PE 137 Coal and Power Course

Opening Remarks

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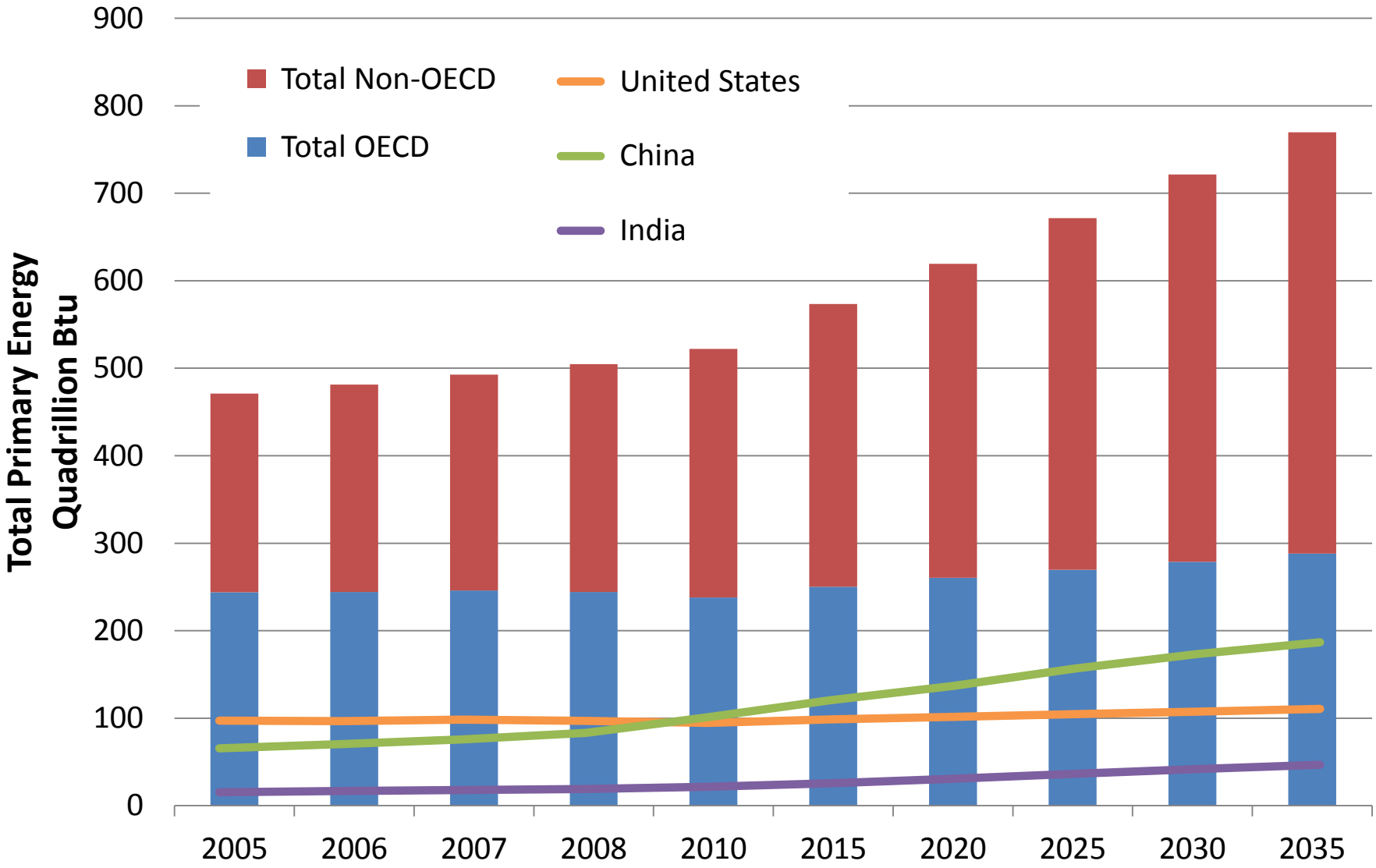
Five Revolutions

- Rising Non-OECD Energy Consumption
- Upstream Oil and Gas Technology Advances
- Globalizing Natural Gas Market
- Creating Necessary Financial Structures
- Expanding Access to Electricity

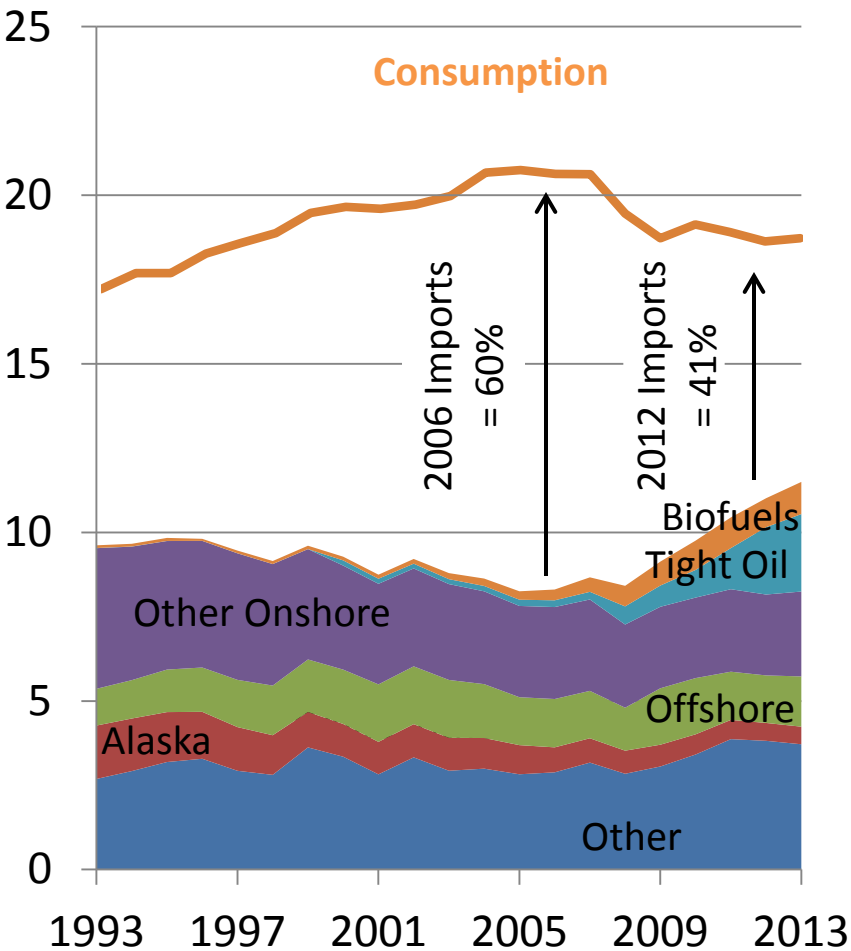
World Energy Consumption Forecast



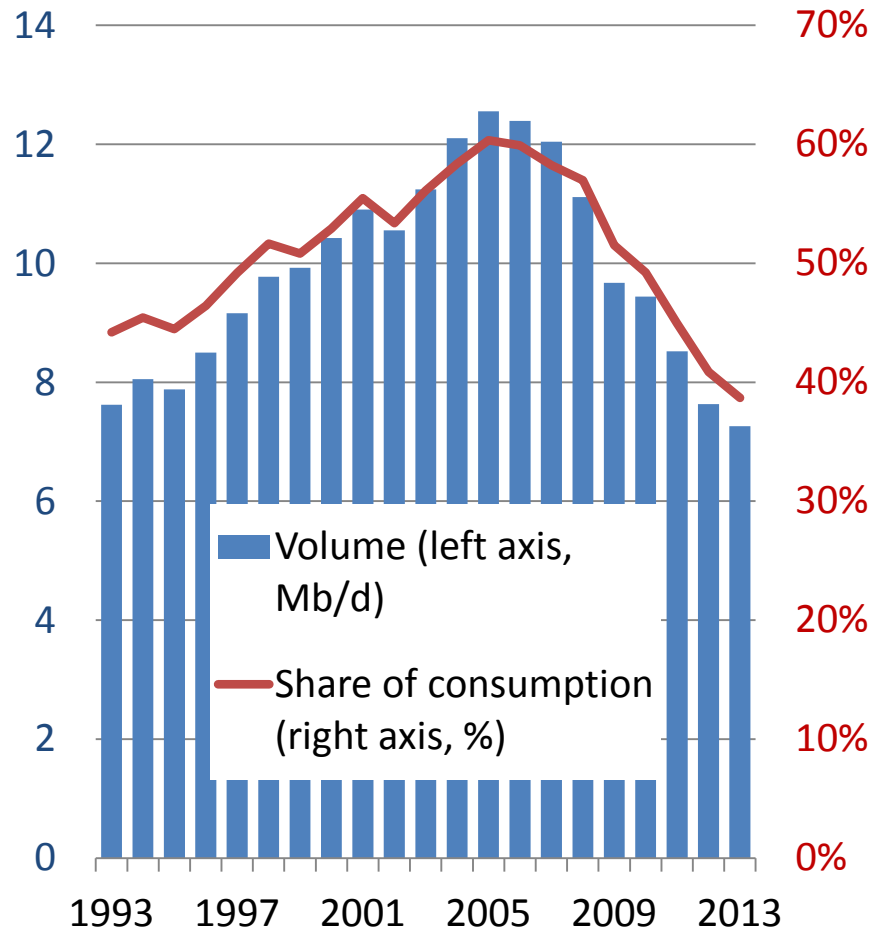
Source: U.S. Energy Information Administration, 2011 International Energy Outlook

U.S. Oil Import Dependence

Oil Supply and Demand (Mb/d)

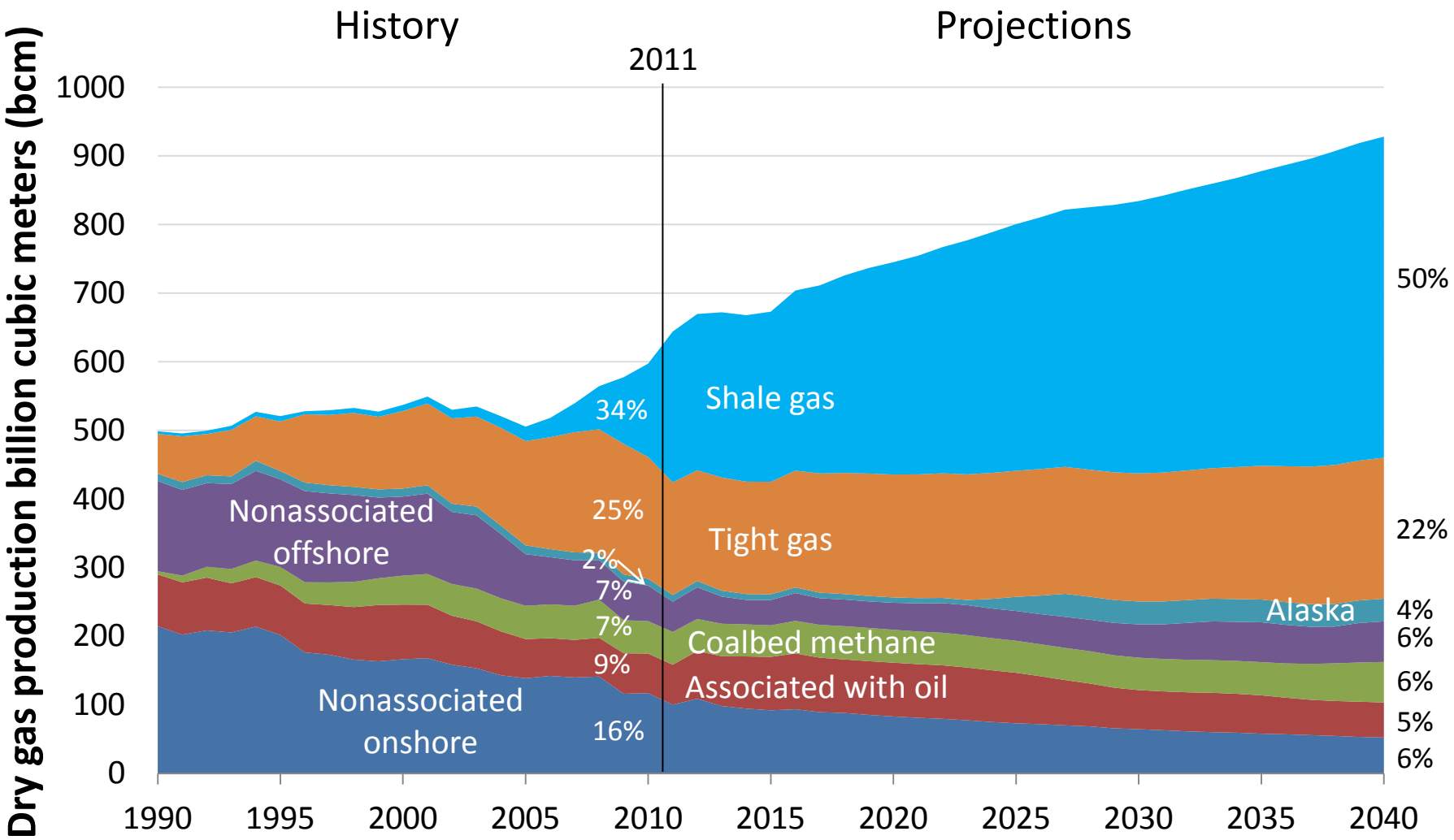


Oil Imports



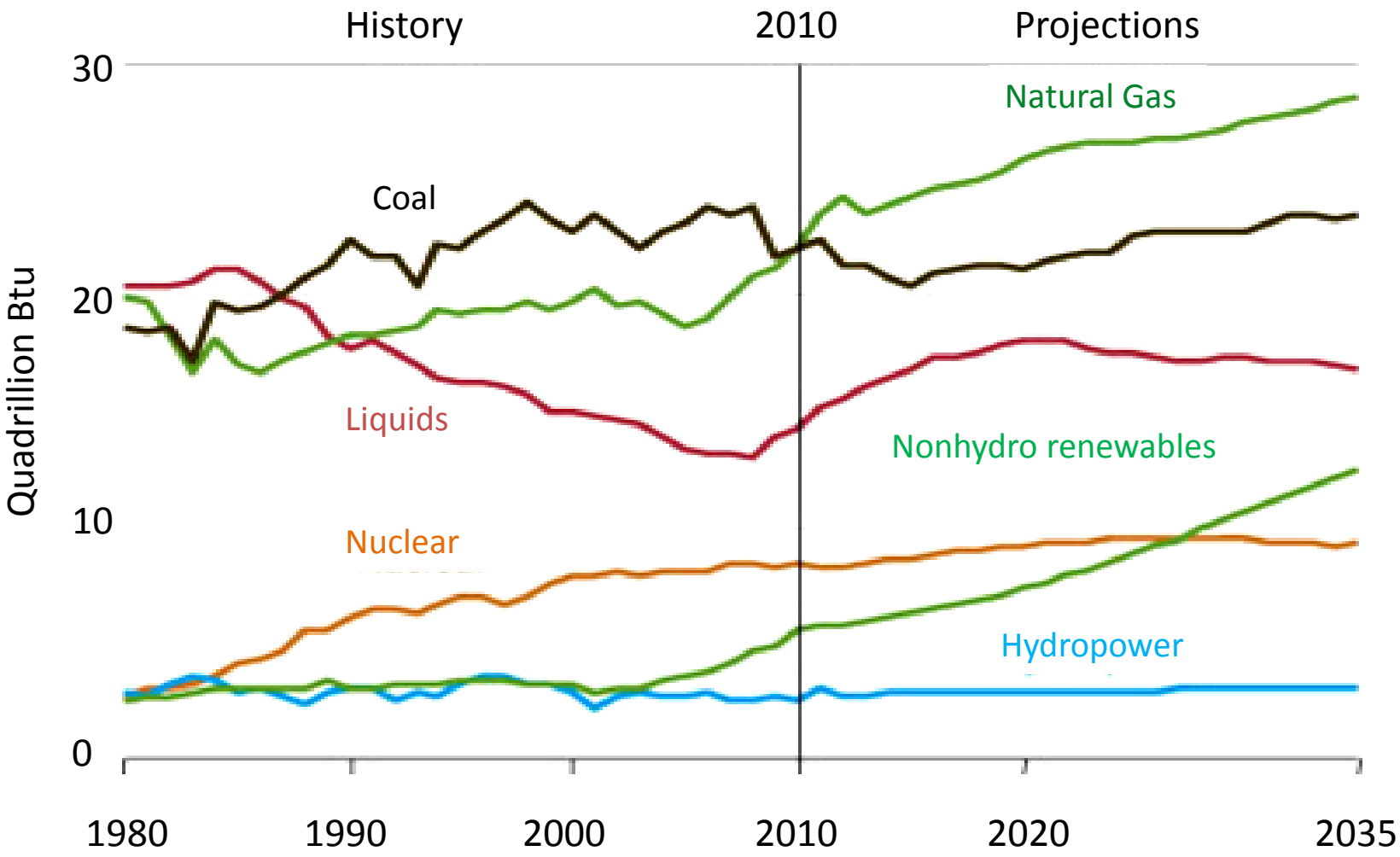
Source and Notes: EIA, Short Term Energy Outlook (October 2012). Figures for 2012-13 are projections.

U.S. Natural Gas Supply by Source



Source: EIA, AE0 2013

U.S. Production By Fuel, 1980-2035



Source: U.S. Energy Information Administration, AEO 2012

Global Gas Markets

World LNG Estimated April 2013 Landed and Hub Prices ($US/mmbtu)

	Production (bcm)	
	2008	2035
Russia	662	881
Iran	130	279
Turkmenistan	71	136
Canada	175	192
United States	575	779
Norway	102	127
Australia	45	155
Qatar	78	260
Indonesia	74	119
Nigeria	32	119
Algeria	82	168
Latin America Total	148	292

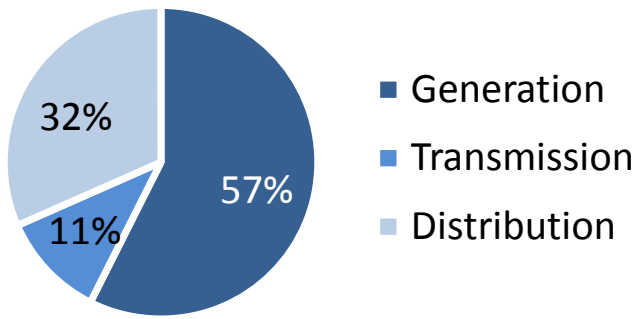
	Reserves (bcm)
Mozambique	2825
Tanzania	565
Israel	407

Source: IEA, FERC, media and industry estimates.

Global Power Sector Investments, Cumulative

(2012-2035)

Power: $16.9 trillion



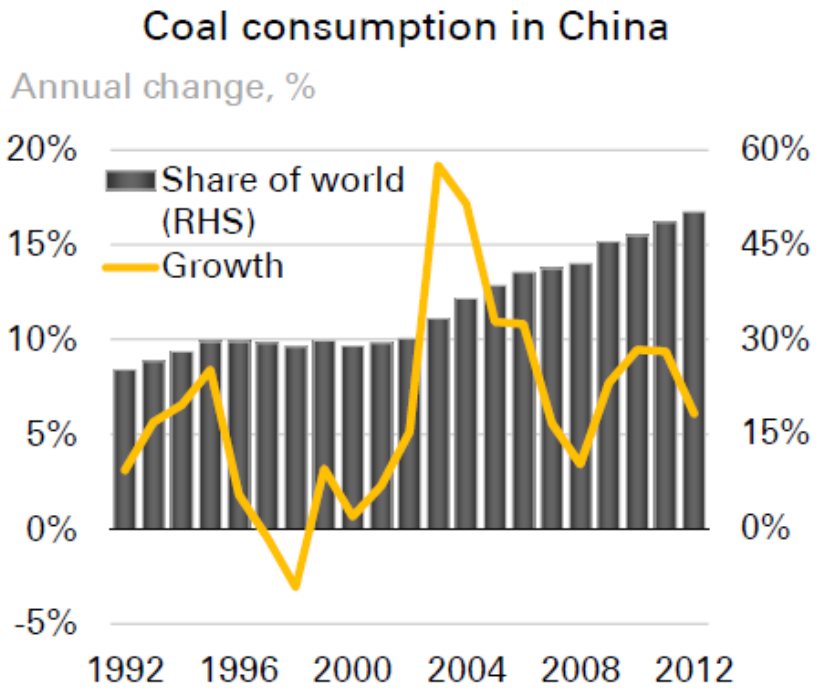
- More than 40% of global investment in the power sector goes to transmission and distribution.
- Nearly two-thirds of investment is in the non-OECD to meet growing demand.

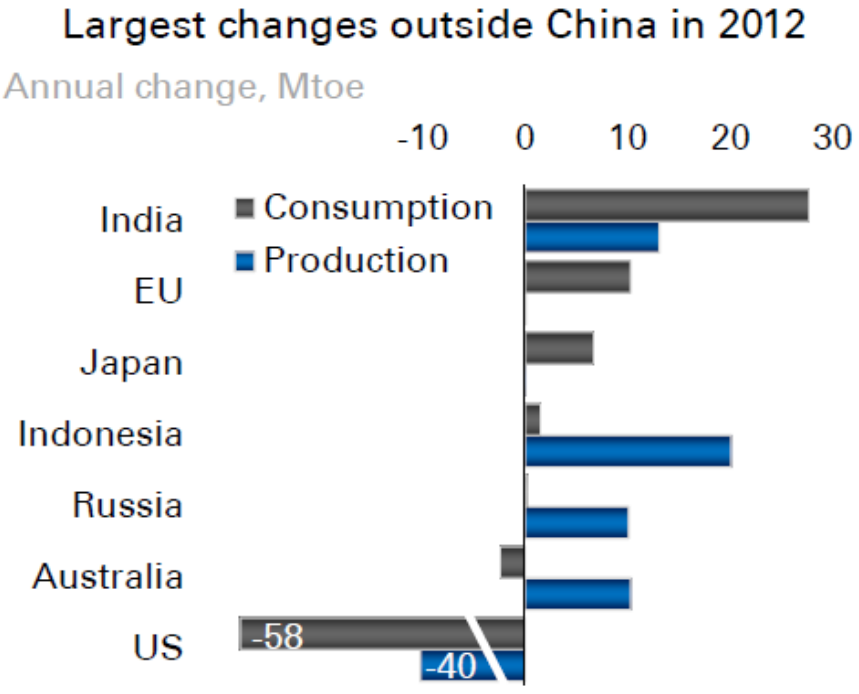
New Investment in Electricity Generation, 2012-2035 ($ billion)			
	OECD	**Non-OECD**	**World**
Coal	451	1,157	1,608
Gas	436	605	1,041
Oil	16	59	75
Total Fossil	***903***	***1,821***	***2,724***
Total Nuclear	***360***	***583***	***943***
Bio-energy	368	280	648
Hydro	418	1,130	1,548
Wind	1,145	984	2,129
Solar PV	717	542	1,259
Other*	226	208	434
Total Renewable	***2,874***	***3,144***	***6,018***
TOTAL GENERATION	***4,137***	***5,548***	***9,685***

Source: IEA, WEO 2012, New Policies Scenario

* Includes geothermal, concentrated solar, and marine

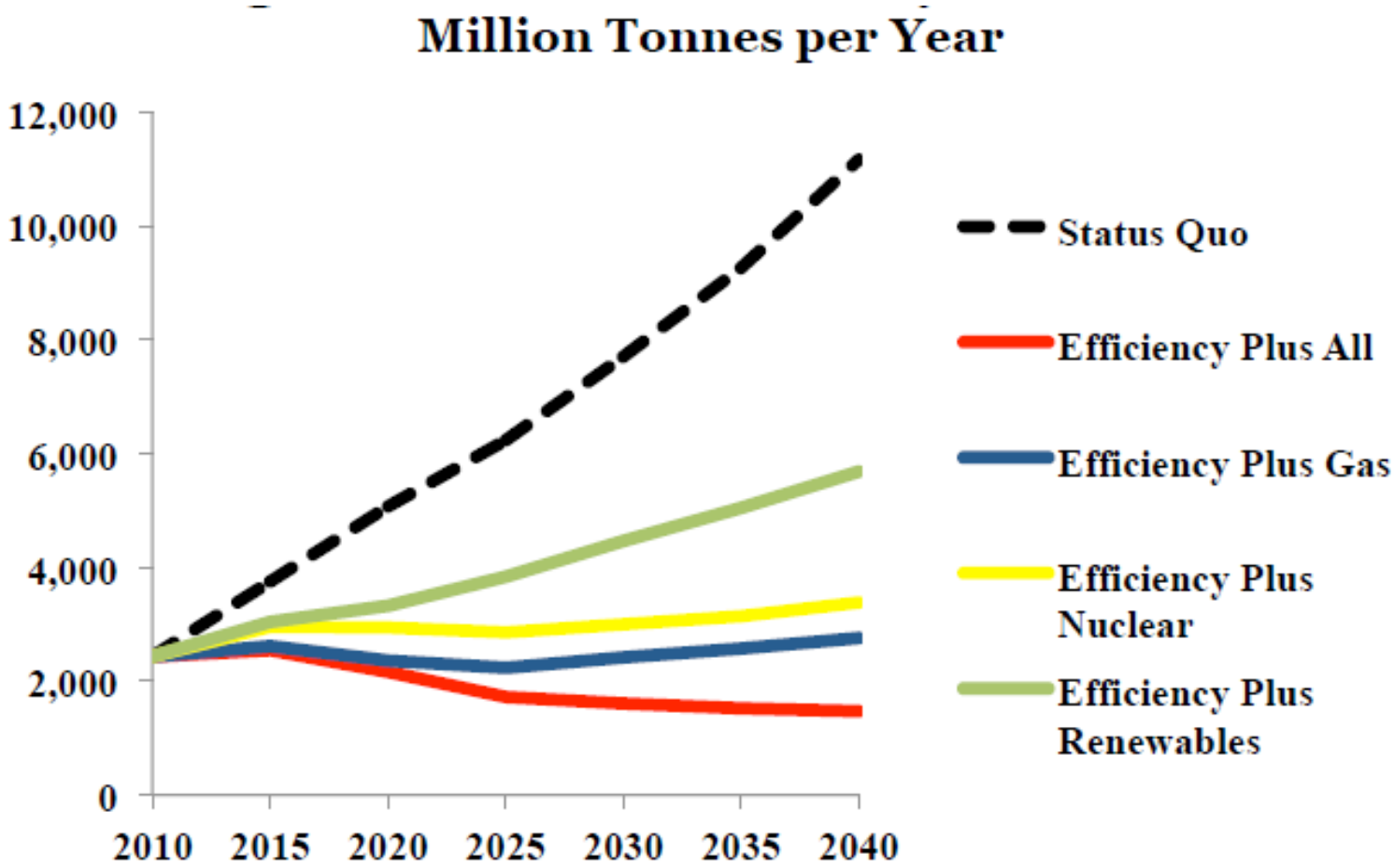
Growth in Chinese demand for coal, driving global demand





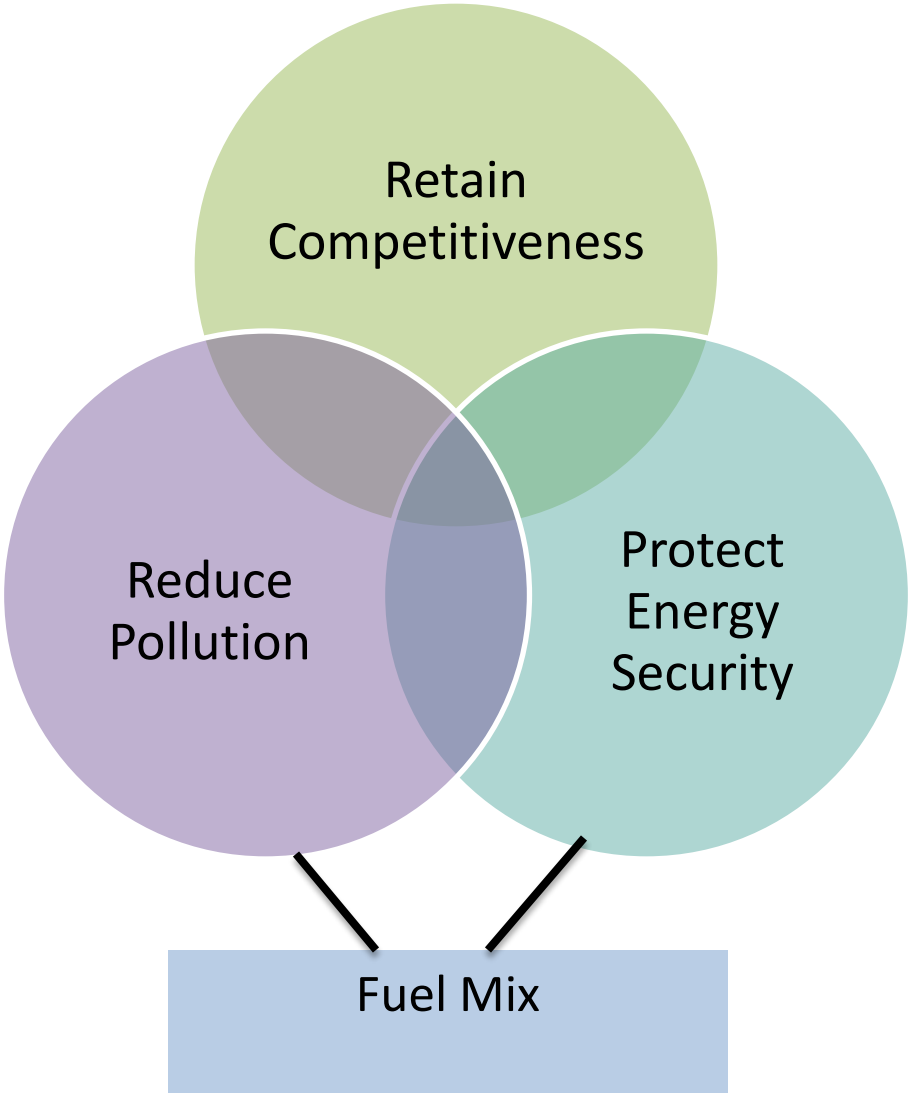
Source: BP Statistical Review 2013

Gas Can Help Reduce Chinese GHG Emissions

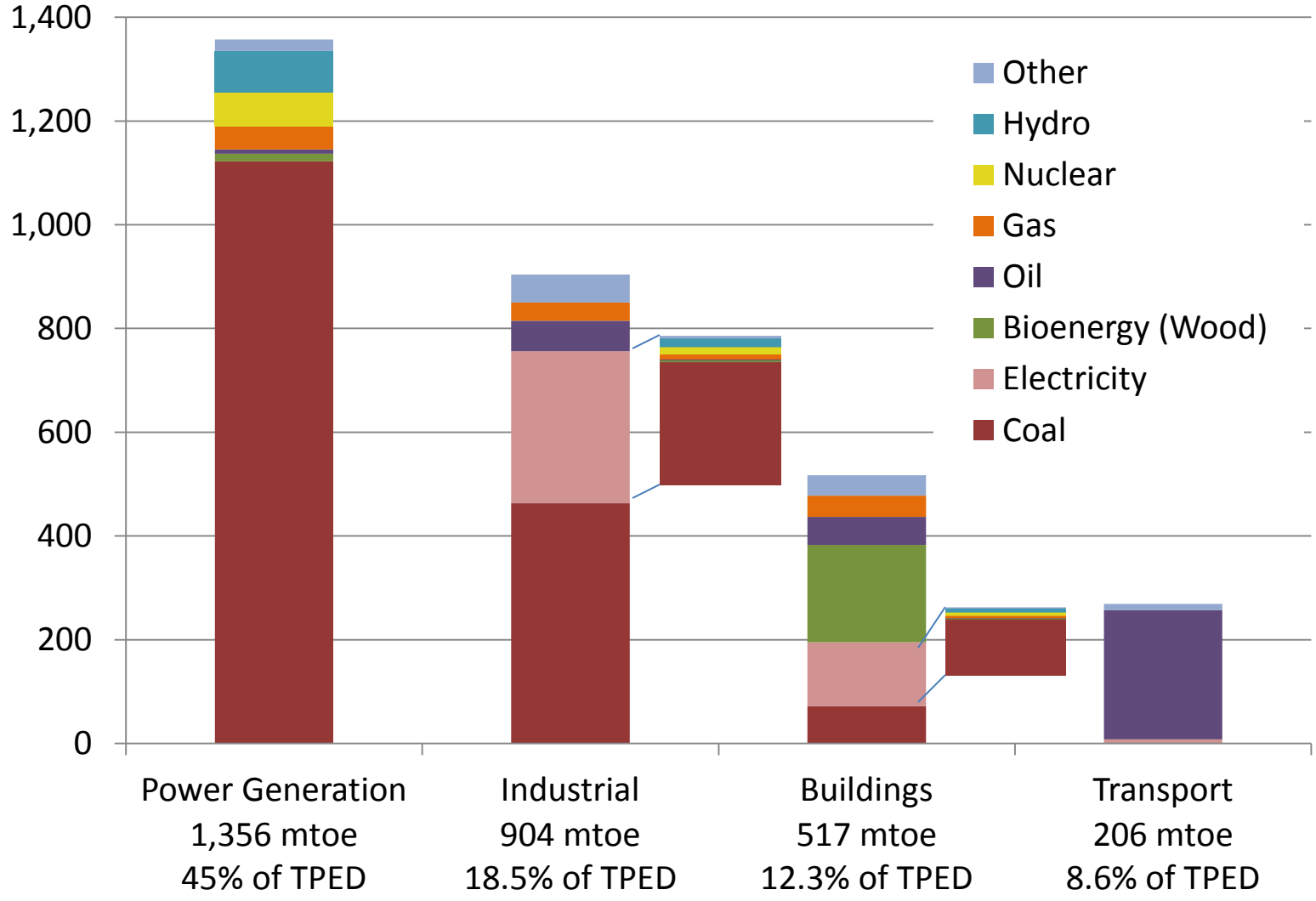


Source: Chandler, William; Wang, Yanjia; Gwin, Holly; Chen, Shiping, China Power, Benefits and Costs of the "Strong, Smart Grid", ENTRI, May 2012

Energy Imperatives



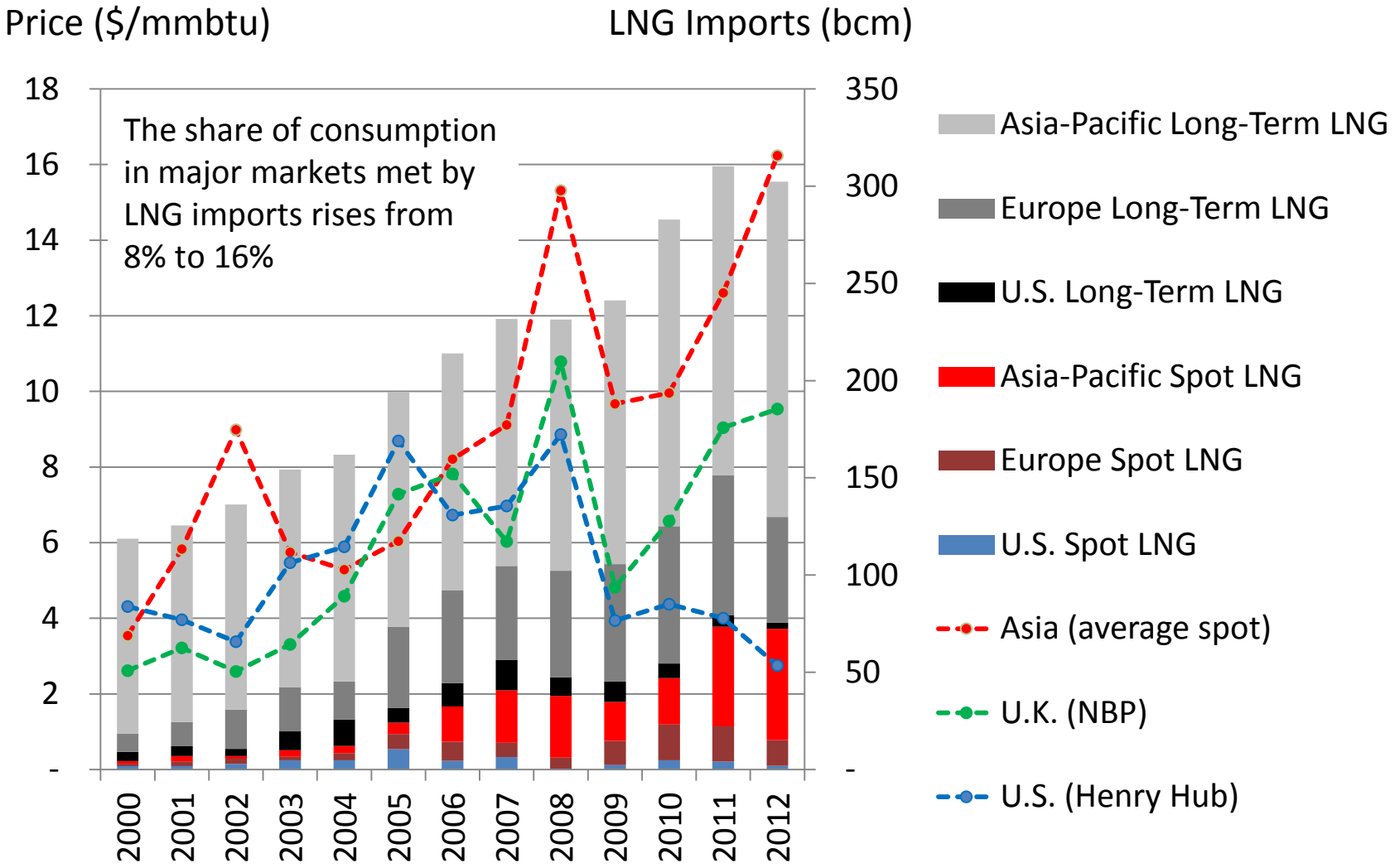
China: Opportunity to switch gas for coal, wood, oil



Source: Total Primary Energy Demand, IEA WEO, 2015 Scenario

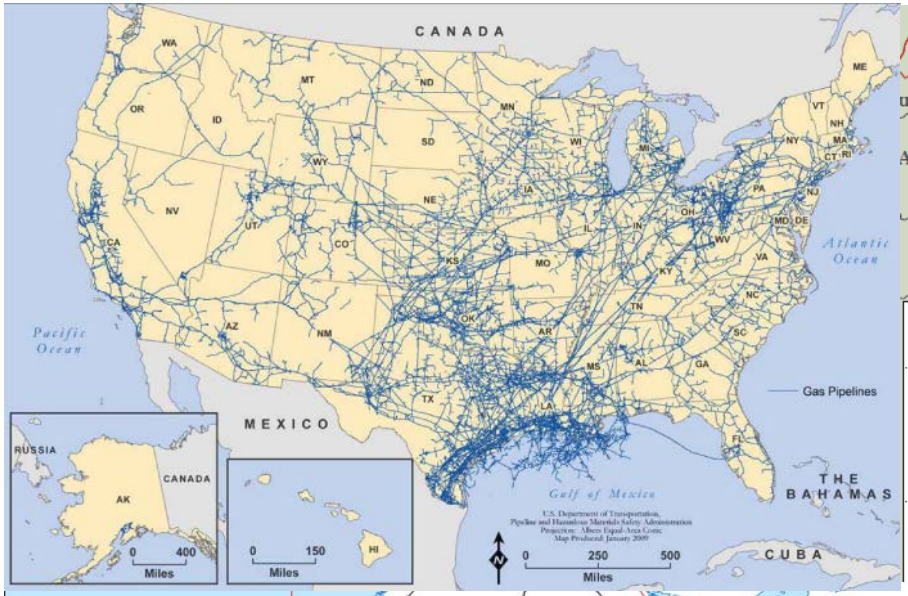
Sharing Best Practices

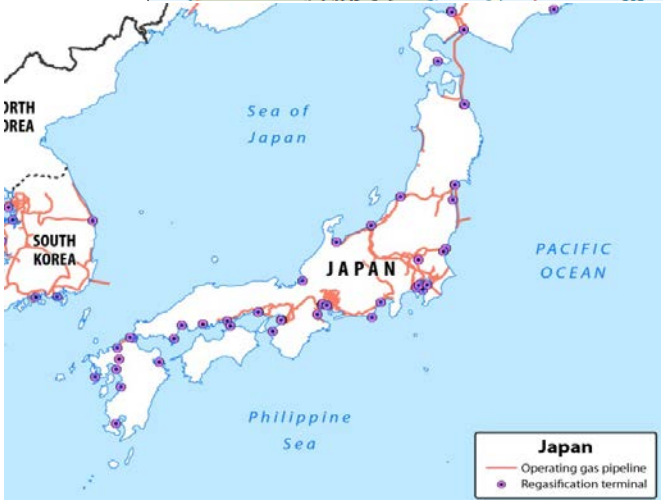
Diverging Gas Prices, Spot Deals Lead Growing LNG Trade



Data source: EIA, PIRA

Natural Gas: Infrastructure and Policy

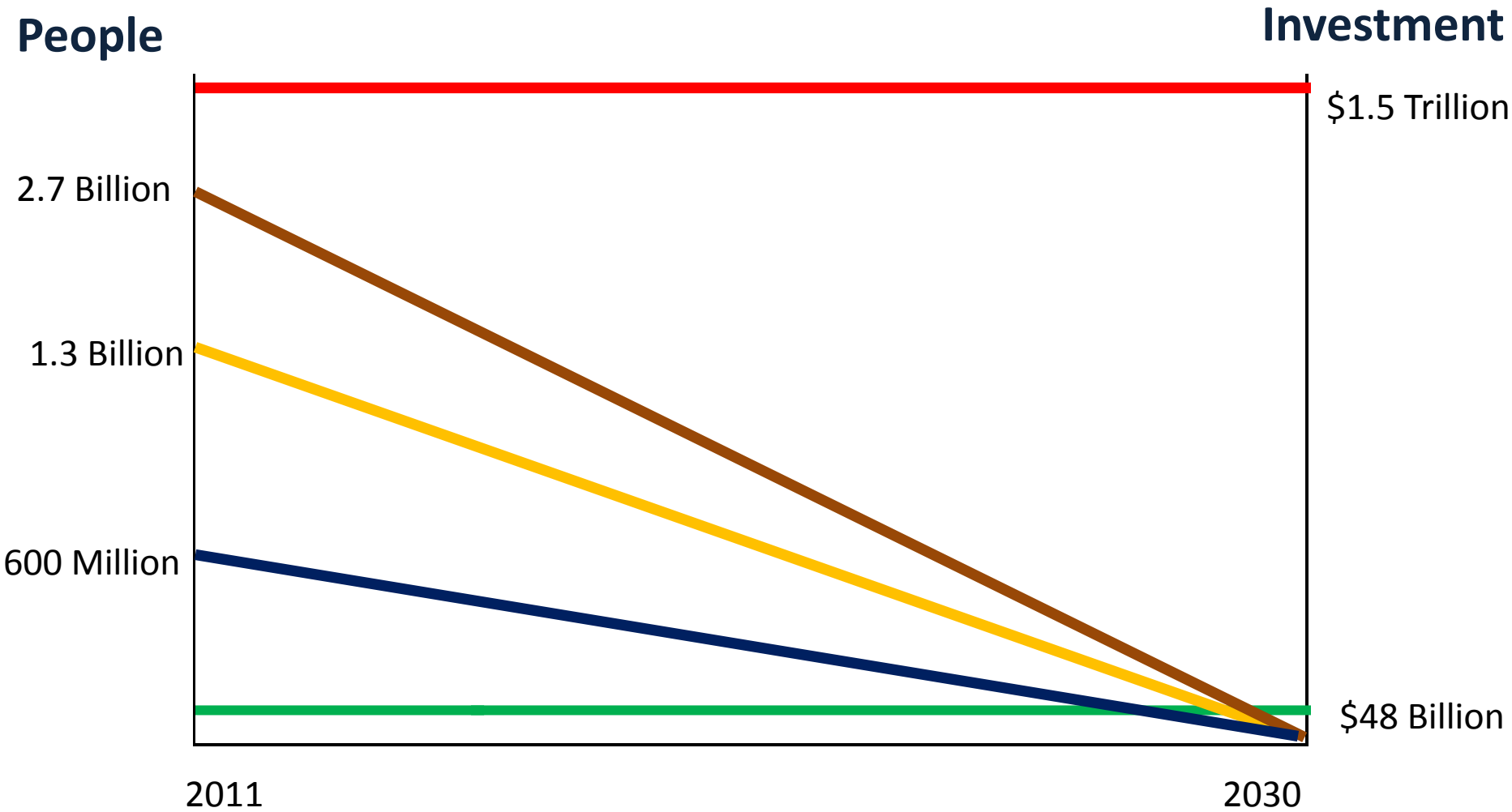




Sources: EIA, IEA, Industry Sources

Investment for Access

(3% of total investment needed by 2030)



Source: IEA

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