# Property rights and the financing of renewable energy technologies
## – How Consumer Stock Ownership Plans contribute to the Energy Transition*

**Prof. Dr iur. Jens Lowitzsch**
Kelso Professor of Comparative Law, East European Business Law and European Legal Policy, Faculty of Economics, Europa-Universität Viadrina Frankfurt (Oder), Germany
Lowitzsch@europa-uni.de

**Guilherme B. R. Lambais**
Department of Economics, University of Brasília, Brazil
gbrlambais@gmail.com

### Abstract

This paper proposes a contractual solution to the problem of financing decentralised renewable energy production. The reorganisation of energy production, esp. the transition from fossil to renewable energy sources ("Energy Transition") is currently acknowledged as a permanent and evolving process. Recognized as one of the main problems in this transition is enabling finance mechanisms that would cover these renewable energy projects in an uncertain and oligopolistic market. This raises the question of whether citizen's co-ownership in RES that emerged over the past 25 years in some countries is a transitory phenomenon or a condition for the "Energy Transition" and if the latter is the case, how to further develop financial participation mechanisms in the RES sector.

Our analysis is based on the theories of property rights, transaction costs and incomplete contracts, which provide a rationale for decentralised energy production. According to standard literature, the traditional market for energy production based on fossils, which generally requires great sums of capital, has allocated property rights in the form of very large organisations, which benefit from economies of scale and are efficiently recouping this capital. That is, large organisations have formed through vertical integration based on transaction costs efficiency and second-best investment incentives. Thus, it is assumed that these technologies are and will be the most economically efficient. However, this interpretation of the energy market assumes that the development of technology is independent from the allocation of property rights.

To improve this standard view and to account for the path dependency of organisations becoming inefficient under changed circumstances and the inability of potentially competitive forms of organisation to emerge it is necessary to include technology as an endogenous factor. Consequently, technology runs a two-way causality with property rights. That is, if new forms of property rights are to be enabled (i.e., ownership and control of decentralised production) this would, in turn, enable alternative forms of technology (i.e., renewables).

Key to facilitate this reallocation of property rights is the design of new finance contracts. We use the example of the "Consumer Stock Ownership Plan" (CSOP) as the necessary contract providing a financing mechanism. We focus on wind and photovoltaic power which have two pronounced structural differences to fossils: (1) they depend on weather and thus are volatile in their power production scheme and (2) they have a marginal cost of production close to zero. CSOPs enable consumers of energy utilities without savings or access to capital credit to acquire productive property, i.e., renewable energy plants while at the same time creating a system of incentives for asset formation. Responding to supply flexibility they tap the potential for demand-side flexibility facilitating smart grids.

We analyse how CSOPs can contribute to financing renewable technologies and what particular advantages their dispersed ownership structure has. As a result we show the economic viability of CSOPs contributing to the reorganisation of energy production.

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# I. Introduction

Due to technological progress and regulatory changes renewable energy production has been boosted over the past 25 years. In the EU-28 between 2005 and 2012 the share of renewable energy production increased from 8.7 to 14.1 per cent[1] getting closer to the HORIZON 2020 energy goal of 20 per cent. Progress in the reduction of greenhouse gas by 20 per cent is also promising.[2] The ambitious objectives of the European Union and the decisive actions of some EU member states have laid the grounds for a shift towards a sustainable, independent and efficient energy supply. However, financing investments in renewable energy sources (RES) remains key to achieving the 2030 goals of a low carbon economy with increased energy efficiency. Changing energy systems from fossil fuels to renewable energy sources (RES) requires financial, technical and social innovation. A new energy infrastructure must be built and individuals motivated to adopt flexible consumption habits to match demand with the supply of volatile energy sources.

Against this background the development and market roll-out of innovative financing schemes for sustainable energy is an important cornerstone of reaching the EU target of at least 27% for the share of renewable energy consumed in the EU in 2030 and thus for energy policy as such. On a market historically dominated by large suppliers citizens investing in RES have become an important factor to meet this challenge, as exemplified by Germany, a pioneer in renewables: As of the end of 2014 citizens – while at the same time being energy consumers[3] – own 50% of the installed renewable power capacities. But the legislative conditions that have so far limited financial risk and allowed for paying back bank loans for RES installations has become less favourable; especially the change from guaranteed feed-in tariffs to auction models across the EU is inclined to hamper the commitment of individuals as it favours large scale projects.

## 1. Motivation

This raises the question of whether citizen's co-ownership in RES is a transitory phenomenon or a condition for achieving the transformation of energy systems from fossil to renewable sources, the "Energy Transition" and if the latter is the case, how to further develop participation mechanisms in the RES sector. Are consumers as co-owners of renewable energy production facilities merely politically desirable to satisfy expectations of participation rooting in claims for distributive justice and to gain acceptance for infrastructure projects? Or does a systemic argument for a disperse ownership structure in RES rooted in economic theory exist, one that is related to the structural differences of renewables and fossils and on which the success of the Energy Transition depends?

The article seeks to answer above query recurring to new institutional economics in general and to the theory of transaction costs in particular. The traditional market for energy production based on fossils that generally requires great sums of capital, has allocated property rights in the form of very large organisations, which benefit from economies of scale and are efficiently recouping this capital. According to standard new institutional economics, the reasons for vertical integration are transaction cost efficiency (Williamson, O. E. 1979) and second-best investment incentives (as the first-best can't be achieved in a world with incomplete con-

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[1] EU energy in figures, 2014 p. 42 http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_31&plugin=1.

[2] http://www.eea.europa.eu/media/newsreleases/policies-put-the-eu-on.

[3] The share of final energy consumption by end-users is stagnant since two decades: Transport has the highest share with approx. one third of total consumption, while households and industry cover approx. one quarter. The service sector settles at around 14%, agriculture at 2%; for the next decade little or no shift is expected. See EU Energy Markets in 2014, p. 7.

tracts; Hart, O., & Moore, J. 1990). After not paying much attention to RES, big energy providers only recently are starting to lean towards significant investments in the renewable business like for example the German RWE. In order to account for the persistence (or path dependency) of organisations becoming inefficient under changed circumstances[4] and the inability of potentially competitive forms of organisation to emerge it is necessary to include technology as an endogenous factor. We maintain that technology runs a two-way causality with property rights. That is, if new forms of property rights are to be enabled (i.e. ownership and control of decentralised production) this would, in turn, enable alternative forms of technology (i.e. renewables). Key to facilitate this reallocation of property rights is the design of new finance contracts.

We argue that with regard to renewables particularly wind and photovoltaic power installations – as their production depends on weather – require a dispersed ownership structure to cope with their volatility. Here, we show that an ownership stake of citizens as consumers in RES motivates adapting to new technologies like smart grids which is key to achieve demand flexibility. Other problems discussed are the financing gap between public and private investments and ownership as a learning process.

## 2. Focus: The challenge for citizen's energy and the potential role of CSOPs

To harness the potential of citizens' investments in RES and preserve its dynamic in a changing regulatory environment innovative solutions are required, solutions that – while building on conventional best practice – address the needs of retail investment as well as the need for stakeholder involvement.

Best practice models implemented across the EU such as energy cooperatives and limited partnerships can be adapted to these purposes and modernised to make it feasible to include commercial investors or municipalities. To advance and further develop successfully implemented models is of particular relevance as some of their inherent characteristics have proven to be an obstacle to compatibility with traditional commercial market models. Cooperatives for example enjoy limited attractiveness for strategic partnership among commercial investors or municipalities, while limited partnerships lack participation of stakeholders in decision-making and local involvement of stakeholders; neither of the models thus combines scalable investment capacity with direct stakeholder involvement which in turn is much needed as a trigger for decentralised renewable energy production.

It is in this setting that the Consumer Stock Ownership Plan (CSOP) – as a financing instrument providing low-threshold access for ordinary citizens to leveraged financing of investments in RES – can play an important role since it is specifically designed to facilitate scalable investments in cooperation with strategic local partners like municipalities or energy suppliers.

The paper is divided into four chapters. After a short introduction, Chapter 2 provides an overview of the most pressing challenges of the "Energy Transition" highlighting in particular issues related to financing RES. The law and economics of a dispersed ownership structure in renewable energy production are discussed in Chapter 3. Chapter 4 presents the Consumer Stock Ownership Plans as best practice to facilitate dispersed ownership of RES in the hands of citizens. Conclusions and policy recommendations are formulated in Chapter 5.

[4] See, e.g., in Germany EOn that is currently splitting its operations into to separate and distinct legal entities, one focusing on fossils and nuclear energy an one exclusively investing in RES.

## II. Energy Transition: From fossil to renewable energy sources

The transformation of energy systems from fossil to renewable sources, the "energy transition", is a global trend.[5] Over the past 25 years many governments decided to shift towards green and sustainable energy systems in the long-term perspective aiming to increase energy production from renewable energy resources (RES). As of early 2014, around 144 countries had corresponding policy targets in place covering such different areas as electricity production, heating and cooling or transport (REN21 2014). So-called modern renewables (including modern forms of bioenergy, hydropower, wind, solar, geothermal, waste and marine) make up 9% of global TFEC.[6] Should all policy targets be met the predicted share will rise to 27% by 2030. The extent of RES in TFEC to a large extent depends on the initial geographic conditions: While Brazil and India for example, representing countries that employ modern renewables in combination with traditional biomass, have achieved around 45% of renewable energy share, Canada and China score around 20% and Germany[7] around 10%. At the same time the US or South Korea did not reach the 10% level yet, and Saudi Arabia for instance uses almost no renewables (all data as of 2010, IRENA (2014).

The motivations behind the energy transition, its objectives, drivers, challenges and opportunities vary from country to country. However, in many industrialized countries, the transition towards more decentralized energy markets can be observed (Karger / Markewitz 2011). This process is accelerated by the deployment of RES, which, unlike the fossil fuels, are commonly available, in general favour energy generation in smaller units and require a much smaller initial investment (IRENA 2014). With these structural changes of energy systems requiring large financial investments, from both public and private sources, the challenge is to implement the transition in a way that will not only be environmentally but also economically a success.

### 1. Fossil vs. renewable energy production: Structural differences – Focus wind and photovoltaic power

We focus on wind and photovoltaic power as they possess particularly apparent characteristics in production due to two pronounced structural differences to fossils:

(1) they depend on weather and thus are volatile in their power production scheme and

(2) they have a marginal cost of production close to zero.

As we will show in the following – under an incentive system changing from feed-in tariffs to auction mechanisms – both of these energy forms have great difficulty to refinance themselves on marginal-cost based markets, as they have a structural price disadvantage on the energy markets due to the mentioned characteristics.

Furthermore, with regard to different RES we observe differences both in transaction cost as in the resulting institutional setting and the allocation of property rights. Ronald Coase (1937) was the first to develop an analytical framework in order to discuss why it is sometimes cost-efficient to execute transactions within a hierarchical organization, i.e., not using market mechanisms. As different RES and their respective value addition processes are associated with different transaction costs there are also different implications with regard to ownership structure: For example, transaction costs are particularly high for bioenergy projects due to

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[5] See efforts of the energy ministers about a UN climate treaty at the G7 energy ministers´ meeting May 2015; for Europe see the Renewable Energy Directive that sets rules for the EU (OJ L 140/16).

[6] According to an analysis by International Renewable Energy Agency (IRENA) conducted for 26 countries, covering about three-quarter of total final energy consumption (TFEC).

[7] In Germany, RES already make up for about 26% in the electricity sector and 10% in the heating sector in 2014; the targets for 2020 are around 40-45% for the electricity sector (see also AGORA 2015).

the heterogeneity of the involved actors and inherent project finance risks. Therefore, – from a transaction cost perspective – an integrated company seems to be the efficient organizational form. Solar and wind energy production, in contrast involve comparatively low transaction costs thus not necessitating an integrated/ hierarchical organizational form (Yildiz 2013).

Finally, the principle of coordinating investment on the basis of a long-term forecast in the regional or national area of the legal monopolies is no longer there as volatility of markets in peak and extreme peak situations combined with low prices during seasonal or structural overcapacity hamper predictability of revenues (Finon 2006). Furthermore, the countercyclical effect of this volatility – RES being fed into the grid at priority with overcapacities causing annual averaged prices to drop (merit order[8]) – have a negative impact on risk from the viewpoint of lenders and investors. In other words due to the volatility of RES they themselves destroy their market price and thus hamper financing investments into RES – a fundamental contradiction with the aim of the reforms, i.e., to facilitate expansion of their share in the energy mix closing the financing gap.

**2. Reorganisation of energy production**

One characteristic of the Energy Transition in most countries is the emergence of decentralized, small-scale renewable energy technologies (RETs), which are changing the structure of the energy supply infrastructure at all levels, i.e., regional, national and interconnected international (Arnold / Yildiz 2015). The most common energy production facilities in this context are small-scale wind farms and solar plants as well as small-scale biogas reactors. These technologies are particularly relevant for citizen participation schemes as the underlying technology and thus the energy generation process is not as complex as it is the case for bioenergy structures.

The size and the mix of the installed distributed generation capacity will depend on the relative size of the costs and benefits of each technology (Pepermans / Driesen / Haeseldonckx / Belmans/ D'haeseleer 2005). Interestingly, traditional financing schemes or investors in the energy sector are not as relevant for RE as one might have expected while at the same time two factors favour citizen's ownership in RES:

- Established energy companies and other related technologies and networks are "locked-in" to their investments in fossil fuel based infrastructures (Unruh 2000) and limited in their financial commitment by the relatively low risk-return-ratios of RE-projects (Arnold / Yildiz 2015).
- Citizen energy projects in contrast are not driven by shareholder value and quarterly profit reports and lack the financial resources to stem large projects; thus they are more likely to accept the relatively high capital costs per kW installed power compared to large central plants *(IEA 2002)*[9]

**3. Changes in the organization of subsidies and the incentive systems**

The extent to which distributed energy generation is integrated efficiently in the electricity market depends on market structure, available subsidies and pricing mechanisms (Pepermans

[8] When selling into the energy markets variable renewables tend to earn less than the average market price as prices tend to be lower during periods when they are most available and higher when they are less available. In contrast, non-volatile resources can earn more during periods when variable renewable energy production is low and demand is high.

[9] Differences in capital costs between the different distributed generation technologies are also quite large, ranging from h 1000kW_1 to over h 20,000kW_1 for combustion turbines and fuel cells, respectively. The capital costs of large central plants, on the contrary, vary from approximately h 750 for gasfired plants to h 1300 for IGCC's and h 1600 for nuclear plants (IEA, 1998).

/ Driesen / Haeseldonckx / Belmans / D'haeseleer 2005). In the context of liberalisation in many countries, the structure of the electricity market is currently undergoing significant changes with the trend from guaranteed feed-in-tariffs to auction models perhaps being the most important one. Under these auction models installed capacity or electricity production are offered in tenders organized by public institutions. The procedure usually takes the form of a so-called *reverse auction* (Fürstenwerth / Preatorius et al. 2014). Unlike in normal auctions where an increasing number of bids to buy something drive prices up, in auctions for RE with a growing number of bids to sell energy price is decreasing. Thus the bidder who offer the lowest price wins the tender and is awarded with a reward, typically in form of a particular feed-in tariff (FIT) or feed-in premium (FIP), for a specified period of time.

Tender systems, be they universal for all RE technologies or differentiating between them, were introduced in diverse forms in many countries as an alternative or an addition to existing FITs and FIPs IRENA 2013. The advantage of tendering the installed capacity (in kilowatts) instead generated electricity (in kilowatt hours) is that it depends on technology and is a benchmark for project developers and investors; the downside is that it does not allow to precisely forecast electricity generation. Although one of the main aims of tendering system is to facilitate the expansion of RE infrastructure in a controlled way, bidders – to win a tender – may offer only the best possible scenario of their projects. Therefore, some projects are not implemented due to additional problems and/or delays not included in the scenario and consequently the awarded remuneration will not be sufficient; this "underbidding" may then result in the expansion targets not being fulfilled. In general economies of scale favour large projects and potent bidders over small projects with limited resources with regard to both the possible amount of installed capacity or generated electricity and the possible discounted price offered (Richter 2012; Fürstenwerth / Preatorius et al. 2014).

As tendering systems entail risks for investors, which may require additional capital or bank guarantees, they may be a barrier to entering the market for private investors and in particular small enterprises. While for example citizen's participation is regarded as an important factor for Germany's success in the energy transition experts warn that tendering system may hamper forms of small-scale investments (Fürstenwerth / Preatorius et al. 2014). One remedy would be to promote local actors, such as municipalities, SMEs, energy co-operatives or private persons in the tenders. The investment risk and capital requirements could be reduced by, for instance, balancing pre-qualifications with fines.

# III. The law and economics of a dispersed ownership structure in renewable energy production

## 1. Further energy transition and reform of energy markets require citizen participation

During the past 25 years communities, small businesses but especially individual citizens have invested heavily in energy from wind, solar and bio mass. Today, a quarter of Germany's total electricity production stems from renewable sources of which roughly half rests in the hands of citizens (Leuphana 2013). To foster the energy transition and a low-emission-economy this path of decentralized energy production has proven efficient. Necessary measures like planning designation or grid extensions are more likely to gain acceptance with the involvement of actors from the civil society (Ethik-Kommission 2011; Schomerus et al 2014). Simultaneously, local communities can function as a learning space for responsible energy consumption. Besides economic impulses, community involvement also offers additional advantages: Local social capital[10] is not just limited to projects of self-organisation, but

[10] Social capital is sociological term, which describes the rate of social cohesion (the 'social climate' so to speak), willingness for cooperation and the potential for mobilisation.

can function as resource for future endeavours. Furthermore, the community can ease their carbon footprint, advance their sustainability profile and thus as result boost their locational attractiveness.

The already existing dispersed ownership structure in renewable energies, as it can be observed in countries like Germany, the Netherlands, Denmark or Great Britain, is primarily rooted in those countries' specific path of energy transition ("Energiewende") and the model of feed-in-tariffs which lay at the core of those reforms.[11] Above all guaranteed feed-in tariffs have facilitated the repayment of RES installation loans, providing investment security as well as an easier assessment of project risks so that new actors, in particular individual citizens could enter the market. As an economic impulse triggering significant innovative potential this model has allowed renewables to achieve grid parity, i.e., a reduction of renewables production costs to a level competitive with that of fossil energy (McKenna 2015). This funding concept's success to promote RES can be exemplified with the case of Germany, where the share of renewable energies in gross energy production reached 25.8% in September 2014, for the first time surpassing brown coal as the country's primary energy source (AGORA 2015).

Still up until now, the success model of consumers becoming producers is wasting valuable potential:

- Firstly, potential is given away through inadequate potential for scaling of investments so that consequently less mid size or large projects with the involvement of citizens are being realised.[12]
- Secondly, there is a trend leading away from feed-in tariffs and towards auctioning mechanisms, which worsens the refinancing of renewable energy plants.[13] This is particularly disadvantageous for small producers and puts them at a disadvantage compared to large producers.

Eventually, this policy shift will have an impact on the ownership structure, especially when considering that big providers are now starting to lean towards massive investments in the renewable business (e.g., RWE). It seems doubtful though whether such a market consolidation entailing a concentration of ownership, is really in line with the decentralised ownership structure required for the "energy transition" as outlined above. On the contrary, in order to continue the success story of the "energy transition" and thus raising the share of renewable energies to 50% a structural change is needed. This needs to include the re-thinking of financing systems (Graichen 2015) that enables to involve all stakeholders. Thus the "energy transition" needs an expansion of decentralised dispersed structures. For these reasons complementary, low-threshold financing models are needed, to harness and spur the positive dynamics of "citizen energy".

## 2. Responding to volatile supply by demand-side flexibility

As storage and transport are not yet economically feasible demand side flexibility is key to mitigate the refinancing problem of RES. Prerequisite to offer dynamic pricing to those wishing to participate and to remove barriers to participation by demand in day-ahead and intra-

[11] The 2000 model law EEG is one of the legal act most often copied in other countries around the world; it has been adopted and transferred worldwide: 71 countries and 28 states/ provinces enacted some form of feed-in policies as of early 2013, led by developing countries with regard to number of FITs in place (REN21 2013).

[12] There are a few large and medium scale projects in Germany that are financed via closed-end funds but other business models suffer from high intra-organizational costs and high transaction costs.

[13] E.g. in: DE, Reform of the EEG in 2014; PL, Reform of the Law on renewables 2014.

day energy markets is the implementation of „Smart-Grids“, „intelligent meters“ etc. which allow for a decentralised connection between production and consumption.

In conventional settings differing incentives of investors and consumers are left separate and distinct with the only link between the two being the contractual supplier-customer relationship.[14] When citizens themselves become producers of the energy they themselves (partly) consume the incentives of a consumer-producer become complementary: The main benefit of planning and matching consumer behaviour with market demand resulting in an optimal price for the energy produced simultaneously goes to the consumer-producer (i.e., the CSOP participant). Instead of creating price effects with negative effects for refinancing of RES and conflicting incentives on energy markets the consumption behaviour is aligned with the production capacities and such can unfold their full potential.

The reform of energy markets must actively engage the demand-side. In many energy markets for large industrial customers direct participation in responsive demand schemes has long been possible. But pushing this direct market participation model to residential and small commercial energy consumers remains a challenge. On the one hand these consumers will mostly neither have the capacity nor the motivation to take action in real time to respond in any reliable or foreseeable fashion. On the other hand given the substantial costs they will be reluctant to install the necessary technical infrastructure since – as a rule being customers of big suppliers – they lack an economic incentive to do so. This changes when consumers become co-producers; now they will have an essential motivation to absorb their renewable energy production by own consumption in times of low prices on the markets due to oversupply (see above); or they will be willing to collectively coordinate their consumption patterns in order to economically benefit from responsive demand schemes:

- And in fact, to access this huge potential opening up energy market access to demand aggregation is crucial. Ideally consumption by individual loads at a significant number of consumer premises is managed under contract to a single service provider. The aggregator – using the demand under contract – then sells the equivalent of energy into the market (AGORA 2014). In the case of the CSOP the aggregator and the consumer-producers are one, which gives the CSOP an additional choice between sale or consumption.
- Further, responsive demand can be achieved by making cogeneration facilities (combined heat and power - CHP) more flexible using distributed thermal energy storage systems. Here the provision of heating (or cooling) when demanded by consumers can be physically decoupled from the CHP plant employing thermal energy storage to make the production of electricity more flexible in response to the needs of the power system. While it is technically feasible and relatively inexpensive to apply this technique directly to thermal appliances at consumer premises the main barrier to implementation is again the incentive.

Thus a dispersed ownership structure provides the economic incentive on the demand side, which the conventional monopolistic supply structure of fossil energy sources impedes**.** CSOPs as a low-threshold financing tool facilitate broad consumer co-ownership in renewables thus are pivotal to tapping the potential for demand-side flexibility when, e.g., implementing smart grids.

[14] As shown above this is detrimental in particular with regard to demand-side flexibility, needed to respond to supply-side volatility of solar and wind energy fed into the grid and to mitigate resulting excessive peaks both in production and consumption.

## 3. Relation between property rights and RE-technology

### a) Social-economic function of property and its sub-functions

Property is a multifunctional legal institution in flux (Roggemann 2010). It is both a legal and an economic category. The general assignment of liability and risks is one aspect of this duality.

- On the one hand, the economic essence of property is the owner's right to receive the income it earns (Kelso/Adler 1958).[15]
- On the other hand, private property has the economic function of both assessing and assigning economic risk and liability; it is the foundation of a credit system based on collateral, in particular on mortgage of private real estate ownership.

The legal institute of property not only provides the indispensible frame for a market economy and competition, it also delivers the basis and the point of connection to related economic categories: "Property does not exist outside the economy, but it rather gives significance to all terms and concepts that are meaningless in non-ownership economies; this applies especially to interest, money and credit, but also to value, price, profit and market" (Heinsohn/Steiger 1997; Hölscher 1996).

Another aspect of this duality is the delimitation of the individual in its relationship to society. After all, the limits of inclusion and exclusion are often congruent to those of owners and non-owners, as social integration in the modern consumer society increasingly entails economic opportunities, or in other words, is facilitated by property ownership. At the same time property also furthers an important emancipatory impulse – of distinguishing oneself from others – which is a mirror image of its power to enable participation (Reich 1964)[16]. Both aspects are inextricably linked to the significance of property ownership for the political stability of a functioning democracy. Early evidence of this can be found in Alexander Hamilton's Federalist Papers of 1788: "[…] power over a man's support is a power over his will." (Hamilton 1788)[17] This makes economic independence an important condition for the development of personal and political freedom.

In this context four legal functions of property may be distinguished:[18]

- the (primary) triple legal force of the model proprietor – to own, to use and to dispose exclusively;
- the right to receive the entire yield and to assume the liability and risks – the "economic function";
- the guarantee of personal rights and freedom, the "individual function"; and
- the integrational or "social function".

These legal functions of property and the constitutional principles backing them have a variety of implications for consumer/citizen's ownership of RES as they touch upon the whole range from production to consumption of energy as well as the role of the individual in society.

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[15] Referring to Pollock v. Farmers' Loan & Trust Co., United States Supreme Court Reports, Vol. 157, 1895, p. 429ff: "For what is the land but the profits thereof? . . . A devise of the rents and profits or of the income of lands passes the land itself both at law and in equity".

[16] „[P]roperty performs the function of maintaining independence, dignity and pluralism in society by creating zones within which the majority has to yield to the owner. Whim, caprice, irrational and 'antisocial' activities are given the protection of law . . . .".

[17] „In the main, it will be found that a power over a man's support is a power over his will".

[18] Distinction following Roggemann 2010 and 1997.

**b) New forms of organisation of property ownership in RES**

Involvement of all stakeholders is recognized as an important tool in policy responses to climate change, including the shift toward green energy. Participation can take diverse forms and occur at different stages of project implementation: (i) information about the on-going development; (ii) planning participation in the decision-making process; (iii) financial participation in the project. Besides the unquestionable beneficial effects that engaging citizens in decision-making already in the planning phase has on the success of project implementation (Devine-Wright 2005) financial participation in the actual project has an additional dimension in particular as it involves the rights to the yield of the investment.

Financial participation in RES can be defined as voluntarily providing private funds for investment; it can be further divided into

- *active financial participation*, when citizens as co-owners also have a say in the governance of the utility (e.g., coops, limited liability companies and partnerships);
- *passive financial participation* where no influence in decision making is involved and the return from the investment is the main aim (e.g., bonds, loans, silent partnerships, limited partnerships).

While financial participation in general may provide consumers with the incentive for maximal involvement, direct active participation entailing both shareholders voting rights gives them the tools to realise it. With regard to citizen ownership (also referred to as "citizen energy") the above mentioned different financial participation schemes can be grouped in citizen participation *in a broader* and *in a narrower sense* (Yildiz 2014). The latter involves a group of actors (private individuals, individual agricultural enterprises or legal entities) from a geographically defined area that invest individually or jointly in renewable energy projects contributing equity with full voting and control rights. The former is a profit driven investment usually with minority interest that entails no or only limited voting and control rights may, e.g., also take the form of bonds or loans.

**c) Contributing to energy efficiency – Ownership as a learning process**

Consumer/citizen co-ownership facilitates energy efficiency through a "learning society". It is widely recognised that energy efficiency is a highly cost-effective resource. It is the lowest-cost method of meeting demand and – as levelized cost analysis demonstrates – cheaper than any other conventional or alternative energy source (Lazard 2014). Turning consumers into owners fosters involvement, commitment, and responsibility and thus contributes to increase energy efficiency. To take full advantage of the cost-effective social and economic benefits of energy efficiency, broader and smarter use of Consumer Engagement Programs (CEP) is needed. In comparison to conventional Technology Installation Programs (TIPs), which are characterised by high barriers to entry for consumers and a lack of scalability, these "behaviour-based" programs are found to leverage innovative engagement strategies more effectively (Laitner/McDonnell, Ehrhardt-Martinez 2013). Other than operating behaviour CEPs aim at increasing the adoption of technology investments as well and such go beyond mere "behaviour change".

However, while CEPs generally are found to dramatically increasing the scale and cost-effectiveness of consumer funded efficiency investments[19] the cost of installation of new technologies by the consumer (esp. Smart Grid related technologies) often hamper the combination of behavioural change and technological potential and thus impede synergies. Fur-

[19] Also known as ratepayer or customer supported energy efficiency investments; see http://emp.lbl.gov/sites/all/files/lbnl-5803e-brief.pdf.

thermore, although CEPs by enabling a large variety of measures without any technology restrictions have the potential to engage in a much more rapid learning process than TIPs, avoiding conflicting interests and aligning incentives is paramount for their success. In order to fully unleash their feature of being self-reinforcing they require all stakeholders to be involved (in contrast to TIPs that are implemented one sided by the utility only).

Involving consumers as co-owners and co-producers is a holistic approach to activate a group of actors, which so far has been difficult to include. Energy consumers are a heterogeneous group when it comes to their social settings and behaviours, but combining ownership driven incentives with such different as sustainability, energy autonomy and the incentive to maximize revenue can help to tap the enormous potential of consumer driven energy efficiency.

**d) Employment effects**

A recent Commission study (European Commission 2014)[20] finds that „new industries with a strong lead market potential have been created, which contribute a value added of about 94 billion EUR or about 0.7% of the total GDP and an induced total employment of about 2 million relating to about 0.9% of the total workforce in Europe in 2011. With respect to job generation effects, a positive impact of RES investments is expected (Lehr / Nitsch / Kratzat / Lutz / Edler 2008; critical though Lambert / Silva 2012 and Böhringer / Keller / Van der Werf 2013). In general, different types of power plants require differently intense treatment. For example, a wind energy power plant requires intense work during the installation process (e.g. for base construction, network connection etc.), but does not require as much maintenance as a photovoltaic plant, which needs to be cleaned frequently. The European Economic and Social Committee (EESC) concludes that: "The growth in renewables brings about new jobs along its value chain. This job generation effect is particularly high in the sectors of energy efficiency (0.38 job-years/GWh), PV (0.87), biofuels (0.21) and wind (0.17) when compared to coal and gas (0.11)."[21]

## IV. Consumer Stock Ownership Plans (CSOPs): Enabling consumers without savings or access to capital credit to acquire productive property

As early as the 1950 an innovative legal and financial instrument for fostering scalable investments in utilities on regulated markets the Consumer Stock Ownership Plan (CSOP) was invented. A CSOP can enable consumers of energy utilities without savings or access to capital credit to acquire productive property of renewable energy plants. Such entities have the advantage that (a) their regulated status increases the probability that they make profits (thereby reducing the risk of credit financing for their acquisition) and (b) their customer base defines a clearly identifiable group of individuals with an economic relationship to the entity.

It is in the setting of the Energy Transition that the CSOP – as a financing instrument providing low-threshold access for ordinary citizens to leveraged financing of investments in RES – can play an important role since it is specifically designed to facilitate scalable investments in cooperation with strategic local partners as communities or energy suppliers. To advance and further develop successfully implemented models is of particular relevance as some of their inherent characteristics have proven to be an obstacle to compatibility with traditional commercial market models. While for example coops enjoy limited attractiveness for strategic partnership among commercial investors or municipalities, limited partnerships lack participa-

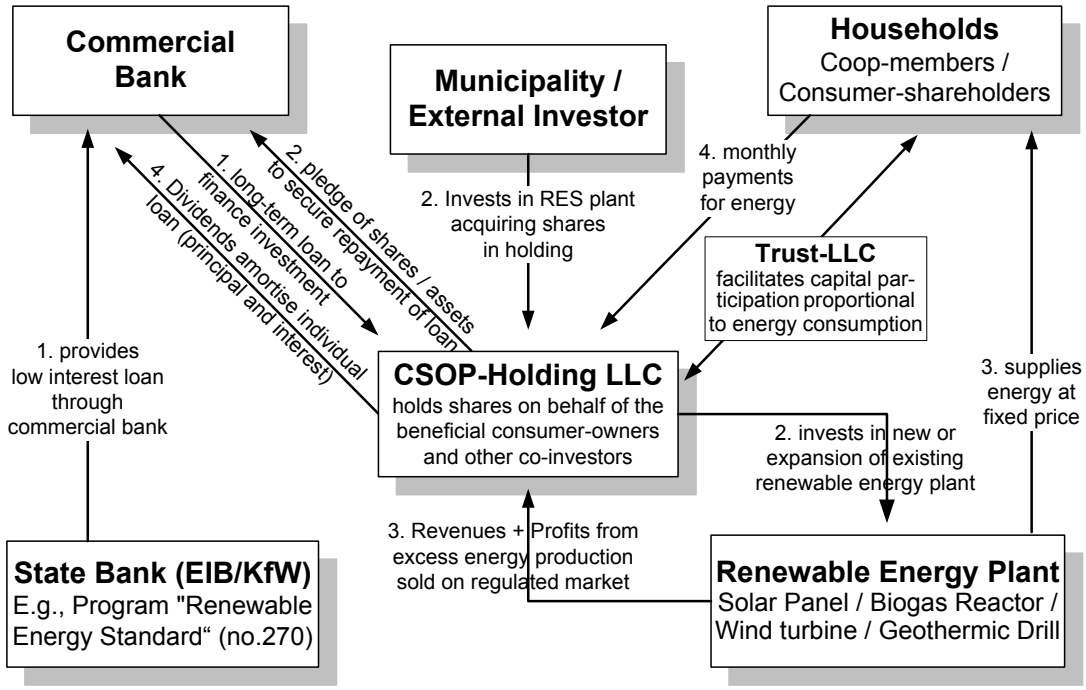
[20] The gross value added of the RES sector may increase to about €100 (120) billion and employment in the RES sector would amount 1.6 (2.1) million persons by 2030 if a target of 30% (35%) in terms of the gross final energy is implemented.

[21] Cf. http://www.renewableuk-cymru.com/wp-content/uploads/2015/01/CivilSocietyRenewableEnergy.pdf

tion of stakeholders in decision-making and local involvement of stakeholders; neither of the models thus combines scalable investment capacity with direct stakeholder involvement much needed as a trigger for decentralised renewable energy production.

**1. Legal structure and financing technique**

A CSOP can buy into an existing or invest in a new renewable energy plant, which is of particular importance for communities that often lack the funding to make the investment themselves. A fiduciary trust set up under this concept, e.g., by the local community, managed by independent trustees is authorized to borrow funds for the acquisition of shares in the renewable energy plant on behalf of the energy consumers.[22] The funds are often provided by a state bank under a specific program to promote RES investments, e.g., KfW's "Renewable Energy Standard", and channelled trough a commercial bank.




The shares acquired by the trust are allocated among the CSOP consumer-beneficiaries in proportion to their respective energy purchases. All of the income in excess of depreciation associated with the CSOP shares must be distributed to the CSOP. These revenues are used to repay the acquisition loan assumed by the CSOP-trust (CSOP-holding LLC). Once this debt is amortized the revenue to the CSOP is distributed as income to the consumer-beneficiaries.

In particular citizens with low income – who as a rule do not dispose of savings necessary for conventional investment schemes – are enabled to repay their share of the acquisition loan from the future earnings of the investment. The financing structure employing two limited liability companies – one as a holding and one as a trust – pools individual investments while benefiting of the borrowing power of the corporate vehicle. At the same time individual liability of citizens is avoided while the participating consumers acquire capital ownership providing them with an additional source of income – an outcome not achieved by, e.g. crowdfunding schemes.

[22] An advantage of funding renewable energy plants through a CSOP is that regulatory authorities can provide the guarantee against risk to the financing lenders by agreeing to set rates for the regulated utility at levels sufficient to assure amortization of the acquisition loan.

Furthermore, indirect share ownership using a separate intermediary entity, which manages the shares held in trust for the consumer-beneficiaries and pools the voting rights executed by the trustee, implies a due "professionalization" of management: Participation in decision-making is channelled through the trustee while individual consumer-shareholders may execute control rights on a supervisory board or an advisory council. Finally, a municipality or an external investor can buy into the project acquiring shares in the holding while being guaranteed corresponding voting rights.

At the same time pooling consumer's rights and obligations as co-owners in the newly founded CSOP-trust (CSOP-holding LLC) also reduces transaction cost with regard to changes of participating individuals, e.g., when consumer-beneficiaries move away from the region and transfer their share to new residents. To ensure easy tradability of the shares, the CSOP-holding's shareholding is facilitated through a trust company. Thus, consumer shareholding in the CSOP-holding is "brokered" by a limited liability company (Trust-LLC); a trust agreement between the consumers and the Trust-LLC is sufficient to render consumer shares fungible[23]: It is the Trust LLC, which – entering into a trust agreement with the consumer-trustors – now holds the shares of the CSOP-holding on behalf of the consumers. In the event of a change of the consumer-shareholder the buyer or heir simply steps into the trust agreement in lieu of the former trustor. Unlike in the case of direct participation of consumers as shareholders of the CSOP holding changes of the shareholders need not be registered and the amount of participation held by the trustee is flexible, can fluctuate and can be easily administrated. The basic mechanism is a trusteeship contract as proven in other investment settings.

## 2. Closing the financing gap

The CSOP provides an innovative financing scheme for sustainable energy production, which is ideally suited for acquiring new capital in the private sector. Matching public and private funds, it consequently facilitates the roll-out of renewable energy investments which in turn contributes to closing the existing financing gap. It does so by leveraging investments of citizens, paying back the employed bank loan with future proceeds from the investment. At the same time – other than cooperative funding – capital participation does not require already existing assets or savings, an important feature for citizens with no or only minimal income. Conventional financing concepts in contrast exclude the weakest strata of society, i.e., people who have little or no income and above all no savings to invest. The inventor of the CSOP, the American investment banker and lawyer Lois O. Kelso thus pointedly called access to capital credit the "eye of the needle" and income from capital ownership an answer to the unequal distribution of assets.[24]

This is of particular significance for small communities who lack the funding to make a complete investment themselves. With its flexible and scalable application of leveraged finance the CSOP can mobilize significant resources to close the financial gap between private and public funding. In particular the CSOP addresses the problem of "sub-scale" investments, i.e., the optimisation of size of the required technical installation. It is, e.g., not sensible to build a 100 kW wind turbine, a project few "small" investors with limited resources might undertake;

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[23] This structure is a standard solution in Germany tested many times by so-called public companies ("Publikumsgesellschaften") in real estate investments, who face a similar problem: A very large number of investors is intended to participate in the equity of a company where every change in ownership, whether it be due to death, sale of shares, or seizure has to be signed into the commercial register following the relevant formal procedures.

[24] Today Kelso's best-known financing technique, the Employee Stock Ownership Plan (ESOP), is an integral part of corporate America. At the end of 2011 there were about 8,926 ESOP and ESOP-like plans in the USA, with about 14.5 million employees participating (13% of private sector employees) holding around USD 994.8 billion in assets; cf.: The ESOP Association http://www.esopassociation.org/medialmedia_statistics .asp.

the CSOP helps these "small" investors to access sophisticated financing instruments, to pool their investment power and to boost it with leverage in order to scale investment and build a much more efficient standard industrial 1.2 MW wind turbine.

### 3. "Valley Nitrogen Producers Inc." – the Flagship CSOP 1958

The first CSOP was implemented by Louis O. Kelso, a business and corporate laywer, in 1958 in Fresno, California. Local farmers – the main consumers of fertilizer – utilized the CSOP to organize a new corporate entity for the production of the fertilizer anhydrous ammonia, Valley Nitrogen Producers Inc. (Kelso Institute 1976) The fertilizer market was controlled at that time by several large petro-chemical companies, who also set prices. Carl Haas, the founding president of Valley Nitrogen Producers, later explained that he took this initiative because the oil companies had been raising the price of anhydrous ammonia to a level – 250 USD per ton –, which he considered exorbitant. He took the problem to Louis Kelso. Upon learning that Haas himself had no capital to invest, Kelso invented the Consumer Stock Ownership Plan (CSOP) and then persuaded the farmers of the Central Valley to become consumer-shareholders of this radically new kind of company.

#### a) Regulatory framework

Although not a regulated public utility, Valley Nitrogen Producers Inc. had a utility's main characteristics. Central Valley farmers, as long-term consumers of fertilizer, were bound to their suppliers exactly as consumers of electricity, gas or water are bound to the suppliers of these necessities. As the need is constant, the relationship is secured by mutual dependency. The proposed corporation also met Kelso's other criteria for a CSOP (Kelso Institute 1976):

- the investments subscriptions were proportional to long-term needs for the product;
- the shares' subscription were acceptable to the bank;
- a limited corporate income tax applied;
- investors contractually committed to buying fertilizer for the maximum period permitted by anti-trust laws, in this case, seven years; and
- the earnings of capital were to be paid out fully and regularly to shareholders (after debt amortization and operational costs).

Since the corporation, under tax regulations then in force, qualified as a farmer-cooperative, income and dividends were tax-exempt, making the loan even more feasible. Nevertheless, when Kelso applied to the major banks for financing the first CSOP, initially asking for 20 million USD with an additional later installment of 100 million USD, to his amazement, the banks one after the other refused to make the loans. Finally Kelso persuaded the Berkeley Bank of Cooperatives (a cooperative bank) to finance Valley Nitrogen Producers as a cooperative even though it was not conventionally structured.

#### b) Implementation

The CSOP made 4,580 farmers instant shareholders of the new fertilizer manufacturer, Valley Nitrogen Producers, Inc. Each farmer subscribed to buy the percentage of shares proportional to his fertilizer needs over a period of seven to ten years. He himself made no financial contribution. The CSOP was mainly secured by the bank loan from the Berkley Bank of Cooperatives, which was backed in turn by the farmers' stock subscriptions. In the management board's report on the project nine years after its founding[25], a sample calculation for a typical shareholder was as follow:

[25] Announcement of the chairman of the Valley Nitrogen Producers Inc. Carl H. Hass to the stakeholders on 27. June 1969.

- He subscribed shares valued at 19,095 USD and agreed that the dividend yield of these shares would be used to repay the Berkeley Bank of Cooperatives loans over a period of ten years.
- In turn he was entitled to 30,271.02 USD dividends during the first nine years of the plan.
- Of these dividends USD 21,131.86 were paid out, of which 16,398 USD was used to pay down his subscription obligation with a remaining balance of 2,697 USD for the last year of the plan.
- The difference between the dividends serving the principal and total payments, i.e., 4,733.86 USD was the farmer's interest payments for the loan financing the acquisition of his stock.
- Additionally, the farmer received the remaining portion of his dividends, i.e., 9,139.16 USD in the form of credits representing loans granted to the company during the last three years.
- This credit was used for the company's growth and geographical expansion. By 1978 Valley Nitrogen Producers Inc. had already four production facilities in California and one in Arizona, as well as a network of distributors in these two states.[26]
- Moreover, the long monopoly, which the big petro- firms had maintained over the fertilizer industry in the Central Valley was broken. The price of the top-selling fertilizer dropped from 250 USD to 66 USD per ton (Kelso Institute 1976).
- Even with this drastic price reduction, Valley Nitrogen Producers Inc. quickly became debt-free and profitable.

The Valley Nitrogen CSOP not only created significant assets for 5,000 farmer-shareholders, but according to estimates of the Kelso Institute, it also saved Californian farmers more than one billion dollars in fertilizer costs over a 15-year period, when fertilizer prices began to rise worldwide. The first CSOP was a great success – for the company, for its farmer-consumer shareholders and for consumers in general – despite the fact that conditions were less than optimum. Unlike a utility, the company had to operate on an unregulated market.

Today Kelso's best-known financing technique, the Employee Stock Ownership Plan (ESOP), is an integral part of corporate America. In 2011 there were about 8,926 ESOPs in the USA, with about 14.5 million participants holding USD 994.8 billion in assets. The overwhelming majority of ESOPs are found in unlisted private companies (firms whose shares are not traded on public stock exchanges); in about 4,500 companies, employees are majority owners and in about 3,500, the ESOP holds 100% of the employer company's shares.[27] However, the Valley Nitrogen CSOP remains so far the only practical example of a classical CSOP by Kelso.

## V. Summary and conclusions

The energy market falls short to sufficiently facilitate consumer's investments in RES that contribute to the energy transition towards sustainable energy production without appropriate incentives (esp. guaranteed feed-in tariffs). The CSOP addresses such market deficiencies even in an evolving regulatory environment. By engaging large numbers of citizens in sustainable energy production and consumption, the CSOP also stimulates a far-reaching stakeholder dialogue which will contribute to improving the legal and financial framework. Making citizens co-owners of energy infrastructure gives them stakes in a process in which they

[26] Cf.: "Valley Nitrogen Names Lindley", Stockton's Port Soundings, June 1978 Vol. 1, No. 7.

[27] Cf.: The ESOP Association http://www.esopassociation.org/medialmedia_statistics .asp.

previously had little part. Relying on leveraged finance in a regulated market environment the CSOP requires only small initial investments of individuals while at the same time making them compatible with both public funds and matching private sector capital. Therefore, once successful, a roll-out of the CSOP as an innovative financing scheme for renewable energy investment will contribute to closing the existing financing gap between private and public contributions.

**1. Broadening productive co-ownership in RES**

This path towards broad access to privately financed productive co-ownership in RES is rooted in best practise models such as energy cooperatives and limited partnerships. These widely accepted financing solutions are already implemented across the EU and have been facilitating citizen ownership in RES for decades. The CSOP will not just simply replicate these successful financing schemes but advance them and thus develop a flexible low-threshold investment mechanism for renewable energy production. Most notably, the CSOP surpasses conventional consumer investment schemes with regard to professionalization of management and its ability to attract third party financing, to be scalable and to allow for bundling of projects.

The CSOP aims at the participation of a wide range of citizens. Special emphasis is put on the inclusion of those who so far lacked the capacity to become involved with the opportunities of the energy transition of their own accord. Locations for the project's pilot plants will be chosen from predominantly technical consideration, though once determined, close cooperation with municipal authorities ensure for citizen dialogue to be as inclusive as possible – with participants and non-participants alike. Besides the municipal authorities, energy SMEs play a key role in the project's realisation. Even before initiating pilot implementation selected enterprises experienced in fields of the renewable energy sector are involved for indispensable input to the research and planning process. In addition, local consumer associations and energy cooperative need to be addressed to facilitate exchange and participation.

**2. Practical feasibility**

Renewable energy CSOPs can benefit greatly from the sector's advanced state in technology in recent years. Whether the investments will finance a wind energy, biogas, hydro or solar energy facility, for all four fields there exist proven, practical solutions at the highest technology readiness level. Once successfully executed, CSOPs as a ready investment guideline, can prepare the ground for further ongoing investments into these technologies. Thus, the CSOP has the potential to push the grounds for a future-proof, smart, ecologic and reliable energy supply scheme and reduced fossil energy sources in the EU. In doing so it is a mechanism to cope with various national challenges in achieving the goals of the "*Energy Transition"* and to strengthen energy independence. It is an integral feature of the CSOP concept to harness the largely unexploited potential of citizens to invest in renewable energy plants.

By continuing this trend in Germany and spreading it to other member states, the CSOP can open previously dormant investment opportunities. Enabling widespread capital ownership of citizens in wind energy projects naturally increases the investment capacity for the renewable energy sector as such. Since CSOP projects with citizen participation make projects possible, which would have otherwise faced opposition, they do not crowd out or replace other market participants, and thus expand the renewable building capacity. Furthermore, in addition to the efficiency of its management structure (trust) as well as the stability of its investment strategy (direct involvement in sustainable energy production), the CSOP constitutes a financial instrument exempt from new regulatory measures, especially from the capital and liquidity requirements (Basel III), which confers on it a considerable attractiveness in financial markets.

### 3. Building capacities and skills

In addition to above-described primary impacts, a decentralised ownership structure could further affect the energy sector through its "learning effects". Proliferating an owner's mindset in previously mere consumers would create policy opportunities for increased energy efficiency or modernisation in the energy sector. A numerous collective of small owners would hold significant political capital and could help to promote previously difficult political topics such as grid extensions. Finally, the CSOP's decentralised structure would trigger a learning process rooted in civil society, encompassed by a twofold dissemination of technical skills and knowledge on energy issues.

- Firstly, consumers becoming owners would lead to an increased awareness of energy issues and offer an incentive for personal energy efficiency, as energy saved would not only reduce bills but also generate income.
- Secondly, as the CSOP model promotes small-scale facilities on a community level, it would entail a local increase in technical skills, both in technical maintenance jobs created through the projects as well as in owners interested in the workings of their capital.

At the same time supporting RE-community projects is closely connected with the policy aim to proliferate renewable energy technology in the context of a low carbon economy, i. e., to facilitate the development of RE installations, stimulate the market for renewables and develop maintenance skills (Walker / Hunter / Devine-Wright / Evans / Fay 2007). Here involving local communities as strategic co-investors together with their citizens has two additional benefits from the macroeconomic viewpoint:

- it enables the governments to provide subsidies for renewable energy technologies be it capital funding or market support without violating EU rules on state-aid as one of the key characteristic municipalities being involved in RES is their "not-for-profit" status;
- it facilitates communal value creation and gives important impulses for social integration of their citizens as decentralised RE projects provide new sources of income and employment especially for rural communities.

Guaranteeing future profits for the white elephants of the age of fossil energy while hampering an important step on the road to a circular and green economy, or ensuring that modern energy systems evolve and that citizens both as producers as well as consumers of clean energy benefit economically is the choice confronting the European Union as it prepares for the so called "Energy Union" and further massive investments in RES.

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