Possible COP-21 Consequences for Russian & International Oil & Gas: Invitation to the Debate

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

- COP-21 – 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, account for 95% of emissions
- From my view: **Major factor of uncertainty in international oil & gas, possibly new paradigm of the international energy development**

COP-21 & New Limits to Growth

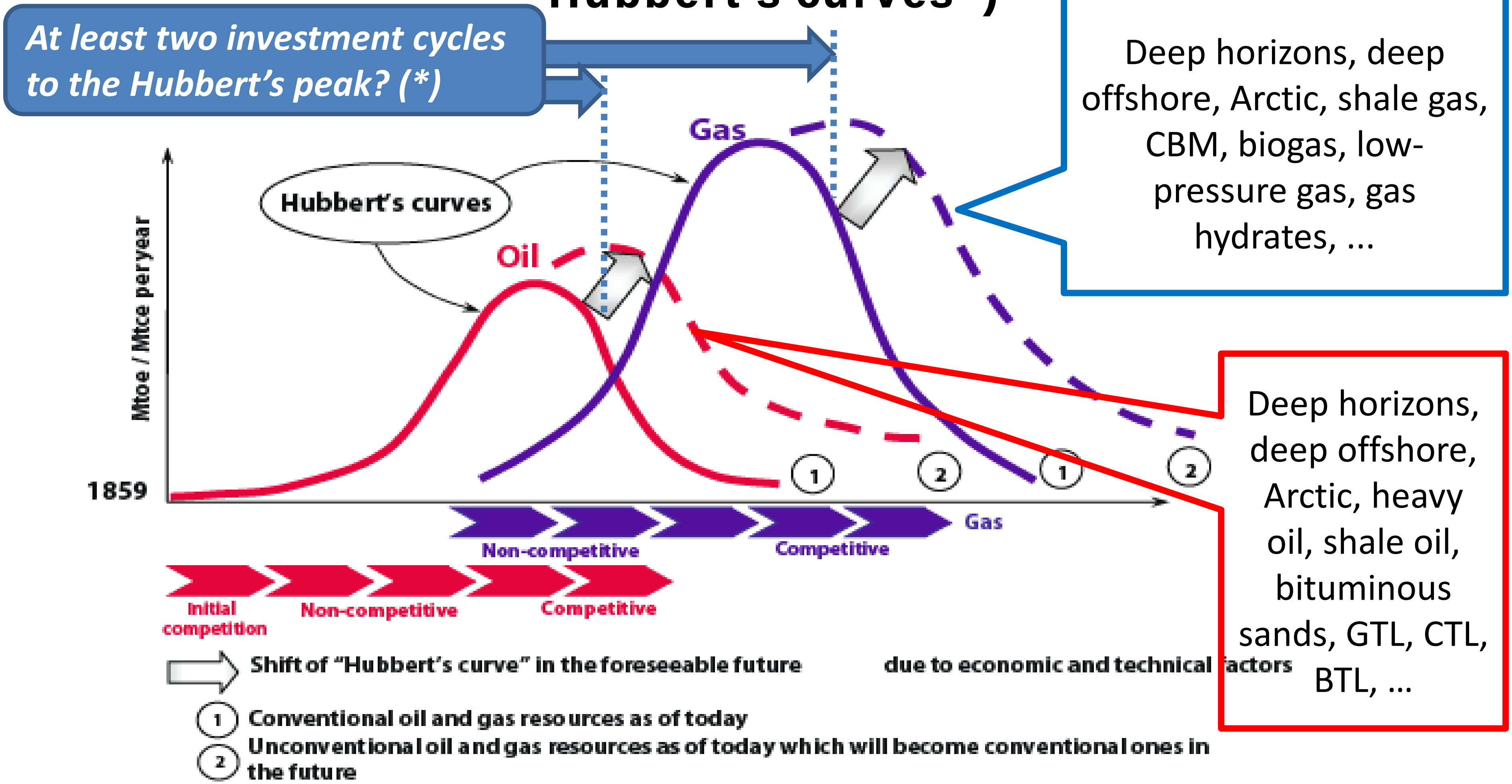
- **IEA (2012)**: to limit global warming **by 2°C** without large-scale implementation of carbon capture & storage (CCS) = not be able to consume (*) **MORE THAN ONE THIRD** of global proven recoverable reserves (PRR) of hydrocarbons (HC) up to 2050
- *OR:* cumulative future CO2 emissions from ***current*** PRR HC volumes are **THREE 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)

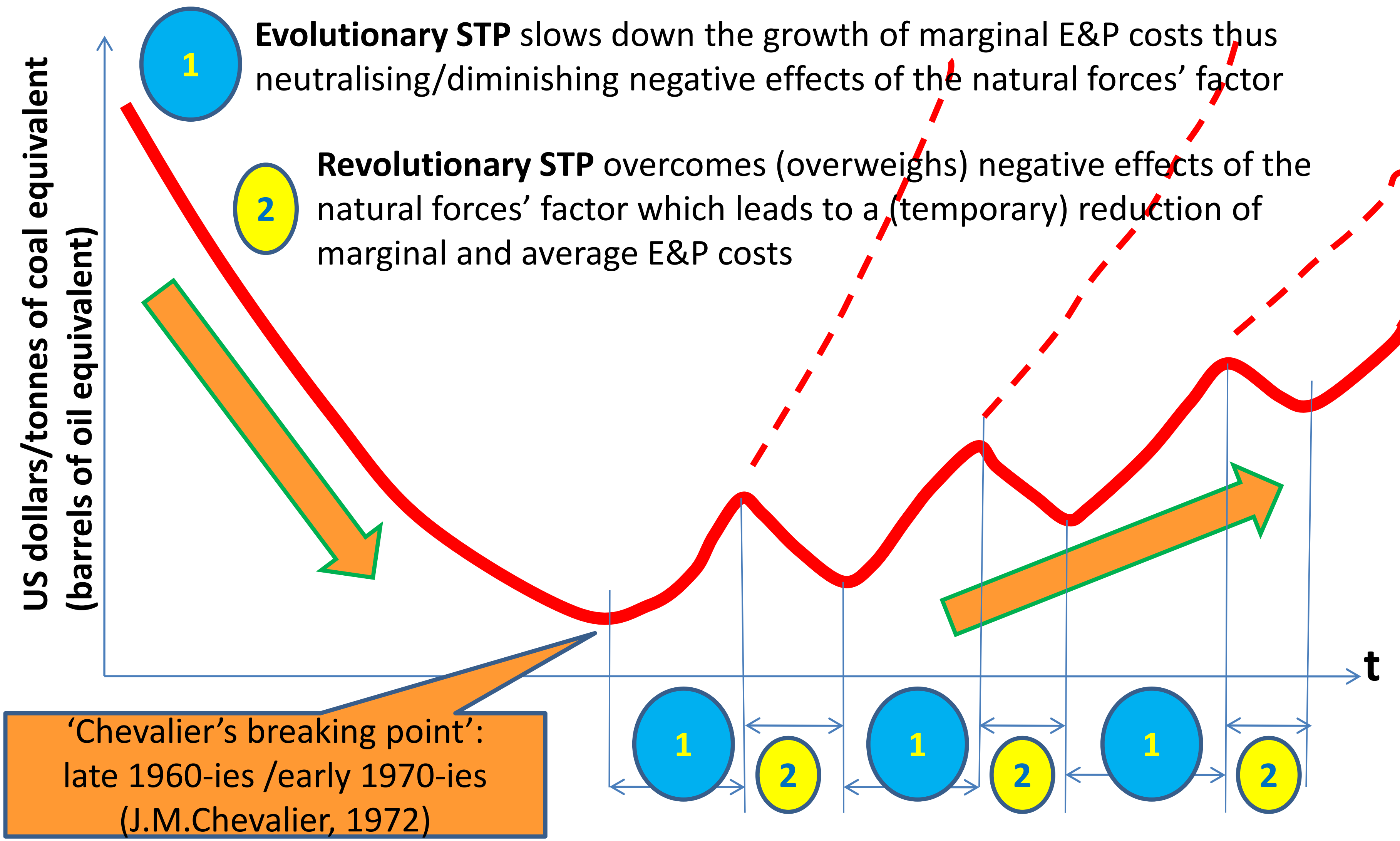
- **PAST:** possible, though in a rather distant future (at least post 2 global invest cycles), if any at all, supply side limitations due to dominant non-renewable character of energy resource base =>
  - "Hubbert's curve" (1949) => bell-type production curve for non-renewable resource extraction => "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)

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



(*) 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

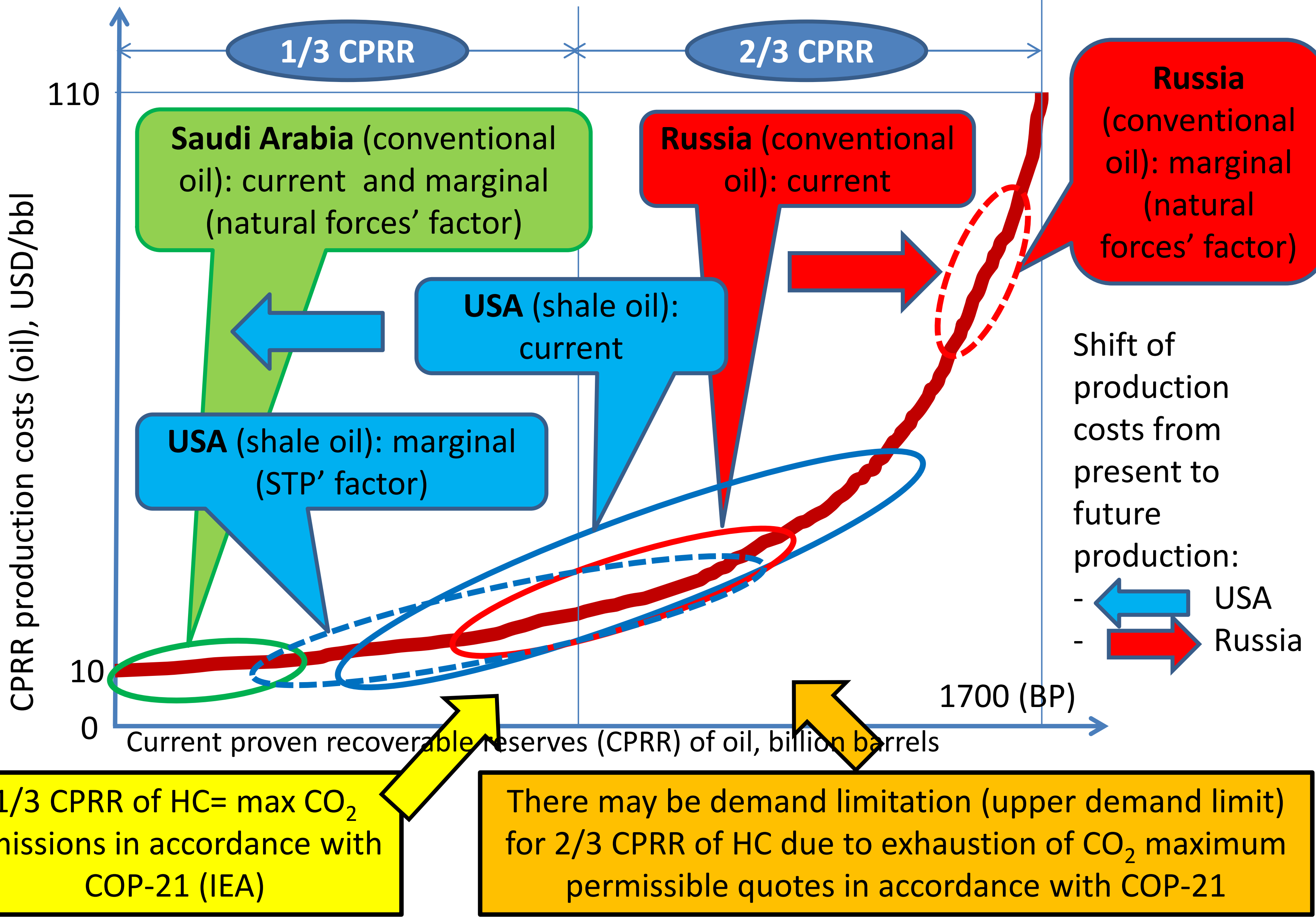
Impact of revolutionary and evolutionary STP on changing exploration and production (E&P) costs for conventional hydrocarbons in the period of growing marginal costs (after 'Chevalier's breaking point', late 1960-ies/early 1970-ies)



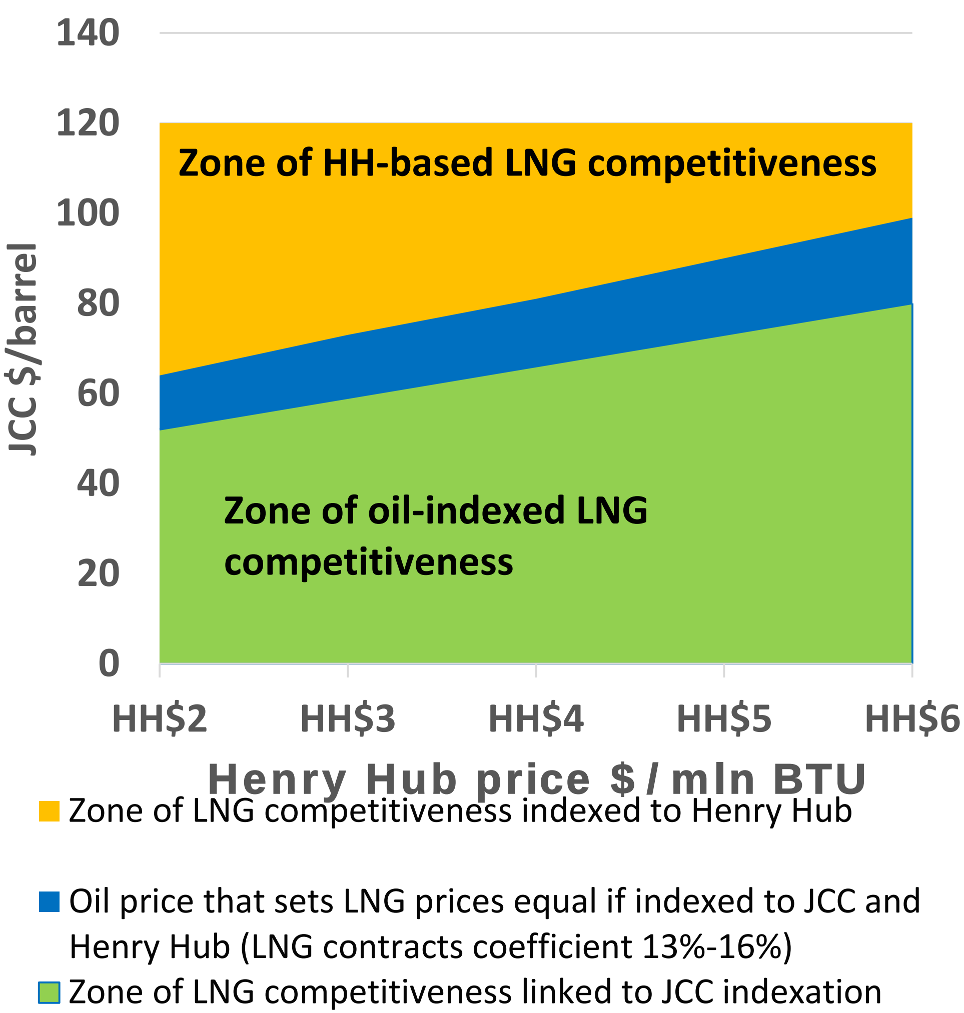
COP-21 & New Paradigm of Energy Development (2)

- **COP-21might radically change 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 CPRR might be demanded by global economy
  - 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 **???**

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



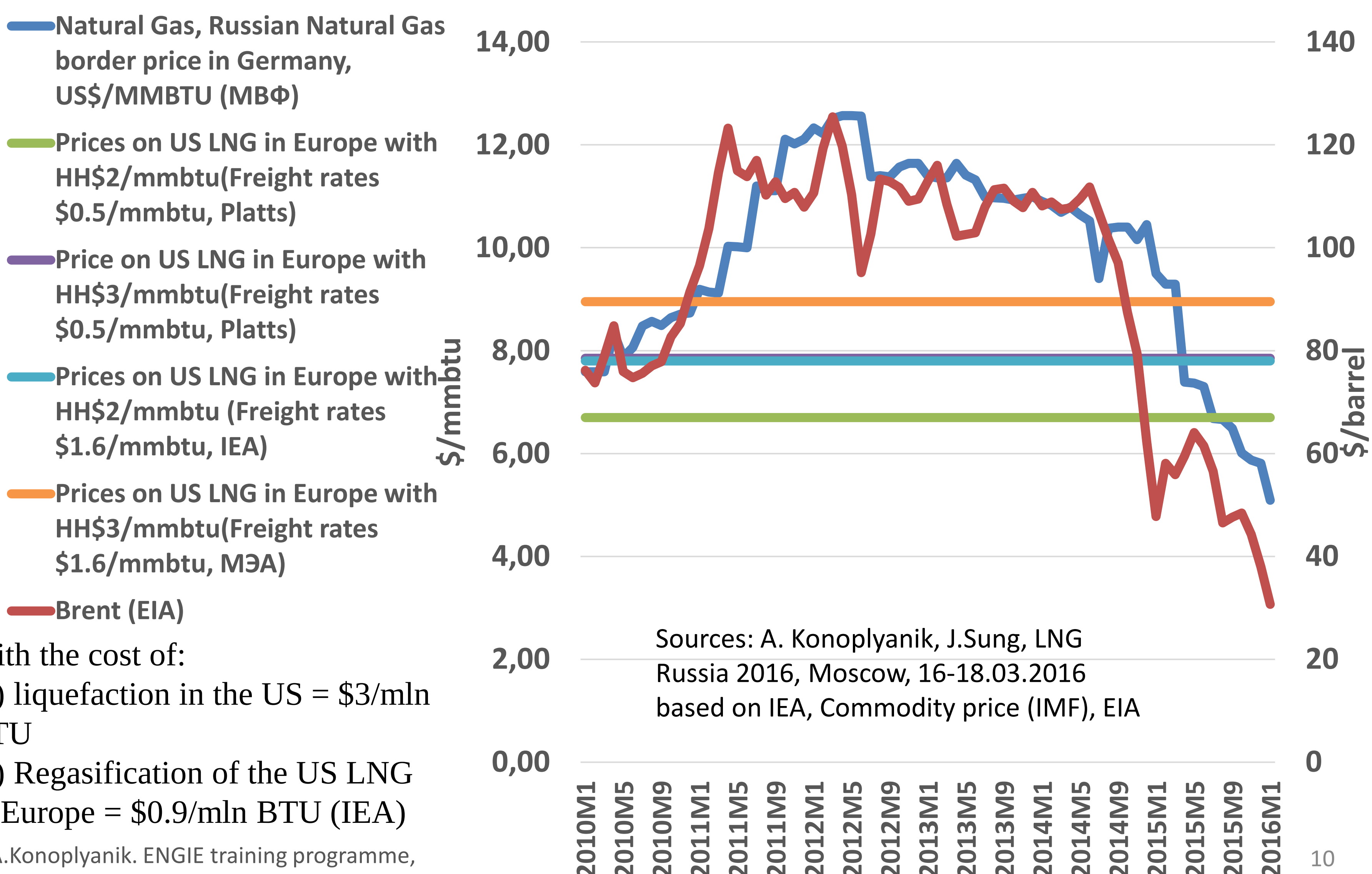
Zones of LNG competitiveness in Asia indexed to JCC (NBRV pricing) and Henry Hub (cost-plus pricing)



- 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*

Sources: A. Konoplyanik, J.Sung, LNG Russia 2016, Moscow, 16-18.03.2016

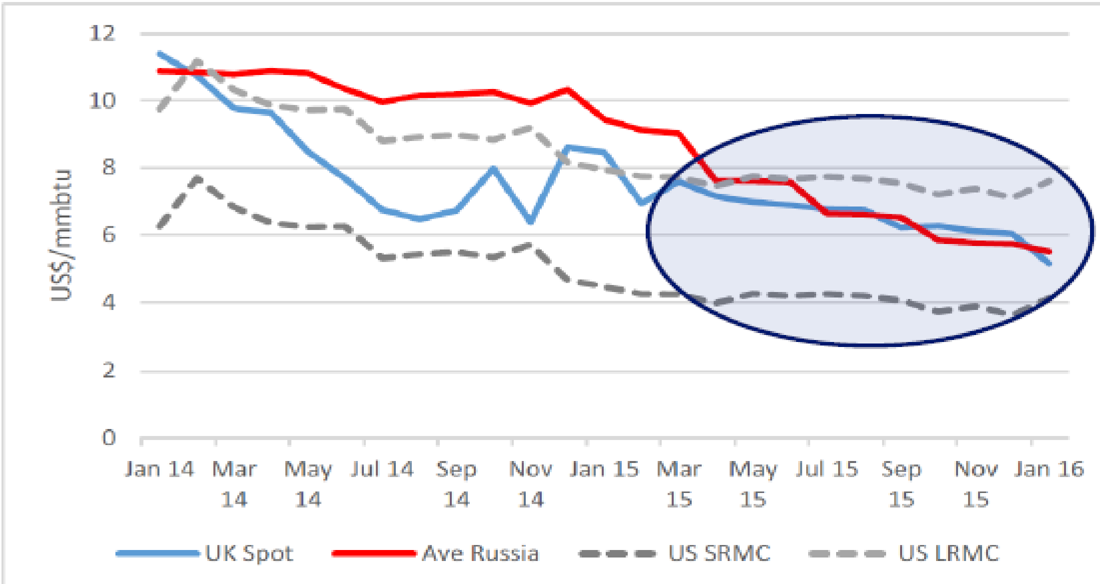
US LNG prices compared against Russian pipeline gas in Europe



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)

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.

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April 2016

Taken from:
Andreas Rau, CEONET4GAS, 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).

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?*

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

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) =>

- to present in different Western "studies" **AS IF RUSSIAN GAS IS MORE DIRTY** than other gases (both pipeline & LNG) &/or other fossil fuels &/or RES, like (*):
  - 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 - of the same origin?*
- *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

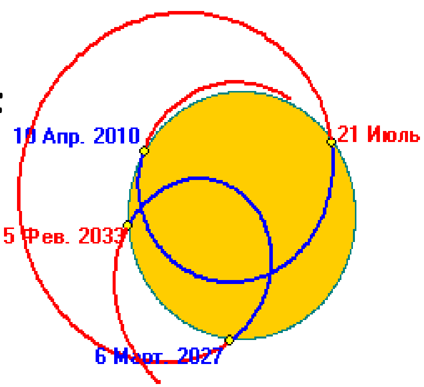
And in the end… Whether the whole concept of man's irreversible impact on climate change is well justified?

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

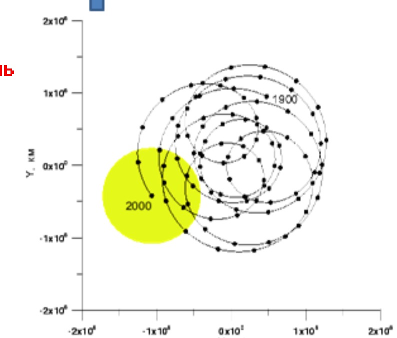
As known, the Earth runs not around the Sun, but around mass center of Solar System (MCSS) which stays away of center of the Sun (CS) & constantly moves. In the period measured by decades deviation of MCSS from CS is comparable with diameter of the Sun => flow of Solar energy to the Earth fluctuates.

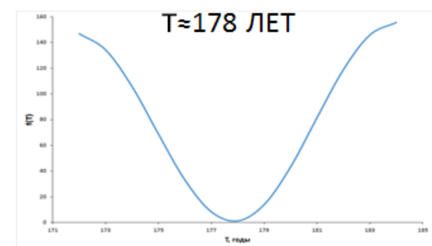
These fluctuations (±24 W/sq.m) BY THE ORDER (10 times) HIGHER than increment of this flow (2.4 W/sq.m), which International Expert's Group on Climate Change called as "result of anthropogenically defined increase in GHG emissions"

"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"



$$\sigma_r \sim 1\% \Rightarrow \sigma_I \sim 2\% \Rightarrow 27\,\frac{\text{Вт}}{\text{м}^2} \gg 2.4\,\frac{\text{Вт}}{\text{м}^2}$$





$$f(T) = \sum_{i=6}^{9} \frac{m_i r_i}{T_i} \sin^2 \pi \frac{T}{T_i}$$

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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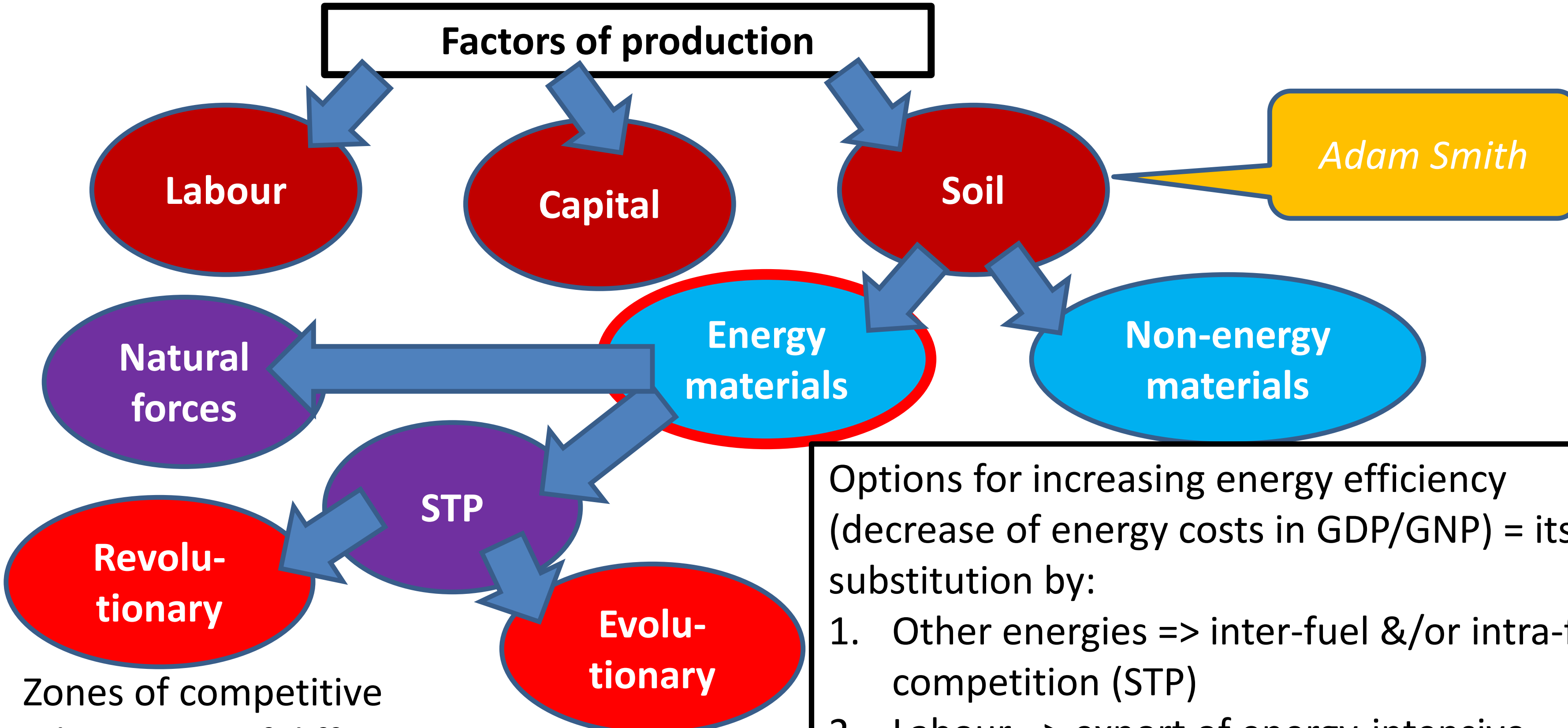
Reserve slides

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 diff. countries:

- Labour: developing (price), developed (quality)
- Capital: developed (Anglo-Saxon),
- Energy (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 LNG export model

Cost-plus model

"Throughput or pay" agreement model

Net-back replacement value model

Shale gas producer

LNG liquefaction & export terminal

115% HH price

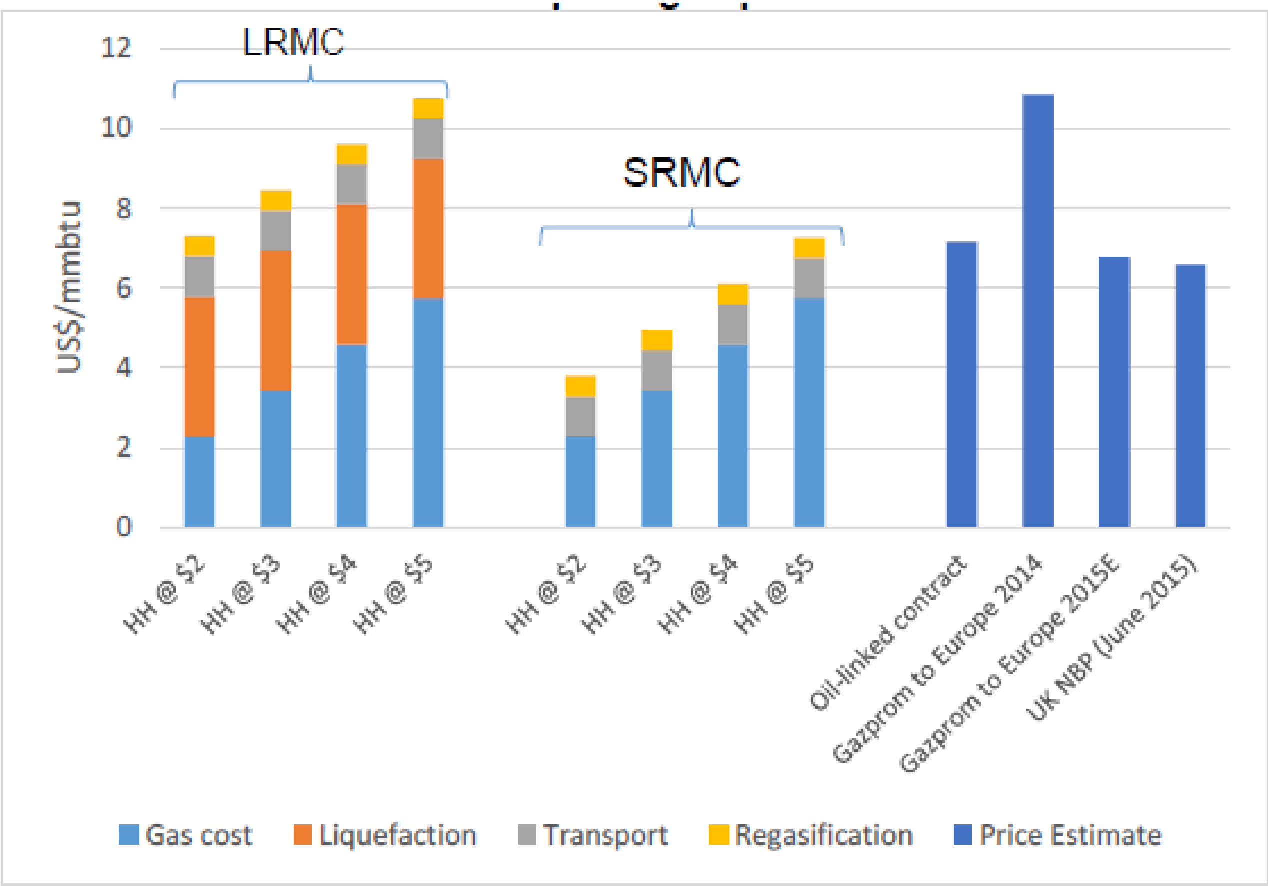
LNG exporter

Debt financing problems => Repayment of growing accumulated debt => Financial bubble

Capacity fee (2.25-3.0 USD/MMBTU) => Cheniere' Sabine-Pass model = risk-free business model for LNG terminal operator; all risks are on shale gas producer & LNG exporter

(1) Pricing problems = pricing scissors: purchasing FOB price going upward, selling CIF price going downward
(2) Price/cost problem = capacity fee fixed obligatory payment

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



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

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