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The US's New National Energy Policy
— Supply-Focused Logic and Positioning of Each Energy Source —

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9.1 Introduction

President Bush announced the National Energy Policy (NEP) on May 17. This was compiled as a report of the National Energy Policy Development Group chaired by Vice-President Cheney, and includes 105 policy recommendations in all.
Apart from an Overview, this report is composed of eight chapters, shown below.

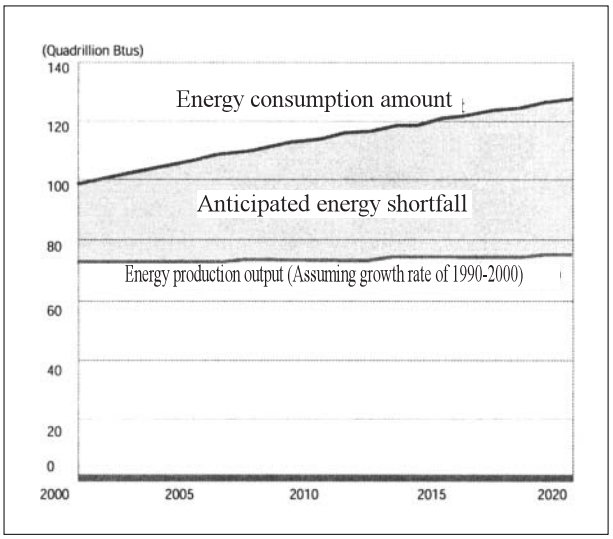
(1) Taking Stock: Energy challenges facing the United States
(2) Striking Home: The impacts of high energy prices on families, communities, and businesses
(3) Protecting America's Environment: Sustaining the nation's health and environment
(4) Using Energy Wisely: Increasing energy conservation and efficiency
(5) Energy for a New Century: Increasing domestic energy supplies
(6) Nature's power: Increasing America's use of renewable and alternative energies
(7) America's Energy Infrastructure: A comprehensive delivery system
(8) Strengthening Global Alliances: Enhancing national energy security and international relationships

Even though a significant portion of the current NEP is devoted to energy-saving and renewable energies, the overall tone clearly sets forth a stance that attaches primary importance to expansion of energy supply capability. This paper surveys the logic focusing on the expansion of domestic energy supply capability, and the positioning of each energy source and related technologies in the NEP.

9.2 Serious gap in domestic energy demand and supply

Consistently emphasized in the NEP is the demand and supply imbalance of domestic energy that will extend into the future. Chart 1 is shown at the beginning of the NEP report, and indicates projections of US domestic energy production and consumption. As Chart 1 shows, if we assume that energy production will progress at the same rate of growth as the 1990s, by 2020 consumption will be about 70% higher than production output, and the US will be faced with a considerable supply-demand gap.
Furthermore, oil production output of the US today is down 39% compared to 1970, and as a result, the level of dependence on overseas oil has risen to about 55%. It is predicted that if the trend continues at this rate, two-thirds of domestic

Chart 1: Projections of US domestic energy production output and consumption amounts



Source: Sandia National Lab. and DOE/EIA

consumption will be dependent on imports by 2020, and in terms of US energy security, it is a situation that can not be overlooked.

What is more, the NEP also takes up the recent escalation of energy prices and the California power crisis, and in addition to noting that the US is facing the first energy crisis since the oil shock of the 70s, concludes that the fundamental reason for it also lies in the domestic energy supply-demand imbalance. In regard to electrical power as well, it is estimated that in the next twenty years demand in the US as a whole will increase 45%, and satisfying this demand will necessitate construction of 1300-1900 power plants (60-90 per year) and expansion of the energy infrastructure, such as the electrical power delivery network. In California at the beginning of the 1990s, there was surplus electric power supply capability, but despite the increase in energy demand that attended the subsequent prosperity and population increase, no large-scale power plants were constructed, and as a result, a major demand excess occurred, considered to have brought about the recent crisis conditions.

And in 1994, the new construction of 43,000MW power plants was being planned for 1995-1999, but those actually built were only 18,000MW. As a reason for this, the NEP cites differences and complexities in regulations by state and regional authorities and the uncertainty of the licensing process, and relaxation of energy-related regulations and simplification of the licensing process form the mainstays of NEP proposals.

9.3 Energy conservation and improving energy efficiency alone are not enough

To resolve the demand-supply imbalance of primary energy and electrical power like that described in the previous section, three approaches are conceivable: "controlling energy demand by energy-saving and greater efficiency," "dependence on imported energy," and "increasing domestic energy supply capability."

Looking at energy-saving and greater efficiency, since the oil shock, the US government and industrial world have worked to promote these, and while the economy has grown 126% since 1973, energy consumption has only increased 30% (half from the shift in industrial structure to the service sector, half contributed by greater energy efficiency). Energy-saving and improved energy efficiency are the no-regrets strategies for solving the global warming problem, and in regard to R&D that leads to improved energy efficiency, such as cogeneration and ITS (Intelligent Transport System), and the purchase of hybrid cars and fuel cell cars, consideration is said to be needed in terms of budget and taxation, and at the same time, it notes that strategies for energy saving and greater efficiency by themselves are not enough to cover the future demand-supply gap predicted at the present point in time.

9.4 Towards increasing domestic energy supply capability — Energy security and eliminating the demand-supply gap

Ultimately, the NEP claims that to continue to ensure energy security and eliminate the energy demand-supply gap that extends into the future, it is essential to work on expanding domestic energy supply capability without delay. Energy security is the top priority of America's trade and diplomacy, and the NEP states that in order to reduce energy price volatility and supply uncertainty, it is important to build strong partnerships with energy-producing countries, and fundamentally, to reduce dependence on overseas energy by increasing domestic energy supply capability.

And from the standpoint of energy security, the necessity of diversifying energy sources is also emphasized. Currently, about 90% of power plants under construction or being planned are natural gas thermal power plants. However, when there is excessive dependence on one energy source, consumers are greatly affected from the escalation of those fuel prices and supply blockages. Therefore, the NEP calls for formulation of energy strategies while considering quantitative expansion of energy supply and diversification of supply sources at the same time.

Furthermore, the NEP also claims that a high quality of life backed by consumption of abundant energy and environmental protection are possible to achieve at the same time, not by rebellious goals

but by comprehensive policies, and that the foundation thereof is technological progress.

9.5 Positioning of each energy supply technology and related technological trends

9.5.1 Primary energy

Oil and natural gas together supply over 60% of all primary energy and almost 100% in the transport sector in particular. By 2020, demand for natural gas is expected to be 50% greater than at present, and oil one-third greater. In contrast to this, the US's domestic oil production output has been going down since 1970, and for natural gas also, growth in production output is predicted to be less than that of consumption in the period from now until 2020.

In particular, the level of dependence on oil imports has risen sharply since 1985. In 2020, it is predicted that the US will have to import two-thirds of its oil for domestic consumption from overseas; two-thirds of the world's crude oil reserves are in the Middle-East, and are subject to the strong price-deciding power of Arab nations. For this reason, oil price fluctuations are apt to become sharp.

Natural gas accounts for one-quarter of US primary energy, and 85% of natural gas consumed in the US is produced domestically. The level of dependence on imports rose from 5% in 1987 to 15% in 2000. Unlike oil, in almost all cases natural gas is produced and consumed in areas close by, so prices are largely localized, and even though prices that had escalated in 2000 settled down a little at the beginning of 2001, they are still at a high level.

At the same time, the progress of mining technologies for oil and natural gas is remarkable, and mining is now becoming possible from reserve locations that had until now been difficult to mine because of costs, geological conditions, damage to the environment and so forth. However, the NEP points out that under current environmental regulations, there are aspects where this kind of technological progress is not being maximized.

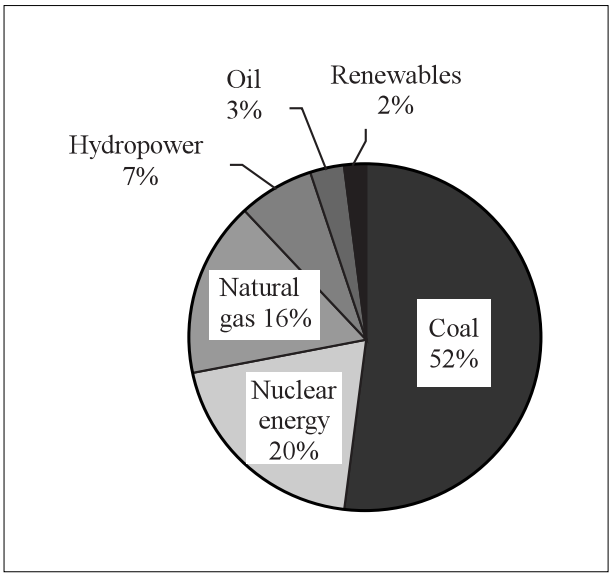
Under these types of conditions, NEP sets forth a policy that actively promotes mining in existing and new oil fields and natural gas fields and in particular, proposes that the ban should be lifted on resource mining companies that use frontier technology in a portion of Alaska's Arctic National Wildlife Refuge (ANWR). Furthermore, the proposal also includes mining offshore and on government-owned land, resource collection from existing oil fields and natural gas fields using the latest technology, relaxation of related regulations, and expansion of infrastructure, such as gas pipelines and oil refineries.

Since approximately 90% of coal is consumed in electricity generation, this will be covered in the next section.

9.5.2 Electrical power

The demand for electrical power is expected to rise 45% over the next twenty years, and it is stated that 393,000MW of new power generation facilities, i.e., 1,300-1,900 power stations (60-90 per year) will need to be built. Mentioning the power crisis in California, the NEP report points out the importance of appropriate system design when promoting liberalization of the electrical power market, and points to increased competition in the electrical power market. Below is a representation of positioning and related technological trends in regard to each power generation source described in the NEP.

Chart 2: Percentages in composition of US power generation sources (2000)



(1) Coal

As Chart 2 shows, coal supplies over 50% of all electrical power. What is more, coal is the most plentiful fuel source in the US, with reserves equivalent to 250 years' supply. 99.7% of coal produced domestically is consumed domestically, and consumption for electrical power use accounts for 90% of that. From 1982 onwards coal prices have been going down, and this is expected to continue until 2020. While resource deposits are plentiful and inexpensive for coal-fired power generation, the environmental burden caused by emissions of sulfur dioxide and nitrogen monoxide is an issue.

Currently, there are almost no coal-fired power stations being built. However, the NEP notes that assuming electrical power production by nuclear energy and hydropower will not grow, excessive dependence on natural gas will become unavoidable unless coal continues to be a mainstay of electrical power supply. Therefore, it will be necessary for coal to continue to play a role as a main energy source in future.

The NEP states that clean coal technology (technology concerned with reducing environmental burden by improvement of heat efficiency in coal-fired power generation, advancement of desulfurization and denitrification, improvement of handling quality, etc.) will enhance the appeal of coal as an energy source, and proposes commitment of two billion dollars in research costs over the next ten years. Particular emphasis is placed on the Fluidized Bed Combustion (FBC) and Integrated Coal Gasification Combined Cycle (IGCC) processes, and reduction of mercury emissions is described as a future task.

In actuality, according to those in charge at the Department of Energy (DOE) Office of Coal and Power Systems, the Clean Coal Power Initiative (CCPI) is one of the features of the fiscal 2002 energy R&D budget (150 million dollars), and the DOE is working towards the verification of thermal power plants (zero-emission plants) with a goal of 2015, aimed at high power generation efficiency (60% or more by coal heat, 75% or more by natural gas), supply of both heat and electricity (overall efficiency 85-90%), zero emission of NOx, SOx, considerable reduction of carbon dioxide emissions (40-50% reduction by improvement of power generation efficiency, and furthermore a 100% reduction in real terms by carbon dioxide fixing and isolation), etc.

(2) Nuclear energy

Nuclear energy is the second largest power source after coal, and supplies 20% of the nation's total electrical power. Even though a few low-efficiency nuclear reactors were closed in the 1990s, 103 nuclear reactors are in operation in the US, and in terms of total amount of power generation, are at the highest level ever. Nevertheless, there has not been any construction of new nuclear power plants since 1973. The performance of nuclear power plants was significantly improved in the 80s, and utilization of facilities has reached nearly 90% of late, and cost-wise also, it is about the same as other power generation sources.

The NEP claims that a 2,000MW increase in power generation amount would be possible by increasing the usage of facilities at existing nuclear power plants to 92%, and a 12,000MW increase would be possible by increase the rated output of each nuclear reactor. Nevertheless, raising the rated output is likely to involve great cost, and furthermore would need to be examined for safety over the long-term by the Nuclear Regulatory Commission (NRC). Therefore as another measure to increase the amount of power generation by nuclear energy, extending the operating period to twenty years is cited, and the NEP notes that this kind of license renewal would be possible for 90% of nuclear reactors. It also states that on the sites of many nuclear reactors, there is still space for construction of new reactors, and compared to the case of building a nuclear reactor at a new location, licensing procedures would be simplified in this case. And as an example of an advanced nuclear reactor with intrinsically high safety, it cites the Pebble Bed Modular Reactor (PBMR). In regard to PBMR, policy managers at the DOE's Office of Nuclear Energy, Science and Technology state that procedures of model approval by the NRC must be commenced hereafter, and moreover that while cost-effectiveness is a major consideration, the first will be introduced in the US around 2006-7 at the earliest, and it is possible

that more will be introduced by around 2010.

On the Yucca Mountain Project concerning geologic disposal of high-level radioactive waste, there are only details reconfirming the role of the DOE and NRC in the licensing process. According to the manager of the DOE Office of Civilian Radioactive Waste Management, there is scheduled to be a judgment from the Secretary of Energy as to whether or not the Yucca Mountain site is appropriate, and currently in addition to the conventional Hot Repository concept, the DOE is conducting a technical evaluation of the Cold Repository concept, where the environmental temperature of spent fuel laid underground is low, and can reduce the uncertainty in safety assessment.

Furthermore, it considers that the retreatment being carried out in England, France and Japan does not obviate the need for geologic disposal of spent nuclear fuel, but can optimize the use of geologic repository. Lastly, it touches on annihilation treatment technology using accelerators, claiming that it can significantly reduce the quantity and toxicity of waste in combination with retreatment.

Based on the above, the NEP considers that for the NRC, ensuring safety is the number one priority, and proposes that it promote licensing approval in regard to increasing the rated output and extending the operating period of existing reactors. It also proposes that the DOE and EPA (Environmental Protection Agency) evaluate nuclear power generation as contributing to improvement of the atmospheric environment. It also states that within the framework of developing advanced nuclear fuel cycles and next-generation technology, the amount of waste material should be reduced, and the possibility should be reinvestigated of researching, developing and implementing fuel processing technology with high nuclear proliferation resistance (pyroprocessing, etc.).

(3) Natural gas, oil and hydropower

Natural gas supplies 16% of America's total amount of power generation, and is expected to account for 90% of the power generation supply amount that will increase in the period from now until 2020. By 2020, the amount of power generation by natural gas will be about triple the current amount, and will account for 33% of all power generation. Cited as advantages in respect to other power generation sources are its low capital cost, short lead-time, high conversion efficiency and comparatively low gas emissions.

Oil currently accounts for 3% of total power generation, and the amount of power generated in the period from now until 2020 is predicted to drop about 80%.

Hydropower accounts for 7% of America's power generation, and the amount of power generation has been more or less constant in the past few years. It is a low-cost source of power generation that does not involve emission of Greenhouse gases, but development is already completed at the majority of favorable locations.

(4) Renewable energies and alternative energies

A chapter of the NEP entitled "Nature's Power" describes renewable energies and alternative energies. As renewable energies, sections are devoted to biomass, geothermal energy, wind power and solar energy, respectively, but there is a sense that content is limited to an explanation of the basic technologies.

As Chart 3 shows, biomass accounts for the majority of power generation by renewable energies excluding hydropower, and though the cost of using these renewable energies is still high, the cost has dropped dramatically thanks to technological innovation in recent years. Renewable energies apart from hydroelectric power in total supply 4% of primary energy and 2% of power generation, and by 2020 are expected to account for 2.8% of the total amount of power

Chart 3: Amount of power generation and power generation costs by new energies (1999)

	Amount of power generation million kWh	Power generation cost (cents/kWh)
Solar	940	20
Wind power	4,460	4-6
Geothermal energy	13,070	5-8
Biomass	36,570	6-20
Hydropower	312,000	2-6

Source: DOE/EIA

generated.

In the NEP, the term alternative energies is applied as the general term for 1) fuels for transport apart from gasoline and diesel, 2) methods of energy usage that differ from the conventional, such as decentralized power source systems, and 3) future energy supply sources, such as hydrogen and nuclear fusion. In regard to distributed power systems, cogeneration systems and fuel cells, etc. are taken up in the main. The use of hydrogen energy is stipulated as promising in the long-term. Furthermore, subterranean transmission lines using high temperature superconductivity are also cited as an example of recent technological success.

"Future prospect of hydrogen is as a companion carrier to electricity, as a storage medium, and as a medium that can meld transportation and electric generation systems into compatible and overlapping systems," said Sigmund Gronich, team leader of DOE's hydrogen program.

While the NEP firmly recognizes the importance of R&D of renewable and alternative energies from the standpoint of energy source diversity, reduction of environmental burden and improving energy usage efficiency, it also considers that there are many problems that must be surmounted in terms of cost and technology, and that it will be some time in the future before they assume a major role in the US's energy systems.

Still, it proposes committing to the R&D of renewable and alternative energies, the approximately 1.2 billion dollars in royalties anticipated from lifting the ban on resource development in the Arctic National Wildlife Refuge.

9.6 Conclusion

The recently announced NEP differs considerably from policies in the time of the Clinton Administration, which were cautious of oil field development and the use of nuclear energy. Having said that, judging from moves in the energy business since last year, it is also true that many experts thought it was almost as they predicted.

Media reportage in the US is showing the greatest interest in policies that promote mining of oil and natural gas, etc., such as lifting the ban on resource development in the Arctic National Wildlife Refuge, etc. In the Japanese media in contrast, reportage emphasis seems to be placed on the change to a line promoting nuclear energy.

Meanwhile, the Democratic Party is putting forth energy policies that stress short-term measures for the recent energy crisis, as well as energy saving, improving efficiency and promoting the use of renewable energies.

Recently, the Democratic Party gained the majority in the Senate, and the chair of the Energy and Natural Resources Committee changed from Senator Murkowski, elected in Alaska and from the faction for energy development, to Senator Bingaman, thought to belong to the faction for environmental protection. In addition to this, Senators of the faction against promoting nuclear energy, such as Senator Reid and Senator Daschle (both Democrats) took up important positions within the Democratic Party and in energy-related budget committees.

"The administration's NEP recognizes the unique role nuclear energy plays supplying low cost, emission-free generation. This recognition by the Bush administration represents a positive sea change for the nuclear power industry on the United States among policymakers," said Jim Hagan, the Director of Nuclear Energy Institute (NEI). However, executing the proposals included in the recent NEP will necessitate revision of legislation in many cases, and attention is focused on the direction of future Congressional deliberations.

The energy policy of the Bush administration takes an optimistic stance in saying that the two objectives: realizing an abundant society based on mass energy consumption, and maintaining the environment, can be solved through a comprehensive policy-type approach based on the progress of science and technology. As to whether or not these really can be achieved simultaneously, we will have to watch US policy trends hereafter also from the standpoint of science and technology policy.