Citizens' Open Model Projects for Alternative and Sustainable Scenarios

August 1, 2004
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Executive Summary

This report constitutes an activities report by the Citizens' Open Model Projects for Alternative and Sustainable Scenarios (COMPASS), a project comprising environmental NGO members and experts who make policy proposals in the fields of energy and global warming. It shares office space with the Institute for Sustainable Energy Policies (ISEP), which performed the project's overall coordination.

We hope that this report will be read by policymakers, government administrators, businesspeople, researchers, media people, citizen group members, and others in a variety of fields associated with the environment and energy, and that it will serve to help spark open debate by everyone to create a society that is sustainable both environmentally and economically.

COMPASS activities have consisted of 13 meetings (including a preparatory meeting) of all members held between October 2003 and July 2004, and smaller field-specific meetings for experts, resulting in this report. On June 8, 2004 COMPASS issued its first press release, and its work has since been in the spotlight.

Chapter 1 explains the problems inherent in Japan's current energy policy, our stance and perception of the problem, this project, and the characteristics of its approach. In other words, it presents an alternative sustainable scenario based on our perception, in which we call attention to the problems in, and propose alternatives to, the energy supply and demand outlook (the Long-Term Energy Supply and Demand Outlook) formulated by the government's (Ministry of Economy, Trade and Industry's Agency for Natural Resources and Energy) Advisory Committee for Natural Resources and Energy (ACNRE).

Chapter 2 uses quantitative simulations to demonstrate that the government's energy policy is lacking in environmental sustainability owing to environmental risks from climate change (2010 CO2 emissions from energy consumption will be 9% over 1990 emissions) and nuclear waste, and that if policy continues unchanged, the results will be a budget deficit (cumulative debt relative to GNP will rise from 1.0 in 2000 to 4.5 in 2030), higher unemployment (4.7% in 2000 to 12.3% in 2030), and poor economic and social sustainability. We called this Scenario A, or the "Boiled Frog Scenario." Chapter 2 also points out that under ACNRE's supply and demand outlook, the macroeconomic indicators underpinning its scenarios are not completely released to the public.

Chapter 3 continues in this direction by proposing two alternative scenarios for avoiding collapse. These are called Scenario B, the "Revival Scenario," and Scenario C, the "Switchover Scenario."

The Revival Scenario assumes the current socioeconomic system and calls for a policy of promoting environmental industries and other measures with targets set at 2010 and 2030, which will make an international contribution to solving problems, achieve employment and economic recovery, reduce CO2 emissions, and ultimately try to phase out nuclear power. Although insufficient, it will bring more environmental and economic improvements than the Boiled Frog Scenario. Specifically, 2010 CO2 emissions from energy consumption will be about the same as 1990 emissions, thereby attaining the Kyoto Protocol target, while unemployment in 2030 will be 8.3% (as opposed to Boiled Frog 12.3%), and cumulative government debt will be 3.4 times GDP (Boiled Frog 4.5 times).

By contrast, the Switchover Scenario takes a more innovative tack by assuming the transformation of how we see the economy, whose main performance yardstick is the GDP, and of the way we work and live, which is currently based on consumption. Under this scenario postmaterialism will progress, and greater environmental improvement will be encouraged. CO_2 emissions in 2030 from energy consumption will be 42% under 1990 (Switchover: 9% under). And while the 2030 GDP will be about that of 1985, the quality of life will improve because of new standards of value.

Chapter 4 compares the main indicators for energy, the environment, and economics in the three scenarios: CO_2 emissions from energy consumption, primary energy supply and its energy mix, final energy demand and percentages by sector, economic indicators (GDP), and others. We also provide the exchange rates, crude oil prices, population, and other data used in our simulations.

Chapter 5 presents a comparison of our main indicators with those of ACNRE.

Based on the findings of this report, Chapter 6 reviews the two alternative scenarios and summarizes the points proposed by COMPASS.

The "ACNRE-COMPASS Comparison Table" at the end arranges the energy and economic indicators of both organizations' cases and scenarios into table form.

As noted at the beginning, we hope that this report will help everyone have open and constructive debate leading to a society that is sustainable both environmentally and economically. We welcome opinions and observations from everyone.

August 1, 2004
Members of the Citizens' Open Model Projects for Alternative and Sustainable Scenarios

Contents

Chapter 1 What Is the Citizens' Open Model Projects for Alternative and Sustainable Scenarios (COMPASS)?

1) The COMPASS Perception of the Problem and Its Approach

About every three years the government's (Ministry of Economy, Trade and Industry's Agency for Natural Resources and Energy) Advisory Committee for Natural Resources and Energy (ACNRE) revises its "Long-Term Energy Supply and Demand Outlook." Despite its being a mere set of targets drawn up by administrative councils, the Outlook virtually defines the government's energy policy in quantitative terms. Unfortunately, however, in content and process the Outlook is nothing but a product of compromise created by bureaucrats reconciling the Outlook with industry interests, thereby making it necessary to point out the problems and propose an alternative.

With this awareness, environmental NGO members and experts who have made policy proposals in the energy and global warming areas came together for this COMPASS project. This is a group whose purpose is to set forth realistic alternative scenarios to the government Outlook, and to elicit broad debate on this topic for the purpose of switching to a sustainable energy policy. COMPASS started in November 2003 (its preparatory meeting was in October 2003), and it released its scenario proposal in June 2004.

COMPASS characteristics are as follows.

(1) It embraces an open-source approach,[i] which means that experts in a variety of disciplines with interest in this matter work together without compensation and contribute their own ideas to create a single product. Linux is an example.

(2) We used the scenario approach, based on the idea expressed by Jorgen Norgard that "The future is not what you estimate, but is what you create." We presented three scenarios which limn future options as we see them.

(3) We combined quantitative analysis with the scenario approach. From the top-down direction we used the Economate macro model plus input-output tables and an energy model, while from the bottom-up direction we used the Long-range Energy Alternatives Planning System (LEAP). Our target year was 2030, the same as that of ACNRE, and we provide the data upon which each of our scenarios is based(figure1) .

Figure 1 Simulation System for Transparent Policy Discussion

Model

Econometrics, Simulation, Top-Down Model

Macro economic model, energy model, and I-O table model are used. Top-bottom integration (Economate is used for top-down model, LEAP is used for bottom-up model.)

Reasons for using these models

1. To ensure transparency for policy discussion by various stakeholders
2. These models can adjust the energy supply and demand structure
3. These models can calculate absolute values（e.g., CO2 emmisions for 2010）

＊targeted years: 2010 and 2030

Note: It is unreasonable to create a scenario past 2030 because of macro model characteristics.

2) COMPASS Participants and Collaborators

Participants

ANDOU Taeko (People's Research Institute on Energy and Environment, PRIEE)

IIDA Tetsunari,* ISHIMORI Yumiko, OHBAYASHI Mika, HATA Naoyuki, FURIHATA Kei, YAMASHITA Noriaki (Institute for Sustainable Energy Policies, ISEP)

KAMIOKA Naomi (The Coalition of Local Government for Environmental Initiative)

KATSUTA Tadahiro, NISHIO Baku, FUJINO Satoshi (Citizens' Nuclear Information Center, CNIC)

SUZUKI Kazue, NAKAJIMA Masaaki (Greenpeace Japan)

TAKASE Kae (Shonan Environmental Research Forum, S.E.R.F. Inc.)

NAKAJIMA Masaru (ViaTech corp.)

HIRATA Kimiko (Kiko Network)

MUROTA Yasuhiro (Shonan Econometrics, Inc.)

YANO Yuko (Yano & Associates)

YAMAGISHI Naoyuki (World Wide Fund for Nature Japan, WWF Japan)

Collaborators

UEZONO Masatake, HAYAKAWA Mitsutoshi (Citizens' Alliance for the Atmosphere and the Earth, CASA)

TSUCHIYA Haruki (Research Institute for Systems Technology)

Frog drawings: KATO Sayoko

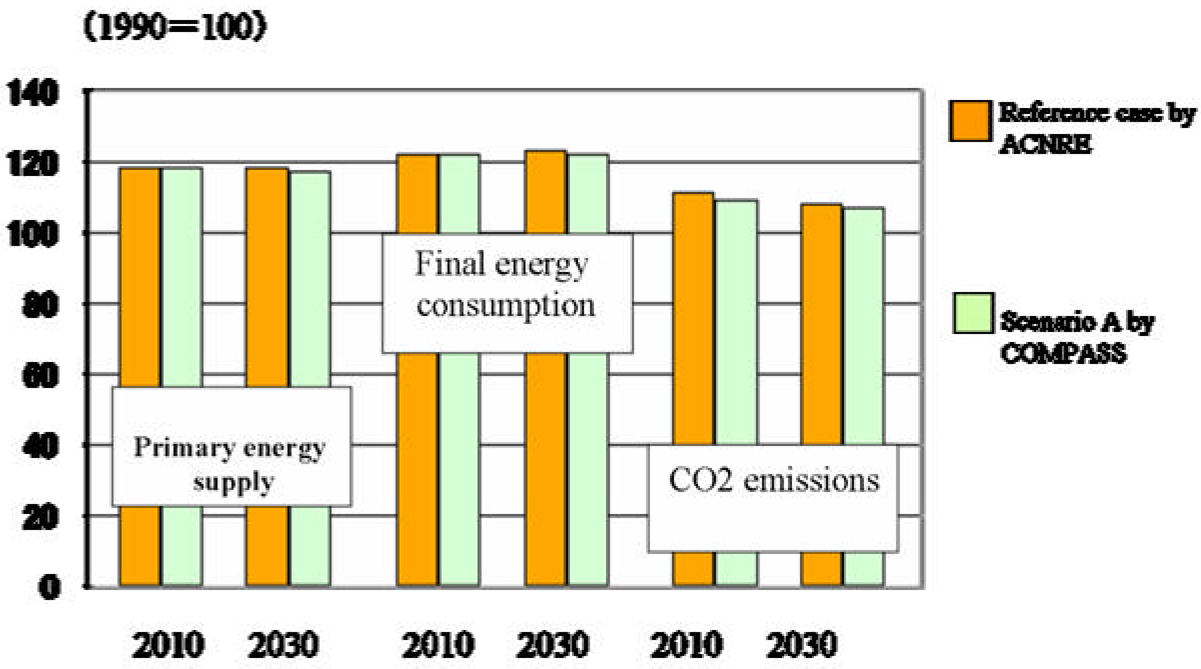
COMPASS shared office space with the Institute for Sustainable Energy Policies (ISEP), which performed the project's overall coordination.

Chapter 2 Scenario A: Boiled Frog

This scenario explores what will happen if the current structure (economic, industrial, energy supply and demand) grows linearly. This is what ACNRE calls its “Reference Case.”

Upon performing the calculations for Scenario A and comparing them with ACNRE’s Reference Case, we interestingly found that they nearly coincided (Figure 2).

Figure 2 Energy Supply and Demand Comparison Between ACNRE and COMPASS: Business as Usual



Both scenarios nearly coincided for reasons including:

- Model structures and methods are similar.
- They use the same assumptions for population (the National Institute of Population and Social Security Research’s median estimates) and other factors.

If that is so, then the macroeconomic structures they assume should also be the same.

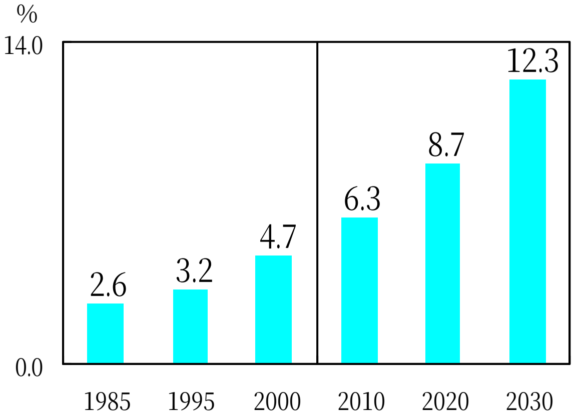
Unfortunately, ACNRE has released hardly any of its macro data (as of July 2004), making it hard to know (Figure 3), but COMPASS calculations indicated that this business-as-usual scenario (BAU) is in no way sustainable (Figure 4).

Figure 3 Extent to Which Macro Data Are Made Public by COMPASS and ANCRE

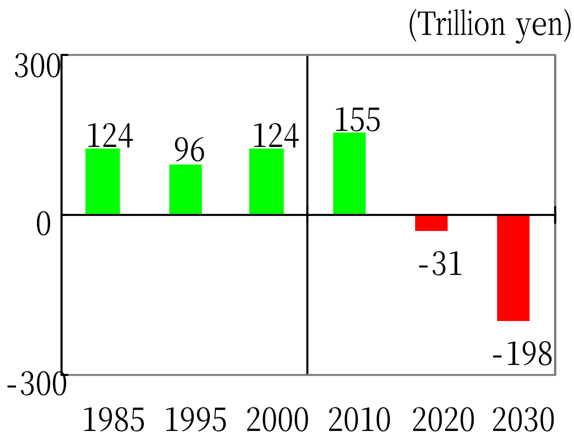
	COMPASS	Advisory Committee for Natural Resources and Energy	Note: (According to ACNRE material dated May 17th)
GDP	O: Released to public	Δ: Partly released	Only average annual growth rate is open
Unemployment rate	O: Released	× : Not released	
Government balance of payment	O: Released	× : Not released	
Current balance	O: Released	× : Not released	
Production of raw materials	O: Released	Δ: Partly released	Only 2010's value is open
Input-output analysis	Included	Not included	Input-output model is not used by ACNRE

Figure 4 Macroeconomic Characteristics: Business as Usual, COMPASS model calculations

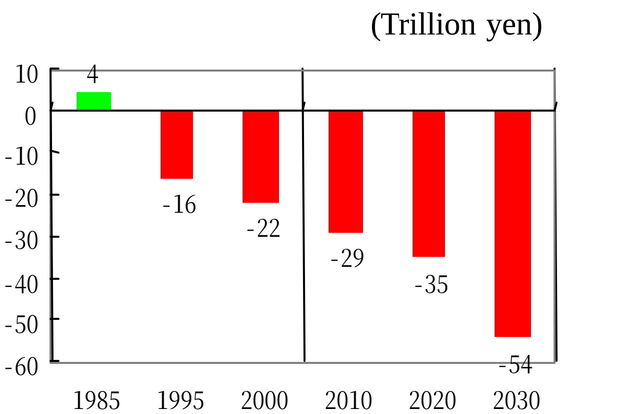
(1) **Unemployment Rate**



(2) **Current Account**

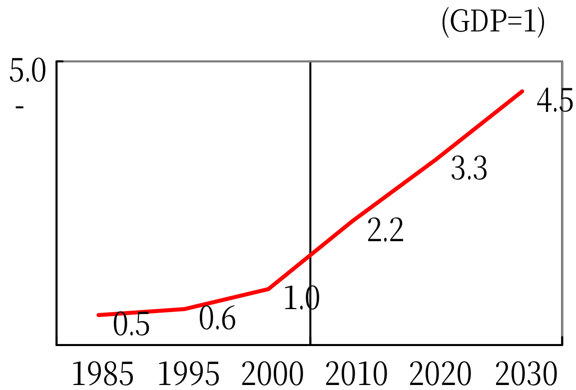


(3) **Fiscal Revenue and Expenditure**



(Based on National Income)

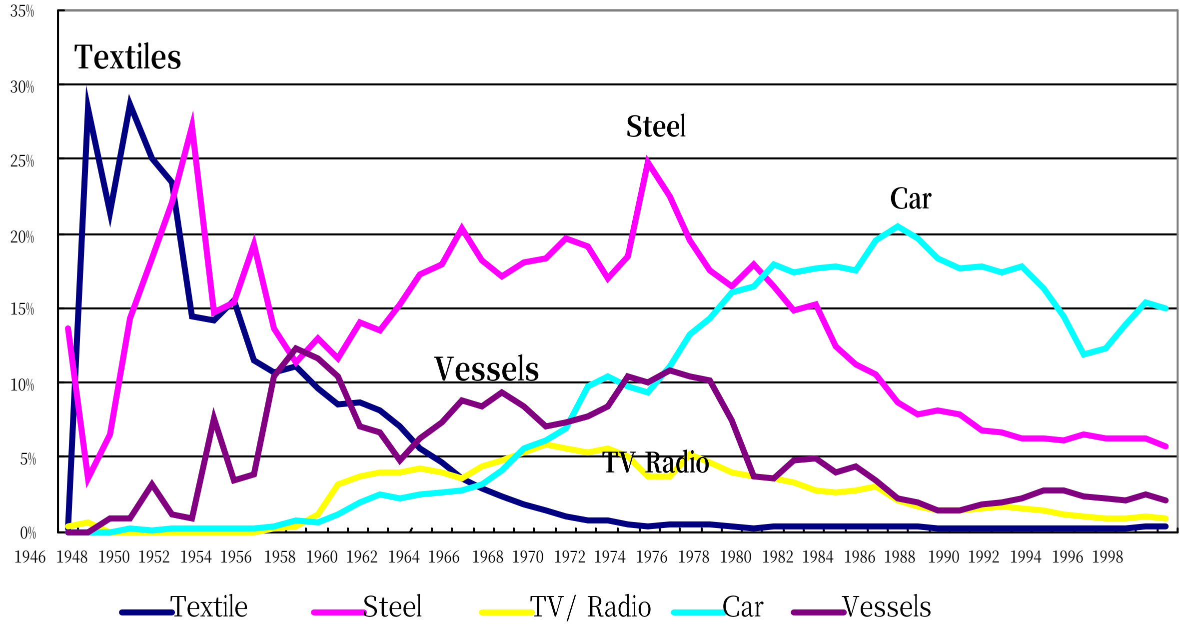
(4) **Government Cumulative Debt to GDP ratio**



(Data: Bank of Japan Fiscal and Economic Statistics Monthly)

One reason for the economic dead-end is that under the BAU scenario there are no leading industries to sustain the future. As Figure 5 shows, until the 1990s Japan's economy maintained its advance because industries kept changing off in the leading position. This pattern no longer continues, although BAU assumes that it will.

Figure 5 Japan's Economic Development and Leading Industries



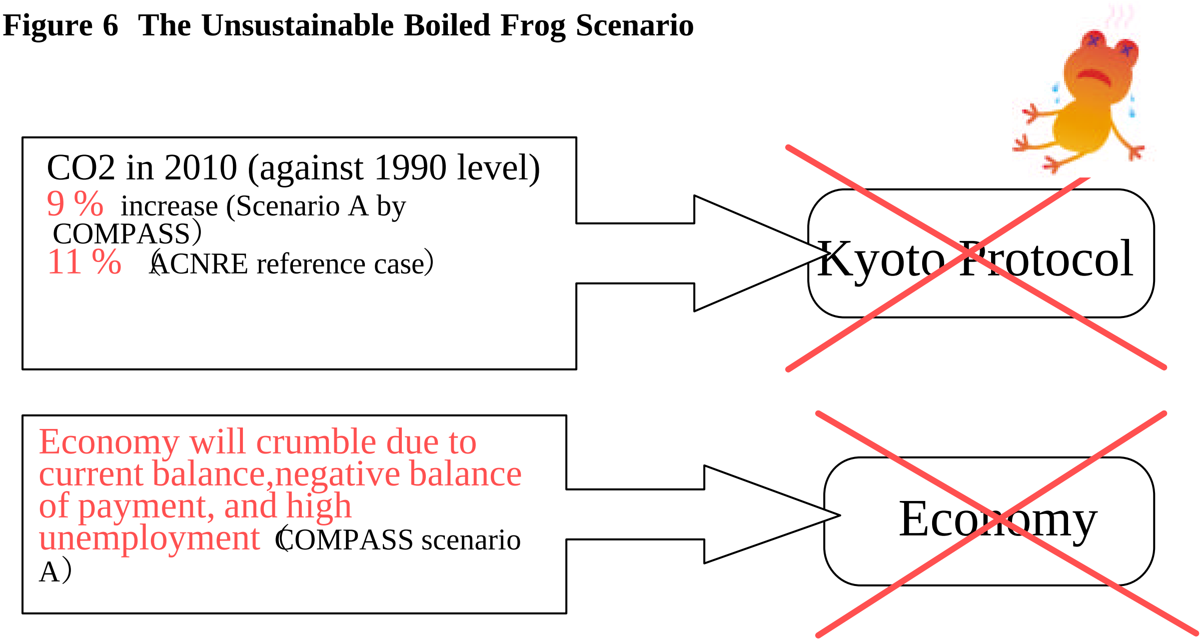
(Ministry of Finance, Trade Statistics)

For this reason the unemployment rate will gradually climb, reaching 12.3% in 2030 (Figure 4). This rate is comparable to the 2000 rates in Italy and Spain of 10.5% and 14.1%. In any case, the government needs to explain what action it would take.

The current account balance would fall into the red, and the deficit would increase, making the government debt 4.5 times the GDP.[ii] This would result in "twin deficits." In particular, it is unrealistic to think that the government debt would increase to that extent, and if the current account balance were in the read, the yen rate would be quite low.

For these reasons we have called the BAU scenario the "Boiled Frog Scenario." It is often said that if you put a frog in water and gradually raise the temperature, the frog will just sit there as it gets boiled. Similarly, it is our judgment that if nothing is done about financial collapse, high unemployment, industrial hollowing, and other problems, at some point the economy will become unsustainable (Figure 6).

Figure 6 The Unsustainable Boiled Frog Scenario



For the purpose of examining this matter as well, we would like ACNRE to release its macro and industrial structure data.

Chapter 3 Two Scenarios for Avoiding Collapse

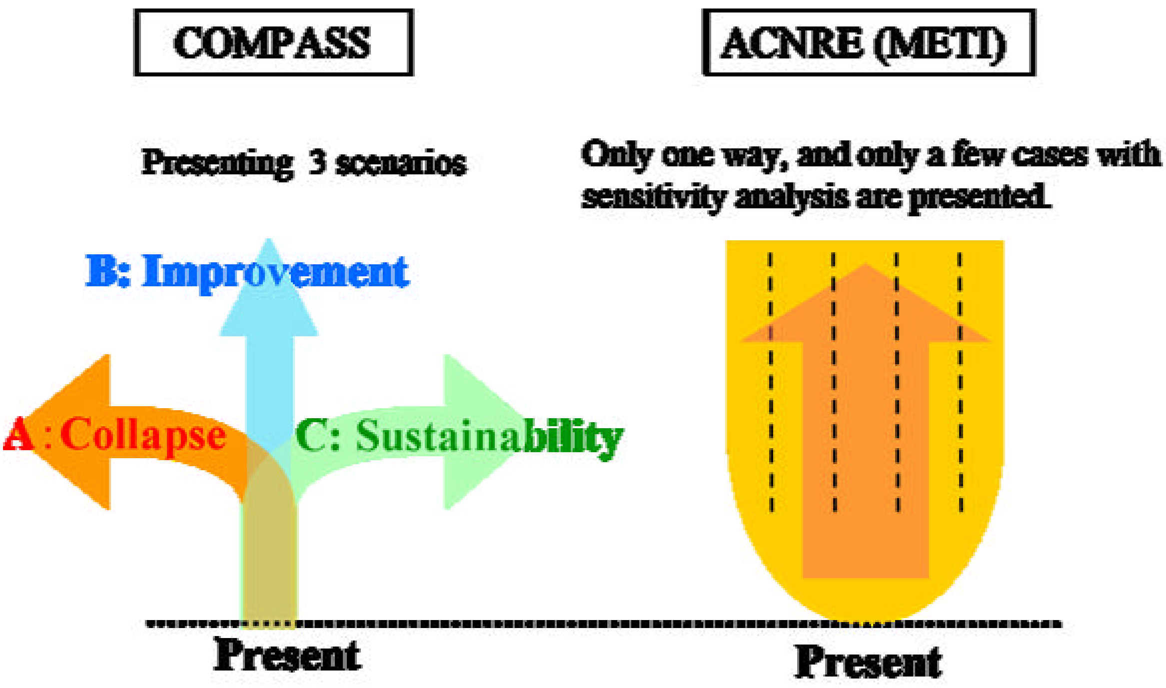
3.1 Difference Between Scenarios and Cases

Taking a cue from the Boiled Frog Scenario, we thought about what scenarios would avoid its collapse.

ACNRE uses several cases to explore the future, but these are not scenarios in our way of thinking because ACNRE assumes the same economic structure will stay in place in all cases. Changes in energy supply and demand induced by energy conservation measures and other elements are subjected to sensitivity analyses.

But as seen above, when trying to anticipate Japan's energy and environmental problems 30 years from now, one must think about and solve macroeconomic and industrial structure problems, and at the same time consider future energy supply and demand, with inclusion of a vision for the future. This simple use of cases (sensitivity analyses) without a vision or exploration of scenarios is not very useful in providing an outlook over the long period of three decades. Figure 7 illustrates the basic difference in thinking.

Figure 7 Differences Between COMPASS Scenarios and ACNRE Cases



3.2 What to Consider When Exploring Scenarios

We decided to consider the following factors through our scenarios.

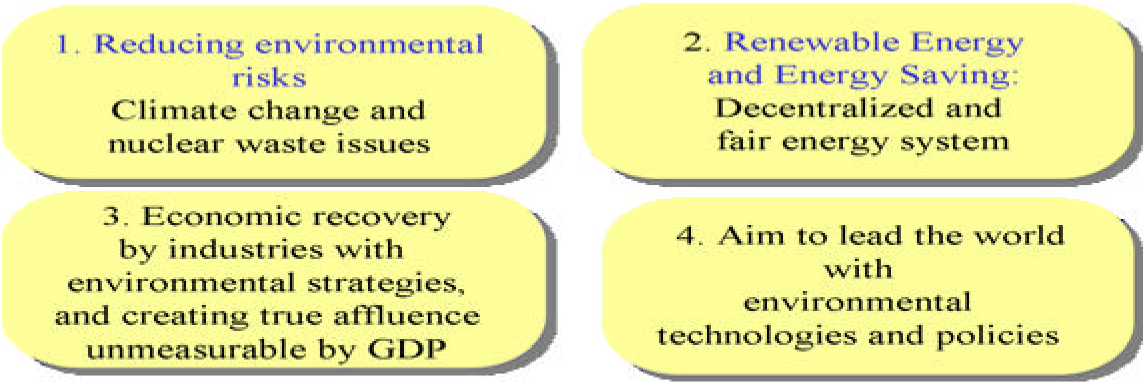
(1) What a future sustainable economy would be like.
(2) CO2 emission cuts that can mitigate global warming (climate change).[iii]
(3) Phasing out nuclear power.
(4) Exploring Japan's sustainability by making an environmental contribution to the world.

First, if the BAU scenario is not sustainable, in what way should Japan's economy be prognosticated over the long term?

Second and third, because we are involved in environment and energy issues, we believe that arresting global warming and phasing out nuclear power are necessary conditions for creating a sustainable society. [iv]

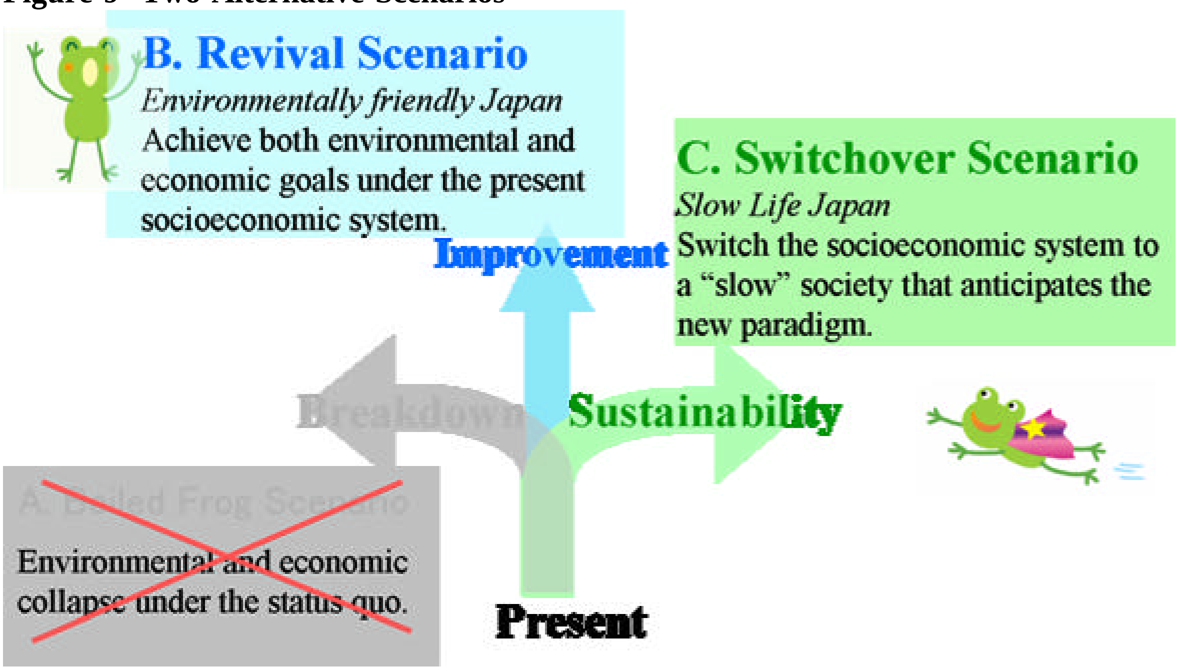
Fourth, basically Japan's economy can survive only through trade with other countries, and for this reason too we looked for a way to achieve this through an environmental contribution to the world. Figure 8 illustrates and sums these up as directions to take toward a sustainable energy society.

Figure 8 A Sustainable Energy Society: Four Directions



Here we present two alternative scenarios (Figure 9). One is the "Revival Scenario," which contrasts with the Boiled Frog Scenario. It assumes the same socioeconomic system and tries to reconcile the economy and the environment within that framework. The other scenario anticipates socioeconomic changes in the 21st century, during which the achievements of the IT revolution will become apparent, and postmaterialism will make headway in the developed countries. Further, we are already seeing the limitations of an economy measured with the GDP. The "Switchover Scenario" incorporate such changes.

Figure 9 Two Alternative Scenarios



3.3 Scenario B: Revival

This scenario overcomes industrial hollowing by making the environmental industry into the next-generation strategic industry, and attempts to achieve both economic vitalization and environmental conservation within the present socioeconomic framework.

3.3.1 Rationale behind the Revival Scenario[v]

This scenario's rationale is the Porter hypothesis and the learning curve.

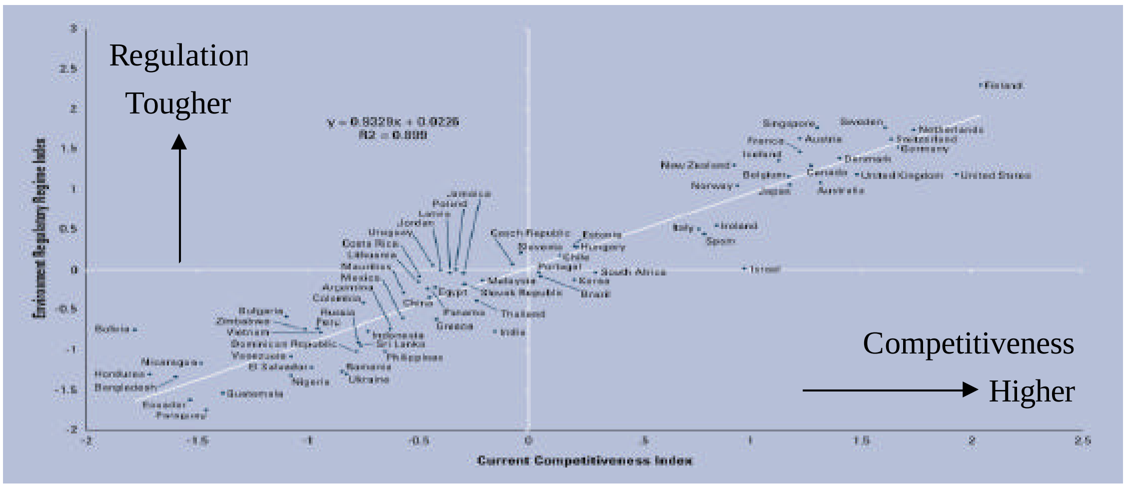
1) Porter Hypothesis

This hypothesis on international competitiveness is advocated by Harvard University's Michael Porter, and is characterized as follows.

- Ordinarily, it is thought that there is a tradeoff between environmental protection and economic competitiveness. Hence it is argued that balance is needed between the social benefit of environmental protection and the business benefit of economic competitiveness.
- This argument rests on a very static framework in which technology, products, manufacturing methods, and customer needs remain unchanged. If businesses manage to minimize their costs under these conditions, environmental regulations will raise costs, and the exports of the countries where those businesses are located will lose to those of other countries.
- However, the definition of competitiveness has diverged from this static framework over the past few decades. The present framework is more dynamic and based on technical innovation. Specifically, the results of many experimental studies have shown that international competitiveness is not found in large-scale production and cheap inputs, but rather depends on whether a business can continuously be technologically innovative. In other words, the source of competitiveness is the capacity to see limitations as opportunities and create new products.
- As long as regulatory standards are appropriately set, environmental protection can actually be a source of technological innovation.

Porter used actual data to verify this (Figure 10), revealing a relationship in which the tougher a country's environmental regulations, the more internationally competitive it is. The coefficient of determination of their relationship is 0.89, which is very high.

Figure 10 Tougher Environmental Regulations Increase International Competitiveness (demonstration of the Porter hypothesis)



Source: Esty and Porter, "Ranking National Environmental Regulation and Performance: A Leading Indicator of Future Competitiveness?," in World Economic Forum, *The Global Competitiveness Report 2001-2002*, Oxford Univ. Press, 2002.

2) Learning Curve

The learning curve is a law arising from the mass production of semiconductors, automobiles, and other products, and describes a phenomenon in which production cost falls by a certain rate when cumulative production doubles.[vi]

$$C_n = AX_n^{-r}$$

Where:
C_n is the nth production cost,
A is a constant,
X_n is cumulative production up to the nth, and
r is a constant indicating the decline.

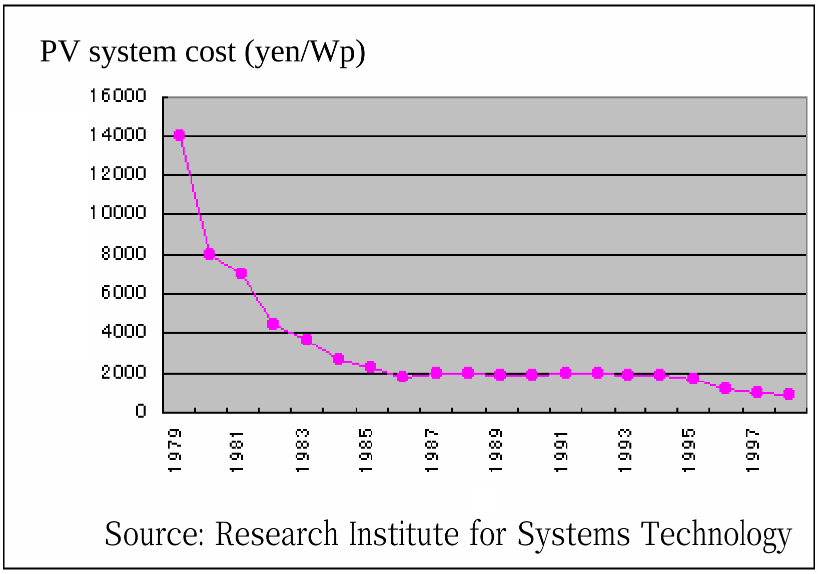
$$\frac{C_n}{C_1} = \left(\frac{X_n}{X_1}\right)^{-r}$$

Therefore, if the constants and cumulative production are known, the equation above provides the rate at which cost declines. Generally, progress indicator F is often used to show the extent.

$$F = \left(\frac{X_n}{X_1}\right)^{-r} = 2^{-r}$$

This is the cost decrease rate when cumulative production doubles, which is generally said to be 0.7 to 0.85 in the semiconductor industry and 0.8 to 0.95 in the machine assembly industry. Examples are the Model T Ford at F=0.85, Sony's laser diode, which was 0.75 initially and 0.85 later, and Japanese photovoltaic cells, which were 0.82 over the 20 years from 1979.

Figure 11 Falling Cost of Photovoltaic Cells

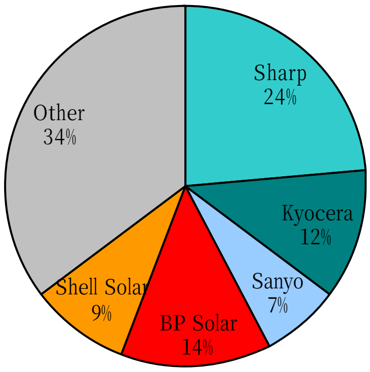


3.3.2 Revival Scenario Concept and Assumptions

1) Thinking Behind the Revival Scenario

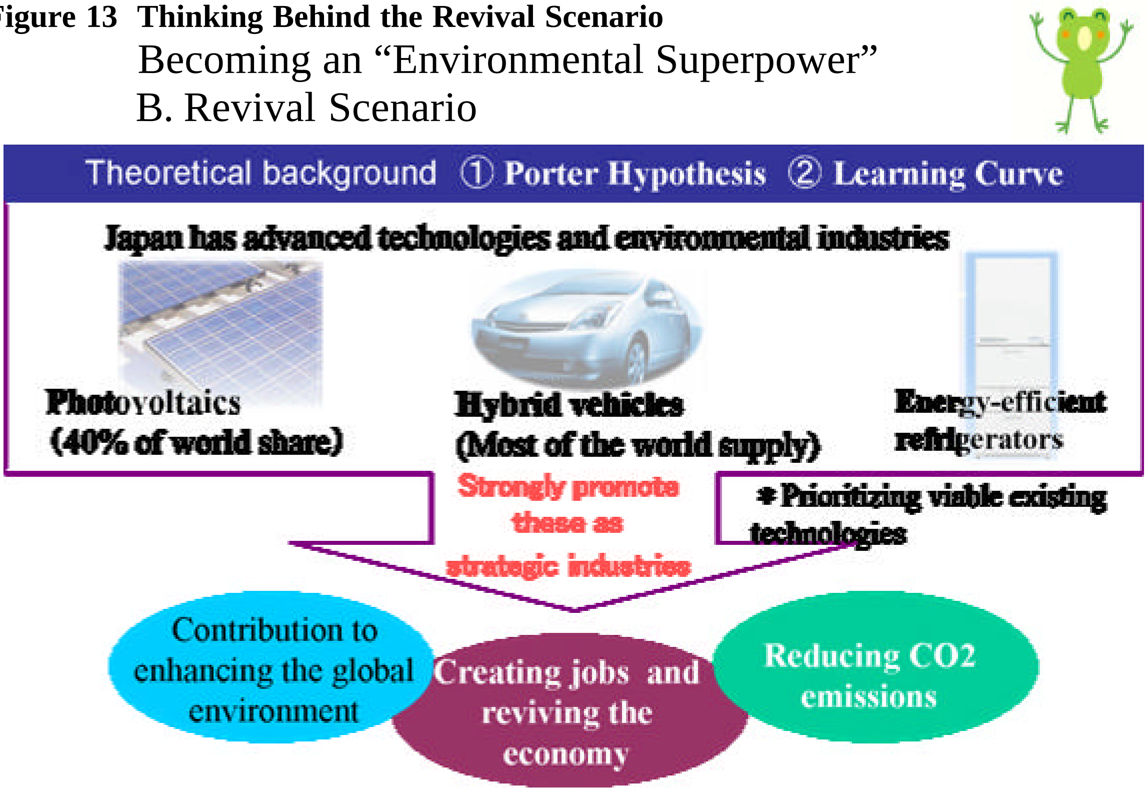
Internationally competitive Japanese environmental industries are hybrid cars (most of world production) and photovoltaic cells (Figure 12).

Figure 12 Manufacturers' PV Market Shares (2002)
Source: *Nihon Keizai Shimbun*, March 12, 2004



If industries like these are provided with a certain amount of initial demand, this leads to a virtuous circle with a progression going from increased demand, to lower prices, expansion of demand, still lower prices, becoming internationally competitive, and to favorable effects on economic growth and employment. At the same time, the increased deployment of photovoltaics and hybrid cars can help cut CO_2 emissions.

Figure 13 Thinking Behind the Revival Scenario



2) Revival Scenario Assumptions

This scenario assumes the following energy-related measures in each sector.

Figure 14 Primary Measures Assumed under the Revival Scenario (2010)

Primary measures assumed by 2010	
Energy Transformation	Improve efficiency of Thermal Plant - improved by 45% on the stock basis Increased renewable energies (Figure 29, P.22) Replace Coal thermal by Natural gas -Reduce coal thermal electricity generation to 1/3, 50% increased Natural gas thermal generation compared to 2000.
Industry	Increased co-generation system -7.6 GW by Gas co-generation -9.8 GW by co-generation (petroleum co-generation included) (48 TWh of electricity)
Commercial	Improved heat insulation -Newly built buildings meet the energy-saving requirement that is 20% stricter than existing requirement. -50% of the buildings(including the renovated buildings)are high efficient -20% stock efficiency improved compared to 1998 Increased co-generation -1.1 GW by Gas co-generation -1.7 GW by co-generation (petroleum co-generation included) (8.3 TWh of electricity)
Household	High efficient refrigerator -consumers choose the most efficient refrigerator, thus replace the existing in-efficient ones -The top runner in 2003 is 351-450 liter size, 180kWh／year. -Stock of refrigerator counts to 50 million. 5 million refrigerators are shipped every year, of which 4.1 million are high efficient. (80% of flow base）。 --40% of the stock , high efficient refrigerators Improved air conditioner -consumers choose the most efficient air conditioner, thus replace the existing in-efficient ones - The most efficient air conditioner is that of the top runner in 2004 -Stock of air conditioners counts to 15 thousands, of which 1 thousand is replaced per year -Stock efficiency is improved by 30% compared to 2000. Better housing insulation: -Newly built housing meet the existing regional energy-saving requirement. -High efficient houses counts 21% of all the housing (renovated houses included) -Stock efficiency is improved by 20% compared to 1998 (renovated houses included) Co-generation; -Gas co-generation 3.9 GW (Electricity 5.5TWh） (petroleum co-generation not included）
Transportation	Hybrid car, High efficient car, -60% improved efficiency -12.75million cars（21% of the household cars）

Figure 15 Primary Measures Assumed under the Revival Scenario (2030)

Primary Measures Assumed by 2030	
Energy Transformation	Improve efficiency of Thermal Plant - improved by 50% on the stock basis Increased renewable energies (Figure 29, P.22) Replace Coal thermal plant by Natural gas plant -Reduce coal thermal generation to 15% of 2000, 80% increased Natural gas thermal generation compared to 2000.
Industry	Increased co-generation system -2.5 GW by Gas co-generation -2.8 GW by co-generation (petroleum co-generation included) (220 TWh of electricity)
Commercial	Improved heat insulation -Newly built buildings meet the energy-saving requirement that is 20% stricter than existing requirement. -5/6 of the buildings(including the renovated buildings)are highly efficient -40% stock efficiency improved compared to 1998 Increased co-generation -1.1 GW by Gas co-generation -2.8 GW by co-generation (petroleum co-generation included) (22 TWh of electricity)
Household	High efficient refrigerator -consumers choose the most efficient refrigerator, thus replace the existing in-efficient ones -The top runner in 2003 is 351-450 liter size, 180kWh／year. -100% of the refrigerator (stock) is high efficient Improved air conditioner -consumers choose the most efficient air conditioner, thus replace the existing in-efficient ones - The most efficient air conditioner achieved 30% efficiency improvement (COP) compared to 2004. -Stock of air conditioners counts to 15 thousands, of which 1 thousand is replaced per year -Stock efficiency is improved by 55% compared to 2000. Better housing insulation: -Newly built housing meet the existing regional energy-saving requirement. -High efficient houses amount to 2/3 of all the housing (renovated houses included) -Stock efficiency is improved by 50% compared to 1998 (renovated houses included) Co-generation; -Gas co-generation 15 GW (Electricity 61TWh) (petroleum co-generation not included)
Transportation	Hybrid car, High efficient car, -60% improved efficiency -65million cars （98% of the cars owned by households）

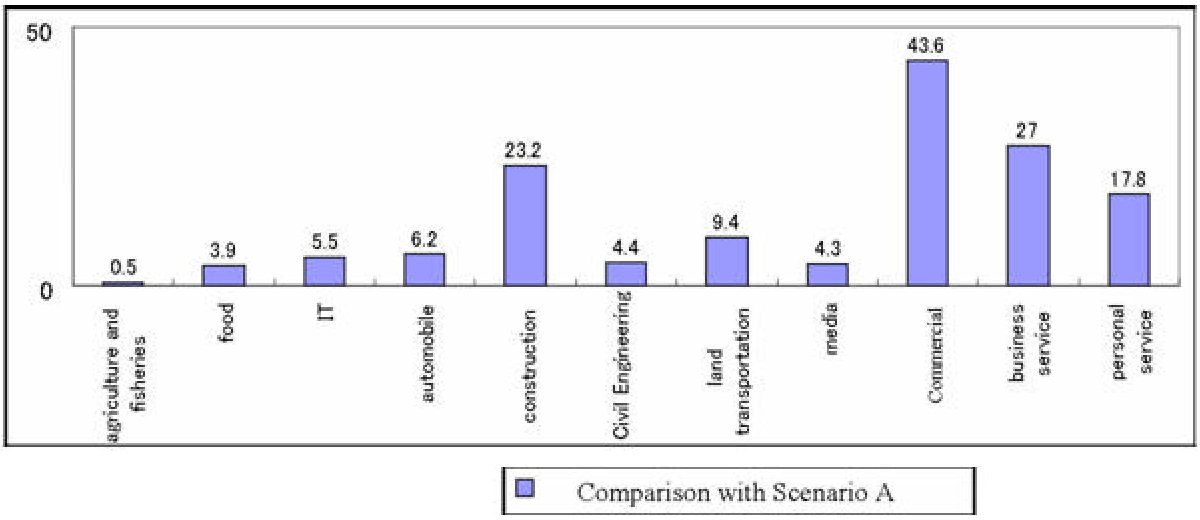
Although this is a quite ambitious plan, the figures are not impossible. It would bring economic vitalization, a modicum of GDP growth, and improvement in macroeconomic indicators (Figure 16). Employment would also increase (Figure 17). At the same time, energy-related CO2 emissions in 2010 would be held down to the 1990 level (Figure 24).

Figure 16 Economic Indicators under the Revival Scenario (comparison with Boiled Frog Scenario at 2030)

	Revival Scenario	Boiled Frog Scenario
GDP（trillion yen） （average growth rate from 2020 to 30）	770 trillion yen （0.9% per year）	725 trillion yen （0.6% per year）
Unemployment Rate （%）	8.4%	12.3%
Current Account （trillion yen）	－16 trillion yen	－198 trillion yen
Fiscal Revenue and Expenditure （trillion yen）	－23 trillion yen	－54 trillion yen
Cumulative debt GDP ratio （GDP=1）	3.4	4.5

Figure 17 Employment Growth under the Revival Scenario

In 2030 there will be 1,950,000 more people working than in Scenario A (Boiled Frog) (based on an analysis of input-output tables) owing to more employment in building construction and other fields thanks to increased investment, and higher commercial employment through a input-output table-like chain.



• Needless to say, achieving the Revival Scenario would make it important to implement appropriate policies and measures. Figure 18 presents some primary policies and measures to be considered in future discussions.

Figure 18 Main Polices and Measures Assumed by the Revival Scenario

Methods	Policy Measures: Future Discussion Topics
Efficiency Standards	New business buildings, energy efficiency, (Insulation), strict standards
	Home appliances(e.g., refrigerators), better energy efficiency for vehicles
	CO2 emission standards for coal-fired power plants
	Mandatory alternative emission plans for newly built power plants
	Restrict construction of new nuclear plants. Phase out current nuclear plants.
Market-Based Solutions	Energy-efficient refrigerators, co-generation, Incentives for fuel-efficient car owners
	Incentives for solar and biomass generation(e.g., zero interest rates)
	Purchase of renewable energy at fixed rates(support for solar and wind)
	Support for fuel switch externalities, coal taxes
	Carbon taxes(Scenario B, supplemental material)
Guided Solutions	Mandatory fuel efficiency labels for machinery and cars, labeling for buildings and housing
	Eco-friendly towns, organized transportation, policy implementation (Increased authority to municipalities)
Government	Construct renewable energy infrastructure on public land, take initiative on BSCO, make use of public utilities

3.4 Scenario C: Switchover

1) Implications

Even within COMPASS there were many different views on the Switchover Scenario. Some people emphasized postmaterialism,[vii] others thought it was more important to stabilize the climate with heavy cuts in CO_2 emissions, and still others thought that the IT revolution would achieve much. But everyone agreed that Japan 30 years from now would naturally be much different because we think it is necessary to limn the combination of high goals (for example, arresting global warming and reducing the risk of radioactive substances) and an easy-to-live society (for example, living the slow life) as a future that we choose.

Following are the thinking behind this scenario (Figure 19) and its socioeconomic concept (Figure 20).

Figure 19 Thinking Behind the Switchover Scenario

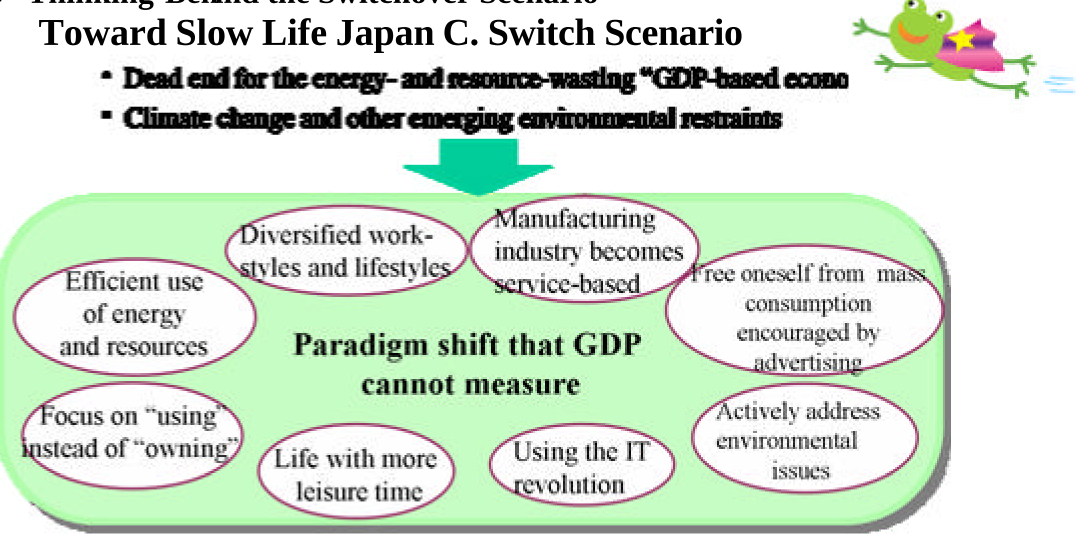


Figure 20 The Socioeconomic System Envisioned by the Switchover Scenario

An open society that focuses on individuals and local societies

Supplemental principal, Disruption of Bureaucratism, Open and widely debated decision making process, Development of individual potential ability

Flexible lifestyles and work styles with diverse values

Shift from controlled and uniformed work style to diverse styles that meet one's pride, self-fulfillment, and willingness to contribute to a society (a free agent society)

Economic system that fully internalize environmental and social costs

Appropriately evaluate external costs (polluter pays principles, Extended producer responsibility)

Energy efficient and renewable energy society

Recycling energy and resources, Shift from "Energy supply" to "Energy service"

Value shift from "Material" to "Time "

More services and less ownership. Lessen labor hours, more time with family and friends. Better settings of life and surrounding landscape.

Co-existence of diverse communities

Renaissance of rural area and district city with its own localities. Capital cities that take influential environmental initiatives.

(*Though globalization is not to be denied, orderly economic and cultural reciprocal relations should be preferred. Citizen's science, intermediate technology will be put priority, and technological progress should adopt precautionary principle.)

Figures 21 and 22 illustrate the Switchover Scenario's background.

Figure 21 Switchover Scenario Backgro und (1)

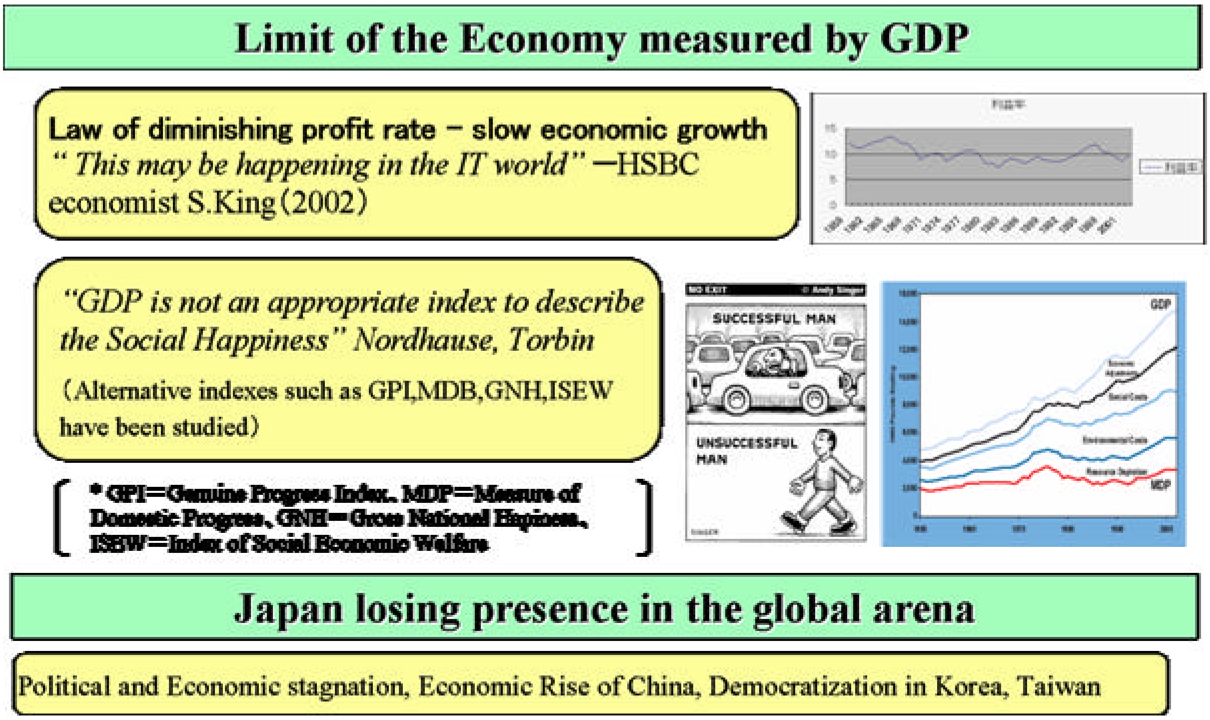
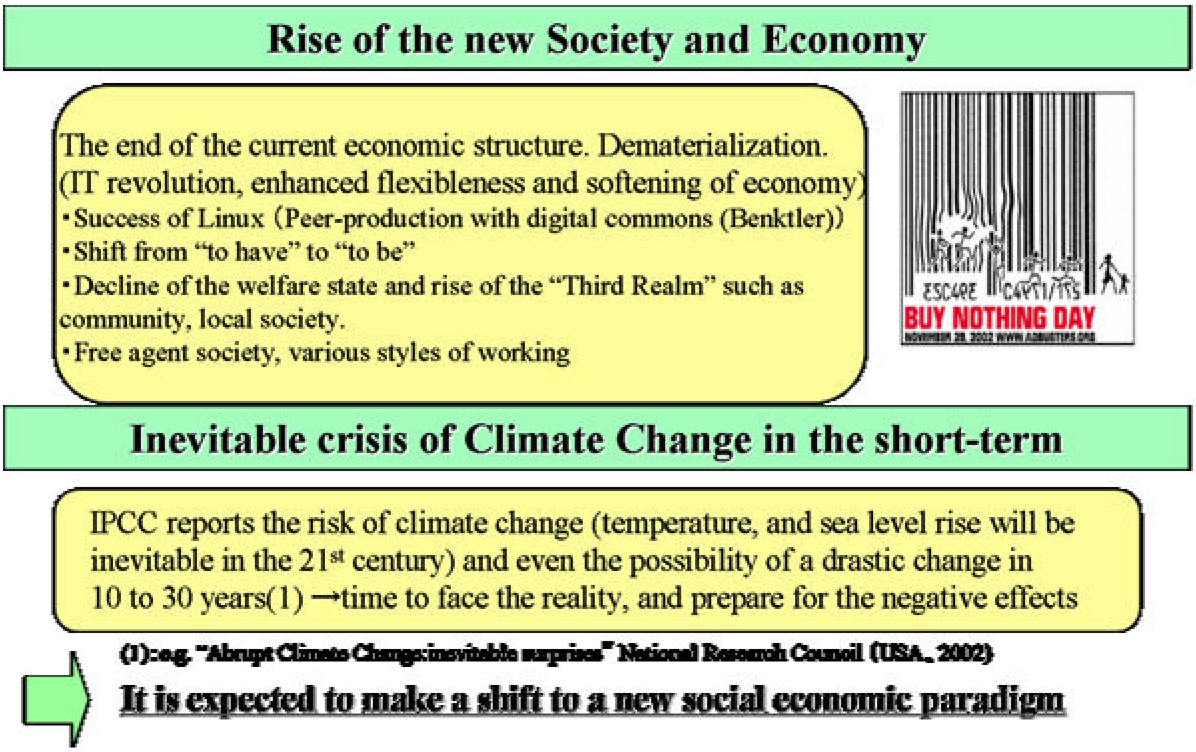


Figure 22 Switchover Scenario Background (2)



Let's consider housing lifetime as an example. Lengthening the lifetime[viii] makes no difference in the services we get from a residence, but housing investment is less. Such design might be called DfX (design for excellence).[ix]

This scenario sees GDP as falling, and returning to the 1985 level in 2030. This may surprise some people, but one must note that it was only comparatively recently that GDP became a yardstick of the overall economy. It was after 1955, at the beginning of Japan's rapid postwar economic growth period, that the government started keeping GDP statistics, which means that it was after Japan started achieving its rapid growth that the government began assessing the economy with GDP growth and size. For example, height might be the optimum indicator for gauging the development of children, but no one uses it to gauge the development of adults. The very question of what kind of indicators should be used to measure the economic soundness of the 21st-century socioeconomic system is open to debate (see the indexes proposed to replace GDP in Figure 21). And in consideration of increasing IT use, the whole idea of conceiving economic scale on the nation-state scope loses validity.

This scenario does not look at the unemployment rate because nothing changes in the way people work. This is usually called the "third realm."[x]

According to Diane Coyle, "The third sector is a varied mixture of activities with rather fuzzy boundaries, some of them outside the formal money economy. It includes charities ... They are all very people-intensive whose purpose is to provide the service rather than maximize the profit" (Diane Coyle, *The Weightless World*, MIT Press, 1998, p. 65).

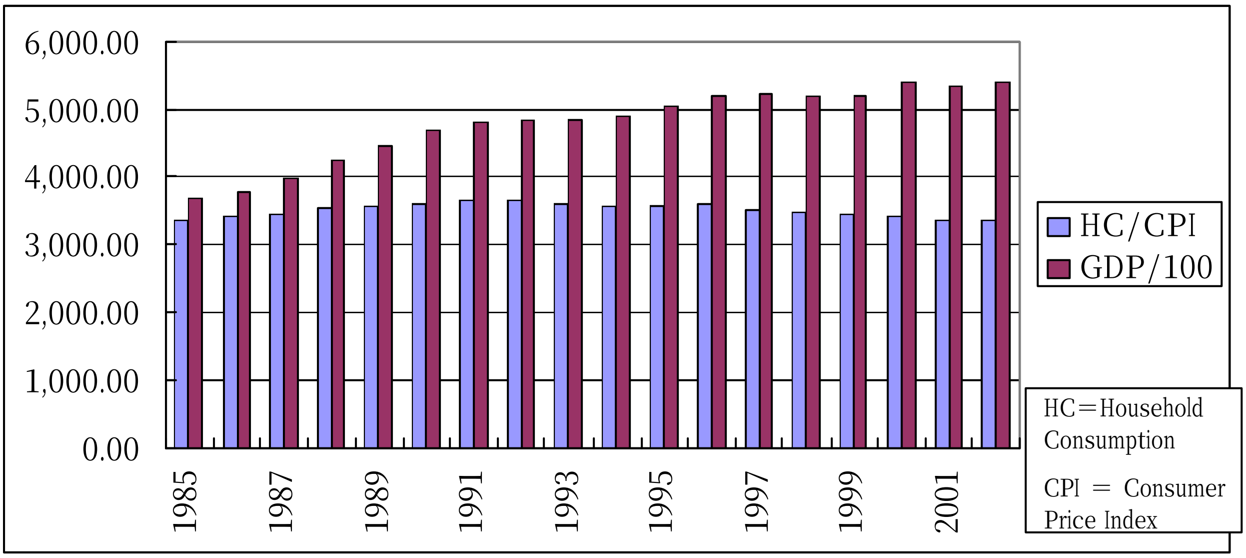
This realm is not tied down to dualistic frameworks such as state vs. market or government vs. private sector, and belongs to none of them. Lester Salamon of Johns Hopkins University explains that just as the latter half of the 19th century was the epoch of the rise of the nation-state, we are not seeing the greatest epoch of the third realm's rise. He notes that this sector already accounts for nearly 7% of employment in the United States.

Until now the labor market has been divided into two parts: the employed (workers in organizations) and others (the unemployed), and the result is an absurd situation in which many people are unemployed while much work that is useful to society is left undone (? ? ・ ? ? ? ?). The third realm is useful in solving this problem. This is because social services (housing, medical care, schools, assuring employment) have been regarded as the work of the government, but government inefficiency in this area has become a problem.

2) Have We Become More Affluent?

GDP will return to the 1985 level under the Switchover Scenario. If we compare the consumption levels of 1985 and the present, have we really become that affluent?

Figure 23 Household Economy Comparison, 1985-2002



Year	Net Household Consumption (100yen/month)		GDP (trillion yen)	
1985	3,352.65	-0.2%	368.21	4.3%
1986	3,406.54	1.6%	379.85	3.2%
1987	3,433.33	0.8%	398.93	5.0%
1988	3,534.19	2.9%	424.29	6.4%
1989	3,556.78	0.6%	444.88	4.9%
1990	3,601.66	1.3%	469.57	5.6%
1991	3,655.94	1.5%	480.86	2.4%
1992	3,651.70	-0.1%	483.02	0.5%
1993	3,597.67	-1.5%	485.30	0.5%
1994	3,562.92	-1.0%	489.59	0.9%
1995	3,574.69	0.3%	504.83	3.1%
1996	3,595.13	0.6%	521.36	3.3%
1997	3,518.01	-2.1%	522.22	0.2%
1998	3,484.51	-1.0%	518.71	-0.7%
1999	3,434.04	-1.4%	520.77	0.4%
2000	3,416.77	-0.5%	539.16	3.5%
2001	3,362.86	-1.6%	532.44	-1.2%
2002	3,344.34	-0.6%	540.61	1.5%

Figure 23 indicates the following.

Real GDP has indeed grown from 1985 to 2002.

- However, real household consumption (per household) declined from 1992. Where did the GDP increase go?
- The 2002 real consumption of ¥334,000/month is slightly under the 1985 level of ¥335,000/month. In other words, the household economy has already experienced minus growth, and our present living standard is the same as that of 1985.
- It is therefore evident that we must reassess the significance of GDP growth.

Chapter 4 Three-Scenario Comparison

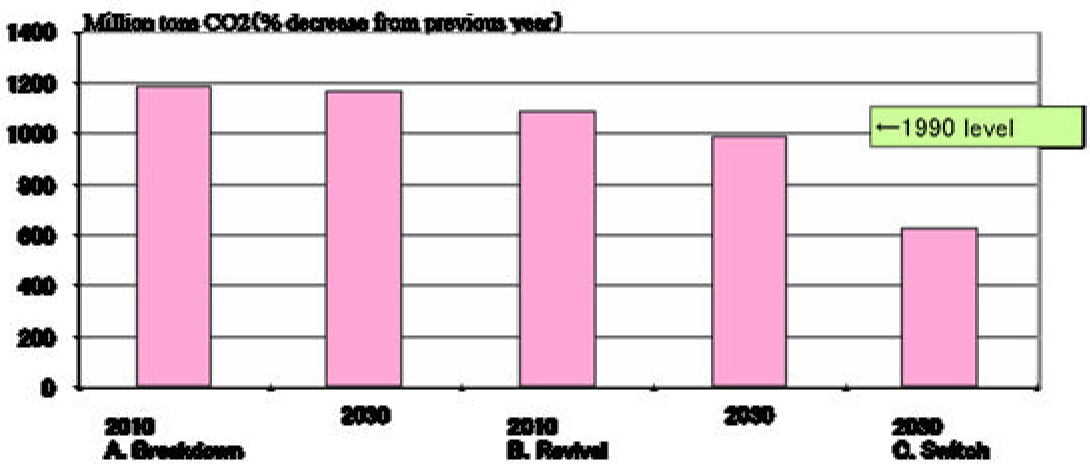
This chapter quantitatively describes the three COMPASS scenarios in terms of energy and economics.[xi]

4.1 Energy Considerations

1) CO2 Emissions from Energy Consumption

- Compared with the 1990 emission level, emissions in 2030 will be 107 under Boiled Frog, 91 under Revival, and 58 under Switchover. The Switchover Scenario will help make CO2 emissions constant.
- Under the Revival Scenario, CO2 emissions in 2010 will be at the 1990 level. Combined with cuts in CFC substitutes and other efforts, Japan would be able to achieve its Kyoto Protocol target.
- Of importance here is that these figures indicate the overall effectiveness of the combination of macroeconomic changes, industrial structure changes, and energy supply/demand changes.

Figure 24 CO2 Emissions from Energy Consumption

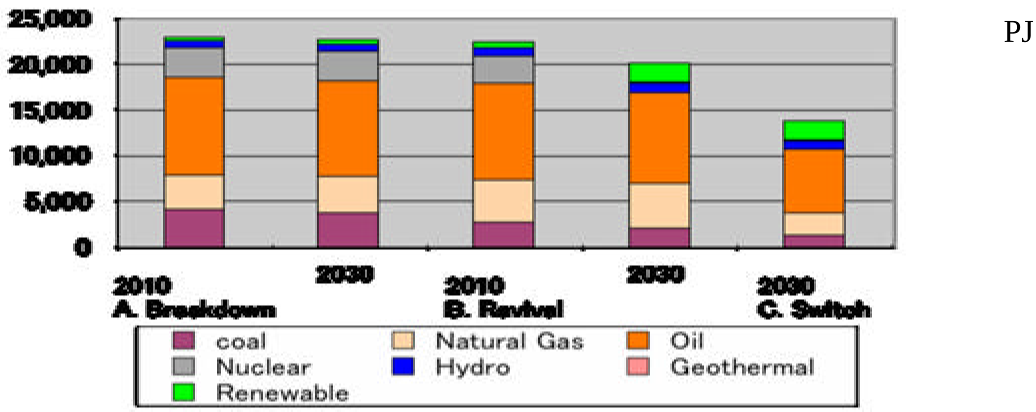


In the Revival Scenario we also performed additional calculations (a sensitivity test) on the effectiveness of CO2 reductions when a carbon tax as been levied. If a tax of ¥6,000 per ton of carbon is assessed beginning in 2005, in 2010 an additional emission reduction of approximately 40 million tons (CO2 equivalent, nearly 4%) could be achieved.

2) Primary Energy Supply

- Oil, coal, and nuclear will have smaller proportions in the Revival and Switchover scenarios than at present, while natural gas and new energy will have larger proportions.

Figure 25 Primary Energy Supply

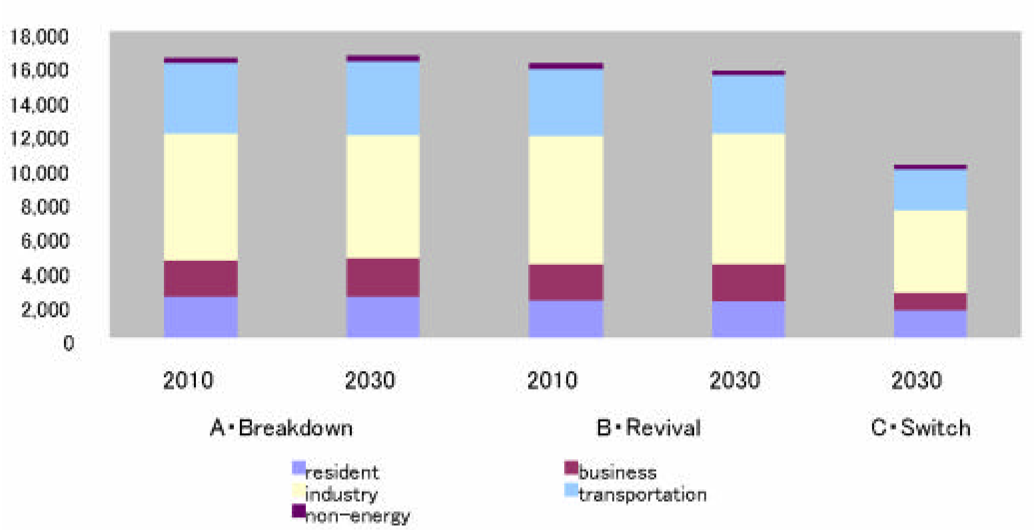


	A. Boiled Frog				B. Revival				C. Switch Over	
	2010	%	2030	%	2010	%	2030	%	2030	%
Total	23921	100	22747	100	22436	100	20183	100	13765	100
Coal	4127	18	3739	16	2694	12	2085	10	1292	9
Natural Gas	3822	17	4055	18	4736	21	4950	25	2464	18
Oil	10628	46	10396	46	10489	47	9886	49	6934	50
Nuclear	3186	14	3186	14	2987	13	0	0	0	0
Hydro	793	3	818	4	839	4	948	5	948	7
Geothermal	33	0.1	37	0.2	67	0.3	133	0.7	133	1
New Energy	432	2	517	2	624	3	2180	11	1994	14

3) Final Energy Consumption

- Comparing Revival to Boiled Frog shows that although energy conservation will be achieved under the Revival Scenario, economic vitalization will increase activity, and energy consumption will not decrease very much.

Figure 26 Final Energy Consumption

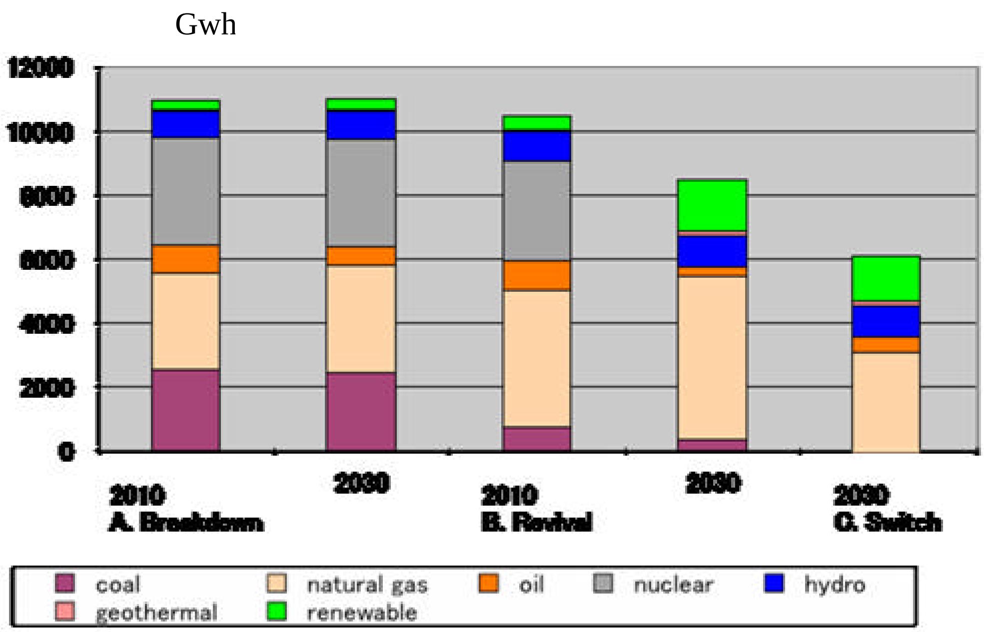


	A. Boiled Frog				B. Revival				C. Switch Over	
	2010	%	2030	%	2010	%	2030	%	2030	%
Total	16425	100	16509	100	16074	100	15658	100	10146	100
Household	2380	14	2399	15	2169	13	2093	13	1570	15
Commercial	2190	13	2230	14	2029	13	2235	14	1042	10
Insudtry	7490	46	7239	44	7561	47	7635	49	4797	47
Transportation	4147	25	4341	26	3947	25	3395	22	2437	24
Non-energy	300	2	300	2	300	2	300	2	300	3

4) Power Production Mix

- Nuclear will fall into disuse, while new energy and natural gas use will increase.

Figure 27 Power Production Capacity



	A. Boiled Frog				B. Revival				C. Switch Over	
	2010	%	2030	%	2010	%	2030	%	2030	%
Total	10957	100	11041	100	10460	100	8467	100	6087	100
Coal	2544	23	2433	22	733	7	333	4	0	0
Natural Gas	2995	27	3370	31	4288	41	5146	61	3085	51
Oil	882	8	588	5	905	9	253	3	463	8
Nuclear	3372	31	3372	31	3161	30	0	0	0	0
Hydro	840	8	865	8	888	8	1004	12	1004	16
Geothermal	35	0	39	0	71	1	141	2	141	2
New Energy	289	3	375	3	413	4	1591	19	1394	23

5) Nuclear and Natural/New Energy

The assumptions for nuclear appear in Figure 28, and those for natural/new energy in Figure 29.

Figure 28 Nuclear Power Assumptions

Nuclear Plants

A. Breakdown ：4 new plants currently under construction will be added, then will stay constant after 2010.

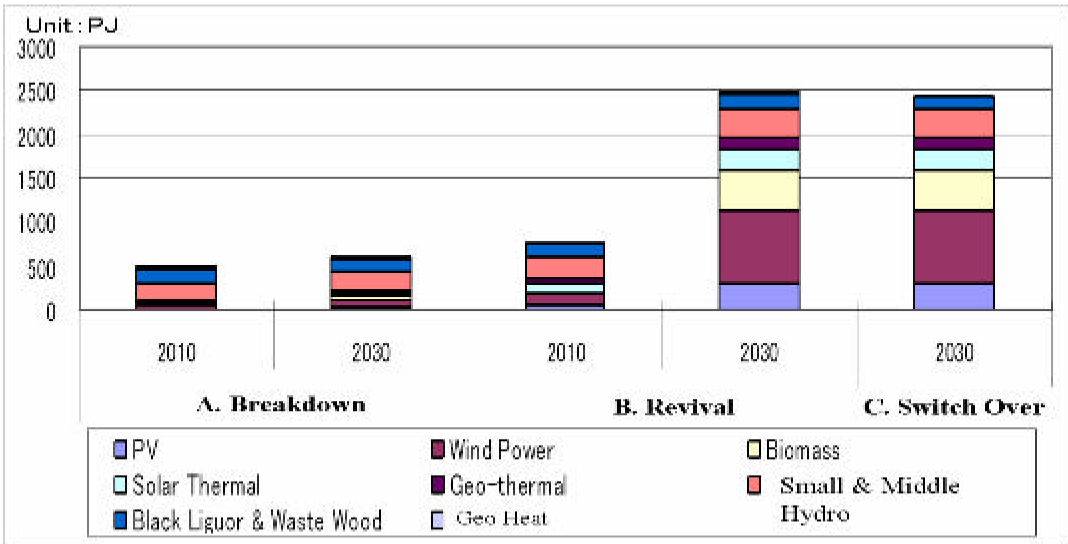
B. Revival ：1 new plant currently under trial operation will be added. Starts to close down plants gradually from 2010, and completes by 2030.

C. Switch Over ：Inherits scenario B. However it is possible that all nuclear plants are closed before 2030.

Capacity Factors

Set to 80% of full generating capacity for all scenarios.

Figure 29 Assumptions on Natural and New Energy Sources



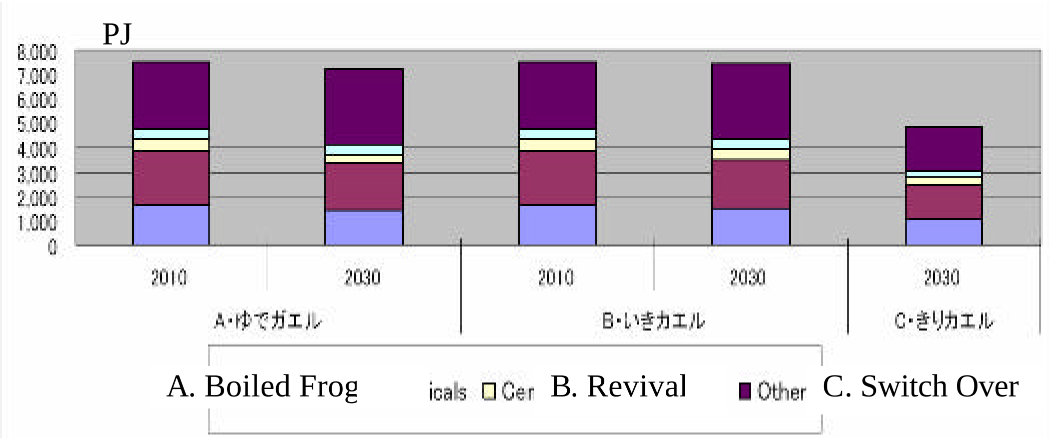
	A. Boiled Frog		B.Revival		C.Switch Over
	2010	2030	2010	2030	2030
PV	11	24	41	298	298
Wind Power	33	95	141	828	828
Biomass	15	31	6	457	457
Solar Thermal	28	28	106	249	249
Geo-thermal	33	37	67	133	133
Small & Middle Hydro	184	208	230	339	339
Black Liguor & Waste Wood	168	162	168	162	111
Geo Heat	6	6	9	9	9
Renewable Total	479	591	767	2475	2424
Solid Waste	81	81	64	87	0
Other New energy	90	90	90	90	42
New energy Total	432	517	624	2180	1994

* Biomass, Black Liquor & waste wood, Other New energy includes both electricity and heat.

6) Energy Situation by Sector

Energy consumption in selected sectors is given below.

Figure 30 Industrial Energy Consumption by Sector



	A ·Boiled Frog		B ·Revival		C ·Switch Over
	2010	2030	2010	2030	2030
Total	7,490	7,239	7,561	7,635	4,780
Iron & Steel	1,601	1,400	1,619	1,489	1,088
Chemicals	2,211	1,898	2,228	1,963	1,365
Cement	474	411	474	426	291
Paper & Pulp	429	389	432	407	292
Others	2,766	3,095	2,783	3,170	1,744

Figure 31 Residential/Commercial Sector Energy Consumption and Related Indicators

	A･Breakdown		B･Revival		C･Switch Over
	2010	2030	2010	2030	2030
Energy Consumption (PJ)	4,489	4,628	4,266	4,328	3,039
Residential	2,380	2,399	2,169	2,093	1570
Commercial	2,109	2,230	2,096	2,235	1042
Population (10 thousand people)	12,753	11,764	12,753	11,764	11,764
Household (thousand household)	50,139	49,024	50,139	49,024	49,024
Commercial Floor Space (100 million ㎡)	18.4	19.9	18.4	20.3	12.3
【Reference】 Total Final Demand (PJ)	16,425	16,509	16,074	15,658	10,146

Figure 32 Transport Sector Energy Consumption and Related Indicators

	A･Breakdown		B･Revival		C･Switch Over
	2010	2030	2010	2030	2030
Energy Consumption (PJ)	4,146	4,341	3,948	3,395	2,437
Passenger	2,767	2,947	2,547	1,997	1,510
Freight	1,379	1,394	1,401	1,398	927
Amount of Passenger Transportation (Billion people km)	1,577	1,781	1,584	1,836	1,039
Amount of Freight Transportation (Billion t km)	618	648	634	646	389
【Reference】GDP (trillion yen)	618	725	622	770	354

4.2 Macroeconomic and Industrial Structure Considerations

1) Overseas Factors

- The yen will depreciate.

Figure 33 Main Assumptions (1): Foreign Exchange Rate

	2010	2030
A. Breakdown	130yen/dollar	167yen/dollar
B. Revival	130yen/dollar	167yen/dollar
C. Switch Over		275yen/dollar

- Crude oil is anticipated to cost $35/bbl (nominal) in 2030.[xii]

  Note: The effects of higher oil price (for example a rise of $6/bbl) are as follows.
  - Macroeconomic: GDP down 0.2%, industrial prices up about 2%, unemployment up by 30,000.
  - CO2 emissions: down by about 55 million tons.

Figure 34 Main Assumptions (2): Crude Oil Price (Nominal)

	2010	2030
A. Breakdown	29dollar/barrel	35dollar/barrel
B. Revival	29dollar/barrel	35dollar/barrel
C. Switch Over		36dollar/barrel

2) Population and Economic Growth Rate

- For purposes of contrast with ACNRE, we used the same assumptions for population, number of households, and other factors. Population will peak in 2006 and then decline.

Figure 35 Main Assumptions (3): Population and Number of Households

	2010	2030
Population (Thousand People)	127,532	117,635
Household (Thousand Household)	50,139	49,024

- Economic growth will be a little higher under the Revival Scenario. Switchover GDP in 2030 will be the 1985 level (Switchover assumes the emergence of “value that cannot be measured by GDP”).

Figure 36 Economic (GDP) Growth Rate

	2000/2010 (2010 GDP)	2010/2020 (2020 GDP)	2020/2030 (2030 GDP)
A. Breakdown	1.4% (618 Trillion Yen)	1.0%(685 Trillion Yen)	0.6%(725 Trillion Yen)
B. Revival	1.4% (622 Trillion Yen)	1.3%(706 Trillion Yen)	0.9%(770 Trillion Yen)
C. Switch Over			▲2.6%(354 Trillion Yen)

3) Production of Primary Commodities

- The industrial structure will be further characterized by services and IT, while the energy-intensive materials industries will have declining production due to falling domestic demand (Figure 37).

Figure 37 Materials Production Volume and Related Indicators

	A. Breakdown		B. Revival		C. Switch Over
	2010	2030	2010	2030	2030
Real GDP (trillion yen)	618	725	622	770	354
Consumer Price Index ('00=100)	99	103	99	105	124
Inflation(%)	▲0.1 2000/2010	0.4 2020/2030	▲0.1 2000/2010	0.6 2020/2030	2.0 2020/2030
Industrial Production Index ('00=100)	116	138	118	149	—
Steel Production (ten thousand tons)	9,200	6,400	9,300	6,900	4,800
Ethylene Production (ten thousand tons)	660	540	670	570	300
Cement Production (ten thousand tons)	7,100	5,500	7,100	5,900	2,600
Paper & Pulp (ten thousand tons)	1,200	1,100	1,200	1160	740

- Meanwhile, industry will be increasingly characterized by services and IT, as follows (based on input-output tables with 1995 real prices under the Revival Scenario).
  Electronic and communication equipment: 4.1% share in 2000, 7.9% in 2030.
  Finance and insurance: 4.1% in 2000, 5.6% in 2030.
  Communications and broadcasting: 1.8% in 2000, 3.3% in 2030.
  Business services: 6.8% in 2000, 11.4% in 2030.

Figures 38 and 39 sum up the macroeconomic and industrial structure-related outlook.

Figure 38 Macroeconomic Outlook

Index \ scenario	A. Breakdown	B. Revival	C. Switch Over
characteristic	Environmental industries are not promoted. Business stagnation.	Environmental industries grow gradually, and economy improves compared to A.	Emerging new paradigm after capitalism of 20th century. Slow life, IT technology.
Unemployment rate	12.3% in 2030 (7,400,000 people)	8.4% in 2030 (5,040,000 people)	Community, society, individual service will generate jobs. Unemployment is a unique issue of an industrial society.
Current balance	Faces deficit after 2020	Deficit after 2030, but much smaller than A.	Almost balanced. But the concept of international trade will loose its meaning.
Fiscal income	Deficit continues (4.5 times GDP ratio in 2030)	Deficit continues, but improved from A (3.4 times GDP ratio in 2030)	Balanced. Economy is less dependent on fiscal expenditure.
Overall evaluation	High possibility of economic collapse before 2030.	Not a perfectly sustainable path, but far better than A.	Most promising path for a sustainable future.

Figure 39 Industrial Structure Outlook

□ **A. Breakdown Scenario**

- Total production changes along GDP change.
- Growing Industry—IT, communication, media, office and service machinery
- Shrinking Industry—Fertilizer, Forestry and Agriculture, Fiber, Coal products
- Automobile Industry will not grow—Saturated domestic demand and on-site production for overseas market.

□ **B. Revival Scenario**

- Total production changes along GDP change.
- Growing Industry—IT, communication, media、 office and service machinery
- Shrinking Industry—Fertilizer, Forestry and Agriculture, Fiber, Coal products
- Automobile Industry will slightly grow—increased exports of highly efficient vehicles

□ **C. Switch Over Scenario**

- Borderless business, new industries; i.e. non profit agriculture, peer to peer, open source software.
- These industries are not limited within domestic border, nor restricted within the existing industrial structures (since Industrial Revolution).

Chapter 5 Comparison with ACNRE

Following is a comparison of the main parameters (at 2030) between COMPASS and ACNRE (see the comparison table at the end of this paper for details).[xiii]

Figure 40 Comparison of Main Parameters (Main Assumptions and Economy) with ACNRE in 2030

Index	Advisory Committee for Energy		COMPASS		
[Section]	Reference Case	Exogenous Macro Factor Case	Scenario A Boiled frog	Scenario B Revival	Scenario C Switch over
[Main Premise]					
Exchange rate	120 (Yen/US$)	120 (Yen/US$) (?)	157 (Yen/US$)	167 (Yen/US$)	275 (Yen/US$)
Crude oil Price	29 (US$/Barrel)	15~35 (US$/Barrel)	35 (US$/Barrel)	35 (US$/Barrel)	36 (US$/Barrel)
Population	117,580 thousand		117,635 thousand		
Household	About 48,670 thousand		49,084 thousand		
[Economy]					
GDP [illegible]	833 trillion yen (1.3%)	673~927 trillion yen (0.4~1.6%)	725 trillion yen (0.6%)	773 trillion yen (0.9%)	354 trillion yen (-2.6%)
Inflation rate	Not Published	Not Published	0.4% (2020/2030)	0.6% (2020/2030)	2.0% (2020/2030)
unemployment	Not Published	Not Published	13.3%	9.4%	—
Current Balance	Not Published	Not Published	−190 trillion yen	−16 trillion yen	

Figure 41 Comparison of Main Parameters (Activity Indicators and Energy) with ACNRE in 2030

Index	Advisory Committee for Energy		COMPASS		
[Section]	Reference Case	Energy Saving Case	Scenario A Breakdown	Scenario B Revival	Scenario C Switch Over
[Index]					
Industrial Production Index	130	130(?)	138	149	—
Passenger Transportation (billion people km)	approximately 1,670	approximately 1,670(?)	1,781	1,836	1,039
Freight Transportation (billion t km)	approximately 530	approximately 530(?)	648	646	389
Total Floor Space (100 million m²)	approximately 20.6	approximately 20.6 (?)	19.96	20.3	12.3
[Energy]					
Preliminary Energy Supply (PJ)	approximately 23,500	approximately 20,750	22,747	20,183	13,765
Final Energy Consumption (PJ)	approximately 16,460	approximately 14,600	16,509	15,658	10,146
CO2 Emission (Compared with 1990)	+8%	−10%	+7%	−9%	−42%

(※The data of Advisory Committee for Energy comes from the report (2004.Jun.16th))

Figures 42 and 43 summarize the results of our two alternative scenarios.

Figure 42 Summary of Scenario B (Revival)

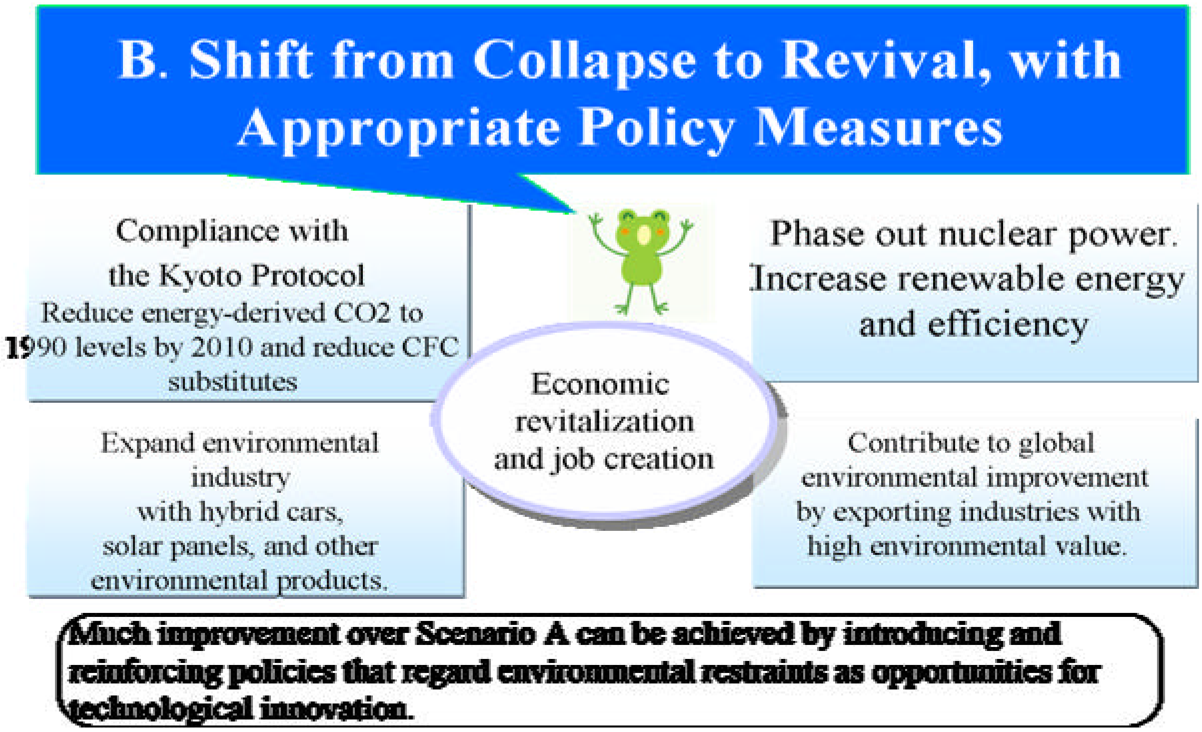
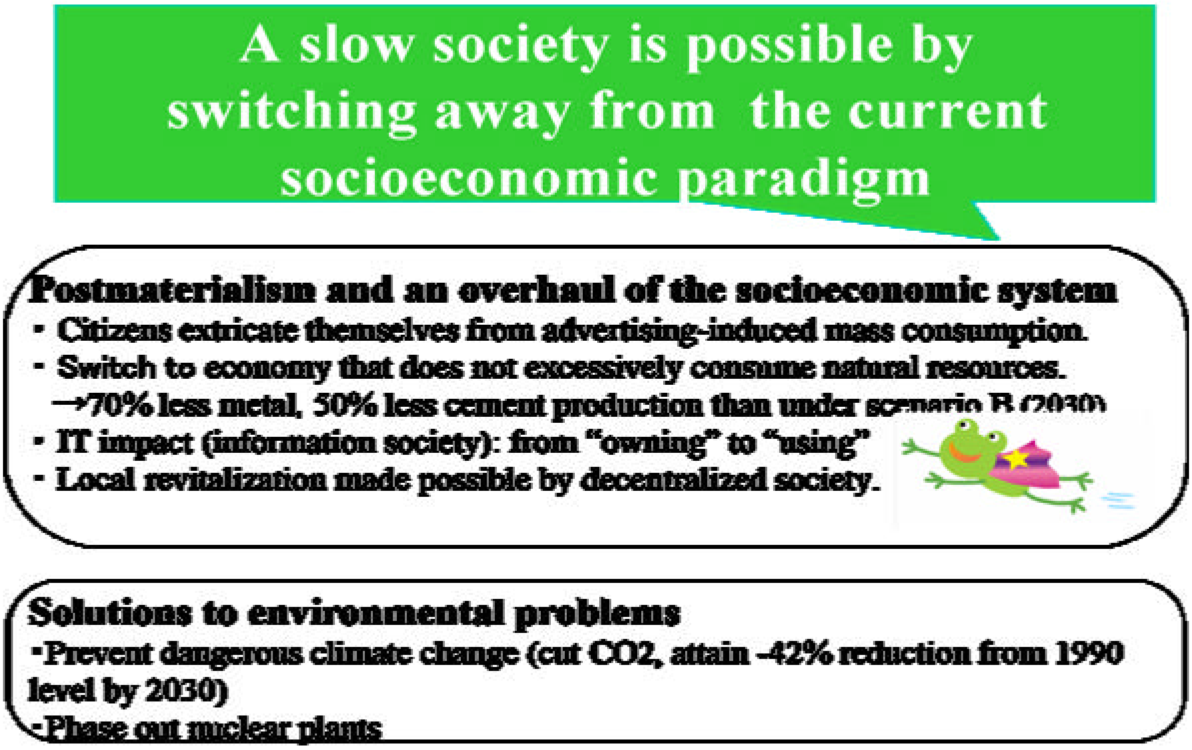


Figure 43 Summary of Scenario C (Switchover)



Finally, Figure 44 summarizes the questions we raised in these energy scenarios.

Figure 44 Questions Raised by COMPASS

1. Government's predictions are unrealistic,

and furthermore, they are not scenarios for decision-making.

2. Economy will collapse under the BAU.

A shift in energy policy must be made.

3. A policy change can rejuvenate both the economy and the environment. This is the decisive moment.

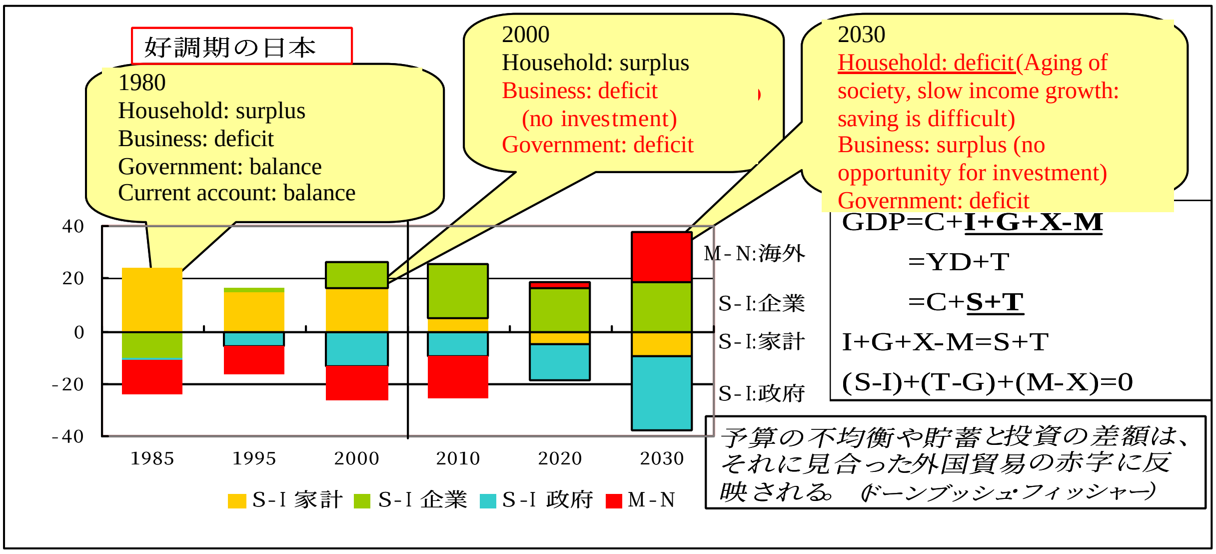
4.Energy policies need to be reviewed and assessed in open and transparent discussions.

We believe that developing a democratic energy policy makes it essential to present energy scenarios from a number of stances including not only the government's (Ministry of Economy, Trade and Industry's Agency for Natural Resources and Energy) advisory committee, citizens, and NGOs, but also a variety of researchers and think tanks, then to have public debate on those scenarios and choose the most desirable one. That will make it possible to approach a sustainable energy society. We hope that our proposals will contribute as much as possible to galvanizing discussion.

This report shall conclude with a quote that is indicative of our thinking.

"The future is not what you estimate,
but is what you create."

Jorgen Norgard



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[i] Benkler, Y., "Coase's Penguin, or, Linux and the Nature of the Firm," *Yale Law Journal*, Winter 2002-2003.

[ii] This is understandable from the investment/savings (IS) balance.
I+G+(X-M)=S+T
(S-1) + (T-G) + (M-X) = 0
(residential/commercial) (government) (overseas)
1985: Household has surplus, business has deficit, government more or less balanced, foreign has surplus (i.e., minus). (This is usual for Japan when economic times are good.)
2000: Household has surplus, business has surplus (nowhere to invest), government has deficit, foreign has surplus (minus).
2030: Household has deficit (savings no longer possible due to aging and to depressed incomes), business has surplus (nowhere to invest, development does not go well), government has deficit, foreign has deficit (plus).

[iii] One view is that global climate change cannot be avoided if Japan is the only country to reduce greenhouse gas emissions. However, because the developed countries have emitted large volumes of GHGs, they have a responsibility to take the initiative and reduce emissions, and it is so written in the Framework Convention on Climate Change, to which the whole world — including the United States — has agreed. As such, it is only natural that Japan substantially reduce its emissions of CO2 from energy consumption, which account for most of its GHGs. Further, with respect to Japan's 2030 CO2 emissions we believe, based on the

following documents, that Japan must reduce its emissions 40 to 50% compared to its 1990 level. This is incorporated mainly into the consideration of CO2 reductions in the Revival Scenario.
Document 1: Climate Action Network (CAN), “A Viable Global Framework for Preventing Dangerous Climate Change (CAN Discussion Paper),” 2003 (http://www.climnet.org/pubs/CAN-DP_Framework.pdf).
Document 2: RIVM (Dutch National Institute for Public Health and the Environment), “Exploring climate rgimes for differentiation of commitments to achieve the EU climate target,” 2003 (http://www.rivm.nl/bibliotheek/rapporten/ 728001023.html).
[iv] This comprises the following two risk reductions.

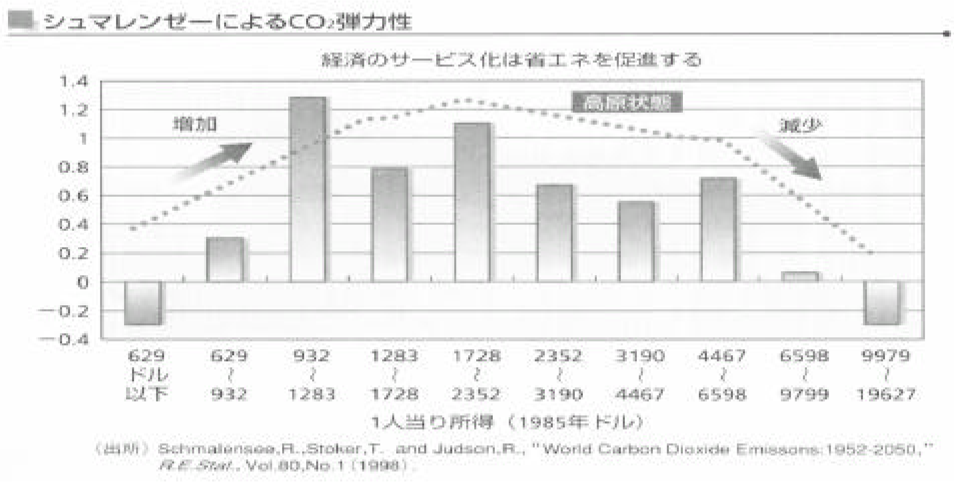
1. Reducing climate change risk.

• The IPCC observes that human activities have induced the warming over the past 50 years, and that in the 21st century atmospheric temperature and sea level will rise further (Intergovernmental Panel on Climate Change, Third Assessment Report (2001)).
• Experts have also pointed out the possibility of sudden adverse impacts every 10 to 30 years (for example, Committee on Abrupt Climate Change, National Research Council, “Abrupt Climate Change: Inevitable Surprises,” National Academies Press, Washington, D.C., 2002 (http://www.nap.edu/books/0309074347.html).
• Arresting climate change with huge emissions cuts is an urgent task for Japan and other developed countries.

2. Reducing the risk of radioactive substances.

• In view of the environmental burden and risk (present and future) of radioactive substances from nuclear power plants, nuclear is not an option as a sustainable energy source.
• Nuclear is reduced to zero in 2030 to mitigate its environmental burden and risk.

[v] Ito, Yasushi, “Environmental Policy and Technological Innovation,” in Teranishi, Shun’ichi, ed., *New Environmental and Economic Policy*, Toyo Keizai Inc., 2003.
[vi] Tsuchiya, Haruki, “Using the Learning Curve to Analyze the Cost of New Energy Sources,” *Solar Energy*, vol. 25, no. 6, 1999.
[vii] One way of seeing postmaterialism is the inverse-U curve (industrialization raises the intensity of goods, but intensity falls as industrial society matures). MIT’s Schmalensee offers an analysis on CO2 (see figure below).



[viii] Calculating backwards from the depletion rate of macro housing stock capital, the current lifetime of a home is under 25 years, but we lengthen this to about 33 years in the model calculations under the Switchover Scenario.
[ix] Yashiro, Tomonari, *Service Providers*, Shokokusha, 2003, chapter 9.
[x] Coyle, Diane, *Postmaterialist Society.* Especially Chapter 4.
Salamon, Lester, *Partners in Public Service: Government and the Nonprofit Sector in the Modern Welfare State.*
[xi] The Switchover Scenario puts greater emphasis on the big picture in 2003 than on continuity. Therefore this scenario gives only the figures for 2030.
[xii] Information on crude oil prices was in many cases obtained from the following sources because Japan does not have an upstream oil industry (i.e., any full-fledged international oil companies).
USDOE/EIA, *Annual Energy Outlook 2004*, Washington, D.C., 2004 (AEO2004) (http://www.eia.de.gov/oiaf/aeo/index.html).
USDOE/EIA, *International Energy Outlook 2004*, Washington, D.C. (http://www.eia.doe.gov/oiaf/ieo/index.html).
International Energy Agency (IEA), *World Energy Outlook 2002*, Paris, 2002.
• Price assumptions in AEO2004 appear to be the judgments of forecasters based on values determined with the International Energy Module. See below. AEO2004, pp. 242-243; USDOE/EIA, *Integrating Module of the National Energy Modeling System: Model Documentation 2004*, p. 7 (http://www.eia.doe.gov/bookshelf/docs.html). Crude oil prices are given in real terms based on US dollars.

[xiii] In comparing COMPASS scenarios with ACNRE cases, we began with a comparison of the COMPASS Boiled Frog Scenario with the ACNRE Reference Case. Another comparison would be the COMPASS Revival Scenario with ACNRE's Additional Measures Case (2010) and Conservation Progress Case (2030). They are similar in the further promotion of energy conservation and other measures. The COMPASS Revival Scenario differs from the latter by offering photovoltaic power, ultra-low-emission vehicles (hybrid vehicles), and other examples of strategic environmental industries, and by working on a nuclear power phaseout by 2030 while holding 2010 CO2 emissions below the 1990 level. Further, ACNRE's Additional Measures Case for 2010 and Conservation Progress Case for 2030 do not form a continuum.