

Electricity & Energy 2019 - Smart Management of Distributed Energy Grids

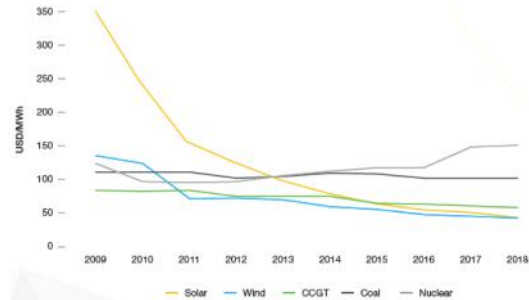
November 6, 2019

MARKET TRENDS

Four Major Trends are Shaking up the Energy Market

Steep drop in solar electricity generation cost

FIGURE 3 SOLAR ELECTRICITY GENERATION COST IN COMPARISON WITH OTHER POWER SOURCES 2009-2018



Graph - Solar electricity generation cost in comparison with other power sources 2009-2018

Source - SolarPower Europe - Global Market Outlook 2019-2023

Battery prices dropping sharply

Lithium-ion battery price outlook

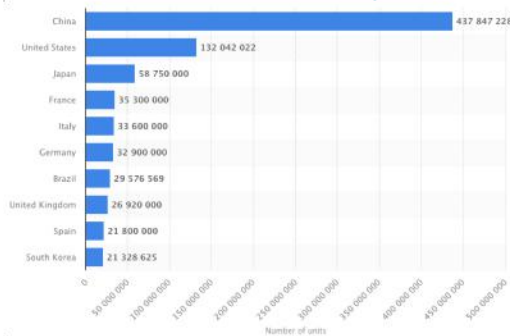
Lithium-ion battery pack price (real 2018 \$/kWh)



Graph - Lithium-ion battery price outlook

Source - Bloomberg New Energy Finance 2019

Millions of smart meters installed by 2020

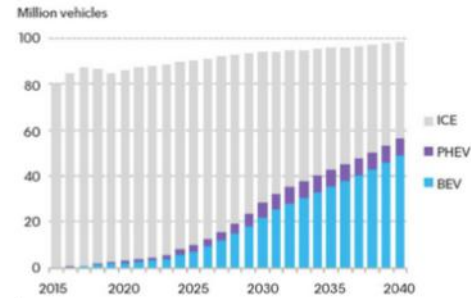


Graph - Outlook on number of installed smart electric meters as of December 31, 2020

Source - Statista 2019

Electric vehicle adoption accelerating fast

Global long-term passenger vehicle sales by drivetrain

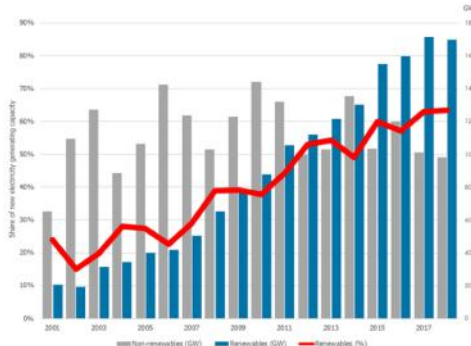


Graph - Global long-term passenger vehicle sales by drivetrain

Source - Bloomberg New Energy Finance - Electric Vehicle Outlook 2019

The energy transition is happening fast ...

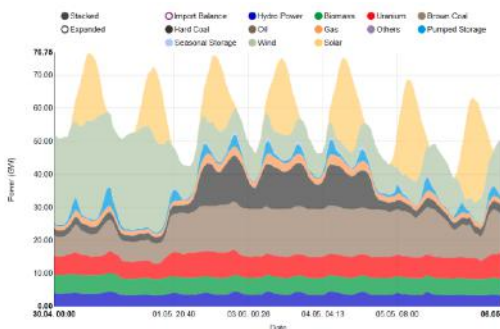
Global newly installed renewable capacity



Fluctuating renewable energies account for two-thirds of global new power generation capacity

Source - www.irena.org

Electricity generation profile in Germany



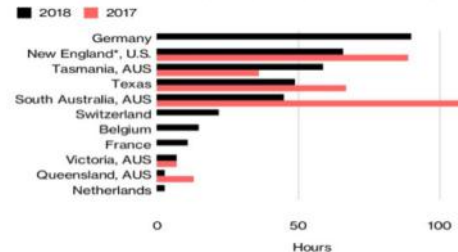
Highly volatile power production in Germany due to solar and wind.

PV and wind cover 3 - 80% of national demand depending on time.

Source - Fraunhofer ISE (sample week May 2018)

... which leads to increased market volatility

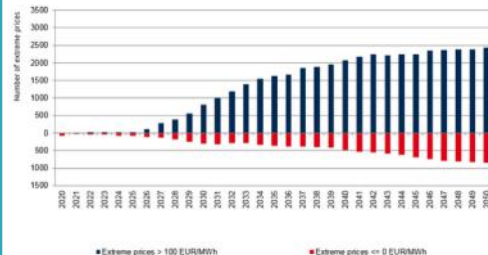
Number of hours with negative intraday prices



Australia, Germany and the US with highest frequency of negative intraday prices.

Source - Epex Spot, National Electricity Market of Australia, ERCOT

Projected extreme electricity spot prices in EU-28



Intervals with extreme electricity prices of above €100 and below zero per MWh will increase significantly.

Source - Energy Brainpool

To secure stability and resilience of the electricity market:

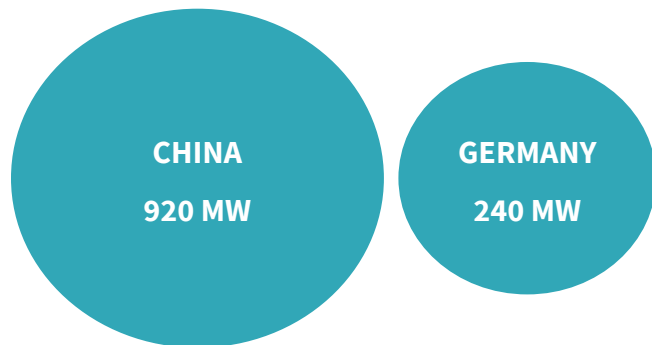
- Production and consumption needs to be managed more actively in the future (incl. forecasting, optimization, control)
- Energy storage needs to be deployed to smooth the renewable generation output

China installed 920 MW of household solar last month

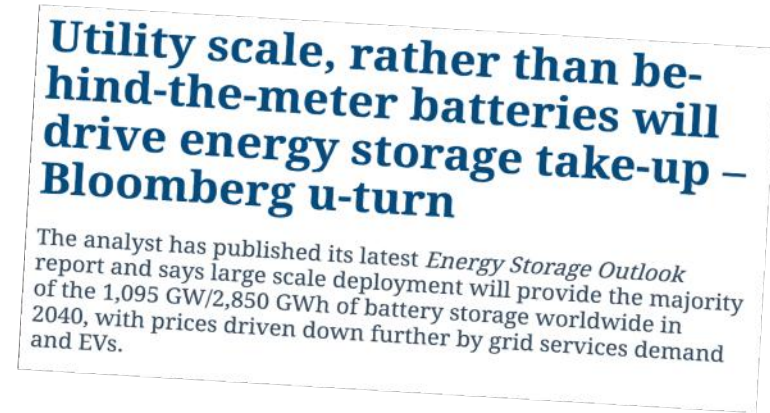
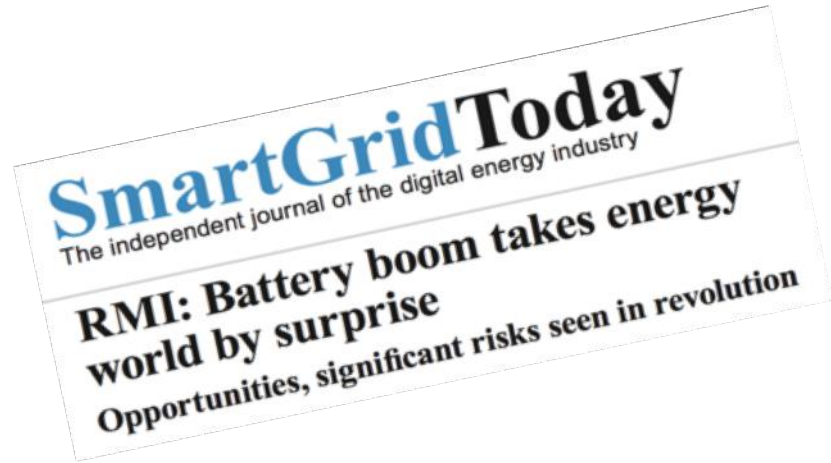
Hopes are high up to 5 GW of residential solar capacity will have been added by the time this month's figures are added, as the household solar feed-in tariff still applies – but only until Thursday. However, the AECEA consultancy has again revised down its overall new capacity expectation for the year.

OCTOBER 29, 2019 **MAX HALL**

New rooftop PV installations per month:



The number of **solar rooftop systems on homes** is expected to more than **double to some 100 million by 2024** globally (IEA).



- **\$1.4 billion invested in battery technology firms** in the first half of 2019 alone (RMI).
- Investments in **energy storage will attract \$662 billion until 2040**.
- **1,095 GW/2,850 GWh of energy storage will be installed by 2040** (BloombergNEF).
- **Lithium-battery costs to fall by a further 50% by 2040** due to increasing demand for electromobility and grid services.

European coal fleet will run at a loss of €6.57bn this year

Economic thinktank Carbon Tracker used financial modeling to determine the profitability of every coal power plant in the EU. On average, 79% of the facilities run at a loss, with Germany, Spain and Czechia among the states particularly exposed to the consequences – for coal investors and the public.

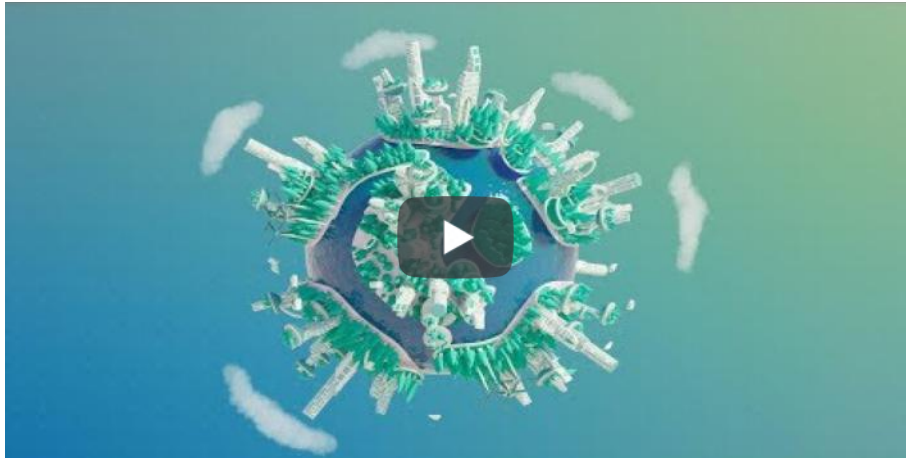
OCTOBER 31, 2019 **MARIAN WILLUHN**

- Analysts estimated **84% of lignite and 76% of hard coal generation capacity is operating at a loss.** (In 2017 “only” 46% of European coal fleet ran at a loss.)
- The two forms could **lose €3.54 billion and €3.03 billion**, respectively, in 2019.
- **Germany (€1.97 billion) is the most exposed country**, followed by Spain (€975 million), and Czech Republic (€899 million).
- **Competition from ever cheaper renewables and gas is growing** → coal will be phased out by 2030.

THE FSIGHT SOLUTION

ENERGY AI -

A network of autonomous agents that optimize energy flow behind & in front of the meter in distributed grids. Our AI platform learns and profiles consumer behavior on a country, regional and cluster level and continuously improves optimization algorithms and results.



PREDICT

Field proven technology with over 40 Machine Learning models able to learn and forecast consumption and production of numerous distributed grid assets.



OPTIMIZE

Employing advanced multi-goal consumption, production and price forecasting. The optimization engine manages the energy flow of each end user and makes real-time decisions regarding buying, selling and storing energy.



TRADE

Collaborative multi-agent trading system autonomously performing Peer-to-Grid and Peer-to-Peer trading to connect independent Prosumer optimization together in communities and entire grid.



- Increasing DER utilization
- Balancing local supply and demand
- Extracting maximum value from flexible resources

Benefits for the End-User

- Cost savings (up to 25%)
- New revenue streams
- Optimize self consumption

Benefits for the Grid Operator

- Avoid grid reinforcement
- Secure energy supply, reliability and resilience
- Balance of local supply/ demand

Benefits for the Energy Provider

- Visibility of end customer consumption & production
- Control of DERs
- New products, pricing & service opportunities

Impressive results from our paid pilots in Israel & Europe

Maale Gilboa (Israel)

Up to 25% energy cost savings and increase of supply-self-sufficiency from 5% to 30% for the prosumers

Energy Community Germany

PV (no battery): 11% energy cost savings (optimization only), increase of supply-self-sufficiency from 19% to 33%

C&I Germany

Payback period from 8 to 3.5 years for the investment in PV, battery and diesel-engine





Maale Gilboa Community

A distributed and renewable energy community microgrid project demonstrating tomorrow's business cases together with a consortium of leading energy companies



Maale Gilboa community:

- 100 km northeast of Tel Aviv
- 750 inhabitants
- Locally governed microgrid

Live Gilboa Iris pilot:

- 200+ residential & commercial participants
- 1.5 MWp PV & wind capacity
- 1,600 MWh yearly production
- 3,200 MWh yearly consumption
- Flexibility options: batteries, EVs, smart home appliances, pump storage
- Example of installed battery systems:



Use cases:

- Individual asset optimization
- Community grid optimization
- Peer-to-Peer / Grid trading
- Flexibility aggregation (VPP)
- Demand side management

Savings potential:

25% total electricity cost savings for community

Ongoing Project - Sawmill, Germany

Situation:

- Industrial plant with high electricity usage (> 30,000 MWh p.a.)
- Grid cost heavily dependent on peak demand
- Unclear correlation btw. production volumes and electricity peaks
- No existing renewable or storage installations

FSIGHT Analysis:

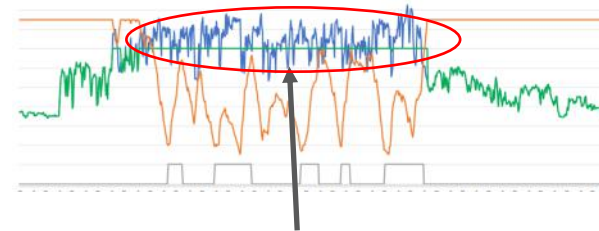
- Analyzed 100s of DER scenarios (PV, battery, generator)
- Analyzed drivers & predictability of demand peaks
- Reviewed flexibility options in plant production levels
- Calculated energy arbitrage opportunities/primary reserve market potential
- Developing real time forecasting model

RESULTS:

- Set-up of **battery + generator**
- **Up-front cost of less than € 2mn**
- **Reduction of peak consumption** by appr. 1 MW
- **Savings of 10-15% of yearly electricity cost** (80% of grid costs saved)
- **Payback time of less than 4 years**



Optimized load profile



Peak shaving results

German community:

- 2 commercial & 15 residential participants

Renewable installations:

- 270 kWp PV capacity

Use cases:

- P2P and community trading

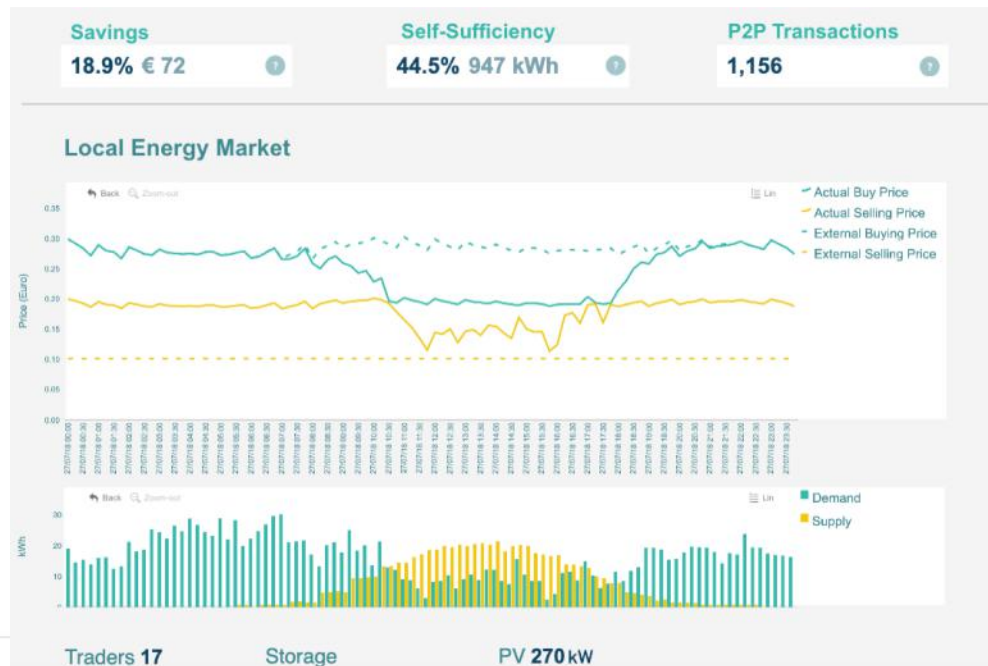
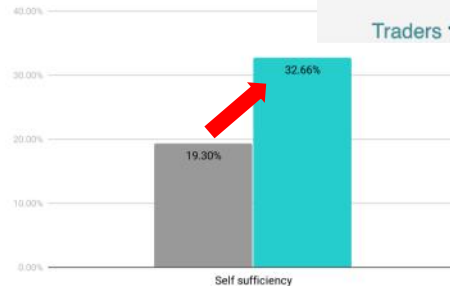
Savings potential:

- 11% cost savings for community (no batteries)
- Increase of self sufficiency from 19% to 33%

Prices (€ ct)



Community self-sufficiency (%)



GERMANY

	2025	2040
Decentralization ratio	22%	33%
\$ Behind the meter	\$43B	\$60B

CHINA

	2025	2040
Decentralization ratio	7%	10%
\$ Behind the meter	\$47B	\$81B

USA

	2025	2040
Decentralization ratio	9%	17%
\$ Behind the meter	\$12B	\$37B

INDIA

	2025	2040
Decentralization ratio	5%	12.5%
\$ Behind the meter	\$7B	\$27B

JAPAN

	2025	2040
Decentralization ratio	10%	30%
\$ Behind the meter	\$11B	\$33B

AUSTRALIA

	2025	2040
Decentralization ratio	22%	45%
\$ Behind the meter	\$12B	\$30B

A large array of solar panels is shown from a low angle, receding into the distance. The panels are dark blue with a grid of silver lines. The sky is a mix of blue and orange, with the sun low on the horizon to the left, creating a strong lens flare and illuminating the clouds. The text "Thank you!" is centered in the middle of the image.

Thank you!