Technology Watch Newsletter

5G and advanced connectivity for the energy transition

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Technology Watch is the Elettricità Futura initiative to monitor global technology trends having the power sector at their heart. In our quarterly newsletter you will find an article with our analysis on a specific technology trend, an article by CESI, our partner for the initiative, and technology news from all over the world selected by Elettricità Futura.

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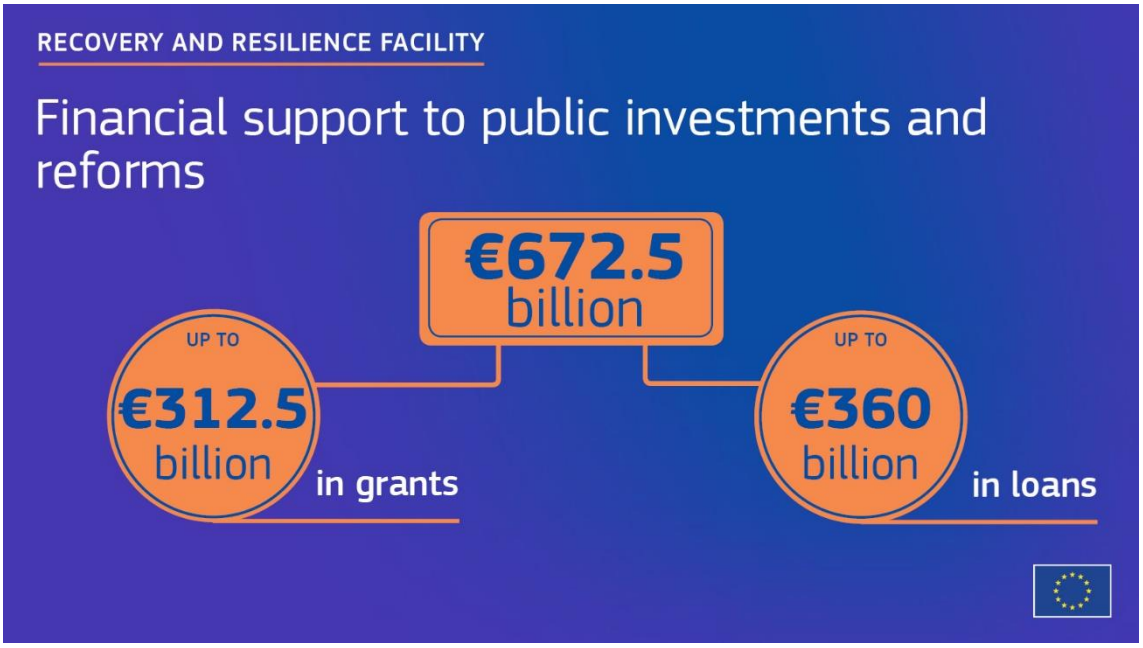
Green and Digital Transition

Author:

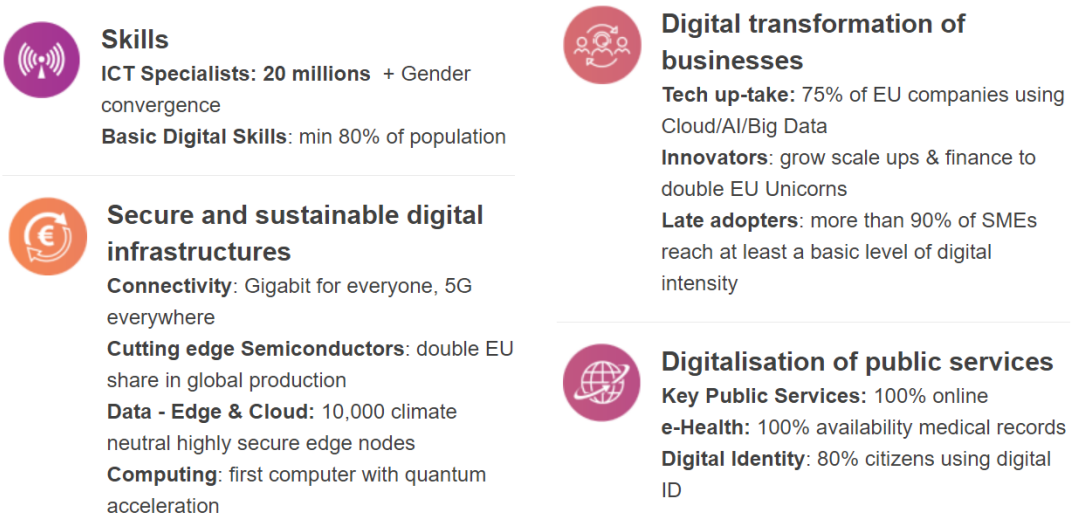
The NextGenerationEU package is a **€750 billion temporary recovery instrument** to help repair the immediate economic and social damage brought about by the coronavirus pandemic.

The Recovery and Resilience Facility: the centrepiece of NextGenerationEU with €672.5 billion in loans and grants available to support reforms and investments undertaken by EU countries. The aim is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions [1]. The Green Deal 2030 target (-55% greenhouse gas emissions by 2030 compared to 1990) will imply for Italy going from a 38% share of renewables over gross electricity consumption in 2020 to 70% by 2030, adding 65 GW of new renewable capacity compared to the 55 GW today, hence achieving a grand total 120 GW.



Member states will have to submit a National Recovery and Resiliency Plan obeying by specific rules, including a minimum 37% of expenditure for climate related investments and reforms and a minimum of 20% to foster the digital transition [2]. This unprecedented plan can effectively boost the development of a more digital EU.

On 9 March 2021, the Commission presented a vision and avenues for Europe's digital transformation by 2030. This vision for the EU's digital decade evolves around four cardinal points and specific objectives [3].



On 25 March 2021, the Member States, in close cooperation with the Commission, agreed on a Union-wide "Connectivity Toolbox". The Toolbox consists of a set of best practices that are considered as the most efficient in allowing and encouraging operators to roll out very high capacity networks, starting from fibre networks and 5G [4].

Such best practices have been defined to help network operators to reduce the cost of gigabit broadband deployment and Member States to adopt an efficient approach for ensuring timely and investment-friendly access to 5G spectrum to mobile operators and other users of spectrum, including for industrial applications. The swift implementation of the Connectivity Toolbox will enable Member States to fully exploit the potential of the Recovery and Resilience Facility. Earlier in March 2021 the Commission presented a Communication on Europe's Digital Decade that sets out the aim to connect all European households with gigabit speeds and to ensure 5G coverage for all populated areas in the EU as well as major transport routes.

The Connectivity Toolbox is the result of Member States' cooperation and commitment to remove obstacles and boost the deployment of very fast networks. 5G has been identified as one of the enabling technologies. For 5G network deployment, operators and users of spectrum for industrial applications should have timely access to EU-harmonised radio spectrum under pro-investment conditions. Member States are responsible for granting the authorisations for the use of spectrum, and should ensure that spectrum authorisation procedures are timely and that they encourage

further investment in 5G networks. In this regard, the Connectivity Toolbox focusses on measures that incentivise spectrum use and 5G rollout. In addition, the Connectivity Toolbox promotes coordinated measures that support wireless connectivity for industrial use cases, including with a cross-border dimension. Furthermore, the Connectivity Toolbox includes proposals for Member States to address general public interest, namely to increase transparency and information about 5G and public health protection.

The Member States are committed to start implementing the Toolbox as soon as possible. As a next step, according to the timeline laid out in the Connectivity Recommendation, Member States should prepare and share with the Commission by 30 April 2021 their national roadmaps to implement the Toolbox, timely matching the finalisation of the Member States´ recovery and resilience plans.

Digital opportunities are big part of the future for the European electricity sector and economy as a whole. Research promoted by ETNO (European Telecommunications Network Operators' Association) shows that 5G alone can generate €113 billion an annual GDP impact and 2.4 million new jobs in 2025 in Europe. Analysis shows also that €150 billion investment is still needed to achieve a full 5G deployment in Europe [5].

References:

[1] European Commission, https://ec.europa.eu/info/strategy/recovery-plan-europe_en#nextgenerationeu, 2021

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[3] European Commission, https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en, 2021

[4] European Commission, https://digital-strategy.ec.europa.eu/en/news/connectivity-toolbox-member-states-agree-best-practices-boost-timely-deployment-5g-and-fibre, 2021

[5] ETNO, Connectivity & Beyond: How Telcos Can Accelerate a Digital Future for All, 2021

Note: weblinks last accessed in April 2021

Impact and benefits of 5G for the energy sector

Author: CESI

CESI
Shaping a Better Energy Future

Digitization is forcefully entering our daily lives, laying the foundations for a smart future in which new technologies will enable a fully connected and home automated world. Precisely for this reason, the need for ever greater energy efficiency and a better response to user needs is leading to the adoption of new and increasingly advanced network technologies, which allow a fast and continuous exchange between consumer devices and utility. To ensure communications between millions of devices, it is therefore necessary to ensure safety and reliability. This is where fifth generation technologies come into play, the so-called 5G, which is also becoming the future of the energy sector.

What is 5G? Let us try to clarify this technology and the main characteristics that distinguish it. The International Telecommunication Union has established a series of requirements that 5G must guarantee, including a latency - understood as response time - of 1 millisecond, a transmission capacity of up to 10 Gbps (compared to 150 Mbps with 4G), the ability to establish up to 1 million connections per square kilometer, and a 90% energy reduction for the sensors used. Thanks to these features, the advent of fifth generation technologies also makes it possible to connect many devices at the same time; compared to 4G, a number of devices per unit area greater than 100 times can be connected.

Other features of the new network are 100% coverage, 99.999% availability, and battery life of up to 10 years. Finally, the last requirement associated with 5G technology is a 90% reduction in network energy consumption. The rapid transmission of data offered by 5G, capable of improving the user experience, will therefore allow fast downloads and access to broadband even in densely populated areas and by moving vehicles. Furthermore, the fifth generation technology will allow the remote control of infrastructures and the exchange of data between vehicles or robotic systems.

Following these peculiarities, 5G is well suited for use in the energy sector, in particular for utilities. Thanks to 5G, energy distribution will be faster and more efficient. In fact, the utilities will be able to collect data up to 20 gigabits per second and will be able to respond quickly and efficiently, given the exponential decrease in latency, close to 1 millisecond. In this way, energy suppliers

will obtain more timely, detailed data, with minimum latency, and distributed over greater distances. Thanks to 5G, suppliers will be able to develop huge databases, which will require intelligent sensors, capable of distributing energy when needed, using stored energy thanks to the latest technology development. Moreover, with the data held by the control centers, the sensors will also know how much energy the utilities will need, guaranteeing them a timely and adequate supply. In this way, the energy system will become more flexible and tailor-made for users.

The applications of 5G in the electricity sector can be divided into three categories. The first concerns sensors, part of the so-called Grid of Things which, by exploiting the low frequency band, will be able to guarantee extended coverage and lower energy consumption of the sensors, with a consequent reduction in related costs. These sensors can be applied to different devices such as smart meters, home automation for demand response, street lighting, charging columns, and smart grids. Through sensors, utilities will have the ability to collect even more precise data to allow optimized management of networks and consumption, both in terms of costs and performance.

A second area of application is that of the real-time operation of the electricity system and the control actions that the utilities implement to ensure its proper functioning. 5G, in fact, ensures very fast response times and very high reliability, crucial characteristics for the protection systems of the electrical network and for the dynamic response of its components.

Finally, the high data transmission capacity, characteristic of the high frequency band, will make it possible to take full advantage of augmented and virtual reality technologies, as well as the use of drones, essential elements in strengthening field operations aimed at maintenance, and asset monitoring.

At the same time, there are some implications of the large-scale adoption of 5G technology. First, with the pervasive presence of sensors that will enable the Internet of Things, we will have an unprecedented amount of data available. This already requires - and will require even more in the coming years - an adequate management of big data in order to be able to correctly collect the information available, avoiding the so-called "data tsunami." A second point of attention derives from the need to adequately update operating procedures and processes in order to correctly extract and correlate the information collected, also through techniques such as machine learning and data analytics.

Even in accessing the light poles, the race to 5G will prove to be fundamental; mobile and fixed telephony providers are installing increasingly smaller innovative cells, to facilitate wireless services that depend on wired backhaul. It is estimated that, in the United States alone, 800,000 cells will be built and installed by the end of 2026. It is precisely in this scenario that 5G fits, thanks

to which electric utilities can analyze, evaluate, and carry out a series of preparatory actions for installation of cells on street lamps: from remote monitoring to data management, from planning future interventions to protection from cyber-attacks. In the United States, EnerNex, the American subsidiary of the CESI Group, supported DSTAR (Distribution Systems Testing, Application, and Research), a US consortium of electrical services, in analyzing the impact of 5G on new street lamp installations. In fact, EnerNex is helping several American utilities in identifying the various opportunities of 5G and in developing the solutions necessary to make the best use of this technology.

Obviously, 5G will certainly require a net enhancement of cybersecurity, due to the increase in vulnerability that would inevitably manifest itself with the growth of connected devices. In order to minimize cyber threats, an effective solution would consist in resorting to the "Security by Design" principle, or designing the security of the infrastructure from the start, to avoid problems arising during normal operations. For example, the attacks on the grid in Ukraine in 2015 and the reports disclosed by Symantec on the intrusions of the "Dragonfly" group on more than 1,000 companies in the European electricity sector have highlighted that the critical energy infrastructure is threatened by potentially disastrous attacks. And even the United States is not immune to such threats, considering the recent SolarWind and Sunburst attack discovered in late 2020 which affected various sectors and government agencies, including the Department of Energy.

Fortunately, in Italy, thanks to the investments and skills put in place by the major national players, we have not so far suffered significant damage to the electricity infrastructures. But this does mean that it is necessary, today more than ever, to equip the utilities with rigorous processes and effective tools for managing digital security. Also in this area, we have joined forces with EnerNex colleagues who collaborate with some of the most important U.S. transmission and distribution operators in the implementation of the 'Critical Infrastructure Protection Program,' the federal program for the defense of sensitive infrastructures.

Finally, in recent years, IT security has also become a pervasive aspect of Operation Technology (OT) systems, particularly in the electricity sector. Through the collaboration between IT and OT, it is therefore possible to integrate new features by exploiting connectivity with the Internet and between systems, protect the network from incoming threats, and make it resilient in the event of cyber-attacks. In this regard, the analysis of U.S. and European standards and regulations for critical infrastructures are fundamental, with a focus dedicated to the electricity sector, as well as the initiatives to be implemented to meet the IT protection requirements: from the so-called cyber-risk assessment the risk notification procedures, passing through the subdivision of the network into sub-categories that can continue to function despite a party having been the victim of a cyber-attack.

Technology News Worldwide

HIGHLIGHT:

Leveraging the 5G network to wirelessly power IoT devices

Researchers at the Georgia Institute of Technology have uncovered an innovative way to tap into the over-capacity of 5G networks, turning them into 'a wireless power grid' for powering Internet of Things (IoT) devices. The breakthrough leverages a Rotman lens-based rectifying antenna capable of millimeter-wave harvesting at 28 GHz.

The innovation could help eliminate the world's reliance on batteries for charging devices by providing an alternative using excess 5G capacity.
LINK

- **#Solar:** According to researchers from Lancaster University, floating solar farms could help to protect lakes and reservoirs from some of the harms of climate change, a new study suggests. However, given the complex nature of water bodies and differing designs of solar technologies, there could also be detrimental ecosystem impacts of deploying floating solar arrays.
  Link

- **#Solar:** Engineers from Rice University design and build windowpanes that redirect sunlight or illumination from indoors to edge-band solar cells.
  Link

- **#Electric Mobility:** Volvo Plans to Sell Only Electric Cars by 2030. The Swedish company would phase out internal combustion engine vehicles faster than other automakers.
  Link

- **#Storage:** Researchers at the Georgia Institute of Technology found that densifying ceramics using flash sintering reduces energy use and may be used to improve the viability of manufacturing complex ceramic structures such as those required for solid state batteries by lowering the temperatures and shortening the duration of the heat treatment.
  Link

- **#5G:** A collaboration project between Rete Ferroviaria Italiana and the Ugo Bordoni Foundation called DINoS5G (Diagnostic Integrated Networks of Satellite and 5G) has obtained 2.6 million euro funding from ESA under the Artes (Advanced Research in Telecommunications Systems) program.
  Link

Note: weblinks last accessed in April 2021

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