

# Carbon Neutrality by 2050

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Eni has developed a new strategy with a short, medium and long-term evolutionary path that envisages the achievement of carbon neutrality by 2050, including direct and indirect GHG emissions throughout the entire life cycle of activities and products.

The business model adopted in this regard includes not only the reduction of emissions but also the development of alternative businesses such as renewables and new businesses based on circularity and the valorisation of resources. The Transition will require the decommissioning of several existing plants and remediation of abandoned areas that could house new assets, thus reducing land consumption to a minimum. Furthermore, as water scarcity is constantly on the rise and waste generation needs to be reduced, sustainable and forward-looking management aimed at maximising reuse and recovery is essential.

# Energy transition and circular economy



## Why is it important to Eni Rewind?

The leverage of the circular economy represents a key factor in Eni's path towards carbon neutrality by 2050, based on an approach that looks at the entire life cycle of products and processes. At Eni Rewind, this perspective is assured through research into continuous development and the ability to regenerate disused industrial sites, as well as to valorise water and waste resources, laying the foundations for developing new projects. Environmental sustainability in all our interventions is an indispensable element for the growth of lasting value over time.

### POLICIES AND OTHER REGULATORY INSTRUMENTS

HSE management process integrated into a Management System Guideline; Eni Rewind Health, Safety, Environment, Public Safety and Quality Policy. Eni Rewind's Integrated HSEQ Policy enhances the Company's circularity aspects and processes.

#### PROGRESS IN 2020

- +50 ha of areas freed up after remediation (hectares intended for reuse)
- +1 million m<sup>3</sup> of water recovered (6.1 million m<sup>3</sup> vs 5.1 million m<sup>3</sup> in 2019)
- +19% recovered vs. recoverable waste (78% vs. 59%)
- Optimisation of consumption in plant management
- Reduction of weighted average Km/ton travelled for waste management
- W2F plant design on an industrial scale at Porto Marghera

#### TARGETS

- Increase land regenerated and made available to the community
- Optimise/Increase the efficiency of water treatment
- Increase volumes of treated water destined for reuse
- Maximise the recovered/recoverable waste ratio
- Development of Waste to Fuel plants on an industrial scale

#### CIRCULAR OUTPUT

Generate value from waste: developing technologies and constructing plants for the revaluation of secondary raw materials. Waste to Fuel technology transforming organic waste into bio-oil and water recovery

#### REUSE, RECYCLING AND RECOVERY

Minimising waste, maximising recovery: water management and treatment in order to optimise reuse and reduce the use of water from nature; promoting waste recovery and the use of in-situ and on-site remediation technologies. Reuse of treated water for the production of demi water for industrial use; Blue Water technology; research and development of bioremediation technologies

#### ECODESIGN AND EXTENSION OF SERVICE LIFE

Design of interventions and management of resources and assets to reduce waste and extend service life: planning of remediation interventions with a view to future land reuse, development of innovative and efficient remediation solutions and resource management. Batch remediation projects; Ponticelle redevelopment project; land reclaimed for the development of energy from renewable sources; application of e-hyrec technology, e-limina method, biopile

#### INDUSTRIAL SYMBIOSIS

Researching and promoting existing industrial, environmental and socio-economic synergies in host territories. CDP MOU; Herambiente other local partnerships (Ponticelle Project, W2F Marghera)

**€158 MLN**  
INVESTMENTS  
2021-2024

The road map towards energy transition has been charted in the Green Deal at European level and includes measures for sustainable, inclusive and equitable growth. This objective will be achieved through economic growth based on the rational use of material and natural resources, transforming climate issues and environmental challenges into opportunities. Eni Rewind is ready to make a tangible contribution by making available skills and know-how, and undertakes to achieve the objectives of sustainable development by searching for new redevelopment and regeneration solutions for natural soil and water resources, as well as industrial, remediated and organic waste, based on the principles of zero consumption and zero waste.

Besides eliminating contamination, environmental remediation minimises land consumption, making brownfields available again for the construction of plants for the production of energy from renewable sources or for the treatment and recycling of waste, acting as a driver for the country's development. In Ravenna, on land undergoing environmental intervention to render it permanently safe, Eni Rewind is creating a platform for the bio-recovery of contaminated soils using 'biopile' technology that exploits the capabilities of native bacteria to biodegrade specific pollutants. This activity will furthermore make it possible to reuse a valuable natural resource in industrial and commercial areas, deriving from the remediation interventions at service stations. After the Gela pilot plant testing the Waste to Fuel technology, which transforms municipal organic waste into bio-oil and water, the design of an industrial-scale plant in Porto Marghera has begun on rehabilitated land owned by the company. Furthermore, in Basilicata Eni Rewind is planning the first application of its proprietary Blue Water technology to maximise the purification and reuse of aquifer water extracted from production wells, contributing to making the Viggiano Oil Centre self-sufficient in terms of water for industrial use, and consequently avoiding water being withdrawn from nature.

To successfully pursue this path focusing on the Green Deal, it is essential to be able to rely on an adequate regulatory environment, the involvement of everyone, from companies to communities, institutions and on a strong management with an overall vision to guarantee the prioritisation and synergy of projects. Today more than ever, it is possible to show how much an alliance of skills is key to ensuring sustainable development for future generations. The cooperation agreements signed by Eni Rewind for the promotion of the circular economy, the redevelopment of industrial production sites and assets and for Waste Management initiatives fall into this context.





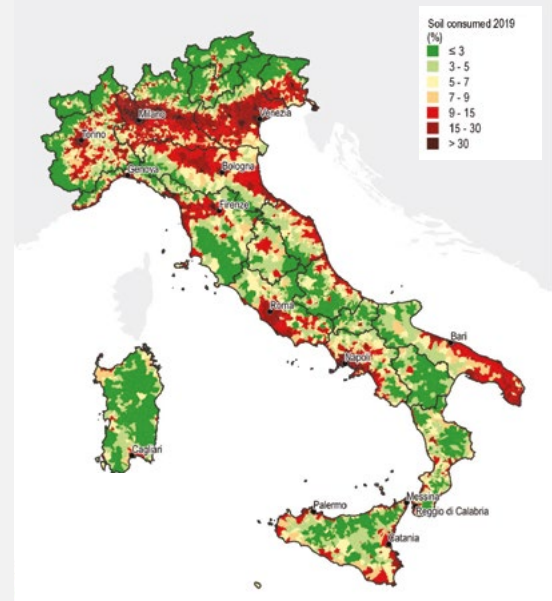
## Scenario elements: challenges and opportunities

The consumption of land in Italy continues to rapidly transform the national territory. In the last year, new artificial coverings have claimed another 57.5 km<sup>2</sup>, or an average of about 16 hectares per day. This is what emerges from the ISPRA Report "Land consumption, territorial dynamics and ecosystem services" – 2020 edition.

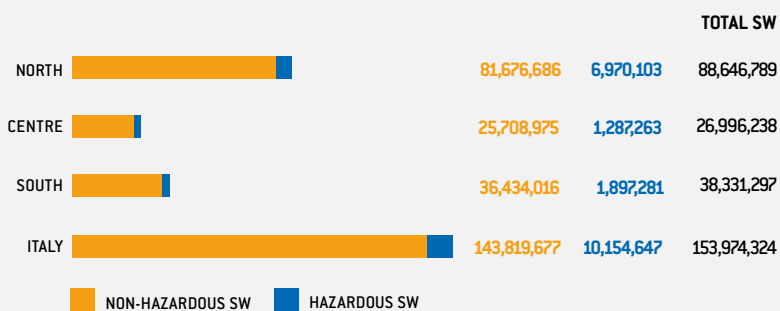
"An increase that, unfortunately, shows no signs of slowing down and in line with what was recorded in the recent past, means our country loses almost two square meters of land every second".

Source: ISPRA analysis of SNPA maps

### LAND CONSUMED AT MUNICIPAL LEVEL (% 2019)

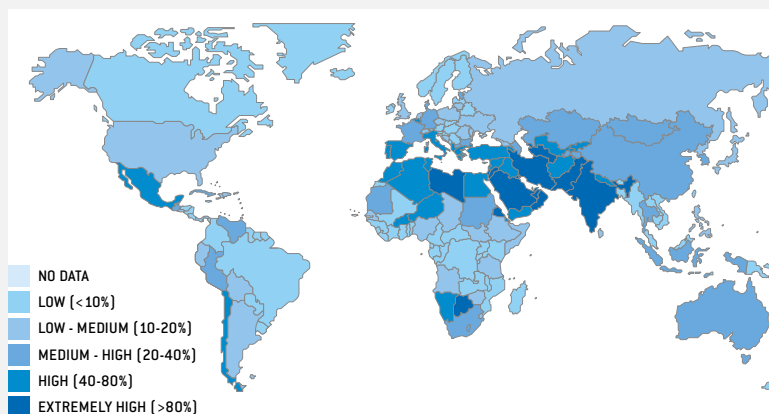


### PRODUCTION OF SPECIAL WASTE BY MACRO-AREA – 2019



In 2019, the production of special waste was at almost 154 million tons. There was a 7.3% increase in total production between 2018 and 2019, corresponding to about 10.5 million tons. The increase recorded is attributable almost entirely to non-hazardous waste, which represents 93.4% of the total waste produced, increasing by almost 10.4 million tons (+7.8%), while hazardous waste increased by 110 thousand tons.

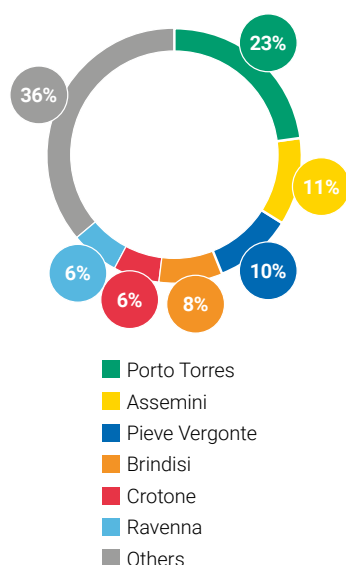
This is what was reported in the ISPRA Special Waste Report - 2021 edition



Baseline Water Stress Tool 2019

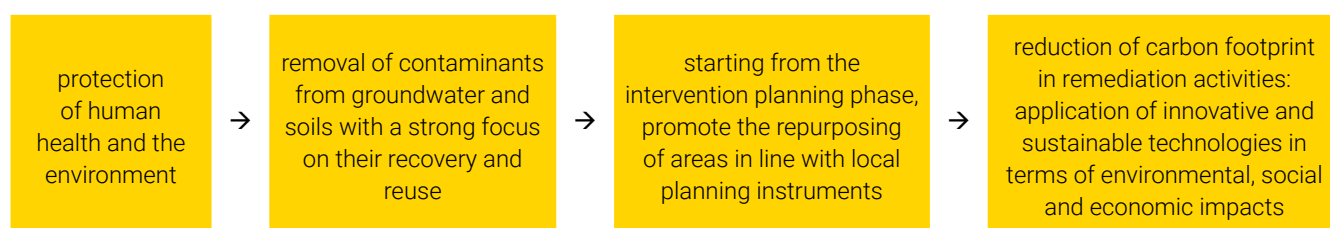
According to the Aqueduct Water Risk Atlas prepared by the World Resource Institute (WRI), global water withdrawals have more than doubled since the 1960s and show no signs of slowing down. Almost a third of the world's population lives in a country with high water stress, such as Italy, where more than 40% of the available water is consumed each year. The WRI report indicates that in several regions of the world there are still untapped or dispersed resources, such as unused waste water, which through regeneration could provide a new source of clean water.



**Proprietary sites.****Main remediation projects**

## Remediation

Remediation activities can generate development opportunities for territories. To achieve this, it is essential that the future reuse of areas is planned from the initial stages of the remediation process, in agreement with local institutions and stakeholders. Today, thanks to the experience and skills gained by operating at more than 80 sites, of which 17 within 13 Sites of National Priority, Eni Rewind is able to oversee each phase of the remediation process for the future regeneration of soils and assets. From the preliminary characterisation surveys to final certification, the aim is to maximise the effectiveness and efficiency of interventions and adopt increasingly innovative and environmentally friendly solutions for every new project, working in conjunction with universities and Eni research centres. With a firm commitment aimed at ensuring the 'circular' management of resources and in compliance with current legislation, Eni Rewind favours the application of in situ technologies that undertake the remediation of environmental matrices in their natural environment, minimising handling, the excavation of soil and water, and waste generation. In 2020, Eni Rewind initiated the progressive transformation from an Eni service company for environmental services to a market operator providing remediation, waste treatment and management and complex projects design and development to third parties.



## Operations on service stations and the pipeline network

Since 2016, based on a mandate from Eni Refining & Marketing, Eni Rewind has been carrying out environmental restoration activities at disused and operating service stations in Italy, and in 2018 added soil and groundwater clean-ups following oil pipeline break-ins.

The activities carried out in 2020 on over 650 Eni service stations (320 operating and 346 disused) involved remediation, decommissioning and asbestos removal activities, as well as a preliminary environmental Due Diligence for the regeneration of existing assets. With a view to increasing the sustainability of the interventions, Eni Rewind reduced the number of Pump & Stock systems installed for the treatment and external disposal of groundwater by about 30%, replacing them with on-site treatment systems (Pump & Treat). Furthermore, it brought from 40% to around 60% the recovery of contaminated soils after treatment.

In 2020, Eni Rewind also managed about 70 contaminated soils and groundwater remediation interventions following deliberate break-ins on Eni's oil pipelines located in Northwest and Central Italy.

In this context, the implementation of "pilot tests" at some sites continued, aimed at applying sustainable remediation technologies, such as "phytoremediation" or innovative biological processes for the bio-degradation of contaminants, as well as Ground Circulation Wells for the closed loop remediation of the aquifer, i.e. without generating waste water. [see page 22](#)

### Ravenna Ponticelle

The Ponticelle area (26 ha) is home to an important production redevelopment project. There were 21 tanks in the area in the past. These were delimited by earth embankments, used for the sedimentation of the plant's rainwater, the equalisation of nitrogenous water and for phytopurification processes. Over the years, the embankments and tanks were removed, after being emptied. To complete the environmental rehabilitation of the area, the main project intervention involved Permanent Safety Measures (MISP), with capping over approx. 18 hectares, aimed at definitively isolating polluting sources in relation to the surrounding matrices and ensuring a high level of human safety. The capping work, designed according to the area's future production developments, was completed in May 2021, with the start of the authorisation process for the redevelopment projects, as well as obtaining the relevant Authorisation (January 2021) for the construction of the photovoltaic plant and related storage.



### Ferrara

The PZPEC023 area at the Ferrara site, extending over about 4.5 ha, is the only area of the plant characterised by the presence of an intermediate layer between the surface and confined groundwater. In view of this particular hydrogeological feature, Eni Rewind submitted a programme to apply bioremediation technology in situ. Following the application of the "e-limina<sup>®</sup>" method (see page 21), Enhanced Reductive Dechlorination (ERD) was proposed and used, exploiting the degradation action of bacteria present in the environmental matrix, with the solution injected into the aquifer through 40 wells. The remediation intervention, started in 2019 and ended in December 2020. Post-intervention monitoring campaigns (lasting one year) are now in progress, which aim to confirm the effectiveness of the bioremediation intervention. Initial results have already shown a reduction in the main contaminant, with a consistently decreasing curve.



### Porto Torres

The Nuraghe Project, divided into two phases at the request of the authorities, concerns the Minciareda, Peci DMT and Palte Fosfatice areas, and is characterised by high sustainability standards. A multi-purpose platform for the on-site treatment of excavated land is being realised. The platform, which uses the most advanced technologies (thermal desorption, soil washing, biopiling, inertisation), will allow the in situ reuse of treated land, complying with the remediation objectives for filling the excavations from which they derive, avoiding transportation away from the site, in line with the regulatory guidelines. The project also uses multi-phase extraction technology to remove volatile contaminants that have migrated into the soil from the underlying groundwater.

Phase 2, relating to the remediation of the Palte Fosfatice area (TENORM - natural radionuclides – according to Italian Legislative Decree 230/95 art. 165 bis) is currently under authorisation.

Furthermore, an important groundwater remediation of the entire site is underway, which includes a 10 km long hydraulic confinement barrier, 164 supernatant recovery wells (of which 5 equipped with the e-hyrec device) and 5 plants that can treat up to 340 m<sup>3</sup>/h of water. The capacity of water treatment is being increased up to 500 m<sup>3</sup>/h, and a thermo-oxidation plant is being installed to extract the gas phase from the water being treated.



### Mantua

At the Mantua site of National Priority, on the basis of the Edison mandate, Eni Rewind is completing the interventions and managing environmental procurement in the Collina Area, of a remediation project where Eni Rewind followed the authorisation process and construction as a non-responsible owner until 2020. Following the Council of State ruling on 1 April 2020, ownership of the remediation obligations were transferred to Edison. The Collina area involves one of the most challenging and complex remediation projects, where ad hoc innovative solutions borrowed from maritime engineering have been implemented.

The interventions involve the removal of the former Montedison landfill with excavations up to 11 m deep in a confined environment, of more than 335,000 tons of waste for disposal in Italian and foreign landfills, or in authorised thermo-destruction plants located in Poland, Germany and France. A perimeter barrier was erected to isolate the area, extending almost 2 km with 1225 metal elements fixed in the ground at a depth of 25 m, and an imposing mobile tent structure (65 m by 75 m) that has the dual function of confining the excavation area and balancing the thrusts on the perimeter barrier while the soil is excavated, ensuring that the activities are carried out safely with an adequate air exchange thanks to a filtration and absorption system on activated carbons. To date, approximately 50 ktons of waste foreseen by the project have been removed and disposed of. There are also 3 water treatment plants operating in the area for the reclamation activities, which guarantee the dewatering of the intervention area, as well as the management of surface run-off and groundwater.



## Interview with Alessandro Labile



**Alessandro Labile**  
Environment and  
Health & Safety Manager  
Acciaierie d'Italia

**The collaboration between Acciaierie d'Italia (ADI) and Eni Rewind in designing the environmental interventions: an experience involving a complex site, what are the results to date and what are the expectations?**

The collaboration with Eni Rewind, which has been in place for more than a year now, has allowed ADI to appreciate the integrated approach between technical experience consolidated in the field of industrial sites remediation and managerial expertise, gained from long-standing and in-depth knowledge on relationships with the various stakeholders and the relevant Authorities. The integration of experience and expertise between parties dealing with different industrial realities, but with a common focus on environmental issues, has allowed both companies to grow in terms of technical know-how.

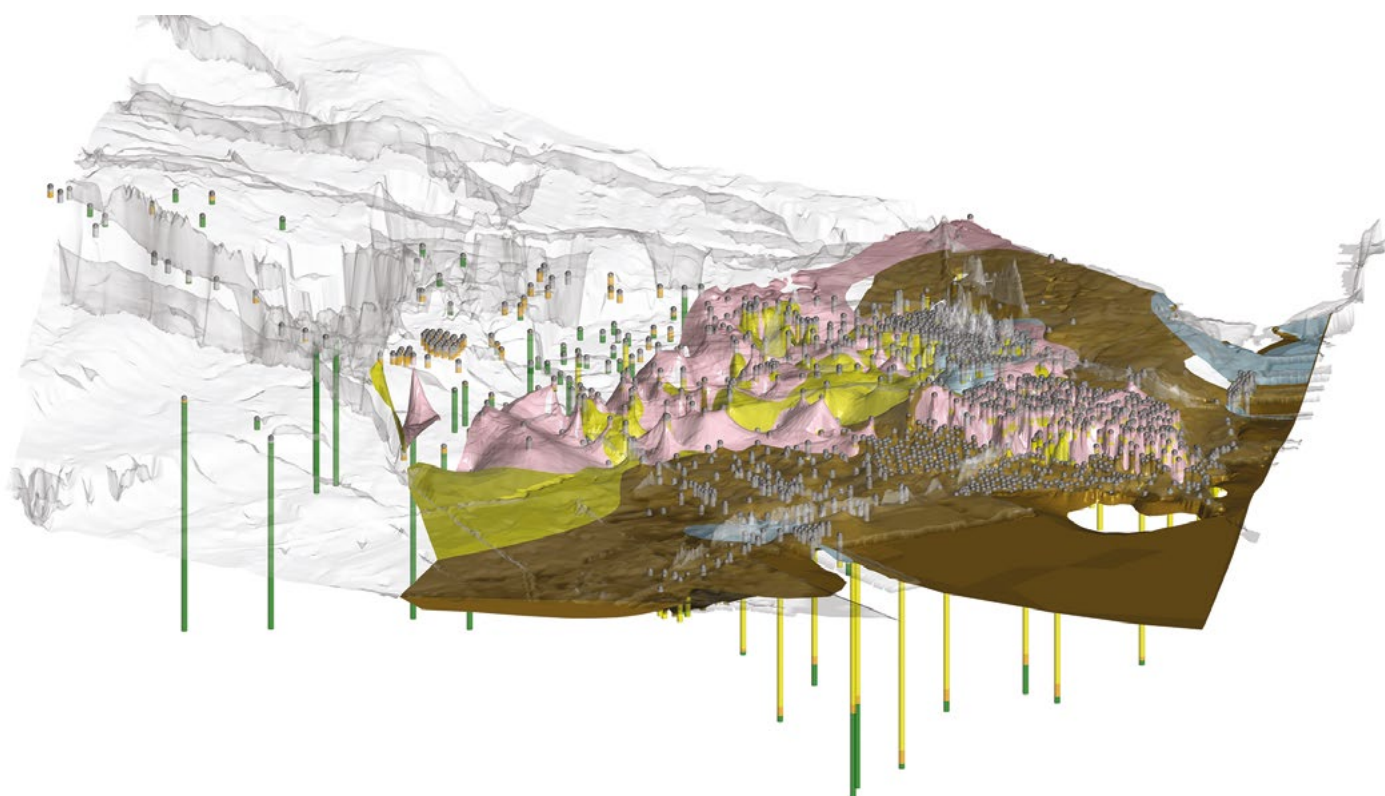
**What were the main strengths of this collaboration?**

The real strength of the collaboration initiated with Eni Rewind is without doubt related to the approach. What makes Eni Rewind's assistance particularly effective is its approach to problems that is not as an external eye, of a mere consultant. Eni Rewind works on the activities on behalf of ADI from the perspective that it usually adopts when dealing with these problems at Eni's production sites; therefore, also from the perspective of contributing to improving the industrial asset and not only performing their specific task on someone else's site.

**Besides the technical support, how do you rate what Eni Rewind has provided to the interaction with Authorities, the Ministry first and foremost?**

We are still in the start-up phase of relations with the Ministry of the Environment regarding issues where Eni Rewind is providing its support. We are certain that the dialogue with the MiTE will be characterised by professionalism, clarity and an openness to discussion on the environmental commitments and technical solutions that we will be proposing.

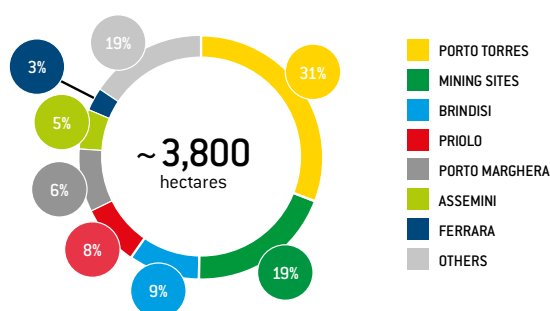
## 3D geological reconstruction of the former Ilva site in Taranto



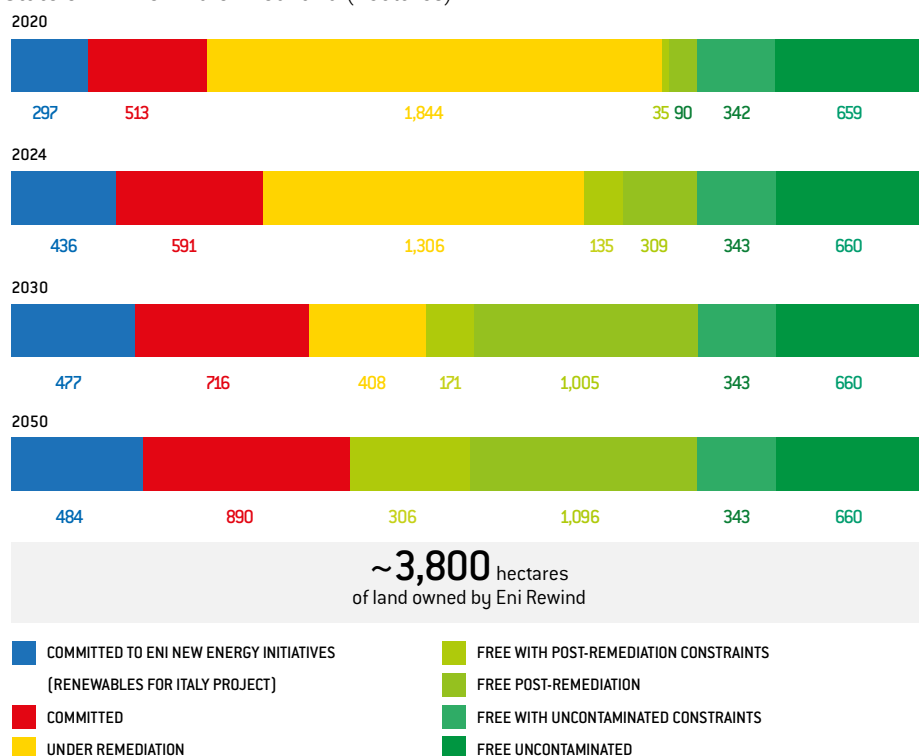
## Remediation and redevelopment of industrial areas

Land is a limited resource because it is not reproducible. Decommissioned and unusable industrial areas are a critical environmental problem, as well as an economic and social shortcoming if not regenerated. The challenge for Eni Rewind is to breathe new life into them based on environmental remediation measures designed for their possible reuse and redevelopment. This could provide many benefits as the areas are located in industrial zones already highly populated and infrastructured that can be used for new production activities in line with the prospects of environmental development and the circular economy, thus avoiding the consumption of "virgin" land.

### Total Eni Rewind areas (%)



### State of Eni Rewind owned land (hectares)



The histograms represent the foreseeable evolution of reclamations on the approximately 3,800 ha owned by Eni Rewind. During 2020, 50% was in the remediation phase, 17% was free from contamination and 8% had been allocated to the Renewables for Italy project, committed to the installation of plants for the production of electricity from renewable sources (11% by the end of 2024). By 2024, a further 14% of the areas are expected to be remediated and made available. In particular, completion of the remediations, their certification and subsequent provision of the areas is foreseen for the sites of Brindisi (116ha), Cengio (18ha), Sa Piramide (37ha), in addition to Manfredonia, Avenza and Assemini.



## 82 MW

total installed photovoltaic capacity at 2020

## 31 MW

Porto Torres plant inaugurated in early 2020

## 22,700

photovoltaic panels installed in Gela



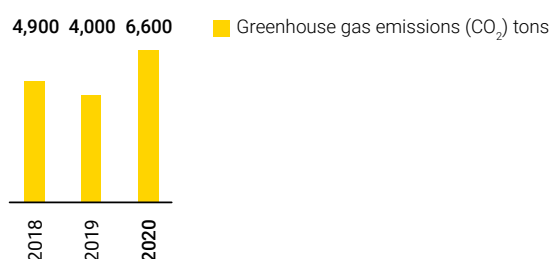
## Eni Rewind's contribution to renewables

The development of renewable energies is central to Eni's strategy of progressive decarbonisation. The consolidated synergy with Eni New Energy, a group company dedicated to the development of projects for the generation of energy from renewable sources, is a practical example of the circular economy. Proprietary areas that have been decommissioned and are no longer productive are used to house renewable electricity production plants, after the environmental intervention by Eni Rewind. The energy produced is used for the energy needs of Eni's industrial assets and the remaining part is fed into the grid.

In this context, of significance are the photovoltaic plants already constructed, extending over 100 ha (power of about 55MWp) at Eni Rewind sites in Assemini, Porto Torres and Gela as well as those authorised in Porto Marghera and Ponticelle. The site in Porto Torres is a virtuous project that has seen the redevelopment of some areas of the Site of National Priority, with the construction of the largest photovoltaic park built thus far by Eni, with an installed capacity of 31 MW. About 70% of the annual production from the plant, inaugurated in early 2020, is intended for companies at the industrial site, with overall savings of over 25 thousand tons of carbon dioxide per year. Porto Marghera will shortly follow, with the authorisation in September 2020 of the project to construct a photovoltaic system of about 2.5MWp, as well as another 346 hectares by 2024, allowing Eni New Energy to reach a total installed capacity of 200MWp and a reduction of about 150 thousand tons of carbon dioxide per year. Furthermore, again at Porto Torres, a 34 MW wind farm has been designed and will be built and managed by Eni New Energy on an Eni Rewind area once the relevant authorisations have been obtained.

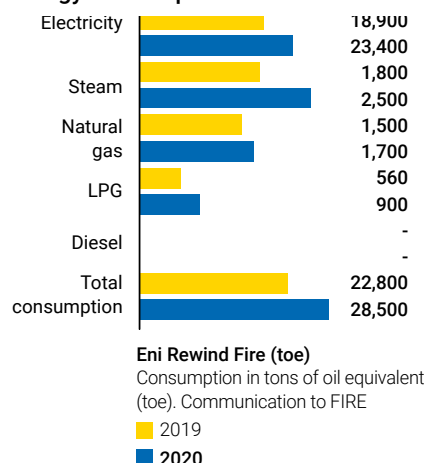
## Decarbonisation: Eni Rewind's performance

### Value of CO<sub>2</sub> emissions

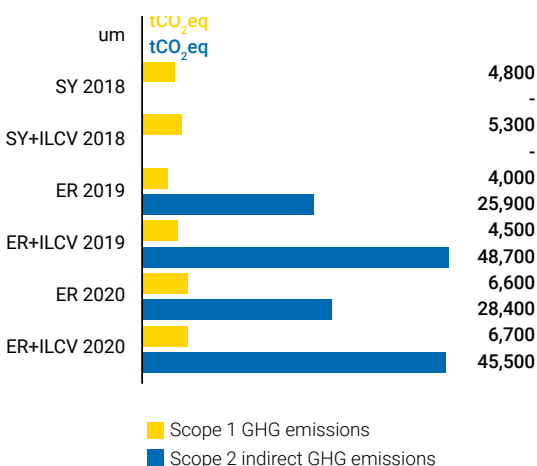


The increase in 2020 is mainly due to the installation of boilers for the production of steam for the Porto Torres GTP that was previously supplied by the Versalis plant.

### Energy consumption



### GHG emissions



# Water Management

Eni Rewind is committed to the implementation of major groundwater remediation interventions at 21 sites. The activities are executed through an integrated aquifer interception system – consisting of over 1,200 pumping wells and 4,900 monitoring wells – and the conveyance of water for purification to 42 treatment plants (GTPs), of which 26 are owned. All assets are aligned with the best technologies available (Best Available Technology - BAT and Best Available Technology Not Entailing Excessive Cost - BATNEEC).

The Company also manages urban and industrial biological treatment systems at the Gela, Cengio and Manfredonia sites. Water treatment processes include strict monitoring plans that ensure full compliance with water discharge quality and atmospheric emissions.

To facilitate the recovery and valorisation of water resources, from a circular economy perspective, the Company promotes and supports research into sustainable and efficient management solutions, with the aim of maximising reuse and reducing the withdrawal of water from the environment. This objective has led to the installation and activation of special demineralised water production sections at GTP plants at Priolo, Gela, Porto Torres, Assemini and Brindisi, intended for reuse within the industrial sites. In other cases, such as in Manfredonia, the treated water is re-injected into the aquifer to restore its natural conditions. In 2020, Eni Rewind treated about 36 million cubic metres of water, recovering about 6 million mainly for industrial use.

## 42

Water treatment plants

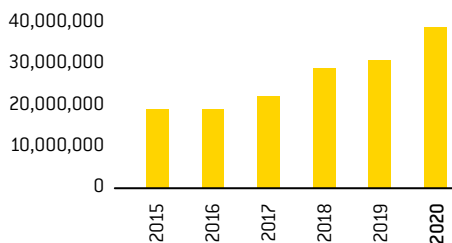
## ~36 million

m<sup>3</sup> treated water

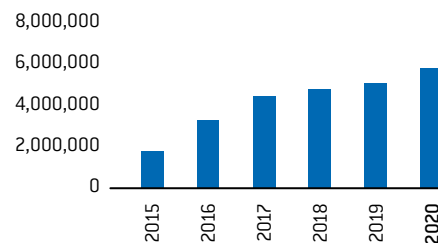
## ~6 million

m<sup>3</sup> recovered water

TREATED WATER (M<sup>3</sup>)



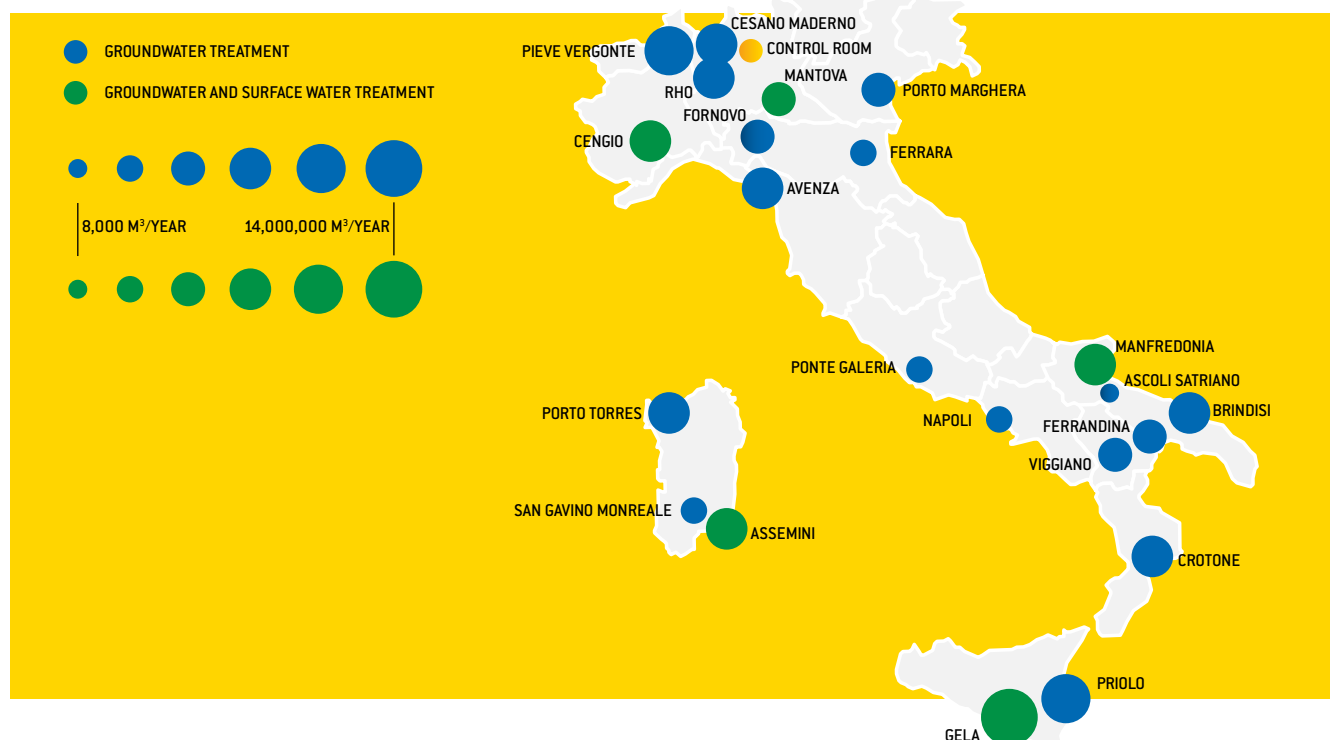
RECOVERED WATER (M<sup>3</sup>)



Priolo GTP system



## Water treatment systems (volumes 2020)



## Solutions for optimising water management

Eni Rewind uses different technologies at water treatment plants according to the contaminants present and the possible salinity adopting chemical-physical sections (metals), stripping (organic chlorinated), filtration with active carbons (organic), biological treatment (ammonia compounds), osmosis (salinity) and water purification for the water to be returned into the groundwater or so that it can be recovered and reused at Eni sites.

In accordance with its mission, Eni Rewind promotes the optimisation of water treatment processes to reduce water consumption by conducting research into new technical solutions. A project to automate and digitise the hydraulic barrier was completed in Crotone based on an instrument that controls the flow rate of the wells in order to extract only the amount of water from the aquifer that is required for remediation operations. To date, a reduction in the amount of water pumped is estimated to be about 5-10%, which corresponds to an equivalent energy optimisation. Furthermore, the new Dynamic Control System is operational in Priolo, based on refining experience and ensuring real-time monitoring of the pressure, flow rate and pH. Its adoption has reduced energy (-10%) and reagent (-15%) consumption and has resulted in an increase in the production of osmotized water.

## Gela

At the Gela Site of National Priority, Eni Rewind, as the operator of groundwater remediation for all the Eni companies present, adopted the e-hyrec device on a large scale ([see page 21](#)) in order to optimise and speed up remediation activity. The automatic device, placed inside the wells and piezometers, carries out the selective separation of the aqueous from the oily phase, recovering only the portion of supernatant hydrocarbon on the surface of the aquifer, unlike traditional systems that withdraw a significant portion of water (about 70-80%). From the end of 2018 to March 2021, over 200,000 litres of oil was recovered in Gela alone, without having to dispose of any aqueous phase. Furthermore, the thickness of the supernatant has gone from over a metre to around one centimetre. The zero balance on the aqueous part, reduces the related disposal costs and minimises remediation times.



## Blue water

In leveraging its know-how and experience in water management, Eni Rewind together with Eni research laboratories, has developed a technology called Blue Water, aimed at the treatment and recovery of production water deriving from crude oil extraction activities. With its application, it will be possible to regenerate reservoir water, as is the case in traditional purification plants, returning it to the surface water or, after further treatment, allocating it for industrial use. This reduces the disposal of outlet waste (salt solutions and sludge), which will be managed at appropriate external plants, and minimises the use of water from natural sources. The first industrial scale plant is being designed for the Val d'Agri Oil Centre in Viggiano, Basilicata, whereby the permit applications are being processed by local authorities. The Blue Water plant is designed for a treatment capacity of 72 m<sup>3</sup>/h, with continuous operation throughout the year (24 h/day; 365 days/year), capable of satisfying the current water requirements of the Viggiano Oil Centre, ensuring zero withdrawals from the environment for industrial use. At the same time, the volume treated by the Blue Water plant will result in an equivalent reduction in production water transported to third-party plants – up to 1,000 km from Viggiano – decreasing the carbon footprint of the waste management process.



# Waste Management

The recovery of industrial waste and waters is an important objective of the circular economy that Eni Rewind pursues in its waste management activities. As the environmental company of Eni, it manages the cycle of waste produced by Eni's industrial activities or from its remediation and decommissioning activities, ensuring on a daily basis the constant control of the entire supply chain in compliance with applicable legislation. In line with sector best practices, Eni Rewind has implemented a plan of interventions to increase the share of waste sent for recovery as an alternative to other disposal methods. In particular, it ensures the environmental sustainability of reclamation interventions thanks to consolidated in situ / on-site technologies such as biopiles and soil washing, which minimise the generation of waste, as they do not involve the excavation and disposal of contaminated soils. About 1.6\* million tonnes of waste were managed in 2020, of which about 90% on behalf of Eni, and about 78% of the recoverable was assigned for recovery (an improvement compared to 2019: about 59%).

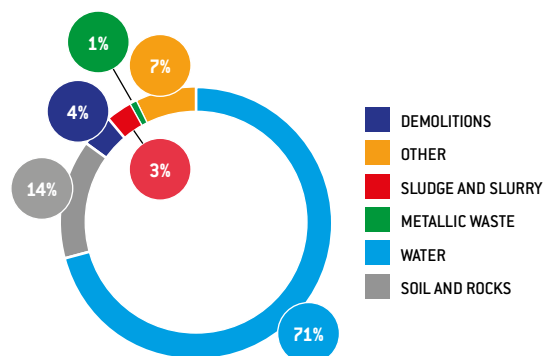
Furthermore, to reduce the transportation of waste by road and the consequent environmental impact, Eni Rewind adopted optimised logistics solutions that favour treatment plants close to the production site (Km 0), resulting in over 90% of waste being managed within a 400 km radius in 2020.

## Waste management

WASTE MANAGED (kton)



TYPE OF WASTE MANAGED



WASTE RECOVERED

2019	2020	Δ vs '19	WASTE RECOVERED	WASTE FROM DEMOLITION	METALLIC WASTE	SOIL AND ROCKS	SLUDGE
59%	78%	+19%	% Waste recovered	73%	100%	79%	89%

\* during 2020, there was a significant decrease in the volumes of waste treated (approximately -15%) directly related to the effects of the lockdown. This figure does not include approximately 100,000 tons relating to the environmental activities managed by Eni Rewind at Eni service stations, where the Company does not act as an intermediary in waste management.



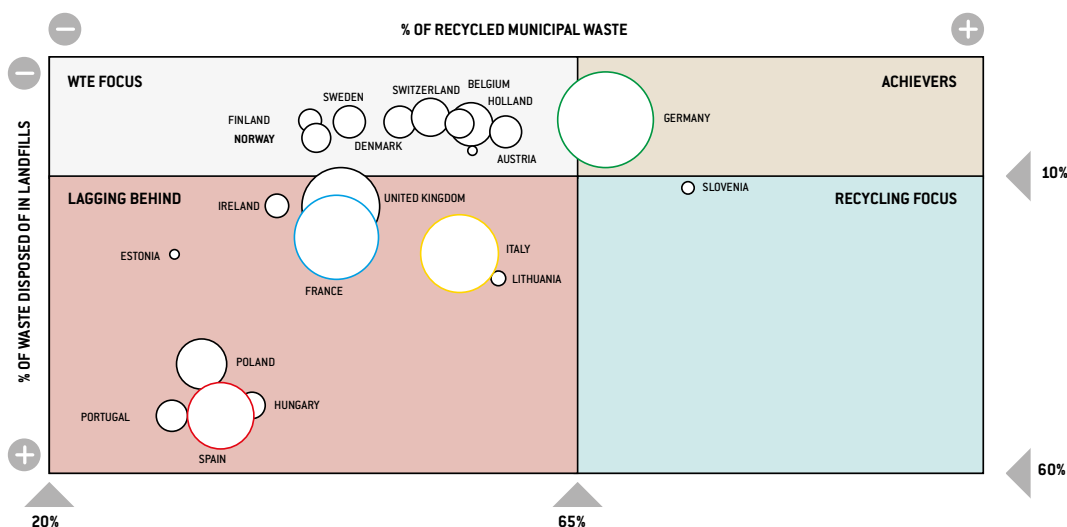
## Waste Management Partnerships

In order to expand and improve the technology of treatment and reuse capacity for all fractions of separate waste collection, promoting end-to-end plant solutions and optimising "closing the loop" processes, Eni Rewind has set up work tables with some of the major Italian Utilities (A2A, Acea, Hera and Iren), but also with key players in the supply chain such as CONAI.

New waste treatment and recycling hubs could be created, in joint ventures between multiple operators and with the involvement of the most proactive municipal companies, at remediated sites and more generally at the Eni industrial sites that will be affected in the coming years by the process of progressive energy decarbonisation. Minimising the disposal at landfills and the transportation of waste outside its region of production, promoting new plants that are appropriately geographically distributed, would generate significant environmental and economic benefits in terms of sustainability and community development.

## Waste management in Italy: context analysis

An analysis carried out by Eni Rewind, developed mainly on the basis of ISPRA 2019 data, shows that Italy recycles 47% of its urban waste, allocates 18% to waste-to-energy and 21% to landfills. Only the countries of the Iberian Peninsula and Central and Eastern Europe have worse indicators than Italy, on average, for landfills and lower recycling rates. In order to reach the European targets by 2035 of recycling rates of more than 65% and landfill contributions of less than 10%, Italy will need to implement an integrated action plan that supports the development of differentiated, increased recycling, and the construction of new plants for the recovery of materials, in particular in the Central and Southern regions of Italy.



The graph shows the positioning of European countries in relation to the EU targets specified in the directives of the "Circular Economy" package. The size of the circles is proportionate to the amount of waste produced by each country. The only country to have already reached both the recycling (65%) and landfill (10%) targets is Germany.

## Interview with Luca Ruini



**Luca Ruini**  
Chairman of CONAI - National  
Packaging Consortium

### What is CONAI's mission and the main initiatives in progress?

CONAI is a non-profit consortium made up of packaging producers and users, created to pursue the objectives of recovering and recycling packaging materials as required by European legislation and implemented by Italian legislation. Almost 800,000 companies subscribe to the consortium system. The consortium system today represents an effective public interest management model: the protection of the environment, according to a principle of shared responsibility between companies, the public administration and citizens. Based on the National Agreement with ANCI, CONAI collects the packaging waste amassed under the separate collection system by the Municipalities and conferred under agreement to the consortium system, recognising the greater costs of separate collection: CONAI manages more than 50% of packaging waste, as an ancillary support to the market. But the Consortium is also committed to promoting the dissemination of a culture of environmental sustainability among companies, starting with the design of packaging with a low environmental impact and providing maximum recyclability at the end of its life. In this context, one of the most important initiatives is the Eco-design competition, which is in its eighth edition this year: it recognises packaging solutions revisited from a sustainable perspective. Despite the difficulties related to the pandemic, the 2021 edition closed similarly to the previous ones with a double-digit percentage increase in submissions. We are taking forward a number of initiatives. It is important to add that CONAI commitment also focuses on professionals working in the field of the circular economy, with a series of training activities to increase their professional skills, and on citizens, who must be educated on the issue of quality separate waste collection.

### Certain publications classify Italy among the best performers for recycling indicators, while others highlight critical structural problems and delays. What are the strengths and where can we improve?

Today, in our country, more than 7 out of 10 packaging units are sent on for recycling and have a second life. In Europe, Italy is a point of excellence in the field of the circular economy: we have nothing to envy from any other country, especially if we look at the packaging sector, which today represents a percentage of just under 30% of total municipal waste. We are first in Europe in terms of the per capita recycling of waste and second, just behind Germany, in terms of per capita recycling of packaging waste. The system as a whole has already met the European recycling targets for 2025. Targets that have already focused on individual packaging materials, with the sole exception of plastic, which lags behind by a few percentage points which should be recovered over the next four years. The green challenges faced by the business fabric of our country will however, be increasingly challenging. We need to deal with the new EU obligations, such as the environmental labelling of packaging. The Consortium has been working on this for months and provides assistance to Italian companies in detailed Guidelines. But also looking for new ways to really close the circle; we still need to work on filling in the gaps. For example, we need tax incentives for whoever chooses to use recycled rather than virgin raw materials. But we cannot ignore the shortage of plants experienced by certain areas in the South: existing plants urgently need to be upgraded and new ones built.

### The European directives on the Circular Economy set ambitious targets to be achieved between 2030 and 2035, which Italy incorporated into its legislation last year. Recent studies and analyses have shown that Italy has a gap in terms of plants, which you also confirmed; this needs to be remedied to reach the targets. What are the proposals and areas you have identified to achieve the targets?

A very recent study, prepared by CONAI for the first time in Italy, quantifies the plant requirements for Central-Southern Italy: 165 new plants are needed so that a complete integrated waste cycle can be implemented, which is increasingly necessary in times of an ecological transition. An estimated investment of over € 2 billion. In order to really close up the circle, it is becoming necessary for the separate waste collected to be processed as close as possible to the place where

the waste itself was collected. This would bring down the environmental and economic impact linked to their transportation to facilities in the Northern-Central regions. The construction of these plants would also have a positive impact from an economic and employment point of view, thanks to the training and hiring of a large number of employees: over 2,300. This is very important during a socio-economic crisis like the one we are experiencing and will be facing in the future.

**The National Recovery and Resilience Plan (PNRR) and waste management: in your experience, can there be opportunities for the sector? What input can the Italian government provide for Governance and how do we get consent from the territories?**

The more than €2 billion that the PNRR has allocated to the circular economy is an opportunity that the country cannot afford to lose. This is a time for dialogue with the local authorities to explain the importance of the new plants, but also to help the regions in Southern Italy equip themselves with professional skills to properly authorise the projects. Our Green Jobs project is part of this process: since 2019, we have been organising post-graduate training courses to facilitate the entry of new young science graduates into the world of the circular economy. After the first two editions in Matera, in 2019 and 2020, the new edition of Green Jobs is starting at the University of Palermo this year. And before the end of the year, we will also be revealing the details of another edition in Calabria.

**In this scenario involving more complex organisational models, how important is it to foster synergies between different industrial realities?**

I would respond very simply: I think it is essential. In fact, synergistic effects are fundamental in any context. Especially during difficult times like the ones we are experiencing, which will probably have repercussions into the long term. Companies' attention to environmental protection is growing, but we also note how wanting to implement synergies also grows in the sharing of best practices, which tangibly realise the drive towards circularity. I am thinking, for example, of the many companies that have been recognised over the years in our eco-design competition: we can clearly see a willingness to create an effective database of cases of excellence, which can then become valid examples for companies today and tomorrow.



### Ravenna Ponticelle

The project for the revival of Ponticelle, a decommissioned industrial area outside the Ravenna petrochemical plant, is a concrete example of how remediation can bring added value to territories and their communities. In synergy with local players and institutions, a virtuous development model will be implemented here to repurpose the brownfield in accordance with the principles of the circular economy. Eni Rewind, owner of the former industrial area, has completed the permanent safety measures (MISP) with capping implemented on 18 of the total 26 hectares ([see page 31](#)). The environmental intervention is preliminary to the start of a redevelopment plan that applies innovative, sustainable and recovery technologies, in addition to the urbanisation works in the area.

The plants envisaged in the Ponticelle Project are as follows:

- **a photovoltaic plant with storage lab** (implemented by Eni New Energy): the structure, authorised by the entities in January 2021, is designed in accordance with the principle of "zero consumption of new land" and will be built on the ground, on a portion of the area involved in the MISP, with a solar tracking system (estimated power of about 6 MW) and with an adjoining storage lab for energy storage.
- **a soil bio-recovery platform via mechanical treatment and bioremediation** (to be realised by Eni Rewind): the plant, with a capacity of 80,000 tons/year, through the use of indigenous micro-organisms (bacteria), will be dedicated to the treatment of soil contaminated by hydrocarbons originating from service stations remediation, with the aim of returning the soil to the same stations after treatment, according to a circular recovery and reuse scheme. It also includes a bio-laboratory able to carry out preventive analyses on the conformity of waste entering the platform and periodic monitoring on the progress and effectiveness of bio-remediation processes.
- **an environmental platform for the management of industrial waste** (to be developed and managed by HEA): on 3 March 2021, a joint company (HEA) Eni Rewind – Herambiente Servizi Industriali was established, aimed at creating a multifunctional platform for the pretreatment and treatment of special waste. The plant will manage up to 60 thousand tons of waste per year, produced by environmental and production activities, prioritising those originated in the region, in line with the European directives of the Circular Economy Package transposed in Italy in September 2020.



## Interview with Michele De Pascale

**Industry, the environment and technological innovation converge in the projects promoted by Eni and Eni Rewind in Ravenna. How can the public and private sector cooperate, what further synergies, to achieve the environmental targets of the Green Deal and of the city of Ravenna? What are the effects?**

The Municipality of Ravenna has always been particularly attentive to the targets in the Green Deal, by directing public funding and its own resources, and especially those that will be coming through in the future from Europe, into energy redevelopment, sustainable mobility and urban regeneration projects.

Likewise, collaboration between public administrations and private companies is essential so that each one can provide a driving force for the investments of the other, enriching the territory with job opportunities, new resources, technological innovation and good practices, and helping it achieve the goals set by Europe far more quickly.

**Never before, as in this historical moment, is it essential to broaden citizens' awareness of the issues around recovery and circularity: how much will the Ponticelle project contribute in this regard?**

In the circular economy, Ravenna can play a leading role at national level. The Ponticelle project, which is recovering a decommissioned area transforming it into a place where renewable energy production plants and land and waste recovery plants coexist and work in conjunction, contributes substantially to achieving this objective.

In this sense, it is also essential to raise awareness among the younger generations, both from the perspective of good practices and offering them specific training and professional opportunities, such as the post-graduate ITS course to become a Senior Circular Economy Technician, which this administration has strongly promoted.

**How do you assess the decision by Eni Rewind and Herambiente to undertake the environmental platform based on the Hera and Eni joint venture for the Environment, HEA SpA?**

This involves an important agreement that establishes the definitive safety and reclamation of a formerly abandoned industrial site, where a technologically-advanced project will now be carried out. A virtuous intervention that makes us protagonists in relation to the issue of the circular economy, and important for the city's economic development. The first fundamental collaboration between two leading industrial groups such as Eni and Herambiente is being substantiated in our region, which can also bring significant future benefits in terms of employment and economic growth for the community.

**The industrial vocation and collaboration between institutions, the territory and operational reality have been decisive in making Ponticelle an example of productive redevelopment. What direction would you recommend to replicate more virtuous projects in Italy or other circular projects in Ravenna, by repurposing industrial areas and promoting industrial symbioses?**

We have worked hard to establish a process for supporting companies that intend implementing important and innovative business projects in the region; this translates into prior discussions on the most significant issues upstream for the formal submission of applications, in order to simplify the bureaucratic process where possible and thus accelerate the timing for issuing authorisations.

We are also always ready to listen to experimental business proposals to build the Ravenna of tomorrow, starting from today's specific context.



**Michele de Pascale**  
Mayor of Ravenna



Eni proprietary technology at the service of sustainable urban waste management in large metropolitan areas.

## Waste to Fuel

The commitment to the regeneration and rational use of resources is also evident at Eni Re-wind with the Eni Waste to Fuel proprietary technology, developed at the Eni Research Centre for Renewable Energy and the Environment in Novara and tested at the Gela pilot plant. The technology enhances the energy potential of organic waste based on a thermoliquefaction process – which transforms it into bio-oil and bio-methane and recovers the water contained therein. A phenomenon that nature accomplishes over millions of years is replicated in just a few hours. The raw material needed for the process is the Organic Fraction of Municipal Solid Waste (OFMSW), consisting of household food waste and waste from the agri-food industry. The bio-oil obtained, which varies from 3% to 16% depending on the composition of the incoming load, can be used in blending as a low-sulphur fuel for maritime transport or refined to produce biofuels. The water contained in the organic waste – up to 60% of its weight – is recovered and reused in the industrial sector. Each step is designed to minimise the waste sent for disposal: even solid waste, consisting of non-transformable waste, is used to generate the heat intended for the plant's energy requirements.



## Development on an industrial scale

The first industrial plant is planned in Porto Marghera, in areas owned by Eni Rewind within the petrochemical site, and will have a treatment capacity of up to 150 thousand tons per year, equivalent the OFMSW produced by approximately 1.5 million inhabitants.

### The advantages

Waste-to-Fuel technology makes it possible to reuse waste raw materials without subtracting resources from the food and agricultural chains. Furthermore, it represents a valid solution for sustainable waste management in line with European policies, in particular the 2020 Circular Economy Action Plan, the 2017 Bioeconomy Strategy and the "European strategic long-term vision for a climate-neutral economy".

1

#### **High energy yield (80%)**

most of the waste's energy potential is recovered compared to other technologies

2

#### **Use of milder process conditions (max 300°C)**

compared to normal biomass pyrolysis processes

3

#### **Reduced treatment time**

incoming waste is converted in a short time (2/ 3 hours)

4

#### **Very limited odour impact**

only when the waste is transported into the plant; the air is systematically purified in the confined area where the OFSMW treatments take place

5

#### **Minimum occupancy of space**

land consumption is <0.3 m<sup>2</sup>/ton OFSMW, significantly lower than alternative plants for the treatment of organic waste

6

#### **Reduced water consumption**

the separated and treated water can be regenerated for industrial uses

7

#### **Reduced environmental impact**

lower CO<sub>2</sub> emissions (-76.5%) compared to the production of bunker oils from fossil sources

8

#### **Economic value of the product**

high market value bio-oil compared to products originating from other OFSMW transformation processes (i.e compost with surplus of increasing supply)





rewind

remediation & waste into development