

A journey into Enel's Circular Economy

Strategies, projects and outcomes



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A journey into Enel's Circular Economy



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NEW FORM OF COLLABORATION



INSIGHTS



A few years ago, when the debate on the **Circular Economy** began, it may have seemed to the superficial observer like a mere ephemeral reworking of already familiar topics. Circularity, however, has rapidly evolved to become a key topic on global agendas today.

The strength of this idea lies in its systematic nature: it embraces the entire economic model and determines, in a concrete and measurable way, a goal to strive toward and clear incentives to act on.

The convergence between the Circular Economy and decarbonization – as we are seeing in recent studies and in the debate at COP 27 – is a key juncture in the transition toward a **sustainable economic model**. Its approach to the use of natural resources should be seen in an integrated way, whether they be renewable sources, fuels, or raw materials. Decarbonization and electrification are not separate topics from circularity, but are part of a paradigm meant to develop an economic model that avoids resource consumption, whether fuels or other raw materials.

For this reason, in 2015, Enel extended what it was already doing in terms of decarbonization to all areas of its business, placing the Circular Economy at the heart of its strategy.

The adoption of a **circular** and **sustainable** model is not a secondary aspect for us, but rather **a central theme that directs everything we do**. The energy transition requires the rapid development of renewable sources and the electrification of consumption, alongside the growth of technologies like smart grids and storage systems. To achieve this ambitious **goal**, it is essential to **integrate technological development** into a broader Circular Economy strategy, starting in the design phase and including all phases: from the choice of raw materials used, to design, operation, reuse, the final recycling of the asset and end-of-life management.

This is perhaps one of the most important lessons we've taken from our experience with the Circular Economy: partially modifying the existing approach will rarely achieve the expected benefits. What is needed is an comprehensive, and sometimes radical, rethinking of the business model itself.

A change we might call epic, and that requires a **systemic approach** to capture all the benefits generated by this transition: environmental, social, economic, and related to security of supply. All are equally important.

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"A journey into Enel's Circular Economy" provides a brief overview of some of our most important projects and initiatives, clearly and transparently sharing what motivated us to accept this challenge and undertake the transformation toward an integrated, circular, and sustainable business model.

Our hope is that this document can provide answers to anyone wondering – justifiably – why a utility company should be interested in the Circular Economy. We trust that this report of our journey will help people understand the centrality of this topic, especially in light of recent developments on the international scene, clarifying the key role that utility companies can play in this transition.

Francesco Starace

Chief Executive Officer and General Manager

Blessee



Historically, the topics of **decarbonization** and the **Circular Economy** have developed separately. Attention to climate change and decarbonization was first recognized institutionally in the 1990s, with the United Nations' *Conference of the Parties* (COP) – UN Climate Change UNFCCC. Starting in the early 21st century, the concept of the **Circular Economy** appeared on the international scene, linked to the development of business models to separate economic and industrial activities from resource consumption (although often mistakenly associated above all with recycling in public opinion). It had its first important institutional recognition **with the EU's 2015 Circular Economy Package**, later one of the cornerstones of the European strategy in 2020 with the **Green New Deal** (Circular Economy Action Plan).

Decarbonization and the Circular Economy have gradually moved closer together, to the point of merging in one single approach. Enel has worked in this perspective since 2015, placing the Circular Economy at the heart of its **strategy**, with the goal of rethinking its **business model** in a circular way, and applying this to all the Group's activities, throughout the entire value chain.

To achieve this, it was necessary to explore and comprehend its potential – environmental and economic – for the various areas of the business. In order to implement a change of this magnitude, discussion and collaboration with internal and external counterparts (Institutions, suppliers, the world of innovation) were a key element.

The strength of this choice lies in its systematic nature: it embraces the entire economic model and defines, in a concrete and measurable way, a goal to strive for and clear levers to act on.

Enel's Circular Model is based on five pillars:

- Circular inputs;
- Product as a service;
- Shared platforms;
- Useful life extension;
- New life cycles.

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With this document, we aim to share the **journey** undertaken by Enel toward a circular business model to generate **competitiveness** and foster **sustainable**, inclusive, and lasting **growth**, divided into four cornerstones:

New business models: Concrete examples of **implementing** business models based on the adoption of the Circular Economy.

Raw materials: The energy transition makes it possible to eliminate fuel requirements by adopting technologies with different raw material needs than traditional technologies. A major challenge is therefore how to make the entire material aspect fit into a fully circular, sustainable, resilient, and competitive approach. One example of an initiative in this area is the **Gigafactory**, flagship project.

Cities and territories: The urban transition must respond to global and local **challenges** that cities face, not only **environmental** and **economic**, but also regarding **social inclusion** and quality of life. In recent years, the Circular Economy has become more and more established as a key to reshaping the urban evolution in an integrated way, between various sectors and different players. Enel is very active in this area.

Enablers: The key enablers, in Enel's experience, are certainly **metrics** and collaboration throughout the **value chain** and across sectors. Metrics have been a focus of the Group since the beginning, leading it to play an almost pioneering role on an international level in the study of metrics linked to circularity. Speaking of enabling factors, one cannot forget the importance of collaborations with players in all stages of the process, from the production of raw materials to the final closure of cycles, because only in this way is it possible to evolve toward a circular model.

The goal is for it to be useful to anyone (businesses, Institutions, associations, enthusiasts on the topic) undertaking the same path, and to foster evolution and collaboration. This is, of course, a picture of an ongoing journey, which is actually coming into its most lively and decisive stages.

A path toward circularity

Enel has recognized the **Circular Economy** as a strategic tool since 2015, integrating the business model transversally into the Group's activities while accelerating the decarbon-ization process.

Overview on Circular Economy

Circular Economy and Decarbonization

Two concepts increasingly connected to one another:

- A significant share of global **emissions** is associated with the mining of raw materials and the production of materials. It is therefore essential to rethink the entire value chain for raw materials themselves and products.
- The Circular Economy, which aims to decouple business from the consumption of resources, considers **renewable energy** – like solar, wind, geothermal, and hydroelectric – essential to meeting overall **energy needs**, with the idea of electrifying consumption in order to power them with sustainable energy.
- The energy transition will require that all new technologies be designed, implemented, and managed from the perspective of the Circular Economy, as regards the raw material cycle as well, in order to ensure the transition's full sustainability and competitiveness.

Rethinking the entire value chain

If waste had been the exclusive focus, Enel would not have been able to act on the causes that generate waste and transform its business model. This is why it follows the principles of the **circular model**, which require an overall view of the life cycle of an asset or product. This **integrated view** is applied to the entire **value chain**, starting in the procurement phase and including all phases (design, choice of resources, reuse or recycling), all the way through to end-oflife management.

Application to core business

This change, to be meaningful, must occur in a company's **main business** above all (for Enel, in the production and distribution of energy, or in solutions for customers), in order to have a substantial impact and to be developed on a large scale. This approach has been pursued not only for assets under development, but focusing on existing assets as well.

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Sustainability and competitiveness

For solutions to be developed on an industrial scale, they need to be **economically competitive**. The name itself – Circular Economy – emphasizes how the transition must address the heart of the economic model and not just an-cillary aspects.

Measurement and quantitative KPIs

The Circular Economy requires a **quantitative approach**. Its **impacts** and **benefits** need to be measurable. They must be measurable using international metrics to assess the economic impact or the Circular Economy supply chain model.

New synergies between different industrial sectors

In the context of the Circular Economy, **interaction** between different sectors is not limited to the delivery of a final product, but can occur throughout the value chain, in terms of raw material exchange (e.g., a material that is discarded by one sector can be an input for another), asset **sharing** (e.g., electric charging infrastructure). It is then possible, by comparing notes and working with different sectors, to develop additional opportunities for circularity.

The role of innovation

Innovation plays a fundamental role. And not only technological innovation, which is of course essential. It can involve ways of dealing with suppliers and customers, as well as contractual and logistical solutions. We need to overhaul the structure of current regulatory systems, until now based on a linear approach, and introduce an integrated approach in its place, based on the Circular Economy.

Governance

The approach to governance must also be modified and redesigned from a joint and integrated perspective. A circular transition requires rethinking the traditional approach for separate areas – whether companies or institutions –, instead defining a **joint vision** to be implemented in an integrated way, involving all the various areas transversally.

Environmental, economic, and social benefits

Environmental benefits: Avoiding the consumption of new resources means not only reducing emissions throughout the value chain, but also **reducing** all kinds of potentially negative impacts, ranging from threats to the biosphere (biodiversity, water, soil).

Risk reduction: A circular model reduces dependency on imported raw materials and focuses more on improved resource use and the utilization of local loops (recycling, etc.), reducing procurement risks and the uncertainty that comes with them. By eliminating or at least reducing the need to extract raw materials and manage waste, environmental risks are also greatly reduced.

Economic benefits: The utilization of resources throughout their life cycle also represents an economic benefit, thanks to reduced procurement costs for raw materials, waste management, and extended service life, investing in design and maintenance. An additional benefit is provided by socalled "product as a service models", which allow users to pay only for the time they actually use an asset, rather than buying it or renting it for a set time.

Social benefits: The passage from a linear model to a circular one can have a significant impact in terms of em**ployment**, while fostering the development of local supply chains. We shift from a model focused on production, where human work is easily replaced by automation, to one more focused on reverse logistics, repair, maintenance, and services, requiring several professional figures with skills that are less replaceable by automation.

The pillars of the Circular Economy

The Group's circular vision is based on **rethinking business** throughout the value chain - starting with the design and procurement phases - and is structured on the following pillars, which determine the business models of reference in the various stages of the life cycle:

Circular design

Useful life extension

Life extension, reuse, recycle

Circular inputs Inputs from renewables, reuse, recycle

Value recovery



New life cycles

Recovering value through upcycling, reuse and recycling



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Product as a service

Provide the customer with a service instead of a product

Increased use



Shared platforms

Shared use



The initial application of the **Circular Economy** is marked by analyzing existing business models and exploring modifications that could significantly reduce resource consumption, while guaranteeing competitiveness.

Often, it is not competitive to adjust a single process stage because, while this may improve environmental sustainability, it may not be economically sustainable or scalable. What is needed, therefore, is a broader **rethinking** of the entire process, to ensure economic competitiveness by adopting new business models.



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Business Model Useful life extension

Project Category Extension of an asset's service life

In 2019, **Enel X** received authorization to develop the projects it presented as part of the first IPCEI (fund for Important Projects of Common European Interest), created to support the European battery supply chain, with 42 European companies in the sector that are participating.

The proposed project develops artificial intelligence tools - based on machine learning - to predict failures and anomalies and to model the degradation of next-generation lithium-ion batteries. The predictive tools aim to extend battery service life and increase their reliability, while optimizing operation and maintenance. The project is expected to be complete by 2023.



Extension of battery service life



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Business Model Useful life extension

Project Category Extension of an asset's service life

Parts and equipment – New Life Project

The project was launched in February 2020 **to give new life** to components in storage and equipment from decommissioned coal-fired power plants. This is made possible by activities based on the principles of the Circular Economy: reuse, resale, donation, and recycling.

The project's scope includes stored materials and components from generation in four countries: Italy, Spain, Chile, and Argentina. Targets for 2022 are to reach about **3,300** components included in the project.



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Business Model
Useful life extension

Project Category Second Life

"Second Life" storage system

The project, first of its kind in Europe, demonstrates the possibility of **using second-life batteries from the automotive sector** integrated into an **electricity generation plant** instead of new batteries.

The project reused **90 batteries from disused Nissan electric vehicles** in a stationary storage plant built at the **Melilla** thermoelectric power plant in Spain. The Second Life project has an available capacity of up to 4 MW and features a maximum accumulated energy of 1.7 MWh, helping improve the reliability of the local electrical grid and ensuring service continuity.



The Spanish city of Melilla, home of the "Second Life" project.





The achievement of increasingly ambitious decarbonization goals requires the complete **transformation** of the energy system, starting with electricity produced from **renewable sources** and the **electrification** of consumption, in order to maximize the use of renewable energy in all final applications. To support this new energy paradigm, energy storage technologies and smart grids must be developed. This evolution also requires, as an indirect consequence, strong growth in **enabling technologies**, such as robotics or digitalization.

This dynamic translates into an **increased need** for raw materials. Enel's transition toward a new energy paradigm therefore includes the procurement of technologies with a composition of raw materials different than in the past and that, in order to achieve a fully sustainable transition, must be analyzed as a whole, considering **environmental**, **social**, and **commodity** components and **geopolitical factors**.

Environmental: For an overall assessment of environmental impacts, different **aspects** must be considered, ranging from CO_2 emissions to water consumption, soil use, waste production, and biodiversity loss.

Social: The raw material supply chain has a social impact as well, including risky working conditions, the robustness of the working environment, the health and safety of workers and communities, the economic development of local communities, and the respect of indigenous cultures.

Commodity: Starting at the end of 2020, with the progressive reopening of economic activities, there was a gradual increase in raw material demand. At the same time, the development of recovery and investment plans and the green transition have shone an even brighter spotlight on the need for materials linked to green technologies. All of this has led to high price volatility in the main raw materials.

Geopolitics: The energy transition's dependence on the availability of these specific raw materials – like other strategic sectors, such as defense and digital technologies – has inspired several countries in Europe, the United States, Japan and Australia to write up lists of Critical Raw Materials (CRM), determined based on their essentiality to the economic system of the user country.



The adoption of a **circular and sustainable model**, as an integral part of the energy transition, will make it possible to reduce dependence on raw materials, especially critical materials, as much as possible, guaranteeing above all full social and environmental sustainability throughout the value chain, and the competitiveness of the business model.

As an industry leader, the Enel Group has created an inhouse **working group** in 2020 dedicated to studying solutions to challenges related to raw materials.

The Group is also carrying out a significant **synergistic business plan** with suppliers, the ecosystem of innovation, companies, and key institutions. In July 2021, Enel was the first utility company to participate in the **European Raw Material Alliance** (ERMA), an initiative launched in late 2020 by the European Union as part of the **Action Plan on Critical Raw Materials** to ensure access to the raw materials needed to achieve the European Green New Deal.



Business Model Circular inputs

Project Category **Circular planning** and resources

Circular Procurement

Enel's Circular Procurement Strategy aims to improve the circularity of purchased products and services by:

Defining metrics and KPIs: By using the EPD (Environmental Product Declaration) system and developing standard metrics (PCR: Product Category Rules), the whole-life environmental impacts linked to material and energy flows in strategic purchasing categories are assessed.

Co-innovation projects with suppliers.

Use of tender requirements and rewards to incentivize suppliers to offer more and more circular products.





Circular inputs

Project Category Circular planning and resources

Technological innovation in PV production (3SUN)

In 2022, Enel Green Power and the European Commission signed a grant agreement as part of the first European Innovation Fund for large-scale projects. This financing will help develop TANGO (iTaliAN pv Giga factOry), an industrial-sized plant for the production of innovative, sustainable, and high-performing photovoltaic modules at the 3SUN factory in Catania, Italy. The factory's expansion will include a 15-fold increase in production capacity (3 GW a year, over the current 200 MW) and an increase in direct and indirect local employment (approximately 1,000 jobs by 2024).



Business Model Circular inputs

Project Category **Circular planning** and resources

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Business Model Circular inputs

Project Category Circular planning and resources

Thermal Energy Storage System (TES)

On 4 November 2022, the first industrial-sized thermal storage system was inaugurated in Italy, at the Santa Barbara power plant. Storage is based on solid material and uses high heat-capacity rocks to retain thermal energy from process fluid. It is made up of sections filled with common rocks, such as basalt, passed through by specific steam passage pipes, to maximize heat transfer. All the materials used are considered environmentally sustainable, since there are no chemical compounds, critical or flammable materials. The TES system, created with the Israeli company Brenmiller Energy Ltd, is the first of its kind: it has the capacity to store up to about 24 MWh of **clean heat** at a temperature of roughly 550°C for five hours, providing the plant with significantly improved re-

silience.



New technologies for storage

Again with the goal of boosting the development of new materials and more sustainable processes, the first innovative commercial alternative chemical storage plant based on gravitational technology will be installed, using other materials in place of critical ones. The plant will be operational in the United States starting in 2024. Specifically, the storage system will use excess electricity from the grid to move large blocks of





Cities generate about **70% of global carbon dioxide emissions**, are responsible for over **60% of overall resource use**, and produce **50% of the world's waste**. Numbers that are set to grow, given city population estimates. There is also a need to maximize the effectiveness of actions on the main areas of urban life, focusing on the priorities for each sector: **renewable energy**, **pedestrianization**, public and private **electrification**, promotion of flexible work models. For the **built environment**, emphasis is placed on the development of consumption efficiency solutions and the use of materials that emit less CO_a.

Enel has helped develop this topic in terms of visibility and development, as well as business solutions. Starting in 2018, the Group has published a **comprehensive document** on the topic each year, in an attempt to encourage debate and spread awareness, engaging stakeholders and companies from other sectors.



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Business Model **Product as a service**

Project Category Electric mobility

Enel X Electric buses in Santiago and Bogotá

In 2018, through an alliance between **Enel**, Metbus and BYD, the first 100 electric buses were added to the public transportation network of Santiago de Chile. The number currently in circulation or in the implementation phase is **1,536 zero-emission vehicles**, served by **19 electric depots** with **327 chargers**: Santiago now boasts the largest fleet of electric buses outside of China.

Starting in 2019, through a collaboration with **Enel X**, the city of Bogotá (Colombia) began to electrify the Transmilenio, a rapid public transport line, with the construction of 2 more depots for electric buses in addition to the 4 already electrified. The total now comes to **422 smart charging stations**, with an **expansion of the electrical fleet** for a total of **about 900 vehicles**.





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Business Model Product as a service

Project Category Electric mobility

Urban mobility with Enel X Italy

Enel X signed a bus-as-a-service contract with the administration of the City of Turin, taking care of the design, maintenance and supply of vehicles. The program will be carried out with the group Autoguidovie, through the company Cavourese, electrification partner for part of Turin's public transportation network. The city will receive 14 e-Buses, the installation of charging stations provided by Enel X Way, maintenance services, and management of the software that monitors charging operations.



()**Business Model**

Circular inputs Project Category Energy systems

and infrastructure

Sustainable Infrastructure

Enel has defined a new business model geared toward the development of Sustainable Infrastructure as an example of a Sustainable by design asset. The goal it to minimize waste and promote recycling in the construction phase, extend service life and rethink asset design and end-oflife recovery in a modular way.

The relationship with the territory is fundamental: for an infrastructure to be sustainable it must meet technical requirements, respecting the socio-environmental context.

The Primary Substation of José Granda in Lima, Peru, was the first location to adopt this model. During its construction, 930 m³ of soil was reused and 520 m³ of demolition residue was recycled, thanks in part to local small businesses.



Project Category Enhancement of the territory

Ecoenel and Urban Gardens - Brazil

The Ecoenel project, launched in 2007 in the state of Ceará, and later in the states of Rio de Janeiro, Goiás and São Paulo, provides electricity bill discounts for customers who sort their own garbage and bring it to specific collection points to be recycled. In 2015, in its report titled "Inclusive Markets in Brazil: challenges and opportunities in the corporate ecosystem", the United Nations Development Programme (UNDP) in Brazil named Ecoenel as one of the 19 best initiatives in Brazil. Since its implementation, the program has collected over 70,000 tons of waste and benefits about 300,000 customers each year.

The Urban Garden project involves using the land under Enel transmission lines, especially in the area of São Paulo in Brazil, for agricultural use by local residents. Products from the gardens are sold directly by local farmers. The initiative reduces soil consumption. To date, 21,000 m² of land have been earmarked for the cultivation of produce. During the COVID-19 pandemic, Enel established a partnership to provide 11 tons of food produced in urban gardens to residents of the Paraisópolis area (São Paulo), directly aiding vulnerable communities.



One of the biggest challenges in the real implementation of the Circular Economy model is how to **determine criteria and metrics** to distinguish between circular and non-circular solutions, how to measure their environmental, economic and social impacts, how to determine targets and understand tools for improvement.

Enel, with the start of its Circular Economy activities in 2015, placed a strong focus on **measuring circularity**. In the initial phases, in the absence of international methodologies with a view of the entire value chain, the company developed its own model for measuring circularity, the <u>CirculAbility</u> <u>Model</u>[®]. The model was made public and shared with peers, competitors and institutions, to bring a purposeful contribution to the discussion.

Starting from this model, more **specific models** to measure circularity were then **developed** in different divisions. An initial essential element is the **procurement** phase, where Enel collects the information needed to measure environmental impact from its suppliers, using tools like the **EPD** (*Environmental Product Declaration*). Enel collects the information needed to measure environmental impacts from its suppliers.

As for customers, with **Enel X**, the circularity of portfolio products is measured through the <u>Circular Economy Prod-</u> <u>uct Score</u> and the circularity of customers at a corporate, product or site level is measured through the <u>Circular Econ-</u> <u>omy Report</u>.

For the first time at **Capital Markets Day** in **2020**, Enel revealed a **KPI** linked to its **electricity production** activities, which measures the consumption of raw materials throughout a production plant's lifetime, in relation to the energy it generates (measuring the tons of raw materials and any fuels for non-renewable sources consumed, relating everything to the energy produced in MWh). In connection with this KPI, Enel has committed to reducing resource consumption significantly by 2030, with the goal of improving its circularity by 92% from 2015 levels.





The importance of **collaboration** with stakeholders is gaining more and more awareness. The Circular Economy, in particular, needs further acceleration in this direction, since redesigning the economic model requires a broad and profound change.

For this reason, the creation of an expanded ecosystem (suppliers, customers, institutions, etc.) is needed, that is not limited to one specific sector, but that gradually includes counterparts from new sectors and areas with whom synergies can be developed.

As proof of this, Enel is an active participant in a number of **networks**, such as:

Enel has also promoted important Alliances:







The **end goal** of the transition toward circularity is ideally to separate all of a company's activities from resource consumption, eventually exclusively using **resources that are renewable or from recycling**. As this is a very ambitious goal, we need to determine a series of intermediate targets to proceed concretely in this direction.

Enel is already adopting a **circular approach** in all its areas of operation. The challenge now is to scale up the implementation of new business models and new circular projects, also by leveraging enabling sectors.

One important aspect in this transition is **time**: it is a matter of making a **drastic change**, to move, in a short time, from the deeply rooted linear model, to a new model. To do this, it is essential **to act in parallel**. Both internally, reviewing the stages of the value chain, and externally, by collaborating with suppliers, stakeholders, institutions, and customers. It is not possible for any subject to be "fully circular" in a "linear" context.

For this reason, increasingly close **collaboration** with suppliers, with companies in the same and different sectors, with customers, with national and local institutions, with the world of research and startups, is essential, both to understand and determine courses of action, and to **concretely pursue** them.





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New business models



Business Model Useful life extense

Project Category Second Life

PIONEER (air stoRage)

The PIONEER project, financed by the Innovation FUND (for the Rome Airport Consortium, **Enel X**, and the Fraunhofer Institute) involves design and development of an innovative **storage system** (nominal capacity of 5MW/10MWh) using electric vehicle batteries from the automotive sector for a second life.

The solution absorbs excess energy produced by the solar plant to cover potential evening peaks in demand at the airport, while providing services to the local electrical grid. Its most innovative feature is its integration of batteries from several automakers, **reducing** supply risk and increasing system modularity. GHG **emissions** are expected to drop by approximate-ly 16,000 tons of CO₂ in 10 years.



PIONEER (airPort sustalnability secONd lifE battEry

Raw materials





Business Model Circular inputs

Project Category New Life Cycles

Recycling projects

Enel aims to develop a circular value chain to manage the end-of-life stage for all new technologies:

Wind: Two demo plants within Enel Futur-e sites in Italy and Spain for wind turbine collection and possibilities of reusing secondary raw materials.

Photovoltaic: Photorama project (European Horizon 2020 program). Automation of the solar panel disassembly process and identification of a suitable treatment to recover valuable materials (purity over 99.9%), reaching a recycling rate of 95%.

Batteries: As part of the second IPCEI, Enel X is working in Italy on solutions for logistics, transportation, storage, automated disassembly processes, and recycling of end-of-life batteries from electric vehicles (60,000 tons/year by 2030) and large storage systems for stationary use.



Business Model Circular inputs

Project Category Circular planning and resources

and Chile.



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Business Model Circular inputs

Project Category Circular plannin and resources

Circular Smart Meter - Closed loop recycling

In 2020, production began on the new Circular Smart Meter, using a circular model and a process aimed at redesigning the value chain of the electronic meter. Enel Grids decided to use materials from disused meters to create new ones. Following its MID certification (the EU's Measuring Instruments Directive), in 2021, 80,000 circular Meters were produced in Italy, with a target of 8.2 million by 2026. 48% of the new Meters' weight is made up of reclaimed materials: the **recyclability** of end-of-life materials (plastic, steel, and other metals) is estimated at **79% of its weight**. During its service life (15 years), each Circular Smart Meter allows for a savings of 7Kg of CO, and 1.1 kg of raw material.

Geothermal lithium (Vulcan)

Enel Green Power signed a partnership with Vulcan Energy to develop projects for geothermal lithium mining. The agreement, relying on the synergy between Vulcan's know-how and EGP's industry experience, will examine the prospects for further development in geothermal lithium starting from the Cesano area, near Rome, not excluding the possibility of further collaborations in Italy and abroad. The development of this lithium supply source is a useful tool to mitigate supply risks for the material, more than 90% of which is currently produced in Australia, China,

Cities and territories



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Business Model Shared platforms

Project Category Energy systems and infrastructure

Energy communities

Enel X has developed a project to build a 200-kW photovoltaic plant and a technological platform to manage the first agricultural energy community in Italy, which brings together a group of Sicilian companies. "Renewable energy communities" are associations between individuals, businesses, or public entities who have decided to join forces to equip themselves with systems to produce and share energy from renewable sources.





Business Model Product as a service

Project Category Energy systems and infrastructure

Enel X Lighting

The city of Bologna was the first site for a Proof of Concept (PoC) of Enel X's adaptive lighting solution. The project included an advanced system of cameras that, based on traffic levels, can automatically adjust brightness on the street, in compliance with UNI 11248/EN 13201 regulations. Local sensors perform automatic analysis and communicate wirelessly with one another with a remote server. The remote server then processes the information and also makes it possible to carry out statistical analysis, and store and display data within a control interface. On LED lights where the solution was applied, further consumption savings of 35% were obtained with this technology.



Business Model Circular inputs

Project Category **Energy systems** and infrastructure

Open Data Program for Smart & Sustainable cities: Helping out in a concrete way local institutions blaze a path to sustainable development, Enel X launched an **Open Data valorization** program - originating both from institutional sources and alternative sources like satellite images, focused on creating solid and immediate indicators, freely and easily browsable through an interactive map in the Enel X YoUrban portal.

With scientific support from the University of Siena, IMT Lucca, and the University of Florence, Enel X devised and developed three free indicators for all Italian municipalities:

quality of life.

Open Data indices for urban sustainability

Circular City Index: Allows the assessment of the urban circularity of a municipality by analyzing the size of parameters like Sustainable Mobility, Environment & Energy, Waste management, and Digitazion, while boosting their levels by locating areas for improvement.

15 Minute City Index: A unique solution at a national and European level, providing 1 synthetic macro indicator, 13 dimensions, and 49 KPIs to implement urban planning based on proximity criteria and actualizing the "15-minute city" model: a city where every citizen can reach essential services either by foot or bicycle. A city where reducing commutes is key to lower emissions while improving urban resilience and

CO, City Index: Developed by Enel X starting from Open data and models from the ODIAC project (Open-source Data Inventory for Anthropogenic CO₂), it allows Italian municipalities to assess the level of anthropic CO₂ emissions for every urban micro-district and over time. Estimates linked to 1 sq km sectors and overall views of local emissions are concrete support to define a customized path for carbon-neutrality actions to be implemented in urban areas.



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