Business from technology

SGEM WP 6
Task 6.6 Management and Operation of Smart Grids

Task 6.6.6 Energy centre microgrid model
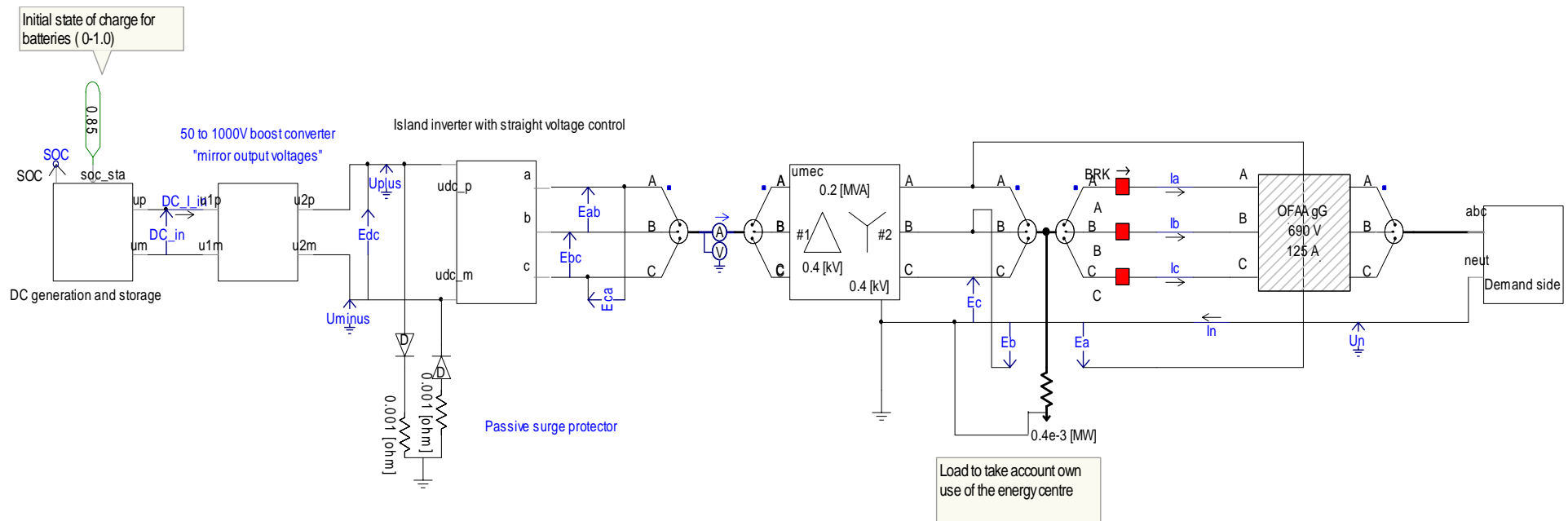
WP 6.6 workshop, 29.8.2011, Tampere
Riku Pasonen
VTT Technical Research Centre of Finland
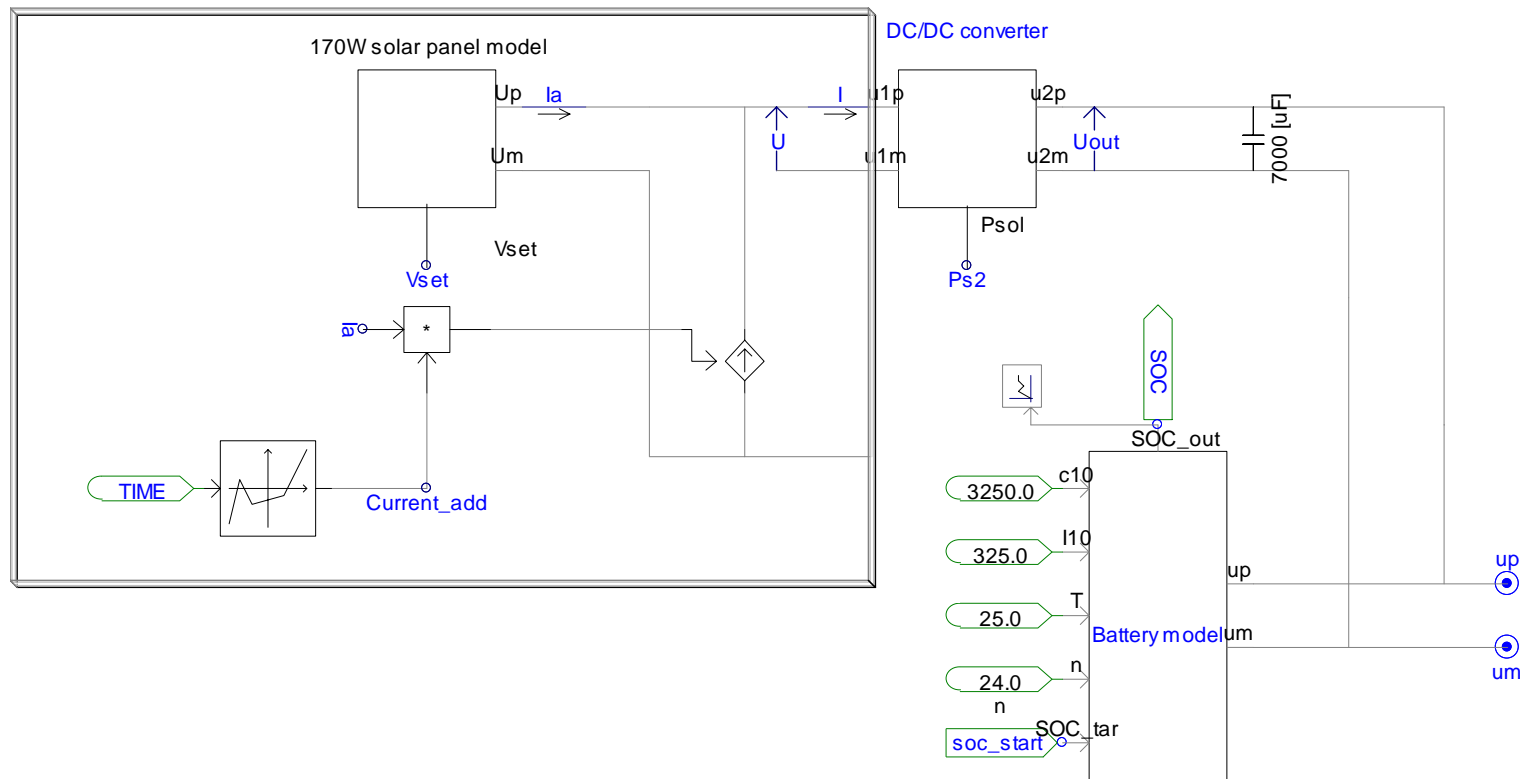
VTT's research topics in task 6.6

- Develop a PSCAD microgrid model by continuing work done in previous phase of SGEM project. (6.6.6)

- Model some single phase loads problematic for voltage level symmetry like heat pumps to PSCAD.(6.6.17)

- Analyse how single phase loads affect microgrid model voltage level symmetry (6.6.17)

- Investigate possibilities to ease the problems by load control and shaping the current characteristics of devices (6.6.17)

Overview of the model structure

DC-generation and storage

PV array model

170W solar panel model

Up   Ia

Um

DC/DC converter

I   u1p   u2p

U

u1m   u2m

Uout

7000 [uF]

Psol

Vset

Vset

Ps2

Ia

*

Current_add

TIME

SOC

SOC_out

3250.0   c10

325.0   I10

25.0   T

24.0   n

n

soc_start   SOC_tar

Battery model

up

um

up

um

Two switch boost converter for solar array

Two switches to generate equal boost to both DC lines

Note that input(panel) voltage is controlled, not output

Variable frequency control for fast response to irradiation changes and to increase operating lifetime
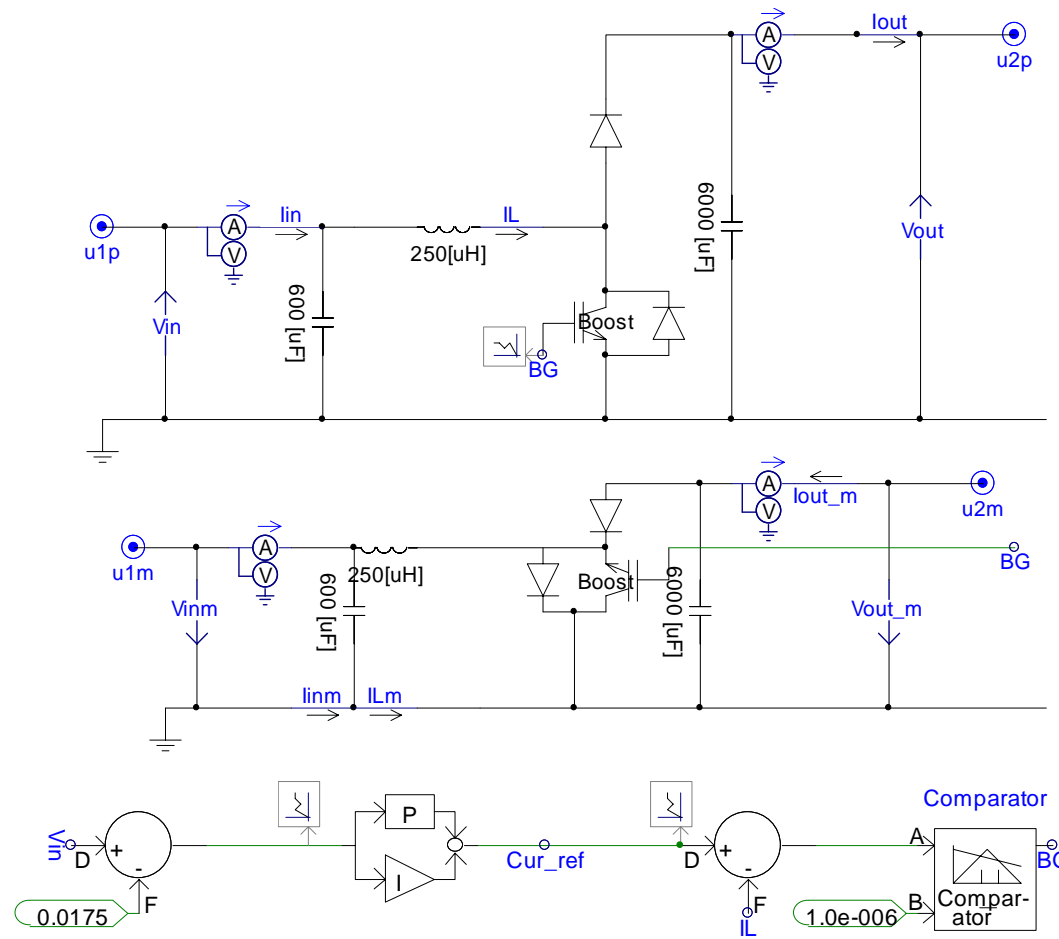
Constant voltage reference

Boost converter between inverter and DC-side

Similar control as with but now output voltage is controlled opposed to input voltage

LV side input nodes are "crossed" to reduce boost demand and improve step response(there is no reason why this could not be used also with solar array)
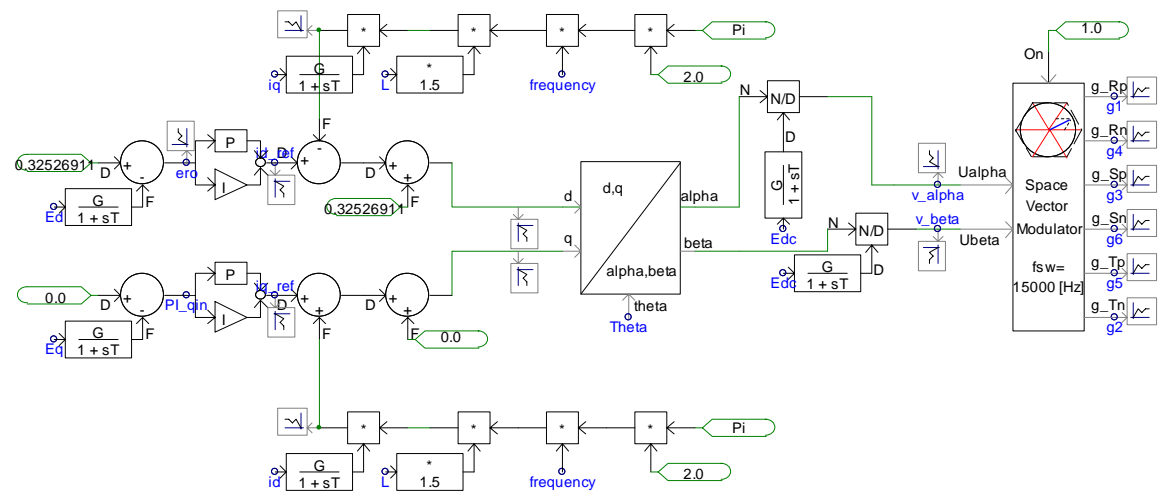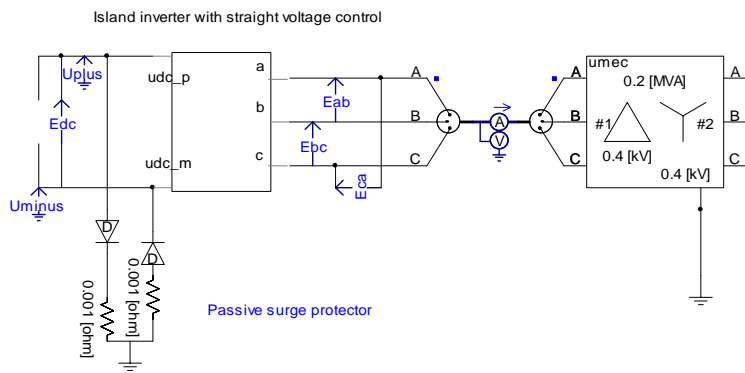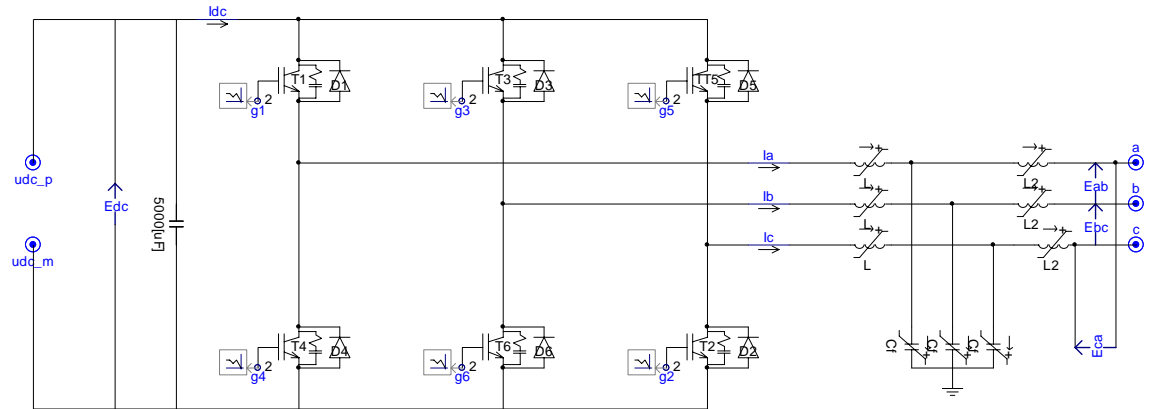
Parameter optimisation done with simplex algorithm to some point but final adjustments done manually
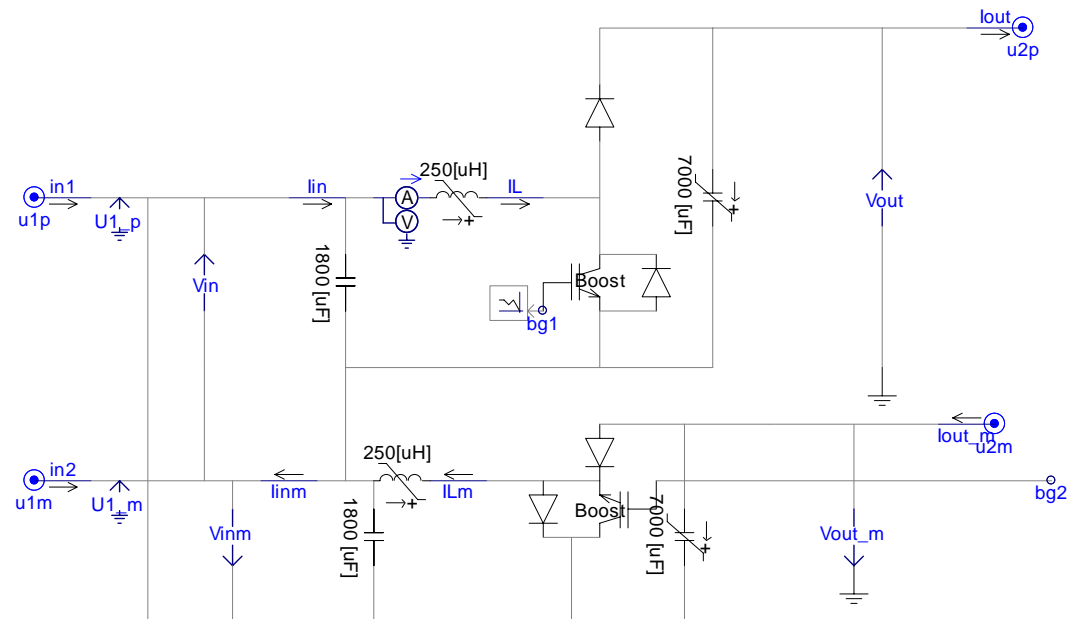
Inverter

Vector control without current controller to increase response for power demand (single loop control method)
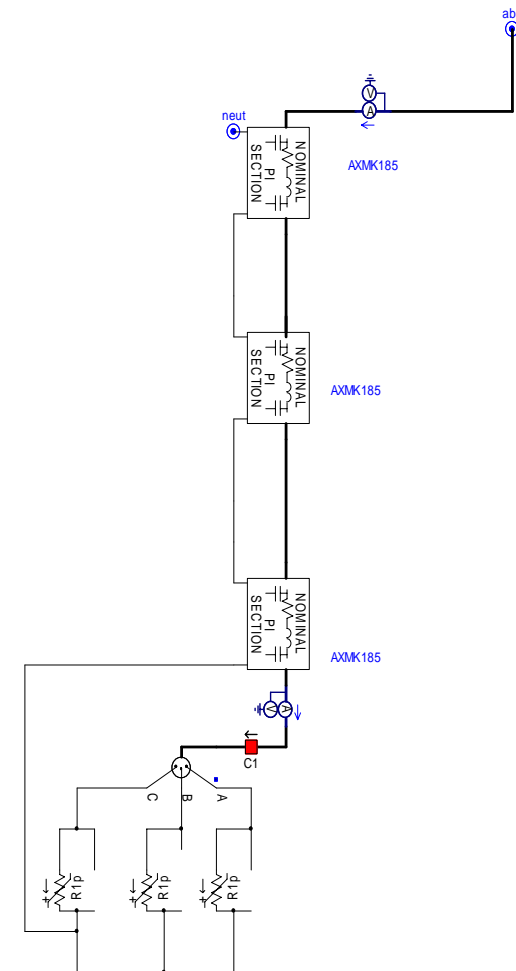
Control adjusts line-to-line voltages which are comparable to line voltages after wye-delta transformer
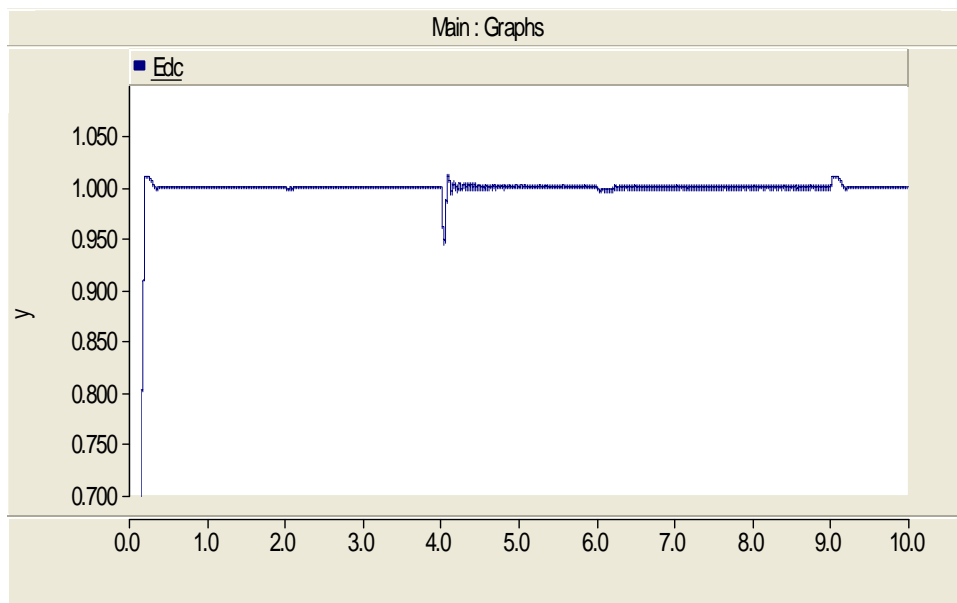
Demand side

Demand side is very basic at this point because load development will be done in task 6.6.17 starting next year
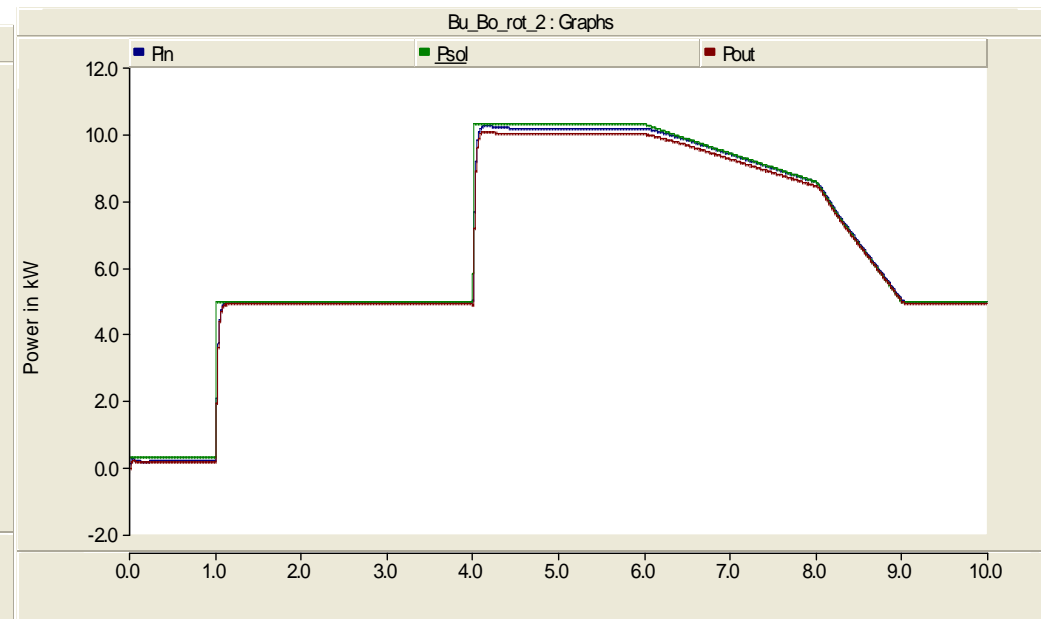
Resistive and reactive 3-phase loads have been tested at this point.
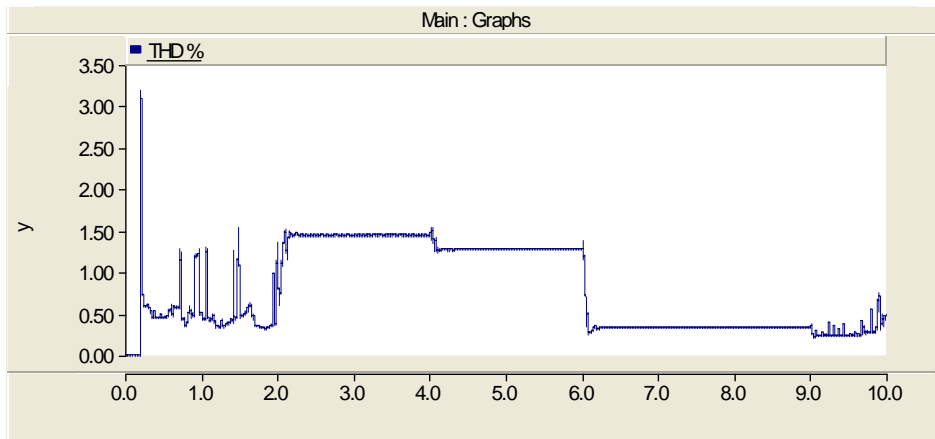
Some results

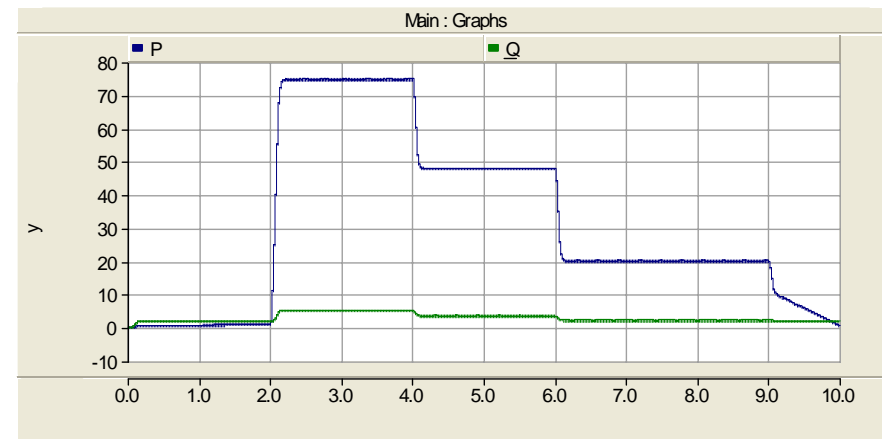Line-to-line DC voltage after boost converter in kV

Solar converter response to irradiation changes in kW (green is available power)
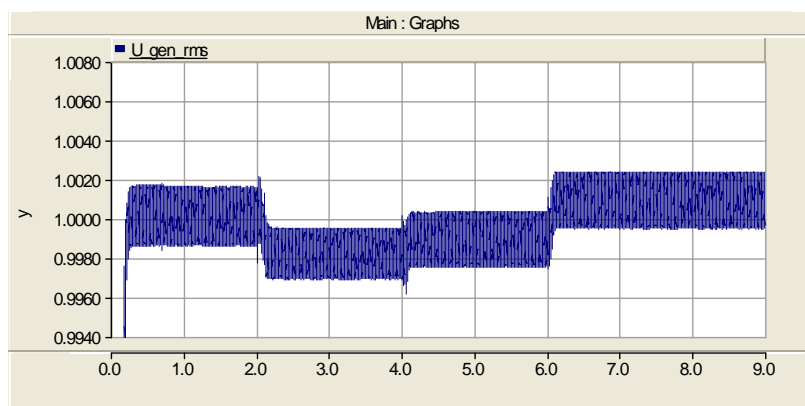
More results

THD related to 50Hz component

Power demand in kW

Line voltage per unit value

Deliverables and schedule

- D6.6.6 Energy Centre Microgrid Model (12/2011)

  -Microgrid model will be uploaded to SGEM PSCAD simulation model library with documentation

- D6.6.17 Feasibilities to control voltage asymmetry with load management in microgrid (Q2/2013)

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