



GMF - OCP Policy Center Joint Seminar series

Atlantic Energy and the Strategic Horizon : The Shifting Energy Landscapes of Atlantic Basin

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- **The Global Energy Flow Map: Energy Flows Past, Present, Future**
- **An Atlantic Basin Energy Renaissance?**
- **An Atlantic Basin Energy System?**

Approximate Atlantic Basin

Global Flows of Tradable Energy

- **Liquids**: travel mainly by ship (pipeline, rail, road)
 - Oil (and derivatives)
 - LNG (liquefied natural gas)
 - Biofuels/'synfuels' (GTL, gas-to-liquids)
- **Solids**: travel mainly by ship (rail, road)
 - Coal
- **Electricity**: moves by international interconnection (transmission cables)

Global Tradable Energy and Seaborne Trade

Tradable Energy Source	Total Tradable Energy Production	Total Energy Traded	Seaborne Energy Trade	Seaborne Energy Trade (mbdoe)	% of seaborne energy trade (mbdoe)
Oil (2012)	86.15mbd	55mbd	48.5mbd	48.5	75.6%
Gas (2012)	2 trillion cm (36mbdoe)	1 trillion cm (18mbdoe)	328bcm	5.93	9.2%
Biofuels (2012)	1.2mbd	0.35mbd	0.35mbd	0.35	0.54%
Coal (2011)	7bn tons (66.6mbdoe)	1bn tons (9.5mbdoe)	978mn tons	9.35	14.6%
Electricity (2010)	19 PWh (32mbdoe)	596 TWh (1mbdoe)	--	--	--
Total mbdoe Total world energy production: 250mbdoe	222 mbdoe	83.85mbdoe (or 38% of total tradable energy production)		64.13mbdoe (29% of total tradable energy production; 76.5% of total energy traded)	100%

The Geography of the Energy Flow Map: 'landscape' vs 'seascape'

- **The global energy 'landscape'**
 - dominated by electricity and gas
 - cable and pipeline
 - primarily 'domestic' or subregional flows
 - largest set of flows
- **The global energy 'seascape'**
 - dominated by oil (+ coal and LNG)
 - marine transport by ship
 - primarily international or 'global flows'
 - most strategic set of flows (seaborne energy trade: upwards of 35% of all merchandise trade flows)

Global Energy Land and Seascapes:

Total Global Tradable Energy Consumed Domestically and Traded by Land and Sea, 2012

Total Global 'Tradable Energy' Produced	Consumed Domestically	Traded Internationally by Land	Traded Internationally by Sea
222 mbdoe	137.64	19.75	64.13
% of total	62%	8.9%	29%

The Emerging Energy Flow Map

- Traditional 'Post WWII' Flow Map
- Emerging Flow Map
- The Potential Future Flow Map?

The Global Energy Flow Map

- The Past Map

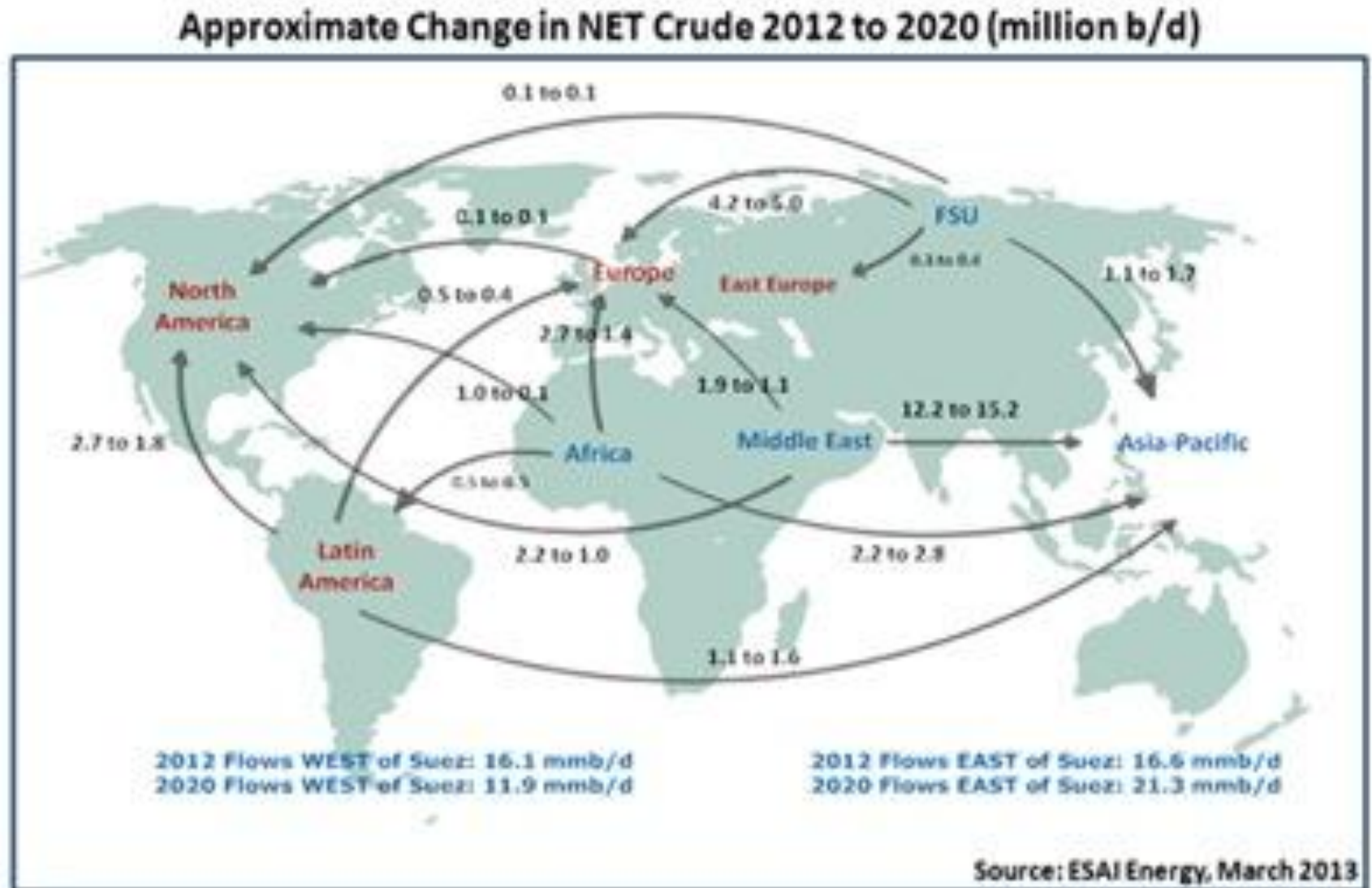
- Center of gravity in Middle East, Russia, Central Asia – ‘Great Crescent’, old Eurasian ‘heartland’
- Providing supply first for North Atlantic and then rising Asian demand

The Global Energy Flow Map

- The Newly Emerging Map

- IEA: “Western Hemisphere is increasingly autonomous”
- More and more, oil is flowing east; by 2035 all Mideast oil and gas will be heading east
- To be supplemented by Atlantic Basin energy exports
- Oil dominates current globally traded energy: approx. 85%

New Map: Oil Flows Shifting Eastward

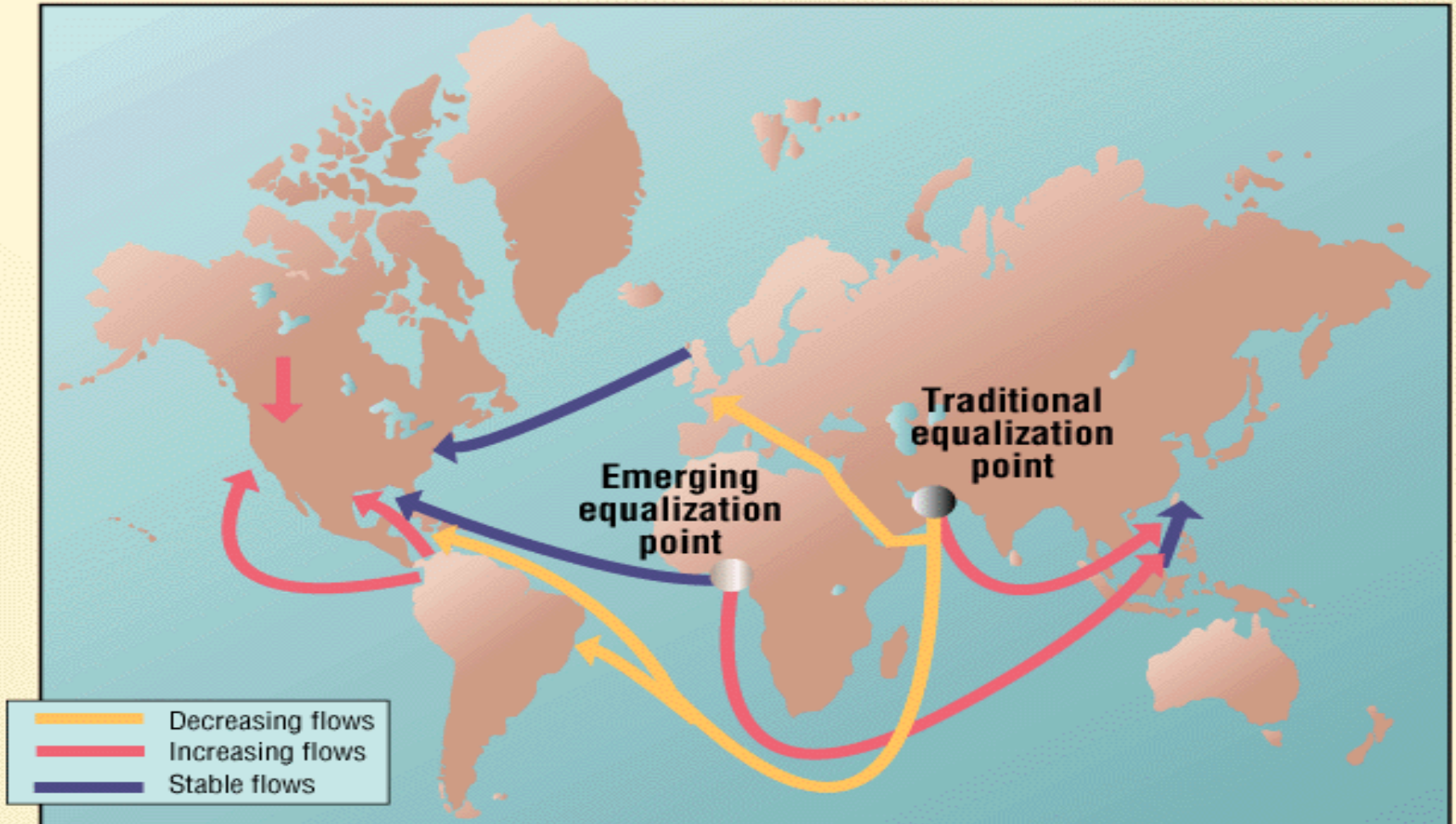


Flows West of Suez = -4.2mmbd

Flows East of Suez = +4.7mmbd

Oil's Global Center of Gravity Shifting into the Atlantic Basin

CHANGES IN WORLD CRUDE OIL TRADE PATTERNS



Source: Purvin & Gertz Inc.

The Global Energy Flow Map

- The Potential Future Map?

- How will the ‘gas revolution’ affect the future map?

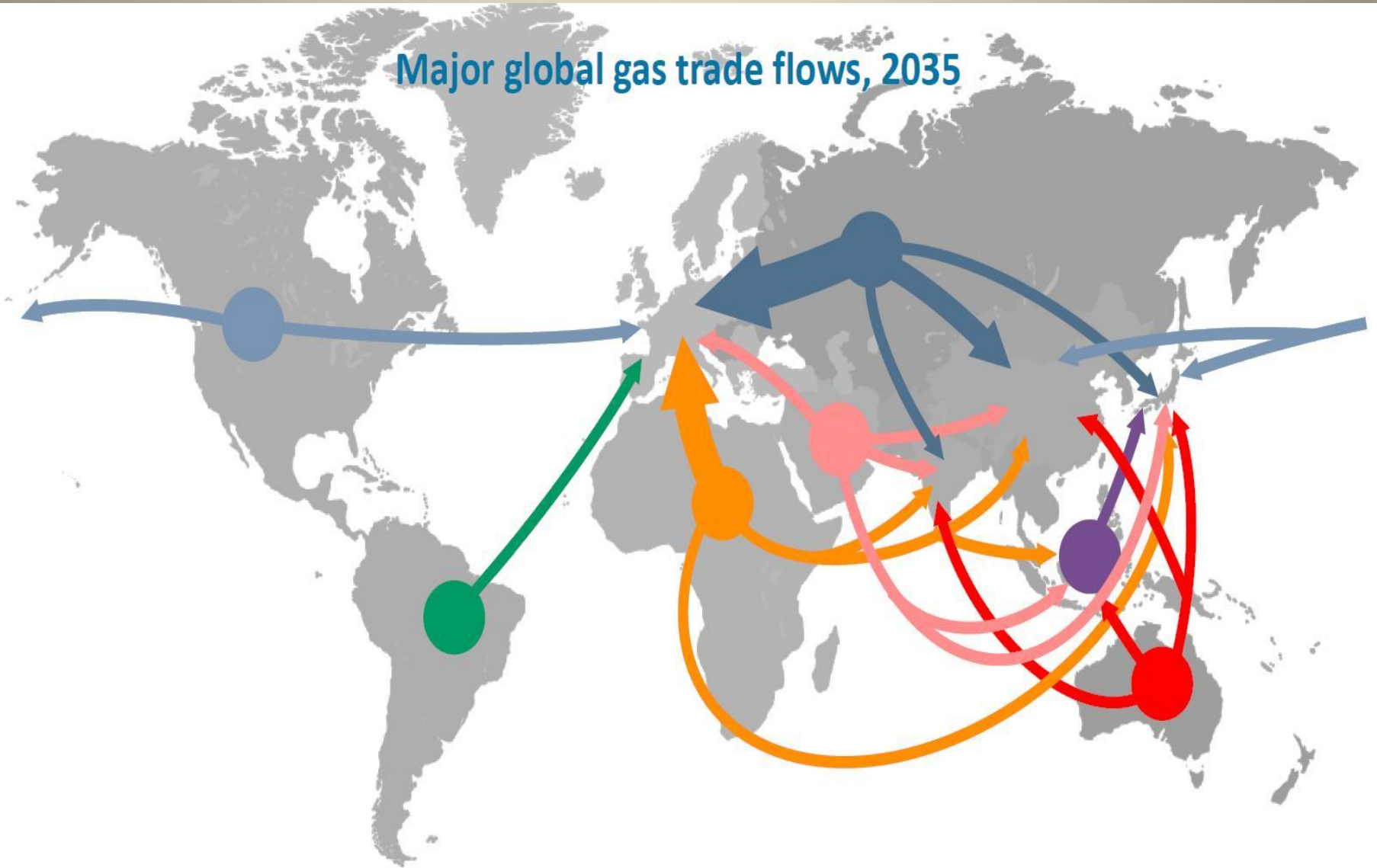
- By 2050, under business-as-usual, gas will account for 80% of total globally traded energy.
- Much of this will be LNG liquids traded by sea
- Together with the low carbon/RE deployment, gas revolution will lead to an increasingly ‘electrified’ world (international electric flows to increase; with corresponding fall in seaborne energy trade flows)

- Will the Arctic modify the global energy flow map of the future? How?

- Energy produced in the Arctic will flow out to East Asia through the Bering Strait (Russian LNG)

Increasing Gas Autonomy of Atlantic Basin to 2035

Major global gas trade flows, 2035



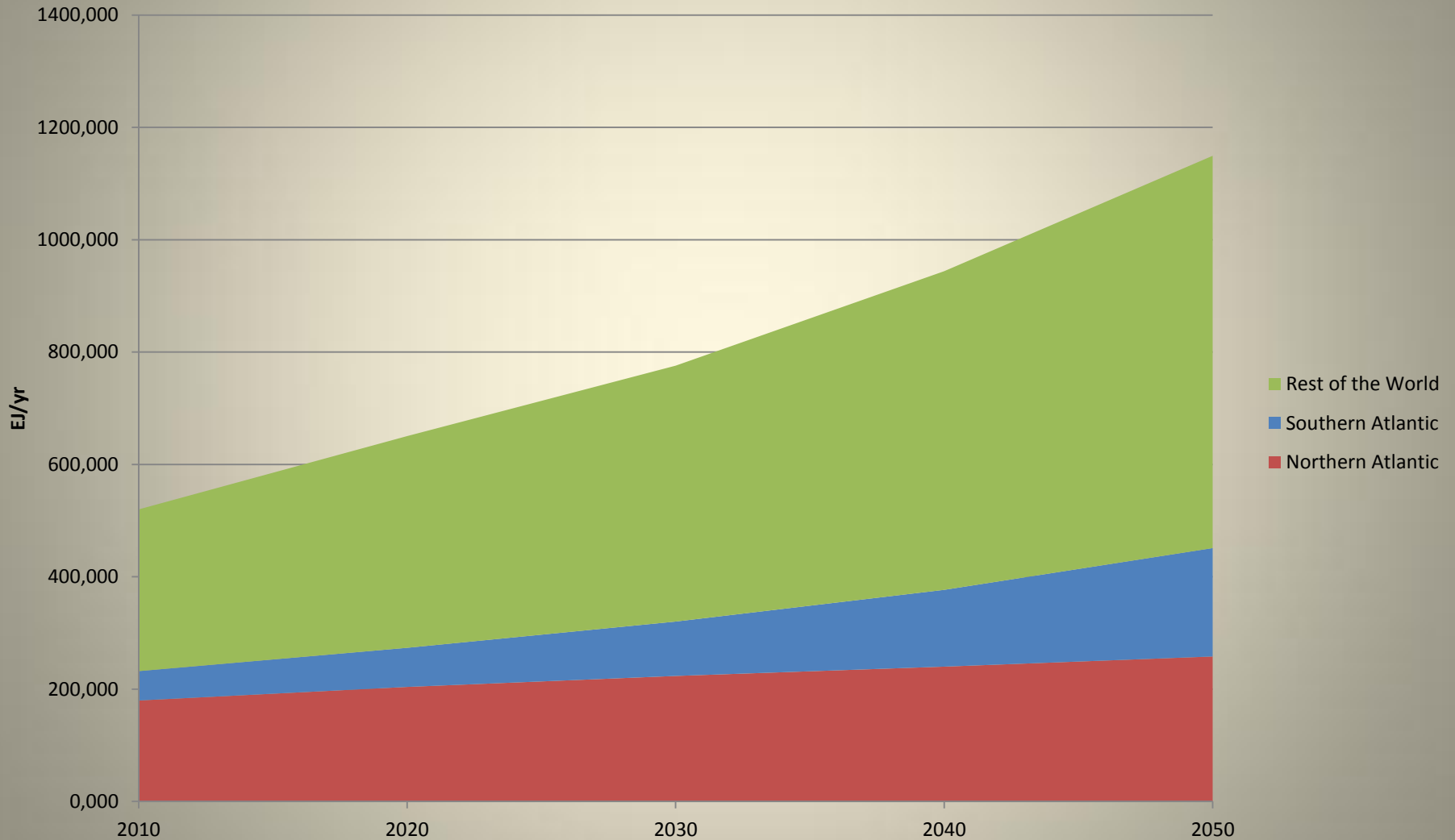
Drivers of the Energy Flow Map

- **Shifts in Production and Consumption loci**
 - Production moving west (Atlantic Basin)
 - North America (Canadian oil sands, US unconventional oil and gas)
 - Latin America (Brazil, Colombia; Mexico, Venezuela, Argentina)
 - Africa (nearly the entire Atlantic rim of Africa; potentially from Morocco to Namibia)
 - Over 40% of global oil reserves and production; nearly two-thirds of gas reserves, if shale gas is accounted for
 - Over 60% of increased oil production to 2035 will come from the Atlantic Basin
 - Consumption moving east (Indian Basin, Pacific Basin, Eurasia)

Dynamic Demand: Atlantic vs. World

- Approximately 40% of world demand from the Atlantic
- Northern Atlantic demand flat to 2050
- Southern Atlantic demand in line with the rest of the world
- Southern Atlantic's share of global energy demand set to double to around 20% by 2050.
- Atlantic demand will be outstripped by the rest of the world, but Atlantic supply is set to boom:
growing imbalance with geopolitical implications

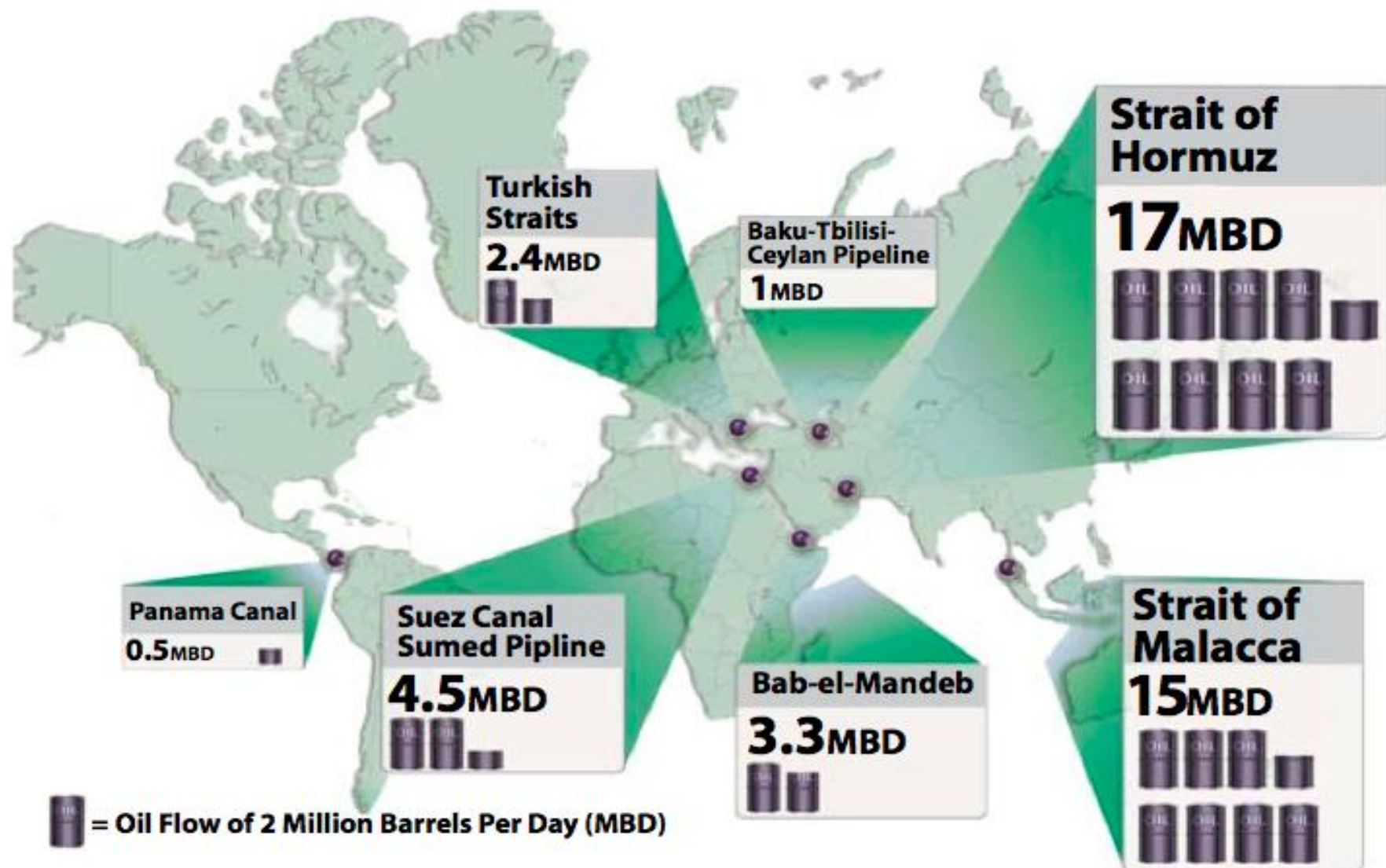
Atlantic vs World Demand to 2050



Drivers of the Energy Flow Map

- **Chokepoints and Key Sea lanes: significance and dynamics**
 - Hormuz (17mbd, 35% of seaborne oil trade), Malacca (15mbd)
 - Suez, Panama (less than 5mdb combined, limitations despite widening)
 - Cape Passage (limits on canals, larger ships, Atlantic emergence, eastward shift)
 - Bering Strait (Russian LNG: Arctic Circle to East Asia from Arctic opening)

Chokepoints: Significance & Dynamics



Drivers of the Energy Flow Map

- **Climate Change and the opening of the Arctic**
 - Arctic could complete (or round out) such an ‘ocean basin’-based vision of the geopolitical globe
 - Potential increased hydrocarbon production in the Arctic
 - Increased seaborne hydrocarbons trade through the potentially opening Arctic sea lanes towards East Asia, through the Bering Strait
 - Reluctant and cautious outlook:
 - Barriers of Harsh Climate and General Conditions
 - Higher risks of all types (recent Lloyds’ report)
 - Any such flows would be dependent on Arctic energy (not cross through traffic)
 - “The Arctic Paradox” and positive climate change feedbacks

Drivers of the Energy Flow Map

- Deployment of renewable or low carbon energy
 - Autochthonous energy sources = reduced globally tradable energy flows
 - of gas and coal for electricity generation
 - of oil for transportation
 - Only viable local, regional and global strategy to maintain a '2 degree world' (if still possible)
 - Current price environment provides a partial, but still insufficient driver for low-carbon energy
 - global oil prices (high) + the price of carbon (low) + falling cost curve of renewables (relatively fast) – fossil fuel subsidies (high) + renewables support (low) = fossil energy costs < renewable energy costs

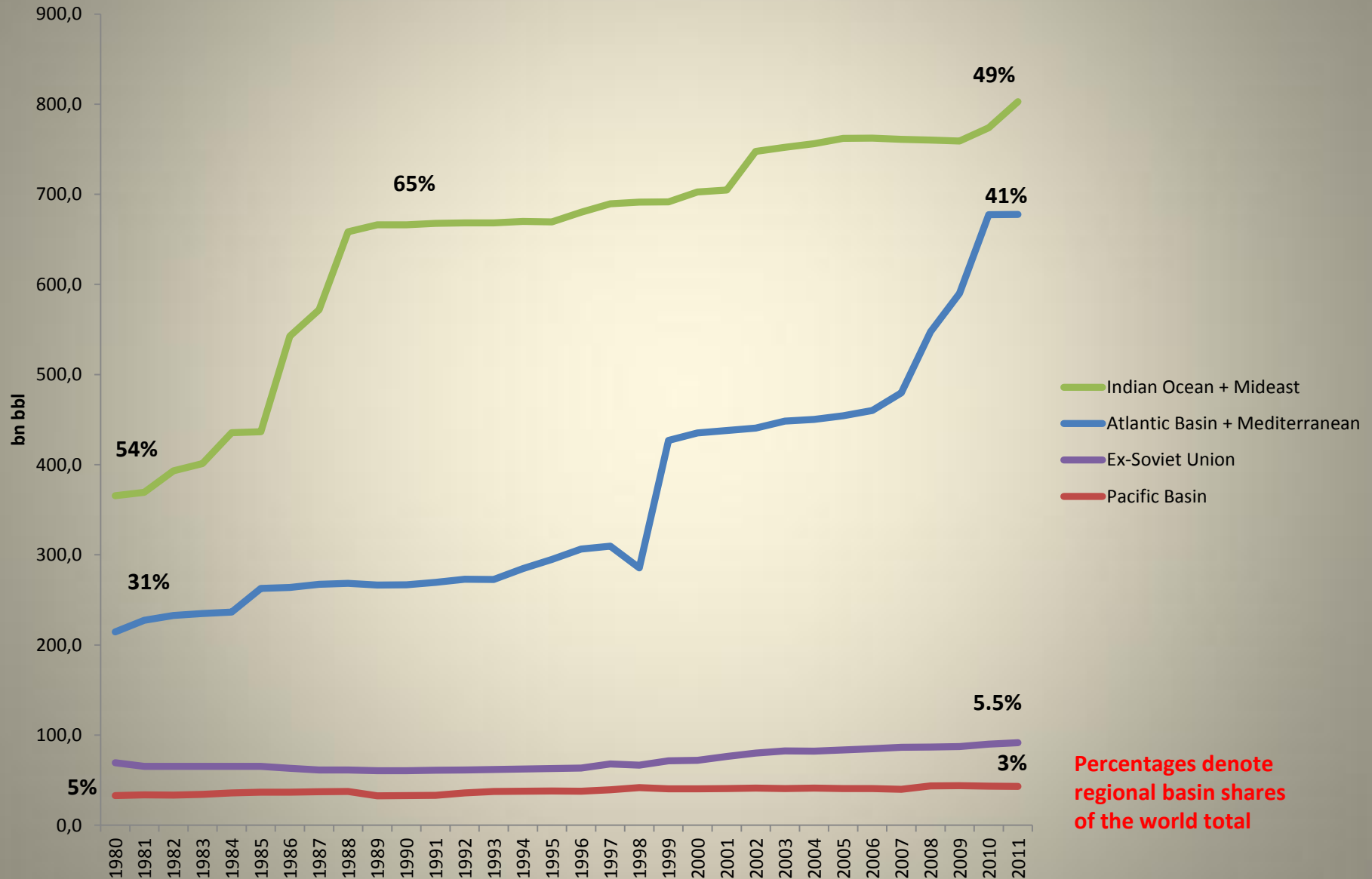
Drivers of the Energy Flow Map

- **The emergence of an 'ocean basin' world**
 - Technological development is significantly upgrading the geo-economic and geopolitical import of the ocean(s)
 - Rising seaborne energy trade
 - Increased offshore energy production
 - Emergence of 'blue economy' (energy, minerals, biogenetic materials, etc)
 - Many terrestrially-dominated perceptions increasingly outmoded; point of view increasingly marine-centered ('seascapes' will rival 'landscapes')
 - Series of 'lake communities': 'maritime rimlands' around a 'binding' inner sea (an opening Arctic reinforces this trend)
 - New regionalisms for 'second best' option to 'global governance'

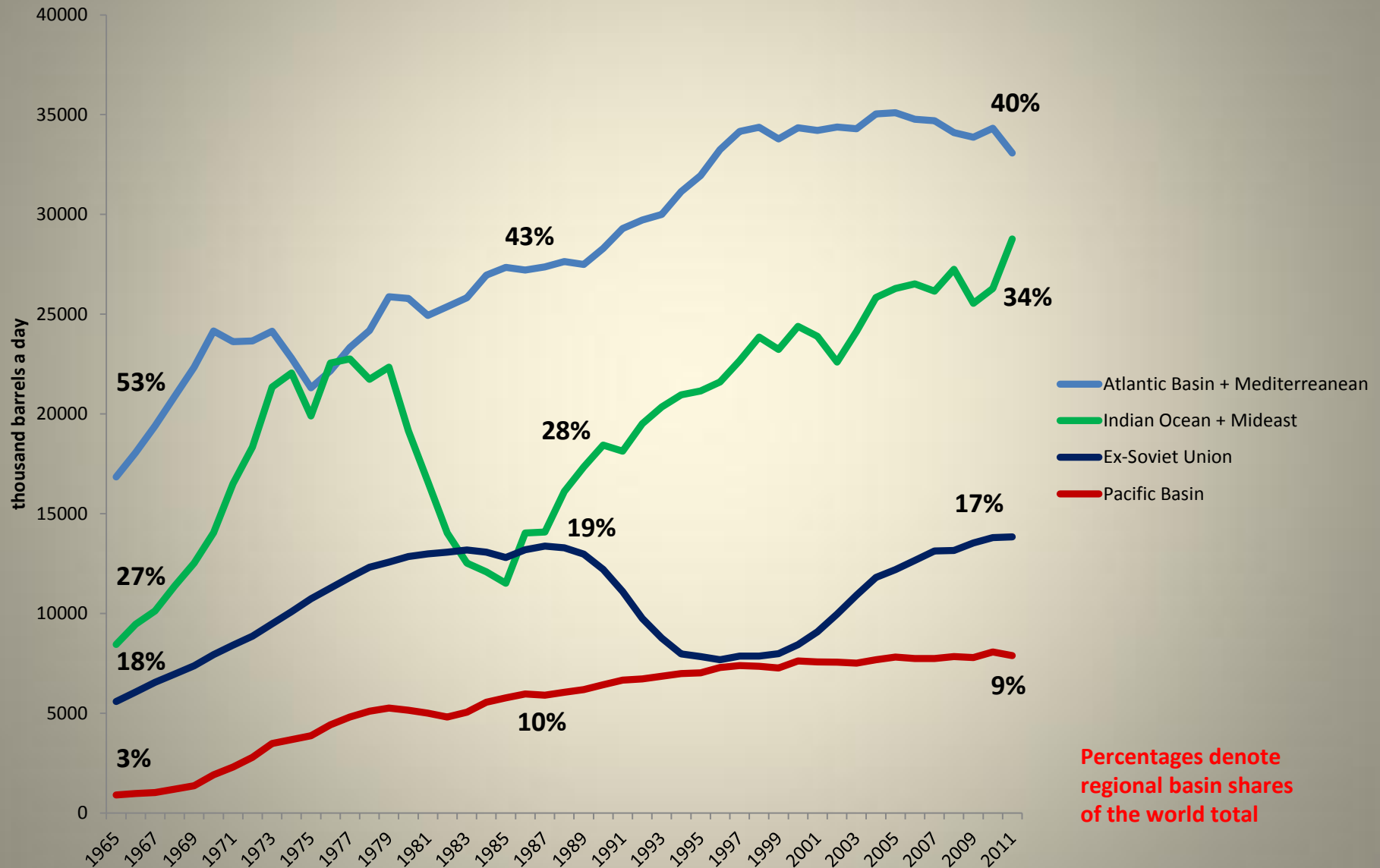
Atlantic Energy Renaissance?

- Boom in Atlantic energy supply
 - Oil (over 1/3 of global production, over 40% of global reserves)
 - New players: Brazil, Guyana Basin, Atlantic Africa
 - Traditional players with enlarged reserves: Canada, Venezuela, US
 - Gas (over 1/3 of global gas and LNG production; 17% of conventional reserves, **but nearly two-thirds of shale gas reserves** – four of the five largest shale reserves in the Atlantic Basin)
 - Renewables (over four-fifths of global installed capacity and biofuels production and trade)

Atlantic Basin Oil Reserves

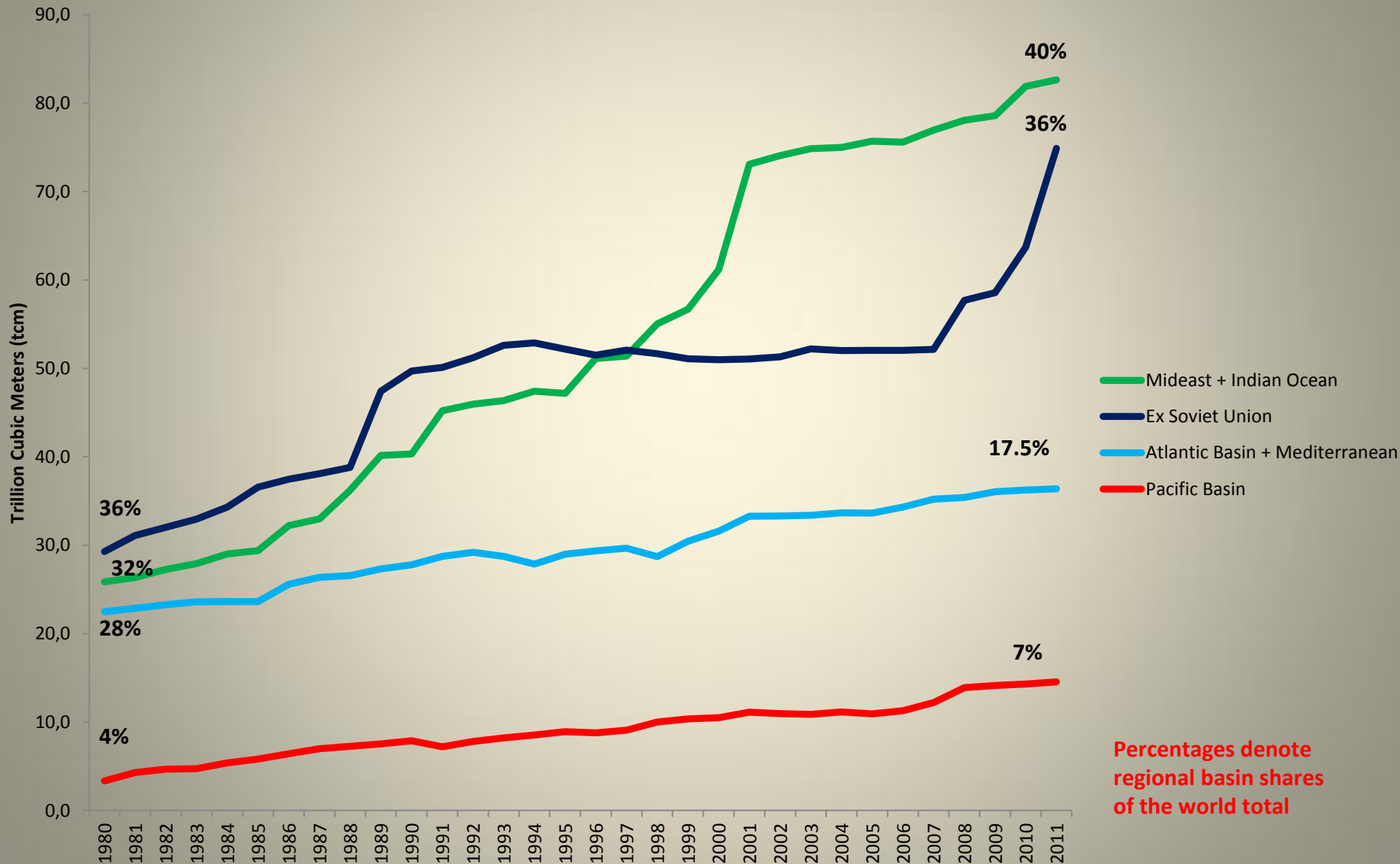


Atlantic Basin Oil Production



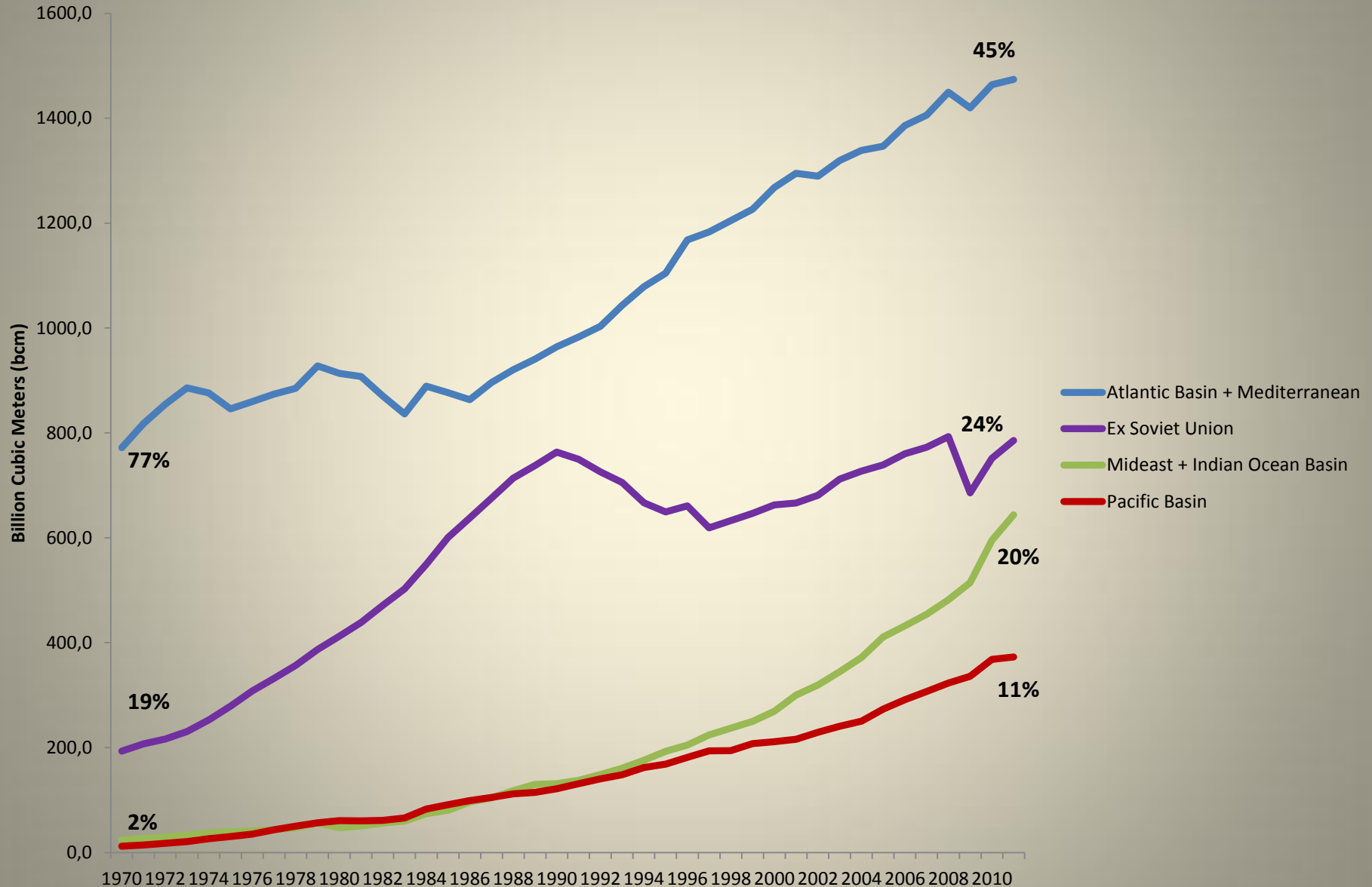
Percentages denote regional basin shares of the world total

Atlantic Basin Gas Reserves

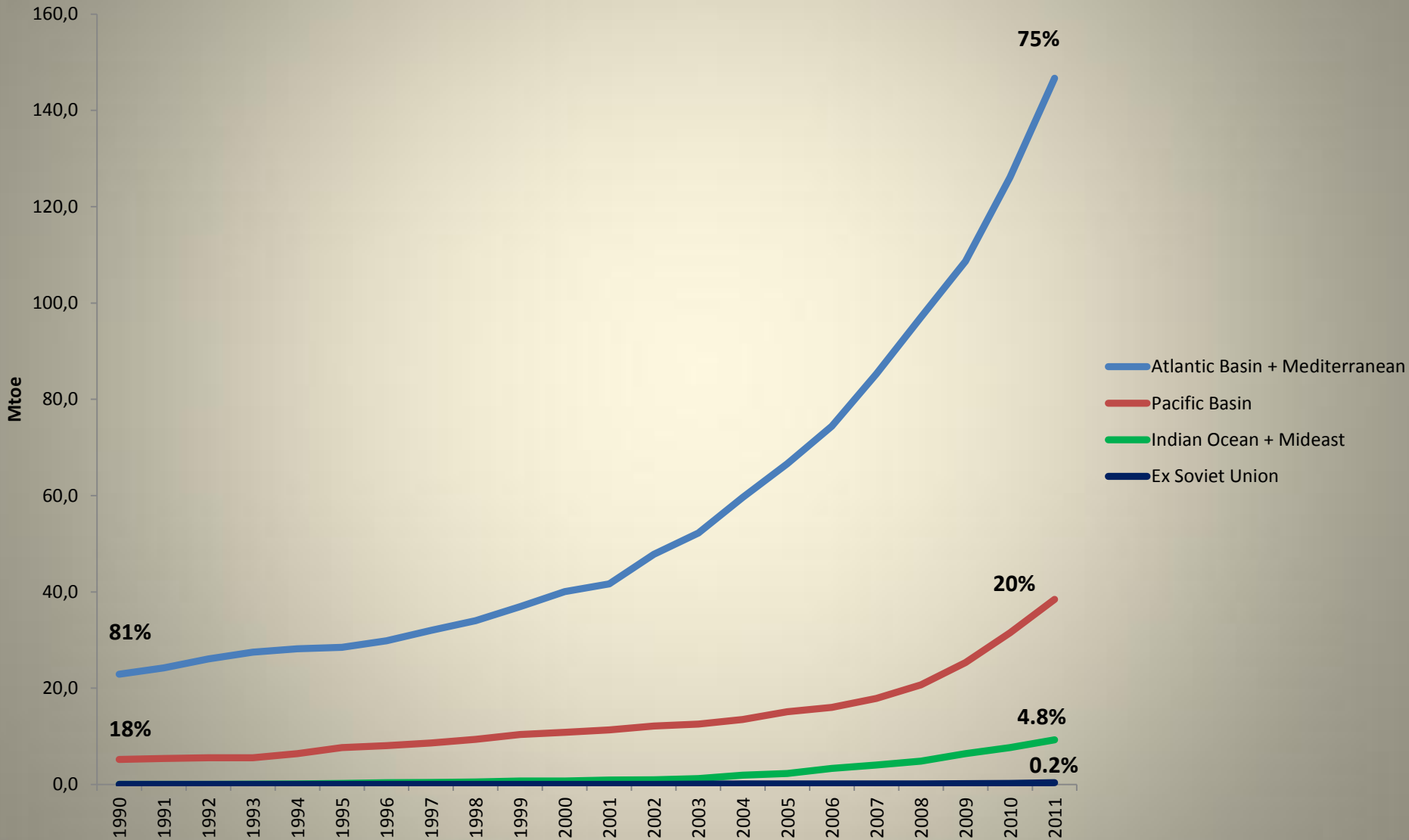


Percentages denote regional basin shares of the world total

Atlantic Basin Gas Production



Atlantic Basin Renewables Consumption



Diversification of Oil Supply to the Atlantic

- Shifting pattern of US oil import dependence
 - Traditional: Middle East, Persian Gulf, Saudi Arabia
 - New rivals to Saudi Arabia and the Arab World (7 of top 10 national suppliers from the Atlantic Basin)
- Proliferation of suppliers significant enough to negatively impact security of US oil supply?

Geography of Top 10 Oil Sources

- Atlantic Basin
 - Canada (1)
 - Mexico (2)
 - Nigeria (4)
 - Venezuela (5)
 - Colombia (8)
 - Angola (9)
 - Brazil (10)
- Broader Middle East
 - Saudi Arabia (3)
 - Iraq (6)
 - Algeria (7)

Atlantic sources will grow in the future, while other regions could slide. Ecuador is 11th, Congo (Bzsa) 14th, Cameroon 15th

An Atlantic Energy System?

- Increasing density of intra-Atlantic energy flows?
- Impact of Eastern Demand on the level of density of intra-Atlantic flows?
- Remaining obstacles: national energy policies (energy nationalisms); pricing issues; general Atlantic financial health

Sufficient Basin Autonomy

- Over a quarter of world oil trade (“pure Atlantic Basin trade”)
- Only 18% extra-basin oil dependence
- 30% of global LNG trade
- Only 6% extra-basin gas dependence (concentrated in EU dependence on Russia)
- Over 80% of global biofuels trade

Barriers and Other External Factors

- Lack of recovery in the Northern Atlantic, has reduced investment in RE and undermined public support for RE
- Current price environment provides a partial, but still insufficient driver for low-carbon energy
 - global oil prices (high) + the price of carbon (low) + falling cost curve of renewables (relatively fast) – fossil fuel subsidies (high) + renewables support (low) = fossil energy costs < renewable energy costs
- Inadequate policy and regulatory environments around the basin (energy nationalisms of various sorts distort)
- Lack of diplomatic/governance structures in the Atlantic Basin (energy or other)
- Lack of Atlantic Basin Consciousness

Cooperation and Governance

- Unique potentials of the Atlantic
 - The potential role of shared values
 - The balance (relationship) between producers and consumers
 - The balance (relationship) between IOCs and NOCs
 - The balance (relationship; ‘pact’) between traditional fossil fuel energies (both conventional and unconventional) and renewable energies (both traditional and non-traditional energy technologies, NRETs)
 - Balance between liquid transportation pathways and electrification of transportation
 - Balance between energy access, sustainable development, energy transformation and climate adaptation. More direct links, particularly in the Southern Atlantic, between energy, climate adaptation and mitigation, land-use and sustainable development

Cooperation and Governance

- The Energy Charter Treaty of Eurasia: Inspiration and Warning for the Atlantic
- The 'Luanda Declaration' of the ABI EPG (June 2013)
- Formation of the Atlantic Energy Forum (AEF)

Policy Implications: Governance and Geopolitics

- Atlantic Basin energy system could generate demand for regional energy governance (Atlantic Biofuels Pact? Atlantic Energy Charter?), even set standards for deepening global governance
- Regionalism as a second best to global multilateralism and a potential building block for global governance, in energy and beyond (An Atlantic Community?)
- But current emphasis on Asia-Pacific and China is pushing the Southern Atlantic toward South-South alignments and global South consciousness (If we pivot to Asia, everyone will)
- Atlantic Basin: most of the world's democracies, the "arc of the West" (Reconfiguration of the Atlantic and renewal of the West?); justifies 'upgrading' the Atlantic

