The New Energy Crisis: Climate, Economics, and Geopolitics

Jean-Marie CHEVALIER

With 3 co-authors: Patrice GEOFFRON, Sophie MERITET & Pierre ZALESKI

• “The New energy Crisis: Climate, Economics and Geopolitics” (Palgrave, 2009)
• “Les nouveaux défis de l’énergie: climat, énergie, géopolitique” (Economica, 2009)

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Foreword by Claude MANDIL

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World Energy Balance

2006
12 Gtoe

2030 Reference Scenario 17 Gtoe

- Coal: 29%
- Oil: 30%
- Gas: 22%
- Nuclear: 5%
- Hydro: 2%
- Biomass and waste: 10%
- Other Renewables: 2%

THIS IS NOT SUSTAINABLE

Demographic Shift

2009
6.8 Billion

+ 2.6

2050
9.4 Billion

- China: 15%
- India: 19%
- Others: 31%
- Africa: 19%
- OECD: 14%


Source: Population Reference Bureau, 2009
Concentration des réserves sur les pays « à risque »

89% des réserves de pétrole
81% des réserves de gaz

Source: CGEMP based on data available from BP (2008) and IEA (2008)

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The Message

1. Energy is a global issue and world energy future has to be sustainable.
2. Oil price is still the leading energy price.
3. A number of elements tend to indicate that energy prices will be much higher than in the past (70 to 80 $/b vs 20 to 30).
4. The building of a single European energy market provides an energy vision of the future.
5. The key strategic principles: energy efficiency - management of the climate change – diversification of energy technologies and sources.
6. A permanent challenge for market intelligence, energy intelligence, catching business and political opportunities.

Conclusion

- Action
- Adaptation
- Prices
- What did you do today?
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Patrice GEOFFRON

Origin of the energy consumption increase since 2000

Source: IEA

☑ Newest issues more located on the demand side
China will mechanically become the first energy market...

Net oil imports in China and India

...meaning that the era of low fuel prices is behind us
Energy-related CO2 emissions by regions in the past…

- Cumulative emissions
- OECD weights 2/3 of past emissions
- OECD ± 15% of world population

… and in the future

- Time for newly industrial countries to emit CO2?

Source: IEA

Reference Scenario
Alternative Policy Scenario
High Growth Scenario
Per-capita related CO2 emissions in 2005

- 2005
- 20%

Per-capita related CO2 emissions in 2030

- 2030
- 45%?
Not only an issue of energy mix, but also of social organisation

Source: IEA

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Sophie MERITET
Ch 6: The USA at a Turning Point?

- Exceptional development of American capitalism founded upon abundant, cheap and domestic energy resources: coal, oil, natural gas, hydro electricity and nuclear.

- A growing dependence on imports for oil and natural gas and a decrease in the domestic productions

- Strategic priority => security of SUPPLY

- Obvious growing awareness of climate change. In the absence of a federal environmental policy, states are taking some initiatives

- Obama (January 2009) “We will harness the sun and the winds and the soil to fuel our cars and run our factories”...
The American energy policy at a turning point....

• Energy - climate change: a challenge and not a constraint!

• Obama (2009) «America can be the 21st century clean energy leader by harnessing the power of alternative and renewable energy, ending our addiction to foreign oil, addressing the global climate crisis, and creating millions of new jobs that can't be shipped overseas»

• A green revolution...

• Project Bill: American Clean Energy and Security Act or Climate Change Bill

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Pierre ZALESKI
**Need for new power plants?**

**Next few decades 2 - 4**

- Priority to energy conservation and efficiency
- **BUT**
- Increase of population
- Need for development for large part of world population – ¾
- Therefore large consensus that demand of electricity will increase (also replacement of older plants)

**Possible energy sources**

- **Fossil – coal, gas, oil**
  - *Dominant – CO2 issue – Finite resources + Geopolitical issue*

- **Hydroelectricity, geothermal**
  - *Limited resources economically acceptable*

- **New renewable – wind, solar, waves...**
  - *Very expensive at least for time being*

- **Nuclear**
Criteria for selection

- Industrial feasibility
- Availability of capital (investment)
- Economy
- Security of supply
- Sustainability
- Environmental effects
- Effects on health of population

Cost benefit - analysis

In general and not purely economic sense

- Varies from country to country

Needs, resources, cost of labor, cost of capital, sensitivity to environment and sanitary effects

- We are therefore discussing examples of some important countries
Nuclear renaissance and low carbon economy

- Large uncertainties

<table>
<thead>
<tr>
<th>Present</th>
<th>2030</th>
<th>2050</th>
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<tbody>
<tr>
<td>370 GWe</td>
<td>400-1000 GWe</td>
<td>600-2000-2500 GWe</td>
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1000 GWe – save 8 G tones CO2/year

- In 2030 differences between BAU and 450 scenarios – 19G tones CO2/year
  - competitive with coal in many countries - without penalty for CO2
  - competitive with coal in all countries - with some penalty for CO2 (≥ 20 $)

Asia Nuclear Energy Perspectives

<table>
<thead>
<tr>
<th></th>
<th>47 GWe</th>
<th>2009</th>
</tr>
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<tbody>
<tr>
<td>Japan</td>
<td>60 GWe</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>90 GWe</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>+ 20 GWe</td>
<td>2017</td>
</tr>
<tr>
<td>South Korea</td>
<td>18 GWe</td>
<td>2009</td>
</tr>
<tr>
<td></td>
<td>25 Gwe</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>60%</td>
<td>2035</td>
</tr>
<tr>
<td>China</td>
<td>9 GWe</td>
<td>2009</td>
</tr>
<tr>
<td></td>
<td>60 GWe</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>160 GWe</td>
<td>10%</td>
</tr>
<tr>
<td>India</td>
<td>4 GWe</td>
<td>2009</td>
</tr>
<tr>
<td></td>
<td>40 GWe*</td>
<td>2020</td>
</tr>
<tr>
<td></td>
<td>400GWe*</td>
<td>2050</td>
</tr>
</tbody>
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*Including 5 Breeders of 0,5 GWe each
*September 2009, declaration of Prime Minister of India

Other countries: Vietnam, Malaysia, Thailand, Indonesia...

ASIA: 300 GWe Estimates of maximum new builds by 2030
Nuclear Energy Perspectives in Russia and USA

**Russia**
- 22 GWe (2009)
- 52 GWe (2020)
- 230 GWe (2050)
- Industrial development of Breeders (2025)

**Presently Breeders**
- 1 breeder 0.6 GWe operating for 25 years
- 1 breeder 0.8 GWe in construction

**USA**
- 100 GWe (2009)
- 110 GWe (2020)
- 300 GWe* (2050)

*MIT and EPRI's perspective

**Russia + USA: 100 Gwe Estimates of maximum new builds by 2030**

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**Uranium resources and production**

- **conventional**
  - including speculative: \(\approx 16\) Millions tonnes
- **unconventional**
  - by product, Phosphate: \(\approx 22\) Millions tonnes
- **extremely expensive**
  - sea water, Granite: \(\approx 4000\) Millions tonnes
- **present production**
  - \(\approx 40\) 000 Millions tonnes/year
- **production 2015**
  - \(\approx 60\) 000 Millions tonnes/year
Uranium consumption

- Presently ≈ 70,000 tonnes > 200 years with conventional resources

If dynamic development of nuclear energy
- present technology
  - conventional and unconventional
  - up to 2060 new reactor's constructions
- with Breeders
  - few thousand years with already mined uranium
- with sea water, granite and thorium
  - factor 100 (additional)

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