

Prioritizing Corporate Investments in R&D to build the RWE R&D Portfolio

IEA Committee on Energy Research and Development,
Experts Group on R&D Priority Setting and Evaluation

Paris, 24 April 2014



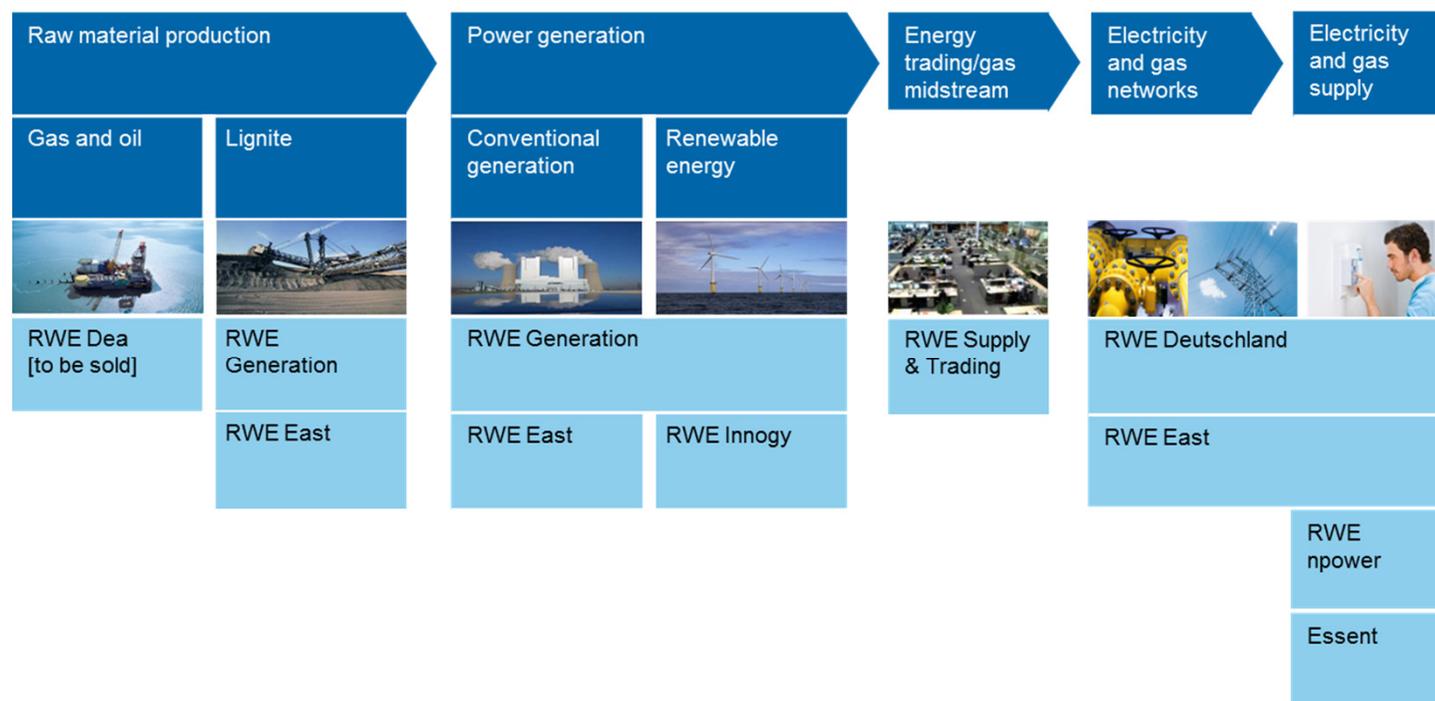
Alexander Wilmes, RWE AG

Agenda

- 1 **RWE:** Large integrated european utility, ranking third in the 2012 ESMT Innovation Index
- 2 **RWE R&D Portfolio Context:** The definition of a portfolio requires strategic/management guidelines and suitable processes
- 3 **RWE R&D Portfolio Development:** Some insight into...
 - **R&D Strategy:** Serves as an enabler of the Group wide strategy
 - **Roadmapping:** A process to derive RWE relevant R&D programmes
 - **R&D-Programmes:** The bridge between long term strategic orientation and mid term R&D targets and budget needs
 - **Selection of project ideas:** Projects must contribute to R&D value drivers
 - **RWE R&D Portfolio:** About 200 projects along the entire value chain

1 RWE

RWE is one of the major integrated utilities in Europe with business along the entire energy value chain



Key Facts RWE 2013

- Revenues: € 54 billion
- EBITDA: € 8.7 billion
- Electricity Sales: 271 billion kWh
- Gas Sales: 335 billion kWh
- Workforce: 66,300

RWE currently ranked third among Europe's 16 largest energy utilities in the ESMT Innovation Index



Innovative R&D has been a tradition at RWE that we want to continue



R&D along the entire value chain, many projects help to make the energy transformation in Germany a success



Further focus on reduction of CO₂ emissions



R&D portfolio with more than 200 projects; around 30 - 50 patents per a



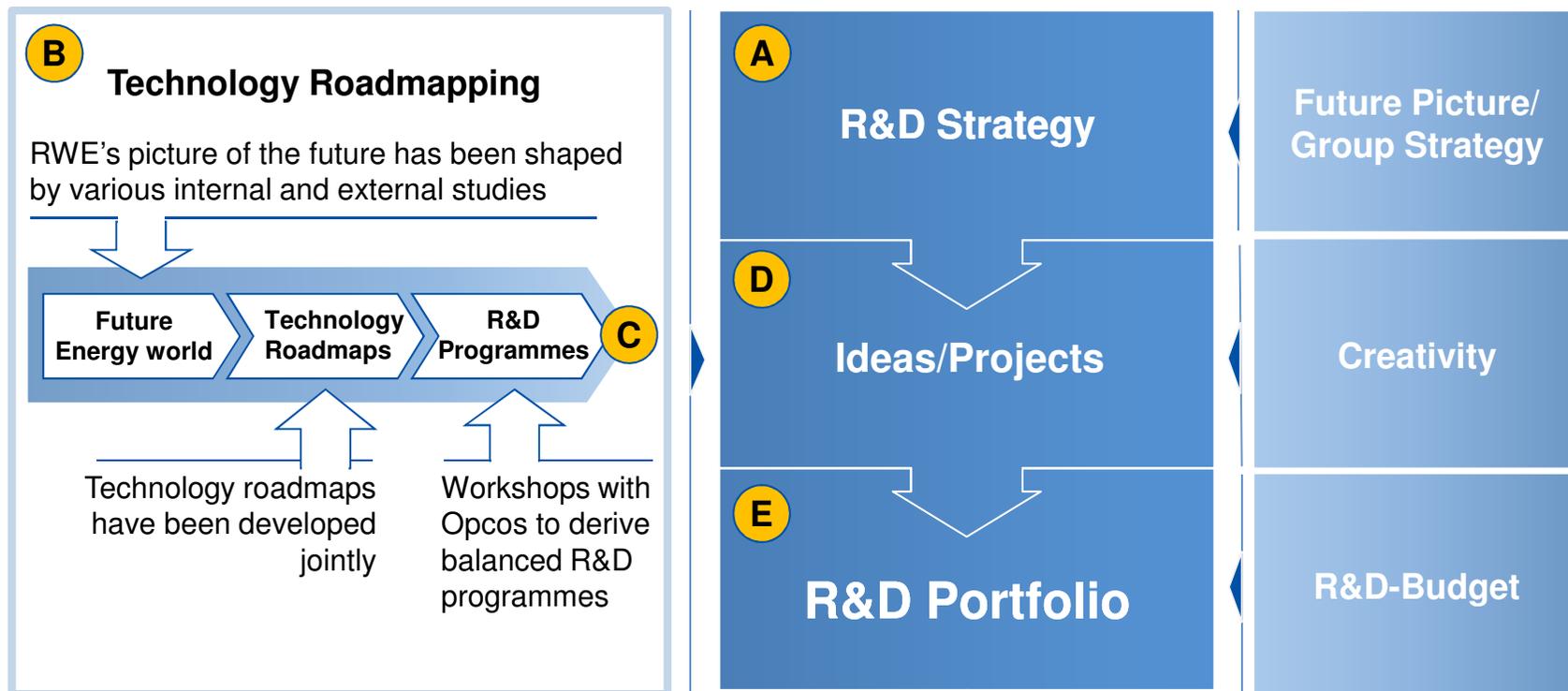
Most R&D projects are developed close to operations in co-operation with suppliers and research institutions



Ranked third among Europe's 16 largest energy utilities in the Innovation Index of the European School of Management and Technology (ESMT Berlin, 2014)

2 RWE R&D Portfolio Context

The definition of the “right” corporate R&D portfolio requires strategic/management guidelines and suitable processes



R&D serves as an enabler of the group-wide strategy

RWE Future Picture

“We will be the **most trusted** and **high-performing** partner for the sustainable transformation of the European energy system”

Focus on R&D relevant topics

Most trusted

- > Deliver innovative, value-adding energy and infrastructure products & services to our customers in Europe
- > Perceived by stakeholders as a positive & reliable contribution for the transformation of the European energy system

High-performing

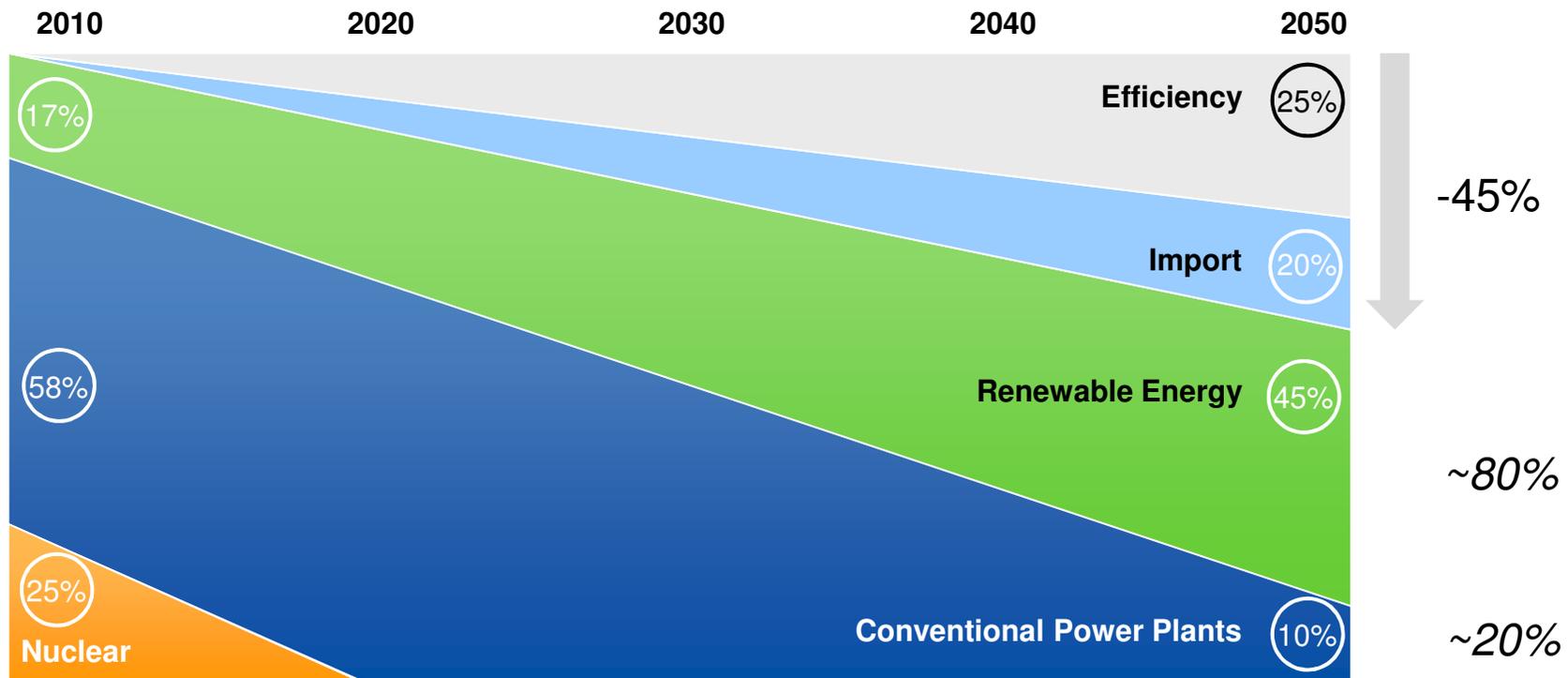
- > Have operational excellence in the top quartile compared to other utilities
- > Bear that “cost efficiency” is particularly essential for the fossil generation business and parts of the retail business

RWE R&D focuses on three main development targets

R&D focus on:	Optimise <u>existing</u> products and processes	Make <u>new technologies</u> economically available	Keep <u>technology options</u> open
Commercial benefit to be expected in:	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> Horizon 1 (up to 5 years) </div> <div style="text-align: center;"> Horizon 2 (up to 10 years) </div> <div style="text-align: center;"> Horizon 3 (up to long-term) </div> </div>		
Examples:	Assets	<ul style="list-style-type: none"> > Automation of lignite equipment, use of RFID > Improvement of corrossions protections 	<ul style="list-style-type: none"> > (Field-) Testing in "Ampacity" > Development of wind offshore foundations
	End-products	<ul style="list-style-type: none"> > Further development of Smart Home > Adaption of charging poles (e-mobility) 	<ul style="list-style-type: none"> > Technology monitoring and assessment, e.g. geothermal, marine energy, CCU > Long-term studies e.g.: "Desertec", "2030+ study for Germany"

Government targets strongly influence the R&D strategy, e.g. the „Energiewende“ in Germany

Energy Concept of the German Federal Government (long term targets)

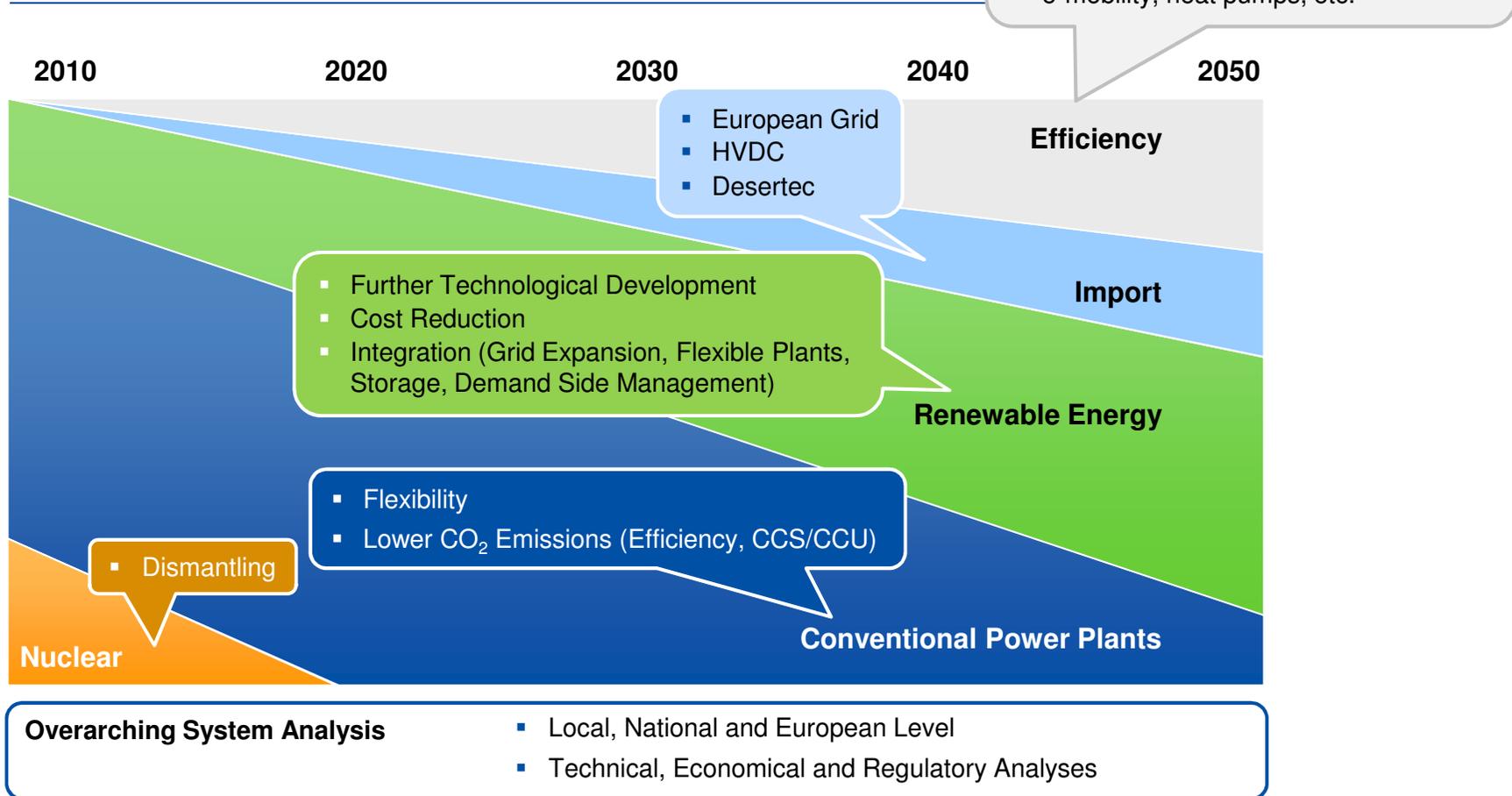


Overarching System Analysis

- Local, National and European Level
- Technical, Economical and Regulatory Analyses

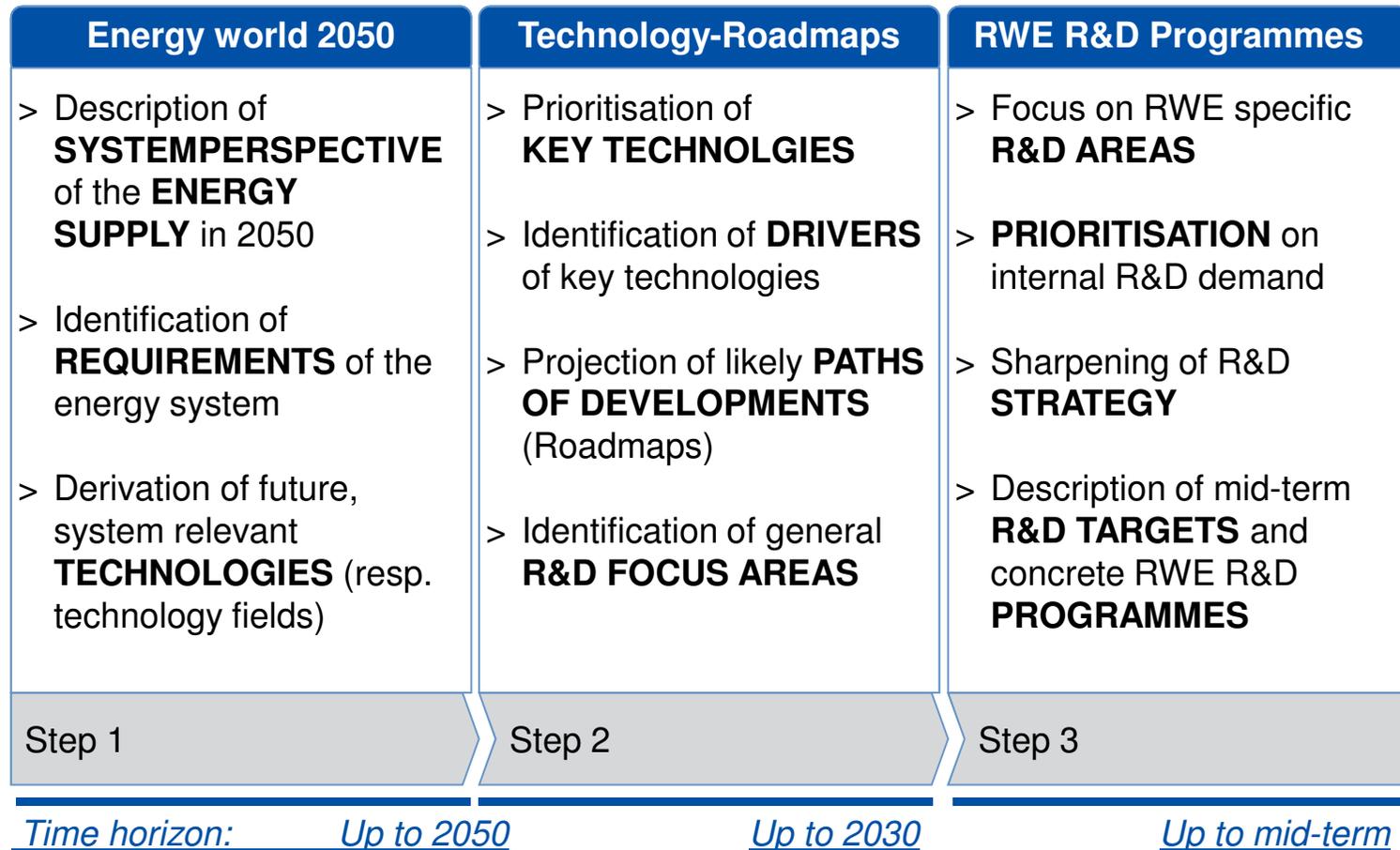
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Energy Concept of the German Federal Government



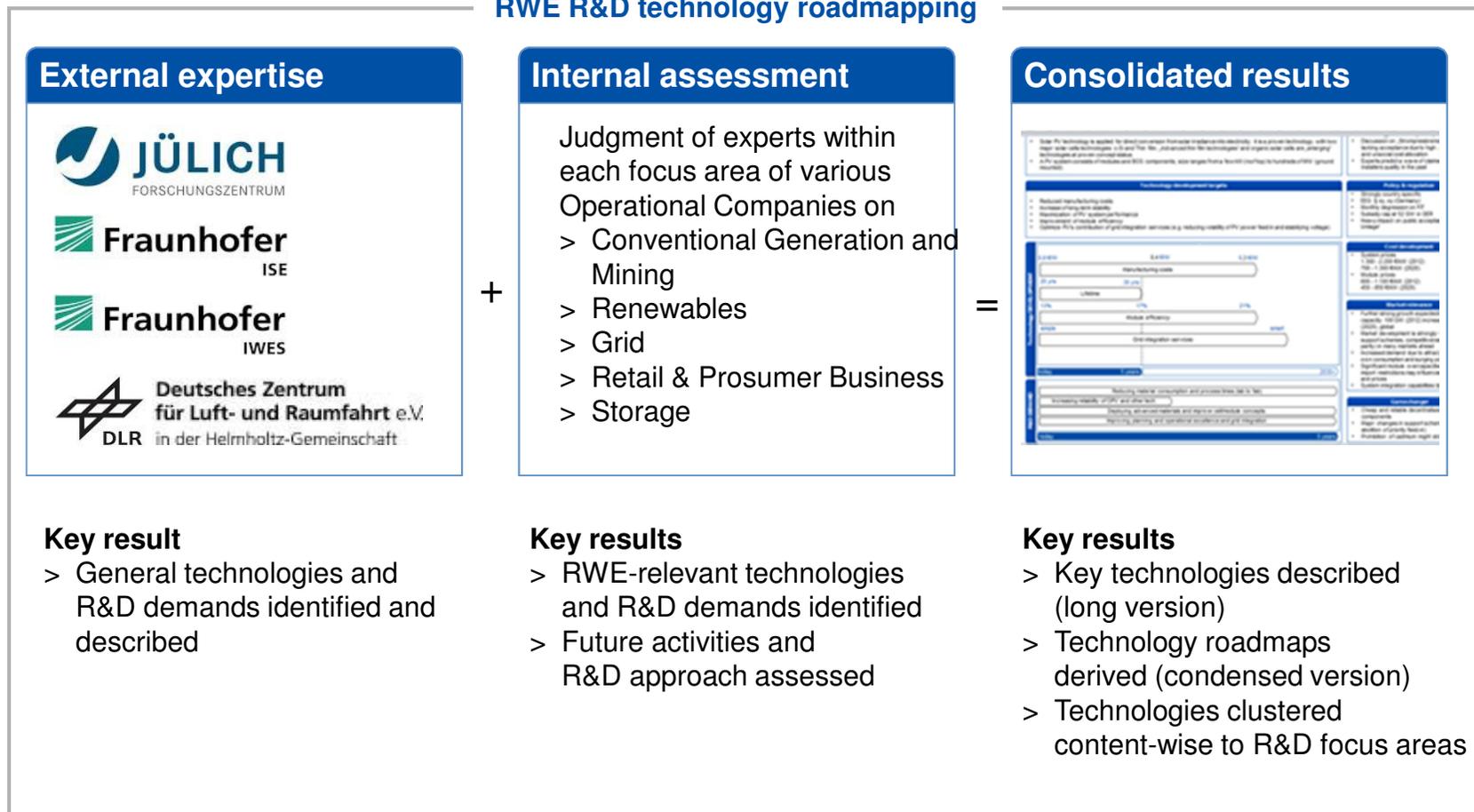
3 RWE R&D Portfolio Development B Roadmapping

A three step approach was carried out to deliver the mid-term R&D programme portfolio



Technology roadmaps have been jointly developed with a highly accepted consortium of scientific institutes

RWE R&D technology roadmapping



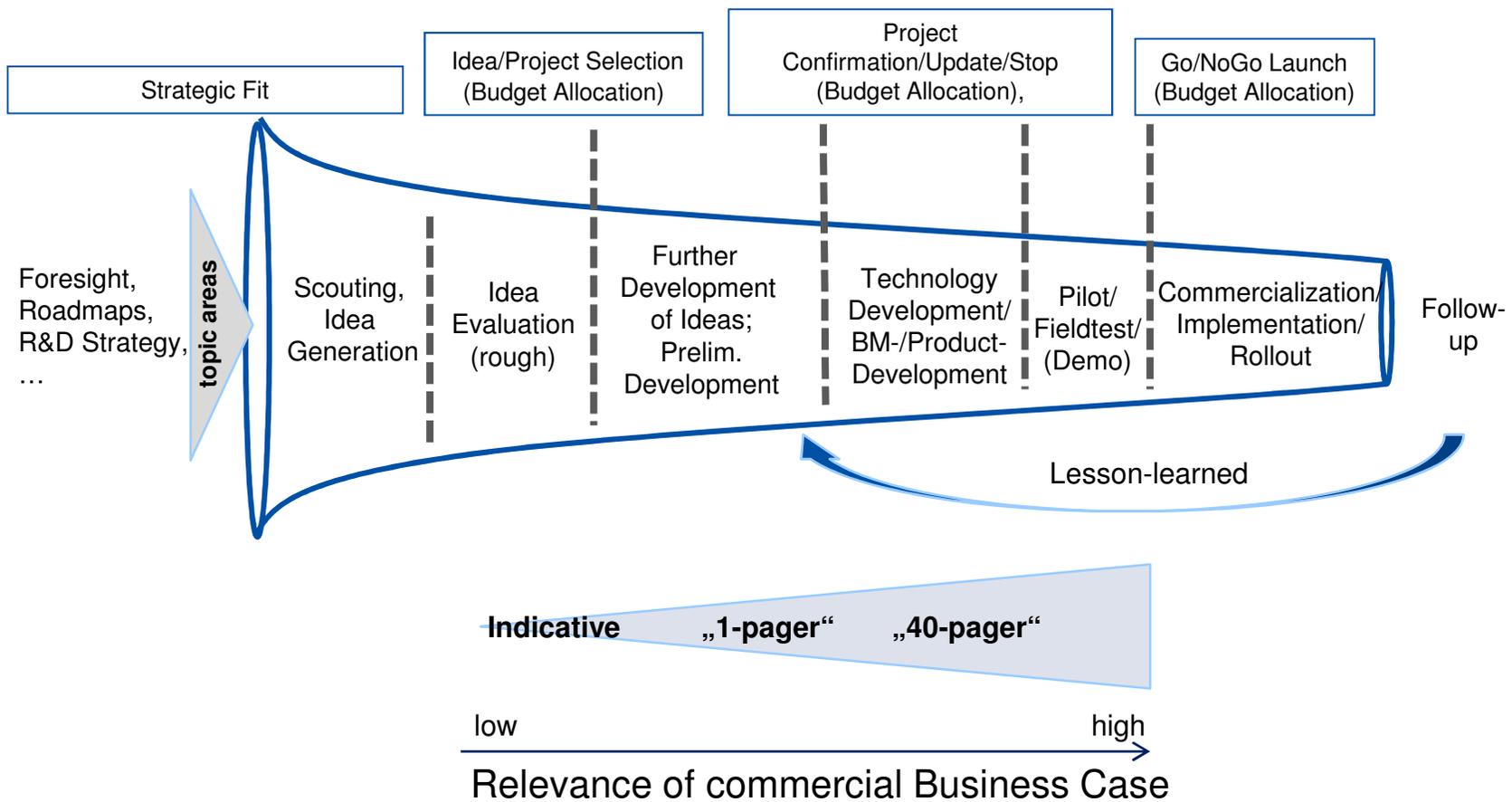
R&D Programmes build the bridge between long term strategic orientation and mid term R&D targets framework

R&D Programme abc									
Description	>								
Targets	<ul style="list-style-type: none"> > Target 1: Optimize ... until > Target 2: Reduce ... by x% until ... > Target 3: ... <p style="color: red; text-align: right;"><i>As measurable as possible (and suitable)</i></p>								
Programme budget	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Average yearly budget (MTP time horizon) in € million p.a. :</th> <th style="text-align: left;">Total</th> </tr> </thead> <tbody> <tr> <td>> Horizon 1 (Operational improvements):</td> <td>X € million</td> </tr> <tr> <td>> Horizon 2 (Development of new technologies):</td> <td>Y € million</td> </tr> <tr> <td>> Horizon 3 (Studies & monitoring):</td> <td>Z € million</td> </tr> </tbody> </table> <p style="color: red; text-align: right;"><i>Link to strategic horizons</i></p>	Average yearly budget (MTP time horizon) in € million p.a. :	Total	> Horizon 1 (Operational improvements):	X € million	> Horizon 2 (Development of new technologies):	Y € million	> Horizon 3 (Studies & monitoring):	Z € million
Average yearly budget (MTP time horizon) in € million p.a. :	Total								
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> Horizon 2 (Development of new technologies):	Y € million								
> Horizon 3 (Studies & monitoring):	Z € million								
Key activities	<ul style="list-style-type: none"> > > > > 								

3 RWE R&D Portfolio Development D Project Ideas / Selection

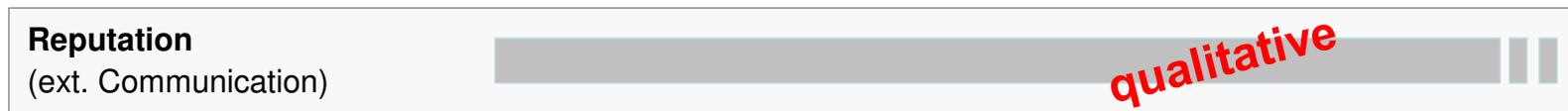
A systematic process is a prerequisite to successfully turn ideas into valuable “innovations”

Main Steps/Gates

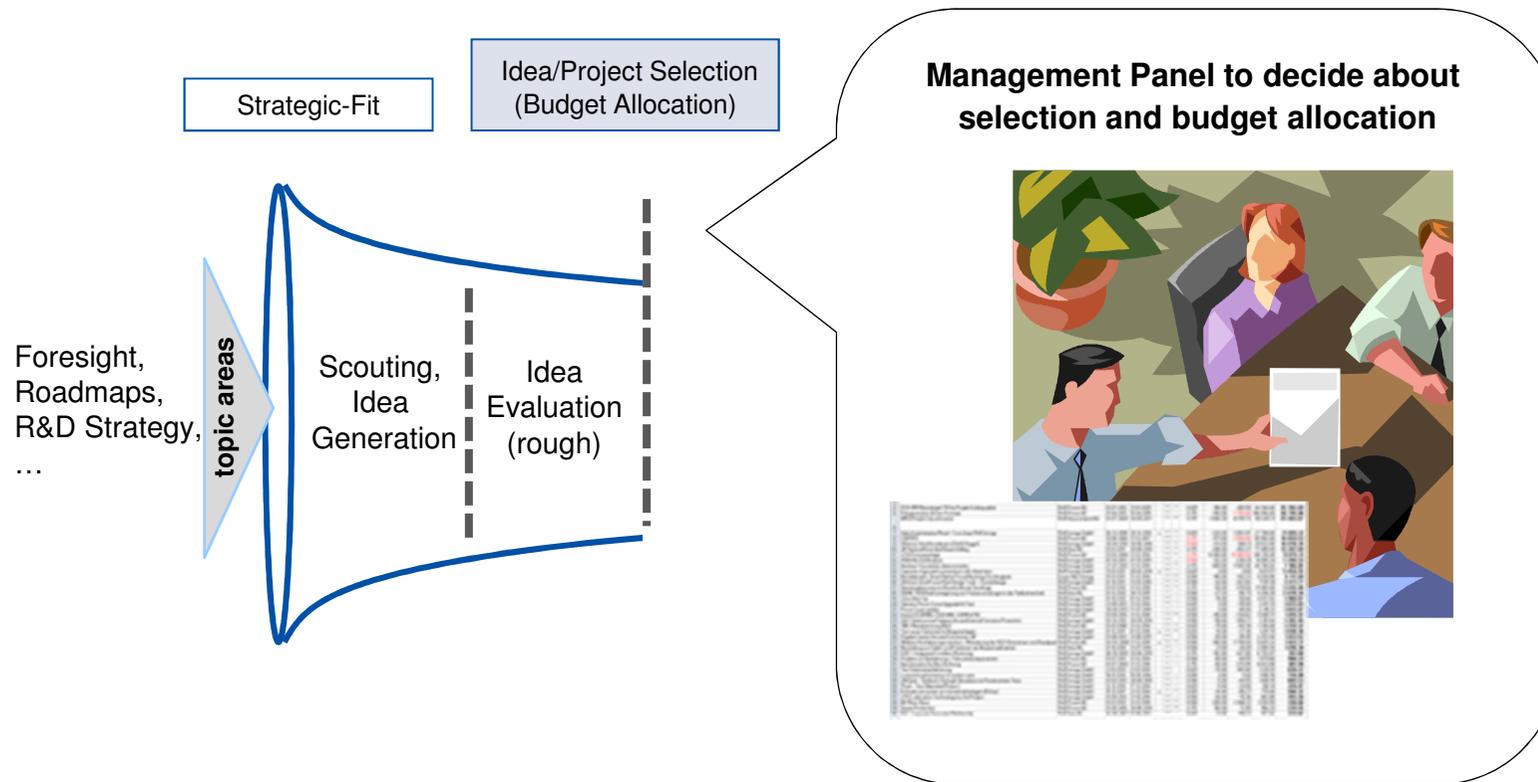


All corporate R&D projects must contribute substantially to our R&D value drivers measured through three „KPIs“

Generation of value over time in 3 dimensions



Prioritization/ranking of projects is a management issue, taking content, KPIs and budget restrictions into account



The current RWE R&D portfolio covers about 200 projects along the entire value chain



Gas/oil

- Reservoir characterisation
- Sedimentation and maturity history
- Gas hydrates

Coal-/Gas-based

- Plant flexibility
- CCS/CCU
- Lignite drying
- Coal quality

Electricity Grids

- Smart grids
- HVDC
- Super conductivity

Residential Households

- Smart energy / metering
- Smart home
- Micro CHP

Mining

- Automation
- Diagnosis of large scale equipment
- Groundwater modelling

Renewable

- Wind offshore
- Wind onshore
- Biomass/biogas
- Marine energy

Electricity Storage

- Compressed-air energy storage
- Heat storage
- Batteries

Transport

- E-mobility
- Comparison H₂ vs. electric drive

Nuclear

- Safety
- Maintenance of know-how

Gas Grids/Reservoirs

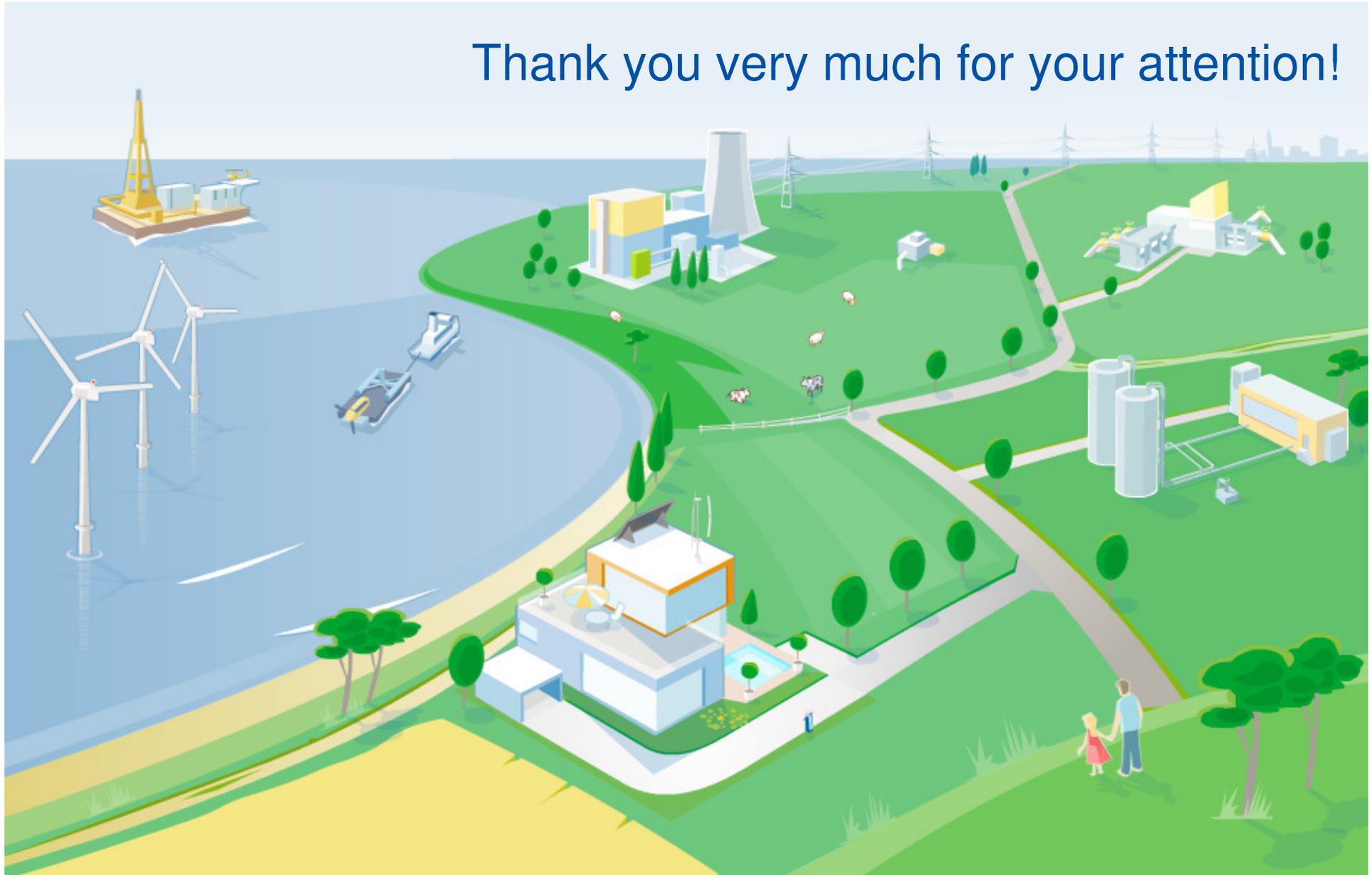
- Pipeline integrity monitoring

Industry/Commerce

- Distributed electricity and heat supplies
- Gas sensors

comprehensive technology and system analysis

Thank you very much for your attention!



If you want to know more: www.RWE.com > Innovation