

APR LNG competitiveness borders within various price models: netback replacement value in APR (Oil indexation - to JCC) vs. cost plus (Gas indexation – to Henry Hub)

Prof. Dr. Andrey A. Konoplyanik,

Adviser to Director General, Gazprom export LLC, Professor at the Chair “International Oil & Gas Business”, Russian State Gubkin Oil & Gas University

Jinsok Sung

Ph.D.Candidate at the Chair “International Oil & Gas Business”, Russian State Gubkin Oil & Gas University

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How LNG prices are formed in the Asia Pacific market

Gas/LNG pricing systems for the international trade

(1) Europe

- Indexation to price of oil products (Heavy fuel oil/gasoil) with discount

(Groningen formula = netback replacement value at the end user/«on the burner», from 1962 - onwards)

- Indexation to gas hubs *(from 2009 – onwards)*

(2) APR

- Indexation to crude oil prices in APR (*JCC, from 1970 - onwards*)

- Indexation to Henry Hub prices in USA *(from 2016, LNG export from USA)*

LNG contract formula for the international trades in APR

- $P(\text{LNG/CIF}) = A(\%) * JCC(\text{CIF}) + B$

“B” = constant

Slope “A” for LNG contracts:

- 17.2% (Oil parity of LNG by calorific value)

- Linkage to oil parity by calorific value with discount => “A” less than 17.2%, so that LNG can be competitive with JCC

Why JCC?

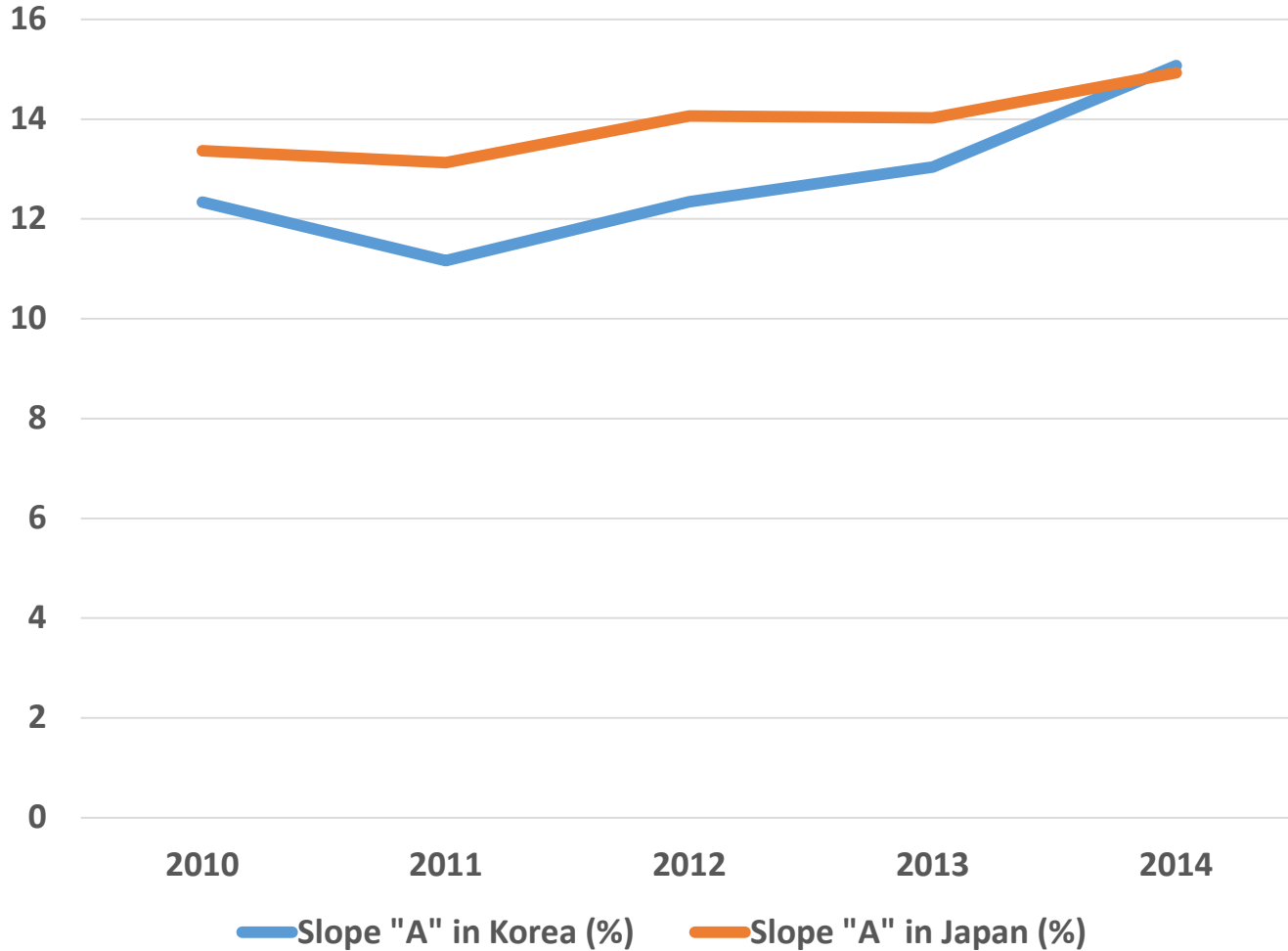
Japan = the first importer of LNG in Asia (from 1969): Middle East crude oil (high sulphur Arabian Heavy oil) as main fuel for electricity generation in Japan in the 70's => direct competition between LNG and crude oil in Japan at power generation sector => linkage to JCC

Source : Putting a Price on Energy: International Pricing Mechanisms for Oil and Gas (Energy Charter Secretariat, 2007);
The Pricing of Internationally Traded Gas (OIES, 2012)

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Slope "A" for LNG contracts in Japan and Korea – by annual average import volume as a whole from 2010 – 2014 (CIF prices)

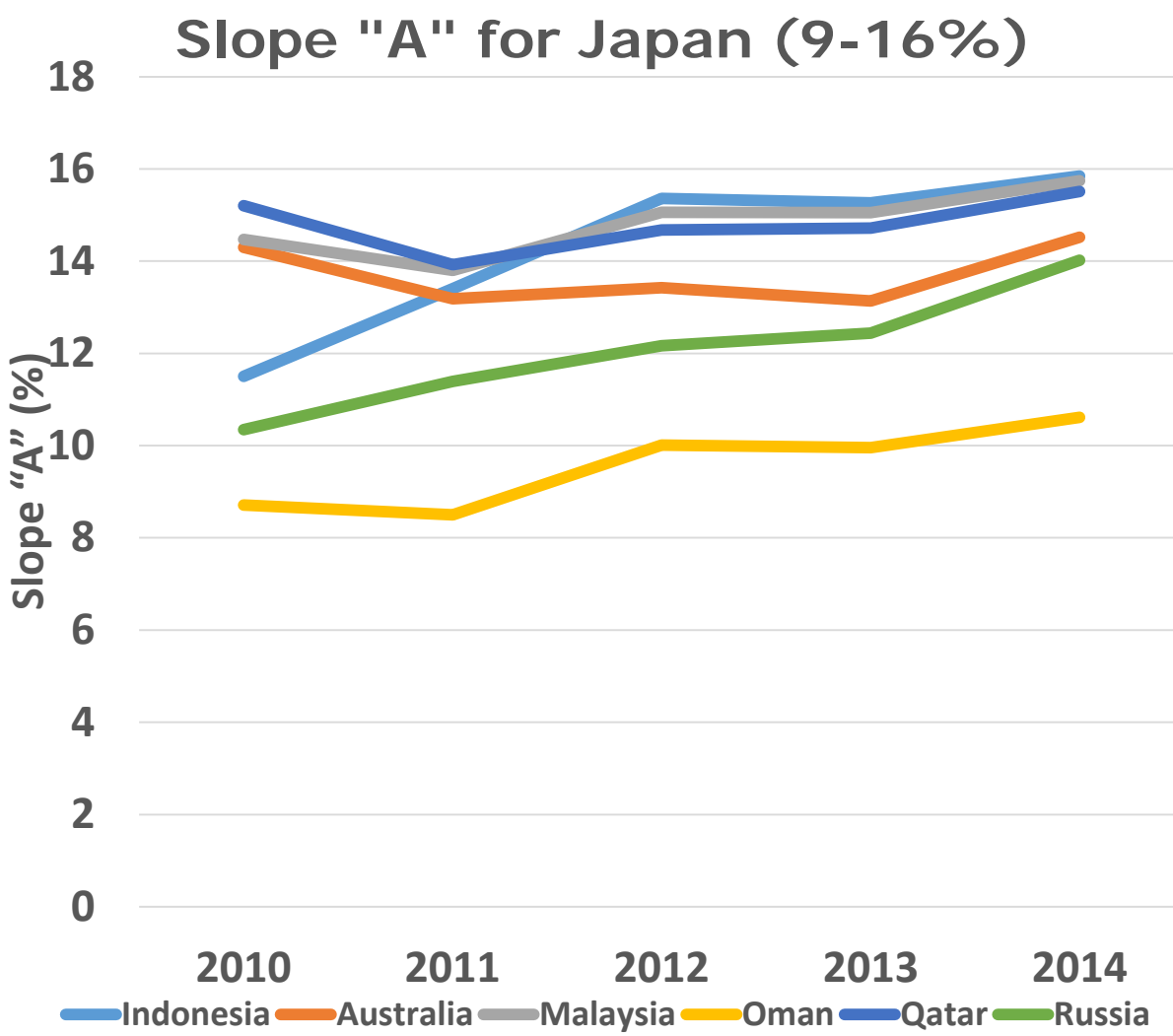
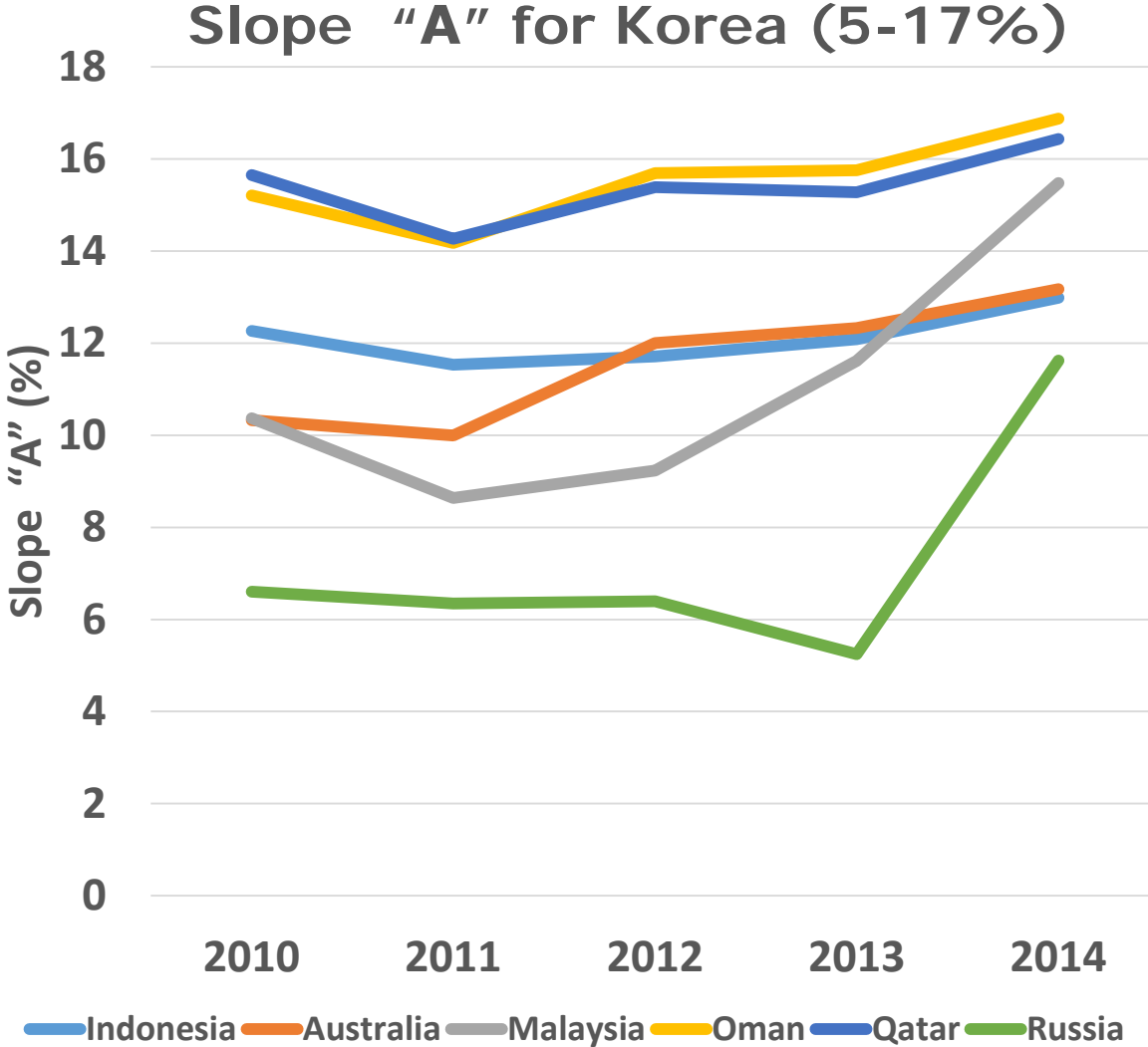


Slope "A" in 2010-2014 fluctuates between:

- Japan – **13%-15%**
- Korea – **11%-15%**

Source: Authors, according to customs statistics of Japan and Korea

Slope "A" for LNG contracts in Japan and Korea - by suppliers in 2010 – 2014 (CIF prices)



Source: Authors according to customs statistics of Japan and Korea

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

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Price dynamics of JCC and Henry Hub

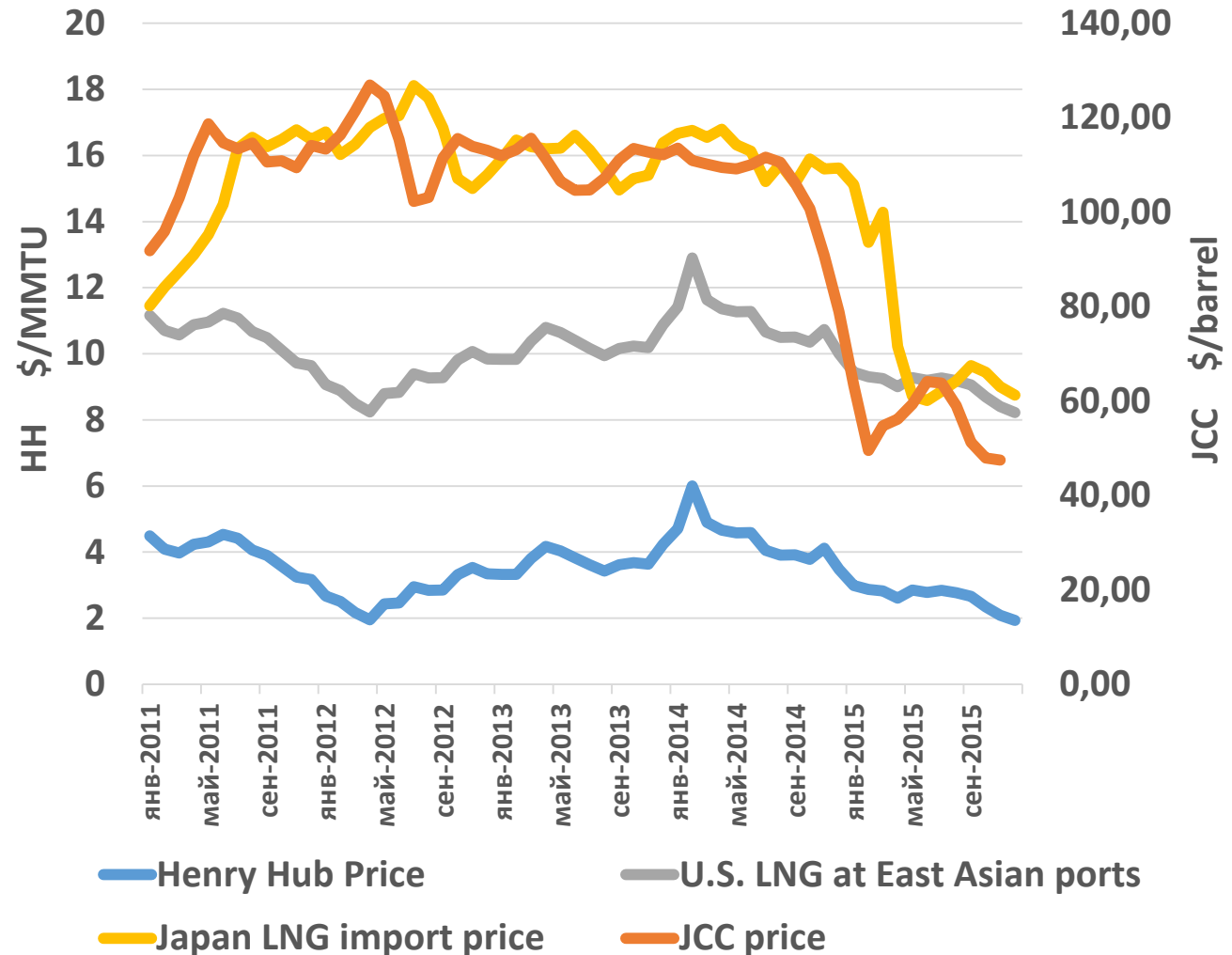
- (1) 2011-2014: multidirectional dynamics of LNG prices with indexation to JCC and gas (Henry Hub) in APR:
 - high crude oil prices,
 - decrease of Henry Hub prices due to increase of shale gas production in USA and absence of possibility for gas export (oversupply of the domestic market)
- (2) From 2014 - onwards: decline of LNG prices with linkage to oil (as a result of global oil prices fall) and Henry Hub prices maintaining low levels (\$2-\$4/MMBTU in 2015)

Will Henry Hub prices continue to stay at low level after:

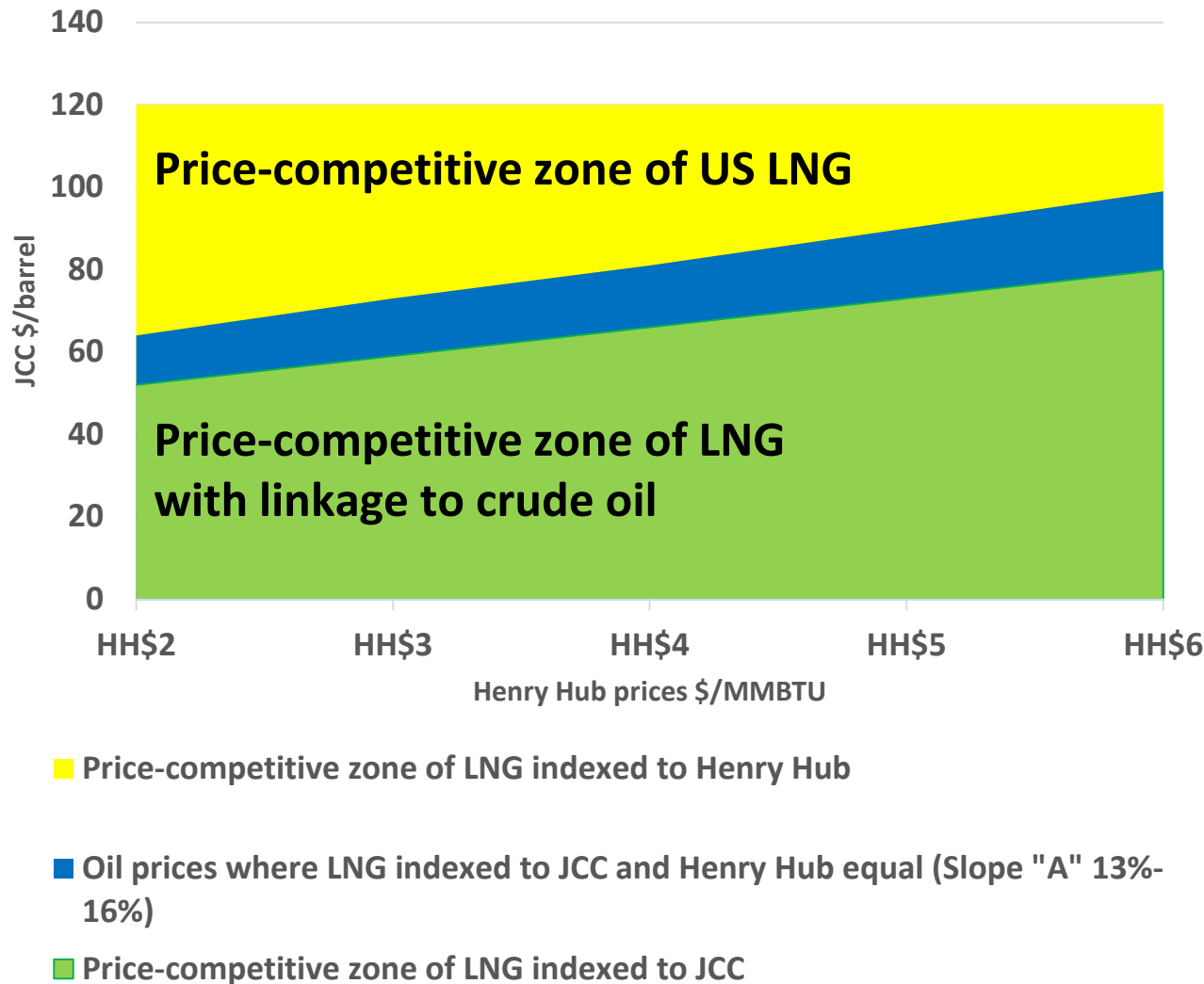
*beginning of LNG export from USA?

*export of pipeline gas to Mexico?

Price "CIF" of LNG with indexation to JCC and Henry Hub in the East Asia



Price-competitive zones of LNG with indexation to JCC and Henry Hub in Asia

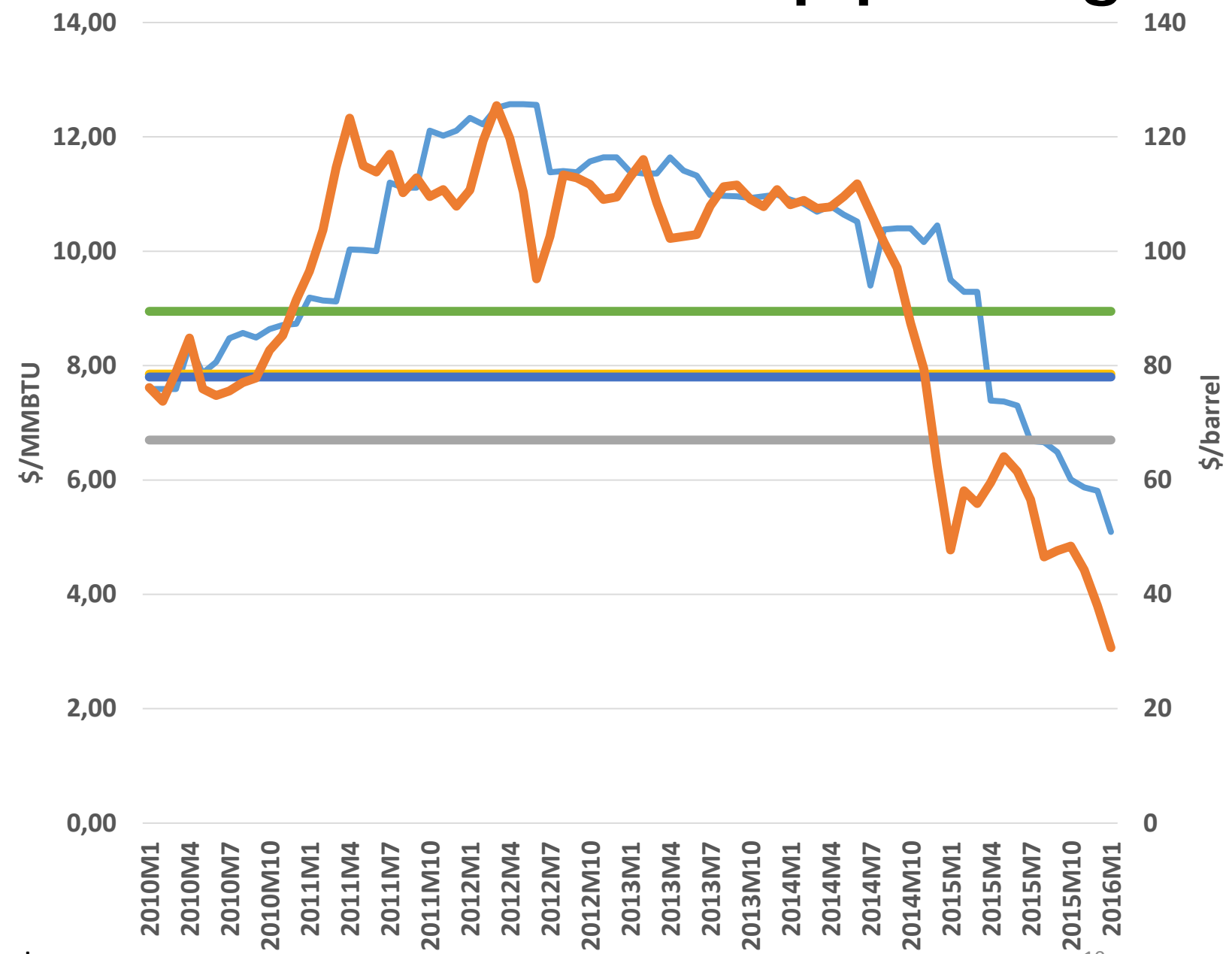


- At Henry Hub price \$2/MMBTU (*lowest price: April 2012/beginning of 2016*), LNG with linkage to oil is competitive in Asia at price **JCC < \$50/barrel (today)**
- At Henry Hub price \$6/MMBTU (*maximum price: beginning of 2014*), LNG with linkage to oil is price-competitive in Asia at price **JCC < \$80/barrel (mid-2010 - end of 2014)**
- At JCC price higher than \$100/barrel, US LNG start becoming price-competitive, if Henry Hub price exceeds \$6/MMBTU, however, ***will oil price of \$100/barrel or higher return?***

Price comparison of U.S. LNG and Russian pipeline gas in Europe

- Natural Gas, Russian Natural Gas border price in Germany, US\$/MMBTU (IMF)
- Prices of U.S.LNG in Europe at HH \$2/MMBTU(transportation cost, \$0.5/mmbtu, Platts)
- Prices of U.S.LNG in Europe at HH\$3/MMBTU(transportation cost,\$0.5/mmbtu,Platts)
- Prices of U.S.LNG in Europe at HH\$2/MMBTU (transportation cost, \$1.6/MMBTU, IEA)
- Prices of U.S.LNG in Europe at HH\$3/MMBTU (transportation cast, \$1.6/mmbtu, IEA)
- Brent (EIA)

- In case of
 (1) liquefaction cost in USA \$3/MMBTU
 (2) regasification of U.S.LNG in Europe \$0.9/MMBTU (IEA)



Source: IEA, Commodity price(IMF), EIA, Authors

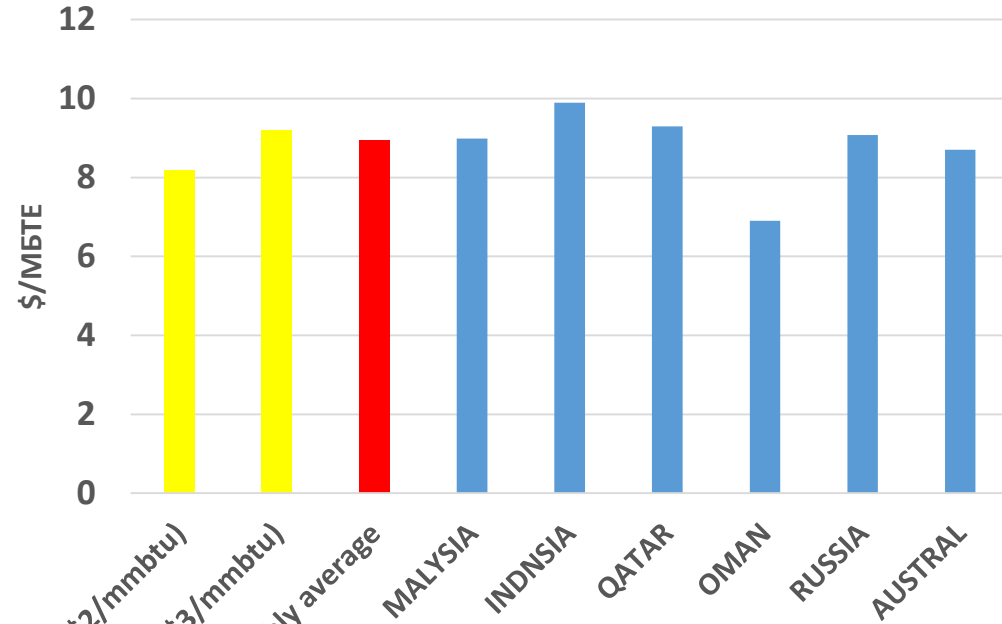
Conclusion

- Wide (5-17%) range of slope “A” for spot and fixed-term LNG contracts in Japan and S. Korea, however, annual average level of slope “A” fluctuates between 11%-15% in 2010 - 2014
- Price-competitive zones of LNG with oil linkage in Asia:
 - (1) at JCC < \$50/barrel, if Henry Hub price = \$2/MMBTU ,
 - (2) at JCC < \$80/barrel, if Henry Hub = \$6/MMBTU,
 - (3) at JCC higher \$100/barrel, US LNG is price-competitive in APR, if Henry Hub price exceeds \$6/MMBTU, however, will oil price over \$100/barrel return?
- Today Russian gas indexed to petroleum products is price-competitive with US LNG in Europe

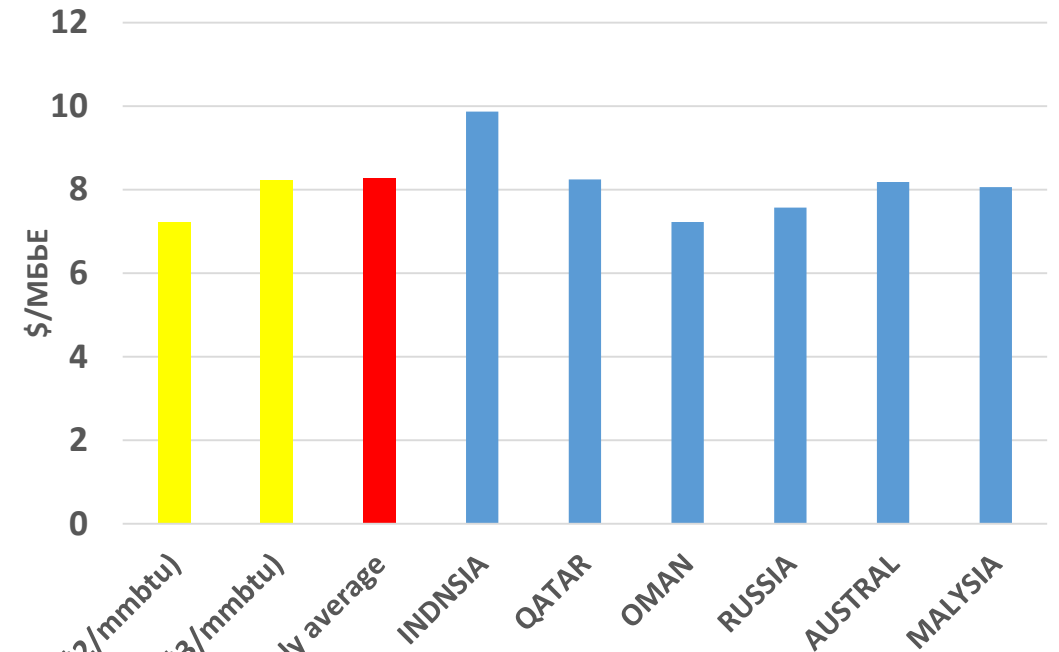
Reserve slides

LNG prices with indexation to oil (JCC) and gas (Henry Hub) in Japan (August, December 2015)

LNG prices (CIF) in Japan (August 2015)
JCC \$59/barrel Henry Hub \$2.77/MMBTU



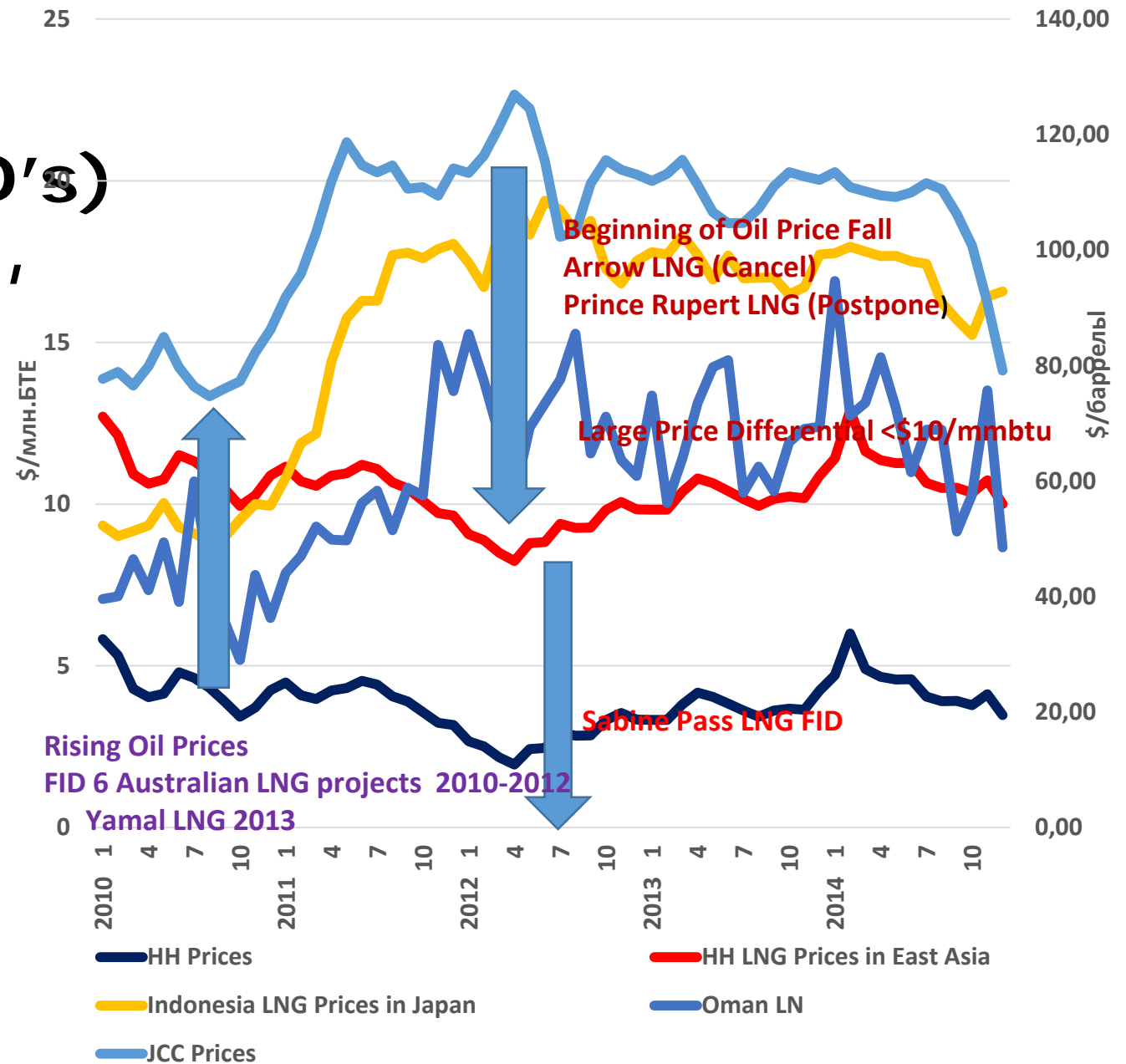
LNG prices (CIF) in Japan (December 2015)
JCC \$43/barrel, Henry Hub \$1.93/MMBTU



Influence of oil and gas prices on the Final Investment Decisions (FID's) of LNG projects in Canada, Australia and USA

Examples of LNG projects, for which, FID's are postponed or cancelled due to low oil and gas prices:

- (1) **Lake Charles LNG** (USA/Received permission from FERC/FID not taken)
- (2) **Prince Rupert LNG** (Canada/postponed)
- (3) **LNG Canada** (Canada/postponed)
- (4) **Arrow LNG** (Australia/cancelled)



Thank you for your attention!

www.konoplyanik.ru

andrey@konoplyanik.ru

a.konoplyanik@gazpromexport.com

jinsok.sung@gmail.com

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