



# Nuclear energy and climate change

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# Section I - Energy Scenarios



- **I.1 The period 2010-2030**

- Projections have at least two scenarios, one high and one low.
- Low scenarios are practically stable. High scenarios between 600 and 890 GWe of nuclear power capacity in operation in 2030, versus 372 GWe today.
- Main competition for nuclear : coal

- **I.2 The periods 2010-2050 and 2100**

- There are fewer detailed projections for the time periods 2030-2050 and 2100
- 1,400-2,000 GWe of nuclear in 2050
- 5,000-7,500 in 2100

- **I.3 Effect on climate change**

- 1,700 GWe – saving of 13 gigatonnes CO<sub>2</sub>
- 19 Gt CO<sub>2</sub> = difference between sustainable and unsustainable scenarios



## Section II-1 Important factors

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- **The will and the determination of governments, especially of large CO<sub>2</sub>-emitting nations, to limit their contribution to climate change, and agreement on this issue between developed and emerging countries;**
- **The sensitivity of nations, especially certain important ones, to the health effects of local and regional pollution by fossil fuel combustion.**
- **The ability of industry to build and operate a large fleet of nuclear plants in a safe, reliable, timely and cost-effective way.**
- **Support by public and national and international authorities for different fuels based on comparative evaluation of their merits and drawbacks**
- **The sensitivity of national governments to choose the cheapest solution, considering that money or resources spent on energy or on electricity supply will restrict the available resources for other important social issues**
- **The technical and economic success, of commercial-scale CCS and, in the near term, the perception of the potential for this technology.**

## Section II- II. 2 Weak points of nuclear power



1. The issue of the risk associated with large accidents.
2. There seems to be a consensus that at least final nuclear waste should be placed in deep geologic repositories. However, sites are difficult to find because of the "NIMBY" effect
3. The issue of proliferation of nuclear weapons is connected with sensitive technology used in nuclear power and not really with the construction and operation of nuclear power plants.
4. The short-term transitional character of present nuclear plant technology

Fast breeder technology exists, but of course has to be improved, especially as regards the fuel cycle. This would give long-term perspective to the development of nuclear energy and make it more attractive for society. It would also minimize the issue of waste disposal.



## Section III- 1 United States

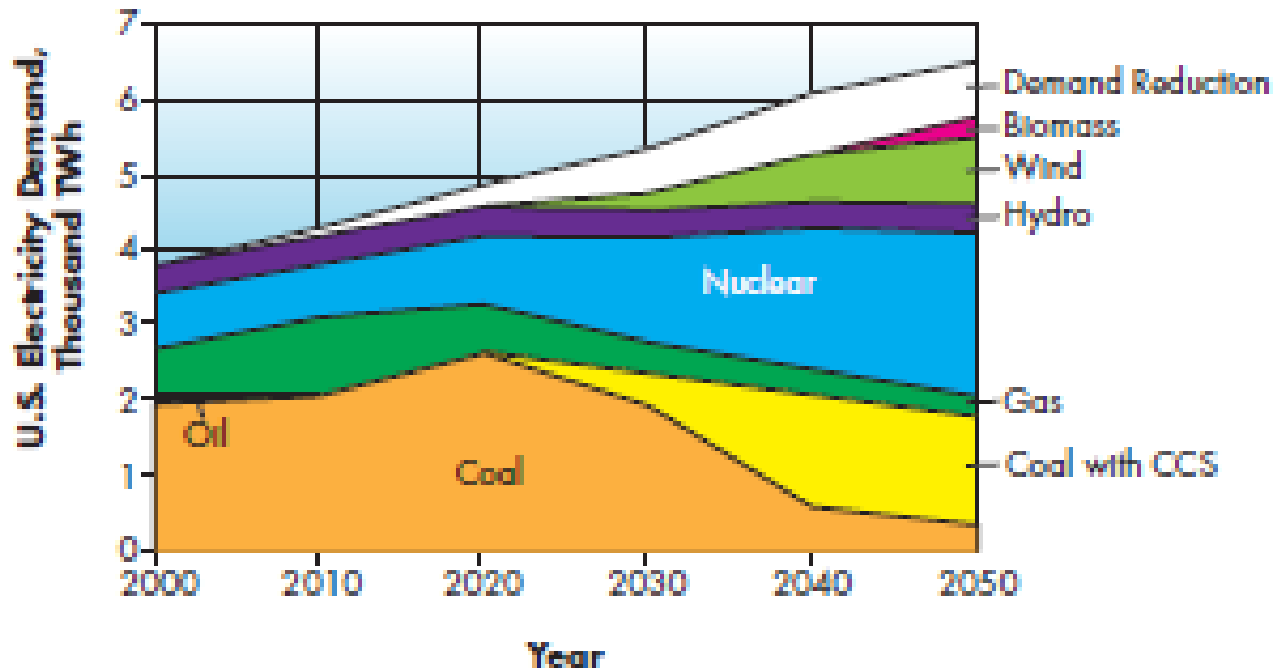
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- **The US energy power situation**
  - The MIT report calculates that new nuclear power plants will not be competitive with coal plants without a strong penalty for CO<sub>2</sub> emissions. However, the same report indicates that if the capital cost of nuclear plants were the same as costs for coal or gas-fired plants, nuclear power would be competitive in the US with coal and gas-fired power on a levelized lifetime cost basis.
- **The US federal system sometimes makes it more difficult to go ahead with a large national program.**
- **Major issue for nuclear energy in the US.**
  - It is the disposal of spent fuel and/or final waste, which is the responsibility of the federal government.
  - Resources of uranium, if only present technology (LWR) is used
- **It seems to us therefore that there are 2 major issues**
  - the construction of six Generation III nuclear power plants on time and within budget;
  - how the issue of reprocessing, waste disposal and ultimately the breeder reactor is addressed.
- **The answer to these questions may make a huge difference in the development of nuclear energy in the US.**



# Projections

- EPRI's PRISM analysis projects a possible electricity generation mix for achieving substantial carbon dioxide emission reductions.



Source : EPRI (2009)

- **The French energy power situation**
  - Today in France, with a reasonable assumption for the cost of oil (about \$60/barrel) and of gas, and probably of coal, which is more or less linked to oil and in spite of a sharp increase in capital cost compared to existing units, nuclear power is competitive even without a CO<sub>2</sub> penalty for fossil fuel.
- **Considering this situation, France's major utilities are very eager to build more nuclear plants.**
- **The two main lessons to be learned from the French experience are:**
  - A very dynamic expansion of nuclear power worldwide, as foreseen by the highest projections, should not be impossible from the industrial point of view, since France, a medium-sized country, was able to expand its nuclear capacity by more than 50 GWe in 20 years, rising from a few percent of nuclear electricity to close to 80% over this period.
  - -A strong and constant support for the nuclear program by politicians and to a large extent by society, combined with a rational industrial organization and a good base of technically skilled workforce led to a technically and economically successful program.
- **Today, French nuclear power plants and, more generally, French nuclear industry are important assets for the French economy upon which many other countries look with envy.**

### III. 3 China

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- **The Chinese government is now giving nuclear development high priority – 2% of total electricity generation presently, more than 5% in 2020, 20% in 2050.**
- **From the industrial point of view, the situation is quite favorable.**
- **A strong development of nuclear energy is under way in China – 60 GWe in 2020, 250 GWe in 2050 - maybe even stronger than assumed in most scenarios mentioned in this paper.**
- **Chinese industry may play a major role in world nuclear energy development.**

- **There are strong signs that nuclear energy development over the next 20 to 40 years will be very dynamic, at least in Asia - China, India, Japan, and South Korea.**
- **On the other hand, there are large uncertainties regarding the pace of development in other parts of the world, notably in the US and some European countries.**
- **Asian industry -- currently based in Japan and South Korea -- already plays a major role in nuclear development worldwide. It will likely play an even more important role once Chinese and Indian nuclear industries mature and strike out to foreign markets.**
- **The development of nuclear energy in the world – an essential element of sustainable development could be strongly accelerated if nuclear energy were accepted in the future post-Kyoto agreement as a clean technology under the Clean Development Mechanism, which would be a rational decision.**

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