Great East Japan Earthquake: Economic Restoration Processes and Impacts on the Major Industries in Japan

March 31, 2011

Yano Research Institute Ltd.
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Introduction

The disaster caused by the Great East Japan Earthquake is still expanding at this moment with its scale and seriousness far beyond our imagination. The serious incident at Fukushima Daiichi Nuclear Power Plant, especially, is presenting concerns that it may have serious impacts, not only on the direct power supply in the disaster-stricken regions and the TEPCO power supply areas in the central part of Japan, but also on the Japanese industrial policies and international competitiveness.

In the meantime, vigorous activities for the recovery are beginning to be observed. The Sendai airport, pictures of which being engulfed by the Tsunami broadcasted on TV was so shocking, has restarted aerial transportation services with its main runway on 16th of March, only 5 days after the disaster. The restoration of social infrastructure is progressing at breathtaking speed, as shown in the full re-opening of the Tohoku Expressway. Also, many disaster-stricken enterprises have started their activities for the normalization of their businesses, by achieving partial resumption of their businesses within 2 to 3 weeks.

It is extremely difficult to analyze the true nature of the damages and the scope of economic losses when the actual status of the wide disaster-stricken regions has not been correctly identified yet. However, the economic environment in Japan has changed drastically since the 11th of March. Under this new business environment, we have to continue or re-start our activities for the future.

In this paper, we have sorted out and reorganized the information made available through various broadcastings and newspapers, and reviewed the economy in the northern regions in Japan after the 11th of March in comparison with the restoration processes from the Hanshin-Awaji Earthquake disasters in 1995. As the external conditions for the economy has changed considerably since then, we are well aware that the estimates are rough and disorderly, but it could be utilized as a reference for the assessment of post 3.11 business environment with business persons who have very little referential information.

At Yano Research Institute, a project is being launched for implementing a full-scale research on the impacts of Great East Japan Earthquake on the industry and consumer expenditure, and to reconstruct a future vision of Japan. We believe that we could contribute to restoring Japan as well as the disaster-stricken regions by fulfilling our responsibility as a market research organization.

We would like to present this report with our best wishes for the earliest possible restoration of the disaster-affected regions and normal daily lives.

March 31, 2011
3.11 Japan Restoration Project Team
Yano Research Institute Ltd.

Note: The disaster-stricken 5 prefectures in this report are Aomori, Iwate, Miyagi, Fukushima and Ibaraki-Prefecture.
Summary

[Research objective]
Yano Research Institute has conducted a research on the Great East Japan Earthquake for reviewing the economic restoration process and impacts on the major industries in Japan, as hereinafter described.

[Research outline]
1. Research period: 29th to 31st of March 2011
2. Research methodologies
   1) Indexes are created for the impacts of Hanshin-Awaji Earthquake on the Hyogo-Prefecture, which then are applied to the prefectural economy in the disaster-stricken regions.
   2) As to the impacts on the major industries, senior executive researchers in charge of respective industrial segment have prepared a report thereon.

[Summary]
1. Prefectural economy in the restoration period
   • Suppose the impacts of Hanshin-Awaji Earthquake on the various industries can be applicable to the Great East Japan Earthquake, the construction sector in the first year after the disaster can be expected to be 167 percent, or to increase by 1,337 billion yen in value compared to fiscal 2010.
   • Gross prefectual production of the construction sectors in the disaster-affected 5 prefectures in 4 years after the disaster is estimated at least to exceed 12,200 billion yen.
   • The most severely impacted will be wholesale and retail sectors, which will shrink to 86 percent of the preceding year after the disaster, and will require very long period to recover.
   • The above estimates, however, have not considered the impacts of the incident at the Fukushima Daiichi Nuclear Power Plant. In consideration of the social, economic and geographical conditions and the demographic structure of the disaster-stricken prefectures, in addition to the special form of disaster with the earthquake plus Tsunami, the damages of the Great East Japan Earthquake are far wider in geographical scale and greater in magnitude, and would take much longer to recover compared to the Hanshin-Awaji Earthquake, even if the impacts of the nuclear plant are excluded.

2. Impacts on the major industries
   • Although large amount of restoration related demands can be expected centered on the construction sector, significant and long-term negative impacts will be imposed on the broader industries, including production, distribution, consumption and service industries, such as the drop of consumer confidence affected by the prolonged nuclear power plant issues, shortage of electric power supply, increase of energy cost, over-reaction to the nuclear contamination of Japanese products in the overseas market, and so forth.
   • In the advanced industrial sectors, such as electronics materials and automotive components and materials, especially, the greater impacts on the global supply chains might lead to the changes in the competitive landscape of materials and components in the global market place
   • In the meantime, the changes toward next generation will accelerate in every industrial segment. It is likely that the rejuvenation of industry and the renovation of social and
economic structure will advance rapidly, including the creation of smart grid concept and next generation city visions, enhanced development of new energy & environment related technologies, accelerated shift to high value-added products in the manufacturing sector, and the reinforcement of international competitiveness with restructuring of global strategy. We should get rid of the long-preserved outdated custom of trades, and resolve the issues which have long been shelved at once, and makes it an opportunity to survive through the globalization with new visions and strategies, which should be a direction for the restoration of Japan.
I. Mid-term forecast of the economy in northeastern Japan based on the post Hanshin-Awaji Earthquake period as a model

Japanese government announced on 23rd of March that the total damage of Great East Japan Earthquake will amount to 15 to 25 trillion yen, which exceeds by large the total damage of Hanshin-Awaji Earthquake of 9 trillion 926.3 billion yen, not counting the economic impacts of Fukushima Daiichi Nuclear Power Plant incident and the rolling blackouts which became necessary.

The World Bank also has commented on the impacts of Great East Japan Earthquake as listed below in “East Asia and Pacific Economic Update 2011 vol. 1” in comparison with the Hanshin-Awaji Earthquake. While accurate information is scarce, Hanshin-Awaji Earthquake should provide important clues for us to review the impacts of this unprecedented natural disaster on our economy.

<table>
<thead>
<tr>
<th>Damage</th>
<th>March 11, 2011: Damage Estimates range from $122 to 235 billion (2.5 to 4 percent of GDP)</th>
<th>The 1995 Kobe earthquake: $100 billion (around 2 percent of GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death toll</td>
<td>15,214 (dead and missing)</td>
<td>6,434</td>
</tr>
<tr>
<td>Cost of private insurance</td>
<td>$14 - $33 billion *</td>
<td>$783 billion</td>
</tr>
<tr>
<td>National budget for reconstruction</td>
<td>$12 billion from current budget Much more in FY 2011</td>
<td>$38 billion over 2 fiscal years</td>
</tr>
</tbody>
</table>

Sources: Government of Japan and private estimates and projections as of March 11, 2011.
Note: * AIR World estimate

1. Industrial structure of Hyogo-Prefecture and the process of restoration

Before starting the study on the disaster-affected regions, the industrial structure of Kobe-Prefecture at the time of disaster and the transition of its gross prefectural production during the restoration processes should be confirmed as below.

![Hyogo-Pref. Distribution by Industry (FY 1994)](image_url)

Source: Prefectural Economy Statistics, Hyogo-Prefecture
The outbreak of Hanshin-Awaji Earthquake was on the 17th of January 1995, which was in the fiscal year of 1994 (From 1st of April 1994 to the end of March 1995). The Japanese GDP in fiscal 1994 was in a trend of slight increase, 101 percent against the preceding year, but the gross prefectural production in Kobe-Prefecture in the same period shrank down to 96.9 percent against the preceding year. In the meantime, special characteristics of the industry in restoration process are
clearly observed in the differences caused by industrial sector, as shown in the big restoration demands generated in specific sectors of the industry based on the large-scale restoration investments after the disaster.

The transition of the economy in Hyogo-Prefecture after the Hanshin-Awaji Earthquake disaster shown in the above listed graphs could be summarized as below.

Transition of Gross Prefectural Production of Secondary Industries in Hyogo-Pref. after Hanshin-Awaji Earthquake by Sector

Transition of Gross Prefectural Production of Tertiary Industries in Hyogo-Pref. after Hanshin-Awaji Earthquake by Sector (Excl. Government Service)

Source: Prefectural Economy Statistics, Hyogo-Prefecture

Source: Prefectural Economy Statistics, Hyogo-Prefecture
• Although the disaster-stricken fiscal year turned out to be negative growth, the economic growth exceeding national average has been achieved in fiscal 1995 with 105 percent and 1996 with 103 percent year-on-year (The national average was 102 percent year-on-year in fiscal 1995 and the same in 1996)

• The construction industry has grown considerably in the 2 years after the disaster, while social infrastructure industries such as electricity, gas and water supply have achieved positive growth with the restoration demands as well. These 2 sectors contributed to increasing the restoration demands.

• The financial service and insurance have grown through 3 years after the disaster. It is presumed that the financial requirements in corporate and household sectors, such as housing loan re-arrangements and new insurance contracts have supported the growth of these industries.

• Real estate business has dropped in the disaster-stricken year, but turns around to growth along with the progress of restoration processes.

• The service industry was flat. However, in view of the fact that the service industry has recorded the rapid growth in the mid to late 1990s driven by social welfare, nursing business and information service industry, and recorded 2.5% national average growth in 1995, the growth rate of service industry in this region should be considered negative.

• The most significant and prolonged impacts of the disaster was on the wholesale and retail industries, which needed 4 years to recover.

2. Transition of the industrial structure and gross prefectural production in the disaster-stricken 5 prefectures, and the forecast in the post disaster restoration period

1) Economic structure of the disaster-stricken area (5 prefectures)
The total gross prefectural production of the disaster-stricken 5 prefectures in northeastern regions in fiscal 2008 was 36,243 billion yen, while the gross prefectural production of Hyogo-Prefecture in 1995 was 19,659.9 billion yen, which indicates a large-scale economy of Hyogo-Prefecture with Kobe City. Although geographical and social structure of Hyogo and the disaster-stricken 5 prefectures are different, such as the ratio of population engaged in agriculture and fishery, there were not so much differences than expected between the disaster-stricken 5 prefectures in fiscal 2008 and Hyogo-Prefecture in 1994 when compared based on the large classification of the industry.

2) Forecast of the post disaster economy of the northeastern regions based on the post Hanshin-Awaji Earthquake period as a model

Based on the presupposition that the impacts of unprecedented natural disasters on each respective industry are the same, the impacts of the Great East Japan Earthquake on the disaster-stricken 5 prefectures are estimated as hereinafter described. Although the method of estimates may be too simple and rough, the estimates could be used as referential data until higher accuracy estimate becomes available with more accurate understanding of the situation in the near future.

[About the estimate]
- Forecasted growth rate of 2.4 percent for the Japanese economy announced by the World Bank on July 14, 2010 was applied uniformly to the gross prefectural production of the 5 disaster-stricken prefectures in fiscal 2009.
- Then, the changes in the production of Hyogo-Prefecture by industrial sector in the restoration period from Hanshin-Awaji Earthquake in 5-year period starting from fiscal 1994 are applied to the total gross prefectural production of the 5 prefectures by the industrial sector.

- External factors such as the latest prediction value of GDP for fiscal 2011 are not considered.
- As above stated, the service industry in the period from 1994 to 1999 has achieved high growth rate of average 3.6 percent, driven by the growing markets such as welfare, nursing, health
insurance, information service and so forth. As the service industry in the disaster-stricken 5 prefectures from 2005 to 2008 has also achieved average 2.6 percent, which is higher than the other industries, Hanshin-Awaji Earthquake model is applied to the service industry as well without any modifications.

Impacts of Great East Japan Earthquake on the gross prefectural production, and the forecast of economic growth in the restoration period by industrial sector

Transition of Total Gross Prefectural Production in Disaster-affected 5 Prefectures after Great East Japan Earthquake (Forecast)

Estimated by Yano Research Institute based on the Prefectural Economic Statistics of Each Prefecture

Transition of Total Gross Prefectural Production in Disaster-affected 5 Prefectures after Great East Japan Earthquake by Industry (Forecast)

Estimated by Yano Research Institute based on the Prefectural Economic Statistics of Each Prefecture
As the disaster happened on 11th of March 2011, and its impacts may become evident in fiscal 2011, which is set to be the first restoration year. Supported by the restoration demands, economic growth by 5 percent compared to the previous year is expected in the fiscal 2011.
Needless to mention, the major sector of restoration demands is construction industry, which is expected to expand to 167 percent (1,337 billion yen in value) of the previous year due to the large-scale restoration demands, and contribute to improving the gross prefectural production.

Although it is necessary to wait for the determination of total damage and the plan for restoration, the total gross prefectural production of the construction sector in 4 years after the disaster is expected at least to exceed 12,200 billion yen.

In the meantime, the total gross prefectural production in agriculture and fishery will decrease to 97 percent of the previous year.

The most impacted will be the wholesale and retail industries, which will shrink down to 86 percent of the previous year. The recovery will take much longer than the other industries.

However, the impacts on the agriculture and fishery will have to be much greater than Hanshin-Awaji Earthquake. And considering the compound nature of disaster coupled with the Tsunami, and additional impact of Fukushima Daiichi Nuclear Power plant incident, the total impacts of the disaster on the economy can be much greater in scope and longer it will take to recover.

Impacts of the nuclear power plant incident, especially, will extend across the whole greater Tokyo metropolitan area in addition to the disaster-stricken 5 prefectures, and the significance of the impacts beyond the calculation. Thus, there is a strong concern that the economic damage may greatly exceed the restoration demand in fiscal 2011.

* Reference

- The estimates herein contained are on the total gross prefectural production of the disaster-stricken 5 prefectures, and are different from the total of the actual restoration demands.
- The total damage of Hanshin-Awaji Earthquake was about 10,000 billion yen, based on which Hyogo-Prefecture made a 3-year budget for 5,700 billion yen as an infrastructure related budget for the restoration.
- Due to the implementation of this budget in the initial fiscal year of restoration, the construction sector has increased by 1,030 billion yen compared to the previous year.
- The gross prefectural production of the construction sector in Hyogo-Prefecture has returned to the pre-disaster level after 5 years. Supposing the pre-disaster level at 1,500 billion yen, the push-up effect in these 4 years amount to 3,385 billion yen. The total gross prefectural production of the construction sector in these period (4 years) amount to about 9,385 billion yen.
II. Actual status of the disaster

The Cabinet Office has estimated the direct damage of Great East Japan Earthquake on the national stock such as housing, facilities of private enterprises, water and gas supplies, roads, port and harbors to be about 0.8 to 1.2 percent, about 16 to 25 trillion yen in value, of the total stock of 2,054 trillion yen. Further, private estimates announced indicate that the impacts of disaster will decrease the national real GDP in Jan to March and Apr to Jun quarters by 0.2 to 1.2 percent (Approx. 0.2 to 1 trillion yen) on annual rate (Based on the researches by individual securities companies).

However, the accurate amount of damages is not known yet. Further researches and information are awaited.

[Reference] Breakdown of the damages in Miyagi-Prefecture only, *Information not available yet for the other prefrectures

<table>
<thead>
<tr>
<th>Work type</th>
<th>Controlled by Prefecture</th>
<th>Controlled by City/Town (Sendai-shi excluded)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of cases</td>
<td>Roughly estimated damage</td>
<td>Number of cases</td>
</tr>
<tr>
<td>Road</td>
<td>149</td>
<td>5,228</td>
<td>496</td>
</tr>
<tr>
<td>Bridge</td>
<td>252</td>
<td>37,488</td>
<td>8</td>
</tr>
<tr>
<td>Revet</td>
<td>321</td>
<td>20,504</td>
<td>2</td>
</tr>
<tr>
<td>Dam</td>
<td>28</td>
<td>987</td>
<td></td>
</tr>
<tr>
<td>Sea coast</td>
<td>63</td>
<td>62,879</td>
<td></td>
</tr>
<tr>
<td>Sand erosion prevention</td>
<td>3</td>
<td>737</td>
<td></td>
</tr>
<tr>
<td>Park</td>
<td>4</td>
<td>3,250</td>
<td>272</td>
</tr>
<tr>
<td>Urban disaster-prevention</td>
<td>1</td>
<td>3,100</td>
<td>0</td>
</tr>
<tr>
<td>Port and harbor</td>
<td>177</td>
<td>28,976</td>
<td></td>
</tr>
<tr>
<td>Sewerage</td>
<td>7</td>
<td>71,400</td>
<td>48</td>
</tr>
<tr>
<td>Pref. operated housing</td>
<td>18</td>
<td>1,150</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>973</td>
<td>235,690</td>
<td>738</td>
</tr>
</tbody>
</table>

(Announced by Civil Engineering Division, Miyagi-Prefecture)

Great East Japan Earthquake
Miyagi-Prefecture: Status of the damages agriculture and related industries (As of 09:00am on the 30th of March 2011)

<table>
<thead>
<tr>
<th>Work type</th>
<th>Total damage</th>
<th>(Of which by Tsunami)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>412,008</td>
<td>406,307</td>
</tr>
<tr>
<td>Livestock</td>
<td>2,190</td>
<td>927</td>
</tr>
<tr>
<td>Forestry</td>
<td>52,263</td>
<td>52,010</td>
</tr>
<tr>
<td>Fishery</td>
<td>347,200</td>
<td>373,200</td>
</tr>
<tr>
<td>Others (Facilities)</td>
<td>8,500</td>
<td>8,500</td>
</tr>
<tr>
<td>Total</td>
<td>849,160</td>
<td>840,944</td>
</tr>
</tbody>
</table>

(Announced by Civil Engineering Division, Miyagi-Prefecture)
## III. Impacts of Great East Japan Earthquake on major industries

<table>
<thead>
<tr>
<th></th>
<th>Short-term (up to 6 months after)</th>
<th>Medium-term (after 6 months to 3 years)</th>
<th>Long-term (over 3 years after)</th>
<th>Short-term (up to 6 months after)</th>
<th>Medium-term (after 6 months to 3 years)</th>
<th>Long-term (over 3 years after)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction</strong></td>
<td>Reconstruction projects supported by government's large supplementary budget should be implemented for early restoration of quake-stricken factories and commercial facilities and for construction of temporary housing.</td>
<td>In addition to reconstruction projects such as public infrastructure restoration, large-scale ground improvement of reclaimed land along Tokyo Bay, including Urayasu-shi, Chiba, are expected. During the process of earthquake reconstruction shifting into full swing, discussion will be activated toward more disaster-resistant nation, and the demand for reconstruction businesses will be expanded as a consequence. As is the case with environmental measures such as energy savings at factories and buildings, ant-disaster measures will become mandatory.</td>
<td>Shortage of construction materials occurs due to damages of construction material manufacturers affected by the disaster. Temporary cash flow problems are widely emerging due partially to difficulties in procuring collection from the disaster-affected customers. Responses to the needs may be insufficient as a result of restructuring efforts engaged in for the last few years.</td>
<td>Supply-demand ratio may become right due to reconstruction needs, and there is a concern about fuel cost escalation. Some see this state as just temporary expansion of construction demand. Some companies could undergo restructuring, including personnel firing planned before the earthquake.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Housing</strong></td>
<td>Three thousand temporary houses are planned to be supplied by the housing industry. Out of this, two thousand houses will be built by the temporary housing industry and one thousand houses by major housing manufacturers. There also should be push demands from those who are concerned about condominium price escalation.</td>
<td>Additional demands related to the reconstruction are expected from apartment and rental housing, housing reconstruction, reinforcement against earthquake and renovation by own efforts of and/or at own expense of the earthquake victims. Used condominiums will be in good demand owing to the rising price of newly built condominiums and cheaper price of used condominiums. Quake-resistance standard will be tightened by revision of Building Standards Act. Spread of energy saving housing with such environment-responsive and energy saving systems as PV (photovoltaic) systems, fuel cells and rechargeable batteries will be triggered in the meanwhile. While there is a steady potential demand of 50 thousand units of new condominiums in the metropolitan Tokyo area, used condominium market will be activated by low-level demand of new condominiums.</td>
<td>Unstable factors include material shortage caused by the damages of housing material manufacturers stricken by the quake. In addition, unstable Middle East situation may cause material and fuel cost increase following the hike in crude oil price. Rise in price of condominiums to be developed in future will be unavoidable due to escalation of construction cost driven by the crude oil price in crane, supply shortage of housing materials, and competition in securing necessary building materials for construction sites.</td>
<td>Downturn in the buying motivation for houses will occur even in other areas than the stricken area. There is a concern about material and fuel cost increase following crude oil price increase. Demands for all-electric houses and related equipment as IH cookware will be stagnant due to forced electric power saving.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Building material</strong></td>
<td>Production will be enhanced for temporary houses, water and sewerage materials for bridges and housing equipment, all of which are necessary for reconstruction after the East Japan Great Earthquake. Special procurements for the reconstruction will be taken care of by utilizing production sites in West Japan and increasing imports. Supply shortage of iron and steel is limited.</td>
<td>As the case of “Housing” described above, additional demands related to reconstruction are expected from apartment and rental housing, housing reconstruction, reinforcement against earthquake and renovation by own efforts of and/or at own expense of the earthquake victims, in addition to the reconstruction demand for electric materials and other materials necessary for the public infrastructure reconstruction. As in the case of &quot;Housing&quot; described above, quake-resistance standard will be tightened by revision of Building Standards Act. Spread of energy saving housing with such environment-responsive and energy saving systems as PV systems, fuel cells and rechargeable batteries will be triggered in the meantime. Industry reorganization will be promoted by the increased number of M&amp;As.</td>
<td>Possible supply shortage of some construction materials such as plywood is a concern. In general, the reduction of workers by manufacturers makes it difficult to promptly arrange the necessary construction materials.</td>
<td>As in the case of “Housing” described above, downturn in the buying motivation for houses will occur in other areas than the stricken area. There is concern about material and fuel cost increase following crude oil price increase. Demands for all-electric houses and related equipment as IH cookware will be stagnant due to forced electric power saving.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The factors that will work to promote the reconstruction from the earthquake disaster and the recovery of Japanese economy are defined as "Drive factors". Likewise, the factors that will give adverse effects on the reconstruction and the economic recovery are defined as "Negative factors.*

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### Construction equipment/ Rental business

- **Short-term (up to 6 months after)**: Reconstruction demands are anticipated in broad scope of areas including hydraulic shovels, dump and other trucks, power generators, portable toilets, rubble removal, support services at evacuation shelters, various equipment for logistics and construction, various materials and human resources.

- **Medium-term (after 6 months to 3 years)**: Reconstruction demands will continue in the areas such as logistics and construction.

- **Long-term (over 3 years after)**: During the process of earthquake reconstruction shifting into full swing, efforts toward more disaster-resistant nation will be made, and the demand for related businesses will be expanded as a consequence.

### Automotive

- **Short-term (up to 6 months after)**: Consumer confidence in eco-cars will further improve. Expectations in electric vehicles will work to an advantage for the industry.

- **Medium-term (after 6 months to 3 years)**: Supply chains starting from raw materials to parts and components and finally to finished cars will be reviewed and renewed demand will be created subsequently. The eco-car market will grow. Spread of electric vehicles will be accelerated and related parts and components businesses will be enhanced.

- **Long-term (over 3 years after)**: Industry structure is going to change drastically, shifting from the conventional automotive industry utilizing internal-combustion engines to the next generation automotive industry typified by the hybrid vehicles and electric vehicles. New business opportunities will emerge with this change in structure.

### Electric appliances/ precision parts/ electronic components & parts

- **Short-term (up to 6 months after)**: Demand for electric appliances and equipment, most of which are for consumer use, will be newly generated for use in temporary housing.

- **Medium-term (after 6 months to 3 years)**: Improved production efficiencies realized by renewal of damaged production equipment and introduction of new equipment, and development of new products will be new foundations of competitiveness. Metabolism of the industry should be boosted by the developments.

- **Long-term (over 3 years after)**: Many companies have production sites devastated by the great earthquake, and there will be no prospects for full recovery. Overall supplies from main parts to niche parts will be in short supply. The semiconductor business, as a part of the process industry, will possibly face a prolonged shutdown.

### Drive factors

- **Short-term (up to 6 months after)**: Supply shortage may occur nationwide as large amount of construction equipment and rental materials are transferred to the devastated areas. Other concerns include raise of raw material and fuel costs such as the high crude oil price triggered by unstable Middle East situation.

- **Medium-term (after 6 months to 3 years)**: Shortage of construction equipment and rental materials is expected due to the nationwide reconstruction demands.

- **Long-term (over 3 years after)**: Demand status will go back to what it was before the earthquake and long-term construction demand will drop after the construction boom having been stemming from the reconstruction needs. Excessive competition before the earthquake will come back.

### Negative factors

- **Short-term (up to 6 months after)**: Demand status will go back to what it was before the earthquake and long-term construction demand will drop after the construction boom having been stemming from the reconstruction needs. Excessive competition before the earthquake will come back.

- **Medium-term (after 6 months to 3 years)**: Domest ic demands for new automobiles could decrease due to downturn in consumer confidence. There should be a negative impact on global supply chains as well. Rise of the overseas production ratio of Japanese automotive manufacturers may be accelerated.

- **Long-term (over 3 years after)**: Demand status will go back to what it was before the earthquake and long-term construction demand will drop after the construction boom having been stemming from the reconstruction needs. Excessive competition before the earthquake will come back.

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*The factors that will work to promote the reconstruction from the earthquake disaster and the recovery of Japanese economy are defined as "Drive factors". Likewise, the factors that will give adverse effects on the reconstruction and the economic recovery are defined as "Negative factors."*
<table>
<thead>
<tr>
<th>Drive Factors</th>
<th>Short-term (up to 6 months after)</th>
<th>Medium-term (6 months to 3 years)</th>
<th>Long-term (over 3 years after)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical</strong></td>
<td>- Excess supply of commodity due to the shutdown of production facilities, resulting in an oversupply of certain chemicals</td>
<td>- Improvement in production efficiencies</td>
<td>- Availability of high-performance materials will be shifted to high-performance producers with minimum expected.</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>- The fish catch in the Sanriku area drops as a consequence of the disaster, causing an increase in the import of fishery products.</td>
<td>- Agricultural products in West Japan will attract much more demand and the demand for rural areas will increase with recovery of logistics.</td>
<td>- The demand for rural areas will increase with recovery of logistics.</td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td>- The damage to domestic food production systems caused by the disaster will lead to a breakdown of supply chains and the number of market participants.</td>
<td>- The demand for rural areas will increase with recovery of logistics.</td>
<td>- The demand for rural areas will increase with recovery of logistics.</td>
</tr>
<tr>
<td><strong>Retail</strong></td>
<td>- The economic impact of the earthquake disaster is huge; the government is working to promote reconstruction.</td>
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</tr>
</tbody>
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*The factors that will work to promote the reconstruction and the economic recovery are defined as “Drive Factors.” Likewise, the factors that will give adverse effects on the reconstruction and the economic recovery are defined as “Negative Factors.”
<table>
<thead>
<tr>
<th>Drive factors</th>
<th>Negative factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transportation</strong></td>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td>Short-term (up to 6 months after)</td>
<td>Overall logistics demands for aid goods delivery to the disaster areas will increase. The government also adopts supportive measures to facilitate transportation, including issuance of instructions in which casting of international charter flight operations is incorporated.</td>
</tr>
<tr>
<td>Medium-term (after 6 months to 3 years)</td>
<td>Energy policies will be reviewed and new R&amp;D investments associated with the review are anticipated, and new markets will be created accordingly. To be specific, spread of such products as fuel batteries for home use and those for industrial use and NAS batteries will be accelerated. In addition, introduction of small dispersed power sources such as OHP will be promoted. Houses with LED lightings and HEMS for power control will be launched. Energy-saving home appliances will further advance.</td>
</tr>
<tr>
<td>Long-term (over 3 years after)</td>
<td>The demands for businesses that use electricity largely at night, or eco-hotels supply more specifically, electromagnetic cookers and electric flo or heating systems will drop. The industries are forced to review their production plans and/or reduce production in accordance with the planned electric outage. Huge costs will have to be paid for reconstruction of the nuclear power plant, solution to the electric power shortage and restoration of electric transmission and transformation facilities. The costs for CO2 reduction and spread of new energy resources will be escalating. The damages associated with the nuclear plant accident will have to be compensated. Electricity expenses could rise, and electricity shortage in summer season is expected. Nuclear energy policies must be reviewed and may be revised.</td>
</tr>
<tr>
<td><strong>Medical</strong></td>
<td>New construction and replacement of medical facilities are expected. Medical records will be more digitized and shared. Metabolism of industries and markets, including voluntary closure and M&amp;As, will progress.</td>
</tr>
</tbody>
</table>

*The factors that will work to promote the reconstruction from the earthquake disaster and the recovery of Japanese economy are defined as "Drive factors". Likewise, the factors that will give adverse effects on the reconstruction and the economic recovery are defined as *Negative factors.*
IV. Impacts on the buildings, constructions, life-line infrastructure

1) Impacts of the earthquake damages

Direct impacts on housing and general buildings are limited, although the interest in anti-earthquake construction will increase.

- In the past, every time major damages of earthquake broke out, people’s interest in anti-earthquake construction had increased, but subsided in a few years.
- It is likely that the people’s interest in anti-earthquake construction will increase again with the occurrence of Great East Japan Earthquake.
- However, after Hanshin-Awaji Earthquake, activities on seismic capacity evaluation and seismic retrofitting have already been progressing. The implementation of seismic capacity evaluation, especially, appears to have reached to a level that those determined have already completed the evaluation. (An understanding has been established that the basic seismic capacity can be secured by abiding by the existing new quake-resistance standards.)
- It is true that the implementation of seismic retrofitting has made little progress, which is due to the substantial expenses required for both public and private facilities including residential houses.
- Also, as the impact of Tsunami is so great rather than the damage of earthquake itself in the current disaster, the impression of earthquake damage itself to the people becomes relatively lower.
- Based on the above described conditions, the impacts of earthquake on the housing and general buildings are expected to be restrictive. (There will be an increased trend of enhancing seismic retrofitting of the public buildings with small seismic index of structure, but the actual implementation may not progress much due to the budgetary constraints.)

The demand for seismic retrofitting on the lifeline & infrastructure facilities will increase again.

- As also listed in the issues and measures for the restoration from Hanshin-Awaji Earthquake disaster, the needs for the promotion of disaster-resistant IT infrastructure and public utility conduits will become the tasks again.
- Although the nuclear power plant incident of Tokyo Electric Power Company has been attracting a lot of attentions, the electric power supply recovery in the regions serviced by Tohoku Electric Power Company is addressing another major problem. In case of Hanshin-Awaji Earthquake, the electric power supply has been fully recovered in a week or so, but in this disaster, even a recovery schedule has not been established yet as of 29th of March, after more than 2 weeks from the disaster. (Many transformer stations, transmission/distribution facilities have been damaged.) (It may require some more time to compare the recovery of gas, water supply and sewage with Hanshin-Awaji Earthquake.)
- These differences may be attributable to the fact that, while the impacts of Hanshin-Awaji Earthquake were concentrated to the relatively limited areas, such as Kobe-Shi and Awaji island, the disaster-stricken regions of this time are expanded to much greater geographical areas, with undulating landscapes including Ou-mountain ranges, and widely scattered residential areas.
- Based on these situations, the importance of seismic reinforcement of the infrastructure focusing on electric power supply will be highlighted again, and may contribute to enhancing the seismic retrofitting of water supply pipes and the development of quake-resistant public conduit, which has made little progress in the past. (However, these issues might possibly be left on hold due to the significance of the nuclear power plant incident issues.)
2) Impacts of the Tsunami damages

Promotion of the addition of disaster-reduction functions on the large-scale constructions in the coastal area, and anti-Tsunami measures at the rivers

- At the time of Hanshin-Awaji Earthquake, the liquefaction of reclaimed lands in the bay area attracted attentions. In the current disaster, enormous damages have been caused by the giant Tsunami.
- Although it is not possible to easily think of effective countermeasures, there are two remarkable points.
- One is the tidal wave preventive function of the expressway which connects Sendai and Ishinomaki.
- This expressway has been constructed with high-embankment method, in view of Tsunami-prevention effect just in case, the effectiveness of which has been proven to certain extent.
- However, the Tsunami went through the tunnels through the high-embankment provided for the daily movement of the people, and damaged the area.
- Based on the verification results of these issues, there is a possibility that the designing of large-scale constructions in the coastal area with disaster-reduction functions, such as breakwater function, will be further enhanced. (Also, there is a chance that the investment will be enhanced on the infrastructure with multiple functions, such as the combination of pier and wave power generation, wind power generation and breakwater function.)
- The other is that the Tsunami ran up the river, destroyed the river banks and expanded the damages.
- In recent years, researches and studies have been carried out on the countermeasures against Tsunami at the Central Disaster Prevention Council with Tokai earthquake and Tonankai earthquake in mind. It could be stated that the dangers and risks have prevailed in the current disaster.
- From now on, reinforcement works on the river constructions such as water gates, sluice gates, dams and so forth which could be a victim of Tsunami, will be enhanced on the coastal part of the river flowing into the Pacific Ocean, with the re-evaluation of Tsunami power rating.

3) Impacts of the nuclear power plant incident and rolling blackouts

The needs for private power generator focused on solar power generation will increase.

- Due to the rolling blackouts necessitated by the nuclear power plant incident, the people living in the area serviced by Tokyo Electric Power Company may have become keenly aware of the weakness of depending on the centralized electric power supply.
- In the disaster-stricken regions as well, where power transmission and distribution systems were destroyed, many people may be feeling frustrated with the weakness of power supply system in the large-scale disaster, and the prolonged recovery from the damage.
- In case of Hanshin-Awaji Earthquake when the power supply has recovered in only a week, people cheered up when the power has restored. For the following certain period, the interest in the private power generation systems such as solar power generation had increased.
The interest, however, subsided rapidly due to the low cost performance of the solar power generation system available at that time. Because of the advanced technologies available today, coupled with the support for environmental issues, it has become far easier to install the solar power generation systems.

Also, activities on the recycled use of automotive batteries for household electricity storage have started, making the installation of private power generation system even more applicable.

Based on these backgrounds, it is expected that the installation of private power generation systems focused on solar power generation will be further enhanced and popularized from now on.

The needs for distributed power supply will increase.

In recent years, the introduction of “smart grid” has been reviewed for achieving stable and efficient power supply and demand balance, as well as to enhance the popularization of dispersed power supply system. In the past, however, the scheme was based on the high dependency on the major electric power suppliers, such as Tokyo Electric Power Company.

However, in addition to the possible increase of objections against the promotion of nuclear power generation as a result of this nuclear power plant incident, it has become clear that the concentration of power supply in small areas is addressing the weakness and risk of significantly impacting the daily lives of the people (rolling blackouts) as well as the business activities.

In order to reduce these risks, the needs for distributed power supplies will increase in the industrial sectors as well.

It might be difficult for individual enterprises to install an independent power supply system good for their industrial applications, but there might be a possibility that a “micro smart grid” may be reviewed as a power supply back up system for an entire industrial park.

The promotion of “all-electric house” may be slowed down.

Up to the date, the promotion of “all-electric house” has been progressing remarkably centered on the regions where city gas is not yet available. However, this movement might be suppressed from now on due to the nuclear power plant incident.

According to an estimate, the additional electric power consumption by the “all-electric houses” built up to date is equal to the power supply of 2 nuclear power generation systems. It is quite likely that the nuclear power plant in Fukushima will be closed down and become inoperable in the future.

Also, the objection against the promotion of nuclear power generation may increase in the other regions not directly affected by the present incident as well, which may become a negative factor for the promotion of “all-electric house” in the future.
4) Other impacts

There is a possibility that the restoration activities leading to a next generation urban development may be accelerated instead of simple reproduction of the past.

- In case of Hanshin-Awaji Earthquake, as the damages were centered on certain parts of the urban areas, restoration of the city, except some regional areas crowded with old wooden houses, could have restored the vitality.

- In case of current disaster, however, the disaster-stricken area is wide spread, including many sparsely-populated areas with many aged people and barely viable communities due to aging and depopulation. Therefore, it might be difficult to revitalize these areas by simply restoring the past.

- In the meantime, there are many activities and demonstration experiments on “compact city” and aforementioned “smart grid city” in search of ideal nature and system of future cities and communities.

- As an organization has proposed, a momentum may increase from now on to create next generation cities and communities by positively implementing and realizing these concepts on the disaster-stricken regions ahead of the other areas, and to revitalize those areas (the restoration of the industry can be achieved at the same time).

Summary

The short term impacts of earthquake disaster will be observed in the increasing restoration demands for the recovery of disaster-stricken regions, especially the demand for special procurements in construction, construction materials and housing industries, construction machinery and leasing industries. Although the supply of bottled water, foods and daily goods becomes temporarily scarce due to the hoardings of these items prompted by the psychological anxieties, the impacts on distribution and retail industries, coupled with the downturn of consumer confidence, will be prolonged for considerable period.

Observing the damages on the production facilities, as a wide range of industries have been damaged, including precision machines and equipment, pharmaceuticals, foods, beverages (beer), chemicals, metals, papers and automotive parts industries, there are concerns on the delayed recovery of these industries. The advanced technologies, such as materials and automotive parts, especially, may have significant impacts on the global supply chains, and may influence the international competitiveness of the Japanese industries if not recovered on time.

In the meantime, the renewal of damaged production facilities and installation of new type equipment will contribute to improving the productivity, and to creating a new foundation of competitiveness with new products. There is a possibility as well that the rejuvenation of the industry may be accelerated through possible re-organization of the industry. Also, the emergence of renewable energies such as solar and wind power generations, and the development of new energy saving electric power control systems such as smart grid have a potential to generate new growing industries. It is expected that the disaster-stricken regions will be developed, after restoration, as disaster-prevention (earthquake and tsunami) model cities, or smart-city model districts with smart-grid power distribution system.

As to the impacts on the production facilities, it is expected that many of the disaster-stricken facilities will remain in Japan by utilizing the renovation support funds and subsidies of the government. In view of the logistics and experienced employees including non-regular employees, it is not likely for the disaster-stricken enterprises to transfer their production facilities to overseas because of the damages. In the meantime, production efficiency improvement or conversion to new industry can be expected by replacing the damaged facilities with the latest new facilities or by converting into an advanced factory.
Great East Japan Earthquake disaster is still in progress, and it may yet take considerable time to determine the scope of damages. The restoration activities, however, have already started.

It is needless to mention that the highest priority must be placed on the normalization of the disaster-stricken people. We need to start, however, from reviewing and making the concept of our land, industry and the nature of our society again from the beginning. That is to say, it is necessary for all of us to face the restoration works as one of the parties involved in this disaster.