Flexibility from the network: Puglia Active project

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C-distribuzione

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Route to excellence

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SAIDI: System Average Interruption Duration Index

Decarbonization effects on the Distribution grid e-distribuzione



23 GW of RES installed on the MV/LV Grid of e-distribuzione at the end of 2018, 94%* of the total RES Capacity installed on the MV/LV Italian grid. PNIEC forecasts 30 GW of PV and 10 GW of wind capacity at 2030: most of the new plants will be connected to the MV and LV networks, 23-25 GW are expected on the MV-LV e-distribuzione network.

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*24,5 GW of unpredictable RES are connected in Italy, at distribution level,

Key role of DSO in a changing energy system *e-distributione*



The distribution network will integrate all the actors actions in order to enable an efficient, economical and sustainable electricity system

DSO needs and targets

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- Minimum Load (difference between consumption and production) on the e-distribuzione Grid is constantly decreasing (3,4 GW in 2017)
- e-distribuzione is becoming an «equivalent producer» for the NTN (this phenomena is already ongoing in some Regions, es. Puglia)

*indicator of the operating conditions of the distribution network (high flexibility, constant and unavoidable increase)

SourceTerna (Italian TSO))

Future developments

- Strong increase of RES installation on the MV/LV e-distribuzione grid, starting from the 23 GW
- Load increase on the e-distribuzione grid due to electric mobility and electrification of consumptions
- Increasing problems due to the overcome of contractual voltage limits for MV-LV users (strong changes of voltage profiles along the line, due to the increasing of DER installed)

An evolution of the grid operation is needed

- The DSO must safely manage much more complex networks where the DERs provide flexibility services: certain GD break off in case of network maintenance is needed
- Real time monitoring of DER is needed by the DSO in order to estimate their state both for the operational planning and the dynamic optimization of the grid configuration
- From the "fit-and-forget" to the "fit-and-control" approach: DSO uses real-time flexibility services at local level in order to manage voltage regulation and solve local congestions
- New TSO-DSO cooperation models, validation of the flexibility services offered by the DER to the TSO is needed

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A more active role of the DSO is needed

Smart grid technology developed by e-distribuzione

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e-distribuzione has developed a real-time architecture since 2010, *compliant* to the Smart Grid IEC 61850 communication standard, enabling:

- Gathering of DER measures and parameters for observability purposes;
- Sending regulation Signals to DER (active and reactive power, cosφ)

This architecture enables:

- □ Maximizing the hosting capacity of the network
- Advanced management and real-time security of DERs for operational and maintenance purposes

The architecture has been tested in the Isernia, POI-P3, Grid4EU projects





MINISTERO DELL'AMBIENTE E DELLA TUTELA DEL TERRITORIO E DEL MARE

Puglia Active Network Project



PROGETTO

Puglia Active Network

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Overview



Pilot already implementable on the platform

Applications actually at disposal

□ Observability 2.0

Monitoring of resources connected to the distribution grid and forecasting of power fluxes

□ Advanced voltage control aiming at maximizing HOSTING CAPACITY of the grid

- Optimized control of PS MT busbar: already at disposal on Puglia Active Network platform.
- Volt/VAr regulation of producers by means of Energy Regulation Interface (IRE)

□ Regulation of Active and Reactive power produced through the Energy Regulation Interface (IRE)

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Advantages

Real-time monitoring of the distribution grid

Better integration of RES

Investment optimization in order to improve and empower the grid

Resolution of local network issues

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Flexibility from Network active agents: Voltage/VAR and active Power control



Real time monitoring of MV distributed generation Open platform for DG flexibility services

Puglia Active Network project E-Mobility



74 public charging infrastructures for electric vehicles perfectly integrated with the distribution network, located throughout the regional territory along the fast travel routes and in over 30 medium and low density countries.



- Open Charging infrastructure, interoperable and multivendor to accept customers from every energy trader
- Interconnection with neighboring regions, maximizing the efficiency of charging Infrastructures
- Simultaneous reloading of several vehicles for less impact on the territory and greater usability of the service

Electric mobility as a network DER

Puglia Active Network project E-Mobility Technology

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- Allows recharging of 2 vehicles at the same time
- •Allows recharging in AC at 22kW (cd Mennekes, type 2) and at 3 kW (cd Scame, type 3a)
- Guarantees a full charge in 1/2 hours (22kW socket)
- Guarantees a full charge in 6/8 hours (3kW socket)
- It is compatible with all electric cars on the market that recharge in AC
- Designed to be interoperable and multivendor (to accept customers with contracts from all energy vendors)





• Allows recharging of 3 vehicles at the same time

- Allows recharging in AC at 22kW-43kW (cd Mennekes, tipo 2) and at 50 kW DC (CHAdeMO and Combo2)
- Guarantees a full charge in 20-30 minutes
- It is compatible with all electric cars on the market
- It extends the travel range by offering the opportunity to travel beyond municipal and regional boundaries
- Designed to be interoperable and multivendor (to accept customers with contracts from all energy vendors)

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LV Customers Demand Response

During the Project deployment, 10.000 LV customers living in Apulia Region are equipped with the Smart Info. The Smart Info enables customers to access their consumption information in order to organise more efficiently the use of appliances and heating and cooling devices.



Customer energy consumption awareness increasing

Future role of distribution network

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2G Electronic Meter

Enabling new value-added services, open protocol

Optical Fiber

□ Improved TLC performance

□ Advanced Automation (IoT, Smart Fault Selection)

- □ 15 minutes daily load curves
- **advanced network management**

Resilience

- □ Probabilistic analysis of network risk
- □ impact evaluation of extreme events
- response capacity in emergency conditions

Electric Mobility Uehicle-to-Grid Fast-Charge Distributed Storage

Secondary substation as data hub Sensors network loT Hub Multi-metering

Renewables Integration

- □ Voltage Control
- □ Congestion resolution
- Monitoring and Remote control
- □ Storage and Microgrids

Active Demand

Energy Management System for energy efficiency and flexibility services for customers, market, network

Open platform for flexibility

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Thank you