

SONNET – SOCIAL INNOVATION IN ENERGY TRANSITIONS

Co-creating a rich understanding of the diversity, processes, contributions, success and future potentials of social innovation in the energy sector

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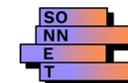
Research report on ‘Local electricity exchanges’ in France



With courtesy of Enagrid



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About SONNET: SONNET is a research project that aims to develop an understanding of diversity, processes, contributions and future potential of social innovation in the energy sector. It is co-funded by the European Commission and runs for three years, from 2019-2022. The SONNET consortium consists of 12 partners across Europe, including academics and city administrations. For more information, please visit our website: <https://sonnet-energy.eu>

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1 FOREWORD

SONNET (Social Innovation in Energy Transitions) brings diverse groups together to make sense of how social innovation can bring about a more sustainable energy sector in Europe. The project aims to co-create a rich understanding of the diversity, processes, contributions, successes and future potentials of social innovation in the energy sector (SIE). We define SIE as combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy. As part of this work, we make use of an embedded case study approach to build a better understanding of the development of diverse SIE-fields (e.g. participatory incubation and experimentation, framings against specific energy pathways, local electricity exchange) over time. Our research questions that frame the case study work are:

- How do SIEs and SIE-fields emerge, develop and institutionalise over time?
- How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?
- What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

A SIE-field is an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this arena/ space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests. An example: The UK cooperative energy field includes SIE-initiatives and SIE-field-actors (e.g. Brighton Energy Co-op, Cooperative UK, Community Energy England, UK Government, City of Brighton), who have a shared understanding of an SIE, which exists as 'organising under cooperative principles to generate renewable energy'.

The structure of this report is as follows. Section 2 provides a summary of the SIE-field relevant for this report and lists some key insights. Section 3 outlines the boundaries of the SIE-field and shows how it has been studied in the country context. Section 4 shows a visual development of the SIE-field. Section 5 tells the historical development of the SIE-field over time, including analytical/ interpretive reflections from the SONNET researchers and quotes from the actors involved in the field developments. Section 6 outlines key research findings, providing answers to the three research questions. Section 7 outlines recommendations for policymakers based on the findings. Finally, Section 9 outlines the methodological approach and includes a more detailed timeline of the SIE-field and its actors.

2 Local electricity exchanges

In SONNET, we investigate the development of the SIE-field called 'Local electricity exchanges'. Within 'local electricity exchange', we will look at multi-actor collectives that experiment with and implement local/ regional 'exchange' (i.e. this includes production, consumption and distribution (and sometimes trading) of renewable energy, whilst being connected to the national grid. They develop novel financial, business model, institutional and technological (digital) innovations within trials and/ or commercial endeavours where multiple non-traditional energy players are actively/ consciously engaging with each other to enable local/ regional 'exchange' of renewable electricity. Reasons for these endeavours can vary e.g. decentralised electricity production, empowerment of local actors, fighting energy poverty etc.. In France, local electricity exchanges refer to three types of endeavours: non-nationalised distributors, collective self-consumption and local PPA - novel contracts supplying locally produced renewable electricity to a predefined group of customers. This report concentrates on the last two that emerged recently.

Key insights

For the SONNET project, *LOCAL ELECTRICITY EXCHANGE (LEE)* is particularly interesting because it reveals a number of important issues for social innovation in energy transitions. In particular, it illustrates that:

- In the French context, LEE can take place in three ways. 1. They can take place in one of the non-nationalised distributors, which have been excluded from the centralisation process that led to the creation of national champion EDF. 2. LEE can take place in projects of collective self-consumption. The definition and support mechanisms for these projects are very strictly regulated. 3. LEE can also take place through local corporate power purchase agreement (PPA). In local PPAs, an electricity supplier facilitates exchanges between a renewable energy production capacity and consumers living in the vicinity of this capacity.
- LEE are contested on mainly three aspects. First, established actors contest the benefit of organising energy locally (as opposed to centrally as is the case today). Second, what characterises a local exchange is subject to various interpretations and the term local has been ambiguously used by alternative green suppliers. Third, LEE, when they require important digital and juridical innovations, are criticized for requiring a level of complexity that surpasses their potential benefits.
- LEE are strongly dependent on the legal framework that determines what is legally possible and financially viable. Current legal framework remains technically and juridically constraining, impeding the emergence and development of LEE.
- Energy decision-making in France is strongly influenced by established actors and LEE actors lack countervailing power to obtain further simplifications of the legal framework.

- Market dynamics around green electricity has strengthened. Ongoing discussions about a label represent an opportunity to valorise LEE by including local production criteria.
- To legitimise their contribution to the energy transition, LEE will have to prove that they can foster subsidies-free investments in renewable energy capacity, contribute to lowering local carbon foot-print, contribute to decreasing network costs, and encourage behavioural changes needed to decrease overall energy consumption.

3 Introduction to 'local electricity exchanges' in France

This report investigates the emergence of local electricity exchanges in France. In accordance with the SONNET case studies on this topic in Switzerland and the United Kingdom this studies defines LEE as multi-actor collectives (including multiple non-traditional energy players) experimenting with and implementing novel financial, institutional, technical (digital) and business model innovations to enable grid-connected local/regional renewable energy exchange (which includes production, consumption, distribution and sometimes trading of energy). The aims of the initiatives and other activities related to LEE is to achieve a greater penetration of renewable energy into current energy systems and to reform an electricity market, which used to be seen, at least in France, as a field monopolised by one national champion, EDF. Local electricity exchanges in France take three forms. The first corresponds to non-nationalised distributors, which have been excluded from the centralisation process that led to the creation of national champion EDF. The second takes the form of collective self-consumption. This form is strongly regulated and allows a legal entity to build renewable energy capacity (usually rooftop solar PV) and supply locally produced electricity to customers located right next to the renewable power plant. Legal entities are often a municipality, a social housing corporation and sometimes a renewable energy cooperative. They can supply electricity without requiring a supplier license. The third type of LEE takes places through local power purchase agreement (PPA). These local PPAs are organised by electricity suppliers that propose to their customers to consume electricity produced near their place of residence. To do so, the electricity supplier creates direct contracts with renewable electricity producers and reserves this electricity to a limited number of customers located in the same or a neighbouring municipality. This report focuses on the last two forms of local electricity exchanges, both on which have recently emerged in the French power sector. Both types of LEE benefit from a growing interest in the idea of decentralization and territorialisation of electricity in France (Poupeau, 2020). To differentiate themselves from standard renewable electricity offers, organisations that propose local electricity exchange often frame their offer as one that gives the possibility to organise “circuit court de l’énergie” or local energy flows in English. This concept of “circuit court” is an analogy to the concept of local cycle common in the food sector and that refers to customers consuming food that is produced in their surroundings and by farmers they are able to identify. Moreover, both forms of local electricity exchanges are developed based on the argument that they can generate benefits locally. Some actors put forward the possibility to generate revenues locally. For instance on the website of energy supplier Planète Oui we can read: “Knowing where your electricity comes from and choosing the producer next door is like supporting the farmer in your area”. LEE can also be a way for consumers to gain more control and visibility over their electricity bill. Specific to local PPAs, is the argument that they can be a way to develop subsidy-free renewable energy capacity. Finally, some interviewees also explained that some project initiators see an interest in developing projects of collective self-consumption to “fight energy poverty, as a means to solve a social problem” (Interview FR-LEE-SIEFIELD-1). Finally, in rural areas especially, creating local electricity exchanges is seen as a way to solve problems due to network instabilities (network fails more often in rural areas located at the end of the grids). This is illustrated by the following extract taken from ACOPREV’s website: “We are at the end of the line, at the edge of the network. This leads to interruptions, but more importantly, difficult maintenance, especially since the overhead lines are subject to high winds. Producing the energy needed for the village's consumption

ourselves would therefore offer a simple solution to secure important functions, such as the cold rooms of the local cattle farmers” (ACOPREV, 2020).

In this report, we study the emergence of local electricity exchanges from 2015 onwards. The Energy Transition Law for Green Growth (LTECV) adopted in 2015 stipulated, among others, the necessity to create a legal framework to allow collective self-consumption. This legal framework represented a stepping stone in the emergence of local electricity exchanges in France (Lormeteau, and Molinero, 2018). In April 2020, 30 collective self-consumption initiatives were operational. More than half were led by municipalities and about a quarter by social housing corporations (Enedis, 2020). Regarding local PPAs developed outside of the legal framework for collective self-consumption, the first offers started to be commercialised in 2019 by electricity suppliers such as Enercoop or Planète Oui.

Local electricity exchanges interest a range of actors. We have already mentioned municipalities, housing corporations (e.g. Gironde Habitat, Soliha), energy suppliers (both established ones such as EDF or Total Direct Energie and more recent and/or alternative ones such as Planète oui, or Enercoop) and renewable energy cooperatives (e.g. Acoprev). Other actors that are interested include firms from the real-estate sector (e.g. Linkcity), supermarkets (e.g. Biocoop). In this field, we also find a number of intermediary organisations that provide advice and support to those who want to initiate a local exchange of electricity (e.g. Tecsol or Greenflex). We also find firms that propose innovate tools to facilitate data management of collective self-consumption projects (e.g. Sunchain or Enogrid). Another important stakeholder is the national distribution system operator (DSO) Enedis as well as local DSOs (e.g. GreenALp). (local) DSOs act as trusted third party by making data about local energy production and consumption available to stakeholders in the projects. Moreover, the Commission de Régulation de l’Energie (CRE) also plays a key role in defining the legal framework surrounding local electricity exchanges. Finally, whether and how fast local electricity exchanges can be developed is a political subject. This is why in this field we also find various organisation that lobby the government for more favourable conditions such as Enerplan (that represents the interest of actors from the PV sector), FNCCR (that represents the interest of municipalities specialised in public services), la Plateforme verte or Hespul (two associations that supports the energy transition). Moreover, evolution of the legal framework also depends on the individual initiatives of two deputies at the national assembly.

In this report, we analyse two initiatives of local electricity exchanges in more detail. The first one is a project initiated by the French national DSO Enedis together with the municipality of la Motte Servelex. The municipality of la Motte Servelex is locally known for being prone to innovate and was for this reason contacted by Enedis to conduct the first collective self-consumption project in the department of Savoie. The second initiative is the partnership between Planète Oui and Valorem to offer a local electricity supply contract.

To conclude, local electricity exchanges are innovative mainly for two reasons. First, they allow relocating electricity production closer to consumers and hold the potential to better align electricity production capacities to local electricity needs. This is illustrated by the following quote: “what is virtuous in the logic of local self-consumption is to minimize the costs and network investments and to produce in relation to the real needs of the territories” (Interview FR-LEE-SIEfield-5). Second, local electricity exchanges also allow reinventing people’s relation with electricity, creating an emotional bound with the electricity they produce. As explained by one of the initiators, “knowing where energy is produced and consumed

allows re-appropriating the territory” (interview FR-LEE-SIEI-1). By territory, interviewees refer to the place where people live, a place that has its own history and identity. This links to more global trend, as there seems to be an increasing interest for local or even hyper-local products (YouGov, 2019).

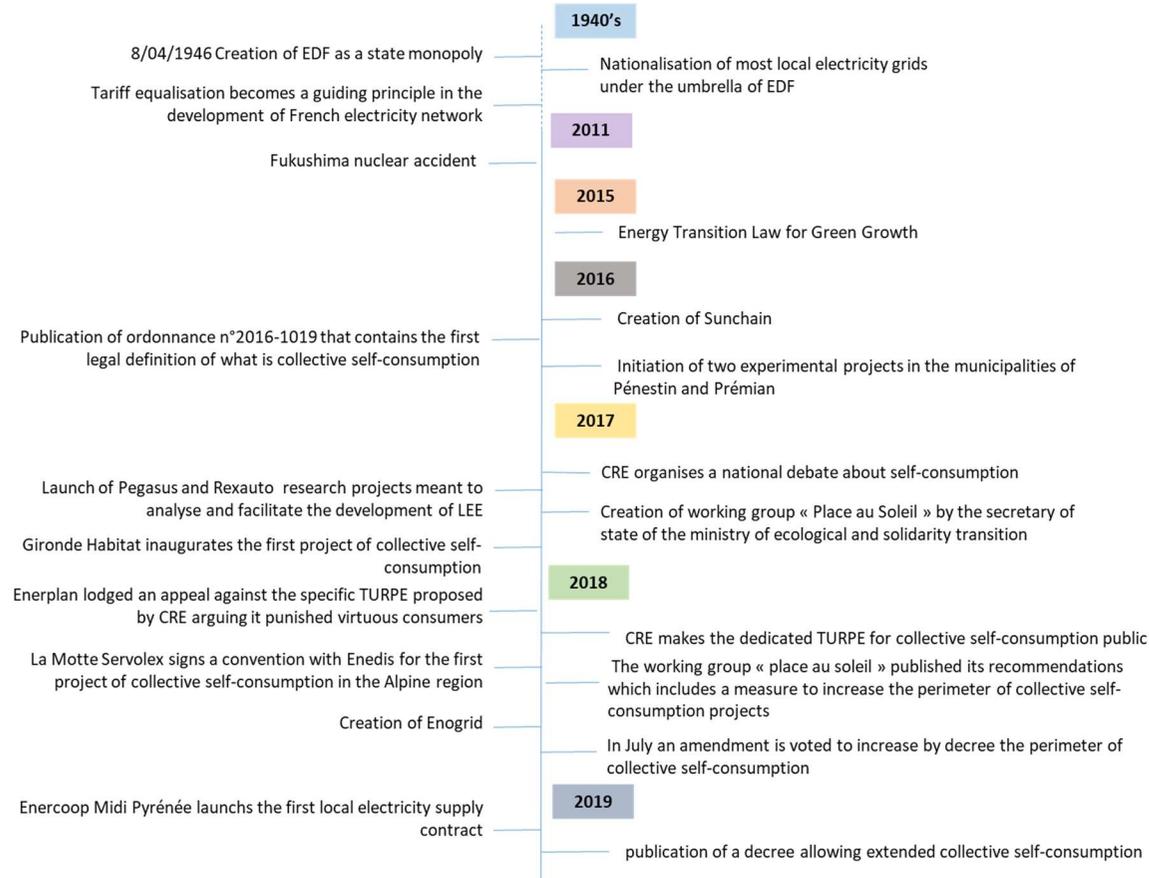
SIE changing social relations

In SONNET, we define a social innovation in energy (SIE) as a combination of ideas, objects and/or actions that changes social relations and involve new ways of doing, thinking and/or organising energy. In this report, we focus on local electricity exchanges (LEE) which refers to multi-actor collectives (i.e. including multiple non-traditional energy players) experimenting with and implementing novel financial, institutional, technical (digital) and business model innovations to enable grid-connected local/ regional renewable energy exchange (must include production and consumption and distribution (and sometimes even trading)).

LEE are organised in order to empower producers and consumers to organise electricity locally and between peers. What is innovative about this type of SIE is first that LEE represent another way of doing electricity. These exchanges are actually often referred to as peer-to-peer exchanges. It is important to highlight that the peers can be quite heterogeneous in their size (they are not limited to small producers/consumers) and in their legal structure (they do not have to be individuals but may also be private firms). Moreover, peers does not have to be prosumers: an entity that simply consumes power can also take part in a LEE exchange. As explained by one interviewee: “it is the local cycle of energy – in French le circuit court de l’énergie) (Interview FR-LEE-SIEFIELD-6). LEE promote the decentralisation of electricity production and the scaling electricity production facilities as close as possible to local electricity needs. Moreover, by proposing a new way of doing electricity, LEE also influence how people think about electricity. Electricity stops being a low interest product (Fischer, 2008) but instead becomes something one can emotionally relate to (see for instance Vernay & Gauthier, 2017).

4 Timeline of local electricity exchanges

This timeline presents the main events identified and that marked the emergence and development of LEE in France.



5 Emergence and development of *Local energy exchanges* over time

Phase 1: a centralised electricity production

At the onset of the electricity system, local electricity energy exchanges were the norm. Electricity networks in France were developed and managed by hundreds of local actors (private firms, cooperative and municipalities). These networks were hardly interconnected and access to electricity was heterogeneous (Defeuilleux, 2001). After the second world war, the electrification of the entire country became a priority for the French government. The law for the nationalisation of electricity and gas of the 8th of April 1946 initiated a large wave of nationalisation that led to the creation of French national champion EDF (Electricité de France). This is when the production, distribution and supply of electricity started to be organised centrally. This did not fully put an end to local exchanges of electricity as some municipalities chose to create DNN (non nationalised distributors) in order to maintain local control on energy related decision-making. In 2007, there were still 157 DNN distributing 5% of French electricity, the remaining 95% being controlled by EDF (Allemand, 2007). These DNN fit our definition of LEE if most of the energy they supply is also produced locally. Moreover, a hundred or so sites including airports, ports, large industrial sites or hospitals also kept closed networks managed independently from Enedis within the site (Observatoire de l'Industrie Electrique, 2017a). No dedicated regulatory framework existed to supervise the functioning of these closed networks. We will however not focus on these types of LEE in this report – the first is not innovative and the second concerns very few projects.

For decades the core priority remained providing French people access to affordable and reliable electricity with as core guiding principle the notion of tariff equalization: disregarding where people lived (in the centre of Paris or in an alpine village), people should pay the same price to access electricity (François-Mathieu Poupeau, 2007). The principle of tariff equalisation is in place for the whole country since the 1980's and is presented as a symbol of solidarity between regions (Observatoire de l'Industrie Electrique, 2017b). Moreover, French energy policy as long been based on an industrial policy aiming at strengthening the national energy champion EDF (Andriosopoulos & Silvestre, 2017).

Electricity sector is for this reason extremely centralised and citizens have long been (or felt) excluded from energy decision-making (Bauby & Boual, 1994).

The 2012 presidential election following the Fukushima incident initiated a shift in energy policy by setting as goal to reduce the share of nuclear power in the electricity mix to 50%. However, French energy system stayed subject to institutional inertia and resistance from incumbents like EDF. As a consequence, no concrete measures are taken to reach the nuclear energy reduction objective (Andriosopoulos & Silvestre, 2017; Aykut & Evrard, 2017).

Regulative, normative and/ or cultural cognitive institutions

Scott (2014: 56-57) defines institutions as comprising “regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life... Institutions are multifaceted, durable social structures, made up of symbolic elements, social activities, and material resources”.

Regulative institutions refer to rules, laws, policies, standards that guide “action and perspectives by coercion or threat of legal sanction” (Hoffman 1999). The energy sector is highly regulated and in France, regulative institutions impede the development of local electricity exchanges by imposing a regulatory framework that strongly limits the economic attractiveness of local electricity exchanges projects. As explained by an interviewee: “there is a tremendous untapped potential because the CRE has put the brakes on for fear that it [referring to collective self-consumption] might get out of hand” (Interview- FR-LEE-SIEFIELD-1). The stated objective is to allow for a controlled development of local electricity exchanges projects in order to avoid that they endanger an already well-functioning electricity system (it is reliable, it has low carbon emissions, it provides affordable electricity).

Normative institutions refer to norms and values and “what is considered appropriate behaviour and can be directed at all actors of a particular field” (Scott, 2001). In the French energy sector it is the norm and value of technical elite stemming from like-minded engineering schools (Ecole des Mine, Ecole polytechnique (known as X)) that dominate. These norms and value are based on a productivist approach favouring centrally manage nuclear power. They impede the development of local electricity exchanges that aim for a decentralised electricity system where the design and operation of production assets should reflect local needs and be managed at least in part locally.

Cultural cognitive institutions refer to shared conceptions of reality, binding expectations, common beliefs that frequently become routine ways of understanding the world. French energy sector is strongly influence by the guiding (and also sacred) principle of tariff equalization. Initiatives that aim at promoting local electricity exchanges are often criticised for trying to brake this very cherished principle. Moreover, attempt at organising electricity locally is criticized for being self-centred. To legitimate their actions, actors that support LEE are developing counter narratives to convince that organising locally makes sense and even creates possibilities to develop new forms of solidarity between consumers.

Phase 2: a first legal framework to allow experimenting with local electricity exchanges

Over time, renewable energy technologies gained maturity and their price decreased so much that they started to reach what is called grid-parity. Grid parity refers to a situation where it is as costly for consumers to produce electricity themselves,

as it is to buy electricity from the grid. This means that renewable energy technologies are becoming more and more attractive for individual consumers who may want to produce their own electricity. This techno-economic maturity opens opportunities for individual producers and consumers to create new forms of relations with one another. This also makes it possible to question whether the centralised electricity system developed after the second world war is still the most adequate to allow a transition to a sustainable electricity system or if a decentralised electricity system based on LEE would be more appropriate to facilitate this transition.

A strong societal trend... that raises multiple questions

The data collected to conduct this case study reveal that in 2017 already there was a consensus around LEE being an important societal trend. An interviewee explained that LEE are “the meaning of history” (Interview FR-LEE-SIEFIELD-8), another that LEE “are a first step towards a new model because it is an expectation of citizens” (interview FR-LEE-SIEFIELD-7). This trend is recognized also by actors that are not in favour of their widespread development. A member of the board of directors of RTE (the transmission system operator) for instance stated, “it is not a hype it is a fact” (Piechaczyk, 2017). Similarly, the head of the CRE argued: “the effect of the development of self-consumption in the coming decades is underway and will profoundly change our energy landscape” (Carenco, 2017).

While actors in the electricity system are conscious that this trend can only get stronger in the future, they are also concerned about the impact this trend may have on the electricity system. The president of CRE for instance published a tribune where he wrote that it is crucial “to examine the consequences that development of self-consumption will, or could have, on the French energy model, particularly in terms of tariffs” (Carenco, 2017). The necessity to ensure that LEE would not disturb the well-functioning of French electricity system has actually been included in article 119 of aforementioned LTECV. The article stipulates the necessity “to implement the measures necessary for the controlled and secure development of facilities intended to consume all or part of their electricity production” (article 119 of the law n°2015-992 of the 17th of August 2015). One important question mark concerns the financial sustainability of Enedis - the national distribution grid operator - and more specifically making sure that collective self-consumption does not lead to unfair grid tariffs to the detriment of those who cannot participate in such a project (Piechaczyk, 2017). As explained by an interviewee, the ambition is not “to shake up a model but instead to construct while respecting the transition from one model to the other” (Interview FR-LEE-SIEFIELD-7).

A legal framework for collective self-consumption

Recognising growing societal interest in LEE, French government ratified the Energy Transition Law for Green Growth (LTECV) in 2015 which stipulated the need to create a regulatory framework for collective self-consumption (Lormeteau & Molinero, 2018). This framework should include two elements: the definition of what can be legally considered as collective self-consumption and the definition of the tariff for using the distribution grid (known as TURPE in French) that should be applicable to projects of collective self-consumption. Both aspects have been source of intense discussion and contestation.

To begin with, the first definition of what can be considered as collective self-consumption was published in July 2016 (ordonnance n°2016-1019). This definition introduced two important elements. First, from a governance point of view, producers and consumers should be organised around a single organising legal entity (called PMO in French) (Commission de Régulation de l'Énergie, 2019). To facilitate the emergence of projects, it was decided that this legal entity would not have to meet standard regulatory constraints normally applicable to an energy supplier (e.g. the obligation of proposing a contract valid one year or to allow people to terminate their contract anytime without having to pay a fee). This however means that consumers participating in a collective self-consumption project are less protected than other consumers (CRE, 2019). Nevertheless, an important activity for the PMO is to sign a convention with Enedis. Among others, this convention defines the technical characteristics of the project (i.e. its perimeter), identifies the participants, defines the obligation of the PMO and of Enedis in the project and specifies the so-called distribution key (i.e. is the electricity produced shared equally among participants or is it adapted to each participant's consumption profile).

The second element was based on a technical characteristics and stipulated that producers and consumers should all be located downstream of the same medium to low-voltage transformer station. As argued by CRE, this came with the advantage that projects of collective self-consumption could be used to improve the dimensioning of the distribution grid (Commission de Régulation de l'Énergie, 2019). In practice, it meant that collective self-consumption was limited to projects taking place within the same building.

Regarding the TURPE, the president of the CRE explained to a journalist: “we are gargling with self-consumption. The CRE is seized for the tariffs. We decided not to hurry to set the famous Turpe (Tariff for the Use of Public Electricity Networks)” (L'Usine Nouvelle, 2017). We will see that it will take another two years before CRE would published the TURPE applicable to collective self-consumption project. Until the CRE had defined which specific tariff would best reflect the cost incurred by collective self-consumption project on the grid, projects could still be developed based on a standard classification.

'Outside' institutional environment shaping the development of the SIE-field

When talking about the SIE-field of LEE, we refer to the space composed of SIE-initiatives (local manifestation of LEE such as the collective self-consumption project of La Motte Servolex or local electricity supply contract of Planète oui), SIE-actors (municipalities, housing corporation or renewable energy communities that actively work on SIE) and SIE-field actors (individuals, organisations or collective that are part of the field and may enable (e.g. Enerplan or technology provider) or impede (e.g. CRE) the SIE). In this space, actors take one another in consideration and have a shared understanding of what the SIE is (even though it may not be consensual) and of their relation to other actors. In the SIE-field, actors also follow similar formal and informal institutions. The SIE-field institutional environment is embedded in a larger encompassing institutional environment. This is what we refer to when talking about the 'outside' institutional environment.

The 'outside' institutional environment of LEE has shaped the development of this field in various ways. First, regulations are inspired by the logic present in regulations pertaining to the energy sector as a whole. Moreover, regulations are always about finding a trade-off between giving some space for the LEE SIE-field to develop without risking unsettling the outside institutional environment and compromising the interest of actors in the prevailing energy field. Second, the 'outside' institutional environment sees LEE as initiatives that aim at contesting the core identity and values of French electricity system and reject these initiatives and tries to delegitimise them.

A national debate on the possible impact of self-consumption on French electricity system

This is why the CRE decided to organise a large concertation in order better grasp the impact LEE (self-consumption especially) could have on the electricity system in order to design the most adequate legal framework. This public consultation on the broader theme of self-consumption (individual and collective) started on the 12 of September 2017 with a conference debate. Participants were very diverse and represented all actors in the value chain (energy suppliers, like EDF, Engie or Direct Energie, equipment provider like Schneider, real-estate developer like Bouygues Immobilier, lobby organisation like Enerplan and FNCCR, network operation Enedis and RTE, and a mayor).

For the president of CRE, this event was important because it is crucial to "reflect together on whether the inevitable development of self-consumption can be controlled for the benefit of all, or whether, on the contrary, it will lead us to question the values of equity and solidarity that have luckily underpinned our energy model since 1946" (Carenco, 2017). For supporters of LEE, this event became "the big operation to scare because self-consumption was going to become the tsunami that would overturn the French electrical system" (Interview FR-LEE-SIEFIELD-1).

What clearly transpired from the discussions and debates is that actors against are using prospective models to present numbers that show how deastrous an uncontrolled development would be. They use these numbers to argue that experimenting with LEE should be controlled and slowed down. Actors supporting LEE are left arguing that it is much too early to prevent experimentations and that if we do not leave space for experimentation, we could never evaluate the potential benefit of project.

In February 2018, CRE published a deliberation summarizing the organisation's recommendation for self-consumption. This deliberation confirmed the need to set-up a specific TURPE for collective self-consumption. The CRE also reiterated that the organisation is not favourable to enlarging the perimeter for collective self-consumption and for exempting project from paying the electricity tax known as CSPE (Commission de Régulation de l'Energie, 2018a).

First experimentations made possible by regional, national and European support

When the first projects were initiated, many uncertainties remained and as expressed by an interviewees, all the actors involved "discovered as they walked" (Interview FR-LEE-SIEI-1). This probably explains why the first projects were realised in the framework of dedicated experimental projects supported by local public authorities and conducted by pioneers. In

2016 for instance, the municipality of Premian in the south of France benefited from a specific convention with the ministry of ecology, sustainable development and energy that covered 80% large part of the costs incurred in buying the technology. This project was the first to experiment with blockchain technology to trace and administratively distribute the power that is generated between the participants of the collective self-consumption project (EnergyStream, 2019). Another pioneering project, Partagelec, was realised in the municipality of Pénestin in Brittany with the financial support of a number of local and regional institutions. It was the first project of collective self-consumption in France that brought together public and private actors (Morbihan Energies, 2018). These two projects are very often presented as examples in public presentations about collective self-consumption. Moreover, Region Nouvelle Aquitaine launched in 2017 a project called Rexauto financially supported by the European Union. Rexauto was meant to foster experimentation with (collective) self-consumption with as main objectives to understand and evaluate the impact of such project on the grid and to build an expertise in order to better support organisations interested in setting up a (collective) self-consumption project (Rexauto, 2017). The very first French project of collective-self- consumption took place within Rexauto and was realised in the city of Bordeaux by the social housing company Gironde Habitat (Enedis, 2017). In Rhône-Alpes Region, the Interreg project Pegasus launched in 2017 was meant to facilitate the development of renewable energy in rural or insular areas through the development of micro-grids. Pegasus supported Acoprev in developing the project of collective self-consumption in the rural village of Saint Julien en Quint (AURAE, 2019). Acoprev has as initial objective to cover 20% of local energy needs (ACOPREV, 2020). The achievements and ambitions of Acoprev to strive to consume 100% renewable energy produced locally convinced the regional energy transition club to select this project as one of the three laureates for the trophée for the energy transition in 2019 (Tenerrdis, 2018).

Make due with a constraining legal framework

When talking with project initiators, it became clear that there was a gap between what was written in the text and what happened in reality and that there was a lack of alignment between actors. In La Motte Servolex for instance, the project initiated by the municipality under the impulse of Enedis was delayed for months. During an interview, the representatives of the municipality explained that the supplier, as balance responsible, can decide to take or to refuse a project. In their case, EDF, the supplier that the municipality had always worked with, had refused theirs. The mayor further explained: “we had the argument to say: we don't understand anything between you at the local level that has pushed us into this innovation saying “Super you are going to be the first in all the Savoie and the Alps”. And then you at the national level tell us “we don't know” (Interview FR-LEE-SIEI-1). For a few months, representatives of EDF and Enedis went back and forth trying to find a solution so that the project could become operational. The mayor further explained: “it seemed obvious to us that between little brother and big brother they would do their business with together. It seemed natural, but it wasn't” ((Interview FR-LEE-SIEI-1) (here the interviewee refers to the fact the Enedis is subsidiary of EDF). EDF, Enedis and La Motte Servolex found a suitable compromise when the decree validating that the perimeter could be enlarged was signed. This decree made it possible to include more buildings in the collective self-consumption project. This way “we became eligible

because EDF thinks that we will not have any surplus to sell" ((Interview FR-LEE-SIEI-1) and that EDF would not have to administrate this surplus, removing some administrative constraints.

Moreover, because the perimeter was so constraining, project initiators looked for loopholes in the law to be able to realise their projects. One illustrative examples if that of Valsophia. This project concerned the construction of four tertiary buildings, a shaded parking and included the development of 1600 m2 of photovoltaic panels. Construction started in 2014 with as objective that part of the electricity produced on site would be self-consumed. When asking for grid connection, the real-estate developer asked for a single grid connection, a small closed network would be constructed within the site between the buildings and the shaded parking. Enedis refused the developer's demand arguing that it "was tantamount to an illegal retrocession of energy and infringed ENEDIS' legal monopoly to ensure the distribution of electricity produced on the site" (Seban & Associés, 2017). This initiated a legal dispute that. If Valsophia would win the case, it would make more projects of collective self-consumption possible by developing small private closed network. For this reason the dispute was closely followed by project developers. In septembre 2018, the regulator comforted Enedis's position. As explained by an interviewee: "it was a kockout from the CRE" (Interview FR-LEE-SIEI-pre1). It meant that projects initiators that ambitioned to do something similar would have to reconsider their plans. This dispute also pushed the regulator to clearly define the conditions under which a closed network can be developed in the prescription n°2016-1725. This definition excludes projects that are targeting residential users. As explained by an interviewee: "CRE reminds us of something that is very important to that which is that an inhabitant has a right that we cannot take away from him/her which is to have free access to any supplier. This means that for all buildings that have as objective to supply residents, the DSO should own the grid up to the apartment" (Interview FR-LEE-SIEI-pre1).

Introduction to the SIE-initiative of la Motte-Servolex

In 2018, the municipality of la Motte-Servolex plans to renovate the municipal theatre and considers installing PV panels (24kwc) on the roof and applying for a scheme of individual self-consumption. The municipality, known locally for being prone to innovate, was contacted by Enedis to experiment with collective self-consumption instead. This would allow the electricity produced on the roof of the theatre to be consumed by more public buildings nearby. For Enedis it was an opportunity to experiment locally with collective self-consumption. In a brochure addressed to local stakeholders, it is stated that "Enedis facilitates self-consumption". However, to be able to really facilitate project, Enedis also had to gain in expertise on this subject.

The municipality welcomed the proposition of Enedis. The mayor explained seeing it as an opportunity "to re-appropriate energy in line with the idea of local energy cycles, of proximity" (Interview FR-LEE-SIEI-1). Moreover, it was also an opportunity to lead by example and encourage others to innovate in the same way they had done already ten years ago when they had been experimenting with LED lighting or more recently on the topic of hydrogen mobility. Because the municipality would be the unique producer and consumer, the municipality could be the PMO (legal entity that organises collective self-consumption). Moreover, the project could benefit from state funds under a

scheme known as TEPOS (TEPOS encourages regions to built renewable energy capacity) which covered part of the costs incurred by the renovation and the PV installation.

Early 2019 a convention was signed between the municipality and Enedis. It was the first of the kind in the Savoie department (Enedis, 2019). Signing a convention with Enedis (or a local DSO) is necessary to officially define the perimeter of collective self-consumption, the way energy produced is shared between the participants and other contractual obligations of both parties. The initial project concerned two buildings, both connected to the same medium to low tension transformer as required by the initial legal definition of collective self-consumption.

The project however still had many hurdles to overcome before it could be operational. First, the municipality found out that consultancy firms were not at all aware of the scheme. As explained by a representative of the municipality in an interview: *“nobody knew where we should connect what. To the point that we were told that what we wanted to connect to the grid was totally impossible because it did not exist”* (Interview FR-LEE-SIEI-1). Moreover, neither the municipality nor local representative of Enedis had expected that EDF would refuse the project. EDF as electricity supplier of the municipality should agree to take on the surplus produced by the PV installation. EDF refused arguing that the project was too small. As explained by the mayor during an interview: *“we had local representatives that were proposing something and a national commission that did not know us because we were too small and belonged to a box that did not exist before”*. The municipality experienced that *“EDF and Enedis were not at all aligned”* (Interview FR-LEE-SIEI-1).

It is only when the perimeter of project was enlarged to 2km and that the municipality could include in the scheme additional buildings including a school, a residence for seniors, and a municipal kitchen that the project was accepted by EDF *“because they think we will not have any surplus”*.

It is interesting to mention also that when we conducted the interview in the summer, collective self-consumption unit was operational for a few months already. However, the municipality of la Motte Servolex still had not seen self-produced electricity being deducted from their electricity bill. According to one interviewee: *“Enedis does not have up to date tools yet”*. As nicely formulated by one interviewee, *“even those promoting the realisation are discovering as they walk”* (Interview FR-LEE-SIEI-1).

To summarize, the LTECV made the emergence of LEE and more specifically collective self-consumption projects possible in France. However, the chosen legal framework was very constraining – the initial definition strongly limited the size of projects and there were still many uncertainties regarding the TURPE that would apply. This resulted in very few projects actually taking place. By the end of 2018, Enedis reported 8 operational projects of collective self-consumption in France (taken from (SiaPartners & Enerplan, 2019). As will be discussed in the next phase, this definition has been criticised for being too constraining and for not being aligned with the reality of urban projects.

Phase 3: LEE gain experimental space but remain constrained

A working group meant to “free” solar energy

For a few years, actors involved in the solar sector had been lobbying for the creation of a working group that should make recommendations to support the development of solar energy in France. In December 2017, M. Lecornu, state secretary for the ministry of ecological and inclusive transition created a working group called “Place au soleil” which was meant to make recommendations to speed up the development of solar energy in France. As explained by the president of Enerplan “the sector had been waiting for this working group for a few years” (Edition des halles, 2017). After creating similar working group for wind power and biomethane, this working group was presented as the third pillar in the government’s strategy to “free up renewable energies with the aim of promoting employment, energy sovereignty and territorial cohesion” (Ministère de la transition écologique et solidaire, 2018). This working group brought together parliamentarians, representatives of solar and electricity sector, NGOs, representatives of local elected officials and various national administrations working for the ministries. In June 2018, Place au Soleil published a list of 40 measures. One of these measures recommended increasing the perimeter of collective self-consumption to allow the development of eco-district and a better optimisation of production and consumption patterns (Ministère de la transition écologique et solidaire, 2018).

Institutional work conducted by SIE-field actors and other field-actors

Institutional work refers to activities of field actor that aim to create, maintain or transform institutions. We have observed that institutional work is done simultaneously by LEE actors and by other field actors (e.g. incumbent actors) with opposite aims.

France is one of the first countries that adopted an official definition for collective self-consumption, thereby creating new institutions specifically regulating these initiatives. Since the adoption of the first definition, SIE field-actors have conducted institutional work in order to advocate for the transformation of regulative institutions. Their aim was, and still is, to obtain changes that would make the definition of collective self-consumption less restrictive and the administrative processes less constraining. To obtain these transformations, SIE field-actors engage in various activities. They try to raise attention of elected officials that can defend their cause in the parliament. They take legal proceedings in the courts to challenge decisions taken by regulatory bodies. They lobby for the creation of working groups working under the umbrella of the ministry and that would jointly make recommendations to policy makers. They are also working on changing normative institutions by showing that another way to organise electricity is possible, one where the system would be organised decentrally and designed to reflect local energy demand. They for instance mobilise regional and European funds to set-up experimentations that can become exemplar for others. They organise and/or participate in events that promote a move towards a more decentralised electricity system. Moreover, they also conducted institutional work to change cognitive institutions by creating a counter technical

narrative. This narrative, inspired from the food sector, talks about an electricity system where energy would be consumed locally and where consumers could choose which production facility they want to finance with their electricity bill. SIE field-actors promote these narratives in their own blogs and in media that are in favour of renewable energy technologies.

On the other hand, we observed that incumbent actors also do institutional work. However, they do so to maintain prevailing regulative institutions or see to it that regulatory institutions that are newly created are sufficiently constraining to impede large-scale development of LEE. Incumbent actors do that behind the curtains and by mobilising informal networks. Interviewees never named actors that lobby against LEE but did suggest that incumbent actors are pushing for amendment that constrain the implementation of LEE. Moreover, incumbent actors rely on the support of CRE to constrain and slow down experimentation around LEE. The CRE publishes deliberation where they advise the government on how to support the development of LEE among others and how to avoid pitfalls. Even though the government is free to decide what to do with CRE's advices, in practice CRE's advices are often followed. This makes CRE a powerful institution. Analysing various deliberation written by CRE reveals a very cautious institution wary of disturbing the status quo. One interviewee for instance explained that « if we had the same DNA at the CRE than at the competition authority for the telecom, we would not be in the current situation at all” (Interview FR-LEE-SIEfield-1). Finally, other field actors also try to delegitimise the cognitive institutions that LEE are trying to create by framing LEE in very negative terms. LEE stakeholders are presented as self-centred, egoistic or communitarian projects. Here other field actors also rely on online media to present their critics of this emerging field.

A contested legal framework that evolves slowly and incrementally

The perimeter had been one of the battle horse of actors interested in experimenting with collective self-consumption who considered that the first definition was too constraining and not representative of urban projects that often involve multiple transformation stations – basically multiple buildings. As explained by an interviewee: “in the beginning it was difficult because the framework was too restrictive” (Interview FR-LEE-SIEI-1). The recommendation of the working group “Place au Soleil” gave more legitimacy to those demanding to enlarge the perimeter. In July 2018, an amendment was voted to replace “downstream of the same medium to low-voltage transformer station” by “within a perimeter defined by a decree”. This opened discussions about what this perimeter should be.

It is interesting to mention that the CRE was consulted on the subject and had recommended further limiting the maximum capacity of the projects (to 1 MW instead of 3 MW) arguing that, because consumers are less well protected, “it is desirable that the framework of the collective self-consumption operation remains limited to operations of modest size” (Commission de Régulation de l’Energie, 2019). This recommendation has however not been followed.

Policies and policy making

The analysis highlights that policies are key in explaining the slow emergence of LEE. Policies have been designed in order to control the development of LEE and make sure that their disruptive potential would be reduced so as to give established actors enough time to accommodate. At the same time, we have observed a very unstable policy framework as the definition of what can be considered collective self-consumption changed regularly. Behind these changes are two opposite forces. On the one hand, we have a finance ministry, regulatory bodies and established actors that try to slow changes down and protect the status-quo. On the other hand, we have the ministry of environment and parliamentarians that are more receptive to the message put forward by SIE-actors.

The thorny question of the cost to use public electricity networks

Agreeing on the definition was only a first step and the CRE was also asked to define the price that participants of collective self-consumption projects should pay to use the public electricity network. This is a really central element because this cost can make or break the business model of collective self-consumption projects. While it seems acceptable and accepted that individual self-consumption should be exempted from paying grid cost, this was contested for collective self-consumption. During an interview a representative of CRE for instance explained that “there is a real difference” given that projects of collective self-consumption use the grid to transport electricity from local producers to local consumers. As further explained by a representative of CRE “there is one principle that is not about to be questioned in the French pricing system, which is that of tariff equalization. As a result, these flows (referring to self-consumed electricity that still transit via the grid) could not be set at zero” (Interview FR-LEE-SIEFIELD-4).

The CRE took about two years to propose a specific tariff for collective self-consumption. CRE worked on proposing a tariff that, they argue, reflect the cost incurred on the network. The interview with two representative of CRE revealed a very complex methodology used to define the specific TURPE. As explained by an interviewee: “we have introduced a tariff qualified as original by some actors based on a distinction between the flux we call self-produced and the flux that we call externally-produced” (Interview FR-LEE-SIEFIELD-4). The CRE then determined network cost for both type of flux. This is based on a principle which they call “cost cascade” and that stipulates that using the low tension grid generates cost in the network upstream and that these cost should be reflected in the tariff. The argument is that these costs are different when electricity is self-produced or when it is taken from the grid. The representative also explained that the tariff has four indexes for each type of flux depending on whether the network is used during winter or summer and during peak or off-peak hours. A price list was published in the deliberation N°2018-115 (Commission de Régulation de l’Energie, 2018b) of the CRE. Aware that this proposed grid price is complex, the CRE suggested it be optional and to leave the decision to project developer to choose this tariff or the standard grid tariff applicable to all (non electro-intensive) consumers. At the time of the interview in summer 2020, no projects had chosen this specific TURPE yet.

Actors supporting the development of collective self-consumption quickly contested this TURPE and their justification. The

syndicate of photovoltaic professionals for instance published a press release entitled: « the CRE publishes its decision to penalize collective self-consumption” (Enerplan, 2018). In this document, they explain that the proposed TURPE is a bit more advantageous for electricity that is self-produced but about 15% more expensive for electricity that is taken from the grid. As argued by Enerplan, choice was made for a “pricing option that penalizes the virtuous consumer” (Enerplan, 2018). The 15th of novembre 2018, Enerplan lodged an appeal against what they called a “punitive” TURPE. Representatives of the CRE are aware of the critics that followed the publication of the TURPE and responded by explaining that those that critic the TURPE have not understood “the “raison d’être of the tariff which is to show which are the moments when an operation effectively can decrease network cost” (Interview FR-LEE-SIEFIELD-4).

Power and power relations (power to + power over + power with)

The innovation history of LEE is very much a story of power. It is the story of established actors, conscious of the disruptive potential of LEE and that use their power to slow changes down arguing that it is necessary to learn about and prepare for these changes instead of risking compromising an already well performing electricity system.

The analysis shows that current power balances are clearly in favour of established actors. Technical elites support the centralised and productivist model based on large-scale nuclear energy production. These elite are well represented in organisation participating in energy decision-making. One of the interviewee for instance argued: “*Carenco (the president of CRE) defends a vertical model, EDF. If we had the same DNA at the CRE than at the competition authority for the telecom, we would not be in the current situation at all*” (Interview FR-LEE-SIEFIELD-1).

Interestingly, preventing PMO to gain too much power is one of the reasons why CRE prefers limiting the size of LEE. In project of collective self-consumption, PMOs are free from some of the constraints that normally apply to energy suppliers; PMOs are able to exert more power over individual consumers than normal energy suppliers. CRE uses this to argue that there is a need to protect consumers and therefore a need to limit the size these projects can have.

The very slow pace of development of LEE is a reflexion of the power of incumbent actors to silence the voices of SIE-actors.

Two opposite frames

When conducting the research, we observed that actors in favour and actors against have opposite visions of what motivates the creation of local energy exchange and the impact these exchanges could have on the sector. Those in favour compare collective self-consumption to shared vegetable gardens where people grow vegetables locally and share their surplus with their neighbours (see for instance (Loyen, 2017). This notion came back a few times in the

interviews. Supporters also argue that it is “peasant’s common sense to exchange, between inhabitants, an essential resource such as energy” (Interview FR-LEE-SIEFIELD-5). They further explain that there is “an emotional logic, that people have an attachment to the local in a context of think local act global” (interview FR-LEE-SIEfield5) and that it is a way to “reappropriate their proximity” (Interview FR-LEE-SIEI-1). LEE are framed as a way to empower individuals to take part in the energy transition.

To these arguments, those against respond that there is a risk of encouraging what the president of CRE called “energetic communitarianism” (Carenco, 2017). Talking about communitarianism has a very strong negative connotation highlighting that participants aim at separating themselves from the rest of the sector. They describe LEE as an attempt of a few to gain power for themselves and break free from responsibilities we all have to support each other. In a similar fashion, the head of a renewable energy cooperative we interviewed sees collective self-consumption as something inward looking. The following quote illustrates this: “we do it for ourselves, we are very happy, it is very egoistic” (Interview FR-LEE-SIEFIELD-10). He further explains “the electrons that are produced on a roof, they will be consumed as close as possible so we are de facto in collective self-consumption” (Interview FR-LEE-SIEFIELD-10). “Flattering consumers on their small desires is not necessarily a good idea” (Interview FR-LEE-SIEFIELD-10) and especially if it results in project initiators building smaller renewable energy capacities in order to be able to self-consume more.

To this, supporter of local electricity exchanges respond that local electricity exchanges could also create opportunities to give away excess electrons to an association or to people in need. An interviewee for instance explained: “EDF agents make self-consumers look like egoists who take advantage of the network by financing it less. If we offered the possibility to citizens who equip themselves to participate in a territorial solidarity, I think it would make sense” (Interview FR-LEE-SIEFIELD-1).

What this section shows is that argument for or against LEE are based on positive or negative expectations. The debate appears to be an emotionally driven as actors try to elicit emotions that would create sympathy or aversion for LEE.

Key changes over time

Based on the descriptive historical provided, we can come back to two key changes that influence the emergence and development of the SIE-field.

First, the report published by the working group « place au soleil » has been an important event in the development of this field. Indeed, the report contained a number of recommendations that gave legitimacy to the claims made by SIE-actors to create a less constraining legal framework around LEE.

Second, we argue that the emergence of local electricity supply contracts also represents an important change. It showed that LEE could also take place without public support and in a much simpler framework (both legally and technically) than what had been attempted so far with collective self-consumption. Moreover, this form of LEE also has the advantage that it fits current institutional environment.

Collective self-consumption, a social innovation driven by technology

This report discusses local electricity exchanges as a social innovation. It is important however to recognize that technical innovations are really central as well and especially in project involving collective self-consumption. Collective self-consumption requires tracing how much electricity is produced and how much electricity do participants use every 30 minutes in order to calculate how much electricity is consumed by whom when. While these calculations may be quite simple in project such as that in la Motte Servolex where the municipality is sole producer and consumer, they are much more complicated in project involving multiple producers and consumers. Moreover, complexity may increase further if participants choose for a dynamic repartition meaning that some consumers may have rights to more of the produced power at certain times.

In France, it is Enedis that collects this information via smart meters installed at each participants and that provides all this information to the PMO. The PMO then can use this information to create the right bills for each participant. However, the volume of information can be quite voluminous and interviews revealed that PMO do not always anticipate how much work it would be to manage this information. One of the interviewee for instance explained that many project initiators they interact with “had not anticipated the need to manage collective self-consumption once the project would start and did not identify the means, the solutions to meet this need” (Interview FR-LEE-SIEFIELD-12). PMOs alone cannot do this and rely on others to provide the required digital platform. These platforms are developed by start-ups such as Sunchain, a spin-off of Tecsol active since 2016 or Enogrid created in 2018.

Some actors we interviewed criticize collective self-consumption because it requires a digital infrastructure that is far too complex. As interviewee for instance stated: “all this for that. It is a blessing for lawyers and technology providers” (Interview FR-LEE-SIEFIELD-7). Some go one step further questioning the added-value of such complex schemes arguing that we should “put the energie of our ingeneers and industrial actors on other projects, where technology is REALLY necessary” (Email exchanges with interviewee FR-LEE-SIEFIELD-10).

The emergence of local corporate power purchase agreements (PPA)

In France, a multitude of alternative green electricity supplier have emerged since the liberalisation of the market. Enercoop was the very first followed in recent years by many others such as Planète Oui, ILEK, or Ekwater. The CRE estimated that at the end of 2019, 11% of residential consumers had a green electricity contract which is 50% more than in 2018 (CRE, 2020). It is only recently that some energy suppliers started proposing local PPAs. Enercoop for instance launched in septembre 2019 an offer call “soleil de Camarès” in a small village in Aveyron. Enercoop constructed a solar farm of 250kWc and proposes selling this electricity to one hundred households living in the proximity for a price slighter higher than Enercoop’s standard offer. Another supplier, Planète Oui launched a similar offer in June 2020 called Mézières Energies. To this end, the supplier has set a partnership up with a project developer called Valorem to build a solar farm of 4.2MWc. Electricity produced is sold to 2500 people living in the vicinity of the farm for a price 10% lower than regulated

tariff (Planète Oui, 2020a; Valorem, 2020a). There are two key activities for electricity suppliers interested in developing a local PPA. First supplier should be able to convince financial institutions of their capacity to cover the costs of the renewable energy capacity throughout its lifetime (contract have to be signed for 20 years or more). Second, supplier should be able to connect produced renewable electricity to consumers located in the vicinity.

Introduction to SIE-initiative Mézière Energie of Planète Oui and Valorem

In 2016, Valorem, a project developer created in 1994 (Valorem, 2020b) is chosen by the municipality of Mézières-lez-Cléry to build a solar park of 4.2 MWc on an old mining site (Valorem, 2020c). In November 2019, when construction is about to start, Valorem signed a partnership with Planète Oui. The objective of this partnership is to make the solar electricity produced available to people who live in the vicinity of the solar park.

Valorem explains in a press release that the project is important because they always wanted that local resources should benefit citizens locally (Valorem, 2020c). For Planète Oui the partnership is a way to comfort their ambition “to create strong partnership with engaged actors in order to contribute to the energy transition” (Valorem, 2020c). Planète Oui presents itself as a pioneer green electricity supplier. Active since 2007, Planète Oui has the ambition to accelerate the development of renewable energy in France and make them accessible to as many people as possible (Planète Oui, 2020b). In 2019 Planète Oui became 1st ex-aequo with Enercoop in the ranking of “really green” electricity supplier of Greenpeace France (Greenpeace France, 2020). In 2020, they have 80,000 customers.

On the 15th of June 2020, Planète Oui launched their offer and propose to 2500 resident of Mézières-lez-Cléry and municipalities nearby to use their electricity bill to finance a solar park built in their direct surrounding (Planète Oui, 2020a).

At the end of this phase, two types of LEE are presents: Collective self-consumption projects and local electricity supply contracts. Both are still in experimental phase. By april 2020, 30 projects of collective self-consumption were operational. 16 of these projects were realised by municipalities and 6 of them by social housing corporations. The number of project offers limited possibilities to learn from such projects and evaluate what their added-value could be for the grid and for consumers.

Phase 4: contributing to the energy transition?

LEE have not institutionalised yet and are subject of contestation. With this last phase, we would like to take the opportunity to come back to various points of tensions or debates.

Contributing to the grid?

The combined development of intermittent renewable energy sources and transport electrification are expected to create additional burden to the grid and important investments especially in the distribution grid. Moreover, some of our interviewees argued that the centralised system has reached its limit. Recent announcements of French Transmission System Operator RTE asking consumers to decrease their consumption to reduce risks of black-out tends to confirm this (see for instance (L'usine Nouvelle, 2020)). This may create a window of opportunity for LEE. As one interviewee explained: "one thing that strikes me is that since I started working in this sector about 20 years ago, we would never have imagined that there would be an uncertainty as winter approaches as to whether it is going to be possible to supply everyone with electricity? And now it's been at least 4/5 years that this has become a recurring theme. In my opinion, the capacity of the territories to manage their energy system in the sense of production and consumption is a major element in resolving this problem" (Interview FR-LEE-SIEFIELD-11).

Can LEE contribute to decreasing these investments and build a more resilient grid? Can the complex digital infrastructure surrounding LEE find its "raison d'être" in helping overcome the challenges faced by the centralised grid by providing flexibility and encouraging people to adapt their consumption patterns? Or could other solutions do this in a simpler way? These seem to be key, yet unanswered, questions.

Further adapting the legal framework surrounding collective self-consumption?

The legal framework surrounding collective self-consumption is still contested on three of its elements. First, the perimeter is still a subject of discussion. Since October 2020, it is possible for actors in rural areas to propose projects of collective self-consumption that are in a broader perimeter (10km radius). However, these projects require a special derogation which will create barriers for projects to be realised. As explained by the deputy who supported this institutional change, "we need to prove that we are capable of finding a business model that is complementary to that of Enedis" (Interview FR-LEE-SIEFIELD-6). Second, actors supporting collective self-consumption would like that buildings that have an energy demand that requires being connected to the medium voltage grid should be able to participate in projects of collective self-consumption. This would concern schools with a large kitchen facility for instance and more generally could be a way to diversify consumption patterns and further increase self-consumption. Finally, how collective self-consumption should be supported is also subject of discussion. Here actors in favour of LEE are not all aligned. Actors that are used to doing big projects would prefer the CRE to publish specific call for tenders. Actors focusing on smaller projects would advocate for a diminution of the taxes and for a fairer TURPE. This last point does not seem about to change as Enerplan recently lost its appeal on the subject (Conseil d'État, 9ème chambre, 28/09/2020, 425378, Inédit au recueil Lebon, 2020).

Contestations and relations between actors

Our analysis of LEC in France clearly shows that there is a lot of contestation going on between SIE-actors and other field actors about the legal framework that should support the development of LEE. Field actors promote a framework that would allow for a controlled development of LEE in order not to upset the existing system. On the other hand, SIE-actors argue that LEE should not be impeded yet as they have barely started to emerge and fight for an easing of the rules.

While we have observed that actors that support LEE know and recognize each other, we also identified few collective actions meant to push for a more enabling regulatory framework. This may be explained by the fact that SIE-actors do not all agree on which form of LEE should be fostered (collective self-consumption, local electricity contract) and which measures would be most appropriate to do that. Their preferences depend on the size of projects they realise (small and big project developers having different preferences) and the appetite of actors regarding whether and how much a digital transformation is desirable.

Creating a label to make things more transparent for consumers

As aforementioned, there are more and more green electricity supply offers on the French market. To guarantee that they supply renewable electricity, suppliers have to buy so-called Guarantees of Origin (GO). GO have been imagined as a means to develop green electricity demand in the EU electricity market. GOs are emitted and sold/purchased on the European energy stock market POWERNEXT. GO are bought independently from the renewable energy purchase contract sourced by the supplier. Currently, GO can be provided either from hydraulics, solar pv, or wind power productions injected anywhere the EU electric grid system.

Green electricity suppliers often highlight that they allow customers to benefit from green electricity produced locally, in the spirit of local energy cycles. However, the “local” characteristic of the energy is contestable. Green electricity may be produced in France but not necessarily in proximity to where customers are located. Moreover, many green electricity supply contracts are “normal” electricity which is made green by importing GO from producers in neighboring countries. In 2019, the CRE estimated that 92% of the GO used for offsetting the green supply contracts were emitted and purchased from hydraulics productions, almost 30% of which were imported from abroad. These numbers also suggest that GO hardly play a role in supporting the development of new renewable electricity capacity.

To create more visibility and transparency for customers, and possibly also create incentives to invest in new renewable electricity capacity, ADEME decided to develop a green electricity label. It invited energy suppliers, consumer association, Green Certificate traders, NGOs, the CRE to share their opinion about the criteria that should be used for such a label. This led to heated discussions: EDF wanted nuclear power to be considered as green. The CRE advocated for a label that would favour subsidy-free renewable energy capacity. Enercoop and renewable energy cooperatives asked for rewarding projects where citizens are involved in the governance. Should supplying power from locally produced electricity also be valorised? Will LEE benefit from this initiative? To our knowledge this is not the case yet as proposed label does not reward

renewable electricity production that is bought by consumers located nearby. When finalising this report, the label headed towards a 2 stars system where suppliers would receive one star when they buy power and GO from French decarbonised energy producers (nuclear power included). They would obtain two stars when suppliers could guarantee that 25% of the electricity sold comes from renewable energy capacity build after 2015 OR when 25% of the electricity sold is produced by projects with a local (citizen) governance (Les Echos, 2020).

To conclude, the LEE field is not institutionalised yet. This field lacks legitimacy and we think that this is because there is an important and still unanswered question: can LEE make a positive contribution to the energy transition? We argue that assessing whether LEE can contribute to the energy transition could be done by answering three questions: can LEE contribute to the development of subsidy-free renewable energy capacity? Can LEE contribute to decrease local carbon footprint? Can LEE increase the resilience of the grid and help decreasing the investments that will be needed on the grid? Can LEE be a means to increase consumer awareness so that they would change their consumption patterns? Behind these questions, lies another important issue: what is meant with “local” and to what extent can locally organizing the electricity sector contribute to the energy transition? It will not be possible to provide meaningful answer to these questions unless more projects can be realised and evaluated.

6 Summary, synthesis and conclusions

6.1 How do SIEs and SIE-fields emerge, develop and institutionalise over time?

In this report, we analysed the emergence and growth of one form of SIE, local electricity exchange (LEE) in France. The electricity system was initially a myriad of local grids and LEE. In France, the political will to electrify the country and secure equal access to affordable electricity resulted in a process of concentration that gave birth to a very centralised electricity system. LEE emerged rather recently as a result of increasing interest in society to consume local and be able to trace where what one consumes comes from. LEE are also a way to gain control over one’s electricity bill and hold the promise of being able to create new forms of solidarity. In France, we identified two types of LEE that develop rather independently from one another: collective self-consumption and local power purchase agreements (PPA).

To begin with, collective self-consumption started emerging a few years ago when a specific legal framework was created to make these initiatives possible. The analysis reveals that this framework, meant to control the pace at which collective self-consumption project develop, is

- Constraining. Current framework makes it very difficult for projects to be financially sustainable and collective self-consumption initiatives often depend on regional subsidies to be realised.
- Contested. Supporter of collective self-consumption actively contest prevailing definition and support schemes arguing that they are so constraining that it is difficult to fully experiment and learn from operational projects

- Unstable. Legal framework has already changed a few times and additional changes that would leave more room for experimentation are expected/hoped for by supporting actors.

The pace of development of collective self-consumption in France is very slow and few projects have emerged so far. Interviews highlighted that conducting a collective self-consumption project is extremely complicated and projects are still experimental. There is a lot to learn both on the legal/organisational side (how the PMO functions and how the PMO can best manage the relations between all stakeholders involved in a project) and on the technical side (how to manage all the energy data that is generated during such a project). Even though projects are formally realised by municipalities, housing corporation and more rarely renewable energy cooperatives, we observed that these actors are often encouraged by others to initiate a collective self-consumption project. Projects leaders we interviewed were for instance encouraged to experiment with collective self-consumption by a real-estate developer or by Enedis.

Today, a range of actor is sceptical about the potential of collective self-consumption to contribute to the energy transition. Established actors view these initiatives as a risk to destabilise a well functioning electricity system. Another critic raised during the analysis is that collective self-consumption is an opportunity for technology providers and businesses to flatter the self-centred desires of consumers and that this takes the focus away from more important aspects such as maximising renewable electricity production and encouraging energy efficiency.

Very recently, a second type of LEE emerged around local electricity contracts. Decreasing cost of renewable energy technologies makes it possible for producers to built new renewable electricity capacity (so far only solar farms on the ground) without depending on national subsidy scheme. Instead, producers can make a direct contract with a supplier. When the supplier chooses to sell produced electricity only to consumers living nearby, we have the emergence of another form of LEE. Only few alternative electricity suppliers have developed such offers. These offers represent a way for suppliers to differentiate themselves in an increasingly competitive market for renewable electricity supply.

Even though LEE have started to emerge in France, this field has not institutionalised yet. To institutionalise, collective self-consumption projects will have to respond to both aforementioned critics. Projects will have to prove that they can be a concrete added-value for the grid, namely that they can contribute to decreasing network costs by reducing the need to reinforce the grid or to maintain it. They will also have to prove that they can help foster behavioural change better than other, less technology intensive solutions, could. Moreover, local electricity contracts will have to prove that they can represent an attractive alternative for energy producers to finance renewable energy capacity without depending on national subsidies. They also have to prove that customers value this type of offer.

6.2 How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?

The outside institutional environment has a crucial role in shaping the LEE field. The energy sector is highly regulated and legal frameworks determine what is legally possible and what is financially attractive. While conducting the analysis, we observed that there is something very attractive and powerful behind the idea of LEE. This SIE could contribute to

empower prosumers and allow local actors to reappropriate energy. At the same time, by promoting an energy system that is quite opposite to how the system is currently organised, LEE also raise multiple questions, doubts, fears. What if LEE would destabilise the system? What if LEE would compromise the principles on which the system has been built? This study shows that the way SIE-field actors and other field actors interact with the outside institutional environment mirrors these hopes and these fears. While SIE-field actors try to obtain the creation of new institutions that would foster the emergence and development of LEE, other field-actors use their power to make sure that newly created institutions remain very constraining so that only a few small projects can be realised.

In order to restrain the emergence of LEE, established actors have framed LEE as an inexorable force that, if uncontrolled, could compromise an already well functioning system. They have used very strong words to influence decision makers in the outside institutional environment by delegitimising LEE. They for instance argue that LEE are communitarian, self-centred, working to break the solidarity principle of tariff equalisation. In response to these critics, SIE-actors have responded that LEE could create opportunities to imagine new forms of solidarity. They have argued that LEE could foster a more virtuous energy consumption. SIE field-actors and other field actors co-shape the narrative that is built around LEE.

6.3 What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

The conducted analysis reveals that LEE benefit from two main enabling factors. First, renewable energy technologies have gained in maturity and have become cost competitive with traditional energy technologies. This makes it much easier to produce electricity decentrally. Second, LEE respond to a societal demand for consuming locally and having more transparency about where what one consumes comes from. Even interviewees that were sceptical about LEE recognized that this is in the spirit of our time. Despite these technical and societal trends, LEE in France are facing a number of impeding factors.

First, France managed to electrify and modernise thanks to a vision that promoted a large scale and centrally managed electricity system. This vision, and all the principles that came with it (i.e. tariff equalisation), have become so deeply institutionalised that policymaking is largely dominated by actors that support this vision. Technical and social innovations are constantly judged on the impact they have or could have on the performance of this long established system. This makes it extremely difficult for actors that promote LEE to be heard because they advocate for a development that would go in the opposite direction to what made the success of French electricity sector so far. Over the years, these actors have gained some countervailing power and have been able to push for changes in the law that make LEE possible. However, these changes have been very slow and incremental and current regulatory framework is very constraining and does not make a large-scale development of LEE possible.

Second, regarding collective self-consumption, besides a specific legal framework, these initiatives also require the development of a digital infrastructure necessary to trace what is produced and consumed by whom and when. A digital transition is necessary to make LEE – and especially collective self-consumption – possible. On the one hand, DSOs have to

develop a digital infrastructure in order to make the appropriate data available to project developers. Appetence to innovate is surely one of the reasons that pushed Enedis to help initiate collective self-consumption projects. On the other hand, innovation is also required in the form of digital platforms needed to make it possible for PMO to process the data provided by their DSO. This creates opportunities for start-ups to develop innovative solutions but adds an additional level of complexity for SIE-initiatives. The analysis revealed that SIE-initiatives tend to underestimate the importance of having access to such a platform once their project is operational.

Third, we observed a lack of alignment between actors regarding the type of support that would be most appropriate to foster the development of collective self-consumption, even among SIE-actors. This makes it easier for policy makers not to change anything.

Finally, regarding local PPA, we have gathered too little data to be able to make strong conclusions. What we expect however, is that one of the the impeding factors is the financial capacity of energy suppliers who need to be sufficiently robust to be able to sign long-term power purchase agreements with renewable electricity suppliers.

7 Recommendations for our city partners, national and EU policy makers and SIE practitioners

SONNET city partners

- While LEE hold many promises, they are also the source of multiple critics. There are however not enough experimentations to be able to distinguish between the false and the truth. Cities can contribute to gather additional knowledge about LEE by supporting local initiatives that aim at creating.
- Cities could consider cooperating with an electricity supplier in the creation of a local PPA.

National and EU policy makers

- In France, ongoing debates about LEE are subjective and based on emotions instead of on scientific facts. This, in parts, reflects the fact that too few initiatives exist that we can learn from. To remedy this, we recommend freeing more space to experiment with LEE to be able to uncover what the actual potential of LEE are (ie. contribution to grid resilience and citizen empowerment) and which pitfalls should be avoided. This may include increasing the maximum capacity of projects, including buildings connected to the medium voltage and/or decreasing taxes.
- Aforementioned experimentations could be used as bases to redefine a specific TURPE for collective self-consumption that is based on data about saved grid costs or additionally incurred grid costs.
- To support LEE, the UE could introduce more restrictive criteria about the origin of the power in the Guarantee of Origin (GO) mechanism.

SIE-field-actors

- The possibility for LEE to contribute to the energy transition is contested by non LEE actors. The juridical and digital complexity of LEE initiatives overshadows their potential added-value. To gain in legitimacy, initiatives will have to prove that LEE can benefit the grid and help consumers adopt more virtuous behaviour (i.e. adapt their consumption pattern depending on network constraints, waste less electricity) better than low-tech solutions could.
- SIE field actors have a small countervailing power and limited capacity to influence energy decision-making. To increase this countervailing power, we recommend that SIE-field actors concert each other in order to find common grounds regarding which measures would be most appropriate to foster the development of LEE. Today SIE-field actors do not speak as one voice. We argue that LEE field actors would have more lobbying power if they aligned their discourse.

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9 Annex 1

Methodology

Thirteen interviews were conducted. We had difficulties interviewing SIE-initiative and only one responded favourably. To compensate for this we did additional document review and analysed reports or publications presenting initiatives, explaining their motivations, the difficulties they face, the lessons learnt. We interviewed various SIE-field actors. These included advocacy groups, consulting firms, technology providers, DSO, regulator, elected officials that supported the field, REC. Our objective was to understand who supported the field, who did not, why, what were ongoing power dynamics and which narrative and counter narratives were used.

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List of interviewees

Code interview	Empirical description of case	Type of actor according to SONNET	Date of interview	Duration of interview	Interviewer
FR-LEE-SIEFIELD-1	Lobby organisation	SIE-field	02/07/2020	64 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-2	Consultancy firm	SIE-field	02/07/2020	54 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-3	DSO	Other field-actor	30/07/2020	58 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-4	Regulator	Other field actor	21/07/2020	50 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-5	Consultancy firm	SIE-field	02/10/2020	36 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-6	Parliamentarian	SIE-field	20/10/2020	15 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-7	Energy supplier	Other field actor	27/11/2020	45 min	Anne-Lorène Vernay
FR-LEE-SIEFIELD-8	Researcher	Other field actor	09/11/2020	75 min	Fabrice Arroyo
FR-LEE-SIEFIELD-9	Consultant	Other field actor	12/11/2020	45 min	Fabrice Arroyo
FR-LEE-SIEFIELD-10	Renewable energy cooperative	Other field actor	27/11/2020	27 min	Fabrice Arroyo
FR-LEE-SIEFIELD-11	Technology provider	Other field actor	23/11/2020	66 min	Fabrice Arroyo
FR-LEE-SIEFIELD-12	Technology provider	SIE-field	15/10/2020	45 min	Anne-Lorène Vernay
FR-LEE-SIEI-1	Municipality	SIE-initiative	02/10/2020	44 min	Anne-Lorène Vernay
FR-LEE-SIEI-pre1	DSO	SIE-initiative	27/01/2020	107 min	Carine Sébi and Nuria Moratal

List of meetings and events attended

As part of data collection process, we participated in online webinars LEE aiming at exchanging best practices. We also participated in and a workshop meant to reflex about LEE and contribute to ongoing public debates.

Event name	Event organiser	Type of event	Date of event	Who attended
Webinair Autoconsommation collective	Gresi21 - Renewable energy cooperative	Online webinar	04.06.2020	Anne-Lorène Vernay
Energy communities for collective self-consumption: frameworks, practices and tools	Université Grenoble Alpes	Online webinar	15.06.2020	Anne-Lorène Vernay
Energy communities for collective self-consumption: frameworks, practices and tools	Université Grenoble Alpes	Online webinar	23.06.2020	Anne-Lorène Vernay
Circuits Courts de l'énergie et nouvelles solidarités énergétiques	Greenflex and LLC et Associés	Online workshop	21.07.2020	Anne-Lorène Vernay