Zero carbon energy generation – How to get there?

Finance for innovation: Towards the ETS Innovation Fund

innogy SE · Dr. Hans Bünting, COO Renewables · 20th January 2017

RWE forged innogy to become a blueprint utility for a decarbonised, decentralized & digitalized energy system

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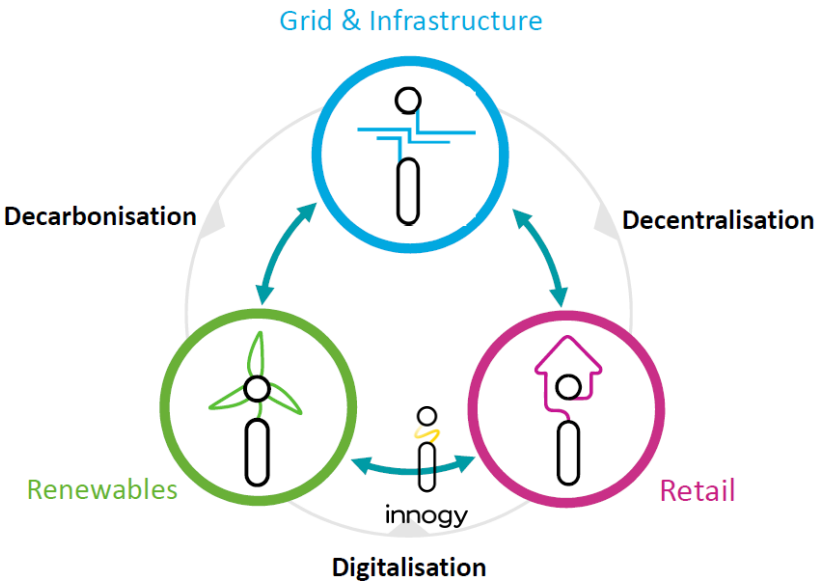
Three „D“s that will transform the energy world

Decarbonisation

Decentralisation

Digitalisation

Our strategic pillars



RES technologies have grown beyond the nursery stage and are ready to provide full-scale decarbonisation

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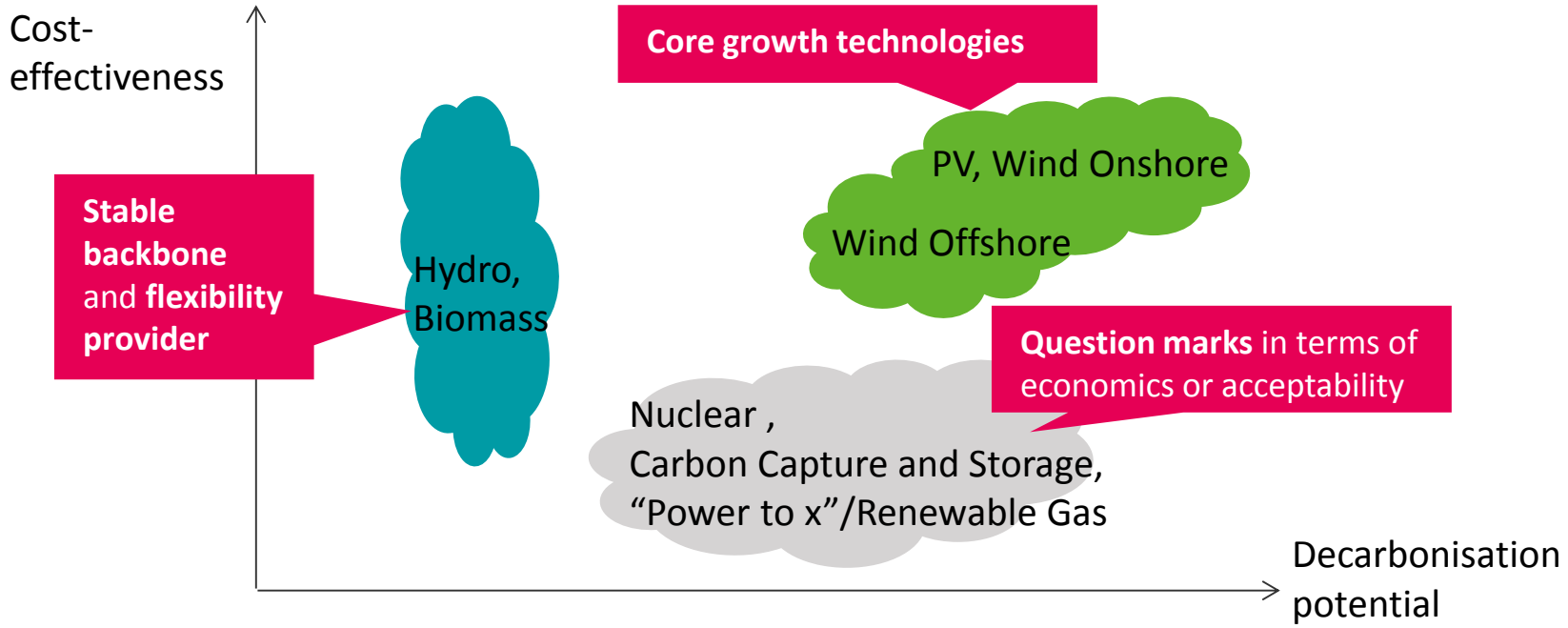
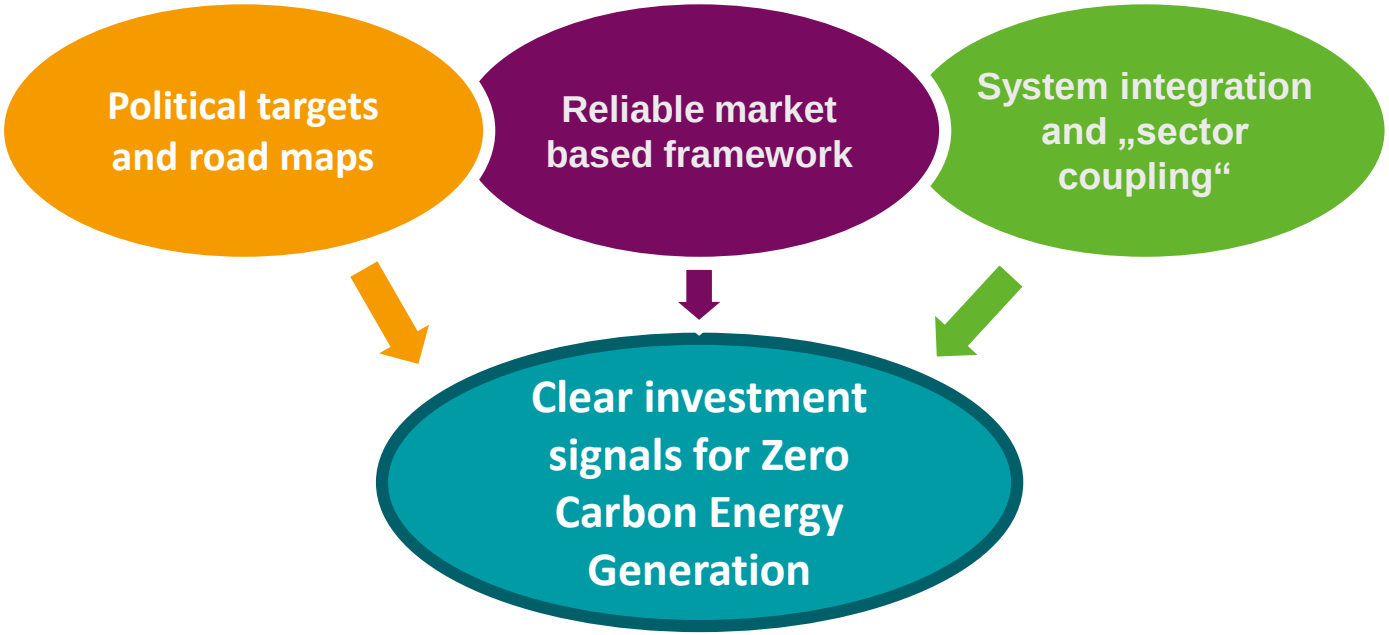
Portfolio of most important decarbonisation technologies



Key innovation needs until 2030

1. *Further cost degressions in large volume generation technologies, esp. PV and Offshore*
2. *Think beyond generation: infrastructure for system stability and RES integration, e. g. smart grids and storage*
3. *Think beyond electricity: “Sector coupling” (transport, heat), also via bio/green fuels*

A stable and long-term political framework is key for the further advancement of low carbon technologies



In a reliable and market based framework
private financing can and should serve as the primary source of funding for innovation and deployment of low carbon technologies

Public financing should focus on areas where technological or market risk inhibits innovation

Prohibitive risk premiums for stand-alone private funding

Public Innovation Funding (ETS Innovation Fund, EIB, KfW loans)

Reducing technology risk:
- Supporting market introduction
- foster R&D for “next generation” technologies
- Think beyond generation: e. g. smart grids, storage, sector-coupling

Reducing market & regulatory risk:
- Support new business models beyond established markets
- Foster industrial spill-overs and export into non EU-markets

Best Funding practice:
- Risk-adequate public funding rates
- Low bureaucracy
- Encourage international co-operation

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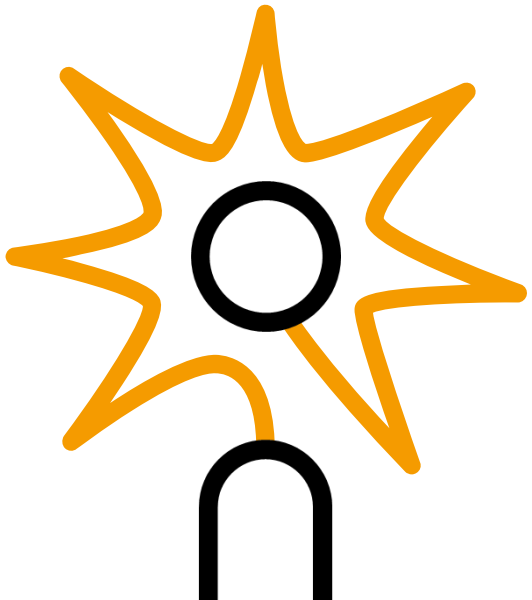
LET‘S INNOGIZE



Back-up

Due to rapid cost reductions wind and solar power become increasingly independent of public support

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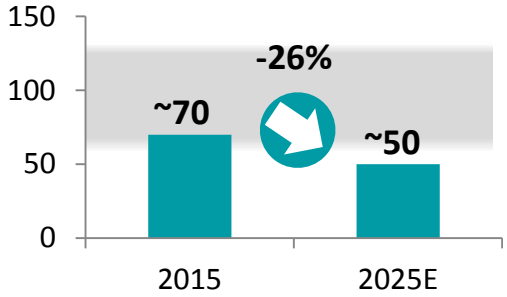
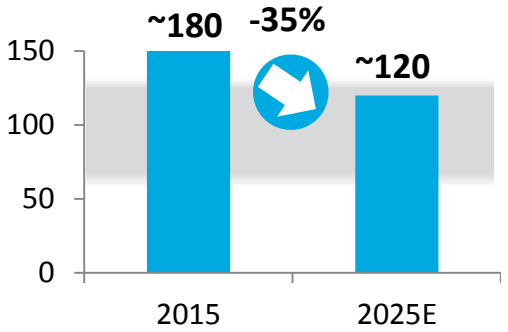
Expected LCOE reductions (USD_{2015}/MWh)*

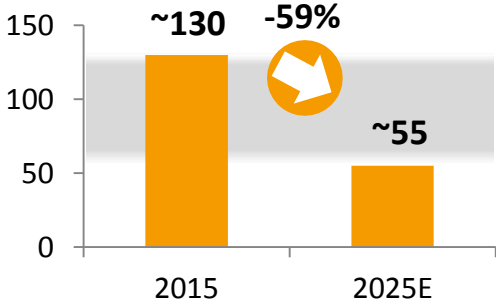
Onshore Wind (global weighted average utility scale)



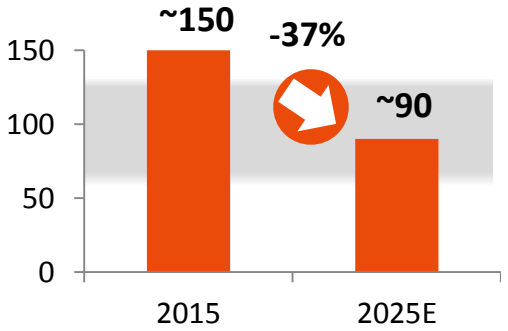
Offshore Wind (global weighted average utility scale)



PV (global weighted average utility scale)



CSP, parabolic (global weighted average utility scale)



Onshore Wind and PV already competitive with CCGTs especially in regions with favorable conditions

*** Source: IRENA 2016**

LCOE range of CCGT for new-build until 2020 (Source IEA, 2015)

In addition, more customers may use self-generated power and actively manage their consumption

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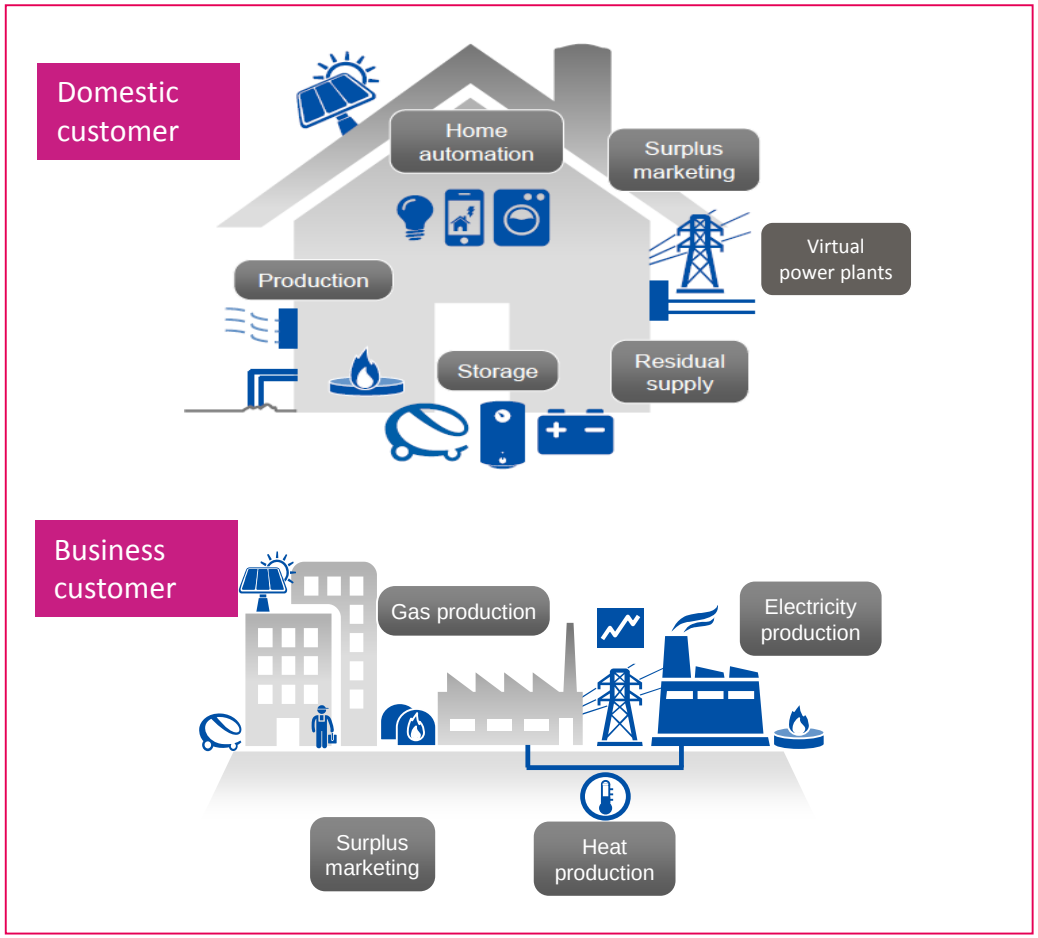
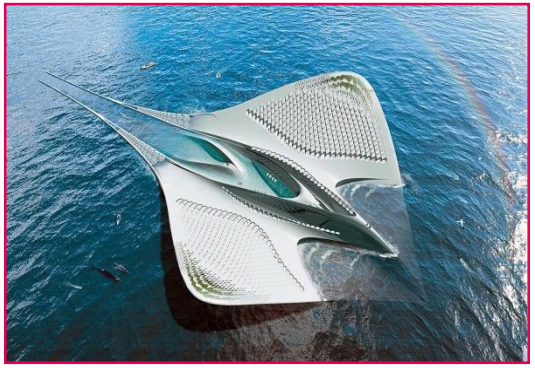
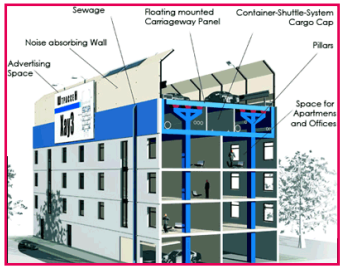
Small scale decentral renewables with prosumer business models



- **Desire of single households, businesses or local communities for partial energy autarky**
- **Becoming "prosumer" is getting attractive due to cost savings in comparison to grid supply – achieving grid parity**
- **In addition, rising penetration of home automation systems enables households to manage their energy needs**

Eventually, a low carbon future is likely to be largely electric - all sectors fueled with renewable electricity





Sources: Stadt Wien, Fraunhofer Gesellschaft, Bilfinger, fosterandpartners, Siemens, Wirtschaftswoche, Dr. Roland Lipp, zenithonline

Excursus: system integration deficits threaten to slow down renewable growth in Germany

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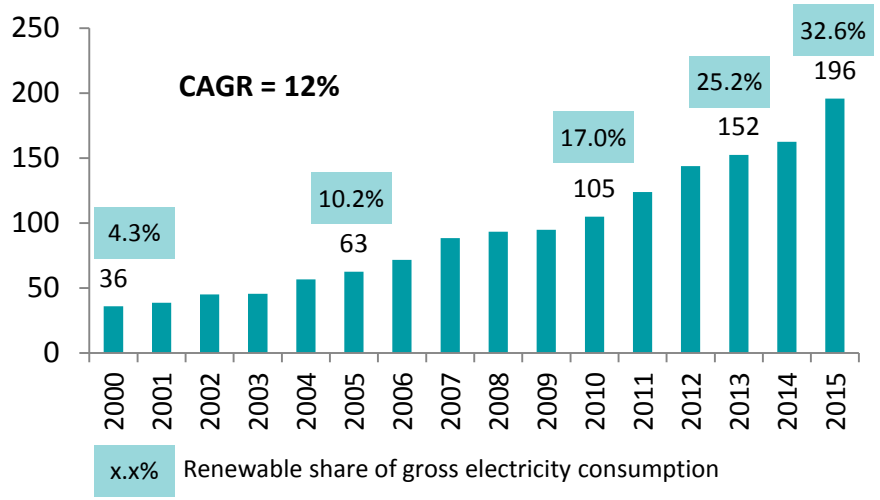
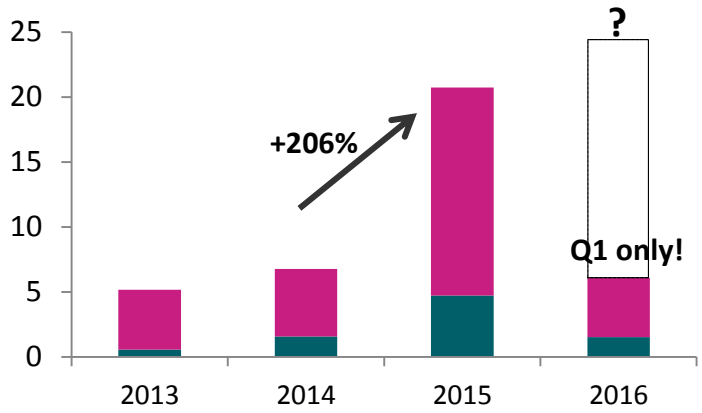
Renewable Electricity in Germany (TWh)



Curtailments and Re-dispatch (TWh)



Source: BNetzA Monitoring report 2015 + Report Q 1 2016

- The German Renewable Support scheme "EEG" was very successful to **boost large volumes** of renewable energy into the system
- Largest share **from intermittent sources** Wind and PV
- More than 32% renewable share of gross electricity consumption in 2015
- However, high "technological pioneering cost"

- Rapid growth of intermittent renewables was **not adequately backed by parallel grid expansion** (e. g. "North-South-Links")
- Increasing need to counterbalance grid congestions with curtailment of renewables and re-dispatch of conventional plants
- **Extra system cost € ~880mn in 2015**
- EEG 2017 "on the break": growth restrictions in "grid expansion areas", offshore North Sea

A stable and long-term political framework is key for the further advancement of low carbon technologies

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	=> 2030	=> 2050
Political targets and road maps for low carbon generation	 • 2030 targets binding on EU level • Enough impulse for member state level?	 • Only indicative on EU level • Backing from Paris process
Reliable market bases framework for low carbon technologies	 • Switch to direct marketing and competitive allocation via auctioning	 • Long term market designs aligned with carbon market? • Pan-European level playing field?
Incentives for system integration and „sector coupling“	 • Delays in national/supranational grid extension • Single carbon price across sectors	

Clear investment signals:
private financing can and should serve as the primary source of funding for innovation and deployment of low carbon technologies