

ISSUE #03
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The NEXT DAY of the GREEK ENERGY LANDSCAPE



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The NEXT DAY of the GREEK ENERGY LANDSCAPE

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ENERGY ECONOMICS

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Abbreviations

"new" NECP	NECP plan presented in January of 2023 and will be issued for public consultation before its submission to the European Commission at the end of June 2023
BEV	Battery Electric Vehicle
DEPA	Public Gas Corporation of Greece
DESFA	Natural Gas Transmission System Operator
EIB	European Investment Bank
FSRU	Floating Storage Regasification Unit
HEDNO	Hellenic Electricity Distribution Network Operator Greek
HEREMA	Hellenic Hydrocarbons and Energy Resources Management Company
IPTO	Independent Power Transmission Operator
KENAK	Regulation of Energy Performance of Buildings
LNG	Liquefied Natural Gas
Mt	Metric tons
NECP	National Energy and Climate Plan
PHEV	Plug-In Hybrid Electric Vehicle
PPA	Plug-In Hybrid Electric Vehicle
PPC	Public Power Corporation
RAE	Regulatory Authority of Energy
RES	Renewable Energy Sources
RFNBO	Renewable Fuels of Non-Biological Origin
toe	Tonne of oil equivalent
TSO	Transmission System Operator
W	Watt

Preamble



As the world moves towards a greener and more sustainable future, energy transition is gaining momentum and Europe is leading the way. The EU has set ambitious targets for reducing greenhouse gas emissions, increasing the share of renewable energy, and achieving climate neutrality by 2050. To meet these targets, the EU has launched various initiatives and policies, including the NECP, a framework with which every Member State can strategize its climate and energy goals, policies and measures in order to reach its national targets. Greece successfully submitted its own NECP along with other Member States in 2019 however, the late geopolitical developments, the Russian invasion to Ukraine and its impact on the energy crisis, as well as the more ambitious targets recently set by the European Commission (Fit for 55 package, REPowerEU), have raised the need for the NECPs to be revised.

With the Greek "New" NECP latest draft document, presented in January 2023 by the YPEN, and in conjunction with the additional

objectives of the recently enforced Greek National Climate Law, remarkable changes in the energy sector are bound to be seen. This publication investigates how the future of the Greek Energy landscape is being shaped through its national objectives and targets, and the measures and policies involved, as defined by the wider EU policy and legislative context. It investigates Greece's "New" NECP targets and objectives and compares them with those of the previous NECP. It explores more specifically the "future" of the eight pillars of energy strategy (fossil fuels, solar and onshore wind, offshore wind, green hydrogen, energy storage, grid/interconnections, energy efficiency, and e-mobility) in terms of the targets which need to be achieved for each of them, and of the investments and projects planned for the near future. This publication concludes with recommendations that address several different areas such as the architecture of the grid, the available space for renewables, the policies, and the operation of the energy market to achieve a sustainable energy system.

A New Era of Sustainability: Energy Outlook of Europe and Greece

EU Energy Policy in Motion – National Energy and Climate Plan (NECP) from Past to Present

The NECPs are to be used as planning tools toward the goal of climate neutrality of EU economies by 2050 (European Green Deal). Each EU Member State is required to submit every 10 years its NECP outlining its climate and energy goals, policies and measures implemented to reach the proposed national targets¹.

The NECPs are a representation of the direction and strategies of national policymakers planning to follow in a 10-year period covering the five dimensions of the Energy Union: decarbonization, energy efficiency, energy security, internal energy market and finally the triptych of research, innovation, and competitiveness. The NECPs offer investors and the European Commission a comprehensive picture of how the climate goals and objectives will be fulfilled and provide insights for the further development of the renewable energy sector to promote investments and the generation of new jobs.

According to the Governance Regulation, the energy-climate objectives, the national targets and contributions included in the NECPs, are non-binding. However, the national targets on annual greenhouse gas emission reductions over the 10-year period, between 2021 and 2030 (2030-horizon) are binding, as determined by Regulation 2018/842, also called the "Effort-sharing Regulation".

Following the adoption of the final NECPs, by 31st December 2019 (COM/2019/285), each Member State must publish biannually a progress report allowing the European Commission to supervise the overall progress and ensure that the targets set are not underachieved. Also, provided that 'significant changing circumstances' do not affect the achievement of these targets, the NECPs must be updated once over the 10-year period. Therefore, countries are now required to submit their updated draft NECPs by 30th June 2023 and their final version by 30th June 2024².

1 https://caneurope.org/content/uploads/2022/08/Final-report_UNIFY_EU-FUNDS.pdf
2 <https://www.energy-community.org/regionalinitiatives/CEP/NECP.html>

Towards climate neutrality – Greek Climate Law

The Greek 'National Climate Law - Transition to climate neutrality and adaptation to climate change' (4936/2022) was published in May 2022 aiming at the adaptation of the country to climate change by reducing CO2 emissions and at its shielding against extreme events (extreme weather and natural hazards). The purpose of the law is to create a coherent framework by establishing a series of policies and measures to ensure the course of decarbonization until 2050, in the most environmentally sustainable, socially just, and cost-effective way³.

The Climate Law concerns energy saving, RES, renewable gases and fuels, the reduction of the carbon print of urban and peri-urban areas, waste management and circular economy, and the enhancement of natural ecosystems. Specifically, it establishes:

- Cost-effective measures and policies to reinforce adaptation to climate change;
- Intermediate mitigation targets for anthropogenic emissions for 2030 and 2050;
- Indicators for monitoring progress towards the achievement of relevant objectives;
- Procedures for the evaluation and the readjustment of the objectives and for taking additional measures;
- Measures for emissions mitigation from power generation, transport, the building sector and the business⁴;

These approaches include, among others:

- Electricity production from solid fossil fuels will cease from 31 December 2028, with a possibility of accelerating the target

3 <https://www.sdram.gr/node/427>

4 <https://www.e-nomothesia.gr/law-news/demosieutheke-sto-phek-ethnikos-klimatikos-4936-2022.html>

- Measures regarding the promotion of zero-emission vehicles as the law foresees that from 2024 a quarter of new company cars for private use will be BEV or PHEV and from 2026 all-new taxi cars and a third of new rental vehicles in Attica and Thessaloniki will be pure-electric vehicles ;
- Limiting emissions from buildings as it is foreseen that from 2025 the sale and installation of new heating oil burners will be prohibited. From 2030 the sale of heating oil will also be prohibited unless it is mixed by at least 30% with renewable liquid fuels. In addition, from 2023, the installation of photovoltaics will be mandatory on at least 30% of the surface of new commercial buildings over 500m²;
- Environmental licensing, projects and activities of category A' of article 1 of Law 4014/2011 (A' 209)⁵ (which requires an Environmental Impact Assessment) are obliged to reduce emissions by 30% until 2030 (base year 2019), while being compatible with to the achievement of the national targets set by the NECP;
- Companies, until 31 October 2023, are obligated to submit a report on the carbon footprint for the reference year 2022, in a publicly accessible electronic database of the Natural Environment & Climate Change Agency. The report includes voluntary emission reduction targets and actions. The measure is addressed to listed companies, credit institutions, insurance companies, fixed and mobile telephone companies, water and sewerage companies, courier companies, electricity and natural gas companies are liable;



Assessing Greece's "New" NECP: A Comparison of Targets and Goals

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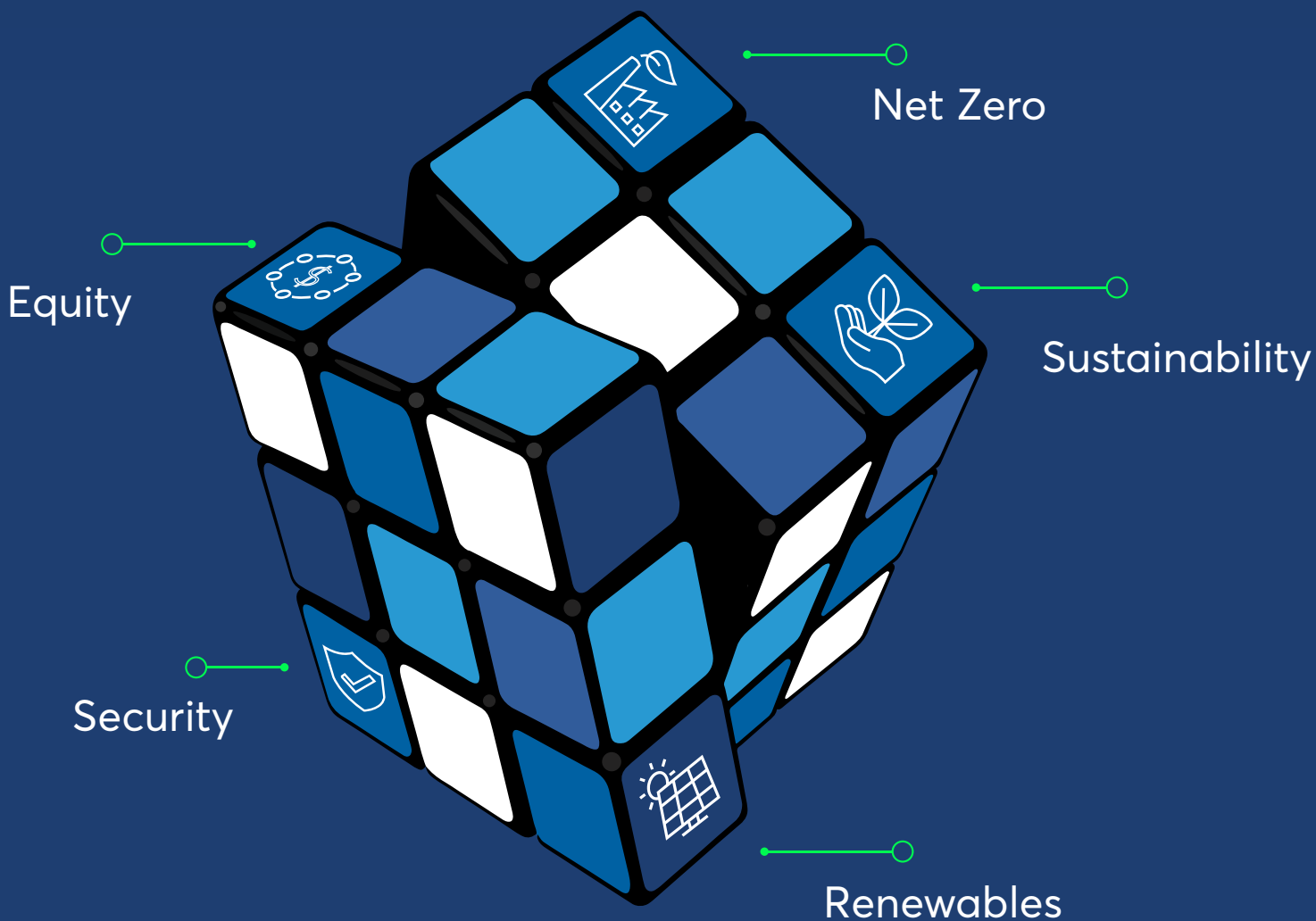
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Floating Storage Regasification Units (FSRUs): The critical infrastructure that safeguards Greece in the new era

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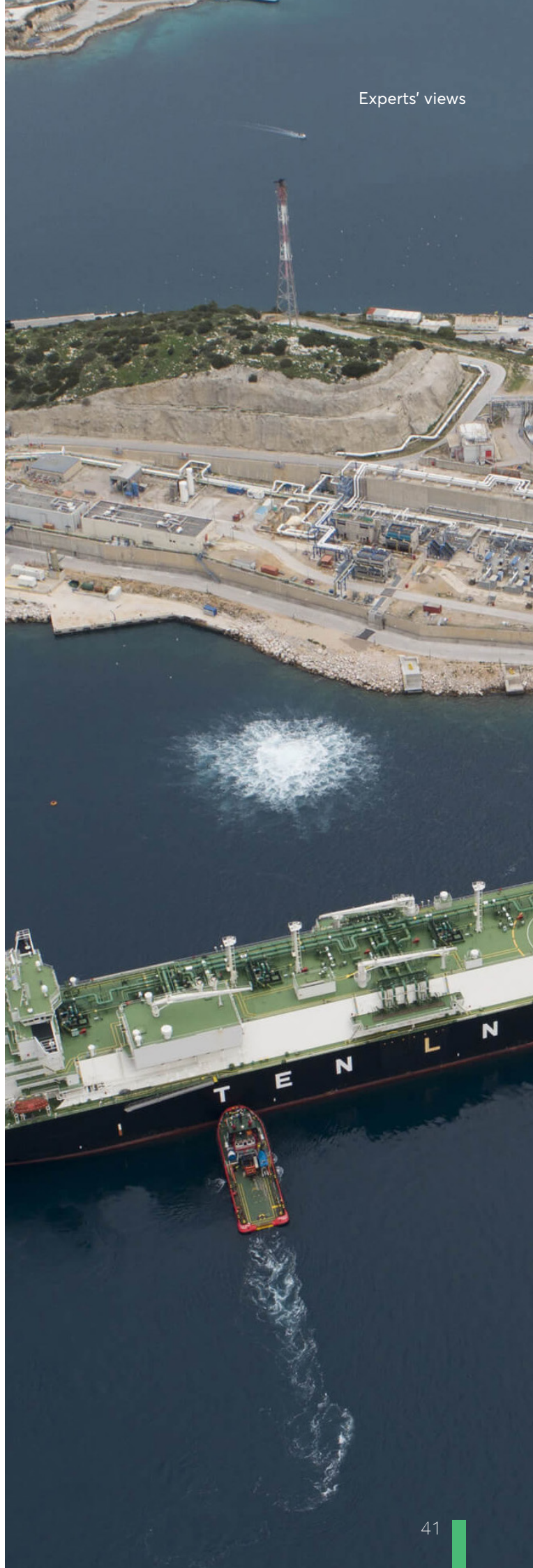
The covid pandemic, the unforeseen developments in the supply chain and the worsening of the energy crisis, due to the Russian invasion of Ukraine have introduced new conditions and challenges in energy markets, jeopardizing the stability of the energy system throughout Europe.

In such a fragile environment, Floating Storage Regasification Units (FSRUs) have emerged as a priority and a pillar of stability, since they can be mobilized in a short period of time, thus increasing the natural gas capacity in the short term. At the same time, FSRUs are ensuring energy security, while reducing dependency on third countries and mostly Russia.

According to the Energy Intelligence Group, Europe is strengthening its energy self-sufficiency through the FSRUs by 49.6 billion cubic meters (bcm) of gas annually. Germany, the greatest importer of Russian natural gas in Europe (Russian gas represented over 50% of German fuel imports in 2021), is aiming to install up to five FSRUs by the end of 2023. Italy, the second largest importer of Russian natural gas (c.40% respectively), is planning to add 10 bcm in the current LNG capacity, as Snam (the operator of natural gas transport and storage in Italy), has purchased three FSRUs this year, two from the ship-owning company Golar LNG (Bermuda) and one more from BW LNG (Norway).

In France, Total Energies are about to develop the "Cape Anne" FSRU in the port of Havre, which is expected to be commissioned in September 2023, while in the Baltics, Finland and Estonia are co-developing an FSRU for LNG sourcing.

Our country is also taking decisive actions in this rapidly changing environment. Greece has invested heavily on the implementation of FSRUs, opening new prospects in the field of LNG. These investments can also accelerate the transition towards a more sustainable energy strategy, both in the short-term and the long-term. FSRUs have several strategic advantages, such as their capacity, their commercial flexibility, the short construction time and the ability of being reused in various locations in a short period of time (compared to in-land facilities), creating many benefits for Greece, especially in terms of energy, environment and economy. Needless to say that the country's geographic position enables the development of such investments. The first FSRU in Greece is operated by DESFA and is located on the island of Revythoussa. This terminal of 225,000 c.m. has played a significant role in the energy sufficiency of the country, while delivering also gas supplies to the northern countries to Greece, when they were facing major energy challenges.



The FSRU in Revythoussa has demonstrated high flexibility and recently increased its capacity to a total of 370,000 c.m. after the addition of an FSU leased by Gaslog.

In the short-term, we expect to see four additional FSRUs in Greece, while the development of Gastrade's Floating and Storage Regasification Unit (153,500 c.m. LNG capacity) in Alexandroupoli is actively proceeding and expected to be commissioned soon. The latter will be feeding mostly the markets of Greece and Bulgaria as well as the markets of the wider region. Gastrade is also planning for 2025 the "Thrace" FSRU (additional 170,000 c.m. of LNG capacity). Moreover, in the FSRU market, Motor Oil group has also established its presence, developing the "Dioriga Gas" FSRU in the district of Agioi Theodoroi, Corinth. Furthermore, a market test for the capacity and usage of Mediterranean Gas's "ARGO" FSRU in Volos was recently initiated. According to DESFA's data, the total demand for natural gas increased by c.11% in 2022 (86.18TWh in 2022, compared to 77.56 TWh in 2021), despite the high prices of gas and the drop in domestic consumption by c. 19%. This growth is attributed to the increase of natural gas exports, from 7.6 TWh in 2021, to 29.54TWh in 2022. The imports of natural gas have also increased to 86.16TWh in 2022 from 77.73TWh in 2021. Revythoussa covered 44% of total imports in 2022, while LNG imports from the USA increased by 64% compared to 2021, representing more than 50% of the total LNG imports in our country.

The trend of LNG imports is expected to continue in the upcoming years, especially the imports from the US, as this might be the only way to reduce Greece's and Europe's dependence on Russian gas. Apparently, this gives a competitive advantage to FSRUs but also to Greece itself, which has a huge coastline, a developed pipeline network, and in recent years has demonstrated stability, economic prosperity and an investment-friendly environment.

Undoubtedly, LNG will play a critical role in the era of energy transition, while its penetration in the natural gas global trade market is expected to significantly increase, in the coming period. Despite the substantial challenges that FSRUs and the rest of infrastructure projects are facing in the current economic environment, (increased investment costs of the projects, inflationary pressures, high financing costs etc.), their role is expected to be of vital importance for the transition to a "greener" and sustainable energy future, not only for the Greek market, but widely for Balkans and Europe.

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Green energy for Greece's growth

Dionysios Andronas

Country Manager of
EDP Renewables (EDPR)
Greece



At EDP Renewables we believe that Greece is an important hub. The impact for Greece is significant when it comes to meeting the National Energy and Climate Plan (NECP), as, by 2030 it aims to increase the overall share of renewable energy sources (RES) in its gross final energy consumption to 35%. Greek renewable energy stakeholders play an important role in the country, as their projects are committed to achieving Greece's clean energy targets.

The increasing penetration of renewable energy into the energy supply mix, the onset of electrification and improvements in energy storage are all key drivers of the energy transition. Renewable energy improves energy security and independence. EDP is clearly an undisputed leader in the energy transition. Whether it is renewable energy, grids, or customer solutions, these are all areas where it has made great progress over the last two decades.

Regarding Greece, the government should simplify the licensing process, review the spatial planning framework, and publish the new laws for energy storage and hybridization by combining wind and photovoltaic technology for the optimal utilization of the project's connection to the Grid. In this way, renewable energy's auctions should be continued distinctly by technology so that wind farms and photovoltaic development proceeds in a balanced way.

Governments will play a critical part in the energy transition, especially through energy system and network planning, support for new technologies, competition policy, and ensuring a just transition.

EDPR, that is developing its offshore projects through Ocean Winds, welcomed the Offshore Wind Act passed in Parliament, early August 2022, as it paves the way for a consistent regulatory framework.



We are looking forward to the next steps of defining clearer milestones such as the definition of the areas but also timing and rules of the competition process. This will allow developers to engage on a concrete path of their investments, and suppliers to have a clearer view of timing for future opportunities. Additionally, the timely grid development will ensure smooth integration of the capacity produced with least constraints.

This will drive to the further penetration of RES by optimizing the use of existing infrastructure and maximizing the production of clean energy. In this way, the company is taking a further step towards the decarbonization of these regions and the increase of renewable energy in the electricity grid.

Additionally, at EDPR we believe that energy storage technologies are the optimal solution facilitating the increasing penetration of renewable energy into the grid.

However, the legislative framework in Greece needs to be finalized by clarifying their remuneration framework and setting the prerequisites for Battery Energy Storage Systems participating into the market through auctions. The company is firmly committed to innovation, for example, through the development of energy storage projects. We have created two new business unit dedicated to the development of energy storage technologies in EU and USA.

It is now more important than ever to invest in renewables as they use unlimited, indigenous, and free resources, which help society to protect itself against these fuel price rises. We are living in a time of prosperity for our sector, and we want to lead the way towards the decarbonisation of the economy.

To achieve this goal, a redesign of the energy market is necessary, prioritizing the consumption of renewable energies and reducing the use of other alternatives that increase the price and do not allow progress in achieving climate objectives.

Advantages and benefits of collocated RES plus Battery Energy Storage System

Apostolos Panos

Head of Energy Management, Enel Green Power Hellas



How to transfer energy across distances: this was the biggest challenge that the energy sector faced successfully in the past. Power systems, including generation, transmission, distribution and consumption points were designed and developed so as to tackle this challenge and meet its requirements.

However, today's main challenge is slightly different: how to transfer energy in time and on time. The goal now is to tackle the stochastic penetration of RES and, simultaneously, to synchronize the usage of clean energy with relevant load demand. As energy generation sources, wind and solar are intermittent and most often non-dispatchable; consequently, deploying Battery Energy Storage systems (BESS) in combination with wind or solar energy can provide a more predictable output, allowing RES to play a key role in satisfying the system adequacy and flexibility needs of the electricity system.

Collocated RES with battery energy storage systems, in behind the meter applications, which can absorb energy not only from RES units but from the grid as well, are considered dispatchable generating units. The battery offers flexibility and balance to the grid by eliminating the stochasticity of renewable energy and enabling large-scale RES penetration into the energy system without taking up additional space in the grid. The connection is such that the maximum power injected into the network is equal to that of the battery inverter, since the purpose of the RES unit is to work supporting the battery. Therefore, the maximum/nominal injection and absorption power of the whole plant is determined exclusively by the storage.

Essentially, it is an equal alternative to stand-alone batteries but with the added value of being charged by a RES unit without placing burden on the network capacity.

It is therefore an excellent solution for converting RES units into controlled and dispatchable units, to which the Grid Operator can send commands for lower or higher power, depending on the needs of the grid, in real time. This fact is extremely vital in increasing the flexibility of the system, achieving stability, and ensuring security of supply.

An equally important advantage of the specific projects is that they do not require investment in the grid to increase the RES penetration rate, since the maximum injection and absorption power of the entire project is equal to that of the storage unit and not to the total sum of storage and RES unit. At the same time, such projects help avoid the waste of green energy, since the storage unit provides the possibility of mitigating curtailments due to grid congestion.

Finally, they contribute significantly to lower costs for the end consumer.



The excess output of the RES unit can be stored in periods of low demand and then injected into the grid at critical moments when the intervention of thermal units would be necessary. Given the current production costs of thermal units, the possibility of injecting low-cost green energy in critical periods instead of running natural gas “peakers” is of extreme importance, as it results in reduced wholesale market prices. In addition, these units can provide services to the network that are necessary to ensure, in real time, the balance of supply and demand. To date, the provision of these services has been the prerogative of mainly thermal units, resulting in their high cost affecting not only the day-ahead market but also the balancing market. In technical terms, collocated RES+BESS, eligible to charge also from the grid, could be characterized as the mechanical analogue of thermal units but with energy production coming from RES. They are an ideal and at the same time quick solution to ensure security of supply and system adequacy, contributing to the reduction of costs for the final consumer and to the increase of RES penetration in the generation mix.

Battery energy storage systems collocated with solar plants can help overcome some of the technical, financial, and operational challenges associated with renewable energy integration and help increase the penetration of renewable energy sources in the energy system. In parallel, they offer technical and economic advantages over units that are powered by gas in balancing markets and providing grid ancillary services. These advantages include quick response times, high efficiencies, low emissions, and lower energy costs.

In conclusion, the integration of RES and BESS, collocated and behind the meter, into the generation mix can result in cost savings for the energy system by reducing the need for expensive peak generation, improving the utilization of existing generation assets & transmission infrastructures, by reducing the need for grid upgrades and expansions. Additionally, by improving the reliability and stability of the energy system, the integration of RES and BESS can benefit electricity end consumers by reducing the frequency and duration of power outages and improving the quality of the power supply.

The "green" and sustainable power in the Renewable Energy sector

Enel Green Power, a global leader in the development and operation of Renewable Energy Sources, has a presence in Europe, America, Asia, Africa and Oceania.

With an uninterrupted presence in Greece since 2008, Enel Green Power applies a new model of sustainable development in the regions where it operates, with the aim of Creating Shared Value with local communities.

As a recognition of its multi-year strategy for Sustainable Development, Enel Green Power has been awarded as one of the "Most Sustainable Companies" in Greece.

THE "GREEN" AND SUSTAINABLE POWER OF ENEL GREEN POWER INCLUDES:



59 plants
for energy
transition
in the country



8 projects for
sustainability
across Greece



481 MWs
of total installed
capacity in Greece

«HEnEx and the Greek National Energy and Climate Plan»

Athanasios Savvakis

President, EnExGroup



In line with the goals of the European Energy Union which aim for secure, affordable and clean energy for EU citizens and businesses, the revised Greek National Energy and Climate Change Plan strengthens its overall greenhouse gas emissions reduction targets with the view to carbon neutrality by 2050 and an additional reduction target of 80% by 2040 which was added by the Greek Climate Law.

In the context of this energy transition, power exchanges like the Hellenic Energy Exchange (HEnEx) support the development of clean energy by providing the relevant financial indicators and price signals that producers need to optimize their existing infrastructure and investors require to plan their new investments in renewable energy sources (RES).

Furthermore, it contributes to optimizing the interconnections between the Greek and the European energy networks by operating a reliable market in which the right price signals are formed, based on supply and demand and in real-time. This interconnection was further enhanced with the launch of the intraday continuous electricity trading (XBID), in November 2022, which was a milestone reached for the Greek energy market, after the launch of HEnEx' Natural Gas Trading Platform. Thanks to XBID, market participants are able to trade on a 24-hour basis, on a single integrated European intraday market, now connecting 25 countries. The completion of this market leads to further European energy market integration, which promotes cross-border trading, optimal capacity allocation, and market efficiency.



Acknowledging the importance of RES in the energy transition, and their role in reaching the Greek National Energy and Climate Plan targets, we are pleased that HEnEX now allows market participants with RES portfolios to adjust their position on a continuous basis and manage the assumed balancing market responsibilities. XBID facilitates the scheduling needs of market participants, thereby allowing for successful market integration of renewables. As the traded volumes increase due to higher market participation, market liquidity also increases. In view of the crucial role of gas as a transitional fuel in Europe's energy transition, aiming to reduce the usage of solid fossil fuels and thus the greenhouse gas emissions according to the Greek National Energy and Climate Plan targets, HEnEX has also launched the Natural Gas Trading Platform in March 2022.

The Natural Gas Trading Platform aims to facilitate the development of new projects for gas and LNG storage and regasification infrastructures which will overall enhance the diversification of sources and supply routes, by improving gas transactions in the Greek market, and, subsequently, the country's energy security.

HEnEx is exploring the development of an ecosystem which will help the local Corporate Renewable PPA market to further expand. Specifically, HEnEx examines the implementation of a centrally-organised RES PPAs platform in Greece, aiming to facilitate the signing of PPAs bilateral contracts by encouraging negotiations and increasing market know-how and experience on PPAs contracts. Taking into account the advantages of HEnEx, a centrally-organised PPA platform could provide transparency and equal access of all players and finally endorse the new investments in RES.

Finally, Ambitious policy frameworks are key to driving investments as well as R&D. Given the potential for Greece to transform into an international energy hub, and most likely to a green hub, HEnEx is committed to developing new products that facilitate market participants' integration and products which expand market coverage to other sources of energy, i.e. such as hydrogen.



The background of the top half of the page is a dark blue gradient. It features a network of white dots connected by thin white lines, creating a mesh-like pattern. Overlaid on this are several semi-transparent financial charts. On the left, there's a candlestick chart with green and red bars. In the center, there's a line graph with a green arrow pointing upwards and to the right. On the right side, there are some percentage values like '+0.94%' and '-0.10%'. Various numbers are scattered throughout, such as '11457', '60658', '20200', '57200', '1.55', '6.79', '0.41', '5.66', '2.99', '6.98', and '9.91'.

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From the traditional concept of Energy efficiency to Net Zero

Konstantinos Georgakopoulos

Head of Unit, Clean Energy Transition, Exergia



The traditional concept of energy efficiency (EE) was for many years the main driver for reducing energy consumption in buildings and industries. Application of energy management practices, replacement of high energy consuming equipment were the prominent measures for reducing energy bills and supporting the competitiveness and cost-effectiveness of industries and big commercial buildings in Europe.

Lately, these consumers, especially the energy intensive ones, are moving towards a new era shifting from the traditional concept of reduction of energy consumption to the concept of carbon emissions reduction to eventually reach the net zero target.

The main vehicles to achieve net zero emissions considered nowadays include a higher penetration of **renewable energy**, like wind and solar, **fuels' shift** towards lower and zero-carbon fuels like green hydrogen, sustainable biofuels and recycled carbon fuels, the deployment of innovative technologies such as **CCS and CCU and adoption of circular economy practices**.

The above concept is supported by several policy initiatives and measures at European level expressed recently such as the EU Green Deal and REPowerEU. One of the cornerstone instruments of the European climate policy is the European Union Emissions Trading System (EU ETS).



The objective of the EU ETS is to reduce emissions in power generation, energy intensive industries and commercial aviation by a certain percentage each year. Based on the cap-and-trade principle, industries buy or receive emission allowances. Failing to comply with the EU ETS requirements, result in severe **fines** per tonne of CO₂ emitted. The EU ETS proved effective enough; since 2005 when launched, EU emissions have been cut by **41%** in the sectors covered. Currently in its 4th trading phase, it has undergone several reforms during its establishment.

The latest reform was part of the Green Deal **"Fit for 55" package** - a set of proposals to revise and update EU legislation which will contribute to the EU's climate goals of reducing net GHG emissions by at least 55% by 2030 and reaching climate neutrality by 2050. In December 2022, the EU Council reached a deal with the EU Commission to cut GHG emissions by **62% by 2030**, compared to 2005. In addition, a new system, the EU ETS II is set to come into force in 2027. The **EU ETS II** will establish a separate emissions trading system for direct emissions from **buildings, road transport, and other fuel-consuming sectors**.

In parallel, the initiatives of determination and implementation of **ESG** (Environment, Social, Governance) and converging to net-zero or low carbon performance tends to be the dominating practice in Europe by the major businesses, but also by SMEs, because these practices are clearly linked with access to financing, modernization of operation and social acceptance of the entrepreneurial activities.

The **new, under approval, NECP of Greece** is also moving towards the same direction. It revises the target for the overall GHG emissions reduction to follow the EU objectives, implying significant reduction of carbon emissions by all consumers, and thus setting a challenging task to be achieved in the forthcoming years.

Considering the above framework, the **Greek energy intensive businesses**, especially those falling under the EU ETS system, should be actively engaged in the new decarbonization era and take immediate actions towards reduction of their GHG footprint and meeting the ESG and net-zero targets.

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The role of PPAs under the new European Market Design

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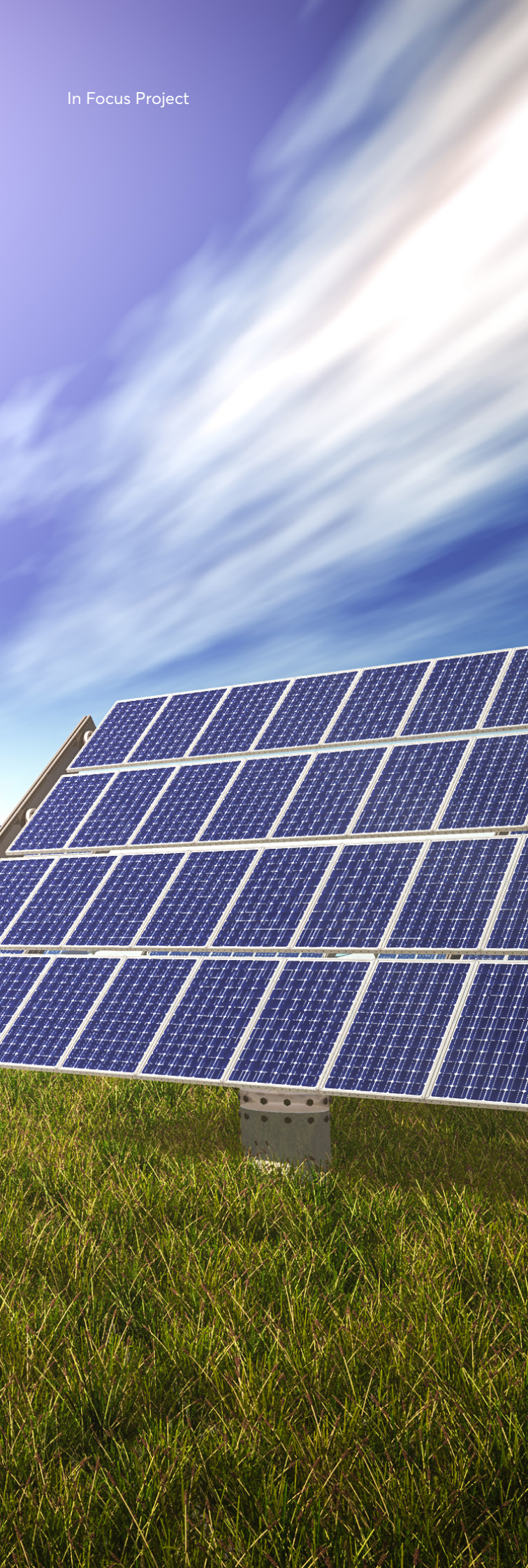


The most recent European Commission's proposals for market design were announced in mid-March 2023. Aiming to boost the further growth of PPAs, Member States are invited to assess the regulatory and administrative barriers to Power Purchase Agreements (PPAs) and to promote the uptake of such agreements.

Social benefits arising from the growth of PPAs include the further acceleration of the Energy Transition to a zero-carbon economy and in parallel, the reduction of reliance on public subsidies. For RES producers, PPAs offer long-term revenue predictability and enable project financing while for the off-taker, PPAs reduce the buyer's carbon footprint as long as the ESG criteria are fulfilled and offer a clear hedge against market price volatility.

Nowadays, the banking system in advanced energy markets is experienced with a variety of PPA structures and is willing to finance both baseload and as-produced PPA-backed projects. Besides, another key trend that is evident in mature European markets is that long-term corporate PPAs have been mostly associated with large PV & Wind projects not eligible for auctions, providing long-term price stability and bankability support with a weighted average tenor of 20 years.

In that context, according to recent proposals, the main objective for each Member State should be to reduce the financial risks associated with off-taker payment default (e.g., through guaranteed schemes). In parallel, public support schemes for renewables should allow project developers to reserve a share of the generation for sale via a PPA.



Hence, the evaluation criteria of the tenders should give preference to bidders presenting a commitment from a potential buyer to sign a PPA. Specific criteria could be applied to the characteristics of the buyer, targeting small-sized corporates, while Member States may require suppliers to sign PPAs to cover a share of their risk exposure on wholesale prices.

In this direction, and for the particular case of Greece the new provisions exclude physical PPAs from the Temporary Revenue Return Mechanism in Day-Ahead & Intraday Markets. This mechanism will enable RES producers and energy-intensive industries to establish PPAs for cleaner and affordable energy supply to the industry.

Furthermore, the procedures leading to the establishment of a platform hosting green-energy Power Purchase Agreements are ongoing at the Hellenic Energy Exchange.



Though still at a preliminary stage, the procedure has already indicated that the PPA platform will offer largely standardized terms as a means of fostering agreements, especially during the platform's early stage. Finally, under the new global context of interconnected Electricity Markets, PPAs already play a crucial role in minimizing the risk of energy prices carried by businesses. Given that PPAs are broadly considered an important tool for reducing the risk of energy price exposure, these contracts support and accelerate the construction of new and more efficient RES Plants throughout the world. Above all, PPAs contribute to the achievement of government environmental goals to combat climate change, hence increasing the proportion of RES in the nation's energy mix.



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Renewables in the Greek Energy Landscape

Konstantinos Mavros

CEO, PPC
Renewables



The current unprecedented energy crisis sounds alarm bells for society and economy at a worldwide level, as the possibility of a global recession remains high. The EU's dependence on Russian fossil fuels proved to be extremely precarious and damaging.

Decarbonization of the energy sector is expected to last for decades, and its success is grounded on transnational governmental decisions over a long period of time. Thus, the acceleration of the energy transition and rapid phase-out of fossil fuels are more necessary than ever. In this uncertain environment, RES are expected to provide the energy system with the needed security and stability.

At the national level, the energy transition is facilitated via concrete and clear policies.

In January 2023, the Ministry of Environment and Energy presented the updated clean energy targets included in the draft of the revised National Energy and Climate Plan (NECP).

Solar PV systems are expected to have a leading role in the energy transition with a total target set at 14.1 GW till 2030. Solar PV sector's positive outlook will strengthen even more given the recovery in the supply chain of PV panels and related equipment and the lowest levelized cost of electricity produced among all forms of energy.

The target set for offshore wind power is 2.7 GW by 2030, highlighting the multidimensional added value expected for the energy system and, overall, the national economy.



In addition, onshore wind energy is expected to follow a steady increase and reach the level of 7.1 GW till the end of current decade. In the field of hydropower, this form of clean energy is expected to rise by about 25% from now and reach 4 GW in 2030. The NECP prescribes more ambitious RES targets for the period to follow, at the levels of 45 GW and 70 GW (in total, including large hydro) by 2040 and 2050, respectively.

Aiming at faster development and more efficient integration of RES in the Greek energy system, the NECP prescribes extensive development of energy storage systems by 2030. Specifically, the related targets for batteries and pumped storage are 5.6 GW and 2.5 GW, respectively.

The strong investment interest in the energy storage sector is also proven by the fact that the Regulatory Authority for Energy has already approved, till the beginning of January, applications for storage projects with a total installed capacity greater than 19 GW. In addition, production of 205 million tons of green hydrogen in 2030 is presented in the revised NECP.

Last but not least, the NECP foresees also the greening of the transport sector via electrification of the electric fleet, by setting a notable target for electric vehicles' sales as share of new registrations at the level of 32% in 2030, as well as a wide set of energy efficiency measures.

PPC Renewables is a wholly-subsidiary of the Public Power Corporation and the only company in Greece active on all forms of RES. The company is leading the energy transition in Greece and, despite the unfavorable conditions imposed by the COVID-19 pandemic and the war in Ukraine, implements a remarkable development plan in the energy sector.

PPC Renewables is targeting through a combination of organic growth and strategic partnerships to further expand its portfolio in innovative technologies, such as offshore wind farms and floating PV parks, as well as participate in the promising new market of battery storage.

We currently have more than 500 MW of operational RES projects and a portfolio of mature projects with a total installed capacity greater than 4 GW. PPC Renewables has one of the most ambitious business plans in Europe, including goals of 5 GW within the next five-year period and 10 GW at the end of the current decade.

New RES investments need to be implemented at an even faster pace than today, facilitated by stable policies, to multiply the total benefits gained for the citizens and the environment.

There is definitely no time to waste!

Committed to a sustainable energy future

Ioannis Maris

Country Representative
Greece, TAP



Trans Adriatic
Pipeline

As Europe transitions to a low carbon future, it still requires a diverse, secure, reliable and affordable energy supply to develop its economy, warm its homes and remain competitive. At TAP, we are focused on making sure the transition happens in a sustainable manner, especially in South-East Europe and the Western Balkans, a region overly reliant on heavy fossil fuels.

Natural gas will remain an important part of Europe's energy mix and has a key role to play in the energy transition. Gas-fired power plants offer the on-demand power needed to complement intermittent renewables. Combined with the application of innovative technologies, natural gas can help achieving EU's 2050 carbon neutrality goal. In the long-term, existing gas infrastructure could be retrofitted for the transportation of decarbonised or renewable gases.



Balancing the energy trilemma

While the long-term climate and sustainability objectives covered in the European Green Deal (EGD) remain unquestioned, in the wake of current security of energy supply concerns in Europe, the importance of the other two dimensions of the energy trilemma (energy security and affordability) has been increased in the short- to mid-term.

Since the start of our operations on the last day of 2020, TAP has consistently contributed to Europe's energy security. So far, we have transported more than 20 billion cubic meters (bcm) of natural gas from the Caspian Basin to Greece, Bulgaria and Italy in a sustainably reliable way. In 2022 alone, we have transported about 11.5 bcm to Europe and we covered approximately 20% of Greece's gas imports.

In the future we could support the region's energy efficiency even more, as TAP is designed for capacity expansion up to approximately 20 bcm per year, the equivalent of heating about 20 million homes. TAP's expansion capacity, which can be achieved in incremental steps, is offered to the market through regular market tests. As the binding bidding phase of the 2021 Market Test closed late January, TAP has now triggered the first level of capacity expansion. This first step will support the pipeline's further expansion until capacity is doubled, provided there is interest from the market. TAP's expansion could also help address the sustainability element of the energy trilemma as new volumes of hydrogen and other renewable gases could be transported in the future.



Building a low carbon future

An initial Hydrogen Readiness study confirmed that TAP has the potential to transport hydrogen blends. We are in the process of testing our materials in an internationally-recognised laboratory to fully assess the suitability to meet the forthcoming hydrogen requirements and opportunities. Similarly, studies by major equipment manufacturers, such as our gas turbine driven compressors for hydrogen readiness, are currently underway.

We set ourselves on a decarbonisation pathway aiming to achieve climate neutrality by 2050. Our short-term target is to reduce TAP's carbon footprint by 5%, methane emissions by 8% and the fugitive emissions by 54% between 2022 and 2025. Last year alone, TAP has achieved an overall reduction of 25% in its greenhouse gas emissions and 38% in methane releases compared to the 2022 forecast.

We recently joined the Oil & Gas Methane Partnership (OGMP 2.0) and we envisage to obtain the "Gold Standard" acknowledgement within OGMP 2.0 during 2025 for our plans to measure and reduce methane emissions. Meanwhile, we have used renowned external specialists to undertake preliminary studies to investigate the feasibility of using electrically driven compressors.

Looking into the future, we are committed to continue operating in line with the world-class industry standards, ready to double the capacity of the asset if the market requests for it, while remaining focused on safety and a sustainable energy future. A potential full-expansion of the pipeline's capacity will enable us to further support Europe's energy transition.



Trans Adriatic
Pipeline

COMMITTED TO A SUSTAINABLE ENERGY FUTURE

As the European part of the Southern Gas Corridor, TAP contributes to the security and diversification of supplies, while actively supporting the energy transition.

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Battery Energy Storage Systems: Present status and expected next steps

Konstantinos Gkouramanis

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Battery Energy Storage Systems (BESS) for grid connected operation has always been a hot topic, among energy professionals. BESS stations and in general energy storage in practice may simulate the thermal plants frequency response features, thus mitigating the Renewable Energy Sources (RES) stations' disadvantage of poor grid stability characteristics. After all, the operation of a properly sized energy buffer is in all cases a stabilizing factor for any energy system, either electrical or mechanical.

The introduction of privately owned BESS stations into the electricity system has become the "next big thing" in the energy market during the previous years with continuously increasing interest.

In Greece, this trend is at its peak due to a number of factors existing nowadays, such as: the higher than ever RES penetration to the electricity distribution grid and the transmission system, the full liberalization of the energy market with the complete application of the target model (since November 2022), the fluctuations of the Market Clearing Prices (MCP) witnessed across the Hellenic Energy Exchange Market (Hex) and the interest of investors in participating in the Balancing Market (operated by the Hellenic Transmission System Operator, HTSO).

The following facts are representative of the current market interest for BESS stations:

- The updated Greek National Energy and Climate Plan (NECP) defines the target for 8 GW of operational BESS by 2030.
- Two auctions for a total nominal power of 900 MW of BESS station under the responsibility of the Regulatory Authority of Energy (RAE) are announced to take place within 2023. The successful bidders of these auctions will achieve operational and construction premium, financed by 200 m€ from the Recovery and Resilience Facility (RRF) resources.
- The numbers in the Greek market indicate that by the end of 2022 (for which there are official records) about 19 GW of BESS stations Producer Affirmations were active. This licensed power exceeds the established grids' target for 2030 by about 2,5 times.

On the other hand, a number of drawbacks are identified by the market stakeholders that hinder the BESS stations prospects materialization. Such drawbacks are:

- The BESS Financial Models are in all cases complex with high degree of uncertainties, resulting in a number of sensitivity scenarios. The uncertainties are mostly associated with the energy purchase and selling price in the Hellenic operated markets (Day Ahead (DAM) and Intraday (IDM)), the income that can be extracted from the Balancing Market, as well as the actual magnitude of the much needed system's ancillary services market. Besides uncertainties currently present, additional matters are correlated with the future market conditions such as the effect of expected market cannibalization, the stations' actual operational costs and ageing factor, as well as the estimated trends of future energy prices until 2050.

- The updated Grid System Code from the Independent Power Transmission Operator (IPTO) required in practice for the issuance of Final Grid Connection Offers and clarification of the BESS stations technical specifications and obligations are pending. The delays identified during the issuance of the environmental permits have in turn further delayed the issuance of BESS stations Grid Connection Offers. This fact introduces complications in the licensing maturity that will be required for the participation in the 900 MW RAE auctions.
- BESS stations are mainly focused on improving the overall electrical system stability and operation via the provision of electrical system ancillary services, reducing intraday clearing price and daily MCP fluctuations and in practice substituting the thermal power plants frequency response characteristics. Nevertheless, such as every RES station applying for a Grid Connection Offer, BESS stations are also negatively affected by the system's lack of energy space (known as system saturation). In practice, the materialization of BESS stations will always require the construction of HV / MV re-enforcement works increasing the actual investment budget and as a result, reducing its financial competitiveness.
- Finally, a series of licensing uncertainties are still coming from the legislative framework. The environmental licensing has only recently been clarified for installations below 100 MW with the issuance of Environmental Commitments, while a number of issues come from the lack of information available at the various public authorities.

All energy market analysis reports, all technical papers issued and current system technical difficulties lead to the evident conclusion that energy storage is the required next step towards a more environmentally friendly, more stable and of lower operating cost energy system. In this case, the future is now moto actually applies.

Energy storage can be achieved mostly via BESS stations, together with large water pumping stations and - in the future - hydrogen exploiting facilities. Significant developments will happen in 2023 with RAE auctions and Grid Connection Offers to be issued. This will help the projects reach the maturity needed for securing lenders' financing. Thus, the mitigation of the installations drawbacks is a necessity in order to achieve projects materialization, since the BESS market in Greece is close to "overheating" before it actually begins. The exploitation of the relevant experience gained from all energy market stakeholders during the previous years from the other RES technologies can facilitate in this task.





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Based on our organization's fundamental principles of integrity, responsibility, reliability, and innovation as well as on our leading energy professionals' extended know-how, we have contributed to the successful implementation of:

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- 55 MW Biogas Stations
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Renewables is the future and TÜV NORD remains a trusted partner in the field of safe and environmental friendly energy generation.



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