Aalborg University

Sustainable Energy Planning and Management

AALBORG UNIVERSITY
DENMARK

Energy planning approach towards participatory policy-making

Energy governance towards energy sustainability

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Final Version

Master's Programme in Urban, Energy and Environmental Planning with specialization in Sustainable Energy Planning and Management

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AALBORG UNIVERSITY
DENMARK

2nd year Master of

Sustainable Energy Planning and Management

Title:

Energy planning approach towards participatory policy-making

Project:

Master thesis, 4th semester SEPM

Project period:

February 2018 – June 2018

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Abstract:

This thesis Master Programme in Urban, Energy and Environmental Planning with specialization in Sustainable Energy Planning and Management has a time-glass research perspective towards a participatory policy-making. The intervention foreseen with the energy planning approach tested in this thesis is at the municipal level. Sintra municipality has set energy policies to implement renewable energy sources and increase energy efficiency. In 2016 the municipality became a Covenant of Mayors signatory. Municipal energy plans (SEAP) established as crucial for the conceptualization and implementation of the energy policies due stakeholders engagement. In fact, the municipality is lacking methods/approaches to be able to achieve this objective. From this point, the research become ampler to understand how Portuguese energy policies and planning approaches influenced the municipal level. Then the research gain again focuses towards the municipal level understanding the cause of problems regarding energy governance structures. Finally, is tested an energy planning approach that try to implement in current institutionalization policy-making a long term-vision and problem structuration regarding actual energy system, due stakeholders engagement in a group of schools in Sintra municipality.

Acknowledgements

In first place, would like to thank my family, particularly my mother and father, because without them it would be literally impossible to initiate and now finish this journey in Aalborg University. A big kiss to my cousins Leonor and Dinis, as for my uncle Didi. Then, need to show my enormous gratitude for my girlfriend, that despite the distance it always supported me and helped me making this journey much easier. Then to my friends, that were always there for me, in a way or in other. A special word, for my all-time friends André Pinto and Francisco Palha, my high school friends Gonçalo Rosado, Manuel Pipa and André Almeida and my university friends Bruno Sequeiros, Ricardo Nunes, João Esteves, Steven Cul and José Correia.

Then would like to thank also Poul Ostegaard from AAU due the acceptance of this thesis topic. Also, would like to show gratitude to Karl Sperling, which was this thesis tutor by inputs and most of all due the sharing of thoughts, ideas and knowledge regarding energy planning with me.

Thank you very much to all!

Mário Sousa Mendes

"O ser humano sempre teve necessidade de criar luz
E a luz sempre foi sinónimo de progresso, inspiração…

(…),

Como Buda dizia que quando mudas, tudo muda.
Deixou mestria, na história da filosofia,
Imensa sabedoria na 'Alegoria da Caverna'.
De costas para a luz nunca terás alforria,
A tua mente será sempre sombria e subalterna,

(…),

Sempre que tu és magnânimo, sempre que és inspirador,
Tu estás a produzir Luz.
E as pessoas querem estar perto da Luz.
Por isso quando produzes Luz tu atrais pessoas,
E quanto mais altruísta, quanto mais inspirador tu fores,
Mais pessoas querem estar perto de ti,.
Esse é o verdadeiro Poder, o Poder da Luz.
Muita gente pensa que dinheiro é poder,
Mas pessoas que verdadeiramente conseguem influenciar,
E guiar outras pessoas são os génios, os filantropos, os criadores de Luz.
E mesmo quando tu morres, a tua Luz fica, fica o teu legado (…)"

Abreviations

AdC	Portuguese Competitivity Authority
CCDR	Coordination Commission of Regional Development
CHP	Combined heat and power (cogeneration)
CM	Covenant of Mayors
DGES	Directorate General for Energy and Geology
EDP	Energies of Portugal
EDP Comercial	Commercial Energies of Portugal
EDP Distribuição	Distribution Energies of Portugal
ERSE	Electricity Services Regulator Entity
EU	European Union
MAOTE	Ministry of Environment, Urban Planning and Energy
RE	Renewable energy
RES	Renewable Energy Source
SEAP	Sustainable Energy Action Plan

Table of Contents

Table of figures

1. Introduction

This thesis finds inspiration in my personal ambition regarding sustainable development issue, still is a scientific research in the energy planning field. Today, the paradigm of energy planner is typified by constant uncertainty, the need to deal with multi-disciplinary actors and with different interests. The goal of actual governance practices is to understand and deal properly with all these elements and processes that lead to a change and adapt actions to boost the global desired path towards sustainable development. It was my perception due literature and own experience that current government institutions (as municipalities) are embedded on short-term and mid-term objectives, which could represent a barrier, for the establishment of a long-term visions in a continuous process, as for example governance concept foreseen. Also, setting an energy planning approach that put the focus on public participation and long-term visions, surely means to deal with current habits, routines, ways of thinking and preconception ideas. The initial challenge was precisely to deal with this element, due a curricular internship in Sintra municipality (Portugal), to achieve an analysis completed connected with reality. Regarding the energy sector, as it seems, Sintra municipality main objective is to pursuit the road towards energy sustainability, framed with Covenant of Mayors pact. Which is a program that will be later on described. Also, my intention is to combine theory and practice, helping to establish long-term visions side by side with short-term actions and between management and self-organization. In Portugal it is verified that approaches and strategies implemented are almost always focused on this four years cycle. This constitute a barrier for the establishment of governance approaches with long-term vision.

Think this thesis research process as an hourglass, that starts from a large-scale perspective (European-national level) to a small-scale case study implementation that intends to produce a concrete contribution for local-national-global energy-climate policies goals.

Sintra municipality energy system is embedded in the national energy system. This means that the Portuguese energy system has a strong power and influence regarding municipalities energy policies and planning approaches. Actual situation of Portuguese energy sector continues to be featured by a high energy dependence (the country imports 75% of the energy it consumes), despite national and municipal plans established in recent years, arguing as crucial to move towards energy sustainability. The Portuguese energy matrix is also highly dominated by the consumption of fossil fuels, in the electric sector the hydro-power and coal are the most energy sources used for primary energy production. As a note, hydro-power energy production units are almost all large-scale infrastructures.

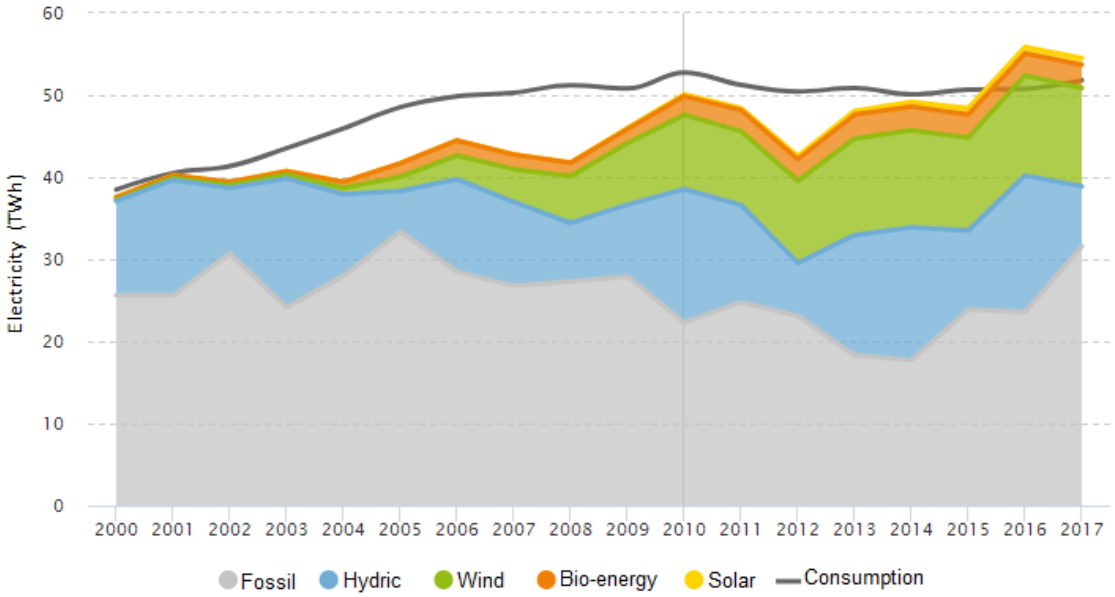

Figure 1: Evolution of electricity production by source in Portugal source:APREN

Since the 90's, due the conclusion of EU adhesion process from Portugal, energy planning policies start to promote even more the reduction of economic and energy sources dependence of Portugal due the use of RE production units. This was a period, that was typified by pressures in the Portuguese socio-technical energy regime, by the landscape. In this period were signed international protocols and promoted conferences to inform and raise awareness regarding the need to change towards an energy system that reduce negative effects for the environment. The trend since the beginning of the year 2000 has been to consume less energy from fossil fuel sources and increase the use of renewable energies. Portugal today faces a problem resulting from its high dependence on centralized electricity production from large hydroelectric plants. As an example, the year 2017 was one of the driest in the history of Portugal, this was reflected in the amount of water available in the reservoirs for electric energy production. EDP, the main energy producer in Portugal and which holds the production rights of Portuguese large scale hydroelectric, increased its capacity at 7.8%, but its production in 2017 was 3% lower compared with previous year. Also, due to this *EDP comercial* announced in 2018 the electricity prices for final consumer will raise. Today Portuguese population have the second highest electricity price in EU and the most-high price to purchase gas. Due to this, some could argue the need to implement local-scale energy planning by promoting the implementation of decentralized energy production units, instead of actual situation which large dimension projects are in construction. An example is the new large hydroelectric, built in Tamega. This project is an investment from a Spanish company (Iberdrola)that intends to invest 1500 million euros, to build a large hydroelectric. Although, the promotion of a more decentralization in enrgy promoted by central government, ended dominated by large hydroelectric operated large international companies. Despite efforts, to move towards a more sustainable energy system, it seems that actual energy regime in Portugal is still dominated by organizations and institutions that despite the implementation of RE productions are still focused on their own interests instead of promoting a more renewable energy system. It seems, that in Portugal niches have been producing few options and ideas to destabilize the socio-technical regime.

Public policies aimed at the electric sector have had positive impacts mainly in market regulation, which was successfully liberalized in 2013 (Araújo & Coelho, 2013). However, the

process of energy planning in the definition of public policy has been conceptualize at a central level. Therefore, public participation has not been stimulated and most of the projects implemented in national territory, related to renewable energies have been large parks with high power installed, operated by private companies. However, public measures have to be optimized, since so far, this method of planning has proved to be, not enough. Given high energy importation and use of fossil fuels for energy production, which characterizes the energy matrix since industrial revolution. The economic and financial crisis that affected Portugal the last ten years didn't help. The economic and social impacts on the implementation of the "Memorando de Entendimento "were negative, the current low diversification of renewable energy sources in the Portuguese energy sector can also be a consequence of the lack of investment in innovation and science during this period. The bet on the environment and energy should be promoted and properly included in the Portuguese economy, because they are sectors that add value and are indispensable in the creation of resilience. (Araújo & Coelho, 2013)

After 2008, several Portuguese municipalities (including Sintra) sign the Covenant of Mayors pact. In the past, reports and plans were produced by municipalities that aimed to protecting environment, and regarding the energy sector some plans were produced in early 2000's. However, these plans were mainly technical, focused on municipal energy matrix characterization and the description of territorial endogenous resources, regarding renewable energy sources implementation potential. Following Covenant of Mayors signing, Portuguese municipalities updated their energy matrix and traced measures to promote CO2 emissions reduction, in municipal energy systems. In 2018 from 119 Portuguese municipalities that sign the pact, 93% had submitted the SEAP and 30% already monitored the first results. Sintra municipality is will now start the monitorization of SEAP results. An arguable point of view, for such a participation of Portuguese municipalities in the CM pact, could be the idea promoted by the CM office that would be easier to adjudicate EU funds for those that are CM signatories. This at least was understood by Sintra energy planners. I think that this statement from the CM office, is related with the idea, that if municipalities sign the CM pact they will be committed to engage citizens and stakeholders around energy policies. Actual adjudication of EU funds demand stakeholders engagement. CM pact tries to establish municipalities as niches for the socio-technical regime. It is argued that, are inside cities and municipalities where most of energy is consumed, and so if they commit to reduce their GHG emissions this will lead to a fundamental regime in the whole national and European socio-technical energy regime.

Despite this, approval of SEAP does not mean that the municipality are in fact, producing good approaches for the objective towards an energy system sustainable. Being the history of the Portuguese energy policies characterized by decisions taken in the central power, now with the existence of hundreds of SEAPs in force, municipalities gain legitimacy and power given their direct commitment to the European Community through the Covenant of Mayors pact. Thus, the local planning process in Portugal needs to be adjusted and optimized. Municipalities organic structures must adapt to this new reality, creating specialized departments equipped with adequate human and financial resources for the implementation of the visions established in the SEAP. Sintra Municipal Council, in December 2017 presented a new organizational chart for the municipal structure, aligned with which is recommended by the European Community and national government. Creating new specialized departments with energy and environmental sustainability, also giving greater relevance to public participation in the municipal decision-making process. As an example, Sintra create a new department called "Environmental Education and Awareness". The municipality has now the challenge to according Covenant of Mayors and municipal SEAP, develop strategies to promote stakeholders and citizens

involvement. This is a new and concrete challenge that municipal energy planners never faced before. The most relevant for Sintra energy sector is SEAP, where it is intended to stablish a bottom-up planning approach to achieve 20% CO2 emissions reduction before 2020. Still, energy developments in Sintra are in the very beginning. Departments with specific tasks for energy have still a lack of expertise and strategies established to achieved energy sustainability goals. The problem is that measures drawn in SEAP seem to be too vague. This problem, for my point of view, almost put energy planning approaches in an obsolete sense, towards Sintra energy sustainability. This because SEAP is the more specific plan, where Sintra municipal energy planners can found inspiration and guidance to lead their daily activities in the energy sector. Moreover, the process of SEAP elaboration ignored CM office directrices regarding the establishment of a base support from citizens and stakeholders during policy-making that is considered has benefit for energy policies implementation in an actors engagement environment. These reasons promote the sense regarding the need to be able to translate theoretical knowledge achieved, during this thesis research, in some sort of action that will lead to contribute positively to the problem resolution in territory. Transition management was the theoretical perspective that provided insights, for the solution formulation, on a shape of policy-making and governance. This perspective revealed, in other contexts, to be a strong planning approach to deal with actual network society that seek sustainable development. It was achieved an agreement from a group of schools called D. Carlos I, for an energy governance experience using transition management insights, to integrate in Sintra community ideas for participatory policy-making, reflection and social learning to promote energy sustainability.

This thesis intends then to contribute in a municipal level, for the establishment of energy planning approaches that seeks for participative policy-making processes. Achieving energy sustainability in an energy system is a very abroad and arguable discussion. Still, contribution from policies in this area could be much more than include environmental concerns in current policy-making. The first challenge is to define for this research work what is understood by sustainable development and energy sustainability.

1.1. Sustainable development

Across European, national and municipal official plans it is clear the objective to achieve sustainable development. But, what is sustainable development?

Searching backwards, to the beginning of the sustainable development concept, it emerged in 1987 in the United Nations (UN) report, *Our Common Future* (Brundtland, 1987) arguing that sustainable development link economic growth, environmental conservation with social cohesion. It is then for the first time associated the idea that the future of next generations should not be compromised due the needed development from current generations (Brundtland, 1987).

Moreover, it is possible to identify simple aspects that refer to sustainable development concept. Firstly, that sustainability concern to an intergenerational event, involving one or two generations (25-50 years) and so a long-term horizon must be treated. Secondly, that sustainability occurs at different levels and scales. Global or national sustainable development does not inevitably imply for local or regional sustainability and vice versa. Thirdly, the multi-disciplinary and multi-sectorial aspect regarding sustainable development. The optimal

situation, that sustainable development seek is for a balance between economic, ecological and social-cultural principles (Pezzoli, 1997). Resuming, sustainable development is a long-term, complex multi-actor and multi-level process (D. Loorbach, Brugge, & Taanman, 2008). The need for sustainable development arising out of a transition context, is an appeal from societal systems that attempt to move towards sustainability but deal with a complex and perpetual system problems (as institutional lock-in and etc.) (Voss & Kemp, 2005). This complexity from sustainable development, is considerably understandable when it is tried to operationalize it, in governance approaches circumstances. Should thus, sustainable development be a continuous process, where social values and interests are negotiated and balanced. It was understood, that are trade-offs from different values and interest in each form of development and all types of development lead to new problems (D. A. Loorbach, 2007). Approaching sustainability as a uninterrupted process leads to the understanding, that is impossible to defined it previously, but instead ensure stakeholders representation, pluriformity and informed debates (D. Loorbach & Rotmans, 2010). Moreover, due it's intrinsic multi-dimensional and dynamic concept, it is impossible to conceptualize due limited terms of static optimization, and through measures established on direct control, rigid goals and predictability (Kemp & Martens, 2007).

In the previous mentioned UN report (Brundtland, 1987), the idea of consensus with a wide variety of strategies and approaches driven by each country and region was aligned to set UN approach for sustainable development. This signify that actors at different levels have found different visions achieving the demand for sustainable development (Kemp & Martens, 2007). In actual situation, the image of sustainable development is the mixture of economic, environmental and social agendas and the commitment to include environmental consideration into policies definition (D. A. Loorbach, 2007). Arguably, the outcome from this situation is a policy-making process based on a disintegrated sight of reality. As Pereira (Pereira, 2013; Teixeira & Pereira, 2012) argued ongoing (Portuguese) governance approaches are not satisfactory to enable a desired uninterrupted governance process to achieve the contribute of diversified actors values and perspectives but also to establish a space for learning process and experimentation. This fact, could represent for Portugal and Sintra an significant barrier to achieve their ambitions regarding sustainability.

Nevertheless, it seems suitable to think in the conceptualization of a governance approach grounded on sustainable development principles, that could be translated for Sintra Municipality energy policy-making process. In this thesis case specifically towards local energy sustainability vision.

1.1.1. Energy sustainability

Once again, multi-level plans have been highlighted the need for an energy transition towards energy sustainability. In many cases, sustainability is seen only in an environmental perspective, but as conclude in previous section sustainable development is a much more abroad concept than promoting system that produce less harmful impacts for the environment. It is suitable to think, that an energy system that seeks for energy sustainability, should make improves in much more sectors than just the environmental.

In this thesis research, the objectives regarding sustainability are seen in a local energy system perspective. This means, that the focuses on governance and planning spheres are regarding the

energy sector, specifically, in terms of EU, Portugal and Sintra municipality sustainable goals. This section purpose is to in basics, assemble dimensions needed to consider a local energy system as sustainable. As all understand, energy is crucial to accomplishment of society needs and ambitions, that is the base for development. Actual services provided by energy sources are immense, providing access to commodities that increase social welfare. Nevertheless, the succession of services that supply energy for consumers and then their consumption habits, could lead to negative environmental impacts, as GHG emissions or the use until the devastation of natural resources. It is then required, an energy system that simultaneously is able to mitigate environmental negative effects, and enable conditions for social and economic progress (Neves & Leal, 2010). Still, Neves & Leal identified three elements that they consider crucial to accomplish energy sustainability at a local (municipal) level:

- Economic: Reduction of local energy dependence, due the creation of strategies, approaches or projects that lead to the creation of business related for example to boost local investment in renewable energy production units and increase energy efficiency.
- Environmental: Reduction of local environment negative impacts generated by non-efficient energy use and the energy supply chain, for example measures to decrease local GHG emissions.
- Social: Creation of green jobs and citizens involvement in policy-making process.

Again, these elements assembled in above mentioned literature were set regarding a local (municipal) scale. Environmental, economic and social impacts driven by the chain that links energy production to final consumption it is impossible to restrict for a municipal scale. Still, it is tried to define dimensions that have influence to move towards ideas as sustainable development and energy sustainability.

Regarding Sintra Municipality, local energy production is almost irrelevant, so the municipality imports energy from the country grid. Nevertheless, despite Sintra does not has inside boundaries large-scale energy production units, this does not mean that there are not negative impacts regarding the energy sector. This because it is remaining, negative impacts driven by transportation and final energy consumption. In Portugal, as described in chapter 4, actual energy system is typified for centralized energy production units, and so municipalities can have an important role to move towards an energy system balanced and secure from centralized and decentralized energy production units.

1.2. Problem definition

Sintra municipality is now dealing with concrete targets, provided by EU Covenant of Mayors office, to reduce their municipal emissions, according to the municipal SEAP plan, approved in Municipal Assembly during 2016. In this Portuguese municipality, almost every planning instrument used (e, g. municipal plans, regulation etc) emphasize ideas connected to sustainable development, and particularly for the energy sector ideas to boost renewable energy implementation and improve energy efficiency. It was my intention, to work side by side with a municipality, to achieve a more in-depth comprehension regarding municipal energy planning practices, achieve proper data and to have a delimitation in territorial terms. This was translated in a curricular internship, in Sintra municipality, from October 2017 until June 2018. It is important to distinguish two different phase, in previous mentioned curricular internship: The

first phase went from October 2017 until January 2018 in the energy efficiency and urban planning department. In this department was at the time, the department that was more focused on energy sector issues. During this period, I had the first contact regarding municipal energy plans that are important for the municipal structure. It was concluded in a form of a academic report, that the municipality had just recently initiate a process of adaptation towards SEAP implementation and has consequence move towards energy sustainability. This first report had a more general approach, and at that time was foreseen a transition management experience that had an ampler influence. Although, it was concluded that to in fact influence and start a process of change in Sintra would require a more experimental approach with a more concrete intervention. Also, this thesis intends to gain distance from transition management approach comparing with last report, using just transition management insights just for the solution formulation. Afterwards, in March 2018 was initiated the second period of curricular internship, this time at the environmental education and awareness nucleus, that is embedded in the department of energy and environmental sustainability. This department was created just in early December 2017 and worked developed here, was completely different from my anterior experience in the energy efficiency and urban planning department. This because, in the energy efficiency and urban planning department activities developed from municipal planners were mainly focused municipal public lighting system maintenance. In this collaboration period, in the environmental education and awareness nucleus tasks had a much more holistic view regarding the energy system. Furthermore, the focus of this department is to create and monitoring programs, strategies or approaches towards environmental sustainability awareness. This nucleus is embedded in the department of energy and environmental sustainability which as the role to be the municipal "gatekeeper" in terms of the implementation of strategies to contribute to reduce negative impacts from climate change. After initial meeting with head responsible from these two departments from Sintra municipality, was clear the uncertainty regarding main municipal energy objective which is the goal of reducing 20% of municipal GHG emissions until 2020, that was established in Covenant of Mayors signature. A fundamental document in Covenant of Mayors objectives execution, is the SEAP. Sintra has a SEAP stablished and approved. Here are set major energy strategies for Sintra municipality for 2020 objectives to reduce 20% of municipal GHG emissions. This document gained a crucial relevance for my master thesis, due the importance of this document for Sintra municipal energy planners. It was understood after reunions with planners from the department of energy and environmental sustainability and the environmental education and awareness nucleus that a serious problem in Sintra SEAP implementation is the lack of strategies to engage stakeholders in an energy governance "sphere". This means that, Sintra is not following Covenant of Mayors recommendations, to be able to create a base support by citizens and stakeholders producing and executing municipal energy policies. This thesis is only focused on the energy sector but regarding the electricity and heating sectors. Following insights given by the theoretical approach used in this thesis, was define an energy governance forum, in partnership with a group of schools in Sintra called *"D.Carlos I",* to slowly bring the culture of debate, reflection, networks, sharing agendas and others to some group embedded in Sintra energy sector. This experience was made in a school because the municipality is responsible to afford energy expenditures from schools inside municipality. This represent a significant expenditure for the municipality, moreover in some schools can represent almost for 90% of total school budget. Also, schools are seen as central supporting local authorities engaging communities for the definition and execution of energy policies. In this sense, were followed recommendations from a European Commission program called *Energy, Education, Governance and Schools* (EGS) (European Commission, 2018) to set this social experience.

1.2.1. Research question and sub-questions

"How to conceptualize an energy governance approach (Sintra municipality) towards a participatory policy-making to achieve energy sustainability?"

Sub-questions:

1) Which is actual situation in Portugal energy system (which Sintra is embedded) regarding energy policies planning approach?
2) How it was established Portugal energy socio-technical regime that disables energy governance structures to move towards energy sustainability? (historical context)
3) Which goals, plans, actions and problems do Sintra municipality have regarding energy policies conceptualization, implementation and monitorization towards energy sustainability?
4) How to stablish an experimental energy strategic transition management arena in Sintra municipality (school environment)?
5) Which results can be drawn from the strategic transition arena in Sintra's schools in terms of actor's behaviors, perceptions and concrete actions for future implementation?

2. Methodology

Finding a solution for this thesis problem, demanded the execution of a variety of methods, somehow aligned to give a proper solution in the end. Also, being the research of this thesis connected to society, it is assumed that it is not possible to be completely objective. Even transition studies highlight this situation and suggest that is needed to develop methodologies that provide a research process transparent and structured. A method used along this thesis is called action research. This method tries to link two different steams: scientific knowledge and practical experience. Also, action research can be conceptualize has the result from four different stages in the research process: planning, acting, observing and reflection (D. A. Loorbach, 2007). The role of a researcher during this process can be compared to a teacher or a facilitator. Moreover, action research has an intrinsic critical perspective regarding other research methods, that are much more focused on the identification of the problem instead of solutions proposals. Still, in methodological terms action research is underdeveloped that lead in critic's view, a possible subjective result. In other perspective, it is arguable that research in social science fields is different from fundamental research in other fields, so for this reason methods can also be different. Visualization of this thesis methodologic process is provided in next figure.

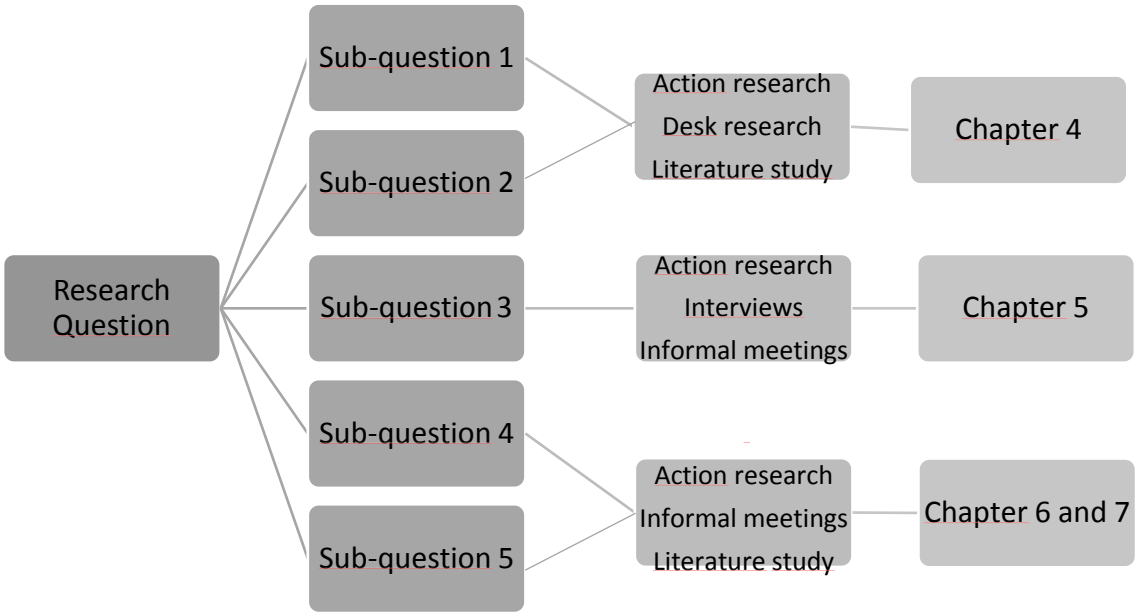

Figure 2: Research methodological model

The answer for sub-question 1 and 2 was built due the use of desk research and literature study methods. This section will be used to understand the scale of the problem, also Sintra energy societal system is embedded in the national energy system. Also, the intention is to give to the reader a framework, regarding the historical context of energy policies in Portugal. For instance, it could be important to understand if energy policies were made at a centralized or decentralized level. Also, to understand which was and is, the role of municipalities in energy policies objectives at a European and national level. Stages identified during this historical context, follow the landmarks set by Araújo e Coelho (Araújo & Coelho, 2013) that execute a roadmap from XX century until 2012, regarding environmental and energy policies implemented in Portugal.

After, Sintra energy policies will be described. This chapter goes in more detail regarding energy municipal policies and approaches. Focused on the identification of plans and regulation that is relevant for energy planning practices in Sintra.

Regarding the school governance approach, apart from theoretical insights from transition management that will be explained in next section, the focus was initially to set-up the meeting. The first idea was to invite actors to the municipality, but due some constraints, that will be made after part of this research analyzes, it was decided to set-up the meeting in the school. The school without any problem provided a room in the school library with enough space and technology to the meeting establishment. Then it was proceeded for the identification of stakeholders representing as school board member, teachers that are related with energy issues in the school, parent's association, municipal departments and national authorities. The identification of each actor was made by me, aligned with the school director and at the sometime informing the head of environmental awareness and education nucleus. After the identification of stakeholders, was made a characterization. Helping in the identification of stakeholders but already in a prioritization way of thinking, it was used a power/interest matrix. This matrix is very basic but still a powerful tool helping in the identification of stakeholders, focused on the power and interest of each stakeholder regarding a certain project. Also, this matrix reveals helpful identifying key stakeholders, meaning that without them it is impossible

to implement the project. This matrix is divided in four quadrants and categories are set for each quadrant (see figure 3).

POWER				
HIGH	**Meet their needs**	Consult and engage on interest areas; Effort to increase interest.	**Key player**	Engagement in energy process making policies; Focus on this group; Regularly consultation.
LOW	**Least important**	Try to inform via general communication.	**Show consideration**	Efforts to keep informed these groups; Identify interest areas through engagement activities; Potential supporter.
	INTEREST	**LOW**		**HIGH**

Figure 3: Power/interest basic matrix

It was understood during the research that this type of meeting demands a visualization during the debate, because this type of discussions can turn ambiguous or an unbalanced contribution from each actor. It was used a web tool called mentimeter, that allow participants in this type of meetings to participate in real-time, using a room projector (to ensure room participants the visualization). Basically, each actor goes to the website menti.com and then it was provided by the event host a code to access the presentation. This tool provides the possibility to create topics/questions that allow inputs from participants and in real-time it is possible to build multiple choice questions, word clouds (brainstorming), 2 by 2 matrix (cost/benefit matrix), speech bubbles (allow an in-depth explanation of each actor thoughts, ideas or proposals) and others. This tool revealed to be a powerful tool improving the efficiency of the meeting and was also useful to draw concrete results. Topics discussed and how the debate was steered considered the theoretical approach shown in next section, specifically transition management levels and activities.

Lastly, during all research process and with different purposes for this thesis research, was driven interviews for some actors. The reason for this, it was to achieve answers regarding some topics that information was lacking. These interviews were semi-structured, some were more general, about Sintra and Portugal situation in terms of energy planning practices or governance, others were more concrete, as discussions regarding strategies drawn in Sintra SEAP. A general overview of these interviews is set in following table, also a summary of each interview can be found in appendix.

Name	**Function**	**Location**	**Date**

Margarida Pereira	University professor in governance and planning fields	Nova University, Human and Social Sciences Faculty	May,2018
Annette Grunwald	Aalborg University professor	Skype meeting	May, 2018
Pedro Teixeira	Head of environmental education and awareness nucleus (Sintra Municipality)	Sintra Municipality	May, 2018
Pedro Flores	Head of environmental sustainability and energy department	Sintra Municipality	May, 2018

Figure 4: Table with actor, location and date of interviews made

3. Theoretical approach

This section intends to put in evidence transition theory and then how it can be related to Portuguese and Sintra municipality context. The idea of transition deal with transformations at a large-scale inside society or relevant sub-systems, that lead to a structural change in a certain societal system. Examples of transitions in societal systems are the transition from carriage to car mobility, extensive to intensive agriculture and the demographic transition (F. W. Geels & Schot, 2007; F. W. Geels, 2005). Today, has European, national and even municipal ambitions suggested in official plans and policies, it is clear the pursuit for objectives regarding concepts of energy sustainability. Assuming this presuppose, is at some point need to understand that society and specifically energy societal system is changing. If the system is changing, in my opinion it is crucial to have a vision, concrete as possible, to understand transition elements dynamics and patterns. Also, if it is achieved the identification and comprehension of transitions, this could result in the facilitation of system interventions towards energy sustainability objectives.

3.1. Transition Theory

Until now, was for me understood that society is in a middle of a transition. The transition that matter for this research, is the energy transition. Any European city is right now in a middle of an energy transition. Now, any citizen cross with electric cars or call for a private company to install some solar panels in the rooftop. My intention was as an energy planner, to understand this concept of transition. In energy terms, how can be conceptualize a transition? Which is fundamental for a transition occur? Which elements make part of a transition? How much time is needed to achieve a transition?

A transition represent then, a fundamental change regarding a stabilized system, in dynamic equilibrium due a duration of time of changes that result in an irreversible reorganization of the system leading to a new and stabilized system (Jan Rotmans & René Kemp, 2001). Recent

literature in this topic, identified fundamental aspects for transitions (Haxeltine et al., 2008; Jan Rotmans & René Kemp, 2001; D. Loorbach et al., 2008):

- Long-term developments, minimum duration of one generation.
- Large-scale social, environmental, technological and institutional processes that fortify and have impacts in each other.
- Interplay between different societal levels (landscape, regime and niche).

Transitions can be described as process with complexity, where should be considered a wide variety of aspects and repercussions. Historical analysis of societal systems (Jan Rotmans, Marjolein van Asselt, & René Kemp, 2001) argued for the identification of different phases in transitions (see figure 5):

- Pre-development phase: while the regime remains stabilized, even though landscape gradually start to change and lead to the development of bottom-up innovations.
- Take-off phase: the process of change start to influence system structure and its regime initiate a transformation.
- Acceleration phase: it is observable fundamental changes due economic, environmental, institutional and social modifications. This phase is also typified by the establishment of continuous diffusion and learning processes.
- Stabilization phase: a new regime is reached due dynamic equilibrium achievement, in parallel speed of societal change turns inferior.

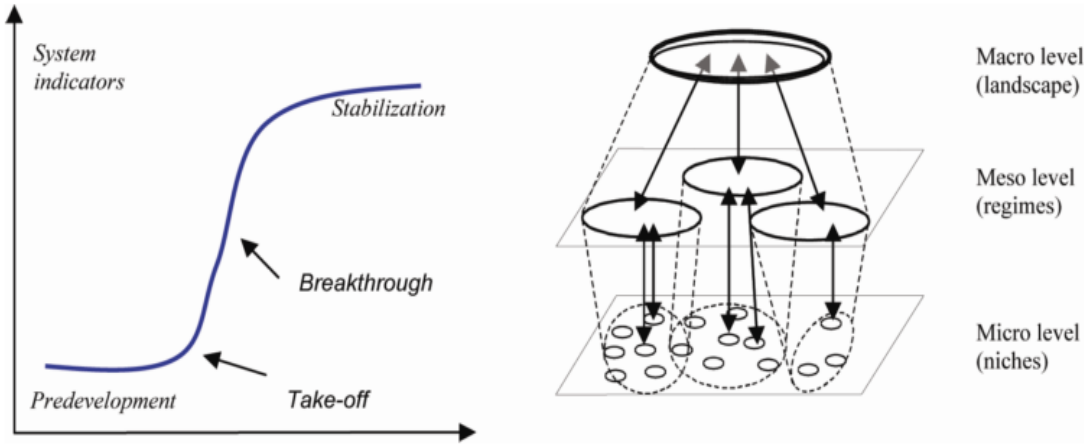

Figure 5: Multi-level and multi-stage models of technological transitions

In transition processes, the change is not straight and direct because it is a result of progress and circumstances that strengthen each other. This means, that multiple levels and scales should have been consider understanding transition processes. The simple multi-level approach used in this thesis sees a societal system divided in 3 levels: The current system regime in the meso-level, innovation and opportunities raises in niches at the micro-level and the macro-level is represented by global long-term objectives and trends as the macro-level.

3.1.1. Multi-level perspective of socio-technical transitions

A transition theory for itself do not create a proper framework to understand transitions towards energy sustainability. An energy transition can be typified as a socio-technical

transition. This multi-level perspective (MLP) applied on socio-technical transitions maintain three conceptual levels above mentioned but identified them as socio-technical landscape, socio-technical regime and niche (I. F. W. Geels, 2005). This perspective essential logic arises from sociology of technology, here three complementary scopes are identified as imperative: (i) socio-technical system, as the concrete, tangible elements required to achieve societal purpose, (ii) elements reproduction and interdependence of socio-technical system are made through social groups, (iii) rules (here seen as regimes) that influence and adapt social groups and stakeholders actions (see figure 6). The comprehension of these above dimensions will be described in this chapter before moving towards the multi-level perspective itself.

Elements and their interdependence of socio-technical system do not occur independently, but are built, reproduced and improve by social groups (Kern & Smith, 2007). Actors from these social groups behaves are framed with cognitive and normative rules, being these rules a strong influence shaping actors activity. This imply that rules create an integrate context that end-up orienting actions. In opposition, these same actions and activities shape rules. This because rules do not occur separately, but in a connection in semi-coherent fixed rules, so called regimes (I. F. W. Geels, 2005; Kern & Smith, 2007).

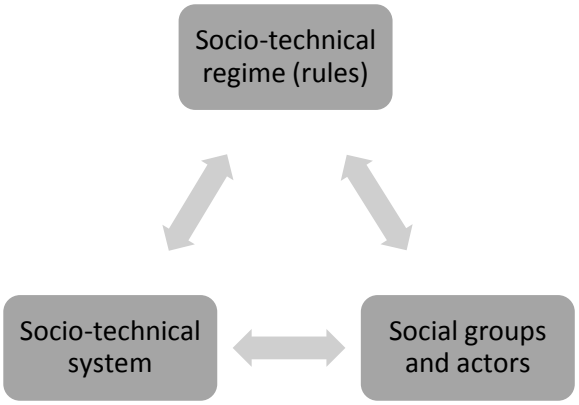

Figure 6: Interrelated analytical scopes

In this context of socio-technical transition, the regime level is typified as “technological regime” (F. W. Geels & Schot, 2007). The rationale behind technological regime concept implies for rules established by cognitive routines, that can be translated in a form of guiding principles, agenda definition, government regulations establishment, standards and others (Rip, Kemp, Schaeffer, & Van Lente, 1997). Also, the term of technological regime was linked to the cognitive routines that the community of engineers has and how this orient their research and development action (I. F. W. Geels, 2005). Although, to include other social groups additionally to the engineers, as policy makers, researchers, consumers and scientists. Despite autonomy regarding each social group, there is still space to interactions due for instance, sharing agendas that lead to interdependencies between groups. The concept of socio-technical regime emerge in this context to represent this inter-group coordination. (F. W. Geels & Schot, 2007).

The *socio-technical regime* constitutes the meso-level in multi-level approach. Because of the direction and management of pertinent social groups implies for the establishment of actual socio-technical system. This stability is also established by the collective role expectations form by actor and organizations embedded in concerted networks (F. W. Geels, 2002). Furthermore, interests and organizations obligations also have a significant role to current socio-technical regime stability. Moreover, industrial and business lobby could contribute for this regime stabilization, due association creation or branch organizations. It is possible to distinguish a wide

variety of reasons that contribute for this socio-technical regime stability. Still, stability do not imply for inertia, but a dynamic equilibrium, understating that innovation still arise but is in a accumulative nature (I. F. W. Geels, 2005). All these stabilization mechanisms disable the possibility to emerge radical innovations into the socio-technical system. It is assumed that radical innovations in early stages cannot compete in the regime markets. Here appear, the concept *niche* as a concrete space for innovation, maintaining their early progress (Rip et al., 1997). Niches can assume different forms, for instance can have the structure of small-market niches, following a concrete selection criterion which is different from current regime. Also, niches que can gain the form of technological niches, where tools and resources are supported by public or/and private investments, also due government subsidies. Also, Geels (I. F. W. Geels, 2005) argue that niches can assume the form of research and development projects but also experimental strategies, promoting actors involvement. Moreover, niches are crucial to provide a space for learning processes on various dimensions as agenda sharing, policy-making and technology. In this sense, niches also enable the establishment of social networks that reinforce innovations as lobby groups, new societal actors networks and user associations (F. W. Geels & Schot, 2007). In the MLP it is furthermore identified the *socio-technical landscape*, which is at the macro scale, where decisions are taken at a global scale but have influence in the sociotechnical development. In this landscape level decisions are taken, and elements are formed from which it is difficult to avoid. This level is beyond direct control of actors and changes through this level cannot be made.

Relation between above three level conceptualized, is a vertical hierarchy. Main feature from MLP is the comprehension of transitions as the interaction between developments at different levels, being possible to describe distinct phases during this process (F. W. Geels, 2002). Firstly, fundamental innovations arise in niches, usually outside or almost from regime sphere influence. In this phase there are not stabilize rules, that can lead for diversified technical arrangements. Networks established by actors in the niche level, usually are small and delicate. Meaning that innovations drawn in this phase still not create a risk for dominant regime in a dynamic-equilibrium(F. W. Geels & Schot, 2007).

The second phase, new innovations are spreading in small market niches, that can bring resources for higher specializations and technical progress. Rules begin to stabilize, due the establishment of a technical pathway of its own. Moreover, consumer usage regarding this new technology, which remains constraint in market niches, still not create a risk for dominant regime, which is still rooted in many means as institutional lock-in, economically and organizationally. These innovations, taking the form as technologies can be remains restraint at niches for decades, because they can meet disparities with the dominant regime (I. F. W. Geels, 2005). Since dominant regime still stable, innovations drawn in niches will have extreme difficult to spread out more broadly.

In phase three, it is verified an extensive development of innovations at the niche level, that start to emerge to mainstream markets, starting a struggle with dominant regime. There are two different dimensions, one intrinsic and other extrinsic, to understand niche technologies breakthrough. The first aspect is related to internal drivers in the niche, as the price/performance ratio (I. F. W. Geels, 2005). Moreover, if actors with power support niches innovations, due their political, financial and organizational resources to boost its implementations and to help prevailing despite another social groups opposition. The other aspect is related to extrinsic circumstances at landscape and regime levels, that are essential in this third phase to create a window of opportunity for innovations in the niche. These windows

appear due pressure between components in the socio-technical regime. This pressure can be also a result of economic, cultural and social modifications at the landscape level that have influence on the regime. Additionally, dominant regime is “contaminated” by expanding within problems, that are impossible to resolve by incremental development. Advancement from the niche level to the regime, does not occur one time only, but in opposition is an arrangement of steps. Innovations constraint in market niches, emerge and progressively to larger market niches, due niches aggregation (see figure 7).

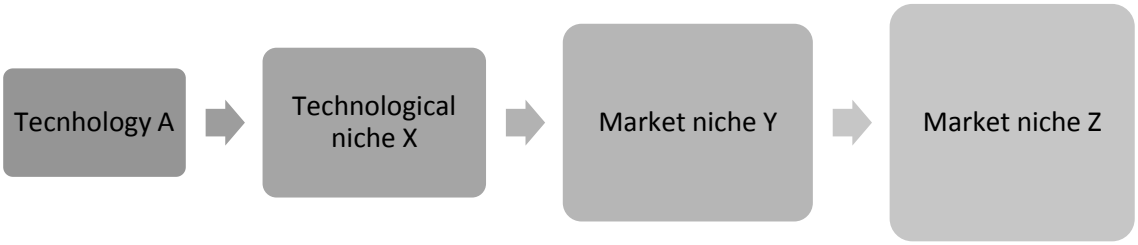

Figure 7: Diffusion in a niche accumulation process

At the same this, additional instruments are established to support niches innovations as policies, infrastructures or consumers habits. This technology becomes more and more stable and create an intrinsic strength due interdependence of these elements created (F. W. Geels, 2002). When the new technology is on main stream markets form an opposition for the dominant socio-technical regime. In phase four, is typified by ample socio-technical modifications, that lead to replacement. This replacement is result of progressive socio-technical modifications during a long period of time. The new replaced regime, can ultimately affect the landscape level (I. F. W. Geels, 2005). A crucial characteristic of MLP is understanding transitions as a result of multiple process, at diverse levels at the sometime. Moreover, MLP put the focus on the arrangements of process in distinct levels, understanding these processes as non-linear due actors and social groups integration. Elements development in the socio-technical regime are the result of actors and social groups activities and judgements. Furthermore, the connection between distinct levels are made due actors actions, and so this dynamic is not

mechanical and neither linear but

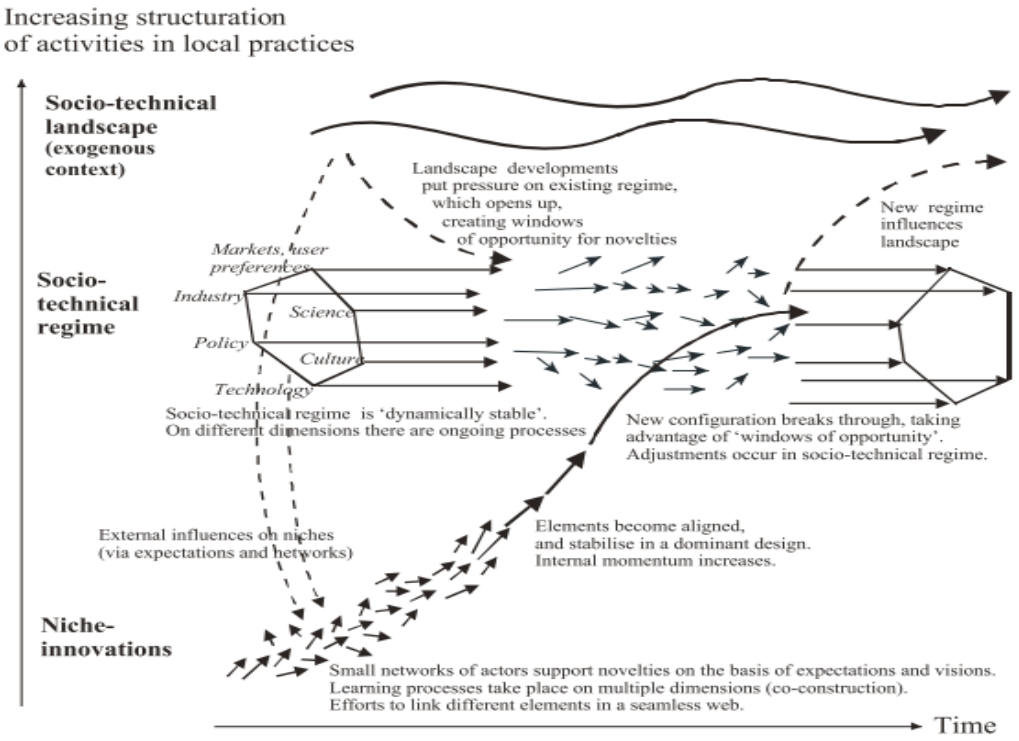

Figure 8:Multi dynamic transition theory model

constructed by social processes. In transitions, general dynamic is a sinuous process characterized by acceleration and slowing down moments. For a visual perception of the multi-level perspective in socio-technical transitions see figure 8.

3.1.2. Transition management

This research use transition management insights in a solution perspective. The conceptualization and understanding of the problem find a framework in transition theory and socio-technical transitions were used. Was my focused, to still in a field of transition research, found an approach that could be suitable helping in the conceptualization of the solution. Looking forward for an energy transition, that seeks a sustainable energy system, it is possible to identify management foundations to achieve it. These basics described by Loorbach, et al., (D. Loorbach, et al., 2008) are a result of three different streams insights: transition theory, complex system science and from historical context analysis. It is a planning objective to constrain the development in a specific direction (steering). In such a context of complexity, steering implies to promote transformations in a (concrete) system due the establishment of conditions where change can occur. Achieving this, is at the same time understand that this context of complexity is not in itself a problem, but instead an opportunity to identify a widespread of steering opportunities.

Assuming that is possible to identify similar patterns from historical and actual transitions, particularly a shift based on escalation of macro influence and micro alternatives that emerge straight to the dominant regime(D. Loorbach et al., 2008). It is then identified main

circumstantial differences comparing the actual situation with last 50 years, regarding Portuguese energy policies and policy-making (chapter 4).

DIFFERENCES COMPARING HISTORICAL ENERGY TRANSITION TO THE ACTUAL AIMED TRANSITION
Rather than economic and technological growth, current policies objective is focused in sustainable development.
Actual problems that drawn, in actual energy transition need are partially caused by previous transition (towards energy production and consumption characterized mainly by fossil fuels use).
Larger infrastructures settlement promotes technologies interdependence.
National government power and centralized planning approaches has turn minor.
Consumers habits characterized by high consumptions and convenience despite high energy cost.

Figure 9: Table of differences comparing historical transitions to the actual desired energy transition

Some researchers (Jan Rotmans & René Kemp, 2001; D. A. Loorbach, 2007; D. Loorbach & Rotmans, 2010), describe an approach to provide an integrated analysis of the energy system. This approach has an implicit framework to reflect about interrelations between exist actors, organizations, recognized problems and to draw innovative solutions. The need for this, is by the reason of actual lock-in in actual energy system, is more than technological and development steering is influenced by a range of effects (e.g, economy or innovation) that work aligned. As a result of these insights, achieving a transition demands a change in infrastructure, institutions, networks, habits and paradigms. All these factors, co-evolved and stabilize due current positive and negative feedback (Jan Rotmans, René Kemp, 2001; D. Loorbach et al., 2008). Also, these elements open space for intervention and no more should be seen at isolation. It is then crucial to manage a transition, an awareness regarding interactions between levels of actual MLG (D. Loorbach et al., 2008).

An aligned concept draw in governance, is the need to deal with uncertainty. These uncertainties could be reduce due system interventions, but surprises will continue to appear (D. Loorbach et al., 2008). This is highly connected to the perception regarding system complexity, so objectives and approaches must be flexible and adaptative. Also, the energy transition towards sustainability envisioned by Sintra municipality, has an implicit social dimension, and thus governance approaches need to include a spread sphere of stakeholders, that should aid for their interactions.

These networks establishment from stakeholders, should contain activities coordinated and structured by the government, that more than this has to develop an effective role supporting and developing these initiatives (Koch, 1998). Moreover, in a transition process, new associations of stakeholders, technologies, multi-disciplinary knowledge and policy instruments, power the initiation of new dynamics and innovation (F. W. Geels, 2002b). Regarding diversification, in an energy planning context, it was continued suggested as merely in technological terms (Verbong & Vleuten, 2002). Each planning intervention is established as a

consequence of an incomplete model, these same interventions further assemble unplanned aspects, that could be partly anticipated (D. Loorbach et al., 2008). The next step, regarding this issue, as Voss and Kemp described (Voss & Kemp, 2005) next level of reflexivity implies in the problem-solving process itself. Assuming that, actual situation is a result partly of, past and present management and policies, thus presumptions behind them must be scrutinized. Considering this assemble characteristics, drawn from energy transition studies, it is then concluded that governance approaches need to combine activities and strategies that provide an reflexive side to gather solutions from activities and identify relevant observations learned (D. A. Loorbach, 2007; Voss & Kemp, 2005).

The translation of above management assumptions, towards an operational approach, made researchers as Rotmans, Kemp and Loorbach (Jan Rotmans & René Kemp, 2001; D. A. Loorbach, 2007) advance with a recursive multi-level framework for transition management, that is suitable in terms of actual energy transition. This transition management model differentiates three levels:

- *The Strategic level:* typified by measures for vision development, strategic debates and long-term objectives establishment. Activities executed during this phase must ensure social and cultural improvements due effective guidance and top-down decision making.
- *The Tactical level:* Illustrate measures of agenda settlement, networking, coalitions development, etc. Regime structures of a certain system, at this level are redefined due the establishment of new structures conceptualized to boost system sustainability.
- *The Operational level:* Characterized by experiments, project building, implementation, etc.

Also, in this transition management, it is distinguished four clusters of activity framed in a cyclical model:

- *Problem definition and vision development:* identification of frontrunners and trendsetters. Problem structuration and formulation of encourage alternative visions.
- *Networks and agenda establishment:* arena participants, in a network environment focused on regulation production, strategies identification and setting transitional objectives (transition paths).
- *Diffusion and experiments implementation:* day to day actions promoted by transition arenas and networks, focused on territory implementation of projects and experiments.
- *Monitorization, evaluation and adaptation:* crossing strategic, tactical and operational level, measures that increment reflexivity and a social learning-process.

This transition management framework provides an context for implementation of approaches, established by progressive analysis of actual situation of the (energy) system (D. Loorbach et al., 2008). Driven analysis for ongoing transition management implementation (in different scales, systems and contexts) regarding the energy transition (D. Loorbach, 2010; D. Loorbach et al., 2008) has drawn an increasing awareness regarding environmental sustainability and the need for change.

In strategic terms, this transition management framework allow the creation of a concrete space for innovative ideas and the settlement of sustainability visions that somehow appear with the purpose to challenge current preconception thinking and performing by transition arenas formulation (D. A. Loorbach, 2007).

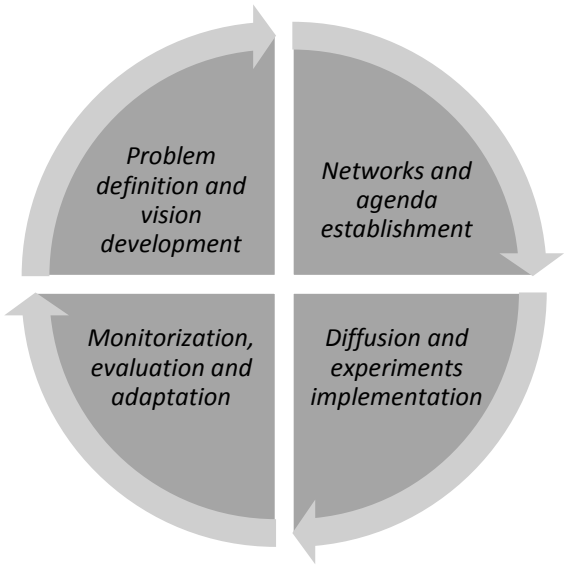

Figure 10: Activity clusters in transition management

4. Energy planning and policies in Portugal (Historical context)

This chapter purpose is to comprehend if energy policies had the expected results and the implementation in Portuguese territory that lead to actual situation of the energy system. Moreover, is due this historical context that a relation with theoretical approach (transition theory and socio-technical transitions) will be made considering information described in this chapter.

Araújo et al.(Araújo & Coelho, 2013), stablished four significant periods which are relevant to build actual national energy landscape, mainly in terms of energy and environmental policies. Hereupon, the industrialization of the country was always linked to the evolution of Portuguese energy mix. At the beginning of the 20th century the main fuel used to produce electricity was coal, allied to new large investments in hydroelectric power plants. Only at the end of the 20th century, also driven by a phase of growth in the industrial sector, the use of oil has gained considerable relevance. In 1973, as a result from the first oil global shock, that led to drastic price increase of this fuel, it is for the first time discussed in Portugal the energy dependence in relation to imported fuels. After the oil shock, the political sector started the discussion around the high Portuguese dependence on imported fossil fuels. As a result, measures were adopted that aimed to safeguard the country in relation to the fluctuation of oil prices, but also to guarantee the supply security for the electric sector(Araújo & Coelho, 2013; Soares, 2016).

The first relevant period in Portugal, regarding energy policies goes from 1973 to 1986, and is described by the foreign energy dependence of fossil fuels. At this time the political solution found was to safeguard, by using protectionist legislation to guarantee that national petrochemical and refineries, which are not competitive and obsolete economically, continue to run. In middle 80's was made a constitutional revision and energy policy had taken in account the preservation of natural resources and the environment, promoting international cooperation in these areas. As consequence, there was a shift in national energy policies, the National Energy Plan (PEN) was created, where it was made the characterization of the national

production energy mix and brought to the political agenda energy discussion. At this time the concerns were mainly focused in the domination of high external dependence on fossil fuels and the possible implementation of nuclear power in Portugal. This period in Portugal, besides being characterized by radical political change, was also defined by the high public deficit accumulated and by the interventions of the International Monetary Fund (IMF) in the years 1977 and 1983. At this time, due to the economic constraints given to international intervention in the Portuguese financial system, the main concerns in the political planning process were economical, envisioning the control of public expenditure (Araújo & Coelho, 2013).

In 1986, with the Single European Act, the European Community began having a legal framework that provided specific policies for the environment, becoming a specific sector with its own agenda within the European Community structure. It was introduced the concept of polluter-pays and implemented the guideline that stablished the need for an Environmental Impact Assessment (EIA) regarding public and private projects if they are possibly harmful for the environment. This was the year Portugal became a member of European Economic Community (EEC), and as a result, this period is characterized by a strong national economic growth. Factors which led to improve Portuguese economy were mainly due to a significant public investment and the private construction sector boost. The road sector has rapidly expanded due to the construction of thousands of kilometers of highways funded mainly by Community funds in partnership with public and private Portuguese sectors. This fact is particularly relevant because, after the investment in these roads, the use of car was (purposely or not) highly promoted. Portugal number of cars is roughly a total of 6 million. From final 80's to final 90's these number went from 2 million cars to almost 5 million(Amador, 2010). Even today, planning approach context is highly shaped by the strong linkage between the use of car and cities planning design. By that I mean that Portuguese cities and municipalities are designed for cars and not for people. Moreover, this approach from territorial planning has a strong impact in final energy consumption as figure 11 illustrate. Energy consumption in the country has increased in this period, particularly oil. However, new coal and gas power plants were built in order to reduce oil dependence. Still in 1986, the legislative framework was promoted to allow a greater diversification of energy sources in national energy mix. Specifically, the use of renewable sources through financial incentives for independent electricity producers. The government makes, for the first-time, reference to the use of endogenous resources to produce energy which has, since that period, always been included in government programs that have stablished current energy policies.

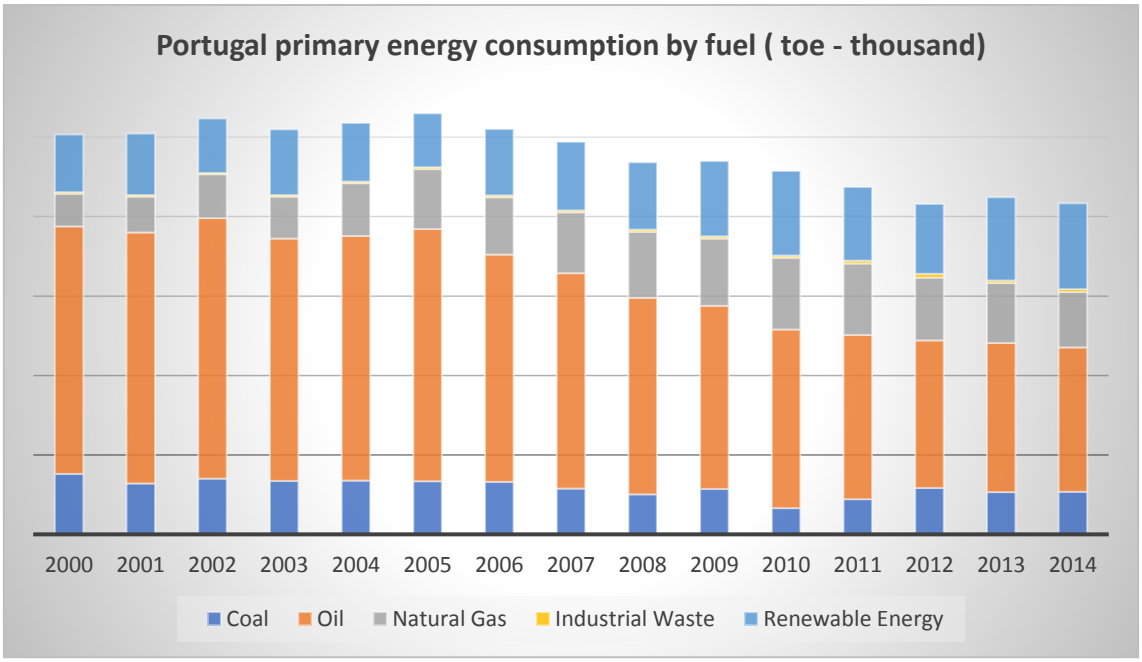

Figure 11: Primary energy consumption in Portugal by sources

The second relevant period for national energy panorama goes from 1986 to 1999 and could be typified for early political awareness regarding climate-energy issues. The social perception and political awareness regarding climate change, start to raise, because for the first time the population and political power is dealing with the concrete challenge of reducing greenhouse gas emissions, given the agreements signed in Kyoto Protocol. The 90's is thus characterized by the growing citizens awareness and the political structure adaptation to meet these new environmental challenges. The political response in this period was initially given by the creation of the Ministry of Environment and Natural resources and also of the National Council for the Environment and Sustainable development (CNADs)(Araújo & Coelho, 2013).

In the aftermath of the Maastricht Treaty, which promoted the creation of the European energy market, resulted in Portugal energy policies aiming at the increase of the level of openness of the national electric sector, in relation to the market. In 1995 was then initiated the liberalization of the energy market and established energy acquisition contracts that guaranteed rents to producers of electricity to coal and gas income equal to the period before liberalization. These rents were calculated taking into account the fixed costs of operation and maintenance, capital investment and variable costs related to energy production (El, Jo, & Ribeiro, 2011). The millennium began for Portugal at an environmental level with enormous negative impacts In Portuguese, Spanish and French coast by the sinking of the tanker *Prestige*. This environmental disaster has once again put on the agenda the environmental concerns that have influenced the energy policies that have been projected for the future.

From 2000 to 2010, this period was driven by the environmental concern intensification and structural energy policies execution. Mandatory regulations related to environmental licensing have been created, but legislation has also been developed for the areas of water, waste, air quality, among others. In 2001, the E4 program was put on the ground (energy efficiency and endogenous energy) and had the objective to tackle the dependence of primary external energy, ensure the safety of supply, reduce energy invoice and promote environmental quality. In financial terms this program encouraged through higher remuneration on the use of electricity, which fluctuated depending on the use of renewable energies and implemented technology. In

this political process of establishing a new energy legal framework, it was stablished the National Program for Climate Change (PNAC), in 2006 was created the Portuguese Carbon Fund (FPC) and finally in 2010 the National Strategy for Climate Change Adaptation was approved in Portuguese parliament. In 2004 it was agreed between Portugal and Spain the elaboration of the Iberian electricity market (Mibel). Despite all this structural change in energy sector, political power agreed to maintain some remunerations for Iberian producers that mainly use fossil fuels for energy production. In mid-2000, the national energy strategy was reviewed, with fundamental axes embedded in the European single market idea. In 2008 was approved the National Plan for Energy Efficiency (PNAEE) aiming to achieve objectives set down by European Directive 2006/32/EC, aiming to improve efficiency in the final use of energy and for energy services. The national Strategy for Energy 2020 set to increase 60% electricity produced and 31% of the final energy consumption from renewable energy sources, in addition to reducing final energy consumption by 20%. After, was approved the National Plan of Action for Renewable Energy (PNAER), which appears as the instrument that sets the country's targets for renewable energy final share in Portugal energy mix. Regarding the electricity sector, energy policies drawn by PNAEE and PNAER show positive results, from 2000 to 2016 Portuguese wind power electricity energy production rose sharply from 168 GWh/year to 12 474 GWh/year. Also, other technology highly promoted during this period was hydro power, went from 10 702 GWh/year electricity energy production to 16 412 GWh/year. After 2008 construction for renewable energy production unit's projects start to slow down, this due to first negative affects suffered in Portuguese economy due the global economic crisis. In the same year, was created the Covenant of Mayors pact by European Commission. This program was created to boost local governments to contribute voluntarily to European Union climate-energy goals. From the beginning, Lisbon, Porto, Cascais and two more Portuguese municipalities signed Covenant of Mayors pact.

When global economic crisis started, Portugal was one of the first European countries that quickly felt the negative financial and economic effects. The Portuguese situation was also recorded by the crisis of sovereign debts, rushing the entry for the third time of the International Monetary Fund (IMF) in the country. From 2011 to 2016 energy policies drawn in this period were typified by economic restrictions, that stopped or finished projects execution. In 2011 the *"Memorando de Entendimento"* was signed, framed in the European financial stabilization mechanism, which in the energy sector complied to (i) conclude the liberalization of national electricity market, (ii) reduce importation dependence of energy power sources, (iii) promote the consolidation of the national energy policy by reviewing the instruments of action, especially financial incentives, (iv) decrease energy production associated costs, (v) make Mibel integration permanent and (vi) stimulate competitiveness in energy market. The *"Memorando de Entendimento"* was a list of commitments between IMF, the European Comission , the national government and civil society to stabilize the national financial sector.

This period was typified by government policies completely focused on the financial commitments established. The implementation of the *"Memorando de Entendimento"* was seen by the government in office, as fundamental in the national policy strategy. The subsidies allocated to renewable energy production projects began to be seen as obsolete and considered responsible for Portuguese tariff deficit. Decree No. 25/2012 has come to suspend new licenses for projects using renewable energies for electrical production. Thus, environmental concerns were put in the background in the energy planning process due lack of incentives and promotion for innovation and projects to promote sustainability in energy sector. Simultaneously, energy planning at a municipal level started a new paradigm, due hundreds of Portuguese municipalities that sign for Covenant of Mayors pact. This represented an important fracture, regarding

Portuguese energy policy-making process. Before, policies were always stablished at a centralized level, seeking for large scale production units projects. Due those municipalities turn into Covenant of Mayors signatories, developed municipal energy plans that stablished strategies to reduce local CO2 emissions. The role of central government suffered a significant change in energy policies, changing from the unique responsible to produce energy policies to share this responsibility with other decentralized government authorities. All Covenant of Mayors signatories must develop a municipal baseline emissions inventory and then identify strategies to reduce municipal CO2 emissions, under a plan called Sustainable Energy Action Plan (SEAP)(Kona et al., 2017).

In 2015, the political environment in Portugal is featured by the change of the government that exercised functions during the process of economic and financial compliance agreed between Portuguese government and International Monetary Fund. In October Of 2015, after the legislative elections was, for the first time in the history of Portuguese democracy, made an agreement between three parties that were voted to compose national assembly, to constitute a viable democratic alternative to stablish a new national government. This was made to provide a drastic shift regarding national policies from the last national government. The new policy objectives are based on the execution of (i) a new development model, (ii) safeguarding social status and public services (iii), relaunch investment in science, innovation and education (iv) to respect international agreements that Portugal is a signatory of to enable the country's sustainable development. The period from 2015 to 2018 could be typified as the opposite comparing to antecessor period, that was characterized for an harmful economic situation that disable investment (Governo de Portugal, 2014). In 2017, after public deficit reduction to 0.3%, allied to the constant increase of GDP and a decrease in unemployment from 2015 until now, the European Union recommended the closure of the excessive deficit procedure, which has been applied since the implementation of *"Memorando de Entendimento"*. This is especially relevant to the energy sector, because since 2008 the economic status in Portugal was featured by high difficulty of access to credit and low income available at public and private level.

Regarding the framework to produce energy policies, it is considered in the current government program (Governo de Portugal, 2014), that adapting structures and political behaviors are needed to optimize planning process. In addition, it is also dedicated a chapter demonstrating the intention of Portugal to lead the energy transition. The ideas described are mainly technical, demonstrating (i) the importance of producing more electric energy from renewable sources, (ii) promote energy efficiency, (iii) and promote the reduction in the consumption of fossil energy sources in the transport sector.

Connecting these insights with transition theory, Portugal is now in the take-off phase regarding the energy transition. This phase is characterized by the concrete initiation of a change in structural terms for the dominant regime. It was concluded, that the biggest contribution to move from the pre-development phase for actual take-off phase came from municipalities. Was seen, that has an answer for economic crisis, many Portuguese municipalities sign the CM pact that put climate-energy policies in the political and technical agenda from Portuguese municipalities. This fact is a concrete proliferation of bottom-up approaches, that is crucial to find a balance between top-down and bottom-up approaches. Also, this phase come clearly after landscape pressures that has influence in Portugal energy regime. I would divide this landscape pressures in national energy regime in three. The first phase was after the oil crisis in the 70's, that for the first time raise environmental-climate policies awareness in Portugal. The second, was after the EU member-adhesion from Portugal in 1986. After this period, policy-

making in Portugal was highly influenced by EU directives. Finally, the third was after 2008 during the economic crisis. This third shock made all Portuguese society in a kind of introspection period. Regarding the energy sector, some scandals were discussed in public arena, and was felt a spirit of bigger transparency. Also, it was understood the economic and fuel dependence from other countries is highly expensive for our generation and next ones. Municipalities has in this period a fundamental role promoting the implementation of RE production units, mainly due SEAP and similar municipal plans established energy policies. Promoting the change in actual socio-technical energy regime, seems to depend on the implementation and promotion of niches as described by transition theory. CM pact intend to establish these SEAPs programs outside the regime influence to promote the creation of technology-niches that pop-up from the municipal scales. Niches intend to be a concrete space to produce innovation that will put pressure on actual regime. This research intends to put in evidence that municipalities just by itself due CM pact agreement, these signatories cannot be all described as technological-niches. What municipalities can do, is to drive policies and actions that will generate a proper environment for innovation in the municipal energy system. Regarding Sintra, the intention from next chapter is to understand what have been made from the municipality in recent years to promote energy sustainability.

5. Sintra energy policies

Assuming as a basis these previous definitions of local energy sustainability, it seems obvious that a characterization of actual energy system in Sintra to see which sources provide energy for this system. It is in this chapter gather data, regarding topics as total municipal consumption, energy production and municipal emissions that result from energy consumption. The most recent source regarding the municipal energy system in Sintra is the SEAP, where it was elaborated in 2016 a base line emissions inventory. In order to complete this task, it was elaborate an energy mix for the municipality, where it was described data as municipal energy consumption, production, consequent GHG emissions, etc. Despite this, SEAP used as data sources collection from 2008 and 2013 regarding the municipal energy system consumption, production and emissions. In this thesis it is assumed that some data can be in some cases antiquated.

5.1. Sintra municipal energy system

Sintra total municipal energy consumption is roughly 3TWh/year. According to SEAP data, final energy consumption rose from to 2000 to 2005 achieving almost 4 TWh/year. From 2005 until now the energy final use consumption has been slightly decrease today's value (see figure 12).

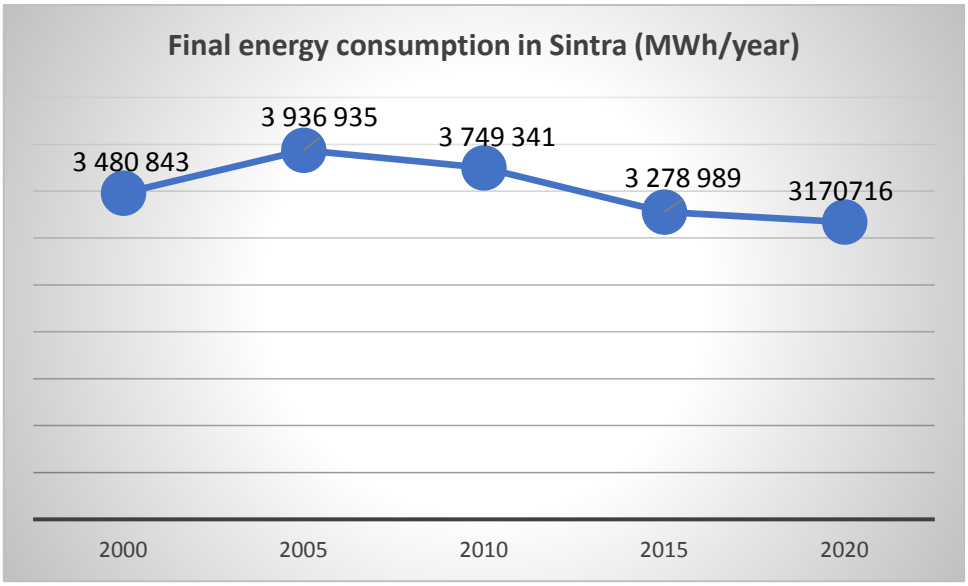

Figure 12: Sintra municipality energy consumption

Regarding total energy consumed inside municipality boarders, is important to highlight the transportation sector. This sector represents slightly more than half of final municipal energy consumption, being then followed by the residential, services and industry sectors (see figure 2). In quantitative terms, transportation sector accounts for final municipal energy consumption with slight more than 2000 MWh/year. The residential sector represents roughly 800 MWh/year, being then followed by the industry sector with approximately 400 MWh/year and the services sector with practically 350 MWh/year. Lastly, municipal buildings and public lighting share for the final municipal energy consumption is almost 90 MWh/year (see figure 13).

Moreover, taking in account last data it is also possible to understand GHG emissions that are associated for each sector inside Sintra municipality energy system. Once again, the transport sector the most significant because is responsible for emissions at 500 thousand tones CO2/year, which is half of total municipal GHG emissions. Then residential sector emissions account with 250 thousand tones CO2/year, the industry sector with 129 thousand tones CO2/year and services sector with 124 thousand tones CO2/year.

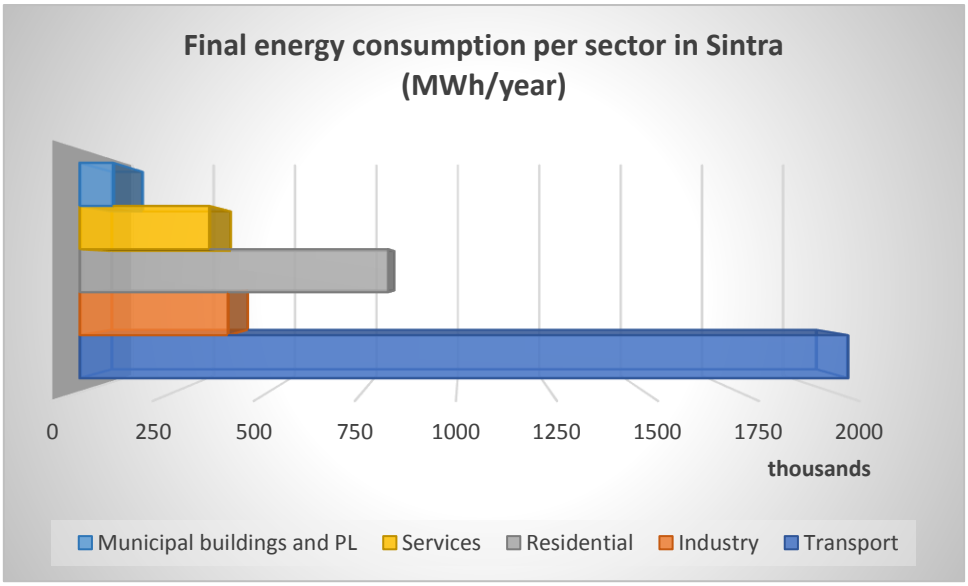

Figure 13: Sintra municipality final energy consumption by sector

Finally, municipal buildings and public lighting are responsible for emissions of 32 thousand tones CO2/year. These data collection put in evidence the importance of transportation sector regarding final energy consumption and consequent GHG emissions. Also, as it seems residential sector is the second sector which has more impact in energy consumption and GHG emissions. Also, as it was showed services and the industry sector have similar demand and emissions, and finally municipal buildings and public lighting seem to be the ones with less significance regarding mentioned topics (see figure 14).

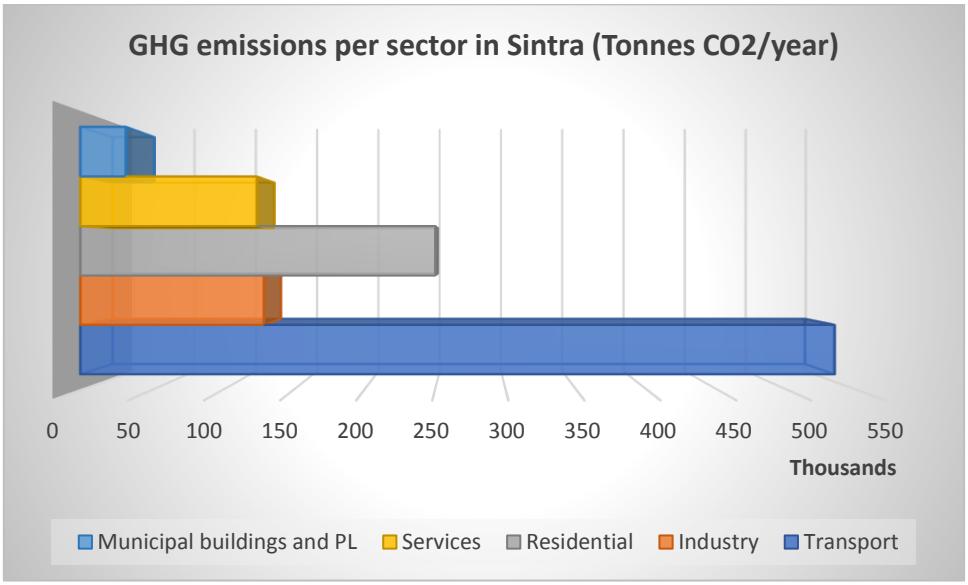

Figure 14: Sintra municipality GHG emissions per sector

Lastly, in general mode, it was divided in three vectors the municipal energy system: electricity, heating and transportation. This was made due the integration of data regarding previous dimensions. The heating vector is the sum of natural gas, butane gas and propane gas. The natural gas in Sintra, is the most used in the heating sector (9%) and propane and butane gas have a similar share consumption (3%). The transportation vector considers petrol, auto gas, fuel diesel and professional diesel. Fuel diesel accounts with 38%, followed by the petrol and

auto gas with 14% share consumption. In total, electricity vector represents roughly 50% of energy consumption, then the transportation sector and finally the heating sector (see figure 15).

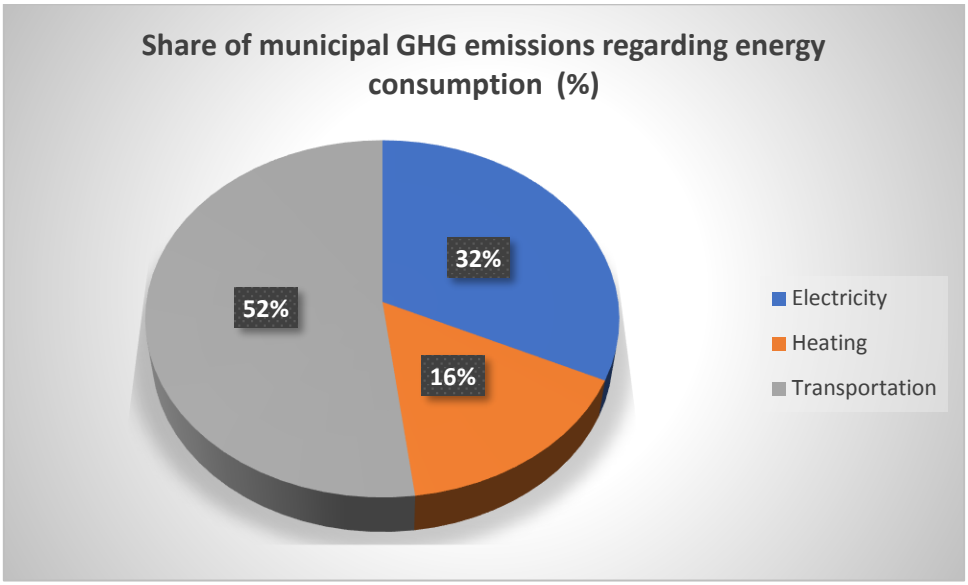

Figure 15: Share of municipal GHG emissions regarding final energy consumption

Also, the municipality is typified by total dependence regarding the energy sector. This because, the energy production inside municipality boarders represent 0,01% for final energy consumption. Sintra has inside boarders only one wind farm with an installed capacity for 20 MWh/year in Almargem village. Despite the proliferation of solar power production units, which were installed on a domestic or business scale, it was not possible to ascertain the current capacity of production installed from this technology.

The energy system of Sintra is possible to see as dependent on fossil fuels, due national system dependence on this type of energy fuel. The energy consumed at municipal level is produced outside the municipality, making the municipality fragile for example in terms of energy prices fluctuation. In addition, part of the concept of energy sustainability is related to energy dependence from renewable energy sources. Renewable energy production is now irrelevant comparing to municipal energy demand. However, legislation and municipal plans have been promoting the use of renewable energy production units and increase energy efficiency. But still, the municipality do not have any data regarding micro and small-scale energy production units, installed by consumers and private sector.

5.2. Sintra municipality energy policies

Since 90's periods, Sintra municipality started to develop and implement some official plans regarding climate-energy topics. Regarding the structure of any municipality in Portugal, is divided in two: the political structure and the technical structure. The political structure can change every four years due municipalities elections cycle. The technical structure is composed by employees and technics that fulfill municipality departments and execute planning practices and day-to-day operations. The technical structure is subservient regarding the political structure because last decision is always taken by the politicians.

Despite of this, in Portugal, a municipality has their legislation regarding energy sector, under the Municipal Urbanization and Regulation Law. This law was reviewed in 2017 in Sintra municipality, chasing the purpose to simplify municipal territorial planning procedures and promote staff accountability in urbanistic operation, which energy sector is embedded. This new legislative framework, intended to continue promotion of administrative simplification, electronic administration, collaboration, trust, sustainability and defense of landscape and urban environment and the use of best planning tools available (Assembleia Municipal de Lisboa, 2013). Regarding energy sector, Sintra Municipal Urbanization and Regulation Law (MURL) since 2012, stablished that urbanistic operation should take in count, the rational use of energy, due the implementation of micro renewable energy production units. The update version from this regulation in 2017, stablish an entire chapter to energy efficiency and renewable energy implementation. This document stablishes as mandatory the use of solar thermal energy in all new private buildings (e.g, residential, commercial buildings) and municipal buildings (e.g, municipal swimming pools) helping to reduce domestic hot water demand. Despite, the intention revealed in MURL, the focused regarding renewable energy implementation is most of all, for new edifications.

In other hand, there are active some municipal plans that are, somehow connected to energy sector. First, Municipal Director Plan (PDM) is mandatory for all Portuguese municipalities and is seen as the most important municipal planning tool. This plan should be central for other municipal plans elaboration and to set strategies for territorial development. Sintra PDM is being reviewed since 2016 and recently was approved the Municipal Regulation for Relevant Projects (PRIM), seeking to boost municipal territorial development and the ability to attract investment that enable citizens quality life. In PRIM, are settled rules for public and private investment, and this regulation is precedent on PDM revision (Câmara Municipal de Sintra, 2016). Regarding the energy sector, it is drawn in this document that is available for Sintra territorial implementation, projects that reveal positive impacts in environment, that contribute for environment sustainability, particularly do the introduction of renewable energy production units. Regarding municipal energy sector, the most relevant important plan is the Sustainable Energy Action Plan (SEAP). This plan, similar to previous ones, is made at Sintra municipal scale and was produced after municipality Covenant of Mayors signature in 2016. As described in Sintra SEAP, this document intends to be main municipal planning tool to achieve Covenant of Mayors climate-energy goals, and to contribute for global climate-change mitigation.

Any municipality that signs Covenant of Mayors pact has to within one year produce a municipal plan of action that stablish approaches, projects or strategies that contribute to boost renewable energy production units implementation. Indeed, Covenant of Mayor Office produced documents that work has standard template intending to help municipalities during SEAP elaboration. First objective in SEAP making-process, is the elaboration of the municipal reference emissions inventory, that would work as basis setting municipal strategies to reduce CO2 emissions. The results from Sintra emission inventory intends to provide concrete calculation regarding municipal final energy consumption, energy supply and then CO2 emissions. The second main mandatory part in SEAP is the definition of strategies and approaches that should match with problems identified in municipal reference emissions inventory. Looking to Sintra SEAP, it is set a commitment by the municipality that will adapt administrative structure, allocating municipal planners to promote actions need in SEAP implementation. In December 2017, following this commitment Sintra municipality drastically change municipal structure. Moving towards the creation of new municipal departments and nucleus, that for the first time in Sintra municipality are working almost exclusively to achieve

Covenant of Mayors objectives. Specifically, the new Municipal department of energy and environmental sustainability that is working side by side with the also new Municipal Nucleus of Environment Education and Awareness. Before this change in Sintra Municipality, the main department that was producing working in energy planning was the Municipal Energy Efficiency and Urban planning, that developed energy activities due the Public Lighting nucleus. The main difference between the previous Sintra municipal structure and the actual one, is that before municipal energy planning approaches were mainly focused on municipal public lighting sector. Now, municipal planners are trying to set a holistic view regarding energy sector, focused for the first time to stablish the development of environment sustainability due education and awareness activities. That is an important shift in Sintra municipality procedures regarding energy planning, and it was mainly induced by Covenant of Mayors pact and SESA acknowledgements. Finally, actual strategy regarding municipal energy sector is set in SESA and seeks the adaption of habits in planning municipality approach, industry, transportation, business, agriculture sector and citizens. Proposals for sustainable energy, made in Sintra SEAP are organized in next table (figure 16), divided by each measure, if the proposal is concrete or non-clear and influenced sectors.

Proposals for Sintra energy sustainability	General description	Measure type		Sectors
		concrete	Non-clear	
Buildings efficient illumination	• Replace incandescent bulbs with compact fluorescent lamps (LFC) or tubular • Replace inefficient bulbs with LED technology	**X**		Municipality and citizens
Public illumination optimize management	• Place flow reducer and brightness sensors • Replace conventional electromagnetic ballasts with electronic ballasts • Place remote control systems • Replace existing bulbs with LED lamps, (eg., semaphore signaling)	**X**		Municipality
Energy audits, efficient construction and buildings certification	• Make thermal insulation build according to solar exposure, climatic conditions	**X**		Municipality
Efficient vehicles	• Renew vehichles for a more eficient fleet		**X**	Citizens and municipality
Electric mobility	• Electric vehicles acquisition; • Provision of public bikes	**X**		Citizens and municipality
Public transports optimization	• Construction of a smart web platform		**X**	Public transportation companies and municipality
Energy management open systems	• Devise an intelligent energy management system and a collaborative platform		**X**	Energy companies and citizens
Solar thermal energy	• Solar collectors for hot water production and heating/cooling systems	**X**		Citizens
Efficient air conditioning and ventilation	• Installing heat pumps • Installing natural ventilation systems • Place automatic control units: timers, presence sensors and thermostats	**X**		Citizens, business and industry sector.
Efficient boilers	• Install thermal solar harness systems for the production of hot water sanitary	**X**		Municipality, business sector, Citizens,

	• Install heating/cooling systems and ambient heating systems: district heating; combined system			
Biomass and forest waste	• Production of electricity and heat due the use of biomass • CHP biomass	**X**		Agriculture sector and business sector
Climate and energy optimization in urban planning	• Use of natural light. • Improving the urban road network to encourage walking, cycling and public transportation		**X**	Municipality
Water sustainable management	• Measures creation for water management		**X**	Citizens, municipality and agriculture sector
Urban waste sustainable management	• Raising awareness and educating for waste prevention, for separating and recycling compost of organic residues		**X**	Citizens, municipality and schools
Fleets optimize distribution	• Acquiring fleets of less polluting vehicles		**X**	Municipality and business sector
Efficient office equipment	• Replace conventional CRT monitors with LCD monitors • Buy equipment with Energy Star label (used in standby low-consumption equipment		**X**	Business sector
Efficient residential equipment	• Replace existing equipment with more efficient models.		**X**	Citizens
Climate-energy sustainability awareness and education	• Disseminate information on the labelling of appliances, telling them which are the most energy efficient equipment • Educating the school population		**X**	Municipality, citizens and schools
Spontaneous carbon emissions reduction	• Raising awareness of the use of renewable energies and forest planting .		**X**	Business and industry sector
Walking and cycling promotion habits	• Reduce the number of vehicles in circulation			Citizens

	• Create partial walking and/or cycling routes, complemented by train routes or other collective transport, when the relief is irregular.		**X**	
Optimization of professional and pendular mobility	• Promote public transportation, carpooling, carsharing and Van pooling		**X**	Citizens, transportation, industry and business sector.
Integrated renewable energy production	• Produce energy for self-consumption		**X**	Municipality, industry and business sector
Urban and business sustainability support investment	• Capturing investment that is entrepreneurial, which can be provided through local support structures		**X**	Municipality and business sector

Figure 16: Table resuming Sintra SEAP proposals

Moreover, in Sintra SEAP are set instruments that was designed to support previous proposals for sustainable energy. The first instrument drawn was the creation of the local observatory for sustainable energy. Following this recommendation in municipal SEAP, was create a new organism in Sintra municipality called Sustainability Observatory of Sintra, that intend to develop monitorization regarding proposals set in SEAP. Also, this observatory has the important role to be a gate keeper of municipal energy sector statistical information. Finally, this organism has the objective to promote the collection of new data that today is not available for Sintra energy sector (Assembleia Municipal Sintra, 2017). The second instrument that is recommended in SEAP, is the execution of an energy and carbon balance inventory. The idea is from the data collected regarding the energy system create a carbon balance focused on energy dimension from municipal emissions. A Web platform is the third instrument identified to promote SEAP implementation. This instrument goal is to be a method of communication between municipality and citizens, promoting events and inquiries regarding climate-energy topics. The last instrument drawn from SEAP recommendations, is to challenge the municipality to stablish a sustainability roadmap for 2020-2030 period. This sustainability roadmap intends to be a map of municipal opportunities regarding sustainable energy implementation, promoting stakeholders and citizens involvement. Strategies drawn in the municipal roadmap should be supported by statistical data collected from the Sustainability Observatory of Sintra. Next table (figure 17) illustrate instruments drawn in Sintra SEAP, if they were implemented until now and implemented which is the responsible actor for that specific complementary SEAP instrument.

SEAP instruments	**Implementation 05/2018**

Local Observatory for Sustainable Energy	No
Energy and carbon balance inventory	No
Web platform	No
Sustainability roadmap	No

Figure 17: Table of SEAP instruments

Also, SEAP during strategies and instruments suggestions promote always the idea that to proper implementation of SEAP it is imperative to achieve citizens and stakeholders support around these proposals.

To conclude, it is possible to identify two distinct municipal strategies to boost sustainable energy implementation. The first strategy is legislative, and it was set in MURL, where due a top-down approach the municipality stablished as mandatory the construction of renewable energy production units projects for all new municipal buildings in Sintra. The second strategy is set on energy planning documents. Moreover, SEAP intends to be a complementary tool for energy planners in the execution of their activities. It is understandable that a document like this, sometimes is not very concrete, because this document approval is a commitment between political and technical municipal structures. It should be a priority for the future implementation report that will be made regarding SEAP, an adaptation of measures in a way that municipal planners can follow such proposals. For instance, could be add for SEAP instruments, a concrete approach to achieve stakeholders engagement and public support for SEAP policies operationalization. Also, measures could be more specific than just informative blocks of text. Regarding this sense, how SEAP elaboration works? In next section will be described in detail the CM pact.

5.3. Covenant of Mayors Pact

It was clear in previous section, that for Portuguese municipalities (included Sintra municipality) Covenant of Mayors participation, represented a fundamental change in municipal energy planning approach. Particularly in Sintra, after Covenant of Mayors signature and other facts, municipal structure change, due the creation of new departments and closing others, that intend to stablish energy policies. Also, Sintra has in hands for the first time, a concrete problem in climate-energy sectors, reducing municipal CO2 emissions. But, what is the Covenant of Mayors pact and SEAP purpose?

In 2008, was announced by European Parliament 20-20-20 climate-energy objectives, seeking to increase 20% of EU energy from renewable energy sources, 20% decrease in EU greenhouse gas emissions and 20% improvement in energy efficiency. European directrices had since this period being promoted these goals implementation into European countries energy systems, for that reason was created the Directive 2009/28/EC, that had the concrete objective to boost European countries renewable energy sources implementation and the European Performance Building Directive 2010/33/EC was reformulated. Moreover, Covenant of Mayors is an aligned tool for European Commission to endorse European cities and municipalities efforts supporting

European Union climate-energy goals. Covenant of Mayors was implemented to help European Urban areas increasing energy efficiency, mainly due renewable energy productions units deployment. This European program was completely focused to involve European cities and municipalities contributing to climate-energy goals. This decision was supported because the International Energy Agency (IEA) identified that more than two-thirds of world energy demand come from urban areas and 70% of CO2 emissions.

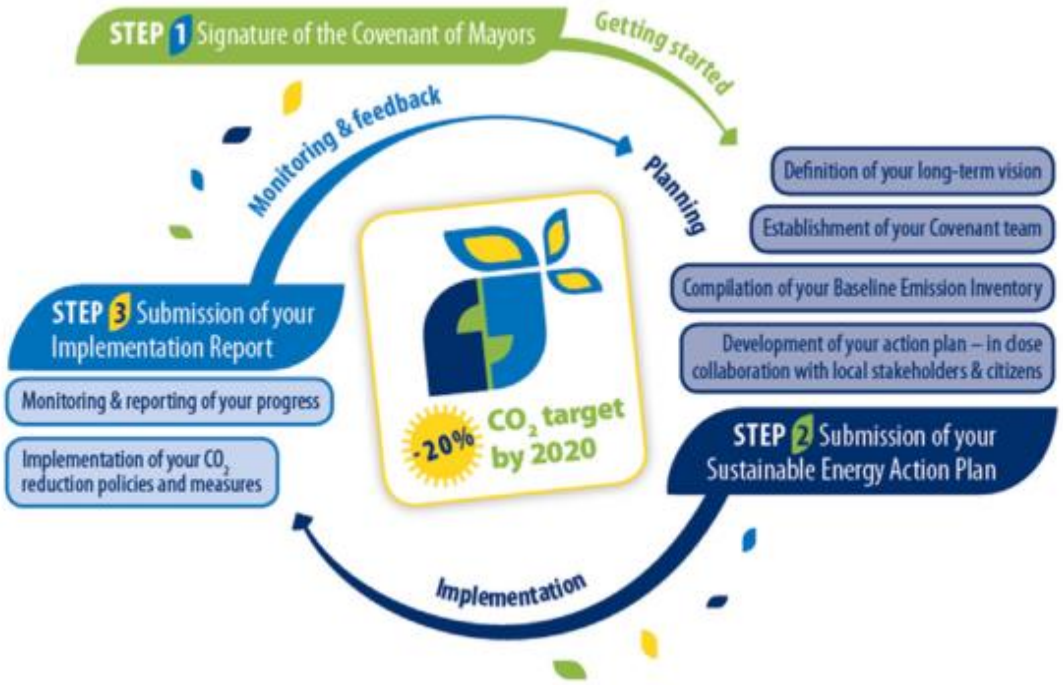

Figure 18: Covenant of Mayors enrolment process

Covenant of Mayors program asks European cities and municipalities to participate due a voluntarily commitment to reduce their greenhouse gas emissions by 20% to the year of 2020. In 2008 when the program started, 96 European cities sign the Covenant of Mayors program becoming the so-called "signatories". From these new 96 signatories in 2008, 5 were Portuguese municipalities. Today, Covenant of Mayors pact aggregate 6855 signatories, 119 are Portuguese cities and towns. All these Portuguese territories have their action plan submitted which represent a municipal sustainable energy action plan that oversee more than 5 million people. So, the number of signatories rose sharply from 2008 until now, not only in Portugal but also across Europe. This fact, do not directly means that all these signatories will fulfill their commitments to the Covenant of Mayors pact. Christoforidis et al., (2013) suggested that main barriers to signatories success, is their capacity defining strategies to make use of financial instruments to support energy sector improvement. Moreover, Covenant of Mayors pact is an initiative that demand citizens public support, promoting their active participation to take action in reduction of GHG emissions. So, for these reasons it is not reasonable to think, that all signatories will be able to find proper approaches that effectively will guarantee SEAP implementation and then a reduction on local CO2 emissions.

Covenant of Mayors program accept any city or municipality, that seek to contribute for climate-change attenuation, reducing local GHG emissions. This European program, is a long-term EU policy instrument, being executed for ten years until today. First step to initiate Covenant of Mayors process, is the City council or comparable official body, inform their will to become

committed to this program. After this initial commitment, it is given one year to new signatories produce a Sustainable Energy Action Plan (SEAP). This official document is designed to be where cities and municipal, concrete strategies are set, to reduce their local GHG emissions. SEAP must include a Baseline Emission Inventory (BEI) that illustrate data as local CO2 emissions, final energy consumption (per sector), local electricity production and reciprocal emissions. This step is made, because the BEI should work as a basis to understand progress or drawbacks, in future SEAP implementation.

Figure 19: Covenant of Mayors step by step

Beyond this, in SEAP making process is also mandatory to include short-term and long-term strategies to boost improvement into local energy sector. Also, it is requested in SEAP, that is set staff for tasks in SEAP production, implementation and evaluation. Moreover, it is highly recommended that SEAP making process, as future implementation promotes stakeholders and citizens involvement. After SEAP elaboration, this plan will be under observation and deliberation from the Covenant of Mayors Office, which is an organism of the European Commission that oversee daily activities regarding Covenant of Mayors program. After SEAP deliberation, from the Covenant of Mayors office, will be decided if the plan is accepted or not. If yes, new signatories will have to produce, 2 years after SEAP acceptance, an implementation report to see if they are on the right direction, towards Covenant of Mayors and SEAP stablished objectives.

Regarding Sintra, Covenant of Mayors program is now going for the step 3 (see figure 18 and 19), being the production of implementation report initiate. SEAP elaboration for Sintra municipality was made by an outside private company called “IrRadiare”. Despite recommendations from the CM office, it is also possible to adjudicate the SEAP elaboration for a company outside the municipality. The reason for this are many, but in many cases, this happen because municipalities do not have inside their structures enough expertise and know-

how to elaborate a document like SEAP. To gain some uniformity from SEAPs around Europe, CM office provide general templates for the elaboration of this document (Covenant of Mayors Office & Joint Research Centre of the European Commission, 2014). At that time, procedures taken to execute SEAP not follow step-by-step recommendations given from Covenant of Mayors office (see figure 18 and 19). Because SEAP submission was made before municipal structure adaptation. Also, in SEAP elaboration it was not followed the recommendation to include citizens and stakeholders in the plan making process. Actual report of implementation that soon will be produced, is an opportunity for Sintra municipality understand main barriers in SEAP execution and to adapt or set approaches that are aligned with Covenant of Mayors office recommendations reducing local GHG emissions. Sintra municipal planners are not sure that goal stablished for GHG emissions reduction will be achieved, despite municipality effort to create new departments that seek to develop work focused on energy sector improvements, these departments were just set in December last year and the number of staff is reduced. The municipality already understood that for an energy transition towards sustainable energy, demands population participation and development of a community sense.

Furthermore, CM pact is a program that stablish a governance approach, promoting the engagement of stakeholders and citizens for conceptualization and implementation of energy policies. Municipalities have a direct interaction with Covenant of Mayors Office (which is an EU office), promoting due SEAP elaboration and implementation the engagement of stakeholders and citizens in energy policies elaboration and accomplishment. This idea leads me for next chapter, which is focused in the identification of governance principles to move from traditional government towards a concrete and continuous governance approach. From a planner point of view, governance activities should also provide steering in an uncertainty context. Next chapter will try to provide insights regarding these issues.

6. Establishing an energy governance approach

The concept of governance pops-up, during this thesis research. Regarding Sintra case, in energy terms, there is an intention to promote a governance approach stablished by the CM pact. The CM pact, for itself tries to stablish this governance approach, due the engagement of multi-level stakeholders to conceptualize and implement energy policies (due SEAP elaboration, implementation and monitorization). An illustrative perception of Sintra, in an MLP perspective, regarding energy stakeholders that have direct influence in municipal energy system please see next figure.

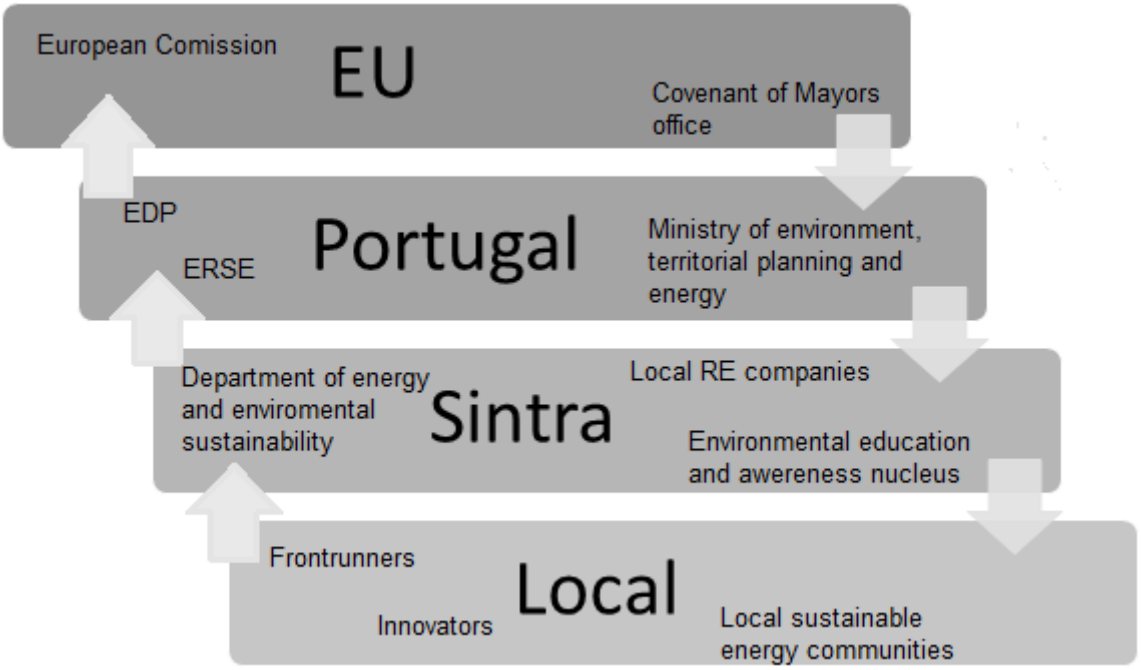

Figure 20: Multi-level governance applied for Sintra

The question that drive this section, is to identify fundamental elements to properly guide governance approaches to deal with interactions from these multi-level actors. Helping to understand and frame this concept for energy planning actions. Furthermore, central government intervention due the new paradigm of globalization, shifted. This new framework of a global market imposed a wider approach regarding policy-making process mainly due (i) central government structure and functions modification, (ii) brought to debate social and economic stakeholders and (iii) the decentralization of power.

6.1. From government to governance

Despite above mention changes in policy-making, the role of government should be kept as central, to manage in desired way, now more than ever, interests from wide variety of stakeholders evolved in governance structure. Usually they move towards their own interests. Governance emerge in actual framework, and Loorbach describe this concept as "*the current practice of government in policy-making in interaction with a diversity of societal actors*" (D. A. Loorbach, 2007). Furthermore, in Portugal governance structures grew due EU rule that for the adjudication of EU community funds only will provided for projects that stablish the engagement of multiple stakeholders. Also, in some cases in Portugal, governance structures failed in their function to promote a continuous process of negotiations that lead to establishment of networks between actors. This because, in many cases, stakeholders only kept their interest in governance structures when was the possibility to receive financial incentives from EU funds. It is then needed to develop approaches that boost the consolidation of cooperation between stakeholders. Actual central government in Portugal, has been promoting the idea of decentralization of powers, to boost power from other government structures as the municipalities. An example of this, was the revision of MURL in Sintra, that was described in the chapter 5. Probably, much more municipalities have been reviewed some municipal regulation

to boost their powers regarding the central government. Despite this, there is a clear signal of centralization in Portugal. A much bigger part of public investment made is from the central government. Also, this debate around decentralization in national territory, is trying to avoid the discussion in terms of a Portuguese regionalization. Despite being explicit in Portuguese constitution, that national territory is divided in administrative terms in four levels (national-regional-municipal-parish council), the reality is different. In this moment, only three of these levels are real implemented in the territory. The legitimacy of the national government, municipalities and parish councils in Portugal are given by the electors. The regional level has been completely "empty" in administrative terms, until recent years. In one hand, recently was created CCDR (Coordination Commission for Regional Development) with the purpose to fulfill the gap in the administrative regional level. Today power from CCDR is quite limited and the structure that compose these regional structures are nominated instead of being a result from citizens elections. Once again, the creation of CCDR structures can be linked to the adjudication of funds. The EU informed all state members, that the attribution of funds will be made at a regional/inter-municipal level. In the other hand, Sintra is part of the AML (Lisbon Metropolitan Area) which claim that empty level at the regional level. AML is a well-established organization in the territory, due the creation of plans and recommendations at an inter-municipal level of 18 municipalities. This organization also demonstrate a strong commitment to promote stakeholders engagement, due the creation of forum's in different areas as energy. Apart from this, AML and CCDR are structures nominated by central government, for this reason they usually change according to the party that has national assembly power. This is obviously, a clear lack of stability to promote governance approaches with a long-term vision because the electoral cycle in Portugal has a duration of four years. In a more practical perspective and towards governance activities implementation, Pereira (M Pereira, 2014) identifies five pillars, that are the basis for a governance approach: (i) a balanced distribution of power that before was contain in central government, (ii) an open approach for public and private stakeholders, guided by common objectives, (iii) the promotion of representative democracy, (iv) the use of methods that boost transparency in decision process, (iv) moving towards cooperation and participation instead of actual dominant vertical hierarchization. Governance is an approach to social mobilization and networks establishment, as on governmental structures, groups or social movements that act outside traditional government approaches influence (Healey, 2006). However, governance activities need to be promoted, due a reliable and reasonable strategic vision for territory guided for social activities, linked to debate and local stakeholders accountability (D. Loorbach et al., 2008a; M Pereira, 2014). Political researchers and other fields researchers driven studies mainly focused on steering and structure society development in a certain direction. Today it is clear a development of unanimity in this multi-disciplinary research field that classical forms of driving society changes are obsolete (D. A. Loorbach, 2007). Actual researchers studies, promotes ideas that governance can surpass this lack of steering in government activities, being an appropriate management mechanism, creating space for sustainable solutions. Nonetheless, governance concept by itself is recognized as integrative process but in an inconclusive development, that is stablished by the diversity of interests and values involved (Margarida Pereira, 2013). Anyhow, it is possible to identify concepts that are the ground to create a steering approach in governance establishment; (i) networks and agendas, (ii) pluriformity and (iii) learning process.

6.1.1. Networks and agendas

Concepts as networks and agendas have emerge in governance research field last years. Stakeholders create formal and informal networks due their reciprocal communication in day-to-day operations. Occasionally these interactions are motivated due mutual interests or because their goals gain benefit if stakeholders work with each other. There is so, a strong linkage in actual society between individuals and organizations, meaning that behaviors and resolutions will have an impact on other stakeholders (D. Loorbach, 2010). Networks stablished between actors usually do not have a vertical hierarchization like organizations, but they can develop and become hierarchical rigid as these organizations. European Union have been stablished a concrete form of network-governance, called multi-level governance (MLG). This concept (MLG), was vastly adopted to provide a notion for a multidisciplinary and spread policy-making process, which involve individuals, organizations and institutions stakeholders at different political levels, from the supranational to the local scale. The optimal vision from EU, in multi-level governance implementation, is for regional (municipal) issues have a continuous line of communication with regional(municipal) actors and vice-versa, legitimizing the creation of smaller-scale groups and actors (Panara & Varney, 2017; Stephenson, 2013). However, Loorbach (D. Loorbach, 2010), argue that MLG policy-making process has the risk to become less transparent, the division of power and each stakeholder responsibility could turn minus evident. This fact could be linked to the Portugal governance "case", Pereira (M Pereira, 2014; Pereira, 2013) demonstrate that Portuguese policy-making is especially centralized disabling optimize implementation of sectorial policies and an inadequate territorial articulation because (i) local governments are typified by the municipalities as a result of regional administrative level absence, (ii) municipalities (most of all those that has smaller population density) are disable to provide sufficient expertise from their staff to design strategies for territorial development, (iii) Portuguese European Union adhesion triggered a structural change in national society (e,g. social, economic and institutional) but not all represented positive impacts and in community benefits, (iv) governance structures that are in collaboration with private stakeholders are essentially focused on EU funds allocation and management, that normally ends after funds application or public sector-private (PP) partnerships, consistently grating significant benefits for the private sector. As it seems, governance is embedded on political, institutional, social and more enclosing environments, suffering the influence of them. Still, MLG reformulated governance approach, putting emphasis on the multi-level framework, redefine it, and promoting paths for participatory policy-making.

Further, other concepts that raise last years in governance research studies, was that of coalitions and agendas, in terms of policies developments (Capella et al, 2015; Sabatier & Weible, 1999). Policy change can be a result of, communication and compromise between different actors coalitions. These "coalitions" are the result of actors organized basing their cooperation on common objectives and beliefs (Capella et al., 2015; D. Loorbach et al., 2008b). The optimal idea from this coalitions work, is that of, each actor (that make part of a certain coalition) should perform a specific task, providing know-how as net-worker, expertise or consultancy (D. Loorbach, 2010). Usually, coalitions intervention is restricted to a specific policy context, approaches and objectives normally shift along time. Kingdon argues (Kingdon, 1955), that for policy developments based on social learning process, through stakeholders negotiations and agendas agreements it is necessary the confluence of three streams: problems, policies and politics.

6.1.2. Pluriformity

Previous concepts of networks and agendas remember both to notions of heterogeneity and pluriformity regarding networks participants objectives, commitments and interests. In this sense, it is necessary to execute approaches that consider the pluriformity from different stakeholders involved, producing coordinate activities that lead to cooperation (D. Loorbach et al., 2008b). This suggest that the, wide variety of stakeholders perspectives should be spelled out, not searching for a future complete consensus (regarding values, norms and beliefs), but instead an commitment to cooperate in a concrete, common problem where in that specific case, consensus is need to pursue that problem (D. A. Loorbach, 2007). Some authors argue that for problem resolution due stakeholders network consensus (regarding that concrete) problem boost territories governability (Margarida Pereira, 2013; Teixeira & Pereira, 2012). So, government promoting, stakeholders involvement and ("problem-sharing") consensus, should play a role, as a "common good" gatekeeper, understanding and consider wide variety of stakeholders interests, norms and values (Campos, 2008).

6.1.3. Social Learning

Finally, the last concept that identified in the governance framework is the establishment of a constant social learning process (D. Loorbach, 2010; D. A. Loorbach, 2007; Teixeira & Pereira, 2012). Specifically Loorbach (D. A. Loorbach, 2007), argues based on social studies that *"(…) social learning is about individuals, groups or organization that question and reflect on the values, assumptions and policies that drive their action and through this change them."* This learning process is much more social rather than analytical or intellectual. Stakeholders interaction, that lead to share their perspectives and expertise, has a positive impact to stimulate a social learning process, which is indispensable to understand each other ideas, motivation and vision to initiate cooperation and developing a common agenda(D. A. Loorbach, 2007).Establishing governance (in fact), it is need to achieve this learning process from stakeholders, due their aggregation, organization and shared expertise aligned with clear communication platforms. This collaborative process gains power over time, being implicit an increase in terms of reliability between stakeholders and their commitment for a cooperative process (Margarida Pereira, 2013).

Previously, it was showed the theoretical approach behind transition management. Then were identified some principles to go from government to governance. The reason for this, is because transition management also intends to assist in the establishment of new governance practices (D. Loorbach, 2010). The translation of transition management approach to a model operationalized, is achieved due the creation of a linkage between the theoretical approach to actual policies, stakeholders behaviors and governance.

6.2. Transition management approach in a governance context

This section intends then to provide this chain between theory to a transition management activity with a concrete translation to the territory. This transition management framework

purposed intends to provide a basis for practices of transition management implementation. The purpose is also to assist in decisions as which step should be taken next or which type of stakeholders must be engaged in different phases of transition management process. The transition management framework differentiate three different forms of activities that concerns to problem level abstraction, the long-term scale involved and the applicable system level (D. Loorbach, 2010). Also, these levels can be distinguished as the strategic, tactical and operational level, still there is no hierarchical relationship between those levels and each level is reciprocal influenced for each other. The differentiation between levels of transition management can be stablished due inherent difference of stakeholders engaged and activities executed. The general idea behind this is that there is a co-evolution between a societal system and an actor-governance system (D. A. Loorbach, 2007). In both these systems the dynamics is translated at three levels, the only difference is the term used (networks-actors-individuals; macro-meso-micro; landscape-regime-niche; system-sub-systems-elements). The linkage between these concepts is that they concern to the perception that societal change is a result of a co-evolution of different forms of development (D. A. Loorbach, 2007). Actors engaged at these different levels, act according their specific interests and skills, that influence their environment in many means. Transition management purpose is then to achieve a governance system supporting, in this case, energy transition due continuously influence, instruct and set activities at different levels.

6.2.1. Strategic transition management

The strategic level in transition management approach is typified by actions that deal to a vision formulation, concerted objectives, long-term target definition and anticipation in a long-term (D. Loorbach, 2010). This planning approach that are dealing to long-term changes, are not aligned and then institutionalized in actual policy making. As an example, actual energy planning approach in Sintra, is focused on short and mid-term actions without any long-term vision, mainly because of political cycles, individual interests and others. This is a main barrier to establish governance approaches (as transition management) for sustainable development: in one hand it needs to avoid regular policy institutions and dynamics to establish on the agenda long-term goals connected to sustainability, but in the other hand is dependent from those regular policy institutions (as Sintra municipality) to translate those ambitions in concrete policies. Transition management aim is to integrate (in a certain logic also to institutionalize) governance activities in a long-term perspective into actual policy-making process. As Loorbach (D. A. Loorbach, 2007) argued *"(transition management) not as a regular and formalized activity, but as a fundamentally necessary element of policy making for sustainable development"*.

Researchers insights, from the historical analysis focused on transitions (F. W. Geels & Schot, 2007; Jan Rotmans, René Kemp, 2001; D. Loorbach & Rotmans, 2010), it was understood that actors, with certain competences and expertise in specific periods of the transition, can have a crucial influence on the establishment of the development path, speed and direction of a transition. Also, it was understood that long-term actions are supported by informal networks, coincidence and individual skills than on scientific discourse, government-based planning and regular policies. Long-term objectives are in the sphere of powerful actors from sectors as science, policy planning and business. Moreover, it was also understood that small groups formed by frontrunners from inside and outside the dominant regime, stimulate a debate culture at the abstract level of a societal system and that lead to put this point of view into

political and societal agenda. Social experiences like these, enable a concrete space for the creation of ideas for the future development and measures to slowly bring those long-term goals into more institutionalize and formalized structures. Once again, historical cases studies (D. Loorbach & Rotmans, 2010) advocate for an idea that the strategic level is pressured by innovative individuals rather than institutions and that these individuals have certain types of knowledge and skills that distinguish them from other individuals and institutions that operate in territory. Despite this, individuals most of occasions work inside of these institutions. Also, a process that lead to the creation and diffusion of different visions and approaches occur in spread out societal networks where individuals communicate. Roles that are crucial to fulfill in strategic phase involve roles as communicator, networker, expert etc. Another recommendations drawn by these observations is to include participants in strategic transition management, should be made specifically based on skills know-how and other capabilities, that they could bring for the debate.

6.2.2. Tactical transition management

The tactical transition management phase it is typified by processes that are concerning the dominant regime of the societal system. Processes identified in this phase are some as, ensure financial support, negotiations, planning approaches, computer modeling etc and institutions as networks, infrastructures, regulations, organizations and rules, that frequently have an intrinsic interest in the preservation of actual regime (D. Loorbach, 2010). In this phase actors operate in terms of the societal system or in sub-systems from the societal system. Using the example of the societal energy system, these sub-systems can be differentiated in terms of distinct energy sources, or even other areas as policy, technology and energy savings. Operations driven by actors in this level are usually only concerned for their specific objectives. In government institutions, as a municipality, institutional disintegration in terms of diverse departments, directorates and nucleus is a major barrier for the integration of long-term policies. Meaning of activities in the tactical transition management are implicitly and explicitly forms of steering (Kern & Smith, 2007). Moreover, in this level first intention is focused on the establishment of formal and informal steering processes and actors boosting change inside institutions structures. Focus is to translate alternative strategic visions, created in the previous level, to this tactical level into institutions own agendas. This basically means, that institutions develop practices and processes to facilitate these strategic visions by means as the removal of existing barriers in regulations, routines or subsidies. In addition to this, can also be set the establishment of a new knowledge, infrastructure or program. This level intends for instance, to work as bridge between long-term strategic visions and short-term process in the regime level. Transition management framework provide tools, as the *transition agenda* which transition paths are established and linked to provide a foundation for specific actions from actors participating.

Loorbach (D. Loorbach & Rotmans, 2010) argue that, in this level change come from actors with concrete skills and a certain institutional relationship. Usually actors with such characteristic are researchers, entrepreneurs, strategic policy planners or business managers. Moreover, these actors are possible to identify “inside” regime institutions, as heads of departments, representatives of relevant NGOs or from business sector. The idea behind these actors identification to later on integrate them in a tactical transition management, is that these actors are able to create space and conquer support from organizations to pursuit transition management agenda and bring it inside their own organizations, institution or other.

6.2.3. Operational transition management

In the operational transition management are all activities in a short-term perspective included. Actors engaged in this level intends to experiment innovative solutions, as technologies, legislation, organizations and others). Some of these experiments will have success and emerge to the regime level, helping to change it, but others will fail due strike backs from the regime. Policies that help for the establishment of experiments in operational transition management level, should be related to the creation of an environment that encourage diversity, initiative, creativity and ultimately innovations (D. Loorbach, 2010).

6.3. Relevant observations

Resuming all these insights from researchers studies, it seems crucial to governance in an context of a long-term transition that (i) all stakeholders steering, and so it is essential to understand opportunities and limitations in this process. Networks developments incite for stakeholders interactions, that can as result shape society and are conceptually specify as "governance". (ii) Top-down planning only interest for some phases of transition, network establishment and reflexive practices interest for others. Steering in a context of transition implies for a reflexive procedure for search, learn and implement experiments (iv) Agendas of advocacy coalitions encourage policy change. Adjacent to individuals and landscape shocks, groups of lobby and coalitions shape changes in policies. Uncertainties, discontinuous processes and innovation are necessary characteristics for societal change. It is then a requirement in a governance approach conceptualization, to handle with these societal mechanisms in a form, that on the long-term society progress in desired path. Top-down management approaches and steering steel have a role in current planning approaches, but a society towards a complex network (governance) demand further strategies and procedures. This change from a policy-making restrained at a centralized level to a paradigm of governance, by that I mean towards a participatory policy-making is guided due increasing complexity of societal system, and it can be possibly appointed as a transition per se. These transition management levels identified in previous session are not rigid, in fact the intention is that occur an interaction and co-evolving processes of governance between those levels. Also, transition management define tools that help in transition management activities implementation along these levels. To coordinate these activities, it can be established a *transition arena* that basically is an instrument to bring certain stakeholders to a discussion table, structure the problem and establish a common vision. Moreover, the idea behind transition arena implementation, is in a tactical level, to define a transition agenda that have measures proposed to achieve common vision settled in strategic level. But, for Sintra municipality energy system actual problem, what this means? As was demonstrated in chapter 4, actual situation of the municipal energy system lead to the conclusion that still is in the pre-development phase. The argue for this, is because the municipality does not produce energy to supply their inhabitants. It was not possible to identify a promotion due the local government or a business dynamic that indicates that the municipality is towards a green-economy. Moreover, the actual technology that support the system has now suffering some changes, almost all regarding the public illumination system, where Sintra has been doing a constant job replacing old technology for LED's. Also, energy planning approaches seem to be very fragmented without a holistic view regarding the energy system. Transition

management approach tries to fit in current energy planning practices as an auxiliary tool to guide a process like this. This section intention from the beginning was in first place to understand what the basis is, to build a steering approach in governance establishment. This because it is now almost demanding for a planner understand to deal with different societal actors. As it seems, the process of planning has the obligation to promote the engagement of stakeholders to achieve certain objectives. For this reason, it is need to think how to deal with this uncertainty and complex inputs from societal actors. The introduction of transition management after the identification of this governance *elements*, is because this theory intends to provide a framework for governance activities. The reason for this, in Sintra municipality specific case and aligned with actual multi-level (European, National and municipal) energy plans and policies, was concluded the need for stakeholder and citizens involvement towards municipal energy policies elaboration and implementation. The focus was then to stablish an experience of establish a strategic transition arena in some group that could have an impact for the municipal energy system. It was accepted by a group of schools called D.Carlos I, to set an meeting to define a long-term vision regarding their energy futures and to identify actual problems towards that vision. Also, this meeting intended to inform stakeholders engaged for this experience, what are municipal objectives regarding climate-energy (as the CM pact) and to put in practice some of measures drawn in SEAP that could be executed for these schools. As suggested by transition management, actual policy-making is focused on the short and mid-term actions. This fact has is verified in Sintra, and initially had a negative effect for the establishment of this strategic arena at the school. When the meeting in the school started to gain form, problems also gain shape. For instance, it was started to be considered that this experience for establish a meeting in a school framed with the energy sector, could be seen as a criticism for other departments work that also has some power in the schools, as the municipal buildings maintenance department. The problem here, was that I could not move forward without the support from the municipality for this meeting, seen that in one hand the establishment of this long-term vision in the school need to circumvent regular policy-making institutions but in the other need these policy institutions to translate these aspirations in specific and operational policies. In the end was found a solution that fits for everyone, which was to introduce this meeting more as a scientific experience framed with my master thesis then an energy planning approach promoted by the municipality itself. The first initial and main goal was then achieved. Establish in current policy-making process some activity, guided by governance principles that put the focus on the long-term. Then the focus was to move towards the establishment of this meeting. Achieving this purpose demanded, the identification and engagement for this arena of actors with certain skills and competences that are somehow related to D.Carlos I schools. The identification of stakeholders for this experience was small and initially the objective was to identify a maximum of 10 participants to set the first experimental energy strategic transition arena for these schools. The selection from participants, considered guidance from transition management theory insights. Taking this into account, was pretended to identify stakeholders that somehow are related with these schools and simultaneously have certain characteristics and skills. A detail explanation regarding stakeholders identification and characterization will be made in section 6.2. Despite this, there were some fundamental principles for the identification of stakeholders, according with transition managements acknowledgements. Initially, the focus was to engage powerful actors from school and from the municipality. Specific actors identified from the school, need to have enough power to translate possible results from this strategic arena for a possible implementation in school agenda. This was achieved by the acceptance of the school director, a teacher that is responsible for school programs that promote the establishment of educative approaches towards environmental sustainability, a teacher that is

responsible for the electricity and heating maintenance and the parent which is the president of parent's association. The municipality was represented by the head of the environmental awareness and education. Also, I performed a role of moderator and tried to put relevant information for the debate table, framed with my experience in sustainable energy planning and management masters.

The main objective was achieved, the creation of this concrete space to promote a work focused on brainstorming, reflection and debate towards energy sustainability. As transition theory identified it is need these "rooms for innovation" to destabilize the dominant energy regime. This activity can be seen as the initial step to stablish a concrete niche in these groups of schools to promote the integration of innovation solutions that are not aligned with current energy regime. This energy approach in a school has also the element of replication. This means that for instance, if this experience achieves positive results, the municipality can promote this type of practices for all schools inside the municipality. Furthermore, it was understood that small groups formed by relevant actors from inside and outside regime institutions, can in fact have influence in political and societal agendas. Also, are these small groups that can slowly bring a long-term vision perspective and then translate that perspective inside their institutions. Other aspect that was the intention due this meeting organization, was to promote the diffusion of ideas regarding municipal energy system, sustainable energy and the school role regarding this issue. This process is important to understand how actors can help each other, in this case, was more to understand how the relation between municipality and school could be improved, in a way, that the municipality support guidance and help to school initiatives in this field. These processes have always an intrinsic aspect of networking. Once again, due the sharing of e-mails and other contact information's it is possible to boost communication between these schools and the municipality. In chapter 7 would be described in detail this meeting set in D.Carlos I schools. As a note, insights provided by transition management for this thesis, are from the strategic transition management and activities developed in this level. In the strategic transition management, activities promoted are related with the structuration of the problem and creating a common vision in a long-term.

Next chapter will described the experience that was produced in D.Carlos I, with many objectives, but most of all to establish an experience towards participatory policy-making focusing in long-term objectives.

7. Towards participatory policy-making (case study)

It was until now understood that Sintra municipality, due their SEAP, demand for creation, adaptation, implementation and monitorization of their energy policies in an environment of stakeholders engagement. This is framed on Sintra energy policies, but also in actual global paradigm of policy-making. A clear example is the demanded construction of governance structures to the EU provision of financial funds. The initial purpose was then to understand what means this environment of governance for an energy planner establish actions to steer development. After, it was presented transition management approach to provide a framework of actions that could be established by an energy planner.

Now is finally presented the experience established to build the first strategic energy transition management arena in Sintra, in a school environment. As last statement said, this was an

academic experience to identify barriers in the establishment of an action like this, achieve a concrete knowledge regarding actors behaviors in structures of debate and reflection and finally to see if this action can be translated in energy policies to promote energy sustainability.

7.1. Meeting purpose and goals

The school was selected for this experience, because it was me the responsible managing to find some group that could have an impact in local energy system. Due personal contacts with teachers from D.Carlos I schools, booked an meeting with the school director to understand what the interest to promote a meeting in the school for the establishment of a long-term vision regarding energy sustainability. Also, the one of purposes with this meeting is to put in practice SEAP measures that until now seem to be forgotten by the municipality. This means that it was also important to achieve from the municipality the motivation and understanding to be engaged in a meeting like this. The professional relationship between me, the head of environmental awareness and education and the head of division of energy and environmental sustainability started in March. From this period was agreed that the result of this collaboration will drawn an experimental action towards stakeholders engagement in a policy-making environment.

The meeting gain form after an invite (see appendix) sent for stakeholders were activities that would be executed were established:

- The establishment of a long-term vision regarding D. Carlos I energy objectives
- The identification of most relevant problems for the long-term vision implementation
- Identification of solutions to overcome problems identified, taking into account each stakeholder role in the school

In fact, the main intention was regarding two initial tasks, seen that discussion like this, are time consuming. In a more abstract way thinking, there was also other objectives, that by me, as researcher intended understand. As was already described in theoretical, niches are fundamental to boost a transition. In this sense, a small group like this, can for instance, be considered a niche. The idea, is that ideas from this niche, emerge due the consolidation of this niche and possible split-fall effect. The concrete identification of this small group of people as a niche, will depend skills and capacities fulfilled by stakeholders engaged and the future institutionalization of conclusions drawn by this meeting from key actors in their institutions (as the school director). In next section will be shown which stakeholders make part of this experience and their roles.

7.2. Stakeholders identification and roles

The identification of stakeholders for this meeting was made by me and D. Carlos I school director. It was explained due meeting with the school director which roles were intended to be achieved, as actors with skills to clearly communicate, that have some expertise in fields as energy, sustainability and energy systems and was mandatory that they need have a concrete position in school structure (as teacher, parents representative etc). After actors proposed by

the school director it was made a power/interest matrix to prioritize stakeholders selection (see figure 21). This matrix was afterwards discussed with the head of environmental education and awareness to understand if something was missing in the identification of stakeholders.

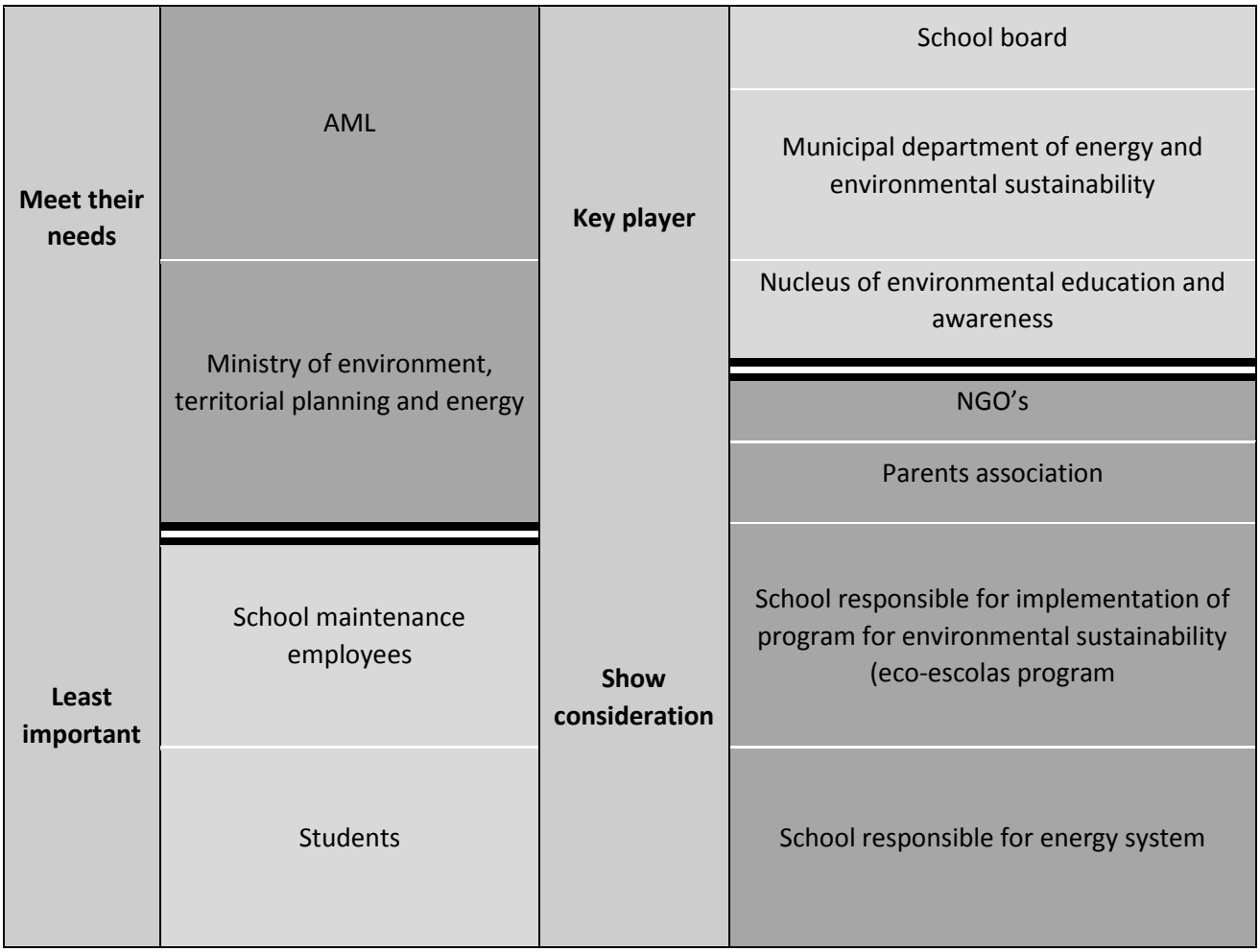

Figure 21: Power/interest matrix for D.Carlos I schools

After drawing the power/interest matrix regarding the meeting in the school, were then invited all stakeholders that were assumed their interest for this meeting. This means, that each actor from key player and show consideration groups received an invite via e-mail (see appendix XXX). In one hand, the power and interest attributed for each group of stakeholders taked into account their concrete power in regulations terms regarding D. Carlos I. Despite the power that regional and national authorities could bring to this discussion, in fact the municipality is the main responsible for D. Carlos I in terms of energy system maintenance, due decentralization of power made from the central government in recent years. In this sense, was made the attribution of stakeholders in the meet their need group. In the other hand, the least important group was settled due their actors characteristics, that lead to the conclusion, for this strategic phase their contribution would be not needed. In next session will be presented meeting work session and drawn results.

7.3. Work session and results

The meeting occurs at 5th of June in D. Carlos I school and six actors (including me) composed this experimental strategic transition management in Sintra. This time of meeting executing problem formulation and the establishment of a long-term vision normally are time consuming. This strategic *arena* was established outside from institutions agendas. This means that actors engaged volunteered went to the meeting after their day-to-day jobs. Figures from this meeting will be in Portuguese (due the use of menti.com as tool to guide debate), but the reader will always find an clear English translation in the text or figure. Also, it is important to refer that the questions are made before the discussion regarding the topic and not after. This meeting promoted the "Danish" culture, so it was provided for participants cookies, tea and fruit to eat and drink during the work session. This could seem irrelevant, but my perception is that happy people are much more productive. The meeting had from the beginning this intention to be formal/informal, it is needed to produce something concrete but in a positive and funny environment.

The first intention was to focus the discussion to achieve actors thoughts and ideas in terms of the energy sector. The first topic discussed was the actual situation of Sintra energy system drawn by the ampler Portuguese energy system. It was asked for each participant describe in one, two words their perception regarding national energy system to be created and discussed at some time a map of words (see figure 22). The final map of words created can be seen in next figure and was composed by these words (left to right and upside down): Governance; Centralization; Low efficiency; Renewables; Not-sustainable; Low efficiency; Ecologic; Positive and Ecologic.

Figure 22: map of words created by participants regarding thoughts of actual energy system

These were each actor contribution regarding their thoughts for actual situation of the energy system. This discussion was also supported by graphs (most of all from this thesis) provided for each stakeholder during questions round. It was evident an opposition perspective regarding actual situation of energy system. The initial idea was then to debate what is renewable and sustainable. It was concluded that despite the number of renewable growth in Portugal, that was mainly due large hydro-power. Participants discussed social and environmental impacts from this type of technology. Also, all actors start to think in terms of energy prices. It was

remembered last year, and how our energy system is dependent from these centralized hydro-electrics and how they influence electricity price in Portugal. Last year was a dry year, and as described in some part of this thesis, electricity prices increase (and Portugal were already in that time one of the European countries with higher energy prices). This year had much more rainfall, and the electricity production from renewables increase a lot that had an impact in Portuguese energy mix. Despite of this, energy prices continue to rise this year. This conversation revealed very helpful for the understanding of topics as:

- Renewable energy is not sustainable energy
- An energy system could be 100% renewable and still be centralized
- Citizens bad habits contribute for low energy efficiency
- Governance activities to decentralize

Still, the next discussion was regarding the concept of a sustainable energy system. So, it was tried to understand once again due a map of words participants thoughts to consider an energy system sustainable. The words that driven this topic were: Cycle; Non – pollutant; Green jobs; Auto-sufficient; Respect the environment; Auto-sustainable; Active civil society; Public participation; Responsibility.

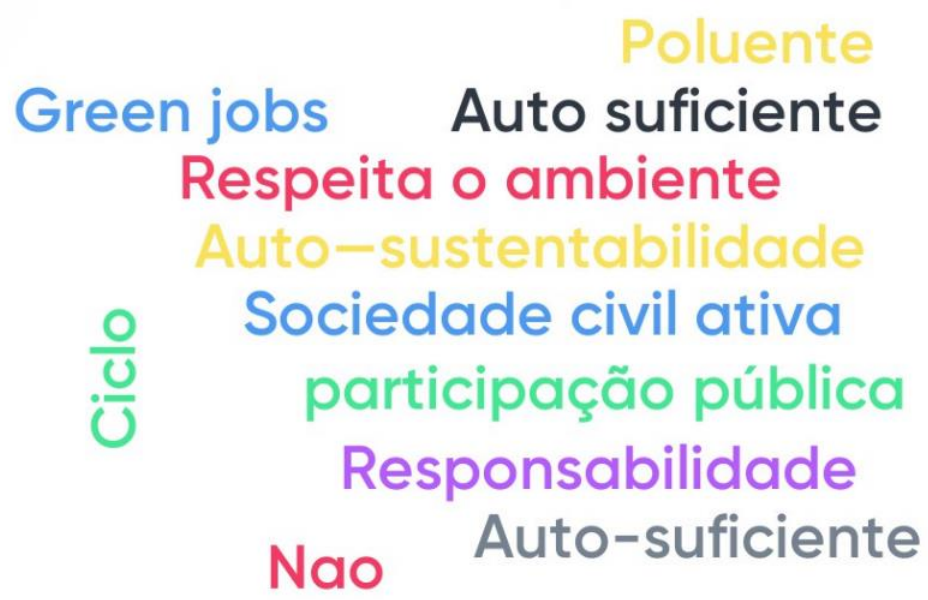

Figure 23: Map of words created by participants regarding thoughts of sustainable energy

These words provided the initial boost to established what it is considered by this strategic transition arena as a sustainable system. During this topic debate it was tried to establish fundamental principles for a sustainable energy system. It was agreed that a sustainable energy system should have three landmarks:

- Social: public participance and governance structures to promote decentralization of the system (due micro and mini energy production units) and to increase social awareness and engagement regarding climate-energy policies
- Technological: Ensure implementation of technology for the system, that fulfill energy demand using renewable energy sources.
- Environmental: Technology used, and efficiency of the system should lead to the minimization as possible of negative environmental impacts from energy production, transportation, consumption and recycling.

After this comprehension achieved by participants, the conversation started focused on the school. Considering principles distinguished in last topic, could we consider D. Carlos I schools sustainable? It was provided once again graphics regarding energy consumption in one of schools to be used as model. Also, it was provided by the school responsible for energy system actual situation in terms of technology used. This was extremely important to establish a communication platform between the school and the municipality. It seems that D.Carlos I has more than 50% of their interior illumination already replaced for LED. Still, the school does not have any energy production units. Furthermore, heating equipment are very old and non-efficient leading to cold temperatures insides class rooms, despite the significant increase of electricity consumption during winter in the school. In other hand, the contribution from the responsible for *ECO-escolas* program implementation regarding measures in energy field. Until now *ECO-escolas* program in D. Carlos I had a bigger focus regarding waste management issues. For this reason, activities in the energy field were very limited, but the focus was mainly to increase awareness of school education assistant workers energy habits. It was then asked considered that at this moment D. Carlos I schools are not energy sustainable because:

- The self-production of energy in D.Carlos I schools, using renewable energy production units is zero.
- The school until now, do not promote constant or spontaneous measures that lead to engagement of actors inside/outside the school to promote sustainable energy inside/outside the school.

The initiation of the next topic was made due asking for participants in a maximum of 100 letters to identify which role should be played by D.Carlos I schools to promote an energy sustainable system inside the school and to contribute also for the ample (municipal-national) energy system. The next figure show inputs from each participant.

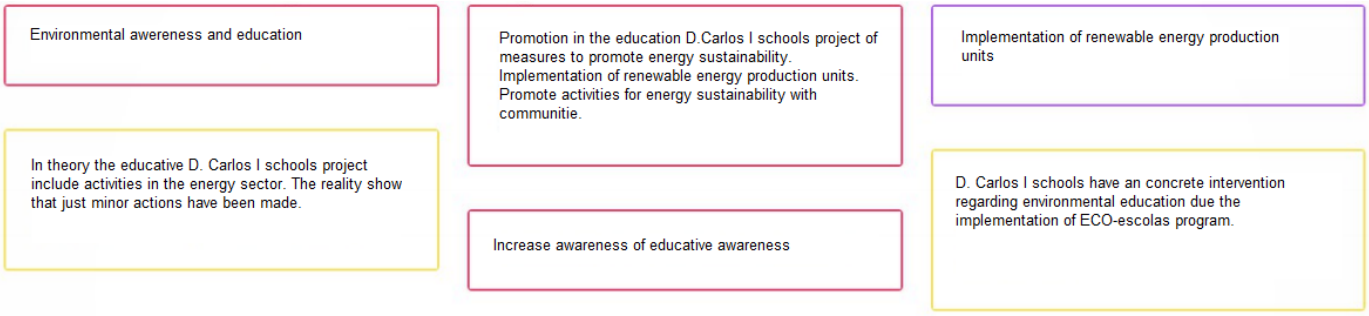

Figure 24: Translation of school roles given participants

These general ideas provided by actors, included three landmarks established for what it was considered by the strategic arena a sustainable energy system. The debate started to gain a more concrete shape, and it was discussed how the school could implement energy objectives. It was understood that as an example, the use of graphs from energy consumption could be a powerful tool to inform the school operational structure and teachers for what are in concrete school's energy reduction goals. The idea after this discussion was then to somehow compare measures/ideas/actions towards sustainable energy to start think in a more operation way and towards the long-vision term definition.

It was pre-made by me, four general actions that could represent four different perspectives regarding the implementation of strategies towards energy sustainability. The actions identified are identified in next figure. The achievement of a visualization from possible results regarding

these questions were obtained due a cost/benefit matrix as show figure 25. This matrix was made due the input from participants for the cost and benefit (in their perception) regarding a possible future implementation in the school from each one of these suggested own pre-made actions. Costs are not in financial terms, but also regarding time-consumption and human - resources. Benefits intended do be set according actors perception of what is sustainable energy concept and the school role.

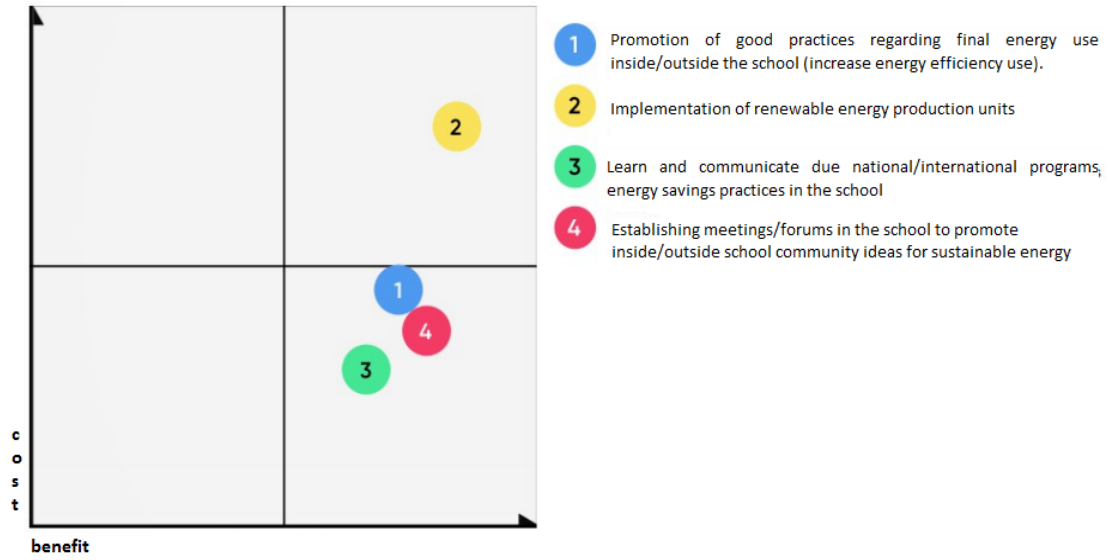

Figure 25: Cost/benefit matrix from four general measures

The conclusion from this matrix was that despite a slightly superior benefit from the action nrº 2 regarding energy sustainability goals, it is at some time by far the action that lead for higher costs. It was then concluded that remain actions (nrº1;3;4) are those that represent a better cost/benefit relation. This topic was to introduce participants to boost their way of thinking towards solutions. The reason for this, is because from the table presented in chapter 5 regarding SEAP measures for sustainable energy, it was selected eight of them that could be implemented in D. Carlos I schools. The idea was the same as the previous topic, namely regarding the intention to produce again a cost/benefit matrix. Main goal here is to understand how SEAP measures can be related to the implementation in the territory and to achieve some feedback from actors.

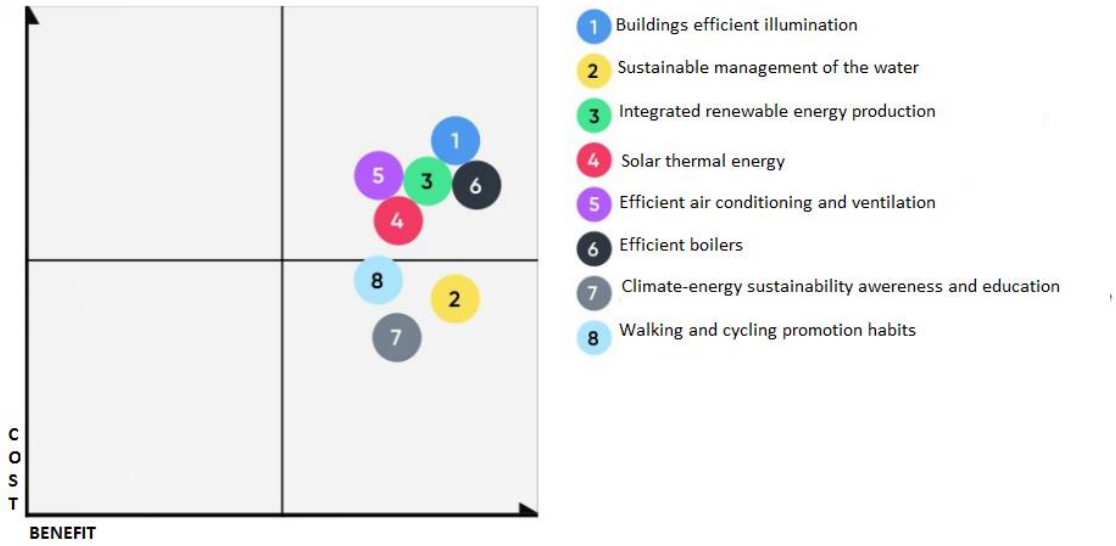

Figure 26: Cost/benefit matrix of SEAP proposals

The first general discussion was about proposals itself and due their vague characteristics it was hard do provided a concrete information for actors. Despite of this it was mainly discussed measures nrº 2; 7; 8 because they have a similar benefit as the others but with reduced costs. During the debate it was understood that measure nrº 8 in fact has much more costs associated. It was understood that infrastructures that are needing to build in the school and in the municipality to fulfill this goal are much higher than initially assumed. The strategy for the school should be then to promote a sustainable management of water and the promotion of climate-energy sustainability education and awareness actions. The solar thermal energy (nrº4) it was also seen as very good solution just for sports facilities that are inside school. The next topic discussed were which problems can have a negative effect on sustainable energy actions promoted by the school. There was identified four problems:

- Disinterest (regarding climate-energy issues) in the school community (students, teachers, operating assistants and technical assistants).
- Lack of involvement of the school with local institutions (as Sintra municipality, NGO, Energy associations etc.).
- Lack of financial funds attribution to promote projects/activities/actions.
- Centralization of the energy planning approach leading to decisions (influencing the school), without consultation with school structures.

Despite an effort to prioritize these problems it was impossible as show figure 27. Initially the perception was that this result can be inconclusive.

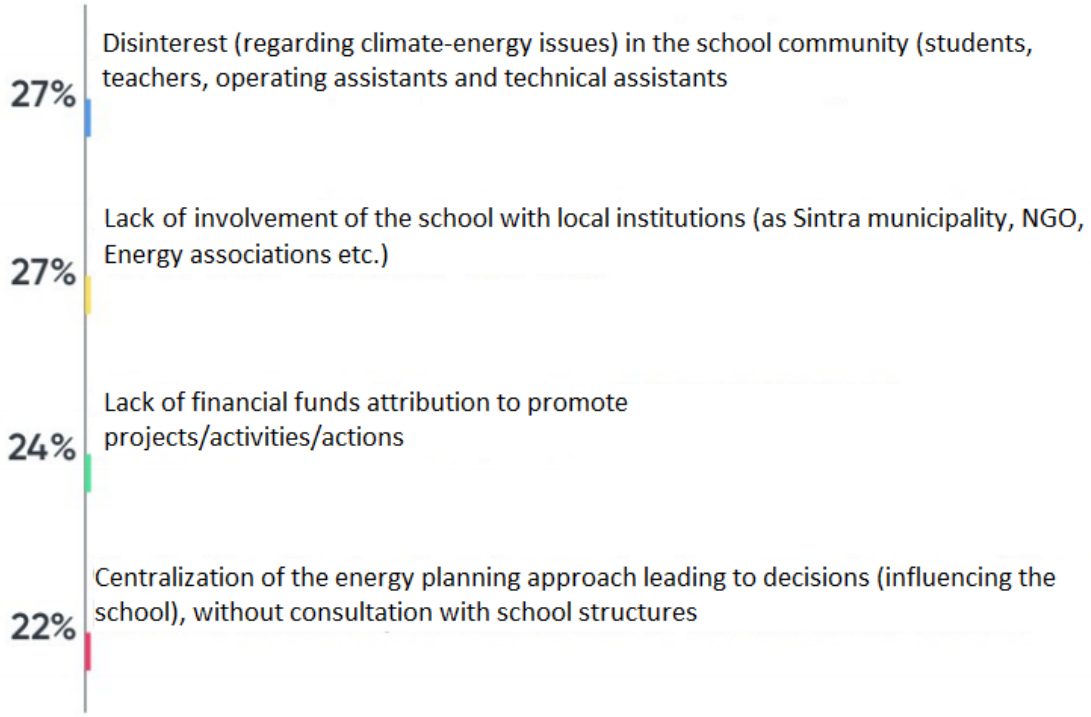

Figure 27: Prioritization of problems for energy sustainability

After the discussion regarding the problem formulation and structuration it was understood that in fact this represent that at this moment D.Carlos I schools have all these problems and they are equally important to establish short and mid-term actions towards an possible long-term vision of sustainable energy. Anyway, it was divided in two these problems. The disinterest in the school community and the lack of involvement of the school with local institutions are the short-term priority. Furthermore, would like to highlight that was understood that main difficult towards energy sustainability in Sintra are not the lack of financial funds. Despite limited financial restrictions that the school and the municipality have it was drawn that a lot of actions can be produced using reduced (or affordable) costs for the school and municipality. The debate entered then in the vision development establishment phase. It was understood until now from this strategic transition arena that intervention made in the school regarding energy sustainability could be divided in two different aspects:

- Social: constant and interrelated action that lead to engagement of actors inside/outside the school to promote sustainable energy inside/outside the school. This can be made the establishment of meetings/forums and including energy sustainability goals in school annual activities plan to inform and aware school community (students, teachers, operating assistants and technical assistants).
- Technological: Implementation of renewable energy production units in the school that match with the energy demand. The use of these energy production units should be executed after feasibility studies and the understanding of concrete contribution in terms of GHG emissions.

After this step it was intended to set a long-term vision regarding energy sustainability goals for the future. In order to simplify this process, it was built six different scenarios that intended to represent aspects drawn previously. Scenarios built for D. Carlos I schools are identified in figure 28.

Scenario	Technological goal	Social goal
1	0% - renewable energy production units implemented	None or fragmented - actions to promote sustainable energy in Sintra community
2	50% - renewable energy production units implemented	None or fragmented - actions to promote sustainable energy in Sintra community
3	100% - renewable energy production units implemented	None or fragmented - actions to promote sustainable energy in Sintra community
4	100% - renewable energy production units implemented	Constant and interrelated - actions to promote sustainable energy in Sintra community
5	50% - renewable energy production units implemented	Constant and interrelated- actions to promote sustainable energy in Sintra community
6	0% - renewable energy production units implemented	Constant and interrelated - actions to promote sustainable energy in Sintra community

Figure 28: Table with scenarios for a long-term vision establishment

It was then asked for each one of actors to vote in one of these scenarios. It was by distance decided (5 votes) that scenario five should be framed has a long-term vision (25 years) for D. Carlos I schools. Despite initial pre-concept that major contribution for a sustainable energy system are the implementation of renewable energy technologies, it was understood during this meeting that contribution, as social, can have also a positive impact for the sustainability of the system and with smaller financial costs. This means that actors in fact, reflected regarding the need to change and the concrete contribution that they could have towards sustainable goals.

The ending of this 2 hours meeting was done by a final feedback from actors involved this experience. Actor's key words regarding this experimental strategic arena were: Sharing; Useful; Important; Stakeholders engagement; Enriching. From my research view it was in fact a success. The behaviors of participants during the debate sessions was vey natural and fluid. It was intended that everyone had some time to participate and in fact that is hard to obtain. Still the mentimeter, was a very important help for this meeting, allowing a real-time visualization and achievement of results that provided very interesting starting points for conversation, reflection and problem formulation. Despite this strategic arena occurred outside the regime influence and institutionalization (because it was made in a framework of personal academic research) the intention it always was to translate conclusions (as problem definition and long-term vision establishment) for these institutions (D. Carlos I schools and Sintra municipality) agendas. As it seems this ultimately goal was achieved due informal intention provided by school director, school responsible from ECO-escolas program and head of environmental awareness and education nucleus to translate this meeting framework and conclusions into their organizations. In one hand, will be produced a small report (5 pages) with conclusions drawn from this meeting to introduce some actions proposed and the long-term vision established here to the school annual activities plan. In the other, the municipality intends to repeat this some framework used for the school meeting in more schools or other groups. Moreover, it was established an informal contact between the municipality and the school that was reinforced. Different responsible that share activities in some field, had the chance to change ideas and understood each other perceptions. The municipality intend now to work closely with D.Carlos I schools helping in the implementation of actions towards sustainable energy. Although, this process to be completed need the establishment of more meetings to move towards tactical and operational levels and activities. This experience revealed to be useful from municipality and school point of view and transition management insights were verified and had in fact relation to Sintra case, as was my intention to represent.

8. Conclusion

This thesis intention was to stablish an experience towards energy governance in Sintra municipality that lead to a participatory policy-making to engage citizens and stakeholders for creation, implementation and monitorization of energy policies. This type of processes is connected to changes in the societal system at a long-term perspective. The idea was to slowly bring a culture of reflection, community engagement and debate to Sintra municipal energy planning processes and for sub-group in the energy sector (in this case schools). It was showed that energy governance like this could have a concrete impact on current policies and institutions. The conceptualization of governance here presented try to establish the development of activities (as long-term vision establishment or problem formulation) by actors engaged in transition arena, matching with actual complex network-society paradigm, which was a fundamental understanding to the implementation of tools (as transition arena) to deal and reflect regarding each actor role in the transition. The experimental strategic transition arena formed in D. Carlos I schools represented a concrete step towards network establishment and sharing agendas that intend to have an effect in actual policies. This experience also was successful creating a concrete space outside the regime to the development of innovative ideas that now due (possible future implementation) of tactical and operational arenas need to grow, mature and emerge. Again, in a perspective of a first step towards energy governance in Sintra this experience was a success. Despite the lack of this culture of reflection, debate and social learning in Portuguese (and Sintra) energy policy making it was surprising that actors engaged seem to be aware of actual energy system and need to change. The main problem was the lack of understanding regarding their specific contribution to promote energy sustainability. Also, in this sense the strategic arena revealed to be very helpful. Still, stablishing an energy transition management approach in a more abroad group (or sub-group) from municipal energy system will drawn similar but probably more complexity, uncertainties, actors and dynamics. It was concluded that Sintra could create a complementary energy planning approach (as transition management) to implement a constant process of engagement with local stakeholders and citizens. This could mean the establishment of more transition arenas that would bring innovative inputs from these (niches) group-works.

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Appendices

Interviews questions

Margarida Pereira:

Initial conversation with no questions about territorial planning, sustainable development, stakeholder involvement and governance in Portugal

What problems can you identify in Portugal in establishing integrated process necessary for governance?
Role of municipalities to ensure this process?

Examples of stakeholder involvement?

How is it usual for stakeholders to meet?

There are examples of long-term planning inside municipalities?

Annette Grunwald:

What is the school role in the community?

How to initiate and guide a debate regarding the energy sector and towards energy sector with school actors?

How to initiate and guide debate?

How to ensure equal participation and a positive environment of work?

How to promote during the debate network-establishment?

Pedro Teixeira:

What is the role of environmental awareness and education nucleus?

In relation to the energy sector, what activities are there?

How important is the covenant of mayors?

Is it indeed a goal of the Sintra Municipal Chamber to comply with the Covenant of mayors?

Is SEAP important in your day-to-day activities?

What do you think about participatory process?

Pedro Flores:

What is the role of department of energy and environmental sustainability?

In relation to the energy sector, what activities are there?

How important is the covenant of mayors?

Is it indeed a goal of the Sintra Municipal Chamber to comply with the Covenant of mayors?

Is SEAP important in your day-to-day activities?

What do you think about participatory process?

School work session invite (English translation)

Meeting – Sustainable energy in the school

To:

Sintra, 25 May 2018.

Subject: Meeting – Proposals for energy sustainability in the D. Carlos I school.

Dear ,

Under the internship framed by the Master's *Sustainable Energy Planning and Management* (*Aalborg University*) in the nucleus of education and environmental awareness of Sintra municipality, is being tested, a governance approach with the aim of helping energy municipal structure reflecting and debating possible energy policies aligned with municipal objectives, in order to Reduce the city's emissions by 20% by the year 2020, which are ratified in the mayors pact.

Would like to invite you to obtain your contribution to this social experience, for the energy sector. We will analyze energy consumption, proposing solutions to increase energy efficiency, reflect on the installation of energy production units referring to the group of schools D. Carlos I.

At this meeting We will reflect and discuss the following themes:

- To establish the long-term vision in terms of energy objectives for the school.
- Identify the problems for the implementation of this vision.
- Identify the solutions to overcome these problems, taking into account the role that each of the present plays in the community.

The meeting It will take place at 5th of June at 16:30 Hours, School D. Carlos I, in the room of the tale that lies in the library of the school. With no other matter at the moment and in the expectation that we can count with your contributions,

we present our best regards.

Carefully

Mario Sousa Mendes