

ENERGY
STUDIES
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APEC Economies: A Paradigm Shift?

Energy Security in APEC Economies

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Energy Security in APEC Economies

1 Defining Energy Security

2 Paradigm Shift: Gas markets in APEC

3 Some Conclusions on Energy Security

Definitions of Energy Security

- **“Energy security” often used with blurred definitions**
 - Frequently used to justify contradictory policies
 - For example, both coal and green lobbies in the US claim government support in energy security terms
- **To measure energy security, clear definitions required:**
 - “the welfare impact of either physical unavailability of energy, or prices that are not competitive or overly volatile” – IEA (2007)
 - “uninterrupted physical availability of energy products on the markets, at a price which is affordable to all consumers (private and industrial)” – EU Commission (2004)
 - “loss of economic welfare that may occur as a result of a change in the price or availability of energy” – Bohi and Toman (1996)
- **The focus is with true economic costs and options rather than actual physical availability**

Tracking Metrics of Energy Security

An initial list of over 20 indicators, cross sectional and longitudinal

Fuel Import Metrics	Energy Expenditure Metrics	Energy Use/ Intensity Metrics	Price volatility Metrics	Environmental Metrics	R & D Metrics
<ul style="list-style-type: none"> • Energy trade balance as % of current account balance • Terms of energy trade trend • Diversity of fuel types • Diversity of fuel sources • Energy Import infrastructure diversity and resilience 	<ul style="list-style-type: none"> • TPES expenditure as % of GDP • Energy expenditure as % of H/H budget • Energy expenditure as % of operating cost of business • energy taxes and subsidies 	<ul style="list-style-type: none"> • Energy consumption per capita • Energy use per \$ GDP • Energy efficiency by industry sector • Energy efficiency of power generation 	<ul style="list-style-type: none"> • Price volatility by fuel • Portfolio risk vs. cost tradeoff • Energy consumption vs. stock levels • Power generation vs. capacity margins • Power capacity diversity 	<ul style="list-style-type: none"> • CO2 emissions per capita • CO2 emissions per \$GDP • CO2 emissions by industry sector • Local / regional pollution (SOx, NOx, lead, PM) 	<ul style="list-style-type: none"> • Private energy R&D expenditure • Public energy R&D expenditure • Renewable energy investments

Definitions of Energy Security

- Attempts to convert multi-dimensions of energy security into single metric for popular consumption
- One recent example : “Index of US energy security” by US Chambers of Commerce
 - 37 individual metrics
 - grouped into 4 headings with weights: geopolitical (30%), economics (30%), reliability (20%) and environment (20%)
- Essentially, all such attempts are ad hoc and arbitrary, with dubious results
 - e.g. high oil price is weighted at 10% (negative) impact, but high oil prices due to prosperity and a booming global economy are completely different from high oil prices due to supply side crisis such as 1970s Arab oil price shocks
 - e.g. high CO₂ emissions accounted as negative indicators, but for the many energy-poor, low CO₂ emissions are part of general poverty and lack of affordable options
- Much bad policy has flowed from the “energy security” mantra

Global and Regional Energy Economics

1 Defining Energy Security

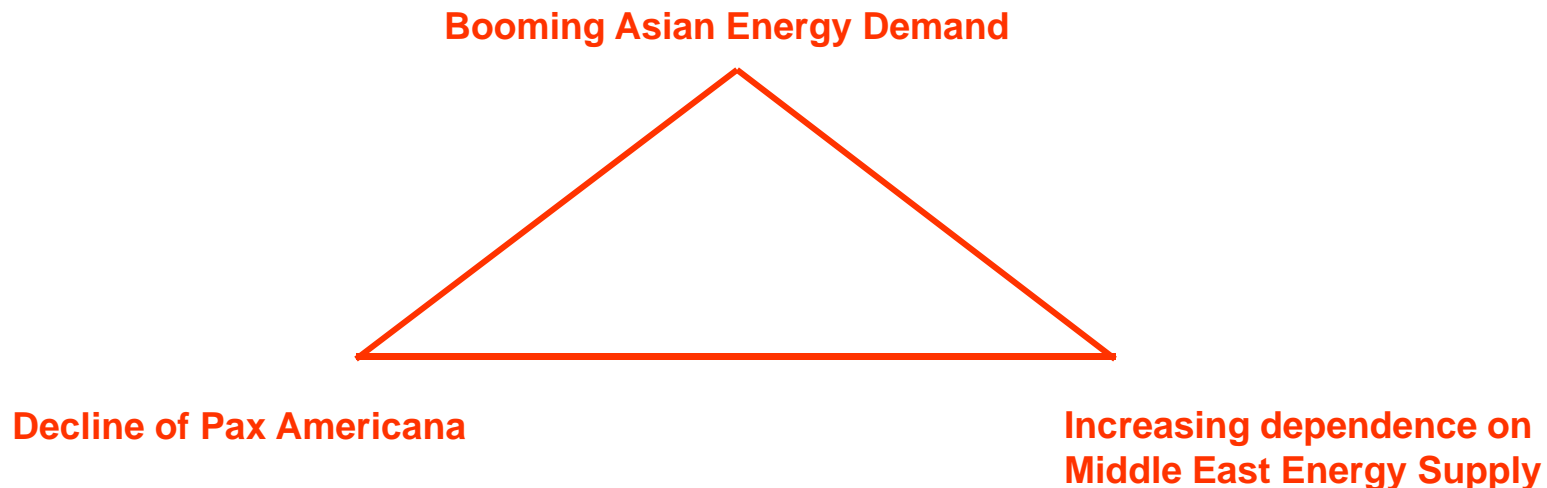
2 **Paradigm Shift: Gas markets in APEC**

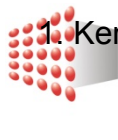
3 Conclusions on Energy Security

One early view of Asian Energy Security

Asia's Deadly Triangle

- About 15 years ago, Kent Calder, Director of the Program on US-Japan Relations at Princeton University,¹ wrote a book on the critical challenges facing Asia, with a fairly grim prognosis
- Asia's rapid economic growth, booming energy demand and its critical energy dependence on the Middle East combined with the waning of American influence in the Pacific Basin would lead to energy shortages, regional rivalries, and a deeper linkage between China and the Middle East
- It is instructive to see how this view fits the current picture



 1. Kent E. Calder "Asia's Deadly Triangle", Nicholas Brealey Publishing Ltd, 1996 London

Primary Energy Demand by Region (MTOE)

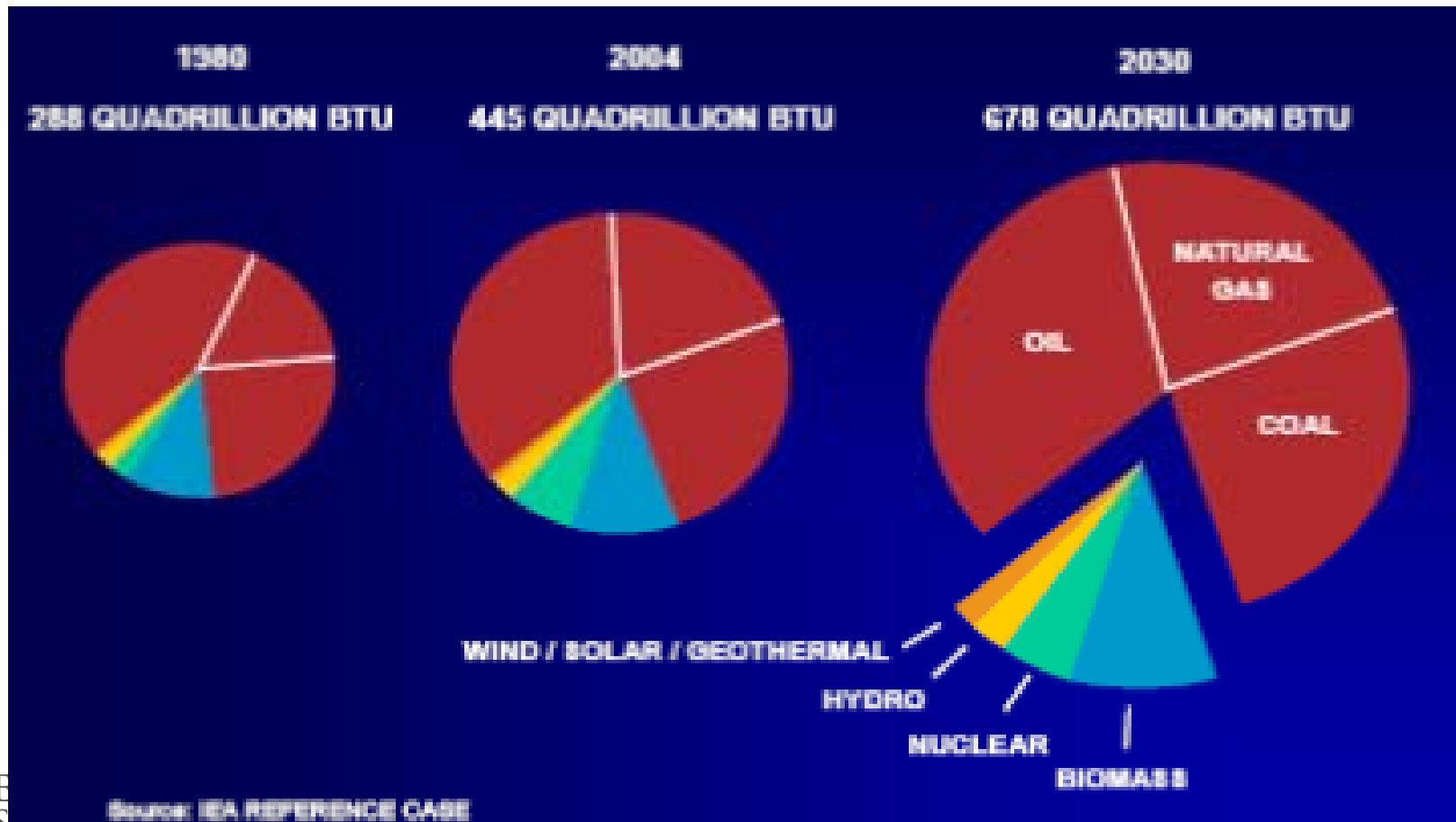
Asia (including China and India) and the Middle East have the most rapid energy demand growth

	1980	2008	2035	CAGR		Share	
				1980-2008	2008-2035	2008	2035
OECD	4,067	5,236	5,681	0.9%	0.3%	43.2%	33.5%
North America	2,102	2,620	2,864	0.8%	0.3%	21.6%	16.9%
<i>United States</i>	1,802	2,160	2,265	0.6%	0.2%	17.8%	13.4%
Europe	1,501	1,766	1,904	0.6%	0.3%	14.6%	11.2%
Non-OECD	2,981	6,567	10,826	2.8%	1.9%	54.1%	63.8%
Asia	1,066	3,724	6,711	4.4%	2.3%	30.7%	39.6%
<i>China</i>	603	2,271	3,835	4.7%	2.0%	18.7%	22.6%
<i>India</i>	208	669	1,464	4.1%	3.1%	5.5%	8.6%
Middle East	114	589	1,000	5.8%	2.1%	4.9%	5.9%
World	7,219	12,132	16,961	1.8%	1.3%	-	-

Source: IEA World Energy Outlook 2011 (New Policies Scenario)

Fossil fuels: indispensable sources of energy

Coal, oil and natural gas occupy a predominant share of fuel sources in the foreseeable future.

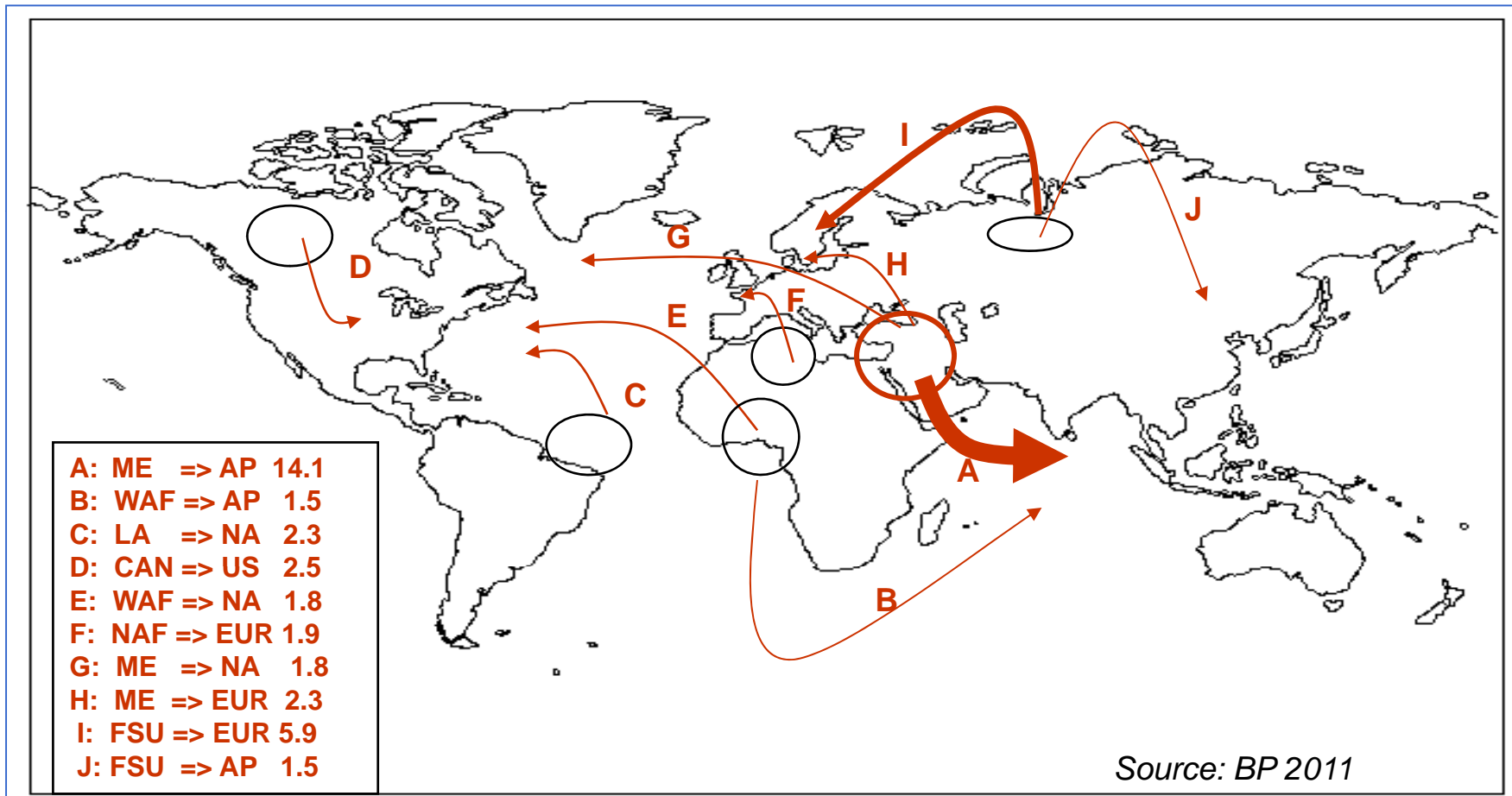


Energy Demand and Supply Fundamentals: Summary

- **Oil, gas and coal will remain indispensable fuel sources for our energy future, despite increasing interest in alternative and renewable energy**
- **Incremental demand will emerge overwhelmingly from the non-OECD countries, in particular the emerging economies of Asia (especially China and India) and the Middle East**
- **Given the geographical distribution of hydrocarbon resources, the Middle East OPEC (and the FSU to some extent) will be increasingly important as suppliers of oil and gas.**
- **Putting the demand and supply pictures together, incremental demand growth emerging from the non-OECD Asian countries will be increasingly met by a few large oil and gas producers.**
- **Non-conventional hydrocarbon sources favor North and South America (shale oil and gas, oil sands, bitumen),**
- **Shale gas “revolution” in the US potential game-changer**

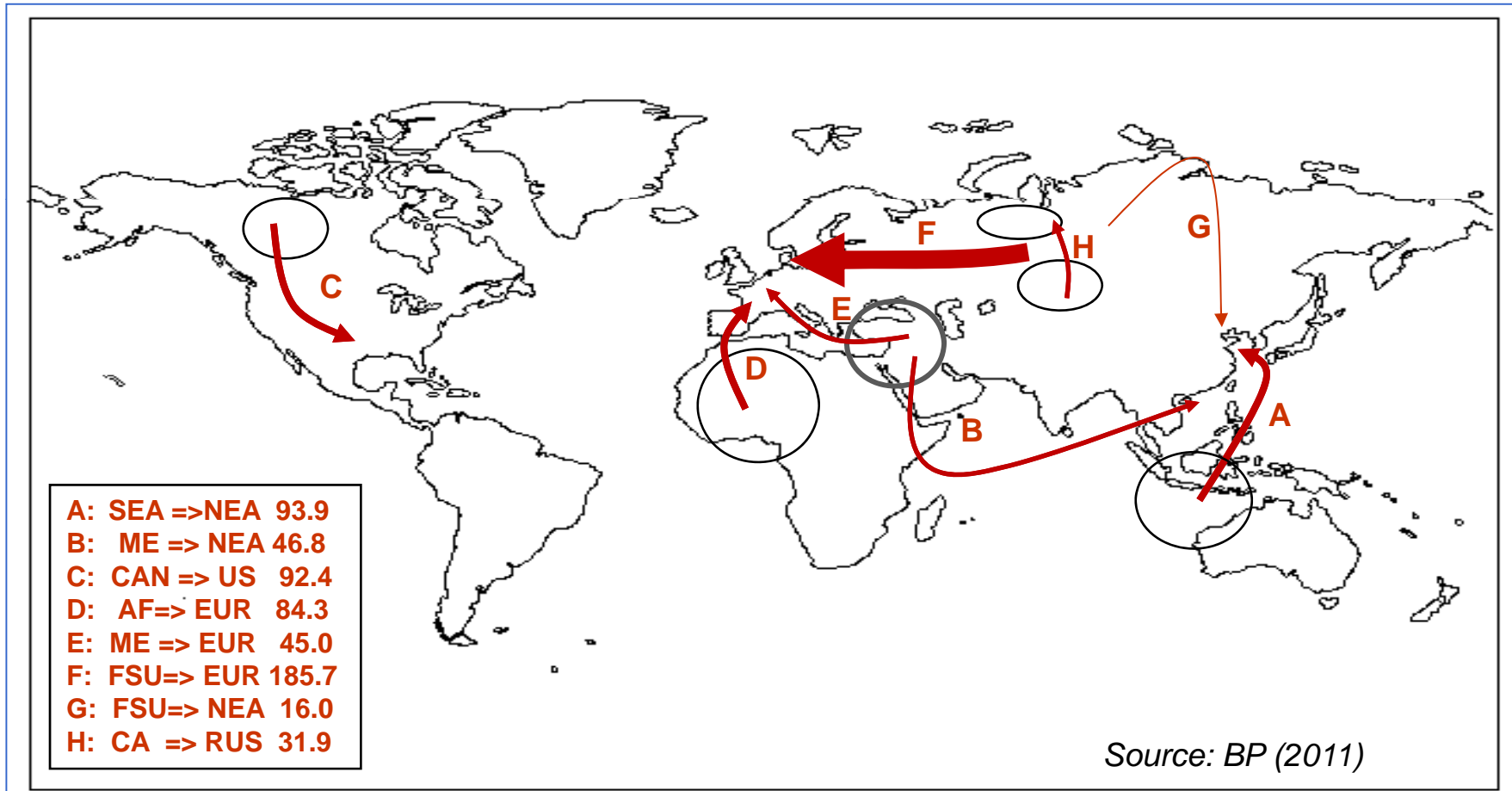
The Middle East-Asia nexus is at the heart of global oil flows

Major Oil Flows 2010 (MMBD)
Total Imports: 53.5 MMBD
Total Global Consumption: 87.4 MMBD



Gas trade remains primarily intra-regional, though inter-regional flows are increasing

Major Gas Flows 2010 (Billion cubic metres)
Total Imports: 975 Bcm
Total Global Consumption: 2858 Bcm



Natural Gas Proved Reserves end 2010 (with potential reserves of North American unconventional gas included)

Unconventional gas changes the picture of Middle East/Russia dominance

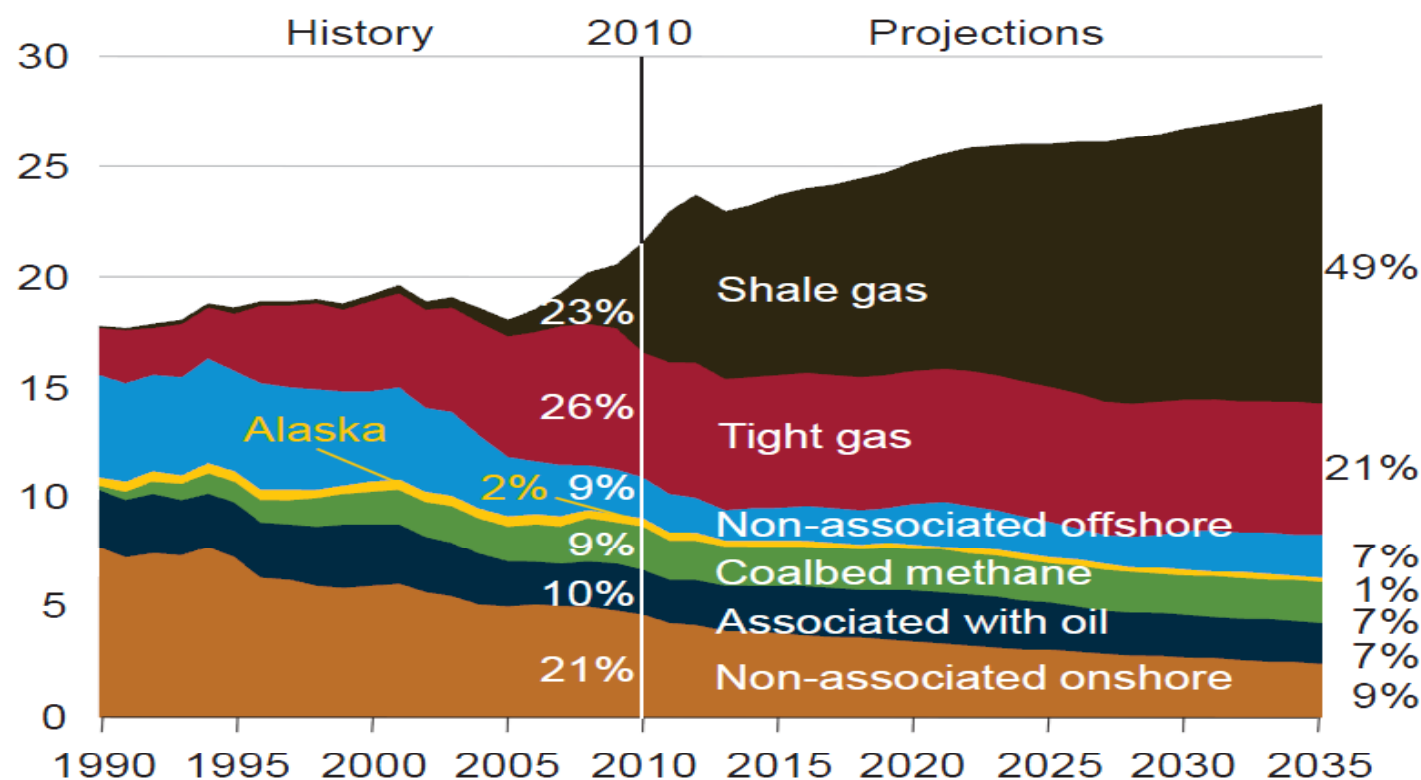
	Tcf	Share of total	R/P Ratio (yrs)
North America	351	5.3%	12.0
North America (incl. potential reserves)	3,525-3,594	36-36.5%	
<i>US</i>	272.5	4.1%	12.6
<i>US (incl. potential reserves)</i>	2170	22.0-22.2%	
<i>Canada</i>	61.0	0.9%	10.8
<i>Canada (incl. potential reserves)</i>	1,338-1,407	13.7-14.3%	
S. & Cent. America	262	4.0%	45.9
Europe & Eurásia	2,228	33.7%	60.5
<i>Russian Federation</i>	1,581	23.9%	76.0
Middle East	2,677	40.5%	>100
<i>Iran</i>	1,046	15.8%	>100
<i>Qatar</i>	894	13.5%	>100
Africa	520	7.9%	70.5
Asia Pacific	574	8.7%	37
World	6,609		58.6
World (incl. NA potential reserves)	9,784-9,853		

Sources: BP Statistical Review of World Energy 2011, Colorado School of Mines (2011), Energy Futures Network and Canadian Society of Unconventional Gas (2011)

EIA US Gas Supply Forecasts

Increase in projected natural gas production in US driven largely by shale gas, which could constitute half of all US gas supply by 2035

U.S. Natural gas production, 1990-2035 (trillion cubic feet)



Source: EIA, 2012

Proposed LNG export projects in North America

Huge theoretical capacity of > 150 million tonnes per annum

Project	Country	Location	Capacity (mtpa)	starting date?
Kitimat LNG	Canada	West Coast	10.7	2015
BC LNG	Canada	West Coast	15.0	2015
Petronas/Progress	Canada	West Coast	7.5	2020
Douglas Chanel LNG	Canada	West Coast	1.8	2015
Sabine Pass LNG (Cheniere)	USA	Gulf Coast	21.0	2015
Freeport LNG	USA	Gulf Coast	21.0	2015
Cove Point LNG (Dominion)	USA	East Coast	13.5	2015
Lake Charles (BG)	USA	Gulf Coast	15.0	-
Jordan Cove LNG, Oregon	USA	West Coast	9.0	-
Cameron (Sempra)	USA	Gulf Coast	12.8	-
Gulf Coast LNG	USA	Gulf Coast	21.0	-
Corpus Christi (Cheniere)	USA	Gulf Coast	13.5	-

Source: press reports

N. American LNG exports outlook

Expected start date and volume of LNG exports is uncertain, with relatively wide ranges among expert outlooks

Expert Estimates	Exporting countries	Start year of LNG exports	Projected volumes	Destination
Nexant	US and Canada	2016	10 mtpa (by 2020), of which 7 mtpa goes to Asia	Mostly Asia
EIA	US	2016	8 mtpa (by 2016) 16 mtpa (by 2019)	Mostly Asia
Gazprom	US	In next 10 years	7-15 mtpa	Mostly Asia
Facts Global Energy	US		>43 mtpa (by 2020)	Mostly Asia
BG	US		45 mtpa (by 2020)	Mostly Asia

Impact on Asia-US price differentials

- Current gas price differentials in excess of \$10-12/MMBtu
- Price differentials of only \$4.50-\$6/MMBtu required to make N. American LNG exports to Asia profitable
 - North American gas glut as a “push” factor
 - Panama Canal expansion in 2014 will make US Gulf and East coasts LNG exports (as well as T&T, West Africa) versatile between Atlantic and Pacific basins
- If significant volumes of trans-Pacific gas trade develop, price differentials will narrow
- Even if actual volumes of N. American LNG exports to Asia are constrained, HH-pricing basis could significantly reduce gas price differentials
 - already a factor in negotiations over Asian LNG SPAs
 - tension between oil-linked and HH-linked formulas (e.g. GAIL, BG and KOGAS’s contracts with Cheniere are HH-based)

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Global Energy Security: Renewed Fears

- **Energy security has again become a key global security issue**
- **High oil prices and intense price volatility has accentuated this concern**
- **Perception of widespread multiple geopolitical risks**
 - **Instability associated with US military intervention in the ME, and its consequences:**
 - **the rise of Iran in regional influence**
 - **the rise of Shia-Sunni tensions in the Gulf**
 - **Arab Spring and its uncertain geopolitical implications**
 - **Venezuela's nationalization of its oil resources**
 - **Russia's tough stance on foreign investments in its oil and gas sectors**
 - **Nigeria's lack of security in its major oil producing regions (Niger delta)**

Energy Security: Supply side policies 1

- **Policies to diversify geographically and fuel-wise can be effective in increasing energy security along the lines of portfolio diversification principles**
- **But the notion that energy security can be improved by ending import dependence on oil and gas from the Middle East is unrealistic and misguided**
 - **The crude oil market is now inherently global, where arbitrage among many players establish international trading patterns and world-wide oil prices adjusted for quality and transport costs**
 - **A policy of simply redirecting oil flows established by the market can be inefficient and does nothing to enhance energy security**
- **Policies that accelerate a premature transition from oil and gas to other sources of energy can be costly and require sustained subsidies**
- **For example:**
 - **Palm oil for bio-diesel can cause deforestation and loss of biodiversity**
 - **Regulations for promoting ethanol (from corn, already subsidized in the US) as a “renewable” gasoline additive may in fact**
 - **create more carbon than conventional gasoline**
 - **cause a net loss to society, while concentrating benefits on powerful political constituencies**

Energy Security: Supply side policies 2

- **For net oil importers, governments have attempted to enhance energy security by pursuing investments in upstream oil E&P**
- **Leading examples of countries promoting state-directed E&P include China, Korea, India, Japan with mixed results**
 - **Overpayment for leases is more likely if commercial decisions are trumped by political imperatives**
 - **Poor record in exploration activity, a highly skilled and technical enterprise**
 - **Potential involvement with host country politics (e.g. China in Sudan)**
- **Market processes are inherently more efficient:**
 - **Countries specialize in sectors in which they have a comparative advantage, and use export proceeds to pay for required imports**
 - **“Making” oil (via exploration and production) is not inherently superior to just buying oil in the open market; it all depends on whether you are better at “making” oil or making other goods and services in order to buy the needed oil**
 - **Subsidizing oil E&P activity may be costly, wasteful and inefficient**
 - **Purchasing equity in oil and gas companies does not yield direct access to energy resources, but gives comparable exposure to energy prices**

Energy Security: climate change policies

- **Government investment in “green” technology**
- **Governments have instituted demand management policies such as**
 - **Regulations on building codes and specifications on insulation, cooling or heating systems, etc.**
 - **Regulations to raise vehicle fuel economy standards**
 - **Requirements on electric utilities to use alternative renewable fuels**
 - **Subsidies and directives on energy technologies**
- **Often, these policies are 2nd best**
 - **Top down mandates are not capable of assessing best technology and investment choices (information efficiencies of decentralized capitalism)**
 - **Governments have a poor record in picking winners (e.g. Solyndra scandal)**
 - **Decentralized decisions by companies and individuals can identify the most efficient solutions.**
 - **For instance, high taxes on gasoline leads consumers to demand more fuel-efficient cars**
 - **A carbon tax would allow utilities to decide the most efficient way to reduce carbon pollution by forcing polluters to pay the real social costs of using dirty fuels**

Conclusions: Energy security defined

- **Energy policies should ensure that**
 - **markets work**
 - **investments and technology should cross borders**
 - **growth of diverse trade and investments flows provide energy supply most cheaply**
- **Are they grounds in “energy security” arguments for government intervention in energy markets?**
 - **Economist’s find results that often run counter to popular beliefs of what we must do for “energy security”**
 - **Broadly, economists would argue that**
 - **Energy security often is best promoted by efficient markets**
 - **Market failure is a necessary but not a sufficient condition for government intervention**

Thank you for your attention!