Trends in Electricity Conservation Measures: Focusing on Responses by Industry Groups and Companies

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As well as the direct damage resulting from the earthquake itself, electricity supply and demand has become a major problem due to the accident at the Fukushima Daiichi Nuclear Power Plant triggered by the Great East Japan Earthquake. Accordingly, this paper discusses trends in electricity conservation measures in 2011 and the issues that arose as a result.

Broadly speaking, there are two types of characteristics in companies' electricity conservation measures. Firstly, overall trends concerning specific electricity conservation measures include a reduction in overtime, moving work start and finish times and total hours forward, changing the timing or length of summer holiday periods, and altering the prescribed days off. Secondly, differences were seen in the measures implemented, according to the characteristics of the business establishment in question. While there is a tendency for head offices to seek to conserve electricity by shortening total working hours, one can see a trend among factories and warehouses toward trying to promote electricity conservation by shifting the operating times, while maintaining the current working hours.

Problems that arose as a result of electricity conservation measures include the fact that they imposed a cost burden on companies. More specifically, these included increases in costs arising from the installation of private power generation equipment and co-generation to conserve electricity, inventory management costs, and labor costs resulting from weekend and night-time shifts.

Having said that, the electricity conservation carried out in FY2011 did not result solely in a cost burden being imposed on companies. Electricity conservation measures also had positive effects, in terms of making corporate management more efficient and diversifying individuals' ways of working.

I. Introduction

The damage resulting directly from the Great East Japan Earthquake on March 11, 2011 was immense, but one of the characteristics of this disaster was that its effects were not confined to this directly-inflicted damage, as the accident at the Fukushima Daiichi Nuclear Power Plant resulting from the earthquake also triggered major problems in regard to electricity supply and demand. The electricity supply and demand problems were not restricted to the areas served by Tokyo Electric Power Company and Tohoku Electric Power Company, but also spread to the areas served by Kansai Electric Power Company and Kyushu Electric Power Company, resulting in efforts being made to conserve electricity across the whole of Japan during the summer of 2011. These electricity supply and demand problems continue to be a major issue in 2012, and do not seem likely to be a purely temporary phenomenon.

This paper discusses trends in electricity conservation measures implemented in 2011 in the aftermath of the earthquake and the resulting issues, focusing primarily on a survey carried out by the Japan Institute for Labour Policy and Training and data that have already been published.

II. Electricity Supply and Demand Problems (Electricity Conservation Measures)

According to a report by the Ministry of Economy, Trade and Industry, within the area served by the Tokyo and Tohoku Electric Power Companies, which had set numerical targets for electricity conservation during the summer of 2011, if one compares the days when the air temperature was the same level as those of the previous year, one can see that the reduction among major commercial customers with contract demand of at least 500kW was 27% in the Tokyo region and 18% in the Tohoku region, while in a comparison of the maximum values, the reduction from the previous year was 29% in the Tokyo region and 18% in the Tohoku region. Even among small-scale commercial customers, with contract demand of less than 500kW, the reduction on the days when the air temperature was the same level as those of the previous year was 19% in the Tokyo region and 17% in the Tohoku region.[1] Thus, the initiatives of industrial sectors and individual companies had a reasonably positive effect, with their electricity conservation endeavors more than meeting the numerical targets. Details of the measures actually taken by companies and industries are examined below.

1. Company Initiatives

At the request of the government, companies implemented their own electricity conservation measures during the summer of 2011. Table 1 provides a summary of some examples of those initiatives.

As the table shows, companies are implementing measures in various ways. An urgent questionnaire survey concerning companies' responses to the disaster carried out by the Institute of Labour Administration provides an insight into the trends among specific electricity conservation measures being implemented or considered by companies (*Rosei Jiho* 2011). The sample size is not so large, but it is a very interesting survey in that it asks specifically about measures being implemented at head offices, factories and business offices.[2] Figure 1 shows a number of points that emerged from this survey that are worthy of attention.

[1] See Ministry of Economy, Trade and Industry, "Follow-up Concerning Electricity Supply and Demand Measures This Summer" (http://www.meti.go.jp/press/2011/10/20111014009/20111014009-2.pdf)

[2] The survey responses covered 105 head offices, 59 factories and warehouses, and 73 business offices and stores.

Table 1. Electricity Conservation Measures by Various Companies

Komatsu (Construction machinery)	Considered the utilization of private power generation in its factories and the flexible use of the holiday system in its office divisions, with a view to achieving its reduction target of at least 30%.
Secom (Security)	The company has a state-of-the-art data center with excellent energy conservation capabilities. Combines information security with electricity conservation.
Fujifilm Holdings (Precision chemistry)	Aimed to meet the target through mass introduction of LED lighting and full use of private power generators.
Fujitsu (Electrical machinery)	Relocated several thousand servers, with some shifted to Toyama Prefecture, in the area served by Hokuriku Electric Power Company, and others transferred to Hyogo Prefecture, in the area served by Kansai Electric Power Company. Private power generation was expanded at manufacturing bases.
Panasonic (Electrical machinery)	Further strengthened the home-working initiative and energy conservation efforts focused on machinery and devices at its business establishments that it was already promoting.
Toshiba (Electrical machinery)	Brought forward to the summer on a rotational basis the holidays of factory employees in the Greater Tokyo area that had been scheduled for the autumn.
Softbank (Communications)	Introduced cloud computing and distributed iPads and iPhones to all staff in an attempt to achieve a 30% reduction.
Nippon Steel Corporation (Steel)	Power purchased from external providers accounts for only 8% of its total electricity usage. Sought to conserve that 8% by switching operations to night shifts and carrying out annual repairs before the summer.
Nippon Paper (Paper manufacture)	Electricity conservation measures at head office included the introduction of summer time and the switching off of lights at 18:00.
Mitsui Chemicals (Chemicals)	Achieved 100% private power generation at its flagship Ichihara Works in Chiba Prefecture and maintained its 25% reduction target despite a cost increase.
Coca-Cola (Japan) Company (Soft drinks)	Achieved a 33% reduction in electricity consumption, far in excess of the government target, through stopping the cooling functions of each of its vending machines in turn.
Seven & i Holdings (Distribution)	Invested ¥10 billion in such initiatives as the introduction of LED lighting and solar photovoltaic power generation, with the aim of achieving a 25% reduction in electricity consumption at its 7-Eleven stores.

Table 1 (*Continued*)

Showa Denko (Chemicals)	Electricity conservation measures at its Ichihara Site, which is home to Showa Denko's Chiba Regional Office and Showa Denko Electronics, which produces electronic materials, such as computers and hard disk recorders, included switching operating times to night shifts and using private power generation.
Oriental Land (Theme park)	At the Tokyo Disneyland and Tokyo DisneySea theme parks, the company curbed use of indoor and outdoor lighting within the parks, while putting visitor safety first. It also sought to conserve electricity in non-customer-facing areas. Furthermore, it introduced private power generation.
MORI Building (Real estate)	The in-house power generation equipment that had been installed in the Roppongi Hills complex, which it operates, came into the limelight at the time of the earthquake and increased its brand power. For more than a month after the disaster, it supplied electricity to Tokyo Electric Power Company. It began to offer a service providing its tenants with data on their power consumption, with the objective of supporting their electricity conservation endeavors.
Odakyu Electric Railway (Railways)	Responded by reducing the number of its *Romansuka* limited express trains, revising its timetables, and partially halting the use of ticket machines, among other measures.
Taiheiyo Cement (Cement)	Curbed power consumption by devising appropriate shifts, while avoiding operations out of normal hours and on weekends, as much as possible, and supplied power to Tokyo Electric when it had spare capacity in its own private power generation.

Source: Compiled from *Keizaikai* (2011).

The top electricity conservation measures are "thorough implementation of overtime reductions," "bringing forward work start and finish times," "changing the timing and length of consecutive summer holidays," and "altering prescribed days off (changing the original prescribed working hours from weekdays to weekends, through rotational shut-downs)." In particular, "bringing forward work start and finish times" showed less variation between head offices, factories and warehouses, and business offices and stores than any other option, so one could describe it as the main electricity conservation measure,[3] which would be the easiest initiative to introduce, as they make it possible to conserve electricity during peak hours, without hindering normal operations.

Furthermore, "bringing forward work start and finish times" was one of the main electricity conservation measures among both manufacturing and non-manufacturing industry, so there is a tendency for it to be used as the main electricity conservation measure, ir-

[3] 52.4% of head offices, 40.7% of factories and warehouses, and 39.7% of business offices and stores brought forward their work start and finish times.

respective of the industry type (*Rosei Jiho* 2011).[4]

On the other hand, "reducing the prescribed working hours each day," "using modified working hours systems," "introducing and extending flexi-time systems," and "personnel shifts via transfers to areas outside those served by Tokyo and Tohoku Electric Power Companies" do not appear to have been considered very much as measures and seem to have been methods that were difficult to adopt as the main means of conserving electricity.

Moreover, at the head office, factory and business office level, one can see slight differences among the aforementioned measures, in terms of the importance attached to them. In particular, while head offices did not attach a great deal of importance to "reducing day shifts on weekdays and implementing evening and night shifts," with 12.4% of these establishments introducing this measure, it was a major electricity conservation measure for factories and warehouses, being implemented by 32.2% of such establishments. A similar trend can be seen in regard to "altering prescribed days off," a measure implemented by 52.5% of factories and warehouses, but only 36.2% of head offices. In contrast, while 18.1% of head offices introduced home-working, the share of business offices and stores introducing this measure was only half of this level, and hardly any factories or warehouses took this step (1.7%).

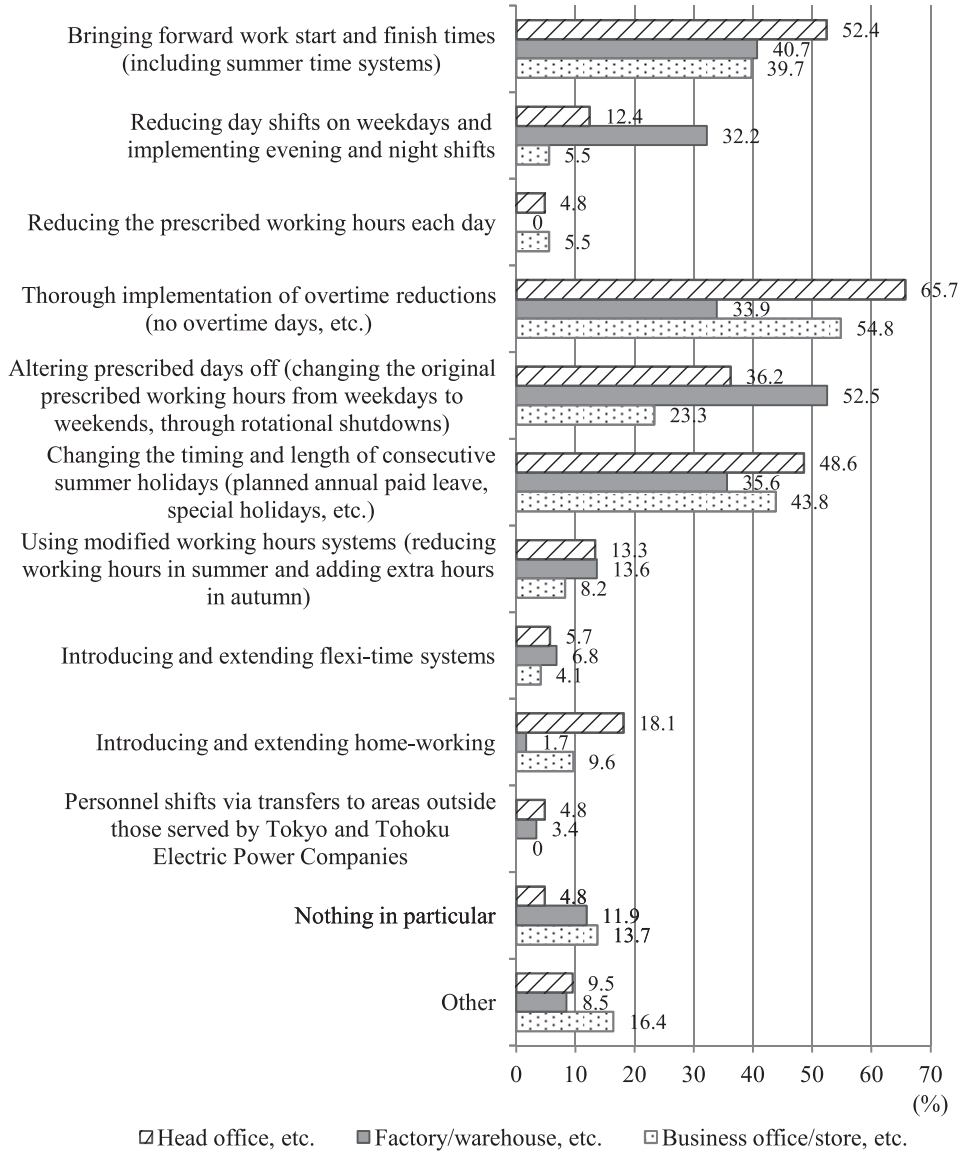
Among factories and warehouses, it is difficult to alter working hours, by reducing hours or changing the number of days of holiday or days off, but instead, they tried to deal with this by altering start and finish times, while maintaining the same length of working hours. On the other hand, one can see a tendency for head offices to seek to conserve electricity by reducing total working hours, by such means as "overtime reductions" and "changing the timing and length of consecutive summer holidays."

Thus, electricity conservation initiatives depend on the type of business establishment, such as whether it is a head office or factory, etc., rather than on the industry type.

The trends among business offices and stores are similar to those of head offices, lying somewhere in the middle between head offices and factories, but compared with those, one does not see any pronounced characteristics in terms of the types of measure introduced. Moreover, if one looks at the proportion of respondents answering "nothing in particular," the highest share is accounted for by business offices and stores, so one can perhaps say that these are the business establishments at which it is hardest to implement electricity conservation measures.[5] While it is not possible for such establishments to extend holidays or reduce overtime as freely as head offices, they cannot alter store opening hours as flexibly

[4] Among head offices, it was the top measure, being implemented by 49.0% of companies in manufacturing industry and 55.4% of companies in non-manufacturing industry. Among factories and warehouses, it was implemented by 38.1% of companies in manufacturing industry (3rd) and 47.1% of companies in non-manufacturing industry (1st). Among business offices and stores, it was implemented by 33.3% of companies in manufacturing industry (3rd) and 45.0% of companies in non-manufacturing industry (1st).

[5] Whereas the proportion of respondents answering "nothing in particular" was 4.8% among head offices and 11.9% among factories and warehouses, it was 13.7% among business offices and stores.



Source: Compiled from *Rosei Jiho* (2011, 13).

Figure 1. Details of Electricity Conservation Measures (Multiple Responses)

as factories can change their hours of operation, so there is a possibility that electricity conservation measures are difficult for them to implement.

The main challenges arising from electricity conservation measures are “it is difficult to forecast the amount of electricity that should be conserved (45.6%),” “it is difficult to secure the understanding of business partners and customers (38.9%),” and “discussions

with labor unions and employee representatives (convincing staff and securing their understanding) (30.0%)."[6] The first issue can be resolved by providing numerical targets, but the latter two are problems relating to dealings between companies and labor-management relations within companies, so it is anticipated that they could form a bottleneck hindering electricity conservation.

2. Industry Initiatives

As described above, each company implemented its own electricity conservation measures. One example of initiatives being undertaken as an industry, cutting across the boundaries between companies, can be seen in the motor vehicle industry. The Japan Automobile Manufacturers Association (hereinafter referred to as JAMA) spearheaded electricity conservation initiatives across the whole of the sector, so this industry is worthy of attention. Unlike the initial proposal, the actual rotating shutdowns involved taking Thursdays and Fridays as scheduled days off and then operating on Saturdays and Sundays, but it would seem to be worth leaving a record of what JAMA's initial proposal was, so let us touch upon this below.

(1) JAMA Initiatives

At a meeting of the Nippon Keidanren (Japan Business Federation) to discuss measures to curb electricity demand during the summer, held on April 15, 2011, JAMA proposed "rotating days off," involving different industries switching their days off to different days. The JAMA proposal sought to reduce peak power demand by changing from a system of taking days off on weekends, when electricity demand is lower than on weekdays, and allocating days off on weekdays between industries in order to equalize electricity demand throughout the week; the specific details were as follows.[7]

In order to combine the curbing of peak power demand with industrial activities, JAMA put forward a basic policy focused on the following two approaches: (i) individual companies maximizing their efforts to conserve electricity in order to avoid rolling blackouts, based on the premise of seeking to avoid any impact on production activities,[8] and (ii) industry-wide initiatives in parallel with this, aimed at achieving an even greater peak power suppression effect. One measure proposed that was focused on the second approach,

[6] Multiple answers were requested, so the total for the top three responses is greater than 100%.

[7] For further details, see Japan Automobile Manufacturers Association "*Kaki Denryoku Juyo Yokusei ni Muketa Rinban Kyujitsu/Kaki Kyujitsu Shifuto no Goteian* (A Proposal for Rotating Days Off and Shifting Summer Holidays Aimed at Curbing Electricity Demand During Summer)" (www.keidanren.or.jp/japanese/policy/2011/029/shiryo3-1.pdf).

[8] Rolling blackouts were implemented for a time in the immediate aftermath of the disaster, with the objective of keeping the quantity of power used within the supply capacity of the electric power companies. For further details, see Tokyo Electric Power Company "Implementation plan of rolling blackout on and after Tue, March 15, 2011" (http://www.tepco.co.jp/en/press/corp-com/release/11031313-e.html).

which was aimed at achieving an even greater peak power suppression effect, was the rotation of days off and long-term holidays within and across industries. One could say that the advocacy of electricity conservation initiatives that go beyond the level of individual companies is a characteristic of JAMA.

One factor behind JAMA's proposal was the fact that there was a large gap between electricity demand on weekdays and on weekends. According to materials submitted by JAMA, whereas peak electricity demand is 58 million kW on weekdays, it is 48 million kW on weekends, so if rotating shutdowns could be used to equalize the gap between weekdays and weekends that results from days off being concentrated on Saturdays and Sundays, it would be possible to curb peak demand on weekdays without reducing the number of hours worked.

Let us now look at the specific proposals. JAMA put forward two measures as methods that would make it possible to curb peak power demand on weekdays, while maintaining normal, full-strength operations. The first involved dividing the 12 companies belonging to JAMA into seven groups, in order to create groups with uniform demand, and allocating days off between the seven groups in such a way that two groups would always be on their days off on any given day of the week, as follows: (i) Monday & Tuesday; (ii) Tuesday & Wednesday; (iii) Wednesday & Thursday; (iv) Thursday & Friday; (v) Friday & Saturday; (vi) Saturday & Sunday; and (vii) Sunday & Monday.

Tables 2 and 3 express this system in tabular form. As can be seen from Table 2, whereas peak power demand on weekdays in each group is 1,000 kW, it is only 400kW on weekends. As a result, there is a large gap between peak power demand on weekdays and that on weekends. The main purpose of the proposal was to seek to even out these differences by implementing rotating shutdowns. The shaded cells in Table 3 show the groups with rotating shutdowns on those days.

As can be seen from the peak power demand rows in Tables 2 and 3, if rotating shutdowns are carried out, it becomes possible to curb peak power demand while maintaining the normal number of hours worked. Thus, JAMA asserted that the amount of weekend power consumption could be allocated to one or other of the weekdays and peak demand for power on weekdays could therefore be reduced by implementing rotating shutdowns.

The second initiative involved distributing the summer holidays usually taken from August 6 to 14 over a period of about a month, from the beginning of the school summer holidays on July 25 through to the end of August. In this case as well, JAMA proposed splitting the 12 companies into four groups, dividing them as evenly as possible in terms of their electricity demand, and having them take their summer holidays in such a way as to avoid coinciding with the traditional *obon* holiday (August 13 to 15) as far as possible.

JAMA estimated that implementing these initiatives would enable weekday peak power consumption during the third quarter of the calendar year to be reduced by 18% in July, 21% in August and 17% in September.

However, peak power demand for JAMA alone accounts for no more than 4% of the

Table 2. Peak Power Demand If Rotating Shutdowns Were Not Implemented
(Unit: kW)

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Group A	1000	1000	1000	1000	1000	400	400
Group B	1000	1000	1000	1000	1000	400	400
Group C	1000	1000	1000	1000	1000	400	400
Group D	1000	1000	1000	1000	1000	400	400
Group E	1000	1000	1000	1000	1000	400	400
Group F	1000	1000	1000	1000	1000	400	400
Group G	1000	1000	1000	1000	1000	400	400
Peak Power Demand	7000	7000	7000	7000	7000	2800	2800

Source: Compiled from Japan Automobile Manufacturers Association, *Kaki Denryoku Juyo Yokusei ni Muketa Rinban Kyujitsu/Kaki Kyujitsu Shifuto no Goteian* [A proposal for rotating days off and shifting summer holidays aimed at curbing electricity demand during summer].

Table 3. Changes in Peak Power Demand through Rotating Shutdowns
(Unit: kW)

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Group A	1000	1000	1000	1000	1000	400	400
Group B	1000	1000	1000	1000	400	400	1000
Group C	1000	1000	1000	400	400	1000	1000
Group D	1000	1000	400	400	1000	1000	1000
Group E	1000	400	400	1000	1000	1000	1000
Group F	400	400	1000	1000	1000	1000	1000
Group G	400	1000	1000	1000	1000	1000	400
Peak Power Demand	**5800**	**5800**	**5800**	**5800**	**5800**	**5800**	**5800**

Source: Same as Table 2.

demand from all major commercial customers. Accordingly, JAMA called on all industries and companies to cooperate in implementing the concept of rotating days off and shifting summer holiday periods on a larger scale, with a view to achieving "smart curbs on peak demand without reducing the number of hours worked." JAMA's proposal involved rotating days off and shifts in summer holidays among a number of industries and companies, so that ultimately industry/company A would take its days off on Mondays and Tuesdays, while industry/company B would take its days off on Tuesdays and Wednesdays, etc. From this, one can see that JAMA envisaged implementing these measures on a scale beyond that

of a single industrial sector.

(2) Initiatives in the Department Store Sector

Outside manufacturing industry as well, there are sectors that are implementing initiatives aimed at electricity conservation throughout the sector as a whole. A leading example of this is the department store sector. The department store sector is one in which suspensions of electricity supply, through rolling blackouts, etc., became a particularly serious problem.

In the department store sector, the impact of secondary damage from reduced opening hours due to rolling blackouts was much greater than the harm resulting directly from the disaster. It takes time for electricity to return to POS (point-of-sale) systems and to check the safety of equipment, so when blackouts occur, it is necessary to close the store for an hour or two either side of the power outage. Consequently, some stores had to completely abandon their business that day. As a result, department store turnover in the Kanto region demonstrated a hitherto-unprecedented major fall of 21.5% in March 2011, in the immediate aftermath of the disaster (Japan Institute for Labour Policy and Training 2011). It is a sector in which electricity problems have a major impact on business, due to their effects on systems that form the basis of their operations, such as POS systems.

In response to this situation, the Japan Department Stores Association established a committee to examine countermeasures, which carried out a simulation of the degree to which each member company within the area served by Tokyo Electric Power Company could reduce power consumption through various electricity conservation measures, without implementing rotating shutdowns. As a result, it was ascertained that each member department store could achieve reductions of 13-25%, so on May 13, the Association published the “Guidelines for Electricity Conservation at Department Stores” and put together a checklist, after which it provided individual companies with support in formulating concrete action plans.

(3) Cases in Which Electricity Demand Did Not Become a Major Problem (Where the Sale of Power Was Possible)

Incidentally, there were some sectors in which electricity conservation was not that great a problem.[9] For example, in the paper industry, pulp and paper mills have boilers that generate heat within the plant, so they are able to carry out private power generation, enabling them to cover the majority of their electricity needs themselves. The Japan Paper Association says that “it is possible to sell electricity by putting spare boilers into service,” and some companies have actually started to consider the option of selling electricity to power

[9] Here, not being a problem refers to the fact that plants are able to supply the power required for their operations themselves. Naturally, there is a possibility that the costs involved in this could become a major problem. The problems arising from securing such electricity will be dealt with in Section III of this paper.

companies. Moreover, in the oil sector, oil refineries are equipped with private power generation facilities and some are working on selling electricity generated on this basis (Japan Institute for Labour Policy and Training 2011).[10]

Thus, there are sectors in which the suspension of power supply from electricity companies due to rolling blackouts, etc. would not have that great an impact on plant operation. Moreover, in such sectors, it is actually possible to sell electricity to electric power companies.

Mitsui Chemicals, which is one of the companies listed in Table 1, is introduced here as a company implementing an initiative focused on the sale of electricity.[11] Mitsui Chemicals, which is a chemical manufacturer, has its private power generation equipment at its flagship Ichihara Works operating at full capacity, so that as well as avoiding having to purchase any electricity at all from Tokyo Electric Power Company, it is able to sell its surplus power back to the latter company.[12] In return for supplying the surplus power, Mitsui Chemicals charges Tokyo Electric Power Company the cost of the fuel required to generate the power supplied, thereby seeking to mitigate the burden of fuel costs resulting from power generation. There are two important points here. The first is that it is actually possible to sell the power generated at a factory. The second is that private power generation entails the problem of how to cover the requisite fuel expenses.

Thus, although it is possible to acquire the electricity required for operations without depending on a power company, this also has the potential to give rise to new problems. The next section examines the problems arising from electricity conservation measures.

III. Problems Arising from Electricity Conservation Measures

1. Increase in Costs Arising from Electricity Conservation

This section examines the issues arising from electricity conservation, with reference to the Agency for Natural Resources and Energy, "*Kaki no Denryoku Jukyu Taisaku no Foro-appu ni Tsuite (Oguchi, Koguchi, Katei ni Okeru Torikumi no Kensho)* (Follow-up Concerning Summertime Electricity Supply and Demand Measures [Review of Initiatives by Large-scale, Small-scale and Household Customers])."[13]

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[10] Naturally, in the oil sector, even where private power generation is possible, measures focused on power peak cuts are being implemented in areas other than plants, such as in offices and at refineries and oil terminals.

[11] For further details regarding the case of Mitsui Chemicals, see *Nikkei Ecology* (2012).

[12] It supplied approximately 40,000kW to Tokyo Electric Power Company between July and September 2011.

[13] For details of examples unable to be covered in this paper, see Agency for Natural Resources and Energy, "*Kaki no Denryoku Jukyuu Taisaku no Foro-appu ni Tsuite (Ooguchi, Koguchi, Katei ni Okeru Torikumi no Kenshou)* (Follow-up Concerning Summertime Electricity Supply and Demand Measures [Review of Initiatives by Major and Small-scale Commercial Customers and Household Customers])" (http://www.meti.go.jp/press/2011/10/20111014009/20111014009-3.pdf).

Firstly, problems for large-scale commercial customers[14] include the increase in costs arising from private power generation and the replacement of lighting equipment in order to conserve electricity. Of the 20 large-scale commercial customers profiled in the report, as many as 14 cited private power generation and co-generation as factors behind cost increases arising from electricity conservation, so one can see that even if companies secured the necessary power while conserving electricity, they incurred a commensurate cost burden. In particular, the problem of cost increases arising from private power generation was pointed out by companies in manufacturing industry, including both the metals and non-metals sectors[15]. Although private power generation was not cited by those in the distribution and other (office-based) categories, respondents in these sectors did point out an increase in costs due to changing lighting equipment (introduction of LED lighting).

Furthermore, cost increases resulting from electricity supply and demand problems affected not simply private power generation and changes of lighting equipment, but also had an impact on inventory management costs and labor costs. Among companies in the chemicals sector were some that front-loaded production in June, ahead of the electricity conservation period, in order to avoid having to reduce production due to cuts in daytime peak power demand, which resulted in their having inventory that would not have arisen under normal circumstances. The costs arising from such things as the purchase of packaging materials due to inventory accumulation amounted to approximately ¥180 million, which was a considerably rise in costs due to electricity conservation measures.

In addition, labor costs also rose among companies that altered their operating hours and switched to shifts at night and on weekends, in order to conserve electricity at peak times. It is not known precisely how much this actually amounted to, but for example, one motor vehicle company has stated that its labor costs increased by 1.3 times, while in the non-metals sector, a company manufacturing optical fibers and power lines reported a rise of 1.2 times.

On the other hand, among small-scale commercial customers, due to the fact that their operations had to conform to the weekend shifts introduced by large corporations, small and medium-sized enterprises, whose business partners cover a multitude of sectors, were apparently compelled to operate without any days off, as they had deadlines set for both weekdays and weekends.

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[14] Large-scale commercial customers are consumers (business operators) with a contract demand of at least 500kW, while small-scale commercial customers are consumers (business operators) with a contract demand of less than 500kW.

[15] Two out of three companies in the chemicals sector, three out of three in the non-metals manufacturing sector, two out of three in the electronics manufacturing sector, three out of three in the motor vehicle sector, and three out of three in the precision instruments and household electrical appliances sector cited this as a factor. In addition, although there is only one example in the steel sector, that one company also indicated this as a factor behind cost increases. Moreover, as an aggregate answer of 15 major companies in the steel sector, the problem of cost increases due to private power generation is also mentioned.

From the information above, one can see that companies bore costs resulting from electricity conservation, due to such factors as the use of private power generation, production adjustment and inventory management, and increases in labor costs due to the shifting of operations to weekends and nights. Although there are differences in degree, cases have been reported in which the costs amount to the equivalent of hundreds of millions of yen on a company scale, and billions of yen when looked at across an entire industry, so one can say that the cost burden of electricity conservation is an issue that cannot be overlooked. Moreover, the issues pointed out by small and medium-sized enterprises demonstrate that it is necessary to give further consideration to the formulation of industry-wide rules concerning operating times. What kind of measures should be taken in response to these problems is a key issue for the future.

2. Electricity Problems Other Than Issues of Electricity Supply and Demand

The electricity problems triggered by the nuclear power plant accident also affect industry sectors in ways other than those relating to issues of electricity supply and demand. For example, in the department store sector, a tendency for foreign tourists to avoid visiting Japan in the aftermath of the earthquake led to a decline in sales at department stores, not only in disaster-stricken areas, but also nationwide.

If one looks at the trends in visits to shops by and turnover from foreign tourists in March 2011, one can see that the number of shoppers plummeted by 44.2% compared with the previous year, while turnover also slumped, falling by 52.2% compared with the previous year. The primary factor behind this was the fall in the number of tourists from China, South Korea and Hong Kong, who accounted for the overwhelming majority of tourists before the disaster (Japan Institute for Labour Policy and Training 2011). Visitors from overseas are extremely important customers for department stores, which are trying to increase sales amid a shrinking domestic market. Thus, electricity problems had an impact on the economy other than in terms of supply and demand.

IV. Electricity Conservation, Corporate Management and Individual Ways of Working

This section returns to the subject of initiatives by companies, looking at examples in which electricity conservation measures have had some kind of impact on management or individual ways of working, as well as pointing out the possibility that recent efforts to conserve electricity have led to greater management efficiency and a diversification in individual ways of working. Below, Komatsu, Seven-Eleven Japan and FamilyMart are profiled as examples in which the implementation of electricity conservation measures provided an opportunity to make corporate management more efficient, while Isetan Mitsukoshi Holdings (hereinafter referred to as “Isetan Mitsukoshi HD”) and KDDI are examined as cases in

which one can see the possibility that measures to conserve electricity are bringing about a change in individual ways of working. These examples are worthy of attention, in that they provide an insight into other aspects of the effects of electricity conservation measures.

1. Reforms in the Production Process Itself Triggered by Electricity Conservation

Among the companies listed in Table 1, which provided a summary of companies' electricity conservation initiatives, are some which took the opportunity offered by the conservation of electricity to improve their business operations. For example, in the process of its electricity conservation activities, the construction machinery manufacturer Komatsu discovered that more electric power was being wasted in its factories than had been envisaged.[16] More specifically, a succession of instances of electricity being wasted became apparent, such as in the devices used to plane construction machinery frames and in processes including cooling and heat treatment. In response to this, the company initiated endeavors to reduce peak electricity usage through reforms of production processes.

The company firstly revised the heat treatment process, which alters the hardness and properties of the construction machinery components. Hitherto, the metal was machined into its final shape while undergoing repeated rounds of heating and cooling, but the company took up the challenge of establishing a new production process in which a single round of heat treatment is used toward the end of the process of manufacturing the finished item, after almost all of the machining of the component has been completed. Through this, the company is aiming to reduce the amount of electricity used per component. Moreover, it has also rethought the welding process, which is essential to the assembly of construction machinery.

As well as reforms in the manufacturing division, the company's design division has also begun to consider revising the blueprints it uses, from the perspective of reducing electricity consumption, with the aim of achieving design that leads to a reduction in processing time. These initiatives are being carried out because, even if the effect per component is minimal, the amount of power consumption that can be reduced overall is significant, if the design of the product as a whole can be revised. In addition, the company is apparently also attempting to curb electricity consumption by curtailing the use of air conditioning and lighting through the consolidation of production lines within factories.

Moreover, in order to ensure that electricity conservation measures identified in one factory are shared throughout the company, a subcommittee that enables engineers in each field to share information beyond individual factory boundaries has been established. Thus, the company is building up a structure that enables it to ensure that if new production techniques relating to electricity conservation become established in one factory, they can be spread laterally to other factories.

As well as seeking a 50% reduction in peak power usage compared with the FY2010

[16] See *Nikkei Business* (2012) for the example of Komatsu outlined below.

level by FY2014 through a range of initiatives, Komatsu is aiming to halve its total electricity consumption, with the objective of cutting electricity procurement costs by approximately ¥4 billion annually on a non-consolidated basis.

As can be seen from the aforementioned initiatives, electricity conservation during the summer of 2011 triggered by electricity supply and demand problems has also had the effect of bringing to light hitherto-unnoticed waste in production processes and encouraging more efficient management.

2. Cost Reductions through Electricity Conservation

As shown in Table 1, in April 2011, Seven-Eleven Japan, which develops convenience stores as franchise chains, set a target of achieving a reduction in electricity consumption of approximately 25% compared with the previous year, and has been implementing electricity conservation initiatives at around 6,000 stores within the area served by Tokyo Electric Power Company.[17] The main electricity conservation measures have focused on replacing equipment in stores, such as switching to LED lighting[18] and replacing air conditioners, refrigeration cases and microwaves with energy-conserving models. In addition, solar panels have been installed in 1,000 stores.

The financial burden resulting from these initiatives was not inconsiderable, amounting to approximately ¥10 billion. However, at the same time, the introduction of such energy conservation measures also has advantages for both the franchise owners and Seven-Eleven Japan, as they have brought about a reduction in the running costs of stores.[19]

Thus, electricity conservation measures are also contributing to making management more efficient, through efforts to reduce store running costs. Furthermore, FamilyMart, which is also in the distribution industry, is aiming to deploy on a global scale the experience it gained from electricity conservation in 2011. At the AFC Summit, an annual conference of FamilyMart executives, which was held in Shanghai on November 1, 2011, a plan was approved to reduce electricity usage by 20% from the 2010 level by 2015 at approximately 20,000 stores in seven countries and regions around the world, including Japan, as well as Taiwan, South Korea, China, Thailand, and Vietnam.[20]

One of the factors encouraging global deployment of electricity conservation is the belief that has spread throughout the company since the Great East Japan Earthquake, that systems that can deal with unprecedented risks, such as earthquakes and other disasters, should be put in place in each country. Compared with Japan, emerging nations such as Vi-

[17] See *Nikkei Ecology* (2012) for the example of Seven-Eleven Japan outlined below.

[18] The lighting at 5,000 of the approximately 6,000 stores within the area served by Tokyo Electric Power Company has been switched to LED lighting.

[19] See also the following statement by Seven-Eleven Japan's PR team. "It is somewhat hard to recognize the effects due to increases in electricity charges and other factors, but there is no doubt that this has led to a reduction in costs for stores in the chain." (*Nikkei Business* [2011, 11])

[20] See *Nikkei Business* (2011) for the example of FamilyMart.

etnam and China have a great deal of scope for conserving electricity, so a considerable electricity conservation effect can apparently be anticipated, simply from installing the latest refrigeration case and air conditioner models.

Thus, there are companies that are applying the knowledge they have gained from electricity conservation to their overseas operations, with the aim of making their stores around the world more efficient.

3. Promotion of Improvements in Management Efficiency and a Better Work-Life Balance

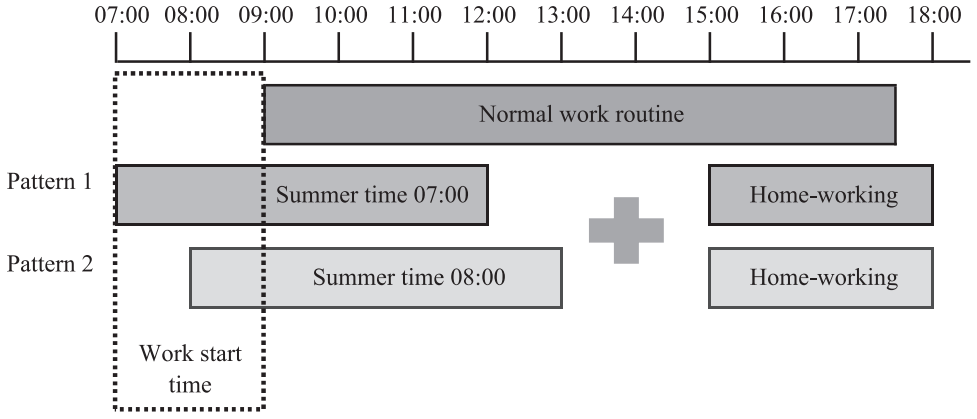
There are also companies that are taking the opportunity offered by electricity conservation measures to try to rethink approaches to management and ways of working. Isetan Mitsukoshi HD, which is one of the major players in the department store sector, decided to take the opportunity offered by electricity conservation measures to reinstate store closing days on weekdays and reduce opening hours. This can be said to be of no small significance, as it is a sign of change in the trend toward increasing the number of days on which shops open and extending opening hours, which has been ongoing since the 1990s.

February and August, which are known as "*nippachi*" (after the names of the months) in the department store sector, are usually periods of sluggish growth in turnover. Accordingly, Isetan Mitsukoshi HD decided to introduce store closing days at three stores in the Kanto region during August, when sales traditionally declined, as it was more efficient from a business perspective to reduce the number of days on which stores opened during this period. It was apparently eight years since a store closing day had been in place. As well as making management more efficient, this initiative apparently also became the focus of attention within the department store sector because it helped to promote a better work-life balance for employees (Japan Institute for Labour Policy and Training 2011).

The initiative subsequently continued and is spreading among a greater number of stores. In February 2012, the store closing day initiative was expanded to include all nine stores within the Tokyo metropolitan area, and it was announced that reduced opening hours would be introduced at a specific store, for the first time since the 1973 oil crisis, 39 years earlier.[21] More specifically, store opening hours were cut by an hour, going from 10:00–20:00 under normal circumstances to 10:30–19:30 for a period of about half a month from mid-February. In conjunction with this, employee working hours also changed from a two-shift system, with a 09:45–19:10 shift and a 10:45–20:10 shift, to all staff working from just after 10:00 until just after 19:30.

Furthermore, in August 2012, the company plans to expand the focus of the reduced opening hours initiative to cover five major stores, including the Ginza and Nihonbashi branches of Mitsukoshi, as well as extending the duration of the initiative from a couple of

[21] See *Sankei Biz* article dated November 1, 2011 (http://www.sankeibiz.jp/business/news/111101/bsd1111011105003-n1.htm).



Source: Compiled by the author from *Nikkei Ecology* (2011).

Figure 2. Image of the Combined Summer Time and Home-Working System

weeks to one month.[22] Although the opening hours differ at the stores concerned, the changes at each store will result in a reduction in opening hours of between 30 minutes and one hour.[23]

As a result, while the total number of hours worked each month will not change, it is anticipated that the number of days on which staff can go home earlier will increase. Moreover, as well as being an electricity conservation measure, such initiatives are being implemented with the objective of reducing costs and improving customer service through a better working environment, so one can see that the recent electricity problems have the potential to effect changes in various forms, in terms of increasing the quality of service and improving the work-life balance of employees.

4. Home-Working

One can see cases in which electricity conservation measures did not simply trigger the introduction of home-working, but also led to the system being applied to many staff. For example, the information and communications provider KDDI implemented an initiative focused on curbing the amount of power used at head office by combining home-working with the introduction of a summer time system.[24]

More specifically, it involves staff starting work an hour or two earlier than usual, working for five hours at the office, and then completing the remaining 2.5 hours of work at home in the afternoon (Figure 2). Approximately 40% of the staff at head office are using this working pattern. As a result of this initiative, as well as conserving electricity through

[22] In February 2012, this was introduced at the Isetan Shinjuku flagship store only.
[23] See *Nihon Keizai Shimbun* article dated June 2, 2012.
[24] See *Nikkei Ecology* (2011) for the example of KDDI.

economizing on air conditioning and lighting, the company succeeded in achieving a 62% reduction in peak power consumption at head office in July 2011, compared with the previous year. Broken down by morning and afternoon consumption, electricity consumption was cut by approximately 50% in the morning, when workers are in the office, and by about 70% in the afternoon, when many staff are working from home. Although it is not possible to make a simple comparison, one can see that home-working systems can be effective in conserving electricity at offices.[25]

Incidentally, the electricity usage situation peculiar to this industry can be seen in the background to the decision to implement this initiative. At least 90% of electricity used by the company arises from communications equipment at its telecommunication bases. It has 13 business establishments with contract demand of at least 500kW in the area served by Tokyo Electric Power Company, which are therefore subject to the 15% reduction target. However, as it is necessary for telecommunication bases to operate around the clock, they became one of the business establishments at which it was difficult to make the requisite operational adjustments. This characteristic of the information and communications industry is thought to have been one factor behind KDDI's decision to promote electricity conservation through changes to ways of working, including the introduction of home-working.

At any rate, the fact that many staff have taken the opportunity offered by the electricity conservation measures to adopt home-working suggests that there is a possibility that such measures are triggering diversification in ways of working.

V. Conclusion

1. Summary of Findings

(1) Characteristics of Electricity Conservation Measures

Let us first of all look at electricity conservation measures undertaken by companies. Firstly, overall trends concerning specific electricity conservation measures include a reduction in overtime, moving work start and finish times forward, changing the timing or length of summer holiday periods, and altering the prescribed days off. Secondly, some differences were seen in the measures implemented, according to the characteristics of the business establishment in question. While there is a tendency for head offices to seek to conserve electricity by shortening total working hours, there is a trend among factories and warehouses toward trying to promote electricity conservation during peak hours by shifting the operating times, while maintaining the current working hours.

[25] Another initiative involves having whole floors or departments take the five-day summer holiday to which they are entitled between July and September at the same time, in order to conserve electricity.

(2) Problems Arising from Electricity Conservation Measures

Looking back on the results achieved in 2011, the reduction in electricity consumption exceeded the target and companies' initiatives have yielded generally positive outcomes, in terms of conserving electric power. However, electricity conservation has given rise to a commensurate cost burden for companies. This demonstrates that the recent electricity conservation endeavors entailed some pain for companies. Factors behind the cost increases included increases in costs arising from the installation of private power generation equipment and co-generation to conserve electricity, inventory management costs, and labor costs resulting from weekend and night-time shifts.

(3) Other Effects of Electricity Conservation

Having said that, as described in Section IV of this paper, the recent electricity conservation endeavors did not result solely in a cost burden being imposed on companies. One would also wish to stress here that the electricity conservation measures implemented in 2011 also triggered greater efficiency in corporate management among some companies and industries. In this sense, electricity conservation measures are helping to strengthen the competitiveness of companies.

At the same time, efforts to reduce electricity consumption are having an impact on individual ways of working. Although one could not say that electricity conservation measures are becoming that widespread, there are companies that have taken the opportunity offered by the need to conserve electricity to popularize home-working among their employees. Moreover, in the department store sector, in which there had hitherto been a sustained trend toward increasing the number of days on which stores opened and extending opening hours, one major company not only introduced store closing days, but also decided to reduce opening hours. Such changes have the potential to have some effect on the work-life balance.

2. Ongoing Observation and Studies Required

The electricity supply and demand problems triggered by the Great East Japan Earthquake—including the question of how to construct a next-generation electricity supply and demand system—are issues affecting not only the disaster-afflicted areas, but also the whole of Japan. The question of how the electricity conservation measures implemented by companies bring about (or fail to bring about) a metamorphosis in individual ways of working in future could become a profoundly interesting theme in labor research. If they do give rise to a metamorphosis, they could become a major theme in their own right as a change in the way of working itself; if not, then they will become a deeply interesting theme representing the rigidity of Japanese people's ways of working.

However, before all of this, one must ask why, for example, the rotating shutdowns proposed by JAMA could not be implemented according to the initial plan, and why they

have not spread as a method that transcends the boundaries between industrial sectors. It will be necessary to carry out a proper follow-up regarding such questions. Moreover, as can be ascertained from the passages concerning the responses of individual companies, there were quite a few companies that cited problems relating to dealings between companies (relationships with business partners and clients) and labor-management relations within the company as issues arising from efforts to conserve electricity. The issue of electricity conservation being faced by companies and its relationship to inter- and intra-company business practices could become a valuable topic in endeavors to shed new light on the characteristics of Japanese companies.

At any rate, from the perspective of contributing to academic research as well, rather than ending as a temporary boom, it would be desirable to maintain an interest in the range of responses implemented in relation to the disaster and conduct regular observation and studies on an ongoing basis.

References

Business Labor Trend. 2011. Daini tokushu: Higashinihon daishinsai ni yoru sangyo/koyo heno eikyo [Special feature 2: Impact of the Great East Japan Earthquake on industry and employment]. July, 34–43.

Keizaikai. 2011. Kininaru kaisha no denryoku kokatsu taio manyuaru [Manuals for dealing with electricity depletion introduced by companies of concern]. June-July, 16–37.

Nikkei Business. 2011. Tanomarezutomo fuyu mo setsuden [Conserving electricity in the winter as well without being asked]. No. 1618, 10–11.

———. 2012. Seme no setsuden taisaku: Kiki wo sakate ni taishitsu kaizen [Aggressive electricity conservation measures: Reforms that beat the crisis]. No. 1637, 70–73.

Nikkei Ecology. 2011. Mada heraseru [Further reductions can still be made]. No. 148, 84–85.

———. 2012. Natsu no kyokun fuyu no sonae [The lessons of the summer are preparations for the winter]. No. 151, 93–103.

Rosei Jiho. 2011. Romu kanrimen kara mita natsu no setsuden taisaku [Summer electricity conservation measures from the perspective of labor management]. No. 3798, 10–25.