

MED & Italian Energy Report

Alternative fuels: a strategic option
for the Euro-Mediterranean area?

EXECUTIVE SUMMARY



A major change in the structure of the European Union's energy mix has been underway for the past two decades: oil still dominates, but Renewables and Biofuels are making marked gains

- As far as the EU's energy mix is concerned, **oil is still the main energy source**, but its share has decreased by 6 percentage points over the last two decades **from 38.7% to 32.7%**.
- **The share of gas increased** from 20.6% to 24.4%.
- **Renewables and Biofuels showed an impressive surge**, gaining more than 11 percentage points from 6.4% to 17.9%.

The Russian invasion of Ukraine has created geopolitical and strategic turmoil in the European energy sector and thus also in our country: gas consumption is decreasing; sources are being diversified and supplies are changing

- Until 2021, **the EU imported 90% of its gas consumption. Russia supplied over 45% of these imports (in 2010 this figure was 31%)**, in addition to 27% of oil imports and 46% of coal imports.
- The other gas suppliers to the EU are: **Norway, the USA, Qatar and Algeria accounting for 47.7% of needs**.
- In 2022 (especially March-September) **Russian gas supplies to the EU decreased by 80%** and there was a process of demand reduction (of end-users), supply diversification and increased LNG imports together with an increase in renewables.
- **Italy is among the countries most affected by the reduction in Russian gas** and reacted with increased imports from Algeria in particular; in September and October 2022, gas imports via the Transmed (Algerian gas entry point) exceeded 40% of total gas imports.
- At the same time, **Italy's import of Russian gas** through the TAG pipeline accounted for 8.7% of total imports in September and even less than 1% in October.

The Southern Mediterranean thus becomes strategic for overcoming the crisis and setting future energy balances, not only for fossil fuels.

- At the strategic level, it is important to strengthen, in a structural manner, the new central role of the **Mediterranean** in order to ensure the security of energy supply in the short and medium term.
- The pace of growth of **renewable capacity in the Middle East and North Africa is expected to increase by more than 100%** over the next five years, from 15 GW to over 32 GW. Capacity expansion is concentrated in five countries: the United Arab Emirates, Saudi Arabia, Israel, Egypt and Morocco.
- **Another opportunity** to implement decarbonisation will be investments in hydrogen; Morocco and the United Arab Emirates have already drawn up road maps and/or signed memoranda on the topic of **green hydrogen**.
- **The EU, at COP27 in Sharm el Sheikh, also signed an MoU with Egypt** to create a partnership on green hydrogen.

The strengthening of the “fossil based” energy dialogue across the Mediterranean is a mandatory answer to the ongoing geopolitical crisis between Russia and Ukraine. However, in the long run, a strategic interplay among energy commodities will be necessary for building a new “green” dialogue.

- The evolution of the energy systems in the Mediterranean region must be intertwined with the **triangle of desirable energy attributes**, which reflects the so-called “energy trilemma”: environmental **sustainability**, energy **security** and **equity**.
- The **conflict** between **Russia** and **Ukraine** is shifting the **priority** from a vertex (environmental sustainability) to the other two (**security** and **social equity**). One of the first effects of this has been a **strengthening** of the fossil-based **energy dialogue** across the shores, since **Algeria** is assuming the role of **key gas supplier** for several countries belonging to the Northern shore, like Italy: in October 2022, the gas import from Algeria through the Transmed pipeline was more than 40% of the total, while the import from Russia was lower than 1%.

- If the reinforcement of the **“fossil based” dialogue** across Mediterranean is a **mandatory** answer to the **contingency** determined by the crisis, **in the long run** the strategical policy choices cannot ignore the need for **balancing** the **three** key **attributes**.
- The **exploitation** of locally available **renewable resources** could lead to benefits not just in terms of increasing **sustainability**, but also with reference to supply **security** for highly dependent countries and social equity, ensuring an **affordable access to energy** to all the citizens. Electricity from renewables is expected to assume the central role in the future energy mix and in building a new “green” dialogue.
- However, **electricity could not assure** by itself the **complete decarbonisation** of the Mediterranean energy systems due to the presence of **“hard-to-abate”** final energy uses (as the production of high temperature process heat in industry, and the long-distance maritime and aviation transport), requiring a **synergy** with **other commodities** (like hydrogen).
- In this framework, a non-negligible **role** could be **played** by the **alternative fuels**, both **biofuels** and **synthetic fuels** (obtained by combining hydrogen and CO₂), whose exploitation fits with the **circular economy** approach at the basis of the European **Green Deal** and which have been already included in the strategic plan of the European Commission **“REPowerEU”**.

In the journey towards a fully decarbonised transport sector, biofuels and e-fuels are expected to support the energy transition, especially for the hard-to-abate segments such as aviation and maritime.

- Biofuels currently play a **fundamental role** in the decarbonisation of the EU transport sector, representing an **83% energy share** of total renewable fuels used in 2020. The EU countries located in the Mediterranean area used around **6,300 ktoe of biofuels in 2020**, equal to 38.8 % of total biofuels consumed at EU27 level; in particular, France, Spain and Italy account for almost 90% of such share. On the other hand, the **Eastern and Southern Mediterranean shores** are **still lagging behind**, with only Turkey and Cyprus reporting limited biofuels consumption figures: of 167 ktoe and 27 ktoe in 2020, respectively.
- **Biofuels demand figures** for the transport sector in the Northern Mediterranean shore are **expected to rise until 2030**, ranging between 8 Mtoe and 12.6 Mtoe, then gradually be complemented by direct electricity and e-fuels are expected

to increase. **Southern and Eastern Mediterranean shores** are expected to follow a similar path but **shifted ahead in time of around two decades**.

- The development of **highly sustainable liquid fuels** value chains is of **paramount importance for decarbonising “hard-to-abate” sectors** such as **international civil aviation** and **maritime transport**.
- An analysis of **technical potential for biofuels production**, based on the biomass feedstock availability potential, in the Mediterranean area for year 2030, has been performed. It mostly considered existing EU-scale studies and focused on **three production pathways**: Sustainable Aviation Fuels (SAF) and Renewable Diesel from ligno-cellulosic biomass, SAF from waste oils and fats, such as Used Cooking Oil and finally Bio Liquefied Natural Gas (LNG) from the Anaerobic Digestion of the Organic Fraction of Municipal Solid Waste (OFMSW). The resulting **total technical potential** for the **Northern EU shore** was estimated at **around 28 Mtoe**. The expected **SAF potential** from oils and fats could cover around **15-16 % of the SAF mandates-driven demand** for 2030, while the projected **Bio-LNG production** could cover around **20% of the expected demand** for the maritime sector. Southern and Eastern Mediterranean estimated technical potential proved slightly lower, mostly due to the existing high uncertainties.

Different policy supporting actions for alternative fuels development are in place in the Mediterranean areas, with the Northern shore leading and the Southern and Eastern shores getting-up to speed.

- Policies fostering biofuels uptake in the transport sector are in place by more than a decade at EU level. Currently, the **2018/2001 RED II Directive contains a 14% RES target** over the total transport sector energy consumption in year 2030, with a **sub-target of 1.75% of advanced biofuels**.
- Within the 'Fit for 55' legislative package a proposal for the **revision of the 2018/2001 RED II Directive** has been presented. It **raised the transport target ambition** and defined it in terms of GHG emissions levels reduction instead of renewable energy consumption. The proposal also **raised the advanced biofuels sub-target** to 2.2% of transport energy consumption and **introduced a new 2.6% target for hydrogen and synthetic hydrogen fuels** in the sector.
- Other targets and mandates were proposed within the **ReFuel EU Aviation** and the **Fuel EU Maritime legislation proposals**, both in terms of GHG reduction and bio/synthetic fuels uptake, in 2050.

- For the time being, the policy framework for alternative fuels of **Eastern and Southern Mediterranean** shore countries is less structured and detailed, in comparison with the one of European countries. Nevertheless, it is worth noticing that policy is rapidly shaping, through the development of strategic plans and roadmaps, together with projects involving industrial partners.
- Within this overall picture, a further **adaptation of existing legislative measures** could **foster and financially support** the Mediterranean **marginal land recovery actions** that bioeconomy and bioenergy could put into place, by using autochthonous feedstocks as an input for their processes.

The establishment of sustainable biomass value chains for biofuels production could represent a win-win solution for both transport sector decarbonisation and the recovery of abandoned or marginal agricultural lands, enabling a more sustainable agriculture.

- **Large-scale bioenergy supply chains** are needed for economically viable biofuels production. Such large-scale production has to be **sustainably designed**, taking into account multiple aspects, and not being limited to GHG reduction only: e.g. supporting sustainable agriculture and forestry, **stimulating growth and jobs** – in particular in rural areas – and possibly allowing for **relevant carbon sequestration** in the soil.
- Several Mediterranean areas are currently experimenting **soil degradation processes** such as loss of Soil Organic Matter, loss of Soil Organic Carbon, erosion, compaction and salination of land. These processes are **further accelerated by climate change** effects such as recurring drought conditions, and could eventually lead to desertification. Carefully chosen biomass value chains, with characteristics of **drought tolerance** and **reduced water demand** would allow to fight such harmful trends.
- The promotion of biomass value chains can therefore **bring benefit to abandoned or marginal agricultural lands**, that could be **used and restored** to produce food, feed and energy, in a sustainable crop rotation scheme. These value chains can also help improving the resilience of agriculture to climate change effects, fostering sustainable models specifically designed for such agro climatic conditions, able to provide many different products over multi-year crop rotations.

Synthetic fuels could not replace fossil fuels in the whole transport sector, but could help in preserving knowledge and infrastructures related to the oil & gas industry, and the conventional internal combustion engines and jet engines in long-range transportation subsectors.

- In the Mediterranean region, **94.2%** of the total **final consumption** of energy in the **transport** sector is currently matched **by oil products**. **75.9%** of the consumption of oil products is due to **road transport** only. Transports are responsible for **29.9%** of the overall **carbon dioxide emissions** in the region.
- The production of **synthetic fuels** via Fischer-Tropsch process **requires green hydrogen** (produced via electrolysis) and **carbon dioxide** (by capturing it from the emissions of industrial activities) as input feedstocks. Both electrolysis and carbon capture **processes** must be **fed by electricity**.
- An estimation of the amount of **electricity** to be produced **for replacing** the consumption of **oil products** in the whole Mediterranean transport sector with synthetic fuels shows that **6,177 TWh/y** should be required, i.e. more than **three times** than the **current** overall electricity **generation** in the entire Mediterranean region. The corresponding required **photovoltaic capacity** is equal to **4,400 GW**, that means two orders of magnitude larger than the PV capacity installed in the Mediterranean region in 2021 (70 GW), with a covered area comparable with the surface of the entire Denmark. In terms of equivalent **nuclear capacity**, this corresponds to **849 GW**, more than twice the global nuclear capacity presently installed (381 GW), requiring 117 ktU/y of natural uranium, a quantity 17 times larger than the natural uranium demand of the Mediterranean region in 2019 (about 6.75 ktU/y).
- If synthetic fuels are adopted for decarbonising only the Mediterranean **aviation** (both domestic and international) and **maritime transport** sectors, the **electricity requirement** would be equal to **1,198 TWh/y**, i.e. 58% of the Mediterranean current electricity generation. This corresponds to the installation of **605 GW** of **solar PV** (more than eight times the currently installed capacity) for the **aviation** and **462 GW** for the **maritime** sector, or to the installation of 363 GW of onshore wind capacity (more than 4 times the capacity currently installed) for the aviation and 237 GW for the maritime sector. In terms of equivalent nuclear generation capacity, the decarbonisation of the aviation and navigation subsectors together requires instead additional 202 GW.

- The overall analysis shows that the **synthetic fuels can represent** neither an **alternative** to **fossil fuels** nor a **competitor** of **electricity**, but instead they could be **helpful** in **conserving** the historically well-established **know-how** and the existing **infrastructures** related to the **oil & gas** industry, that can be partially reconverted for supporting the generation, distribution and storage of these commodities, and the traditional end-use technologies like **conventional internal combustion engines** and **jet engines**, which still remain necessary **for long-range transportation** sectors that require high energy density and that will reasonably continue to rely on liquid fuels.

Maritime transport and ports are playing an increasingly important role in this context and are moving towards new models based on energy development: Green Ports and Green Ships

- **Ports are effectively becoming poles for industrial and energy development.** Due to the fact that they are terminals for fossil and renewable sources, as well as gateways for pipelines coming primarily from North Africa and bringing energy flows, they are also located close to highly energy intensive industries. This will increase their economic and strategic value.
- **Italian ports play a vital role in the transportation of energy**, as evidenced by the fact that 34% of traffic is in fact made up of liquid bulk (over 163 million tonnes in 2021). In the first six months of 2022 the threshold of 80 million tonnes was exceeded (+5.6% on 2021).
- **The top 5 Italian energy ports** account for approximately 70% of traffic. They include Trieste, Cagliari, Augusta, Milazzo and Genoa. Three of these are located **in the Mezzogiorno area**.
- The NRRP entails strategic challenges in the energy sector for ports. In fact, **€9.3 billion was earmarked for our maritime infrastructure** with the aim of contributing to the aims set out in the Plan of making our ports more energy efficient and sustainable. All the port network authorities have started projects for the reduction of energy consumption and for the improvement of environmental sustainability levels in ports, while Decree Law 50/2022 has given port network authorities the role of **'energy communities'**, also entrusted with promoting the consumption of renewable energy in port and back-port areas.
- A new port model closer to that of Northern European ports is appearing in Italy: the **Green port**. This is a place where energy consumption is efficient, services

are offered to vessels using **alternative fuels** and facilities are present to cater to needs of mooring and diversified **bunkering**. At the same time, digital technologies are used and intermodal models deployed which are increasingly aimed at pursuing the objective of emission reduction.

- **Shipping** is a sector currently undergoing deep changes. If the entire global transport sector accounts for **24% of total CO2 emissions, maritime transport makes up 2.3% of this and 1.8% of overall greenhouse gases**. The maritime sector's environmental footprint is certainly rather small compared to the huge volumes of goods transported around the world, but nevertheless the decarbonisation of shipping is on the priority list of both the United Nations, via the IMO (International Maritime Organisation), and the European Union.
- Shipowners need to make significant investment for their fleet to become increasingly greener through the **use of alternative fuels and technologies that can bring emissions to net zero**. The costs of investing in net-zero or low-emission fuels are considerable and these are currently up to **three times more expensive than conventional marine fuels**.
- **Between January and October 2022, 63% of the fleet in orderbooks** (vessels currently in shipyards) was made up of **alternatively fuelled units**, mainly LNG and Methanol.
- According to authoritative estimates predicting the possible scenario for 2024, the entire European industry is expected to spend a **minimum of \$3.5 billion and a maximum of \$14.5 billion** on decarbonising seaborne container transport, mainly as a consequence of the application of new environmental norms and the shift to green fuels.
- Currently, **LNG is the prime option in orderbooks** (Jan-Oct) with 52% of the total fleet fuelled by alternative sources, followed by methanol with 8.5%. 11.5% of these vessels will be 'Ammonia Ready'.
- **Many container carriers are investing in alternative fuels**. A few examples include: the Chinese Cosco Shipping Holdings which has ordered **twelve 24,000-TEU vessels with dual methanol power** with a total value of about \$2.9 billion which will be allocated to their container transport units, OOCL and Cosco Shipping Lines, with 7 and 5 vessels each respectively. The Danish Maersk announced last October that it would order **six 17,000-TEU dual-fuel methanol containerships**. These vessels will be launched in 2025 and accompany the other similar units that the shipping group has recently ordered and which will be delivered in the same year, resulting in a total of 19 new ships. The French CMA CGM has also announced that it has ordered 10 dual-fuel LNG ships and 6 methanol powered vessels which brings its orderbook portfolio to 69 new vessels. The Swiss liner MSC has ordered 28 LNG containerships for a total cost of almost

\$3.5 billion. In addition, the company has €3 billion worth of orders for **three LNG-powered cruise ships**. The first delivery was made in October 2022: MSC World Europa is the first cruise ship in the world to be equipped with the state-of-the-art technology of LNG fuel cells.