Local energy planning in France: a way to reinforce energy transition

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Keywords

local and regional energy planning, long-term strategies, savings potential, networks, e-learning, renewable potential

Abstract

Decentralization is a process initiated in France for several years. Recent laws (MAPTAM, NOTRe) have confirmed this dynamic by strengthening the responsibilities of local authorities, and Energy Transition for Green Growth (TECV) law particularly in the energy field. Liberalization of energy markets forced local authorities to position themselves in the market offers for their own needs and thereby appropriating more specifically energy issues. Lastly, local strategies implemented with shared governance are essential to make the ownership of the energy transition by citizens and stakeholders.

In this context, the Regional Directorate of ADEME launched the Local Energy Planning (LEP), a process to support local authorities, as a means to define local energy strategy. Beyond supporting territories in the Energy Transition and the Third Industrial Revolution in Hauts-de-France, goal of LEP is to enable local authorities, including elected officials, to gain skills with their responsibilities, define their energy strategy of medium/ long term as well as actions to implement in the short term. A major issue of ESP is to ensure independence of this energy strategy in the public interest.

First, energy consumption, production and networks are analysed and mapped. Energy demand and potentials of local renewable energy are projected at medium and long term to define targets. Development needs, strengthening coexistence and energy networks are specified in these studies. Finally, a roadmap defines the means (technical, financial, economic) to achieve these goals with all stakeholders of the territory.

The paper present how a local approach of energy issues can be a way to accelerate Energy Transition based on some lessons learned from local energy strategies to reach ambitious goals in 2050 (100 % renewable ...) in the Energy Transition context in France. Finally, coordination challenges of a double movement both upward (local authorities) and down (State) are explored.

Introduction

France is a historically centralized country that has undergone an important process of decentralisation over the last 30 years. Local authorities received an increasing number of responsibilities in policy fields such as transportation, education, economic development or urban planning. This decentralisation can also be seen in the field of energy policies. In parallel, the need to develop renewable energy to meet the challenges of the energy transition is widely acknowledged. Shifting from a massively centralized energy system to a more (or even fully) decentralized one in a few decades is a major challenge. Local authorities will have to take part in such a dare.

This evolution, quite important in France, means a massive paradigm shift. An increasing number of international organisations, for example the European Commission (EC, 2016), the International Energy Agency (IEA, 2008 and 2016) or the International Renewable Energy Agency (IRENA, 2016) and the Climate Action Network (RAC, 2016), are considering territories, cities and urban areas as a key lever in the energy transition. Primarily, because urban areas will be places were future energy end use will take place, but also because they can be a relevant scale of action to implement energy-efficiency measures and programs, energy system optimisation and renewable energy policies. This opens up new perspectives to reach the ambitious climate targets worldwide and in France (Theys, 2011).

This paper aims at discussing the challenges and opportunities related to decentralisation in the field of energy. First of all (first section), the evolution of the energy context in France is described, especially the last laws and regulations, and the technical implications of the energy transition. Then, a presentation is given on how this evolution meets a wider trend towards decentralisation in France (second section) and bottom-up initiatives from local authorities at the national and European scale that have gained momentum in the 2010's (third section). At last (fourth section), a methodology developed in the Hauts-de-France Region by ADEME and the Regional Council to help local authorities take on board energy issues is presented: Local Energy Planning. In a concluding section, interests and limits of theses dynamics and this approach are discussed.

The current energy context in France

FROM A HISTORICALLY CENTRALIZED ENERGY SYSTEM...

The energy system in France is currently (and has historically been) highly centralised. It mainly relies on fossil and nuclear resources (oil for transport, gas for heating, and electricity from nuclear plants for some industrial and specific uses). Coal is no longer a major source of energy since it was replaced by nuclear energy mainly in the 1980's (MEEM, 2016).

As in a lot of developed countries, energy production, transportation and distribution are provided by centralized infrastructures and organisations. In the cases of electricity or gas, the state has internalized almost all of the regulation of the system through the creation of a vertically integrated public monopoly for production, transport and sale. Even with some local energy distribution companies as Grenoble or Metz (Gabillet, 2015); energy policy was largely a centralized policy. Since the early 2000s and the end of the nationalised regime, many organizational and technical changes have radically changed the foundations of this model and opened up for a transition phase. These include the liberalisation of the energy market, the development of decentralised production (through the development of renewable energy) and the increasing power of local and regional authorities (Boutaud, 2016).

... TO A FUTURE DECENTRALISED ENERGY SYSTEM?

In 2012, a few months after the presidential election of France, the new elected president François Hollande launched a national debate (*Débat National sur la Transition Energétique*) in order to prepare the next energy law. It was a mean to confirm the long-term objectives (2050), partly defined in POPE (2005) and Grenelle (2010) laws. Concerning GHG, and midterm (2030) objectives, the debate was an opportunity for many stakeholders to define, present and discuss scenarios about evolution of the energy system. Twelve scenarios elaborated by a variety of stakeholders (academics, energy companies, NGOs and public agencies, including ADEME) were studied. They all showed that renewable energy needed to play a more important role in the French energy system. The main differences between the scenarios were the global level of energy demand (even if no scenario described a high increase) and the share of nuclear power in the electricity mix.

Table 1 presents the main technical and economic evolutions presented in ADEME's scenario (VIDALENC, 2013). Based on two pillars (energy efficiency and renewable energy), the visions show that renewable energy could be considerably developed in 2030 and 2050. This means that energy generation will be more decentralised, and calls for a greater involvement of local authorities in energy planning.

After a debate in the Parliament, the main conclusions of the National Debate were transcribed in 2015 in the Energy Transition for Green Growth Law (*Loi de Transition Energétique pour la Croissance Verte* – TECV). The main objectives of the Energy Transition Law are to:

- Reduce greenhouse gas emissions by 40 % by 2030 and by 75 % by 2050 (compared to 1990 levels).
- Reduce the share of nuclear energy in electricity production by 50 % by 2025 (compared to the current situation about 75 %).
- Reduce fossil energy consumption by 30 % by 2030 (compared to 2012 levels).
- Reduce final energy consumption by 50 % by 2050 (compared to 2012 levels).

The Energy Transition Law also introduces specific measures, which give more power to local authorities. The application decree No. 2016-849 published in summer 2016 define precisely the new ambitions of the Local Air and Climate Energy Action Plan (PCAET) that local authorities (with more than 20,000 inhabitants) have to implement. This decree is replacing the less ambitious Local Climate and Energy Plan (PCET). Full diagnostic of energy consumption and production must be established, and potentials of evolution must be defined too, at last a cartography of energy networks (electricity, gas, heat) (ADEME, 2016).

The wider decentralisation trend in France

France is a centralized country. But as defined in the Constitution from 1958, four local administrative levels share responsibilities with 101 counties, 36,700 municipalities, 22 regions and 2,600 municipality groups.

The decentralisation movement that is taking place in the energy field in France meets a wider decentralisation trend that can be traced back to 1982 and the first decentralisation laws (the *Defferre* laws). Then in 2003, the *Raffarin laws* were the second act of decentralisation, which gave new responsibilities to local authorities.

Finally, two recent laws were passed in the 2010's that give more power to local authorities. These are (1) the Modernization of Territorial Public Action and Assertion of Metropolitan Areas (MAPTAM) law and the (2) New organization of the Republic (NOTRe) Law. Because of these two laws, energy is now a crosscutting theme each level (region, county, group of cities, municipality) of government must deal with.

The Modernization of Territorial Public Action and Assertion of Metropolitan Areas (MAPTAM) law was passed in

Table 1. ADEME Foresight exercise: technica	I and economic consequences.
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	2015	2050			
Technical consequences: Supply and Distribution					
Primary Energy	Extensive import of gas, oil, coal, ura- nium (from 98 to 100 %)	Major local or national production (from 50 % to 100 % depending on scenarios and energy vectors)			
Electricity	58 nuclear power plants (GW) on 19 sites 10 sites with oil power plants, 10 with gas and 4 sites with coal (GW) Approximatively 2,000 on-shore wind farms (MW)	50,000 wind turbines (MW) Thousands of PV plants (MW) Millions of roofs with solar panels (kW) Biomass cogeneration (MW) Power-To-Gas site (MW) 			
Gas	5 import points –interconnections (pipe- lines coming from over countries)	Thousands of methanisation units (depending of the size and type of production)			
Oil	99 % of oil consumed is imported 10 refineries on the national territory	Oil phased out from the transportation system New transport system with millions of charging stations (home, office) linked to the electric grid, and some thousands to the gas network			
Economic consequences					
Economic	€40 to 70 billion/year needed in 2012 to import gas and oil About €1 billion/year needed to import uranium	Probably the same amount in order of magnitude but with a significant shift and expansionist effect on the national and local economy			

2014. It describes in details the role of each level of governance. On energy issues, these are the following:

- The Region is responsible in the following policy fields: planning, biodiversity protection, climate, energy, air quality, economic development, transportation, research.
- The County is responsible in the following policy fields: social action, fuel poverty, solidarity between territories.
- Municipalities (and groups of municipalities métropoles, communautés d'agglomération, de communes) are given enhanced responsibilities in the field of sustainable mobility, local public services, and local development. Around major cities, metropolitan areas are given reinforced responsibilities on energy issues compared to "minor" groups of municipalities.

The New organization of the Republic (NOTRe Law) was passed in 2015. It provides details on the power of the Metropolitan Area of Paris (Grand Paris) and strengthens leader role of the regions on energy transition.

Bottom-up initiatives from local authorities

This decentralisation trend meets bottom-up initiatives from local authorities at the national and European scale that have gained momentum in the 2010's. Such initiatives aim at positioning local authorities as a relevant, even necessary, actor in the energy field and at showing that they do not have to wait for international or national actors to act against climate change. This is not an exhaustive list but a selected one with steps that demonstrate the possibility to act a local level in different ways.

LOCAL AUTHORITIES' NETWORKS

At the European level, such initiatives include the Covenant of Mayors for Climate and Energy, that was launched in 2008 with a view to coordinate local initiatives and advocate for more ambitious commitments from States in the negotiations of the European 2020 Climate and Energy Package. This bottom-up movement, led by Energy Cities, Climate Alliance, CCRE, FE-DARENE and EUROCITIES started with the support of the European Commission, now counts over 7,200 signatories. New signatories now pledge to reduce CO_2 emissions by at least 40 % by 2030 and to adopt an integrated approach to tackling mitigation and adaptation to climate change.

At the national level in France, the Positive Energy Territories (TEPOS) Network was launched in 2010 (CLER, 2010). This is a network of local authorities, mainly from rural areas, that commit to a 100 % renewable energy supply target. The energy transition is framed by these territories as an opportunity rather than a constraint. It can be seen as one of the first informal steps to put local actions on the energy transition agenda.

RETHINKING CITIES IN A POST CARBON SOCIETY

Such initiatives were supported by research and foresight. In 2009, a foresight program called "Rethinking Cities in a Postcarbon Society" was launched by the Foresight Mission of the French Ecology Ministry and ADEME. The main aim was to identify the role that local authorities, and more broadly local actions, can play in the energy transition particularly in France. The program provided a deep analysis of the potential levers of action for cities (transportation, housing, urban planning etc.). The final report (Theys, 2013) advocated for an empowerment of local authorities within a wider national policy framework that should also adopt strong commitments and dedicate appropriate resources to the energy transition.

The broadest commitment of territories in energy transition is part of theses "legacies".

GREATER LYON: A PIONEER EXAMPLE OF ENERGY PLANNING AT THE LOCAL LEVEL

Some local authorities have been particularly pioneering on these issues. Greater Lyon (*Lyon Métropole*) is one of those, implementing energy planning at the local level, with a governance with many stakeholders. In June 2015. it launched the Energy Master Plan project to make the most of the new competencies that were given to local authorities in the field of energy. This four-year experimental and voluntary approach is a milestone in the implementation of the Territorial Climate-Energy Plan implemented in 2012. The Energy Master Plan is a tool for territorial planning of the energy transition. It aims to build a metropolitan energy strategy and integrate energy into the definition of public policies and the resulting projects.

The first step in this process is to carry out a territorial energy audit (consumption, distribution infrastructure and energy production). This assessment is based on geographical mesh (IRIS) data provided by the Metropolitan authorities and a number of partners, most notably energy system operators. This work of characterization makes it possible to build a strong evidence base for the Metropolis to implement its new responsibilities.

This allows the construction of a scenario at 2030 of the energy consumption of the territory. This reference scenario is built in a transversal way with the services of the Metropolis, to include the main orientations of the metropolitan planning documents (Urban Travel Plan, Territorial Coherence Scheme, General Sanitation Scheme, etc.). It constitutes a kind of "Business As Usual" scenario that can be used as a base for discussion with other internal metropolitan services and economic actors.

Then, simulation scenarios, or exploratory scenarios, will be elaborated to imagine possible futures of the urban area. The exploratory method offers flexibility in defining and prioritizing actions. The aim is to show the diversity of possibilities of evolution of the local energy system and the investments of the territorial stakeholders. Answers collected during the call for contributions launched with the political and economic players of Greater Lyon will be used to create the alternative scenarios. Discussion between stakeholders that will feed this work will make it possible to define a solid and shared metropolitan energy strategy.

Even if today the ambition of the energy strategy of Greater Lyon is unknown, the process is still underway; the participative process seems interesting to follow, particularly for the second urban area of France.

Empowering local authorities: local energy planning

As described in the previous sections of this paper, trends (the rise in renewable energy generation, decentralisation, and the bottom-up initiatives from pioneering local authorities) are converging towards a more important involvement of local authorities in the energy transition. However, these authorities need to be given the right tools to act.

This section describes a methodology developed in the Hauts-de-France territory by ADEME and the Regional Council: Local Energy Planning or Programming (ADEME, 2015). The methodology is especially inspired by the work done in in the TEPOS Network and ambitious territories, like Greater Lyon. Its all the more relevant as the Nord-Pas-de-Calais / Hauts-de-France Region launched in 2013 a major policy in favour of the energy transition, the Third Industrial Revolution. Developed with Jeremy Rifkin, the Master Plan of Third Industrial Revolution (Rifkin, 2013) was the first time in France a Region was setting such an ambitious target for the energy transition: by 2050, 100 % of the energy consumption of the regional territory should be covered by renewable energy. This regional policy is an important support for local authorities that want to engage in Local Energy Planning. It means that it is no longer necessary to discuss the goal, but only the means to achieve it at an infra-scale. Today, many local authorities in the Hauts-de-France Region (such as the Pays de Saint-Omer, Communauté urbaine d'Arras, Syndicat des Flandres Loos-en-Gohelle...) have started to develop Local Energy Planning with theses ambitious targets in mind.

LOCAL ENERGY PLANNING: OVERVIEW OF THE METHODOLOGY

Local Energy Planning (or Programming) (LEP) is a methodology to implement the energy transition at a local level (city and more often, a larger area). Table 2 describes the main steps of the methodology. It is designed to be a step by step, year after year, continuous improvement process (with indicators defined to follow and evaluate the transition).

Dealing with energy supply and consumption simultaneously

An important aspect of the methodology is that it requires local authorities to look simultaneously at energy supply and consumption. All energy-consuming sectors (industry, transport, buildings and agriculture) and all local energy productions are taken into account. The methodology encompasses all the direct energy used by the inhabitants and stakeholders of the territory, but does not take into account indirect energy embodied in purchased goods. LEP is not only an evaluation of the local potentials of renewable energy, but in the same time, it is a way to work on energy efficiency potentials.

Furthermore, the identification of the different networks (electricity, gas, heat, hydrogen etc.) is crucial for the choice of their development. In some cases, local authorities choose to finance a neighbourhood insulation program instead of strengthening networks. This is typically the kind of choice that can be done only when all energy aspects (production and consumption, financial issues) are considered simultaneously in a global approach, and not sector-by-sector.

Another example: there are many methanisation plants in the north of France. Installed capacity of windfarms is already important with more than 2,5 GW. In near future, the link between hydrogen production with surplus of electricity and CO_2 from clean gas will be an opportunity for power-to-gas (P-t-G) production.

The range of opportunities that arise from considering energy as a global and local ecosystem is indeed wider than when you only consider one technology or mean of production and then another independently. It is therefore particularly relevant that local authorities carry out such holistic analyses, as they

Table 2. Main step	ps of local	l energy p	lanning.
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Phase 1 Understanding the energy context of the territory	Phases 2 Perspectives: understanding the potential of the territory	Phase 3 Strategy and action planning
This phase aims at: Understanding the energy consumption and production in the territory Mapping energy networks and grids (gas, electricity, heat, hydrogen) Understanding the new responsibilities of the local authorities	This phase aims at: Conducting a local foresight exercise (demographic, economic, urban plan- ning) Assessing the potential for energy sav- ings and renewable energy production Mapping networks, grids and their development	This phase aims at: Elaborating scenarios for 2050 Elaborating a multi-years (5 years) actions plan with stakeholders commit- ments Identifying indicators Monitoring

are the only actor that can go beyond an approach by sector – electricity, gas, heat – and that can aim for coordination between the different networks.

Engaging local energy stakeholders

Indeed, if both terms "planning" and "programming" are used, they do not mean exactly the same thing. Planning is a way to insist on the central role of public authority. Programming means that the public authority is more in the leader position and coordinator, but not mainly maker. The goal is the same, but the way to do it is slightly different.

The methodology is a multi-stakeholders involvement process, as a new kind of local energy governance. A larger degree of decentralisation calls for a larger number of local actors to be involved. It can also lead to more conflicts over decisions. Therefore, stakeholder participation is crucial. It is conceived as a way to engage all the stakeholders to carry out their individual parts, with their own means and try to find some convergence of interest. Hence, the methodology aims at building shared visions.

Special care is given to the results are presented, as all stakeholders should be able to understand them. Maps and appropriate sheets data are a mean to do so. In fact, cartography is crucial for crossing the stakes, and appropriating energy-related issues by elected representatives and policy makers. Of course, GWh, Toe, GHG, etc. are unavoidable indicators. But the aim of the LEP is not to communicate with the same stakeholders as before. The common language to elaborate is an important output during the process. In this logical approach, producing socio-economic indicators like employment in energy industries, territorial energy bills... are necessary.

The outputs from a LEP are extensive and must include outreach, communication, policies, programs, funding sources, participatory financing etc. Planning endeavour must be developed in a shared long-term vision and all these means are necessary in order to focus resources, increase collaboration with stakeholders, and sustain momentum toward specific goals.

Local energy planning: interests and limits

Today, energy decentralisation is still in the making, and the transformation of the energy system is not yet completed. Challenging the centralized energy model and forming a new paradigm for a fully or massive decentralized energy model is more a wish than a fact. It is however possible to draw some conclusions regarding its interests and limits.

LOCAL ENERGY PLANNING AS A TOOL FOR A NEW VISION FOR THE TERRITORY

Energy as an opportunity...but only for the pioneers?

Contrary to the GHG reduction plans, which are mandatory for local authorities with more than 20,000 inhabitants since TECV law, LEP is a way to improve the local economy and attractiveness of the territory. If some territories, in particular the members of the TEPOS networks, engaged in voluntary energy transition process, they do so because they see it as an opportunity for them in terms of local resources, sedentary jobs, territorial marketing. In rural areas mainly, renewable energy development and energy saving policies are a way to improve resilience and to strengthen the economy. It is a way to create "local" jobs (linked to a domestic market), instead of "nomadic" jobs (linked to international market) (Giraud, 2012).

However, questions remain as to how such momentum can extend to other territories. In a massively decentralized system, all territories will have to take of their part. But will all of them be motivated and able to act? Not all territories are equal, particularly in terms of financial means and skills. An important challenge for the energy transition will be to make sure that solidarity mechanisms are put in place to ensure that all territories can and will act. For instance, the way price equalization (i.e. the fact that the price of electricity is the same everywhere in France regardless of where you consume it) will evolve in the next years will be of great importance.

Management from centralized form of governance to decentralize one

Currently France is still at a crossroad between two or three electricity, and probably energy, systems (centralized, decentralized and hybrid) (France Stratégie, 2017). It is not possible to say that a choice in favor of one system or another has been made. Even with acknowledge to that more and more responsibilities are given to local authorities, the future role of the state, local authorities, energy utilities, and citizens is not at all stabilized. If the responsibilities of the local authorities are becoming more and more important, their financial resources must also be substantial.

A first step towards integrating the energy system in urban planning

Today, energy planning is not mandatory in urban planning. Issues regarding connection to the grid and network are not usually tackled before the end of the planning of urban projects. Having a full inventory of the current means of production, their perspectives, the potential of renewable energy of the territory is the first step to promote a coordinated approach. Tomorrow, an integrated approach between urban, mobility, housing and energy planning must be defined.

Strong ambitions ... but are there limits to autarky?

Energy transition strategies adopted by local authorities show very strong ambitions. In a lot of cases, a goal of a 100 % renewable local energy system is set by local authorities. Even if a detailed analysis of the cases is necessary to assess the goal in each context, this is remarkable as national commitments are less ambitious.

However, the limits of autarky, a physical concept, must be considered. One Sof them is the fact that it will not be possible (nor does it seem to be desirable) to produce all the renewable energy technologies needed at a local scale. For instance, a wind turbine implies imports of minerals, rare earths etc. Autonomy, a political concept, is probably a more interesting goal to aim for.

An adaptation to local characteristics ... but without the local citizens?

An important benefit of the local energy study is the diversity allowed. An energy system based on renewable energy will be very different from one area to another, depending on the energy sources available (wind, water, solar PV, solar heating, geothermic, biomass, biogas, waste heat ...). The local energy mix elaborated in the different local energy planning carried out are quite heterogeneous even if the goal stay the same.

However, the involvement of citizens and local communities is still quite low. For instance, community energy projects are marginal in France compare to other countries such as Germany or Denmark (IDDRI, 2014). Implication of local authorities is the first step, a more important involvement of inhabitants would help to accelerate the energy transition and create a sense of ownership.

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