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Outlook: Energy Transition and Regulatory Framework 2.0: Insights from the European Union

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30.1 Common Trends, Challenges, and Convergence Patterns in the Energy Transition

For the first time ever, in 2016, the electricity sector[1] was the largest recipient of energy investments, mainly in renewable capacity (IEA 2017c; IRENA 2018a). Despite a steady and impressive growth rate since

[1] While the energy transition is not limited to the electricity sector but includes the heating and cooling as well as the transport sectors, this chapter focuses on the former as it has the largest potential for decarbonisation and is the one where the most action has been undertaken so far (Welsch et al. 2017).

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1990, the share of renewable energy sources (RES)—especially variable RES (vRES) such as wind and solar power—is still limited in the worldwide total energy supply and ranks third behind coal and natural gas but closing in on them (IEA 2017a, b). However, recent forecasts underline that this investment trend and increased deployment of vRES[2] are unlikely to subside and, on the contrary, may even accelerate due to cost reduction,[3] provided regulatory adaptions are undertaken worldwide but particularly by regional leaders such as China, the United States of America, India, Japan, and the European Union (EU) (IEA 2017b).

Three policy goals—sometimes mutually reinforcing each other, sometimes contradicting each other—define energy policy. Those are energy security, affordable/competitive energy prices, and sustainability/decarbonisation (concept of trilemma Sect. 17.1.2; see also Buchan 2015). They can be reformulated more precisely, for example in terms of (de)centralisation of the energy system, market regulation, fight against energy poverty, or nuclear phase-out. While each country has different drivers, faces specific problems, and responds to them differently in the political arena (see Sects. 2.1 and 2.2), common trends, challenges, and convergence patterns can be identified in transitioning to a low-carbon economy:

(1) *Due to their volatility, the increasing deployment and market penetration of vRES paradoxically hampers their integration in energy systems, both at the grid and market levels*. On the one hand, uncertainties in predicting supply entail difficulties for grid management and therefore higher integration costs, which are increasing retail prices and are passed on to final

[2] In spite of a dip in the amount of investment in RES (IEA 2017c; IRENA 2018a), capacity has increased and will continue to do so. Global RE capacity should increase by 43 per cent between 2017 and 2022, twice the growth of coal and natural gas combined. Wind and solar are expected to account for 80 per cent of this growth. By 2022, Denmark will be the world leader with 70 per cent of its electricity-generation capacities coming from renewables while other European countries, such as Germany, should attain 25 per cent. Most BRIC countries will probably double their share of vRES generation to reach 10 per cent (IEA 2017a).

[3] The International Energy Agency (IEA 2017d) observes that the cost of clean energy technologies, that is, vRES but also battery storage, has dramatically decreased in the last years: 25 per cent for wind energy, 40 per cent for battery storage, and 70 per cent for solar power since 2010. The competing International Renewable Energy Agency (IRENA 2018d) even mentions a reduction of 81 per cent for solar energy for the same period and states that cost reductions are constantly underestimated (IRENA 2018c, d). All in all, this shows that renewables are becoming the "least-cost source of generation" (IEA 2017d; IRENA 2018d).

consumers. On the other hand, vRES bear the risk to lose their value with increasing market penetration as wholesale prices decrease due to the merit-order effect, thus threatening their attractiveness as an investment opportunity (IEA 2017a). To cope with this variability, better integrate vRES, and secure investments, various solutions in system flexibility are investigated: grid reinforcement, extension, and interconnection; the complementarity of other flexible (renewable) supply sources like power-to-gas; the development of storage and smart technologies; and demand-side response to name a few (IEA 2017a; Welsch et al. 2017).

(2) *Doubts are raised about the actual level of investments in RES being sufficient to meet long-term growth of electricity demand (IEA 2017c), not to mention the low-carbon target set by the Paris Agreement in late 2015*. All in all, the IRENA (2018a) estimates that USD 25 trillion have to be invested in RES by 2050 to meet the latter requiring to triple the actual annual investment rate. For the EU to meet a 34 per cent RES share in final consumption by 2030,[4] would necessitate USD 73 billion per year, that is, 0.3 per cent of the current EU-28 GDP and an increase of around USD 20 billion per year compared to the 2016 investment level (IRENA 2018c). At the same time fossil industries are carbon locked-in and although exponential in growth the movement for divestment is still limited.[5] Therefore, it seems unrealistic to rely solely on traditional energy investors to pursue this effort, independently of favouring a decentralised energy system or not. New actors, such as households, communities, and businesses, are increasingly important as (co-)investors effectively blurring the traditional market roles between investor, producer, and consumer to become prosumers (IEA 2017c; IRENA 2017; Welsch et al. 2017).

[4] In 2014, the European council agreed to a target of 27 per cent share of RES in energy consumption by 2030. However, a report ordered by the Commission (IRENA 2018c) estimates that a share of 34 per cent could be attained with a saving potential compared to the reference scenario. Thus considering political (Paris Agreement) and technological developments (unexpectedly quick cost reductions), 27 per cent is considered a conservative and inadequate hypothesis. More on the 2030 EU RES target in Sect. 30.3.

[5] Carbon lock-in describes the technological and institutional path-dependency of energy systems based on fossil fuel (Unruh 2000). Divestment here refers to the disposition or sale of an asset by a company as a way for a company to restructure the portfolio of its assets, in this case all investments in fossil energy sources; this amounted to 50 billion in 2014, 2.6 trillion in 2015, and 5 trillion (probably underestimated) in 2016 (Arabella advisors 2015, 2016)

The issue of an investment gap is even more important considering that with around 90 per cent of investments private investors carry the bulk of the effort (IRENA 2018a).

(3) *The role of public institutions is specific and cannot be reduced to their investment capacity or financial support*. Public financial institutions complete or enable private investments as they tend to invest in international projects or provide guarantees against different risks or market failures, like technology immaturity, early-stage project development, unpredictability of revenues, and high transaction costs[6] (IEA 2017d; IRENA 2018a). While public investment was estimated to just USD 14 billion, support policies for RES amounted to USD 66 billion in 2015 (IRENA 2018a); at the same time subsidies for fossil fuels are still estimated to make up almost the double those for RES in 2016 (IEA 2014). Nonetheless, a recent trend in policy is a decrease in policy support and a generalised move away from regulated feed-in tariffs (FITs) and towards auction mechanisms, independently of the market structure or the type of policy support (IEA 2017a, c; IRENA 2018b, d). Additionally, a recurring concern for the deployment of RES is regulatory and policy instability, in particular retroactive decisions like those undertaken in Spain in 2013 and 2014 (IEA 2017a, c; IRENA 2018a, b, see Section 19.5.1). Given the sensitivity of investments to economic cycles and regulatory instability, governments are responsible for the coherence between their actions and their international engagement to fight climate change; however, these are or were often traded off against other political and economic priorities (Buchan 2015; IRENA 2018a). Thus maybe more than their role as economic agent, it is their role as policy-makers building a long-term, stable, and secure strategy and framework, which becomes increasingly important.

[6] For example, the European Investment Bank (EIB) analyses market failures in the energy efficiency sector: the lending activity is often unattractive for conventional financial institutions due to the multiplication of small loans leading to high transaction costs. The same can be said for investment in RES. Bundling loans through platforms or specific instruments have a role to play to correct this (https://ec.europa.eu/commission/priorities/jobs-growth-and-investment/investment-plan-europe-juncker-plan/investment-plan-results/efsi-energy-sector_en). The Consumer Stock Ownership Plan (CSOP) presented in Chapters 1 and 8 would be an alternative to pool resources.

(4) *Finally, the energy transition faces various acceptance problems*. The classical example is the "not in my backyard" (NIMBY) reaction against grid extensions or the installation of new plants, in particular wind turbines. Acceptance has also decreased as rising costs of the energy transition are passed on to end consumers while commercial consumer groups are spared. For example in Germany, energy-intensive industries are exempted from the renewable energy levy (EEG-Umlage) financing FITs allegedly to avoid competitive disadvantages on international markets; however, this privilege also applies to self-consumption leading to concerns about the impact on retail prices. The discussion about distributive justice (see also Chap. 4), either framed as burden-sharing of support policy costs (Ecofys et al. 2014), fair contribution to grid costs (Welsch et al. 2017), or access to ownership, highlights the relationship between acceptancy on one hand and allocation of resources, benefits, and costs on the other. Furthermore and although not specific to energy, technological change coming with digitalisation, for example, smart meters or (semi) automated load management systems, is viewed with suspicion by many energy consumers. The deployment of these technologies has implications for data protection as well as privacy issues, and is accompanied by a push for new behavioural norms such as demand-flexibility to the individual. Therefore, the energy transition holds not only a technical or economical but also a sociological dimension important to acknowledge in terms of economic modelling and policy-making.

Thus, while forecasts predict further deployment and acceleration of investment in RES, they do so conditionally that the market and policy framework is substantially adapted. These challenges point towards major changes of energy systems worldwide and the emergence of new social, political, economic, and legal models. Considering that this book focuses on consumer (co-)ownership, this chapter centres on the future role consumers will have and the European strategy to put them in the centre of a new market design. Therefore, while some considerations are general and can apply outside of Europe, some others are specific to the EU, which pursues liberalisation and market integration policy in parallel to its energy transition. Drawing on similar developments in other countries demand-flexibility and price incentives as crucial tools for market design are of particular interest.

30.2 The EU's New Market Design: Harnessing the Potential of Consumer (Co-)Ownership?

In the light of the rapid deployment of RES,[7] the EU was perceived as a front-runner of the energy transition for more than two decades. Long-term targets and important policy support, both contributing to investment security, are considered the two key factors which enabled this development (IEA 2017b; IRENA 2018c). However, since 2011, efforts faltered, in terms of both investment and deployment (IEA 2017a; IRENA 2018c) with the EU losing its pole position.

(1) *Background: EU energy policy and Energy Union*: To address this as well as other persistent issues specific to the EU energy policy, the 2014-nominated Juncker Commission launched the so-called Energy Union (European Commission 2015a). Often presented as a new start for the EU's energy policy by the European Commission (2015a), its reception has been, however, lukewarm with a lot of actors adopting a wait-and-see approach (Friedrich Ebert Stiftung et al. 2016; Turmes 2017; Zachmann 2015). One likely reason is that this policy merely reaffirms previous consensual goals, that is, competitive, secure, and sustainable energy in an internal energy market to the benefit of consumers, which are, however, persistently lacking implementation as the European Commission admits (2015a). The Energy Union thus does not so much redefine the EU energy policy as it aims at improving implementation through better coordination and coherence between different policy strands, in particular market integration and vRES promotion. The reference to "citizens at its core", "new deal for energy consumers", "clean energy for all Europeans", used by the Commission in relation to the Energy Union, should not merely be understood as consumers being the main beneficiaries but truly as a policy target group to be activated. The achievement of those goals requires the transformation of the energy system as well as traditional market roles and institutional configurations (European Commission 2015a, d).

[7] RE consumption increased from 9 per cent in 2005 to 16.7 per cent in 2015 and is on track to meet the 20 per cent target for 2020 (Eurostat 2017; IRENA 2018c).

Using the energy transition as an opportunity to achieve a more general goal of supranational integration, the European Commission (2015d) requires "a market fit for renewables" (liberalised internal market) and "promoting renewables fit for the market" (market integration of vRES). While the internal market and climate and environmental policy arose at different points in time and moved at a different pace, they merged in a common energy policy in 2007 with the Lisbon Treaty and are now handled conjointly (Berrod and Ullestad 2016; Buchan 2015).[8]

(2) *Developing a new market design*: Drawing back on the challenges identified in Sect. 30.1, that is, system integration, RE investments, role of public institutions and public acceptance, it is clear and acknowledged by the EU that providing the right framework for consumers is crucial for success. Following the launch of the framework strategy in February 2015, the Commission published three preparatory documents and a public consultation in July, focusing on market design, especially market compatibility of RES and their support schemes on one hand and on the role of energy consumers as active market players—producing their own energy among other things—on the other (European Commission 2015b, c, d). The test with regard to consumer (co-)ownership models is whether the final result of the "Clean Energy Package", in particular the recast of the Renewable Energy Directive (RED II) and of the Internal Electricity Market (IEM) regulation and directive, will harness its potential to facilitate both "renewable self-consumers" and "renewable energy communities" (for the EU definitions see Sect. 30.3). A positive outcome would harmonise standards at the European level and provide a model

[8] The legal basis for the EU energy policy is to be found at the article 194 of the Treating on the Functioning of the EU (TFEU). It is a shared competency, that is, the Member States can legislate on the matter unless the EU, which has precedence, does. It combines a supranational approach but still grants important prerogatives to the Member States. In particular the second paragraph states that Member States are free to choose their energy mix and the form of support schemes without prejudice to state aid and competition policy. The third introduces a derogation to the ordinary legislative procedure where taxation is concerned. Thus, while the EU sets a frame and a convergence path, the Member States still have a lot of room of manoeuver and possible veto power to safeguard their sovereignty. For the topic of this book the main pieces of relevant secondary law are the renewable energy directive (2009/28/EC) and the internal electricity market directive (2009/72/EC).

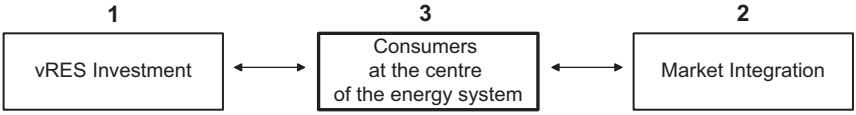

Fig. 30.1 Goals of a new energy market design in the EU

for other legislations worldwide like Germany's Renewable Energy Act almost two decades ago replicated in many countries worldwide.

In developing a new market design, the Commission's identified priorities are (1) (variable) RES promotion and deployment, (2) market integration, and (3) putting "[consumers] at the centre of the future energy system" which includes making them self-consumers and (co-)owners (European Commission 2015a, d). The attractiveness of RES in general is assessed on the wholesale market, where they compete with other generation sources while the attractiveness of self-consumption depends on retail prices (Welsch et al. 2017). The challenge is how to frame a coherent policy approach to incorporate prosumers, be they individuals, communities, or SMEs, as central actors linking vRES investments and market integration as shown in Fig. 30.1. The following sections focus on those three goals and their respective challenges.

30.2.1 Supporting (Variable) RES Investment: Remuneration and a Stable Regulatory Framework

It is widely agreed that the EU managed to successfully promote the deployment of RES through the adoption of the 2020 Climate and Energy package—in particular the RED (2009/28/EC)—in 2008, providing a stable framework with long-term binding targets and leaving Member States in charge of incentives for investments to reach them (Fig. 30.2). However, a number of problems, which would impede further deployment, arose.

(1) *Adequacy of support schemes and sufficient remuneration*: Performance criteria for support schemes are (1) policy effectiveness, that is, the ability

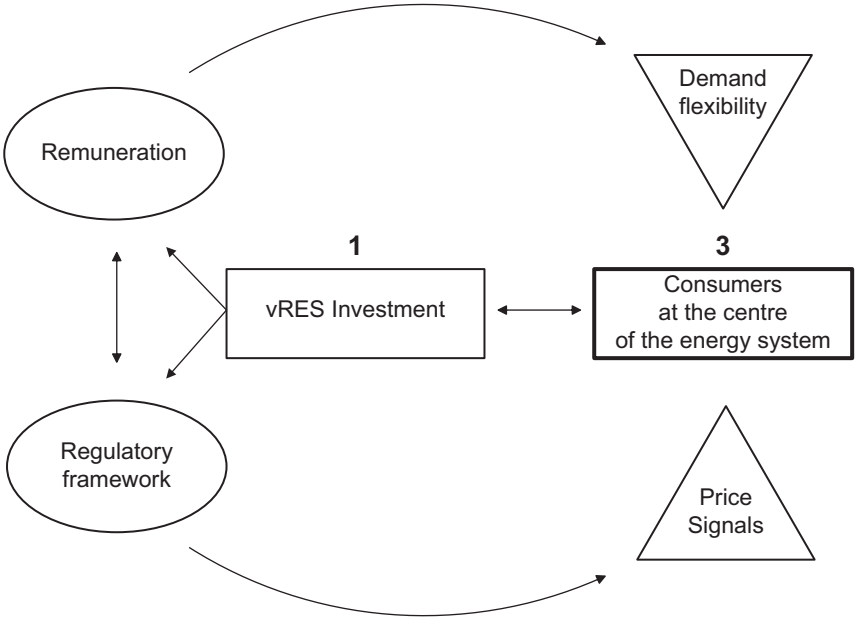

Fig. 30.2 Unlocking (variable) RES investment

to trigger new investments; (2) static effectiveness, that is fulfilling set target at the lowest possible overall costs; (3) dynamic efficiency, that is target achievement over a long-term considering whether a policy instrument helps drive down costs of less mature technologies; and (4) compatibility with market principles and distributional effects, that is, an equitable distribution of rising costs (Ecofys et al. 2014). There is, of course, no perfect solution and trade-offs are permanent between those criteria.

While the European level provided a framework and binding national targets, achieving the set share of RES in final consumption in particular through support schemes is the responsibility of national governments. As a result of the lack of RES' competitiveness and some national industrial policies, RES promotion schemes had been initially disconnected from market mechanisms (European Commission 2015a; Zachmann 2011). Such national policies had the merit to remunerate sufficiently,

trigger investments and achieve or retain an innovation leader position. However, they are not considered apt for the current state of technological development, increasing RE market penetration requiring demand-flexibility, strict rules on public finance and the principle of free movement in the internal market. While the first two are general considerations which apply around the world, the last one is specific to the EU. In particular, the use of price signals as a steering instrument is impeded by the lack of common rules, a problem exacerbated by national segmentation within the EU single market where support schemes are nationally designed and therefore not only incompatible with market principles but also with each other (Friedrich Ebert Stiftung et al. 2016; Zachmann 2011). The possibility of designing joint RE support foreseen by the RED 2009/28/EC remained unexploited. Therefore, today European policy-makers are concerned with pricing issues as current wholesale and retail prices do not reflect the competitive (internal) market equilibrium. With liberalisation, price convergence, and cross-border flows in the single market leading to increased competition and reduction of prices for end consumers, pressure on national policy-makers is rising. However, despite action since the 1990s, liberalisation is incomplete and remainders of historically national markets like regulated and social tariffs as well as high market concentration are still present (European Commission 2015a; Eurostat 2017, see also section 1.c of the country chapters).[9]

In short, the current setup managed to trigger investment (criterion a) and drive down costs for less mature technologies (criterion c) but is not adapted to reaching RES target at the least cost (criterion b) nor taking into account market compatibility or distributional effects (criterion d). Following the multiplication of cases and important decisions of the European Court of Justice on national support schemes,[10] the European Commission (2014) published the Environment and Energy State aid guidelines and envisaged that support schemes should be market based

[9] In at least 12 out of 28 Member States, the market share of the largest electricity producer is over 50 per cent. In this book, only the Czech Republic and France are examples of this ownership structure.

[10] See in particular Case C-573/12 Åland Vindkraft.

when possible with a gradual introduction of auctions and tenders to allocating support instead of administrative procedure, and premiums as operating aid instead of FITs, not waiting for the recast of the RED and following a worldwide trend.

The question is to which extent this change will still provide sufficient remuneration to keep on triggering investment, especially when considering that the increasing penetration of vRES paradoxically destroys their attractiveness (see Sect. 30.1). This development is inclined to hamper the commitment of individuals as it favours large-scale (commercial) projects (see Chap. 1 as well as Sect. 13.6 on auctions round in Germany in 2017). Therefore, an efficient support scheme is not necessarily a market-based one. Both the EESC and the EC emphasise the need to maintain FITs with a close monitoring to adjust tariffs and avoid overcompensation (SWD141 European Commission 2015d; EESC 2015). As many others (Ecofys et al. 2014), the EESC proposes FITs as the main form of support for small-scale RE-projects with citizen participation as it provides security for small investors. The European Commission (2014) considered exemptions for small installations in its guidelines and some were, indeed, included in the RED II recast (see Sect. 30.3). The regulatory framework should therefore offer remuneration schemes for investors, in particular prosumers, sufficient to remunerate the investment under different levels of transaction costs while providing enough stability and simplicity to reduce risk and transaction costs altogether. Otherwise investments will decrease as risk premiums rise and policy costs with them (Ecofys et al. 2014).

(2) *Regulatory framework*: The RED 2009/28/EC aimed at a share of 20 per cent of RES in gross final consumption in the EU by setting national binding targets to the Member States and mandating the reporting and monitoring of their national actions plans, which were deemed strong governance tools providing stability and investment security. It also provided common rules on guarantees of origin (Article 15 RED) and for access to and operation of the grids (Article 16 RED), in particular a priority dispatch for RES. These were strong measures to trigger RES investment but not sufficient to unlock citizen energy in Europe, as highlighted by the European Economic and Social Committee (2015) in its study on the role of civil society in the implementation of the RED. Specific

barriers for citizen energy identified were, amongst others, grid connection hurdles as well as tenders and direct marketing increasing the administrative burden. The aforementioned guidelines foresaw important exemptions for installations smaller than 500 kW (except wind: smaller than 3 MW or no more than 3 generation units). Those installations, for which market integration of RES "may not be feasible or appropriate" (European Commission 2014), do not have to be supported by premiums, their operators do not have standard balancing responsibilities and no measures are put in place to disincentives generation in time of negative prices. Installations up to 1 MW (6 MW or 6 generation units for wind) are exempted also from participating in tenders. While the RED and the guidelines provided positive long-term price signals, other regulatory measures sent contradicting ones to the market and vRES investors; this concerns the asymmetric level of support between fossil fuels and RES (see Sect. 30.1) and the lack of credibility of the Emission Trading System, Europe's carbon price market (European Commission 2015a). Therefore, as vRES investments become less attractive than they could, their market integration is hampered in case of high base load or overcapacity. However, wholesale prices are continuously decreasing since 2009 as these distortions are progressively removed and as a result of the merit-order effect, aggravated by increasing penetration of vRES and overcapacities in some markets (European Commission 2015a, 2016; Welsch et al. 2017).

To conclude, an enabling framework for RES investment should reconcile contradictory objectives: long-term commitment to predictability and sufficient remuneration of investment with adaptation to changing conditions. In particular with regard to support schemes, it is important to keep close to technological progress, to avoid possible over-remuneration impairing efficiency and to control policy costs and distributive effects (Ecofys et al. 2014). Furthermore, it has to balance market competition and efficiency with sufficient guarantees for new actors like prosumers which being not entirely profit driven, are likely to behave different from incumbent actors (see Chap. 5), and bear higher transaction costs. This argument will be developed further in Sect. 30.2.3.

30.2.2 Market Integration: Supply Management and Price Formation

As mentioned before, market integration implies making the market fit for vRES and vice-versa, both with a long-term and a short-term perspective. While the previous section focused on both aspects with a long-term perspective on price and regulatory measures for the promotion of vRES, this section will discuss the short-term market integration, that is, coping with volatility through quantity management and price formation (see Fig. 30.3).

(1) *Quantity management*: Whereas the energy system was previously driven by demand, the intermittency of vRES' generation reverses that logic, especially because of priority dispatch and merit-order effect. On the supply side, with an increasing vRES share, conventional power generation units see their role reduced to flexible back-up facilities. However, considering that some units are not flexible—such as nuclear power plants providing base load—and that in general their marginal cost is higher than

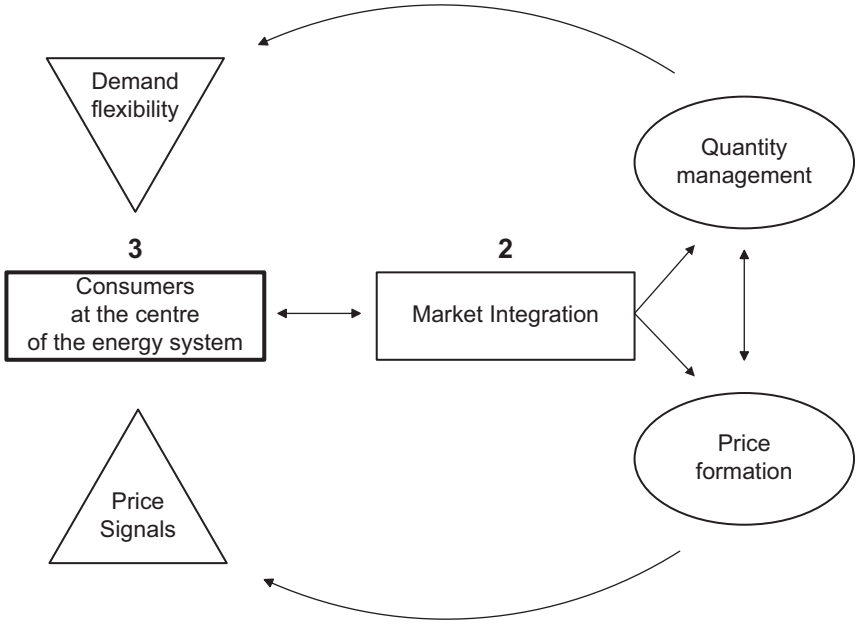

Fig. 30.3 Market integration

that of vRES reduces their overall economic profitability. This threatens their ability at providing ancillary services[11] to ensure security of supply (Welsch et al. 2017; Zachmann 2011). Therefore, the introduction of capacity support mechanisms are envisaged by some Member States but cautiously assessed at the European level (European Commission 2015a; Welsch et al. 2017).[12] Further solutions on the supply side are: (i) increasing grid interconnection and expansion, including through regional cooperation and the European Projects of Common Interest List, (ii) technological innovation such as long-term storage, including power-to-gas, and (iii) improving the reliability of forecasts, including through algorithms and artificial intelligence (European Commission 2015a, d; Welsch et al. 2017). These investments require long-term price signals and regulatory stability. Finally, with increasing penetration, priority dispatch and the refrained use of curtailment of vRES may become less judicious from a grid stability and cost-efficient perspective (Welsch et al. 2017). On the demand side, there are various possibilities, including short-term storage through (car) batteries and sector coupling, aggregation and (automated) load-control, dynamic pricing. However, in the current state, many flexibility solutions to cope with variability face obstacles: immaturity of available technologies and prohibitive costs as well as their unclear distribution and thus lack of acceptance from the demand side. Examples for this are smart meters or batteries. Therefore, the European Commission (2015a) is adamant that the future market design should remove regulatory barriers to facilitate long-term price signals for investments in these technologies, infrastructures, and business models, which would enhance the potential of demand-flexibility. Meanwhile it should enable short-term price formation to be dynamic and incentivise flexible consumption patterns.

(2) *Price formation*: Current short-term price signals are not adapted to increasing vRES share as the link between price formation and quantity management still based on previous measuring patterns is distorted, both

[11] Ancillary services are services required to maintain grid stability and security of supply. It includes frequency control, spinning, and operating reserves (Welsch et al. 2017).

[12] Strong political oppositions on the necessity of supporting conventional actors to ensure security of supply exists considering that (1) fossil fuel are already subsided more than RES (see Sect. 30.1), (2) overcapacity already exists in some markets, and (3) introducing capacity mechanisms could further distort the internal market as non-market-based RES support schemes did.

at wholesale and retail level. Many factors hampering the formation of competitive market equilibrium (see Sect. 30.2.1) were already mentioned as distorting long-term price signals. However, they also distort short-term price signals in the wholesale market. For example, volatility is not reflected if the electricity sold to the grid is remunerated through FIT or sliding premiums.[13] Thus some support schemes can make generation insensitive to market signals and are particularly harmful in times of negative prices. Also because of the lack of interconnection and price convergence at the European level, there are, not one, but many wholesale markets, which hamper the balancing of volatility over larger zones (Welsch et al. 2017).

Demand-flexibility is considered primordial for coping with volatility in the short-term. Therefore, compared to flexibility solutions which still need to mature (see above), price formation will focus on retail prices giving short-term price signals for consumers. Retail prices, that is, final energy prices, are made up of an energy component—wholesale price of energy consumed—and a tax-and-levies component, including grid tariffs and support scheme surcharges. Further distortions stem from distributional effects putting a burden on private end consumers as already mentioned. Indeed, while wholesale prices are decreasing, retail prices are increasing because of taxes and levies (European Commission 2016). This is particularly visible with front-runners like Denmark and Germany.[14] While high retail prices incentivise self-consumption, they bear the risk to further increase imbalances between the actors. This leads to a self-enforcing "utility death-spiral" (see Sect. 29.2.2), provided grid tariffs are not adapted to changing conditions (Welsch et al. 2017). Furthermore because an increasing share of retail prices are constituted of fixed tax and levies, the variable share (wholesale price) diminishes, making variation in prices less perceptible for consumers. Furthermore, measuring and billing consumption patterns are not yet adapted. Dynamic pricing and the technologies required for this are not rolled out on a large scale yet.

[13] FIT are regulated tariffs disconnected from market price. FIP combine market price with either a fixed premium (independent of market price) or a sliding premium (variable to match market price with a predetermined tariff level).

[14] Denmark and Germany have the highest share of taxation in total electricity cost and overall the highest total electricity cost for households (http://ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_price_statistics#Electricity_prices_for_household_consumers).

As prices are distorted and less volatile, generation and demand is inclined to become less reactive and elastic to short-time prices and vice-versa. Thus, the current setup might incentivise self-consumption to the detriment of demand-flexibility. Consequently, recalibrating long-term price signals through a competition policy and linking wholesale and retail markets are priorities for a new market design (European Commission 2015d).

30.2.3 Promotion of Consumer (Co-)Ownership: Fair Competition Conditions and Remuneration

The following section discusses the challenges of promoting consumer (co-)ownership in the countries under consideration against the background of the previous two sections on the promotion of RES and market integration. We provide an overview of relevant regulatory and support measures for self-consumption in Table 30.1 combining two approaches: one focusing on prices (with regard to RES generation in general and self-consumption where applicable) and one focusing on regulatory measures for self-consumers or consumer (co-)ownership. Chapters 5 and 28 highlighted that the drivers for participating in prosumership and (co-)ownership models are diverse and not necessarily motivated by economic factors like profitability, and showed a broad variety of prosumership and (co-)ownership models. This induces that there is not a one-size-fits-all regulatory framework and that different forms and levels of support are the basis for an effective promotion. The recognition of a variety of actors, organisational forms and specific measures to ensure a level-playing field taking transaction costs into account are necessary to ensure the promotion of RES and a fortiori of (co-)ownership in a competitive market. Against this background, the indicators outlined in Table 30.1 are organised as follows: *Column B* lists the types of support schemes and their allocation (restricted to operating and excluding initial investment aid); *Column C* focuses on net metering; *Column D* assesses if energy collective schemes or (co-)ownership enjoy recognition (implicit or explicit); *Column E* lists specific regulatory measures.

Table 30.1 Regulations and support for self-consumption in the countries under investigation

A: Country	B: Types and allocation of support schemes	C: Net metering policy	D: Recognition of collective schemes or (co-)ownership	E: Specific regulatory measures (+facilitating/−hindering)
Czech Republic	FIT (phase-out) for small installations	No	No	+ Exemption from connection permit and generation licence for micro-installations
Denmark	FIT or FIP (except PV); tenders	Yes	Yes	No
France	FIT (phase-out) or FIP	No	Yes	+ Specific grid tariffs for small installation, exemption for collective consumption schemes in operating rules
Germany	FIT (phase-out) and FIP; tenders	No	Yes	+ Specific rules for collective schemes in tenders, restricted exemptions to RE surcharge for self-consumers
Italy	FIT or FIP for small installations (except PV)	Yes	Yes	+ Connection, license exemption for small installations or non-commercial producers
The Netherlands	No support schemes	Yes	Yes	+ Supply permit exemption
Poland	FIT or premiums in tenders	Yes	No	− Connection fees, licensing for cooperatives, permit
England/Wales	FIT (phase-out)	No	Yes	No
Scotland	FIT (phase-out)	No	Yes	+ Connection procedure

(*continued*)

Table 30.1 (continued)

A: Country	B: Types and allocation of support schemes	C: Net metering policy	D: Recognition of collective schemes or (co-)ownership	E: Specific regulatory measures (+facilitating/−hindering)
Spain	FIT or FIP (phase-out); tenders	No (but legally possible since 10/2018)	No before 10/2018; Yes after 10/2018	+ since 10/2018: right to self-consumption and self-consumption-sharing, administrative and technical simplification for small installations − before 10/2018: compulsory registration and additional taxation ("solar tax")
Switzerland	FIT (phase-out) or FIP	No	Yes	+ Obligation of purchase the excess, exemption from direct marketing − Costly measuring requirement
California	FIT	Yes	Yes	No
Canada	FIT	Yes	Yes	No
Brazil	FIT (phase-out); tender	Yes	Yes	No
Chile	No support schemes; tender	Yes	Yes	+ Total or partial exemption from grid costs for small installations, obligation of connection
India	Quota or FIT; tender	Yes	Yes	+ Exemption from connection permit, licence
Pakistan	FIT; tender	Yes	Yes	No
Japan	FIT	No	Yes (but de facto prohibition of energy cooperatives)	+ Exemption from direct marketing − All other rules concerning grid connection or feed-in are detrimental for prosumers

Source: Own elaboration from country chapters

(1) *A level-playing field*: Considering that consumer investment projects are mostly small- to medium-scale, and often motivated by non-economic (local element, social interactions, environmentalism, etc.) or non-commercial factors (saving consumption costs but not primarily selling), they tend to bear higher transaction costs than conventional actors. Clear, simple, and stable rules are important for such actors to consider investment in the first place. Heterogeneous and heavy administrative and operating requirements as well as a long project development phase are important barriers to consumer (co-)ownership and the implementation of the 2020 strategy (European Economic and Social Committee 2015; Welsch et al. 2017). Recognition of the specificity of consumer investment, individually, collectively or as co-owners, in the legislation is a first step (see Column D). This can be done explicitly by introducing a definition of those new actors or implicitly by enacting specific rules (Column E) under certain conditions, like small capacity and spatial restriction. While almost all analysed countries recognise explicitly or implicitly individual consumer ownership, the picture is somewhat unclear for collective or (co-)ownership schemes. The recognition is sometimes explicit, in France, Germany, Denmark, Switzerland, Pakistan, Brazil, California, and so on. Sometimes it is implicit by relying on the already existing cooperative movement and regulation, in Poland, Czech Republic, Italy, Chile, and so on; however, in a few cases, namely in Japan RE cooperatives are de jure prohibited. Some European countries not covered in this book recently adopted comprehensive legislation, for example, Greece in January 2018.[15]

Specific rules for consumer ownership concern mostly grid interaction. They are often beneficial, especially for individuals/small installations which are exempted from specific requirements, enjoy simplified procedures or reduced costs. However, they are also a few examples

[15] The law provides with guidance on the role of citizens in the energy transition, insisting on the social economy and energy poverty aspects as well as the role of municipalities in particular on the many islands, includes new technologies (storage) and innovative approaches as virtual power sharing investments. For more information, go to https://www.rescoop.eu/blog/energy-communities-in-greece-new-legislation.

highlighting increased administrative or financial burden. In Spain, prosumers suffered from additional taxation (until 2018), and in Switzerland, they have to disburse a prohibitive amount of money to comply with measuring requirements. Concerning long-term price signals, the move from guaranteed tariffs to market-based remuneration and to administrative allocation in tenders is observed in almost every country under consideration. This is especially true for the EU countries as consequence of the European state aid guidelines of 2014. The impact of this trend on the consumer investment has already been highlighted in this book (see Chap. 1 and Sect. 30.1 amongst others). Furthermore, the high upfront capital costs and the difficulties to access conventional financing exclude a large share of potential consumer-investors. Investing aid—as opposed to operating aid such as guaranteed tariffs—or the existence of innovative business models was not made into a category of this table to beware of complexity. But this remains a key point and the premises of this book (see in particular Chap. 4 on Energy Justice and Chap. 8 on the Consumer Stock Ownership Plan (CSOP) as inclusive financing technique) to enter into the second phase of the energy transition.

In summary, market-based long-term price signals, complexity of regulatory framework, and application of competitive market rules without exemptions are often considered as hampering consumer investment. The fact that rules (or their exemptions) are moved from the RED to the IEM in the Clean Energy Package is a sign that consumer investment in RES is increasingly being considered with a market approach. There are, however, uncertainties on what consumer (co-)ownership is really capable of. While it is important to keep a variety of actors and a level-playing field, the levelling part may not be as demanding and inefficient from a cost or system perspective.

(2) *Remuneration*: Producers and consumers behave according to price and financial incentives. Prosumers are reactive to retail prices as consumers and to the remuneration of the electricity fed into the grid as producers. By combining price signals of both sides, they are by definition flexible, provided those price signals are not distorted (see Sect. 30.2.2). More general, the potential of prosumership is boosted by two factors: (1) vRES achieved grid parity and having marginal costs of pro-

duction close to zero are cost-competitive (European Commission 2015d); (2) self-generated energy is on average cheaper than energy bought on the retail market (Zachmann 2011). However, price differential plays an important part in cases of peaks and slumps for incentivising demand-flexibility. Although the EC favours self-consumption, selling electricity to the grid is still a crucial driver for refinancing RE investments and demand-flexibility (Roth et al. 2018). The EC estimates that commercial consumers can achieve a rate of self-consumption of between 50 and 80 per cent since business activity and consumption are aligned with on-site production (SWD141 European Commission 2015d). This is especially true for PV because of parallel daily patterns of production and consumption (see Fig. 30.4). For residential consumers, the estimated self-consumption rate ranges between the base line scenario of 30 per cent and a scenario with flexibility measures such as Information and Communication Technologies (ICT) and co-generation like power-to-heat and cooling available of up to 70 per cent (SWD141 European Commission 2015d). Furthermore, commercial prosumers, especially SMEs, are increasingly present on the RE markets with demand load profiles that are complementary to those of private households from a system stability perspective (see Fig. 30.4 and Chap. 29). Here again business models that permit combining investments of private individuals, SMEs and municipalities as the CSOP will be

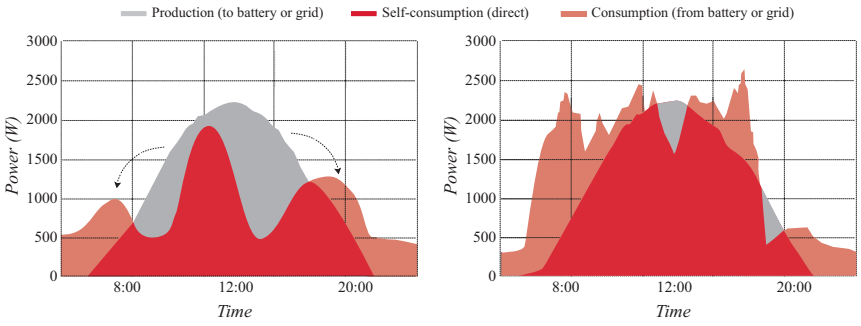

Fig. 30.4 Effects of electrical storage on direct self-consumption for prosumers: residential consumption left side; commercial consumption right side. Source: Fronius, SMA 2015

important to facilitate RE (co-)ownership. Therefore, price components in particular network charges (see Sect. 29.1) and remuneration need to be adapted accordingly.

Network charges for prosumers (for details see Sect. 29.1 and Table 29.1)—Because increasing market penetration of RE drives up the costs of network operators, there is growing pressure to adapt network tariffs to changing conditions. The design of network charges has an influence on consumption behaviour. For this reason, although total or partial exemption from network charges for prosumers may constitute a possible support measure, it risks to lose an important steering mechanism for demand-flexibility. Exemption from grid costs exists for example in France and Chile (Column E) but also in other European countries not covered by this book, such as Croatia or Malta (European Commission 2015b).

Remuneration of electricity fed into the grid for prosumers—Three options to design support schemes are available: (1) whether schemes are generation or capacity based, (2) volume or price based, and (3) whether support is total or partial (Ecofys et al. 2014). Different models for remuneration and price signals like FITs, premiums, and quotas exist with different impact on production behaviour as well as on the decision between self-consumption and selling. The most important criterion is whether support is total or partial.

Feed-in Tariffs (FITs) are long-term purchase agreements over 10–25 years for the supply of RE into the grid sold on the market by the grid operator with the producer receiving the fixed tariff and being freed of direct marketing requirements (European Economic and Social Committee 2015). As prices are guaranteed, regulated, and disconnected from market functioning (Ecofys et al. 2014) prosumers do not receive market signals indicating whether self-consumption or sale is economically more feasible. Nevertheless, with remuneration above the market price and without fluctuation, there is a higher probability of feeding electricity into the grid in periods of negative prices (Ecofys et al. 2014) congesting the network while in periods of low supply and high prices, feeding into the grid would be beneficial for the network; these effects are, however, ambiguous and difficult to control. An advantage of FITs in

this context is that they can be adapted to be more flexible by removing support in periods of negative price or be designed to be dependent on the load by linking them to an peak/off-peak classification or residual demand (Ecofys et al. 2014).

Feed-in Premiums (FIPs) and quotas on the other hand are a partially guaranteed tariff, where the variable market price is complemented by an additional premium. This additional revenue covers the costs of direct marketing and can be fixed (fixed premiums) or variable (floating premiums and quotas) and can be restrained by caps and/or floors (Ecofys et al. 2014). Quotas combine an electricity price and a certificate price, which are both market based. Since volume targets are set, the price is therefore the variable of adjustment and price signal. All in all, quotas allow better competitive price formation than premiums. With the market price being part of the remuneration they imply a price signal for prosumers to be demand-flexible.

Self-consumption and net metering—In net metering approaches the grid functions as a back-up storage for the prosumer. The exact quantity of electricity fed into the grid can be taken out of the grid at a later time while paying only the grid costs (European Economic and Social Committee 2015). While—during a set period of time: monthly, hourly, or even instant in the case of Denmark—net metering is the physical compensation for production volume exceeding self-consumption, that is, the meter turns back, net billing is the economical compensation of the production value over the self-consumption value. The remuneration can be the market price or combined with support schemes such as FITs or FIP (see above). The compensation often is at a retail price exceeding the value of generation to the electricity system (SWD141 European Commission 2015b) but can also be less than the price paid for energy consumed from the grid.

While net metering is beneficial to the prosumer it is problematic for the energy system as a whole, above all when large deployment levels are reached (SWD141 European Commission 2015b). Price variation and grid constraints, that is, peaks or slumps are not taken into account and thus, as with FITs, price signals and demand-flexibility are impaired. Therefore, a number of restrictions and adaptations have been implemented to make net metering "grid-friendlier" and more flexible. The EESC promotes the combination of FITs with net metering to provide

small investors with guaranteed fixed prices while at the same time benefitting from grid flexibility measures (European Economic and Social Committee 2015). In many countries, net metering is restricted in time (Denmark) or to small-scale projects (Netherlands, Belgium) or by evaluating at wholesale price the electricity fed in, which is then paid or credited to the prosumer (Italy) (SWD141 European Commission 2015b). Finally, net metering requires that the owner of the RE system and the self-consumer are identical while it is not possible when the plant's owner is a third party (SWD141 European Commission 2015b). Exceptions are virtual net metering, the "postal code" approach in the Netherlands or the new German tenant electricity model (see the respective country reports). In Czech Republic, net metering does not officially exist. However, in practice, distributors provide preferential tariffs for self-consumers.

During the trilogue concerning the recast of the RED (February to June 2018), that is, the negotiation between the two co-legislators (European Parliament and Council of the EU) moderated by the European Commission, net metering and exemption from grid costs were one of the primary bones of contention. However, the final compromise (for details see Sect. 30.3) stresses that prosumers are the link for reconnecting market integration and vRES promotion, both as demand-flexible consumers and potential new investors. Their potential, however, can only be harnessed conditional on a market design offering a level-playing field and allowing for dynamic market-based price signals that have the potential to kick-start demand response and foster a stable but adaptable framework for long-term investments. Further advantages of prosumership include ownership as a learning process for energy efficiency (see Chap. 3) and addressing energy poverty issues in a deregulated market through energy efficiency (European Commission 2015b) and savings from self-consumption (European Commission 2015d). Figure 30.5 illustrates the interdependency of (1) investments in vRES, (2) vRES' market integration, and (3) demand-flexibility under the new market design that promotes prosumership and consumer (co-)ownership and sees the consumer at the heart of the energy markets.

However, merely stating the theoretical arguments and advantages of prosumership for achieving other goals does not address challenges con-

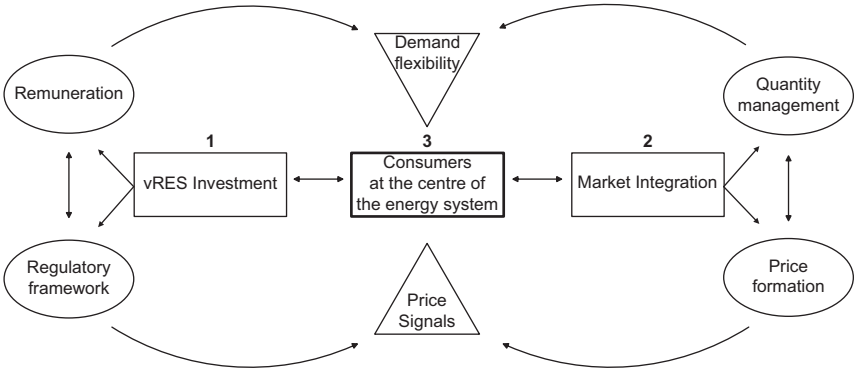

Fig. 30.5 Overview of a new market design addressing vRES integration and investment through promotion of prosumership/consumer (co-)ownership

cerning the promotion of prosumership, such as competitiveness, which can sometimes contradict those primary goals. Considering that storage technology is not yet feasible, prosumers have to choose between self-consumption and sale. One of the goals of a new market design integrating vRES production efficiently is to make prosumers demand responsive and to avoid network congestion.

30.3 Policy Options to Support Consumer (Co-)Ownership: The Example of the EU Clean Energy Package

In order to implement the approach described above, the European Commission published the Clean Energy Package for all Europeans[16] in November 2016. The Directive on Energy Performance on Buildings was adopted and published in the Official Journal. As of September 2018, the proposals on the Energy Efficiency Directive, the RED II and the

[16] Over 1000 pages: eight proposals of legislation covering energy policy governance, RE, EE, energy performance of buildings, electricity internal market, cooperation of energy regulators, innovation, and so on. For more information on the content and state of play, go to https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans.

Governance Regulation reached political agreement in the inter-institutional negotiations (so-called Trilogue); the negotiations on the IEM Regulation (IEMR) and Directive (IEMD), however, had just started. Furthermore, the Energy State Aid Guidelines for the period 2020-2030 containing rules on support schemes and tenders were under revision and the final national energy and climate plans are scheduled to be published by the end of 2019 (drafts by December 2018).

Going back on what made the first RED a success, namely strong governance tools to ensure long-term signals and regulatory stability, the Clean Energy Package takes a step back: (1) instead of national binding targets a binding EU-wide RES share target for 2030 is set to 32 per cent (along with a reduction of 40 per cent of Greenhouse Gas and 32.5 per cent for energy efficiency savings); (2) the level of 32 per cent is an improvement from the 2014 European council decision of 27 per cent but still coming short, which could be corrected by using the planned upward review clause in 2023; (3) the governance tools (national action plans, reporting, and monitoring) are not set in the RED anymore but in a specific governance regulation, which extends the reporting requirement, like including indicators on consumer (co-)ownership if applicable (Article 18 Governance regulation), and also include a corrective mechanism should Member States strategies diverge from the collective path (European Commission 2018a, b). Consumer (co-)ownership received explicit recognition of its crucial role—in terms of fighting energy poverty, increasing acceptance, fostering local development, incentivising demand-flexibility, and so on—and of its rights and duties in the recitals 52 to 55. But, more importantly, it includes clear definitions (Art. 2 RED II) and two dedicated articles (Arts. 21 and 22 RED II). Figure 30.6 provides an overview.

To sum up, consumers, individually (households and non-energy SMEs), collectively (tenant electricity) or in communities (cooperatives and other business models), have the right to consume, store, or sell energy generated on their premises. It also invites the Member States to provide an "enabling framework" on the basis of an assessment of financing, administrative, and regulatory barriers as well as discrimination in procedures or charges concerning support schemes, grid interaction, and market rules. This will be integrated to the national reports and actions plans mandated by the governance regulation. Finally, the RED II emphasises in its recitals

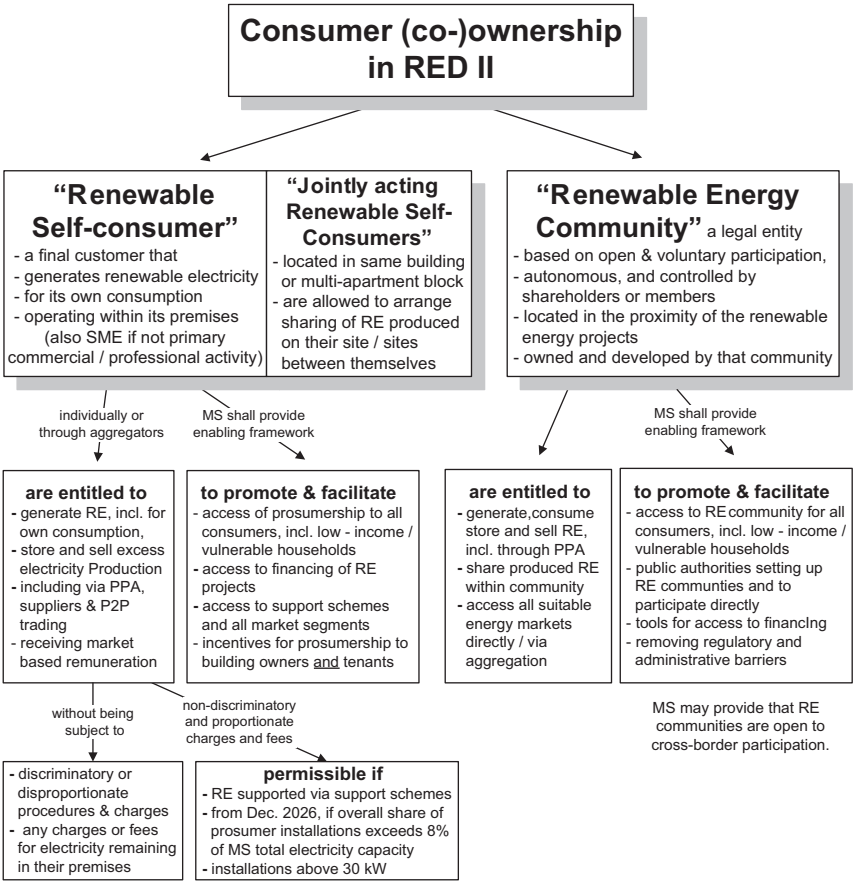

Fig. 30.6 Overview of the RED II regulation with regard to consumer (co-) ownership. Source: Own elaboration after (Council of the EU (SG) 2018)

that "[t]he specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects can hamper their competition on equal footing with large—scale players, namely competitors with larger projects or portfolios". Such the directive recognises the possibility of preferential rules for consumer (co-)owned projects in coherence with the general principle of equality in EU law stating that "similar situations should be treated equally, while dissimilar situations can be treated differently". The independence of such local renewable energy is

in particular safeguarded by referring to the principle of autonomy stemming from the cooperative world (see Chap. 7 on RE cooperatives).

Interestingly, the final oppositions against the RED II proposal concentrated inter alia around the level of the RE target ambition and on framework for consumer (co-)ownership with the result that they were negotiated against each other (Council of the European Union, 2018c). While the European Parliament and the European Commission adopted a progressive position, the Council was more reserved, insisting that those new actors have not only rights but also obligations towards the system. In the end, it were the recent changes in the Italian and Spanish governments becoming more favourable of prosumership, and the strong resistance of Germany—giving up its reputation as front-runner—against the target that somewhat unexpectedly tilted the balance towards a strong framework for consumer (co-)ownership against a lower target (Euractiv and Keating 2018; Euractiv et al. 2018). However, many proponents of the energy transition actually rejoice because they believe that systemic change is more important and that with the right framework conditions it will actually be easy to exceed the target. In October 2018, the Spanish government anticipated the transposition of the RED II promulgating law (Act 15/2018) that promotes prosumership and removes obstacles to consumer (co-)ownership (see Chap. 19).

However, a large part of the concrete market rules applicable will be defined by the IEMD and IEMR, still in negotiation between the European Commission, Parliament and Council. As of September 2018 (Council of the European Union, 2018a), all three institutions foresee derogations from fundamental market rules for small installations and demonstration projects for innovative technologies "to avoid unnecessary administrative burden for certain actors, in particular households and SMEs" (recital 11 IEMR). This concerns for example balancing responsibility (Art. 4 IEMR) and market-based dispatch (Art. 11 IEMR). The IEMD defines the "active consumer" (Art. 15) and the (local) "energy community" (Art. 16) reflecting the RED II definitions of "renewable self-consumer" and "renewable energy community" (Council of the European Union, 2018b). Potential dissent between the European Parliament and the Commission on the on side and and the Council on the other regards a) the exemption capacity threshold for small installa-

tions (Arts. 4, 11 IEMR), b) cost-reflective network charges (Art. 16 IEMD), and c) whether energy communities have to be local or not (Arts. 2 and 16 IEMD). The legislative schedule foresees the IEM Trilogue negotiation to be closed until the end of 2018 and the adoption of the whole package, that is, IEMD and IEMR, RED II, Energy Efficiency Directive as well as Governance Directive before the European elections in May 2019. After that, Member States will still have some room for manoeuver in the transposition of the directives 18 months after their entry in force, that is, by the end of 2020.

30.4 Conclusions

An optimal market design will seek to avoid both, an oligopoly with concentrated ownership in the hands of a few detrimental to competition as well as a fragmented market with a plethora of small players driving up transaction costs and impeding governance/system balancing (see Sect. 1.2.2). While thus a future market design should preserve the plurality of actors on the energy markets enabling diversity in prosumership—including SMEs, small-scale citizen projects, and individual producers with for example rooftop PV installations—it has to ensure proper market integration (see also Chap. 1). This involves contradictory goals and entails a series of trade-offs: (1) *policy efficiency and simplicity*: integrating new (and most of the time small and inexperienced) actors in a complex setting requires an efficient but simple framework to reduce transaction costs, for example, concerning balancing forecast responsibilities (Ecofys et al. 2014) and allocation schemes like tenders (Ecofys et al. 2014); (2) *predictability and flexibility*: support schemes should be predictable both for investors and public finances but should be flexible for adapting to evolving market conditions (Ecofys et al. 2014); (3) *sharing of benefits and costs*: exemptions for some consumers lead to a higher end-price supported by the remaining consumers, which threatens their acceptance of vRES (Ecofys et al. 2014).

These trade-offs touch upon particular interests of different actors that may be conflicting like those for example of consumers as (co-)owners on the one side and grid operators and other final end consumers on the other side. One way to reconcile these interests and align them with EU

regulatory policy is the support and deployment of innovative organisational and contractual arrangements that would allow to pool and scale RE investments (co-)owned by consumers while opening them to combinations of municipal or commercial investments. An example of such an innovative financing concept is the CSOP discussed in Chapters 8 and 9. It seems furthermore clear that brokering between different actors—incumbent and new—their interest and their roles will become increasingly complex. Creating a level-playing field for RES and self-consumption to compete against other generation sources or flexibility measures in a non-discriminatory manner is important but meets opposition from incumbent actors fearing adverse consequences on their market position. Crucial in this debate is to determine who is responsible for overall system stability and at what cost as any economic inefficiency directly impacts retail electricity prices consumers pay (European Commission 2015b; Friedrich Ebert Stiftung et al. 2016).

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