Japanese Policies in Maritime Industry

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- Future technology and Finance on maritime sector in Japan and Norway -
1. Overview of Shipping & Shipbuilding Industries in Japan

2. Policies of MLIT in Maritime Sector
   2.(1) Basic Act of Ocean Policy
   2.(2) Big Data Application and IoT for Maritime Industry
   2.(3) Reduction of CO2 / SOx / NOx
   2.(4) Hydrogen Energy
   2.(5) Other Technological Development

3. Financial Support

4. Cooperation between Norway and Japan
1. Overview of Shipping & Shipbuilding Industry in Japan
Overview of Shipping Industry in Japan

Global seaborne trade volume and Japan's merchant fleet share

(million tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume of global seaborne trade (A)</th>
<th>Volume carried by Japanese merchant fleet (B)</th>
<th>Global share of Japanese merchant fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>4,129</td>
<td>598</td>
<td>14.5%</td>
</tr>
<tr>
<td>1994</td>
<td>4,934</td>
<td>670</td>
<td>13.6%</td>
</tr>
<tr>
<td>2005</td>
<td>7,638</td>
<td>778</td>
<td>10.2%</td>
</tr>
<tr>
<td>2006</td>
<td>8,363</td>
<td>803</td>
<td>10.0%</td>
</tr>
<tr>
<td>2007</td>
<td>8,907</td>
<td>833</td>
<td>10.1%</td>
</tr>
<tr>
<td>2008</td>
<td>8,573</td>
<td>866</td>
<td>10.0%</td>
</tr>
<tr>
<td>2009</td>
<td>8,259</td>
<td>824</td>
<td>9.1%</td>
</tr>
<tr>
<td>2010</td>
<td>9,031</td>
<td>819</td>
<td>10.0%</td>
</tr>
<tr>
<td>2011</td>
<td>9,440</td>
<td>967</td>
<td>10.2%</td>
</tr>
<tr>
<td>2012</td>
<td>9,839</td>
<td>1,001</td>
<td>10.1%</td>
</tr>
<tr>
<td>2013</td>
<td>10,175</td>
<td>1,027</td>
<td>10.1%</td>
</tr>
<tr>
<td>2014</td>
<td>10,529</td>
<td>1,035</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

(Source) 1. Global marine cargo volume according to Clarkusons"SHIPPING REVIEW DATEBASE". 2. Japan's merchant fleet share of transport compiled by the Maritime Bureau of the MLIT.
Overview of Shipping Industry in Japan

Vessel type of Japan’s merchant fleets

Outside: Gross Tonnage (1,000)
Inside: number of vessels

Total
119,899,000 ton
2,566 vessels

(source) Maritime Bureau of MLIT
Japan’s shipbuilding industry keeps domestic production, sustaining local economy and employment. (about 125,000 employees, US$ 27 billion of sales, 90% of domestic production, including ship machinery industry)

Mainly domestic production, in local areas

Ratio of domestic production

- Oversea: 15%
- Domestic: 85%

Ratio of local production

- Big city area: 7%
- Local area: 93%

Sustaining local economy and employment

The ratio of output share of shipbuilding industry in each region in eastern Japan

- Imari: 30%
- Mihara: 12%
- Nakatado: 22%
- Marugame: 26%
- Sasebo: 18%
- Saikai: 35%
- Nagasaki: 18%
- Saeki: 10%
- Usuki: 24%
- Tamana: 24%
- Imabari: 81%
● Competing with China and Korea in the world market. (2014 share was about 20%, 3rd share in the world)

● Due to yen appreciation by Abenomics and the development of energy-saving technologies in parallel with its global standardization, the number of shipbuilding orders to Japanese companies has been growing increasing after 2013. (The share of Jan-Sep 2015 became 29%, 2nd place in the world, overtaking China.)

Back to high performance & high quality vessels built by Japanese shipbuilding companies

Japan’s share of new order increased, and China lost the share.

Japanese shipbuilding companies now in position to increase the production.
Ex. Imabari Obtained the orders of Ultra Large Container Carriers, and their new dock is under construction.

Shipping & shipbuilding market will expand with the world economy’s growth in the long term.
In spite of recent sluggish market.
Structure of Maritime Cluster in Japan

National Maritime Research Institute (NMRI)

Shipping industry (Carriers) (overseas / coastal)
Number of companies: abt 200 / abt 2,450
Employees: abt 7,000 / abt 66,000
Business revenue: abt US$39 billion / abt US$11 billion

Ship owners (overseas / coastal)
Number of owners: abt 700 / abt 1,600
Employees: abt 1,400 / abt 21,000

Charter contract

Cargo owners

Transportation service

71% are for Japanese fleet (in value terms)

Shipbuilding industry
Number of Companies: abt 1,000
Employees: abt 83,000
Business revenue: abt US$20 billion (major 13 companies)

58% are for shipbuilding companies in Japan (in value terms)

Ship machinery industry
Number of companies: abt 1,100
Employees: abt 47,000
Production output: abt US$8 billion

Seafarers
Coastal Seafarer
abt 27,000

Overseas seafarers
Japanese abt 2,000
Foreigner abt 56,000

Organization for Training
Marine Technical Education Agency
8 schools, 450 students/year

National Institute for Sea Training
Independent Administrative Institution
5 school ships

Nautical colleges and National Institute of Technology
7 schools, 370 students/year

Academic Institutes
- Universities
- Technical school (e.g. High school)

Contribute to R&D

Supply of Engineers

Stable Supply

Contribute to R&D

Contribute to R&D
2. Policies of MLIT in Maritime Sector
CHAPTER III Basic Measures

○ The State, in order to promote the ocean industries and to strengthen the international competitiveness, shall take necessary measures with regard to the Ocean Industries to nurture and secure the human resources (abr.). (Article 24)

CHAPTER IV Headquarters for Ocean Policy

○ The Headquarters shall be headed by the Director-General of the Headquarters for Ocean Policy, the post which shall be served as Prime Minister. (Article 32(1))

Prime Minister Shinzo Abe, in the meeting of the Headquarters for Ocean Policy (December, 2014)
In 2013, “Basic Plan on Ocean Policy” was adopted for further development of Japan’s Maritime Industry, in the form of reinforcement of Basic Act on Ocean Policy.

(extract)

Chapter VIII. Promotion of Marine Industries and Increase in International Competitiveness

(1) Solidifying management base

a. Maritime transport industry, shipbuilding industry and infrastructure system

(i) Increasing competitiveness to obtain orders

- In efforts to make the Japanese shipbuilding and ship machinery industries more competitive to receive new contracts, make efforts toward reducing carbon dioxide, exhaust (NOx and SOx) emissions and other environmental pollutants from ships in compliance with regulations related to the issues and ensuing ship safety.

- Under coordination between the industrial, academic and governmental sectors, implement technological development for high-value-added vessels to help boost international competitiveness of the Japanese shipbuilding, ship machinery and marine resources–related industries.
2.(1) Big Data Application and IoT for Maritime Industry
Background

Dawn of Maritime Broadband Era.
• Development of satellite system and communication technology
• After VSAT, it becomes common to have real time and fixed-rate charged services

There are great potential in maritime sector for new services, innovation using IoT and big data

Example

Smart operations using real time support from land
• Weather, sea condition, voyage planning
• Ship condition (load, oscillation)
• Monitoring cargo

Effective maintenance
• Trouble alert, preventive system
• On ship repairing support
Japan’s Policy

Japan Revitalization Strategy (Growth Strategy) 2015

The development of IoT, big data, and artificial intelligence having brought about unprecedented change in the industry / employment structures, therefore, the government will consider, how the government and private companies should be prepared to seize such chances.

In maritime fields, it is a key to,

- Promote developing technology which enable us to make use of big data in ship operation.
- Be speedy, involving other sectors.

Therefore, Maritime Bureau,

- Supports for technology development (budget for FY2016, US$ 0.6 million).
- Considers the scheme to promote its advanced use.

and leads innovation in whole maritime sector !!
2.(2) Reduction of CO2 / SOx / NOx
CO₂ emissions reduction requirement in IMO

- Improving energy efficiency of international shipping is an important issue because of a constant increase of international shipping transport demands.
- In July 2011, IMO accomplished a introduction of global regulation on energy efficiency of international shipping. The regulation came into effect in January 2013.
- IMO has been developing a data collection system of fuel consumption of ships as a further measure for enhancing the energy efficiency of international shipping.

Energy efficiency requirements for new ships

- From 2013, new ships have to meet the energy efficiency, which gradually become strict.
- It is not allowed to build ships, which do not satisfy criteria.

- Start
  - 2013: 10% reduction
  - 2015: 30% reduction
  - 2020: 20% reduction
  - 2025: ""
Technology development project (2009-2012) succeeded in 30% reduction of CO2 emissions from ships, and achieved IMO requirement by 2025.

Japan has promoted further developments of maritime environment technology which aim to further reduce CO2 emissions.

Examples

**Engine system**
- Heat recovery system with which low-temperature waste heat is used

**Fuel shift**
- Dual fuel gas engine

**Propulsion system**
- Controllable pitch propeller

**Hull**
- Low-frictional coating
【Strengthening environmental regulation of international shipping】
• Environmental regulation for shipping is getting more strict and SOx regulation will be strengthened in the all sea areas in the world from 2020 at the earliest.
⇒ Natural gas fuel can reduce CO2 and NOx as well as SOx at the same time.

【Expansion of natural gas use】
• Production and the use of natural gas are expanding
• Japan implemented the diversification of energy supply by the import of less expensive natural gas including shale gas and by the support for natural gas development by Japanese companies.
• Natural gas will be used as fuel for ships also in North America and Asia also as it is used more in Europe.
Current Status and Future Trends of Ships Fueled by Natural Gas

Overview of ships fueled by natural gas

- In September 2015, Japan's first natural gas-fueled vessel “Sakigake” was delivered.
- Japan’s Ministry of Economy, Trade and Industry and the Ministry of Land, Infrastructure, Transport and Tourism supported this building.
- LNG is supplied to the ship from a tank truck.

<table>
<thead>
<tr>
<th>Owner</th>
<th>NYK Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight's</td>
<td>Wing Maritime Service</td>
</tr>
<tr>
<td>Shipyard</td>
<td>Keihin Dock</td>
</tr>
<tr>
<td>Operating location</td>
<td>Yokohama harbor</td>
</tr>
</tbody>
</table>

Natural gas-fueled vessels are mostly used in emission control area, and expected to become popular in the future. NYK Line is constructing the world’s first natural gas-fueled car carrier ※ and natural gas bunkering vessel. (scheduled to be completed this year).

※ NYK and the joint venture of foreign companies are building

| Natural gas fuel car carriers | Natural gas fuel supply ship (Image) | Fuel supply landscape (image) |
2.(3) Hydrogen Energy
Main Challenges

### 3E + S (Energy Security, Economic Efficiency, Environment + Safety)

- *Strategic Energy Plan of Japan, April 2014*

#### Energy supply

<table>
<thead>
<tr>
<th>Country</th>
<th>Energy Source</th>
<th>Self-sufficiency (% of Primal Energy Supply)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>677.4%</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>235.4%</td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>166.2%</td>
<td></td>
</tr>
<tr>
<td>33rd</td>
<td>6.0%</td>
<td></td>
</tr>
</tbody>
</table>

#### Greenhouse gas emissions

- Source: Greenhouse Gas Inventory Office of Japan
- Source: METI

**Japan’s Primary Energy Source**
- First Oil Crisis: Dependence on fossil: 90%
- FY2012: Dependence on fossil: 90%

**Transport**
- Middle East Dependence: 29%

**Crude Oil**
- Middle East Dependence: 83%

**Nuclear Power**
- Middle East Dependence: 1%
As for future secondary energy, **hydrogen is expected to play a central role**, as well as electricity and heat.

*Strategic Energy Plan of Japan, April 2014*
Step by step approach to realize hydrogen society

Expansion usage ← Establishment of mass hydrogen supply

### Phase: 1
**Installation Fuel Cell**
- 2009: Micro-CHP FC
- 2015: FCV
- 2017: Large-CHP FC
  - around 2020: FCV fuel cost ≤ HEV fuel cost
  - around 2025: FCV cost competitive ≥ HEV

### Phase: 2
**H2 Power Plant/ Mass Supply Chain**
- Accelerate RD&D
- Realize reasonable H2 Price
  - 2nd half of 2020’s:
    - H2 cost (CIF) : JPY30/Nm³
    - Enhance supply chain in Japan around 2030:
      - Import H2 from overseas
      - Full Scale H2 Power Plant

### Phase: 3
**CO2-free Hydrogen**
- around 2040:
  - Full scale CO2-free H2 (Renewable energy, CCS, etc)

Tokyo Olympic/ Paralympics

- 2020
- 2030
- 2040
# Projects for Establishment of Mass Hydrogen Supply

## Building hydrogen supply chain

<table>
<thead>
<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td>(NOK 137 million in FY2015)</td>
<td>(NOK 9 million + overhead cost in FY2014)</td>
</tr>
</tbody>
</table>

Demonstrate the whole supply chain of hydrogen produced from untapped overseas energy resources

Demonstrations on:

- **Method(s) of hydrogen production** from e.g. by-product hydrogen, brown coal (untapped overseas resources)
- **Transportation and storage** in the form of cryogenic liquid hydrogen or organic hydride
- **Power generation** using (imported) hydrogen

### Power generation

- Production
- Transportation and storage
- Power generation

### Development of loading system for LH2

<table>
<thead>
<tr>
<th>FY2014 – 2018</th>
<th>FY2014 – 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>(NOK 9 million + overhead cost in FY2014)</td>
<td>(NOK 137 million in FY2015)</td>
</tr>
</tbody>
</table>

Develop ship-shore loading system(s) for cryogenic liquid hydrogen

Key Issues:

- **R&D** (Emergency Release System, swivel joints etc.)
- **Procedures** for loading/offloading operations
- **Safety regulations and standards**
Fuel cell boat as a future ship

Advantage of fuel cell boats

- Environmental performance
  - No emission of CO₂, NOₓ neither SOₓ when use
- Comfortableness
  - Less vibration and noise

Set target on water taxies and small restaurant ships for the Tokyo 2020 Olympic games

Small restaurant ship

Water taxi
Planned Activities for Fuel Cell Boat

Technical challenges to be addressed

- FC degradation by salty air
- Continued high load operation
- FC operation in ship motions/ load fluctuation
- Leak prevention/ detection
- Prevention of ignition
- Emergency preparedness

Remaining challenges:

- Cost (boat itself, fuel)
- Fuel supply (availability, infrastructures etc.)
Extensive experiences of Norway & ambitious visions and projects of Japan → Cooperative initiatives in the future
2.(5) Other Technological Development
Japan imports Shale gas in North America via Panama Canal.

Targeting the completion of Panama Canal expansion program in 2016, Japanese shipbuilding companies have developed a new generation LNG carrier with larger tank which improves transport efficiency.

- Conventionally, it was a mainstream to use the spherical tank detached from the hull.
- Liquefied Shale Gas is to be transported by larger vessels which can pass through “New” Panama Canal (49m width).
- Due to the modification of the tank’s shape, loading efficiency has improved by 16% compared with the conventional carriers.
- The reduction of Japan’s energy procurement cost of is expected through transportation cost savings.
Support Program for the Developments of Offshore Technologies

- Support the development of offshore technologies which contribute to ensure high durability, reliability and safety for the offshore utilities (FLNG, Ultra-deepwater drilling platform)
- Program Period: 2013～2017
3. Financial Support
JOIN will back up the financing of projects by holding a considerable portion of the equity of SPC. This equity finance scheme can improve bankability of the project.
JOIN’s Focus to Invest

- High-speed railways
- Urban railways / transport system
- Toll roads
- Ships / offshore units
- Port terminals
- Airport terminals
- Urban development
- Logistics
Scope of funding

Projects, to be supported by JOIN, need to be relevant to overseas transport* or urban/regional development.
* "Transport" includes not only “traditional” sea transport such as the operation of LNG vessels and container vessels, but also offshore projects such as the operation of FPSO, FLNG, PSV, AHTS, shuttle tankers and Logistics Hub.

Where the funding can go

- Owning/O&M SPC of the LNG Vessel
- Owning/O&M SPC of the FPSO
- Owning/O&M SPC of the PSV/AHTS

Example of lease financing structure

<table>
<thead>
<tr>
<th>OWN</th>
<th>O&amp;M SPC</th>
<th>Debt</th>
<th>Charter contract &amp; O&amp;M contract</th>
<th>Oil &amp; gas company</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Japanese banks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local bank etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japanese investors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norwegian investors</td>
<td></td>
<td></td>
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<tr>
<td>JOIN</td>
<td></td>
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</tbody>
</table>
4. Cooperation between Norway and Japan
Cooperation between Norway and Japan

【Norway】

• In 2011, Norway and Japan signed “Memorandum on Cooperation in the Field of Maritime Technology and Industry”.

• Norway and Japan are in good cooperation for the preparation for two big international maritime exhibitions; Norshipping (in Norway) & SEA JAPAN (in Japan).

• During these exhibitions, international maritime seminars and round tables are held by the mutual cooperation between Norway and Japan.

• Norway and Japan have had high level bilateral meetings (Vice Ministers and Directors for Maritime Bureau) and exchange their policies to foster the mutual relationship during these events.
**Exhibition in the Maritime Cluster Zone**

Japanese and overseas shipping / shipbuilding / ship machinery companies, research institutes, maritime organizations and other parties participated to appeal their leading technologies like maritime environmental-friendly technologies and offshore resource development technologies. (Participants: 18,672 persons in total)

**Seminars organized by MLIT**

“International Maritime Seminar”
- Theme: Green growth in the maritime industry and offshore resource development.

“Maritime Environmental Technology Seminar”
- Theme: world-leading environmental-friendly technologies

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We are looking forward to seeing you in **SEA JAPAN 2016**!

(13th ~ 15th April, 2016 in TOKYO)
Tusen Takk!