Digitalisation & Solar

Communities and prosumers – business models for communities

Sonia Dunlop, Policy Adviser, SolarPower Europe

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"The increasing role of consumers in the transformation of the power sector: innovations leading the way"

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What we want policy makers to do...

SolarPower Europe's regulatory asks on solar and digitalisation

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 measurement of consumption and grid feed-in, as smart metering is a catalyst for new solar business models. Ensure that consumers have access to their smart meter data and guarantee that the roll-out of smart meters will not discriminate against new and existing innovative solutions and solar prosumers. Avoid imposing extra costs on smart meter customers, or mandating a single gateway for all energy data in and out of a building. Ensure that self-consumed electricity is not subject to taxes, fees or charges.
8. Ensure that proposals within the market design package for metering and consumption **data** to be made available between DSOs, TSOs, customers, suppliers, aggregators and energy service companies are maintained. Guarantee that state of the art and up-to-date data protection and cybersecurity standards are put in place.
9. Maintain provisions in the proposed revision of the Energy Performance of Buildings Directive on a **smartness indicator** for homes and ensure that on-site electricity generation is given a bonus within the methodology for setting cost-optimal minimum energy performance requirements for new and renovated buildings. Ensure that this methodology takes a holistic view of sector coupling, so that excess PV electricity can be used and stored e.g. as heat via heat pumps, or hot water storage.
10. Ensure that EU-level work on **standards and interoperability**, within the Digital Single Market includes solar PV systems, smart buildings and smart grids. Encourage the Commission to come forward with its 'baseline' standardised data format as soon as possible, which individual device or service manufacturers will then add additional features to.

SolarPower Europe's "Regulatory asks on solar and digitalisation" were drawn up by the Digitalisation and Solar Task Force, a group of members within the association working together to ensure that the solar PV sector in Europe makes the most of the opportunities arising from the digitalisation of the energy system. It follows the Solar industry's seven commitments on digitalisation. An in-depth report on the market opportunities for digitalised solar will follow later this year.

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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 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

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...and what we have committed to doing

The solar industry's seven commitments on digitalisation

1. **Prosumer choice:** We will promote transparency and choice for prosumers in particular encouraging mechanisms for easy switching from one product, platform or aggregator, to another.
2. **Peer-to-peer exchanges:** We will support decentralised peer-to-peer energy exchanges and explore innovative solutions, such as blockchain technology.
3. **Smart and stable grids:** We will collaborate closely with network operators to build smart and stable grids that include solar, storage and flexible demand. These grids will use real-time data to optimise electricity generation and demand. This will also allow the system to maximise the market-based ancillary services that inverters can provide and be remunerated for, such as reactive power and frequency response.
4. **Reducing costs:** We will use digitalisation to make solar more cost-effective both in terms of up-front costs and levelised cost of electricity (LCOE), thus enhancing the competitiveness of solar.
5. **Interoperability:** We will encourage the interoperability of software with compatible hardware, to enable the transfer and sharing of data that is both secure and efficient
6. **Data protection and cybersecurity:** We will champion data protection and recommend that all companies active in the solar industry implement state-of-the-art data protection, in-line with established EU-wide principles. We will put in place stringent cybersecurity measures.
7. **Sharing excellence:** We will endeavour to share digitalisation excellence, gathered within the European industry with the rest of the world, with specific emphasis on supporting the developing world.

SolarPower Europe's "Seven commitments on digitalisation" were drawn up by the Digitalisation and Solar Task Force, a group of members within the association working together to ensure that the solar PV sector in Europe makes the most of the opportunities arising from the digitalisation of the energy system. The European solar PV sector commits to these seven points with the aim of aiding the transition to fully digitalised solar. A set of regulatory asks and an in-depth report on the market opportunities for digitalised solar will follow later this year.

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The solar industry’s seven commitments on digitalisation

1. Promote **prosumer choice**
2. Support **peer-to-peer exchanges**
3. Help build smart and stable grids
4. Reduce costs
5. Encourage interoperability
6. Champion data protection and cybersecurity
7. Share excellence

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DIGITALISATION & SOLAR:

Task Force Report

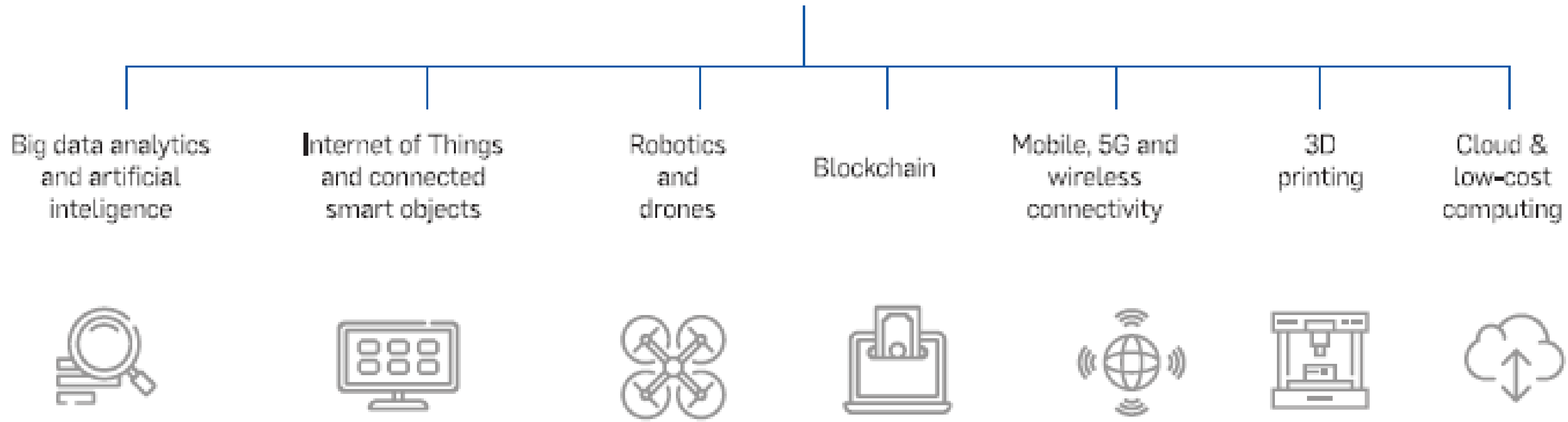
October 2017

SolarPower Europe

What is digitalisation?

? HOW CAN SOLAR MAKE THE MOST OF THE MARKET OPPORTUNITIES OF DIGITALISATION? HOW CAN DIGITALISATION BE A DRIVER FOR MORE SOLAR DEPLOYMENT? HOW CAN DIGITALISATION IMPROVE AND CREATE NEW SOLAR BUSINESS MODELS?

WHAT IS DIGITALISATION?



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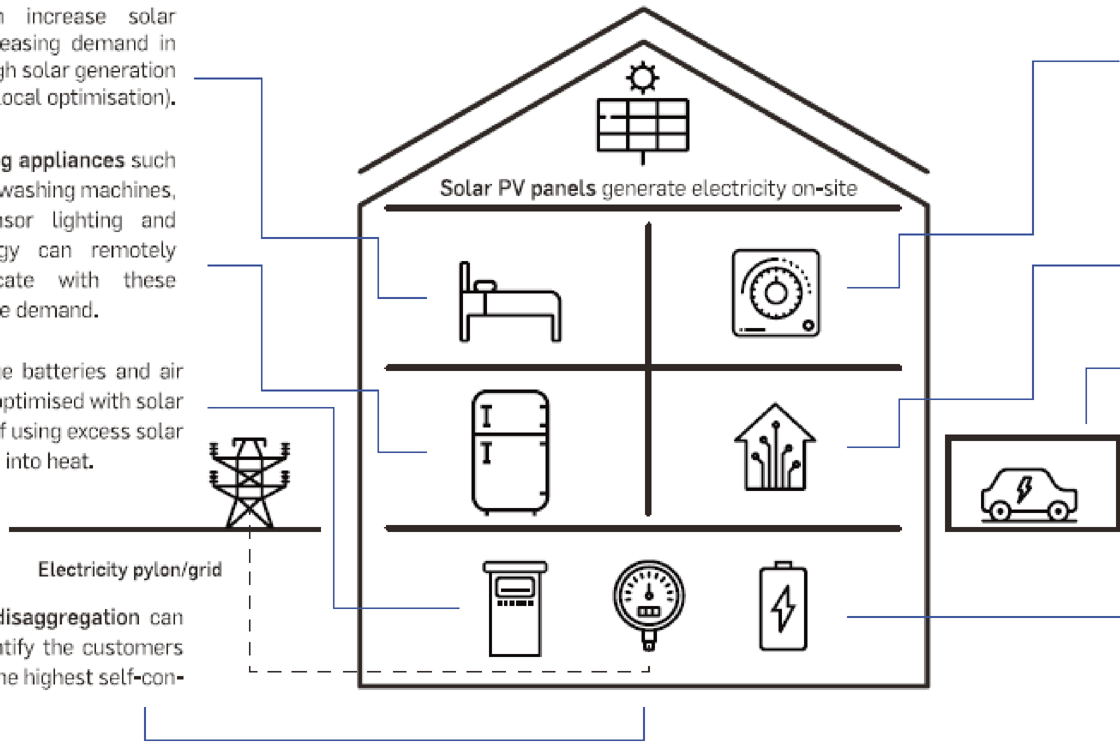
The Smart Building Package

THE SMART BULDING PACKAGE

Demand response can increase solar self-consumption by increasing demand in the building at times of high solar generation and vice versa (known as local optimisation).

Smart automated building appliances such as fridges, tumble dryers, washing machines, dishwashers, motion-sensor lighting and blinds. Digital technology can remotely control and communicate with these appliances to adapt on-site demand.

Heat pumps, heat storage batteries and air conditioning units can be optimised with solar generation and be a way of using excess solar electricity by converting it into heat.



Smart meter data and disaggregation can also be used to help identify the customers that are likeliest to have the highest self-consumption rates.

Smart learning thermostats that are internet connected can be combined with electric heating or cooling. Solar providers in the US are already offering customers free smart thermostats.

Smart building energy management systems which can also provide monitoring, are made possible with wireless communications, advanced data analytics and the Internet of Things.

Smart electric vehicle charging in car parks and the PV4EV 'drive on sunshine' solution could significantly increase self-consumption rates for some households and businesses, especially when combined with storage.

Battery storage is a mutually reinforcing technology when combined with PV. Residential storage can increase solar PV self-consumption rates from approximately 30% to 70% with added system benefits of reducing network and system costs.

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Will GAFA dominate this world too?

WILL 'GAFA' DOMINATE THIS WORLD TOO?

Opinion is divided as to whether the 'GAFA' giants of the tech world (Google, Apple, Facebook and Amazon) will dominate the building energy management system space by incorporating these systems into their platforms, or whether these systems will emerge as platforms in their own right. Given many people already interact with Google, Apple and Amazon on a daily basis, there is a natural pull towards those providers, especially in the residential segment. They are well-positioned to offer a seamless customer experience across different channels. In the commercial segment, we are likely to see other platforms emerge.

Equally important is how interoperable different hardware and software systems will be. It is important that different services do not emerge in separate silos. Nest and Samsung are developing their 'Works with Nest' and 'Works with Samsung SmartThings' smart-home ecosystems. Apple HomeKit, Amazon Echo and Google Home are all potential competitors. Some analysts however have commented that to date these providers have focused more on entertainment systems than energy.

There are also multi-provider platforms such as Mozaiq (a collaboration between ABB, Cisco and Bosch), Wink and If This Then That (IFTT) which consists of small 'applets' that can connect different products and services from different brands. The EEBus initiative, originally funded by the German government, is considered by many to be the strongest interoperability initiative in Europe and has created a 'common language for energy' which is attempting to overcome the highly fragmented array of protocols in the smart home and smart grid space. The Smart Buildings Alliance for Smart Cities, based in France, is also developing its own smart buildings standards called Ready2Services and Ready2Grids.

Do these technologies pay for themselves?

DO THESE TECHNOLOGIES PAY FOR THEMSELVES?

The key question is do these smart home technologies currently increase or decrease the return on investment on an installation when combined with solar? If not yet, when will they? Compared to the total cost of the PV installation, many of these add-on technologies are relatively low cost. Smart thermostats are already advertising paybacks of less than two years on their own, and this could be reduced further when combined with solar and electric heat. Pilot projects have shown that in the medium term the payback period on an energy management system can be less than two years for modern single-family homes with controllable loads.

However at present adding one of these items to a PV system can, in many countries, reduce the payback period on the package as a whole. Previous SolarPower Europe analysis has shown that under current conditions solar-only systems often provide higher rates of return than solar-plus-storage systems[6]. As storage and smart technology costs decrease this will gradually shift and the business case for combining solar with this new technology will be clear.

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Beyond fit and forget PV installations

BEYOND FIT AND FORGET: UPSELLING SOLAR WITH ADDITIONAL SERVICES

Up until now many residential and commercial rooftop solar installers have been 'fit and forget' installers, where once connected an install generates little additional value. Some may do ad-hoc operations and maintenance, but this has in the past often been unviable (or unnecessary) with small-scale systems.

In the future thanks to new digital technologies, installation companies could start obtaining extra value by also up-selling related solar services. The reverse is also true: some utilities are already co-selling solar to their customers, part of utilities playing a bigger role with customers in terms of home optimisation and self-generation[7]. And this package of services can be personalised for every consumer - mass personalisation is itself a product of digitalisation. We've seen Software as a Service (SaaS), this is Solar energy as a Service (Seaas) [8] . Examples of such solar services include:

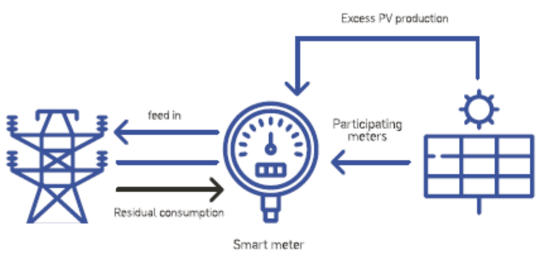
- **Operations & maintenance services** – remote monitoring sensors, wireless communications and software now allows installation and third party providers to offer cost-effective O&M services to small-scale systems.
- **Aggregation services –** with remote controllability, the installer can provide aggregation services[9] for the excess electricity to increase revenues and meet minimum bid sizes in electricity markets. This flexibility can also be remunerated with additional revenue streams from balancing and ancillary services. The exact amount of increase in revenue that can be achieved will vary from country to country, based on existing remuneration and the regulatory framework.
- **Finance** – zero-down solar with 'freemium'-style power purchase agreements made possible by smart metering, leasing financing schemes or loans can increase the potential customer base. Insurance can also be added on as an extra financial product. Digitalisation is also transforming sources of finance, with online crowdfunding communities raising finance for projects in countries where banks are reluctant to lend.
- **Flat rate pay monthly models –** instead of paying per kWh for electricity consumed, customers could be offered a fixed pay monthly price or capped price where a third party works to reduce electricity demand by maximising self-generation and reducing energy consumption. Existing flat rate models currently only guarantee a flat rate within a certain consumption range, and the flat rate is adjusted if consumption goes above or below that. Some flat rate models even include heat and power, guaranteeing pre-determined temperatures in a building.
- **Complementary technology** – see list of smart technology in previous section on increasing self-consumption rates.
- **Energy audits -** energy efficiency improvements and energy audits based on consumption data can further reduce carbon footprint and be co-sold with solar.
- **Residual power supply –** this is defined as the portion of electricity demand that is not supplied by the PV system. This could be enhanced further with a dynamic pricing tariff[10] or if customer has electric vehicle(s) a dedicated 'PV+EV' tariff could be offered. EV-specific time of use tariffs are already available in California [11] .

COLLECTIVE SELF-CONSUMPTION AND 'SMART' POWER PURCHASE AGREEMENTS

BLOCKCHAIN BOX

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.

MIETERSTROM



Smart metering and digitalisation can also act as a catalyst for new solar PV business models in multi-occupancy buildings.

Multi-occupancy buildings – both residential and commercial – have historically been a more challenging market for solar PV than single occupancy buildings, due to barriers around the measuring and billing for solar-generated electricity consumed by different entities or flats in the building.

However with the advent of smart metering – and there are already 11 million smart meters across the EU - new business models have emerged.

A leading example of this in Europe is the 'tenant electricity' or 'Mieterstrom' model in Germany[13]. This is where a third party installs and owns a PV installation with a smart generation meter on an apartment block, and sells the electricity to participating apartments in the building through mini Power Purchase Agreements. The apartments must all have a smart meter and can either be owner occupied or rented. This model allows people who live or work in multi-occupancy buildings to also benefit from self-generated solar electricity and save on their energy bills, and it is made possible thanks to smart metering.

Other variants of this model include the collective self-consumption model in France[14] within which smart meters are mandatory and the shared generation facility model in Austria[15]. In France there are outstanding issues to be resolved regarding network charges and balancing responsible parties.

Finally, digitalisation also allows the implementation of mini power purchase agreements at the level of a single socket. An initiative in the United States called SunPort[16] has created a plug-in converter-style device which sources solar electricity for all consumption from that specific socket.

Grid-connected microgrids

GRID-CONNECTED MICROGRIDS

Another business model that has emerged thanks to digitalisation is grid-connected microgrids [17]. Grid-connected microgrids can be used to reduce energy costs, source renewable electricity, provide back-up or uninterruptible power supply. They are made possible thanks to advanced microgrid management software platforms that optimise the different generation sources within the microgrid.

Leading consultants in this sector define a grid-connected microgrid as follows:
"A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid. A microgrid can operate remotely, or connect and disconnect from the grid to enable it to operate in both grid-connected and island-mode."[18]

There is a considerable overlap between large (and especially commercial and industrial) self-consumption and the use of grid-connected microgrids, with the major difference being that grid-connected microgrids are also engineered to be able to provide back-up and continue operating during a grid power outage. This often involves the use of battery storage or gas or diesel generators.

The two major business opportunities for solar based grid-connected microgrids are industrial sites and municipalities. Both are geographically discrete areas, and in some countries like Germany municipalities often have their own distribution system operators.

(For off-grid microgrids, and especially those in the developing world, see box at end of report. These are not generally considered to be relevant in Europe, other than for the smallest and most remote islands.)

BLOCKCHAIN BOX

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.

Peer-to-peer platforms

SIEMENS

CASE STUDY:
SIEMENS: A MICROGRID GROWS IN BROOKLYN

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 New York company, is working with Siemens Digital Grid and Siemens' startup financer next47 to realise this approach with a microgrid in Brooklyn. There, neighbours with and without photovoltaic systems are buying and selling solar power from each other on a blockchain platform that automatically documents each transaction. The project is a pioneer in the movement towards a distributed 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 systems and other relevant projects in this field:

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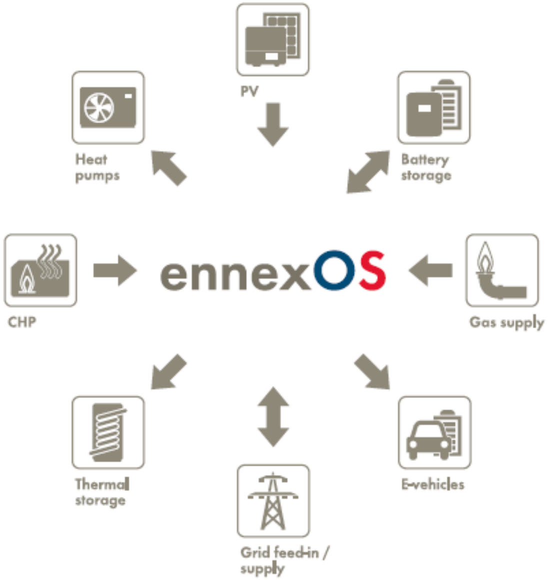
Energy management platforms

CASE STUDY:
SMA'S ENNEXOS ENERGY MANAGEMENT PLATFORM OPENING UP NEW OPPORTUNITIES IN THE ELECTRICITY BUSINESS

The digitisation of the energy transition offers excellent opportunities in the form of innovative business models for companies in the renewable energy industry. This is because decentralisation and digitisation complement each other perfectly and turn current energy supply structures upside down. With connected, intelligent energy management solutions and the interlinking of various sectors, SMA is giving the electricity prosumers of the future new possibilities to exploit the full potential of this new energy world.

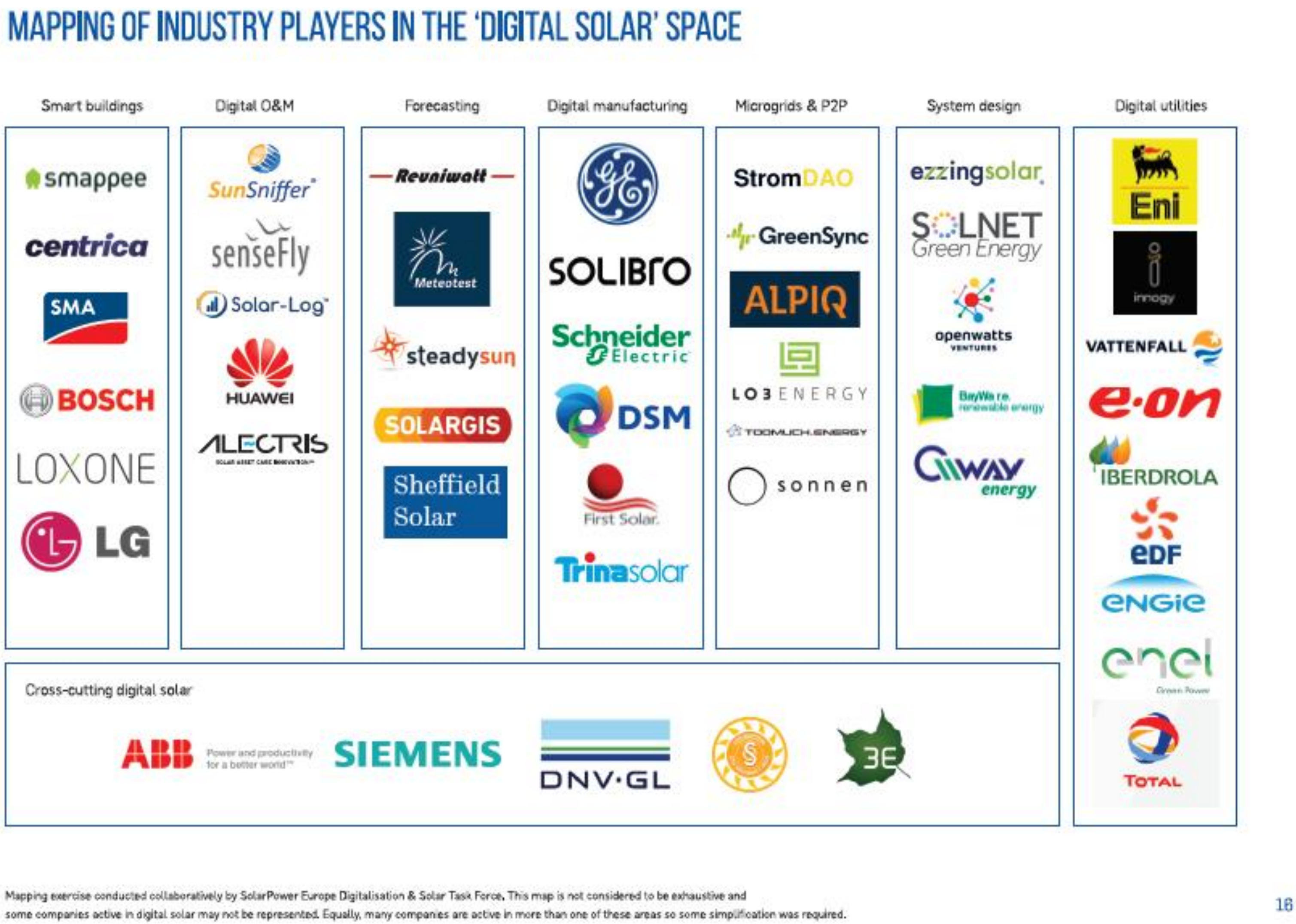
One example is that of a shopping mall: a big Leclerc supermarket in Bordeaux in the south of France has already been able to cut its electricity costs by approximately €75,000 to date since a 500kW solar carport was installed. Using SMA system technology, the solar power produced is used in the supermarket and shopping mall, covering 15% of its annual demand. Electric charging stations were installed as a bonus. Customers can use them to charge their electric vehicles in the parking lot while they do their shopping. This example is only the beginning. Thanks to targeted energy management, companies and business operators are not only able to make themselves largely independent from utilities, they can also develop new business models. Self-generated solar power can be re-sold using digital interfaces. This allows companies to become electricity traders or part of a virtual power plant consisting of several decentralised power generation plants.

The new energy management platform ennexOS from SMA offers modular solutions for sales support, planning, simulation, configuration and the operation of decentralised energy supply systems. It will be possible for the first time to interlink the various energy sectors thanks to the energy management platform. All energy sources are combined, whether they are sources of generation like PV systems, combined heat and power (CHP) units and heat pumps or sources of demand like heating, air conditioning, cooling and lighting systems. This allows energy flows to be brought into perfect alignment as well as optimising consumption and costs. By incorporating battery storage systems this energy can also be used at any time of day.



SMA

Mapping of players in “digital solar”



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Questions?

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