RWE Power

Post Combustion Capture from coal

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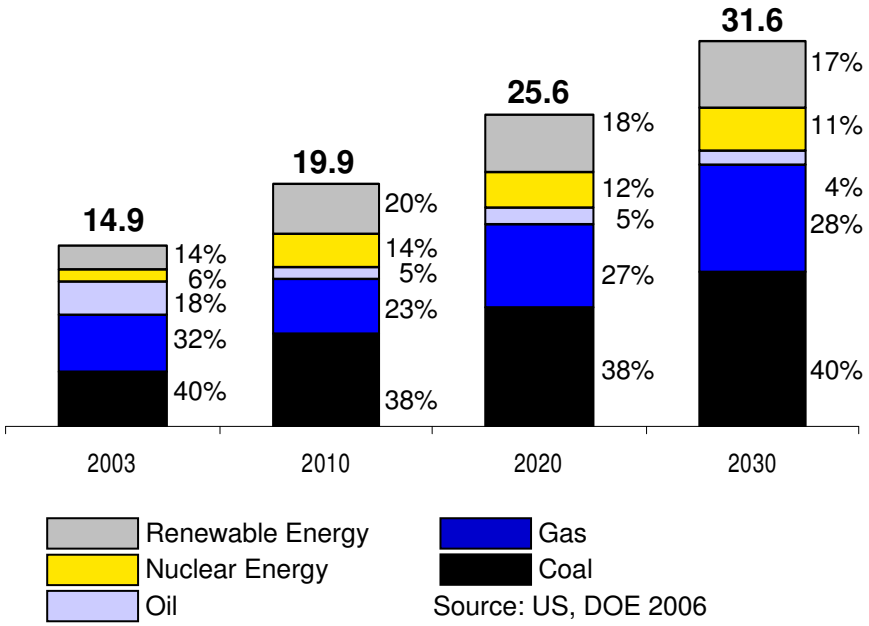
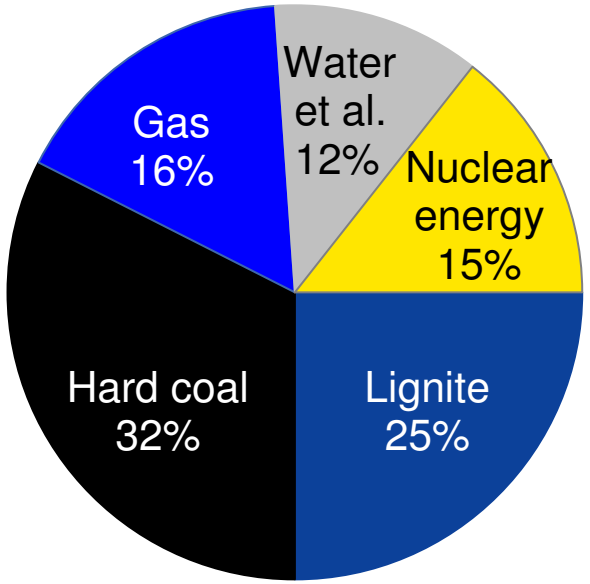
Continuing important Role of fossil Energy Sources in Energy Mix calls for Progress in Technologies

Electricity generation world-wide billion MWh



Source: US, DOE 2006

Lignite and hard coal are top-ranking in RWE's generation mix



Generation capacity (43 GW)

Rising world energy consumption demands increased use of fossil energy carriers.

EU import dependence is rising.

Global climate protection demands action.

RWE develops solutions for CO_2 reduction, especially for lignite as the sole national energy carrier with reliable supply

RWE's decisions on CCS

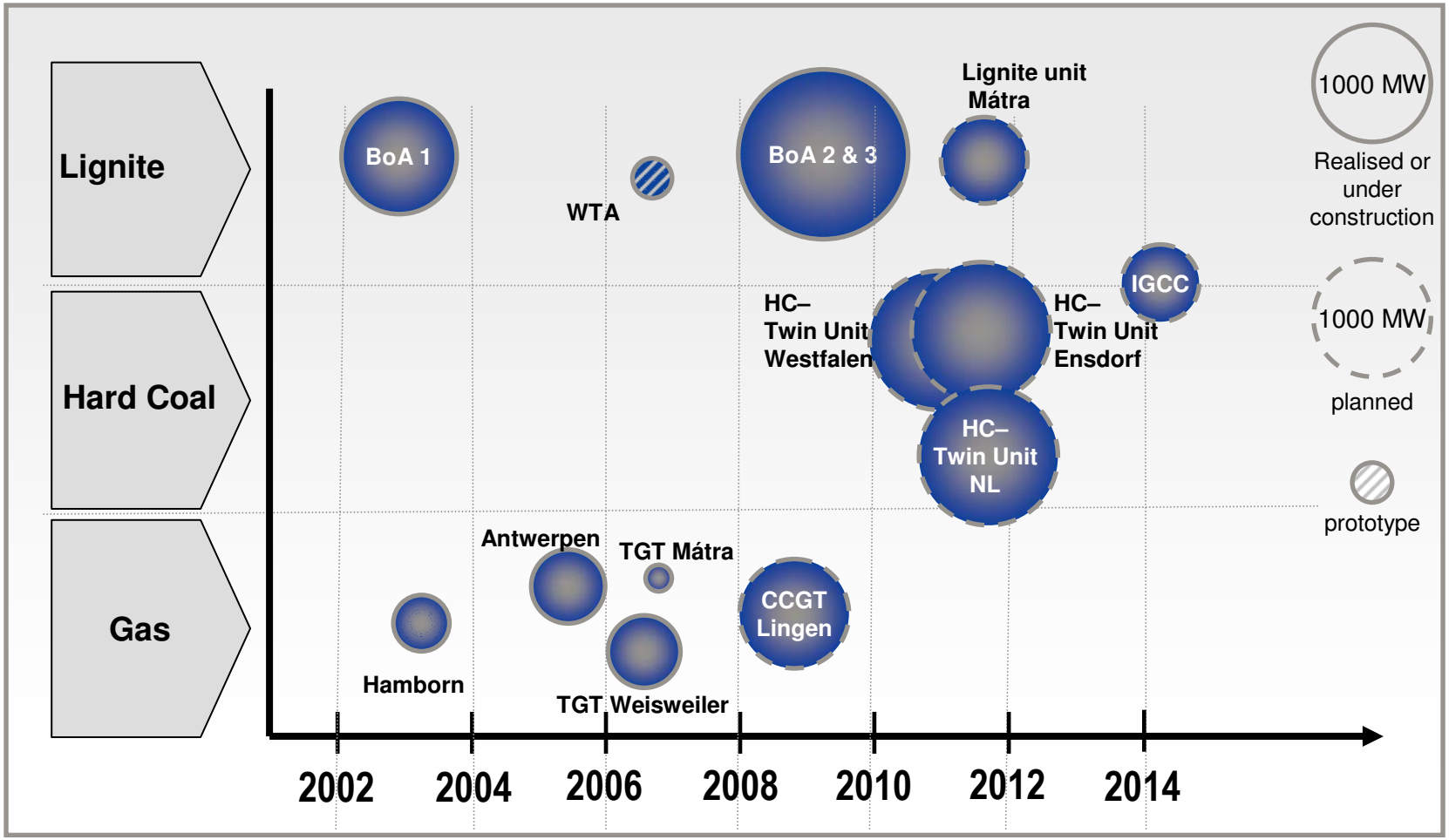
1. RWE Power develops and builds a **zero-CO_2 450 MW coal-fired power plant** based on IGCC technology incl. CO_2 transport and storage;
start of operation is planned for 2014.

2. In parallel, RWE will develop the technology of **CO_2 scrubbing** for future advanced coal-fired steam power plants and as a retrofit option for modern installations.
   - RWE Power will focus on CO_2 scrubbing for lignite
   - RWE npower will perform a feasibility study for a Clean Coal 1,000 MW steam power plant in Tilbury and carry out tests for CO_2 scrubbing in hard coal plants.

Post Combustion Capture (PCC)
- Motivation for RWE's Engagement

- PCC is the only option to realise significant reduction of CO_2-emissions in existing fossil fired power plants
- Innovative conventional power plants will still be constructed and installed in the coming 10 years
- Operation and availability of the power plant is not influenced even in the case of an outage of the PCC-process (PCC is an end-of-pipe technology)
- Retrofitting of existing power plants requires at least space for the facility and access to a pipeline towards a storage

Power plant renewal programme of RWE Power has been intensified



Post Combustion Capture (PCC)
- Basic concept of a PCC plant

720 t/h CO_2

Power plant
1,100 MW

Flue gas

3,960 t/h total
(800 t/h CO_2)
1 bar a
52 °C

CO_2 capture plant
Solvent: 30 % MEA

Cleaned gas
with
80 t/h CO_2

Post Combustion Capture (PCC)
- Chances & Risks of the Development

Chances

- Retrofit for existing and future advanced power plants can be ensured
- < 30 € / t CO_2 are achievable
- Less than 10 % points of efficiency loss are reachable
- Capture ratios of 90 % can be easily realised
- Commercial process available by 2014 can be accomplished

Risks

- The scale-up to non-pressurised volume flows of more than 2 mill. m^3/h represents the highest risk (besides CO_2-storage related issues)
- Trace elements in flue gas can not be exactly quantified yet, cumulated they could lead to higher operating expenses (thus pilot plant is obligatory requirement

Post Combustion Capture (PCC)
- RWE Project overview and tasks

Goals

- Efficiency loss < 10%-pts
- Guarantees
- < € 30 / t CO_2

Project development	Pilot and conceptual phase	Construction and operation of demonstration plant
■ Global screening ■ Technical/economic evaluation ■ Solvent development ■ Formation of a partnership	■ Investigation of potential solvents ■ Pilot plant operation ■ Optimization of a fully integrated PCC concept for a coal-fired plant ■ Cost analysis	■ Basic and approval engineering ■ Detailed engineering ■ Erection of a demonstration plant ■ Operation for two years

Tilbury - photo montage

- Tilbury located on north bank of Thames Estuary
- Large Combustion Plant Directive
- 2 x 800 MW supercritical
- CCS ready
- Operational by 2014

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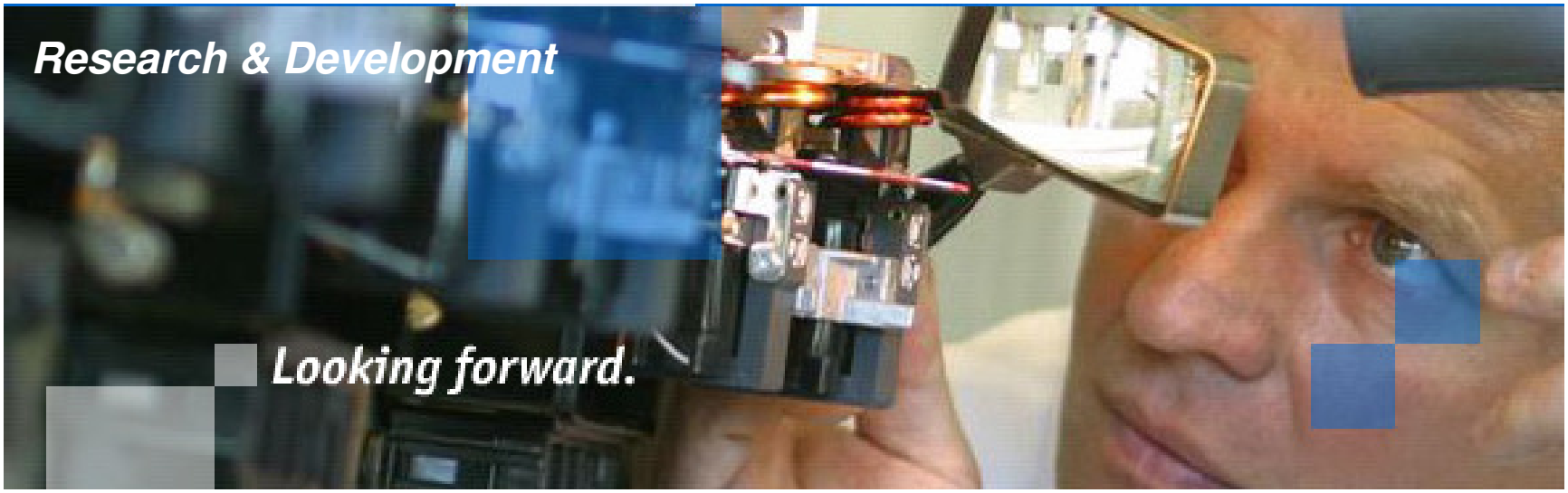

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