A PUBLICATION OF:
HAEE
WWW.HAEE.GR
HELLENIC ASSOCIATION *for* ENERGY ECONOMICS

inFOCUS

ISSUE #05
JUNE 2024

Innovation in the Energy Sector Toward the Net-Zero Era

TOP CATEGORIES

IN FOCUS

ISSUE #05 | JUNE 2024

INNOVATION IN THE ENERGY SECTOR TOWARD THE NET-ZERO ERA

HAEE
WWW.HAEE.GR
HELLENIC ASSOCIATION *for* ENERGY ECONOMICS

Editor-in-chief

Prof. Dr. Kostas Andriosopoulos
Audencia Business School;
Secretary of the BoD, HAEE

Authors



Konstantinos Sfetsioris
Senior Project Manager

Ilias Tsopelas
Research Associate

Alexandros Smyrniotis
Research Associate

Contents

List of Figures

List of Tables

Abbreviations	
CAPEX	Capital Expenditure
CBAM	Cross Border Adjustment Mechanism
CCUS	Cabron Capture Utilisation and Storage
CRMA	Critical Raw Materials Act
CSRD	Corporate Sustainability Reporting Directive
DAC	Direct Air Capture
DMFC	Direct Methanol Fuel Cells
EaSI	Employment and Social Innovation
EDCI	ESG Data Convergence Initiative
EIC	European Innovation Council
EIT	European Institute of Innovation and Technology
ERDF	European Regional Development Fund
ESF+	European Social Fund Plus
ESG	Environment Social Governance
ESPIA	European Solar PV Industry Alliance
ESRS	European Sustainability Reporting Standards
ETS	Emissions Trading System
GHG	Greenhouse Gas
GNI	Gross National Income
GRI	Global Reporting Initiative
IPTO	Independent Power Transmission Operator
JRC	European Joint Research Centre
JTM	Just Transition Mechanism
M&A	Mergers & Acquisitions
NSRF	National Strategic Reference Framework
NZIA	Net-Zero Industry Act
OPEX	Operational Expenditure
PE	Private Equity
PEM	Proton Exchange Membrane
PPC	Public Power Corporation
PPP	Public-Private Partnership
RES	Renewable Energy Sources
RfP	Request for Proposal
RIA	Research and Innovation Action
RWM	Region of Western Macedonia
SAF	Sustainable Aviation Fuels
SASB	Sustainability Accounting Standards Board
SLO	Social License to Operate
SME	Small-Medium Enterprises
SOFC	Solid Oxide Fuel Cell
SPV	Special Purpose Vehicle
STEP	Strategic Technologies for Europe Platform
TSC	Transparent Luminescent Solar Contractor
VC	Venture Capital

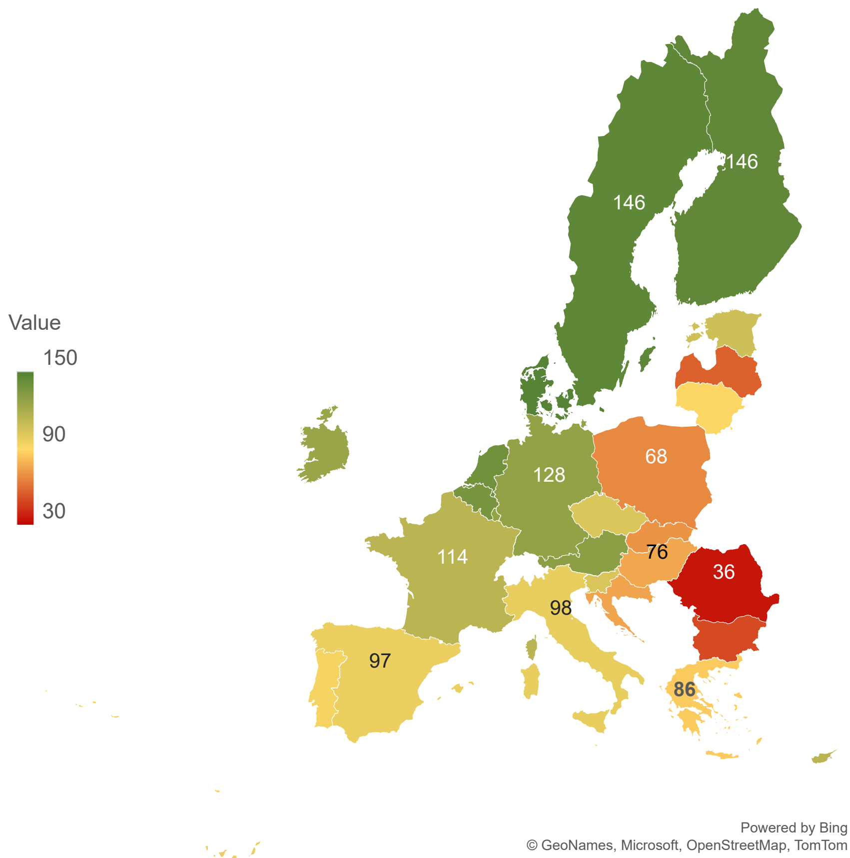

Figure 1:The European Innovation Scoreboard in 2023, Source: European Commission

Preamble

Innovation has nowadays become a term tantamount with all aspects of new business. On the other hand, geopolitical uncertainty, clouding highly interconnected global markets and the climate crisis, has focused industrial investors on energy security. Energy security, however, is achieved through diversifying energy sources whilst ensuring sufficient and sustainable power generation. The European Union has since long understood its, in the long-term, unsustainable dependency on imports from third countries and is actively working on becoming self-sufficient.

When looking into the energy landscape, for a region to become self-sufficient, it needs to utilise the full potential of its domestic resources. Thus, innovation stands at the cradle between true self-sufficiency and perpetual reliance on imports. In the context of modern-day Europe, innovation serves as the cornerstone of achieving energy independence, considering the complexities of the 21st century. Specifically, the EU has adopted in recent years an indicator to monitor the innovation progress of its Member States. In 2023, the leader in innovation was Denmark, with Greece being classified in the "Moderate Innovators" cluster **(Figure 1)**, showcasing significant progress over the past years.

The shift towards Renewable Energy Sources (RES) for example, has acted as a prime catalyst for innovation. It has driven the development of more efficient solar panels, wind turbines and other technologies, making them increasingly more competitive than fossil fuels. The collective innovative drive also fostered the emergence of smart grids and energy storage solutions, enabling better integration of renewable energy into existing infrastructure. These advancements not only enhance energy security, but also contribute to reducing carbon emissions.

Importance of Innovation in Modern-Day Europe

The energy sector has witnessed a significant rise of innovative solutions, across perspectives. Whilst some purely focus on generating energy, others focus on efficiency and the recycling of resources. Throughout the past five years, some of the most significant innovations are Solar-Wind Power Integration, Rooftop Turbines, Photovoltaic Smart Glass, Next-Gen Hydrogen Technologies, and Direct Air Capture (DAC).

Solar-Wind Power Integration

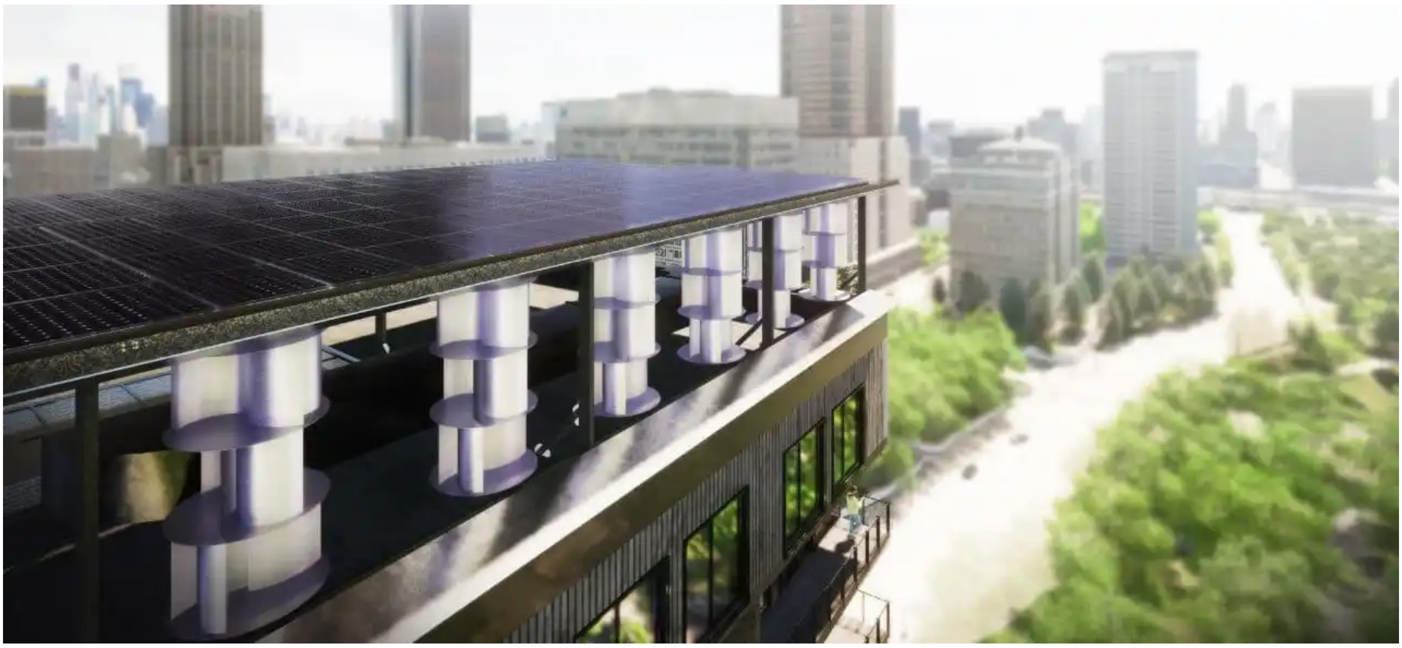

Figure 2: Building Integrated Hybrid Solar-Wind Systems, Source: Uneole

Such solutions aim to make renewable energy power plants operate at maximum capacity throughout the year. In the winter, wind power typically is the best option, whilst long summer days tend to favour photovoltaics. This considered, the core issue with both technologies, is that it is difficult to implement a widespread integration with urban environments. A start-up in France, however, managed to find a solution for residential and commercial areas with flat roofs.

This hybrid system integrates two small silent wind turbines with solar panels, generating 40% more energy than an ordinary rooftop panel. As they are also made from recycled aluminum and steel, this also makes the technology a prime example of a technological application which can help the EU reduce its imports dependency of energy and materials[1].

1 Unéole: The Mixed Energy Platform

Rooftop Turbines

Figure 3: Rooftop Wind Turbines, Source: Aeromine

Designed for commercial and industrial rooftops, rooftop turbines have managed to offer 24/7, year-round performance for urban buildings, without the negative effects of similar existing installations (i.e. Consistent noise pollution and vibrations). The design essentially utilises the accelerating winds, flowing between buildings, further enhancing them through their aerodynamic design and creating a low-pressure zone behind the central collum, sending the air past the internal propeller, thus generating power. Most importantly, rooftop turbines are made of highly durable materials, requiring little-to-none import dependency of materials such as silicon or rare earth minerals[2].

2 Aeromine Technologies: Rooftop Turbines for Commercial and Industrial Rooftops

Photovoltaic Smart Glass

Figure 4: Photovoltaic Smart Glass, Source: Thermosash

A smart solution which can be used for Building-Integrated Photovoltaics (PV), City-Integrated PV, Vehicle-Integrated PV, and Device-Integrated PV applications. Photovoltaic Smart Glass products may range in efficiency and output, based on their transparency levels. Transparent PV Smart Glass specifically, can be used to convert UV and infrared waves to electricity, while transmitting visible light into building interiors. There are several available options (e.g. Thin-film PV, Polymer Solar Cells, etc.), however, Transparent luminescent solar contractor (TSC) based smart glass holds the highest reported transparency record, at 86%, although with less than 1% conversion efficiency.

Alternatively, solutions based on Semi-Transparent Perovskite solar cells, have recorded 13% efficiency, with slightly lower transparency levels, at 77%. PV smart glass applications are currently most suited for commercial and public buildings, which are already using glass panes with lower transparency levels compared to typical residential windows[3].

3 Smart Glass World: Transparent Photovoltaic Smart Glass

Next-Gen Hydrogen Technologies

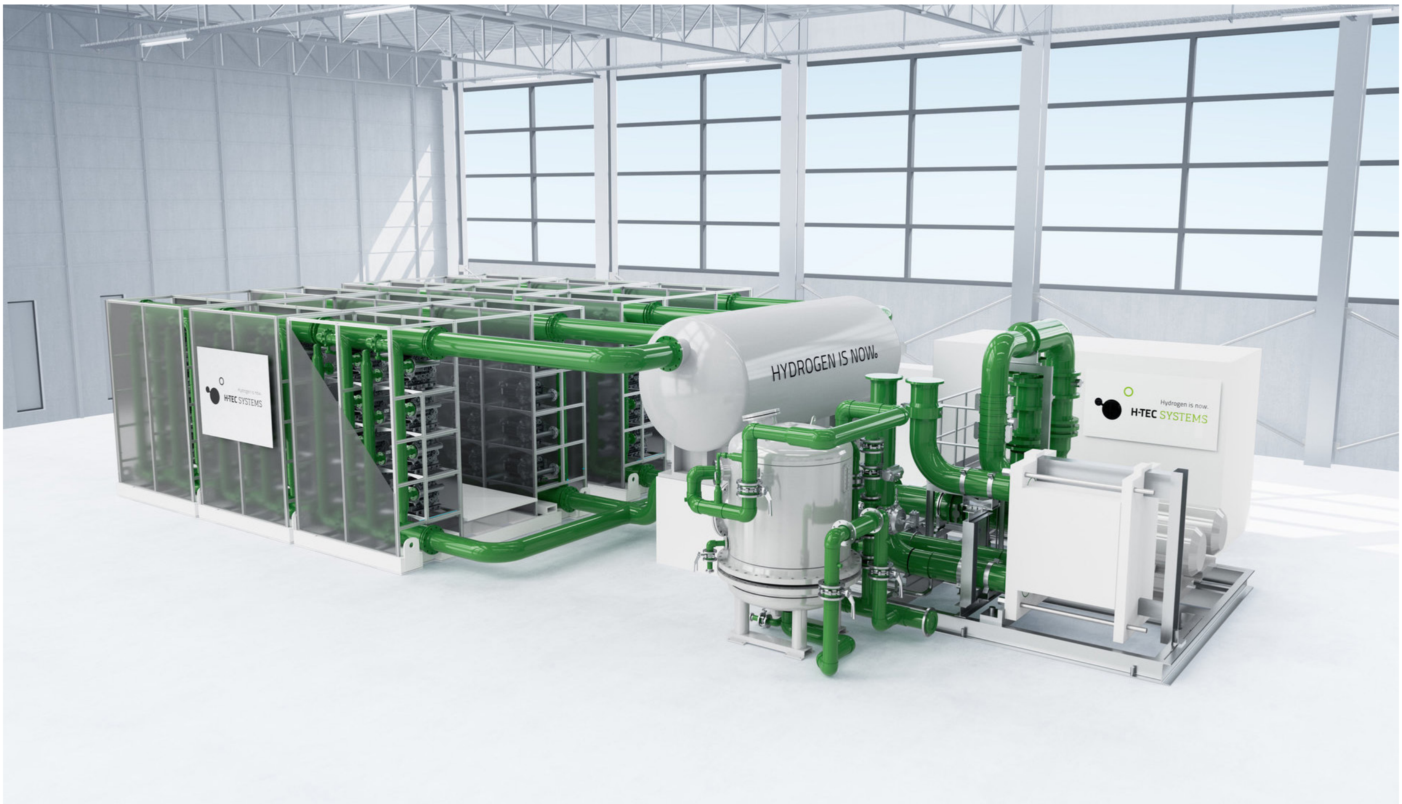

Figure 5: PEM Electrolyser, Source: H-TEC Systems

Hydrogen is undoubtably one of the most crucial technologies within the journey to energy transition. Global energy markets are currently focusing their efforts on H2 electrolysers for hydrogen production and hydrogen fuel cells for power generation.

> With respect to production, a company in the New South Wales region of Australia, was awarded $1.5 million to pilot a 200 KW electrolyser, which managed to produce 1 kg of H2 using 41.5 kWh of electricity. An astonishing number, considering the International Renewable Energy Agency has set a goal of achieving a global average of 45 kWh/kg by 2025.[4]

The scientific community is also exploring new ways for Hydrogen Production methods. On the side of traditional Green Hydrogen production, recent advancements in electrolyser technology, including the development of solid oxide and proton exchange membrane technologies, have improved process efficiency and cost-effectiveness.

Furthermore, Biohydrogen production has also begun being talked about as it is connected to non-hazardous waste management. Biohydrogen production, basically refers to Hydrogen produced from biomass or organic waste materials through processes such as biological fermentation on thermochemical conversion.

A method not only offering an alternative to traditional green hydrogen production, but one with the possibility of becoming an integral part of the waste streams across various key waste-intensive industries (e.g. food industry).

Fuel Cells have also witnessed significant developments, through the improvement of catalyst materials (based on non-precious metals and nanostructures) so as to enhance performance and durability at lower costs and material dependency. New more efficient and flexible designs have also been tested (i.e. Solid Oxide Fuel Cells – SOFCs and Direct Methanol Fuel Cells – DMFCs), promising compatibility with portable electronics and large-scale power generation. [5]

4 NSW Gov: Hysata's electrolyser technology puts Australia at the forefront of the green energy revolution.
5 US Hydrogen Expo 2023: Latest Developments in the Hydrogen Sector

Direct Air Capture (DAC)

Figure 6: Direct Air Capture (DAC), Source: Concept Render

Direct Air Capture (DAC) represents a range of technological applications which extract atmospheric CO2. Their key differentiations depend on their relative environment and scalability needs. Specifically, solid DAC (S-DAC) is most effective in small-scale industrial applications, whereas liquid DAC (L-DAC) has the best scalability performance. This comes down to their design specifications.[6]

Each distinctive DAC technology has its own set of advantages and trade-offs. In the case of S-DAC applications, the technology is less capital-intensive, it offers modular scalability, operationally it relies on low-carbon energy and is most likely to see OPEX/CAPEX reductions in the coming years. However, S-DAC applications are more energy-intensive than their counterparts, they require manual maintenance for the replacement of absorbent materials and their scalability can prove expensive, as despite being modular, they take over significantly more land than their counterpart technologies. L-DAC on the other hand, stands out for its low energy-intensiveness, its large-scale capture capacity, the fact that it requires common commercial solvents to operate efficiently, and that the technology has adapted from existing commercial units. Despite the advantages of L-DAC, industrial applications require significantly higher OPEX and CAPEX, on its current development and it relies on Natural Gas Combustion for solvent regeneration, although this is expected to become fully electrified in the future.

There are still significant innovation opportunities for DAC applications across market sectors, including synthetic fuel generation, especially for the aviation industry, such as in the case of Sustainable Aviation Fuels (SAF).

6 OECD: Direct Air Capture | A Key Technology for Net Zero

Agrivoltaics

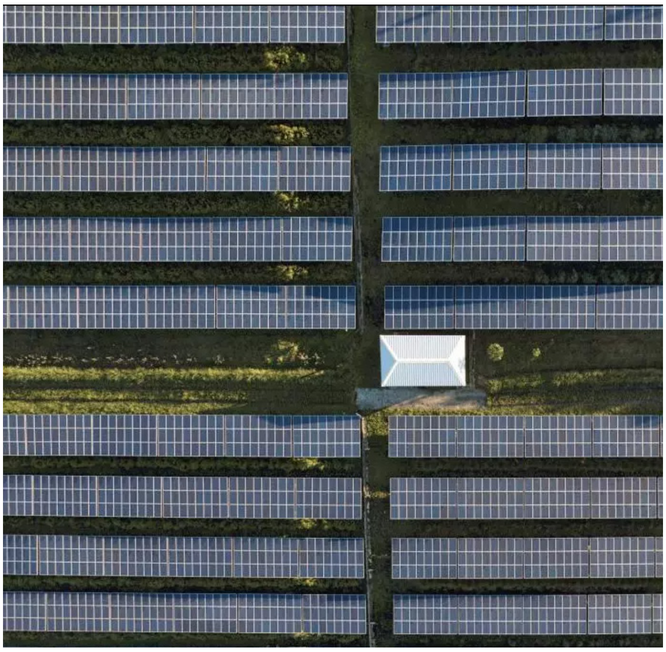

Figure 7: Agrivoltaics, Source: AKUO Energy

Agrivoltaics are considered one of the most promising solutions for meeting European solar PV goals by 2030. Applications range from agrivoltaics shade houses, anticyclonic photovoltaic greenhouses, trackers, and water management systems. These solutions can be tailored to the specification needs of each site, also enabling the application of technology for the purpose of predator and heat protection of breeding farms.[7]

According to the European Commission, agrivoltaics systems could result in 944 GW of DC installed capacity, by covering a mere 1% of the utilised agricultural area. This considered, although agrivoltaics have half the capacity of conventional PVs, covering the same landmass, expected results still surpass EU goals for 2030, whilst also resolving the dispute of farmers and clean energy producers regarding land use.[8]

Floating Solar PV

Figure 8: Floating Solar, Source: AKUO

Bridging the gap between increasing solar PV farms and reducing occupied landmass, floating photovoltaics enable the deployment of solar farms on lakes and other bodies of water. Worldwide capacity reached levels significantly over 2 GW in 2021 and according to the Institute for Solar Energy Systems, this sub-sector is one with enormous untapped potential.

Additionally, floating solar panels offer a variety of advantages. Floating solutions offer higher efficiency levels of up to 15%, due to the water's natural cooling effect, lowering operational temperatures. Furthermore, the inherent reflective properties of water also amplify PV efficiency as it increases photon reception. On the downside, despite the reduced installation costs, floating solar panels have higher maintenance costs, as it requires specialized equipment and skilled personnel.[9]

7 Agrivoltaics: Innovation Serving Farmers
8 European Commission: Agrivoltaics alone, could surpass EU photovoltaic 2030 goals
9 The Advantages and Disadvantages of Floating Solar

The full version of the edition is available only for HAEE Members.

If you are not still a member, join HAEE here.

WWW.HAEE.GR
HELLENIC ASSOCIATION *for* ENERGY ECONOMICS

Experts' views

Christakis Giorgos

BCG BOSTON CONSULTING GROUP

Dr. Anestis Anastasiadis

ΔΕΗ Public Power Corporation

Konstantinos Eleftheriadis

Deloitte.

Dr. Kostas Chrysagis

ΔΕΗ Public Power Corporation

Ioannis Skarakis

PARK WIND
JERA GROUP

Ioannis Maris

Trans Adriatic Pipeline

Dr. George Papadakis

ΔΕΗ Public Power Corporation

Innovating for a Sustainable Future: The Energy Sector's Strategic Path to Carbon Neutrality

Christakis Giorgos

Project Leader, BCG Athens Expertise in Energy and Technology

In response to escalating climate challenges, the global community, under the auspices of the 2015 Paris Agreement, has embarked on an urgent mission to forge a sustainable, low-carbon future. This pact underscores a unified commitment towards net-zero emissions by mid-century. Such a commitment demands an unprecedented transformation within the energy sector, encompassing production, distribution, and consumption, posing both a monumental challenge and a unique opportunity for innovation and visionary leadership.

Currently, leading energy conglomerates are expanding their investment horizons to include low-carbon initiatives, optimizing processes, and enhancing energy efficiency throughout their operations. Central to realizing these strategic pivots is the role of innovation, introducing breakthrough technologies and methodologies to significantly reduce carbon footprints.

Innovation is not "one word fits all", though the definition comes by deciding which types of innovation a company wants to pursue. Understanding that innovation is not a monolith but a spectrum of opportunities, companies are defining their innovation strategies. This involves selecting specific domains to pioneer—ranging from new business models and operational redesigns to alternative service channels and process enhancements. By defining specific domains for innovation, organizations can ensure their efforts are strategically aligned, signaling a clear direction for where and how to innovate effectively.

To translate these innovation aspirations into tangible outcomes, energy firms are heavily investing in research and development (R&D) while embracing a variety of other platforms including incubators, accelerators, and Corporate Venture Capital (CVC) funds:

- **Incubators** offer early-stage ventures with essential tools, mentorship, and resources, fostering their development from ideation to market readiness.
- **Accelerators** concentrate on expediting the growth of existing startups, providing intensive mentorship and capital investment to achieve rapid scalability and market viability.
- **CVC funds** entail direct investments by established corporations into external startups, endorsing technologies or business models that promise innovation and growth.

Beyond these mechanisms, many energy companies are establishing dedicated innovation hubs and adopting open innovation platforms, with participation of universities and research institutes among others. These initiatives facilitate broad-based collaboration and idea exchange within the innovation ecosystem, effectively democratizing the innovation process. By integrating the entrepreneurial spirit of startups with the substantial resources and market reach of established companies, these platforms and vehicles serve as vital conduits for the development and market introduction of novel technologies that are in alignment with strategic objectives.

This comprehensive strategy not only pushes the technological frontier of energy companies but also fosters a vibrant innovation ecosystem. By extending beyond conventional R&D efforts, this approach significantly supports the strategic vision and long-term goals of the energy sector, propelling it towards a future where innovation, sustainability, and strategic foresight are seamlessly integrated.

However, companies often find themselves in a paradox where the more successful the innovation and the higher its adoption, the cheaper the technology becomes, potentially reducing returns. To navigate this and ensure sustainable returns, it's essential for companies to refine their operating models to support continuous innovation. There are three imperatives that can enable this journey:

- Establishing robust governance structures to oversee innovation efforts,
- Allocating sufficient budget and capital expenditure strategically across promising innovation domains,
- Linking the innovation domains to Key Performance Indicators (KPIs) that measure both financial returns and environmental impact.

By doing so, energy companies can maintain a balance between innovation-driven growth and financial sustainability, ensuring that investments in new technologies, business models and internal processes yield adequate returns to fuel ongoing innovation.

Beyond Renewables: Emerging Technologies for a Low-Carbon Future

Konstantinos Eleftheriadis

Partner, Financial Advisory | Energy Industry Leader, Deloitte Greece

Deloitte.

As we move towards a more sustainable future, innovation has emerged as a critical factor in driving this transition. Innovation should take place on multiple fronts, not only in low-carbon technologies but also environmental-oriented business models and flexible financing options. We need to invest heavily in research partnerships between universities and industry, while we bring together team of experts with deep knowledge across the energy sector to collaborate on new ideas and solutions. In recent decades, innovative solutions and technological advancements have significantly reduced the capital costs of RES, while simultaneously increasing their operational efficiency. As a result, renewable energy investments have become increasingly attractive, accelerating the penetration of renewables in power systems worldwide.

The combination of Fit for 55 and REPowerEU speeds up the rate of the transition of the European economy to an extraordinary degree. Greece has made significant progress towards energy transition by developing a robust renewable energy generation base in 2023, serving as the primary source of electricity. Hydros, solar and wind energy are the main sources of renewable energy, with the last two technologies having a significant pipeline of capacity additions in the works. However, an increased RES penetration in the mix creates challenges which make the continuation of decarbonization more demanding. This underscores the need to incorporate emerging technologies such as Battery Energy Storage Systems (BESS), Carbon Capture & Storage (CCS), Hydrogen, and others.

While these technologies require substantial financial aid to become cost-competitive, we have seen significant cost reductions in the past. The cost of BESS has decreased substantially due to technological advancements and drop in raw materials' prices. With the expected further improvements in duration and performance, BESS will play a crucial role in ensuring system stability and balancing the market. To that end, BESS projects have started gaining attention from investors as returns have risen, especially in the case of collocation with RES, where the energy curtailments are minimized.

Hydrogen and CCS/CCUS are widely recognized as key enablers of decarbonization in hard-to-abate sectors. In the case of CCS in Greece, we have witnessed several pilot projects from energy-intensive companies, with Prinos CO2 project gathering attention since it will be a commercial scale CO2 storage hub, serving the wider region. Also, in the maritime sector, CCS is considered as an onboard option for reducing carbon emissions of various types of vessels, further underscoring its importance in the green transition.

In the case of hydrogen in Greece, there has been limited activity with major players from various sectors collaborating to develop pilot projects while the regulatory framework is under development. The initiatives are currently limited in scale; however, hydrogen has significant potential for a wide range of applications. It is crucial to approach hydrogen holistically and explore the most effective ways of producing and utilizing it. The commercialization of hydrogen presents several challenges, particularly in terms of transportation and consumption of the off taker. Nevertheless, the market potential for hydrogen is significant, particularly for companies. With the proper incentive mechanisms, hydrogen could offer an environmentally and economically viable solution for decarbonizing hard-to-abate sectors for industries that rely on thermal power in their production.

Undoubtedly, all aforementioned technologies are essential for driving the green transition. Nonetheless, due to their high capital requirements, they are currently limited in scale. To facilitate growth and reduce costs, subsidies, or innovative financing tools will be necessary, like the Innovation Fund and the Recovery & Resilience Fund (RRF) that companies can utilize to fund the development of innovative solutions to accelerate the energy transition.

In Deloitte, we develop solutions that contribute not only to an environmentally friendly but also to an economically sustainable future, while meeting the increased needs of clients in the rapidly evolving energy landscape. We invest heavily in research and development to stay at the forefront of innovation as we have established several research partnerships with leading universities and research institutions and innovation hubs worldwide. With our innovative and goal-oriented approach, we strive to maximize value creation for our clients.

Innovation hubs: Reference to the Energy Island in Belgium and how it will serve both the future offshore wind developments in PEZ as well as interconnections with other countries in the North Sea.

Ioannis Skarakis

Country Manager for Greece and Senior Origination & Tender Officer in Parkwind (Jera Group)

In recent years, governments and developers have rolled out ambitious plans to build "energy islands" in the North Sea and Baltic Sea, aiming to serve as large-scale offshore energy hubs. These islands will connect surrounding offshore wind farms with onshore power markets and will form the building blocks of an integrated European offshore electricity grid. Such energy projects promise to enhance cooperation among neighboring countries, leading to energy security and independence across the region.

Belgium stands out as a leader in this endeavor, having already established itself as an early mover in the offshore wind market, boasting a current installed capacity of up to 2.3 GW. The federal government has demonstrated decisive action by announcing plans in 2021 to significantly increase offshore wind energy capacity within the new concession area of the Princess Elisabeth Zone (PEZ), targeting an additional production capacity of between 3.15 GW to 3.5 GW, resulting in a total capacity of 5.4 to 5.8 GW of offshore wind energy in the future (Figure 1).

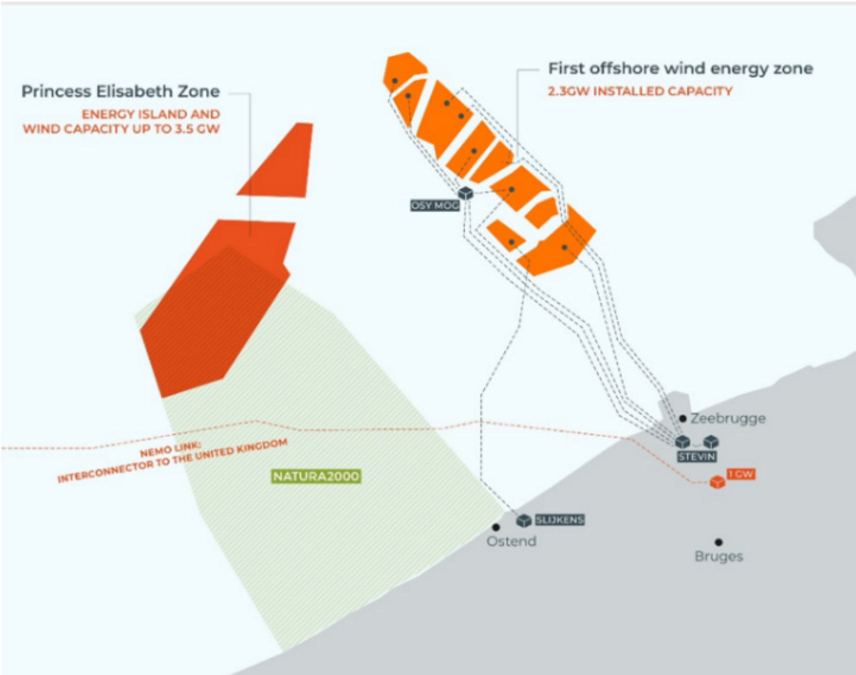

Figure 1 Offshore wind concession areas in Belgium

As part of the European recovery plan, Belgium has embarked on a groundbreaking initiative to construct one of the first artificial energy islands in the North Sea, connecting the PEZ farms to the mainland as well as facilitating crucial interconnections with neighboring countries. Belgium's commitment to these cutting-edge projects not only positions the nation as a leader in sustainable energy solutions but also exemplifies its dedication to shaping the future of offshore wind energy on an international scale. The construction of the energy island forms a crucial part of Belgium's plan to develop the North Sea into a "green energy powerhouse" (Figure 2).

Figure 2 PEZ Energy Island (Belgium)

Meanwhile, given the significant offshore wind potential in the Aegean Sea, Greece has a unique opportunity to emerge as a key energy hub in southern Europe, supplying renewable energy both domestically and to neighbouring countries. Parkwind (JERA Group) is committed to contribute positively to this endeavor by delivering the first offshore wind projects within the Greek market. Through the development of such projects, Greece can play a central role in advancing renewable energy efforts across the region, promoting sustainability and economic growth.

Parkwind is an integrated offshore wind developer that develops, finances and operates offshore wind farms around the globe. Since July 2023, Parkwind has been operating as part of JERA Co., one of the largest power generation companies in the world, and is now part of JERA Nex, JERA's renewable energy subsidiary. Together, Parkwind and JERA have more than a decade of experience and over 1,5 GW of offshore wind assets under operational management in Belgium and Germany, the UK, Taiwan and Japan, in addition to an extensive pipeline of offshore wind projects in development around the world including in Belgium, Germany, Ireland, the UK, Norway, Greece, and Australia/New Zealand.

Innovation in the Energy Sector Toward the Net Zero Era

Public
Power
Corporation

Dr. George Papadakis
Head of Section

Dr. Anestis Anastasiadis
Head of Section

Dr. Kostas Chrysagis
Director

EV4EU[1] is an Horizon RIA project that lasts for 3.5 years, from June 2022 to November 2025, focusing on strategies and business models for the management of electric vehicles (EVs) in European Union. It involves 16 partners, academic and industrial ones, from 4 countries: Denmark, Portugal, Slovenia and Greece. In each country, a rigorous demonstration takes place to examine crucial aspects of the EV mobility and to evaluate and verify the developed technologies, while highlighting their benefits.

The Greek demonstration involves PPC as the charging point operator **(CPO)**, HEDNO as the distribution network operator **(DSO)** and Aiglon as the EVs provider. PPC, in particular, is in charge of developing a novel, open-source platform for the management of EV chargers, called **O-V2X-MP**[2]. Its backend is quite complex, integrating numerous components for user, sessions, data and logs management through a microservices architecture based on Docker, as shown in Figure 1.

1 https://ev4eu.eu
2 The source code is available at: https://www.github.com/EV4EU/ov2xmp

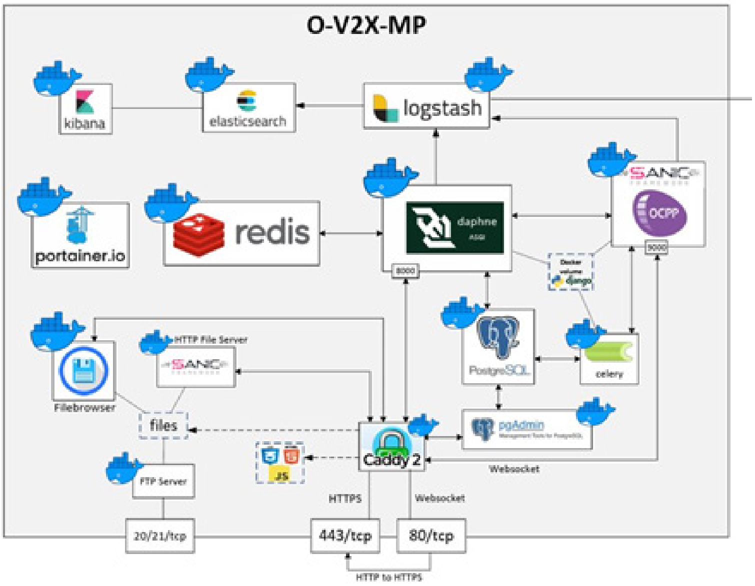

Figure 1 Offshore wind concession areas in Belgium

Based on the OCPP 1.6 and 2.0.1 protocols, this platform supports all necessary commands for exchanging messages between individual smart charging stations and the CPO so as to activate a wide range of services. More specifically, these commands lay the ground for providing value-added services to two types of users:

1. End users, i.e., EV drivers, who can search on a map for the nearest chargers or the nearby chargers with the lowest prices along with the corresponding routing towards the selected point. They can also manage their history and view various statistics about their charging sessions and the corresponding payments.
2. Administrators of the CPO, who can manage the connected chargers, check their current status, run diagnostics in case of errors and even address them remotely. Most importantly, the CPO administrators can connect with the DSO in real time to enable two types of advanced services:

a. Demand response services for coordinating the charging load of EVs with the power generation of renewables. Upon detecting reverse power flow, due to the excessive power generation from solar and/or wind farms, the DSO identifies locations for price reductions, which are then communicated to the CPO. The latter adjusts the charging station tariffs and notifies the EV owners through the platform, encouraging them to exploit the increased renewables production. This situation is typically called green charging.

b. Dynamic capacity contracts procurement and activation. The DSO procures contracts with the CPO that allow for requesting capacity limitation services for the day ahead or in real-time with a pre-determined cost so as to reduce constraints in the distribution system in cases with excessively high loads. For example, the DSO might request to halve the power of EV chargers (e.g., from 22kW to 11kW, thus doubling the duration of the charging session) to save capacity for other services.

Fuelling a sustainable future

Ioannis Maris

Trans Adriatic Pipeline (TAP) Country Representative Greece

Trans Adriatic Pipeline

> As Europe moves towards achieving climate neutrality, TAP can eventually become a significant supporter of the goals outlined in the European Green Deal and the Paris Agreement.

TAP has been recognised by the EU's Directorate General for Neighbourhood & Enlargement as a flagship project for the decarbonisation of the Western Balkans, fostering access to cleaner and affordable energy in the region. In fact, as we enter the fourth year of operations, we have successfully facilitated the adoption of a less carbon-intensive energy source in Greece, Bulgaria and Italy. To date, we have transported over 33 billion cubic meters (bcm) of gas to Europe. In Greece, we are the third-largest supplier, accounting for up to 18% of total natural gas imports in 2023.

These are significant accomplishments already, however we can contribute to Europe's security of energy supply and decarbonisation objectives further if we progressively double the pipeline's capacity, which is currently at 10 bcm/a. TAP's expansion capacity is offered to the market through regular Market Tests organised every odd year. The 2021 Market Test resulted in binding commitments which will add an extra 1.2 bcm per year to the pipeline capacity by 1 January 2026 – which is just the first step towards further expansion. The 2023 Market Test is currently ongoing and we are optimistic for its outcome.

Towards a hydrogen-ready Infrastructure

TAP's potential full expansion will not only address security of supply challenges, but also could contribute to advancing the EU's decarbonisation targets by facilitating the transportation of new volumes of green hydrogen and other renewable gases. Our ambition is to develop the asset for hydrogen and potentially bio-methane transportation, initially in the form of a blend with natural gas. In 2021, a study on hydrogen readiness verified TAP's capability to transport hydrogen blend in the future. Having invested in developing the necessary test facilities, this year we will conduct tests on our pipeline materials in an internationally recognized laboratory. This will allow us to fully assess the pipe materials' suitability to meet the forthcoming hydrogen requirements and opportunities. Similarly, later this year, we plan to start assessing the suitability of other existing equipment for the transportation of hydrogen quantities.

We are working closely with our shareholders, key vendors and the industry, as the investments in facility upgrades and the percentage of hydrogen to be transported will likely be developed incrementally over time to align with hydrogen market demands and comply with relevant market regulations.

On a decarbonisation pathway

As part of our commitment to decarbonisation, we are dedicated to ensuring our own operations are climate neutral by 2050. In both the short and long term, our focus is on prioritising initiatives that have the highest impact on reducing greenhouse gas emissions, while also enhancing energy efficiency measures. In 2023, we achieved an overall reduction of approximately 30% in our greenhouse gas emissions and about 70% in methane emissions compared to the annual forecast.

Based on the studies conducted, 90% of TAP's CO_2 emissions emanate from the operation of our gas-powered compressors. In this context, we are considering the installation of new electro-compressors in both the existing and new stations in the event of future expansion. This includes defining the connection points to electrical grid, grid reliability and the availability of green electrical power to meet the power requirements of the new compressors.

In a nutshell, TAP has made significant strides in promoting Europe's decarbonisation efforts and enhancing the continent's energy security. Looking into the future, a potential full expansion of the pipeline's capacity will enhance our ability to bolster Europe's energy transition efforts, while we are directing our efforts towards making our operations climate neutral by 2050.

faria
renewables

Faria Renewables S.A. is the collaborative brainchild of Faria Group and Capenergy 5 Fund. Together, we are dedicated to fostering Renewable Energy Source (RES) projects across Europe, including Greece and other regions. Our focus extends to Offshore Wind, Onshore Wind, PV, Hybrid, Storage, Green Hydrogen, and pioneering applications. With the goal of becoming a premier Independent Power Producer (IPP) utilizing renewable energy sources, we work in tandem to develop and operate these projects.

OUR VISION:

Our vision is to empower a sustainable, green future. We are committed to facilitating the transition to renewable energy by creating efficient and eco-friendly energy solutions.

OUR GOALS:

Our primary goal is to establish ourselves as the leading Independent and Sustainable Power Producer in the rapidly expanding Greek and international markets. To achieve this, we diversify our portfolio of Renewable Energy Projects, and we actively promote innovative storage solutions and Green Hydrogen. These efforts will not only enhance the stability of the electricity network but also foster resilience and reliability.

FARIA Renewables S.A.   fariarenewables.com

inFOCUS

ISSUE #05 / JUNE 2024

INNOVATION IN THE ENERGY SECTOR TOWARD THE NET-ZERO ERA

A PUBLICATION OF:

HAEE

WWW.HAEE.GR

HELLENIC ASSOCIATION *for* ENERGY ECONOMICS