



Report on results, concepts and surveys for public engagement

Deliverable D7.4

Report on results, concepts and surveys for public engagement

Deliverable D7.4

Editor: Michele Contini
(m.contini@santannapisa.it)

Responsible Task leader: Sant'Anna School of
Advanced Studies

Work package 7, Task 7.4

March 2020

Website: <http://www.gemex-h2020.eu>



The GEMex project is supported by the European Union's Horizon 2020 programme for Research and Innovation under grant agreement No 727550

Table of Contents¹

Table of Contents	2
List of figures	5
Abbreviations	6
Partner	8
Executive summary	10
Introduction	12
1 Public engagement for renewable energy sources (RES) developments: a review behind and beyond acceptance	14
1.1 <i>Public engagement vs public acceptance: definitions, determinants and processes</i>	14
1.1.1 References	18
1.2 <i>Public authorities' strategies and tools for public engagement in the energy field</i>	20
1.2.1 Engaging citizens: participatory and deliberative processes	20
1.2.2 Deliberative mini-publics: determinants of efficacy and a case study	21
1.2.3 References	24
1.3 <i>Between trust and knowledge: the role of expertise</i>	25
1.3.1 Technological decision making	25
1.3.2 The expertise dilemma: democracy or expertocracy?	25
1.3.3 Governance approaches and the role of experts in environmental conflicts	26
1.3.4 Models of scientific knowledge and environmental conflicts	28
1.3.5 References	30
1.4 <i>The relationships between consumers and companies in the development of RES projects</i>	32
1.4.1 Stakeholder theory, corporate social responsibility (CSR) and consumers-outcome variables	32
1.4.2 The commodity perspective: towards the energy context	37
1.4.3 Emerging trends between CSR, consumers-outcome variables and the commodity realm	40
1.4.4 References	42
1.5 <i>Measurement methods of socioeconomic impacts of RES projects</i>	49
1.5.1 Definition of social impacts	49
1.5.2 Importance of measuring social impacts	50
1.5.3 Steps involved in social impact measurement	51
1.5.4 Indicators/metrics for social impact measurement	53
1.5.5 Methods for social impact measurement	55
1.5.6 Socioeconomic impacts of renewable energy projects	56
1.5.7 Studies focusing on measurement of socioeconomic impacts of RES technologies and projects	58
1.5.8 Concluding outline	60

¹ The content of this report reflects only the authors' view. The Innovation and Networks Executive Agency (INEA) is not responsible for any use that may be made of the information it contains.

1.5.9	References	62
1.6	<i>The geothermal energy specificity</i>	67
1.7	<i>A review of practices from the side of project developers and operators in order to achieve social acceptance of geothermal power plant projects</i>	70
1.7.1	Review of social acceptance practices	71
1.7.2	Prevention and minimization of undesirable effects	71
1.7.3	Creating benefits for local communities	72
1.7.4	Community engagement activities	73
1.7.5	Principles governing engagement activities	75
1.7.6	Concluding outline	76
1.7.7	References	77
2	Private actors' perspective on engagement processes for RES developments and geothermal energy developments	80
2.1	<i>Introduction</i>	80
2.2	<i>Energy companies and consumers: an analysis of their CSR-based relationships</i>	83
2.2.1	Theoretical background	83
2.2.2	Consumers' associations and their influence on corporate reputation	84
2.2.3	Company's CSR activities and their influence on consumer loyalty	91
2.2.4	Concluding outline and the case of Mexico	100
2.2.5	References	102
2.3	<i>Energy companies' internal organisation dynamics for developing local communities' relationships: engagement strategies and organisational arrangements</i>	108
2.3.1	Theoretical framework	108
2.3.2	Organisational dynamics for developing local communities' relationships: a focus on the Mexican context	112
2.3.3	Organisational dynamics for developing local communities' relationships: a European case	121
2.3.4	Concluding outline	127
2.3.5	References	128
2.4	<i>Cases of multinational companies involved in public engagement issues: examples of practices</i>	129
3	Addressing the social context for developing engagement processes: a Social Impact Assessment approach	135
3.1	<i>Introduction: a participatory refinement of projects' social impact</i>	135
3.1.1	References	140
3.2	<i>Local communities affected by the project: a description</i>	141
3.3	<i>The communities' perspective</i>	145
3.3.1	Social aspects, participatory SWOT analysis and geothermal developments	145
3.3.2	Energy-related determinants and economic/environmental/social issues: a survey to local communities	159
4	A conceptual model for public engagement	168
4.1	<i>The public engagement conceptual model</i>	168
4.2	<i>Engagement strategy focus: geothermal developments</i>	172

4.3	<i>Public engagement strategies for technical development scenarios</i>	173
5	Sustainability Scenarios: from citizens and companies engagement to meso and regional effects	176
5.1	<i>Forecasts versus scenarios and the role of citizens engagement</i>	176
5.2	<i>Sustainability hangs on engagement: definition of structural characteristics of engagement</i>	178
5.2.1	Community's propensity toward the development of a new RET facility (geothermal)	179
5.2.2	Propensity of companies to facilitate engagement on RETs	181
5.3	<i>RETs innovation and governance of change</i>	185
5.3.1	Scenarios of engagement: expected impacts on communities and company	186
5.4	<i>Behavioural Propensity index linking to Input-Output (I-O) analysis</i>	190
5.5	<i>Input-Output Approach</i>	193
5.5.1	A modular approach	193
5.5.2	Database and macro-indicators	193
5.6	<i>References</i>	197
6	Conclusion	200
7	Acknowledgements	202

List of figures

Figure 1. A scheme of the Public engagement process: inputs, outputs and results (our elaboration on the basis of Devine-Wright 2007; Batel et al., 2013, Ravazzi and Pomatto 2014)	16
Figure 2. Impact value chain; modified from Clark et al. (2004)	49
Figure 3. Five-stage process for social impact measurement (Hehenberger et al., 2013)	52
Figure 4. Categorization of factors affecting social acceptance of renewable energy projects (Source: Modified from Stephanides et al. (2019))	70
Figure 5. Conceptual model with hypotheses	86
Figure 6. The Acoculco Geothermal Zone (ZGA) with its three components. (Source: C. V. Hernandez Ramirez <i>Propuesta desarrollo local en tres localidades de la Zona Geotermica Acoculco</i>)	141
Figure 7. A logical scheme to analyse the interviews	146
Figure 8. Distribution of questionnaires collected in Jonuco Pendernales, Cruz Colorada and Ocoiala in the municipality of Chignahuapan	159
Figure 9. Energy sources used in households for different purposes	160
Figure 10. Existence and use of hot springs	161
Figure 11. Energy saving activities/ behaviours	161

Figure 12. Perceptions towards various social issues	162
Figure 13. Trust towards different information sources on energy issues (production, provision, cost)	163
Figure 14. Importance of issues related to energy production/use on a community level.....	163
Figure 15. Views on economic and environmental impacts	164
Figure 16. Existence of specific environmental impacts related to energy use or production, in relation to households	164
Figure 17. The conceptual model for guiding the strategy for the consultation process for public engagement (PE) ..	169
Figure 18. From structural characteristics of engagement to meso and macro impacts	177
Figure 19. Structural determinants of engagement. Source: adapted from Wehn and Montalvo 2018	186
Figure 20. Scenarios of inter-engagement in geothermal uptake (Source: adapted from Montalvo (2007)).....	187
Figure 21. Determinants of RET engagement propensity (Adapted from Montalvo & Moghayer 2014)	190
Figure 22. Production structure in I-O data base.....	194
Figure 23. Trade structure in I-O data base	195
Figure 24. Architecture of a CGEM	196

Abbreviations

ACF	– Ambuja cement foundation
ACL	– Ambuja cements Ltd.
ASYV	– Agahozo Shalom Youth Village
CA	– Corporate ability
CD	– Communication domain
CFE	– Comision Federal de Eletricidad
CFI	– Comparative fit index
CSR	– Corporate social responsibility
CUT	– Communication transparency
CVVV	– Constant-variable-value vignette
EAP	– Economically active population
ED	– Environmental domain
EI	– Environmental impact
EIA	– Environmental impact assessment
EMCA	– Environmental management and coordination act
GBC	– Ghana bauxite company Ltd
GT	– Geothermal technologies

ILC – Impact on local communities
I-O – Input-output model
KMO – Kaiser-Meyer-Olkin
LAC – Latin America and the Caribbean
LOY – Consumer loyalty
MN – Managers nationality
PA – Public administration
PCR – Perceived corporate reputation
PCSR – Perceived corporate social responsibility
PE – Public engagement
PSQ – Perceived service quality
NGO – Non-governmental organisation
OCSE (or OECD) – Organizzazione per lo sviluppo e la cooperazione economica (Organisation for economic co-operation and development)
RES – Renewable energy sources
RFF – Réseau Ferré de France
RMSEA – Root mean square error of approximation
RTA – Rio Tinto Alcan
SD – Social CSR domain
SDGs – Sustainable development Goals
SHGs – Self-help groups
SEM – Structural equation modelling
SIA – Social impact assessment
STS – Socio-technical systems
TLI – Tucker-Lewis index
UNs – United Nations
WOM – Word-of-mouth
WUSC – World university service of Canada
ZGA – Acoculco geothermal zone
ZIIA – Direct Influence Area of Acoculco
ZNA – Acoculco core zone

Partner

Consiglio Nazionale delle Ricerche (CNR)

Adele Manzella

Centre for Renewable Energy Source and Saving Foundation (CRES)

Spyridon Karytsas, Mendrinos Dimitrios

Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO)

Carlos Montalvo, Evgueni Poliakov

Sant'Anna School of Advanced Studies (SSSA, Task leader)

Michele Contini, Eleonora Annunziata, Massimo Battaglia, Tiberio Daddi, Francesco Rizzi, Marco Frey

University of Turin (UNITO)

Alessandro Sciullo, Dario Padovan

Executive summary & Introduction – Consiglio Nazionale delle Ricerche (CNR), Centre for Renewable Energy Source and Saving Foundation (CRES), Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Sant'Anna School of Advanced Studies (SSSA), University of Turin (UNITO)

1. Public engagement for renewable energy sources (RES) developments: a review behind and beyond acceptance

1.1 Public engagement Vs public acceptance: definitions, determinants and processes – University of Turin (UNITO)

1.2 Public authorities' strategies and tools for public engagement in the energy field – University of Turin (UNITO)

1.3 Between trust and knowledge: the role of expertise – University of Turin (UNITO)

1.4 The relationships between consumers and companies in the development of RES projects – Sant'Anna School of Advanced Studies (SSSA)

1.5 Measurements methods of socioeconomic impacts of RES projects – Centre for Renewable Energy Source and Saving Foundation (CRES)

1.6 The geothermal energy specificity – University of Turin (UNITO) and Consiglio Nazionale delle Ricerche (CNR)

1.7 A review of practices from the side of project developers and operators in order to achieve social acceptance of geothermal power plant projects – Centre for Renewable Energy Source and Saving Foundation (CRES)

2. Private actors' perspective on engagement processes for RES developments and geothermal energy developments – Sant'Anna School of Advanced Studies (SSSA)

3. Addressing the social context for developing engagement processes: a Social Impact Assessment approach

3.1 Introduction: a participatory refinement of projects' social impact – University of Turin (UNITO)

3.2 Local communities affected by the project – University of Turin (UNITO)

3.3 The communities' perspective – University of Turin (UNITO) and Centre for Renewable Energy Source and Saving Foundation (CRES)

4. A conceptual model for public engagement – Sant'Anna School of Advanced Studies (SSSA), University of Turin (UNITO), Centre for Renewable Energy Source and Saving Foundation (CRES) and Consiglio Nazionale delle Ricerche (CNR)

4. Sustainability scenarios: from citizens and companies' engagement to meso and regional effects – Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO)

Conclusion – Consiglio Nazionale delle Ricerche (CNR), Centre for Renewable Energy Source and Saving Foundation (CRES), Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Sant'Anna School of Advanced Studies (SSSA, Task leader), University of Turin (UNITO)

Executive summary

The theme of public engagement is particularly relevant when, as in the case of geothermal technologies, switching the energy system to renewable sources may produce relevant economic, environmental and social impacts.

A multidisciplinary approach to deal with public engagement in geothermal development was adopted following several steps. First, a preliminary investigation was carried out on local public perception of (geothermal) energy and on the overall boundary conditions (e.g. social, environmental, economic, etc.), in order to take into account all the socio-economic and environmental issues related to the project. Second, a quali-quantitative investigation was conducted on different stakeholders to discover their interpretations and perspectives on geothermal energy development issues. Questionnaires and open-ended interviews were conducted with citizens, companies, public authorities and local communities both in Mexico, Europe and a selection of developing countries. Suitable variables and indicators/quantitative models were defined to monitor, ex-ante, the possible sustainability-related consequences, thus representing an integrative part of the work.

Based on the above, a conceptual model was built to combine public authorities' and private companies' efforts in fostering sustainable energy transition by taking into account local communities' socio-economic characteristics. Different levels are identified as follow, according to an increasing public engagement.

The *Information level* relies entirely on the information provided to the public about the project's details and potential impacts on the local and wider community. It corresponds to a minimal level of relations between companies and local communities, which are considered as an actor without any active role. Public authorities are mainly involved in defining the boundaries of the community to be investigated.

The *Communication level* includes active engagement of the public, and it is contingent upon the company's willingness to engage in conversation with communities. The flow of information and knowledge is bi-directional and the community is surveyed to contribute to the definition of the impacts. Public authorities are crucial in identifying the stakeholders and, more generally, in facilitating the engagement of the public.

The *Collaboration level* considers the public as being part of the project development, while the project and its impacts' evaluation need to be adapted to the specific local/social needs. It is characterised by a high level of relations between companies and local communities, in which a continuing dialogue with no imbalances is present. Public authorities facilitate the process by providing the right arenas where the diverse actors could meet and collaborate.

The *Participation level* consists in the actual engagement of the public in the design of the project. Companies adopt the set of engagement practices based on the diversity of expectations while public authorities are co-designers of the initiative, providing the institutional environment where the process takes place.

These four levels are structured according to an increasing public engagement, from the lowest level – i.e. the information level – to the highest level – i.e. the participation level. The conceptual model enables to simultaneously provide an integrated framework of three different perspectives from actors, and serves as a guideline on how to balance them, according to the level of engagement desirable and really achievable.

Scenarios of citizens' engagement in the development of the geothermal site for energy production are then provided. These scenarios enable to explore systemic influences that might affect sustainability in the communities and the regional environment in the long run. By considering the behavioural model proposed in the chapter and the conceptual model previously presented, different engagement scenarios are developed. The input-output (I-O) approach is also outlined, to guide future analysis and assessment of impact of renewable energy developments in the region.

Introduction

The promotion and implementation of large industrial projects has been considered for many decades a unanimous symbol of progress. Projects such as oil plants, dams, motorways were considered able to provide sole benefits to people and the society at large through jobs, economic development, and power at the state level. However, benefits were just a part of the picture. Numerous cases can be identified where infrastructural projects were poorly developed and managed, causing social and environmental problems such as losses of jobs and damages to the environment. In addition, it can be fairly stated that even if such projects provided benefits at the state (or global) level, they certainly caused issues at the local level, where drawbacks usually outweighed the advantages. Local communities affected by the projects and wider sectors of public opinion started to oppose to these projects and the idea of progress behind, making a general claim for the adoption of few key principles: transparency and openness of project developments, involvement of citizens and accountability.

Transparency and openness of project developments refer to the opening of projects to as much stakeholders as possible, thus strengthening trust among them and legitimising the activities carried out. Moreover, the involvement of citizens, who are directly and locally affected by the project, means to implement specific engagement actions and adopt new forms of debate and democratic procedures for reinforcing their interest in the public domain and make their voice be part of the process. Last, accountability refers to the process of defining, implementing and monitoring impact reduction and compensation measures.

These key principles can be adopted by public or private actors when developing large industrial projects. For example, in the public authorities' realm, the concept and practice of participatory democracy has gained consensus as an essential complement of representative democracy, since it allows people to obtain an immediate and strong voice over certain projects, and reinforce their critical and analytical spirit as taxpayers. In the private actors' realm, instead, Corporate Social Responsibility (CSR) has gained strong importance as a theoretical concept and practical tool for ensuring the goodness of relationships with all stakeholders while simultaneously pursuing profitability objectives. This is the result of the growing recognition that companies are accountable not only for pursuing profits (shareholders' interest), but also for creating value for all society (stakeholders' interest). Lastly, as accountability has gained momentum, new and more sophisticated measurements methods are needed to consider the impacts – especially the social and environmental ones – of large industrial projects.

Among large industrial projects, renewable energy sources (RES) developments and, in particular, geothermal energy developments perfectly represent a symbol of progress, since they contribute to satisfy economic and social needs (provision of energy) while addressing contemporary challenges such as reducing climate change and fostering a more sustainable model of development. However, RES developments receive oppositions to their development. The questioning and the impairment of these projects is due not only to technical issues but also to issues related to the inability of public or private actors to manage the – usually local – drawbacks perceived by people.

As Giuseppe Mandrone – professor in Applied Geology at University of Torino – stated about geothermal energy "most of the technical problems, if not already solved, may be solved. The hard challenge is social"².

Given the general framework outlined above, the current report presents a comprehensive work in which different perspectives are considered with the aim of achieving public engagement in geothermal energy³.

The first chapter reviews the main themes relating to the current debate on public engagement, taking different perspectives. The themes of public authorities' and private actors' literature that relates to the relationships between stakeholders and public engagement are considered. In addition, it includes specific focuses on measurement methods of socioeconomic impacts and geothermal energy, reviewing current practices for achieving social acceptance of geothermal power plant projects.

The second and third chapter consider the perspectives of the two most important stakeholders in geothermal energy projects and, in particular, in the GEMex project: private companies aimed at developing geothermal plants and local communities potentially affected by such developments, together with the role of public administrations.

The fourth chapter refers to the conceptual model for public engagement. Based on the analyses carried out, the chapter provides a conceptual model for building strategies of public engagement. In addition, scenarios for public engagement strategies are also provided based on different technical development scenarios.

The fifth chapter provides scenarios for citizens' engagement in the development of the geothermal site and preempts the conclusion of the report in the very last section.

² From an in-depth interview to Giuseppe Mandrone, associate professor in Applied Geology at the University of Torino, in order to collect all the information needed to understand the technological variety of geothermal applications and related potential impacts and criticalities (Interview submitted in Torino, November 2017)

³ As far as the proposal is concerned, the Rogers' technology adoption model (Rogers, 1976) was mentioned as a framework to be used to shed lights on the determinants of social acceptance. However, the partner consortium realised that such model was not suitable in this context. The model is conceived for innovative products and it is linked to the innovation adoption curve, which classifies people into various categories of adopters based on choices they voluntarily agree to do. In this case, the decision to purchase has to be made freely and implemented voluntarily. For this reason, the Rogers' technology adoption model was not considered as suitable in developing Task 7.4 activities, and a different approach was followed.

Rogers, E. M. (1976). New product adoption and diffusion. *Journal of consumer Research*, 2(4), 290-301.

1 Public engagement for renewable energy sources (RES) developments: a review behind and beyond acceptance

This chapter comprehends different perspectives of analysis, considering the main themes relating to the current debate on public engagement. The first paragraph explains the features of public engagement, while the second takes the public authorities' perspective and describes some of their strategies and tools for public engagement in the energy field. The third paragraph reviews the governance approaches and models that refer to environmental conflicts, taking into account the role of expertise. The fourth paragraph considers the private actors' literature and reviews the relationship between stakeholders and public engagement from a corporate social responsibility (CSR) perspective. The fifth paragraph relates to measurement methods of socioeconomic impacts while the sixth and seventh are much more focused on geothermal energy, describing its peculiarities and reviewing current practices for achieving social acceptance of geothermal power plant projects.

1.1 Public engagement vs public acceptance: definitions, determinants and processes

A point that is worth clarifying from the beginning is that *engagement* and *acceptance* are far to be synonymous. First of all, because the former pertains to the realm of active participation, while the second to the realm of passive reception and secondly because engagement could be intended as the process of involvement while acceptance (both as merely lack of opposition or more convinced support) could be intended as the product of the involvement process. In other words, public engagement has to be considered as a complex and structured system of activities (see par.3) put in place in order to effectively involve people in the decision and implementation process, while public acceptance may be (or not be) a result of such activities. A successful process of public engagement thus is not inevitably connected with more acceptance since it may produce an actual support to the project and/or a convinced acceptance or even neither of the two when resulting in the so called 'zero option' of abandoning the project (Batel et al., 2013, Ravazzi and Pomatto, 2014).

A careful and useful reviewing of the main factors that influence the level of acceptance for RES projects is provided by Devine-Wright that grouped them into three main categories (Devine-Wright, 2007)⁴.

A. Personal factors: socio-demographic characteristics such as age, gender and social class.

B. Socio-cultural factors.

b1. Degree of awareness and understanding: even if the direction isn't clear since there is limited evidence that more informed individuals are more accepting of low carbon technologies.

b2. Political beliefs intended as prejudicial adoption of a position for or against the project.

b3. Environmental beliefs and concern that should motivate in supporting projects aligned with environmental concern and climate change; however, some findings actually suggest a more complex relationships between environmental concern and public acceptance of renewable energy

⁴ The list below is an adaptation from the original version of Devin-Wright (e.g. the group here labelled as Social-Factors were identified as Psychological in the original)

technologies depending upon the scale of 'environment' that is the focus of public concern, and how the various impacts of such technologies are evaluated at different scales.

b4. Place attachment: the potential significance of affective aspects of people-place or people-technology interactions that are implicated in public responses to low carbon.

b5. Perceived fairness and levels of trust in key actors in the development, including the developer, local authority and regional development organisations, which in turn influenced public responses to information and assessments provided as part of the statutory planning process.

C. Contextual factors

c1. Technological factors: scale and type: low carbon technologies for energy generation are diverse and vary both in their relative impacts and in their extent of implementation. It is possible to classify three scales of implementation of renewable energy technology: micro (at single building or household level); meso (at the local, community or town level); macro (at large scale 'power station' level). Since each scale of technology will present different impacts on the local economy, community and environment, public attitudes towards, and engagement with renewable energy technologies implemented at different scales is likely to vary considerably.

c2. Institutional factors: ownership structures, the distribution of benefits and the use of participatory approaches to public engagement: models or structures of ownership employed in renewable energy technology developments can vary widely, encompassing public/private and individual/collective dimensions. Many authors, consistent with a 'deliberative turn' within the social sciences have advocated more participatory approaches to public engagement, to at least minimise social conflict if not to secure public acceptance. However, it cannot be assumed that deliberative public engagement in renewable energy developments will secure public acceptance, as it may cause an opposite result.

c3. Spatial factors: regional and local context, spatial proximity and NIMBYism: a way of thinking about public acceptance of unwanted land-uses suggesting that those opposing developments are motivated by concern 'for their back yard'; however there is limited empirical support for the NIMBY hypothesis (Devine-Wright, 2005).

Figure 1 is an attempt to synthesize what described so far about the relationships among public engagement and public acceptance. As shown in the figure, the process of public engagement is affected by a number of different conditions that play the role of inputs and context for the process itself (Institutional settings, Social aspects, Knowledge and the peculiarities of the Project at stake). The first effect of the public engagement activities could be the modification of these initial inputs/conditions so that a reinforcement and circular process of the activities themselves may emerge as a first output. Then, this renewed context may produce, through the public engagement process, one of the results mentioned above that may range from a mere acceptance to a more convinced support and even to a reinforcement of the conflict or to a '0' option, that is abandoning the project.

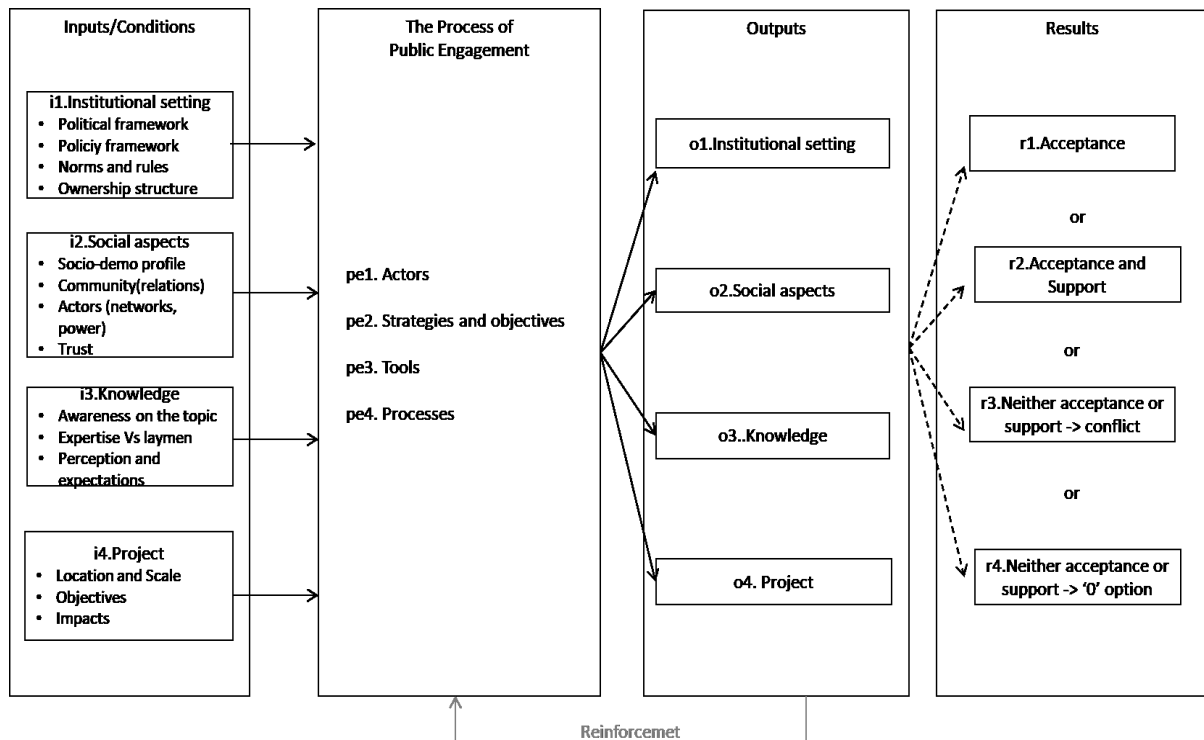


Figure 1. A scheme of the Public engagement process: inputs, outputs and results (our elaboration on the basis of Devine-Wright 2007; Batel et al., 2013, Ravazzi and Pomatto 2014)

What is interesting to consider when dealing with public acceptance of RES is the high level of implicit contradiction in terms of values of reference diffused among the public, the b3 point of the listed above. Development of RES is in fact a process mainly associated with positive imaginaries connected to the themes of energy sustainability, the green economy and the political autonomy related to the provision of alternatives from oil. But, at the same time, even among people in favour of RES, the local conflicts regarding the construction of the plants are a widespread phenomenon, documented in many parts of the world and for the different renewable sources. Often, large coalitions that oppose on a local level against RES projects include citizens' committees and the same environmental associations, which also generally support the use of renewable energy (Petrella 2012, Puttilli, 2014). As an example, in Italy in 2016 359 environmental local conflicts had been detected with more than half in the energy sector (56,7%) followed by waste management sector (37,4%). Within the energy sector, oppositions were mostly oriented against RES plants (75,4%) and in particular against biomass (43 plants), composting (20) and wind farms (13) (Nimby Forum, 2017).

Based on a careful revision of the most recent literature (Maggiolini and Pomatto, 2016), it is clear that the factors to explain the start and the evolution of territorial conflicts, also in the case of renewable energy, are of two types: the externalities of the plants, of a material or symbolic nature, and the imbalance between negative externalities, strongly concentrated at the local level, and the potentially widespread potential benefits that could be associated with the disputed projects (Della Porta and Piazza, 2008; Fedi and Mannarini, 2008; Bobbio, 2011).

In fact, also this type of infrastructures can determine undesirable land transformations, such as the consumption of soil, the micro-level deterioration of pre-existing ecosystems and the alteration of the

landscape as well as various types of harmful or disturbing emissions (Puttilli 2014). Negative externalities can be objectively assessed only partially and often combine material aspects and symbolic aspects. As mentioned above, among the factors for public acceptance (*place-attachment*), the territory does not simply correspond to an objectively given physical environment, as regards the articulated set of material and symbolic elements that are linked to the interaction of the social groups living in that area. This also means that these social groups are endowed with an emotional attachment to the territory and that part of their social identity is linked to it. A project can interfere with the sense of attachment and with the territorial identity of local communities and consequently with the awareness of local actors to be able to play an effective role in decision-making processes (Vorkinn et al 2001, Devine-Wright 2009, 2011a, 2011b, Devine-Wright et al. 2010, Maggiolini and Pomatto, 2016).

Despite these complexities, public engagement seems to be more than an option but an actual need for decision makers in order to support the transition of current energy systems towards RES. In designing the right strategies for effective public engagement particular attention has to be paid to how the different factors affecting the potential acceptance /conflict (Devine-Wright, 2007; see above) are deployed and affected by the specific intervention or project. In fact, these technologies are not neutral components of technical systems but relevant parts of complex socio-technical systems (STS). In other words, systems in which technical components are crucial but are framed into a social context that they contribute to shape being at the same time shaped (Walker and Cass, 2011) and that, as such, require close collaboration between public authorities, industry technicians and social scientists, practical and localized knowledge of citizens and communities.

1.1.1 References

- Batel S., Devine-Wright P., Tangeland T. (2013) Social Acceptance of low carbon energy and associated infrastructures: A critical discussion. *Energy Policy*, 58, pp1-5
- Bobbio L. (2011), Conflitti territoriali: sei interpretazioni, in *TeMA. Journal of Land Use, Mobility and Environment*, n. 4, pp. 79-88.
- Della Porta D., Piazza G. (2008), Le ragioni del no. Le campagne di protesta contro la TAV in Val di Susa e il ponte sullo Stretto, Milano, Feltrinelli.
- Devine-Wright P. (2005), Beyond NIMYism: Towards an Integrated Framework for Understanding Public Perceptions of Wind Energy, in *Wind Energy*, vol. 8, n. 2, pp. 125-139.
- Devine-Wright P. (2007), Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review, School of Environment and Development, University of Manchester, Manchester
- Devine-Wright P. (2009), Rethinking NIMYism: The Role of Place Attachment and Place Identity in Explaining Place-Protective Action, in *Journal of Community & Applied Social Psychology*, vol. 19, n. 6, pp. 426-441.
- Devine-Wright P. (2011a), From Backyards to Places: Public Engagement and the Emplacement of Renewable Energy Technologies, in P. Devine- Wright (ed.), *Renewable Energy and the Public. From NIMBY to Participation*, London and Washington, Earthscan, pp. 57-70.
- Devine-Wright P. (2011b), Place Attachment and Public Acceptance of Renewable Energy: A Tidal Energy Case Study, in *Journal of Environmental Psychology*, vol. 31, n. 4, pp. 336-343.
- Devine-Wright P., Howes Y. (2010), Disruption to Place Attachment and the Protection of Restorative Environments: A Wind Energy Case Study, in *Journal of Environmental Psychology*, vol. 30, n. 3, pp. 271-280.
- Fedi A., Mannarini T. (a cura di) (2008), *Oltre il Nimby. La dimensione psico-sociale della protesta contro le opere sgradite*, Milano, Franco Angeli.
- Maggiolini M., Pomatto G. (2016) Fonti nuove, conflitti vecchi: l'approccio top down non paga. Due impianti fotovoltaici a confronto. *Rivista Italiana di Politiche Pubbliche*, 3: 399 - 426
- Nimby Forum (2017), IX Edizione Rapporto Nimby Forum, Comunicato stampa, <http://www.nimbyforum.it/area-stampa/comunicati>.
- Petrella A. (2012), Innovazioni e conflitti nella gestione locale delle energie rinnovabili: quattro casi italiani a confronto, in *Stato e Mercato*, n. 95, pp. 283-321.

Puttilli M. (2014) Geografia delle fonti rinnovabili. Energia e territorio per un'eco-ristrutturazione della società. Franco Angeli, Milano, IT

Ravazzi S., Pomatto G. (2014) Flexibility, Argumentation and Confrontation. How Deliberative Minipublics Can Affect Policies on Controversial Issues, *Journal of Public Deliberation*, 10, 2, 10

Vorkinn M., Riese H., (2001), Environmental Concern in a Local Context: The Significance of Place Attachment, in *Environment and Behavior*, vol. 33, n. 2, pp. 249-263.

Walker G., Cass N. (2011), Public Roles and Socio-Technical Configurations: Diversity in Renewable Energy Deployment in the UK and Its Implications, in P. Devine-Wright (ed.), *Renewable Energy and the Public. From NIMBY to Participation*, London and Washington, Earthscan, pp.43-56.

1.2 Public authorities' strategies and tools for public engagement in the energy field

1.2.1 Engaging citizens: participatory and deliberative processes

The need of engaging citizens and diverse local stakeholders in the decision processes related to the development of renewables is relevant both to the knowledge building side and to the practical implementing side. This involvement in planning and defining interventions is one of the important factors in explaining the social acceptability of projects, together with other factors of an economic and social nature (Sovacool, 2012), even if it has not to be given for granted that more participation and more awareness triggered by more engagement will produce more acceptance (Devine-Wright, 2007).

In fact, given a conflict raised around a RES project, the traditional approach based on compensation or distributive negotiation is often not effective in solving these kinds of conflicts, principally because of the ineffectiveness of the monetary conversion principle for environmental goods (Munton, 1996).

But even if the importance of taking into account the point of view of the citizens is quite spread among decision makers, it has to be underlined that ordinary citizens, in general, have very few opportunities to make their voices heard in the formulation of a public policy or intervention (i.e. RES project). They can manifest their orientation in various ways (e.g. letters, demonstrations, and petitions) but they are very unlikely to be heard. Some more influence can be produced if they organize or join a *group of interest* or form a *committee*. However, the forms of collective action may need social and institutional requirements (e.g. level of education, income, political and environmental awareness, competitive political system ...), that are not universally distributed and that can be particularly scarce in areas, such as those of interest to the Gemex project, that are characterized by marginality, with a low population density and with a low socio-demographic profile.

However, over the last decades, some tools have been developed and implemented that public administration can adopt to allow citizens to take part directly in the formulation and implementation of policies and projects. These are the innovative decision-making processes that are inspired by the principles of *participatory democracy* and *deliberative democracy* (Bobbio et al., 2017).

Participatory processes aim to enable citizens to press public administrators to take care of their needs. Born as a spontaneous and militant mobilization process in the late '70s, they have been institutionalized at the end of 80s' when the Brazilian city of Porto Alegre introduced the participatory budget, that is a process parallel to the institutional one that annually defines the commitments of municipal spending, aimed at involving the inhabitants of the city in defining spending priorities for public interventions (Allegretti, 2003 cited in Bobbio et al. 2017). Since then, thousands of experiences and variations in participatory budgeting have been experimented all over the world (www.participatorybudgeting.org).

Deliberative processes have a partially different objective, closely connected with the knowledge building described at par.2, that is to promote an open and in-depth discussion between citizens who have different or opposing ideas, points of view and interests, in order to develop solutions in a constructive way. A deliberative process is generally carefully structured along the following elements (Bobbio et al 2017, Ravazzi and Pomatto, 2014):

- careful planning of the process under the supervision of a committee that is an expression of the various interests and perspective on the issue under debate;
- public sharing of a set of information and points of view on the issue under debate;
- conduction of mediated respectful discussions between ordinary citizens united in small arenas in order to argue and find constructive solutions;
- methods of recruiting participants other than the spontaneity of participatory experiences (e.g. random selection or targeted selection);
- involvement of citizens, experts, interest groups and public authorities in order to bring together expert knowledge and profane knowledge;
- assistance of professionals (so called *facilitators*) that are experts in group dynamics, complex decision-making processes and alternative conflict resolution.

Participatory and deliberative processes are both experiences that are promoted by public administrations, without any legal obligation (except few cases such as the recent Italian legislative decree on public debate ex art.22, comma 2, D.lgs. n. 50/2016) and constitute a specific phase within a broader decision-making process. The results they produce is to bring the point of view of ordinary citizens into the public arena. It is worth underlining that these processes play a consultative role. As well as other proposals coming from other civil society actors or interest groups, they aim to influence the decision processes but the final decision remains in charge of public administration. Therefore, participatory and deliberative processes have consultative and non-decisional value and have to be intended as tools to integrate and strengthen and not to replace current democratic and representative decision-making processes.

1.2.2 Deliberative mini-publics: determinants of efficacy and a case study

The processes briefly described above are commonly labelled as deliberative mini-publics (Grönlund et al., 2014). A lot of variables may affect their efficacy, but the empirical evidence suggested that at least three factors could favour the efficacy of these processes (Ravazzi, 2007 and 2017; Ravazzi and Pomatto, 2014):

- a. the commitment of the political and institutional authorities who were responsible for the final decisions. This commitment may be publicly unexpressed, although in some cases public authorities make explicit promises and provide a clear and quantifiable amount of financial resources devoted to the process.
- b. the timing of the process, that is to start building the participatory tools at an early stage of the decision process when alternative options are still available.
- c. the active interest of civil society, that is the willing of the local civil society in actively participating to the public decisions.

Different solutions may be adopted in order to implement a participatory approach in project development (e.g. deliberative polls, citizen juries, public debate) and they produce different effects in effectively dealing with these three factors. Among these solutions, the *public debate* has been gaining attention in the last decade as a form of hybrid solution that combines participatory and deliberative aspects. Introduced in France in the 90s, it provides that preliminary projects of major works are submitted to the discussion of citizens who, in a structured and transparent process, can formulate objections and propose modifications. Most of the participants are people directly affected by the proposed interventions. The process is organized in participatory phases (less structured and open to all the interested public) and deliberative phases (more

structured and involving selected stakeholders). It is extremely important that all the phases are rigorously conducted by professional independent facilitators (Bobbio et al., 2017).

Based on a comparative research on two case studies in Italy (Ravazzi and Pomatto, 2014), the hybrid form of public debate seems to work better than other participatory solutions with respect to two dimensions that are particularly important in order to support the effective engagement of citizens in public works: the way of including different views, which is mainly linked to the participant selection method and the way of making participants discuss, which is structured through facilitation methods. The hybrid process (see box A) was set up with a flexible arena and the discussions alternated argumentation and confrontation while the pure model was set up with a rigid randomized arena and purely argumentative dialogic. The results were highly different in the two cases: combining a flexible arena with a mix of argumentation-based and confrontation-based discussions, the hybrid process was able to help the results to be taken into account by public institutions while the pure model did not influence the final decision and moreover raised institutional conflicts.

Box A - A case study of Public Debate in Italy - A New Highway Stretch

(adapted from Ravazzi and Pomatto 2014, pp 5-6)

In Genoa, the construction of a new highway stretching alongside the already existent one is a topic that has been under discussion since the eighties.

A first draft, dating back to 1984, was strongly opposed by several citizen committees, while a new policy window opened in 2001, when the public work was included in a National programme of strategic public works.

A second project was developed between 2003 and 2005 by Highways for Italy (HI), a public Italian company, but its approval was again shelved after new local opposition.

In 2006, HI drew up a third project that was approved by the Region, the Province and the Municipality of Genoa, the three administrative organizations in charge of permits for the implementation of the work. The project included, amongst others, the demolition and reconstruction of a highway bridge in a highly populated area adjacent to a large factory. Again, this third project raised oppositions and protests, but this time the mayor of Genoa decided to promote a deliberative process to discuss the HI project and other alternative options with the citizens.

The process was designed according to the model of the *Debàt Public*.

In November 2008, the City Council appointed an independent Commission to design and manage the whole process. HI soon had to draw up a dossier with various alternatives as a preliminary knowledge base for the participants. A phase of bilateral meetings between the Commission and stakeholders then followed, with the task of mapping all the opinions and discourses about the topic and the various aspects that could be addressed in the public meetings.

The direct participation of citizens started in 2009, and immediately raised the local mobilization of civil society leaders, associations and citizen committees. A group of entrepreneurs started an intense communication campaign in the main local newspapers in order to promote the usefulness of the new highway. Some citizen committees instead formed a network to oppose the public work and organized a protest march in which nearly three thousand people took part. Criticism of the Commission and the process came from both sides. Overall, the deliberative process lasted about six months and alternated moments of information exchange and face-to-face discussion. At the same time, organizations and individuals could upload documents to address specific issues or propose alternative projects on an online platform (the “Notebook of the actors”). The public meetings took place over three phases: six meetings were focused on the alternative options projected by HI and were open to all citizens; six meetings were focused on specific issues related to the public works and again there was no selection of participants; four planning workshops were designed to deal with controversial issues that had emerged in the previous meetings, with the aim of suggesting new solutions (Table 1). Overall, in the first and second phase meetings, 33 technicians and experts were involved, and 45 Notebooks of the actors were uploaded on the website by organizations and ordinary citizens.

The deliberative process ended with the Commission drawing up a report, in which the core contents of the debate were synthesized. The report stated that the process had produced new proposals for the highway stretch and a request was made to establish a local observatory composed of residents to control the implementation phase. A few days after the Commission presentation, HI presented a new project, in which one of the new options proposed by the participants was clearly taken into consideration. The new project resulted in having much less impact on the territory; in terms of the demolitions of buildings, the residents living between 25 and 60 meters from the highway decreased from 497 to 85 while the residents subjected to the demolition of their houses dropped from 503 to 122. In addition, other suggestions made at the meetings were included in the new project: the adoption of a new excavation technique to further reduce the risks associated with the extraction of asbestos rocks, the remuneration of the demolished houses at market prices (above the minimum compensation required by the Law), and the institution of a local observatory to control the implementation phase.

1.2.3 References

Bobbio L., Pomatto G., Ravazzi S. (2017) *Le politiche pubbliche. Problemi, soluzioni, incertezze, conflitti*, Mondadori Education

Devine-Wright P., (2007), *Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review*, School of Environment and Development, University of Manchester, Manchester

Grönlund K., Bächtiger A., Setälä M., (eds.) (2014), *Deliberative Mini-Publics. Involving Citizens in the Democratic Process*, Colchester, ECPR Press

Munton D., (1996) (ed.), *Hazardous Waste Siting and Democratic Choice*, Washington, Georgetown University Press

Ravazzi S. (2007) *Civicrazia. Quando i cittadini decidono*, Aracne, Roma

Ravazzi S., Pomatto G., (2014) Flexibility, Argumentation and Confrontation. How Deliberative Minipublics Can Affect Policies on Controversial Issues, *Journal of Public Deliberation*, 10, 2, 10

Ravazzi S. (2017) Sustainability policies and participatory governance: alternative paths to improve policy making and manage conflicts, Paper Presented at Aisre Conference, 20th – 22th September, Cagliari (IT)

Sovacool B.K., (2012), Conceptualizing the Acceptance of Wind and Solar Electricity, *Renewable and Sustainable Energy Reviews*, vol. 16, n. 7, pp. 5268-5279.

1.3 Between trust and knowledge: the role of expertise

1.3.1 Technological decision making

In recent decades environmental conflicts related to the land use for the realization of public works have been gaining growing relevance in the public debate and in the political agenda. Big technological infrastructures in particular (e.g. airports, power plants) have been often accompanied by strongest opposition thus confirming that relevant technological progresses are always controversial: jointly with relevant benefits they may produce equally relevant unexpected side effects (Nelkin, 1974; Della Porta and Piazza, 2008; Fedi and Mannarini, 2008; Bobbio, 2011). The 'technological' nature that has been assigned to these processes has produced a sort of identification of these processes as something different from other policy arenas. Conflicts about the localization of (e.g.) power plants with respect to the preservation of the livelihood among local communities have often been addressed from a merely technological and almost useless (when not counterproductive) perspective e.g.: physical requirements for the infrastructure construction, significance of the forecasts that testify the need for the infrastructure, a precise assessment of environmental and health risk. From this stage, along the decades of raising conflicts on land use, this hyper-technologization of conflicts has evolved towards a different framework based on the overcoming of clear separation between technological and social dimension, the loss of the neutrality of scientific discourse, the growing relevance of the social construction of conflicts and above all a vision of technology not as an ineluctable exogenous fact but as the result of the interplaying of social, ecological and technological variables (Schwarz and Thompson, 1990).

A novel combination of interactions among institutions, wider public and experts has been growing relevance in dealing with public issues, as the environmental ones, characterized by a high level of technological complexity and potential involvement of citizens (Padovan and Magnano, 2011; Padovan et al., 2011). Scientific expertise, in this framework, is considered as a crucial component of this interaction in such a way that a new category of decision process can be identified: Technical Decision Making (TDM). TDM is a decision process characterized by an intense interplaying of political and scientific dimensions due to the public relevance of the issues to deal with: e.g. choosing for nuclear or coal plants, adopting Kyoto protocol, accepting a waste incinerator. TDM means that both the public and the scientific community may contribute in defining and finding solutions to problems in these fields that once were considered as merely technological (Collins and Evans, 2002) since competences and knowledge about technologies and their impacts have to be integrated by the tacit, lay knowledge diffused among people. A crucial point, therefore, is to understand the development of the diverse forms of knowledge, the definition of diverse expertise and their related values and meanings and how this expertise is influenced and influences the institutional, social and scientific context (Berkes, 1999).

1.3.2 The expertise dilemma: democracy or expertocracy?

It is not easy to provide a shared and absolute definition of expertise. It could be defined as a social action that makes available to oneself or third parties the skills to achieve certain goals or objectives with some probability of success. Usually one can group under the same category of expertise a series of activities that are familiar to our experience and which are defined essentially by opposition to non-experts. Expertise can therefore be considered a relational category. Experts share some relationships with their "clients" - whether

they are laymen, politicians, institutions, movements - that is added to the relationships between the actors involved in the dispute. The complexity of the processes of governance of modern society require an even wider use of experts able to fill in the lack of knowledge about social processes and have available some cognitive tools to take decisions, on very different scales. The reproductive basis of contemporary differentiated societies is increasingly dependent on specialized knowledge and skills, as well as by equally specialized roles and institutions. In these societies the problem of credibility and trust is particularly relevant, since those who decide on policies are almost always lacking in ad hoc expertise, thus making their decisions depending on trusted advisers. Experts in these techno-scientific issues have firstly long been imprisoned only on one side of the controversy, in a perpetual dialogue with decision-making politicians and professionals; lately they have been gradually involved, both as consultants and as adversaries, in groups of pressure, protest or public opinion and some of them have clearly chosen to be on the opposition hand. The topic of scientific credibility of experts is therefore crucial for the functioning of modern social systems. In short, expertise provides formulas to determine the problems that emerge at the social level and the best solution to solve them. Notwithstanding this technological relevance a lot of studies on the role of scientific experts in public controversies have shown that in some conflictual contexts scientific knowledge is surprisingly weak and scarcely legitimized. The socially constructed nature of scientific evaluations makes it plausible that certain assertions can be questioned, challenged, and even the object of growing scepticism. Basically, we are increasingly asking whether scientific expertise can be used in decision-making processes in a neutral and clearly impartial manner. In short, expertise provides formulas to determine the problems that emerge at the social level, but the solutions suggested to solve them are not always accepted and are often challenged. Such events pose a cogent dilemma, that between democracy and "expertocracy" (Barnes and Edge, 1982; Yearley S., 1992a; Yearley S., 1992b; Collins and Evans, 2002, Bechmann and Hronsky, 2003; Padovan et al., 2011).

Seen from this perspective, the theme of expertise has significant political implications concerning the problem of democracy and equity. Expert knowledge is a kind of patrimony endowed with a power that ordinary people can't control, acquire or share, which however undergoes as indirect control. In this Foucaultian view, the power of experts is considered a violation of the basic conditions of democratic accountability that poses the dilemma between capitulation to the "government of experts" and the affirmation of a democratic government of a "populist" nature that acts based on fear and rumours (Turner, 2001).

In any case, as mentioned above, expertise is not always the adviser and support of the strongest interests as many of the environmental damages generated by production processes, technologies, consumption practices have been identified by scientists (Yearley, 1992b).

1.3.3 Governance approaches and the role of experts in environmental conflicts

A central role in environmental conflicts is exercised by institutions as entities that have a central responsibility in the use of environmental assets. The high complexity of the assets to be regulated imposes a massive use of knowledge codified that produces the abundant use of experts by institutions. But public institutions have been suffering for some time from recurrent crises of legitimacy, credibility and above all trust of citizens). Mistrust in institutions reduces their ability to govern and regulate the system, with significant consequences on the institutional capacity to activate actions of public interest. An attempt to

shelter the institutional crisis was the introduction of the concept of governance or similar concepts such as "reticular forms of organization", "governance network", "network organization". It represents a complex and hybrid alternative way to top-down political regulation (i.e. to the hierarchical control of central institutions), to the strictly intended market regulation (based on the principle of utility exchange) and to community regulation (based on the principle of reciprocity). Governance refers rather to the concept of networks of relationships, generated by a negotiation process that guarantees a form of social regulation aimed at achieving defined objectives (Powell W. W., 1990; Uzzi B., 1997, Jones et al., 1997; Mayntz R., 1999;).

In the governance perspective, the role of expertise and experts is greater than in other decision-making models. Similarly, to what happens in a corporate governance network, in a network of territorial governance, the experts also have the task of setting in motion and oiling some important social mechanisms that make a governance process possible. Or, in other words, that makes it possible adaptation, coordination and social exchanging by selecting access to exchanges, informing, pushing towards shared values and cultures (Jones et al., 1997). The local dimension of governance is perhaps the one with the greatest potential to implement sustainable development strategies to protect the environment and populations, to change the daily behaviour and consumption patterns of individuals in a sustainability perspective, promoting coordinated projects and actions at the level of the territory among the local communities (Ward H. 1996, Andrew and Goldsmith, 1998;).

As mentioned above the role of experts in environmental and technological controversies has become increasingly central and differentiated as large installations, structures and works increased during the past decades. Experts have initially become crucial at the service of projects of national interest by being called to work alongside governments and large companies. The case of the nuclear industry is very clear: the nuclear industry and the governments that supported it were endowed with such financial resources as to allow all the experts they wanted to assert the low risk of the plants while a persistent problem of the opponents was the absence of resources and therefore of experts able to provide different evaluations (Wynne B., 1982).

Then, with the growth of environmental movements, even the opponents were equipped with their experts and the recruitment of other expert knowledge to be used in public arguments in support of the mobilizations against major works resulting in an alternative to this technical rationality. Environmental movements, local and national pressure groups, spontaneous movements of citizens have increasingly integrated and questioned scientific knowledge by proposing and identifying new or little-known environmental risks. This point is decisive for understanding the radical change that has marked the analysis of the risk society, which has always been dominated by experts such as engineers or economists. The movements have challenged the ordinary definitions of risk, creating a pluralization, often conflicting, of those same definitions. Thanks also to these contributions, knowledge on the risks and dangers of technical-scientific civilization, now recognized by everyone, could be imposed against the often-strenuous resistance of a "technical-scientific rationality" closed in itself, provincial and prisoner of its faith in progress (Beck, 2000, p.77). This technical-scientific rationality has also been challenged on its own normative level, by a new social process of creating an "ecological rationality" based on the collective taking of decisions (Dryzek, 1997).

1.3.4 Models of scientific knowledge and environmental conflicts

The emergence of conflicts on the staging of environmental and social impacts of technological infrastructures poses the problem of the nature of the relationships that is created between experts, the public and policy makers in the context of disputes. In this perspective it is worth to consider two types of characterization of scientific expertise that are based on the relationships between experts and stakeholders. The first is the Funtowicz model (Funtowicz, 2008) that traces a genealogy of the various types of science:

- a "modern" model of science according to which scientific incontrovertible facts will produce correct insights and consequently effective policies. This is the traditional and well-known "technocratic" vision dependent on an alleged perfectibility of science both in the theoretical and in the practical field.
- a model of the "precaution" based on uncertain and inclusive information. In concrete policy processes, it is recognized that scientific facts are neither completely certain nor definitive for policies.
- a "contextualized" model of science (framing), characterized by arbitrariness and misuse of choice. In the absence of conclusive facts, the scientific information becomes an input among others necessary for the policy process.
- a model based on extended participation or "post-normal" science. Given the recognition of the difficulties that mark the use of science in the political process, it becomes increasingly difficult to defend the monopoly of accredited expertise in providing information and scientific advice to decision makers. "Science" (understood as the activity of expert technicians) is therefore considered one of the components of "relevant knowledge" that becomes part of a process as evidence. The ideal of rigorous scientific demonstration is replaced by that of public dialogue. Through this knowledge co-production, the extended peer community creates a democracy of expertise in the context of a post-normal science.

The second model is the Callon's typology (Callon, 2000) that distinguishes three modes of "technological democracy", i.e. three ways to make a complex reality comprehensible even to non-specialists in technical and scientific debates.

- The mode of *public education* where scientific and rational knowledge is opposed to knowledge based on superstition. Scientists must educate the public from scratch and learn nothing from the public. The public debate has no role in the decision-making system, except as a communication tool that allows citizens to partially understand the evolution of science and technology. Science here is conceived as an autonomous source of progress. The crucial point is the relationships of trust between the two entities. Mistrust arises from ignorance and is fought by scientists through training and public information.
- The mode of *public debate*, where scientific knowledge is universal as in the first model, but not completely and it is more interesting for the analysis of the relationships between scientists and laymen. The latter have the capacity for sociological analysis that completes the uncertainty of science. This model detects conflicts between experts and the need to organize surveys, public hearings and focus groups to create a dialogue and understand the collective representation of problems. The legitimacy of the political decision is linked to this open debate. But the problem of representation poses a problem in this model. Who will be allowed to take part in the debate?
- The mode of *co-production of knowledge* where, differently from the two previous modes, the dynamics of knowledge production is the result of a tension between the production of knowledge for general purposes and the production of knowledge connected to the complexity of the singular local situations.

Each of these models can be put to work in order to describe a real situation. None of them can be considered as the best but this approach to problems poses the definitive problem of the profane active contribution to the enrichment of the objectives and results of scientific knowledge produced in the laboratory.

Typologies by Funtowicz (Funtowicz, 2008) and Callon (Callon, 2000) are quite similar, mainly taking into account the degrees of public involvement in the debate on technological risks and the ability of the public to force the expertise to a closer comparison and to influence policy decisions accordingly.

To conclude, also the models of conflict outlined in the literature refer essentially to these modes of public involvement.

A first model claims that the issues involved in environmental conflicts are so complex and marked by uncertainty that they are difficult to understand. It is believed, in this context, that detailed and quantitative analyses are necessary to assess risks, that people are not able to understand the technologies and methodologies used to monitor and control risks, and that the majority of public opinion involved in the conflict is ignorant and/ or subject to irrational fears (Kemeny, 1980)

A second model of conflicts emphasizes the *total distrust* of public opinion towards any type of expertise. In this case, people worried about environmental risks have learned not to trust expert knowledge because they are "servants" of the interests of powerful subjects (private, public or NGO). This type of mistrust undermines not only the technological projects of government agencies or large companies, but also the credibility of the scientific community. A generalized and widespread distrust emphasizes that interests deeply influence scientific knowledge, even those that come from public institutions.

A third model is the approach of *politics of interest*. This perspective of rational choice applied to decision-making processes on technology argues that political actors are naturally driven to manipulate uncertainties and ambiguities for their particular purposes. The knowledge of expertise is used politically and is constantly exploited in favour of the politicization of technical expertise. Indeed, disagreement among experts is not only used to challenge or promote preferred technological decisions but is often one of the main causes of the onset or intensification of conflict (Campbell, 1982). The disagreement between technicians therefore reflects "the normal process of polarization that must be foreseen in any intense controversy" (Manzur, 1981). By reducing environmental conflicts and the role of experts to simple variables of incontrovertible and irreconcilable interests, it is obvious that the choice or the imposition of choice depends on the power of the actors in the field. To this model of rational policies of interest, a more dynamic and complex view of technological conflicts can be substituted. The comparison of these risks is usually more complicated and less clear than it appears, even in the distribution of actors on the fronts of the promoters and opponents. The technological decisions are rarely adhering to a simple synoptic table of prevailing but autonomous social values. Technology is not neutral: "it always bears the imprint of the social anvil on which it was forged" (Schwartz and Thompson, 1990).

1.3.5 References

- Andrew C. and Goldsmith M. (1998), From Local Government to Local Governance – and Beyond?, *International Political Science Review*, 19, 2, 101-117;
- Beck U. (2000), *La società del rischio*, Carocci, Roma; ed. orig. 1986.
- Barnes B., Edge D., (Eds), 1982, *Science in Context*, Open University Press, Milton Keynes
- Bechmann G., Hronsky I., (eds.), 2003, *Introduction to Expertise and its Interfaces. The Tense Relationships of Science and Politics*, Edition Sigma, Berlin
- Berkes F., (1999), *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*, Taylor and Francis, Philadelphia
- Bobbio L. (2011), Conflitti territoriali: sei interpretazioni, in *TeMA. Journal of Land Use, Mobility and Environment*, n. 4, pp. 79-88.
- Callon M., (2000) Des différents formes de démocratie technique, *Les Cahiers de la sécurité intérieure*, 37-55
- Collins H. M., Evans R. (2002), “The Third Wave of Science Studies: Studies of Expertise and Experience”, *Social Studies of Science* 32/2, 235–296
- Dryzek J., (1997) *Rational Ecology*, Basil Blackwell, Oxford
- Fedi A., Mannarini T. (a cura di) (2008), *Oltre il Nimby. La dimensione psico-sociale della protesta contro le opere sgradite*, Milano, Franco Angeli.
- Funtowicz S. and Ravetz J. (2008), “Post-Normal Science”, in Cutler J. C. (Ed.), *Encyclopedia of Earth, Environmental Information Coalition, National Council for Science and the Environment*, Washington, D.C.
- Jones C., Hesterly W. S., Borgatti S. P., (1997) A General Theory of Network Governance: Exchange Conditions and Social Mechanisms, *Academy of Management Review*, 22, 4, 911-945;
- Kemeny JG, (1980), Saving American Democracy: The Lessons of Three Miles Island, *Technology Review*, No. 82, 1980, pp. 67-75
- Mayntz R. (1999) La teoria della governance: sfide e prospettive, *Rivista italiana di scienza politica*, 1, 3-21;
- Nelkin D. (1974), *Jetport: The Boston Airport Controversy*, Transaction Books, New Brunswick, N.J.
- Padovan D., Alietti A., Arrobbio O., (2011), Le opportunità discorsive dell’expertise nel conflitto sul Tav in Val di Susa, in Pellizzoni L. (a cura di), *Conflitti ambientali. Esperti, politica, istituzioni nelle controversie ecologiche*, Il Mulino, Bologna, 2011, pp. 235-258

Padovan D., Magnano M., (2011), Genesi e ruolo dell'expertise nelle controversie ambientali. Il caso del Tav in Val di Susa, in Pellizzoni L. (a cura di), *Conflitti ambientali. Esperti, politica, istituzioni nelle controversie ecologiche*, Il Mulino, Bologna, 2011, pp. 201-233.

Pellizzoni L. (ed) (2011) *Conflitti ambientali. Esperti, politica, istituzioni nelle controversie ecologiche*, Bologna, Il Mulino, pp. 129-145.

Powell W. W., (1990), Neither Market nor Hierarchy: Network Forms of Organization, in B. Staw and L. L. Cummings (Eds), *Research in Organization Behavior*, Greenwich, JAI Press, 295-336;

Schwarz, M., & Thompson, M. (1990). *Divided we stand: Redefining politics, technology, and social choice*. Philadelphia: University of Pennsylvania Press

Turner S., (2001), 'What is the Problem with Experts?', *Social Studies of Science*, 31, 1, pp. 123-49

Uzzi B. (1997) Social Structure and competition in interfirm networks: The paradox of embeddedness, *Administrative Science Quarterly*, n. 42, pp. 35-67

Yearley S. (1992a) "Skills, Deals and Impartiality: The Sale of Environmental Consultancy Skill and Public Perception of Scientific Neutrality", *Social Studies of Science*, vol. 22, n. 3, pp. 435-453;

Yearley S. (1992b) Green Ambivalence about Science: Legal Rational Authority and the Scientific Legitimation of a Social Movement, *British Journal of Sociology*, vol. 43, n. 4, pp. 511-532

Walker G., Devine Wright P., Hunter S., High H., Evans B., (2010), Trust and Community: Exploring the Meanings, Contexts and Dynamics of Community Renewable Energy, in *Energy Policy*, vol. 38, n. 6, pp. 2655-2663.

Ward H., (1996), Green Arguments for Local Democracy, in King D. and Stoker G. (Eds), *Rethinking Local Democracy*, Macmillan, London, 130-157

Wüstenhagen R. – Wolsink M. – Bürere M.J. (2007), Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept, in «*Energy Policy*», vol. 35, n. 5, pp. 2683-2691.

Wynne B. (1982) *Rationality and Rituality: The Windscale Inquiry and Nuclear Decisions in Britain*, British Society for the History of Science, Chalfont St Giles, Bucks

1.4 The relationships between consumers and companies in the development of RES projects

1.4.1 Stakeholder theory, corporate social responsibility (CSR) and consumers-outcome variables

Stakeholder Theory represents one of the most affirmed theories that foresee companies' active role in relating with their stakeholders (Freeman, 1994). "Stakeholder Theory frames firm management within a wider context and requires a reformulation of the corporate objectives" as well as strategies and practices (Sidhoum and Serra, 2017; Evans and Freeman, 1988), since the needs of companies' stakeholders – namely "employees, financiers, customers, employees, and communities" (Freeman, 1994) – should all be considered. Studies on stakeholder theory have already proved its effectiveness, since the generation of value for the different stakeholders have resulted in value generated also for shareholders (Pătări et al., 2011; Moneva et al., 2007). Stakeholder Theory is usually operationalised through the implementation of CSR best practices. Since its first conceptualization in 1953 (Bowen, 1953), the concept of CSR has been defined in numerous ways. While Friedman highlighted the purely economic nature of social responsibility (Friedman, 1962), Carroll (Carroll, 1979; Carroll, 1991) presented a four-dimension framework of corporate responsibilities, including economic, legal, ethical and philanthropic responsibilities (Brunk, 2010). Savitz and Weber (Savitz and Weber, 2006) underlined, instead, the protection of the environment, which should be pursued simultaneously to the improvement of the quality of life and without undermining companies' ability to remunerate shareholders (Brunk, 2010). According to Gendron (2002), one of the most comprehensive definitions of CSR was given by The Conference Board of Canada, stating that "CSR is the set of relationships that the firm has with all stakeholders: customers, employees, community, shareholders, governments, suppliers and competitors. The elements of social responsibility include investing in the community, the relationships with employees, creating and maintaining jobs, being concerned about the environment and financial performance" (Gendron, 2002). This definition underlines how the CSR concept fits perfectly, from a Stakeholder Theory perspective, in a different way of thinking and building companies' strategies and practices, reversing the business-as-usual perspective. By implementing CSR, companies are able to consider "the social and environmental consequences of their activities" (Dobele et al., 2014), while simultaneously accounting for the needs and expectations of their stakeholders (Benites-Lazaro and Mello-Thery 2017; Sachs and Ruhli 2011; Scherer et al., 2013; Suchman, 1995).

Despite the conceptualisation of CSR, it is unrealistic for firms to consider equally all stakeholders' needs and expectations (Dobele et al. 2014). The prioritisation of stakeholders represents a process in which companies account for the differences in stakeholder relationship as well as their attributes – such as their interests, their ability to pressure the firm, or to develop synergies, etc. (Dobele et al. 2014; Henriques and Sharma, 2005; Rowley, 1997; Onkila, 2011).

When considering stakeholders' prioritisation, consumers represent one of the groups with the highest priority. Consumers represent a key stakeholder for companies, since without their purchasing behaviour no business would be sustained. In addition, consumers are becoming more concerned about the impact of companies' activities on the social and natural environment, and they are increasingly demanding more socially responsible behaviours. In particular, consumers have become more sensitive when considering firms in controversial industries, in which social and environmental impacts are more likely to occur (Dobele et al. 2014). The energy sector represents a typical example, since social and environmental responsibility practices

have been often neglected in the past for competitive reasons. Nowadays, consumers do not accept a company taking advantage of its relationships with them – or other stakeholders or the environment – “nor they want to feel cheated due to egoistic CSR motivation” (Hur et al., 2014). “Among the high-profile examples are Gap and Nike (sweat-shop and child labour at manufacturing firms in Asia); Nestlé (aggressive marketing of baby-milk formula in Africa); Shell Oil (Brent Spar and the Niger Delta controversy)” (Brunk, 2010). In these cases, consumers’ boycotts have caused damages to the profitability of the company in the short-term – due to a loss of revenues – and in the long-term – due to damages to the image and reputation of the company –, by harming other product categories and/or brands in the companies' portfolio (Brunk, 2010). On the contrary, when a company performs a sincere social and environmentally friendly behaviour accounting for different stakeholders’ needs, consumers tend to be positive towards the company itself, and perform positive responses.

Numerous studies have analysed the phenomenon of CSR in the management literature. However, limited literature has paid attention to the mechanism of consumer’ responses to CSR practices (Su et al., 2017; Romani et al., 2013). In fact, when adopting the consumers’ perspective, studies tend not to use CSR practices in their measurements, but instead they use the perceptions consumers have about the CSR practices a company is implementing to form their beliefs, intentions and behaviour.

Due to the aforementioned theoretical outline and gap, we structured an explorative review focussing on the relationships between CSR and consumers’ responses. We proceeded as follow.

- We identified specific consumer’s responses – i.e. consumers-outcome variables – that are influenced by companies’ CSR practices. Taking inspiration from the conceptual model of Maden et al. (2012), we identified consumers’ satisfaction (CS), consumers’ loyalty towards the firm and consumers’ perceived corporate reputation. We presented a brief definition of each consumers-outcome variable, describing the impact of CSR on each of them regardless of the setting adopted in each study.
- We then focused our analysis on the commodity context, since it represents a context in which CSR could play a major role in influencing consumers’ responses.
- We finally addressed the energy industry as part of the commodity context, with energy being the most relevant commodity sector and in line with the overall aim of this document.

Ultimately, we give some insights about the possible linkages between the commodity- and the energy-context, and the consumers-outcome variable emerged in the literature.

Consumers’ satisfaction

Consumers’ satisfaction refers to an overall evaluation of a company’s product or service, resulting from a consumption experience (Park et al., 2017; Luo & Bhattacharya, 2006; Anderson et al., 2004; Fornell, 1992; Westbrook, 1987). From a theoretical standpoint, there are three ways that can explain the linkage between CSR and consumers’ satisfaction (Luo & Bhattacharya, 2006). The first relates to the definition of the “generalised customer”. By considering customers as a more general stakeholder interested in the overall standing of the company, they would be more likely to be satisfied by products or services from socially responsible companies (Luo & Bhattacharya, 2006; Martinez and Rodriguez-Del Bosque, 2013; Hsu, 2012). Secondly, consumers’ satisfaction of firms’ offerings can be, not surprisingly, enhanced when higher levels of

consumer-company identification are present (Luo & Bhattacharya, 2006). Since CSR has been proved to be antecedent of consumer-company identification, consumers' satisfaction would subsequently benefit from CSR initiatives (Luo & Bhattacharya, 2006; Hsu, 2012). Ultimately, the same consequential path can be applied to consumers' perceived value of firms' offerings: if a company implements CSR initiatives, consumers will be more likely to perceive higher value of its products or services (Luo & Bhattacharya, 2006; Martinez & Rodriguez-Del Bosque, 2013).

From an empirical point of view, numerous studies have proved the positive relation between CSR and consumers' satisfaction. Luo & Bhattacharya (2006) found a positive and significant influence of CSR and consumers' satisfaction, relying on data of the Fortune 500 companies. In addition, consumers' satisfaction was also a mediator in the relation between CSR and companies' market value. In the retail industry, Park et al. (2017) confirmed a positive and significant relation between consumers' beliefs of retailers' commitment to CSR and satisfaction, being enhanced also by consumers' trust. Other studies – considering both service and manufacturing industries – confirmed the positive and significant relation between CSR and consumers' satisfaction (Su et al., 2017; Park et al., 2017; Martinez and Rodriguez-Del Bosque, 2013; Hsu, 2012). It is worth mentioning that consumers' satisfaction was found to mediate the relation between CSR and consumers' loyalty (Su et al, 2017; Park et al, 2017; Martinez & Rodriguez-Del Bosque, 2013; Dean, 2002; DeWitt et al., 2008; Román, 2003), but not the relationships between CSR and consumers' perceived corporate reputation (Hsu, 2012; Andrews et al., 2004; Baron and Kenny, 1986; Holmbeck, 1997; Luo and Bhattacharya 2006).

Consumers' loyalty

Previous researches have suggested that consumers would be interested not only on their mere purchasing behaviour, but also in the "CSR activities being pursued by the companies whose product/services they buy" (Swaen & Chumpitaz, 2008). The literature that studies the impact of CSR activities – and/or consumers' perception of them – in influencing consumers' loyalty in purchasing/using a product/service refers to this view.

Consumers' loyalty represents a two-dimension concept, being formed by behavioural and attitudinal loyalty (Inoue et al., 2017; Harris and Goode, 2004; Perez et al., 2013). Behavioural loyalty refers to a repeated purchase/use of a product or service over a period of time (Inoue et al., 2017; Kumar and Shah, 2004; Leenheer et al., 2007). In addition, behavioural loyalty can be also linked to positive words-of-mouth (WOM), which relates to the consumers' willingness to recommend the product/service. Even though indicative of a behavioural option, behavioural loyalty can be performed simply due to lack of alternatives and, in that case, just a partial representation of the overall concept of loyalty would be provided (Perez et al., 2013). A broader and more complete conceptualisation of loyalty considers also the attitudinal loyalty, which refers to the cognitive, affective and conative elements of loyalty (Brunk, 2010; Harris and Goode, 2004; Kumar and Shah, 2004). The first refers to the preferability of a product/service over others. The second considers the favourable attitude towards the product/service given by a repeated use. The third relates to the forming of a behavioural intention towards the product/service, with a deeper level of commitment (Brunk, 2010; Harris & Goode, 2004; Hennig-Thurau et al., 2002; Janda et al., 2002; Zeithaml et al., 1996).

Numerous studies have analysed consumers' loyalty with respect to the effect of companies' CSR actual practices or consumers' perception of them.

When considering the former, some studies found the relation between CSR and consumers' loyalty to be mediated by additional constructs. Huang and Cheng (2016) identified a positive and significant impact of consumers' CSR associations on consumers' loyalty, via the mediation of consumer-corporate identification and the moderating role of consumers' involvement. In their contribution, consumers' loyalty can be enhanced by investment in CSR practices, leveraging on consumer-corporate identification to increase consumers' willingness to repurchase, recommend and say positive things about hospitality and financial services (Huang and Chen, 2016). Similarly, Martinez and Rodriguez-Del Bosque (2013) identified a positive and significant relation with regard to CSR association and consumers' loyalty in the hotel industry, with the mediation of CCI and the additional constructs of consumers' trust and consumers' satisfaction – traditionally considered antecedent of loyalty (Martinez and Rodriguez-Del Bosque, 2013). "Customers are more likely to believe that responsible companies operate honestly in their activities and reflect interests of both parties in the relationships when making decisions, which contribute to the trustworthiness and honesty of these companies and the satisfaction of customers" (Martinez and Rodriguez-Del Bosque, 2013). In slight contrast with Huang and Chen (2016), Inoue et al. (2017) used both consumers' involvement and consumers' commitment as mediators of the relationships between perceived CSR and consumers' loyalty. In the context of a professional US sport, perceived CSR was found to positively influence consumers' loyalty in attending football games. While consumers' involvement positively mediates the relation between perceived CSR and loyalty, the indirect effect of perceived CSR turns negative when the effect of involvement on loyalty is mediated by commitment (Inoue et al., 2017). Consumers' commitment was also used by Lacey and Kennet-Hensel (2011) to mediate, along with consumers' trust, the relation between perceived CSR and consumers' loyalty – operationalised according to different dimensions of loyalty like WOM, level of repurchase and follow performance. The relation was fully mediated, and the effect of perceived CSR on commitment and commitment on loyalty towards attending games of an NBA team strengthened over time (Lacey and Kennet-Hensel, 2011). Consumers' trust was also used by Pivato et al. (2008) to mediate the positive relation between perceived CSR and consumer' brand loyalty, in the context of Italian food chains. The relation as well as the mediation effect were confirmed. The mediating role of both consumers' trust and consumers' satisfaction was confirmed by other studies, such as Román (2003) and Park et al. (2017). While the first operated within the financial industry (Román, 2003), the second considered these relationships in the retail industry, highlighting how CSR commitment positively influenced both trust and satisfaction (Park et al., 2017). The sole mediating role of satisfaction was tested in the relation between CSR associations and WOM and loyalty intention by Walsh and Bartikowski (2013). They confirmed the positive relationships, focussing on consumers of retail firms in US and Germany. Ultimately, Plewa et al. (2015) used CSR image and firm image as mediators between perceived CSR – referring to a specific sphere of CSR, namely corporate volunteering – and loyalty – in its components. The relation is proved to be positive, and CSR image strengthens loyalty (Plewa et al. 2015).

When considering the latter – i.e. the effect on consumer loyalty of consumers' perception of CSR practices –, various studies highlighted a direct and positive effect.

In the context of professional sports in US, Lacey et al. (2015) found a direct positive influence of perceived CSR on WOM for attending games of an NBA team. Another study performed in the US is that of Lichtenstein et al. (2004). They carried out the study in the US national food chain, finding a positive direct relationships between perceived CSR and perceptual corporate benefit – a concept measured also by attitudinal loyalty. By using a mix of different companies, Lee et al. (2012) and Stanaland et al. (2011) confirmed the positive relation between perceived CSR and consumers' loyalty, finding other significant positive relationships between perceived CSR and consumer-corporate identification, and perceived CSR and consumers' trust and

consumers' perceived corporate reputation respectively. Ultimately, Maden et al. (2012) confirmed a direct positive relation between perceived CSR and consumers' loyalty, studying firms belonging to very different industries – airlines, telecommunication, and banking.

The literature extensively supports the relation between CSR and consumers' loyalty in a wide variety of forms, either directly or indirectly. By consolidating such positive relation, we also support the stream of research that foresees CSR as a driver for increasing firms' financial performance and market value. More intense will be the loyalty of consumers towards socially responsible firms; more likely such firms would perform financially better in the long term (e.g., Lacey and Kennett-Hensel, 2011; Brammer and Millington, 2008; Wang et al., 2005). In a similar vein, firms can enhance their market value by using CSR. Even though firms can reach potential economic gains, the aforementioned relationships are usually not univocal. While some researchers suggested that superior financial performance is delivered primarily due to reputation effects (Plewa et al, 2015), others affirmed that the relation between CSR and market value is mediated by, for example, consumers' satisfaction (Luo and Bhattacharya, 2006). As a consequence, firms should acknowledge the value of CSR practices with respect to consumers, even though they should pay attention to their implementation, due to the multiple impacts – both at a consumer and at a corporate level – CSR is able to express.

Consumers' perceived corporate reputation

Corporate reputation can be defined as a perceptual construct, since “it resides in the minds of stakeholders” (Lin-Hi and Blumberg, 2016), referring to their overall evaluation of a company (Lin-Hi and Blumberg, 2016; Deephouse, 2000; Dowling and Moran, 2012). In particular, we focused on a consumer-based corporate reputation, defined as “the customer's overall evaluation of a firm based on his or her reactions to the firm's goods, services, communication activities, interactions with the firm and/or its representatives or constituencies (such as employees, management, or other customers) and/or known corporate activities” (Walsh and Beatty, 2007). In the literature, the establishment of a positive link between perceived CSR and consumers' perceived corporate reputation is usually based on signalling theory (Lin-Hi and Blumberg, 2016). In practice, it is assumed that implementing CSR practices allows companies to signal favourable characteristics, such as that the company is “reliable and honest” (McWilliams and Siegel 2001, p. 120), and cares about stakeholders' – and society's at large – needs (Lin-Hi and Blumberg, 2016; Bhattacharya et al., 2009; Jones and Murrell, 2001).

According to the literature, various studies have analysed the relation between perceived CSR and perceived corporate reputation from a consumer perspective, finding both direct and indirect paths.

Regarding the first type of path, Engizek and Yaşin (2017) found a direct and positive relation between the perception of CSR and the perception of corporate reputation, assessed by consumers in the context of bank industry. Consumers' perceived corporate reputation was not the outcome variable of the model, and it mediated the relationships between CSR and affective commitment, reflecting a sense of involvement with the service provider (Engizek & Yaşin, 2017). In the study of Lai et al. (2010), consumers' perceived corporate reputation assumed a similar role as in the one of Engizek and Yaşin (2017). The direct and positive relation between perceived CSR and consumers' perceived corporate reputation was confirmed, as well as its mediating role, considering a context of Taiwanese manufacturing and service companies. Brand performance was the outcome variable of the model, and it was influenced indirectly by perceived CSR via consumers' perceived corporate reputation. Pfau et al. (2008) assessed the impact of a CSR campaign

performed by two companies considered best-in-class, such as Johnson & Johnson and McDonald. The three outcome variables – consumers' perceived corporate reputation, corporate image and corporate credibility – were all directly and positively influenced (Pfau et al., 2008). In their study, Su et al. (2017) carried out an empirical analysis focussing on the setting of the hotel industry. They found that CSR positively and directly influenced consumers' satisfaction and consumers' perceived corporate reputation, with the latter being stronger than the former (Su et al., 2017). Moreover, consumers' perceived corporate reputation influenced positively and indirectly loyalty intentions, via the mediation of consumer commitment (Su et al. 2017). Ultimately, Turban & Greening (1997) focused on CSR by using a corporate financial performance (CFP) rating. They found higher CFP in companies with higher reputation and higher attractiveness towards potential employees (Turban and Greening, 1997).

Considering the second type of path, Hsu (2012) and Lee et al. (2017) found consumers' perceived corporate reputation being influenced by perceived CSR simultaneously in a direct and indirect way. In the case of the indirect path, the former contribution considered consumers' satisfaction, while the latter brand image (Hsu, 2012; Lee et al., 2017). Both researches were carried out in the context of insurance industry, the former focussing on life-insurance while the latter on non-life insurance (Hsu, 2012; Lee et al., 2017). Similarly, Fatma et al. (2015) identified a direct and indirect influence of perceived CSR on consumers' perceived corporate reputation in the context of retail banking, with consumers' trust as mediator of the relationships. Ultimately, Park et al. (2014) analysed the relationships between CSR and consumers' perceived corporate reputation, having consumers' trust as a mediator variable and economic, ethical, legal and philanthropic responsibilities as dimensions of CSR. While economic and legal responsibilities had direct impact on consumers' perceived corporate reputation, the effect of ethical and philanthropic responsibilities was fully mediated by trust (Park et al., 2014).

The literature extensively supports the relation between perceived CSR and consumers' perceived corporate reputation, grounding on the assumption of signalling theory. By consolidating such positive relation, we also support the stream of research that foresees CSR as a driver for having a strong brand performance. Since the reputation serves “as a signal for the underlying quality of a firm's products and services” (Lai et al., 2010), consumers – and stakeholder in general – would be more likely to maintain relationships with a firm perceived as having a high reputation (Lai et al., 2010; Roberts and Dowling, 2002), thus fostering its financial gains. Despite potential economic gains, the aforementioned relationships are usually not univocal, since mediating (or even moderating) variables can be present. As a consequence, firms should acknowledge the value of CSR practices with respect to consumers, even though they should pay attention to their implementation.

1.4.2 The commodity perspective: towards the energy context

Commodities represent a different setting as compared with the ones considered in the previous paragraph. Commodities conventionally identify “raw materials and basic foodstuffs – such as bananas, cotton, coal, [...] etc. – that are extracted or grown in one area of the world and sold on the world market for industrial or consumer use elsewhere” (Ngai and Nola, 2012). In practice, a commodity is an economic good (or service) that is characterised by a full (or substantial) fungibility, meaning that it is traded by considering the instances of the product (or service) as equivalent (or nearly equivalent), regardless to who has produced it. As a consequence, the price becomes the main driver upon which basing the decision to purchase or not the

commodity product (or service). The price of a commodity is typically established as a function of its market as a whole which is traded both in spot and derivative markets.

Previous research has demonstrated a positive effect of CSR practices on consumer-outcome variables in a wide variety of settings (Engizek and Yaşın, 2017; Huang and Chen, 2016; Inoue et al., 2017; Lacey and Kennet-Hensel, 2010; Pivato et al., 2008; Kim, 2015). However, firms may still be reluctant in investing in CSR initiatives, since “the payoff from socially responsible programs is not guaranteed and may take time” (Mohr and Webb 2005, p. 122). Instead of being proactive in the implementation of CSR, they can decide to adopt what it could appear as a safer and easier approach, meaning the implementation of *passive CSR* by merely complying with social and environmental mandatory standards (Kim, 2015). Especially in non-commodity industries, companies can rely on additional factors – such as product features and consumers’ beliefs about the product (or service) – that can still allow the establishment of positive relationships between themselves and consumers, reducing the potential importance of CSR practices to this aim. As a matter of fact, Kim (2011) found that CSR practices implemented in industries “with risk-related offerings (information and technology industry), have much weaker influences on product evaluation compared to other industries” (Kim, 2015). Contrarily to this premise, in commodity-based context, the price represents the main factor through which companies can compete as well as establish positive relationships between themselves and consumers, distinguishing their product (or service) from others. In such context, CSR practices could represent an additional factor of recognisability, helping companies in fostering positive relationships with consumers. Since the generalisability and accuracy of CSR studies results could be enhanced by having a focus on a specific industry – e.g. setting – (Kim, 2015; Guthrie et al., 2008), we reviewed the literature by considering studies accounting for the relation between CSR and consumer-outcome variables in a commodity-setting.

The research of Kim (2015) considered a typical commodity-setting: food. In particular, the author analysed consumers’ reactions “to the food industry’s environmental CSR approaches by varying levels of CSR and price as CSR trade-offs” (Kim, 2015). The author limited the analysis at the environmental CSR practices, since the stakeholder of the food service industry considered them the most important ones (Kim, 2015; Kassinis and Vafeas, 2006; Welford et al., 2007). Moreover, the author varied product prices and (environmental) CSR levels, identifying passive and proactive ones. While the former regards the mere compliance with laws simply fulfilling companies’ economic and legal responsibilities (Carroll, 1979), the latter refers to the adoption of voluntarily practices supporting economic, social and environmental development outreaching government regulations (Kim, 2015; Torugsa et al. 2012). Ultimately, the three dependent variables of the study were attitude towards the company, supportive communication intention and purchase intention. The first regards the favourability or unfavourability of consumers’ evaluation about the company, and it is considered as an antecedent of consumers’ loyalty as well as behavioural intentions (Kim, 2015). The second refers to positive behaviours towards communication intentions – i.e. information seeking and WOM – about CSR practices from consumers (Kim, 2015; Bhattacharya and Sen, 2003). The third relates to the consumers’ favourable intentions to prefer and pay more for products from the company engaging in CSR practices (Kim, 2015, Brown and Dacin 1997).

The findings show a stronger positive effect of proactive CSR approaches on attitude towards the company, purchase intentions and communication intentions than passive ones. Individuals attributed greater value to environmentally sustainable companies and its products (Bhattacharya and Sen, 2003; Mohr and Webb, 2005), pronouncing their competitive advantage as compared with companies that do not actively commit to CSR. In addition, increases in product prices are more likely to generate their effect in the passive CSR condition than in the proactive one, suggesting that proactive behaviour is able “to compensate for higher

prices in terms of supportive intentions and purchase intentions” (Kim, 2015). However, when considering attitude towards the company, price still represents an important determinant in consumers’ decision, since consumers privileged companies “that charge cheaper prices across proactive and passive CSR conditions” (Kim, 2015). Ultimately, a possible backlash of a passive CSR approach was identified. When passive CSR approach is combined to cheaper prices, consumers showed the weakest purchasing intention. “That is, individuals do not appreciate cheaper prices when a firm takes a passive approach and simply adheres to the minimum required by the law/regulations to meet society’s demands for environmental responsibility” (Kim, 2015). This could be due to the lower levels of environmental concern and fewer supply chain long-term strategies for which the food industry has been criticised (Kim, 2015).

From this study it is emerged that price still plays an important role in the commodity-based context. However, CSR practices – even though limited only on environmental practices – represent a relevant factor of companies’ recognisability for consumers. In particular, the positive effect of proactive CSR on attitude towards the company, purchase intentions and communication intentions underline the importance of companies’ proactiveness in the environmental domains, as well as in an adequate communication towards consumers, a basic assumption behind the positive effects of proactive CSR (Kim, 2015).

The energy context

Companies belonging to the energy sector are increasingly being pressured by stakeholders – such as policy makers, international organisations, consumers, etc. – to effectively tackle their social and environmental impacts. In fact, the energy sector represents one of the most impacting sectors in terms of affecting the social and natural environment, being also considered as a “dirty sector” (Miras-Rodriguez et al., 2015; Mio, 2010; Kerckhoffs and Wilde-Ramsing, 2010). In addition, energy is a commodity. Likewise the companies of the food industry within the previous paragraph, energy companies could experience similar consequences in their relationship with consumers when adopting CSR practices. Accordingly, we reviewed the literature by considering studies accounting for the relation between CSR and consumer-outcome variables focussing not only on the broader spectrum of commodities, but with lens towards the energy-setting.

In their study, Pritchard and Wilson (2017) examined consumers’ responses to a new wind farm – that is, a product that “offers environmentally sustainable features” (i.e. a Green New Product, GNP) (Olsen et al., 2014: pp.119) – and their impact on the energy service company’s reputation – i.e. a centennial US energy utility. They found consumers’ product-performance evaluation as significantly explaining the service company’s reputation: thus, perceiving products (or services) of good quality, determine positive corporate reputation (Pritchard and Wilson, 2017). In addition, “consumers who saw a strong relationships between the energy utility and the GNP lowered their overall evaluation” (Pritchard & Wilson, 2017). This could be due to the long-standing fossil-fuels-based experience of the company. However, dual level communication strategies are preferable when introducing and positioning GNP (Pritchard & Wilson, 2017). Communication aspects emerged with great importance also in the contribution of Vries et al. (2015). Their study analysed “when and why people might respond negatively to energy companies that engage in CSR activities in the environmental domain” (Vries et al., 2015). In particular, they examined when consumers may suspect of corporate greenwashing, considering the case of an energy company communicating – based on environmental (public-serving) motives or economic (firm-serving) motives – its investment in the development of a CO₂ emission reduction technology. They found that consumers are very suspicious about

energy companies communicating environmental motives for investing in environmental measures (Vries et al., 2015), since they expect firms to operate following firm-serving motives – such as profit maximization and image enhancement (Vries et al., 2015). By adopting public-serving motives, company's reputation is unlikely to improve, since consumers perceive the communications as rhetoric (Vries et al., 2015). Contrarily, consumers suspected less when the energy company communicates firm-serving motives for investing in an emission reduction technology (Vries et al., 2015). Ultimately, the results strengthen – although indirectly – the stream of research that foresees a relation between corporate tactics and the public. Knowing about corporate tactics influences individuals' attitude towards the company (Friestad and Wright, 1994), "which, in turn, may influence whether or not people endorse the positions advocated by these companies" (Vries et al., 2015). If consumers thus believe that a company's investment is an act of greenwashing, "this may not only affect reactions to the organization, but also attitudes to this climate change mitigation technology itself" (Vries et al., 2015).

From these studies some insights can be gained. One of the most interesting insights is that both studies highlight an influence of consumers' perception of companies' features – i.e. company's reputation and company's act of greenwashing respectively – on the technology the company is investing on. This effect should be highly considered, since the acceptability of the technology a company wants to use is linked to what people think about the company itself – if it has a good reputation – or to what people think about the company's behaviours – if it is doing or not greenwashing. Moreover, energy companies need to communicate their CSR efforts very carefully: even though, in the commodity context, a proactive CSR approach always had positive effects (or at least non-negative), the consumers' perception of greenwashing represents a concrete issue, not only for the company itself but also for the technology. By taking insights from the commodity context, energy companies should also be very careful in just limiting their actions to be compliant with the law – i.e. passive CSR –, since the co passive CSR and cheaper prices determine potential backlash. To conclude, the path towards an effective CSR is full of risks for energy companies: especially the communication aspect emerged as critical. Additional studies are needed to fully explore the implications of such communication aspect on other consumers-outcome variables, as well as other company-based aspects towards the consumers-outcome variables identified in literature.

1.4.3 Emerging trends between CSR, consumers-outcome variables and the commodity realm

By jointly looking at both the review of CSR and consumers-outcome variables, and the ones for the commodity- and energy- context, some similarities emerged. Even though some indication can be given, attention should be paid in the attempt of generalizability, since we found too few studies regarding the commodity- and energy- context.

Consumers' perceived corporate reputation is positively affected by product/service quality, and this linkage can be confirmed in all settings. We can affirm that the relation – at least for the energy-context – is direct and not mediated. This finding remarks the importance of reputation "as a signal for the underlying quality of a firm's products and services" (Lai et al., 2010), which also impact customers' satisfaction. Also, in the energy-context, it would be more likely to maintain relationships with a firm perceived as having a high reputation (Lai et al., 2010; Roberts and Dowling, 2002), thus fostering its financial gains. Moreover, in the commodity-context – and by extension also it could be, in theory, applicable in the energy-context – we can highlight positive influences of CSR towards attitude towards the company, communication intentions and

purchase intentions. This is consistent with previous literature that sees CSR positively influencing consumers' loyalty. In fact, positive attitude towards the company, positive communication intentions and positive purchase intentions can be associated with positive repurchase intentions, as well as positive WOM – which is consolidated as being a proxy of loyalty. Ultimately, the findings within the commodity- and energy- context found support, for the most part, within the unspecific-context literature. However, the fact that the energy-context studies highlight an influence of consumers' perception of companies' features on the technology the company is investing on should be remarked. This is quite new, and we have not found studies recalling such linkage. Accordingly, additional research is needed to better comprehend such relation and its implications.

1.4.4 References

- Anderson, Eugene W., Claes Fornell, and Sanal K. Mazvancheryl (2004), "Customer Satisfaction and Shareholder Value," *Journal of Marketing*, 68 (October), 172-85.
- Andrews, J. C., Netemeyer, R., Burton, S., Moberg, P., & Christensen, A. (2004). Understanding adolescent intentions to smoke: An examination of relationships among social influences, prior trial behaviors, and antitobacco campaign advertising. *Journal of Marketing*, 68(4), 110–123.
- Baron, R. M., & Kenny, D. A. (1986). The moderator- mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173–1182.
- Benites-Lazaro, L. L., Mello-Théry, N. A. (2017). CSR as a legitimatizing tool in carbon market: Evidence from Latin America's Clean Development Mechanism. *Journal of Cleaner Production*, 149, 218-226
- Bhattacharya, C. B., Korschun, D., & Sen, S. (2009). Strengthening stakeholder-company relationships through mutually beneficial corporate social responsibility initiatives. *Journal of Business Ethics*, 85(2), 257–272.
- Bhattacharya, C. B., & Sen, S. (2003). Consumer–company identification: A framework for understanding consumers' relationships with companies. *Journal of Marketing*, 67(2), 76-88
- Bowen HR. (1953). *Social responsibility of the businessman*. NewYork, NY: Harper and Brothers.
- Brammer, S., Millington, A., (2008), 'Does it Pay to be Different? An Analysis of the Relationships Between Corporate Social and Financial Performance', *Strategic Management Journal* 29(12), 1325–1343
- Brown, T., & Dacin, P. (1997). The company and the product: Corporate associations and consumer product responses. *Journal of Marketing*, 61, 68–84.
- Brunk, K. H. (2010). Exploring origins of ethical company/brand perceptions—A consumer perspective of corporate ethics. *Journal of Business Research*, 63(3), 255-262
- Carroll AB. (1979). A three-dimensional model of corporate performance. *Academy of Management Review*;4(4):497–505.
- Carroll AB. (1991). The pyramid of corporate social responsibility: toward the moral management of organizational stakeholders. *Business Horizon*;34(4):39–48.
- Dean, A. M. (2002). Service quality in call centres: Implications for customer loyalty. *Managing Service Quality: An International Journal*, 12(6), 414–423
- Deephouse, D. L. (2000). Media reputation as a strategic resource: An integration of mass communication and resource-based theories. *Journal of Management*, 26(6), 1091–1112

DeWitt, T., Nguyen, D. T., & Marshall, R. (2008). Exploring customer loyalty following service recovery: The mediating effects of trust and emotions. *Journal of Service Research*, 10(3), 269–281.

Dobele, Angela R., Kate Westberg, Marion Steel, and Kris Flowers. (2014). "An examination of corporate social responsibility implementation and stakeholder engagement: A case study in the Australian mining industry." *Business Strategy and the Environment* 23, no. 3: 145-159

Dowling, G. R., Moran, P. (2012). Corporate reputations: Built in or bolted on?, *California Management Review*, 54(2), 25–42.

Engizek, N., & Yasin, B. (2017). How CSR and overall service quality lead to affective commitment: mediating role of company reputation. *Social Responsibility Journal*, 13(1), 111-125

Evans, W.M., Freeman, R.E., (1988). A Stakeholder Theory of the Modern Corporation: Kantian Capitalism. *Ethical Theory and Business*. T. Beauchamp and N. Bowie.

Fatma, M., Rahman, Z., & Khan, I. (2015). Building company reputation and brand equity through CSR: the mediating role of trust. *International Journal of Bank Marketing*, 33(6), 840-856

Fornell, C., (1992), "A National Customer Satisfaction Barometer: The Swedish Experience", *Journal of Marketing*, 6 (January), 1-21

Freeman, R. E. (1994). The politics of stakeholder theory: Some future directions. *Business Ethics Quarterly*, 409-421

Friedman M., (1962). *Capitalism and Freedom*. Chicago, IL: University of Chicago Press.

Friestad M, Wright P. (1994). The persuasion knowledge model: How people cope with persuasion attempts. *Journal of Consumer Research* 21: 1–31. DOI: 10.1086/209380

Gendron, C. (2002). Envisager la responsabilité sociale dans le cadre des régulations portées par les nouveaux mouvements sociaux économiques Les cahiers de la Chaire—collection recherche No 01-2002

Guthriea, J., Cuganesanb, S., & Ward, L. (2008). Industry specific social and environmental reporting: The Australian Food and Beverage Industry. *Accounting Forum* 32, 1–15

Harris, L. C., Goode, M. M. (2004). The four levels of loyalty and the pivotal role of trust: a study of online service dynamics. *Journal of retailing*, 80(2), 139-158

Hennig-Thurau, Thorsten, & Klee, Alexander. (1997). The impact of customer satisfaction and relationships quality on customer retention: A critical reassessment and model development. *Psychology and Marketing*, 14(8), 737–764.

Henriques I, Sharma S. (2005). Pathways of stakeholder influence in the Canadian forestry industry. *Business Strategy and the Environment* 14(6): 384–398.

Holmbeck, G. N. (1997). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. *Journal of Consulting and Clinical Psychology*, 65(4), 599–610.

Hsu, K. T. (2012). The advertising effects of corporate social responsibility on corporate reputation and brand equity: Evidence from the life insurance industry in Taiwan. *Journal of Business Ethics*, 109(2), 189–201

Huang, M. H., & Cheng, Z. H. (2016). Strategies to enhance consumers' identification with a service firm. *Journal of Services Marketing*, 30(4), 449–461

Hur, W. M., Kim, H., & Woo, J. (2014). How CSR leads to corporate brand equity: Mediating mechanisms of corporate brand credibility and reputation. *Journal of Business Ethics*, 125(1), 75–86

Inoue, Y., Funk, D. C., & McDonald, H. (2017). Predicting behavioral loyalty through corporate social responsibility: The mediating role of involvement and commitment. *Journal of Business Research*, 75, 46–56

Janda, Swinder, Trocchia, Philip J., & Gwinner, Kevin P. (2002). Consumer perceptions of internet retail service quality. *International Journal of Service Industry Management*, 13(5), 412–431.

Jones, R., Murrell, A. J. (2001). Signaling positive corporate social performance: An event study of family-friendly firms. *Business and Society*, 40(1), 59–78.

Kassinis, G., Vafeas, N. (2006). Stakeholder pressures and environmental performance. *The Academy of Management Journal*, 49, 145–159.

Kerckhoffs T, Wilde-Ramsing J. (2010). European Works Councils and Corporate Social Responsibility in the European Energy Sector. Stichting Onderzoek Multinationale Ondernemingen: Netherlands.

Kim, Y. (2015). Consumer responses to the food industry's proactive and passive environmental CSR, factoring in price as CSR tradeoff. *Journal of Business Ethics*, 140(2), 307–321

Kim, S. (2011). Transferring effects of CSR strategy on consumer responses: The synergistic model of corporate communication strategy. *Journal of Public Relationships Research*, 23, 218–241.

Kumar, V., Shah, D. (2004). Building and sustaining profitable customer loyalty for the 21st century. *Journal of Retailing*, 80(4), 317–329. <http://dx.doi.org/10.1016/j.jretai.2004.10.007>.

Lacey, R., Kennett-Hensel, P. A. (2011). Longitudinal effects of corporate social responsibility on customer relationships. *Journal of Business Ethics*, 97(4), 581–597

Lacey, R., Kennett-Hensel, P. A., & Manolis, C. (2015). Is corporate social responsibility a motivator or hygiene factor? Insights into its bivalent nature. *Journal of the Academy of Marketing Science*, 43(3), 315-332

Lai, C. S., Chiu, C. J., Yang, C. F., & Pai, D. C. (2010). The effects of corporate social responsibility on brand performance: The mediating effect of industrial brand equity and corporate reputation. *Journal of Business Ethics*, 95(3), 457-469

Lee, C. Y., Chang, W. C., & Lee, H. C. (2017). An investigation of the effects of corporate social responsibility on corporate reputation and customer loyalty—evidence from the Taiwan non-life insurance industry. *Social Responsibility Journal*, 13(2), 355-369

Lee, E. M., Park, S. Y., Rapert, M. I., & Newman, C. L. (2012). Does perceived consumer fit matter in corporate social responsibility issues? *Journal of Business Research*, 65(11), 1558-1564

Leenheer, J., van Heerde, H. J., Bijmolt, T. H. A., & Smidts, A. (2007). Do loyalty programs really enhance behavioral loyalty? An empirical analysis accounting for self-selecting members. *International Journal of Research in Marketing*, 24(1), 31–47. <http://dx.doi.org/10.1016/j.ijresmar.2006.10.005>.

Lichtenstein, D. R., Drumwright, M. E., & Braig, B. M. (2004). The effect of corporate social responsibility on customer donations to corporate-supported nonprofits. *Journal of Marketing*, 68(4), 16-32

Lin-Hi, N., Blumberg, I. (2016). The link between (not) practicing CSR and corporate reputation: Psychological foundations and managerial implications. *Journal of Business Ethics*, 1-14

Luo, X., & Bhattacharya, C. B. (2006). Corporate social responsibility, customer satisfaction, and market value. *Journal of Marketing*, 70(4), 1–18.

Maden, C., Arıkan, E., Telci, E. E., & Kantur, D. (2012). Linking corporate social responsibility to corporate reputation: a study on understanding behavioral consequences. *Procedia-Social and Behavioral Sciences*, 58, 655-664

Martínez, P., Rodríguez del Bosque, I. R. (2013). CSR and customer loyalty: The roles of trust, customer identification with the company and satisfaction. *International Journal of Hospitality Management*, 35, 89-99

McWilliams, A., & Siegel, D. S. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, 26(1), 117–127.

Mio C. (2010). Corporate social reporting in Italian multi-utility companies: an empirical analysis. *Corporate Social Responsibility and Environmental Management* 17(5): 247–271. DOI: 10.1002/csr.2

- Miras-Rodríguez, M. D. M., Carrasco-Gallego, A., & Escobar-Pérez, B. (2015). Has the CSR engagement of electrical companies had an effect on their performance? A closer look at the environment. *Business Strategy and the Environment*, 24(8), 819-835
- Mohr, L., & Webb, D. (2005). The effects of corporate social responsibility and price on consumer responses. *The Journal of Consumer Affairs*, 39, 121–147.
- Moneva JM, Rivera-Lirio JM, Muñoz-Torres MJ. (2007). The corporate stakeholder commitment and social and financial performance. *Industrial Management & Data Systems* 107(1): 84–102. DOI: 10.1108/02635570710719070
- Ngai, M., & Nolan, M. (2012). Labor and Global Commodities: Introduction. *International Labor and Working-Class History*, 81, 4-7
- Olsen, M., R. Slotegraaf, and S. Chandukala. (2014). Green claims and message frames: How green new products change brand attitude. *Journal of Marketing* 78(3): 119–137
- Onkila T. (2011). Multiple forms of stakeholder interaction in environmental management: business arguments regarding differences in stakeholder relationships. *Business Strategy and the Environment* 20(6): 379–393.
- Park, J., Lee, H., & Kim, C. (2014). Corporate social responsibilities, consumer trust and corporate reputation: South Korean consumers' perspectives. *Journal of Business Research*, 67(3), 295-302
- Park, E., Kim, K. J., & Kwon, S. J. (2017). Corporate social responsibility as a determinant of consumer loyalty: An examination of ethical standard, satisfaction, and trust. *Journal of Business Research*, 76, 8-13.
- Pätäri, S., Jantunen, A., Kyläheiko, K., & Sandström, J. (2012). Does sustainable development foster value creation? Empirical evidence from the global energy industry. *Corporate Social Responsibility and Environmental Management*, 19(6), 317-326
- Pérez, A., del Mar García de los Salmones, M., & Rodríguez del Bosque, I. (2013). The effect of corporate associations on consumer behaviour. *European Journal of Marketing*, 47(1/2), 218-238
- Pfau, M., Haigh, M. M., Sims, J., & Wigley, S. (2008). The influence of corporate social responsibility campaigns on public opinion. *Corporate Reputation Review*, 11(2), 145-154
- Pivato, S., Misani, N., & Tencati, A. (2008). The impact of corporate social responsibility on consumer trust: the case of organic food. *Business ethics: A European review*, 17(1), 3-12.
- Plewa, C., Conduit, J., Quester, P. G., & Johnson, C. (2015). The impact of corporate volunteering on CSR image: A consumer perspective. *Journal of Business Ethics*, 127(3), 643-659

Pritchard, M., & Wilson, T. (2018). Building corporate reputation through consumer responses to green new products. *Journal of Brand Management*, 25(1), 38-5

Roberts, P. W., Dowling, G. R., (2002), 'Corporate Reputation and Sustained Superior Financial Performance', *Strategic Management Journal* 23, 1077–1093.

Román, S. (2003). The impact of ethical sales behaviour on customer satisfaction, trust and loyalty to the company: An empirical study in the financial services industry. *Journal of Marketing Management*, 19(9-10), 915-939

Romani, S., Grappi, S., Bagozzi, R.P., (2013). Explaining consumer reactions to corporate social responsibility: the role of gratitude and altruistic values. *Journal of Business Ethics* 114 (2), 193–206.

Rowley TJ. (1997). Moving beyond dyadic ties: a Network Theory of stakeholder influences. *Academy of Management Review* 22(4): 887–911.

Sachs, S., Rühl, E., (2011). Stakeholders Matter: a New Paradigm for Strategy in Society, First. ed. Cambridge University Press, New York.

Savitz AW, Weber K.; (2006). The Triple Bottom Line: How Today's Best-run Companies Are Achieving Economic, Social and Environmental Success – And How You Can Too San Francisco, CA: John Wiley & Sons.

Scherer, A.G., Palazzo, G., Seidl, D., (2013). Managing legitimacy in complex and heterogeneous environments: sustainable development in a globalized world. *Journal of Management Studies* 50, 259e284

Sidhoum, A. A., & Serra, T. (2017). Corporate social responsibility and dimensions of performance: An application to US electric utilities. *Utilities Policy*, 48, 1-11

Stanaland, A. J., Lwin, M. O., & Murphy, P. E. (2011). Consumer perceptions of the antecedents and consequences of corporate social responsibility. *Journal of Business Ethics*, 102(1), 47-55

Su, L., Pan, Y., & Chen, X. (2017). Corporate social responsibility: Findings from the Chinese hospitality industry. *Journal of Retailing and Consumer Services*, 34, 240-247

Suchman, M.C., (1995). Managing legitimacy: strategic and institutional approaches. *Academy of Management Review* 20, 571e610.

Swaen, V., & Chumpitaz, R. C. (2008). Impact of corporate social responsibility on consumer trust. *Recherche et Applications en Marketing (English Edition)*, 23(4), 7-34

Torugsa, N. A., O'Donohue, W., & Hecker, R. (2012). Proactive CSR: An empirical analysis of the role of its economic, social and environmental dimensions on the association between capabilities and performance. *Journal of Business Ethics*, 115, 383–402.

Turban, D. B., & Greening, D. W. (1997). Corporate social performance and organizational attractiveness to prospective employees. *Academy of Management Journal*, 40(3), 658-672

Vries, G., Terwel, B. W., Ellemers, N., & Daamen, D. D. (2015). Sustainability or profitability? How communicated motives for environmental policy affect public perceptions of corporate greenwashing. *Corporate Social Responsibility and Environmental Management*, 22(3), 142-154

Walsh, G., Bartikowski, B. (2013). Exploring corporate ability and social responsibility associations as antecedents of customer satisfaction cross-culturally. *Journal of Business Research*, 66(8), 989-995

Wang, H., J. Choi, J. Li, (2005), 'Too Little or Too Much? Reexamining the Relationships Between Corporate Giving and Corporate Social Performance', *Academy of Management Proceedings* G1–G6.

Welford, R., Chan, C., & Man, M. (2007). Priorities for corporate social responsibility: A survey of businesses and their stakeholders. *Corporate Social Responsibility and Environmental Management*, 15, 52–62.

Westbrook, R. A. (1987). Product/consumption-based affective responses and postpurchase processes. *Journal of Marketing Research*, 24, 258–270.

Zeithaml, Valerie A., Berry, Leonard L., & Parasuraman, A. (1996, April). The behavioral consequences of service quality. *Journal of Marketing*, 60, 31–46.

1.5 Measurement methods of socioeconomic impacts of RES projects

1.5.1 Definition of social impacts

As a first attempt to make an approach toward the definition of social impacts, it should be mentioned that according to Vanclay (2002), social impacts – either positive or negative – must be experienced or felt, at an individual, family/ household or institutional/ communal/ societal level. Impacts can be corporeal, i.e. felt by the body as physical reality, or perceptual/ emotional. The significance of each social impact is possible to vary among different places, projects, communities and groups within a specific community. In addition, as Wainwright (2002) highlights, impacts include intended as well as unintended and both long-term and short-term effects.

Following the above, it should be noted that many efforts have been made to define “social impact” on a common basis, although it is clear that there is still a lack of consensus concerning the definition of the term (Maas and Liket, 2011). This lack of agreement creates a barrier for the academic discussion on the subject of social impact, as well as the use of methods for its measurement (Maas and Boons, 2010; Maas and Liket, 2011). A variety of definitions of the term “social impact”, as well as definitions for other related terms, is provided in Table 1, following the work of Maas and Liket (2011). According to Maas and Liket (2011), the main differences are detected in the use of words like impact, output, effect and outcome; in addition, “social impact” is in many cases substituted by terms like social value creation (Emerson et al., 2000) and social return (Clark et al., 2004). Furthermore, Vanclay (2002) points out the difference between “social impacts” and “social change processes”: in many cases variables perceived as impacts are not in themselves impacts, “but rather represent the measurable outcomes of social change processes, which may or may not cause impacts depending on the situation”. For example, variables such as growth of population or presence of construction workers are not impacts *per se*, but change processes that lead to impacts (Vanclay, 2002).

Clark et al. (2004) tried to attune all different approaches, in order to offer a common basis for the subject. The result was the impact value chain (Figure 2), which makes a distinction between outputs, outcomes and impacts, making it clear that they are different concepts. Moreover, as stated by The New Economics Foundation (2004), the four basic components of social value creation measurement are a) input (resources invested in the activity), output (direct and tangible results of the activity), outcome (changes to people caused by the activity) and impact (outcomes minus an estimation of what would have happened anyway).

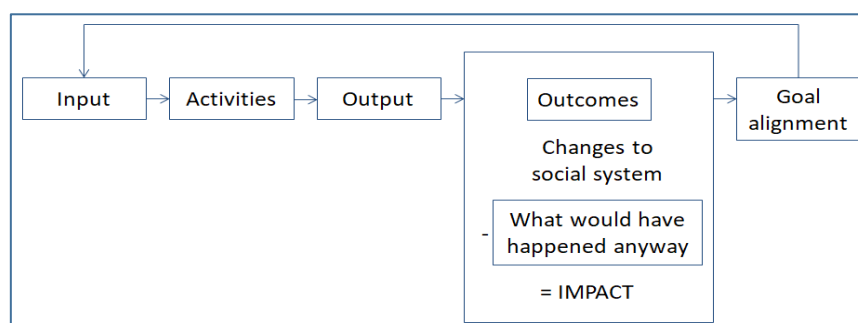


Figure 2. Impact value chain; modified from Clark et al. (2004)

Reference	Term	Definition
Clark et al. (2004)	Impact	...we mean the portion of the total outcome that happened as a result of the activity of the venture, above and beyond what would have happened anyway.
Latane (1981)	Social impact	...we mean any of the great variety of changes in physiological states and subjective feelings, motives and emotions, cognitions and beliefs, values and behavior that occur in an individual, human, or animal, as a result of the real, implied, or imagined presence or actions of other individuals.
Freudenburg (1986)		...refers to impacts (or effects, or consequences) that are likely to be experienced by an equally broad range of social groups as a result of some course of action.
Burdge and Vanclay (1995)		...includes all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society. Cultural impacts involve changes to the norms, values, and beliefs of individuals that guide and rationalize their cognition of themselves and their society.
Gentile (2000)		...the wider societal concerns that reflect and respect the complex interdependency between business practice and society.
GECES (2013)		...the reflection of social outcomes as measurements, both long-term and short-term, adjusted for the effects achieved by others (alternative attribution), for effects that would have happened anyway (deadweight), for negative consequences (displacement), and for effects declining over time (drop-off).
IAIA (n.d.)		...the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.
GECES (2013)	Social outcome	..social effect (change), both long-term and short-term achieved for the target population as a result of the activity undertaken with a view to social change taking into account both positive and negative changes.
Burdge and Vanclay (1995)	Social impact assessment	...the process of assessing or estimating, in advance, the social consequences that are likely to follow from specific policy actions or project development, particularly in the context of appropriate national, state or provincial environmental policy legislation.
Vanclay (2002)		...the process of analyzing (predicting, evaluating and reflecting) and managing the intended and unintended consequences on the human environment of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions so as to bring about a more sustainable and equitable biophysical and human environment.
European Union/ OECD (2015)	Social impact measurement	...aims to assess the social value and impact produced by the activities or operations of any for-profit or non-profit organization.
SEEE (n.d.)		...the process of trying to provide evidence that your organization - whether it is a social enterprise, voluntary or community organization or traditional business - is doing something that provides a real and tangible benefit to other people or the environment.

Table 1. Definitions of “social impact” and relevant terms

1.5.2 Importance of measuring social impacts

Why is the measurement of social impacts so important? As pointed out by The New Economics Foundation (2004) “what gets measured, gets valued”. However, measurements are valuable only when they are useful

and relevant. Thus, it should be clear “why you are measuring, for whom, what different stakeholder groups want from measurement and how the outcomes will be used” (Muir and Bennett, 2014). Literature gives, in general, more emphasis to the measurement of social impacts of non-profit organizations and social enterprises, rather than the impact of businesses. Nevertheless, according to the available literature, measuring social impacts should be of high importance for businesses, organizations and institutions as it can assist them to:

- Inform and involve internal and external stakeholders on the achievement of social impacts and assist the creation of trust and mutually beneficial results (Franks, 2012; Golden et al., 2010; Meldrum et al., n.d.; Miesing, n.d.);
- Use as a marketing tool and publicity material towards customers and other stakeholders (Golden et al., 2010; Meldrum et al., n.d.; The New Economics Foundation, 2004);
- Improve accountability and credibility and make intangible results more tangible, through the provision of measurable results (Maas and Liket, 2011; Meldrum et al., n.d.; Miesing, n.d.);
- Secure or maintain funding of business, project, etc. (Golden et al., 2010);
- Maintain license to operate; through impact measurement, businesses can show stakeholders (communities, government authorities, etc.) that they create benefits for the local economies and societies, thus reducing the risk of negative publicity, protest and declining government support (WBCSD, n.d.);
- Support the creation of a more favourable policy and funding environment; companies can show policymakers that they contribute to public policy goals, thus assisting them to develop the proper mix of rules and incentives needed to maximize business contribution (WBCSD, n.d.);
- Enhance product and service innovation; companies can understand the needs and incentives of their customers, thus being able to develop successful new products and services and improve existing ones (WBCSD, n.d.);
- Identify issues early, thus avoiding and reducing costs, compared to unplanned solutions (Franks, 2012);
- Enhance compliance with international principles and standards (Franks, 2012).

In addition, and in the context of energy-related projects, it should be noted that understanding and quantifying non-energy impacts can benefit efficiency opportunities through program design and marketing by addressing, not only energy-related impacts, but non-energy interests of stakeholders as well (Lawrence Berkeley National Laboratory, 2016).

1.5.3 Steps involved in social impact measurement

Social impact measurement can be a difficult process and requires careful planning and involves carrying out processes and activities with the aim of recording the progress that has been made towards specific goals (Epstein and Yuthas, 2014; Spector et al., n.d.), i.e. identifying and quantifying the effects on all related stakeholders (Rinaldo, 2010). These processes and activities may include deciding on what to measure, the collection and analysis of information and use of the results for reports (Spector et al., n.d.). Rinaldo (2010) mentions that in order to measure social impact, a framework is needed to organize the assessment of all aspects of impact measurement; the framework can utilize various tools or methods to collect information.

However, until now no common framework on social impact measurement exists (European Union/ OECD, 2015).

According to Muir and Bennett (2014), social impact measurement “should be an integrated, interdependent part of strategy and day-to-day operations”, achieved through the three-step phase of a) purpose clarification (what are the organization’s goals?), b) process determination (how to achieve social impacts?) and c) performance measurement (what and how much change has taken place?).

Meldrum et al. (n.d.) describe the required steps for social impact measurement in a simple way as: a) what are the impacts?; b) who will you ask?; c) what will you ask? (indicators), d) measure the actual change made.

Based on the Impact Measurement Roadmap developed by Epstein and Yuthas (2014), impact measurement has four steps. In the first step the expected impacts are defined; in the second, the purpose and use of the measures are defined; in the third, the most important measures are defined for each specific case; the last step involves the development of a system for gathering, analysing and communicating results and improving impacts.

In 2012 the GECES sub-group on Social Impact Measurement was set up in order to reach an agreement on a European methodology for impact measurement of social enterprises, aiming to adopt a measuring process rather than setting specific metrics or indicators. The specific methodology consists of five stages (GECES, 2013): a) identification of objectives (why to measure?), b) identification of stakeholders (who and how is involved?), c) setting relevant measurement (how to measure?), d) measuring, validating and valuing and e) reporting, learning and improving (Figure 3).

As mentioned above, reporting (GECES, 2014) and communicating (Epstein and Yuthas, 2014) the measured impacts is a basic step of the whole process; in this context, WBCSD (n.d.) provides advice on how to better communicate the measured impacts to all relevant stakeholders:

- Be open on the decisions made, concerning what and why is measured;
- Assist them to understand your way of thinking; this way they can give more useful feedback;
- Offer them relevant, honest and clear information;
- As far as it is possible, a) use well-accepted methods, b) present finding in the proper context and c) acknowledge negative impacts;
- Receive feedback from them, in order to confirm that your way of thinking and hypotheses are correct, or if any other variables have not been taken into account.



Figure 3. Five-stage process for social impact measurement (Hehenberger et al., 2013)

According to WBCSD (n.d.), there are specific challenges when measuring social impact. Namely a) impact changes may take a long time, creating an issue to organizations that don't have resources for long-term studies, b) non-relevant activities can affect the measured variables and c) lack of reference data; in order to measure "change", data from "before" and "after" are required. However, in many cases "before" data are not available, as their collection was not organized.

WBCSD (n.d.) mentions that there are available tools to deal with these issues – except for the "time" issue. For example, in order to deal with the absence of reference data, change can be measured through a comparable population or a control group. Of course, these techniques can add cost and time to the total measurement process.

1.5.4 Indicators/metrics for social impact measurement

The development and application of proper indicators and metrics is an essential part of social impact measurement, as "indicators are the foundation for evaluating change" (Muir and Bennett, 2014). Indicators and metrics show whether progress has been made on individual outcomes or goals, presenting no, positive or negative change over time; they can be either qualitative or quantitative (Muir and Bennett, 2014), while providing a common language and a basis for meaningful communication between all involved stakeholders (Golden et al., 2010; Muir and Bennett, 2014). Based on Allan et al. (n.d.), since energy projects may have either positive or negative impacts, the expected impacts should be framed neutrally to account both positive and negative impacts. A decision should be made concerning the level of performed analysis, i.e. if it is going to be on a micro (individual, program) level, a meso (organizational, community) level or a macro (societal, sector) level. This decision will assist the selection of appropriate indicators and meaningful data (Muir and Bennett, 2014). Another aspect that should be taken into account during indicator selection is that impact can only be truly assessed and understood when local context is taken into consideration (Spector et al., n.d.), while it is important to measure at the start and finish of the change process, in order to indicate the change made during the process (Meldrum et al., n.d.).

The concept of social indicator research is closely linked to that of social impact assessment (SIA), which uses social indicators to monitor and analyse unintended consequences of planned interventions (Carrera and Mack, 2010). Apart from quantitative data, qualitative data is also important, as it helps to contextualize the quantitative data, and offers an understanding of the causal relationships between outputs and outcomes (Spector et al., n.d.).

However, in many cases it is difficult to create precise and transparent indicators that can accurately represent the amount of generated social impact (Miesing, n.d.), since social impacts are often difficult to measure and quantify (Maas and Liket, 2011; Miesing, n.d.). As mentioned by Golden et al. (2010), social metrics are difficult to identify, quantify and measure compared to measuring financial results through traditional financial metrics. In many cases this is due to the qualitative nature of social impact, making it hard to attach an objective value to it (Maas and Liket, 2011). In addition, there is an absence of a widely accepted theory for the measurement of social impacts; however, the available different concepts or models can be used for social indicators research (Carrera and Mack, 2010).

A research of the available literature provides a plethora of different characteristics that can be important for the development and identification of suitable indicators and metrics. In this context, Hirschberg et al. (2007) define requirements of indicators:

- Scientific (measurable and quantifiable, meaningful, clear in value, clear in content, appropriate in scale, no redundancy or double counting, robust and reproducible, sensitive and specific, verifiable, hierarchical);
- Functional (relevant, compelling, leading, possible to influence, comparable, comprehensive);
- Pragmatic (manageable, understandable, feasible, timely, covering different aspects of sustainability, allowing international comparison).

Based on Dale and Beyeler (2001), indicators should be a) practical (easy, timely, and cost-effective to measure), b) sensitive and responsive to both natural and anthropogenic stresses to the system, c) unambiguous with respect to what is measured, how measurements are made, and how response is measured, d) anticipatory of impending changes, e) predictive of changes that can be averted with management action and f) estimable with known variability in response to changes.

According to Carrera and Mack (2010) and Meadows (1998), the following criteria were applied in order to guide the selection of indicators in the context of the NEEDS project:

- Clear in value;
- Coherent and consistent;
- Appropriate in scale;
- Sufficient in information;
- Data or data collection methods available for each of the indicators.

As reported by Muir and Bennett (2014), quality indicators should be SMART (Specific, Measurable, Attainable, Realistic, Timely) or based on QQT (Quality, Quantity, Time), while an indicator should be:

- A good “conceptual fit”;
- From a quality data source;
- Able to capture the essentials (who, what, how much, how many and/ or when);
- Achievable and measurable;
- Able to be tracked over time.

In line with Mann (2012), impact metrics should have the following characteristics: a) relevant to multiple stakeholders, b) able to cover a range of different scenarios (technology, time, location), c) able to provide a system-level and local-level view of impacts, d) ideally quantifiable, e) linked to actual impacts and f) easily communicated.

Golden et al. (2010) mention that indicators should be useful, feasible and credible, i.e. being rigorous, replicable, transparent and difficult to misuse. Dale et al. (2013) in their work selected indicators that were practical, sensitive to stresses, unambiguous, anticipatory, predictive, estimable with known variability, and sufficient when considered collectively.

According to Mann (2012), examples of metrics for social impacts are: health impacts, new technology acceptance, education opportunities and needs, employment, GDP, gender impacts, rural development, energy access, safety and security, energy security, food security and cultural preservation. When referring

specifically to energy systems, relevant social indicators can fall into the categories of social well-being, energy security and provision, trade, profitability, resource conservation, and social acceptability (Carrera and Mack, 2010; Dale et al., 2013).

1.5.5 Methods for social impact measurement

The way indicators are used and analysed constitutes the methods or approaches applied (Muir and Bennett, 2014). Several different methods for the measurement of social impacts exist; as WBCSD (n.d.) mentions, “measuring socioeconomic impact is a surprisingly big umbrella”. Each method has its advantages and disadvantages and provides a different point of view, while it can be applied to a group of indicators individually or can be incorporated within whole approaches of change assessment. For example, qualitative and/or quantitative methods⁵ are used in many measurement approaches (Muir and Bennett, 2014).

According to Dufour (2015), there are two historical trends in social impact measurement, namely one focusing around “social accounting and audit (SAA)” and another around “social impact assessment (SIA)”. SAA provides a process for accounting for an organization’s social, environmental and economic activities, and, where possible, the consequences of those activities (Gray, 2000; Meldrum et al., n.d.). Moreover, SIA includes the processes of analysing, monitoring and managing intended and unintended social consequences -both positive and negative- of planned interventions, as well as any social change processes caused by them (IAIA, n.d.). Initially, SIA was created to examine an intervention in forehand, however its widespread use lead to its use as an evaluation tool as well (Dufour, 2015). According to IOCPG (2003), the main principles for SIA are: a) achieving extensive understanding of the involved local and regional settings, b) focusing on key elements of the human environment, c) identifying research methods, assumptions and significance, d) providing quality information for decision making, e) ensuring the analysis of any environmental justice issues and e) undertaking evaluation/ monitoring and mitigation actions.

Different measurement methods are developed around the world by companies, organizations, etc., varying in perspective, purpose and approach (Maas, 2008). In addition, a variety of guidance documents is developed, on how to measure social impact (Maas, 2008). WBCSD (n.d.) mentions that the variety of different tools -based on different assumptions, functionality, types of impact and purposes- may make it difficult for a company to compare and choose among them. WBCSD (n.d.) offers an overview of existing socioeconomic impact measurement methods for business needs; it includes methods a) focusing exclusively on socioeconomic impacts and methods b) that have been developed for business. According to WBCSD (n.d.) there is a range of methods available for other types of organizations, which although could be adapted for companies, the effort required for adaptation is significant.

Maas (2008) and Maas and Liket (2011) present a list of quantitative social impact measurement methods, others developed for non-profit or governmental organizations (e.g. SROI, OASIS, SCBA) and other for for-profit corporations (e.g. SRA, ACAFI, TBL). The methods were found to differ on the following dimensions: users (profit/ non-profit), purpose (screening/ monitoring/ reporting/ evaluation), time frame (prospective/ ongoing/ retrospective), orientation (input/ output), length of time frame (short term/ long term),

⁵ Qualitative methods: participant observation, interviews, focus-groups, document and policy analysis, ethnography and observation, and participatory methods; data analysis can be performed through thematic analysis, document and policy analysis, triangulation, network analysis, case study and narrative analysis. Quantitative methods: surveys, control trials, cohort studies, experimental design studies and analysis of datasets; data analysis can be performed through descriptive statistics, econometrics and modeling (Muir and Bennett, 2014).

perspective [micro (individual)/ meso (corporation)/ macro (society)] and approach (process methods/ impact methods/ monetarization) (Maas, 2008; Maas and Liket, 2011). Based on their analysis, Maas (2008) and Maas and Liket (2011) indicate that a) methods vary based on their activities, objectives and desired measured impacts of different types of corporations, b) a method originally developed for a specific kind of organization could be adapted in order to be used in other types of organizations (e.g. SROI⁶), c) no method can be applied by all types of corporations or can measure the whole range of impacts and that d) social impact methods that really measure impact have to take an output orientation and concentrate on longer-term effects.

Furthermore, Dufour (2015) lists the available tools and methods for the measurement of social impact of work integration social enterprises (WISEs) -a subset of social enterprises. In this context, Dufour (2015) summarizes the different dimensions of impact measurement methods as: a) timeframe (prospective, ongoing, retrospective), b) accountability (external/ internal stakeholders), c) approach (process, impact, monetization), d) analytical lens (cost-effective, cost-benefit, other), e) purpose (screening, monitoring, reporting, evaluation, stakeholder analysis), f) orientation (input, output), g) length of time frame (short term, long term), h) perspective (micro, meso, macro).

According to Florman et al. (2016), existing methods give attention mainly on ESG (Environmental, Social and Governance), social enterprises and investors pursuing an impact investing approach, thus underestimating the role of business activity and its related financial, employment and other gains. Florman et al. (2016) performed an evaluation of general social impact assessment methods, concluding that their main strengths are increasing usability, inclusiveness and ability to demonstrate value, while weaknesses are their resource-intensive nature, subjectivity, narrow focus on social outcomes, insufficient transparency and inaccessibility.

1.5.6 Socioeconomic impacts of renewable energy projects

The existing literature has put much emphasis on the environmental benefits (including the reduction of global and local pollutants) of RES, while socioeconomic impacts have not received a comparable attention (Del Río and Burguillo, 2008). On the other hand, socioeconomic benefits are becoming important for renewable energy deployment, as policy makers see potential for increased income, industrial development and job positions for economies facing low growth (IRENA and CEM, 2014). Various studies have examined and assessed the social and economic impacts of different RES technologies.

Akella et al. (2009) identified the social, economic and environmental impacts of renewable energy systems. Social benefits included a) creation of job positions for the locals, b) increased self-reliance, c) consumers having a choice concerning energy source, d) improved health and e) technological advances. Emphasis was given on the multiple benefits of job creation to other sectors of the local economy which occur through the increased spending due to the new jobs and revenues. The importance of local processing and manufacturing of materials and technologies to job creation was also highlighted.

According to Domac et al. (2005), renewable energy sources, and specifically bioenergy, can offer a variety of socioeconomic impacts both on a national level, as well as on a local level. On the national level RES offer

⁶ SROI offers a framework for measuring non-financial impact per investment and can be applied by companies, investors, non-profits and governmental entities; it expresses the value of the social impacts in financial terms (Golden et al., 2010; The New Economics Foundation, 2004).

avoidance of carbon emissions, environmental protection and security of energy supply; on the local level, employment or job creation, contribution to regional economy and income improvement can be achieved. These benefits can result in increased social cohesion and stability (mitigating rural depopulation, regional development, rural diversification) coming from the introduction of an activity that generates employment and income, as well as an overall increased standard of living in terms of environment, health, and education. Based on the literature review performed by the specific study, bioenergy projects can create socioeconomic benefits a) on a macro level (security of supply/ risk diversification, regional growth, reduced regional trade balance, export potential), b) for the supply side (increased productivity, enhanced competitiveness, labour and population mobility, improved infrastructure), as well as c) for the demand side (employment, income and wealth creation, induced investments, support of related industries).

Vezmar et al. (2014) present the positive and negative environmental, social and political impacts of different renewable energy sources, including solar power, biomass power, fuel cells, hydro power, wind power and geothermal power. Positive socio-political impacts include a) employment creation (manufacturing, construction, O&M), b) new income sources for local communities, c) improved standard of living, d) regional development, e) opportunities for rural areas, f) reduction of demand for electricity from conventional sources and decreased dependence on imported energy, g) provision of electricity to areas with no access to electricity grid, h) improvement of local infrastructure and i) improvement of local population's skills and education. Possible negative impacts may include noise, unpleasant smell, impacts on the landscape, displacement of people from flooded areas and cultural heritage impacts.

Sheikh et al. (2016) evaluate the social and political impacts of renewable energy, through a literature review. Social impacts were categorized into four criteria, namely a) public perceptions (e.g. aesthetics, impact of lifestyle, social benefits, impact on property values), b) employment (e.g. job creation, addition to employment diversity, poverty alleviation), c) health & safety (e.g. public safety, work safety) and d) local infrastructure development (e.g. development of infrastructure, local empowerment).

In many cases, studies examine the socioeconomic impacts of specific renewable energy sources, such as solar or wind power. For example, Rapp (n.d.) addresses the socioeconomic and socioenvironmental impacts of wind power projects. Positive impacts include job creation (short-term during project construction, fewer jobs during O&M phases), increased income for rural landowners and income diversification (additional income from wind farm leases). On the other hand, negative impacts can include noise (mainly within wind farm boundaries), visual impact and potential displacement (requiring resettlement when land is expropriated). Simas and Pacca (2013) focused on socioeconomic benefits of wind power, indicating that benefits such as technology transfer and jobs during manufacturing, installation and operation stages can be created. The employment opportunities created can lead to social and economic benefits for the local communities. Moss et al. (2014) examined the socioeconomic impacts of solar projects in Australia. They concluded that both large- and small-scale solar projects can lead to positive social impacts related mainly to economic benefits from job creation (mainly for operation and maintenance) and benefits for remote communities. According to Rogers et al. (2012), community-based RES projects can have a range of social impacts, that can result to additional positive sustainability outcomes, such as acceptance of renewable energy developments, awareness on renewable and sustainable technologies and issues, uptake of low carbon technologies, and sustainable/ pro-environmental behaviors.

Furthermore, studies focusing on the socioeconomic impacts of RES in specific area types also exist. Jaramillo-Nieves and Del Río (2010) review the impacts that RES projects can have on islands' sustainability. The

socioeconomic impacts that have been identified include a) job creation which in addition can positively affect the prospects of the young local population, b) improvement of job quality (e.g. more permanent jobs), c) social cohesion and human development, d) diversification of energy supply, e) increased self-reliance and f) improvement locals' quality of life through electricity distribution. OECD (n.d.) deals with impacts of RES in rural areas. Renewable energy projects are an opportunity for stimulating economic growth in rural communities, offering benefits such as new revenue sources (increase of tax base, income for land-owners and land-based activities), new job and business opportunities (direct jobs such as operating and maintaining equipment, mostly indirect jobs throughout the RES supply chain), innovation in products/ practices/ policies, capacity building and community empowerment (accumulation of skills, etc.) and affordable energy (production of own energy instead of importing- generating reliable and cheap energy can trigger economic development).

In addition, there are cases where socioeconomic impacts on specific population groups are evaluated. For example, Nelson and Kuriakose (2017) focus on the socioeconomic impacts that renewable energy projects can have on the livelihoods, employment opportunities, and lives of women, their families and communities. The benefits that RES can create for women are a) that reduced labour and time poverty facilitates women's and girls' gain in education, social capital and well-being, b) large-scale RES infrastructure can provide women, as well as men, with employment opportunities, c) a broader set of livelihood options can be created, d) women can develop enterprises that require reliable sources of energy and e) women and their families experience improved health outcomes and quality of life. On the other hand, the construction and operation of large -scale RES infrastructure can also have negative social and gender impacts, including gender-based violence increase (e.g. increased expenditures on alcohol, family dissolution, sexual harassment, gender-based violence). Furthermore, the construction and operation of large-scale RES projects can lead to the displacement of communities, with different impacts for women and men.

1.5.7 Studies focusing on measurement of socioeconomic impacts of RES technologies and projects

Socioeconomic benefits are becoming more important as a key driver for the deployment of RES, through the creation of income, improvement of trade balance, contribution to industrial development and job creation. However, analytical work and empirical evidence on these topics remain relatively limited (IRENA and CEM, 2014; Sastresa et al., 2010), characterized by the absence of a) focus on the regional and local level and b) an explicit theoretical framework (Del Río and Burguillo, 2009). According to Sastresa et al. (2010), the studies on the socioeconomic impacts of RES usually consider specific aspects and provide analyses that are difficult to extrapolate. Studies applying "input-output" models [e.g. Oliveira et al. (2014) and Rodríguez-Serrano et al. (2016)] can have a complex interpretation, while being limited to use for global and political decisions (Sastresa et al., 2010). On the other hand, conceptual and methodological frameworks developed for a complete socioeconomic analysis (e.g. Del Río and Burguillo) can offer the possibility of achieving a global analysis, however can lead to excessive data dispersion and little clarity in the method (Sastresa et al., 2010). In any case, studies focusing on the theoretical and empirical examination of specific socioeconomic impacts of RES technologies and projects mainly on a regional or local level are presented below.

Del Río and Burguillo (2008) developed an integrated theoretical framework in order to analyse the social and economic impacts of RES on local (rural and regional) sustainability; the framework can be empirically

applied to show these benefits in different developed countries. In this context, the dimensions that were taken into account included a) quantitative and qualitative impacts on employment, b) income generation effects, c) demographic impacts, d) energy impacts, e) educational impacts, f) impact of the project on the productive diversification of the area, g) social cohesion and human development, h) income distribution, i) impact on tourism, j) local R&D&D, k) industry creation, l) impact on the municipal budget and m) use of endogenous resources. Furthermore, Del Rio and Burguillo (2009) empirically analysed the benefits of three different RES technologies on local sustainability, by applying the above-mentioned conceptual and methodological framework in three different places in Spain.

Sastresa et al. (2010) presented an integrated method for the assessment of socioeconomic impacts –job creation- of RES projects on a regional scale. The method focuses on job creation, considering it as the most direct measure of the socioeconomic potential of RES projects. The method can be considered as an outside-to-in analysis, in which employment is the core and each level affects those that surround it. The developed method was applied to analyse the socioeconomic impacts of RES for the region of Aragon in Spain, taking into account job creation, job quality, as well as other indicators of the area such as technological development, per capita income, human capital and regional development.

Vergara et al. (2014) identify that in most cases the social benefits of renewable energy projects are not taken into account in cost comparisons of different technologies. In this context, they developed a methodology of quantifying these benefits for Latin America and the Caribbean (LAC), in order to provide information to decision-makers for the promotion of RES. The quantification of social benefits is made in terms of avoided costs (climate change avoided costs, avoided pollution control cost, avoided energy security costs) and economic benefits (improvements in payments balance and job creation). The results indicate that the created benefits are large enough to balance the cost disadvantage of RES in comparison to fossil fuels.

Hatlelid and Aass (2016) examined the socioeconomic ripple effects –as well as the coherent value of these effects- of investments in electrification and renewable energy in Sub-Saharan Africa. In specific, they studied the case of the Agahozo Shalom Youth Village (ASYV) solar power plant in Rwanda, through the application of the input-output (I-O) model. In terms of economic impacts, they examined the local value creation attributed to local suppliers, regarding both the construction and operation periods of the project. In this context, they estimated the demand created for products, services and local employment concerning planning, manufacturing, construction, grid connection, O&M. In addition, the effect of electrification on productivity gains, poverty reduction, people's well-being, health and education were examined.

Through a questionnaire survey on residents, Shoaib and Ariaratnam (2016) examined economic and social impacts, both at a community and a household level, of community-based RES projects in two towns in Afghanistan. Based on the survey results, most positively perceived social impacts on the household level were personal security, family interaction and learning conditions for children. On the contrary, economic impacts at the household level were viewed rather modestly, with the reduction of energy expenses being the most important one. On the community level, the most significantly perceived economic impacts were job creation and improvement of small enterprises, while the most important social benefits were the improvement of education and health care services.

ACCIONA (2016) developed a methodology for measuring the socioeconomic impact of its activities in the markets where it operates. The theoretical development of the methodology was accompanied by the performance of two first studies, measuring the contribution of ACCIONA Energy's activity in the renewable sector in Mexico and South Africa (wind and photovoltaic), allowing the completion, testing and correction

of the model. Factors that were measured included a) contribution to GDP (absolute value, per MW), b) contribution to job creation (total values & per MW, direct, indirect and induced), c) contribution to energy security and independence (value of reduction of energy imports), d) community development projects (amount invested, type of activities), e) emissions avoided (CO₂, NO_x, SO_x, avoided healthcare costs, avoided costs related to climate change), f) water use avoided and g) land use (increase of forest area).

The European Union Energy Initiative (2017) provided some guidelines regarding the measurement of employment created through RES projects, taking into account direct, indirect and induced jobs. It was indicated that the measurement of indirect and induced employment effects is more complicated and continuous than that of direct employment effects, while there are limitations to their assessment. In addition, it was mentioned that in order to measure employment effects, their monitoring should be integrated early on into project and program design. Furthermore, the importance of agreeing on the metrics and methodologies for measurement and gaining a clearer understanding of indirect and induced impacts was highlighted, in the context of achieving a transparent comparison between technologies, projects and programs. Accurately measuring employment effects can assist the design of the most efficient and effective projects and programs, while enabling better comparative analysis between technologies and countries.

ClimateXChange (Allan et al., n.d.) analysed the economic and social impacts of local energy initiatives in Scotland. Concerning social impacts, aim of the project was to provide a methodological basis for the assessment of social impacts the local initiatives. Therefore, the project aimed to create a framework to provide a) a consistent definition of the potential social impacts of local energy projects and b) a replicable method by which to gather evidence of these impacts in practice. In order to achieve this, workshops with the participation of local stakeholders were organized. During the workshops outcomes and impacts were identified, while the ways in which these could be measured were discussed. After the conduction of the workshops, the researchers analysed the results in order to develop a working version of the social impact framework. The next step was to test the applicability of the framework through various local energy projects.

1.5.8 Concluding outline

Despite the increasing significance of socioeconomic benefits for the deployment of renewable energy projects, analytical work and empirical evidence on these topics remain relatively limited. In this context, the work that has been done so far regarding the methods for measuring the social impacts created by renewable energy projects was reviewed, with the aim of enhancing the understanding and facilitating further improvements in the specific field. Additionally, and having in mind the limited existing work related specifically to RES, the assessment broadened its research to other sectors applying social impact measurement, targeting findings that can be applied in the RES sector as well.

Taking under consideration the importance of measuring social impacts, themes such as “why to measure”, “for whom”, “who and how will use the outcomes” occur; measuring social impacts is of high importance for businesses as it can –among others: enhance awareness and trust, can be used as a marketing tool, improve accountability and credibility, maintain license to operate and support the creation of a more favourable policy and funding environment. The examination of the steps involved in social impact measurement in order to optimize all involved planning, processes and activities include a) identifying objectives and stakeholders, b) setting relevant measurement (indicators), c) measuring and validating and e) reporting and

improving are identified. An essential part of social impact measurement is indicators and metrics; the main characteristics for the creation of an appropriate set of indicators focus mainly on the principles of science, functionality and pragmatism. Finally, the last part of the review deals with the existing studies that focus on the measurement of socioeconomic impacts of renewable energy technologies and projects, taking under consideration the theoretical frameworks, models and methods applied, the specific dimensions that were examined, as well as the implications of the presented empirical results.

1.5.9 References

- ACCIONA, (2016), "ACCIONA develops methodology for measuring the socio-economic footprint of its activities", retrieved on Feb 2018 from: <https://www.acciona.com/news/acciona-develops-methodology-measuring-socio-economic-footprint-activities/>
- Akella, A. K., Saini, R.P., and Sharma, M.P., (2009), "Social, economic and environmental impacts of renewable energy systems", *Renewable Energy*, 34(2), pp. 390-396.
- Allan G., Harnmeijer J., Melo P., Abdul-Salam Y. and Creamer E., (n.d.), "The economic and social impacts of local energy: Project update", ClimateXChange, Scotland's centre of expertise connecting climate change research and policy.
- Burdge R., and Vanclay F., (1995), "Social impact assessment", In: Vanclay, F., Bronstein, D.A., editors, *Environmental and social impact assessment*, Chichester: Wiley, pp. 31–65.
- Carrera, D.G., and Mack, A. (2010), "Sustainability assessment of energy technologies via social indicators: Results of a survey among European energy experts", *Energy Policy*, 38(2), pp. 1030-1039.
- Clark C., Rosenzweig, W., Long, D., and Olsen, S., (2004), "Double bottom line project report: Assessing social impact in double bottom line ventures", *Methods Catalog*.
- Dale, V.H., and Beyeler, S.C., (2001), "Challenges in the development and use of ecological indicators", *Ecol. Ind.*, 1(1), pp. 3-10.
- Dale, V.H., Efroymsen, R.A., Kline, K.L., Langholtz, M.H., Leiby, P.N., Oladosu, G.A., ... and Hilliard, M.R., (2013), "Indicators for assessing socioeconomic sustainability of bioenergy systems: a short list of practical measures", *Ecol. Ind.*, 26, pp. 87-102.
- Del Río, P., Burguillo, M., (2008), "Assessing the impact of renewable energy deployment on local sustainability: Towards a theoretical framework", *Renewable and Sustainable Energy Reviews*, 12(5), pp. 1325-1344.
- Del Río, P., Burguillo, M., (2009), "An empirical analysis of the impact of renewable energy deployment on local sustainability", *Renewable and Sustainable Energy Reviews*, 13(6-7), pp. 1314-1325.
- Domac, J., Richards, K., and Risovic, S., (2005), "Socio-economic drivers in implementing bioenergy projects", *Biomass and Bioenergy*, 28(2), pp. 97-106.
- Dufour, B., (2015), "State of the art in social impact measurement: Methods for work integration social enterprises measuring their impact in a public context", 5th EMES International Research Conference on Social Enterprise: Building a scientific field to foster the social enterprise eco-system.
- Emerson, J., Wachowicz, J., and Chun, S., (2000), "Social return on investment: Exploring aspects of value creation in the non-profit sector San Francisco", The Roberts Foundation.

Epstein, M.J., and Yuthas, K., (2014), "Measuring and improving social impacts: A guide for non-profits, companies and impact investors", Berrett-Koehler Publishers, Inc., San Francisco.

European Union Energy Initiative (EUEI), (n.d.), "The employment effects of renewable energy development assistance", Policy Brief.

European Union/ OECD, (2015), "Policy brief on social impact measurement for social enterprises", Policies for social entrepreneurship, Luxembourg: Publications Office of the European Union.

Florman, M., Klinger-Vidra, R., and Facada, M.J., (2016), "A critical evaluation of social impact assessment methodologies and a call to measure economic and social impact holistically through the External Rate of Return platform", LSE Enterprise Working Paper No 1602.

Franks, D., (2012), "Social impact assessment of resource projects" International Mining for Development Centre, Mining for Development: Guide to Australian Practice.

Freudenburg, W.R., (1986), "Social impact assessment", *An. Rev. Soc.*, 12(1). pp. 451–478.

GECEs, (2013), "Proposed approaches to social impact measurement in the European Commission legislation and practice relating to EuSEFs and the EaSI", Sub-group on Impact Measurement, 21 Nov 2013.

Gentile, M.C., (2000), "Social impact management, a definition", Discussion Paper II Aspen ISIB: The Aspen Institute.

Golden, K., Hewitt A., and McBane M., (2010), "Social entrepreneurship: Social impact metrics", MaRS White Paper Series.

Gray, R., (2000), "Current developments and trends in social and environmental auditing, reporting and attestation: a review and comment", *International Journal of Auditing*, 4(3), pp. 247–268.

Hatlelid, I.B., and Aass, J., (2016), "The socio-economic impact of renewable energy in Sub-Saharan Africa: A ripple effect analysis of the ASYV solar power plant in Rwanda", Master's thesis.

Hehenberger, L., Harling, A.M., and Scholten, P., (2013), "A practical guide to measuring and managing impact", EVPA Knowledge Centre Report.

Hirschberg S., Bauer C., Burgherr P., Dones R., Schenler W., Bachmann T., and Gallego Carrera D., (2007), "Environmental, economic and social criteria and indicators for sustainability assessment of energy technologies", New Energy Externalities Developments for Sustainability (NEEDS) Project, Del. 3.1 – RS 2b.

International Association for Impact Assessment (IAIA), (n.d.), "Social impact assessment", retrieved on Dec 2017 from: <http://www.iaia.org/wiki-details.php?ID=23>

Interorganisational Committee on Principles and Guidelines for Social Impact Assessment (IOCPG), (2003), "Principles and guidelines for social impact assessment in the USA", *Impact Assess. Proj. Apprais.*, 21(3), pp. 231-250.

IRENA and CEM, (2014), "The socio-economic benefits of large-scale solar and wind: an econValue report".

Jaramillo-Nieves, L., Del Río, P., (2010), "Contribution of renewable energy sources to the sustainable development of islands: An overview of the literature and a research agenda", *Sustainability*, 2(3), pp. 783-811.

Latane, B., (1981), "The psychology of social impact". *American Psychology*, 36(4), pp. 343.

Lawrence Berkeley National Laboratory, (2016), "Evaluating and quantifying the non-energy impacts of energy efficiency", EM&V Webinars.

Maas, K.E., (2008), "Social impact measurement: Towards a guideline for managers", EMAN-EU 2008 Conference: Sustainability and Corporate responsibility accounting measuring and managing business benefits, pp. 75-78.

Maas, K.E., Boons, F., (2010), "CSR as a strategic activity: value creation, integration and redistribution", In Louche, C., Idowu, S.O., and Filho W.F., editors, *Innovative CSR*, Greenleaf Publishing, Sheffield, pp. 154-172.

Maas, K.E., Liket, K., (2011), "Social impact measurement: Classification of methods", In: *Environmental management accounting and supply chain management*, Springer Netherlands, pp. 171-202.

Mann M.K., (2012), "Metrics for evaluating conventional and renewable energy technologies", NREL/PR-6A20-57497.

Meadows, D.H., (1998), "Indicators and information systems for sustainable development", A Report to the Balaton Group, The Sustainability Institute, Hartland Four Corners.

Meldrum, B., Read, P., Harrison, C., (n.d.), "White Paper: A guide to measuring social impact", Social Impact Tracker.

Miesing, P., (n.d.), "Measuring social impact", School of Business, UAlbany-SUNY, Albany, New York.

Moss, J., Coram, A., and Blashki, G., 2014, "Solar energy in Australia: Health and environmental costs and benefits", The Australian Institute, Technical Brief.

Muir, K., and Bennett, S., (2014), "The Compass: Your guide to social impact measurement", Sydney, Australia: The Centre for Social Impact.

Nelson, S., and Kuriakose, A.T., (2017), "Gender and renewable energy: Entry points for women's livelihoods and employment", Climate Investment Funds.

- OECD, (n.d.), “Linking renewable energy to rural development”, Executive Summary, Brief for Policy makers.
- Oliveira, C., Cassidy, N., and Coelho, D., (2014), “Employment effects of electricity generation from renewable energy technologies in the UK”, *Proc. 22nd International Input-Output Conference*, July 2014.
- Rapp K.W., (n.d.), “Addressing the social impacts of wind power development”, Energy Sector Management Assistance Program, International Finance Corporation – World Bank Group.
- Rinaldo, H., (2010), “Getting started in social impact measurement: A guide to choosing how to measure social impact”, The Guild, St John’s House, 25 St. John Maddermarket, Norwich.
- Rodríguez-Serrano, I., Caldés, N., De la Rúa, C., Lechón, Y., and Garrido, A., (2016), “Socioeconomic, environmental and social impacts of a concentrated solar power energy project in Northern Chile”, *Renew. Energ. Env. Sust.*, 1, pp. 5.
- Rogers, J.C., Simmons, E.A., Convery, I., and Weatherall, A., (2012), “Social impacts of community renewable energy projects: Findings from a woodfuel case study”, *Energy Policy*, 42, pp. 239-247.
- Sastresa, E.L., Usón, A.A., Bribián, I.Z., Scarpellini, S., (2010), “Local impact of renewables on employment: Assessment methodology and case study”, *Renewable and Sustainable Energy Review*, 14(2), pp. 679-690.
- Sheikh, N.J., Kocaoglu, D.F., Lutzenhiser, L., (2016), “Social and political impacts of renewable energy: Literature review”, *Technological Forecasting and Social Change*, 108, pp. 102-110.
- Shoaib, A., Ariaratnam, S., (2016), “A study of socioeconomic impacts of renewable energy projects in Afghanistan” *Proc. Eng.*, 145, pp. 995-1003.
- Simas, M., Pacca, S., (2013), “Socio-economic benefits of wind power in Brazil”, *J. Sust. Dev. Energ., Water Env. Syst.*, 1(1), pp. 27-40.
- Social Enterprise East of England (SEEE), n.d., “Measuring making a difference: An introduction to social impact measurement”.
- Spector, A., Carey, E., Leung, G., McCarthy, K., Moynihan, K., and Durakovic, N., (n.d.), “Impact measurement in the clean energy sector”, Global Impact Investing Network (GIIN), GIIN Network Insights.
- The New Economics Foundation, (2004), “Measuring social impact: The foundation of social return on investment (SROI)”, London Business School.
- Vanclay, F., (2002), “Social impact assessment”, In: Munn, T., editor, *Encyclopedia of global environmental change*, Chichester: Wiley, 4, pp. 387–93.

Vergara, W., Isbell, P., Rios, A.R., Gomez, J.R., Alves, L., (2014), "Societal benefits from renewable energy in Latin America and the Caribbean", Inter-American Development Bank - Climate Change and Sustainability Division - Energy Division, Technical Note No. IDB-TN-623.

Vezmar, S., Spajić, A., Topić, D., Šljivac, D., Jozsa, L., (2014), "Positive and negative impacts of renewable energy sources", *International journal of electrical and computer engineering systems*, 5(2), pp. 47-55.

Wainwright, S., (2002), "Measuring impact: A guide to resources", London, NCVO Publications.

World Business Council for Sustainable Development (WBCSD), (n.d.), "Measuring socio-economic impact: A guide for business", Business solutions for a sustainable

1.6 The geothermal energy specificity

Among renewables, geothermal energy deserves particular attention due to its huge potential in providing sustainable usable energy (power and heat) (Sigfússon and Uihlein, 2014; Sigfússon and Uihlein, 2015), its peculiar technological closeness both to renewables and conventional (fossil) energy sources (see later for details), the wide heterogeneity of geothermal technologies (GT) applications, services and connected Socio-Technical Systems (STS) and the strength of opposition and barriers that have been hindering the exploitation of this potential. The former three aspects should be jointly considered in developing public engagement activities that could positively impact on the latter.

The wide variety of GT applications comes from the combination of three elements (and of their specific attributes): *heat source* that may be positioned at different depths from 100 m to 5 km or the ordinary earth's heat radiation; a *reservoir* that is a deep area of permeable and hot rocks where fluids may circulate, absorb and transfer heat; a *geothermal fluid* the heat carrier from depth to the surface. All of them vary in attributes and intensity; the natural occurrence of reservoir and fluids can be artificially enhanced. Thus, all GT applications are based on the idea of using heat of the earth to produce usable energy but they differ in the typology of resource they're based on⁷. When considering just the heating capacity of earth, geothermal resource can be seen (like other renewables) as a worldwide diffused, widely decentralized and everywhere easy to access resource; when considering the availability of large amount of hot water or steam from the subsurface, it can be seen (like fossils) as a more punctual resource available only in specific locations. Considering the presence and the characteristic of the three elements, geothermal energy technologies can be used to fulfil mainly three different aims (Sigfússon and Uihlein, 2014; Sigfússon and Uihlein, 2015; ETIP-DG, 2018):

- Power Generation, obtained by steam turbine where heat is transformed into mechanical energy and then into electricity via a *generator*. The fluid sent to the turbine can be the geothermal fluid extracted from the ground (*direct or flash steam systems*) or a secondary fluid heated by the geothermal fluid through a heat exchanger (*binary systems*). A system of deep wells (1-4 km) has to be drilled and geothermal fluids often bring chemicals and gases like CO₂, H₂S and others.
- Heating&Cooling (H&C) such as space and district H&C, heating of public baths and swimming pools, heating of greenhouses, industrial process heat, and agricultural drying, obtained by direct heat of geothermal fluids. Depending on the energy demand, geothermal fluids are extracted from shallow or deep depth, by means of wells. These fluids have little chemicals, and no gas content.
- Heating&Cooling applications enhanced by using Ground Source Heat Pumps (GSHP). Heat pumps can be used to adjust the temperature of geothermal fluids to the (higher) level needed, for example, in a residential building, or to adjust the temperature of heat coming from cooling the building to the (lower) level required to inject it into the ground. Geothermal fluids may be used but also the ordinary earth radiation is enough to provide the thermal steadiness needed by a heat exchange to work. In the latter case a fluid, usually clear water, is circulated in pipes embedded at shallow depth (1- 200 m) in the subsurface, and exchange heat with the ground.

Among the three geothermal energy applications, the most strategic and controversial for energy transition is power generation while at the moment the most relevant is GSHP that in terms of usable energy (measured

⁷ See note 1 and Us-DOE (2017) 2016 Annual Report Geothermal Technologies Office

in MW) in 2010 at a global scale produced two times more energy than direct use and three times more energy than power generation. Geothermal energy provides also an opportunity to be exploited by combined production of heat and power (CHP) and cascade utilisation (stepwise usage at progressively lower temperatures) and therefore increases the total efficiency in strictly economic terms and the variety of services and benefits in a wider social perspective [an example of cascade uses are power generation, district heating and cooling, industrial processing, greenhouses, fisheries, de-icing, and spa bath (Sigfússon and Uihlein, 2014)].

For what described so far, it is demonstrated that on the one hand GT for power production faces similar problems as other renewables. But on the other hand, geothermal power offers advantages in a social acceptance discussion like the project participation possibilities through the direct use of heat (Reith et al., 2013).

To the aim of improving public engagement and acceptance, it is relevant to consider some peculiarities of GT in terms of their impact and consequent public acceptance. First of all, the main shortcoming of geothermal energy is that it is a local source, so that it is not economically feasible to transport the fluid over long distance. Additionally, both electricity production and large thermal GT developments often result in relevant changes to the local environment (Popovski, 2003) such as:

- Building of a large plant for electricity production and radical modification of the landscape.
- New people with higher and different living standards move into the area.
- Young locals leave the traditional local economy and way of life by getting these better paying jobs.
- Introduction of new and different economic sectors and potential strong competition to the existing traditional production (greenhouses, aquaculture).
- Economic benefits are coming, but often only for a limited number of people.
- Life infrastructure and organization come with a new project, (e.g. better road connections, potable water supply, better management of the effluent water, better supply to the local market with everyday goods).

These changes may produce clear positive or negative effects for the local community but part of them maybe more controversial being at the same time an opportunity or a damage often depending on the perception of the community itself.

Thus, given a specific area endowed with geothermal resource, GT development may impact on: ecosystems (air, land, flora, fauna, and superficial and underground water, climate change effects); human health (water and air quality, noise, health status and nutrition); economy (detrimental impact on some production activities, damages to crops and private properties, tourism, employment, research and development); poverty (access to energy, income and living condition); consumption and production patterns (energy use, waste generation and management) (Popovski, 2003; Shortall et al., 2015). However, the main point regarding public engagement is that the relevance of this impact depends on the point of view of the local residents of the impacted community that is strongly linked with several local factors: socio-economic conditions, cultural background, and individual or group interests, reaction against landscape modifications and alteration of natural features of cultural or religious interest (Popovski, 2003).

Keeping in mind these specificities of GT is crucial in order to have a clear idea of the socio-cultural variables to be considered when designing public engagement strategies. So, in the next sections we focus first on the

role of experts in infrastructural project and on their relationship with laymen, a relevant dynamic for building a shared vision on the projects and consequently affecting their acceptance. Then, some conceptual and practical tools to structure productive public engagement strategies will be described.

References

ETIP-DG (European Technology and Innovation Platform on Deep Geothermal) (2018) Vision for Deep Geothermal, ISBN 9788879580359

Popovski, K. (2003). Political and public acceptance of geothermal energy. *Lectures on the sustainable use and operating policy for geothermal resources. UNU-GTP, Iceland, publ, 1*, 31-42

Shortall R., Davidsdottir B., Axelsson G., (2015) Geothermal energy for sustainable development: A review of sustainability impacts and assessment frameworks. *Renewable and Sustainable Energy Reviews* 44, 391–406.

Sigfússon B., Uihlein A. (2014) Technology, market and economic aspects of geothermal energy in Europe. EU Joint Research Centre - Institute for Energy and Transport, Petten, NL

Sigfússon B., Uihlein A. (2015) Technology, market and economic aspects of geothermal energy in Europe. EU Joint Research Centre - Institute for Energy and Transport, Petten, NL

1.7 A review of practices from the side of project developers and operators in order to achieve social acceptance of geothermal power plant projects

With concerns for climate change and increased energy dependency rising on a worldwide level, the development of geothermal power projects can offer a solution towards the achievement of sustainability. However, the development and operation of geothermal power projects depends strongly on their acceptance at the local level, where the installation is to be built. As transpires from academic writings, lack of social acceptance increases the risk of failures, cost escalation and project delays, and may even lead to the termination of the project (Jobert et al., 2007; Batel et al., 2013; Enevoldsen and Sovacool, 2016).

Social acceptance of energy innovations is essential for the development of a technology (Wüstenhagen et al., 2007); the key factors that can influence social acceptance of renewable energy projects are presented in the following figure:

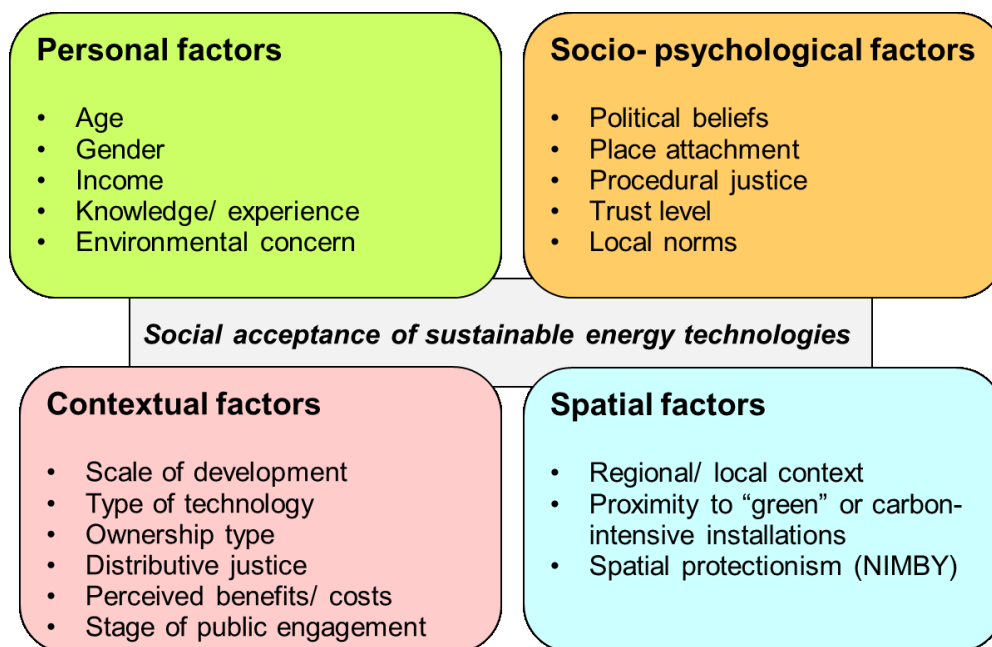


Figure 4. Categorization of factors affecting social acceptance of renewable energy projects (Source: Modified from Stephanides et al. (2019))

Cases of social conflict involving geothermal power projects have been recorded globally: indicatively a mention could be made to the cases of Tiwi geothermal area in Philippines (Camu and Santiago, 2000), Berlín power plant in El Salvador (Zepeda and Rodriguez, 2005), Upper Rhine Graben in Europe (Schwellenbach and van Douwe, 2016; van Douwe et al., 2016), Milos and Nisyros Islands in Greece (Karytsas et al., 2019).

In the past, different definitions have been given regarding the successful social acceptance of geothermal projects. According to de Jesus (1995), "social acceptability is attained if the project activities do not result in drastic changes from the regular conditions of the area and if the affected sectors can see some advantages issuing from the project". On the other hand, Cataldi (2001) mentions that "social acceptability of a profit-

purposed project is the condition upon which the technical and economic objectives of the project may be pursued in due time and with the consensus of the local communities; consensus to be gained by acting in consonance with the dynamic conditions of the environment, and in the respect of the people's health, welfare, and culture". In addition, Popovski (2003) adds that "social acceptability is one of the most important parts of the process of geothermal energy development in a specific environment. It is not possible to complete a successful project if initially not identifying the elements of the local environment, which can influence its social acceptance; and not designing proper organizational, technical, economic, and other solutions in order to remove the negative opinions".

In this context, aim of the present study is to examine and present a review of the different strategies and practises applied so far, mainly by the geothermal development and operation companies, in order to move towards social acceptance of local communities.

1.7.1 Review of social acceptance practices

The examination of the social acceptance practises applied so far reveals specific differences between time periods and types of countries. Referring to emerging and developing economies, the first reports on social acceptance practises concerning specific geothermal power plants indicate that focus had been given mainly on providing benefits to local communities and minimizing any undesirable side effects. In such cases, the role of the local stakeholders was mainly to provide input for the planning of community development programs and / or CSR activities, as presented for example for different cases in Philippines (Meidav et al., 1995; Camu and Santiago, 2000; Anaye and Cala, 2005), Indonesia (Slamet and Moelyono, 2000; Ibrahim et al., 2005) and El Salvador (Zepeda and Rodriguez, 2005).

On the other hand, Kenya seems to have given more emphasis on public engagement; this has been achieved on the basis of the Environmental Management and Coordination Act (EMCA) established in early 2000 (Ogola, 2004). In this context, the relevant reports for Kenya describe the planning and implementation of information and consultation activities involving different local stakeholder groups, among which there are local inhabitants in some cases; relevant cases involve Menengai (Manyara and Mading, 2012), Suswa (Chebet, 2013), Olkaria I Units 4 & 5 and Olkaria IV (Barasa, 2015b) and Eburru (Barasa and Mathenge, 2015).

The examination of, rather limited, reports on geothermal power plant social acceptance activities in developed countries reveals that emphasis has been given to organized engagement activities, including different implementation phases and stakeholder groups. One of the first works belongs to Beck (1990), providing a guide towards public information activities for Hawaii. More recent efforts focus both on information and consultation activities involving local stakeholder groups, as described for the cases of ARRC/Pawsey Geothermal in Australia (Carr-Cornish et al., 2011), Groß-Gerau in Germany (Wallquist and Holenstein, 2015) and the Upper Rhine Graben (van Douwe et al., 2016).). A recent review of societal engagement within the geothermal sector in Australia, Canada, France, Greece, Iceland, Italy, Japan, New Zealand, Philippines, Switzerland, Turkey (Manzella, Pellizzone, Allansdottir Ed., 2019) describes the variety of methods used in different countries, and on what base the various studies have been launched.

1.7.2 Prevention and minimization of undesirable effects

One of the main concerns towards social acceptance is the prevention and minimization of undesirable effects on the environment and people; based on the recorded experiences, practises that can assist this goal

include: a) the development of an environmental action plan, focusing on the measures necessary to avoid or minimize any undesirable effects (Cataldi, 2001; Wetang'ula, 2010), b) appropriate environmental management and design practices, and organization of works during the project's construction and operation phases (ENGINE, n.d.; Zepeda and Rodriguez, 2005), c) integrated procedures for ensuring compliance with health, safety and environmental standards (Zepeda and Rodriguez, 2005), d) the creation of an environmental guarantee fund, with the intention to be used in cases of rehabilitation and compensation for damages that may be a result of the project's operation (de Jesus, 2005), as well as e) the organization of various environmental actions, e.g. afforestation of the affected areas in order to preserve the ecosystem (Wetang'ula, 2010). Furthermore, the identification of cultural sites and the creation of a plan to preserve them can minimize the possibility of creating disturbance to them due to the construction and operation of the project (Chebet, 2013).

The direct compensation for damages caused by the project's activities to private or public property, e.g. crops, animals, facilities, buildings, roads and infrastructure is of equal importance. According to Cataldi (2001), in these cases it is necessary for the project manager to have a flexible attitude, to adopt compensatory measures and to conclude the negotiations in a short time, in order to maintain good relationships with the local communities.

1.7.3 Creating benefits for local communities

The creation of benefits for local communities can be achieved either by directly granting money to local authorities (municipalities, regions, etc.), which is usually defined by the relevant legislative framework (Anaye and Cala, 2005; de Jesus, 2005), or through the realization of local development programs. The provision of funds to local administrative authorities can have either the form of a share of the company's profits -representing the usage rights of the region's energy resources- (Anaye and Cala, 2005; de Jesus, 2005), or a percentage of any levy, right or fee for the development and exploitation of geothermal resources (Camu and Santiago, 2000). The collected funds can be used to subsidize the price of electricity in the areas where the energy source is located [due to the subsidy, the region may become attractive for further investment, leading to more jobs and economic benefits for local people (Camu and Santiago, 2000)], as well as for the implementation of development projects (infrastructure construction, provision of services, etc.) for the local communities (Anaye and Cala, 2005; de Jesus, 2005).

Through local development programs, the economic, social and human development of communities close to the project can be supported. This way, the company responsible for the project can fulfil the objective of providing benefits to the communities in which it operates, recognizing their contribution to national security and development by hosting the project (Zepeda and Rodriguez, 2005; Wetang'ula, 2010; Chebet, 2013). These actions can also be part of a Corporate Social Responsibility (CSR) program implemented by a company (Wetang'ula, 2010; Barasa, 2015b). Through these actions, the company can improve its trust and relationships with stakeholders (Slamet and Moelyono, 2000; Musembi, 2010), thus reducing tensions and delays that affect geothermal projects (Zepeda and Rodriguez, 2005); this way it can acquire a "license to operate", that can lead to several long-term financial and non-financial benefits (Musembi, 2010). In order to plan actions that meet the needs of local communities, it is advised that the company should a) investigate and record local economic, social, etc. conditions, b) discuss with local authorities, local organizations and associations, etc., and c) continuously monitor the actions, so that the future programs can be improved

through the recorded experience (Meidav et al., 1995; Barasa, 2015b). The following actions can be included in the above-mentioned framework:

- Improving education: Building new educational facilities, improving educational infrastructure, providing equipment and supplies (e.g. books) to schools, providing scholarships to local students and providing meals for students in areas where this is needed (Chebet, 2013; Barasa, 2015b; Kurgat and Omwenga, 2016).
- Improving health and sanitation: Contributing to residents' access to health services through the provision of medicine and healthcare services, improving access to clinics, delivering food to weak population groups (Musembi, 2010; Wetang'ula, 2010; Chebet, 2013).
- Local environment protection: Environmental awareness actions, environmental cleaning activities, participation in actions dealing with emergency disasters (e.g. community aid in case of a flood or during a drought) (Musembi, 2010; Chebet, 2013; Barasa, 2015b).
- Strengthening the local economy and entrepreneurship: Training programs for improving / developing locals' skills and knowledge in business management and organization issues, skills related to their work etc. (possibly focusing on specific groups such as women and younger people) (Anaye and Cala, 2005; Ibrahim, 2005; Musembi, 2010), offering jobs related to the project to the locals (depending on the skills required by the project) (Wetang'ula, 2010; Manyara and Mading, 2012; Kurgat and Omwenga, 2016), preferring to purchase supplies from local resources and services (Musembi, 2010; Kurgat and Omwenga, 2016), business opportunities for locals (Slamet and Moelyono, 2000; Kurgat and Omwenga, 2016), technology transfer for local production improvement (Musembi, 2010), funding research beneficial to the local community (e.g. research on agricultural activities) (Barasa and Mathenge, 2015), encouraging local economy diversification in rural areas through the development of ecotourism and aquaculture units that can utilize geothermal resources (Musembi, 2010).
- Improving infrastructure: Construction or improvement of roads, bridges, multipurpose halls, markets, electricity networks, water supply networks and provision of transport services (Musembi, 2010; Chebet, 2013; Kurgat and Omwenga, 2016). Providing discharged steam or hot water with a low cost or no cost, for use in public buildings, cultural centers and other public facilities (Cataldi, 2001). Promoting culture and sports: Organization and sponsorship of sports and cultural events (Musembi, 2010; Wetang'ula, 2010; Chebet, 2013), construction of sports infrastructure (Ibrahim et al., 2005), participation in the restoration of buildings / areas / parks, etc., with the aim of promoting cultural heritage and tourism (Camu and Santiago, 2000), providing grants for research or publication of studies on important aspects of the development potential, history, traditions and culture of the project's area (Cataldi, 2001).

1.7.4 Community engagement activities

Engagement activities involving local communities are of major importance for achieving social acceptance of a geothermal power plant project, as they enhance trust between the company and the community, reduce reactions / controversies, and increase the company's acceptance level concerning the implementation of the project. Engaging with the local communities can assist the activities presented above -referring to undesirable effects associated with prevention and minimization, and benefit provision- thus

improving the relation between the local community and the company in terms of procedural and distributional justice.

In order to achieve these objectives, the implementation of a comprehensive action plan is essential. Based on the examination of previous geothermal project development action plans, the following practices have been performed concerning engagement, in the context of communication and collaboration with local communities:

- Realization of a socio-economic study of the area of interest during the early stages of the project's development. The study should include issues such as administrative boundaries, land uses and forms of ownership, population, natural resources, infrastructure, public services, sources of income, transport, cultural attractions, historical sites, energy use and demand, identification of stakeholders and their views on geothermal energy, benefits that are valued by local communities (Wallquist and Holenstein, 2015; van Douwe et al., 2016). Based on the findings of the study, the process of public engagement should be adapted to the specific circumstances (Wallquist and Holenstein, 2015).
- Creation of a group of local stakeholders with participation of local government, representatives from all local communities, environmental protection groups, representatives of the agricultural and business sector, etc. Provision of information to the group about the company's actions and future plans and dialogue in order to achieve common trust. Through this group a forum can be created, where environmental and social concerns of the local communities can be presented in time to the company responsible for the project, in order to address all controversial issues and lead to a mutual agreement, that will contribute to the acceptance of the project (Manyara and Mading, 2012; Thompson, 2014; Barasa and Mathenge, 2015). This approach allows the integration of local knowledge, experiences and different interests, as well as an excessive exchange of information between all participants (Wallquist and Holenstein, 2015).
- Discussion involving a large part of the local communities. Provision of detailed information on geothermal energy, the project under development, as well as the opportunities and risks that accompany it. Participants should have the opportunity to discuss the benefits and risks of the project, ask questions and express their concerns to the project's representatives (Carr-Cornish et al., 2011; Wallquist and Holenstein, 2015; van Douwe et al., 2016).
- Implementation of information activities targeting all different stakeholders, i.e. local administrative bodies, government agencies, residents, non-governmental organizations, local organizations (consumers, residents, etc.), private enterprises, etc. Information activities should be implemented throughout the planning and implementation phase of the project. The information content may concern the geothermal resource, description of the project, potential effects on the environment, measures and benefits for local communities (Leucht et al., 2010; Wallquist and Holenstein, 2015; Shoedarto et al., 2016). Tools that can be used to inform different types of stakeholders include project site visits, lectures, a website, newsletters / brochures, press releases, an information centre, a liaison office, social networks, construction of a demonstration unit, participation in events (participation in scientific / commercial / environmental fairs, university events and NGOs), organization of scientific meetings, networking with groups with similar interests (Beck, 1990; Carr-Cornish and Romanach, 2012; Manyara and Mading, 2012; Schwellenbach and van Douwe, 2016).

1.7.5 Principles governing engagement activities

The engagement activities reported above should be governed by specific principles in order to assist their successful implementation. Through the examination of completed geothermal project development action plans, the following principles have been identified:

- Engagement activities should be the fundamental step in the overall development process of a geothermal project (Chebet, 2013; Thompson, 2014).
- Engagement activities should not be performed only behind “closed doors” (i.e. in meeting rooms, offices or hotels) which cut off the local community, but should be organized outdoors, close to the local community. This way, transparency can be ensured, as the risk of community representatives transferring distorted or incomplete information to the community can be mitigated. In parallel, “open” activities can support the better understanding of all local groups - even the weakest ones (Barasa, 2015a).
- Honest information should be provided to the locals, in an understandable way and adapted to the local culture (ENGINE n.d.; Leucht et al 2010; Shoedarto et al 2016). The information should come from reliable and objective sources (Leucht et al., 2010; Carr-Cornish et al., 2011).
- The heterogeneity of the public should be recognised, on the basis of its demographic characteristics, knowledge, power, values and interests (Leucht et al., 2010; Wetang’ula, 2010)
- All involved stakeholders should be addressed as equal, in order to create a proper relationships, based on honesty and trust (de Jesus, 2005).
- Any issue concerning the project should be openly addressed, even the negative ones. A “common” language / terminology should be created, to ensure clear, effective, and accurate communication among all associated parties (Schwellenbach and van Douwe, 2016).
- All interests, including those not represented or represented to a limited extent, should be taken into account during the distribution of impacts, damages and benefits (de Jesus, 2005; Wetang’ula, 2010).
- A specific person should be designated to be the "face" of the project and communicate in an appropriate manner with all related stakeholders (Schwellenbach and van Douwe, 2016). Additionally, it should be noted that the participation of high ranked representatives from the organization's administration in the dialogue can be interpreted by the local stakeholders as sincerity and recognition of responsibility (de Jesus, 2005; Wetang’ula, 2010).
- The activities of the project should be monitored by a group composed of local government representatives, local communities, etc., pointing out the company's willingness to run transparent operations (de Jesus, 2005).
- Careless practices should be avoided, especially at the beginning of a geothermal project, as they can lead to the creation of an initial negative view from the part of the local communities; in that case, the re-establishment of a positive image may require huge investment in effort and time. Thus, appropriate technical / technological and organizational practices should be applied during all phases of the project, from research up to operation and maintenance (ENGINE, n.d.).
- All commitments made in the context of engagement with local communities should be actually implemented (de Jesus, 2005; Wetang’ula, 2010).

1.7.6 Concluding outline

The current review presents an overview of the strategies and practises implemented so far, towards the achievement of social acceptance of geothermal power projects. The experience recorded up to now indicates that project developers / operators enhance the social acceptance procedure through a) the engagement of local communities, b) the prevention and mitigation of undesired effects and c) the creation of benefits for local communities. It should be noted that the recorded engagement activities focus mainly on communication and consultation, while the aspect of active participation (in decision making, etc.) of local communities is still not so common in geothermal power projects.

In parallel, public authorities -on a national, regional and / or local level- can contribute to reaching social acceptance mainly through the implementation of suitable legislative frameworks (e.g. distribution of specific percentage of the profits for the development of the area, realization of socioeconomic impact studies) and participation in the development of required social infrastructure.

The principles that should govern all the above-mentioned practices and activities include honesty, objectivity, adaptation to local conditions, equality, trust, openness, taking into account interests of all involved parts, accountability and actual realization of the commitments made.

1.7.7 References

- Anaye, J. and Cala, C.L., (2005) Geothermal energy development as a medium towards total community development: the Philippine example, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey, 24-29.
- Barasa, P.J., (2015a), Integration of environmental management system in monitoring of environmental and social aspects associated with operation of Olkaria II geothermal power plant in Naivasha sub-county, Nakuru County, Kenya, *Proceedings of the 40th Workshop on Geothermal Reservoir Engineering Stanford University*, Stanford, California.
- Barasa, J.B., (2015b), Public participation in the implementation of 280MW geothermal power projects at Olkaria in Naivasha sub-county, Nakuru County, Kenya, *Proceedings of the World Geothermal Congress 2015*, Melbourne, Australia.
- Barasa, P.J. Mathenge, R.W., (2015), Stakeholder engagement through participatory research: a case study of Eburru geothermal wellhead generator in Nakuru County, Kenya, *GRC Transactions*, 39, 233-238.
- Batel, S., Devine-Wright, P. and Tangeland, T., (2013), Social acceptance of low carbon energy and associated infrastructures: a critical discussion. *Energy Policy*, 58, 1-5.
- Beck, A.G., (1990), Dealing with controversial facts: geothermal public information in Hawai'i, *GRC Transactions*, 14(1), 583-588.
- Camu, M., Santiago, R., (2000) Social development in the Philippines' Tiwi geothermal area, *Proceedings of the World Geothermal Congress 2000*, Kyushu - Tohoku, Japan, (2000).
- Carr-Cornish, S., Romanach, L., (2012), Exploring community views toward geothermal energy technology in Australia, *CSIRO*, Pullenvale, Australia.
- Carr-Cornish, S., Huddleston-Holmes, C. and Ashworth, P., (2011), The ARRC/Pawsey geothermal demonstration project: an example of how to engage the community, *Proceedings of the 2011 Australian Geothermal Energy Conference*, Melbourne, Geoscience Australia.
- Cataldi, R., (2001), Social acceptance of geothermal projects: problems and costs", *Proceedings of the European Summer School on Geothermal Energy Applications 2001*, Oradea, Romania, 343-351.
- Chebet, S.K., (2013), Community engagement in Suswa geothermal prospect, *GRC Transactions*, 37, 779-784.
- De Jesus, A.C., (1995), Socio-economic impacts of geothermal development, *Proceedings of the World Geothermal Congress 1995*, Florence, Italy, Pre-Congress Course on Environmental Aspects of Geothermal Development. IGA / CNR-International School of Geothermics.
- De Jesus, A.C., (2005), Social issues raised and measures adopted in Philippine geothermal projects, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey.

Enevoldsen, P. Sovacool, B.K., (2016), Examining the social acceptance of wind energy: practical guidelines for onshore wind project development in France, *Renewable and Sustainable Energy Reviews*, 53, 178-84.

ENGINE – Enhanced Geothermal Network of Europe: Increasing policy makers’ awareness and public acceptance, *WP5*, Deliverable 38, (n.d.).

Ibrahim, R.F., McCloskey, B., Sutisna, E., Pranoto, R., Munaf, I., Gordon, R. Stevensen, R., (2005), Corporate Social Responsibility implementation in the Darajat geothermal project, Garut, West Java, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey.

Jobert, A., Laborgne, P. and Mimler, S., (2007), Local acceptance of wind energy: factors of success identified in French and German case studies, *Energy Policy*, 35(5), 2751-2760.

Karytsas, S., Polyzou, O. and Karytsas, C., (2019), Social aspects of geothermal energy in Greece, in: *Geothermal Energy and Society*, Manzella, A., Allansdottir, A. and Pellizzone, A. (Ed.), 123-144, *Springer, Cham*.

Kurgat I.K., Omwenga J., (2016), Impact of power generation project on the livelihoods of adjacent communities in Kenya: a case study of Menengai geothermal power project. *International Journal of Scientific and Research Publications*, 6(10), (2016), 610-624.

Leucht, M., Kölbl, T., Laborgne, P., Khomenko, N., (2010), The role of societal acceptance in renewable energy innovations breakthrough in the case of deep geothermal technology, *Proceedings of the World Geothermal Congress 2010*, Bali, Indonesia.

Manyara D., Mading P., (2012), Environmental and social considerations in geothermal development: case study Menengai, Kenya: moving towards green and clean economy, *GRC Transactions*, 36, 1227-1232.

Manzella A. Pellizzone A., Allansdottir A. (Eds). (2019) *Geothermal energy and Society. Lecture Notes in Energy*, 67, 288 pp. *Springer International Publishing*, ISBN 978-3-319-78285-0, <https://doi.org/10.1007/978-3-319-78286-7>, 2018.

Meidav M.Z., Calica M.C. Enalpe E.E. (1995), Model of social responsibility and community service: case history of Unocal/ Philippine geothermal INC’s experience with the Mak-Ban and Tiwi fields, *Proceedings of the World Geothermal Congress 1995*, Florence, Italy.

Musembi R., (2010), Corporate Social Responsibility (CSR) in geothermal development: the case of the Geothermal Development Company (GDC), Kenya, *Proceedings of the ARGEO-C3, 3rd East African Rift Geothermal Conference*, Djibouti, 516-521.

Ogola, P.F., (2004), Appraisal drilling of geothermal wells in Olkaria Domes (IV), Kenya: baseline studies and socioeconomic impacts, *Geothermal Training Programme, The United Nations University*, Reykjavik, Iceland, 267-306.

Popovski, K. (2003), Political and public acceptance of geothermal energy, *Geothermal Training Programme, The United Nations University, IGC2003 – Short Course*.

Schwellenbach E., van Douwe A., (2016), The citizens' initiative in deep geothermal energy, *Proceedings of the European Geothermal Congress 2016*, Strasbourg, France.

Shoedarto, R.M., Aries, F.R., Irawan, D., Perdana, F., Arisbaya, I., Indrawan, B., (2016), Raising public acceptance of geothermal utilization through direct application in Indonesia, *Proceedings of the 41st Stanford Workshop on Geothermal Reservoir Engineering, SGP-TR-209*.

Slamet, U., Moelyono, D.G., (2000), Maximizing community benefits and minimizing environmental impacts in the Gunung Salak geothermal project, Indonesia, *Proceedings of the World Geothermal Congress 2000*, Kyushu - Tohoku, Japan.

Stephanides, P., Chalvatzis, K.J., Li, X., Lettice, F., Guan, D., Ioannidis, A., Zafirakis, D., Papapostolou, C., (2019). The social perspective on island energy transitions: Evidence from the Aegean archipelago. *Applied Energy*, 255, 113725.

Thompson, R., (2014), An assessment of the socio-economic and marine environmental impacts associated with the St. Kitts and Nevis geothermal energy project, Graduate Project, NS: *Dalhousie University*, Halifax, (2014).

van Douwe A., Stahl L.K., Kreuter H., (2016), Acceptance of geothermal projects in a critical environment in the Upper Rhine Graben, *Proceedings of the European Geothermal Congress 2016*, Strasbourg, France.

Wallquist, L., Holenstein, M., (2015), Engaging the public on geothermal energy, *Proceedings of the World Geothermal Congress 2015*, Melbourne, Australia.

Wetang'ula, G.N., (2010), Public participation in environmental and socioeconomic considerations for proposed 2.5 MW pilot Eburru geothermal power project, Kenya, *Proceedings of the World Geothermal Congress 2010*, Bali, Indonesia.

Wüstenhagen, R., Wolsink, M., Bürer, M.J., (2007), Social acceptance of renewable energy innovation: an introduction to the concept", *Energy Policy*, 35, 2683–2691.

Zepeda, N., Rodriguez, A. (2005), Socially responsible geothermal development in El Salvador, *Proceedings of the World Geothermal Congress 2005*, Antalya, Turkey.

2 Private actors' perspective on engagement processes for RES developments and geothermal energy developments

This chapter addresses the energy companies' perspective on engagement processes. The first paragraph provides a theoretical framework upon which the other paragraphs are built. The second paragraph describes two studies that account for the effect engagement processes have on the relationships between energy companies and consumers, from a CSR perspective. The third paragraph comprehends an analysis of the internal organisation of two energy companies, to shed light on how engagement strategies and organisational dynamics are interrelated. The last paragraph provides cases of multinational companies involved in engagement processes with different results.

2.1 Introduction

Companies are increasingly becoming accountable not only for pursuing profits (shareholders' interest), but also for creating value for all society (stakeholders' interest). In particular, companies belonging to the energy industry and aimed at implementing RES developments – and geothermal energy developments – are strongly affected by this increased accountability, since they represent a potentially highly-impacting sector in terms of affecting the social and natural environment.

In this context, Corporate Social Responsibility (CSR) has gained importance as a theoretical concept and practical tool for accounting for stakeholders' interest while simultaneously pursuing companies' profitability objectives. The notion of accountability in front of various stakeholders includes the idea that energy companies – and companies in general – should dialogue with all of them to know their needs and expectations, thus establishing good relationship and avoiding performing (socially and environmentally) negative behaviours. Even though stakeholders are all important, it is unrealistic to equally consider them. The prioritisation of stakeholders represents a process in which companies account for the differences in stakeholder relationships, in order to identify which stakeholder is key in specific cases. In large industrial developments such as the RES or geothermal ones, communities (or citizens) are considered as a key stakeholder, since they are able to decide the fate of the project development with their behaviours – oppositions, petitions, and boycotts represent examples of communities' behaviours able to stop the project development and increase costs for energy companies.

Public engagement processes represent a complex and structured system of activities that aim at involving communities in the decision and implementation process. Good engagement processes represent a prerequisite for building consensus between energy companies and their key stakeholder – i.e. in this case communities – about large industrial projects such as the geothermal ones, even though they do not guarantee that acceptance will be achieved. Through such processes, energy companies (and companies in general) can pursue the objectives stated in the concept of CSR – i.e. to dialogue with stakeholders for accounting for their needs and expectations – and avoiding potentially negative social and environmental impacts from the project development. Thus, engagement processes can be considered – from the private actors' perspective – as part of the concept and practices of CSR.

If engagement processes are considered as part of the concept and practices of CSR, their effect should not only be seen with respect to communities – i.e. the target stakeholder of the engagement processes –, but also with respect to other company's stakeholders. In fact, developing engagement processes with

communities may affect the overall CSR strategy as well as the relationships the company has with other stakeholders. For example, engagement processes can allow the company to show to the general public its CSR-based behaviour, thus boosting its reputation. This, in turn, may result in better access to credit, since financial institutions would expect lower communities' oppositions during the project development and, thus, lower financial risk. As such, the development and implementation of engagement processes should be harmonised with the overall CSR strategy, considering the effect that such a strategy may have on other company's stakeholders.

To do that, it is important to act along two avenues of research. It is important:

- I) to analyse the effect of CSR on other relevant company's stakeholders, to understand how the CSR strategy needs to be built to satisfy such stakeholders' needs and expectations.
- II) to analyse how to build and manage internally engagement processes with communities, to ensure harmonisation with the CSR strategy.

Together with local communities (or citizens) which represent the main stakeholder of the analysis, consumers were chosen as another relevant stakeholder of the analysis. Local communities are a key stakeholder in the GEMex project and they represent the ones most strongly affected by the development of a geothermal energy power plant. Consumers, instead, represent another relevant stakeholder due to the importance of consumers' purchasing behaviours as end users, on companies' survival and competitiveness: the more a consumer purchase from a company, the more the company will be likely to achieve good financial performance.

The aim of this chapter is thus twofold. First, it aims at analysing the effect of CSR on consumers, to understand how CSR strategy needs to be built to satisfy the end user's needs. Second, it aims at analysing how companies can build and manage internally engagement processes with communities, to ensure harmonisation with the CSR strategy.

The chapter is articulated into four paragraphs, with the first being the introduction. In between, two out of three paragraphs mirror the aforementioned axes of analysis, while one comprehends examples of practices of multinational companies involved in engagement processes.

2.2) Energy companies and consumers: an analysis of their CSR-based relationships

This paragraph mirrors the first axis of research and it comprehends two different studies, with a common theoretical framework that refers to consumers. The first study analyses energy companies' reputation based on consumers' perception of CSR activities and service quality, in order to understand if good CSR strategies and activities can have some sort of positive outcome for energy companies. Such positive outcome is represented by the enhancement of company reputation, since positive reputation positively affect consumers' purchasing and/or loyalty behaviours. The second study, instead, investigates which kind of activities are considered as "good CSR activities" by consumers, since the energy companies' perspective regarding the implementation of CSR activities may be different from that of consumers.

2.3) Energy companies' internal organisation for developing local communities' relationships: engagement strategies and organisational arrangements

This paragraph mirrors the second axis and it comprehends two different studies with a common theoretical framework that refers to companies' internal organisation. The first study provides an overview of the

organisational dynamics of the Mexican state-owned energy company (i.e. Comision Federal de Electricidad, CFE) when relating with local communities. The second study provides an overview of the current and past organisational dynamics when relating with local communities of an affirmed company in the geothermal energy sector (i.e. Enel), considered a frontrunner in socially and environmentally responsible behaviour.

2.4) Cases of multinational companies involved in public engagement issues: examples of practices

The last paragraph provides cases of multinational companies involved in engagement processes with potentially relevant findings and inputs for the GEMex project.

2.2 Energy companies and consumers: an analysis of their CSR-based relationships

2.2.1 Theoretical background

The efforts companies exert to include Corporate Social Responsibility (CSR) principles within their strategies and actions are more and more a fundamental component of business strategies. More than ever before, companies are implementing activities based on Corporate Social Responsibility (CSR) principles such as socially responsible employment, minority and local communities support programs, natural capital preservation programs, and CSR disclosure reports (Sen and Bhattacharya, 2001; Ali et al., 2017). This phenomenon can be explained by the beneficial effects of CSR strategies and activities on a wide variety of aspects, such as company's market value and financial performance, consumer-company identification, company's legitimation, etc. (Brown and Dacin, 1997; Lee et al., 2012; Swaen and Chumpitaz, 2008; Luo and Bhattacharya, 2006).

The majority of the literature on CSR takes a company's perspective (Öberseder et al., 2013). However, recent researches have focused their attention also on the link between CSR and consumer response (Lichtenstein et al., 2004; Luo and Bhattacharya, 2006; Mohr and Webb, 2005; Sen and Bhattacharya, 2001; Brunk, 2010). This trend reflects the need for companies to gain a better control on the impact of CSR activities on their stakeholders, in order to be able to adequately deliver CSR strategies and activities (Öberseder et al., 2013).

Research supported the beneficial effect of CSR on consumer response, such as consumer perceived corporate reputation (PCR) and consumer loyalty (LOY) (Sen and Bhattacharya, 2001; Brown & Dacin, 1997; Huang and Cheng, 2016; Lacey et al., 2015; Stanaland et al., 2011; Lee et al., 2012). PCR is defined as "the [consumer's] overall evaluation of a company over time" (Lee et al., 2017), and, according to signalling theory (Spence, 1974), both CSR activities and quality of products/services represent major indicators for helping to build a good reputation (Brown and Dacin, 1997). Consumer loyalty is, instead, defined as a repeat purchase/use of a product or service over a period of time (Leenheer et al., 2007). The interest in consumer loyalty is due to its recognized connection with competitiveness, since the more a consumer is loyal to a company performing favourable CSR activities (with comparable quality of products/services), the more such a company will be likely to achieve good financial performance.

The analysis of PCR and consumer loyalty has different implications for companies. The former does not have a direct association with financial performance, since higher reputation does imply higher revenues – consumer perceived corporate reputation is usually considered as an antecedent of market-related consequences. However, reputation is crucial when starting building both a market-based relationships and engagement processes with local stakeholders. Conversely, LOY does directly relate with market consequences and competitiveness, since higher consumer loyalty means higher consumer retention and thus better financial performance. Given these different implications and the different literatures previously recalled to explain those concepts, two studies are developed focussing on:

- 2.2.1) The analysis of CSR activities and quality of products/services as major signals for energy companies for building a good reputation in front of consumers;
- 2.2.2) The analysis of approximated real-life CSR activities for orienting actual consumer decision in terms of enhancing their loyalty.

Previous researches pointed out that society's features may account for variations in consumer-related outcomes (e.g. Morgeson et al., 2011; Walsh and Bartikowski, 2013). Given that, countries with similar characteristics to Mexico such as patterns of development in terms of increasing levels of industrialisation and population (Cowan et al., 2014) are considered – i.e. Brazil, Russia, India, China, South Africa. Among those, we considered in the first study countries with similar cultural orientations – i.e. Brazil, China and South Africa –, while in the second study we included all countries.

2.2.2 Consumers' associations and their influence on corporate reputation

Theory and hypotheses

Consumers' associations refer to how consumers associate information with a company, which affect their "responses to the product and services offered by that company" (Brown and Dacin, 1997), influencing its reputation and revenues. According to Brown and Dacin (1997), there are two types of consumer's corporate associations: Corporate Ability (CA) associations and Corporate Social Responsibility (CSR) associations. CA association identifies the extent to which consumers perceive that a company has the skills and abilities to produce and deliver its products and/or services. Typically, a company that focuses on its corporate abilities relies on the expertise and competence of its employees in order to improve the quality of its products and/or services (Luo and Bhattacharya, 2006). On the other hand, CSR association identifies the extent to which consumers perceive that a company focuses on its societal obligations, going beyond its mere economic interests (Walsh and Bartikowski, 2013). A company with this focus is typically involved in the community, the sponsorship of cultural events and corporate philanthropy.

A company's organizational effectiveness regarding the quality of its products/services – thus, signals for CA associations –, and a company's social performance – thus, signals for CSR associations – represent major signals for building a good reputation (Brown and Dacin, 1997). Understanding the relative importance of these two associations is particularly relevant in times of scarce resources, when the coordination of investments on the quality of product/services and on CSR may present trade-offs and create tensions between different business functions. As such, companies should understand how to adapt the signalling of their key features to the market environment (Walsh and Beatty, 2007) and thus leveraging more on CSR or CA depending on the attributes that characterise their key stakeholders (Walsh and Beatty, 2007). Notably, beside trade-offs in investments, CA and CSR associations might have also possible synergies in determining market outcomes. In fact, He and Li (2011) focused on the iterative effect between CSR and CA associations, suggesting that CSR association could be strengthened by good CA association.

This study aims at analysing the relationships between consumer's CA association and CSR association, and consumer's PCR in a commodity market. Based on the literature above, it can be expected that consumers will attribute a significant level of reputation when having positive evaluations on CSR and CA association. Therefore, it is hypothesised that

H1 – The higher the perceived CSR (PCSR), the higher the consumer's perception of corporate reputation (PCR)

H2 – The higher the perceived service quality (PSQ), the higher the PCR

Moreover, the presence of a relationships between CSR and CA associations can be expected, which is influenced by personal factors such as personal cultural values. Therefore, it is hypothesised that:

H3 – PSQ mediates the relationships between perceived CSR (PCSR) and consumer's perceived corporate reputation (PCR)

Previous researches pointed out that cultural differences account for variations in consumer-related outcomes (e.g. Morgeson et al., 2011; Walsh and Bartikowski, 2013). Distinguishing between the concepts of individualism and collectivism is one of the most established ways to classify the influence that cultural environments have on consumers. Collectivistic cultures emphasise individuals' cooperation, favouring the importance of the group's objectives instead of those of the individual, and tend to behave in accordance with social norms (Liu and McClure, 2001; Morales Espinoza, 1999). Conversely, individualistic cultures value personal initiatives, favouring the individual's efforts and achievement over the group's, and tend to be more concerned with personal needs and goals (Donoghue et al., 2016).

Given the objective of GEMex, countries with comparable cultural environments to Mexico are considered in the study. Thus, the focus on the analysis was on consumers coming from developing countries with a collectivistic culture – i.e. consumers coming from Brazil, China, South Africa and Mexico. Since collectivistic cultures emphasize the importance of PCSR as compared with individualistic cultures, it is hypothesised that

H3 – The relationships between perceived CSR (PCSR) and perceived corporate reputation (PCR) will be stronger than the relationships between perceived CSR (PCSR) and perceived service quality (PSQ).

Method

Data gathering has been undertaken in Brazil, China, South Africa and Mexico. The unit of analysis consisted of customers living in the metropolitan area of capital cities so as to account for the most relevant dynamics of interest for the service industry.

The electricity supply sector emerged as an optimal research setting for testing the hypotheses introduced above. First, electric utilities are crucial for the development of fast-growing economies. Despite that, these companies are facing relevant challenges caused by environmental and social pressures, profound technological changes (i.e. renewables, smart grids, etc.) and the introduction of new policies and regulations (e.g. the unbundling). Thus, these companies should be able to face the challenges of an open market by achieving a better understanding of what consumers think about them and why, so as to make the most effective investments in corporate reputation (e.g. is it better to lower the energy costs by exploiting far resources regardless the conditions of indigenous populations or to preserve equal rights by investing in renewables and socially responsible interventions?). Second, the electricity supply is a service that represents a commodity in all the metropolitan areas of capital cities. Thus, it offers similar conditions to customers from the same region, which reduces the influence of contingencies that are not under control in this study.

The study was performed on primary data from a survey conducted among consumers in the metropolitan area of the capital city of each country. In particular, the survey targeted consumers who were either the owner of the house or had the electricity bill at their name. This choice was due to the characteristics of the constructs, since we asked questions related to the relationships between the electricity provider and the consumer as well as questions related to the quality of the service. Data were collected between February

2018 and March 2018. Questionnaires were gathered through computer assisted web interviews, via a specialised survey collecting company. The sample consists in – approximately – 300 respondents per country, giving a total amount of respondents of 1216. The sample included 593 men – 48,7% of the total respondents – and 623 women – 51,3% of the total respondents. The questionnaire consists of 18 questions, with one being optional. The questionnaire can be divided according to three sections: 1) an introduction regarding the aim of the study, the institution as well as the researchers involved, and the time needed to fulfil the questionnaire; 2) measurement of the constructs PCSR, PSQ and PCR; 3) participants' demographic information i.e. gender, age, level of education, and family components. The questionnaire was prepared in English and translated to Spanish, Chinese and Portuguese following the double-translation principles by Spanish, Chinese and Portuguese mother-tongue researchers. If the double-translation process undermined the questions comprehensibility, we rephrased and/or changed the questions involved, repeating the double-translation process. Moreover, a pre-test of approximately 20-25 SSI's respondents per country was performed, to reveal possible weaknesses and misunderstanding from the text. The questionnaire avoided use of ambiguous or unfamiliar terms, vague concepts and complicated syntax in order to make the questions simple, specific and concise (Podsakoff et al., 2003). Within the introduction, anonymity and confidentiality of respondents was guaranteed, and it was asked to respond as truthfully as possible, since there were no right or wrong answers. In addition, each respondent was assured about data aggregated use and the scientific – and non commercial or promotional – objective of the study.

The measurement of the constructs PCSR, PSQ and PCR adopted a seven-point scale from 1 to 7. The scale body of text was the same for the three constructs, rating 1 as the lowest value – strongly disagree – and 7 the highest value – strongly agree, with randomly reversed poles. We referred to prior studies to design the questionnaire items, which were adapted to the specific characteristics of the study. While PCSR was measured through five questions (Swaen & Chumpitaz, 2008; Hur et al., 2014), the other two constructs were measured by four questions (Huang and Cheng, 2016; Wang et al., 2003; Walsh and Beatty, 2007; Hur et al., 2014). A pre-test with 20-25 SSI's respondents per country was performed in order to detect misunderstandings, ambiguities, or other difficulties participants could encounter with the items. Figure 5 shows the conceptual model built to test our hypotheses. PCSR and PSQ are used as predictors of PCR, and the mediating effect of PSQ on the relationships between PCSR and PCR is tested. To run statistically the conceptual model, the SEM (Structural Equation Modelling) technique was performed.

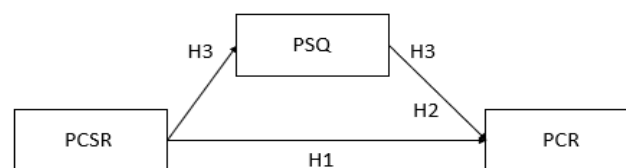


Figure 5. Conceptual model with hypotheses

Hypothesis	Hypothesised path	Hypothesised sign
H1	PCSR → PCR	+
H2	PSQ → PCR	+
H3	PSQ mediator of the relation PCSR → PCR	+
H4	PCSR → PCR > PSQ → PCR	Not present

Table 2. Hypotheses with the hypothesized paths and signs

Results and discussion

The Cronbach α was estimated per each construct in each country. Table 3 shows the Cronbach values, which are above the recommended threshold of 0.7 (Hair et al., 1998), confirming the reliability of the measurement of this study (Chen and Chang, 2013). In addition, Table 2 shows the retained factors and the factor loadings per each country estimated through a confirmatory factor analysis, confirming that each construct can be classified into only one factor. Lastly, the Kaiser-Meyer-Olkin (KMO) measure displays values above the recommended threshold of 0.8 (Cerny and Kaiser, 1977). Thus, construct validity can be confirmed.

Country	Construct name	α	N. of factor
All countries	PCSR	0.8701	1
	PSQ	0.8797	1
	PCR	0.9060	1
Brazil	PCSR	0.8555	1
	PSQ	0.8541	1
	PCR	0.9026	1
China	PCSR	0.8554	1
	PSQ	0.8562	1
	PCR	0.8953	1
South Africa	PCSR	0.8542	1
	PSQ	0.8928	1
	PCR	0.9057	1
Mexico	PCSR	0.8433	1
	PSQ	0.8713	1
	PCR	0.8951	1

Table 3. Constructs, Cronbah α , and number of factors regarding the countries all together and for each country taken separately.

We used SEM to verify the hypotheses H1; H2; H3; H4. When considering all countries as a single pool, the overall fit measures of the full model are reported in Table 4. They are all acceptable since they are lower – or higher – than the threshold values recommended by literature – Root mean square error of approximation (RMSEA) < 0.08; Comparative fit index (CFI) > 0.95; and Tucker-Lewis index (TLI) > 0.91 (Beauducel and Wittmann, 2005; MacCallum et al., 1996; Hu and Bentler, 1999).

Fit measures	All countries
RMSEA	0.079
CFI	0.962
TLI	0.952

Table 4. RMSEA, CFI and TLI, of all countries taken all together.

Results show that PCSR is positively related to PCR (direct effects). Thus, H1 is confirmed. Similarly, PSQ is positively related to consumer's PCR (direct effects). Therefore, H2 is confirmed. In addition, there is an indirect effect of PCSR on PCR, with the relation between PCSR and PSQ being statistically significant. Thus,

the mediation effect of PSQ on the relationships between PCSR and PCR is confirmed, supporting H3. In particular, the mediation effect is partial, with the indirect effect of PCSR on PCR being stronger than its direct effect. This finding extends prior research (He and Li, 2011; Luo and Bhattacharya, 2006) since it proves that the CA association can also be seen as a mediating factor in the relation between CSR association and consumer-related outcomes. When considering the strength of the relationships, the direct effect of PCSR on PCR is weaker than the direct effect of PSQ on PCR. Thus, H4 is not supported, even though the strengths of the total effects are reversed. As such, we can affirm that at the general level consumers in developing countries attribute greater importance to the service quality of electric utilities rather than its social performance in enhancing its reputation.

Constructs		Direct effects (All countries)	Indirect effects (All countries)	Total effects (All countries)
		Coefficients	Coefficients	Coefficients
PCR ←	PSQ	.7528668**	0	.7528668**
	PCSR	.3369113**	.7757426**	1.112654*
PSQ ←	PCSR	1.030385**	0	1.030385**

Table 5. Coefficients detailed for type of effect – direct, indirect and total – of all countries (as a single pool) [*p<0.05 and **p<0.01].

When considering each country separately, the overall fit measures of the full model detailed for each country are reported in Table 6. They are all acceptable since they are lower – or higher – than the threshold values recommended by literature (Beauducel and Wittmann, 2005; MacCallum et al., 1996; Hu and Bentler, 1999).

Fit measures	Brazil	China	South Africa	Mexico
RMSEA	0.077	0.073	0.079	0.074
CFI	0.951	0.965	0.937	0.972
TLI	0.939	0.956	0.921	0.965

Table 6. RMSEA, CFI and TLI, of each country.

PCSR was found to be significant and positive when directly relating with PCR in all countries considered, thus confirming H1. Similarly, H2 was confirmed for each country, with PSQ always being significant and positive. In particular, the direct effect of PCSR on PCR is weaker than the direct effect of PSQ on PCR, with South Africa being the only exception, even though the difference is minimal. Thus, H4 is not supported. This study highlights that it is not always true that companies with a high social performance can gain direct benefits, such as enhanced PCR (Lacey et al., 2015). PSQ emerges as the most powerful aspect to manage for improving reputation from the consumer perspective, especially in environments where there is high competition and a low possibility of differentiation between products (Swaen and Chumpitaz, 2008) as in the electricity supply service.

Additionally, the relation between PCSR and PSQ is always positive and statistically significant, as well as the indirect effect of PCSR on PCR. The mediation effect of PSQ on the relationships between PCSR and PCR is confirmed, thus supporting H3. The mediation effect of PSQ is partial, with a stronger total effect of PCSR on

PCR as compared with PSQ. These findings show a more complete picture as compared to the results related to the direct effect of PCSR and PSQ on PCR. In fact, it can be stated that CSR association constitutes "a general context allowing consumers to assess a company's products" (Swaen and Chumpitaz, 2008), since it always has an effect – direct and/or indirect (i.e. mediated) – on PCR. Since it always has an indirect effect on PCR, "CSR may eventually be viewed less as a relationships motivator and more as one necessary precondition" (Lacey et al., 2015). As such, electricity companies focussing only on PSQ may overlook the crucial role of CSR and experience the weakening of their reputation in the long-term.

Constructs		Direct effects (Brazil)	Indirect effects (Brazil)	Total effects (Brazil)
		Coefficients	Coefficients	Coefficients
PCR ←	PSQ	.8608087**	0	.8608087**
	PCSR	.3220222**	.8790807**	1.201103**
PSQ ←	PCSR	1.021227**	0	1.021227**

Constructs		Direct effects (China)	Indirect effects (China)	Total effects (China)
		Coefficients	Coefficients	Coefficients
PCR ←	PSQ	.7704226**	0	.7704226**
	PCSR	.2668613*	.6640393**	.9309007 **
PSQ ←	PCSR	.8619157**	0	.8619157**

Constructs		Direct effects (South Africa)	Indirect effects (South Africa)	Total effects (South Africa)
		Coefficients	Coefficients	Coefficients
PCR ←	PSQ	.5779471**	0	.5379471**
	PCSR	.5808057**	.7317766**	1.312582 **
PSQ ←	PCSR	1.360313**	0	1.360313 **

Constructs		Direct effects (Mexico)	Indirect effects (Mexico)	Total effects (Mexico)
		Coefficients	Coefficients	Coefficients
PCR ←	PSQ	.7418964**	0	.7418964**
	PCSR	.4165062*	.8770563**	1.293563**
PSQ ←	PCSR	1.182182**	0	1.182182 **

Table 7. Coefficients detailed for type of effect – direct, indirect and total – of each country [*p<0.05 and **p<0.01]

Conclusion and implications

In countries with a more collectivistic culture, the focus of electric utilities on societal issues can be used as a useful strategic option, since they can benefit from communicating their positioning and values to consumers relying on both social aspects – thus influencing a consumer's CSR association – and product/service quality aspects – thus influencing a consumer's CA association.

Electric utilities can always use their corporate abilities for strategic and communicational purposes, since the CA association has been always found to positively contribute to the corporate reputation regardless of the country considered. However, the results of the third hypothesis reveal the potential narrowness of a strategic and communicational approach that solely considers corporate abilities. The CSR association emerged as constituting “a general context allowing consumers to assess a company's products” (Swaen & Chumpitaz, 2008), since it always has an effect – direct or indirect (i.e. mediated) – on reputation. Thus, electric utilities should not give their strategic and communicational efforts the sole aim of influencing consumer's CA association. Contrarily, they should consider the indirect impact of CSR association. Since, it represents the consumer's general context for building positive reputation, electric utilities should configure their CSR strategy and activities with consumers' needs and values as well as prefer investing in the long-run on increasing PCSR rather than increasing PSQ.

Consequences in terms of investment priorities and communication strategies can thus be deduced. In collectivistic countries, where the local culture emphasizes the importance of the rights of communities over those of individuals, electric utilities should prefer investing on increasing PCSR rather than increasing PSQ. Due to its role of relationship motivator, poor CSR strategy can impair establishing a relationships between consumers and electric utilities to the point where investments in higher PSQ would not be sufficient to motivate a relationships. Electric utilities should thus keep investing in increasing the quality of the service in the short term, while investing in CSR activities should be their leading goal in the long-term.

2.2.3 Company's CSR activities and their influence on consumer loyalty

Theory and hypotheses

Research supported the beneficial effect of CSR on consumer responses (Huang & Cheng, 2016; Lacey et al., 2015; Stanaland et al., 2011; Lee et al., 2012). Despite such important role, CSR has often been studied in aggregated form, and thus little is known about the way in which “[specific] corporate [CSR-related] decisions are perceived by the public” (Brunk, 2010). Consumers’ views of CSR should not be substituted by those of companies, as the business perspective regarding the implementation of CSR activities may be different from that of consumers (Gonzalez-Rodriguez et al., 2019; Brunk, 2010). For example, companies could communicate their CSR activities by using mass media such as TV and internet, while consumers may prefer to receive information by word-of-mouth from the beneficiaries of such activities, as a sign of effective companies’ commitment and behaviours. As such, differences in consumers’ and companies’ perspectives may impair CSR activities effectiveness, leading to adversarial consumers’ responses (Brunk, 2010). In particular, consumer loyalty can be undermined, and companies can suffer from damages to their profitability. Consumer loyalty is one of the most used dependent variables in conceptual models for investigating the effect of CSR (Lacey et al., 2015; Stanaland et al., 2011, Lee et al., 2012), since it is strictly connected to competitiveness – i.e. the more a consumer is loyal to a company, the more such a company will be likely to achieve good financial performance.

This paragraph thus investigates which CSR activities are the most effective in influencing consumer loyalty. We categorised CSR activities in CSR domains, representing the areas of responsibility usually ascribed to companies. Such domains are three: the social CSR domain (SD), the environmental CSR domain (ED) and the communication CSR domain (CD). The SD generally refers to the establishment of responsible relationships and behaviours with actors such as employees, suppliers, local communities, NGOs, etc., in order to account for the impacts that companies have on the society. The ED regards the establishment of responsible behaviours in terms of environmental protection as well as relationships with environmental bodies, in order to account for the impacts that companies have on the environment. Last, the CD refers to the company’s way of communicating the activities falling into the previous domain. In fact, communication emerges as crucial when conveying a company’s social performance since literature underlined that consumers lack knowledge and actual recognition of CSR activities even though they are being performed by companies (Lee et al., 2012; Swaen & Chumpitaz, 2008).

This study aims at empirically testing the CSR domains that consumers value most when deciding whether a company deserves their continued loyalty or not. In addition, it aims at empirically testing the relative importance consumers give to each CSR domain when evaluating their level of loyalty towards a company. Such aims are pursued by using CSR activities based on real-life approximated situations, since consumers’ perceptions of CSR do not necessarily coincide with the actual companies’ social performance, often due to communication issues (Perrini et al., 2010; Bhattacharya et al., 2009).

Based on the literature above, it can be expected that consumers will acknowledge companies’ efforts in different CSR domains, and will convert such efforts into a significant degree of loyalty when evaluating them as positive and important. Therefore, we hypothesize that:

1a) The more a consumer considers the social domain (SD) of a company's CSR activities as positive and important for himself/herself, the more he/she will be prone to be loyal to the company.

- 1b) The more a consumer considers the environmental domain (ED) of a company's CSR activities as positive and important for himself/herself, the more he/she will be prone to be loyal to the company.*
- 1c) The more a consumer considers the communication domain (CD) of a company's CSR activities as positive and important for himself/herself, the more he/she will be prone to be loyal to the company.*

Some studies have investigated the multidimensional nature of CSR, but very few have attempted to develop a multidimensional scale of measurement by establishing which CSR domains are relevant to consumers (Alvarado-Herrera et al., 2017; Öberseder et al., 2014). Öberseder et al. (2013) and Brunk (2010) qualitatively demonstrated that consumers and companies attach a different level of importance to CSR domains and to different aspects within a domain. Therefore, we hypothesize that:

- 2) The more a company engages in CSR activities following a descending level of importance among the environmental, social and communication domain, the more a consumer will be loyal to the company.*

Method

An experimental field study was conducted to empirically test the aforementioned hypotheses. Brazil, Russia, India, China, South Africa – BRICS – and Mexico were considered in the study, as they are all emerging economies with similar patterns of development (Cowan et al., 2014).

Primary data from a survey conducted among consumers in the metropolitan area of the capital city of each of the BRICS nations and Mexico were studied. Data were collected between February and March 2018. The answers were gathered through computer-assisted web interviews, via the specialist survey collecting company Survey Sampling International (SSI). The sample consisted of approximately 300 respondents per country, giving a total of 1520. The sample included 740 men (48.7% of the total respondents) and 780 women (51.3%).

The rank-ordered logistic regression (rologit) model was chosen to test the hypotheses. Such method can convey greater realism to the respondent (Cavanagh & Fritzsche, 1985) because it offers “a range of situational or contextual factors” (Robertson 1993, p. 592) that “approximate real-life decision-making situations” (Barnett et al., 1994, p. 473). Thus, the rologit model enables an analysis of “how decision makers combine attributes of alternatives into overall evaluations of the attractiveness of these alternatives” (StataCorp., 2005). The alternatives – or vignettes – represent scenarios that an individual needs to evaluate and rank, while maximizing his/her utility (Weesie, 2003; Schu & Morschett, 2007). Within each vignette the individual is presented with different attributes and is asked to provide an overall evaluation of them. Through the individual's ranking, which represents the dependent variable, the model gives the relative importance that individuals assign to each attribute.

The survey was designed and conducted through four steps: i) identification of the *attributes*; ii) definition of the *modalities of variation* of each attribute; iii) construction of the *vignettes*; and iv) measurement of *preferences*.

- i) The current literature was reviewed and three domains related to the CSR concept were identified: the social domain (SD), the environmental domain (ED), and the communication domain (CD). SD was structured using two attributes: the impact of the geothermal development on local communities (ILC) and the nationality of companies' managers involved in the development (MN). The ED was structured

using one attribute: potential environmental impact of the geothermal development (EI). Last, the communication domain was structured using one attribute: the transparency of the CSR communication (CUT). Table 7 shows further details on the process of attributes identification.

Domain/Step	Identification of attributes
Social domain (SD)	<p>The SD represents a composite domain with very different actors and interests. The focus is on companies' responsibilities towards communities and managers, which represent types of stakeholders typically involved in a geothermal energy facility development. The interests of LCs are often overlooked in favour of urban consumers' energy needs, and they can be subjected to risks and opportunities due to underground exploration and the construction and running of the facilities. Managers, instead, are directly involved in the implementation of companies' operations, and hiring local managers can be effective in ensuring a non-discriminative working environment, and in representing local interests. Consumers thus evaluate the potential social consequences of a geothermal energy facility development on the LCs, and they evaluate how human resources are managed by the company.</p> <p>The SD is structured using two attributes: the impact on local communities (ILC) and managers' nationality (MN).</p>
Environment domain (ED)	<p>Consumers evaluate the potential negative consequences of a geothermal energy facility development on the environment nearby.</p> <p>The ED is thus structured using one attribute: environmental impact (EI).</p>
Communication domain (CD)	<p>Consumers evaluate the way in which companies communicate their CSR activities.</p> <p>The communication domain is thus structured using one attribute: communication transparency (CUT).</p>

Table 8. Attribute identification process

- ii) After their identification, attributes' most relevant modalities of variation were established. The modalities of variation represent the degrees of variation of an attribute and, as they vary along a broad spectrum of possible degrees, the relative importance given by consumers to each of them can be identified. An initial list of modalities of variation was identified based on the literature, detailing for each modality related importance (Öberseder et al., 2014, Öberseder et al., 2013; Brunk, 2010; Ballesteros et al, 2015). A pre-test with approximately 20 consumers per each BRICS country was conducted, asking them to elicit the most appropriate modalities of variation and assign them weights. In fact, to run the rologit model, different weights must be attributed to each modality of variation, to establish the relative importance along the spectrum of possible degrees. Table 8 shows all the attributes, and the modalities of variation for each attribute with related weights.

Attribute/Step	Modalities of variation of each attribute	Weight
Impact on local communities (ILC)	The well-being of the local community is higher because of the presence of the company	3
	The company does not generate positive or negative impacts for the local community	2
	The company negatively impacts the well-being of the local community	1

Managers nationality (MN)	The company ensures a balance between employing (nationality) managers and foreign managers	3
	Only a minority of the managers employed by the company are from foreign countries	2
	The company employs only (nationality) managers	1
Environmental impact (EI)	The company has no negative impact on the natural environment	3
	The company has a limited, but not permanent, negative impact on the natural environment	2
	The company has a highly negative and permanent impact on the natural environment	1
Communication transparency (CUT)	The company provides transparent and reliable information to customers about its activities	3
	The company provides only partial information to customers about its activities	2
	The company does not provide information to customers about its activities	1

Table 9. Attributes, modalities of variation and associated weights

iii) As the study was conducted in BRICS, both translation accuracy and overall comprehensibility of the questionnaire had to be ensured. To such aims, a three-step vignette building process was carried out. At the end, six vignettes were built and the survey was distributed to all of the respondents from BRICS. Table 10 shows the description of the vignette building process. The vignettes used in the survey are reported in Annex 1 at the end of the paragraph.

Phases	Description
First phase	Double-translation principles were applied for translating the survey from English to Spanish, Chinese and Russian by mother-tongue researchers in the respective languages. Misunderstandings and mistakes emerged from both lexical/grammatical and interpretational differences, due to BRICS different cultures and ways of interpreting sentences and phrases – i.e. country-based asymmetries in the overall comprehensibility of the questionnaire.
Second phase	To ensure lexical/grammatical accuracy, sentences were rephrased and/or some words were changed, and the double-translation process was repeated. To ensure the overall comprehensibility of the questionnaire, vignettes were structured according to the constant-variable-value vignette (CVVV) method, which predicts the individual's judgement over an identical set of vignettes. Among all the possible combinations of the different modalities of variations, respondents decided through the pre-test the most plausible, creating identical vignettes for each respondent. By doing this, the vignettes' degree of meaningfulness in the countries they were evaluated in was ensured, along with the lexical/grammatical accuracy. In fact, a random mix would have led respondents to evaluate potentially absurd vignettes, increasing the risks of questions being answered randomly. Thus, the vignettes used were also the most plausible from a practical perspective; i.e., they could concretely "approximate real-life decision-making situations" (Barnett et al., 1994, p.473).
Third phase	Another pre-test with 20-25 SSI respondents was carried out to validate the process of vignette building.

Table 10. Vignettes building process

iv) The preferences were measured using the individuals' rankings. We asked respondents to follow the sequential choice process. First, they were asked to rank their most preferred vignette out of the six as the first. They were then asked to choose their least preferred vignette out of the remaining five and rank it as the sixth. This process was repeated for the remaining (four) vignettes, identifying the second and the fifth, and the third and the fourth. This process is known as the "repeated best-worst" (González Dávila et al., 2016), and can help respondents rank their preferences (González Dávila et al., 2016). To facilitate consumers in the "repeated best-worst" process, we used progressive letters (A, B, C, etc.) to mark each vignette, displaying an ordinal representation of them all.

The survey was structured into three sections: 1) an introduction regarding the aim of the study, the institution and the researchers involved, and the time needed to fulfil the questionnaire; 2) context information about the vignettes and their rankings; 3) participants' demographic information i.e., gender, age and level of education. Before the ranking, the respondents were provided with context information about the vignettes they were about to evaluate, as this can facilitate semantic processes (Shapiro, 1999). To account for additional bias, the introduction ensured the anonymity and confidentiality of the respondents and requested that they responded as truthfully as possible because there were no right or wrong answers. Each respondent was assured about the use of aggregated data and the scientific, non-commercial and non-promotional objectives of the study. Missing values within the ranking implied the exclusion of the respondent from the study.

The rank-ordered logistic regression model "can be generated through a random utility model where respondents rank the m alternatives" or vignettes (Guimarães et al., 2016) (in this study $m = 6$), in accordance with their preferences – in our case with their willingness to keep purchasing electricity from the same provider. The utility obtained from alternative $j = 1, \dots, m$ is given by

$$U_j = \beta_{0,j} + \beta_{1,j}X_1 + \dots + \beta_{k,j}X_k + \varepsilon_k$$

where

- $X_1 \dots X_k$ are the explanatory variables, i.e., the modalities of variation of the attributes ILC, MN, EI and CUT;
- $\beta_{0,j}, \beta_{1,j} \dots \beta_{k,j}$ represent the coefficients to be estimated by the statistical software (Stata);
- ε_k represents the error terms.

Any ranking of the m vignettes can be seen as a sequence of company actions, ranging from those with the highest individual utility – in terms of consumer loyalty – to those with the lowest utility (Guimarães et al., 2016). Table 11 shows all the hypotheses with the hypothesised paths and signs.

Hypotheses	Domains	Hypothesised path	Hypothesised sign
H1a	SD	ILC → Cons. Loy.	+
		MN → Cons. Loy.	+
H1b	ED	EI → Cons. Loy.	+
H1c	CD	CUT → Cons. Loy.	+
H2	Not present	ED > SD > CD	Not present

Table 11. Hypotheses with the hypothesised paths and signs

Results and discussion

When all countries are considered (Table 12), the results show that three out of four attributes are significant. ILC, EI and CUT are significant and have positive coefficients, while MN is not significant and has a negative coefficient. Consequently, H1b and H1c are confirmed, while H1a is confirmed for ILC but not for MN. When considering the strength of the coefficients in the case of all BRICS, ILC plays by far the most important role in consumer loyalty towards the company, followed by CUT and EI respectively. Thus, H2 is not confirmed.

The effect of the companies' behaviour on the well-being of local communities represents the most important attribute influencing whether consumers are loyal or not to the companies. That is, consumers consider of primary importance how and to what extent the development of geothermal energy facilities affect the social environment – i.e. the local communities – near such facilities. Previous studies have highlighted the importance of involving local communities when developing energy facilities (Dobele et al., 2014; Benites-Lazaro and Mello-Thery, 2017; Hall et al., 2015). These results demonstrate that such involvement can not only determine positive site-specific consequences, such as reducing local tensions, but it can also directly and positively affect companies' financial performance.

Unlike ILC, MN is not significant, showing no impact on consumer loyalty.

Environmental protection (EI) is the least important factor influencing whether consumers are loyal or not to the companies. This contrasts with previous research suggesting that consumers are well aware of the importance of protecting the environment and are even willing to boycott companies that cause environmental damage (Brunks, 2010). These results show that negative and permanent impacts on the environment nearby the geothermal energy facility are not perceived as a threat, even though such kind of impacts would surely affect local communities' well-being a trade-off emerged from consumers' prioritisation of attributes. A trade-off, thus, emerges regarding consumers' prioritisation of attributes. While consumers have rated local communities' well-being as the most relevant attribute in their decision to be loyal towards the energy company, they have evaluated a potential direct cause of local communities' unhealthiness – i.e. environmental pollution – as of little importance. A possible explanation of such trade-off could be linked to the consumers apparent mental categorisation of companies' actions based on what happens locally, i.e., within the capital city of their home country, or far away from them, i.e., at the site of the geothermal energy facility (Brunks, 2010). Thus, in the context of environmental protection, the distance between consumers and the energy facility potentially causing environmental damage can help explain the weak effect of EI.

Last, CUT has a strong and positive impact on consumers' loyalty, even though its strength is only half of the ILC's strength. This means that a reliable and transparent communication between energy companies and consumers is of considerable importance in consumers' decision to be loyal – or not – to the energy company. Through its impact on companies' financial performances, communication should be carefully managed by energy companies, and phenomena of "greenwashing" should be avoided, since both perceptions of greenwashing and deliberately misleading strategies can damage what consumers think about the company itself (Peattie et al., 2009; Parguel et al., 2011), impairing their loyalty and company's profitability.

Countries	Attributes			
	ILC	MN	EI	CUT
All countries	.4773478**	-.0383154	.084717**	.2291415**

Table 12. Coefficients and level of significance for each attribute detailed for all countries [$*p<0.05$ and $**p<0.01$]

When examining each country separately (Table 13), differences emerged. The level of significance of the attributes EI and CUT changed among the countries, with EI being significant only in the case of China and CUT being not significant only in the case of India. Conversely, ILC and MN do not change among countries, with the former remaining always significant and the latter always not significant. In terms of sign, all the significant coefficients among the countries are positive, implying a positive contribution of such attributes to consumer loyalty towards the company – although with different weights. Consequently, H1a is confirmed for ILC but not for MN, regardless of the country considered. H1b is confirmed only in the case of China, and H1c is confirmed in the cases of Brazil, Russia, China, South Africa and Mexico. In terms of coefficient strength, ILC still plays the most important role in consumer loyalty, regardless of the countries considered. Similar to the case of all countries, the second most important attribute is CUT for four countries out of the six: Brazil, Russia, South Africa and Mexico. Conversely, CUT is preceded by ENV as the second most important attribute in the case of China. Thus, H2 is not confirmed for any of the countries considered.

The importance of dealing with local communities and enhancing their well-being is confirmed for all countries. A company's impact on the local community's well-being thus represents the key attribute regardless of the country considered. As such, the generalizability of this finding across developing countries that share similar socio-economic characteristics with the ones considered in the study can be ensured.

Conversely, MN is always not significant, remarking the fact that employing foreign or non-foreign managers is not a matter of consumers' evaluation.

EI is not significant in five out of the six countries – Brazil, Russia, India, South Africa and Mexico – with China being the exception. The mental categorization of consumers, distinguishing between what happens locally and far away, may account for this non-significance (Brunks, 2010). Conversely, EI is significant and of considerable importance in China and is stronger than CUT, while for Brazil, Russia, India, South Africa and Mexico CUT is the second most important attribute. A possible explanation could lie in the leading role played by China in addressing environmental pollution (mainly from its industrial processes). Such role may result in Chinese consumers being more sensitive to environmental issues compared with the other countries in the study, leading them to prefer EI over CUT in terms of importance.

CUT represents the second most important attribute influencing whether consumers are loyal or not to the company in four of the six countries: Brazil, Russia, South Africa, and Mexico. Reliable and transparent CSR communication is considered to be of high importance and to have a direct and positive impact on companies' financial performance. Despite its importance in Brazil, Russia and South Africa, CUT is not significant for India. Moreover, India is the only country in which MN, EI and CUT are simultaneously not significant, and shows the lowest ILC strength compared with the other countries. Possible explanations could be due to the fact that in India, from a cultural perspective, doing good discreetly is more desirable than doing good for publicity (Amaladoss et al., 2013). This cultural peculiarity also affects CSR communication, which is usually structured in a top-down approach and without the participation of employees and other stakeholders (Amaladoss et al., 2013). Thus, Indian consumers identified ILC as the only attribute worthy of evaluation, leaving the company with much room for manoeuvre in its CSR activities.

Countries	Attributes			
	ILC	MN	EI	CUT
Brazil	.4839619**	-.0690771	.0379106	.2997329**
Russia	.6811824**	-.0829496	.0980183	.3686322**
India	.2182059**	.0124115	.059231	.060384
China	.441597**	-.0733204	.2123668**	.1655273*
South Africa	.5836309**	-.0606806	.0270758	.3160659**
Mexico	.4656317**	.0448477	.0938501	.1698364**

Table 13. Coefficients and level of significance for each attribute detailed for each country [*p<0.05 and **p<0.01]

Conclusion and implications

The two attributes of SD show very different impacts on consumer loyalty. From a strategic perspective, companies should prioritize the understanding of how and to what extent their business actions (e.g. development of energy facilities) impact local communities' well-being over the employment of managers with multicultural backgrounds. In fact, this is what consumers value the most when considering their loyalty. This finding is extremely valuable for multinational energy companies involved in the construction of energy facilities – and, in particular, geothermal energy facilities –, as it allows the identification of common prioritises across countries when considering CSR strategies and activities.

In terms of CSR activities within the ED, companies should consider the trade-off resulting from consumers' prioritization of attributes. Environmental pollution can be a potential direct cause of poor health in local communities, even though consumers rated it as of low importance in terms of their loyalty to the company. This trade-off may tempt the companies to focus their attention on guaranteeing consumer loyalty by prioritizing CSR activities within the SD and the CD instead of within the ED. However, ED-based CSR activities still have strategic value for the analysed companies. In fact, such activities can indirectly contribute to consumer loyalty through two different ways. First, CSR activities aimed at protecting the environment around the operation site can ensure local communities' well-being, which positively influences consumer loyalty. Second, these activities can strengthen communication, which has been identified as the second most important attribute for consumer loyalty. Consequently, companies' ED-based CSR remain favourable strategic and operational activities, regardless of the importance given by consumers.

In terms of CD-based CSR activities, companies should ensure reliable and transparent CSR communication to positively affect consumer loyalty. In particular, it is of strategic importance to avoid phenomena of greenwashing, which consists of “a selective disclosure of only positive information about [companies'] performance”, deflecting “attention from [companies'] environmental and social shortcomings” (Vollero et al., 2016). If they detect greenwashing, consumers perceive a lack of sincerity and orient their behaviour towards negative reactions, such as taking part in public protests and changing their purchasing behaviour in favour of other companies (Brunk, 2010). Consequently, companies' CD-based CSR activities should emphasize the transparency and reliability of the content communicated and ensure continued communication with established ad-hoc content.

These findings also have implications for managers. By focusing on the leverage typically used to increase the customer base, i.e., reducing prices and improving customer care, energy companies may overlook important strategic aspects. To avoid this, they should i) assess the CSR domains and attributes that consumers value the most, according to the country where the business action or facility is implemented; ii) prioritize their CSR investments according to the assessment, adjusting for potential trade-offs such as that within the ED; and iii) identify communications strategies that can convey in a transparent and reliable way consumer demands.

2.2.4 Concluding outline and the case of Mexico

These studies contribute to one of the aims of the second chapter, which is to analyse the effect of CSR on other relevant company's stakeholders for shedding light on how the CSR strategy needs to be built to satisfy such stakeholders' needs and expectations. In particular, the ultimate purpose is to avoid that poorly developed CSR strategies and activities would negatively affect engagement processes (and vice versa), resulting in negative impacts on the relationships with key stakeholders.

By briefly recalling the main findings and implications of the two studies, it can be summarised that

- Energy companies operating in countries characterised by collectivistic cultures such as Mexico can rely on both social aspects – thus influencing a consumer's CSR association – and product/service quality aspects – thus influencing a consumer's CA association – to enhance their reputation. In addition, CSR constitute “a general context allowing consumers to assess a company's products” (Swaen & Chumpitaz, 2008). As such, electric utilities should consider that to prioritise CSR investments as compared to service quality investments, and consider the indirect impact of CSR association as a consumer's general context for building positive reputation.
- Energy companies should prioritize their CSR activities, considering the social domain of CSR, its communication domain and its environmental domain respectively. The understanding of how and to what extent the development of energy facilities – and in particular geothermal energy facilities – impact local communities' well-being has the highest importance for consumers in the capital city of each country. Reliable and transparent communication has a lower priority as compared with local communities, but it outmatches the importance given to the environmental impact of the geothermal facility.

Focussing on Mexico, specific insights can be given.

- Since Mexico is considered as having a collectivistic culture (where individuals' cooperation is emphasised, and citizens tend to behave in accordance with social norms), energy companies operating in such a country can rely on both social and product/service quality aspects to enhance their reputation. In addition, investments aimed at increasing PCSR among Mexican consumers are a priority compared to investments in PSQ, and they need to be adequately configured in order to understand which kind of activities consumers consider as socially responsible activities and represent their values.
- Urban Mexican consumers consider of primary importance the impact on local communities of geothermal energy developments when evaluating their level of loyalty. The employment of managers from multicultural backgrounds is not a matter of evaluation, while a transparent and reliable communication (the communication domain, CD) outmatches the importance given to the negative environmental impact potentially caused by geothermal energy (environmental domain, ED). Despite that, attention should be paid in dealing with negative environmental impacts because Mexican consumers show a trade-off in their attribute prioritisation behaviour. Even though they rated environmental pollution as of low importance in terms of their loyalty to the company, it can be a potential direct cause of poor health in local communities. As such, ED-based CSR strategies and activities still have strategic value for energy companies developing geothermal energy facilities in Mexico. In fact, such activities can indirectly contribute to consumer loyalty through two different ways. First, CSR

activities aimed at protecting the environment around the operation site can ensure local communities' well-being, which positively influences consumer loyalty. Second, these activities can strengthen communication, which has been identified as the second most important attribute for consumer loyalty. CD-based CSR activities should be characterised by ad-hoc content and inspired by transparency and reliability principles. For example, CSR communication based on superior environmental performance of geothermal energy developments to the benefit of local communities could represent a good starting point for effective communication campaigns.

2.2.5 References

- Ali, W., Frynas, J. G., & Mahmood, Z. (2017). Determinants of corporate social responsibility (CSR) disclosure in developed and developing countries: a literature review. *Corporate Social Responsibility and Environmental Management*, 24(4), 273-294.
- Alvarado-Herrera, A., Bigne, E., Aldas-Manzano, J., & Curras-Perez, R. (2017). A scale for measuring consumer perceptions of corporate social responsibility following the sustainable development paradigm. *Journal of Business Ethics*, 140(2), 243-262
- Amaladoss, M. X., & Manohar, H. L. (2013). Communicating corporate social responsibility—A case of CSR communication in emerging economies. *Corporate Social Responsibility and Environmental Management*, 20(2), 65-80
- Ballesteros, B. C., Rubio, R. G., & Ferrero, J. M. (2015). Efecto de la composición del consejo de administración en las prácticas de responsabilidad social corporativa. *Revista de Contabilidad*, 18(1), 20-31
- Barnett, T., Bass, K., & Brown, G. (1994). Ethical ideology and ethical judgment regarding ethical issues in business. *Journal of Business Ethics*, 13(6), 469-480
- Beauducel, A., & Wittmann, W. W. (2005). Simulation study on fit indexes in CFA based on data with slightly distorted simple structure. *Structural Equation Modeling*, 12(1), 41-75
- Benites-Lazaro, L. L., & Mello-Théry, N. A. (2017). CSR as a legitimatizing tool in carbon market: Evidence from Latin America's Clean Development Mechanism. *Journal of Cleaner Production*, 149, 218-226.
- Bhattacharya, C. B., Korschun, D., & Sen, S. (2009). Strengthening stakeholder–company relationships through mutually beneficial corporate social responsibility initiatives. *Journal of Business Ethics*, 85(2), 257-272
- Brown, T. J., & Dacin, P. A. (1997). The company and the product: Corporate associations and consumer product responses. *The Journal of Marketing*, 68-84.
- Brunk, K. H. (2010). Exploring origins of ethical company/brand perceptions—A consumer perspective of corporate ethics. *Journal of Business Research*, 63(3), 255-262
- Cavanagh, Gerald F., S. J. and Fritzsche, David J., Using Vignettes in Business Ethics Research, in *Research in Corporate Social Performance and Policy: A Research Annual*, Lee E. Preston, ed. Greenwich, CT: JAI Press Inc., 1985, 279-293.
- Cerny, C.A., & Kaiser, H.F. (1977). A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioural Research*, 12(1), 43-47.

- Chen, Y. S., & Chang, C. H. (2013). The determinants of green product development performance: Green dynamic capabilities, green transformational leadership, and green creativity. *Journal of Business Ethics*, 116(1), 107-119
- Cowan, W. N., Chang, T., Inglesi-Lotz, R., & Gupta, R. (2014). The nexus of electricity consumption, economic growth and CO2 emissions in the BRICS countries. *Energy Policy*, 66, 359-368
- Dobele, A. R., Westberg, K., Steel, M., & Flowers, K. (2014). An examination of corporate social responsibility implementation and stakeholder engagement: A case study in the Australian mining industry. *Business Strategy and the Environment*, 23(3), 145-159
- Donoghue, S., Strydom, N., Andrews, L., Pentecost, R., & de Klerk, H. M. (2016). Differences between Black and White South Africans in product failure attributions, anger and complaint behaviour. *International Journal of Consumer Studies*, 40(3), 257-267
- European Commission. Directorate-General for Employment. (2001). *Promoting a European Framework for Corporate Social Responsibility: Green Paper*. Office for Official Publications of the European Communities
- Gonzalez Dávila, O., Koundouri, P., Pantelidis, T., & Papandreou, A. (2017). Do agents' characteristics affect their valuation of 'common pool' resources? A full-preference ranking analysis for the value of sustainable river basin management. *Science of the Total Environment*, 575, 1462-1469
- Guimarães, M. H., Nunes, L. C., Barreira, A. P., & Panagopoulos, T. (2016). Residents' preferred policy actions for shrinking cities. *Policy Studies*, 37(3), 254-273
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis*. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Hall, N., Lacey, J., Carr-Cornish, S., & Dowd, A. M. (2015). Social licence to operate: understanding how a concept has been translated into practice in energy industries. *Journal of Cleaner Production*, 86, 301-310
- He, H., & Li, Y. (2011). CSR and service brand: The mediating effect of brand identification and moderating effect of service quality. *Journal of Business Ethics*, 100(4), 673-688
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55
- Huang, M. H., & Cheng, Z. H. (2016). Strategies to enhance consumers' identification with a service firm. *Journal of Services Marketing*, 30(4), 449-46
- Hur, W. M., Kim, H., & Woo, J. (2014). How CSR leads to corporate brand equity: Mediating mechanisms of corporate brand credibility and reputation. *Journal of Business Ethics*, 125(1), 75-8

- Lacey, R., Kennett-Hensel, P. A., & Manolis, C. (2015). Is corporate social responsibility a motivator or hygiene factor? Insights into its bivalent nature. *Journal of the Academy of Marketing Science*, 43(3), 315-332
- Lee, C. Y., Chang, W. C., & Lee, H. C. (2017). An investigation of the effects of corporate social responsibility on corporate reputation and customer loyalty—evidence from the Taiwan non-life insurance industry. *Social Responsibility Journal*, 13(2), 355-369
- Lee, E. M., Park, S. Y., & Pae, J. H. (2008). The effect of the perceived fit between corporate and CSR activities on corporate credibility and consumer loyalty: the mediating roles of consumer perception of CSR activities. In *Proceedings of the 2nd World Business Ethics Conference*. HKBU Hong Kong
- Lee, E. M., Park, S. Y., Rapert, M. I., & Newman, C. L. (2012). Does perceived consumer fit matter in corporate social responsibility issues? *Journal of Business Research*, 65(11), 1558-1564
- Lichtenstein, D. R., Drumwright, M. E., & Braig, B. M. (2004). The effect of corporate social responsibility on customer donations to corporate-supported non-profits. *Journal of Marketing*, 68(4), 16-32
- Liu, R. R., & McClure, P. (2001). Recognizing cross-cultural differences in consumer complaint behavior and intentions: an empirical examination. *Journal of Consumer Marketing*, 18(1), 54-75
- Luo, X., & Bhattacharya, C. B. (2006). Corporate social responsibility, customer satisfaction, and market value. *Journal of Marketing*, 70(4), 1-18
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1(2), 130
- Mohr, L. A., & Webb, D. J. (2005). The effects of corporate social responsibility and price on consumer responses. *Journal of Consumer Affairs*, 39(1), 121-14
- Morales Espinoza, M. (1999). Assessing the cross-cultural applicability of a service quality measure a comparative study between Quebec and Peru. *International Journal of Service Industry Management*, 10(5), 449-468
- Morgeson, F. V., Mithas, S., Keiningham, T. L., & Aksoy, L. (2011). An investigation of the cross-national determinants of customer satisfaction. *Journal of the Academy of Marketing Science*, 39(2), 198-215
- Öberseder, M., Schlegelmilch, B. B., & Murphy, P. E. (2013). CSR practices and consumer perceptions. *Journal of Business Research*, 66(10), 1839-1851
- Öberseder, M., Schlegelmilch, B. B., Murphy, P. E., & Gruber, V. (2014). Consumers' perceptions of corporate social responsibility: Scale development and validation. *Journal of Business Ethics*, 124(1), 101-115
- Parguel, B., Benoît-Moreau, F., & Larceneux, F. (2011). How sustainability ratings might deter 'greenwashing': A closer look at ethical corporate communication. *Journal of Business Ethics*, 102(1), 15

- Peattie, K., Peattie, S., & Ponting, C. (2009). Climate change: a social and commercial marketing communications challenge. *EuroMed Journal of Business*, 4(3), 270-286
- Perrini, F., Castaldo, S., Misani, N., & Tencati, A. (2010). The impact of corporate social responsibility associations on trust in organic products marketed by mainstream retailers: a study of Italian consumers. *Business Strategy and the Environment*, 19(8), 512-52
- Podsakoff, P.M., Mackenzie, S.B., Lee, J.Y., Podsakoff, N.P., (2003), Common method biases in behavioural research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88 (5), 879e903
- Robertson, D. C. (1993). Empiricism in business ethics: Suggested research directions. *Journal of Business Ethics*, 12(8), 585-599
- Savitz AW, Weber K. (2006) The Triple Bottom Line: How Today's Best-run Companies Are Achieving Economic, Social and Environmental Success – And How You Can Too. San Francisco, CA: John Wiley & Sons.
- Schu, M., & Morschett, D. (2017). Foreign market selection of online retailers—A path-dependent perspective on influence factors. *International Business Review*, 26(4), 710-72
- Sen, S., & Bhattacharya, C.B., (2001), "Does Doing Good Always Lead to Doing Better? Consumer Reactions to Corporate Social Responsibility," *Journal of Marketing Research*, 38 (May), 225-44
- Sen S, Bhattacharya CB, Korschun D. (2006). The role of corporate social responsibility in strengthening multiple stakeholder relationships: a field experiment. *Journal of the Academy of Marketing Science* 34(2): 158–166
- Shapiro, S. (1999). When an ad's influence is beyond our conscious control: Perceptual and conceptual fluency effects caused by incidental ad exposure. *Journal of Consumer Research*, 26(1), 16-36
- Spence, A. M. (1974). Market signalling: Informational transfer in hiring and related screening processes (Vol. 143). Harvard Univ Pr.
- Stanaland, A. J., Lwin, M. O., & Murphy, P. E. (2011). Consumer perceptions of the antecedents and consequences of corporate social responsibility. *Journal of Business Ethics*, 102(1), 47-55
- StataCorp, L. P. (2005). *Stata base reference manual* (Vol. 2).
- Swaen, V., & Chumpitaz, R. C. (2008). Impact of corporate social responsibility on consumer trust. *Recherche et Applications en Marketing* (English Edition), 23(4), 7-34
- Vollero, A., Palazzo, M., Siano, A., & Elving, W. J. (2016). Avoiding the greenwashing trap: between CSR communication and stakeholder engagement. *International Journal of Innovation and Sustainable Development*, 10(2), 120-140

Walsh, G., & Bartikowski, B. (2013). Exploring corporate ability and social responsibility associations as antecedents of customer satisfaction cross-culturally. *Journal of Business Research*, 66(8), 989-995

Walsh, G., & Beatty, S. E. (2007). Customer-based corporate reputation of a service firm: scale development and validation. *Journal of the Academy of Marketing Science*, 35(1), 127-143

Wang, Y., Lo, H.-P., & Hui, Y. V. (2003). The antecedents of service quality and product quality and their influence on bank reputation: Evidence from the banking industry in China. *Managing Service Quality*, 13(1), 72–83.

Weesie, J. (2003). Rank-ordered logistic regression. *Stata Statistical Software*, 8(3), 425–439.

Annex 1

Context information
Your electricity provider wants to develop a geothermal energy power plant in the rural area around the city in which you live. Geothermal energy involves the use of hot fluids from underground for the production of electricity. The power plant will be in the area of some local communities, and it will produce electricity for the part of the city in which you live.

VIGNETTE	RANK
<p>The company negatively impacts the well-being of the local community.</p> <p>The company has a highly negative and permanent impact on the natural environment.</p> <p>The company employs only (nationality) managers.</p> <p>The company provides only partial information to customers about its activities.</p>	
<p>The company negatively impacts the well-being of the local community.</p> <p>The company has no negative impact on the natural environment.</p> <p>Only a minority of the managers employed by the company are from foreign countries.</p> <p>The company provides reliable and transparent information to customers about its activities.</p>	
<p>The company does not generate positive or negative impacts for the local community.</p> <p>The company has a highly negative and permanent impact on the natural environment.</p> <p>Only a minority of the managers employed by the company are from foreign countries.</p> <p>The company does not provide information to customers about its activities.</p>	
<p>The company does not generate positive or negative impacts for the local community.</p> <p>The company has a limited, but not permanent, negative impact on the natural environment.</p> <p>The company ensures a balance between employing (nationality) managers and foreign managers.</p> <p>The company provides reliable and transparent information to customers about its activities.</p>	
<p>The well-being of the local community is higher because of the presence of the company.</p> <p>The company has a limited, but not permanent, negative impact on the natural environment</p> <p>The company employs only (nationality) managers.</p> <p>The company does not provide information to customers about its activities.</p>	
<p>The well-being of the local community is higher because of the presence of the company.</p> <p>The company has no negative impact on the natural environment.</p> <p>The company ensures a balance between employing (nationality) managers and foreign managers.</p> <p>The company provides only partial information to customers about its activities</p>	

2.3 Energy companies' internal organisation dynamics for developing local communities' relationships: engagement strategies and organisational arrangements

2.3.1 Theoretical framework

Within the broad field of CSR, the development of positive relationships between companies and local communities (or citizens) is considered as one of the most traditional forms of business engagement with society. From a theoretical standpoint, research on such relationships has attracted increasing attention. To the purpose of this paragraph, some research areas were identified as key theoretical cornerstones of the studies presented in the next paragraphs.

1. Engagement strategies

This research area refers to the identification of different engagement strategies between companies and local communities according to different level of intensity of the engagement. Within this area, three strategies of engagement with the local communities are identified, which outline a continuum of strategies with an increasing level of engagement.

The first strategy is the *transactional strategy*. It is characterised by a minimal level of relationships between companies and local communities, and relies on a “giving back” principle. Companies keep occasional relationships with local communities, and communications are usually on a one-way basis – from the company to the local communities. A transactional strategy typically includes the performing of practises (or activities) unilaterally identified and implemented by the company, which usually follow a reactive process rather than a proactive one. Examples of such practices are philanthropy – e.g. volunteer programs, sponsoring community events, and scholarships – and information sessions – e.g. presentations about company's operations.

The second strategy is the *transitional strategy*. It is characterised by a medium level of relationships between companies and local communities, and builds on the company's willingness to engage in conversation with communities, relying on a “building bridges” principle. Companies keep more repeated relationships with local communities, and communications are usually on a two-way asymmetric basis – communication flows to and from the local communities, but an imbalance is present in favour of the company. A transitional strategy typically includes the creation of spaces where local communities can show complaints, formulate demands, and express their expectations about companies' practices. In addition, companies can use several tools for gathering information about local communities' expectations and perceptions, such as surveys, focus groups and public meetings. Example of companies' practices are public consultations, and cause-related marketing initiatives.

The third strategy is the *transformational strategy*. It is characterised by a high level of relationships between companies and local communities, and relies on a “changing society” principle. Companies keep frequent relationships with local communities, and communications are usually on a two-way symmetric basis – a continuing dialogue with no imbalances present between the company and the local communities. Local communities are considered a knowledgeable actor that can contribute to joint initiatives, and companies usually share with them control over the whole process of engagement. Example of companies' practices are joint decision-making and joint project management.

By building on those strategies, Delannon et al. (2016) identified a fourth engagement strategy, the *integrational* one. This strategy comprehends the mobilisation of a set of practices that belong to more than one strategy of engagement, directed towards the highest level of engagement, and relies on an “embracing flexibility” principle. By implementing this strategy, companies show a high level of knowledge of the social context in which they operate and a high level of sensitivity, since they are able to adapt the set of practices based on the diversity of expectations from different local community groups and achieve the highest level of engagement.

Table 14 summarises definitions and examples of practices associated with engagement strategy.

	Transactional strategies	Transitional strategies	Transformational strategies	Integrational strategies
Definition	<ul style="list-style-type: none"> • Minimal level of relationships, based on a “giving-back” approach • One-direction communication flows • Companies are reactive and do not perceive community relationships as strategic 	<ul style="list-style-type: none"> • Relationships in which the community can express complaints and expectations regarding companies’ practices • Two-way asymmetric communication (more firms-to-community than vice versa) 	<ul style="list-style-type: none"> • General understanding between parties • Focus on common issues and on building social capital • Two-way symmetric communication 	<ul style="list-style-type: none"> • Merge of aspects from the three strategies, embracing flexibility towards the community
Practices	<ul style="list-style-type: none"> • Providing information to community (e.g. focus group) • Investing in philanthropy • Development of the competencies of employees 	<ul style="list-style-type: none"> • Survey, focus groups and public meetings to understand community’s complaints and expectation • Corporate community committees 	<ul style="list-style-type: none"> • Round table • Working groups • Partnerships • Joint initiatives 	<ul style="list-style-type: none"> • Investing in philanthropy • Survey, focus groups and public meetings • Joint initiatives

Table 14. Definition of the different engagement strategy and some examples of practices

2. Organisational arrangements

This research area examines, instead, the organisational arrangements that support such strategies, with a focus on five internal dimensions that vary in relation to different levels of engagement (and thus different strategies) – i.e. financial resources, human resources, competencies, status (level of importance of the relationships with the local communities) and measurement tools.

Transactional strategies do not include financial resources to be used for developing relationships, while integrational strategies can rely on both dedicated and significant financial resources. In between, transitional strategies do comprehend resources but limited and not dedicated to relationships with local communities. Lastly, transformational strategies include financial resources and dedicated to local communities’ relationships, but still limited.

Transactional strategies do not comprehend dedicated human resources, while integrational strategies do include dedicated human resources, who are able to tailor engagement strategies on the context in which the company operates and creates synergies with the communities. In between, transitional strategies do not comprehend dedicated human resources but they do include significant support from

external resources, such as consultants. Lastly, transformational strategies comprehend dedicated human resources, with only a partial involvement of external consultants.

In the case of competencies, transactional strategies do not include resources with specific competencies, and managers from other areas are called to deal with relationships with local communities. On the contrary, integrational strategies comprehend resources with specific competencies and tailored expertise, which coordinate their activities both within and outside the company in order to develop synergies with the communities. In between, transitional strategies include resources with scattered competencies, which are not coordinated towards community relationships. Lastly, transformational strategies include resources with specific competencies, but still not coordinated and not able to create synergies with the community.

Status identifies the importance attributed to corporate community relationships within the company. Transactional strategies consider relationships with communities as a marginal issue, while integrational strategies include such relationships among the issues the company needs to consider at the strategic level. In between, transitional strategies attribute a discretionary level of importance to relationships with communities, according to factors such as managers' personal attitudes, the social context in which the company operates, etc.

Measurement tools represent tools able to measure the goodness of corporate community relationships and the extent to which the ultimate aim of such relationships is reached (measuring the impact of their community relation practices). While transactional strategies do not include measurements tools, integrational strategies comprehend accurate and reliable tools. In between, transitional strategies include limited measurement tools adopted on a discretionary basis. Transformational strategies differ from transitional ones in that measurement tools are adopted on a regular basis.

Table 15 displays the organisational arrangements for each engagement strategy.

	Transactional strategies	Transitional strategies	Transformational strategies	Integrational strategies
Financial resources	No dedicated financial resources	Few and not dedicated financial resources	Dedicated but still marginal financial resources	Dedicated and significant financial resources
Human resources	Non-dedicated human resources	Non-dedicated human resources but supported by external resources (consultants)	Dedicated human resources, and partially supported by external resources (consultants)	Dedicated human resources, tailoring the engagement strategies and creating synergies
Competencies	Non-specific competencies (diverse set of managers are called to deal with community relationships)	Scattered competencies present in the company but not coordinated towards community relationships	Specific competencies but still not coordinated	Specific competencies (tailored expertise) and coordinated in order to generate synergies
Status (level of importance) of the corporate	Corporate community relationships are perceived as a	The relevance of community relationships is discretionary	Corporate community relationships are perceived as salient for the company	Corporate community relationships are perceived as a strategic issue

community relationships	marginal issue for the company			
Measurement tools	No measurement tools	Limited measurement tools, and on a discretionary basis	Limited measurement tools, but on a regular basis (e.g. surveys)	Accurate and reliable tools (formal evaluations)

Table 15. Organisational arrangement defined for each engagement strategy.

3. Conception

This theme refers to the ultimate purpose of companies-local communities' relationships. That is, it identifies the purpose companies would like to reach when implementing local communities' relationships. In their study, Lopez-Navarro et al. (2018) identified two opposite purposes, one requiring the minimum effort to be achieved – i.e. “being accepted by the community” – and the other requiring the maximum effort to be achieved – i.e. “being considered as part of the community”. While the former purpose refers to the minimum level of commitment required for not being disturbed during daily activities, the latter one refers to the maximum level of commitment needed for establishing higher level of dialogue and proactivity among parties, to build a sense of community among them. Such categorisation can be seen as mirroring the strategic approaches at the extreme of the Delannon et al. (2016) categorisation – i.e. transactional strategy and integrational strategy. Moreover, it is possible to broaden Lopez-Navarro et al.'s (2018) categorisation of purposes by following the scheme of Delannon et al. (2016). Companies could thus follow purposes such as “being accepted through cooperation on specific projects decided by the company” as related to transitional strategies, and “being accepted through cooperation on specific projects co-defined with the community” as related to transformational strategies.

These research areas form the theoretical basis of the two following qualitative studies, which have the overall aim of shedding light on how companies have built and managed engagement processes.

Through the analysis of the organisational arrangements and the role of conception, insights can be provided about how company's internal organisational dynamics are managed and structured when relating with local communities. While some interviewees may have the same view on the strategic approach pursued, others may disaccord. As such, the more a certain interviewee's opinions are identified as pertaining to a strategy, the more such a strategy would be considered as really in place. On the contrary, the more interviewee's opinions are not identified as pertaining to a certain strategy, the more the strategic direction would be considered as blurred. Different interviewee's opinions may also be considered as a sign of change within the strategic direction of the company. Thus, the analysis relies on the critical reading of the interviews to ensure the most appropriate depiction of the reality. Last, conclusion aims at providing useful insights on how to manage more effectively the current strategic approach and on how to improve towards strategies based on higher levels of engagement.

2.3.2 Organisational dynamics for developing local communities' relationships: a focus on the Mexican context

Method

CFE (Comision Federal de Eletricidad) represents the Mexican state-owned company for generating, transmitting and selling electricity. After the energy reform approved in 2014, CFE was asked to divide its businesses between generating, transmitting and selling electricity. The study focused on the company called *Gerencia de Proyectos Geotermoeléctrico*, entitled to the production of electricity from geothermal resources both in Los Humeros and Acapulco.

The study was conducted through a case study (Yin, 2017) and it investigates the internal organisational dynamics of CFE when relating with local communities.

The case describes three interviews of two managers directly involved in building and managing relationships between CFE and local communities – one at the operative level and one at a more strategic level – and one former director of CFE – retired in 2007 (Table 16).

Interviewee	Working position	Gender
Interviewee 1	Former Director	M
Interviewee 2	Manager (operation level)	M
Interviewee 3	Manager (strategic level)	M

Table 16. People from CFE interviewed, with details about gender and working position.

The study was conducted in two phases: i) a preparatory analysis of documents, ii) the collection of information via semi-structured interviews with the aforementioned interviewees. For both phases, we adopted a content analysis method (Graneheim and Lundman, 2004; Krippendorff, 2012). Content analysis consists of codifying pieces of writing into various items (or categories) depending on selected criteria. The categories were derived from an integrated framework of analysis considering dimensions related to the research areas and themes described in the theoretical framework.

First, a review of selected documents – coming from scientific literature and grey literature – was performed in order to provide contextual information as an informative basis for the subsequent interviews. Second, in the field trip of Task 7.4 that the European team carried out in April 2018, the face-to-face in-depth interviews were conducted, with the fundamental help and assistance of the Mexican research team of WP9.

Each interview was conducted in Spanish by one researcher of the European team, with the assistance of one Mexican researcher from WP9 and the support of a digital recorder, which later allowed the transcription *verbatim*. Each transcript was then validated by the interviewee.

In order to guide the discussion towards the integrated framework, so as to create an open discussion within defined boundaries (Denzin and Lincoln, 2005), a semi-structured protocol was defined and shared with the interviewees in advance. The protocol of the interview was structured in four sections devoted to the identification of: *general information* (1), *managing social acceptability issues and organisational structure* (2), *organisational arrangements for dealing with social acceptability* (3) and *relationships with supervisor, peers and communities* (4). For each section, a set of 3-4 questions was outlined.

Following Krippendorff (2012), a content analysis was performed on interview transcripts in order to highlight, for each section of the protocol, their key features.

We used a comparison method and coded the collected materials using Nvivo software, in order to systematically examine each interview, based also on recurrent words and keywords. All interviews were

coded using a common structure; this led to a coherent and comparable tree of nodes for each interview. Each source was explored among interviewee by word frequency, in order to identify the most frequent words related to the dimensions of analysis, and by additional keywords selected by the researchers. We thus obtained six groups of frequent words and additional keywords, each group corresponding to a specific dimension of the framework of analysis. Details on such groups of words are provided in the Table 17.

Dimensions of analysis		Words frequency counting and keywords
Organisational arrangements	Financial resources	Budget(s), money, resource(s), finance, financial
	Human resources	Human, resource(s), people, work(s), person, hire/hiring, manager
	Competencies	Competencies, profile, expertise,
	Status	Issue(s), relevance, strategy(ic)
	Measurement tools	Measure(s), indicator(s), tool(s), evidence(s)
Conception		Project(s), objective(s), relationship(s), job(s), responsible(s)

Table 17. Words searched for each dimension of analysis.

Data sorting and the in-depth analysis highlighted recurrent characteristics and emerging relationships among themes, thus enabling subsequent conceptualizing (Taylor et al., 2015). Though unavoidably affected by a certain level of subjectivity (Locke and Lloyd-Sherlock, 2011), the in-depth textual analysis enriched the understanding on how companies have built and managed engagement processes with local communities. In order to reduce subjectivity bias, results were validated by the members of the European research group, enhancing the soundness of the interpretation (Denzin and Lincoln, 2005).

Results and discussion

Transaction strategy

By focussing on the transactional strategic⁸ approach, two dimensions of analysis were identified: measurement tools and conception.

Measurement tools are able to measure the goodness of corporate community relationships and the extent to which the ultimate aim of such relationships is reached. Due to the different characteristics of each site of production, it seems that a wide range of manoeuvre is given to social and environmental managers for identifying suitable social projects. As such, company's effort towards the use of measurement tools seems to be lacking. While interviewee 3 described managers' range of manoeuvre, interviewee 2 condensed all his positive opinions towards measuring in the following statement.

Everything has been evolving due to the staff's own experience of being in contact with the communities (Interviewee 3)

And

I think we cannot work to what I feel or what I believe ... there is a lot of information to be potentially used for (developing) sustainability indicators, since what we have to do must be measurable! (Interviewee 2)

As such, it would be more arduous to achieve high social projects without developing measurement tools among different generation points.

Regarding **conception**, it emerges that the company has always tried to be accepted by the community. Moreover, acceptance was based on transactional terms in previous years, to provide minimum requirements for a peaceful relation. Interviewee 1, retired in 2007, stated that

The hejidatarios (the landowners) were paid for the permission to drill and build platforms and pipes [...]. (Interviewee 1)

And

[...] hejidatarios were firstly employed in the plants at the time of their construction and (also some of) their (male) sons. (Interviewee 1)

In addition, it seems that this transactional focus was mainly due to the presence of the Gerencia de Desarrollo Social, a different department of CFE, which was in charge to manage social issues – e.g. communications towards people, environmental programs, etc. With the energy reform in 2014, CFE modified its structure and the Gerencia was disbanded.

With the energy reform, the CFE as such does not exist, as we knew it. (Interviewee 2)

And

⁸ *Transactional strategy.* It is characterised by a minimal level of relationships between companies and local communities, and relies on a “giving back” principle. Companies keep occasional relationships with local communities, and communications are usually on a one-way basis – from the company to the local communities. A transactional strategy typically includes the performing of practises (or activities) unilaterally identified and implemented by the company, which usually follow a reactive process rather than a proactive one. Examples of such practices are philanthropy – e.g. volunteer programs, sponsoring community events, and scholarships – and information sessions – e.g. presentations about company's operations.

No, it (Gerencia) does not exist anymore. (Interviewee 2)

Even though the focus on transaction terms to ensure good relationships is more comprehensible, the dismantling of the Gerencia de Desarrollo Social put under pressure the Gerencia de Proyectos Geotermoeléctrico to ensure adequate relationships with communities.

Transitional strategy

By focussing on the transitional strategic approach, four dimensions of analysis are identified: financial resources, human resources, competencies, and status.

It seems that there are limited **financial resources** for environmental and social activities. In particular, financial resources seem to be not specifically dedicated to community relationships as they were used in the past – before the energy reform in 2014.

I know that those time are not going to return, where there was a specific resource for the social area. (Interviewee 2)

And

[...] the resources we had (for communities), we no longer have them. (Interviewee 2)

However, it is underlined that social activities can be performed, but differently from the past. In fact, in previous years, financial resources were often used as a compensation measure for geothermal energy developments.

People were aware of the opportunity represented by geothermal development for getting money as a mitigation mean. (Interviewee 1)

People within communities were thus accustomed to policies based on monetary subsidies – and it is interpreted that such feeling is still present among people. Indeed, it emerges that such communities are able to move from a site to another, to force subsidy-based negotiations with the company. Moreover, it also seems that, in previous years, there was a low level of control on the decision to perform or not community-based projects. Even when subsidies were not involved in the negotiation process, social projects tended towards approval.

(They are) accustomed to a certain subsidy policy from the government and yes, we have seen these growths towards areas that could be interesting or that they think are interesting. So, we are always in the negotiation with them. (Interviewee 3)

And

[...] people are used to receive money from the government [...], and thus they want money instead of opportunities to work. (Interviewee 1)

And

At some point before the reform, well, the safest thing to do was to pass the projects. (Interviewee 3).

Today, it seems that the company is trying to develop a different approach. Due to financial constraints, social activities can only be performed if social and environmental managers demonstrate that they are crucial for continuing generating and do not only represent an expense and, hopefully, they are able to generate some sort of income.

[...] the social section of CFE [...] has evolved from giving subsidies to, now, new types of support.
(Interviewee 3)

And

Each person in charge of this area (the social and environmental area) has to request a budget and back it up with a project. So now it has to deal with the finance – and other conditions – of the company to see if it is feasible to carry out the project and if it will be profitable. (Interviewee 3)

Even though this approach could be logic from a managerial perspective, it emerges that social and environmental managers are facing additional efforts in developing social projects.

It's not easy to say with this (kind of activities) that you're going to get more money (Interviewee 2).

As such, it can be suggested that social projects would be significantly reduced without adequate preparation of social and environmental managers, potentially resulting in tension with communities.

Regarding **human resources**, it seems that no resources are specifically dedicated to community relationships, even though social and environmental managers are present within the company.

It's not easy to say with this (kind of activities) that you're going to get more money, or if you put a person responsible for this (kind of activities – i.e. community relationships), the company will have a better relationships. (Interviewee 2)

Despite such lack, it emerges that some attempts were made to provide additional information to social and environmental managers regarding community relationships. In particular, such attempts refer to informative communications and internal courses, which were carried out by internal human resources who had a natural aptitude and experience on such themes (and not by external consultants).

This course [...] was very important since we would have had the same knowledge. (Interviewee 2)

And

So, when feeding the system (information system within the company) with all environmental and social components, we try to have more or less the same line of work in all different communities [...].
(Interviewee 3)

As such, it can be suggested that additional information provided by external consultants could be useful in increasing the overall level of awareness and knowledge of community relationships dynamics.

In addition, it could be read that social and environmental managers are the first human resources – in terms of hierarchical scale – dedicated to establish relationships with communities. In case of conflicts with the company, it seems that the local Director of CFE – and not social and environmental managers – is in charge of negotiating with communities, to establish agreements and commitments and avoid additional conflicts.

At the geothermal field, we have social responsibility areas. So, they are in charge of being in contact with the community [...]. (Interviewee 3)

And

[He] has the capacity to establish commitments and agreements with the communities. (Interviewee 3)

When considering **competencies**, it seems that CFE has competencies to deal with communities' relationships, but they are scattered and not coordinated. It could be interpreted that CFE is going through a transition phase. In past years employees had predominantly technical or legal competencies while, today, also social science profiles are strongly considered. Interviewee 1 reported his past experience and stated that:

Only graduated in law [were considered for working at Gerencia]. (Interviewee 1)

Conversely, Interviewee 3 underlines the changing process explaining currently ongoing and stated that:

It has been advancing since, at first, pure chemists, biologists, engineers, lawyers were present... and now also profiles of anthropologists [are sought]. (Interviewee 3)

This change seems to be mainly due to organisational dynamics. In fact, social aspects are considered together with the environmental ones, creating a single area within the Gerencia de Proyectos Geotermoeléctricos. As such, profiles with a much more solid background related to environmental science are starting to be flanked by social science profiles. Even though it can be read that they are still almost absent, profiles such as anthropologists and sociologists are now considered as key for establishing and maintaining good community relationships.

So, this social area falls into the environmental area [...]. So, everything social falls into the environmental area this would reflect in the selection of personnel of the company [...]. (Interviewee 3)

And

Now with the social aspect, other types of profiles of sociologists and anthropologists are also sought. (Interviewee 3)

And

[...] there are no sociologists but still... that is the direction that we are taking. (Interviewee 3)

Lack of coordination towards community relationships seems to be related to a lack of internal procedures and certification focused on the social area, which are, instead, present for the environmental area. This leads social and environmental managers to interpret differently their role, sharpening the differences among the activities carried out.

In the social part there is not a type of recognition of this kind. So, it is about working only with the experiences, [...] considering the differences of the sites. (Interviewee 3)

And

So, [...] the activities we do at Los Humeros do not replicate in other areas: some yes, some others do not ... we still need to standardize something else. (Interviewee 2)

Last, it can be read that some barriers still remain in encouraging inter-disciplinary carriers. In fact, a supportive attitude towards studies for a master degree or PhD emerges, but only to deepen the knowledge related to the current position of the manager. As interviewee 2 pointed out:

The company if you want to study a master's degree, supports you to study a master's degree or a doctorate, but it has to be related to your career. (Interviewee 2)

When considering the **status** – i.e. the importance attributed to community relationships –, it seems that a discretionary importance is attributed to community relationships. As previously reported, no standard and/or compulsory procedures on how to build and manage community relationships are provided, and social and environmental managers are left with a wide range of manoeuvre to build and manage community relationships. To exemplify the concept, Interviewee 2 stated that

This (community relationships) is not a recipe: it is about arriving at a specific place, working with people... it is a lot of time and also personal interest [...] (Interviewee 2)

And

No, it is not mandatory (to develop community relationships activities), the social part is not mandatory. (Interviewee 2)

Despite potential lacks deriving from this discretionary, it could be interpreted that CFE is going through a transition phase. Different insights – as compared with the competencies – still provide a sense of transition involving the importance attributed to community relationships by the company, which goes towards encouraging more effective approaches for carrying out projects with the community. Efforts seem to be pointed towards sharing good practices of community relationships within the company and integrating community projects within the daily activities of the company.

I do think that we would have to find a way to integrate these projects (projects of the social area that do not constitute a sole expense) in an integral planning of the development of a generation project [...] (Interviewee 3)

And

[...] although it is not done under the same scheme of work, or do not have perhaps the same vision or worldview, you can start doing something. So, I think that this is already a good gain that what is being done can be extrapolated to other places. (Interviewee 2)

Given the premises, the sense of transition towards a more important role of community relationships within the company should cross all operation sites, to encourage a company's standardised way of proceeding. Thus, it seems that certifications and procedural efforts within the social area should be considered as of high priority to guide and speed up this process.

When considering the **conception** – i.e. the ultimate purpose companies would like to reach when implementing local communities' relationships –, it could be interpreted that the company's aim is directed towards being accepted by the community through cooperation on certain projects. However, it seems that such projects are not the results of a constructive and strategic dialogue between the company and the communities. In fact, it seems that relationships and acceptability are based on a listening-and-reacting principle, in which the company decides (or not) to provide what communities seem to perceive as important.

The support has always been given [...]. It is always like “I have a resource, they are asking for it, is it good?”, “There it is, go ahead”. (Interviewee 3)

And

They arrived, they invested, conflicts, interests, and they fell... productive projects felt like the production of chicken, the production of mushrooms, [...] all those activities are experiences for which (I saw) there was not either the participation nor the state of consciousness we aim for [...], (which is needed) to allow all to give value to what we wanted to do. (Interviewee 2)

As an additional evidence to this lack of dialogue, projects are often left behind since they start to be perceived as useless by communities after the initial phase. As Interviewee 3 stated

Well, there have been projects that have developed at the time, but it is up to the people whether they will continue or not. [...] So, they (individuals) give up and [...] projects are left behind. (Interviewee 3)

As such, the company aims at being accepted by the community but it faces issues in finding effective communication ways with the communities, to share knowledge and reach the same level of awareness.

Transformational strategy

By focussing on the transformational strategic approach, one dimension of analysis is identified: the **conception**.

It emerges that, in certain cases, the company has a more proactive approach towards people so as to be accepted through cooperation with co-designed projects. Despite that, it seems an occasional way to proceed, based on the personal aptitude of the managers involved. As Interviewee 2 stated:

Sometimes, people ask me “why do you spend evening with them?” [...] but that’s when ideas are born. [...] I can give ideas but things have to come from them [...]. And we have to give them a structure to their ideas. (Interviewee 2)

And

There have been many infusions of many projects and we have only seen how they invest and how they fall again, because they are not a part, they did not make it part of the people. (Interviewee 2)

Integrational strategy

No dimensions of analysis were identified as pertaining to an integrational strategy approach.

Conclusion and implications

Table 18 represents the summary of the findings previously identified.

Organisational arrangements \ Engagement strategies	Transactional strategies	Transitional strategies	Transformational strategies	Integrational strategies
Financial resources		1,2,3		
Human resources		1,2,3		
Competencies		1,2,3		
Status (level of importance) of the corporate community relationships		1,2,3		
Measurement tools	2,3			
Conception	1	2,3	2	

Table 18. Results of the analysis of CFE. The stronger the colour, the more the interviewee's statements are aligned to the characteristics of a certain strategy. The numbers in white identify who – interviewee 1 or 2 or 3 – expressed opinions aligned to a specific engagement strategy, and they are reported for each dimensions of analysis.

Table 18 shows a quite strong alignment of interviewees' opinions regarding the *Gerencia de Proyectos Geotermoeléctrico's* organisational dynamics for developing local communities' relationships. Substantial accord among the three interviewees can be remarked on four out of six dimensions of analysis – i.e. financial resources, human resources, competencies, and status. In particular, such four dimensions are concentrated on the transitional strategic approach. In addition, two interviewees – i.e. interviewee 2 and interviewee 3 – consider measurement tools as pertaining to the transactional strategic approach, while one interviewee – i.e. interviewee 1 – does not mention them. When considering the last dimension of analysis, interviewee 1 considers conception as pertaining the transactional strategic approach. Interviewee 3 considers it as pertaining the transitional strategic approach, while interviewee 2 provides a dual opinion. He identified the company's ultimate purpose as pertaining to transitional strategies but he also criticised such approach, and suggested an alternative way to proceed. He described his approach as being much more based on transformational features. This is very important for the Gerencia since it highlights that more advanced strategies are spontaneously arising from current organisational dynamics. As such, it is of paramount importance to properly share such approach within the company to improve current practices and properly guide – even with external consultant – such spontaneous movements towards the features of transformational strategies for a company-wide application.

The analysis also identifies the priorities for improving the current strategy and the related level of engagement. Strategic implications for management are thus straightforward. Managers should i) implement measurements tools to measure the goodness of corporate community relationships, in order to implement virtuous feedback loops, ii) uniform among social and environmental managers the objectives of the Gerencia in their relationships with the communities, in order to have a standardised way of proceeding; iii) build on current level of organisational arrangements to improve the current engagement strategy across sites of production; iv) promote the spontaneous more-advanced approaches that are arising, to foster organisational changes.

2.3.3 Organisational dynamics for developing local communities' relationships: a European case

Method

The company analysed is the Italian company Enel. Enel is considered an excellence at the global level regarding both technologies adopted in geothermal developments and sustainability. Its industrial policy is committed to the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development adopted by all countries of the United Nations (UNs), and its experience in dealing with geothermal developments is recognised at the international level due to its historic fields, which are running in Tuscany (Italy) since the beginning of the 20th century. In particular, the company developed geothermal energy plants in America [both North America (US), and South America (Chile)], with projects where local communities were affected. In such cases, the company valorised its experience in dealing with communities and it obtained results in terms of both successfully developing geothermal energy and avoiding local conflicts. Describing its experience in approaching new countries and contexts – and, indeed, communities – is thus considered as of great importance, since its current way of operation could represent a standard at the sector level, to which Mexican energy companies could be called to meet in an unbundled energy market. For these reasons, the study focused on Enel and its experience of investing in geothermal developments outside its national frontiers.

Likewise the case of CFE, the study was conducted through a case study (Yin, 2017) and it investigates the internal organisational dynamics of the company, in its experience of establishing and maintaining relationships with local communities.

The case includes three interviewees, all of them former managers of the company and involved – to different extent – in its international geothermal energy development (Table 19).

Interviewee	Working position	Gender
Interviewee 1	Former manager (operation/strategic level) responsible for international business development	M
Interviewee 2	Former manager (operation/strategic level) project engineer in international business development	M
Interviewee 3	Former manager (operation/strategic level) responsible for an historic geothermal field and involved in international business	M

Table 19. People from Enel interviewed, with details about gender and working position.

As for the case of CFE, the study was conducted in two phases: i) a preparatory analysis of documents, ii) the collection of information via semi-structured interviews with the aforementioned interviewees. For both phases, we adopted a content analysis method (Graneheim and Lundman, 2004; Krippendorff, 2012). Content analysis consists of codifying pieces of writing into various items (or categories) depending on selected criteria. The categories were derived from an integrated framework of analysis considering dimensions related to the research areas and themes described in the theoretical framework.

First, a review of selected documents – coming from scientific and grey literature – was performed in order to provide contextual information as an informative basis for the subsequent interviews. Second, the face-to-face in-depth interviews were conducted in Europe between January and April 2019.

Interviews were conducted in Italian by one researcher, with the support of a digital recorder, which later allowed the transcription *verbatim*. Each transcript was then validated by the interviewee.

In order to guide the discussion towards the integrated framework, so as to create an open discussion within defined boundaries (Denzin and Lincoln, 2005), a semi-structured protocol was defined and shared with the interviewees in advance. The protocol of the interview was structured in four sections devoted to the identification of: *general information* (1), *managing social acceptability issues and organisational structure* (2), *organisational arrangements for dealing with social acceptability* (3) and *relationships with supervisor, peers and communities* (4). Due to the company's long history of production from geothermal energy, specific attention was directed to the company's evolutionary trend in its relationships with local communities, in order to look at the factors driving changes between different engagement strategies. For each section, a set of 3-4 questions was outlined.

Following Krippendorff (2012), a content analysis was performed on interview transcripts in order to highlight, for each section of the protocol, their key features.

We used a comparison method and coded the collected materials using Nvivo software, in order to systematically examine each interview, based also on recurrent words and keywords. All interviews were coded using a common structure; this led to a coherent and comparable tree of nodes for each interview. Each source was explored among interviewee by word frequency, in order to identify the most frequent words related to the dimensions of analysis, and by additional keywords selected by the researchers. We thus obtained six groups of frequent words and additional keywords, each group corresponding to a specific dimension of the framework of analysis. Details on such groups of words are provided in Table 20.

Dimensions of analysis		Words frequency counting and keywords
Organisational arrangements	Financial resources	Budget(s), money, resource(s), finance, financial, tax(es), measure(s)
	Human resources	Human, resource(s), people, work(s), person, hire/hiring, manager(s), team
	Competencies	Competencies, profile, expertise(s), resource(s), coordination
	Status	Issue(s), relevance, strategy(ic)
	Measurement tools	Measure(s), indicator(s), tool(s), evidence(s)
Conception		Project(s), objective(s), relationship(s), job(s), responsible(s)

Table 20. Words searched for each dimension of analysis.

Data sorting and the in-depth analysis highlighted recurrent characteristics and emerging relationships among themes, thus enabling subsequent conceptualizing (Taylor et al., 2015). Though unavoidably affected by a certain level of subjectivity (Locke and Lloyd-Sherlock, 2011), the in-depth textual analysis enriched the understanding on how companies have built and managed engagement processes with local communities, with a particular focus on the evolutionary perspective. Such analysis was carried out jointly considering the processes associated with the two geothermal energy developments previously mentioned – in the US and Chile. In order to reduce subjectivity bias, results were validated by the members of the European research group, enhancing the soundness of the interpretation (Denzin and Lincoln, 2005).

Results and discussion

Transaction strategy

No dimensions of analysis were identified as pertaining to a transactional strategic approach.

Transitional strategy

By focussing on the transitional strategic approach, one dimension of analysis can be identified: the status.

When considering the **status** – i.e. the importance attributed to community relationships –, it seems that a discretionary importance is attributed to community relationships. In this case, discretionary refers to an approach to communities that can be considered as utilitarian. The company increases or decreases its community-based efforts according to the extent to which the project development is ensured.

At the end of the day, it is a utilitarian approach... the multinational company's approach [...] to pursue its industrial objectives. (Interviewee 2)

[...] yes, communities were seen like this...as a stakeholder to be kept quiet. (Interviewee 1)

Despite that, there are not unanimous opinions on the importance attributed to community relationships, since different perceptions of *status* seem to emerge from the words of our interviewees – which emerge in the next section.

Transformational strategy

By focussing on the transformational strategic approach, six dimensions of analysis can be identified: financial resources, human resources, competencies, measurements tools, status, and conception.

It seems that **financial resources** for environmental and social activities are considered as not particularly substantial, even though a part of them seems to be specifically dedicated to citizens/communities' relationships. It can be read that such resources are used with different purposes. First, they are used as compensation measure to landowners and communities for the occupied land, and – indirectly – for local public authorities, to finance social activities through the payment of ad-hoc taxes and measures.

For the initial phase, we had less than 1% of the total investment [...] (but still) we had to increase the (funds for that) budget. (Interviewee 1)

And

[...] geothermal resources are owned by the landowner, and I need to pay royalties to extract them [...]. So, by staying there (over the land of a certain landowner) I have to pay. (Interviewee 1)

And

So, there was a relation with each individual (landowner) and with the county, which made clear requests, practically economic requests... such as to renovate the firefighter's equipment. (Interviewee 1)

Second, financial resources are also allocated for specific social objectives and used to encourage social projects that can potentially determine positive spill-overs to the population, such as projects to foster local economic development.

There was a worksheet on social responsibility [...] in which there were social objectives (to be reached), such as the planning of visits to schools, the planning of meetings with communities to understand potential issues, etc. (Interviewee 1)

And

There was also interest in projects able to cause spill-overs [...], such as the women cooperative which repaired solar panels to their houses (to community members' houses). (Interviewee 2)

Despite financial resources seem to be properly allocated, it could be noted that no feedback loops in terms of effectiveness of the expenses was mentioned. Thus, it seems to be lacking the real perception on the effectiveness of social expenses.

Regarding **human resources**, it seems that specific resources are dedicated to community relationships, with a dedicated team in charge of all aspects of community relationships.

A manager was responsible for all aspects, from the relationships with landowners to the relationships with the county, to verify the compliance of the covenant. [...] then, there was another (manager) who practically managed the relationships with landowners and a site manager, always physically present there [...]. (Interviewee 1)

This dedicated team was included into the business development unit, which represents the business unit in charge of developing business outside national frontiers. It can be read that such team is structured to follow the geothermal development across all its phases – preparatory phases, agreement, engineering phase, building phase, etc. – to ensure that all project's social objectives are achieved. In fact, in the past, the dedicated team was used to operate only with the business development unit and, after the signing of the covenant, leave to the operation unit the takeover of the project.

Within the business development unit, it was created a team in charge of the relationships with the territory and, only afterwards, it has been decided to move it across all units of the development. [...] (This is done) to show the same "facet" to the communities [...] and to avoid failing its initial aims, in terms of social aims. (Interviewee 2)

And

Once signed the agreement (for the power plant), my role was to move forwards until completing the development. [...] and there were dedicated people to them (to social and communication activities) (Interviewee 1)

With this organizational structure, it seems that the achievement of social objectives can be ensured. However, no comments were made on how synergies can be developed and managed, and adequate preparation is needed for compliance managers in order to tailor the company' efforts on the needs and expectations of communities.

When considering **competencies**, it can be read that people with specific competencies deal with the management of community relationships. In particular, competencies usually sought are communication-

related profiles, sociologists and social scientists, and also people with past experiences in communication procedures. For the role of director, it can be read that graduates were preferred and, in particular, non-technical graduates.

Sociologists were sought... people related to communication, to processes related to the whole process of communication... because relationships with the territory (the communities) are also communication-based relationships. (Interviewee 2)

And

The director was graduated, but not technical [...] and there were (in the team) people with experiences in communication. (Interviewee 1)

Moreover, it can be interpreted that there was coordination between managers dealing with communities' relationships at the development site and their senior managers in Italy, in order to both ensure agreement on social objectives and enhance knowledge and culture on geothermal energy. In particular, the opportunity to see (in Italy) how their concerns – e.g. tourism – could be integrated in a responsible geothermal development was given to Chilean local representatives.

We arrange a social responsibility plan [...] in accord with Rome (the headquarter). [...] Yes, I remember it...the frequent interactions with our department in Italy. (Interviewee 1)

And

Where there is not a cultural background (on geothermal energy) ... it's difficult. So, we made them see the district heating, the greenhouses, the geothermal manifestation that were still ongoing... so they were reassured that their tourism would be continued.

Specific competencies and coordination are crucial elements in the organisational arrangement of *competencies*. However no reference to synergies or synergistic approaches between communities and the company could be identified, which would have led towards an integrational strategic approach.

Regarding **status** – i.e. the importance attributed to community relationships –, it seems that a salient importance is attributed to community relationships. Local communities' and public authorities' representatives were invited in Italy to show how geothermal energy could contribute to the local development, and presentations with all stakeholders were held to present the company's idea of geothermal energy development.

[...] we presented at all levels, from the municipality to the community, our development plan... so as to understand and meet their needs. (Interviewee 1)

And

[...] it was something (the trip to show Italian geothermal developments) that showed satellite activities... to demonstrate a (potential) linkage with local development. (Interviewee 3)

And

They (local representatives) were invited in Italy to see how it (geothermal energy) works and the development model that could be proposed. (Interviewee 1)

As previously noted, different perceptions of *status* seem to emerge.

Measurement tools are able to measure the goodness of corporate community relationships and the extent to which the ultimate aim of such relationships is reached. It can be read that measurement tools were mostly based on project progresses, and on the extent to which an objective was not, partially, or fully achieved. Community relation activities were specifically included, and periodic reports were asked to show the level of progresses.

There was a worksheet on social responsibility with objectives also in terms of social responsibility [...]. (Interviewee 1)

And

It (the evaluation) is based on the objective... I think with statistics like the number of families benefitting from a certain measure, realization time of certain activities, etc. (Interviewee 2)

When considering the **conception** – i.e. the ultimate purpose companies would like to reach when implementing local communities' relationships –, it could be interpreted that the company's aim is directed towards being accepted through cooperation on projects that are co-defined with the communities. Interviewee 3 put it in a straightforward way by saying that

(Enel) has always tried to establish such a type of relation... (a relation so as for) putting yourself into their shoes [...] and develop the territory (in economic and social terms). (Interviewee 3)

Conclusion and implications

The following table represents the summary of the findings previously identified

Organisational arrangements \ Engagement strategies	Transactional strategies	Transitional strategies	Transformational strategies	Integrational strategies
Financial resources			1,2	
Human resources			1,2	
Competencies			1,2,3	
Status (level of importance) of the corporate community relationships		1,2	1,3	
Measurement tools			1,2	
Conception			1,2,3	

Table 21. Results of the analysis of CFE. The stronger the colour, the more the interviewee's statements are aligned to the characteristics of a certain strategy. The numbers in white identify who – interviewee 1 or 2 or 3 – expressed opinions aligned to a specific engagement strategy, and they are reported for each dimensions of analysis.

Table 21 shows a quite strong alignment of interviewees' opinions regarding Enel's organisational dynamics for developing local communities' relationships. Substantial accord among the three interviewees can be remarked on five out of six dimensions of analysis – i.e. financial resources, human resources, competencies, measurement tools, and conception. Such five dimensions are concentrated on the transformational strategic approach. In addition, there is not unanimous overall opinion on the organisational arrangement status. Interviewee 2 considers status as pertaining to the transitional strategic approach, while Interviewee 3 considers it as pertaining to transformational strategic approach. Differently, Interviewee 1 seems to have different opinions, since he simultaneously considers status in the transitional and transformational strategic approach. The different opinions on status could be due to different perceptions of the company's behaviour and strategic directions. Interviewee 1 seemed to recognise all the important procedures and tools used to implement a transformational strategic approach, but he failed to describe a real commitment for such way of proceeding. In light of this, it could be fairly stated that personal opinions may account for such variations, even though it could be underlined that efforts should still be made by the company to ensure a more uniform way of perceiving community relationships.

The analysis also identifies the priorities for improving the current strategy and the related level of engagement. Strategic implications for management are thus straightforward. Managers should i) implement raising awareness activities and training programs, in order to enhance importance and more positive perceptions within the company on corporate community relationships, ii) include feedback loops on financial resources, in order to measure the effectiveness of the social expenses, iii) ensure adequate preparation of compliance managers, so as to develop a more critical view on the needs and expectations of communities and encourage projects with potential positive spill-overs effect, iv) enhance competencies in building such projects, through the support of qualified NGOs. Last, as a result of the aforementioned improvements, conception would automatically change towards an integrational strategic approach.

2.3.4 Concluding outline

The two analyses aim at shedding light on how companies have built and managed engagement processes. Results show a quite strong alignment of interviewees' opinions regarding companies' organisational arrangements and, thus, their engagement strategies – i.e. transformational strategy for Enel and transitional strategy for CFE. This seems to suggest that companies have built over time a common knowledge on such arrangements and have relied on certain values and ethical principles to be shared among managers. This represents an optimal starting point for building any CSR strategy, since shared values and ethical principles could inspire its development and provide the strategic harmonisation required with the engagement strategy. In addition, results highlight that the few misalignments regarding managers' opinion come from retired people. This seems to suggest that both companies are moving forward in terms of practices and engagement strategies, challenging their organizational features towards more advanced levels of engagement. As a last remark, the companies' improvement-oriented attitude is extremely important if the evolutionary perspective is considered. The Evolutionary theory posits the 'survival of the fittest' approach, which stimulates companies to be stronger and more efficient as time passes in order to survive in the market. In terms of social responsiveness, more socially responsible companies could gain a competitive advantage and could drive less socially-oriented companies out of the market in the long-term. Given that, both companies would have benefits from their improvement-oriented attitude, especially beyond the short-term economic results.

2.3.5 References

- Delannon, N., Raufflet, E., & Baba, S. (2016). Corporate community engagement strategies and organizational arrangements: a multiple case study in Canada. *Journal of Cleaner Production*, 129, 714-723
- Denzin, N. K., & Lincoln, Y. S. (Eds.). (2011). *The Sage handbook of qualitative research*. Sage publications
- Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2), 105-112
- Krippendorff, K. (2005). *The semantic turn: A new foundation for design*. crc Press
- Locke, C., & Lloyd-Sherlock, P. (2011). Qualitative life course methodologies: Critical reflections from development studies. *Development and change*, 42(5), 1131-1152.
- Lozano, R., Carpenter, A., & Huisingh, D. (2015). A review of 'theories of the firm' and their contributions to Corporate Sustainability. *Journal of Cleaner production*, 106, 430-442.
- López-Navarro, M. A., Tortosa-Edo, V., & Castán-Broto, V. (2018). Firm-local community relationships in polluting industrial agglomerations: How firms' commitment determines residents' perceptions. *Journal of Cleaner Production*, 186, 22-33
- Taylor, S. J., Bogdan, R., & DeVault, M. (2015). *Introduction to qualitative research methods: A guidebook and resource*. John Wiley & Sons
- Yin, R. K. (2017). *Case study research and applications: Design and methods*. Sage publications

2.4 Cases of multinational companies involved in public engagement issues: examples of practices

This paragraph provides cases of multinational companies involved in engagement processes with potentially relevant findings and inputs for the GEMex project.

From social licence to operate to engagement: the case of Rio Tinto Alcan in Ghana	
Context	<p>RTA – i.e. Rio Tinto Alcan – is the bauxite and aluminium subsidiary of the Rio Tinto group, which is a leading global mining company that focuses on finding, mining and processing Earth's mineral resources. Rio Tinto started its extracting activities in Ghana in 1974, focussing on the western part of Ghana in the district of Bibiani-Anhwiaso-Bekwai (BAB). Through the joint venture Ghana Bauxite Company Ltd (GBC) with the Ghanaian government, the subsidiary RTA operated in Ghana until 2011, when its share in GBC was purchased by the Chinese company Bonsai Minerals Group.</p>
Issues & solutions	<p>As a result of strong oppositions in 2006 to one of its mining projects located in India, RTA decided to revitalise and strengthen its CSR efforts, especially towards local communities. Through a profound revision of its CSR strategy and activities, RTA discovered that they were mainly focussed on short-term objectives, many of those revolved around one-off hard infrastructure investments that responded to specific community' requests.</p> <p>In the same year, RTA changed its CSR strategy and launched a 3 years Social Sustainability initiative in the BAB district of Ghana. The initiative was design within the broader BAB district's strategy for the Sustainable Development Goals, and it was supported in its implementation by the non-governmental organisation (NGO) WUSC – World University Service of Canada. After a period of due-diligence between RTA and WUSC, a formal partnership was set up, to reach four main objectives:</p> <ul style="list-style-type: none"> • Enhanced governance and service delivery. Strengthening the BAB district Assembly and local committees in responsiveness, accountability and transparency. • Strengthening quality of services. Improving educational quality, access to clean water and hygiene factors. • Economic growth and employment for youth. Training young people in locally-relevant trades to improve income and employability. • Gender equality. Ensuring equal participation in decision-making committee, in all training activities and in accessing to resources and services. <p>Through the RTA-WUSC partnership, WUSC was able to average RTA resources to increase development outcomes in the region, while RTA was able to ensure improved local acceptability through community-driven CSR.</p>
Key success factors	<p>1) Strong-community engagement</p> <p>A strong belief was that engagement would have resulted in the achievement of the objectives, contributing to the sustainable development of the district. In practice, this</p>

	<p>meant that WUSC and RTA identified broad objectives, while strategies on how to reach those objectives were developed with and by local communities and District Assembly representatives</p> <p>2) Mobilisation of multiple stakeholders</p> <p>RTA's inclusive approach to collaboration was crucial in ensuring the success of the partnership. In particular, the alignment of the project objectives with the local authorities' development framework allowed synergies and efficiency, which ensure the future sustainability of the initiative.</p> <p>3) A project accelerator</p> <p>Established NGOs, such as WUSC, often have the trust of local communities and officials. Partnering with them helps to signal community members that the partner – RTA in this case – is committed to the effective and local relevant implementation of the project and CSR strategies will be supported by effective expertises.</p>
--	--

Table 22. Description of the case of Rio Tinto Alcan (Source: "Field Action Science Report", Veolia Institute)

A process for acceptability: the case of a railway infrastructure project in France	
Context	<p>The goal of this infrastructure was to link Paris to Bordeaux in just two hours, representing one of the most ambitious railway infrastructure projects undertaken in recent years. This is a project on a grand scale with a complex timetable. This infrastructure is the first example of rail contract granted by the French network operator Réseau Ferré de France (RFF) to a private operator – VINCI – for a period of 50 years from 30 June 2011. The contract covers the design, construction and operation of the entire line. The terms entail penalties for late delivery that could challenge the economic and financial balance of the entire project.</p>
	<p>The local acceptability of the rail infrastructure is dependent on the way in which all these impacts are managed.</p> <ul style="list-style-type: none"> • The landscape and countryside, which would be significantly changed by the construction of the rail line; • Local residents and farmers, who would see their land and daily life affected by the construction and running of the rail line; • The environment and biodiversity, across the 14 Natura 2000 sites (sites which are specially protected due to the rarity and/or fragility of the wild species they shelter) the rail line will affect. <p>The key challenges posed for avoiding these impacts are multiple.</p> <ul style="list-style-type: none"> • A financial challenge: costs of compensatory measures could prove to be very high. • An operational challenge: the implementation of impact reduction and compensatory measures requires the identification of practical solutions in the field,

<p>Issues & solutions</p>	<p>which have significant consequences for construction conditions and the methods used onsite.</p> <ul style="list-style-type: none"> • A legal challenge: law establishes the three inseparable obligations applying to the environmental impacts of major infrastructure projects: “to avoid, reduce and compensate for negative environmental effects”. The construction and operating company addressed each of these obligations through the implementation of measures throughout every phase in the design and construction of the rail way. • A governance challenge: the issue of acceptability does not fall neatly into any precise legal category and no real governance structure yet exists. So, outside the specific legal framework, it is essential to invent ad-hoc organisational and decision-making methods. <p>Given these many challenges, the strategy adopted builds on three cornerstones.</p> <ol style="list-style-type: none"> 1. Stakeholder accountability. <p>A series of meetings were held with local stakeholders to gain an understanding of their perception of the project and its impacts, their expectations and their concerns. This stage was crucial in terms of representation and made it possible to identify all the project’s environmental stakeholders at local level and source locally all the skills needed to define and implement impact reduction and compensation measures. The local level stakeholders were identified as:</p> <ul style="list-style-type: none"> ➤ environmental associations and experts with the ability to identify potential areas and the measures to be implemented for each protected species affected by the project; ➤ professional federations (fishermen, farmers, etc.) with the ability to define those measures assessed as ‘acceptable’, identify land within the areas jointly defined, and support the relevant professionals in implementing these compensatory measures. <p>The next step was to draw on these local skills by applying the principle of accountability to involve the stakeholders in the process of defining and implementing impact reduction and compensation measures. After a series of bilateral meetings over a period of two months, a meeting was held in December 2010 to bring together all stakeholders with the project management team to formulate an initial agreement on cooperation methods.</p> 2. The principle of contractual agreement <p>The next stage was to prepare a framework within which the compensatory measures would be operationally implemented. This agreement sets out the major compensation measures, maps their locations, and allocates individual roles (ecological analysis, site identification, etc.). At the same time, bilateral agreements were signed with each stakeholder concerned in order to define reciprocal missions between them and their counterparts.</p> 3. Shared governance
--------------------------------------	---

	<p>Three governance bodies were set up to guide and monitor the measures implemented while strategic coordination of some cross-disciplinary topics is delegated to partners in the non-profit sector.</p> <ul style="list-style-type: none"> ➤ The Management Strategy Committee develops and proposes the compensatory measure implementation policy. ➤ The Working Groups and On-site Support Groups respectively provide support and follow-up for the compensation measures implemented in the four habitats and impact reduction measures in the on-site construction phase. ➤ The Local Monitoring Operational Committee ensures compensatory measures. <p>These governance methods have enabled stakeholders to be involved not only in defining and implementing compensatory measures, but also in supervising and monitoring them.</p>
Key success factors	<p>A number of key factors for success have clearly emerged:</p> <ul style="list-style-type: none"> • Management involvement: a very high level of involvement by management and its support for the decision to manage compensatory measures in house have together facilitated the emergence of fast and innovative solutions. • The integration of environmental issues at a very early stage: the decision to identify and discuss these issues early on with all stakeholders has enabled a rapid pace of progress. • Partnership: the assertion and recognition of stakeholders as partners rather than simply suppliers, has ensured the development of a climate of trust and mutual respect for each other's positions. • The leadership role played by the construction and operating company: throughout the process of defining and implementing compensatory measures, the company has played its role as leader to enable the clear definition of the status and legitimacy of each stakeholder. • Transparency: the opening up of the project to all stakeholders further strengthened the trust and transparency required to reach agreement. • Consensus: the decision-making processes engaged in with non-profit partners meant that no voting took place; consensus was required for all the solutions and compensatory measures defined. The definition of consensual solutions meant that the measures submitted to central government departments respected the wishes and interests of all local stakeholders

Table 23. Description of the case of VINCI (Source: "Field Action Science Report", Veolia Institute)

A community-based CSR strategy: the case of a cement company in India	
Context	<p>Ambuja Cements is a controlled company of the global cement conglomerate LafargeHolcim, one of the leading cement industry players in India. Communities have always been a primary stakeholder for Ambuja Cements Ltd. (ACL), which has a long history of innovating for sustainability and social impact by adopting a CSR approach. Stakeholder (and community) engagement-based CSR approach is particularly suitable to companies with plants in rural or peri-urban disadvantaged areas, and willing to analyse and improve community development around their factories, such as the ones of Ambuja Cements.</p>
Issues & solutions	<p>For companies that leave a tangible print on the local environment and communities, as manufacturing companies' plants such as the ones of ACL, the core objective of the corporate responsibility projects should be local community development, to strengthen their reputation and engagement around their factories. In fact, the core objective of the corporate responsibility projects at Ambuja is to empower communities to recognise their true value and work towards its fulfilment - with Ambuja serving as a catalyst to help the community develop with the same strides as the company. ACL focuses on Agro- and Skill-based Livelihoods and Entrepreneurship, Water Management, Women Empowerment, Health and Sanitation and other related issues across the communities around its factories and areas of operations (21 locations in 11 States) and it can show a sustained process of community development and empowerment with the following numbers:</p> <ul style="list-style-type: none"> • 25,000 youth trained in over 38 locally relevant trades with a 75% placement rate; • 28,000+ farmers supported in capacity building, cost optimization and yield increase through the Better Cotton Initiative; • 1,142 SHGs promoted and supported with a focus on livelihoods and empowerment; • Ambuja's Foundation has extensively worked on water resources development management at several locations by supporting communities for construction and/or renovations of more than 2,000 different water harvesting structures. <p>All CSR initiatives at Ambuja are driven by a dedicated Foundation, Ambuja Cement Foundation (ACF), which brings together professionals working with a systematic and strategic approach towards solving community issues.</p>
	<p>A number of key factors for success have clearly emerged</p> <ul style="list-style-type: none"> • A bottom-up approach to assessing needs All ACL programmes are designed through bottom-up need assessment discussions. Ambuja's Foundation has set up a rigorous process of assessing local community needs through multiple rounds of focused discussions that bring together women's groups, farmers, youth, village administration and local Panchayats (elected local governing boards in India). Programme design is based solely on what the community resonates with as important issues to them. This ensures subsequent buy-in and cooperation in all activities undertaken by the Foundation. • Collectivization and community empowerment

<p>Key success factors</p>	<p>Ambuja's Foundation actively promotes community ownership, control, access and maintenance of resources through peoples' participation and strengthening of community-based institutions. ACF has funded and encouraged the formation of many such groups like associations gathering water users, Pani Samitis (local committees on sanitation and water), Watershed Committees, Farmer Groups, co-operatives or Self-Help Groups (SHGs).</p> <ul style="list-style-type: none"> <p>Leveraging native wisdom</p> <p>Ambuja's Foundation has always worked by leveraging the traditional knowledge systems of the local community to craft local solutions to issues. For example, in the water-scarce areas of Rajasthan, ACF worked by reviving traditional water harvesting structures called khadins, which prolong irrigation throughout the year.</p> <p>Partnerships and sustainability</p> <p>ACF has actively reached out to build partnerships with local banks, non-profit institutions, other companies, development agencies, policy makers and the Government in a process to make ACF projects sustainable through effective collaboration.</p> <p>Empowering women in the community</p> <p>ACF supports the entrepreneurial activities of Self-Help Groups through funding, regular training, and promoting income-generating activities. Across locations, women in SHGs are involved in activities such as dairy development, nurseries, vegetable farming, mushroom cultivation, incense-stick making, handicrafts and food processing. These activities have been instrumental in creating a value for women's work while strengthening their entrepreneurial spirit.</p> <p>Process and systems rigour</p> <p>ACF has put in place the necessary rigour and systems to realise a strategic long-term CSR program that is deeply connected to the local contexts and communities around the 22 plants across the country, by creating rigorous field reports and documentation, comprehensive monitoring of outputs and third-party audits for completed programs, case study booklets and knowledge dissemination.</p>
-----------------------------------	--

Table 24. Description of the case of Ambuja Cements (Source: "Field Action Science Report", Veolia Institute)

3 Addressing the social context for developing engagement processes: a Social Impact Assessment approach

*Social Impact Assessment is a process,
not a product
(Vanclay et al. 2015)*

3.1 Introduction: a participatory refinement of projects' social impact

Beside and beyond the economic and environmental assessment, Social Impact Assessment (SIA) is a conceptual approach, operationalized through diverse research techniques and methods, aimed at helping individuals and communities, as well as government and private-sector organizations, in investigating the possible social consequences for human populations and communities of social changes that may result from the implementation of policies, plans, programmes and projects.

SIA is the “systematic analysis, in advance, of the likely impacts a proposed action will have on the life of individuals and communities” (Burdge, 1999) and it is a sub-field of the integrated social sciences that pursues the ambition of building a knowledge base coherent with the systematic appraisal of impacts on the ordinary life of persons and communities whose environment is affected by a proposed policy, plan, programme or project. The definition has been expanded by the Interorganizational Committee on Guidelines and Principles for SIA to include “all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society” (Burdge, 1999).

SIA is an interdisciplinary approach that incorporates and integrates many fields such as: sociology, anthropology, demography, development studies, gender studies, social and cultural geography, economics, political science and human rights, environmental psychology and law. Born as an extension of the environmental impact assessment (EIA) aimed at providing insights on the likely positive and negative effects of a project/policy, SIA researchers and practitioners have been carrying out for the recent years an effort to develop a stand-alone activity for analysing, monitoring and managing the social consequences of planned interventions, and by logical extension the social dimensions of development in general. More than a mere field of research, SIA is conceived as a methodological approach or framework integrated in the project's development process and finalized at its improvement.

SIA is targeted to many diverse beneficiaries. SIA practitioners aim at working with all the diverse actors involved in projects' development in order to pursue a complex of intertwined different objectives. They work with communities to achieve better development outcomes for them, with public administration development agencies and private sector companies to design better projects and policies, with regulatory agencies to provide information for refining the regulation affecting the development of projects.

Even if the approach has reached a high level of standardization (IAIA, 2009) SIA has to be adapted to local circumstances in order to provide effective results in terms of understanding of the dynamics that may be driven in the short, medium and long run by the project under scrutiny.

SIA, as all assessment activities, is done before a project is implemented and therefore becomes a valuable tool in the decision process. SIA may provide the following relevant integration to the traditional approaches and methods for the economic, environmental and social assessment of projects and policies (Esteves et al., 2012):

- providing both qualitative and quantitative indicators of social impacts useful for decision-makers and the wider community of citizens;
- understanding how a proposed action will change the lives of persons (individuals and households);
- alerting decision-makers about the (direct and indirect) changes driven by the project in diverse areas;
- including suggestions for alternatives to the proposed action;
- including suggestions for improvement of the project and mitigation measures;
- SIA is an ongoing process carried out while the impacts are being generated.

With respect to its origin as an extension of the Environmental and Economic assessment, the ‘contemporary’ SIA is quite far from the technocratic approach that characterized its first development. Table 25 shows a comparison among many diverse dimensions that helps in making clear the major differences between a traditional approach aimed at measuring the impacts on society of a project, and the current approach aimed at investigating, jointly with the communities affected by the project, not only the extent of the impact but the definition of the impacts themselves, through the adoption of a constructivist perspective.

	Technocratic paradigm	Constructivist paradigm
Axiology	Value-free, neutral	Multiple value systems
Ontology	Mechanist Nature Vs Culture Universalist Functionalist Certainty Security	Socially constructed reality, Integration of nature and culture Context-dependent Ecologically systemic Uncertainty Risk
Epistemology	Positivist Objectivist Findings true Nomothetic	Constructivist Subjectivist Created findings Ideographic
Method	Expert-driven process Top-down focus Experimental/manipulative Hypothetical-deductive At the design stage of the project Impact identification/prediction oriented Quantitative methods Expert knowledge	Participatory Bottom-up focus Hermeneutical/dialectical Inductive method, grounded theory Throughout the project cycle Social impact/risk management plan Mixed methods Stakeholders feed in information/data
Theory	Uncritical Weak theoretical linkages to social theories Impacts understood as external forces	Reflexive Strong linkage to social theories Impacts understood as complex processes
Governance	Top-down and Technocratic Oriented toward approval and impacts Rationalist planning	Bottom-up, Democratic, Participatory, deliberative

	Normative, regulatory Project sustainability	Oriented towards sustainability and acceptance Deliberative planning Contextual, negotiated Social sustainability
--	---	--

Table 25. Six dimensions for comparing Social Impact Assessment paradigms⁹

Moving from the conceptual to the practical ground, as mentioned above, an effort for the standardization of the typical activities undertaken in an SIA has been carrying out in the last decade (IAIA, 2009; Vanclay et al., 2015). SIA essentially involves:

- scoping the key social issues (the significant negative impacts as well as the opportunities for creating benefits);
- understanding (i.e. profiling) of the communities likely to be affected by the project including a thorough stakeholder analysis to understand the differing needs and interests' actors;
- collecting baseline data and identifying community needs and aspirations;
- forecasting the social changes that may result from the policy, programme, plan or project;
- establishing the significance of the predicted changes, and determining how the various affected groups and communities will likely respond;
- examining other options and identifying ways of mitigation of negative impacts and maximization of positive opportunities;
- participatory processes to facilitate community discussions about desired futures, the acceptability of impacts and to integrate community inputs in order to reach a negotiated agreement between communities and developers based on free, prior and informed consent;
- developing a monitoring plan to inform the management of change.

The most structured SIA processes result in the delivery of a social impact management plan (SIMP) aimed at putting into operation all benefits, mitigation measures, monitoring arrangements and governance arrangements. In such a way, decision makers and civil society are enabled to implement their own respective management action plans and embed them in their own organizations, establish respective roles and responsibilities throughout the implementation of the project, and maintain an ongoing monitoring.

From the company perspective, the benefits of SIA are widely recognized and include:

- certainty for project investments and increased chance of project success
- reduction of potential social and environmental risks and conflicts
- ability to identify issues early on and to incorporate unavoidable costs into project planning and more generally improving planning
- information and involvement of internal and external stakeholders and support in building trust
- quality of life for employees and improved attraction and retention of skilled workers
- a positive legacy beyond the life of the project

⁹Adapted from Aledo-Tur and Dominguez-Gomez, 2017

- competitive advantage through enhanced social performance and corporate reputation

The link between SIA and CSR is getting stronger and stronger with the growing recognition of the importance of social issues connected to the implementation of projects and policies among institutions, governments and project developers. The greater responsibilities placed on individuals and organizations, are matched by expanded corporate policy. Project developers engaged in leading practice in impact assessment implement ongoing social monitoring and management programs, and community feedback mechanisms. SIA methods are used to assist decision-making and prioritization of social investments by project proponents.

Social investments often form part of the corporate social responsibility initiatives of companies by which proponents seek to improve the balance of costs and benefits of projects by enhancing positive outcomes and mitigating negative impacts. A social development needs analysis (SDNA) tool has been developed (Esteves and Vanclay, 2009) to assist managers to evaluate community development alternatives and to match social investments with community needs and regional planning priorities, while simultaneously addressing the strategic risks faced by project developers.

In any case, this positive integration of different perspective and methods and the SIA diffusion itself, is still at the beginning and hindered by organizational, cultural and financial factors. First of all, compared to the extent of analysis and resources devoted to biophysical issues, SIA usually has a minor role. Social practitioners have insufficient influence in shaping project/development alternatives, and, despite the increase in social roles within many organizations, the project managers who are responsible for commissioning and delivering impact assessments often have little social experience. Due to the resource's constraints, the tendency for proponents is still to produce assessments that only meet the basic requirements coming from the regulators. Then, the availability of data needed for the development of an effective SIA is still an issue in developing countries. Secondary data sources quickly become outdated and it is often necessary to supplement desktop research with local data collected by skilled social researchers. Primary data helps strengthen baseline information and better identify the existing unmet needs. Methodological issues such as reliability and validity, robustness and significance levels are weaknesses in many SIA studies. Third aspect, closely related to the previous, the quality of analysis is another area that asks for improvement. Assessments are sometimes little more than a social and economic profile of the impacted communities compiled from secondary data sources and integration with environmental, health and cultural heritage issues can be superficial. Finally, the public participation continues to be often more a statement than an actual activity effectively implemented. SIAs often do not meet public expectations of being a deliberative process to determine the acceptability of a project. Rather they are seen at best as a process for incremental project improvement, and always at risk to be considered as an attempt for project legitimization. Public participation ranges from being the provision of periods for public comment and the supply of information, to being the active involvement of stakeholders in shaping the SIA process and the opening-up of governance processes to include local communities in decision-making about projects (Franks et al., 2010).

Based on what described so far and taking into account some recent contribution from the literature, an attempt can be made to define an ideal-typical process of SIA, developing along the following phases (Dendena and Corsi, 2015; Vanclay et al., 2015; Johnston and Lane, 2018):

1. Screening: a review of the main features of the project process and expected results in order to define a first overview of the potential impacts.
2. Community Profiling: a careful description of the main economic, social and cultural aspects characterizing the communities affected by the project.
3. Scoping: identification of the social domains likely to be affected by the project.
4. Assessing Impacts: foreseeing the extent, time horizon and targets of the impacts (who will be affected, how and when).
5. Monitoring: methods, techniques and processes for the ongoing evaluation of the impacts production.
6. Developing Alternatives: finding different options and/or refinements that may vary from the first projects for the objectives and/or for the process.
7. Mitigation: defining the best way to address any relevant negative effect that may be produced by the project development or results.
8. Management and Evaluation: putting in place the right organizational and methodological tools for an effective measurement of the effects produced by the projects and for its management, inspired by what define sub points 4, 5 and 7.
9. Participatory Process: beyond the mere information and consultation, the actual involvement of the expected targets (communities and other stakeholders) in the co-designing, co-management of the project.

Inspired by the SIA perspective, the section will firstly explore the local communities with attention paid to a general description of their socio-economic profile (3.2) with a specific focus on energy perception and use (3.3). Then the results of a combined engaging research activity aimed at grasping new information and perception from the communities' perspective are provided (3.4).

3.1.1 References

Corsi S., Oppio A., Dendena B. (2015) ESIA (Environmental and Social Impact Assessment): a Tool to Minimize Territorial Conflicts, *Chemical Engineering Transactions*, 43, 2215-2220.

Esteves AM, Franks D, Vanclay F. (2012) Social impact assessment: the state of the art. *Impact Assess Proj Apprais* ;30(1):34–42.

Franks, D., Fidler, C., Brereton, D., Vanclay, F. & Clark, P. (2009) *Leading Practice Strategies for addressing the Social Impacts of Resource Developments*. St Lucia: Centre for Social Responsibility in Mining, Sustainable Minerals Institute, The University of Queensland.

IAIA (2015) *Social Impact Assessment: Guidance for assessing and managing the social impacts of project*

Johnston K.A., Lane A.B. (2018) The role of time and social churn in impact assessment: An engagementbased model. *Environmental Impact Assessment Review*, 71, 102-109

Vanclay, F. (ed.) (2014) *Developments in Social Impact Assessment*. Cheltenham: Edward Elgar.

Vanclay, F., Esteves, A.M., Aucamp, I. & Franks, D. (2015) *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*. Fargo ND: International Association for Impact Assessment.

3.2 Local communities affected by the project: a description

The Acoculco area has been studied for geothermal exploitation since the 80's, without success. Through the project, it has now been reconsidered as worthy of being studied. It is located in the northern portion of the state of Puebla and it includes part of the state of Hidalgo. It is 110 km far from Mexico City, in the north-east direction, while it is 100 km far from Puebla City in the north direction. The most important towns in the area are Zacatlán and Chignahuapan (Puebla), which are connected to Mexico City by federal highway No. 132 and 112, and to the city of Puebla by highway No. 119.

The Acoculco Geothermal Zone (ZGA) determines the spatial area in which direct and indirect social impacts can be observed and the logical structure for defining the boundaries of the Social Impact assessment can be drawn. The ZGA is divided into three areas: the Core zone, the Direct Influence area and the Indirect Influence area. Below is the delimitation and description of each of them (see Figure 6).

- *Core Area: project Infrastructure (Cruz Colorada).*
The Acoculco Core Zone (ZNA) refers to the drilling area defined by CFE in which two geothermal wells have already been drilled. This area should comprehend the infrastructure related to the construction and operation of the power plant, and a buffer area required by current regulations and the area of socioeconomic influence that will be directly influenced by the project.
- *Direct impact: geographic location, socioeconomic and environmental aspects (San Francisco Terrerillos, Jonuco Pedernales, Cuautelolulco, Chignahuapan).*
The Direct Influence Area is the area adjacent to the Core Zone. Such area comprehends the area in which environmental impacts can be observed and the path connecting the wells with the surrounding towns. The Direct Influence Area of Acoculco (ZIIA) is delimited by the town of San Francisco Terrerillos, Jonuco Pedernales, Cuautelolulco and the municipal seat Chignahuapan (Puebla).
- *Indirect impact: location, socio-economic and environmental indirect impact (Ocojala, San José, Corral Blanco, Peñuelas).*
The Indirect Influence Area is the area surrounding the Direct Influence Area, in which the indirect impacts coming from the development of the geothermal project can be detected (COFEMERSIMIR, 2015). The Indirect Influence Area of the Acoculco Geothermal Zone is delimited in the towns of the municipality of Chignahuapan: San José Corral Blanco, Ocojala and Pueblo Nuevo Peñuelas.

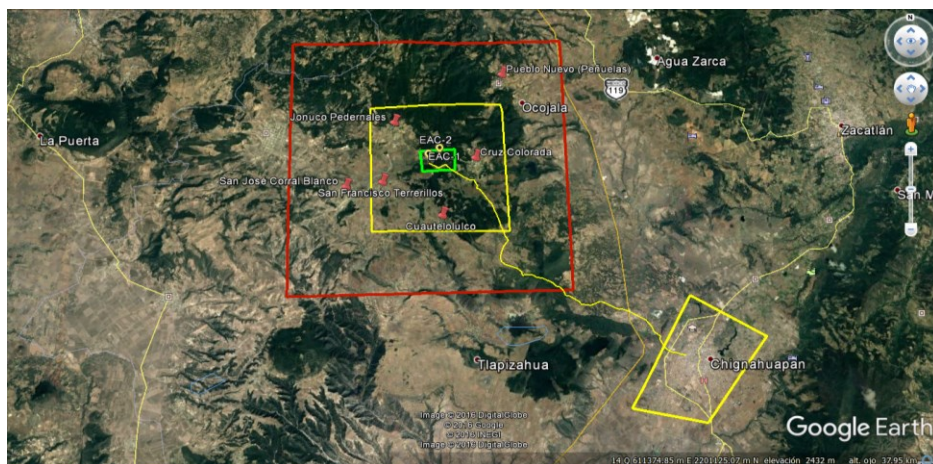


Figure 6. The Acoculco Geothermal Zone (ZGA) with its three components. (Source: C. V. Hernandez Ramirez *Propuesta desarrollo local en tres localidades de la Zona Geotermica Acoculco*)

The area of interest comprehends four communities that are within the municipality of Chignahuapan, in the state of Puebla. Chignahuapan is located at an approximate distance of 120 kilometres from the city of Puebla, capital of the state that bears the same name. It should be added that it is located at a distance of about 190 kilometres from Mexico City. The city is at an altitude of 2,290 meters above sea level.

The populations are represented by the ejidos of Cruz Colorada, Jonuco Pedernales and Ocojala.

The community of Cruz Colorada, is located at an approximate distance of 17 kilometres from the city of Chignahuapan, which is the municipal head of the municipality of the same name; likewise, it is located at a distance of 12 kilometres from the town of Acoculco; It should be noted that to reach this ejido, it is necessary to drive an approximate distance of seven kilometres on dirt roads; the ejido is located at an altitude of 2,839 meters above sea level.

In the case of the community of Jonuco Pedernales, it is at a distance of approximately 22 kilometres from Chignahuapan and 8 kilometres from Acoculco. Similarly, to reach the community it is necessary to drive on a dirt road of approximately 2 kilometres. The ejido is located at an altitude of 2,912 meters above sea level. The town of Ocojala (EO), is located at an approximate distance of 34 kilometres from Chignahuapan and 18 kilometres from Acoculco. The ejido is located at an altitude of 2,600 meters above sea level.

		Puebla State	Chignahuapan	Cruz Colorada	Jonuco Pedernales	Ocojala
Pop 2010 (Total)		5,779,829	57,909	464	418	337
Pop 2010 (M)		2,769,855	28,228	241	215	170
Pop 2010 (F)		3,009,974	29,681	223	203	167
trend	1990-2000	+10%	+7%	-1.1%	+2.6%	-4.7%
	2000-2010	+14%	+18%	-10.4%	-17.7%	-30.5%

Table 26. Population within the area affected by the project (Source: Socio-economic aspects associated with the area of influence of the GEMEX project, WP9)

Table 26 shows the characteristics of the population within the area affected by the project, displaying a slight majority of female at country and municipal level, while reversed at ejidos level.

In contrast to what happened at the state level, the communities' growth rate displays erratic trends in the years analysed (Table 26). For example, in the case of Cruz Colorada, it has witnessed a negative cumulative growth rate above 10% 16% in the last 10 years, while in Ocojala it has reached a negative rate of above 30%-35%. In general the three remaining communities have experienced a decrease in their population, which could be associated with a negative net migration rate. In addition, this could be an indicator of the scarce possibilities of income generation at the community level, which is why local people are forced to migrate to nearby cities in search of better living conditions.

	Houses	Puebla	Chignahuapan	Cruz Colorada	Jonuco Pedernales	Ocojala
2000	Total	1,065,882.00	10,356.00	101	88	115
	Inhabited	1,028,692.00	9,874.00	97	86	101
2010	Total	1,735,626.00	17,614	149	109	127
	Inhabited	1,392,053.00	14,007	115	87	91
	Total	62.8	70.1	47.5	23.9	10.4

Variation 2010 – 2000 (%)	Inhabited	35.3	41.9	18.6	1.2	-9.9
---------------------------	-----------	------	------	------	-----	------

Table 27. Total and inhabited houses in the area affected by the project (Source: Socio-economic aspects associated with the area of influence of the GEMEX project, WP9)

Chignahuapan is located in a mountainous region, where there are coniferous forests of pine, oak and oyamel. Such forests make the Municipality of Chignahuapan one of the main timber suppliers in the state of Puebla (Municipal Government of Chignahuapan, 2014). High yield of maize production is obtained in the western region of Chignahuapan which includes the localities of Ciudad de Chignahuapan, Cruz Colorada, Jonuco Pedernales, Ocojala.

Community	Number of Ejidatarios	Area (hectares)		
		Common use	Parcelada*	Total
Cruz Colorada	77	527.67	480.41	1008.08
Ojojala	143	79.73	651.71	731.44
Jonuco Pedernales	122	408.92	484.29	893.21

*It can be used only by the *ejidatario*, who is the owner

Table 28. Distribution of the land by destination of use (Source: Socio-economic aspects associated with the area of influence of the GEMEX project, WP9)

	Economically active population		Economically inactive population		Employed Population		School Grade (years)
	N	% (tot pop)	N	% (tot pop)	N	% (active pop)	
Puebla	2,178,686.00	37,6	2,084,110.00	36.0	2,098,095.00	96.3	8.0
Chignahuapan	21,160.00	36,5	21,368.00	36.8	20,650.00	97.5	6.7
Cruz Colorada	158	34,0	165	35.5	156	98.7	5.5
Jonuco Pedernales	112	26,7	173	41.3	112	100	4.0
Ojojala	112	33,2	134	39.7	106	94.6	5.6

Table 29. Human capital: employed, unemployed and education (Source: Socio-economic aspects associated with the area of influence of the GEMEX project, WP9)

Tables 29 and 30 present information on a set of statistics referring to the number of people who are part of the Economically Active Population (EAP), as well as the data associated with the population that have a job. In the same way, there is information related to the number of homes in each of the localities that have drinking water, sewage and electricity; finally, it also has information regarding to the average level of education of the inhabitants, in addition to the number of people who have access to public health services. Taking some values from those shown in this table and comparing them with those associated with the population shown previously, we can calculate the unemployment rate, as well as the coverage of public services in households; in this context, we observe a low rate of unemployment, except for what happens in 2010 with the ejido of Ocojala. In general, in the three communities, around 70% of the houses have access to drinking water and electricity; in contrast, sewage service coverage is very low and, the proportion of the

population that has access to health services is extremely heterogeneous among the three communities with the lowest level for Ojoala (9.22%).

Area	Drinking water	Sewage	Electricity	Health service
Puebla	66%	69%	77%	49.5%
Chignahuapan	72%	61%	77%	42.0%
Cruz Colorada	72%	43%	76%	81.3%
Ojojala	3%	30%	72%	9.2%
Jonuco Pedernales	69%	17%	78%	80.6%

Table 30. Access to services (% of total population, 2010) (Source: Socio-economic aspects associated with the area of influence of the GEMEX project, WP9)

As a summary and according to the statistical information presented in previous pages, the geographic area of interest where the four communities are located corresponds to a rural area that presents high levels of marginalization and social lagging; with scarce employment opportunities, as well as the lack of basic infrastructure to improve their commuting conditions to the cities. We should add, the almost null presence of – public and private- health services in the four communities.

In the same way, we should add that they are communities where the most important economic activities are agriculture – for self-consumption –, and livestock activities – especially in the breeding of sheep – with little profit margins. As a result, part of the population migrates to the cities in search of better sources of income.

3.3 The communities' perspective

3.3.1 Social aspects, participatory SWOT analysis and geothermal developments

SIA practices ask for an in-depth involvement of communities potentially affected by the activities to address 3 main objectives:

- collecting primary data and information that could help in refining the 'measurement' of projects' effect on the local socio-economic dynamics and cultural aspects;
- grasping the local communities' perception of the proposed intervention;
- identifying the main resources, needs, criticalities of local communities in order to define possible strategies of intervention.

In order to address these objectives, two engaging activities have been carried out:

- interviews with representatives of the local communities (*ejidos*) settled close to the exploration area (see 3.2) and with local administrators (Table 31);
- a participatory SWOT analysis, in which information was mainly gathered by the Mexican partners (due to language barriers) and the development was jointly carried out between Mexican and European groups (Table 32).

In addition, a questionnaire survey to the households of the communities of Colorada, Jonuco Pedernales and Ocojala was conducted during the fourth quarter of 2018.

Communities / Local authorities	People	Role	Social group	Gender
I1. Cruz Colorada	4	<ul style="list-style-type: none"> • Juez de Paz (Justice of Peace) • Nurse • A representative of the women's community • Former <i>Comisaria</i> 	<i>Avecindado</i> <i>Avecindada</i> <i>Avecindada</i> <i>Ejidataria</i>	M F F F
I2. Jonuco Pedernales	2	<ul style="list-style-type: none"> • Secretary of the Community • Vice <i>Comisario</i> 	<i>Ejidatario</i> <i>Ejidatario</i>	M M
I3. Ocojala	1	<ul style="list-style-type: none"> • Juez de Paz (Justice of Peace) 	<i>Ejidatario</i>	M
Cruz Colorada / Jonuco Pedernales / Ocojala	51	<ul style="list-style-type: none"> • Not specified 	<i>Households</i>	M & F
I4. Chignahuapan	5	<ul style="list-style-type: none"> • Mayor • Secretary • Assessor to Environment & Public In. • Assessor to Agriculture • Assessor to Urban Infrastructure 	 <i>Local</i> <i>Public</i> <i>Administration</i>	M M M F M

Table 31. Local communities and authorities involved in the process

The interview protocol that has been submitted to local communities and stakeholders was conceived as a semi structured interview, allowing the research group to be flexible with respect to the cultural, institutional and contextual specificity of the subjects interviewed. That means that not all the section of interviews could be administrated to all the subjects and that not all the inputs collected can be significantly grouped around the main dimensions explored in the interview scheme.

Thus, an ex-post reaggregation of the information collected has been implemented (Figure 7) as a refinement of the analytical approach on the basis of the actual results of the research process.

After the analysis of the interviews, three main domains of interest can be identified related to the description of the local context (A, B, C in figure 7). Based on the information provided and the discussion carried out around these domains, the main social and economic aspects, perceived as relevant by the community, have been described in terms of criticalities, needs and opportunities. This process of co-definition the relevant social and economic aspects through the active engagement of the local communities allows to critically assess the material and immaterial, positive and negative externalities (see par 1.4) connected to the geothermal development at the local level (D in the figure). Specific attention is then paid to explore the perception of the geothermal energy among the local communities in order to assess their concerns and expectations with respect to the project development.

In order for the interviews to be a fruitful exchange more than a collection of information, and in order to support the basic level of engagement (i.e. shifting people's awareness) specific room has been left (F) for providing in the basic description of the planned interventions and the connected externalities in the local area. Following this logical scheme, in the following the most relevant results of the interviews are provided with specific attention paid on the identification of the most feasible strategies for communities' engagement and local development.

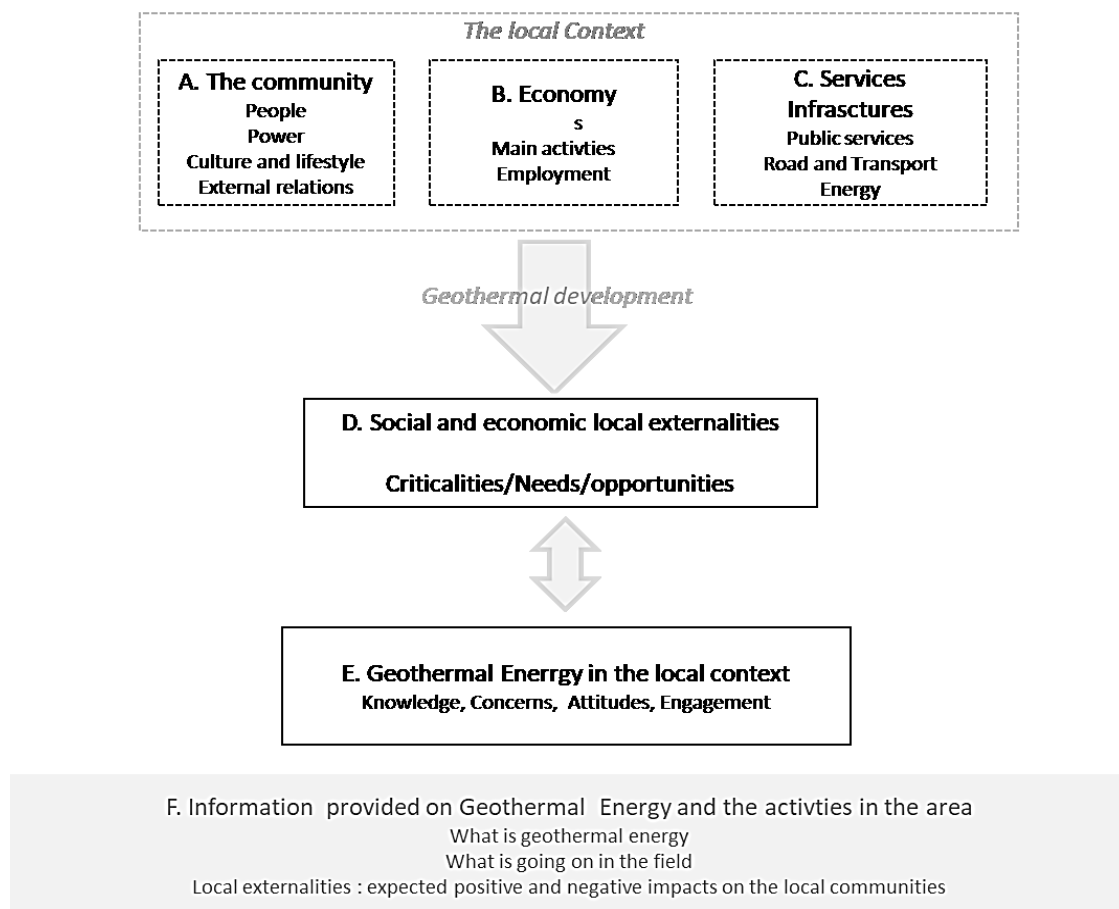


Figure 7. A logical scheme to analyse the interviews

The participatory SWOT analysis

	Positive Aspects	Negative aspects
Internal Perspective	What makes your community strong? <ol style="list-style-type: none"> 1. Strong solidarity that drives people getting together in order to address problems 2. Capabilities and tools to well manage the forest 3. Land productivity both for crops and animals 4. Water availability both thermal and for domestic use 5. Road Infrastructure 6. People's attitude for learning and improving 7. Touristic potential 8. Air quality 9. Good general attitude of people, quiet and peaceful 10. An international recognisant for good forest management 11. Good attitude for trade 	What makes your community weak? <ol style="list-style-type: none"> 1. Unemployment 2. Public security 3. Migration of young people 4. Lack of proper healthcare structures 5. Lack of proper educational structures 6. Social gap: rights and income differences between <i>avencidados</i> and <i>ejidatarios</i> 7. Gender gap: young women usually not educated and unemployed 8. Lack of proper tools and machineries for production 9. Lack of properly paved road infrastructures 10. Not satisfying public transport
External Perspective	What are the main opportunities/needs to be satisfied for developing your community? <ol style="list-style-type: none"> 1. Building a hospital 2. Sawmill, carpentry and furniture factory 3. Tourism development for which some interventions are needed: funicular, cabins, car rental, training... 4. Dressmaking and tailoring shops 5. Public lighting 6. Farming, a good opportunity for women employment 7. Secondary school 	What are the main problems affecting your community and the main threats you're scared of? <p><u>General</u></p> <ol style="list-style-type: none"> 1. Lack of employment opportunities for young people that more and more often move to the US 2. The gap in terms of opportunities and befits between <i>avecindados</i> and <i>ejidatarios</i> 3. The community will get smaller and smaller until it disappears 4. Low income for <i>ejidatarios</i> (small land owners) 5. Crops robbery that nobody dares to report to the public authority <p><u>Related to the geothermal plant development</u></p> <ol style="list-style-type: none"> 1. To be moved to other places once the plant will have been installed 2. A more invasive intervention by the public authorities on the territory 3. Fires in the forest 4. The (local) climate change. The seasons are drier than before with major problems occurring to the crops used for self-sustaining 5. Water and environmental pollution 6. To be deceived by the company that will not provide proper salary

Table 32. A SWOT-inspired participatory analysis (items are ordered by relevance)

Results and discussion

A. GENERAL ASPECTS

The three communities are characterized by a similar demographic structure with a total population that vary from around 300 people up to 700 and an almost equal distribution among men and women. They are small rural communities where between 10% and 30% of total population is represented by *ejidatarios*, the fraction of landowners, and all the rest (*avencidados*) employed as workers in agriculture and with livestock. They are affected by a high uncertainty about the actual amount of people living in the community, since they have quite a high, and variable, rate of temporary migration. Migration seems, at least in the perception of the interviewed, to be driven more by a cultural factor than by actual needs to be satisfied or relevant opportunities to be exploited.

We should be around 500...with 52 ejidatarios (I1)

We are approximately 700 but we can't be sure as many people migrate [...] the youth should be around 200 and the population is almost equally divided between men and women. There are 110 ejidatarios, 88 of which with right of exploiting the forest (derecho de uso común) and 22 that just own their own land (I2)

We are 107 ejidatarios and almost 200 avencidados, summing at around 300 people (I3)

Many young people go to Chignahuapan since they have the support of close relatives already living there and actually many people from Cruz Colorada migrated to the town even if they don't find a stable employment or an actual improvement of their quality of life, as the cost of life in Chignahuapan is far higher than here [...] but the youngest say "No matter the challenge, I will move anyway to Chignahuapan" (I1)

The ordinary life and distribution of power in the communities are shaped by the *ejidatario* system, that is the organizational device to manage land property and the rights to access the exploitation of the common goods, such as the forest.

To make it very simple the description of this system, the whole area the community is settled on is the *ejido* that is divided into parcels. The communities are divided in two groups: *ejidatarios* that are the owners of the parcels (a share between 10 % and 30 % of the entire population) and the *avencidados* that are all the rest of the population. The group of *ejidatarios* is then divided into two subgroups, the ones that in addition to be land owners have also the right to exploit the forest and the ones that just own their own land. Given this distribution of the basic properties, *avencidados* are strongly dependent from the *ejidatarios* both for their daily life (they are settled on land owned by others), for work (they are often temporary recruited by the land owners) and for using the natural ecosystem.

varios de la comunidad ocupan un trabajador por lo regular, todos los ejidatarios le dan trabajo a los avencidados pero sí hay que irle a joder —a trabajar(I1)

[...] o por lo regular los señores ejidatarios son los que tienen su madera, a lo mejor ellos puedan vender una camionetadita o todos los señores grandes que son ejidatarios tienen por lo regular a sus hijos

[common use forests?] ¿Y ahí sí podrían entrar libremente a agarrar leñita? No precisamente pero pidiéndola sí, pero muy libremente no. ¿Para eso tienen reuniones semanales? No, cada mes pero solo se reúnen todos los señores ejidatarios

A balance in this unequal distribution of (mainly economic) power is provided by the institutional setting adopted for steering the communities. First of all, the decision making process is strongly characterized by a collective approach with most of the decisions taken by the assembly of the *ejidatarios*, not only for issues

of public interest but also for an individual owner to be allowed in as an example, sell or fraction or build on its parcel.

[Questions & Answers on some procedures following the ejidatario system]

Q: O sea que si yo vengo y les quiero comprar una casa en la zona urbana ¿Puedo ser dueño aunque no sea ejidatario? ¿El ejido no tendría problema? A: Ahorita sí, antes no, donde no está de acuerdo el ejido es una parcela, debe venir a renunciar ante todos Q: ¿La casa sí se puede comprar pero no necesitas a ser ejidatario? A: No ser ejidatario, se llega a trato con el dueño y aquí se van al notario. Q: i yo quisiera construir más allá de donde está construido y ahí empiezan las parcelas? ¿Cómo se negocia eso? A: se les tiene que pedir permiso al ejido[...] se tiene que pasar al dominio pleno para que yo pueda darle un pedazo a otra persona o a mi hijo, lo que sea, porque tenemos un candado del RAN (Registro Agrario Nacional) de que una parcela no podemos fraccionarla, tiene que ser toda, nada más un pedacito no

Si tienes 5 hijos, si te mueres ¿Qué pasa con tu parcela? que heredarlos antes de dejar un testamento o en palabra porque puede ser hacer ¿Y ahí se volverían ejidatarios? [...] No, nada más es uno. Yo soy ejidatario y ellos van a estar conmigo ahí en mi terreno [...] Solamente uno se queda con derecho al uso común, con derecho al monte. Las parcelas se pueden repartir nada más de palabra, un pedazo no se puede repartir

There are two political authorities: the *comisario ejidal* that is the representative of *ejidatarios* and the *juez de paz*, that is the representative of the entire community. These two authorities are both representative of the community toward the exterior but internally *juez de paz* is perceived as the most powerful and is in some way a guarantee in taking collective decisions the interests of the entire community are considered

las autoridades ejidales son las más afines a las cuestiones productivas y que el comisariado y que el juez de paz es más cercano a las cuestiones sociales? Se dedica más el juez a las cuestiones sociales con toda la comunidad [...El juez] es como la ley aquí ... comisariados nada más al ejido, la administración ¿El juez puede encarcelar a alguien? No, no tenemos en dónde y lo que no se pueda solucionar aquí lo turna a un juez calificador. (I2)

Notwithstanding the concentration of power, there is a quite wide spread of the attitude towards a collective approach in decision making and more generally in the life of the community. People seem to feel to be part of a group that share interests and values and the relationship with the surrounding environment play a relevant role in shaping the community identity and lifestyle.

La forma normal de convocatoria es tener un grupo y trabajar, que la administración sea equitativa y todos iguales, si es un grupo que tengamos beneficios por partes iguales. Es un grupo el que trabajamos y todos igual a trabajar en utilidades parejas [...] Si han tenido sus reuniones pero independientes de cada quién, padres de familia aparte, grupo de PROSPERA aparte, ejidatarios aquí cada quién sus asambleas, comunidad rural (avecindados)[...] Pues sería bueno una con todos, a veces trabajar en conjunto es bueno pero es muy difícil y es bueno trabajar en sociedad (I1)

Aquí en el pueblito, aquí nos reunimos...por ejemplo, en la fiesta del pueblo se reúnen todos, después sí hay pequeñas asambleas pero no a todos asiste uno [...]aquí sí salimos, por lo regular cuando se llega la temporada de la Semana Santa el día sábado se junta la familia y nos vamos a La Alcaparrosa y allá jugamos futbol o con los chamacos y es otro ambiente, allá en el bosque es otra cosa, aparte aquí en nuestro pueblo está muy tranquilo pero allá es otra tranquilidad, está muy a gusto uno allá (I1)

Por lo regular en esas fechas de Semana Santa nos vamos a la laguita o a la Alcaparrosa, a los azufres o por ahí, a lo mejor ya no todos juntos pero allá coincidimos en el bosque (I1)

The relationships with other places around and with administrative level deserve attention to grasp the general attitude of local communities.

With respect to the metropolitan area (Chignahuapan) the dependency is first of all in terms of completion of the productive chains, both for the corn and for the little developed wood industry, and then to integrate the usual diet with other products.

(We go to Chignahuapan) because we lack the proper machinery for the nixtamalization [...] or we would like to have some diverse food , such as lamb [...] and in particular for the wood drying in the proper ovens that we don't have here in the community (I1).

With respect to the other communities around, the relationships are more cooperative complementary and based on the provision of complementary services, even if the level of services, and consequently the quality of life, in the diverse communities is quite heterogeneous, as in the example below about education services and greenhouses

We have all the education degrees, from the kindergarten to the secondary [...] Students come here from Cruz Colorada, Tlachaloya, San Isidro Pedernales, San Miguel y San Francisco Terrerillos (I2)
We don't have greenhouses [...] so we need to go to Pueblo Nuevo and get the trees for reforestation (I3)

Although if quite far, the central state is perceived as present in many of the main activities characterizing the life of the community, with particular relevance of the administrative units and national programmes in charge of managing agriculture, forestry and more general social concerns.

Right now our strongest relationships are with CONAFOR (Comisión Nacional Forestal), SEMARNAT, PROFEPA, Servicios Ambientales, SAGARPA, Desarrollo Rural and, Promosan, a specific project for women (I2)

B. ECONOMY & LOCAL EMPLOYMENT

The main activities for all the communities are agriculture and forestry, but they have a different degree of relative relevance depending on the specific community. Trade and commerce are almost absent and, when present, they mainly consist in almost informal exchanging of products among producers.

A common trait, connected with the *ejidatario* system, is the relative strong concentration of economic power in the hands of the minority of *ejidatarios*.

Regarding the forest, it is for sure an important economic asset and its maintenance (cleaning up and reforestation) is a major activity for many of the locals. Forest is first of all a source of material for feeding economic activities and to produce energy. Then it is also a source of direct income as the maintaining service is paid by the state, even if not always is perceived as actually profitable by local communities. It has to be highlighted that only *ejidatarios* gain directly by the forestry while the others are hired as temporary workers.

...lo fuerte, lo que nos ayuda –lo platicábamos hace un rato- es la madera, esa es nuestra fuente de trabajo, la madera pero no toda la comunidad cuenta con ese apoyo [just ejidatarios] nosotros como avecindados o loteros tenemos otras necesidades, no es lo mismo que un ejidatario y de cualquier modo sí nos echan la mano, nos dan trabajo (I1)

El bosque [...] nos lo estamos acabando, porque aun así aquí se trabaja así, sí se tala pero así como se tala se reforesta, son muchísimos árboles los que se reforestan, a lo mejor ya no los vamos a ver del tamaño de los que estamos derribando (I1)

Madera también pero es poco [...] apoyos por servicios de medio ambiente captura de carbono, aire, agua y de ahí... a veces es bueno estar dentro de esos programas de manejo que le damos al bosque pero a veces

nos complica porque es más trabajo porque tenemos que hacer brechas corta fuego, podas, chapeos [...] Comercios hay poco, la producción es casi para autoconsumo y animales, hay tiendas pero de abarrotes (I2)

With respect to agriculture, the sector is affected by the combination of two factors that hamper the development of more profitable activities the particular climate and the lack of proper machinery, a technological gap that obstacles the potential variety of the production.

Local communities mainly produce a monoculture of corn for self-sustenance. There is a residual production of cereals like oats and grain but due to the above mentioned constraints they are not quite high in quality to represent an economic value or a good basis to improve the variety of diet for humans. The local production of wheat can only be used to feed the animals that, jointly with the surplus of production in corn, represent a basis for trade in order to get complementary foods, like beans and other meats.

por lo regular en Cruz Colorada se siembra en marzo, lleva todo un año cosechándolo hasta por noviembre, se corta se guarda y de ahí vamos agarrando todo el año, a lo mejor el que cosecha un poquito más hasta le echa a un borrego y ese borrego lo pone gordito y lo vende para ocuparlo para comprar otras cosas que no se dan aquí, frijoles o algo así. El maíz aquí lo cosechamos

nuestra cebada no cubre los requisitos para llevarla allá, nuestro grano es muy delgado y no se la reciben a uno. Nuestro grano lo ocupamos para forraje de los animales (I1)

El campo, más que nada la agricultura. Maíz, cebada y avena. Hemos intentado tener semillas mejoradas pero no se aclimatan, no aprueban, será por la altura o por los terrenos o por falta de tecnificación; el clima es muy frío, no alcanzan a producir a veces no se les da la altura[...]Y parte del ganado o ganadería, de lana, ovinos; a veces somos mil usos, tantito agricultura, tantito ganadería [...]

El ganado [...] no tenemos ese aprovechamiento, igual la vendemos pero no igual, solamente para carne digamos [...] No hacen chamarras porque nos hace falta unos capacitadores de eso pero –cómo le dijera- hubo un apoyo del gobierno ... está un taller de capacitación a la gente pero la maquinaria... (I2)

... si nosotros tenemos una caja de ahorro es el campo porque es un ahorro que estamos metiendo ahí, haciendo gastos para barbechar, para sembrar [...] hay tienditas pero aquí se vende muy poco, hay veces que cuando se nos da la cosecha de ahí mismo le quitamos una tonelada o media de maíz para tener para el gasto [...]Lo que se produce en el campo es más para comer ...por eso le digo que cuando se da de ahí le vamos mordiendo tantito. Uno va vendiendo 100 o 200 kilos para ir a comprar el recaudo, los frijoles, cualquier cosita[...]aquí no se vende la leche, que hacen un quesito y por ahí entre la familia “véndeme un queso” y lo venden, “véndeme un litro de leche” y a veces se cobra, a veces no (I3)

As mentioned in section A, the potential economic development is hampered by the dependency of the local production on the services and mediators from outside the community. The productive chain of livestock, agriculture and wood industry is only partially developed inside the communities and, as a consequence, the majority of the economic benefit is exploited by others than the locals. A major concern in this respect is, in addition to the technological gap, the lack of entrepreneurial culture among the locals that are mainly interested in the short run satisfaction of basic income needs.

Somos productores de ganado pero nada más producimos, llega el intermediario y se lo lleva [...] a \$300 pesos el kilo y a nosotros nos pagan a \$50 pesos el kilo, entonces hacer la cadena productiva desde la producción hasta la barbacoa, hasta el consumidor, ahí se ve todo el beneficio (I2)

la madera igual, entrar a la cadena productiva, el ser productores, hacer muebles lo más chiquito que pueda darle su toque final pero nos hace falta mucho, igual a veces nos hace falta organización para hacer todo eso dicen aquí “yo no quiero trabajar” “yo no quiero invertir” [...] otros no los necesitan y si yo no lo necesito y lo puedo poner para el aserradero y poner los metros que me tocan de madera para el aserradero y para que la procesen y le saquen más dinero...pero no, todos la vendemos en rollo, todos quieren el dinero, aunque sea poquito (I2)

Given this economic structure, stable employment is one of the major problem perceived by the communities. There is in any case a strong 'culture of work' and people are trained in working, even if within the family context, from the very young age, a pre-requirement that allow them to be recruited as workers in many different jobs (e.g. drivers, farmers, ...).

La más grande competencia es que habemos muchos que saben cómo trabajar en el campo y en la ganadería (I3)

As mentioned above, many (often young) people move away for work but only a small fraction move permanently while the majority for short terms contracts.

¿Los jóvenes van y vienen? Según cuentan los que han ido ahora está bien canijo, ahora ya lo vieron por el lado de que se van por contrato, entonces sacan sus papeles, se van 3 meses o 6, regresan se están 2 meses y se vuelven a ir. Por ese lado está muy bien porque ya no tienen que irse a la aventura. ¿Y los contratan en Los Ángeles? [...] aquí hay unas personas en Chignahuapan que se dedican a hacer esos contratos y ya se van (I1)

Hay muchos jóvenes que se van pero desde chicos empiezan a trabajar. Los que están con nosotros van igualmente trabajando al campo, hay muchos que luego acá no hay trabajo para ellos y se van a trabajar, se van de choferes, se van para el otro lado (I2)

le damos trabajo de ahí se va sacando para comer porque no tienen parcela, no tienen de dónde echar mano y ya si yo tengo mis animales para cuidar...como yo tengo caballos, tengo gallos y hay veces que necesito uno o dos trabajadores, entonces al que veo más amolado le digo "vente ayúdame" y le doy \$200 o \$300 pesos, aquí se pagan \$150 pesos al día de 8 a 4 de la tarde y hay veces que los ocupo dos o tres veces por mes, dos días o tres días [...] muchos se están yendo a trabajar a un invernadero de flores por ahí por la carretera, está grandísimo allí hay bastante gente, nada más que le está haciendo mal a la garganta a los que andan fumigando por la química que fumigan y llega a la boca. Muchos ya no van a trabajar, les sale mucho como sarpullido en la cara, no pueden ver y se les hincha la cara, muchos ya no van a trabajar. Les dan \$1,100 a la semana, se van a las 5 de la mañana, entran a las 6 y salen a las 4 de la tarde (I3)

C. SERVICES & INFRASTRUCTURES

As it is usual the case for dispersed communities, the availability of services and technologies is generally lower than the satisfaction of social needs would require, even if among the communities (as mentioned above) a quite relevant heterogeneity can be detected, that in some way results in source of integration among communities

Education services are the most heterogeneously distributed. Since they are often related to the population density, they are concentrated in some places and there are people able to access all the services and others forced to move to access the services where they are available. To overcome this disparity a proper transport service could play a relevant role but for the moment (see below) it seems to be highly underdeveloped.

No contamos con un bachiller, mi chamaca ya salió de la secundaria y ya no estudió por lo mismo, se nos dificulta ir a otro pueblo a donde sí hay [...]

Escuelas tenemos todas, desde preescolar hasta media superior, hasta bachiller [...]

[...] Los jóvenes lo piden mucho, lo que hicimos de investigación los muchachos de bachillerato es lo que más piden, caminos y transporte para que puedan llegar a las escuelas, para ellos es algo que les importa mucho, que haya más conexión entre las comunidades [...] Sí, eso es bueno pero el que pone un transporte si no es redituable va a decir para qué...pero sí es bueno, que hubiera una cada hora por lo menos

Conversely, the situation of the health services provision is quite homogeneous among the communities. The usual service organization is based on two components: a permanent presidium of an auxiliary able to provide the basic assistance and relying on an essential medical equipment and furniture (local sanitarium or *casa de salud*); a periodic visiting of a doctor in charge of deeper analysis and usually booked in advance by locals. The overall satisfaction is quite low because the periodicity of the doctor visiting is not reliable enough to give the people the feeling to be actually assisted. The communities raised complaints and specific requests for the health service to be improved but they were not successful

Nuestra casa de salud también no está en muy buenas condiciones [...] hemos hecho alguna solicitud para que nos apoyen a lo mejor no con un doctor permanente pero sí una vez o dos a la semana pero no se lleva a cabo (I1)

El responsable de la casa de salud...viene a lo mejor cada 8 días o cada 15 pero esa pregunta sería para la auxiliar porque tiene más o menos conocimiento de eso. De hecho cada familia le programan su consulta familiar y tienen que ir todos, lo checan a uno...y pues de medicina a lo mejor sí traigan pero quién sabe qué tanta. A lo mejor vienen 2 veces al mes (I2)

tenemos una decretada como casa de salud está un poco amplia para un pequeño hospitalito pero carecemos de un médico de planta, medicamento, viene una unidad móvil del municipio de Chignahuapan cada 8 días, cada 15...hacen una rutina de día y ahí mandan por grupos, vienen cada 8 días porque un grupo... o un día unos y otro día otro y no tener a todo el grupo amontonado[...] Vienen cada 8 días, a veces ni vienen. A veces a los 20 días. [...] Dentistas, estudios de todo, Papanicolaou, cervicouterino, próstata, diabetes, todo y orientación y capacitación a los hombres y a las mujeres. [...] Tenemos una auxiliar que está de planta que es de aquí pero si no tiene medicamento Curaciones, inyecciones, toma de presión, control de azúcar...eso es lo que tenemos (I3)

Water services also need to be strongly improved. Regarding water for domestic use the satisfaction of people needs is quite high, or at least well perceived by people. On the one hand, due to the specific environment (high mountains, water springs and not industrialized area) the provision of good drinking water is wide spread and the need of having hot water is not among the priorities (and in any case can be easily reached by wood warming).

El agua potable la traemos de allá de la Alcaparrosa, en tubería y aquí hay dos cajas de agua, ahí la almacenamos y hay una persona que va y le abre y se distribuye en el pueblo, pero la traemos de por allá donde están los azufres(I1)

The main concerns are about water for industrial (agricultural) use and, above all, for a correct management of sewage. One additional problem for local agriculture, in fact, is its dependency from the natural water cycle that consistently affect the quantity and quality of the crops. Thus, a proper infrastructure for irrigation (pumps and pipes) would improve a lot the production.

Aquí nosotros no tenemos de riego, es de temporal [...] La más grande necesidad es que a veces lo que sufrimos es de agua para riego porque todo aquí es temporal, aquí tenemos que esperar a que caiga agua del cielo para poder sembrar, para cultivar. Otra, si se pudieran hacer pozos con bombas para regar (I2)

Drain and sewers are in any case at the most relevant issue related to water as they affect, through the risk of contamination of water and soil, both the general quality of life and the agriculture production

eso necesitamos –a veces dicen que no hay dinero- para hacer una planta de tratamiento de aguas negras, entonces todo se descarga al río y si contaminamos esto llegaría hasta Hidalgo y se pasa al río no sé cuál, todo lo vamos a ir contaminando [...] Drenaje nada más una parte, un kilómetro o 700 metros, nada más

está el tramo general, faltan conexiones. Y estamos haciendo descargas fecales pero cada quién su fosa séptica, no tiene caso echar el drenaje al río. Deja que nada más fuera contaminación(12)

Regarding mobility of people (road infrastructures and transport service) improvement are expected and needed, that may play a relevant role in overcoming the unequal distribution of other services in the area and it is worth to highlight that individual mobility (i.e. moving by private car) it's still the most diffused way to travel. This high intensity in car use motivates the low satisfaction about the quality and density of the road network (interventions are expected for create new trails and improve the existing ones) and the still not critical satisfaction about public transport, even if an increase in the daily routes would be highly appreciated.

cuentan con su carrito viejito pero ahí andan y por eso mismo a lo mejor esto del transporte no se da muy bien, porque aquí el que baja a Chignahuapan va y se lleva su carrito (11)

...el transporte publico es suficiente... porque aquí cada quien tiene su unidad, aunque sea viejitos los carritos pero ahí andamos en ellos (13)

[...]nuestra carretera, es pura terracería, qué bueno que metieran la carretera pavimentada.

El transporte no es eficiente porque tenemos uno en la mañana que viene a las 8 y se va y regresa a las 2, se va y regresa otra vez a las 5 (12)

Sí, hay un servicio colectivo pero nada más es en la mañana y en la tarde y sí, yo creo que todo eso ya se vería estando bien el camino van a poner más servicio, si viene una a lo mejor van a venir dos...que en realidad no hay mucha gente

The final focus of this section is on the provision of energy and the (partially related) diffusion of technologies among people.

With respect to energy, the main source, as expected, is biomass and in particular the residuals of the forest maintenance. Wood is the cheapest way to satisfy energy needs of the communities in terms of daily and domestic life (heating water and houses, cooking, etc.) and electricity is the complementary source for feeding the few appliances they have. Gas also is sometimes adopted but not at a wide scale as it is not provided by the grid and is far more expensive than wood. An important issue with energy provision is connected with electricity that is available only for domestic use, while the provision of the triphasic for industrial use has been identified by one interviewed as a relevant leverage of potential development (or at least as an obstacle for the development of industrial activity)

no nada más con leña, ya también hay gas. Hay quien cocine con gas pero con leña sí se ahorra un poco más [...] La leña aquí nosotros...de lo mismo del bosque, se tala la madera y lo que son los rollos más gruesos esos se venden a Chignahuapan pero lo que es el brazuelito (brazo más chiquito) ese nosotros no lo quedamos (11)

¿Calientan la habitación? No, por lo regular no, aquí cuando hace mucho frío se va uno a la camita y se echa uno bastantes cobijitas[...]¿Y ni el agua calientan? Sí, de hecho para bañarnos ya hay calentador de leña (11)

La leña es la forma de energía más importante...Según la mayoría ya tienen gas pero –sí hay distribución de gas- pero ahorita el gas está bien caro, a veces yo me doy a veces la posibilidad pero ya viendo, estando sobre la marcha y si está bajando o subiendo mucho el costo entonces regreso a la leña porque por ejemplo si necesito bañarme voy al bosque y traigo bastante leña (11)

¿Nunca han usado sustituto para la leña? No¿Esas pastillas –No ¿y aprovechamiento de la energía del sol o molinos de viento? No. [...] una persona o dos ya tiene su calentador solar pero como para el baño...(12)

¿tienen refrigeración? Hay quien en el pueblo ya tienen sus aparatos, refrigerador y así varias cosas. Yo en la casa no tengo pero aquí no es como en la ciudad, yo he estado unos cuantos años en la Ciudad de México

y allá se echa a perder muy rápido la comida, aquí dura, aquí no está tan caluroso y cuando es una familia no muy grande no tenemos necesidad[...] (I1)

La electricidad la tenemos al alcance, nada más la doméstica, hace falta...no podemos desarrollar otra fuente de empleo porque la energía siempre es necesaria, nos hace falta la trifásica, tenemos lo básico para cocinar

The technological endowment is generally quite basic and particularly low when it comes to the ICT. This technological gap doesn't allow the communities to be actually connected to the contemporary network of information. In fact, if almost everyone owns a device to be informed (TV, radio) and many people owns a communication device, only half of the population owns a mobile phone and almost nobody has a computer at home. The digital gap becomes thus really relevant when comes to the internet connection and this could reinforce the marginality and dependency of the area, as noticed by an interviewed.

En las escuelas tienen internet pero es circuito cerrado, no sale, a veces lo apagan las maestras para que no andemos ahí [...] Los chamacos que están ahorita en la secundaria ya...es mucha tecnología para mí, ahorita por ejemplo con los programas de CONAFOR yo les digo "hay que autorizar un programa" "busca en internet" tengo que ir a los ciber (internet) a decirles "búscame esto" porque yo no sé manejar eso, imprimir...y es interesante pero [...] ¿Y servicio en las casas también tienen? Celular y fijos, partes iguales porque a veces unos estamos muy abajo y no nos llega la señal. (I2)

D. SOCIAL AND ECONOMIC LOCAL EXTERNALITIES

On the basis of the main evidences of the previous sections, here below a short list of positive and negative local externalities is provided, defined with respect to the local needs and opportunities:

POSITIVE EXTERNALITIES

- Improvements of infrastructures (transport, electricity)
- Improvement of services (schools, medical center)
- Direct and indirect economic effect (direct employment in the plant building/maintenance, providing basic services to the employees of the plant, development of local enterprises in agriculture and wood industry)
- Reinforcement of the community (stop to youth migration, valorization of local resources, better connection among villages)

NEGATIVE EXTERNALITIES

- Environmental impact:
 - pollution of air and water
 - damage (up to destruction) of the forest resources
- Reinforcement of social and economic gaps within the community (due to the specific distribution of power and resources).
- Increase of territorial disparities (due to the localization of the plants in a specific ejido).

E. GEOTHERMAL ENERGY & RELATED DETERMINANTS

A specific room in the interview was left for a focus on geothermal energy, intended as a twofold opportunity to get information from people about their knowledge, concerns and expectation and to spread basic knowledge about what geothermal energy actually is and what actual risks are connected to its development.

Regarding the knowledge and awareness about geothermal, people have confidence with the resources since the hot springs are part of the local culture (and also considered as potential for touristic development)

todo depende de la fe que le tengan al agua, van y se meten si les duele un brazo o algo y sí hay quien dice "se me quitó". ¿Y funciona? Funciona, mucha gente por aquí por "Los Baños" que les decimos nosotros, por ahí estuve unos meses cuidando un aparato y ahí iba mucha gente a curarse o a traer en garrafas y se la lleva. Algo debe de tener, hay hartas personas que vienen de la Ciudad de México y van, agarran y se hacen sus mascarillas de lodo (I1)

But they have very little knowledge about the potential in terms of energy production. This little knowledge produces both skepticism, expectations but generally they seem to be open (and even curious) to be more and better informed

¿Puedo preguntarte qué idea tienes de la geotermia? Según tú ¿Qué es la geotermia? Eso es lo que ustedes me van a decir...(I1)

Hay gente que nos dice que esto nos puede traer dificultades pero hay quien también opina diferente, que esto de la geotérmica, algo así...que es la energía más sana, pero hay quien opina lo contrario, que no que nos puede traer dificultadesEs el que está planteando todo esto porque ya tiene mucho tiempo, de hecho ya hay dos perforaciones allí, por eso digo que tiene rato que tienen viendo todo esto[...]hacen lo que tienen que hacer y se van (I1)

Hasta ahorita no sabemos ni cuál es la función, sí nos interesa y a veces estamos entre sí y no porque no sabemos los daños que nos van a hacer hasta estar funcionando (I2)

el desarrollo de esta planta a la vez es buena y estar preocupándose tanto como gobierno, las empresas en desarrollar esto porque es para un futuro grande yo pienso, para muchas generaciones porque si no imagínate cuánto están invirtiendo en traer gente capacitada, traer esto para que dure un año o dos (I2)

Leaving apart this lack of information, the general attitude, mainly built on a word-of-mouth knowledge, seem to be in principle in favor of the geothermal development even if the uncertainty produces some vague but relevant concerns

están planteando poner algo de geotermia, algo así...bueno, entonces sí me gustaría que si llegara a hacer algo –aquí nosotros estamos preocupados porque no tenemos mucho trabajo- yo creo que habiendo una cosa de esas se generaría algo de trabajo y no tendríamos que –hartos jóvenes se van a Estados Unidos y pues tienen que salir a buscarle (I1)

pero pienso que sí es bueno, nosotros a lo mejor no accedemos aquí a algo, a lo mejor si este proyecto viene a lo mejor lo van a poner en Jonuco Pedernales o lo van a poner en Terrerillos o Acocolco...yo sería de la opinión de que al rato va haber beneficio y a lo mejor vamos a decir "por qué dejamos que se fuera", mi opinión es que sí es bueno que lo pongan aquí

[...] No sé si tienen preguntas o curiosidades, no sé si tú tengas preguntas. Sí, ¿Qué posibilidades hay de que sí se lleve a cabo esto aquí?

tenemos necesidades y tenemos preocupaciones [...] bueno que vengan de otros países a hacer el proyecto y que sea un estudio para no tener daños a la vegetación o a los humanos porque si no de qué sirve que bajemos costos en la energía pero que nosotros vamos a tener costos de enfermedades (I2)

Pues ahorita tenemos que ver que sigan trabajando y nos saquen de la duda a ver para dónde pueden hacer esto, a ver dónde están los manantiales de agua caliente. Esperamos a la otra que vengan dónde vamos a ver esto (I3)

As often is the case, a more (and self) informed minority has started organizing in small groups to act against the plants

¿Hasta ahorita quiénes son los que podrían estar en contra? Pues a veces se reúne uno aquí y hay quien... personas que se están preparando y dicen que a lo mejor nos puede traer algunos daños pero aquí los campesinos no decimos mucho, es quien se está preparando más (estudiando) (I1)

The main concerns about geothermal development are related to potential impact on health (of people and animals) and on the potential damages to the forest

Pues a lo mejor como enfermedades [...] o que algo si arroja un gas o algo que vaya a perjudicar al bosque, si llega a salir algo y de repente todo nuestro bosque esté seco, esa es nuestra preocupación (I1)

Está bien, bajar la energía, va a tener un bajo costo pero como le estaba diciendo hace rato, después vamos a tener problemas, enfermedades de los animales, nosotros y de dónde vamos a sobrevivir o nos pelamos todos porque aquí el patrimonio es el ganado y el bosque en parte, la agricultura. Si va haber afectaciones en eso, esa es mi preocupación (I1)

Then, an interesting point has been raised regarding the opportunity to actual being benefitted (and not only exploited) or in other words to be actually involved in the development process and the related economic and social benefits

Es que por ejemplo el socioeconómico o social ¿hasta dónde podemos nosotros decir “aquí podemos meter la cuchara” y hasta dónde no? Porque si no, es que dicen...lo socioeconómico y social y llega CFE es dueña de la geotérmica si es que se llega a construir es la CFE y aquí le dice a Jonuco “tú ya no tienes nada que ver aquí” (I2)

One further element that shows a good degree of awareness is about the distribution of the risks along the life cycle of the plant and the counterpart accountable for them. First of all, beyond the type of risk, people are concerned also about the time when these risks are more likely to be, if during the plant building process or all along its productive lifetime or both. Then, a major concern is about having certainty of the institutions/companies/peoples responsible to intervene and mitigate the eventual problems in case something bad happens.

Los riesgos que se puedan presentar son cuando se esté trabajando la planta, o después de que esté funcionando. ¿Representa un riesgo cuando esté la planta echándose a andar en la construcción o después de que esté funcionando? ¿Los riesgos a quién vamos a atacar de los riesgos? Ellos como investigadores no, ahorita vienen, hacen el trabajo y se van a ir...se pasa a CFE o a qué institución vamos a atacar para los riesgos, cuando estén trabajando en la construcción pues va a ser la constructora particular...ya teniendo la constructora terminada la planta y ya está trabajando y hay otro riesgo ¿A quién se le va a quedar, a CFE o va haber otro?

Beside the (moderate) concerns about the potential risks, geothermal development is perceived as an opportunity for the local (economic) development in terms of employment

Yo veo que varias de las personas más grandes o como nosotros a lo mejor ya ni nos toque trabajar, a lo mejor los jóvenes ya que estén más preparados porque aquí se necesita algo de... a lo mejor van a agarrar a las personas más preparadas (I1, I2)

As a driver of development of other activities

Pues a lo mejor puede haber gente trabajando ahí, lo veo de ese modo a lo mejor no me dan trabajo pero voy y les vendo tacos o algo, algo bueno debe de acarrear esto, refrescos o algo qué sé yo... (I1)

Or directly as a crucial component for the completion of the production chain (i.e. in the wood industry)

Podría ser hasta para eso de secar madera [...] Por lo general nosotros nos lo llevamos a Chignahuapan y donde sierran la madera tienen sus estufas. (I1)

Finally, it is worth to underline that people has a good attitude for a stronger involvement in order to be better informed and in order for their concerns, needs and expectations to be taken into consideration.

Podría ser bueno que CFE venga y escuche las necesidades de la comunidad y venga alguna persona o nosotros ya platicarlo y pedirle "estas son nuestras necesidades y queremos que si se logra el proyecto a lo mejor nos pavimenten nuestro camino" o así otras cosas pero hacer convenios para que de alguna manera nosotros quedemos bien.

No sé, se me viene la idea que me gustaría ver una planta como esas ya funcionando y platicar "¿Qué les ha afectado? ¿Qué problemas tiene? ¿En qué les ha beneficiado mucho?" porque ahorita yo es lo que les decía al principio: temo y tengo necesidad pero ¿por qué? porque estoy a ciegas, no he visto nada de eso, no sé ni cómo va a funcionar eso y cómo les voy a pedir algo económico o algo si todavía la planta ni está aquí... como dicen, "primero ordeña la vaca o compra primero la cubeta", ese es el problema. (I2)

They know that somewhere else something similar has been implemented and they know that a good way to go ahead is to learn from the past experiences.

sí afectan poquito más, de hecho la otra vez que vinieron no sé ...ir a Humeros para que la gente vea cómo...para que se descarten varias dudas (I1)

3.3.2 Energy-related determinants and economic/environmental/social issues: a survey to local communities

A questionnaire (see Annex 2) was distributed to the households of the communities of Cruz Colorada, Jonuco Pedernales and Ocojala, dealing with following issues:

- Use of energy sources in household;
- Existence and use of hot springs;
- Performance on energy saving activities;
- Importance of social issues;
- Trust of information sources on energy issues;
- Issues related to energy production/use on a community level;
- Economic and environmental impacts of energy production.

In total 51 responses were collected from households of the three communities. The survey was performed during the fourth quarter of 2018.

Results and discussion

The sample was distributed among households of the three communities. The majority of questionnaires were collected from Jonuco Pedernales, followed by Cruz Colorada and Ocojala (Figure 7).

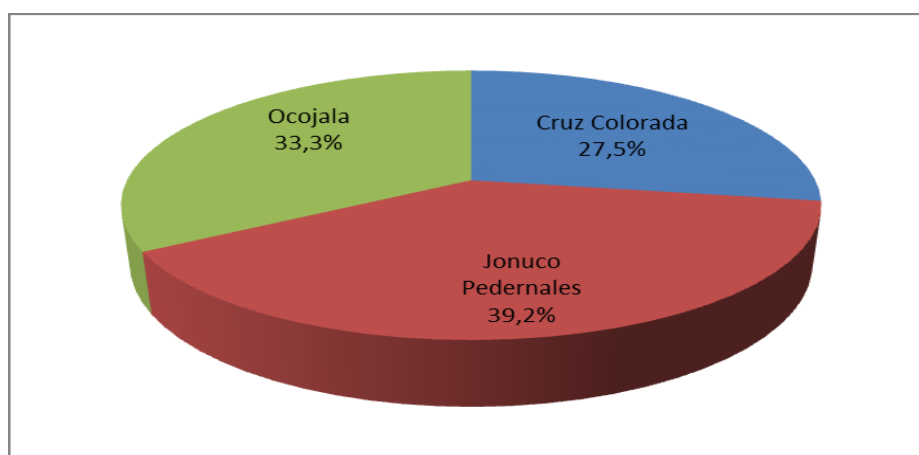


Figure 8. Distribution of questionnaires collected in Jonuco Pedernales, Cruz Colorada and Ocojala in the municipality of Chignahuapan

Figure 8 presents the energy sources used in the households for different purposes. The majority of the responding households use firewood for cooking, house heating during the winter and water heating. Electricity is the prevailing energy source for lighting (during winter and summer/spring) and electrical devices. When talking about house cooling, the vast majority (96%) has answered that does not use any kind of energy for this purpose. In terms of duration, the top three uses involve house heating during the winter (4.45 hours/day), cooking (3.84 hours/day) and lighting during the winter (3.05 hours/ day) (Table 30).

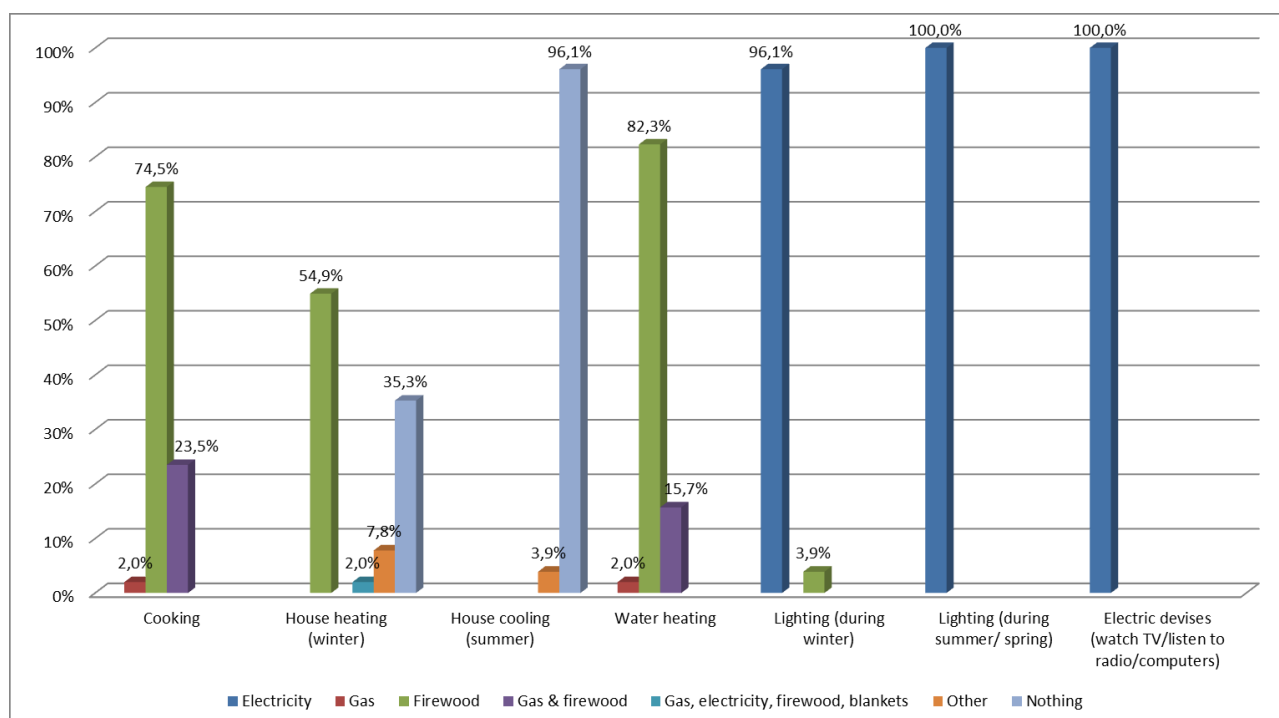


Figure 9. Energy sources used in households for different purposes

	N	Minimum	Maximum	Mean	Std. Deviation
Hours per day cooking	51	1	12	3.84	2.701
Hours per day heating the house during the winter	33	0	24	4.45	4.597
Hours per day cooling the house during the summer	5	0	0	0.00	0.000
Hours per day for water heating	51	0	2	1.18	0.477
Hours per day lighting during the winter	51	1	8	3.05	1.491
Hours per day lighting during the summer/ spring	51	1	8	2.40	1.613
Hours per day using electric devices (TV, radio, etc.)	51	1	24	2.65	3.337

Table 33. Energy uses: hours per day

Figure 10 presents the situation regarding the existence and use of hot springs by the members of the households of the three communities. The majority (80%) has replied that there are no hot springs in the proximity of their community. The remaining 19.5% is categorized in three groups: 10% has hot springs near their community and uses them either for therapy and health (8%) or for other uses (2%), while the remaining 10% doesn't use the hot spring near their location (reason: the don't know how to use them; n = 4).

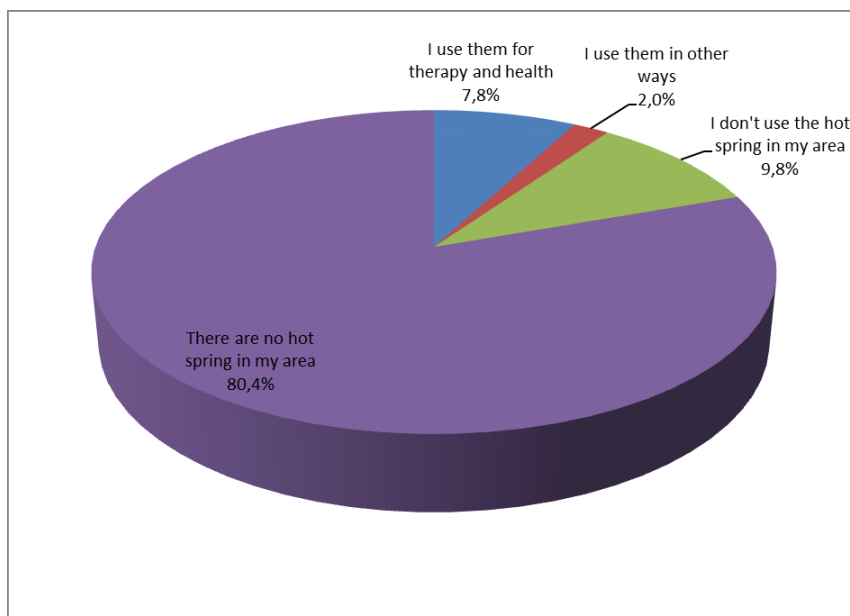


Figure 10. Existence and use of hot springs

Figure 11 presents specific energy saving activities performed by the household members of the three communities. The most popular activities involve a) switching off the light when not in the room, b) covering pots and pans to keep in the heat when cooking and c) drying clothes outside. On the contrary, the least performed activities include the insulation of hot pipes, closing windows and doors when the heating source is on and using energy saving bulbs.

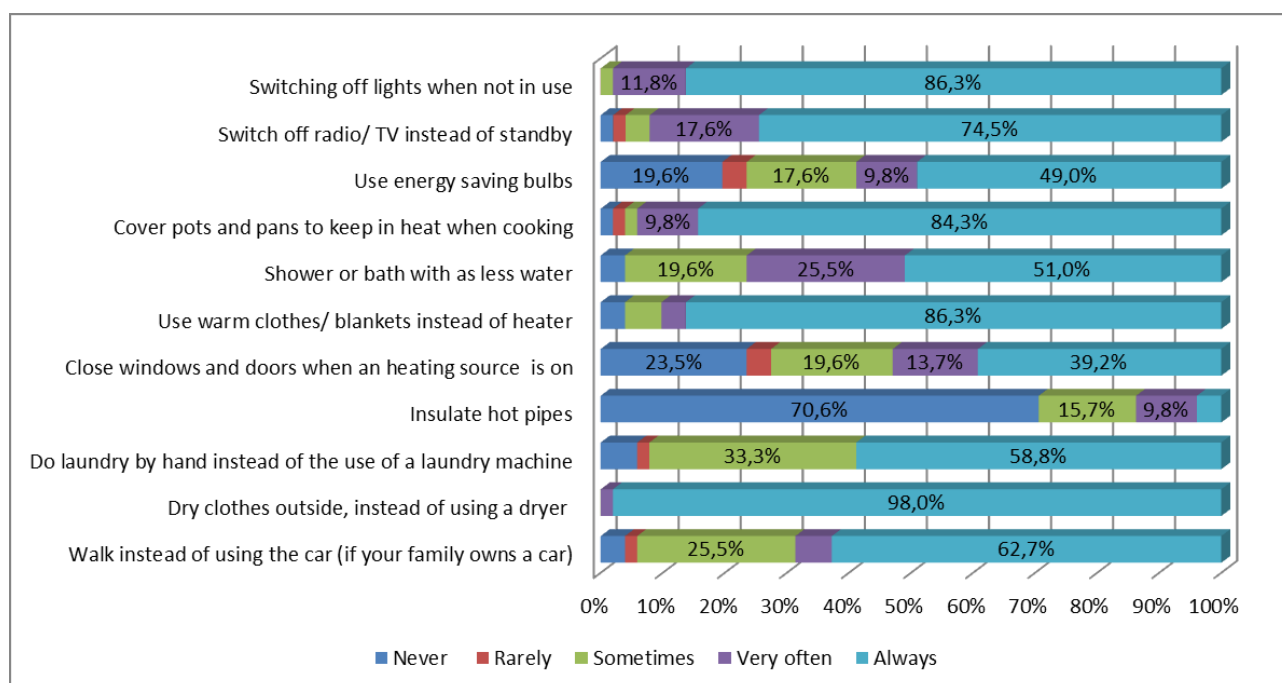


Figure 11. Energy saving activities/ behaviours

Figure 12 presents the results concerning the households' perceptions towards the importance of different social issues. Healthcare and job are rated as the most important ones, while energy security's importance has the 6th position among the 7 different options.

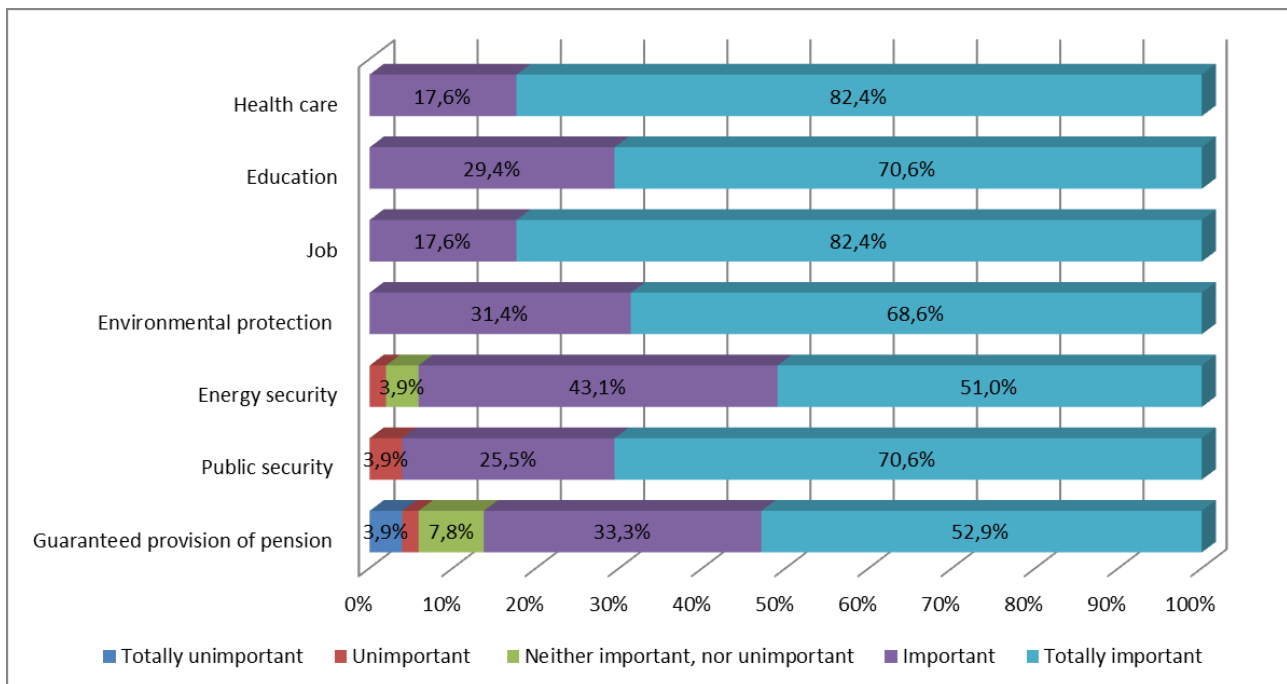


Figure 12. Perceptions towards various social issues

Figure 13 presents the results concerning the households' trust levels towards different information sources, in the context of energy issues (production, provision, cost). The most trustworthy sources (trustworthy & totally trustworthy) are academics and energy utility companies. On the other hand, mass media/TV, neighbours and community representatives have the highest negative evaluations (untrustworthy & totally untrustworthy). In some cases, the results are ambiguous, with the positive and negative opinions presenting similar scores: e.g. community representatives, neighbours, and mass media/TV.

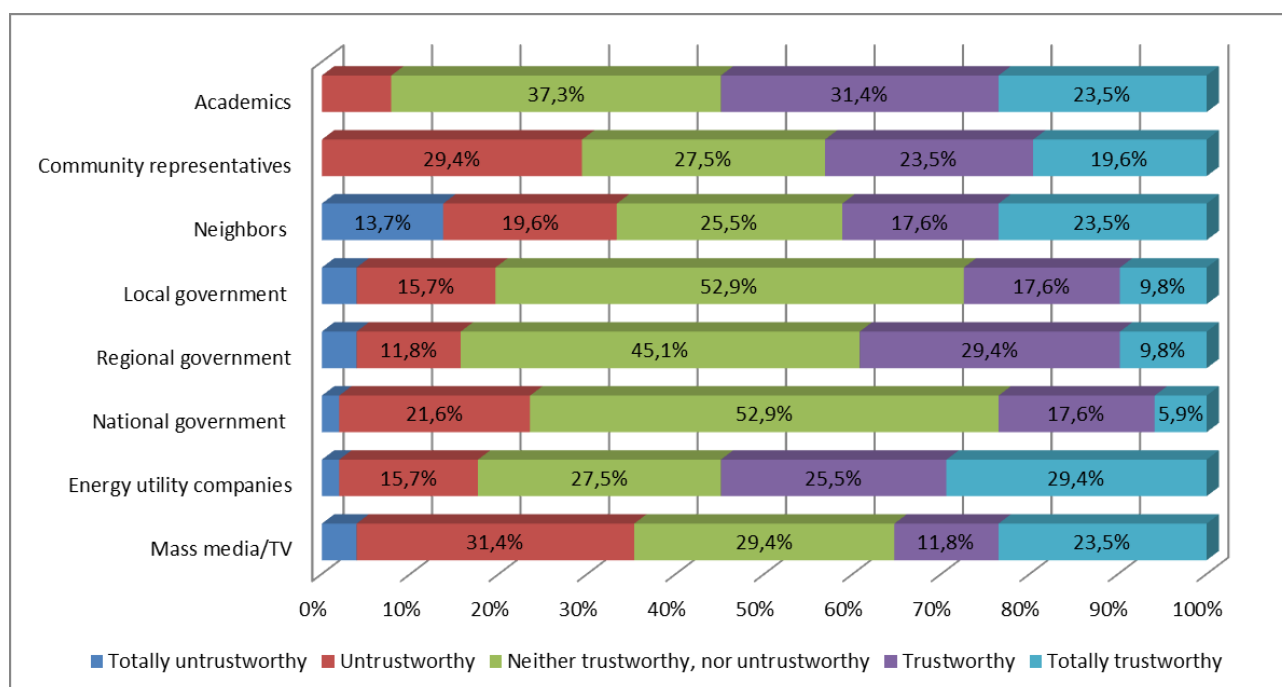


Figure 13. Trust towards different information sources on energy issues (production, provision, cost)

Figure 14 presents respondents' views on the importance of issues related to energy production/use on a community level. All issues are rated of high importance; however, the most important ones are access to electricity, improvement of infrastructures and environmental impacts (based on answers: important & totally important).

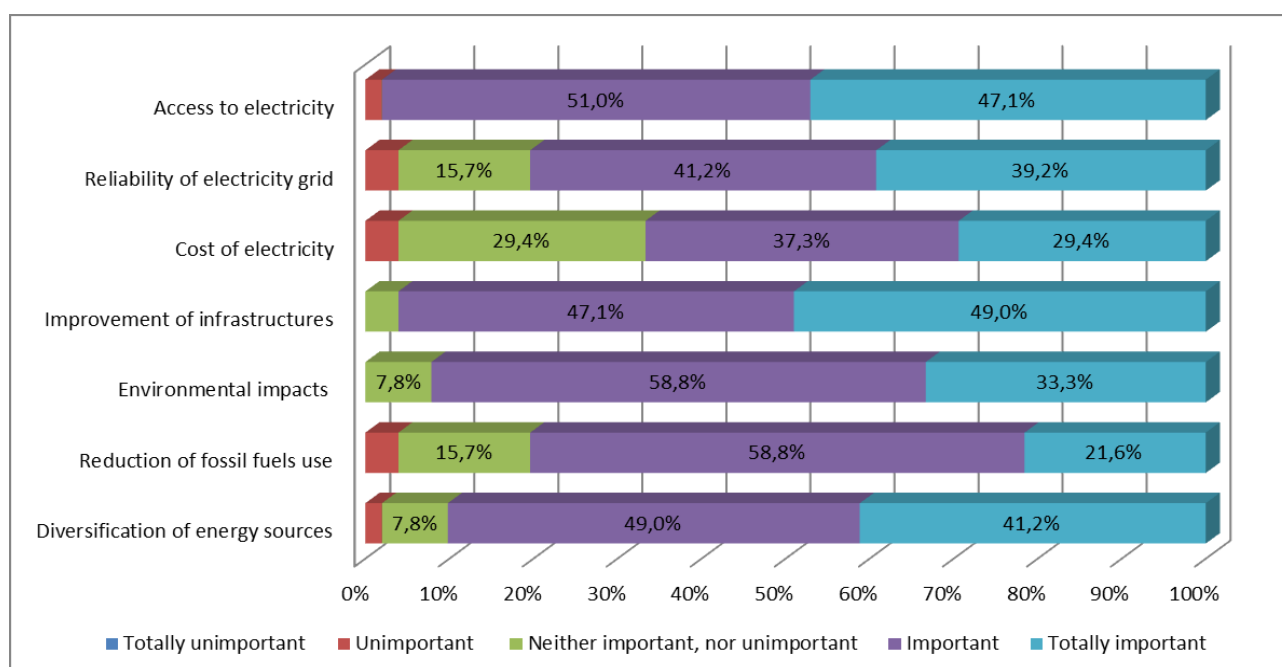


Figure 14. Importance of issues related to energy production/use on a community level

Figure 15 presents respondents' views on the energy related economic and environmental impacts. It is clear that the vast majority of the respondents state that he/she is aware of the environmental impacts of energy and electricity generation. In addition, the majority states that can afford the costs related to the electricity needs of its household.

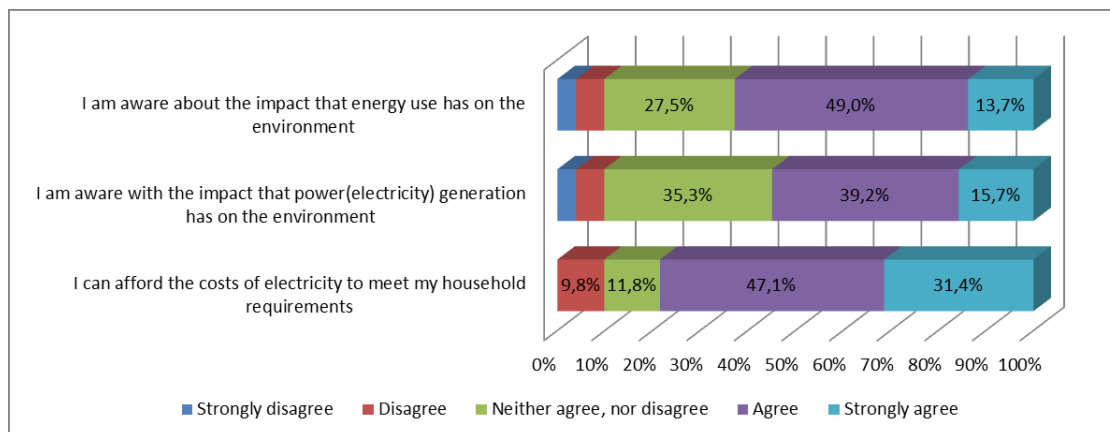


Figure 15. Views on economic and environmental impacts

Figure 16 present respondents' views on the existence of specific environmental impacts related to energy use or production, in relation to their households. The results on these impacts are highly ambiguous, with very low percentages of neutral responses and a balance between positive and negative answers. In any case, the impacts that seem to have the highest effect (agree & strongly agree) are outside air pollution, inside air pollution and waste production, while those with the lowest effect (disagree & strongly disagree) are smell and water pollution.

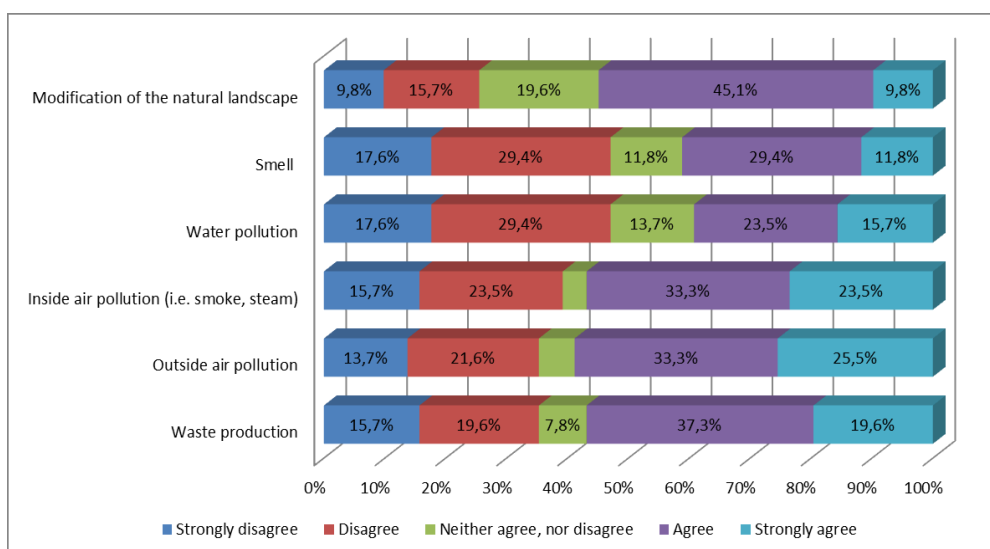


Figure 16. Existence of specific environmental impacts related to energy use or production, in relation to households

Annex 2

Encuesta

Fecha: _____ Localidad: _____ Folio: _____

A. ¿Cuál de las siguientes acciones realiza en su hogar? ¿Para qué usos y por cuántas horas al día?

Acción	HORAS/DIA	Gas	Electricidad	Leña	Otros
Cocina					
Calefacción de la casa (invierno)					
Refrigeración de la casa (verano)					
Calentamiento de agua					
Iluminación (durante el invierno)					
Iluminación (durante verano/primavera)					
Dispositivos eléctricos (ver televisión / escuchar radio / computadoras ...)					

B. ¿Hay algún manantial de agua caliente en su área? ☐ Sí ☐ No

Si es así, ¿lo usas? ☐ Sí ☐ No Si lo utiliza, ¿para qué?

☐ Limpieza de la casa

☐ Higiene personal

☐ Lavar la ropa

☐ Terapia y salud

☐ Otro _____

Si no lo utiliza, ¿por qué? (respuesta abierta)

C. ¿Con qué frecuencia implementa las siguientes actividades /comportamiento?

	Nunca	Raramente	Algunas veces	Muy a menudo	Siempre
Apagar las luces cuando no están en uso					
Apagar la radio / TV en lugar de esperar					
Utiliza focos de bajo consumo.					
Cubre las ollas y sartenes para mantener el calor al cocinar					
Se ducha o se baña con menos agua					
Usa ropa de abrigo/mantas en lugar de calentador (anafre)					
Cierre las ventanas y puertas cuando el calentador (anafre) está encendido					
Aisla las tuberías calientes					
Lava la ropa a mano en lugar del uso de una lavadora.					
Seca la ropa al sol, en lugar de usar una secadora					
Camina en vez de usar el carro o transporte.					

D. ¿Qué importancia tiene cada uno de estos temas para usted en este momento?

	Totalmente insignificante	Sin importancia	Ni importante, ni sin importancia	Importante	Totalmente importante
Cuidado de la salud					
Educación					
Trabajo					
Protección del medio ambiente					
Seguridad energética					
Seguridad Pública					
Provisión garantizada de pensión					

E. ¿En qué medida de confianza considera usted las siguientes categorías con respecto a la información sobre temas de energía (producción, provisión, costo) en México?

	Totalmente indigno de confianza	indigno de confianza	Ni confiable, ni no confiable	Digno de confianza	Totalmente Digno de confianza
Academias / Universidades					
Representantes de la comunidad					
Vecinos					
Gobierno local					
Gobierno regional					
Gobierno nacional					
Empresas de servicios energéticos					
Medios de comunicación / TV					

F. Impacto económico y ambiental.

	Muy en desacuerdo	En desacuerdo	Ni de acuerdo, ni en desacuerdo	De acuerdo	Totalmente de acuerdo
f1 Soy consciente del impacto que tiene el uso de la energía en el medio ambiente.					
f2 Soy consciente del impacto que tiene la generación de energía en el medio ambiente.					
f3 Puedo pagar los costos de energía para cumplir con los requisitos de mi hogar					
f4 ¿Considera que los siguientes efectos relacionados con el uso o la producción de energía son relevantes para su hogar?					
i. Modificación del paisaje natural.					
ii. Olor					
iii. Contaminación del agua					
iv. Contaminación del aire interior (es decir, humo, vapor)					
v. Contaminación del aire exterior					
vi. Producción de residuos					

G. ¿Qué tan importante considera los siguientes temas relacionados con la producción / uso de energía para su comunidad?

	Totalmente insignificante	Sin importancia	Ni importante, ni sin importancia	Importante	Totalmente importante
Acceso a la electricidad					
Fiabilidad de la red eléctrica.					
Costo de energía					
Mejora de infraestructuras.					
Impactos ambientales					
Reducción del uso de combustibles fósiles.					
Diversificación de fuentes de energía.					

4 A conceptual model for public engagement

4.1 The public engagement conceptual model

A conceptual model to address the multiple challenges of an effective public engagement (PE) should be able to provide a robust theoretical perspective from which deriving effective practical strategies.

PE is a complex process involving different actors with different resources and different objectives

Actor	Resources	Objectives
Private (enterprises, designers...)	Financial, technical, knowledge	Implement the project, Minimize opposition Benefit customers
Society (local communities, citizens)	Knowledge, relational	Maximise benefit and minimize negative impact Respect of culture, values and practice
Public Administration	Power, rules, relational	Local development, avoiding conflicts, political consent

Table 34. The actors of the Public Engagement process

Based on the analyses and the results of the previous chapters, our proposal is, on the one hand, to integrate the most diffused approaches that usually these actors adopt in order to engage the public and address social aspects in developing energy projects and, on the other hand, to maximize the interplaying of the resources that these actors usually may put in place and the objectives they usually wish to pursue.

In practice, the proposal is to create a conceptual model able to guide the alignment of three different perspectives and the maximisation of the synergies that can be created from the integration of the different stages of the processes from which looking at public engagement:

- Corporate social responsibility (CSR), that operationalizes the perspective of the private company, proponent of the project/intervention;
- Social Impact Assessment (SIA) and participatory process, that operationalizes the perspective of society, affected but not necessarily benefitted by the project/intervention;
- The role of Public administration (PA), which may vary from the mere providing of information to the support to co-design.

The actors involved (companies, SIA practitioners and affected local stakeholders, and public administrations) should actually cooperate by sharing information and processes thus obtaining high benefits in terms of pursuing their own objective (e.g. to develop a good CSR for the company) and, at the same time, build a shared and multi-perspective vision of the social aspects to be addressed and of the PE strategies to be implemented.

Figure 17 shows the conceptual model. The interplaying of the different stages of the above-mentioned processes need the support of specific knowledge basis (*knowledge support* in the figure), fed by and shared among all the actors involved. The alignment of the different processes results in the definition of different degree of PE, described here below.

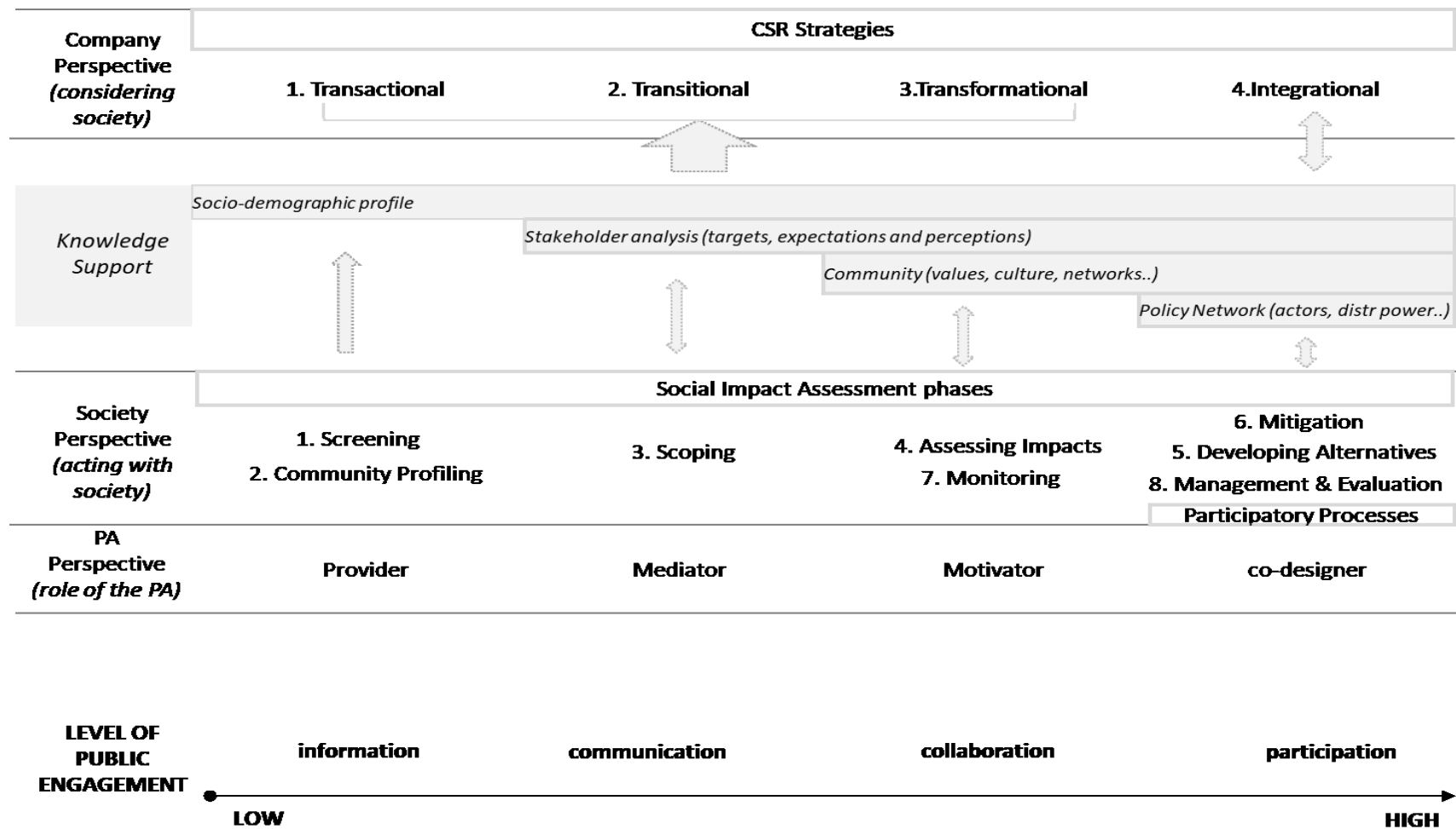


Figure 17. The conceptual model for guiding the strategy for the consultation process for public engagement (PE)

Information

This is the level of PE that relies entirely on the information provided to the public about the project's details and potential impacts on the local and wider community. It corresponds to the transactional level of a company's CSR strategy and to the screening and community profiling of the SIA. Companies keep occasional relationships with local communities, and communications are usually on a one-way basis (from the company to the local communities) while SIA practitioners and communities are involved in providing the knowledge support in terms of basic information mainly related to a careful social and demographic description of the community(ies) potentially affected. The public administration may play a role as provider of information and support, such as in the definition of the boundaries of the communities to be investigated and in the support of researchers/practitioners for data collection.

Communication

This is the first level of PE that includes an active engagement of the public. With respect to the information level, the flows of information and knowledge is bi-directional and the community are surveyed (through different means and techniques) in order to contribute to the definition of the impacts to be assessed and to the strategies to be adopted. It corresponds to the transitional stage of the company's CSR strategy and to the Scoping stage of the SIA. Companies keep more repeated relationships with local communities, and communications are usually on a two-way asymmetric basis (communication flows to and from the local communities, but an imbalance is present in favour of the company), while SIA practitioners and communities are involved in providing the knowledge support in terms of a robust stakeholders analysis aimed at identifying the diverse categories potentially affected, the specific impacts they are exposed to, their expectations and opportunities to be engaged. The role of the PA is important in identifying the stakeholders and, more generally, in facilitating the engagement of the public by providing legitimate channel of communication and legitimacy to the entire process.

Collaboration

This level of PE asks to actually engage the public in being part of the project development by adapting the project and the impact evaluation to the specific local/social needs. The public (stakeholders, citizens, local representatives) becomes part of the process by providing concrete changes and refinement to the overall concept. It corresponds to the transformational stage of the company's CSR strategy and to the Impact Assessment and Monitoring stage of the SIA. Companies keep frequent relationships with local communities, and communications are usually on a two-way symmetric basis (a continuing dialogue with no imbalances is present between the company and the local communities), while SIA practitioners and communities are involved in providing the knowledge support in terms of an in-depth investigation of the local communities (or, more generally, of the targets potentially affected) aimed at carefully describing their culture, values, relational dynamics, formal and informal rules and norms, expectations and opportunities. The role of the PA at this level is to facilitate the process by providing the right (virtual and organizational) arenas where the diverse actors could meet and collaborate and to stimulate both the companies in being challenged by the discussion as well as the active participation of the public.

Participation

This is the highest level of PE and consists of the actual engagement of the public in the design of the project, both in the first stage of the conception of the project and/or in the subsequent revisions and refinement. The process of engagement should take the form of an inclusive participatory process and should make use of the methodologies and techniques derived from the established tradition of participatory democracy (i.e. deliberative arena, public debate just to mention a few). This level corresponds to the Integrational stage of the company's CSR strategy and to the Mitigation, Developing Alternatives & Management stages of the SIA. Companies are able to adapt sets of practices based on the diversity of expectations from different local community groups and achieve the highest level of engagement, while SIA practitioners and communities are involved in providing the knowledge support in terms of a robust analysis of the policy network involved in the decision and implementation process, that is to collect information about the decisional arena, the distribution of (formal and informal) power among the actors, the complex dynamics of interaction among solution and problems (i.e. the garbage can model). The public administration plays the relevant role of being a crucial co-designer, since it is part of the policy network itself and at the same time it provides the institutional environment where the process takes place.

4.2 Engagement strategy focus: geothermal developments

The insights gathered from previous paragraphs show that companies always play a crucial role in public engagement processes, sometimes as one of the main actors to be mandatorily included, more often as the initiator of the process itself.

In a case of today's greenfield geothermal developments, CFE should follow its current strategic approach – i.e. transitional approach – and involve SIA practitioners and local communities for developing stakeholders' analysis with the categories affected and participating to studies for gathering expectations and opportunities for being engaged. In addition, CFE should involve the public administration both as a mediator to facilitate the interaction with the local communities and as a legitimacy generator to improve the public trust towards the channels of communication and the public recognition of reliability for the entire process at large. CFE should be aware that this process could also be used as a reputation building process, since the insights gathered from the previous paragraphs show that consumers positively evaluate CSR-related activities. In particular, the more CFE's activities would enhance local communities' well-being and would effectively communicate such enhancement to the market, the more CFE's attractiveness would be likely to increase, having a potential positive impact on the company's revenues – assuming that consumers are able to change their energy provider. Even though for today's greenfield geothermal development CFE should follow its current strategic approach, we suggest that future cases of greenfield geothermal development could benefit from an improved approach in terms of engagement level. From the insights gathered in the previous paragraphs, we provided strategic implications for management to improve CFE's current approach, in order to strengthen the acceptability of its energy developments and its ability to retain customers.

In a case of today's brownfield geothermal developments, CFE should ground on its current strategic approach – i.e. transitional approach – and attempt to improve it towards a transformational strategy, to strengthen the already established relationships with local communities. While, from an internal perspective, CFE should follow the route defined in previous chapters and modify its organisational arrangements accordingly to an improved strategic approach. CFE should, from an external perspective, make local communities part of the project development, adapting the project and the impact evaluation to the specific local/social needs. This comes from the establishment of a two-way symmetric basis communication with local communities, which provides geothermal development projects with concrete changes and refinements. SIA practitioners are crucial in this case, since they help local communities (and CFE) to provide the necessary knowledge support, unveiling local/social needs and describing relevant social aspects such as relational dynamics and values. In addition, CFE should involve public authorities to facilitate the process of engagement, since they can represent legitimacy to the process and a motivator for communities to engage. CFE should also be aware that this process could also be used as a reputation building process, as it was in the case of greenfield geothermal developments.

4.3 Public engagement strategies for technical development scenarios

The conceptual model aims at providing a general framework able to support the definition and implementation of public engagement strategies by considering the perspectives of different actors involved in the consultation process: companies, public administrations and the local communities themselves. The conceptual model is intended as an ideal type to be adapted and tuned to the specific local context. In the following paragraph, examples of this context-specific adaptation are provided. In order to approximate real-life situations, two scenarios of public engagement processes are described, with the aim of simulating strategies and activities implementable in the specific case.

The two scenarios refer to the technical development of the two following geothermal energy technologies: “scenario PG” where only Power Generation is deployed, and “scenario PGDU” where Power Generation and Direct Uses are deployed. Such scenarios are described by taking into account the perspectives of the companies, of the public administration and of the local communities.

A company developing and/or operating the geothermal resource is the driver (often the initiator) of the geothermal development but it is just one of the actors of the development process. To the sake of the project itself, companies have to act in coordination with the Public Authorities (PA in the following), on the one side, and by considering the specificities of the local context and communities on the other. In addition to this systemic approach, the company should consider the specificity of the different geothermal technologies to be implemented, each of them characterized by specific outputs and impacts on the local communities. With respect to these technological variety, different technical development scenarios can be considered, and consequently the company has to operationalize differently its engagement strategies and the basic principles beneath them, in accordance to the four stages of different stages of engagement strategy (Fig. 17): transactional, transitional, transformational and integrational.

In the case of the “giving back” principle (provision of benefits and minimization of undesirable effects) that characterises the transactional strategy, the company basically decides unilaterally which activities need to be performed to establish a relationship with local communities. In particular, such activities vary across technical scenarios. In the case of power generation (PG) deployment, the company autonomously identifies the most important impacts of its operations, which usually relates to the construction and production site. The company then identifies and carries out activities aimed at achieving a peaceful coexistence with local communities, thus running of some social programs, such as volunteering and sponsoring local events, and providing information, such as planned drilling periods and operation logistics. In the case of power generation and direct uses (PG & DUs) deployment, the company accounts for impacts that are more diffused within the surrounding environments, since issues may also derive from the construction and running of DUs services. In developing this strategy, the company provides DUs services that are favourable for its financial performance and immediately usable, with no need to better understand local communities’ actual need – e.g. heating house service. As such, the company includes activities related to provision and maintenance of DUs services to ensure a peaceful coexistence with communities, thus considering such services as additional to the provision of information and running of social programs. Although almost autonomously defined and implemented by the company, for the transactional strategy to be successful a strong support by the local Public Authorities is needed. First of all because many of the activities to be developed by the company need to be accepted and authorized by the PA. Then, the PA support is crucial in the legitimization of the strategy itself in order for the activities proposed to be perceived not just as a private initiative given as a

compensation but as an opportunity for the community as a whole. PA plays the role of *provider* of formal and informal conditions for the strategy to be effectively implemented.

In the case of the “building bridge” principle that characterises the transitional strategy, the company keeps more repeated relations with local communities, and it surveys them to make them contribute to the definition of the impacts to be assessed. Local communities may highlight impacts that were not considered by the company and widen the operations for which the company is considered responsible. In any case, the company still decides which activities need to be performed. In the case of PG deployment, impacts are still related to the construction and production site but additional information may be required by communities on the impact of the power generation on, for example, land and water. For this reason, the company performs seminars, engaging workshops and other educational activities to give information in a more structured way and ensure a transparent debate with local communities. In the case of PG & DUs deployment, the company accounts for additional impacts as compared with the PG deployment case. In developing this strategy, the company provides DU services that suit local communities’ basic needs while favouring its financial performance, such as agricultural applications (e.g. greenhouse heating, aquaculture, etc.) or public thermal bath. As such, the company includes activities related to provision and maintenance of DUs services, and seminars and engaging workshops are carried out also for gathering information on the type of DU service preferred. Given the level of engagement of the communities requested by this approach, the PA should be involved as an active part of the strategy. PA should play the role of *mediator* to support the company both in identifying the main actors of the local system and to get in contact with them and guarantee a good level of reactivity. In addition to this social mediation, the PA needs to be involved also for the definition and provision of new local services that have to and designed in accordance with the pre-existing system of services.

In the case of the “changing society” principle that characterises the transformational strategy, the company keeps frequent relations with local communities, which become part of the process and provides concrete changes and refinements. In this case, the company performs those activities that are identified in accord with local communities. In the case of PG deployment, impacts are identified by the company and local communities, focussing not only on the construction/production site and on the local surroundings but also on the determinants of public acceptance. For this reason, the company performs open forums and promotes shared solutions together with local communities so as to effectively align and empower public expectations with the strategic management of socio-economic and environmental elements. In the case of PG & DUs deployment, the company accounts for additional impacts as compared with the PG deployment case. In developing this strategy, the company identifies together with local communities those DUs that financially favour both of them. In fact, the joint identification of suitable DU services often includes those services able to generate positive spill overs, such as greenhouses, in addition to basic ones such as heating houses. Thus, the company and local communities collaborate for the provision of a more fruitful DU service. The role of PA in the transformational strategy goes beyond the level of providing formal and informal legitimacy or supporting the stakeholders and community engagement, as in the previous strategy. Given the challenge for the company to involve the communities in the definition of the activities, PA should play as *motivator*, in order for reaching a level of active participation in the process. Through participatory initiatives, such as public debates and consultations, the PA can catalyse the participation of the whole communities avoiding the self-selection process that can drive the participation of a small subset of motivated people.

In the case of the “embracing flexibility” principle that characterises the integrational strategy, the company adapts sets of practices based on different local communities’ needs, which are still a crucial part of the process. In this case, the company and the local communities co-design ad-hoc activities based on the context specificities and cooperate for co-building them. Through the pursuing of flexibility, differences between of PG deployment and PG & DUs deployment are minimal, and the company promotes inclusive participatory processes to identify opportunities, foster partnerships and empower local communities. This would mobilise local resources – both tangible and intangible –, thus increasing local development. Finally, in the case of the integrational strategy, the PA has to be involved as an actor of the co-designing process. In addition to be an essential component of any strategies proposed by the company to be implemented (first of all for mere reason of legal viability), the PA is the only actor of the development process able to provide an overall view of the (public and private) interventions targeted to the local area and, moreover, of the potential impacts in the short and medium run. The role of PA as *co-designer*, thus, is not only played at the level of providing ideas and knowledge but also at the level of looking at the strategy from a complex and integrated perspective.

5 Sustainability Scenarios: from citizens and companies engagement to meso and regional effects

This chapter aims at presenting basic principles of creating bottom up scenarios of citizens' engagement in technological developments and scale up potential sustainability effects in populations where the geothermal energy facility operates. The chapter is organized as follows. First there is a brief discussion about the difference between scenarios and forecast linked to the conceptualization of engagement as discussed in previous sections. Second, a model is proposed to capture the factors affecting the engagement of the two key actors with a stake in geothermal energy facility, in the Mexican case, local population ("ejidatarios" and "comuneros") and the company developing the geothermal generation facilities (CFE a federal government agency). Third, with the conceptual model presented and insights taken from previous sections, scenarios of engagement are presented. Fourth, a method to link the engagement levels and propensity to engage in the development of renewable energy technology is proposed. Last, the features and types of I-O analyses that can be conducted are outlined to guide future analysis and assessment of impact of renewable energy developments in the region.

5.1 Forecasts versus scenarios and the role of citizens engagement

The need to foresee the expected returns of investments in new facilities that imply substantial investments requires an assessment of potential outcomes and constrains. In terms of environmental sustainability, the likely outcomes of investments in geothermal energy technologies are generally expected to be positive, given its relative environmentally benign features compared to power generation based on fossil fuel. Saying the latter, the likely economic and social direct and indirect effects are less certain. In many cases, as amply discussed in chapter one, this is due to difficulties of data availability and the measurement of sustainability attributes that often are subjective. The need to forecast effects and outcomes is clear but in this case is not possible. However, what is possible is the generation of plausible scenarios that could guide public and sustainability policy. This argument comes out of the differences between forecasts and scenarios approaches which we briefly outline below and gives a clear justification to the approach adopted to foresee plausible effects of developing geothermal energy facilities.

The most common differentiation between scenarios and forecasts is that the later aim to predict future events with a margin *probability* error (e.g., weather forecasts and business cycles). In turn, scenarios aim to foresee *plausibility* of events without asserting probability margins (de Jouvenel, 2000). Scenarios concern current events or situations that could evolve from an initial state of affairs to a new situation in the near or long term future (Bishop, et al., 2007, Godet and Roubelat, 1996). Forecasts are validated or falsified in due time by actual events while scenarios cannot. Plausibility only means that a scenario does not contradict our current knowledge about nature and society and its likely evolution (Popper 2008).

The level of detail in which the future is described is usually greater in the case of scenarios, often taking the form of extensive narratives while forecasts often refer to numerical changes of an indicator (temperature, stocks value, weather, production of sales levels, etc.). The time horizon of forecasts rarely extends beyond few days, months or even years while scenarios can extend over several decades for example, population scenarios, climate change, etc. (Börjeson, et al., 2006; Farjad et al., 2019).

A more essential difference than the ones mentioned is the conceptual divergence. Forecasts assume that the future is somehow fixed and that, not only but also for this very reason, it can be discovered. The objective of forecasts is to enable decision makers to respond to impending events with a view to reduce negative effects or increase benefits from these event imply. Forecast have the drawbacks of not accounting for the complexity of systems, insufficient knowledge, the role of human's volition and surprise events. In contrast scenarios are based on the conceptualisation that the future cannot be unveiled but is something that must be constructed itself (de Jouvenel, 2000, Lindgren and Bandhold, 2003). This places the engagement of people as a central actor in the creation of the future. Thus, scenarios do not aim to reduce uncertainty but provide a blueprint(s) of a *future that is yet to be decided* upon and that is fundamentally uncertain (de Jouvenel, 2000). *In the construction of the future the different levels of engagement of communities, government and companies play a key role shaping its form.* The form of development will determine the potential impacts at the local level (Rosenbaum et al., 2012).

The dynamics through which renewable energy technology projects generate local and regional impacts are not well understood. As seen in the previous chapters, there is a relatively clear agreement on understanding local acceptance of renewable energy, but there is consistently less evidence of local impacts associated with project development and outcomes of subsequent operation. It can be expected that in most cases (like is the case of Acoculco) the most substantial local impacts will be associated with indirect project outcomes following private and government investments in socio-economic development in the local community (e.g., roads, telecom, electricity distribution, education, provision of water and sanitation). Project developments are characterised by different community needs and objectives, invariably often drawing on disparate private, government and public values, which ultimately influences the renewable energy technologies local impacts.

Based on the above, the creation of scenarios based on engagement and scaled up to regional effects on sustainability (Economy, society and environment) requires a new approach linking engagement of stakeholders in specific sustainability aims to its likely regional effects. The former can be captured with the behavioural models developed and applied recently in other areas of technology adoption and diffusion (Montalvo 2006; Montalvo 2007; Montalvo and Moghayer, 2011 and Wehn and Montalvo 2018). Such approaches enable to gauge the different rationales at stake towards societal goals and generate indicators of propensity that can feed into and complement I-O analyses. The later can be captured either: 1) direct assessment (in flora, fauna, emissions and waste, as well as the quality of resources; 2) via indirect assessment using proven methodologies of input-output analysis based on regional or national accounts aggregated data (e.g., Dietzenbacher et al., 2013 Wood et al., 2015; Faturay et al., 2017; Stadler et al., 2018; and Bulavskaya et al., 2018). The figure below indicates the process to conduct the linking of the two approaches and the generation of scenarios.



Figure 18. From structural characteristics of engagement to meso and macro impacts

5.2 Sustainability hangs on engagement: definition of structural characteristics of engagement

In the case of Mexico, the CFE is the primary actor starting the energy generation projects based in the regional planning needs deriving from industry, agriculture or communities development. Once this is decided at the corporate level of CFE, communities are involved primarily as a role of accepting the development. Following from the previous chapter, the strategy adopted by CFE might be transactional, transitional, transformational and integrational. The confluence to common goals underpinned by a fair and transparent distribution of benefits, costs and effects across different stakeholders is asymmetric, thus currently characterised by a transitional approach. This might generate tensions between the communities, especially those that are affected in their communal property. In order to assess the sources of asymmetry already identified in previous chapters, here a behavioural model is proposed to generate different forms of engagement.

The transformative capacity of renewable energy technologies is contingent on their adoption (acceptance) and diffusion in a community, across a given sector or economy. In turn, such diffusion depends on (at least):

- the extent to which the deployment of the technology is seen by businesses, citizens and civil society as generating economic and social benefits;
- the extent to which communities (citizens and consumers), business, policy and regulatory environments support technology deployment;
- the level of resources (aggregated demand, financial, knowledge & skills), and
- the resistance or acceptance of legacy systems bureaucracies that face renewal and substitution.

Definition of model structure and boundaries

The impacts of digital disruptive technologies arise from their substitution effects, driven – above all – by their level of diffusion across the European economy. As mentioned in the introductory paragraph to this Task, diffusion is a function of the adoption of specific technologies by companies (producers) and individuals (consumers). The modelling of technology adoption is generally done based on data such as volume/value of sales, volume/value/type of services provided, levels of investment for a specific technology in a given period of time and geographic scope. When such data are available, it is possible to estimate rates of diffusion and economic effects (Rogers, 2005). In cases of infrastructural project like renewable energy technologies projects that can have effects in a specific location and the chain of effects in the community and the economy such data is not available. Similarly, the effects that it could (and will) have in the environment have not been measured, but these can be captured in the expectations of the community and the companies in charge of the construction and operation of the geothermal facilities. For this reason a different approach is needed. We are then here proposing a model whereby the effects of the facilities are the results of the mediating technology and the engagement of the stakeholders in the process. The effects are captured by addressing the perceptions and expectations of the communities and stakeholders in the region.

This section outlines how to explore and explain the behaviour of communities in specific situations and contexts. It presents a series of definitions that enable the exploration of the perceived reality of a

community of people, and proposes hypotheses about how these perceptions and beliefs might affect their engagement in the development of a new renewable energy facility.

5.2.1 Community's propensity toward the development of a new RET facility (geothermal)

Community's attitude towards RETs

Attitude is the degree to which decision-makers make a favourable or unfavourable evaluation or appraisal of a specific path of action. Based on this definition, in relation to the behaviour of people pertaining to a community, the attitude toward a specific renewable energy technology (RET) is an index of the degree to which the community likes or dislikes (approves or disapproves of, agrees or disagrees with, etc.) any aspect of the development of a new RET facility in their community. Each behavioural belief links the specific RET development to an outcome or an attribute that is valued positively or negatively. Thus, it can be expected that communities will prefer behaviours believed to produce desirable consequences, that accord with the values and goals of the community (comuneros or ejidatarios themselves). The attitude towards the new RET results from the accumulated connotative load associated with the salient behavioural beliefs or relevant information regarding the implications and expected outcomes of the new RET facility.

Examples of negative attitudinal beliefs concerning the installation of the new RET facility are: the CFE will not facilitate the installation of Triphasic AC for the development of new business in the town; the economic outcome of this RET is likely to deliver few jobs; such things as clean RET do not exist, thus the technological and economic risks are high or the impact on the environment are unclear. Such beliefs imply negative connotations for negative outcomes. These negative beliefs can be expected to contribute to the adoption of a negative attitude towards any RET. A negative attitude is likely to prevent any engagement in enforcement (or policy design) activities. However, the perception of positive outcomes can be expected to produce a positive attitude (e.g., these will depend on how other complementary investments by government are actually done. Roads, water sanitation, education, etc.). The beliefs that determine attitude are assumed in general to arise from the perceived social benefits and risks to the public interest that would imply and the perceived political benefits and risks that would accrue to the ejidatarios that own the land where the RETs will be operating.

An index of the attitude (A_R) of the community towards a specific RET can be obtained, as shown in equation (1), by multiplying the subjective evaluation (e_{ri}) of each belief attribute and the strength (b_{ri}) of each salient belief, with the resulting products summed over n salient beliefs

$$A_C \propto \sum_{i=1}^n b_{ci}e_{ci} \quad (1)$$

where,

- A_C is the Community attitudes toward the RET;
- b_{ic} is the belief (subjective probability) that the new RET will lead to outcome i ;
- e_{ic} is the evaluation of outcome i by inhabitant of the community;
- \propto indicates proportionality between the sum of the $b_{ri}e_{ri}$ product and a direct measure of attitude;
- Σ is the sum of the products of n salient behavioural beliefs and subjective probabilities or likely outcomes.

Community's social norms and supporting environment towards RETs

As defined above the subjective norm is an index of the importance that people give to their significant referents (e.g., individuals, groups, or organizations) and whether they are perceived to approve or disapprove of the RET in question. In the case of the communities, the subjective norm can be conceptualised as the social pressure or social norm that arises from the context in which the people living the community exerts on its members. Here we can define the communities *perceived social norm* (N_R) as the importance that people give to different crucial referents to engage or not in a specific RETs development, its implementation or operation. The Community's perceived social norm arises from the accumulated connotative load of its normative beliefs. For example, influential ejidatarios as referents, which in a particular situation might be pushing for or against the development and operation of RETs, ejidos organizational internal lobbying, administrative and budgeting goals, partisan political agendas, etc. Examples of external referents are the perceptions and expectations of the local community and the wider public, the electorate's voting preferences, legal mandates and requirements, industry lobbying, etc.

An index of the community's perceived social pressure towards the RETs development can be calculated by multiplying the strength of each normative belief (n_{cj}) by the Community's motivation (or perceived necessity) to comply with or follow the referent in question (m_{cj}). The social norm is hypothesised to be directly proportional to the sum of the resulting products across n salient beliefs, as shown in equation (2).

$$N_C \propto \sum_{j=1}^n n_{cj} m_{cj} \quad (2)$$

where,

- N_C is the Community's perceived social norm;
- N_{cj} is the Community's normative belief concerning referent j ;
- M_{cj} is the Community's motivation to comply with, follow or anticipate the preferences of referent j

It is hypothesized that those members of the community that in general perceive high social pressure in favour of the RET development will be more prone to engage and support RETs in the locality.

Control over the process of engaging in RETs development

Perceived behavioural control as defined above is the perceived ease or difficulty of performing the behaviour itself. This index differentiates between behaviours that are under volitional control and those that are not. In the context RETs, 'to engage in RETs development' can be considered a behaviour that in many cases is not under the volitional control of the communities where the development takes place. The perceived control over any RETs development of implementation process (C_C) is an index of the presence or absence of the requisite resources and opportunities to engage in the development (or operation) of a RETs particular project. The beliefs held by people leaving in the community of interest may be based on past experience, second-hand information, or any other factors that increase or reduce the perceived difficulty or feasibility of participating the development (or operation) of the new RET facility. Depending on the perceived resources, institutional influence and power of specific influential people (ejidatarios) in the community, the community itself might hold and their perceived control (or influence) over the internal institutional or organisational planning of new projects on the part of the firm, the willingness of the community to engage

in the RET project can be strong or weak. Overall, perceived control over the development (operation) process arises from the accumulated connotative load of beliefs with regard to the perceived ease or difficulty of achieving any of the desired outcomes from the RETs implementation.

An index of the perceived control over RETs development (or operation) process can be estimated by multiplying the control belief strength (c_{ri}) by the perceived power (p_{ri}) over the specific factors that facilitate or inhibit the participation in the development of implementation of a new RET facility. The resulting product is summed across the n salient beliefs as shown in equation (3).

$$C_C \propto \sum_{i=1}^n c_{ci} p_{ci} \quad (3)$$

where,

- C_R is the Community's perceived control over the RET development process;
- c_{ri} is the control belief strength of the Community;
- p_{ri} is the perceived power over the particular factors that facilitate or inhibit the participation and outcomes of the RET development (or operation), as perceived by the communities;

Finally, in order to integrate the above constructs, equation (4) suggests that the strategic or tactical intent of the regulatory entity to promote innovation is a function of the three indexes introduced above:^{*}, [†]

$$R \sim W_R = w_1 + w_2 A_R + w_3 N_R + w_4 C_R \quad (4)$$

where:

- R is the overt behaviour, the engagement of the Community in RETs;
- W_C is the willingness to engage in RETs;
- A_C is the Community's attitude toward engagement in RETs;
- N_R is the Community's perceived social pressure towards engagement in RETs;
- C_R is the Community's perceived control over engagement and outcomes in RETs;
- w_i are the parameters to be determined empirically;
- $+$ indicates an algebraic sum;
- \sim suggests that willingness is expected to engagement.

5.2.2 Propensity of companies to facilitate engagement on RETs

Similar to the above, this section proposes a set of definitions to explore and predict the conditions under which the firm would be more prone to engage with the community to co-develop RETs in a given locality.

Attitudes towards engagement in community development

As defined above, attitude is the degree to which people have a favourable or unfavourable evaluation or appraisal of a specific behaviour. In the realm of the firm, the attitude towards engagement in community development can be defined as: an index of the degree to which the firm likes or dislikes (approves or

^{*} An exposition of the complete method to explore beliefs, questionnaire protocol development and application, as well as the validation of method and theory underlying the basic model used in this paper, can be found in Montalvo (2002)

[†] The linearity of the equation is well established in the literature (see Montalvo, 2006; Ajzen, 1991; Harland et al, 1999).

disapproves of, agrees or disagrees with, etc.) any aspect arising from engagement in community development. Each behavioural belief links specific behaviour to an outcome or an attribute that is valued positively or negatively. Thus, it can be expected that firms will tend to prefer behaviours believed to produce desirable consequences. The attitude towards the RETs and the engagement of the community in their development and operation results from the accumulated connotative load associated with the salient behavioural beliefs or relevant information regarding the implications of the planned project and engaging the community. The beliefs arise from two realities within the firm: the wider social and environmental benefits and the economic (and in case of CFE political) consequences for the firm.

Examples of negative attitudinal salient beliefs are: it can be costly to involve the community, it can be unreliable, costly and time consuming to co-develop, etc. Such beliefs imply negative connotations for negative outcomes. These beliefs can be expected to contribute to the formation of a negative attitude toward the engagement of the community in the planning and construction of the new RET facility. A negative attitude is likely to prevent any engagement in community co-development activities. With the perception of positive outcomes or in the presence of a positive attitude the opposite outcomes can be expected. An index of attitude (A_F) can be obtained, as shown in equation (5), by multiplying the subjective evaluation (e_{fi}) of each belief attribute by the strength (b_{fi}) of each salient belief, with the resulting products summed over the n salient beliefs.

$$A_F \propto \sum_{i=1}^n b_{fi} e_{fi} \quad (5)$$

where,

- A_F is the firm's attitude toward the engagement of the local community on RET activities;
- b_{fi} is the belief (subjective probability) that the engagement of the local community on RET activities will lead to outcome i ;
- e_{fi} is the evaluation of the outcome i made by the firm's manager.

Firm's normative beliefs and subjective norms

In the case of a firm's behaviour, the subjective norm can be conceptualized as the social pressure or social norm that arises from the context in which the firm operates. Here we can define the firm's *perceived social norm* (N_F) as the importance that the firm's manager gives to different crucial referents to engage or not to engage the local community on RET activities. It results from the accumulated connotative load of normative beliefs that managers may hold. That is, it depends on how managers perceive the thinking of important referents within the firm about what the firm's behaviour should be (e.g., corporate staff suggestions, central planners expectations) and how they perceive external referents (e.g., industrial and sectoral lobbying, customers' expectations, legal requirements and public perceptions). As in the case of the community, here it is made explicit that the behaviour of the firm might be influenced by other actors or institutional factors than the local community. It is assumed that those firms with high social pressure to be in harmony with the local communities will be more willing to engage engagement of the local community on RET activities, as these will be perceived as necessary to maintain their legitimacy and license to operate. The sources of important referents might be; local communities, estate and federal parliamentarians, NGOs, etc.) and the regulatory mandate of the company (in the case CFE). This index can be calculated by multiplying the strength of each normative belief (n_{fi}) by the manager's motivation (or perceived necessity) to comply with or follow

the referent in question (m_{fj}). The social norm is hypothesised to be directly proportional to the sum of the resulting products across the n salient beliefs, as shown in equation (6).

$$N_F \propto \sum_{j=1}^n n_{fj} m_{fj} \quad (6)$$

where,

- N_F is the firm's perceived social norm;
- n_{fj} is the firm's normative belief concerning referent j ;
- m_{fj} is the firm's motivation to comply with, follow or anticipate to the preferences (or behaviour) of referent j .

Firm's perceived control over the engagement process

Perceived behavioural control was defined above as the perceived ease or difficulty of performing the behaviour. In the context of the firm, the engagement of the community in the co-development of the new RET facility can be considered as a behaviour that in many cases is not under the volitional control of the manager. Perceived control over any RETs development (or operation) facility process (C_F) is an index of the presence or absence of the requisite resources and opportunities to the engage the community. These beliefs may be based on past experience in past RETs projects, organisational, budgetary or regulatory constraints any other factors that increase or reduce the perceived difficulty or feasibility of community engagement in co-developing RETs. Overall, perceived control over the engagement process arises from the accumulated connotative load of beliefs with regard to the perceived ease or difficulty to achieve the planned outcome of the new RET facility. Depending on the perceived control over engagement (i.e., resources for community development) the willingness of the firm to engage the community in RETs development and operation can be expected to be strong or weak.

An index of the perceived control over the engagement process can be estimated by multiplying the control belief strength (c_{fi}) by the perceived power (p_{fi}) of the specific factor that facilitates or inhibits the performance of the action. The resulting product is summed across the n salient beliefs as shown in equation (7).

$$C_F \propto \sum_{i=1}^n c_{fi} p_{fi} \quad (7)$$

where,

- C_F is the firm's perceived control over the engagement of the community activity;
- c_{fi} is the control belief strength;
- p_{fi} is the perceived power over particular control factors that facilitate or inhibit the conduction the engagement of the community.

Finally, as was the case for the communities, in order to integrate the above constructs equation (8) suggests that the firm's strategic or planned behaviour concerning engaging the community in RETs is a function of the three indexes presented above. The form of the function of attitude, social norms and perceived control over engagement with the willingness to engage, actual engagement, must be determined empirically.

$$F \sim W_F = w_1 + w_2 A_F + w_3 N_F + w_4 C_F \quad (8)$$

where:

- F is the overt behaviour, the engagement of the firm in community development activity;
- W_F is the firm's plan or intention to engage in community development;
- A_F is the firm's attitude toward the engagement in community development activities;
- N_F is the firm's perceived social norm concerning engagement in community development activities;
- C_F is the firm's perceived control over the engaging the community in the RETs development process;

5.3 RETs innovation and governance of change

Experience in the fields of environment, public utilities and market regulation has demonstrated that in the regulatory game interdependencies and power asymmetries have always existed (Nowotny, 1989; Ziegenhagen, 1986; Laffont and Tirole, 1993). Similarly, in innovation studies the role of multi-actors and networks is assumed to determine the selection environment of innovations (Nahuis, 2005, Smits and Kuhlmann, 2004). The framework presented above gives an indication of what might be the behavioural drivers of different actors in specific situations. A wide variety of factors, depending on the type of innovation in question and the internal and external contexts of the firm and communities, influences the engagement process and the success of the RETs facility itself (including technical failure). By applying the structural model presented above, we can systematically explore the determinants of governance dynamics towards the engagement in RETs in the context of both the community and the firm.

Many scenarios can be proposed. For example, a firm can be highly motivated to engage the community by normative aspects of behaviour (i.e., by political pressures). In addition, the firm might be able to exploit good economic opportunities in combination with producing laudable social outcomes. Taking into account only those aspects concerning attitudes and social norms and neglecting past experience and current control over the engagement process (i.e., economic resources, timing and capabilities) might lead to misleading conclusions. Another example is when a firm is highly motivated to engage the community by attitudinal aspects of behaviour (e.g., economic opportunities and good effects on the environment) coupled with good capabilities and resources to engage the community in co-development of RETs. Both of these aspects might be optimal, but normative aspects (e.g., regulatory pressures or contractual arrangements) might, nevertheless, hamper the community engagement process.

Similarly, on the community's side we might have people that perceive substantial economic, environmental and societal gains arising from specific RETs. This perception might be reinforced by strong community demands, while at the same time facing strong opposition from industry, which might threaten political positions or be certain to engender fierce conflict in the short term. These opposing forces may make the local communities unwilling to engage in such a conflictive policy-making process or enforcement of a controversial regulation. In general, the engagement and its governance outcomes will arise from the interaction between communities and firms mediated by the preconditions that determine their behaviours. In scenarios where there is a mismatch of the preconditions that determine the behaviours of these agents we could expect a conflict of interests. In such conditions RETs developments would be unlikely to occur.

Figure 19 below shows the likely sources of mismatch in the agendas represented by the communities and the interest of the company in the process of engagement of RETs development. Figure 1 is intended to illustrate the engagement model's major components as described above. It aims to make explicit the idea that the behaviour of both actors, despite their different *behavioural criterion* - i.e., communities aiming to *engage with their own goals and interest* and the company (CFE) development of new RETs facilities to promote regional development – constitute different sides of the same coin, that is, governance of engagement in RETs development and operation in specific location. Both groups of actors face different pay offs and outcomes in the development of RETs. In addition, the structural model in figure 19 below serves to organise and aggregate the different factors identified in previous chapters that drive the engagement and deployment of the geothermal energy facilities and the impact of the technology itself. This model is intended to facilitate testing the structural relationships between factors affecting engagement. It also facilitates identifying sources of asymmetries in the goals, expected outcomes, pressures as well as capacities to

participate in the deployment of geothermal facilities for the different actors involved in the process (in this case CFE and the communities of Acoculco)

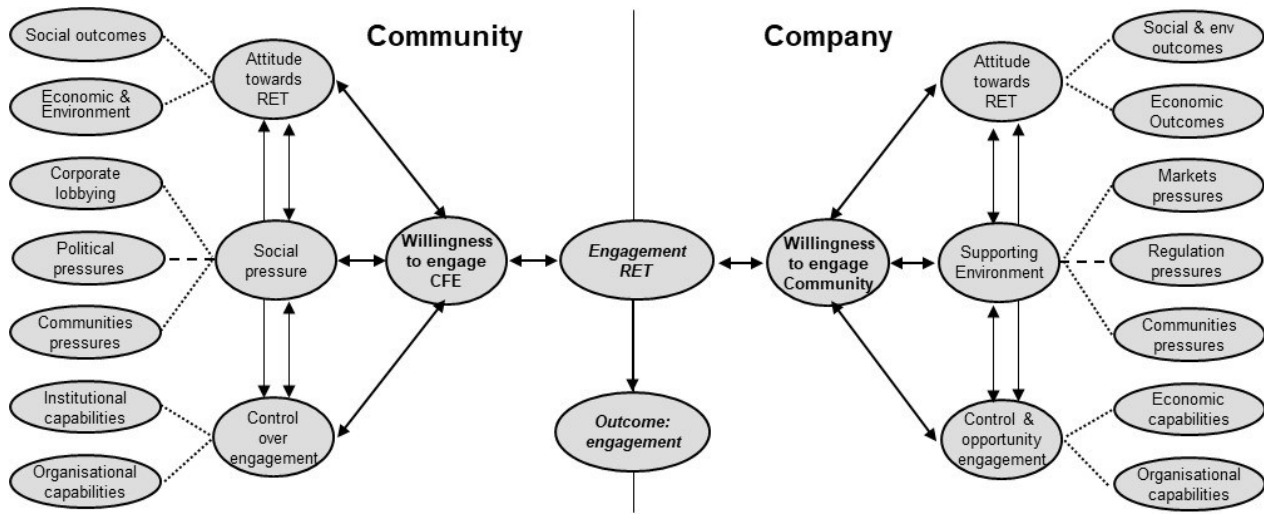


Figure 19. Structural determinants of engagement. Source: adapted from Wehn and Montalvo 2018

5.3.1 Scenarios of engagement: expected impacts on communities and company

In the following, plausible scenarios of future developments are described. Each of those developments could play out differently in the micro and meso-economics and sustainability of the region of interest. These scenarios enable to explore systemic influences that might affect sustainability in the communities and the regional environment in the long run. With the combination of the three structural dimension of the behavioral model proposed (attitudinal, normative and instrumental) a multitude of scenarios can be developed. The perspective of engagement can be bi-directional, taking the perspective of the company intending to engage the community or the community trying to engage with the company. In this case following the models of engagement (transactional, transitional, transformational and integrational) presented in chapter 2 and 4, we take the perspective of the company engaging the community. For matters of presentation three categories are here outlined and depicted in figure 20 below. The figure indicates situations where the behavior of one actor affects the behavior of the other actor. First, in situation (a) there is a mutual proportional response on each other actions of the actors in the system. Second, in situation (b) a large effort to promote engagement in the development and adoption of new renewable energy technology a less than proportional response in the adopting units. Last, in (c) when a relative smaller effort to promote engagement produces a more than proportional response in the adopting units.

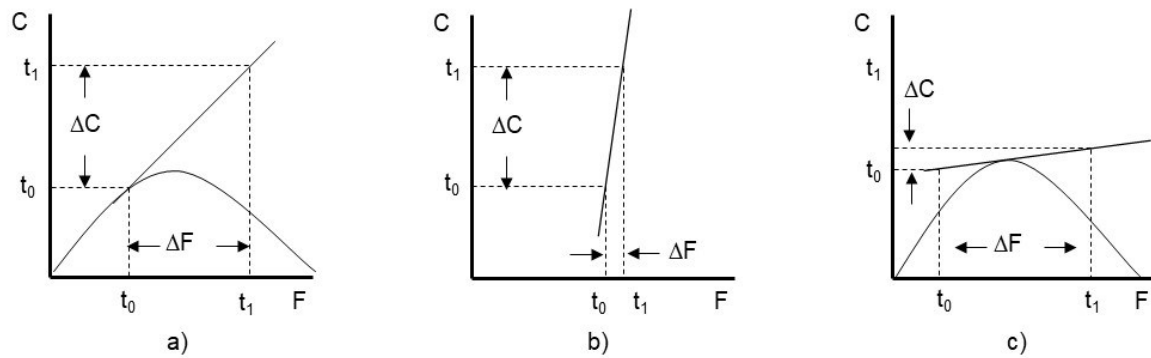


Figure 20. Scenarios of inter-engagement in geothermal uptake (Source: adapted from Montalvo (2007))

When quantitative data is available the model can be used following Montalvo (2007) to simulate a binary dynamic relationship between those adopting units (communities, business and consumers) and promoters of deployment of renewable energy technologies (technology suppliers and government).

For the *first category*, scenarios indicate that convergence towards common goals can indeed occur when there is relative high homogeneity in the conditions for RETs deployment perceived by stakeholders leading to a common trend. In **Scenario (a)** in Figure 20 when $\frac{dF}{dC} = \pm 1$ we can expect a dynamic of governance characterised either by collusion or collaboration towards engagement in RETs deployment. For any effort on the company or government that includes community development we can expect a proportional reaction from the community. The sources and situations of collusion or collaboration can be defined by comparing the indexes of attitudes, social norms and perceived control of both group of actors as defined in Sections above.

In the case of collusion or corruption in setting goals (between company and influential ejidatarios), notwithstanding that all the other factors influencing the behaviours of the community and the company are conducive to community deployment, this might be delayed, development goals set to a lower level of ambition or not occur at all. In this scenario, under a purely transactional engagement model, there might be concurrence the some stakeholders agendas but not towards sustainable development to the short term interest of some individuals. Here, a situation of corruption between some stakeholders can be envisaged. The outcomes of geothermal well deployment might benefit directly some locals via the supply of energy at high voltage for industrial or commercial applications. This can be disapproved by the broader community depending on how the benefits of new economic development spreads amongst the population. Such preferential treatment might lead to few influential people in the community accept and facilitate the deployment of RETs with little or negative effect in the community or the environment. The influential ejidatarios as they control the land property might be imposition to impose such decision and norm in the community as others might have little power and control in the decision to accept the deployment of RETs under unfavorable conditions. Conversely, in a situation of collaboration within a transitional and transformational engagement models, the values, beliefs and motivations of the broad community and the company match and converge towards desirable societal goals, community development. Any positive proposition made by the company receives a positive response of collaboration from the local community, in the interests of a common sustainability goal.

In **scenario (b)** when $-1 < \frac{dF}{dC} < 0$ we can expect that the process of RET deployment will converge towards the desired level of sustainability. We can expect a dynamic of positive governance whereby the factors influencing the behaviour of both actors are conducive to the deployment of RETs in the locality. In this scenario we can expect to have a response more than proportional engagement from the local community to any efforts on community development done by the government and company. Figure (20b) indicates situations in which there is a strong effort from the government and company side to follow a transformative or integrative model of engagement. Here a minimum regulatory effort produces a major change in the behaviour of the community supporting RETs deployment. Provided that there are clear capabilities and visions driving behavioural change towards specific RETs, we can expect that engagement of both main stakeholders will converge towards the success of policies promoting the deployment of RETs.

When we refer to desired level of sustainability this means that there is agreement and approval on the expected outcomes of the stakeholders in RETs deployment. This means that the expected returns of geothermal wells investment are in agreement with the plans of the company investing (CFE). Similarly, there is agreement and satisfaction with the RETs expected returns in the community. The investments are likely to not only bring direct benefits on temporary employment in RETs facility construction stages, but some long term employment for some members of the community, as well as provision of better road access that the new energy infrastructure might demand, and the benefits that high voltage energy supply might bring to attract other business to start in the community. Such outcomes are likely to generate a *positive attitudinal* predisposition in the inhabitants of Acoculco. Similarly, a positive *social norm towards RETs* is promoted by influential and respected ejidatarios that are in contact with the company directives and aware of long term attractive development plans of the RET company and federal government in the community. As seen in chapter one, the capacity to engage in community development by Acoculco and nearby towns inhabitants is limited (*low control on engagement and RETs outcomes*). In this scenario, strong additional investments in community development are planned or committed to the community the state or federal government to enable development (in health, education and training, telecommunications, additional business development activities, etc.). This will enable the community to participate and engage more integrally to compensate for the low number of inhabitants, low average level of education, the current low level of economic activity limited to small scale and low productivity in forestry, season agriculture and cattle. In this cases it is possible to foresee a dynamic of strong engagement in RET in the community even considering trade-offs with environmental externalities in the long term. Under these conditions a relative small effort in the side of the RETs deployment company will get a large engagement of the local community. Such engagement may secure better outcomes for sustainability as demonstrated in available literature (employment, economic development and sustainability outcomes) (Manzella et al., 2018; Tvinnerein and Ivarsflaten, 2016; Dvořák et al., 2017; and Agustine, 2019)

In **scenario (c)**, in contrast to (a) and (b), when $0 < \frac{dB_F}{dC} < 1$, efforts to deploy RETs by the company receive a response less than proportional on engagement from the local community. Here the company is likely to follow a transactional and transitional engagement model. As mentioned above, the deployment of RETs are perceived to have relative benign impact on the environment, but its deployment is likely to have a lesser impact on sustainability in the local environment and its inhabitants without a broader community development plan. As seen in the previous scenario, a transactional approach might be induced by plans already set for the deployment of the RET facility without or minimal consultation with the (broad) local community. This occurs because factors other than might influence the behaviour of the company (e.g.,

regional entrepreneurs pressures, economic opportunities, feasibility of technological, perceived environmental risks, etc.) present conditions not conducive for the community to engage in RETs deployment. With the company presenting plans of RETs deployment without earlier engagement and informing on the outcomes for the community (uncertainty on employment, environment and new economic activity) this is likely to create a *negative attitudinal predisposition* in the local population to RETs deployment. The engagement is likely to be negative and creates a *negative social norm* in the community to any plea of the company to accept and engage in RET deployment. As mentioned above and in earlier chapters, the local community has little agency to start new economic or sustainability projects in the community. This already creates a perception of *low control in the development* of the community, negative perception that would be increased by the advent of a new project that has not been previously consulted. With an attitudinal predisposition and social norm that are negative and the perception of no participation in the forming of the RET deployment plan, any effort of the company to cooperate and engage the community is likely to produce little engagement, if not resistance, in the community. The scenarios indicate that when the company supplying RETs under models of engagement characterized by a CSR transactional models of engagement is likely to be contestation by the local communities. Deployment will depend on enforcement power that create economic and political risks for the company and policy makers. This in any case limits convergence to sustainability goals.

5.4 Behavioural Propensity index linking to Input-Output (I-O) analysis

The expect effect of any technology deployment is contingent in its adoption and implementation. In turn the latter is contingent upon the willingness to engage (an actual engagement) of the actors involved (or not) in its deployment. In the case of the geothermal facility in Acoculco the effects on sustainability, as discussed above is contingent to a large extent on the willingness to engage in the process of planning and implementation of the RET project. In this section we propose an approach that captures the propensity to engage of the two main actors that have an interest to engage in the process of RET deployment. Following Montalvo (2006) and Montalvo and Moghayer (2014) here is proposed that the major components of the engagement model presented above (attitude, social pressure, and control over engagement) can be used to create a multi-dimensional construct. This construct that here is denoted as total engagement propensity (**TEP**). This index is to be used as a multiplier of planned investments in RETs in standard input-output approach to assess intersectoral sustainability impacts. The relationships between the three constructs and the respective paths between different drivers generating engagement propensity and moderating is actual engagement are depicted in Figure 5.5 below.

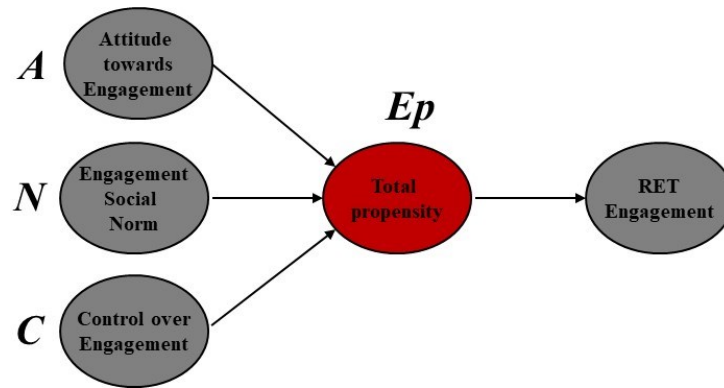


Figure 21. Determinants of RET engagement propensity (Adapted from Montalvo & Moghayer 2014)

The first component, a cognitive component of engagement in RET (A) is captured through an index of predisposition towards the engagement in RETs in a community/company participatory form. The evaluation of each factor regarding potential outcomes of RET engagement (a_i) is done by a differential semantic that combines the subjective evaluation of each belief attributed to the engagement in RET and the strength of that belief. The resulting ratings across a scale (A) are summed over the i salient beliefs.

$$A \propto \sum_{i=1}^I a_i$$

Where,

- A is a stakeholder evaluation toward the engagement in RETs activities;
- a_i is the belief that the engagement in RETs is related to outcome i ;
- Σ is the sum of the I salient outcomes arising from RETs engagement activities.*

* The usage of this type of scale for all three components of the engagement propensity is preceded by the empirical validation of the scale. That is, the internal cohesiveness of all items composing the scale is be demonstrated. If the reliability test is not satisfactory the computation of the index should not be conducted. This is contingent on a satisfactory value of Crombach α test for each of the scales generated. The structural validation is done via a principal components analysis and the predictive power with a standard linear regression.

The second component, a normative component of engagement in RETs, is captured through the subjective social norm (N). The dominant social norm concerning RETs engagement is estimated with a differential semantic for each normative belief of the stakeholders perceived pressure or perceived necessity to comply with or follow the referent in question (n_j). The social norm is hypothesised to be directly proportional to the sum the J salient beliefs concerning referents, as shown below.

$$N \propto \sum_{j=1}^J n_j$$

Where,

- N is the perceived social norm amongst stakeholders;
- n_i is the stakeholders motivation to comply with, follow or anticipate to the preferences of the referent j , and
- Σ is the sum of the J salient normative beliefs to produce an index of the overall perception of social pressure present in the stakeholders and the need to engage in RETs deployment.

The third component, an instrumental component of innovative behaviour (C) is captured through the estimation of the perceived control and power over the engagement and deployment of RETs. (C) is estimated by assessing the control beliefs (c_k) upon of the specific factor that facilitates or inhibits the engagement in RETs deployment. The resulting ranking for each factor affecting control over engagement is summed across the K salient beliefs as shown below.

$$C \propto \sum_{k=1}^K c_k$$

Where,

- C is the perceived control over the engagement activities amongst stakeholders,
- c_k is the perceived capacity or control over factors that facilitate or inhibit the engagement process,
- Σ is the sum of the K salient control beliefs to produce an index of the overall perception of control over the engagement process.

Finally, following Montalvo (2006), in order to integrate the above components the following equation indicates that the total engagement propensity across the stakeholders is a function of the three components presented above, i.e., $TEP = f(A, N, C)$. The function f is assumed to be an increasing and concave function in each of its variables, A , N , and C and is defined as $TEP = f(A, N, C) = A^{\alpha_1} \cdot N^{\alpha_2} \cdot C^{\alpha_3}$, with $\alpha_1 + \alpha_2 + \alpha_3 = 1$ and $0 \leq \alpha_i \leq 1, \forall i$. Where,

- $TEP \geq 0$ is the target population's total propensity to engage in a specific activity to deploy RETs;
- $A \geq 0$ is the stakeholders attitudinal predisposition to engage on deployment of RETs activities;
- $N \geq 0$ is the stakeholders experienced social pressure concerning the engagement in RETs deployment;
- $C \geq 0$ is the stakeholders degree of control over the RETs engagement process;
- $0 \leq \alpha_i \leq 1$ is the weight of the component, this weight is given by the percentage of the variance

explained by each of the components in the model.*

Note that the parameters α_i measure the responsiveness of *TEP* to a change in levels of either *A*, *N*, or *C*. The assumption that $\alpha_1 + \alpha_2 + \alpha_3 = 1$, means that the function has constant returns to scale. That is, if *A*, *N*, and *C* are each increased by 5%, *TEP* increases by 5%. The aggregation of diverse propensities across a population sample will generate an estimate of the total engagement propensity at the community, region, sector or country level (this will depend on scope and level of analysis taken in the empirical application of the model). The total engagement propensity can be conceptualised to consist of the concatenation of social investment capacity and framework conditions that give support to innovation as experienced by the community, entrepreneurs, en companies where the RETs deployment is to take place firms.

This first quantitative estimation of *TEP* will constitute the initial parameters that will affect the stock variables of an Input-output model. This estimation is generally known as the “initial conditions” in any simulation experiment and will give as a result a base line scenario of quantitative impacts. One of the major challenges in quantitative scenario development is the reliability and validity of the parameters used as initial conditions of the variables of interest. This is valid for popular models like agent based and systems dynamics modelling as well as in general equilibrium modelling for macro-economic forecasts. When there are no data available (e.g., time series data) to calibrate the parameters of a model, generally the approach followed is to have a number of experts that agree on the size and direction of the likely effects (i.e., achieving concurrent validation). An additional step to ensure the reliability of the parameters to be used in the scenario modelling is to strive for structural validation. This means, that the relationship between variables is confirmed by means of statistical analysis indicating the strength and direction of the relationship.

One additional hurdle concerns the aggregation of disparate sources of influence on the variables of interest (environment, employment and jobs) into a coherent set of relationships that can be reliably tested. For this reason, we adopted here an intermediate structural model with a double purpose. First, it enables to translate opinions expressed by people living in the communities and the company deployment the geothermal facility, concerning the likely effects into numerical composites amenable to statistical testing.

* The weight of each component is calculated via a test of principal components. This test also serves to test the robustness of the model for a particular application (for an in depth discussion see Montalvo 2002, pp.198-220). If the empirical structure (i.e., data set) fits the model proposed (i.e., most of the variance is explained with three components) the model can be considered valid.

5.5 Input-Output Approach

The following paragraph offers a description of the Input-Output model that is often used in the assessment of sustainability and effects at the sectoral or regional levels. As mentioned above there are several input-output data bases available in Europe, the most advanced examples are the WIOD and EXIOMOD I-O databases. These data bases run with general equilibrium models and can run at the country level or cross-sectoral level. In general, they enable the measurement of the environmental and economic impacts of policies*. As a multisector model, it accounts for the economic dependency between sectors. It is also a global and multi-country model with consistent bilateral trade flows between countries at the detailed commodity level. Based on national account data, it can provide compressive scenarios regarding the evolution of key economic variables such as GDP, value-added, turn-over, (intermediary and final) consumption, investment, employment, trade (exports and imports), public spending or taxes. For example EXIOMOD thanks to its environmental extensions, it makes the link between the economic activities of various agents (sectors, consumers) and the use of a large number of resources (energy, mineral, biomass, land, water) and negative externalities (greenhouse gases, wastes). As this is database offers a prime example of I-O applications to assess sustainability impacts we will describe it as an example to replicate. It offers a modular approach, based on standardised data, enabling I-O and CGEM, including data from macro-indicators related to producers, households, trade, and the environment. Below the basic traits of the database are described.

5.5.1 A modular approach

EXIOMOD's name stands for EXtended Input-Output MODEL. "Extended" refers to the fact that EXIOMOD can extend the standard Input-Output (IO) analysis in two main directions: (1) to Computational General Equilibrium Model (CGEM) analysis, and (2) to specific topics such as environmental impacts, energy, resources or transport. EXIOMOD is based on a modular approach specifically designed to conduct both IO analysis and CGEM simulation. With this modular approach and depending on the subject under investigation, the modeller can easily change the regional and sectorial segmentation as well as the level of complexity regarding the specification of the model by switching on or off specific blocks. This allows for customization, resulting in an appropriate model setup for each research question. The main objective of this modular approach is to overcome several criticisms formulated to standard CGEMs. In particular, an important issue for the analyses of results obtained with a multi-sector and/or multi-region CGEM is the abundance of linkages and effects which are difficult to separate from one to another. This is all the more true that the results heavily depend on many assumptions such as the level of elasticity, closing rule, underlying data for the sector disaggregation.

5.5.2 Database and macro-indicators

Database

The current version of EXIOMOD uses the detailed Multi-regional Environmentally Extended Supply and Use (SU) / Input Output (IO) database EXIOBASE (www.exiobase.eu) (Tukker et al., 2009). This database has been developed by harmonizing and increasing the sectorial disaggregation of national SU and IO tables for a large number of countries, estimating emissions and resource extractions by industry, harmonizing trade flows

* For a full description and examples of applications of EXIOMOD see Tatyana Bulavskaya et al 2016.

between countries per type of commodities. Moreover, it includes a physical (in addition to the monetary) representation for each material and resource use per sector and country. The I-O data base has one of the most detailed products and environmental extensions that are currently available from input-output tables. The database covers 48 regions (43 countries representing around 90% of the world GDP and five rest of the world regions), 200 products and various environmental indicators.

Macro-indicators

Producers

The nesting structure used in the current version of the model is shown in Figure 3 but can be easily adjusted using the modular approach of I-O data base. The production technology is modelled as a nested Constant Elasticity of Substitution (CES) functions. The nesting structure allows for introducing different substitution possibilities between different groups of inputs. At the first level, we assume that material inputs for production are perfectly complementary to the aggregate input of capital, labour, energy, that is no substitution is possible. At the second level, energy can be substituted to the aggregate input capital-labour. At the third level, the elasticity of substitution between labour and capital is equal to one and equals the Cobb-Douglas function.

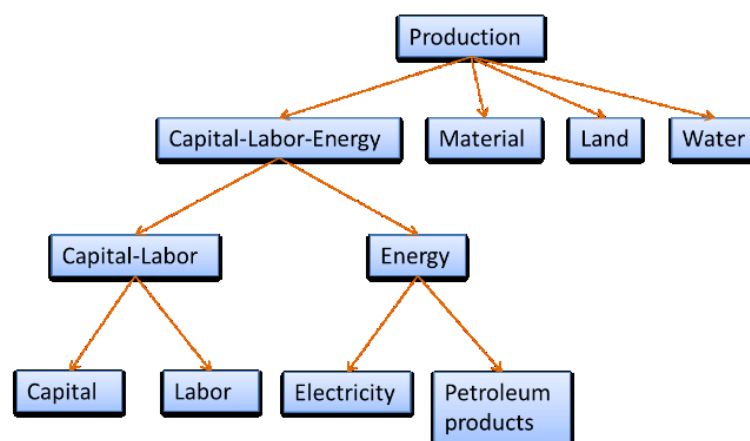


Figure 22. Production structure in I-O data base

Households

The household's utility is specified as a LES-CES function (Linear Expenditure System - Constant Elasticity of Substitution) allowing to differentiate between necessity and luxury products. This function defines a subsistence level for each good consumed which lead to an elasticity between consumption and revenue lower than one. For instance, for food we have a high subsistence level, whereas for other products consumption is more sensitive to the level of income. For instance, the overall subsistence level of consumption corresponds to 33 percent of total consumption, but this level jumps to 80 percent for food products. Above this minimum level of consumption, substitution between good is possible depending on the price. In the modular approach of EXIOMOD the household's utility function could be switched to the standard CES function in order to simplify the model.

Trade

The trade structure is schematized in the Figure below. At the first level, the user (e.g. final consumer or sectors) can either import a good buy the good from the domestic market. In a second step, all imported products from the different users are aggregated to calculate the total level of imports. In a third level, imports can be supplied by different countries. We assume a CES function characterized by possibilities of substitutions between regions of origin. We assume that trade in energy, water and construction is much less flexible in terms of changing trade partners compared to trade of other products.

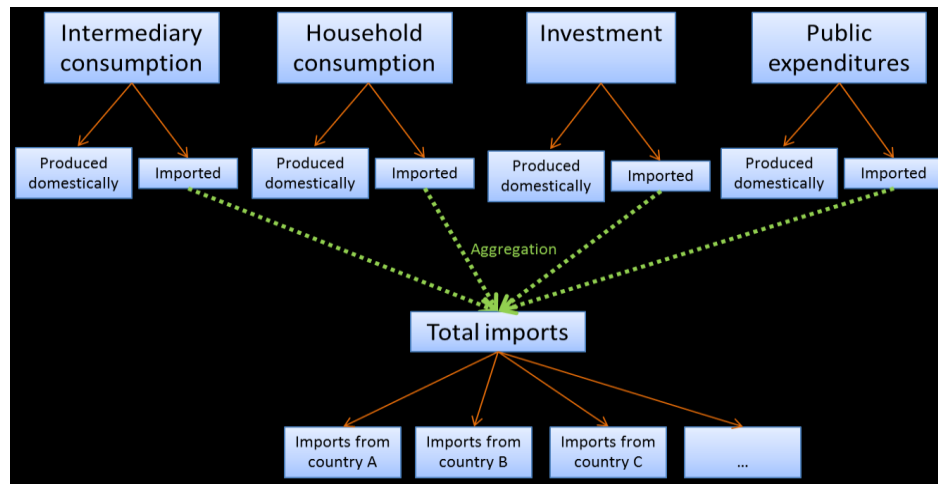


Figure 23. Trade structure in I-O data base

Environment

EXIOMOD related the resource use to the economic activity in several ways. CO₂ emissions are directly related to the level of consumption of the energy commodities responsible of the emission. Water consumption of economic activities is related to the level of production. For households, it is related to the water consumption (purchased from the water supply sector). Materials (such as metal, non-metallic minerals, etc.) are related to the production of the mining sector responsible of the extraction.

Conducting IO and CGEM analysis

EXIOMOD can perform a standard I-O analysis which is typically useful to answer to the following type of questions. What is the economic impact of developing a particular sector (in terms of employment, value-added, investment, etc.)? Will domestic or foreign producers benefit the most? Which other economic sectors will benefit from it? With the inclusion of environmental extensions, I-O tables can also be used to derive and compare various indicators of resource use: e.g. consumption-based versus production-based indicators. But I-O analysis has the disadvantage to leave price effects aside. The CGE module can be activated to overcome this limit. A CGEM takes into account the interaction and feedbacks between supply and demand as schematized in Figure 24. Demand (consumption, investment, exports) defines supply (domestic production and imports). Supply defines in return demand through the incomes generated by the production factors (labour, capital, energy, material, land, etc.). To ensure the equilibrium between supply and demand, an assumption regarding the “closure” of the system has to be done.

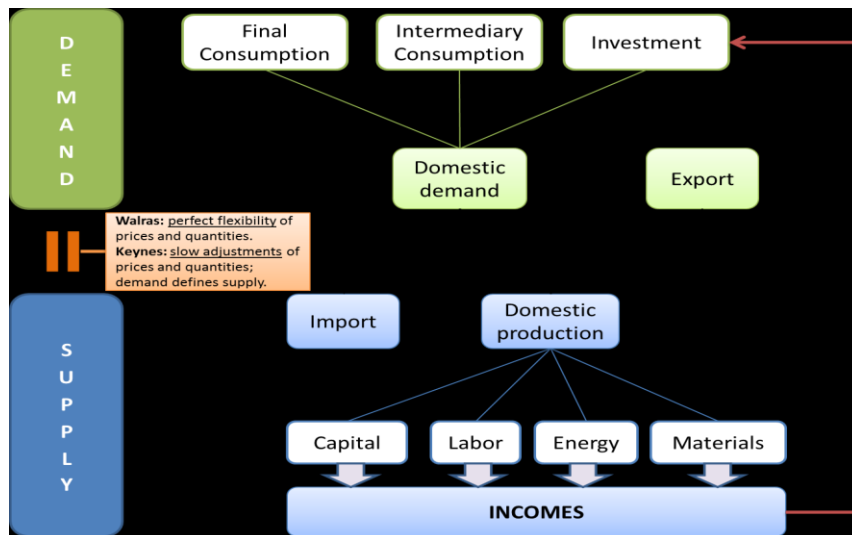


Figure 24. Architecture of a CGEM

Link to macro-economic modeling: measuring economic impacts

With the TEP index simulation it is possible to estimate scenarios of economic impact which apply the above logic for the qualitative (rank) assessments for each scenario under consideration. The output indicators include economic structures, innovation indicators, etc. For the model EXIOMOD described, the indicators generally are used to characterise the competitiveness of EU industry. This includes often includes:

Labor markets effects:

- Demand for labor (volume and type of skills)
- Mismatch supply and demand of skills (generated by the model)
- Wages variation and inequality (potentially rising wage inequality via skill-biased technological change)

Competitiveness indicators:

- Trade balance (exports-imports) (generated by the model)
- Productivity

Variables to optimize are the effects on sustainability:

- Employment
- Health and care
- Energy
- Mobility
- Finance
- Sustainability (resource efficiency and cleaner production)

5.6 References

- Augustine, C. R., Millstein, D., McCall, J. D., Macknick, J. E., Nicholson, S. R., Keyser, D. J., ... & Heath, G. A. (2019). *GeoVision Analysis Supporting Task Force Report: Impacts. The Employment Opportunities, Water Impacts, Emission Reductions, and Air Quality Improvements of Achieving High Penetrations of Geothermal Power in the United States* (No. NREL/TP-6A20-71933). National Renewable Energy Lab.(NREL), Golden, CO (United States).
- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211.
- Bishop, P., A. Hines, and T. Collins. "The current state of scenario development: an overview of techniques." *Foresight - The journal of future studies, strategic thinking and policy* 9, no. 1(2007): 5-25.
- Börjeson, L., et al. "Scenario types and techniques: Towards a user's guide." *Futures* 38, no. 7(2006): 723-739.
- Bulavskaya, T., & Reynès, F. (2018). Job creation and economic impact of renewable energy in the Netherlands. *Renewable Energy*, 119, 528-538.
- Dvořák, P., Martinát, S., Van der Horst, D., Frantál, B., & Turečková, K. (2017). Renewable energy investment and job creation; a cross-sectoral assessment for the Czech Republic with reference to EU benchmarks. *Renewable and Sustainable Energy Reviews*, 69, 360-368.
- de Jouvenel, H. "A Brief Methodological Guide to Scenario Building." *Technological Forecasting and Social Change* 65, no. 1(2000): 37-48.
- Di Bartolomeo, G., & Saltari, E. (Eds.). (2016). *Theoretical Foundations of Macroeconomic Policy: Growth, Productivity and Public Finance*. Routledge
- Dietzenbacher, E., Los, B., Stehrer, R., Timmer, M., & De Vries, G. (2013). The construction of world input–output tables in the WIOD project. *Economic Systems Research*, 25(1), 71-98.
- Farjad, B., Gupta, A., Sartipizadeh, H., & Cannon, A. J. (2019). A novel approach for selecting extreme climate change scenarios for climate change impact studies. *Science of The Total Environment*, 678, 476-485.
- Faturay, F., Lenzen, M., & Nugraha, K. (2017). A new sub-national multi-region input–output database for Indonesia. *Economic Systems Research*, 29(2), 234-251.
- Godet, M., and F. Roubelat. "Creating the future: The use and misuse of scenarios." *Long Range Planning* 29, no. 2(1996): 164-171.
- Laffont, J.J. and Tirole, J. (1993) *A Theory of Incentives in Procurement and Regulation*, Cambridge, MA: MIT Press.

- Lindgren, M., and H. Bandhold. *Scenario Planning - The link between future and strategy*. Basingstoke: Palgrave Macmillan, 2003.
- Manzella, A., Bonciani, R., Allansdottir, A., Botteghi, S., Donato, A., Giamberini, S., ... & Scrocca, D. (2018). Environmental and social aspects of geothermal energy in Italy. *Geothermics*, 72, 232-248.
- Montalvo, C. (2006), What triggers change and innovation, *Technovation*, 26(3): 312-323.
- Montalvo, C. (2007), Explaining and predicting the impact of regulation on innovation: towards a dynamic model, *International Journal of Public Policy*, Vol. 2, Nos. 1/2, 5-31.
- Montalvo, C., & Moghayer, S. (2011). State of an innovation system: theoretical and empirical advance towards an innovation efficiency index. Paper presented at the DRUID Conference 2012
- Nahuis, R. (2005) 'The politics of innovation: self-service on the Amsterdam trams', *Technology in Society*, Vol. 27, No. 2, pp.229–241.
- Nowotny, K. (1989) 'The economics of public utility regulation', in K. Nowotny, D.B. Smith and H.B. Trebing (Eds.) *Public Utility Regulation: The Economic and Social Control of Industry*, Boston: Kluwer, pp.9–27.
- Popper, R. (2008). How are foresight methods selected?. *Foresight-The journal of future studies, strategic thinking and policy*, 10(6), 62-89.
- Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster; Montalvo, C., & Kemp, R. (2008). Diffusion of cleaner technologies: Modeling, case studies and policy. *Journal of Cleaner Production*, 16(1).
- Rosenbaum, E., Benini, L., & Ciuffo, B. (2012). Development of Sustainability Scenarios. European Commission, Joint Research Centre: Ispra, European Commission.
- Senge, P. M., & Forrester, J. W. (1980). Tests for building confidence in system dynamics models. *System dynamics, TIMS studies in management sciences*, 14, 209-228.
- Smits, R., & Kuhlmann, S. (2004). The rise of systemic instruments in innovation policy. *International journal of foresight and innovation policy*, 1(1-2), 4-32.
- Stadler, K., Wood, R., Bulavskaya, T., Södersten, C. J., Simas, M., Schmidt, S., ... & Giljum, S. (2018). EXIOBASE 3: Developing a time series of detailed environmentally extended multi-regional input-output tables. *Journal of Industrial Ecology*, 22(3), 502-515.
- Tatyana Bulavskaya, Jinxue Hu, Saeed Moghayer and Frédéric Reynès (2016). EXIOMOD 2.0: EXtended Input-Output MODel: A full description and applications. TNO Working Paper Series 2016-02

Tukker, A., Poliakov, E., Heijungs, R., Hawkins, T., Neuwahl, F., Rueda-Cantuche, J. M., Bouwmeester, M. et al., (2009). Towards a global multi-regional environmentally extended input-output database. *Ecological Economics*, 68(7), 1928–1937. <http://doi.org/http://dx.doi.org/10.1016/j.ecolecon.2008.11.010>

Tvinnereim, E., & Ivarsflaten, E. (2016). Fossil fuels, employment, and support for climate policies. *Energy Policy*, 96, 364-371.

Wehn, U., & Montalvo, C. (2018). Knowledge transfer dynamics and innovation: Behaviour, interactions and aggregated outcomes. *Journal of Cleaner Production*, 171, S56-S68.

Wood, R., Stadler, K., Bulavskaya, T., Lutter, S., Giljum, S., De Koning, A., ... & Simas, M. (2015). Global sustainability accounting—Developing EXIOBASE for multi-regional footprint analysis. *Sustainability*, 7(1), 138-163.

Ziegenhagen, E.A. (1986) *The Regulation of Political Conflict*, New York: Praeger.

6 Conclusion

The report presents a comprehensive work and it is built following a stepwise approach.

The first chapter reviews the main themes relating to the current debate on public engagement, considering private and public actors' perspectives, geothermal energy specificities, and practices and measurements methods to assess social impacts. The second chapter considers the perspective of private companies aimed at developing geothermal plants. Such companies are considered when relating with consumers and when managing internal organisational dynamics, with the ultimate purpose of achieving public engagement. The results of surveys suggest that companies can benefit from accounting for socio-economic and environmental responsibilities in their project developments. In particular, energy companies in Mexico can experience higher consumer loyalty and better corporate reputation if their CSR investments are focused in the social domain, communication domain and environmental domain respectively. Considering this information within a company's CSR strategy could drive strategic improvements, and reinforce the dynamic that sees more socially responsible companies gaining a competitive advantage and driving less socially-oriented companies out of the market in the long-term.

The third chapter focuses on local communities potentially affected by such developments, taking into consideration the role of public administrations within the SIA approach. Local communities are considered by accounting for different social aspects, energy-related determinants and economic/environmental/social issues, while local administration are considered in their role within the engagement process. Information was gathered at different levels (i.e. local, national (Mexican) and international), to be able to provide context-specific results and implications as well as more general ones.

In the fourth chapter, a conceptual model is shown, representing a guide for developing strategies for public engagement. Such model condenses the work carried out in the previous chapters and allows to simultaneously consider the perspectives of all the actors involved in an engagement process. Companies, SIA practitioners and affected local stakeholders, and public administrations are all considered and the interplay of the different perspectives and their stages results in the definition of different degrees of public engagement. This simultaneous representation of multiples perspectives is crucial since is able to align actor-specific processes and approximate real-life situations in which strategies and activities are evaluated. This is can be very useful not only for developing the appropriate engagement strategy, but also to reduce to the minimum potentially negative conflicts and strengthen the end result. Moreover, the presence of different degrees of public engagement allows each actor to develop a modular approach. Companies, SIA practitioners and affected local stakeholders, and public administrations can start building the engagement strategy at the most adequate level to their actual knowledge and abilities, and move forward when their specific knowledge basis is well structured. This chapter also includes a focus on CFE's geothermal developments and descriptive technical development scenarios.

The fifth chapter presents different sustainability scenarios. By adopting a model for capturing the structural factors affecting the engagement of the two key actors with a stake in geothermal energy facility, different scenarios of citizens' engagement are proposed, also providing linkages to input-output (I-O) analyses. The scenarios show cases in which (a) there is a mutual proportional response among the actors involved; (b) there is a large effort to promote and a less than proportional response in the adopting actor; (c) there is a relative smaller effort to promote engagement and a more than proportional response in the adopting actor. While in the (b) case we can expect that the process of RET deployment will converge towards the desired

level of sustainability, in the (c) case any effort of the company to engage the community is likely to produce little engagement, if not resistance. Lastly, the (a) case either collusion or collaboration dynamics towards engagement in RETs deployment can be developed.

To conclude, we can affirm that the promotion and implementation of large industrial projects such as the geothermal ones can still be considered as symbol of progress as long as social acceptance issues are tackled through the methodological approach followed in this report. Even though the report grounds on deep literature-based roots, it is not necessary to provide such effort in future project developments. By using the conceptual model in Fig. 18, a shared and multi-perspective vision of the social aspects to be addressed and the public engagement strategies to be implemented can be developed, allowing the building of an overarching approach to large industrial projects. This would create not only direct benefits for the actors involved, but it could generate positive spillovers that (perhaps) were not considered in the first place. While the conceptual model is related to a more strategic perspective, the model relating to the sustainability scenarios represents a methodological tool that can provide more quantitative-oriented assessments of citizens' engagement dynamics. Such tool can represent an added value to the use of the conceptual model, since ex-ante consequences to project developments can be understood and, eventually, corrective actions can be defined. Within the context of the GEMEx project, the methodological approach provided here can be used by all actors involved. CFE can benefit from better understanding of consumer-related dynamics and organisational structure dynamics related to engagement strategies, targeting the desired level of engagement and making scenarios on the possible consequences. Local communities, together with SIA practitioners, can provide the knowledge support required, through an assessment of, for example, socio-economic needs and environmental threats. Local authorities can better understand their role in project developments, supporting different phases of the engagement process. Last, national authorities could use the approach followed in this report as a basis for guidelines for sustainable energy development projects, ensuring that all interests in such projects are taken into account and balanced. As such, given these premises, we hope and look forward to seeing many stakeholders committing to implementing the suggestions in this work.

7 Acknowledgements

Special thanks to Ing. Miguel Angel Ramírez Montes Subgerencia de Estudios Gerencia de Proyectos Geotermoeléctricos and the Comisión Federal de Electricidad (CFE) team for providing us access to the production site of Los Humeros and for showing availability in doing interviews with and providing materials to us. We highly appreciated working with all of you.

We also acknowledge our Mexican colleagues for their help and collaboration during our field works in Mexico. In particular, many thanks to Dr. Zayre González Acevedo for having contributed to the coordination of the field trips and having supported European partners with materials and constant dialogue. Furthermore, we thank our European colleagues for their collaboration and help during this three-year work.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 727550 and the Mexican Energy Sustainability Fund CONACYT-SENER, project 2015-04-268074.



Coordination Office, GEMex project
Helmholtz-Zentrum Potsdam
Deutsches GeoForschungsZentrum
Telegrafenberg, 14473 Potsdam
Germany