

pvmagazine special

The energy transition's missing link?

Power-to-gas application picks up in pace.

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European solar comes of PPAge


Offering lower risk and cheaper capital, PPAs are powering the PV renaissance.

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The smarter E Europe 2019

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The background image shows a large, busy exhibition hall. In the foreground, a large crowd of people is seen from behind, looking towards a stage. On the stage, several large solar panels are displayed on a raised platform. A man in a blue shirt is standing next to the panels, possibly giving a presentation. In the background, more people are walking around, and a large screen displays a close-up of solar panels. The overall atmosphere is one of a major industry event.

THE SMARTER E EUROPE: EUROPE'S LARGEST PLATFORM FOR THE ENERGY INDUSTRY

The smarter E Europe: Beyond a niche

In 2018, Europe's largest solar exhibition Intersolar Europe kicked off as part of The smarter E Europe platform. This year's event will also bring something new, says Solar Promotion CEO Markus Elsässer.

Intersolar Europe is now part of The smarter E Europe and it launched last year with a whole new concept. You could sum up the concept as moving, "out of the niche of renewables." Was it successful?

Yes, absolutely. Last year, we expanded the event even further with two new exhibitions. They took place in The smarter E Europe platform alongside Intersolar Europe, which we have been organizing for the past 27 years, and the battery and energy storage exhibition, ees Europe, which we launched in 2014. This year will be the same. We have seen clear growth of around 20% in exhibition space and expect some 1,300 exhibitors. We are also highly confident that we will once again be able to welcome around 50,000 industry visitors from 160 countries. That makes The smarter E Europe the largest energy industry platform in Europe. This shows that the concept is working and has gained market acceptance.

Part of the new concept is to attract visitors from new target groups. Are they showing up, and is the trend gathering momentum?

Last year we saw already that we were able to attract a number of new visitor target groups – from the international energy industry, for instance, along with commercial and industrial companies looking to switch to a renewable energy supply and carbon-neutral production.

What groups of visitors do you still have to work on?

In the field of electromobility, for example, there are target groups that we haven't yet adequately addressed. Electromobility was a secondary issue within Intersolar Europe in previous years and was addressed as a special part of the main exhibition. With Power2Drive Europe, we now have a dedicated exhibition hall for charging infrastructure, smart charging, and electromobility, where visitors can experience new developments up close and personal. This lets us address target groups outside the energy industry that we haven't yet reached with the classic Intersolar and ees energy events, groups



Photos: Solar Promotion GmbH

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The smarter E Europe is the largest energy industry platform in Europe, and continues to expand in its offering with the changes of the energy system.

like the housing industry, facility managers, fleet managers, or suppliers and developers within the automotive industry itself.

What about the utilities?

We've seen the proportion of visitors from the international energy industry skyrocket since we started focusing on markets, technologies, and new developments in the energy industry across all sectors at The smarter E Europe. The platform will showcase pressing issues like the overall renewables system with decentralization, digitalization, virtual power plants, networks, microgrids, energy management, storage, and electrification of the transport sector.

You also initiated the Energiewende Award (Energy Transition Award) with the release of a study. According to the study, only one fifth of energy suppliers offers PV. Will the others follow suit?

There's no way around it. As an energy supplier, if you want to continue to be successful in the energy business in the future, the only way to do so is to switch to renewables and convert generation capacities accordingly. Innovative energy suppliers help consumers who want to organize their own energy supply and offer the corresponding solutions. Others also act as energy brokers, offering platforms that bring distributed producers together with consumers.

In the field of array installation, do energy suppliers compete with established installers?

Not necessarily. There are a number of energy suppliers who have good working relationships with installers and who place orders and customers with them.

So, Intersolar offers a fruitful gathering place for installers to link up with utility companies?

Absolutely, yes.

What else is new this year?

One of the things we are planning to do is expand the power-to-gas segment. Up until now, ees Europe has been 90% about battery storage – so, short-term power storage.

***“There is no way around it:
As an energy supplier, if you want to
continue to be successful, the only way
to do so is to switch to renewables”***



"We want to illustrate the fact that we have to electrify the transport sector with renewable energy, and the renewable associations and the transport sector have to work hand in hand," says Solar Promotion CEO Markus Elsässer.

Here, we want to significantly expand our offering in the future. The higher the proportion of renewable energy in the power grid, the more important long-term and seasonal storage technologies like power-to-gas become. This year, we concluded a strategic partnership for power-to-gas with the two major associations in Europe. One is Eurogas, an association representing gas infrastructure companies, gas storage facilities, and the gas pipeline network; the other is Hydrogen Europe, whose members include electrolysis suppliers and players in the energy and transport sectors. We want to present the issue with both of them and their member companies. There will also be a separate conference.

And what about the solar sector?

We are finally seeing significant growth of solar again in Europe and increasingly, also in the construction of subsidy-free power plants. This started in Spain and now news of the first German plants is coming in. The more this becomes known, the more it will motivate players in the energy industry, along with industrial and commercial enterprises, to shift their power supplies to renewables.

As you mentioned, you work closely with the associations on power-to-gas. Is it the same with associations in all of the other areas as well?

For each exhibition, we deal with the key issues that drive the market today and in the future. This also means supporting the relevant trade associations in pulling down market barriers and advancing the markets as a whole. We have been working to promote renewables in the market since we started 30 years ago. It is becoming increasingly important to break down hurdles and accelerate the expansion of renewables, especially in light of climate change. Part of this is taking a cross-sector, digital and decentralized view of the energy industry and intelligently linking the areas of power, heat and mobility based on renewable sources of energy. We recently published a manifesto with renewable energy associations, for instance, which involved the solar, wind and electromobility associations. We want to illustrate the fact that we have to electrify the transport sector with renewable energy, and the renewable associations and the transport sector have to work hand in hand. **pv**

Interview by Michael Fuhs

“We are finally seeing significant growth of solar again in Europe and increasingly, also in the construction of subsidy-free power plants”

Drivers of energy convergence

The expansion of The smarter E Europe exhibition and conference continues apace in 2019, with the expansion of power-to-gas, and solar and battery storage's increasing competitiveness capturing new territory. It is managing to meet both system requirements, and customer demand.

The risks posed by the energy transition to the stability of electricity networks appear to have been misrepresented. In its annual energy paper released last month, J.P. Morgan's chairman of market and investment strategy Michael Cembalest delivered his take on the progress of Germany's Energiewende, or energy transition.

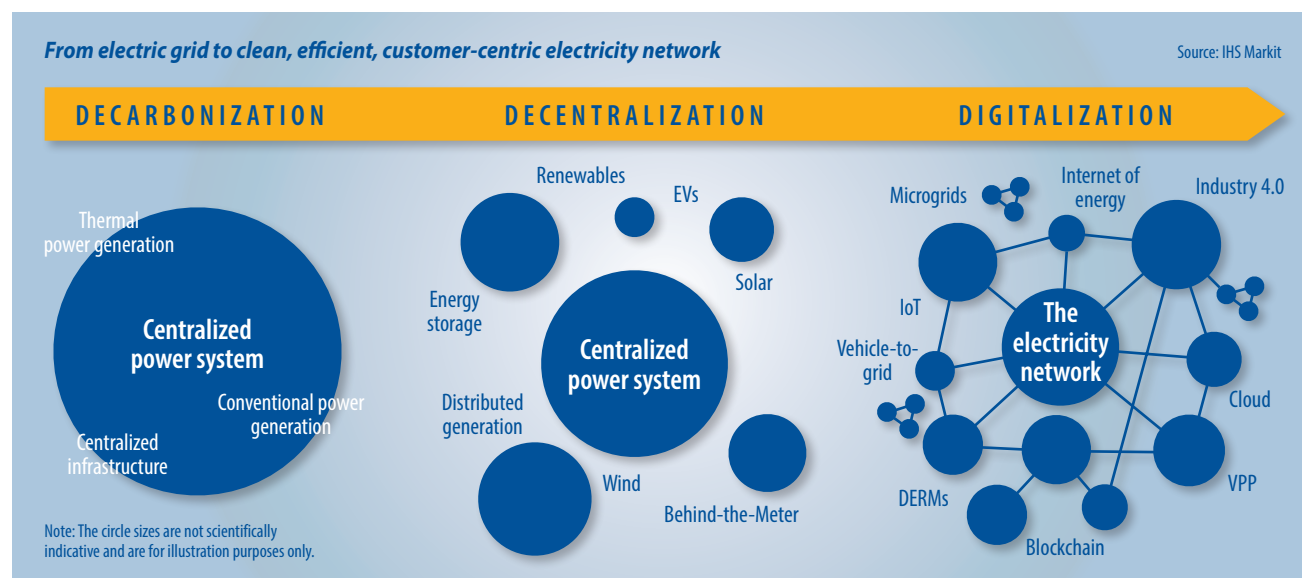
While Cembalest's conclusions were pessimistic about Germany's ability to decarbonize in line with the goals set out by its politicians, he noted that electricity network stability has increased as penetrations of solar PV and wind generation continue to creep higher.

"German power outages are actually down since 2006, and Germany's 15 minute average annual outage figure for 2017 was practically the lowest in Europe by a wide margin," writes Cembalest in the report, titled *Achievements and Distractions on the Road to Decarbonization*. It is an observation that aligns with that of other, more optimistic, observers of the

energy transformation currently underway. "The way I see it, until you get to 30% of solar there is no problem whatsoever [in terms of system stability and balancing] in every situation. We can continue happily placing solar panels and no one is the wiser," says Auke Hoekstra, a senior advisor to the Eindhoven University of Technology and the founder of Zenmo simulations. Hoekstra is currently leading the Spark City research program, which is utilizing a multi-disciplinary, agent-based simulation model of the energy transition.

"Once you get to 30-40% of solar, and combined with wind, 70-80% penetration, you really have to manage all of the fluctuations, particularly seasonally, basically through storage or very large area networks," says Hoekstra. "You need some form of longer term storage. That is where hydrogen comes in. I am seeing a bright future for the people who make hydrogen."

Hydrogen can also be converted to methane (pp. 66 – 68), albeit at lower effi-



ciencies. But it also increases applications, potentially for the heating and industrial sectors.

Whole system approach

In his 2019 annual paper, J.P. Morgan's Cembalest continues that while a pathway for decarbonization of the electricity system, with reliability remaining robust, is becoming clearer in Germany, he notes that much work has to be done to reduce greenhouse gas emissions from the country's transportation, industrial and agricultural sectors – challenges on which significant progress is being made.

"Electro mobility so far is super flexible," says Auke Hoekstra. "Right now, cars stand still for 23 hours a day. People often say that charging of EVs at work is not a big deal, but with work charging and solar, people can charge at their workplace and can absorb a lot of the solar surpluses." Hoekstra is also optimistic about the potential for vehicle-to-grid applications, enabled by larger and more robust car batteries. "The number of battery cycles is really increasing, we expect in the future that car manufacturers will be much less worried about V2G," he adds. Hoekstra can envisage EVs meeting morning peak demand, and then re-charging during the hours of peak solar production, leaving a full battery for the journey home and to supply evening demand peaks. "It looks like V2G will have a much brighter future than we originally thought."

In all of this, the consumer – or increasingly, prosumer – should not be forgotten. "The decentralization [of the energy system] is driven by the need to be cleaner and renewable, and the will of the general public to want to be more independent and to own their energy," argues Sam Wilkinson, associate director, solar and energy storage at IHS Markit. "But then that system can only work in an efficient way if we add on this digitalization part, which is all about communication, control and the intelligence." These digital components to which Wilkinson refers include a wide gamut of emerging concepts and applications (illustrated left), including microgrids, virtual power plants (pp. 73-75) and may involve the deployment technologies such as blockchain for energy trading.

Digitization of energy is providing opportunities for many new companies and business units within existing players. Utilities, whose unrivaled position in




the power system of the past is being challenged by the process of decentralization, are finding opportunities as they have the scale and customer relationships needed to prosper (pp. 76 – 78).

"These are these futuristic concepts are just as much about business model as they are about technological innovation," says Wilkinson.

Underpinning the rapid trend towards decentralization is solar's ever-increasing competitiveness. With each year, its appeal to both generation asset owners, households and commercial power procurers alike increases (pp. 70-72). And encouragingly, PV ticks both public acceptance and economic boxes.

"Solar will be the overall winner in terms of how cheap it will be per kilowatt hour," says Hoekstra.

It is pleasing to see The smarter E Europe straddle more sectors and place itself at the center of this fast moving transition. It is forging new partnerships, including with the gas sector (p. 69) and increasingly becoming an embodiment of the changes that are not only required on a systemic level, but which are also being demanded by citizens.  Jonathan Gifford

“The power system of the past is being challenged by the process of decentralization”

The what and when

Often touted as the missing link in the energy transition, power-to-gas (P2G) has not yet had its time to shine. While the technology has been around for decades, large-scale projects have been exceptionally rare. Over the last year, however, encouraging signals are emerging as research, pilot projects, and small-scale applications appear to have picked up pace. As debate continues about the tipping point for P2G in terms of conversion efficiency and costs, some market players are optimistic about near-term prospects.

It is certainly an attractive scenario for acceleration of the energy transition. As renewables do their bit in reducing carbon emissions from the electricity sector, synthetic gases – hydrogen and methane – open up a further possibility for greening the gas network. They can also be used to store excess solar and wind energy over long periods of time and to address seasonal intermittency challenges in the grid after being converted back into electricity.

Hydrogen and methane from green electricity sources can also play a role in sector coupling, be it for heating, transport, or industry. So-called ‘syngases’ can also be produced from fossil fuels and biomass. Power-to-gas (P2G) refers to the use of renewable electricity to produce these gases through electrolysis and methanation. But there is a downside: During these processes a lot of energy is lost.

Average efficiencies of electrolyzers, which use renewable electricity to break water down into H₂ and oxygen, exceed 70%, and this conversion efficiency can be assumed for on-site use and direct feed-in to the gas network. If the gas needs to be stored and transported, compression or cooling of hydrogen brings losses which can go up to 35%. If hydrogen is reconverted into electricity through fuel cells, the overall process efficiency ends at 30-35%, with significant amounts of energy lost as heat.

Additional synthesis processes can be used to convert hydrogen gas into methane. While the advantage of the process is that the final product is the gaseous energy source which is already the main component of conventional natural gas and can therefore be freely injected into the gas grid, additional energy loss of around 8% is inevitable.

How soon is now?

There are different assumptions about the point at which P2G will go mainstream

and become cost competitive. An international team of economists from Germany’s Technical University of Munich, the University of Mannheim, and Stanford University in the United States says Germany and the U.S. state of Texas could already host small wind-powered P2G projects that could compete in cost terms with conventional power sources, while large-scale should be viable by 2030.

Another report commissioned by the European Climate Foundation suggests a fossil fuel-free energy system in Europe by 2050 should largely rely on smart electrification and energy efficiency, which could turn out 36% cheaper than green hydrogen at scale, but still considers hydrogen viable where it adds the highest value, such as with seasonal storage and peak power supply. And yet another study for the Hydrogen Council (2017) envisages that by 2050, 18% of global final energy demand could be met by hydrogen, equal to about 78 exajoules (EJ), while the economic assessment by the International Renewable Energy Agency (2018) estimates hydrogen’s economic potential at about 8 EJ globally by 2050 in addition to feedstock uses. While the Hydrogen Council roadmap is the industry’s consensus vision of hydrogen’s potential in the economy under the right circumstances, it is just one vision of numerous potential outcomes; IRENA’s assessment looks at the mix of options to achieve targets set out in the Paris Agreement, ranking options by their substitution cost.

Oslo-based energy advisory firm DNV GL forecasts demand for hydrogen in the energy sector to rise from about 1,000 metric tons today to 39-161 million metric tons per annum in 2050, under various scenarios. Its most recent study into green hydrogen concludes that production of hydrogen from electrolyzers will become competitive with production from natural gas by 2035. “Our research

“Synthetic gases open up a further possibility for greening the gas network”

of P2G

Photo: Siemens



Electrolyzers like this one use renewable electricity to produce hydrogen. A recent study from DNV GL concluded that production of hydrogen from electrolyzers will become competitive with production from natural gas by 2035.

shows there is a competitive position for green hydrogen,” says Theo Bosma, Program Director Power and Renewables at DNV GL. Clearly, competitiveness is directly dependent on the composition of the power system, that is high penetration of solar and wind that causes frequent oversupply. “We analyzed developments up to 2050, and saw there can sometimes be even 3,000 hours of oversupply, so it means it’s absolutely competitive. But, it will be already [the case] in 2035 that it will start to make sense to produce hydrogen through electrolysis, with a sufficient number of hours of low electricity prices compared to steam methane reforming, where you obviously need to pay the penalty for the CO₂ emissions,” Bosma says – noting that in the end, it’s all about the cost of electricity.

Yes, but first

As for the main reasons for the economic feasibility of hydrogen between 2030 and 2050, DNV GL points to three key devel-

opments: falling costs of electrolyzers, increasing periods when low or zero cost prices for electricity are available, and the introduction of carbon taxes and incentives for low carbon solutions. Indeed, the introduction of supportive P2G policies worldwide remains critically important. For instance, investments in Germany thus far have been hampered by regulation, since electrolyzers are classified end users of green power and subject to all corresponding taxes and levies. Another issue is a lack of stronger carbon pricing.

German transmission system operators are nonetheless striving to pave the way to the coupling of electricity and gas networks for the energy transition. Tenet, Gasunie Deutschland and Thyssen-gas are working on a 100 MW P2G pilot plant in Lower Saxony, and Amprion and Open Grid Europe are deploying a project of the same size in the district of Emsland. Such large-scale projects are critically important for P2G project capex to be reduced.

Photo: H-TEC Systems



H-TEC systems managing directors Frank Zimmermann and Joachim Herrmann. GP Joule subsidiary H-TEC has supplied its electrolyzers to a project in northern Germany which uses energy from wind installations to produce hydrogen which powers local buses and other vehicles.

“With more and more players announcing projects, the cost of the technology is decreasing”

“Economies of scale are a factor, especially regarding fuel cells. The storage system is a part of the whole application, but we are already using components that are produced in large quantities, such as steel cylinders,” says Wolfgang Wolter, CEO of Germany-based Wystrach.

There are also large-scale initiatives in the gas sector. Last year Australia’s gas pipeline owner Jemena launched the nation’s biggest trial to generate hydrogen from renewables and inject it into the existing gas network. This could see approximately 250 homes in Sydney using the fuel within five years. Thus far, acceptance of the technology has been hampered by safety concerns, particularly regarding fire risk. “It is a misconception that hydrogen applications are of great risk. Safety standards are high, and before an application enters the market it is proven and tested very well,” says Wolter.

As large energy input is needed for P2G to work, feedstock has to be unlimited and free. In such a case, conversion efficiency would not be the most critical metric, and the technology could do its bit on deep decarbonization. Speaking about prospects for further development, Kaila Haines, Marketing Director at Nidec ASI notes that it is complex when many different actors must all coordinate their product development efforts in order to make solutions accessible where they are needed along the entire supply and demand chain.

“With more and more players announcing projects, the cost of the technology is decreasing, making the introduction of the technology at the consumer level more and more interesting. Now health and safety standards have to catch up and legislators need to get in on the act too,” says Haines.

The times they are a-changin’

P2G makes seasonal storage of renewable electricity in gas grids possible and this could help stabilize electricity grids as well as cut the costs of grid expansion. On top of that, the technology can also play a role in transport decarbonization. A project in northern Germany initiated by GP Joule is using a tanker to supply hydrogen gas stations in nearby towns, where local buses and an increasing number of other vehicles refuel several times a week. Hydrogen is produced by on-site wind-fueled electrolyzers with around 74% efficiency, supplied by GP Joule subsidiary H-TEC Systems. The manufacturer is seeing more customers willing to buy their technology.

“Time has moved on,” says Frank Zimmermann, Managing Director of H-TEC Systems. “A few years ago, we had all these philosophical discussions at trade shows about how and where we can deploy hydrogen, people were approaching us saying they had too much energy from their renewable plants and were wondering if there is anything they can do with hydrogen. When we talk with customers today, it is all about concrete projects.”

Today, an electrolyzer costs between €1,000 and €2,500 per kilowatt of output, but material and manufacturing costs are expected to decrease. “I see the same trajectory as in the solar industry 20 years ago. As my physicists say, when you look at the stacks, you will see the same learning curves we have seen in photovoltaics, because these are literally only cells you are stacking together. They will scale,” says Zimmermann.

Once the costs of investing come down, driven by economies of scale, electrolyzers will turn from price takers into price makers. But, there will still be a few more boxes to tick for a large-scale market launch to happen. “We are already working on commercial plants for tier-1 players so as far as we are concerned P2G is already going mainstream,” says Nidec’s Haines. “But larger-scale deployment won’t occur until the infrastructure is more widely available.” **PV** Marija Maisch

A new power couple heads to Munich

The smarter E Europe is hosting a full day of discussions on one of the most talked about themes in the European energy sector in 2019: power-to-X. On the back of a new cooperative agreement, Thursday, May 16 will see an exciting program of power-to-X launched for the first time at the Internationales Congress Center München (ICM).

Terminology that was coined by the IT sector is often applied to the energy transition. Sometimes, disruption is used. However, convergence may be more apt.

This is certainly the case espoused by advocates of power-to-gas (P2G) or power-to-X: the coming together and coupling of various parts of the energy sector – including those that superficially may appear to be rivals.

The underlying development that those supportive of P2G foresee is that ‘excess’ electricity generated by zero-marginal-cost solar and wind facilities, can be converted to gas – and then utilized in a range of applications for which battery storage is either unfeasible or entirely unsuitable. It is envisaged that the production of ‘green’ hydrogen, or even methane, may be attractive particularly at those times that solar PV or wind is producing electricity in excess of what is needed on the grid.

The conversion of solar electricity to gas, particularly hydrogen, is something that James Watson has been “increasingly convinced of” in recent months. Watson, who served as the CEO of SolarPower Europe for well over four years, is now the Secretary General of Eurogas. In advance of his taking on the new role, he told **pV magazine** that while he still sees a significant role for battery storage in the European energy system of the future, P2G presents opportunities for both the solar PV and gas sectors.

“I think when you have this huge amount of gas infrastructure that exists today, it is unlikely that we’re not going to keep it active and full,” said Watson. “Thinking about things like that, then the opportunity is to fill this gas network with gas from renewable feedstock.”

New partnership

Following through on this vision, Watson has brought Eurogas into a new tri-party

cooperative agreement to advance sector coupling, with P2G at its core, at Europe’s largest energy industry platform.

In 2019, Eurogas is now collaborating with both Hydrogen Europe and The smarter E Europe to deliver a new all-day conference program focused on power-to-X, which will see energy suppliers and retailers, generation asset owners and operators, grid operators and P2G equipment suppliers come together to discuss the future of green gas production from renewable sources. Investors and politicians engaged in the sector will also be attending and taking part in discussions.

“Solar and gas could be one of the couples of the future,” said Hydrogen Europe’s Jorgo Chatzimarkakis, in a release announcing the new cooperation. “The dream to produce endless energy from the sun and to transport it cheaply as hydrogen via the existing gas grids can become a reality.” **pV**

Jonathan Gifford

From left to right: James Watson, Eurogas, Markus Elsässer, Solar Promotion, and Jorgo Chatzimarkakis, Hydrogen Europe.



Photo: Solar Promotion

European solar comes of PPAge

From scorching Seville to rainy Rostock, investors claim that power purchase agreements (PPAs) have made European solar farms bankable without government subsidies. By providing lower risk for cheaper capital, they are powering a renaissance in established PV markets and lowering the cost of solar electricity in Europe.

Last month, a single contract signed into existence 708 MW of photovoltaic arrays to be built across the Iberian Peninsula. The mammoth deal between offtaker Audax Renovables and developer WElink will roll out as much solar capacity as was installed in Spain and Portugal from 2013 to 2017 combined.

It is no isolated event. Artur Lenkowski, Senior Associate at IHS Markit, says that solar PPA activity in Europe grew from 360 MW in 2017 to more than 2.4 GW in 2018. These projects bring together a colorful range of investors and operate across diverse jurisdictions, but one point many have in common is that they are being built without government subsidies.

"We are competing head-on with market rates," says Peter Alex, head of investor relations at Energiekontor, which has just signed a 15 year PPA with electricity supplier EnBW for an 85 MW solar farm near Rostock, Germany. "The project came as a

big surprise to the market and politicians, but we can already sell solar electricity in Germany that is competitive with fossil fuels and nuclear."

"We see a lot of projects across Europe, especially in the south," says Anne Joeken, head of communications at Statkraft, a leading supplier of renewable energy in Europe. Her employer notably closed a 175 MW PPA in early 2018 to buy electricity from the Don Rodrigo solar power plant near Seville in Spain. "There are various sources for funding new PV capacity with PPAs becoming a more relevant one as grid parity evolves," she says.

The news offers timely respite to Europe's battered solar sector as governments across the region phase out financial incentives for renewable energy. "In the past, there was a lot of solar implementation in Europe, but it was usually supported by subsidies," says Georg Hoefler, Investment Director in the renewable energy team of Allianz Capital Partners. "The difference now is that offtakers are private and there is no government support."

Low risk takeoff

Hoefler explains that new European photovoltaic parks have attracted investment on the back of falling costs for solar technology, relatively high electricity rates, and – usually – excellent irradiation. But the final ingredient that has brought these projects into existence has been the security of a long-term buyer for their electricity. "The reason we sign PPAs is that banks won't finance the solar park if its developer doesn't know who will buy the electricity," says Jaime Jaquotot Núñez, Head of Strategy at Audax Renovables.

"We chose to sign our PPA with EnBW because they have a very good credit rat-

A PV plant built by Energiekontor in Northern Germany. The company says that with the advent of corporate PPAs, it will be able to build a solar plant anywhere it finds a suitable site.



Photo: Energiekontor

ing,” says Energiekontor’s Alex. “This helps a lot when you can go to a bank and show a solid company balance sheet.”

When, in late 2018, Allianz Capital Partners acquired Portugal-based solar projects Ourika and Solara 4, their PPA with Audax Renovables was bundled into the purchase. MEAG, the asset manager for Munich Re and ERGO, purchased the 175 MW Don Rodrigo PV plant in December 2018 also with the Statkraft PPA included.

“As long as the probability of default of the offtaker is low and PPA terms and conditions are reasonable, funding should not be an issue at all,” says Robert Pottmann from MEAG, adding that other PV projects in the EU are likely to be funded through PPAs in the future. “We have valid indications from banks that they would be highly interested in providing non-recourse finance to the [Don Rodrigo] project.”

Green demand

Jaquotot Núñez points out that the cost of generating electricity from renewables dropped below wholesale electricity rates on Southern European electricity exchanges over a year ago. He says that in principle it should no longer be necessary to sign a PPA but guarantees of price stability entice investors, lowering interest rates.

“The pool price of electricity offers only a snapshot of the electricity price as of today,” says Hoefler. “Investors need long-term visibility with regard to their revenue line and I think the emergence of long-term PPAs is a very important factor in that.”

In this respect, PPAs will prove crucial, explains Lenkowski. “They will provide the long-term revenue certainty needed for future projects to be bankable and obtain financing as government support for renewables is phased out.” He adds that IHS Markit believes solar costs have dropped to a level where the majority of future additions will not require government support.

Audax has agreed to buy the electricity produced by Solara 4 and Ourika for 20 years. Over this period the energy supplier will sell the power without subsidies to some 300,000 clients spread across Europe.

“Many of our customers are small and medium-sized enterprises that consume a lot of power during the day and little at



Photo: Audax Renovables

Audax has agreed to buy electricity produced at the Solara 4 and Ourika plants for 20 years. Over this period the energy supplier will sell the power without subsidies to some 300,000 clients spread across Europe.

night,” says Jaquotot Núñez. “Thanks to the PPA, we can offer them a fixed electricity rate with no uncertainty in their bills and with all the environmental benefits of 100% renewable electricity.”

Alex points out that the arrangement also results in more photovoltaics coming online. “Today only solar parks smaller than 10 MW and that fit a range of conditions can benefit from German subsidies,” he says. “With this breakthrough, we can build a solar park anywhere where we find suitable sites.”

Market hurdles

When asked why the European solar industry did not organize itself this way sooner, Jaquotot Núñez points out that government incentives like feed-in-tariffs, net metering schemes, and auctions were necessary to roll out renewable energy technologies on electricity markets until their cost dropped below that of incumbent energy sources. Since this transition, the second challenge has been to remove the subsidies.

“Until the feed-in-tariff disappeared, the PPA made no sense,” he says, as Spanish utilities were legally obliged to buy renewable energy at a centrally determined cost.

“We are not keen on informing politicians that we can realize solar projects without the help of the EEG [German Renewable Energy Act],” says Alex. “We still profit from it in other projects and don’t want it canceled any time soon.”

However, from the perspective of con-

“The second challenge has been to remove the subsidies”



The Ourika PV plant in Portugal was acquired in late 2018 by Allianz Capital Partners, and a PPA with offtaker Audax Renovables was bundled into the purchase.

“The best thing governments can do to encourage the emergence of solar PPAs is to stay away from them”

sumers and the energy transition, the trend towards corporate PPAs will make it possible to install more solar at less expense to society. “Every time a PPA is signed, electricity consumers should celebrate,” says Jaquotot Núñez. He adds that the best thing governments can do to encourage the emergence of solar PPAs is to stay away from them.

“Every time a government says that it will hold an auction or feed in a new incentive for renewable energy, international investors paralyze capital flows until they know what will happen,” says Jaquotot Núñez. “That slows down the roll-out of PV and forces unnecessary costs onto consumers. Today, the largest and fastest moving solar projects in Europe are unsubsidized. They produce the same environmental benefits for the grid but cost nothing to their users.”

One area in which Jaquotot Núñez still welcomes the intervention of policy is in removing market barriers. He says that the European Commission has taken commendable steps in revising the regulatory framework for the European energy sector, setting a 32% renewable energy target for 2030 and eliminating hurdles to sign private PPAs.

“The revised Renewables Directive is much more than just a target,” said EU Climate Action and Energy Commissioner Miguel Arias Cañete at the Global Wind Summit in September 2018. “There is a clear requirement to remove regulatory barriers to long-term renewables power purchase agreements and to facilitate their uptake.”

The Spanish government infamously backtracked on state-backed deals on feed-in tariffs in 2013 and introduced (now removed) taxes on self-consumption of solar electricity. Similar measures have crept into law across the EU as legislators struggle to accommodate the volume of solar and wind that has come online.

“We have enshrined the key principle in legislation that support should be predictable and stable, with no retroactive changes,” said Arias Cañete. “The revised Renewables Directive includes elements, which, taken together, should ensure a more stable development of the investment framework for renewables than we have seen in the past. Ultimately, the best recipe for a positive investment climate is long-term visibility and clarity.”

Safety in diversity

Dealing with risk is exactly where PPAs can help. “For us, these investments are all about structuring projects to meet long-term insurance liabilities,” says Hoefler. “We are trying to structure a relatively risk protected proposition. In that respect we prefer entering projects at a later stage and securing long-term stable cash flows which are not correlated to any financial markets.”

As partners work more closely together on Europe’s emerging PPA market, Jaquotot Núñez says that all players are gaining confidence with this kind of contract and moving towards ever larger installations and longer-term agreements.

“With the European impulse for this kind of deal, PPAs will happen in all countries,” says Jaquotot Núñez. Energiekontor notably plans on expanding its operations in Portugal, southern France, and the United States. “We are planning PPAs in the USA with more than 100 MW each,” says Alex. “Electricity prices are much lower there, but meteorological conditions are fantastic.”

Hoefler says that the volume of new solar installations without governmental subsidies constitutes a big shift in the market and hopes to see more projects of this kind in the future. But he also warns that more PPAs will require more offtakers to provide price and revenue certainty for new projects.

Audax is willing to help with the task. “Our customers are definitely interested in green and renewable power,” says Jaquotot Núñez. “That is something that we see all over Europe.”

Today, 5% of the electricity that Audax Renovables sells on the Iberian Peninsula comes from wind and 2% from solar. As the PPAs signed to date come into operation, the company will ramp the contribution of solar up to 25% and plans on formalizing solar PPAs to cover at least 50% of its supply with solar in due course. **PV**

Benedict O'Donnell

Tapping new markets

The energy transition does not only change electricity generation, but ideally also how we consume. Electricity markets in Europe, however, must deal with legacy regulations that fail to incentivize ideal consumption patterns to reduce curtailment and make the best possible use of the renewable energy assets we have. The result is towering bills for ancillary services, that could easily be avoided with a few regulatory tweaks and virtual power plants.

Europe, despite being at the forefront of the energy transition in many respects, has been hesitant to adopt microgrids, largely due to complex market regulations and established practices of distribution/transmission system operators (DSOs/TSOs). The Navigant Research quarterly Microgrid Deployment Tracker shows that as of Q4 2018 only about 9% of the world's 2,258 microgrids (19.5 GW capacity planned or installed) had been deployed in Europe. With rapid expansion of solar PV and other variable renewable generators looming in Europe, microgrids and virtual power plants (VPPs) could serve an important purpose. They both allow either spatial or temporal alignment of demand and supply in the energy market, and provide stability. Conventional means of addressing these issues are rather expensive or unsuitable for the optimal use of variable renewable energy. Peter Asmus, author and contributor to Navigant Research writes: "A unique confluence of factors makes Finland the best opportunity for microgrids in Europe. Finland is not only the global leader on

smart meter deployments, with 99% of its 3.5 million customers having access to this technology, but it also has a deregulated wholesale and retail market that features 83 distribution system operators, with the largest distribution networks composed of 200,000 customers."

Put a price tag on it

After a series of blackout events in 2011 and 2012, Finnish policymakers reacted by setting a price on power outages. Since 2013 DSOs are obligated to pay compensation to customers. Under the compensation system, single event outages between 12-24 hours will incur a 10% reduction on annual delivery fees, outages of 120-192 hours a 100% discount and outages in excess of 288 hours will result in compensation of 200%. The typical annual delivery fee for a Finnish household is €94. If an outage of 20 hour duration occurs, the cost of the interruption for the DSO will be €0.78 per household per minute. Academic Sinan Küfeoglu calculated the so-called 'shadow prices' of one minute of interruption for 78 of the 83 Finnish

"A unique confluence of factors makes Finland the best opportunity for microgrids in Europe"

Biogas systems can provide dispatchable power and could remedy grid bottlenecks, but the potential is left untapped, due to the current regulatory regime.



Photo: BayWa r.e.

Photo: Nextkraftwerke



While in the olden days grid operators picked up the phone to make adjustments, today algorithms can manage thousands of assets.

“When we have markets VPPs are a suitable instrument to manage large amounts of assets”

DSOs between 2013 and 2015. The analysis shows the shadow price per outage was determined at about €0.40 per minute per household for the vast majority of DSOs. With this market mechanism in place, for many DSOs, it was simple to determine the cheapest option to address the issue.

Since the problem of outages in Finland had been connected to the vulnerability of overland lines due to severe weather conditions, one solution to the problem is to lay the power lines underground. Navigant's Asmus suggests that, “According to research performed by Lappeenranta University of Technology (LUT), the lowest cost option for 10-40% of the medium voltage branch lines would be low voltage direct current microgrids.”

As a response, Siemens and Schneider Electric, among others, were commissioned by DSOs to build a microgrid. Finland, by putting a price on power outages, set in motion market mechanisms whereby DSOs look to reduce the costs of infrastructure adjustments and weigh up their options to stabilize the grid in the optimal way.

Learning from the Finns

Apart from microgrids, Europe's power grid can be assisted through the implementation of VPPs. There are additional services that virtual power plants are likely to perform at a better price point than conventional means of doing it. These services include delivering system flexibility, re-dispatching of power, and grid ancillary services. The example from Finland illustrates how regulation can be a driver of technology adoption in ways that are in line with what the grid, and electricity consumers, require. Likewise, regulations

for VPPs could similarly be improved in order to better manage curtailment and create an effective re-dispatching market.

Already, in some European markets, VPPs are allowed to provide grid ancillary services. At the same time “the provision of grid ancillary services through virtual power plants has brought down the costs of providing the services significantly, in the markets where it is possible,” says Daniel Hölder, management board member of BayWa Clens, a subsidiary of BayWa for energy trading and flexibility options. The German regulatory authority, Bundesnetzagentur, publishes its monitoring report once a year, in which the regulatory authority lists the full costs for grid ancillary services in Germany. In 2017, these costs came in at close to €2 billion. The cost to provide primary secondary and tertiary balancing reserve are about €145 million. A considerable portion comes from compensation for curtailment at €609 million and re-dispatch claims of €291 million. Curtailment and re-dispatch, in Germany and wider parts of Europe, are two measures TSOs perform outside of any market mechanism, but solely based on regulatory requirements.

Legacy regulations

VPP providers BayWa Clens and Nextkraftwerke both argue that VPPs can tackle both curtailment and re-dispatch, more cheaply and efficiently than conventional methods. Re-dispatch describes the process by which a TSO decides to use loads from two or more power plants in a different way than had been agreed upon the day before, to avoid grid bottlenecks. The TSO has the authority to ramp down the power output of one power plant before a bottleneck and increase the power output of one that sits behind that bottleneck.

In countries where this process is not yet market driven, TSOs are rather unlikely to consider small-scale generators, such as 100 kW biogas or 2 MW solar PV plants in the process. The problem is that in most European countries the “distances between large thermal power stations can be more than 100 kilometers and can only be adjusted in intervals of 10 or more megawatts,” Jan Aengenvoort, Communications Director at Nextkraftwerke explains. This results in the effect that if a bottleneck is to be avoided, only a single power plant operator can be considered.

This is not only logistically complicated for the grid, but it eliminates competitive market impulses. Since there are no other options available, the operator of the plant required to make the adjustment dictates the price. There is no competition.

Turning the measure into a market exercise allows VPPs to make smaller and local adjustments by tinkering with the power outputs of distributed generators, which can be adjusted with high granularity and are spread much more evenly throughout the country, Aengenvoort asserts. In so doing, the prices for re-dispatching could be seriously undercut.

The absence of a market mechanism might have made sense at a time when the grid was fed by very few large power stations. At that time grid operators would pick up the phone to notify the plant operators and request changes in the power output. Over the last two decades, the European power system featured incrementally more distributed assets, which still have yet to be optimized. “Virtual power plants need markets, and when we have markets VPPs are a suitable instrument to manage large amounts of assets,” says Hölder.

In another piece of legacy regulation from the olden days of energy infrastructure, many European markets incentivize flattened consumption profiles of industrial consumers. Of course, thermal generators (can) produce without fluctuation, and hence to eliminate fluctuations from the consumption profile worked in grid operators’ favor. Therefore, industrial consumers managing to flatten their consumption profile received discounts on their energy bill. In obscure cases in Germany, this has worked to the effect that golf courses, as Aengenvoort explains, get a discount on their grid charges if they had their lights running all night illuminating acres of land. Hölder adds that in other instances, factory owners could be financially penalized if they were to switch on an additional piece of heavy equipment. The reason is that the additional load puts them at a higher peak load class. That would be the case even if, from a grid operation perspective, it would even be helpful to increase consumption in a factory, because of the high availability of variable renewable energy.

Instead, TSOs must resort to curtailment because industrial consumers not only lack incentivization but are financially penalized when they try to help



Photo: Kenueone/ pixabay

Curtailment and re-dispatch costs can be reduced through the deployment of smarter management technologies.

balance demand and supply. In 2017, curtailment in Germany had been up 47% year-on-year and accounted for nearly a third of all the system-related ancillary service costs.

Winter package no remedy

The market operation of curtailment and re-dispatching, in particular, is not without criticism. “Until 2021, re-dispatch and curtailment are supposed to operate under a single rule,” says Hölder. “But I also know that within Bundesnetzagentur [the Federal Network Agency] and the German Ministry for Economic Affairs there are sceptics for a market-based regulation of re-dispatch.” Regulators fear that plant operators will purposely create bottlenecks to then participate in the markets to remedy the problems that they have created. For Hölder, it is not that black and white and while he understands the concerns of the regulators, he also suggests that these solutions are still needed, and a good market design is possible. The Netherlands has already moved forward and allows for market-based re-dispatching.

While the EU’s new clean energy package foresees a slow turn towards market-based approaches for curtailment and re-dispatch, it is unlikely that within the immediate future a unified EU-wide approach will be found. The package also clearly identifies the important role of VPPs and will allow for their use in ancillary service markets. For now, the positive experience of providing balancing power and frequency control using VPPs has not inspired policymakers to use the same technology to address the costly issues of re-dispatching and curtailment. PV

Marian Willuhn

Utilities in a time of energy transition

Many customers want their energy suppliers to provide them with offerings that promote the transition to low or zero carbon sources – the energy transition. Yet only around a fifth of German utilities feature PV in their portfolio. Conversely, in the electromobility segment, utilities seem to be ahead of the game.

“It is not the case that energy suppliers have little by way of ‘green alternatives’ to offer”

Germany, Austria and Switzerland have a diverse landscape of energy suppliers. EuPD Research has identified a total of 1,800 companies, 1,250 of which are located in Germany. They are all in competition with one other and when it comes to the energy transition, many are still in their infancy. This will be one of the greatest challenges facing electricity and gas suppliers in the future. Consumers might do well to look to the players that have made the most progress in the energy transition. But first, they have to find them. That is where EuPD Research, the German Cleantech Institute (DCTI) and The smarter E Europe come in.

This year, they will once again recognize trailblazers at the Munich exhibition and conference with the ‘Energiewende Awards’ (see p. 79). Energy suppliers from Germany, Austria and Switzerland that are already well positioned will be honored. “With the Energiewende Award, we have created an impartial reference for end customers, showing which energy suppliers are already setting the example today in addressing the individual aspects of the energy transition and acting in the customer’s interests,” says Martin Ammon, who heads the study at EuPD Research.

Awards process

The basic idea behind the award, Ammon says, is that the recognized utilities will gain broad acceptance as companies competent in renewable energy issues and the energy transition. In 2018, as many as 71% of the consumers surveyed said they agreed with this statement. For instance, customers want information about the energy transition in general, as well as renewable energy technology and available subsidies. This interest is particularly pronounced in the electricity sector, where 73% of the respondents wanted

such products and services last year, says Ammon. Electricity is followed by the fields of heat and energy efficiency.

It is not the case that municipal utilities and energy suppliers have little by way of ‘green alternatives’ to offer. Quite the contrary. Analyses in 2018 showed that 21% of some 1,250 German companies surveyed had PV products on offer. But, Ammon continues, little expansion of this offering has occurred since then and the percentage has remained roughly the same. Analysis reveals that large energy suppliers are particularly well represented in PV, with nearly one in two offering some type of PV solution. For medium-sized energy suppliers with annual sales between €10 million and €50 million, the figure was 28%, and for small municipal utilities, 12%.

Solar PV was even more prominent among the energy suppliers surveyed in Austria. There, 69% of large energy suppliers have PV in their portfolio, 42% of medium-sized ones, and 12% of the small ones. On average, 28% of utilities in the Alpine republic have such offerings – almost double the percentage of the Swiss energy suppliers. Even among the Swiss, PV is mainly within the purview of large and medium-sized utilities.

Heidelberg shines

The municipal utility in Heidelberg (Stadtwerke Heidelberg) has been offering solar products for around 20 years. “Up to now, we have largely managed to cover the whole spectrum,” says managing director Michael Teigeler. The offering ranges from small roof systems to tenant power and commercial and industrial (C&I) systems. In addition, Stadtwerke Heidelberg offers lease models and maintenance, as well as other services relating to PV systems. While many municipal utilities and energy suppliers tend to use white-label

Photo: Stadtwerke Heidelberg

solutions, at least when it comes to designing and installing PV systems, Stadtwerke Heidelberg provides PV in-house. “For smaller rooftop systems, there is a pool of installers we draw on when we receive enquiries,” Teigeler explains. The focus is always on quality, which is why the pool gets re-evaluated and refreshed from time to time. In the case of larger rooftop projects – for example, in the C&I segment or for tenant power projects – the utility opens a public tender to find the right engineering and installation partner.

Selling PV systems is not necessarily an attractive business for utilities. They want to retain as many of their customers as possible, which is why more than half of them now also offer leasing models, explains EuPD Research analyst Ammon. Teigeler confirms this. Stadtwerke Heidelberg’s leasing models are geared more to larger customers, such as the C&I segment. The most attractive option is for companies to consume the power they generate on site, but many recoil at the high initial outlays PV plants require, which, in the D-A-CH region, take longer to amortize than other capital investments. As with multi-family dwellings, the leasing model therefore functions better in the C&I segment. “And this is actually our core clientele,” says Teigeler.

Add a battery

Battery storage systems are a popular addition to a rooftop solar system – a good two thirds of energy suppliers offer them, according to the EuPD Research analysis. More than half of these companies also offer economic feasibility calculations. Stadtwerke Heidelberg has a solar calculator on its website. But it is more of a gadget, says Teigeler. It is not actually used to generate quotes. “But it nudges customers to write an e-mail or make a phone call,” he says.

In addition to rooftop solar, Stadtwerke Heidelberg offers a wide range of green-power tariffs. Teigeler thinks it is important that this is genuine green electricity. Some of the utility’s products are certified with the Grüner Strom label – the gold standard in renewable authentication. Customers pay an additional surcharge of between one and four cents per kilowatt-hour on the Grüner Strom certified tariff. The cash collected from the surcharge is channeled into a fund used to finance new solar projects or other climate protection measures, explains Teigeler. But even in a university town like Heidelberg, where



Though only around 20% of utilities in the D-A-CH region offer PV to their customers, many of these companies are remarkably far ahead when it comes to electric vehicle offerings.

many well-off people live and many are inclined to do something to protect the climate, not everyone is willing or able to pay the Grüner Strom premium, which is why Stadtwerke Heidelberg also offers somewhat cheaper green electricity rates that are certified with the ok-PowerLabel, says Teigeler.

The widespread view that younger people, in particular, are enthusiastic about green electricity and especially committed to climate protection, contrasts with Teigeler’s own experience. “According to our surveys, our green electricity customers are, on average, 55 years old, live in urban areas and apartment buildings and primarily use local public transport.” In surveys conducted by the Stadtwerke, usually 30% of respondents say that they purchase green electricity. “But in reality, it’s only 15% of our customers,” says Teigeler. He suspects social status is behind the inflated values – that is, people think that their communities expect them to purchase green electricity.

Communication lacking

Another question is how customers become aware of solar PV, storage or green tariffs in the first place. EuPD Research shows that there is still room for improvement when it comes to communication. In the survey, 38% of customers reported that their energy supplier had been in contact with them, while 20% had approached utility companies on their own initiative. In Austria and Switzerland, rates of proactive communication were even lower.

“Many energy suppliers are astonishingly far along when it comes to electromobility”

Teigeler says that his utility does a lot of work to raise awareness of their projects. “We’ll talk about it.” There are on-site events, and they put the word out over social media. In Teigeler’s view, it is important to make energy tangible and experiential. “We want the Stadtwerke to be visible in the city as well,” he says. At the same time, he admits that this face-to-face marketing – both in the residential and C&I segments – is an arduous process that costs considerable time and effort.

Mobility accelerates

Many energy suppliers are astonishingly far along when it comes to electromobility. According to EuPD Research, only 45% of consumers actually have that expectation when it comes to their utilities. Ammon explains the discrepancy: “Although the German market is still lacking in this segment, energy suppliers see great sales potential here.” Like a number of its competitors, Stadtwerke Heidelberg offers a wide array of electricity rates for EVs – depending on whether charging is done at home or on the road, for instance. Teigeler admits that a degree of standardization is needed. And he is not alone in this view.

Ammon is also convinced that pricing models for car charging will change considerably. A lot of power utilities are also already actively involved in setting up EV charging infrastructure. They sell wall-mounted chargers for residential customers and are installing their own chargers in their regions for commercial customers. Stadtwerke Heidelberg wants to increase the number of its semi-public chargers in the city from the current dozen or so to 150 by 2020.

Learning from the big players

When you think of energy suppliers in Germany, the big four invariably come to mind: Eon, RWE, EnBW and Vattenfall. They have long since left rooftop PV by

the wayside and, arguably, have ignored the progress of the energy transition. However, the tide appears to have turned. Last year, the first three each received at least one award in various categories: EnBW for the energy transition; RWE subsidiary Innogy for energy efficiency; and Eon in heat and mobility.

EnBW, in particular, seems to have seen the writing on the wall and now offers its customers a comprehensive green power package. With its “EnBW Solar+” offering, the company combines PV and storage with an integrated wall-mounted unit for EV charging at home. In addition, a company spokesperson explains, a cloud solution lets customers use their own electricity – virtually at least – at all 25,000 EV chargers in Germany, Austria and Switzerland. According to EnBW, the company currently installs an average of 500 PV systems with battery storage for on-site consumption in households every month.

Innogy has similar products for households. It offers complete solutions for PV systems with and without storage, and an optional wall-mounted charger – enabling consumers to charge EVs with their own solar power from the roof. The RWE subsidiary is also proactively building out the charging infrastructure with a little financial help from the German state of North Rhine-Westphalia. Eon, too, now offers a wide range of services. In the PV segment, it has products for both private households and industrial customers. The same goes for electromobility.

But in the era of the energy transition, it is not necessarily the case that large utilities have a head start or are better positioned than their small municipal counterparts. “It is always a question of how these offerings are fleshed out and handled. Much depends on the commitment of the people behind the products,” says EuPD’s Ammon. At the same time, the competitive situation in the energy market cannot be overlooked; there is not only massive competitive pressure among the established players, but also companies traditionally active in the renewables sector are now trying to establish themselves as utilities. Ammon summarizes the situation: “Consolidation has begun and, at the same time, new players such as Sonnen and Hanwha Q-Cells are muscling their way onto the market, further increasing the pressure on municipal utilities and traditional energy suppliers.” **PV**

Sandra Enkhardt

EnBW’s headquarters in Karlsruhe. The Baden-Württemberg utility’s ‘EnBW Solar+’ offering combines a PV and storage solution with an integrated wall-mounted unit for EV charging at home.



Photo: EnBW

Simply the best...

In 2019, EuPD Research, DCTI and The smarter E Europe are launching the third iteration of their utility awards. Officially named **Energiewende Awards der Energieversorger**, the prize recognizes utilities that have been doing an outstanding job in creating new business models catering to customers that are embracing the energy transition in the D-A-CH region (Germany, Austria and Switzerland).

Utilities have always been a nexus between power generation and the customer, and play a central role in how customers experience the electricity system. Their offering and the communication of such can make or break significant advances in the energy transition in the region where each operates.

It makes sense each year to step back and look at those that have leveraged their unique position in the energy landscape to foster the energy transition.

To ascertain which are worthy of recognition, The smarter E Europe is bringing together EuPD Research and the Deutsche CleanTech Institut (DCTI). Those selected will receive the Energiewende Award for Utilities. The event will take place as a part of The smarter E Europe. On May 16, from 1:45 pm to 3:45 pm, at The smarter E Forum in Hall B3, booth B3.570, EuPD Research is set to take the stage to share insights regarding the role of utilities in the energy transition, followed by the award ceremony and networking drinks.

Innovation models

European utilities are entering a period of rapid change. Few doubt that utilities will continue to play a central role in the energy system of tomorrow and, as such, they must evolve with the times. Their business models are changing. The energy transition-related products and services utilities have in their offering are an important driver for the shift towards decentralized and clean power generation.

EuPD Research developed a quality model to determine the engagement of utilities to pursue the needs of customers with regard to electricity, mobility, efficiency and heating, which is reflected in the award categories. According to the model, a utility will be judged by its offerings of PV systems and software tools that allow for energy monitoring to improve efficiency, or EV charging business models.

Award assessment

Contrary to other industry awards, based on applying, prequalification and nomination, the Energiewende Award for Utilities considers all of the nearly 1,800 utilities active in Germany, Austria and Switzerland.

Core to determining the winner is a customer survey. Private households, as well as commercial and industrial customers, are asked to list the products and services that are of paramount importance to them in relation to the energy transition. The survey is performed quantitatively, and participants have the chance to rank higher key products and services they think are more critical.

Customer experience is simulated through an anonymized 'mystery shopper' process. The system considers how the utility presents its offering online, and how customer communication online and over the phone is conducted. The experience is translated into a point system and transferred into a ranking.

With a holistic eye on the energy transition, the Energiewende Award for Utilities features four categories, all of which have been dubbed as critical elements to its success. Additionally, there will be one award recognizing overall performance in the field of energy transition. **PV**

Award categories: Energiewende Award for Utilities 2019

- Electricity
- Mobility
- Efficiency
- Heating
- Energiewende



More information:
<https://www.energiewende-award.de>



Photo: EuPD Research

Renewable, decentralized and digital

Alongside the four exhibitions taking place under The smarter E Europe platform in 2019, the show organizers will bring a packed conference schedule to the event, with 250 speakers scheduled to present and discuss the latest developments from the new world of energy across four different conferences, with more than 1,800 attendees expected.

Conference program

Tuesday, May 14

09:30 - 11:00	Conference opening: Renewables 24/7: Accelerating the transition
11:30 - 13:00	Interactive buildings: The building blocks of renewable energy systems
14:30 - 16:00	Smart Homes: Giving customers convenience and control
16:30 - 18:00	Small but mighty – microgrids and local energy projects
18:00 - 21:00	Joint conference barbecue

Wednesday, May 15

09:00 - 10:30	Digital innovation – taking green procurement to the next level
11:00 - 12:30	Value extraction from distributed assets for TSOs and DSOs
14:00 - 15:30	Digital platforms – coordinating distributed assets in practice
16:00 - 17:30	Democratizing wholesale markets – energy trading in a decentralized world

One highlight of this year's program will be the Smart Renewable Systems conference, spread over two days at Munich's International Congress Center. While parallel conferences will examine the state of play for solar, energy storage, and e-mobility respectively, Smart Renewable Systems will address the all-important links between these segments, and the development of intelligent systems for energy generation, distribution, and consumption.

As the energy system changes from one based on energy flowing from large generators in one direction, to one where generation is distributed and moving in multiple directions simultaneously, a wealth of technologies and business models are emerging to reshape the market and build the energy system of the future.

The Smart Renewable Systems conference will examine this future energy market, where the line between consumer and producer is blurred and links to heating, transport, and other sectors become ever more pronounced. It will also look at the challenges and opportunities that this transition poses, as well as the solutions that are emerging in the form of smart-home energy management, microgrids, and virtual power plants.

Homes and buildings

Individual sessions at the conference will be devoted to the use of buildings as energy generation facilities, and the innovative sector coupling strategies that can allow commercial buildings to dou-




ble as electric vehicle charging points, or even providers of flexibility services to the broader grid. Innovations driving the adoption of 'smart home' concepts will also be examined, including efficiency measures such as smart thermostats and monitoring/automation for household appliances – which give users control and insight over their energy consumption.

Digital distribution

The technologies and processes that allow us to move toward a reliable, 24/7 energy supply based on renewable resources will be another key focus for the conference – from virtual power plants aggregating and directing the output of geographically separate resources, to microgrid concepts that can allow commercial consumers to greatly reduce their energy costs and emissions.

Finding the value

With new technologies come new applications, and there is a wealth of potential new business models for energy. Sessions at the conference will examine how these innovations are changing the way energy is bought and sold, how transmission and distribution operators can get value from a distributed system, and the growth of both large-scale corporate PPA models and smaller energy community projects. 

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