Chapter 12
Prosumers as New Energy Actors

Rafael Leal-Arcas, Feja Lesniewska and Filippos Proedrou

Abstract This chapter analyses the opportunities that prosumers, as new energy actors, bring to achieving energy security goals in the context of the European Union (EU). In energy governance, there is a progressive top–down diffusion of potential, competences, and leverage across the energy value chain from States and corporate actors towards prosumers. Private and public finance should be attracted and directed to infrastructure schemes that will enable a transition from the traditional centralised power network to the decentralised nexus of smart grids. Technology will play a crucial role in facilitating the role of prosumers in the new market in-the-making.

Keywords Prosumers · Energy security · Sustainable energy · Energy democratization · Decentralized energy

12.1 Introduction

The increasing role of new actors in law-making has received attention since the 1990s [1]. Developments in climate change and environmental law in this era have catalysed innovative governance approaches by non-State actors and international organisations. These developments have created new legal challenges, both public and private, in a global multilevel governance context. New actors are not solely involved in contributing to thematic law and policy agenda setting, developing solutions, and providing oversight capacity; they are also becoming important players in delivering services. Opportunities to deliver services are growing

R. Leal-Arcas (✉)
Queen Mary University of London, London, UK
e-mail: r.leal-arcas@qmul.ac.uk

F. Lesniewska
School of Oriental and African Studies, University of London, London, UK

F. Proedrou
University of South Wales, Pontypridd, UK

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as the global economy reconfigures around advancing information and communications technologies illustrated by the rapidly emerging 'gig' economy.[1]

In this new setting, ample space is created for the emergence of new energy actors, a principal one being prosumers, namely consumers who are also producers of (renewable) energy and who use energy in a smarter and more efficient manner. Energy prosumers is an umbrella term referring to self-generating energy providers, whether households or energy communities. Individuals contribute to the energy supply in their vicinity via their own installed renewable energy capacity, more often than not solar roofing, wind energy, or combined heat and power [2].

This chapter critically analyses the new challenges and opportunities that prosumers bring to achieving energy security goals in the European Union (EU). The EU, along with the United States (US), is a pioneer in engineering a hybrid electricity market model, where traditional power plants will be supplemented by virtual power plants, a plethora of small, individual energy producers and a corresponding new set of mechanisms to cater for the new market. That said, the adoption and customisation of (elements of) this new energy architecture by other countries will hinge upon the degree of its success within European soil. This chapter contributes in two specific ways. First of all, it critically discusses an emerging new actor in the EU's energy security that we refer to as prosumers. Second, it illustrates in broad terms the ways in which this new actor will cooperate with other actors in the EU energy market and contribute to the European Union's energy goals.

In this context, side by side with traditional threats and challenges, new risks, but also opportunities, arise for the ensuring energy security [3]. The energy sector is undergoing a large-scale low-carbon transition. What is underemphasised in this transition is that it involves a major paradigm shift from a supply-driven to a demand-side energy policy. Driven by a mix of geopolitical, economic, climate, and technological considerations, the energy sector is moving towards a new architecture, the principal pillars of which are progressive electrification, a cleaner energy mix, renewable indigenous energy production, increased energy efficiency, and the development of new markets to produce, transmit, and, crucially, manage energy [4]. The key to this overhaul is the slow, but already underway, development of prosumer markets.

[1]'A gig economy is an environment in which temporary positions are common and organizations contract with independent workers for short-term engagements.' (See WhatIs.com (2016) Definition: Gig Economy, updated May 2016, http://whatis.techtarget.com/definition/gig-economy, accessed 12 October 2017.).

12.2 The 'Gig' Economy and New Technologies

The emergence of the 'gig' economy implies the introduction of new actors. The increase in service provisions such as Airbnb, contracting, free-lancing, self-employment, and on-demand Web-based platforms such as Uber are challenging traditionally regulated economic relations. It is not possible to isolate the 'gig' economy per se. Various terms are used, mostly interchangeably, to describe these new economic phenomena including the 'gig' economy, the 'sharing' economy, the 'collaborative' economy, the 'peer-to-peer (P2P)' economy, and the 'access' economy, amongst others. It is arguable whether these notions reflect the same economic model, especially given the plurality and diversity of the activities and the various forms that the 'sharing' scheme may take [5]. Yet, overall the concept itself appears to be simple and has a certain dynamism that fits within the broader context '[t]he advent of the collaborative economy, in combination with artificial intelligence, big data and 3D printing' [6].

To economists, the 'gig' economy represents what is termed as a 'disruptive innovation' [5]. The 'gig' economy offers opportunities for existing and new market players to engage in new forms of economic exchanges. However, it also has negative impacts on current relations among market participants, policymakers, and regulatory authorities. It remains to be seen how this new economy alters the mechanisms of traditional economic schemes.

The growth of the 'gig' economy is intrinsically linked with new technologies. Many innovations depend on access to data at reduced costs. Arguably, there is a chance to maximise economic growth if we have more openly shared data under proper ethical structures, instead of competing data silos.[2] Data become 'most valuable when open and shared'.[3] In the EU, for instance, economic security and growth is associated with the provision of cloud computing. Special Rapporteur Hans Graux claims:

> Allowing easy on-demand access to information technology services, cloud computing can significantly reduce capital expenditure, as cloud users only pay for what they actually use. [… This will foster] innovative business models and services across all industries, generating new advantages for customers and companies alike. […] Small businesses (SMEs) in particular can benefit from the cloud, as they can get access to high-performance IT solutions, which will help them to adapt quickly to new market developments and to innovate and grow their businesses faster [7].

Given this perspective, the cloud has an enormous part to play in decentralised energy provision in the EU energy generation, as it will open up opportunities for new small- and medium-scale actors. To achieve this, Graux envisages a sharing economy that is not held back by regulation and barriers to market access.

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[2]See the views expressed by Mark Parsons, Secretary-General of Research Data Alliance, in M. Parsons (2017) Letters to the Editor, The Economist, 27 May 2017, at 20.

[3]Ibid.

In the context of a decentralised energy system—a system that places the consumer at the centre of action, empowers the consumer, and therefore democratises the energy system [8]—it is important to talk about smart grids. The term 'smart grids' can be defined in a variety of ways. The following definition is used by the European Regulators' Group for Electricity and Gas (ERGEG), the Council of European Energy Regulators (CEER), and the European Commission in a number of documents:

> [A s]mart grid is an electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it—generators, consumers and those that do both—in order to ensure economically efficient, sustainable power systems with low losses and high levels of quality and security of supply and safety.[4]

Smart grids are integrated systems that include information, technologies, influences from society, managerial supporting arrangements, political limitations as well as legal considerations. Smart metering systems are a stepping stone towards smart grids empowering consumers to actively participate in the energy market. Smart metering systems and smart grids foreshadow the impending 'Internet of Things', and the potential risks associated with the collection of detailed consumption data are likely to increase in the future when combined with data from other sources, such as geo-location data, tracking and profiling on the Internet, video surveillance systems, and radio frequency identification systems.[5]

Across the EU, decentralisation, as well as the development of smart grids and smart metering installation, is occurring at differing rates with the purpose of reducing greenhouse gas emissions. In 2014, approximately 42% of European countries already had a strategic roadmap in place for the implementation of smart grids, while 58% did not [9]. Enabling the necessary regulatory reforms across the spectrum of issues will require innovative approaches to law and regulatory design. The implications of smart grids like the 'gig' economy itself for law, regulation, and policymaking are only beginning to be considered [10]. 'Gig'-based economic activity often raises issues with regard to the application of existing legal

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[4]See ERGEG, Position Paper on Smart Grids—An ERGEG Public Consultation Paper, E09-EQS-30-04, 10 December 2009, at 12; ERGEG, Position Paper on Smart Grids—An ERGEG Public Conclusions Paper, E10-EQS-38-05, 10 June 2010; European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Smart Grids: from innovation to deployment, COM (2011) 202 final, 12 April 2011; CEER, CEER Status Review on European Regulatory Approaches Enabling Smart Grids Solutions ('Smart Regulation'), C13-EQS-57-04, 18 February 2014.

[5]Article 29 Data Protection Working Party, Opinion 04/2013 on the Data Protection Impact Assessment Template for Smart Grid and Smart Metering Systems ('DPIA Template') prepared by Expert Group 2 of the Commission's Smart Grid Task Force, 00678/13/EN WP205, 22 April 2013, at 5; Council of Europe, Committee of Ministers, Recommendation CM/Rec(2010)13 of 23 November 2010 of the Council of Europe Committee of Ministers to Member States on the protection of individuals with regard to automatic processing of personal data in the context of profiling, CM/Rec(2010)13, 23 November 2010, at 1.

frameworks and blurs established lines between consumer and provider, employee and self-employed, or the professional and non-professional provision of services.

All of this can result in uncertainty over applicable rules, especially when combined with regulatory fragmentation stemming from divergent regulatory approaches at the national or local level. When it comes to energy, fragmentation of policies, regulations, and cooperation platforms is a constant problem in its utilisation and trade, creating barriers to communication and effective solutions [11]. It remains to be seen whether the impact of such disintegration may slow down the spread of smart grids or, on the contrary, whether it will have the potential to boost it in the future. The European Commission has noted that there is a risk that regulatory grey zones are being exploited to circumvent rules designed to preserve the public interest [12]. In reality, the 'gig' economy is merely adding to a pattern of decentring governance and the emergence of a 'post-regulatory' world [13].

12.3 New Energy Actors

The emergence of new actors on the energy market will influence the feasibility of fulfilling goals related to a more effective energy utilisation. Prosumers have the potential of increasing energy efficiency and securing stable energy supplies for a wider range of consumers, including themselves. New opportunities arise for a new type of economic activity, that of energy aggregators, in what seems to be a much more variable business energy landscape. This role can be fulfilled by incumbent market players as well as by new companies that will focus on encouraging their customers' efficient use of energy and contracting the surplus capacity, which they can sell in a 'flexibility package' to the distributors and utilities. Small storage providers can also emerge in an evolving market that needs back-up capacity and last resort solutions to respond to energy supply and demand variability.

A high premium will be paid for such flexibility services, so the corporate rationale is evidently present. Importantly, there are strong grounds for such economic activity to take place at the community (or even at the district/neighbourhood) level, with co-operatives appearing as a potent form of entrepreneurial type of organisation [14]. The energy market increasingly calls for integrated energy services companies which will optimise both digital technology and electricity distribution by means of trading flexibility services [15]. There are reasons to be optimistic about the affordability of technology advancement for future prosumers: when smartphones came out, they were unaffordable; today, around 80% of phones in the US are smartphones [16]. By analogy, the same effect should happen in energy technology.

There are many ways for citizens, small businesses, and communities to contribute to the energy transition, actively participating in different aspects of the energy market to become true 'energy citizens'. Citizens are no longer resigned to the role of passive consumers, but have the potential to be energy producers, or 'prosumers', particularly through self-generation of renewable energy, energy storage, energy conservation, and participation in demand response [17]. From a legal point of view, prosumers are still considered individuals rather than commercial actors. Their coming together as energy communities will necessitate a more commercial legal status. In general, the future legal status of prosumers is one of the issues that remain unsettled and will have to be determined by the upcoming EU energy regulation.

Crucially, the new energy market creates ample opportunities for individuals and households to become energy traders [18]. Either directly *vis-à-vis* established utilities or indirectly through aggregators, prosumers are empowered to trade the energy they have conserved or produced, thus killing two birds with one stone by facilitating flexibility and network optimisation as well as raising extra revenues for themselves. Indeed, the emphasis of the undertaken energy overhaul lies in distributed energy resources (DER), which enhance local generation and flows into the network [19].

The establishment of a prosumers market is very much a work in progress. Smart grids are the hardware that will allow their full-fledged development, while relevant regulation will be its software. The Commission has taken a solid stance in its Winter Package on several key issues:

- First, it provided for consumers' right to consume the renewable electricity they generate without facing undue restrictions. This means that national jurisdictions that still forbid self-generation will be displaced by EU legislation. On top of this, consumers will be empowered to trade the energy they produce to energy companies, this way becoming active participants in the energy markets and pillars of their consolidated resilience.
- Second, a separate type of energy entity, namely energy communities, is explicitly recognized. Prosumers will be granted the right to group and function in the market collectively.
- Third, more information will be provided regarding energy performance and the sources of district heating and cooling systems. This is a key issue if prosumers and energy communities are to be in practice empowered to improve on their energy performance, including both production and consumption as well as trading. Added to the above, further scrutiny will be paid to improving the quality of information consumers will get. This calls for further refinement of the Guarantees of Origin system with regard to energy resources.

Placing prosumers at the centre of energy markets also requires widespread active demand participation by consumers. This boils down to the 'corporatisation', rationalisation, and economisation of consumer behaviour [20]. Demand response is all about consumers making use of the services digital technology provides to better adjust their energy use to their needs and at the same time adapt their energy usage to the most affordable energy price bands throughout each day. This can grant them significant benefits in terms of energy conservation, efficiency, savings, and extra dividends. Critical information on the state of the grid and running prices enables consumers to turn down, for example, the heating system at peak times to save on energy. This way pressure to the grid is relaxed and the consumer is remunerated. On the other hand, making use of cheap energy (when, for example, solar panels and/or wind turbines generate ample energy) leads to valuable energy savings/surplus for trading [21].

Smart applications and dynamic price contracts are different ways to achieve energy efficiency maximisation. With regard to the former, instructing smart appliances, like the washing machine, to operate at the time of the lowest prices within a day is an energy saver. When it comes to the latter, consumers can take note of their consumption patterns and negotiate corresponding contracts with electricity suppliers. Such contracts should be increasingly on offer and become increasingly more sophisticated and flexible, taking into account that competition is expected to mature and become consolidated. A number of pricing mechanisms can be utilised, such as real-time pricing, time-of-use pricing, critical-time pricing, tariff-of-use pricing, and time-variable pricing to reflect market fundamentals and substitute for traditional methods of dealing with supply-demand disequilibria, such as load-shedding and self-rationing.

Implementing dynamic pricing contracts, however, is more easily said than done. From the perspective of utilities and energy services companies in general, the variability, multi-dimensionality, and heterogeneity of energy use render the 'representative agent' approach deficient in a demand response programme. While a one-size-fits-all programme is hardly the solution, designating appropriate contracts for vastly different (and dynamic) consumer profiles is a daunting task. Efficient contracting is hence practically challenging, especially if one also takes into account the supply side. Suppliers themselves differ in the cost (disutility) they have to bear to draw on flexibility services to match demand each time and are naturally loathe to shoulder extra costs [22].

A crucial parameter that will to a great extent determine the scale of optimisation of smart grids will be the successful incorporation of storage capacity in the system in the form of batteries. This remains commercially challenging, with controversy over the efficiency gains lingering. The use of storage batteries will enable the optimal function of the network, not least since it will reduce peak consumption, system-wide generation costs, losses, and network congestions. At the same time, it will lessen the need for further investments in network expansions [23].

Whether electric vehicles are the optimal means of storage is also debatable. The use of double (or old) batteries, logistical issues pertaining to charging periods and infrastructure costs, as well as the optimisation of the network with vehicles plagued off the grid in rush hours, all remain thorny issues to be sorted out in the near future. On the bright side, the spill-over to one of the most pollutant energy sectors—transportation—holds high promise for scaled-up performance in carbon reductions, an outcome direly needed if designated climate measures fail to stabilise the rise of global temperature in time [24].

The modern grid has been operationally grounded on the worst case dispatch philosophy. Given that the supply side was a priori known, utilities had to balance it with demand which could be in most cases predicted to lie within certain bands. In order to tackle any incidents of supply-demand imbalance (owing either to any supply side failure or to an unpredicted surge in demand), a large reserve capacity was retained. While this added to overall costs and carbon emissions, it provided a shield of protection against power cuts and inevitable load-shedding [25].

Following the same principles and rationale hardly makes any sense for smart grids, whose very function is based on the stochastic and dynamic nature of both supply and demand. An increased degree of intermittent renewable energy, unreliability of storage, micro-grids, variability in consumer choice, and the function of smart appliances all increase uncertainty in both supply and demand of electric power. This variability and unpredictability can be mediated and tackled by a number of tools, such as sensors, smart meters, and a wide range of demand response mechanisms that provide accurate information on the state of the power system and the supply-demand equilibrium as well as more refined means of control of energy use [26].

Following this rationale, a reconsideration and ensuing redefinition of risks management seems appropriate. What constitutes acceptable risk must certainly be adjusted to the new operating conditions of smart grids and replace the current measures of risk. In this context, it is necessary to pass from only quantities to quantities plus probabilities in supply–demand information analysis. Demand response of individual consumers has to be aggregated into a probabilistic demand curve, analogous to the generation availability curve of intermittent renewable energy [27]. The focus lies constantly on the fluctuations in the *net load,* the difference between total demand (load) and variable generation. A number of attributes are fundamental when considering balancing the load, such as capacity, ramp rate, duration, and lead time for increasing or decreasing supply as appropriate [28].

Cross-border markets and their potential must also be integrated into risk management analysis. The EU's current cross-border electricity trade has worked well in the day-ahead market. A big part of national markets are now coupled, stimulating price competition, improving balancing, and enhancing back-up capacity and hence resilience. Importantly, cross-border markets should increasingly expand to include non-EU Member States that have joined the Energy Community and can also include capacity from neighbouring states outside the Energy Community. While cross-border capacity is definitely a source to tap from, a number of physical barriers such as congestion, lack of transmission capacity, and/or under utilisation have, in several cases, resulted in sub-optimal transmission returns and hub market differentials, which impede, rather than facilitate, cross-border trade. Moreover, while the traditional timeframe for most of electricity trading has been day-ahead trade, moving towards 'real-time', intra-day trade remains a challenge [29].

12.4 Conclusion and Recommendations

This chapter sheds light on the emergence of a new actor, namely the prosumer, in the EU's energy security arena. Sustainable energy is rapidly becoming an EU special brand, like the protection of human rights, in the quest for looking after the environment. Achieving sustainable energy encompasses the following points: decarbonising the economy, democratising access to energy (namely everyone has the right to participate), digitalisation, diversification of energy supply, and disrupting traditional energy cycles. Leadership is shifting from national politics to local politics and, therefore, power is being decentralised. For instance, when there is a natural disaster in a given neighbourhood, citizens do not contact the head of State or government of the nation, but the mayor of the city. A clear example of this trend towards local politics is the Local Governments for Sustainability platform.

Following trends in the EU towards decentralisation and the emergence of a 'gig' economy, the energy sector is currently undergoing a large-scale transition. One of its core aspects is the progressive top–down diffusion of the potential, competences, and leverage from EU institutions, States, and corporate actors across the energy value chain towards prosumers, who need to be at the centre of the energy transition for it to happen democratically in a bottom–up manner. This phenomenon can be conceptualised as energy democratisation, namely moving away from a few energy companies monopolising access to energy towards energy owned mainly by consumers, making consumers of the utmost importance.

All of this is achievable by shifting the current paradigm to one that is more human-centric, by linking projects to people, and more collaborative in how it tackles various obstacles, whether legal or behavioural. Think of the analogy of organic food: it is more expensive, but for many, its benefits outweigh the costs. Moreover, consumers have the power to choose either organic or non-organic. By the same token, many citizens are interested in climate-friendly products even if they are more expensive. This means that we need to look at the whole production process, not just the end product, if we are serious about consumer empowerment. To get there, legislation must remove barriers to participation and protect and promote consumers to enable them to produce, store, sell, and consume their own energy.

While all of the above creates ample potential for facilitating and improving the EU's security of supply as well as fulfilling its climate targets, several caveats exist. These not only are confined within energy security prerogatives, but also extend to the critical management of digital security, which the digitalisation of energy services brings to the fore. So, for consumers to become prosumers and engage in the energy transition, it will be crucial to make the process interesting and simple and to inform them much more, given the current level of energy consumer dissatisfaction. Here is where cities can play a major role at educating citizens on energy transition and climate change mitigation, not least because cities consume three quarters of the world's energy, and because they are smaller entities than countries or regions, so it is easier to get things done. Even more impactful would be to educate companies and policymakers on sustainable development, since there are fewer of them than there are citizens. Doing so will shift the paradigm from a system that is producer-centric to one that will be consumer-centric. This paradigm shift is crucial because development is not possible without energy and sustainable development is not possible without sustainable energy.

In an ever-shifting context, demand management emerges as a key issue. The provision of adequate and precise information to prosumers—so that they can optimise their use of smart grids—as well as the transition to targeted, flexible contracts to adjust to the needs of prosumers need to be embedded in well-articulated broader policy and market regulatory frameworks. Moreover, private and public finance should be effectively attracted and directed to indispensable infrastructure schemes that will enable the transition from the traditional centralised power network to the decentralised nexus of smart grids. And it is well known that where finance flows, action happens. Last but not least, the technologies that will be prioritised in terms of energy generation to back renewable energy generation will play a crucial role in facilitating the role of prosumers in the new market in-the-making. Since renewable energy is becoming more competitive, more green jobs will be created in the future and the trend towards a clean energy revolution is ever closer. This energy transition into renewable energy, in turn, will help both enhance energy security and mitigate climate change. So rather than investing large amounts of money into building liquefied natural gas terminals and gas pipelines, the EU should make a greater effort to invest in renewable energy.

The emerging establishment of prosumer markets is an invaluable development that will enable the transition from supply-driven to demand-side EU energy policy. This cannot but have far-reaching ramifications for the amply politicised and securitised gas trade with Russia as well as for furthering the internal EU market architecture. It is expected that it will decrease flows of energy as well as dependence on Russian gas in the medium term while at the same time acting as a stimulus for further market integration in the energy, climate, and digital economy realms.

Giving civil society a greater voice is imperative for the energy transition to happen. Below are some of the necessary actions:

1. Speeding up action on the ground and localising global agendas;
2. More alliances between countries and donors in the decarbonisation process;
3. Greater collaboration between civil society, governments, and NGOs to include all layers of governance;
4. Bringing together different camps of governments;
5. Scaling up the capacity of local governments;
6. Webbing[6] will be necessary: we need to look at issues and challenges, not sectors; temporal linkages are required, namely using time as an indicator given

[6]By webbing, we are referring to connecting different issues in a broader policy approach rather than approaching them in silos.

its importance in the context of decarbonisation, and there needs to be policy coherence.

Finally, in the future, energy will be consumed near where it is produced. How will this impact international trade (in energy)? Furthermore, the protectionist concept of 'buy local' seems to be going global. This policy is suggested, among other things, to reduce greenhouse gas emissions from transportation, which will benefit climate change. But what implications will it have for international trade? Unless there is more innovation in transportation, there is a chance that this policy will result in less demand for international trade. How can international trade and climate change mitigation work together harmoniously without impeding each other in the context of an emerging decentralised energy system? New actors and modes of governance are changing the traditional global trading system, or at least are contributing to the transformation from inter-State dealings to completely different forms of governance in which non-State actors (including individuals) play a role. The EU has been a social laboratory to test hypotheses of multi-level governance in the past, which are pertinent for the case of energy transition. The above questions are all very relevant to a future research agenda in the broad field of international economic law and governance.

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