NEAC Policy Sub-Committee

Outlook for energy and the role of nuclear power

June 23, 2008

The Premise

- More than 50 years since the launch of the Atoms for Peace initiative, the implications -- in energy, environmental, and national security terms -- of our nuclear policies are greater than ever.

The Mission

- The next president will face fateful choices on energy.
- These choices will have profound energy, environment, safety, and security implications.
- The mission of this Subcommittee is to understand choices and implications of the nuclear option, with a view to framing recommendations.

Global Energy Outlook

- High and rising hydrocarbon prices drives inflation, dampens growth, strengthens adversaries.
- Emerging market growth likely will keep spurring demand for more power generation.
- Technology choices in electricity sector can significantly affect carbon emissions.
  - 36 nuclear power plants now under construction worldwide
  - China adding two coal-fired plants per week
  - Renewables will also contribute

US Energy Outlook I

- US now grappling with challenge posed by dramatic increase in hydrocarbon prices
- Renewables and conservation will contribute
- In power generation sector, three major baseload options:
  - Coal - plentiful, but major GG emitter
  - Natural gas - less GG, but prices rising
  - Nuclear - no GG gas, but other challenges

US Energy Outlook II

- Transportation sector still dominant.
  - 70% of all US petroleum use
- Electricity primarily supplied through large grids
  - 20% nuclear; coal and natural gas supply much of the balance
- Apart from baseload, nuclear may play other roles:
  - Produce hydrogen for transportation sector
  - Smaller reactor to produce process heat and distributed power off grid

Comparing the Alternatives

- Energy efficiency
- Capital costs
- Operating costs and margins
- Safety
- Environmental impacts
- Security (including nonproliferation)

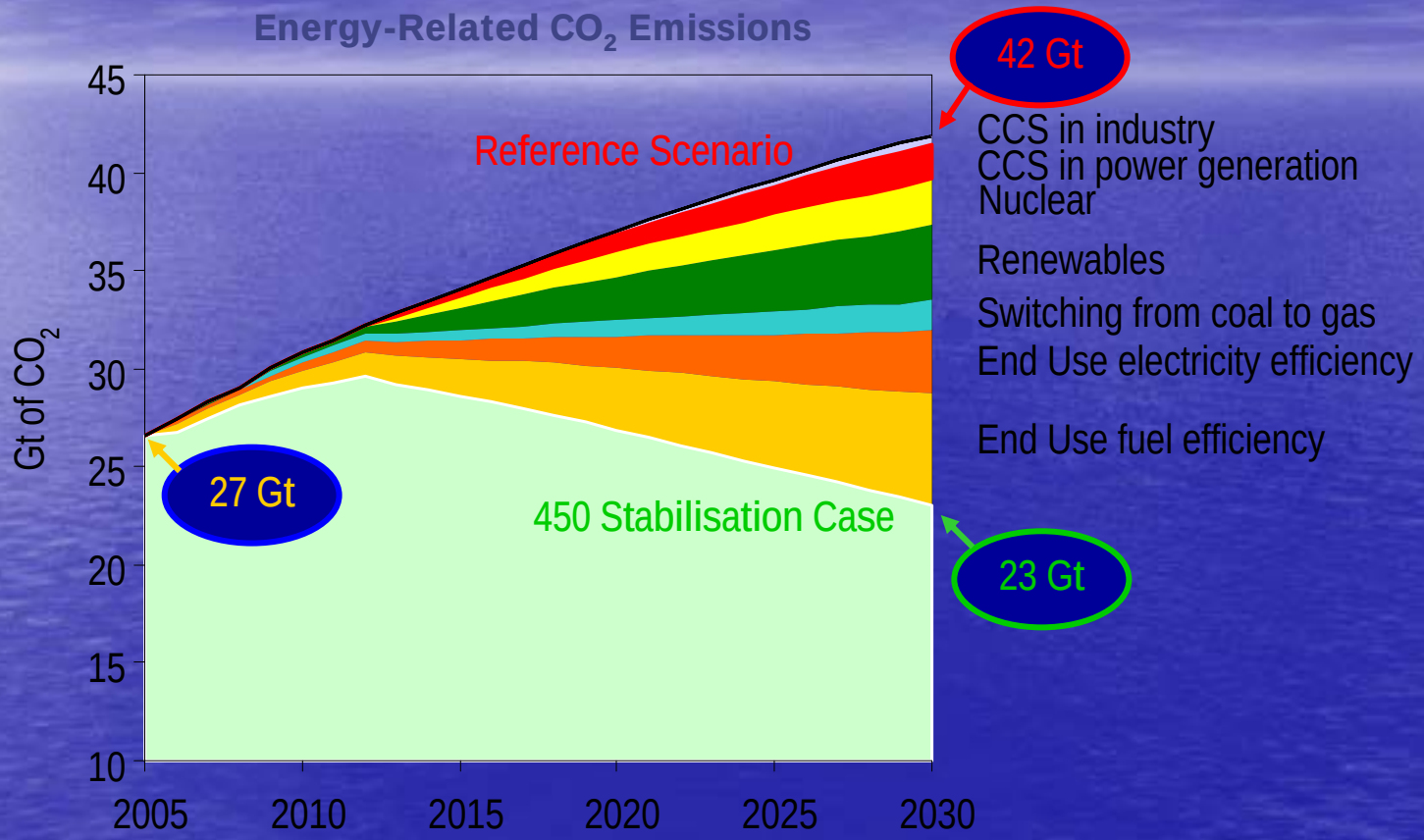
Nuclear energy and climate change

- Impact of pricing carbon on competitiveness of nuclear power.
- Potential contribution of nuclear power to curtailed greenhouse gas emissions, under different scenarios.
- Policy issues:
  - Carbon credits for nuclear
  - Government subsidies
  - Carbon tax v. cap-and-trade

Role of Nuclear in US

- Three cases, projected to 2020/2030:
  - Case A: No new build (new build NOT inevitable)
  - Case B: Existing Policy:
    - EIA Base Case – assumes no change in existing policy
    - 17GWe added by 2030
    - Would reduce nuclear from 19% to 18% total US electricity generation
  - Case C: Carbon constrained
    - Warner-Lieberman Bill
    - 45 GWe added by 2030

CO_2 Emissions - 450 Stabilisation Case



By 2030, emissions are reduced to some 23 Gt, a reduction of 19 Gt compared with the Reference Scenario

US domestic policy implications of expanded US nuclear fleet

- Waste management
- Research and development
- Human resources
- Supply chain management
- Safety
- Security
- Reactor licensing
- Policy environment

Waste management

- What can/should be done to resolve issues related to storage, treatment, and permanent disposal of waste?
- What are economic, technical, licensing and political issues that must be resolved in addressing back-end alternatives?

Research & Development

- Priorities:
  - Safety, life extension, decommissioning existing fleet
  - Emphasize new build of Gen III+ reactors
  - Robust research but no early deployment of Gen IV
  - Back-end solutions
  - International collaboration (e.g., fast, small reactors)
- Consequences of deteriorating R&D infrastructure
  - Need to strengthen university and industry programs
- How can labs/facilities be modernized and made more relevant and efficient?
- Government role?
- Private industry role?

Human resource needs

- What is current US nuclear talent pool:
  - Engineers
  - Scientists (physics, chemistry, radiochem)
  - Technical
  - Regulatory staff
  - Management
- Projected requirements for each nuclear scenario, and implications for human resources

Security

- Elements of security
  - Physical protection
  - Material control and accountability
  - Safeguards
  - Cybersecurity
- Assess security of--
  - Government facilities
  - Reactors
  - Fuel cycle facilities
  - Transport
  - Transmission & distribution networks
- Policy priorities based on assessment

Safety

- Elements of safety
  - Design for design-basis accidents
  - Training personnel & culture of safety
  - Maintenance and management
- Assess safety of--
  - Government facilities
  - Reactors
  - Fuel cycle facilities
  - Transport
- Policy priorities based on assessment

Supply chain management

- How capable is the US to support all links in the nuclear power plant and fuel cycle supply chain, if new reactors are built?
- What steps would be needed to fill gaps in the chain?
- How much can the US safely rely on foreign suppliers for each of those gaps?

Reactor Licensing

- How can the NRC improve the efficiency of the licensing process, optimizing time and costs?
- How should the NRC, as an independent agency, fulfill its mission in consultation with the cabinet departments of the USG (DOE, EPA, DOS, DHS) and the 50 states?

Policy environment

- How can a long-term strategy be implemented given the frequency of US energy policy changes?
  - Role of government
  - Role of private sector
- What are the policies required to support the Case A, Case B and Case C scenarios?

International implications of increased reliance on nuclear power

- New build is already occurring ex-US (36 reactors under construction)
  - WNA: 93 reactors planned, 218 proposed
- Safety, environmental, security issues are universal for nuclear power.
- A significant accident or incident anywhere will affect acceptability of nuclear everywhere, including US.

Relationship of expanded reactor fleet and related fuel cycle activities

- If NPP expansion is accompanied by linear expansion of countries engaged in enrichment and reprocessing, increased risk of proliferation
- Important to institutionalize fuel cycle mechanisms to reduce that risk, e.g., multilateral arrangements, fuel assurances, leasing, fuel bank, etc.
- Urgency to finalizing these mechanisms before individual countries make decisions that pre-empt a regime of restraint in fuel cycle proliferation

US policy considerations on nuclear nonproliferation: civil v. military uses I

- Relation of the growth of nuclear energy to nonproliferation: fuel cycle
  - front end - fuel assurances, stockpiles
  - back end – used fuel management and disposal
  - Integrated – cradle-to-grave, leasing
- Relation of the growth of nuclear energy to nonproliferation: countries
  - NPT States (Iran)
  - Non-NPT States (India, North Korea, Pakistan, Israel)
- Value of US leadership
  - International cooperation with P-5, IAEA, others

US policy considerations on nuclear nonproliferation: specific issues

- Modernize US and multilateral export controls
- Develop discrete threat reduction strategies for state vs. non-state actors
- Decide appropriate US policy toward cooperation with key nations (e.g., Russia, India)
- Coordinate US domestic nuclear policies with foreign and multilateral policies and efforts.

Role of key players in Nonproliferation

- UN Security Council
- NPT regime (Additional Protocol, UNRes 1540)
- IAEA (20/20 Study)
- Nuclear Suppliers Group
- Regional arrangements (e.g., Tlatelolco. NWFZs).
- Multilateral efforts (PSI, Global Initiative to Combat Nuclear Terrorism, etc.)
- Scientific community
- Industry
- NGOs

Conclusions

- Nuclear power could play a significant role in efforts to limit greenhouse gas emissions. The US has a lot of work to do to prepare domestically before nuclear power can play that role.
- It is critical that domestic and international implications be analyzed and addressed if nuclear expansion is to be a viable option for the US and other countries.
- If the US does not expand its nuclear fleet but other nations do so, it will become increasingly difficult for US to carry significant weight in international efforts to manage global nuclear expansion.
- Given stakes to US, and high US standards in safety, it is in US national interest to play a leadership role in global efforts to address safety, security, environmental, and proliferation implications of nuclear power.