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Role of Nuclear Power for Sustainable Development in Asia



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IEA World Energy Outlook '07

The Challenge:

More secure and lower carbon-energy system

Outlook

- -Fossil fuels :remain dominant (84%) source of energy, '05-'30
- -Coal demand: biggest increase by 73% till '30, mostly in China and India
- -Electricity demand will be doubled by '30
- -Electricity supply will require around \$22 trillion investment to meet demand through '30
- -In reference scenario, CO₂ emission increases by 57% by '30

Australia Changed Nuclear Policy

- Rich in indigenous energy resources
- Energy exports are important revenue
- Energy demand growth will be 1.6% per year through 2030
- Not ratified the Kyoto Protocol

Policy :

(1)Reduction of CO2 emission by energy saving and NRE development

(2)Asian Pacific Partnership on Clean Development and Climate (Australia, China, India, Japan, Korea, USA)
(3)Development of energy infrastructure for transport of energy resources

(4)New administration has a policy not to promote nuclear power

Bangladesh - Rooppur NPP Project

- 87% of electricity produced from indigenous natural gas (depleting fast)
- Only 42% population access to electricity
- Electricity demand increases, 4.5-8% per year

Policy:

- (1)Electricity access to all population at affordable price
- (2)Renewable energy development
- (3) Import option: oil and coal
- (4)Early implementation of Rooppur NPP project (2 x 600MW)

China Challenging Energy Security

- I. Increase in energy demand through 2030 by three times: Economic growth >10%
- 2. Coal continues to be main energy source, around 70%, causing serious air pollution, one third of land is contaminated by acid rain
- 3. Imported oil shares about 40%
- 4. Share of CO2 emission 18.8% (2005)
 Policy:

(1)Energy saving 4% per year (2)Clean coal technology (3)Development of hydro power (4)Development of nuclear power)

China, Expanding Nuclear Power Program

- Current Capacity; 11 NPP (9 GW) in operation
- Projected nuclear power capacity; Total 40 GW in 2020 (4% of electricity) Total 80 to 120 GW in 2030
 Challenges: localization of larger plant (1GW) construction to reduce plant cost

India's Electricity Demand Sharply Increasing

- 40 % people, no access to electricity
- Per-capita power consumption, one fourth of world average
- Energy demand increasing 8–10% per year
- Current power capacity, 140GW needs to be increased to 700GW by 2020
 60% power from coal burning

India, Challenging Nuclear Power Expansion

- Current capacity; 15 NPPs, 3.4 GW
- Planned capacity; 25-30 GW increase by 2020, including FBR of 500MW by 2010
- Nuclear power program to meet rapid increase of electricity demand, to reduce air pollution and to reduce CO2 emission
 60% electricity is from coal causing serious pollution

Indonesia Introducing Nuclear Power

- Available energy resource: oil 23 years, gas 62 years, coal 146 years (large reserve of fossil fuels)
- Energy demand increase: 3.4% per year
- Electricity demand increase: 3 times, 29 GW in '00 to 100 GW '26
- Export of gas, coal, oil: important national revenue

Policy:

- (1)Decrease oil share from 63% in '03 to 20% in '25
- (2)Increase coal to 33% '25, 71% electricity by coal '10
- (3)Two NPP (1GW each) in operation '15-'16
- (4)90% electrification by '20
- (5)Increase new renewable energy to 5% '20

Japan

- Energy self sufficiency is only 4% (hydro), (if nuclear is included 18%)
- Oil share in energy demand is 47%
- Energy demand will decrease slowly after around 2020
- 55 NPPs in operation, 2 NPPs under construction, 11 new NPPs are under planning
- Share of CO2 emission is 4.5%
- **Policy** : (1)Further increase of energy efficiency
 - (2)Decreasing oil dependence by increasing nuclear, coal, and NRE
 - (3) Mitigation of GHG emission
 - (4) Enhancement of PA for nuclear power
 - (5)Implementation of nuclear fuel cycle

Korea Expanding Nuclear Power

- Energy consumption growth rate : 3.2% per year ('02 ~'05)
- Very limited indigenous energy resource (16% incl. NP, 3.1% without NP) highly depending on import of oil, gas and coal
- Electricity resource : coal 28.2%, nuclear 27, LNG 26.6, oil 7.1)

Policy : -Strict regulations on energy efficiency -Expansion of NPP to reduce oil for power (20 NPPs in operation with operation factor 90%, 4 under construction, 4 under planning) -Enhancement of energy supply security

Malaysia Studying Nuclear Option

- GDP growth is 5.9% in '06
- Oil reserve for 19 years, NG reserve for 33 years
- Energy demand will be doubled by 2020
- Electricity generation capacity 19.4 GW in '06 should be increased to 29GW in '20
- Electricity generation source ; 65%NG, 26% coal, 6% hydro

Policy:

- (1) Security and reliability of fuel supply
- (2) Environmental concerns
- (3) Reduction of share of gas to 33% by '20 in power generation with increase of coal and hydro to 22%, and nuclear & NRE to 9% to 36%
- (4) Nuclear power option is studied by relevant ministries

Philippines Starting Nuclear HRD

- Energy consumption increased by 3.5% per year (GDP growth 4.5% in '03)
- Oil shares 38% of energy demand. Oil demand increase 7.2% per year ('02~'04)
- Moderate reserve of oil, coal and natural gas
- Energy self sufficiency is 56% ('04)
- Large geothermal energy (1931 MW in '03)
- Bataan NPP (620MW) not operated since '87 is under inspection by IAEA for possible restart of operation

Policy : -Increase reserves of indigenous oil and gas through more intense exploration

- Promotion of renewable energy, such as biomass geothermal, solar and wind
- -Study on nuclear power, HRD has started

Thailand Introducing Nuclear Power

- About 60% of energy is imported
- About 90% oil is imported
- Natural gas ; self sufficiency 75%, 30 year reserve
- Electricity : high dependence on natural gas of 77%, 13% coal,
- High electricity demand increase 6.6%/y

Policy : (1)Security of energy supply (2) Saving energy (3) New renewable energy (bio fuels, solar) (4) Nuclear power, 2GW in '20, 2GW in '21 (5) Public awareness and acceptance, key issues for nuclear (6) Switching mode of transport from cars to railway and waterway

Vietnam Starting Nuclear Power

- Population of 80 million increasing to 100 million in 20 years
- GDP growth 8% per year
- Energy demand increase, 4 times in 20 years
- Electricity demand increase, 12-15% per year
- Oil reserve for 30 years, coal for 127 years
- Net energy export 2% in 1990 increase 55% in 2005
- Export of oil and coal shares 25% of total export revenue

Policy: (1)Energy infrastructure (2) Long term energy security (3) Energy saving (4) Environmental protection (5) Nuclear power 1GW in 2020



FNCA Panel Noted Followings on Nuclear Power 2007 (1)

- 1. Nuclear power is a proven technology with safety assurance and economic competitiveness
- 2. Nuclear power dose not emit CO₂, SO₂ and NO_x in operation, and contribute to mitigation of climate change and environmental pollution

FNCA Panel Noted Followings on Nuclear Power 2007(2)

- 3. Nuclear power is not included in CDM. Importance of appealing COP inclusion of nuclear power in CDM
- 4. Introduction of nuclear power requires infrastructure such as safety regulation and security system, human resources development, public acceptance, economic analysis, and assurance of nonproliferation of nuclear materials

The 8th FNCA Ministerial-level Meeting

Date: December 18, 2007, Tokyo Organized by: Atomic Energy Commission of Japan General Chairperson: The Honorable Mr.Fumio KISHIDA Minister of State for Science and Technology Policy (Japan)



The Heads of

Delegation of Bangladesh, China, Indonesia, Japan, Korea, the Philippines, Thailand, and Viet Nam Signed December 18,2007

FNCA Joint Communiqué on "The Peaceful Use of

Nuclear Energy for Sustainable Development"

- To work towards raising global awareness that, in the framework of addressing global warming beyond 2012, it is important to
 - promote the utilization of civilian nuclear power as a clean energy source in a manner that ensures nuclear nonproliferation, safety and security,
 - recognize that nuclear power emits no greenhouse gases and therefore should be considered in the Clean <u>Development Mechanism (CDM)</u>, and that the Special Climate Change Fund should be available for use for civilian nuclear power plants.
- The Joint Communiqué was circulated by <u>IAEA INFCIRC</u> in 2008
- In COP sub-committee in June, 2008, <u>Japan proposed to</u> <u>study the issue of inclusion of nuclear power in CDM</u>

FNCA Study Panel on Cooperation for Nuclear Energy in Asia

 1st Panel Meeting on cooperation for human resources development (HRD) for nuclear power (Oct. 30-31, 2008):

-Sharing information on HRD for nuclear power introduction

-Setting web-site on HRD program for training of nuclear power

-Providing basic training by ANTEP and WS

2nd Panel Meeting on cooperation for development of infrastructure for ensuring nuclear safety (Sept. 1-2, 2008)

Nuclear Power Contributes Mitigation of GHG Emission Coal 975 g/kWh Nuclear 22 g/kWh The 4th Report of IPCC Working Group - III (Mitigation of Climate Change by 2030) Summary for Policymakers : SPM April 30 – May 3, 2007 Bangkok, approved in Nov.2007 "Given cost relative to other supply option nuclear power, which accounted for 16% of the electricity supply in 2005, can have an 18% share of the total electricity supply in 2030 at carbon prices up to 50\$US/tCO2-eq. but safety, weapons proliferation and waste remain constraints."

Rising Expectations on Nuclear Power for GHG Reduction and Energy Security

Current status (March '08 IAEA):

-439 NPPs in operation in 30 countries
sharing 16% of global electricity since 1986
-35 more under construction

Projections by IAEA

Increase from ca. 370GW to 690GW in '30
Rapidly expanding in Asia

IAEA Projection of Nuclear Power Capacity

Projections of Nuclear Generation Capacity worldwide, 2020-2030



Nuclear power generation is projected to grow mainly in regions where it is already established.

690GW 2030

370GW 2007

Large increase in Far East and North America

Nuclear Power Trends

1. Italia decided to start NP program (May '08) 2.Gulf countries expressed strong interest in NP, Int. Conf. Nucl. Energy (May '08, Bahrain) 3. IEA estimates 32 NPP increase per year to achieve 50% reduction of GHG by '50(June 6, WEO '08) 4. In India 25-30 GW additional NPP will be in operation by 2018 to 2023 (April, '08) 5. In USA 4-8 new NPP in operation by 2016 6. Chinese NP program to be expanded at higher rate from 40 GW in '20 to 120 - 160 GW in '30 (May 27, '08, Tokyo)

Talking points of Panel-1 Policy and implementation

- Roles of nuclear power for sustainable development to meet demands without CO2 emission
- Challenges for NPP expansion, such as fuel supply assurance, SF management and assurance of safety, security and safeguards (3S)

 Possible international cooperation for introduction of NPP in developing countries with assurance of safety, security and safeguards (3S)

Roles of multilateral cooperation frameworks, such as IAEA, NEA, ASEAN+3, FNCA