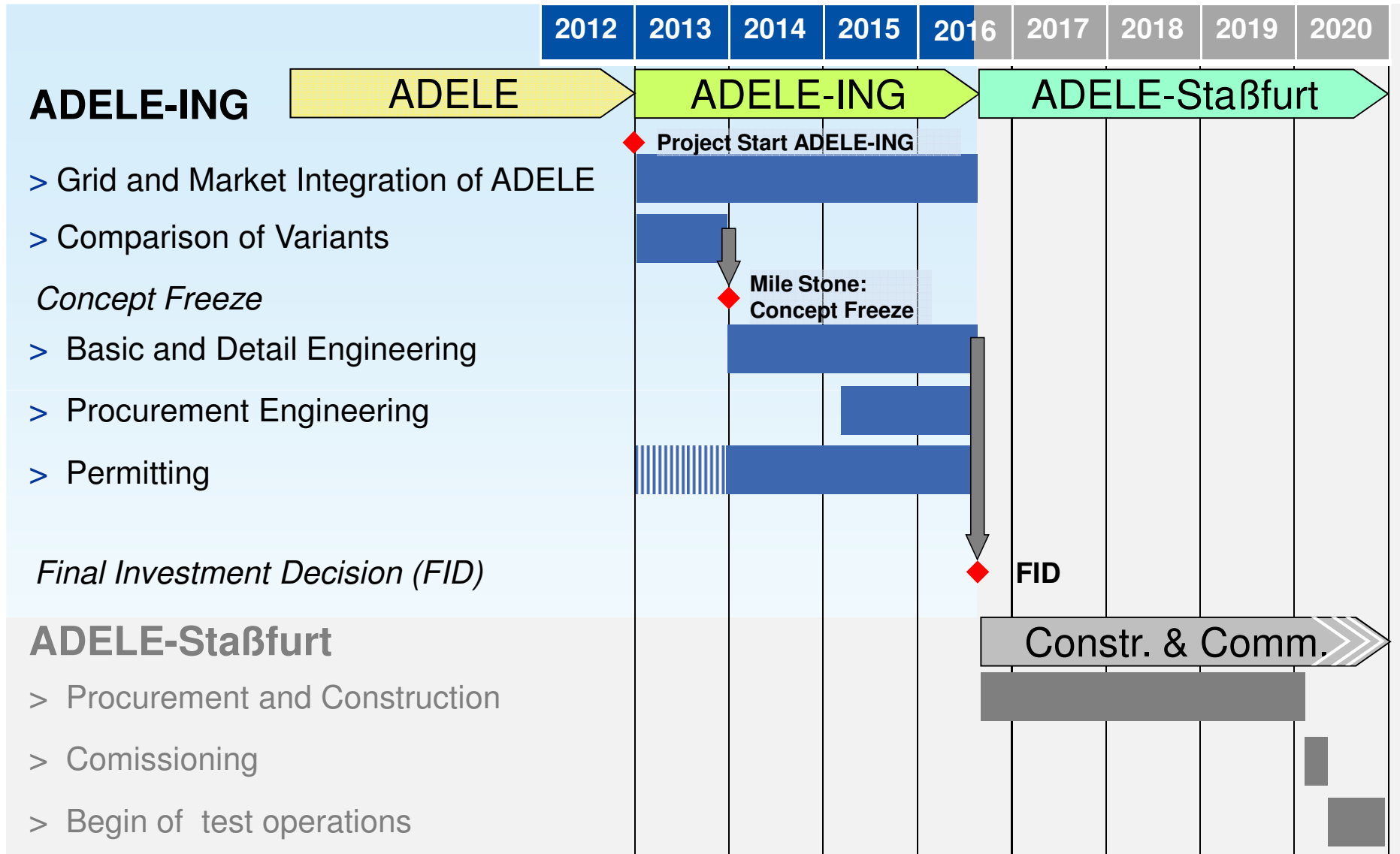


Adiabatic Compressed Air Energy Storage in Context of the Markets

Policy Debate: Facilitating energy storage to allow fast growth of sustainable energy

Dr.-Ing. E. Hauptmeier
Brussels, 26th of June 2013

Current Status: Preparation of a Demo Site



Why choosing Adiabatic Compressed Air?

Back in 2008 Pumped Hydro Storage looked very prosperous

- > Typical operational schemes switched from classic day-night-cycles to short and frequent operation patterns
- > The RES directive (2009/28/EC) fixed RES goals by country, hence technical storage potential could be determined, especially steep RES introduced ramping

The identified first estimation of storage potential indicated that available PHS potential would not be fully sufficient

- > RWE was involved in the European AA-CAES project and convinced of the technology
- > Adiabatic CAES seemed natural follower to PHS since:
 - Theoretical efficiency of 70% was closest to PHS, even comparable with old plants
 - Potential German sites were close to wind generation centers in the north
 - CAPEX was expected to come close to PHS with larger scale deployment

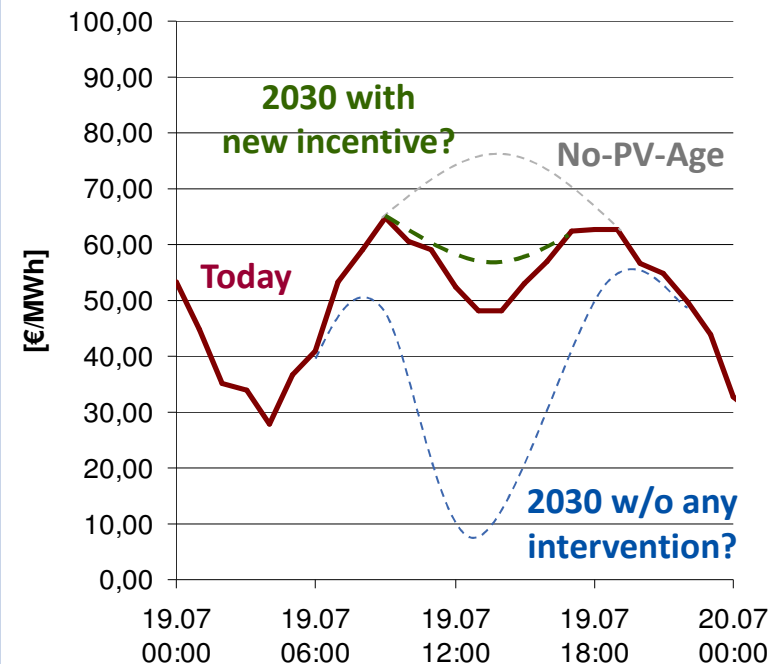
Central Storage is macro-economically useful, but faces micro-economic pressure due to market and regulation

- > Market evolution did not reflect the estimated need of flexibility sufficiently in any bulk market
- > Present energy only markets do not produce any business case for any new-built storage
- > Consequently storage roll out is limited. Hence CAPEX-decline for A-CAES will be smaller as expected.
- > Yet, maximising social economic benefits central storage is still option of choice, but only after 2030
- > Current regulation focuses on local remedies, not on the system

Reference CASE Germany

Since 05/2013: Incentive for residential batteries limiting PV feedings to 60%

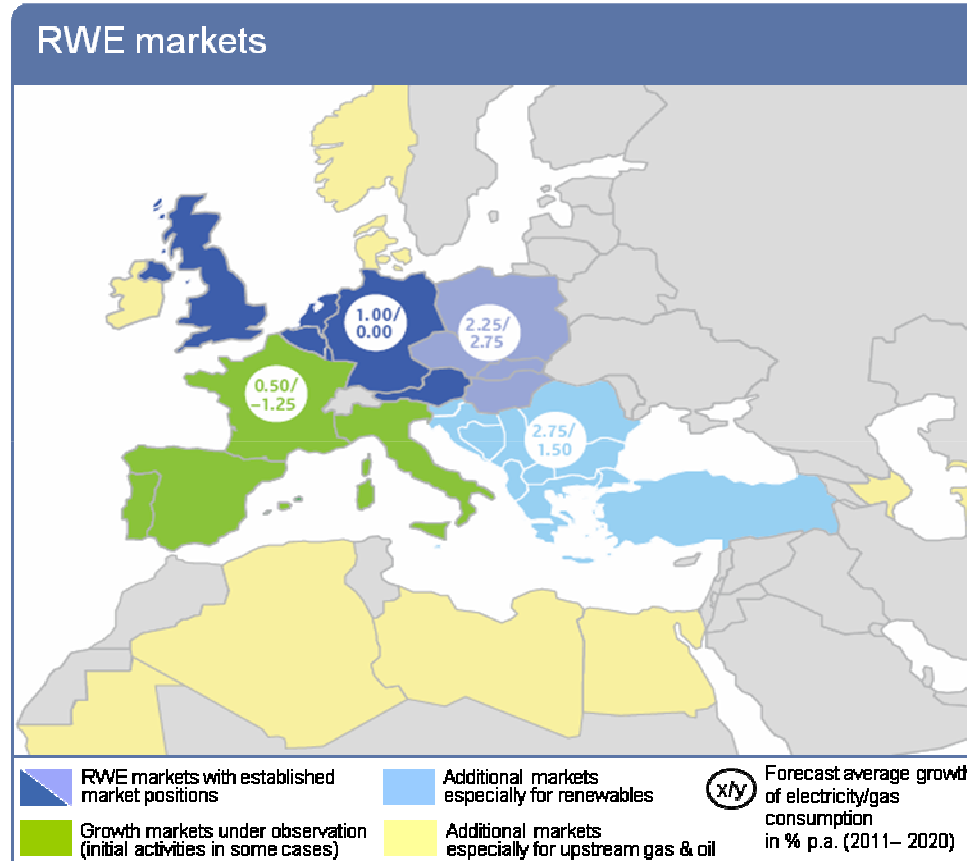
German EEX-Spot Market Prices 2011



THANK YOU VERY MUCH
FOR YOUR ATTENTION AND
LET'S COLLECTIVELY BE:



RWE is a major European player



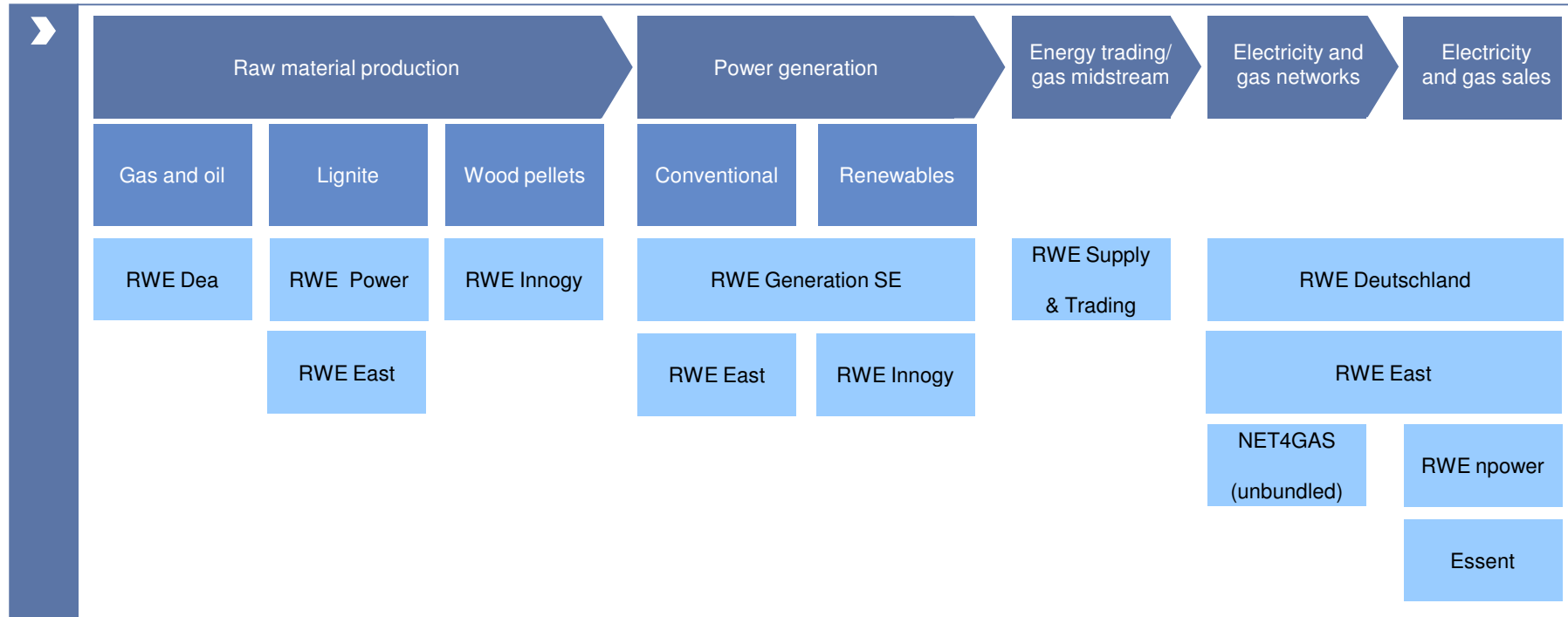
Leading positions in core markets

Market ¹ \ Product	Electricity	Gas
Germany	No. 1	No. 3
UK	No. 4	No. 4
Netherlands	No. 2	No. 1
Central Eastern and South Eastern Europe	<ul style="list-style-type: none"> > No. 2 in Hungary > No. 3 in Slovakia > No. 5 in Poland > Presence in the Czech Republic > Presence in Turkey 	<ul style="list-style-type: none"> > No. 1 in the Czech Republic > No. 2 in Slovakia > Leading position in Hungary
Total Europe	No. 3	No. 6

➤ We have leading positions in two of Europe's largest markets as well as in fast growing SEE/CEE markets and own a large upstream position in both Europe and North Africa.

¹ Market positions of the RWE Group in terms of sales for 2012.

RWE Group is covering the whole value chain



RWE Group Key Data (2012)

- € billion 53,227 external revenues
- 70.208 employees
- Power: 342.000 grid km, 278 billion kWh
- Gas: 38.000 grid km, 307 billion kWh
- 16 Mio. electricity customers
- 8 Mio. gas customers

RWE Group R&D (2012)

- 450 Employees R&D
- R&D-expenditure: ~ € million 150 p.a.

ADELE-ING – Eight Partners, Six Tasks

