Anti-Russian economic sanctions'2014 in Oil & Gas - & Russia's Arctic offshore development

Dr. Prof. Andrey A.Konoplyanik,
Adviser to Director General, Gazprom export LLC,
Professor, Chair "International Oil & Gas Business",
Russian State Gubkin Oil & Gas University
www.konoplyanik.ru

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Deep offshore vs. outer space

	Altitude / water depth	Number of visitors
Outer space (*)	Min = 19-20 km ISS = 337-430 km	**?**
Moon	Av. = 384 400 km	**?**
Mariana trench	11 km	**?**

(*) ISS = International Space Station. Orbital space flight = at least 1 full revolution around Earth. Ballistic space flight: (a) with trajectory exceeding 100 km altitude (classification *Fédération Aéronautique Internationale, FAI*) or (b) with trajectory exceeding 50 miles (80.5 km) but below 100 km altitude (classification *United State Air Forces, USAF*) (https://ru.wikipedia.org).

Deep offshore is much more difficult to develop than outer space

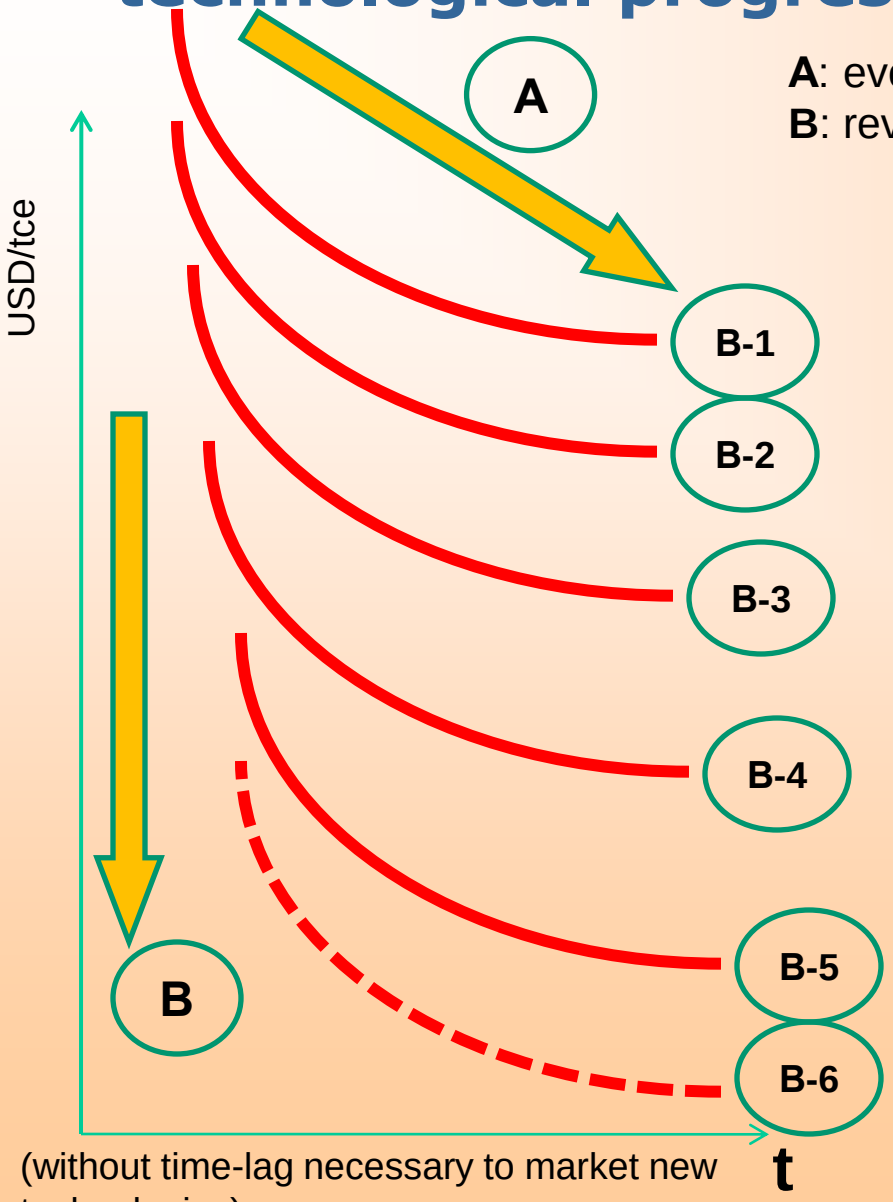
	Altitude / water depth	Number of visitors
Outer space (*)	Min = 19-20 km ISS = 337-430 km	**558** from 35 states (since 1961)(25.11.2014)
Moon	Av. = 384 400 km	**12** (since 1969)
Mariana trench	11 km	**3** = 2(1960) + 1(2012)

(*) ISS = International Space Station; as of 25.11.2014: 558 made orbital space flight; 7 made ballistic space flight with trajectory exceeding 100 km altitude (classification *Fédération Aéronautique Internationale*, *FAI*); 6 made ballistic space flight with trajectory exceeding 50 miles (80.5 km) but below 100 km altitude (classification *United State Air Forces*, *USAF*) (https://ru.wikipedia.org).

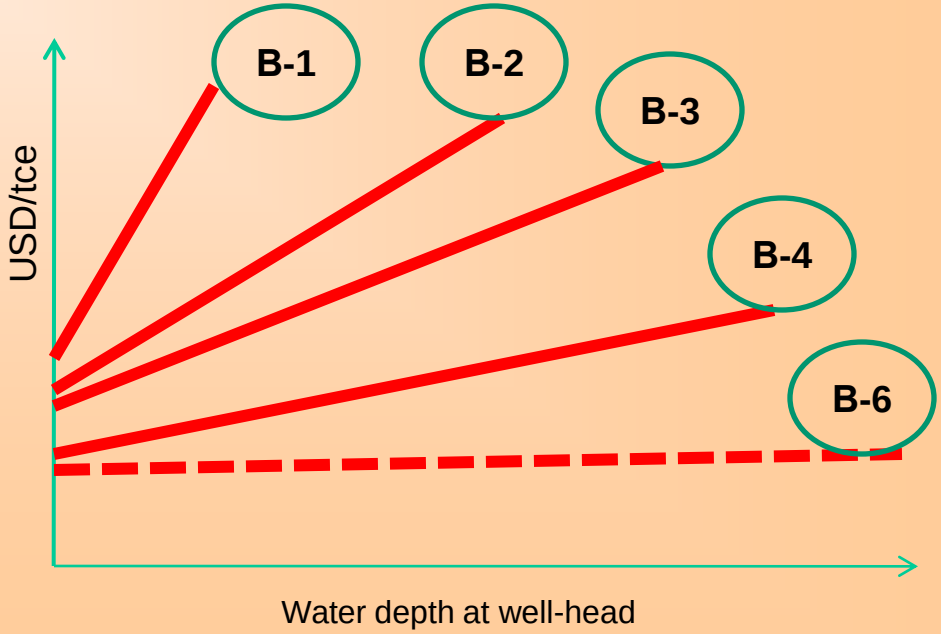
"Learning curves": evolutionary & revolutionary technological progress in offshore oil & gas

A: evolutionary progress (learning curves)
B: revolutionary progress

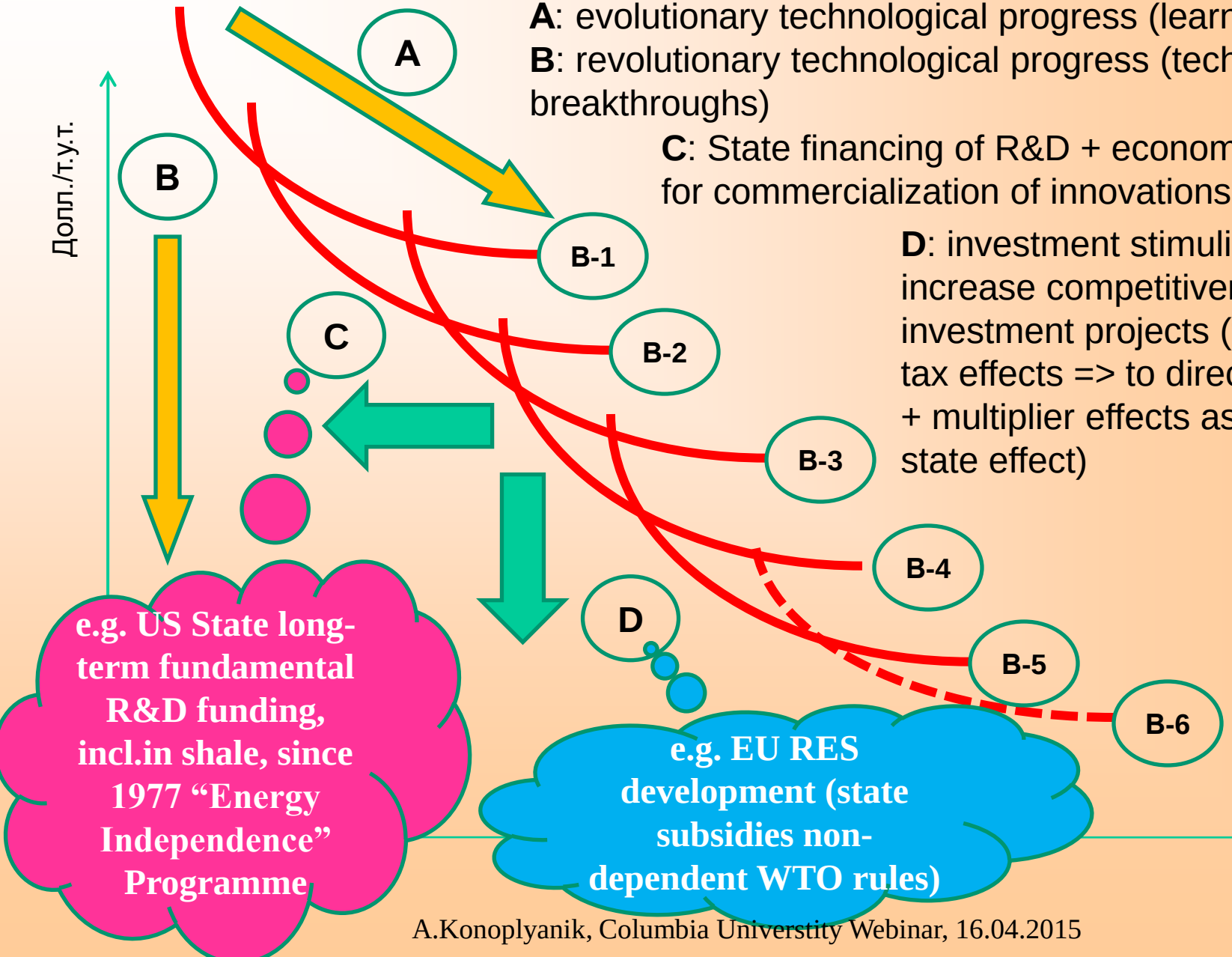
Offshore technologies:
B-1: conventional platforms (piled & gravity)
B-2: semisubmersibles + tension-leg platforms
B-3: semisubmersibles + dynamic positioning
B-4: no platform (subsea wellhead completion)
B-5: floating LNG
B-6: ???



(without time-lag necessary to market new technologies)



"Learning curves" & the role of State



A: evolutionary technological progress (learning curves)
B: revolutionary technological progress (technological breakthroughs)

C: State financing of R&D + economic stimuli for commercialization of innovations

D: investment stimuli to increase competitiveness of investment projects (from direct tax effects => to direct + indirect + multiplier effects as criteria for state effect)

Major stages of Russia offshore development

Source: Ю.Ампилов. Освоение шельфа Арктики и Дальнего Востока: проблемы и перспективы. – "[Russia] Offshore", №4(6), Nov.2014, p.9

2002-2014: Discoveries in gulfs & bays of Kara Sea, production started offshore Sakhalin Island.
Prirazlomnoye (2014)
Shtokmanovskoye (2025?)
Leningradskoye (2030?)
Rusanovskoye (2035?)
New areas of Arctic offshore (2050?)

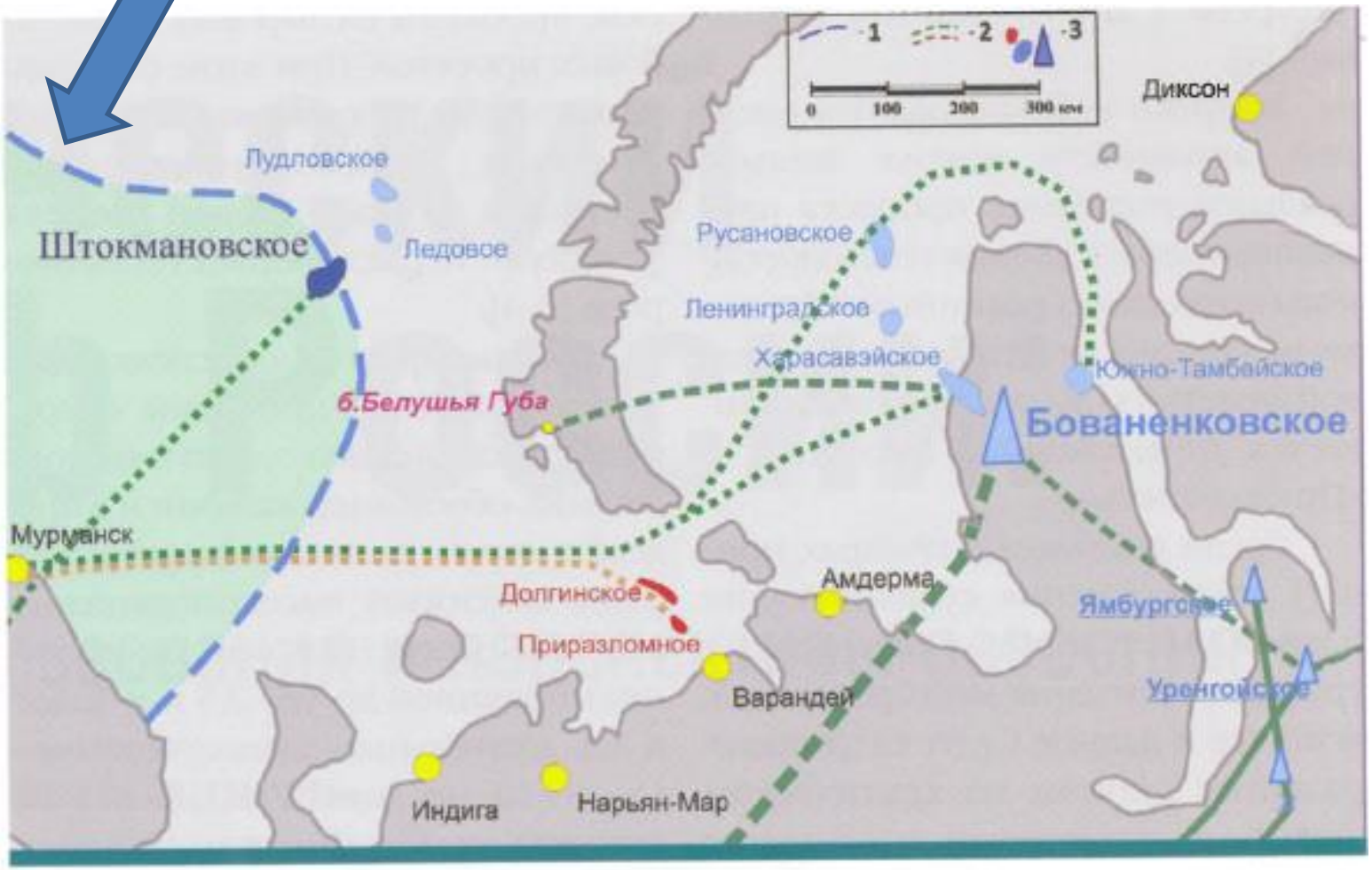
1972-1980: Beginning of systematic offshore geo-physical surveys, prior to this – field trials only

1980-1985: Intensification of geo-physical surveys, creation of "Glavmorneftegaz", construction of a series of drill-ships & rigs

1985-1990: Major discoveries of Arctic & Far Eastern offshore fields, which establish today the fundament of resource base for future [offshore] oil & gas production

What influence of sanctions on Russian Arctic offshore?

Average annual ice cover frontier in Russian Arctic offshore



Принципиальная схема вариантов организации транспорта нефти и газа с арктического шельфа и полуострова Ямал:
1 — среднегодовая граница ледового покрова; 2 — возможные трассы вывоза углеводородов; 3 — месторождения нефти и газа

Source: Григорьев Г.А., Новиков Ю.Н. Арктический шельф России: состояние недропользования и перспективы освоения. – «Нефть и капитал», №3 (219), март 2015, с.32 (30-33)(Arctic shelf of Russia: state of subsoil use and development prospects).

Average size of offshore licensing areas in Russia & worldwide – vs level of their exploration

Рисунок 3

Средние размеры лицензионных участков на шельфе в разных странах

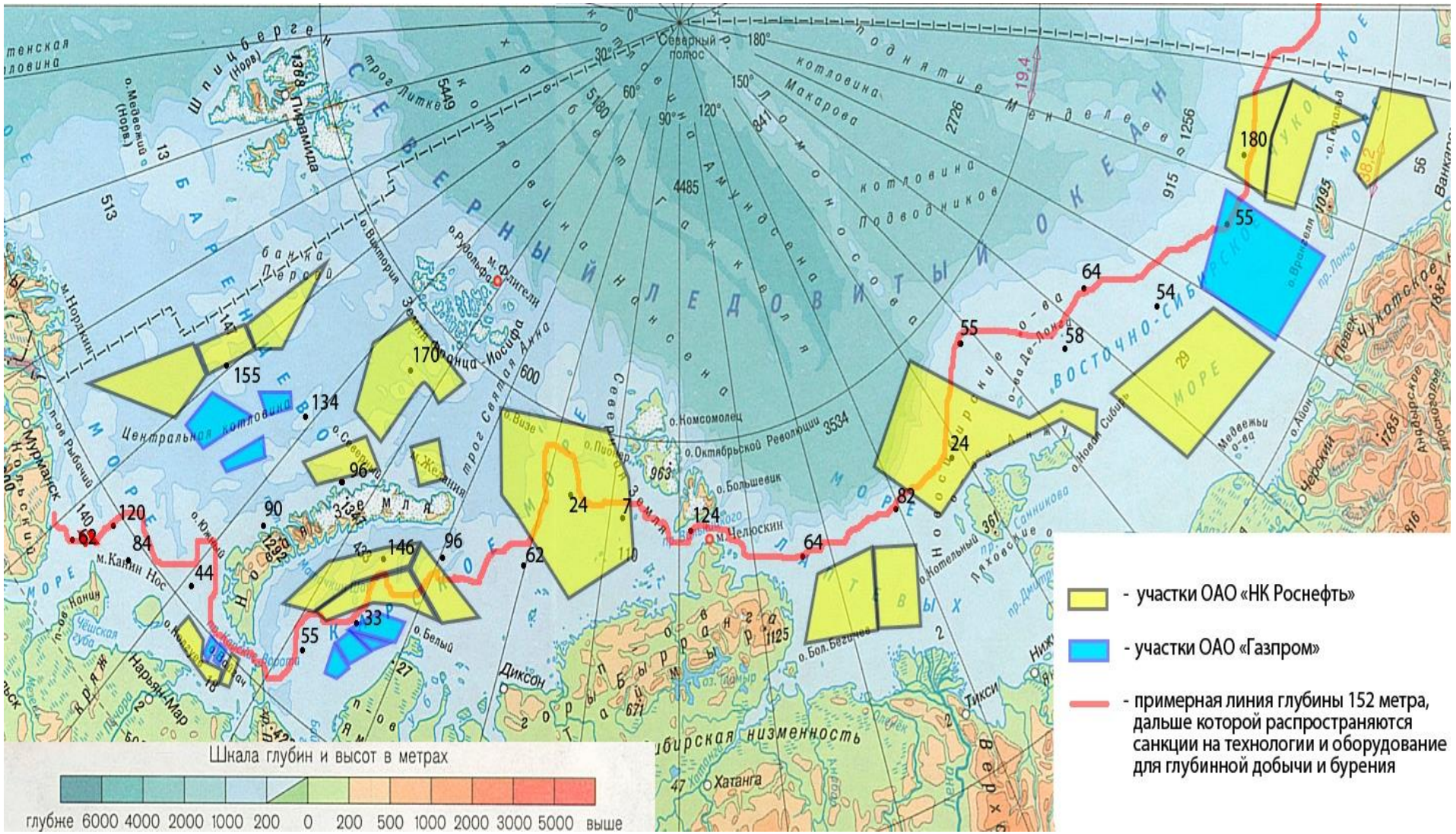
Source: Ю.Ампилов. Освоение шельфа Арктики и Дальнего Востока: проблемы и перспективы. – "[Russia] Offshore", №4(6), Nov.2014, p.9, 12.

"Through the whole period of Russia's offshore activities more than 200 offshore wells were drilled, though the level of Russia offshore exploration, compared to its neighbours, is appr. 20 times lower than in Norwegian offshore & 10 times lower than in US part of Chukchi Sea"

Background data on Western part of Russian Arctic offshore (Kara Sea - 0,21 linear km/km2, Barents & Pechora Sea - 0,5 linear km/km2) much higher than on its Eastern part, but significantly lower than in analogical foreign areas (Norway's part of Barents sea - 1,01 linear km/km2)

Huge unit size & cumulative acreage of licensing areas, severe environment, low level of background data & exploratory activities => huge demand for CAPEX, for access to technologies & finance under existing ambitions. Are they affordable with/without sanctions? Where can they come from?

Russian Arctic offshore licensing areas & Western technology sanctions cordon water depth line



Prepared by V.Buzovsky, Gubkin RSO&GU, Chair “International O&G Business”, Master programme 2014-2016.
V.Buzovsky. “Factor analysis of Russian Arctic shelf exploration. Strategic differences between OJSC "NK Rosneft" and OJSC "Gazprom" approaches”. – Presented at Gubkin students scientific Conference April-2015

Arctic offshore: different sanctions' effect for deep & shallow waters

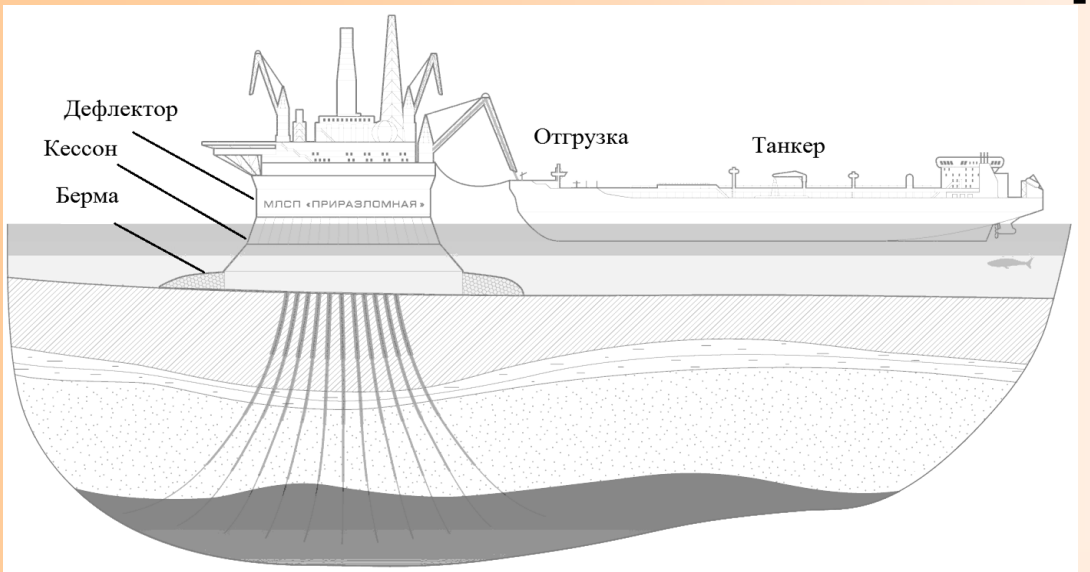
Shallow waters

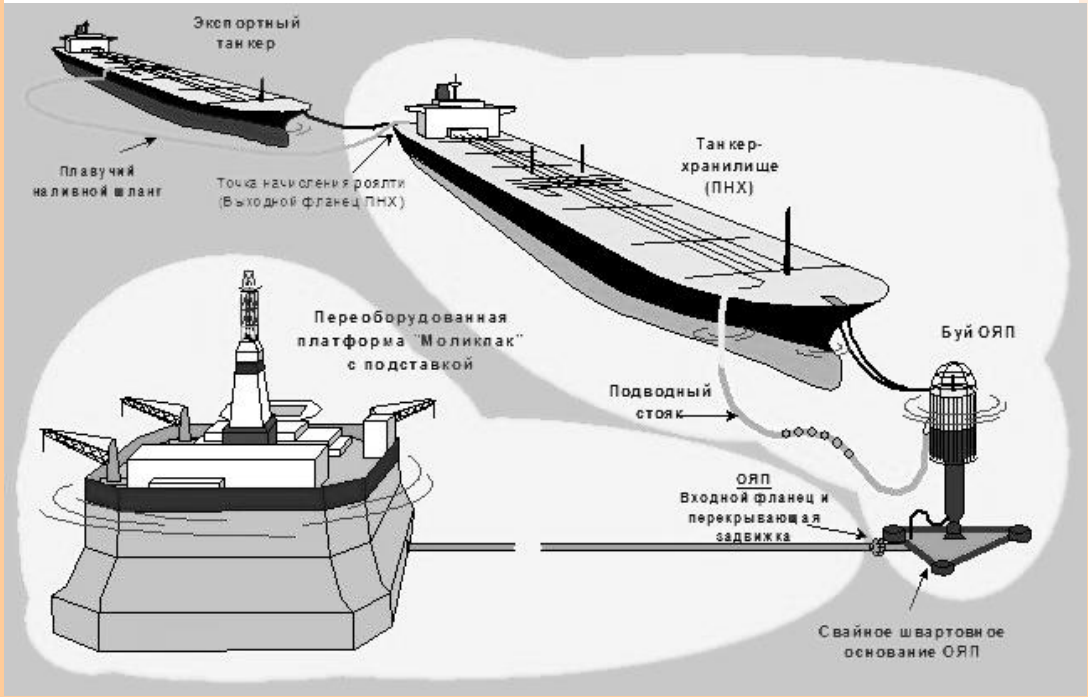
- Evolutionary STP available (cost decrease due to learning curve), mostly Western experience
- Mostly artificial islands (non-retained, gravity, spray ice, metal caissons) or concrete gravity platforms (in latter case – within weak ice conditions
- Big institutional differences even under similar technical characteristics of projects (institutional learning curve in Russia => Prirazlomnoye vs Sakhalin-2 (1st stage) case
- Sanctions postpone today's shallow water development with available Western technologies => postpone possible environmental damages & costs overruns

Deep waters

- Current shallow-water technologies are not convertible/adaptable for deep-water development – technological breakthrough (B-6) is needed
- No technologies for Arctic deep offshore safe development available anywhere in the world today
- Revolutionary STP needed => demand for post-sanctions international cooperation starting with joint R&D
- Sanctions provide window of opportunities for adaptation of long-term state energy policy => to rethink "risk of spending (waste of) money for 'unburnable fuel' "

Prirazlomnoye *(above)* & Sakhalin-2 (1st stage) *(below)* projects: similar natural environment & technologies – different economic results. Why so? (1)





Sources:
http://www.gazprom.ru/about/production/projects/deposits/pnm/;
http://ingailow.my1.ru/news/karta_neftegazovykh_proektov_sakhalina_strategija_okhrany_okruzhajushhej_sredy_pri_osvoenii_neftegazovykh_mestorozhdeni/2014-04-11-38

Prepared by Yu.Popova & N.Troshina, Master programme 2014-2016, Chair "International Oil& Gas Business", Gubkin RSO&GU / "Comparative analysis of development factors of shelf projects Prirazlomnoye and Sakhalin-2: common and special" – Presented at Gubkin students scientific Conference April-2015.

Prirazlomnoye & Sakhalin-2 (1st stage) projects: similar natural environment & technologies – different economic results. *Similarities* (2)

Prirazlomnoye oilfield (Pechora Sea)

- Water depth 19-20 m, 60 km from shore
- tmin - 48 C°; weather window (no ice) 4 months; ice conditions 9-10 rate
- Gravity: Artificial island (metal caisson 126x126m, build by Rosshelf in Severodvinsk 1995-2002)
- Second-hand platform (derrick) – former North Sea Hutton (finally 90% need for modernization, costs overruns, etc.)
- 36 platform slots

Sakhalin-2, first phase: Piltun-Astokhskoye oilfield (Sakhalin offshore)

- Water depth 32 m
- tmin - 42 - 44 C°; weather window (no ice) 6 months; ice conditions 9-10 rate
- Gravity: Artificial island (metal caisson 111x111 m, ordered / built in Komsomolsk-on-Amur)
- Second-hand platform (derrick) – former Alaska Cook Inlet modernized in Korea
- 32 platform slots

Based on: Yu.Popova, N.Troshina. "Comparative analysis of development factors of shelf projects Prirazlomnoye and Sakhalin-2: common and special" – Presented at Gubkin students scientific Conference April-2015.

Prirazlomnoye & Sakhalin-2 (1st stage) projects: similar natural environment & technologies – different economic results. *Differences* (3)

Prirazlomnoye oilfield (Pechora Sea)

- License
- License awarded 1993, works started 2003, first oil Dec'2013 => **10/21Y**
- Finally one single Russian company (multiple attempts to create different JV/consortia failed)
- Internal conflict of interest long existed around Rosshelf (O&G producers vs manufacturer)

Sakhalin-2, first phase: Piltun-Astokhskoye oilfield (Sakhalin offshore)

- PSA
- PSA signed 1994, effective date 1996, first oil 1999 => **3/5Y**
- Consortia initially of only foreign companies, then Gazprom joined => "learning curve" for Gazprom
- Internal conflict of interests between foreign companies quickly solved

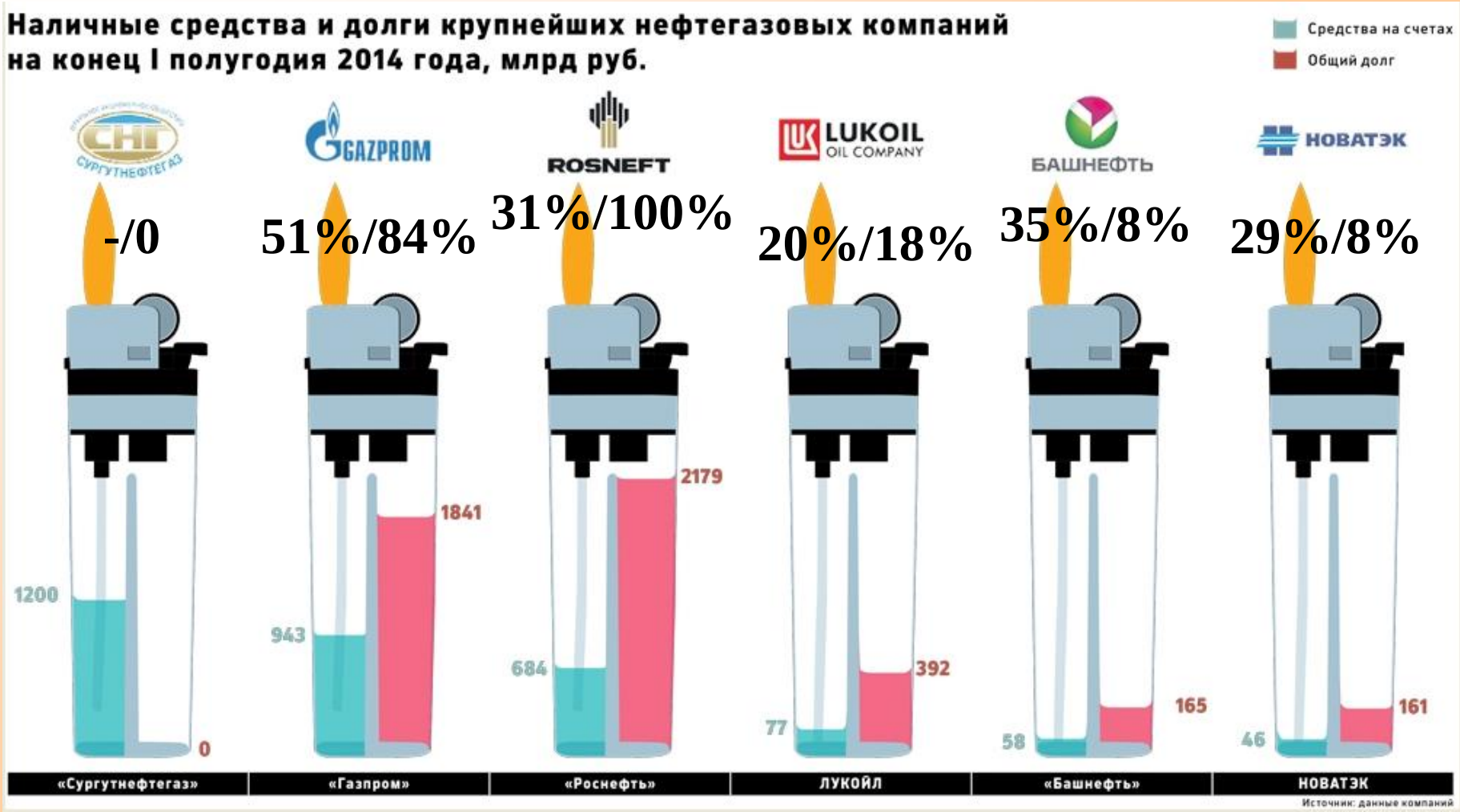
Based on: Yu.Popova, N.Troshina. "Comparative analysis of development factors of shelf projects Prirazlomnoye and Sakhalin-2: common and special" – Presented at Gubkin students scientific Conference April-2015.

Factors influencing Russia Arctic offshore O&G development: Rosneft vs Gazprom

Factors	Rosneft	Gazprom
Licensed acreage, explora-tory level	***Factor sensitive.*** Rosneft holds 80% of total Russia licensed offshore acreage , incl. 70% of acreage in least explored Eastern Arctic offshore areas, 30% in more-less explored Western areas	***Factor less sensitive*** for Gazprom. It holds less 20% licensed offshore acreage , most in more explored Western offshore Arctic areas.
Techno-logical	***Factor sensitive.*** Rosneft does not possess practical offshore experience (except in shallow-water "Sakhalin-1" with Exxon & Sodeco), & in more explored Western part of Russian Arctic offshore more than half of its acreage lies beyond 500ft water depth which is a cordon line for Western technological sanctions	***Factor less sensitive.*** Gazprom has 3 active offshore projects (Prirazlomnoye in Pechors Sea, and "Sakhalin-2" in consortia with Shell, Mitsui, Mitsubisi, & Kirinsky projects offshore Sakhalin), plans to start production at Dolginskoye field in Pechora Sea. Gazprom tries to take small already explored acreages close to acting projects.
Financial	***Factor sensitive.*** Rosneft has highest among Russian O&G companies net-debt (1772 bln Rb, Q3-2014), cash/debt ratio 30%, debt financing possibilities limited, Arctic offshore projects require huge CAPEX – larger acreage of licensed areas, lower their exploratory level	***Factor less sensitive.*** Gazprom's net debt second large among Russian O&G companies (1265 bln Rb, Q3-2014), cash/debt ratio 50%, debt financing possibilities limited, but demand for CAPEX is much lower, compared to Rosneft – less acreage of licensed areas, higher their exploratory level
Total licensing acreage	Current allocation of licensing acreage is ***highly sensitive*** for Rosneft. Offshore licensed acreage & POW are huge & go beyond available technological & financial resources even without sanctions	Current allocation of licensed areas is ***less (not very) sensitive*** for Gazprom, since it has 3 acting Arctic offshore projects & 1 soon to enter in production, most of CAPEX is already done, technological & financial resource for these projects should be enough

Prepared by author & V.Buzovsky, Master programme 2014-2016, Chair "International Oil& Gas Business", Gubkin RSO&GU. V.Buzovsky. "Factor analysis of Russian Arctic shelf exploration. Strategic differences between OJSC "NK Rosneft" and OJSC "Gazprom" approaches". – Presented at Gubkin students scientific Conference April-2015

Available cash on the balance & overall debt of major Russian O&G companies (end-Q2/2014)



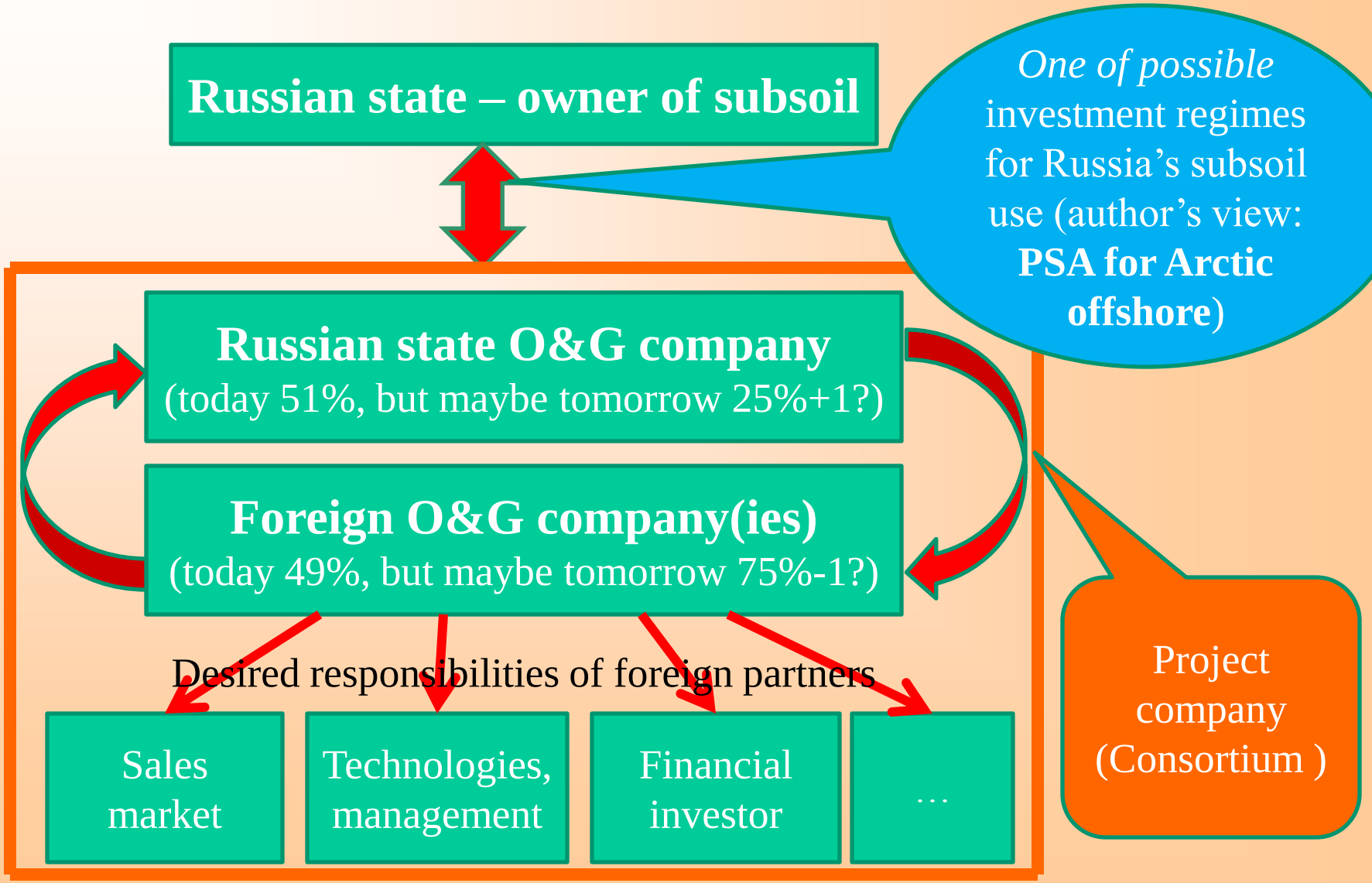
Note: <u>Numerator</u> = cash vs debt ratio (%), <u>denominator</u> = company debt as % of Rosneft debt - as indicators of absolute & comparative sensitivity for financial sanctions

Source (of original picture): Т.Дзядко. «Газпрому» санкции не помеха. – «РБК-daily», 15.10.2014, http://rbcdaily.ru/industry/562949992650092

Y-track in offshore licensing policy (sanctions effect)

- ***Either*** state to soften licensing parameters in Arctic offshore to keep licenses with Rosneft & Gazprom (state support of state companies):
  - To ease access to National Welfare Fund money, further tax concessions, etc.
  - To postpone production start-up dates, soften minimum POW, allow majority shareholding of foreigners in offshore consortia (China ?), etc.
- ***Or*** state to stay with existing terms of Arctic offshore licensing agreements which will made it difficult for Rosneft & Gazprom to fulfill obligatory licensing terms under sanctions:
  - Non-fulfillment of POW => return of licenses to state (to Unallocated Subsoil Fund) => to place them (sometime later) for bidding again
  - Softening access criteria to offshore subsoil (exp. 1 May) => new offshore subsoil users to appear?

Possible organizational structure of consortia for Russian Arctic offshore O&G development (*within author's concept of multiple investment regimes for subsoil use*)

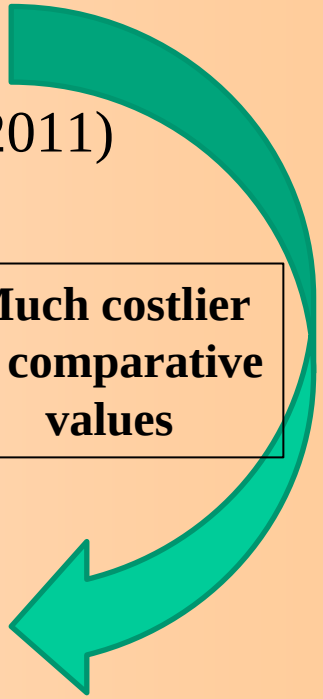


2 options to react on Western Sanctions. Option 1: to stay with same priorities in energy (supply-side), but to try overcome sanctions negative effects

- Aim to continue production growth in marginal areas (multiplier effect), but to substitute Western technologies & Anglo-Saxon finance:
  - To substitute Western technologies
    - Import substitution (by non-Anglo-Saxon import), but
      - China, India are not competent enough to substitute Anglo-Saxon O&G manufacturing for Arctic offshore, even in shallow Arctic waters
    - Import substitution (by domestic production) => domestic investment climate => downgrade tax pressure, but
      - Oil price decline => budget revenue fell => strong stimuli to increase tax pressure to compensate tax losses => another Y-track for state
  - To substitute Western (Anglo-Saxon) finance
    - National Welfare Fund => too many claimants (esp. Rosneft)
    - Asian/BRICS financial markets => tied loans, but lack of adequate manufacturing equipment/production skills
- **=> Too costly, too environmentally risky, risk of stranded assets?**

Some Worldwide Central Bank Rates

- Anglo-Saxon & related:
  - Eurozone: **0.05%** (Key Interest Rate, 04.09.2014)
  - United Kingdom: **0.50%** (Bank Rate, 05.03.2009)
  - USA: **0-0.25%** (Funds Rate, 16.12.2008)
  - Switzerland: **0-0.25%** (SNB-Target Range, 03.08.2011)
- Asia (except China):
  - Japan: **0-0.10%** (Call Rate, 05.10.2010)
  - South Korea: **2.0%** (Base Rate, 15.10.2014)
  - Hong Kong: **0.50%** (Base Rate, 17.12.2008)
- BRICS:
  - Brazil: **11.25%** (Selic rate, 29.10.2014)
  - Russia: **9.5%** (Key Rate, 31.10.2014)
  - India: **8.0%** (Policy Repo Rate, 28.01.2014)
  - China: **6.0%** (Lending Rate, 05.07.2012)
  - South Africa: **5.75%** (Repurchase Rate, 17.07.2014)



Source: http://www.cbrates.com/ (as of 09 Nov 2014)

2 options to react on Western Sanctions. Option 2: to change priorities in energy (both supply- & demand side)

- Energy supply: From more to less costly production/primary supply
  - from Greenfields in Arctic offshore to EOR in onshore Brownfields with already developed infrastructure
  - slowdown or postponement Arctic offshore development in the most risky (economically & environmentally) – deep water & heavy ice areas
- Energy demand: From increase of primary supply to increase of energy efficiency
  - to slow down/diminish demand for new supplies, firstly from marginal areas, & for incremental CAPEX in their development (compensate fall-down of budget revenues due to oil price decrease, to exchange this for invest.stimuli)
- Consequences:
  - diminished risk of environmental damages with still unknown consequences (f.i. oil spills in Northern waters)
  - less demand for most capital-intensive energy investments within narrowing & worsening opportunities for raising them
  - more opportunities for national R&D & manufacturing

Western sanctions against Russian O&G – or against Western industries itself?

- Today all Arctic offshore development is concentrated in its shallow waters. It is based on "Evolutionary STP" technologies which adapt current Arctic onshore (artificial islands) & Northern offshore (stationary platforms) E&P technologies to Arctic offshore conditions. This is based on adaptation of available Western technological offshore solutions to Arctic conditions (incl. second-hand, giving them second life – another benefit for the West). But by such technologies one can not develop deep Arctic offshore.
  - Like second life of North Sea's Hutton platform (upper derrick) at Prirazlomnoye or platform (upper derrick) from Alaska's Cook Inlet at first stage of Sakhalin-2 dev't.
- Western sanctions – is most probably "a shoot in its own foot": they closed Russia's shallow offshore Arctic waters as target market (from today onward) for available Western technologies (incl. second-hand use of existing &/or joint new production in Russia) for such offshore.

Western sanctions against Russian O&G – & prospects of next step cooperation

- Break-through commercial technologies ("Revolutionary STP") for deep Arctic offshore development do not exist elsewhere in the world, yet. Such technologies can (=> **shall**) be developed jointly by all Arctic littoral states after sanctions are lifted.
  - to use cooperation effect rather than competition to pass profitability benchmarks.
  - Plus "economy of scale" & multiplier effects of joining efforts => deep Arctic offshore O&G as "sixth innovative cluster of Russian economy"
  - Best case example as a reference point: USSR-USA Soyuz-Apollo space project 1975

Thank you for your attention!

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

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