

The Trend of the Science and Technology Policy in the US

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5.1 Introduction

The Bush Administration inaugurated in this January is now groping for new science and technology policies.

The science and technology policy of the US has a great influence on the world due to its vast budget amount. For instance, the governmental budget for science and technology in this fiscal year in Japan is about ¥3.4 trillion, while the same in the US is \$90.9 billion (about ¥11 trillion), which is three times larger than the Japanese budget.

In the May issue of "Science and Technology Trends" (Japanese version, "The trends of the science and technology budgets in Japan, the US and Europe"), we outlined the trends of budget allocation in the US and the EU, by taking the opportunity when the Council for Science and Technology Policy studied the priority policy of the science and technology budget for fiscal 2002 into consideration.

In this report, we introduce the trend of the science and technology policy in the US more specifically.

In this May, an energy policy was announced in the U.S. that represented a significant turnabout. The announced "National Energy Policy" (NEP) may significantly influence the R&D policy in the energy field in the US.

Based on this circumstance, in this report, we first explain in general about "the general view of the science and technology policy," and then discuss "the view of the R&D policy in the energy field" in particular. In addition, we focus on the IT policy (the former Clinton Administration attached importance to this policy, but the Bush Administration did not announce any specific directions for this policy as of yet.), which is in contrast to the energy policy, and discuss mainly

the future directions of the R&D policy.

5.2 The general view of the science and technology policy

5.2.1 Points of difference from the former Administration

We can observe points of difference between the Bush Administration and the former Clinton Administration as follows.

- The position of OSTP (Office of Science and Technology Policy)
- The governmental budget for science and technology
- Expectation for R&D activities of private companies

We summarize the policies of the Bush Administration on the respective points as follows.

(1) The position of OSTP

The former Clinton Administration had promoted a consistent science and technology policy by holding the slogan "Development of science and technology is the engine of economic growth."

On the other hand, the Bush Administration has not yet assigned a person as secretary of OSTP, even though half a year has elapsed from the inauguration of the Administration.

For such difference, many participants of the 26th AAAS (American Association for the Advancement of Science) colloquium held in Washington D. C. in May 2001 indicated the opinion, "The Bush Administration may intend to revise the existing centralized policy executed by OSTP, and transfer authorities to the respective departments."

(2) The governmental budget for science and technology

In the President's Budget Message for fiscal 2002 announced on April 9, 2001, the entire budget for science and technology increased by 6.1% from the previous year.

In particular, DOD (Department of Defense) and NIH (National Institutes of Health), for which President Bush had publicly pledged to "support actively" during the Presidential election, requested budgets exceeding more than 10% of the previous year's amounts.

As a result of this increase, the requested amount of budgets for other institutes including DOE (Department of Energy), NSF (The National Science Foundation) and USDA (US Department of Agriculture), etc., was reduced by 5 to 10%.

On the other hand, the budgets of DOE, NSF and USDA had increased by about 10% from the previous year in the budget for fiscal 2001 (under the former Clinton Administration). The deference between these two Administrations is obvious.

Mr. Rankin, deputy secretary general of the American Mathematical Society, pointed out, "I have no objection to the increase of the budget for NIH, but it is important to increase the R&D budgets for mathematics, physics and engineering, etc., with well balance as well in consideration of technological innovations in the future."

(3) Expectation for R&D activities of private companies

The Bush Administration intends to utilize the capabilities of private companies for research and development, in the same way as the former Clinton Administration.

On this point, Mr. Peterson, representative of the science and technology policy program of SRI International, said, "In contrast with the former Clinton Administration aiming to lighten the burden of the government by making the industry bear a part of R&D costs, the Bush Administration promotes this policy further and takes a stance that private companies should execute all the R&D they can do, and the government will specialize in fundamental research activities that are difficult to execute by private companies."

Mr. Alexander, vice president of Washington Core, a

think tank in the US, forecasts, "the policy of the Bush Administration aiming towards a smaller government is in accordance with the tradition of the conservatives of the Republican Party, and this policy may not be revised for the time being."

Thus, the science and technology policy of the Bush Administration seems to have changed from the previous Administration. Some persons such as Mr. Koizumi, section chief of the budget/policy program of AAAS said, "The Bush Administration sufficiently recognizes the importance of science and technology, but it is now fully occupied with materializing the commitments made in the Presidential election concerning, "reduction of taxes, attaching importance to education, strengthening of the national defense, and expansion of supports to NIH", with other policies just left over."

5.2.2 Noticeable movements related to interdisciplinary R&D

In the middle-to-long-term science and technology policy of the US, the word "interdisciplinary" may be a keyword.

(1) Forecasts of NIC (National Intelligence Council)

In December 2000, NIC publicly announced "Global Trends 2015," which forecasted the changes in global politics, economy, science and technology, conflicts, and environments, etc., to take place until 2015.

For changes of science and technology, this report forecasts, "IT will be a motivating power for technological innovations globally." However, it does not mention how IT will drive technological innovations, and what kinds of influences to society are expected.

(2) Investigations executed by RAND Corp.

In order to execute further investigation on the expected changes of science and technology, NIC has requested RAND Corp., a prominent think tank in the US, to conduct the relevant investigation.

RAND released a report, "The Global Technology Revolution: Bio/Nano/Materials Trends and Their Synergies with Information Technology by 2015," in March 2001.

Table 1: Expected synergy effects produced with technology interactions

Possibility of materialization by 2015 ○ Possibility of materialization is high △ Possibility of materialization is unknown	Examples of technological innovation (Areas)	Biotechnology			Materials technology			Nano technology		
		Generically modified foods	Medicine appraising simulatio	Non invading operations	Artificial heart organism	Personal authentications (IC chips)	Rapid productions at global bases	Micro location confirming tags	Nano scopes for observing inside organisms	Catalytic air nano cleaners
○	Generically modified foods (Genetics) — △ Production of foods optimized to climates	↑ Health ↑ Nutrition ↑ Environments	↑ Health	↑ Health	↑ Health	—	—	Health needs assessments	↑ Lifetimes	
○	Medicine appraising simulation (Bio simulation) — △ Shifting to custom medicines and diagnosis	↓ Cost / Time	↑ Health	↑ Health	↑ Health considering individual differences (Subsets)	—	—	—	—	
○/△	Non invading operations (Biomedical engineering) — △ Extension of lifetimes	↓ Cost / Time	↓ Cost / Time	↓ Cost / Time	(Subsets)	—	—	Manufacturing technology	—	
○	Artificial heart organism (Artificial organism) — △ Treatments for heart failures by using reproduced organisms	—	—	—	↓ Early deaths caused by congenital diseases	—	—	Manufacturing technology	—	
△	Personal authentications (IC chips) (Smart materials) — ○/△ Instant secure IID	—	—	—	—	Online purchasing / privacy problems	—	Manufacturing technology	—	
○/△	Rapid productions at global bases (Rapid manufacturing) — ○ Expansion of NGOs' activities	—	—	—	—	—	↑ Consumptions	—	Manufacturing technology	
○	Micro location confirming tags (Smart system chips) — ○/△ Continuous monitoring of materials distributions	—	—	—	—	—	—	↑ Privacy failures	—	
△	Nano scopes for observing inside organisms (Nano devices) — ○ Indicate use of health information	—	—	—	—	—	—	—	↑ Preventive medical treatments	
△	Catalytic air nano cleaners (Molecular manufacturing) — △ Drastic reduction of loads on the environment caused by fossil fuels	—	—	—	—	—	—	—	—	

*Descriptions in cells are partially omitted.
*Source: The Global Technology Revolution: Bio/Nano/Materials Trends and Their Synergies with Information Technology by 2015, Rand Corp

We pick up 3 areas each from the fields of "Biotechnology", "Materials technology" and "Nano technology" and forecast examples of technological innovation in the respective areas, which are expected to be materialized by 2015

- Having global influences
- Having specific influence coverage limited to geographical conditions, industrial sizes, economical conditions, etc
- Synergy effects are small.
- Omitted due to diagonal symmetric

This report consistently advocates the importance of interdisciplinary R&D and analyzes that "technological innovation will be driven by synergy effects produced by interactions among biotechnology, materials technology and nanotechnology in the future." And it is essential to properly combine IT, which is a fundamental technology.

Some examples of these synergy effects are shown in Table 1.

The report only indicates the synergy influences (for covering globally, a specific region, etc.) produced by interactions of the respective technological innovations listed on the axes of ordinates and abscissas, but does not mention about the details of these synergy effects. For instance, in this table, we can see that an interaction of "the genetically modified foods technology" in "the biotechnology field" on the ordinates axis and "the artificial heart organizing technology" in "the materials technology field" on the abscissas axis will bring a synergy effect that "will contribute to the promotion of health globally." However, it is not mentioned how this synergy effect will be produced and how it will contribute to the promotion of health, etc.

(3) Activities of DARPA (Defense Advanced Research Projects Agency)

DARPA is under DOD (Department of Defense) and is in charge of research and development of

advanced technologies in the national defense field. DARPA started the "Bio:Info:Micro Program" in October 2000.

Mr. Fernandez, who was the director of DARPA under the former Clinton Administration, advocates the importance of interdisciplinary R&D. He forecasts, "DARPA will mainly execute R&D activities that combine biotechnology, IT and micro system technology in the future."

"The Bio:Info:Micro Program promotes the establishment of the following new areas and will influence R&D activities in areas other than national defense" said Mr. Eisenstat, a person in charge of the program.

(New areas to be establish)

- Artificial system engineering covering from nano units to global-sized units
- Computer simulations of the genesis of creatures (Algorithms and development /practical use of models)
- Synthesizing production engineering of materials and chemicals modeling organic functions
- Computer neuroscience considering interactions of humans and systems
- Platforms modeling biological processes
- Modeling and simulation of complicated activities of creatures
- Platform of minute units required for cell analysis

Table 2: Descriptions related to R&D activities in the NEP

Purposes		Proposals related to R&D activities
An increase of energy productions	Lifting of the embargo on drilling oil and natural gas in ANWR	<ul style="list-style-type: none"> — To promote the R&D for the most advanced drilling technology, minimizing loads on the environment — To invest \$1.2 billion gained through the bid of leases in ANWR toward R&D of substitute/reproducible energies (wind energy, solar, biomass and geothermal)
	Promotion of low pollution coal power generation	<ul style="list-style-type: none"> — To invest \$2 billion for research on clean coal technology over 10 years
	Promotion of atomic power generation	<ul style="list-style-type: none"> — To review the investment on international cooperative R&D related to the reuse of spent nuclear fuel
Reproducible energy	Development substitutes for vehicle fuels	<ul style="list-style-type: none"> — To integrate the R&D activities of hydrogen batteries, fuel cells, and dispersed-type batteries — To increase investments for developing next generation energy sources (hydrogen, etc.)
Improvement of energy efficiency	Improvement of transportation efficiency	<ul style="list-style-type: none"> — To promote R&D related to transportation reliability and superconductive power transmissions

Source: <http://www.whitehouse.gov/energy>

In this section, we review in general the entire science and technology policy in the US. In the next section, we review the R&D policies in the fields of energy and IT in particular.

5.3 The R&D policy in the energy field

The energy policy is one of the policies in which lines have been drastically switched from the former Clinton Administration to the Bush Administration.

More than 1 month has elapsed from the announcement of the National Energy Policy (NEP) by the Bush Administration, and it is being reported by the media and analyzed by think tanks. Discussion points concentrate on foresights of energy projects, protection of the environment, regulation issues, etc., with few reports discussing the influences of the energy field on R&D activities.

Thus, we analyze the influences of the NEP on the R&D activities in the energy field in this section.

5.3.1 Shift of energy policy

NEPDG (the National Energy Policy Development Group) represented by Vice President Cheney at the command of President Bush, has provided the NEP and President Bush announced it in his speech at St. Paul (Minnesota state) on May 17. The NEP switches the ordinary energy policy. In the NEP, a policy to expand energy supply is launched, and promotion of atomic power generation and lifting of the embargo on drilling oil and natural gas in the Arctic National Wildlife Refuge (ANWR) are advocated. It has created a stir in various segments of society.

5.3.2 The NEP's influence on the DOE's R&D program

The NEP instructed Mr. Abraham, secretary of energy, to "investigate the investment conditions

Table 3: Budgets for R&D programs of the DOE

(Unit: \$ million)

Area/(Major programs)	Fiscal 2001 (Clinton)	Fiscal 2002 (Bush)	Increasing rate
Atomic energy	81	57	- 29
(Nuclear energy research concept)	34.8	18.1	- 48
(Nuclear energy equipment optimization)	5	4.5	- 10
Low-level liquid radioactive waste treatment facility	390	445	14
Fossil energy	392	296	- 25
(Clean coal technology)	0	150	—
(Carbon capture)	18.8	20.7	10
(Ultra- low pollution fuel)	23.4	7	- 70
Reproducible energy	328	227	- 31
(Biomass/Biofuel)	86.3	80.5	- 7
(Hydrogen)	26.9	13.9	- 48
(Geothermal)	26.9	13.9	- 48
(Wind energy)	92.7	42.9	- 54
Improvement of energy efficiency	39.6	20.5	- 48
(Industrial use)	149	88	- 41
(Use for transportation)	255	239	- 6
Nuclear security	6,641	6,777	2
(Storing)	246	305	24
(Cyber security)	28.8	58	101
(Non- proliferation action)	204	195	- 5
Total	7,700	7,400	- 4.5

Source: Budget of the United States Government, Fiscal Year 2002, Office of Management and Budget

of each R&D program currently executed by DOE, and how much the programs that have been executed or are being executed contribute to the improvement of energy efficiency, and then to report to the President."

Based on this report, DOE will again set up the R&D programs in accordance with NEP's policy, and execute it from fiscal 2003.

5.3.3 *The R&D budget of DOE in the draft Message of fiscal 2002*

In Table 3, we compare the budgets of fiscal 2001 and the draft Message of fiscal 2002 for major R&D programs.

In the draft Message of Management and Budget of fiscal 2002, the R&D budget for the DOE has been reduced by 4.5% from the previous year.

The R&D budget related to the low-level liquid radioactive waste treatment facility has been increased due to the transition from the research phase to the development phase, and, furthermore, technology development related to designing and modeling, and preparation for constructing storage facilities will be promoted actively in the future.

As a theme related to the NEP, the clean coal technology project has been established.

On the other hand, all of the project budgets for reproducible energy and improvement of energy efficiency has been reduced.

5.3.4 *Trends of deliberations in Congress*

In early June, there was a big change that would influence later deliberations in Congress. The change was the appointment of Senator Bingaman of the Democratic Party to chairman of the Energy & National Resource Committee of the Senate.

The background to this change was the secession of Senator Jeffords from the Republican Party. Before that, the number of seats held by the Democratic Party and the Republican Party in the Senate were equal. As a result of this secession, the Democratic Party has been holding the majority and the post of chairman of the standing committees has been shifted from Republicans to Democrats.

Senator Bingaman is the drafter of the energy budget bill for the Democratic Party. For the R&D

budgets of the DOE, the different points between the budget bill of the Democratic Party and the draft Message are as follows:

- Strengthening R&D investment
- Establishment of the spent nuclear research bureau (Taking charge of R&D related to the processing technologies of high-level radioactive waste and spent nuclear fuel)

Another foundation of the energy policy of the Democratic Party is the "Comprehensive and Balanced Energy Policy Act of 2001." This act puts emphasis on protection of the environment, and attaches importance to the effective use of energy rather than the increase of energy productions.

It is said that the Republican Party members advocating protection of the environment are holding key deliberations in Congress. One of reasons why Senator Jeffords left the Republican Party is that he could not agree to the lifting of the embargo on drilling oil and natural gas in the Arctic National Wildlife Refuge.

In the same way, "It is highly expected that other members of the Republican Party will indicate their objection to lifting the embargo on drilling oil and natural gas in the Arctic National Wildlife Refuge" said Senator Chafee of the Republican Party, taking the position of environment protection in Washington Post article.

5.3.5 *Reactions of the related bodies*

Since many related bodies may influence the U.S. Congress, we review opinions of the related bodies in this section.

(The energy industry)

- Mr. Parker, representative of American Gas Association

"I would like to praise the fact that the NEP authorized and guaranteed to construct new gas transmission pipelines totaling 38,000 miles by 2015. Now, energy policies and infrastructures based on changes of lifestyles are required."

- American Petroleum Institute

"The NEP's line to increase energy productions is indispensable for future economic development in the US"

- National Petrochemical & Refiners Association

"The NEP advocates the increase of energy productions and the protection of the environment. This is a well-balanced policy. I appreciate, in particular, that the NEP mentioned about the evils of the current restrictions on expansion of refinery facilities."

(The environment protecting bodies)

- Mr. Hawkins, representative of Climate Center of the Natural Resources Defense Council

"The NEP said that they would invest \$2 billion into the research of clean coal technology over 10 years. This is just favorable treatment to the coal mining industry. For reducing emissions of carbon dioxide, it is more effective to strengthen environmental restrictions, instead of investing taxes. Lifting of the embargo on drilling oil and natural gas in Alaska, which is advocated in the NEP, is scarcely effective in solving the energy issue the US is currently facing, but will bring benefits to the existing pipeline operators in Alaska."

- Mr. Crap, representative of the National Environmental Trust

"The NEP did not indicate any short-term solution to the energy issue. Constructing new nuclear plants and lifting of the embargo on drilling oil and natural gas in the Alaska Natural Protection Area will not contribute to the increase of energy productions for at least 5 years."

(Research institutes)

- Mr. Lake, chairman of the American Nuclear Society

"I would like to praise the Bush Administration in recognizing the importance of nuclear energy and for promoting the construction of new plants. I hope that Congress will also promote the Bush Administration's energy policy."

- Mr. Corbin, head of the Nuclear Energy Institute

"It will be a bright future for nuclear research activity since the NEP mentioned nuclear energy as an indispensable future energy source for the US. Increases of investments and excellent students in this field are highly expected."

- Dr. Robert Aymar, head of the International Thermal Fusion Experimental Nuclear Reactor (ITER)

(At the press conference in the International Symposium for Electro Machining (ISEM))

"The former Clinton Administration showed a weak attitude toward Congress, but I hope the Bush Administration will strongly promote its energy policy."

(Think tanks)

- Mr. Peterson, representative of SRI International

"As far as looking at the draft Message and the NEP, I observed that the Bush Administration does not attach much importance to R&D activities of the DOE. This trend will not change."

- Mr. Taylor, chief editor in charge of the Natural Resource Policy of Cato Institute

"The 105 proposals presented by the NEP indicate only the direction of the policy, but there is no possibility of materialization."

- Mr. Ebel, energy program director of the Center for Strategic and International Studies

"The NEP has little immediate effect and is insufficient in solving people's urgent concerns about the rising cost of petrol, the electricity crisis, etc."

(The state government)

- Mr. Davis, governor of the State of California

"In California, electricity demand will increase during the summer and we are concerned about the spread of the energy crisis. The NEP mainly contains middle-to-long-term policies and has no immediate effect. The Bush Administration may be using the energy crisis of our state as a pretext to advocate the increase of energy productions."

5.4 The R&D policy in the IT field

The area, in which the former Clinton Administration attached importance to but the Bush Administration has yet to indicate any clear policy on, is the IT field. In this section, we review the Bush Administration's R&D policy in the IT field.

5.4.1 *The R&D budget in the IT field for fiscal 2002*

In the President's Budget Message for fiscal 2002, the budget for the cross-departments IT program (networking/IT R&D plan) did not increase drastically from the previous year (increased by 2.1%) and the contents have no significant changes.

The persons concerned with the governmental R&D program in the IT field commented about the Bush Administration's policy as follows.

- Mr. Abdali, chief of the Computer/ Communications Research Section of NSF

"IT research and development is an important issue holding sway over the industrial future of a nation, and President Bush is well aware of this. The Republican Party also hopes that the Bush Administration will continue to promote the former Clinton Administration's R&D policy in the IT field. Even if the Bush Administration proposes a plan to drastically reduce the R&D budget in the IT field, Congress should not approve it."

- Mr. Frani, head of the National Coordination Office for Information Technology R&D

"The Bush Administration is aware of the importance of research and development in the IT field, similar to the former Clinton Administration, and hopes that the activity will be led by the industry. (The May issue of "Science and Technology Trends"(Japanese version))

From these comments, we can observe from the current situation that the Bush Administration is now fully occupied with materializing the commitments made during the Presidential election campaign and the R&D policy in the IT field is just a left over, as pointed out by Mr. Koizumi, section chief of the budget/policy program of AAAS, which was mentioned in the above 5.2.2 (3).

5.4.2 *Industry-university cooperation in the IT field*

The Clinton Administration had increased investments for fundamental research activities.

Mr. Blumenthal, senior administrator of the Computer Science & Electronics Communications

Committee of NRC (National Research Council) praises this as a way to attach importance to fundamental research activities and said, "Since private companies mainly develop products that will bring benefits in the short term, it is difficult for them to deploy fundamental research activities or make infrastructure preparations. It is important that fundamental research activities and infrastructure preparations be executed with the leadership of the government."

On the other hand, many researchers in universities conducting fundamental research attach importance to cooperation with private companies.

- Mr. Gillet, senior administrator of the MIT Technology, Policy and Industry Center

"In the IT field, the number of researchers relying on private companies for their research costs is increasing."

- Prof. Ottinger, representative of the Information Resource Policy Program of Harvard University

"I previously received funds for our research activities from the government. During the past few years, I have relied on private companies only, since the research costs supplied by the government vary with the fiscal year and it is difficult to make middle-to-long-term research plans."

Both of them have been requested to provide advice on the government's IT policy on several occasions. And Prof. Ottinger, in particular, successively held posts as a governmental committee member.

We now introduce a comment indicating doubt on these ideas by the researchers in universities.

- Mr. Coward, senior technology and policy analyst of the SRI International Science and Technology Policy Program

"Since there were many private companies related to the IT industry, of which business results had upward tendencies up to last year, they actively invested in university research costs. However, business results of many companies have deteriorated recently, due to the economic recession. There is anxiety that investments from

private companies for university research activities will generally fall in the future."

5.4.3 PITAC recommendation

The PITAC recommendation is a factor having significant influence on the R&D policy in the IT field.

PITAC is an organization composed of 23 top-level experts gathered from industries and universities, and provides advices to the President on the R&D policy in the IT field.

One recent typical recommendation of PITAC is "The IT for the 21st century" issued in 1999. This recommendation warned that governmental R&D activities in the IT field was excessively inclined toward applications, and recommended sufficient support for fundamental researches indispensable for developing the next generation technologies and security of the nation to the Clinton Administration at that time.

In this year, PITAC will announce new recommendations related to the R&D policy in the IT field for the future, and appraise the policy

of the 1999 recommendation. These PITAC's activities are worthy of notice.

5.5 Conclusion

In conclusion, directions of the Bush Administration's science and technology policy are gradually becoming obvious.

The following can be cited as points worth noticing in the future.

- What kind of person will be assigned to take the post of presidential aide for science and technology?
- Trends of deliberations in Congress with regard to the governmental R&D budget for fiscal 2002
- Results of the review of the R&D program made by the DOE in accordance with the NEP
- New recommendations of PITAC related to R&D in the IT field