Impact of carbon prices on investment decisions

IETA-EPRI-IEA 9th Annual Workshop on Greenhouse Gas Emission Trading
Paul Dawson, RWE Supply and Trading
14 September 2009
## More Growth, Less CO₂ – Our Strategic Roadmap for 2012

<table>
<thead>
<tr>
<th>What we aim to do</th>
<th>Target for 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defend and expand existing margins in RWE key markets Germany and UK</td>
<td>GER: defend/grow margins on current volumes UK: defend/grow volumes and profitability</td>
</tr>
<tr>
<td>Increase level of regional diversification</td>
<td>Share of non-German operating result grows from 27% (2008) to 40 - 50%</td>
</tr>
<tr>
<td>Boost proportion of renewables in our generation portfolio</td>
<td><strong>More than tripling of installed base to 4,500 MW</strong></td>
</tr>
<tr>
<td>Reduce carbon exposure</td>
<td><strong>Reduction by 20% (compared to 2006 emissions)</strong></td>
</tr>
<tr>
<td>Strengthen gas midstream activities</td>
<td>Profitably increase contracted European gas supply purchase volume from 40 to 60 bcm p.a.</td>
</tr>
<tr>
<td>Grow equity gas business organically</td>
<td>Doubling of hydrocarbon production by 2012/2013 to 12 bcm p.a.</td>
</tr>
</tbody>
</table>
Specific Measures to reduce carbon exposure

Energy efficiency
- Invest in best available technology: lignite, hard coal, gas, CHP
- Strong R&D: Develop new technologies e.g. fluidised bed drying, increasing steam parameters
- Energy efficiency business unit

Renewables
- Substantial increase of current investment budget (on average at least 1 billion p.a. until 2012)

CDM & JI
- €150 million budget
- Target of 90 MT over 2008 – 2012

CCS
- Industrial scale with coal gasification: 450 MW project
- R&D
CO₂ Avoidance Costs Compared to Old Lignite

Specific CO₂ reduction costs¹
in €/t of CO₂

- Lignite (BoA): 17 – 19
- Nuclear power: 24 – 28
- Hard coal: 31 – 33
- CCGT²: 41 – 45
- Wind: 38 – 64
- Hydro: 46 – 78
- Photovoltaic: 525 – 670

¹ Calculation of costs:
- Allocation of CO₂ certificates is not taken into account
- Subsidies for renewables are not considered
- Rough estimation of costs of sequestration
- A comparison with prices of European emission allowances is not possible on basis of this illustration

² CCGT: Combined-Cycle Gas Turbine.
RWE's Kyoto Credit Portfolio 2008-12

Projects as of December 31, 2008

Contract volume by technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>Million Certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂O</td>
<td>11.96</td>
</tr>
<tr>
<td>Hydro</td>
<td>15.01</td>
</tr>
<tr>
<td>Other</td>
<td>1.74</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0.90</td>
</tr>
<tr>
<td>Biomass</td>
<td>2.67</td>
</tr>
<tr>
<td>Coal mine methane</td>
<td>2.25</td>
</tr>
<tr>
<td>Biogas</td>
<td>0.79</td>
</tr>
<tr>
<td>Wind</td>
<td>2.50</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>12.46</td>
</tr>
<tr>
<td>HFC23</td>
<td>10.68</td>
</tr>
</tbody>
</table>

Contract volume by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Million Certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>42.62</td>
</tr>
<tr>
<td>Ukraine</td>
<td>0.27</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>0.40</td>
</tr>
<tr>
<td>South-East-Asia</td>
<td>1.03</td>
</tr>
<tr>
<td>India</td>
<td>1.83</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3.30</td>
</tr>
<tr>
<td>Egypt</td>
<td>3.48</td>
</tr>
<tr>
<td>South Korea</td>
<td>7.90</td>
</tr>
</tbody>
</table>
Technology Development

- RWE Power plans to develop and build 450 MW coal-fired IGCC plant at Goldenbergwerk site in Huerth near Cologne
  - Includes CO₂ transport and storage to demonstrate the whole CCS-chain
  - Commissioning scheduled for 2014
- RWE Group R&D budget at €1bn 2007 to 2013 - more than two thirds are directed to carbon avoidance
- Further development of CO₂ scrubbing for advanced conventional power plant technology:
  - RWE npower plans to design and build the first carbon dioxide capture 1MW pilot plant at a UK coal power station (Aberthaw, South Wales)
  - Possible 25 MW demonstrator plant at Tilbury.
  - Testing and development of new capture processes and solvents with pilot facility at Niederaussem power plant (with BASF and Linde)
  - Similar project at AEP’s hard coal-fired Mountaineer plant (1,300 MW) in New Haven, West Virginia (with AEP and Alstom)
Nuclear Strategy: Preservation of Nuclear Competence, Growth in New and Existing Markets, Zero CO₂

**Investment criteria**

- **Security**: Focus on countries with an existing nuclear framework (legal, infrastructure, waste)
- **Nuclear framework**: Highest standards (plant security, technology, quality), focus on new builds
- **Strategic fit**: Attractive market, fit with RWE’s portfolio and strategy
- **Financial criteria**: The same standard criteria as for other generation new build projects

**UK**

- New nuclear programme since 2006
- Auctioning of NDA sites in 2009
- JV with E.ON to build at least 6 GW

**Romania**

- Construction of two new CANDU units (2 x 720 MW) in Cernavoda
- Commissioning planned for 2015/16

**Bulgaria**

- Construction of two AES 92 units (2 x 1,000 MW) pressurised water reactor units in Belene
- Commissioning planned for 2014/15

**RWE activities**

- NPP units being planned/considered

**National frameworks**

- National framework for new build until 2015
- National framework for new build between 2016 and 2025
Have the market mechanisms had a noticeable impact on companies investment decisions?

- Yes, absolutely
  - Operations and maintenance
  - Extension and replacement
  - New construction
  - New technology

- Other factors play a role:
  - Capacity balance
  - Subsidies

- The fact that carbon prices are uncertain and are not the sole driver is a fact of life in an uncertain world

So what’s the real question?
Is the carbon price sufficient? The dangers of second-guessing

- Supplementary support
  - Why pay twice (eg, once for carbon and again for “low carboness”)?
  - Clear justification required
  - Masking residual market signals = risk of picking losers

- Floors
  - Why discard upside?
  - Overprovision

- Caps and smoothing
  - Under-delivery
  - Moral hazard
  - Crowd out commercial responses
  - Markets can deal with price uncertainty but not policy uncertainty

How credible is a policy which admits failure from the outset?
Market design not intervention is the key

Deeper = efficiency

Longer = certainty

Wider = Environmental credibility

- International extension and linking
- Transitional offsets (projects/programs)
- Additionality
- Supplementarity
- Border measures

- Flexible points of compliance
- Complementary policies

- Wider and deeper = longer
- Compliance flexibility (banking/borrowing)
- Long-term signals vs short-term tuning
Conclusions

- Carbon prices already drive investment
- Further development of coherent market framework will deliver further benefits
- Avoid second-guessing market delivery