

SMARTTEES: Deliverable 5.1 (Report)

Theoretical framework for the definition of locally-embedded future policy scenarios

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Wind Park in the Haze. Offshore Wind Park in the Baltic Sea near Samsø, Denmark. Image credit - m.prinke. Licensed under Creative Commons. (CC BY-SA 2.0)

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Table of Contents

Table of Contents	3
Executive summary	4
List of abbreviations	6
1. Introduction.....	7
2. Conceptualization and categorization of policy instruments in social energy innovations.....	8
2.1. Policy strategies implemented in cluster 1: ‘Holistic, shared and persistent mobility plans’	12
2.2. Policy strategies implemented in cluster 2: ‘Island renaissance based on renewable energy production’	17
2.3. Policy strategies implemented in cluster 3: ‘Alliance for a district regeneration based on energy transitions’	22
2.4. Policy strategies implemented in cluster 4: ‘Urban mobility with superblocks’	26
2.5. Policy strategies implemented in cluster 5: ‘Energy efficiency and fuel poverty’	31
2.6. Insights from the analysis of energy policies at the case-study level	35
2.7. Outcomes from the policy-scenario workshop “envisioning strategies for energy urban transitions”	37
3. Key elements of Social Innovations in energy transitions.....	39
3.1. Drivers and barriers of social innovations in energy transitions.....	39
3.2. Conceptual analysis of replicability and transferability of social innovations in energy transitions.....	46
3.3. Theoretical implications from an energy justice and equality perspective	51
4. Social Innovation pathways and lessons learned from energy transitions.....	58
4.1. Factors driving social acceptance of social innovation and collective empowerment	58
4.2. Brief overview of lessons learned in social innovation journeys in SMARTTEES	74
5. Implications for the design of policy scenarios	75
6. References	83

Executive summary

This document presents the common conceptual framework for the development of locally embedded policy scenarios in the SMARTTEES case studies. The conceptual framework will inform the methodology for the co-creation of policy scenarios in each case, but also aims to be a stand-alone tool that policy-makers can use to conceptualize and implement the policy tools that can lead to citizen engagement with and acceptance of energy policy, the adoption of sustainable energy behaviours and to adequately manage setbacks and conflicts in the process.

The development of a conceptual framework for policy scenarios builds upon a series of research activities conducted in the SMARTTEES project. First, within SMARTTEES, we conducted a **comparative analysis of the policies implemented in the social energy innovations** as part of work package 3 (“profiles of social innovation”). Building on the case-specific analysis in WP3, we developed a **categorization of policy instruments** that can guide reflection on commonalities and differences across social innovation cases, and provide a way to look at policy combinations that are most effective in the different stages of development of a particular social innovation. This categorization is presented in chapter 2 of this report (sections 2.1-2.5), followed by an analysis of the main **insights on the policy contexts** that condition the success of energy-related social innovations (as reported in sections 2.6 and 2.7).

With the aim of grounding both the analysis of already-implemented policies and the definition of alternative policy scenarios, we further reviewed scientific literature on key factors acting as **drivers of and barriers to the adoption of sustainable energy behaviours**, as well as those shaping **public acceptability** of energy-relevant social innovations and **citizen empowerment** (section 3.1). As one of the main objectives of SMARTTEES is to support replication of successful social innovations, we include a **conceptual analysis of the replicability** and transferability of social innovations in energy transitions (section 3.2.). Moreover, we provide a theoretical understanding of **energy justice and equality** (section 3.3), as a key dimension of energy transitions and a crosscutting theme in this project.

Beyond the theoretical understanding of factors influencing successful implementation and replication of social innovations in energy transitions, the conceptual framework has been enriched with the results of empirical work carried out in the project, through in-depth interviews carried out in each case. The outcomes of the qualitative research conducted in the SMARTTEES case-studies provide rich knowledge on the social dynamics that influence the course of social innovations, with a particular focus on those that foster or hinder social acceptability of these innovations, and citizen empowerment to both engage in social innovation processes as well as to adopt new behaviors. They also shed light on the **social mechanisms of contestation, resistance and conflict**, the circumstances under which they occur and how such contestation is resolved. The result of this empirical analysis is integrated in chapter 4 (section 4.1), and provides an in-depth analysis of the relevant social dynamics of energy transitions.

Using the categorization of policy instruments described in Section 2, and preliminary insights into the dynamics of energy-relevant social innovations, we also conducted a workshop with case representatives during the second SMARTTEES General Assembly, to reflect on the lessons learned on what fosters successful social innovations in energy transitions. These insights are

presented in section 4.2, together with their implications for the conceptualization of policy options in energy transitions.

The integration of all these theoretical, empirical and practical insights described above will constitute the **conceptual framework for the definition of locally embedded policy scenarios** in the SMARTEES project. We define a set of dimensions that will be used to define policy scenarios in the project, and will be refined as a tool that policy-makers can use as a map to navigate the different stages of implementation of social innovations in energy and to define effective, locally-adapted policies to foster acceptability, citizen empowerment, and adoption of sustainable energy behaviours (Section 5).

As already mentioned, the conceptual framework will inform policy scenario workshops¹, (workpackage 5, tasks 5.3) conceived in the SMARTEES project as processes of knowledge co-production, reflexive thinking and decision-making regarding the possible policy alternatives towards social energy innovations and the potential negative policy effects. The outcomes of policy scenario workshops (WP5.task 5.4 and 5.5) will provide insights on best strategies to overcome citizen resistance and increase public acceptability as well as supporting energy innovations by supporting citizen engagement in the design of energy policies.

Policy alternatives will then be integrated in social simulation models (WP7), and their outcomes will be assessed. Furthermore, the conceptual framework will also be integrated as a tool within the SMARTEES policy-sandbox (WP8), to support reflexive thinking and planning of policies to foster socially acceptable and inclusive energy innovations.

¹ The methodology of WP5 is a multi-stakeholder participatory approach involving a selection of key actors in foreseen deliberative processes that co-create realistic pathways for realizing and developing energy transitions (SMARTEES Description of Action).

List of abbreviations

[AHP]	[Aberdeen Heat & Power Ltd]
[BCE]	[Basic Capability Equality]
[CA]	[Capabilities Approach]
[EC]	[European Commission]
[EE]	[Energy Equality]
[EJ]	[Energy Justice]
[EU]	[European Union]
[DoA]	[Description of Action]
[PEB]	[Pro-environmental behaviour]
[PV]	[Photovoltaic]
[SI]	[Social Innovation]

1. Introduction

The SMARTTEES project focuses on the human factor in energy transitions and aims to foster a deep understanding of the individual and social factors influencing acceptability of and engagement in energy related social innovations, as well as the dynamics involved in the adoption of social innovations and their replication to different local contexts. as well as the adoption and diffusion of sustainable energy behaviours Grounded on recent developments towards developing a theory of social innovation, which stress the relevance of designing the adequate framework conditions that foster societal transformations (Haxeltine et al., 2016), the project focuses on the political, organizational and social conditions that either support or hinder the social acceptability² of energy-related social innovations and their successful replication across contexts.

The question of how to formulate policy that stimulates social innovation for energy transitions is at the core of the SMARTTEES project, which studies successful social innovations in the energy domain and aims to extract patterns that can be replicated in other places and contexts. As part of this agenda, **work-package 5 looks at the policy approaches applied in existing cases of social innovations in the domain of energy** (grouped in five clusters of social energy innovations that will be described below) and **put the focus on the political, institutional and organizational frameworks (barriers and drivers) that condition and structure social acceptability of energy policies** and the successful transferability of these social innovations across contexts.

As part of its endeavour to provide policy recommendations that can support the replicability of successful energy-related social innovations, we aim to develop theoretically- and empirically-informed policy scenarios that harness the potential of social innovations to support the transition to clean and sustainable energy in Europe. As part of Workpackage 5, we aim to co-create, together with key stakeholders in each case study, a series of policy scenarios that can support replication and acceleration of energy transitions through social innovation. The outcomes of these scenarios will be assessed through social simulations using agent-based modelling and will provide useful insights into most effective policy approaches to foster socially innovative energy transitions.

² Public acceptability is a broad concept that refers to people's general evaluation of an energy policy or a specific energy project (e.g. the extent to which they endorse or reject a particular energy technology) (Perlaviciute et al, 2018).

2. Conceptualization and categorization of policy instruments in social energy innovations

Developing effective **policy for energy transitions** is of key importance if Europe is to meet the emissions reductions goals established in international agreements such as the Paris Agreement (by which the signing states commit to keep the global temperature increase below 2°C). Recently, the Strategy for a Climate Neutral Europe by 2050³ (EC, 2018) has been approved, which declares the ambition of the EU to become a zero-carbon region in 30 years. The challenge of climate change mitigation calls for the engagement of a variety of strategic economic sectors (e.g. mobility and transport, building sector, power sector, industry, agriculture), governments and institutions, and citizens and policy instruments at different scales. At local level⁴, most of the cities and islands involved in SMARTEES have already defined strategies aiming at reaching ambitious energy transition goals.

Energy transitions require the active mobilization of citizens and social transformations that support sustainable energy use. Social innovations have been hailed as potential mechanisms to activate citizen engagement in the definition and implementation of sustainable energy policies, promote acceptability of new energy infrastructures and technologies, and support wider societal transformations in social norms and consumption cultures towards sustainability. Recent reports of the European Union emphasize the **capabilities of social innovations to effectively respond to social challenges** (e.g. energy transitions), by mobilizing people's creativity to develop solutions, make better use of scarce resources and/or promoting an innovative and learning society (BEPA, 2010; Avelino et al, 2017).

Energy innovations have been grouped in five clusters in SMARTEES. Ten reference cases (two reference cities or islands per cluster) have been selected for the empirical analysis of the dynamics of social innovation, as listed below. An overview of the social innovation in each cluster is provided in table 1.

- a) Holistic, shared and persistent mobility planning (Zürich and Groningen)
- b) Island renaissance based on renewable energy production (Samsø and El Hierro)
- c) Energy efficiency in district regeneration (Malmö/Augustenburg and Stockholm/Järva)
- d) Urban mobility with superblocs (Vitoria-Gasteiz and Barcelona),
- e) Co-ordinated, tailored and inclusive energy efficiency schemes for fighting fuel poverty (Aberdeen and Timisoara).

³ This strategy is aligned with previous European policies such as the 'European CoEU's Strategy for Adaptation to Climate Change' (2013), the EU 'Clean Energy for All Europeans Communication' (2016), the European Commission 'Accelerating Clean Energy Innovation Communication (2016) and European directives such as the 'EU Revised Renewable Directive' (2018).

⁴ For example, the municipality of Groningen aims to be CO2 neutral by 2035 as stated in the Routekaart (roadmap) Groningen CO2-Neutraal 2035 by using only renewable sources of energy. The Barcelona's Strategy for Energy Transition claims to "make a decisive move towards energy sovereignty through the supply of 100% renewable energy, with zero emissions, making its access more democratic and reclaiming its management as a public service".

Cluster	Case-study	Case-study description
Holistic, shared and persistent mobility plan	Main Reference Case: Zürich	This social innovation is using the mobility plan as a way of mobilizing and coordinating many societal actors (different branches of local authorities, citizens, constructors, transport companies, etc.) towards the common goal of a more sustainable and efficient city transport system.
	Supporting Reference Case: Groningen	
Island renaissance based on renewable energy production	Main Reference Case: Samsø	This social innovation is based on the mobilization of the citizens and innovative partnerships set-up of an island to achieve energy independence through renewable and energy efficiency measures as means to overcome the factors that put the community itself in danger and revive island communities.
	Supporting Reference Case: El Hierro	
Alliance for a district regeneration based on energy transition	Main Reference Case: Malmö	This social innovation includes hard and soft measures to transform the district such as local energy production and energy efficiency measures, urban green spaces, transport system transition measures, and citizen participation.
	Supporting Reference Case: Stockholm	
Urban mobility with superblocks	Main Reference Case: Vitoria-Gasteiz	This social innovation is based on an urban innovation (superblocks) that introduce low-carbon mobility practices through the reorganization of urban space, which minimizes the use of motorized modes of transportation. The city is reorganised into superblocks, car-free areas designed to maximize public space and keep private cars and public transport outside of the neighbourhoods, redesigning the inner streets for use by pedestrians.
	Supporting Reference Case: Barcelona	
Coordinated, tailored and inclusive energy efficiency schemes for fighting fuel poverty	Main Reference Case: Aberdeen	This social innovation is characterized by public authorities working in coordination with supply companies and civil society organisations in order to implement energy efficiency measures for houses and buildings with the aim of fighting fuel poverty with a tailored and inclusive approach.
	Supporting Reference Case: Timisoara	

Table 1. Overview of five clusters of social innovation in the SMARTEE project. Adaptation from Deliverable 3.4. (pp. 13-14).

To first understand the factors that influenced social innovation pathways in the energy domain and how these were shaped, **an analysis of the policy strategies** implemented by the ten social innovation cases studied in the SMARTEES project was performed. This analysis has been conducted in order to gain a deep knowledge on the diversity of energy policies and interventions conducted in the different case-studies to achieve their goals and gain public acceptability. This analysis has been also complemented with a review of European, national and regional policies that establish the political and normative framework for the starting out and development of social energy innovations and local energy transitions (see annex1). As a result of this comparative analysis among the ten case-studies, a list of policy instruments has been identified and clustered in the following four general categories:

- 1. Normative and regulatory approaches.** This category refers to legal instruments and regulations that create the regulatory framework for a particular energy innovation. This category includes instruments such as obligations schemes, taxes or penalization measures.
- 2. Infrastructure and technology upgrade measures.** These types of measures focus on investments in public and private infrastructures and technologies, as well as the provision of technical guidelines and training.
- 3. Financial incentives for the market and for individual households.** These include tax benefits and economic measures that provide incentives for business and/or financial support for households (e.g. subsidies, grants, loans) to foster innovation in the energy domain and tackle energy inequality and poverty.
- 4. Consumer awareness, decision-aid and empowerment measures.** This category includes policy tools that provide individuals with the knowledge and tools to adopt well-informed decisions about their energy consumption and to implement changes in their household energy consumption through refurbishments, adoption of new technologies and energy behaviour changes. They include information and education campaigns, decision-aid policies (e.g. advisory services), consumer empowerment initiatives and participatory approaches to the definition and implementation of energy policies.

In the following sections the policy strategies implemented in the five clusters of social innovations will be analysed case by case, in order to identify the prevalent policy approaches adopted by pioneers and promoters to design and implement each social energy innovation. A table summarizing the main policies adopted in each social innovation is included at the end of each section⁵. **The following table summarises the main policy instruments implemented in the five clusters of social innovations, providing examples of the type of measures adopted in the different cities and islands.**

Policy instrument	Typology	Examples of measures implemented in the SIs
Normative and regulatory approaches	Technical and regulatory documents	Plans and programs approved that are basis for the different social innovations
	Obligation schemes	Regulations that limit the number of parking spaces; restrictions on car use in city areas
	Penalization measures	Higher parking fees in particular areas.
Infrastructure and technology upgrade measures	Public and private infrastructures and technologies	Public infrastructures and services that facilitate sustainable mobility, removing existing barriers for pedestrians and cyclists, e.g. improvement of public

⁵ The policies listed in these summary tables are largely described in deliverable 3.1. The brief content of the tables has been elaborated by Gabriele Quinti (K&I).

		<p>transport system and cycling infrastructures (holistic mobility & superblocks, district regeneration).</p> <p>Green infrastructures and nature-based solutions to increase neighbourhood quality of life.</p> <p>Technological innovation in the renewable energy installations adapted to the conditions of the territory (El Hierro, Samsø), creation of a net of charging points for electric cars (El Hierro)</p> <p>Local energy production and building energy efficiency measures (district regeneration, energy efficiency solutions and fuel poverty solutions)</p>
Financial incentives for the market and individuals	Tax exemptions	Tax free measures in parking areas outside the city.
	Financial support (Subsidies, grants, contests, awards)	With the benefits of the energy plant, El Hierro provides subsidies and incentives for farmers, hotels and other sectors to install renewable energy technologies (e.g. solar panels). Other set of public grants aims to support purchasing electric cars and e-bikes (residents)
	Energy justice measures	Grants and subsidies for housing energy improvements and prioritise work on the homes of families in vulnerable situations and at risk of social exclusion
Consumer awareness, decision-aid and citizen empowerment policies	Information and education campaigns	Campaigns on mobility education for children; Promotion city-fair choice of behaviours; promotion of sustainable mobility
	Decision-aid policies	Consultation and advisory services (e.g. specific energy audits and other feedback schemes)
	Consumer empowerment initiatives	Measures and training actions aiming at improving citizens' competence for adoption of energy-saving behaviour. Business models based on co-ownership of?
	Participatory approaches	Citizen consultation. Formal and informal residents' consultation processes through the creation of Neighbourhood Councils, a new formal entity under development aimed at further fostering the communication between the citizens and municipality (Groningen); referenda promoted by Zürich's City Council) Participatory deliberation and design Participatory workshops explaining the aims of the project and involving citizens in the design, implementation and ownership of the SI (Samsø, district regeneration processes)
	Monitoring/evaluation	Periodic reports of implemented activities and of outcomes regarding behavioural changes (Zürich, Vitoria-Gasteiz); Periodic citizen satisfaction surveys (Zürich, Groningen, Vitoria-Gasteiz). Evaluation of

		superblocks' impact in terms of infrastructures and health impact perception (BCN). Assessment of reduction of gas emissions and fuel consumption (El Hierro).
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Table 2. Overview of policy instruments and measures implemented in the five clusters of social innovation in the SMARTEES project.

A brief description of each case study has been included in the next section, to make this report a stand-alone document. A more detailed description of each cluster and case-study is provided in deliverable 3.1 (for a background of the profiles of social innovations “in action”⁶), and deliverable 3.4 (final report on “five models of social innovation”⁷).

2.1. Policy strategies implemented in cluster 1: ‘Holistic, shared and persistent mobility plans’

Case-study: Groningen (Netherlands)

Groningen is an old, compact city originating from the third century with around 200.000 inhabitants, including a student population of around 60.000. Since the early 1970’s the city planning has focused on facilitating cyclists and pedestrians in the city, and de-intensifying car-use in the city⁸. Whereas in the 1950’s and 1960’s the idea of planners was that all traffic passing through Groningen should be routed via the central market of the city, thereafter people increasingly started to realise that a growth of car traffic could have a negative impact on the living conditions in Groningen. Hence, in 1975 the city council, dominated by young left liberals, decided to work on the division of the inner city into four sectors, making it impossible to drive with your car directly from one sector into another.

This solution reduced the car traffic significantly, making cycling the safer and faster option. Despite many protests, in particular of many shopkeepers, in 1977 the plan was implemented. This traffic circulation plan served as a tipping point in the traffic management of the city: from a car-minded planning the management turned towards an integral perspective on traffic. This emphasized the importance of quality of life in the city and contributed to a mind-set that led to pedestrians and cyclists being provided with high quality infrastructure. The resulting favourable conditions benefited the further development and adaptation of infrastructure.

⁶ Caiati, G., Marta, F. & Quinti, G. (2019). Report on Profiles of Social Innovation “In Action” for Each Cluster. SMARTEES Deliverable 3.1; April 2019.

⁷ Caiati, G., Marta, F. & Quinti, G. (2019). Report on Five Models of Social Innovation. SMARTEES Deliverable 3.4; June 2019

⁸ For a 15-minute view of how the traffic system in Groningen works and how people experience this, check the following 15 minute Youtube film by Streetlabs: https://www.youtube.com/watch?v=fv38J7SKH_g&t=50s

Case-study: Zürich (Switzerland)

The story of the Zürich Mobility Strategy goes back to the 1970s. Until the 1970s, public spaces in Zürich were designed primarily to handle automobiles (a "car-friendly city" as symbol of progress). In the 60s and 70s the city administration developed two different projects for underground solutions for short distance public transport. Both projects were rejected in referendums. In fact, this vote against large investments in new technologies made clear that tax-payers wanted the existing surface public transport system working better and more efficiently instead of leaving surface to cars and adopt a two level (surface and underground) mobility system. In this regard, immediately after the second referendum (1973) a "people's initiative" was launched for projects to speed up trams and buses. As a matter of fact, this initiative marked a turning point in the development of the city and gave the important impulse that a majority of the population expressly agreed to a policy aimed at improving urban space for people, with a residential area very attractive decreasing traffic congestion through an improvement of surface public mobility. It is upon this impulse that the Zürich Mobility Strategy is rooted.

Since the beginning the main actor was (and still is) the Municipality. Many other actors are involved, such as Canton, transport enterprises, business community, car groups, bike groups, Quartierkonferenzen (networks of local associations), "street communities" and the scientific community. The governance of the mobility strategy is rooted on a very strong system of direct democracy characterized by the implementation of various referenda (promoted either by public local authorities or by citizens) and traditional consultations of citizens at the local level.

The "Holistic mobility" cluster focuses on the development of holistic and comprehensive mobility plans at the city-level pursuing a transformation of citizens' mobility patterns. We describe the policy tools in each of the four categories defined above.

Normative and regulatory tools. In both case-studies, the implementation of the social innovation required the approval of plans and regulations in order to alter travel model choice, foster pedestrian and bicycle use while limiting or disincentivising the use of private motorized options. Examples of prohibitions and penalization measures are restrictions for private traffic in the city and parking policy regulations that limit the number of parking spaces. For example, in Groningen the "Traffic Circulation Plan" approved in 1977 divided the inner city into four sectors, confined by physical barriers or signs that cannot be crossed by the cars, making it impossible to drive with car directly from one sector into another. In both cases, normative and regulatory tools reduced the car traffic significantly, making cycling the safer and faster option. This type of measures was sometimes complemented with a few **financial incentives** such as tax reductions for parking outside the city centre (Groningen) or subsidies schemes for the purchase of electric vehicles (Zürich).

Infrastructure and technology upgrade measures. In both cases, efforts focus on creating new infrastructures for sustainable transportation such as cycling, the improvement of public transport system (e.g. hybrid or electric public transport) and removing existing barriers for pedestrians and cyclists. For example, in Groningen, measures such as narrowing streets for cars and thereby leaving more room to bicyclists or pedestrians were taken. Shared spaces were introduced in many areas in order to give more rights to the non-motorized traffic. Biking highways are being currently developed to support e-bikers at a commuting range to 25km.

In Zürich, the strong improvement of public transport involved the increasing of the number of lines and their length (including a suburban railroad network), enhancing their reliability and quality (frequency, speed, good connections, WiFi availability, simplified tariff and ticket structures, effective claim system, etc.), enlarging the train stations, etc.. Moreover, bike lanes were extended (and on-street parking spaces reduced) and the city council promoted car sharing and bike sharing services.

Citizen empowerment policies. Both cities have implemented a combination of a variety of policy instruments among which citizen participation has contributed to the adoption of the social innovation. In Zürich, the mobility culture has been addressed over 30 years. In general, the city of Zürich and all the other local planning authorities try to engage stakeholders and do engage them in formal and informal fora as much as they can. Before the final decisions are taken, there normally is a formal request for comments where most of the formal actors get a chance to be involved (e.g. the Quartierkonferenzen in each of the 12 sub-areas of Zürich are always asked formally to comment and cooperate with the local authorities).

Traditional tools of direct democracy in Zürich

The city of Zürich and all the other local planning authorities try to engage stakeholders and do engage them in formal and informal fora as much as they can. The referendum is generally the conclusion of a process. Before the final decisions are taken, there normally is a formal request for comments where most of the formal actors get a chance to be involved; for example, there are Quartierkonferenzen (networks of local associations) in each of the 12 sub-areas of Zürich, and these networks of associations are always asked formally to comment and cooperate with the local authorities.

Some lessons of Zürich initiative are: (a) Proceed gradually, step by step, avoiding too fast and too big changes in a short time, avoiding almost always radical measures. (b) Negotiate constantly with citizens or specific groups (e.g., the representatives of the main important business groups) on specific measures. (c) Adopt targeted policies (e.g., with contact persons for mobility consultations in large companies). (d) Give priority to “pull” measures (such as intensive improvement of public transport or the set-up of bike lanes) over “push” measures, which have however been implemented, but with less emphasis (such as the increase of the parking price). Big changes in citizens’ mobility behaviours towards new behaviours much more pro-environment are well documented (despite some resistances).

In Groningen, different instances of **citizen consultation** and referenda have been adopted over time. While at the beginning citizens were not involved in decision-making (and large contestation arised from shopkeepers and groups of interests), in the following steps (especially since the 1990s) inhabitants were engaged in referenda and local consultations regarding different sustainable mobility measures (e.g. the closure of the Noorderplantsoen park for car traffic for a test period of a year and the following referendum by which citizens voted for or against a permanent closure of the park for car traffic). More recently, ‘Neighbourhood Councils’ have been created, which are a new formal entity under development aimed at further fostering the communication between the citizens and municipality (Groningen).

The closure Noorderplantsoen park for car traffic in Groningen

One of the interesting further developments was the closure of the Noorderplantsoen park for car traffic. The Noorderplantsoen is a remainder of the city defence works, which has been developed into a park following the architecture of an English garden style, characterized by meandering paths and serpentine ponds, inspired by wild nature. The traffic situation in the park became more problematic over the years. In particular, sharing of the road by cars and cyclists turned out to be unsafe. Moreover, quality of the park decreased due to NO_x, small particles and sound emissions, and a lower safety, especially for playing children. The situation brought the local population and policy-makers together in organising a referendum on closing the Noorderplantsoen for car traffic. Part of this project was a test period of a year (1993), where the park was closed for cars. After a year, during which the population could experience the impacts of the interventions on their lives, a referendum was organised. The local population could either vote for or against a permanent closure of Noorderplantsoen for car traffic. On 5th of October 1994, a majority vote of 50.9% decided in favour of a permanent closure. Following this outcome, vivid discussions emerged on the plans associated with the closure. The municipality organised a broad discussion that served as a platform for colliding interests of different groups. One interest group defended the ecological value of the park, as the Noorderplantsoen hosts monumental trees, shrubs, wild and semi-wild plants, birds, bats, butterflies and mushrooms. Organizers of cultural events emphasized the cultural value of the park, proposing a flexible, open roof construction on the playground for stage activities for an audience of around 500 people. The residents were mainly interested in the use of the park for leisure. These three different groups engaged in discussion with the municipality, and neighbourhood organizations contributed to achieving an acceptable balance.

In terms of **monitoring and evaluation**, the municipality of Zürich elaborates periodic reports assessing the impact of the implemented activities in terms of use of transports and behavioural changes, as well as conduct periodic surveys about citizen satisfaction with public transport and mobility facilities.

CASE-STUDY: HOLISTIC, SHARED AND PERSISTENT MOBILITY PLAN: ZÜRICH		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	Urban Traffic Programme - "Stadtverkehr 2025"
	Obligation schemes	Low-speed zones in residential areas – 20/30 km/h max Car circulation prohibition in some streets
	Penalization measures	Increase of the parking prices in the city
Infrastructure and technology upgrade measures	Public and private infrastructures and services	Enlargement and modernization of sustainable public transport network (WiFi availability, simplified tariff and ticket structures, effective claim system, etc.) Diffusion of electric cars

		Increasing of car sharing and bike sharing services
	Technological innovations	Traffic lights programmed to give way to public transport vehicles (through a sensor system). A central control room was created for the management of the public traffic in real time.
Consumer awareness, decision-aid, & empowerment policies	Information and education campaigns	Marketing and sustainable mobility measures targeting public transport users and citizens (e.g. mobility education for children)
	Participatory approaches	Direct democracy system: Implementation of various referenda (promoted either by public local authorities or by citizens) and traditional consultations of citizens at the local level Consultations at the street level. The municipality negotiates constantly with citizens or specific groups (e.g. business groups) on specific measures
	Monitoring/evaluation	Continuous/periodic monitoring and evaluation activities (including surveys to users). Periodic reports of implemented activities and of outcomes regarding behavioural changes

Table 3. Overview of policy instruments and measures implemented in Zürich case-study

CASE-STUDY: HOLISTIC, SHARED AND PERSISTENT MOBILITY PLAN: ZÜRICH		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	Traffic Circulation Plan (TCP – 1977)
	Obligation schemes	Strict parking regime (e.g. only the inhabitants are capable of parking their cars in their own neighbourhood) Permanent closure of Noorderplantsoen for car traffic
Infrastructure and technology upgrade measures	Public and private infrastructures and services	Construction of new cycle paths inside and outside the city of Groningen 10,000 parking places for bikes near the main train station Improvement of public transport Park and ride facilities in the outskirts for car users coming from out of town to park their car and take a transfer bus directly into the old town

		Different rental systems, such as the OV-fiets that connects rental bikes with train travelling, and the SwapBike for hiring a bike for longer periods of time
	Technological innovations	A rain sensor has been connected with some traffic lights to prioritise bikes when it rains. Biking parking-lots with an electronic system monitoring free space
Financial incentives for the market and individuals	Financial support (Subsidies, grants, contests, awards)	Reduced parking taxes outside the town
Consumer awareness, decision-aid & empowerment policies	Information and education campaigns	Direct communication with the citizens since the beginning in the neighbourhoods of the city. Social media used to inform and communicate with citizens
	Participatory approaches	Citizens and shopkeepers/entrepreneurs were involved in planning processes in later stages of the social innovation.
	Monitoring/evaluation	Evaluation of the Plan; specific measures were (and are) carefully monitored. Periodic citizen satisfaction surveys

Table 4. Overview of policy instruments and measures implemented in Groningen case-study

2.2. Policy strategies implemented in cluster 2: ‘Island renaissance based on renewable energy production’

Case-study: Samsø (Denmark)

The case of Energy Island Samsø started in 1997 with an attitude critical to the dependence of the islands on energy supply from the mainland. Growing criticism of some aspects of the quality of life proposed by contemporary society and the idea of promoting a new relationship with the environment was prominent at the start of the project. This was connected with strong islander identities of the inhabitants, but also an economic threat of deteriorating job opportunities. The values of sustainability and respect for the environment were (and are) crucial and were already starting to develop before the project was implemented. At the same time, inhabitants were strongly identified with living on “their” island which was also connected to a specific way of handling obstacles. A participatory approach was adopted since the initial conception of the project. Despite citizens’ involvement was limited at the beginning, the promoters aiming at involving citizens right from the start.

In Samsø, 11 land-based wind turbines and 10 offshore wind turbines, and a 2500 m² solar panel system have been built and made operational; the use of biofuels by farmers has been promoted. The 100% of the island's electricity currently comes from wind power, with surplus electricity exported to the mainland grid, and 75% of its heat comes from local solar power and biomass. Renovation of 200 homes has increased efficiency and energy savings; and some passive buildings

such as the Energy Academy have been built. Denmark's Renewable Energy Island Samsø is a role model (i.e., making Samsø's experiences applicable to other contexts in a simple form), a frontrunner and signpost for the energy transitions to come. The project has received intercontinental recognition from Japan to EU institutions, from the White House to Danish 'Climate Municipalities'.

Case-study: El Hierro (Spain)

El Hierro 100% renewable energies" is the energy project launched by El Hierro Island (Canary Islands) pursuing the sustainable development of the island based on the production and management of renewable energy (Sustainable Development Plan, 1997). This energy innovation, promoted by the local authority (the Cabildo de El Hierro), started as a technological innovation in renewable energies aiming at becoming a self-sufficient territory based on renewable sources, taking the advantage of the geographic characteristics of this volcanic island (2002). El Hierro developed a Wind Pumped Hydro Power Station with the aim of making this island the first capable of self-supplying electrical energy (inaugurated in 2015). It consists of five wind turbines capable of producing 11.5 megawatts of wind power to supply electricity for approximately 11,000 residents, an additional number of tourists, and three water desalination facilities. The Cabildo of El Hierro managed to get sufficient financial (mostly provided by regional and national administrations) and human resources to build the energy installation. They created a new energy company, "Gorona del Viento SA" (founded in 2004), which is a public-private enterprise owned by the local government (Gorona del Viento Board of Directors is chaired by the president of the Cabildo de El Hierro) with the partnership of the regional government, the Technological Institute of the Canary Islands (ITC) and private energy company operating on the isle (Endesa).

In terms of outcomes, the main impact concerns to the reduction of CO2 emissions as a consequence of the reduction on consumption of fossil energies in the island energy production system. The project also guarantees the electricity and water self-sufficiency on the island, reducing the vulnerability of the islanders. In 2018, El Hierro achieved the milestone of supplying the 97% of energy demand by renewable sources during the month of July. Besides, a change in energy-saving behaviours has been achieved in households as a result of environmental education initiatives as well as subsidies granted to the residents aimed to support residents' renewable self-consumption facilities or purchasing electric cars and e-bikes. Support from the islanders has increased due to the plant has become a key element in the economic development of the isle, attracting sustainable and scientific tourism and gaining international reputation.

An important characteristic of this cluster is that each of the cases is an example of changing not only the ways of consuming but also of producing and managing energy.

Infrastructure and technology upgrade measures. The ambition of this cluster is to build a fully renewable energy systems aiming at becoming self-sufficient territories. In this endeavour, the promoters of both initiatives engaged in the implementation of renewable energy infrastructures able to supply the electric needs of the island, with a significant component of technological innovation. While El Hierro was able to obtain most of the financial investment from external sources (e.g. national funds), in Samsø there were no local extra incentives from the public sector, which makes the Samsø initiative self-sustainable. Samsø demonstrated that a social innovation can be supported without any public subsidies.

Consumer awareness, decision-aid, & empowerment measures. Environmental education activities as well as impact monitoring and assessment of the outcomes of installing renewable

energy plants are measures adopted in both cases. Furthermore, strategies to promote **citizen empowerment** have been strategic in the Samsø case, due to its bottom-up approach to renewable energy transition and the community leadership of the project. The Samsø case has generated a **public/private alliance** in the management of the whole project in all its aspects (including its citizen funded models). The promoters developed participatory workshops explaining the aims of project and involving citizens in the design, implementation and the **co-ownership of innovative energy business models**. Various professional groups such as farmers (in part initially hostile), environmentalist groups and citizens were progressively involved (in financing and other decision-making). The Samsø experience has been capitalized through the set-up of the **Samsø Energy Academy**, which involves businesses and the scientific community. The Academy has been hosting researchers and students studying renewable energies, organizing conferences, managing a show centre, providing consultancy and organizing meetings between research and business people.

In El Hierro, **information and environmental education campaigns**, as well as guided visits to the energy plant have been organized in order for islanders and visitors to gain knowledge on the energy innovation. Notwithstanding the information facilitated about the project ‘El Hierro 100% renewable energies’, a sector of residents and stakeholders criticized the low performance of the plant or the lack of direct impact on their economies (e.g. they do not observe a reduction in the energy bill). In terms of citizens’ engagement and ownership, Gorona del Viento was conceived as an institutional project from the start, although the involvement of different public and private actors has progressively increased along time. At the current stage of the project, the promoters plan to increase the participation of the islanders in energy self-consumption by providing them information and subsidies for installation of renewable energy facilities, as explained below.

Financial incentives for individuals and business. El Hierro Council has recently launched a series of financial incentives aiming at the engagement of the population in self-consumption behaviour. For instance, with the benefits of the plant, the island government granted farmers, hotels and other business sectors funding to install solar panels. The benefits of the plant provide also the Cabildo with funds for the development of sustainable mobility programs, with the installation of electricity charging points across the island, giving subsidies to residents for purchasing e-cars and improving energy efficiency in disadvantaged homes.

Normative and regulatory tools are relevant in El Hierro. The government of the isle has approved in 1996 the El Hierro Sustainable Development Plan that is considered by the promoters as the instrument that paved the way for the development of the social innovations. Also, the constitution of the Public-private energy company "Gorona del Viento SA" provided the legal status to the project to be launched as an energy production installation operating under the supervision of the Spanish energy regulator.

CASE-STUDY: ISLAND RENAISSANCE BASED ON RENEWABLE ENERGY PRODUCTION: SAMSØ		
Policy instrument	Types of policy measures/interventions	Examples of policy measures

Infrastructure and technology upgrade measures	Technological innovations	11 land-based wind turbines and 10 offshore wind turbines, and a 2500 m2 solar panel system built and made operational 3 new district (10 villages) heating plants, 2 of which straw-fired and one powered by woodchips and solar panels (2500 m2 solar panel system). A district heating system developed in several areas of the island
Consumer awareness, decision-aid, & empowerment policies	Information and education campaigns	Set-up of the Energy Academy (2007)
	Consumer empowerment initiatives	Development of a new business model involving public-private-citizens co-ownership in new energy technologies Governance configuration as a “democratic foundation of the project” characterizing its ownership
	Participatory approaches	“Kitchen meetings” (private ‘meeting technology’ held on friendly terms between the project developers and islanders) “Café Good Energy” (informal meetings having the purpose of creating an open space for discovering the Samsø citizens’ common vision for energy)
	Monitoring/evaluation	Continuous self-evaluation as a fundamental element generating a self-creativity and a continuously developing project on Samsø

Table 5. Overview of policy instruments and measures implemented in Samsø case-study

CASE-STUDY: ISLAND RENAISSANCE BASED ON RENEWABLE ENERGY PRODUCTION: EL HIERRO		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	El Hierro Sustainable Development Plan (1996) El Hierro Sustainable Transport Plan (2011) Public-private partnership to create "Gorona del Viento SA" renewable energy plant
Infrastructure and technology upgrade measures	Public and private infrastructures and technological innovations	Wind Pumped Hydro Power Station on the island of El Hierro. It consists of five wind turbines capable of producing 11.5 megawatts of wind power to supply electricity for approximately 11,000 residents, an additional number of tourists, and three water desalination facilities

		Installation of electricity charging points to meet the demand of existing electric vehicles
Financial incentives for the market and individuals	Financial support (Subsidies, grants, contests, awards)	<p>Subsidies for low-income households' exchange of old home appliances (e.g. fridges) for efficient ones</p> <p>Subsidies for residents that want to change their regular car for an electric car (subsidies are up to 7.000€)</p> <p>Financial support for renewable energy self-consumption facilities (e.g. solar panels) in farms, businesses and buildings</p>
Consumer awareness, decision-aid, & empowerment policies	Information and education campaigns	<p>Informative material and dissemination of news in local media, excursions with schools and associations for the elderly, specialized days with participation of social and cultural representatives of the Island, etc.</p> <p>The plant organizes "open doors days" inviting citizens to visit the plant and see by themselves the dimension of the project and according to the promoters</p> <p>Energy-saving education activities. E.g. Distribution of 4,200 low-energy light bulbs with LED technology among the island's school population</p> <p>Training programmes: agreements with more than 20 Spanish and European educational institutions to become a training institution for students and researchers</p>
	Monitoring/evaluation	Periodic information about the performance of the energy plant and the fulfillment of the objective of becoming a 100% renewable island

Table 6. Overview of policy instruments and measures implemented in El Hierro case-study

2.3. Policy strategies implemented in cluster 3: ‘Alliance for a district regeneration based on energy transitions’

Case-study: Malmö (Sweden)

The district regeneration in Malmö, primarily the area of Augustenborg, and secondarily the area of Hilda, features multiple district-wide projects focused on sustainability and local involvements while improving the quality of life and fostering social cohesion in the area. Notwithstanding the environmental values were not part of the renovation plan at the very beginning they were included (in the framework of a sustainability perspective) at the early stage as pivotal for the project. A holistic perspective (toward sustainability) was adopted, including building insulation, mobility, renewable energy generation and the modification of energy-related behaviours. The Augustenborg project did not foresee renewable production in the beginning but now produces solar energy and small-scale wind, and a pilot project of production of biogas from food waste has started.

In the cluster of Energy efficiency in district regeneration, the main change in governance configuration is the switch from a governance system based only on formal partnership between different institutional stakeholders (e.g., the municipality and the public local housing company), to a model of extended and informal partnership involving a wider set of actors: universities, schools, citizens groups, individuals, local businesses, etc. The extension of the governance system to such actors was a long-lasting and progressive process. The project was based on a participative and inclusive approach, based on resident involvement in providing suggestions on the foreseen activities. This involvement was planned from the beginning from officials, and although it had some initial struggles, was eventually considered a success. Ekostaden Augustenborg shows how relatively small amounts of policy funds can be used to initiate much greater actions toward green building. It also reflects the fact that these modernist apartments’ blocks are part of a stock of literally millions of apartments of the same type which must be renovated all around Europe to reach the European long-term goals for energy efficiency (200 million Europeans are currently living in similar 60s and 70s building stock). This will be a great inspiration, in particular, for other cities in the colder, northern climate zone.

Case-study: Stockholm (Sweden)

The social innovation process in Skärholmen is part of the Stockholm city case. Similar to the other cases on this cluster, the social innovation in Skärholmen refers to the regeneration process of two districts built between the 60s and the 70s in the Swedish “Million homes program”. In the following decades, as a consequence of de-industrialization processes and of the welfare state crisis, Skärholmen were affected by high rates of unemployment and criminality and has always been characterized by a high presence of immigrants (mostly from African and Asian countries). From a technical perspective, Skärholmen was also characterized by low energy efficiency of buildings, and by an urgent need of building renovation.

The main focus was the improvement of the quality of life and fostering social cohesion in the area. A holistic perspective was adopted, including building insulation, mobility, renewable energy generation and the modification of energy-related behaviours. One of the core measures was the refurbishment of the buildings to increase their energy efficiency through the insulation of walls and roofs, as well as a series of awareness-raising and training programs for reducing the residents’ energy consumptions have been carried out. A common feature of this cluster is related to the promoters of the social innovation. In Skärholmen the district renovation was promoted by the city administration jointly with the local public housing company. The project was based on a

participative and inclusive approach, based on resident involvement in providing suggestions on the foreseen activities. The participatory feature of the project was adopted to cope with the emergence of the strong opposition of the residents to the original plan. A set of other actors joined the project during its implementation, as promoters of other related small projects, side events, and initiatives, or taking the lead of part of the project. In this sense, it can be stressed how the group of promoters was extended during the development of the social innovation.

The general ambition of this cluster is to foster public-private-citizen partnerships triggering district regeneration. This social innovation targets sustainable energy systems in districts as well as pursues the social and economic development of deprived communities (tackling energy poverty). A combination of **infrastructural and technological policies, regulatory measures** and high levels of **citizen involvement** have been implemented in both Malmö and Stockholm:

Infrastructure and technology upgrade measures (aiming at improving people's quality of life and fostering social cohesion in the area). District regeneration cases foster the improvement of energy efficiency in buildings, usually implementing local energy production models that might involve the resident's ownership of the energy facilities. These infrastructural measures are also combined with the improvement of public spaces in the neighbourhood, such as the creation of green infrastructures and nature-based solutions to increase the neighbourhood's quality of life (e.g. organic food gardens). Furthermore, the improvement of public transport systems and cycling infrastructures facilitate sustainable mobility and better connections to the city.

Normative and regulatory approaches. Malmö approved several regulations aiming to improve the environmental sustainability of the project. For example, the obligation for the inhabitants of the new building "Greenhouse Augustenborg" to plant organic food.

Consumer awareness, decision-aid and empowerment measures. Participatory approaches have been crucial for the successful implementation of both social innovations (aiming a deep involvement of citizens/societal actors in the decision-making process). This has involved the establishment of partnerships between public actors (e.g. municipality), private sector (e.g. housing companies), and residents. In the case of Malmö, residents and citizens were deeply involved -since the beginning- in the co-design of the social innovation, fostering citizens' empowerment through their engagement in the decision-making process. Interventions were largely discussed in advance with residents through the organization of public consultation actions, regular meetings and permanent working groups among promoters and residents, giving them the possibility to express their suggestions and observations in order to have the possibility to adjust and modify the plan. In terms of monitoring, in the Malmö case, residents assess their own CO2 footprint and work together to find ways of decreasing it.

Concerning the Stockholm case, after an initial period of serious confrontation between residents and authorities, citizens' participation was structured via the "Järva dialogue", a complex system of consultation and cooperation facilitated by working groups, open dialogue with experts and co-design activities. Interventions were discussed in advance with residents, giving them the possibility to provide and plans were subsequently adjusted. In certain cases, some aspects of the plan were co-designed by residents. In terms of **information and**

communication strategies, Samsø launched a communication strategy characterized by a strong culture sensitivity (due to the high presence of immigrants) through translating the published materials in the different languages spoken in the neighbourhoods. In Stockholm the social innovation involved cultural mediation that served the purpose of including the perspectives of different groups, including vulnerable ones such as immigrant women.

CASE-STUDY: ALLIANCE FOR A DISTRICT REGENERATION BASED ON ENERGY TRANSITIONS: MALMÖ (AUGUSTENBORG)		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Obligation schemes	Speed limits for cars in the area (30 km/h; 15 km/h in garden streets) The obligation for the inhabitants of the new building “Greenhouse Augustenborg” to plant organic food
Infrastructure and technology upgrade measures	Public and private infrastructures and services	Refurbishment of buildings to increase their energy efficiency through insulation of walls and roofs 450 m2 solar thermal plant and 100 m2 photovoltaic; school building has been equipped with solar collectors; etc. Pilot project of production of biogas from food waste Green infrastructures and nature-based solutions: New storm water drainage system was introduced and roof gardens were developed to prevent flooding in the area Green Line’s zero emission electric street train service New building “Greenhouse Augustenborg” (to plant organic food) Botanical roof garden Green spaces, garden streets
	Technological innovations	Encouragement of a local use of electric vehicles; Car-pooling among residents;
Financial incentives for the market and individuals	Financial support (Subsidies, grants, contests, awards)	Café summer partially subsidized breakfast/lunch for facilitating the socialization of low-income residents

Consumer awareness, decision-aid, & empowerment policies	Information and education campaigns	Awareness raising and training programs for reducing the residents' energy consumptions Communication initiatives characterized by a strong culture sensitivity (due to the high presence of immigrants) through translating the published materials in the different languages spoken in the neighbourhoods
	Consumer empowerment initiatives	Permanent working groups, dialogue with experts; women empowerment (e.g. talking in public) in particular for non-Swedish women
	Participatory approaches	Extensive and direct involvement of the residents in the decision-making process through extensive public consultation, regular meetings, and permanent working groups, dialogue with experts, informal gathering and co-design
	Monitoring/evaluation	Some residents have taken part in a programme to assess their CO2 footprint and then work together to find ways of decreasing it

Table 7. Overview of policy instruments and measures implemented in Malmö case-study

CASE-STUDY: ALLIANCE FOR A DISTRICT REGENERATION BASED ON ENERGY TRANSITIONS: STOCKHOLM (JÄRVA)		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Infrastructure and technology upgrade measures	Public and private infrastructures and services	<p>Refurbishment of the buildings to increase their energy efficiency through insulation of walls and roofs</p> <p>Instalment of photovoltaic panels on 40 roofs in the area (10,000 m2 photovoltaic – 1.4 MWp)</p> <p>Infrastructural interventions to support and prioritise cycling (and walking) in the area (introduction and extension of cycle paths, removing of obstacles, installation of street lights for bikes, new asphalt coating; etc.)</p> <p>Site-built and prefabricated technology for additional insulation of facades (the units have been tested for efficiency, flow ratios, tightness, and noise in fan rooms, space requirements and defrosting)</p>
Consumer awareness,	Information and education campaigns	Two-way communication privileging direct contacts and face-to-face interactions; communication

decision-aid, & empowerment policies		Initiatives characterized by a strong culture sensitivity (due to the high presence of immigrants) through leveraging on cultural mediator (the residence host in Järva); and taking into account different groups' perspectives, especially the one of immigrant women Collaborations with the library/school to ensure an environmental emphasis in education
	Consumer empowerment initiatives	Awareness raising and training programs for reducing the residents' energy consumptions Free bike courses for residents
	Participatory approaches	"Järva dialogue", working groups and dialogue with experts; Establishment of a climate week
	Monitoring/evaluation	Calculation model for greenhouse gas emissions (measurements have been carried out in 14 existing multi-family houses to evaluate different installations of heat recovery units)

Table 8. Overview of policy instruments and measures implemented in Stockholm case-study

2.4. Policy strategies implemented in cluster 4: 'Urban mobility with superblocks'

Case-study: Vitoria-Gasteiz (Spain)

In Vitoria-Gasteiz, the Superblocks Model has been defined in the 'Sustainability Mobility and Public Space Plan' (2008) elaborated by the Council of Vitoria-Gasteiz, in the design of which different actors were involved, such as other municipal areas and public administrations as well as politicians and stakeholders signing the 'Citizens' Pact for Sustainable Mobility' (2007) or local associations and individuals forming part of the 'Sustainable Mobility Forum'. Besides, a series of participatory meetings with residents and neighbourhood associations facilitate information and citizens' participation in the designing of the plan. Despite the resistance and protest received from the retail sector and business allocated in the affected areas (new superblocks areas with restricted car circulation), the political consensus guaranteed that the superblocks plan was implemented and sustained over time.

Two superblocks have been fully completed and 19 superblocks have been partially implemented and three more interventions are planned in 2019-2020. In the last decade, the evaluation and assessment of the plan reports the positive impact of mobility policies on the environmental quality of the city due to the relevant decrease in the use of the private cars and the increase of sustainable transportation inside the city (public transport, bicycle, walking). Besides, superblocks have become calm areas for spare, shopping or sports and population claim the extension of the plan to new areas of the city.

Case-study: Barcelona (Spain)

This social innovation is based on the urban redistribution of space in superblocks, small areas in neighbourhoods designed to maximize public space and keep private cars and public transport outside of the neighbourhoods, redesigning the inner streets for use by pedestrians. Superblocks introduce low-carbon mobility practices as well as allow (new) social uses of the free-car public space. Through the *Urban Mobility Plan*, Barcelona city is planned to be organised into 503 superblocks, as approved in the 'Let's fill the streets with life' superblock programme (2016). The plan is being implemented by the Municipality of Barcelona, which formed a technical secretariat (promoter) to lead the programme, receiving also technical support from other municipal areas. Other actors involved are: 1) supra-municipal public administrations, 2) district (political) councils, 3) local politicians and 4) neighbourhood stakeholders, residents' associations, specific groups of interests, district NGOs and third-sector entities (local politicians and stakeholders act as both supporters or opponents to the superblocks programme). Although, only five superblocks have been fully or partially implemented so far, some positive outcomes have been measured in the pilot interventions: improvement of environmental and public space conditions, increase of green areas, enhancement of social activity and social interaction in the neighbourhood.

Superblocks in Barcelona have received social support and social acceptance in certain areas (e.g. Sant Antoni, Horta) but also high levels of protests and contestation in others (e.g. pilot superblock in Poblenou) that have been reduced overtime. Social contestation was motivated by the lack of information and lack of social participation before starting the urban interventions. Changes in the pilot project were made after, following the suggestions of residents and the citizens' associations in the area. In the following superblocks, the city council promoters designed a participatory process engaging a wide representation of residents and groups of interests in the area that co-designed the superblock "Action Plan" for a period of almost 1 year. The Action Plan is also introduced in advanced to the affected population and suggestions from residents and stakeholders are included.

The goal of the superblock cluster is to re-organize mobility in small areas of the city – so-called superblocks – in which motorized traffic is restricted to main roads while the interior of the superblocks (with limited traffic) is dedicated to new uses such as sports, children playgrounds, new green areas etc., increasing residents' quality of life and social cohesion.

Normative and regulatory approaches. In both cases, innovative interventions have been set up through strategies and policy plans such as the Sustainable Urban Mobility and Public Space Plan (Vitoria-Gasteiz) or the Superblocks Programme "Let's fill streets with life. Establishing Superblocks" (Barcelona). Both cities also launched public commitment initiatives like the Vitoria-Gasteiz Citizens' Pact for Sustainable Mobility' or the "Barcelona Mobility Pact" signed by the City Council and a diversity of stakeholders and local actors such as mobility-linked associations, companies, institutions, and public bodies to launch mobility initiatives and reaching consensus on improving the sustainable and safety mobility. Moreover, specific policy plans have been approved in both cities to enhance sustainable and active mobility. Superblocks also rely on regulations of urban mobility, by restricting the use of private cars in superblocks or by using traffic restrictions or prohibitions (e.g. do not allow to car circulation inside superblocks) that, in Vitoria-Gasteiz are accompanied by taxes measures (e.g. car parking).

Infrastructure and technology upgrade measures. Infrastructural interventions (structural and tactical urbanism) are fundamental in terms of transforming public spaces dedicated to car use into new social and green spaces (green infrastructures and nature-based solutions), increasing also the level of walkability of the area and incentivising pedestrian and bicycle

traffic. The improvement of public transport services, bike lines and actions fostering the connectivity of the city are infrastructural and technological measures adopted in Barcelona and Vitoria-Gasteiz.

Consumer awareness, decision-aid and empowerment measures. Dissemination and information policies related to sustainable mobility have been fostered in both Barcelona and Vitoria-Gasteiz. In Vitoria-Gasteiz, a number of communication strategies were defined by the City Council for gaining social support and changing citizens’ patterns of mobility behaviour. First, under the claim “I join. It’s worth it!”, a communication and behavioural change campaign was launched inviting the citizens to participate in the plan. This campaign included advertising in newspapers, bus shelters, radio and Internet. Besides, an “ambassador group” was formed, consisting of volunteers from the Vitoria-Gasteiz City Council, the Environmental Studies Centre as well as students from the University of the Basque Country. The city council has organized a series of environmental education activities to raise awareness on mobility and the sustainable use of transport, as the “European Car Free Day” (since 2000) or the “European Mobility Week”. Bike driving courses in schools focused on increasing youth population competences for cycling on streets and interurban roads.

Participatory approaches seem to be relevant when the superblocks programme is launched in a new area of the city. For example, Barcelona launches participatory processes with the purpose of involving local residents and businesses in the co-design of the superblock, and establishing a “promoting group” of stakeholders involved in the definition of the actions and measures of the “Superblock Action Plan”. The process consists of three phases: a) Preliminary stage. Presentation of the superblock to the neighbourhood; b) Definition and drafting: from examination to Action Plan; c) Projects and implementations of the action plan (mainly infrastructural and tactical measures, prohibitions and limitations to car circulations). In Vitoria-Gasteiz, a specific participatory body, the Sustainable Mobility Forum engaged public and private actors, experts and individuals in the co-designing of the Sustainability Mobility and Public Space Plan. Furthermore, a series of participatory meetings with residents and neighbourhood associations facilitate citizens’ participation in the designing of the Plan.

In terms of **monitoring and evaluation**, both cases have implemented procedures to assess the outcomes of the plan. Vitoria-Gasteiz publishes impact reports of the Sustainability Mobility Plan at the city level and conducts periodic surveys measuring citizens’ patterns of mobility and satisfaction with public transport and mobility facilities. Barcelona assesses the impact at the superblock level, developing a system of indicators to measure the results in terms of public space, green areas, environmental quality, and citizens’ perception of health impacts.

CASE-STUDY: URBAN MOBILITY WITH SUPERBLOCKS: VITORIA-GASTEIZ		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	Public commitments: ‘Citizens’ Pact for Sustainable Mobility’ (2007) Sustainable Urban Mobility and Public Space Plan

		<p>The update of the Municipal Ordinance of Traffic and Circulation restricting motorized traffic inside the superblocks (with exceptions)</p> <p>Drafting of the Ordinance of Cyclist Mobility</p> <p>Drafting of the Special Plan of Cycling Lanes</p>
	Obligation schemes	<p>Low-speed zones in superblock areas</p> <p>Car circulation prohibition in some streets inside the superblock</p>
	Penalization measures	Increase of the parking prices in the superblocks
Infrastructure and technology upgrade measures	Public and private infrastructures and services	<p>Infrastructural and tactical urbanism measures in superblocks restricting car mobility or speed limits providing safer roads for bikes and pedestrians</p> <p>New green areas in superblocks</p> <p>New tramway lines and renovation of the city's public transport system</p> <p>Main cyclist mobility network</p> <p>Increase the offer of bicycle parking in the public streets as well as commercial areas, public institutions, industries and other private activities</p>
	Technological innovations	<p>Information System for the management of the infrastructures of cyclist mobility</p> <p>Design and development of the computer application for managing the bicycle registration system</p>
Consumer awareness, decision-aid, & empowerment policies	Information and education campaigns	<p>Campaigns related to the bicycle: "Bicycles are for all year"; Vitoria-Gasteiz bicycle week; photography competition "Vitoria-Gasteiz, the bike and you"; bike campus campaign</p> <p>Communication of the new regulation regarding the use of bicycle</p>
	Consumer empowerment initiatives	<p>Courses for the use and maintenance of urban bicycles.</p> <p>Road safety education campaign in school centres</p>
	Participatory approaches	<p>Public participatory bodies: 'Sustainable Mobility Forum'</p> <p>Participatory processes before the implementation of the Sustainability Mobility and Public Space plan, aiming at neighbourhood and residents</p>

		<p>participation in the design of the measures adopted in the plan</p> <p>Ongoing participatory process about the revision of the Sustainability Mobility and Public Space plan (2019)</p>
	Monitoring/ evaluation	<p>Elaboration of 'Evaluation report of the Sustainable Mobility and Public Space Plan and the Master Plan for Cyclist Mobility of Vitoria-Gasteiz. 2006-2016'</p> <p>Municipal survey on mobility patterns (panels and telephone survey conducted every 4 years)</p> <p>Elaboration of the report on the status of cyclist mobility</p> <p>Annual revision of the Cyclist Master Plan</p>

Table 9. Overview of policy instruments and measures implemented in Vitoria-Gasteiz case-study

CASE-STUDY: URBAN MOBILITY WITH SUPERBLOCKS: BARCELONA		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	<p>Public commitments: The "Barcelona Mobility Pact"</p> <p>Council of Barcelona Government measure: "Let's fill streets with life. Establishing Superblocks in Barcelona" (2016).</p> <p>Barcelona Urban Mobility Plan for 2013-2018</p> <p>Barcelona Green and Biodiversity Plan for 2020</p>
	Obligation schemes	<p>Low-speed zones in superblock areas</p> <p>Car circulation prohibition in some streets inside the superblock</p>
Infrastructure and technology upgrade measures	Public and private infrastructures and services	<p>Infrastructural and tactical urbanism measures in superblocks restricting car mobility, prioritizing active mobility and public areas for pedestrians</p> <p>Modification of public transport services related to the mobility inside superblocks and increase connections between superblocks and other areas of the cities</p> <p>Enlargement of the cyclist mobility network across the city</p> <p>E-bike programs and increase the offer of public bicycles in the city</p>

		Green infrastructures in superblocks
Consumer awareness, decision-aid, & empowerment policies	Participatory approaches	New model of organizing the general public's participation, pursuing the “co-responsibility” of residents in the co-designing of the superblock in each area and the definition of the Action Plan.
	Monitoring/evaluation	Ad-hoc assessment tools with a system of indicators for the impact assessment grouped in five domains: Habitability, Mobility, Green spaces and biodiversity, Economic activity, and Demography A specific study is being conducted by the Barcelona Health Agency to measure the impact of the superblocks on beneficiaries and neighbours’ health

Table 10. Overview of policy instruments and measures implemented in Barcelona case-study

2.5. Policy strategies implemented in cluster 5: ‘Energy efficiency and fuel poverty’

Case-study: Aberdeen (Scotland, UK)

This social innovation is concerned with the development of Aberdeen’s heat network and associated household energy efficiency schemes in the city. This is a ‘live’ case in that the case-study research is taking place at the same time as the planning of a new phase of heat network development in Torry, one of Aberdeen’s more deprived neighbourhoods. The Aberdeen case-study explores the development of district heating at a city-scale, within a context in the UK where heat networks are not a common domestic energy source. Only 2% of the overall heat demand in the UK is met by heat networks (ADE, 2018). As such, growing the capacity for heat network development in the UK requires not only the uptake of existing technical solutions, but also significant social and political innovation to create supportive social, political and economic environments in which district heating infrastructure can be developed at the local level in line with national-level policy ambitions.

The primary driving ambition behind the inception of the Aberdeen Heat Network was to reduce fuel poverty in the city, particularly amongst tenants in high rise social housing blocks relying on inefficient electric heating systems (Hawkey & Webb, 2014; Scottish Futures Trust, 2015). Aberdeen City Council recognised that providing affordable warmth in these properties would help to ameliorate not only the economic deprivation of social housing tenants but also the deterioration of the housing stock due to damp, and the health problems of tenants exacerbated by a cold and damp living environment (Scottish Futures Trust, 2015). The continued development of the heat network and associated energy efficiency schemes over the past 15+ years has occurred within a political context marked not only by concerns over fuel poverty, but also by increasing policy ambitions at local, national and international levels around carbon reduction as part of a wider energy transition. As such, the initiative has been driven by the complementary objectives of addressing fuel poverty and improving the energy efficiency of the city’s housing stock (Webb, 2015; Hawkey & Webb, 2014).

Aberdeen City Council set up Aberdeen Heat and Power (AHP) in March 2002 to deliver the proposed district heating developments in the council’s high-rise housing stock. AHP was established as a not-

for-profit ESCo (energy services company) and is often referred to in the council as an 'arms-length organisation'. Initial loans to AHP for the construction of the first phase of heat network development were underwritten by Aberdeen City Council, which is reported to be an unusual occurrence for district heating financing in the UK context. The current phase of heat network development in Aberdeen centres on the Torry area, in which plans for an Energy from Waste (EfW) facility with associated district heat network serving neighbouring housing and public buildings are currently in development.

Case-study: Timisoara (Romania)

European statistics show that over 10% of the European Union population is confronted with the problem of energy poverty. Energy poverty is conceptualized as a situation where a consumer may not have access to energy supply services due to unsatisfactory material conditions. According to European statistics, Romania is the country with the highest risk of energy poverty, with around 40% of the population being at risk in 2015 (compared to other member states where this risk is around 24%). Romanian law defines "vulnerable customer" as a final customer belonging to a category of household customers who, because of their age, health or low income, are at risk of social exclusion". Unfortunately, Romania faces several failures in terms of national regulations and solutions associated with this issue. Actions such as reducing pollution and gas emissions, reducing energy costs for low-income people, financial solutions to support vulnerable consumers have not been able to lead to an increase in people's well-being related to energy issues.

The Timisoara case-study focuses on a live project led by the Municipality of Timișoara, which aims to alleviate fuel poverty in the area of Timisoara through an integrated program offering individualized household support to access energy efficiency improvements. The Municipality of Timișoara is committed to provide citizens' access to secure, sustainable and affordable energy, such as heating through the Local District Heating Company in order to guarantee a decent standard of living for residents. However, Timișoara has a significant number of buildings, built mainly from 1960 to 1990, with low thermal insulation. Energy efficiency improvements in existing buildings is essential not only for achieving national energy efficiency objectives in the medium term, but also for achieving the long-term objectives of the strategy on climate change and transition to a competitive low-carbon economy by 2050.

The Municipality of Timișoara has undertaken energy renovation works in privately owned buildings, consisting in the construction of the thermal envelopes (especially for the buildings constructed in the communist period). Among other measures, the Sustainable Energy Action Plan includes the future implementation of the following actions:

- Promoting the installation of solar panels in order to provide domestic hot water to south-facing homes/residential buildings, at a rate of 2% / year of all buildings with southern exposure in Timisoara Municipality;
- Promoting the installation of off-grid photovoltaic panels with power between 1 and 3 kW for electricity production, at a rate of 2.5% / year of buildings with southern exposure in Timisoara Municipality.
- Population awareness of the benefits of using the renewable energy through the promotion of responsible energy behaviours among young people and education programs on optimal temperature in households.

Cluster 5 aims to support local schemes that address energy efficiency, fight fuel poverty and energy inequality.

Normative and regulatory approaches. A number of normative tools have already been developed by the municipalities of Aberdeen and Timisoara, consisting of local strategies and plans to increase energy efficiency in deprived areas or households (e.g. "Powering Aberdeen: Aberdeen's Sustainable Energy Action Plan" or the "Sustainable Energy Action Plan 2014-2020 for Timisoara Municipality").

Infrastructure and technology upgrade measures. Most policies in this cluster are related to infrastructure and technology measures to improve building energy efficiency, such as the Aberdeen's large-scale domestic heat network developed at multi-storey blocks or the construction of the thermal envelopes in private residences in Timisoara (these works have reduced the energy consumption in by 65-70%, the thermal comfort increased significantly, and the indoor climate was improved). In October 2018, it has been decided to couple this program with actions fighting energy/fuel poverty/vulnerability in buildings.

Financial incentives for individual households. Infrastructural measures have been combined with **financial incentives** for residents (subsidies, grants). For instance, the 'Aberdeen Affordable Warmth Scheme' offers assistance and loans to owner occupiers paying 10% or more of their income on heating their home.

Consumer awareness, decision-aid and empowerment measures. Local policies in this cluster also focus on engaging the citizens in **consultation and decision-making** processes. For example, the Aberdeen city council has created a steering group formed by stakeholders from public, private and civil society sectors to guide the implementation of the Energy Action Plan, providing input from civil society actors. Partners in this fuel poverty project have identified community engagement as a critical element in the success of the project.

CASE-STUDY: COORDINATED, TAILORED AND INCLUSIVE ENERGY EFFICIENCY SCHEMES FOR FIGHTING FUEL POVERTY: ABERDEEN		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	Powering Aberdeen: Aberdeen's Sustainable Energy Action Plan (October 2016) Torry Draft Locality Plan 2017-27 Community Planning Aberdeen and Aberdeen City Council, 2017
Infrastructure and technology upgrade measures	Public and private infrastructures and services	First large-scale domestic heat network developed at multi-storey blocks at Stockethill Energy from Waste facility with associated district heat network serving neighbouring housing and public buildings
Financial incentives for the market and individuals	Financial support (Subsidies, grants, contests, awards)	The Aberdeen Affordable Warmth Scheme offers assistance and loans to owner-occupiers Scotland-wide support for energy efficiency improvement focus largely on private housing

Consumer awareness, decision-aid, & empowerment policies	Participatory approaches	Aberdeen’s Community Planning Partnership, in consultation with the local community, developed a Locality Plan 2017-2027 for the Torry area Multistakeholder participatory process: a steering group has been set up to guide the implementation of the Energy Action Plan

Table 11. Overview of policy instruments and measures implemented in Aberdeen case-study

CASE-STUDY: COORDINATED, TAILORED AND INCLUSIVE ENERGY EFFICIENCY SCHEMES FOR FIGHTING FUEL POVERTY: TIMISOARA		
Policy instrument	Types of policy measures/interventions	Examples of policy measures
Normative and regulatory approaches	Technical and regulatory documents	Sustainable Energy Action Plan 2014-2020 for Timisoara Municipality (“Planul de Acțiune pentru Energia Durabilă a Municipiului Timișoara”)
Infrastructure and technology upgrade measures	Public and private infrastructures and services	Energy renovation works in privately owned buildings: construction of the thermal envelopes. Specific actions fighting energy/fuel poverty/vulnerability in buildings inhabited by the citizens

Table 12. Overview of policy instruments and measures implemented in Timisoara case-study

2.6. Insights from the analysis of energy policies at the case-study level

In this chapter the policy instruments implemented in ten successful case-studies of social energy innovations have been analyzed, with the aim of identifying available policy options and combinations that can foster social innovations for energy transitions. As observed in most of the cases, **a combination of four types of policy approaches** has been adopted by the promoters of these social innovations: normative and regulatory instruments, supportive infrastructure and technological upgrades, financial incentives, and policies targeting better levels of environmental and health literacy, as well as citizen empowerment.

First, as the majority of the innovations are launched by local policy institutions, **normative and technical instruments** (such as strategic plans, programmes and local regulations) usually constitute the political and regulatory basis sustaining the social innovation. For example, different types of obligation schemes, taxes and penalization measures have been implemented in order to change people's mobility patterns in cities. However, these types of measures might be perceived as negative by specific groups of local actors, which led, in some cases, to instances of contestation and protest. Obtaining **political consensus** (regarding the normative and technical instruments adopted) among the different parties involved in the municipality has been crucial for some social innovations to cope with social contestation. Political consensus also guarantees the long-term continuity of the project, as the implementation of these type of projects frequently requires time and resource investment as well as political support.

Social energy innovations are also embedded in **institutional and legal contexts that might favour or limit their impact**. For example, a favourable context for renewable energy innovation projects has been reported in Denmark. The Danish government launched a national contest to "become Denmark's renewable energy island" that the isle of Samsø won in 1997. This contest was the starting point the social innovation development. In Romania, however, there is an absence of institutional coordination to tackle the energy poverty phenomenon, which has increased in intensity despite the fact that one of the five objectives of the Romanian Energy Strategy was "to reduce energy poverty and protect vulnerable customers".

Social energy innovations also involve a significant investment in **new infrastructures and technologies**. This has been observed in all clusters that, for example, focused their efforts on creating new infrastructures for sustainable transportation (holistic mobility, superblocks), renewable energy infrastructures able to supply the electricity needed (El Hierro, Samsø), or district heating systems (Aberdeen). Upgrading infrastructures and improving public services has also been an effective strategy to change consumption patterns. However, these measures work better if they are accompanied by good education and communication strategies, through measures targeting increases in people's competence to adopt the social innovation.

Financial incentives (tax benefits, tax exemptions and economic measures) are useful when innovations entail relatively high installation costs, as observed in Aberdeen or El Hierro, or the purchasing of particular technologies (e.g. electric vehicles). Although they are useful

incentives for switching to renewable energies or zero-emission modes of transportation, they are not present in all cases. Sometimes, such incentives already exist at national or regional level. For example, incentives to purchase energy efficient vehicles, aids for the installation of electric charging points or grants for the implementation of electric bicycle rental systems already exist in Sweden, Spain and other European countries. Even when they do exist at other levels, cases show that it is still useful to consider them at local scales, when possible, and especially when economic factors are identified as barriers to the capacity or willingness to adopt a social innovation.

Consumer awareness, decision-aid and empowerment measures have also been adopted in these social energy innovations. Common strategies in most of the SIs have been the development of **information and dissemination campaigns** that, for instance, provide information for citizens to identify and implement measures to reduce their energy demand or to change their patterns of behaviour. However, simple information provision seems to be insufficient. As many cases demonstrate, the engagement of citizens and communities in the co-design of public urban plans, policies and strategies are fundamental for an energy innovation to be accepted and endorsed by citizens. **Participatory approaches** have been adopted in most of the case-studies and public involvement has proven crucial to the successful development of the social innovation.

Public participation in the project was not always planned from the beginning but was developed as a strategy to deal with the emergence of strong opposition to the project by certain groups. The SMARTEES case-studies emphasize the importance of planning and implementing **consultation and participatory decision-making** processes in the development and implementation of particular energy-relevant interventions. These should be implemented from the first stages of development of the SI, engaging a wide representation of residents and interest groups in the definition of the project and the measures to be adopted. **Bottom-up approaches** represent, one of the main challenges in social innovation processes, due to fears of citizen contestation and rather top-down governance cultures, where consultation is limited to expressing agreement or disagreement with particular projects, and not seen as an ongoing process of collaboration and co-creation involving a wider set of actors and citizens.

Some cases occur within governance systems that have embedded consultation strategies, such as referenda. Zürich, for example, benefitted from traditional tools of referenda promoted by local institutions and inhabitants by which citizens voted for or against different measures to be adopted for improving the mobility in the city. The Groningen case is another successful example of the use of voting tools to involve citizens in decision-making. Both examples constitute successful experiences of citizen empowerment and involvement that might inspire future developments of consultation processes for energy transition policies.

Monitoring and evaluation strategies become useful tools that might increase citizens' support to a social energy innovation, especially if inhabitants are involved in the evaluation exercise (e.g. measuring energy consumption at households). Monitoring strategies involve periodic reports assessing the impact of the implemented measures and periodic surveys

assessing citizen satisfaction with the SI. The dissemination of the evaluation reports might be good instruments for increasing citizens' awareness and perception of collective efficacy in tackling environmental, health and energy poverty issues. If adequately fed into the policy process, they can lead to corrective measures to increase policy effectiveness.

The analysis of the policy strategies developed in the SMARTEES case studies show the general **absence of decision-aid policies** (e.g. consultation and advisory services to support consumers and reduce inequalities) that help citizens to introduce changes in their own behaviour. Only in a few cases **educational and training measures** have been adopted (e.g. cycling courses for children in Vitoria-Gasteiz), but more opportunities exist for this type of policies to be deployed. Additional **consumer empowerment initiatives**, such as the simplification of administrative, legal and technical requirements for the adoption of new energy technologies would be useful for social energy innovations to be implemented in new contexts.

2.7. Outcomes from the policy-scenario workshop “envisioning strategies for energy urban transitions”

Using the categorization of policy instruments presented above, a workshop with case representatives was organized during the SMARTEES second Annual General Assembly (25-27th June 2019), aiming at reflexively identifying lessons learned from their involvement with the social innovations. Participants were asked to reflect on three questions: 1) What are the most important lessons you draw from your experience?; 2) What kind of policy interventions would you like to test in the future?; 3) What policy strategies would you *like* to implement in your city, but it seems too challenging?. A synthesis of the main lessons is provided below.

The analysis of the policies and interventions that have been implemented at the case-study level shows the **preference for normative policies and infrastructural/technological measures** adopted by the policy actors. Structural changes are perceived as the basis of many energy innovations, but the process of implementation of such energy innovations also matters. As several case-study representatives pointed out in the policy scenario workshop conducted in A Coruña, implementing radical changes that might cause disruption or major discomfort should be avoided, and major **infrastructure changes should be performed gradually** in order to gain social acceptability.

Pilot interventions become effective strategies to demonstrate the positive impact of the social innovation and gain support for further replication and upscaling.

Another important lesson drawn is that the framing of the social innovation should emphasize health and social benefits, and not only environmental ones. For example, the superblock model was framed not only as targeting the emissions reductions and switching to sustainable patterns of mobility, but also as a way to reclaim public space for social uses. Promoters of energy efficiency projects in households emphasized other benefits of **energy saving projects**, such as employability, gender equality or social cohesion, etc. Participants also highlight the potential of **combining infrastructural, technological and financial measures** (e.g. incentives, subsidies) that might enhance the economic and social impacts of the social innovation.

Citizen engagement. Initially, government-led strategies were preferred in most of the cases, although different levels of negotiation or consultation with citizens and/or specific groups (stakeholders, beneficiaries) were adopted as the main strategy for gaining social support and dealing with contestation or conflict. However, policy strategies that foster consultation and citizen participation in decision-making and co-design from the planning stage seem to be more successful in terms of citizen's engagement in the social innovation. Consultation processes should be set up in such a way as to generate a sense of ownership of the process, which entails sufficient financial and temporal resources, knowledge of strategies to maintain participants' motivation as well as certain levels of flexibility from the promoters to accept residents' suggestions and preferences. Citizen endorsement is also influenced by contextual conditions, such as the lack of confidence in the expected outcomes of the energy project or distrust in the promoters or political actors involved in the social innovation.

Besides normative, infrastructure and financial conditions shaping energy-related social innovations, the success of particular social innovations is dependent upon the adoption of new behaviours. City representatives also stress the necessity of improving those **policies tackling behavioural resistance**. Among others, the lack of awareness, existing local or social norms, cultural conditions, social identity, symbolic beliefs, or the lack of a sense of efficacy have been observed in the case-studies as barriers to the adoption of new energy behaviours

3. Key elements of Social Innovations in energy transitions

We now turn to a brief review of the main factors influencing the emergence and consolidation of social innovations, their public acceptability, as well as citizen empowerment to both participate in the process of developing a particular social innovation, as well as adopt new energy behaviours. We also include a conceptual analysis of factors influencing replicability and transferability of social innovations in energy transitions, as well as a clarification of the concepts of energy justice and equality.

3.1. Drivers and barriers of social innovations in energy transitions

3.1.1. Factors influencing the emergence or consolidation of social innovations in the energy domain

The SMARTEES project aims to provide “a significant advance in the comprehension of the human dimension of energy transitions through social innovations, specifically on a set of behaviours that influence energy consumption patterns and, therefore, defining effective strategies of collective intervention to tackle energy issues at local and wider scales” (SMARTEES DoA). Considering the climate crisis, the rising of inequality and the multiple social and environmental challenges that Europe is facing, social innovation has become a useful response to complex and intertwined societal problems (Avelino et al., 2014). Significant social innovations in the energy domain have been found at the local and international level as drivers for low-carbon transitions, such as innovations in energy supply (Boonstra et al, 2015), energy community (Hewitt et. al, 2019), renewable energy grassroots networks (Elle et al, 2015), social innovations in low carbon mobility and inclusive transportation (Butzin, Rabadjieva & Emmert, 2017), sustainable co-housing movements (Picabea et al, 2016; Kunze & Philipp, 2016), as well as diverse manifestations of active participation in policy making processes (Moulaert, 2017). The recent developments on a theory of social innovations present significant insights on the barriers and drivers for social energy innovations that result of interest for the analysis conducted in the frame of the SMARTEES project.

In terms of the barriers and constraints affecting the acceptability of social innovations in the energy domain, Ooms and colleagues (2017) point to several contextual factors, such as the lack of public interest in energy, the dominance of the traditional actors in the energy market as well as to the lack of funding and investment as the principal difficulties for energy innovation initiatives to start or to be developed (ibid. pp.10-11). The political and normative context is extremely important for the successful implementation of social innovation projects. The regulatory frames or financial policies can have a large impact on the economic sustainability of these projects. For example, Danish grassroots energy initiatives encountered a big setback when the national government cancelled the funds to renewable initiatives (Elle et al., 2015). In Sweden, the lack of security for investors and the excessive bureaucracy led to a decline in wind power private investments (Hewitt, 2019). Thus, supportive legal frameworks that guarantee equal access to the energy system for new actors are fundamental for community energy projects to arise and mainstream (Elle et al, 2015). Legal and policy support (e.g. favourable regulations, economic incentives) facilitate technological innovation, investment, networking activities and the strengthening of social innovations in the energy

sector (Elle et al, 2015; Ooms, Huygen & Rhomberg, 2017) as well as for supporting inclusive and sustainable mobility (Butzin et al, 2017).

In their analysis of social innovations in the transport system, Butzin and colleagues (2017) stress that local political actors often play a relevant role in supporting local SI initiatives, but their impact can be limited whether they do not receive support at the national level, due to the lack of general awareness about the benefits of social innovations in mobility and transport (ibid. pp 32). Further, the lack of adequate infrastructures (e.g. lack of charging infrastructures) and technical restrictions (car autonomy) have been pointed also as common barriers for the adoption of energy innovations as reviewed in deliverable 2.1 of the SMARTEES project (Cohen et al, 2018).

Several studies (Wolsink, 2007, 2010; Wolsink and Breukers, 2010; Walker and Devine-Wright, 2008; Schuitema & Bergstad, 2012 in Steg et al, 2015) showed that top-down approaches on renewable energy projects (e.g. installation of windmills) inhibit public acceptability, while participatory approaches, which engage citizens in decision-making processes, enhance public support. Resistance or negative responses towards sustainable energy projects are usually related with instrumental “one-way” communication strategies that limit people’s capacity to express their opinion.

In order to manage social resistance, Perlaviciute and colleagues (2018) advocate for participatory approaches driving public acceptability and trust building. Involving promoters and citizens in participatory processes from the early stages of the project contribute to reach to solutions that take into account the multiple values and interests of different stakeholders (ibid, pp.52). Besides, public acceptability can be affected positively by other policy strategies such as financial incentives (especially when large investment is needed), the attribution of positive symbolic values towards the energy innovation or information and education strategies (Perlaviciute et al, 2018).

Haxeltine and colleagues (2016) stress the relevance of designing the adequate framework conditions that favour citizen engagement in starting and developing innovative solutions to respond to societal needs. Forms of wider democratisation and self-management are also common organizational practices in many social innovations, due to “SIs appear highly suited for self-determination and participatory decision making” (Pel et al, 2017, pp. 179). Because social innovations emerge from collectives of individuals who share common ambitions, work together in common goals maintaining intrinsic motivation and commitment, the contexts for interaction and social relations seem to play a powerful role in determining the success or failure of a social innovation (Haxeltine et al, 2017). For instance, a strong motivation of the promoters and involved actors, and the access to knowledge and skills necessary to work on solutions for sustainable energy, have been pointed out as key drivers for social innovation while the lack of know-how or the practitioners’ fatigue are factors that might jeopardize the development of the social innovation (Ooms et al, 2017).

Recent developments on the theory of social innovation point out that SI processes also require forging new types of relationships with political, market and social actors with different motivations and goals (Pel et al, 2017). Avelino et al. (2017) define ‘transformative social innovation’ as “a change in social relations, involving new ways of doing, organizing, framing and/or knowing” that manages to “challenge, alter or replace dominant institutions”. This conceptualization focuses on the development of new social relations, which considers social innovation as a phenomenon co-produced and characterized by a pushing of the established boundaries between institutional actors in the market, policy and the third sector

(Avelino & Wittmayer, 2015), which might attempt to achieve a more radical transformation of current status-quo, involving contestation or confrontation with the dominant institutions. The involvement of civil society in social innovation at the city level involves consequently an institutional change “shifting from traditional bureaucratically-managed policies” to new cooperative or participatory approaches in decision-making, empowering citizens through their active involvement in policy co-design¹. This is relevant for the SMARTEES project so as like Hewitt et al report in their review of SI in the European energy community, many of these energy initiatives adopt public-private partnerships schemes – particularly local governments – combined with a certain degree of involvement of citizens’ groups in decision-making.

3.1.2. Dynamics of empowerment and disempowerment in social innovations

Social dynamics of empowerment and disempowerment are significant dimensions in the development of social innovations, which often relate to the active engagement of citizens in the public arena (Moulaert, 2017), and the SMARTEES project has ambitions to develop a collective model of empowerment that analyses the supportive contextual conditions that contribute to it.

Empowerment has been conceptualized as “a meaningful shift in the experience of power attained through interaction in the social world” (Brodsky & Cattaneo, 2013) and that involves gaining capacity of resilience and obtaining the necessary resources to carry out effective action towards goal achievement (Cattaneo and Chapman, 2010; Chan et al, 2017). Papaioikonomou and Alarcón (2017) defined empowerment, in the context of grassroots consumption innovations, as the capacity of a group to control their destiny and their lives, developing knowledge and resources to be more autonomous and capable of achieving their purposes. These authors emphasize the need to explore the spaces and meanings “that ethically-minded consumers collectively create to become empowered, to achieve their social and environmental objectives, and to bring about social change” (ibid.pp1) further.

Haxeltine and colleagues (2017b) conceptualize (dis)empowerment as the process through which human actors (individuals and groups) gain the capacity and willingness to mobilise resources to achieve their goals:

“People are empowered to persist in their efforts towards institutional change, to the extent that basic needs for relatedness, autonomy, and competence are satisfied, while at the same time experiencing an increased sense of impact, meaning, and resilience” (ibid pp.11).

Avelino et al (2019) stress the psychological dimensions of empowerment, “which underlies and possibly precedes the process of gaining access to resources” due to “empowerment requires not only access to resources, but also the capacity and willingness to mobilise them, and the belief that one can” (pp3). Building on a combination of political theory and the social-psychological theory of self-determination theory (Deci Ryan & Deci, 2000), Avelino and colleagues (2019) operationalize the psychological process of empowerment in six dimensions: (1) relatedness, (2) autonomy, (3) competence, (4) impact, (5) meaning, and (6) resilience. Aiming at exploring the dynamics of collective empowerment, the authors focus on the relational and organizational conditions for psychological need satisfaction collectively created in the context of social innovation networks. They argue that, while the psychological dimensions of empowerment are experienced at an individual level, they are constituted through relations, shared practices and collective action, which result in a sense of gaining impact, meaning and resilience” (ibid pp.4). Also, studying social innovation international

movements and networks, the authors found that the six dimensions of empowerment “are fulfilled through a process of multi-layered community-building in both local initiatives and translocal networks, particular combination of ‘local deepening’ and ‘translocal expansion’ that is specifically empowering” (pp18-19).

Dimension of empowerment	Individual & collective sense of empowerment	Local mechanisms for deepening	Translocal mechanisms of expanding
Relatedness	We are related to each other	Creating conditions to renew relations in ways that support wellbeing (e.g. face to face contact, spontaneous interactions).	Meeting and relating to others in other places.
Autonomy	<i>We can determine what we do</i>	Creating local contexts that facilitate doing things differently in line with one’s values.	Creating larger supportive contexts for autonomous action – e.g. by pooling resources and creating alternative markets.
Competence	<i>We are good at what we do</i>	Developing & sharing local skills & expertise through hands-on experimentation and learning	Developing and sharing translocal skills and expertise, through becoming part of a larger movement and developing strategies for wider transformation
Impact	<i>We can make a difference</i>	Changing local circumstances and expanding ideas to local communities.	Increasing access to resources and legitimacy, based on evidence that there is local and global impact.
Meaning	<i>We believe in what we do</i>	Local sense-making and collective identity.	Confirming the broader existence of certain shared values (e.g. shared narratives).
Resilience	<i>We can adapt & recover</i>	Drawing on local networks created to survive crises/ pressures.	Sharing & learning from each other’s failures & challenges; drawing on the resources of a larger movement.

Table 13. Dimensions of empowerment in relation to local and translocal mechanisms. Source: Avelino et al, 2019 (pp.19).

This psychological empowerment framework has been adopted in the SMARTEES project when exploring the empowerment dynamics of social energy innovations in the empirical research conducted in qualitative interviews with social innovation practitioners and stakeholders. The results of this empirical work are presented in the next chapter of this deliverable.

3.1.3. Psychological factors influencing acceptability of sustainable energy behaviour

Environmental psychology has deeply studied the social and psychological conditions for pro-environmental behaviour and citizens' engagement in collective action. A series of individual factors such as information and knowledge, moral and personal values, self-identity and self-efficacy have been found as relevant conditions that motivate (or undermine) energy behaviour (Stern, 2011; Abrahamse & Steg, 2011). Concerning the factor of information and knowledge, environmental awareness appears as a predictor of pro-environmental intention, while the lack of information and knowledge can undermine individual behaviour. For instance, people have a limited understanding of the impact of their own behaviour in terms of climate change emissions and tend to attribute the responsibility of carbon reductions to other actors instead of changing their own patterns of consumption (Whitmarsh et al., 2011).

In a review on the factors underlying energy behaviour, Steg et al. (2015) stress the role of moral and personal values as drivers for several energy-saving behaviours in both work and home contexts, derived from the experience of "pleasure and satisfaction from doing the right thing", according to their moral considerations (ibid, pg.5).

Self-identity is also relevant in promoting consistent energy behaviour, especially due to positive spillover effects in the short term (Steg, Shwom, & Dietz, 2018). Pro-environmental self-identity was a stronger predictor for carbon offsetting behaviour as well as for a wider set of pro-environmental behaviours related to water and energy saving or green consumption, while travel and political behaviours were not significantly predicted by identity (Whitmarsh and O'Neill, 2010 pp. 311-312).

Self-efficacy relates to the individual perception of being capable to perform a specific behaviour. Perceived high levels of self-efficacy seem to be associated with climate change adaptive behaviour (Van Valkengoed & Steg, 2019). However, the perceived lack of self-efficacy – related to the perception of personal safety – emerged as significant barrier for bicycle usage in a qualitative analysis on cycle commuting in two Spanish cities (Lois, López-Sáez & Rondinella, 2016).

The perception of collective efficacy – defined as the belief that the group is capable of affecting important aspects of its environment (van Zomeren, Saguy, and Schellhaas (2012) – increases people's collective action so as being a member of a group increases people's perception about what they (as a group) can achieve. The perception of collective efficacy has a positive effect on the intention to adopt electric vehicles. For example, feeling part of an efficacious collective increase the intention to purchase of electric cars in Germany so as collective efficacy could turn people's feelings of helplessness in facing climate change action (Barth, Jugert & Fritsche, 2016).

Trust in policy-makers and actors promoting an energy innovation also influences public acceptability towards an energy policy (Steg et al, 2015). Trust also affects consumers' acceptance of energy efficient products and services as Cherry et al (2018) point out, distrust between peers, organizers and businesses is a key determinant of public acceptability of product-service systems services aiming at reducing the purchasing of certain products.

Psychological scholars stress the key role of social influence dynamics⁹ in people's sustainable behaviour (Abrahamse & Steg, 2013). The influence of social norms (Cialdini, 2003, Cialdini & Goldstein, 2004; Nyborg et al 2016) in promoting energy saving conducts have been largely studied in a variety of domains and contexts such as bicycling (Sherwin, Chatterjee & Jain, 2014), public transport use (Zhang et al, 2016), and electric vehicle purchasing (Hiselieu & Rosqvist, 2016). Muñoz López & Rondinella (2016) found social influence dynamics that foster sustainable mobility patterns in Vitoria-Gasteiz, due to specific social groups starting to travel by bike, like almost all of the representatives of the political groups travel by bike, the major of the city and journalists suggesting that this might have been one of the key explanatory factors of the success of the bike in the city (ibid pp.51).

Social influence processes seem to be particularly effective when they involve social interaction and people perceive they would be socially rewarded or sanctioned (e.g. driving an electric vehicle, riding a bike). The meta-analysis conducted by Abrahamse & Steg (2013) studied the empirical evidence on the effects of the six main social influence approaches commonly used in psychological interventions: (i) the use of social norms in information and feedback provision, (ii) block leaders and social networks, (iii) public commitment making, (iv) modelling, (v) social comparison and (vi) feedback provision about group performance. The authors conclude that despite the presented evidence of the efficacy of social influence variables on pro-environmental behaviour, more research is needed "on the assessment of the conditions under which social influence approaches are most effective in applied settings" targeting specific groups (Abrahamse & Steg, 2013, pp 1783). García-Mira et. al. (2016) found that organizational networks play a significant role in influencing pro-environmental behaviours at the long term, such as low-carbon mobility.

Social identity processes can be remarkable drivers of pro-environmental behaviour. Psychological empirical research stresses the efficacy of community identity as forces of mobilization (Bomberg & McEwen, 2012) that have the potential to foster new social norms. Environmental reputation is also a key driver for people to engage in energy-saving practices within the organizations they belong to when these practices are perceived as significant part of their organizational identity (García Mira and Dumitru, 2014).

Empirical evidence also exists that community-led approaches have long-term effects on desired behavioural change as a consequence of individuals and communities' interaction, which lead to the creation of new social norms and attitudinal change. Hiselieu and Rosqvist (2016) stress the potential and efficacy of campaigns aiming at changing social norms and attitudes towards low-carbon mobility behaviour, specifically, according to the authors, if interventions adopt a persuasive or emotional approach rather than a rational or informational style.

⁹ Social influence is defined as the process by which an individual's thoughts and actions are changed by the thoughts and action of others (Sherwin et al 2014).

3.1.4. Behavioural spill-over effects of energy policies

Truelove et al (2014) point to the unintended effects that public interventions (eg. environmental campaigns) might have on people's future behaviour and the implications that this spillover effect might have for policy. Truelove et al (2014) approach spillover as the response – at the level of the individual consumer or household – to an environmental intervention, however, other authors (Lacasse, 2016) acknowledge that spillover might occur spontaneously, without specific interventions. Positive behavioural spillover¹⁰ occurs when a past pro-environmental behaviour increases the likelihood or extent of engaging in new or different pro-environmental behaviour. Research demonstrate that positive spillover is more likely to occur between similar pro-environmental behaviours, e.g recycling and package waste reduction (Thøgersen, 1999), as well as between dissimilar pro-environmental behaviours such as recycling, consumption of organic food and public transport use (Thøgersen & Ölander, 2003). Researchers point that spontaneous positive spillover between different behaviour categories is low and only would occur when pairs of pro-environmental behaviour are perceived as similar (Thøgersen & Ölander, 2003, Thøgersen, 2004).

There is also empirical evidence of positive spillover effect in the energy domain. Some studies report positive relations between green consumerism behaviours and renewable energy acceptance (Thøgersen and Noblet, 2012) as well as between fuel-efficient driving styles and intentions to reduce meat consumption (Van der Werff et al., 2013), or the use of energy-saving light bulbs and use of unbleached paper (Harland et al., 1999 cited in Truelove et al, 2014). However, other studies report negative behavioural. For example, Miller et al., (2007) and Barr et al (2010, cited in Truelove et al, 2014) report a negative relation between daily energy behaviour and vacation choices, which suggests a moral licencing effect of a pro-environmental behaviour at home. Also, a rebound effect of energy efficiency improvements has been reported in studies measuring increase of energy use (Binswanger, 2001, Herring, 2006 cited in Truelove et al, 2014). A study of car-owners in Sweden found that owners of an e-car are less willing to curtail their driving than owners of a conventional car (Jansson et al., 2010). Besides, economic measures can produce a 'rebound effect' in low-carbon choices when the financial incentives are finished (McLoughlin et al, 2019). Recent literature reviews on positive spillover and rebound effects in climate-friendly behaviours (Nash et al, 2017; Truelove et al 2014, Thøgersen, 2012) conclude that literature is still inconclusive and more empirical evidence for both positive and negative effects existing.

¹⁰ Behavioural spillover can generally be defined as an observable and causal effect one behaviour has on another. More specifically, to constitute spillover, the behaviours must be different (i.e., not related components of a single behaviour), sequential (where one behaviour follows another), sharing a motive (e.g., pro-environmentalism), and involving a common link (e.g., reducing CO₂ emissions). In addition to observable changes, indicators of spillover-related effects might include less observable (conscious or unconscious) changes through parallel processes, including identity, values, and knowledge/ awareness (Nash et al, 2017, p.2).

3.2. Conceptual analysis of replicability and transferability of social innovations in energy transitions¹¹

Using SMARTEES definition of social innovation, the investigated types of innovations are specified as processes¹² of social change, not as specific actions or interventions taken by municipalities. For example, in the ‘islands and renewable energy’ case cluster the experiences of Samsø (Denmark) and El Hierro (Spain) are investigated with respect to planning and executing large scale renewable energy generation in the islands’ electricity grid. The social innovations in these cases are not the building of wind farms and pump-hydro storage, these are engineering feats. Instead, it is the process of gaining acceptance (reducing opposition) to these installations, and gaining participation and buy-in from the citizens, either through monetary contributions in the case of Samsø, or changes in energy consumption behaviour and the adoption of home solar power in the case of El Hierro. Similarly, with the ‘mobility in superblocks’ case cluster Vitoria-Gasteiz and Barcelona changed traffic patterns by building superblocks within their cities. The intervention here is the shutting down of streets and change in traffic patterns that was instituted at the municipal level. The social innovation here is the process of changing behaviour of citizens with respect to how they use the streets, their transportation choices and their acceptance/opposition to the superblocks.

As such, the SMARTEES project is trying to understand how researchers and local policy-makers or grassroots movements can tap into the underlying social relationships, interactions and knowledge and nudge these elements in a desired direction through targeted interventions – thereby initiating or speeding up a social innovation process. With this definition in hand, we can conceptualize the replicability and transferability of social innovations in the context of the underlying drivers of relevant social processes, i.e. what factors are affecting individual or group behaviours and dynamics related to the topic of the social innovation?

Within each SMARTEES case cluster, we have different cities applying similar interventions to affect social innovations. We generally observe that cities that apply similar interventions can have very different outcomes in some cases, and in other cases similar outcomes. The question addressed in this section is to lay the groundwork for the reasons why a local intervention targeting a social innovation can have different outcomes across cities, to give a conceptual basis for addressing the central, tiered research question:

- Are social innovation lessons learned and successful interventions transferable between cities?
- Will similar interventions have similar effects on social innovation processes within different contexts?

¹¹ This section has been elaborated by Jed Cohen (EI-JKU).

¹² We note here that the issue of social innovation being defined as a tangible thing (e.g. a new technology or physical change) or as a process is a central choice in defining the term. Our choice to define it as a process fits with prominent definitions (e.g. Haxeltine, et al., 2017) and does not conflict with the EU definition, which is broadly defined to avoid this issue.

- Can SMARTEES research identify critical factors/barriers of social innovation that ‘predict’ transferability of interventions between cities?

Within each of the five SMARTEES case clusters, two different cities have applied interventions to similar areas with the goal of starting, or quickening, a process of change (i.e. a social innovation). In some clusters, the cities are very different, e.g. Samsø vs El Hierro have very different climates, socio-economic and cultural backgrounds. While in other clusters, the cities are more similar, e.g. Vitoria-Gasteiz and Barcelona share a national culture. The ABM modelling efforts in SMARTEES will model the intricacies of the social innovation processes in these and the other three case clusters, making it possible to understand critical factors that enabled the observed outcomes, or inhibited a greater level of success.

To aid in the ABM and analyses efforts in SMARTEES, herein we identify four categories of factors that drive social innovations and are particularly relevant when assessing their replicability within cities/contexts and their transferability to different cities/contexts¹³:

1. **Physical environmental characteristics:** In regard to certain sustainable practices the physical environment can be a strong barrier/driver to social innovations (e.g. greater share of pedestrian mobility)
2. **Cultural and social norms:** Such norms can form a strong barrier or driver of social innovations; different norms can change the way that citizens and groups respond to interventions (e.g. propensity to oppose new policies/infrastructure)
3. **Regulatory, policy, and market conditions / infrastructure:** Along with physical characteristics, there are broader characteristics of the regulatory and market environment that can impact the efficacy of an intervention and the trajectory of social innovation (e.g. prices of fossil fuels, existence of federal subsidies, etc.)
4. **Existence of specific actors:** In some cases, critical individuals or organizations have been identified in driving the success of social innovations such as, opinion leaders (individuals who promote a strong message), community organizations, civic organizations (shopkeepers associations, foundations, etc.), among others.

The following subsections delve into each of the four categories listed above, giving a more detailed discussion of how these factors impact the replicability/transferability of social innovations in an effort to move towards answering the tiered research question highlighted above and laying the conceptual groundwork for investigations into this question. These discussions are context and technology un-specific and will pull from various experiences and literatures regarding the impacts of these categories of factors on social innovation.

¹³ Deliverable 2.2 identifies- for each of the five topics of social innovations in SMARTEES- critical elements and key factors that will drive the social innovation process underlying that the scientific literature has pointed out as relevant. The reader is encouraged to see that document for further background.

1. Category 1: Physical environmental characteristics

Physical environment characteristics can be hard limits on the transferability and replicability of a social innovation.

In a prediction context, this means that replicability and transferability potential can go to zero if certain physical environmental conditions exist or do not exist. For example, the social innovation of urban gardening uptake, which thrives in some arable climates (Teuber et al., 2019), is not applicable to dense cities with no available space for planting (or rural areas with no urban space) or areas with harsh climates. Similarly, the uptake of electric cars can be inhibited by inclement weather, which affects battery life, and long distances between desired locations (Biresselioglu, 2018).

Limiting or enabling physical characteristics can be manifest in the man-made environment or products of uncontrollable physical elements (e.g. weather, elevation, existence of coastline, etc.).

The distinction between manmade factors and physical factors is perhaps most clear in the case of travel mode choices of individuals where both types of environmental characteristics can play a strong role in the decision-making process. On the side of manmade environmental effects, Mouratidis et al. (2019) show that denser urban areas give higher satisfaction to bikers than sub-urban environments. This effect is mostly driven by suburban residents having longer average travel distances between key locations (e.g. from work to home). Thus, promising proxy variables to measure the transferability of bike/pedestrian usership social innovations may be urban density measures or measures of average distances travelled in an area.

In terms of uncontrollable physical elements, the climate is an obvious factor that is not controllable and varies strongly across European cities. Ashquar et al. (2019) showed that temperature and humidity levels drive bike usership within a given city, and it holds to reason that this effect would be present between cities as well, with the caveat of allowing for weather adaptations between populations used to dealing with certain conditions. The work of WP 2 in SMARTEES will look to quantify such physical characteristics and their effects on transportation mode choice to better inform replicability and transferability of social innovations in this topic area (i.e. the case clusters of holistic mobility and superblocs).

2. Category 2: Cultural and social norms

In a seminal research paper, Allcott (2011) showed how the provision of social norms can strongly affect energy conservation behaviour of households. Social norms in Allcott's research context were defined as the energy consumption of similar households, thereby providing consumers with a 'benchmark' of what socially appropriate behaviour is and encouraging them to improve their own behaviour. Similarly, when it comes to a broader characterization of social innovations in energy, the cultural and social norms perceived by an individual or group can shape the social innovation process and have a strong effect on the populations' response to a policy intervention.

Energy lifestyles, i.e. the typical usage and behaviours related to energy in an individual or group, are shaped by social norms, and subsequently shape social norms as they evolve over time.

For instance, in Austria and Norway and Spain it was shown via qualitative interviews that perceiving a social norm of responsible energy consumption actually led to lower energy consumption levels in individuals (Schwarzinger, et al. 2018). On the other hand, individuals exhibit clustered energy lifestyles indicative of self-reinforcing social norms, where a typical behaviour becomes accepted in a group even though it may be considered detrimental to those outside of the group (Schwarzinger, et al. 2018). Thus, such lifestyle-related norms have a feedback effect in shaping energy behaviours and in social innovation processes. One way to account for the existence of these norms is to look at the clustering of energy lifestyles within a given locality. More and highly distinct clusters suggests a fragmented, and likely strong, social norm within specific groups. For social innovation transferability, such a finding would suggest that multiple interventions would be needed to address all groups effectively.

Energy cultures are local-context and temporally specific, and consist of combinations of material, normative, and habitual elements.

Energy cultures is a term that broadly defines the cognitive, technological, behavioural and normative specifics of energy consumption within a given group or society. Whereas a social norm is simply the typical, or accepted behaviour in a given energy context, the energy culture encompasses all facets of energy behaviours including their technological enablers. As such, it is critical to recognize that energy cultures are always undergoing a process of change (i.e. social innovation in SMARTEES) and that an energy culture is temporally and location-specific (Lettmayer et al. 2018). However, similar to energy lifestyles discussed above, energy cultures have been shown to occur in clusters making it possible to assess the similarity of energy cultures between cities (Stephenson et al., 2010). In the case of similar energy cultures, we would assume a greater level of transferability in social innovation understanding and interventions between target municipalities, all else equal.

3. Category 3: Regulatory, policy and market conditions / infrastructure

Included under this category (though also relevant to categories 2 and 4) is the availability of a policy or regulatory model for the city to follow. Haxeltine et al. (2017), stress the importance of community building within translocal networks in enabling the replication of social innovations and related interventions. This can include providing examples of regulation, policy or market supports that had a positive effect in moving towards the desired outcome. Consequently, this is a major impact of the SMARTEES project in sharing experiences directly between case clusters and follower cities with the dissemination activities of the project.

Regulatory, policy and market conditions in social innovation is likely best illustrated in the context of energy technology adoption (e.g. solar and e-mobility solutions) where a wealth of research has investigated the intricacies of enabling factors and barriers in these dimensions.

Regulatory continuity, uncertainty, and knowledge can affect social innovation uptake.

In the case of PV adoption and the social innovation of citizens becoming prosumers of energy, it has been shown that continuity, knowledge and trust in the regulatory/policy framework can greatly increase uptake of solar units (Tsvetanov, 2019). Thus, cities with records of quick

changes or backtracking in regulations/policies and with low levels of trust from the populace will find it harder to implement interventions and affect a social innovation process.

Financial policy incentives are strong drivers of social innovation uptake – especially when the behavioural change incurs a cost on individuals.

In PV adoption, a wealth of policies and regulation has been used in an effort to increase adoption rates in some areas. An empirical analysis comparing the many policy options present in the U.S states showed that financial incentives, specifically rebates, had the strongest effects on solar adoption rates amongst households (Crago and Chernyakhovskiy, 2017).

Market conditions, notably costs, prices, and return on investment are strong drivers of social innovation uptake and related behaviours.

In the realm of e-mobility adoption, a recent literature review of barriers and motivators to adoption showed that costs and expected savings were recurring themes across the literature (Biresselioglu et al., 2018). Interestingly, it has also been shown that e-mobility and solar adoption are linked decisions; a link that is in part driven by the increased payback rate of a solar unit when an electric vehicle is also purchased (Cohen et al., 2019). These market concerns can be captured and used to interpolate transferability of social innovations between cities by comparing data on prices, costs, and monetary benefits related to the social innovation in question.

4. Category 4: Existence of specific actors

In terms of opposing, initiating, or hastening a social innovation process, the existence of specific actors within a local area can be a key factor. These actors may be pre-existing organizations of like-minded individuals (e.g. conservation groups), or trade unions motivated by economic concerns. Moreover, the pertinent actors may be prominent individuals, termed 'opinion leaders' in the literature, who vocally support or oppose an intervention or social innovation. For example, past literature has shown that citizens follow political leaders' opinions when it comes to their conclusions about climate change, and political polarization on the issue is a cause, not an effect, of polarization in the general populace (Kousser and Tranter, 2018).

The existence and willingness of opinion leaders to support a social innovation can drive transferability as well as the affinity or willingness of the population to heed a given opinion leader.

In research regarding the acceptance and support for a social innovation involving the entire remake of the local energy system, the effect of a supportive political opinion leader was tested across four European nations: Austria, Germany, Italy and Switzerland (Azarova et al., 2019). In this work, three types of opinion leaders were presented to respondents in each nation, a local mayor, national chancellor, or EU parliament member. In two of the tested nations, Austria and Germany, the words of the opinion leaders had no discernible effects on acceptance of the energy transition in the community. However, in Italy and Switzerland the opinion leaders did change acceptance behaviour to a statistically significant degree. Specifically, in Switzerland the support of the local mayor improved acceptance for a local

energy transition. In Italy, the support of national and/or EU level politicians improved acceptance for a local energy transition. This shows that not only can the existence of opinion leaders vary across regions, i.e. a public figure willing to vocally support a social innovation, but also the effect of such opinion leadership can vary with the region and with the type of opinion leader chosen. This complexity in determining the existence and effect of an opinion leader makes assessing transferability in this regard potentially difficult. However, Azarova et al. (2019) point to trust in government and other institutions as a proxy for these effects, noting that the Swiss result (positive effects on acceptance from local mayor's support) could be expected given the high trust levels and broader purpose of Swiss local governance relative to EU municipal governments.

Certain local actors can hinder/help the energy transition with respect to public acceptance issues.

In the case of wind energy, one major distinguishing factor in acceptance levels between French and German case-studies was shown to be the existence of a network of support amongst local actors (Jobert et al., 2007). In SMARTEES, this idea of the importance of the local network is often stressed by the partners from the lighthouse case of Samsø renewable energy island – who experienced success in a large part because of building out a local network of support. However, the opposite effect can also occur. For example, in the Languedoc-Roussillon region in France, a local coalition of winemakers and tourism workers formed to oppose wind turbine installations (Jobert et al., 2007). In terms of the transferability of social innovations and related-interventions, it would be helpful for cities to compare the prominent actors and groups in their area to those present in the areas of the successful case. Actors with a reason to be for or against the social innovation should be approached very early in the process in an inclusive and cooperative way to try and gain their support.

3.3. Theoretical implications from an energy justice and equality perspective¹⁴

Social innovations have already been conceptualised in relation to energy justice (Hiteva and Sovacool, 2017), while energy justice (EJ) was argued to be in close relation to energy equality (EE) (Pellegrini-Masini, 2019), therefore it will be discussed in this section how these concepts relate to one another and what the implications for research on social energy innovations are.

3.3.1. Energy justice and energy equality

In recent years, energy justice (EJ) has established itself as a guiding concept in reframing social and policy research regarding energy consumption, sustainability and energy poverty (Heffron and McCauley, 2017; Sovacool et al., 2016). Its merit could be the scholarly effort of taking ethical arguments to the core of the academic and policy research on the energy transition.

¹⁴ ¹⁴ This section has been elaborated by Giuseppe Pellegrini Masini (NTNU).

EJ was defined by several authors since its first appearance (Guruswamy, 2010), although two definitions became prevalent. One holds that EJ “...aims to provide all individuals, across all areas, with safe, affordable and sustainable energy.” (McCauley et al., 2013, p. 1). The authors (McCauley et al., 2013) elaborate further on this, indicating that three tenets define EJ, and namely ‘distributional justice’, ‘procedural justice’ and ‘recognition justice’. Distributional justice deals with equity in the distribution of goods, while procedural justice advocates for fair participation in processes of energy policymaking and finally recognition justice means recognizing and granting the rights of marginalized social groups (McCauley et al., 2013).

Sovacool and Dworkin (2015, p. 436) instead defined EJ: “...as a global energy system that fairly disseminates both the benefits and costs of energy services and one that has representative and impartial energy decision-making.” At the same time the authors indicated ten principles that lie at the core of EJ: ‘availability’, ‘affordability’, ‘due process’, ‘transparency and accountability’, ‘sustainability’, ‘intragenerational equity’, ‘intergenerational equity’, ‘responsibility’, ‘resistance’, and ‘intersectionality’ (Sovacool et al., 2017, p. 687).

Principle	Description
1 Availability	People deserve sufficient energy resources of high quality (suitable to meet their end uses)
2 Affordability	All people, including the poor, should pay no more than 10% of their income for energy services
3 Due process	Countries should respect due process and human rights in their production and use of energy
4 Transparency and accountability	All people should have access to high quality information about energy and the environment and fair, transparent, and accountable forms of energy decision-making
5 Sustainability	Energy resources should be depleted with consideration for savings, community development, and precaution
6 Intragenerational equity	All people have a right to fairly access energy services
7 Intergenerational equity	Future generations have a right to enjoy a good life undisturbed by the damage our energy systems inflict on the world today
8 Responsibility	All actors have a responsibility to protect the natural environment and minimize energy-related environmental threats
9 Resistance	Energy injustices must be actively, deliberately opposed
10 Intersectionality	Expanding the idea of recognitional justice to encapsulate new and evolving identities in modern societies, as well as acknowledging how the realization of energy justice is linked to other forms of justice e.g. socio-economic, political and environmental

Table 14. "An energy justice conceptual framework reconsidered" (Sovacool et al. 2017, p.687)

It has been argued (Kymlicka, 2002, p. 4) that each theory of justice: “shares the same 'egalitarian plateau.... each theory is attempting to define the social, economic, and political conditions under which the members of the community are treated as equals”. Pellegrini-Masini et al. (2018) observed that this was precisely the case for EJ, and that equality could be considered the root concept of EJ. They observed that both ‘formal equality’ and ‘substantive

equality' were two conceptual dimensions that underpinned EJ's tenets and principles outlined by the two major definitions of the concept (McCauley et al., 2013; Sovacool et al., 2017). Pellegrini-Masini et al. (2018) argue that the principles and tenets of EJ would favour not absolute equality but, higher levels of equality that would entail the use of the concepts of formal and substantive equality as benchmarks to gauge the implementation of EJ's fundamental tenets and principles. This view aligns with the opinion of DeMarco (2001) who held that equality was a benchmark concept suitable to value the implementation of other central concepts for modern western societies, such as democracy, freedom, participation etc.

However, even if we accept that equality could be a root concept of EJ, what are the policy implications? Even if we affirm that EJ is aimed at establishing higher levels of formal and substantive equality of citizens in several processes, this being regulatory processes, or processes of production or consumption, which together establish an energy system, what are the desirable levels of equality that the energy system should attain? Moreover, should we argue explicitly for Energy Equality? A recent attempt defined EE as follows: "Providing all individuals with equal opportunities of using energy services, energy technologies, and consuming energy and embodied energy for satisfying personal needs and nurturing capabilities" (Pellegrini-Masini, 2018, p. 13). This definition provides some indication of the level of equality that would be desirable to be attained so that an energy system can be considered equal: in fact, equality per se is a generic term, which could be referred for example to procedural equality, equality of consumption or equal satisfaction of basic needs only, while using the terms "equality of opportunity" makes explicit reference to a level of equality implying distributional justice without discounting personal preferences.

The cited definition establishes a direct link to "needs" and "capabilities", two concepts that already have an established record of empirical research. Theories of needs arose principally as theories of human motivation (Maslow, 1987) while the capabilities approach (CA) was developed in relation to moral philosophy and economy studies (Nussbaum, 2003; Sen, 1992, 1979). Sen (1979, p. 217), who pioneered this approach argues for the moral desirability of "basic capability equality" (BCE), which he distinguishes from other types of equality. Specifically, BCE differs from utilitarian equality, based on the equality of marginal utility for each individual, which is implemented through the equality of treatment of everyone's interests, and also, from total utility equality, i.e. absolute equality. Finally, BCE distinguishes itself from Rawlsian equality, which is instead based on a theoretical level of equality that could be agreed on by whoever was not aware beforehand of his relative position in a distribution of goods in a hypothetical society. He argues that while total utility equality (absolute equality) might address problems of unequal distribution, it does not address the problem of unequal capabilities unless it is assumed that all human beings are the same in their abilities and inclinations, which is not the case. Sen (1979) appears to be mindful of the difficulties entailed in defining and measuring basic capabilities, still, he advocates to focus on this approach because in his opinion what matters for assessing individual utilities is not so much goods but what goods do on human beings (Sen, 1979, p. 219). Sen argues that needs can be interpreted as capabilities: "I believe what is at issue is the interpretation of needs in the form of basic capabilities. This interpretation of needs and interests is often implicit in the demand for equality. This type of equality I shall call 'basic capability equality'." (Sen, 1979, p. 218). Certainly, focusing on capabilities instead of needs might create a shift of focus from motivations driving individual actions (needs) to the ability to act to satisfy those motivations, which would appear to be two related but different things. The satisfaction of needs seems to be mainly a matter of achieving a purpose, being capable of satisfying a need appears instead

as a condition that holds the potential of achieving a purpose (need's satisfaction), nevertheless without considering this achievement as inevitable. In this respect, capabilities seem to be more difficult to capture through indicators which in many cases build on data registering outcomes rather than abilities and potentials.

If we go back to the definition of EE introduced earlier (Pellegrini-Masini, 2018), we can see that it points to equal opportunities of using services, technologies and of consuming energy and embodied energy in order to satisfy personal needs and developing and holding capabilities. The proposed definition, therefore, distinguishes between needs and capabilities. The idea underneath is that a core of essential needs should be met independently from making individuals capable of satisfying certain basic needs such as food, safety, acceptable housing. Other needs, however, such as achieving career goals, or establishing significant social ties, appear to be more easily facilitated fostering capabilities than in any other way. The reason for this is that basic needs attain the survival of individuals and assuming that we live in a society that wants to ensure that each of its members would meet their basic needs, we might have to resort to providing direction to those subjects that cannot develop capabilities for meeting them or that would face anyway extreme environmental obstacles in acting towards meeting them.

In energy terms, the definition differentiates between pursuing equality with respect to energy consumption only and extending this pursuit to embodied energy, too (i.e. the energy consumed to produce goods). In the first case, EE would not go much further than ensuring that basic levels of energy consumption are warranted for everybody, in order to provide necessary comforts to all individuals in buildings. At most, this could be stretched to include access to public transport or any form of transport necessary for working and socialising. In the second case, having a minimum degree of equality in relation to embodied energy consumption might allow all citizens to achieve, for example, adequate standards of education in order to limit unequal career prospects.

3.3.2. Policies favouring Energy Equality

Scholars have attempted to list and rank capabilities. Particularly known is Nussbaum's list of "central human capabilities", which includes the following ten capabilities (Nussbaum, 2003, pp. 41–42): 1 life, 2 bodily health, 3 bodily integrity, 4 senses imagination and thought, 5 emotions, 6 practical reason, 7 affiliation, 8 other species, 9 play, 10 control over one's environment. Sen (2005) heavily criticizes the drawing of a hierarchical list of capabilities, because he considers this against democratic scrutiny and public reasoning and incapable of capturing the specific social reality of a given context. Perhaps because of the aversion by Sen, the founder of the capabilities approach (CA), there is a lack of empirical studies that aim at validating a universal list of capabilities. The same cannot be said of theories of needs and particularly those that were conceived in empirically driven disciplines, like psychology. In this area, the most famous is the theory of motivation of Maslow (1987), which was conceived in the 1940s. Maslow's humanistic approach has been criticized but it has withstood several empirical tests (Oishi et al., 1999; Sheldon et al., 2001; Taormina and Gao, 2013).

There is no easy objection to complement the CA by Sen with the Maslow's theory of needs, as Sen (1979) himself indicated that capabilities are themselves an interpretation of needs, emphasizing choice and possibilities over actual goods' distribution. Maslow's (1987, pp. 35–47) hierarchy of needs, which arguably could correspond to an equivalent hierarchical list of

capabilities, comprises the following needs: 1 physiological needs, 2 safety needs, 3 belongingness and love needs, 4 esteem needs and 5 the need for self-actualization. It was objected that this list is culture, and context-dependent but research suggests otherwise (Taormina and Gao, 2013).

In a CA perspective, what might appear of fundamental importance is whether citizens have the capabilities necessary to satisfy the listed needs. This reasoning might translate to the energy policy area: it makes sense to think whether and how it is desirable to grant that all citizens have access to energy services and technologies in order to be capable of satisfying all or at least as many as possible of the needs listed.

It is not possible here to discuss thoroughly whether equality or at least some levelling is desirable, something that has always attracted a vast amount of theoretical and empirical research (Okun, 2015), which has recently bent towards giving merit to equality for creating better societies (Wilkinson and Pickett, 2010a). Assuming that some degree of equality is desirable it could be argued that policies favouring energy equality would need to intervene in order to favour the possibility of satisfying Maslow's list of needs (or any improved version that might be supported by empirical tests).

For policy-making, Maslow's needs could be organized in two clusters as follows: A (basic needs) physiological and safety, B (higher needs) belongingness, esteem, self-actualization. This distinction is supported by some empirical evidence (Sheldon et al., 2001). Cluster A would mean ensuring that individuals are capable of meeting their physiological and safety needs. Clearly, in terms of energy policy, these needs invoke interventions that attain the provision of warm, safe living environments. There is a vast literature regarding fuel poverty and, more broadly, energy poverty, which is impossible to review here. What is evident though is that energy poverty is an issue that has far-reaching effects (Walker and Day, 2012), confirming Maslow's theory that if basic needs are not sufficiently met individuals will find it difficult or impossible to satisfy higher needs. Therefore, the capabilities of individuals to satisfy those basic needs should be prioritized over further policy interventions.

In table 15 an essential range of policy interventions aimed at increasing energy equality is presented. These are by no means exhaustive, but they provide an initial indication of what type of policies could address basic and higher needs. Not all of these policies are strictly energy policies, particularly when embodied energy is considered. Embodied energy is already used as a term to account specifically for the energy necessary to produce buildings, mostly, but also manufactured goods (Kara et al., 2010). More recently, the term has been used in the social sciences and rephrased as "embodied energy injustices" (Healy et al., 2019) in order to highlight global environmental injustices related with indirect energy consumption through the production and use of goods. A broad discussion of energy equality should not exclude embodied energy, because this accounts for a large part of the energy consumed worldwide and within countries. For example, in the EU, only 25% of final energy consumption is consumed by households (European Energy Agency, 2018).

The current levels of energy consumption inequality appear very high, as research indicates that the poorest half of the global population is responsible for only 10% of the global total lifestyle carbon emissions and that the wealthiest 10% of the global population is responsible for 50% of emissions (Oxfam, 2015). Similarly, even within nations, the differences between low income and high-income individuals are very large (Oxfam, 2015). Somebody could object that still, this inequality warrants the satisfaction of basic needs to the vast majority of the world population, but, even if that was the case, energy equality is about advocating for

equality of opportunities of energy consumption in relation to the satisfaction of all needs, not only the basic ones. The urgency of considering embodied emissions has been pointed out in recent research about energy justice (Sovacool et al., 2017), and, in analogy, the same could be said for embodied energy.

Needs	Policies affecting direct energy consumption	Policies affecting embodied energy consumption
Physiological Safety (basic needs)	Energy poverty (fuel poverty) policies The satisfaction of basic heating, cooling, cooking and warm sanitary water needs Ubiquitous and sufficient street lighting in all neighbourhoods	Income support policies Provision of public housing schemes
Belongingness Esteem Self-actualization (higher needs)	Measures warranting sufficient mobility for family, social and work activities Provision of adequately warm and lighted public buildings	Progressive taxation Personal energy (carbon) allowance schemes Education services and school facilities freely accessible for all and at all levels

Table 15. Needs and energy policy interventions towards energy equality.

Social acceptability of energy equality policies

Energy equality policies might have significant political and economic implications. A substantial increase in redistributive policies would be needed in order to support currently disadvantaged individuals and for reducing the gap between wealthier individuals, who are responsible for the largest direct and indirect energy consumption, and the rest of the population. A system of personal energy allowance, or carbon energy allowance, if the policy focus was directly on reducing carbon emissions, could be considered. This could be justified on the grounds of reducing carbon emissions per capita but would also have the benefit of rising general environmental awareness and weakening the resistance of some sectors of society towards redistributive measures based on higher progressive taxation. While a reduction of general economic incentives could dampen to some extent individual economic initiative and productivity, the so-called trade-off between equality and efficiency (Okun, 2015), a further socioeconomic development towards more egalitarian societies is seen as a necessity to create sustainable development (Mészáros, 2001; Pereira, 2014; Wilkinson et al., 2010; Wilkinson and Pickett, 2010b).

While the range of variables influencing social acceptability of policies might be multiple and varied in nature, it is possible to attempt a grouping of the variables that most likely have influence. The main division in categories is drawn from a similar categorization developed for research about acceptability of wind farms in planning phase (Pellegrini-Masini, 2017) but is supported by another very similar categorization, albeit worded differently, that was developed for variables affecting support for climate policies specifically, and which emerged

from an extensive literature review (Drews and van den Bergh, 2016). Therefore, support is hypothesized to be influenced by 1 ‘resources’ like income, education, information, 2 ‘contextual variables’ like trust toward proponents, transparency and fairness of the decision-making process, and 3 ‘psychological variables’ like the perception of collective and subjective benefits and costs, pro-environmental attitudes, political values. This is by no means a definitive list, but these variables have been empirically tested for their effect on acceptability of environmental policies, which has been shown to be, to various degrees, significant (Drews and van den Bergh, 2016; Dreyer and Walker, 2013; Haring et al., 2018; Kallbekken and Sælen, 2011; Ziegler, 2019).

3.3.3. Social innovations and energy equality

Social Innovations were defined in SMARTTEES as follows: “Social innovation in energy transition is a process of change in social relationships, interactions, configurations, and/or the sharing of knowledge leading to, or based on, new environmentally sustainable ways of producing, managing, and consuming energy that meet social challenges/problems” (Caiati et al., 2019). SIs therefore are defined as processes of change that can be identified in a set of often interacting actions carried out by multiple stakeholders.

In a similar fashion of the qualitative analysis carried out by Hiteva and Sovacool (2017) of social innovations through an energy justice framework, an analysis of SIs using an energy equality framework could be attempted looking at the specific actions realized in an SI’s process of implementation. Looking back at the proposed definition of EE, it could be argued that energy equality lies at the intersection of distributive justice, procedural justice and recognition justice, the three tenets of energy justice (McCauley et al., 2013), while at the same time advocating for actions that deliver needs’ satisfaction and capabilities enhancement. Therefore, a basic qualitative analysis of social innovations with regards to energy equality could look the actions that have been implemented and whether they have been, or at least were perceived to be, enhancing distributional equality, procedural equality, inclusiveness (recognition justice), and need’s satisfaction and capabilities enhancement.

4. Social Innovation pathways and lessons learned from energy transitions

4.1. Factors driving social acceptance of social innovation and collective empowerment

This section focuses on the analysis of the main drivers and barriers influencing the social acceptability of socially innovative policies in the energy domain. This section builds on the empirical data collected in WP3 (profiles of social innovation) as well as the results of the qualitative interview analysis conducted according to the interview protocol and common framework for qualitative data analysis elaborated in WP4 (task 4.4).

4.1.1. Methodological framework

A specific ‘Interview Protocol’¹⁵ was designed for studying qualitatively the conditions, processes and dynamics that motivated, enabled and sustained social innovation in the energy domain. Grounded on the theoretical framework described in section 3.1, this interview protocol is constituted by five blocks of research questions addressing the following dimensions: 1) Profiles of social innovation: general questions oriented to obtain in-depth knowledge about the social innovation; 2) Motivations for participation in social innovation (values, goals and motivations that foster SI); 3) Factors and dynamics influencing social acceptability for energy innovations (exploring dynamics of social influence, identity and strategies to deal with social resistance); 4) Instances of psychological empowerment and disempowerment; and 5) Instances of positive and negative behavioural spillover effect.

The comparative analysis of the results of the ten case-studies will focus the strategies to achieve the public acceptability towards the social energy innovations, the different motivations underlining resistance and contestation as well as the measures adopted by the social innovators to deal with conflict.

Sample

A number of 6 to 10 interviews were conducted in the 10 case-studies. The sample was distributed over four main categories of ‘key informants’: (a) “social innovators”: pioneers, front-runners and civil society groups who actively engaged in the development of each social innovation (e.g. political and technical responsible from city council, social groups starting up the project, etc.); (b) “key supporters”: further social groups of citizens or stakeholders that supported the social innovation; (c) “beneficiaries/recipients” of the social innovation, including critical voices regarding the SI; and (d) “experts”, other type of informants that provided a critical, external and well-informed opinion about the SI (see deliverable D3.4¹⁶ for a more detailed description of the sample).

¹⁵ Lema-Blanco I., Dumitru A. and Garcia-Mira R. (2019). SMARTEES Interview protocol. SMARTEES Project. Wp4. Task 4.4. December-January 2019.

¹⁶ Caiati, G., Marta, F. And Quinti, G. (2019). Report on “Five models of social innovation”. SMARTEES Project.

Data analysis

Semi-structured interviews were transcribed by the case-study researchers in the original language and were analysed following systematic qualitative procedures based on processes of data coding, data display and interpretation (Willing, 2013, Miles, Huberman & Saldaña, 2014). Based on the analysis and categorization of a reduced number of interviews a proposal of a coding framework has been formulated aiming at helping researchers to code their interviews (as discussed and completed by all the case-study researchers during the SMARTEES Annual General Assembly in A Coruña in June 2019). However, in the spirit of grounded theory (Willing, 2013), this coding framework has been enhanced when new descriptive and analytical categories emerged from the data.

4.1.2. Barriers to social innovations: Resistance, contestation, and non-involvement in social innovation

Qualitative in-depth interviews with pioneers and promoters, civil society actors and beneficiaries of the social innovations show large evidence of the diverse motivations and factors underlining citizens' resistance, contestation or reluctance to be involved in social energy innovations. One of the principal lessons learned by the practitioners is that leading a social innovation generally involves dealing with internal, political and citizens resistance (e.g. interest gaps between different groups of population; political differences; lack of confidence in the success of the SI), and different targeted strategies need to be implemented in order to anticipate and/or reduce resistance and gain institutional and public support to the innovative projects.

Types of resistance and contestation

1. Internal/institutional resistance

Internal or institutional resistances have been reported by the practitioners in different social energy innovations. In the superblock clusters, both Barcelona and Vitoria-Gasteiz pioneers and promoters mention that, at the beginning, they had to deal with the strong reluctance of other municipal departments to implement certain measures, because they had a different vision of the mobility and needs of the city, or they complain that "such changes are not easy, and that there usually is a lack of resources for implementing them" (BCN_01) or the changes would have a negative impact on traffic mobility (VG_01). The interviewees from Barcelona argue that in order to reduce this reluctance, at the same time they propose a change, they also provide a viable solution to the potential difficulties:

"Planning departments have been very supportive. Management departments dealing with daily staff and maintenance didn't. Convincing them costs a lot. Think that a pedestrianized street has much more green parterres, for example. That means you need many more gardeners to maintain it. That means that if you have not planned that and you have thought that the streets only have trees, then you have to make a change and you have to organize people to take care of these new green areas. Well, this involves also economic resources (...) You have to always show that changes can

be done, in which way. In order to convince people in these departments, give them the problem and give them the solution, not just the problem” (BCN_01).

Institutional resistance was also reported in the holistic mobility cluster. The young and inexperienced politicians that lead the Groningen project had to deal hard with the resistance from the planning agencies or the traffic police. In words of one respondent a broad resistance did exist, not only against the traffic plan but against change in general. “The resistance was sometimes very personal and insulting” (GRO_02). In the case of Zürich, the main contestation related to the overlapping of competences between the municipality (the main promoter of the “sustainable mobility strategy”) and the regional administration (Canton of Zürich), with responsibilities on the management of mobility/traffic/transport. As one interviewee explains “the city does not own all the roads inside the city. Some of them are owned by the canton that decides what is happening on those roads (...). The Canton of Zürich perceives the policy of the city of Zürich has been very much guided by a wish to make the city a bit essentially nearly un-urban. And the Canton really stresses that the transport systems need to serve the whole canton and the needs of the population and business” (ZUR_06).

2. Political resistance

Due to most of the social innovations are city-level projects, they usually need the support or involvement of different political institutions, such as the city council or the island government. This involves also struggling with different political positions and motivations. Political division was reported as negative by the promoters of the Groningen and the Barcelona innovations, which served to create social alarm among the citizenship or to endorse the positions of specific groups affected by the projects, such as the shopkeepers. As one of the promoters of the Aberdeen innovation puts it, they had to work hard to obtain the support of all parties represented on the Council and ensure that the heat network project was not taken as a party-political issue. They did so by adapting messages to the different interests of the parties, strengthening the fuel poverty aim when talking to the Labour party while emphasizing the local business interests when presenting the project to the Tories.

3. External resistance and contestation

A number of factors have been argued to explain the **resistance of inhabitants, stakeholders and specific groups of interest** against social innovations in the different case-studies, as listed below:

- **Fear of changes.** Several interviewees mention that people seem to feel “always” fear of any kind of change that modifies the status quo: “people are often resistant to change even regarding projects that improve their quality of life” (VG_09). This relates to the natural resistance to lose the perceived commodities (e.g. having a bus stop near to home) or assumed rights (e.g. “the right to drive a car”) that motivate the main protests against car circulation and parking restrictions in the holistic mobility and superblocks clusters. As one of the promoters of the Barcelona superblocks explains: “In this project, the starting problem is fear. People have a lot of fear. As we pursue a change in the way of organizing the city, a change of the predominance in the use of the public space, to give priority to the people instead of the car... then, this involves changes in the way of mobility... and provokes fear, as any process of change, isn’t it?”

We found as a principal problem the fear to any changes. The residents, citizens, all feel fear” (BCN_01).

- **Confrontation of different interests and goals.** There are also specific groups that are concerned about the impact of the SI. The shopkeepers (who led the main protests against the Groningen mobility plan and the Vitoria-Gasteiz superblocks model), the local/neighbourhood businesses, the retail sector, etc., manifest preoccupation with the potential negative impact on their economic activity. Others are concerned about changes in the type of economic activity inside the area (for example, closing the traditional retail activity and opening more bars and terraces in the streets affected by the project), as one interviewee mentions regarding the Sant Antoni Superblock (Barcelona). In the Zürich case, contestation came from people living in rural areas of the Canton of Zürich having different priorities (e.g. a large use of the car) as well as from few sectors of the business community in the City of Zürich who fight for a better access to their shops or to their working places.

- **Top-down measures perceived as impositions or measures alienated by the citizens.** A few of the cases illustrate that top-down measures can produce strong contestation or the non-involvement in the social innovation. As reported in the negative experience in Poblenou (Barcelona), where the participatory process started after the implementation of the pilot intervention, the social contestation raised against a measure that was perceived as an “imposition” by the city council, without being discussed with the neighbourhood. According to one of the interviewees in Barcelona, the Poblenou experience served them to implement changes in the superblocks participatory approach, avoiding “top-down” effective interventions. As she explains, most of these **participatory co-designing processes** currently entail one year and a half negotiating with the members of each superblock promoting group and explaining future changes to citizens in several open meetings organized in the neighbourhood. Thus, one of the lessons learned by the promoters is that “consensus requires time and despite these processes are slower than expected, going step by step serves to reduce contestation and gain social endorsement” (BCN_01). In the El Hierro case, as the project started without the involvement of the citizens, there is still a sector of the population that does not feel any interest or sense of ownership, feeling that the renewable energy project “was like throwing the money, because it is not an important project for the island, they invested a lot of money but they have not achieved anything yet” (HIE_05).

- **Reluctance of citizens to engage in decision-making processes.** Participatory processes that require citizens’ engagement in co-designing might face the reluctance of certain sectors of the society to be involved in the activities proposed. This might occur due to the lack of previous experience in participatory/democratic processes, as reported in the Malmö case, where the inhabitants themselves did not initially understand why they were being involved either. There are also specific groups of residents that might not feel part of the project, for example, specific groups of immigrants that might not speak the local language. Also, as the promoters of the Stockholm case pointed out, another challenge relates to the difficulty of maintaining

people involvement during an extensive timeline, so as the project involves a long and gradual transformation process of the area and the impact of changes only might be perceived after several years or decades:

“How can we keep a project like this interesting and alive and have people involved, wanting to influence the decisions and be willing to take in information, when it is so long-term and goes so slowly. That, I would say, is a challenge; and we therefore try to work with a long-term perspective, but also, what we can do here and now, that we can connect to the project focus Skärholmen that involves something positive for peoples’ everyday life, now, today” (STO_01)

- **Sense of loss of control or autonomy.** One of the major resistances reported by the Aberdeen promoters is the concern of residents at the early stage that, if they join the district heating project, they would lose control over the heating of their houses if the city council decide to switch off the heating.
- **Trust issues: lack of confidence in the efficacy of the social innovation.** As the fuel poverty cluster shows, social energy innovations have to deal with the lack of confidence of the beneficiaries regarding the effectiveness of the energy projects. Being involved in a pilot experience creates negative feelings from the potential beneficiaries, because they do not have references of other places in which the project is working well. For instance, Aberdeen Heat and Power company experienced most resistance to the heat network with the first set of residents to have the installed, so as they showed great reluctant to install a new technology that they had not previous references that it really works. The Timisoara case-study shows the peculiarity of the lack of trust in local-based initiatives. Residents are not confident on investments that are not the result of attracting external funds, preferably international. In other words, the community distrusts that the project has sufficient funds to complete it successfully:

“The complexity of developing an industrial product with the involvement of many stakeholders, from very different backgrounds, private and academic. People do not trust in such alliances. They said that a product incorporating photovoltaic panels can only be profitable if it is financed through EU funds or other non-reimbursable funds” (TEP_01).

- **NIMBY effects.** Whether the social innovation involves, for example, the construction of an energy facility or a transport station, this might create a NIMBY (“not in my backyard”) effect from citizens living nearby to the new installation. This has been reported in the Samsø case. As one interviewee explains, the main contestation and resistance arise against the establishment of the biogas plant. The issue has triggered debate and resistance by many who do not want to have a biogas plan nearby due to the potential increase of traffic in the area and the worsening of the quality of the air.

Strategies to deal with conflict and resistance

The interviews also provide insights about how pioneers and promoters of the different social innovations were able to deal with the public resistance and contestation. Usually, a combination of strategies was set out, that range from the initiation of a **negotiation and mediation process**, engaging supporters and critical voices in a dialogue with the city council; **inclusive and targeted communication strategies** adapted to specific groups of actors and citizens, aiming at gaining the trust of these actors; and the **designing of participatory processes** that involve beneficiaries and citizens in the co-designing of the measures (these strategies are described in the section 4.1.3). Despite social contestation is not perceived as desirable by the promoters, they also recognize that in occasions the resistance against the plan has occasionally served to involve people in the public debate, building consensus about the policies that need to be implemented in order to tackle with social and environmental challenges.

4.1.3. Factors driving social acceptance of social energy innovations

The qualitative interviews conducted with participants of the different social energy innovations developed in the ten cities and islands involved in the SMARTEES project provide substantial evidence of the factors that drive the social acceptance of the SIs at the local level. The empirical data contribute also to the comprehension of the conditions and social dynamics that influence the successful development of the energy innovations. This includes both citizen's acceptance of the new energy policy – and the adoption of the new behaviours that a specific social innovation pursues – and the factors that favour the development of social energy innovations in cities and islands.

In terms of the factors that condition the acceptability or endorsement of an energy social innovation, six main categories of factors have been identified across the ten case-studies, which relate to the adequate provision of information and communication, the facilitation of advice and training, or the implementation of new services that foster the adoption of new energy-saving behaviours. Other set of categories relate to the active involvement of citizens in decision-making processes aiming to enhance collective empowerment, or the celebration of new local identities shared by the inhabitants of a city or a specific area or territory. Finally, providing opportunities to experience the benefits of these social innovations, through pilot projects, become empowering strategies for people to support the energy transitions.

I. Factors related to the provision of information, education and training

a. Dissemination, communication and education strategies

Promoters and civil society actors participating in social energy innovations stress the importance of implementing – at an early stage – dissemination, communication and education strategies about the ambition, the characteristics and the changes that the social energy innovation involve. Information provision can be fostered by different strategies and measures, such as educational programmes, environmental awareness campaigns, citizen forums, interviews, etc. The cases of Samsø, Vitoria-Gasteiz, Barcelona or Stockholm show that strategic performance of effective information and communication campaigns targeting

specific groups or adapted to different types of audiences, is critical in order to inform citizens of the benefits of the innovation and increase public awareness concerning several social and environmental issues.

For example, in the Samsø case, the promoters deployed a targeted communication strategy addressing resistance of the community towards a biogas plant. This strategy comprised information about different aspects of the project and its consequences tailored to different audiences. They also organized a series of informative meetings and informal conversations with the islanders before the political debate that would decide whether the biogas plan will be build or not, as the following quotation illustrates:

“I think we have had twelve public meetings on biogas on Samsø alone. We have communicated something about what does it consist of, and it does not have much to do with official planning, but there have been some meetings. We talked about biogas and architecture; biogas, carbon and soil; biogas and traffic; biogas and nutrients. So, we have tried with the different angles to nuance the stories of biogas plants”
(SAM_01)

One of the promoters of the Skärholmen district project (Stockholm) mentions that, in addition to the dissemination activities carried out in the district, the promoters conducted a big survey where people had access to digital maps of the area, and could mark both their favourite places and the places they think that needed development. They included the young population in these activities, conducting in-depth interviews with children in local kindergartens that helped to prioritize the interventions and identify neighbours' preoccupations that the project could solve, such as improving safety in public spaces.

In Timisoara, a communication and dissemination strategy targeting particular communities of interest was used in order to test peoples' perception of the project and its implementation as well as to increase the degree of acceptability and support to the project. According to one of the interviewees, the direct participation of the promoters in the dedicated events, presenting the technical details, the advantages and strengths of the project, gaining the confidence of the people, was the essential factor in the success of any action involving citizen collaboration and commitment.

The promoters of the Barcelona and Vitoria-Gasteiz superblocks programmes performed targeted communication and effective dissemination strategies aiming at capturing citizen's interest and gaining their support to the implementation of a superblock in their neighbourhood. One of the interviewees, actively involved in the promotion of the Barcelona superblock model, highlights the importance of “doing pedagogy” and “make an effort” to explain the complex technical issues implicit in the project. They sustain their discourse with objective data and adapting the messages to different audiences focusing on the topics more relevant to each social group (e.g. retail associations, business, schools). As one of the promoters of the Barcelona superblocks explains, when presenting the project to the population, they avoid alarming citizens, but capture their interest appealing to health conditions and establishing a link between the environmental conditions of the neighbourhood and the direct effects on the residents' health:

“We have always talked about health, about that the bad management of the city had negative effects on their health, with a series of negative indicators that we show, as noise pollution, air pollution, level of accidents or a sedentary lifestyle. We presented all the negative indicators and how we could influence them, which meant to improve

people's health conditions, people's lives. This makes that people change their mind. When our discourse is more technical, more theoretical, half of the people did not understand it, the other half got bored. And some people saw it as something subversive, and it causes fear, right?" (BCN_01).

- **Advising, consultation and training strategies**

As several cases demonstrate, providing information and targeting communication is not sufficient for people to engage in social innovations. Innovations that require technical knowledge, training or investment in technologies (e.g. solar panels, smart-meter use) might require specific **advising, consultation and training efforts** focusing on empowering citizens in the adoption of energy saving measures. On the island of Samsø, a training project has been promoted in relation to circular economy and sustainable farming practices, the efforts encompass talks, demonstrations and support to the implementation of new systems and practices among farmers. In Vitoria-Gasteiz, the Centre of Environmental Studies in collaboration with local cyclists' associations have promoted bicycling courses for students and adult people to increase their competences for safer cycling on streets and interurban roads. On the contrary, the lack of educational and training programmes in Barcelona has been reported by one of the interviewees as a significant barrier to the wider adoption of cycling as the main mode of transportation in the city.

II. Factors related to citizen empowerment in energy transition

a) Community active involvement in decision-making

Enabling citizens, society actors, experts and stakeholders to engage in decision-making processes about the social innovation has been reported as one of the most effective strategies to gain public acceptance for a social energy innovation. The majority of the case-studies in SMARTEES have displayed participatory strategies aiming at involving residents, beneficiaries and different groups of interest in the co-designing of the programmes. Such participatory strategies involve different levels of commitment that range from process of **information and consultancy** organized at early stages of the social innovation (e.g. Sustainable Mobility Forum in Vitoria-Gasteiz), long-term participatory **involvement in co-design processes** (e.g. district renovation initiatives, superblocs promoting groups in Barcelona), **negotiation or mediation processes** with beneficiaries and opponents as a response to social contestation and protests (e.g. holistic mobility plans in Groningen), or active **engagement in the ownership** of the social innovation (e.g. renewable energy plans in Samsø).

Participatory and bottom-up approaches become more successful than technocratic or top-down policies. When the Groningen City Council launched a traffic circulation plan aiming at reducing motorized traffic in the city and fostering low carbon mobility behaviour, large contestation raised against the measures from different inhabitants and groups of interest. This negative response provoked a change in the way that the municipality used to interact with the stakeholders and the citizens. As one interviewee mentions, while the administration used to be "more technocratic" and did not involve citizens in decision-making, for the mobility plan the promoters moved from a technocratic policy towards a more organic policy making structure where meeting people and building relations was very important (GRO_01). Special meetings were organised with relevant stakeholders and experts as well as with

residents, which vividly discuss the plans the neighbourhoods. Pioneers conclude that “the change from a technocratic towards a participative way of policy making is essential” (GRO_02). In the Zürich case, community involvement in decision-making processes was the main strategy adopted from the beginning to achieve support and acceptability, together with voting measures, such as referendum measures.

Involvement in co-design processes increases both social acceptability and resident’s sense of ownership. This is one of the main lessons drawn from the Ecostaden Augustenborg project (Malmö case). As one of the promoters states, since the project started and before any structural changes were implemented, workshops with the inhabitants and “a lot of interviews and assessments were organized to find out what would work, what would not work, and how the inhabitants would experience the changes” (MAL_01). The interviewee mentions that this bottom-up approach was an advantage, as every inhabitant could at least find some project they liked and took interest in: “One of the advantages of Augustenborg here was that it happened so terribly much at the same time, so that even if you didn't think that waste sorting was the most amusing activity, you thought it was fun to be able to be with and contribute and share your views on the development of the parks” (MAL_01). Similar outcomes were found in other case-studies, such as the superblocs programme in Barcelona and the renewable energy project in Samsø.

Social acceptability depends on the resident’s trust and perception of efficacy. The Barcelona City Council launched participatory processes involving organized citizens in the process of co-designing the superblock in each specific neighbourhood. Citizen’s engagement functions optimally when a representative sample of the population (residents, stakeholders, representatives of different social and economic groups of interest) gets involved –and eventually endorse the process– including critical voices. According to one of the respondents such participatory processes work “when the promoter team is able to **build trust** with the participants and **enhance citizen’s confidence** on their own capacity to have an opinion about the project” (BCN_01). She remarks that the Superblock Action Plan should be consequent with the decisions adopted in the participatory meetings (enhancing citizen’s collective efficacy perception). Providing face-to-face information adapted to each neighbourhood, involving technical and policy actors together with residents and stakeholders in public meetings, was a key factor for gaining social endorsement to the Sustainable Mobility Plan in Vitoria-Gasteiz. As one of the pioneers explains, the City Council adopted a flexible attitude, welcoming proposals of improvement from the citizens. Every proposal was studied, its technical viability was analysed and explained, and people felt that they really had the chance to make changes in the plan.

b) **Celebrating new (local) identities**

Creating the experience of a city/neighbourhood as a pleasant, friendly, clean and accessible place to live, work or visit, can enhance citizens’ endorsement of the social innovation. As one of the interviews conducted in Groningen illustrates, the implementation of the traffic circulation plan was perceived a very positive experience, turning into a festive atmosphere:

“I remember when I implemented the plan there was really enthusiasm in the city. People were very proud that we did it. You had to change thousands of traffic signs in one night, so it was really a transition in one night, it was a light atmosphere, people

liked it. And we planted trees, and I remember at one tree planting ceremony people came to you and told very good what you are doing” (GRO_02).

Thus, the citizens started supporting the developments even if they initially were opposed, because they observed it was good for the city (e.g. the inner city developed into a welcoming and friendly place for people to shop, walk and visit, the older neighbourhoods were restored and flourish). In Vitoria-Gasteiz, the implementation of the main changes in public transport, car traffic and parking limitations was announced as a “big event” involving more than a hundred volunteers and local media in a communication and behavioural campaign which included advertising in newspapers, radio, bus shelters, outdoor advertising etc. Besides, receiving international awards as becoming the “European Green Capital” was celebrated as a collective success that acknowledges the new environmental identity of the city.

c) **Making change easy**

Public acceptability depends also on people’s experience with the social innovation and their capacity to engage in new energy behaviours. Whether the changes implemented facilitate citizen’s daily life, people will increase their willingness to change their patterns of mobility, energy consumption or lifestyles. For example, in Vitoria-Gasteiz, the sustainable mobility plan was accompanied by a radical transformation and modernization of the public transport system, including a new electric card that connected all public transport services, as well as the construction of a network of bike lanes that permit people cycling across the city. In other cases, making the change easy would involve the removal of financial burdens, providing incentives and grants (e.g. for investment in solar panels) or facilitate social and technological engagement.

In Groningen, large car-parks placed at the outskirts of the city make it easy for city visitors to leave their cars there and use a cheap and fast public transport option to reach to the city centre: “cycling paths were built, and parking garages were built in the city centre, making it easy for people to visit the city without parking cars on the streets” (GRO_02). In Aberdeen, district heating promoters had to deal with individual owners who were unable to pay outright for the costs of the district heating installation in their homes. In order to address this issue, the energy manager of the Aberdeen City Council set up an affordable warmth loan fund: “the repayment of the loan is based on what is affordable for the resident, without putting them into fuel poverty” explains one of the promoters.

d) **Pilot projects that demonstrate that change is feasible**

Some interviewees also remark the importance of developing pilot projects, simulations and demonstrative strategies in specific areas or neighbourhood of the city, allowing citizens to see that changes are tangible and lose their fear of changes. The pilot superblock in Vitoria-Gasteiz permits the inhabitants to visualize to what extent a superblock increases the neighbourhoods’ quality of life and, as a result, they demand similar measures in their streets and neighbourhoods. The Aberdeen district heating network is also a good experience to illustrate this effect. When the promoters intend to install the heat network in the Hazelhead area, many concerns and resistances from residents had to be tackled. As one interviewee explains, they did so by “arranging a bus trip for the tenants from Hazelhead to go to Stockethill [the pilot experience] and talk to the tenants that already had this type of heating,

and that was far more convincing than anything we could have said”. Those who already had the heat system installed told the prospective beneficiaries that it was “warm, controllable, affordable”. According to the interviewees, word-of-mouth between residents has been crucial in overcoming resistance to the installation of the heat network.

III. Factors related to social influence dynamics: Social Innovations becoming accepted as “the new normal”

A third category of factors arising from the qualitative data relate to social influence dynamics by which social innovations become accepted “as the new normal”. These phenomena are observed mainly in those social innovations that are more matured now, and that had time for people to observe the benefits of the energy transition and adopt new behavioural patterns at the individual and collective level. For social innovations to become a new social norm, several conditions have to occur. These relate to changes in mindsets, views and inhabitants' attitudes that consequently lead to the adoption of low-carbon behaviours and sustainable lifestyles. Changes also affect to modes of relations and practices in institutions, modifying the power relations between different institutions, communities and individual citizens. Finally, social innovations frequently favour the creation of new collective identities (environmental, social, place identities) that foster the social acceptability of the energy social innovation.

▪ Changes in mindsets, views and attitudes

The creation of new social norms entails a collective change in people’s worldviews, mindsets and attitudes towards an environmental or societal issue. This might involve, for example, increasing citizen’s awareness about environmental or health issues that lead to a change of individual and collective priorities. As observed in Barcelona, citizens involved in superblocks are more concerned now about the impact of environmental pollution on their health or on their children’s cognitive development, as the promoters provided scientific evidence for the impact of air pollution in the city of Barcelona. In Vitoria-Gasteiz, the respondents observe a change in the attitude towards public transport. While in the past the bus users were perceived as people who cannot afford a car or were unable to drive one, nowadays using the tramway or the bike is positively seen as “something modern and cool” (VG_09). This was favoured by certain groups of influence (e.g. politicians, journalists) that normalize these new behaviours.

Superblocks in Vitoria and Barcelona favoured changes in how people perceive the public spaces. Respondents report that citizens demand now high-quality public space and green areas for public use and social interaction (e.g. organizing parties, sports competitions and art events on the streets) instead of more space for car parking. Changes in people attitudes might influence citizens’ support for new environmental policies to be implemented in the future. In Groningen, because the plans resulted in a growth of the city, inhabitants supported the new developments of the city. Further, a long-term vision was widely developed on the value of the city, and on ecology, clean air, and how to transfer it to the next generations. In Zürich and Vitoria Gasteiz, the interviewees point that the new vision that lead the whole mobility system has been accepted as the best policy by the majority of the local politicians, which also allowed changes in local regulations and norms.

- **Changes in behaviours and lifestyles**

The creation of a new social norm involves also changes in people's patterns of behaviour. Behavioural changes directly related to the social innovation have been observed in most of the cases, such as the Holistic Mobility Cluster or the Superblock Cluster, where people increase their use of public transportation or adopted active mobility patterns in the city (e.g. cycling, walking, etc.). In the city of Zürich the social innovation has favoured the development of new forms of local entrepreneurship concerning bike sharing and car sharing. According to one interviewee, sharing a car instead of purchasing one is becoming a new norm in Zürich: "we have a constantly growing number of citizens who do not possess a personal car. It is true also for me, for my family; for many years now. we do not have a car; we do not use it and many other people in Zürich do the same" (ZUR_07). In El Hierro, the adoption of energy-saving behaviours has been reported as a consequence of educative or financial measures implemented by the island council. For example, residents have changed old bulbs by the led ones as a result of an educative campaign conducted in schools. Individuals and business apply for subsidies for purchasing electric cars and e-bikes. The promoters report also an increasing interest in renewable self-consumption alternatives (e.g. installation of solar panels in farmers, households, restaurants and tourist buildings), which installation is being subsidised by the island government.

- **Changes in power relationships and empowerment community**

Social innovations frequently involve also changes in the relations among the different actors at the city level fostering local entrepreneurship and citizens active engagement in local democracy. The District Regeneration cluster presents evidence of community empowerment processes. The social innovation fostered residents' active participation in local decision-making processes inside and outside of the project, which was not frequent at the beginning of the project. As one of the promoters of the Groningen case mentions, as a result of the SI, the city council adopted a new paradigm in their relationships with the inhabitants by which "the old technocratic policy came to an end". Changes were happening and the residents understood and that their neighbourhood could be benefitted by the new policies.

- **Changes in institutions**

The Aberdeen district heating system has been driven at a city scale as a way to find solutions to local social, economic and environmental problems. This differs substantially from other district heating initiatives unfolded in a number of European countries, where developments were supported by greater government control and regulation of services. The local-level response in Aberdeen led to the development of a new model of organisation whereby the council established *Aberdeen Heat & Power* as a not-for-profit company which remains its close partner and leads in taking forward the infrastructural development and operational aspects of the Aberdeen Heat Network. This new model also carried new opportunities to explore different ways of pricing domestic energy which could be more sensitive to the needs of the recipients. Other examples of public-private entrepreneurship have been reported in El Hierro and in Samsø, where small local business, farmers and citizens were also involved in the ownership of the new institutions created in the frame of the SI.

- **Creation of new identities**

The social acceptance of a social innovation could be also influenced by identity dynamics. It has been observed in several case-studies the creation of new social, environmental or local identities that relate to the new collective visions of the city or place (e.g. Vitoria-Gasteiz “green identity”). Some cases present evidence of the existence of new local (or neighbourhood) pride, where residents feel proud of living in a specific area (e.g. in regenerated districts, superblocks) or being part of a community that has successfully implemented an energy transition (as observed in both Samsø and El Hierro).

4.1.4. Dimensions of empowerment and disempowerment

In the analysis of drivers and barriers for social innovations in the SMARTEES case-studies, researchers have also explored the psychological empowerment dimensions that influence the development of the SI and the motivations for people to engage or sustain their involvement in the social energy innovations positively or negatively. The type of relationships forged among the practitioners, as well as their increasing capacity to gain knowledge and abilities and material and human resources appear as relevant conditions for the development of the SI. Besides, experiencing a sense of impact and meaning foster promoters and citizens’ commitment towards social energy innovations as described below.

- a. **Relational dimensions: changes in the quality of relations**

Interviews with pioneers and promoters of most of the case-studies present evidence that social innovations enable the emergence of new types of relations forged among the different actors involved. First, **new intergroup relationships** are built between the so-called “promoters”, those people and groups involved in the promotion of the social innovations. Strong intergroup connectedness provides an enabling environment for social innovation based on collaboration, shared motivation and mutual support. For example, in the case of Barcelona, the promoters stress a positive feeling of being part of a united group that pursues a common goal, despite the internal discussions and differences of opinion that they might had along the project. In Augustenborg (Malmö) and Timisoara, interviewees report the generation of social ties between all partners involved, bridging different community interests and taking advantage of the strengths of each partner.

Changes in the quality of relations have also been observed **between local authorities or public servants** – specifically when they are the promoters of the SI – **and the citizens and/or stakeholders/social actors** (e.g. citizens organisations, business, mass media) involved in participatory processes. Social innovations usually create new spaces for social interaction and co-designing processes that foster empathic relations with citizens, trust building and two-side communication. Thus, citizens experience more power and a sense of efficacy when they can improve the project with their proposals. In some cases, changes of relations involve also **human-technology interactions** like in the Stockholm case-study, where the social innovation needed a processes of learning how to use the digital interfaces connected to the local administration, such as the social office or housing office where residents applied for renting apartments.

Negative and disempowerment effects were found when the promoters and social actors perceive the lack of policy support to the social innovation, they feel a loss of communication with decision-makers or perceive that the project might be at risk. These circumstances are described as “demotivating situations” that might decrease the commitment of the promoting teams or citizens involved in participatory processes.

b. **Gaining sense of competence**

Participants in SIs appear to have developed competence and mastery in the endeavour of launching a social innovation when they acquire **new knowledge, abilities and skills** that permit them to achieve their goals. In Barcelona, one interviewee explains that, as promoters, they learned new social skills and abilities to facilitate participatory processes, “talking face-to-face with the neighbours, being flexible and open to other visions while not losing the aims of the programme” (BCN_01). Furthermore, increasing their capacity to evaluate and assess the impact of the SI is highlighted by the promoters as essential to address new challenges in the city. On occasions, competence is experienced by receiving the support of other relevant actors, such as the scientific community (e.g. universities, technological institutes) or business actors, who contribute with their expertise to the project.

A sense of competence is also gained by the beneficiaries and social actors involved in the SI when they develop capacity of social and political influence. One of the interviewees involved in the Skärholmen project (Stockholm) acknowledges the connection between being involved in SI and the participation of citizens in democratic processes such as the local elections: “the participation in the last election actually increased in Skärholmen for the first time since a long time” (STO_01). The respondent is convinced that if they succeed in increasing the participation in democratic processes, this will stimulate participation in other democratic processes including future urban development.

c. **Gaining financial and technical resources**

Developing competence and mastery also relates to the access to sufficient financial and technical resources to successfully deliver the project. In some cases, resources proceed from the public institutions that promoted the social innovations (e.g. municipalities) and in other cases external financing and technical support are needed for the social innovation become a reality (e.g. El Hierro, Vitoria-Gasteiz). In the case of Samsø, funds for starting out the energy transition in the island mostly proceeded from the residents, farmers and local business, which constitutes a paradigmatic example of community empowerment and ownership. In Vitoria-Gasteiz, the superblocs experience enabled the city to participate in EU-funded projects, which has become a way of increasing their capacity to launch new superblocs and sustainable mobility projects and enhancing their innovative capacity. On the contrary, the lack of financial resources is perceived as a condition that limits the impact of the programme as reported by other respondents.

d. **Gaining sense of impact**

Social innovation promoters experience a sense of impact when they perceive the benefits and outcomes of the implemented interventions. As most of the respondents explain, being involved in projects that eventually become a “tangible reality” is extremely satisfactory and

serves to sustain motivation overtime. For example, one of the leaders of the Barcelona superblocs programme expresses great emotion and happiness when she personally observes the social regeneration of the neighbourhood of Sant Antoni. Together with the improvement of the environmental quality, she emphasizes the fact of “seeing children playing on the street, which did not happen before” and observing children and elderly people socializing on streets “while they were isolated before” (BCN_01).

Another interviewee from Zürich stresses the ability of the promoters to achieve the pursued objectives of the mobility strategy, which has **become a model for other cities**: “most of Zürich people are aware of this strategy, they like it. Many of them are also proud of it, and it works so well. And they like to tell people of other cities ‘come here and you’ll see how good it works here’” (ZUR_07). Most of these social innovations have served as an inspiration for energy transitions in Europe and worldwide, and the interviewees show great pride of this upscaling capacity.

Such perception of positive impact might be affected, however, by the **existing limitations that cause frustration** within the promoting teams. In the case of Barcelona, being a small team is considered as a limitation by the promoters, so as “there are few human resources for a big effort” and they have not the sufficient capacity to launch a major number of superblocs across the city that truly demonstrate the positive benefits of the programme. The interviewees also mention the **lack of political consensus** about the superbloc programme (this is object of political discussion among the different parties) as a negative situation, that might limit the promoters’ sense of impact. In the case of El Hierro, the **national regulations** on the energy system are perceived as limiting conditions to the upscaling of this type of social innovations, as in Spain public-private partnerships in energy production are still limited and energy self-consumption models were not facilitated by the national government for a time.

e. **Gaining sense of meaning**

Practitioners and SI activists experience also **personal satisfaction and pride with their own participation** and contribution to the project, which becomes a motivational factor to stay engaged despite the issues they face during the development of the project. One of the participants in the Groningen case-study ensures that “it is very satisfying to make other people enthusiastic about a plan, and that that makes being a politician a wonderful job” (GRO_02). For those who supported the initiation of the Aberdeen district heating project, there is also a strong sense of having built a long and experimental process from “scratch”, which had opened up an enthusiasm, energy, and ambition for the heat network. Sense of meaning also involves the certainty that achieving a sustainable change in the city is feasible and “the social innovation has surely enhanced the life conditions of citizens” (VG_09). As several interviewees from different cases remark, the opportunity to “make a change” in their own city and see the impact and the benefits that the social innovation is bringing is highly motivating for them and increases their commitment to the project.

The promoters of these social innovations are **happy to share their experience with others** interested in the project as observed in the cases of El Hierro or Samsø, who receive numerous visits from other islands around the world. One interviewee from Timisoara mentions with pride that they received the invitation to collaborate with an agricultural university in Nepal “within an Erasmus+ project where we exchanged information and ideas related to the use of renewable sources for irrigation” (TEP_01). **Receiving others’ acknowledgement** increases

the sense of empowerment and meaning and compensates all the effort done in the project. One interview from Groningen refers to the many compliments he received after the implementation of the traffic circulation plan, even from the chamber of commerce representing the shopkeepers, who did not like the plan but finally appreciated the way in which it was implemented (GRO_02). One of the pioneers in Vitoria-Gasteiz describes a very satisfying experience when her own neighbours recognized they did a good work, despite the critics received at the beginning (VG_09).

The sense of meaning can be lost in the process of development of a social innovation. As one of the interviewees of the Samsø case points, some of the Energy Academy developments are creating distance between the locals and the project and thus, representing a thread for the maintenance of the sense of meaning within the inhabitants:

“Some critical voices are starting to come down at the Academy, where they work in projects that do not benefit Samsø. Somehow, we work with Hawaii, Australia, South Africa, but when will Samsø benefit from it? I think some people think that something's happening, they're going too far into projects instead of the biogas plant. Why doesn't it come? There is nothing concrete, no goals set” (SAM_01).

f. **Developing resilience**

Social energy innovations have favoured a change of framing and worldviews, contributing to the development of certain resilience capacity to tackle new socio-environmental challenges at the city level so as “the city is much more prepared now to face issues like climate change” (BCN_01). Participants from Barcelona and Vitoria-Gasteiz coincide in the idea that healthy and sustainable mobility discourses are more endorsed now by the wider population. Inhabitants are more aware now of the effects of pollution on health and wellbeing and that the superblock programme is perceived by a part of the population as good intervention which has a positive effect on people's quality of life and that residents from other areas of the city demand now similar interventions in their neighbourhoods. Also, physical interventions implemented in the different SIs have prepared the cities/islands to tackle new energy and environmental challenges, such as the renewable energy projects in Samsø and El Hierro or the public transport and bike lane networks in Zürich, Groningen and El Hierro.

However, as one of the promoters of the Barcelona superblocks programme points out, more interventions in the city are needed in order inhabitants can “see the benefits” of these social innovations. Sustainable transitions require the support and alignment of the majority of the inhabitants and there are still resistances to adopt more radical changes in current patterns of behaviour. The example of the airport of Zürich, located nearby to the city and with an enormous number of flights every day, is presented by one of the interviewees as a situation of disempowerment: “most of the people are aware of the problem, but their behaviour is not according to their knowledge. I know that this is probably not only here” (ZUR_07).

4.2. Brief overview of lessons learned in social innovation journeys in SMARTEES

The SMARTEES second Annual General Assembly organized a specific session as an “Energy Innovation Summit: Fair and sustainable energy transitions in European cities and islands” aimed at sharing knowledge and experience on social energy innovations. Representatives of nine of the ten case-studies involved in the SMARTEES project¹⁷ presented their own experience as promoters and shared the three main lessons drawn from the implementation of an energy social innovation in their cities and islands. A summary of the main insights and challenges is presented in figure 1.

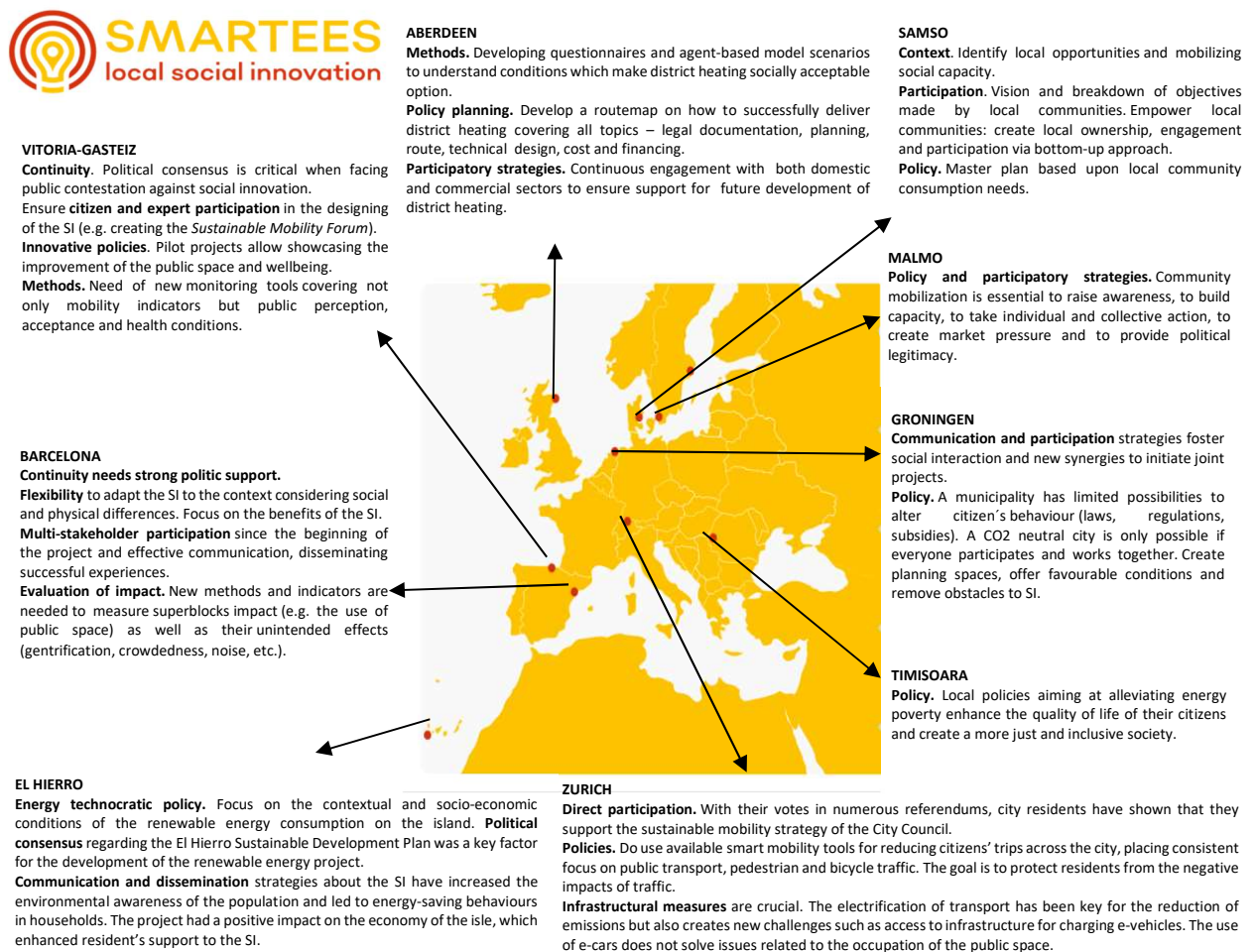


Figure 1. Lessons learned from social energy innovations. Summary of city representative presentations in the ‘Energy Innovation Summit’ (A Coruña, June 26th, 2019).

5. Implications for the design of policy scenarios

This deliverable has analysed the existing policy scenarios at the European, national and regional or local level of each case-study involved in the SMARTEES project establishing a categorization of the different policy measures adopted in the energy domain at the different scopes. The impact of these different energy policies has been investigated from a social science perspective, providing empirical knowledge about the factors driving public acceptability of energy policies. This paper integrates also the different outputs of the SMARTEES empirical research investigating the strategies and practices adopted by the pioneers and the promoters of social energy innovations in ten reference cases. This study includes the analysis of both the contextual conditions and the psychological factors which influence energy collective behaviour, operating as drivers and barriers for energy transitions. The aim of this final chapter is to contribute to scenario building work by providing a plausible and robust theoretical framework – grounded on empirical data – that helps policy actors to tackle energy transitions. The following work to be conducted in work-package 5 will develop policy scenarios – theoretically solid and empirically grounded on qualitative and quantitative data – for a number of reference and follower cities of five clusters of social energy innovations, supported by dynamic simulations of policy implementations (the theoretical principles of the simulation models to be implemented in SMARTEES are described in deliverable 7.2. (Antosz et. al., 2019).

Existence of a variety of policies measures and interventions able to be adopted and adapted to the context

Four main categories of policy instruments have been largely adopted by policy-makers in their endeavour to implement an energy transition at the local, regional and national level: 1) Normative and regulatory approaches, 2) Financial incentives for the market and for individual households, 3) Infrastructure and technology upgrade measures, and 4) consumer awareness, decision-aid and empowerment policies. The following insights can be concluded from the comparative analysis among the policies adopted in the SMARTEES case-studies:

- 1. Emphasis on regulatory approaches.** Most of the energy policies studied have been adopted guided by a set of legal instruments and regulations set up at the EU level that constitute the general normative frame under which energy innovations arise. However, as observed in several cases, the normative frame is sometimes insufficient or might even undermine the capacity of cities and islands to experiment or develop innovative projects tackling energy and societal issues. The case of El Hierro and the limitations to renewable energy community projects in Spain demonstrate that the EU ambitions can be limited by the national governments while other European regions (e.g. Denmark) have strongly empowered consumers to become “prosumers” and invest in renewable technologies for self-consumption. **Supportive legal and financial frameworks that guarantee equal access for new actors to the energy system are fundamental for community energy projects to arise at the national and local level.**
- 2. Financial measures presented as strategic measures to increase public acceptability.** Economic incentives (e.g. subsidies, credits and loans, grants, etc) have positive effects, especially when economic investments are needed (e.g. installation of district

heating systems, solar panels, e-car purchasing). However, financial incentives do not always have the expected effect on public acceptability, particularly when people are driven by other motivations or values, or, like psychological literature points out, whether the financial measures are finished, and citizen's intrinsic motivation has been undermined. Then, financial measures must be accompanied by other type of policies oriented to **fulfil the different needs of the population and strengthen the shared values and identities** taking place in each territory.

3. **Infrastructure and technology upgrade measures** are highly relevant for social innovation acceptance, especially when they are oriented to facilitate the adoption of new behaviours by citizens and groups of interests and increase the self-perception of people about their competence to introduce sustainable changes in their lifestyles. Besides, infrastructural changes might involve the creation of **pilot projects or urban experiments** to test to what extent a specific measure is being accepted and the barriers and drivers operate in the adoption of an energy social innovation.
4. **Targeted communication and education strategies** should be adopted when a social innovation is being implemented. Research suggests that public acceptance is not only affected by the access of financial or infrastructural measures but also by the perception that the energy policy is aligned with people's values and interests and that this will bring collective benefits. As observed in several cases, **public health and environmental concern are strong motivations that influence social acceptability of energy transitions**.
5. **Participatory and collaborative approaches enhance community empowerment**. Empowering citizens in energy innovations involves an institutional change shifting from traditional "top-down policies" to new cooperative or participatory approaches in decision-making, empowering engaging citizens – as well as other private and market actors – in policy co-design.
6. **Evaluation and assessment** of the impact of the different policy measures and infrastructures is essential for policy decision-making also involving inhabitants in the follow-up of the projects or programmes implemented. More structured approaches are needed that take into consideration the secondary effects of a energy project besides environmental impact, employability, gender impact, social cohesion and energy justice dimensions must be taken into consideration.
7. **Put the focus on behavioural factors**. Energy policies generally focus on the re-designing of the urban environment (e.g. introducing infrastructural changes) and facilitating energy-saving adoption via technological innovations, with less attention on behavioural factors. Policy measures that focus on behavioural change are frequently limited to information schemes while social acceptability is conceived as a necessity mainly when contestation emerges from the public (Perlaviciute et al, 2018). However, as previous studies have already pointed out (Mundaca, 2019), policy-makers have generally failed to address psychological/behavioural factors that influence policy acceptance via, for example, the use of social influence and social norms approaches, the strength of new local and environmental identities or the perceived collective efficacy in coping environmental and societal challenges. Further,

as the city-representatives participating in the SMARTEES Annual General Meeting (2019) pointed out, citizens' behaviours are conditioned by a series of constraints and resistances that need also to be tackled. Among others, the lack of awareness, existing local or social norms, cultural conditions, social identity, symbolic beliefs, or the lack of sense of efficacy have been observed in the case-studies as barriers for energy transitions.

Consideration of underlining socio-economic and political conditions, collective and individual ambitions and emotions involved when a social innovation is deployed

Social innovations in the different cities and islands that are part of the SMARTEES project show that despite sharing similar ambitions and goals, and even being implemented following same approaches, one successful policy can turn into a failure when this has been adopted in a different context. Thus, the context matters and the existing physical, social and economic characteristics – and the community structure – of each place or territory need to be studied and considered when a social innovation is planned. The same project can be perceived as a disruptive element or a cause of frustration if the needs of the specific community or the effects on personal comfort and perceived wellbeing are not considered by the promoters. Further, other psychological dimensions, like place attachment, can become a cause of resistance so as the impact of an energy project can be seen as a threat to the place people feel attached to.

Promoters of the energy innovations usually address policy acceptability by public information and awareness campaigns that are not enough for people to engage in new behaviours. As both clusters of district regeneration and fuel poverty illustrate, the success of these energy initiatives depended on the volunteering involvement of the inhabitants – considered as beneficiaries of the SI – in the districts, and their acceptance depended on how they perceive the benefits of the SI as well as their capacity of being involved in the co-designing of the policy interventions. The promoters should also consider the existing political conditions (e.g. trust in policy leaders) and psychological barriers (e.g. local cultures) that might interfere with the goals of the project, identifying also new opportunities for intervention.

The following factors operating in social innovation acceptance should be anticipated:

- Potential **internal resistances** among different departments of the city council and preoccupation regarding the reaction of citizens and stakeholders against the energy policy.
- **Citizen's resistance to changes** and perceived loss of commodities or assumed rights.
- Existence of **different interests and goals** among different groups of citizens that should be listened and considered in the deployment of the project. Flexibility is needed in order to be able to modify the planned intervention according to the specific contextual characteristics and social demands.
- **Trust issues**: lack of confidence in the promoters (e.g. city council leaders), perceived lack of efficacy of the energy measures and sense of loss of control or autonomy.
- **Economic issues** and **infrastructural barriers** that might impede the adoption of the desired sustainable behaviour.
- **Cultural barriers** or inexistence of social norms that promote low-carbon behaviours.

Attention to the process of implementation. Become social acceptability normative

Social energy innovations are sustained over time when they have been largely accepted by the inhabitants. The SI pioneers and promoters should care of the process of implementation of the energy policy ensuring the public acceptability of the measures to be implemented. In doing so, two-way communication channels should be established with beneficiaries and groups of interest in place, allowing people to express their opinion and their interests being carefully considered, having impact on decision-making.

Beyond information and communication, citizen engagement strategies (from the early stages of the project) seem to become normative in social innovations. Public participation should be carefully designed and organized considering the most adequate time to involve both general public and specific groups of interest; the rules and mechanisms to participate in decision-making processes, and the commitment required from participants.

The principal factors affecting public engagement in SI relate to the perception of social innovations as impositions (when communication has failed among the promoters and citizens) or if such energy policies are not aligned with citizen's preoccupations or interests. Promoters might have to deal also with the reluctance of citizens to engage in decision-making processes, as they perceived they have not the capacity or knowledge to be involved. Thus, participatory and bottom-up approaches become more successful than technocratic or top-down policies. As the empirical work evidence, citizen involvement in co-design processes increases both social acceptability and resident's sense of ownership.

In order to gain social acceptability and citizens' commitment, a number of strategies can be set up:

- **Dissemination, communication and education strategies.** Strategic performance of effective information and communication campaigns targeting specific groups or communities of interests, adapted to different types of audiences aiming at informing citizens about the benefits of the innovation and changing their mindset regarding several social and environmental issues.
- **Advising, consultation and training strategies.** Provision of technical knowledge, advise and training or energy-saving measures (e.g. solar panels, smart-meter use) measures. Empirical evidence in SMARTTEES show that SIs forge new relations between people and technologies and specific competences need to be developed in order to people be involved in these SI.
- **Community active involvement in decision-making.** Enabling citizens, society actors and stakeholders to engage in decision-making processes about the social innovation development. Participatory strategies range from process of **information and consultancy**, long-term participatory **involvement in co-designing processes, negotiation and mediation processes** with relevant communities of interest or active **engagement in the ownership** of the social innovation. **The specific strategies designed to engage citizens in decision-making processes and the adequate planning of the participatory processes become crucial for the successful development of the social innovations.** Promoters should pay attention to the different needs and motivations for citizens and stakeholders to engage in public participation and define

strategies of public participation or direct democracy since the beginning of the project.

- **Empowerment of local communities.** Fostering local entrepreneurship and citizens active engagement in energy innovation. This might involve changes in the existing institutions (e.g. policy bodies, legislation), the creation of new organizations as well as the establishment of new kind of relationships and partnerships between different types of actors (e.g. public-private-citizen partnerships).
- **Evaluation and assessment of the public acceptance of the social innovation.** Energy transitions are long-term processes that are developed along different phases of implementation. The impact of each policy intervention should be monitored and evaluated, also in terms of citizens' engagement and public acceptance, in order to be able to make decisions about the following policy measures and drawing lessons for the future.
- **Empower promoters and social actors involved.** Create enabling environments for social innovation, that forge social ties among a diversity of committed persons that share common goals that collaborate and provide mutual support. The provision of sufficient financial and technical resources become crucial for people to gain sense of impact as well as the remotion of existing barriers and impediments to the development of the social innovations. Celebrating succeeds and achievements, as well as receiving the external acknowledgement regarding the accomplishments, increases promoters' sense of meaning and contributes to sustain their motivation and commitment.

CHECK-LIST: towards a conceptual framework for the development of policy scenarios

Policy instrument	Types of measures	Strategies to be considered in the implementation
Normative and regulatory approaches	Technical and regulatory documents	<ul style="list-style-type: none"> - Evaluate national/regional policy framework, taking advantage of Institutional and legal contexts that might favour the impact of SI. Cope with institutional and normative frames that might act as barriers for SI. - Obligation schemes, taxes and penalization measures might be perceived as negative by residents and local actors. They can lead to instances of contestation and protest. - Obtaining political consensus (regarding the normative and technical instruments adopted) among the different parties involved is crucial in coping with social contestation. - Pay attention to equality issues: Provide equal opportunities to use energy services.. Design policies to support currently disadvantaged individuals.
	Obligation schemes	
	Penalization measures	
Infrastructure and technology upgrade measures	Public and private infrastructures and technologies	<ul style="list-style-type: none"> - Pay attention to the process of implementation: radical changes might cause disruption or major discomfort in citizens. Proceeding gradually with infrastructural transformations becomes the best practice to gain social acceptability. - Pilot interventions become effective strategies to demonstrate the positive impact of the social innovation and gain support for upscaling the social innovation. - Make change easy. If infrastructure is perceived as insufficient or deficient, people will not use them thus rendering them ineffective.
Financial incentives for the market and individuals	Tax exemptions	<ul style="list-style-type: none"> - Economic incentives have positive effects especially when Sis involve citizens' economic investments. Take into consideration the economic conditions (acting as barriers) and needs of specific groups of population. - Accompanied by other type of policies oriented to foster intrinsic motivation for sustainable behaviour
	Financial support (Subsidies, grants, contests, awards)	
Consumer awareness, decision-aid and citizen empowerment policies	Information and education campaigns	<ul style="list-style-type: none"> - Targeted communication and education strategies: Address psychological factors that influence policy acceptance. Appeal to social norms in information and feedback provision. Strengthen local and environmental identities and/or city reputation. Increase perception of collective efficacy. Consider moral and personal values.

		- Tackling constrains and resistances: lack of awareness, existing local or social norms, cultural conditions, social identity, symbolic beliefs or the lack of sense of efficacy.
	Decision-aid policies	- Advising, consultation and training strategies. Provision of technical knowledge, advice and training for the adoption of energy-saving measures. - Pay attention to necessary skills in adopting a particular energy innovation.
	Consumer empowerment initiatives	- Training actions that aim to improve citizens' competence for adoption of energy-saving behaviour are useful. - Foster local entrepreneurship and citizens' active engagement in energy innovation, which might involve changes in the existing institutional practices - Fostering the creation of new organizations or new kind of relationships and partnerships between different types of actors (e.g. public-private-citizen partnerships). - Promote business models that allow for co-ownership of energy technologies
	Participatory approaches	- Establish two-way communication channels with citizens, stakeholders and groups of interest. - Citizen engagement strategies: community active involvement in decision-making planned and implemented as a part of the process of social innovation, better since the first stages of the SI. Engaging a wide representation of residents and groups of interests in the definition of the project and the measures to be adopted. - Flexibility from the promoters to accept residents' suggestions and preferences. - Resources and time investment: Public consultation is a complex and time-demanding process that requires sufficient resources, time and capacity for maintaining participants' motivation. - Direct democracy tools available for the implementation of a social energy innovation (referenda). - Avoid the perception of SIs as impositions or not alignment with citizen's preoccupations or interests.
	Coping resistance, contestation, and non-involvement in social innovation	- Pay attention to potential internal/institutional resistance; political resistance and citizens' resistance. - Combining strategies: negotiation and mediation process; inclusive and targeted communication strategies; involving beneficiaries in the co-designing of the measures - Building trust (facing lack of confidence in the promoters).
	Monitoring/evaluation	- Involve inhabitants in evaluation and monitoring exercises

		<ul style="list-style-type: none"> - Publication of periodic reports assessing the impact of the implemented measures. - Periodic surveys about citizen satisfaction with the SI. - Structured approaches and monitoring tools/methods that evaluate the positive and negative effects of an energy project. Beyond environmental impact, health impact, employability, gender impact, social cohesion and energy justice dimensions must be assessed.
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Table 16. An overview of building blocks for the development of policy strategies for the successful implementation of social innovations in the energy domain.

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ANNEX 1

Table gathering data on public energy policies that might inform policy scenarios

NAME OF THE CASE-STUDY:	
POLICY	OBJECT OF ANALYSIS
Climate change adaptation strategies approved/implemented	Which of the national strategies/plans at national level seem to be relevant to the definition of the SMARTEES policy scenarios?
National/Regional strategies and sectorial plans of interest for the definition of policy scenarios	<p>Is there any strategy/plan to maximise the benefits from Energy Efficiency (including zero emission buildings)?</p> <p>Is there any strategy/plan to maximise the deployment of renewables and the use of electricity to fully decarbonise energy supply?</p> <p>Is there any strategy/plan to promote clean, safe and connected mobility?</p> <p>Is there any strategy/plan to promote better spatial planning (including green spaces that can be drivers to renovate houses, improve living conditions, reducing travel time and associated stress)?</p> <p>Is there any strategy/plan to enhance citizen's engagement in climate action and/or green lifestyles? (Regulatory measures, corporate responsibility initiative, emerging societal trends)</p> <p>Is there any strategy/plan to enhance/facilitate local ownership of low-impact energy investments? e.g. for creating local energy companies (regulatory measures, financial incentives, etc.)</p> <p>Is there any strategy/plan to enhance/facilitate consumers' social innovation initiatives in energy domain? e.g. for creating renewable energy citizen's cooperatives, for ownership of self-production energy infrastructures (regulatory measures, financial incentives, etc.)</p> <p>Other national/regional strategies towards energy transitions</p>
Local strategies and sectorial plans of interest for the definition of policy scenarios in each local case-study	<p>Is there any strategy/plan to maximise the benefits from Energy Efficiency (including zero emission buildings)?</p> <p>Is there any strategy/plan to maximise the deployment of renewables and the use of electricity to decarbonise energy supply?</p> <p>Is there any strategy/plan to promote clean, safe and connected mobility?</p> <p>Is there any strategy/plan to promote better spatial planning (including green spaces that can be drivers to renovate neighbourhoods, improving living conditions, attract people to live close to work, reducing travel time to work and associated stress)?</p>

	<p>Is there any strategy/plan to enhance citizen’s engagement in climate action and/or green lifestyles? (Regulatory measures, corporate responsibility initiative, emerging societal trends)</p> <p>Is there any strategy/plan to enhance/facilitate local ownership of low-impact energy investments? e.g. for creating local energy companies (regulatory measures, financial incentives, etc.)</p> <p>Is there any strategy/plan to enhance/facilitate consumers’ social innovation initiatives in energy domain? e.g. for creating renewable energy citizen’s cooperatives, for ownership of self-production energy infrastructures (regulatory measures, financial incentives, etc.)</p> <p>-Other local energy transition initiatives (e.g. related to sustainable consumption, health education, environmental education programs, etc)</p>
<p>Strategies and plans related to the Sustainable Development Goals</p>	<p>Is there any strategy/plan to tackle SD goals?, in specific, but not only:</p> <ul style="list-style-type: none"> • End poverty in all its forms • Ensure healthy lives and promote well-being • Achieve gender equality and empower all women and girls • Ensure access to affordable, reliable, sustainable and modern energy for all • Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all • Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation • Make cities and human settlements inclusive, safe, resilient and sustainable • Ensure sustainable consumption and production patterns • Take urgent action to combat climate change and its impacts
<p>Strategic actors</p>	<p>List those strategic actors that might be involved in the definition of policy scenarios (in each local case-study) (e.g. Renewable Energy Foundation that lobby for a legal change in energy system in Spain)</p>