Metadata of the chapter that will be visualized in SpringerLink

Book Title	Nearly Zero Energy Communities
Series Title	
Chapter Title	Energy Initiatives in Europe
Copyright Year	2018
Copyright HolderName	Springer International Publishing AG

Corresponding Author	Family Name	**Krozer**
	Particle	
	Given Name	**Yoram**
	Prefix	
	Suffix	
	Division	
	Organization	University of Twente
	Address	Enschede, The Netherlands
	Email	y.krozer@utwente.nl

Abstract	Energy business shifts from the centralized organizations to networks of producers and consumers labelled as distributed energy generation. This global paradigm shift on energy markets is analyzed with focus on the European Union. The changes evolved during last three decades when the neo-liberal ideology dominated policies. The analysis is that imperfections caused by the vested interests on energy markets have motivated innovators to pursue downscaling of energy technologies based on the local, renewable resources. The innovative efforts invoked numerous local energy initiatives. Their motivations are presented. Local energy initiatives created conditions for adoption of the renewable energy technologies in communities entailing adaptations to the local conditions, which enabled the distributed energy systems. The energy enterprises constituted the fastest growing business in the European Union during 2008–2014. This growth can be attributed to policy support of the renewable energy supplies and to market demands for the distributed energy systems.

Keywords (separated by '-')	Local initiatives - Renewable energy - Enterprises

Energy Initiatives in Europe

Yoram Krozer(✉)

University of Twente, Enschede, The Netherlands
y.krozer@utwente.nl

Abstract. Energy business shifts from the centralized organizations to networks of producers and consumers labelled as distributed energy generation. This global paradigm shift on energy markets is analyzed with focus on the European Union. The changes evolved during last three decades when the neo-liberal ideology dominated policies. The analysis is that imperfections caused by the vested interests on energy markets have motivated innovators to pursue down-scaling of energy technologies based on the local, renewable resources. The innovative efforts invoked numerous local energy initiatives. Their motivations are presented. Local energy initiatives created conditions for adoption of the renewable energy technologies in communities entailing adaptations to the local conditions, which enabled the distributed energy systems. The energy enterprises constituted the fastest growing business in the European Union during 2008–2014. This growth can be attributed to policy support of the renewable energy supplies and to market demands for the distributed energy systems.

Keywords: Local initiatives · Renewable energy · Enterprises

1 Introduction

Deployment of energy in communities involves procurement of power and heat supplies. The cost-effective energy suppliers are tendered, as prescribed in regulations on public procurement in many countries, including the European Union countries and the United States. Such procurements usually exclude issues that do not contribute to lower costs or effective performance, for instance local jobs creation, involvement of local businesses, local training, pollution prevention and other attributes of social and environmental qualities. Such additional benefits of supplies are key communities' interests but they are accrued by the suppliers, not by communities. Concerns about distribution of the additional benefits related to energy services triggered initiatives for distributed energy systems, meaning for power and heat generation from local energy resources, distribution through the local grid with storage and local services for efficient balancing of the energy use. The distributed energy systems use mainly renewable energy resources, in particular small scale photovoltaic, local electricity and heat grids, energy storage systems, electric vehicles and charging stations, demand response and measuring; many also include wind power and biofuels with combined heat - power [1].

In memoriam of Cornelis Johannes van Leeuwen (22 January 1930–25 February 1993), safety manager of the Unilever and environmental activist that turn company to grow for sustainability.

I. Visa and A. Duta (eds.), *Nearly Zero Energy Communities*,
Springer Proceedings in Energy, DOI 10.1007/978-3-319-63215-5_7

The global market of the distributed energy systems grows. The global capacity is estimated to be about 109.9 GW in 2015 and 125.9 GW in 2016; the market value about USD 65.8 billion in 2015 and USD 69.7 billion in 2016, including the distributed wind and combined heat-power it is above USD 113.5 billion in 2016 [2]. Although the value excluding wind and co-generation is only 8.1% of the global energy market in 2015 and 8.9% in 2016 the distributed energy systems grow about three times faster than the global energy market [3]. The growth projections vary from 9.5% to 18.8% annual average, which are realistic figures regarding 17.3% growth of the distributed energy systems in the United States between 2008 and 2017 based on the statistical data [4]. Such data is not found for the European Union.

This paper is about the drivers of this global paradigm shift from the large scale energy supplies towards the distributed energy systems. The focus is on the European Union. The train of thought is presented that market deficiencies caused by the vested energy business with supportive policies have triggered innovators' initiatives for downscaling of energy technologies entailing local energy initiatives in communities which created markets for enterprises pursuing the distributed energy systems. This argumentation refers to economic discussions about drivers of technological change for the common goods, such as environmental quality. The mainstream, neoclassic economic argumentation is focused on competition. Given competition, prices invoke allocations of resources for cost-effective technology development. Technology development in this view is driven by the market prices and policy support. No doubt that prices under competition are relevant but not for efforts during many years of technology development under fluctuating prices. The evolutionary economic theory underlines quasi-autonomous technological development through search for allocations of resources and selecting of the appropriate solutions for the targeted performance. Policies, herewith, determine the scope of alternatives for the search and influence the selection process through criteria for decision making. This argumentation reflects the process of technology development but does not explain why certain technologies are pursued and adopted and other fail. In the third, behavioral perspective, technology development and adoption are driven by the societal urgency for alternatives, for instance deficient environmental performance invokes sense of urgency for innovations. Innovations emerge when social actions create conditions for innovators to act and to adopt their efforts [5]. This paper underpins the behavioral viewpoint on energy markets in Europe.

After this introduction, deficiencies on energy markets from the communities' perspective are presented. Then, local energy initiatives are illustrated as conveyors of alternative energy suppliers. Thereafter, growth of enterprises in energy business in the European Union is shown and the main drivers of growth are discussed. Finally, conclusions are drafted.

2 Energy Market

Until 1990s, deployment of energy in the European communities was usually in domain of state enterprises, the energy utilities. They operated on the national level though some communities also owned utilities, e.g. in Germany. If a community aimed to improve its energy supply it had no choice but convince the state authorities about funding and negotiate about operations with the utility. In the capitalist European countries, the energy use was served by the private installation firms and professionals, not in the communist ones. The monopoly position of energy utilities is increasingly undermined in 1990s as the neo-liberal ideology aiming at the private ownership reached policies of the left and right wings. Energy exploration and generation is privatized, distribution remained in the domain of state. The privatization created hybrid public-private energy markets in the European Union. State firms operate as if private, for example Vattenfall [6]. There are also private companies that enjoy state protection through subsidies and regulations, e.g. state interventions on energy markets in the European Union approach €118 billion a year only in favor of the vested energy firms [7]. The scale of the energy firms enlarges because they focus on consolidation of their interests through mergers and rent-seeking for public funds rather than competition. Market analysts argue that such hybrids deliver the worst of private and public systems because they can avoid discipline of competition due to state protection and public controls of state enterprises entailing corruption and inefficiencies which amplified concerns [8]. In effect, prices of energy use increased despite the neo-liberal promises about efficiency due to competition. For example, the residential electricity prices in the European Union grew above inflation by more than 3% annual average during the last decade.

When vested interests are busy with rent seeking, they usually miss the emerging disruptive innovations [9]. This also occurred on the European energy markets. From 1990s on, the perceptions of uncontrollable scale of energy firms, the increasing energy prices without tangible benefits to the residents and concerns about growing pollution invoked innovative responses engineers who pursued downscaling of energy technologies to the individuals' and communities' scales [10]. Initiatives for local waste digesters, solar boilers, wind mills, co-generation and other energy technologies on farms, districts and even individual houses mushroomed. From the policy perspective, it is argued that such initiatives pursued democratization of energy systems because generated "open" locally embedded decisions as to oppose to "distant", decision making in private firms and "closed" institutional decision making in utilities [11]. It is doubtful if this was prime objective of the innovators busy with downscaling of energy technologies but the effect was market entry of the small scale renewable energy technologies. They did force market changes albeit often unintentionally. This response was economic from the communities' perspectives because the distribution of costs and benefits between energy enterprises and communities was unbalanced. For illustration, a community of 100 000 residents would pay yearly about €25 million to €150 million to energy suppliers in a low-income country (e.g. Romania) respectively high-income country (e.g. Germany), or alternatively it could downscale energy generation with more than 500 respectively 1000 full time jobs in the community. The considerations about income and jobs for local economic development, as well as concerns about environmental qualities, in particular with regard to the emerging issue of climate change, were drivers of local energy initiatives from mid-1990s on. These were, for example regional initiatives for wind power in the Spanish Navarra, urban solar energy in the German Freiburg, biofuels in the town of Güssing in Austria and many others [12]. These local energy initiatives introduced the customer-specific energy services which were perceived unattractive by the vested energy suppliers. The costs of renewable energy technologies were often higher than the lowest costs fossil fuels technologies but the benefits to the communities were also larger. AQ1

3 Local Energy Initiatives

The local energy initiatives often start as a citizens' initiative driven by concerns with the community development and environmental qualities. They created social networks for purchase and use of renewable energy technologies and generated expertise about uses of energy services. Many adapted technologies for their local purposes. They can be considered as the "user innovators" in the sense of consumers that adapt available energy technologies for their use and disseminate know-how about applications in the communities rather than organizations that pursue technologies for sales [13]. For instance, several farmers on the Danish island Samsø introduced digesters of agricultural residues for heating and windmills for electricity entailing energy self-reliance on the island, except for mobility, and promote their experiences through the local energy academy. This technology development blurs distinction between energy producers and consumers, labelled as "prosumers" [14].

Meanwhile, the number of local energy initiatives has grown into hundreds; for example, more than 1200 are registered in Germany, about 400 in the Netherlands. The initiators are usually social activists, farmers or small firms who start non-governmental organizations on voluntary basis. The voluntary approach often evolves into partnerships, associations, cooperatives and other forms of enterprises. For example, the Ecopower in Belgium emerged mid 1990s in a group of anti-nuclear activists aiming to operate a windmill as alternatives for nuclear power and evolved in two decades into a wind power cooperative with 40000 members sharing about 5% of the Belgian energy market. Many initiatives are started by local politicians and institutions aiming at the local economic development, for instance the Green Energy Cluster emerged as an instrument for the rural development in Transylvania (Romania). Such organizations generate income along with social fairness, environmental performance and other ethical attributes. This integration of the ethical attributes in business models is often labeled as social enterprises in order to distinguish from the commercial enterprises focused on profit [15], but practices are fluid because all organizations must be profitable for continuity, nearly all organizations use private and public resources and most firms embrace some kind of social responsibility [16]. This integration is increasingly considered business-wise because the ethical attributes in products and services add value to sales [17].

Studies on the governance of local energy initiatives show that the participants generate high know-how even in small communities although the capabilities are due to tinkering rather than technology development [18]. It is also suggest that the initiatives foster dissemination of their energy know-how to various segments of societies [19] and adaptations of technologies to situations in various communities [20]. Inquiries into opinions of local energy initiatives in the Netherlands, Italy and Romania about success factors and barriers show many similarities across these countries [21, 22]. Social involvement, contacts in the community and economic capabilities are considered to be key success factors in all three countries through more important in the Netherlands than in Italy and Romania. In addition, low start-up costs, short payback time and generation of the non-monetary benefits, such as green image, are considered important in all these countries though the economic performance is perceived as key issue in Romania. Regulations and limited capital are pinpointed as main barriers in Italy and the Netherlands; lack of policy support is the additional barrier in Romania. Scholars also pinpoint at risks. One issue is the disparity between high expectations of the initiatives about public engagement and low consumers' readiness to participate, which can overstate capabilities of the initiatives [23]. Another issue is the development beyond the scale of community because large scale needs specialization and involves bureaucracy [24]. It is also argued that the initiatives innovate on market niches with limited impacts on the energy market and hybridization with vested businesses is advocated [25]. Many initiatives, however, turned into the energy business.

Local energy initiatives developed markets for the distributed energy systems through generation of entrepreneurial skills, organization of experiments and demonstration projects, lobbies for public procurement of renewable energy and support of renewable energy technologies entailing high regional capabilities, e.g. North Jutland and North Germany in wind energy. Due to the lobbies, most countries introduced subsidies for development of renewable energy technologies and price guarantees for deliveries of renewable energy to grid called feed-in tariffs. All these factors enabled commercialization of the downscaled energy technologies entailing markets of the distributed energy systems. This commercialization has two major impacts for energy markets. One impact is that energy markets are increasingly driven by customers' preferences and consumers' behavior because different energy technologies can be used to meet demands, which rival scale of the vested energy enterprises. Another one is that organizations on energy markets evolve from hierarchic institutions to networks.

4 Energy Enterprises

During the period 2008–2014 the European Unions experienced a booming energy business, which is largely due to the distributed energy systems [26]. This is indicated by the number of enterprises and persons working in the energy business. Statistical data for the European Union for 2008–2014 is used. This period covers recession during 2008–2011 after the financial crisis in 2008 when the total income of the European Union has decreased by about 4.5% and recovery during 2012–2014 when the pre-crisis income level (in the current euro) is reached. During this period, public support through high feed-in tariffs for renewable energy is introduced in several European countries. Before 2008 there were mainly subsidies for cost-effective project proposals and after 2014 the feed-in tariffs were reduced because considered unnecessary. Appendix shows per country in the European Union the number of enterprises in the energy business, the public support as delivered by the Commission of European Energy Regulators [27] and the annual changes of the enterprises and the public support.

Table 1. Number of all enterprises, in information and communication business and in energy business with their employment in the European Union during 2008–2014

Numbers in millions	2008	2009	2010	2011	2012	2013	2014
All enterprises	24	25	25	25	25	25	25
Birth of enterprises	2	2	2	2	2	2	3
Birth in the total	9.7%	9.6%	9.7%	9.7%	9.3%	9.6%	10%
Persons in the enterprises	142	137	135	137	138	136	140
Persons per enterprise	6	6	6	6	6	5	6
Information and communication	0.82	0.86	0.89	0.93	0.97	0.98	1.04
Birth of enterprises	0.10	0.10	0.11	0.12	0.12	0.12	0.13
Birth in the total	12%	12%	13%	13%	12%	13%	12%
Persons in the enterprises	5.7	5.6	5.6	5.7	5.9	5.8	6.0
Persons per enterprise	7	7	6	6	6	6	6
Electric power, gas, air conditioning	0.06	0.08	0.10	0.11	0.14	0.15	0.15
Birth of enterprises	0.01	0.02	0.02	0.02	0.02	0.02	0.01
Birth in the total	17%	21%	24%	18%	16%	11%	18%
Persons in the enterprises	1.24	1.27	1.27	1.30	1.35	1.35	1.34
Persons per enterprise	21	17	13	11	10	9	13

The boom of the energy business is underpinned by the number of enterprises, their birth and persons in the enterprises which are employees and employers. These indicators are shown in Table 1. In addition, the birth percentage in all enterprises indicates attractiveness for start-ups. The persons per firm indicate capital intensity; fewer people per enterprise mean use of technologies for human resources. Data on all enterprises in the European Union, enterprises in information and communication technology, often considered the most dynamic business, and in electricity, gas and air conditioning are compared. The latter indicates the energy business. The energy business covers mainly renewable energy because the total energy consumption in the European Union stagnates and the fossil fuels consumption decreases. Data on Greece and Malta are deficient.

The number of all enterprises remained around 25 million during this period; out of it about 10% were start-ups. Although the total number of persons decreased by more than 5 million during the recession, this 3.5% decrease in total is percentwise smaller than the income fall, but employment did not recover in 2014 as the number of enterprises did. On average about 6 persons worked per enterprise. The information and communication covered about 0.82 million enterprises, i.e. 3.4% of all, out of it 12% to 13% were start-ups. The employment slowly increased after a minor dip. On average 6 persons worked in an enterprise. The energy business covered about 60000 enterprises in 2008, it is about 0.25% of all enterprises, and increased to about 150000 in 2014, i.e. about 0.6% of all. This business attracted many start-ups, about 18% annual average, up to 24% a year during the recession, i.e. relative much more than in information and communication. More people got work despite capitalization as number of persons per enterprise decreased, which is presumably due to shifts from consultancy to product delivery and installations. The energy business is among the most attractive businesses in European Union that generates employment despite of capitalization.

There are differences in the energy business between countries. The number of enterprises per GDP varies, e.g. Bulgaria has twelve times less enterprises than Luxemburg and ten times less than Denmark. One would expect many enterprises in the energy business in the countries that use much energy to produce value because there is much to gain through better energy performance. The indicator of energy use per value is energy intensity, meaning energy consumption per euro GDP [28]. The average of the European Union is 0.09 kg oil equivalent per euro (i.e. about 1 kWh per euro) but the spread is from 0.24 kg oil equivalent per euro in Bulgaria down to 0.06 kg oil equivalent per euro in Denmark. Contrary to this expectation, the correlation between the countries' energy intensity and number of energy enterprises is negative though low (Pearson correlation: $R^2 = -0.25$). The growth of energy business is driven by other factors than the energy intensity.

5 Drivers of Energy Business

Several factors can drive the growth of energy business. One factor can be the income. One would expect that recovery from the crisis would generate growth of energy business. Hence, the annual average growth of enterprises in the European Union is estimated for the period of recession 2008–2011 and recovery 2012–2014. The same data and indicators for all enterprises, the information and communication business and energy business are used. Table 2 shows the results. The recessions had hardly impact on the number of enterprises but reduced employment whereas recovery increased the enterprises number but hardly employment. The recession and recovery had hardly effects on the information and communication business that kept 4% growth rate but the employment decreased during recession entailing moderate recovery. Contrary to the expectation, the energy business got boost during the recession as the number of energy enterprises increased by 24% a year. This growth was due to 30% annual growth of start-ups which were presumably mainly the technology-based enterprises because the number of persons per enterprise decreased (the total employment has grown). The growth of energy business continued during the recovery but a slower rate though even this rate was twice higher than the information and communication business. The main reason for the slower growth was that lower number of start-ups growth and they were less technology-based as the capitalization also decreased.

The explanation for the boost during the recession period could be policy support of the energy business. Policy support is often pinpointed as the driver of renewable energy technology: "wind turbines turn on subsidies" is framed by the vested energy interests. The effect of policy support on the energy business growth is assessed with data on the public support for the renewable energy production and energy efficiency. Although this data is deficient because data for 2011 and 2013 are not found and it is unclear whether there is no data or no support in a year, the policy support was not decisive for the business growth. The number of enterprises and public support has

Table 2. Growth of enterprises and their employment in the European Union

	Annual average growth		
Number x million	2009–2011	2012–2014	2009–2014
All enterprises	1%	1%	1%
Birth of enterprises	1%	2%	1%
Birth in the total	0%	0%	0%
Persons in the enterprises	−1%	1%	0%
Persons per enterprise	−2%	0%	−1%
Information and communication	4%	4%	4%
Birth of enterprises	6%	4%	5%
Birth in the total	2%	−1%	1%
Persons in the enterprises	0%	2%	1%
Persons per enterprise	−4%	1%	−1%
Electric power, gas, air conditioning	24%	10%	17%
Birth of enterprises	30%	−15%	8%
Birth in the total	4%	6%	5%
Persons in the enterprises	2%	1%	1%
Persons per enterprise	−18%	9%	−4%

increased in the European Union, obviously the countries with larger energy business gave larger support, but this public support was relevant for the energy business growth during the recession 2008–2011 and hardly relevant during the recovery. The cross-countries Pearson correlations between the growth of business and public support are low but negligible during the recovery. The public support has fostered start-ups during recession but has little effect when income recovered, even cause crowding-out is some cases.

The raising international prices of fossil fuels could also support introduction of enterprises based on the renewable energy technologies. This price effect on electricity generation, however, should not be overstated because the price increase was moderate in real dollar cents per kWh. During 1990s, the real price of coal-coal is the main energy resource for electricity generation-fluctuated around the average of 0.38 dollar cent per kWh. During the period 2008–2014 the real coal price was higher because average 0.52 dollar cent per kWh but well-below the prices during 1980s. This price increase has fostered introduction of gas for electricity generation but renewable energy was considered much more costly except the large scale hydropower. The price effect on mobility could be larger because the average price of oil increased from 1.7 dollar cent per kWh during 1990s to 5.6 dollar per kWh during 2008–2014 (though below the prices during 1974–1983) [29]. However, the energy market related to mobility has hardly changed during the high oil prices.

Culture related to energy performance in communities is also relevant but hardly studied systematically. For instance, the number of enterprises in the energy business grew fast in Austria and the Netherlands despite low and decreasing public support during 2008–2014. This is contrary to, for example Czech Republic, France and Spain that experienced slower growth of the energy business despite larger public support. Vivid communities are apparently key factor for the start-ups in the energy business though they need public support for continuity because this business needs substantial capital outlays.

6 Conclusions

The emergence of distributed energy systems as a paradigm shift on the global energy markets is discussed based on experiences in the European Union. The train of events can be summarized. Entry of innovators pursuing downscaling of energy technologies through use of local energy resources for local markets can be comprehended as market response to deficiency caused by the vested energy interests with support of policies because the costs and benefits of energy supplies were unevenly distributed among the supplying enterprises and demanding communities. This institutional nexus unintentionally invoked sense of urgency to pursue income and jobs generation in communities entailing downscaling of technologies by the tinkering innovators using mainly biofuels, wind power and solar power. Due to mushrooming local energy initiatives the downscaling innovations are disseminated as rivals to the scaling up on energy markets. The local energy initiatives developed communities' markets for the distributed energy systems due to lobbying for the public support, generating local capabilities in energy technologies, experimenting with business models for the local energy service, promoting adoption of solutions in communities and so on. This development created conditions for fast growth of the energy business after during the economic recession after the crisis in 2008 and continuation during recovery up to 2014. As the market has grown, the marginal costs of renewable energy technologies decreased. This evolution during two last decades towards the distributed energy systems has two major consequences for the global energy markets: energy markets are increasingly driven by the know-how about the costumers' preference and consumer behavior and the markets evolve toward horizontal network of suppliers and demanders.

This narrative about changes on energy markets towards the distributed energy systems differs from the conventional storytelling about changes due to high fossil fuels prices and large public support to the rival renewable energy technologies, as well as about the quasi-autonomous technological development that generates novel cost-effective technologies. This paper underlines that the growing markets of distributed energy systems are generated primarily as results of social engagement to avoid deficiencies on energy markets and trailblazing innovators that were able to link this sense of urgency with tangible alternatives. This engagement enabled market growth of the distributed energy systems entailing lower costs technologies due to specializations in supplies. It is a promising development from the perspective of social fairness and environmental qualities. The encouraging experience on the European Union energy markets is instructive for other policies.

Appendix

See Tables 3, 4 and 5. AQ2

Table 3. Number of enterprises in electricity, gas, steam and air conditioning supply

	2008	2009	2010	2011	2012	2013	2014
European Union	60,044	75,017	96,104	114,448	138,651	148,844	149,180
Belgium	265	382	469	551	611	625	651
Bulgaria	528	1,166	1,412	1,802	2,112	2,133	2,053
Czech Rep.	822	1,599	3,008	5,411	6,566	14,352	10,335
Denmark	*1,646*	1,660	1,674	1,792	1,876	1,821	1,784
Germany	23,445	28,765	38,821	48,284	60,460	61,965	63,657
Estonia	249	246	226	226	238	239	240
Ireland	209	283	310	325	326	*405*	483
Greece	:	:	:	:	:	:	:
Spain	14,346	14,990	15,319	15,593	18,609	15,242	14,929
France	4,493	10,034	16,403	17,473	17,969	18,555	18,990
Croatia					388	513	560
Italy	2,478	2,973	4,097	6,601	9,029	10,267	10,546
Cyprus	2	6	9	18	29	44	48
Latvia	281	324	373	405	458	479	506
Lithuania	252	292	405	487	1,777	1,276	1,494
Luxembourg	52	56	59	63	71	71	73
Hungary	489	506	556	585	620	622	664
Malta	:	:	3	3	1	2	
Netherlands	836	879	820	852	914	953	1,191
Austria	2,601	2,744	2,923	3,099	3,464	3,782	3,813
Poland	2,332	2,826	3,200	3,596	4,140	4,943	4,779
Portugal	665	700	730	801	881	925	941
Romania	506	609	885	934	1,144	1,369	1,422
Slovenia	405	493	636	812	1,314	1,539	1,595
Slovakia	273	320	410	462	436	470	503
Finland	718	728	740	770	795	833	885
Sweden	1,546	1,681	1,791	2,083	2,228	2,354	2,728
United Kingdom	605	755	825	1,420	2,195	3,065	4,310

Table 4. Public support of renewable energy and energy efficiency (italic are interpolations because of absent data)

Million euro	2008	2009	2010	2011	2012	2013	2014
Europe		19106	25166		45601		53741
Correlation*		0.85	0.91		0.90		0.89
Belgium		489	729		1490		1,285
Bulgaria							
Czech Rep		150	488		1268		1,379
Denmark		294			568		915
Germany		5,618	9,512		16288		19,474
Estonia			42		17		18
Ireland					56		56
Greece					1165		1,162
Spain		6,035	5,371		6165		5,307
France		556	1,511		2488		3495
Croatia					22		69
Italy		2,638	3,427		9585		12,336
Cyprus							48
Latvia							82
Lithuania		25			49		44
Luxembourg		16	14				37
Hungary		83	242		99		157
Malta							4
Netherlands		639	690		686		0
Austria		307	378		361		477
Poland					1038		1,413
Portugal		528	752		781		1,046
Romania			37		190		394
Slovenia			36				69
Slovakia							
Finland			16		47		80
Sweden		478	483		495		370
Un. Kingdom		1,250	1,438		2743		4,024

* Cross countries collection with enterprises

Table 5. Increase of enterprises in energy business and increase of public support of energy enterprises

	Increase energy enterprises numbers			Increase support schemes million euros		
	2010/2009	2012/2010	2014/2012	2010/2009	2012/2010	2014/2012
European Union	28%	20%	4%	32%	35%	9%
Correlation				0.74	0.28	0.01
Belgium	23%	14%	3%	49%	43%	−7%
Bulgaria	21%	22%	−1%			
Czech Republic	88%	48%	25%	225%	61%	4%
Denmark	1%	6%	−2%	−100%		27%
Germany	35%	25%	3%	69%	31%	9%
Estonia	−8%	3%	0%		−36%	3%
Ireland	10%	3%	22%			0%
Greece						0%
Spain	2%	10%	−10%	−11%	7%	−7%
France	63%	5%	3%	172%	28%	19%
Croatia			20%			77%
Italy	38%	48%	8%	30%	67%	13%
Cyprus	50%	80%	29%			
Latvia	15%	11%	5%			
Lithuania	39%	109%	−8%			−5%
Luxembourg	5%	10%	1%	−13%	−100%	
Hungary	10%	6%	3%	192%	−36%	26%
Malta		−42%	−100%			
Netherlands	−7%	6%	14%	8%	0%	−100%
Austria	7%	9%	5%	23%	−2%	15%
Poland	13%	14%	7%			17%
Portugal	4%	10%	3%	42%	2%	16%
Romania	45%	14%	11%		127%	44%
Slovenia	29%	44%	10%		−100%	
Slovakia	28%	3%	7%			
Finland	2%	4%	6%		71%	30%
Sweden	7%	12%	11%	1%	1%	−14%
United Kingdom	9%	63%	40%	15%	38%	21%

References

1. Krozer Y. (2015). Theories and Practices on Innovating for Sustainable Development. Dordrecht-Heidelberg: Springer. I appreciate permission of Springer for publishing this paper
2. https://www.navigantresearch.com/research/distributed-energy-resources-global-forecast, Accessed 7 June 2017; http://www.grandviewresearch.com/industry-analysis/distributed-energy-generation-industry, Accessed 7 June 2017

3. The global energy market can be found in https://www.greentechmedia.com/articles/read/u.s.-advanced-energy-revenue-grew-by-just-1-in-2016, Accessed 7 June 2017
4. https://www.statista.com/statistics/222082/projected-us-smart-grid-market-size-since-2009/
5. Krozer, Y.: Innovations and the Environment. Springer, London (2008)
6. The largest energy firms by revenues are state companies in Saudi Arabia, China, Kuwait, Russia and Brazil
7. Krozer, Y.: Chapter 11 (2015)
8. Economist, The Rise of the Hybrid Company, 3 December 2009
9. Christensen, C.M.: The Innovator's Dilemma, 1st edn. Harper Business, New York (2000)
10. Among the first downscaled technologies were digester of organic waste and wind mill operating from 1986 on in Daersum a small village in the Frisian region (the Netherlands)
11. Walker, G., Devine-Wright, P.: Community : what should it mean? Energy Policy **36**, 497–500 (2008)
12. Krozer, Y.: Renewable energy in European regions. Int. J. Innov. Reg. Dev. **4**(1), 44–59 (2012)
13. von Hippel, E.: Democratisation Innovations, 1st edn. MIT Press, Cambridge (2005)
14. Toffler, A.: The third wave, 1st edn. Bantam Books, New York (1980)
15. Stevenson, H., Austin, J., Wei-Skillern, J.: Social and Commercial Entrepreneurship: Same, Different, or Both? Entrepreneurship Theory Pract. **51**(1), 1–22 (2006)
16. Doherty, B., Haugh, H., Lyon, F.: Social enterprises as hybrid organizations: a review and research agenda. Int. J. Manag. Rev. **16**, 417–436 (2014)
17. Clinton, L., Whisnant, R.: Model Behaviour 20 Business Model Innovations for Sustainable Development. SustainAbility, London (2014)
18. Ornetzeder, M., Rohracher, H.: User-led innovations and participation processes: lessons from sustainable energy technologies. Energy Policy **34**, 138–150 (2006)
19. Ison, N.: Governance of Community Energy Projects. Lancaster Environment Center, Mimeo (2010)
20. Seyfang, G., Haxeltine, A.: Growing grassroots innovations: exploring the role of community-based initiatives in governing sustainable energy. Environ. Planning C: Gov. Policy **30**, 381–400 (2012)
21. Boon, F.: Local is Beautiful. In: Master thesis, University of Utrecht - Geoscience (2012)
22. Dragoman, M.C.: Factors influencing local initiatives in different contexts. In: Thesis, University Twente (2014)
23. Rogers, J.C., Simmons, E.A., Convery, L., Weatherall, A.: Public perceptions of opportunities for community-based projects. Energy Policy **36**, 4217–4226 (2008)
24. Hielscher, S., Seyfang, G., Smith, A.: Community Innovation for Sustainable Energy, Centre For Social and Economic Research on the Global Environment, School of Environmental Sciences, University of East Anglia Norwich, Mimeo (2011)
25. Arentsen, M., Bellekom, S.: Power to the people: local energy initiatives as seedbeds of innovation? Energy Sustain. Soc. **4**(2), 2–12 (2014)
26. Bertoldi, B., Boza-Kiss, B., Panev, S., Labanca, N.: ESCO Market Report 2013. Joint Research Centre, Ispra (2014)
27. Council of European Energy Regulators, Status Review of Renewable Energy and Energy Efficiency Support Schemes in EU, Brussels
28. Per enterprise, the European average GDP was about €0.5 million but the spread was from €0.12 million in Bulgaria to €1.45 million in Luxemburg and €1.13 million in Denmark, i.e. 12 respectively 10 times higher
29. https://www.eia.gov/totalenergy/data/annual/showtext.php?t=ptb0709

Author Query Form

Book ID :	**448128_1_En**
Chapter No :	**7**

Springer
the language of science

Please ensure you fill out your response to the queries raised below and return this form along with your corrections

Dear Author
During the process of typesetting your chapter, the following queries have arisen. Please check your typeset proof carefully against the queries listed below and mark the necessary changes either directly on the proof/online grid or in the 'Author's response' area provided below

Query Refs.	Details Required	Author's Response
AQ1	Please check and confirm if the edits made in "thousand separators".	
AQ2	Please check and confirm the inserted citation of Tables 3–5 are correct. If not, please suggest an alternate citation.	

MARKED PROOF

Please correct and return this set

Please use the proof correction marks shown below for all alterations and corrections. If you wish to return your proof by fax you should ensure that all amendments are written clearly in dark ink and are made well within the page margins.

Instruction to printer	*Textual mark*	*Marginal mark*
Leave unchanged	• • • under matter to remain	
Insert in text the matter indicated in the margin		New matter followed by or
Delete	through single character, rule or underline or through all characters to be deleted	or
Substitute character or substitute part of one or more word(s)	through letter or through characters	new character or new characters
Change to italics	under matter to be changed	
Change to capitals	under matter to be changed	
Change to small capitals	under matter to be changed	
Change to bold type	under matter to be changed	
Change to bold italic	under matter to be changed	
Change to lower case	Encircle matter to be changed	
Change italic to upright type	(As above)	
Change bold to non-bold type	(As above)	
Insert 'superior' character	through character or where required	or under character e.g. or
Insert 'inferior' character	(As above)	over character e.g.
Insert full stop	(As above)	
Insert comma	(As above)	,
Insert single quotation marks	(As above)	or and/or or
Insert double quotation marks	(As above)	or and/or or
Insert hyphen	(As above)	
Start new paragraph		
No new paragraph		
Transpose		
Close up	linking characters	
Insert or substitute space between characters or words	through character or where required	
Reduce space between characters or words	between characters or words affected	