

## CONCEPT GRID

 A unique testing facility dedicated to “smart” equipment and solutions

The experimental platform “ Concept Grid ” allows a wide range of experiments for preparing tomorrow’s networks.

This particular design places it mid-way between laboratory tests and experiments in the field. Concept Grid offers the possibility to create and conduct, in complete safety, complex testing campaigns which would be impossible to perform on a real network.



Concept Grid is a real “ smart ” distribution network representative of a real electric system from the primary substation to residential appliances.

The MV network consists of 3 km of underground cables and overhead lines, to which are added 120 km simulated by RLC banks. Three different neutral point treatments can be selected according to needs. Five secondary substations allow the energy to travel over 7 km of LV network which can be connected to a motor generator or a power amplifier. Coupled with a real-time simulator, the amplifier allows us to generate complex generation or power consumption scenarios.

**A complete set of loads and distributed energy resources are connected: PV panels, micro-wind turbines, remote controlled household appliances, terminals for electrical vehicle charging, storage systems,...**

Concept Grid is an advanced integration and investigation platform powered by the skills and expertise of EDF’s R&D teams, in order to improve and validate our customers solutions.



## CONCEPT GRID

|                    | ELEMENTS                                  | DESCRIPTION  | COMMENTS   |
|--------------------|---|--|--|
| ARCHITECTURE       | Networks                                  | 7 km LV<br>3 km MV<br>120 km MV simulated (RLC)  | Flexible underground cable and overhead lines network  |
|                    | Station                                   | One primary substation (20 MVA transformer)<br>Five secondary substations HTA/BT from 250 to 1,5 MW<br>1 transformer H61 (160 kW)                                      | Vacuum breakers<br>Transformer with amorphous sheet steel  |
|                    | Residential area                          | 5 sample houses<br>Charging terminals for electrical vehicles (Normal and fast ..)<br>PV, micro wind generator   | Linky smartmeter structure on the whole district   |
|                    | Storage system (SS)                       | Li-ion battery (50 kW;106 kWh)<br>Supercapacity (70 kW)<br>Li-ion battery (160 kWh)<br>Hydrogen system   |  |
|                    | Ultra fast charging testing platform (EV) | Capability to connect and supply<br>High power charging stations for EV up to 1,5MW .<br>Dedicated concrete surface of 160 square meters to welcome different chargers |  |
| DISTURBANCES       | MV Networks                               | Faults   | Overhead and underground<br>Single-phase to earth, line to line, Three-phases<br>3 Neutral treatments: impedant, compensated, active |
|                    | LV Networks                               | Motor generator  | 50 kVA (generating or absorbing)<br>Voltage disturbance ( $\pm 11\%$ Around Un)<br>Frequency disturbance ( $\pm 3$ Hz Around 50 Hz)  |
|                    |   | Power amplifier  | 120 kVA (source) / 60 kVA (load)<br>Voltage, current and frequency<br>Creation of harmonics up to 25 kHz                             |
|                    |   | Short-circuit  | Line to ground, line to line, three phase  |
| TELECOMMUNICATIONS | Mono-mode optical fiber                   | SCADA (61 850)<br>Data transfer by IP-MPLS   | Supervision, remote control<br>Measures, advanced grid supervision functions   |
|                    | Power Networks                            | PLC communication  | Linky smartmeter Structure-Load control  |
|                    | Wireless                                  | Study of any protocols (in particular resistance to a disrupted electric environment   | Remote controlled switches<br>Sensors  |

### Real-time simulation

| FONCTION      | DESCRIPTION   |
|---------------|---|
| Simulation    | OPAL-RT licence, Real time, Up to 8 cores, P-HIL compatible   |
| Amplification | four quadrants linear amplifier, 3 modes (U, I, Z), 120 kVA (source) / 60 kVA (load) → unique !<br>P-HIL compatible |

