



Low Carbon Hydrogen Economy in Uzbekistan



This project is supported by EBRD Shareholder Special Fund



THE COLOURS OF HYDROGEN

Grey Hydrogen

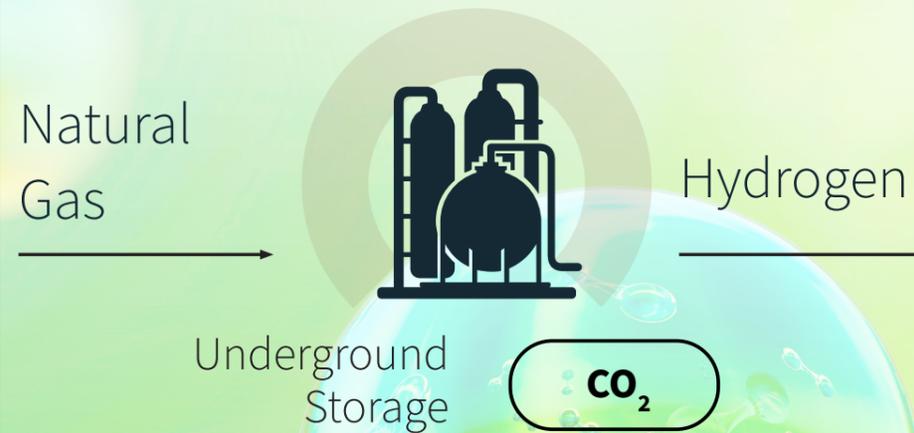
Steam methane reforming (SMR) of natural gas



- Fossil fuels are used as a feedstock and chemically converted to yield hydrogen
- High emissions and uses non-renewable resource

Blue Hydrogen

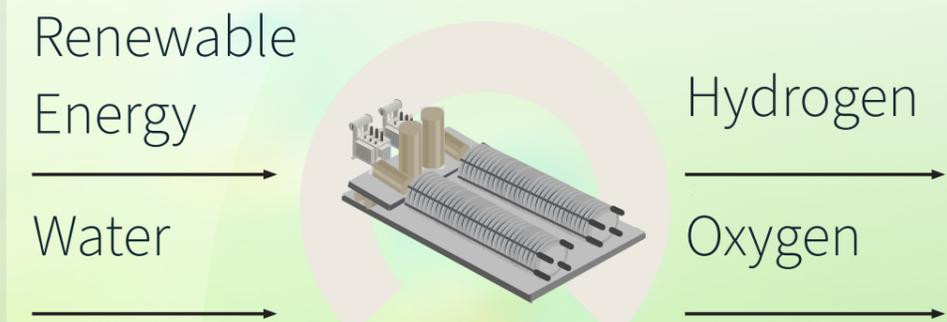
SMR with carbon capture and storage (CCS)



- Similar to grey hydrogen but with capture and storage of CO₂ emissions
- Low Scope 1 and 2 emissions but still uses non-renewable resource

Green Hydrogen

Water Electrolysis



- Uses electrolysis (separation of water into H₂ and O₂) to form hydrogen
- Minimal Scope 1 and 2 emissions

Uzbekistan's strengths in developing a low carbon hydrogen economy

Uzbekistan's industrial sectors show potential demand for low-carbon hydrogen

Being an industrially-oriented country, a low carbon hydrogen economy in Uzbekistan could offer a means for decarbonisation of key chemical industries.

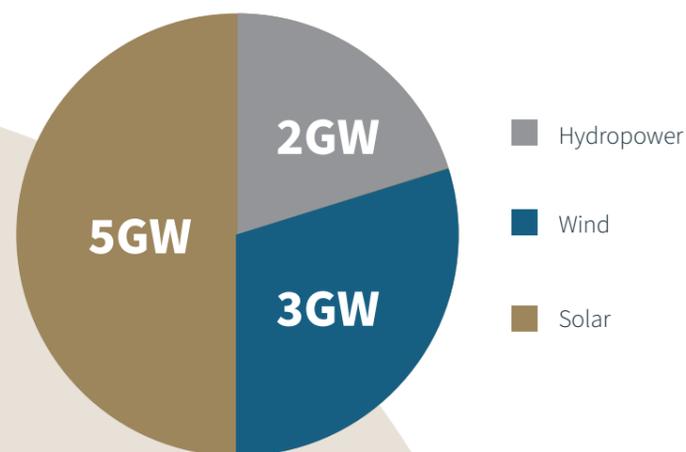
Uzbekistan's ammonia and methanol industry could lead its blue and green hydrogen demand. Additionally, Uzbekistan is very well placed from a technology perspective to produce low carbon synthetic fuels. The country has synthetic fuels/syngas experience through its Gas-to-Liquid (GtL) plant, which uses Fisher-Tropsch (FT) technology. When paired with a sustainable/low carbon feedstock, this technology can be used to produce sustainable fuels for aviation and other hard-to-abate sectors.

Uzbekistan is one of the world leaders for production of metals (uranium, gold, copper, etc) and its mining industry is of strategic importance. These sectors are candidates for hydrogen use, particularly as a means to decarbonise mining vehicles.

Uzbekistan has good natural resources

Uzbekistan is one of the world's largest natural gas producers, annually producing around 60 billion cubic metres. The vast natural gas and oil field in the Bukhara-Khiva region could be a potential low-cost source of natural gas for blue hydrogen production. In addition, the ongoing development of Gazli underground gas storage in the region is key for hydrogen storage.

In terms of availability of renewable resources for green hydrogen production, Uzbekistan renewables sector is experiencing rapid growth. A low carbon pathway for the electricity sector has been developed with the support of EBRD. Within the framework of the energy sector reform, Uzbekistan launched a rapid expansion of its renewable electricity generation capacities that envisages a six-fold growth in the period 2018-2030. A potential approach for a low carbon economy in the country could be to use renewables to save natural gas use in power generation, freeing up gas reserves for conversion into higher value products.



Planned expansion of renewable energy generation capacity by 2030

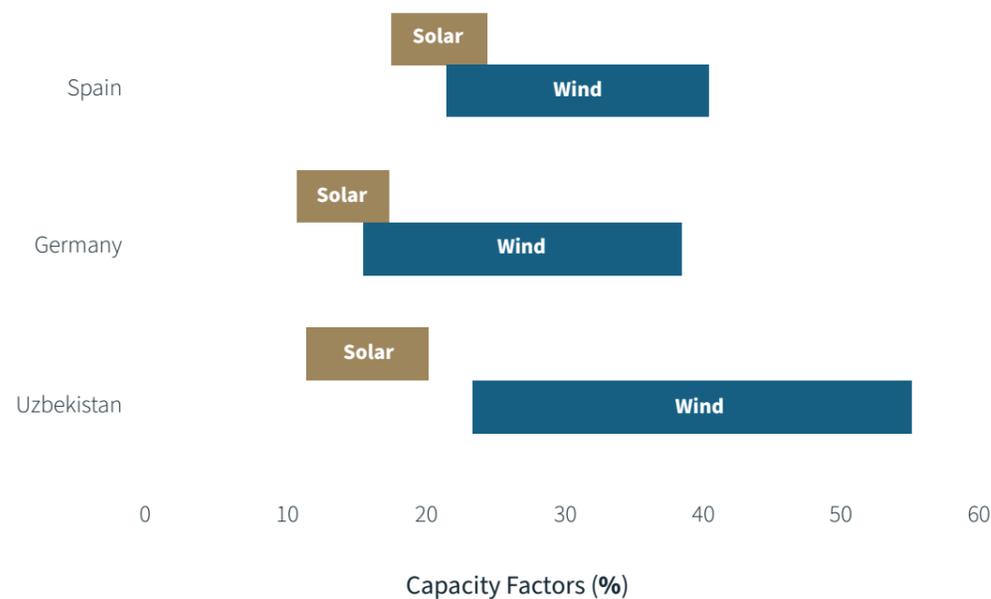


In the revised Nationally Determined Contributions (NDC) document, adopted in 2021, the Uzbekistan's government set out targets to increase the share of renewable-based power generation to at least 25% by 2030, outlining plans for construction of new facilities with 10 GW of capacity (solar – 5 GW, wind – 3 GW and hydropower – 2 GW).

UZBEKISTAN'S LOW CARBON HYDROGEN PRODUCTION COMPETITIVENESS

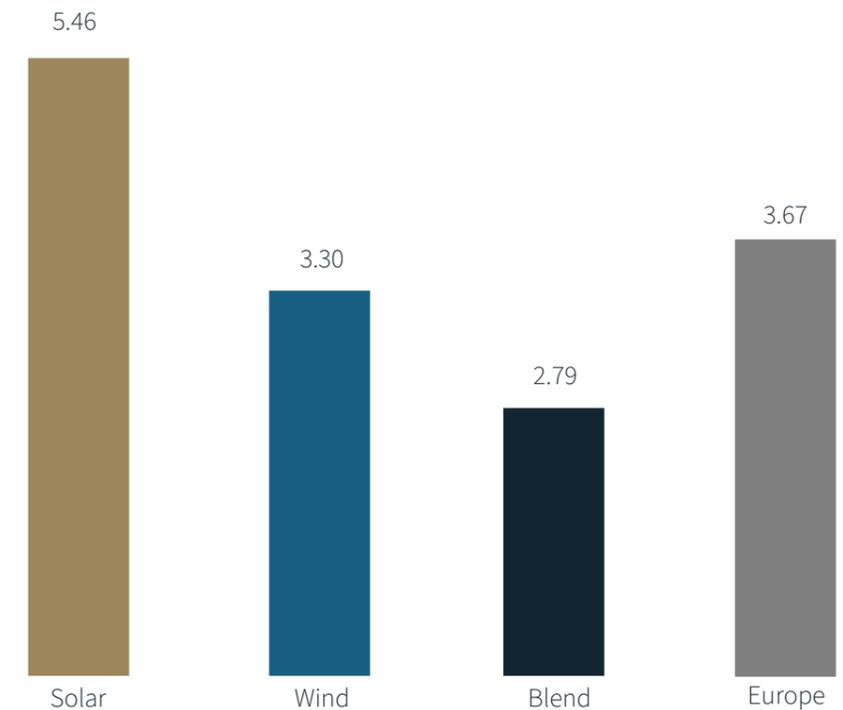
Uzbekistan has potential for production of both green and blue hydrogen

Due to its rich natural gas reserves, the country has a good potential for blue hydrogen production. Whilst export of blue hydrogen to Europe may be limited due to current trade flows, the availability of CO₂ storage and pre-existing gas infrastructure would result in commercial competitiveness, making it the fuel of choice for domestic demand. Most blue hydrogen consumption can be expected to happen in-country and will be competing in the local legislative environment (i.e. without a ETS scheme or carbon tax).



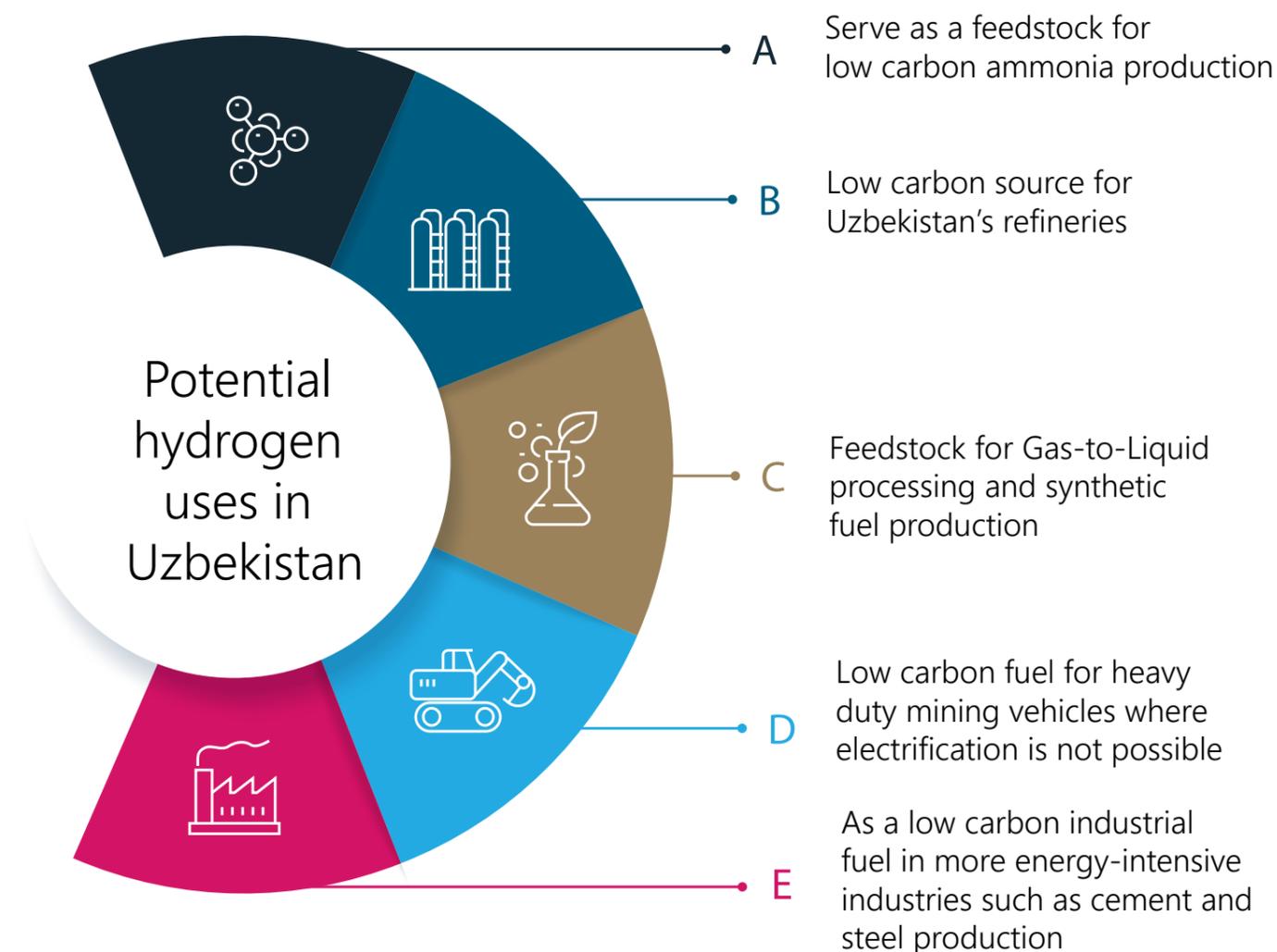
Renewable resource capacity factors compared

The lowest cost green hydrogen option for Uzbekistan would be to combine wind and solar which can maximise the load factor, achieving a LCOH in 2030 of around 2.79 €/kg. Though there is an abundant renewable resource in Uzbekistan, high wind-speeds are limited to a small area. Using only solar power would increase the LCOH to 5.46 €/kg.



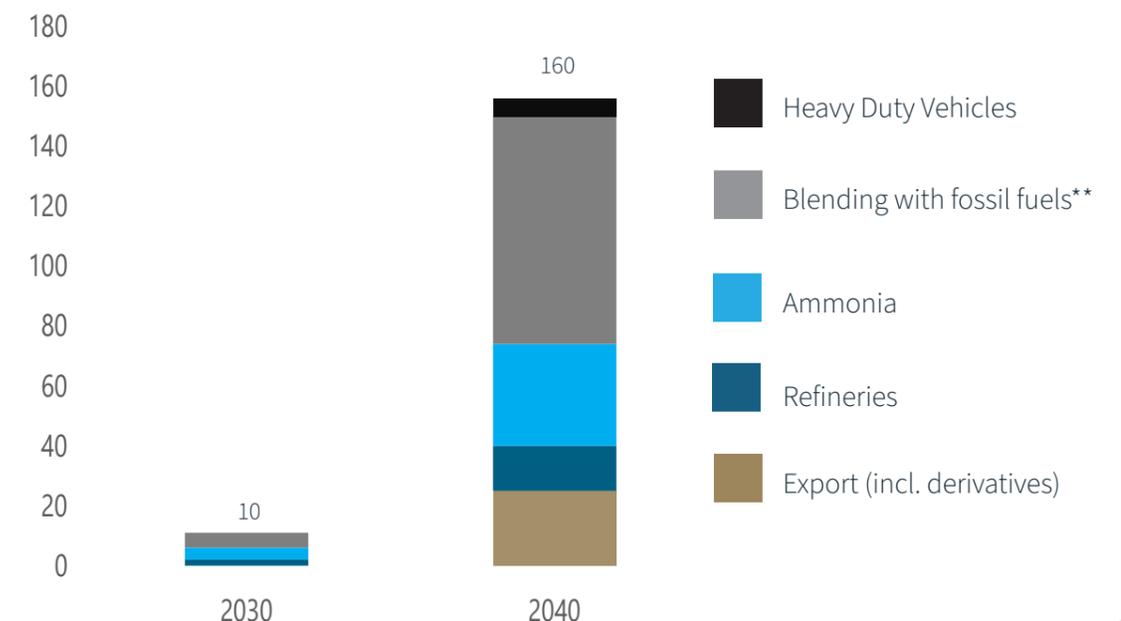
Green Hydrogen LCOH in EUR/kg (2030)

How low carbon hydrogen can be used in Uzbekistan and potential for exporting



Uzbekistan's future hydrogen demand depends largely on its natural gas and key domestic industries. The current hydrogen demand is about 460 kTPA limited to use in ammonia production (80%), methanol production (14%) and for synthetic fuel production (6%). As Uzbekistan is a large producer of ammonia and fertilisers there is a substantial potential to use low carbon hydrogen for ammonia production. Moreover, the hydrogen demand for synthetic hydrocarbon and methanol production, met currently by natural gas, could be displaced by low carbon hydrogen. Additionally, Uzbekistan's refineries could potentially use low carbon hydrogen as feedstock as part of their future modernisation. The steel and cement industries will also play a major role in the low carbon market.

With its established ammonia and methanol markets and extensive natural gas distribution systems, Uzbekistan has potential for a significant low carbon hydrogen demand. Uzbekistan also plans to be a major exporter of mineral fertilisers. Although Uzbekistan is not favourably placed geographically to supply products to the European market, as low carbon markets become established in other geographic regions, Uzbekistan has potential to supply low carbon products such as ammonia and fertilisers, and the chemical products from gas-to-liquid and methanol-to-olefins processes at competitive prices.



Growth of low carbon hydrogen in Kazakhstan (kilotonnes per annum)*

*Mixture of additional low carbon hydrogen demand and displacing existing grey hydrogen demand which is currently 460 kTPA

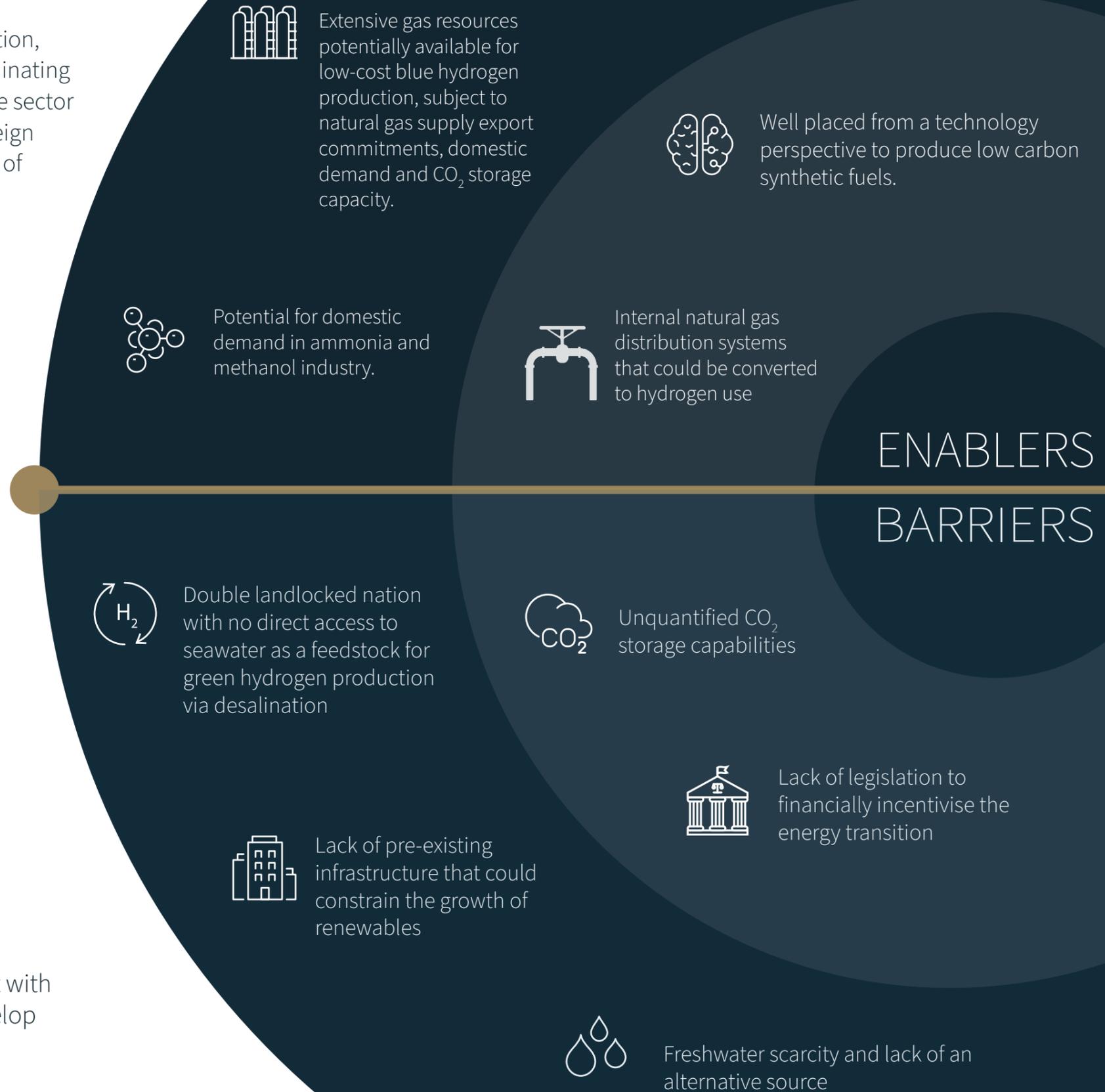
** Deblending at downstream industrial sites

Relevant Policy & Regulations

To strengthen the energy sector and prepare for the energy transition, Uzbekistan has launched large-scale sector reforms aimed at eliminating monopolistic practices, creating a suitable environment for private sector participation and a more favourable regulatory framework for foreign investors. In recent years, the country has also adopted a number of energy-related laws and regulations.

- 2018** Uzbekistan ratified the Paris Agreement and submitted its first Nationally Determined Contributions (NDC) document
- 2019** Government has approved the Strategy for the Transition to the Green Economy
- 2019** Adoption of the regulation on Use of Renewable Energy Sources
- 2020** Adoption of the regulation on the Rational Use of Energy
- 2021** Adoption of the revised NDC version
- 2021** Creation of an inter-ministerial commission for the development of renewable and hydrogen energy
- Next** Implementation of a strategic framework agreement with Saudi Arabia's ACWA Power and Air Products to develop hydrogen research programmes and projects

There are various enablers and drivers in developing a low-carbon hydrogen economy in Uzbekistan:



What Uzbekistan needs to build a low carbon hydrogen economy

Government Actions

Uzbekistan is in a strong position to develop a low carbon hydrogen economy owing to its substantial hydrogen production potential. Considering the country's rich gas and renewable resources, recent years has seen a significant interest in developing low carbon and green hydrogen production in the country. Moving to a future hydrogen economy will require new electricity infrastructure, testing the existing pipelines for hydrogen blending limits and repurposing where required and, potentially, exploring natural hydrogen storage facilities, such as salt caverns or carbon sinks, in the region. All these aspects will need to be regulated. A national strategy will also be needed to develop a roadmap to enable a significant scale up of hydrogen across Uzbekistan, including evaluation of its CO₂ storage capabilities, upstream emissions and the balance of domestic gas production compared with demand.

It would seem more logical to encourage rapid growth in renewable power to displace natural gas from power generation, allowing more high value products such as synthetic fuels and olefins (and derivatives) to be created. Any focus in Uzbekistan should first be on improving its electrical infrastructure and renewable energy supply before considering hydrogen as an opportunity to decarbonize further. The country's government should work alongside industry and other stakeholders to seek out these potential demand opportunities, locking in buy in.



Clear hydrogen roadmap and commitment to infrastructure

Financial Incentives and legislation

Expansion of electricity grid

Maximizing Low Carbon Economy Benefits

To maximise benefits to Uzbekistan it is necessary to have a coordinated ramp up of the domestic market demand, local supply chain and upskill the workforce. Financial incentives will be required to boost take-up in low carbon hydrogen demand in key industrial sectors such ammonia, methanol, refining, etc. This could be in the form of end user obligations on certain industrial and transportation sectors to use green hydrogen or ammonia. In the long term, it might well be possible for Uzbekistan's government to levy export taxes on hydrogen and energy sectors, such as clean ammonia and methanol, but only after the hydrogen economy has been established and infrastructure is in place.



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