Universität Stuttgart
IER Institut für Energiewirtschaft
und Rationelle Energieanwendung

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EnerKey

„Renewable energy technologies for Gauteng – Progress and current achievements for a low carbon city development

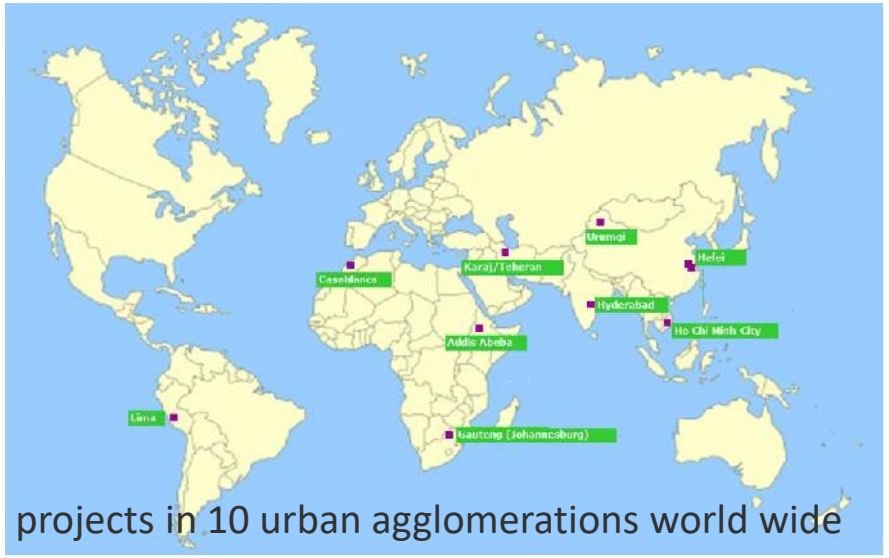
Dr. Ludger Eltrop
Head of Dept.
„System analysis and
Renewable Energy“
Visiting Prof. UJ (SA)

The “MEGACITIES” – program of BMBF

Overall goal: developing and implementing innovative and effective structures for climate efficient structures in future megacities.

Objectives for Gauteng

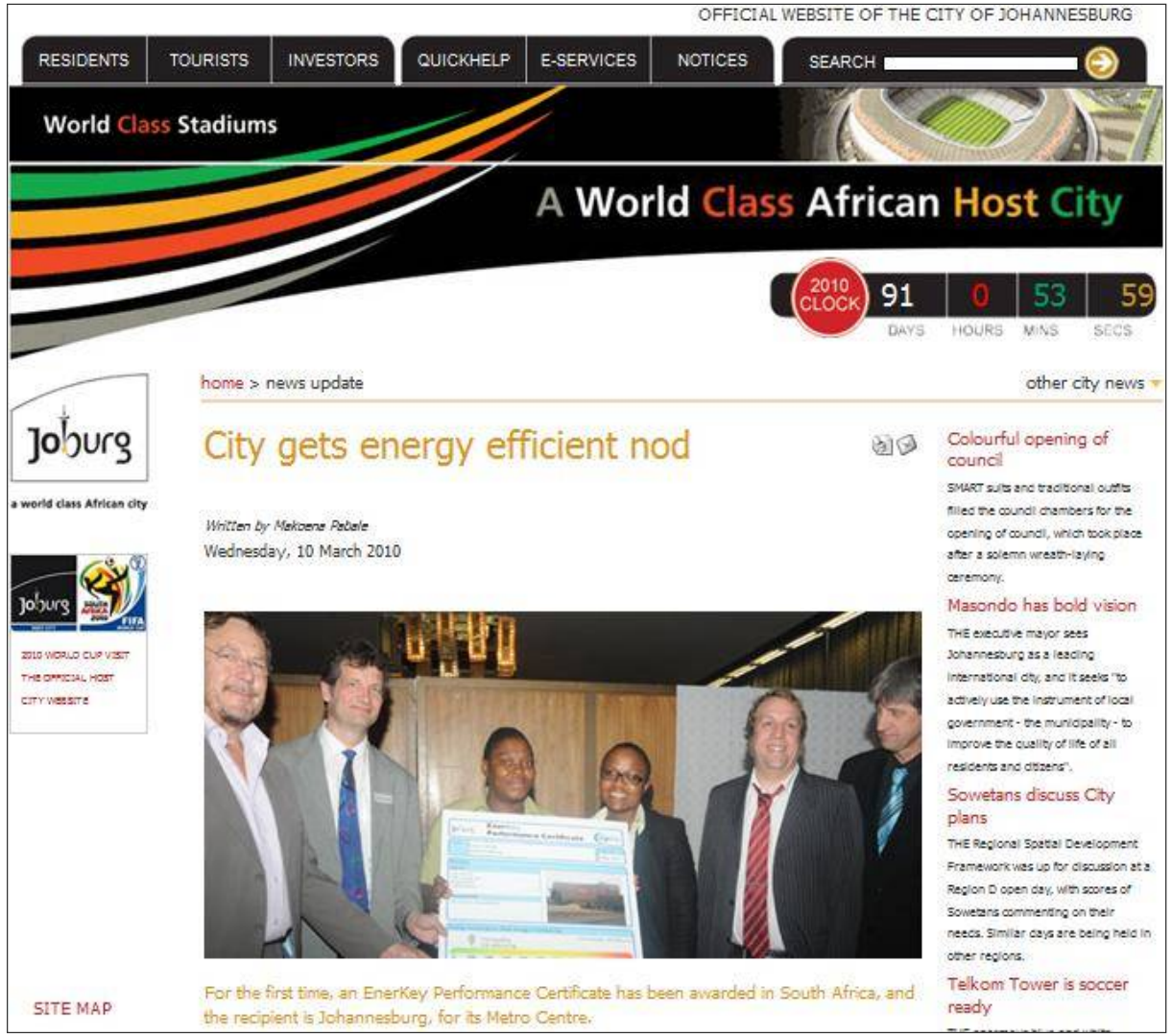
1. identify most effective technologies and measures for energy structures and climate protection
2. develop, apply and provide tools/instruments for advanced urban energy planning and climate protection
3. demonstrate the feasibility of integrated approaches for robust decision making and sustainable long-term progress
4. foster implementation by forming strategic partnerships between research, city administration, business and implementation agencies/NGO
5. initiate, monitor and improve exemplary case studies and practical solutions



projects in 10 urban agglomerations world wide

Exemplary result of the EnerKey program

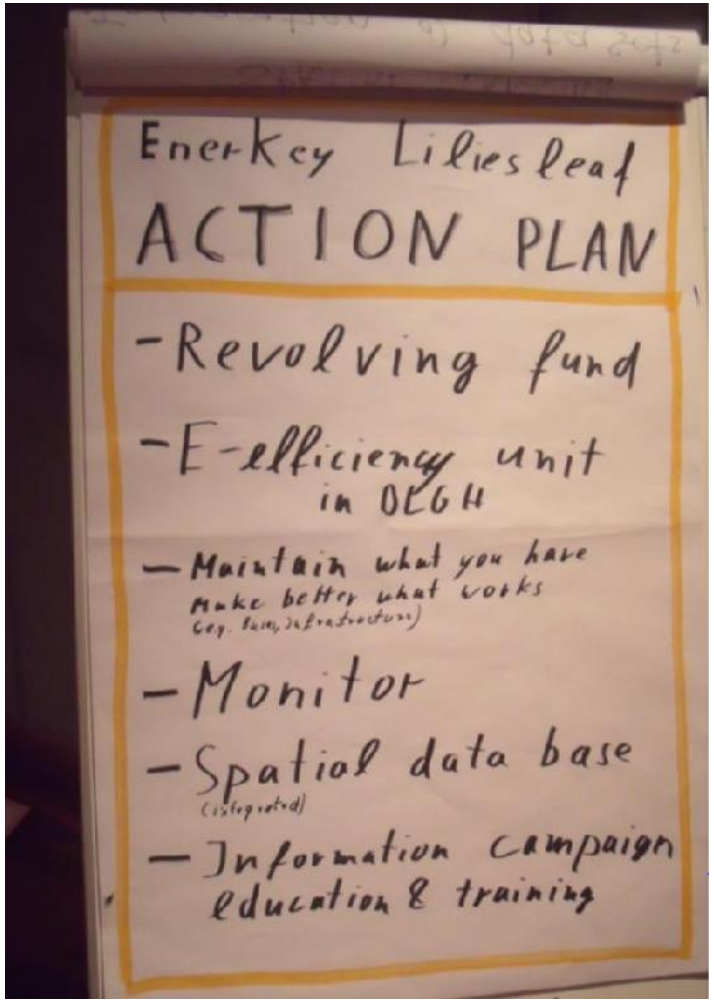
First EnerKey Performance Certificate to City of Joburg



Other results and implementation activities

- Energy management
- Energy auditors training
- SeTAR stove test center
- iEEECo settlements
- ASH climate house
- Long term perspective group (ELPG)
- EnerKey schools project
- Training for energy planners
- CDM evaluation tools
- CDM PoA development

EnerKey Liliesleaf Action Plan for Gauteng 2015



Key Areas	
	1. Governance - setting the right incentives
	2. Government – leading by example
	3. Liveable buildings – building an inclusive environment
	4. Transport and mobility – integrating the needs

Key Areas	
	5. Industry – using Best Available Technologies and creating a dedicated agency
	6. Energy supply systems – taking advantage of regional and renewable resources
	7. International cooperation – strengthening the 'Global City Region'
	8. Land use and urban development – keeping a balance

The energy transition – a multifaceted transformation

Solutions for energy intensive industry

Costs and revenue distribution

Decentralisation of energy structures

New and emerging technologies

Sector coupling

distribution grid

Market based vs. regulatory measures

Downscaling of technologies

Political framework

Electricity, heat & mobility sector

Cellular systems on neighbourhood scale

Social justice and equal access to services

The German Energy Transition - A project for the whole society!!

1. Nuclear phase-out

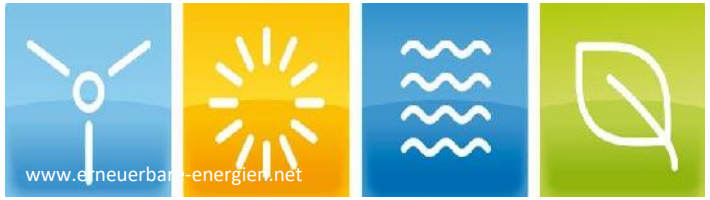
2. Energy supply with renewable energy technologies

3. GHG emission reduction and reaching the Paris emission targets (< 2°C)

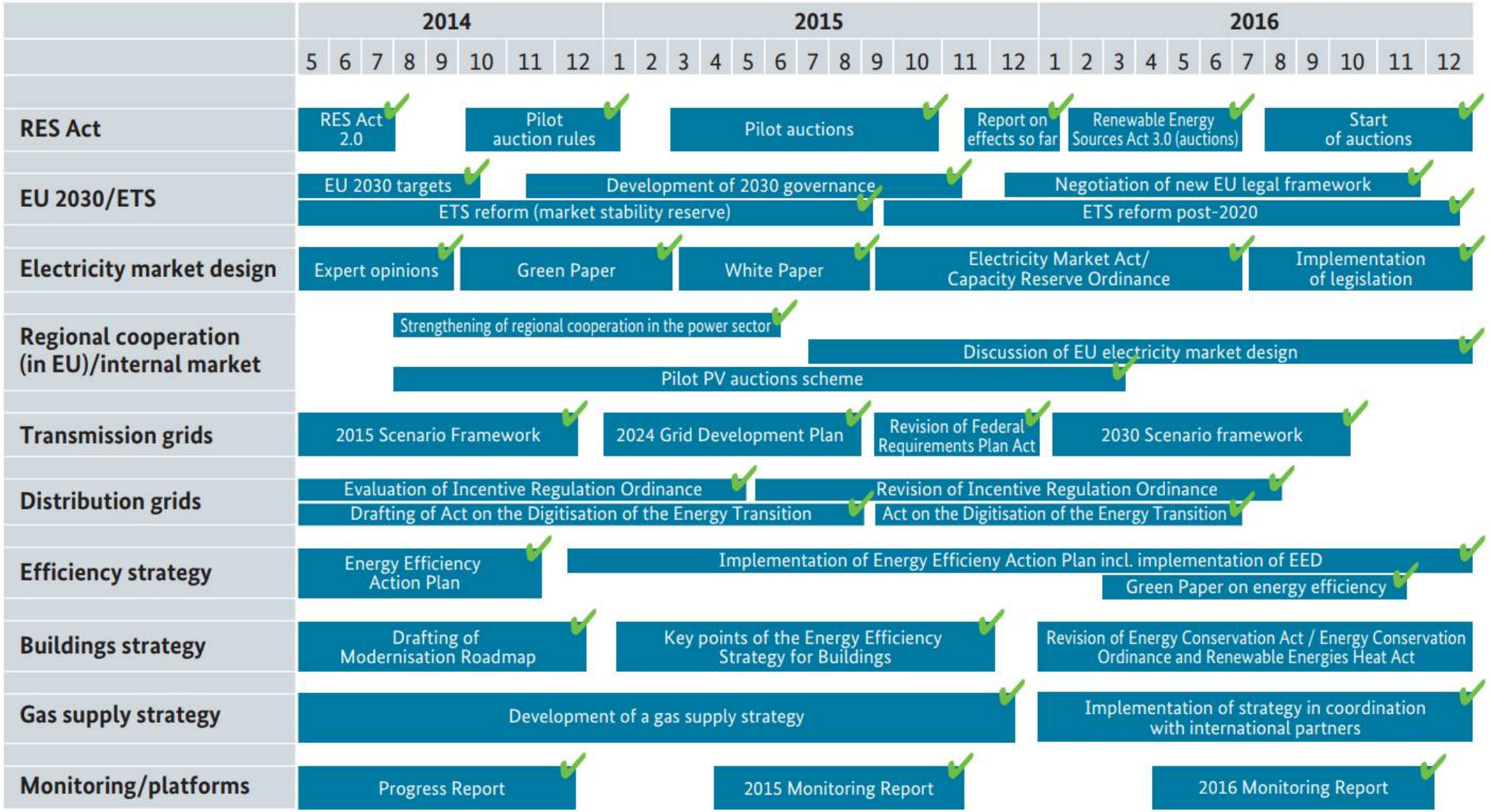
4. From central to decentral energy infrastructures

5. Maintaining Germany's economic strength and competitiveness

6. Democratisation and peoples participation in a vital infrastructure

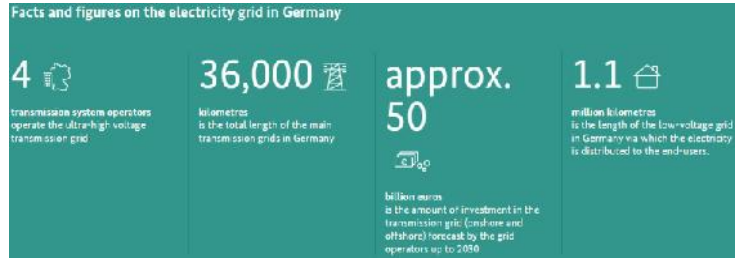


The energy transition in Germany – key projects and activities 2014 - 2016



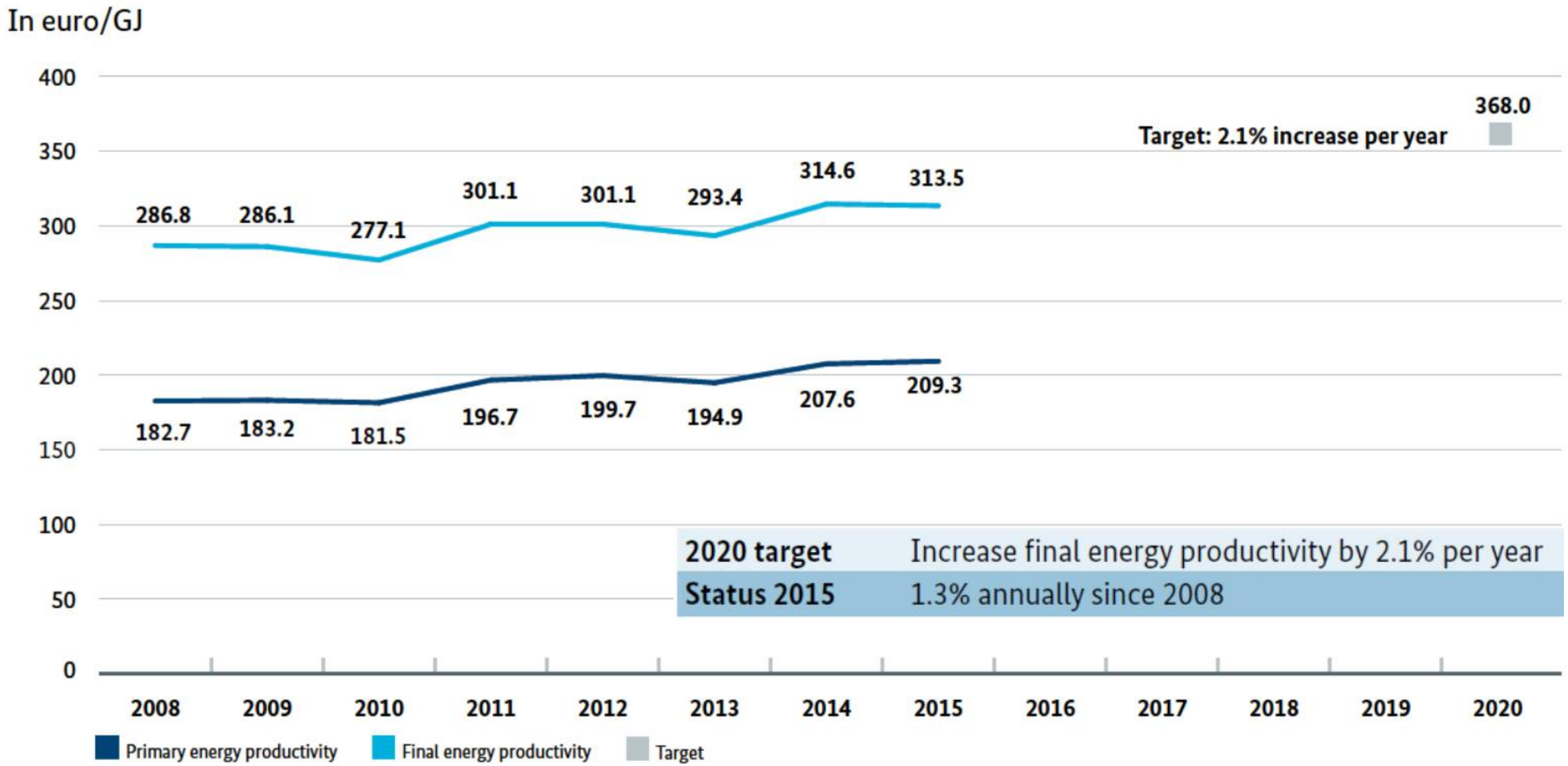
Source: BMWi 2018, 3rd update Dec. 2016

The energy transition is on the full run and has changed the whole energy system already now!



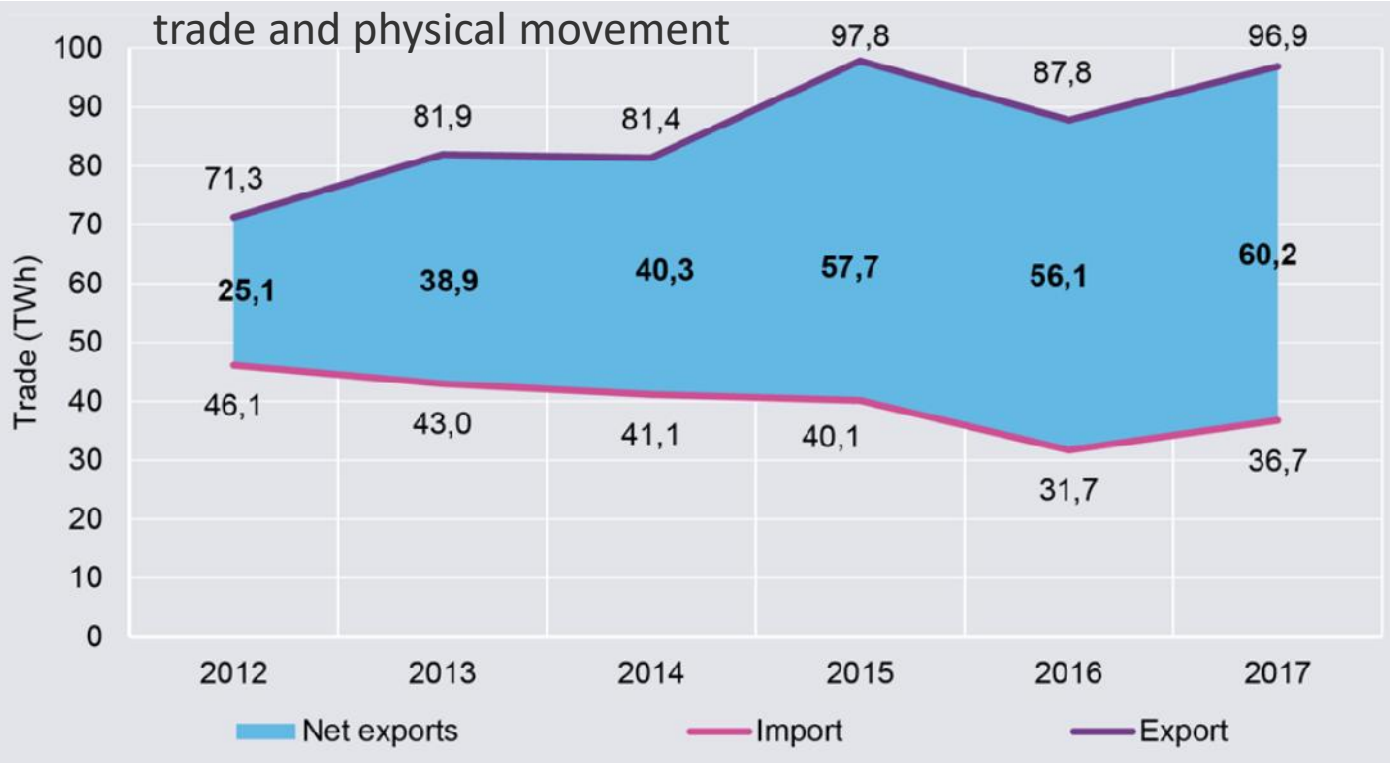
Source: BMWi 2018

Energy productivity in Germany increased

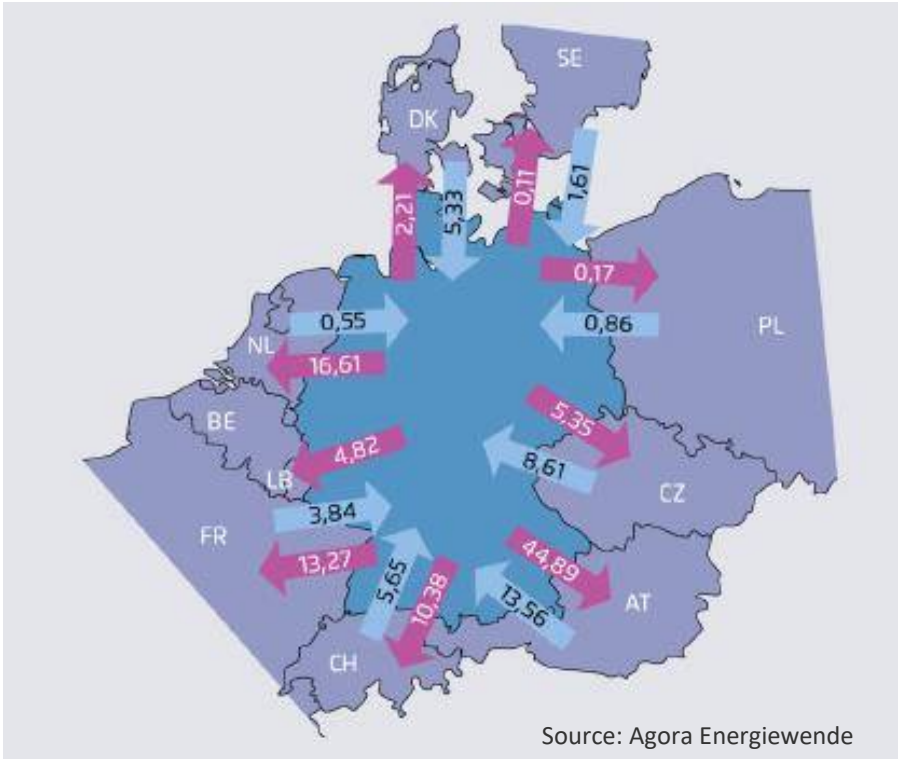


Source: AGEB und AGEE-Stat. 2016, from BMWi 2017

Export-Import balance for electricity increased considerably

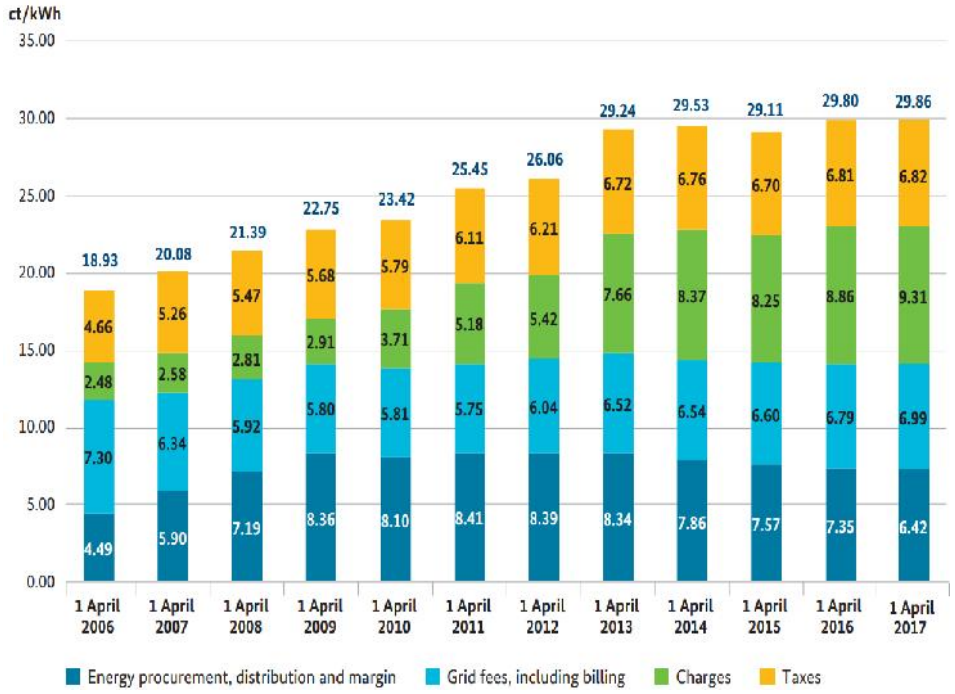


Electricity Export and Import from Germany 2015



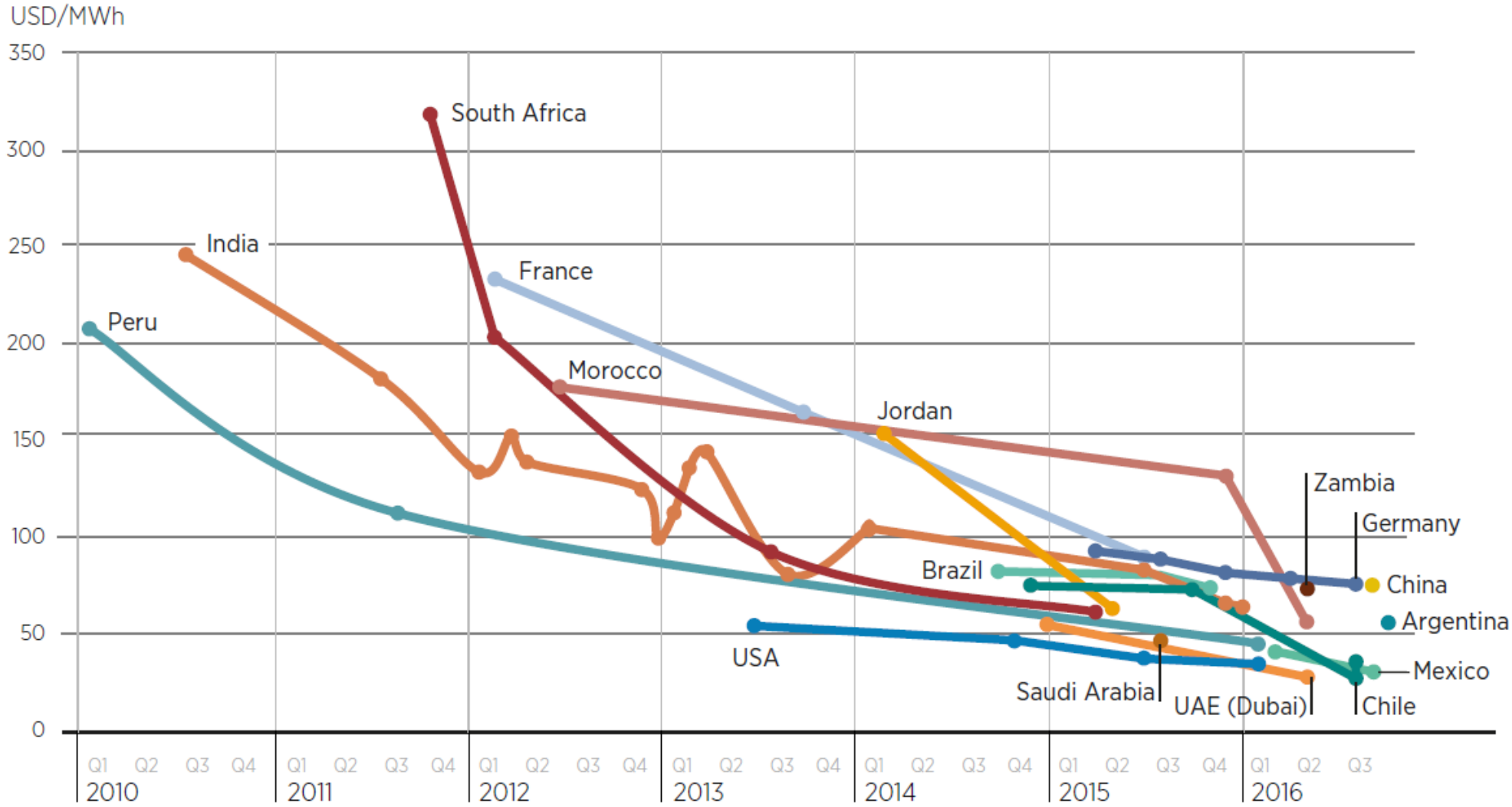
Source: AGORA Energiewende 2017

The question of costs becomes vital for acceptance and economic competitiveness



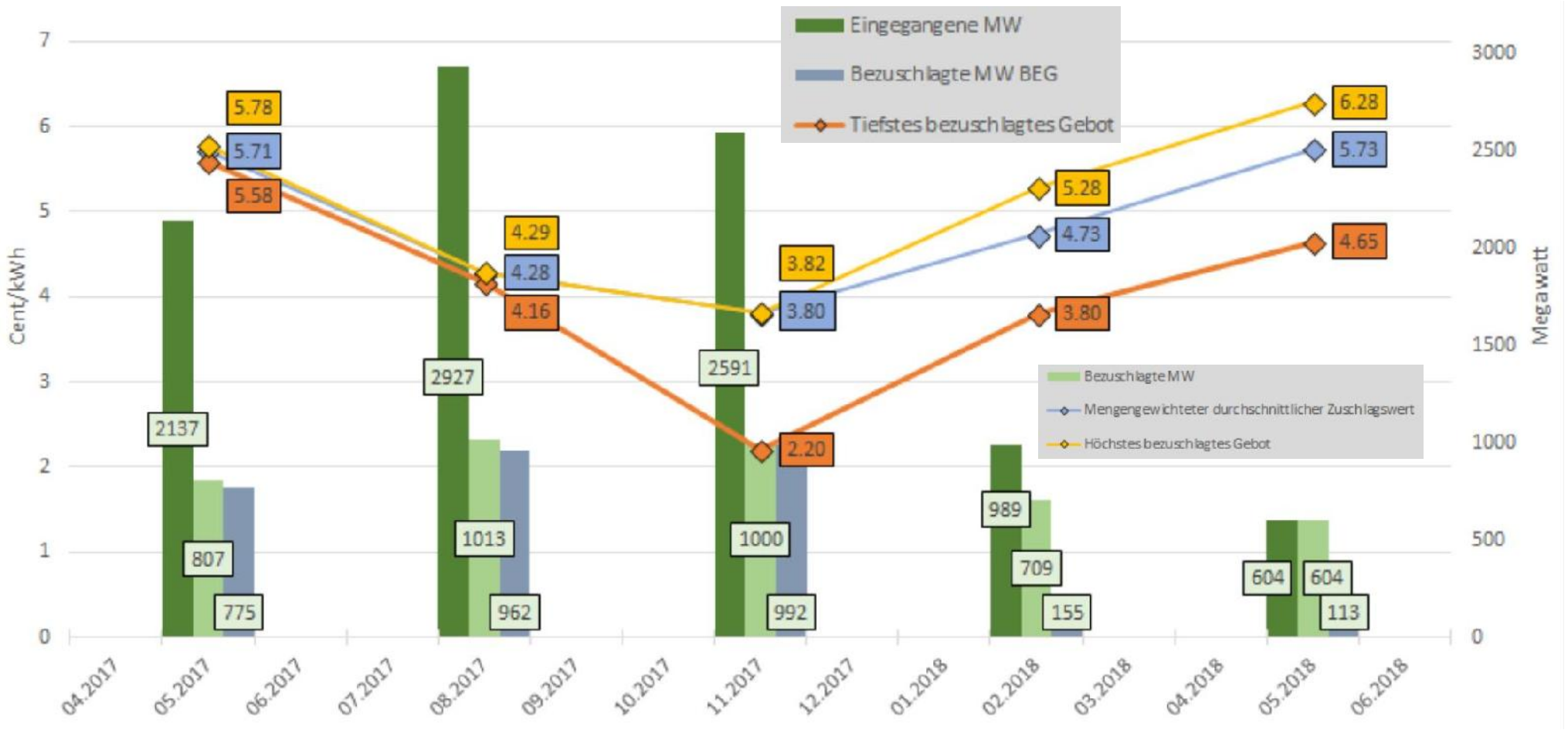
Source: www.weltflaggen.de

Auction price development for utility scale solar PV installations – world wide comparison



Source: IRENA 2017

Price development for wind onshore within the new auction system in Germany



Source: green[::]match 2018

Wind offshore projects with no subsidies are in sight!

Dong Energy breaks subsidy link with new offshore wind farms

Danish group to build German schemes without financial aid in groundbreaking deal

© Bloomberg

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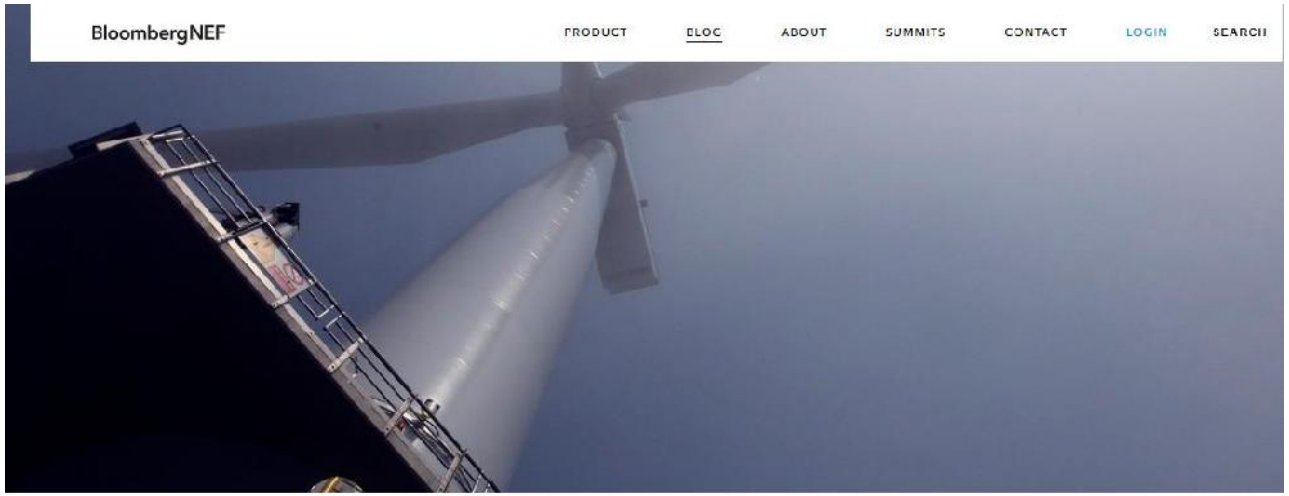
Pilita Clark, Environment Correspondent APRIL 14, 2017

The green power industry has hit a milestone after the world's largest offshore wind farm company said it would build two German schemes without any subsidies.

Source: Financial Times



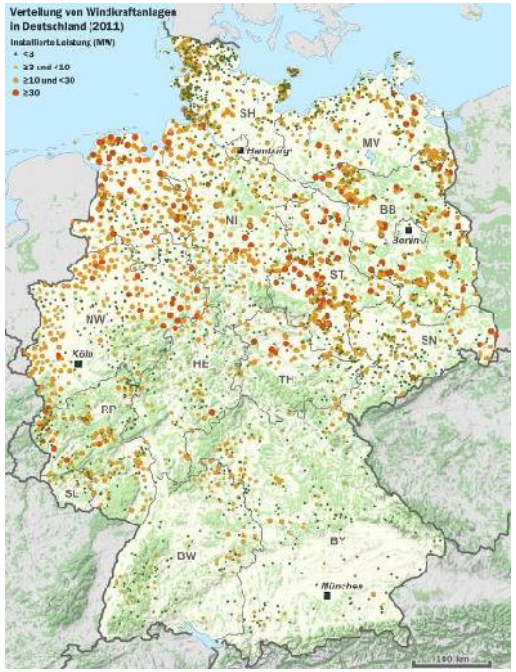
Dong Energy's Zero-Subsidy Offshore Wind Farms Are Ripe for 'Farm-Downs'

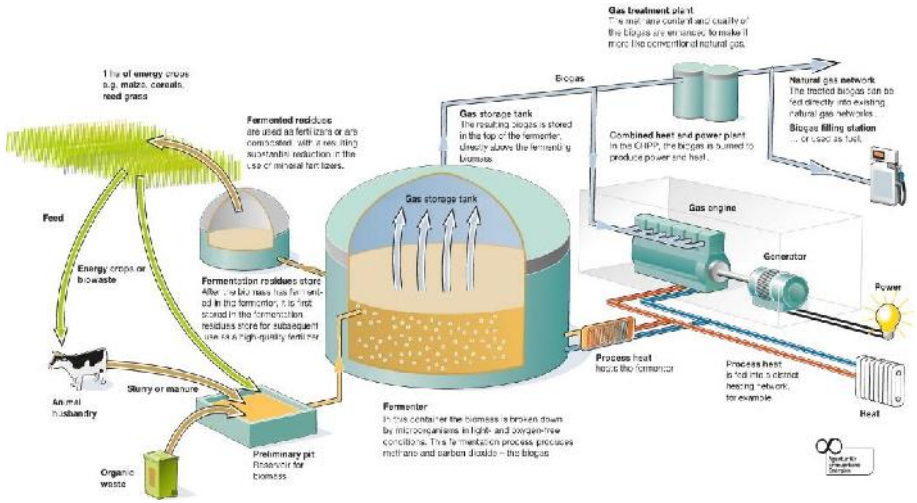
August 22, 2017

By Bryony Collins, Bloomberg New Energy Finance editor. This article first appeared in BNEF's 'New Energy Deals' publication, available to clients on the web and on the Bloomberg Terminal.

Source: Bloomberg NEF

Technology development and integration is key!





Mega wind turbines (15-20 MW) are on the way


Twelve to 21-MW turbines are possible and with today's components

By Paul Dvorak | November 12, 2018

Windpower ENGINEERING & DEVELOPMENT

WINDPOWER MONTHLY

WindTech: ZF modular concept scalable for 15MW turbine

1 March 2018 by Elze de Vries

INDIA/BELGIUM: Elze de Vries visits the gearbox manufacturer's facilities in India and Belgium to talk about market challenges and discover how the company's flexible platform can help drive down costs while scaling up for ever bigger turbines.

GOOGLE TRANSLATE

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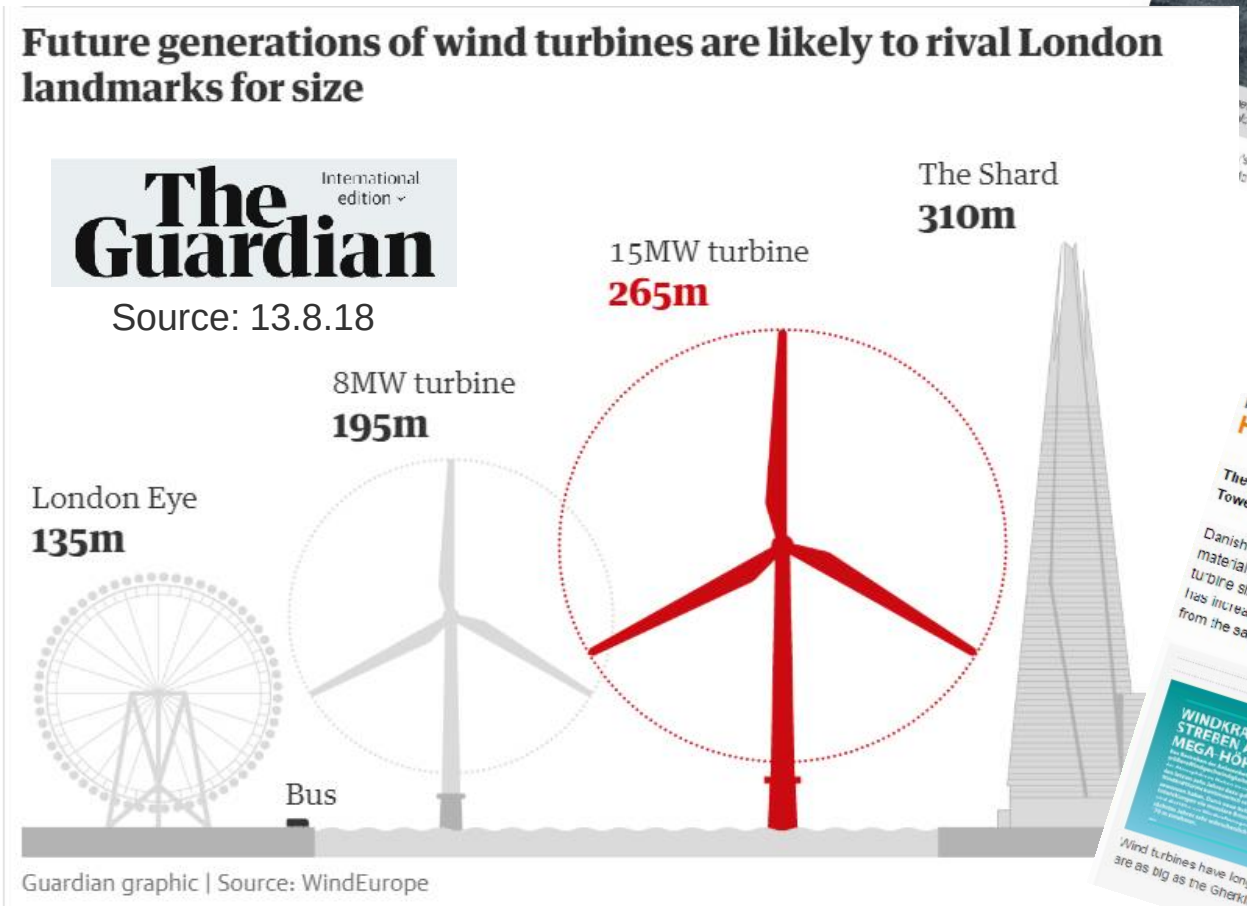



12-15 megawatt turbines possible within years, says Dong Energy

Thu 18 May 2017 by David Foxwell

Print story Email us

Offshore Wind


Innovation

How big can wind turbines get?

The latest wind turbines have blade tips reaching up as high as the Gherkin in London. Next stop, Eiffel Tower.

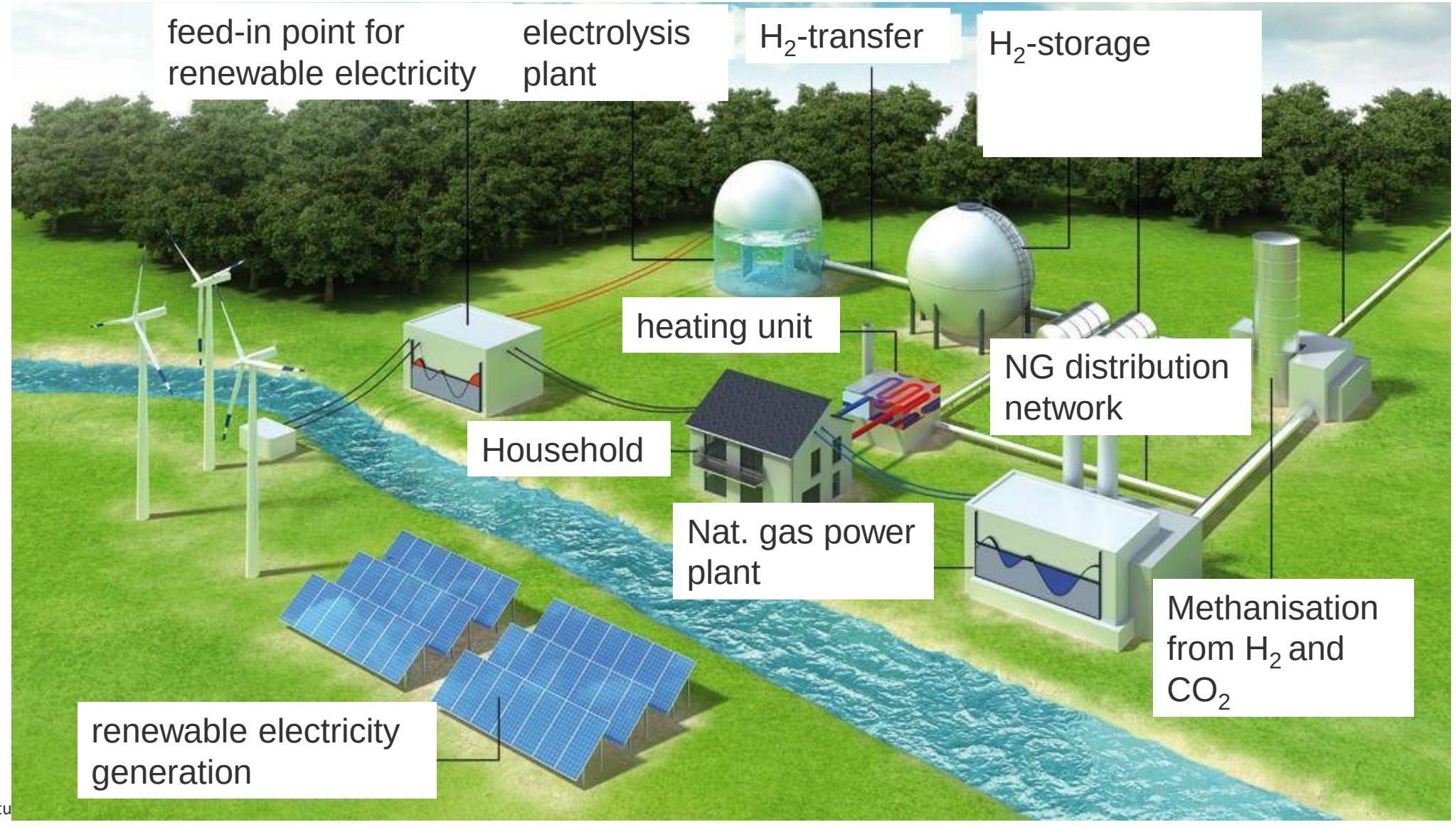
ERNEUERBARE ENERGIEN

Danish wind power technology specialists K2 Management say that new installation methods and new materials could take hub height up to 170 meters in the foreseeable future. In the past few years, the average turbine size installed in Germany, for instance, has continued to increase. Since 1999, the average hub height has increased by 48 percent. The higher you get, the stronger the winds blow, and they come more constantly from the same direction with less turbulence.

WINDKRAFTTÜRME STREBEN AUF ZU MEGA-HÖHEN

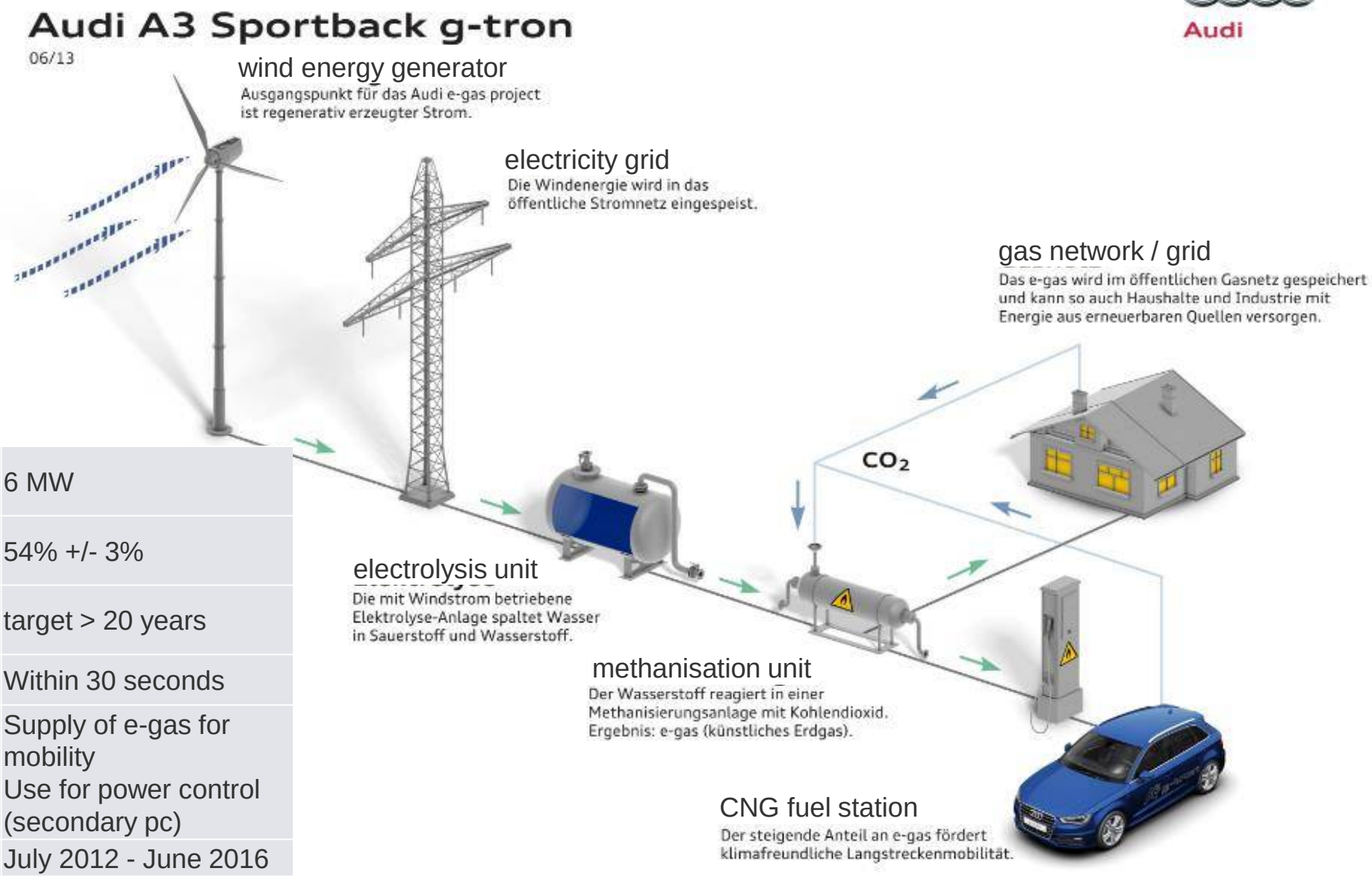
Wind turbines have long been as big as the Statue of Liberty and giant Ferris wheels. You can now also buy some that are as big as the Gherkin skyscraper in London. Machines as tall as the Eiffel Tower are already in the works as well.

The new flexibility option: sector coupling and „P2G” (power-to-gas)



source: EnBW

World wide first industrial Power-to-Gas-plant AUDI



Typ. plant capacity	6 MW
efficiency: AC/VN CH_4	54% +/- 3%
Life time at 1 cycle/day	target > 20 years
Availability	Within 30 seconds
Application examples	Supply of e-gas for mobility Use for power control (secondary pc)
Operation time	July 2012 - June 2016

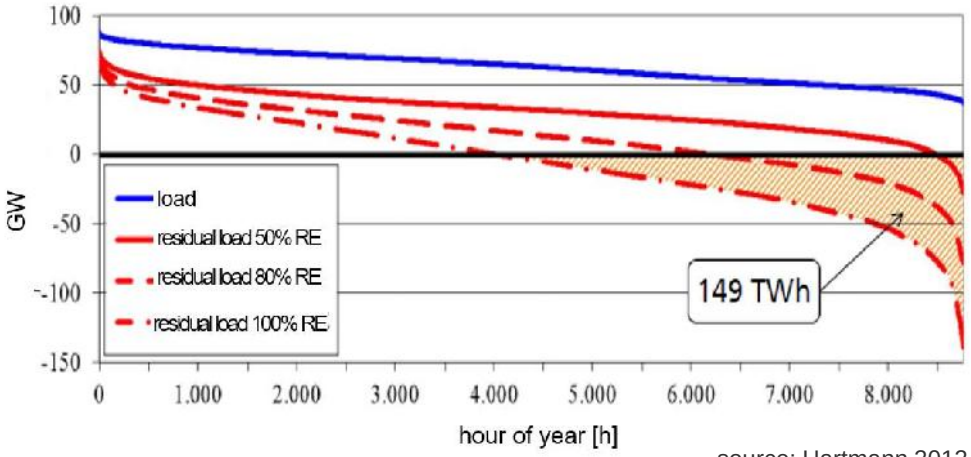
Source: http://forschung-energiespeicher.info

PV - the renewable energy for the urban environment

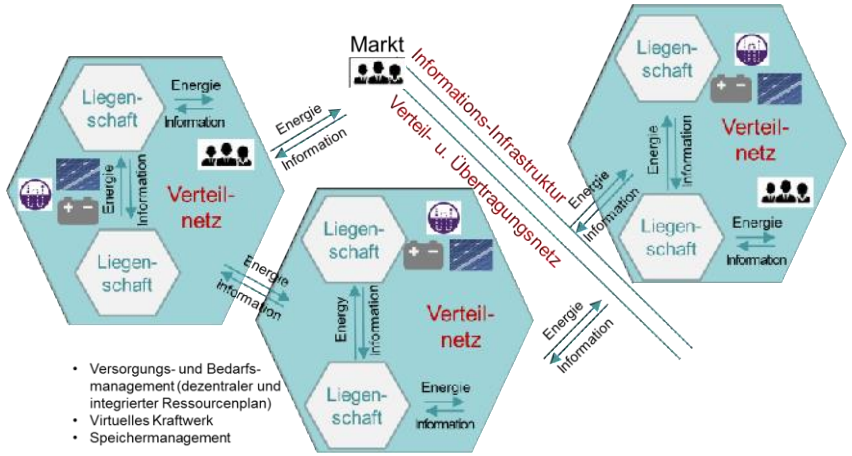
Space is available in the cities - especially on offices and industrial buildings

Many opportunities are there – combination with e-mobility and local energy cells

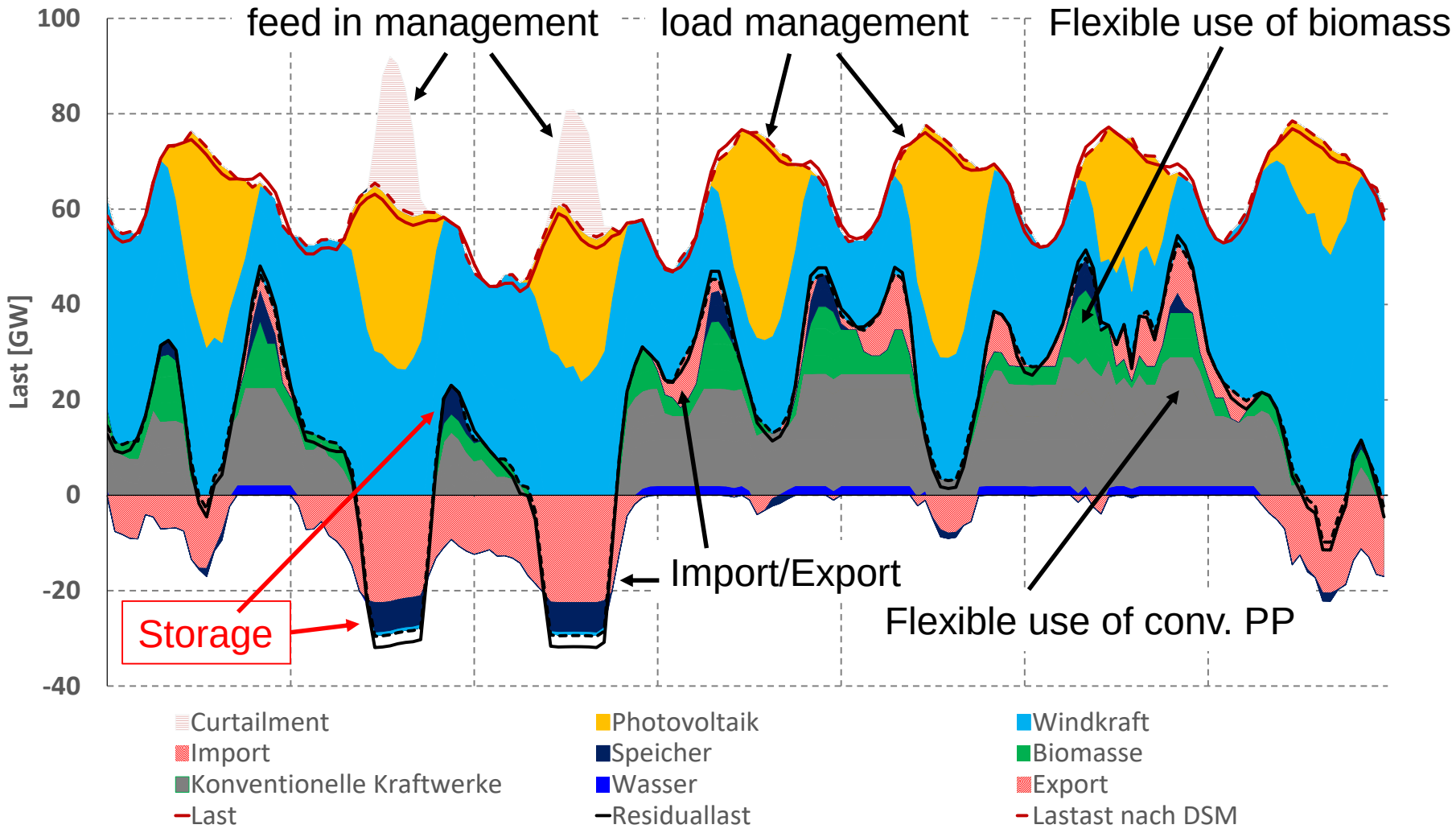
How will the future look like? Five ideas …



source: Hartmann 2012



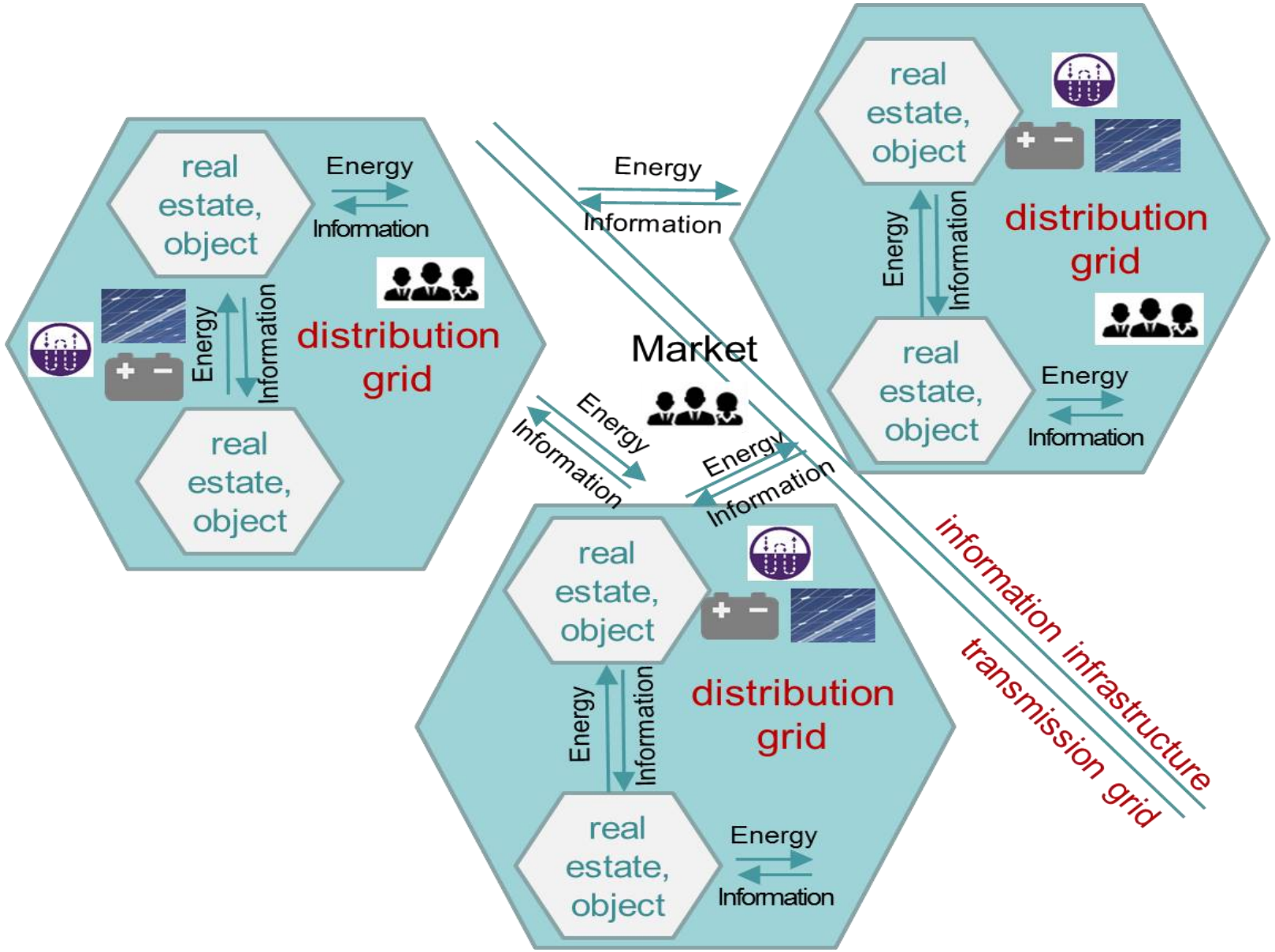
Flexible (electricity) energy systems are key – from demand to supply driven energy systems



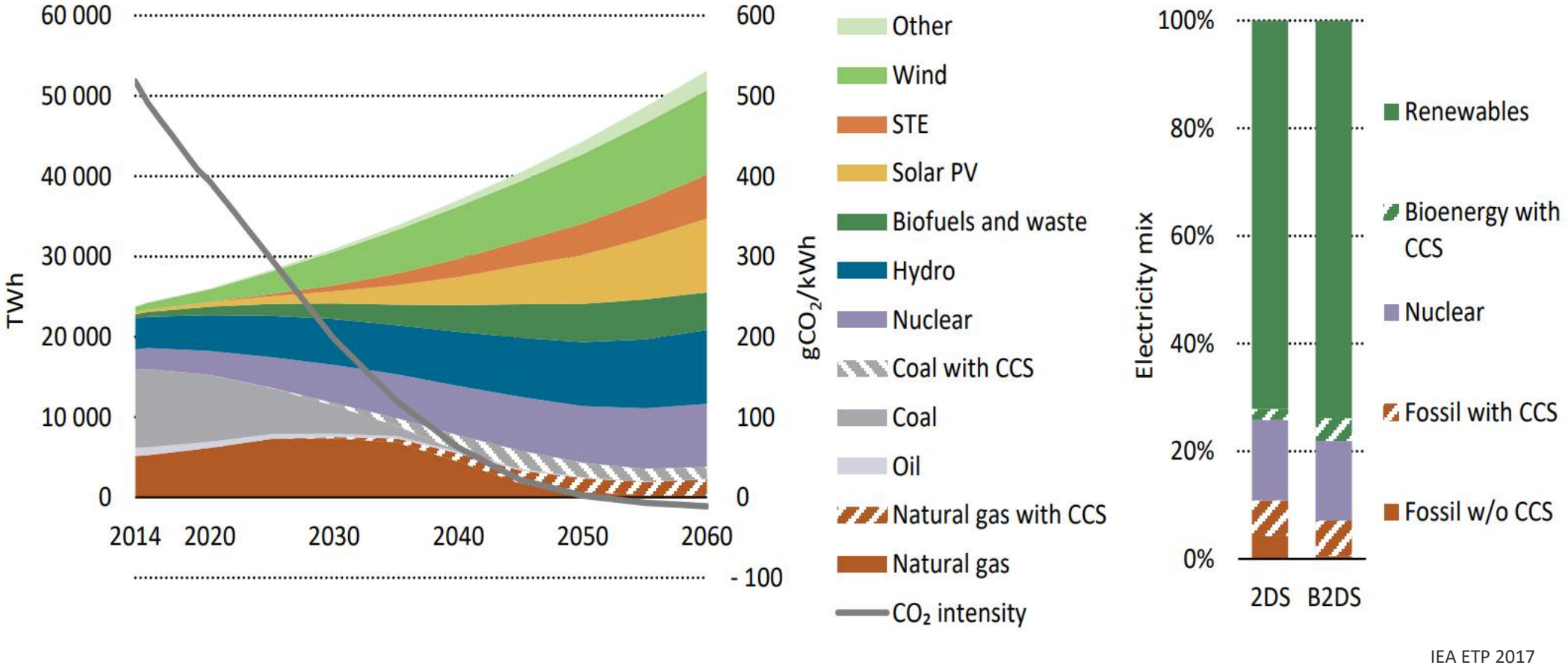
* example week

Source: IER University Stuttgart

Small scale, autonomous, reliable and sustainable local ‘energy cells’ are becoming attractive



Bioenergy must be used wisely as a decisive ‘flexible’ technology and energy rich C-resource

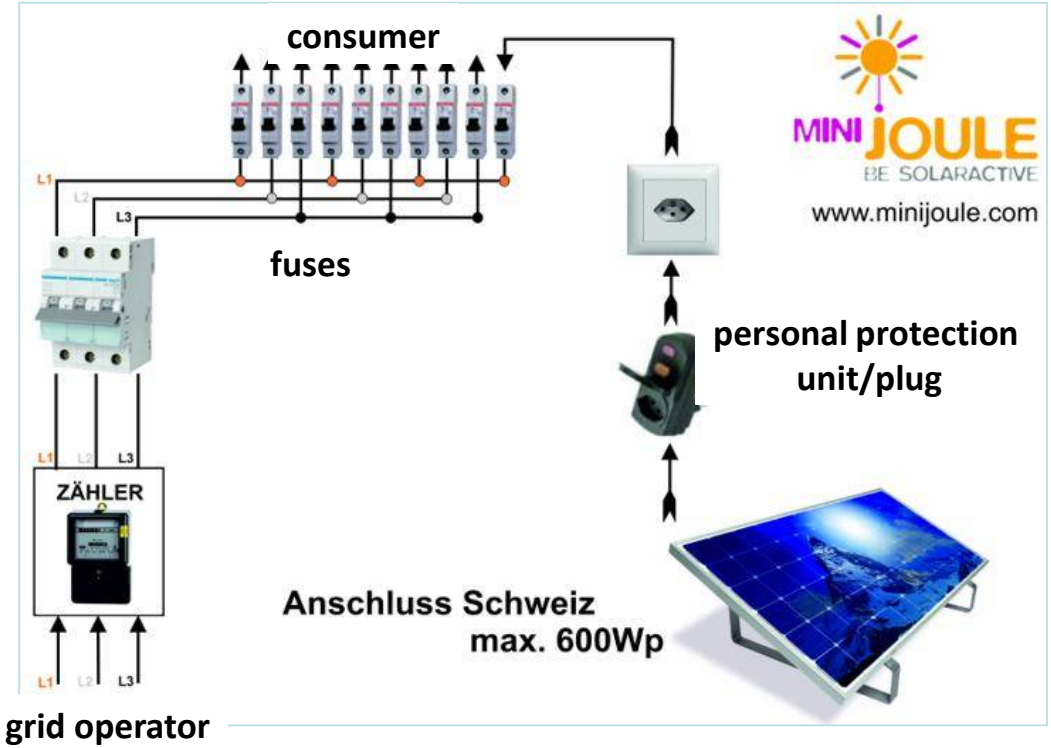


IEA ETP 2017

Global electricity generation is decarbonized by 2050 in B2DS and becomes a source of neg. emissions with significant deployment of BECCS (B2DS=beyond 2° scenario; BECCS = 2% of sustainable bioenergy with CCS; 2DS = 2° scenario; rts=reference technology scenario)

Source: IEA ETP 2017

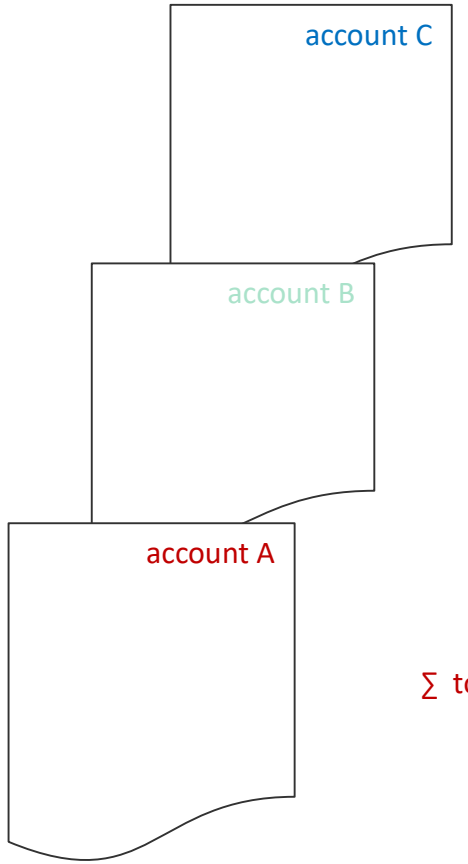
The share of self-production and consumption will increase



Small scale and plug-in PV

Storage systems need to be integrated in a smart, intelligent way

The electricity bank



∑ total kWh produced

∑ total kWh produced

∑ total kWh produced

System: Lithium-Ion-Batteries (ads-tec) **capacity:** 100 kW, 116 kWh extendable to 580 kWh; **operation:** since Dec. 2014
operator: Netrion GmbH **application:** lokal flexible storage unit for 18 households and commerce/industry

Quelle: MVV und ads tec

Conclusions

1. The energy transition is inevitable and gives more competitiveness and strength
2. Improved technologies allow small scale and efficient local (cellular) energy systems
3. “Flexibility” becomes the key issue of the new energy system
4. Biomass energy has a vital role for rural energy and levelling-out volatile energy (wind & solar)
5. Solving the ‘coal’ and ‘gas’ question is decisive for reaching the GHG emission targets
6. Environmental and social goals are equally important than the technical challenge

The future of energy is very exciting!!

Let‘s do it together!

Universität Stuttgart
Institut für Energiewirtschaft und
Rationelle Energieanwendung (IER)




Thank you

for your attention

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