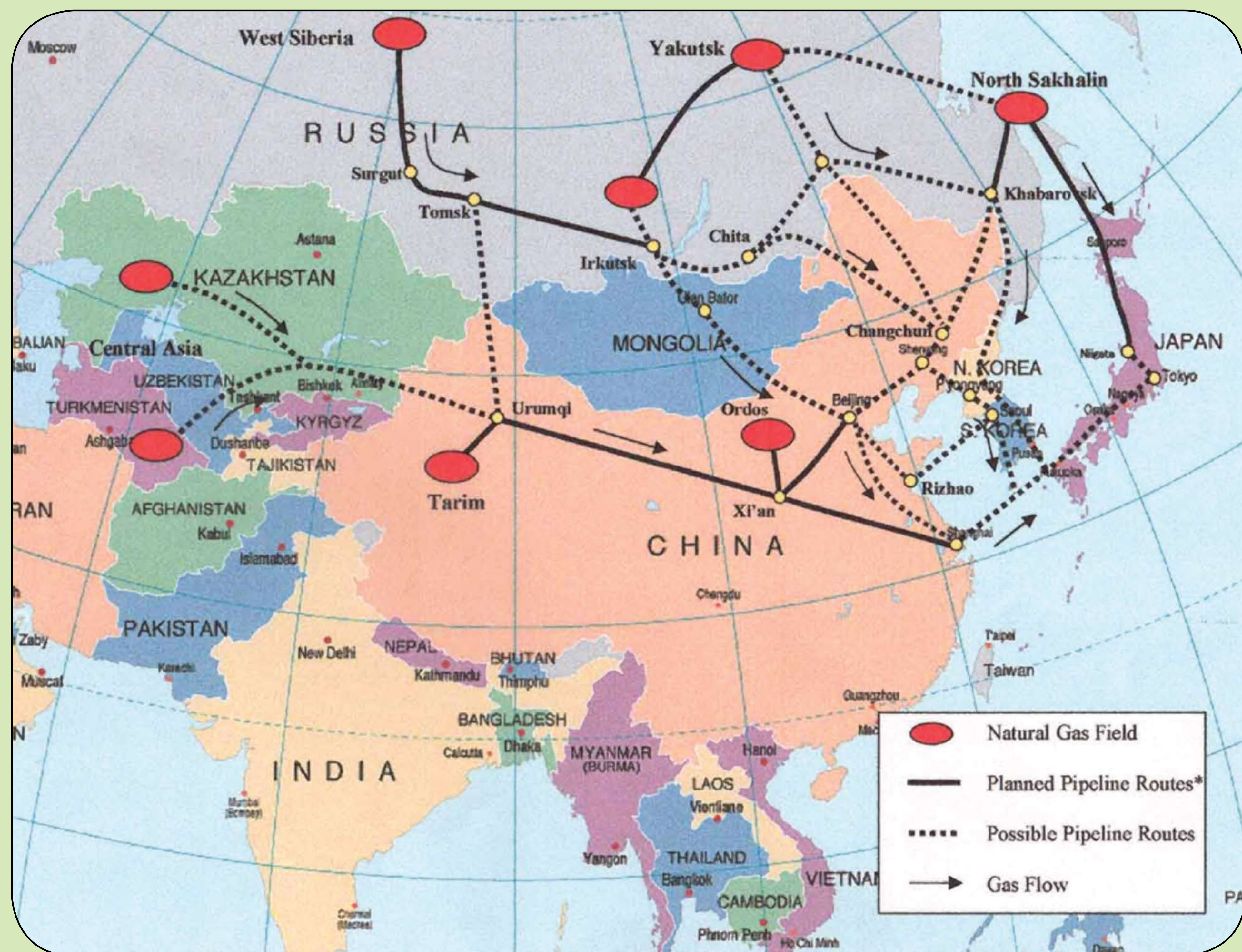


Proposal for a Northeast Asian Hydrogen Highway From a Natural-gas-based to a Hydrogen-based Society

K. O'Hashi, D. Eng.
General Manager, Nippon Steel Corporation
Tokyo, Japan

M. Hirata, D. Eng.
President, Shibaura Institute of Technology
Tokyo, Japan

W. Leighty
Director, The Leighty Foundation
Juneau, AK, USA



Capacity of Gaseous Hydrogen (GH2) Pipelines

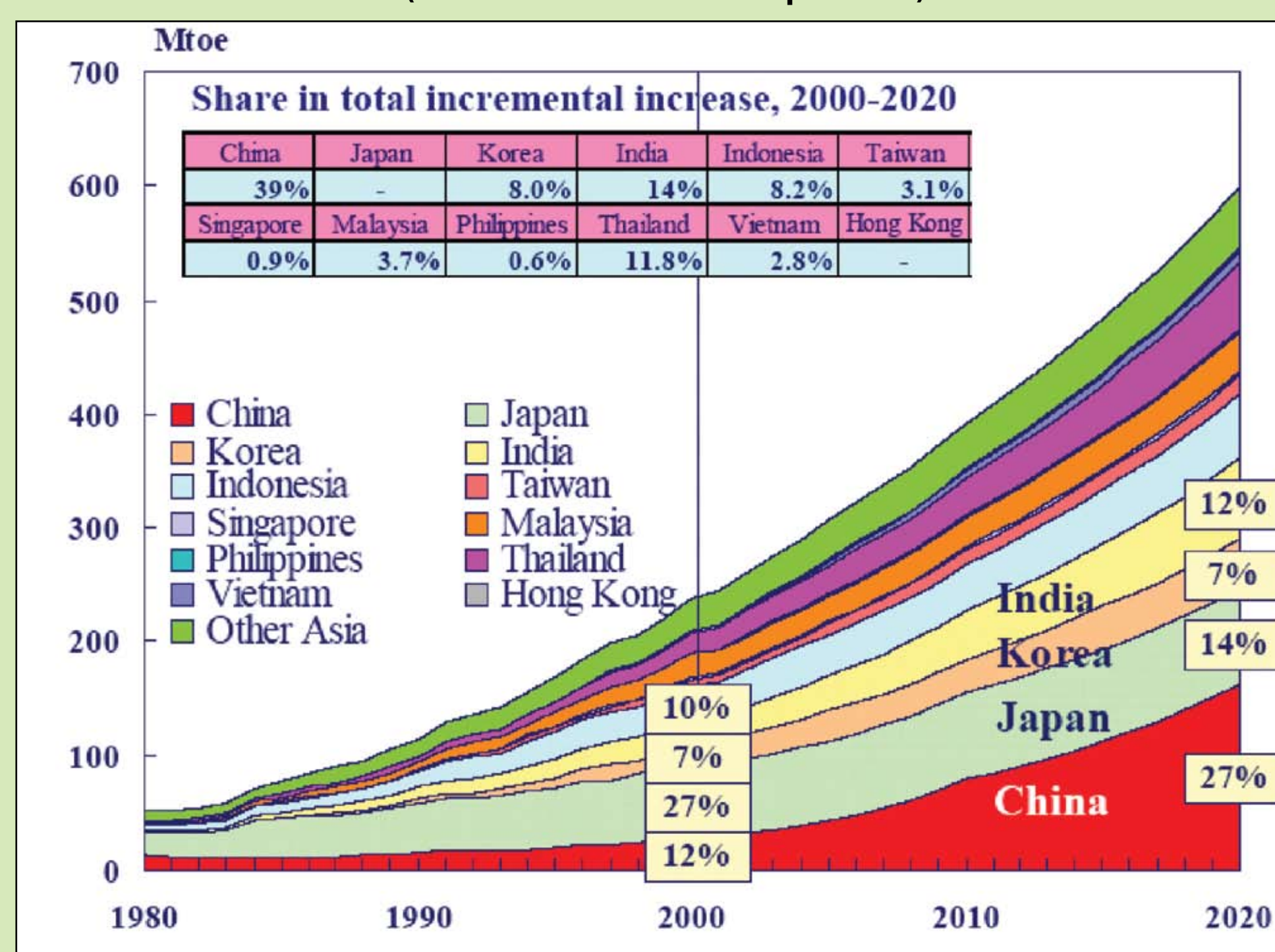
- Without input or midline compressors
- At 100 bar pipeline input pressure, 35 bar delivery pressure

Distance km	Nominal Diameter inches	Capacity GW	Capacity MMscfd	Capacity Million Nm3 / day	Capacity Tons per day	Storage Capacity MMscf	Storage Capacity Tons
320	20	2.8	702	18.1	1,869	141	374
320	36	12.3	3,100	80.1	8,253	450	1,199
480	20	2.3	573	14.8	1,526	211	562
480	36	10.2	2,580	66.7	6,869	675	1,798
800	20	1.8	444	11.5	1,182	352	936
800	36	7.9	1,998	51.7	5,319	1,126	2,997
1,600	20	1.2	313	8.1	833	703	1,872
1,600	36	5.6	1,413	36.5	3,762	2,251	5,994

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 extant natural gas pipeline system

Predicted Asian Countries Demand for Natural Gas (Mtoe: million tons of oil equivalent)



Estimated Asia Renewable Energy Resources

Renewable Resource	Annual Production TWh (billion kWh)
Hydro	3,000
Geothermal	3,300
Wind	Unknown
Solar	Unknown
Total	Unknown

