

Low-carbon hydrogen production in CIS countries and its role for hydrogen ecosystem and export potential

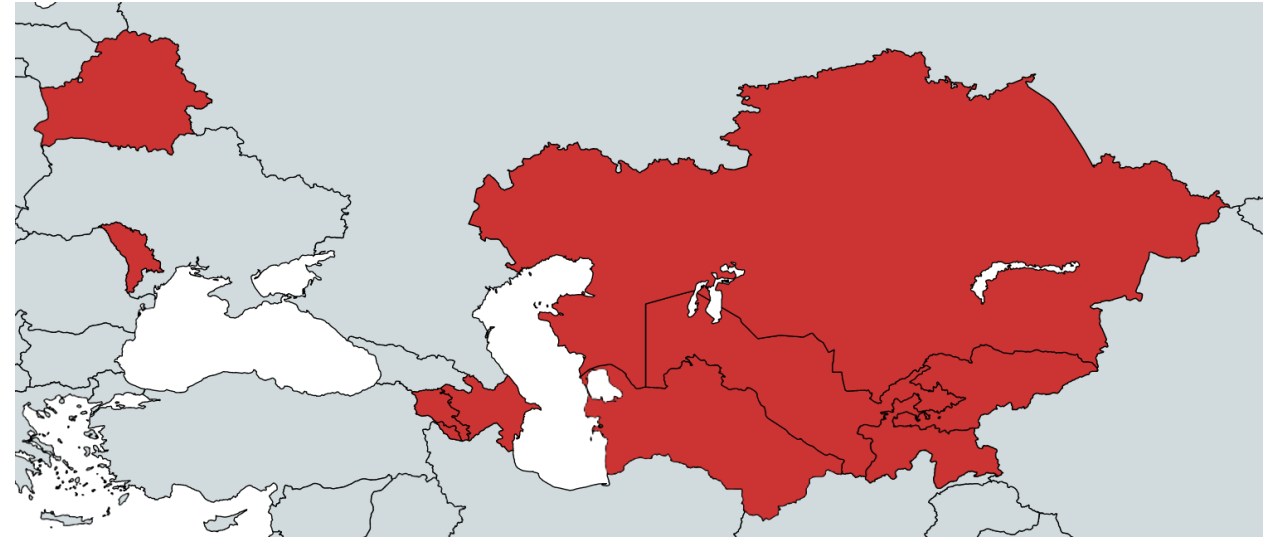


Yury Melnikov,
Independent Sustainable Energy Consultant,
UNECE

**75 YEARS
OF ECONOMIC INTEGRATION
AND COOPERATION
IN THE REGION**

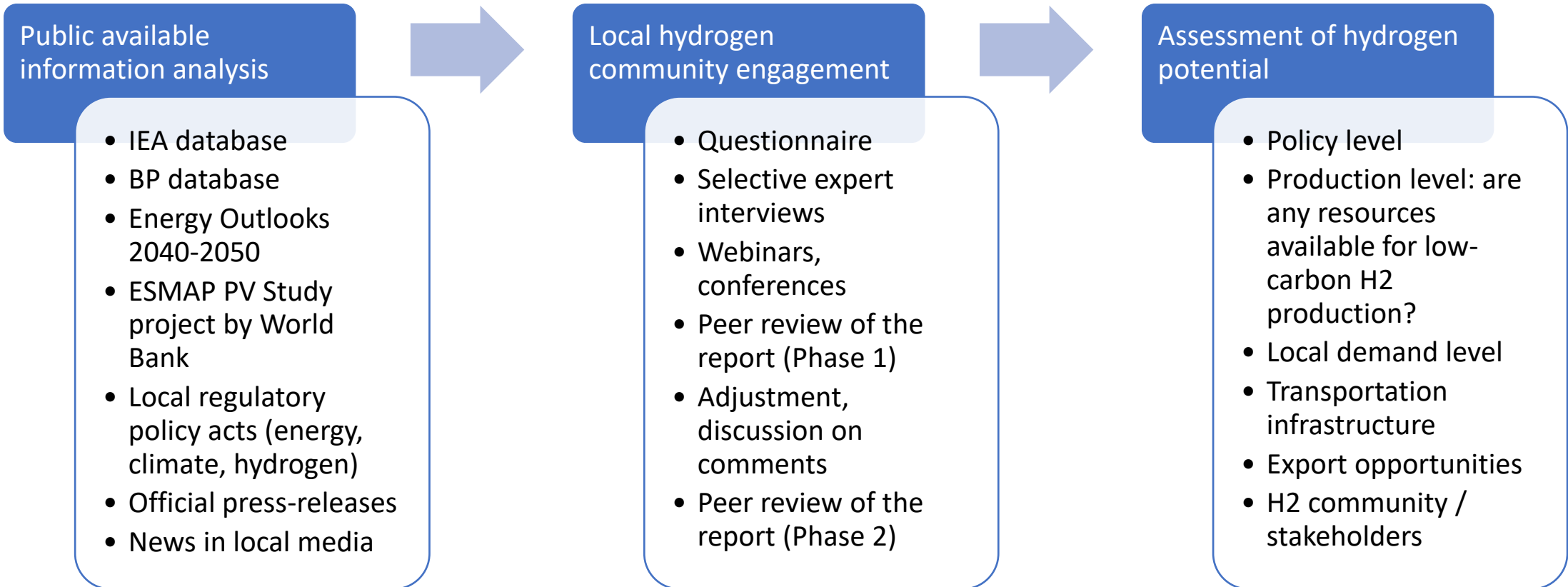
Project scope and geographical coverage: Low-carbon hydrogen potential for 9 beneficial countries

- energy mix assessment
- current long-term energy and climate policy review
- assessment of local resource potential: renewables, natural gas, CCUS, nuclear power
- review of activities in the field of hydrogen economy
- conclusion on the potential (hydrogen production, local demand, export opportunities) and possible priorities of future hydrogen strategy



Armenia, Azerbaijan, Belarus, Moldova, Kazakhstan,
Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan:
100+ million people, 4.3 million km²

Information sources and assessment methodology



Resource potential outlook: key general assumptions

Technologies or H2 “color”

- “green” (electrolysis + renewables)
- “blue” (natural gas + CCUS)
- “yellow” (electrolysis + nuclear power)
- Technology agnostic, but GHG emissions are very important

Renewables

- Solar, wind, hydro
- Renewables deployment rate is crucial (only a part of **new added** renewables can be used for hydrogen production)
- **Curtailement of renewables** is another possibility (also for existing hydro)
- 55 kWh per 1 kg H₂

Natural gas + CCUS

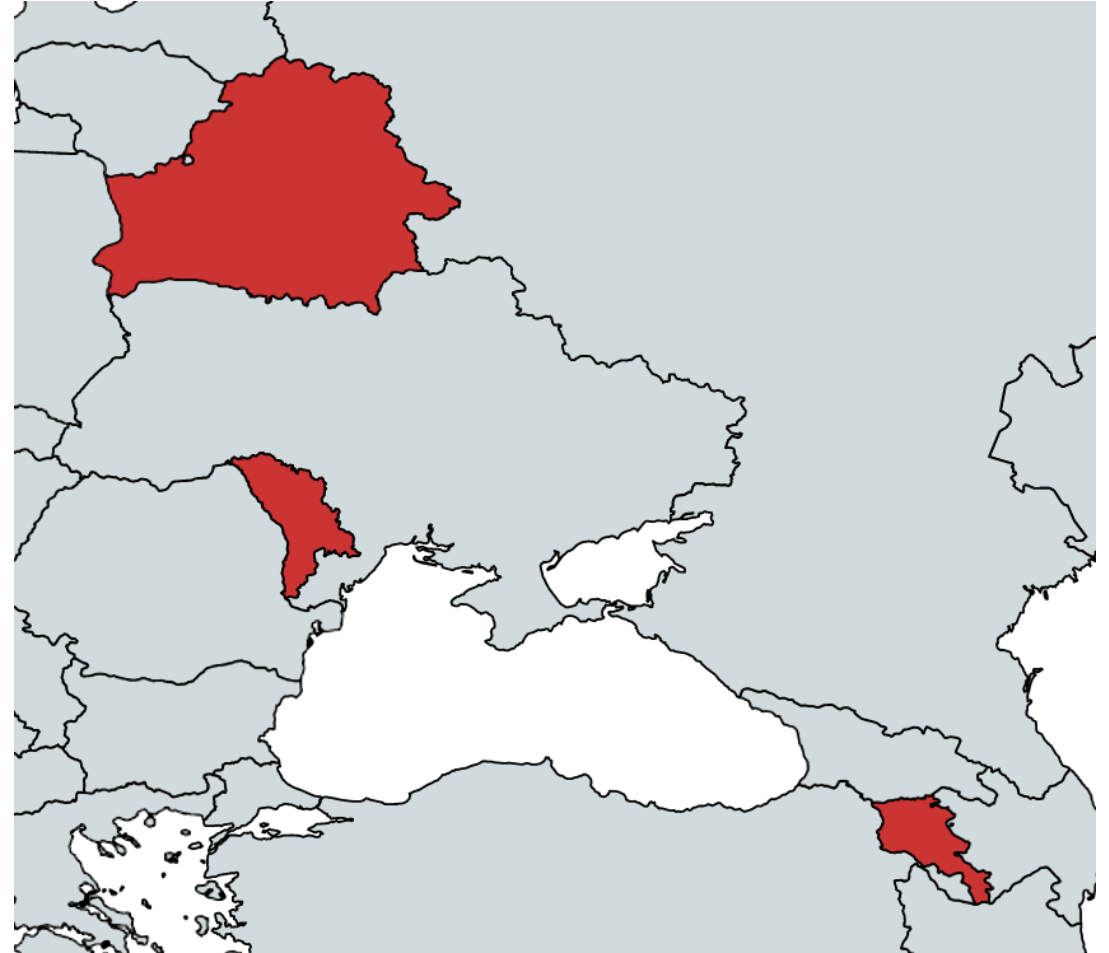
- Available only for natural gas producers (NG import is not sufficient for H₂ production)
- NG production / demand trends are important
- CCUS development is crucial to realize this potential
- 5.3 m³ CH₄ / 1 kg H₂, 10 kg CO₂ / 1 kg H₂

Nuclear

- Available only for countries with own existing/planned nuclear power plants
- Development trends are important (only a part of **new added** nuclear power plants can be used for hydrogen production)
- **Curtailement is a possibility** (Belarus case)
- 55 kWh per 1 kg H₂

Insights: Eastern European group (Belarus, Moldova, Armenia)

- practical absence of own hydrocarbon resources (in particular, natural gas)
- dependence on energy imports
- natural gas stands for 30-60% of the energy mix
- nuclear power in different phases (Armenia, Belarus)
- PV / wind electricity is a common source for hydrogen production
- domestic hydrogen demand and renewables deployment is limited because of policy
- hydrogen policy is not in the agenda yet



Source: www.mapchart.net. The boundaries and any other information shown on the maps do not imply, on the part of the author, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Insights: Caspian group (Azerbaijan, Turkmenistan)

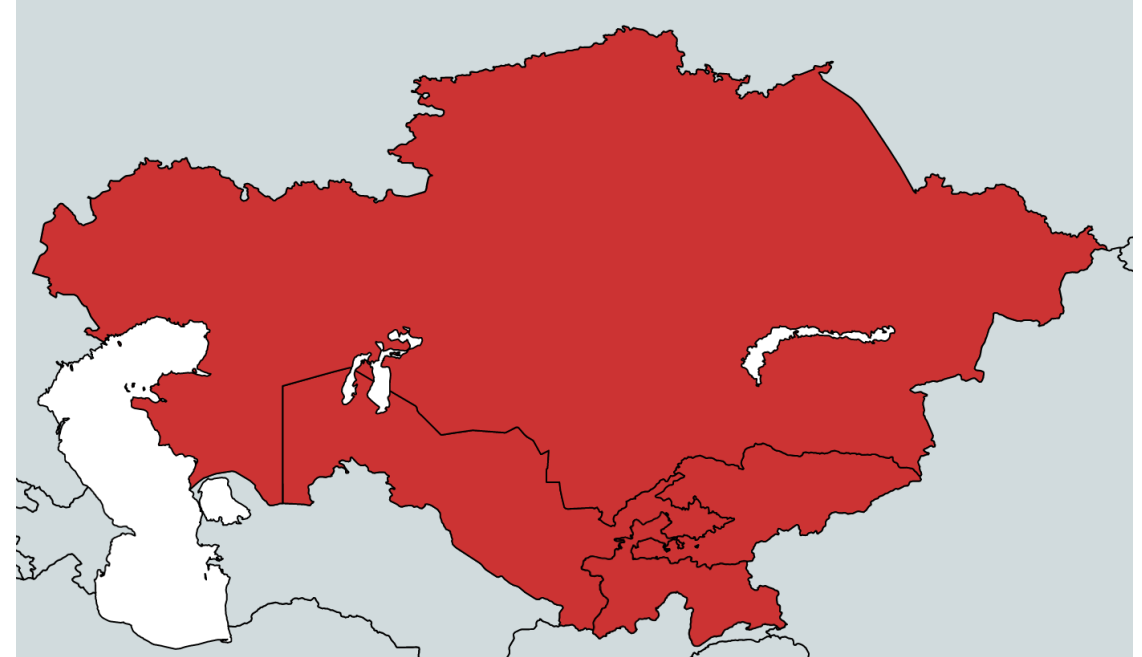
- energy-abundant countries with an overwhelming natural gas share in the energy mix
- energy exporters to the EU (Azerbaijan) and China (Turkmenistan)
- long-term energy strategies not yet published
- opportunities to produce hydrogen from natural gas and CCUS
- huge hidden renewables potential, including offshore wind in the Caspian Sea
- new gas transmission infrastructure as an opportunity for hydrogen
- first steps in hydrogen projects (MoU in Azerbaijan, hydrogen for foreign affairs in Turkmenistan)



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Insights: Central Asia group (Kazakhstan, Uzbekistan, Tajikistan, Kyrgyzstan)

- Kazakhstan and Uzbekistan are energy-abundant countries based on fossil energy resources, but with ambitions of major changes in the energy mix (Kazakhstan aims for carbon neutrality by 2060)
- Kazakhstan and Uzbekistan are regional front-runners in terms of renewables and hydrogen economy development
- Tajikistan and Kyrgyzstan are energy-deficient countries with a huge share of hydropower and energy shortage problems / aging infrastructure issues
- Renewables curtailment (hydro power plants) is an option for hydrogen production
- Gas infrastructure could be considered for hydrogen transportation, after aging issues are solved and all stakeholders in the region are involved



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Preliminary Common Insights

- realization of the hydrogen potential will depend not so much on resources as on technologies and the cost reduction rate
- hydrogen export is limited due to the great distance from key importers (the EU, Japan) and lack of access to the sea
- local demand for hydrogen will open up new opportunities
- the interconnectedness of the new gas infrastructure and its focus on China creates the potential for joint activities in the pipeline transport of hydrogen
- international cooperation is crucial to unlock the region's low-carbon hydrogen potential

Next Steps

- Finalization of reports: Q3 2022
- Publication: Q4 2022 (in English & Russian)
- Key event: 2nd Almaty Energy Forum “Innovating and Modernizing Energy Infrastructure in Central Asia”, November 14-16, 2022