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Case Study

Enel's Innovability:

Global Open Innovation and Sustainability



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“Sustainability is the goal; innovation is the tool.”

Francesco Starace, CEO of Enel

Introduction

As Francesco Starace left the World Economic Forum in January 2019, the Swiss mountain air made him shiver. The conference in Davos had brought together more than 250 political leaders and over 1,000 high-level representatives from the corporate sector worldwide. As CEO of Enel, one of the largest power utilities companies in the world with €75 billion in revenues in 2018, he had been invited to talk about the transformation of the energy sector and its potential to combat climate change.

The fourth industrial revolution, or “Globalization 4.0” as it was called in Davos, was bringing technological advances at an extremely fast pace. Starace emphasised the decisive role of technology and business model innovation as a driver for reducing CO₂ emissions and creating a more sustainable world through the increase of renewable energy production, the digitalization of energy assets and the electrification of other industries such as transportation.^{1, 2}

In 2019, Enel was strongly committed to making affordable reliable and sustainable energy available for all, and to long-term shared value creation for its stakeholders. Top management was convinced that sustainability, together with innovation, would be the engines driving inclusive growth in conditions of dynamic balance.

Starace and his team were determined to lead the energy transition from an ecosystem perspective, building an Open Power platform that would open electricity access to more people and open the world of energy to new technologies, new uses, new ways of managing and new partnerships (see Exhibit 1). He had made innovation and sustainability strategic pillars for the company, embracing the notion of ‘open innovation’ – harvesting ideas externally (rather than just in-house) from an ecosystem of start-ups, SMEs, universities, researchers, suppliers, other corporations, and employees.

In an effort to open up Enel to the world, he had created an international network of ‘Innovation Hubs’, in Israel, USA, Spain, Italy, Russia, Brazil and Chile, and launched ‘Open Innovability’ the first energy crowdsourcing platform – connecting outside innovations with the company’s internal needs. These, he hoped, would provide the input that Enel needed to lead the energy transition towards a more sustainable future. In addition, Starace and his team had transformed the corporate culture, readying Enel’s workforce (around 69,300 employees) to take advantage of all opportunities opened up by the fourth industrial revolution.

1 World Economic Forum (2019), Discussion Panel: *“Realizing the Energy Transition”*, Davos, 23-06-2019. Accessed June 17 2019

<https://www.weforum.org/events/world-economic-forum-annual-meeting/sessions/realizing-the-energy-transition>

2 Enel (2019a), Press Release: *“Globalization 4.0 will save the climate”*, 28-01-2019

As the car taking him to the airport passed a demonstration of high school students urging action against climate change, he found himself wondering “Are we doing enough, fast enough?”

Starace knew that the transition to sustainability in the energy sector had a long-term horizon, but at the same time he wanted to convey a sense of urgency:

“We need to have the milestones that you can measure at the end of the year. People need to have a tangible evidence that what they are doing is material. If you don’t have that, it becomes a blur, vague – a strange environment in which people get disoriented and lose motivation.”

Will our innovation approach yield the changes in technologies and business models that we need to become sustainable? Is our “Innovability” approach, combining innovation and sustainability the right path going forward? He wondered. As he contemplated the energy and determination of the young protesters demonstrating in the streets, he reflected: “What we do has to work for them.”

The Energy Industry

Since Edison created the first large-scale privately-owned company for public electric illumination on Manhattan Island in 1882 (serving 85 customers and lighting 400 light bulbs), electricity is no longer an expensive novelty but an essential commodity. In 2017, 89% of the world’s population had access to electricity, increasing at an average of 0.8% per year since 2010,³ principally generated by fossil fuels (65%), hydroelectricity (16%), nuclear power (10%), renewables (i.e., solar, wind, geothermal, among others) (7%), biofuels and waste (2%).⁴

The value chain has four segments: generation, transmission, distribution, and sale of electric power. *Generation* by power plants, where primary sources (e.g., coal, oil, gas, etc.) are transformed into electricity. *Transmission* involves the bulk movement of electricity at high voltage (i.e., from 69 kV to 765kV) over long distances from power-generating sites to electrical substations located near consumption hubs, where the voltage is lowered. *Distribution* – getting mid-to-low voltage electricity (i.e., 35kV or less)⁵ from the substation to the end-consumer, when the final voltage is between 110V and 250V. *Sale* covers billing and managing the relationship with consumers.

Power companies compete in the generation segment to supply electricity at the lowest possible cost. Economic efficiencies were achieved by deploying large-scale power plants. Hydroelectric and nuclear power were capital-intensive and took time to build (averaging 7.7 years for a nuclear plant).⁶ Large thermal plants were subject to variations in the price of

3 The World Bank - Data (2019). *Access to electricity (% of population)*. Accessed Oct 10 2019 at <https://data.worldbank.org/indicator/eg.Elc.Accs.Zs>

4 International Energy Agency (2019). *Electricity Information 2019*

5 Robert J. Alonzo P.E. (2010), in *Electrical Codes, Standards, Recommended Practices and Regulations*

6 Pedro Carajilescov and João M. L. Moreira (2011), *Construction Time of PWRs*

fossil fuels: for example, the cost of the fuel was more than 60% of the cost of producing electricity at a natural gas-fired combined cycle power plant (including the initial investment and operation costs during its lifetime).⁷

Due to the capital-intensive nature of the industry, the *transmission* and *distribution* segments were natural monopolies. In countries where electricity was privatized, regulators granted concessions to power companies, assuring them of a return on investment as long as they supplied the commodity and provided the service at the quality standards specified.

At the turn of the 21st century, new policies emerged – particularly in Europe – to incentivise the use of renewable energies, a move partly driven by the UN Framework for Climate Change (the Kyoto Protocol) to reduce CO₂ in the atmosphere, and partly to reduce dependence on imported fossil fuels. Annual investment in renewables grew from US\$46.6 billion in 2004 to US\$298 billion in 2017, largely surpassing the US\$132 billion invested in fossil fuel plants (and the US\$17 billion invested in nuclear plants), driven by solar photovoltaic plants (49%), and windfarms (29%).^{8,9}

The cost of solar photovoltaic plants and windfarms fell dramatically as a result of technology improvements and the experience gained by technology developers over time. For example, the cost of a photovoltaic module fell from US\$3.5/Watt in 2000 to US\$0.62/Watt in 2016¹⁰ (see Exhibit 2). Solar PV and windfarms became competitive: electricity generated by these technologies came within range of the cost of burning fossil fuels (see Exhibit 3).

The most significant changes in the energy sector were in the generation segment, driven by the market for renewable energies. In the transmission and distribution segments, the focus was on reducing costs and achieving efficiencies rather than disruptive innovation.

By 2019, four megatrends were disrupting the status quo for network operators:

- **Decarbonization** of energy production. It was estimated that 77% of new generating capacity added by 2050 would be Renewables¹¹;
- **Electrification** of large sectors of the economy such as transport and heating. It was estimated that global demand for electricity would increase by 62% by 2050¹¹;
- **Decentralization** of power generation, triggered by a fall in the cost of Photovoltaic and batteries for energy storage, as consumers became ‘prosumers’, selling their excess electricity to the grid or to their peers. Customers increasingly looked for customized solutions to their needs;

7 Schroeder et al. (2013), *Current and Prospective Costs of Electricity Generation until 2050*

8 Frankfurt School & Bloomberg New Energy Finance (2018), *Global Trends in Renewable Energy Investment 2018*

9 International Energy Agency (2018), *World Energy Investment 2018*

10 Our World in Data (2019), *Solar PV Module Prices*. Accessed Oct 10 2019 at <https://ourworldindata.org/grapher/solar-pv-prices>

11 Bloomberg New Energy Finance (2019), *New Energy Outlook 2019*.

- **Digitalization** of all assets, especially the grid, with advances in smart metering, automation, sensors, and the connection of power-consuming devices to the internet of things (IoT) (see Exhibit 4).

It was estimated that these megatrends could unlock US\$2.4 trillion in value over the next 10 years.¹² Although utilities were investing in the digitalization of the grid, it was still a small share of overall investment. In 2018, around US\$291 billion was invested in electricity networks worldwide, of which a mere 12% was destined for smart grid infrastructure and smart metering, and the rest was spent on traditional equipment.¹³

Enel Group

In 1962, the Italian government set up the *Ente Nazionale per l'Energia Elettrica* (National Entity for Electricity) or Enel, nationalizing the assets of companies generating, transmitting and distributing electricity in Italy to create a single national electricity system.

During the 1990s, the member states of the European Union agreed to open the electricity and natural gas markets to competition, ending state monopolies. On 16th March 1999, by government decree no. 79, Enel was divided into three companies corresponding to generation, transmission and distribution: *Enel Produzione*, *Terna*, and *Enel Distribuzione*. Under the new law, Enel could not make more than 50% of electricity generated in Italy. The same year, 31.7% of the company was privatised and listed on the Milan stock exchange. The IPO, which remains among the largest in the world, raised more than US\$17 billion.¹⁴

In the new millennium, Enel entered an internationalization phase, mainly via mergers and acquisitions. In 2007, Enel acquired Endesa, the largest power company in Spain and Latin America, valued at €42.5 billion.¹⁵ In 2008, the electricity generated by Enel outside Italy (156.9 TWh) surpassed local generation for the first time (96.3 TWh).¹⁶

In 2008, Enel consolidated its efforts to reduce its environmental impact by creating a subsidiary, Enel Green Power (EGP), that was dedicated to developing the production of electricity from renewable energy, a strategic move in line with market trends in energy generation. From its inception, the focus was on growing EGP as a way to diversify power sources, mitigate risks associated with traditional generation (e.g., carbon tax, price fluctuations), and enter new markets. Within 10 years, EGP became one of the world's leading renewables operators, with 39.2GW of installed capacity, generating energy from over 1,200 plants around the world from sources including hydro, wind, solar, geothermal and biomass.¹⁷

12 The World Economic Forum (2017). *The Future of Electricity: New Technologies Transforming the Grid Edge*.

13 International Energy Agency (2019), *World Energy Investment 2019*

14 Shen L. (2019), Fortune Online, *These are the 9 biggest IPOs of all time*. Accessed June 08 2019 at <http://fortune.com/2019/04/26/biggest-ipos-history-uber/>

15 Kramer M. and Nadella B. (2018), *Enel: The Future of Energy*, Harvard Business School

16 Enel (2008), *Enel: Annual Report 2008*

17 Enel Green Power (2019), *About us*. Accessed June 08 2019 at <https://www.enelgreenpower.com/about-us>

In 2017, a new division, Enel X, was created to provide new solutions for customers beyond supplying a commodity (i.e., electricity), in the areas of energy efficiency, smart home, distributed generation, electric mobility, smart cities, industry 4.0, IoT, and financial services.

By 2018, Enel was one of the world's leading integrated electricity and gas operators, working in 34 countries across five continents, with about 69,300 employees. It generated energy with a managed capacity of more than 89.8 GW, selling gas and distributing electricity across a network spanning approximately 2.2 million km for 73 million end users, making it the largest private electric distribution network globally. Enel Group was also the first private renewable player worldwide, boasting a renewable footprint of over 43 GW managed capacity. Almost half of the energy generated by Enel in 2018 was produced with zero CO₂ emissions (see Exhibit 5). Enel was also the first in the world to replace traditional electromechanical meters with smart electronic meters, enabling real-time readings and remote-control management for greater energy efficiency. This innovative measuring system was also critical for the development of intelligent grids, smart cities and electric transportation.

Enel operations generated around €76 billion in revenues. Its gross operating margin of €16.4 billion derived from infrastructure and network (47%), renewables (28%), retail (18%), thermal generation and trading (7%), and was balanced between Italy (45%), Iberia (22%), South America (27%), and others (7%) (see Exhibit 6).

The New Era

Francesco Starace, the man behind the success of Enel Green Power, was 59 when he was appointed CEO of Enel in 2014. For him the challenge was clear: the energy industry was changing at a fast pace and Enel had to change if it was to thrive in a new era –

“What we are experiencing is a bombardment of technology and business model changes that affect the whole value chain in ways that are faster and have more angles than we were used to before....These changes are blurring the boundaries between the energy sector and other industrial sectors such as transport, telecommunications and chemicals.”

In a major change of strategy, he made innovation and sustainability the pillars of future growth, seeking to transform Enel from a traditional, reactive company to one that was open, agile, and proactive –

“We didn't have a culture of innovation, thus we needed to create one. Innovation needs a purpose and most businesses find this purpose in competition because if you don't innovate the competition will beat you. But I believe in the world we have a sustainability problem to solve and address much more urgently than a competitive problem. The business model we had as an industry was increasingly unsustainable going forward. Could we change our business model without innovating? The answer is no, we haven't been able to change it for many years. Only innovation can really help in becoming more sustainable. Sustainability is the real driver for innovation...so I decided to put them together.”

Enel looked to create long-term sustainable value for all its stakeholders by adhering to UN Sustainable Development Goals in its investment decisions. Its plan was to reduce specific CO2 emissions by 2030 (SDG13: 0.23 g/kWheq), and to promote the economic and social growth of the local communities in which it operated. Other goals by 2030 were: SDG4 quality education for 2.5 m beneficiaries, SDG7 affordable and clean energy for 10 million people, SDG8 decent work conditions for 8 million beneficiaries (see Exhibit 7). Maria Cristina Papetti, Head of CVS, Sustainability Projects and Practice Sharing, commented:

"We moved from a CSR approach to something that fit our strategy that aimed to change the way a utility can stay in the market in the long run, running a sustainable business, thanks to innovation. The question was simple: How can you lead the energy transition the world is facing without being responsible? We translated the academic Creating Shared Value approach into a methodology applied to our value chain, so that sustainability is integrated into our daily activities, and it is done not by a central function but by the people managing the business from Business Development, to Engineering Construction and Procurement up to Operation"

In 2014, Ernesto Ciorra, a consultant, teacher and serial entrepreneur, was invited by Starace to lead Enel's new Department of Innovation and Sustainability, blending the two to give birth to what was called "Innovability". Prior to joining Enel, as an external consultant, Ciorra had been commissioned to make an assessment of why innovation was not succeeding at Enel. The CEO was impressed with his findings:

"Starace told me I had identified all the gaps but nobody knew how to fix them. So he said: 'Now you join us and fix all of them – but please propose a wider approach, a more exciting, more ambitious programme.'"

Ciorra was convinced that innovation could not be deployed as fast as Starace wanted if Enel kept working in internal silos – and missing opportunities outside:

"I started from scratch to rethink innovation – and rethink innovation to serve sustainability – and both of them embedded in the business line."

He proposed a shift from in-house R&D to "open innovation" – which meant accepting new ideas from outside the company as equal in importance to internally generated ones.¹⁸ Applying his model, Enel would start by identifying *needs, requirements* and *problems* from the core business (i.e., the demand for innovation), and then scout for solutions from start-ups, SMEs, universities, providers and other companies (i.e., the supply of innovation). The process would be structured, monitored and centralized by the Innovation team. The projects would be ran directly by the innovation team at the business lines to be closer to the business and guarantee faster industrialization of successful results.

Clearly, this was no easy task. For it to succeed would require not only a change in ways of working but the transformation of the company culture – a change in Enel's DNA.

18 Henry W. Chesbrough (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*.

A New Structure

The existing organizational structure was vertical: decisions were made from the top-down and each division operated separately. Indeed when Starace became CEO in 2014, Enel was a portfolio of companies operating almost independently. Each country manager was in charge of P&L along the entire value chain (generation, distribution, marketing & sales) but there was little communication among countries or divisions, and no sharing of ideas.

With the help of Francesca Di Carlo, head of People and Organization (i.e., human resources), Starace implemented a matrix structure based on lines of business and geographical regions. The business lines (Thermal Generation, Trading, Infrastructure & Networks, and Enel Green Power) were put in charge of managing and developing assets, with the goal of optimizing performance and increasing return on capital for all the regions in which Enel was present. The geographic units were responsible for the sale of electricity and natural gas, and for managing relationships with external stakeholders (i.e., customers, institutional bodies, local regulators). Operations were supported by Global Procurement, Global Digital Solutions (i.e., IT), Administration, Finance and Control (AFC), and other holding functions that oversaw governance at the group level. Operations were the responsibility of both the country manager and the respective head of business line, sharing objectives and thus increasing communication within the company (see Exhibit 8). P&L was reflected in the matrix structure: revenues were responsibility of the country manager, costs (CAPEX and OPEX) were the responsibility of the business lines, while EBITDA was a shared objective. Di Carlo commented:

*“At the beginning we had to deal with the risk of bureaucracy, but this is no longer a problem. In 2015, we redefined our values. We identified values from the working behaviours of the top 200 people at Enel. Those values were voted by some 20,000 people randomly in the organisation. We recognised that **trust** and **responsibility** were among the four values that represented the company. Keeping these values in mind, we reconciled roles and responsibilities, eliminating all organisational “blah, blah, blah”. We refounded the old system with a RACI (Responsible, Accountable, Consulted, Informed) system. Everything was mapped. You know what you are responsible for and what you are accountable for. However, we didn’t create a manual, we allowed ourselves to be flexible.....and that is when trust play its role.”*

Before the restructuring, innovation and sustainability had played a secondary role, driven by Regulatory Affairs, the department to which they belonged. Each line of business conducted its own internal R&D, essentially making incremental improvements to existing technologies. There was a disconnect from operations and no ‘sharing’ among different R&D departments. The new structure bundled Innovation and Sustainability together, and elevated those functions to the same level of the business lines, reporting directly to Starace.

Under the new matrix structure, Ciorra set up innovability teams in every business line, managed by innovation managers who reported directly to him as well as the head of the business line. The innovability teams looked for *challenges* at every level of their respective business lines (i.e., operations, maintenance, safety, engineering, etc.), scouted and tested

solutions, and supported their colleagues in implementing those solutions into the real business. Having the innovability teams working within the business lines and in a matrix structure allowed the company to test projects more efficiently and avoid duplication across countries and business lines, reducing the cost of innovation. Innovation and sustainability were embedded in the line, hence more direct, faster and efficient. Giovanni Tula, Head of Sustainability Global Power Generation, commented:

“The people of my team are working directly with the guys from operations and maintenance, engineering and construction, and all the other business functions, and they are also in touch with all the major central units for each technology (solar, hydro, wind, etc.). The fact that we are integrated with the business is a success factor for collecting needs and identifying solutions that are then implemented into the business.”

Another major change was the creation of the Digital Solutions staff function in 2018, formed from the merger of the ICT department with business people. The aim was to work towards the digitalization of the Group’s assets, its client relationships, and the way employees worked. Over 2,000 people in the Group adopted ‘agile’ methodology to support the quest for innovation and digitalization. Digital Solutions had its own dedicated Innovation Manager.

The innovation teams within the business lines and Digital Solutions were supported by holding innovation functions directly under Ciorra, who was in charge of fostering corporate culture, managing scouting and stakeholder relationships for the innovation ecosystem, monitoring activities and intervening to smooth processes and procedures when needed – what Ciorra called the “innovation factory”. New ideas and technologies came from all over the world. Fabio Tentori, Head of Innovation Hubs, Startups and Business Incubation, said:

“We connect the Group to the best innovation ecosystems in the world. Our job is to continuously scout new opportunities to innovate our traditional businesses and to create new valuable businesses that are sustainable in the long term for Enel and for everybody around us.”

A New Culture

A structure that brought innovation and sustainability closer to operations was helpful, but it was not enough to achieve the results Starace wanted. A complete change of mindset was required, as he explained:

“We needed to change that approach, we needed to innovate and to push the sustainability issues into innovation domain in order for innovation to really have the right drive in our industry. You could say that we could continue to do our own business the way we were used to do, and probably nothing would have happened in the next five years to us. We would probably be fine. But if we wanted to go and look beyond that, we should change immediately. We need to find a completely different way of doing things because we want to grow in a sustainable way and we want to address the key sustainability issues we are facing in an innovative way. So in that

sense, sustainability is needed because without it innovation cannot fly in an energy company.

For decades we focused on not making mistakes. You cannot have a failure in a generation plant or in a network system because it will generate a large blackout, affecting a massive number of households. The culture of the industry was to run away from any possible mistake and focus on avoiding any new possible mistake. Fear of making mistakes is really a terrible environment for innovation. It is toxic."

Several programmes were designed to shift that mindset and promote innovation. One was "My Best Failure", launched in 2015. The idea was to encourage employees to share their "failure stories" online within the Group, reward entrepreneurial spirit, and replace fear of mistakes with an "open, no blame culture" that thrived on lessons learned.

Another 'mindset shifter' was a corporate entrepreneurship programme called "Make it Happen!", where employees were encouraged to form teams and develop ideas for new start-ups or ways to improve Enel's business. The selected teams (after an evaluation process) went to the acceleration phase where they had six months full time and a budget to work on their idea and transform it into a new business. Ciorra underlined the ongoing nature of the challenge:

"I think that we'll never end the cultural revolution, because we need to push all our people to make more mistakes, more failures, to try new and to fail fast. It's a never-ending story."

By implementing these activities and an active communication campaign, the urgency of change cascaded through the company. Also, the fact that innovation and sustainability had been raised to the same level as the business lines sent a strong message from the top.

Enel's investment committee, which included Ciorra as Chief Innovability Officer, evaluated opportunities based also on indicators of sustainability and innovation. To accomplish long-term sustainable value creation, Enel started the investment evaluation process by measuring all the related economic, social and environmental implications. From the start of the construction activities to the end of the useful life of the project. All projects needed to match defined sustainability and innovation criteria, otherwise the Group would not invest. Ciorra commented:

"I am part of the investment committee along with six other executives. We review and decide on all the investments of the Group. Since I joined, we have approved more than €28 billion of investments. But we have also rejected billions of investments...because we thought they could be disrupted by innovation or because they were not sustainable.

In Enel we are very much focused on both the present and the future! I'd like to explain better thanks to an analogy with gaming. The CFO is playing chess – anticipating, analysing, studying and planning every future move. He forecasts what is foreseeable...he is in fact responsible for actual cash flows. I play poker, trying to find the right cards, but also I must be able to close when I have bad cards – to fail very

fast and close the play, and bet again, bet again, bet again. My goal is to find future cash flows.”

Enel had a three-year sustainability plan and a three-year strategic plan (that had to be in line), which were continuously reviewed and adapted according to the changes in the ecosystem. For this, Ciorra coined the term “Startegy”, because:

“We can define the starting point of the strategy, nothing else. After, we must co-design the strategy with the communities where we work. We have to redesign our strategy according to human rights, according to social needs, according to innovation that comes from technology, and according to disruptions that can come from social beings, communities or new parties.”

Open Innovation, Digitalized Process at the Core of the Business

Enel digitalized the entire innovation process and structured it in a five-step approach: Identify needs – Select a scouting tool – Originate a solution – Execute proof-of-concept – Scale-up into the business (see Exhibit 9). The entire process was supported by a unique digital platform used by all entities involved as a tool for work. Each step was recorded and there were several tools to perform tasks and keep track of development.

The innovation managers pushed for a change in mindset in the business lines – from a solution-seeking approach to a problem-seeking approach. Once they had defined a challenge based on the problem/need identified, it would be given to the world of innovators to be solved – without imposing a particular path, requirements or technology. The only imperative was that the solution worked. Starace noted:

“The identification of the problem initiates a mental process that is extremely valuable because that itself frees creativity within the company. So this was an incredible change mechanism. People were free to identify problems and were actually praised for that.”

The innovation managers were in charge of an ongoing process of identification of *needs* and *challenges* for their respective business line. Through workshops and active communication, they prioritized the needs coming from each country. These were merged at a global level, to eliminate duplicates, and prioritized again, as Robert Denda, Head of Innovation and Technology for Infrastructure & Network, observed:

“Without losing what are the country needs, we have a prioritized list for the whole Enel Group, for each of our functions. This is a periodic process – it's not just done once, it's basically continuous during the year. We take from this list the main challenges. There are hundreds of challenges now in this space. We cannot take all of them, we instead focus on the most relevant ones in terms of business impact.”

All requirements were digitalized and uploaded to the platform using a tool called “I NEED”, which allowed everybody in the company to post needs and to see what other teams have

been looking for. I NEED was used to gather all the *challenges*, align them across the entire company, communicate them to the scouting teams, and keep track of each one.

Once *challenges* were identified, the innovation managers chose the right tool to find the solution for each *challenge* from a portfolio of internal and external tools (See Exhibit 10). An internal tool developed in 2014 was the Enel Idea Factory Project. It was designed to crowdsource solutions by harnessing the potential of all Enel employees, with facilitation by internal experts of innovation methodologies (creative problem solving, design thinking, lean start-up) to encourage the use of lateral thinking and enhance creativity. Throughout the group, country-level Idea Hubs were created in order to support the Idea Factory.

A network of 'Innovation Ambassadors' was born – a community of employees passionate about creativity that facilitated, trained and helped problem solving in their own business area on a volunteer basis. By 2019 the Idea Factory involved more than 4,000 employees and had developed 38 successful projects. Alessia Sterpetti, Head of Open Innovation and Idea Factory, said:

"The Enel Idea Factory approach, together with the great proactivity and commitment of Enel people, were key elements in allowing the Global Renewable Business Development team to completely review the photovoltaic auction strategy so that they were awarded with the construction of a power plant in Brazil. This was a great achievement for our Renewable business line."

Among the external alternatives were the crowdsourcing platform *OpenInnovability.com*, scouting through the network of Innovation Hubs, and workshops with suppliers, universities and research institutions (more details in the next chapter).

In addition to direct internal and external tools, *Innovation Communities* were formed by employees interested in a company-wide topic (e.g., energy storage, drones, hydrogen), to deepen the knowledge of that specific topic and to share it with the entire Group. There was no hierarchy – any employee could join – and by 2019 they had proposed over 110 use cases, of which 60% were scaled-up.

Once a potential solution was scouted, the innovation teams of the business line worked with the owner of the *challenge* (i.e., the team of the business line that had identified the problem), pre-assessed the impact of the solution at scale, and together designed a proof-of-concept (POC) phase, with clearly defined KPIs. If the solution matched those KPIs, it would be scaled-up directly into the business through a 'massification' and industrialization phase. The projects were tracked digitally, allowing the innovation team to identify any internal obstacles that might block the POC or scale-up phases. Said Nicola Rossi, Head of Innovation Global Power Generation:

"Ideas are important, but what is even more important is the delivery of solutions. Innovation projects without scale-up do not produce real value. You have to think about scaling up from the minute you start on an innovation project. We need to carry

out these projects together with our internal stakeholders. Engagement with stakeholders in all the project phases is really key to success.”

Marco Gazzino, Innovation manager at Enel X, added:

“Working in an integrated way with business starts also from a proper selection of innovations to bet on. That’s why we developed a metric to predict and measure the business impact of the most of the innovation projects. That way we can prioritize our action where the value is and rely on a more reactive interaction with business units.”

Cinzia Corsetti, Head of Electricity and Gas Markets Innovation, added:

“The entire innovation process, integrated with good practice sharing action among markets, is also applied to provide our 72 million electricity and gas customers with an ever-improving customer experience. Our goal is to be a customer-centric company and we believe that there is no better way than starting by listening to ‘the voice of customer’.”

Scouting for Solutions

Once the *challenges* from the business lines were defined, the “Innovation Factory” was activated and the search for solutions was opened to Enel Open Innovation ecosystem, external and internal. To find external solutions, Enel used crowdsourcing, for massive reach to look for ideas or solutions to specific needs, and targeted scouting through the network of Innovation Hubs, to identify start-ups and SMEs with new business models or technologies.

Crowdsourcing: OpenInnovability.com

In 2017, Enel implemented a crowdsourcing platform OpenInnovability.com, where all technological needs and *challenges* were published and rules, deadlines and rewards were clearly defined. Crowdsourcing was used to find ideas and specific solutions: one example was the search for a solution to prevent fraud/theft by making it harder to access the electrical cabinets that protect electronic equipment, often located in public areas.

In order to increase its reach, Enel partnered with InnoCentive, a global crowdsourcing platform for innovation with access to a network of more than 400,000 solvers (more than 5.5 times the total Enel workforce). Based in the US, InnoCentive was created in 2001 by Alph Bingham and Aaron Schacht. By 2019, the platform had launched over 2,000 challenges and received more than 162,000 solutions from 190+ countries.¹⁹

In addition to the *challenges* posted by the company, OpenInnovability.com allowed external parties (start-ups, SMEs, institutions, corporations, NGOs, researchers and individuals) to propose additional projects or ideas that might be of interest.

19 Innocentive (2019). *Innocentive web page – about us*, accessed June 08 2019 at <https://www.innocentive.com/about-us/>

Since OpenInnovability.com went on-line in 2017, 66 *challenges* have been launched, attracting more than 3,000 proposals and 200 interesting solutions from 96 countries (see Exhibit 11). For example, Enel wanted to save soda in its geothermal plants (used to regulate the acidity of the liquid used in operations). After years working with universities and researchers on the topic, in 2017 Enel launched the challenge on the OpenInnovability platform. A biologist (who had never been in a geothermal plant but whose research was relevant to the challenge) suggested splitting the entry of soda into the scrubber and introducing a dosage system to optimize the quantity consumed by the different sections. She was awarded €15,000 and the internal geothermal team began testing her promising novel solution.

According to Angelo Rigillo, Head of Innovation Governance, Intelligence and Partnership, the potential existed to take the platform further:

“The next step is to widen as much as possible our solver community to make OpenInnovability.com a well-known brand in our industry and beyond. We want to have other companies launching challenges on our platform –any company, as long as the challenge is in line with the UN Sustainable Development Goals.”

However, as Ciorra commented:

“We are leveraging this platform to get ideas and knowledge from around the world. This is an asset, a high-value asset, but it is not valorised on our balance sheet, unfortunately.”

Targeted Scouting: The Innovation Hubs Global Network

To ensure the success of the open innovation approach, Enel needed fast access to new ideas, technologies and business models from start-ups, SMEs, universities, and researchers around the world. To build bridges to this ecosystem of potential partners at a global level, in 2016, Enel opened its first Innovation Hub in Tel Aviv. CEO Starace explained the choice of location:

“We were looking for a location with a combination of innovation, talent and capabilities that was dense enough to sustain a variety of questions [for which] we sought answers. Israel presented a perfect case. This is a compact environment with highly concentrated amount of smart people. The reason for the entrepreneurial background is that it’s rooted in the system with a strong academic link.”

Fabio Tentori, Head of Innovation Hubs, Startups and Business Incubation, added:

“We opened in Tel Aviv first because is a very easy place to go and find a solution. There is a lot of innovation happening there. Tel Aviv has got everything: cybersecurity, IoT, digital payment, drones, and nowadays mobility and much more. You know that after one year you will have two or three success stories to tell internally to the company. Because when you do innovation, you need success stories to build momentum and to convince more people inside the company to do even more.”

Each Innovation Hub formed a network of relations within each ecosystem to support Enel in finding the best solutions to its needs and to discover new untapped opportunities for development. To multiply the success stories, Tentori's team replicated the model every time an attractive location was presented, leveraging the specific characteristics of each ecosystem. Enel opened three other global hubs in San Francisco, Madrid and Boston. As one of the most important start-up centres in the world, San Francisco brought together start-ups, talent, venture capital investors, and high-tech corporations in a single location:

"Enel has planned to invest about €5.4 billion in digitalization of all its assets, customer relationships and people. San Francisco is then the right place where to find digital technologies to make this happen. And by connecting to the network in San Francisco, we are connecting to great start-ups from all over the world."

From Madrid, Enel Innovation Hubs managed the connection with the whole European ecosystem of innovation. Tentori continued,

"When it comes to energy efficiency, smart cities and renewable energy, Europe is one of the most advanced ecosystems. Europe is forefront in the battle to climate change! We picked Madrid because we have a couple of senior people there that are really good at this job. So we asked them to cover the whole of Europe."

In Boston, home to several world-class universities, the ecosystem included a large number of start-ups in the energy sector. Enel located its Innovation Hub at Greentown labs, the largest cleantech incubator in the US:

"Boston is the place to be for hardware technologies in cleantech and in the broader energy sector, such as storage, electric mobility, demand response, smart grid... With Boston and San Francisco we are exposed to nearly all the best ideas from the US."

In addition, Enel deployed innovation hubs within its existing labs to foster innovation through co-working, leveraging the expertise of Enel's engineers in Catania (Sicily), where more than 100,000m² were dedicated to renewable energies, using an "artificial sun" to test technologies; in Milan where Enel had a lab focused on the development of its future distribution network; and in Pisa, which hosted the lab of the thermal generation business.

In addition, Enel deployed local innovation hubs also in countries where it had a strong industrial presence – Chile (Santiago), Brazil (Rio de Janeiro together with Sao Paulo) and Russia (Moscow) – to be close to the people who implemented the technology, as Tentori explained:

"We realized that our hubs and labs can work together with startups to develop solutions faster and more aligned to our needs. In fact, we opened hubs also where we have our people, they hold the expertise and are the real reason why innovation happens. From the international hubs we often find technologies that can solve global challenges, but we always have to test them where we have our experts, in the countries of industrial presence of the Group. In addition, local presence allows to look for solutions to local challenges that are necessarily related to the particular area. For

instance, in South America distribution lines are mainly located overhead, quite different to Europe where lines go underground. So you have different challenges.”

At the Innovation Hubs, Enel provided help to start-ups and SMEs by opening the doors of its laboratories and allocating resources to develop solutions. However, the main value came from the expertise it provided to scale up a solution to an industrial level, as Robert Denda, Innovation Manager Infrastructure & Network, explained:

“We have our engineers in a co-working environment to work together with those start-ups. The start-up might have the creativity, the idea, but maybe they don't have the skill to scale up fast or there are other things missing. We try to bring those things together with our engineers who are really trained in industrialization.”

If a solution proved to be effective, Enel entered into a commercial partnership with the start-up and gave it an opportunity to scale up (via Enel's businesses) to global level. Enel tended to avoid taking equity. Having experimented in the past with the corporate venture capital approach, it felt that this was not the right strategy. Tentori commented,

“The management of a large corporation like Enel is not applicable to a small company that needs to grow and experiment freely at a fast pace. We were sabotaging our acquisitions with our heavy governance; we were putting a brake on initiatives that made us acquire the company in the first place. We rather support them from a technology and development perspective and let them free to innovate, without necessarily imposing our ideas.”

Partnering with Enel – as its first big customer – allowed the start-up to grow and find other partners. Tentori added,

“We ourselves connect the start-up with the capital market, if they need to raise equity we can introduce them to a wide range of institutional investors who are able to support them. In addition we give startups the opportunity to connect also to some of our suppliers if they need a boost in the industrialization phase or we help them to find additional customers for their solutions to grow faster and more reliably.”

Enel only considered direct investment (M&A) in start-ups or SMEs that had a competitive advantage in a strategic field that Enel wanted to enter (yet lacked the technology to do so). For instance, in 2017, the San Francisco Innovation hub scouted eMotorWerks, a start-up that had developed a charging station for electric vehicles and a platform able to optimize the charging of vehicles and enable vehicle-to-grid technology. After a period of collaboration, Enel decided to acquire the start-up to fill a technological gap in that area. The acquisition of eMotorWerks allowed it to improve its electric mobility offering and enter the North American market. Tentori commented,

“The eMotorWerks operation brought to Enel a technology that it would have taken a lot of time and resources to develop. Their solution covered a significant portion of the spectrum of things we were missing, thus the acquisition accelerated our business.”

By 2019, four years after the opening of the first innovation hub in Tel Aviv, Tentori's team had scouted more than 6,000 start-ups around the world and had done a preliminary assessment on over 1,000 of them. The team had about 250 projects underway, had committed more than €30 million in commercial relationships (mainly proof-of-concept), and more than 50 projects had been scaled up globally (see Exhibit 12).

One success story was Nozomi Networks, a start-up proposing a cybersecurity solution for critical infrastructure. Nozomi tested its technology on Enel's infrastructure and Enel gave it resources to develop the sensors, systems and algorithms that Nozomi had designed. After a year of testing, Enel decided to adopt the system. By 2019, Nozomi had raised more than US\$50 million in capital from VCs and had become a leader in this area. Cybersecurity was a major concern for Enel but not its core business. By supporting Nozomi Networks, Enel overcame its lack of technology and expertise in that area.

Moving Ahead

In 2018, Enel's strategy was to capture opportunities from the energy transition, focusing on four pillars: grid development and automation, growth in renewable capacity (aiming to be carbon-free by 2050)²⁰, e-mobility and urban infrastructure. The deployment of innovation was key to achieving growth in each area.

On grid development and automation, Enel was mainly developing solutions for grid digitalization. For instance, the innovative Network Digital Twin® architecture, that gave access to an up-to-date and accurate virtual replica of the physical power network, its components and system dynamics. It relied on digitalization of power network operation processes combined with use of new technologies. IoT and sensors generated a continuous flow of information from the edge of the network. With 3D modelling technologies, an accurate digital replica of physical assets was possible. Artificial intelligence supported analysis and decisions. Augmented and virtual reality enhanced the ability to work with the Network Digital Twin®. The Network Digital Twin® had a profound impact on power system operation and maintenance, network design and development, integration of distributed energy resources, and workforce management and training. It allowed closer, more innovative forms of cooperation and interaction with suppliers and technology partners, customers and other stakeholders. As Robert Denda explained:

"Flexibility, resilience and sustainability are key features of power networks that drive the energy transition. Our latest innovation, the Network Digital Twin® is a huge program gluing together the technologies and innovative concepts in an architecture that becomes a fundamental enabler of this transformation, also provoking profound changes of how the network of the future will be managed".

For growth in renewable energy capacity, Innovability was seeking new technologies for electricity generation and energy storage, and solutions to improve the speed of deployment of new renewable plants and make operations more efficient – always with an eye to

20 Enel (2018a), *Sustainability Report 2018*

sustainability along the supply chain, maximizing benefits for stakeholders (like local communities) and minimizing the overall impact. As Giovanni Tula stated:

“Innovation in solar PV manufacturing and installation, and in wind turbine materials and designs has developed so fast that PV modules prices decreased by 85% and wind turbine prices by 49% since 2010. Nowadays building Renewable Energy Systems is cheaper than coal plants and, also thanks to the incoming innovative solutions, it will soon get cheaper than operating existing coal plants.”

Nicola Rossi added:

“Innovation in thermal generation is aimed at supporting the growth of renewables in the transition period to reach the target to exit from fossil fuel by 2050. Our focus is to identify and implement innovative and sustainable solutions to manage the phase out from coal generation and to upgrade the gas fleet in order to provide flexibility services to the grid in an efficient and sustainable way. This means to drastically change the original mission of the gas plants through the integration of new technologies, like energy storage and advanced automation.”

For e-mobility, urban infrastructure and services, retail and industrial business – areas that overlapped with other industrial sectors – competition was aggressive and Enel had to be agile in deploying new solutions. For that purpose, Starace had created Enel X in 2017, which unified under the same umbrella several innovative business models developed by other business lines. In addition it brought together three start-ups acquired the same year – *Enernoc*, for US\$250 million, which positioned Enel as a global leader in demand response;²¹ *eMotorWerks*, the 19th fastest growing company in the US, which had deployed 25,000 smart-grid charging stations at the date of the acquisition;²² and *Demand Energy Networks*, an intelligent control software provider, project developer and operator specialised in battery storage optimisation.²³ Marco Gazzino explained:

“We focus on new businesses, products and services for B2B, B2C, and B2G customers. Enel X competitive landscape is different, there is more competition than in traditional energy market, and to tackle that Enel X has to operate in faster way to test and implement new business models and services. Putting our customers at the centre is paramount.”

Gazzino believed that this customer-centric approach allowed Enel X to guide and serve customers as they navigated through the radical transformation underway in the energy market. In less than two years since entering the market, Enel X had built innovative solutions to help commercial and industrial businesses, retail customers, utilities, and even the

21 Enel (2017a), *Press Release: Enel Group Completes acquisitions of leading us-based provider of smart energy management services enernoc*

22 Enel (2017b), *Press Release: Enel acquires eMotorWerks to provide grid balancing solutions and tap into US e-Mobility Market*

23 Enel (2017c), *Press Release: Enel acquired US-Based energy storage software and project developer demand energy*

Demand Response industry itself to navigate these kinds of challenges to create value from their energy resources, and to maintain a stable and reliable electricity grid. Enel X ranked among the top three electric vehicle charge infrastructure manufacturers worldwide²⁴ and retained its lead as the world's first Demand Response operator for managed capacity.

Innovation and Sustainability: What Next?

In August 2018, for the third time in four years, Enel appeared in *Fortune's* "Companies that can change the world" ranking thanks to the positive social impact of its corporate strategies. A couple of months later, Enel received another prize, the "Master of reinvention" – the people's choice – for the organization that most successfully reinvented itself when faced with a major challenge to its previously successful business model.²⁵ In November 2018, Enel was included in the "Top 12 Corporate Start-ups Stars", recognizing the most active companies in the field of innovation.²⁶

In 2019, five years after Starace took control, Enel's stock had increased by almost 66%, rising from €4.06 to €6.75 (see Exhibit 13), for a total market capitalization of €68.67 billion.²⁷

Following the Investor Day dedicated to Innovation (14th June 2019) at the Innovation Hub in Catania, where the open innovation approach was presented to investors, JP Morgan wrote,

*"We see Enel as one of the global leaders in the implementation of the energy transition, with an integrated business model that allows to capture growth opportunities in a wide range of business within the energy sector and with a geographically diversified footprint."*²⁸

Not only did the stock market acknowledge its pursuit of sustainability through innovation, but the capital markets in general. On 5th September 2019, Enel launched the world's first bond for general purposes linked to the Sustainable Development Goals. The issue, totalling US\$1.5 billion, was oversubscribed by almost three times – orders totalled US\$4 billion.²⁹

Despite these promising results, Starace was still troubled. Once on board the plane back to Rome, he thought to himself,

"There will be a time in the future when what is considered sustainable today will not be sustainable anymore. Don't think that those wind turbines and those lakes of PV panels will be fantastic forever. Change is continuous – you have to be prepared."

24 Navigant Research Leaderboard: EV Charging Network Companies - Assessment of Strategy and Execution for 15 Companies Offering Public Charging Networks and EV Charging Services Published 4Q 2018

25 Awarded presented by London Business School – Enel (2018b), Annual Report 2018

26 Enel (2018c), Press Release: Enel wins the SEP Europe's Corporate Start-up Stars Award 2018

27 Bloomberg (2019). Bloomberg: Enel Spa. Accessed in October 05, 2019 at

<https://www.bloomberg.com/quote/ENEL:IM>

28 Javier Garrido (2019), *ENEL*, Europe Equity Research, J.P. Morgan Cazenove, 17 June 2019

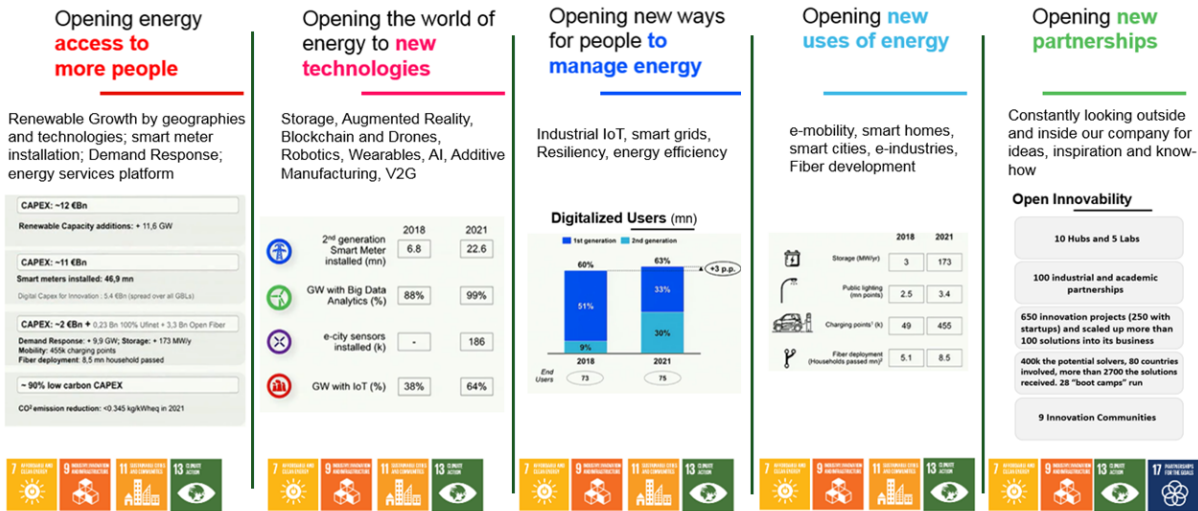
29 Enel (2019c), Press Release: Enel launches the world's first "General Purpose SDG Linked Bond"

Was Enel innovation approach enough to deploy all the innovation required to lead the sustainable transformation of the energy sector? Should Enel deploy more Innovation Hubs in different parts of the world and/or find other ways to capture innovation opportunities? Were the Innovation Hubs simply providing incremental innovation, or ready to spot and adopt disruptive technologies and business models?

Aware of the magnitude and speed of the energy sector's transformation ahead, he reflected:

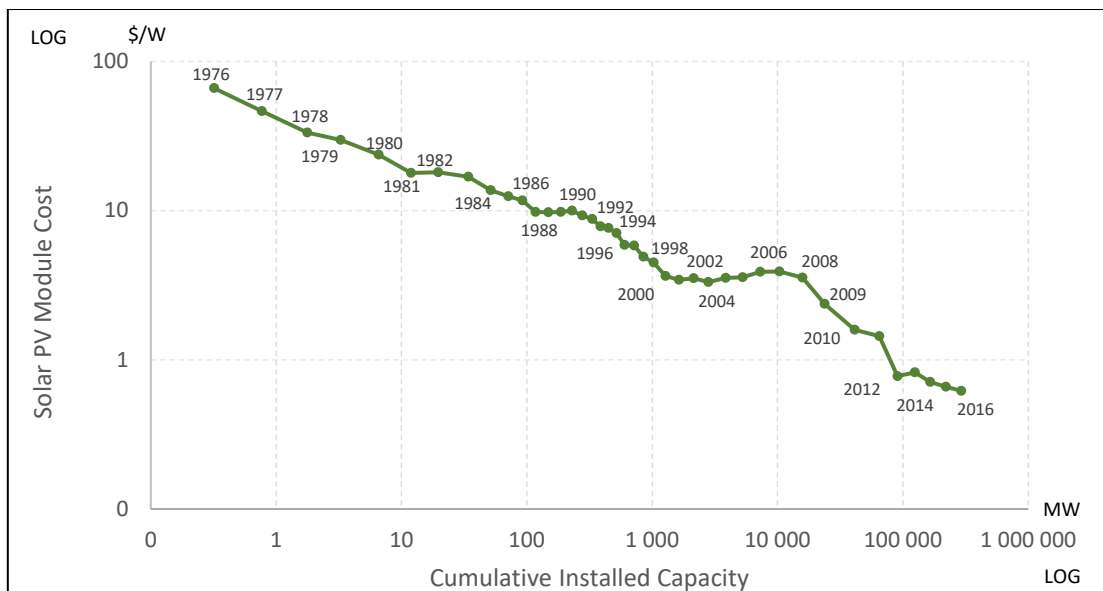
"The nice thing about sustainability and innovation is you work basically in the future, which is an open-ended future. You work saying, 'I have time, and I will be sustainable from now on - in different ways, more sustainable more globally, more deeply.' But in what timeframe? Everything happens a little faster than we think. I have a theory that anything you think will happen in one year – take 30% off and more or less it will be right. If you think about it, just go back in your life and say, 'I thought this would happen in X'. Then it happened in X minus 30%, if not more. "

Exhibit 1 OPEN Power Strategy



Source: Enel

Exhibit 2 Solar PV Learning Curve: Module Prices (US\$ per watt-peak) vs. Cumulative Installed Capacity (Megawatt-peak), 1976 and 2016



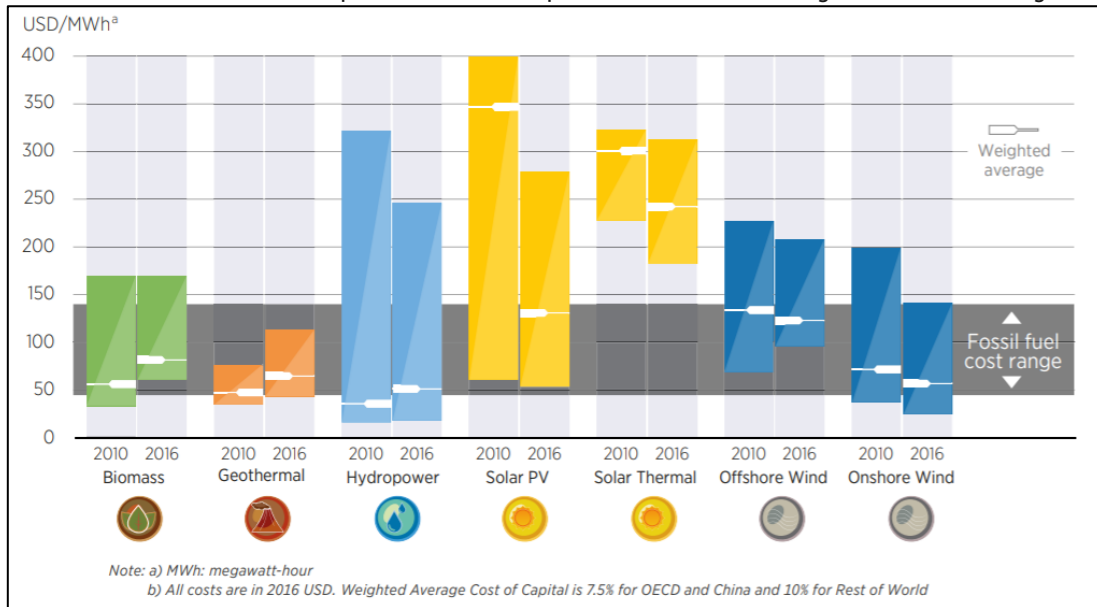
Source: Our World in Data (2019). Solar PV module prices vs. cumulative capacity, 1976 to 2016.

Accessed October 10 2019 at https://ourworldindata.org/grapher/solar-pv-prices-vs-cumulative-capacity?stackMode=absolute&country=OWID_WRL

Exhibit 3

Levelized Cost of Electricity for Utility-scale Power (ranges and averages), 2010 and 2016

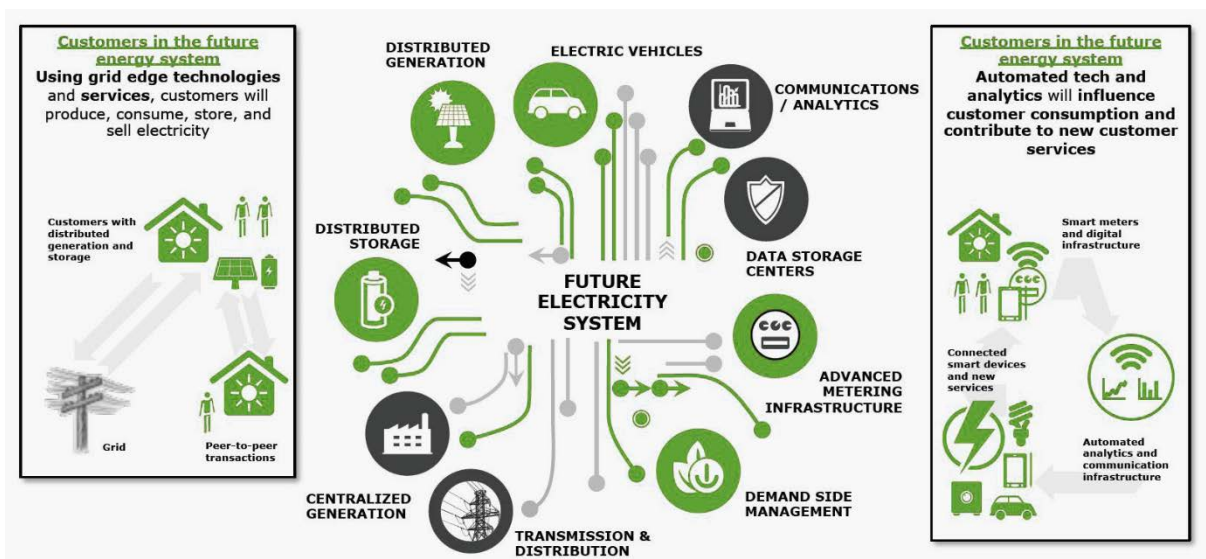
The **levelized cost of energy (LCOE)** is a metric that considers the cost of implementation and the cost to operate the asset over its lifetime, divided by the energy output of the asset over that lifetime. It allows to standardise and compare the economic performance of different generation technologies.



Source: IRENA (2017), Rethinking Energy 2017: Accelerating the global energy transformation. International Renewable Energy Agency, Abu Dhabi

Exhibit 4

Future Energy Systems



Source: The World Economic Forum (2017). The Future of Electricity: New Technologies Transforming the Grid Edge.

Exhibit 5

Enel: Generation Capacity by Primary Energy Source

MW	2018	2017	Change		
Net efficient thermal capacity	43,099	43,294	-	195	-0.5%
coal	15,828	15,965	-	137	-0.9%
CCGT	17,244	17,251	-	7	0.0%
fuel oil/gas	10,027	10,078	-	51	-0.5%
Net efficient nuclear capacity	3,318	3,318	-	-	-
Net efficient renewable capacity	39,203	38,305		898	2.3%
hydroelectric	27,844	27,799		45	0.2%
wind	8,190	7,431		759	10.2%
geothermal	804	802		2	0.3%
biomass and co-generation	42	57	-	15	-26.3%
other	2,322	2,216		106	4.8%
Total net efficient generation capacity	85,620	84,917		703	0.8%

Source: Enel (2018b), *Annual report 2018*

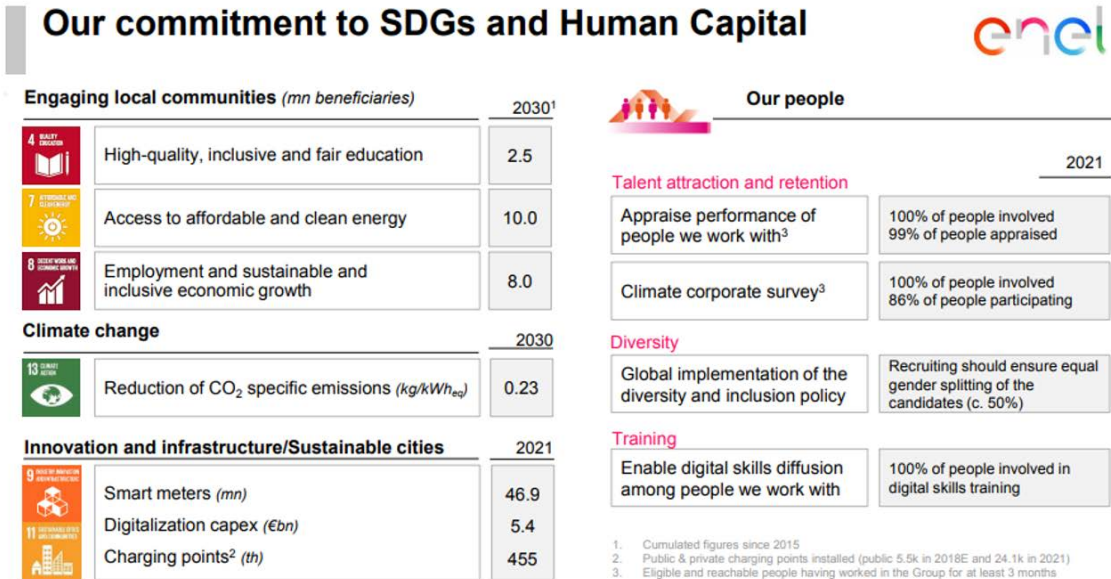
Exhibit 6

Enel Gross Operating Margin 2018 (Millions of euro)

	Local Business		Global Business Lines					Total
	End-user markets	Services	Thermal Generation and Trading	Infrast. & Networks	Enel Green Power	Enel X	Other	
Italy	2,233	119	22	3,679	1,220	31	-	7,304
Iberia	676	80	425	1,965	361	51	-	3,558
South America	-	104	469	1,921	2,028	56	-	4,370
Argentina	-	1	142	157	46	-	-	344
Brazil	-	42	7	915	395	-	-	1,275
Chile	-	61	124	247	877	19	-	1,206
Colombia	-	-	51	406	544	37	-	1,038
Peru	-	-	145	196	156	-	-	497
Other countries	-	-	-	-	10	-	-	10
Europe and Euro-Mediterranean Affairs	12	1	233	152	115	3	-	516
Romania	12	1	-	152	62	3	-	230
Russia	-	-	233	-	1	-	-	232
Slovakia	-	-	-	-	-	-	-	-
Other countries	-	-	-	-	54	-	-	54
North and Central America	-	-	6	-	711	3	-	708
United States and Canada	-	-	6	-	398	3	-	395
Mexico	-	-	-	-	140	-	-	140
Panama	-	-	-	-	113	-	-	113
Other countries	-	-	-	-	60	-	-	60
Africa, Asia and Oceania	-	-	-	-	58	4	-	54
South Africa	-	-	-	-	54	4	-	50
India	-	-	-	-	9	-	-	9
Other countries	-	-	-	-	5	-	-	5
Other	-	11	26	20	115	16	201	159
Total	2,921	85	1,117	7,697	4,608	124	201	16,351

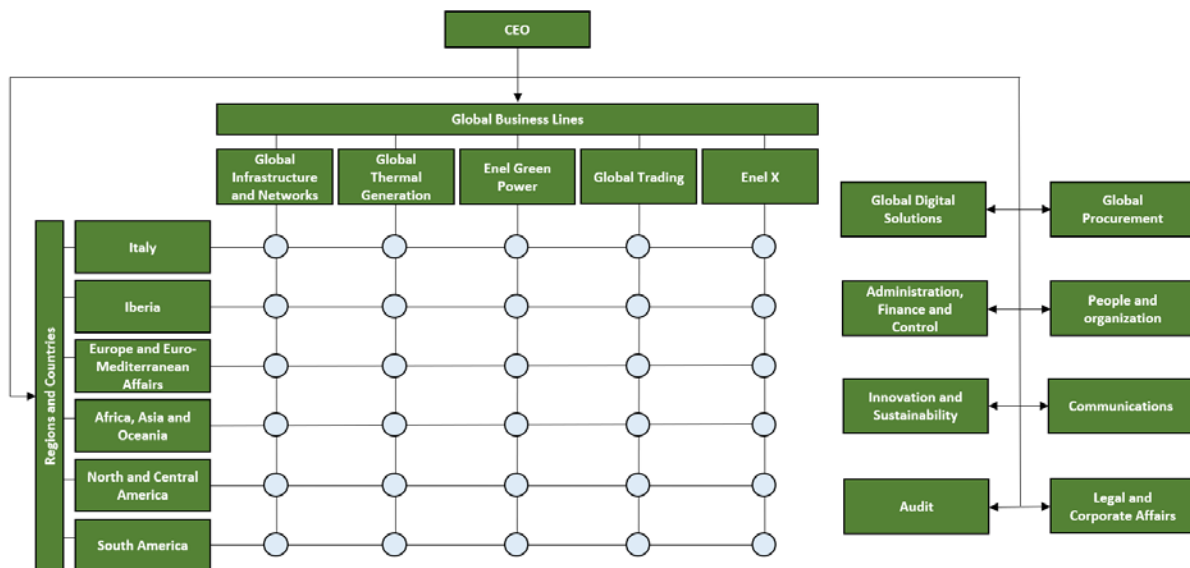
Source: Enel (2018b), *Annual report 2018*

Exhibit 7 Enel SDGs performance



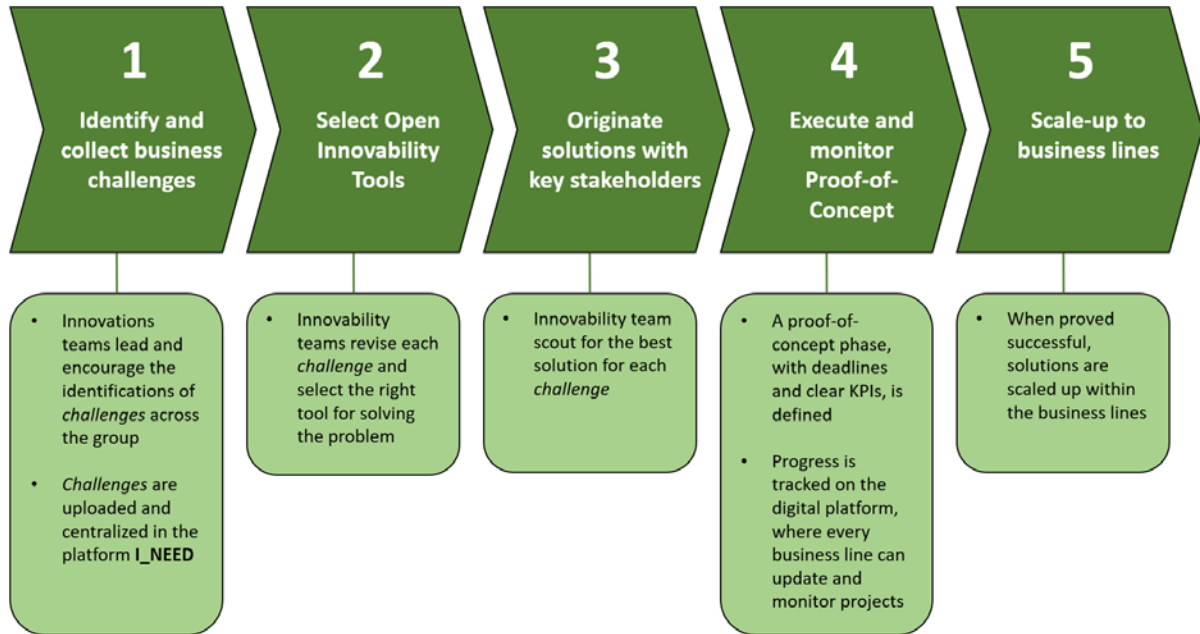
Source: Enel

Exhibit 8 Enel Group Organizational Structure



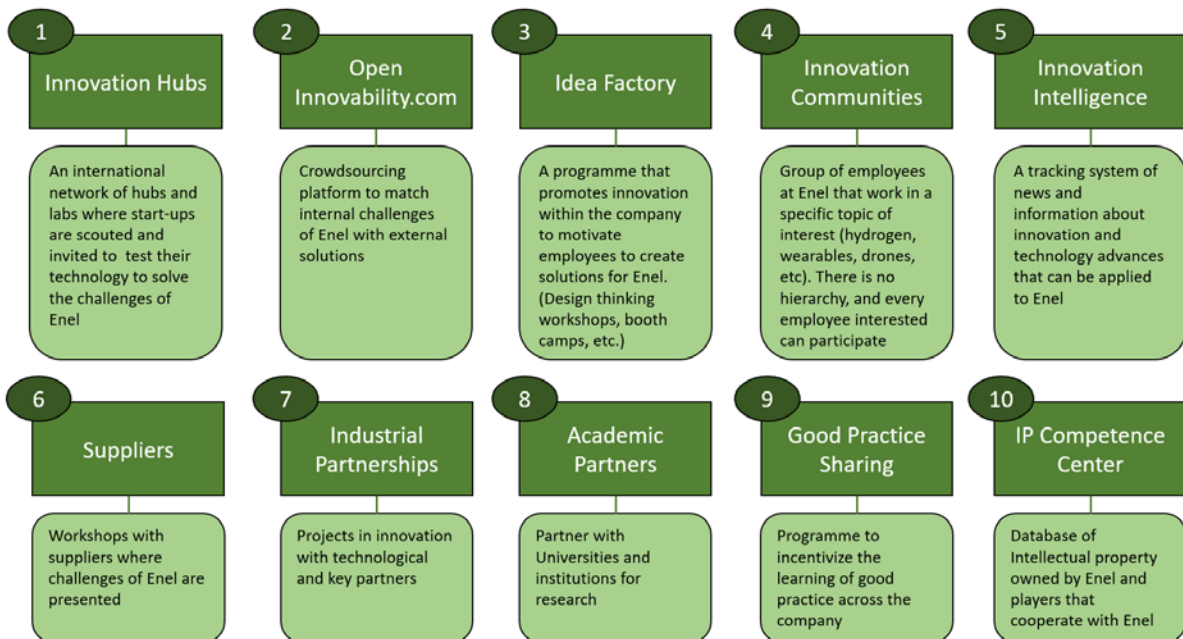
Source: Enel (2018b), Annual Report 2018.

Exhibit 9 Innovation Process at Enel



Source: Enel

Exhibit 10 Open Innovability tools at Enel



Source: Enel

Exhibit 11

Proposed Solutions Gathered by OpenInnovability.com by Country

Solutions proposed worldwide (2,611)					
Country	# Solutions	Country	# Solutions	Country	# Solutions
Italy	779	Canada	43	Egypt	15
USA	224	United Kingdom	42	Greece	15
Spain	192	Romania	42	Portugal	14
Colombia	157	Peru	36	Indonesia	14
Brazil	153	France	34	South Africa	13
Chile	125	Nigeria	32	Turkey	13
India	98	Ethiopia	23	Netherlands	13
Russia	58	Ukraine	23	Bulgaria	11
Israel	53	Germany	23	Saudi Arabia	10
Philippines	52	Mexico	20	China	10
Argentina	46	Guatemala	16	Other	212

Source: Enel

Exhibit 12

Projects Activated with Start-ups/SME at the Innovation Hubs

Country/Region		Italy	USA	Europe	Israel	Russia	Brazil	Chile	
Innovation Hub		Catania Pisa Milan	San Francisco Boston	Madrid	Tel Aviv Haifa	Moscow	Rio de Janeiro San Pablo	Santiago	Total
Area / Technology	Renewable Solar, Wind, Storage, Hydro, Marine, Geothermal, Hybrid	30	15	14	6				65
	Process Improvements & Automation IoT, Safety, Robotics, Drones, Predictive/Prescriptive Maintenance	14	8	11	6	4	3	2	48
	Digital Solution Cyber Security, Cloud, Image & Video processing, Chabot	15	3	8	1		1		28
	Network solution Smart Grid, Network management, Metering Technologies	1	2	8	8		2	1	22
	Home solution IoT, Energy Efficiency, New Products & Services	7	1	14	1		4		27
	Electric mobility	7	5	4					16
	Smart city	4	1	2	0		1		8
	Power Plant- efficiency & diagnostic Efficiency, flexibility, environmental monitoring, water management	6	2	2	3			1	14
	Market & Customer Experience	5	1	4			1	4	15
	Big Data & Analytics	1	2	5	0				8
	Artificial Intelligence	3	1	1	0			1	6
	Other HR Solution, Circular Economy,.....	2		2					4
Total		95	41	75	25	4	12	9	261

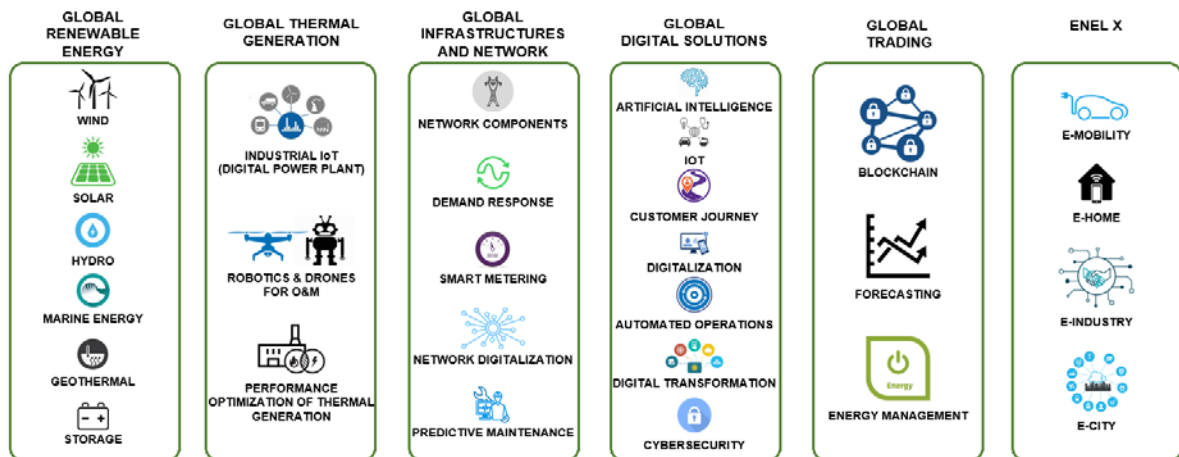
Source: Enel

Exhibit 13 Enel Stock Price



Source: Marketwatch website. Accessed October 05 2019 at <https://www.marketwatch.com/investing/stock/enel/charts?countrycode=it>

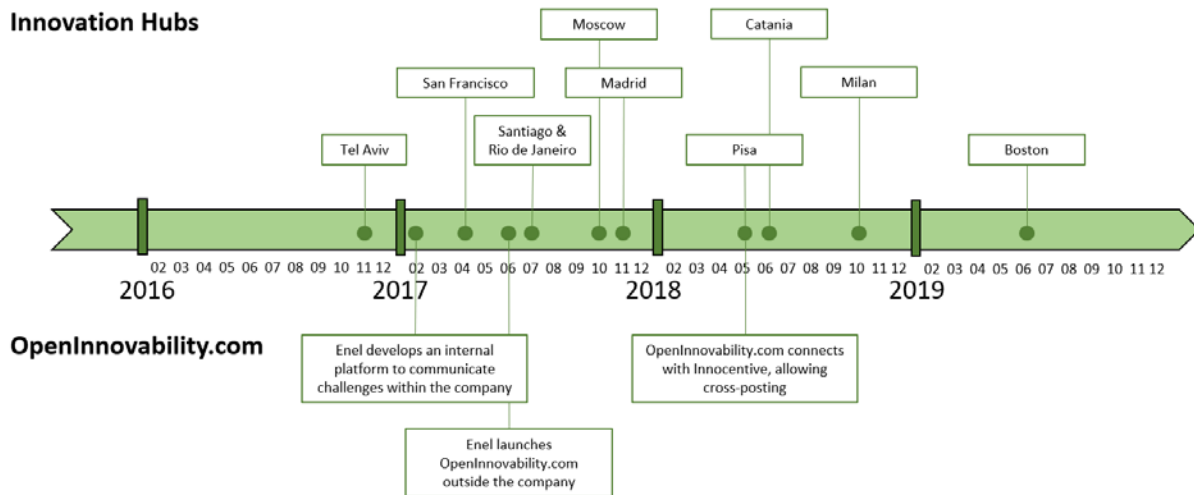
Exhibit 14 Areas of Interest of Enel by Business Line



Source: Enel

Exhibit 15

Timeline Innovation Hubs and OpenInnovability.com



Source: Enel

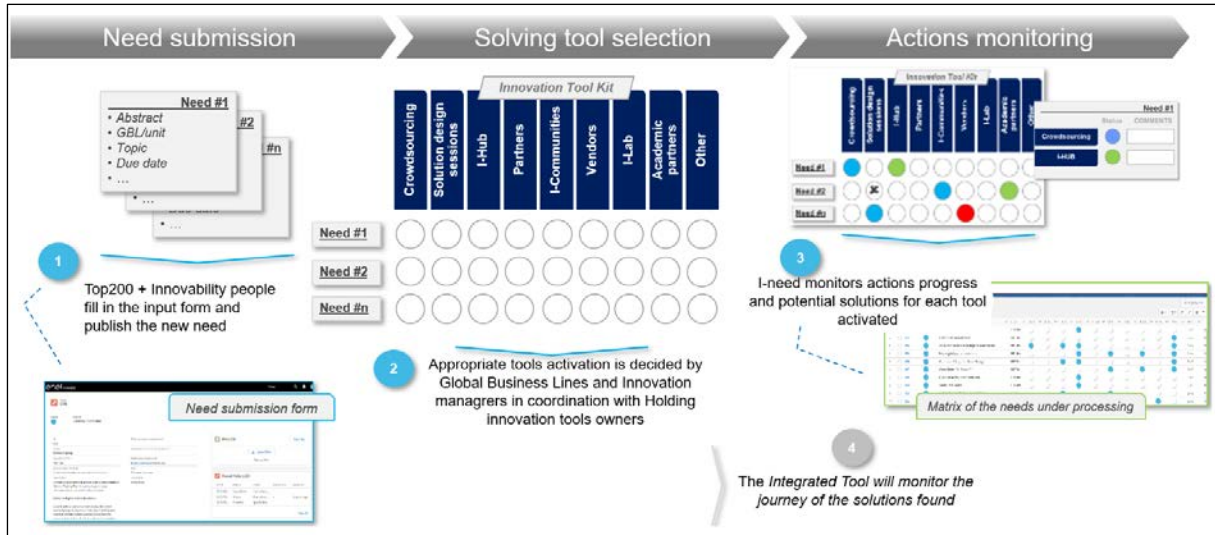
Exhibit 16

Map of Innovation Hubs



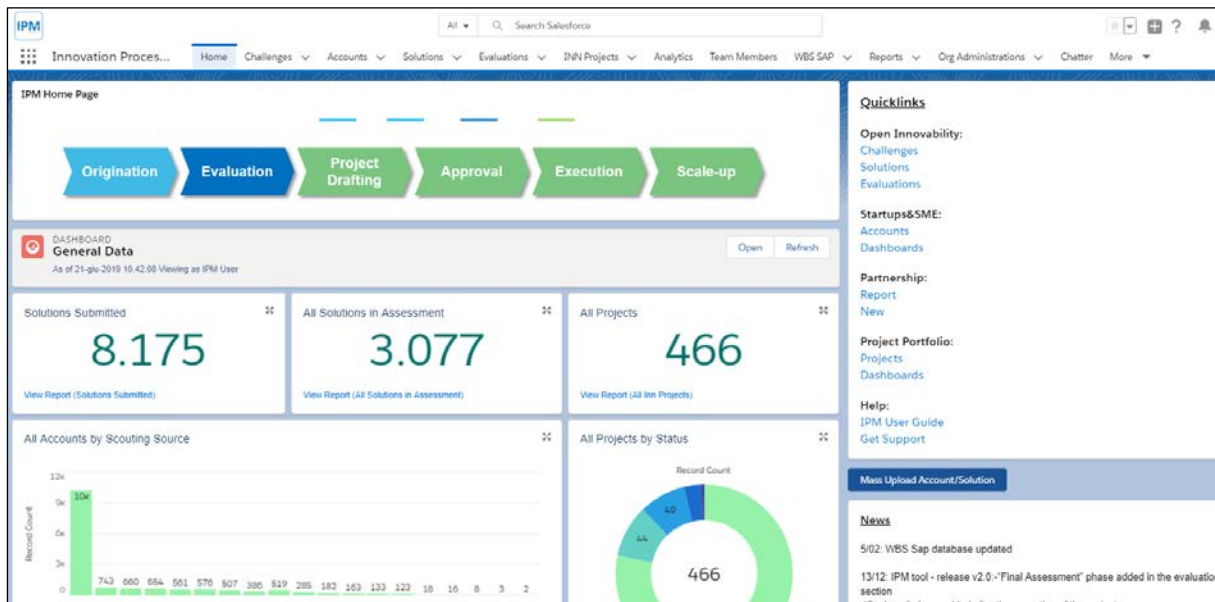
Source: Enel

Exhibit 17 "I NEED" Platform Description



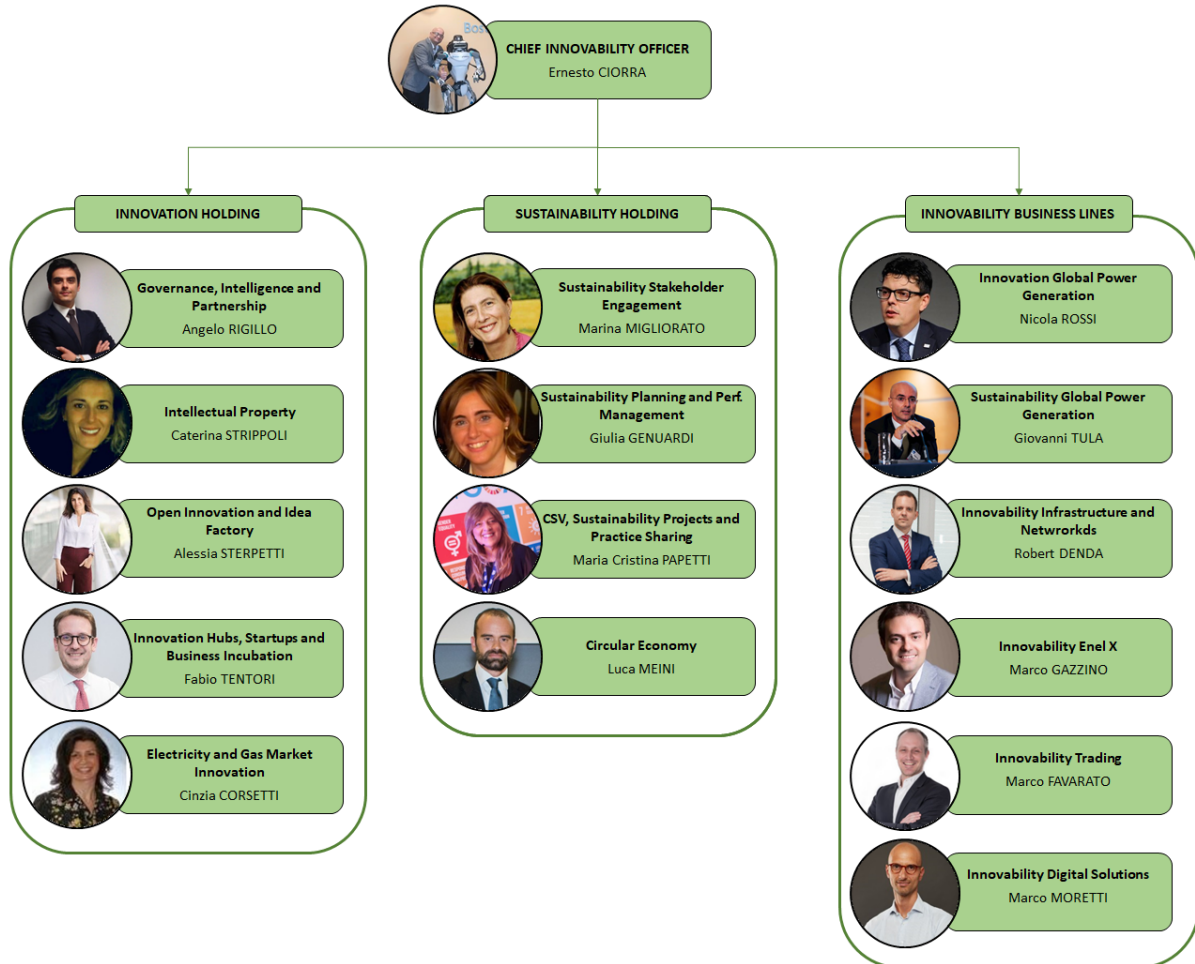
Source: Enel

Exhibit 18 Screenshot of Innovation Process Monitoring (IPM Tools)



Source: Enel

Exhibit 19 Innovability Department Org Chart



Source: Enel

Exhibit 20

Bios

Francesco Starace. CEO and General Manager of Enel S.p.A. since May 2014, he joined the Group in 2000 holding several positions including CEO and General Manager of Enel Green Power. His previous work experiences were in General Electric Group, ABB Group and in Alstom Power Corporation too. Member of the Advisory Board of the UN's "SE4All" initiative since 2014 and of the BoD of the UN's Global Compact since 2015. The European Commission appointed him Member of the "Multi-stakeholder Platform on the Implementation of the SDGs in the EU" in September 2017. On 31 May 2018, he was honoured as the Cavaliere del Lavoro, following the signing of the decree by the President of the Italian Republic. In September 2019, Mr. Starace accepted an invitation from the Rockefeller Foundation to become a member of the Global Commission to End Energy Poverty. Graduated in Nuclear Engineering from the Polytechnic University of Milan.

Francesca Di Carlo. Since July 2014 she is the Group's Head of Human Resources and Organization. In this role, she led a significant re-organization of the Group with the aim of integrating Enel's largest subsidiary - the Spanish listed Group Endesa, as well as its wide Latin America portfolio - into a single Group. Since mid-2017 she is also in charge of Enel's digital transformation, in order to transform processes and way of working in both mature businesses and markets by spreading Agile throughout the organization. The results achieved made Enel win the "Real Innovation Award" by London Business School in November 2017. She currently sits on the board of Enel Italia, Enel Cuore Foundation, Open Fiber - Italy's largest wholesale broadband operator - and Petrofac - leading international service provider to the oil and gas production and processing industry. She entered the Enel Group in September 2006 as Head of Corporate Strategy, before becoming Head of Audit in January 2008. Before entering the Enel Group, she held several roles in Telecom Italia Group and even before in UBS in London. She is graduated cum laude in economics at the Sapienza University of Rome.

Ernesto Ciorra is head of the Enel Group's Innovability. He began his career as a partner at consulting firm Busacca & Associati, helping the telecommunications business on a number of innovative projects. In 2003, Ciorra founded the consulting firm Ars et Inventio, which he headed up until taking up his current position. He supported the planning of the Chief Innovation Officer function at leading firms around the world, coming up with innovative ideas that have since become popular worldwide. Ciorra taught Innovation Management at several Italian and Spanish universities and was the scientific coordinator of the Masters in Innovation Management run by Italian newspaper Sole24Ore's Business School. He was a member of the advisory board of the Master in Innovation Strategy at Ca' Foscari University of Venice, and the director of the Advanced Innovation Management Programme at IE Business School in Madrid. He is the author of three collections of poems and a play that has been performed in several Italian theatres.

Fabio Tentori is head of Innovation Hubs, Startups and Business Incubation in Enel. Since 2017 Fabio is also the CEO of Enel Innovation Hubs srl, the innovation arm of Enel Group. He manages all collaborations with startups and SME within Enel Group and the presence in innovation ecosystems worldwide: Silicon Valley, Israel, Italy, Spain, Russia, Chile and Brazil. Since joining Enel in 2013, he has gained relevant experience in the energy innovation domain, covering several roles in the development of the residential energy services business in Italy. Prior to Enel, Fabio was an Engagement Manager within the strategy and corporate finance function of McKinsey & Company, based in Milan and in London. Fabio holds a MBA degree with honours achieved in 2010 at INSEAD, and graduated in Business Administration and Finance at the Università Cattolica of Milan. He often lectures innovation management at business schools, universities and at international events.