

Positive governance and accelerated deployment of Solar Photovoltaics and Distributed Storage

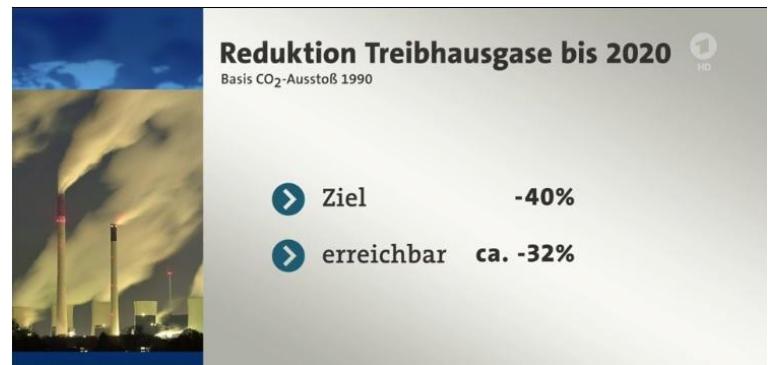
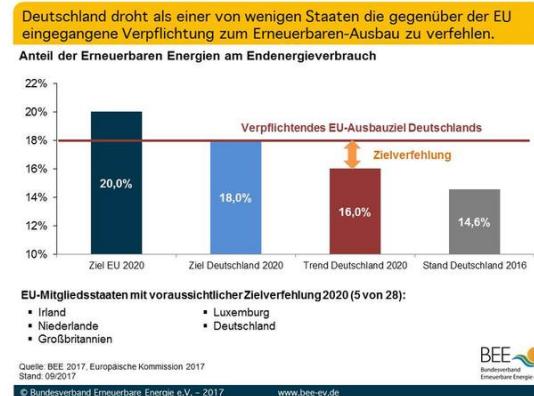
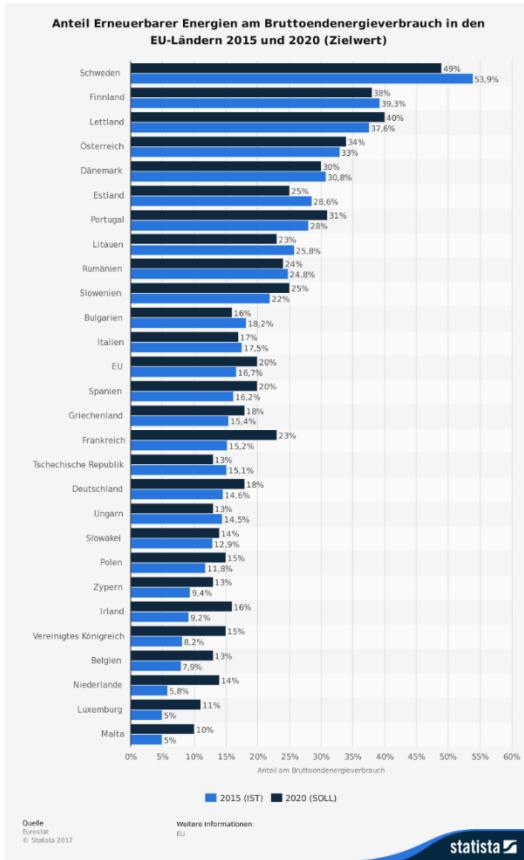
as key global climate change solution
at all institutional levels



Introductory remarks

- Climate change is a serious ethical problem of our societies, amplified by the fact that successfully proven and fast decarbonisation measures are available, but often „**sistematically disregarded**“ or **sabotaged** by governments and corporate controlled media
- German climate change mitigation policy risks to become a **serious failure** with regard to European renewable energy targets 2020 and Paris Agreement ambition levels
- This is certainly not due to sincere macroeconomic considerations in the face of the **immense damages** already caused by fossil lifestyle (floods, cyclones, fires etc.)

Business-as-usual is radical risk-taking



Climate change has drastic impacts

Climate Change Will Make Parts of South Asia Unlivable by 2100, Study Says

Justin Worland

Aug 02, 2017



Temperatures in heavily populated South Asia will exceed habitable levels by the end of this century without efforts to stem manmade climate change, according to new research.

Quelle: TIME magazine, citing study in Science Advances



Importance of Photovoltaics for climate politics



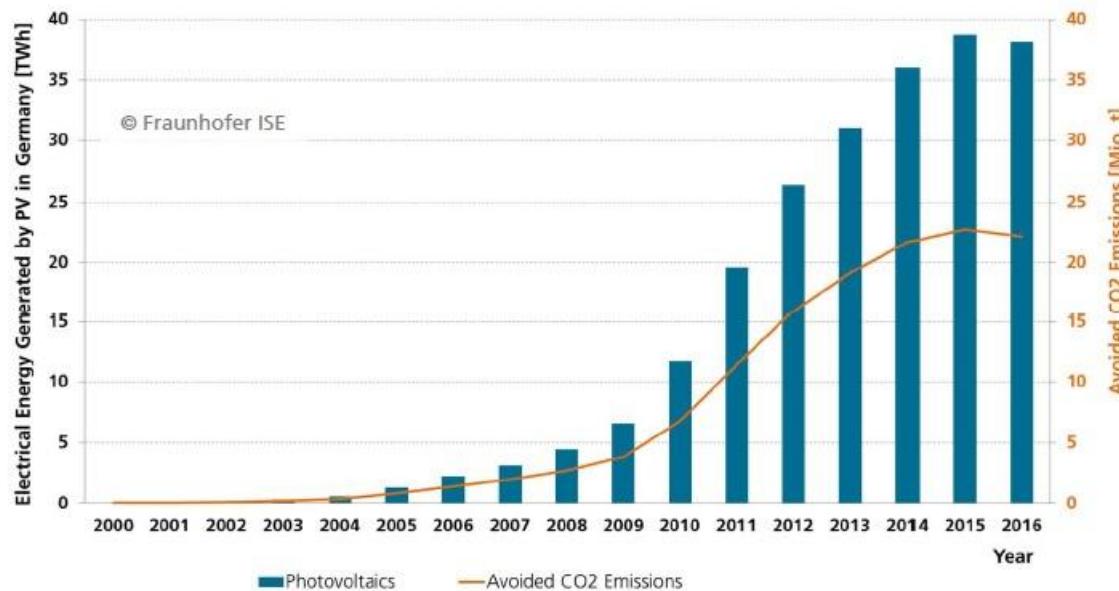
What is so special about PV?

- Pioneering **technological, regulatory** and **financial solutions** for fast photovoltaic growth are already successfully applied in many places around the globe
- Massive organised media campaigning and **continued obstructive governance initiatives** against the deployment of PV and complementary BES technologies are observable in a number of countries (following a similar pattern)
- At the same time, these zero carbon technologies have the **highest overall potential** in almost all geographies, are **highly modular, without emissions** and can be introduced with **low technological and economical risks**

Ubiquitous availability of solar PV

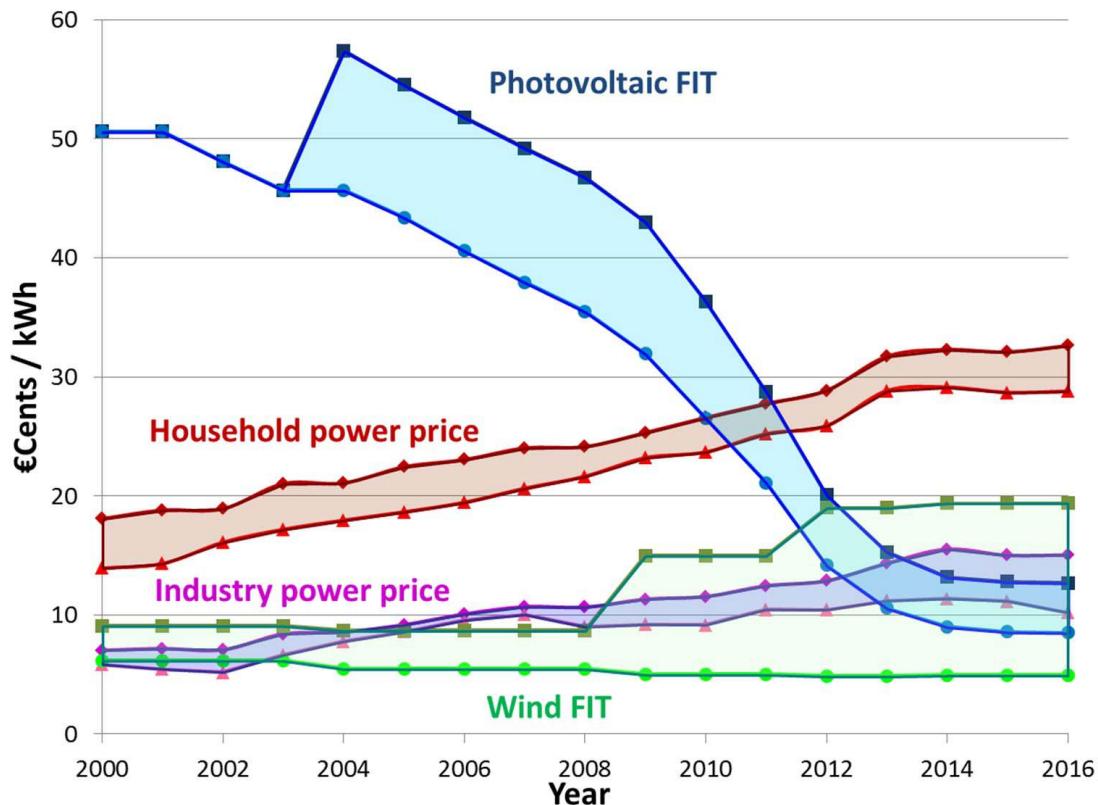
- „Solar is not about finding the perfect piece of grass in the UK, but **it's about thinking you can put it anywhere**; then you start realising the scope to expand solar.“ [Alison Fitch, Huawei Smart PV Business Europe]
- „With the advent of affordable storage and the „Internet of Things“ **the world for photovoltaics has changed completely**. What we are doing today is to connect the photovoltaic generator reasonably with storage, heating, ventilation and air conditioning systems as well as electric vehicles and to **control them intelligently via platforms.**“ [Pierre-Pascal Urban, SMA]

Very fast mitigation solution



Data: BMU, BDEW, BMWi, Federal Environmental Agency (UBA) 2017. Graph: PSE AG 2017

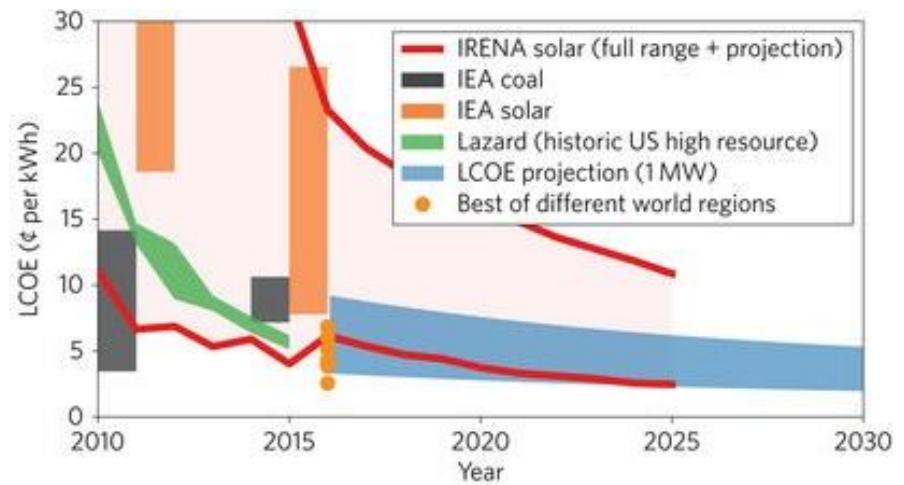
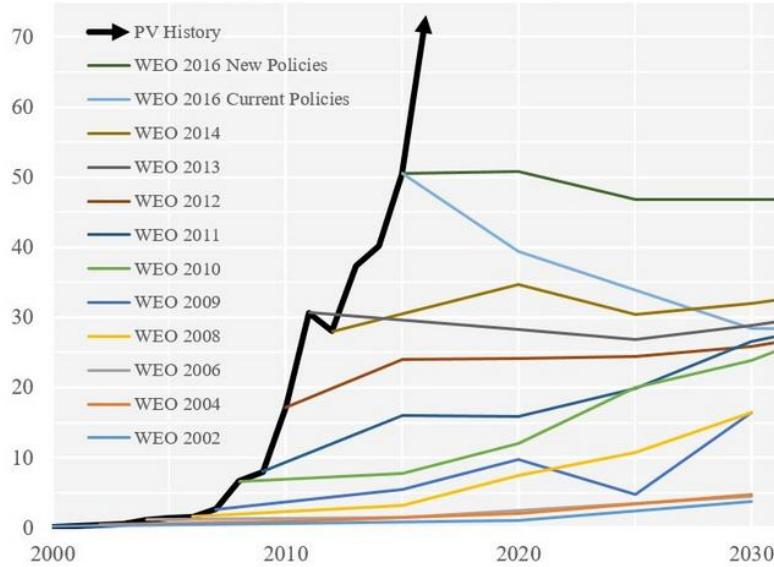
Very cost-effective decarbonisation



Electricity costs	
Household 1 000 kWh/a to 2 500 kWh/a incl. VAT (2000-2016: +3.8%/a)	
Household 2 500 kWh/a to 5 000 kWh/a incl. VAT (2000-2016: +4.6%/a)	
Industry 500 MWh/a to 2 GWh/a net price (2000-2016: +4.9%/a)	
Industry 20 GWh/a to 70 GWh/a net price (2000-2016: +3.5%/a)	
Feed-in tariff for PV	
PV Rooftop up to 10 kW (2000-2016: -8.3%/a)	
PV freestanding (2000-2016: -10.5%/a)	
Feed-in tariff for Wind	
Wind offshore, initial tariff, acceler. Model (2000-2016: +4.8%/a)	
Wind onshore, basic tariff (2000-2016: -1.4%/a)	

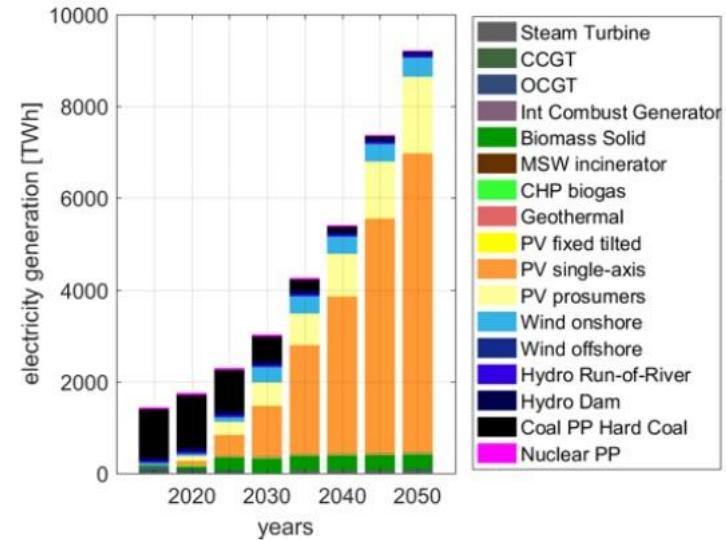
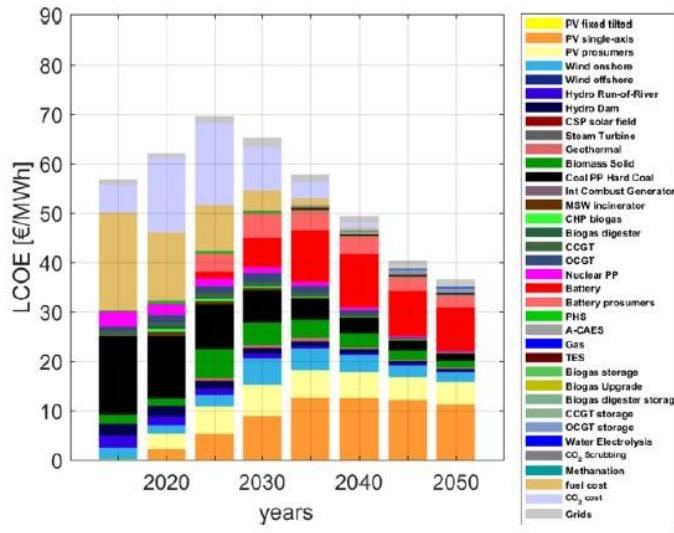
Data: BMU, EEG 2014 and BMWi Energiedaten. Design: B. Burger - Fraunhofer ISE , Update: 04 July 2017

Exponential growth potential



Predictive models have **consistently underestimated PV deployment!**

Low-cost decarbonisation pathway



Gulagi, Breyer, Bogdanov: “The Demand for Storage Technologies in Energy Transition Pathways Towards 100% Renewable Energy for India”, Conference Paper · 11th International Renewable Energy Storage Conference, March 14-16, 2017, Düsseldorf

Importance of governance for high growth PV



Politics can make a difference ...

Indien erreicht im ersten Halbjahr 4,7 Gigawatt Zubau

■ Indien hat im zweiten Quartal 2017 rund 1.869 Megawatt Solarstromleistung neu ans Netz gebracht. Dies bedeutet kumuliert im ersten Halbjahr rund 4.765 Megawatt (MW) – mehr als im gesamten Jahr 2016 mit 4.313 MW. Dies geht aus

ABB installiert Wechselrichter an 750 Bahnhöfen in Indien

■ ABB India, Teil des Schweizer Energie- und Automatisierungstechnikkonzerns ABB Ltd., wird Wechselrichter für 750 Bahnhöfe der staatlichen indischen Eisenbahngesellschaft Indian Railways liefern. Die Leistung der Inverter liegt je nach Station zwischen fünf und 50 Kilowatt. Die Solaranlagen werden von der

indischen Firma Indian Railways mehr als 8.000

terre Solaranlagen zu errichten. In einer zweiten Stufe hat sich die Bahngesellschaft das Ziel gesetzt, sämtlichen Strombedarf aus eigenen Ressourcen zu decken. Indian Railways verfügt über derzeit installierte Erneuerbare-Energie-Leistung von 36 Megawatt und diese auf 1.000 Megawatt anheben.

U.S. Solar Market Insight

In Second Largest Q2 in History, U.S. Solar Industry adds 2.4 GW of capacity

Updated September 11, 2017

The U.S. installed 2,387 megawatts (MW) of solar PV in Q2 2017 to reach 47.1 gigawatts (GW) of total installed capacity, enough to power 9.1 million American homes. This represents an 8% increase over the same quarter last year, and the industry is poised to install more than 12 GW of solar capacity before the end of 2017.

New York sees 800% surge in solar

New York By Danielle Ola | Feb 22, 2017 11:04 AM GMT | 0

support from private and state entities. Source: Flickr/Diana Robinson

New York governor Andrew Cuomo announced yesterday that state-supported solar power has increased nearly 800% over the last five years.

From December 2011 to December 2016, New York solar has leveraged nearly US\$1.5 billion in private investment, and has been a key driver of the state's 50% by 2030 renewable energy portfolio standard (RPS).

In different senses ...

Kurze Blütezeit

Der Bau von Freiflächenanlagen bis 750 Kilowatt ist nur noch stark eingeschränkt möglich

Die mit dem EEG 2017 geschaffene Befreiung kleiner Freiflächenanlagen bis 750 Kilowatt von der Ausschreibungspflicht hatte das Potenzial, die Zubauzahlen in Deutschland spürbar nach oben zu treiben. Das aber war ganz offenkundig nicht gewollt, deshalb wurde diese Tür im Zuge der letzten Gesetzesnovelle wieder zugeschlagen. Nur eine Übergangsregelung sorgt dafür, dass wenigsten die bereits begonnenen Projekte nicht als Investitionsruinen enden.



Frank Schäfers / PHOTON Pictures

Es müssen nicht immer etliche Megawatt sein – auch kleine Freiflächenanlagen sind ein interessantes Marktsegment

What can (local) governments do?

- Move PV and Battery Energy Storage deployment to the centre of climate policy implementation at local and regional levels (**following a deep decarbonisation pathway**)
- Create an increasingly flexible network at all levels of the electricity deliverability system (DSO 2.0) – supporting the **transition from a load-following to a supply-following paradigm**
- Approve steering taxes on damaging behavior (“burning fossil fuels”) and **develop creative regulatory measures** (“Urban law”)
- **Create active green investment facilitation units** (“Green Banks”) that assure financial sustainability of various initiatives and innovations
- **Protect sustainable capital investments** of conscious people that eliminate fuel costs and harmful emissions (-> **lower LCOE** through low risk premiums connected with legal guarantees, e.g. feed-in arrangements and the abandonment of discriminatory actions against photovoltaics)

Importance of storage policies

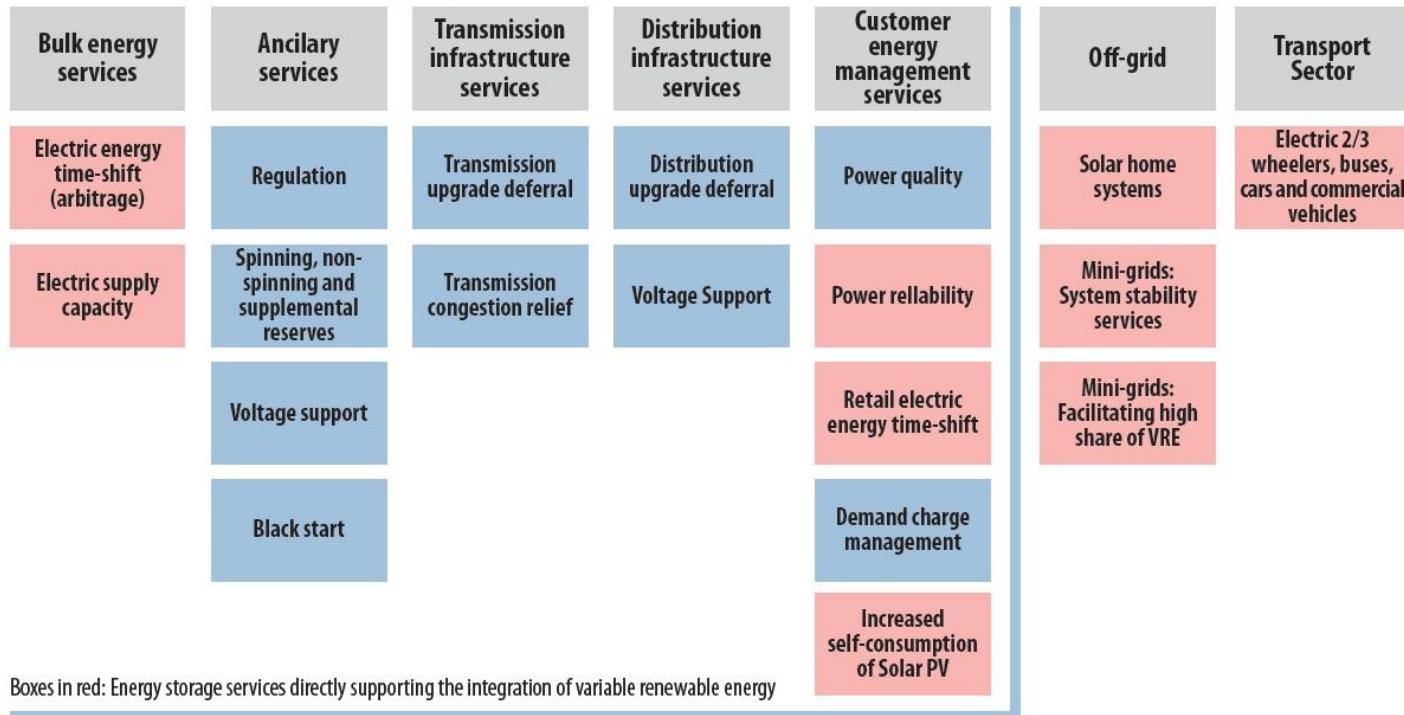


Battery storage for DSOs+Prosumers

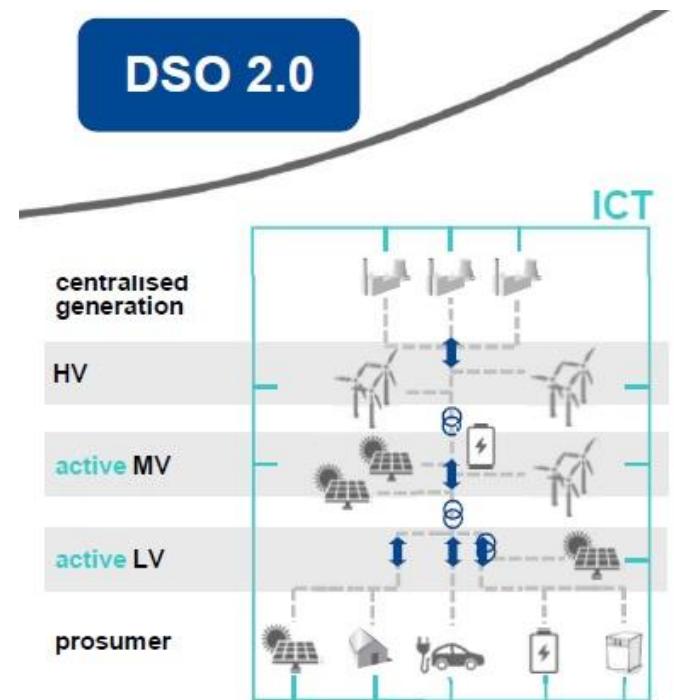
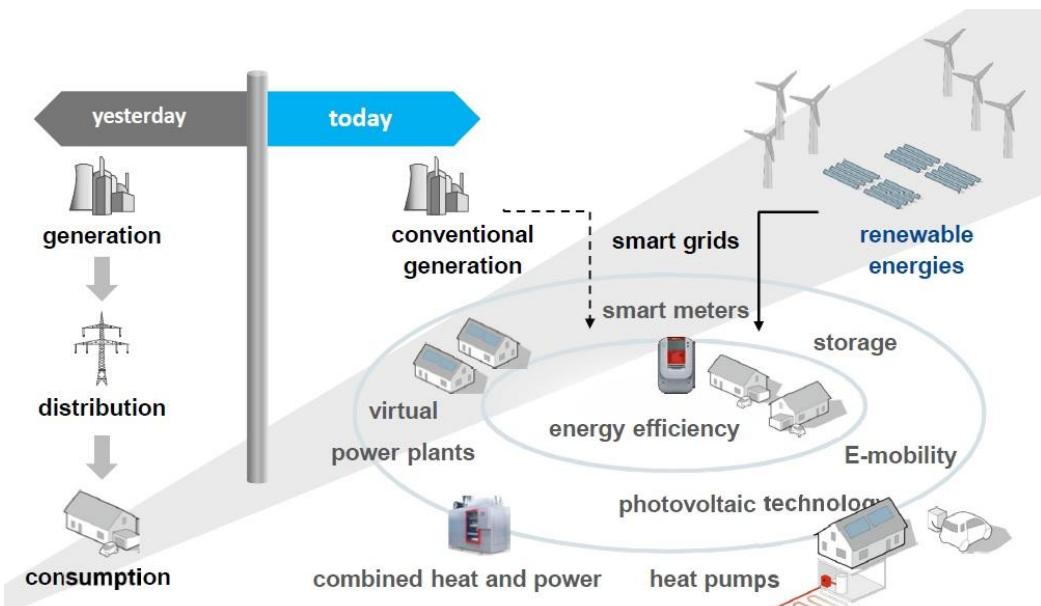
- Allows **sharp decarbonisation** in key segments of the energy market – notably when paired with new PV installations
- Ability to derive **multiple value streams** by providing a range of services with one storage system
- New **flexibility and service delivery options** enabled by local generation, storage, controllable loads and intelligent communication („**DSO 2.0**“):
 - **Congestion management** in the distribution grid and in the transmission grid out of the distribution grid
 - **Voltage quality management** in the distribution grid and in the transmission grid out of the distribution grid
 - **Physical balancing of generation and load** in the distribution grid and balancing power for the transmission grid out of the distribution grid
 - **Restoring of supply** in the distribution grid and in the transmission grid out of the distribution grid

Multiple value streams ...

Figure ES1: The range of services that can be provided by electricity storage

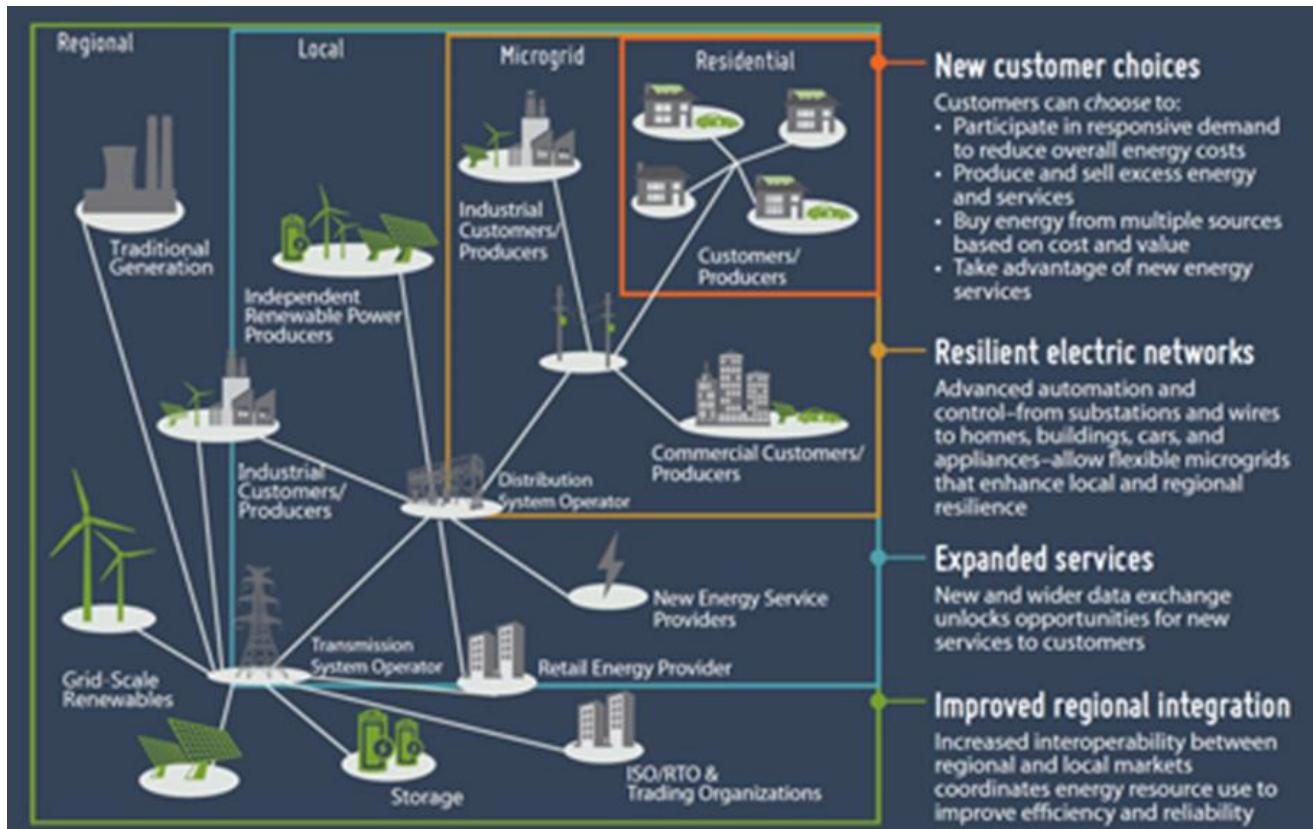


DSO 2.0 concept



Source: EWE Netz / Enera

Transactive energy system concept



Source: GWAC

Importance of transportation policies



Electric transportation as key lever

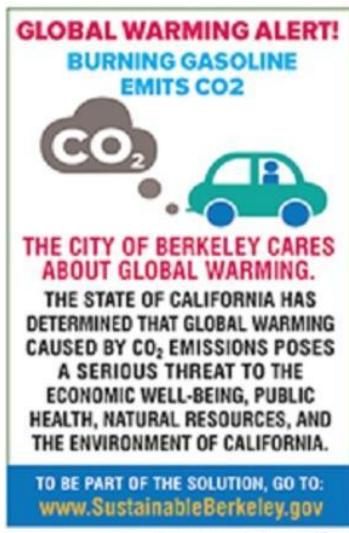
- Steering taxes, carbon-emission-based taxing of fuels
- Public awareness that burning fossil fuels is causing sadness and despair for other people around the globe
- Dedicated parking space for **shared BEVs** (P2G possible)
- Restricted access zones for ICEs in cities
- Increased share of **electric busses and taxis**
- Making cities for people (cf. <http://gehlpeople.com/>)

Awareness raising at the right place

Coming Soon in Canada: Gas Stations With Climate- Change Warnings

Like cigarette warning labels, but for fuel

JOHN METCALFE | NOV 20, 2015 | TECHNOLOGY



Give parking space to shared BEVs

Brooklyn Turns to Data to Help Solve Its Car-share, Parking Problem

The New York DOT is launching a two-year, data-driven pilot program in an attempt to reduce vehicle ownership and free up precious parking spaces.

BY NEWS STAFF / AUGUST 23, 2017



Source: Renault Netherlands

Electrifying public transport

Nagpur gets India's first fleet of electric vehicles

By Rajat Arora, ET Bureau | Updated: May 27, 2017, 01.18 AM IST



24
Comments

A+



The pilot project will commence with a 200-strong fleet, including 100 of Mahindra's new e2o Plus vehicles.

NAGPUR: The Orange City has become India's first city to have [electric mass mobility system](#). It will have a fleet of 200 electric vehicles including taxis, buses, e-rickshaw and autorickshaws, all of which will be fully owned by cab aggregator Ola.

Road transport and highways minister Nitin Gadkari, along with [Maharashtra Chief Minister Devendra Fadnavis](#), inaugurated [India's first multi-modal electric vehicle project](#) at the Nagpur Airport Complex on Friday.

Since January 30th, the two high-capacity 100% electric buses circulate with passengers in Barcelona, on the H16 line of Metropolitan Transports of Barcelona (TMB).

This is the first line, between Forum and Zona Franca, which integrates the two first bi-articulated 100% electric buses of 18m with Opportunity charging. The battery is recharged up to 80% in less than 8 minutes in the layover time, at the end of the route in Zona Franca, thanks to the ultrafast 400 kW charger installed by Endesa in Spain. Endesa has also provided the two chargers for the overnight charging at TMB depot.

OFFICIAL

Amsterdam's Schiphol airport launches fleet of 167 Tesla electric taxis

NOAH JOSEPH Oct 20th 2014 at 7:51AM



Financing upfront investments vs. fuel costs



A mosaic of finance strategies

- Reducing financial cost components
- Reducing soft cost components
- Influencing device prices by procurement policies
- Transforming markets with Green Banks (e.g. making storage investments bankable)
- Allowing for innovative community solar funding

Reducing financial cost component for distributed solar+storage projects

Figure 12: The share of the costs of capital in the LCOE of PV systems

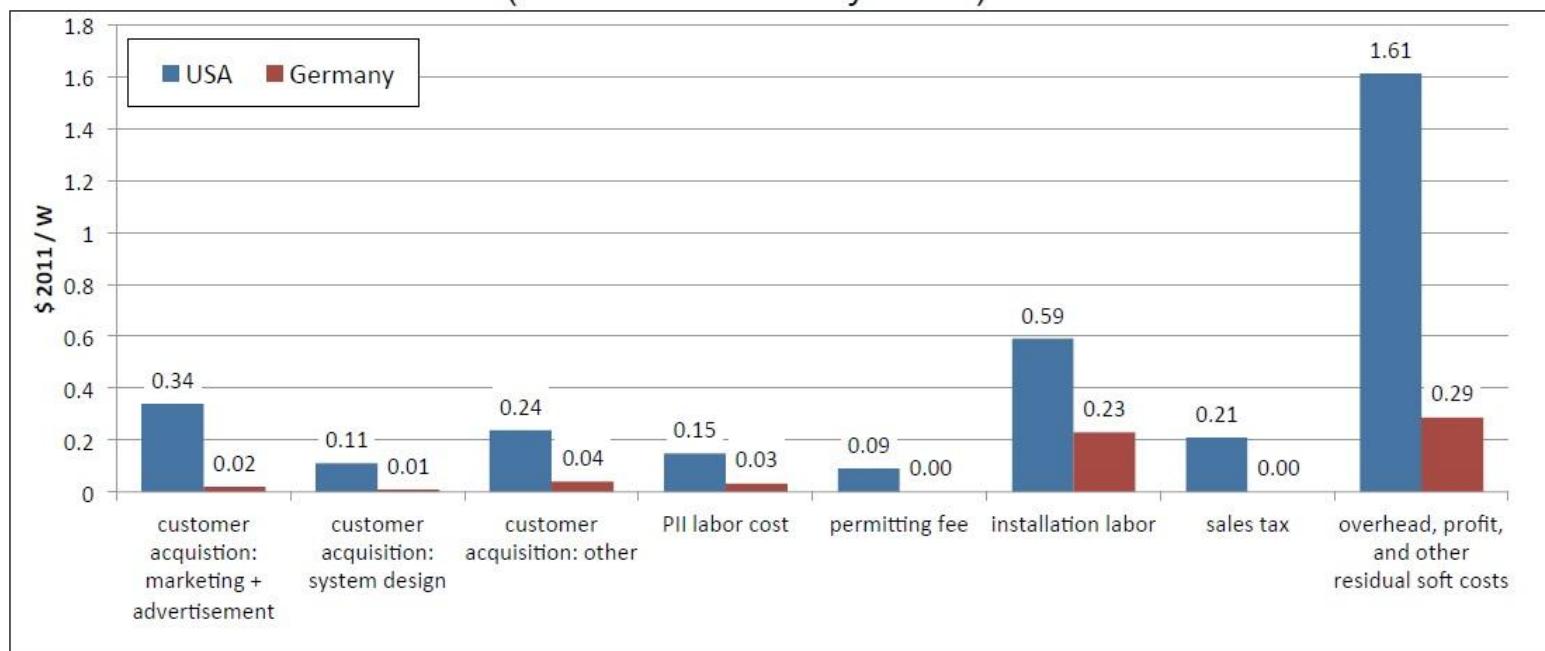


Notes: This example is based on output of 1 360 kWh/kW/y, investment costs of USD 1 500/W, annual operations and maintenance (O&M) of 1% of investment, project lifetime of 20 years, and residual value of 0.

KEY POINT: When the WACC exceeds 9%, over half the LCOE of PV is made of financial expenditures.

Reducing soft cost component for distributed solar+storage projects

**Comparison of Soft Costs for Residential PV in Germany and the U.S.
(customer-owned systems)**



Source: Berkeley Lab 2013

Influencing device prices by procurement policies

Business ▶ Policy

India orders 770 million LED light bulbs, prices drop 83 per cent

Subsidised bulbs sold for US\$1.28, cuts peak load by 2,346 MW

By Simon Sharwood, APAC Editor 1 Apr 2016 at 03:03

85 SHARE ▼

Shri Piyush Goyal, India's minister of State (IC) for Power, Coal and New & Renewable Energy yesterday celebrated the fact that in just 20 months the price of LED lightbulbs has fallen from 310 rupees (US\$4.68) to 54.9 rupees (\$0.84), an 83 per cent plunge that is partly India's fault.

In early 2015 the nation adopted a policy called the [Domestic Efficient Lighting Programme \(DELP\)](#), which sees the nation acquire LED lightbulbs for subsidised sale to households. Prime minister Narendra

AUTOS • ELECTRIC VEHICLES

Cities Across the U.S. Will Splurge on Electric Vehicles After Automakers Said There Wasn't Enough Demand

By Ryan Kilpatrick March 15, 2017 March 15, 2017

Thirty U.S. cities, including New York, Los Angeles and Chicago, are looking to spend \$10 billion on electric cars and trucks in a bid to prove to automakers that there is healthy demand for low-emission vehicles.

Municipal authorities have asked automakers about a total of 114,000 electric vehicles such as police cruisers, Bloomberg [reports](#).

HANDWERKER, HÄNDLER, DIENSTLEISTER

Die Fan-Gemeinde des Streetscooters wächst

Datum: 15.10.2017 12:33 Uhr

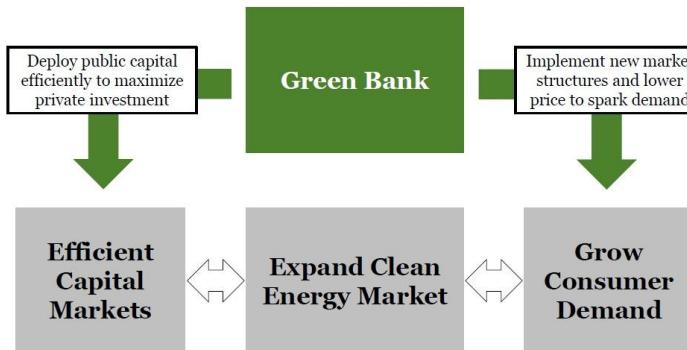


DEUTSCHE POST
Neue Fabrik für E-Transporter geplant

Den StreetScooter fertigt die Deutsche Post künftig nicht mehr nur in Aachen: Der Konzern will in Düren eine weitere Produktionsstätte eröffnen. So soll eine Jahresproduktion von 30.000 Fahrzeugen gewährleistet werden. [mehr...](#)

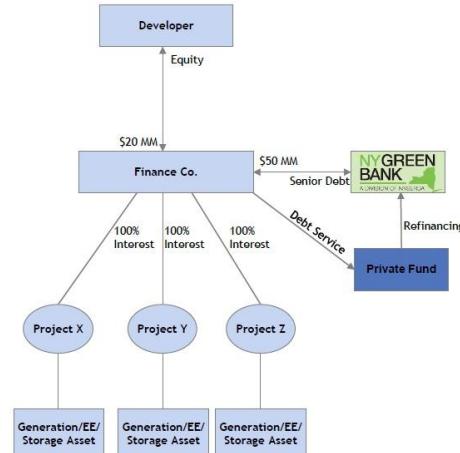
Transform markets with Green Banks

Tactics at Work: Use Green Banks to Transform Markets



Quelle: Green Bank Connecticut

Senior Aggregation Facility (Storage Assets)



Quelle: New York Green Bank

Community Solar initiatives

Solar power plant in Vienna a nature habitat

The Local

[news.austria@thelocal.com](http://news.austria.thelocal.com)
@thelocalaustria

2 September 2014
17:04 CEST+02:00

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The solar power plant in Vienna's 23rd district. Photo: Wien Energie/Thomas Preiss

A solar power plant in Vienna serves a double function - not only does it create renewable energy, but it also provides an optimal habitat for endangered insects and small mammals.

Vienna residents can purchase up to ten photovoltaic panels from Wien Energie. Each panel costs €950. They then rent the panels back to Wien Energie and receive an annual fee of €29,45, per year, per panel - for a minimum of five years.

After around 25 years Wien Energie buys the solar panels back and the resident is repaid in full.

The Sun Exchange (crowd platform)



- Real-time revenue streaming
- Block-chain connected smart meters
- Totally transparent investment performance tracking

“Earning income from the infrastructure you want to see in the world”

Concluding remarks



Positive governance can lead the way

- Political and community support for PV is an essential pillar of success in climate politics
- Sharp decarbonisation requires storage and local balancing of generation and load
- Unsustainable behaviour should be challenged
- Desirable transformations need a promoter and can rely on excellent examples
- Critical cost components can be influenced

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CLIMATE ACTION PLANNING



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FINANCING · PROCUREMENT ·
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ENERGY MONITORING & ANALYSIS

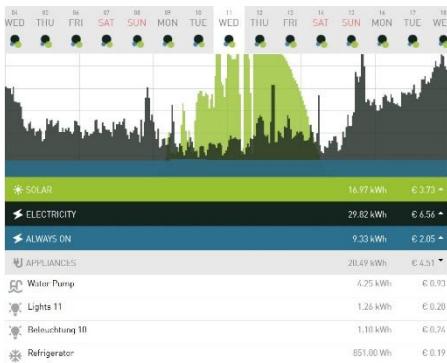


TRANSFORMATIVE PRODUCTS



REMOTE ASSET OPERATION &
MANAGEMENT

Serial produced system technologies



Highly efficient & affordable units

Many Thanks!

Contact:

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Zukunftsrede

„Wir waren jene, die wussten, aber nicht verstanden, voller Informationen, aber ohne Erkenntnis, randvoll mit Wissen, aber mager an Erfahrung. So gingen wir, von uns selbst nicht aufgehalten.“

Roger Willemesen, WER WIR WAREN - Zukunftsrede, Juli 2015