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National **Green** Hydrogen Strategy - Georgia,
most cost-competitive supplier of **Green H2**
to the European Union

Prepared by **H2exagOn**

Photo: Lake Ritsa, Abkhazia, Georgia

Foreword

The world is aiming to accelerate change towards low-carbon energy systems that enable robust economic development and limit the rise in global temperature to well below 1.5°C. Providing universal access to affordable, reliable, sustainable, and modern energy services by 2030 is, therefore, a key sustainable development goal. It means that rapid and deep reductions in greenhouse gas emissions are needed to avoid dangerous climate change, which will necessitate low-carbon transitions across the energy sector where the green hydrogen will play a key role.

The broad features of the required energy transitions are common to all countries, but it is also important to mention that different countries will inevitably follow different transition pathways.

The National Green Hydrogen Strategy of Georgia is the country-specific transition pathway that supports developing economy to address three main goals of the energy transition: energy efficiency, security of supply, and sustainability. By utilizing its abundant renewable energy sources in a sustainable manner, and converting green electricity into the green hydrogen (power-to-gas) for export to the EU, Georgia can attract billions of foreign investment, create hundreds of thousands of new jobs, a sustainable circular economy and a resilient society. Doing so, Georgia will become an essential part of the European integrated energy system by ensuring the security of supply and adding the reliability of available green hydrogen. Furthermore, it can guarantee access to clean energy to mitigate the impact of the energy value chain on the environment and on the global climate in particular.

Green Hydrogen as the most abundant substance in the universe as never before creates a unique opportunity where the “last person” can now be the “first person” to be reached with innovative energy products and services. This is a true sustainable revolution in the worldwide energy systems.



David Otarishvili
Managing Partner, H2exagOn

Introduction

EU call for action

Climate change and environmental degradation present an existential threat to Europe and the world. To overcome this challenge, Europe needs a new growth strategy that transforms the Union into a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases by 2050, where economic growth is decoupled from resource use and where no one and no place is left behind.

According to the European Commission, to become climate-neutral by 2050, Europe needs to transform its energy system, which accounts for 75% of the EU's greenhouse gas emissions. The EU strategies for [Energy System Integration](#) and [Hydrogen](#), adopted in 2020, will pave the way towards a more efficient and interconnected energy sector, driven by the twin goals of a cleaner planet and a stronger economy.

Energy System Integration

The [EU Strategy for Energy System Integration](#) will provide the framework for the green energy transition. The current model where energy consumption in transport, industry, gas and buildings is happening in 'silos' - each with separate value chains, rules, infrastructure, planning and operations - cannot deliver climate neutrality by 2050 in a cost efficient way; the changing costs of innovative solutions have to be integrated in the way EU operates its energy system. New links between sectors must be created and technological progress exploited.

Energy system integration means that the system is planned and operated as a whole, linking different energy carriers, infrastructures, and consumption sectors.

Hydrogen strategy

In an integrated energy system, hydrogen can support the decarbonization of industry, transport, power generation and buildings across Europe. The [EU Hydrogen Strategy](#) addresses how to transform this potential into reality, through investments, regulation, market creation and research and innovation.

Hydrogen can power sectors that are not suitable for electrification and provide storage to balance variable renewable energy flows, but this can only be achieved with coordinated action between the public and private sector, at EU level. The priority is to develop [Green](#) hydrogen, produced using renewable energy.

This gradual transition will require a phased approach:

- From 2020 to 2024, the EU will support the installation of at least 6 gigawatts of renewable hydrogen electrolyzers in the EU, and the production of up to one million tonnes of renewable hydrogen.
- From 2025 to 2030, hydrogen needs to become an intrinsic part of the EU's integrated energy system, with at least 40 gigawatts of renewable hydrogen electrolyzers and the production of up to ten million tonnes of renewable hydrogen in the EU.
- From 2030 to 2050, renewable hydrogen technologies should reach maturity and be deployed at large scale across all hard-to-decarbonize sectors.

“To achieve the goals set by the European Green Deal, the Plan will mobilize at least €1 trillion in sustainable investments over the next decade”

The most ambitious strategies for green hydrogen are in the European Union (EU). The EU as a whole has a target of 40 GW by 2030. The EU strategy also sets a target volume of 10 million tonnes of hydrogen per year (MtH₂ /year) by 2030, which would require 40 GW of electrolysis in neighboring countries.

Why Green Hydrogen?

Current trends of energy market in Georgia

According to the Energy Sector Overview study issued in 2019, overdue of energy policy may delay investment in the electricity sector: Delays in deregulation, subsidized tariffs, and problems with construction permits (including public pushback) create downside for returns and increases project payback periods.

The abolishment of PPAs, which were designed to hedge price risk, and transitional period of new energy market model increases investment risk for generation companies. All factors mentioned, resulted in drop of FDI's. In 2018, FDI into energy dropped 30% y-o-y to USD 157 mln. In Q1 2019, FDI into the sector fell to USD -9mln. On the other hand, growing imports and the expected electricity deficit is expected to lead to higher electricity prices in the coming years.

Electricity market players are exposed to FX risks. Regulated prices on electricity in the local market in the medium term period, together with the depreciation of GEL against USD for the last year's decreased

sector revenue in USD. Also, depreciation of TRY against USD decreases export price of electricity in Turkey, the key export market.

The worldwide outbreak of Covid-19 has brought the world to a standstill, and tourism as a main driver of Georgia's economy has been the worst affected. According to many international experts it will take several years to fully come back to normality and because of the enormous worldwide competition to attract tourists after the pandemic period, it will be harder for the country to be allocated as a top destination for international visitors.

Given reality and related risks as never before creates an urgent matter to make the energy sector as a backbone of the Georgian economy. But to make the necessary transformation, the main goals should be the creation of new business opportunities, facilitating cooperation, and building new partnerships within the hydrogen sector.

Fully utilizing its natural resources in a sustainable manner and converting clean electricity into the Green hydrogen (Power-to-Gas), creates a unique opportunity for the country.

If hydrogen is to make a substantial contribution to the energy transition and climate policy as soon as possible, Georgia should make a commitment to scaling up European, and if possible global, approach. Government must align with the decisions and developments in the country and region. As such, the policy agenda must provide an active national and international strategy.

Hydrogen has the potential to become a globally traded commodity. Production in Georgia can take place with the use of large water electrolysis project(s) for export purposes. Smaller-scale production sites may also be set up. Country with abundant hydro energy potential will focus on the export of green hydrogen to the EU and will become regional energy hub in the future for green hydrogen production due to its favorable location, its ports, free industrial zones, gas grid and future storage capacities.

In the long term perspective domestic demand for hydrogen will be concentrated in the industrial clusters, to heat buildings and in refueling stations for transport.

The challenge is to set up a green hydrogen value chain. This is a complex issue. Demand, production, supply, storage and related infrastructure will all have to develop and there are major dependencies between them and are significantly influenced by government policy. Certainly at the start and in the development phase, it is obvious that the public sector should play its role. The introduction of a new energy carrier is a complex endeavor. As such, the government must steer and guide this whole process.

Most cost-competitive *Green Hydrogen* from Georgia to Europe

Georgia is a country in the Caucasus region. Situated at the juncture of Western Asia and Eastern Europe, it is bounded to the west by the Black Sea. Strategically located on the “Silk Road” Georgia comes to be a transit corridor with strategic access to the sea and a door to Europe. Since 2014, Georgia enjoys Deep and Comprehensive Free Trade Area with the European Union, which mean tariff free trade for product and service with all EU28 states



Due to the availability of natural resources Georgia boasts more than 26,000 rivers with a green electricity generation potential estimated at 40 billion kWh per year. Around 13 TWh domestic demand and Greenfield hydro potential of 27 TWh. Georgia is ranked 40th globally by per-capita freshwater resources. Only four EU countries and one CIS country are in the top 40.

Easy of doing business	Economic freedom	Crime Index
7 th	8 th	5 th
One of the essential country For doing business	Free and open market economy	One of the safest country In the world

Taking into account the country’s strategic location, bilateral trade regimes and available potential of renewable energy and water sources, Georgia like never before have a unique opportunity to become one of the biggest and cost-competitive producer and supplier of the carbon-free commodity and become an essential part of the European integrated energy system.

National Green hydrogen Strategy 2021-2030



As countries take action to decarbonize their economies and new technologies are developed, the export markets for clean fuels will scale and diversify, opening opportunities for further growth.

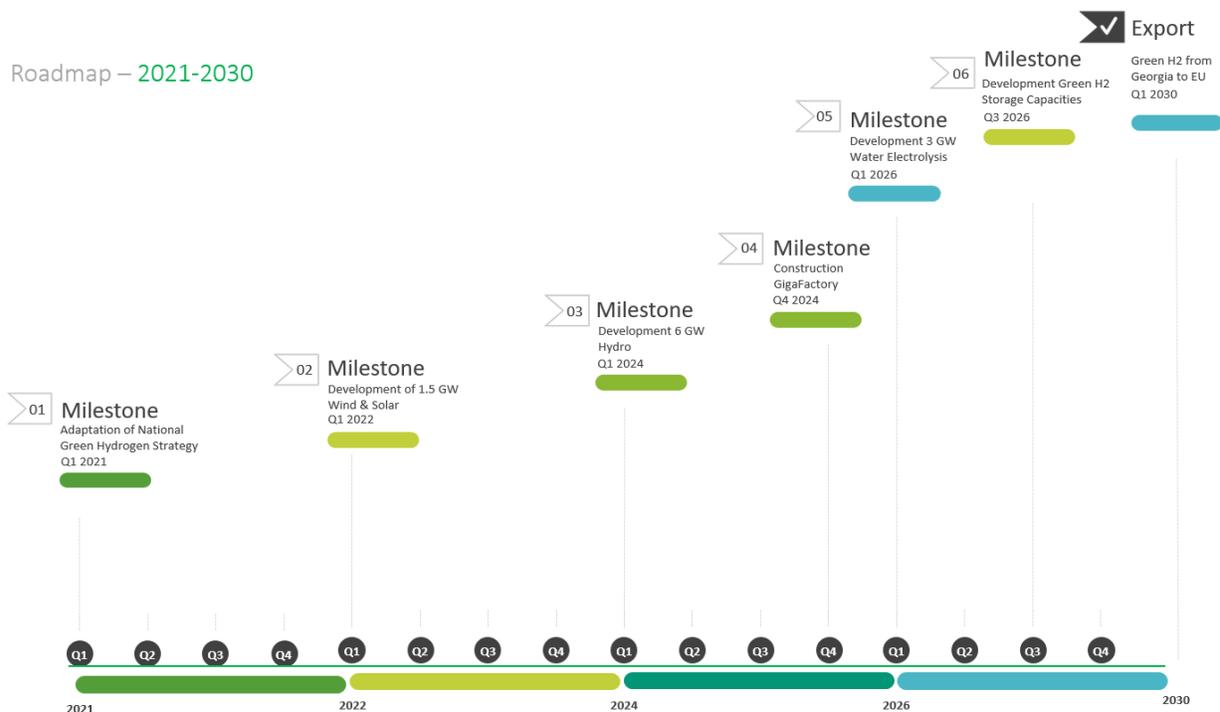
National Green Hydrogen Strategy covers two phases of development:

Phase I 2021-2023 - Covering domestic demand on electricity: Annual electricity generation grew at a 3.8% 6-year CAGR to 12.1 TWh in 2018. Over that same period, consumption increased at a 5% 6-year CAGR to 12.6 TWh. Supply and demand imbalances increased net import to 0.9 TWh for the same period. In 2019, generation has decreased 2.1% y-o-y to 6.2 TWh, leading to 185% growth in net imports to 0.4 TWh. For the first phase it is crucial to solve import and security of supply related issues by developing and integrating available 1.5 GW Wind & Solar into the national grid to cover domestic demand on the electricity, and 700 MW Pump-storage hydro as a system back-up.

Phase II 2023-2030 – Development and preparation for export 2023-2030: Development of 6 GW (technical potential) hydro power, 1 GW electrolysis and fuel cell manufacturing factory, 3 GW water electrolysis and related infrastructure. Produced electricity from hydro will be fully converted into the green hydrogen (power-to-gas). Power generation should be directly connected for the green hydrogen production facilities as much as possible to avoid related costs for electricity grid expansion. Instead, storage capacity should be developed, where surplus green hydrogen will be stored. It will create crucial flexibility in the energy system. Storage will be used to maintain distribution of green H₂, or stored hydrogen will be repowered back to electricity via a fuel cell system if needed. (Power-to-Power). It is crucial that the development of the electricity grid and the hydrogen grid should be effectively coordinated.

Roadmap 2021-2030

For roadmapping National Strategy the back-casting methodology was applied, which literally means looking back from the future. A more comprehensive definition is “generating a desirable future, and then looking backward from that future to the present in order to strategize and to plan how it could be achieved”. To differentiate it fundamentally from forecasting: the end-state is stipulated, that is, rather than derived. A back-casting approach can help to highlight where momentum must be broken and re-directed in order to achieve future objectives, while forecasting tends to extend current trends out into the future to see where they might arrive. Desirable future in this case is to achieve self-sufficiency in line with the energy security, environmental and economic goals of Georgia by becoming a regional hub of green hydrogen production and one of the biggest and cost-competitive supplier to the EU by 2030.



Phase I Key Milestones: Development of Wind & Solar 1.5 GW , and 700 MW Pump-storage Hydro

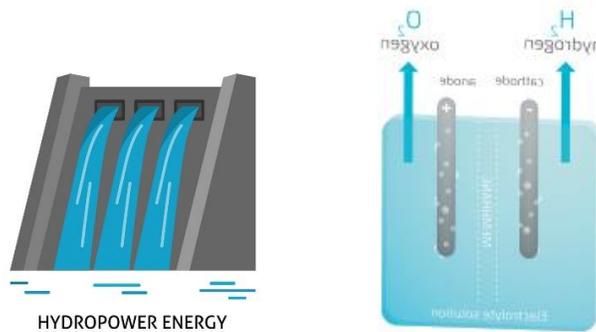


Q3 2021 – Project preparation 1.5 GW Wind & Solar, 700 MW Pump-storage hydro

Q1 2022 – Q1 2024 – El. Grid expansion to integrate Wind & Solar capacities

Q3 2022- Q1 2024 – Construction of Wind & Solar farms

Phase II Key Milestones: Development of 6 GW Hydro & 3 GW Water Electrolysis



Q1 2021 – Adaptation on National Green H2 Strategy and creation of National Green Hydrogen Council

Q3 2021 – International Consortium

Q1 2022 – Project(s) preparation

Q4 2022 – Energy Academy – Work Force Preparation

Q1 2024 – Step-by-step construction of 6 GW Hydro

Q1 2023 - Q4 2024 – Construction 1 GW Fuel Cell and Electrolysis Factory

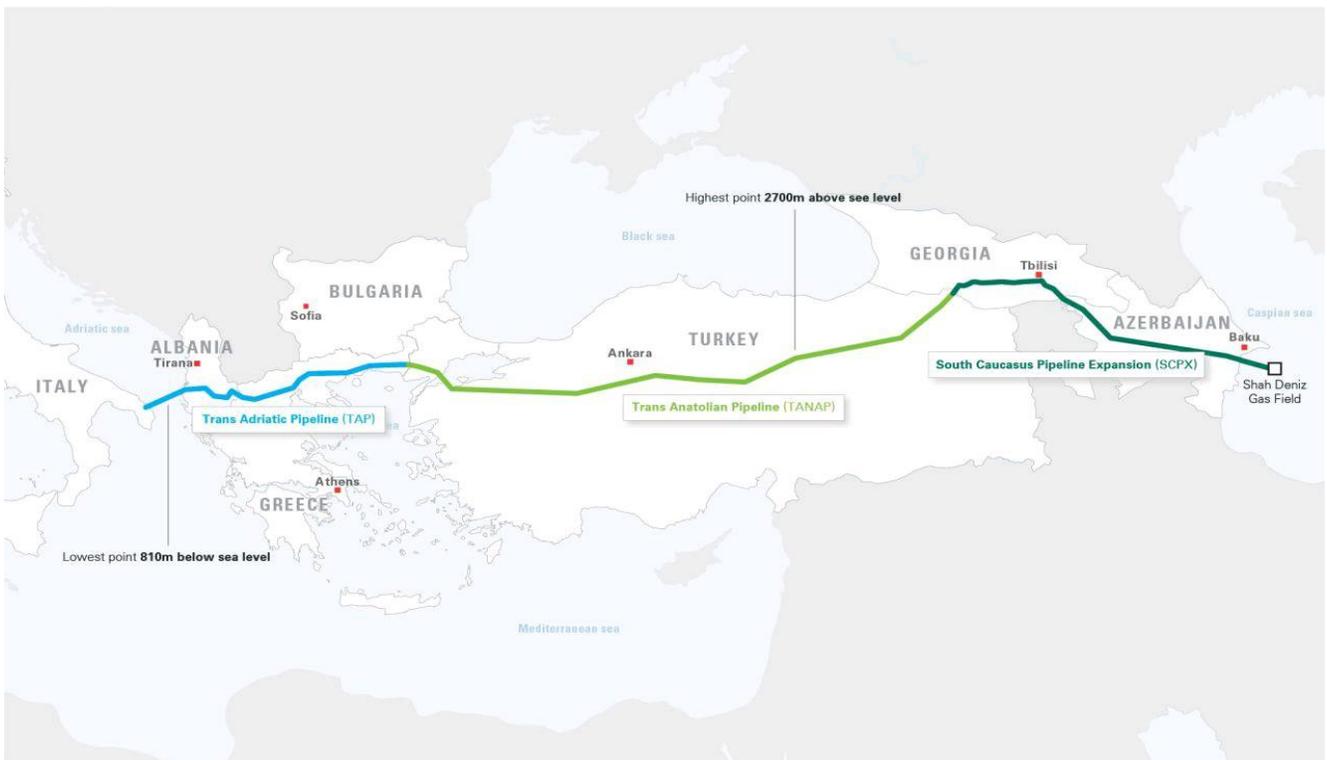
Q1 2026 – Step-by-step construction 3 GW water electrolysis and related infrastructure

Q3 2026 – Development Green Hydrogen Storage Capacities

Q1 2029 – Q4 2029 – Preparation for Export

Q1 2030 – Export of Green hydrogen from Georgia to the EU

Given the access to critical assets, the integrated value-chain approach and hydro power potential, the western Georgia is uniquely positioned to accelerate the hydrogen ecosystem. Western part of the country can become a hydrogen valley. 3 GW water electrolysis and related infrastructure can be developed near seaside and port zone(s), while 1 GW manufacturing factory can be built at Free Industrial Zone(s). Produced **Green** hydrogen will be transported to the EU by special Vessels (e.g. liquefied, compressed, ammonia) via Black Sea, covering Eastern and Central European countries. Admixing **Green** hydrogen with natural gas in SCP(X), which is the part of the world's most complex energy project known as The Southern Gas Corridor, is another attractive alternative covering South-West European countries.



Beside the **Green** hydrogen production, Georgia can become a worldwide hub for manufacturing and exporting related technologies e.g. electrolysis and fuel cells. It will attract additional hundred millions of foreign direct investments.

Hydrogen presents an attractive opportunity for Georgia to lead an emerging industry. The European decarbonization strategy increasingly stresses the relevance of hydrogen and the need to accelerate innovation. Georgia can build on its position to accelerate hydrogen developments and lead this emerging industry, positioning the country as the essential part of the European hydrogen backbone.

Georgia can cost-effectively develop an integrated hydrogen ecosystem, to become a game-changer in the global hydrogen developments, and to accelerate the Georgian hydrogen momentum. In addition, the country has unique access to the critical assets required for a cost-competitive hydrogen ecosystem. By becoming a regional hub for the green hydrogen production it creates additional opportunities in the future to scale-up by integrating Caspian Sea region countries with their offshore wind potential in the local energy ecosystem.

Table 2. Offshore wind technical potential in the Caspian Sea, GW

Country	Fixed	Floating	Total
Azerbaijan	35	122	157
Kazakhstan	265	153	418
Turkmenistan	46	27	73
<i>Caspian Sea – Total</i>	<i>509</i>	<i>336</i>	<i>845</i>

Source: [World Bank](#).

To make it happen, it is crucial to bridging regulatory and standards gaps throughout the hydrogen value chain to ensure safety and give certainty to investors. A regulatory development plan, coordinated throughout all public services that will hold regulatory authority over the hydrogen value chain, should be executed to establish the international standards. Regulation should be developed in coordination with the private sector, promoting international standardization and harmonization.

Creation of early and transparent participatory platforms between communities and project developers is crucial. Dialogue between them should be initiated by the State, ensuring robust communication and capacity building.

National competencies and technical skills required along the value chain of green hydrogen. Energy Academy should be established for preparation of locals with those capabilities. A timely preparation in this regard will create a professional and quality workforce. Local technicians and specialists with adequate knowledge and skills will consolidate a national hydrogen ecosystem. Strong local capacities will give way to new businesses and tech innovations.

This National Green Hydrogen Strategy has the most efficient potential to stimulate the economic recovery from the coronavirus crisis. As never before, it is a unique opportunity for Georgia to become an essential part of the EU’s integrated energy system, attract billions of foreign investment, create hundreds of thousands new jobs, a sustainable circular economy and a resilient society.

4 main pillars for action



These pillars provide a framework for private and public, local and international action to deploy crucial efforts for the development of the green hydrogen ecosystem in Georgia. We do believe that it can form the blueprint for the rest of the world.

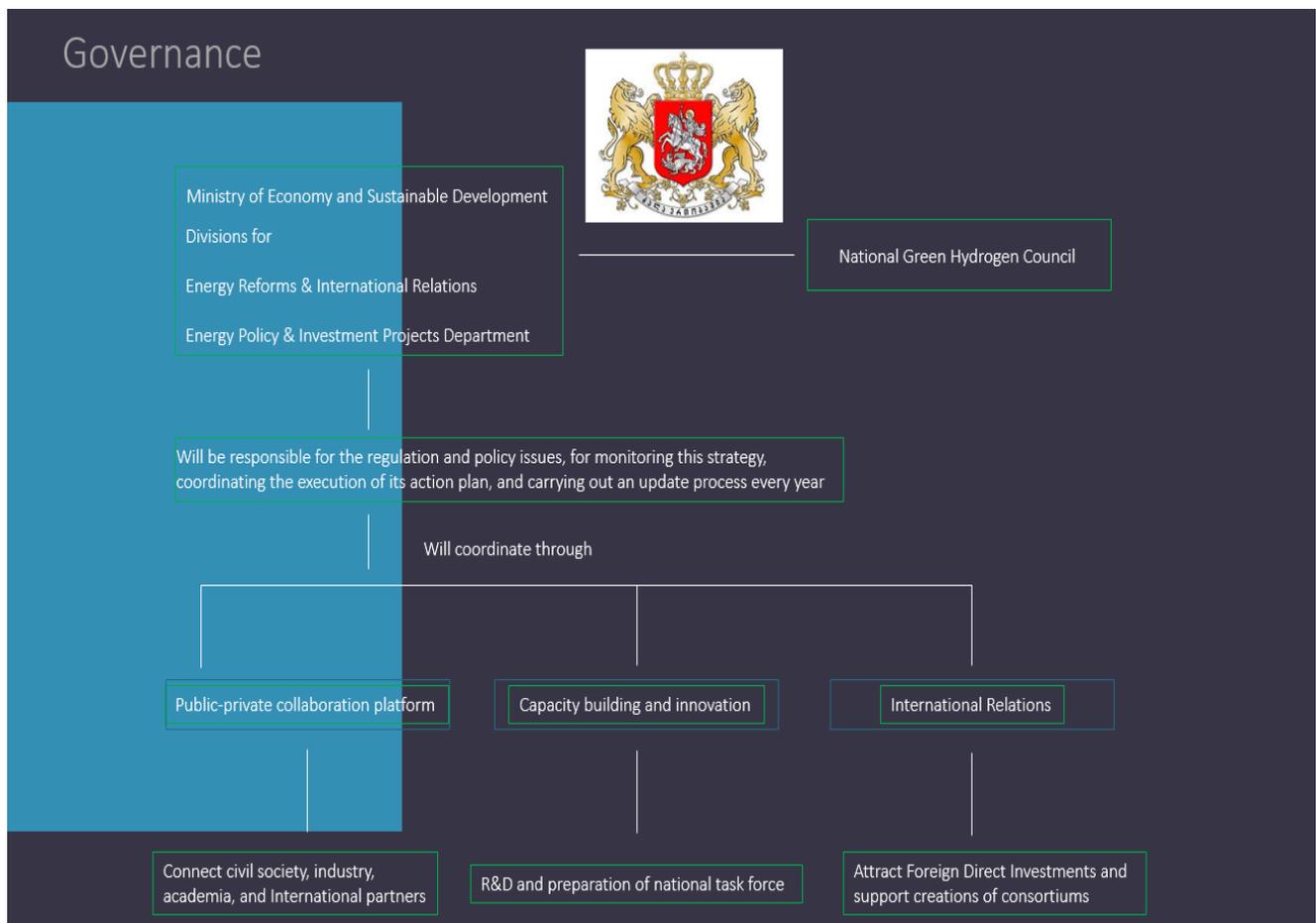
Quality: Though it is common today to define a successful economy in quantitative growth terms, we will find ways to work on a better world and a better life. This is the quality statement made by us. The quality statement of a better life, in a better world. Low-carbon transitions are often seen as a techno-economic implementation challenge, justified by climate science and driven by R&D and carbon pricing, but accelerated transitions also depend upon widespread social acceptance (to create legitimacy and support for strong transition policies) and business support. Sociotechnical transitions gain momentum when multiple innovations are linked together, improving the functionality of each and acting in combination to reconfigure systems. For that reason, green hydrogen industrial development shall be coherent with its socio-environmental context, incorporating international proven best practices and dialogue. The public-privet coordination is crucial.

Balance: Doing a good thing in a right way. When talking about sustainable or renewable energy projects, it is crucial to have a clear understanding of the difference between sustainability and renewability, because sustainable energy production describes how an energy resource is utilized and renewability describes the nature of the resource. So, it is crucial to harness a country's renewable energy potential in a sustainable manner, by respecting and protecting natural resources and the environment, while effectively contributing to the creation of sustainable economy, energy systems and resilient societies.

Trust: The majority and scale of today's challenges are by far too big to be tackled on an individual level. As such, the tendency to exchange knowledge and become an integral, trusting link in sustainable networks – locally and globally – should be our collective mindset. This is the mindset that is critical for promoting open innovation and, in the end, an open and innovative society. This is our vision of trust – simply defined, but arguably the most complex of all values to put into practice.

Ambition: To find a balance between material, cultural, ethical, individual and collective global values, we are driven to invest in and redefine what it means to become a game-changer. Whatever it is, this is a challenge that extends far beyond pure economics. Ambition in this context means that we are not afraid of setting lofty levels of achievement and longer-term goals, as well as goals based on more than economic feasibilities. They should be based on the balance of qualitative life, cleaner planet, greener economy and resilient societies at the horizon.

Governance



H2exagOn
Power of Water & H2uman Intelligence



About the Company

As a global Engineering & Management consulting company dedicated to the energy transition H2exagOn partners with leaders in business, government and society to tackle their most important challenges by turning them into opportunities. We are transforming innovative ideas into positive business cases to speed up the transition process. H2exagOn is a member of the European Clean Hydrogen Alliance.

Working across the European continent and EU associate countries, we align our business with EU Green Deal to contribute Energy System Integration and Hydrogen strategies. Our main mission is to unlock new business opportunities for the energy sector representatives while supporting new technologies to find their places in the real time projects. With a main focus on Green Hydrogen business sector, we solve most complex systems and create sustainable value chains from production to distribution. Our resource pool consists of global energy expertise specialized in different renewable energy sources and comprehensive project management.

The name H2exagOn, is implying the hexagonal crystal structure of hydrogen.

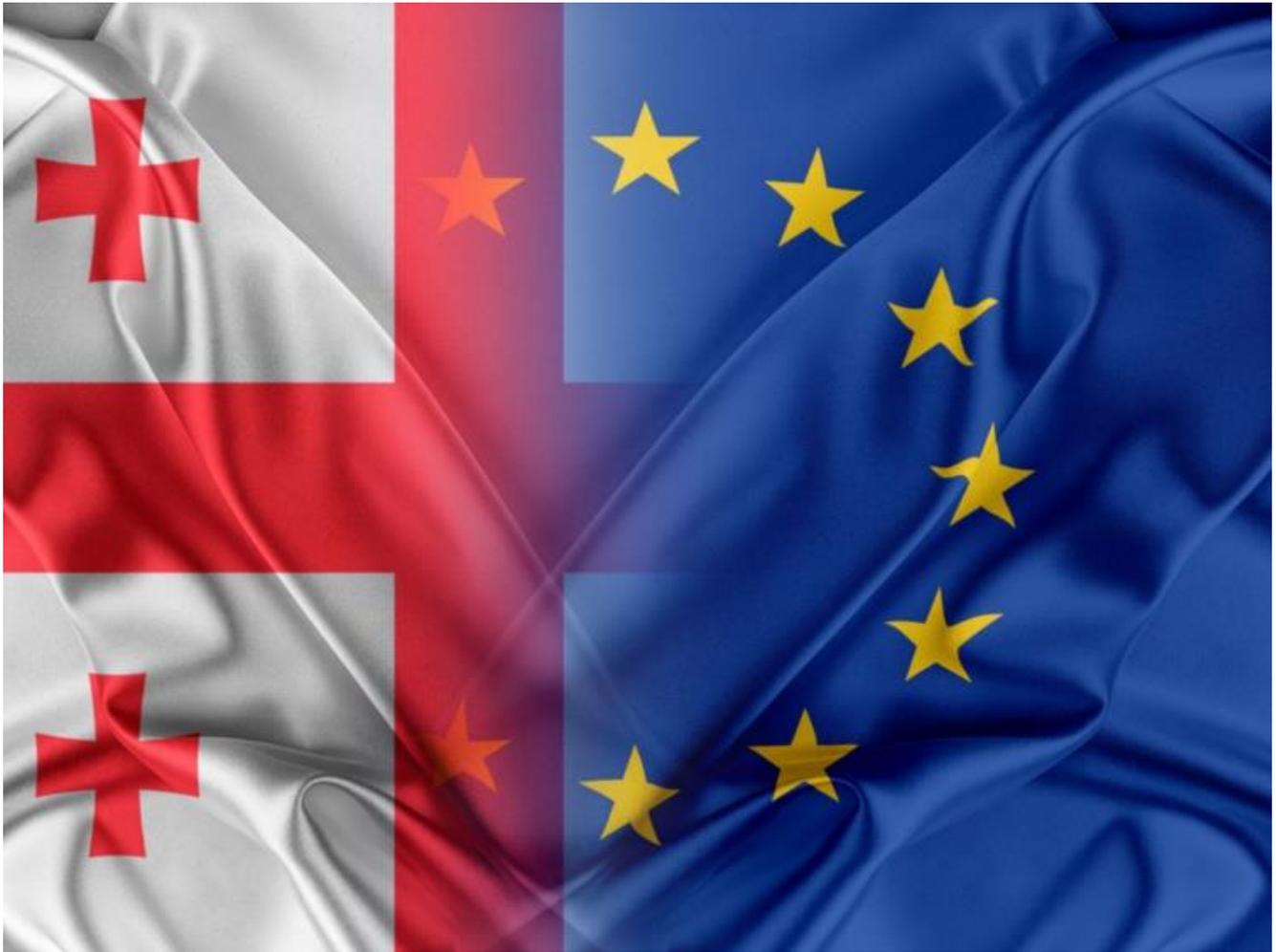
According to the crystallography hexagonal crystal family is one of the six crystal families which includes two crystal systems. In geometry hexagon is a six sided polygon as it is presented in the logo of the company. Symbolically we demonstrate all continents under one mission to create carbon-free future.

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A handwritten signature in black ink, appearing to read 'David Otarishvili', is positioned above a horizontal green line.

Signature



This document is a preliminary version released for a public consultation process. The definitive version will be made public once the comments of the public-private sectors are collected and considered.

Please send your comments and feedback at following email:

h2exagon@h2exagon.com