Russia's Hydrogen Strategy in the making & prospects for effective Russia-EU cooperation in this field: different aspects for WS2 GAC discussions

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The 32-th meeting of WS2 GAC, online, 13.11.2020

Disclaimer: Views expressed in this presentation do not necessarily reflect (may/should reflect) and/or coincide (may/should be consistent) with official position of Gazprom Group (incl. Gazprom JSC and/or Gazprom export LLC), its stockholders and/or its/their affiliated persons, or any Russian official authority, and **are within full personal responsibility of the author of this presentation.**

Structure of presentation

1) **Russia's Hydrogen Strategy in the making: what's in the package**
2) Russia's Hydrogen Strategy in the making: how it is seen from the outside (WEC-LBS study)
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4) How "Clean Hydrogen from Natural Gas Alliance" proposal can correlate with both Russia's Hydrogen Strategy in the making and existing proposals (incl. from the EU & individual EU MS side) for Russia-EU cooperation in hydrogen area

1. Presidential Decree as of 04.11.2020 on diminishment of GHG emissions in Russia by 2030
2. Governmental Ordinance as of 09.06.2020 on Energy Strategy of Russia to 2035
3. Governmental Ordinance as of 12.10.2020 on hydrogen action plan in Russia up to 2024

1

УКАЗ

ПРЕЗИДЕНТА РОССИЙСКОЙ ФЕДЕРАЦИИ

О сокращении выбросов парниковых газов

В целях реализации Российской Федерацией Парижского соглашения от 12 декабря 2015 г. п о с т а н о в л я ю:

1. Правительству Российской Федерации:

а) обеспечить к 2030 году сокращение выбросов парниковых газов до 70 процентов относительно уровня 1990 года с учетом максимально возможной поглощающей способности лесов и иных экосистем и при условии устойчивого и сбалансированного социально-экономического развития Российской Федерации;

б) разработать с учетом особенностей отраслей экономики Стратегию социально-экономического развития Российской Федерации с низким уровнем выбросов парниковых газов до 2050 года и утвердить ее;

в) обеспечить создание условий для реализации мер по сокращению и предотвращению выбросов парниковых газов, а также по увеличению поглощения таких газов.

2. Настоящий Указ вступает в силу со дня его официального опубликования.

КАНЦЕЛЯРИЯ

Президент
Российской Федерации В.Путин

Москва, Кремль
4 ноября 2020 года
№ 666

2

ПРАВИТЕЛЬСТВО РОССИЙСКОЙ ФЕДЕРАЦИИ

РАСПОРЯЖЕНИЕ

от 9 июня 2020 г. № 1523-р

МОСКВА

1. Утвердить прилагаемую Энергетическую стратегию Российской Федерации на период до 2035 года (далее - Стратегия).

2. Федеральным органам исполнительной власти руководствоваться положениями Стратегии при разработке и корректировке государственных программ Российской Федерации и иных документов стратегического планирования.

3. Рекомендовать органам государственной власти субъектов Российской Федерации руководствоваться положениями Стратегии при разработке и корректировке государственных программ субъектов Российской Федерации и иных документов стратегического планирования.

4. Минэнерго России совместно с заинтересованными федеральными органами исполнительной власти:

представить в 6-месячный срок в Правительство Российской Федерации проект плана мероприятий по реализации Стратегии;

обеспечить реализацию Стратегии.

5. Признать утратившим силу распоряжение Правительства Российской Федерации от 13 ноября 2009 г. № 1715-р (Собрание законодательства Российской Федерации, 2009, № 48, ст. 5836).

Председатель Правительства
Российской Федерации М.Мишустин

3

ПРАВИТЕЛЬСТВО РОССИЙСКОЙ ФЕДЕРАЦИИ

РАСПОРЯЖЕНИЕ

от 12 октября 2020 г. № 2634-р

МОСКВА

1. Утвердить прилагаемый план мероприятий "Развитие водородной энергетики в Российской Федерации до 2024 года" (далее - план).

2. Федеральным органам исполнительной власти, ответственным за реализацию плана, обеспечить его реализацию.

3. Минэнерго России осуществлять мониторинг и контроль реализации плана и ежегодно, до 30 марта, представлять в Правительство Российской Федерации информацию о ходе его реализации.

Председатель Правительства
Российской Федерации М.Мишустин

Source: (1) http://publication.pravo.gov.ru/Document/View/0001202011040008; (2) http://static.government.ru/media/files/w4sigFOiDjGVDYT4IgsApssm6mZRb7wx.pdf; (3) http://static.government.ru/media/files/7b9bstNfV640nCkkAzCRJ9N8k7uhW8mY.pdf

Presidential Decree & its framework

- Presidential Decree orders the Government:
  - to ensure decrease of GHG emissions by 2030 to 70% level as of 1990 with maximum consideration of ***absorbing capacity of the forests*** and other natural ecosystems **conditioned with sustainable social & economic development**
  - to develop and approve Russian long-term development strategy with low GHG emissions till 2050 with taking into consideration specificities of individual industries
  - to ensure conditions for measures to diminish & prevent GHG emissions, and for ***increase of their absorption***.

- 21.09.2019 then PM of RF D.Medvedev has signed Government Resolution that RF has accepted *(but not ratified)* Paris Agreement, incl. the statements that RF considers:
  - (i) important to protect & increase ***absorbing capacity of the forests*** & other ecosystems & ***their maximum possible account*** including in realization of Paris Agreement,
  - (ii) unacceptable to use Paris Agreement & its mechanisms as instruments for creating barriers for sustainable social & economic development of the Parties to UN FCCC ***(=> debate on EU carbon border tax).***
- *For reference:*
  - Russia is among few states who has outstripped its Kyoto Protocol obligations of GHG emissions through Kyoto first period – no more than 100% from 1990 level (*mostly due to structural changes of 1990-ies*).
  - In 2012 new national task was established – 75% of 1990 level to 2015 which was reached before 2015. In 2015 Russia stated its readiness to reach 70-75% of 1990 to 2020. Time for new aims for new period
  - **Importance of sustainable development (priority of energy efficiency measures) & absorbing capacity of the forests**

Russia's GHG emissions and absorbing capacity of the forests

- Today Russia's GHG emissions level is about 50% from 1990 *including* forests absorbing capacity and already about 70% *without* it.
- **NB1:** this means that dependent on ***debate on calculation methodology of forests absorbing capacity***, absolute values of Russia's GHG emissions might even further grow => **debate on methodology does matter!!!**
  - **Whether it worth adding this issue to WS2 decarbonisation agenda?**
- **NB2:** acc.to "**Frontiers in Forests and Global Change**" magazine (*), giant trees accumulates disproportionally large carbon volumes: studies within US National Parks in Oregon & Washington states showed:
  - giant trees with diameter more than 53.3 cm equals to 3% of total quantities of the trees but they accumulate 42% of total carbon stock in above-ground biomass of these forests ecosystems,
  - giant trees with diameter more than 76.2 cm equals to 0.6% of total quantities of the trees but they accumulate 16% of total carbon stock in above-ground biomass of these forests ecosystems,
  - With further growth giant trees accumulate more & more carbon (absorb CO2)
  - **NB3:** ***Most of Russian Taiga (boreal forest) consists of giant trees…***

(*) https://nangs.org/news/markets/vyyasnilosy-kakuyu-roly-v-izmenenii-klimata-igrayut-gigantskie-derevyya?utm_source=newsletter_1734&utm_medium=email&utm_campaign=n-d-n

Russian Energy strategy to 2035 – section on Hydrogen (p. 47)

- **Aim:** Russia to become one of world leaders in H2 production **and export (*)**
- **Measures:**
  - State support for development of **infrastructure for transport (*)** and consumption of H2 & MHM
  - State support for H2 production
  - Stepping up H2 from CH4 production, incl. with RES, nuclear
  - Development of domestic low-carbon technologies of H2 production by gas conversion & pyrolysis, electrolysis, etc., incl. possible localization of foreign technologies
  - Stimulate domestic demand for fuel cells in transport, H2 & MHM use to accumulate & convert energy
  - Develop regulatory base for hydrogen safety in energy
  - Intensify international cooperation in H2 energy development & entry to foreign markets
- **Criteria** for H2 energy development = **export of H2 (*)**:
  - 2024 – 0.2 mln tonnes,
  - 2035 – 2 mln tonnes
- **(*) these terms provides different interpretations, incl. wrong perceptions**

?

Hydrogen action plan in Russia up to 2024: some key elements related to clean H2 from CH4 and to international cooperation (acc. to Governmental Ordinance as of 12.10.2020)

No	Task	Time
1.1-3	To develop Hydrogen strategy, Project office for realization of H2 strategy, Interagency Task Force	2021-Q1
2.7	To develop state support measures for priority pilot projects of H2 for energy use, incl. demonstration	2021-Q1
2.8	To develop state support measures for **export of H2** for energy use **(different interpretations/perceptions possible)**	2021-Q2
3.11	System of criteria to select priority projects	2021-Q1
3.12	To develop & annually adjust the list of priority projects	2021-Q1
3.14	Suggestions on engineering centers (to monitor & adjust annually)	2021-Q1
4.15	To provide for creation, manufacturing & implementation of **pilot projects for H2 production without CO2 emissions**	2024
4.16	To provide for creation of test-fields for **low-carbon H2 production** at O&G refining facilities & on **gas production sites**	2023
4.17	To provide for creation, manufacturing & testing of **gas turbines on methane-H2 mix (MHM)**	2024
4.19	To provide for realization of pilot project of **H2 production based on existing nuclear power stations**	2023
5.20	To develop & annually adjust the Register of existing & prospective H2 technologies	2021-Q1
5.21	To provide for development of domestic energy-efficient technologies of production, **transportation & storage of H2**; approbation of **H2 & MHM as a fuel** (with different content of H2 in MHM) **for gas turbines & boilers**	2021-2024
5.22	Research of technologies & their full production cycles GHG-tracks for different production, transportation & utilization	2021-2024
5.24	Research on **marketing of carbon black**	2021-2024
5.25	Proposals for System of certification fro decarbonized H2	2021-Q2
6.27,32	National system of standardization H2+MHM; external cooperation in standardization MHM	2021-Q1,4
8.39-43	International cooperation (*to prepare proposals*) **(=> critical stage – NOW - for domestic & international debate!!!)**	2020-2024

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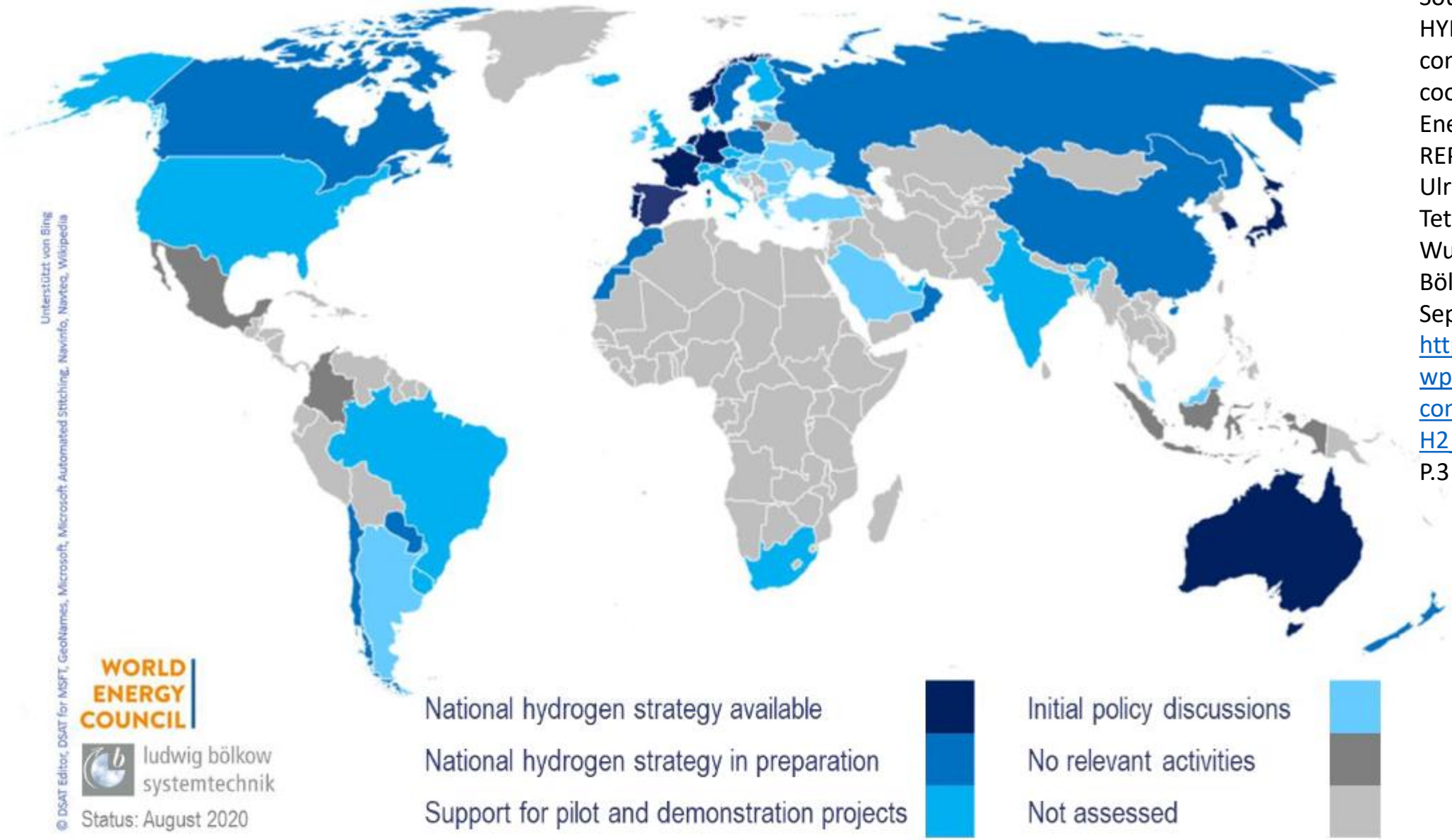
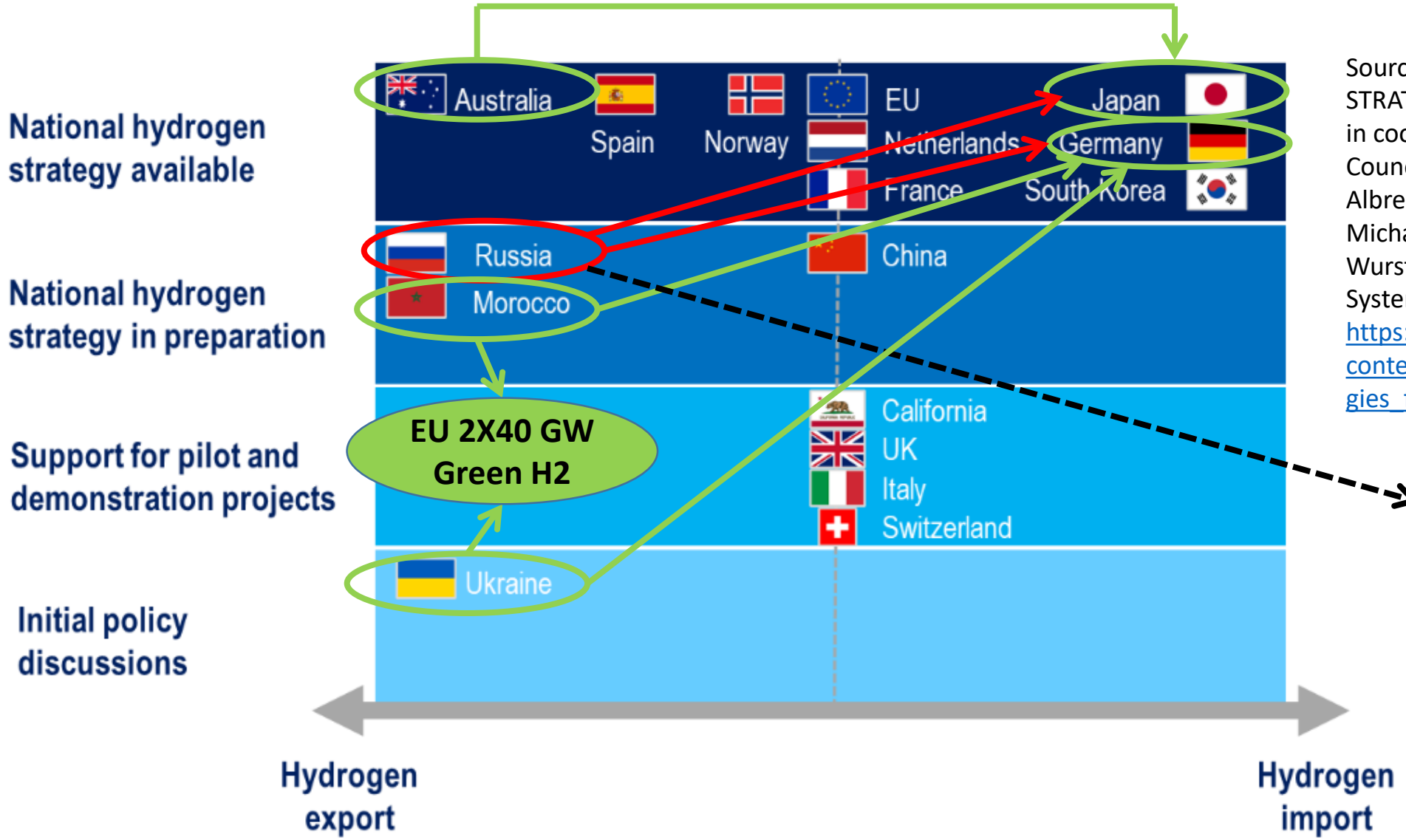


Source: INTERNATIONAL HYDROGEN STRATEGIES. A study commissioned by and in cooperation with the World Energy Council Germany, FINAL REPORT. Dr. Uwe Albrecht, Dr. Ulrich Bünger, Dr. Jan Michalski, Tetyana Raksha, Reinhold Wurster, Jan Zerhusen, Ludwig-Bölkow-Systemtechnik GmbH, September 2020, https://www.weltenergierat.de/wp-content/uploads/2020/10/WEC_H2_Strategies_finalreport.pdf, P.3

Figure 2: Status of international hydrogen activities of national governments (August 2020)



Source: INTERNATIONAL HYDROGEN STRATEGIES. A study commissioned by and in cooperation with the World Energy Council Germany, FINAL REPORT. Dr. Uwe Albrecht, Dr. Ulrich Bünger, Dr. Jan Michalski, Tetyana Raksha, Reinhold Wurster, Jan Zerhusen, Ludwig-Bölkow-Systemtechnik GmbH, September 2020, https://www.weltenergierat.de/wp-content/uploads/2020/10/WEC_H2_Strategies_finalreport.pdf, P.6

Based on perceptions (straightforward interpretations) of H2 section in Russian Energy Strategy up to 2035; internal debate in the course of its preparation; & dominant EU (i.e. German) vision of Russia's H2 strategy developments

Figure 4: Selected countries classification in respect to availability of a dedicated strategy and hydrogen imports/exports

In reality ***Pyrolysis factually ignored***: the term is mentioned 2 times within 56-pages EU H2 Strategy (as of 08/07/2020), once – incorrectly – as synonym to SMR+CCS under "blue H2", which is, in turn, only temporary unwelcome involuntary choice

The only country with multiple choices for H2 through the whole spectrum of options through the whole time-line

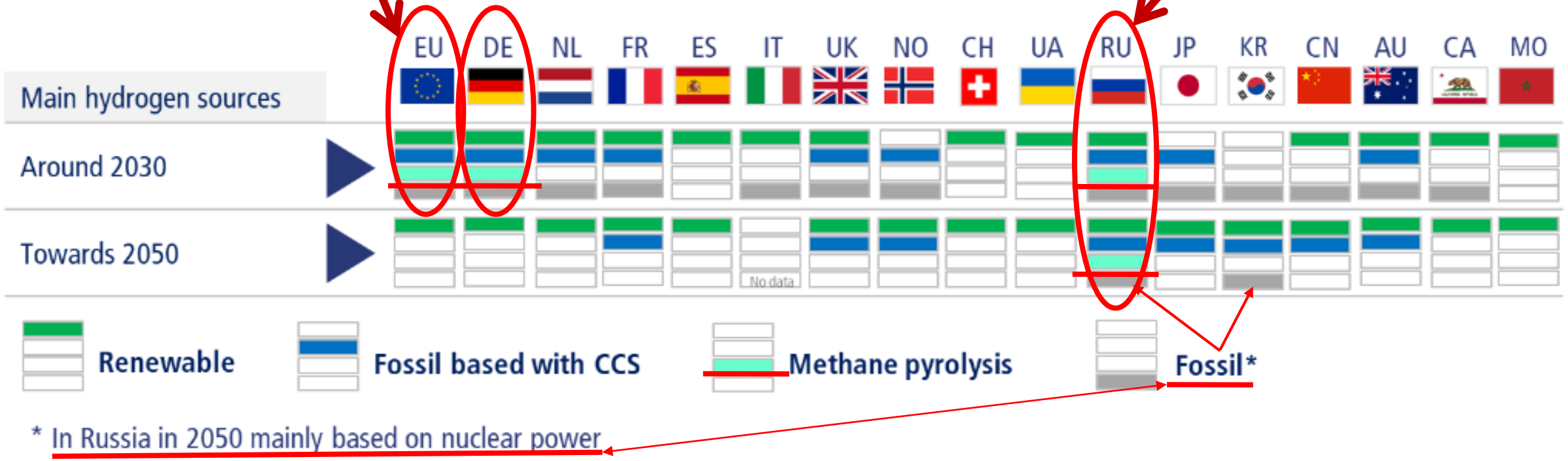


Figure 19: Considered medium- and long-term hydrogen production options by country

Source: INTERNATIONAL HYDROGEN STRATEGIES. A study commissioned by and in cooperation with the World Energy Council Germany, FINAL REPORT. Dr. Uwe Albrecht, Dr. Ulrich Bünger, Dr. Jan Michalski, Tetyana Raksha, Reinhold Wurster, Jan Zerhusen, Ludwig-Bölkow-Systemtechnik GmbH, September 2020, https://www.weltenergierat.de/wp-content/uploads/2020/10/WEC_H2_Strategies_finalreport.pdf, P.33

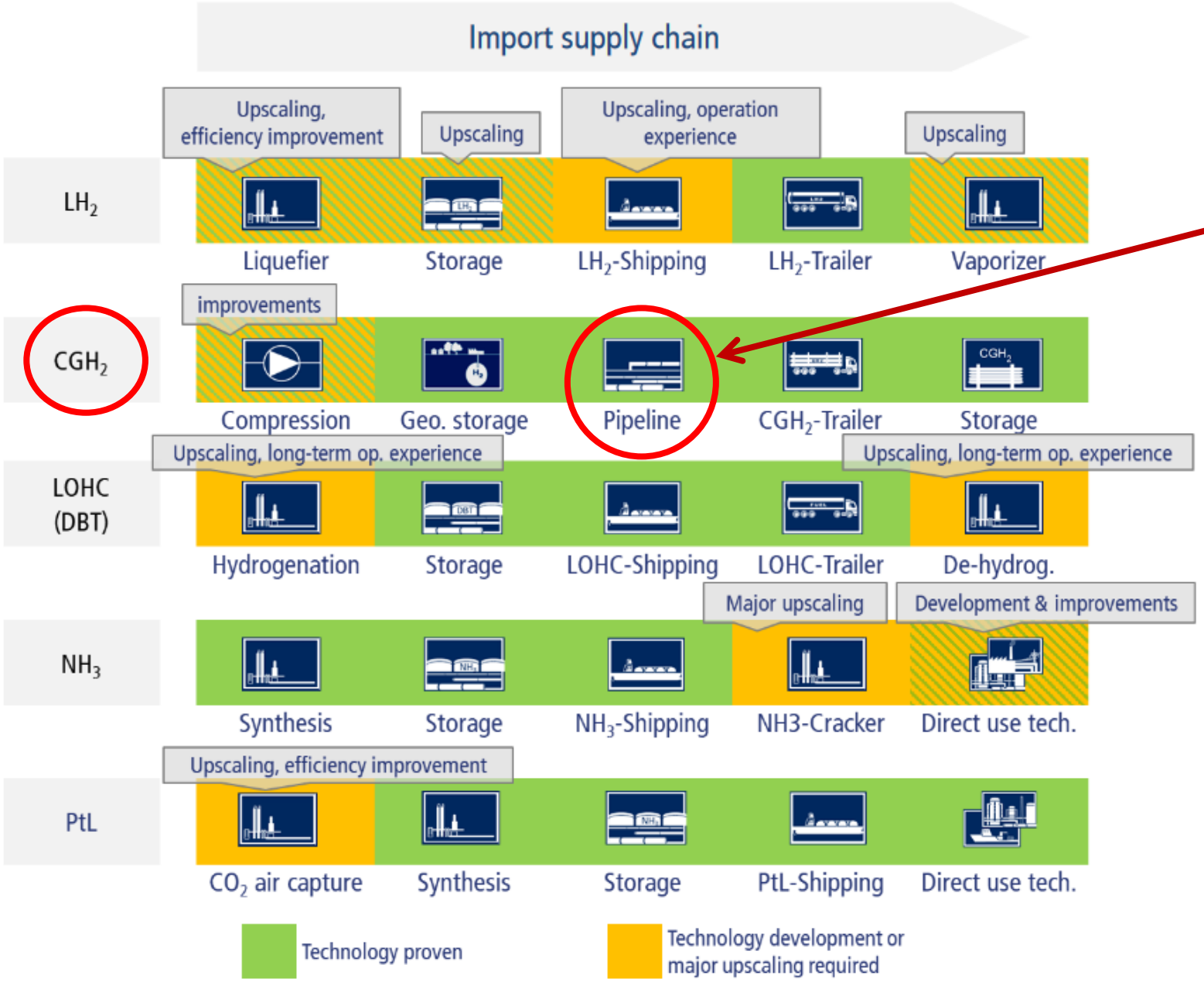


Figure 24: Principle technology availability of main export/import technologies

Wrong perception on long-distance transportation of H2: considered to be as available (technologically proven) as long-distance transportation of CH4 – WHICH IS NOT THE CASE!!!

Source: INTERNATIONAL HYDROGEN STRATEGIES. A study commissioned by and in cooperation with the World Energy Council Germany, FINAL REPORT. Dr. Uwe Albrecht, Dr. Ulrich Bünger, Dr. Jan Michalski, Tetyana Raksha, Reinhold Wurster, Jan Zerhusen, Ludwig-Bölkow-Systemtechnik GmbH, September 2020, https://www.weltenergierat.de/wp-content/uploads/2020/10/WEC_H2_Strategies_finalreport.pdf, P.64

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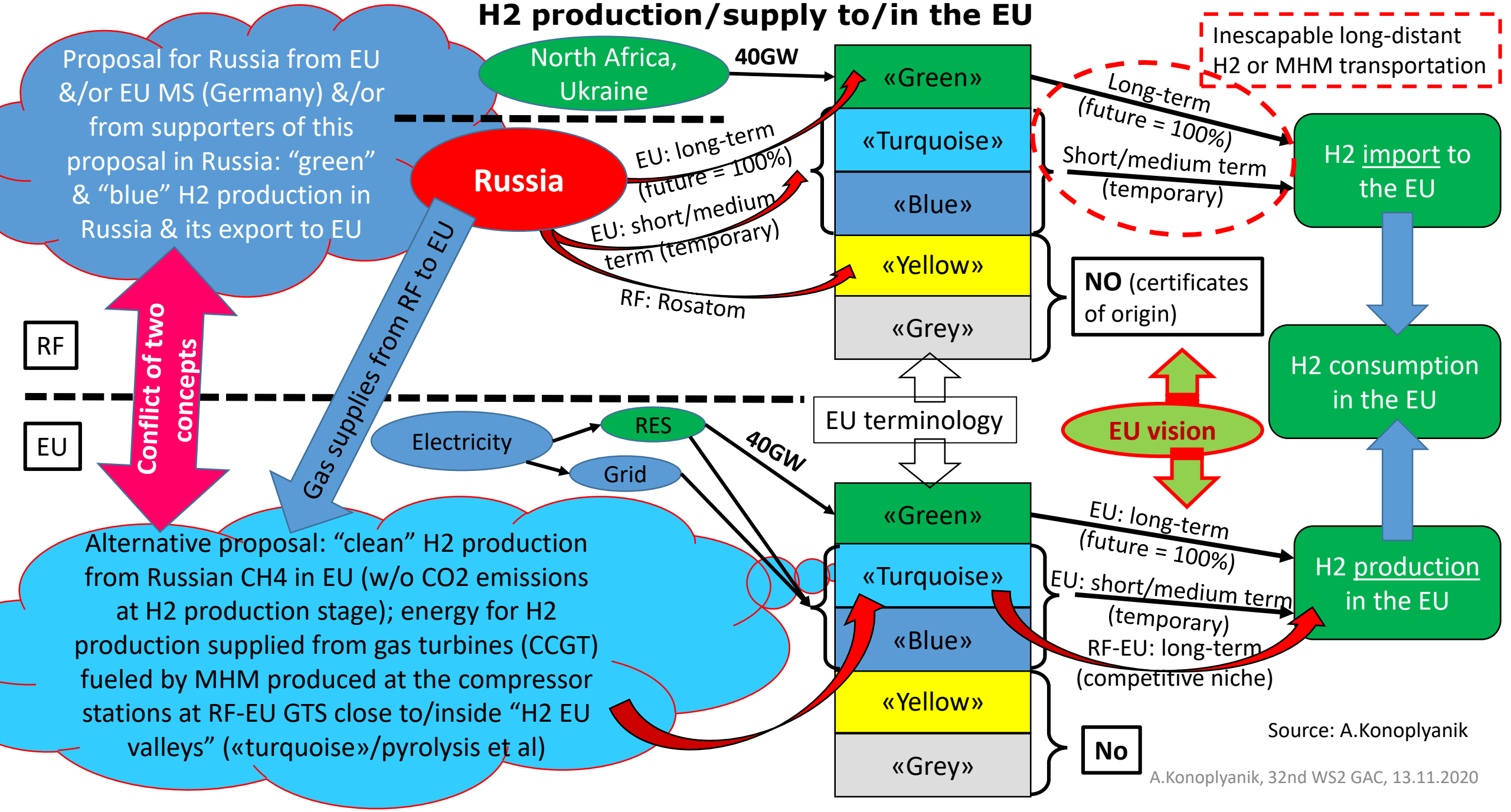
Russia-EU cooperation prospects in H2 area as it seen by different parties: alternatives for H2 production/supply to/in the EU



Source: A.Konoplyanik

Decarbonisation upstream: some physical & chemical barriers to long-distant high-pressure transportation & storage of H2 (acc. to Litvinenko et al, SPB Mining University) (*)

(1) Effectiveness of gas pipeline transportation is directly contingent upon quantities of the product, and thus on the density of gas. **As concentration of H2 in MHM increases from 10 to 90 %, density of MHM decreases more than four times.**

(2) **Energy obtained from** one volume of **H2 is 3.5 times less than the energy obtained from methane.**

(3) Increase in energy required to compress 1 kg of MHM to raise the pressure by 1 MPa with increasing proportion of H2. While **H2 content in MHM rises from zero to 100%, energy costs (work) are raised by around a factor of 8.5.**

(4) Increasing proportion of H2 in MHM increases explosion risks of the MHM

(5) Export/storage of *liquid* H2: **CH4** liquefies at atmospheric pressure and temperature below - 161.5 °C, LNG volume is 600 times less than its gaseous form. **H2** liquefies at atmospheric pressure and temperature below -252.87 °C, it reduces in volume by 848 times. **(ii)** The closer temperature of a substance to absolute zero, the more **quantum properties** (superfluidity, superconductivity, etc.) begin to appear. **(iii)** Under same conditions and tank capacity it is **possible to store or transport almost 5.9 times more LNG than liquid H2.**

(6) H2 has extremely high penetrating ability, its molecules spread faster than molecules of all the other gases in the media of another substance and penetrate through almost any metal. **Pressurized H2 is capable to escape even from airtight tanks during long-term storage.**

(7) Research into effect of H2 on metals has been carried out for decades. Back in 1967 in USSR scientific discovery "Depreciative effect of hydrogen on metals“ was made (N 378), however, the reactivity of hydrogen is still not sufficiently studied, whereas its negative effects have already become a substantial technical issue (**stress corrosion**). Due to stress corrosion Gazprom replaced over 5,000 km of large-diameter pipelines.

*(*) Within **43** items of RF Gov't Action plan on H2 Saint Petersburg Mining University is mentioned as co-participant in **42** items*

Source: Litvinenko V.S., Tsvetkov P.S., Dvoynikov M.V., Buslaev G.V., Eichlseder W. Barriers to implementation of hydrogen initiatives in the context of global energy sustainable development. Journal of Mining Institute. 2020. Vol. 244, p. 428-438. DOI: 10.31897/PMI.2020.4.5

Decarbonisation downstream: contractual issues of long-distance gas deliveries for clean H2 production downstream the EU (bankability of decarbonization)

- How to consider carbon neutrality:
  - at the **entry point to EU** (CH4 contains C => means “dirty” => might be taxable by proposed “carbon import duty”), or
  - at the **exit of technological process of H2 production deep inside EU** (clean H2 from CH4 by pyrolysis *et al* does NOT contain CO2), =>
    - Validity of the current trend within banking community to phase-out from fossil-fuel-based projects (f.i. EIB decision as of Nov’2019) => clarification & further debate needed
- LTC issue in clean H2 production:
  - Necessity to **“contractually protect” (ring-fence) CH4 flow for clean H2 production** => requirement for cross-border LTC => what adaptation of LTC might be needed, if any?
  - LTC destined for gas supplies to (or: being part of) ring-fenced (to be better financeable) investment project of clean H2 production at the end of cross-border pipe **SHALL not be an object for on-border entry import “carbon” duties**
    - Clean intended end-use is more important for climate change purpose than carbon content in transit /input feedstock/energy product, entering the EU (methane leakages to be considered)
    - If full value chain carbon-track taxation, then:
      - NOT at the entry border
      - To consider WHOLE life-cycle through direct & adjoining industries (upstream to mining), RES/non-RES

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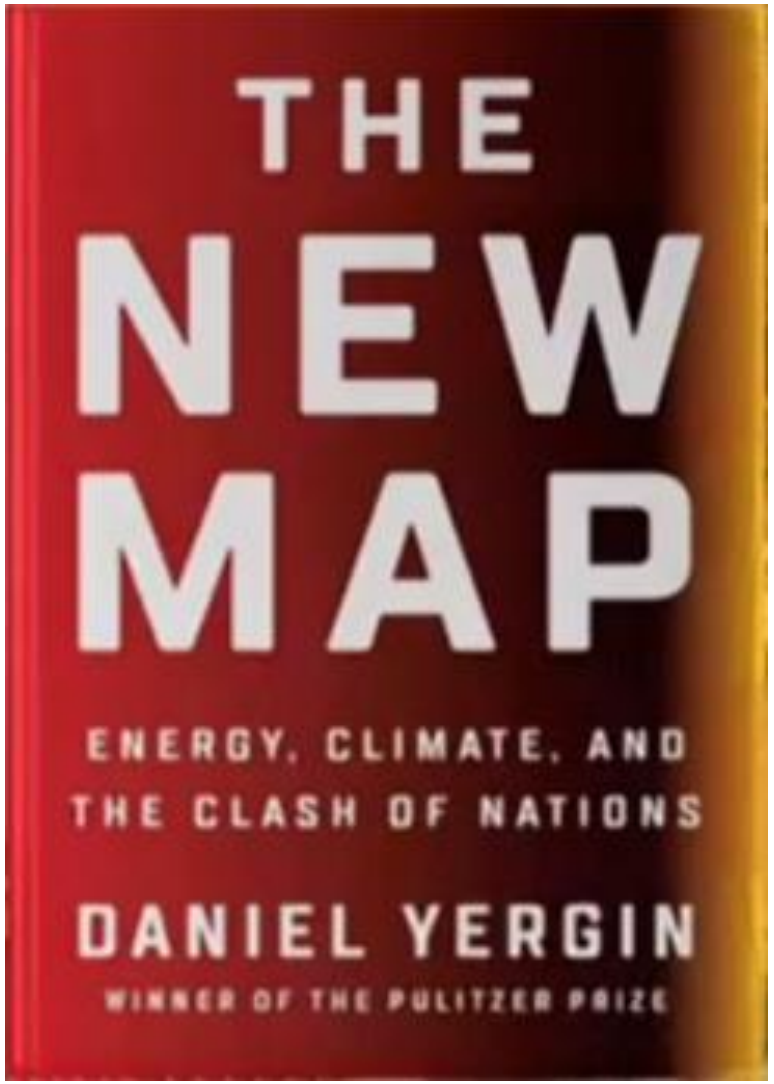
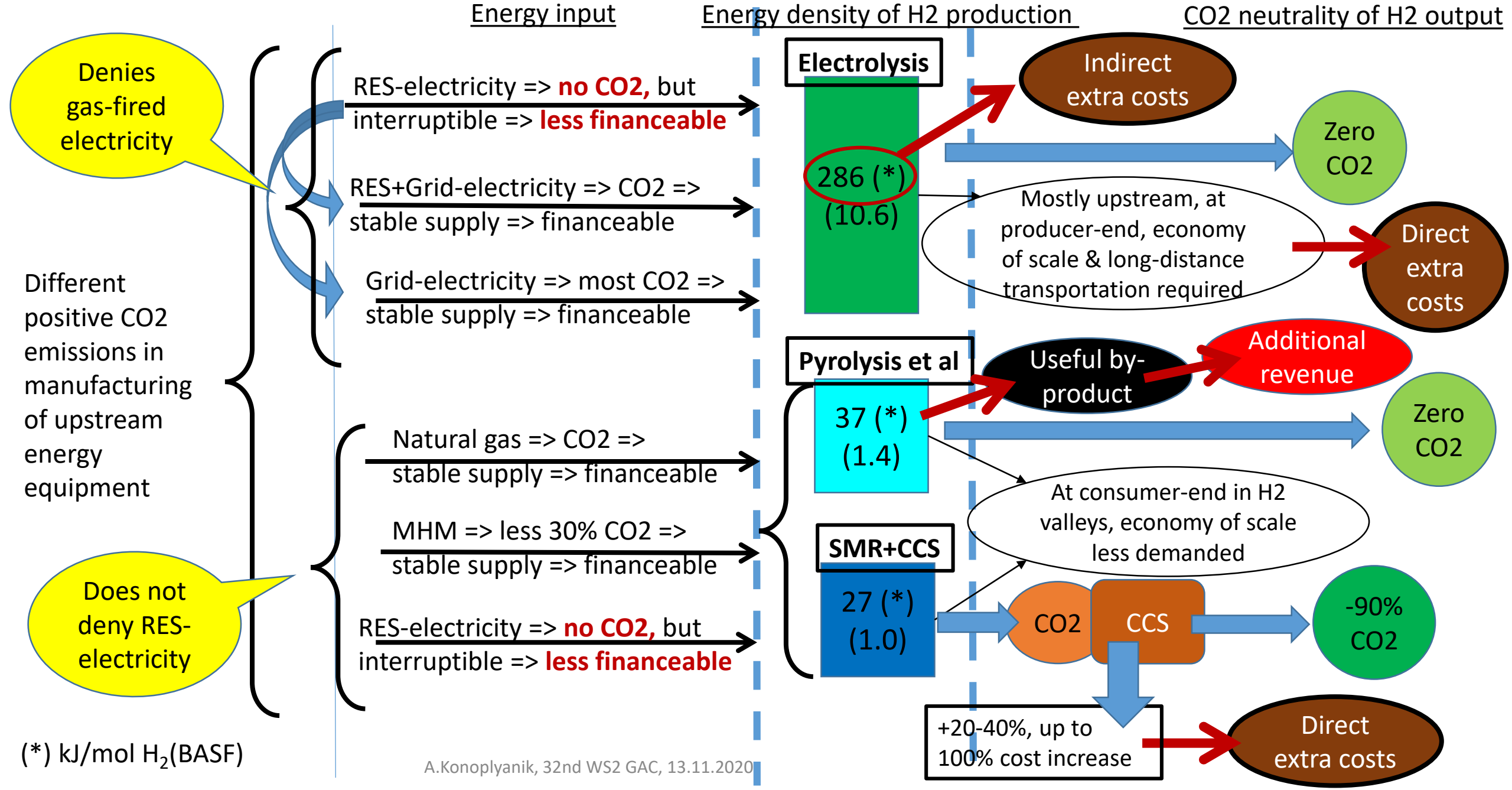


Daniel Yergin,
Pulitzer Prize winner for "The Prize" book at presentation of his new book "The New Map" (US Atlantic Council, 25.09.2020, online):

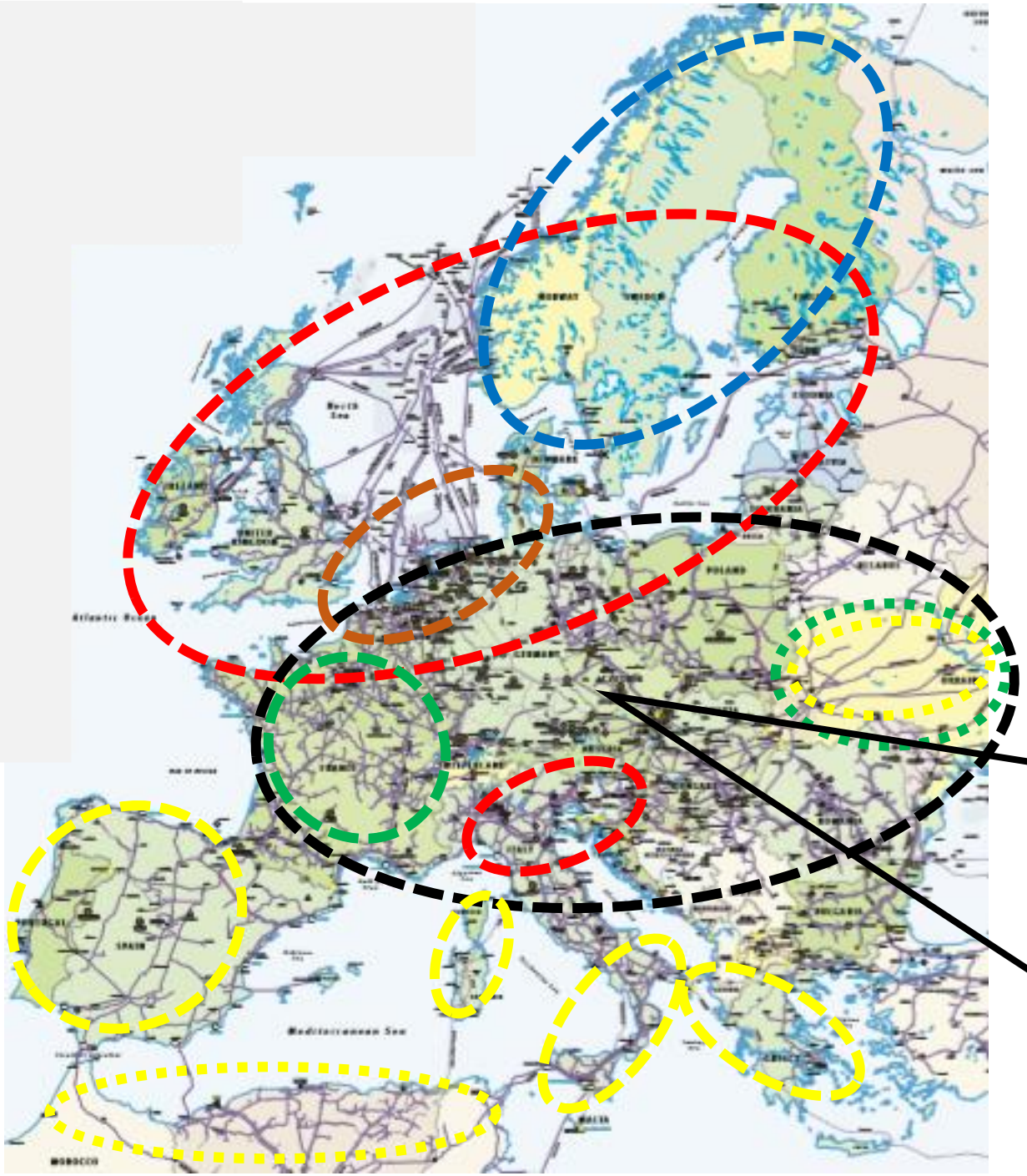
"**NEW SUPPLY CHAINS FOR NET-ZERO CARBON REQUIRES CARBON!!! …**
They require diesel to operate shuttle in mining…"

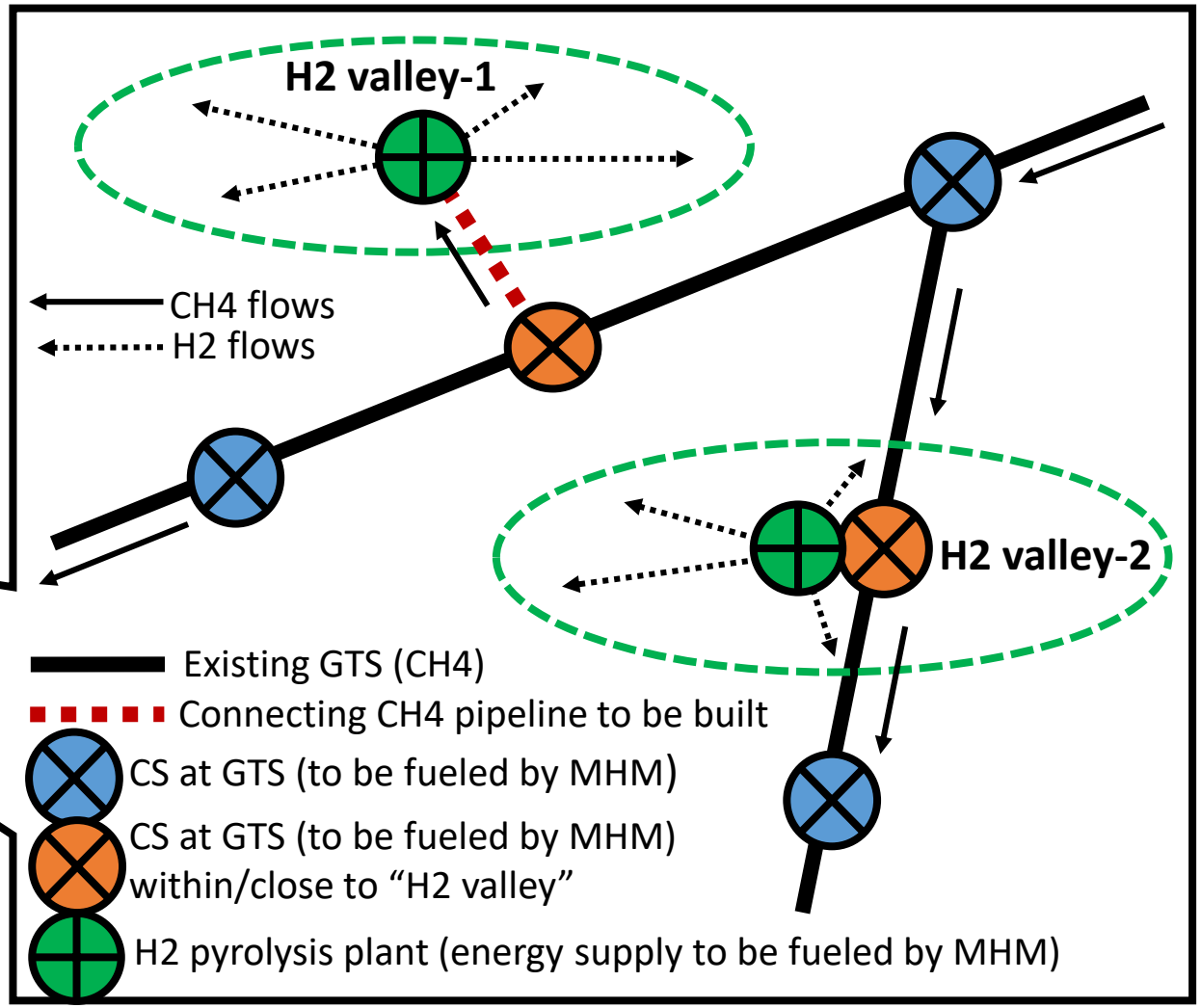
Source: A conversation with Pulitzer Prize winner and energy expert Daniel Yergin, Atlantic Council, 25.09.2020 (https://www.youtube.com/watch?v=hWMOU8IjRhI)

3H2: Input-output CO2 options – no totally clean alternative through value chain



Approximate scheme of clean H2 production from natural gas placement within existing cross-border RF-EU gas value chain (gas grid) inside the EU close to prospective "hydrogen valleys"

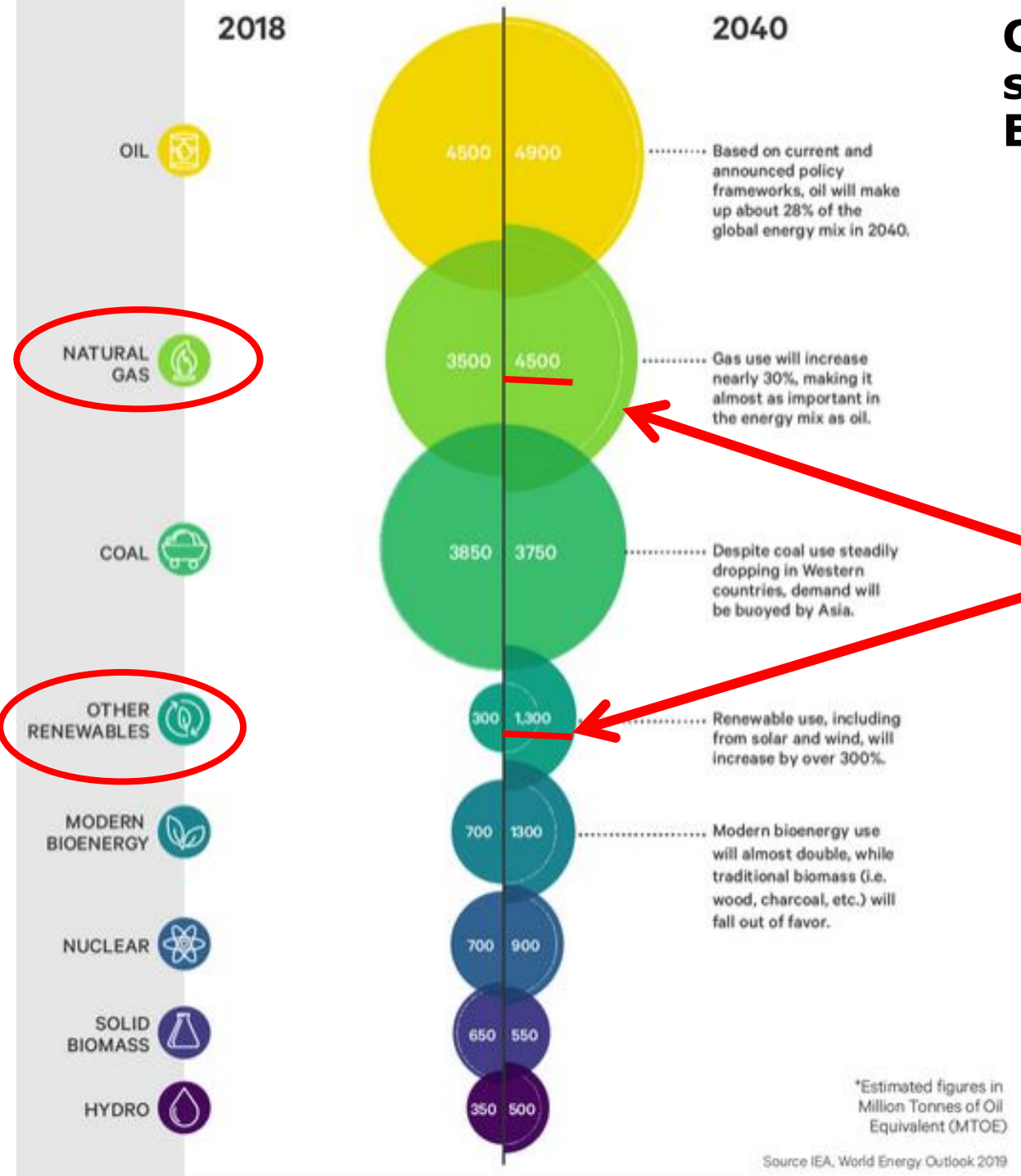




Clean H2 production (w/o CO2 emissions) from natural gas downstream EU based on existing Russia-EU GTS & MHM produced at CS on-site

- Clean H2 production close to EU demand centers (H2 valleys) located close to existing compressor stations (CS) at cross-border RF-EU GTS. To use gas from the grid:
- As energy source for:
  - (1) transportations work:
    - to produce MHM on-site at CS on transportation routes of Russian gas to the EU;
    - to use this MHM at these CS as a fuel gas instead of methane for further gas transportation.
    - Such substitution of CH4 by MHM as fuel gas at CS diminishes CO2 emissions by 30% (acc.to Gazprom);
  - (2) clean H2 production:
    - at the H2 production plants which are to be built close to these CS in “H2 valleys”;
    - scale of production adequate to H2 demand of particular “H2 valley”;
    - energy supply of CCGT of adequate capacity - acc.to above-mentioned scheme in (1).
    - Though substitution of CH4 by MHM as fuel gas is not for transportation work, but for energy supply (electricity &/or heat) to H2 production plant;
- (3) As a feedstock for:
  - new clean H2 production plants from CH4;
  - plants to be located close to CS and aimed to cover H2 demand of local “H2 valley” (this will exclude demand for long-distance transportation of H2 or MHM).

Changes in the global energy mix: 2018 vs stated policies 2040 (acc. to IEA Global Energy Outlook 2019), MTOE



With today's 85% of global primary energy coming from non-RES, it is counter-productive to stipulate intensive growth of RES (*incl. as a source of renewable H2 production with zero CO2 emission at production stage*) by banning natural gas aimed for the same purpose (*incl. as a source of non-renewable H2 production with zero CO2 emission at production stage*) – to "decarbondioxidinize" (*) economic growth

(*) term proposed by K.Neuymin (Gazprom) at WS2 18/09 meeting

Source: The World's Projected Energy Mix, 2018-2040 // Visual Capitalist, February 3, 2020 (https://www.visualcapitalist.com/the-worlds-projected-energy-mix-2018-2040/)

Thank you for your attention!

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