MOL’s Market Position in LNG Shipping

MOL has the largest fleet of LNG Carriers in the world.

![Chart showing MOL's LNG carrier fleet compared to other companies.](Image)
MOL’s Market Position in LNG Shipping

World's Largest LNGC Owners and Managers
Experience and Know-How of LNGC Safety Operation
MOL’s Partners in World-Wide Commercial Relation
First Experience of LNGC Shipbuilding in China as a Foreign Shipping Company

Challenging for Technical High Level Project
⇒ Participation in “YAMAL LNG Project”

YAMAL LNG Project

Share Holder
- NOVATEC 50.1%
- CNPC 20%
- TOTAL 20%
- SILKROAD FUND 9.9%

LNG Production
16.5 million tons / year (5.5 million tons / year x 3 Train)

Production Start
- Train 1 in 2017
- Train 2 in 2018
- Train 3 in 2019

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Production Start
- Train 1 in 2017
- Train 2 in 2018
- Train 3 in 2019

Project Outline

LNGC Fleet Plan

<table>
<thead>
<tr>
<th>Ship Owner Ship’s Name</th>
<th>Shipbuilding Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sovcomflot</td>
<td>2016, November</td>
</tr>
<tr>
<td>2 Dynagas/CLNG/Sinotrans</td>
<td>2017, July</td>
</tr>
<tr>
<td>3 Dynagas/CLNG/Sinotrans</td>
<td>2017, September</td>
</tr>
<tr>
<td>4 Teekay/CLNG</td>
<td>2017, October</td>
</tr>
<tr>
<td>5 MOL/China Cosco Shipping Vladimir Rusanov</td>
<td>2017, December</td>
</tr>
<tr>
<td>6 Teekay/CLNG</td>
<td>2018, July</td>
</tr>
<tr>
<td>7 MOL/China Cosco Shipping</td>
<td>2018, September</td>
</tr>
<tr>
<td>8 Dynagas/CLNG/Sinotrans</td>
<td>2018, October</td>
</tr>
<tr>
<td>9 Dynagas/CLNG/Sinotrans</td>
<td>2018, November</td>
</tr>
<tr>
<td>10 Dynagas/CLNG/Sinotrans</td>
<td>2018, December</td>
</tr>
<tr>
<td>11 Dynagas/CLNG/Sinotrans</td>
<td>2019, April</td>
</tr>
<tr>
<td>12 Teekay/CLNG</td>
<td>2019, July</td>
</tr>
<tr>
<td>13 MOL/China Cosco Shipping</td>
<td>2019, September</td>
</tr>
<tr>
<td>14 Teekay/CLNG</td>
<td>2019, October</td>
</tr>
<tr>
<td>15 Teekay/CLNG</td>
<td>2019, November</td>
</tr>
</tbody>
</table>
### LNG Transportation Plan

**WINTER** (mid Nov～June)
- ARC7 15 LNGCs shuttle to Europe
- Light ice-class LNGCs to Asia (ARC4 or less, up to 11 ships)
  - Distance: 13,700 miles
  - One voyage: 55 days @10 knots

**SUMMER** (July～mid Nov)
- ARC7 15 LNGCs to Asia via NSR transit
  - Distance: 4,900 miles
  - One voyage: 20 days @10 knots

### Benefit of Arctic Sea Route

**Benefit**
- Short-cut transit route from Europe to Asia
  - Energy Saving
  - Multiple option of transit routes
- Access to potential energy resource in Arctic ocean
  - Arctic water accounts:
    - 17% of discovered natural gas in the world
    - 30% of undiscovered natural gas in the world

**Outstanding**
- Ice navigation Crew training
- Crew health: Polar night/Polar day
- Infrastructures: SAR station (Search & Rescue), Repair dockyard, Airport
- Limited telecommunication environment
  - (large capacity communication service is not available)
- Custom clearance in Russia
- Bathymetry data (insufficient navigation chart)
- Ice map provider - Weather forecasting system
YAMAL ARC7 LNGCs - Vessel Specification

**ARC7 LNGC (15 vessels) Principal Particulars**

<table>
<thead>
<tr>
<th>Builder &amp; Delivery year</th>
<th>DSME in Korea, Delivery Year: 2016:(1), 2017:(4), 2018:(5), 2019:(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship Owners</td>
<td>Sovcomflot (1), Teekay (6), Dynagas (5), MOL (3)</td>
</tr>
<tr>
<td>Classification Society</td>
<td>Class BV &amp; RMRS</td>
</tr>
<tr>
<td>Ship Dimension</td>
<td>Loa 299m x B 50m x D 26.5m x Ice draft 12.0 m</td>
</tr>
<tr>
<td>Cargo Tank</td>
<td>GTT No96 Membrane, 172,600 m3 (100% filled)</td>
</tr>
<tr>
<td>Propulsion</td>
<td>AZIPOD 3 units (DFDE Generator 6 sets)</td>
</tr>
<tr>
<td>Ice Class</td>
<td>RMRS ARC-7 (1st year ice, 210cm thick), Winterization -52 deg.C.</td>
</tr>
</tbody>
</table>

YAMAL ARC7 LNGCs - Vessel Specification

1. **Double Acting LNG Carrier**
   - Ship Speed (Ahead 2kts/Astern 5 kts) at 1st year 150cm Level Ice

2. **Ice Strengthened Hull Structure**
   - 25% increased hull steel, up to 70mm thick, Low temp steel, Ice coating

3. **Engine Room design**
   - Complete double hull, Two engine rooms (center bulkhead), Ice Sea chest

4. **Navigation Bridge**
   - Dual bridge stations, Totally enclosed, Polar design Nav/Radio equipment

5. **Winterization in Living Quarters**
   - Triple source heating system, Sauna/Hot water swimming pool

6. **Winterization on Deck**
   - Semi enclosed mooring space, Electric driven, Heat tracing, De-icing

7. **Life Saving Equipment**
   - Polar design LSA, Survival kits
Features of YAMAL Arc7 LNGC

**Double Acting Operation**

- Ahead for Open Sea & Light Ice
- Astern for Heavy Ice

**Ice Knife**
Bow is reinforced by casting construction.

**3 POD Propulsion system**
Enable double acting operation easily.

**Propulsion Performance**

<table>
<thead>
<tr>
<th></th>
<th>Ahead</th>
<th>Astern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Sea</td>
<td>19.5knot</td>
<td>-</td>
</tr>
<tr>
<td>Level Ice 1.5m</td>
<td>2knot</td>
<td>5knot</td>
</tr>
</tbody>
</table>

**Dual Bridge Station**

- Dual Bridge Station
- FWD W/H
- AFT W/H

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**H2424 Vladimir Rusanov Ice Trial**

**Ice Trial**

- **Trial Period**: Feb.22-Mar.15, 2018
- **Test Area**: Kara Sea
- **Purpose**
  1. Ice Performance Capability (Speed/Turning)
  2. Operation of Azipod & Main Generator
  3. Operation under Low Temp. Environment
  4. \( \alpha \): Familiarization for Ice Navigation (Crew)

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Thank you for your attention.