



German Energiewende – Challenges and Opportunities

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www.german-energy-solutions.de/

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Agenda

- **Introduction RLI**
- Energy Transition to Renewable Energies in Germany
(Energiewende)
 - Overview
 - Challenges
 - Opportunities
- Decentralized Systems
- Conclusion

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Reiner Lemoine Institut



Overview

- Not-for-profit research institute
- 100 % subsidiary of Reiner Lemoine-Foundation (RLS)
- Established 2010 in Berlin
- Managing Director: Dr. Kathrin Goldammer
- Member of: ARE, eurosolar, BNE, dena, EEA



Reiner Lemoine
Founder of Reiner Lemoine-
Foundation

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Fields of Research



Transformation of Energy Systems

We analyze and optimize future scenarios with an energy supply largely based on renewable energy sources.

- Scientific monitoring of the energy transition– on national, regional and EU-Scale
- Simulation and optimization of cross-sectoral energy systems
- Analysis of single technology performances in integrated energy systems (energy storage, PtG, PtH, cogeneration)
- Research on transitional energy processes

Mobility with Renewable Energies

We analyze sustainable mobility concepts through sophisticated implementation and optimization of renewable energy systems.

- Battery electric mobility: propulsion of vehicles using electric energy from Renewable Energies
- Hydrogen-electric mobility: production of hydrogen via electrolysis and Renewable Energies
- Synthetic-methane-gas-based mobility: production of methane gas via electrolysis, Renewable Energies and methanation

Off-Grid Systems

We support the development of sustainable energy supply for remote regions.

- Strategies for rural electrification
- Simulation and optimization of hybrid mini-grids
- Combining GIS-analyses and energy system simulations
- Market potential analyses and business implementation strategies

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Energiewende at a glance – Main objectives

- To combat climate change,
- To avoid nuclear risks,
- To improve energy security,
- And to guarantee competitiveness and growth.

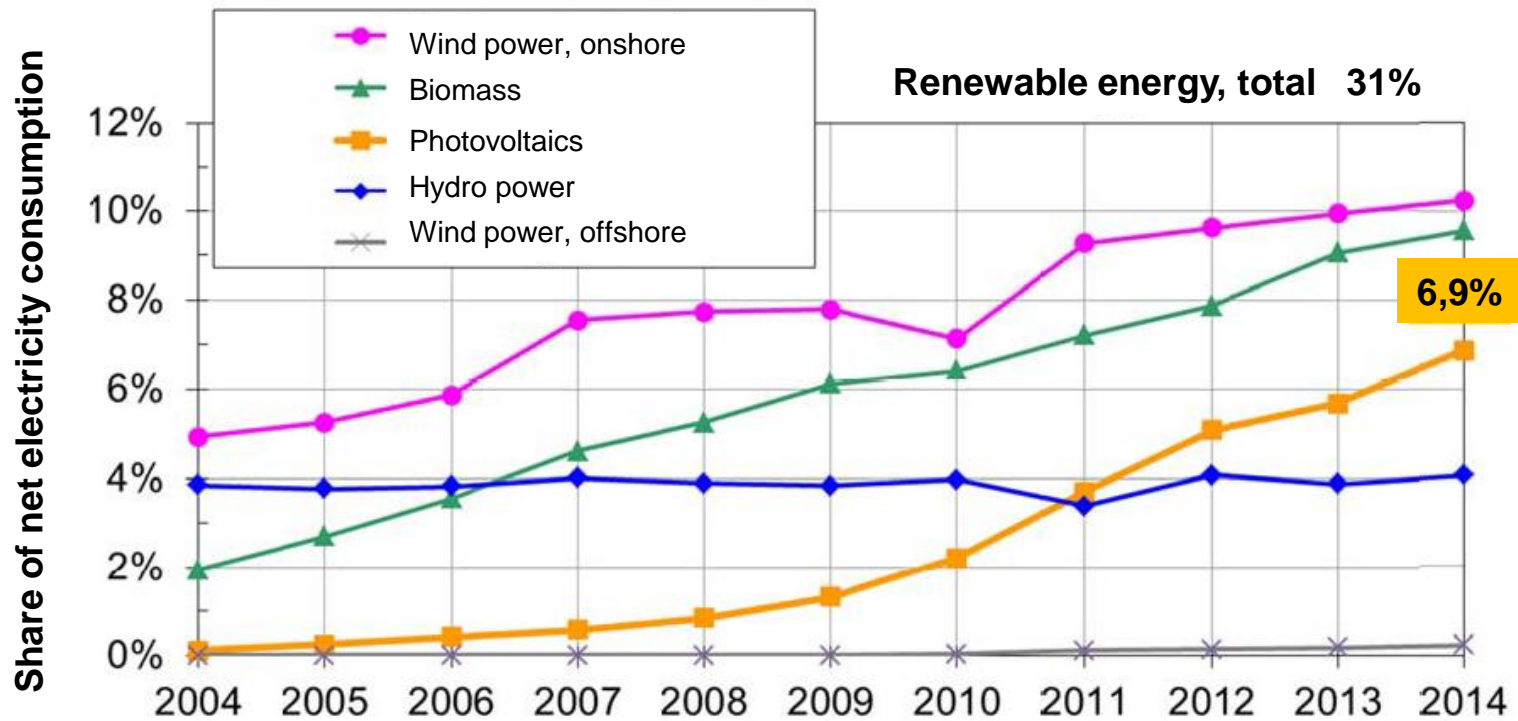
→ All objectives can be reached by increased RE shares!

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Energiewende – RE development (electricity)



Goal: 80 % by 2050!

Source: Fraunhofer ISE (2015)

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Energiewende – challenges

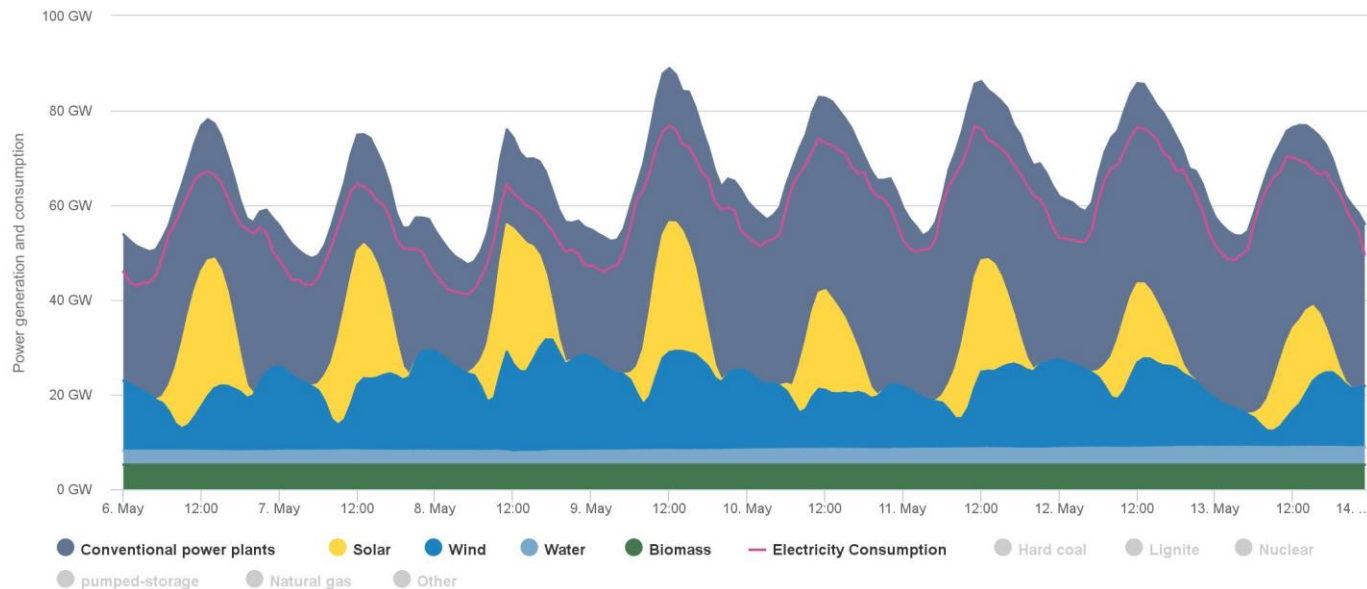
- Technical
- Economical
- Legal
- Political / social

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Energiewende – challenges: technical



Agora Energiewende; Current to: 18.05.2016, 14:10

- Stability of frequency and voltage (in all grid levels)
- Distribution (temporal and spatial)

Source: Agora Energiewende (2015)

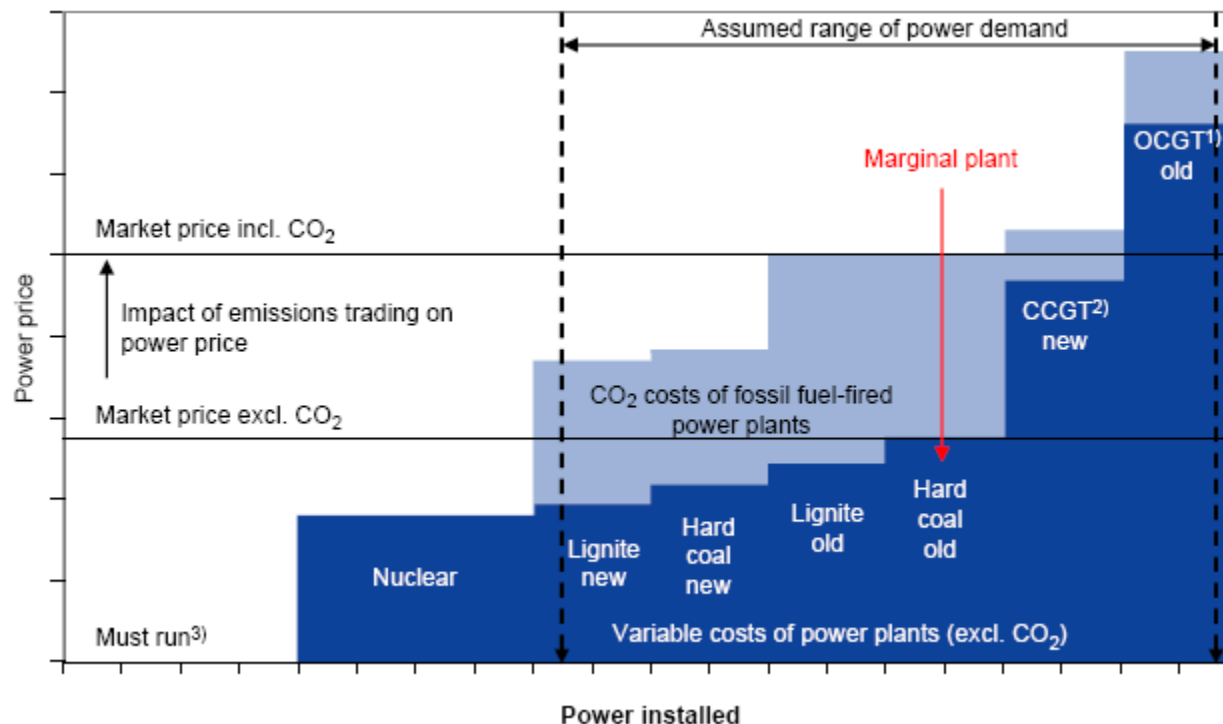
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Energiewende – challenges: economical

- Market failure of merit order and combined fixed feed-in tariff

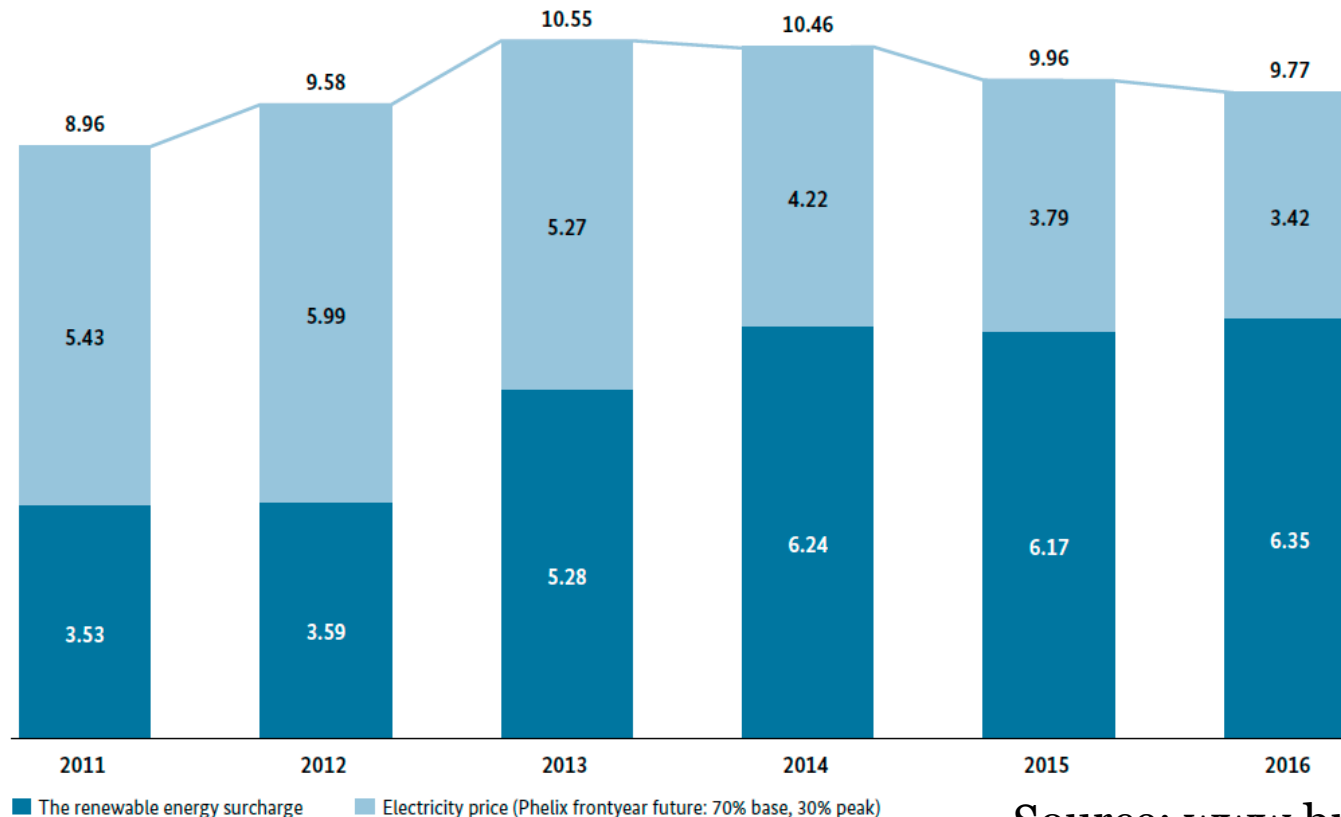


Source: RWE facts & figures 2015

Energiewende – challenges: economical

- New market models are needed

Sum of the price on the electricity exchange and the renewable energy surcharge in cent/kWh

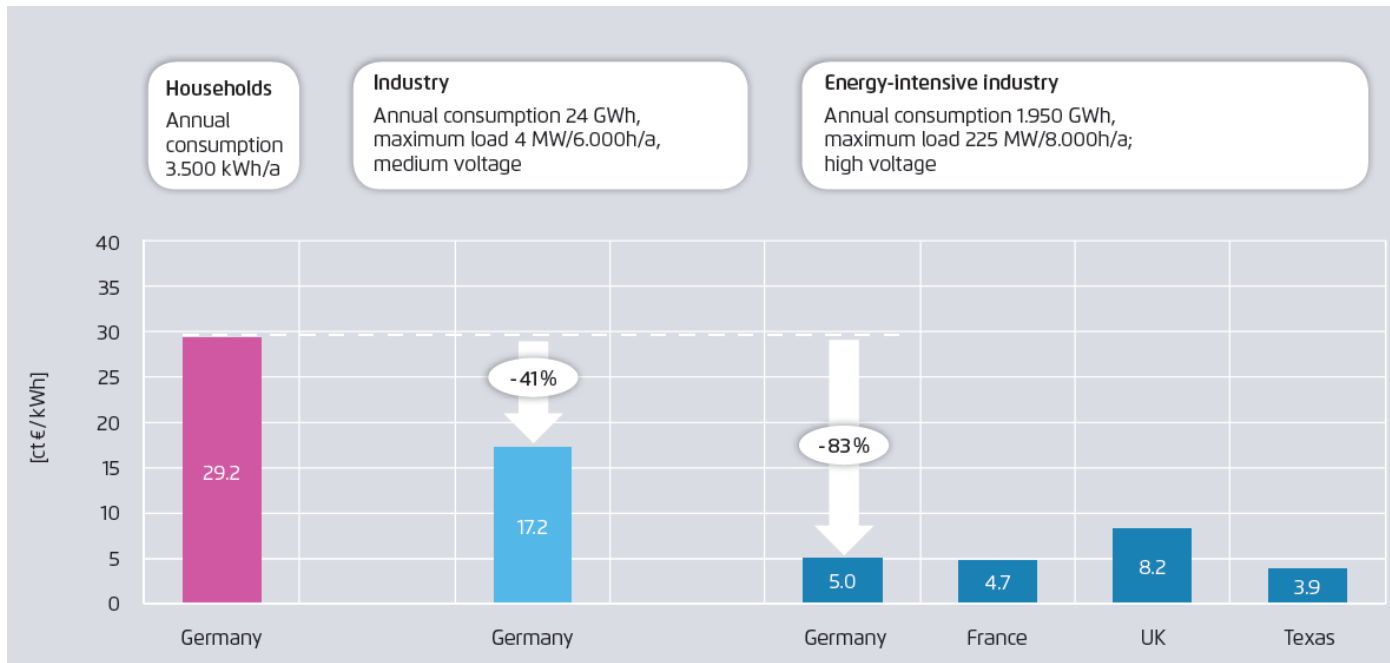


Source: own calculations based on information from www.netztransparenz.de and the European Energy Exchange

Source: www.bmwi.de

Energiewende – challenges: social / political

- Renewable energy act (EEG) sets regulations and feed-in tariffs for RE
 - Industry is partly excluded to pay RE surcharge
 - Domestic customers take over high shares of the costs (35 %), their consumption accounts for 25 % only



Source: Agora
Energiewende
(2015)

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RE in Germany – Energiewende next steps

Till 2020 (Focus: Flexibilisation)

- 52 GW PV power capacity
- Increased energy efficiency focusing on night time consumption
- Smart demand management
- Integration of battery storage solutions
- Reinforcement of grid connection to neighboring countries

Beyond 2050 (Focus: Storage)

- 200 GW PV power capacity
- Integrated renewable energy storage system, power-to-gas
- Increased energy efficiency focusing on buildings
- Heat supply 100% covered by RE
- Transport sector mainly relies on electromobility or RE gas driven vehicles

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Energiewende: opportunities in Germany

High investments have been conducted and many more are to come

- Appr. 220 billion euros were invested in renewable energy (in all sectors) from 2000 to 2014
- 15 billion euros annual investments are expected to transform the power sector (including 9-10 billion euros for new renewable energy capacity)
- 370,000 jobs are accounted for the renewable energy industry in Germany in 2013 (net increase of 18,000 jobs up to 2020)

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Energiewende: opportunities for all countries

Challenges need solutions!

- New technologies
- New players
- New financiers
- New business models

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Energiewende: opportunities - technologies

Technologies / options providing flexibility

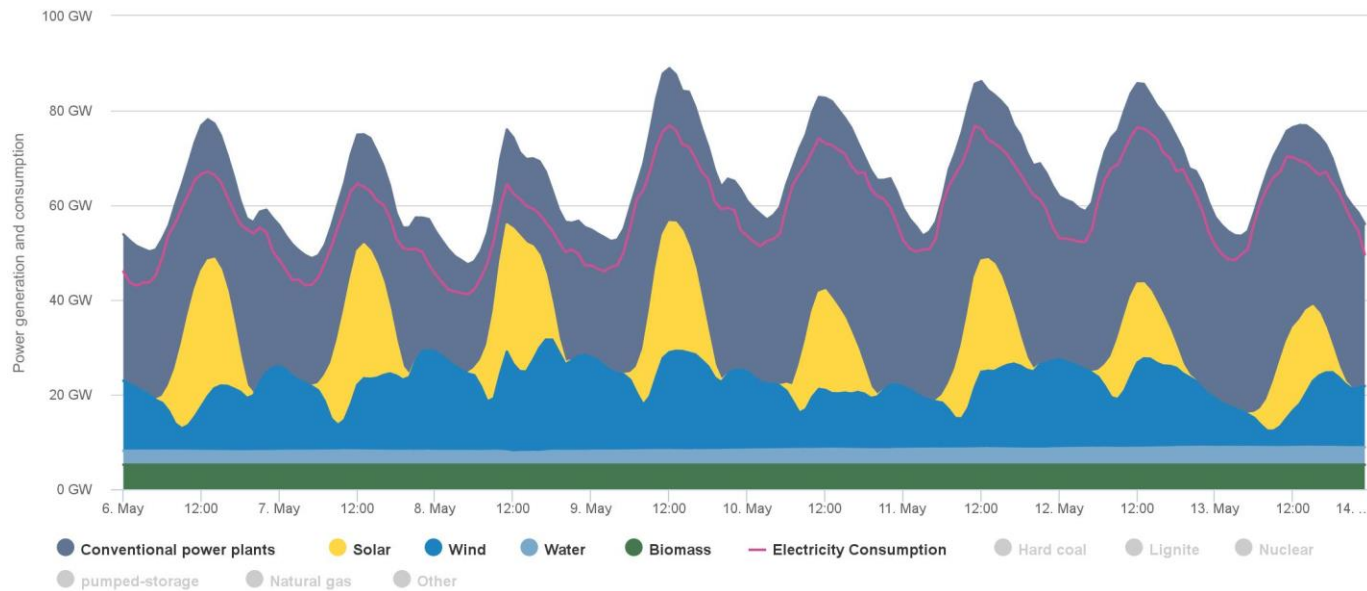
- Flexible operation of thermal power plants
- Grids and transmission capacities for import/export
- Demand side management
- Embedded hybrid mini-grids
- Storage (batteries, Power-to-X)
- Further integration of the electricity, heating and transport sector

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Energiewende: opportunities - technologies



Agora Energiewende; Current to: 18.05.2016, 14:10

→ **Technological challenges can be seen as solved**

- (e.g. in Germany power outages stand at less than 15 minutes per customer per year)

Energiewende: opportunities – new players

Large utilities with conventional baseload plants are struggling

- Spot market prices are decreasing
- Higher flexibility is demanded
- „Green electricity“ is demanded

→ New business models for utilities, IPPs and providers

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Energiewende: opportunities – new financiers

Besides utilities many players can invest into power generation capacities via RE

- Private persons (e.g. roof-top PV)
- Community projects (e.g. in rural areas or as local fund)
- SMEs (e.g. roof-top PV on industrial or stock buildings)
- „Green“ investment funds or banks

→ New money is floating into the power sector and everyone can participate in this market now

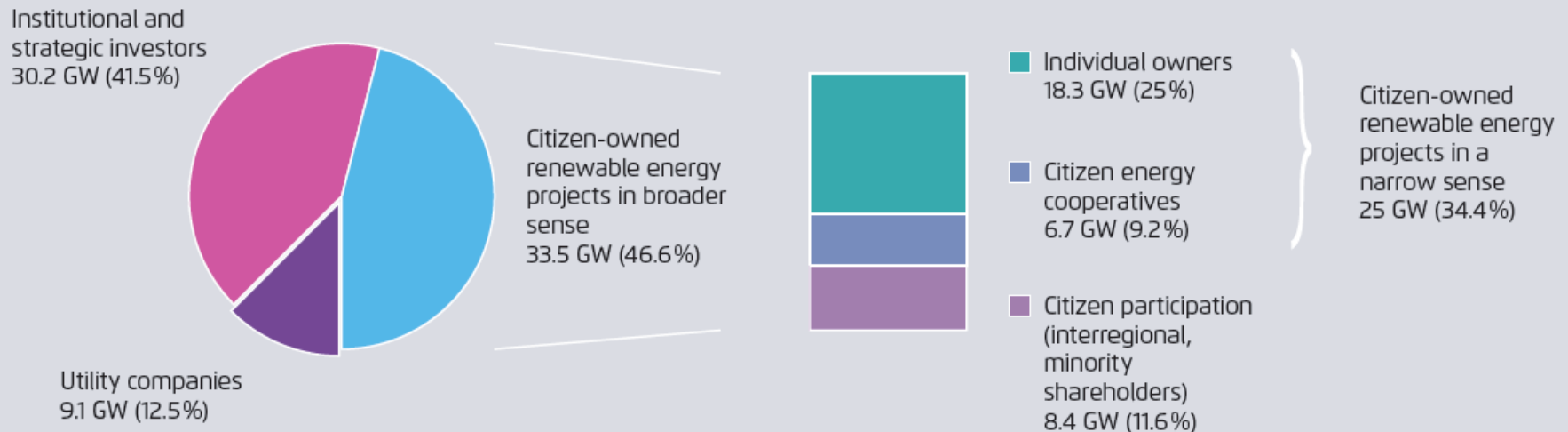
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Energiewende: opportunities – new financiers

Installed renewable energy capacity broken down by ownership in Germany in 2012



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Energiewende: opportunities – new business models

Stakeholders can profit of the challenges by providing solutions

- Grid operators: Storage options, smart-grids, smart meters
- Utilities: Large scale RE, flexible conventional plants
- IPPs: Large and medium scale RE, flexible conventional plants, storage options, local markets (supply and demand directly coupled)
- Technical service: FiT over 25 years requires continuous maintenance
- Policy: New market designs

→ Big will not beat small anymore. It will be the fast beating the slow!

Energiewende: opportunities for Thailand

Solar PV is a very promising market

- FiT from 5.66 to 6.85 THB/kWh for PV
- Irradiance up to 2,000 kWh/m² per year (1.5 times higher than in Germany)
- Very attractive FiT
 - Additional services can be financed
 - Turn-key providers for solar roof-top
 - O&M services
 - Batteries for large scale farms
 - Financing institutions (tailormade loans for PV)
 - Pension funds (25 years of secure payments)

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PV-Hybrid Mini-Grids - Motivation

Diesel power plants:

- high power generation costs
 - diesel fuel price, transport costs, low efficiency
- CO₂ emissions, air pollutants
- **Upgrade of diesel mini-grids with Renewable Energies**
- lower power generation costs
- lower fuel dependency
- fewer CO₂ emissions, fewer detrimental environmental effects
- existing diesel generators serve as back-up power sources



Destroyed diesel power barge, Lazi, Siquijor. May 2013.

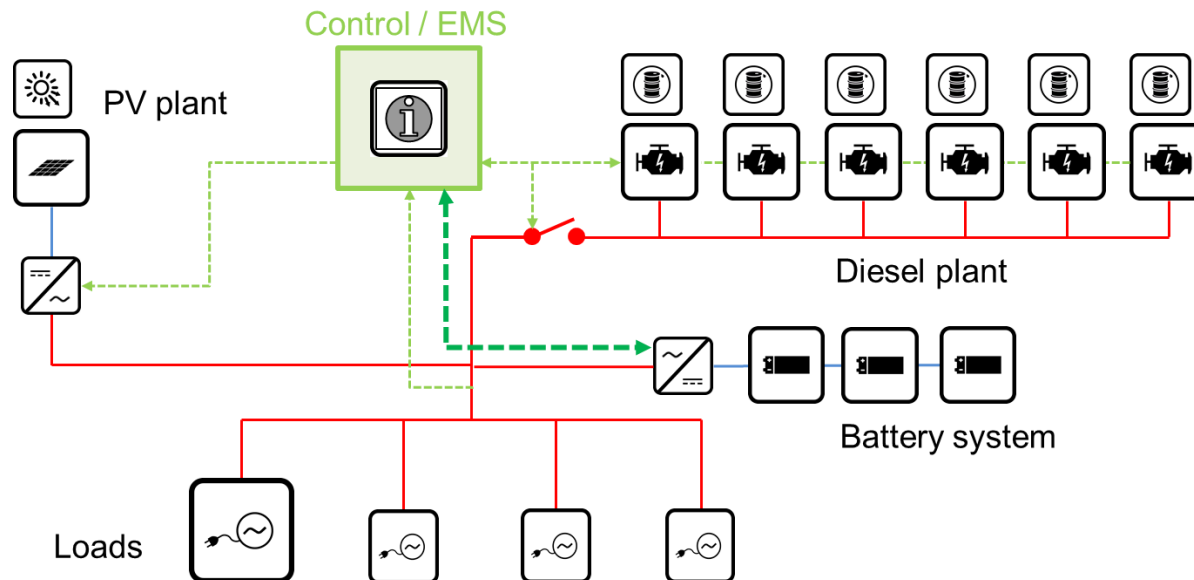
Source: Paul Bertheau

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PV-Hybrid Mini-Grids – What is a mini-grid?



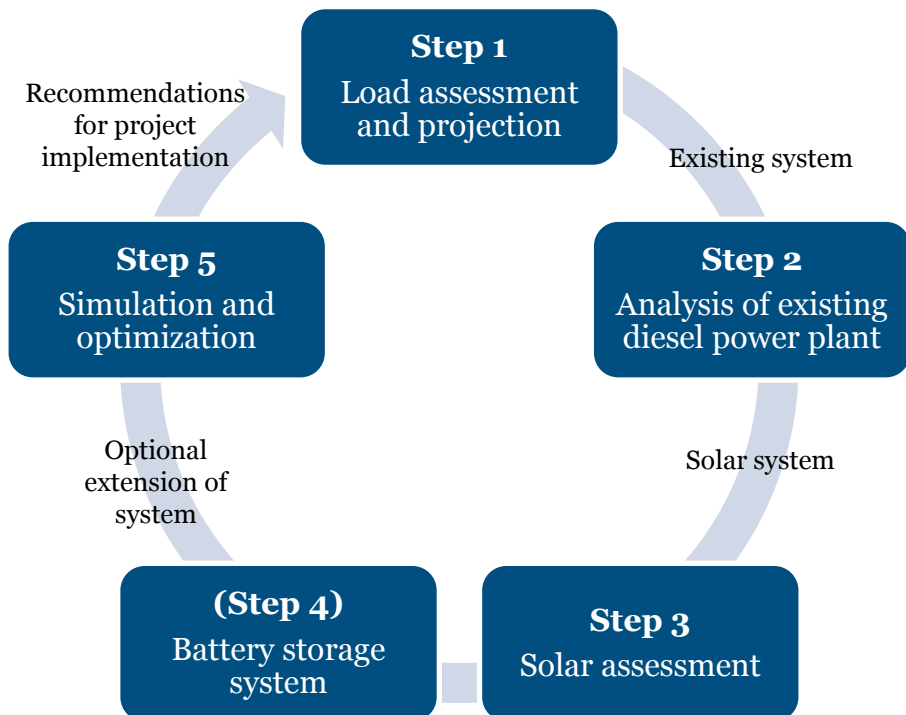
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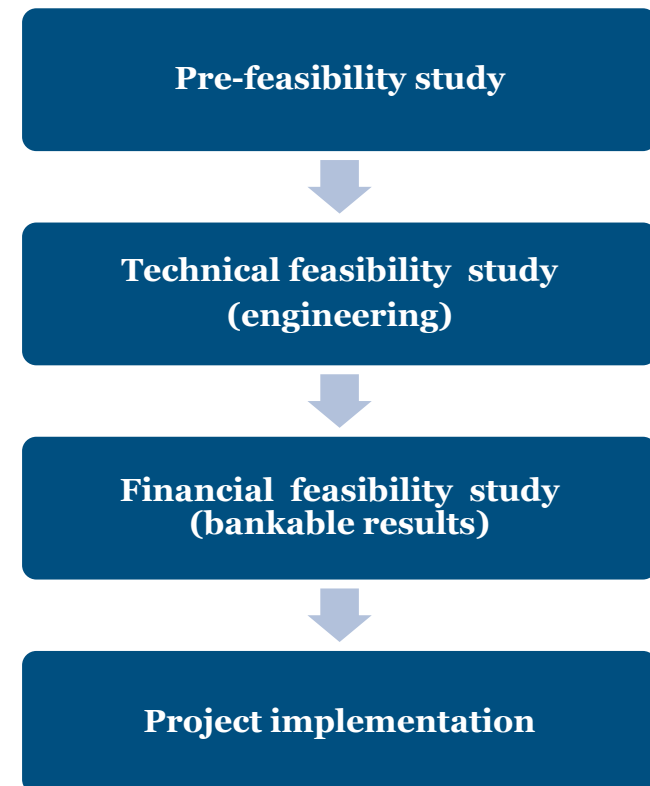
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PV-hybrid power plants – Feasibility assessment

Pre-feasibility



Project development



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Energiewende – A sunny future!

Thailand can profit from the experiences in Germany

- Avoid the mistakes – proceed to the opportunities
 - Clear policy / legal agenda (master plan!)
 - Choose the right new technologies
 - Secure financing and investments
 - Include society and distribute costs fairly

→ We wish you a sunny future!

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Thank you for your attention!

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Sources

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