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Transforming the energy system: what role for nuclear power?

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Challenging the Myths. A Transatlantic Debate on Nuclear Power and the Civil-Military Dilemma

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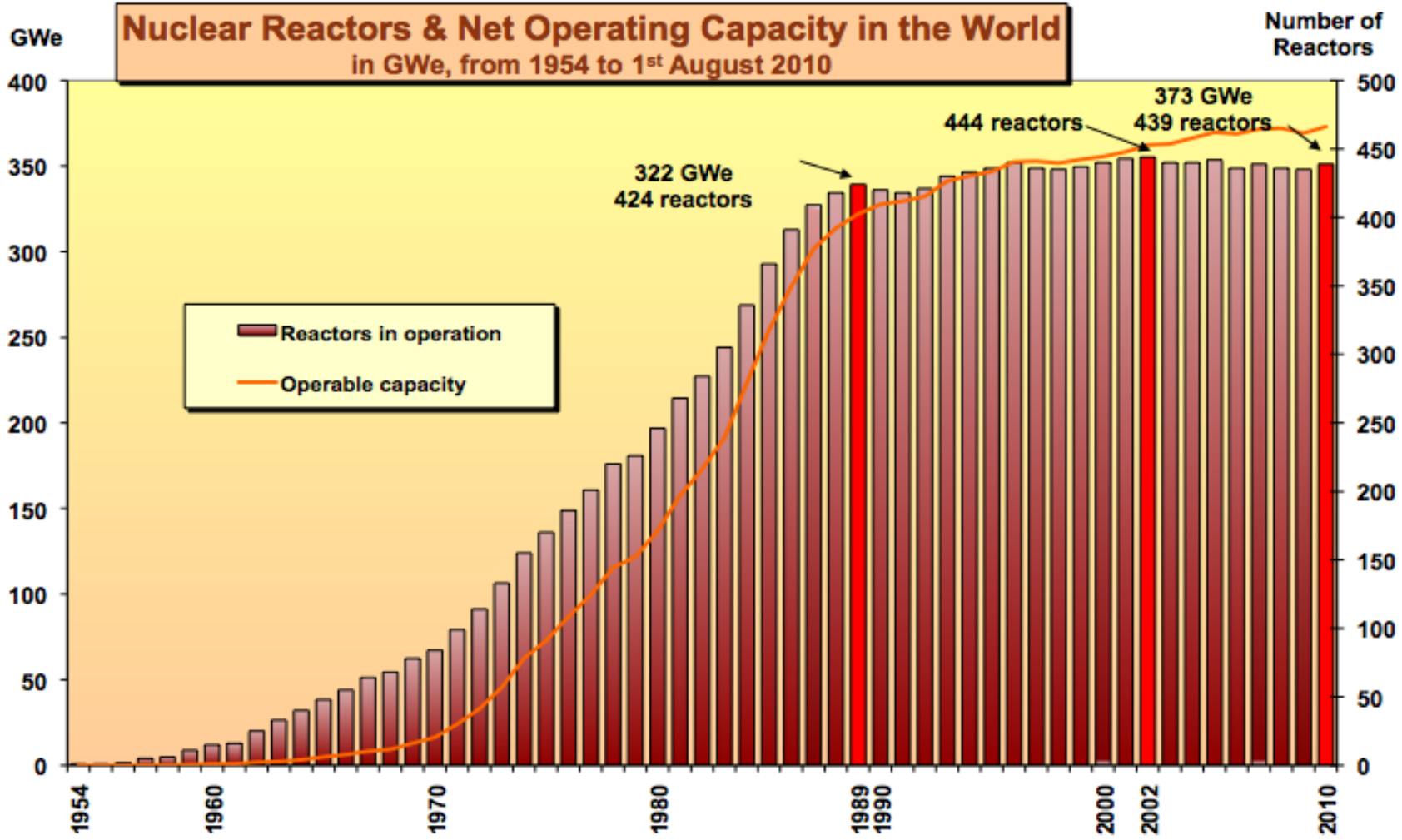
Momentous times

In some cases, the surprise element is only a matter of timing: an energy transition, for example is inevitable; the only questions are when and how abruptly or smoothly such a transition occurs. An energy transition from one type of fuel (fossil fuels) to another (alternative) is an event that historically has only happened once a century at most with momentous consequences .

(US National Intelligence Committee 2008)

World nuclear develoment



Source: IAEA-PRIS, MSC, 2010

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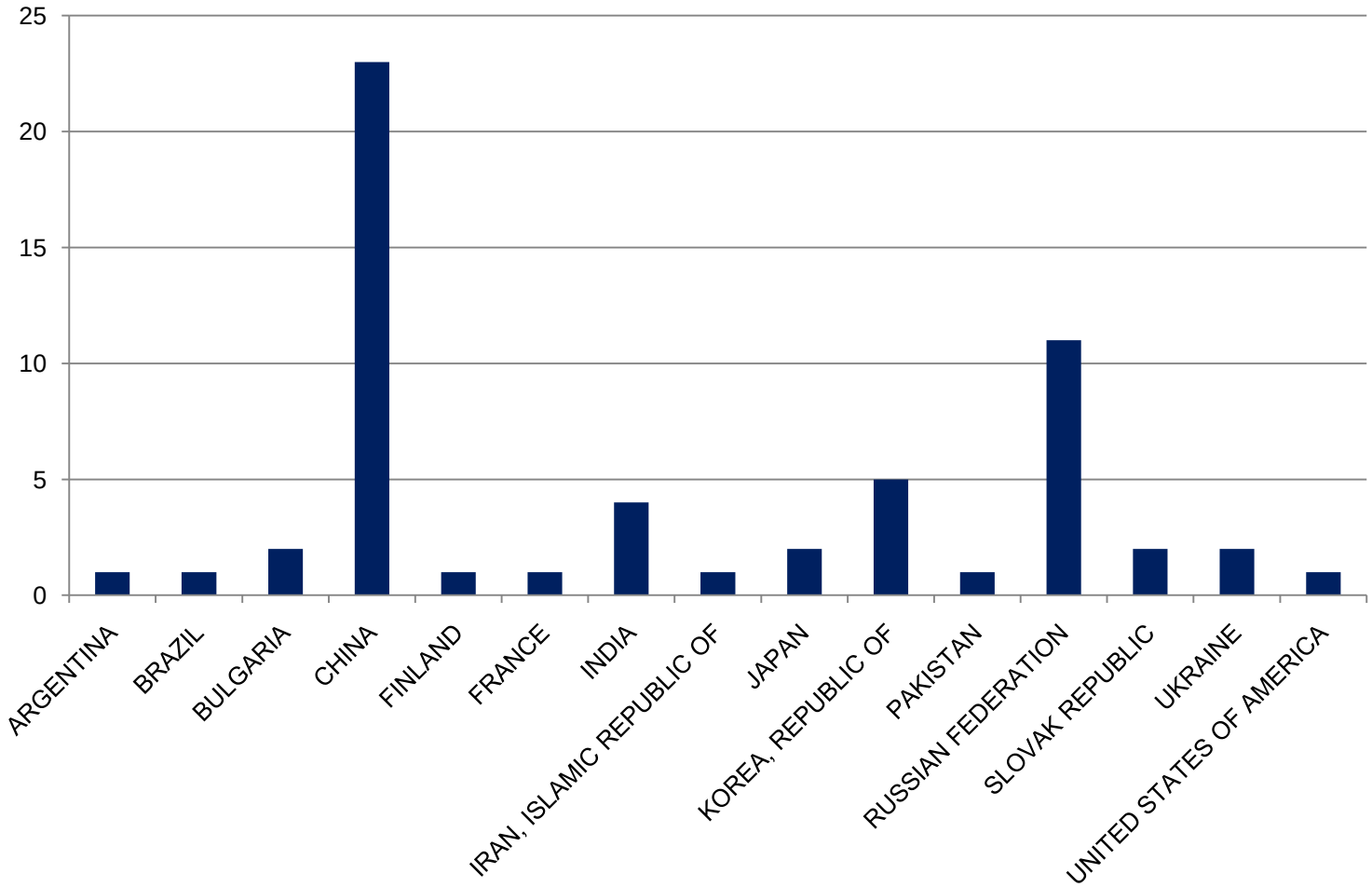
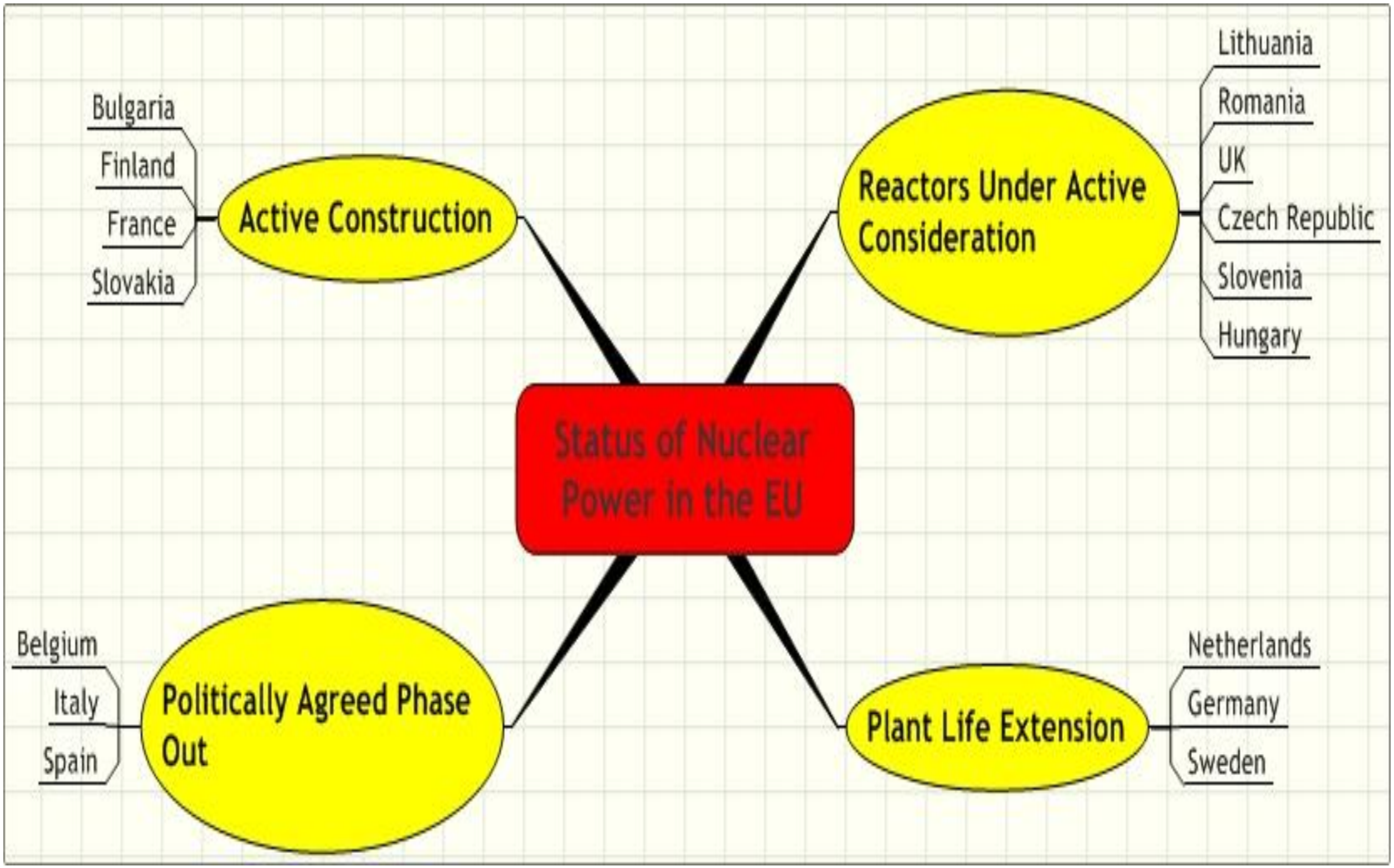
Nuclear reactors under construction

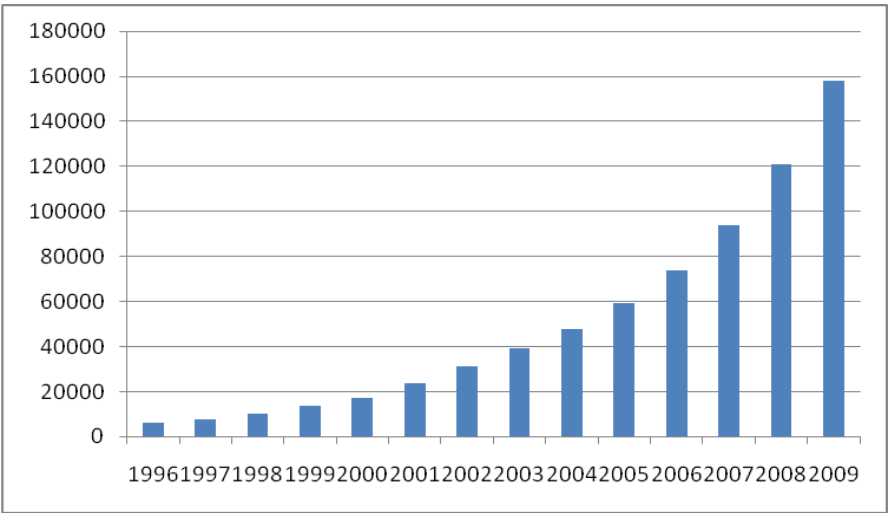


Status of nuclear power in the EU in 2010



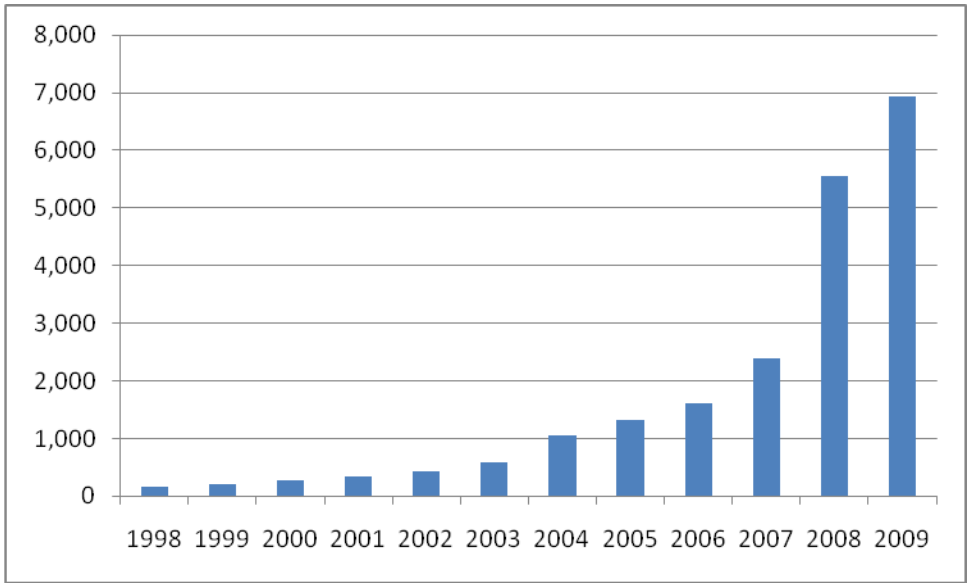
Growth of renewables

Wind Power



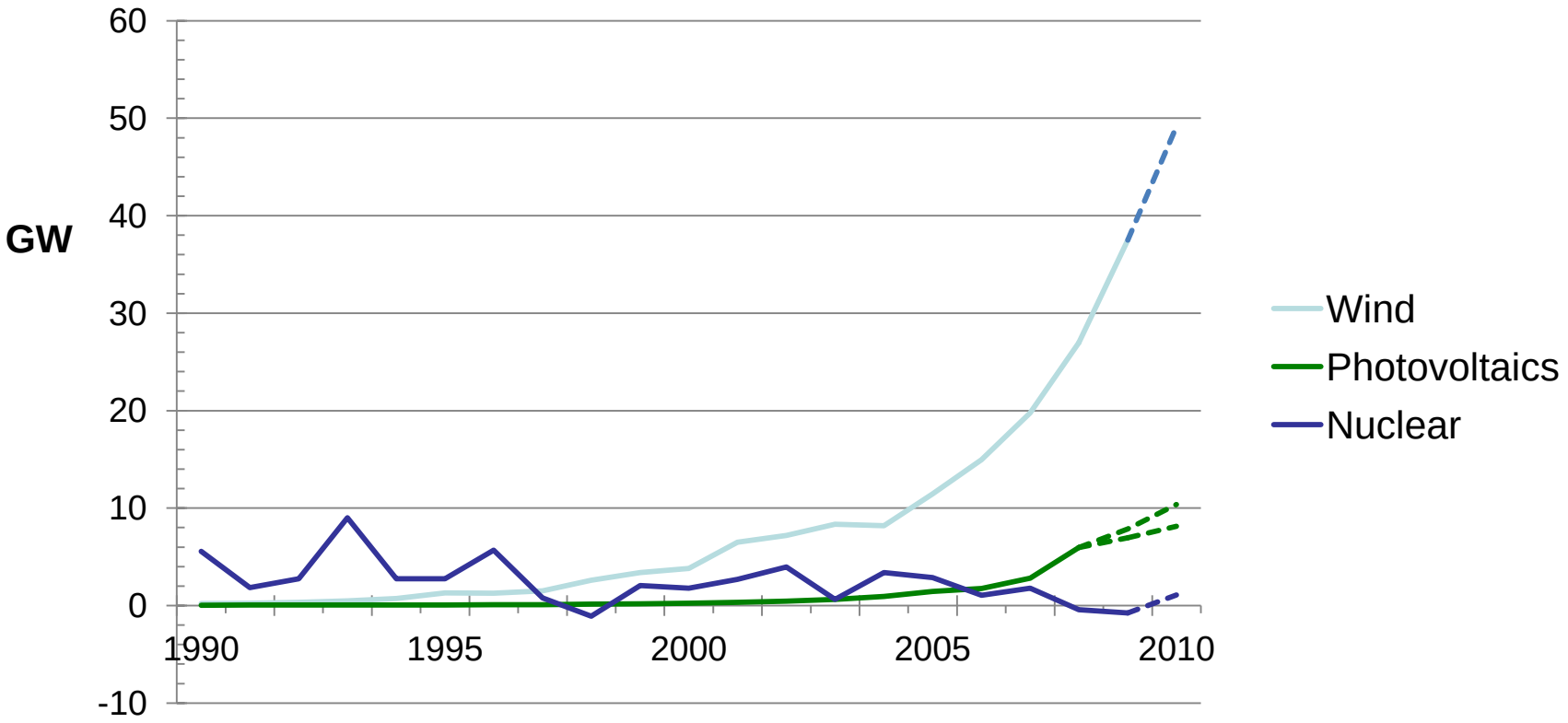
Source: GWEC 2010

Solar pv



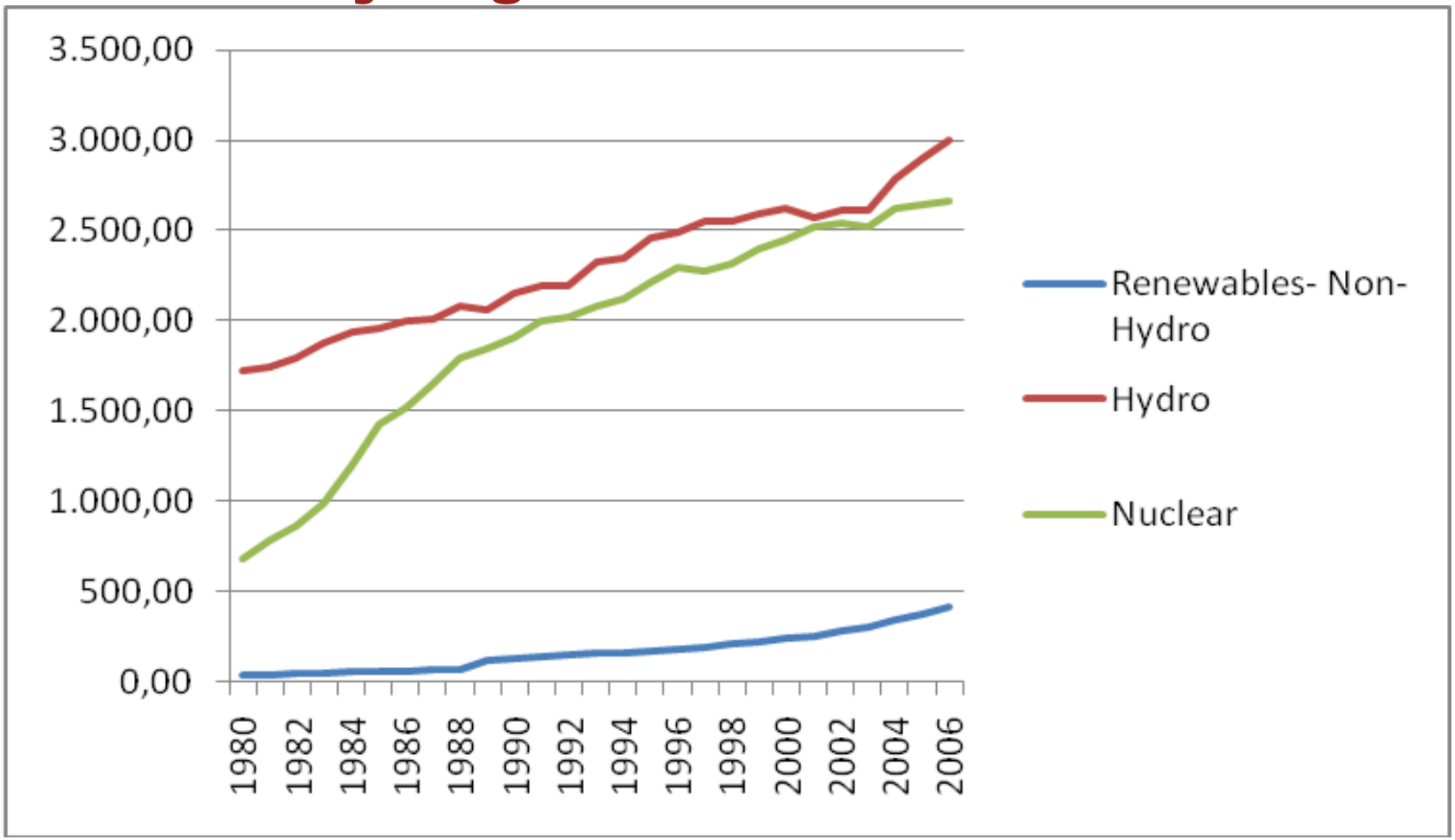
Source: Earth Policy Institute 2010

Annual net additions to global generating capacity



Source: Amory Lovins, RMI, personal communication, 2010

...but electricity from nuclear is still considerably larger than 'new renewables'



Source: Earth Policy Institute, 2009.

What will determine types of new build?

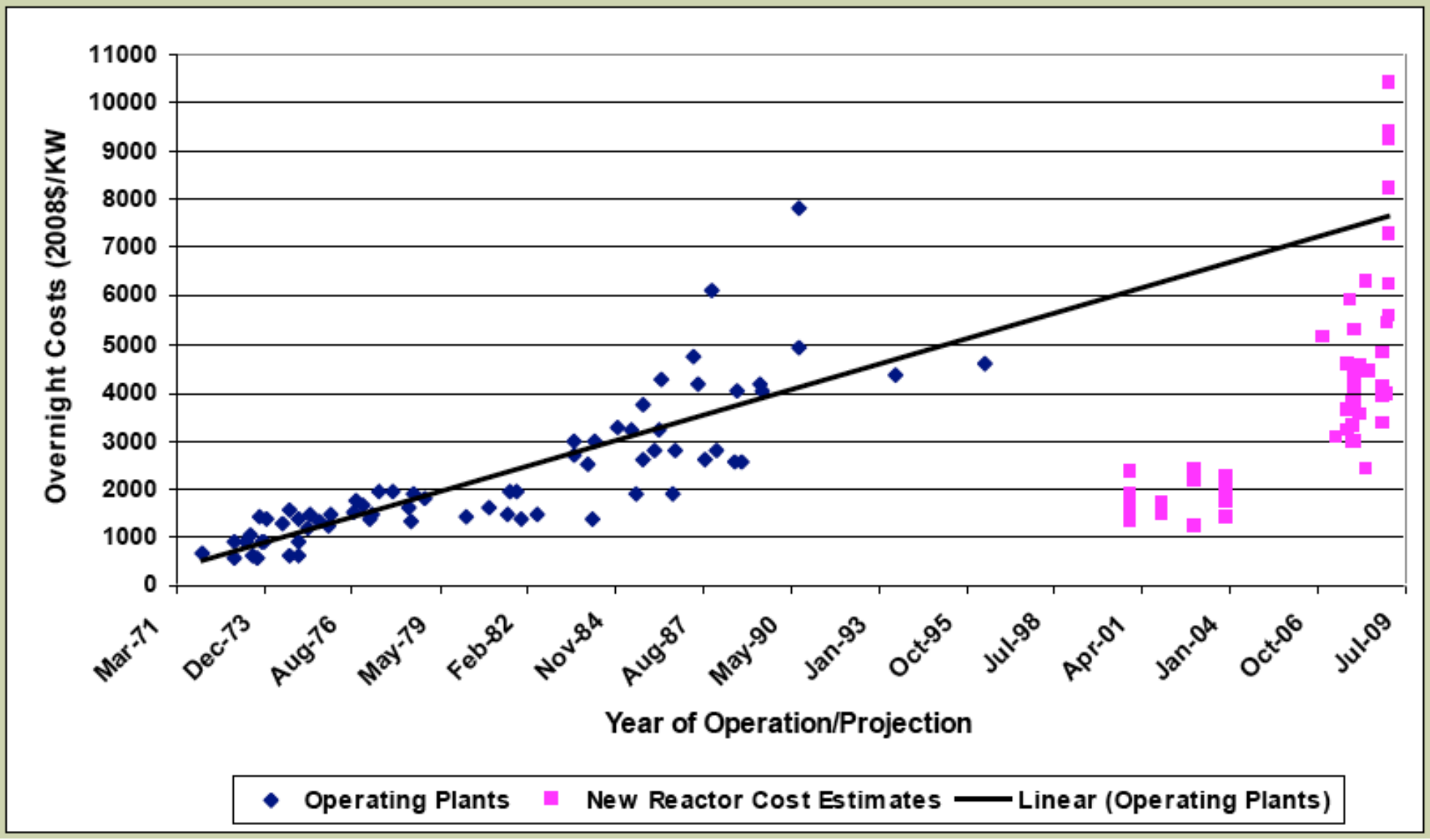
- Cost
  - Amory Lovins: “But nuclear power is about the least effective method: It does save carbon, but *about 2 to 20 times less per dollar and 20 to 40 times less per year than buying its winning competitors.”*
  - Duke University: “Solar photovoltaics have joined the ranks of lower-cost alternatives to new nuclear plants,” John O. Blackburn, professor of economics.
- Systems
  - Warwick Business School: *The undermining of other technologies means that nuclear power is not complementary to other low-carbon technologies. This refutes the argument that all low-carbon technologies should, and are able to, be harnessed together so that they can harmoniously work together to reducing carbon dioxide emissions. On the contrary, the government has to make a choice between a nuclear future and one dominated by renewable generation and the more efficient use of energy.*

Recent experience in Europe – Olkiluoto 3 in Finland

- Construction started in 2005. Originally planned commercial operation in the first half of 2009.
- Latest estimate is for electricity production only in 2013
- At the start a guaranteed fixed price of €3.2 billion was set.
- With 2-3 years left, cost-overrun approximately €2.7 Billion (90%)
- Additional costs of buying in replacement electricity

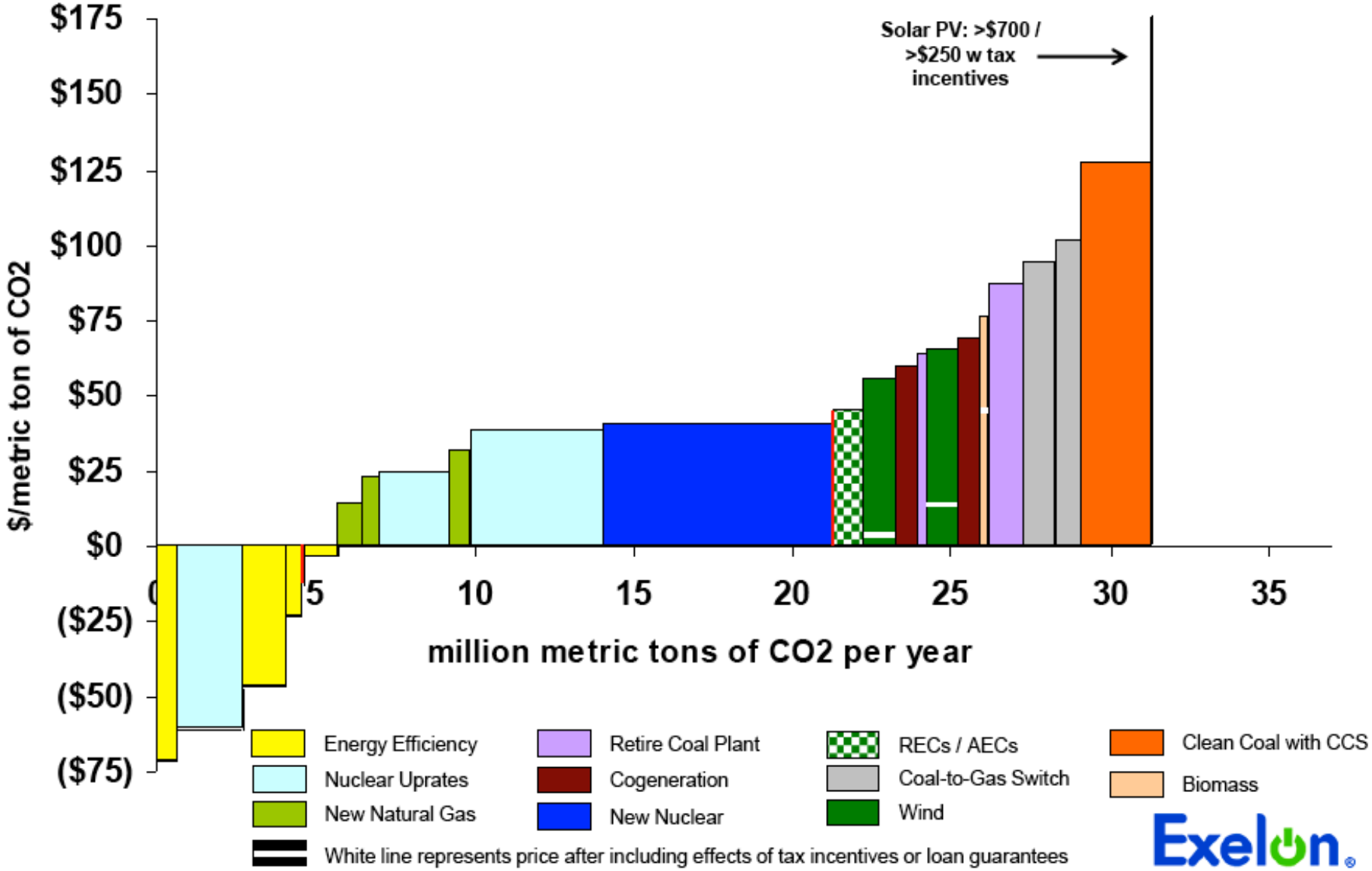
- **These problems have probably impacted on international orders of EPR, e.g. China, UAE**

Learning curve US nuclear reactors



Source: Cooper 2010

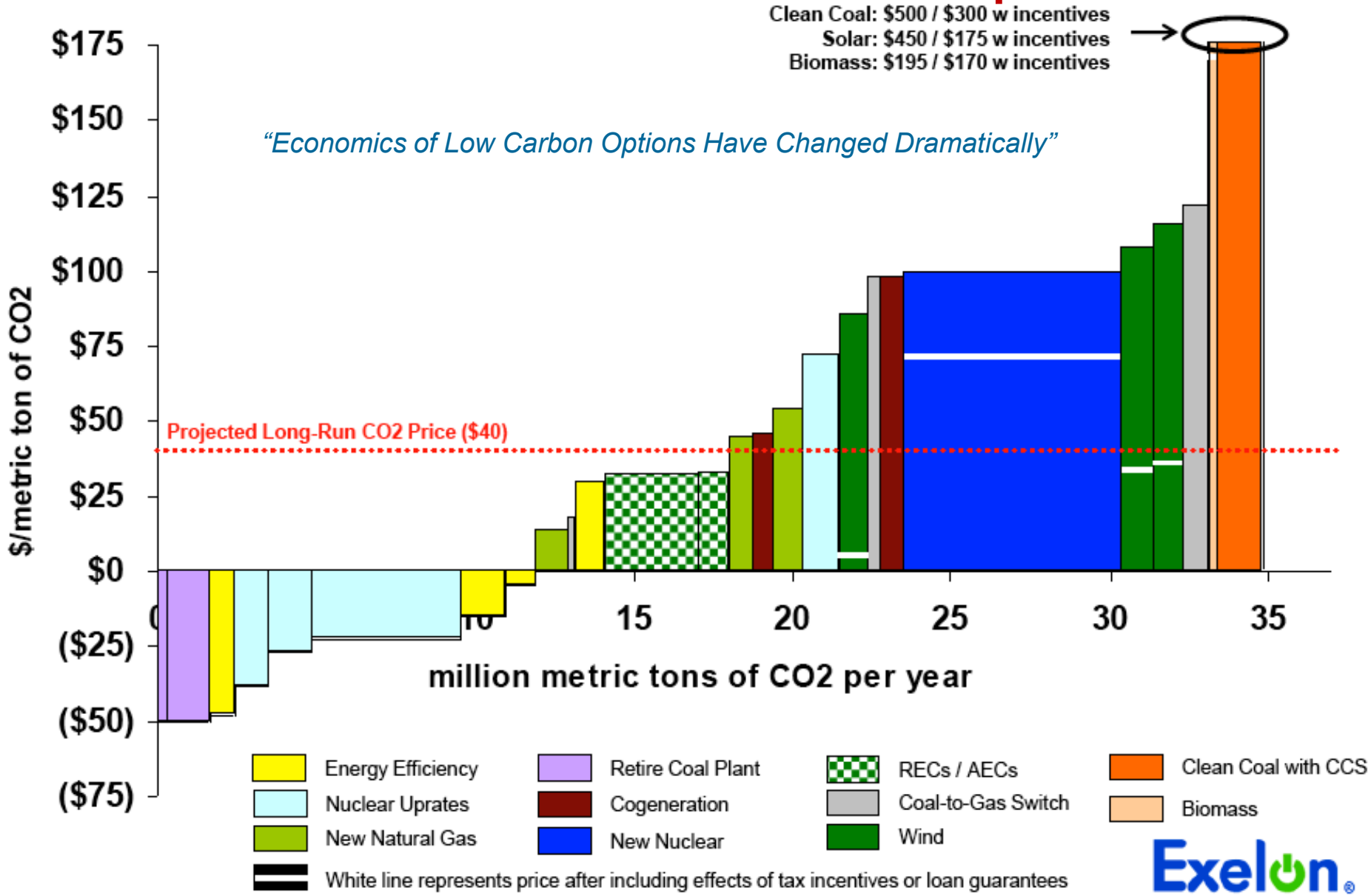
Exelon's View of Carbon Abatement Options in 2008



Exelon.

Source: John Rowe, Exelon

Exelon's view of carbon abatement options in 2010



Exelon

Source: John Rowe, Exelon

System Issues

- System management
  - Moving away from need for base load capacity (large centralised capacity which is always operational) to avoid conflicts between renewables and nuclear, already in Germany and Spain
  - Integration of greater number of independent power producers (often intermittent)
  - Greater harmonisation of demand and supply needs – smart grids
- Grid capacity
  - Targets for renewables through until 2020. In EU 20% of energy by 2020 -> 35% electricity
  - Development and deployment of gas

Will shale gas be a global game changer?

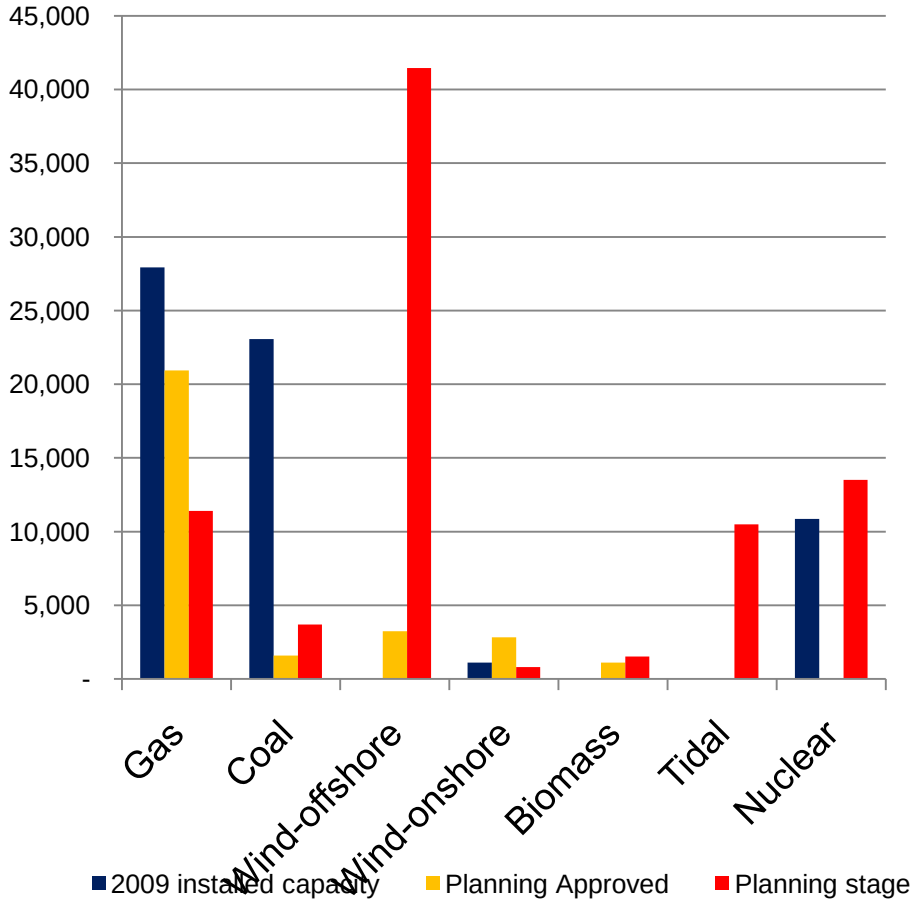
"A major new factor – unconventional natural gas – is moving to the fore in the US energy scene…it ranks as the most significant energy innovation so far this century. It has the potential, at least, to cause a paradigm shift in the fuelling of North America's energy future*." HIS Cera, 2010*

- Shale accounted for 1% of natural gas in US in 2000, today 20%; forecast to reach 50% by 2035.
  - Already impacting on electricity sector
  - Potentially accelerate movement to LPG and electric vehicles
  - Significantly reducing need for LNG import and impacting global market
- European potential still unclear – much smaller exploration infrastructure

- Key questions determining extent of global impact:
  - How large is potential economically available resource ?
  - What are limiting environmental impacts, water contamination, methane leakage etc?
  - Rate of depletion of fields is undocumented.
  - How far will gas be used in non-electricity sectors?
  - Chevron "price tag is too high" to justify the investments required

UK electricity options

Potential new build MW)



- New capacity is needed to replace largely coal and nuclear stations
- EU target, likely to mean 30-35% of res electricity by 2020 (4 fold increase)
- Large gas construction already underway
- Efficiency drive further reduce projected demand increase

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Source: Platts and DECC 2010

The future for nuclear power?

- Investing in new nuclear is “a potentially courageous 60-year bet on fuel prices, discount rates and promised efficiency gains” – UBS 2006
- What has changed?
  - No proven technology track record
  - Lower cost of capital and financial risks
  - Lower prices and less certainties for gas

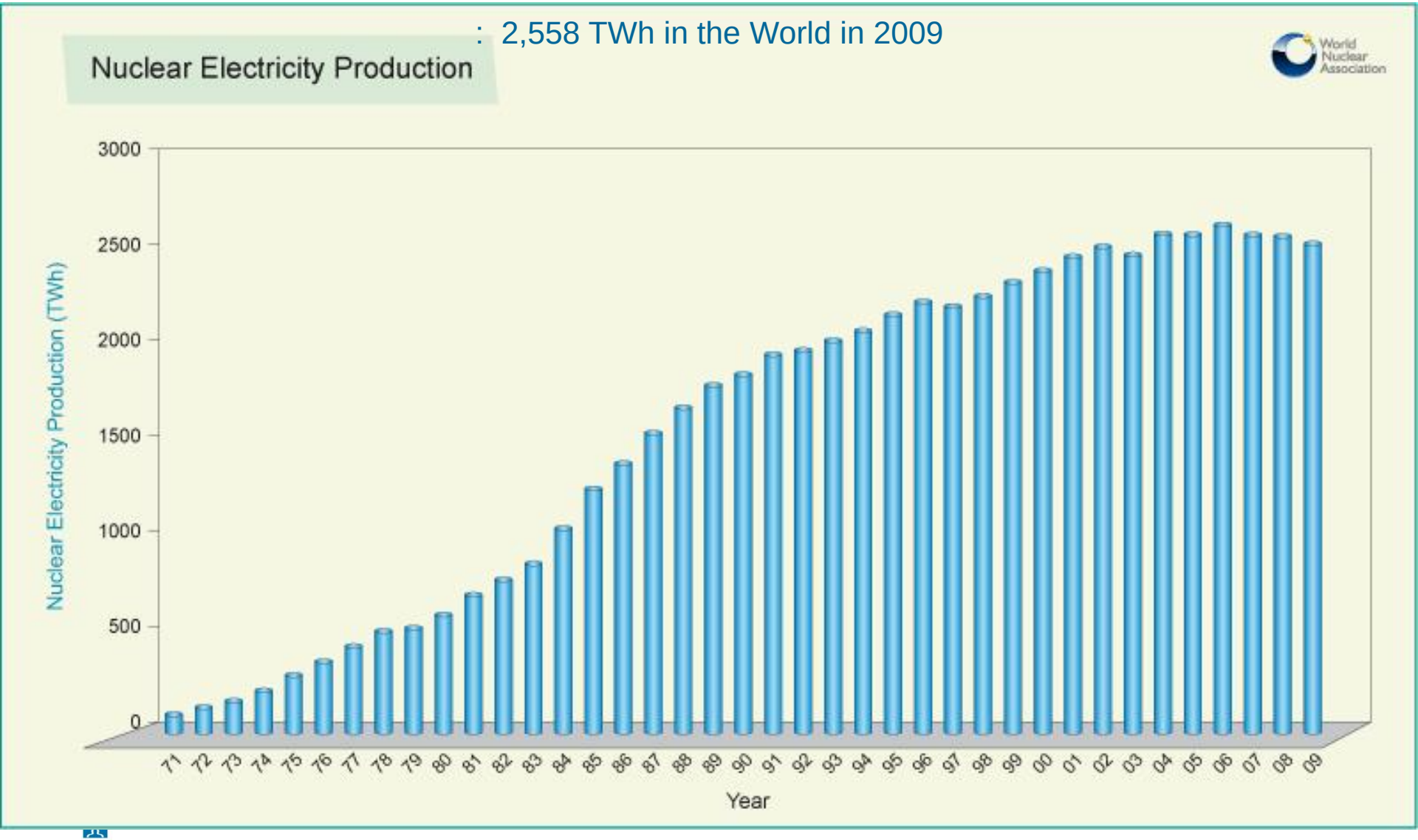
Spares

Change in German Nuclear Law

- On 11 June 2001, the red-green government coalition in Germany signed a *declaration on the nuclear phase out* with the 4 biggest energy companies
- Main amendments were the ban of nuclear new built, a ban on reprocessing of spent fuel as well as the limitation of the average life span of the reactors to 32 years.
- Currently *17 reactors* are operating in Germany
- Conservatives and Liberals announced during the election campaign of 2009 to prolong the lifetime of nuclear reactors
- Agreement reached in September 2010 that:
  - Reactors built before 1980 would operate for an additional 8 years
  - Those built afterwards for 14 years
  - A nuclear fuel tax of Eur2.3 billion annually through 2016
  - Nuclear operators will contribute to a fund for renewable energy technology research through up-front payments of around Eur1.4 billion a year until 2016
- To turn the bills into law, the government intends to use its majority in the lower house (Bundestag) to overrule the upper chamber (Bundesrat) – with subsequent legal challenges
- Government studies suggest the yearly increase of renewables will decrease from today 5.185 MW to 3.448 MW
- However, the Government reiterated its support for renewables and set targets for renewable up to 80% by 2050.

Global nuclear electricity production

: 2,558 TWh in the World in 2009



Nuclear Power in the EU in 2008