


## 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 distribution grids.

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 grid.



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

The MV grid consists of 3 km of underground cables and overhead lines, to which are added 120 km simulated by RLC banks. Three different grounding system can be selected depending on to needs. Eight MV/LV transformer stations allow the energy to travel over 7 km of LV grid which can be connected to a motor generator or power amplifiers. Coupled with a real-time simulator, the amplifiers allow 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, Electrical Vehicle (EV) charger, heat pumps, storage systems, resistive loads...



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	Grids	7 km LV 3 km MV 120 km MV simulated (RLC)	Flexible underground cables and overhead lines
	Transformer Station	One HV/MV station (20 MVA transformer) Seven MV/LV station ranging from 250 to 1,6 MVA 1 transformer H61 (160 kVA)	Vacuum breakers Transformer with amorphous sheet steel
	Residential area	5 sample houses Charging terminals for electrical vehicles (Normal and fast...) PV, micro wind generator	Linky smartmeter structure on the whole district
	Storage System (SS)	LV Li-ion Battery (33 kW, 50 kW, 160 kW, 280 kW) SS MV Li-ion Battery (750 kW)	Grid-forming and grid-following operation Tests possible with the hydrogen platform
	Ultra fast charging testing platform	Dedicated concrete surface of 160 m <sup>2</sup> to test different chargers	Capability to connect and supply high power charging stations for EV up to 1,6MW
PERTURBATIONS	MV Grid	Faults	Overhead and underground Single-phase to earth, line to line, Three-phases 3 grounding system: impedant, compensated, active
	LV Grid	Motor generator	On demand
		Linear power amplifier	120 kVA (source) / 60 kVA (load) Voltage, current and frequency disturbances Creation of harmonics from 40 Hz up to 25 kHz
		Switching power amplifier	400 kVA (source and load) Voltage, current and frequency disturbances Creation of harmonics from DC up to 25 kHz
		Solar farm	Simulation of PV production with real inverter up to 30 kWc 160 kWc of PV production available
		Short-circuit	Line to ground, line to line, three phase
	DC Grid	Switching power amplifier	400 kW (source and load) in monopolar configuration, up to 800 V DC 200 kW (source and load) in monopolar configuration, up to 1500 V DC
2 DC power supply		15 kW (source or load) from 0 up to 1500 V DC Voltage and current disturbances	
TELECOMMUNICATIONS	Mono-mode optical fiber	SCADA (61 850) Data transfer by IP-MPLS	Supervision, remote control Measures, advanced grid supervision functions
	Power grid	PLC communication	Linky smartmeter structure Load control
	Wireless	Study of any protocols (in particular resistance to a disrupted electric environment)	Remote controlled switches Sensors

### Real-time simulation and energy management

FONCTION	DESCRIPTION
Simulation 	OPAL-RT licence, Real time, Up to 8 cores, P-HIL compatible
Amplification 	2 amplifier four quadrants, 3 modes (U, I, Z), up to 400 kVA, P-HIL compatible
EMS	Development and test of control algorithms

