

# Impact on Oil Distribution and Lessons from the Great East Japan Earthquake

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The Institute of Energy Economics, Japan

**Oil Information Center**

## The Great East Japan Earthquake

- (1) Date: March 11, 2011
- (2) Magnitude (scale of earthquake) : 9.0  
The fourth largest earthquake on the record all over the world
- (3) TSUNAMI caused great damage to a wide range of coastal areas



Disaster area by TSUNAMI



Petro station hit by TSUNAMI



Temporary service station utilizing ISO tank containers

# 1. Damage by the Great East Japan Earthquake

## Outline of the Great East Japan Earthquake

Date and time: 14:46 on March 11, 2011

Epicenter: Sanriku Coast

Depth of hypocenter: 24 km

**Magnitude: 9.0**

Maximum seismic intensity: 7 on Japanese scale  
(Kurihara City, Miyagi)

Tsunami: Enormous with **the wave height of more than 10 m** and the maximum run-up height of 40.1 m on some areas

Type of earthquake: Ocean-trench earthquake,  
reverse fault type

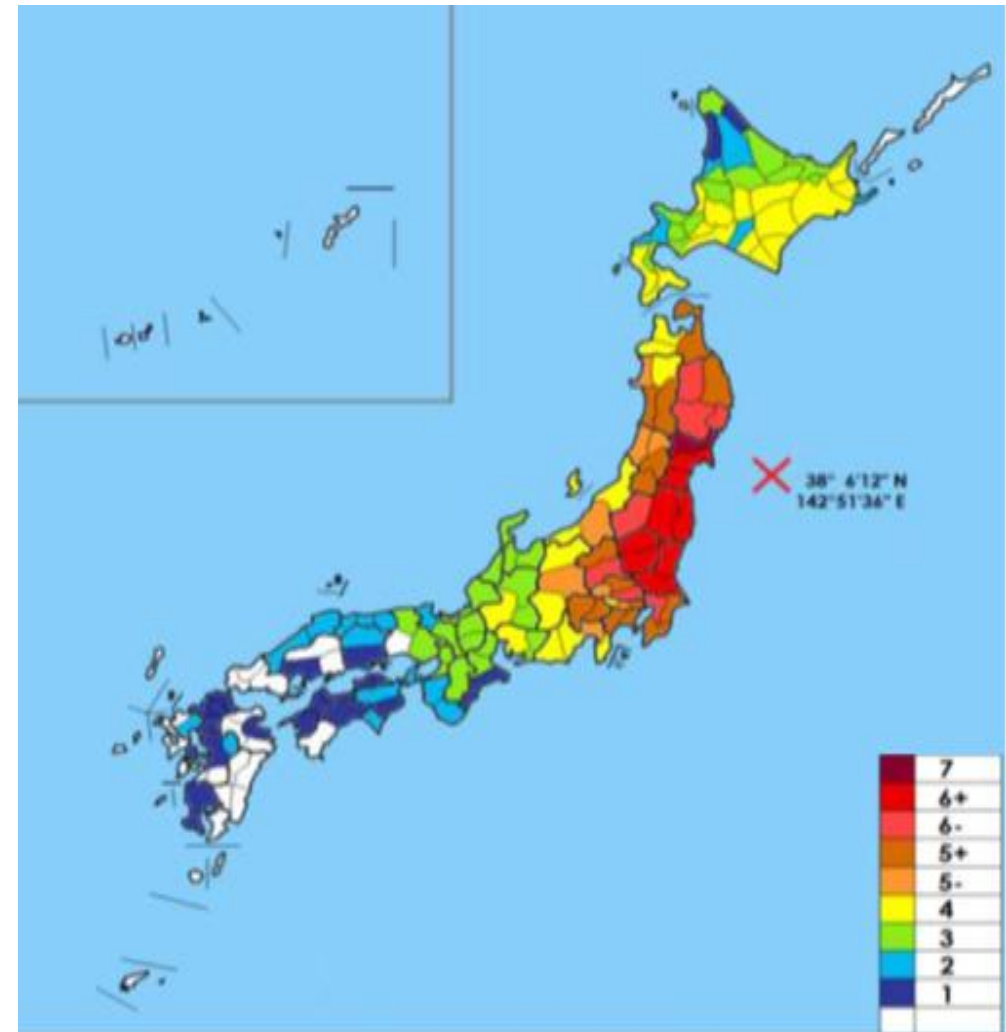
Casualties: **18,487 deaths and missing persons**  
(as of October 10, 2014)

Building damage: **401,306 buildings** totally or half collapsed

Damage to nuclear power plant

The accident involving a leakage of large amounts of radioactive substances occurred in TEPCO Fukushima Daiichi Nuclear Power Plant complex, due to failure of cooling function for reactors.

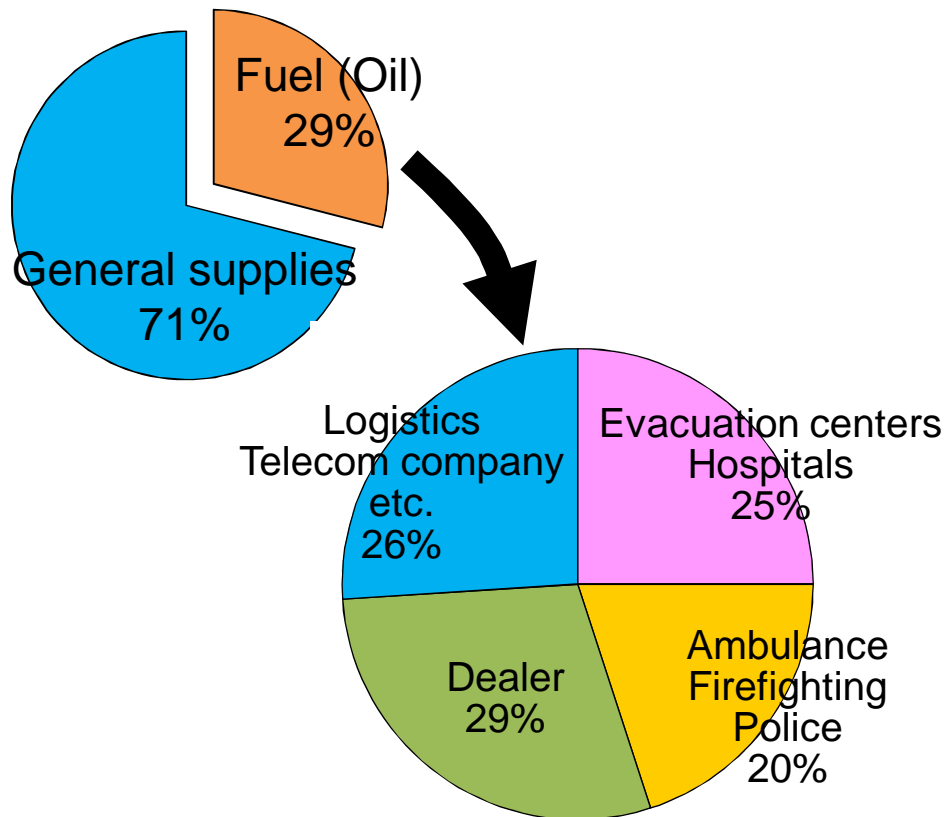
Amount of direct damage: **16 to 25 trillion yen**



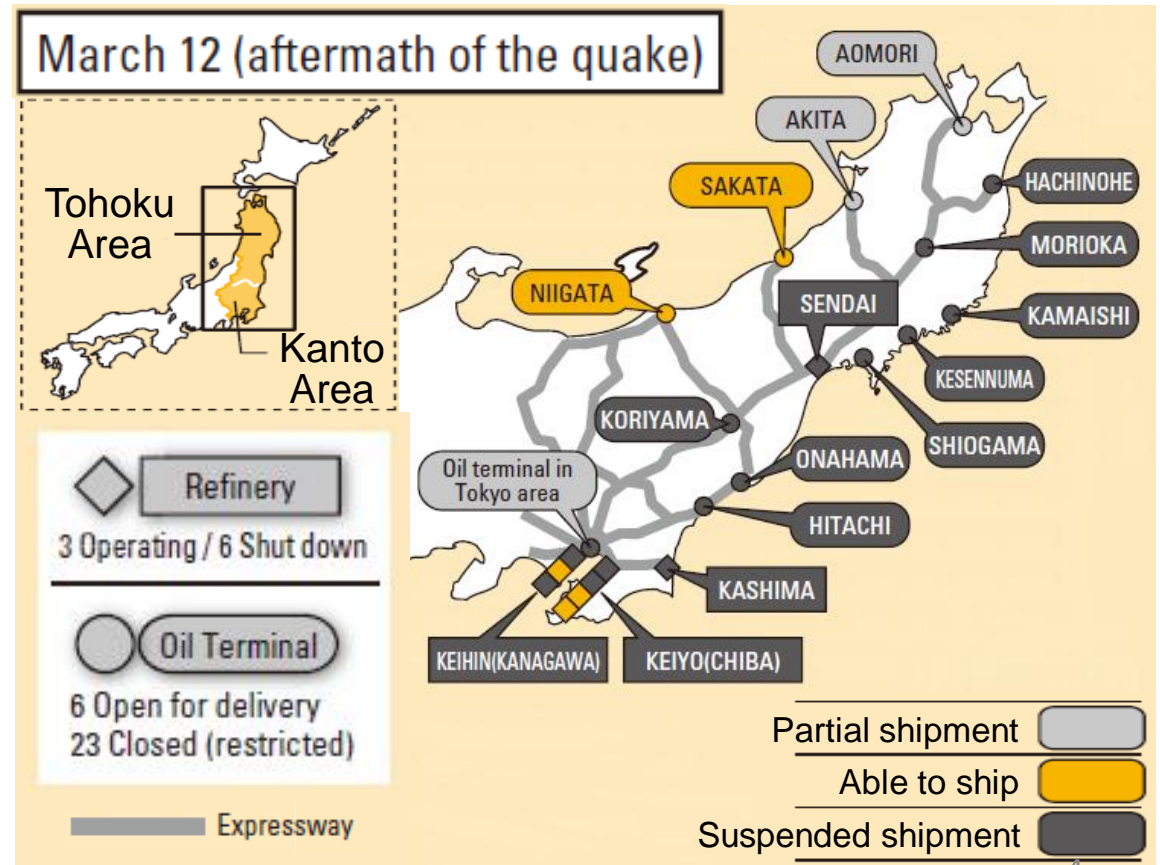
# 2. Outline of Damage to Infrastructure

- From the moment, electricity and city gas supply was disrupted and the petroleum industry was received many supply requests as the % stand alone+
- Social infrastructures (such as road and harbor) including petroleum-related facilities were seriously damaged.
- In some areas, supply of petroleum products disrupted temporarily.

Emergency requests from the disaster area



Operating Situation of Refineries and Oil Terminals



# 3. Impact on and Recovery of Oil Facilities (Refinery)

Wholesalers	Group refinery	Refining Capacity 10,000B/D	Operation and Product Shipment Status
JX Nippon Oil & Energy	Negishi	27.0	Resumed operations on March 21
	Kashima	25.3	Stopped the whole operation/shipments. Resumed in early June
	Sendai	14.5	Ditto.Resumed production on March 9, 2012
	Muroran	18.0	Not affected
	Osaka	11.5	Completed regular maintenance
	Mizushima	23.7	Not affected
	Marifu	12.7	Not affected
	Oita	13.6	Not affected
Showa Shell Sekiyu	Toa Oil/Keihin	18.5	Resumed shipment on land and sea on March 13
	Showa Yokkaichi	21.0	Normal operations
	Seibu Oil/Yamaguchi	12.0	Normal operations
Tonen General	Tonen General/Kawasaki	33.5	Resumed operations on March 18
Fuji Oil	Sodegaura	14.0	Normal operations. Resumed shipments on sea on March 13
Cosmo Oil	Chiba	22.0	Stopped the whole operations/shipments. Resumed operations of part of the system on January 12, 2012
Kyokuto Oil	Chiba	17.5	Resumed operations on March 16.Full production on 21.
Idemitsu Kosan	Chiba	22.0	Normal operations
	Hokkaido	14.0	Normal operations
	Aichi	16.0	Normal operations
	Tokuyama	12.0	Normal operations

### 3. Impact on and Recovery of Oil Facilities(Oil depots)

Status: ○ Keep shipping, △ Temporary stopped, × Function totally stopped

Prefecture	Oil depots	Status	Resumption of operations	Prefecture	Oil depots	Status	Resumption of operations
Aomori	TOT Aomori	○	March 20	Fukushima	TOT Onahama	△	March 31
	JONET Aomori	○			JX Onahama	△	March 29
	TOT Hachinohe	△			Onahama Petroleum	△	March 19
	JX Hachinohe	△			JOT Koriyama	△	March 25
	Idemitsu Hachinohe	△		Akita	JX Akita	△	March 15
	JONET Hachinohe	△			Shoyu Akita	○	
Iwate	JOT Morioka	×	March 20		Idemitsu Akita	○	
	IOT Kamaishi	△	March 20		TOT Akita	○	
Miyagi	Kamei Miyako (Kesenuma)	×	Tank washed away by Tsunami Resumed shipments on September 2, 2011	Yamagata	TOT Sakata	△	March 14
	TOT Shiogama	△	April 1	Ibaraki	TOT Hitachi	△	March 17
	Zen-noh Sendai	×	Piping and shipment facilities damaged. Resumed shipments on November 23, 2011		Idemitsu Hitachi	△	March 29
	Idemitsu Shiogama	△	March 17				
	Shell Shiogama	△	April 10				
	EM Shiogama	△	March 20				
	Kamaei Shiogama	△	March 18				
	Marubeni Shiogama	△	May 9				

TOT:Tozai Oil Terminal, JOT: Japan Oil Terminal, IOT: Iwate Oil Terminal, JONET: Japan Oil Network

### 3. Impact on and Recovery of Oil Facilities (SS)

#### Damaged Service Station in Kesen-numa City



Source: Zensekiren

### 3. Impact on and Recovery of Oil Facilities (SS)

#### Damaged Service Station in Shichigahama, Sendai City



Source: Zensekiren



## 4. Responses by the Government and Private sector

### (1) Response by Government

- ▣ The Government implemented the following measures by requesting that oil companies transfer more products from western Japan to damaged areas in Tohoku and Kanto regions.

#### Measures (Typical)

- Bringing in tank trucks on a large scales(300Trucks added)
- Transfer of a large amount of gasoline from oil refineries in western Japan to the Tohoku region
- Early recovery of functions of oil depots on the Pacific side (Oil depots in Shiogama and Hachinohe)
- Designation of SSs as supply bases, and preferential supply of petroleum to them

# 4. Responses by the Government and Private sector

## (2) Responses by the private sector

- “ Reinforcement of production system, that is, increase of the capacity , and increase of the operation rate in oil refineries
- “ Increase of domestic supply through emergency imports of gasoline and stopping exports of oil products
- “ Transfer of oil products from western Japan and Hokkaido into damaged areas using coastal tankers, and tank cars and trucks
- “ Establishment of a cooperative system among oil companies in damaged areas, such as the joint use of oil depots
- “ Bringing in approx. 300 tank trucks to damaged areas from western Japan
- “ Provision of information about the operation of SSs in damaged areas, as an information activity ease the anxiety of disaster victims



Operation room in Emergency Headquarter of PAJ

# 4. Responses by the Government and Private sector

Joint use of Oil Depots in Shiogama

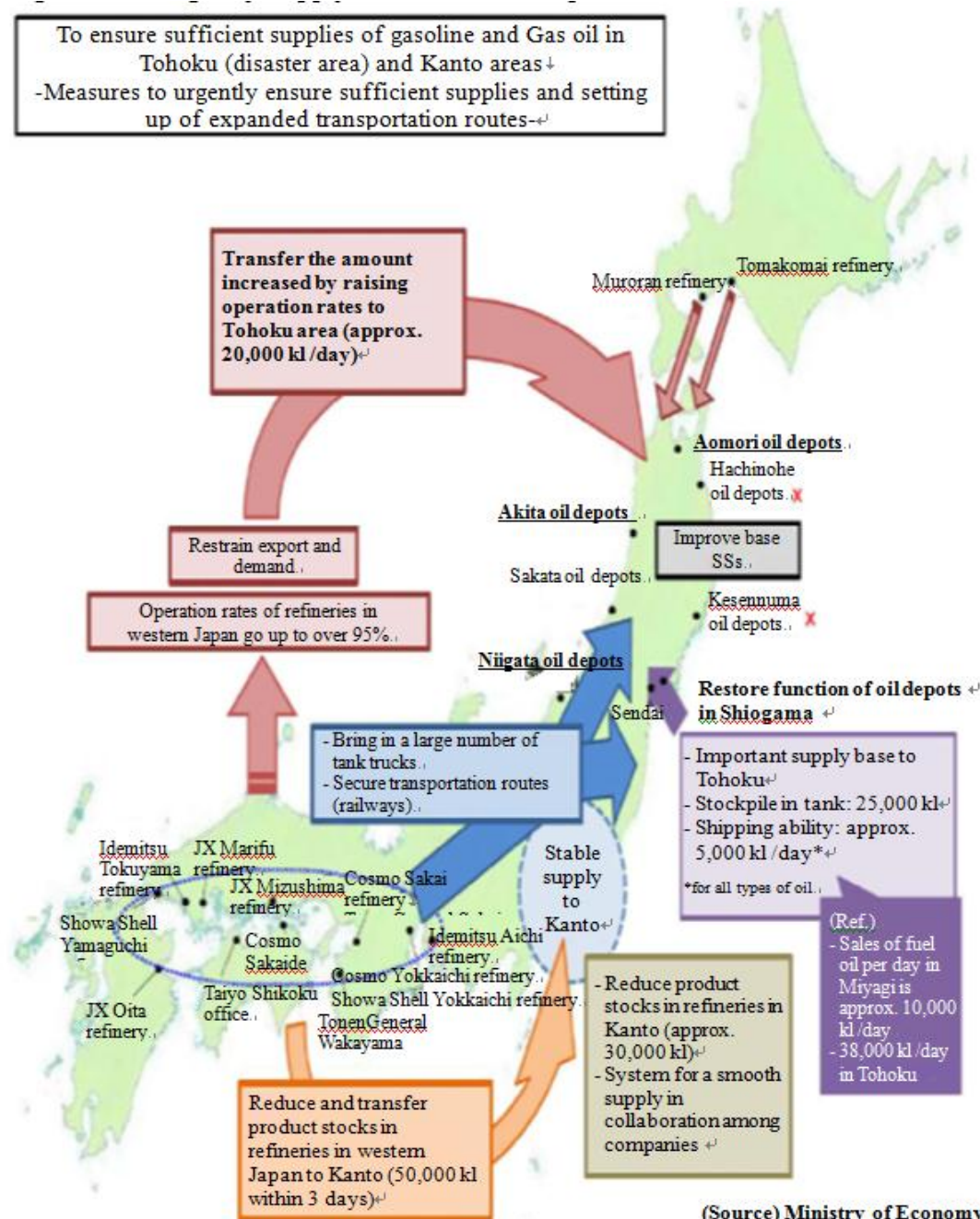


Temporary SS operation in Area having no SS near by



Source: PAJ

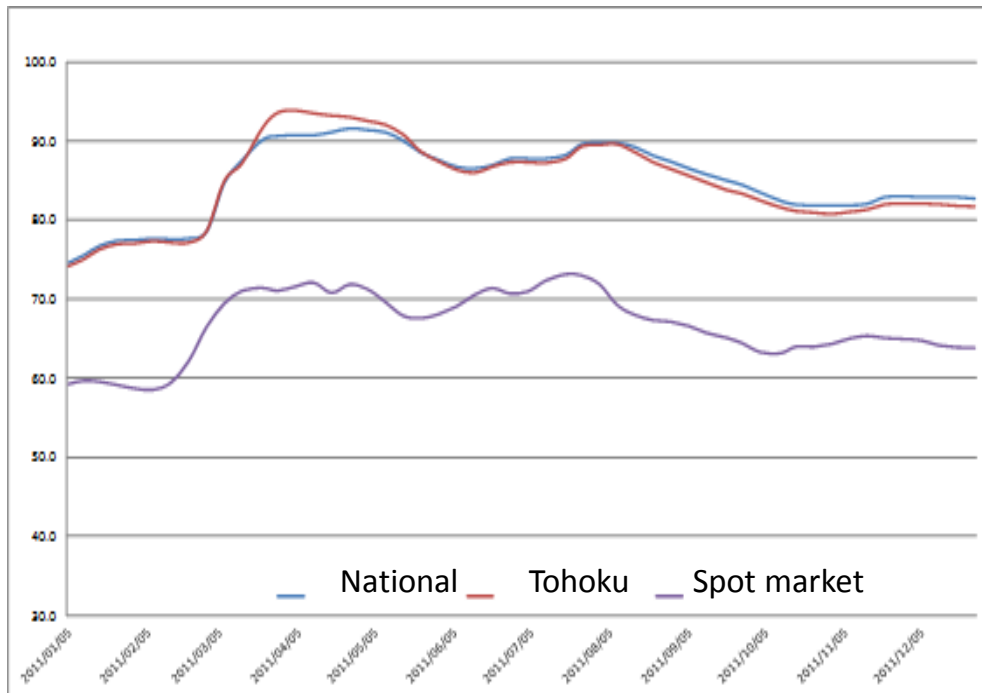
# 4. Responses by the Government and Private sector



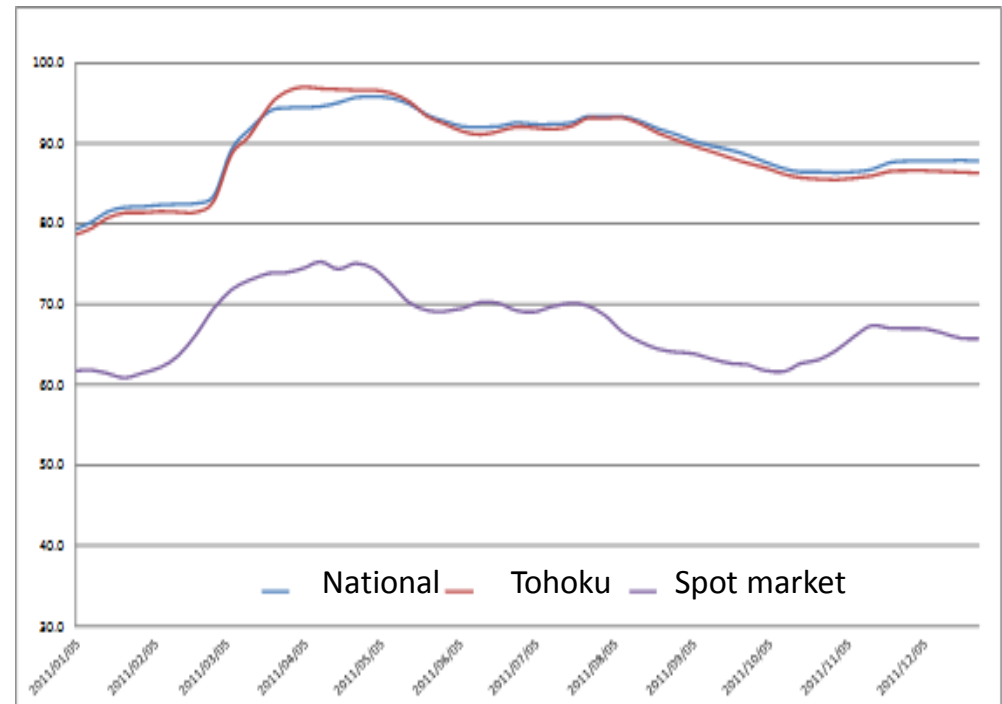
(Source) Ministry of Economy, Trade and Industry+

# 5. Prices of Oil Products after the Earthquake

## Trends of Gasoline price



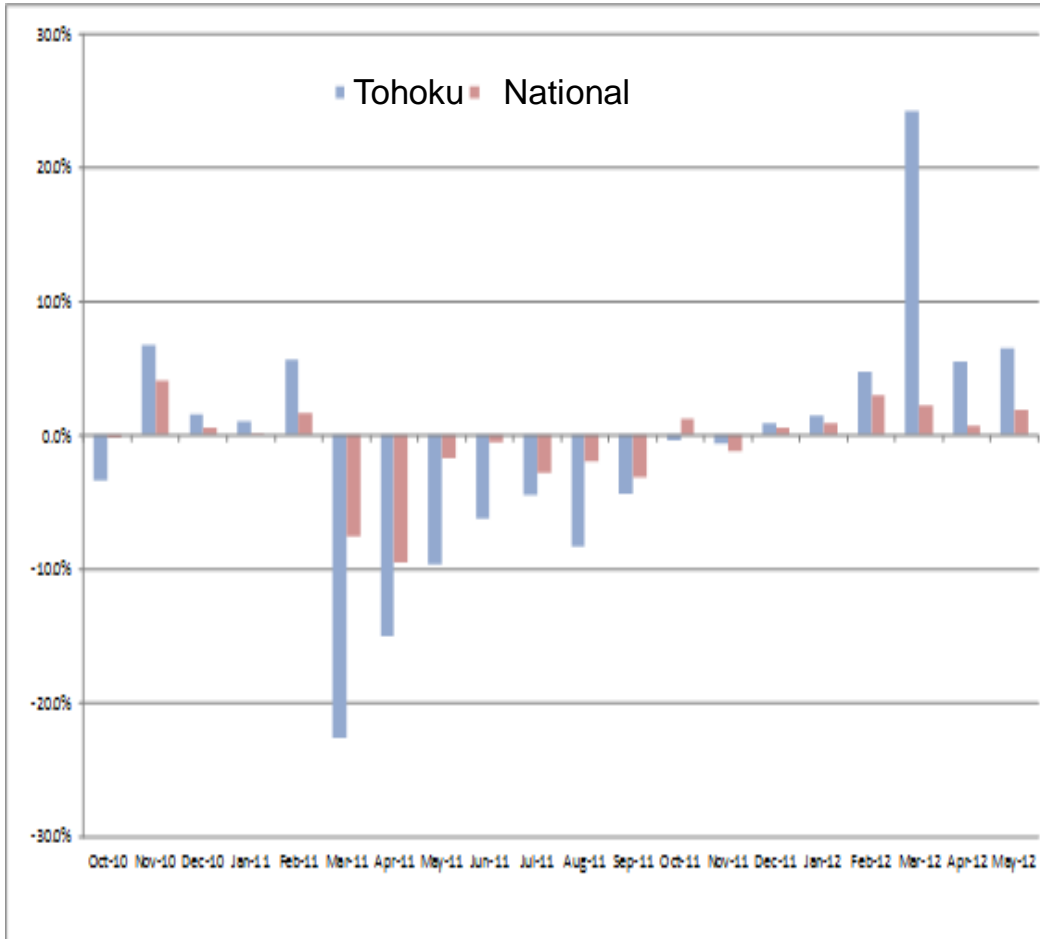
## Trends of Gas oil price



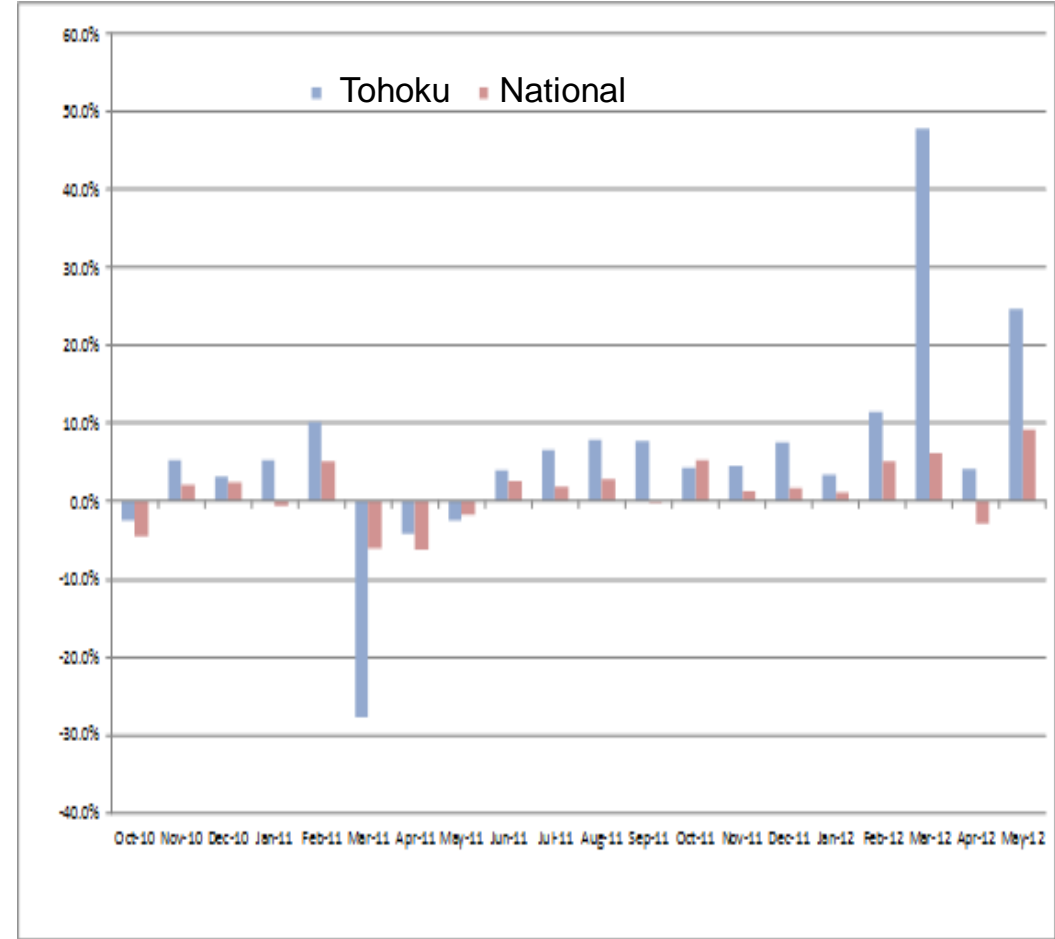
Source: Oil Information Center

# 6. Demand for Oil Products after the Earthquake

Comparison of gasoline demand with previous year



Comparison of gas oil demand with previous year



Source: PAJ

# 7. Enhancement of Emergency Response Capability

Oil industry is addressing the enhance of the initial response for the emergency situations in cooperation with the governments, etc., based on the experience of the Great East Japan Earthquake.

## The accident or trouble (Typical)

- loss of Communication function by Tsunami etc.
- It took a great deal of time to gather Information about the fuel supply to the important facilities

- breakdown of machines such as a pump
- blackout of shipping facilities
- Many requests of fuel supply by drums

- 1,400 requests for emergency supply from the government were responded to

## Measures (Typical)

- Strengthening of communication tool
- Development of a system to centralize information from each oil company at a time of disaster

- Waterproofing of electric facilities
- Deployment of emergency power supply units
- Maintenance and reinforcement of drum filling facilities

- Set up an emergency office to respond to supply requests from the government



Drum filling facilities

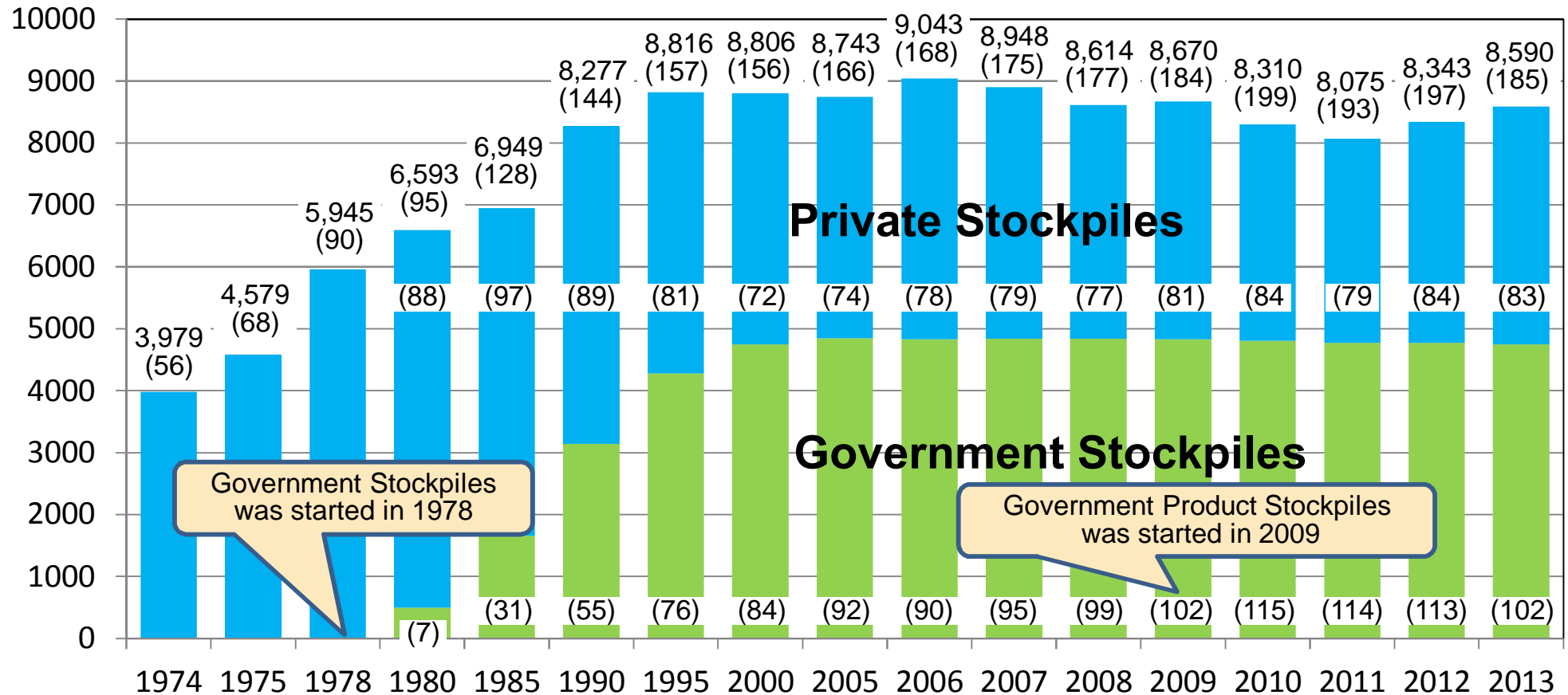


Pump with the waterproof door

# 8. Oil Stockpiling in Japan

- In response to OECD recommendation in 1962, the oil stockpiling system in Japan virtually started from FY1972.
- The current level of stockpile is equivalent to 180 days or more of domestic demands, in combined with the government and the private stocks.

10,000KL, (day) Trends of Oil Stockpiling in Japan (end of March each year)



\* Totals may not match due to rounding



# 9. Amended the Oil Stockpiling Act (1)

- The Oil Stockpiling Act was amended in 2012 for further strengthening of the oil supplying system in the disaster, considering the experience of the Great East Japan Earthquake.

## 1) Amended requirements for mobilization of stored oil

	Before the amendment	After the amendment
Requirement of release	Oil supply disruption from overseas	Government can release the stockpile at the time of a <b>domestic oil supply shortage in a certain area due to a disaster.</b>

## 2) Increasing of government products stockpile

	Before the amendment	After the amendment
Composition of Stockpile	<b>Crude : Products</b> (Kerosene) = <b>99% : 1%</b>	<ul style="list-style-type: none"> <li>➤ <b>Increase the quantity</b></li> <li>➤ <b>Various product types</b> (Gasoline, Gas oil and Light fuel oil)</li> </ul>

## 9. Amended the Oil Stockpiling Act (2)

### 3) Mandatory development of plans for supply cooperation

Refiners and wholesalers are obliged, in advance, to jointly develop supply cooperation plans for 10 regions across Japan, for supplying oil to the affected people from the disaster.

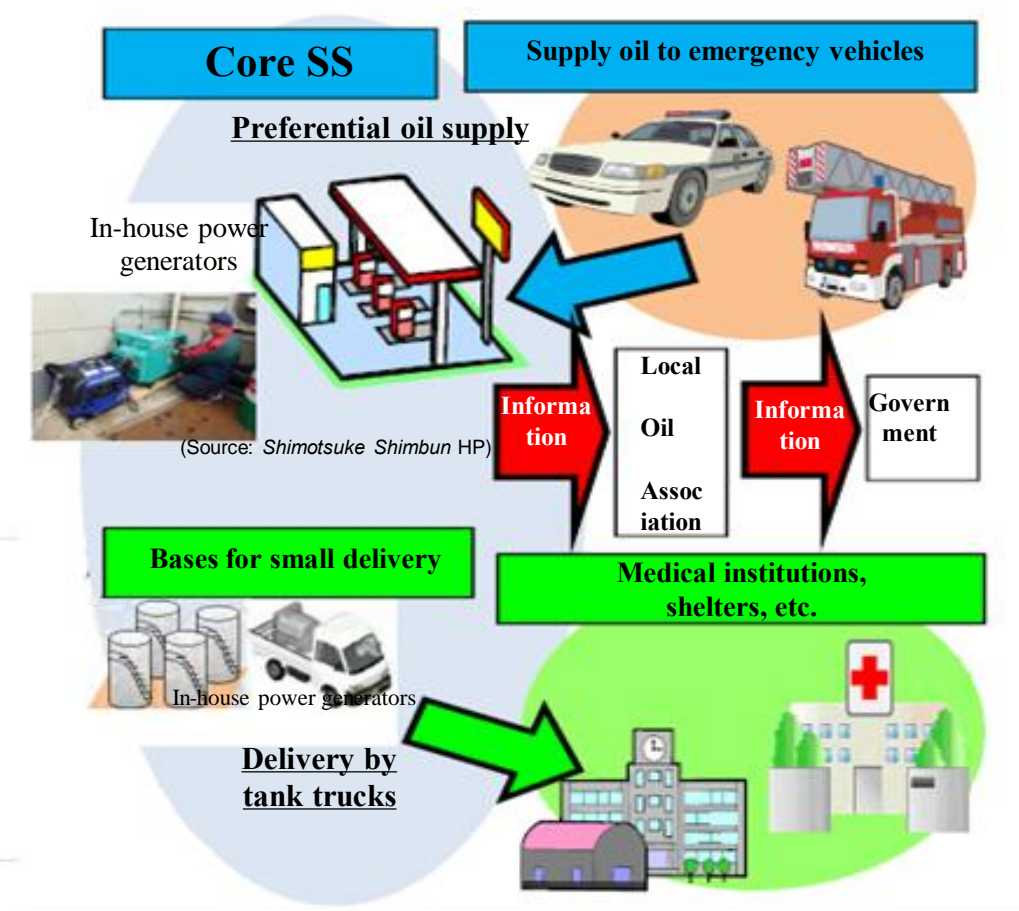
- a) **Establishment of a joint work structure** among refiners and wholesalers
- b) **Joint use of facilities** among refiners and wholesalers
- c) **Cooperation in oil transport** among refiners and wholesalers
- d) **Communication procedures with the government**
- e) **Information on storage facilities for national oil stockpiles**
- f) **Exercise of the plan**



Cooperation among oil companies  
in the disaster area.  
(Joint use of oil depots)

# 10. Subsequent Responses

## (1) Responses by the Government



(source) The Agency for Natural Resources and Energy

# 10. Subsequent Responses

## (2) Response by the Oil industry

### 1) On the hardware side

- “ Strengthen functions to receive and ship products
- “ Prepare tanks and piping for earthquake and liquefaction
- “ Prepare piers and shore protection for earthquake and liquefaction
- “ Enhance quake resistance of high pressure gas facilities
- “ Ensure safety stop of facilities

### 2) On the software side

- “ The wholesalers prepare oil supply cooperation plans for disaster in order for the wholesalers to meet the requests for fuel supply jointly and quickly, and to handle them from an action operation room when a large-scale disaster occurs.
- “ Each oil company has formulated a **Business Continuity Plan (BCP)** for their group ranging from oil refineries to affiliated SSs, in order to promptly supply the minimum petroleum necessary to maintain social functions at the time of a large disaster.

- “ As lessons from the Great East Japan Earthquake, **%Petroleum+** was the energy of distribution and an independent type a **superior emergency capability**.
- “ **Oil stockpiling continues to be important**. The improvement of oil product stockpiles by reviewing the ratio of crude oil to oil products would be a key.
- “ It is important to ensure a stable supply of energy down to the final consumers, and vital to **establish an emergency supply system**.
- “ It is and continues to be important to improve **%Core SSs for disaster +**, which should be equipped with in-house power generators and large tanks in order to reinforce the emergency capabilities of the oil supply chain.