Hitotsubashi University
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IIR Working Paper WP#12-12

May 2012

Institute of Innovation Research
Hitotsubashi University
Tokyo, Japan
http://www.iir.hit-u.ac.jp

A Pitfall of Environmental Policy: An analysis of "Eco-point Program" in Japan and its application to the renewable energy policy

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Abstract

By analyzing the policy making process and the policy effects of “the Program to Promote the Spread of Green Home Appliances (Eco-point Program)” implemented in Japan during May 2009 to March 2011, and examining the current Japanese renewable energy policy (especially Feed-in Tariff), this paper aims to illustrate pitfalls that a green policy is likely to fall in.

Eco-point Program was promoted by Ministry of Environment to reduce GHG, Ministry of Economic, Trade and Industry (METI) to stimulate economic activities, and Ministry of Internal Affairs and Communications (MIC) to disseminate digital terrestrial broadcasting. This was a kind of policy that aimed at “killing three birds with one stone.” 690 billion yen was spent for these objectives, out of which more than 80% was devoted to promote purchases of flat-panel TVs.

Our analysis indicates that environmental effects of Eco-point Program were considerably smaller than expected. Eco-point Program also seemed to induce many imported TVs, which might cause sharp declines of Japanese electronics companies.

Japan is currently confronted with three serious issues: “GHG reduction,” “stable energy supply,” and “economic development,” which tend to be mutually contradicted. One “seemingly” simple way to solve these problems simultaneously is to promote new green industries associated with renewable energies or energy saving technologies.

However, as our analysis on Eco-point Program suggests, mere expansion of green markets through government spending does not guarantee long-term economic growth of the country. When technology is widely available due to standardization and commoditization, expansion of domestic markets may just deteriorate long-term competitiveness of domestic firms and industries.

An environmental policy often encompasses different issues such as an energy policy and an economic policy; the same policy is possibly implemented with different objectives. Our analysis illustrates that such a structure, though it is often inevitable, may have a risk of that nothing is solved. Especially the words of “eco” and “energy” may sometimes be too powerful to deliberately consider long-term economic effects.

1. Introduction

1.1 Complex problems faced by Japan

Former Democratic Party of Japan Prime Minister Hatoyama's declaration at the 2009 United Nations Climate Change Conference of Japan's intention to reduce greenhouse gases (GHG) by 25% by 2020 compared with 1990 is still a fresh memory. The speech was received with thunderous applause in the hall. Domestically, however, his remarks were also subjected to various criticisms as naive words that disregarded the adverse effects on Japan's economy. Most of these opinions noted that unless Japan envisages purchasing a significant number of emissions rights when emissions are actually slashed by 25% by 2020 compared with 1990, there is no specific scenario laid out to realize this goal. It was provisionally calculated that just to reach the target of an 8% reduction compared with 1990 set out under former Liberal-Democratic Party Prime Minister Aso, Japan would have to construct nine new nuclear plants and boost plant operating rates from the 60% level up to 81%. Even when combined with measures to increase solar power generation by a factor of 20, encourage the adoption of next-generation automobiles and various other energy-saving initiatives, it was still uncertain whether Japan could ultimately achieve this goal (Kaneko, 2010). So when the 25% reduction goal was laid out suddenly, it wasn't unreasonable for the proposal to be met with critical opinions.

To make matters worse, the Great East Japan Earthquake in March 2011 resulted in

the accident at the Fukushima Nuclear Power Station, and a situation now exists where even the continued use of existing facilities, let alone the construction of new nuclear plants, is being questioned. In 2009 the government was planning to raise the percent of the power supply by nuclear power from 30% to nearly 50% by 2030[1]. Although portions of Japan's nuclear energy policy remain in flux, with voices advocating a break away from dependence on nuclear power plants, it seems impossible to think Japan can proceed with an energy policy that relies on nuclear power in the future as assumed in conventional planning.

Along with being a major energy policy shift, the movement to break with nuclear power generation points to an even more serious issue for environmental policy. Japan probably can cover the immediate electricity shortage resulting from the shutdown of nuclear power plants by restarting thermal power plants[2]. It is also clear to anyone who looks, however, that if Japan continues to generate CO_2 at the current level it will not be able to maintain even the status quo, let alone achieve a reduction of 25% compared with 1990.

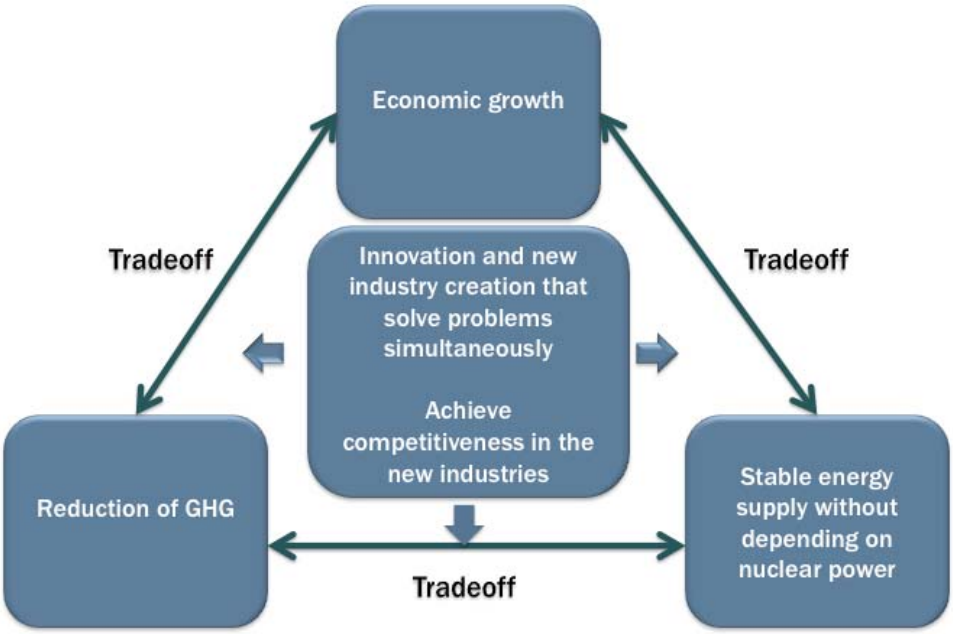
The problems do not stop with the environment and energy. There is a possibility that global warming measures and energy countermeasures both might become shackles on the growth of Japan's economy. Although there are various arguments concerning the power generation cost of nuclear power, most opinions concur that as long as the current price of oil continues, the cost to generate electricity using oil-fired thermal power plants will be greater than the cost to generate electricity using nuclear power. According to a comparison of power generation costs from fiscal 2006 through fiscal

year 2010 prepared by The Institute of Energy Economics, Japan, the cost per kWh for nuclear power generation is estimated at 7.2 yen, while the cost for thermal power generation is 10.2 yen (The Institute of Energy Economics, Japan, 2011)[3]. In fact, a trial calculation indicated that Japan's nine electric power companies incurred a total additional fuel expense of 1.7 trillion yen in fiscal 2011 alone[4]. If Japan continues to supplement the shortfall in nuclear power generation with oil-fired thermal power, the further rise in Japan's cost of electricity, which is already high compared with other nations, will have a negative effect on Japan's industrial infrastructure[5].

Nor can the effect of global warming countermeasures on industry be ignored. Not only will the reduction of greenhouse gases put a damper on domestic business operations, if Japan is unable to reach its objective the result will be an outflow of wealth to other countries in the form of emissions rights purchases. With Japan's economic recovery being delayed because of the earthquake and the prolonged appreciation of the yen, many firms might have no choice but to relocate their base of operations from Japan if, to add insult to injury, the industrial sector is compelled to adopt energy and environmental countermeasures.

As this highlights, Japan currently is confronted with many mutual contradictions and three serious issues, in terms of its "energy problem (stable energy supply)," "environmental problem (reduction of greenhouse gases)" and "industrial problem (long-term economic development)" (See Figure 1). The situation is like a complex simultaneous equation that at first glance appears to have no solution.

Figure 1: Three intertwined problems



1.2 Naïve policies promoting green industries

There is one way for looking at this complex equation as if it might be solved instantly. That is the promotion of new green industries that take advantage of innovations in energy conservation and new energy. The three problems of “environment,” “energy” and “economic development” would likely be solved if, for example, it becomes possible to cover electric power supply using renewable energy that does not emit CO_2 and extensive industry can be created on that base, or if new groundbreaking energy-saving technologies stimulate industrial development. Therefore the government is searching for various policies that will promote the growth of new green industries.

One such policy in Japan was the Program to Promote the Spread of Green Home Appliances (referred to below as Eco-Point Program), which we will later analyze in detail, implemented from April 2009 through March 2011. By this policy, the government tried to solve the environmental problem and energy problem while also simultaneously attempting to stimulate the growth of electronics-related industries and domestic employment.

In addition, The Act on Special Measures concerning the Procurement of Renewable Energy Sourced Electricity by Electric Utilities was enacted in August 2011, and a feed-in tariff purchase system for the total volume of renewable energy will be implemented in Japan as well. The spread of renewable energy, exemplified by solar power, will be promoted rapidly as a result, and along with achieving a move away

from nuclear power generation and a reduction in CO_2, the recovery of Japan's economy based on the growth of new energy industries is anticipated. This is another policy of killing two birds with one stone.

Things are unlikely to work out so smoothly, however. The problem is this: even if environmental problems and the energy supply issue are solved by using a hefty amount of tax revenues, will the expansion of green industry really spur growth of the economy? The worldwide new energy industry is projected to grow from a scale of 30 trillion yen in 2010 to 86 trillion yen in 2030[6]. Certainly the industry will grow. If firms are unable to internalize values created in that growing industry, however, economy will not achieve the expected growth. The growth of a new energy industry does not guarantee development of economy.

The solutions to both the energy supply problem and environmental problem will require capital. Scenarios in which the invested capital can be properly recovered must be outlined. For that, the nature of the technological progress that shapes the industry, and the best approach to the accompanying corporate competition, will have to be understood.

The point we really must understand, however, is whether firms have the ability to compete internationally in the newly-growing green industry, and whether they can drive the growth of the economy over the long haul. Any assessment of energy policy and environmental policy can be greatly influenced by the answers to this question.

However, in the formulation of green policies, much of this will slip between the cracks. Why? To answer this question, below we first analyses a process of

implementing Eco-point Program and its results, and then examines the recently-settled Feed-in Tariff Scheme for Renewable Energy in Japan.

2. Results of Eco-point Program

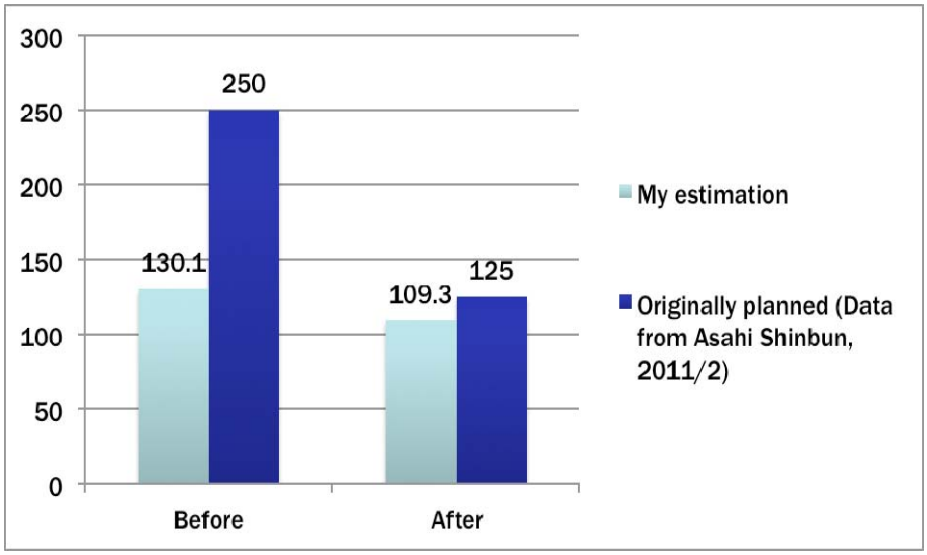
Eco-Point Program was an economic and environmental policy enacted in the supplementary budget for fiscal 2009. The program, which granted eco-points for purchases of highly energy-efficient air conditioners, refrigerators and televisions that consumers could accumulate and use for purchases of gift certificates, prepaid cards or designated goods, was a program intended to prevent global warming, revitalize the economy and popularize televisions capable of receiving terrestrial digital broadcasts. The program was launched on May 15, 2009, and designated products purchased by March 31, 2010 were eligible for the point grants. The deadline for point grants was extended while gradually improving the conditions, first to December 31, 2010 and then to March 31, 2011.

The budget appropriated for Eco-point Program was 690 billion yen; as of August 31, 2011, the number of eco-points issued totaled 639 billion yen, of which 521.7 billion yen or roughly 82% had been issued for purchases energy-efficient televisions. Substantively, the program could have been called a “program to promote purchases of flat-panel TVs.” Therefore we analyze the program below by turning our focus to flat-panel televisions.

2.1 Envisaged and realized energy-saving results

Although no primary resources remain concerning the extent to which the achievement of energy-saving results from Eco-point Program was initially envisaged by the Ministry of the Environment, according to Asahi Shimbun, a 50% reduction in annual power consumption from 250kWh to 125kWh per television was projected[7]. As shown in Figure 2, however, according to an estimate by the authors, annual power consumption per television was actually reduced by only about 16%, from 130kWh to 109kWh[8] (for the estimation method see Footnote 8[9]). Such divergence between the plan and actual numbers is thought to have originated from the fact that 1995 models were used as the standard before replacement purchases even though the average years of use for televisions is 10 years or less, and the fact replacement purchases were accompanied by rapid advances in the enlargement of television size. Thus if Eco-point Program is considered only as an environmental countermeasure, it has not delivered the envisaged result[10].

Figure 2: Projected and Realized Energy-saving Effects of Eco-point Program (kwh/year)



2.2 Realized economic results

As for economic results, the Ministry of Economy, Trade and Industry (METI) released a report in June 2011, claiming that this program generated an economic effect of five trillion yen, an amount that was seven times the budget amount, and created employment for 320,000 people[11].

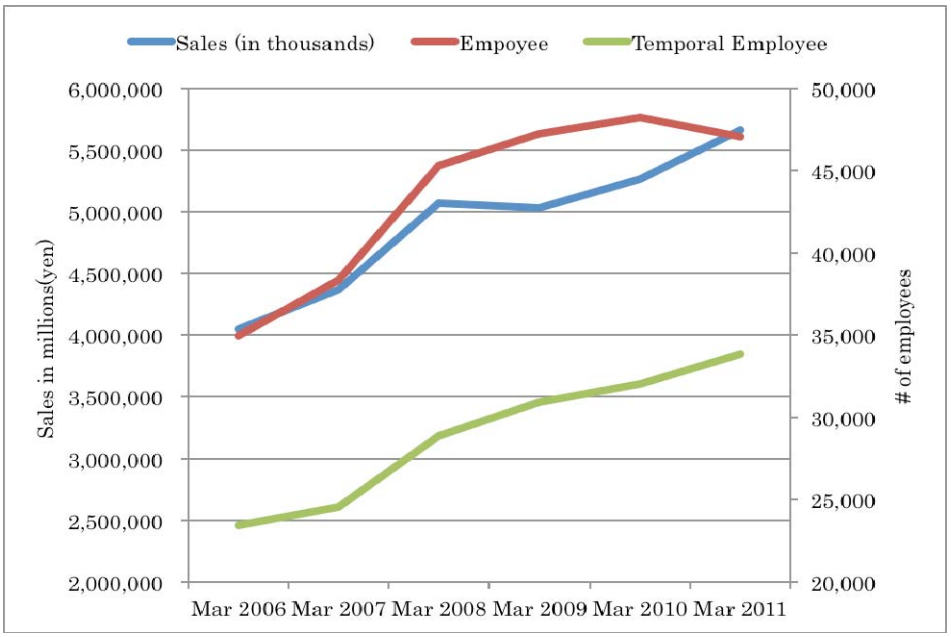
Caution must be exercised, however, when interpreting the results of an analysis of macroeconomic effects utilizing inter-industry relations tables. The five trillion yen economic effect is the increase in the amount of production on a nominal basis, which totals the production inducement amount and counts the amount of intermediate goods production more than once. With regard to employment as well, the result appears to have been calculated by multiplying the employment coefficient computed for each industry segment by the volume of increased production, and there is a question of

whether it is valid to apply the employment coefficient “as is” to the extremely competitive television business.

Moreover, even if there was a temporary increase in employment, this growth was not necessarily continued after the program was completed. The typical private company could forecast a falloff in demand once the program ended and would want to control its increase in hiring as much as possible.

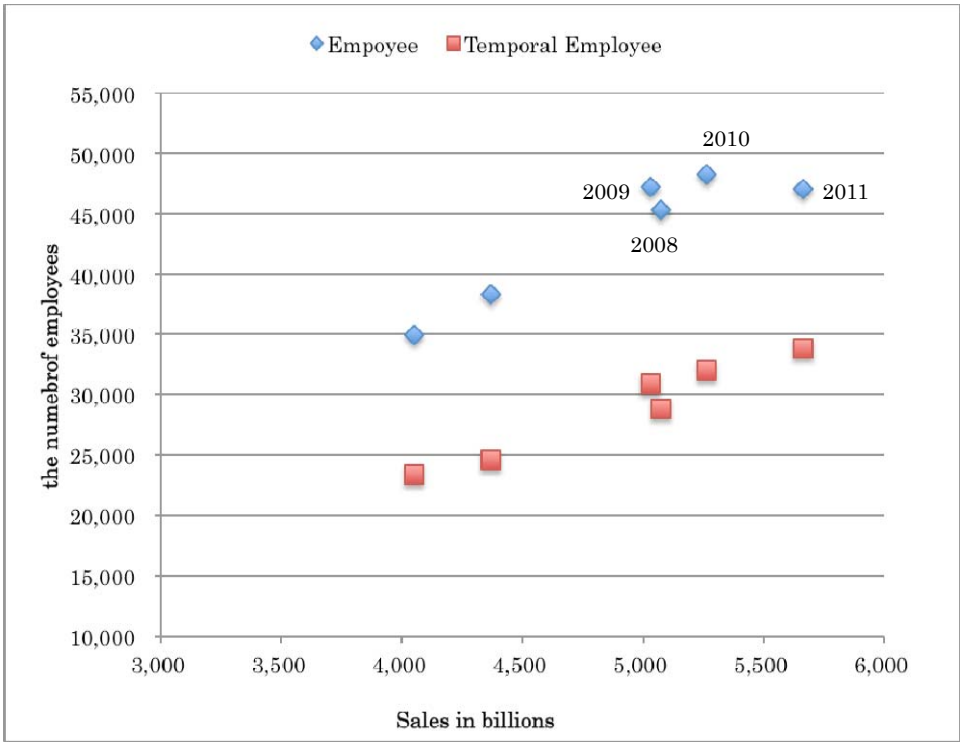
To confirm such conjectures, Figure 3 shows the sales and the number of employees for the top seven Japanese electric appliance retailers, whose sales values account for approximately 70% in electric appliance retail sales in the Japanese market. During March 2009 to March 2011, the period covered by Eco-point Program, sales grew by more than 600 million yen. The number of employees was however stable during this period: only temporary employees were increased. Figure 4 illustrates this more clearly. There seems no relationship between the sales and the number of employees in the period covered by Eco-point Program. Retailers certainly enjoyed boosted sales thanks to Eco-point Program, but seemed to handle them only with temporary employees hired.

Figure 3: Sales and the number of employees in Japanese top seven electric appliance retailers



Source: annual reports

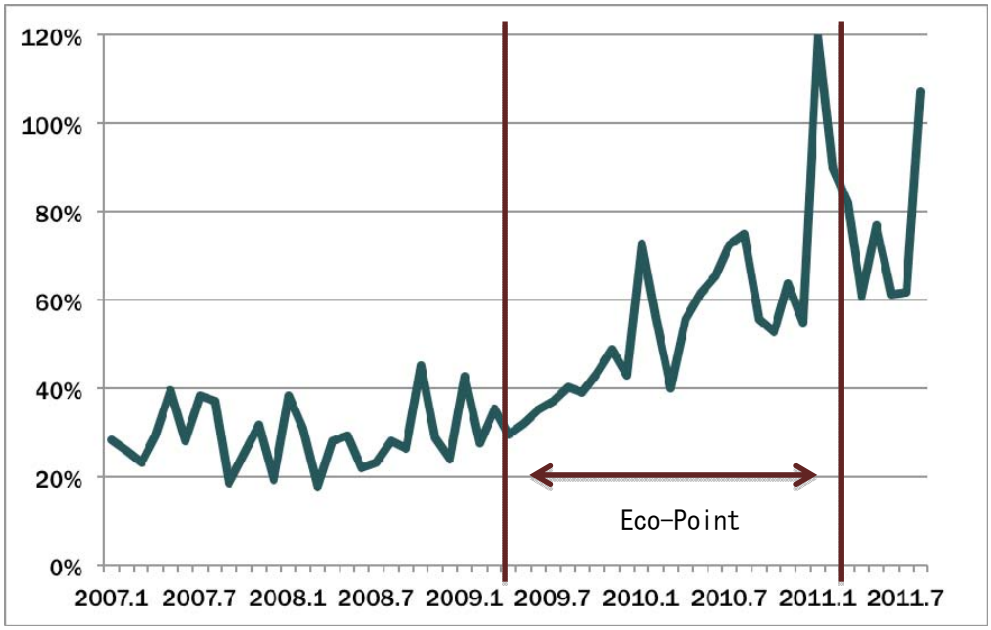
Figure 4: Relationships between sales and the number of employees in Japanese top seven electric appliance retailers



Source: annual reports

The long-term economic effects from Eco-point Program should be reflected on the enhanced international competitiveness of firms related to the television industry. Judging from this aspect, however, a question mark has to be attached to this program. Figure 5 shows the percentage of imports in the total domestic shipments of flat-panel TVs. Note, however, that the import ratio calculated has been estimated higher than the actual because the number of domestic shipments is an independent statistic from JEITA, while the number of units imported is based on Ministry of Finance customs statistics, which have broader scope of coverage.

Figure 5: The percentage of imports in the domestic TV shipments in Japan



Source: JEITA and Ministry of Finance

As is evident from Figure 5, the import rate rose rapidly from the time the eco-points were introduced. Since globalization of the electronics industry has progressed rapidly in recent years, we cannot attribute the jump in imports solely to the introduction of the eco-points. The economic downturn caused by the Lehman Brothers bankruptcy in 2008 and the subsequent progress of the appreciation of the yen in particular both probably gave impetus to this trend. It is, however, not plausible that Eco-Point has little effect on increased imports since increase in imports did progress rapidly exactly during the eco-point eligibility period.

The import rate, which was about 30% prior to introduction of Eco-point Program, exceeded 100% immediately before eco-points were terminated. It appears the imports

were a response to expected urgent demand. While there are no statistics that show whether these imports were from the overseas production plants of Japanese firms or were supplied from overseas ODM firms, according to a survey by the author, Japanese firms such as Toshiba and Sony relied on Taiwanese ODM firms for a considerable percentage of products, particularly low-priced goods.

Such a condition can be easily envisaged if the advances in the technologies that go into televisions and the structure of competition in the industry are examined. From the consumer's viewpoint, introduction of eco-points substantively means a reduction of the purchase price. Even individuals who previously had put off making a replacement purchase will head to their local shop, because TVs become cheaper to buy. Since such shoppers are presumably sensitive to prices, the market competition will develop mainly on price. Because it is impossible to prevail with domestically produced high-cost goods as price competition takes hold, firms come to rely on imports from overseas.

ODM firms that can inexpensively supply TVs that offer sufficient performance abound in other countries. Many of the technologies that comprise a television are general-purpose and standardized. In 2008, before eco-points were introduced, fabless overseas semiconductor firms that supplied standard chipsets already accounted for about 70% of the world's semiconductor chipsets for TVs[12]. Even liquid crystal panels, a core device, can be procured easily from Taiwanese such as CMO and AUO. In industries where the technology has been generalized and production globalized, expansion of the domestic market is a blessing, but production won't be kept at home and is moved easily to other countries.

An additional negative point is that as a result of severe price competition, the television business of Japanese firms was placed in a dire situation where it might be difficult to maintain competitiveness[13].

For fiscal year 2011, top three Japanese TV producers, Sony, Sharp, and Panasonic, together incurred over 1.5 trillion loss after tax, as indicated in Table 1 below, most of which came from their TV businesses. Panasonic announced that it would restructure its television business by cutting 1,000 workers and soliciting early retirement requests in its related semiconductor operations. Sony announced the operating loss in its TV business for the fiscal year ending in March 2012 would amount to about 175 billion yen[14]. Hitachi also planned to withdraw from domestic television production and shift to outsourcing manufacturing to a foreign firm[15].

Table 1: Sales and Net Profit after tax for major Japanese electronics makers

(Fiscal year 2011, in billion yen)

Company	Sales	Net Profit
Hitachi	9,666	347
Panasonic	**7,846**	**(772)**
Sony	**6,493**	**(457)**
Toshiba	6,100	74
Fujitsu	4,468	43
NEC	3,037	(110)
Mitsubishi	3,639	112
Sharp	**2,456**	**(376)**

These successive cutbacks in the television business can be attributed directly to the march of Korean firms into the international market, supported by the benefits of the strong yen and weak won, and Japanese firms probably would have found themselves in difficulty regardless of whether eco-points had been introduced or not. In that respect, eco-points might even have helped in a small way to prolong the life of Japan's TV business. Just how much significance was there, however, in such an extension of the business's life? Companies expecting market expansion as a result of eco-points might invest in domestic plants. When the eco-points end, however, they will shutter the plants and restructure. In an industry that can satisfy customer needs sufficiently with general-purpose technology, growth of the domestic market will not enrich the economy over the long-term.

It may be that the introduction of eco-points did have an effect from the standpoint of a smooth shift to terrestrial digital broadcasting. One must question, however, whether the shift to terrestrial digital broadcasting would not have really progressed if there had been no eco-point system. If it was just a shift, wouldn't purchase subsidies for terrestrial digital broadcasting tuners have been more effective?

3. Process of Eco-Point Program being designed and implemented, and pitfalls of the environmental policy

Why was Eco-point Program implemented despite doubts about its overall results? If

deliberately considering consumer behaviors, a state of TV technology, and a competitive situation in the global market, a policy maker could have easily understood that the program would not have expected energy-saving and economic effects. Then why?

Below we describe a process that Eco-point Program had been designed, and then explore an answer to this question, which will highlight the pitfall that environmental policy tend to fall in.[16]

3.1 A process of implementing Eco-point Program

The Eco-Point Program originally had been envisaged as Ministry of the Environment sought to achieve the goals of the Kyoto Protocol. In 2007 when the Eco-point Program was envisaged, the Ministry of the Environment was conducting a review of the Kyoto Protocol Target Achievement Plan. Under the Kyoto Protocol, countries were to be subject to penalties when their targeted reduction could not be achieved. Although the total volume of Japan's greenhouse gas (GHG) emissions in fiscal 2006 had declined from the previous year, still further reductions were needed. In fiscal 2007, there were concerns that Japan's emissions volume would be greatly higher than the reduction target, and that Japan would be compelled to purchase emissions rights in order to accomplish its goal[17].

Consequently the Ministry of the Environment shifted toward a policy to reduce greenhouse gas emissions by not only enlightening the public about environmental issues but also by granting economic incentives for behavior (eco-action) that took the

environment into consideration. The ministry introduced an Eco-Action Points Program to grant points that can be exchanged for various products, including the purchase and use of environmentally-aware products and services, and in 2008 began offering support for firms to implement corporate and local government eco-points as a model project.

The major characteristic of this Eco-Action Points Program is that it grants an economic incentive for environmentally-conscious behavior by consumers. The objective of these economic incentives, however, was always the solution of environmental problems, including a contribution to the achievement of environmental goals such as a 25% reduction of greenhouse gases (GHG) compared with 1990, and market expansion or the development of firms' competitiveness were not among the goals[18].

The Ministry of the Environment gradually began putting greater emphasis on the reduction of CO_2 emissions from households. With households, the problem is reducing electricity consumption by home electrical appliances such as refrigerators and air conditioners. This led to the concept of achieving a reduction in CO_2 by promoting replacement of home electrical appliances with products offering excellent power consumption efficiency.

Ministry of the Environment began collaborating with the METI in order to disseminate energy-saving home appliances. On October 18, 2007, it established the Energy-Efficient Household Appliance Promotion Forum in cooperation with the METI. This forum was established with the objective of promoting energy-saving home electrical appliances as a national movement together with appliance manufacturers,

retail businesses, consumer organizations, industry groups and other entities. The positions of chairman and vice-chairman of the Forum were filled by directors from corporations such as Matsushita Electric Industrial Co., Ltd., Hitachi, Ltd., Mitsubishi Electric Corporation and Sharp.

Although the Ministry of the Environment strengthened its ties with the METI in this manner, the policy intent was always achievement of the targeted reductions under the Kyoto Protocol. At the House of Councillors Research Committee on International Affairs and Global Warming Issues on October 31, 2007, the director of the Ministry of the Environment's Global Environment Bureau referred to his ministry's efforts with the METI to promote replacement purchases of energy-efficient products, and declared this should be able to achieve a 6% reduction under the Kyoto Protocol by giving eco-points and CO_2 greater visibility[19]. There was no reference any to economic policy aspects.

Since the global financial crisis in 2008, however, aspects of economic policy have gradually been added to the environmental policy because the METI has begun taking part in the commercialization of the Eco-point Program. The METI had long envisaged tying Japan's energy conservation technologies to industry competitiveness. Ties between the METI and the Ministry of the Environment have been strengthened as they have worked to closely link environmental problems to economic issues such as trading of CO_2 emissions rights.

Just as at the Ministry of the Environment, the Eco-point program was originally considered by the METI as well to be aimed at cutting CO_2 emissions volume[20]. The economic policy aspects have appeared strongly in METI policies since 2008, however.

On April 1, 2009, for example, the head of the METI's Commerce and Information Policy Bureau told the House of Councillors Committee on Economy and Industry that "Japan's electric machinery and electronics industries possess extremely superior environmental capabilities and technological skills, even when compared internationally. Broadly spreading so-called green household electrical appliances – energy-saving home electrical appliance models that make use of these environmental and technical capabilities – will contribute to overcoming global environmental concerns, and simultaneously lead to strengthening the international competitiveness of the electric machinery and electronics industries[21]". In addition, on April 14, 2009 the director of the METI Economic and Industrial Policy Bureau described the goal of the Eco-point Program to the House of Councillors Committee on Economy and Industry by noting, "Although under this countermeasure we've established the eco-point system for green high energy-saving home electrical appliance products and established a policy urging purchase promotions in the consumer sector, we also expect this to function like two wheels of an automobile in that it's a policy to expand the market by encouraging buying intent if we talk about this from the consumer side, and it's to stimulate energy-saving investments on the producer side if we talk about the Resource Productivity Innovation Plan and about plans to strengthen the management base"[22].

One can now see that the goal of strengthening the competitiveness of Japan's electronics industry had now been incorporated into the Eco-point Program. On April 10, 2009, then-Prime Minister Aso announced "emergency economic measures", which included as one of the policy items "accelerating the spread of green home electrical

appliances by means such as eco-points." An aspect as industrial policy was clearly added.

Moreover, in addition to its objectives as a CO_2 reduction and economic measure, the Eco-point Program also came to be positioned in relationship to terrestrial digital broadcasting in Japan. In April 2009, for example, the Vice Minister of the METI described the Eco-points Program as an effort whose goals are addressing global warming, revitalizing the economy and promoting the spread of terrestrial digital broadcasting TVs[23].

The spread of terrestrial digital broadcasting televisions was not included among the original purposes of the Eco-point Program. The organ that appended this terrestrial digital broadcasting objective to the policy goals was the Ministry of Internal Affairs and Communications (MIC). The ministry had been formally studying the digitalization of terrestrial broadcasting since 1997, and had decided to end terrestrial analog television broadcasting by July 24, 2011. However, as of the spring of 2009 terrestrial digital broadcasting television penetration was only about 40%, and more than 60 million TVs still needed to be replaced[24]. The MIC therefore planned to use the Eco-point Program to facilitate the penetration of TVs capable of terrestrial digital broadcasting reception. Consequently the standards for eco-point grants were revised, and in addition to products offering energy-saving performance, products capable of receiving terrestrial digital broadcasting were included[25].

By adding a policy target for diffusion of televisions for terrestrial digital broadcasting, however, the importance of such TVs rose substantially. The household

sector was noted, however, and the Ministry of the Environment's policy objective of CO_2 reduction was not the only reason the focus of administration policy was placed on televisions.

As a result, the goal became one of killing three birds – measures for controlling global warming, economic revitalization measures and the program to promote the spread of terrestrial digital broadcasting – with one stone, through the Ministry of the Environment, the METI and the MIC[26]. Then, through the process of multiplying the justifications for resource mobilization, the focus shifted little by little from the original policy objective of each organization.

3.2 Strange bedfellows

The Eco-point Program can be understood to have been a program mutually supported by the different respective objectives of the Ministry of the Environment, the METI and the MIC. The result can be called a policy of "strange bedfellows." Inevitably, environmental and energy policies always have to be related to other policies including economic policy. Thus the fact a policy is executed under the "strange bedfellows" approach might be natural. Moving a policy forward by incorporating various reasons using the "strange bedfellows" technique becomes especially necessary when a policy's effects are uncertain[27]. "Strange bedfellows" is also a double-edged sword, however. Difficult policies can be achieved if the approach is used skillfully and with focused intent. Depending on the circumstances, however, different policies become mutually interdependent and, as a result, a situation could arise in which none of the outcomes

that should be achieved is realized.

Looking at the eco-points example, the program was realized as an environmental policy by borrowing the rationales that it was an economic measure and it promoted the transition to terrestrial digital broadcasting. The original purpose as a countermeasure to global warming, however, has not been sufficiently achieved. On the other hand, even though the program was accomplished as an economic measure by borrowing the rationale of a global warming countermeasure, it did not lead to the revitalization of Japanese firms. So although it might be necessary to pursue policies using a structure in which the policies mutually in this manner rely on each other's *raison d'être*, the danger is conceived that the programs will run on autopilot without necessarily sufficiently achieving their respective goals.

3.3 The magic words "environment" and "energy"

Another lesson to be learned from the eco-points example is the power of the words "environment" and "energy." Just as the ring of the word "eco-points" has left an impression, the word "environment" exerts a strong pull on people. The words "new energy" also have rapidly gained a strong appeal today, now that public awareness of conserving electricity has been heightened as a result of Japan's nuclear power plant disaster. Very few people can come right out and repudiate policies to "solve environmental problems" or "solve the energy problem." Isn't this the reason why the introduction of eco-points also could be accomplished easily by slapping the prefix "eco" on it, even though the effect as economic policy was not necessarily clear? It

would be all the more difficult to oppose now, because it would revitalize the domestic market and consumers at least would receive a substantial benefit[28].

Global warming countermeasures and the promotion of new energy, however, entail a substantial cost. Lightly advancing such policies without outlining the scenarios by which that cost can be recovered over the long-term might push the country's economy toward bankruptcy. The complex problems shown in Figure 1 can be solved by the new industries created through global warming countermeasures and the development of new energy only after Japanese firms have achieved the virtuous cycle of creating added value, internalizing that value and creating further innovations. As long as this point is forgotten, the words "environment" and "energy" will retain their strong appeal.

3.4 The illusion that "market expansion leads to economic development"

One more reason Eco-point Program was implemented despite ineffective overall performance seems to reside in a shared concept that the domestic market expansion leads to nation's economic development. But this becomes an illusion in an industry where technological progress has slowed, technology has been generalized and competition is international in scope, expansion of the market in a specific country does not necessarily bestow sufficient benefits on that country's economy. Indeed it might have the effect of providing customers to foreign companies, just as Eco-point Program induced rushing imports of TV sets from East Asian countries. Still, because it is important for "the environment" and "energy," the magic words appear again.

4. Examining an example of the Feed-in Tariff scheme for solar power in Japan

Lessons learned from the example of Eco-point Program are not particular to this program. They can be applied more or less to any green policy. Since an environmental policy is related to different issues such as energy and economic issues, different policy objectives may often be attached to the same policy, which give rise to “strange bedfellows” situation. The words of “eco” and “energy” are globally getting a strong power to persuade various people. Since expansion of domestic markets creates at least temporal jobs, subsidizing purchase of green products is welcome for most people.

However, without understanding the characteristics of the technology comprising an industry, and the structure of the competition among firms that originates in those characteristics, and then incorporating the long-term economic effects from improvement of the international competitiveness into the scenario, the result could end up being a stiff bill in the future. If everyone is dazzled merely by the early diffusion of green products, the public will have to bear the costs incurred for spreading the technology for many years.

Below we examine the policy promoting renewable energy in Japan, especially focusing the policy for solar power, and illustrate a possibility that the same trap as the Eco-point Program fell in may take place.

4.1 The possibilities for solar power generation

Among all sources of renewable energy, solar power is the alternative currently

expected to gain the most popularity as well as the technology given the most preferential public sector support. In Japan, the Excess Electricity Purchasing Scheme for homes, which was launched in November 2009, initially paid 48 yen/kWh, and for photovoltaic power facilities installed in fiscal 2011, purchases of surplus electricity at 42 yen/kWh are guaranteed for ten years. Because the electricity rate for a normal household is about 20 yen/kWh, surplus electricity will be purchased at a price more than double the current rate.

In addition, the Act on Special Measures concerning the Procurement of Renewable Energy Sourced Electricity by Electric Utilities was enacted in August 2011, and the full-volume feed-in tariff system for renewable energy will be implemented in July 2012. Purchase price applied to commercial facilities was set to 42 yen/kWh for 20 years (See Table 2 below for the purchase price and the purchase period for selected renewable energies including solar power).

Table 2: Selected figures for 2012 FIT scheme for renewable energies in Japan

	Solar power		Wind Power		Geothermal	
Size	>10KW	<10KW	>20KW	<20KW	>15MW	<15MW
Purchase Price (yen/kWh)	42	42	23.1	57.75	27.3	42
Purchase Period (year)	20	10	20	20	15	15

Source: METI

Purchase price of 42 yen/kWh for 20 years is far from the current international price. Even in Germany that has led the world in PV system installation with sophisticated Feed-in Tariff, purchase price for 2012 is now being considered to be 13.5c/kWh to 19.5 c/kW reflecting reduction of imported PV production cost. Purchase price in China is currently 1 RMB/kWh. Purchase price in Japan is two to three times higher than these countries. How can it is justified?

The reasons why solar power particularly has garnered the greatest expectations among all types of renewable energy and is being given preferential treatment have been explained as follows.

Solar power is a distributed power generation system, with which everyone can cooperate, and except for the immediate cost problem there are relatively few technical and social factors hindering installation of the equipment compared with other power generating systems, and the technology is expected to spread quickly. Diffusion of the technology will be accompanied by many benefits that will be enjoyed not only by manufacturing but also by industries such as distributors and equipment installers, which will contribute to domestic industrial development and help ensure employment. The technology also does not generate CO_2, and once installed will continue to generate electricity without the need for fuels. While the fact the technology can only generate electricity during the daytime is a problem, at least it will contribute to a power grid electric power generation peak shift, and even this problem can be solved if combined with batteries. Moreover, solar power is a power generation system that is being mass produced, and the cost can be expected to drop in the future. According to a rough rule

of thumb, the cost has been shown to decline by 20% when accumulated production volume doubles[29]. Moreover, in its road map, the New Energy and Industrial Technology Development Organization (NEDO) projects the cost to generate power, which exceeded 40 yen/kWh in 2007, will drop to 14 yen/kWh in 2020 and 7 yen/kWh in 2030[30]. If the cost can be brought below the price of electric power for industry, replacing nuclear power plants will become sufficiently feasible. Therefore a purchase price of 42 yen/kWh is said to be justified[31].

Another reason behind the expectations for photovoltaic generation in Japan is the fact that for over 40 years Japan has led the world in this technology. If Japanese firms possess leading technologies, Japanese firms will benefit from expansion of the domestic market and be able to develop globally using their technological capabilities. In fact, rough calculations have been released that show Japan's GDP will not decrease even if all nuclear power generation is replaced by solar power[32].

There is agreement on the point that early diffusion of photovoltaic generation holds the key to "phasing out nuclear power," and no opposition to initially giving preferential treatment to solar power, for which a mass production effect can be anticipated, among all types of renewable energy. Where there are misgivings, however, is on the point of whether Japanese firms will acquire international competitiveness in this new industry, and be able to enrich the economy over the long term, as a result of expending a substantial amount of funds and moving ahead with the full-volume feed-in tariff purchase system.

As the analysis of the effect of the Eco-point Program illustrated, policies to spread

the technology basically will result in price competition. Of course this is one of the objectives, because lowering the price is necessary in order to popularize the technology. As was seen in the case of flat-panel televisions, however, in industries where the technology has been standardized and generalized, there is a high probability this will work toward promoting the inflow of imports from other countries and putting pressure on the domestic activities of Japanese firms. While various companies will be enriched by expansion of the domestic market, and employment will be created over the short term, over the longer term it is likely to act as a drag on economic development if it encourages a decline in the international competitiveness of Japanese firms.

4.2 Competition in solar power generation systems

For a long time Japanese firms led the world in the technological development of photovoltaic cells, but their share of global solar cell production now amounts to less than 20%. Japanese firms have seen their share erode rapidly since 2006, and today the market is controlled by Chinese companies, which have captured a market share exceeding 50%. The reason upstart ventures have gained strength so rapidly lies in the fact solar cell manufacturing technology has become a commodity. Today most photovoltaic cells for homes are made of crystalline silicon (monocrystalline and polycrystalline). Although cadmium telluride (CdTe) thin-film solar cells produced by the U.S. company First Solar for the electricity business rival crystallization silicon-type photovoltaics, as a whole the main market is overwhelmingly in crystalline silicon cells. Crystalline silicon photovoltaic cell manufacturing technology has been generalized,

and by relying on a turnkey solution firm in Europe or the U.S., a cell or module production plant can be set up quickly. Compared with semiconductor chips, which are similarly fabricated on a silicon substrate, the purity of the silicon and degree of miniaturization required for today's crystalline silicon photovoltaic cells are low, and the number of production processes also is small. The number of production steps and intermediate materials are also fewer than those needed to produce liquid crystal panels.

The theoretical energy conversion efficiency value for crystalline silicon photovoltaic cells is estimated to be about 29%; with cell energy conversion efficiency of 25% already being achieved at the research level, performance gains are nearing their limit. This development has been accompanied by a shift in the focus of competition to cost. It is against this backdrop that Chinese firms have moved to the forefront so quickly. Despite nearing their limit technologically, crystalline silicon photovoltaic cells account for the majority of the market because in terms of the per-watt price[33] at the mass production level, crystalline silicon solar cells have the highest economic efficiency.

4.3 Merits and demerits of technology diffusion policies

Given these circumstances, if the full-volume feed-in tariff purchase system is started in Japan and the rapid diffusion of photovoltaic cell is promoted, a large number of crystalline silicon solar cells that provide high economic efficiency would probably be introduced at this time. Assuming that solar cells offering high economic efficiency directly would tend to be selected because photovoltaic cells are not a luxury product,

the possibility that installations of inexpensively produced foreign panels will increase is high.

Of course, in the sales of photovoltaic cell for homes there are various barriers to entry for foreign companies, such as certification processes, ensuring domestic distributors and installation contractors. Many overseas photovoltaic cell firms are already taking aim at the start of the feed-in tariff purchase system in Japan, however, and continue to establish sales offices in Japan[34]. In photovoltaic cells, which are evaluated by per-watt price, even if its product performance is excellent a company cannot compete and win if its cost is high. A flood of cheap photovoltaic cells is easy to imagine. In fact, in the United States, existing firms that have found themselves in difficulty amidst the onslaught of sales of inexpensive solar cells manufactured in China have filed a suit charging dumping[35].

Even if cells and modules are manufactured in other countries, there is still a sufficient possibility for expansion of the market in Japan to have a long-term economic effect if, as in the LCD panel industry, Japanese firms control the manufacturing devices and materials. However, most of the market for manufacturing devices for photovoltaic cells is controlled by European and American firms. With regard to materials, although Japanese firms have large market shares in cover glass, backing sheets and sealants[36], crystalline silicon photovoltaic cells use few intermediate materials to begin with and most of the cost is for the silicon raw material.

If the full-volume feed-in tariff purchase system is begun, photovoltaic cells will surely spread rapidly in a short span of time, perhaps even as seen in the former

examples of Germany and Spain. For resolution of energy and environmental problems, this is highly preferable. Moreover, if nothing else, domestic industries such as logistics, retailing and construction are likely to benefit by the spread of solar power. However policies to encourage the rapid spread of solar power in the domestic market will promote the spread of existing general-purpose technologies and an accompanying influx of low-cost items, and cause the international competitiveness of domestic photovoltaic cell manufacturers to decline even further. At the risk of being repetitive, it is not a case where “diffusion = economic growth.”

Worse, purchase price of 42 yen/kWh, far from international prices, will incur heavy burdens for electricity users. This high price may save domestic PV module producers for a couple of years, but have little effect for enhancing their international competitiveness under the highly standardized technologies.

We see the same

5 Conclusion

A green policy inevitably involves complex issues. It must simultaneously address not only the energy problem but also the environmental and economic problems. As long as these three problems are not balanced, any green policy will not last long. Various political responses are therefore being considered.

Many of the measures envisaged, however, seem to not sufficiently consider the contribution to long-term economic development through improvement of the

international competitiveness of firms in the anticipated new industries. In a word, they are poorly balanced even though they are drafted with the aim of solving the three problems simultaneously. Why is it thus? As reasons, the following three points have been identified in this paper.

(1) The “strange bedfellows” trap

(2) The power of the magic words “energy” and “environment”

(3) The illusion that “market expansion leads to economic growth”

Although it is sometimes necessary to attempt to solve the three different objectives of energy, the environment and the economy with a single political response, the “strange bedfellows” strategy is likely to become a problem. From the respective viewpoints of the environmental, energy and economic goals, a specific policy might not have sufficient validity. Sometimes it becomes possible to move forward with a policy simply because the policy is able to solve all three issues simultaneously. As too often happens, however, a situation may occur in which, even though the economic objective (or the energy or environmental objective) cannot be sufficiently accomplished, this is deemed acceptable with the excuse that the other two goals can be achieved. This is the strange bedfellows trap. When thinking about green policy, a political response that extends across many ministries and agencies is by all means necessary. If the ministries and agencies do not work closely together in a proper manner, however, the danger of falling into the “strange bedfellows” trap is high.

When the power of the magic words “energy” and “environment” is added to this mix, consideration of the long-term effects on the economy based on an industry level analysis becomes even more superficial. When something is claimed to be for the purpose of a stable energy supply and environmental protection, few are the individuals who can object.

That is not to say, of course, that the impact on the economy is not considered. What consequently becomes a problem, however, is the illusion that “diffusion (market expansion) leads economic growth.” In an industry where technological progress has slowed, technology has been generalized and competition is international in scope, expansion of the market in a specific country does not necessarily bestow sufficient benefits on that country’s economy. Indeed it might have the effect of providing customers to foreign companies. Still, because it is important for “the environment” and “energy,” the magic words appear again. Because such a mechanism can be glimpsed, it can be seen as dangerous.

There is no doubt the development and spread of renewable energy holds the key to solve environmental problems. It must not, however, be carried out in a manner that harms economy over the long term and leaves behind a huge bill to be paid by future generations. To move forward in a new energy industry, where to place the focus and the timing will be probably critical. As a nation, it will be especially important to judge what to invest resources in, and with what timing, through an industry or firm-level analysis that looks at the nature of the technologies that constitute the new energy industry, the technologies’ lifecycles, the degree to which the technologies have been

standardized, the international competitive conditions, comparative advantage, the sources of competitive advantage and the possibility of maintaining that competitive advantage. Of course, each firm's strategy will also be important.

What we are thought to need now is a scenario that clarifies the targets in our sights and timing in order to move ahead with conversion of the energy mix, based on a deep understanding of the realities of the technology and industry.

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[1] Target value envisaged in the case of maximum introduction in the August 2009 *Outlook for Long-term Energy Supply and Demand (Recalculation)* from the Ministry of Economy, Trade and Industry's Agency for Natural Resources and Energy

[2] In fact, most of the power supply to cover the shutdown of nuclear plants after the earthquake was supplied by restarting operations at shuttered oil-fired power plants. According to actual results for power generated and purchased, nuclear power generation, which accounted for more than 30% of all power with 21.7 billion kWh in February 2011, had fallen to just 2.1 billion kWh one year later in February 2012. On the other hand, over the same timeframe thermal power generation increased from 40.9 billion kWh to 62.9 billion kWh and now accounts for 74% of all power[2].

[3] Thermal power also includes coal and LNG, and the cost for thermal power generation rises even further if only oil-fired thermal power is considered.

[4] *Sankei News*, September 14, 2011
http://sankei.jp.msn.com/life/news/110914/trd11091400320000-n1.htm

[5] According to the *2011 IEA Key World Energy Statistics*, in the first quarter of 2011 Japan had the third highest electricity rate for industry among 23 countries, and the sixth highest rate for households among 27 countries.

[6] Taken from the Agency for Natural Resources and Energy's *New Energy Industry Study Group Interim Report* released in March 2012

[7] "Slapdash Trial Calculation of CO_2 Reduction From Home Appliance Eco-Points: Replacement Purchase Setting, All '95 Models of Same Size," *Asahi Shimbun*, February 5, 2011, evening edition, p.1.

[8] The number of TVs shipped domestically during the eco-point program period was approximately 40 million units; assuming the annual power consumption per unit was reduced by 21kWh, the total

reduction in power consumed comes to 840 million kWh. Assuming a household electricity rate of 20yen/kWh, the total savings comes to 16.8 billion yen. This entire 16.8 billion yen amount cannot be called the result of the eco-point program, however, because even without the introduction of eco-points, replacement purchases would likely have been made in conjunction with the transition to terrestrial digital broadcasting, and energy-saving measures conceivably would have been introduced in the competitive television market.

[9] The average years of use was assumed to be 9.5, the average for the figures from the *Consumer Confidence Survey* category "Trend in Replacement Purchases of Main Durable Consumer Goods (Normal Household)" for March 2010 (9.3 years) and March 2011 (9.7 years). Next, the number of domestic units shipped during the eco-point period and the number of domestic units shipped nine years and six months earlier were determined by television size based on JEITA data. The weighted average was then calculated by multiplying the number of units shipped each year by the power consumption by the size of the televisions sold each year, which was obtained from the Ministry of the Environment's "Shinkyusan" on-line energy efficiency website.

[10] Of course, our purpose is not to assert the program was indiscriminately ineffectual, because it did achieve various results; these include the fact development of energy-saving technologies was accelerated, and consumers' energy conservation awareness was heightened, as a result of this program.

[11] Ministry of Economy, Trade and Industry Economic and Industrial Policy Bureau, Research and Statistics Department; *The Analysis of all Industrial Activities (The First Quarter of 2011)*: "[Topics] Influence of the Eco-Point System for Home Appliances on Production and Consumption" June 14, 2011

[12] According to a survey by *DigiTimes*.

[13] Of course this is not to assert that all of these problems are because of eco-points. Developments such as the continuing strength of the yen, and especially the depreciation of the won, which has boosted the export competitiveness of rival Korean firms, have been directly critical factors.

[14] "Sony Cuts TV Sales Target by Half Business Loss Up to 175 Billion Yen　Will Seek to Shrink Panel Procurement Costs" *Nihon Keizai Shimbun*, November 3, 2011 morning edition p. 9.

[15] "Hitachi to Withdraw from TVs　Price Competition with Korea　Limits　Shrinking Domestic Market　Each Company Reviewing its Business" *Tokyo Yomiuri Shimbun*, August 4, 2011 morning edition, p. 8.

[16] The purpose here is not to criticize Eco-Point Program. We present no materials here simply to judge the worth of the program as a whole, and do not plan to pass judgment, because the program probably had various effects indirectly. Nevertheless, the reason this example has been introduced is that it illustrates a

trap into which policies concerning the environment and energy seem to fall.

[17] "Notification Concerning Greenhouse Gases Emissions Volume in Fiscal 2007 (Final Figures)," Ministry of the Environment press release materials, April 30, 2008.

[18] "Eco-Action Points Guidelines," Ministry of the Environment, March 2011.

[19] Remarks by Hideki Minamikawa on October 31, 2007 to the House of Councillors Research Committee on International Affairs and Global Warming Issues.

[20] Remarks by Kenji Kondo (then-director of the Ministry of Economy, Trade and Industry Commerce and Information Policy Bureau) on April 14, 2009 to the House of Councillors Committee on Economy and Industry.

[21] Remarks by Kenji Kondo (then-director of the Ministry of Economy, Trade and Industry Commerce and Information Policy Bureau) on April 1, 2009 to the House of Councillors Committee on Economy and Industry.

[22] For example, remarks by Kazuo Matsunaga (then-director of the Ministry of Economy, Trade and Industry Policy Bureau) on April 14, 2009 to the House of Councillors Committee on Economy and Industry.

[23] Remarks by Masaaki Taniai (then-Vice Minister) on April 22, 2009 to the House of Councillors Committee on Economy and Industry.

[24] Remarks by Kazuyoshi Akaba on March 13, 2009 to the House of Councillors Committee on Economy and Industry.

[25] Remarks by Masaaki Kobayashi (then-Councillor, Minister of the Environment Secretariat) on March 24, 2009 to the House of Councillors Committee on Economy and Industry.

[26] Remarks by Kunio Hatoyama (then-Minister of Internal Affairs and Communications) on April 16, 2009 to the House of Councillors General Affairs Committee.

[27] Takeishi, Aoshima and Karube (2012) highlighted the "strange bedfellows" strategy as one method of proceeding with innovation activities that are highly uncertain. It has been shown that when investment in uncertain innovation is not easily justified, parties promoting an innovation can appeal to various individuals and reasons and obtain support for the innovation from various viewpoints.

[28] The consumer surplus was unmistakably increased by the introduction of eco-points.

[29] Cost of Photovoltaic Power Generation National Institute of Advanced Industrial Science and Technology (AIST) Research Center for Photovoltaic Technology, November 8, 2009;http://unit.aist.go.jp/rcpvt/ci/about_pv/economics/cost.html

[30] In a trial calculation in 2007, the power generation cost for photovoltaic power was 46 yen/kWh.

One-third of this amount, however, was financial expense (20-year loan, 4% annual interest rate). The cost excluding interest is thought to be about 30 yen/kWh. When considered this way, it's believed that as electricity for the home solar power will certainly reach grid parity in the near future. Another problem, however, is that a large proportion of the photovoltaic generation module cost is the cost for raw materials (70% or more), a variable cost, which makes it difficult to achieve a mass production effect. Unlike liquid crystal panel, which have seen rapidly falling prices in recent years, solar panels have few intermediate materials and there is a high probability that mass production will not necessarily lead directly to a drop in cost. In fact it has been pointed out that many of the cost reductions to date have been achieved in the power module and installation costs (Kono et al., 2004), and it is thought that realizing cost reductions through extensions of existing technology that will achieve the road map will be difficult.

[31] Preferential treatment for photovoltaic generation is not confined to Japan but is a global trend.

[32] "Phasing Out Nuclear Power: Achievable in 50 Years With No Negative Economic Effect Employment From Solar Power – Trial Calculations by University of Tokyo Associate Professor," *Mainichi Shimbun*, July 3, 2011 morning edition, p. 2.

[33] The cost to produce 1W of electric power.

[34] "Overseas Leaders in Photovoltaic Cells Follow Each Other into Japan – Taiwan's Motech Industries to Build Plant in Hokkaido" *Nihon Keizai Shimbun*, August 6, 2011 morning edition, p. 11.

[35] "7 U.S. Firms Bring Suit Against Chinese Solar Cell Manufacturers Charging 'Dumping"; Case Likely to Affect Sino-U.S. Ties" *Nihon Keizai Shimbun*, October 20, 2011, evening edition p. 3.

[36] Ministry of Economy, Trade and Industry, Agency for Natural Resources and Energy *Interim Report of the Study Group* on *New Energy Industry* March 2012.

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