Energy Options in the post-Fukushima world

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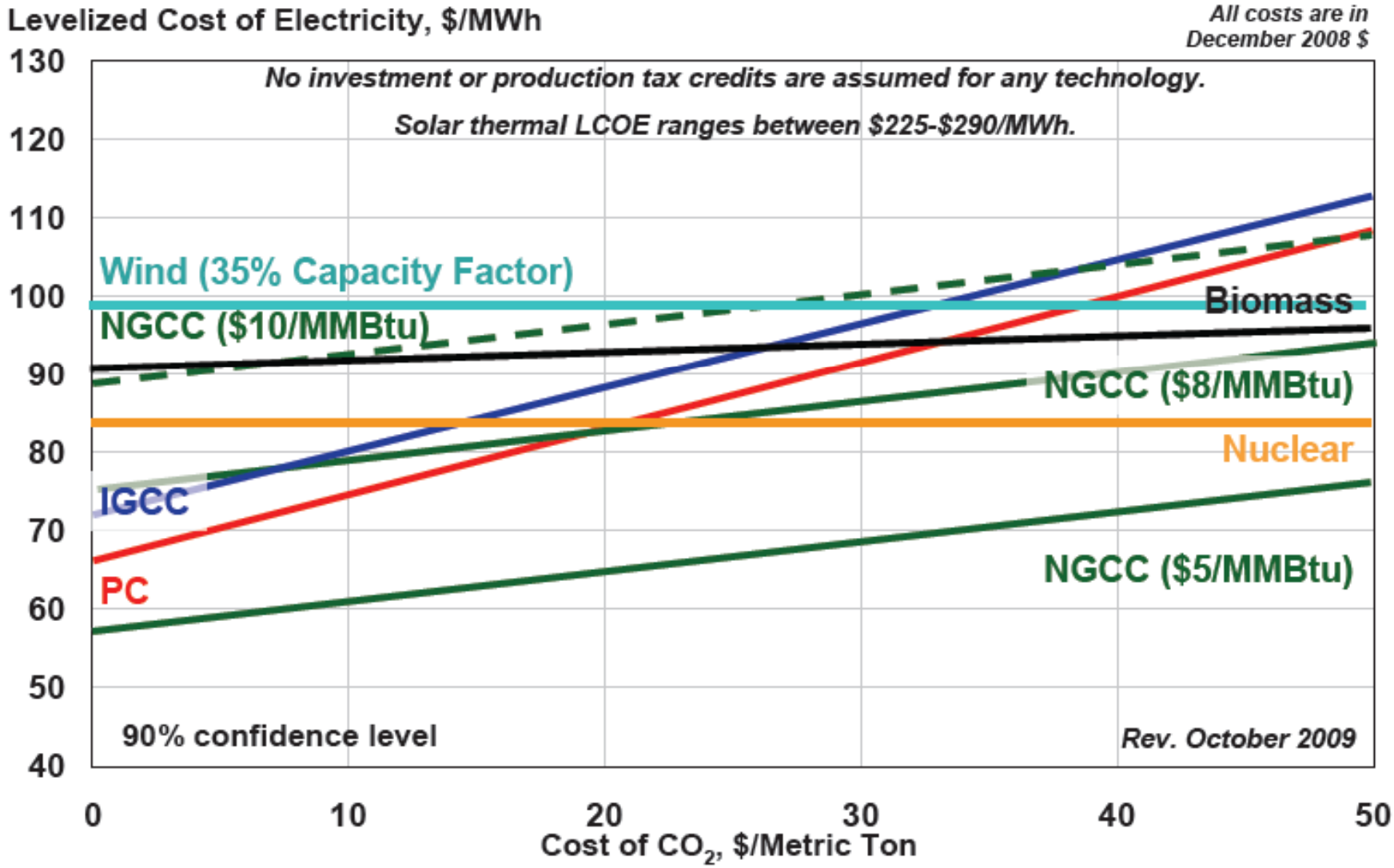
Key Points

- Fukushima is a set-back for the widespread use of nuclear, as a climate change option
- Gas is the fuel of the 21st century
- Solar PV to gain substantially, if cost trajectory follows the microchip
- Look at substantial gains on how we use energy (energy efficiency)

Comparative Levelized Costs of Electricity – 2015



The nuclear energy option

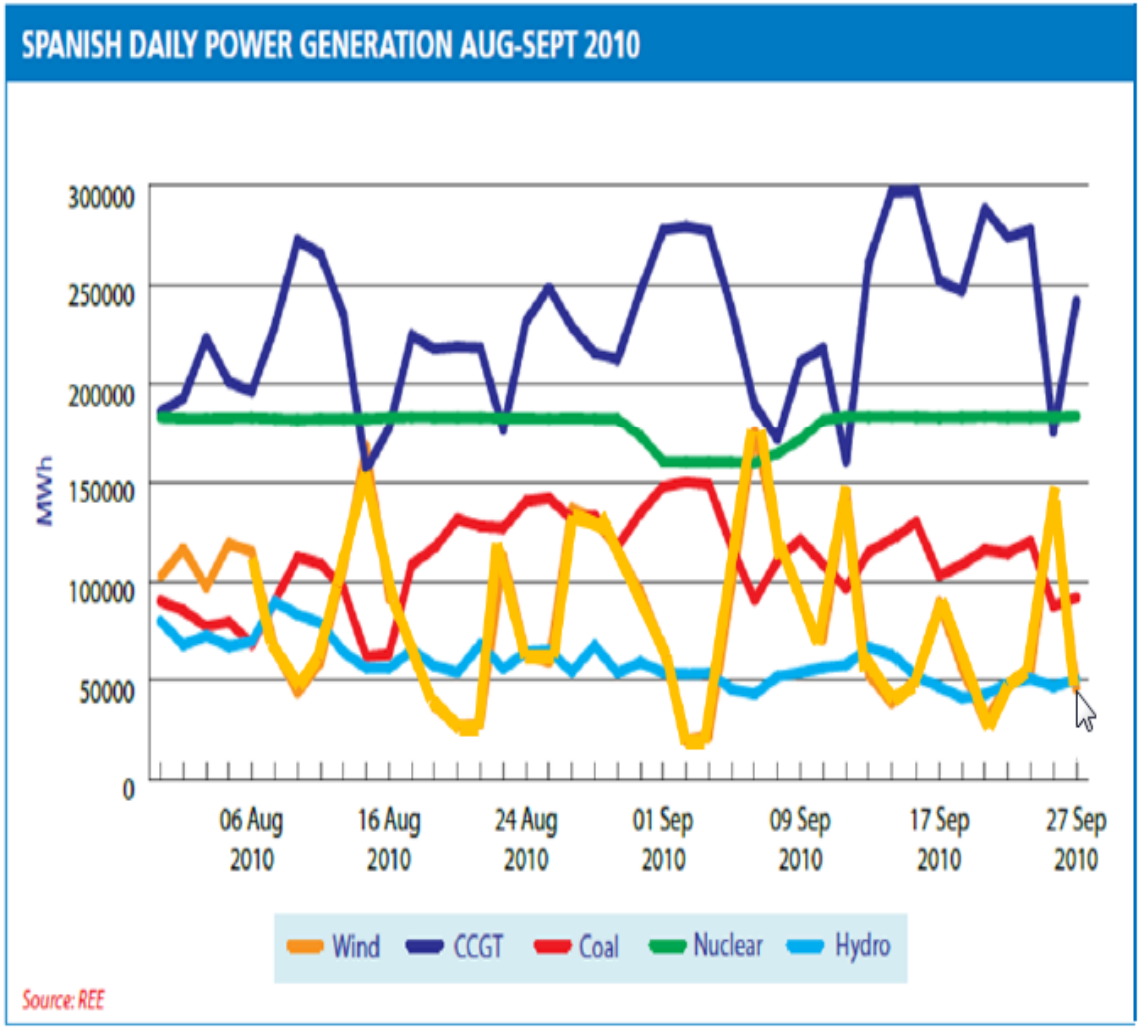
- Nuclear is not an economic, but a strategic option
- Countries which are already pursuing nuclear will not change their plans (e.g., China and India)
- But widespread use as a climate change option is in doubt, at least in the short-term

Natural Gas: The fuel of the 21st century

- Plenty of gas, but reserves far from consumption centers
- Huge shale gas reserves developed in the US; to be developed in countries such as China, Poland & Ukraine, too
- Plant efficiency: 60%+ and moving higher; half of the coal carbon footprint
- LNG costs are declining; emerging options: CNG and GTL

Wind power: Oversold!

- Low capacity factor; Difficult to recover investments
- Unpredictable availability
- When available, not stable
- Back-up power and grid strengthening are essential
- Nevertheless, it is benign energy and should be pursued



Concentrated Solar Thermal (CSP)

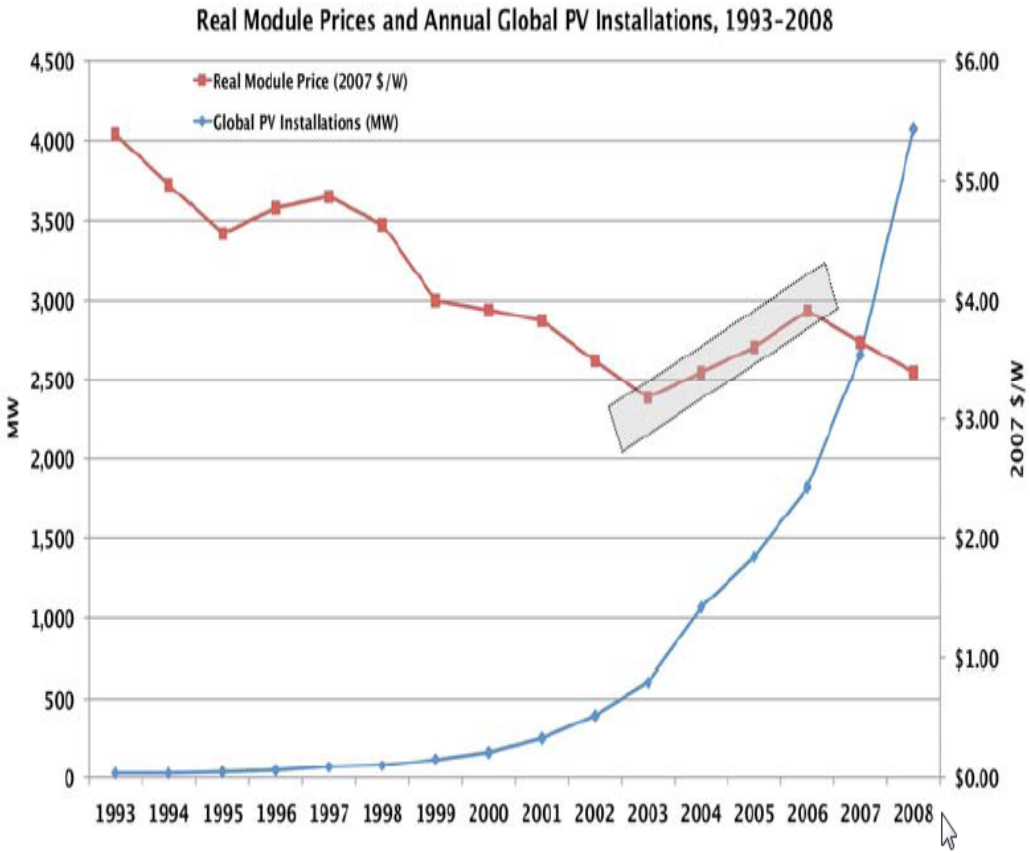
- Many projects started recently, but future is uncertain
- Positives
  - More predictable energy supply than wind; generation at peak demand
  - Storage is an option, even though not competitive yet
- Negatives
  - Requires large surface
  - Requires cooling water
  - PV is becoming a touch competitor!

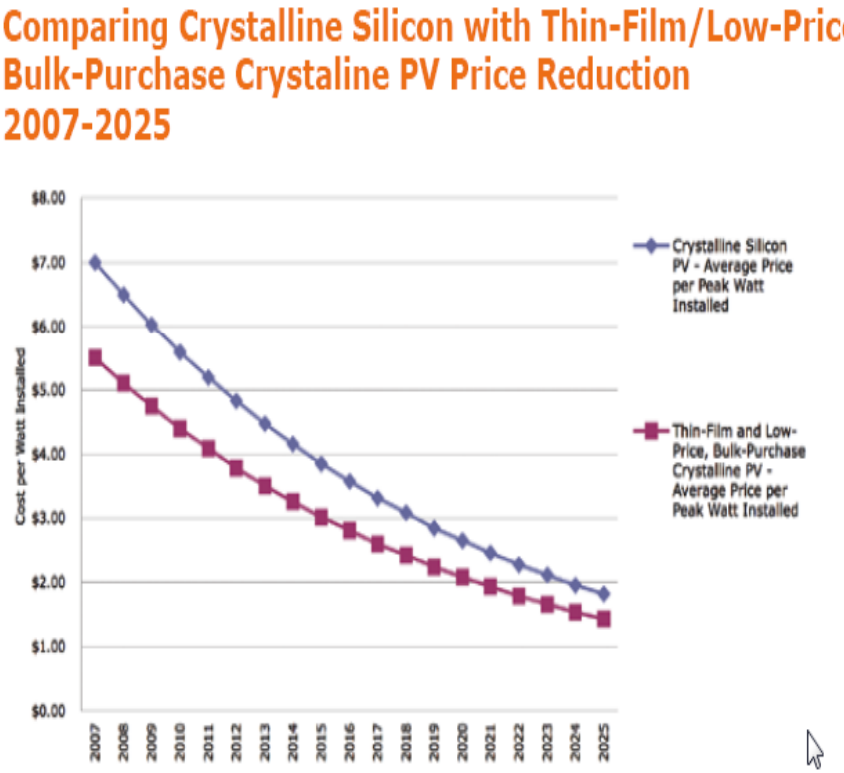
Solar PV: The future is bright!

- PV installations growing very fast worldwide
- New materials; PVs capable of covering every surface → distributed generation
- PV is expensive, but costs are declining rapidly; potential for substantial reductions

Photograph by Michael Melford

PV Costs are trending down





Source: Clean Edge, 2008

PV TECHNOLOGY, PRODUCTION AND COST, 2009 FORECAsT EX-7

Watch for substantial improvements in energy efficiency

- Revitalization of the cities
  - By 2030, 3 out of 5 of the total 8 billion people will live in cities
  - City architecture and public infrastructure to maximize efficiency
- Public transport
- Energy management systems
- Move from mechanical systems to electrical to bio/informatics
  - Biochips
  - Traveling holograms (video-conferencing)
  - ...

Thanks