A view on evolution of Russia's gas export strategy within changing global economic and gas landscape

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Presentation at the "*GECF Monthly Gas Lectures*" series,
Gas Exporting Countries Forum (GECF), Qatar, Doha, 15 October 2018

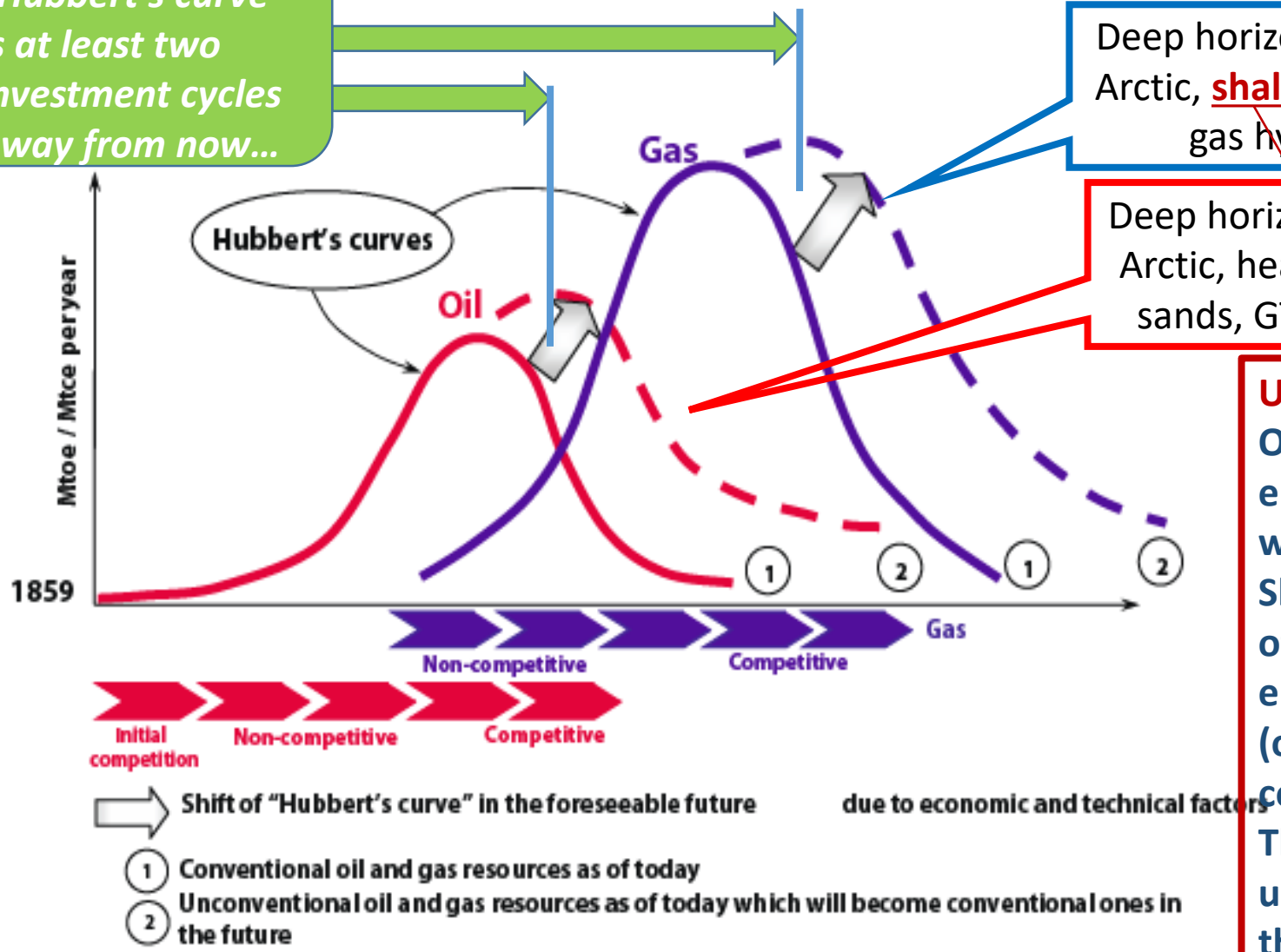
Table of contents

Current Paradigm of International Energy Development: Hubbert, Hotelling, Chevalier (three pillars acc. to this author)

- Possible, though in a rather distant future (at least post 2 global invest cycles), if any at all, supply side limitations due to dominant non-renewable character of energy resource base =>
  - "**Hubbert**'s curve" (1949) => bell-type production curve for non-renewable resource extraction => predicted US oil production peak 1970 =>
    - "peak oil" theory ("*geologists*" vs "*economists*"),
    - first (alarmist) report to the "Club of Rome" (1972) =>
    - respond of Sh. A.Z.Yamani "Stone age came to an end not because end of stones…"
  - "**Hotelling** rule" (1931) => the future value of fossil fuel in-situ increases by the value of the current interest rate within the time-frame => back-stop technologies
    - from "cost-plus" pricing (*lower investment price*) to "net-back replacement value" pricing (*upper investment price*),
  - **BUT** both theories:
    - did not consider possible demand-side limitations (f.i. due to environmental considerations) => work for increasing future cost & value of in-situ non-renewable energy resource within time-frame, at least (Chevalier, 1972) during post-"**Chevalier**'s breaking point" period (since early 1970-ies)

Economic interpretation of "Hubbert's curves" (acc. to Konoplyanik)

Potential peak of "Hubbert's curve" is at least two investment cycles away from now…



Deep horizons, deep offshore, Arctic, **shale gas**, CBM, biogas, gas hydrates, etc. ...

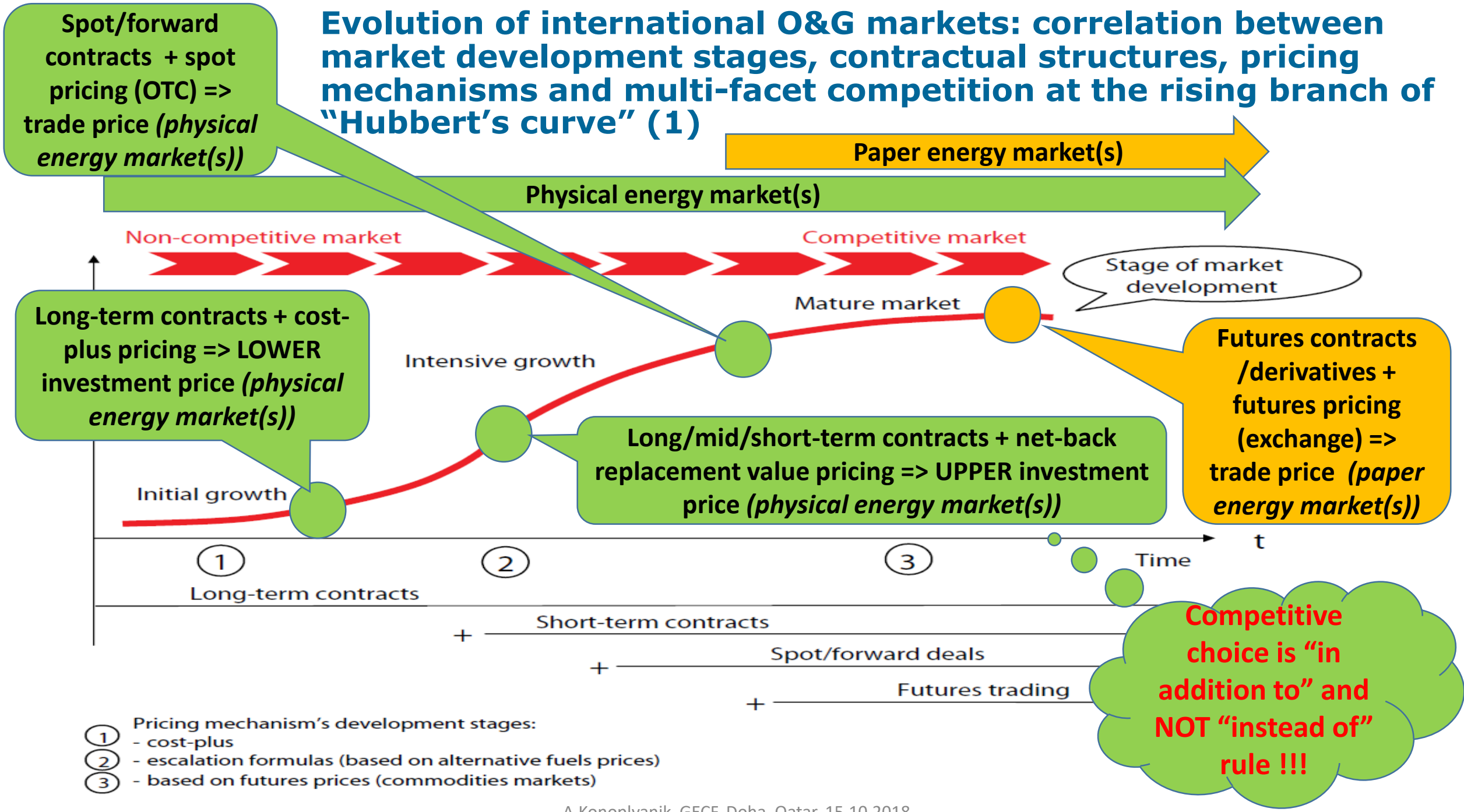
Deep horizons, deep offshore, Arctic, heavy oil, **shale oil**, tar sands, GTL, CTL, BTL, etc. …

NOT in the sub-soil (in place) or at the well-head (primary energy), **BUT** at the burner-tip (in end-use)!

US shale gas (& oil) revolution converted shale O&G from "non-conventional" to "conventional" energy resources since made them competitive with incumbent conventional energies. =>
Shale O&G have moved to the area below (inside of) "Hubbert's curves" – the area of conventional energies (in economic sense) from the area above (outside of) "Hubbert's curves" – the area of non-conventional energies. =>
This moves O&G peaks of "Hubbert's curves" upside-right & prolongs "hydrocarbon's era" for the mankind. =>
This means *(acc. to Konoplyanik)*, we are living within left rising branch(es) of energy markets development' "Hubbert's curve(s)"

Primary source (basic figure (*)): A.Konoplyanik. Energy Security and the Development of International Energy Markets (pp. 47-84), p.49. – in: *Energy security: Managing Risk in a Dynamic Legal and Regulatory Environment.* /Ed. by B.Barton, C.Redgwell, A.Ronne, D.N.Zillman. – International Bar Association / Oxford University Press, 2004, 490p.
(*) later reproduced in "Putting a Price on Energy…" (ECS, 2007, p.53), where this particular basic picture is taken from

Evolution of international O&G markets: correlation between market development stages, contractual structures, pricing mechanisms and multi-facet competition at the rising branch of "Hubbert's curve" (1)



Mechanism of defining "replacement fuel/price" ("upper investment price") under lack of (limitation of) & excessive energy supplies

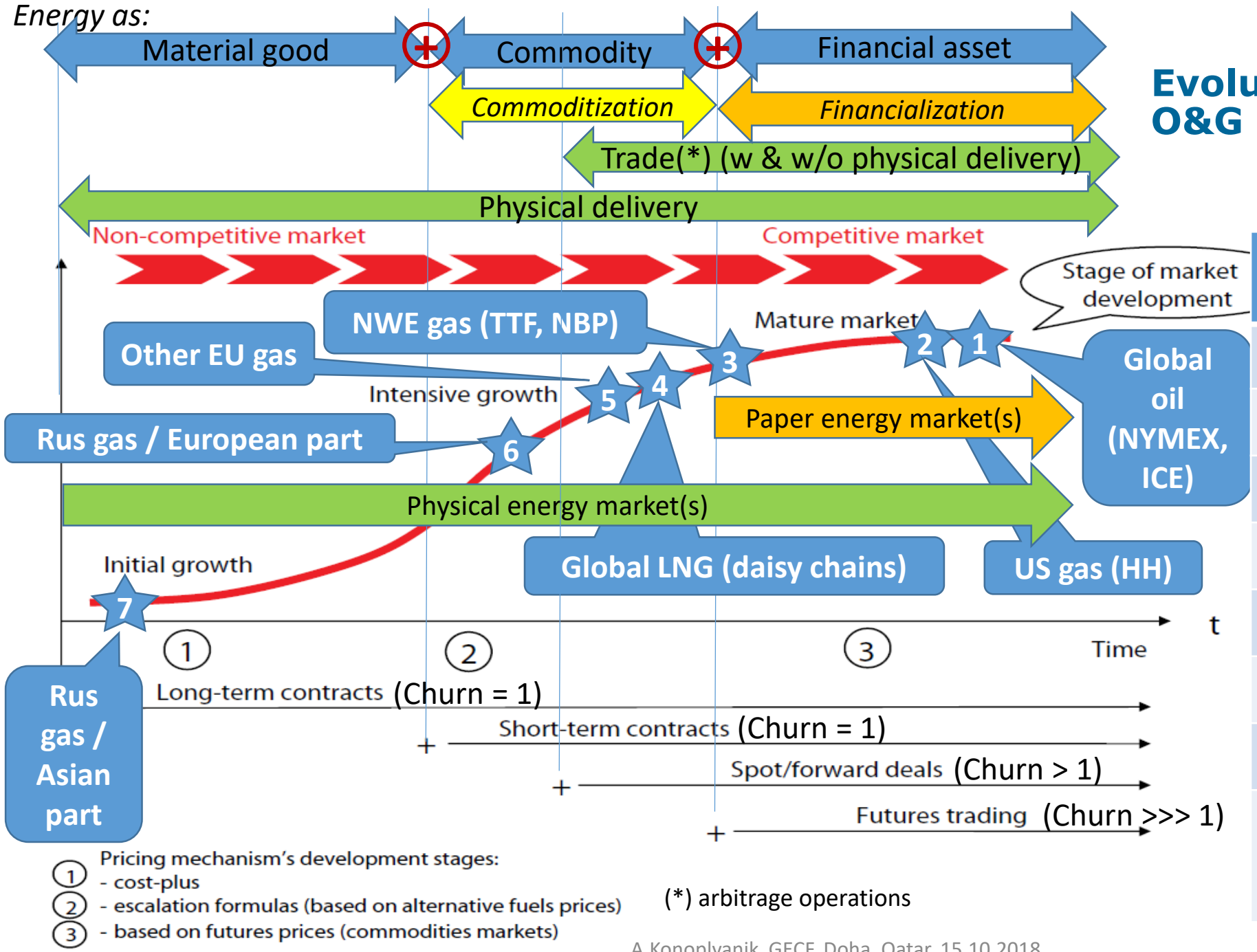
Perception of "peak supply"

- Energy demand **outruns** supply for given energy => **UNDER-supply** of given energy
- Replacement value (*upper investment price*) defined within **INTER-fuel competition** of given energy with **other** energies (with suppliers of **other** energies) (Ricardian + Hotelling rent)
- Indexation "given energy vs **other energy**":
  - RFO vs coal (WE, 1950/60-ies),
  - gas vs petroleum products (Europe, since 1962),
  - LNG vs crude oil (Asia Pacific since end-1960-ies)

Perception of "peak demand"

- Energy demand **lags behind** supply of given energy => **OVER-supply** of given energy
- Replacement value (*upper investment price*) defined within **INTRA-fuel competition** – between different suppliers of **given** energy (back to Ricardian rent) =>
  - importance of HHI, etc. measurements of market concentration / possibilities for price manipulation
- Indexation "given energy vs **same energy from other / different suppliers**" =>
  - oil, gas indexes (hubs / marketplaces)

Evolution of international O&G markets: … (2)



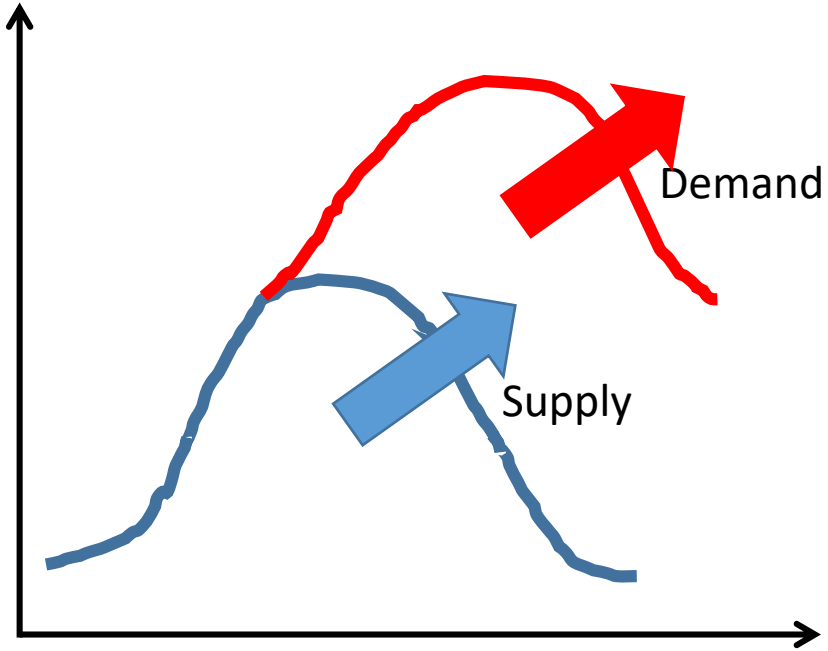
Energy markets vs churn rates

Energy, marketplace	Churn (appr.)
Global oil (NYMEX, ICE)	2000
US Gas (Henry Hub)	300-400
NWE gas (TTF)	25-45
NWE gas (NBP)	10-15
Other EU gas	3-5 & less
EU GTM benchmark	8
Vision EU gas business	15
Global large-scale LNG (OTC/daisy chains)	(single digits?)

World Energy: The Change of Paradigm?

Supply	Demand
- Hubbert peak (curve) - Hotelling rent (theorem) - Chevalier turning point - STP (resource rent, economy of scale) - International law (access to resources)	- Economic growth (industrial-type, supply centralization & concentration) - Population growth

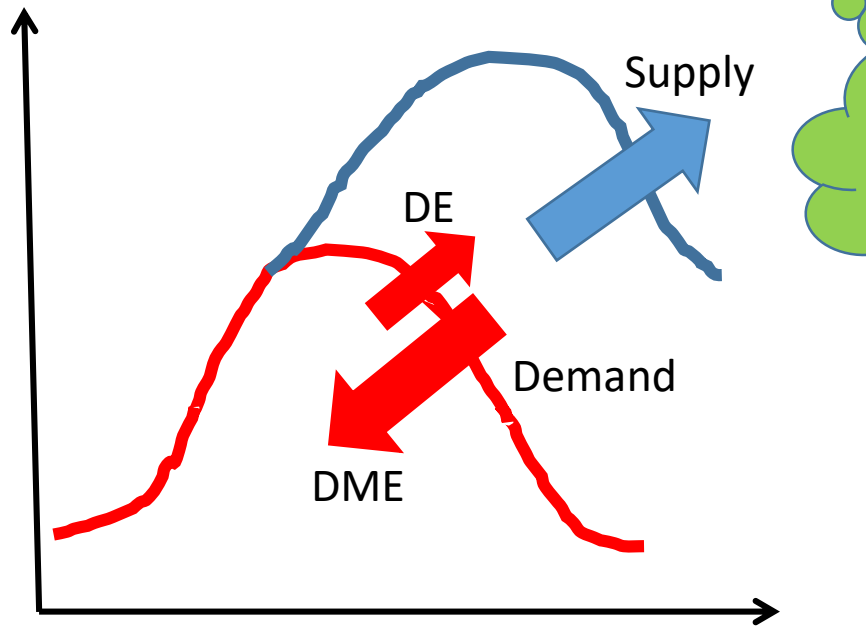
Future energy supplies (NRES) more costly & limited (depletion rent) => **low-cost NRES wins more rent, development of high-cost NRES delayed**



Past/current: "peak supply"?

Supply	Demand
- STP (technological rent, e.g. US shale revolution => Hotelling *anti*-theorem	- Four steps in departure from oil - Energy efficiency (delinking energy demand & economic growth, post-industrial-type) - COP-21 (upper limit/emissions) - New type of economic growth in poor(est) DE (non-industrial, decentralized) & in DME (post-industrial)

Future energy supply less costly & plentiful (partly due to demand limitation?) => competition among energy suppliers increases => **low-cost NRES wins & takes all market, high-cost NRES cut-off**



From Current to Future: "peak demand"?

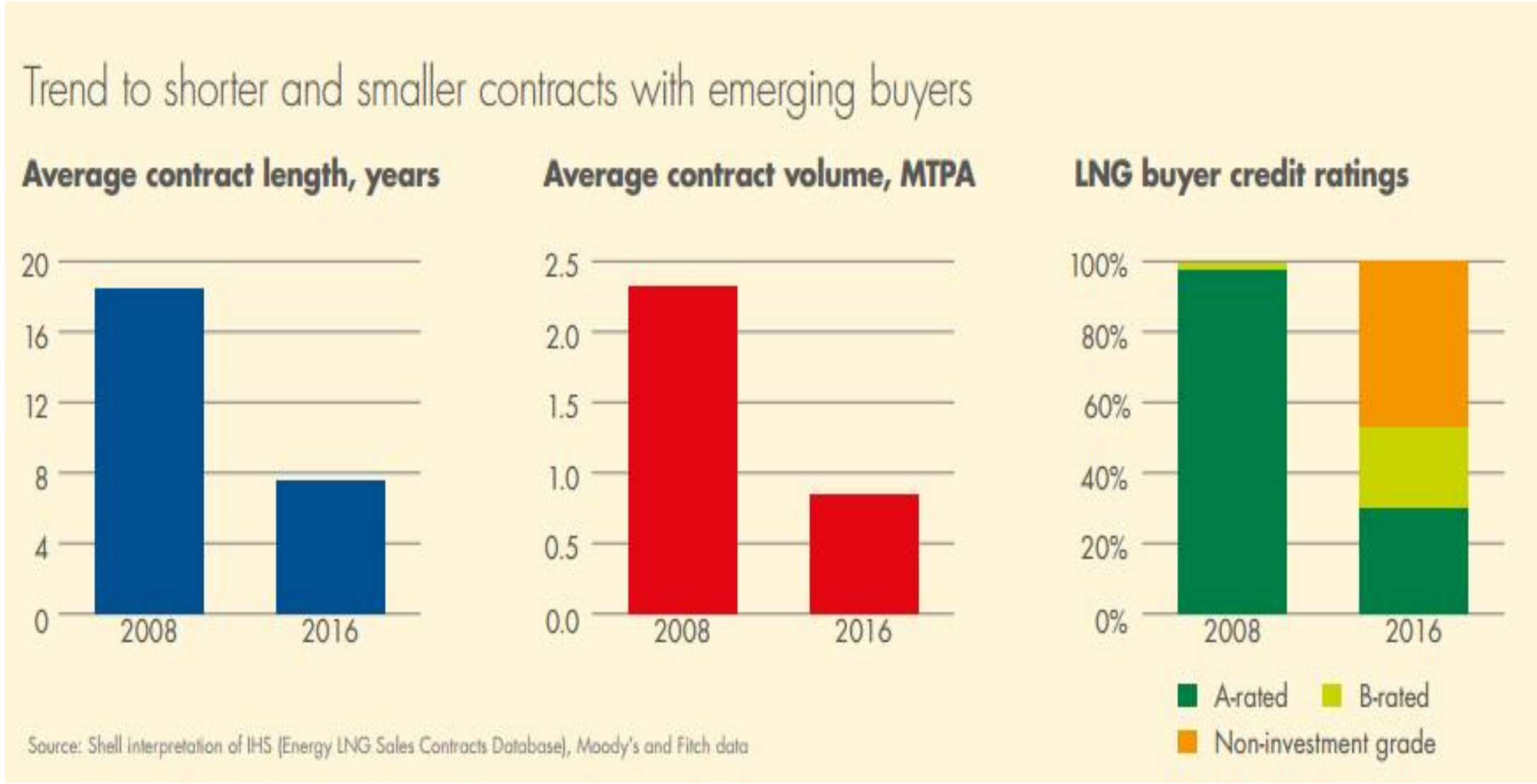
Competition at international gas markets tightens

DE – developing economies,
DME – developed market economies,
STP – scientific & technical progress
COP-21 – Paris climate agreement 2015 ("Conference of Parties")
NRES – non-renewable energy sources

Table of contents

Global Gas Markets of the Future: role of LNG

- Global gas market**s** (plural) ***OR*** global gas market (singular)?
  - From regional (mostly pipeline-based) gas markets to global gas (pipeline + LNG) market(s) => LNG as market(s) integrator
    - LNG as "*second* gas revolution" (IEA) => brings revolutionary changes + "domino effects" as with "*first* gas (US shale gas) revolution"
- Changing institutional structure of **globalized (global?) LNG market**
  - From historical base-load LNG demand (Japan, Korea, Taiwan – "energy islands") to increasingly flexible demand:
    - semi-peaks of load curves (competitive demand),
    - supply diversity (SoS)
  - From investment stability to trade flexibility => from large-scale projects ("economy of scale") with LTC (investment tool) with NBRV pricing (oil indexation) & fixed destination (initial stage LNG development) to:
    - delivery flexibility (from DES/CIF to FOB contracts) & portfolio purchases (VICs with assets in both upstream & downstream),
    - "smaller-scale economy" which opens new business areas:
      - Upstream: cost-cutting technical progress => from "economy of scale"(as instrument of resource rent extraction) to technological rent extraction => i.e. floating LNG (FSRU/FSLU) => respond to lower credit ratings of new LNG market entrants => spin-off effect for LNG market growth
      - Downstream/end-use: small–scale LNG => new business areas opened for gas (i.e. mobility - road transport, bunkering; decentralized gas supplies - gasification/households)
    - multiple LNG pricing => what future of LNG pricing models? =>



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

Gas pricing options

- Gas industry has imported NBRV pricing model (Hotelling rent) from oil industry:
  - Oil: indexation to coal (Europe, 1950-ies)
  - Gas: indexation to petroleum products (Netherlands, 1962) & to crude (Japan, 1969)
- From NBRV under excessive demand (undersupply) = “oil indexed” pricing:
  - crude-indexation (Asia Pacific)
  - petroleum-products indexation (EU)
  - both oil-indexation (Asia Pacific) & PP-indexation (EU) do co-exist now, though with diminished role in gas trade (IGU), & would exist in future LTC
- … to “gas-to-gas” competition under excessive supply (oversupply) = “gas indexed” pricing (back to Ricardian rent):
  - Henry Hub (USA)
  - EU hubs (TTF, NBP)
  - Asia-Pacific: emerging hub(s) yet to be developed in JKM => Tokyo? Shanghai? Singapore?
- Today’s dual gas pricing beyond USA:
  - Asia-Pacific: oil-indexed (JCC-based) vs Henry-Hub-based (cost/spot plus) LNG pricing
  - EU: PP-indexed (Russian LTC mostly adjusted to TTF) vs EU hubs (TTF/NBP)
- Multiple pricing models to coexist in different markets

LNG making Gas a global commodity

- Current global LNG similarity to oil market development in 1980-ies:
  - Diminishment of (i) contract duration, (ii) unit contract volumes, (iii) company size for entering LNG market, & (iv) thus their credit ratings => has increased LNG market volatility & risks => demand for hedging risks => stipulate development of "paper" (financial segment of) LNG market from ***hedger's-side*** (producers/consumers)
  - Due to LNG, regional gas price *differences* become "spreads" (W.Peters/f.RWE) (*differentials*) => price arbitrage deals as driver of trades (making LNG as global commodity) => appetite to risk stipulate development of "paper" (financial segment of) LNG market from ***speculator's-side*** (traders)
- BUT: at which stage of development LNG paper market is now?
  - "LNG trading business now in its infancy", "spot in LNG is in its early stages" (CEC, Sept.2017)
  - Technical difficulties with back up storage capacities: evaporation; discrete cargoes
  - No standard LNG contract yet – prerequisite for financial trades => though two LNG model contract templates exist:
    - GIIGNL (FOB & DES) template contract – more European slanted
    - AIPN template contract – more American slanted
- Changing institutional structure of **consolidated global gas market**: whether it will be *same as OR different from* **global oil market** in its institutional structure (Contracts? Pricing? Balancing? Grid or point-to-point system? **Regulation?** Etc.)

Global LNG market regulation: prospects for GECF?

- Register spot market (basis for standardized contract) once global spot LNG trading sufficiently established:
  - Experience of Rotterdam spot oil market development: ***GECF in global LNG possible role (?) like EU Commission's role in Rotterdam oil market development in 1979***
    - First two stages (1960-ies, 1973-1978) were business driven => 1979 Tokyo Summit of 6 major oil importers tried to moderate Rotterdam market activity => CEC played executive role => "check-run" (register of spot transactions for 6 months in 1978) => 1979/80 new "COMMA" register was introduced (Commission Market Analysis) "with voluntary participation of the industry to have a deeper understanding of the Rotterdam market's structure & operations" (*)
- Regulation (common playing field for international trade/WTO will not work):
  - "LNG is a global business and it is very difficult to see how it can be globally regulated. In time it could be imagined that the market could be coalesce around a standardized contract (as oil trading has) but it is difficult (at least at the moment) to envisage a single governmental or regulatory authority to cover the global LNG industry, one that the EU, USA , Australia, Russia, Qatar, Yemen and all the other national players could agree to submit to. LNG will not have a single regulatory or governmental authority driving change across the industry and enabling a market, not in the same way as a national regulator (or supra-national one like the European Commission)" (*) =>
  - ***A challenge for GECF within global LNG market?***

(*) Follow-up study to the LNG and storage strategy, DG ENERGY, Sept'2017, p.115-116, 123

Table of contents

EU import gas demand, international LNG & Russian gas

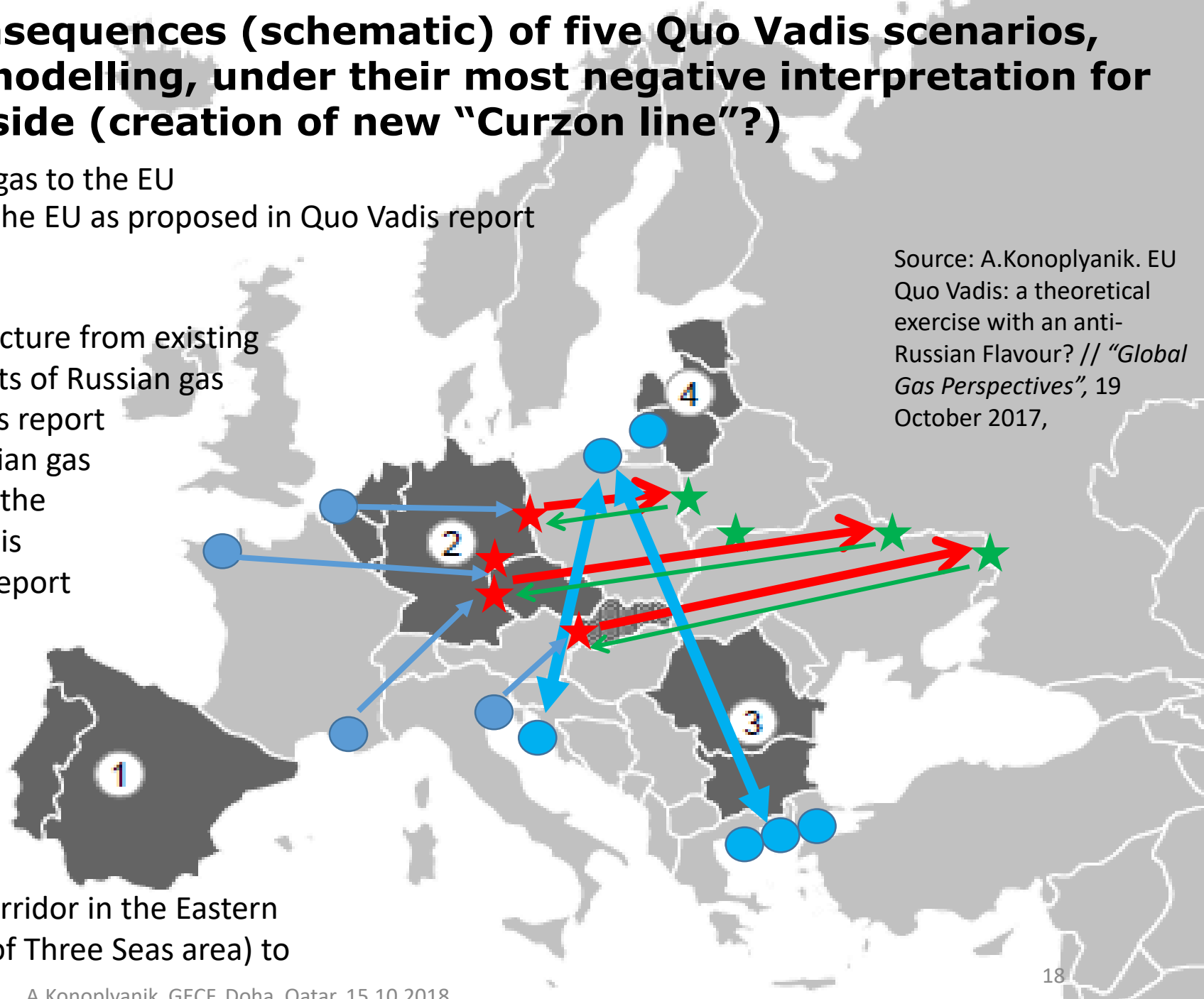
- EU mature gas market => stagnation (decline?) of gas demand, but growth of import gas demand
  - Domestic gas production decline (UK/Norway North Sea, Groningen)
  - Withdrawal coal (environment) & nuclear power stations (radiation safety/load curve - baseload)
- EU sees LNG as competitor to (Russian) pipeline gas in Europe (diversity of supplies), but large-scale LNG producers prefer other (non-EU) markets:
  - 25% utilization rate of existing EU regaz facilities means EU market is less attractive for global LNG;
  - Not enough connecting pipelines from coastal EU regaz facilities to inside EU (REKK: only about 25%)
  - Russian pipeline gas in EU has won its dominant niche at EU market (now about 34%) in global competition (in fair play) with international LNG (S.Dale/BP) since it is cheaper than (US) LNG (now a given fact evident both for experts & politicians)
    - => “positive discrimination” of Russian gas in EU?

US LNG: how to compete with Russian gas in Europe? To take off a competitor!

- US-EU Summit decision (25.07.2018) on EU purchases of US LNG:
  - EU to co-finance (under PCI) & build 9-11 new regaz LNG terminals & connecting North-South pipelines in the "Intermarium" area?
    - How to payback? Similar to RES (must-run electricity)? Must-run regasification & priority consumption?
- US Senators Murphy and Johnson introduced 10.10.2018 "the European Energy Security and Diversification Act"; it will authorize:
  - $1 billion, from fiscal year 2019 to 2023, in US financing for European energy projects (natural gas interconnectors, storage facilities, liquefied natural gas (LNG) import facilities and reverse flow capacity)
    - Most probably, tied loans (US Exim) => like post-WW2 Marshall Plan for Europe?
  - the USTDA and other agencies to support U.S. private sector investment in strategically important energy projects in Central and Eastern Europe
  - Murphy: "we can help break Putin's grip on Europe and create jobs here in the U.S."
- Artificial barriers for Russian pipe gas to EU in favour of US LNG? (2017/2018 CEC Quo Vadis project)
- Multiple US & EU economic sanctions on Russia, Russian businessmen, businesses & projects, incl. special emphasis on energy projects, incl. demonization of NS2 pipeline
- US LNG in EU diminishes EU welfare but favoures US business (expanding its market share) ((*Nothing personal. America First. Only business*.))
- "Security premium"? But under "LNG flexibility" producer or LNG off-taker decides
  - even PIGNiG has recently signed FOB, not DES, US LNG contract

Possible application consequences (schematic) of five Quo Vadis scenarios, selected for quantitative modelling, under their most negative interpretation for Russian side (creation of new "Curzon line"?)

- Existing key delivery points of Russian gas to the EU
- New delivery points of Russian gas to the EU as proposed in Quo Vadis report
- Existing LNG terminals
- New LNG terminals
- Development of new pipeline infrastructure from existing LNG terminals to existing delivery points of Russian gas within the EU as proposed in Quo Vadis report
- Shift of existing delivery points of Russian gas inside the EU to their new locations at the external border of the zone of EU acquis application as proposed in Quo Vadis report
- Transfer of existing transit business of Russian gas to existing delivery point within the EU to the mid-stream companies of the EU as proposed in Quo Vadis report
- (1) New merged regional gas market zones as proposed in Quo Vadis report
- New North-South EU gas pipeline corridor in the Eastern part of the EU (Intermarium / zone of Three Seas area) to connect new LNG regaz terminals



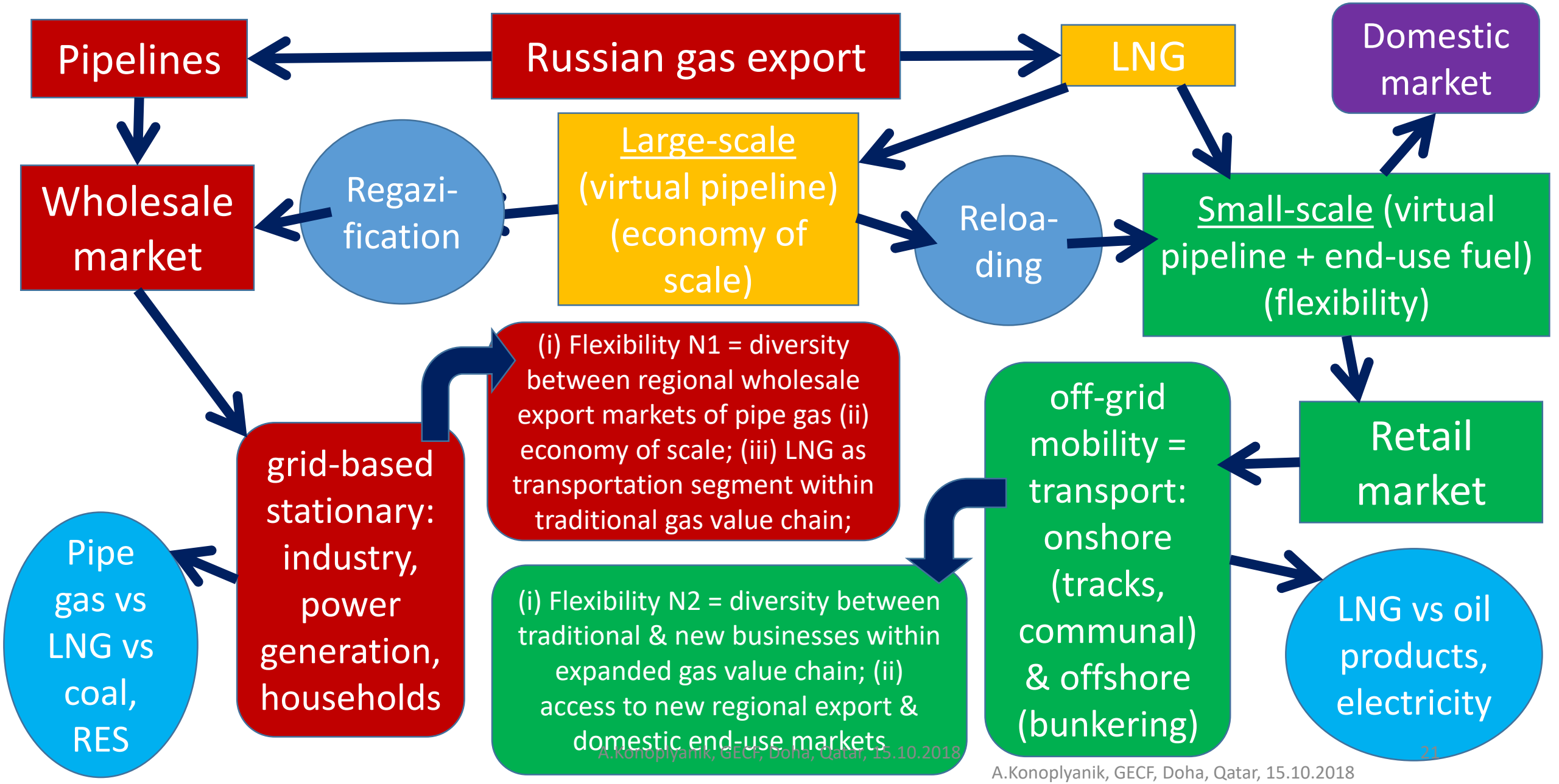
Source: A.Konoplyanik. EU Quo Vadis: a theoretical exercise with an anti-Russian Flavour? // *"Global Gas Perspectives"*, 19 October 2017,

Table of contents

Russian gas in Europe & role of gas decarbonisation

- Gas has been long victimized by climate-change-oriented consumers (first & most in EU) as being a fossil fuel (though the cleanest among them all)
  - Past: gas has been considered as “transition fuel” to decarbonized energy future (“digital, electrical, renewable” future energy world => carbon-free RES only) =>
    - EU: Green domestic electrons vs dirty foreign molecules
  - Now: whether gas is still a “transition fuel” OR it becomes a “destination fuel” ?
- EU as major promoter of steadily increased environmental targets => now CEC vision (attitude to gas) is changing:
  - from “RES-only-based” to “RES plus decarbonised gas-based” EU energy future (as a stated concept) =>
    - whether this is only a EU phenomenon or a characteristic feature of the “Future Global Gas Market(s)”
- New potential for additional gas supplies: pipeline & LTC cross-border gas supplies are immanently more appropriate for decarbonisation (from economic standpoint) than spot and/or LNG supplies
  - New potential for additional Russian gas supplies to the EU (pipeline + LTC)
    - Topical question: at which particular part of the cross-border gas value chain would be mutually beneficial to decarbonize gas: upstream, midstream or downstream; how to balance costs and rewards
    - Topic for Russia-EU inter-government cooperation in gas since decarbonisation is a cross-border issue (new key topic in the agenda of EU-Russia GAC WS2)

Russian gas export strategy development & prospective role of LNG

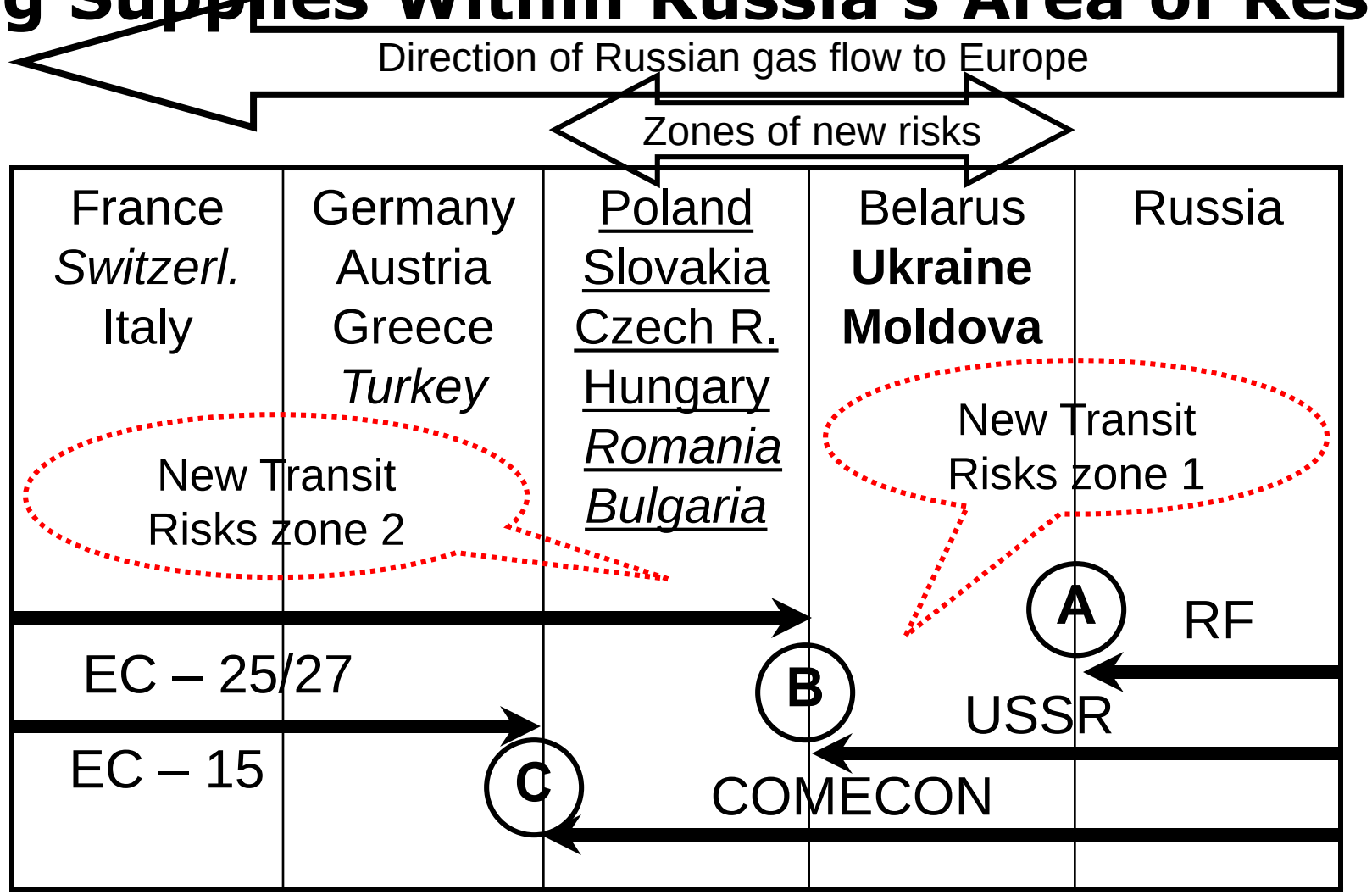


A.Konoplyanik, GECF, Doha, Qatar, 15.10.2018

Russian small-scale LNG – an additional business option

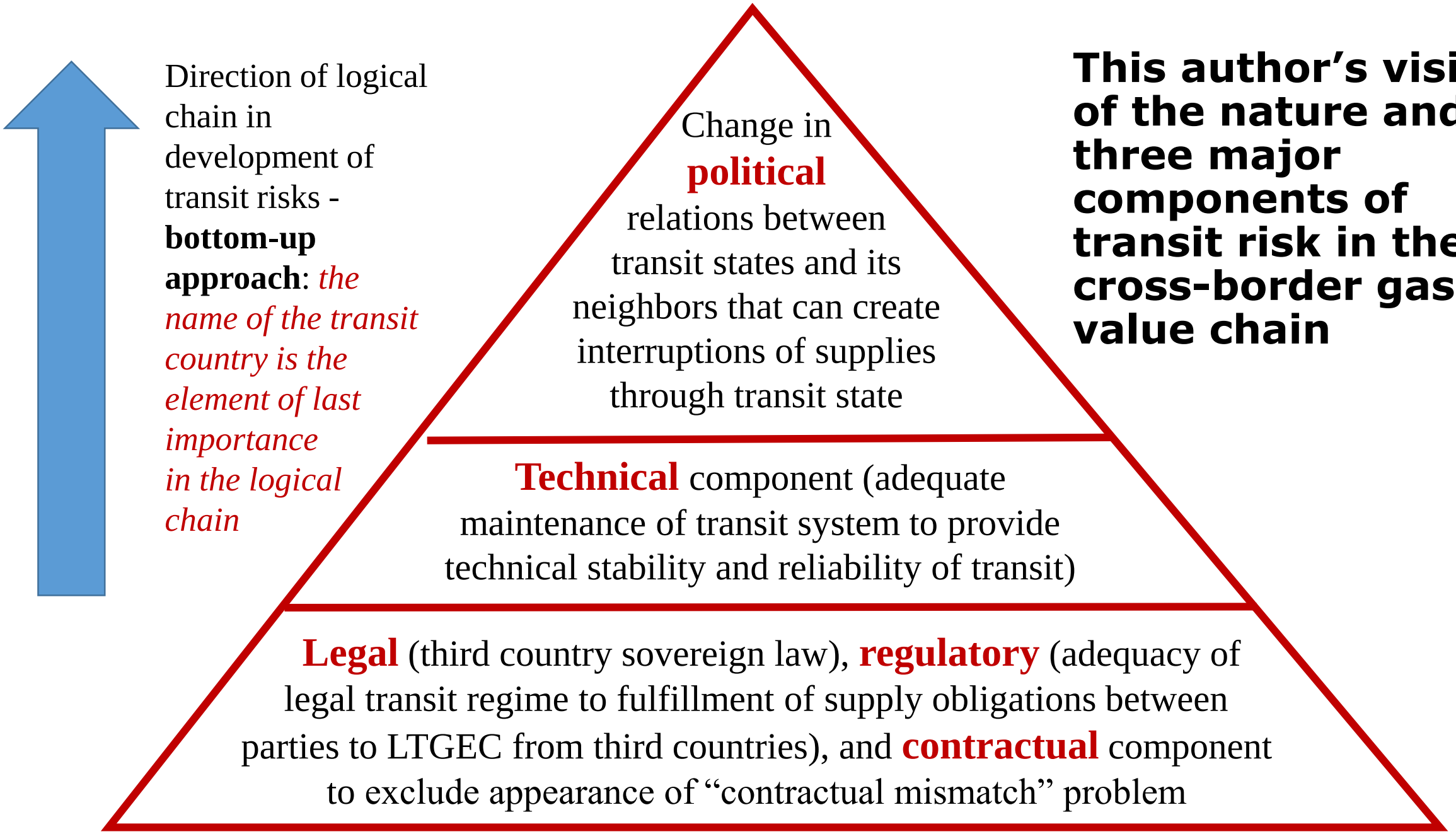
- A new market option for Russian LNG: Russian small-scale LNG
  - to the EU (Baltic & Black seas, Danube River area) from existing & new small LNG plants (incl. reloading) (incl. Rein-Main-Danube corridor – part of TEN-T):
    - Mobility:
      - road transport – heavy trucks,
      - railways,
      - river barges & coastal ships (bunkering & delivery)
    - Big cities:
      - municipal transport,
      - retail trade systems deliveries
  - at Russian Far East ("Sakhalin-2" vs Yamal LNG (Kamchatka reloading) project's cooperation):
    - Decentralized gas supplies coastal areas
    - Coastal & sea fishery fleet bunkering

Russian Gas Supplies to Europe: Zones of New Risks for Existing Supplies Within Russia's Area of Responsibility



Italic – non-EU countries; New EU accession states: underlined – since 01.05.2004, *underlined + italic* – since 1.01.2007; **Bold** – FSU states members of ECOMT; A, B, C – points of change of ownership for Russian gas and/or pipeline on its way to Europe

Direction of logical chain in development of transit risks - **bottom-up approach**: *the name of the transit country is the element of last importance in the logical chain*



This author's vision of the nature and three major components of transit risk in the cross-border gas value chain

Russia-EU common interest & mechanisms for minimizing transit risks

- Prior to dissolution of COMECON/USSR:
  - Delivery points at COMECON-EU border, de facto no transit via COMECON, producer/exporter had full operational control on gas value chain from wellhead to delivery point
- After dissolution of COMECON/USSR:
  - New sovereign independent states between producer/exporter (Russia) and EU => producer has lost control on transit part of gas value chain => transit risks
  - To minimize transit risks for importer & exporter = to diversify:
    - For importer: multiple sources of supply, **routes** (+ suppliers)
    - For exporter: multiple markets, **routes** (+ importers)
  - => diversification of routes = common interest for producer/exporter & importer => to exclude transit totally or alternative pipelines (by-passes) without and/or alongside with transit routes

New Russian gas export strategy in European gas supplies (this author's vision)

- EU - target gas market for Russia => to cover incremental import demand:
  - in line with EU gas market regulatory rules (further contractual adaptation) +
  - to obtain adequate (best effective) supply infrastructure => from linear/radial (pre-2019) to circle-radial (post-2019) Russian gas supplies to the EU
- Changing role of transit routes: from key export corridors - to supporting (back-up) corridors; by-passes are the new key routes
  - By-passing UA pipelines - both Northern (NS 1 & 2) & Southern (Turkstream):
    - Not "Putin's pincers" (acc. to some international media), but diversity of supplies to the mutual benefit (transit risk mitigation) of producer/seller & consumer/buyer (Russia & EU)
    - Economic justification of by-passes (comparative economic task): building shorter modern new routes to the EU from new resource base (Yamal) vs deep modernization of existing old longer routes to the EU from former resource base (Nadym-Pur-Taz)
  - Access to transit capacities post-2019:
    - under Third EU Energy Package (2017 CAM NC INC) rules (UA a party to Energy Community Treaty): demand for capacity (open season); Entry-Exit tariffs => ring-fenced route/capacity & separate EU-certified TSO => EU TSO; financing capacity modernization with IFIs (escrow accounts as political risk mitigation tool); 1st step: 30 BCM (2 UPU lines into one)

Thank you for your attention!

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