

“THE INTEGRATION OF RENEWABLE ENERGY IN ITALY IS A MULTIFACETED CHALLENGE THAT REQUIRES ADDRESSING INFRASTRUCTURE, REGULATORY, MARKET, AND TECHNICAL ISSUES”



Renewable energy integration in Italy, as in many other countries, faces several challenges. Following the celebration of Energyyear Italy in Milan in October 2024, where INFOENERGETICS was Media Partner, we talked to UL Solutions, a global independent safety science company with more than a century of expertise innovating safety solutions, to learn about the main challenges facing the country's renewables market.

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UL Solutions transforms safety, security and sustainability challenges into opportunities for customers in more than 100 countries. The company delivers testing, inspection and certification services, together with software products and advisory offerings, that support our customers' product innovation and business growth. The UL Certification Marks serve as a recognized symbol of trust in our customers' products and reflect an unwavering commitment to advancing their safety mission.



What are the main Challenges of Renewable Energy Integration in Italy?

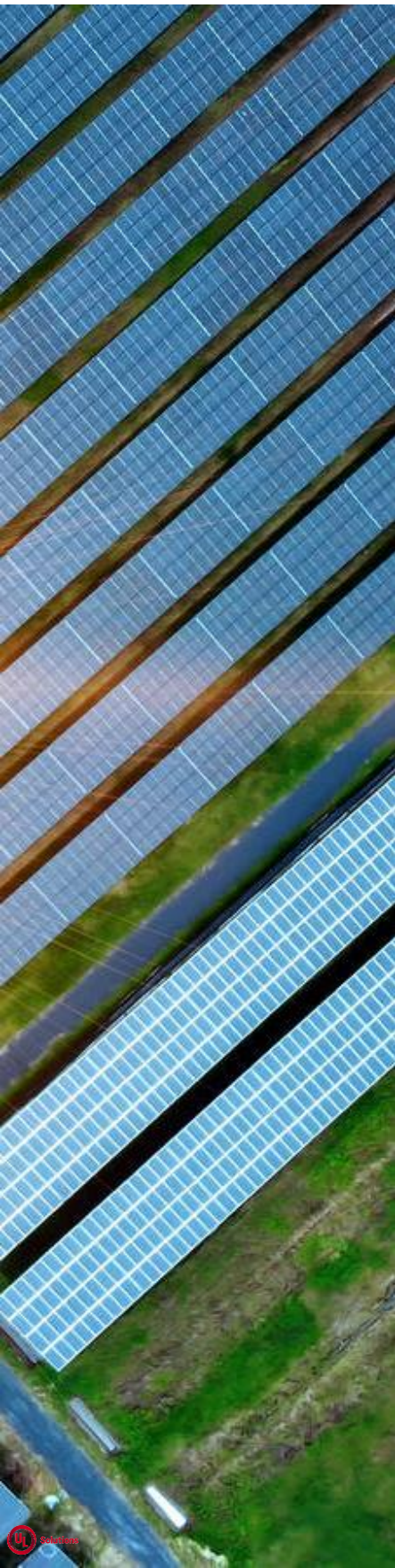
Renewable energy integration in Italy, as in many other countries, faces several challenges. First, we can talk about the Grid Infrastructure.

The **existing grid infrastructure** have not been designed to accommodate a high penetration of renewables, which are often variable and distributed in nature. Upgrading the grid to handle the intermittent supply while to maintain reliability and stability is a significant challenge as it means investments for the distribution and transmission system operator. Now most of the requests for grid integration of renewables are waiting reinforcement of the grid, especially at distribution level.

Also, establishing a **regulatory framework** that encourages investment in renewables while ensuring fair competition and grid reliability is complex. Italy has been working on this even by different incentive plans, but it's an ongoing process with room for improvement.



Another important challenge is **storage, flexibility and new paradigms**. As renewable generation increases, so does the need for energy storage and flexible demand response to balance supply and demand. Italy needs to invest in storage technologies, based on battery or hydrogen, and demand-side management to mitigate the variability of renewable energy sources. Having a closer point of distributed energy to the point of consumption can avoid grid congestion issues. The paradigm of “prosumers” (producers and consumers) which ten years ago was only in the literature now it is reality in the country.



Additionally, the **microgrid concept** of having facilities with local generation that can work independently from the main grid, is considered more and more in Europe. Climate changes in the region are further reinforcing the need for resiliency.

Integrating renewable energy into the **electricity market**, ensuring that there is a fair and efficient mechanism for pricing and trading renewable energy, is a challenge. This includes dealing with the legacy of feed-in tariffs and transitioning to more market-based mechanisms to avoid selling renewable energy without profitability.

Finally, ensuring **power quality, voltage regulation, and frequency control** with high levels of renewables requires advanced technical solutions and operational practices. Power plant controllers help the coordination of renewable energy sources.

What is the importance of Grid Code Compliance?

Grid code compliance is crucial for several reasons. Compliance with grid codes ensures that all connected systems operate within the parameters that maintain **grid stability and reliability**. In other words, grid codes enable the higher penetration of the distributed energy resources, which are mainly renewables, reducing risks of power discontinuity in the electrical system.

Also, interoperability ensures that different systems can work together seamlessly and interact with the grid operators, which is particularly important as the number of diverse DERs increases.

Grid codes are mainly performance standards, but they consider **safety functions**, like the anti-islanding, that protect both the grid infrastructure and the people who interact with it.

Finally, about efficiency, by standardizing the requirements for connection and operation, grid codes help to **streamline processes** and reduce the potential for inefficiencies or conflicts between systems.



What Role does Digitalization will play?

Digitalization is set to play a transformative role in the integration of renewable energy. **Digital technologies** enable more sophisticated grid management capabilities, including real-time monitoring and control, which are essential for integrating variable renewable energy sources. Solutions such as Distributed Energy Resource Management Systems (DERMS) are using “digital twins” of the different units to supervise and regulate the grid.

These digital tools can **predict when equipment needs maintenance** before it fails, reducing downtime and increasing the efficiency of renewable energy assets. Additional, data analytics and AI can leverage **big data analytics** can **optimize the operation** of renewable energy systems and the grid, improving decision-making and operational efficiency even by forecasting AI-based algorithms.

Also, **blockchain and smart contracts** can facilitate peer-to-peer energy trading and transparent, automated transactions, which can be particularly useful for distributed generation models.

UL Solutions' Support for Renewables

UL Solutions provides a **range of services** to support the renewable energy sector and grid code compliance:

- **Advisory Services:** Our experts provide guidance on renewables installation including grid code compliance, performance optimization, and risk management.
- **Software Tools:** We develop software solutions for design, simulation, and management of renewable energy systems including microgrids.
- **Simulation:** We provide model validation for units and simulation studies for power plants if asked by the local grid code or to support the utilities and the plant developers in understanding the impact of a grid integration. This service can speed up the integration process, increasing the confidence of the different operators.
- **Testing and Certification:** We offer testing and certification services to evaluate whether products meet regulatory requirements and industry safety standards for both the IEC and UL markets as a single source provider. UL Solutions has decades of experience in the renewables business, having supported over 200 renewable installations through our grid code compliance services for energy equipment and power systems. Nowadays, UL Solutions is accredited for more than 60 grid codes covering all the world.



In summary, **the integration of renewable energy in Italy is a multifaceted challenge** that requires addressing infrastructure, regulatory, market, and technical issues.

Grid code compliance is essential for maintaining a reliable and safe electricity system.

Digitalization offers tools for **better managing and optimizing renewable energy integration**, and UL Solutions supports the renewable sector through a variety of services for safety and grid code compliance with the aim to ensure safety, reliability, and performance.

