

Transition “Niches” as Spaces for Re-envisioning the Energy System: The Case of Self-Consumption

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The emerging practice of self-consumption is seen as a potential contributor to the energy transition. But the idea of expanding it on a large scale is surprisingly controversial. Defined as producing and consuming one's own electricity, self-consumption is still struggling to catch on and is the subject of much industry debate in France. In this article, we aim to shed light on this new practice, looking at it through the concept of a transition “niche” (Schot & Geels, 2007), a space for experimentation that, under the right conditions, can help to radically transform an established system. It is easy to identify a niche that led to a systemic transformation after the fact. But while a niche is still a niche, it is likely to be the subject of considerable debate. This is the angle from which we propose studying self-consumption: in the discourse shaping their practices, what are the differing positions of stakeholders, between those advocating controlled expansion of the niche and those looking to transform the system?

In the midst of the climate crisis, France is frequently criticised for its “inertia” in making the energy and green transition. While expanding renewable energy sources is a key plank in energy transition roadmaps, it must go hand in hand with bolder targets for distributed energy generation and new consumption practices. One such practice is self-consumption, which is where an electricity consumer generates their own power. But although France has had a legal framework for it in place since 2017 (Act of 24 February 2017 ratifying the Order of 27 July 2016), the practice has yet to really catch on, with the country's energy industry debating how to scale it up and whether it should be. To understand the issues surrounding the expansion of self-consumption, we propose studying it using the concept of a “transition niche”: an emerging practice that can have an impact on a system, the transition of which is based on changes to multiple interconnected levels and dimensions.

Beginning with an overview of the main challenges involved in transitioning France's electric power system, we will identify self-consumption as a “transition niche” and demonstrate the interest of studying it via the discourse of electricity stakeholders. We will then present our analysis, by identifying the different representations of self-consumption as a niche that can have an effect, whether positive or negative, on different dimensions of France's electric power system (specifically, the regulatory/political, economic/commercial, technological and social dimensions).

We will show that, in addition to the usual factors (technological, economic and regulatory) used to identify a niche (Turnheim & Geels, 2019), collective spaces of commentary and debate also influence its expansion and its integration in the transition process.

The “socio-technical” transition of France's electric power system

Although self-consumption has only recently been included in transition roadmaps, France's electric power system has a long history of change (Dunsky, 2004; Raineau, 2011), undergoing numerous transformations since it was built in the late 19th century (Beltran & Carré, 2017). The result is a centralised power system that, until it was opened up to competition in the 2000s, was run by a single public corporation, EDF, in charge of electricity generation, supply, transmission and distribution. With the development of France's substantial nuclear power programme, undertaken to ensure the country's energy independence and to control costs, the electric power system was progressively built up around large plants, supplying the entire country via a power transmission and distribution system at a single rate (the French principle of *péréquation tarifaire*, or tariff equalisation).

As electricity cannot be stored, operating the power system requires a constant balancing of supply and demand. France has a robust system in that

consumption is aggregated, which means demand can be smoothed and generation can be more easily adapted – an argument in favour of a centralised system. It is also a highly reliable system with a very low failure rate.

That said, the transformations France is currently faced with appear to be unprecedented in scope (Rüdinger et al., 2017). There are two inherent limitations of the dominant power system: the scarcity of conventional fossil and fissile fuels, and climate change. As demand continues to steadily rise, these limitations suggest that the system is facing a new energy transition. While there is little remaining debate about the facts of the climate emergency, the 2015 Energy Transition and Green Growth Act set out a roadmap with targets for reducing greenhouse gas emissions and increasing the share of renewables in the energy mix, putting the electric system front and centre in the energy transition.

These targets involve moving away from a centralised power generation system, managed by a small number of dominant players with clearly defined roles, to a decentralised system that is more difficult to manage due to the intermittent nature of renewable energies, involving numerous stakeholders with redistributed roles and a heavy focus on digital technology. Faced with this combination of uncertainty and complexity, the “inertia” preventing the power system from making the transition is the subject of great political debate in France. Some see it as a problem of an entrenched centralised system (Boutaud, 2013), where the dominant players are holding back its transformation (Evrard, 2014). But according to a fact-finding mission on the obstacles to the energy transition launched by France’s National Assembly in summer 2018, the issue appears to be more complex than that.

To study the issue, we propose considering that the electric power system is undergoing a “socio-technical” transition, as conceptualised by Schot and Geels (2007). A transition is a process by which a system, i.e. an organised set of structures and actors, shifts from state A to state B via change processes on multiple levels (Geels, 2010). A transition is “socio-technical” when there are dual dimensions of technological change and structural change to the rules, beliefs and routines underlying the system (Geels, 2011). At macro level, the “landscape” in which the socio-technical regime is embedded can undergo change: structural transformations of the environment over the long term force the regime to adapt. At micro level, “niches”, i.e. spaces for technological or social innovation, can develop, initially on the margins of the system before potentially disrupting or transforming the existing regime. According to Geels’s model, the transformations of a regime in transition take place on multiple dimensions: technological, economic/commercial, regulatory/political and social (Geels, 2002). The technological and regulatory dimensions are often identified as foundational to the transformation of the energy system.

But Geels’s approach is retrospective. Although it is able to identify niches in hindsight, after the transition has occurred, it is much more difficult to determine mid-transition whether a given practice is a niche

that will lead to a major systemic change, or whether it will remain relatively minor. In our view, the case of self-consumption appears to illustrate the fact that, during the transition process, a niche is a space for debate that cannot be used to predict the outcome of the transition.

Self-consumption: a controversial transition niche

Self-consumption is when an individual, entity or community consumes electricity that they generate themselves, typically via a photovoltaic (solar power) system. While France has an established photovoltaic industry (ADEME, 2016), self-consumption is a relatively new practice. Until 2016, existing laws only allowed users to sell any excess solar energy they produced to EDF under a specific buyback agreement. The option to practise self-consumption was formalised with the Act of 24 February 2017, which sets out two scenarios: “individual” self-consumption, where power is produced and consumed by the same individual, and “collective” self-consumption, where power is shared between one or more producers and one or more consumers. (See Table 3 on page 18 for a breakdown of the differences between the two). While this legislation officially introduced the practice of self-consumption in France, it remains in its early stages, with only 16 “collective” self-consumption setups registered so far.

Despite its fledgling status, self-consumption has had strong proponents from the start, as well as its share of sceptics and doubters. France’s Energy Regulation Commission (CRE) organised a wide-ranging consultation exercise between 2017 and 2018 in an attempt to more clearly define the technical and legal scope of the practice as well as principles for pricing and subsidies. Everyone was able to express their views on the nature and extent of the potential “disruptions” posed by self-consumption.

Given its status as an emerging and experimental practice, self-consumption can be considered a “niche”: it meets the criteria of a practice that departs from the existing system (or “regime”), is disrupting the system and, under certain conditions, is working to transform it (Geels, 2011). At present, however, it is more the subject of debate as to what it could be as opposed to something concrete. This calls into question the traditional conception of a niche. First, while the literature suggests that the experimental nature of a niche makes it essentially technological in nature (Schot & Geels, 2007), self-consumption is experimenting with solutions that encompass more than just technology, such as uses and behaviour associated with the practice, its pricing principles and the governance of the regime. Second, the current definitions of a niche conceive of it as a “protected” space (Smith & Raven, 2012), relatively sheltered from the institutional pressures of the existing regime (Turnheim & Geels, 2019). Yet experimentation with self-consumption has sparked a host of questions about how it might disrupt the existing system. We propose studying this discourse to understand how this “transition niche” is perceived, and in fact socially constructed, by stakeholders.

Methodology

We conducted an analysis of the discourse on self-consumption in the electric power industry. There were three phases.

First, we conducted a documentary analysis on the concept of self-consumption (legislation, reports, press review) in early 2018 to understand the context of the subject matter and put together a list of interview subjects. We therefore focused on industry stakeholders that had explicitly and publicly spoken out on the matter during the consultation exercise led by the CRE.

Second, we conducted a series of interviews (16 interviews lasting an average of 80 minutes, of which 14 were recorded and transcribed) in mid-2018, after the consultation exercise, when the debate was at its most intense and stakeholders were taking clear positions on the matter. We used this data to identify the structural dimensions of the discourse around self-consumption. In light of the definition of a niche as a space for technological and social experimentation (Schot & Geels, 2007), we analysed what appear to be topics of experimentation, definition and debate. A first attempt at open coding revealed a large majority of topics that were more systemic in nature. In other words, in response to the question "In your opinion, what is self-consumption and how do you see it potentially expanding?", interview subjects instead discussed "What would the future electricity system look like if self-consumption were to expand?". After several attempts at coding, we used multi-thematic coding to group the different points of tension in the discourse (Ayache & Dumez, 2011), reflecting the different dimensions of the existing regime (here

the current electric power system) mentioned by the interview subjects.

Third, we monitored developments in the legislation and the official discourse of the interview subjects (press releases, media appearances) between 2018 and 2020, in order to identify their position over the entire period. This enabled us to triangulate the data collected during the interviews.

Industry discourse on self-consumption

One outcome of self-consumption would be a change in the roles of electricity industry stakeholders, who as a result may or may not be in favour of its expansion. However, there are still many areas of uncertainty as to the impact it would have on these stakeholders. The industry discourse has created a "theatre" of discussion and debate, gradually building and shaping this still experimental niche.

Three positions

The scale of the debates that followed the CRE consultation in 2018 illustrates to what extent the issue of the expansion of self-consumption, particularly the "collective" category, has divided the electric power industry. When a consumer pays their electricity bill, a portion goes towards funding the operation of the system, but also toward the profits of a certain number of participants in the value chain: the electricity producers, the transmitter, the distributor, the suppliers, etc. Our study involves a sample of these stakeholders, presented in Table 1.

Stakeholder	Role in the electricity system
Commission de régulation de l'énergie (CRE)	Regulator. Independent administrative authority.
Réseau de transport d'électricité (RTE)	Transmission system operator (high and ultra-high voltage lines). Monopoly, subsidiary of EDF (50.1%).
Enedis	Distribution system operator (low and medium voltage lines). Near monopoly, subsidiary of EDF (100%).
Enercoop	100% renewable energy supplier. Cooperative, contracts directly with energy producers.
EDF Énergies nouvelles (EDF EN)	Renewable energy electricity producer. Subsidiary of EDF (100%).
Total Solar	Solar power project developer. Subsidiary of Total.
Enerplan	France-wide multi-sector employers' association for the solar power industry. Members belong to the manufacturing, construction, trade and service industries.
Groupement des particuliers producteurs d'électricité photovoltaïque (GPPEP)	Association of individual photovoltaic electricity producers (more than 9,000 members).
Fédération nationale des collectivités concédantes et régies (FNCCR)	Federation of local authorities and their government-funded institutions responsible for organising and/or operating certain utilities (more than 800 members).
Région Occitanie	Local authority.
Bouygues Immobilier	Property developer.
EmbiX	Start-up specialising in smart grid solutions.
Schneider Electric	Provider of digital power and automation solutions.

Table 1. Stakeholders in the electric power industry

Many stakeholders depend on the end user's electricity bill, but self-consumption would disrupt the underlying formula, with self-consumers still continuing to use electricity from the power grid when they are not getting enough from their solar panels. Faced with the uncertainties associated with these disruptions, stakeholders in the existing system have adopted and defend different positions, based on their interpretation of the situation (Reverdy, 2010). From the way they express these interpretations, their positions can be divided into three categories: committed, ambivalent and hesitant. These categories reflect the content of stakeholders' explicit discourse, as well as their interests and roles in the electric power system.

At one end, the "committed" camp includes stakeholders with a direct interest in the expansion of solar power and self-consumption products and services, as a potential growth vector of the photovoltaic industry. Solar energy employers' association Enerplan is the leading stakeholder having demonstrated a strong commitment in favour of expanding self-consumption and supporting it through various tax and economic incentives.

At the other end, the "hesitant" group includes those who, at national level, oversee the operation of the electric power system, such as the RTE and the CRE. It should be noted that these stakeholders are not against self-consumption, but advocate controlled expansion of the practice.

In between these two positions, those categorised as "ambivalent" appear to be partially on board with some aspects of these changes but are mindful of the consequences, considering there to be still too much uncertainty to take a firm position.

Table 2 categorises the electricity stakeholders based on the position expressed in their discourse as part of this study.

These positions, which are relative, reflect our own analysis of the discourse collected during the study and do not necessarily imply that these stakeholders are entrenched in their position, that their strategy is limited to that position, or that there are not other positions held within the organisation.

The discourse around the prospect of an expansion of self-consumption

We will illustrate these three positions by studying the stakeholders' discourse around four dimensions of the system that are currently in transition and that the expansion of self-consumption would disrupt: regulatory/political, economic/commercial, technological and social.

The regulatory/political dimension

Traditionally, France's electricity pricing formula has been based on the principle of *péréquation tarifaire* (tariff equalisation), which ensures "solidarity", or a fair distribution of the cost among individuals and regions. Accounting for roughly a third of the price per kWh, the public transmission system access tariff (TURPE) goes toward funding the system operators to ensure access for all users. A self-consumer who generates their own electricity will either not use the system at all or use it very little, only when they generate more than they consume or consume more than they generate. When they are not using the system, should they have to pay this contribution toward its management? And the same issue applies to taxes on electricity, which account for another third of the price of a kWh consumed from the system, in terms of a smaller tax base and lower contributions from self-consumers. Deciding whether self-consumers should be treated the same as other consumers opens the door to reconsidering the principles of electricity pricing, a hotly debated subject.

Indeed, pricing is the focus of much debate. It is a major factor in the decision to expand or limit the practice of self-consumption.

These mechanisms reveal a two-tier political and regulatory transition. At one level, initiatives are being introduced to encourage the expansion of self-consumption and related technologies (tax exemptions, investment incentives, calls for tender, etc.). At another level, there is a high degree of hesitancy from the regulator in the face of the uncertainties that we will outline in the following sections. However, the speed at which France makes the transition on the policy and regulatory fronts is not a trivial concern. To understand this, it is necessary to contextualise France as one actor among others with varying degrees of power and influence in the transition race. On the one hand, France wants to win the competition against powers such as China, which will require agility and speed. On the other hand, regulations tend to tightly control the expansion of self-consumption. This is where stakeholders' positions diverge in opposite directions.

The "hesitant" group advocates controlled expansion, so that any real impacts on the system can be gradually integrated:

"As for support mechanisms, they must be adapted to the wide range of situations and allow for an optimal and controlled expansion of self-consumption. [...] However, support for self-consumption must not impede the development of large ground-mounted

Position	Stakeholder
Hesitant	CRE, RTE
Ambivalent	Enedis, Enercoop, EDF EN, FNCCR, Embix
Committed	Enerplan, GPPEP, Bouygues Immobilier, Schneider Electric, Total Solar, Région Occitanie

Table 2: Summary of positions reflected in the discourse of electricity stakeholders vis-à-vis the expansion of self-consumption

solar power plants, which are a major, and affordable, contributor to the objectives of renewable energy expansion”⁽¹⁾ (CRE report, 2018).

“Committed” stakeholders would like to see a faster expansion of self-consumption in order to develop solutions to the issues it raises, which implies protections and incentives:

“To ensure it doesn’t thrive right away, it will be prevented from expanding. That’s the revolutionary recommendation that has emerged from the CRE. [...] It’s as if they’re wearing bifocals: magnifying anything that might pose a problem, and minimising the rest. [...] Our recommendation is to say: ‘we’re still early days on this’. If the only thing we need is to not be taxed and to not receive any subsidies in return, it really is a free-market system. And then: ‘at first, there will be no macroeconomic effect, let’s have tax exemptions for the CSPE,⁽²⁾ the TICFE,⁽³⁾ for 15 years’” (interview with Enerplan).

In between these two positions are the “ambivalent” stakeholders, who see the change as presenting opportunities in other areas, but also risks.

The economic/commercial dimension

As a practice, there are two main facets to self-consumption: new manners of production (local, decentralised) and new manners of consumption. The trend toward decentralisation and the arrival of activist consumers⁽⁴⁾ (Cochet, 2000) is driving a transformation of the economic regime that France’s electricity system is built on. Self-consumption changes the value-creation mechanisms around electricity. First, it is forcing

electricity suppliers to reconsider their economic model:

“Historically, we have been buyers and sellers of electricity, but all electricity suppliers are asking themselves: ‘How do we break out of this single-product model? How can we diversify? And how can we offer new services?’ [...] What’s at stake for us as suppliers, and for all suppliers, is that these new services are in almost direct opposition to the core of our business” (interview with Enercoop).

It also concerns the transmission and distribution of electricity, the first managed by RTE and the second mainly by Enedis. For these stakeholders, there is an additional layer of uncertainty: What will the system of the future look like? How much of it will be made up of renewables? Where does self-consumption fit in? Or the move to moderate energy consumption? How will these new forms of electricity generation and consumption be distributed geographically? How will regional integration work (smart cities, positive energy areas, etc.)? The answers to all of these questions have impacts on both the infrastructure and the operation of electricity systems, as well as their funding model:

“Wide-scale expansion of self-consumption must be planned for, monitored and controlled so as not to jeopardise how the system is funded and operated. We also need to be careful about the pricing of self-consumption so as not to generate costly deadweight effect for the community. Electric power systems are based on the principle of solidarity, i.e. fair distribution of cost for the community. As an energy supply method, self-consumption must be an option that works alongside others, but it can’t disrupt the overall balance of solidarity” (interview with RTE).

The issue of the coverage area for collective self-consumption (see Table 3) is particularly significant, since it means limiting the arrangement to users of a same electrical substation, which is often a single building. The “committed” group say that this limits the size of the setup and minimises economies of scale, whereas the “hesitant” group say they are considering the reality of electricity flows, which always travel to the nearest exit point.

⁽¹⁾ Translator’s note (TN): All citations attributed to stakeholders have been translated from French.

⁽²⁾ TN: Contribution to the public electricity service (*contribution au service public de l’électricité*).

⁽³⁾ TN: Domestic consumption tax on electricity for end-users (*taxe intérieure sur la consommation finale d’électricité*).

⁽⁴⁾ TN: Loose translation of “*consomm’acteur*”, a portmanteau of “consumer” and “actor” (in the sense of “participant” or “activist”).

	Individual	Collective
Producer	An individual person	One or more persons
Consumer	The same individual person	One or more persons
Structure	N/A	Producers and consumers grouped together under an organising entity to distribute the self-produced electricity
Coverage area	N/A	Participants sharing the same electrical substation
Indirect support	Exempt from TURPE	Yes
	Exempt from CSPE	Yes
Direct support	Investment incentive	Yes

Table 3: Comparison of individual and collective self-consumption

Although self-consumption is challenging the traditional electricity market transaction mechanisms, it is also a source of new monetisable needs. We are seeing the emergence of new types of service providers, such as "aggregators", which balance electrical capacity from decentralised production sites to ensure more flexibility between supply and demand. Energy producers are beginning to expand their commercial offerings for self-consumers, as well as support services to help consumers optimise their bills.

There is also the ability of a niche to gain strength through connections with other niches:

"Because the issue for the industry, with home automation, electric vehicles, smart charging and vehicle-to-grid and vehicle-to-building charging, is to make the best possible use of local flexibility. That's where the real challenges are. As long as we stick with a super-centralised system, without any incentives for system operators or distributors to optimise how they work, and covering all their costs, well... we'll stay stuck in 1946. We won't join the 21st century, like other countries are doing" (interview with Enerplan).

At regional level, there are also challenges in terms of supporting the growth of SMEs, new entrants in the energy sector, and issues of savings on their own (often high) energy bills, but as owners of the systems they are not indifferent to the potential additional costs. The "ambivalent" group remain moderate:

On the issue of changes in electricity pricing: "It's another area we're keeping an eye on, to see signs that there will be a certain level of equalisation, and that we don't end up completely overhauling the system. [...] The overall vision of elected officials is to maintain a certain level of service quality [...] so that we maintain an optimum level, and so that we see a return of small and medium-sized enterprises and industries to the regions" (interview with the FNCCR).

In view of these uncertainty factors, the current picture of the economic consequences at national level remains unclear.

The technological dimension

Large-scale expansion of self-consumption would involve spikes in production at times of day and periods of the year of off-peak consumption. While self-consumption represents a "grow your own" option for electricity consumption and a way to lower household electricity bills – France's environmental and energy control agency, ADEME, estimates these savings to be between 15% and 25% (ADEME, 2018) – there are also other possibilities. For consumers who want to do more than just cut costs and sell electricity back to the grid, then an energy storage solution may become necessary:

"Storage would allow holding a surplus of electricity over a relatively short period, and this relatively short period is what is called a 'power peak'. If you absorb the peak, there is no need to adapt the grid or the nuclear plants to handle it" (interview with GPPEP).

Storage is therefore the second major technological innovation underlying an expansion of self-consumption. It should be noted that storage could also help avoid having to make power grid reinforcements (and the associated costs) and help secure the supply of electricity in edge-of-grid areas. Although a range

of solutions are under development (batteries, use of electric vehicles, etc.), storage remains a major uncertainty variable due to cost. While it would seem to be an essential innovation, the CRE has noted its absence in existing projects:

"The consultation led by the CRE revealed that storage is still rare in self-consumption setups" (CRE report).

For some private stakeholders, the regulatory framework is to blame:

"Right now in France, the regulatory framework penalises – or rather does not encourage, to put it more tactfully – the installation of batteries. Not at all. Economically, it doesn't make sense to have a self-consumption setup with a battery. Because basically, if you produce electricity locally but don't consume it yourself, you get compensation for selling it back to the grid" (interview with EDF EN).

The third technological innovation is digital. Eventually, technology would enable self-consumption to be not just a way to earn extra income for a handful of households, but rather a broader restructuring of the electric power system. To this end, "smart" technologies (smart grids, micro-grids, smart meters, blockchain) would allow energy consumption and production to be managed in real time, by distributing locally produced electricity in response to needs and, crucially, by adapting needs to production.

The degree to which self-consumption would disrupt the existing system depends on whether it is used in conjunction with storage or with smart technologies. If there is a massive expansion of renewable energies, including via self-consumption, the production of this energy would be intermittent by nature (sun, wind) and a new method would be needed for balancing supply and demand: without storage, consumption would need to adapt to the constraints of intermittent power. This ability to manage electricity demand is known as "demand-side management". But once again, there are not many projects factoring in this variable:

On the topic of calls for tender in the region: "In our system for scoring bids, there is a criterion for demand-side management [...] but very few projects take it into account, and if they do, it's with thermal energy storage" (interview with Région Occitanie).

The social dimension

While there is mounting debate on the technological, regulatory and commercial aspects of self-consumption, little is being said about the social transformations that it could lead to. We have therefore identified some unexplored social transition aspects.

First, the expansion of self-consumption raises the question of social acceptance: Would everyone want to become a self-consumer? Intuitively, the "grow your own" approach to electricity would seem to have its appeal. However, the issue of underestimating social acceptance has more than once taken France's electricity stakeholders by surprise (Chamaret et al., 2020): Linky smart meters, resistance to high-voltage lines, etc. There is also the recurring argument that self-consumption could lead to individuals taking control of their production and consumption by making them visible. Consumers would become activist consumers or consumer-producers (Cochet, 2000):

"Simply by looking at the graph, with your electricity production on one side and your consumption on the other, and when you notice that you're consuming more than you're producing, you think, 'Can't I just try to consume less?' And so the effect is to spur people to use less energy" (interview with GPPEP).

If this kind of consumer awareness occurs, it raises the question of whether it will affect how people use energy from the grid:

"So the relatively stable portion, that's handled internally, it's the consumer who manages that. And then what they give us, or what they consume, is only what we call 'la dentelle'⁽⁵⁾ in other words, anything over and above that. And that's what's the most complicated for us to manage. First, because it's a smaller volume but the same amount of management [...]. And so when we collect little bits of "dentelle" here and there, based on cloud cover, etc., and we no longer have the base, that has a major impact for us. [...] It doesn't mean it's not worthwhile, but it does mean we really need to think about how to do it" (interview with Enercoop).

Lastly, this new method of energy consumption requires considering the effects that its expansion could have in terms of inequality, in two respects. The first is that self-consumption may not be an accessible option for lower-income households, causing them to contribute more to funding the system than self-consumers, who, in the case of the "individual" category of user, contribute nothing at all for the self-generated electricity they consume (TURPE and tax exemptions, see Table 3). The second is regional inequality in terms of disparities in the number of sunlight hours. In both cases, it is the principle of tariff equalisation and solidarity between individuals and regions that is at issue. Maintaining equalisation is pitted against recreating solidarity through other mechanisms:

"We were told, 'Yes, but nationwide solidarity...' Agreed! But what if we came up with new models? That's what Enerplan is now proposing, to open up contracts for selling surplus electricity to community solar programmes, for example. So that when there is extra electricity, it can be redirected to low-income consumers" (interview with Enerplan).

Our analysis of the discourse around self-consumption reveals that the experimentation taking place within this niche is not in relation to the technology itself, or the associated practices, but the vision of the entire system and how it might evolve. However, there is nowhere near a consensus on this vision.

The role of stakeholders in gradually expanding the definition of self-consumption

The power struggle between electricity stakeholders following the CRE consultations in 2018 has persisted, particularly with regard to the rules around collective self-consumption, with the individual category benefiting from enough support measures and tax exemptions to be economically viable – and these measures have not been challenged (see Table 3). Changes to the definition

have gradually been fuelled by the discourse behind the various positions described above. Beginning in 2018, the discourse of the "committed" camp found a policy position in the solar power plan of the Ministry for the Ecological Transition, which uses a wider coverage area for collective self-consumption, does not limit support measures for facilities (< 500 kWp) and opens up the possibility of third-party investors. Similar developments are underway at European level with the EU Directive of 11 December 2018. In 2019, the PACTE⁽⁶⁾ Act and the associated ministerial order permanently broadened the scope of collective self-consumption and increased the cumulative power limit for facilities. The category is still not exempt from TURPE or CSPE, to the dismay of the solar power industry. To address the remaining financial constraints, the regions have begun to play a major role by granting subsidies to collective self-consumption projects.

At each of these stages, interventions by stakeholders to influence politicians and lawmakers have been the subject of controversy. For example, the most ardent of the "committed" camp, such as Enerplan, complain that the CRE has been holding things back, calling for limits every time new measures are proposed. Other stakeholders, like this manager of a solar power design office who has published numerous articles on the subject, have also spoken about their own lobbying efforts:

"It's taken time, planning, consultations and meetings with MPs and senior DGEC⁽⁷⁾ officials to get here. That's a fact" (A. Joffre, TECSOL, Vertsun, 26 September 2019).

This debate between the "committed" and "hesitant" sides has also involved other, more direct means of action, such as court challenges. Enerplan has twice petitioned the *Conseil d'État*, France's highest administrative court: once in 2017, against a circular from the economy and finance ministries (Bercy) on CSPE exemptions, and a second time concerning the CRE's 2018 decision on optional TURPE pricing specific to collective self-consumption setups, a measure considered to be "punitive".

Furthermore, as details relating to collective setups have been clarified, there has been increasing engagement on the matter from stakeholders whose position was initially less clear or more reluctant. This has resulted in the development of commercial offerings and communication campaigns designed to raise consumer awareness about collective self-consumption. At least two of the main suppliers, EDF EN and Total Direct Énergie, now have full-scale self-consumption offerings, from project assessment to implementation, including support services and smart management solutions. EDF was also involved in one of the 20 collective setups that have materialised so far. Enercoop produces educational webinars on the subject. Enedis was involved in the first collective setup and is supporting five more projects at national level.

⁽⁵⁾ TN: Literally, "lace".

⁽⁶⁾ TN: Business Growth and Transformation Action Plan.

⁽⁷⁾ TN: Directorate General for Energy and Climate.

Although self-consumption is yet to be practised on a large scale, it is continuing to expand through a space of discussion and debate. In the following section, we will discuss the theoretical and practical implications of these results.

Discussion and conclusion

The persistent debates on self-consumption demonstrate why “transition niches” should be understood as spaces for commentary and discourse, as well as spaces for technological experimentation. Within these spaces, stakeholders observe the uncertain development of a still-emerging practice, leading them to come together to deliberate on how the system could be reconfigured. While Geels’s approach cannot be used to identify whether, in principle, an activity is a niche or not, it can nevertheless serve as a guide for discussion and analysis: it is an “orienting theory” as defined by Whyte (1984). As such, we believe it could be used for future research on the possible disruptions of other identified niches, such as smart technologies (smart meters, connected homes, etc.) or new forms of storage or mobility. Our analysis of self-consumption as a transition niche has allowed us to draw several theoretical and practical insights on how transitions take place.

First, our study of the discourse surrounding self-consumption has helped to clarify the nature of the controversy over its expansion. Our analysis illustrates the degree to which the transition to which a niche belongs requires deconstructing all of the existing structures – technological, political and regulatory structures, as well as social, economic and commercial ones (Schot & Geels, 2007). While there is consensus among stakeholders as to the disruptive potential of self-consumption, where viewpoints diverge or falter tends to be on the issue of how to find a new equilibrium: whereas the positions of stakeholders are relatively clear in the regulatory and economic dimensions, they are less certain or remain unspoken in the social and technological dimensions. This conclusion suggests further exploring the mechanisms at work in the reconstruction of a shared representation of a system in transition, taking into account the uncertainties present in the different dimensions of the system (Reverdy, 2010).

Our analysis of the discourse on self-consumption as a niche, in terms of its effect on the dimensions of the regime, reveals the existence of particularly strong uncertainty in the social dimension. This is indicative of the difficulty of taking practices into account in navigating the energy transition: despite experience from past transformations of large systems, analysis is more focused on the technological aspects, with little attention paid to practices. Yet practices are key to analysing the trajectory of self-consumption. Studying energy consumption from a theory of practice approach (Warde, 2005) seems particularly promising, in that it offers a way of moving away from an analysis of “having” toward an analysis of “doing” (Dubuisson-Quellier & Plessz, 2013). In the matter at hand,

from a consumer’s perspective, the consumption of electricity would appear to have more to do with “doing” something (through their use of the electricity) than “having” something (i.e., owning a number of kilowatt hours). Reckwitz (2002) defines a social practice as a routinised type of behaviour consisting of several interconnected elements: bodily activities, mental activities, knowledge, know-how, and things and their use. An energy consumer remains relatively unaware of the practices associated with energy use, which are based on both habit and the structures in which the uses are established (Gram-Hanssen, 2011; 2014).

From a management perspective, a better understanding of electricity consumption practices would help identify catalysts for change. The stakeholder discourse we have analysed contains practically no mention of the practices of self-consumers. As it stands, the discourse is based on relatively vague depictions, even inventions, of the self-consumer. Are there specific obstacles and opportunities based on energy consumption practices? Answering such questions would help to better envision how to structure, initiate and manage the trajectory for the expansion of self-consumption (Dubuisson-Quellier, 2016; Dumez & Renou, 2018).

In conclusion, the concept of a “niche” has helped to better define the disruptive nature of the phenomenon of self-consumption. It has revealed the difficulty in building a shared representation of the new equilibrium that needs to be found, in light of the uncertainties associated with each dimension and how they interact. Furthermore, the case of self-consumption suggests the need to take a theory of practice approach to the study of socio-technical transitions, in order to better understand how a technical innovation turns into a social transformation, and to understand the role that such transformations could play in the transition of the system as a whole.

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