World Experience for Georgia

Central Asia Decarbonizing the Southern Gas Corridor

Policy Note

Summary

Herewith we would like to draw attention to a synergy between the long-term perspective of a clean energy hub in Central Asia and the mid-term possibility of importing substantial amounts of natural gas from Turkmenistan to the EU over the Southern Gas Corridor. The ample resource of wind and solar energy combined with the vast unoccupied territories in the vicinity of the Caspian Sea provides the practically unlimited technical possibility for the production of green electricity and green hydrogen, to provide a sizeable contribution to global efforts of climate change mitigation and decarbonization of energy use. This opportunity can be combined with the long-discussed concept of the Trans-Caspian pipeline and provide an economic solution that in the mid-term could provide substantial amounts of natural gas to the EU and in the long term would help the EU to achieve its Net Zero emissions goal, by supplying large amounts of green hydrogen over the Southern Gas Corridor. Numerous factors may affect the feasibility and realism of this project, however, we believe that it deserves at least initial consideration by policymakers of the region and the EU and further studies to near the inevitable future where the CA RE resource gets utilized on a large scale.

1. Russia's invasion of Ukraine and EU Energy supply

Russia's aggression in Ukraine has drastically changed the picture of energy supply for the European Union and the world. It has urged the EU to hastily look for short- and medium-term alternatives to Russian oil and natural gas. The available LNG and pipeline gas alternatives seem to be barely sufficient for the coming winter and next periods[1] and European Commission is actively working on new supply options. One example is the memorandum signed on July 18 between the EU and Azerbaijan[2]. It envisages an additional 10bcm/a of Azeri gas to be supplied to the EU by 2027 through an expanded TAP pipeline and Southern Gas Corridor (SGC). The MoU also envisages cooperation in renewable energy development in Azerbaijan, echoing the plans of the Azeri government to step up the renewable energy in the country. Georgia-EU subsea cable[3] and the Zangezur corridor are viewed as potential routes for the export of additional green energy to the EU.

MoU implies the doubling of TAP pipeline capacity as well as significant investment in new Azeri gas fields and gas transportation systems. Indeed, Azerbaijan is currently lacking production capacities and imports the gas for its own use from Turkmenistan through an Iran-enabled swap. Although the discussed doubling of the swap volumes could free up more Azeri gas for the EU there has been no explicit indication of this opportunity as well as the long-discussed Trans-Caspian gas pipeline that was the project of common interest for a while intended to bring Turkmen gas to EU. Whether this last option is being considered or completely abandoned is not clear.

[1] bne IntelliNews - IEA chief warns Europe its gas efforts won't be enough even as Brussels inks deal with Azerbaijan

[2] Press corner | European Commission (europa.eu)

[3] Subsea cable is now under feasibility assessment

In the RePowerEU plan and the EU External Energy Strategy [4] EU has confirmed its commitment to a net zero 2050 pathway including the target of 10 million tons of domestic renewable hydrogen production and 10 million tons of imports by 2030.

To facilitate the import of 10 million tons of hydrogen by 2030, the European Commission aims to conclude partnerships to ensure trade and investment in renewable and low-carbon fuels. Three major Planned hydrogen import corridors, from the North Sea region, the Southern Mediterranean, and Ukraine are those where existing gas pipelines can be upgraded to carry a substantial amount of hydrogen or biogases. EU is planning to promote broader energy partnerships, combining gas cooperation with long-term cooperation on hydrogen. The **Southern Gas Corridor (SGC**): "Infrastructure for the transmission of gas from the Caspian Basin, Central Asia, Middle East, and eastern Mediterranean Basin to the EU" is identified as a priority corridor[5] although not explicitly mentioned in the amended TEN-E regulation of 2022.

Caspian Gas for the EU

Central Asia and the Caspian basin have been viewed as potential source of energy for Europe and the world markets for decades. However, the initial high ambition of the Southern Gas Corridor was reduced to only 10 bcm/a over TAP to the EU, falling short of promises for bringing vast Turkmen gas resources to Europe[6]. China and Russia have taken the advantage of most Turkmen gas exports while Russia and Iran were effectively blocking the attempts to realize the Trans-Caspian gas pipeline opening up the ways for Turkmen gas to Europe.

Nevertheless, the high energy potential from the East of Caspian remains in place, and the war in Ukraine may be creating new conditions for its utilization. The Central Asian countries are looking for a higher degree of independence from Russia which has demonstrated to be an unreliable monopolistic partner disregarding the sovereign interests of its neighbors. Turkmenistan is looking to expand its gas exports to the region but also to Europe[7]. This intention may be strengthened once Russia, due to excess of its gas, terminates its purchases of 10bcm/a from Turkmenistan, thus cutting the government off the source of badly needed cash. Kazakhstan is actively looking for diversification of oil export routes in avoidance of Russia's blocking of the Novorossiysk export terminal.

Given the Russia-inflicted crisis, the Trans-Caspian pipeline is getting renewed attention despite the previous criticism[8]. A few recent papers claim that recent geopolitical developments make TCP, in one of its potential versions, a likely strategic project that could soon find new sponsors[9].

Below we argue that the potential for a Giga scale renewable energy development in the west of Central Asia adds another potential strong argument in favor of revisiting the TCP idea.

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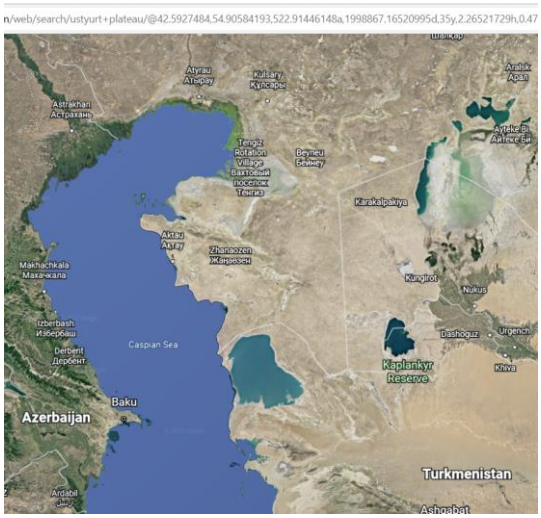
[4] EU External Energy strategy EUR-Lex - 52022JC0023 - EN - EUR-Lex (europa.eu)
[5] Trans-European Networks for Energy (europa.eu)
[6] Exclusive: European Union sees supplies of natural gas from Turkmenistan by 2019 | Reuters
[7] Gas sector: growth of production and diversification of exports (turkmenistan.gov.tm)
[8] E.g. Trans-Caspian Pipeline—Still a pipe dream? - Atlantic Council
[9] Is It Time To Revisit The Trans-Caspian Pipeline Plan? (yahoo.com); A trans-Caspian gas pipeline could solve Europe's energy crisis | Arab News; Trans-Caspian Gas Pipeline Project May Be Resumed, Says Expert | Economy (business.com.tm); The Future of the Trans-Caspian Gas Pipeline | Global Risk Insights

Central Asia as a green electricity and hydrogen hub for the EU

If mankind survives climate change and achieves sustainable living conditions, the energy supply is going to be dominated by renewable energy and green hydrogen[10]. IEA and Irena agree that by 2050 about 90% of electricity shall be renewable, with about 70% coming from variable solar and wind. The projections of global green hydrogen production vary between 300 and 800 million tons a year[11]. The energy geopolitics will evolve around regions, with major energy flows between the regions happening mostly through super grids and logistic centers of green hydrogen, ammonia, or other synthetic fuels. According to IRENA "Green hydrogen will be most economically produced in locations that have an optimal combination of abundant renewable resources, available land, access to water, and the ability to transport and export energy to large demand centres". Innovation and access to critical minerals will give an additional competitive advantage. Sub-Saharan Africa, Middle-East, Patagonia, and the Australian desert have been often discussed as prime regions for leadership in renewables, however, this does not preclude other regions to have a competitive advantage[12].

The fossil-rich Central Asia has a lot to offer also in terms of clean energy. Vast unoccupied territories with good solar and wind potential can provide practically infinite volumes of green electricity and potentially the green hydrogen. IEA[10] assesses that only the Deserts of Kara-Kum and Kyzyl Kum can accommodate 26.3 and 22.5 TW of solar panel capacity capable of producing respectively 30.4 and 26 thousand TWhs - about global electricity production in 2021[13]. However, it is not only about the theoretical potential of energy production - the development of Giga-size projects will be more realistic in the areas with an optimal mix of conditions for the production and export of green electricity and hydrogen.



[10] https://irena.org/-/media/Files/IRENA/Agency/Publication/2022/Mar/IRENA_World_Energy_Transitions_Outlook_2022.pdf (IEA 2022) https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

[11] Geopolitics of the Energy Transformation: The Hydrogen Factor (irena.org)

[12] https://iea-pvps.org/wp-content/uploads/2020/01/Energy_from_the_desert_Ed-5_2015_lr.pdf

[13] Global electricity generation 1990-2021 | Statista

As an example, one could look at the 200 thousand km^2 plateau of Ustyurt located between the Caspian and Aral seas shared by Kazakhstan, Uzbekistan and Turkmenistan. Its territory, five times the size of the Netherlands, is essentially an unoccupied flat clay and gravel desert with altitudes varying from 150 to 370 m, only a few towns scattered along its sides, and a 2.2 thousand km^2 national reserve at its South-West edge. This plateau has the highest wind potential in CA, comparable to offshore wind speeds in the Caspian Sea,[14] and good solar potential[15].

A rough calculation shows that only **20% of this territory** could accommodate up to 800GW of Wind or 2000GW of solar power and produce 2.4-2.8 thousand TWh of electricity which if converted to green hydrogen would produce **45-50 Megatons of H_2 – the energy equivalent of 150bcm of natural gas supplied by Russia to the EU** until recently [c)].

The significant advantage of this plateau compared to the vast deserts of Kara Kum or Kyzyl Kum is in its high wind speeds, better geology conditions, and proximity to the Caspian Sea which can provide an access to low salinity water and possible options for the export of green hydrogen and green electricity.

The estimates are based on the following assumptions:

- Average capacity factors: Solar PV 16%, Wind power - 35% .
- Average power densities: solar PV – 50MW/km^2 [16], Wind power – 20MW/km^2 [17]
- Electricity consumption for hydrogen production: – 55kWh/kg
- Pipeline transportation of hydrogen by pipeline: – 85% of natural gas throughput[18]

These are moderate assumptions mostly conservative compared to the original sources. The result is presented for demonstration of scale rather than as exact calculation; with the main purpose – to justify more accurate assessments and measurements.

The energy potential of such locations is bigger than major oil and gas deposits in the world and it is a low carbon and inexhaustible. It exceeds by far the needs of regional markets. Evacuation of this amount of energy will require the construction of electricity super grids and huge electrolyzer capacities as well as export logistic networks for hydrogen or synthetic gases. It could justify the strengthening of export routes by adding more gas pipelines and subsea cables. Due to the outstanding scale, this possibility goes far beyond the level of a single project and could be formulated as a development program for the region. The important reserves of critical minerals[19] would add to the competitive advantage of the CA region to become the lead producer of needed clean energy technologies.

In a long term, the Giga scale RE projects are likely to be implemented in different prospective regions globally, to achieve a sustainable carbon-free future. The green-field Giga RE development is already becoming a reality and China has recently announced the development of 450 GW of RE capacity in Goby Desert[20]. However, this example will be hard to replicate in other regions unless there is an incremental path of economically feasible projects that will finally lead to the Gigascale development.

TCP can provide such an incremental path for RE Giga development in the West of CA. If TCP gets constructed with the condition of transporting the green hydrogen from Central Asia, it could transit increasing volumes of hydrogen and ultimately provide the possibility of **full decarbonization of the**

[14] Global Wind Atlas
[15] Global Solar Atlas
[16] IEEE Xplore Full-Text PDF:
[17] https://www.sciencedirect.com/science/article/pii/S0973082620303367
[18] https://www.gascade.de/fileadmin/downloads/wasserstoff/whitepaper-h2-infrastructure.pdf
[19] Vakulchuk, Indra Central Asia is a missing link in analyses of critical materials for the global clean energy transition - ScienceDirect
[20] Huge Chinese Desert Projects Will Power Next Wave of Wind, Solar - Bloomberg

Southern Gas Corridor. If TCP gets implemented with the 30 bcm capacity as initially envisioned, it will be able to transit 4-5 million tons of hydrogen annually that could be delivered to the EU and the world markets. This would require about 140GW of wind or 330GW of solar capacity and take about 2% of the RE potential of the plateau. One should note that there is already a discussion of partial 20% decarbonizing of TANAP[21], however, the potential of Azerbaijan might be insufficient for full decarbonization of SGC.

Discussion

In summary, two mutually reinforcing strategic possibilities could increase the chances of each other. The vicinity to the Caspian Sea and the Southern Gas Corridor (300km), a combination of high wind and solar potential, availability of vast territories, and appropriate terrain, makes the West part of Central Asia arguably a competitive source of green electricity and green hydrogen for the EU and other markets. This potential can be unlocked by the construction of the Trans-Caspian pipeline that could eventually lead to full decarbonization of the Southern Gas Corridor and supply to the EU of 4-5 mln tons of green hydrogen. On the other hand, green hydrogen could provide an additional upstream resource that would make TCP feasible. If constructed, the TCP is not going to become the stranded gas asset but rather serve for gas export in the medium term and later for green hydrogen and gradual decarbonization of the Southern gas corridor.

This challenging perspective deserves a more detailed assessment of technical, economic, and political factors involved, as well as subsequent ingenious technical, business and political engineering to be realized. Nevertheless, the endeavor may be worth of effort as it may open up a huge source of renewable energy for the EU and the world, as well as deliver huge technical and economic benefits to participant countries. It can also pave the way for further much bigger volumes of green electricity and green hydrogen from Central Asia at later stages. Meanwhile, each of the components can proceed at its own pace due to many supportive factors:

- EU's search for alternative energy resources coincides with the willingness of CA countries to find new ways to export their energy resources; 10bcm of Turkmen gas can be freed right away once Russia terminates the purchases.
- A convention on the legal status of the Caspian that was signed between all littoral states in 2018 allows Azerbaijan and Turkmenistan to agree among themselves on the construction of TCP with only environmental issues to be agreed upon with others.
- A recent breakthrough agreement between Turkmenistan and Azerbaijan on the joint development of the disputed Dostluk field[22] in the Caspian sea opens a new page of cooperation that may help with the Trans-Caspian pipeline as well.
- The EU has added the natural gas (and nuclear) projects to the EU taxonomy of sustainable activities thus reverting its 2020 decision (TEN-E regulation amendment) to end support of gas pipelines.
- Current gas prices make green hydrogen more competitive and suggest that it may be better to pay for the new infrastructure rather than pay inflated prices for the gas.

[21] TANAP could supply hydrogen to Europe | Daily Sabah
[22] New Era for Ashgabat and Baku? - CABAR.asia

- Central Asia is actively working on RE development and the Giga scale projects are starting elsewhere thus offering precedents and experience.

On the other hand, numerous impediments and risks could prevent the progress even in the case of economic and technical feasibility. This includes the readiness of CA countries for cooperation, the willingness of gas-rich countries to allow hydrogen transportation rather than developing and exporting their gas, and the results of Russia's war in Ukraine, *etc., etc*.

Nevertheless, the suggested opportunity deserves a closer consideration and more detailed assessment, while the discussions on TCP and the RE developments in Central Asia proceed at their own pace. CA and EU might incorporate this long-term vision in their cooperation on RE development and gas supply discussions. Detailed measurements of wind and solar resources might be conducted in preparation for small-scale projects and further feasibility studies. Kazakhstan could start piloting the MW scale projects to understand the operational conditions for solar and wind technologies on the Ustyurt plateau and test the grounds for potential cooperation with Turkmenistan etc. Many other steps could be taken for nearing the future where Central Asia with its vast Renewable Energy and critical mineral resources plays an important role in addressing global climate change and EU's energy security.

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