Challenges in electricity – a focus on Europe
Agenda

- Short and medium term impact of the German moratorium
- Longer term challenges: maintaining supply security during decarbonization
Germany: Moderate, 10% price reaction due to excess capacities

Utilisation factors in Germany

EU power prices still below the level that would recover investment in new plant
Microeconomics of the moratorium: who is paying?

- Elastic supply due to excess thermal capacity
- Lost producer surplus
- Nuclear and renewables
- Supply before
- Supply after
- Demand
European scale effects of the moratorium

Where the replacement of German nuclear comes from?

- German coal and French nuclear plays a key role
EdF’s higher load factors counterbalanced reactors shut-down in Germany

Nuclear generation in Germany, France and the UK, 2010-2011 (TWh)

- Germany
- France and UK

2010
- Shut down of 7 GW
- -22 TWh

2011
- Improved EDF’s load factor
- +24 TWh

Germany

France and UK
One of the biggest investment waves into coal fired plants outside China is taking place in...
Maintaining reserve margin will necessitate new investments before 2020

Reserve margin in Germany (% of installed capacity above peak demand in 2010)

Current installed capacity and 12 GW of capacity under construction in Germany can cope with shut down of 7 reactors
Reduction of Southern European imports is a high cost reserve

Physical energy flows between European countries, 2008 (GWh)

Source: ENTSO-E

* Not to be confused with contractual electricity exchanges
Renewables are the prime driver of supply growth
German moratorium: Even with policy success, gas will be needed to deliver CO₂ reductions

German electricity mix with 10% demand reduction, no nuclear, 35% renewables and CO₂, at the target level
Weak demand and renewables expansion leads to falling carbon prices

Making coal the most profitable source of power in Europe
Excess capacity + oil indexed gas + nuclear phase out puts utilities into a financial squeeze

Stock prices of major utilities, 2007 Jan = 1.00

- RWE
- E.ON
- GdF
Longer term challenges: maintaining supply security during decarbonization
Electricity is not going out of fashion

Even with all the energy efficiency achievements in 450 ppm, EU power demand grows by more than the current German system
Is CCS deployment on track?

CCS | Netherlands stops Shell's CO2 storage project in Barendrecht

The Dutch government said Thursday it will not allow oil giant Shell to store millions of tonnes of carbon dioxide in a depleted gas reservoir under a small town, upholding the fears of townspeople.

E.ON: incentive could have saved Kingsnorth CCS project

Company suggests "low carbon" version of the Renewables Obligation including CCS and nuclear might have kept project in the UK

By Will Nichols

Storage Concerns Delay Australian CCS Timeline

March 21, 2011

On 27 January 2011, Australia's federal government announced that it would delay and reduce the funding available to support its A$2 billion carbon capture and storage (CCS) Flagship funding program in order to support Queensland's flood recovery efforts. As part of those efforts, A$150 million in CCS Flagship funds will be deferred until after 2015, while A$80 million will be cut from the CCS Flagship budget altogether. Key tends in this On Point include:

Carbon capture approvals behind UAE-BP project delay

http://www.google.com

Norway delays CCS project again, angers greens

By Catalina Fournier

21 Oct 2010

(Reuters) - Norway said on Tuesday it would delay again a decision to finance a top carbon capture project, this time to 2016, in a setback for a technology that is seen as key to mitigate climate change.

Rotterdam offers the location for the construction of a large-scale power station, which has access to the sea for ships that can transport the CO2 and the solid fuel.

Updates

Announcement - Feasibility study stopped

After close consultation between Havenbedrijf Rotterdam NV and C. GEN NV it has been decided on October 25, 2010 to stop the feasibility study on the establishment of a hydrogen power plant (Integrated Gasification Combined Cycle) on the Kop van de Beer-site.

The reason is the technical feasibility of this location, coupled with uncertainties regarding regulation and storage of CO2 in the Netherlands
450 ppm in the EU: growth of intermittent renewables is comparable to gas fired generation today

981 Twh incremental wind and solar PV till 2035
Renewable energy is now reaching a macroeconomically important scale

PV's share of total business investment

- 2008/09 Spain
- 2010 Czech Republic
- 2010 Germany
- 2011 Italy
The economic efficiency of policy is increasingly important

- **Mainly FITs/FIPs**: Dark blue
- **Mainly TGCs**: Pink
- **Mainly other/multiple**: Green
- **None**: Orange

![Graph showing additional annual premiums and additional share in annual generation](image_url)

- **Czech Republic**: High additional annual premiums and high additional share in annual generation
- **Germany**: Moderate additional annual premiums and high additional share in annual generation
- **Italy**: High additional annual premiums and moderate additional share in annual generation
- **Belgium**: Moderate additional annual premiums and moderate additional share in annual generation
- **Slovak Republic**: Moderate additional annual premiums and low additional share in annual generation
- **Other 26 countries**: Various combinations of additional annual premiums and additional share in annual generation
All flexibility sources will be needed

- Dispatchable power plants
- Demand side Response (via smart grid)
- Energy storage facilities
- Interconnection with adjacent markets

A biomass-fired power plant

Industrial

A pumped hydro facility

Scandinavian interconnections

Demand side Response (via smart grid)
As gas backs renewables, its load factor declines

Leading to concerns on the adequacy of market design
Gas infrastructure needs of backing renewables

25 GW wind (around the current German capacity) backed by gas turbines needs to be prepared

On an hourly basis
Max-Min demand spread = 21.4 GWh, which equals:
- 80% of current German gas-fired generation capacity
- 4.4 million m³ natural gas demand – within the range of linepack gas

On a daily basis
Max-Min demand spread = 445.2 GWh, which equals
- 91 million m³ natural gas demand
- 20% of German gas storage peak withdrawal rate – but most of that is designed for winter – summer cycling

On a yearly basis
Max-Min demand spread = 22.3 TWh, which equals
- 830 running hours of all current German gas-fired generation capacity
- 4.2 BCM of natural gas demand, or 4.5% of total German gas consumption (2010)
Very, very large transmission capacity upgrade needs

Source: EWI Cologne, Optimal transmission grid scenario
Is there sufficient coordination on dealing with volatile flows?

Czech electricity grid company ready to block German wind power

Czechs and Poles on the verge of sending disruptive flows of German wind-produced electricity back down the lines to the sender.

Poland threatened German energy policy

Construction of a new power line: Dena chief urges accelerated expansion of Kohler

Border blockade for green electricity: Because the Polish network operator fears an overload, he wants to prevent the import of wind and solar power from Germany. The head of the German Energy Agency is now calling on ENTSO-E to mediate with the gridusing country.

Austria to ban import of nuclear fueled energy

Effect on ČEZ remains uncertain as experts question feasibility of plan

Posted: July 13, 2011
By Cat Coggiolone - Staff Writer | Comments (1) Post comment
Rollout of electricity storage will be essential

Europe has winter peak demand (+80 GW) and 0 solar PV at system peak (December evenings)
Nuclear production in Europe: which scenario are we in?
In imperfect capital markets, project size matters: big lumpy projects with implementation risk face higher WACC

**Solar PV**
- Average project size 10000 Euros
- Investors: over 300000 middle class families
- Project implementation in weeks

**Nuclear**
- Average project size 1000000000 Euros
- Investors: less than 10 companies in Europe with adequate balance sheet
- Project implementation in a decade
Compared to an „ideal”* nuclear project, the impact on NPV

*Ideal project: 4 billion usd/GW, 6 years, 8% wacc, 80 usd/mwh power price
Direct involvement of institutional investors can bypass balance sheet constrains

Offshore wind (Gunfleet Sands, UK)

Electricity transmission (RWE Amprion, Germany)

New nuclear post construction (Hinkley Point, Oldbury, UK)
Thank you for your attention