Energy Community

Regional Training for the Employees of Parliaments of Armenia, Azerbaijan, Georgia, Moldova, Türkiye and Ukraine

OVERVIEW OF GAS MARKETS: SUPPLY, DEMAND AND MARKET STRUCTURE

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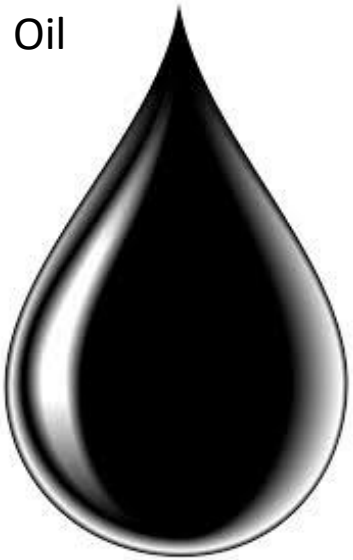
Natural gas - basis

Natural gas as fossil fuel

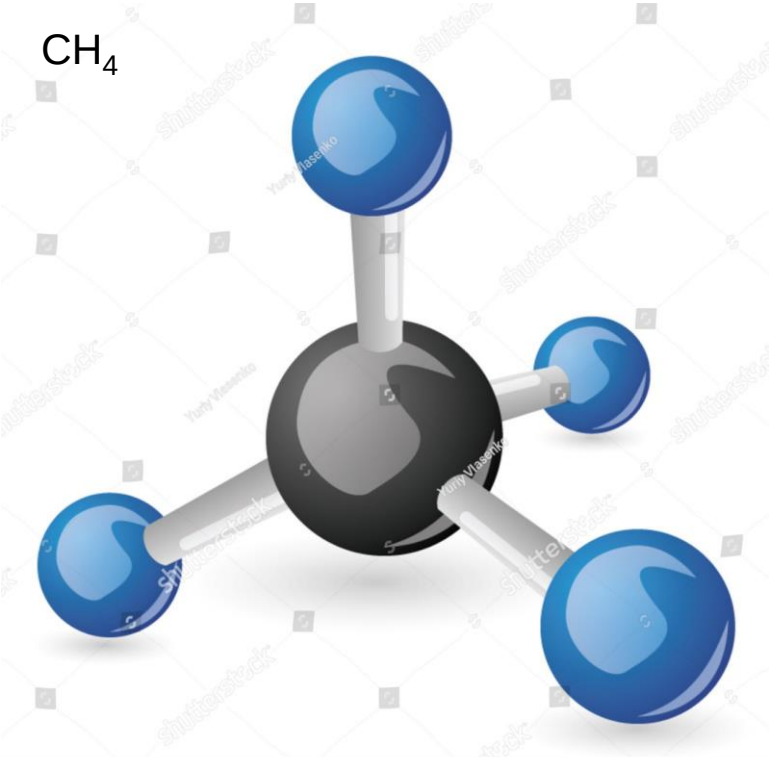
Coal

Oil



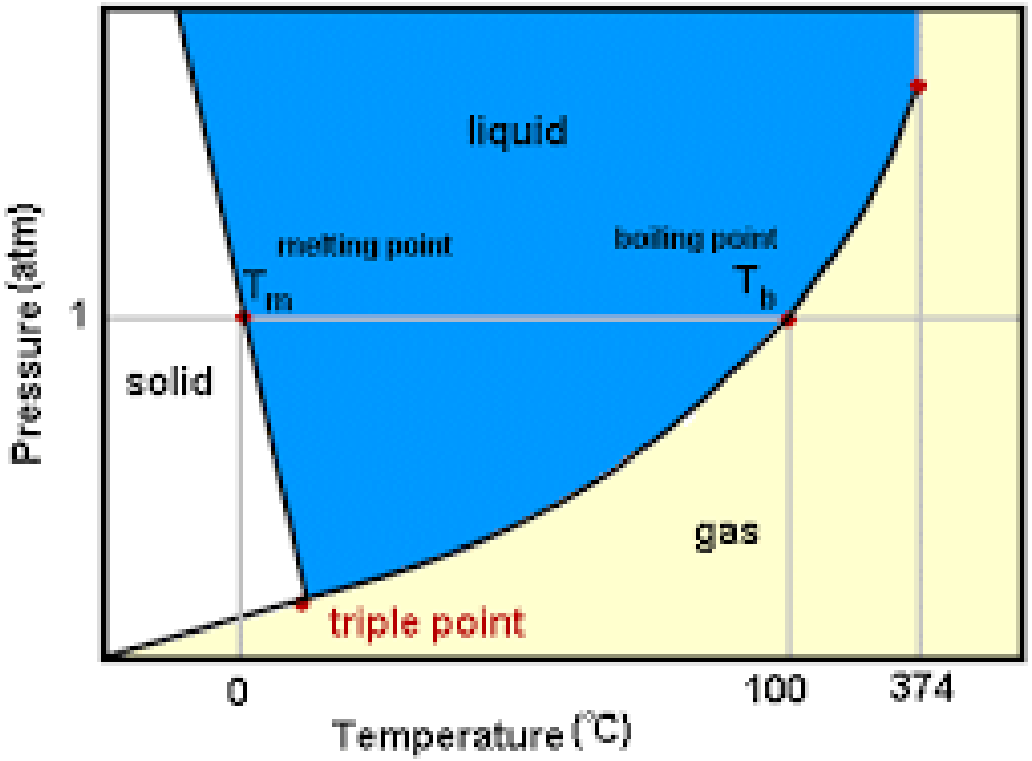
Natural Gas

Natural gas as ....gas mixture



- Formed when organic materials were exposed to heat (65 -160 °C) and pressure without oxigene (biogenic, thermogenic processes)
- Hydrocarbon gas mixture:
- Mainly Methane – CH_4 , but other higher alkanes (C_xH_Y), CO_2, N_2, H_2S...can be present
- „Wet“, „Dry“, „Sour“ natural gas....
- Different composition in the Netherlands (80-85% CH_4), Russia (98% CH_4), Qatar (90% CH_4)....

Natural gas as fluid



LNG liquid

Conditions: 1 bar & -162 °C
1 m³ LNG : 600 m³ NG
LNG: 430 kg/m³
Ship – steel & aluminium
1st transport in 1959
Today cca 50 ships in world
(15 000 – 56 000 t)

LPG

CNG gas

Conditions: 200 -250 bar &15°C
1 m³ CNG : 100 m³ NG
CNG and NG: 0,717 kg/ m³
High octane number: 120, used in transport sector mainly

Natural gas transport

Gas via Pipelines

CNG in trucks

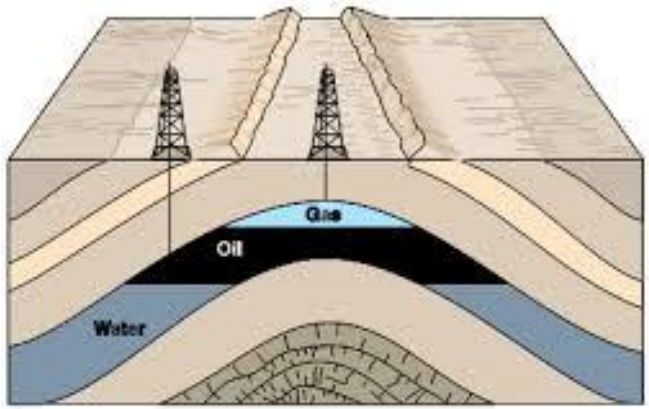
LNG in ships

Pipelines < 4000 km < LNG

Natural gas – where to find it?

Preconditions:

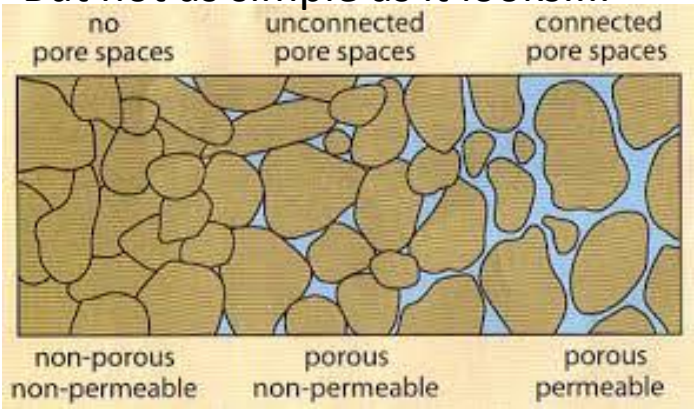
- **Reservoir rock (limestone, sandstone)**
- **Impermeable rock (clay, marl)**
- **“Geological” trap**



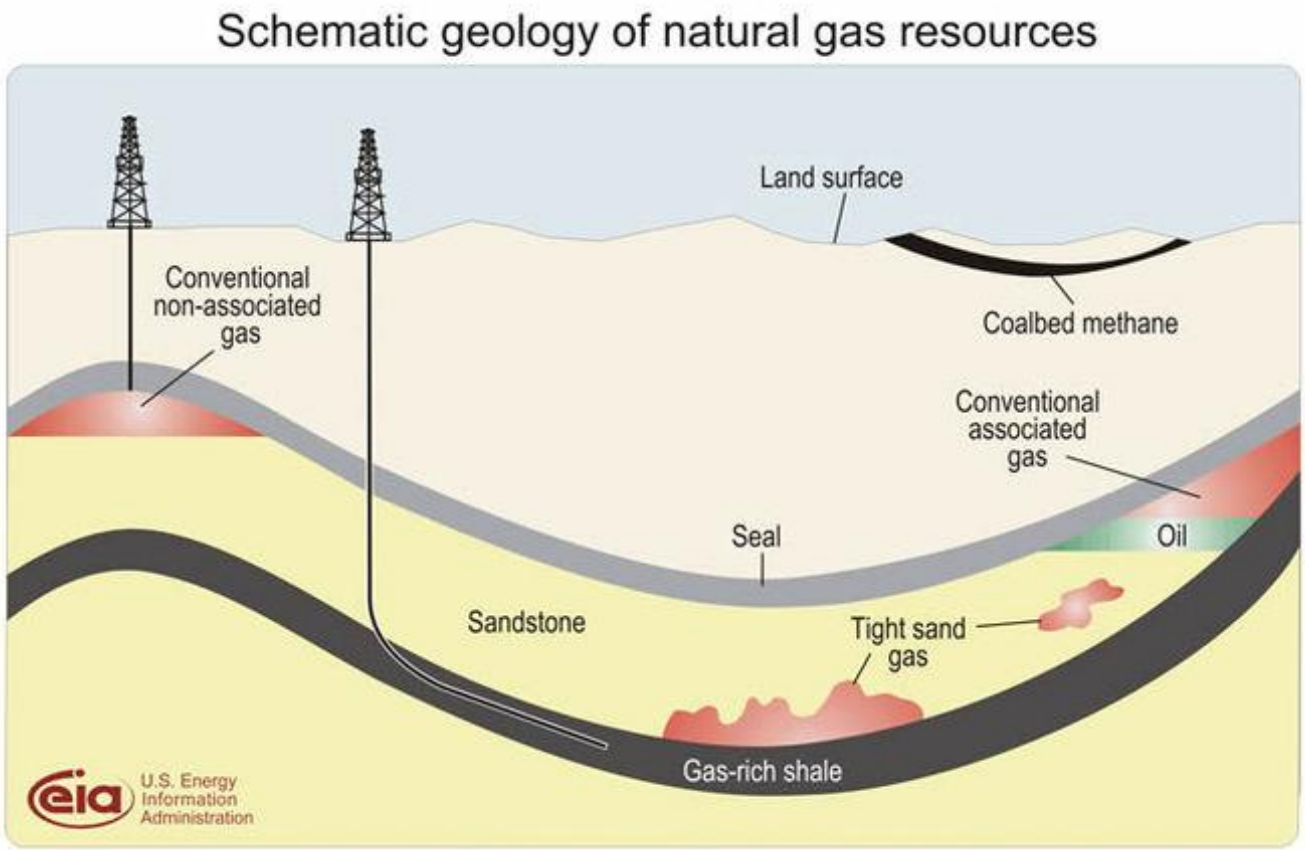
How we know where to find it?

Basic principles:
Sound and magentic rays have different velocities in different materials

But not as simple as it looks....



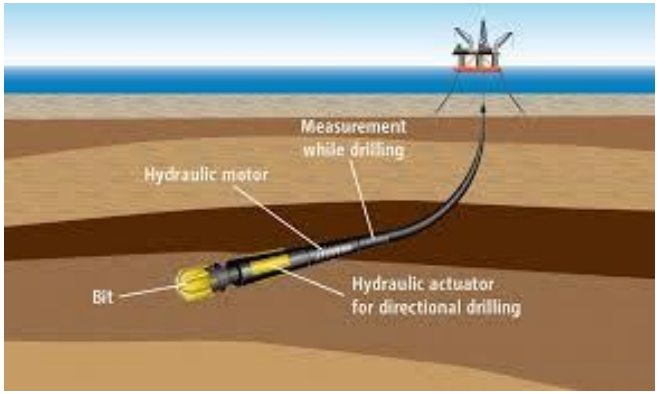
Nature as a great designer



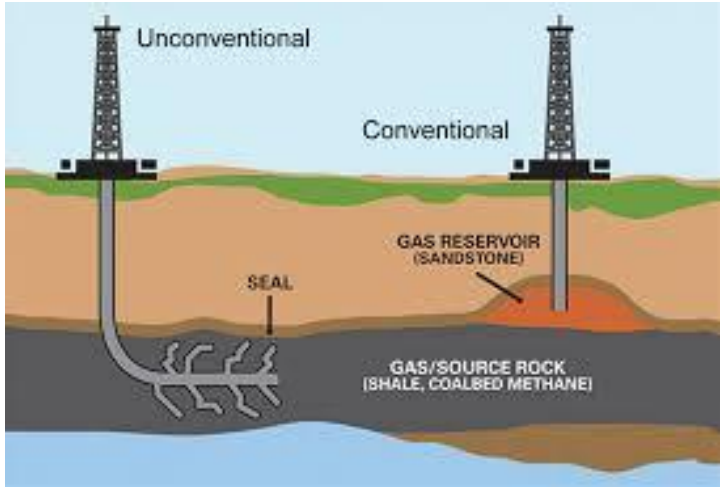
Humans as great inventors

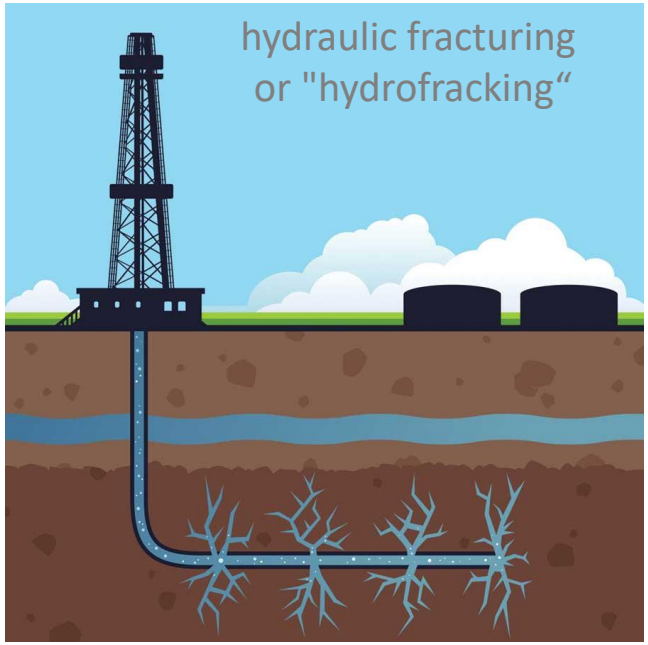
On shore / Off Shore

Extreme conditions:
Pressures above 700 bar
Temperature above 160°C
The deepest well > 9000m

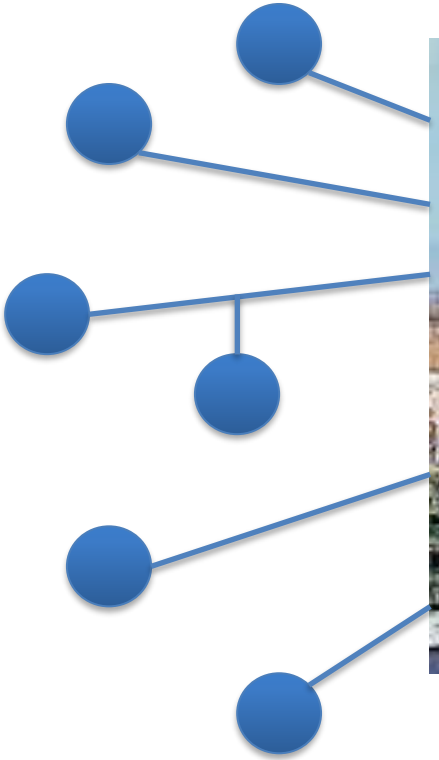


Slanted wells
Group of wells from the same platform
Horisontal drilling





Between production and transport

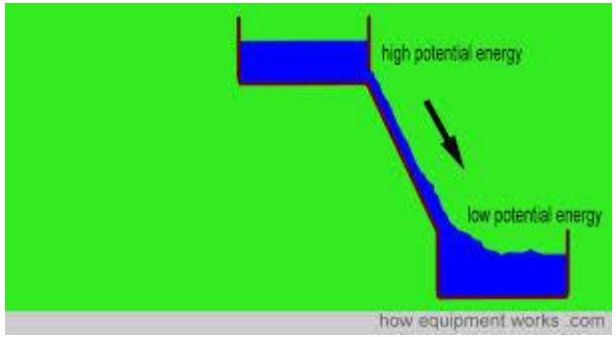


Removal of H_2O, CO_2, H_2S,
and if in place: C_2H_6, C_3H_8.....

Commpressor station (optional)

To customers

Natural gas according to the law of physics



Always from higher to lower pressure

Loses in pressure (energy for transport), not in volume (m^3, content of energy)

Always interrelations between p, V, T

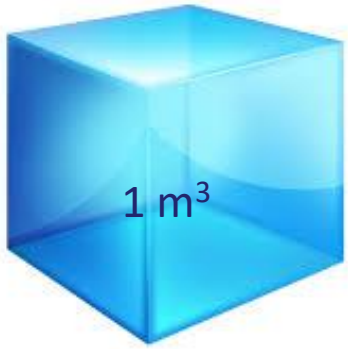
$$p_1V_1/T_1 = p_2V_2/T_2$$

NG normal velocity:
3–30 m/s
(10-100 km/h)

Natural gas measurment

- Delivery – m^3
  - At which pressure, at which temeperature?
  - Stanard m^3 1 bar, 15 °C
  - Normal m^3 1 bar, 0 °C
  - Russian gas at 20 °C

$$p_1V_1/T_1 = p_2V_2/T_2$$



m^3 at 1 bar

20° C	15° C	0° C
1,017351	1	0,947946
1	0,982944	0,931778
1,073217	1,054913	1

Meter + corrector

Natural gas as energy

- Energy content depends on composition
- 1 m^3 = ? cal = ? (x 4,186) Joule
- Gross calorific value (GCV) vs Net calorific value (NCV=0,9 GCV)
- Eurogas 2014 statistics: 39 MJ/m^3 (NCV 35,1 MJ/m^3)
- Russian gas: 38,2 MJ/m^3 (NCV 34,4 MJ/m^3)

Link with electricity:

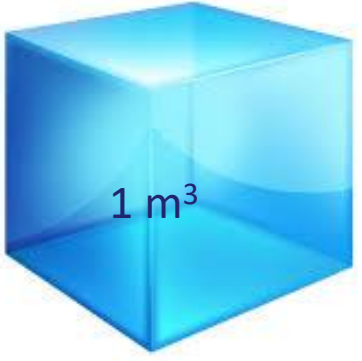
1 Wh = 3600 Ws = 3600 J = 3,6 kJ

Aproximately (to remember):
1 m^3 ≈ 10 kWh
1000 m^3 ≈ 10 MWh
1 mil m^3 ≈ 10 GWh
1 Bil m^3 / y ≈ 10 TWh / year

Link with oil:

1 toe = 41, 86 kJ = 11,63 MWh

~~ 1200 m^3



Take care:
kilo (10^3), Mega (10^6),
Giga (10^9), Tera (10^{12})....

Natural gas = energy

- *Climbing energy wise requries 360 kcal/h*
- *1m3 of NG enough for 25,86 h of climbing*
- *1 hour climbing = aproximately 300 m up*
- *1m3 of NG enough to climb 7757 m*
- *(Mont Blanc is 4810 m, Elbrus 5642 m, Kazbek 5054m)*

$1\ m^3 \approx 9308\ kcal$

Walking energy wise requries 280 kcal/h

1m³ of NG enough for 33,24 h of walking

1 hour walking = aproximately 4-6 km

1m³ of NG enough to walk 133-199 km

(Vienna – Graz = 200 km)

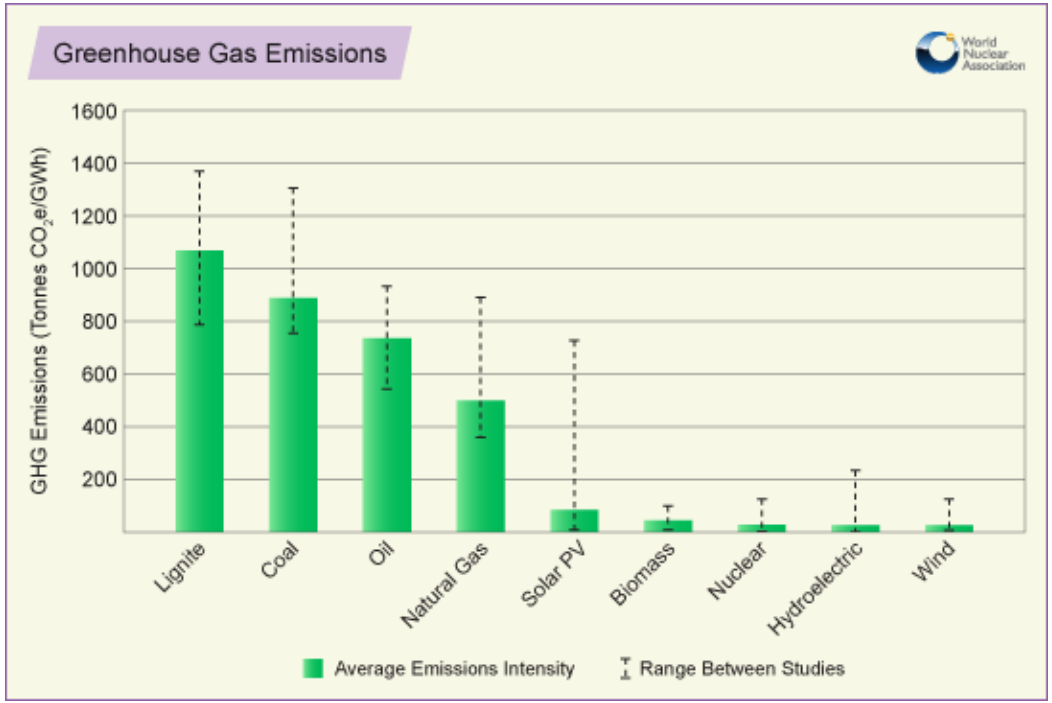
Natural gas... Safety

Precondition:

5 -15 % vol CH_4 in air

That is reason for odorisation

Natural gas... GHG emmissions



Natural gas – market basis

Natural gas as used to be...

An unwanted by-product of oil production – flared, vented
Local gas grid – instead of flaring

Transport via pipelines as a precondition
(steel & welding technics in 1950s, 60s

Direct interlink between production, transmission and supply

Security of supply / security of demand

Long term relationships, long term contracts

Natural gas as commodity....

Competition with other energy commodities in different sectors

New applications / new customers

New producers / new markets

New requirements / new roles / new businesses

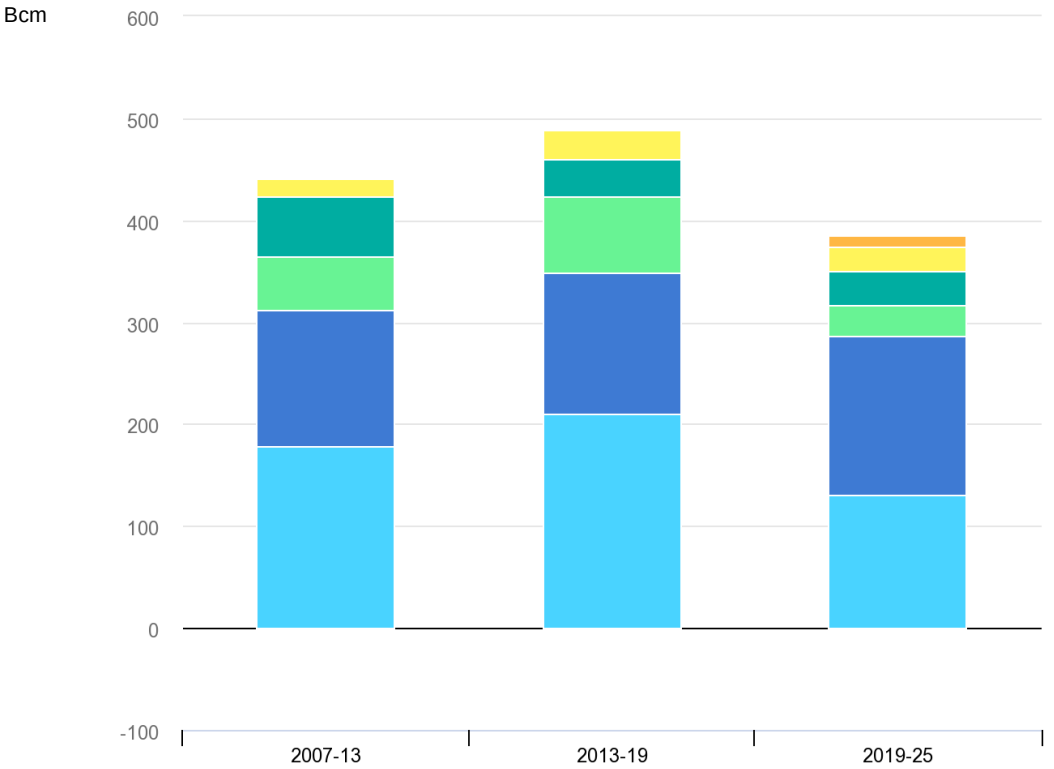
Contracts – long-term / short term

Price formulas/indexes

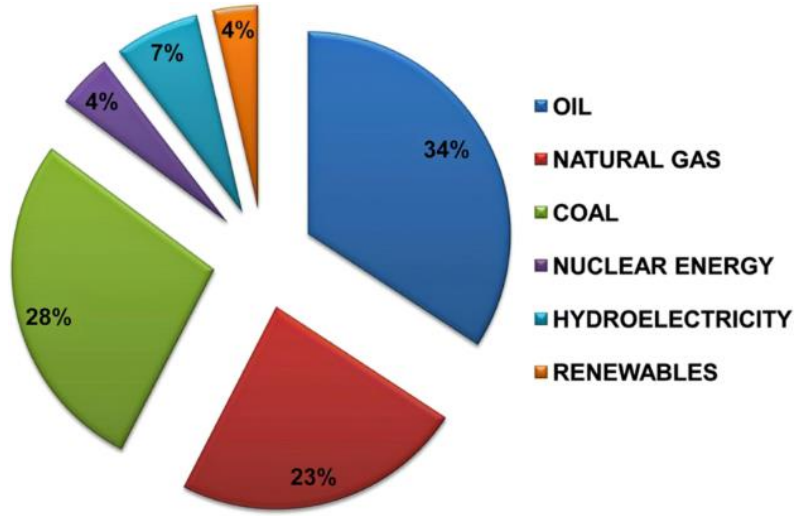
Spot markets

- **Producer**
- **Trader (wholesale/retail)**
- **Supplier**
- **Customer**
- **Transporter**
- **Distributor**
- **LNG shipper**
- **LNG terminal**
- **Storage operator**
- **Exchange**

Natural gas demand

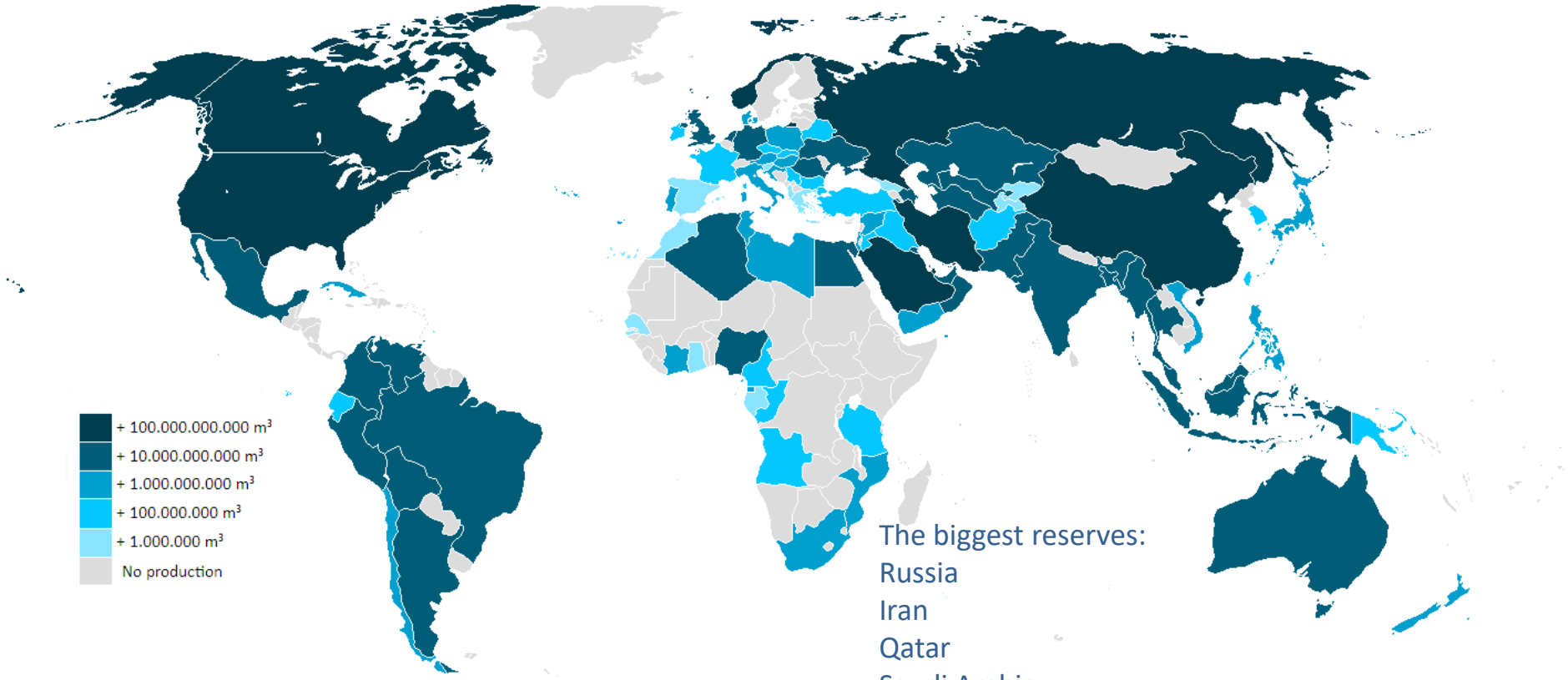


Source: IEA



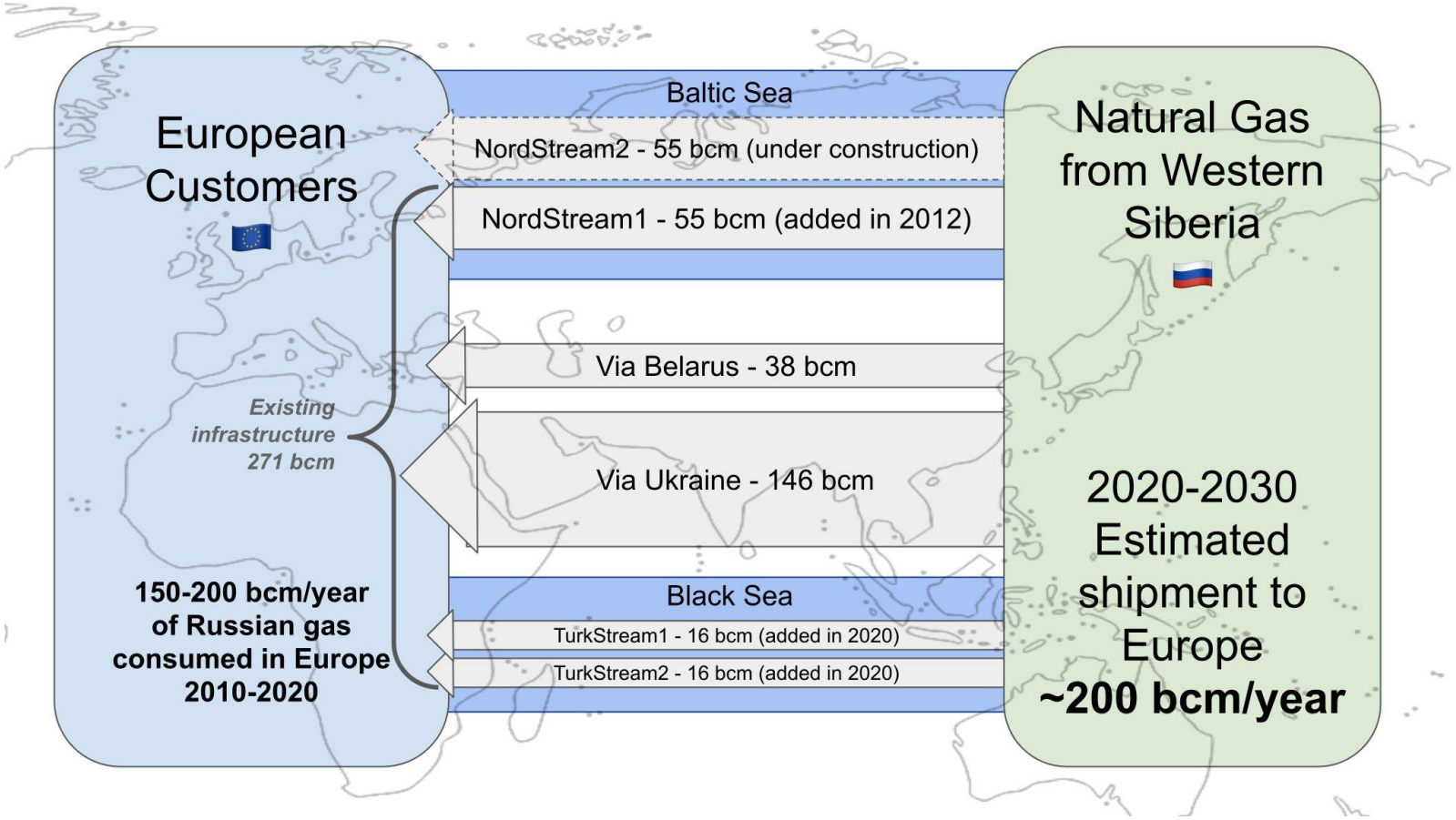
Source: Research Gate

Natural gas production champions

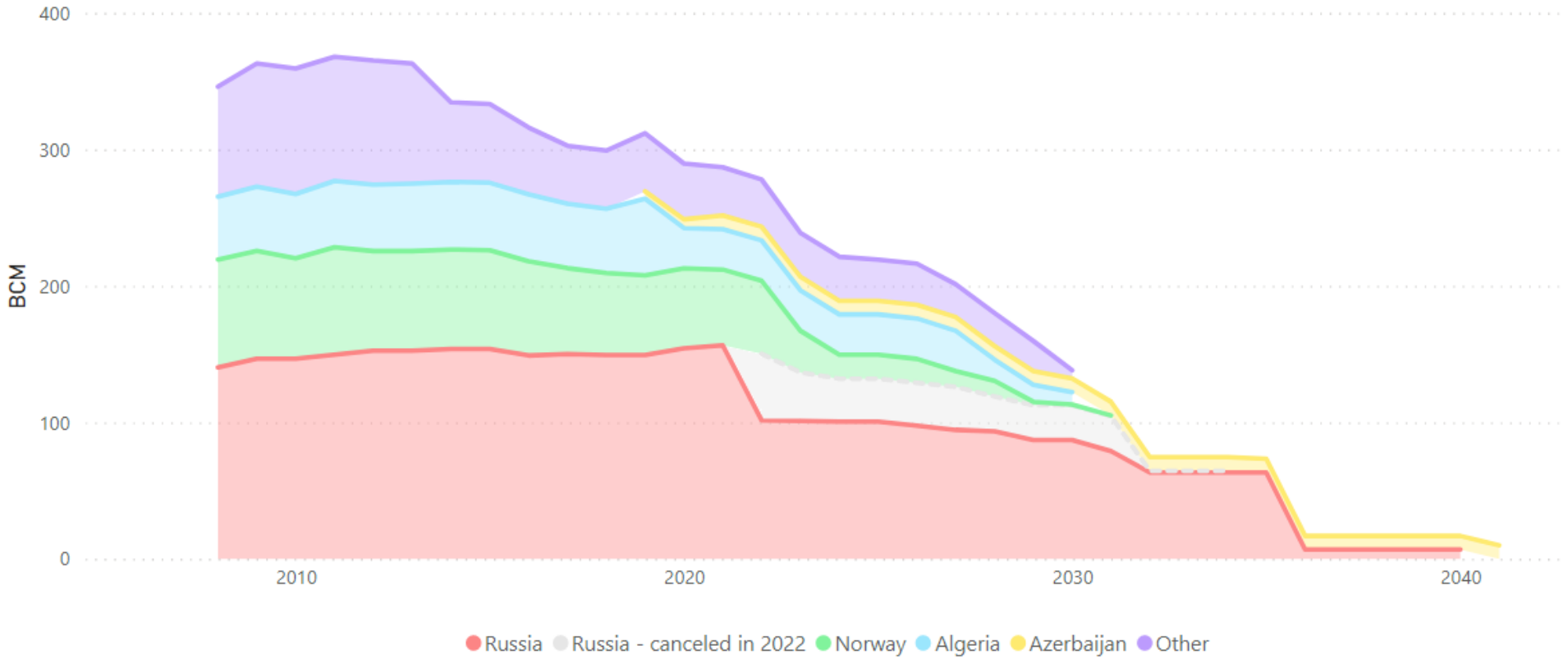


The biggest reserves:
Russia
Iran
Qatar
Saudi Arabia

Dependencies, interdependencies…
Europe - Russia Gas Trade prior to 2022

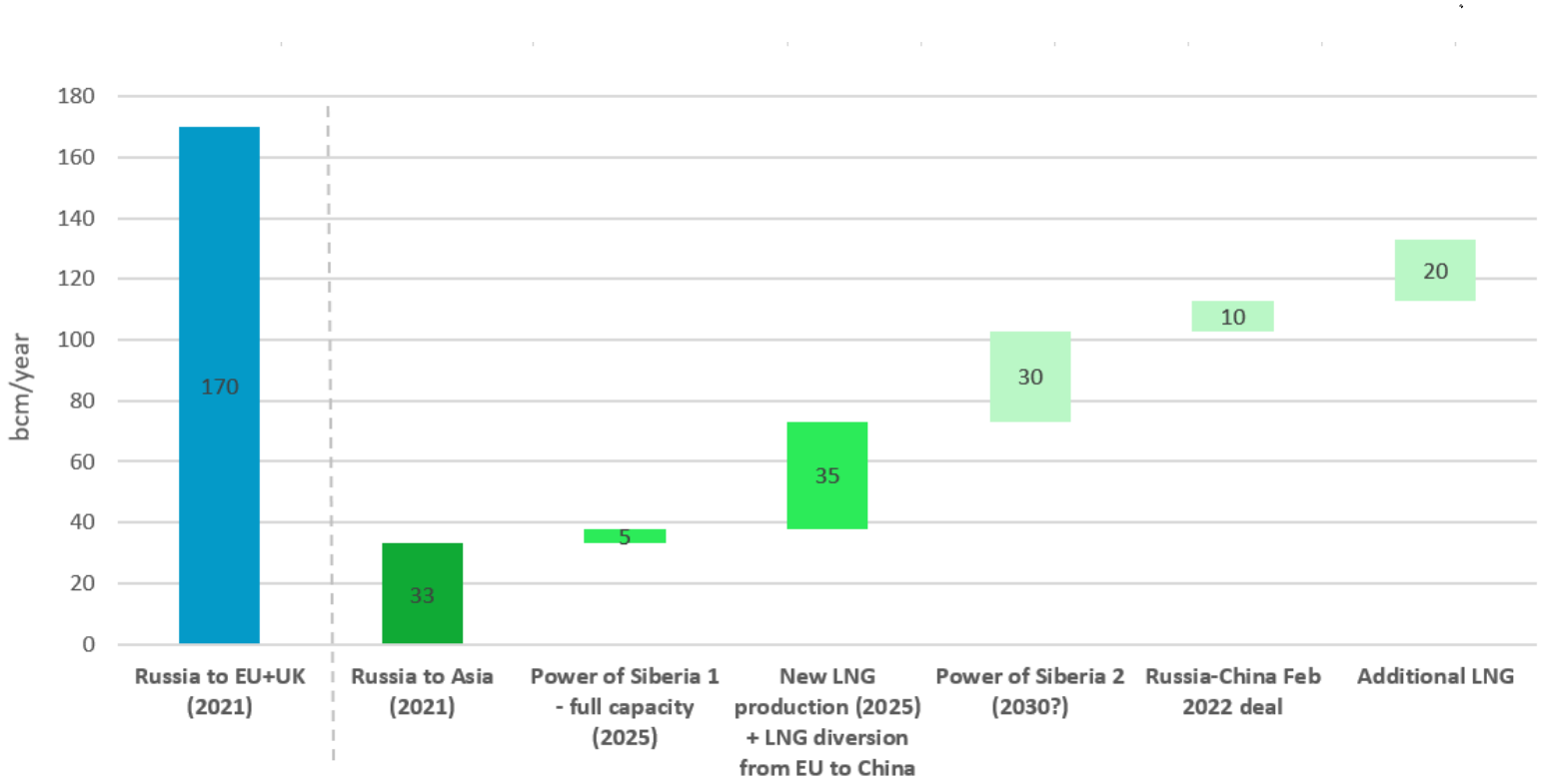


Russian long-term contracts were supposed to be LT for EU



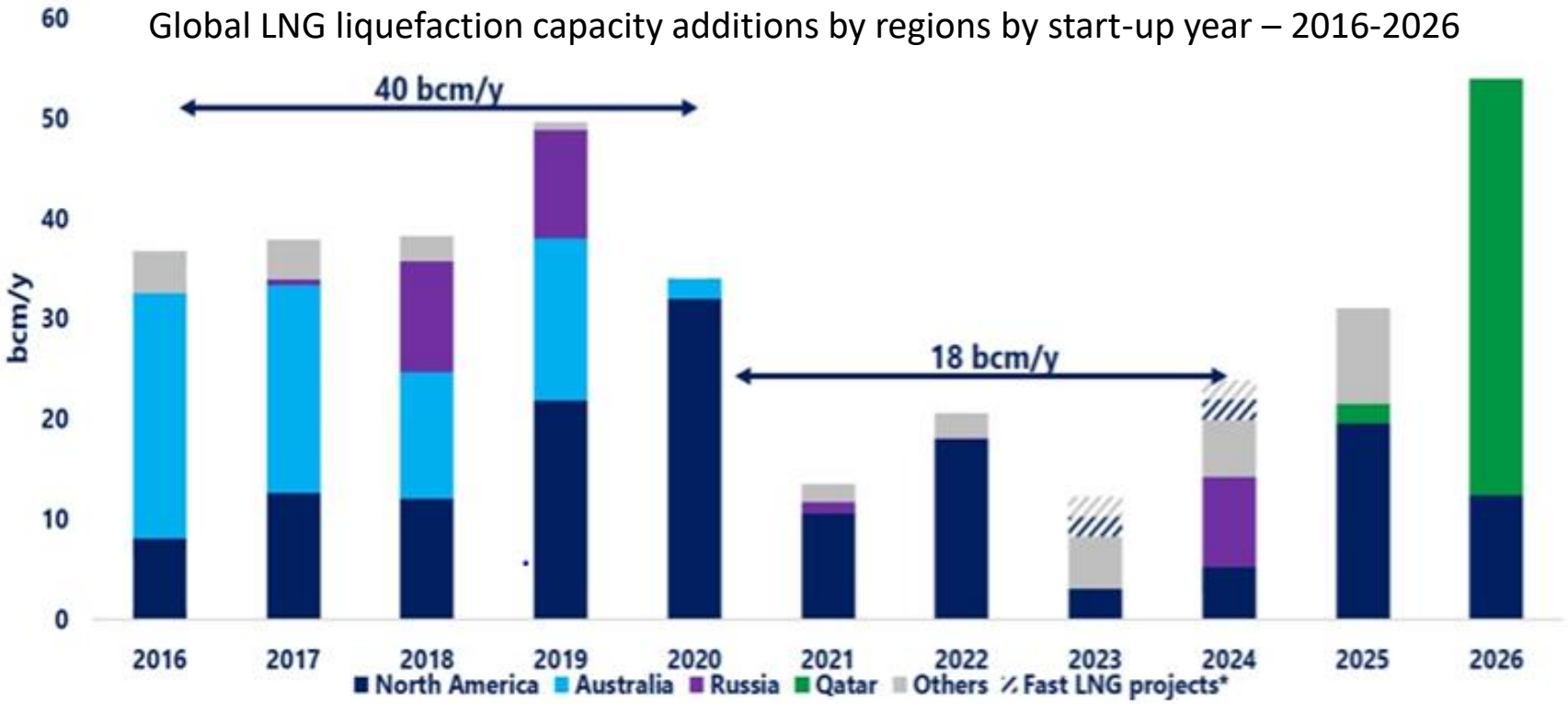
Source: ACER calculation based on Cedigaz and NRAs

Current Russian gas supply cannot just 'go elsewhere'



Source: Eurostat Energy database; Centre for Strategic and International Studies; IEA: Energy Fact Sheet: Why does Russian oil and gas matter?

Natural gas as global commodity



The EU will compete for extra volumes with Asia which will see growing demand, partly for overall economic growth, partly for lowering coal usage.

Natural gas – what will come next?

THANK YOU
FOR YOUR ATTENTION

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