

Carbon Abatement: Power Sector View

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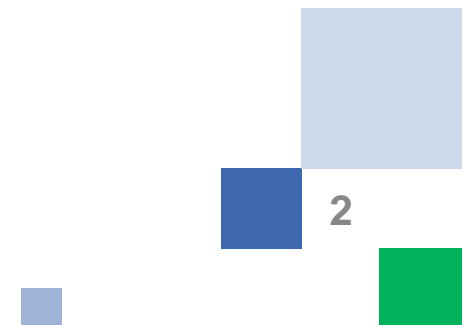
**Engineering Manager, RWE
npower**



Purpose

- To reflect the diverse views of the Power Sector on
 - needs
 - means
 - to achieve reduction of carbon emissions to the environment

- To identify the barriers to be overcome to achieve the Government's desired CO2 reduction targets



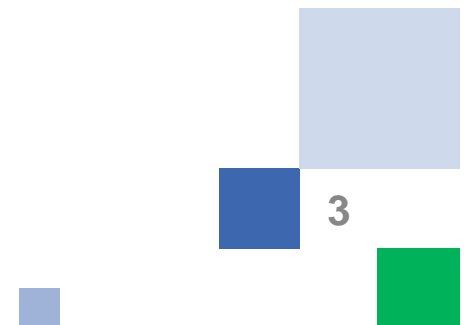
Power Sector

■ Power Sector Supply Chain comprises

- OEMS:
 - Alstom, Mitsui Babcock, SMEs, etc
- UK Utilities:
 - RWE, EON, EdF, Scottish Power, Scottish & Southern, International Power, Drax Power, British Energy, Centrica, etc.
- Technology providers:
 - Universities, Research Organisations, etc.

■ Other Key Stakeholders:

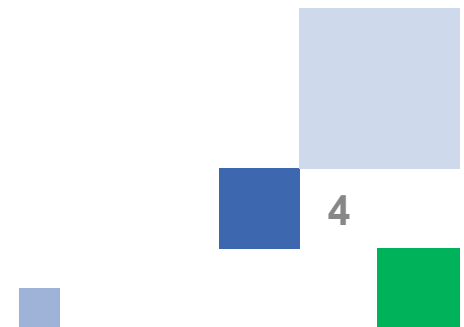
- OFGEM
- DEFRA/DTI
- EnvAge & HSE
- Public



RWE npower



- Part of the RWE Group of Companies (May 2002)
- Leading integrated UK energy company
- Core businesses are energy production, retailing, operations and engineering
- RWE npower's retail business, "npower" is one of UK's top three energy suppliers
 - Joined forces with Greenpeace to provide clean electricity product, "Juice", to 50,000 customers
 - npower produced 10% of electricity used in England and Wales



RWE npower - Generation

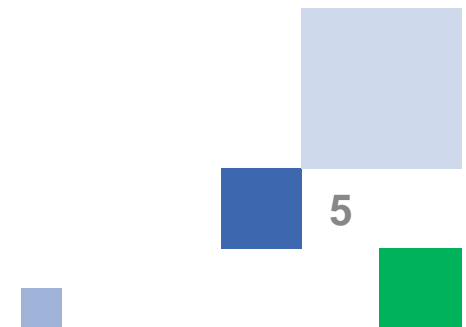


- In the UK, we own and operate a flexible portfolio of power stations, capable of generating around 10,000MW

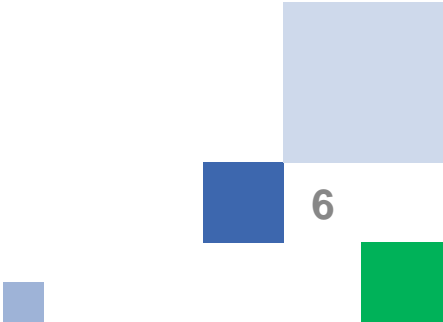
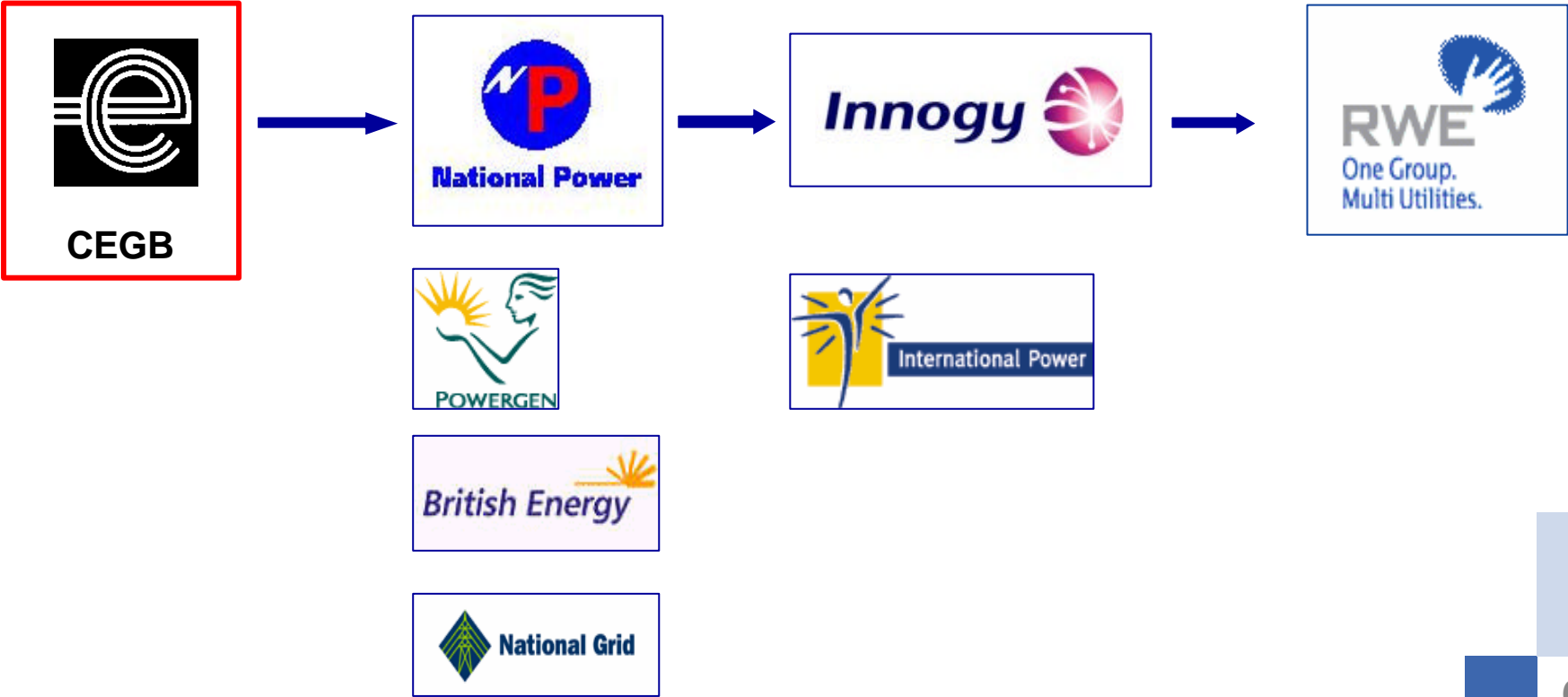
- We are market leaders in cogeneration and renewable energy production
 - Over 45% of npower's generation is from clean sources of power

 - UK's leading developer and operator of both on-shore & off-shore wind farms
 - 11 UK wind farms -> 160MW

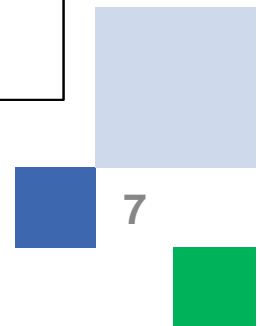
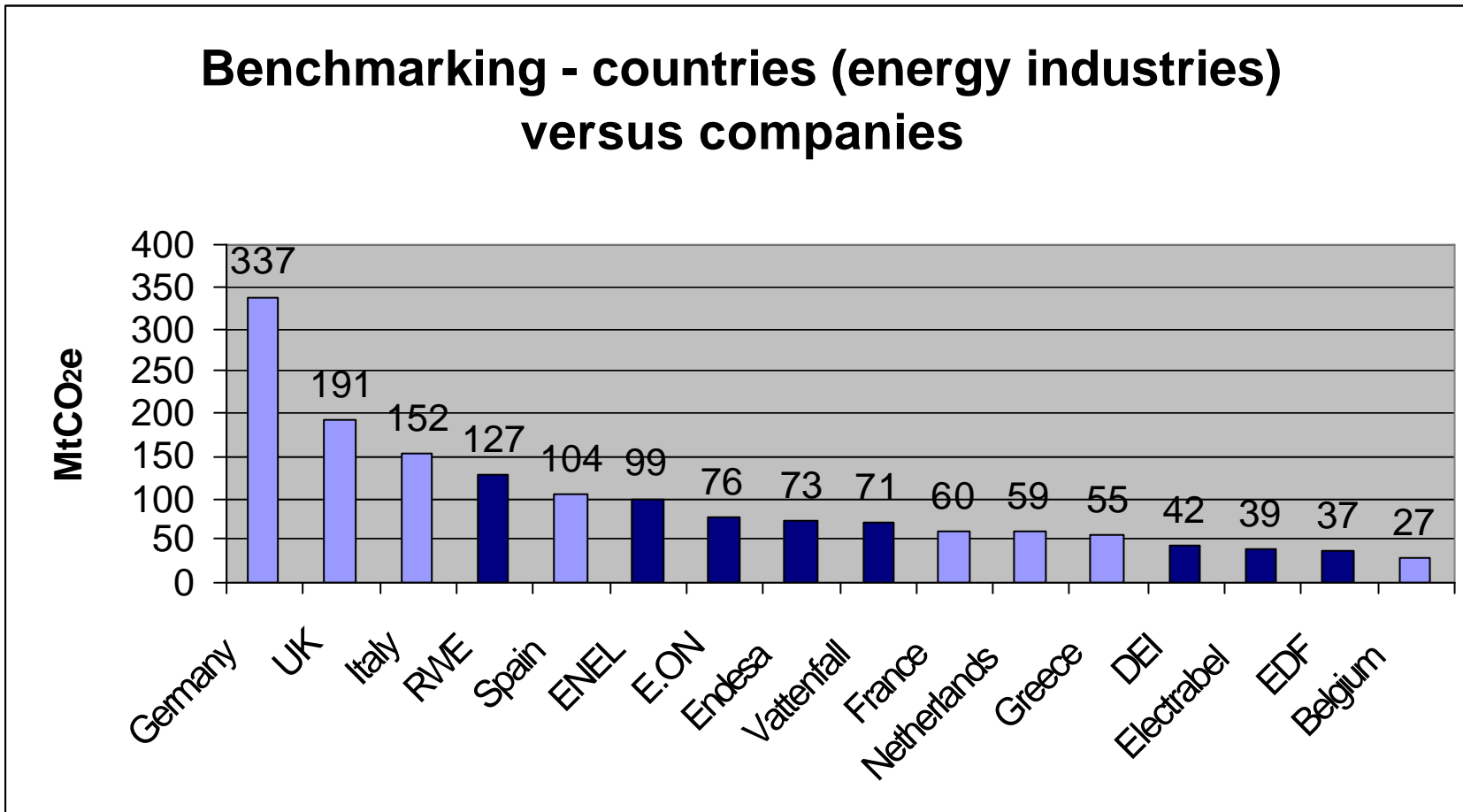
 - UK leading hydroelectric generator
 - 8 stations -> 50MW



RWE Innogy's Heritage



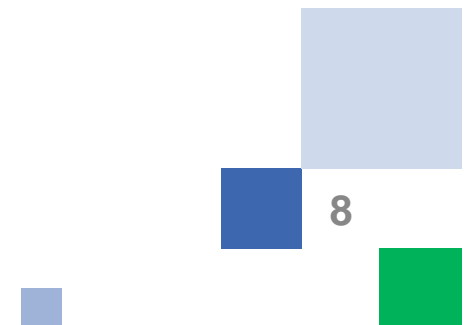
Why is Carbon Abatement Important to RWE



APGTF



- Advisory Body to DTI on Power Generation (fossil fired) R&D needs
- Membership is by Trade Associations, e.g.
 - AEP, PGCA, CHPA, etc.
- Provided CAT Strategy Report that greatly influenced DTI CAT Strategy
- I am AEP representative on APGTF



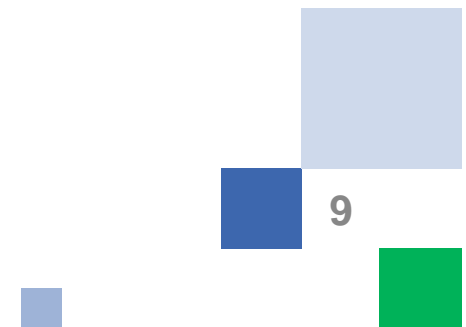
APGTF View on Drivers



- Fossil fuels will form part of UK Energy Mix in C21st
 - Carbon Abatement Technology (CAT) will be required

- Government want UK to be leaders in combating climate change
 - global viewpoint required, not just UK

- By 2030 4700GW of new generating plant required (~\$4.1B)
 - CAT will be required



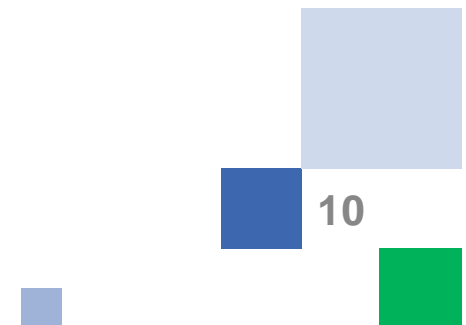
APGTF View on Strategy



- CO2 reduction through two CAT routes:
 - Generating plant efficiency increase
 - Carbon capture & sequestration (CCS)

- Efficiency improvements now
 - Benefit other emissions & requirement of IPPC
 - Technology driven & relatively low cost
 - Much R&D done – industry led

- CCS later
 - Legal and public concern issues to be addressed
 - Much R&D required – to be industry led
 - Capital intensive & possibly high operating costs



APGTF: OEM Needs



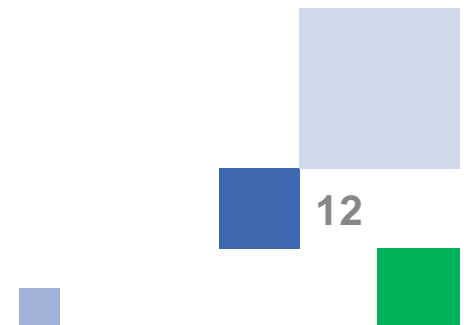
- Global power generation equipment supply market
- UK need demonstration plant
 - To demonstrate UK capability to foreign potential equipment purchasers
 - To maintain technology competence in UK
 - In utilities, OEMs & Technology Suppliers
- UK benefits from healthy power generation equipment supply business sector
 - Revenues for tax man
 - Employment for high quality technical people

APGTF: R&D



- Mainly an issue for equipment suppliers
 - Utilities can buy equipment from across the world

- Needs to support both CAT routes
 - Higher efficiency plant can reduce UK CO2 by 20%
 - Twice Kyoto requirement
 - CCS a global solution to CO2 with continued fossil fuel use
 - CCS removes 80%+ of CO2



CAT Now? Obstacles



■ Market Drivers

– Definitions

- Spread = electricity price minus fuel price
- “Spark Spread” is spread for gas
- “Dark spread” is for coal

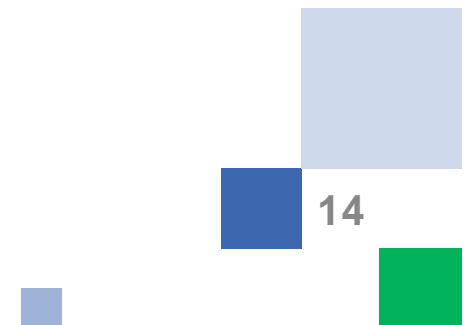
– Currently “spread” issue

- High gas prices = high electricity prices
 - Spark spread is small
 - Dark spread is high
- More coal use but not enough financial incentives to invest

CAT Now? Uncertainty Obstacles



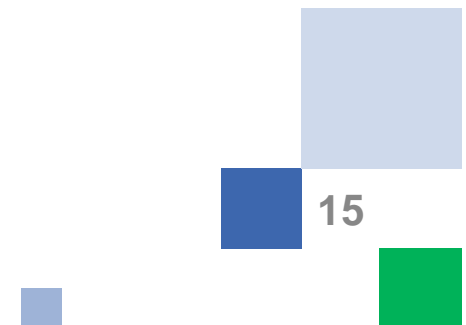
- High level of regulatory (Government) uncertainty
 - DEFRA/DTI
 - RO; Energy Review; Nuclear option
 - ETS – Allowance Applications: 2008, 2012
 - Fuel prices
 - Gas (why so high now?)
 - Coal (Chinese influence)
 - Capital Markets
 - Lenders “burnt fingers” in the past
 - Power Generation no longer low risk



Supply side reductions

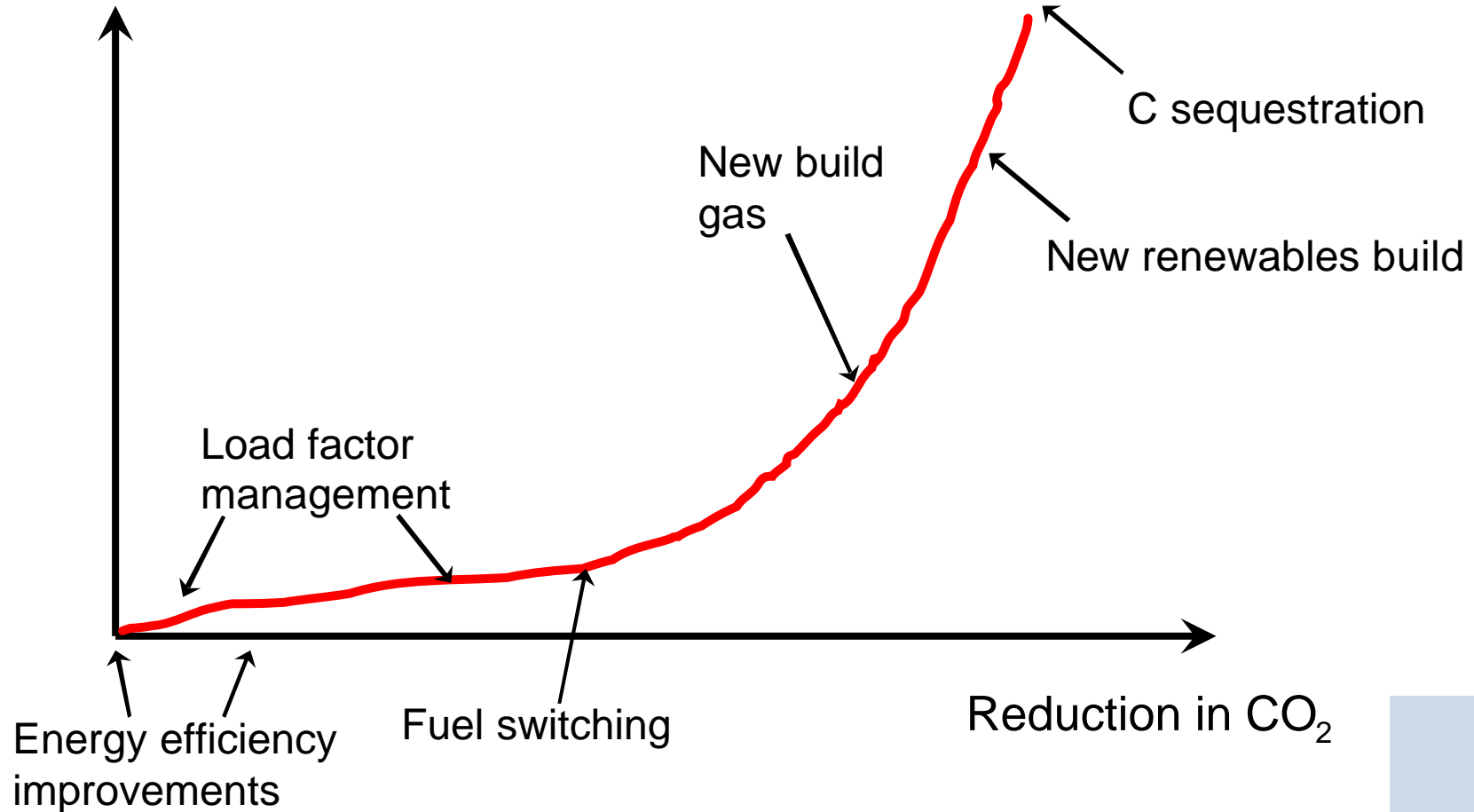


- CHP
- Retrofitting existing plant with of improvement reasons
- Fuel switch to low carbon and fuels (gas, methanol)
- New more efficient power plant
- CO₂ removal – technology issues not resolved, especially in highly oxidising conditions eg CCGT exhaust
- Business
- Wind
- Other renewables



Internal cost of carbon for an electricity generator

Marginal cost £/tCO₂



An essential component of in-house assessments

CAT: Outcome



- Currently not sufficient drivers or confidence to invest
 - Still R&D programme
 - Industry will need:
 - Capital grants
 - Consistently high electricity prices
 - More stable regulatory (in particular implementation) regime, including OFGEM

- LCPD and IPPC seen as biggest issues in sector currently



Crystal Ball?

- Role for Nuclear = unclear
- Gas or gas or gas?
 - 130 years of current demand
 - 100,000 BCM of gas reserves “in Europe”
 - nearly half in Russia
 - quarter in Iran
- Need some extra incentive to retain coal
- If we get it wrong:-

