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Everything must change in order to stay as it is. The impossible decentralization of the electricity sector in France☆

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ABSTRACT

Driven by many actors, the issue of energy decentralization has reappeared on the French political agenda. Celebrated in the past for its capacity to modernize and electrify territories, the centralized model now appears in crisis and is disputed for its inability to meet the new challenges of energy transition. On the contrary, local authorities are put forward, given the strengths they may have, in terms of knowledge of territories, proximity to citizens or synergy. Symbolizing this growing interest, the reference to "territories", to "local authorities", to "decentralization" has now become unavoidable in legal texts, giving rise to an abundant academic literature.

There is a significant gap, in France, between this new rhetoric and the institutional reality, and the centralized model remains firmly established. We propose to explain this permanence by using a multilevel analysis approach mobilizing the concept of "policy networks". We first draw a mapping of the different forces involved in the issue of energy decentralization, highlighting ideas and interests they defend, as well as the resources they can mobilize. In a second part, we show how these different networks have shaped an institutional framework in which the role of local authorities remains highly controlled. In the energy industry sector, it is essentially reduced to the distribution segment. In other areas where energy is involved (housing, urban and regional planning, etc.), this role is more important, since local authorities are more perceived as allies by centralizing forces, able to territorialise the energy policy objectives they defend.

1. Introduction

Driven by many political forces, large environmental NGOs[1] and several transnational networks of local authorities (such as Energy Cities, Climate Alliance, Cities for climate protection, etc.), the issue of decentralization in energy has emerged in Europe on the national political agendas. Whereas previously it had been celebrated for its capacity to modernize and quickly electrify territories, the centralized model now appears in crisis and is disputed for its inability to meet the new challenges of energy transition. On the contrary, local authorities are put forward, given the strengths they may have. The arguments are of various kinds. Some highlight efficiency issues of decentralized models: in-depth knowledge of territories by local actors (better exploitation of resource potential), proximity to citizens (mobilization and awareness of energy issues), ability to manage problems in a way more horizontal (synergies between jurisdictions in transport, urban planning or housing) [1]. Others insist more on the political dimensions of democracy [2]. Symbolizing this growing interest, the reference to "territories", to "local authorities", to "decentralization", to "territorialization" has now become unavoidable in legal texts, giving rise to an abundant academic literature on the subject [3].

Yet, in France, there is a significant gap between this new rhetoric of the "local" and the institutional reality. Despite many evolutions and the emergence of political alternatives, the centralized model remains firmly established, sending observers back to the now famous Lampedusa's formula, according to which "everything must change in order to stay as it is". We propose, in this article, to explain this permanence by using a multilevel analysis approach mobilizing the concept of "policy networks" [4]. We will develop this approach in section 2. In order to analyse ongoing changes in the institutional frame, we will rely on a corpus of materials that we have been building for some twenty years on energy policies in France. It is made up of numerous surveys and observations, which have enabled us to better identify the major coalitions of actors who are positioning themselves on the issues of decentralization in energy. Given the editorial constraints, we will develop only the case of electricity. In France, this energy plays a decisive role in the energy transition trajectory, both physically and institutionally.

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[1] To avoid burdening the text, we have not developed all the acronyms used in this article. See the complete list, translated into English, in the abbreviations list.

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List of abbreviations [english translation]

ADCF	Association des communautés de France [Association of French intercommunalities]
ADEME	Agence de l'environnement et de la maîtrise de l'énergie [Agency for the environment and energy management]
AEME	Agence pour l'économie et la maîtrise de l'énergie [Agency for the energy saving and management, the forerunner of ADEME]
AODE	Autorités organisatrices de la distribution d'énergie [Energy distribution organizing authorities]
APE	Agence des participations de l'État [Agency in charge of State holdings]
CEA	Commissariat à l'énergie atomique [Atomic energy agency, responsible for developing nuclear technology]
CGT	Confédération générale du travail [General confederation of labour, a trade union]
CFDT	Confédération française démocratique du travail [French democratic confederation of labour, a trade union]
CLER	Comité de liaison sur les énergies renouvelables [Renewable energy liaison committee, a NGO now named CLER-Réseau pour la transition énergétique, CLER-Network for energy transition]
COP	Conférence des parties [Conference of the parties]
CRE	Commission de régulation de l'énergie [Commission of the energy regulation]
DGE	Direction générale des entreprises [Directorate-General for enterprise]
DGEC	Direction générale énergie climat [Directorate-General for energy and climate]
EDF	Électricité de France
EPR	European pressurised reactor
FNCCR	Fédération nationale des collectivités concédantes et régies [National federation of local authorities responsible for public services]
GGE	Greenhouse gas emissions
IEA	International energy agency
MEDEF	Mouvement des entreprises de France [French union of enterprises, the largest employers' organization]
NGO	Non governmental organization
OECD	Organization for economic cooperation and development
PCAET	Plan climat air énergie territorial [Territorial climate air energy scheme]
PDU(I)	Plan de déplacement urbain (intercommunal) [(Intercommunal] urban transport plan]
PLH	Programme local de l'habitat [Local housing program]
PLU(I)	Plan local d'urbanisme (intercommunal) [(Intercommunal) local development plan]
RAC	Réseau action climat [Climate action network]
RTE	Réseau de transport d'électricité [National power grid]
SCoT	Schéma de cohérence territoriale [Territorial coherence scheme]
SFEN	Société française d'énergie nucléaire [French society of nuclear energy]
SRADDET	Schéma régional d'aménagement, de développement durable et d'égalité des territoires [Regional development scheme]
UFE	Union française de l'électricité [French union of electricity]

Although it represents only 22% of final consumption energy, its weight is very important in the political decisions related to decentralization, because of the nuclear issue and the still very important place occupied by EDF, the former state monopoly. This weight of electricity is also likely to strengthen in the future, in France but also in the world. IEA International Report 2018 says electricity should be the main driver of energy transition [5].

After exposing our theoretical framework (section 2), we will present our results in two steps. We will first draw up a mapping of the main forces involved, highlighting ideas and interests they defend, as well as the resources they can mobilize (section 3). Presented in the first part, this inventory shows that decentralization issues are carried by three main networks of actors, which we will call "historical Jacobins" (dominant in public decision), "alternative decentralizers" (still emerging) and "moderate decentralizers" (discrete but influential). In a second part, we will see how these different networks have shaped an institutional framework in which the role of local authorities remains highly controlled (section 4). In terms of the industrial organization of the electricity sector, it is essentially reduced to the distribution segment, because of the historical role played by local authorities. Local government action, however, remains very limited to a weak player role. In other areas where energy is involved (housing, urban and regional planning, etc.), this role is more important, since local authorities are more perceived as allies by centralizing forces, able to territorialise the energy policy objectives they defend. But, again, it encounters a strong national framing, including the financial capacity of local authorities.

We will then discuss this results and conclude the article (section 5).

2. Theory, methods and material

In this first section, we specify the theoretical frame as well as the methodology and the corpus of materials we have used in this article.

2.1. Theory

Energy decentralization issues can be analyzed by using theories on intergovernmental relations or multi-level governance, which focus on understanding how different levels of government, differentiated on a political point of view, interact to manage public problems and, more generally, to ensure the regulation of our contemporary societies [6]. Among these, it seems to us that the theory of policy networks is particularly heuristic [7]. This approach, which has spread in the field of multilevel analysis from the 1990s onwards, is very useful to analyse the ongoing recomposition of the governance system, insofar as it makes it possible to better understand the coalitions involved in the decentralization issues, some of them trying to control the rise of local authorities.

The network approach is based on the following assumptions [8].

1. The analysis of multi-level relationships must emancipate from a reading grid based on formal categories inherited, in particular, from law or administrative science, which ranks actors according to their nature, duties and sphere of belonging (public vs. private, economic vs. non-economic, political vs. administrative, etc.). In particular, it invites us to use very carefully the notion of "level" (European Union vs. states, state vs. local authorities, regions vs. cities, etc.) which does not allow us to understand the forms of complex relationships that can link these actors and do not necessarily follow the logics of opposition (rivalries, competition, conflicts, etc.).
2. Another way of analysing these relationships is to start from the ideas and interests that actors defend in relation to a given problem, and to identify the networks, informal or formal, these actors build on these issues, as well as the meta-networks that encompass them. There is a policy network when stable exchanges intervene over time, which allow to share representations and consolidate agreements about an issue (energy decentralization in this article). Meta-networks are

networks of networks. They are made up of actors who do not necessarily have direct relationships with each other, although their ideas and interests may converge on the vision of a specific problem. These meta-networks are based on looser structures of exchange between networks and appear, in the form of a broad coalition, when an important event occurs (vote of a law, reform of a sector, decision-making that may have financial implications, etc.). On this occasion, actors at the interface between several policy networks play the role of intermediaries, which allow them to build a large coalition defending a common cause.

2.2. Methods

This type of theory requires a two-step methodology.

First, it is necessary to identify the different types of networks that exist around the phenomenon under scrutiny (here the setting of energy decentralization on the political agenda). This task requires a detailed knowledge of the field studied, made possible thanks to two types of materials.

1. The study of official documents in order to "capture" the positions of the actors on the issue, directly (when they are put on the agenda) or indirectly (when they appear at the turn of other issues affecting the sector as a whole). In particular, the aim is to identify for each actor his logic of action and the stakes that energy decentralization issues represent for him. These stakes are of different nature: political, economic, institutional, cultural, etc. They are both material (the materiality of production units or infrastructures in our case) and immaterial (symbolic aspects, etc.).
2. Interviews conducted with these actors on the subject, which allow the information to be completed in two directions. First, interviews enrich the understanding of the positions of the various stakeholders, their logics and the interests they defend. Second, they are an opportunity to identify the resources that each of the players can mobilize, alone or within a network, to express its point of view and try to influence the institutional framework (in our case for regulating the electricity sector).

The Table 1 presents the analytical tool used in this first phase.

This task makes it possible to map the actors presented in section 3 (Fig. 1) and to draw Table 2.

The identification of these networks and their resources allows us to understand the distribution of legal duties between State and local authorities in the electricity sector, considering the industrial organization (production, transmission, distribution, supply) and some major areas in which local actors are involved (housing, mobility, climate change, planning, fuel poverty, etc.). The analysis is developed in section 4 (result 2), which draws the general frame of intergovernmental relations in energy in France.

2.3. Materials

To carry out such a work, it is necessary to gather a sufficiently large material to be able to "catch" the system of actors in all its complexity and in its long-term dynamics. Our corpus is based on an observation of more than 20 years of the field of energy and issues of decentralization. Here is the list of the materials used (surveys, seminars, participation in consultation processes, supervision of student work) to map the networks of actors and identify the resources they mobilize to shape the institutional framework of electricity governance.

1. Personal research on the role of French local authorities in the regulation of energy: historical aspects; decentralization and liberalization of the energy market (1990–2000); EDF strategy towards local authorities; role of regions in the energy planning process; local energy climate policies; the rise of metropolises, etc.
2. Supervision of three PhD theses: action of operators held by local authorities [9]; role of European associations of local authorities on energy legislation (Corinne Belvèze, thesis to be defended in 2020); strategies of metropolises in terms of energy transition (Mathilde Marchand, thesis in progress).
3. Participation, as an expert, in the national debate on energy transition (2013), preparing the vote on the *Loi sur la transition énergétique et la croissance verte* (energy transition and green growth act, voted in August 2015): member of the working group on "governance" (reading the actors' booklets, writing a synthesis note on local energy governance, co-writing the final note of the group).
4. Consultation of the documents written by 200 actors during the consultation launched by the French State for the multiannual energy planning (2018): reading the actors' booklets, identifying arguments, mapping positions, etc.
5. Animation of a seminar organized with the Ministry of ecology on the role of local authorities in energy (2015).
6. Co-animation of a seminar practitioners-researchers on the financing of the energy transition by local authorities (2017–2019).

3. Result 1. actors and networks involved in the decentralization issues

Since the 1990s, the question of decentralization, which had never completely disappeared from the concerns of energy stakeholders [10], has been put back on the French political agenda, thanks to several joint dynamics. First, liberalization has opened up new windows of opportunity for local authorities, calling into question the existence of former national monopolies and, indirectly, the importance of the role played by the State. Once criticized, local authorities, and especially municipalities, were thus able to re-appropriate historical competences in the organization of the market, particularly in the area of public distribution [11]. Parallel to this process, which has not yet been completed in France, the decentralization laws have strengthened local authorities in several areas concerning energy management: housing, urban planning, mobility, social policies, etc. Finally, the last major change has been the fight against climate change. In a complementary way to the major international negotiations (the different rounds of the COP[2]), local authorities took full account of the subject, in order to legitimize their role in the sector, like many of their counterparts abroad [12].

These different processes have brought in new players, which complicates the governance of the electricity sector. The diagram in Fig. 1 maps the three main policy networks that are now positioned on the issue of decentralization, directly (by their claims) or indirectly (by the discrete influence they may have on major public policy choices). It distinguishes 5 main spheres of activity: politics (the political class and this issue); state administrations; operators of the energy sector; trade unions, NGOs and professional associations and, finally, associations and networks of local elected officials. As policy networks postulate, these spheres are not compartmentalized from one another. Between them circulate ideas and interests around the issue of decentralization, that give rise to large and mixed alliances.

3.1. Historical jacobins

The network of "historical Jacobins" brings together actors who have been dominant for a long time in the French electricity system. It is made up of four main circles of actors, who defend interests and logics of action that contribute to the maintenance of a centralized model, based on nuclear energy and led by the State.

[2] Conférence des parties (conference of the parties).

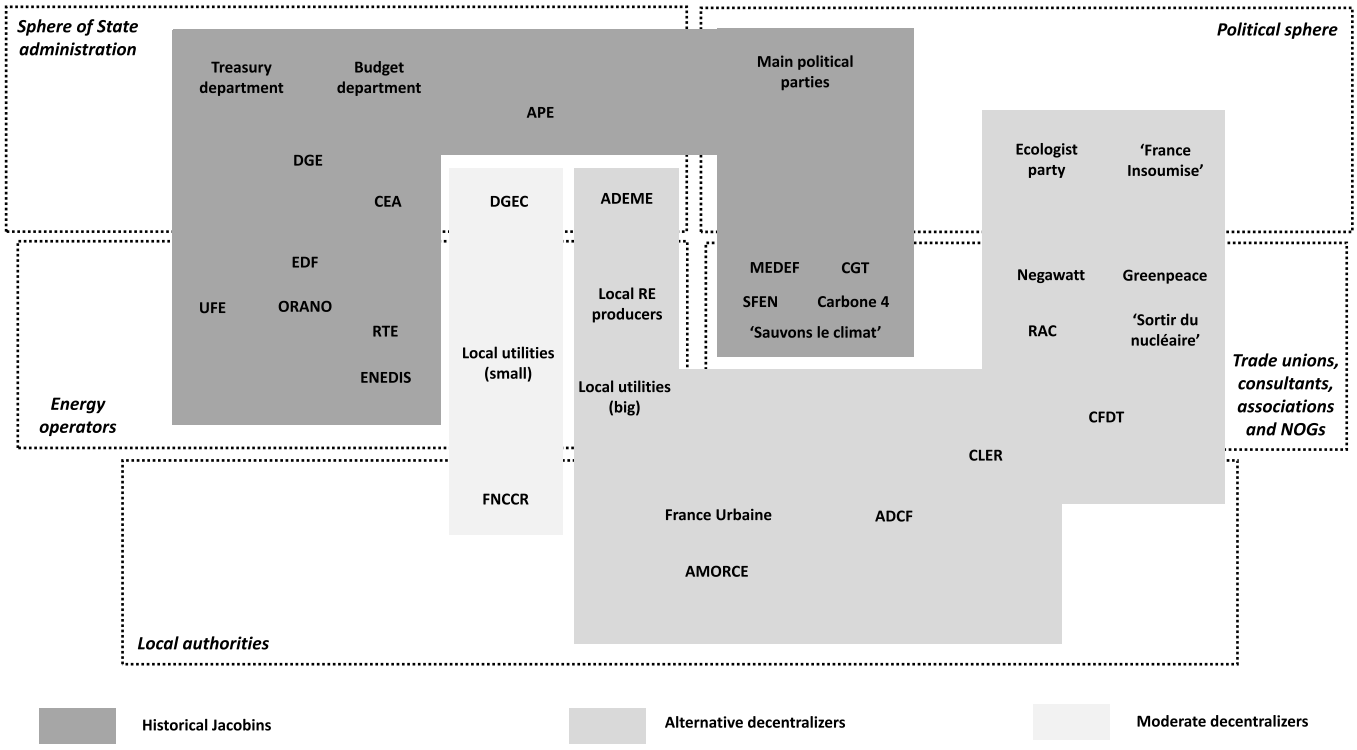

Fig. 1. Mapping of networks of actors involved in decentralization issues in France.[3]

Table 1
Analytic tools used in the article.

Type of actor	What are the arguments for him concerning energy decentralization? What is at stake?	What are the resources (economic, political, technical, etc.) he can mobilize to put forward his point of view?
Network 1		
Actor 1		
Actor 2		
… / …		
Actor n		
Network 2		
… / …		
Network n		

3.1.1. *Strengthening the domestic market to conquer the international: the lobby of the nuclear industry*

This network was built largely around the industrial complex that was formed in France from the nuclear sector, in the 1960s, in its first military and then civil dimensions [13]. Its main industrial players are Orano (former Areva) and EDF, which, in 2017, bought a part of the first [14]. Orano is the company responsible for the operation, transport and management of nuclear fuels. EDF builds and operates, in France but also abroad, the plants that use this fuel. Around them are other public or parapublic institutions, such as the CEA, the SFEN and the UFE[4], which bring together nuclear actors, as well as the powerful *Corps des Mines*. As one of the *grands corps de l'État*, its members are very present in the sector, occupying the main management positions in companies and administrations (for example in EDF and Orano).

It is from this first nucleus that the French electronuclear industry develops. Now, it accounts for about 70% of electricity production and 16% of primary energy consumption in metropolitan France [15]. Its economic weight is very important, in terms of capital assets. The stakes are also commercial, since the French nuclear industry has been positioning itself internationally, facing US and Chinese competitors. Even though the IEA statistics show that the sector is clearly losing momentum in the world, especially with regard to the development of renewable energies [16], in France, nuclear proponents want to remain present on the market, by developing new units, in particular the European Pressurised Reactors (EPRs). Partnerships and equity investments have already been initiated with England (Hinkley Point), Finland, but also China and India. For those involved in this sector, removing France from nuclear power would entail heavy economic and industrial consequences. Such a political decision would contribute to disequilibrate a little more the French trade balance, with electricity sales worth around 2 billion euros each year [17]. It would lead to job losses in regions affected by site closures, that are sometimes subject to unemployment. It would result in higher tariffs for all French consumers. Finally, it would compromise the international strategy of Orano and EDF, giving a very negative signal to EDF's potential partners.

3.1.2. *Supporting "national champions" and keeping low prices: the Ministry of Finance*

The nuclear industry finds a strong ally in the Ministry of Finance. Whereas it had been reluctant to develop nuclear plants in the 1970s, considering the cost they represented [18], it is now one of the strongest supports of this industry. Four actors are involved within this ministry, or are closed to, which weighs very heavily on French political and

[3] Acronyms are developed in the article.

[4] CEA: Commissariat à l'énergie atomique (research center); SFEN: Société française d'énergie nucléaire (scientific association); UFE: Union française de l'électricité (professional association which brings together the main energy operators: production, transport, distribution, supply, services managing different functionalities, etc.).

Table 2
Arguments, stakes and resources used by the three policy networks.

Policy networks	Arguments and stakes	Resources
Historical Jabobins	*Economic*	**Very important**
	Low cost nuclear energy (for households, for businesses).	Control of the political agenda.
	Nuclear contribution to the French trade balance (exports).	Administrative weight (Ministry of Finance).
	The nuclear industry as a strong job creator.	Strength in the media.
	The necessity to support EDF and Orano in their international expansion strategy.	(Quasi) monopole of expertise on electronuclear sector (economic model, reality of costs, risks).
	Environmental and health	State culture and centralization still very present among citizens.
	Decarbonisation of the energy mix.	Strength of the *Corps des Mines* (professional network) in the main ministerial and business positions in energy (technical advisers, CEO or directors, head of State administration departments).
	Nuclear power, an indispensable complement for developing renewable energies (problem of intermittence, security of supply).	
	Social	
	Difficult redevelopment of nuclear sites.	
	Low cost of nuclear energy for low income consumers.	
	Political and symbolic	
	Radiance of France.	
	Unity and equality (through equalization of tariffs between regions).	
Alternative decentralizers	*Economic*	**Limited**
	Renewable energies as strong job creators.	Increasing visibility in the media.
	Savings brought by the reduction of energy consumption.	Emerging expertise, but not always recognized as legitimate by the State.
	Reduced dependence on oil and uranium.	Weak administrative weight (the ADEME is only a State agency, not a ministry).
	Cost to dismantle nuclear power plants are underestimated.	Support of a small part of the political class.
	Local development.	
	Environmental and health	
	Nuclear risks.	
	Decarbonisation of the energy mix.	
	Social	
	Reducing consumption to better fight against fuel poverty.	
	Political and symbolic	
	A more democratic governance of energy sector.	
	Energy autonomy.	
	Decentralization as an ideal of political life.	
Modereate decentralizers	Mix between the arguments of "historical Jacobins" (preservation of the national framework, support for EDF) and "alternative decentralizers" (local development, territorial balances between poor and rich regions in energy, and between rural and urban areas, protection of the most precarious populations).	**Medium**
		Discrete access to major actors (EDF, Ministry of ecology).
		Discrete weight on Parliament.
		Strong expertise.

administrative decisions: the DGE, the APE,[5] the Treasury and the Budget.

We will not dwell on the DGE, which, in charge of the French industry, supports the strategy of consolidation and expansion of the electronuclear sector. It is supported by the MEDEF,[6] which represents the interests of large French energy-consuming companies, and which is very favorable to nuclear energy. Both the DGE and the MEDEF consider that the nuclear industry provides low prices, among the best in Europe, both for industrial and domestic consumers [19]. For them, it is then essential to continue to operate existing nuclear plants and not to dismantle them too early. It is also important to launch new nuclear programs (such as EPRs of new generation), in order to favor the development of the French nuclear industry. In comparison, supporting renewable energy is considered as less important and as a public expenditure, more than a strategic long term investment for the sector. This argument is shared by the Budget Department.

The APE represents the interests of the State-shareholder. As such, it is heavily involved in the management of large energy companies, as it has significant shares in the sector. EDF alone accounts for 22% of the total assets held by the APE, an amount of 23 billion euros in 2017 [20]. Destabilizing this company by calling into question its pro-nuclear strategy would be likely to drop the share price (already historically low compared to its rating) and to reduce the high level of dividends that are paid each year to the State (1.7 billion euros in 2017, or 50% of the total amount collected by the State on its participations [21]). Thus, in a certain way, the APE has little choice today to speak in opposition to EDF (and Orano) on their nuclear strategy. The high level of dividends paid each year by EDF also explains the support of the Budget and Treasury Departments, who are seeking resources to increase the State's revenue and contribute to its deleveraging, in a context of reduced public spending. Finally, the Budget Department aims to maintain a high level of production from nuclear power plants as a means to avoid reducing consumption, particularly by subsidizing the thermal renovation of buildings (tax credits, subsidies, etc.). This short-term strategy undeniably serves the interests of the electronuclear industry, delaying the consideration of the real costs of dismantling power stations in the longer term.

3.1.3. *The fear of dismantling: the major network operators*

Network operators in charge of transport and distribution lines are

[5] DGE: Direction générale des entreprises; APE: Agence des participations de l'État.

[6] MEDEF: Mouvement des entreprises de France.

also involved in debates on institutional organization. Although they present themselves as neutral actors, their interests converge to maintain a rather centralized model, which legitimizes their historical existence, built around the construction of interconnected infrastructures serving the entire territory (universalization of networks). Indeed, against the idea of an energy system based on autonomy and post-networks territories [22], they plead for preserving and strengthening national and local infrastructures, to foster the development of renewable energies (fight against intermittence by pooling production sources), electric vehicles (France has very ambitious targets in this area) and smart networks (to better drive demand). These new challenges require, according to them, significant investments to adapt and modernize networks [23]. They also require strong coordination, under the aegis of integrated operators, and not dispersed.

Beyond these technical and economic arguments, grid operators know that they too are playing their survival, as integrated organizations, at a time when discussions on energy decentralization are increasing. RTE,[7] in charge of the transport network, is still relatively little impacted by the issue because the company owns its infrastructure and is not really challenged in its role of national monopoly. Enedis, which operates the distribution lines [24], is much more threatened by ongoing developments. The company does not own its networks. These are the property of local authorities, since the law of June 15, 1906. The management of these infrastructures which, for the time being, has escaped the liberalization process, could be put in competition in the future, some local elected officials claiming to be able to call on other operators or to create their own structure. Enedis therefore seeks to defend its unity, by highlighting the advantages of centralized network management. This interest is also that of EDF, which owns 100% of the capital of Enedis, and which, as such, receives each year a very large amount of dividends (659 million euros in 2017, 513 in 2018 [25]).

3.1.4. A strong ideological attachment to centralization: the support of the French political class

The majority of the French political class also remains very faithful to the historical model, based on the role of the State and recourse to the electronuclear industry. This was illustrated by the last presidential campaign in 2017 and the victory of Emmanuel Macron, when several arguments have been put forward in favor of centralization. The values of solidarity between territories and the fight against urban-rural inequalities continue to be very present in debates on governance issues. Discussions about the territorial differentiation of electricity rates, which was overwhelmingly rejected by elected officials, attest to this. These actors continue to want to place the State as the guarantor of national unity, in the face of the risks of excessive decentralization.

The nuclear issue is associated with these Jacobin values, insofar as it embodies, in the eyes of many elected officials, the vision of a general interest served by the *grands corps de l'État*, a symbol of power and radiance of the country [26]. From this point of view, the 2011 Fukushima nuclear accident did not, surprisingly, give rise to a real questioning of this political support. On the contrary, as some researchers have shown [27], the major pro-nuclear political parties (notably located on the right of the political spectrum) developed, shortly after this accident, an intense activity of reframing rhetoric to relegitimize the use of nuclear power, in the face of a destabilized public opinion. The arguments put forward were mostly economic (independence of France, low cost of the current energy mix). Initially not very present in the media sphere, they then progressively imposed themselves in the debates, competing those put forward by the opponents of the nuclear industry, around the issues of industrial risk and impact on health and environment. One could add another complementary rhetoric, developed since the 2000s. It concerns climate change issues. Nuclear energy is indeed often presented as the "champion "of decarbonation [28], compared to other sources such as renewables, presumed to be less effective because of their intermittency. The association *Sauvons le Climat*, of which the SFEN is a member, or the consultant firm *Carbone 4* defend this link between recourse to nuclear energy and preservation of the environment.

3.2. Alternative decentralizers

Faced with this broad and strong alliance, the forces embodying an alternative decentralized model have emerged more recently in France, around three main types of actors.

3.2.1. Challenging the electronuclear industry: NGOs and ecologist parties

The opposition to nuclear energy played a key role in challenging the centralized model [29]. It was formed from the 1970s, around a network of activists from which will be born associations such as *Greenpeace* or *Sortir du nucléaire*, very present in the debates on energy. Their criticism relates both to the risks that nuclear poses to society (environment, health, etc.) and to the political regime that it underlies. Opponents denounce the existence of a kind of "State technocracy", bringing together a small number of actors who impose their choices on citizens, without any real consultation. Nuclear power is thus associated with a denial of democracy, which serves the interests of a ruling class defending a highly contested productivist model.

This associative mobilization has been expanding gradually to other types of actors. On the side of the trade unions, if the CGT, well established at EDF, remains very favorable to the centralized and nuclear model, the CFDT, another great federation, is very early against the nuclear and promotes a stronger decentralization.[8] But it is above all the ecologist parties that are making these demands on a broader, national scale. Appeared on the political scene in the 1970s, they enshrine the decline (as a first step) and the exit (longer term) of electronuclear production in all their political programs. Other forces have joined them more recently, located to the left of the political chessboard, such as the party *France Insoumise*. For them, beyond the question of risks, it is a decentralized model of society that is put forward, energy being considered as an important area in democratic life. Against the nuclear, these parties and historical NGOs plead for the massive use of renewable energies, which, according to them, favor the reappropriation of energy by citizens. As these develop, alternative operators to major companies join this activist network, often more discreetly and less politically: citizen cooperatives (Enercoop), small companies specialized in renewable energy, energy communities, etc.

3.2.2. Energy demand management: the emergence of an alternative within the state

At a time when opposition to nuclear power is growing, France, like most of the European countries, is plunging into a major energy crisis, following the oil shock of 1973. Whereas one of the answers to this event is the launch of the electronuclear program, other ways are explored. They call for a rethinking of the energy consumption model supported by the centralizers, based on nuclear energy. Against the opinion of EDF and the Ministry of Finance, a few State actors argue in favor of an ambitious energy saving policy, to reduce the French global energy bill. First isolated within the administrative sphere, they manage to convince the government to create a specific agency dedicated to these issues. The AEME[9] was born in 1973, with the mission of proposing measures to save energy, especially in buildings [30]. In particular, it targets electric heating, which is widespread in France and which the proponents of the electronuclear programme seek then to develop. In doing so, competing visions appear within the State, which somewhat undermine the

[7] Réseau de transport d'électricité.

[8] CGT: Confédération générale du travail; CFDT: Confédération française démocratique du travail.

[9] Agence pour l'économie et la maîtrise de l'énergie.

unanimity that existed previously.

Heir of the AEME and its successor agencies, the ADEME,[10] created in 1992, today embodies this public policy of energy savings. It argues for a strategy of a sharp decrease in consumption which, as in the past, goes against the interests of nuclear proponents, who wish to extend the life of their plants and build new EPRs. Over the years, the ADEME also defends the massive use of renewable energies, bringing it closer to the actors described above. This support is reflected in the publication of numerous reports, one of which, published in 2016, proposes a 100% renewable energy production mix, in total opposition to the scenario advocated by the nuclear industry [31]. Around the ADEME are many organizations that share its vision of the production mix and the decrease in consumption. This includes Negawatt, CLER and RAC.[11] These environmental actors, who have a strong expertise in energy, challenge EDF's argument that nuclear power would be the most relevant solution in the fight against climate change (decarbonated energy, problem of intermittent renewable energies). For these associations, implementing ambitious public policies to decrease energy consumption and to produce renewable energy can make it possible to reduce greenhouse gas emissions (GGE) just as effectively.

3.2.3. Implementing energy-climate jurisdiction: the commitment of big cities

Long removed from regulation [32], big cities have reappeared on the decision-making scene since the 1990s, particularly in light of the issues they represent in the energy sector [33]. Liberalization has opened up new opportunities, allowing them to switch suppliers and to produce renewable energy by themselves or by using new operators. The fight against climate change has also legitimized their role. The City of Paris led the launch of the C40, an informal organization of major global cities that intend to pursue ambitious policies to reduce GGE. In many other cities, local elected officials and citizens have also made this issue a high political priority, believing that local level has its role to play, facing, according to them, the inertia of states and major international organizations.

This rise has translated into a political will of greater decentralization. Cities believe that it is essential to give them more power and autonomy in energy management, as they face many economic, social and environmental challenges. Much of the consumption is now on an urban scale. Air pollution issues have become urgent to address. The thermal renovation of buildings remains a major stake. Fuel poverty requires a fine intervention with the populations concerned. Lastly, the international competitiveness of French metropolises also depends on their ability to set up efficient energy systems. For all these reasons, cities are questioning the unified nature of the French model and are calling for new leeways. They join to act, through different networks of actors, including France Urbaine (Urban France). France Urbaine is a large national association created in 2015 to defend the interests of big cities. It asks (discreetly but regularly) for completing the process of liberalization by allowing cities and all local authorities to put Enedis in competition. Thus, cities could call on other operators or even create their own structure, giving them more leverage to implement their public policies. Although its interests diverge sometimes with those of France Urbaine, the ADCF, which federates all the intercommunal structures, is quite close to this position.[12]

3.3. Moderate decentralizers

We can identify a third and last network of actors, which is positioned more midway. We propose to call it "moderate decentralizers". This policy network advocates a form of relaxation of the centralized model, without switching to a new model, in which local authorities would have very extensive powers.

3.3.1. Territorializing public policies: the DGEC

The vision and strategy of the State are not unified concerning (de) centralization issues. Between supporters of maintaining or strengthening the historical model (Finance) and those (ADEME) who advocate for its profound transformation, the DGEC[13] takes an intermediate attitude. This Directorate-General of the Ministry of ecology is in charge of implementing France's strategic orientations in energy policy: liberalization of the French market, fight against climate change, development of renewable energies, energy efficiency, etc. To carry out these missions, in a context of tension on public expenditure, the DGEC tries to rely on relay actors to multiply its action as close as possible to the territories. Among them, local authorities play a particularly important role, in relation to the assets they may have (knowledge of resources, proximity to the inhabitants, synergies between sectors, etc.).

The challenge for the DGEC is therefore to mobilize the local level to support it in its multiple missions, if necessary by strengthening certain regional or metropolitan areas jurisdictions in targeted fields (territorial planning, housing and urban planning). This is evidenced by the references to "territory" in many pieces of legislation or administrative discourse, or the multiplication of the term "territorialization" for some fifteen years. Different from "decentralization", it refers, for them, to the mobilization of local authorities around the achievement of the objectives of the State, which are often quite ambitious with regard to the weak means involved. This strategy includes the implementation of regional energy planning schemes, co-produced by the State and the regions [34]. Other tools are mobilized too, such as "labels" or call for projects. Even if they are based on limited financial resources, these instruments are a way for the DGEC to build new relationships with the actors of the territories, in particular with local authorities, in order to achieve its national goals.

3.3.2. Preserving rural interests vis-à-vis cities: the FNCCR

For rural stakeholders, the decentralization of energy represents a real threat. Indeed, the historical model that was built in France from the interwar period was accompanied by numerous mechanisms of economic redistribution in favor of rural territories [35]: standardization of tariffs regardless of the place of consumption (tariff equalization), very important investments in rural areas (State subsidies and EDF funds), etc. For many elected officials and citizens living in the countryside, the rise in power of cities could challenge these measures, while the context is often difficult in their territories (rising unemployment, deindustrialization, closure of public services, etc.).

These claims are relayed by a powerful national association: the FNCCR.[14] Founded in 1933, it has always defended the interests of rural areas, against private operators and, after nationalization, against EDF. Over the years, it has built a network of influence that has heavily influenced the choices of the State and EDF [36]. It was at the origin of the national equalization rates, which was adopted in France in the 1960s. Since liberalization, the action of FNCCR has been maintained, if not reinforced, through alliances concluded with EDF and the State, to preserve the centralized model [37]. The association today advocates moderate decentralization, which may strengthen the powers of local authorities while maintaining a strong national framework managed by the State, and guaranteeing powerful mechanisms of territorial redistribution between rural and urban areas.

3.3.3. Small local public operators

Ninety-five percent of public energy distribution is provided by

[10] ADEME: Agence de l'environnement et de la maîtrise de l'énergie.

[11] CLER: Comité de liaison sur les énergies renouvelables (now named CLER-Réseau pour la transition énergétique); RAC: Réseau action climat.

[12] ADCF: Association des communautés de France.

[13] DGEC: Direction générale énergie climat.

[14] FNCCR: Fédération nationale des collectivités concédantes et régies.

EDF's subsidiary Enedis. In the remaining 5% of the territory, local public or semi-public operators, created before the nationalization, provide this essential public service. While some large urban structures exist (Strasbourg, Metz, Chartres, Bordeaux, Colmar, etc.), in most cases, local public operators are small and located in rural areas or small towns. Their survival has hitherto depended heavily on the redistribution mechanisms put in place by the State to guarantee homogeneous and universal access to energy networks: aids to balance budgets, subsidies, advantageous energy purchase rates to EDF, etc. [38].

This relatively strong dependence on the State explains the attachment of these small operators to a centralized system. Very few of them are in favor of greater decentralization, of which they fear losing out. A total liberalization of the French distribution sector, now preserved, could jeopardize their position on the market, which today enjoys multiple forms of protection, thanks to the centralized model (no competition in their territory, except for supply). Only the biggest operators could draw their pin from the game, which explains why some of them, however rare, are tempted to join the ranks of the supporters of a broad decentralization.

3.4. Summary of the arguments and resources of the three main stakeholder networks

Table 2 sums up the positions of the main actors on the (de) centralization issue, as well as the resources they have. It shows a great asymmetry in favor of the "historical Jacobins". They continue to accumulate numerous and diverse resources, which gives them an even prominent place in the evolution of institutional games.

4. Result 2. A hybrid model of energy regulation

These three main networks of actors draw a new model of energy governance in France, which can be described as hybrid (see diagram in Fig. 2). It is no longer completely centralized because the action of decentralizing coalitions has had effects on the redistribution of powers between the State and local authorities. It is not however decentralized, many features characteristic of the old model remain still very present, under the influence of the alliance of Jacobin forces. To understand emerging forms of regulation, two main dimensions must be distinguished: the industrial organization of the sector on the one hand, and public policies with a strong energy component on the other.

4.1. Industrial organization

The industrial organization of the energy sector shows a great continuity with the historical model. As illustrated in Fig. 2 and in appendix (different jurisdictions), local authorities generally play a weak role.

4.1.1. A weak role in the production, transmission and supply of electricity

In production, major operators remain dominant, whether they come from nuclear power (70% of electricity production) or renewable energies (20%). In this latter segment of the market, the smaller alternative operators that appeared in the 1970s and 1980s have given way to larger companies, including EDF and Engie, which have profoundly transformed this sector [39]. They now have subsidiaries producing renewable energies, managed in a very centralized way. In this context, local authorities play a marginal role. They can invest in local projects, in the form of shareholdings in public or semi-public operators. But their intervention should not be overstated, given their real economic weight and the influence of this intervention on the entire electricity system. Indeed, in many cases, projects are viable only to the extent that they benefit from purchase prices subsidized by all consumers, which do not call into question the regulation of the sector.

In transport, local authorities action is even more limited, with no jurisdiction to significantly influence RTE. RTE has its own infrastructure and is mainly owned by EDF. It is rather during the process of concerted action around major infrastructure projects that local authorities can intervene, to try to modify the passage of power lines on the public domain.

The supply segment also offers little direct control, with tariffs set by economic operators (for market offers) or by the State (regulated tariffs, with a light consultation of local authorities). Local authorities can mainly act as energy consumers (to reduce their bills, buy green energy, etc.), by using their bargaining power, alone or through purchasing entities. They do not have the power to group all or part of the energy consumers in their territory, to negotiate on their behalf offers with suppliers. Such an option, rejected until now by the State, would constitute a significant change, which would amount to re-establishing the concession regime that prevailed until the creation of EDF [40].

4.1.2. A more important but thwarted role in the distribution

It is in the distribution that the action of the local authorities is today

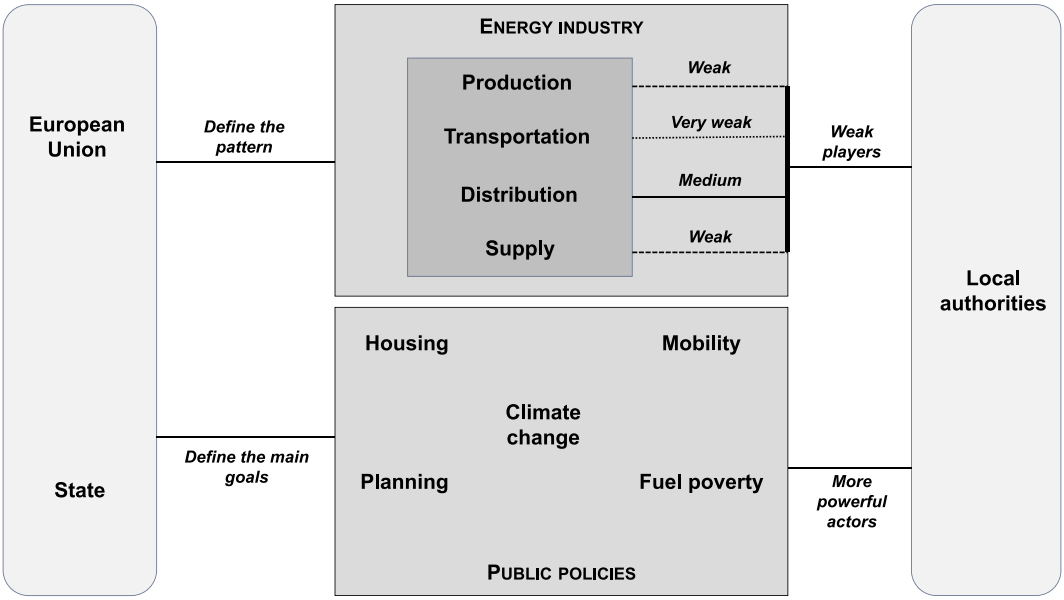

Fig. 2. Articulation between European Union, State and local authorities in the energy sector in France.

the most significant. It is explained by the maintenance, despite the nationalization (1946) and the liberalization, of a historical jurisdiction of the communes and their unions: their function of "energy distribution organizing authorities" (AODE, *autorités organisatrices de la distribution d'énergie*). This competence, which somehow also exists in Germany, forces an energy distributor to ask permission from the local authority to serve a territory. In return, the operator is committed to providing energy to all consumers. It also pays concession fees to the local authority and assigns ownership of the networks to it at the end of the contract (20 years in general). The role of local authorities is therefore, in theory, important, considering the weakness of their margins of maneuver elsewhere.

Distribution activity, however, is still very strongly regulated by the centralizing coalition. The stakes are primarily financial, especially for Enedis and EDF, its main shareholder. As we saw in section 3, Enedis is a very profitable enterprise at the moment, which allows its parent company EDF, highly indebted, to better balance its accounts [41]. Giving more power to local authorities by allowing them to change their distributor Enedis could have negative effects on these financial transfers. The strategy of EDF and Enedis, endorsed by the State, therefore consists in getting the distribution sector out of the liberalization process. In doing so, the risk of dismantling Enedis is eliminated, as local authorities are still forced to sign contracts with this company. This inability to use an alternative operator considerably limits the local bargaining power, in particular the amount of royalties paid to AODEs. This amount reached 316 million euros in 2014 [42], plus a part of local electricity taxes (400 million euros in 2011 [43]). These sums, very important, could increase if Enedis would be put in competition, especially in cities, the most attractive territories for distributors.

4.2. Public policies integrating energy

Local authorities have a little more room for maneuver with regard to public policies integrating energy (housing, planning, mobility, etc.), insofar as their action does not directly affect the industrial organization of the energy sector and the economic and financial strategies of EDF. In these areas, their action is even sought by the State, in particular by the ADEME and the DGEC, which seek to find local relays to implement their national objectives (reduction of GGE, efficiency energy, fight against fuel poverty, etc.). However, local intervention is not free of constraints, as other sectoral interests may oppose too radical measures in favor of energy. To take only the example of housing, the most emblematic, the issue of thermal renovation of buildings stumbles on the financing of measures, insufficiently provided by the State. Public and private landlords seek not to bear the burden of ambitious public policy alone, which could have a significant impact on real estate markets. As a result, they maintain a constant pressure on local authorities, so that they do not impose excessive regulations.

In these areas, it is rather indirectly, via planning tools, that local authorities are entering the game of energy regulation. If they can impose certain rules in housing (thermal consumption of new buildings, installation of photovoltaic panels) or in the development of new areas (production of renewable energies, buildings with high environmental quality), their action largerly involves the drafting of energy-climate planning documents at the regional (SRADDET) and local (PCAET) levels[15] (see appendix 1). These documents define the main strategic orientations of regions and cities, in terms of planning, mobility, development of renewable energies or housing policy. The major challenge, and the main obstacle to greater local intervention, lies in the financial capacities of local authorities. While these can create new economic tools (local operators, third-party finance companies, public-private partnerships), their room for maneuver remains limited. Over the past few years, their demands have focused on the proceeds of the "climate energy contribution", introduced in 2014 by the State to tax CO_2 emissions. Aimed at fuelling policies in favor of energy transition, it represents several billion euros that currently abound the general budget of the State. Shortly after it was set up, the main associations of local authorities demanded to receive a part of it, in view of their jurisdictions in the field of energy transition. But this request today stumbles on the veto of the Ministry of Finance, which seeks to keep the proceeds of the tax. This blocking shows that, despite the existence of levers of action higher than in the energy industry, local and regional authorities must cope with a system of dominant actors seeking to limit the effects of any decentralization.

[15] SRADDET: Schéma régional d'aménagement, de développement durable et d'égalité des territoires; PCAET: Plan climat air énergie territorial.

5. Discussion and conclusion

Since the 1990s, issues of decentralization in energy have (re) appeared on the political agenda in France. They are carried by more and more numerous and diversified actors, coming from the world of NGOs, experts and consultants, trade unions, associations of local authorities, economic operators but also State administrations. These actors, who have long been disregarded, mobilize economic, technical, political and social arguments that legitimize the implementation of alternative models of regulation of the energy sector, more anchored in the territories. In France, as in other countries, the academic world has echoed these initiatives by analyzing local projects, modes of territorial governance, the rise of decentralized energy, thus moving the center of gravity research questions from the national to the local level.

By replacing the action of local authorities in multi-level actors' games, we have shown, like other researchers [44], that it is necessary to move out of a purely "localist" focus of local intervention forms, to articulate it with other scales of regulation. Indeed, at a time when the legitimacy of a territorial approach is put forward by many actors, others develop ideas and strategies that are instead based on a stronger centralization. It is therefore important to reconcile academic fields that are often separate, between, on the one hand, those who analyse national public policies and their integration into larger regional institutions, such as the European Union (with authors not very sensitive to the territorial question; see the manuals on European energy policies), and, on the other hand, those studying the emergence of local solutions to the energy transition, in the assumption that it foreshadows profound transformations.

This article demonstrates that these two simultaneous dynamics come together to draw, in France, a new model of energy regulation, of hybrid nature. No more centralized as in the past, but not too much decentralized, it gives rise to a selective integration, by the dominant historical coalition, of local authorities. For that, this coalition can mobilize many resources, especially political (a certain conception of society and solidarity between citizens and territories) and economic (the weight of past choices in terms of production and industrial organization of the sector). The industry organization is still largerly locked, including distribution where local jurisdictions are most important. Public policies impacted by energy issues are more open to local authorities, but these actors do not really have all the levers, particularly financial ones, to act fully. Another distinction, quite close, can be done between generation and use of electricity. Although some actors would like to change the regulatory model, recent reforms tend to confine local authorities to a role of supporting new modes of energy consumption, in buildings and transport namely. In doing so, local authorities are weakened in their potential role of questioning the energy system, and instead are turning into relays of the state and large operators in the territories.

It is in this perspective that we must understand the reference to the title of this article, which insists on the elements of inertia due to the permanence of institutional games very anchored in history, and which can not be ignored in the analyzes on energy transition. Admittedly, technological innovations, such as the decentralization of the means of

production, have effects on regulatory regimes. But these cannot be studied in a univocal way, technical and institutional systems having links of reciprocal influence [45]. Similarly, the emergence of digital, in which some see the end of vertical and hierarchical systems [46], gives way to forms of differentiated appropriation, depending on the strategies of actors and the institutional frameworks. The example of France, one of the most centralized countries, offers a stimulating case study that can be tested in other countries with a more federal or decentralized tradition, in which the actions of territories and local authorities are also questioned.

Declaration of competing interest

None.

Appendix

The jurisdiction of the French territorial collectivities in energy-climate [a].

	Climat related jurisdictions	Production and distribution of energy			Energy demand management	
Région	Leader (*chef de file*) "Climate, air quality, energy and sustainable development of the territory" Planning for economic development, transport, climate, air energy and biodiversity (SRADDET) Agriculture (management of European funds)	Crowdfunding	Develop distribution networks Operate a renewable energy production facility	Regional biomass and wind schemes	Third party financing	Public service of energy efficiency Coordination of territorial platforms for energy renovation
Départements	Roads (*départementales*) Middle schools Transport of handicapped children			Energy distribution organizing authorities (AODE)		Leader (*chef de file)* "Fuel poverty"
Établissements publics de coopération intercommunale	Leader (*chef de file)* "Sustainable mobility and air quality" Development of several planning documents (PLU(I), PDU(I), PLH, SCoT,[b] PCAET)					Coordinator of the energy transition Management of energy renovation platforms
Communes	Leader (*chef de file)* "Sustainable mobility and air quality" Roads					Building permit

[a] Source: Réseau action climat, « Nouvelles compétences climat-énergie des collectivités territoriales », mai 2016, page 34 (according to a table from the French Ministry of the Interior).

[b] PLU(I): Plan local d'urbanisme (intercommunal); PDU(I): Plan de déplacement urbain (intercommunal); PLH: Programme local de l'habitat; SCoT: Schéma de cohérence territoriale.

References

[1] Poupeau F-M. Central-local relations in French energy policy-making: towards a new pattern of territorial governance. Environ Pol Govern 2014;24(3). https://doi.org/10.1002/eet.1637.

[2] Becker S, Naumann M. Energy democracy: mapping the debate on energy alternatives. Geogr. Compass 2017;11(8). https://doi.org/10.1111/gec3.12321.

[3] [a] Urban energy governance: local actions, capacities and politics. Energy Pol. 2015;(78) Special issue.[b] Sub-national government and pathways to sustainable energy. Environ. Plan. C 2017;35(7):1139–339. Special issue.

[4] [a] Rhodes RAW. Beyond Westminster and Whitehall: the sub-central governments of Britain. London Winchester, Massachusetts, USA: Unwin Hyman Allen & Unwin; 1988.[b] Marsh D, Rhodes RAW. Policy networks in British government. Oxford: Clarendon Press; 1992.

[5] International energy agency. World energy outlook. 2018.

[6] [a] Pickvance C, Préteceille E. Introduction: the significance of local power in theory and practice. In: Pickvance C, Preteceille E, editors. State restructuring and local power. A Comparative Perspective. London and New York: Pinter Publishers; 1991. p. 1–17.[b] Stoker G. Intergovernmental relations. Public Adm 1995;73(1): 101–22.[c] Thoenig JC. Territorial politics. In: Rhodes RAW, Binder SA, Rockman BA, editors. The Oxford handbook of political institutions. Oxford: Oxford University Press; 2006. p. 281–302.[d] Poupeau F-M. Analyser la governance multi-niveaux. Grenoble: Presses universitaires de Grenoble; 2017.

[7] [a] Rhodes RAW. *Beyond Westminster and Whitehall: the sub-central governments of Britain*. London Winchester, Massachusetts, USA: Unwin Hyman Allen & Unwin; 1988.[b] Marsh D, Rhodes RAW. *Policy networks in British government*. Oxford: Clarendon Press; 1992.

[8] Poupeau F-M. Analyser la governance multi-niveaux. Grenoble: Presses universitaires de Grenoble; 2017.

[9] Gabillet P. Les entreprises locales de distribution à Grenoble et Metz : des outils de gouvernement énergétique urbain partiellement appropriés. University of Paris Est; 2015. PHD Thesis.

[10] Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.

[11] Poupeau F-M. Le service public à la française face aux pouvoirs locaux. Les métamorphoses de l'État jacobin. Paris: CNRS Éditions; 2004.

[12] [a] Bulkeley H. *Cities and climate change*. London: Routledge; 2013.[b] Urban energy transitions: places, processes and politics of socio-technical change. Urban Studies 2014;51(7). Special Issue.[c] Energy Policy. Urban energy governance: local actions, capacities and politics. Special Issue 2015;78.

[13] [a] Simonnot P. *Les nucléocrates*. Grenoble: Presses universitaires de Grenoble; 1978.[b] Frost RL. *Alternating currents: nationalized power in France, 1946–1970*. Ithaca, N.Y: Cornell University Press; 1991.[c] Hecht G. *The radiance of France: nuclear power and national identity after world war II*. Cambridge, Mass: MIT Press; 1999.

[14] APE, Rapport d'activité 2016-2017, p. 40.

[15] RTE (Statistiques production, consommation échanges, 2018) and MTES (CGDD, Chiffres clés de l'énergie, Édition. 2018. p. 18.

[16] According to the IEA, nuclear power now accounts for only about 10% of global electricity generation (World Energy Statistics or Report, 2018). The growth rate of this industry is much lower than that of renewable energies.

[17] Based on data from the UFE (which does not take into account uranium imports to establish this balance).

[18] Simonnot P. Les nucléocrates. Grenoble: Presses universitaires de Grenoble; 1978.

[19] The idea that the nuclear industry offers the lowest prices is the subject of major controversies, namely around the cost of dismantling nuclear power plants. Despite this, the DGE and the MEDEF remain faithful, now, to their positions.

[20] APE, Rapport d'activite 2016-2017.

[21] *Ibidem*.

[22] Coutard O, Rutherford J. The rise of post-networked cities in Europe? Recombining infrastructural, ecological and urban transformations in low carbon transitions. In: Bulkeley H, Castan Broto V, Hodson M, Marvin S, editors. Cities and low carbon transitions. London: Routledge; 2011. p. 107–25.

[23] According to RTE (Reseau de transport d'electricite), the energy transition is expected to cost around 33 billion euros in France over 15 years (source : website of *Le Monde*, 17 septembre 2019).

[24] With a few exceptions, since only 5% of the French territory is served by local public companies, inherited from history.[a] Gabillet P. Les entreprises locales de distribution à Grenoble et Metz: des outils de gouvernement énergétique urbain partiellement appropriés. PHD Thesis. University of Paris Est; 2015.[b] Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.

[25] EDF, Document de référence 2018 incluant le rapport financier actuel, p. 457.

[26] Hecht G. *The radiance of France: nuclear power and national identity after world war II*. Cambridge, Mass: MIT Press; 1999.
[27] Brouard S, Gougou F, Guinaudeau I, Persico S. Un effet de campagne. Le déclin de l'opposition des Français au nucléaire en 2011-2012. Rev Fr Sci Polit 2013;63(6):1051–79.
[28] Topçu S. La France nucléaire. L'art de gouverner une technologie contestée. Paris: Seuil; 2013.
[29] Ibidem.
[30] [a] Pautard E. *Vers la sobriété électrique. Politiques de maîtrise des consommations et pratiques domestiques*. PHD Thesis. University of Toulouse II-Le Mirail.; 2009.[b] Pour mémoire. L'histoire des politiques de maîtrise de l'énergie en France. Special Issue15; 2015.
[31] ADEME, Artelys, Armines-Persee, Énergies demain. A 100% renewable electricity mix? Analyses and optimisations. Testing the boundaries of renewable energy-based electricity development in metropolitan France by 2050. January 2016.
[32] Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.
[33] In 2008, an IEA-OECD report estimated that urban areas account for about two-thirds of overall energy consumption (IEA, World energy outlook, 2008).
[34] Poupeau F-M. Quand l'État territorialise la politique énergétique. L'expérience des schémas régionaux du climat, de l'air et de l'énergie. Polit Manag Public 2013;30(4):443–72.
[35] [a] Poupeau F-M. La fabrique d'une solidarité territoriale. État et élus ruraux dans l'adoption d'une péréquation des tarifs de l'électricité en France. Rev Fr Sci Polit 2007;57(5):599–628.[b] Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.
[36] Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.
[37] Poupeau F-M. Le service public à la française face aux pouvoirs locaux. Les métamorphoses de l'État jacobin. Paris: CNRS Éditions; 2004.
[38] Gabillet P. Les entreprises locales de distribution a Grenoble et Metz: des outils de gouvernement energetique urbain partiellement appropries. PHD Thesis. University of Paris Est; 2015.
[39] Évrard A. *Contre vents et marées. Politiques des énergies renouvelables en Europe*. Paris: Presses de Sciences Po; 2013.
[40] Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.
[41] This does not mean that EDF can drain its subsidiary as it sees fit. Rules exist that govern Enedis' profits and prevent it and its parent company from abusing the monopoly position of Enedis. These rules are set by the CRE, which regulates the energy sector.
[42] Source: CRE.
[43] Source: Cour des comptes.
[44] [a] Emelianoff C. Local energy transition and multilevel climate governance: the contrasted experiences of two pioneer cities (Hanover, Germany, and Växjö, Sweden). Urban Stud 2014;51(7):1378–93.[b] Goldthau A. Rethinking the governance of energy infrastructure: scale, decentralization and polycentrism. Energy Res Soc Sci 2014;1:134–40.[c] Jaglin S. Urban energy policies and the governance of multilevel issues in cape town. Urban Stud 2014;51(7):1394–414. [d] Rohracher H, Späth P. The interplay of urban energy policy and socio-technical transitions: the eco-cities of Graz and Freiburg in retrospect. Urban Stud 2014;51(7):1415–31.
[45] Hughes TP. *Networks of power. Electrification in western society*. Baltimore: The John Hopkins University Press; 1983. p. 1880–930.
[46] Rifkin J. The third industrial revolution: how lateral power is transforming energy, the economy, and the world. London: Palgrave Macmillan; 2011.

Bibliography

Becker S, Naumann M. Energy democracy: mapping the debate on energy alternatives. Geogr. Compass 2017;11:8. https://doi.org/10.1111/gec3.12321.
Brouard S, Gougou F, Guinaudeau I, Persico S. Un effet de campagne. Le déclin de l'opposition des Français au nucléaire en 2011-2012. Rev Fr Sci Polit 2013;63(6):1051–79.
Bulkeley H. Cities and climate change. London: Routledge; 2013.
Coutard O, Rutherford J. The rise of post-networked cities in Europe? Recombining infrastructural, ecological and urban transformations in low carbon transitions. In: Bulkeley H, Castan Broto V, Hodson M, Marvin S, editors. Cities and low carbon transitions. London: Routledge; 2011. p. 107–25.
Emelianoff C. Local energy transition and multilevel climate governance: the contrasted experiences of two pioneer cities (Hanover, Germany, and Växjö, Sweden). Urban Stud 2014;51(7):1378–93.
Energy Policy. Urban energy governance: local actions, capacities and politics. Special Issue 2015;78.
Environment and Planning C. Sub-national government and pathways to sustainable energy. Special Issue 2017;35(7):1139–339.
Évrard A. Contre vents et marées. Politiques des énergies renouvelables en Europe. Paris: Presses de Sciences Po; 2013.
Frost RL. Alternating currents: nationalized power in France, 1946–1970. Ithaca, N.Y.: Cornell University Press; 1991.
Gabillet P. Les entreprises locales de distribution à Grenoble et Metz : des outils de gouvernement énergétique urbain partiellement appropriés. PHD Thesis. University of Paris Est; 2015.
Goldthau A. Rethinking the governance of energy infrastructure: scale, decentralization and polycentrism. Energy Res Soc Sci 2014;1:134–40.
Hecht G. The radiance of France: nuclear power and national identity after world war II. Cambridge, Mass: MIT Press; 1999.
Hughes TP. Networks of power. Electrification in western society, 1880-1930. Baltimore: The John Hopkins University Press; 1983.
Jaglin S. Urban energy policies and the governance of multilevel issues in cape town. Urban Stud 2014;51(7):1394–414.
Marsh D, Rhodes RAW. Policy networks in British government. Oxford: Clarendon Press; 1992.
Pautard E. Vers la sobriété électrique. Politiques de maîtrise des consommations et pratiques domestiques. PHD Thesis. University of Toulouse II-Le Mirail; 2009.
Pickvance C, Préteceille E. Introduction: the significance of local power in theory and practice. In: Pickvance C, Preteceille E, editors. State restructuring and local power. A Comparative Perspective. London and New York: Pinter Publishers; 1991. p. 1–17.
Poupeau F-M. Le service public à la française face aux pouvoirs locaux. Les métamorphoses de l'État jacobin. Paris: CNRS Éditions; 2004.
Poupeau F-M. La fabrique d'une solidarité territoriale. État et élus ruraux dans l'adoption d'une péréquation des tarifs de l'électricité en France. Rev Fr Sci Polit 2007;57(5):599–628.
Poupeau F-M. Quand l'État territorialise la politique énergétique. L'expérience des schémas régionaux du climat, de l'air et de l'énergie. Polit Manag Public 2013;30(4):443–72.
Poupeau F-M. Central-local relations in French energy policy-making: towards a new pattern of territorial governance. Environ Pol Govern 2014;24(3). https://doi.org/10.1002/eet.1637.
Poupeau F-M. Analyser la gouvernance multi-niveaux. Grenoble: PUG; 2017.
Poupeau F-M. L'électricité et les pouvoirs locaux en France (1880-1980). Une autre histoire du service public. Bruxelles: Peter Lang; 2017.
Pour mémoire. L'histoire des politiques de maîtrise de l'énergie en France. Special Issue 2015;15.
Rhodes RAW. Beyond Westminster and Whitehall: the sub-central governments of Britain. London Winchester, Massachusetts, USA: Unwin Hyman Allen & Unwin; 1988.
Rifkin J. The third industrial revolution: how lateral power is transforming energy, the economy, and the world. London: Palgrave Macmillan; 2011.
Rohracher H, Späth P. The interplay of urban energy policy and socio-technical transitions: the eco-cities of Graz and Freiburg in retrospect. Urban Stud 2014;51(7):1415–31.
Simonnot P. Les nucléocrates. Grenoble: Presses universitaires de Grenoble; 1978.
Stoker G. Intergovernmental relations. Public Adm 1995;73(1):101–22.
Thoenig JC. Territorial politics. In: Rhodes RAW, Binder SA, Rockman BA, editors. The Oxford handbook of political institutions. Oxford: Oxford University Press; 2006. p. 281–302.
Topçu S. La France nucléaire. L'art de gouverner une technologie contestée. Paris: Seuil; 2013.
Urban Studies. Urban energy transitions: places, processes and politics of socio-technical change. Special Issue 7, 2014;51.