Proposal for a Northeast Asian Hydrogen Highway
From a Natural-gas-based to a Hydrogen-based Society

The proposed Northeast Asian Natural Gas Pipeline should be built of hydrogen-capable linepipe, so that energy from the diverse, abundant, renewable resources of this vast region may be gathered and transmitted as gaseous hydrogen (GH2), replacing natural gas reserves as they are depleted.

- Diverse, large, rich, renewable energy resources can be synergistically generated, converted, transmitted, and stored at seasonal scale as GH2 in pipelines, and perhaps stored in geologic formations
  - East Siberia and Sakhalin are rich in natural gas
  - Most of Russia’s untapped hydroelectricity is in East Siberia
  - Kamchatka, Chishima (Kuril) Islands, and Sakhalin have rich coastal and offshore wind
  - West China has abundant solar
  - Kamchatka has large geothermal
  - The extent and intensity of these renewables has not been accurately assessed
  - Northeast Asia’s environmental protection and energy security require a large, new pipeline system to gather and transport, throughout the region, natural gas in the short term and renewable-source hydrogen in the long term
  - European Commission’s (EC) “NaturalHY” program is assessing technical and economic aspects of adding renewable-source GH2 into Europe’s existing natural gas pipeline system

Capacity of Gaseous Hydrogen (GH2) Pipelines
- Without input or midline compressors
- At 100 bar pipeline input pressure, 35 bar delivery pressure

Predicted Asian Countries Demand for Natural Gas

Estimated Asia Renewable Energy Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Annual Production (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermal</td>
<td>3,300</td>
</tr>
<tr>
<td>Wind</td>
<td>Unknown</td>
</tr>
<tr>
<td>Solar</td>
<td>Unknown</td>
</tr>
<tr>
<td>Total</td>
<td>Unknown</td>
</tr>
</tbody>
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Source: IEEJ, Nov 2004

Distributed Generation (DG) adding great value.
Seasonal-scale storage in geologic formations would firm renewables.

GH2 PIPELINE STORAGE
• Provides ~ 12,000 MWh of energy storage, for 1,600 km pipeline,
36” diam, “unpacked” from 70 to 35 bar.

INSPECTION
• Intelligent pigging” inspection pipeline, large enough for frequent “in
12” diameter, greater than 70 bar, GH2
IRHTDF is a 30-100 km,
Distributed Generation (DG) adding great value.