Transformation of global LNG market: Second Global Gas Revolution with time-lag based on oil-market model

Prof. Dr. A.A.Konoplyanik,
Adviser to Director General, Gazprom export LLC;
Co-chair of Work Stream 2 "Internal Markets", Russia-EU Gas Advisory Council,
Member of the RAS Scientific Board on System Research in Energy

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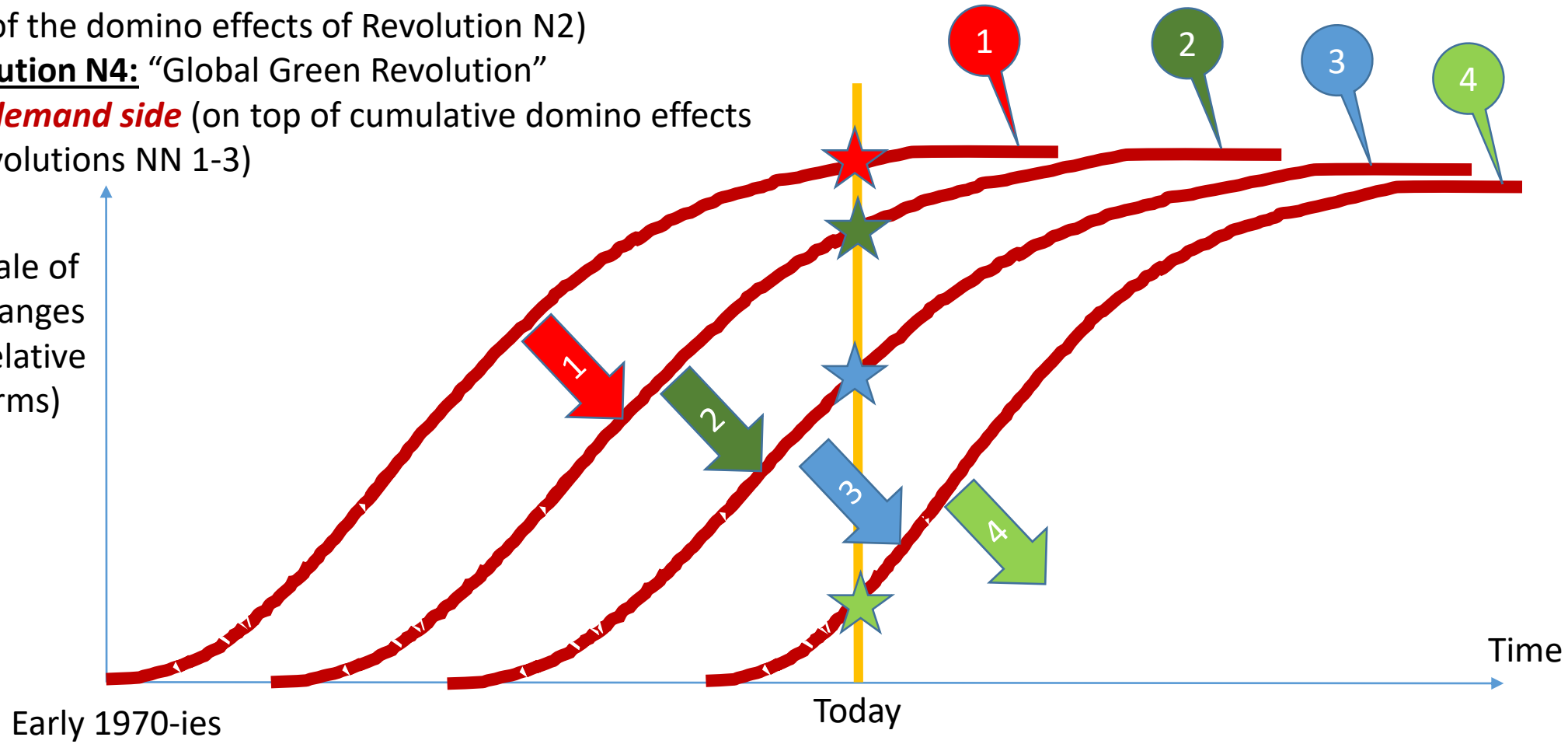
The waves of energy revolutions (repeated dynamics) and their domino effects

1. **Revolution N1:** "Revolution of Supply Expansion & Energy Efficiency" – on both global ***supply and demand side*** (respond of developed market economies on oil shocks of the 1970-ies)
2. **Revolution N2:** "US Shale Revolution" – on ***supply side*** (one of the domino effects of Revolution N1 – US rush to energy independence)
3. **Revolution N2:** "Global LNG Revolution" – on ***supply side*** (one of the domino effects of Revolution N2)
4. **Revolution N4:** "Global Green Revolution" – on ***demand side*** (on top of cumulative domino effects of Revolutions NN 1-3)

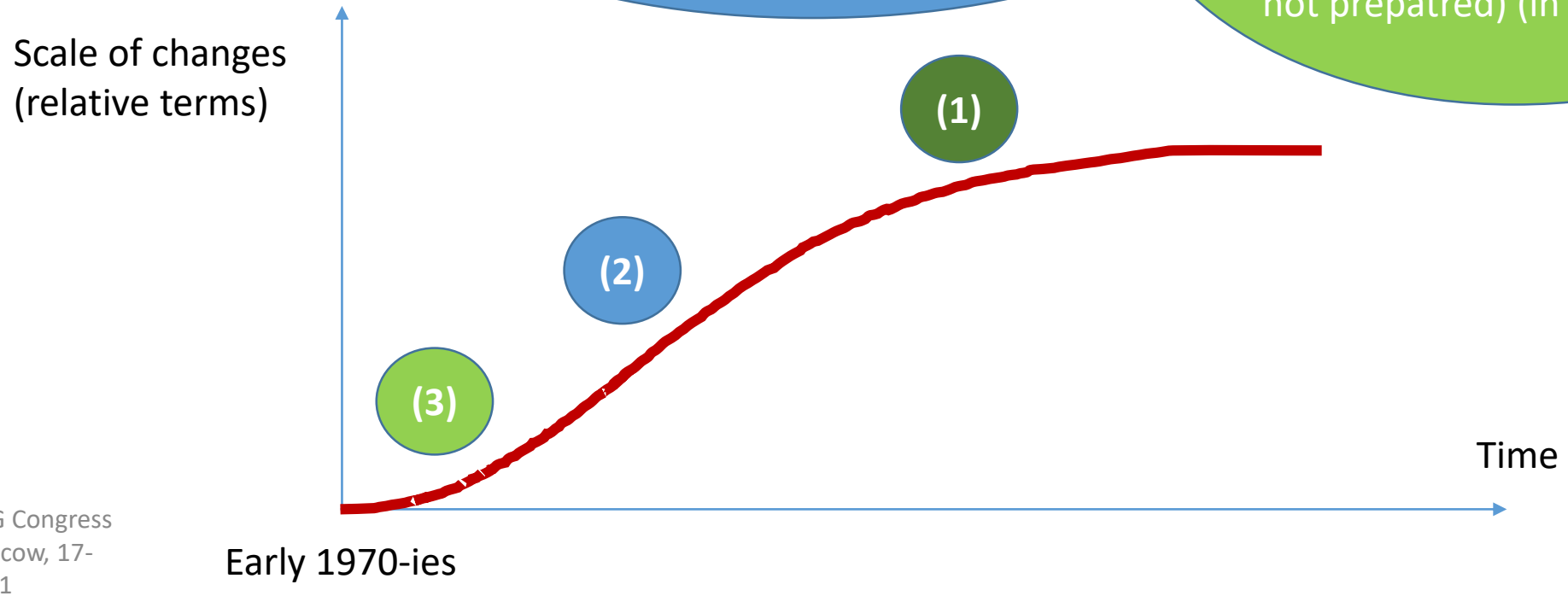


Three global gas revolutions – today at different stages of corresponding waves

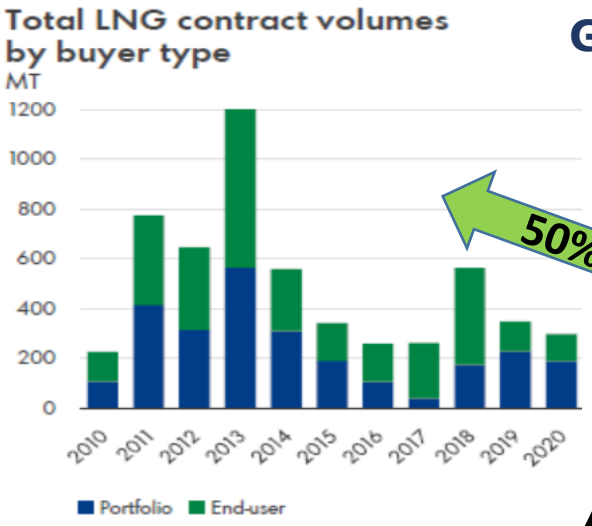
(1) US “Shale Revolution” & its global “domino effects”: accomplished, we are facing its multi-facet consequences & fading direct effect (wave on the peak)

(2) Global “LNG Revolution” and its global “domino effects” – in the making & accelerated development, not all consequences have shown up yet (wave on the lift)

(3) Global “Green Revolution” – ongoing, its global domino effects yet to be seen but can be predicted (technologically in the search, not yet commercialized, regulatory is not prepatred) (in the infancy)



Global LNG market: evolution of contractual structures => increased flexibility, diminishing contractual duration



50%

30%

Portfolio or trader buyer (FOB)

Spot contracts

Portfolio or trader buyer

5

Utility buyer

Portfolio or trader buyer (FOB)

Short-term portfolio contracts

Portfolio or trader buyer

4

Utility buyer

Portfolio buyer (FOB)

Long or Medium term Portfolio contracts

3

Utility buyer

Off-taker FOB

Destination free long- or medium-term contracts

2

Destination specific long- or medium-term contracts

1

Utility buyer CIF/DES

For domestic consumers (wholesale & retail markets)

For re-export to third countries

Regasification & supply to GTS (wholesale market)

Regaz

Regaz LNG terminal

Onshore (fixed)

Offshore (floating/FSRU)

LNG

Reloading to:

lsLNG (ships)

ssLNG (ships)

ssLNG (trucks / railroad tanks)

Re-export to third countries

To domestic (retail) market

Gas from individual separately developed field

LNG plant

Onshore (fixed)

Offshore (floating)

Gas purchased from GTS – in case of MTPA (i.e. US Henry Hub)

Supplies from GTS

Supplies from GTS owned by producer – in case of no MTPA (i.e. Gazprom)

Evolution of contractual structures at LNG market

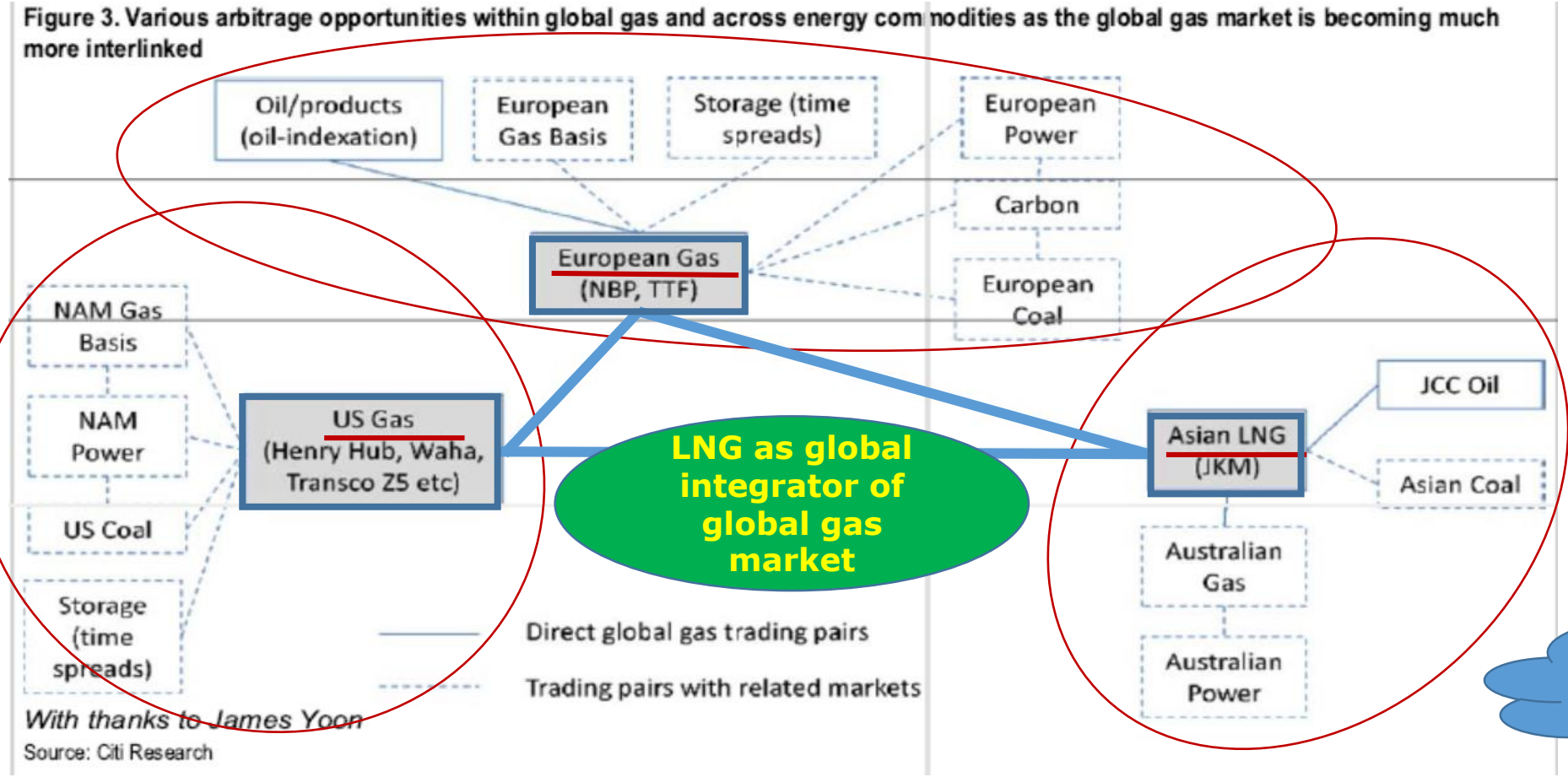
LNG in global gas trade: 2020=40%, 2040=60%; increase in LNG export 2016-2019 = +28%

lsLNG = large-scale LNG; ssLNG = small-scale LNG

Source: compiled by the author based on adapted version of the chart (positions 1-5) from: H.Rogers. Does the Portfolio Business Model Spell the End of Long-Term Oil-Indexed LNG Contracts? // OIES, Energy Insight: 10, April 2017, 21 pp.

Expanding opportunities for arbitrage operations within global gas market in formation – and between energy markets

Source of diagramme: Ed Morse. Global Gas: War and Peace - Russia's stance on a Gas-OPEC & market share war to dictate global gas' future, other energy. // Citi, 18.11.2019
(*) Managing Director, The Gas Value Chain Company GmbH, Germany (former RWE)

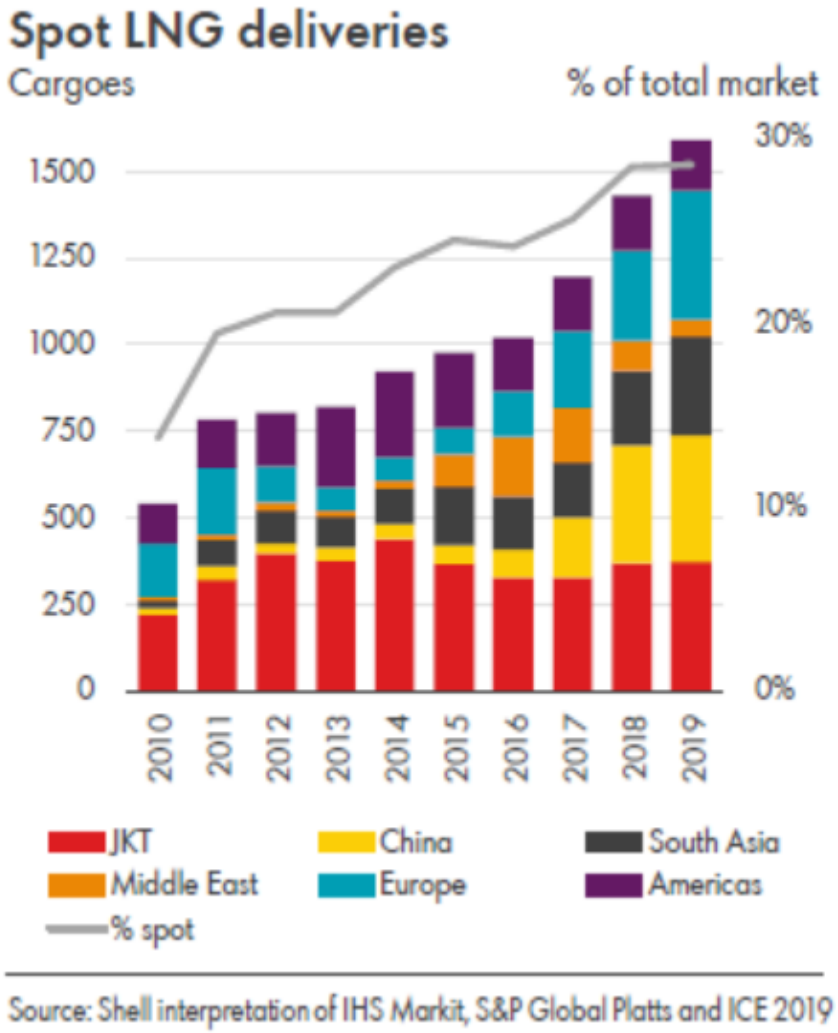


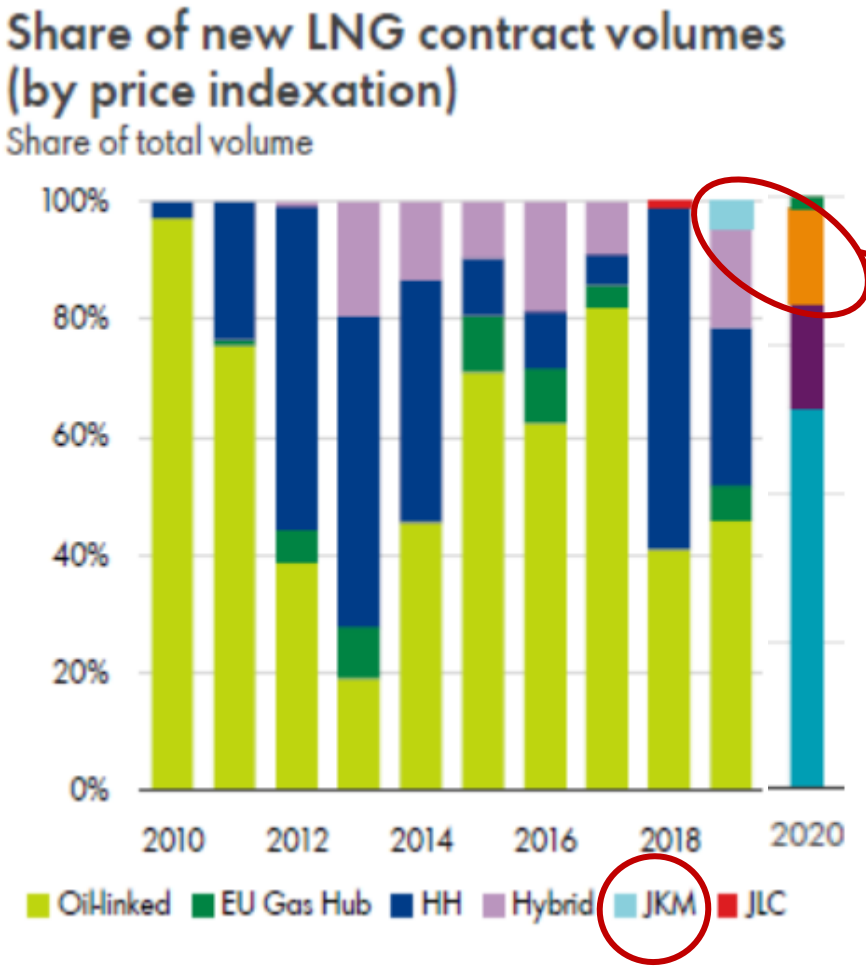
LNG links together regional (mostly pipeline) gas markets into global integrated (pipeline + LNG) gas supply system; thus LNG forms global integrated energy market & global energy supply system

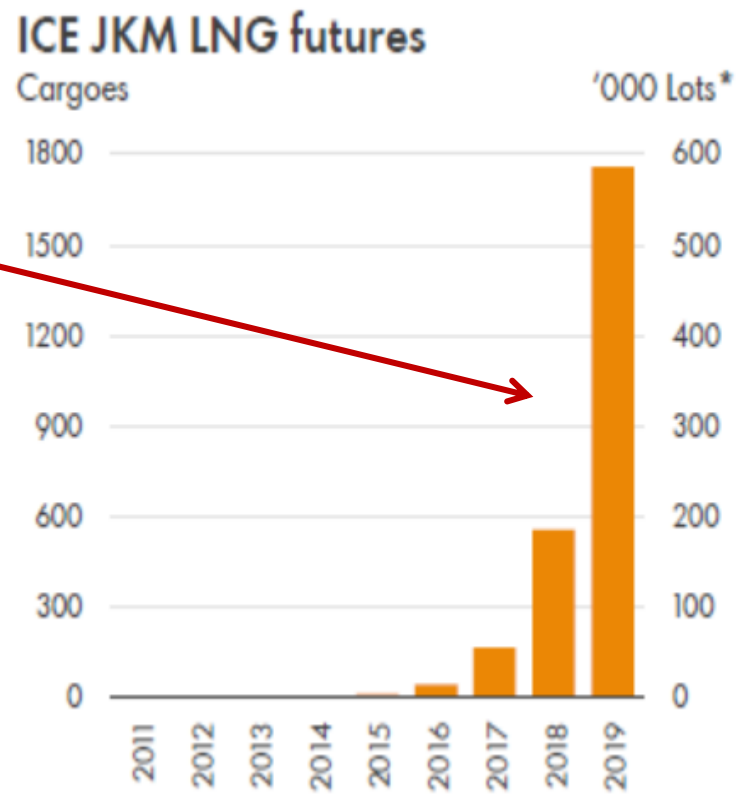
From price differences – to price differentials (spreads)
(Dr. Wolfgang Peters)

In the past "gas regions" (mostly of pipeline gas) were isolated from each other. Gas prices in one region did not influence gas prices in another one. Today these price differences are qualified as "spreads". This is a trade term, not statistical term. Price differences can be qualified as price differentials ("spreads") if one can earn on buying-and-selling at different markets (arbitrage operations). This is possible within free flow of goods based on availability of diversified infrastructure. This is what happened at global LNG market when US LNG has entered it in 2016 with new contractual model: FOB-based pricing & open supply destinations for off-takers - different from traditional CIF/DES pricing model. This paved the way to portfolio LNG trade.

Global LNG market is at the stage of development similar to that of the global oil market as of the 1980-ies: it enters commoditization phase



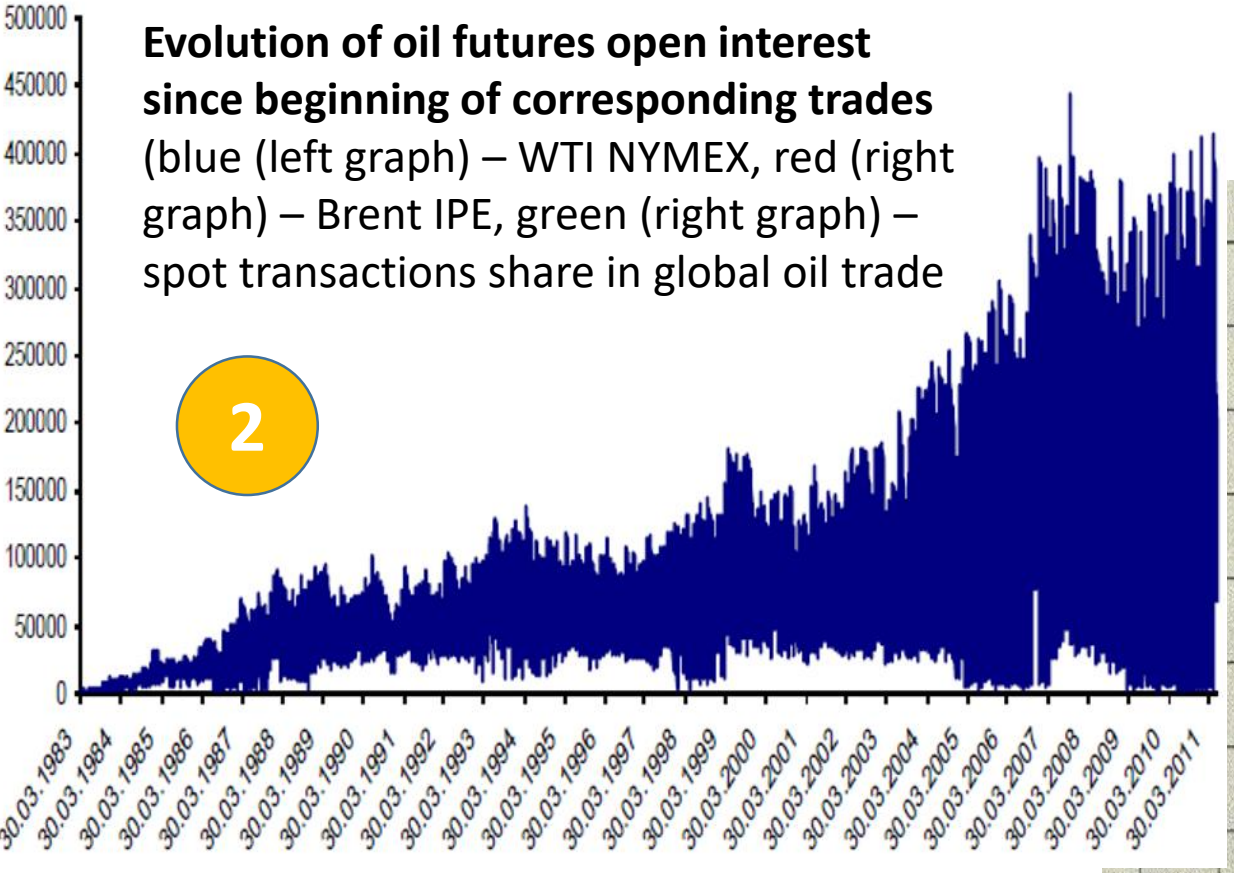


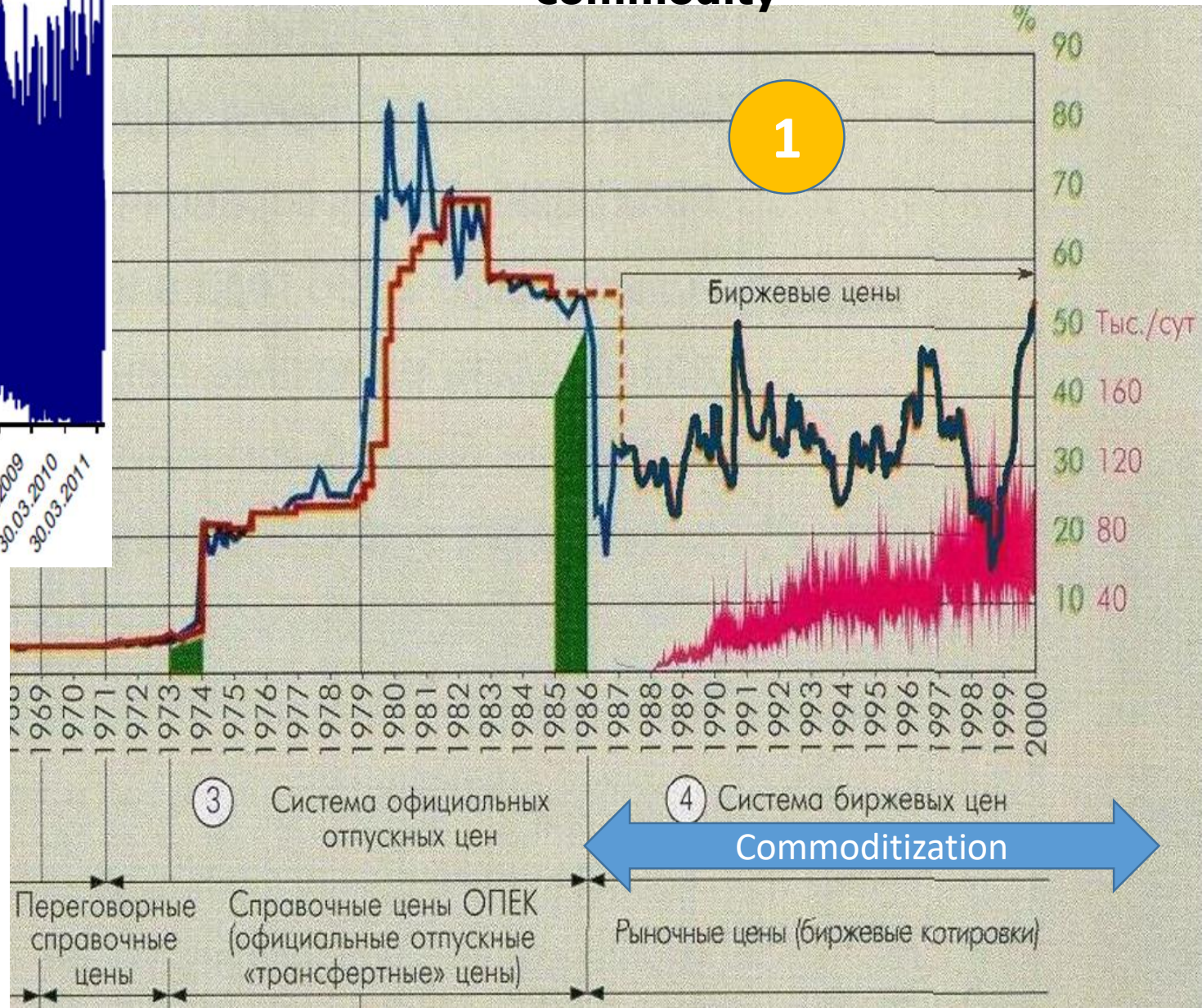


Source: Shell LNG Outlooks 2020-2021

Global oil market: beginning of commoditization phase (1980-ies) – oil is converted from just physical good into a commodity

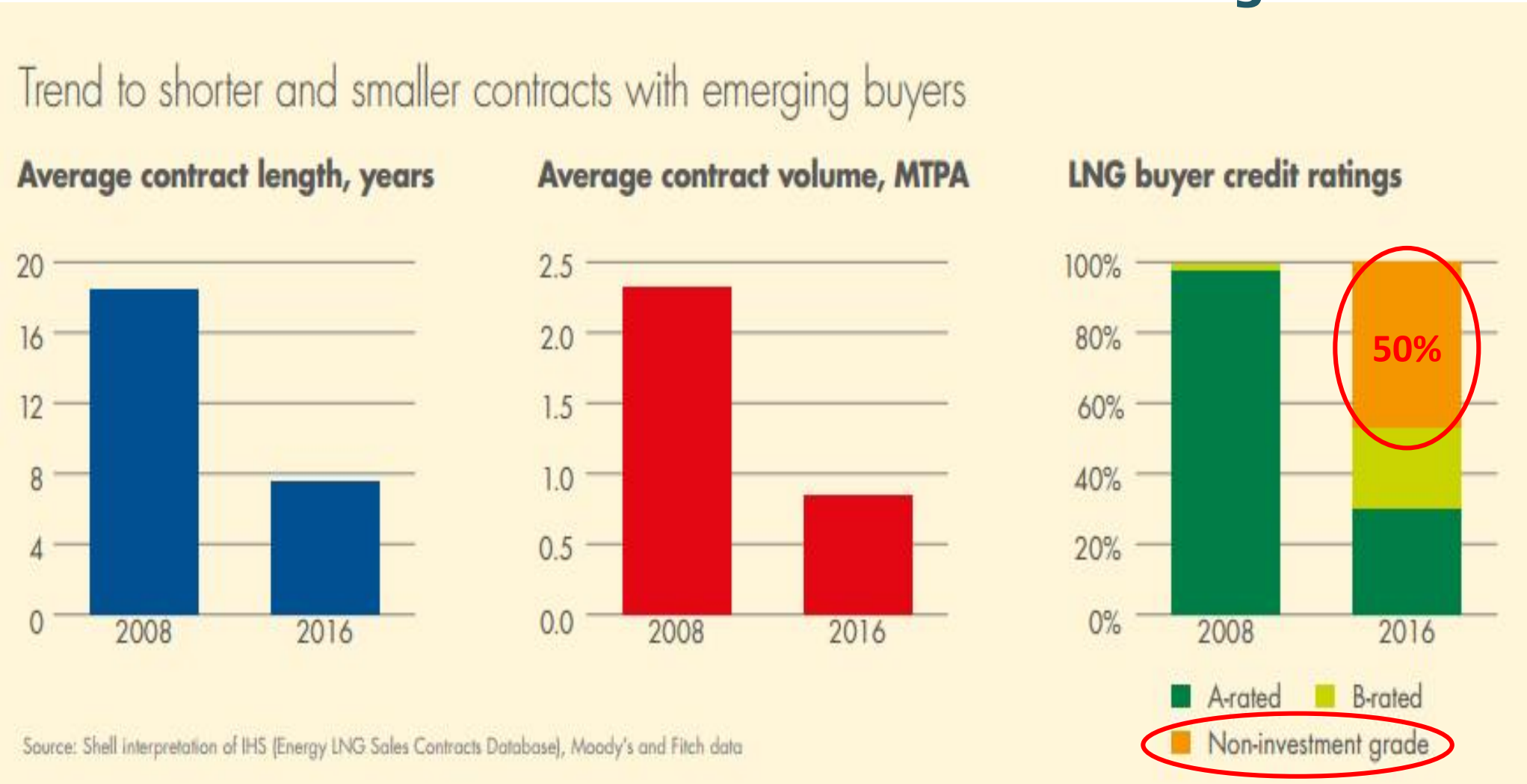
Evolution of oil futures open interest since beginning of corresponding trades (blue (left graph) – WTI NYMEX, red (right graph) – Brent IPE, green (right graph) – spot transactions share in global oil trade





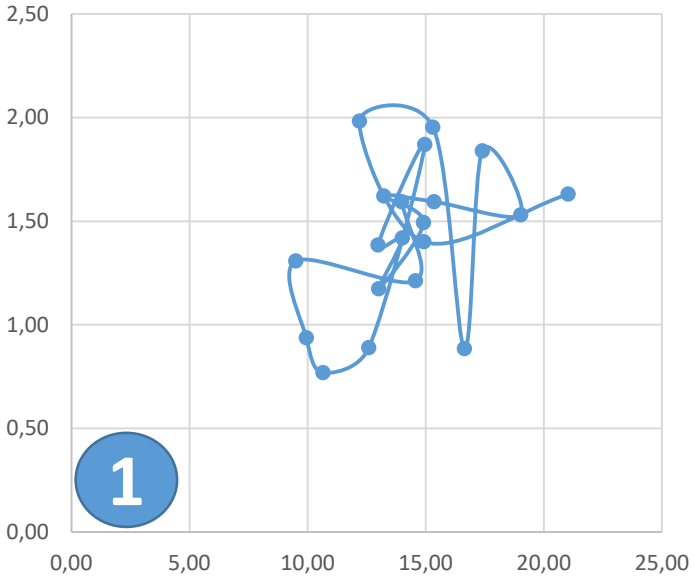
Source: (1) Compiled by M.Belova & E.Melnikova, students of State Academy of management, 2001 (right graph);
(2) Ya.Mirkin. Financial mechanism of oil price formation. // Presentation at the seminar “Oil & Gas Dialogue”, IMEMO RAS, 22.06.2011 (left graph)

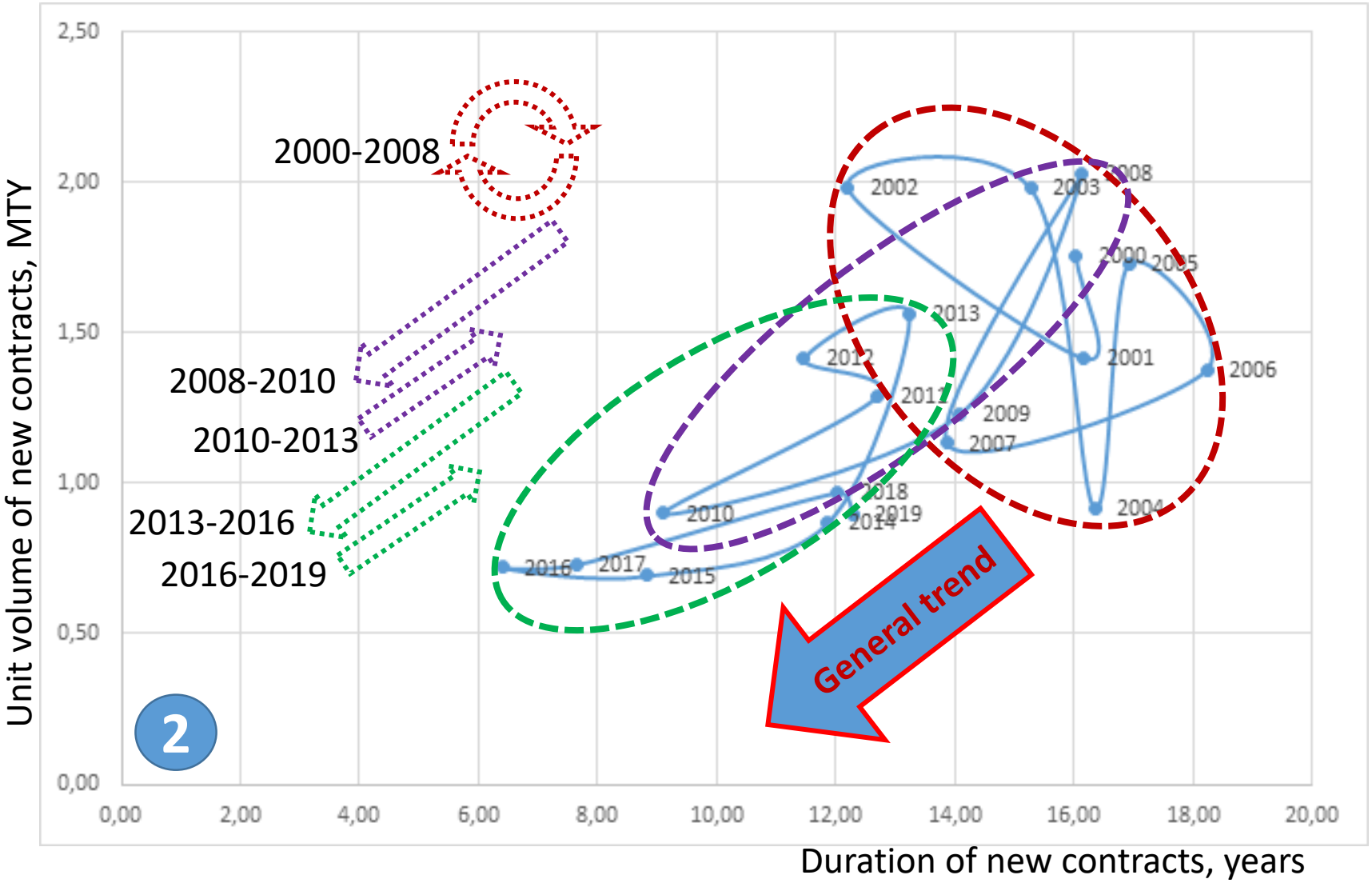
Evolution of LNG market provides flexibility of supplies by the cost of increasing risks, incl. in result of entering the market by the new entrants with low credit ratings



Source: http://www.shell.com/energy-and-innovation/natural-gas/liquefied-natural-gas-lng/lng-outlook/_jcr_content/par/textimage_1374226056.stream/1488553857051/a705af89455bb6e099374be9bef73e24dea0dc130e468cdd5c23e7f4a7c7344f/shell-lng-outlook-2017-infographic.pdf

General diminishment trend in duration and unit volume of new LNG contracts – "pendulum effect" reaction to market changes





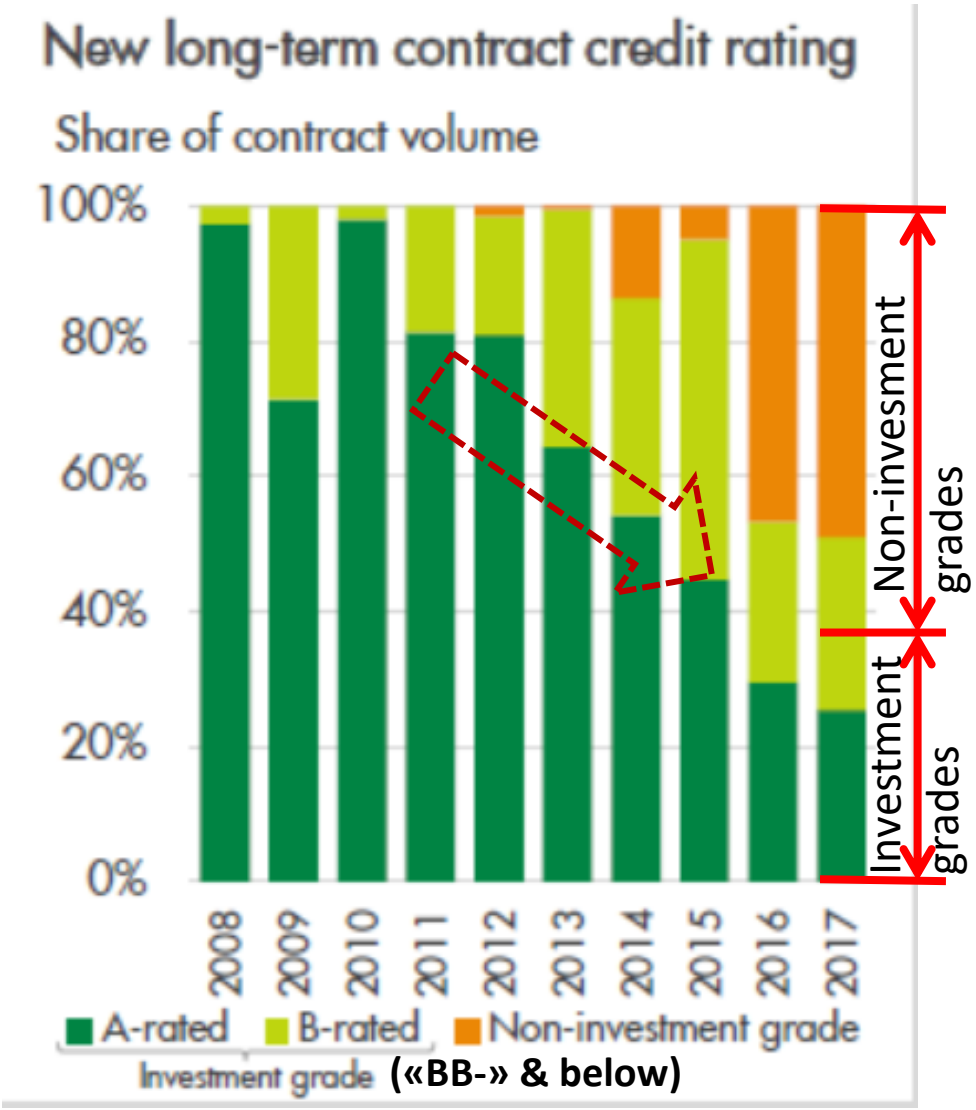
Legend:

(1) All contracts

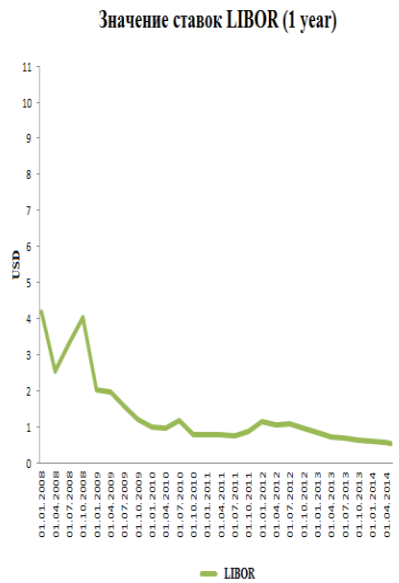
(2) All contracts less cancelled and non-binding, also excluding mega-projects since they are investment-based (long-term to pay-back investment/debt capital) and thus have different commercial logic compared to trade-based contracts (PSA)

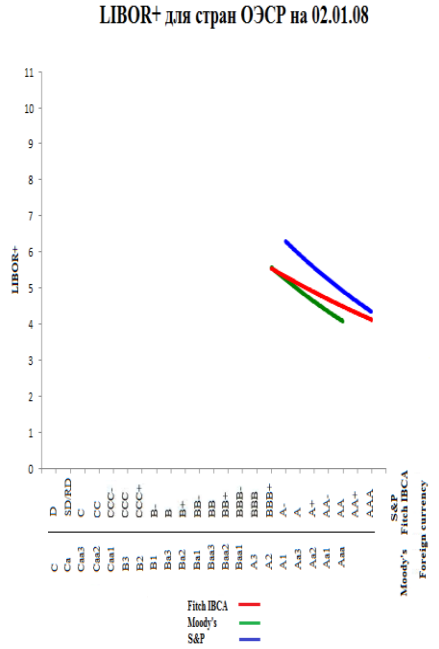
Calculated by Andrej Haug (Gazprom export/post-graduate Gubkin University) based on IHS Markit database; based on 948 contracts through 2008-2019

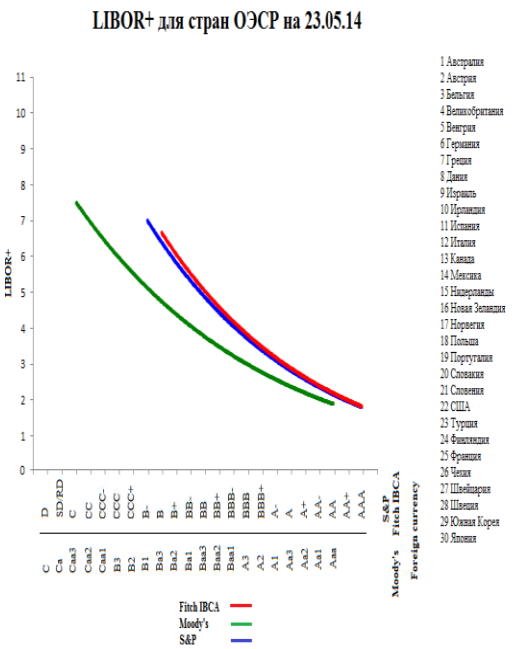
Financial consequences of the current stage of development of LNG market



Source: Shell LNG Outlook 2018







Calculations made by M.Larionova, Master student 2013-2015, Chair 'International Oil & Gas Business", Russian Gubkin State Oil & Gas University, on the data from rating agencies.

Diminishment of unit volumes & durations of contracts eases entry to LNG market of new participants (consumer states & their companies) with worsening credit ratings. This increases risks & financial costs (of raising debt capital => LIBOR-plus) of LNG market development. Demand for hedging instruments: (1) expansion of FSRU/FLNG, (2) accelerated transition to financialization of LNG market development (paper LNG market based on standard contract), and (3) increasing role of (reverse to) LTC.

THE FSRU MARKET: 2020 AND BEYOND

CURRENT & FORECASTED PROJECTS 2008 – 2020

Country	Terminal Name	Start-Up Year	Nameplate Receiving Capacity (MTPA)
1. United States	Northeast Gateway	2008	4.5
2. Argentina	GNL Escobar - Excelerate Exemplar	2011	3.8
3. Indonesia	Nusantara Regas Satu - FSRU Jawa Barat	2012	3.8
4. Israel	Hadera Deepwater LNG - Excelerate Expedient	2013	3
5. Italy	Toscana - Toscana FSRU	2013	2.7
6. Indonesia	Lampung LNG - PGN FSRU Lampung	2014	1.8
7. Lithuania	Klaipeda LNG - Hoegh Independence	2014	3
8. Brazil	Bahia LNG - Golar Winter	2014	3.8
9. Kuwait	Mina Al Ahmadi - Golar Igloo	2014	5.8
10. Jordan	Aqaba LNG - Golar Eskimo	2015	3.8
11. UAE	Dubai Jebel Ali - Excelerate Explorer	2015	6
12. Pakistan	Port Qasim Karachi - Excelerate Exquisite	2015	3.8
13. Brazil	Pecem LNG - Excelerate Experience	2016	3.9
14. Indonesia	Benoa LNG	2016	0.3
15. Colombia	SPEC FSRU - Hoegh Grace	2017	3
16. Egypt	Sumed - BW Singapore	2017	5.7
17. Pakistan	Port Qasim GasPort - BW Integrity	2017	5.7
18. China	Tianjin FSRU - Hoegh Esperanza	2018	6
19. Bangladesh	Moheshkhali - Excelerate Excellence	2018	3.75
20. Turkey	Dortyol LNG terminal	2018	5.4
21. Bangladesh	Moheshkhali - Excelerate Excelerate	2019	3.8
22. Jamaica	New Fortress LNG - Golar Freeze	2019	3.6
23. Russia	Kaliningrad FSRU	2019	2.7

Country	Terminal Name	Start-Up Year	Nameplate Receiving Capacity (MTPA)
24. Turkey	Etki LNG terminal - Turquoise	2019	7.5
25. India	H-Gas LNG Gateway (Jaigarh) - Hoegh Cape Ann	2020	4
26. Brazil	Sergipe LNG Terminal	2020	3.6
27. India	Jafrabad FSRU	2020	5
28. Brazil	Acu Port LNG	2021	5.6
29. Croatia	Krk LNG terminal	2021	1.9
30. Indonesia	Cilamaya - Jawa 1 FSRU	2021	2.4
31. El Salvador	El Salvador FSRU	2021	0.5
32. Cyprus	Cyprus FSRU	2022	0.6

World FSRU projects at the beginning of the 2020-ies

Source: THE FSRU MARKET: 2020 AND BEYOND. IQPC Ltd, UK (https://plsadaptive.s3.amazonaws.com/eco/files/event_content/fsru-2020-speaker-interview-)

Thank you for your attention!

www.konoplyanik.ru
andrey@konoplyanik.ru
a.konoplyanik@gazpromexport.com

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