ELECTRA

European Liaison on Electricity Committed Towards long-term Research Activities for Smart Grids
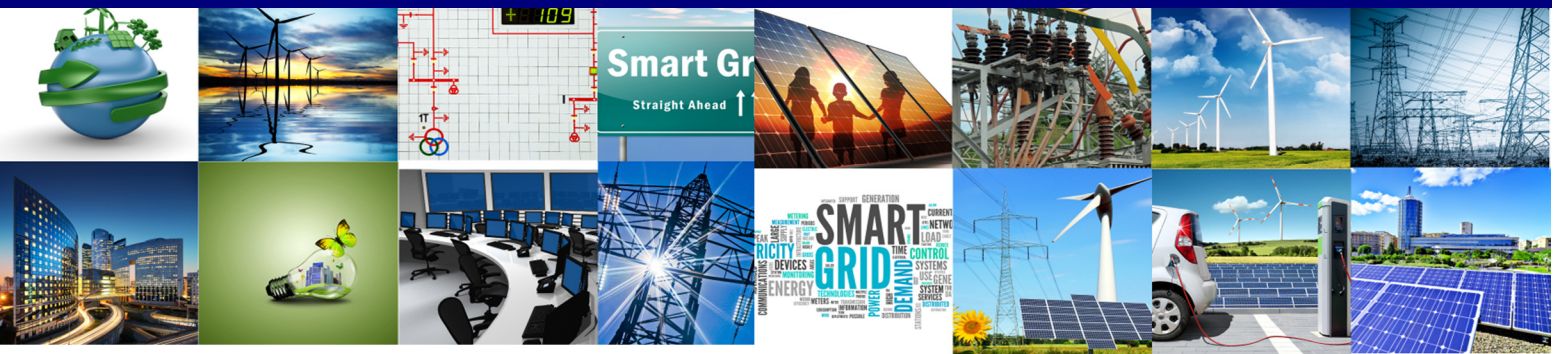
WP 5

Increased Observability

Deliverable 5.2

Functional description of the monitoring and observability detailed concepts for the Distributed Local Control Schemes

<Annex: Summary of SRPS candidates>

20/12/2015

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1 Overview

Suitable test grid models, or even whole power system models, must be selected in order to be able to represent the theoretical as well as the empirical developments coming from the ELECTRA project. The election of a common power system model to avoid contradicting of obsolete information in reporting formats or software implementations is essential to guarantee the interoperability of the results obtained by the partners. This common power system model receives the name of Single Reference Power System (SRPS). The SRPS presents as the main advantage the implementation of the power system as power simulation software independent. In this way, the partners are allowed to use the software packages they are more comfortable with. To get extra information about the definition and objectives of the SRPS in ELECTRA, see deliverable D5.1 [3]

As mentioned in section 2.2.1.2, SRPS candidates have been identified by means of a survey distributed among partners. This second survey was trying to pick up all the relevant information about known test grids and test grids repositories to be analysed in ELECTRA for building the SRPS concept.

In the next sections, the main characteristics about the single test grids (14) or repositories (5) assembled from the survey is summarized and presented by using a common template.

2 Single test grids

2.1 NH-Grid

Identifier	NH-Grid
Data privacy	Restricted
Number of nodes	Variable (ten thousands)
Voltage levels	MV & HV
Grid scheme	-
Steady-state studies based on available data	- Power flow - Short-circuit
Transient regime studies based on available data	- Slow transients - Electromechanical - Electromagnetics - Phasor - Continuous mode - Three-phase unbalanced
DER models available	No
Data format/Software	Simulink/SimPowerSystems

2.2 HV benchmark TN

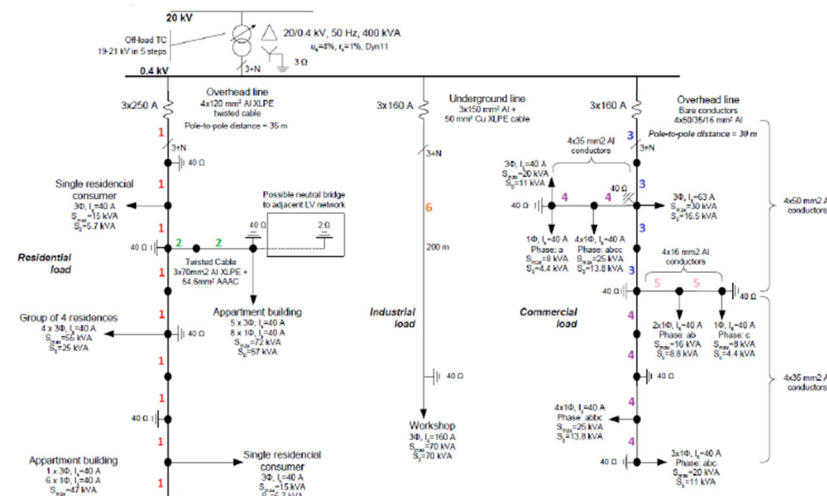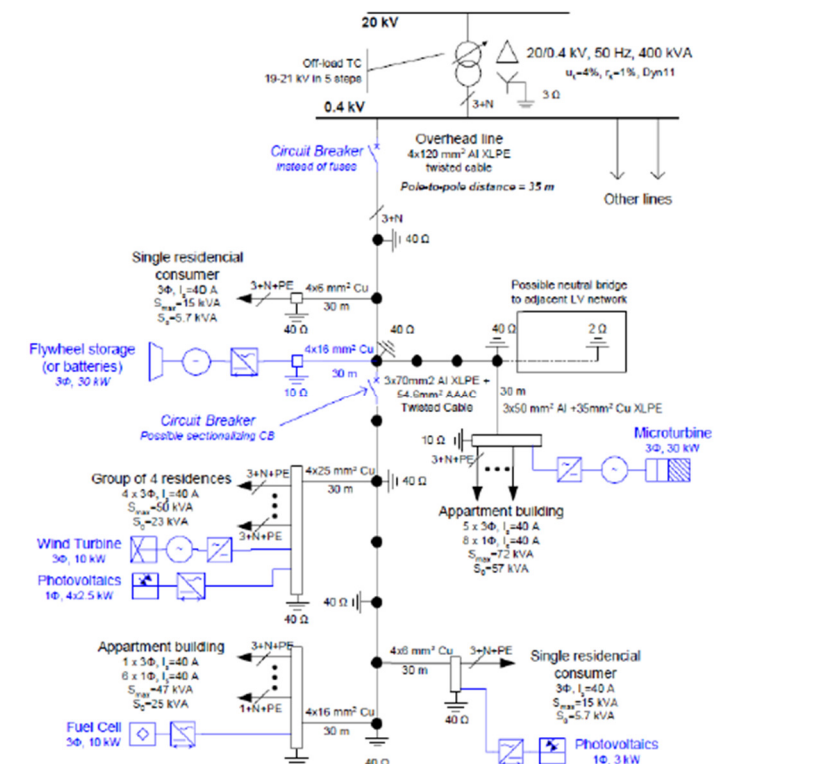| Identifier	HV benchmark TN
Data privacy	Public
Number of nodes	13
Voltage levels	HV
Grid scheme	
Steady-state studies based on available data	• Power flow • Short-circuit
Transient regime studies based on available data	• Slow transients • Electromechanical • Electromagnetics • Phasor • Continuous mode
DER models available	Yes (Wind, hydro)
Data format/Software	.pdf
Link	http://www.e-cigre.org/Order/select.asp?ID=16639 (free downloadable as CIGRE member)

2.3 MV benchmark DN

Identifier	MV benchmark DN
Data privacy	Public
Number of nodes	30
Voltage levels	MV

Grid scheme	
Steady-state studies based on available data	- Power flow - Short-circuit
Transient regime studies based on available data	- Slow transients - Electromechanical - Electromagnetics - Phasor - Continuous mode
DER models available	Yes (Wind, PV, storage and CHP)
Data format/Software	.pdf Google folder: CIGRE MV & LV Grids (Provided by AIT): - PowerFactory - PSSE - SRPS
Link	- Cigre Task Force C6.04, "Benchmark Systems for Network Integration of Renewable and Distributed Energy Resources", Report No. 575, April 2014. - http://www.discern.eu/datas/DISCERN_WP6_D6.1_Identification_of_the_scenarios_and_distributed_intelligence.pdf

2.4 LV benchmark DN

Identifier	LV benchmark DN
Data privacy	Public
Number of nodes	2 main buses
Voltage levels	LV

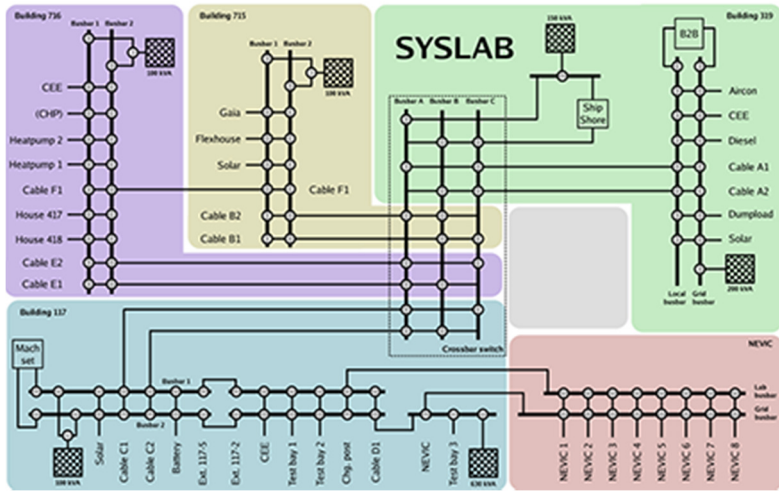| Grid scheme	• LV benchmark / One-line diagram
	• Residential feeder with DER resources
Steady-state studies based on available data	• Power flow • Short-circuit
Transient regime studies based on available data	• Slow transients • Electromechanical • Electromagnetics • Phasor • Continuous mode • Single-phase • Three-phase unbalanced

DER models available	Yes (Wind, PV, storage and microturbine)
Data format/Software	.pdf Google folder: CIGRE MV & LV Grids (Provided by AIT): - PowerFactory - PSSE - SRPS
Link	• Cigre Task Force C6.04, "Benchmark Systems for Network Integration of Renewable and Distributed Energy Resources", Report No. 575, April 2014. • http://www.discern.eu/datas/DISCERN_WP6_D6.1_Identification_of_the_scenarios_and_distributed_intelligence.pdf

2.5 (IEEE) MV/LV European Reference Grids

Identifier	(IEEE) MV/LV European Reference Grids
Data privacy	Public
Number of nodes	tbd
Voltage levels	MV/LV
Grid scheme	tbd
Steady-state studies based on available data	• Power flow
Transient regime studies based on available data	Limited by used software
DER models available	Yes (small hydro, PV, wind), as negative load (profile-based behaviour of the mentioned DER's; no detailed component models.)
Data format/Software	PowerFactory, PSSE
Link	tbd

2.6 SYSLAB

Identifier	SYSLAB
Data privacy	Restricted
Number of nodes	17
Voltage levels	LV

Grid scheme	
Steady-state studies based on available data	• Power flow • Short-circuit
Transient regime studies based on available data	• Slow transients • Electromechanical • Phasor • Single-phase
DER models available	Yes (Wind, PV, storage, diesel, EV and flexible loads)
Data format/Software	PowerFactory
Link	http://www.powerlab.dk/Facilities/SysLab/Technical-Specifications

2.7 CIM IOP

Identifier	CIM IOP
Data privacy	Public
Number of nodes	60 / 100
Voltage levels	HV
Grid scheme	-
Steady-state studies based on available data	• Power flow
Transient regime studies based on available data	-
DER models available	No

Data format/Software	CIM
Link	https://groups.yahoo.com/neo/groups/cimxml

2.8 Nodes

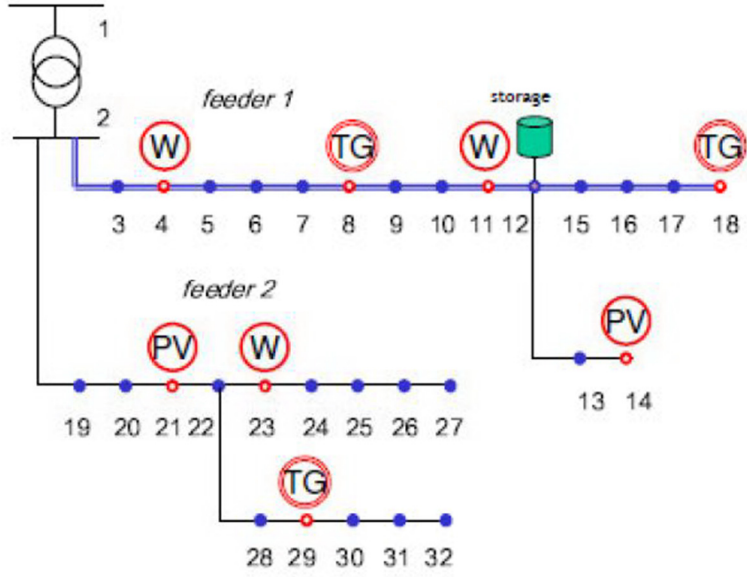| Identifier	32 nodes
Data privacy	Public
Number of nodes	32
Voltage levels	MV
Grid scheme	
Steady-state studies based on available data	● Power flow ● Short-circuit
Transient regime studies based on available data	● Slow transients
DER models available	Yes (Wind, PV, storage and microturbine)
Data format/Software	Excel, Matpower, CIM, PowerFactory
Link	http://www.rse-web.it/documenti.page?RSE_originalURI=/documenti/documento/314220&RSE_manipulatePath=yes&country=ita

2.9 FIN_MV_OverheadGrid

Identifier	FIN_MV_OverheadGrid
Data privacy	Restricted
Number of nodes	1
Voltage levels	MV
Grid scheme	-
Steady-state studies based on available data	- Power flow - Short-circuit - Power quality studies
Transient regime studies based on available data	- Slow transients - Electromechanical - Electromagnetics - Phasor - Continuous mode - Single-phase - Three-phase unbalanced
DER models available	No
Data format/Software	PSCAD

2.10 FIN_MV_CableGrid

Identifier	FIN_MV_CableGrid
Data privacy	Restricted
Number of nodes	1
Voltage levels	MV
Grid scheme	-
Steady-state studies based on available data	- Power flow - Short-circuit - Power quality studies
Transient regime studies based on available data	- Slow transients - Electromechanical - Electromagnetics - Phasor - Continuous mode - Single-phase - Three-phase unbalanced
DER models available	No

Data format/Software	PSCAD

2.11 FIN_LV_Grid

Identifier	FIN_LV_Grid
Data privacy	Restricted
Number of nodes	2
Voltage levels	LV
Grid scheme	-
Steady-state studies based on available data	• Power flow • Short-circuit • Power quality studies
Transient regime studies based on available data	• Slow transients • Electromechanical • Electromagnetics • Phasor • Continuous mode • Single-phase • Three-phase unbalanced
DER models available	No
Data format/Software	PSCAD

2.12 WSCC_9

Identifier	WSCC_9
Data privacy	Public
Number of nodes	9
Voltage levels	HV/MV/LV

Grid scheme	
Steady-state studies based on available data	- Power flow - Short-circuit
Transient regime studies based on available data	Slow transients
DER models available	No
Data format/Software	PSS/E (.raw)
Link	http://publish.illinois.edu/smartergrid/wscc-9-bus-system/

2.13 ISOL_grid

Identifier	ISOL_grid
Data privacy	Public
Number of nodes	40
Voltage levels	MV

Grid scheme	
Steady-state studies based on available data	• Power flow • Short-circuit
Transient regime studies based on available data	• Slow transients • Electromechanical • Electromagnetics • Continuous mode
DER models available	Yes (Wind. Hydropower plant, pumped storage)
Data format/Software	PSS/E (.raw, .dyr)
Link	http://www.mdpi.com/1996-1073/5/7/2351

2.14 Two_areas

Identifier	Two_areas
Data privacy	Public
Number of nodes	11
Voltage levels	MV/HV
Grid scheme	
Steady-state	• Power flow

studies based on available data	• Short-circuit
Transient regime studies based on available data	• Slow transients
DER models available	Yes (Wind, PV, storage, diesel, EV and flexible loads)
Data format/Software	PSS/E (.raw), GE PSLF (.epc), PowerWorld (.pwb)
Link	http://publish.illinois.edu/smartergrid/two-area-system/

2.15 Nordic32

Identifier	Nordic32
Data privacy	Public
Number of nodes	32
Voltage levels	MV/HV
Grid scheme	
Steady-state studies based on	• Power flow • Short-circuit

available data	
Transient regime studies based on available data	• Slow transients • Electromechanical • Electromagnetics
DER models available	No
Data format/Software	PSS/E (.raw, .dyr), .pdf
Link	http://www.diva-portal.org/smash/get/diva2:609184/FULLTEXT01.pdf

2.16 Grid Annenieki

Identifier	Grid Annenieki
Data privacy	Restricted
Number of nodes	122
Voltage levels	MV
Grid scheme	
Steady-state studies based on available data	• Power flow • Power quality studies
Transient regime studies based on available data	• Slow transients • Continuous mode
DER models available	Yes(Hydropower plant)
Data	MATLAB (.m)

format/Software	
Link	http://energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Forskning%20-%20PSO-projekter/10613%20Final%20report.pdf

3 Repositories

3.1 Gridlab-D

Identifier	Gridlab-D
Data privacy	Public
Number of nodes	50 to 1400
Voltage levels	MV
Steady-state studies based on available data	• Power flow • Short-circuit
Transient regime studies based on available data	-
DER models available	-
Data format/Software	Gridlab
Link	http://www.gridlabd.org/models/

3.2 IEEE_transmission_static

Identifier	IEEE_transmission_static
Data privacy	Public
Number of nodes	14/24/30/39/57/118/300
Voltage levels	HV
Steady-state studies based on available data	• Power flow • Short-circuit
Transient regime studies based on available data	-
DER models available	-

Data format/Software	IEEE Common Format
Link	http://www.ee.washington.edu/research/pstca/

3.3 IEEE_transmission_dynamic

Identifier	IEEE_transmission_dynamic
Data privacy	Public
Number of nodes	145/162
Voltage levels	HV
Steady-state studies based on available data	- Power flow - Short-circuit
Transient regime studies based on available data	- Slow transients - Electromechanical - Electromagnetics
DER models available	-
Data format/Software	IEEE Common Format, EPRI format (dynamic data)
Link	http://www.ee.washington.edu/research/pstca/

3.4 IEEE_distribution

Identifier	IEEE_distribution
Data privacy	Public
Number of nodes	4/13/34/37/123/8500
Voltage levels	LV/MV
Steady-state studies based on available data	- Power flow - Short-circuit
Transient regime studies based on available data	-
DER models available	-
Data format/Software	Excel, PSCAD
Link	http://ewh.ieee.org/soc/pes/dsacom/testfeeders/index.html

3.5 EPRI

Identifier	EPRI
Data privacy	Public
Number of nodes	288/1335/2998
Voltage levels	LV/MV
Steady-state studies based on available data	- Power flow - Short-circuit - Power quality studies
Transient regime studies based on available data	-
DER models available	-
Data format/Software	OpenDSS
Link	http://smartgrid.epri.com/SimulationTool.aspx