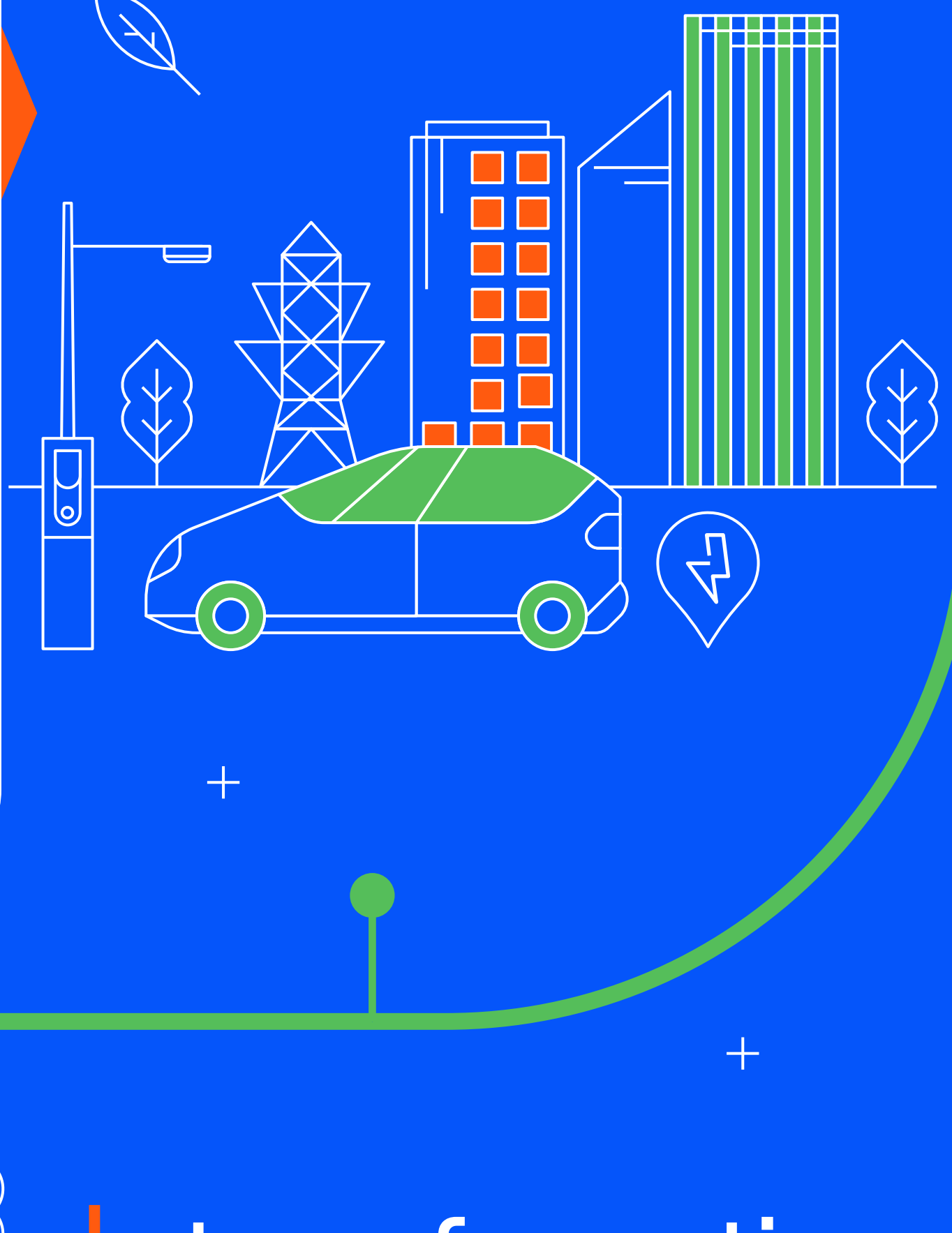


Flexibility Lab

towards flexible power distribution networks

+ decarbonization + renewable resources + electrification

As power systems are evolving driven by the increasing **electrification** on the **consumption side** (EV, heat pumps) and the **growing** share of **renewables** in the generation energy mix, enhanced capabilities and a new regulatory framework will be required to manage distribution networks and to achieve the **decarbonization targets** on the roadmap to a net-zero future.



+ transformation

The progress towards this new energy paradigm has required a **transformation** of traditional passive distribution networks into **smart grids**, combining the use of conventional equipment with the upcoming **digital solutions**, making the electricity network more effective in remote control and continuous **exchange of information** with connected **Distributed Energy Resources (DERs)**.

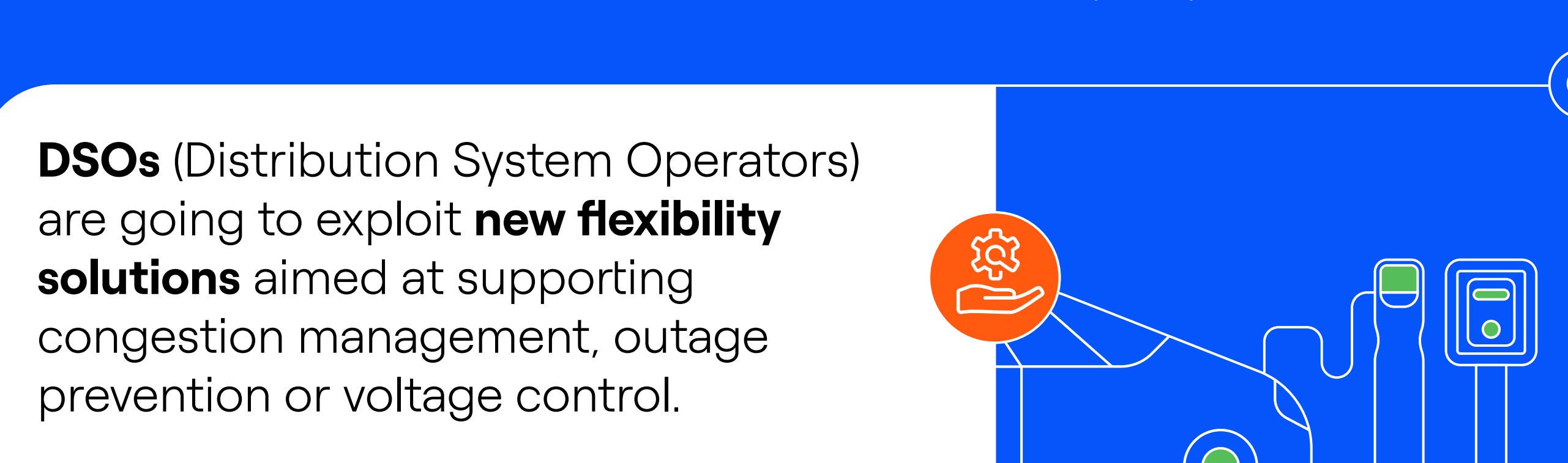
+ smart grid



▶ **DSOs** Distribution System Operators



+ digital solutions



DSO role for flexibility

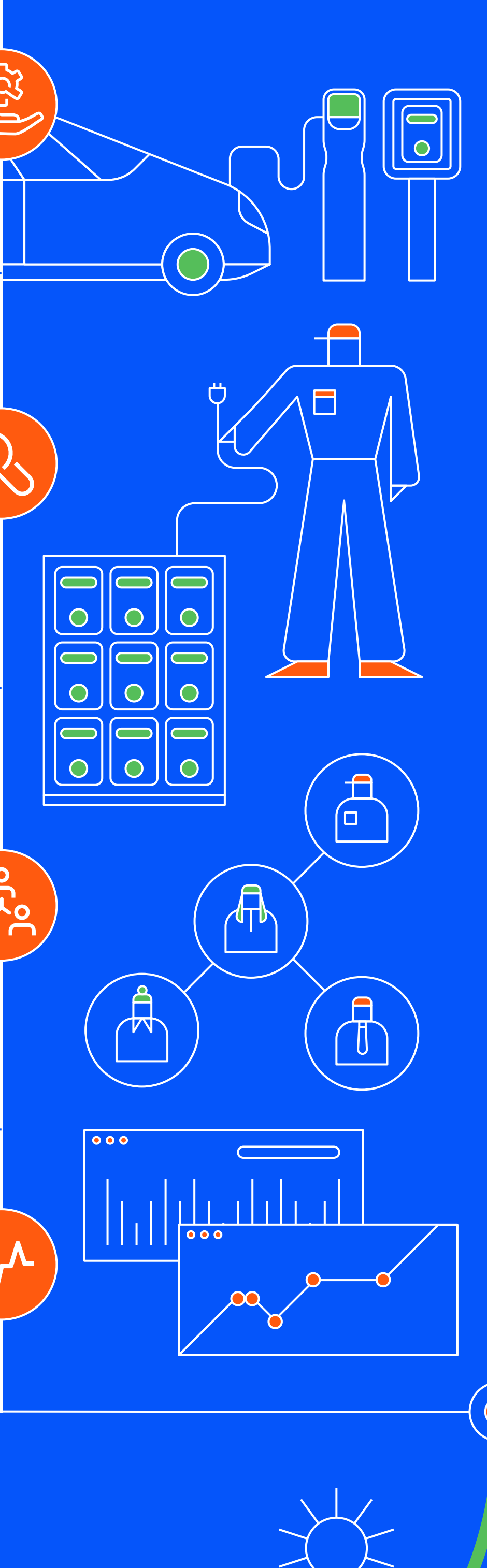
▶ **DERs** Distributed Energy Resources

DSOs (Distribution System Operators) are going to exploit **new flexibility solutions** aimed at supporting congestion management, outage prevention or voltage control.

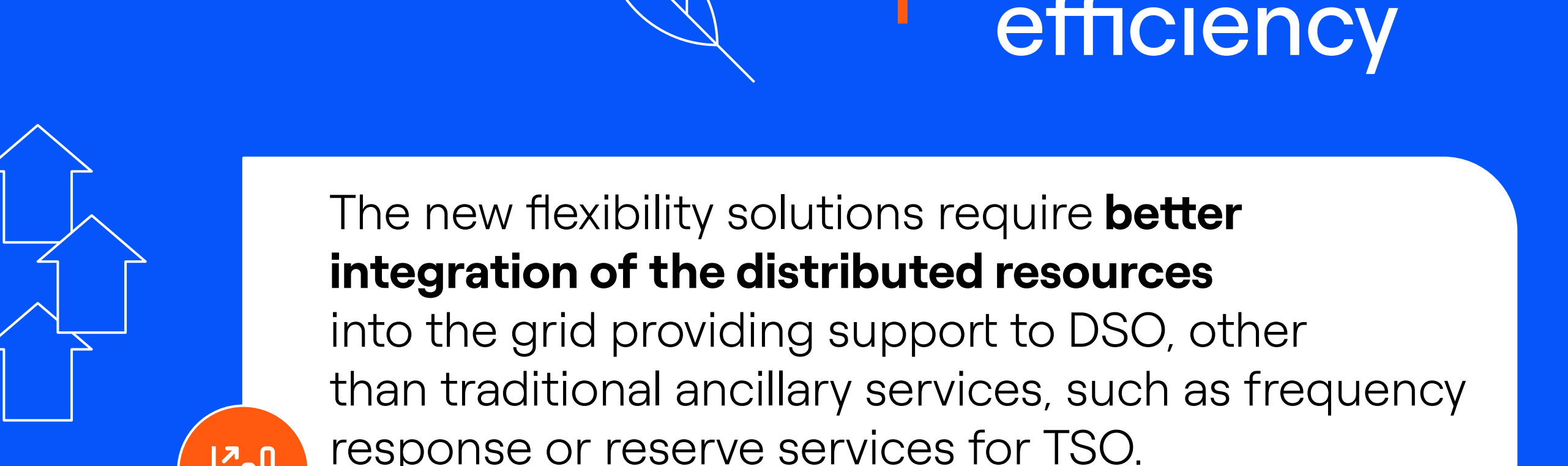
In this context, DSOs will be the **neutral facilitator** of **flexibility services** to be provided by **owners or aggregators of DERs** (such as stationary batteries, solar PV, EV charging station operators, etc.), or by **demand response mechanisms**.

The Enel Flexibility Lab is aimed at **enhancing collaboration** with **all stakeholders involved** on this path: **providers of flexibility services**, manufacturers of related technologies, energy communities, DSOs and TSOs (Transmission System Operators).

The interaction among all the players must be carried out in an orchestrated way to obtain a **reliable and value accretive local electricity system**.



+ interaction system



+ new services efficiency

The new flexibility solutions require **better integration of the distributed resources** into the grid providing support to DSO, other than traditional ancillary services, such as frequency response or reserve services for TSO. The **design of new flexibility services** for DSOs purpose, based on new market mechanisms to be implemented, should be pursued to cope with the requirements of the actors involved in the active operation of the distribution system.

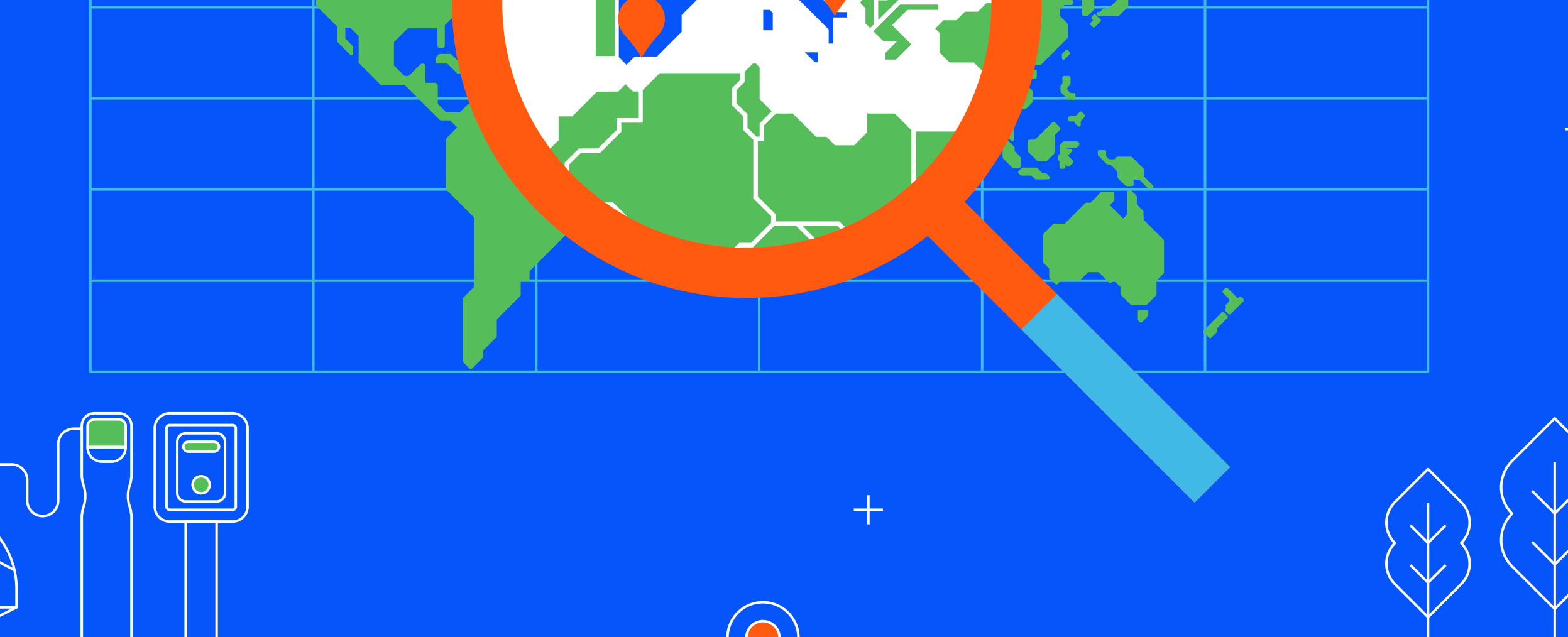
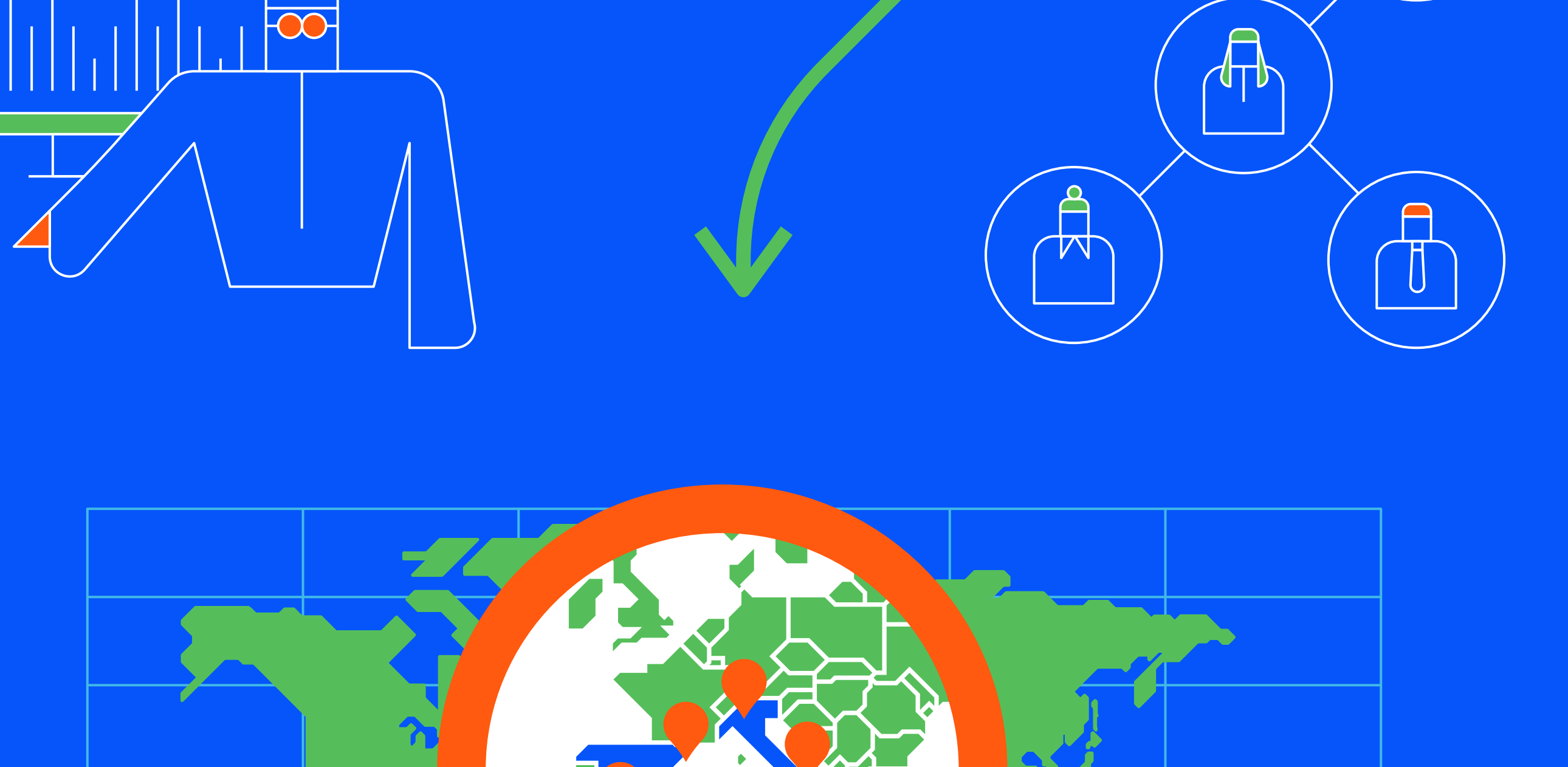
+ roadmap

+ laboratory

The Enel Flexibility Lab is open for collaboration in Italy and Spain

The **Milan** facility is specialized on medium voltage and **Bari** facility focuses on low voltage and microgrids. Both of them offer real-time digital simulation and emulation possibilities, stress-testing and system integration of the various flexibility resources, such as distributed generation monitoring, observability and regulation systems, electric mobility, storage systems and reactive power compensation systems.

The **Barcelona** hub where the Flexibility Control Center is located, monitors the different flexibility activities around Spanish regions and is equipped for electric mobility testing and vehicle to grid integration. The **Malaga** facility, located in a unique living lab scenario provided by the city's smart grid environment, offers a city's smart testing ground for demand modulation services.



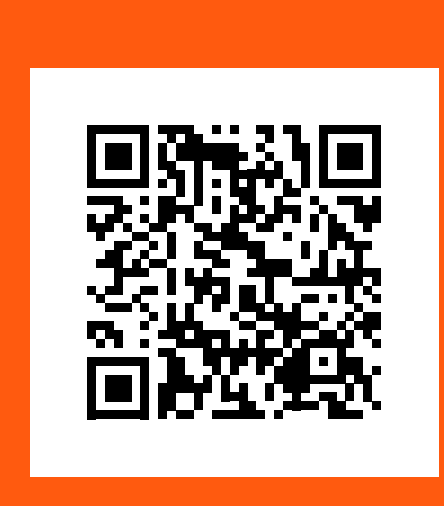
Testing services for devices, resources, and flexibility management systems

Through our **Flexibility Lab** we are interested in exploring the **development potential** of flexibility services for DSOs with the active participation of all stakeholders, making the following services available

- ▶ Testing on communication interfaces and protocols
- ▶ Support for the characterization of resources and flexibility devices
- ▶ Evaluating flexibility services configuration parameters
- ▶ Assessing the impact of configurations on networks, resources/devices
- ▶ Verify asset management software
- ▶ Security and interoperability testing

+ the advantages +

1. Assess the compatibility of interfaces/devices /resources with the provision of flexibility services
2. Define and test the correct operating parameters
3. Evaluate service delivery in different network configurations
4. Carry out stress tests under extraordinary operating conditions (e.g. climatic events, major disconnections, widespread fault events)
5. Simulate different adjustment scenarios and possible impacts on networks



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