Project no. 314277

STEEP PROJECT

Systems Thinking for Comprehensive City Efficient Energy Planning

Seventh Framework Programme

Theme Energy

D4.1 Study on the applicability of

scaling district interventions to the city level

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STEEP PROJECT

**Systems Thinking for Comprehensive
City Efficient Energy Planning**

SEVENTH FRAMEWORK
PROGRAMME

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Introduction

The Steep project has reached the midway point and this deliverable seeks to summarize the lessons learned in implementing the initial models across the pilot districts as wider planning activity at city level is developed.

The three cities identified one district in their respective city to carry out the modelling, and the selection has been made following different criteria. It is timely to now consider and understand the impact of this activity at municipal level; where the methodology has been applied and tested successfully, and where there is scope to make modifications in the next phase of implementation taking into account the contextual variables and border definitions.

There will be similarities between the district and the whole city, but also differences. It is important to consider how a district interacts with the wider city and its dependencies. This analysis will inform the next phase acting as a guide for the larger scale model.

In this deliverable the results of the initial system thinking methodology will be used to calibrate the procedure for the adaptation to the whole city implementation. Moreover, the three test models of the pilot district will be analysed and integrated to develop a preliminary scheme to be used as model zero in the city plan modelling.

1. The vision

The vision offers a guiding principle for city policies. It also provides an overall scope that each plan – or single measure in the short, mid or long term – sets out to achieve.

The partner cities have been active in sustainable planning over many years, each of them approaching the project with a defined vision for their future. Whereas all are linked to the Covenant of Mayors initiative the goals are different in terms of targets, implementation and timescales. In commencing the project each partner city had to select a pilot area suitable for the development and testing of planning models. As such, the pilot districts were identified because of their capacity to adopt and reflect the city changing process taking into account both the opportunities and challenges a future "smart city plan" will present.

	Bristol	Florence	San Sebastián
Vision (targets and time horizon, adoption instruments)	CO2 emission targets adopted in 2009: -25% by 2015 -40% at 2020 Strategic plans: > Bristol 20:20 > city council climate & energy framework > Bristol Community strategy for energy	Florence of the future targets adopted in 2011: -20% CO2 at 2020 -45% CO2 at 2030 -75% CO2 at 2050 Strategis plans: > SEAP > Structural plan "zero volumes"	SEAP commitments(2011) -20% CO2 at 2020 -40% of the city council energy consumptions Strategic plans: > SEAP > Smart city plan
Pilot district startegy	The Temple quarter has been chosen for the project due to the aspiration to make it the city's first carbon neutral development.	The Cascine park has been selected because it reflects the city's priority (mobility–buildings–ICT) and its characyeristics will be helpful in the dissemination and communication strategies.	The Urumea area represents a rich mix of uses and it shows limits in its spatial development as the whole city suffers.
Priorities	The priorities are formally detailed: the Bristol city council climate change and energy security framework sets out 19 broad strategic activity in 8 sectors with 65 specific actions	The main priorities are mobility and buidings; the second one is targeted trough planning and public properties as exemplar role. Communication is the other priority to multiply the results in those two sectors.	There has been no prioritisation in the implementation of the objectives set in the SEAP even if the sectorial targets have been differentiated and detailed.

1.1   The districts CATWOE examples

The first task in the modelling process was to look at the definition; the starting point, i.e. the purpose of the district plan.

The STEEP methodology views Systems Thinking as the means, or process, by which an agreed transformation can be achieved. The methodology relies heavily on modelling the transformation as a system by groups of stakeholders using Hierarchical Process Models (HPM) and is described fully in the STEEP deliverable D2.1 (Yearworth, Schien, & Burger, 2014). Modelling a transformation as a system using HPM requires a top-level process to be identified that acts as a descriptor, or the purpose of the system. Further details of this step are described in D2.1 (ibid). The important thing to note here is that the STEEP methodology makes use of the root definition approach from Soft Systems methodology (SSM) (Checkland & Scholes, 1999), as defined using the CATWOE acronym as follows

- Customers – those affected by the transformation

- Actors – those responsible for bringing about the transformation

- Transformation – describing the desired change in the state of an entity (e.g. a city district)

- Weltanschauung – the worldview or cognitive orientation of the group of actors trying to achieve the transformation

- Owner – those who could prevent the transformation taking place

- Environment – all of the external factors that constrain or enable the transformation to take place

Consensus amongst stakeholders regarding a high-level objective for the modelling has to be achieved; this is essential in the process for prioritising interventions, as it allows a specific focus on what can be plausibly achieved and who will own this process. We emphasise these points as crucial to the successful implementation of the STEEP methodology:

1. There must be clear ownership of the process

2. Deciding the transformational goal and defining the stakeholder group are co-dependent activities

It was decided to use a preliminary model developed by partners to start the process, but during the implementation of the participative methodology also the overall goal had to be refined following this coproductive approach.

San Sebastian decided from the begining that the goal for the pilot area should result from the stakeholders' meetings; in Bristol the transformational statement changed after first session as in Florence where, due to an unpredictable contingency, the root

definition developed by the project partners had to be changed during the second meeting to fit the stakeholders' upcoming needs.

The resulting visions for the pilot districts are:

	Bristol	San Sebastian	Florence
Root definition	"A system for the Smart City Group (A) at Bristol City Council (O) to achieve energy efficient development of the TQEZ (T) for the Bristol community at large (C) by promoting a set of practices around open data and GIS modelling (W) and which is seen as essential activity for the City to meet commitments to 2050 emission targets (E)"	"A system for Donostia Smart City Team (A) at Donostia City Council (O) for the development of the Urumea Riverside District Smart Plan (T) for the citizens (C) by promoting a number of initiatives for the transformation of the energy, ICT and mobility sectors (W) which are essential for a sustainable development to meet 20-20-20 targets"	"A system to make the Cascine Park in the municipality of Florence (O) an attractive, green and Smart resource (T) for the citizens (C) through the stakeholders' and the Administration's commitment (A) implementing innovative and effective solutions (Q) to pursue the energy and environmental Florence Smart city's policy (E/W)"
Objective	Achieving a low carbon TQEZ development	Getting to a neighbourhood close to zero emissions	Pursuing a Smart Cascine park vision

It is clear that in the first two cases the accent has been set on the emissions issue while in the third the vision is wider and related also to the socio-economic development of the area (because of the contingency, and allowed by the limited size of the area).

Also, the timeframes are different, but in any case they are reflecting the cities' current strategies in sustainable policies.

1.2 The development of the cities' visions

It should be highlighted that in two cases the target set for the pilot area is more ambitious than the respective city's target: the Temple quarter aspired to become the first zero emission district in Bristol and the URUMEA pilot area in San Sebastian has chosen a "nearly zero" emission vision. This difference is based on a detailed analysis of the potential to be exploited. The vision in fact ought to be "tailored" to the specific situation even if, at long term, the technological evolution could influence the time needed to achieve it.

The critical point is that while at district level it is not very difficult to analyse the potential in detail, at city level it could take a substantial amount of effort. This consideration brings us back to the principal motivation of the STEEP project: energy planning seen as a wicked problem which has to be approached in a co-productive and iterative way: it is important to mention that the transformation statement is dynamic, in that it can be modified at different stages of the process if it is considered necessary.

The "purposeful transformation", which represents the reason of every single deriving activity in a hierarchical process scheme, should be:-

- sufficiently ambitious to catch the interest of stakeholders and to start the change

- realistic in scope not to waste time in fruitless discussions

- wide enough to touch every sector of influence but focussed on the topic

- flexible in approach to be able to fit future evolution and re-calibration due to the monitoring feedbacks

These considerations lead us logically to thinking about the implementation of the STEEP methodology as an ongoing planning process. The system model describes the processes that are needed to achieve the transformational goal. For any sufficiently messy problem – and energy master planning is considered such – the expectation is that the need is unlikely to be met simply with an agreed solution, but will require continuous effort to bring about alignment of stakeholders' views on the problem and possible interventions. Whilst the STEEP methodology is designed to lead to actions, which will be documented as plans, these are not its end goal; it is the transformational system that is important.

The STEEP Collaborative Stakeholder Engagement Platform, which is currently under development has the potential to enable an 'online' implementation of the STEEP methodology. The project partners recognise that getting groups of stakeholders together in group model building workshops is a considerable undertaking. Whilst the benefits of doing this are clear – not least in the buy-in already achieved by having a stakeholder turn up to a workshop before any modelling has been done – there is still nonetheless a perceived need to try and broker group decision making in a way that is de-coupled in time and in place. Although this is an area of active research (Ackermann, Franco, Gallupe, & Parent, 2005; Alberto Franco, 2009; Bryson, Ackermann, & Eden, 2004; Eden & Ackermann, 2013; Franco, 2007, 2008; Morton, Ackermann, & Belton, 2007; Renger, Kolfschoten, & de Vreede, 2008; Sheffield, 2009a, 2009b), we believe that the STEEP Collaborative Stakeholder Engagement Platform makes such an approach technically feasible and thus offers a real opportunity to advance the state of the art in this field.

2. Data availability

Task 1.4 was concerned with the collection and harmonisation of data from all three of the STEEP partner regions for use within the energy master-plan process model. Under this task, each city identified a number of potentially useful datasets relevant to their case study area and then categorised them in line with a list of definitions provided by CSE (e.g. 'building characteristics', 'transport and mobility' and so on). Partners were also asked to describe each of their datasets based on the parameters set out within the INSPIRE directive, and to upload this information to an on-line wiki tool. The purpose of the wiki was to create a means of cataloguing and sharing the data, and also provided users with the ability to compare and contrast the available datasets in terms of content, format and availability.

It might be assumed that where a larger geographical area is to be analysed, obtaining enough data to cover the entire zone may be more problematic. However, in the cases of Florence, San Sebastian and Bristol, many of the datasets used to represent the case study areas were originally produced at city or regional-level. This is likely to be very location-specific however, and dependent on how each of the datasets selected is procured and produced. Where multiple, similar datasets are required, there is a greater risk that they may overlap, be in different formats, have different levels of granularity or make use of different symbology or notation. It is also possible that more people will need to be involved in the collection process, more gaps in the data may become apparent, and a greater number of licensing conditions will need to be acknowledged and complied with. Overall, there is some potential for the scaling up of data collection and harmonisation to become increasingly complex, but this may not be the case in every event.

Scaling up to citywide level may also require the scope of data to be broadened. Each specific district will have different characteristics and in some cases unique data sets e.g. data pertaining to a river, which only flows through certain districts. Attempting to accommodate all this data may be challenging and may need an additional scoping exercise to the one undertaken for the case study area.

Many of these problems have already been addressed to a certain extent by the move from a spreadsheet-based data management tool to a web-based wiki tool. For example, the wiki can help facilitate good collaborative working by allowing multiple users at different locations to enter data simultaneously and to track changes in their work through effective version control. The software also has a flexible structure, which can be easily adapted to accommodate different scales or quantities of data. Finally, the 'open' nature of the tool may mean that a larger number of users have the opportunity to modify its underlying configuration, which could result in a constant process of improvement whereby new and innovative solutions to issues of increased complexity and incompatibility of datasets may be developed. At present, larger datasets do cause

the mapping tool to run at a slightly slower rate, however this is something that is currently being addressed by the project team.

It is expected that the Collaborative Stakeholder Engagement Platform being developed under STEEP will help shape the data collection and harmonisation process when it is trialled in early 2015. Its role in supporting energy master planning will enable many data sets to be considered, visualised and compared. This will in turn also encourage the identification of new data, which in most cases should be relatively easy to collate and harmonise seeing as the wiki tool is embedded within the Platform itself.

3. Working groups definition

It is clear that a city is a complex system in which energy flows across many different sectors, mobility affects everyday life and ICT supports and interacts with all sectors providing solutions. This system involves many different stakeholders that should be part of the planning process. Therefore there must be an Open and Innovative approach. An approach that must not only be applied to the involvement of stakeholders in the development of the Plan, but also in understanding the contribution of interventions, identifying opportunities and barriers, as well as validating the whole process of planning.

From the perspective of municipal services to citizens, automatic and efficient management of urban infrastructure can create new services more responsive to the specific needs of citizens (improving mobility, energy conservation, efficiency improvements, etc.). And this can only be achieved by listening to citizens, operators, companies and implementing services accordingly.

The collaboration between city leaders, national, regional and local governments (administrations), academics, international and local companies, sustainability organizations and experts will achieve a higher quality of integrated planning in the following target groups:

– Public: improved manageability of the services offered to citizens, lower consumption of resources and promotion of the local economy.

– Citizens: making information usable and accessible, increasing comfort and quality of life and effecting cost savings due to lower energy consumption.

– Private Companies: emergence of new market opportunities, potential cost savings through efficiency and infrastructure and increased awareness of the needs of the customer.

It will, therefore, be important to identify and engage key public and private stakeholders across the whole value chain, as well as communities of interest who need to be involved in "Smart" planning.

Three subtasks were considered in the project to be effective in the engagement process:

- Stakeholder Analysis

- Diffusion events and engagement

- Stakeholder events

- Decision-making architecture

The present chapter will consider the stakeholder analysis and definition as well as the first approach to how organize stakeholder events. Both must be considered together in order to make a definition of most appropriate working groups. In the case of the collaborative stakeholder engagement platform it will be part of the web platform that will be developed under task 6.3. Based on experience in Bristol we suggest that the ownership of the STEEP process for engaging stakeholders over a transformational goal requires integration within existing decision-making processes i.e. an enlargement or enhancement of existing ways of making decisions that have a bearing on the desired transformation. Achieving this integration of decision-making *architecture* is another way of defining what it means to take ownership of the STEEP process.

3.1   Stakeholder Analysis

It is necessary to undertake a thorough analysis of stakeholders that are part of the system. The analysis will depend on the definition of the Plan that each city may consider.

The concept of Smart City, and therefore its planning, has not been agreed either by academics or by cities themselves. We have reached a point in which even each company presents its own definition of what a Smart City means. It is not unusual to find many models that sometimes are just based in ICT interventions, or some others that will consider a way of living, education or other more social aspects.

Once each city has decided, its approach can elaborate the stakeholder analysis. In most cases however there are three big groups of stakeholders that can be considered:

- Energy & Sustainability

- Mobility

- Integrated Solutions (ICT applied to the city)

These are three basic groups that follow main trends from EU considerations towards obtaining integrated measures, smart, in European cities. In any case we are presenting

a simple classification that could be helpful for the analysis and selection of stakeholders for these groups or others:

– Local Administration: This is a main group of stakeholders as triggers of possible changes in the city. By "local administration" we mean any department and/or company related to the city council. Among others sustainability, mobility, housing, infrastructure, urbanism, maintenance, water services or energy efficiency departments can participate.

– Regional/National Administration: In the case of Regional and/or National Administration same departments can be considered. In some cases the specific weight of the Regional Government would be sufficient, in other cases the intervention of National Government should be sought depending on the responsibilities level.

– Electricity Operators: This is a reference group for any company related to power generation, distribution and/or commercialization (including Energy Services Companies ESCOs). All of them play an important role directly linked to the reduction of emissions by reducing consumption and electricity costs by providing and using data better managed.

– ICT Operators: In this group they will be included operators from the telecommunication field including internet providers, telephone operators, etc.

– Gas Operators: Companies that provide generation, distribution and/or commercialization of gas in the city.

– Public Transport Companies (usually part of the local administration)

– Water Operators: Operators of Water supply and disposal to the city (most of the time it will be municipal but it can be supplied by private companies as well).

– Environmental Organizations: Organizations, private or public, working to foster sustainability of cities through any type of actions

– Energy Organizations: Organizations, companies, clusters, etc. related to the Energy field that can be considered interesting as a stakeholder in each city.

– ICT Organizations: Organizations, companies, clusters, etc. related to the ICT field that can be considered interesting as a stakeholder in each city.

– Transport Organizations: Organizations, companies, clusters, etc. related to the Transport field that can be considered interesting as a stakeholder in each city.

– Academic & Research Organizations: Academic and Research & Development centers that can provide knowledge and innovative approaches to what the city needs and must develop. The research concept must be understood in an open sense, allowing the participation of any entity that can add something interesting to the process.

- Financial Organizations: Financial sector should also be involved somehow in the system thinking process. Their participation will be requested for the implementation of many actions. Therefore it would be interesting to already have and consider their assessment and information during the early stages.

- End-users' Organizations: This group of stakeholders gathers end-users in any of the fields of the Smart City Plan. It also includes community and voluntary organisations relevant to the district considered.

- And Citizens' Organizations: In this case other organizations no considered in previous epigraphs can be added. Here, even individuals (citizens) can participate if interested.

There can be as many stakeholders in each identified group as each city decides. No minimum or maximum numbers have been established. Each city is very different and depending on the size of the city, the local structure, the participation or not of a regional government, the number of organizations and companies in the deployment of services and products will vary.

Their classification will be by thematic technologies, sectors, responsibilities, etc. to ensure that they are engaged in all relevant parts of the process to support the co-production approach. Each city will adapt the list to their context, situation and possibilities, and taking always into account the key stakeholders for the city. This means that, in the least, there should be representation of each of the defined groups.

3.2 Diffusion events and engagement

The cities determined that the most challenging part of the process is the engagement of stakeholders. There is often a question of value to the stakeholder in the process. What are the benefits to them if they participate? The answer is not always clear for all stakeholders, at least not from the outset. It could be argued that gaining some knowledge of, and participating in, the planning process offers considerable advantage and valuable information for future developments in the city, for all stakeholders. This is hard to measure given the application of the learning through the process will be unknown. Certainly, participating in the planning process must be voluntary.

So, the question is how to engage them? What can be done?

It is interesting to disseminate properly the City planning process. The communication at all levels, press, television, newsletters, radio, etc. will give a consistent framework to the City's willingness to develop the Plan. It is a way of demonstrating engagement and thus, compromise, by the administration. The message should be clear and state that this exercise is meaningful for the city and will, as a result, impact the implementation of actions. It should be stated clearly that this is not only to co-produce a document but an

implementation Plan for the City. In this sense, the involvement of the City's politicians and not only technicians is important.

Together with the dissemination in different communications media, it is helpful to create events to which selected stakeholders can be invited. This enables a more targeted approach to encourage key stakeholders to participate in the process. It provides an opportunity to explain the scope of the planning process, the goals that the City intends to achieve and what kind of collaboration is proposed.

In some cases direct contact should be sought. The engagement of big players is more difficult and in these cases personal interviews may help. This is also true for some departments within the City Council itself where the culture is more often than not to work in silos. Contacting key stakeholders on an individual basis will encourage their involvement and on a deeper level builds confidence into the process.

Something useful for the communication and engagement process is the development of a Stakeholder Engagement Platform through which all stakeholders can participate, share data and information, send comments and interact with other stakeholders. In the STEEP project a specific platform has been developed for this purpose.

3.3   Stakeholder Events

As part of the engagement process it should be clearly stated how stakeholders may participate. For example, the preparation of workshops should include setting out the purpose, goals and objectives, timelines and so forth in developing and working with selected methodologies. In most cases this information itself becomes an important and useful resource in addition to the data gathered from the workshop discussions and post event feedback.

The "transition" time between the different meetings should not undermine the overall engagement process. That is, it is best to avoid a scenario of holding isolated events – rather, establish a mechanism for continued engagement.

The number of events will depend on the Smart City definition, and the number of working groups that need to be established. It is recommended that at least three events (workshops) per working group are developed with these core objectives:

- – 1st Workshop: Diagnostic of situation and pointing out main goals

- – 2nd Workshop: Elaboration of intermediate goals and defining key processes

- – 3rd Workshop: Selection of projects to achieve City's goals

3.4   Lessons learnt from stakeholder participation in pilot districts

It is critical that a full stakeholder analysis is conducted prior to modelling workshops, in order to involve the most appropriate people in the process. The main difficulty encountered by project partners in STEEP was being able to engage large energy/ utility companies and developers that will participate in the planning process and that (in most cases) will be the ones that can make final decisions regarding interventions.

The involvement of stakeholders makes the goals and values of the planning activity accessible to the broadest possible audience and adds additional problem-solving capabilities to the process. Involving the public in the programme is not just worthwhile for the reasons outlined above, it is also interesting from the point of view of empowering citizens. Through their involvement in the programme, citizens acquire new skills and personal qualities which they may later apply in other areas. This is particularly true where they are involved in projects or long-term programmes.

It is important to highlight that a common difficulty in conducting this process in each of the three cities was securing the identified necessary stakeholders to attend the sessions thereby ensuring optimum contributions based on expertise.

That is why it is important to involve a variety of different technical experts and professionals with a mixture of expertise and experience. To help with facilitation, it is recommended that the modelling sessions are broken down by technical area, with an appropriate number of modelling sessions held with sub-groups who specialize in each of the process areas. If this is not feasible, we recommend that the main group is subdivided after the initial modelling process, with individuals with specialisms in relevant areas developing the sub-processes further. This will ensure that during the exploration of issues, options and arguments, the most appropriate individuals will be concentrating on the relevant aspects of the model.

4. Modelling large scale interventions

Considerations regarding the final target/vision, availability of data and stakeholder involvement are reported above. The differences between a district modelling and a whole city plan are mainly concerned with scale: at municipal level the number of measures to be analyzed, as well as the number of stakeholders to involve, can be significant. The process is the same no matter what the scale and complexity and maintaining a high level overview will overcome the potential for working in continuous loops.

4.1   Preliminary model

An example of good practice could be the production of a "model zero" which, from a certain stated root definition and transformational goal, creates a first simplified model to start the discussion.

It could be drawn from the existing policies and strategies and on the basis of the district model test revised with the present scaling up study results. It is important to note that this is provided as a suggestion and must be modified and integrated in the coproductive process.

At this stage all the stakeholders should be involved to gain consensus about the overall target and to make them understand the complexity of the problem.

After this first meeting the modelling can be carried on as a whole or shared in subprocesses as illustrated in the next paragraph.

As an example, in Florence, the district plan was developed through several "plenary" sessions involving all the stakeholders in the discussion regardless of their technical expertise or skillset. Reaching consensus on the plan and an integrated model was achieved, but the process took longer due to deliberating over specific issues involving stakeholders with and without the knowledge of that specific technical area.

4.2   Subprocesses

San Sebastian has involved a large number of stakeholders across three working themes to build a Smart City Plan: Energy & Sustainability, Mobility and "Solutions" (applied ITC to city needs). Overall the municipality has engaged 160 people/organizations. The administration has already gone through a diagnostic process to identify the goals that the planning group should be working with. This first session allowed the city to have a shared swot analysis in each field. With this information, and together with the different City Council departments, the Spanish partners chose the areas to work with for the city's Smart Plan. Now San Sebastian can count on over 20 sub groups developing

interventions using the UNIBRISTOL methodology: each table with specific goals trying to find out the critical processes/options to create specific projects that will be incorporated in the Smart Plan as real actions.
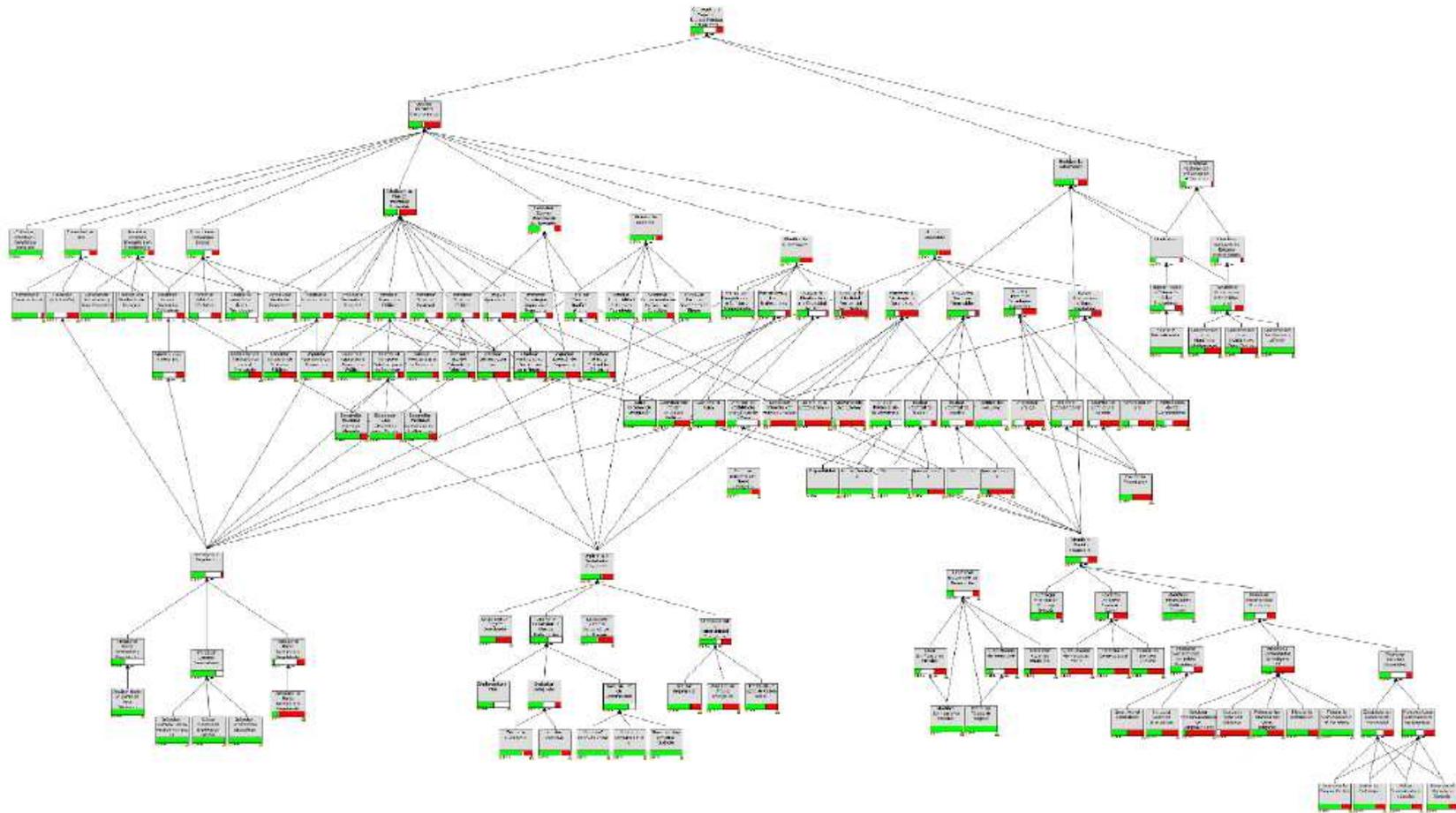
The next phase has been to use the SPeAR tool for the selection of the most interesting projects. All working closely with stakeholders.
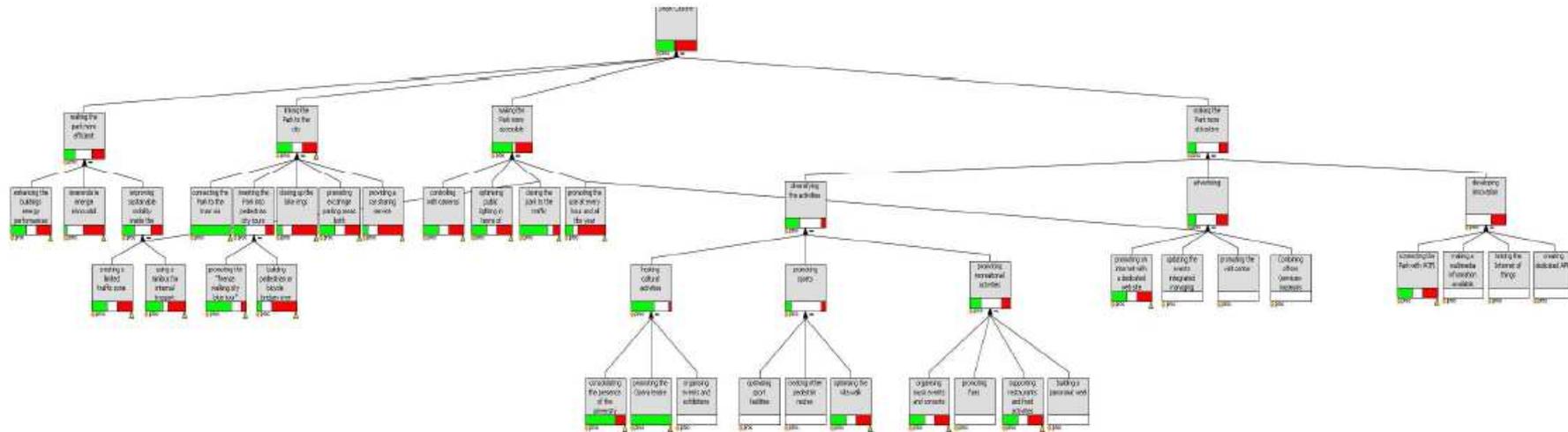
Bristol (Temple Quarter Enterprise Zone)
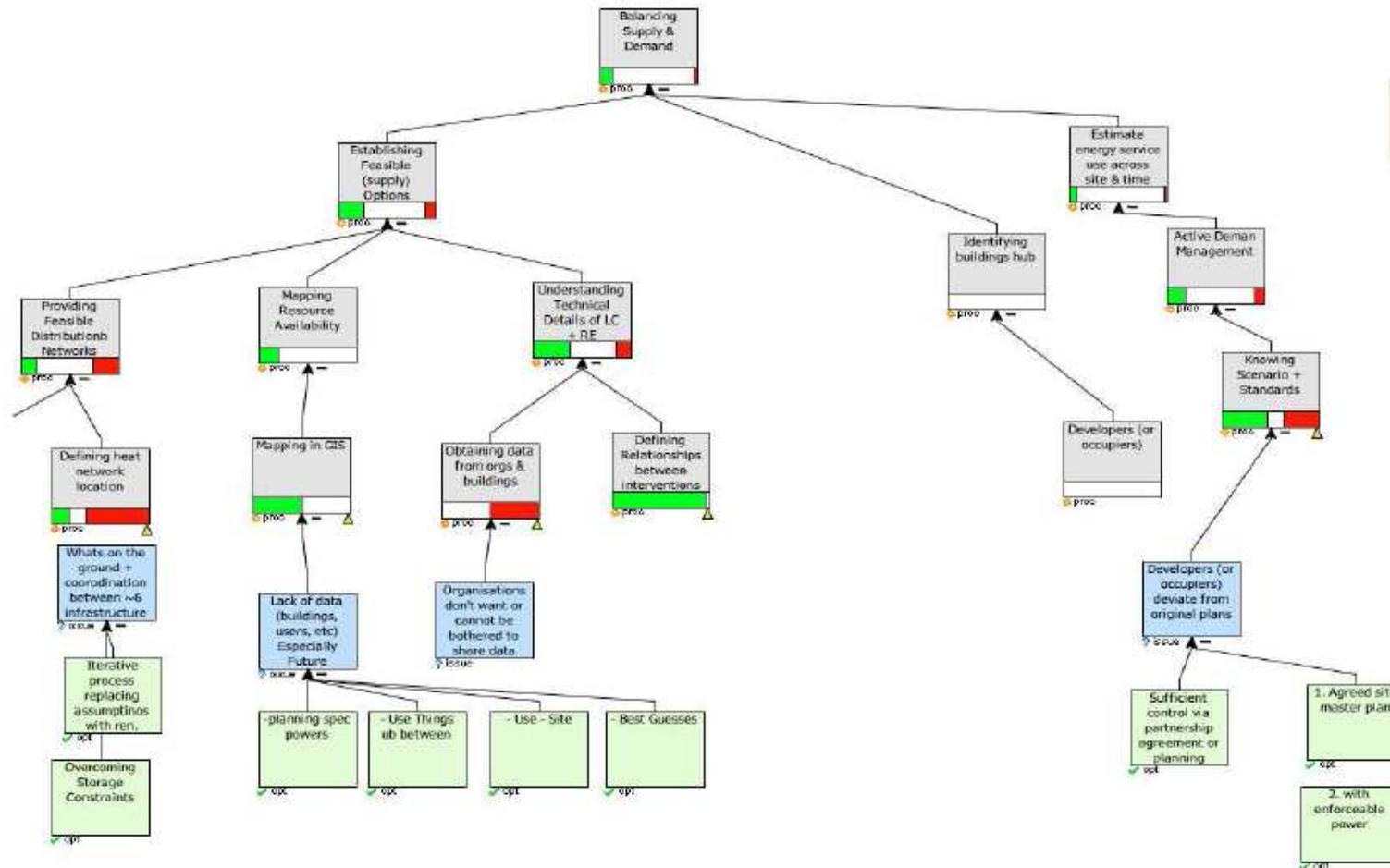
Donostia-San Sebastian (Urumea Riverside)

Florence (Cascine Park)

4.3   Lessons learnt from the pilot districts planning

During the test phase these were the main problems encountered:

1. A question that can arise in relation to the Process Improvement Chart, is how to determine which level to stop modelling the sub-processes themselves and to start to define the issues, options and arguments for the process. It is important to recognize that there is no correct answer to this, as the moment to start to analyze issues can vary depending on the sub-models that are listed. In some cases common sense will determine which processes are specific enough to start with the next stage. There is therefore an inherent risk at the end of the Model Building Workshops, that there will be a different level of definition for each sub-model and therefore the relevance of the identified interventions. However, a useful heuristic that can be applied by the workshop facilitator is to keep pushing at the 'how' questioning to derive further detail about necessary processes. At some point the group in question will respond with the recognition that there are multiple answers to the question 'how' and these demonstrate that the understanding in the group is shifting away from a process view to one that is articulating specific *options*.

2. Working in different subprocesses can make it difficult for those in attendance to propose integrated interventions that respond to a high-level transversal strategy for the district. Conscious effort needs to be made to transmit this view and interest to all the stakeholders to ensure consensus regarding future interventions. Again, this is something that needs to be addressed by the workshop facilitator to bring sub-groups back together in plenary session to try and recover the transverse view. However, it is recognised that this is difficult when dealing with large groups and is something of a live research issue in the problem structuring methods academic community. See for example (Shaw, Westcombe, Hodgkin, & Montibeller, 2004).

3. Although the modelling process is the main vehicle for prioritising interventions, it must be considered that the outputs from this process will be the products of –only–the individuals who took part within the workshop discussions. At this stage of the methodology therefore, the 'actionable' options should be subject to a 'sense-checking' process whereby they are considered by the 'owners' of the transformational statement and other experts external to the workshop process itself. This sense-checking will provide a list of options that are both feasible and

desirable in the particular context of the city involved. This is intended to be a first phase of a quality assurance process that helps refine the list of potential interventions.

Although we have identified these as 'problems', they can all be mitigated using the strategies suggested. This reflection on experience of Problem Structuring Methods (PSMs) in action is in fact an essential feature of their use, and their definition (Yearworth & White, 2014). Given that each city has its own unique problem context and the actions emerging from the implementation of the STEEP methodology are in themselves unique to that setting it is incumbent on us as practitioners to contribute to methodological learning and development.

Another issue is that if a community is interested in a co-productive approach, there are a number of ways in which it can do this. The following are suggestions about how to involve the stakeholders in the planning process of the whole city:

•   The preliminary model is developed mainly by "experts" in community policy and administration. Stakeholders are involved in a second stage during the preliminary model discussion and evolution

•   In communities which are divided into independent districts it could be a good idea to divide the planning team into a professional co-ordination team, (comprising community employees) and several "habitat teams". The habitat teams consist primarily of local stakeholders and each team is supervised by a member of the co-ordination team. These teams concentrate on their immediate surroundings or "habitat" (area, district etc.).

•   As an alternative to forming habitat teams, it is also possible to divide members of the public into specialist teams (e.g. transport, town planning, alternative energy sources etc.). However, the focus on the immediate surroundings is lost as a result of the specialisation of citizens' activities.

Use of the STEEP Collaborative Stakeholder Engagement Platform could be used to speed-up the process of moving between different groupings of stakeholders and potentially remove some of the barriers to participation that might exist for some.

5. Analysis of the actions

Each city has experience in specific actions related to sustainable use and production of energy (Covenant of Mayors, IEE, CIVITAS, CONCERTO, Green Digital Charter, etc.). Furthermore, each city has a specific economic, social and political situation that will result in different actions in a future integrated Smart City Plan. Following the work carried out in WP1.1 and 3.1 where the existing best practices have been collected and analysed, each of the three cities has developed a test model for a restricted area selecting with a co-productive approach a set of sustainable measures to be implemented. Now all these actions must be analysed and revised in order to detect current problems, successful results, synergies, etc. in a possible wider implementation at city level.

SPES, acting as the leader of this task, asked the cities and participants to go further in detail filling in a template for a selected set of actions undertaken in the district master planning. These actions could be about ICT, mobility or energy efficiency and also behavioural. The template asked about the actual size of the implementation, the stakeholders involved, the financial strategy, the duration and the expected impact, the strengths/weaknesses foreseen enlarging the implementation.

Partners were asked also to provide an evaluation of the measure through the pilot experience, but also with a risk matrix, LCA procedure where possible and PESTEL analysis.

This work could be useful for the definition of the preliminary model of the whole city, selecting from the test model those actions with a high replicability level.

5.1 Type of actions

The most important actions resulting from the test models are related to the three main sectors (buildings, ICT and mobility) in a technical, managerial and social ambits.

The set analysed involves different kind of measures: the options, emerging also from work in T2.3, included in the district plans are

- Implementable general processes

- Implementable technological detailed processes

- Implementable non technological detailed processes

- Planning process interventions

It is important to note that the STEEP 'systems thinking' methodology adopts an 'holistic' approach to solving difficult or complex problems, (in this instance -achieving a city's carbon reduction targets) and therefore it identifies the various non-technical

interventions that should be taken as well as which technologies may be adopted. The STEEP methodology explicitly tries to explore the potential organisational and behavioral interventions that could/should be made in addition to new or innovative technological solutions.

5.2   Evaluation tools

Partners have been asked to judge the replicability potential of the actions from their experienced point of view, identifying strengths and weaknesses on the basis of the model test and their skills. To support the evaluation they were provided with three optional tools that could contribute to detail the potential and the barriers.

A recommendation that arose from the D2.3 was that only 'actionable' options and interventions should be taken forward to a strategic analysis. Generic options such as 'future proofing' are unsuitable as they do not (yet) contain enough detail for exploration of possible options.

One important aspect to bear in mind is that those tools are strategic supports which should supplement and not replace a city's decision-making process regarding interventions. This is consistent with the view of achieving a coherent decision-making architecture, where the STEEP process is integrated into existing decision making.

PESTEL analysis

The objective of the PESTEL analysis is to evaluate the feasibility of each initiative considering the different Political, Economic, Social, Technological, Legal and Environmental implications for each. This step was considered as a gating process on the actions emerging from the group stakeholder workshops and reflects the recognition that the participants my not have a comprehensive enough grasp of their operating environment to reject options that may not be feasible.

The strengths of this methodology are

- it provides questions that help identify wider impacts and influences of interventions
- it can be used on physical, organisational and behavioural interventions
- It has a bespoke approach developed using SPeAR® tool
- there are 12 Indicators to score
- it provides a visually intuitive output to assist with decision-making

The PESTEL analysis can be used to both provide a framework for detailed technical analysis in conjunction with deliverable D3.1, but also to provide a more qualitative analysis of the feasibility of each initiative beforehand.

An aspect that needs to be considered in the PESTEL analysis is whether all type of processes can be passed through the tool: in principle, the analysis could be applied to most types of process but each city needs to decide if it is valuable or not to apply the PESTEL analysis given their own timescales and capacity.

The overall result will provide a visual understanding of the strengths and weaknesses of each initiative, giving a basis upon which to prioritize interventions.

Risk matrix

A risk matrix of all the possible risks or difficulties that could arise when delivering different types of interventions at the city level, which include both behavioral and technological interventions (e.g. Smart City Actions), has been produced in some cases.

Risk assessment is an effective means of identifying process safety risks and determining the most cost-effective means to reduce risk.

LCA

LCA is an internationally standardized method (ISO14040 series) and used by a large number of companies and governments.

LCA is the scientific basis used typically behind e.g. the Eco-design Directive, and Eco-label Regulation. On EU level a series of technical guidance documents building on the ISO 14040 series is currently being developed, coordinated by the European Commission's Joint Research Centre (JRC).

From the experience gathered by partners in other EU projects the LCA methodology applied to a Sustainable Energy Action Plan doesn't affect the result significantly except for few measures related mainly to Renewable energies (PV, biofuels,…) and waste management. The geographical limit conventionally agreed for the SEAPs makes the LCA approach less interesting, on the other hand the calculation is very complex in some cases.

Partners were free to decide if the LCA approach was suitable or not for each different measure.

5.3   Replicable actions

The three district plans present some similarities in the structure and in the measures adopted as well: those actions which have been selected in different realities as the testing districts are, show a high replication potential.

It should be highlighted that the structure of the plans is somehow recurrent (technical, regulatory, social aspects of the efficiency, mobility and ICT sectors) while going into

detail in the model's lower levels the actions implemented become more and more tailored to the local situation.

There is also the expectation from previous use of problem Structuring Methods (PSMs) such as the STEEP process that the more generic actions are likely to be about the methodology itself. There is nothing in the modelling process that prevents participants from modelling processes that relate to the methodology itself. In the literature review conducted prior to methodology design reported in D2.1 about 50% of the processes identified were methodological in nature, as opposed to the problem content. The use of problem structuring methodology to model the process itself is recognised as valid (Checkland & Winter, 2006).
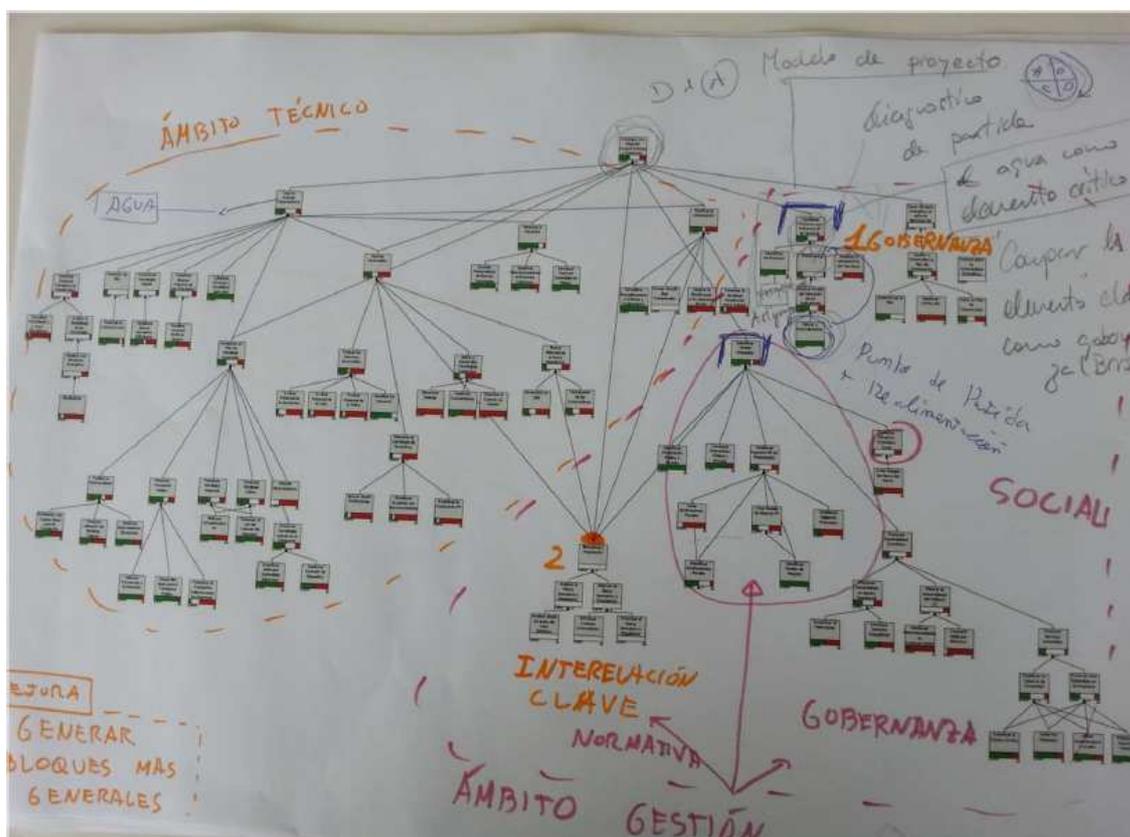
A snapshot for the modelling section in San Sebastian Urumea district

In general the technological processes strongly depend on the boundary conditions and are replicable only in similar environments. The other kind of measures, more general and not strictly technological, present a higher replication potential.

The actions analysed by the three municipalities are those listed below.

Mobility

- Limiting car parking and increasing bike parking

- Connecting to park and rides

- Providing subsidised premises for cycle courier businesses

- Mandating development of sustainable travel plans by tenants

- Providing good routes walking to/ from bus/tram stops

- limited access to vehicles in restricted areas

- Adapting Infrastructure for Sustainable Mobility

- promoting the use of LEV or ZEV (focus on electric mobility)

Buildings, energy efficiency, energy supply

- smart lighting

- Establishing new building regulations

- Establishment of a local energy infrastructure planning advisory service

- Establishment of an energy supply financing and delivery mechanism

- efficiency in sport centers

- Promoting sustainability in the residential area

- Finding alternatives to the regulatory framework for renewable energies

ICT

- Internet of things

- Open data / Enabling increased access to real energy consumption data

- Development of a Collaborative Stakeholder Engagement Platform

Behaviour/policy

- Gaining stakeholder participation

- Mapping stakeholders

- Understanding property developer business models

- Funding models that address local objectives

- Framing the story

- Creating brand image in the center (Barrio)

- Promoting sustainable services

- Penalize consumption and promote savings

5.4 A preliminary model draft

The 'Hierarchical Process Modelling' has been described in detail in D2.1. This methodology allows the development of the model starting from the top level process, and breaking this down into a number of sub-processes by identifying what action needs to be taken to achieve each of these.
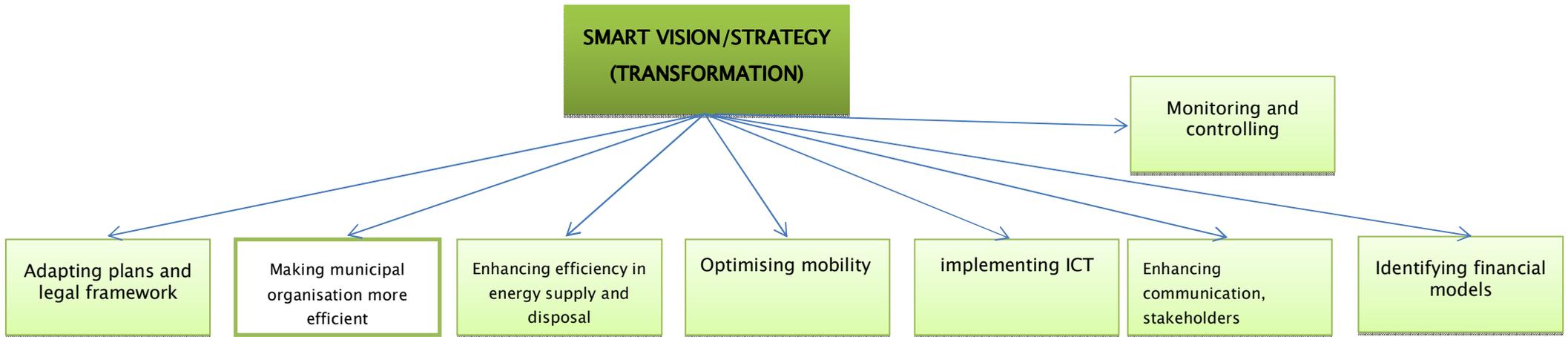
Although optional, it's advisable to define and present a preliminary model to stakeholders (result from D2.3) in the initial workshop for them to analyze and modify. This will serve as a starting point for discussion.

The aim of this deliverable was to find out which procedure and measures could be replicable in other realities or at wider levels. The output is a detailed analysis of the three pilot experiences and a draft of a preliminary model to be adapted at local level which includes all the aspects merging from the pilot actions which could be integrated and implemented in other realities.

The model drafted below is the result of the comparison between the pilot plans taking into account the actions analysis carried out by the partners with the supporting tools.

The vision of a SMART city, that has to be defined at local level, is articulated into several subprocesses, commonly recurring in the pilot plans, decomposed in possible actions with a high replicability level.

A subprocess regarding the municipal organization efficiency has been added to those found in the district models: it contains all the measures belonging to the administration which have been collected under this new branch just to focus them and put the accent on the city's actions to play an exemplar role. This work has been done following the SEAP philosophy, but it's up to the cities to highlight this aspect or to put their own actions within the other subprocesses together with the private sector.

SMART VISION/STRATEGY (TRANSFORMATION)

Monitoring and controlling

| Adapting plans and legal framework | Making municipal organisation more efficient | Enhancing efficiency in energy supply and disposal | Optimising mobility | implementing ICT | Enhancing communication, stakeholders | Identifying financial models |

Preliminary model first level processes

0   Vision/strategy

1   **Adapting plans and legal framework**

1.1   Analysing upper level current plans/regulations with influence

1.2   Updating municipal development planning(energy, mobility, urban planning,..)

1.3   Aligning landowners' obligations(buildings regulation, approval and monitoring)

1.4   Establishment of a local energy infrastructure planning advisory service

2   **Making municipal organisation more efficient**

2.1   Energy efficiency

- municipal buildings
  - Energy and water consumption review,
  - quantitative targets for RES, efficiency and climate impact
  - refurbishments,
  - exemplary projects
- Public lighting
- Sport facilities
- Administration mobility management (municipal vehicles, mobility of the staff)

2.2   Internal structure

2.3   Procurement

3   **Enhancing efficiency in energy supply and disposal**

3.1   Innovating energy supply offer and networks

3.2   Promoting Local energy production

- installing RES
- exploiting waste heat from industry
- promoting CHP
- implementing district heating/cooling

3.3   Promoting Energy efficiency

- analysing big service plants: Water supply, waste water treatment
- Managing Waste
- saving energy in Industrial processes
- saving energy in Tertiary sector (including public properties)
- saving energy in Residential sector

4   **Optimising mobility**

4.1   Building new infrastructures (connections, new facilities, recharging networks,...)

4.2   Traffic calming, parking management (traffic control, parking management, restricted areas, speed limits and control,…)

4.3   Promoting non-motorised or low emission mobility (pedestrian areas and footpaths, cycle paths, bike parkings and sharing, electric mobility,…)

4.4   Optimising public transport (frequency and lines, prirority, intermodality and connections, fares,…)

4.5   Using infomobility

5   implementing ICT

5.1   Disseminating digital networks

5.2   Testing internet of things

5.3   Providing opendata
* Enabling increased access to real energy consumption data

6   Enhancing communication, stakeholders involvement

6.1   Planning communication strategies
* Development of a Collaborative Stakeholder Engagement Platform
* Providing an energy helpdesk
* Linking the territorial identity with the energy smart targets

6.2   Looking for cooperation with authorities, associations, local multipliers
* Mapping stakeholders
* Gaining stakeholder participation

6.3   Providing support for private activities: promotion of sustainable services


7   Identify financial models

7.1   Finding available subsidies and useful financial schemes

7.2   Understanding property developer business models

7.3   Funding models that address local objectives

7.4   Establish public-private financing schemes

7.5   Promoting economic sustainability

7.6   Promote economic and social attractiveness

8   Monitoring and controlling

7.1   Developing energy balances and indicators

7.2   Evaluating climate change risk

Despite identifying these high-level processes from the experiences of the STEEP partners in Bristol, San Sebastián and Florence we urge care with placing too much consideration on this particular set. The key message from the STEEP project is that it is the planning *process* that is important; plans are inherently transitory and merely specific artefacts of the process.

For completeness, what we know about the STEEP methodology as a process has been captured in its own modelling language and is shown in the following Figure.
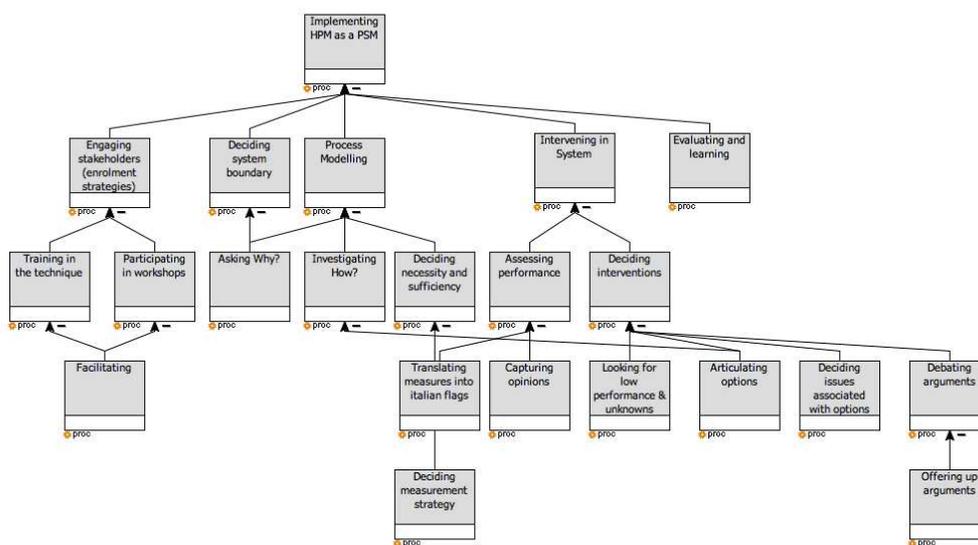
Whilst the STEEP methodology has been adequately articulated in D2.1, reflections on its use in practice have been captured in this deliverable, as well as in D4.2 and D2.5. As the STEEP project moves into its final phases the overall learning will in addition be captured in the STEEP Collaborative Stakeholder Engagement Platform.

6. Conclusions

The STEEP project test phase has been highly effective in adopting the system thinking approach for the first time, but it is important to recognize that smart energy plans depend heavily on the specific context and boundary conditions. For this reason, it is important to bear in mind the following lessons learned for a future planning phase:

• It is very important to provide a full stakeholder analysis before the modelling workshops, in order to involve the most appropriate people in the process.

• Energy planning processes can take a lot of time even in a single district as was the case in this test phase: it is important to set some milestones regarding the model drafting ensuring, on the other hand, the inclusion of all the stakeholders in the workshops taking into account all the possible perspectives.

• It should be pointed out that the previous stages of the process have a big influence in the final result: the data available, a proper definition of the transformational statement, the guidance provided to the attendees are fundamental to the quality of the process.

• It is recommended to consult a variety of different groups of experts in the relevant field in order to minimize risk.

• The 'scaling strategies' can vary:

1. replication in other areas/sectors

2. a real "scaling" increasing the size of the initiative and its impact

3. and "preparing the ground" through interactive measures for other wider initiatives

For points 1 and 2, the potential for expanding the scale of existing projects can be reinforced by strong governance, sustained sponsorship and the right stakeholder mix.

• The overall success of a Smart City depends on the effectiveness, coherence and balance of the set of initiatives across the city: a successful measure attracts wide support, targets concrete problems and produces observable impacts whatever its nature.

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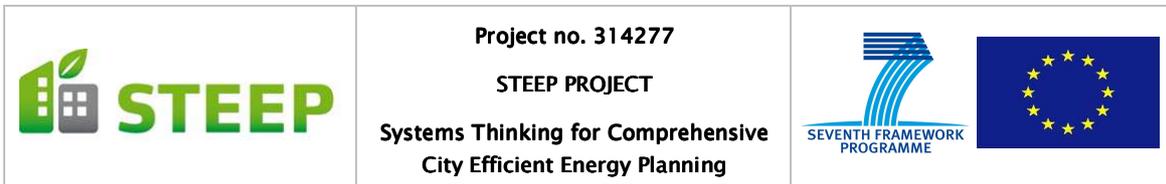
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