

«Парижское соглашение по климату: переход к новой модели развития мировой энергетики. Возможные последствия для России и мира»

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«Современные энергетические рынки, Москва,
02.11.2016**

What is COP-21 & what it's future role?

- COP-21 (21st Conference of Parties) – the Paris agreement within UN Framework Convention on Climate Change, was prepared within climate conference in Paris,
- regulates the measures on diminishing CO2 emissions post-2020,
- adopted by consensus on 12 December 2015,
- signed on 22 April 2016,
- 179 signatory states (UN = 193 states), account for 95% of emissions
- After EU has ratified COP-21 on 04.10.2016, it has passed the needed threshold (more than 55 states representing 55% of global emissions to join the Agreement) in record time => the Paris Agreement will enter into force on November 4, 2016 (on 30th day after critical ratification), only days before the opening of COP-22 in Marrakesh, Morocco.
- From my (and not only) view: **COP-21 is major factor of uncertainty in international oil & gas, possibly the new paradigm of the international energy development**

COP-21 & New Limits to Growth

- **IEA (2012)/IPCC (2014):** to limit global warming by 2°C without large-scale implementation of carbon capture & storage (CCS) = not be able to consume (*) **MORE THAN ONE THIRD (IEA) (IPCC: 1/4-1/3)** of global proven recoverable reserves (PRR) of hydrocarbons (HC) up to 2050
- *OR:* cumulative future CO₂ emissions from **current** PRR HC volumes are **THREE (IEA) to FOUR (IPCC) TIMES HIGHER** than the upper limits of such emissions which are agreed upon in Paris bearing in mind sustainable global development.
- IEA: 2/3 of such potential emissions will come from coal, 22% from oil and products, and 15% from gas.

(*) through technological chains from production to end-use of each fossil fuel (coal, petroleum products, gas) in each energy/non-energy use of energy resources

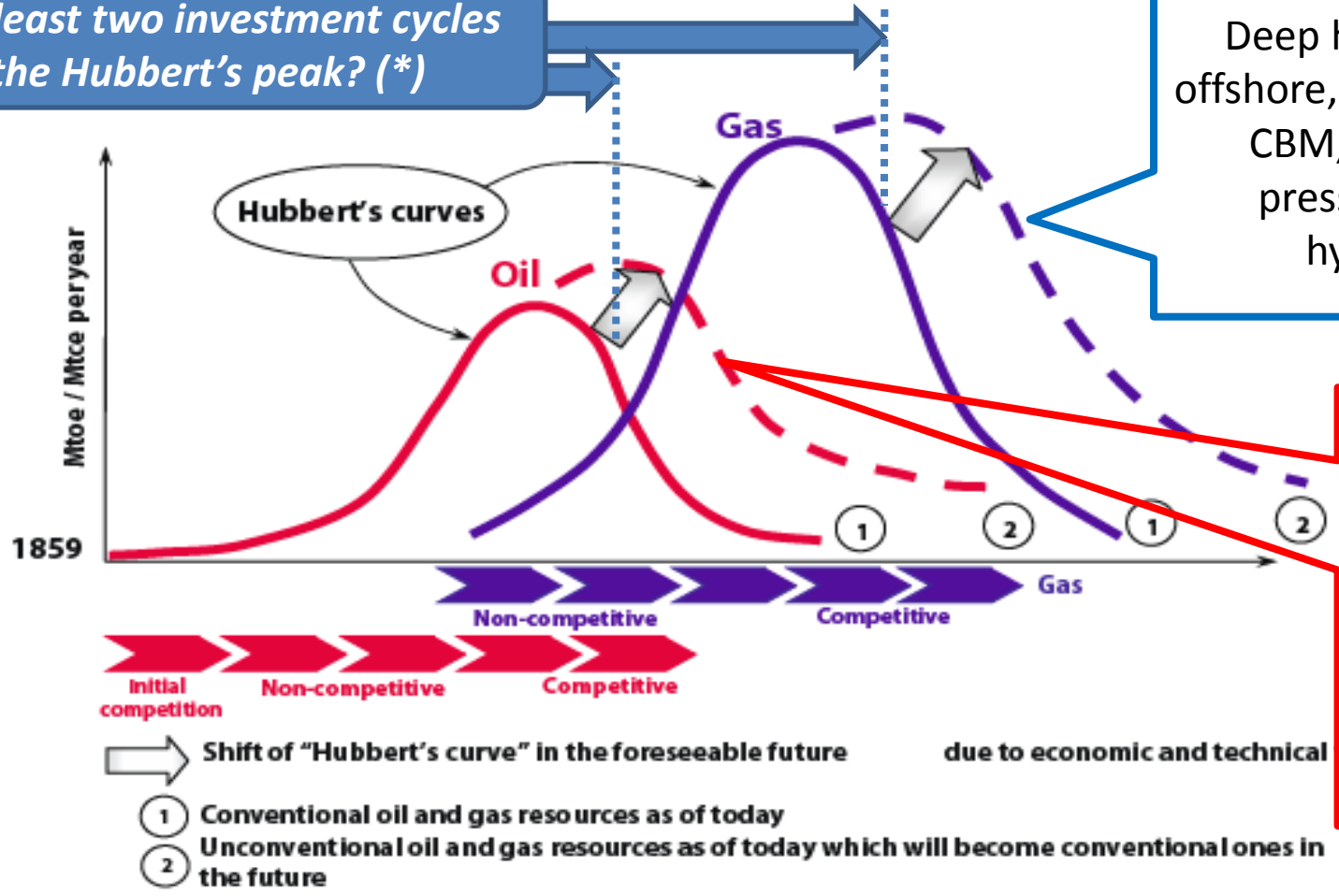
COP-21 & New Paradigm of Energy Development (1)

- **PAST:** 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 => “peak oil” theory,
 - “Hotelling rule” (1931) => the future value of fossil fuel in-situ increases by the value of the current interest rate within the time-frame,
 - Both theories did not consider possible demand-side limitations,
 - Both works for increasing future cost & value of in-situ non-renewable energy resource within time-frame, at least during post-“Chevalier’s breaking point” period (since early 1970-ies):
 - “Evolutionary” STP just slows-down E&P cost increase of non-renewable energies influenced by “natural” factor (the latter over-weigh influence of STP)
 - “Revolutionary” STP can overweight negative influence of “natural” factor and thus can lead to temporary decline in E&P costs of non-renewable energies

Evolution of international oil & gas markets: from less to more competitive environment (economic interpretation of "Hubbert's curves")

At least two investment cycles to the Hubbert's peak? (*)

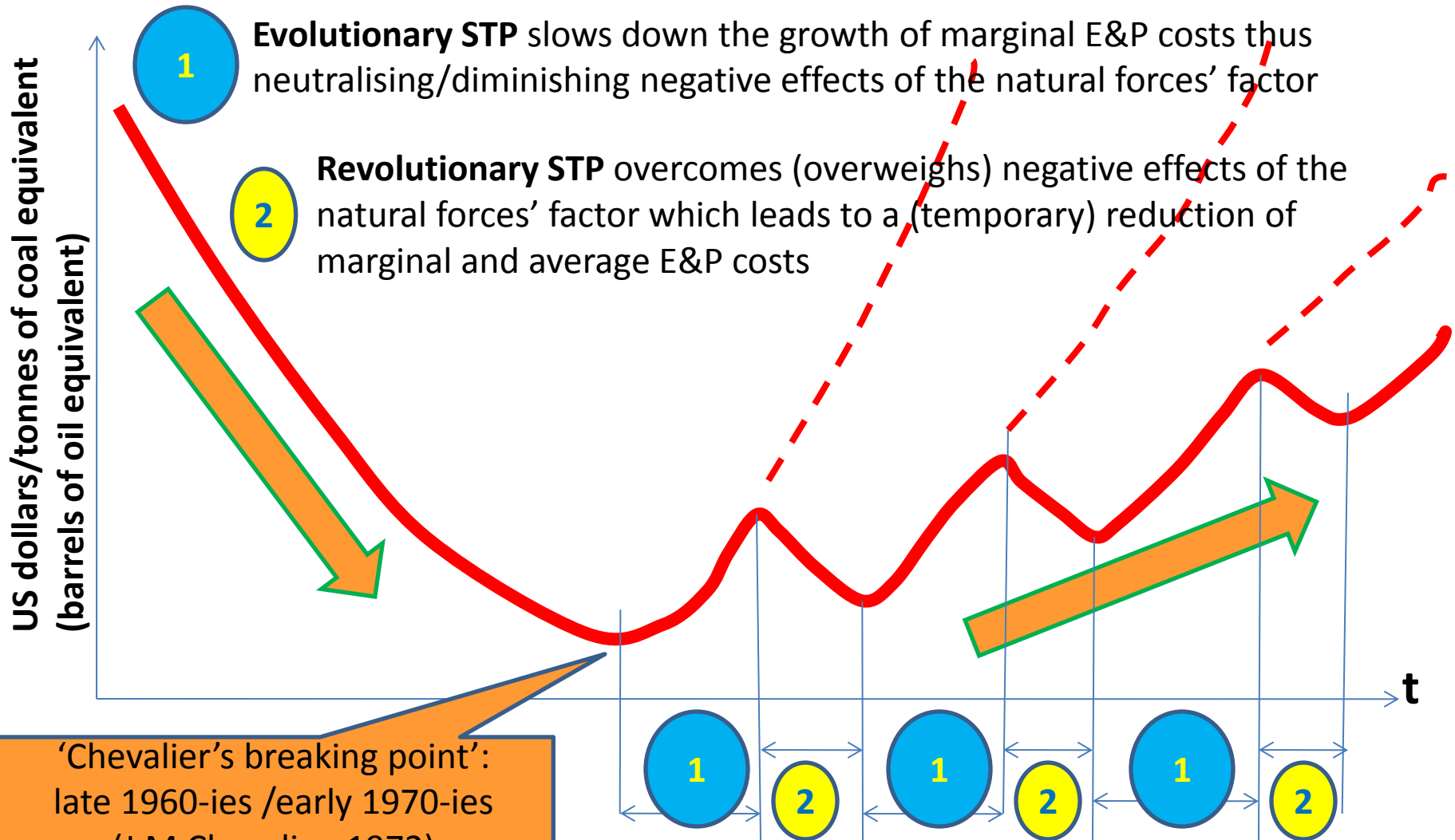
Deep horizons, deep offshore, Arctic, shale gas, CBM, biogas, low-pressure gas, gas hydrates, ...



Deep horizons, deep offshore, Arctic, heavy oil, shale oil, bituminous sands, GTL, CTL, BTL, ...

(*) 1st invest cycle = today's commercial technologies which shall pay back full CAPEX in their RD&D & commercial utilization before they will be substituted by new technologies of the new invest cycle which today stays at RD&D stage and thus predetermines this 2nd invest cycle

Impact of revolutionary and evolutionary STP on changing exploration and production (E&P) costs for conventional hydrocarbons in the period of growing marginal costs (after 'Chevalier's breaking point', late 1960-ies/early 1970-ies)



COP-21 & New Paradigm of Energy Development (2)

- **COP-21 might radically change the paradigm of future energy development !!!**
- **FUTURE**: possible limitations on the demand side of global energy induced by the climatic-based restrictions on emissions (COP-21) - **???**:
 - not all today's CRR might be demanded by global economy (“unburnable carbon”)
 - decreasing (NOT increasing) value of oil in place due to its staying potentially unclaimed (an opposite to Hotelling rule)
 - stimuli for quicker extraction and utilization of the current PRR HC
 - this will accelerate expectations of the “cheap oil” era (“cheap” means not because of decreasing production costs but because of diminishing price that the society will be ready to pay for it)
 - future possible oversupply artificially created by climate change agenda **???**

New energy paradigm => new international law priorities => new areas for international cooperation: **CURRENT**

- Mostly non-renewable energies (NRE) within mostly physical energy markets & mostly centralized commercial (industrial-type) energy value chains:
 - Natural resource-rent generation & collection:
 - Geology risks
 - Monetization of nonrenewable resource rent
 - Cost plus (self financing) = minimum LT price
 - NBRV + indexation (maximization of marketable rent) = maximum LT price
 - Sovereignty over natural resources
 - UN GA Res. 1803, Dec'1962; ECT Art.18, 1994/98
 - Access to resources => political risks (incl. nationalization, expropriation) => instruments of its mitigation:
 - Investor-host Gov't agreements (concessions, PSAs, risk-service, etc.)
 - International law instruments: BITs, MITs
 - Access to capital, technologies, innovation within mostly non-competitive & non-transparent energy world

New energy paradigm => new international law priorities => new areas for international cooperation: **FUTURE?**

- NRE & RES (climate change) within physical & paper energy markets within centralized (industrial-type) & decentralized (rural + post-industrial) commercial energy value chains:
 - Nat.resource/technological rent generation & collection
 - Access to capital, technologies, innovations in the more-and-more competitive & transparent energy world
 - Environmental considerations (pollutant pays) => “climate change” as new “production factor”
 - Transition risks => financial stability/risk mitigation:
 - Re-pricing of fossil fuels due to technological change demanded by world decision to limit fossil fuels emission (COP-21) =>
 - “Unburnable carbon” => huge drop of energy assets values => how to exclude financial risk & shock:
 - Financial Stability Board (FSB), the international body set up by the G20 in 2009 to monitor risks to the financial system
 - » *NB: G-20 accounts for 85% of the global emissions*

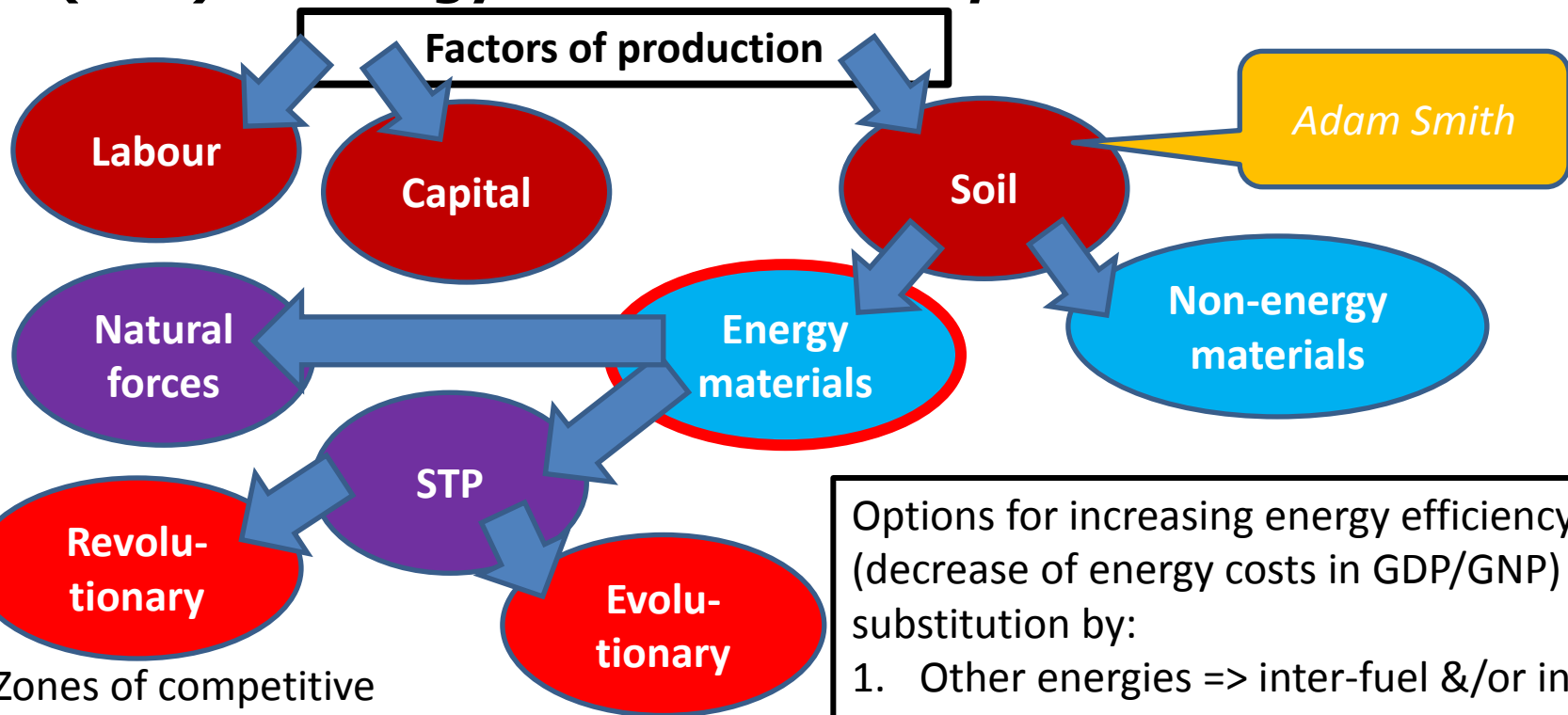
Mark Carney, G-20 FSB Chair, at Lloyd's First City Dinner of London

(29.09.2015): Climate change and financial stability

- “There are three broad channels through which climate change can affect financial stability:
 - First, **physical risks**: the impacts today on insurance liabilities and the value of financial assets that arise from climate- and weather-related events, such as floods and storms that damage property or disrupt trade;
 - Second, **liability risks**: the impacts that could arise tomorrow if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible. Such claims could come decades in the future, but have the potential to hit carbon extractors and emitters – and, if they have liability cover, their insurers – the hardest;
 - Finally, **transition risks**: the financial risks which could result from the process of adjustment towards a lower-carbon economy. Changes in policy, technology and physical risks could prompt a reassessment of the value of a large range of assets as costs and opportunities become apparent.
- The speed at which such re-pricing occurs is uncertain and could be decisive for financial stability.
- Risks to financial stability will be minimised if the transition begins early and follows a predictable path, thereby helping the market anticipate the transition to a 2 degree world.
- Forward-looking regulators consider not just the here and now, but emerging vulnerabilities and their impact on business models.”

This is much important for RF. Why?

Political economy of energy: factors of production, inter-factors' competition, & Scientific & Technological Progress (STP) in energy – & *current competitive niche for Russia*



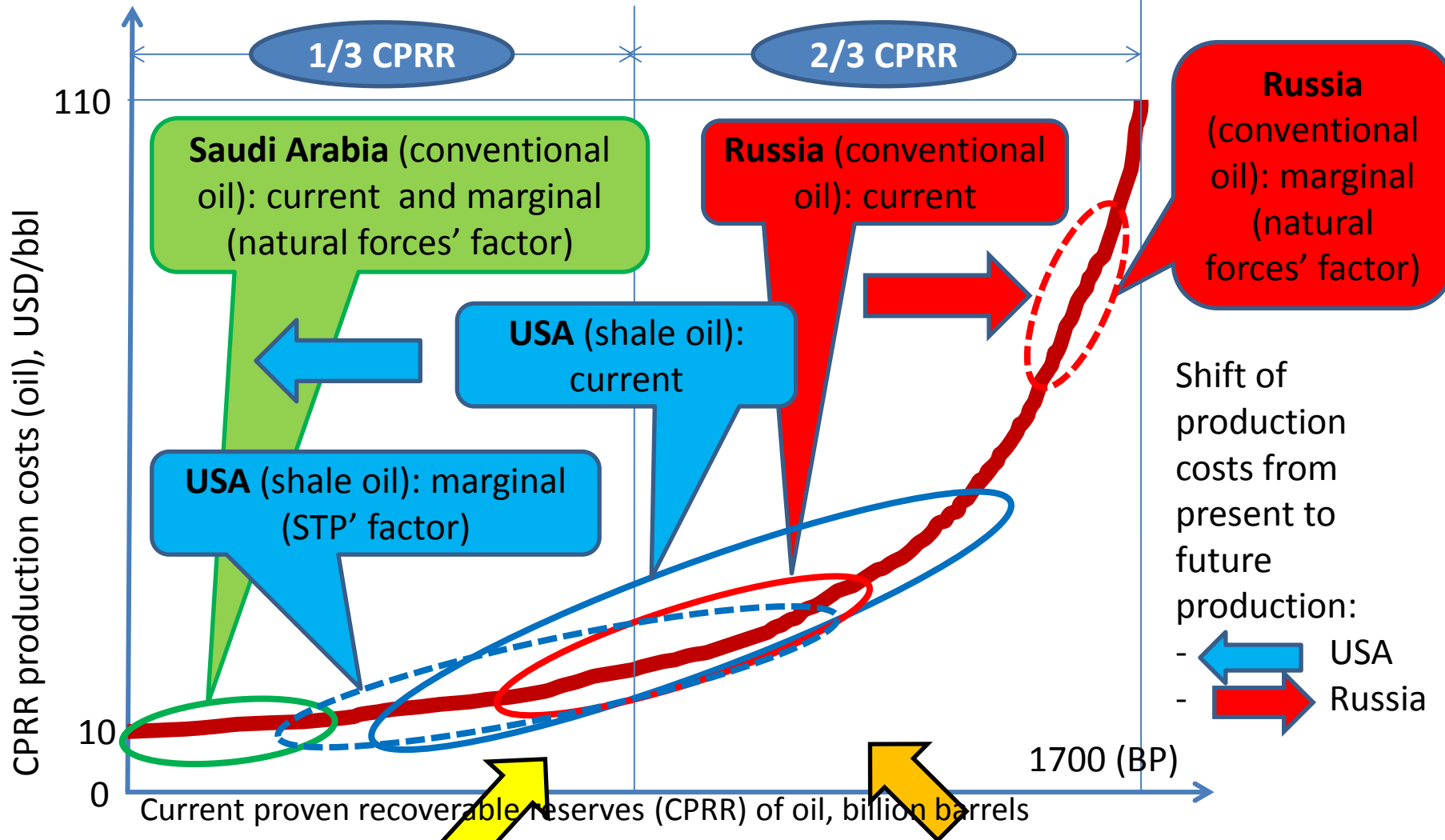
Zones of competitive advantages of different groups of countries:

- Labour: developing (price), developed (quality)
- Capital (financial markets & innovations, technologies): developed (Anglo-Saxon),
- Energy (nonrenewables, hydrocarbons): OPEC, USA, Russia => ***the only current competitive niche for Russia***

Options for increasing energy efficiency (decrease of energy costs in GDP/GNP) = its substitution by:

1. Other energies => inter-fuel &/or intra-fuel competition (STP)
2. Labour => export of energy-intensive industries to developing states
3. Capital => increase of energy efficiency (STP)
4. Non-energy materials (in non-energy use of energies) => (STP)

US shale oil & COP-21 influence on global oil supply curve (order of the figures): consequences for Russia



1/3 CPRR of HC= max CO₂ emissions in accordance with COP-21 (IEA)

There may be demand limitation (upper demand limit) for 2/3 CPRR of HC due to exhaustion of CO₂ maximum permissible quotes in accordance with COP-21

COP-21, low prices, US LNG & fight against Russian gas in EU

Aim of fight: to get rid of rival within the narrowing demand niche for gas? (if COP-21-based demand restrictions + low oil price effects for gas) =>

- different West. studies: **AS IF RUSSIAN GAS IS MORE DIRTY** than other gases (both pipeline & LNG) &/or other fossil fuels &/or RES, i.a. (*):
 - US Dep't of Energy on long-term GHG perspective on exporting LNG from the US as of May, 29 2014 (long-term GHG perspectives for NG)
 - Karlsruhe Institute of Technology (KIT) Study as of March 2016 (argues the results of the above & official estimates of the US Environment Protection Agency)
 - PÖYRY Study as of June 2016 (coal vs NG)
 - EXERGIA/COWI for DG ENER, "Study on Actual GHG Data for Diesel, Petrol, Kerosene, and Natural Gas", July 2015 (to provide information about the lifecycle GHG emissions of fossil fuels used in transport)
- **NB1:** *Current thesis of as if "more dirty" Russian gas is additive to post-2009 thesis of Russia as if "non-reliable" source of gas*
 - *substitution of notions: "non-reliable **source**" vs "non-reliable **transit route from the source**" to the market*
- **NB2:** *The Trans-Atlantic fight against NordStream-2 & other Russian UA bypasses*
 - *To "softly" force Russia to continue gas supplies to EU post-2019 through more risky & costly UA transit route (?) (**administrative barriers for competitor – Rus gas - to diminish its competitiveness to US LNG In EU?**)*
- **NB3:** *Parallel with different spheres, like f.i. WADA treatment of US & Russian Olympic & Paralympic athletes in Rio?*
 - *substitution of notions: fact of allowed doping vs source of information (hackers)*

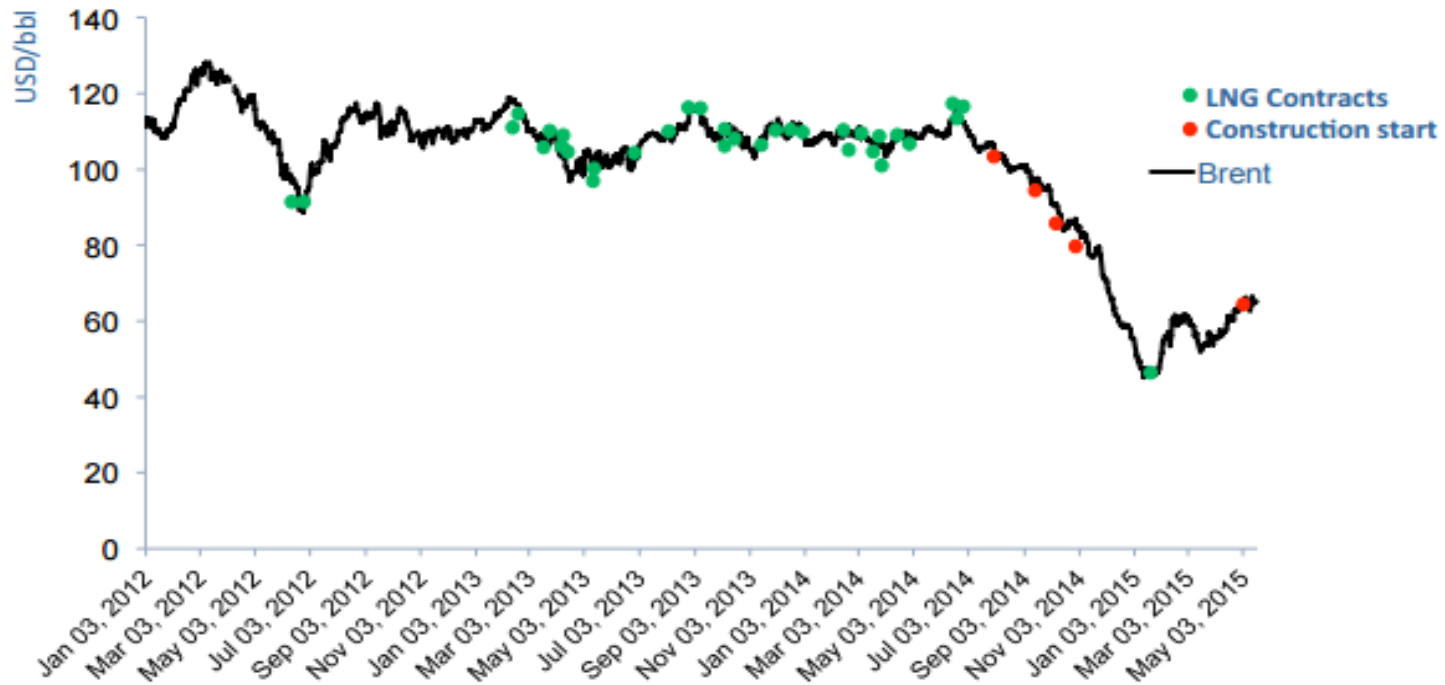
(*) Source: D. Leonov, N. Sudarev. COP-21 – role of NG in Decarbonization and Sustainability of EU economy.; K. Romanov. The Role of Natural Gas In Decarbonization and Sustainability.// Russia-EU Gas Advisory Council, Work Stream 2 "Internal Markets" meeting, Vienna, E-Control, 01 July 2016

US LNG export pre-history

- US shale gas revolution domino effects on US gas:
 - Rocket-style increase of domestic shale gas production post-2007 has led to oversupply within US gas market =>
 - US domestic gas market has almost closed for import LNG post-2007
 - Till Feb'2016 US - “energy island” => HH price went down/stayed low => price gap with Europe & Asia Pacific => both foreign non-US areas - premium markets for US gas
 - Debt financing of US shale gas development => growing indebtedness of US shale producers within US “energy island” domestic environment
- To pay-back CAPEX in US shale gas production within low domestic gas (HH) prices => reorientation/economic stimuli for export
 - Conversion of regas import LNG terminals to liquefaction export LNG terminals
 - Key target market – Asia Pacific with oil-indexed LNG price premium (esp. after Fukushima accident)
 - Third line of Panama channel expansion (Summer 2016) for US LNG to Pacific (unit size of LNG cargos increased 3 times)
- **BUT:** New export US LNG strategy was developed in end-2000-ies/first-half-2010-ies when oil price stood high (above 100 USD/bbl)

Buyers seem to become cautious on the competitiveness of Henry Hub based LNG

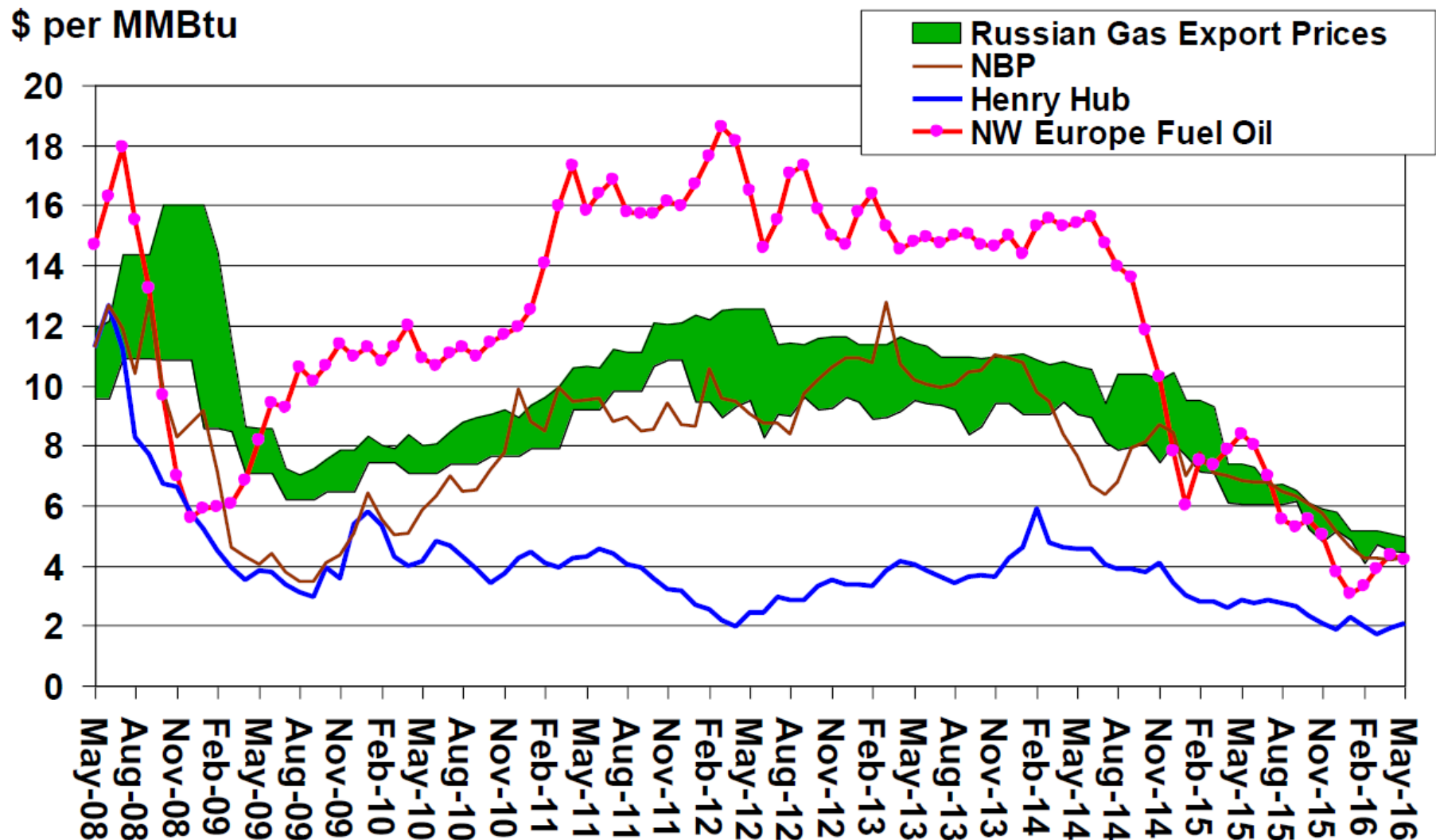
Medium-Term
Market Report
2015



- *Financing of projects with previously signed contracts is unproblematic*
- *Only one small contract (0.75 Mt/Y) was signed since oil peaked*

Source: Costanza Jacazio, Senior gas analyst, International Energy Agency. Gas: medium-Term Market Report 2015. Market Analysis and Forecast to 2020. – Presentation at The Center on Global Energy Policy, Columbia University, New York, NY, USA, 20.06.2016, <https://energywatch-inc.com/wp-content/uploads/2015/07/IEA-Medium-Term-Gas-Market-Report-Presentation.pdf>

Convergence of Gas Prices



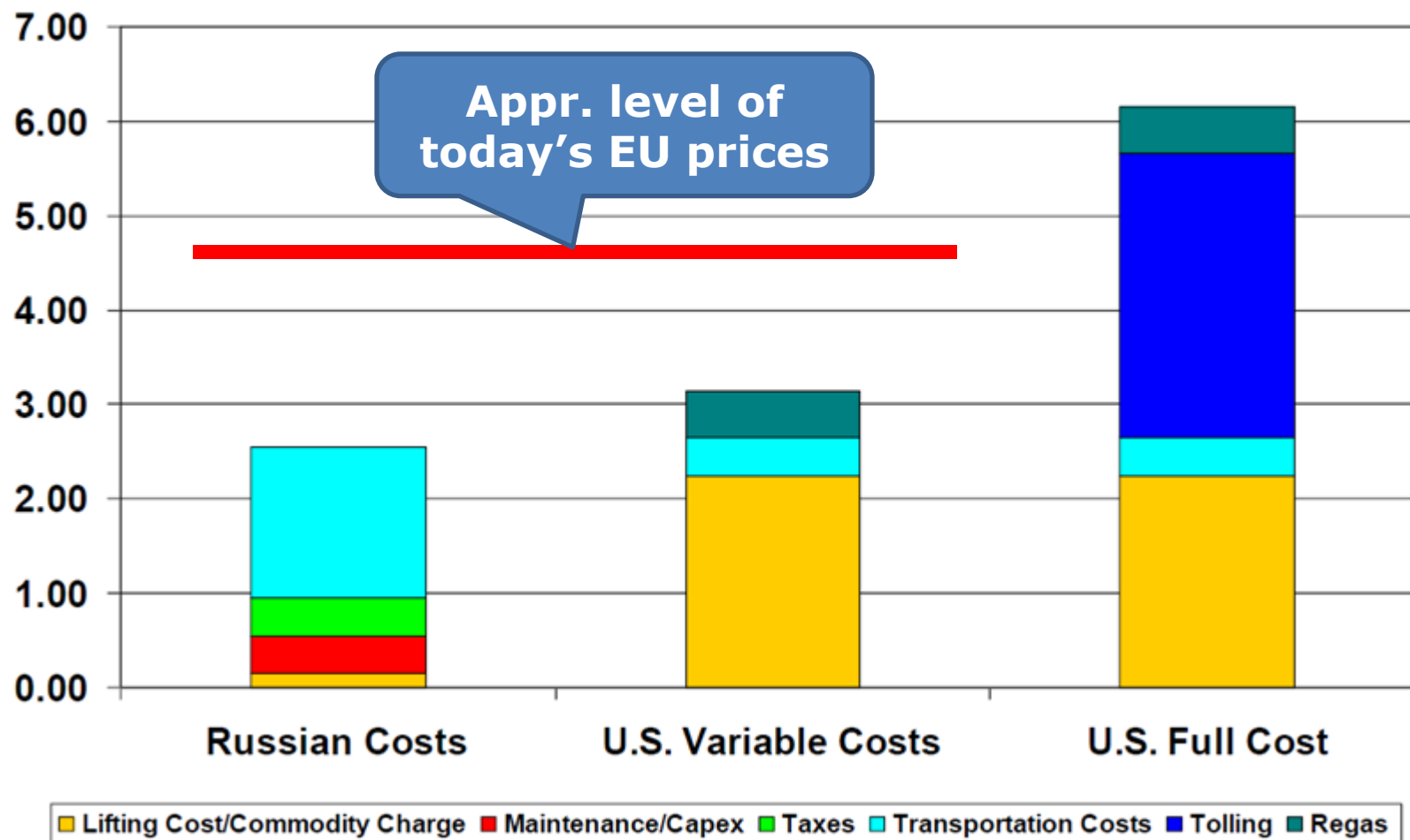
Source: PIRA

Source: S.Komlev. Gazprom on the European Market Problems and Solutions . ETCSEE2016, 15-16 June, 2016, Bucharest, Romania

A.Konoplyanik, MGU, 02.11.2016

Gazprom Sees No Threat from US LNG to European Pipeline Gas

\$/MMBtu, assumes 115% of Henry Hub at current prices



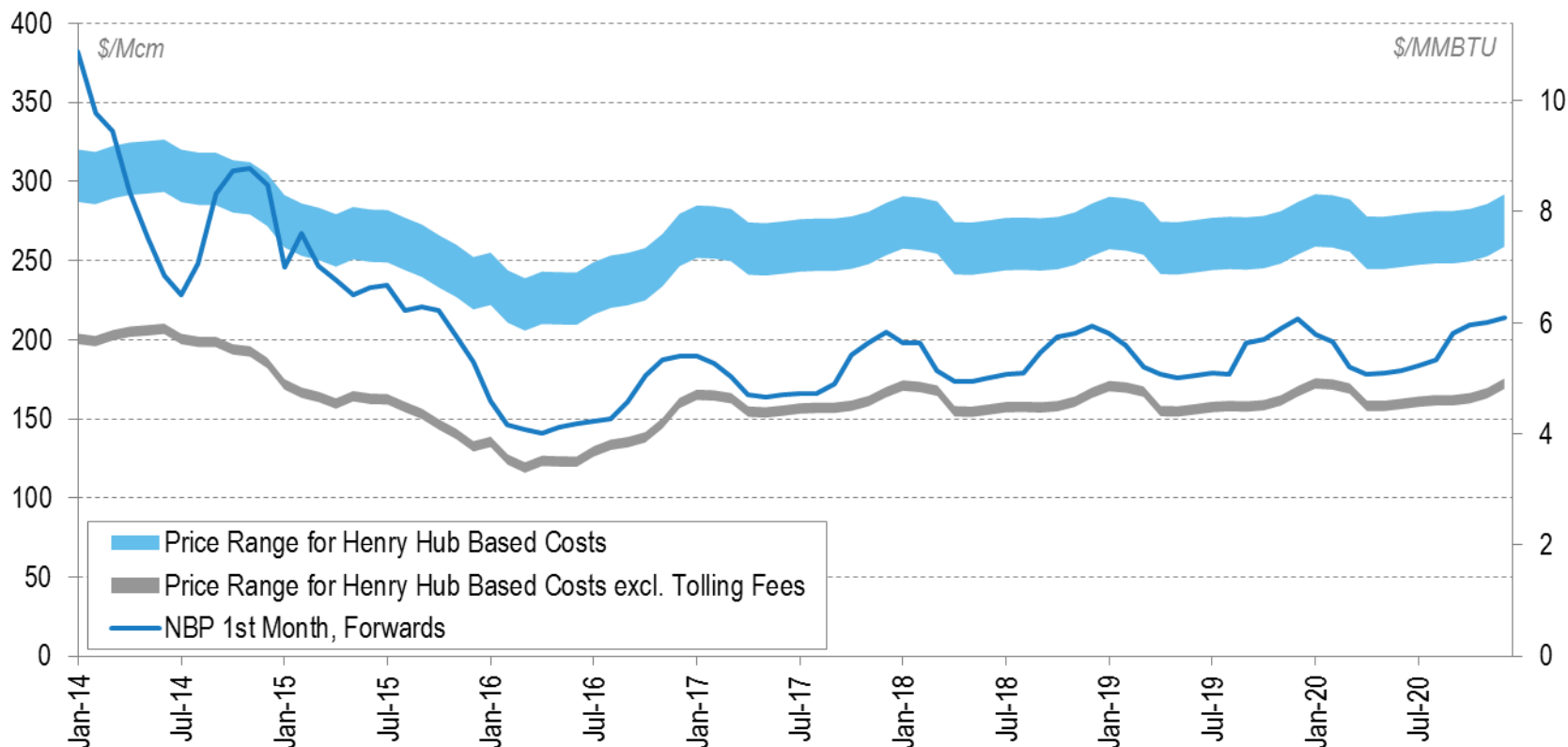
Source: PIRA

Source: S.Komlev. Gazprom on the European Market Problems and Solutions . ETCSEE2016, 15-16 June, 2016, Bucharest, Romania

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US Benchmark Prices are Poised to Rise Within a Year, Meaning Export Costs to Europe Will Also Gain

Estimated Costs* of US LNG Deliveries to Europe in comparison with European Traded Forwards**



* Based on Henry Hub Forward Curve, $P = HH * 115\% + X$, where X – costs of liquefaction, shipping, regasification

** NBP Forward Curve

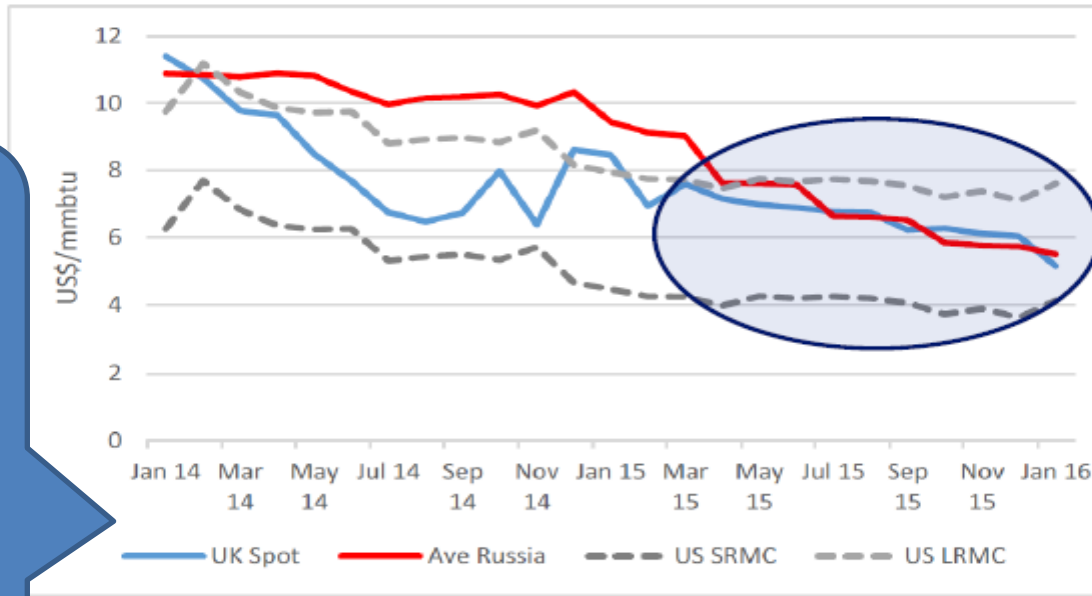
Source: Bloomberg, Wood McKenzie

Source: S.Komlev. Gazprom on the European Market Problems and Solutions . ETCSEE2016, 15-16 June, 2016, Bucharest, Romania



European Gas Prices vs. Marginal Cost of US LNG

Source: The Oxford Institute for Energy Studies



European gas prices below long run marginal cost of US LNG,
limiting appetite for new investments into LNG projects.

Taken from:

Andreas Rau, CEO NET4GAS, s.r.o. The Current Environment for Gas Infrastructure Investment. // Central European Gas Congress, Bratislava, April 27, 2016

Original source:

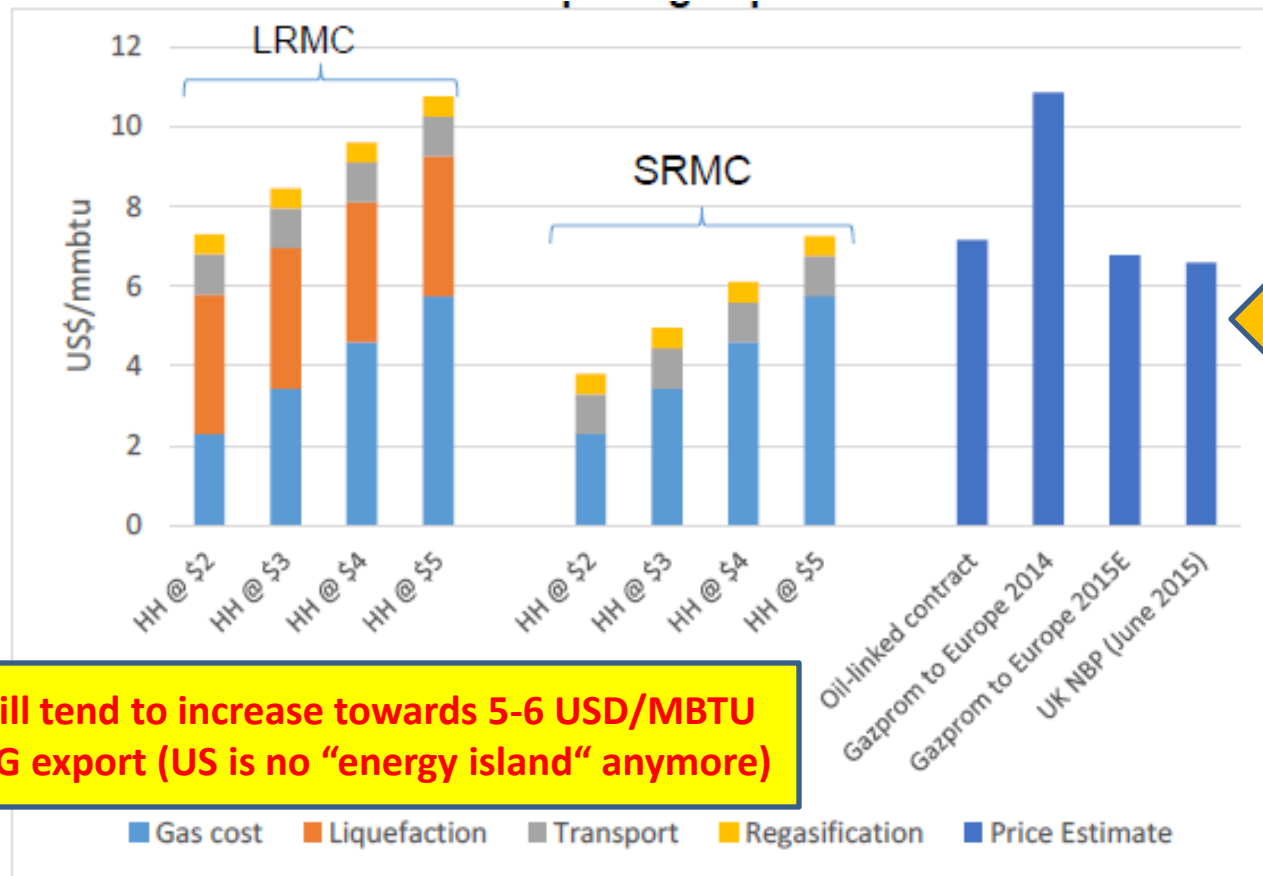
James Henderson. Gazprom – Is 2016 the Year for a Change of Pricing Strategy in Europe? – OIES, OXFORD ENERGY COMMENT, January 2016, p. 7 (fig. 3).

J.Henderson's conclusions on US LNG competitiveness in EU are trusted in other parts of Europe...

US LNG is less competitive to Russian pipeline gas in the EU by LRMC (CAPEX + OPEX) & is competitive there only by SRMC (OPEX) (Henderson) =>

this does not diminish the increasing “debt bubble” of US shale gas producers – the resource base for US LNG export => *short-term “window of opportunities” for US LNG in the EU?*

The cost of US LNG versus European Gas prices (acc. to J.Henderson & T.Mitrova)



EU 2016 spot gas prices level

US HH prices will tend to increase towards 5-6 USD/MBTU with growing LNG export (US is no "energy island" anymore)

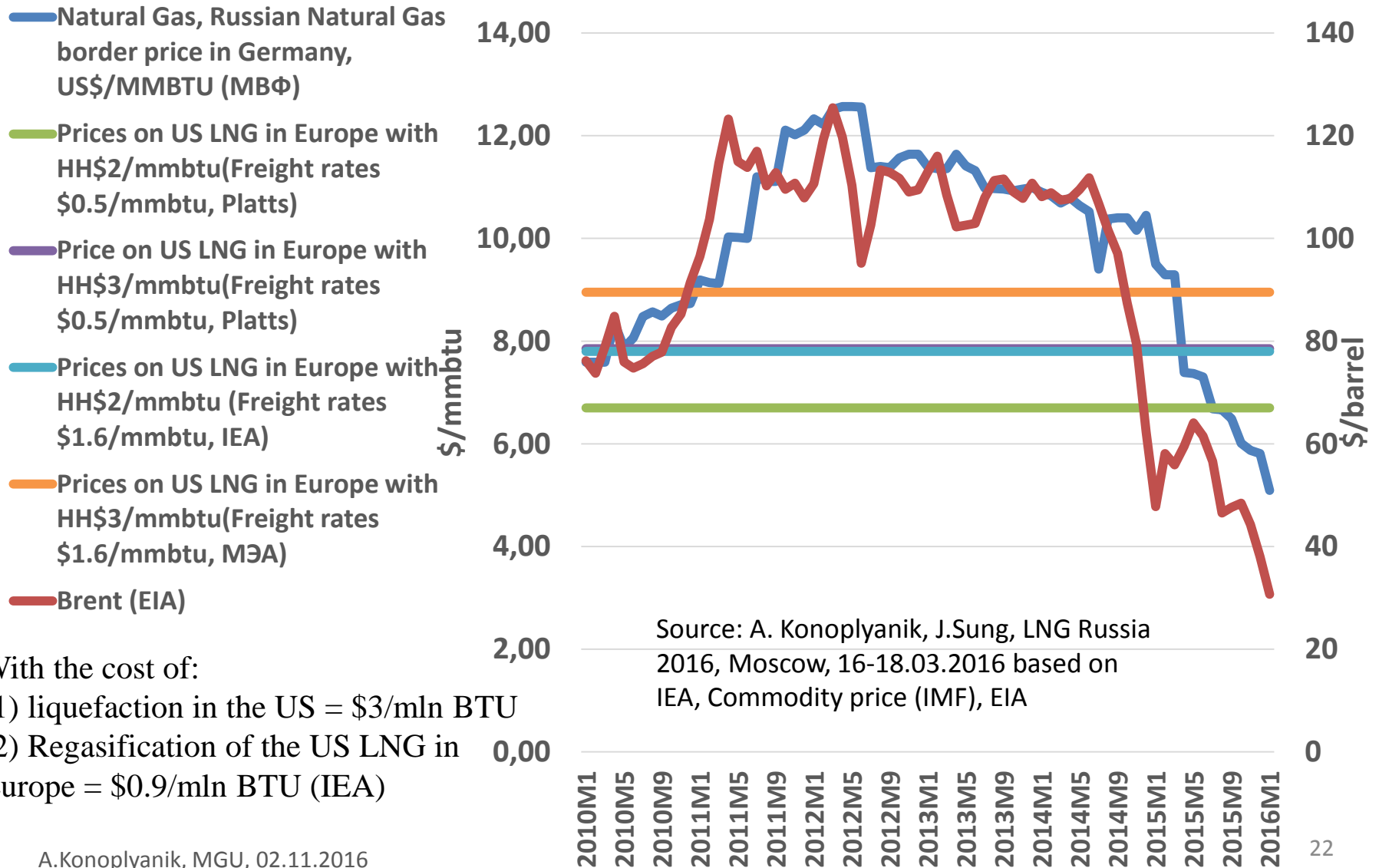
Sources: Cheniere Energy, Energy Intelligence, Gazprom (n.b. oil-linked contract calculated at an oil price of \$65/barrel)

Source of original chart: James Henderson & Tatiana Mitrova. The Political and Commercial Dynamics of Russia's Gas Export Strategy. - OIES PAPER: NG 102, September 2015, p. 44

Thierry Bros on US LNG competitiveness vs Russian gas in the EU

- Thierry Bros: “HH price will guarantee Gazprom European rent in 2020e! ... Even if Europe market moves to near full spot indexation, if it is inked to the US via the costs of LNG exports, Europe price could remain 6 USD/MBTU (cost of liquefaction, shipping & regasification) above HH. ... In short, the liquid US market will guarantee minimum profit for Gazprom and revenues for the Russian state”
 - (T.Bros. After the US Shale Gas Revolution. // Editions TECHNIP, Paris, 2012, p.149)

US LNG prices compared against Russian pipeline gas in Europe

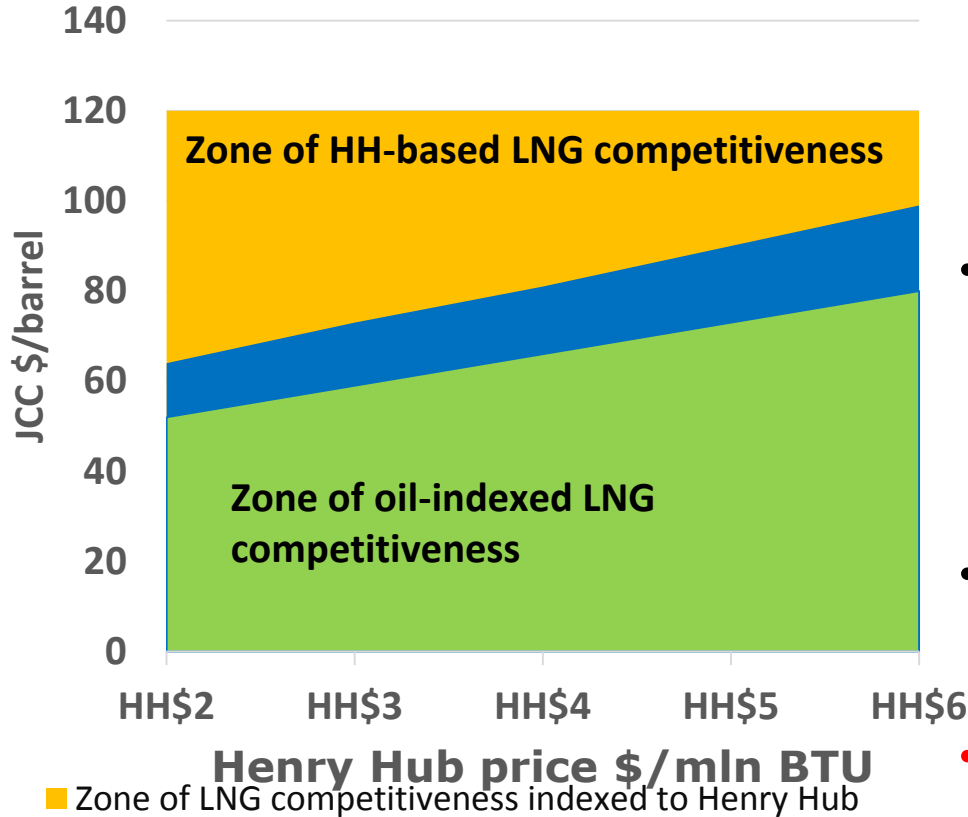


With the cost of:

(1) liquefaction in the US = \$3/mln BTU

(2) Regasification of the US LNG in Europe = \$0.9/mln BTU (IEA)

Zones of LNG competitiveness in Asia indexed to JCC (NBRV pricing) and to Henry Hub (cost-plus pricing)



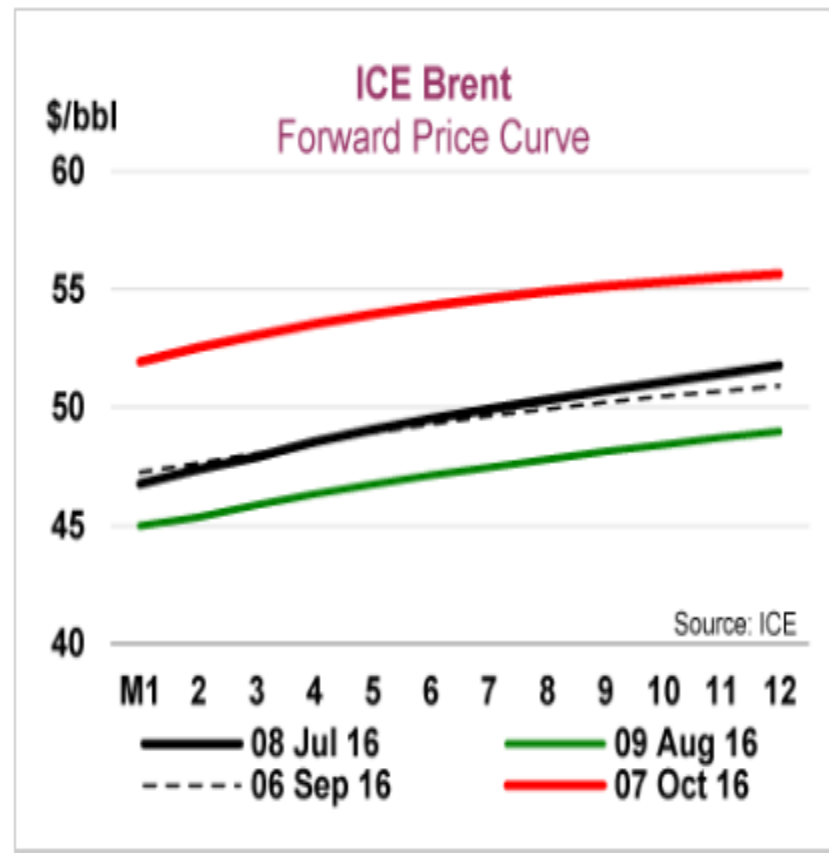
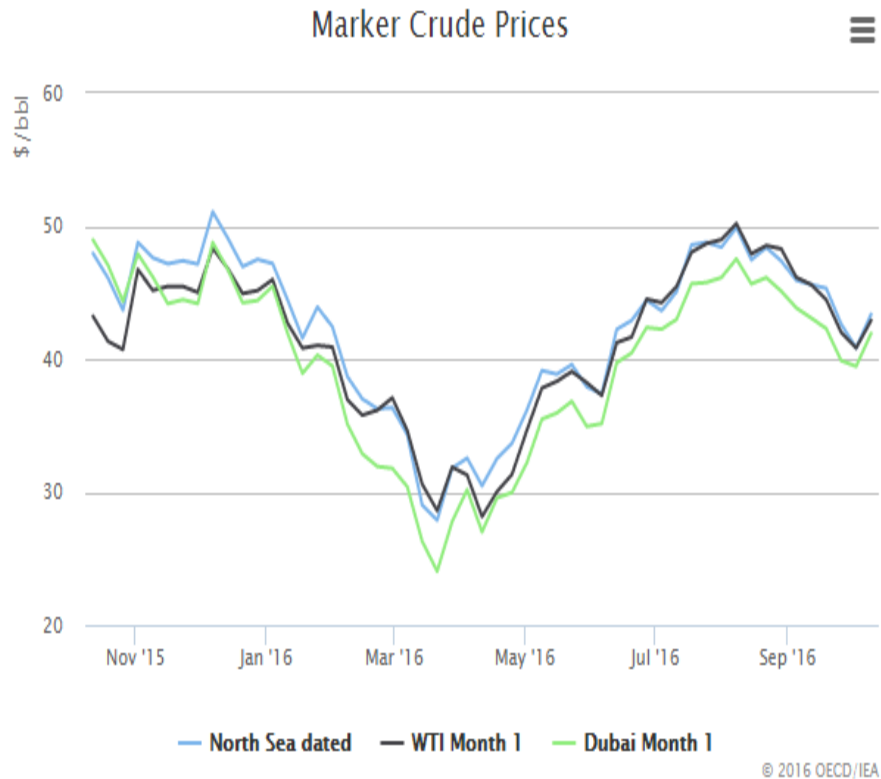
- With the oil price of **\$2/MMBTU** at Henry Hub (*minimum value: April 2012, beginning of 2016*), oil-indexed LNG will be competitive in Asia if JCC price **< \$50/barrel** (*at present*)
- With the oil price of **\$6/MMBTU** (*maximum value: beginning of 2014*), oil-indexed LNG will be competitive in Asia if JCC price **< \$80/barrel** (*mid 2010 – end of 2014*)
- With JCC price **above \$100/barrel**, US LNG becomes competitive if Henry Hub price **exceeds \$6/MMBTU**,
- **BUT WHETHER OIL PRICES LIKELY TO RETURN TO \$100/BBL AND ABOVE? => My answer is “NO”, at least in the foreseeable future, due to “domino effects” of US shale revolution**

Views from NY Times “Oil & Money” Conference (London, October 2016) – not supportive for US LNG to be competitive against oil-indexed gas

According to the overarching view presented by several speakers oil is preparing to settle into a \$50-\$60 a barrel range. BP chief executive Bob Dudley picked that band when asked where he saw oil trading in 2017, while the heads of independent oil traders such as Vitol, Mercuria and Gunvor all predicted prices would trade between \$55 to \$58 a barrel this time next year.

Cited from: “South-East Europe Energy Brief, Market Fundamentals and Prices”, October 22, 2016, Issue No 216, July-August-September 2016, Published by the Institute of Energy for South-East Europe, p. 5.

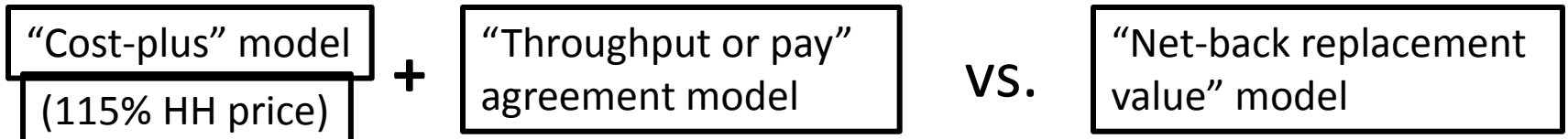
Oil market in contango, but not high enough to prove competitiveness of US LNG against oil-indexed gas?



Source: IEA Oil Market Report, 11 October 2016, <https://www.iea.org/oilmarketreport/omrpublic/>

At current oil price range of 40-50 USD/bbl US LNG seems not to be competitive in Asia with oil-indexed LNG; at oil price within 50-60 USD/bbl range (as expected for 2017) US LNG is questionably competitive in Asia even at 2 USD/MBTU

US LNG export model & EU/HH price scissors



Debt financing problems => Repayment of growing accumulated debt for shale producers => Another financial bubble at US market (like in 2008)?

Capacity fee (2.25-3.0 USD/MMBTU) => Cheniere' Sabine-Pass model = :

- (a) risk-free business model for LNG terminal operator;
- (b) all risks are on shale gas producer & LNG exporter

(1) Pricing problems = pricing scissors:

- (a) purchasing FOB price (Henry Hub) to go upward (US is not “energy island” anymore),
- (b) selling CIF price going downward (oil-indexation as NBRV &/or spot)

(2) Price/cost problem = capacity fee fixed obligatory payment (on top of growing HH price)

And in the end... Whether the whole concept of man's irreversible impact on climate change is well justified?

International Panel on Climate Change (IPCC, 2014): the effects of anthropogenic greenhouse gas emissions, together with other anthropogenic drivers are “extremely likely to have been the dominant cause of observed [global] warming since the mid-20th Century”.

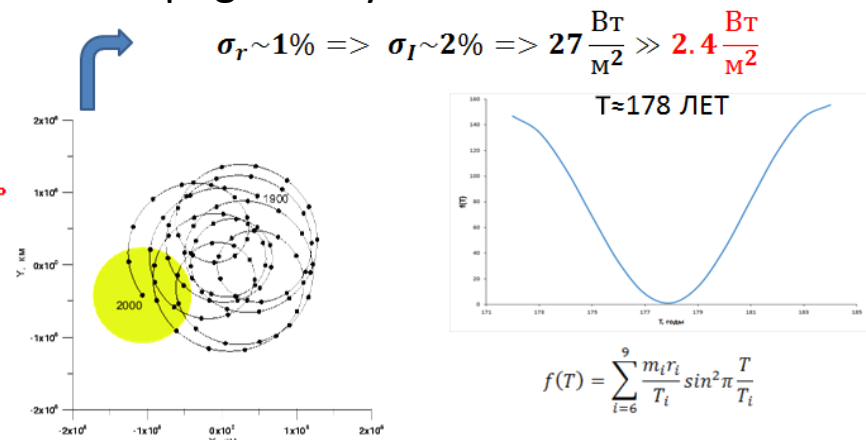
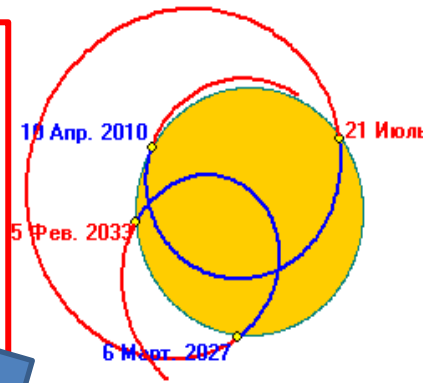
Specialists in solar activity are well aware of the climate change 178Y cycle !

As known, the Earth runs not around the Sun, but around mass center of Solar System (MCSS) which stays away of center of the Sun (CS) & constantly moves. In the period measured by decades deviation of MCSS from CS is comparable with diameter of the Sun => flow of Solar energy to the Earth fluctuates.

These fluctuations (± 24 W/sq.m) BY THE ORDER (10 times) HIGHER than increment of this flow (2.4 W/sq.m), which IPCC called as “result of anthropogenically defined increase in GHG emissions”

“RAS Presidium view, presented at request of RF President, on **TOTAL ABSENCE OF SCIENTIFIC SUBSTANTIATION OF GLOBAL WARMING DOCTRINE is strongly justified even at the level of elementary appraisals”**

A.Konoplyanik, MGU, 02.11.2016



Sources: Крученицкий Г.М. Климатическая доктрина РФ и защита национальных интересов России. НЕУСТРАНИМЫЕ ПРОТИВОРЕЧИЯ (в печати); он же. Презентация на Круглом столе «Риски реализации Парижского климатического соглашения для экономики и национальной безопасности России». Аналитический центр при правительстве РФ, 19.07.2016; Крученицкий Г.М., Матвиенко Г.Г. Физические причины долговременной изменчивости глобальной температуры. "Оптика атмосферы и океана" (в печати).

Thank you for your attention!

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