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Expanding the World's Natural Gas Pipeline Networks: Economics and Geopolitics

Mitrova Tatiana

Energy Centre
SKOLKOVO Business School

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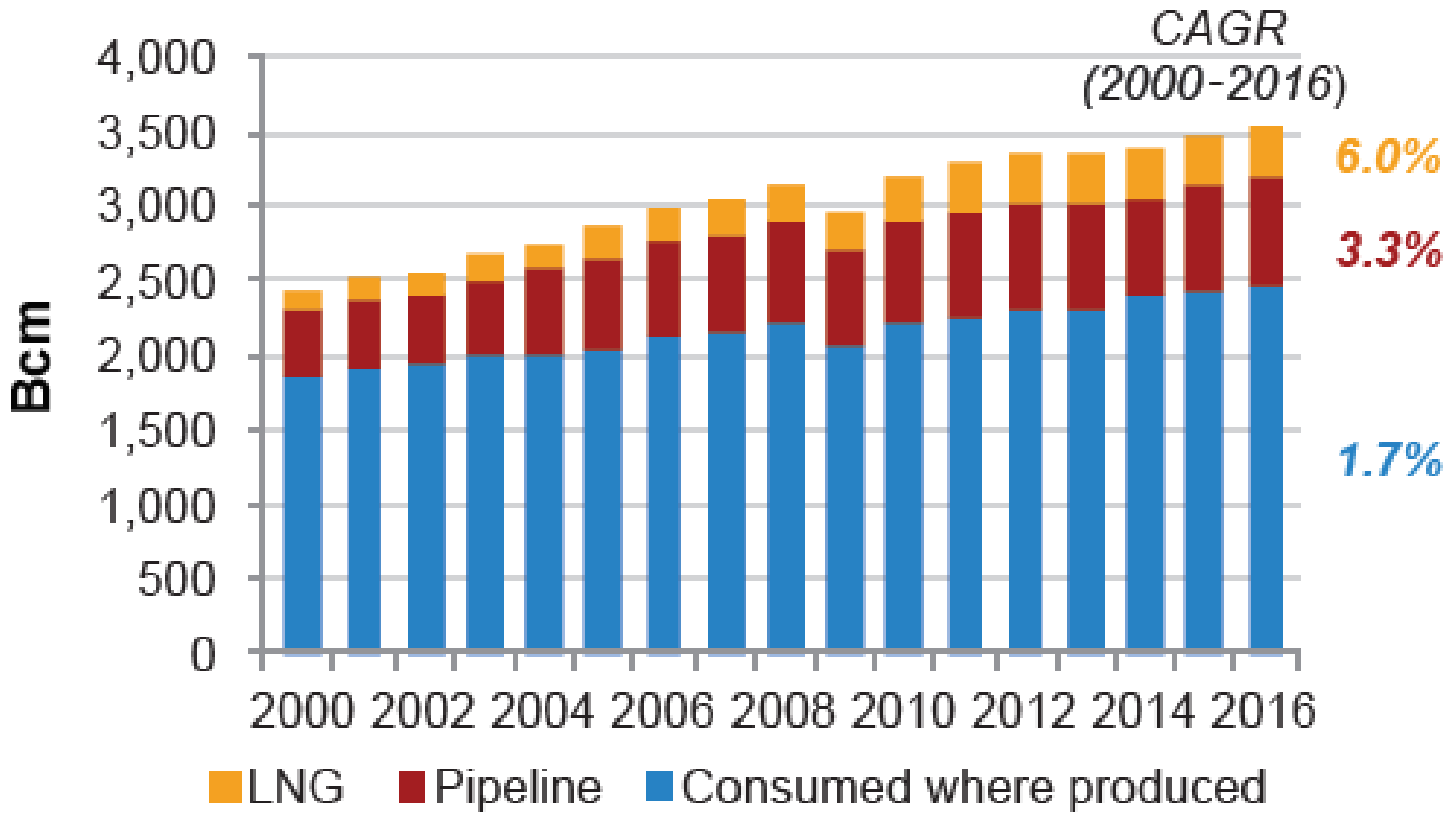
~70% OF THE GAS IN THE WORLD IS CONSUMED DOMESTICALLY AND DELIVERED VIA PIPELINES

Global Gas Trade, 2000–2016



Note: CAGR = Compound Annual Growth Rate

Sources: IHS Markit, BP Statistical Review of World Energy

HISTORICALLY NATURAL GAS MARKETS DEVELOPMENT WAS DRIVEN BY PIPELINE INFRASTRUCTURE EXPANSION

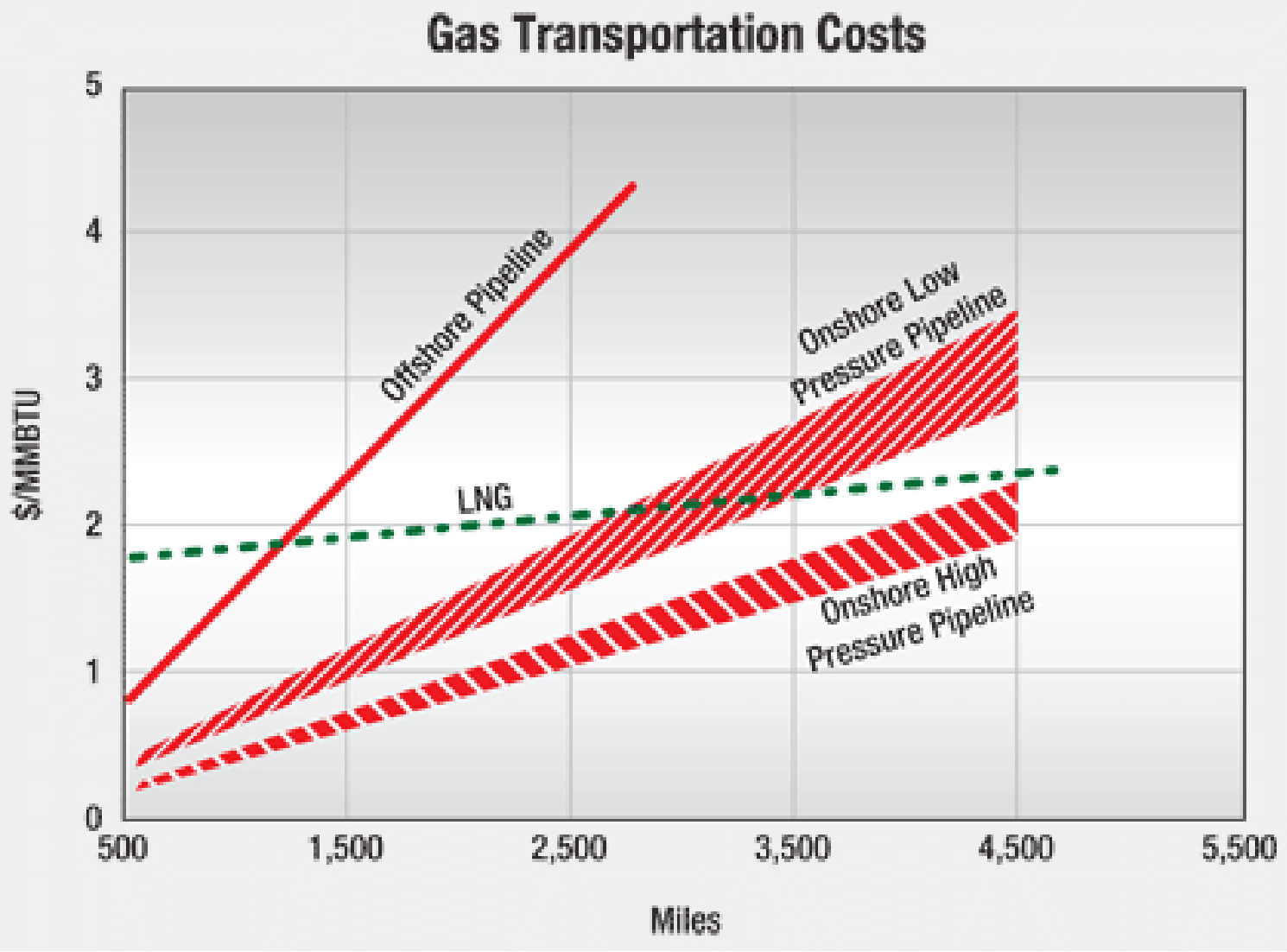
TRANSACTION COSTS IN PIPELINE GAS TRADE DEFINE INSTITUTIONAL STRUCTURES OF THE GAS MARKETS

- High specificity of assets and high probability of opportunistic behavior
- Long character of relationship between counterparts with strong interdependence
- High degree of uncertainty due to long investment cycle and long period of the subsequent operation of specific assets
- Strategic, social and infrastructural importance of gas industry as well as its role in formation of the state budgets, which causes active intervention of the state in its institutional structure
- International gas trade is often linked with geopolitical relationship between countries, which increases state involvement
- Transaction cost economics suggests that these characteristics of transactions favor mechanisms allowing to save on transaction costs (vertical integration or when vertical integration is impossible – for example in international relations - its substitutes – long term contracts with rigid obligations of the parties).

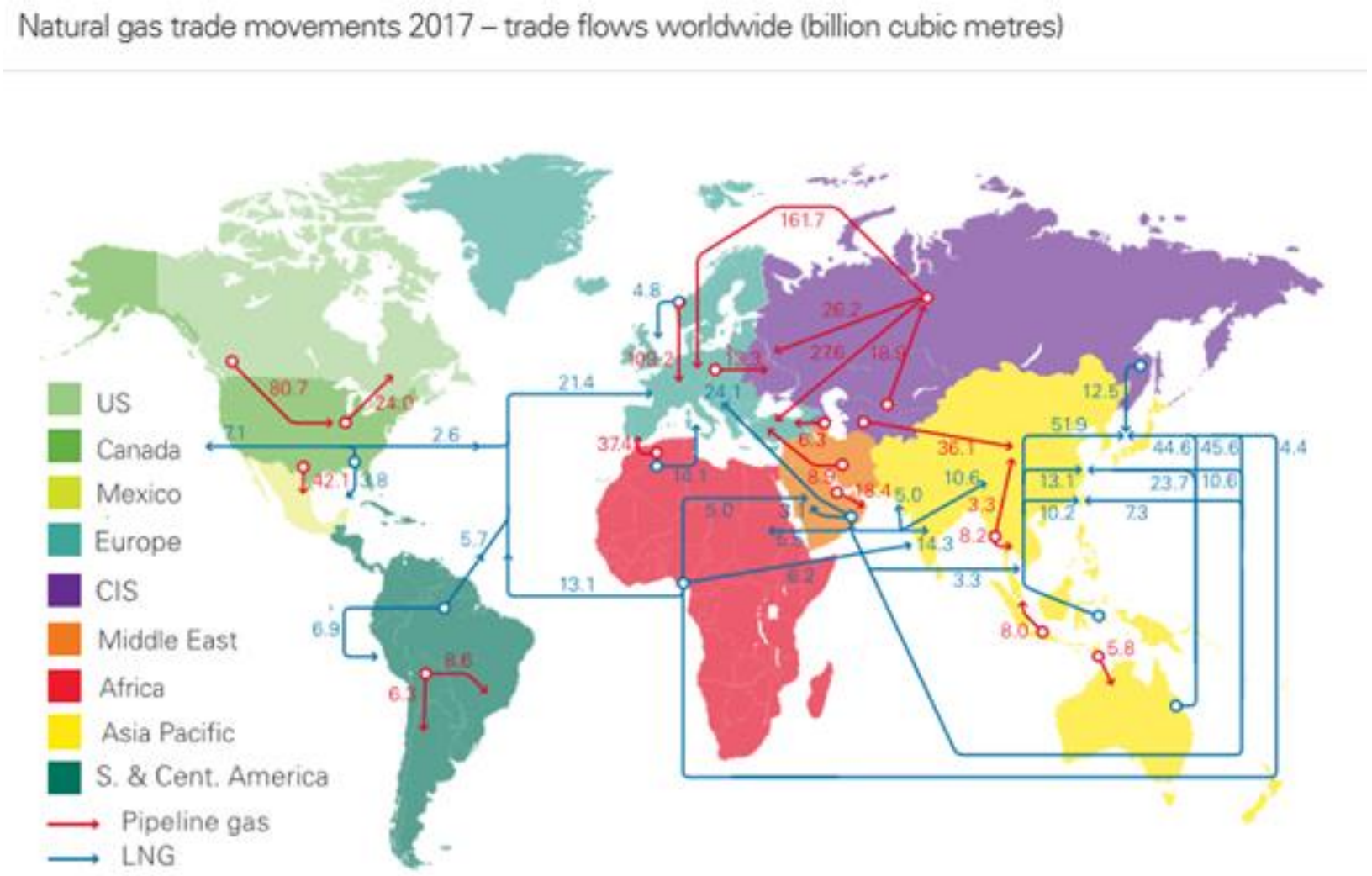
EVOLUTION OF NATURAL GAS MARKETS

Features	Local	National	International	Transcontinental
Main product	Pipeline gas	Pipeline gas	Pipeline gas, LNG	Pipeline gas, LNG, GTL
Infrastructure	Few unlinked gas pipelines between producer and consumer	National gas supply systems	Development of huge long-distance cross-border pipelines and bilateral LNG supply	LNG and pipeline gas supply from several countries, development of international pipeline systems
Market volume	Few BCM	$10\text{-}10^2$ BCM	Few hundreds BCM	More than TCM
Institutional gas market structure	Local vertically integrated monopolies	National vertically integrated monopolies, independent gas production companies	Bilateral international contracts between two national companies, intergovernmental agreements	Multiply contracts between many companies, transnational vertically integrated energy companies
Competition	No	In certain conditions competition in gas production is possible	Competition between domestic production and imports	Competition between domestic production and multiply import sources
Aspects of energy security	Physical Investment	Physical Investment Price and volume	Physical Investment Price and volume Geopolitical	Physical Investment Price and volume Geopolitical Transit
Mechanisms of transaction costs reduction	Local monopoly, super-long-term contracts	National monopoly, Long-term contracts	National monopoly, long-term inter-governmental agreements	Multilateral international agreements, swaps of assets, consortiums

PIPELINE GAS VS LNG TRANSPORTATION COSTS



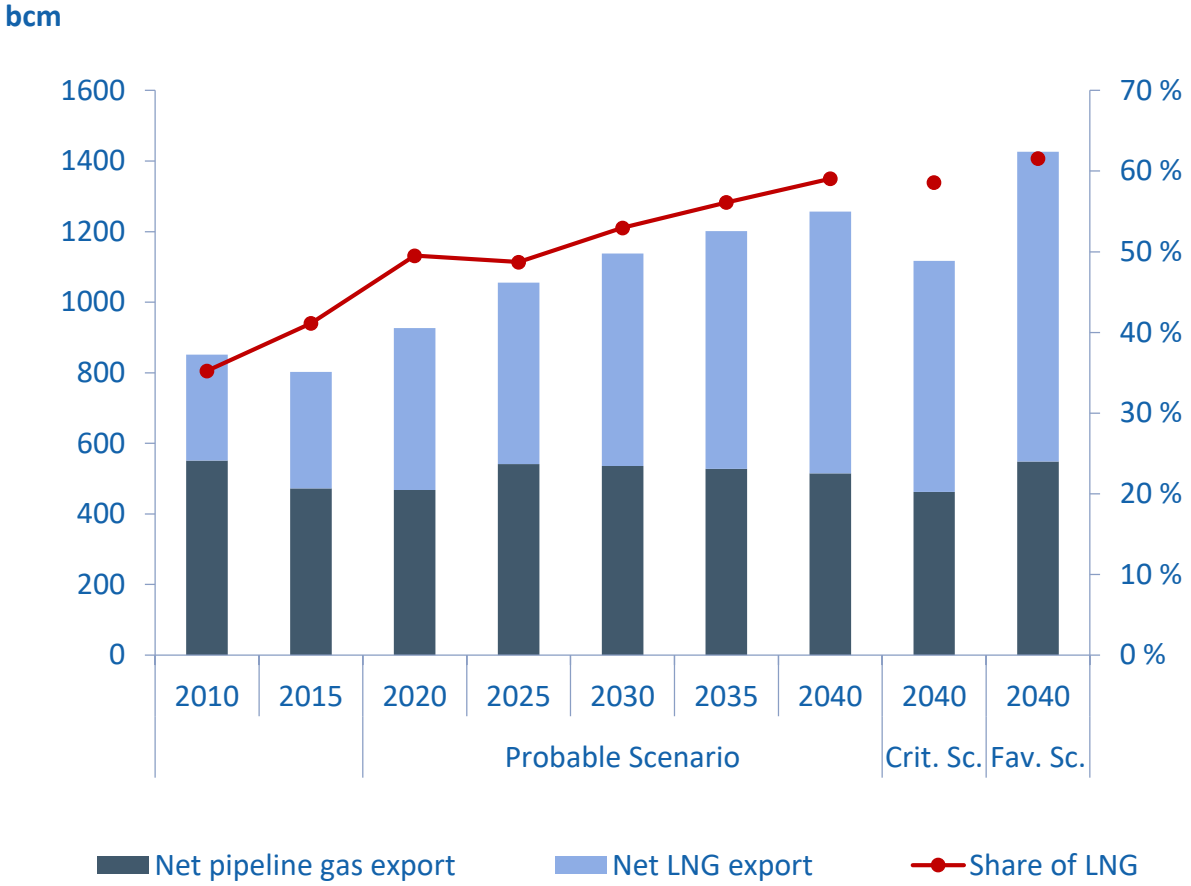
DURING THE LAST DECADE GLOBAL LNG TRADE WAS GROWING MUCH FASTER THAN INTERNATIONAL PIPELINE GAS TRADE



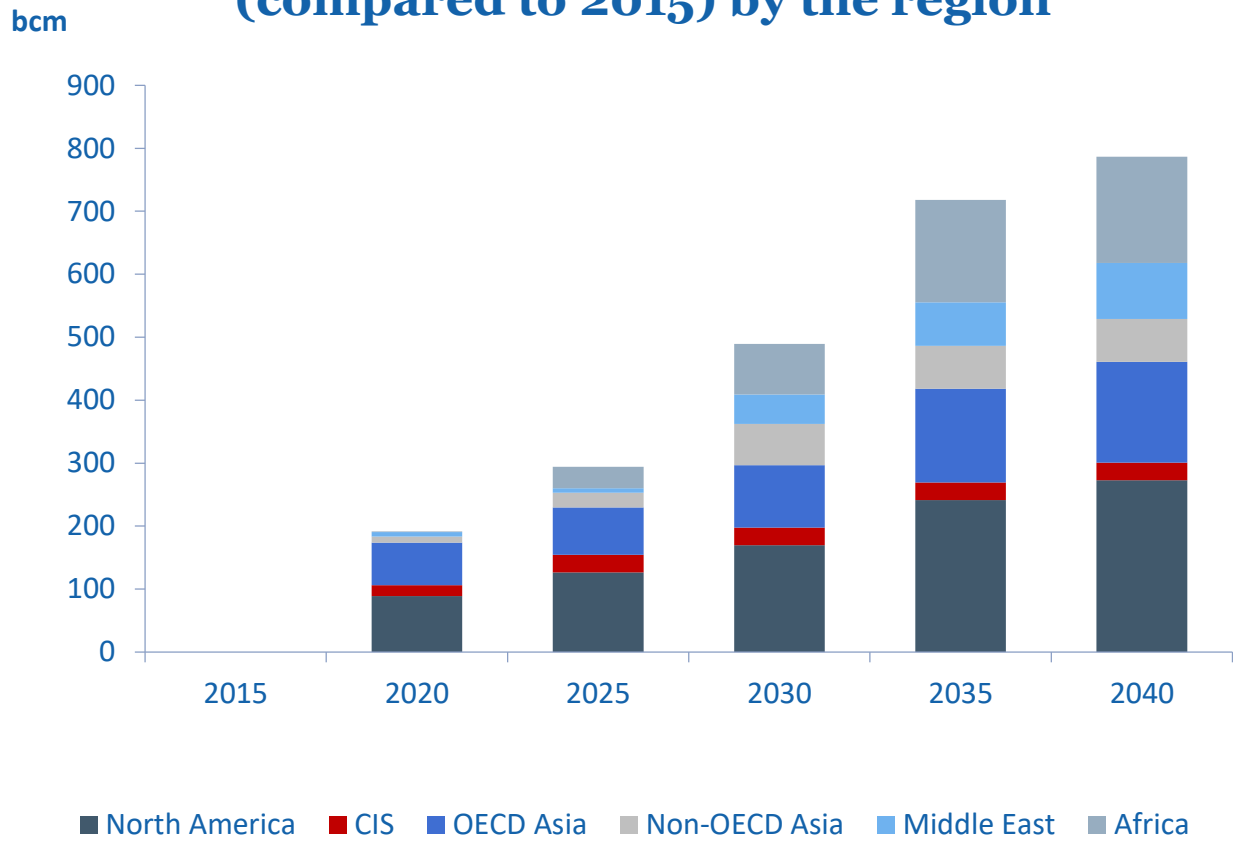
Source: BP Statistical Review of World Energy 2018

BY 2040 THE SHARE OF LNG IN THE GLOBAL GAS TRADE WILL REACH 60%

Global net-export of LNG and pipeline gas



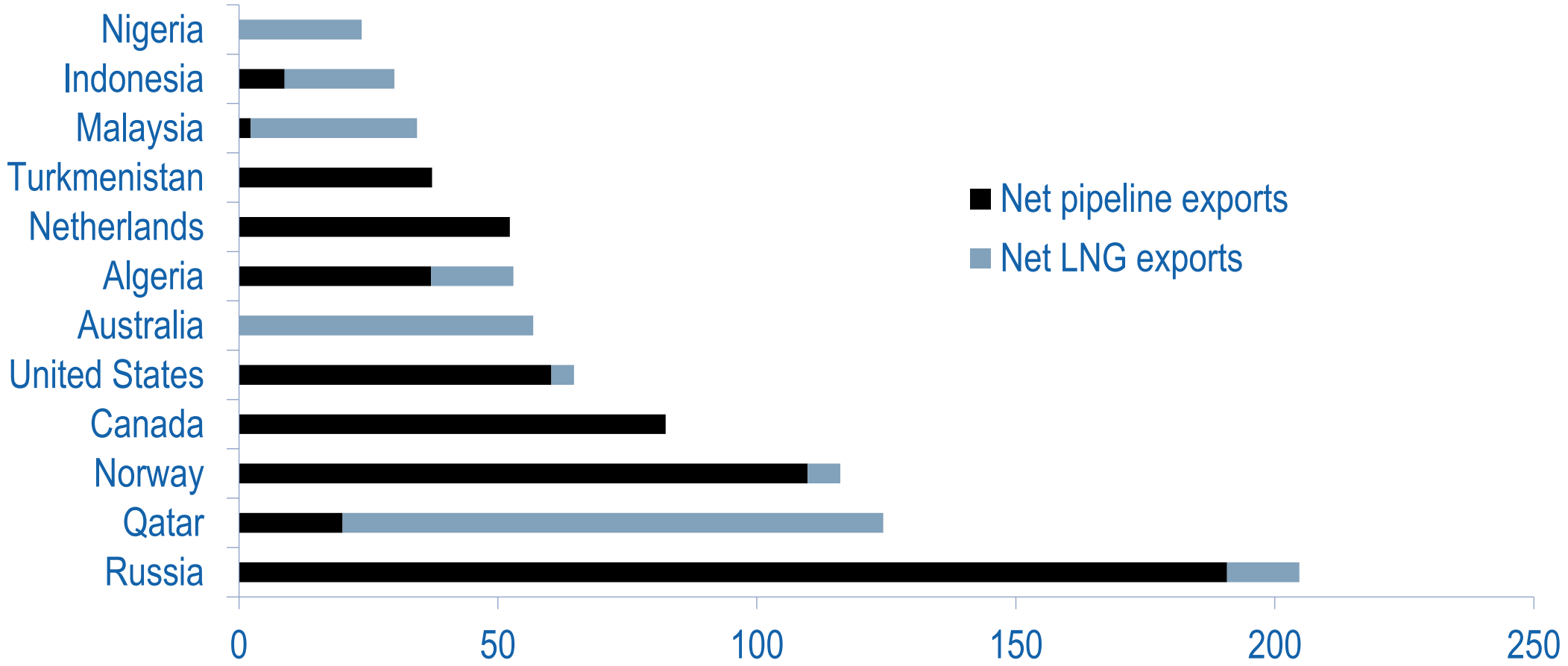
Global liquefaction capacities addition (compared to 2015) by the region



Source: Global and Russian Energy Outlook, ERI RAS-AC

THE WORLD`S LARGEST NET EXPORTERS OF GAS

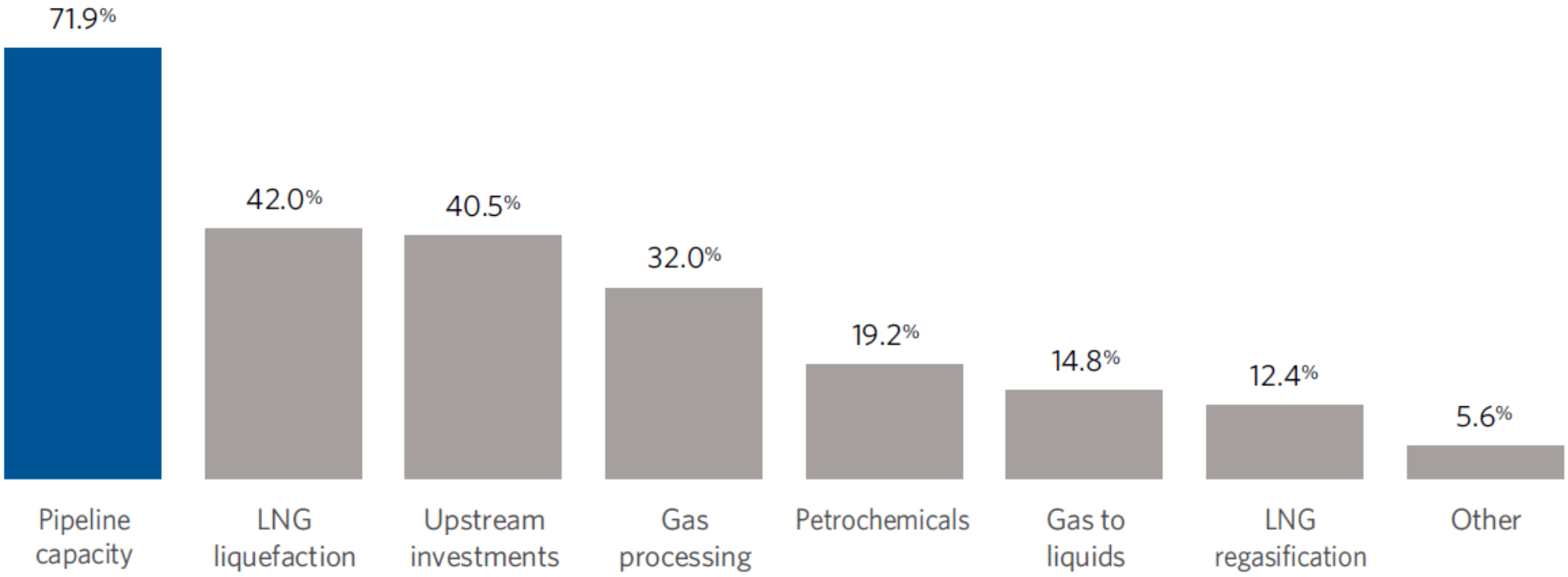
Main net exporters of gas (pipeline and LNG) in 2017, bcm



Source: BP Statistical Review of World Energy 2018

PIPELINE GAS INVESTMENTS REMAIN EXTREMELY IMPORTANT FOR THE INDUSTRY (BUT LESS FOR POLITICIANS)

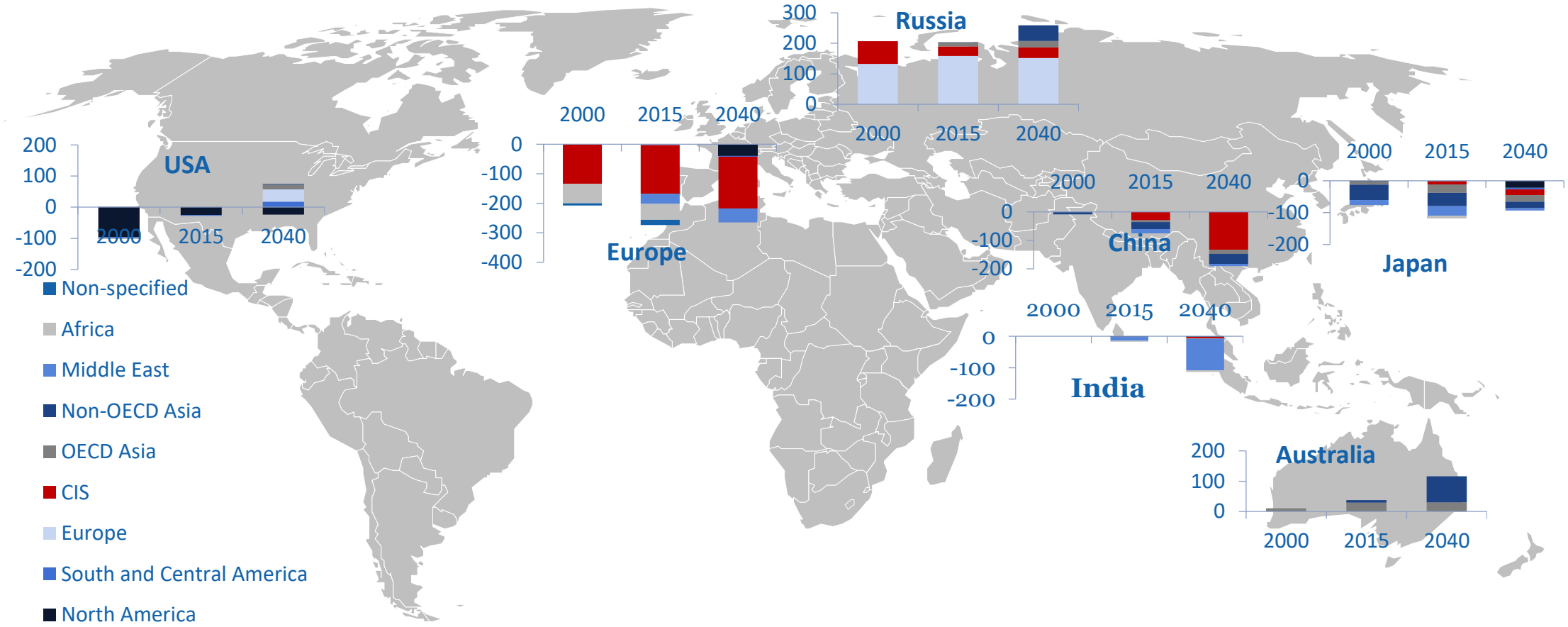
Which infrastructure investments are most critical for growth in the natural gas market? (Select up to three)



Source: Black & Veatch

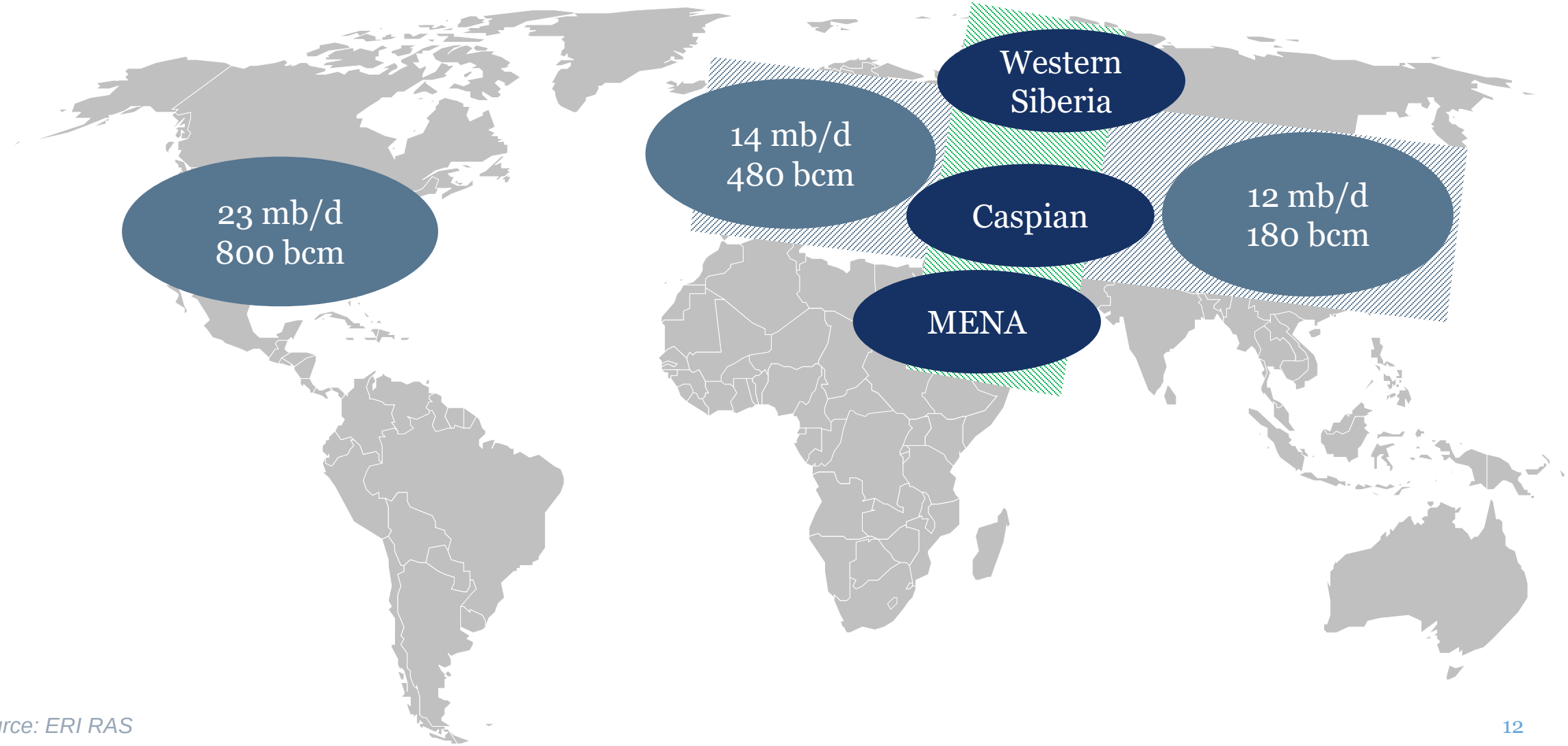
GLOBAL GAS TRADE OUTLOOK: DEMAND GROWTH IS MOVING TO ASIA

Pipeline gas and LNG export and import by the main countries, Probable Scenario



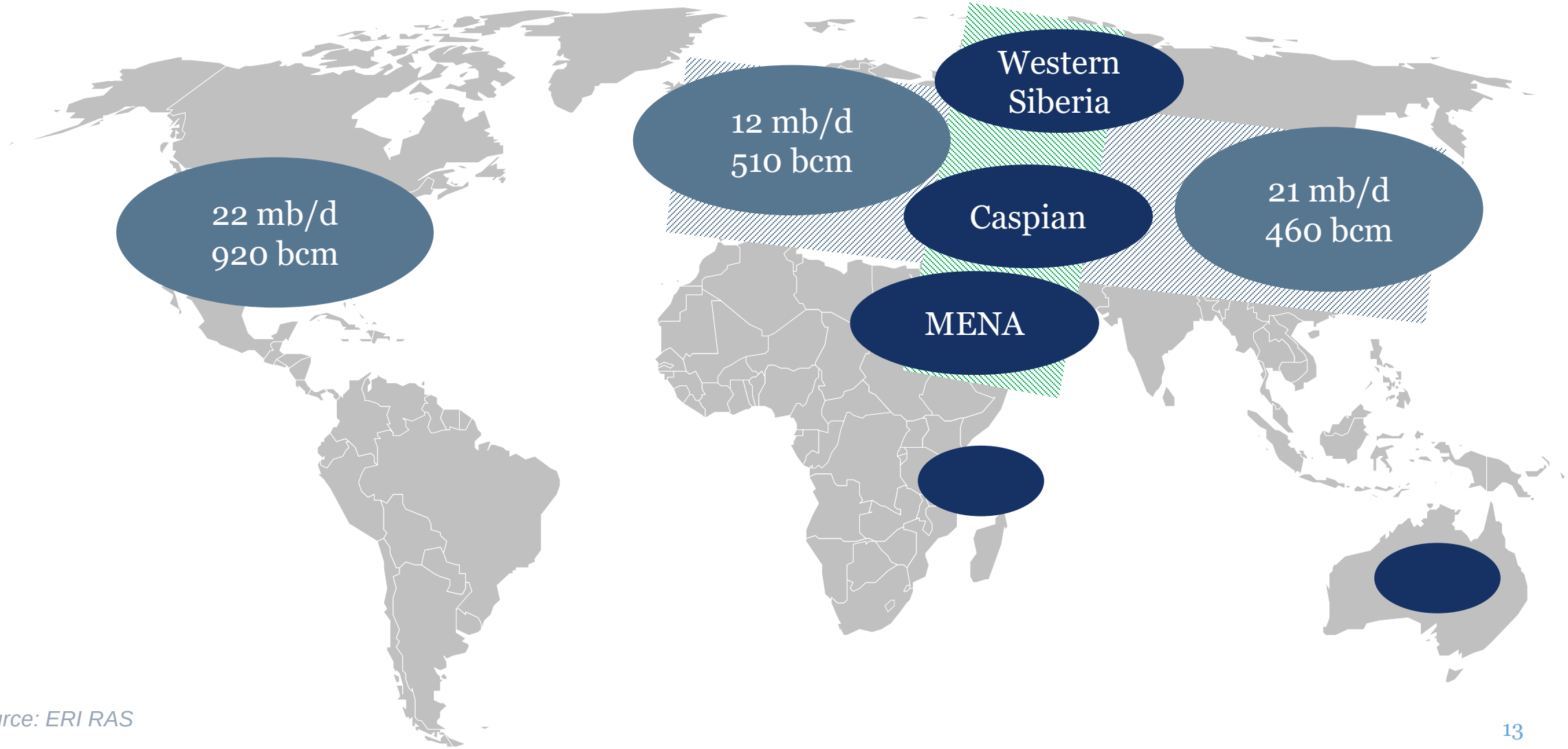
Source: Global and Russian Energy Outlook, ERI RAS-AC

INTERNATIONAL ENERGY TRADE IN 2000: FORMER "GLOBAL ENERGY ORDER" WITH THREE MAJOR HYDROCARBON SUPPLIERS



Source: ERI RAS

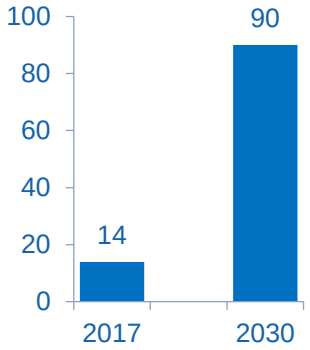
“REPARTITION OF THE MARKETS”: INCREASING NUMBER OF PRODUCERS AND SHRINKING OECD MARKETS



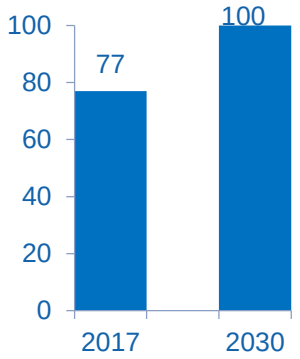
Source: ERI RAS

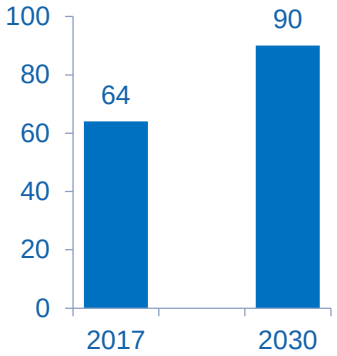
AND THERE ARE 4 MAJOR LNG PRODUCERS EXPANDING THEIR LNG CAPACITIES…

USA

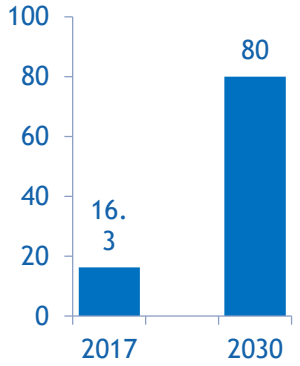


Qatar



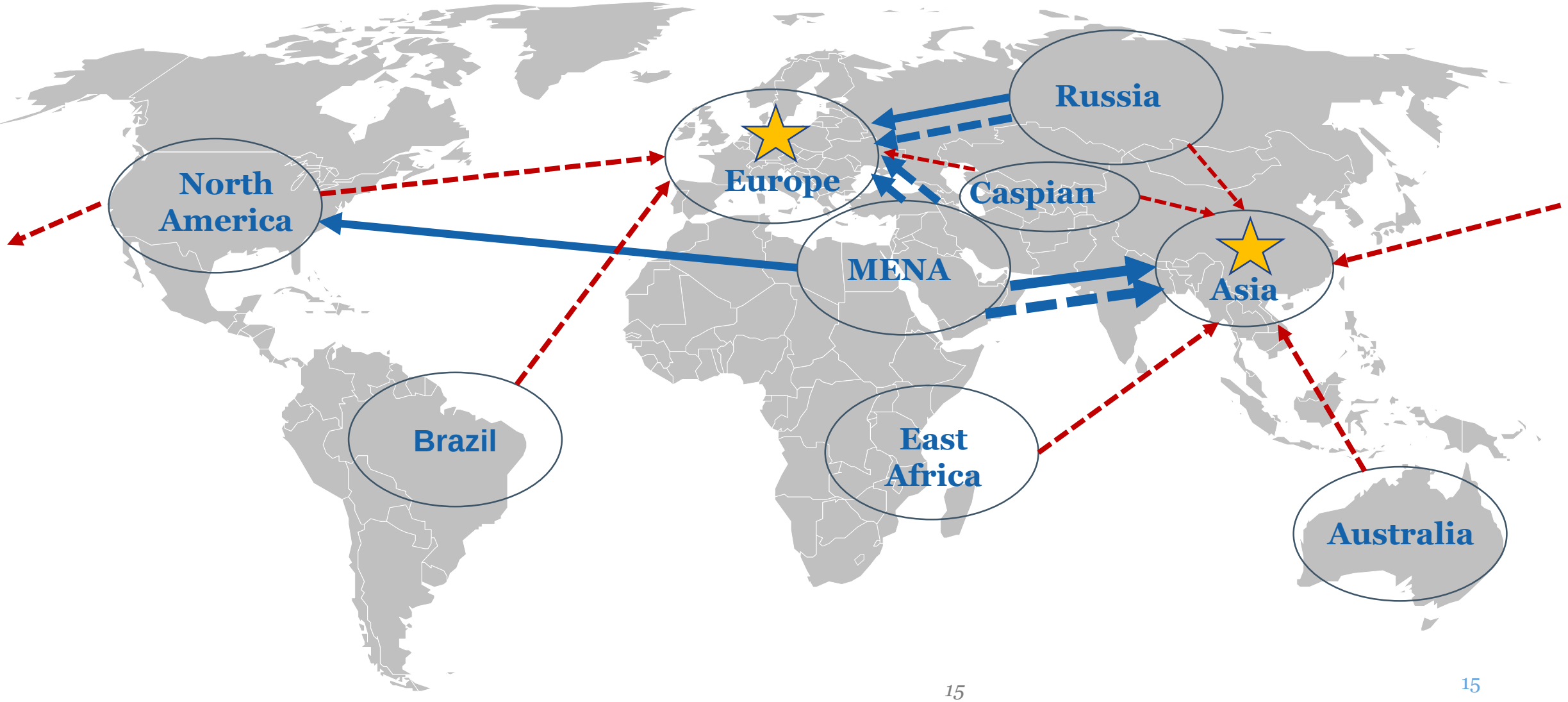


Australia



Russia

CHANGING GLOBAL ENERGY LANDSCAPE: "REPARTITION" OF THE SHRINKING NICHES IN THE BUYERS` MARKET AND CHANGING ENERGY FLOWS



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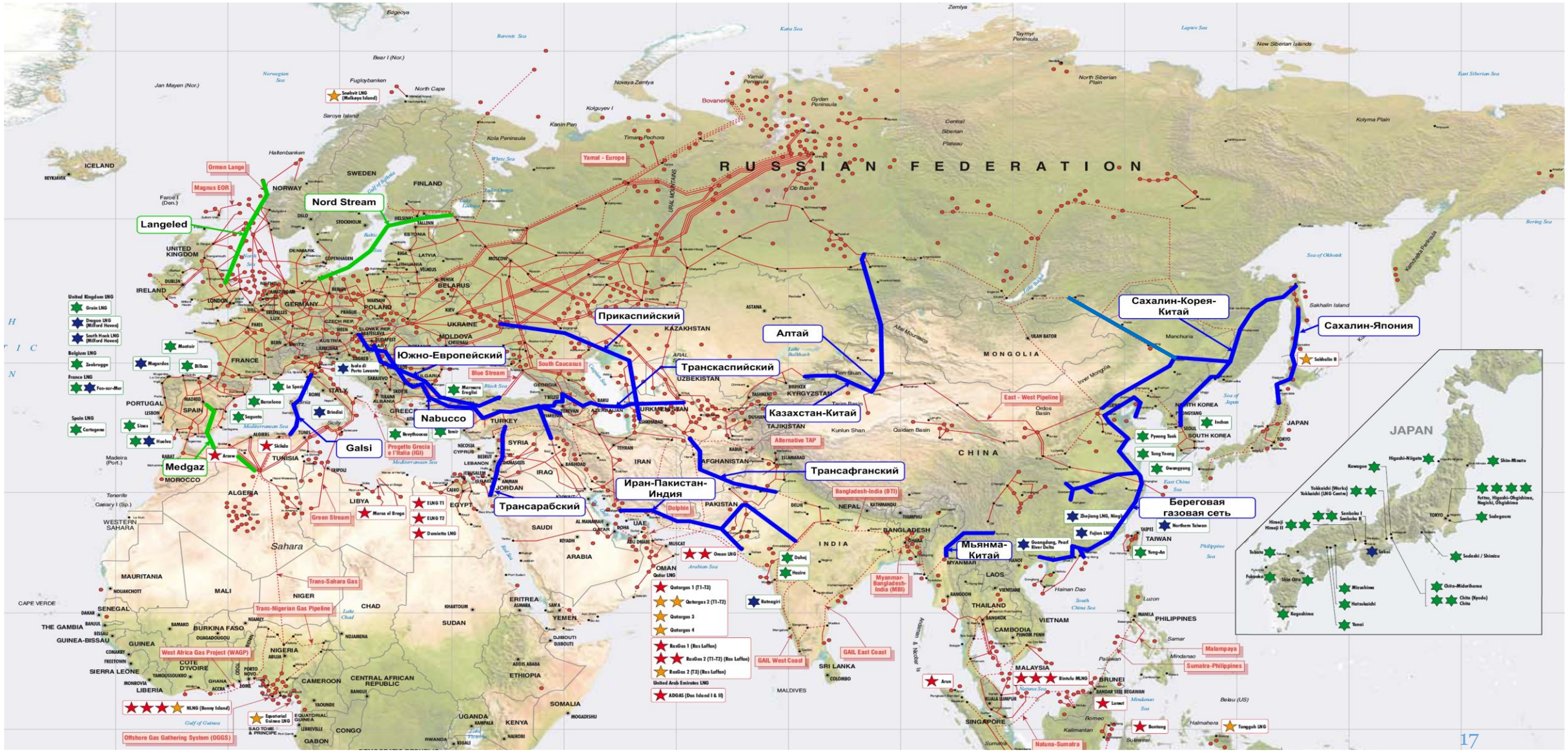
CENTRAL ASIAN GAS KNOT

EMERGING EURASIAN GAS MARKET



THE EMERGING EURASIAN GAS MARKET AND ITS MAIN PRINCIPLES

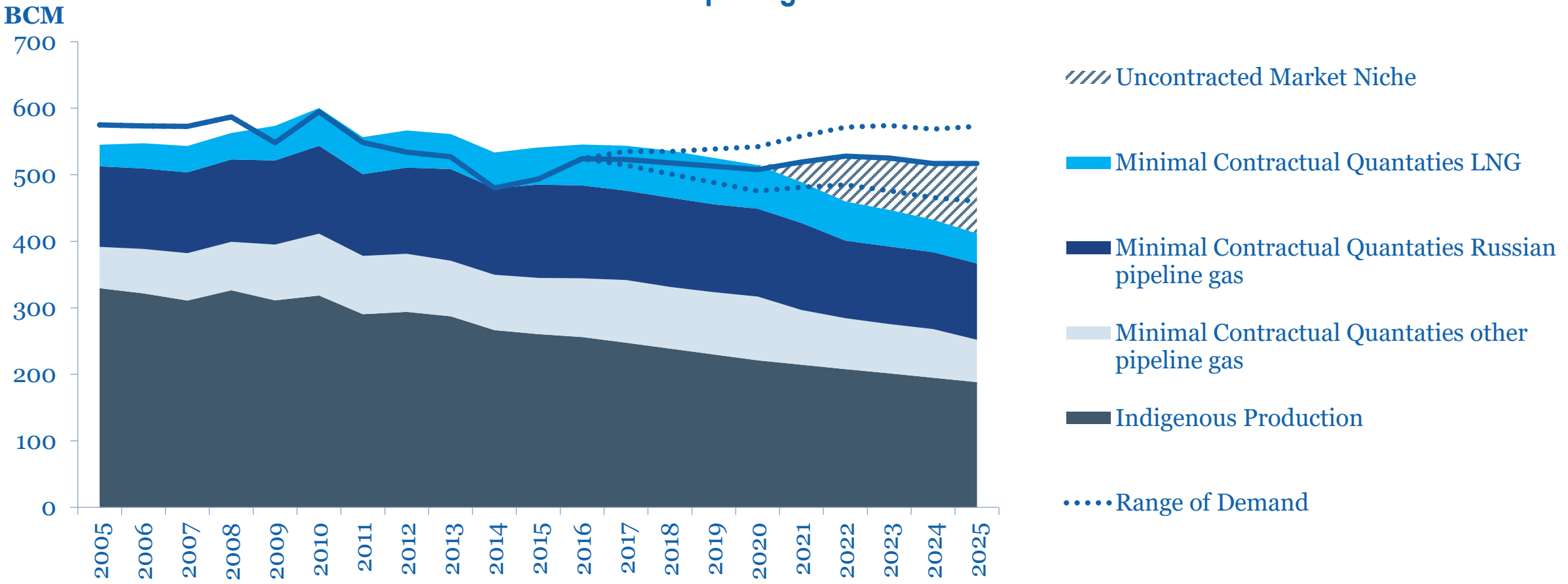
- Single pipeline gas pricing mechanism (net-back pricing from the major consumer markets in Europa and in Asia) with the lowest prices in the heart of Eurasia.
- Single gas pricing mechanism is supported by competition with LNG. Alternative fuels – coal, RES and nuclear – will limit any attempts of monopolistic pricing.
- Variety of contract terms (long-term/ spot; bilateral/multilateral)
- Hub development (TTF, NBP, NCG, Saint-Petersburg, Turkey, Shanghai, JKM, Singapore, …)


Norwegian Sea
Iceland
Sweden
Finland
Norway
Russia
North Sea
Denmark
United Kingdom
Ireland
Belarus
Poland
Germany
Ukraine
Austria
Kazakhstan
Mongolia
Bay of Biscay
France
Romania
Italy
Spain
Uzbekistan
Kyrgyzstan
Greece
Turkey
Turkmenistan
Portugal
China
Mediterranean Sea
Syria
Tunisia
Afghanistan
Iraq
Iran
Morocco
Pakistan
Algeria
Libya
Egypt
Nepal
Western Sahara
Saudi Arabia
India
Myanmar (Burma)
Oman
Mauritania
Mali
Niger
Sudan
Yemen
Thailand
South China Sea
Chad
Gulf of Aden
Arabian Sea
Bay of Bengal
Andaman Sea
Vietnam
Burkina Faso
Guinea
Ghana
Nigeria
South Sudan
Ethiopia
Laccadive Sea
Gulf of Thailand
Malaysia
Gulf of Guinea
Somalia
Kenya
Gabon
DR Congo
Indones
Java Sea
Tanzania
Angola
Zambia
Mozambique


INOGATE

European gas market consists of two segments: LTCs and spot, Gazprom has secured impressive portfolio of LTCs…

European gas balance

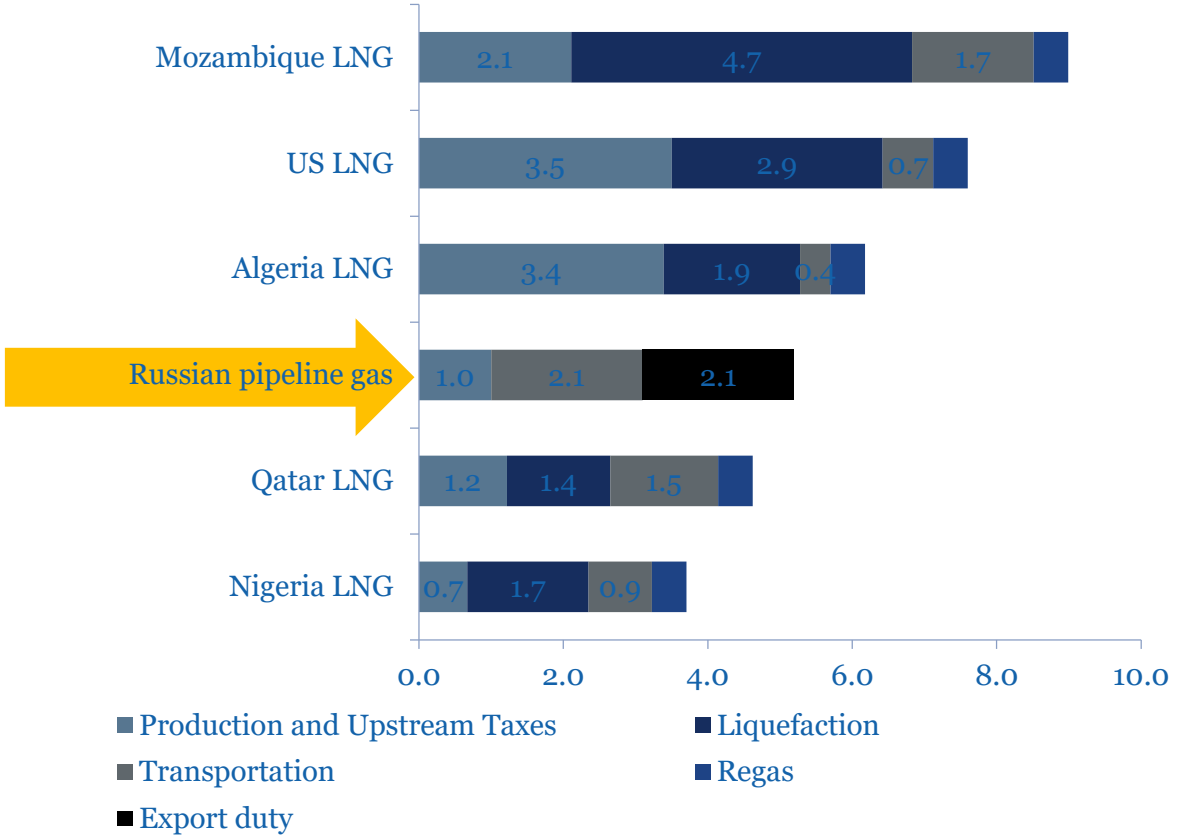


Sources: Nexant WGM 2017, IEA World Energy Balances 2017, IEA Natural Gas Information 2017

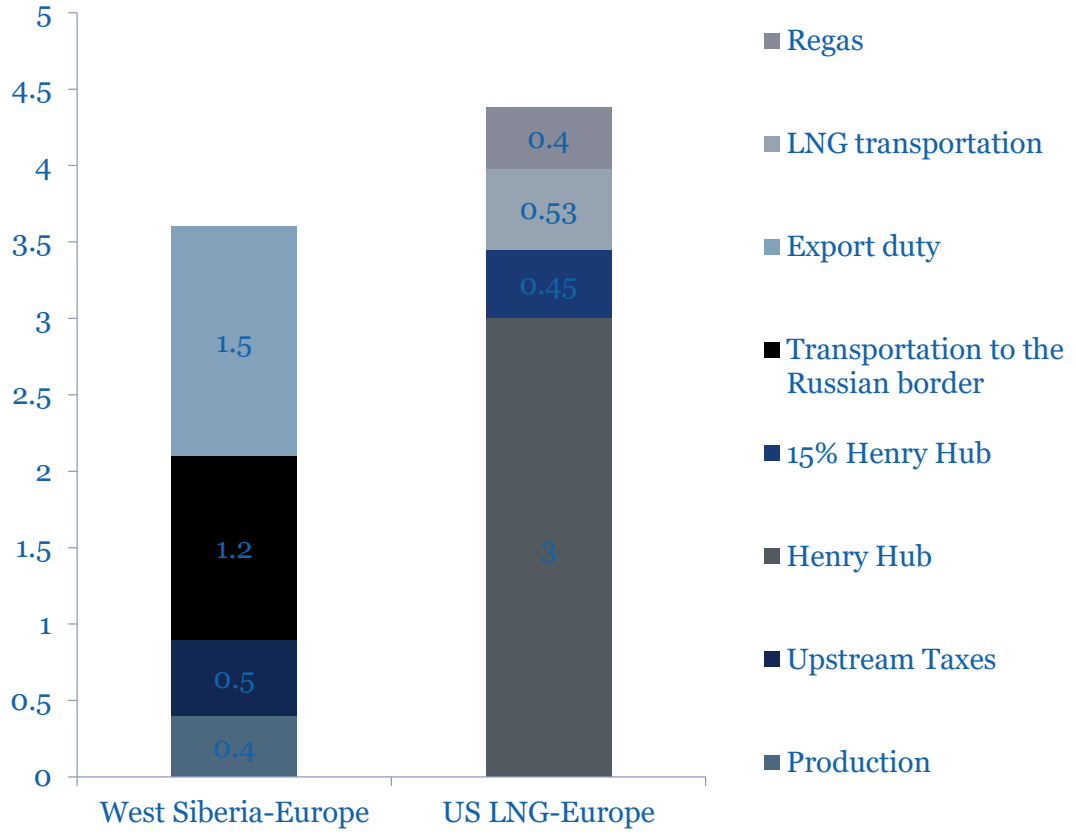
* Europe-41 without Turkey

PIPELINE GAS IS WELL PLACED IN EUROPE TO COMPETE ON SPOT WITH LNG

Long run marginal supply costs to Europe (Russian pipeline gas and US LNG)



Short run marginal costs to Europe (Russian pipeline gas and US LNG)



GLOBAL OIL PRICES AND ASIAN GAS DEMAND WILL DEFINE COMPETITIION BETWEEN PIPELINE GAS AND LNG IN EUROPE

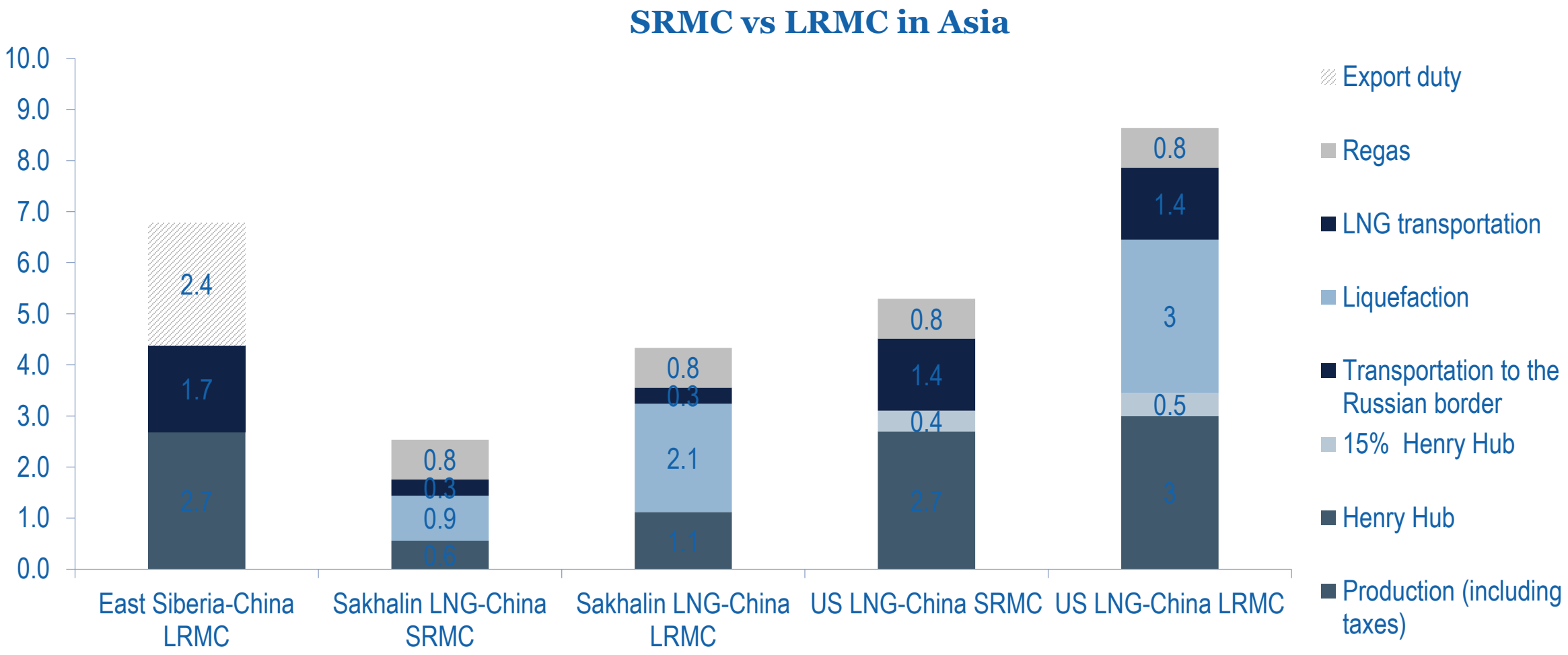
European scenario matrix

	Low oil price	High oil price
High Asian demand (no LNG glut)	Low LNG availability Gazprom expanding gas exports NO CHANGE	Increasing competition for LNG with Asia/ Further contract revisions by Gazprom
Weak Asian demand (LNG glut)	Increasing competition between pipeline gas and LNG Gazprom voluntarily decreasing contractual prices	Tough competition between pipeline gas and LNG PRICE WAR (voluntarily increasing supply in order to drop prices and crowd away competitors)

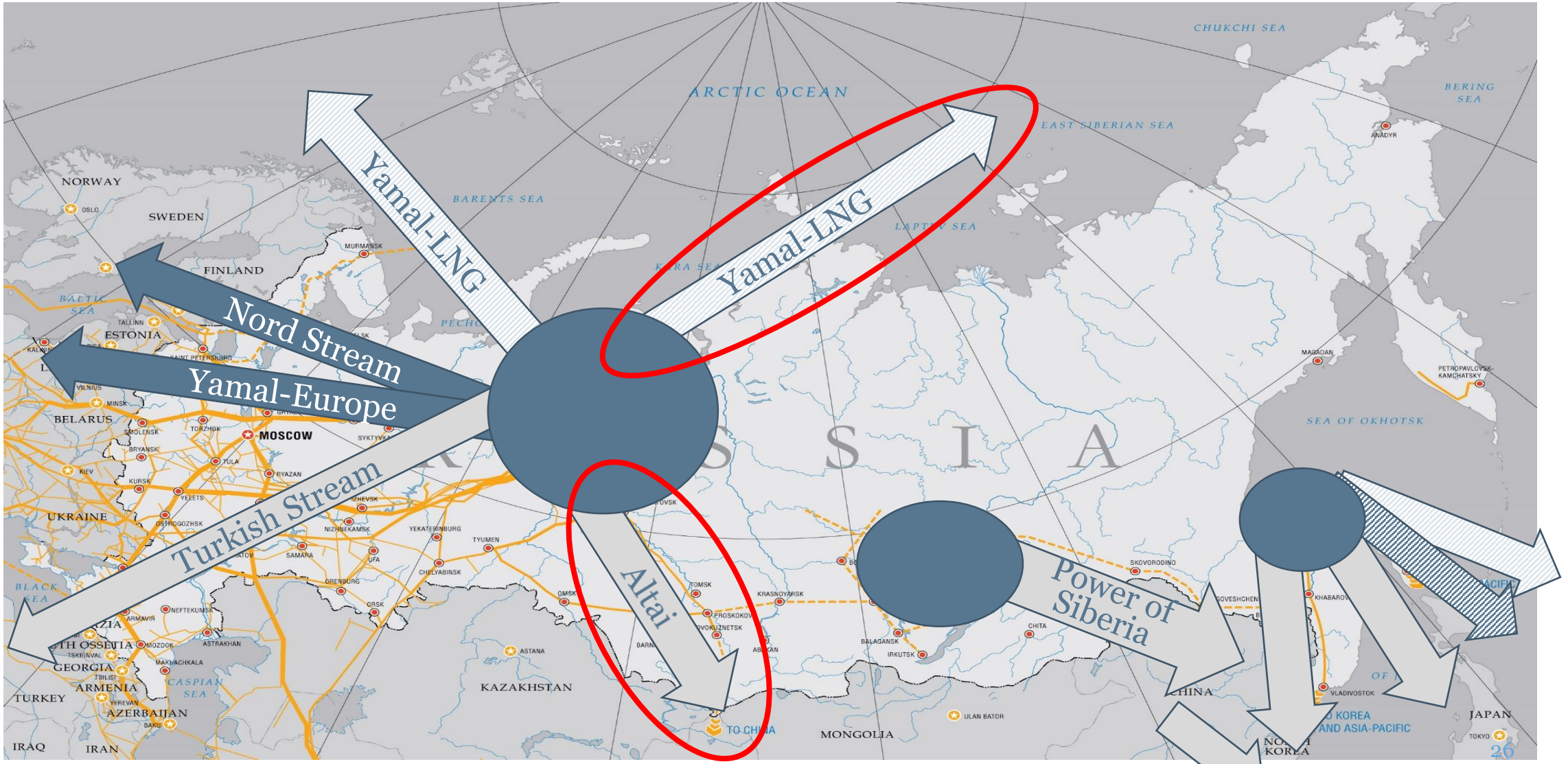
EASTERN PIPELINES IN EURASIA

Source: OIES

PIPELINE GAS IS AMONG THE CHEAPEST OPTIONS IN ASIA



RUSSIA'S ROLE AS A KEY MARKET ARBITRAGE POINT AS A SUPPLIER TO EUROPE AND ASIA



NEW TRANSITIONAL PERIOD

- Need for huge investments to produce and transport more gas from remote areas
- Growing number of parties involved in each transaction increase geopolitical concerns and also complicate transactions
- Growing number of market participants with different institutional frameworks
- Growing number of transit countries increase transit risks
- Fast regulatory reforms in many countries create additional uncertainties and decrease trust to the state guarantees
- Growing competition increases producers` risks
- “Energy nationalism” and increasing national security-of-supply concerns
- Changing markets and growing uncertainties lead to higher transaction costs and demand multilateral institutional changes and development of new instruments

NEW BUSINESS MODELS?

- Shorter contracts, higher flexibility, “uberization”, new trading platforms
- Portfolio optimization (aggregators with cheap capital)
- Demand creation
- Enhanced vertical integration (cost control in the upstream supply chain, integrated complex solutions for the final consumers)
- “Green gas”

CONCLUSIONS

- Pipeline gas still is the backbone of the international gas trade development and its role should not be underestimated.
- Pipeline gas trade is associated with higher asset specificity, higher transaction costs and vertical structures
- Economics of the pipeline projects is driven by the economy of scale
- It is increasingly difficult for develop pipeline projects in the stagnant or declining markets
- Pipeline projects are associated with much higher geopolitical risks
- In the future new global framework, involving both pipeline gas and LNG trading and portfolio optimization, could evolve
- Hydrogen could play a role