Blockchain and solar PV

Market trends and future applications

Sonia Dunlop, Senior Policy Adviser

Workshop on open marketplaces to spur innovative energy services, 22 October 2018

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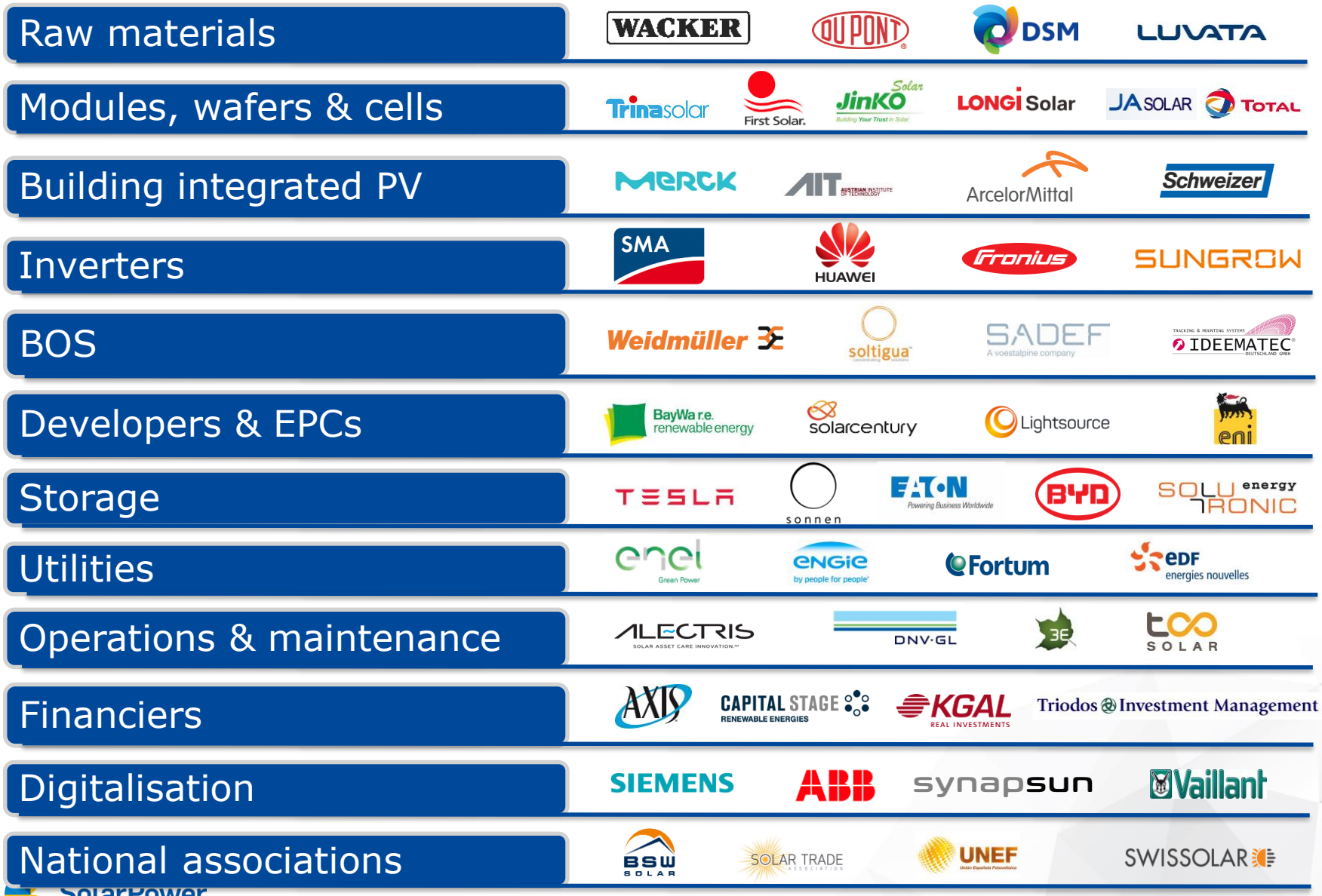
Covering the whole value chain



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Examples of Task Force members

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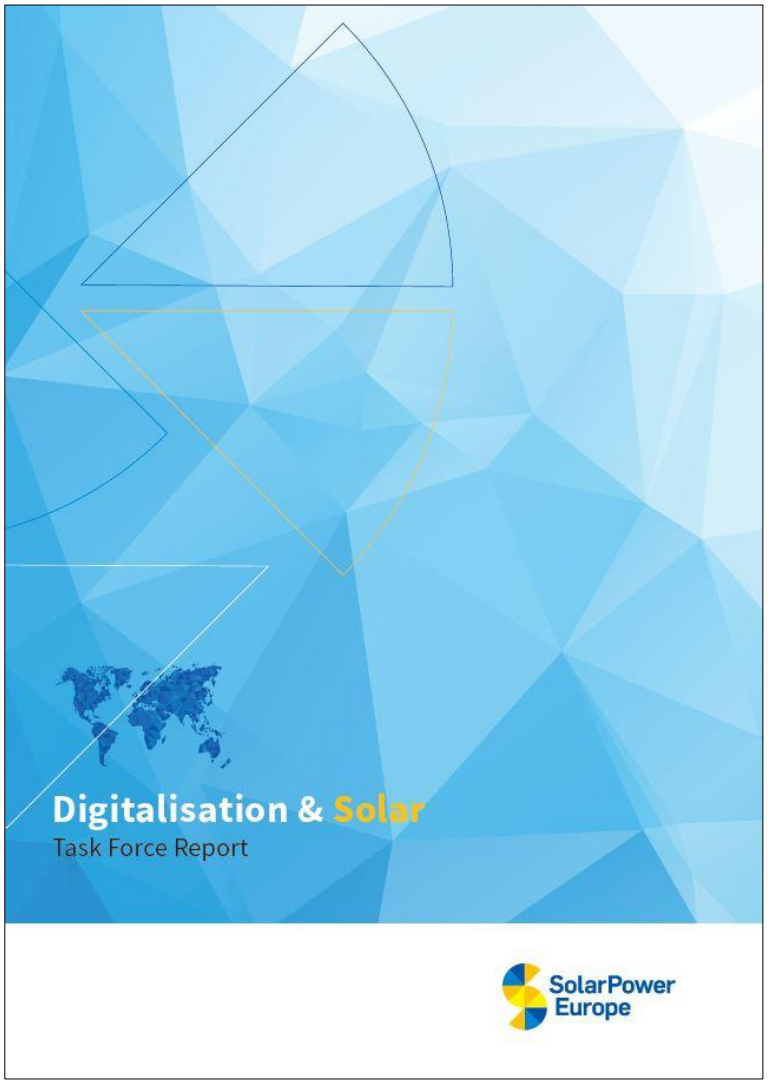
“Digitalisation & Solar” report



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#1 Extra value from cryptocurrencies

BLOCKCHAIN

Providers can also give customers extra value from their PV installations with **cryptocurrencies**, which are based on blockchain technology. The service provider can allocate the customer with cryptocurrencies designed to apportion additional value to solar or renewable electricity, such as SolarCoin, GENERcoin and EnergyCoin. These cryptocurrencies are usually allocated per MWh of solar electricity produced and can later be converted to Bitcoin and hard currency.

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Case study: SolarCoin

CASE STUDY: SOLARCOIN:
A DIGITAL ASSET TO INITIATE THE GLOBAL ENERGY TRANSITION

SolarCoin is an international and community-based initiative promoting the development of solar energy and self-consumption using one of the most disruptive technologies to have emerged in recent years: blockchain. SolarCoin is like an airmile programme and any solar power producer can connect their solar panels to the SolarCoin network by registering their solar install to the SolarCoin website, receiving 1 SLR (ie SolarCoin, §) for each MWh of solar energy produced.

Blockchain, the technology behind Bitcoin and other digital currencies is a decentralised ledger which allows participants to communicate and validate data and monetary transactions on a same registry, available peer-to-peer to all participants in the network. This can apply to solar energy as well.

SolarCoin uses blockchain technology to generate a decentralised, incorruptible and auditable record of

SOLARCOIN GRANT PROCESS

1

SolarCoin Foundation & Affiliates accept verification methods

2

Generator Verified
Claimant Verified

3

Claim delivered

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#2 Microgrid management

BLOCKCHAIN

Blockchain technology is well suited to the management of flows within a grid-connected solar microgrid, determining when generation assets within the asset should be powered up or down. This technology can also if applicable govern transactions within the microgrid.

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Case study: Brooklyn Microgrid

CASE STUDY:
A MICROGRID GROWS IN BROOKLYN

SIEMENS

The traditional centralised model of linear power generation and delivery through limited market or monopoly conditions is giving way, especially on a local level, to more diverse, dynamic, and complex systems with multiple actors and multilayered energy, information, and money flows. The changes towards these so-called Distributed Energy Systems are in response to renewable energy, smart technologies, and other new opportunities, as well as new policy goals – such as reducing emissions and extending energy access. To meet the respective project goals they can be customised to match the consumer's requirements as well as enabling actors to shape local generation and consumption in response to market price signals to achieve the lowest overall cost of energy.

LO3 Energy, a young Ne
Siemens Digital Grid
next47 to realise this
Brooklyn. There, ne
photovoltaic systems a
from each other on
automatically docume
is a pioneer in the m

energy supply system that draws on renewably-generated sources. On top of the above mentioned goals like emission reduction or small-scale trading of environmentally-friendly electricity, this solution enables self-sufficient operation in case of unexpected incidents in the public grid. To achieve this, the project plans to install battery storage units within the grid, which in combination with the local distributed generation and demand response solution will keep the lights on at least temporarily during the next storm-related emergency.

Find out more about the Brooklyn microgrid:

Learn more about Siemens solutions for distributed energy

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#3 Peer-to-peer trading

BLOCKCHAIN

There is potential for the application of blockchain technology in peer-to-peer platforms. Blockchain works well as a platform for micro-transactions as it can reduce transaction costs, reduce barriers to entry and do away with traditional exchanges or intermediaries. This applies to not just trading between domestic households but also businesses and even larger installations. Transactions within the platform are administered and stored in a decentralised way, creating a secure system and inspiring trust. Smart contracts can fully automate the platform with settings that are pre-determined by the prosumer e.g. minimum sell price and maximum buy price. Some analysts claim that the IOTA Tangle blockchain or a private blockchain is more suited to energy trading than public blockchains as the transactions are processed faster.

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Case study: Toomuch.energy

Pilot test in Port of Antwerp: largest in Europe

toomuch .energy

The toomuch.energy platform has been selected to perform a large scale simulation of neighbor electricity trading in the Port of Antwerp. The pilot project simulated the trading of 3.900 MWh and is probably the largest of its kind in Europe.

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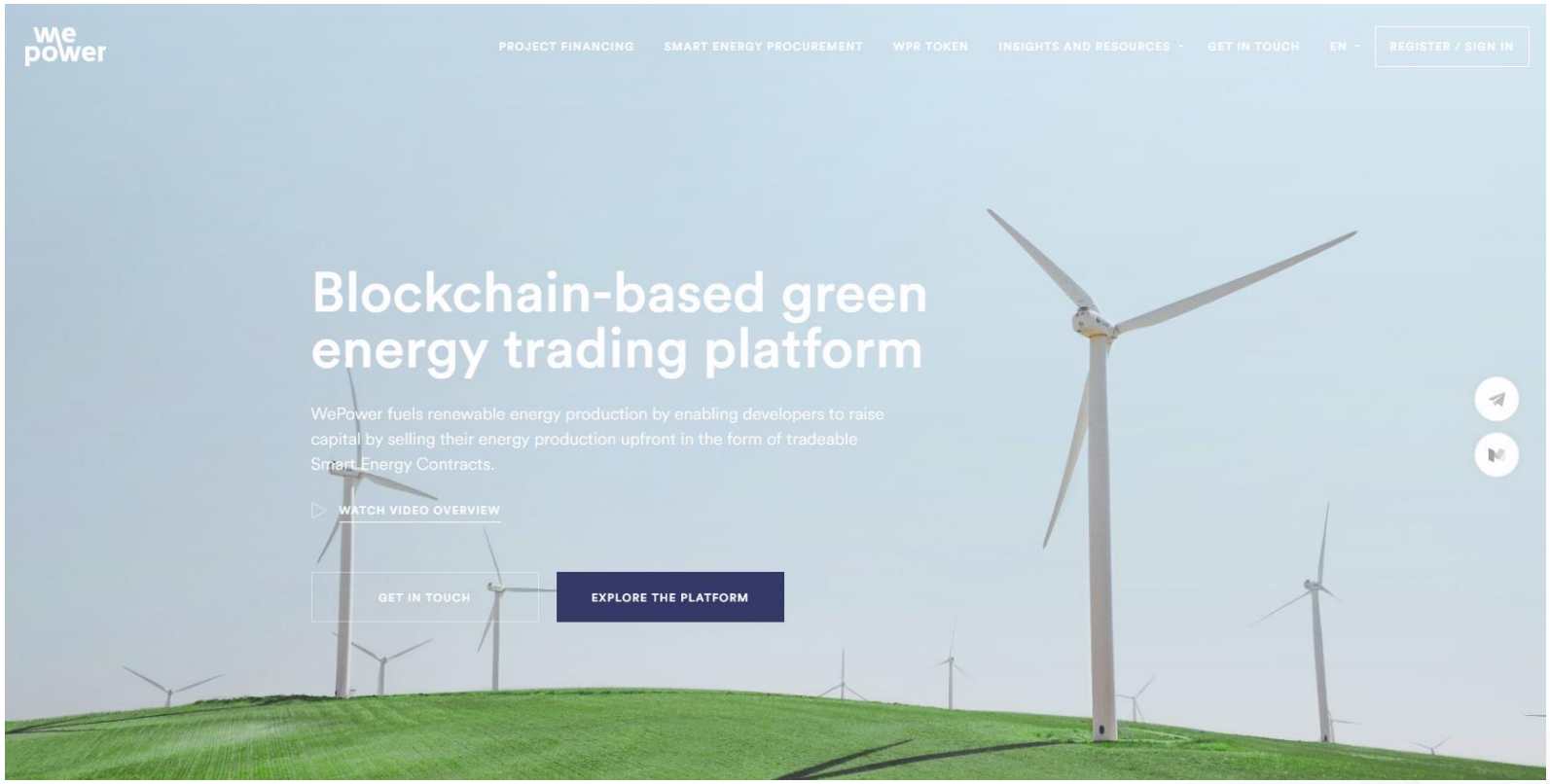
Case study: WePower



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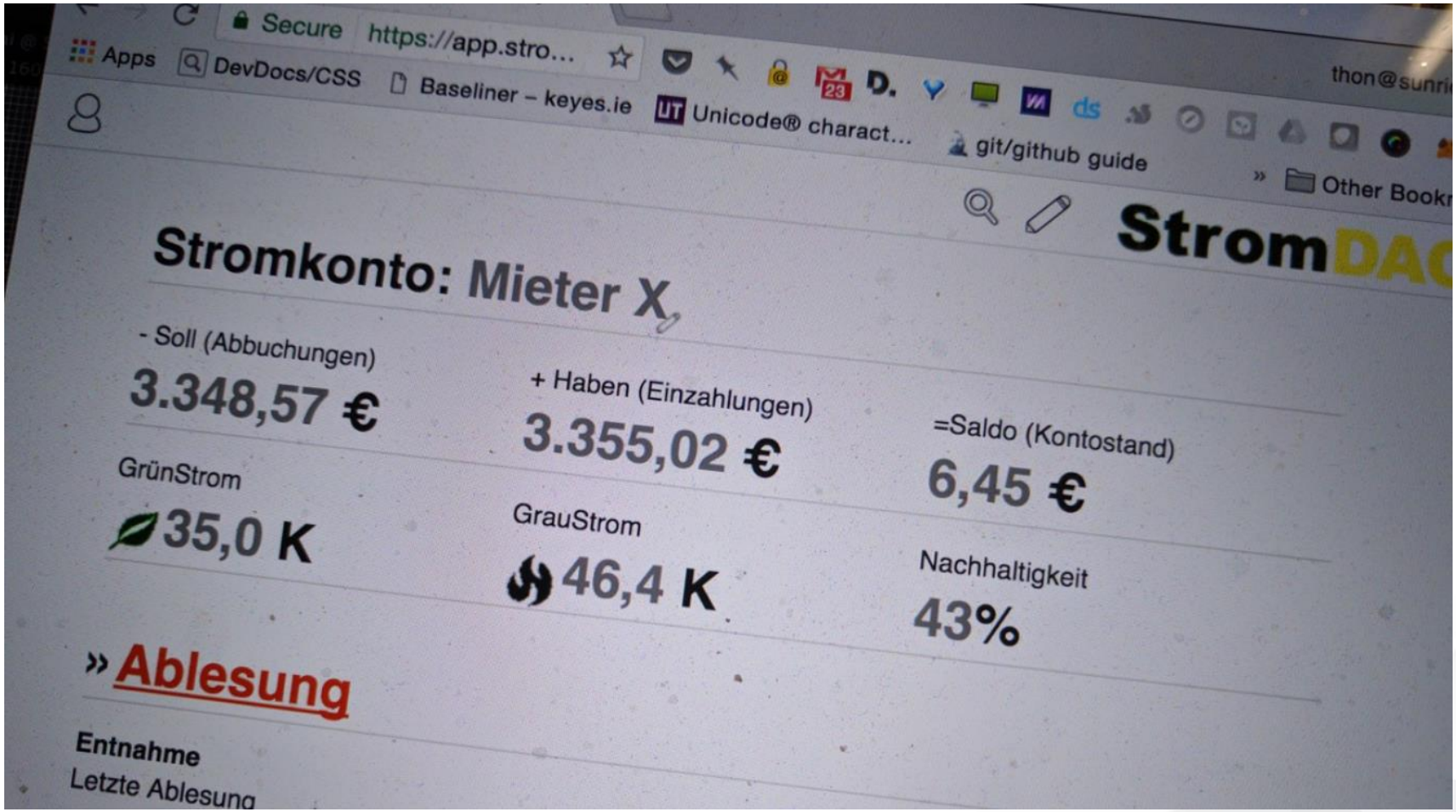
Case study: StromDAO



#4 Renewables grid integration

BLOCKCHAIN

With Blockchain distributed ledger technology you can attribute demand to specific consumers down to five minute intervals or even a minute-by-minute basis, logging when, where and by whom the electricity is generated. This could help optimise network operations at distribution and transmission level. Blockchain technology, especially when coupled with artificial intelligence technology, could simplify or eliminate the clearing process, which is the reconciliation of forecasted or planned consumption against customers' actual consumption as recorded by their meters. Supply and demand could be balanced with smart blockchain contracts within microgrids, virtual power plants, and the balancing market.

Inverters can be shock absorbers or handbrakes for the grid.

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Case study: Sonnen and TenneT

TenneT
Taking power further

Home | Our key tasks | Our grid | Electricity market | E-Insights | Company

News 11/02/2017 Innovation German

Europe's first blockchain project to stabilize the power grid launches: TenneT and sonnen expect results in 2018

+ Downloads & Contact

- **TenneT uses decentralized home energy storage systems networked via blockchain technology to stabilize the power grid**
- **First flexible use of energy storage provided by sonnen to stabilize the power grid**
- **Pilot stage to run for six months**

Bayreuth, Wildpoldsried, 2 November 2017. The first pilot project in Europe using decentralized networked home energy storage systems and blockchain technology to stabilize the power grid formally kicked off. Transmission system operator TenneT has been sucessfully using those home energy storage systems for redispatch. With this and after several months of preparation, TenneT and the world's largest residential energy storage company sonnen launched the pilot phase of the project, which is expected to continue until mid 2018. During this time, decentralized energy storage systems will be integrated into TenenT's grid via blockchain technology. The blockchain solution was developed by IBM while sonnen provides the pool of home energy storage systems that form the network and are operated by sonnen e-Services. The intelligent

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#6 Collective self-consumption

BLOCKCHAIN

Blockchain distributed ledger technology could be used to account for solar electricity flows within a multi-occupancy building and smart contracts could help flats or occupiers automatically buy power when it is cheapest. This could be a new and better way of accounting for the power flows from rooftop to apartment or business unit, although added value would have to be proven compared to existing smart meter technology.

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Case study: Heidelberger cooperative

#7 Renewable certification

BLOCKCHAIN

Blockchain technology is well suited to the management of flows within a grid-connected solar microgrid, determining when generation assets within the asset should be powered up or down. This technology can also if applicable govern transactions within the microgrid.

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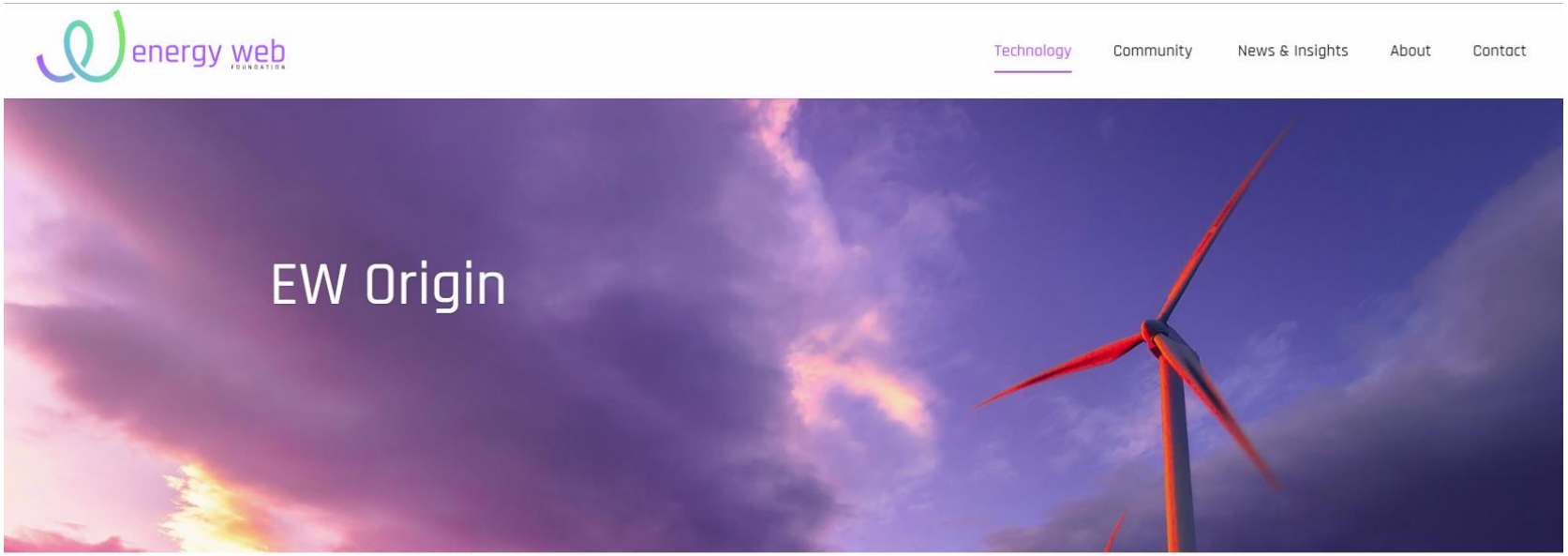
Case study: EWF Origin



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Case study: Groen Leven/Certiq

Mapping of stakeholders

Mapping of industry players in the 'digital solar' space

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10 Regulatory Asks

SOLARPOWER EUROPE'S REGULATORY ASKS ON SOLAR AND DIGITALISATION

In June 2017 the SolarPower Europe Digitalisation & Solar Task Force published its "Regulatory asks on solar and digitalisation" to set out what policy changes are needed at national and EU level to promote the digitalisation of the sector. They were:

1. Remove barriers to the peer-to-peer trading of electricity, such as (but not exclusively) supply license requirements, concluding contracts between peers, network charging and existing and future systems for the delivery and billing of electricity.
2. Ensure that the implementation of regulation does not preclude new technologies and business models for the trading of and accounting for electricity, such as blockchain and cryptocurrencies that create incentives for PV and enable prosumers to participate in energy markets.
3. Encourage regulation that allows aggregators to compete with conventional generators in all electricity markets and offer services in these markets via new or different digital technologies, such as Virtual Power Plants. Allow aggregators to combine resources from all voltage levels and use appropriate measuring equipment for the size of the installation.
4. Use digitalisation to develop flexibility markets with more automated tools and standardised products, as well as standardised requirements for the provision of system services both behind the meter and at distribution and transmission level. Reform intraday and spot-markets to enable large-scale solar and solar-plus-storage plants to take on balancing responsibilities.
5. Accelerate the deployment of smart grid technology, so that more solar can be integrated into the system and both utility-scale and small-scale solar can provide services to the grid. In conjunction, reform incentives for network operators, to encourage them to implement smart grid technology as an alternative to strengthening cables and transformers. Also provide more funding to smart grid and smart market integration projects such as within the Connecting Europe Facility funding instrument.
6. Reward the speed and accuracy that distributed energy resources such as solar and storage can provide in terms of grid support services.
7. Accelerate the deployment of smart metering functionality, real-time m… consumption and grid feed-in, a… a catalyst for new solar business… consumers have access to thei… and guarantee that the roll-out … not discriminate against new and… solutions and solar prosumers. A… costs on smart meter custome… single gateway for all energy d… building. Ensure that self-consun… subject to taxes, fees or charges.
8. Ensure that proposals within … package for metering and consu… made available between DSOs … suppliers, aggregators and … companies are maintained. Gua… the art and up-to-date dat… cybersecurity standards are put…
9. Maintain provisions in the propo… Energy Performance of Buildi… 'smartness indicator' for hom… on-site electricity generation is g… the methodology for setting cos… energy performance requirem… renovated buildings. Ensure tha… takes a holistic view of sector… excess PV electricity can be use… heat via heat pumps, or hot wat…
10. Ensure that EU-level work o… interoperability, within the Di… includes solar PV systems, smart… grids. Encourage the Commissio… with its 'baseline' standardised c… as possible, which individual … manufacturers will then add adc…

These regulatory asks were coordi… Technology on behalf of the So… Digitalisation and Solar Task Force.

SOLARPOWER EUROPE'S REGULATORY ASKS ON SOLAR AND DIGITALISATION

1 Remove barriers to peer-to-peer trading
2 Ensure regulation does not preclude new technologies and business models
3 Encourage aggregators
4 Develop flexibility markets with more automated tools
5 Accelerate smart grids
6 Reward solar grid support services
7 Accelerate the roll-out of smart metering functionality
8 Ensure data exchanges
9 Maintain the 'smartness indicator' for buildings
10 Include solar in standards and interoperability initiatives

Go Digital declaration

GO DIGITAL

AND MAKE THE MOST OF THE RENEWABLES REVOLUTION

New digital technologies are breaking down the traditional boundaries within the energy sector, opening the door to a new era of flexibility. Smart demand response, sector coupling and energy systems 4.0 – the opportunities are countless to make the most of the energy transition. Above all, the digitalisation of the power system has proved to be extremely efficient for network operation and integration of renewables, reducing the need for curtailment and other measures such as capacity markets.

Building on the International Energy Agency's successful report on "Digitalisation & Energy" published in November 2017, SolarPower Europe highlights the many reasons why European policymakers should embrace this revolution and "go digital" when thinking about future electricity market design.

1. DIGITALISATION WILL MAKE THE ENERGY TRANSITION CHEAPER

According to the IEA report, the digitalisation of the power sector could help save up to $80 billion a year. This huge potential will alleviate public finances, but first and foremost the consumer bill.

- **Digitalisation makes better use of the existing grids**

According to the IEA report, the uptake of smart demand response could save $270 billion of investments in energy infrastructure by 2040.

Analysis has shown that a combination of solar and digitalised 'grid supporting' storage which controls the maximum grid feed-in can double the low-voltage grid capacity to absorb feed-in of variable renewables (up to 60%) without any other additional infrastructure.

System operators can also maximise the use of interconnector capacity, thereby bringing an additional source of flexibility to the system without additional investments. Variable RES input can be managed and stored most cost efficiently when connected and handled at medium voltage level.

- **Digitalisation reduces the need for back-up capacity**

European Commission modelling[1] has shown that further digitalisation will trigger a peak decrease of 36GW in 2030, leading to €1,383 million per year in benefits for the distribution and transmission grid and €3,772 million per year in reduced back-up capacity.

1

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Upcoming report: When solar policy went digital

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A Digital Energy High-level Expert Group?

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Digital Solar & Storage

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www.digitalsolar-storage.org

Thank you

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