MORE MICROGRIDS – Advanced Architectures and Control Concepts for More Microgrids

Contract No: SES6 -019864

WORK PACKAGE A

TASK TA1: Requirements For Various DGs In Supporting Microgrid Operation

Deliverable DA1

Datasheet for Major DG Units

Final Version

December 2007

Document Information

Title: DA1
Datasheet for Major DG Units

Date: 2006.07.24

Task(s): A1 Requirements For Various DGs In Supporting Microgrid Operation

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Access: X PUBLIC

Status:

_ For Information
_ Draft Version
_ Final Version (internal document)
_ Submission for Approval (deliverable)
X Final Version

1. Contents

1.1. List of Tables

2. Introduction

This report aims to provide an insight of the necessary data for installing, operating and studying DG sources, storages and DSM in Microgrids context giving emphasis on the seamless transition between isolated and interconnected operation.

The structure of the tables is the following:

- Name of the parameter
- Short description
- Typical measurement units
- Research Area
- Priority

In the category Research Area the following acronyms have been used

I *Information for installation procedures of the DG source*
O *Information about the operating scheduling of the unit*
E *Information about environmental parameters of the DG unit*
R *Information concerning reliability issues of the DG units.*
M *Information needed for modeling the DG sources as electrical devices e.g resistances etc.*
S *Information needed for safety procedures of the unit.*

Also in the tables it has been stated the term priority. This has to do with the priority of the parameters. 1 stands for high priority data while 2 stands for data with reduced priority that if they are not provided typical data can be used and not very significant problems in the analysis in other work packages is foreseen.

In section 3 the datasheet about the DG sources to be connected is provided. Section 4 deals with storage data while section 5 deals with converter requirements. Section 6 describes the necessary data for implementing DSM policies while Section 7 presents some special characteristics of the network needed.

The tables are used to describe different DER units, are used as a data source for a data sheet and will be provided in a data base. The structure of the data base and its implementation as joint electronic data base are presented in section 8.

3. Major DG sources

In this section the common characteristics of DG sources are first described and then the special characteristics of each unit or group of units are studied and related tables are completed.
The following DG sources are expected to be installed in Microgrids :

a. Internal Combustion Engines (ICE)
b. Microturbines
c. Fuel Cells
d. Wind Power
e. PV
f. Small Hydro

a-c are units that consume fuel while *d-f* are units that do not consume fuel.

TABLE 3.1 COMMON CHARACTERISTICS OF DG SOURCES

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Weight	The weight of the unit	kg	I	2
Height	The height of the unit	m	I	1
Length	The length of the unit	m	I	2
Width	The width of the unit	m	I	2
Surface Needed	The area needed for installation of DG	m^2	I	2
Output Current Type	The output current of the DG source	AC/DC	I, O.M	1
Phases No	The number of phases	3ph	I, O,M	1
Nominal apparent power	Nominal apparent power of unit	kVA	O	1
Voltage	The voltage of the connected device	V	O, I	1
Minimum Voltage	The minimum operating voltage	V or p.u	O, I	1
Maximum Voltage	The maximum operating voltage	V or p.u	O, I	1
Minimum Active Power	The technical minimum of Active Power for the unit	kW	O	1
Maximum Active Power	The technical maximum of Active Power for the unit	kW	O	1
Minimum Reactive Power	The technical minimum of reactive Power for the unit	kVar	O	1
Maximum Reactive Power	The technical maximum of reactive Power for the unit	kVar	O	1
Nominal Power factor	The nominal power factor that the unit can operate (cosφ)	0.9 lagging	O	1
Nominal frequency	Nominal operation frequency of unit	[Hz]	I,O,M	1
Minimum Frequency	The minimum frequency limit	Hz	O,M	1
Maximum Frequency	The maximum frequency limit	Hz	O,M	1
Transformer No minal Power	The nominal apparent power of the transformer	[kVA]	M,I,O	1

Transformer winding-unit	winding type - system side	delta	M,I	1
Transformer winding type - grid side	The winding type on system side	wye	M,I	1
Transformer ratio	The transformation ratio of transformer	[V:V]	M,I	1
Transformer short circuit voltage	The relative short circuit voltage	[V]	M,O	1
Transformer Efficiency	The efficiency of transformation for determining the losses	%	O,M	1
Isolation Transformer	Does an isolation Transformer exist>?	Yes/No	M	1
Protection class	The type of protection class	SKLII	S	2
Shut down parameters adjustable	Are the shut down parameters adjustable?	[Yes/No]	S	2
Anti islanding protection	Is there an anti islanding protection?	[Yes/No]	S	2
AC/DC sensitive residual-current device	Is there a AC/DC sensitive residual-current device?	[Yes/No]	S	2
Insulation monitoring	Has the device an insulation monitoring application?	[Yes/No]	S	2
Overload performance	The behaviour of the device when overloaded	[SBG, LB, APV]	S	2
Failure Rate	Reliability factor that the unit is out of service due to maintenance or breakdown.	Hours/year	R	1
Maintenance	How often the DG source needs maintenance	Times/year	R	1
Mean Time to Repair	The time needed to repair the DG source	Hours	R	1
Mean Time Between Failure (MTBF)	The mean time between successive failures of the DG source	Hours	R	1
Noise	The noise by the operation of the application	[dB(A)]	E,I	2
Installation Cost	The installation cost (pay-back analysis)	€/kW	I	1
Investment costs	The investment costs of the unit	€	I	1
Lifetime	The lifetime of the unit	Years	I	1
Operating and Maintainance cost	independent costs for the unit for the operation and maintainance-not fuel cost	€/year	I	1
Salvage Value	The value of the unit at the end of its lifetime	€	I	1
Transformer No minal Power	The nominal apparent power of the transformer	[kVA]	M,I,O	1
Internal DC-switch	Has the device an internal DC-switch?	[Yes/No]	S	2

3.1. *Fuel Consuming Units*

TABLE 3.2 CHARACTERISTICS OF UNITS CONSUMING FUELS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
CHP mode	If the unit is going to operate on CHP mode or not	Yes / No	I, O, R, M	1
Type of fuel	Fuel used for operation	Natural gas, diesel oil etc	O	1
Start up fuel	Type of fuel needed for starting up	Natural gas, diesel oil etc	O	1
Shut down fuel	Type of fuel needed for shutting down	Natural gas, diesel oil etc	O	2
Fuel Coefficient A	The constant parameter of fuel consumption	kg/h	O	1
Fuel Coefficient B	The linear parameter of fuel consumption	kg/kWh	O	1
Fuel Coefficient C	The quadratic parameter of fuel consumption	kg/kW^2h	O	1
Efficiency at 30 % of P_{nom}	Efficiency at 30 % of P_{nom} of unit	[%]	O	2
Efficiency at 50 % of P_{nom}	Efficiency at 50 % of P_{nom} of unit	[%]	O	2
Efficiency at 70 % of P_{nom}	Efficiency at 70 % of P_{nom} of unit	[%]	O	2
Efficiency at 100 % of P_{nom}	Efficiency at 100 % of P_{nom} of unit	[%]	O	2
Start up Fuel Consumption	Fuel consumption during start-up	kg-lt	O	1
Shut down Fuel Consumption	Fuel consumption during shut down	kg-lt	O	2
Start up time	Estimated Time needed for starting up the unit (exact time not always available)	min	O	1
Shut down time	Estimated Time needed for shutting down (exact time not always available)	min	O	2
Up Rate	At what rate can the unit can increase its output from a specific operating point	kW/min	O	1
Down Rate	At what rate can the unit can decrease its output from a specific operating point	kW/min	O	2
CO_2 emission	The emission rate of CO_2	kg/kWh	E	1
NOx emission	The emission rate of NOx	kg/kWh	E	2

SO_2 emission	The emission rate of SO_2	kg/kWh	E	2
Particles emission	The emission rate of particles (PM-10)	kg/kWh	E	2
Number of revolutions	The number of revolutions of the stator	rpm	M(steady state analysis)	2
Stator resistance	The stator resistance	Ω	M (steady state analysis)	1
Stator reactance	The stator reactance	Ω	M (steady state analysis)	1
Rotor resistance	The rotor resistance	Ω	M(steady state analysis)	1
Rotor reactance	The rotor reactance	Ω	M (steady state analysis)	1
Magnetizing reactance	The magnetizing reactance of the machine	Ω	M (steady state analysis)	2
Transient reactance	The transient reactance, Time constant	p.u	M	1
Sub-transient reactance	The transient reactance, Time constant	p.u	M	2
Electrical Efficiency	Electrical efficiency of the device	%		1

The following table refers to units operating in CHP mode, additionally to the previous table.

TABLE 3.3 UNITS IN CHP MODE.

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Heat Capacity	The heat output of CHP unit	kW_{th}	O	1
Electrical Capacity	The power output of CHP unit	kW_e		1
Overall Efficiency	The efficiency of converting input fuel into usuable heat and power	%	O	1
Effective mean gas input pressure (CHP)	Effective mean gas input pressure for a gas-engine (CHP)	mbar	O	2
Swept volume	The swept volume of the engine	ccm	O	2
Average Heat to Power Ratio	It is the ration of power to heat, necessary for coupling heat and electricity	2.0	O	1
Output Heat medium	The heat medium used as output of the CHP	Output heat nedium	O	1
Max Output Temperature	Max output temperature	K	O	1
Exhaust heat exchanger	Is there an exhaust heat exchanger	Yes or No	O	2
Energy Utilization Factor (EUF) or Net Efficiency	The sum of the useful electrical and heat outputs as a proportion of gross	%	O	2

	energy input			
RC	The ratio of fuel in ideal cycle over the fuel in real cycle	%	O	2

TABLE 3.4 FUEL CELLS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Fuel Cell Type	The technology used for fuel cell	SOFC (Solid Oxide Fuel Cell)	I, O, M	2

TABLE 3.5 MICROTURBINES

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Shaft speed	The revolution speed for the shaft in the Microturbine	rpm,	M	2

3.2. Non Fuel Consuming Units

These units do not consume fuel, they are emission free and depending on the technology used, they have some different characteristics provided in the tables below.

TABLE 3.6 WIND POWER

Parameter Name	Description of the Parameter	Unit or Example	Research Area	
Nacelle Height	The Height of the nacelle	m	I	1
Nacelle mass w/o rotor	The mass of the nacelle without rotor	[kg]	I	2
Rotor Diameter	The diameter of the Rotor	m	I	1
Cut in wind speed	The Wind velocity the Wind Turbine starts producing energy	m/s	O	1
Cut out wind speed	The Speed at which the Wind Turbine stops producing power	m/s	O	1
Survival wind speed	The survival wind speed of the wind turbine mainly for small wind turbines	m/s	O	1
Nominal Wind Speed	The Wind Velocity at which the Wind Turbine reaches its nominal Output	m/s	O	1
Typical Wind Power Curve	To show what is the production for different wind speed values	Power vs velocity curve	O	1
Speed Control method	How the blade is controlled	Pitch or stall	M	1
Blade revolutions	The number of revolutions of the blades per minute	rpm	M	2
Blade number	The numbers of blades of WEC	3	M	2
Generator Type	What type of generator is used	Asynchronous	M	1
Generator rev	number of revolutions	rpm	M	2
Generator Voltage	The output voltage of the generator	V	M,I	1
Stator resistance	The stator resistance	Ω	M (steady state analysis)	1
Stator reactance	The stator reactance	Ω	M (steady state analysis)	1
Rotor resistance	The rotor resistance	Ω	M(steady state analysis)	1
Rotor reactance	The rotor reactance	Ω	M (steady state analysis)	1
Magnetizing reactance	The magnetizing reactance of the machine	Ω	M (steady state analysis)	2

Gearbox design	The design of the gearbox	spur gear unit, w/o gearbox,	M	2
Gearbox steps	The steps of the gearbox	3	M	2
Gearbox drive ratio	The drive ratio of the gear box	1/94	M	2
Main brake	What kind of main brake?	[pitch , Discbrakes...]	M	2
Power curve, certified	Is the power curve certified?	[Yes/No]		1
rotor area		[m2]	Can be calculated	2
Rotor-mass including hub	The rotor-mass including hub	[kg]		2
Rotor-type description	The description of the rotor-type	NOI 34, LM 34.0		2
Rotor-material	The material of the Rotor	GFK		2
Nacelle design	The design of the nacelle	[drained, partly integrated, integrated]		2
Generator (in case this is NOT the grid interface)	design	SG, IG, DFIG, ...]		2
	number		M	1
Tower design	The design of the tower	[steel tube]	M	2
Tower-mass	The mass of the tower	[kg]	M	2
Rotor speed control	What kind of rotor speed control is implemented?	[pitch, DFIG, DC-link & inverter, ...]	M	2
Secondary Brake system	What kind of secondary brake system?	[pitch, Discbrakes...]	M	2
Wind direction tracking system	What system for tracking wind direction?	[active/passive]	M	2

TABLE 3.7 HYDRO/PUMP STORAGE POWER UNITS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Unit type	If there is a dam or pump storage	e.g Run of the river	I, O	1
Turbine Type	The type of the hydro turbine	pelton, caplan	I, M	2
Pipe Capacity	Maximum water inflow/outflow rate	m^3/s	I, O	1
Efficiency	The conversion efficiency of the Hydro turbine	%	O	1
Pumping Capacity	The amount of water the Unit can pump	m^3/h	I, O	1
Dam Size	What is the content of the dam, if exists	m^3	O, I	1
Effective head	Net height in meters (between up dam and generator)	m	I, O	1
Generator Type	The type of generator used	Synchronous, salient poles	M, O	1
Number of Installed Pumps	How many pumps are installed	3	I	1

Pumps Active power Capacity	The capacity of each pump	kW	O	1
Pump Reactive power coefficient	The power coefficient of reactive power	cosφ	O	1
Transient reactance	The transient reactance, Time constant	p.u	M	2
Sub-transient reactance	The transient reactance, Time constant	p.u	M	2

TABLE 3.8 PV UNITS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Cell Type	Type of cell	Amorphous Si	I	1
Module Area	Area of module	(m^2)	I, O	1
Site angle	Site angle of the installed application latitude	latitude [^{0}]	I, O	1
Azimuth angle	Azimuth angle of the installed application	Deg. [^{0}]	I, O	1
NOTC	Normal operating temperature condition	[deg C]	O	1
Construction movement	Whether the construction is movable or fixed	Fixed	I,O	1
Efficiency	The efficiency of the Conversion of Solar Energy to Electricity	(%)	O	1
Peak power	Installed peak power	kWp	O	1
Module Frame Material	Module frame material	Aluminium	O	2
Temperature Dependency	Power alteration because of temperature dependency	%/^{o}K	O	1
Pollutant Coefficient	Ratio of production of a polluted PV surface to a clean one	0.89	O	1
Installation angle	Installation angle of the installed application	Beta (^{0})	O	1
Open Circuit Voltage	Open-circuit voltage of module	V	M	1
Short Circuit Current	Open-circuit current of module	A	M	1
Series Resistance	Series resistance	Ω	M	1
Shunt resistance	Shunt resistance	Ω	M	2
Connection	Connection of the module	[cable, socket]	I,M	2
Cell manufacturer	Name of the cell manufacturer	Sharp		2
IEC 61215 / 61646	IEC 61215 / 61646	[Yes/No]	M	2

4. Storage Systems

Storage systems are expected to participate widely in the Microgrids, to help in the seamless transition of Microgrids from interconnected to isolated operation. Additionally to electricity storage devices mainly batteries and flywheels, increased installation of CHP units is expected to lead to thermal storage installations. The following tables describe an overview of the required data for both electrical and thermal storage.

TABLE 4.1-BATTERIES

Parameter Name	Description of the Parameter.	Unit or Example	Research Area	Priority
Battery Type	What is the storage medium	Gel, lead acid	I, O	1
Building design	The building design of battery	closed,	I	2
Electrolyte	Electrolyte	sulphuric acid	M	2
Nominal Capacity	The Capacity of the batteries specific hours e.g C10	Ah	I, O	1
Long Term capacity	Capacity like C100	[Ah]	I,O,M	2
Nominal Voltage	The cell voltage	V	O	1
Maximum Discharge Current	The maximum output current that can be drawn out of the batteries	A	O	1
Maximum Charge Current	The maximum current that can be used to charge the batteries	A	O	1
Maximum Power	The Maximum power that can be drawn from the battery in an emergency	kW	O	1
Efficiency	Describes the losses in the battery during the charge and discharge	%	O	1
Self –discharge per day	The energy storage device , especially batteries lose some of their charged capacity	% Capacity/Day	O	1
Peukert Parameter	The Peukert parameters declared as the number solving I^n*t=constant	1.05-1.5	O	1
Weight	The weight of the storage device	kg	I	2
Dimensions	The dimensions of the storage	M	I	2
Material of anode	Material of anode	lead dioxide	M	1

Material of cathode	Material of cathode	lead	M	1
Permanent charging voltage	Permanent charging voltage	[V]	M	1
Max. charge voltage	Maximum charge voltage	[V]	M	2
Min. Discharge voltage	Minimum discharge voltage	[V]	M	1
Durability cycles (IEC 896-2)	Numbers of cycles	graph	O	1
Numbers of cycles at 50% discharging depth	Numbers of cycles at 50% discharging depth	3000	O	2
Volumetric energy density	Volumetric energy density of Batt	[Wh/L]	M	2
Gravimetric energy density	Gravimetric energy density of Batt	[Wh/kg]	M	2

TABLE 4.2 STORAGE SYSTEMS –FLYWHEELS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Capacity	The energy Capacity of the flywheel	kWh	O	1
Maximum Output Current	The maximum output current that can be drawn out of the flywheel	A	O	1
Maximum Input Current	The maximum input current that can be applied to the flywheel	A		1
Maximum Power	The Maximum power that can be drawn out from the flywheel	kW	O	1
Efficiency	Describes the losses in the flywheel during the charge and discharge	%	O	1
Input Voltage	The connection Input voltage	V	O	1
Output Voltage	The output connection Voltage	V	O	2
Rotation Speed	The rotation speed of the shaft	rpm	I, M	2
Dimension	The dimension of the storage device	m	I	2
Weight	The mass of the rotating shaft	Kg	I, M	2
Inertia	The inertia of the storage mass	kg/ms^2	M	1
Stand by losses	The losses in stand by mode	% or kW	O	1

4.1. Thermal Storage Devices

TABLE 4.3 THERMAL STORAGE

Parameter Name	Description of the parameter	Unit or Example	Researc h Area	Priority
Capacity	The maximum energy content of the storage device	kWh	O,M	1
Volume	The storage volume of the device	m^3	O,I,M	1
Storage Medium	The medium used for storing energy	Water	I, O,M	2
Specific Heat Coefficient	It is the specific heat for heating up one volume unit of the storage medium	$kJ/m^3\ ^0C$	O	1
Temperature Output	The output temperature of the medium	^OC	O	2
Temperature Input	The input temperature of the medium	^OC	O	2
Efficiency	The efficiency of charge and discharge	%	O	1
Stand-by Losses	The losses of the storage device in standby mode	kJ/h	O	1

5. Power Electronics (Inverters etc)

Power electronic devices, either inverters or other types of converters are expected to be widely used in a Microgrid due to the need of rectifying, altering or stabilizing the current and output voltage produced by the DG sources.
The following table summarizes the required data to describe the operation and modeling of inverters.

TABLE 5.1 INVERTERS CHARACTERISTICS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Capacity	The capacity of the converter	kVA	O	1
Nominal electrical DC Power	Nominal electrical DC input Power	[kW]	O	1
Nominal Voltage DC	The nominal input voltage	V	I, O,M	1
Max. voltage DC	Max. input voltage DC to the inverter	[V]		1
Nominal current DC	Nominal input current DC to the inverter	[A]	O	2
Maximum Input Current	The maximum input current that can be drawn into the inverter	A	O	1
Maximum Output Current	The maximum output current that can be drawn out of the inverter	A	O	1
Output Voltage	The output voltage	V	I, O	1
Maximum Active Power	The Maximum power that can be drawn out from the inverter	kW	O	1
Efficiency	The efficiency of the inverter	%	O	1
Stand by Losses	Percentage of stand by losses for the inverter	%	O	1
Phases	The number of phases the converter is connected to	1ph	I, O,M	1
Type of electronic switches	Which are the power electronics components used	e.g IGBT	M	1
switching frequency	Switching frequency of power electronic switches	ms	M	2
Control mode	What is the synchronization	e.g Droop control	O, M	1

	mode of operation			
Minimum input active power	Power feed in starts at what power?	[W]	O	1

6. Demand Side Management (DSM)

Demand Side Management is a key-feature for the seamless transmission of Microgrids from interconnected to island mode. The following table summarizes the characteristics for the DSM modeling.

TABLE 6.1 DEMAND SIDE MANAGEMENT REQUIREMENTS

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Capacity	The capacity of the load offering to change its demand	kW	O	1
Operating method	If the load is curtailed (not operating at all) or shifted	Curtailed	O	1
Control steps	The number of steps for controlling the device, is it ON/OFF or can reduce its output.	3	O	1
Percentage of Disconnection	How much of the load is disconnected at each control step	%		1
Control mode	If the load is disconnected on-line or at specific time-steps	On-line	O	1
Advance Time	The time frame to be known in advance for connecting/disconnecting the load	Minutes	O	1
Minimum Outage Time	The minimum time that the load can reduce its consumption	Minutes	O	2
Maximum Outage Time	The maximum time that the load can reduce its consumption	Minutes	O	1
Minimum Up time	The minimum time before the next switch off for the load	Minutes	O	1

7. Other Components of the Network

These tables summarizes the rest components that can be used to control the power flow in the network e.g capacitors.

TABLE 7.1 CAPACITORS TABLE

Parameter Name	Description of the Parameter	Unit or Example	Research Area	Priority
Connection type	The type of connection (Wye-delta)	Wye-delta	I, O	1
Type	Series/shunt capacitor	Series/Shunt	I, O	1
kVar	The reactive power capacity	kVar	O	1
Banks Number	The discrete steps of the capacitors	4	O	1
Capacitance	The capacitance of the capacitors used.	μF	I, M	2

TABLE 7.2 DATA SET ON INTERFACE PROTECTION RELAYS

Parameter Name	Description of Parameter	Unit or Example	Research Area	Priority
Loss of mains protection relay	Is the loss of mains protection relay included?	[Yes/No]	M	1
Overvoltage protection relay: voltage	Minimum voltage to trigger Over voltage protection relay	[V]	M	1
Overvoltage protection relay time	Minumum time for triggering overvoltage relay	s	M	1
Undervoltage protection relay voltage	Under voltage protection relay: voltage and time	[V]	M	1
Undervoltage protection relay time	The minimum time that the relay can withstand undervoltage	s	M	1
Overfrequency protection frequency	The set point of overfrequency protection	Hz	M	1
Overfrequency protection time	Over frequency protection relay: time	s	M	1
Underfrequency protection relay	Underfrequency protection relay: frequency value	[Hz]	M	1
Underfrequency protection time	The minimum time that the relay can withstand Under frequency	[s]	M	1
Overcurrent protection relay:	Minimum current for triggering Over current protection relay:	[A]	M	1
Overcurrent protection time:	Minimum time for triggering Over current protection relay:	s	M	1
Over unipolar voltage protection relay voltage	Over unipolar voltage protection relay: voltage and time	[V]	M	2
Grid impedance-measure protection relay	Grid impedance-measure protection relay: impedance and time	[Ω]	M	2

Parameter Name	Description of Parameter	Unit or Example	Research Area	Priority
Over unipolar voltage protection relay time	Over unipolar voltage protection time	s	M	2

TABLE 7.3 DATA SET ON THE GRID INTERFACE

Parameter Name	Description of Parameter	Unit or Example	Priority
Forced stop in case of limits exceedance	Forced stop in case of limits exceedance possible?	[Yes/No]	2
Stand-by in case of limits exceedance	Stand-by in case of limits exceedance possible?	[Yes/No]	2
For power quality devices, which are able to work in "islanded mode", point out the grid parameters used to determine grid faults or failures that cause the transition from "grid connected mode" to "islanded mode" and highlight if the operator can set those parameters			2

8. DER Units Data Base

The aim of the data base is to search the available DER units relating to specific DER issues for example the type of the generator and the kind of renewable energy or emissions repectively, its rated power and its ability concerning remote control, facilitating the research efforts.

A data base for systematic and detailed listing of the DER units was generated. This data base is web based and will be available on the project intranet. The structure of the data base and its web interface are described:

8.1. Structure of the Data Base

The DER units available at the partner laboratories are compiled in a data base called DERlab esd (DERlab equipment & service data base).

The data base aims at facilitating the research efforts by providing a survey of the DER units of the different partners. It can be used for preparing joint research projects. Furthermore the experience of single partners with specific equipment can be made available for the entire project consortium and it provides the platform for sharing knowledge.

To enable structured queries on the data they are related the type of the DER or generator respectively and operation mode.

These categories are listed in tables and can be easily extended, when a more detailed description is necessary. The tables are displayed below as screenshots from the data base.

←T→	ID	Resource
	1	Battery
	2	CHP
	3	Flywheel
	4	Fuel Cell
	5	Hydro
	6	Wind
	7	PV
	8	Turbine

FIGURE 8-1 DER CATEGORIES

←T→	ID	GeneratorType
	1	rotating
	2	static

FIGURE 8-2 GENERATOR TYPE CATEGORIES

←T→	ID	OperationMode
	1	grid connected
	2	islanded
	3	connected or islanded

FIGURE 8-3 TABLE OPERATION MODE CATEGORIES

Using these categories the data are filled in. Structure and content of the data base are described in the following.

The data base exits of one main list in which all project participants are able to enter and change their data. Another three lists containing categories and definitions are in the responsibility of the data base administrator. The structure of the data base is displayed below. The data field are listed with a short description or examples in brackets where needed.

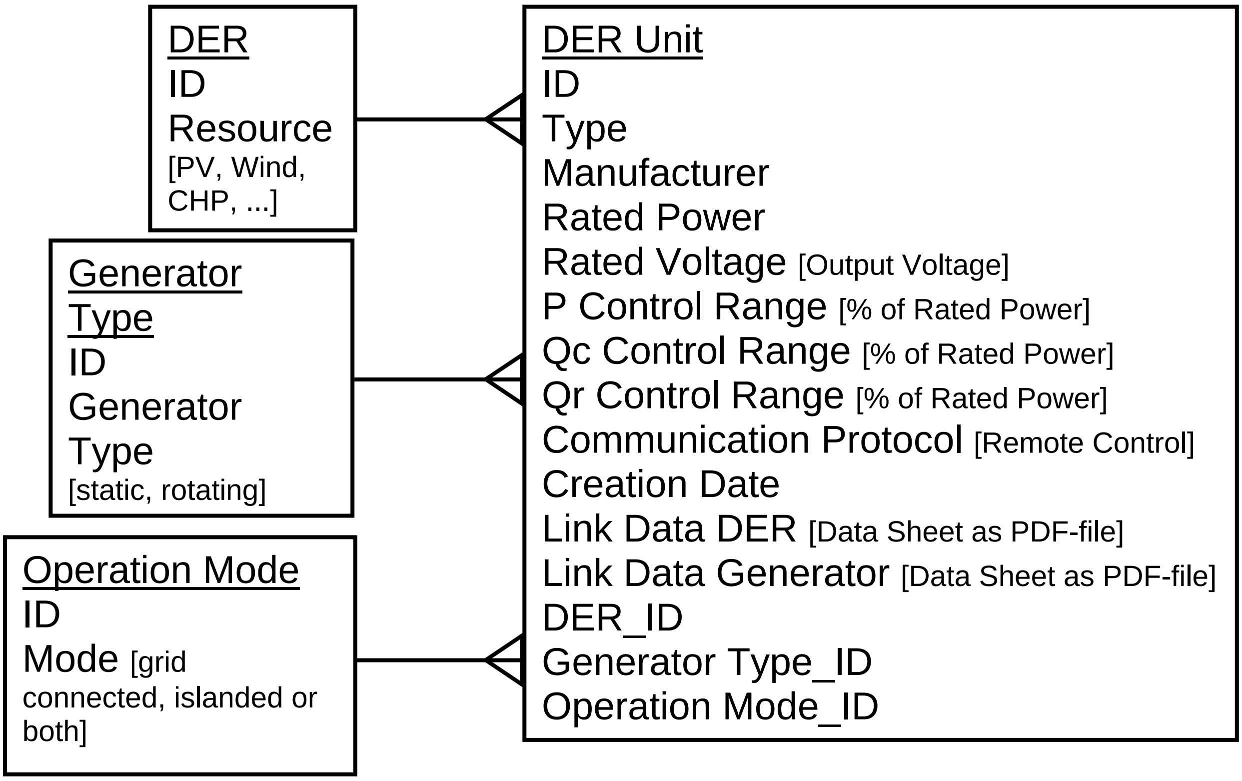


FIGURE 8-4 STRUCTURE OF THE DATA BASE

The content of the main list is described in detail below.

Data field name	**Description**
Index	Consecutively numbered
Type	Type or model of the device
Manufacturer	Manufacturer of the device
Rated Power	Rated power at the point of interconnection to the grid
Rated Voltage	Rated output voltage at the point of interconnection to the grid
P Control Range	Power output control ability as percentage of rated power
Qc Cotrol Range	Capacitive power output control ability as percentage of rated power
Qr Cotrol Range	Reactive power output control ability as percentage of rated power
Communication Protocol	Ability of remote control and type of communication protocol
Creation date	Date of creation of the entry
Link Data DER	Link to data sheet of the manufacturer or according to the tables above as PDF-file
Link Data Generator	Link to data sheet of the manufacturer or according to the tables above as PDF-file

FIGURE 8-5 DESCRIPTION OF DATA FIELDS OF THE TABLE DER UNIT

8.2. Implementation as Joint Electronic Data Base

The data base itself is implemented as relational data base using phpMyAdmin. Therefore web access is possible. The data base will be accessible via the project intranet by all participants. The phpMyAdmin interface and structure is shown below.

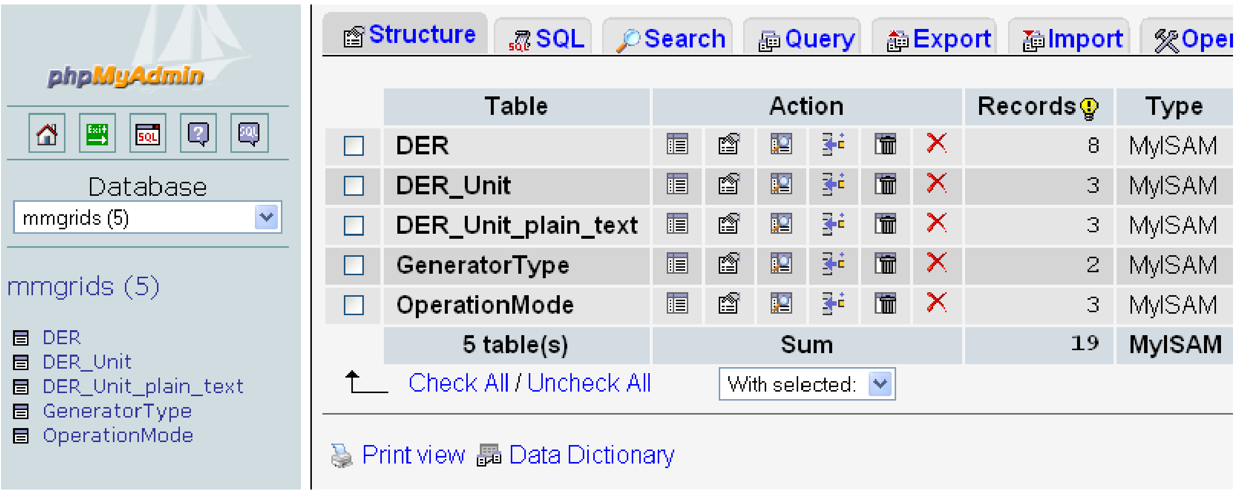
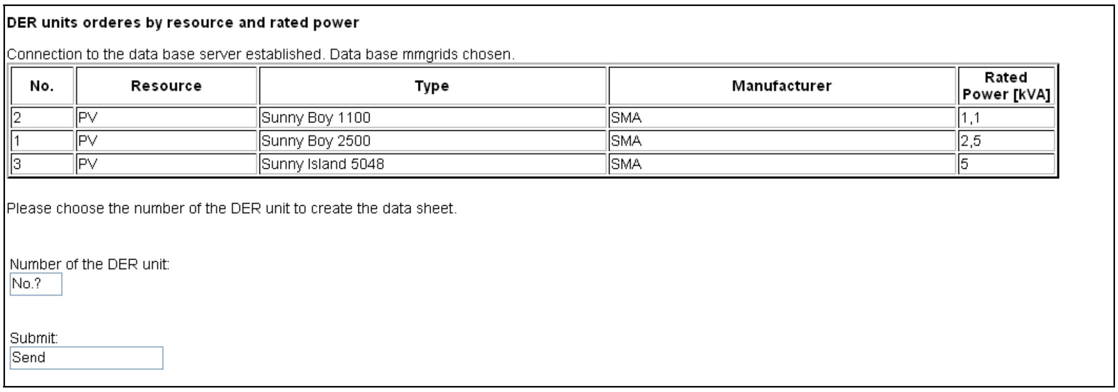


FIGURE 8-6 STRUCTURE OF THE DATA BASE IN PHPMYADMIN

To enter or change individual data the phpMyAdmin interface can be used. But for easy access a HTML form as web interface will be provided. This HTML form is created similar to the data sheet required by the german network operator EON concerning embedded generators operating in parallel to the grid. A screenshot of the input form is shown in Figure 8-8 at the end of this chapter.

For the output there are lists generated and displayed as HTML file. An Example is shown in Figure 8-7. The number of the device in question could than be chosen and an output data sheet will be generated according to the input form in Figure 8-8.



DER units orderes by resource and rated power

Connection to the data base server established. Data base mmgrids chosen.

No.	Resource	Type	Manufacturer	Rated Power [kVA]
2	PV	Sunny Boy 1100	SMA	1,1
1	PV	Sunny Boy 2500	SMA	2,5
3	PV	Sunny Island 5048	SMA	5

Please choose the number of the DER unit to create the data sheet.

Number of the DER unit:
No.?

Submit:
Send

FIGURE 8-7 EXAMPLE OF AN OUTPUT LIST OF THE DATA BASE

DATA SHEET OF A DG UNIT

Type of DG Unit

☐ wind turbine
☐ photovoltaic system
☐ CHP unit
☐ fuel cell
☐ hydro power
☐ other

System
Manufacturer: _______________
Type: _______________

Electrcial System Data
Rated power [kVA] ....
Rated voltage [V] ....

Grid feeding generator
☐ induction generator
☐ doubly feed induction generator
☐ synchronous generator
☐ inverter
  ☐ 1-phase
  ☐ 3-phase
  ☐ with transformer
  ☐ without transformer

System Controll

Active power
☐ controllable
controll range [%] ......

Reactive power
☐ controllable
controll range [%] ......

Operation mode
☐ designed for islanded operation

Communication:
☐ remote controllable
communication protocol: _____________

Emissions:
CO_2 emissions (g/kWh): ________

Detailed data
☐ manufacturer data sheet available

Developed within the MoreMicroGrids Project
under contract SES6-?????
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FIGURE 8-8 INPUT FORM OF THE DATA BASE

9. Conclusions

As first step it was investigated which data are necessary concerning installing, operating and studying DG sources, storages and DSM in Microgrids context giving emphasis on the seamless transition between isolated and interconnected operation. These data are listed in detail.

As second step a data base was set up to provide detailed information about DER units available within the consortium. The data base is accessible by all partners via the project intranet. The data will be filled in by all participants and enable the members of the consortium to assess whether and where an experiment with certain parameters can be conducted.