

Electricity is the Key Energy for Low Carbon Future

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EXPERT WORKING GROUP ON
ENERGY COOPERATION IN NORTHEAST ASIA:
CHALLENGES IN ACHIEVING ENERGY EFFICIENCY**

Power Plants Suspended(including those under periodic inspection)due to the Great Earthquake

- Tohoku Electric 5.66GW
 - Nuclear(Onagawa) 2.17GW
 - Thermal(Sendai, Shin-Sendai, Haramachi) 3.39GW
- TEPCO 15.9GW
 - Nuclear(Fukushima-1&2) 9.1GW
 - Thermal(Hirono, Hitachi Naka, Kashima, Higashi-Ogishima) 6.8GW
 - (Power purchased from Others(Soma, Joban and Kashima Joint Power Cos, & Japan Atomic Power) 5.6GW)

Impacts of March 11 Great Earthquake

- Power shortage in this summer
 - government to set legal curb on power consumption by large-lot users
- Energy policies face review
 - No-more nuclear dependent energy supply?
 - Change Japan's CO2 reduction target?
- Japan's crisis will affect N-power worldwide

Global Energy Risks

- 1. World energy demand will be expanding at higher speed.**
- 2. NEA is the world biggest energy market. In 2005, China overtook Europe in terms of energy consumption and will be, the world biggest energy consumer by 2015.**
- 3. High fossil fuel dependency in Asia may cause another oil shocks in near future.**
- 4. Supply vulnerability of regionally uneven distribution of oil reserves will continue.**

Global Environmental Risks

- 1. World CO₂ emission has increased and will increase more than double by 2050.**
- 2. More than 80% of the incremental demand will occur in developing countries.**
- 3. China has already overtaken EU and will overtake USA soon in terms of CO₂ emissions and NEA share of CO₂ emissions will be more than half of the world**

The Road to Reduce CO2 Emission

$$\mathbf{CO2=(CO2/ENERGY)(ENERGY/GDP)(GDP)}$$



1. Energy Efficiency Up → Fuel Efficiency & Industrial Structure
2. Fossil Fuel Dependence Down → Fuel Choice → Natural Gas & Nuclear & RES
3. Economic Growth Down

Energy policy in 21st century will be driven by the triple challenges of

- making substantial reduction in emissions of greenhouse gases, such as CO₂
- while ensuring a secure supply of energy
- all at reasonable cost to the economy for promoting economic competitiveness in the globalizing world

Electricity is expected to play very important role to tackle the triple challenges

- on the supply side, potential advances in power generation technology and CCS
- on the demand side, advances in efficient electro-technologies such as heat pumps and the potential of electricity in transport, such as shinkansen, light rail, EV etc
- both will help to reduce carbon emissions and boost energy supply security

Electricity is Key to a sustainable future (1)

- Electricity generation accounts for a third of world's CO₂ from energy use, which in turn accounts for two-thirds of all greenhouse gas emissions.
This is one of the sectors in which deep cuts in emissions are most practicable – the technologies for producing electricity without emitting carbon dioxide are either in use or close to deployment.
- A carbon neutral power supply delivered through a properly functioning competitive energy market will be a key part of the solution to the great energy climate challenges.

Electricity is Key to a sustainable future (2)

- Electrification also offers cutting emissions from other sectors: EV and Electric heat pumps
- But, low-carbon power will be more expensive and will require huge investment in infrastructure and improvement in energy efficiency.
- An entirely new type of electricity grid will be required
- Trinity of generation : nuclear, renewables and fossil fuel plants with CCS

Renewable Energy

- Anticipated that commercial renewable energy technologies will make growing contributions to the world's energy supply and demand mix in coming decades due to continuing innovations, improving cost competitiveness, expanding policy mandates, and enduring challenges relating to energy security, fuel price volatility, climate change, and sustainability.
- However, there remains a massive gap between available sources and ones that currently can be harnessed in economically, environmentally, and socially acceptable ways. Solar and wind power is unstable energy and should be separated from existing power grids.
- Technical progress is critical to fill this gap.

Nuclear Power

- Nuclear power is an essential part of portfolio of carbon-free generation
- High capital costs but low running costs: suited for stable base-load power generation
- At present, 16 % of world's electricity is produced by nuclear power stations in 30 countries with 372 GW and projected to rise to 433 GW by 2030, mainly in Asia.
- Large risks and uncertainties in both licensing and subsequent construction, operation, waste management and decommissioning. Controlling costs is a key and difficult objective.

Thermal Power Generation

- **Coal-fired generation** will remain an indispensable part of a well-balanced and diverse supply of power resources.
- The latest advanced clean generating technologies should be used wherever possible and demonstration of **CCS** technology should be accelerated.
- More use of **natural gas** for generation is a quick way to cut CO₂ emissions. Conventional coal-fired to be replaced by latest (CCGT) to cut CO₂ emissions by more than half.

Natural gas

- We need to introduce and support research into RES for low carbon future. But cannot expect immediate results. More use of natural gas is a quick way to cut CO₂ emissions.
- Huge gas fields are close by NEA, such as Russia Far East, Australia, SEA and Central Asia.
- Almost the entire thermal power generation fleet in Japan and Korea will need to be replaced in the coming decades. Conventional coal-fired to be replaced by latest combined cycle gas turbine(CCGT) to cut CO₂ emissions by more than half.
- As gas system is compact, it can be easily installed in inland areas or factory premises, if gas pipeline is close by
- If fuel-cell cogeneration systems using natural gas are installed in commercial complexes, homes and other facilities, energy efficiency would dramatically rise while CO₂ emissions would drop.
- Clean natural gas is a good choice for back-up generation system for solar and wind power.

Network Issues

- The present grid networks were constructed and optimized to take advantage of the cost savings from large scale centralized power stations.
- Climate change will have significant impact on the operation & development of T & D network caused by
 - new and distributed generation technologies
 - changes in demand patterns
 - smart grids and its contribution
- Increasing use of RES, distributed generation, EV, etc will have significant implications for network operation.
- The paradigm of centralized power supply will be overtaken by the development of small and decentralized generation units

Electricity is the key energy to attain common goal of achieving low-carbon future

- Electricity is key to implementing solutions to climate change.
- Electricity is key to a sustainable future
- Electricity is key to achieving greater energy efficiency
- Electricity is key to economic growth and job creation

Electric Power Supply Options

1. To maintain a secure and stable supply of electricity and to make significant emissions reductions in the power sector, it is imperative that all energy supply options be kept open. There are no easy or universal solutions and the optimum mix of resources should reflect local availability and the nature of regional integration.
2. Nuclear power is a key part of the solution to both climate change and energy security. Policy makers and electric industry must work to enhance public understanding of the benefits of nuclear power in providing reliable and emissions-free, electric energy.

Electric Power Supply Options

3. Advanced technologies, including clean coal technologies, provide the key to combat climate change and enhance energy security. Government climate strategies must be harmonized with the projected availability of these technologies in order to make meaningful emission reductions.
4. In expanding renewable energy as low emitting technology, improvements in the grid system will be required. To realize this, expedited licensing procedures and additional investments must be recovered from stakeholders in an appropriate manner.

Energy Efficiency and Transportation

5. Improved energy efficiency is an important objective in addressing climate concerns. This will require consumer education, improved building and efficiency standards and supportive regulation. Expansion of new “smart” grid and end-use consumer technologies will enable improvements. Energy efficiency offers an effective, short-term way to achieve lower carbon intensity at acceptable costs to consumers.
6. In addition to carbon reduction efforts in electric supply and increased electrification, significant carbon reductions can also be achieved in the transportation sector with the deployment of new Plug-in Electric Hybrid Vehicles.

Increased Investment

7. To ensure that the growing demand for electricity is met in a secure manner will require the electricity industry to make major investments in generation, transmission and distribution over the next decades.

A stable investment climate based on long-term, coherent legal and emissions frameworks is critical for the electricity industry to deliver this future low-carbon emissions energy system.

Climate Change Policies

8. Carbon emissions, per unit of economic output, are moderating in the developed economies, but it will take time and significant investment in new nuclear power plants, clean coal and renewable energy to replace the vast existing energy systems through the use of advanced technologies.
9. The move toward a low-carbon energy system will also require an increased focus by both industry and government on the commercial demonstration of promising technologies, including CCS, to allow for the continued use of coal necessary in many countries.

Climate Change Policies

10. All sectors, including transport, industrial and residential, must participate in fair, equitable and appropriate ways in the global effort to combat climate change. In this regard, considering the role of electricity in improving standards of living, potential electrification in society as a whole should be continuously explored while promoting energy savings and consequently reducing greenhouse gas emissions in every sector.

Climate change is a long-term issue, which will need to be tackled over the next 50 years or more.

But if we delay our actions, our cumulative emissions will require steeper reductions and lead to higher costs.

Any actions to tackle with the challenge needs huge investment and international cooperation.

Global energy-climate challenges require a global approach. Why not work together for our future!