A Study by the MPW Institute LLC:

Attitude Towards Decentralized Electricity Generation

2015

The MPW Study

Decentralized electricity generation is supposed to solve several problems faced by today's electricity markets and networks[1]. It is also one of the main contributors to the reduction of CO_2-emissions and the improvement of energy efficiency[2]. No wonder, most countries around the world have adopted legislative measures to promote decentralized electricity generation[3].

But at the same time, those promoting the traditional centralized energy system make their claims: Who will pay grid fees if the rich generate their own electricity and go off-grid?[4] How can grid-stability be safeguarded with more and more renewable energy fluctuating into the grid?[5] In other words: How can the old powers stay in control?

Legislators around the world are torn between the legitimate arguments of both sides. Besides that, most countries are just starting to experiment with decentralized energy. How is the attitude of legislators towards decentralized energy resources at the end of 2015? Are they leaning towards a proactive approach and move their countries into a decentralized, smart future? Are they doing nothing? Or are they inclined to protect the old centralized systems? This MPW Institute study is supposed to give you a first insight in the answers to these questions.

About MPW

As an operation with interdisciplinary activities, MPW Legal & Tax and MPW Consulting GmbH provide committed consultancy services for players in the energy services market. Our joint consultancy spectrum enables us to provide comprehensive business, tax, legal, technical and sales-related consultancy - all from a single source.

MPW Institute LLC represents those activities of MPW which revolve around the scientific reviewing of global or national issues in the energy services sector and which take place outside the scope of actual consulting projects. Within this unit we conduct research projects and surveys of a scientific nature, devise publications and organise and mount events. MPW Institute LLC is based in New York City.

What can you expect from this study?

The study is rating the attitude towards decentralized electricity generation in 15 countries[6]. It is not rating the economic benefits to be gained from the subsidies or penalties available in each country. The rating provided below just rates whether the overall attitude is positive towards decen-

[1] *http://www.europarl.europa.eu/document/activities/cont/201106/20110629ATT22897/20110629ATT22897EN.pdf*
[2] *https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch4s4-3-8.html*
[3] *The World Alliance for Decentralized Energy (WADE) maintains a database with relevant regulations: http://www.localpower.org/pol_policies.html*
[4] *Just providing one example regarding Oklahoma: http://newsok.com/oklahoma-house-passes-solar-surcharge-bill/article/3955378*
[5] *Again just one article instead of many: http://www.energyandinfrastructure.com/index.php/sections/columns1/801-power-solutions*
[6] *Australia, Brazil, China, Denmark, Finland, Germany, Italy, Mexico, Sweden, United Arab Emirates, United Kingdom, United States (California, New York, North Carolina, Texas)*

tralization, or neutral, or negative. To give the reader at least a certain level of granularity, the study differentiates between two main business cases:

Feed-in Scenario

Decentralized generation can be used to feed the electricity into the grid. The questions raised in this scenario are: Does the legislation provide feed-in tariffs? Is it possible and promoted to feed electricity into the grid? Or is the legislation making it difficult or even impossible to feed surplus electricity into the grid?

Self-Supply Scenario

Decentralized generation can also be used to cover the on-site demand. In this scenario, the questions are: Does the legislation subsidize or promote self-supply? Or is the legislation penalizing self-supply?

It is clear that not a single scenario in the real world is probably falling into either of these categories. Nevertheless, these two scenarios highlight the two main concerns regarding decentralized generation: Fluctuation that leads to grid instability (represented by the feed-in scenario) and Lack of financing for a common grid (represented by the self-supply scenario.

Some legislative measures like net-metering are somewhat in the middle of the two scenarios. Net-metering is allowing the producer to feed into the grid with the same revenue per kWh as he pays for electricity from the grid. This way net-metering is a feed-in tariff of sort but also promotes self-supply. In the course of this study our contributors have tried to analyze each legislative measure in order to understand the spirit of the legislation as well as its practical implications.

Producer

In this study we also separated three distinct groups of decentralized electricity producers or DER owners: Private persons, Business entities, and utilities. This granularity is helpful since the legislation often differentiates between these groups regarding the allocation of incentives.

Sites

Finally, we realized that some incentives are allocated depending on the type of site where the decentralized generation takes place. To honor this fact, the study differentiates between Residential, Commercial building, and Heavy industry.

The end result of each country study is a rating that represents the average attitude among the two scenarios, three producer groups and three site categories, altogether eighteen ratings that represent either a positive, neutral, or negative attitude towards decentralized electricity generation.

Results

The countries can be grouped into three tiers. Tier one represents the leading countries regarding decentralized generation. These are Australia, Denmark, and New York. These countries have a predominantly positive attitude towards decentralized generation. They promote and incentivize most scenarios to a certain extent.

Tier two represents the countries that are developing a positive attitude towards decentralized generation or have developed such an attitude to a certain extent. These countries are: the majority of those surveyed in this study: Brazil, California, China, Finland, Italy, Mexico,

Country rating summary from positive to negative

	Business Model: Self-Supply	Business Model: Feed-in
1. Denmark	🟢	🟢
2. Australia	🟡 🟢	🟢
3. New York	🟡 🟢	🟡 🟢
4. California	🔴 🟢	🔴 🟢
5. North Carolina	🔴 🟢	🔴 🟢
6. Brazil	🟢	🟡
7. Italy	🟡	🟢
8. Sweden	🟡	🟢
9. United Kingdom	🟡	🟢
10. China	🟡	🟡 🟢
11. Finland	🟡	🟡 🟢
12. Mexico	🟡 🟢	🟡
13. United Arab Emirates	🟡 🟢	🟡
14. Germany	🔴	🟢
15. Texas	🔴 🟡	🔴 🟡

This summary represents the average attitude in a country towards dezentral energy generation.
Positive attitude 🟢 *Neutral attitude* 🟡 *Negative attitude* 🔴

North Carolina, Sweden, United Arab Emirates and United Kingdom.

Tier three represents countries where the traditional centralized approach seems to still have or have regained predominance. Besides Germany only Texas falls into this category.

The above table represents the results of this study by listing the countries in order of their rating from a favorable to a non-favorable attitude towards decentralized energy resources. For further details on each country, please see the detailed country pages.

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Denmark

The Danish Ministry of Climate, Energy and Building published the Energy Agreement in March 2012. It contains a wide range of ambitious initiatives with the target of 100% renewable energy in the energy and transport sectors by 2050. The Agreement states that by 2020 approximately 50% of electricity consumption should be supplied by wind power and more than 35% of final energy consumption should be supplied from renewable energy sources.[2]

Electricity from renewable sources is promoted through a premium tariff, in which a variable bonus is paid on top of the market price. However, the sum of the bonus and the market price cannot exceed a statutory maximum per kWh. This depends on the energy used and the date of connection of the system. Eligible technologies for the premium tariff are wind energy, solar energy, biogas, hydro-power and biomass. Entitled for the bonus are owners of plants who produce electricity from these renewable sources.[3]

Wind energy[4]

If electricity is produced in coastal wind farms established by public tender and 30% of the ownership share of the wind park belongs to residents or enterprises from a municipality with a coastline and within 16 km of the site, an extra bonus of 0.01 DKK can be received. Also plants financed by utilities can receive a subsidy of 0.353 DKK per kWh with a maximum of 42,000 full load hours plus a guaranteed bonus of 0.10 DKK per kWh. Self-supply with an installed capacity of up to 25 kW receive a subsidy of 0.60 DKK per kWh (commissioned before 20.11.2012). Plants commissioned after November 2012 with a maximum capacity of up to 10 kW receive 2.50 DKK per kWh and plants with maximum capacity of more than 10 kW receive 1.50 DKK per kWh.

Solar energy[5]

Solar installations (connected between November 2012 and March 2013) with up to 400 kW capacity receive maximum subsidy of 1.30 DKK per kWh. Household and self-consumption connected installations (connected between March and June 2013) with max. 6 kW capacity receive a maximum subsidy of 1.30 DKK per kWh. Installations commissioned after June 2013 receive a maximum subsidy of 0.60 DKK per kWh for 10 years, then 0.40 DKK. An

Name	Kingdom of Denmark
Electricity market liberalization	late 1990's[1]
Electric power transmission and distribution losses*	7%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

increased support is available for household and self-supply installations with max. 6 kW.

Biogas and biomass[6]

Commissioned installations after November 2012 with up to 6 kW can choose between maximum subsidy 0.793 DKK per kWh and maximum subsidy of 1.30 DKK per kWh for 10 years. For newer plants the bonus will reduce annually until 2018.

Hydro-power[7]

Currently wave energy installations with capacity of up to 6 kW receive a maximum subsidy of 1.30 DKK per kWh, applicable for 10 years. For newer plants the bonus will reduce annually until 2018.

Also subsidies are allocated to small-scale renewable energy systems as well as loan guarantees for local initiatives for the installation of wind energy systems. Eligible technologies to receive subsidies are solar energy, biogas, biomass and hydro-power, provided that the technologies are connected to the grid. The purpose is to promote market introduction of installations and small-scale pilot projects. The subsidy covers investment, preparation and installation costs as well as consultancy costs. Eligible for the subsidy are enterprises and institutions. It is possible to receive both the premium tariff as well as the subsidy.[8] Also heating generated from renewable energy sources is exempt from taxes.[9]

Denmark is a leading player in combined heat and power and has been able to reduce its carbon emissions while retaining the fuel consumption level unchanged for decades. There are a total of 670 centralized and decentralized CHP plants in Denmark. Already 80% of district heating in Denmark is cogenerated with electricity and the majority of customers pay less for district heating than the alternative cost with an oil burner.[10] CHP has priority grid access and financial support for production and expansion. There are production-independent subsidies as well as production-dependent subsidies for electricity producers. Operating subsidies are awarded as price supplements for biomass or as fixed total price for biogas. Heating from biomass-based cogeneration is also exempt from taxation. Natural gas CHP is subject to taxation, although CHP systems with less than 150 kWel can operate unregistered and thus pay full fuel tax but no electricity tax.[11]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

[1] http://ec.europa.eu/social/BlobServlet?docId=3452&langId=da
[2] http://www.efkm.dk/sites/kebmin.dk/files/climate-energy-and-building-policy/denmark/energy-agreements/FAKTA%20UK%201.pdf
[3] http://www.res-legal.eu/en/search-by-country/denmark/single/s/res-e/t/promotion/aid/premium-tariff-law-on-the-promotion-of-renewable-energy/lastp/96/
[4] http://www.res-legal.eu/en/search-by-country/denmark/single/s/res-e/t/promotion/aid/premium-tariff-law-on-the-promotion-of-renewable-energy/lastp/96/
[5] http://www.res-legal.eu/en/search-by-country/denmark/single/s/res-e/t/promotion/aid/premium-tariff-law-on-the-promotion-of-renewable-energy/lastp/96/
[6] http://www.res-legal.eu/en/search-by-country/denmark/single/s/res-e/t/promotion/aid/premium-tariff-law-on-the-promotion-of-renewable-energy/lastp/96/
[7] http://www.res-legal.eu/en/search-by-country/denmark/single/s/res-e/t/promotion/aid/premium-tariff-law-on-the-promotion-of-renewable-energy/lastp/96/
[8] http://www.res-legal.eu/search-by-country/denmark/single/s/res-e/t/promotion/aid/subsidy-the-forskve-programme-funds-for-small-renewable-energy-technologies/lastp/96/
[9] ttp://www.res-legal.eu/search-by-country/denmark/tools-list/c/denmark/s/res-hc/t/promotion/sum/95/lpid/96/
[10] http://www.ens.dk/sites/ens.dk/files/politik/Kina-samarbejdet/Materialer/Faktaark/chp.pdf
[11] http://www.code2-project.eu/wp-content/uploads/Code-2-D5-1-Final-non-pilor-Roadmap-Denmark_f2.pdf

Australia

The Renewable Energy Target (RET) in Australia was designed to reduce CO_2 emissions and to ensure that 20% of Australia's energy supply will come from renewable sources by 2030. Since January 2011, the RET operated two programs: the Small-Scale Renewable Energy Scheme (SRES), and the Large-Scale Renewable Energy Target (LRET).[2] The large-scale scheme is a financial incentive, which encourages investment in renewable sources, such as wind and solar farms. Accredited renewable energy producers (both individuals as well as businesses) are able to create certificates based on the amount of electricity they produce above their baseline. One certificate is equal to one megawatt hour of renewable electricity and can be sold or transferred to other individuals and businesses. All power stations generating renewable energy can apply for these certificates, regardless if the station feeds the electricity into the grid, if the electricity is used by a business or factory or if the power station itself consumes the electricity.[3]

The Small-scale Renewable Energy Scheme is a financial incentive for individuals and small businesses for installing and generating renewable energy from renewable sources for example solar, hydro or wind. These small-scale producers are entitled to a number of small-scale technology certificates (STCs), which is calculated by the amount of electricity generated or displaced. The number of certificates depends also on the geographical location and installation date of the system over the course of up to 15 years. The certificates must be created within 12 months after installation and can be sold to balance some of the purchasing and installation costs of the system, or even transferred to other individuals or businesses at a negotiated price. The capacity limit for solar panels is no more than 100 kW (output less than 250 MWh), wind system 10 kW (output less than 25 MWh) and hydro system no more than 6.4kW (output less than 25 MWh). Otherwise the system is classified as a power station and can then be eligible for the large-scale generation certificates.[4 5]

In Australia a net feed-in tariff is run state by state. The net feed-in tariff is actually a net-metering regulation, since the FIT's only offset the producer's (generally a

Name	Commonwealth of Australia
Electricity market liberalization	1970[1]
Electric power transmission and distribution losses*	5%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

household) electricity usage. In most states the tariff is paid for households, small businesses, community organizations and other small electricity customers for the excess electricity produced from renewable sources. These tariffs are available only for apartments or houses.[6] For example in Australian Capital Territory (ACT) the Electricity Feed-in (Renewable Energy Premium) Act 2008 stipulates, that medium and micro renewable energy generators are eligible for a renewable energy premium for producing electricity from renewable energy sources. A medium renewable energy generator is defined as a generator with total capacity more than 30 kW, but not more than 200 kW. Micro generators are described as generators with a total capacity not more than 30 kW. The premium rate applies if the generator is connected to the grid.[7]

Interesting Projects

Testing a model for residential solar and battery storage

In August 2015 the Australian Renewable Energy Agency (ARENA) announced support for Ergon Energy Queensland to explore new approaches in providing solar energy and battery storage systems to residential customers. The project creates a virtual power plant with solar and storage systems that will be monitored and controlled in order to evaluate if a virtual power plant can add value to the network by managing the supply of renewable energy into the grid, performing demand management as well as reducing network peak load. The duration of the pilot project is 12 months, it uses 33 systems consisting of a 4.9 kW photovoltaik array and a 12kW/5kW battery storage and control system. The results of the project will provide more information about the costs and benefits of these types of models. Customers, businesses and utilities could utilize even more renewable energy, if this pilot project is successful.[8]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

[1]Friðrik Rafn Larsen (2013) Implications of electricity sector liberalization on marketing decisions.
[2]http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target
[3]http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Power-stations/Large-scale-generation-certificates
[4]http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Agents-and-installers/Small-scale-technology-certificates
[5]https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator
[6]http://yourenergysavings.gov.au/rebates
[7]http://www.legislation.act.gov.au/a/2008-21/current/pdf/2008-21.pdf
[8]http://arena.gov.au/media/testing-a-model-for-residential-solar-and-battery-storage/

USA

Unlike many countries, the United State's national government does not have the authority to regulate the electric grid at the distribution level. This means that each state has its own policies when it comes to distributed generation (DG). These laws are typically passed by a state legislature and regulated by Public Utility Commissions. The national government regulates transmission and large power plants, because the energy they use crosses state borders. Neither transmission nor large power plants are directly related to DG. In the US, utility ownership of DG is generally seen as an unwarranted expansion of monopoly power. DG supporters fear that the utility will use this expansion of monopoly power to crush competition from DG companies, ultimately resulting in higher prices and lower deployment levels. However, for the purposes of this report, we are treating all countries uniformly and utility ownership of DG improves a country or states score.

Net Metering and feed-in-tariffs (FiT)

All but seven states in the US have net metering laws, which are similar to the feed-in-tariffs (FiT) found in many other parts of the world. Under both net metering and FiTs, DG can sell electricity to the utility owned grid. The types of systems that can participate in both schemes are typically prescribed in the law or regulations that authorize the policies. For example, solar can almost always participate, but participation by wind, biogas, and other types of DG depend on what is allowed under the specific Fit or net metering policy.

There are important differences between FiTs and net metering. For example, distributed generation participating in a FiT often gets compensated above the per kilowatt-hour rate of electricity for a prescribed period of time. Facilities participating in net metering only get the per kilowatt-hour rate charged by the utility. Under net metering, for purposes of calculating compensation, it is irrelevant to the consumer if the energy is sold to the grid or consumed onsite. If consumed onsite, the consumer avoids the cost of purchasing electricity from the utility. If electricity is sold to the utility, they get the rate they would have paid for purchasing power. Since these are equal, it does not change the customer bill if the energy is consumed onsite or sold to the grid. In most states, net metering is designed so that participants size their systems so they do not generate significantly more electricity than they use onsite over the course of a month. When they produce more than they us, a credit is applied to the next month's billing cycle. At the end of the year, any excess production is reconciled.[1]

Renewable Portfolio Standard

A renewable portfolio standard (RPS) requires that utilities purchase a certain amount of the energy sold to customers from renewable energy sources. It is common for an RPS to have carve-outs for rooftop solar or other distributed generation. The RPS has a built in market for renewable energy credits (RECs), which are created for every megawatt hour of renewable energy generated. The utility satisfies its RPS mandate by buying RECs, and the number of RECs required can be ratcheted up the amount of renewable energy required under the RPS as prices fall or to meet environmental goals.

[1] *http://programs.dsireusa.org/system/program/detail/453*

New York

New York is undergoing a major rethinking of its energy policies and regulations. The centerpiece of this change is the Public Service Commission's (PSC) Reforming the Energy Vision (REV) Proceeding. The changes envisioned under REV are intended to enable evolving business models, which will support greater penetration of distributed energy resources (DER). DER is defined broadly to include battery storage, DG, demand response, microgrids, electric vehicles and energy efficiency.[6]

Under REV, the state's utilities will take on the role of distribution system platform (DSP), a new function which will help manage DER installation and operation. The DSP will also ensure that DER is coordinated with wholesale energy markets, compensated for providing grid services, and deployed strategically in pockets suffering from high electricity prices due to congestion.[7] The utilities, acting as DSPs, will be incentivized to provide these services through market based earnings, but are restricted in the types of DER they can own. The PSC envisions that as more DER is deployed, the utilities will find new earning opportunities in the form of services provided to DERs and that these earning opportunities will replace traditional utility profit generating activities.[8]

Combined heat and power (CHP) systems that provide generation for onsite use are eligible for technical support from the New York State Energy Research and Development Agency (NYSERDA). One of the barriers to CHP in New York is that many generation units are not sized to provide the full power to the site. Therefore they must draw some power from the grid, exposing them to standby tariffs.[9]

As with other states with net metering, in New York owners of DG are paid the utility rate of electricity when they sell to the grid. Since using energy onsite allows them to not purchase from the grid, they are essentially compensated identically whether they use the energy themselves or sell it to the grid. (see section on net metering).

DG owners are given incentives to use more of their own power, or to curtail use, when the grid is congested. New York has Time of Use (ToU) rates, which allow customers to save significantly if they lower the amount of power they use on-peak. If they participate in demand response, either

Name	New York
Electricity market liberalization	1999[1]
Electric power transmission and distribution losses	5.8%[2 3]
Access to electricity	100%
Number of power outages in a typical month	.5[4 5]

through using their own generation or by cutting use on peak, they can get payments though the New York ISO capacity markets.

New York's net metering policies allow generation systems to be sized according to the type of system and the end user. Residential systems can be up to 25 kW for solar, 100 kW for farms, and 2 MW for non-residential. Wind is identical, except that it can be up to 500 kW for farms. Net metering can also be done using micro CHP, fuel cells, and micro-hydro. Each of these technologies has its own limits on system sizes.[10]

In addition to limits to the size of individual systems, states also limit the amount of net metered generation within a utility service territory. In New York the limits are 6% for all sources except for wind which is .3%.[11] Recently several utilities have sought relief from the PSC when they approached the net metering cap, but were ordered to continue processing net metering applications until a new tariff can be designed under REV.[12]

As stated in the proceeding section, consumers are compensated for any energy sold to the grid at the per kilowatt hour rate charged by the utility. However, distributed generation in New York and much of the United States have other incentives. One of the most important of is the renewable portfolio standard (RPS). New York's REC markets are somewhat unconventional in that a state agency buys the RECs using funds generated by a rider to utility rates. Reform of this system is under consideration, but mostly discussed in the context of large-scale renewables, not DG. As mentioned earlier, New York is undergoing a major restructuring of its electricity markets and regulations. It is not possible to detail all of the changes here as they are spread out over numerous PSC proceedings and actions taken by state agencies. A small sample of the changes includes community choice aggregation, community solar initiatives, and incentives for micro-grids.

The New York Sun Initiative is a direct example of how the state is promoting distributed solar and represents a significant compliment to the state's net metering laws. Under the Initiative, the different regions of the state are assigned blocks, each with megawatt capacity goals. Each block is then divided into residential, small and large non-residential systems. Incentives are available until the megawatt block for each region is met, at which point new but lower incentives will be available. The ultimate goal is to expand the use of solar power in New York, while fostering a market that will no longer need subsidies to thrive.[13]

Interesting Projects

Each utility was required to submit a "non-wires demonstration project" in late summer 2015. These projects are intended to find DER solutions that would allow the utilities to avoid a capital expenditure, such as a new transmission project or expanded substation.

Prior to submitting its demonstration project Consolidated Edison, the state's largest utility, submitted an ambitious plan to avoid expanding a substation to growing energy demand. The project, known as the Brooklyn-Queens Demand Management Plan, proposes that a $1 billion upgrade to two substations be deferred and instead a combination of DER and traditional utility investments be employed to resolve impending overloading of the distribu-

tion system.[14]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility[15]
Site: Residential[16]	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

[1]New York Independent System Operator (NYISO), Timeline: 1999, http://www.nyiso.com/public/flash/timelinenyiso/NYISO/index.jsp
[2]http://www.eia.gov/electricity/state/newyork/
[3]Formula: Estimated losses/ Total supply=%losses
[4]https://www.oe.netl.doe.gov/OE417_annual_summary.aspx
[5]Formula: 6 events/15 months=.5 events/month
[6]http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={0B599D87-445B-4197-9815-24C27623A6A0}
[7]Ibid.
[8]http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={4895462I-2BE8-40A8-903E-41D2AD268798}
[9]http://www.nyserda.ny.gov/Cleantech-and-Innovation/Power-Generation/CHP/Public-Policy-Issues
[10]Ibid.
[11]Ibid.
[12]http://www.cuny.edu/about/resources/sustainability/nyssolar/NYSNetMeteringAnalysis.html
[13]http://ny-sun.ny.gov/About/NY-Sun-FAQ
[14]http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={83594C1C-51E2-4A1A-9DBB-5F15BCA613A2}
[15]Utilities in New York are allowed to own DG when it provides grid services and the market cannot, or will not supply the needed DG.
[16]Except when the market will not make an investment in DER, for example low income residential consumers. In these limited cases, utilities can potentially own DER.

California

California is the United States' clean energy leader, installing more solar capacity in 2014 alone than all other states combined installed between 1970 and 2011.[6] The state generates about 5% of its electricity from solar, up from 1.9% in 2013.[7] This number does not include energy generated from projects under 1 megawatt in size like rooftop installations. Facilities less than 1 megawatt in capacity total about 2.9 gigawatts.[8]

The state legislature set a target of 30% renewables by 2020 in California Law AB 327. Under AB 327, utilities are required to submit Distribution Resource Plans that enable greater deployment of DERs. In September 2015, the renewable energy target was lifted to 50% renewables by 2030 through SB 350.[9]

California has a much larger population and economy than the other states. In fact, one in eight US Citizens live in the California[10] and its economy is 40% bigger than the Texas economy, which is the next largest state.[11] Given its relative size, California policies have a major impact on the other states.

The California Public Utility Commission's (CPUC) Self-Generation Incentive Program provides rebates to qualifying DG facilities located on the consumer's side of the meter.[12] Technologies eligible for these products include wind turbines, waste heat to power technologies, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells, and advanced energy storage systems.[13] Each technology receives a different incentive level ranging from $1.65 per watt for emerging technologies to $.44 for non-renewable CHP.[14] Distributed solar is managed under a different CPUC program called the California Solar Initiative.

California, like most states has net metering and a renewable portfolio standard. For an explanation of these policies please see the introduction to the United States section. Commercial, Industrial, Local Government, Nonprofit, Residential, Schools, State Government, Federal Government, Agricultural, Institutional organizations are all eligible for net metering.[15] The follow generation types are

Name	California
Electricity market liberalization	1996[1]
Electric power transmission and distribution losses	6.7%[2 3]
Access to electricity	100%
Number of power outages in a typical month	1[4 5]

permitted: Geothermal Electric, Solar Thermal Electric, Solar Photovoltaics, Wind (All), Biomass, Municipal Solid Waste, Fuel Cells using Non-Renewable Fuels, Landfill Gas, Tidal, Wave, Ocean Thermal, Wind (Small), Hydroelectric (Small), Anaerobic Digestion, Fuel Cells using Renewable Fuels.[16] There are different programs each of which have different system size limits, between 1 MW or 5 MW depending upon the program.

Excess generation is credited to customer's next bill at the kW hour rate charged by the utility. After the 12-month cycle, a customer can choose to receive a payment for the credit or roll over credits indefinitely. The payment is calculated at a rate equal to the average spot market between 7 AM and 5 PM for the year the surplus power was generated.[17] The customer owns all RECs generated by their system.

In April 2015, the California Public Utility Commission (CPUC) proposed reforms to the state's complex tiered system of electricity rates. Under the old system, consumers paid more per kilowatt hour as their monthly usage increased.[18] The reform could make it less economically viable for high-income consumers (who use more electricity) to put solar on their roofs. Alternately, it could make solar more affordable for low usage consumers.[19]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

[1] http://www.nytimes.com/2000/12/23/national/23ENER.html?pagewanted=all
[2] http://www.eia.gov/electricity/state/california/
[3] Formula: Estimated losses/ Total supply=%losses
[4] https://www.oe.netl.doe.gov/OE417_annual_summary.aspx
[5] Formula: 12 events/12 months=1 events/month
[6] http://www.seia.org/state-solar-policy/california
[7] Ibid.
[8] http://www.pv-magazine.com/news/details/beitrag/california-hits-5-solar--offsets-hydro-losses-due-to-drought_100018783/#axzz3nusmjQYn
[9] http://www.greentechmedia.com/articles/read/california-bill-50-percent-renewables
[10] http://www.ppic.org/main/publication_show.asp?i=259
[11] http://www.lao.ca.gov/LAOEconTax/Article/Detail/90
[12] http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/
[13] Ibid.
[14] http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/aboutsgip.htm
[15] http://programs.dsireusa.org/system/program/detail/453
[16] Ibid.
[17] Ibid.
[18] http://www.greentechmedia.com/articles/read/californias-major-residentia-rate-reform-a-mixed-bag-for-solar-economics
[19] Ibid.

North Carolina

In 2014 North Carolina installed 397 MW of solar, more than any other state except for California.[5] Total solar installations in North Carolina were 1,088 MW, up from less than 1 MW in 2007.[6]

Of the four states profiled, North Carolina is the only one where the utilities remain vertically integrated. In other words, North Carolina utilities still own all aspects of the electricity supply and delivery system (generation, transmission, and distribution). In states that have not restructured their power sectors, a federal statute called the Public Utilities Regulatory Policy Act (PURPA) still remains as an important incentive for non-utility generation.

Under PURPA, utilities must buy electricity from qualifying facilities (QFs) at the avoided cost of generating it themselves. The avoided cost is another way of saying that utilities must pay QFs the cost of generating the next unit of electricity themselves. In North Carolina, PURPA was originally intended to support independent hydroelectricity projects, but has since become an important driver for the solar industry. The state's unique implementation of PURPA allows QFs under 5 MW to receive a 15-year fixed price contract at the utilities avoided cost.[7] The long-term financial certainty has helped to keep finance costs low for project developers.[8]

North Carolina has a renewable portfolio standard, which requires investor owned utilities to procure 12.5% of the energy sold over their system from renewables by 2021. Municipal utilities and electric coops must reach 10% renewables by 2018.[9]

Some North Carolina utilities offer incentives for businesses that use self-generation to supply their own power during peak energy events. Compensation is based on the available demand a business can shed during a peak event and their performance during peak events. More details are discussed during contract negotiations.[10]

North Carolina has a net metering law available to the following generation types: Solar Photovoltaics, Wind (All), Biomass, Hydroelectric, Hydrogen, Landfill Gas, Tidal,

Name	North Carolina
Electricity market liberalization	Not liberalized
Electric power transmission and distribution losses	%[1 2]
Access to electricity	100%
Number of power outages in a typical month	1.08[3 4]

Wave, Wind (Small), Hydroelectric (Small), Anaerobic Digestion, Fuel Cells using Renewable Fuels.[11] The law limits the capacity of each renewable energy system to 1 MW.[12] Customers with net metering facilities must adopt time of use rates or forfeit any RECs generated by their systems.[13]

Excess generation is typically carried over from one billing period to the next. Any excess generation that is not used by the beginning of summer is surrendered to the utility with no compensation at the renewable energy system owner.[14] For system owners who have opted for time of use rates, treatment of excess generation is more complex. Peak energy generation is used to offset peak energy consumption and off peak generation is used to offset off peak consumption. In the case of excess generation, remaining on-peak generation is used to offset off peak consumption.

In January 2015, the Public Utility Commission (PUC) rejected a utility proposal to reduce the PURPA contract term from 15 to 10 years and reduce the size of qualifying solar facilities from 5 MW to 100 KW.

Currently third party solar is not allowed in North Carolina, but the Energy Freedom Act, which is under consideration by the state legislature would change this.[15]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility[16]
Site: Residential	👍	👎	👎
Site: Commercial building	👍	👎	👎
Site: Heavy industry	👍	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👎	👎
Site: Commercial building	👍	👎	👎
Site: Heavy industry	👍	👎	👎

[1]http://www.eia.gov/electricity/state/northcarolina/
[2]Formula: Estimated losses/Total supply=%losses
[3]https://www.oe.netl.doe.gov/OE417_annual_summary.aspx
[4]Formula: 13 events/12 months= 1.08 events/month
[5]http://www.seia.org/state-solar-policy/north-carolina
[6]Ibid.
[7]http://blog.rmi.org/blog_2015_04_27_five_reasons_for_north_carolinas_rapid_emergence_as_solar_energy_leader
[8]Ibid.
[9]http://programs.dsireusa.org/system/program/detail/2660
[10]http://www.duke-energy.com/pdfs/PowerShare-summary-update-car-final-lr.pdf
[11]http://programs.dsireusa.org/system/program/detail/1246
[12]Ibid.
[13]Ibid.
[14]Ibid.
[15]ttp://www.greentechmedia.com/articles/read/north-carolina-bill-would-launch-opportunity-for-third-party-owned-solar
[16]http://www.duke-energy.com/pdfs/FAQs_10.21.pdf

Brazil

In 2012 ANEEL (Brazil's energy regulator) approved rules that aimed to reduce barriers of installation of small distributed generation, including micro-generation with up to 100 kW of power and mini-generation 100 kW to 1 MW.[2] In 2015 ANEEL announced, that this regulation has enabled the installation of 534 renewable energy systems with a power of up to 1 MW to date. 500 of these power systems are photovoltaic (PV) installations. In a new regulation the power limit for the micro-generation and mini-generation will be changed to 75 kW and 5 MW, respectively. Furthermore, the costs and time it takes to install a micro-generation and mini-generation renewable energy power system will be reduced. The Brazilian Government is also planning to exempt revenue generated by distributed generation PV projects developed in the country from the ICMS (a state tax that range from 7-25%). This tax break is expected to encourage 700,000 residential and commercial customers to install solar micro-generation systems by 2024.[3 4]

Micro- and mini-generation is compensated according to the Energy Compensation system (net-metering regulation), provided that the production plant is connected to the grid. If the generated electricity exceeds consumption, the surplus energy should be used to lower the consumption tariff in another place or at the month's invoice. The producer receives credits for the generated energy, which are valid for 36 months. The producer also has the possibility to use the credits for another unit, provided that the units are in the same area and from the same owner. The costs and benefits for the producer depend on a number of things, such as energy source (wind turbine, biomass, hydro-power), technology and type of generation equipment, location and electricity rate. Also, power generated at a certain time must be used to compensate for the consumed energy during the same period. The credits for surplus energy should be used to offset consumption at another time period in the same consumer unit and in the same billing cycle, or in any other consumer unit chosen by the producer.[5] Furthermore, the Brazilian National Development Bank provides low-interest financing for renewable energy projects. These projects however have to meet local content requirements and in order to meet these requirements the supplier must be pre-accredited by the bank. A

Name	Federative Republic of Brazil
Electricity market liberalization	1998[1]
Electric power transmission and distribution losses	17%
Access to electricity	99.5%
Number of power outages in a typical month	0

grid access policy includes a transmission and distribution tariff discounts for biomass, hydropower (also under 1MW), solar and wind. Energy generated from renewable sources can also receive fiscal incentives such as import tax exemptions and state tax exemptions.[6]

Six Brazilian states have passed exemptions on the electricity VAT for all solar distributed generation using the net-metering system in their regions, from the first of September 2015. The net-metering scheme can accommodate Brazilian renewable energy facilities of up to one megawatt of power. The scheme lays down detailed micro-generation with a capacity of up to 100 kilowatts and generation up to one megawatt. The tax exemption is expected to bring stimulus to people to produce their own energy and to stimulate consumption and industrial production in this segment. The application of ICMS to all electricity fed into the grid for net-metering facilities is considered one of the main barriers to development of such systems. Brazil is undergoing a complex moment in the power sector due to the lack of rain in recent months and its impact on hydraulic production, which covers about 70% of the mix. The government is seeking to diversify its energy matrix and encourage other renewables.[7 8 9]

However, photovoltaic solar cells are imported to Brazil and are very expensive due to the high import taxes (28% for solar panels and 81% for inverters).[10] According to the "New Energy Outlook 2015" study by Bloomberg New Energy Finance, a fifth of all Brazil's installed capacity will come from distributed energy generation produced by consumers primarily from solar panels. But the still expensive solar energy must become more competitive.[11]

Business model Self-Supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

[1] ftp://ftp.zew.de/pub/zew-docs/dp/dp07080.pdf
[2] http://www.aneel.gov.br/aplicacoes/noticias/Output_Noticias.cfm?Identidade=5457&id_area=90
[3] http://www.photon.info/photon_news_detail_en.photon?id=93066
[4] http://www.aneel.gov.br/aplicacoes/noticias/Output_Noticias.cfm?Identidade=8534&id_area=90
[5] http://www.aneel.gov.br/arquivos/pdf/faq_482_18-12-2012.pdf
[6] http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Latin_America_Policies_2015_Country_Brazil.pdf
[7] http://www.greentechmedia.com/articles/read/latin-america-solar-update-ma-activity-intensifies?utm_source=Daily&utm_medium=Headline&utm_campaign=GTMDaily
[8] http://www.greentechmedia.com/articles/read/latin-america-solar-update-ma-activity-intensifies?utm_source=Daily&utm_medium=Headline&utm_campaign=GTMDaily
[9] http://www.pv-magazine-latam.com/noticias/detalles/articulo/brasil--cear-y-tocantins-eximen-del-icms-a-la-solar-en-medicin-neta_100019848/
[10] http://cleantechnica.com/2014/11/05/brazil-brings-low-cost-solar-power-detail/
[11] http://www1.folha.uol.com.br/mercado/2015/08/1673817-em-25-anos-consumidor-vai-gerar-em-casa-energia-equivalente-a-6-itaipus.shtml

Italy

The Authority for Electricity Gas and Water published a report on distributed generation in Italy in August 2014. This report defines distributed generation as a group of generation plants connected to the electricity distribution networks. Small generation (piccola generazione) is a combination of installations for the production of electricity, also by means of cogeneration, with a generation capacity that does not exceed 1 MW. Micro-generation (microgenerazione) is a combination of installations for the production of electricity, also by means of cogeneration, with a generation capacity that is lower than 50 kW.[2] According to the report photovoltaic plants as well as biomass, biogas and bio-liquids with an installations of less than 10 MVA have been growing in recent years. The report shows, that in 2013 the gross production of electricity from distributed generation amounted to 63.444 TWh (an increase of 6,3 TWh compared to 2012). About 80% of the 20.3 TWh of electricity generated by photovoltaic is fed into the grid and 20% consumed locally.[3]

The Ministerial Decree of 6th July 2012 established procedures for supporting electricity generated by plants using renewable energy sources (RES-E) (other than photovoltaic) with a capacity of at least 1 kW. The incentives apply to new, totally rebuilt, reactivated, repowered/upgraded or renovated plants with commissioning from January 2013. The support can be granted for the net electricity generated by the plant and fed into the grid. This means, that self-consumed electricity is not eligible for incentives. The all-inclusive feed-in tariff can be granted for plants with a capacity of up to 1 MW. Additionally, there is an incentive for plants with a capacity of above 1 MW. There are however processing and administration fees for the incentive applications.[4]

There is also a feed-in scheme program that grants incentives for electricity that is generated by photovoltaic plants and that are connected to the grid. Plants with a minimum capacity of 1 kW can benefit from a feed-in tariff, which is based on the electricity produced. The feed-in tariff is granted for a period of 20 years and varies depending on the capacity and type of plant. Individuals, organizations, public entities, non-commercial entities and owners of single or

Name	Italian Republic
Electricity market liberalization	late 1990s[1]
Electric power transmission and distribution losses*	7%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

multiple housing units may apply for the feed-in scheme.[5]

Photovoltaic (PV) plants that have a capacity of up to 50 kW installed on buildings as well as plants plants with capacity not exceeding 12 kW have access to the incentives if they file an application. There are also premiums for plants that have been manufactured in one of the Member States of the European Union or in the European Economic Space, and for plants that are installed on buildings whose modules replace roofs/covers from which Eternit or asbestos has been completely removed.[6] Furthermore small PV plants on buildings and building-integrated PV plants with innovative features with a capacity of up to 1 MW can apply for an additional premium (up to 30% of the base tariff). The premium is granted for energy performance improvements of the building or building unit where the PV plant is installed and for PV plants that are installed on new buildings.[7]

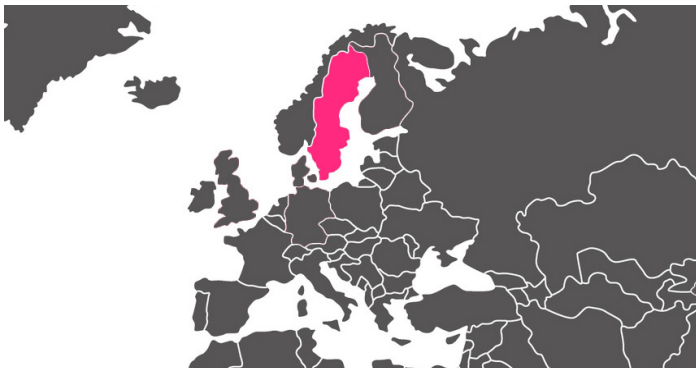
In May 2015 distributed energy generated by "prosumers" was discussed in an international conference in Pesaro organized by Legambiente, an environmental organization in Italy. The Legambiente presented a manifesto, which asks for the elimination of all existing barriers to self-supply as well as to the sale of energy from renewable sources, simplification of procedures for approving projects and help to the government to promote measures that go in the direction of 100% renewable. The manifesto proposed that municipalities should push self-production of energy from renewable sources, the production and sales of energy produced from renewables by enterprises and cooperatives should be opened to users located in the same communal area, energy innovation should be stimulated in apartment buildings and that self-supply by citizens and businesses should be simplified and rewarded.[8]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

[1] https://en.wikipedia.org/wiki/Electricity_sector_in_Italy
[2] http://www.autorita.energia.it/it/inglese/techprofile/14/427-14st.htm
[3] http://www.assoelettrica.it/lautorita-fa-il-punto-sulla-generazione-distribuita-in-italia/
[4] http://www.gse.it/en/qualificationandcertificates/Incentives%20Ministerial%20Decree/Pages/default.aspx
[5] http://www.gse.it/en/feedintariff/Photovoltaic/Pages/default.aspx
[6] http://www.gse.it/en/feedintariff/Photovoltaic/FifthFeed-inScheme/Pages/default.aspx
[7] http://www.gse.it/en/feedintariff/Photovoltaic/EnergyEfficiencyPremium/Pages/default.aspx
[8] http://www.qualenergia.it/articoli/20150515-una-nuova-generazione-distribuita-di-prosumer-di-energie-rinnovabili

Sweden



Ever since the oil crisis of the early 1970s, Sweden has invested heavily in alternative energy sources. Sweden consumes a substantial amount of electricity per capita (15,000 kWh per person/year). 78% of electricity in Sweden comes from nuclear power and hydroelectric power. Cogeneration from combined heat and power (CHP plants) account for approximately 10 % of the electricity output in Sweden. Since January 2008, a new law on energy declarations has been in force in Sweden. Based on an EU directive and applying to all owners of private homes, blocks of flats and other premises, the declaration scheme aims to promote more efficient energy use. The Government is investing heavily in information and advice for households on how to save energy.[2] There are two support schemes for distributed energy resources in Sweden.

Electricity certificates

Renewable energy producers can apply for Electricity Certificates, which are granted by the Swedish Energy Agency. The producer receives a certificate for each megawatt hour of renewable electricity produced. These certificates are a financial support for renewable electricity and provided by the state. The certificates can be sold on the market and provide additional revenue in addition to the usual electricity sales. The sources entitled to receive these certificates are wind, certain hydropower, certain biofuels, solar, geothermal, wave energy and peat in CHP plants. The facility has to be licensed and the electricity generation measured per hour.[3]

Support for solar cells

The Government has allocated investment aid for photovoltaic systems. Enterprises, public organizations and individuals can apply for the support. The support includes installation of all types of grid-connected photovoltaic systems. Companies can receive 30%, public organizations and individuals can receive up to 20% support on investment. The amount is calculated on the basis of the eligible installation costs. In September 2015 the Government announced, that the investment budget for solar cells will be increased to SEK 225 millions in 2016 and thereafter SEK 390 millions each year from 2017-2019. It is also possible to apply for tax deduction for photovoltaic installations, but the producer cannot receive both support schemes. The deduction is currently 50%.[4]

Name	Kingdom of Sweden
Electricity market liberalization	1996[1]
Electric power transmission and distribution losses*	7%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

Producers of electricity with solar panels on house roof or wind turbine on their property, have the right to receive a tax credit for the excess electricity fed into the grid under certain conditions from January 2015. The tax credit is calculated per kilowatt hour (kWh) for the electricity fed into the grid, however maximum electricity fed into the grid per year is 30,000 kW, which equals to 18 000 SEK (Approx. 1.900 EUR) per year.[5] The electricity produced on the property is complemented by the electricity bought from the electricity supplier. If the electricity production is less than the consumption, there is no surplus electricity to be fed into the grid and thus no tax credits are generated. Excess production can also be sold to an optional power trading company, in order to receive a small compensation from the network operator.[6 7]

Entitled to receive this tax credit are micro-producers (small scale production of renewable electricity), both individuals as well as legal entities. The entry and exit points from the grid have to be through the same connection at the main fuse as well as the electricity meter and the producer has to notify the network operator of the production and the feeding into the grid. To qualify as a micro-producer, the maximum fuse of the access point cannot exceed 100 Amp.[8]

Interesting Projects

Egen El - Eagle[9]

Tenants can jointly invest in solar panels on the roof and link them in to the building's common electricity meters. All houses have their own meters and different meters for each apartment. The buildings general meter controls electricity in staircases, laundry rooms, pumps and so on. A landlord can also produce the electricity by using the roof and facade. The residents can themselves produce their own electricity on the roof. Each share is then connected to each apartment's fuse box and those who do not want to participate, have neither costs nor revenue from the electricity.

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

[1] http://www.svenskenergi.se/Elfakta/Elmarknaden/
[2] https://sweden.se/society/energy-use-in-sweden/
[3] http://www.energimyndigheten.se/fornybart/elcertifikatsystemet/elproducent/
[4] http://www.energimyndigheten.se/fornybart/solenergi/stod-till-solceller/
[5] http://ec.europa.eu/energy/sites/ener/files/documents/1_EN_autre_document_travail_service_part1_v6.pdf
[6] https://www.skatteverket.se/omoss/nyheter/2015/nyheter/skattereduktionformikroproduktionavfornybarel.5.12815e4f14a62bc048f26ab.html
[7] http://www.skatteverket.se/rattsinformation/skrivelser/2014/skrivelser2014/131325316141 1.5.3aa8c78a1466c584587134c.html
[8] https://www.skatteverket.se/omoss/nyheter/2015/nyheter/skattereduktionformikroproduktionavfornybarel.5.12815e4f14a62bc048f26ab.html
[9] http://egenel.etc.se/bostadsratter/ornen-flyger

UK

The Department of Energy & Climate Change updated in November 2013 the UK Renewable Energy Roadmap. According to the Roadmap, the Government is aiming to maximize the potential of decentralized supply and distributed generation. Distributed generation is supported by mechanisms such as the feed-in tariff scheme (FIT), license lite and the Renewables Obligation in the UK.[2]

Households, communities and businesses that generate electricity from small-scale renewable and low-carbon technologies (up to 5MW) and consume the generated electricity, are entitled to receive a feed-in tariff. The 'generation tariff' for self-supply depends on size and technology of the system as well as from when the system was installed.[3] Large-scale electricity generating stations, who use on-site the generated electricity, are qualified to apply for the Renewable Obligation (RO).[4 5]

The feed-in tariff scheme (FIT) promotes the use of small-scale renewable and low-carbon electricity generation technologies. The FIT pays a tariff for the electricity generated and the 'export tariff' for the electricity fed back into the grid.[6] Households, communities as well as businesses with an eligible installation are entitled to receive the FIT. Photovoltaic, wind, hydro and anaerobic digestion with a total capacity of 5MW or less are eligible for the scheme. Also eligible are micro combined heat and power installations with a total capacity of 2 kW or less.[7]

The Renewables Obligation (RO) supports large-scale renewable electricity generation in the UK. In order to rule out double counting, small wind, PV, anaerobic digestion and hydro generating stations (accredited after March 2010) with up to 5 MW power have a one-time option to choose either the FIT scheme or the RO. If a generating station is accredited under the FIT scheme, it is no longer eligible for the RO. The only exception here is, if the generating stations installed technology is extended to above 5 MW. However, solar generating stations with above 5 MW are not eligible for the RO.[8]

Name	United Kingdom of Great Britain and Northern Ireland
Electricity market liberalization	1983[1]
Electric power transmission and distribution losses*	8%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

All organizations generating or supplying electricity to the public network must be licensed. For small suppliers the regulatory costs and industry codes are often unreasonably high and require high up-front investment and ongoing resourcing. The Licence Lite enables small generators / suppliers to enter the electricity supply market directly.
A small generator / supplier can partner with an existing licensed supplier and supply electricity directly to the consumer. Licence Lite offers market entry to organizations, that are not able to interact with the technicalities of the energy system, supports distributed electricity generation and allows the generator to supply directly to their consumers.[9]

The Domestic and Non-Domestic Renewable Heat Incentive (Domestic RHI and Non-Domestic RHI) are financial incentives promoting the use of renewable heat. Households with a domestic Energy Performance Certificate (EPC) are able to apply for the Domestic RHI system. Commercial, public or industrial premises with renewable heating can apply for the Non-Domestic RHI, for example large businesses, schools, hospitals, etc. Renewable technology eligible for the incentive are air and ground source heat pumps, biomass, solar thermal, geothermal and combined Heat and Power (CHP) amongst others.[10]

In July 2015 the U.K. Government announced, that it will remove many subsidies for solar from April 2016.[11] Solar generating stations with up to 5 MW will no longer be eligible for the Renewable Obligation. In addition, the Government published a Consultation on a review of the Feed-in Tariffs scheme in August 2015[12], which proposes also the removal of the feed-in tariff incentives. According to the Solar Trade Association, solar makes up 84% capacity of all FIT projects and 99% of all solar rooftop installations take advantage of the FIT.[13]

Interesting projects

Flow - The boiler that generates electricity as it heats your home[14]

The British company Flow Energy Ltd launched a boiler early 2015 that provides hot water and heat in the customer's home, but also produces electricity that can power the household devices. Customers can choose between two packages the 'flow finance' and the 'flow freedom'. Customers sign a five-year contract and pay £75,50 a month to a finance partner, but Flow Energy rebates the customer with £80 per month in cashback. Customers have to switch their energy provider to Flow and assign the FIT to Flow for five years. After five years the FIT is shared between the customer and Flow. In the end the customer only pays for the installation. The customers pays upfront for the boiler and the installation (cost for the boiler £3675). The customer then receives £80 per month from Flow for five years, with a total reduction of the energy bill of £4800 after five years. This amount will be delivered irrespectively of the amount of electricity the boiler generates. Also in this package the customer has to switch the energy supplier to Flow and assign the FIT to Flow for five years. After five years the customer will benefit from the FIT, this reduction is then linked to how much electricity the boiler produces.

However, the Flow boiler has not yet been launched, due to VAT issues. The UK government is obligated by a European Court ruling to change the 5% VAT for low carbon products to 20%, which is the standard rate, since the lower rate is illegal. This will have a major impact on the costs and the

attractiveness of the Flow business model. The launch has been postponed until the VAT situation will be definite by the government, which is resisting the change.

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

[1] http://www.pique.at/reports/pubs/PIQUE_CountryReports_Electricity_UK_November2006.pdf
[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/255182/UK_Renewable_Energy_Roadmap_-_5_November_-_FINAL_DOCUMENT_FOR_PUBLICATIO___.pdf
[3] https://www.gov.uk/feed-in-tariffs/overview
[4] https://www.ofgem.gov.uk/sites/default/files/docs/2015/04/renewables_obligation_-_guidance_for_generators_13_april_2015_v2.pdf
[5] https://www.ofgem.gov.uk/environmental-programmes
[6] http://www.energysavingtrust.org.uk/domestic/feed-tariff-scheme
[7] https://www.ofgem.gov.uk/sites/default/files/docs/2015/02/fitfactsheet_0.pdf
[8] https://www.ofgem.gov.uk/sites/default/files/docs/2015/04/renewables_obligation_-_guidance_for_generators_13_april_2015_v2.pdf
[9] https://www.ofgem.gov.uk/sites/default/files/docs/2015/04/482_an_introduction_to_licence_lite_factsheet_web_0.pdf
[10] https://www.ofgem.gov.uk/environmental-programmes/domestic-renewable-heat-incentive-domestic-rhi/about-domestic-rhi
[11] http://www.pv-magazine.com/news/details/beitrag/uk-to-scrap-subsidies-for-small-scale-solar--announces-changes-to-fit_100020303/#axzz3mjzXx0Ep
[12] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/458660/Consultation_on_a_review_of_the_Feed-in_Tariffs_scheme.pdf
[13] http://www.pv-magazine.com/news/details/beitrag/solar-alliance-urges-uk-government-to-support-small-scale-fit_100020753/#axzz3mjzXx0Ep
[14] http://www.flowenergy.uk.com/meet-flow/

China

As the world's largest energy user, the Chinese energy choices and energy policy have a major influence on the climate change in the world. The environmental impacts of coal have resulted in China turning to renewable energy sources. Since then, China has the largest installed capacity of wind and hydroelectric power and majority of solar heating and biogas installations in the world, which has made China a major exporter of renewable energy technology. There was more new renewable energy capacity installed in China in 2013 than the whole of Europe[2]. The Chinese government issued a reform plan in April 2015, which encourages competition in the power sector. At the moment the State Grid controls most of the utility operations in China. According to the reform plan the regulated electricity prices would shift to a market-based system, except for households, agriculture, public utilities and public services, also allowing private and foreign entities to enter the sales and distribution business.[3 4]

The focus of renewable investment has shifted from large utility projects to businesses, since these are the biggest energy consumers in China. In 2013 a new feed-in-tariff was introduced for output from distributed PV rooftop projects. A tariff is also paid for project owners from the state grid for any surplus energy generated. The current policy encourages self-generation and self-consumption, since the power generated from distributed solar is more valuable than the electricity sold to the grid. Since multi-point grid connections are not allowed and residential power prices are lower than the industrial and commercials rates, residential solar projects are fairly unattractive.

Commercial and industrial businesses are encouraged to invest in decentralized generation, because they can consume the majority of electricity generated at the source. However, small installations under 6 MW are exempt from having to apply for a power generation license and since July 2014 grid operators can issue commercial invoices to individual solar rooftop owners, which enables a quicker payment of subsidies as well as payment for electricity fed into the grid. These small installations also receive a credit for excess energy fed back into the grid. The Chinese government also supports renewable projects by finan-

Name	People's Repulic of China
Electricity market liberalization	State-owned[1]
Electric power transmission and distribution losses*	6%
Access to electricity*	100%
Number of power outages in a typical month*	0.1

** World Bank Open Data*

cial subsidies. One of the two national solar PV subsidy programs is an up-front subsidy for building-integrated solar systems. The other subsidy is provided by the Golden Sun Demonstration Program for on- and off-grid solar systems with 50% of the total cost for on-grid installations and 70% for off-grid in rural areas.[5 6 7]

However, there are still barriers for renewable energy transition in China. For example, solar PV leasing models have encountered issues related to ownership of a property during the contract period. If the business owner changes during the contract period, the contract might not be respected. For developers, receiving their share in due time and fully might prove difficult, since the saved tariff and received subsidies should be shared between the roof owner and the developer.[8]

It is stated in the recent 13th Five-Year-Plan in 2015 that in the near future, distributed energy generation will be promoted and emphasized by the Chinese government and with two specific focuses: centralized and distributed large-scale long-distance electricity transmission. The following graph shows the geographic capacity of power generation in China.[9]

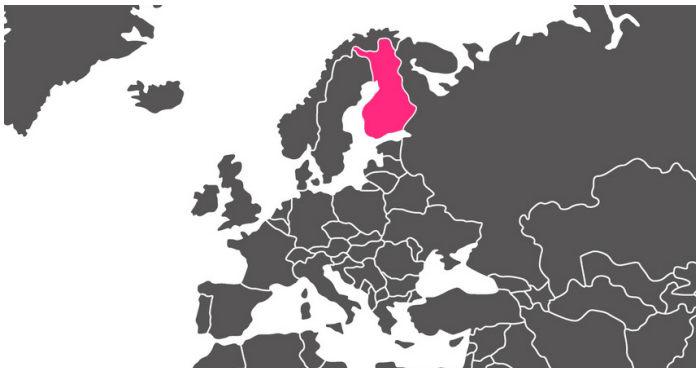
In developed countries (EU5, Japan and the US), the challenges of distributed energy generation is regarding the expansion of existing infrastructure, the challenges for China are different: the challenges lie more in the development of a whole new transmission and distribution system to meet the rapidly growing electricity demand as distributed power can provide electricity to remote areas where there is no transmission and distribution network.[10]

Business model Self-Supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👍	👍
Site: Commercial building	👎	👍	👍
Site: Heavy industry	👎	👍	👍

[1] http://www.statista.com/topics/2038/chinas-power-sector/
[2] http://irena.org/remap/IRENA_REmap_China_report_2014.pdf
[3] http://www.chinadaily.com.cn/business/2015-03/26/content_19912740.htm
[4] http://switchboard.nrdc.org/blogs/blinamore/china_power_sector_reform_plan.html
[5] https://www.ge.com/sites/default/files/2014%2002%20Rise%20of%20Distributed%20Power.pdf
[6] http://irena.org/remap/IRENA_REmap_China_report_2014.pdf
[7] http://www.theclimategroup.org/_assets/files/RE100-China-analysis.pdf
[8] http://irena.org/remap/IRENA_REmap_China_report_2014.pdf
[9] https://www.nrel.gov/international/pdfs/1_liangzhipeng_reifi5.pdf
[10] https://www.ge.com/sites/default/files/2014%2002%20Rise%20of%20Distributed%20Power.pdf

Finland



In recent decades, Finland has been among the leading industrialized countries to use renewable energy, bioenergy in particular. Meanwhile, for over twenty years, Finland has aimed to produce as much electricity as possible through combined heat and power plants (CHP). Finland ranks among the top nations utilizing CHP. Finland has also managed to establish an exceptionally decentralized and versatile energy system, based on both large and small energy production plants and diverse energy sources.[2]

In March 2013, The Ministry of Employment and Economy released the Energy and Climate Strategy 2013[3]. The Strategy 2013 states that in the context of Finnish electricity production, small-scale generation has rather limited potential. Nevertheless, in the future small-scale generation may play a significant role in reducing the consumption of purchased electricity needed in buildings during the hours of daylight, in seasons favorable to producing solar power. The promotion of small-scale generation will also create a lead market for Finnish companies operating in the sector. Finland has first-class expertise, especially in smart-grid solutions related to small-scale generation. Their export potential could be significantly promoted through domestic demonstration opportunities.

Households, farms and small businesses on suitable locations can produce electricity for their own needs, for example with solar panels or small wind turbines. The network operator is responsible for offering a reliable grid and guarantees the supply of electricity and safety for all network users. If the power generated in the plant is not consumed solely by the producer, a separate agreement will be drafted for feeding the electricity into the grid between the producer and network operator. The producer can feed the electricity into the grid and sell it at the electricity market. A number of electricity retailers buy electricity from small-scale installations, the producer can choose the most suitable option. As a small-scale producer the electricity can be sold tax-free, but as a consumer, the electricity he buys is taxable.[4 5]

For micro-producing consumers with maximum installed capacity of 50 kVA there are two incentive schemes.[6]

Name	Republic of Finland
Electricity market liberalization	1995[1]
Electric power transmission and distribution losses*	3%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

- The domestic help
  This can be obtained for a variety of home or recreational dwelling related maintenance. It includes for example the installation of solar thermal, geothermal and air source heating pumps. The deduction of taxation is granted for the work of the installation, not for travel expenses or supplies. In 2014 the maximum deduction was EUR 2.400 per person.
- Energy support
  It is possible to apply for an investment support for energy solutions using renewable energy sources. The maximum subsidy is 40% of the investment, for solar 30%. The investment support can be granted to businesses, municipalities and other entities as well as for climate and environmentally friendly investment and settlement projects, but not for private individuals.
- Rural energy subsidies
  Biogas power plants may receive support from the Ministry of Agriculture and Forestry. Biogas plants operating at farms are a part of the agricultural investment financing. The support aims to promote the generation of energy for self-supply of the farm.

For micro-producing companies with minimum 50 kVA and maximum 2 MVA installed capacity there are also two incentive schemes.[7]

- Energy support
  Companies, municipalities and other entities are able to receive support for energy solutions using renewable energy sources, amounting to a maximum of 40% of the investment. Individuals are not eligible for this support.
- Feed-in tariff[8]
  Renewable electricity production on an industrial scale is promoted with feed-in tariffs. The minimum limits for eligibility for wood chips, wood fuel and biogas is 100 kVA and 500 kVA for wind power. The feed-in tariff is paid for 12 years and varies depending on the production format and energy source. Feed-in tariff is only available for new installations.

However, zoning may prevent the installation of solar panels, municipalities have different practices for installing renewable energy and the current feed-in tariff does not promote small-scale renewable energy generation.[9]

The “Greens” in Finland demand incentives for small-scale production of electricity, wind power, solar power and for households, in order to make it profitable for small-scale producers to invest in renewable energy.[10] As a result, in March 2015, an evaluation team of the Ministry of Environment recommended, that small-scale renewable energy production permit procedures should be eased and speeded up.[11]

As of May 2015 a change in the law has come into force, that clarifies the taxation of small-scale electricity production and in particular the photovoltaic systems. A key change is that electricity power plants with less than 100 kVA rated power as well as larger plants with an annual output of up to 800 000 kWh are exempt from the electricity tax obligation. This means, that these producers are allowed to use the generated electricity by themselves or assign directly to another for consumption tax-free. Such micro power plants, such as solar panels, can be households, farms and businesses.[12]

Interesting Projects

Farmivirta[13]

This project was chosen as the climate project of the year in 2014. Farmivirta is local energy from local small producers.

Electricity is produced by small and micro power plants with renewable raw materials for the producer's own use and the excess electricity is sold as Farmivirta. Farmi differs from traditional electricity contracts in such a way that every small producer prices the electricity itself. The utility Oulun Energia act as an intermediary between the user and the producer. Farmivirta producers are committed to producing energy from renewable energy sources, such as wood, water, wind and sun. Farmivirta measurement, calculation and follow-up procedure is verified by an outside expert.

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👍	👍
Site: Commercial building	👎	👍	👍
Site: Heavy industry	👎	👍	👍

Photovoltaic and heat recovery at Lappeenranta student housing foundation - LOAS[14]

The house was built in May 2013. 32 solar panels have been installed on the roof of the house. The panels produce energy for nine kilowatts. The generated energy is used for example for corridors with power LED lamps for lighting. A similar panel of the amount of the current price is around EUR 20 000 and the payback period is estimated to less than 20 years. Apartment building modern ventilation system again to recover heat from the air blown from the inside out. The system also heats the inside of the imported air. The new ventilation system cost hundreds of thousands of euros.

Helen - own solar power plant[15]

The energy company Helen (Helsingin Energia) offers solar panel packages for households, apartment complexes and businesses. The packages include renewable energy self-sufficiency, dimensioning according to the customers' needs and a sustainable and safe solution. Helen also buys excess electricity at market prices.

[1] https://www.tem.fi/en/energy/electricity_market
[2] https://www.tem.fi/en/energy
[3] https://www.tem.fi/files/36292/Energia-_ja_ilmastostrategia_netti-julkaisu_ENGLANNINKIELINEN.pdf
[4] http://energia.fi/sahkomarkkinat/sahkoverkko/pientuotanto
[5] http://energia.fi/sites/default/files/ohje_tuotannon_liittamisesta_jakeluverkkoon.pdf
[6] http://www.motiva.fi/toimialueet/uusiutuva_energia/sahkon_pientuotanto/kuluttaja_alle_50_kva/pientuotannon_tuet
[7] http://www.motiva.fi/toimialueet/uusiutuva_energia/sahkon_pientuotanto/yritys_50_kva_2_mva/pientuotannon_tuet
[8] http://www.energiavirasto.fi/en/web/energy-authority/feed-in-tariff
[9] http://yle.fi/aihe/artikkeli/2015/06/18/uusiutuva-energia-valtavirraksi-esteina-verokarhu-ja-saadosviidakko
[10] http://yle.fi/uutiset/tenteissa_vihreat__nain_puolue_vastaa_ylen_vaalikysymyksiin/7895760
[11] http://www.suomenmaa.fi/etusivu/7365449.html
[12] http://www.tekniikkatalous.fi/tekniikka/energia/2015-04-27/Vappulahja-valtiolta-S%C3%A4hk%C3%B6n-pientuotannon-verotushelpottuu-toukokuun-alussa-3260255.html
[13] https://www.oulunenergia.fi/tuotteet-ja-palvelut/sahkoa-kotiin/tee-sahkosopimus/farmivirta
[14] http://www.enne.fi/fi/esimerkkikohteet/aurinkoenergiaa/aurinkosaehkoeae-loas-lla
[15] https://www.helen.fi/kotitalouksille/palvelumme/uudet-energiatuotteet/aurinkopeneelipaketit/

Mexico

In 2013 a series of energy reforms were enacted in Mexico to open up the energy sector for new players and to remove subsidies for oil products and electricity tariffs. However, a part of these reforms, the Energy Transition Law, is still going through the legislative process and has stood still for a year now. The clean energy power generation target in Mexico aims to achieve 40% in energy generation from zero to low-emission energy types by 2035. The clean energy power includes renewables but also nuclear and fossil fuels with carbon capture and storage. With renewable energy, nearly 3 million people would have access to electricity in rural areas that currently are not connected to the grid. Already in 2008 the Mexican government enacted the Law for the Use of Renewable Energies and the Financing for the Energy Transition, which promotes and regulates the use of renewable energy sources and clean technology for electricity generation, which was not meant for public service (for example self-supply off the grid). This law has increased the interest of the private sector in developing renewable energy projects. [2]

The self-supply scheme in Mexico allows the customers to generate their own electricity from renewable sources and feed the excess energy into the grid. The excess energy can be balanced against future consumption or recompensed according to the contract terms. The term is misleading, since the consumption can be physically separated from generation and the electricity is transferred through the national grid. Self-supply or net-metering is economically appealing in many cases, since already in 2010 the cost of electricity of certain distributed generation technologies was lower than the average electricity tariffs for residential and industrial customers. Due to lack of knowledge in renewables and suitable financing or incentives improving profitability, the deployment has been stalled.[3 4]

This kind of self-supply is profitable for commercial sector consumers and residential users who are subject to the DAC (doméstico de alto consumo) tariff, which is the highest electricity tariff paid for consumers with high electricity demand. The self-supply deployment of solar installations has spread from rural areas to urban areas and has become

Name	United Mexican States
Electricity market liberalization	State-owned[1]
Electric power transmission and distribution losses	15%
Access to electricity	99.1%
Number of power outages in a typical month	1.6

very promising in the commercial sector.[5 6] Private actors can generate electricity for their own use on their own premises, but there are no incentives for this sort of off-grid self-supply in Mexico.

Fiscal incentives are also in place in Mexico for all renewable energy, these allow companies and individuals to depreciate 100% of expenses on equipment in one fiscal period. Furthermore, solar users receive a 20% discount in their water bill in Mexico City.[7]

According to the International Renewable Energy Agency (IRENA) Remap 2030 report on Mexico, appropriate legislative framework, which allows diverse proprietary structure, involves self-suppliers, simplifies administrative procedures, creates net-metering/billing schemes and advances metering infrastructure, is needed in order to strengthen distributed power generation. Although small-scale projects create energy savings, difficulties may arise in qualifying for or negotiating reasonable finance. In order to assure profitability renewable energy producers will probably establish bilateral contracts. The development of renewable energy will lack behind until new economic incentives are determined.[8]

Interesting Projects

Solar project in Chihuahua

The largest state of Mexico is leading in the use of solar panels for residential applications. The use of solar panels can save up to 50% in the electricity consumption. When the residential energy generation surpasses the consumption, the surplus is kept by the Federal Commission of Electricity (CFE, Comisión Federal de Electricidad). The CFE discounts the amount of surplus produced from the own household electricity meter. The CFE has two rates, the denominated 1B and the denominated HDC (high domestic consumption). The first rate, is for households who consume less than 800 kWh bimonthly, which is subsidized by the government at a rate of 2 pesos per kWh. The HDC is for households that consume more than 800 kWh each two-month period, and is subsidized by 4 pesos per kWh. The households with HDC-level of consumption are the ones to install solar systems. For example, in a household with a consumption of 1,300 kWh bimonthly, a solar system could be installed to generate 600 kWh. The household would then only pay the lower 1B rate to the CFE for the remaining 700 kWh. An energy company, Sigma Comercio y Consuloria, has planned to install a solar panel system in every residence in the state. They are in a business alliance with a solar firm in Chihuahua, which leases the solar panels produced by Sigma and offers to clients with financing plans from five to eight years. Energy savings from these projects are high and the availability of financing and considerable savings in electricity bills should encourage residential customers.[9]

Business model Self-Supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

[1] https://en.wikipedia.org/wiki/Electricity_sector_in_Mexico
[2] http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_Mexico_report_2015.pdf
[3] http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Latin_America_Policies_2015_Country_Mexico.pdf
[4] http://transatlanticrelations.org/sites/default/files/IRENA_RE_Latin_America_Policies_2015.pdf
[5] http://transatlanticrelations.org/sites/default/files/IRENA_RE_Latin_America_Policies_2015.pdf
[6] http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_Mexico_report_2015.pdf
[7] http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Latin_America_Policies_2015_Country_Mexico.pdf
[8] http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_Mexico_report_2015.pdf
[9] https://www.wilsoncenter.org/sites/default/files/Border_Solar_Romero_0.pdf

UAE

The United Arab Emirates (UAE) consist of seven emirates with autonomy in local affairs in each emirate including the management and regulation of energy and resources. The power markets are characterized by natural gas-fired generation and cogeneration for desalination. Almost 100% of electricity generation is gas-fired, only in rare circumstances heavy oil and diesel are used when natural gas supplies are insufficient. Due to the temperature and humidity changes, electricity demand in the UAE is strongly seasonal. The electricity tariffs not only vary between the emirates but are also differentiated between UAE nationals and expatriates. Renewable energy is mostly produced from solar, waste-to-energy and wind. Also thermal cooling and transport fuels pilot projects exist. In 2009 Abu Dhabi set a target of achieving 7% renewable energy generation by 2020, followed by Dubai with a target of 5% renewables by 2030. In order to reach these targets, solar power has been the primary focus of UAE efforts. In Dubai a metering framework has been placed to encourage solar PV on rooftops and a building code requires that new buildings meet 75% of their water heating requirements from solar power.[2]

The latest initiative from the Dubai Electricity and Water Authority (Dewa) will enable residents to generate their own power. The utility has released the standards for installing photovoltaic panels to produce electricity from solar power in buildings in Dubai. This will allow customers to install solar panels to produce electricity in Dubai. Furthermore, the customers will likely be able to sell any surplus power they generate to the utility. Any surplus of production will be fed into the electricity network. Residential buildings, villa owners and private and government companies are still able to install solar panels on their rooftops in order to generate power for their personal consumption. Residents and entities are able to submit applications for solar power generation and have to pay only a meter fee of Dh 1,500. Should the resident be absent for a longer period of time the solar panels continue generating electricity, which is fed into the Dewa power grid. Once the resident returns, the surplus power will be adjusted. Due to this adjustment in the energy bill, consumers have no limitations in the amount of electricity fed into the grid.[3 4]

Name	United Arab Emirates
Electricity market liberalization	2006[1]
Electric power transmission and distribution losses*	7%
Access to electricity*	97.7%
Number of power outages in a typical month*	0

** World Bank Open Data*

In March 2015 the problems and concerns of suppliers and potential customers were discussed in Dubai, since the Dewa Smart Dubai plan is based on a net metering system. Green energy companies call for feed-in-tariff instead of net metering, in order to encourage solar generation. Due to the plunging cost of photovoltaic technology the Dewa sees that the customers might not need the extra encouragement that a feed-in tariff provides. The performance of this project is reviewed periodically by the Dewa and improvements will take place if needed.[5]

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👎	👎
Site: Commercial building	👍	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

[1] https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&uact=8&ved=0CD4QFjAEahUKEwiNtfuhmvbGAhXIshQKHRD9DHs&url=https%3A%2F%2Fwww.energyinst.org%2Ffilegrab%2F%3Fref%3D1751%26f%3Dreview-paper-renewable-and-sustainable-energy-reviews.pdf&ei=lnazVY2SEsjlUpD6s9gH&usg=AFQjCNE4qbhcX4keUWUFZ3uFMfwUVVCffQ&bvm=bv.98717601,d.bGg

[2] http://www.irena.org/remap/IRENA_REmap_UAE_report_2015.pdf

[3] http://www.emirates247.com/business/energy/how-dubai-residents-can-profit-from-solar-power-2015-02-01-1.578896

[4] http://www.emirates247.com/news/emirates/your-guide-to-generating-solar-power-in-dubai-to-slash-dewa-bill-2015-03-16-1.584272

[5] http://www.thenational.ae/business/energy/calls-for-dubai-to-introduce-feed-in-tariff-to-aid-rooftop-solar

Germany

In 2010 the key policy document outlining the German energy transition (Energiewende) was published. The "Energiewende" aims to shift from nuclear energy and other non-renewable energy sources to decentralized renewable energy and energy efficiency. The goal is an environmentally friendly and energy-savings oriented economy. The basic idea of the "Energiewende" is the expansion of renewable energy sources. The share of electricity generation from renewable energy sources is expected to reach 40-45% until 2025 and 55-60% until 2035.[2]

The most important tool for the expansion of renewables is the Renewable Energy Sources Act (EEG). It enables renewable technologies such as wind and solar to enter the market with support provided by fixed tariffs, a purchase-guarantee and priority feeding-in of renewable electricity into the grid. The last amendment entered into force on 1st August 2014. With help of the EEG act, renewable sources are now generating 25% of the electricity in Germany.[3] Until the amendment of the EEG act in August 2014, plant operators that generated electricity from renewable sources received a fixed compensation for each kilowatt-hour fed into the grid from the transmission network operators usually for a period of 20 years. Meanwhile, the plant operators have to sell their electricity on the market and receive a market premium from the network operators. The market premium compensates for the difference between the fixed feed-in tariff and the average market price of electricity. This is optional for older systems and for small new plants, who still can continue to claim a fixed compensation. The difference between the expenditure for compensation payments and premium payments and earnings from commercialization revenue of network operators is being allocated to the power consumption. The result is the rate of the EEG surcharge.[4]

The 2014 makeover of the EEG also imposed the EEG surcharge on self-supplied electricity. In the past it was unclear whether self-supplies would have to contribute to the EEG system. This shift in policy is driven by an ongoing discussion in Germany about the usefulness of self-supplies. Some argue that those who "fled" to self-supply in the past, did so to avoid the EEG surcharge[5]. This action is

Name	Federal Republic of Germany
Electricity market liberalization	1998[1]
Electric power transmission and distribution losses*	11%
Access to electricity*	100%
Number of power outages in a typical month*	0

** World Bank Open Data*

deemed un-social and against the benefit of the majority. It is unclear at the moment whether Germany will keep a positive attitude towards decentralized generation. The same discussion came up when the renewed Combined Heat-Power Cogeneration Act (KWK-G) was discussed in 2015. Incentives for self-supply have been reduced as a result. The promoters of CHPs in Germany claim that it is now economically difficult to run smaller CHPs.[6]

Feed-in

Small renewable plant operators (i.e. PV, Wind etc.) are entitled to the fixed feed-in tariff if

- the electricity from installations are commissioned before January 2016 and have a total maximum installed capacity of 500 kW, and
- if the electricity from installations are commissioned after December 2015 and have a total maximum installed capacity of 100 kW.[7]

The total maximum installed capacity for small installations is reduced from year to year.

Cogeneration is also expected to contribute to the success of the energy transition in Germany. The federal government wants to improve the incentives for cogeneration until 2020[8]. There are two incentive schemes for cogeneration in Germany[9]:

1. The Federal Office of Economics and Export Control (BAFA) pays a one-off investment grant to the plant operator with an installed system of electric power up to 20 kW.
2. Conformable to the Combined Heat-Power Cogeneration Act (KWK-G) regardless of the electric power of the CHP plant, the grid operator will pay a supplement based on the authorization order of BAFA for the generated electricity from the plant, for a certain period of time.

The CHP act is now amended as of January 2016. The federal cabinet published a draft of the new bill on 23th of September 2015[10]. The essential change in the new CHP act is that electricity from plants over 100 kW will only be

Incentive schemes conformable to CHP act 2016 (draft bill)

Unit category	CHP-supplement		
	Feed-in*	Self-supply or decentral commercialization without network transit*	Self-supply
		Only plants with ≤ 100 kW	Only for plants in energy-intensive** businesses
up to 50 kW	8 ct/kWh (+ 0,6 ct/kWh***)	4 ct/kWh	5,41 ct/kWh
> 50 kW to 100 kW	6 ct/kWh (+ 0,6 ct/kWh***)	3 ct/kWh	4 ct/kWh
> 100 kW to 250 kW	5 ct/kWh (+ 0,6 ct/kWh***)	–	
> 250 kW to 2 MW	4,4 ct/kWh (+ 0,6 ct/kWh***)	–	2,4 ct/kWh
> 2 MW	3,1 ct/kWh (+ 0,6 ct/kWh***)	–	1,8 ct/kWh

* The general supply grid

** Businesses or independent business units for which the EEG levy is limited for self-consumed electricity by BAFA

*** Bonus for CHP plants that replace the existing coal-fired CHP plants

Graph 1: A systematic presentation of the proposed funding structure in CHP act 2016[11]

funded if the electricity is directly marketed or consumed by energy-intensive businesses. Although the final changes in the legislation process smoothed the effect of this change to a certain extent, the new KWK-G is still considered a less favorable framework for CHP in Germany.

Self-supply

Small installations that generated and consumed the energy on-site were not obliged to pay the EEG surcharge. This was changed in the 2014 EEG amendment, because of "inequitable competitive advantages". All new plants meant for self-supply will have to pay the EEG surcharge in full. New installations with renewable energy or highly efficient cogeneration plants pay a reduced EEG levy. Until the end of 2015 this amounts to 30%, then 35% in 2016 and 40% in 2017. Self-suppliers are exempt from this only[12]

- if the electricity is generated in technical sense (electricity consumed by the power station itself),
- if the self-supplier is not directly or indirectly connected to a grid system,
- if the self-supplier supplies itself fully with electricity from renewable energy sources and does not claim any financial support for the electricity which it does not consume itself, or
- with maximum capacity of 10 kW, which consume annually no more than 10 MW, are exempt from the EEG surcharge.[13]

This combined regulatory framework leads to the conclusion that Germany is leaning towards a negative attitude towards decentralized generation if the power is used on-site.

Business model Self-supply	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👎	👎	👎
Site: Commercial building	👎	👎	👎
Site: Heavy industry	👎	👎	👎

Business model Feed-in	Owner: Private person	Owner: Business entity	Owner: Utility
Site: Residential	👍	👍	👍
Site: Commercial building	👍	👍	👍
Site: Heavy industry	👍	👍	👍

[1] http://www.gtai.de/GTAI/Navigation/EN/Invest/Industries/Smarter-business/Smart-energy/germanys-energy-concept,t=the-german-electricity-market--a-brief-overview,did=622868.html
[2] http://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/Energiekonzept/0-Buehne/ma%C3%9Fnahmen-im-ueberblick.html
[3] http://www.bmwi.de/EN/Topics/Energy/Renewable-Energy/2014-renewable-energy-sources-act.html
[4] http://www.bmwi.de/DE/Themen/Energie/Erneuerbare-Energien/erneuerbare-energien-auf-einen-blick.html
[5] http://www.welt.de/debatte/article14657601/Merkels-energiepolitische-Geisterfahrt-ohne-Bremse.html http://www.welt.de/wirtschaft/energie/article129472520/Oekostrom-Reform-ist-der-Anfang-der-Grausamkeiten.html
[6] http://www.bkwk.de/fileadmin/users/bkwk/download/politik/B_KWK_Positionspapier_KWKG-Novelle__13_04_2015.pdf
[7] http://www.gesetze-im-internet.de/eeg_2014/__37.html
[8] http://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/Energiekonzept/0-Buehne/ma%C3%9Fnahmen-im-ueberblick.html
[9] http://www.bafa.de/bafa/de/energie/kraft_waerme_kopplung/
[10] http://www.mpw-net.de/nc/aktuelles/detail/verbesserung-kwkg-2016.html
[11] http://www.mpw-net.de/fileadmin/media/mpw/Bilder_News/KWK-Foerderung_nach_KWKG_2016_Entwurf.pdf
[12] https://www.bmwi-energiewende.de/EWD/Redaktion/Newsletter/2014/20/Meldung/die-wichtigsten-neuerungen-auf-einen-blick.html
[13] http://www.gesetze-im-internet.de/eeg_2014/__61.html

Texas

Texas is unique among the fifty states in that it operates its own electric grid in isolation of the rest of the country. For this reason, it's wholesale electricity markets are not subject to regulation form the Federal Energy Regulation Commission (FERC). However, it does have wholesale energy markets operated by the Energy Reliability Council of Texas (ERCOT). Texas is the second largest economy in the United States coming in only second to California.[6] While there has been speculation that Texas is on the verge of a solar boom, it is unclear if it has begun. Texas is currently the nation's largest producer of utility scale wind energy, with over 15 GW of installed capacity.

In 1999 Texas adopted a RPS goal of 10,000 MW by 2025. It already achieved this goal mostly through large-scale wind development. There is a voluntary carve out for 500 MW of renewable energy other than wind.[7]

Several municipalities have their own RPS goals. For example, Austin aims to have 50% renewables by 2020 and 65% by 2025. The RPS includes 600 MW of new utility-scale solar by 2017, 200 MW of local solar by 2020 (100 MW of which is customer-controlled), and 200 MW of fast-response storage by 2024.[8] In addition, the municipal utility San Antonio City Public Service has an RPS that includes solar PV, wind, and landfill gas. Under the RPS, the utility must meet 20% of its electric peak demand from these sources by 2020.[9]

In 1999 the Public Utility Commission of Texas (PUCT) completed rule making that enabled distributed energy. The act recognized customers' right to have onsite-distributed generation.[10] The Commission recognized that distributed generation (DG) provides benefits during peak energy events, improves reliability, and provides customers' with the ability to control costs.[11] The Commission found that the cost for connection studies for DG of less than 500 kW that export no more then 15% of their generation are small and should be born by all utility ratepayers who will receive the benefits mentioned above. For larger projects the DG customer should bear the cost.

Projects that have more than one MW of capacity and do

Name	Texas
Electricity market liberalization	1999[1]
Electric power transmission and distribution losses	4.7%[2 3]
Access to electricity	100%
Number of power outages in a typical month	1.08[4 5]

not intended to sell the power on the wholesale market must register as a self-generator. Companies must register as a power-generation companies if they own projects of one MW capacity or more, do not own transmission or distribution facilities and intend to sell the power on the wholesale market.[12]

Texas is one of only seven states that has no net metering or feed-in tariff.[13] [14] However, as mentioned above, four Texas municipalities and one electricity retailer offer do.[15] Limits on systems range from 10 kW to 50 kW and many different types of generation are allowed depending upon the municipality or retailer.[16]

There have been several recent attempts to get a net metering law adopted at the state level. To date these have failed, but given the political climate some speculate that local adoption of net metering laws will continue. Solar City, the country's leading roof top solar installer, announced in March 2015 that it had negotiated a net metering deal with MP2 Energy.[17] MP2 Energy is a generation owner and retail supplier of electricity.

Business model Self-supply	Owner: Private person	Owner: Business entity[18]	Owner: Utility
Site: Residential	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

Business model Feed-in	Owner: Private person	Owner: Business entity[19]	Owner: Utility
Site: Residential	👍	👍	👎
Site: Commercial building	👍	👍	👎
Site: Heavy industry	👍	👍	👎

[1]http://www.ercot.com/about/profile/history#1999
[2]http://www.eia.gov/electricity/state/texas/
[3]Formula: Estimated losses/Total supply=%losses
[4]https://www.oe.netl.doe.gov/OE417_annual_summary.aspx
[5]Formula: 13 events/12 months= 1.08 events/month
[6]http://www.lao.ca.gov/LAOEconTax/Article/Detail/90
[7]http://programs.dsireusa.org/system/program/detail/182
[8]http://programs.dsireusa.org/system/program/detail/897
[9]http://programs.dsireusa.org/system/program/detail/2473
[10]http://www.puc.texas.gov/industry/electric/business/dg/dgmanual.pdf
[11]PUCT, Substantive Rules. Chapter 25. Electric
[12]Ibid.
[13]http://www.greentechmedia.com/articles/read/what-are-the-most-pressing-issues-facing-public-utility-commissioners
[14]http://www.greentechmedia.com/articles/read/that-mean-old-texas-sun
[15]http://programs.dsireusa.org/system/program?state=TX&type=37&
[16]Ibid.
[17]http://www.solarcity.com/newsroom/press/solarcity-mp2-energy-offer-solar-texas-homeowners-less-utility-power-without-local
[18]Ibid.
[19]Ibid.

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