



Guten Morgen

Renewable Energy Technology Integration in Cyprus – An Overview

Andreas Armenakis, Network Engineer at the Electricity Authority of Cyprus
Melios Hadjikypris, Post-Doctoral Research Associate at the University of Cyprus

IEEE PES Austria Chapter Lecture, Nov 21, 2019 – Vienna, Austria



IEEE PES
Austria Chapter

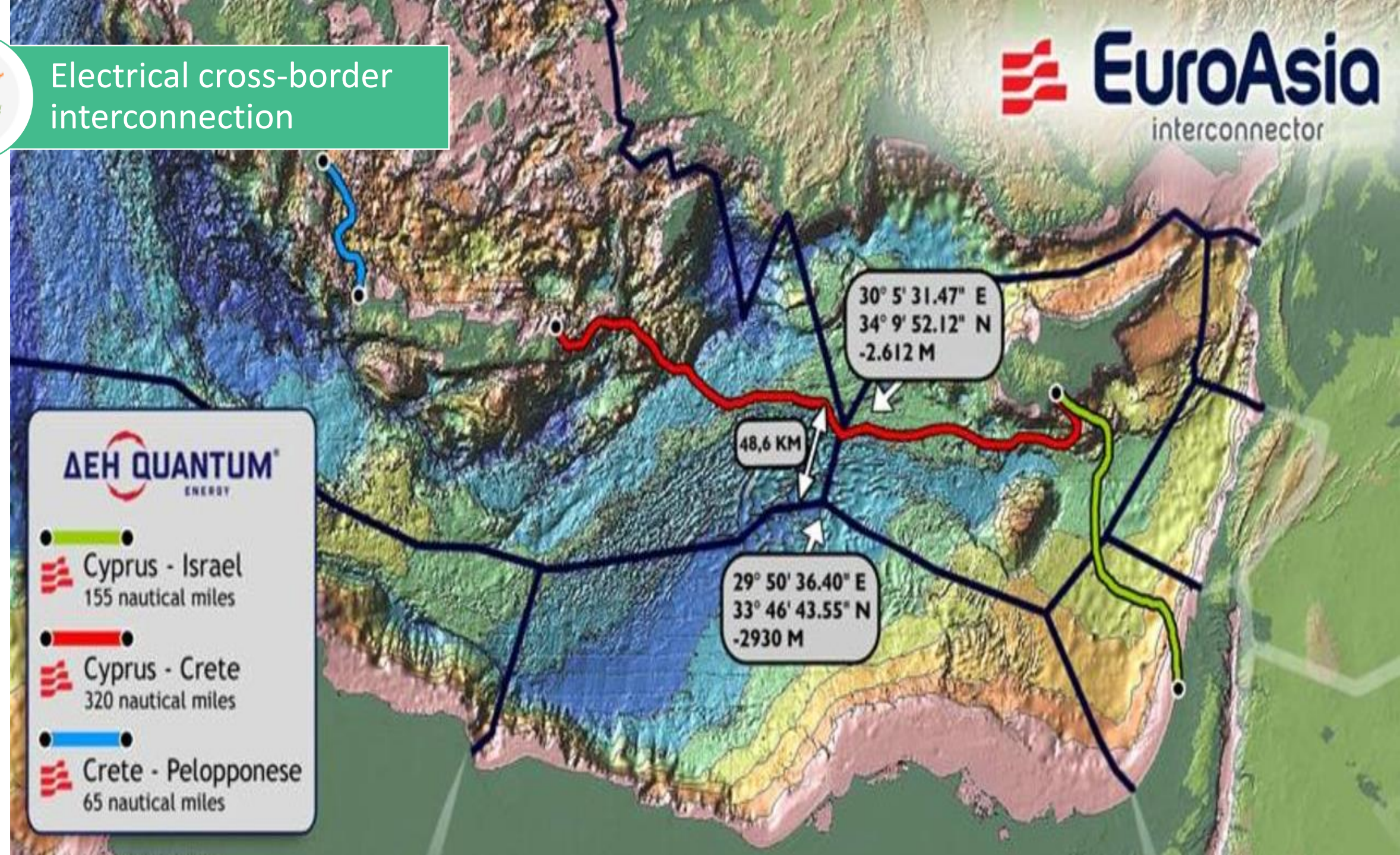


Monday, 11-7-2011

13 Deaths & 62 Injuries
2,5 Billion Euro damage after
a self detonation of 90
ammunition containers
corresponds to 850MW-PV



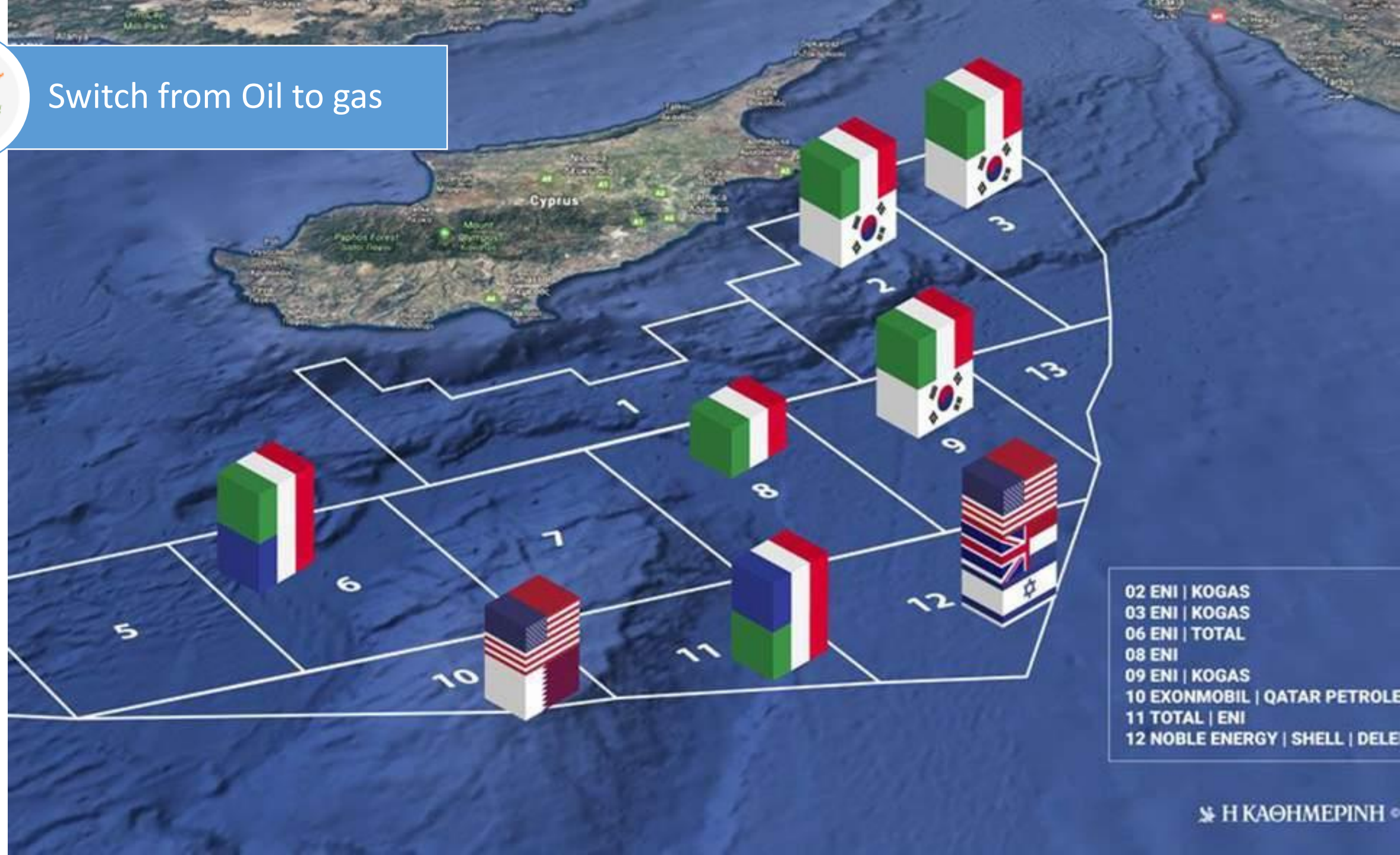
Electrical cross-border interconnection



-  Cyprus - Israel
155 nautical miles
-  Cyprus - Crete
320 nautical miles
-  Crete - Peloponnese
65 nautical miles



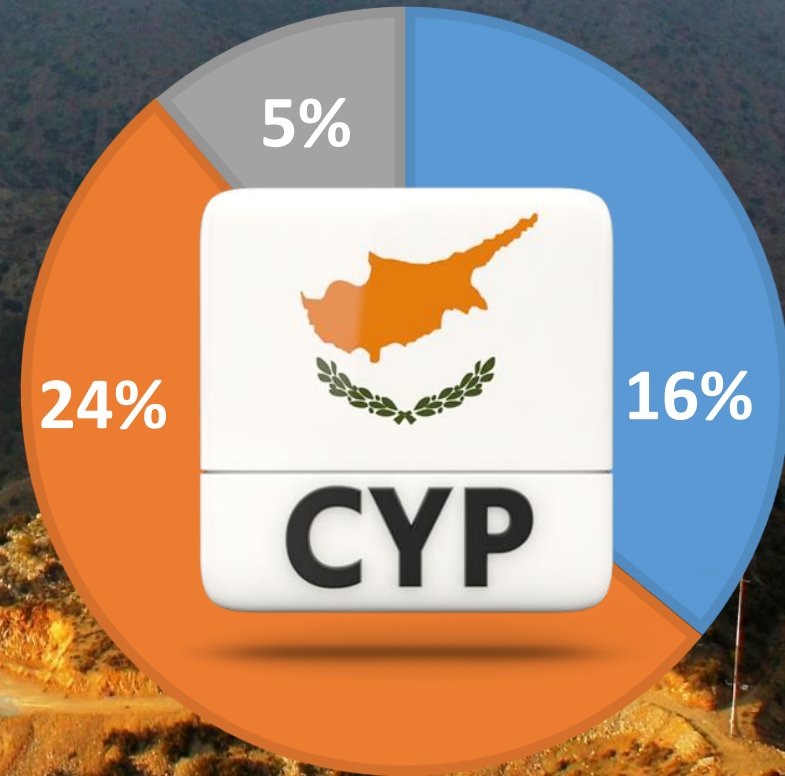
Switch from Oil to gas





13% RES CY Target 2020

...still a nightmare or not?



Kampi-Farmakas, 2,4MW Wind Park - Nicosia Area 2015

■ RES-E ■ RES-H&C ■ RES-T



Rapid increase in the share of RES (MW)

8MW PV Vassilikos Cement Factory 2019

- Feed-in Tarif
- Net-Meetering/Net-Billing
- Tendering Schemes
- Avoidance Cost Revenue Stream
- Wholesale Electricity Market



Rapid increase in the share of RES (MW)

8MW PV Vassilikos Cement Factory 2019

136

237

291

497

2019

2020

Missing 2020

2021



Allowances & Penalties

For 2020, the EAC has budgeted €85.6m in projected expenses for the purchase of CO2 emissions allowances.

The EU recommended a penalty payment of €11,400 for each day that Cyprus has not fulfilled the 20% RES



Specific Requirements





Investment (€85M)



**AMI &
MDMS**





R&D (€56M)



Demand
Response &
RES
Integration

T & D
Storage



PV &
Storage



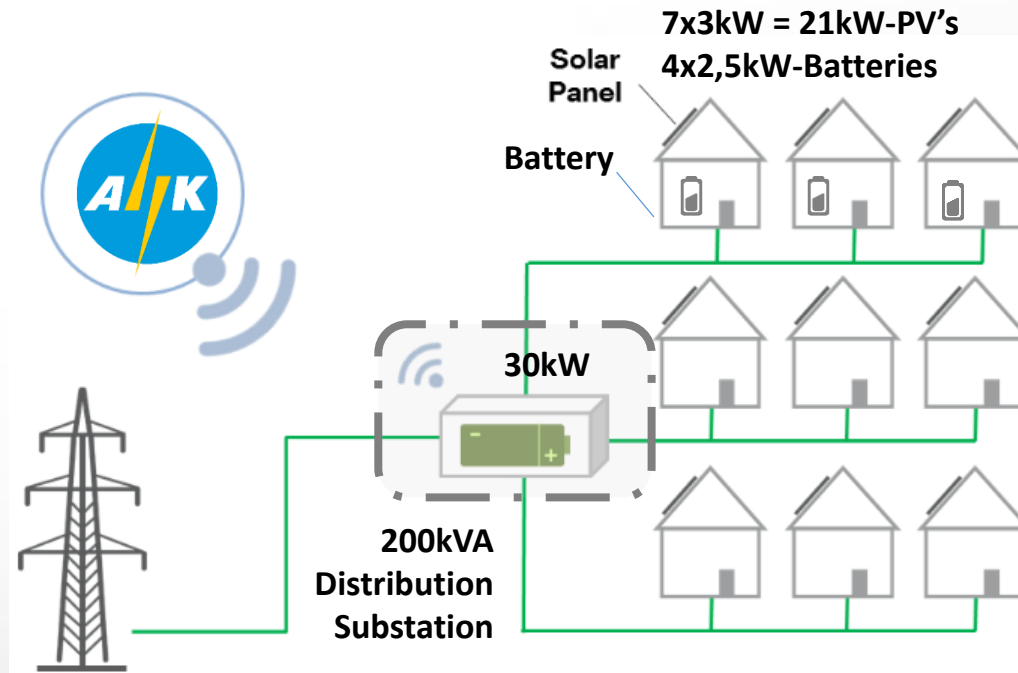


StoRES – Pilot sites





Community Battery

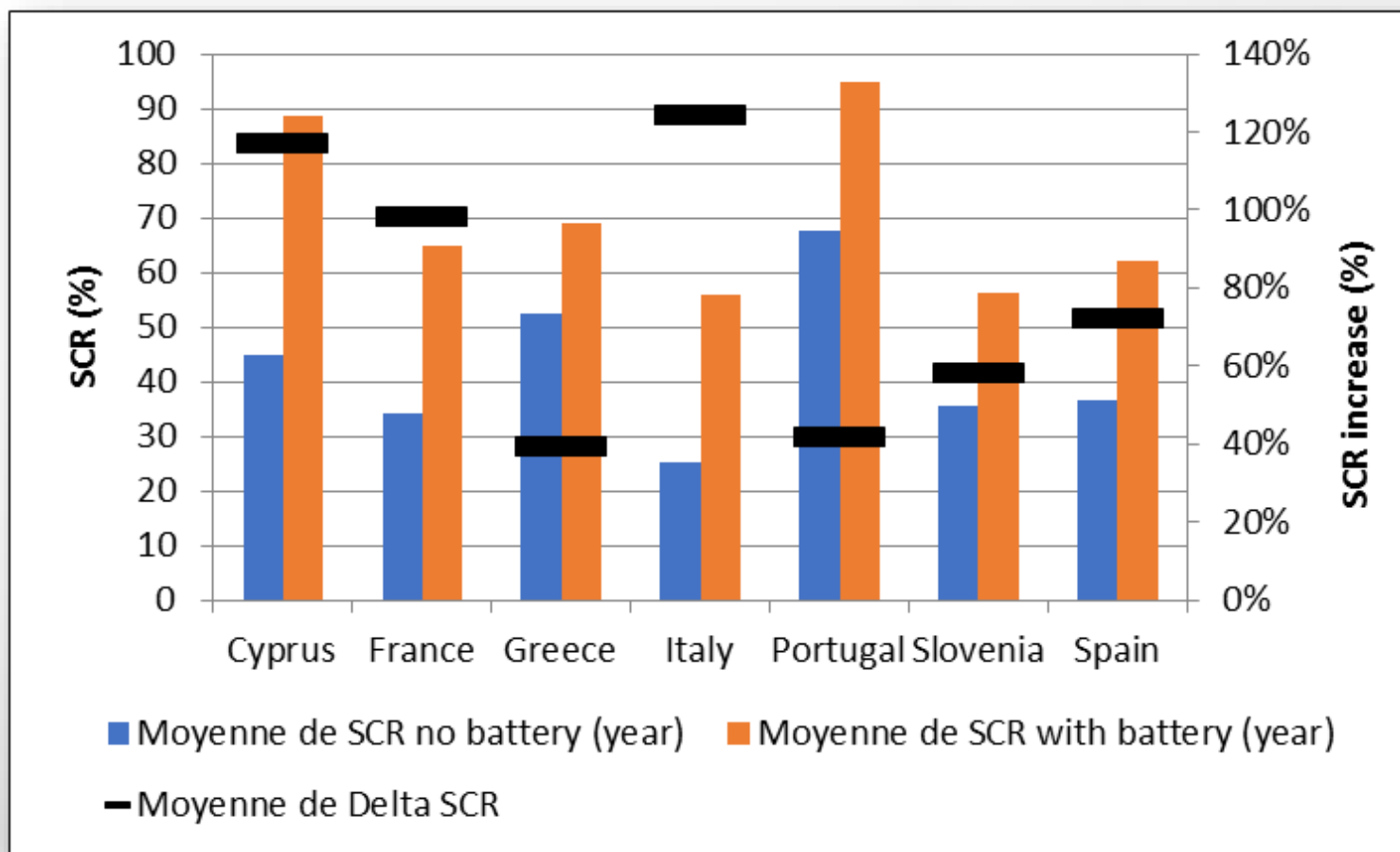


StoRES Community Battery Energy Storage System





Increase of self-consumption (~ 88%)





www.stores-livinglab.eu

Choose your site :

Cyprus 01

☒ Raw data ☐ Average profiles

File starting date :
02/02/2018

29/10/20'



to

01/11/20'



Validate dates

<<<

<<

<

File ending date :
01/11/2019

>

>>

>>>

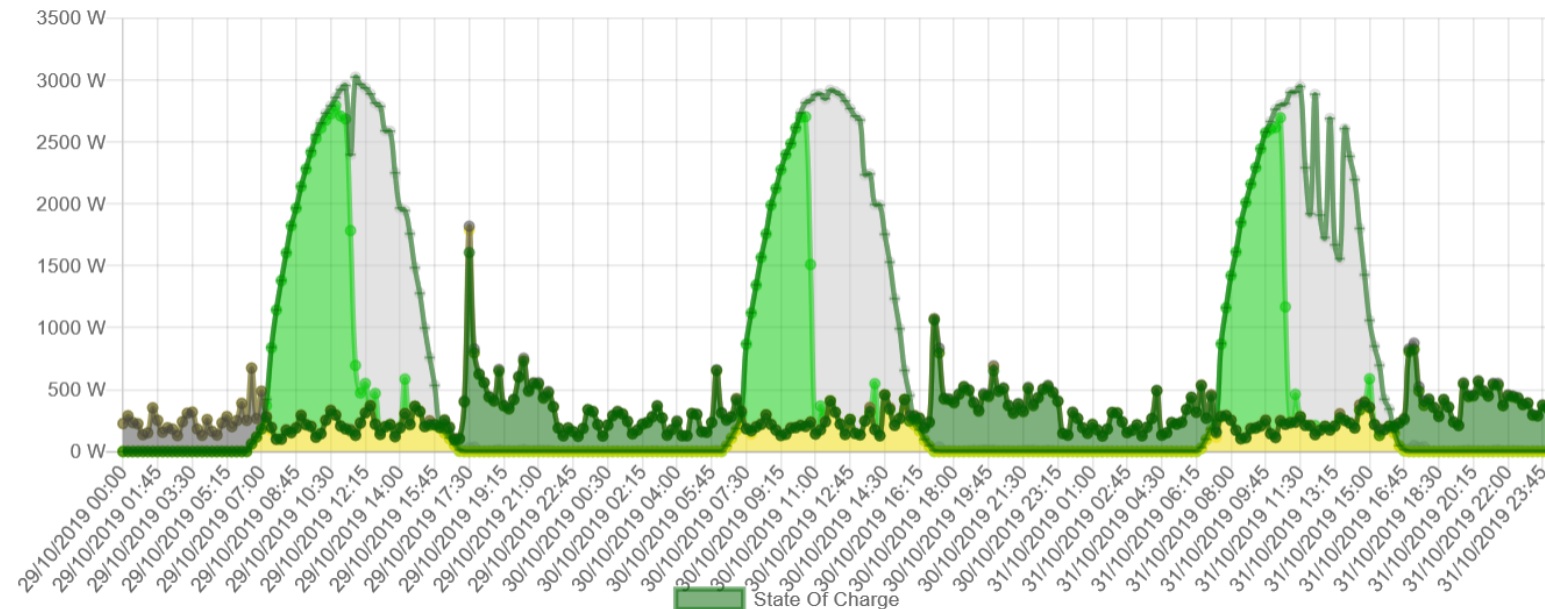
Start hour



End hour



Power production Power storage discharge Power grid import Load consumption Direct use
Power storage charge Power grid export



Cyprus 01



Country: Cyprus

Location: Nicosia

Type: residential

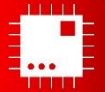
PV power: 3 kWp

PV inverter capacity: 3.75 kVa

Battery power: 5 kW

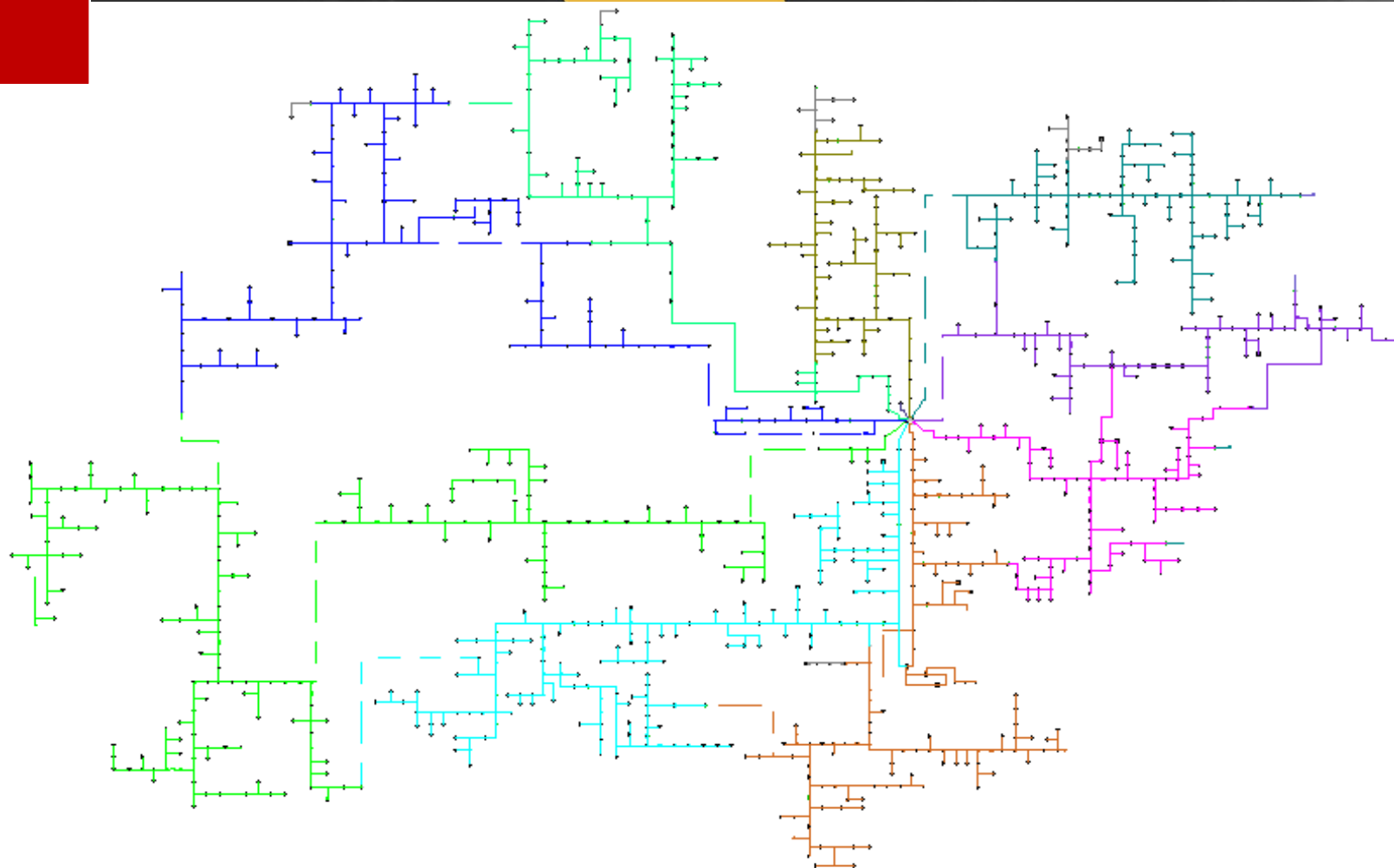
Battery nominal capacity: 9.8 kWh

Battery usable capacity: 9.3 kWh



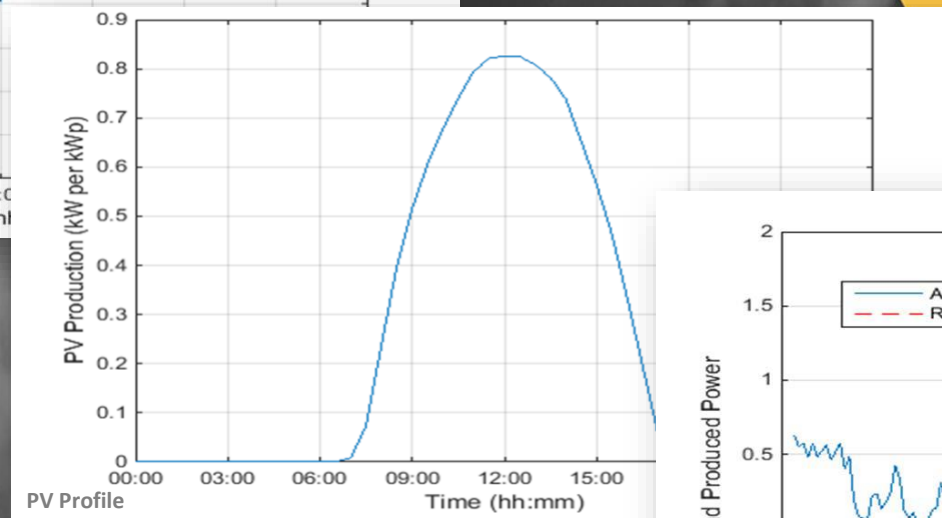
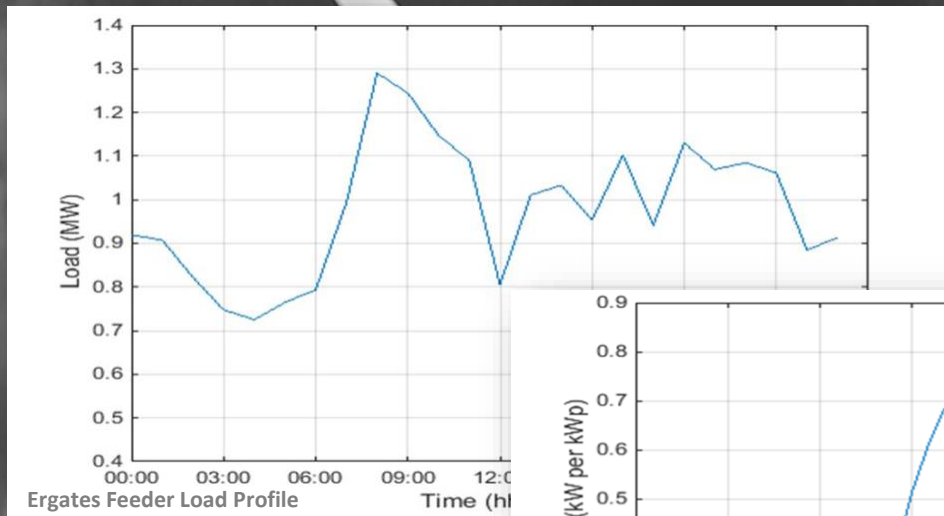
DigSilent - ArcGIS

In the beginning we imported into DigSilent all the network components, line types and lengths and then all the geographic information from the ArcGIS database.

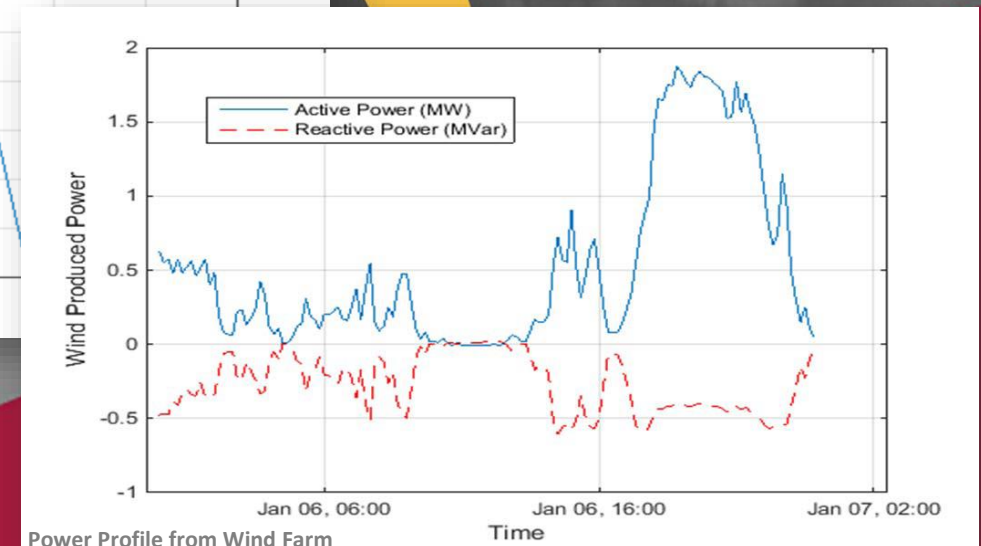


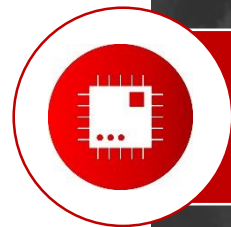
Load/Power Profiles

We generated different simulations based on generation and load profiles for proving the model, while satisfying voltage constraints and power capacity.

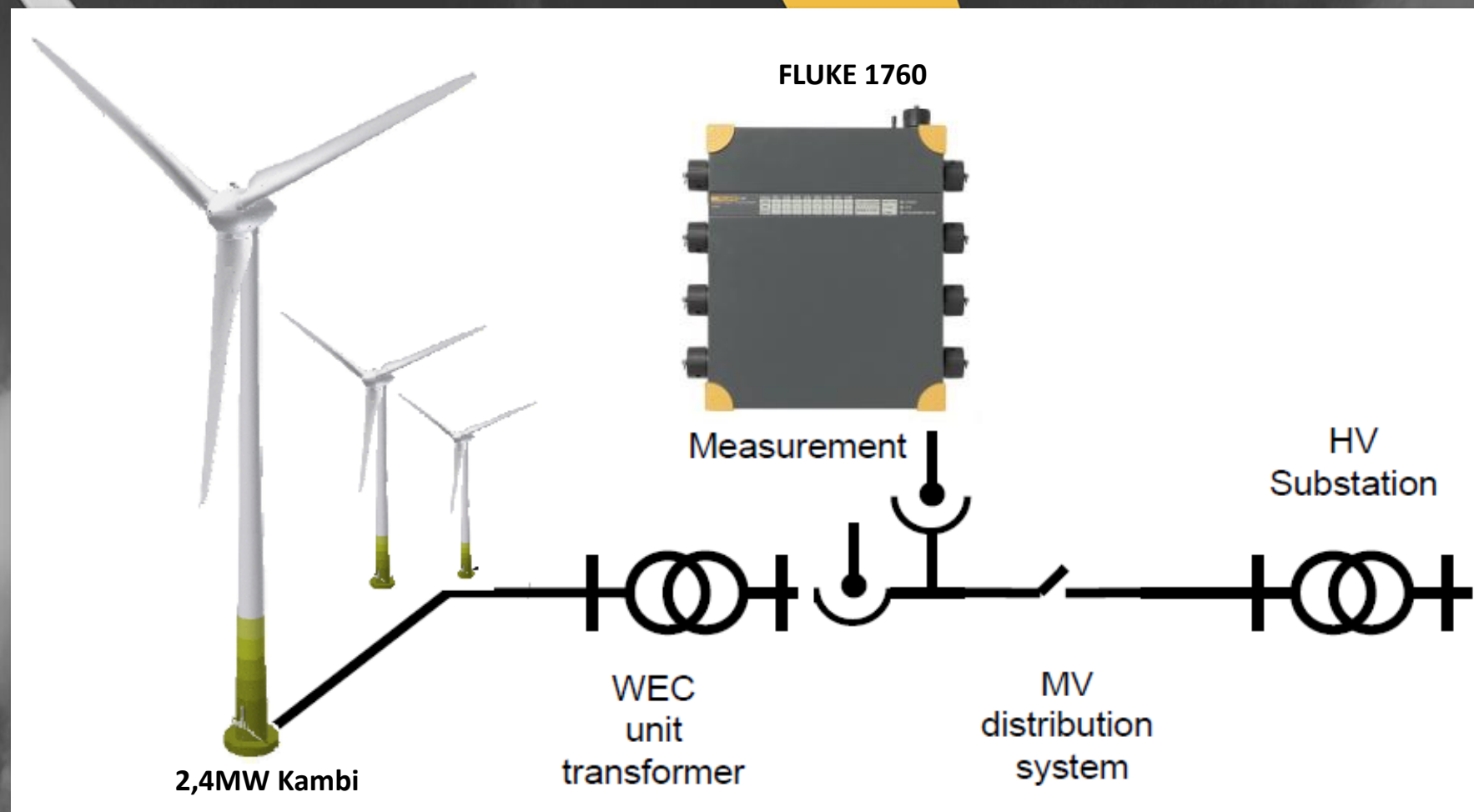


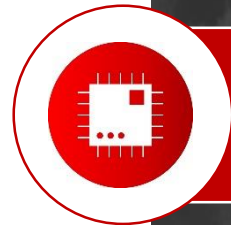
Scaling factors were defined as the ratio between the local load consumption and the total load of the feeder.





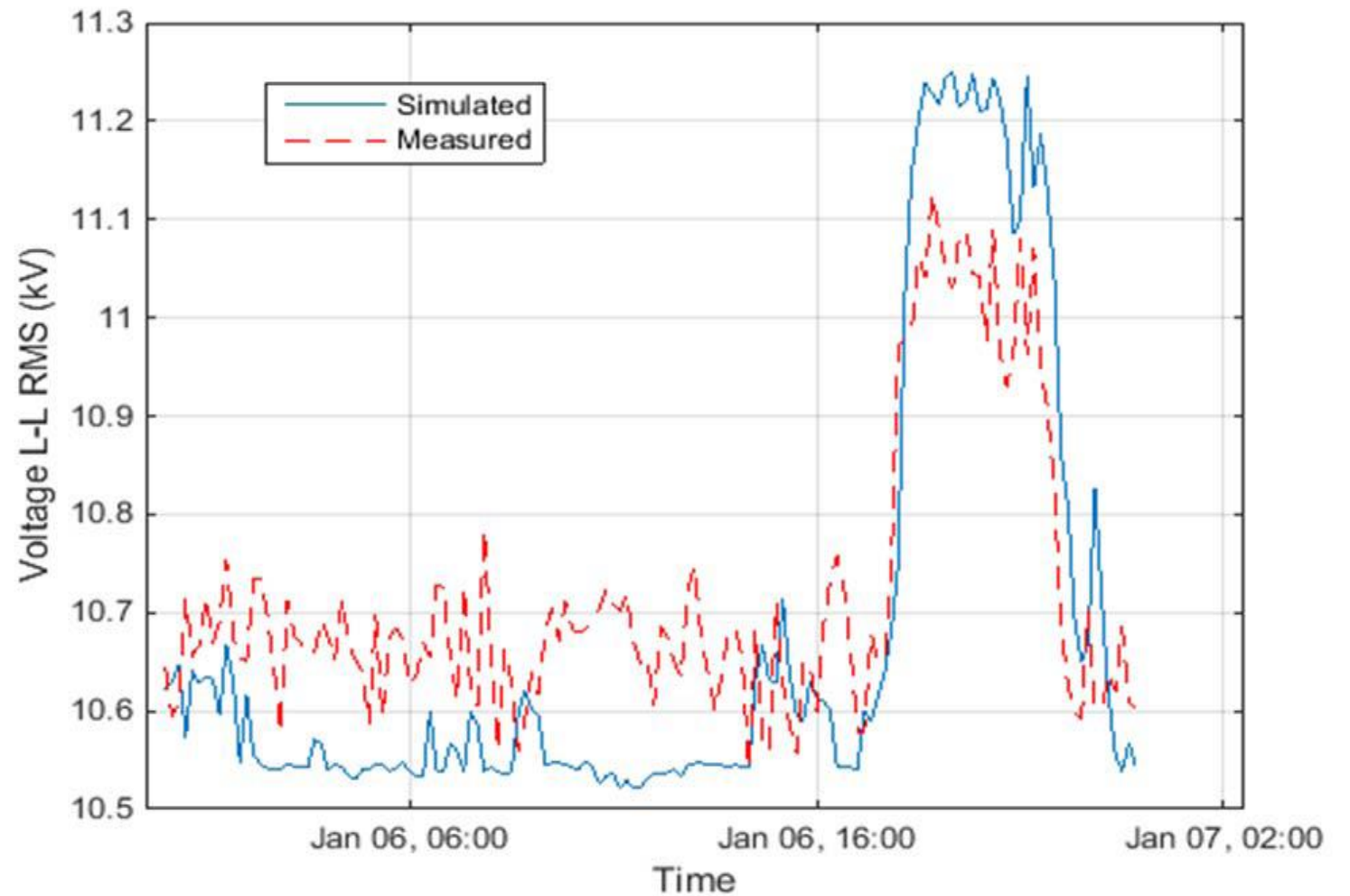
Power Quality (Fluke)





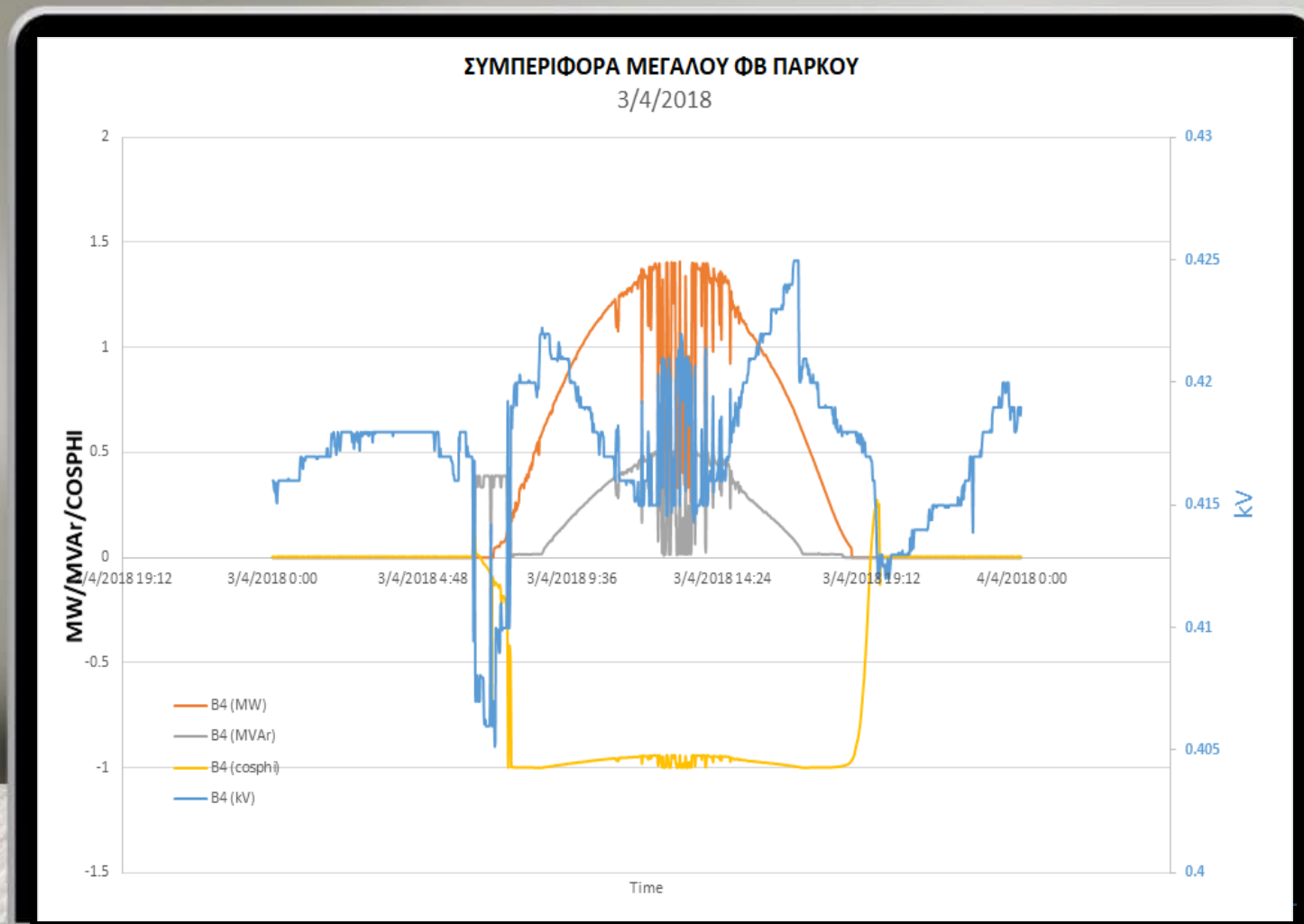
Simulated vs Measured Voltage Profile

Proof of model
completed with various
load profiles and
Measurements





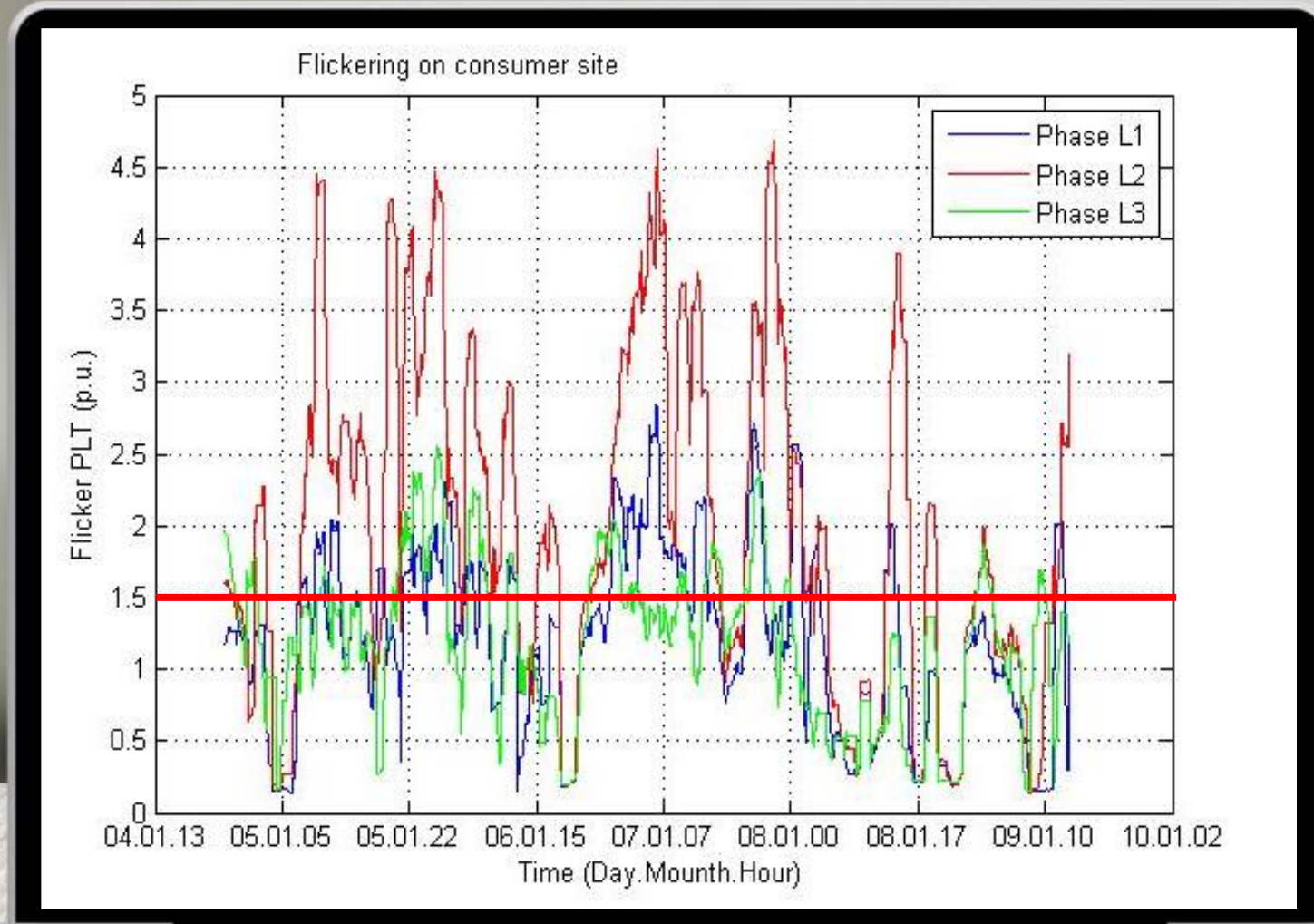
Power Quality 1,5MW PV



... Bad Inverter and Protection Settings



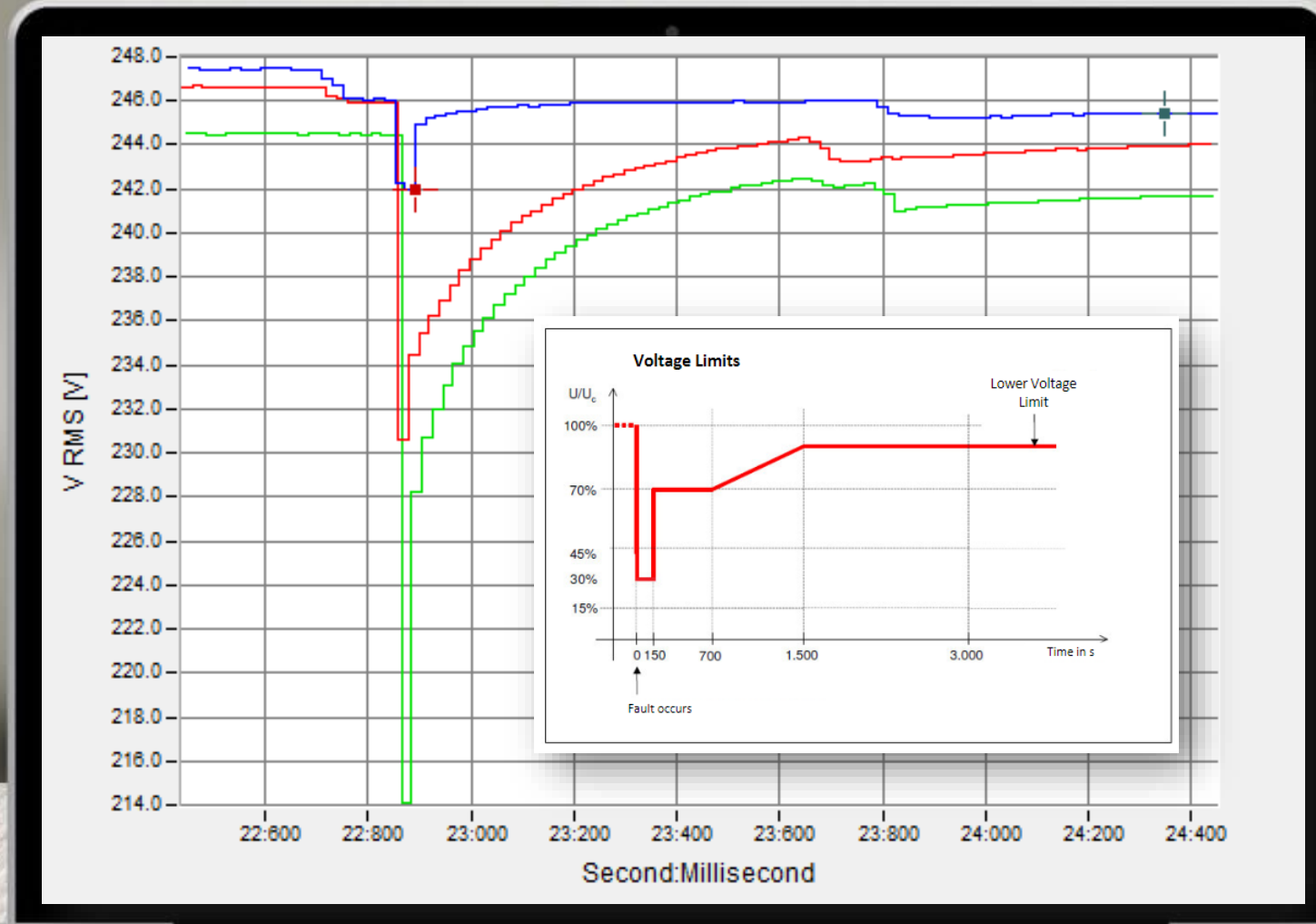
Power Quality- Flickering



...on site measurements shows flicker values reaching 4,5



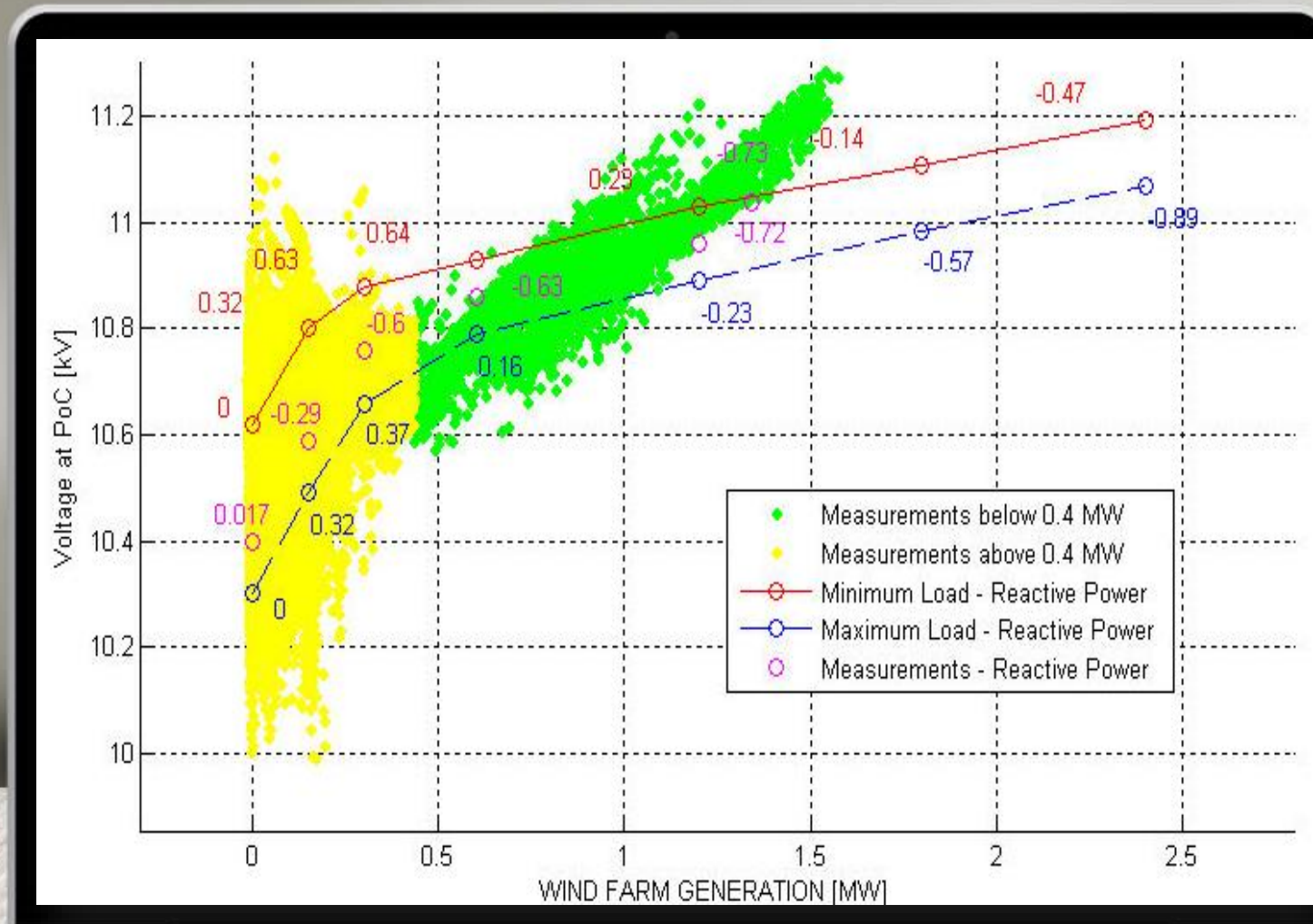
Power Quality- Flickering



...on site measurements shows flicker values reaching 4,5



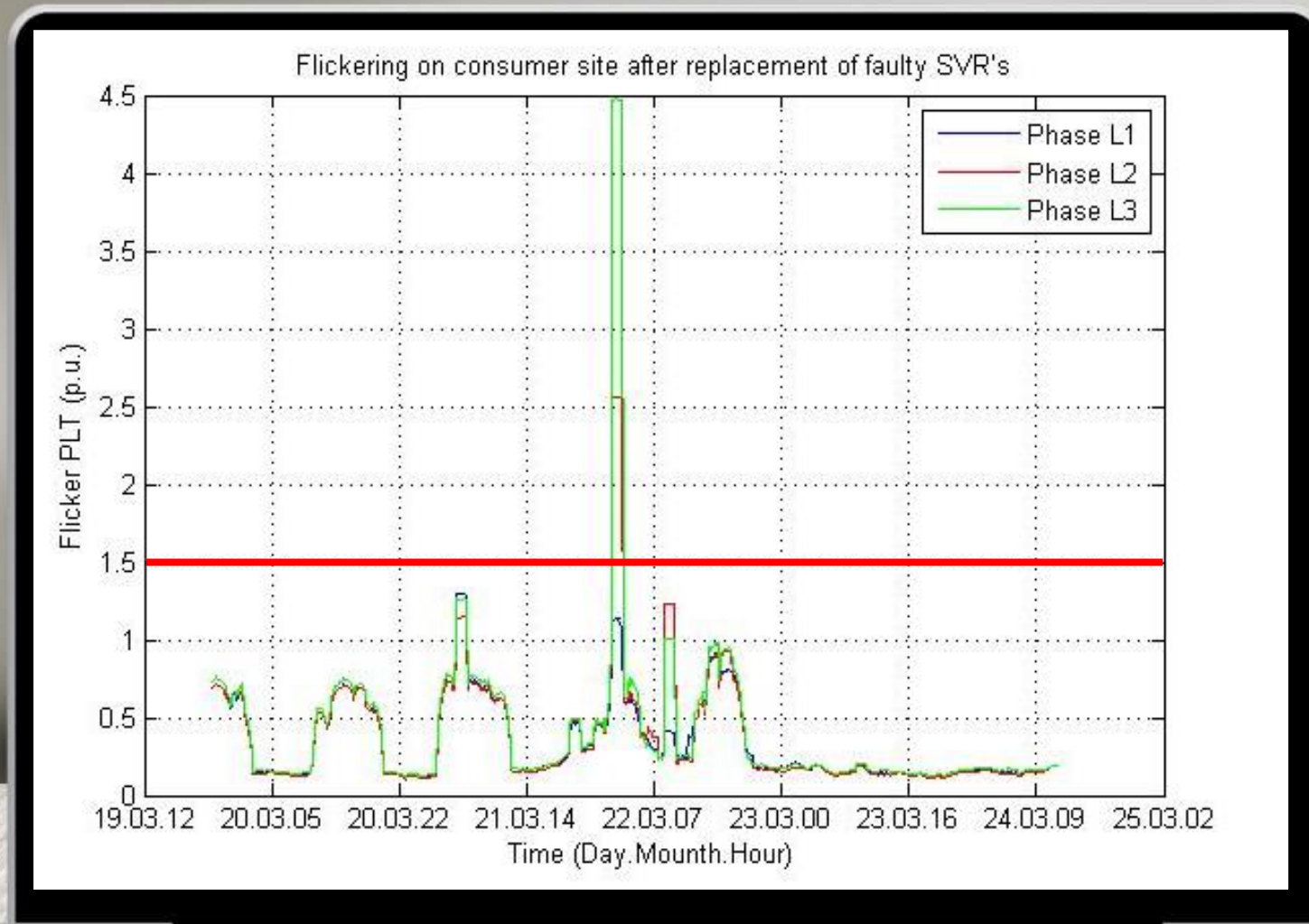
Power Quality- Flickering



... Installing of a digital VR from the 2,4MW Wind Owner & EAC AVR Replacement —



Improvement



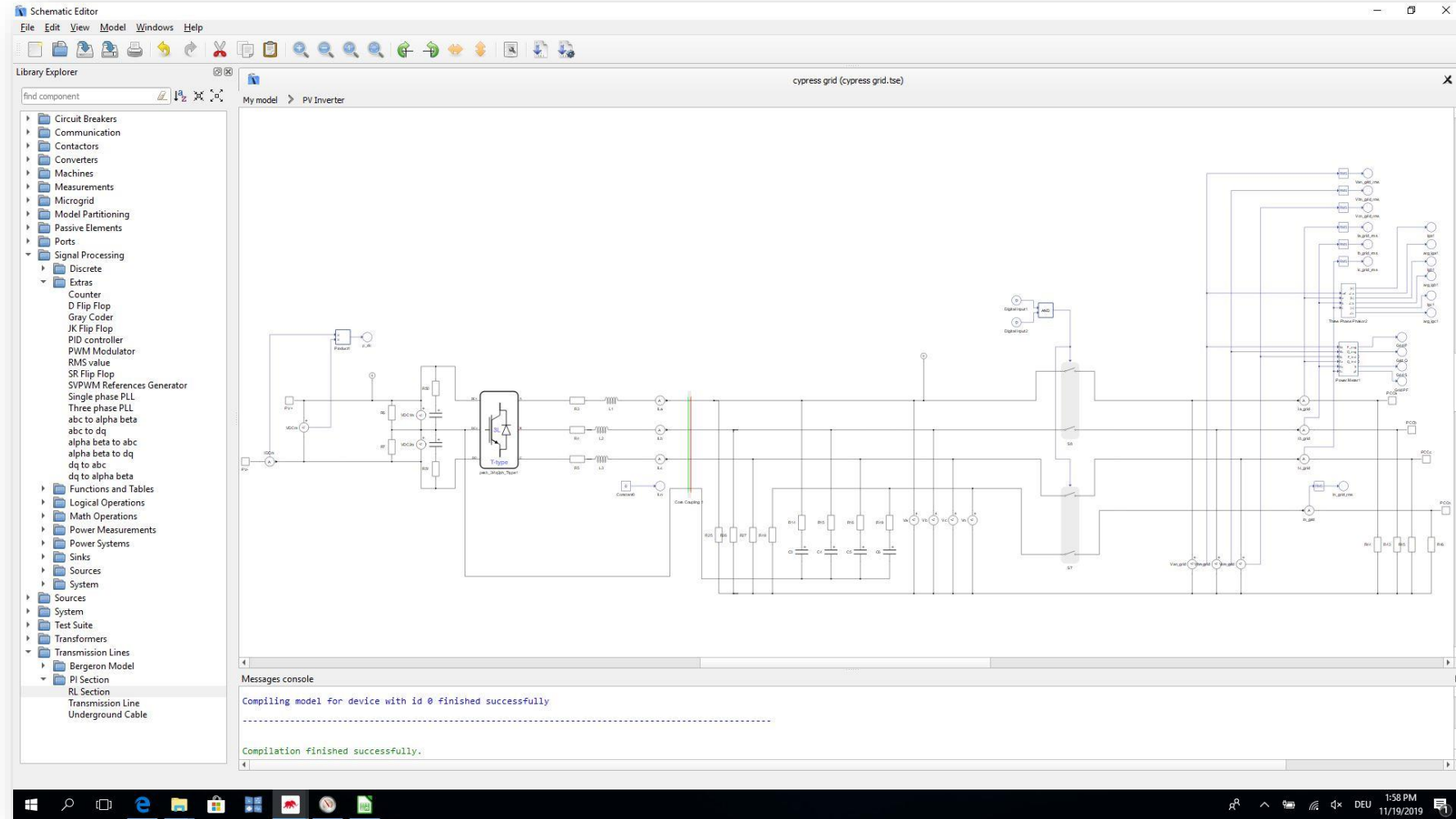
... Serious improvement of Flickering



CHIL – Feeder Simulation

CYPrus grid optimal integration and control of RES ParkS

Modeling of power feeders with PV's on a HiL environment.

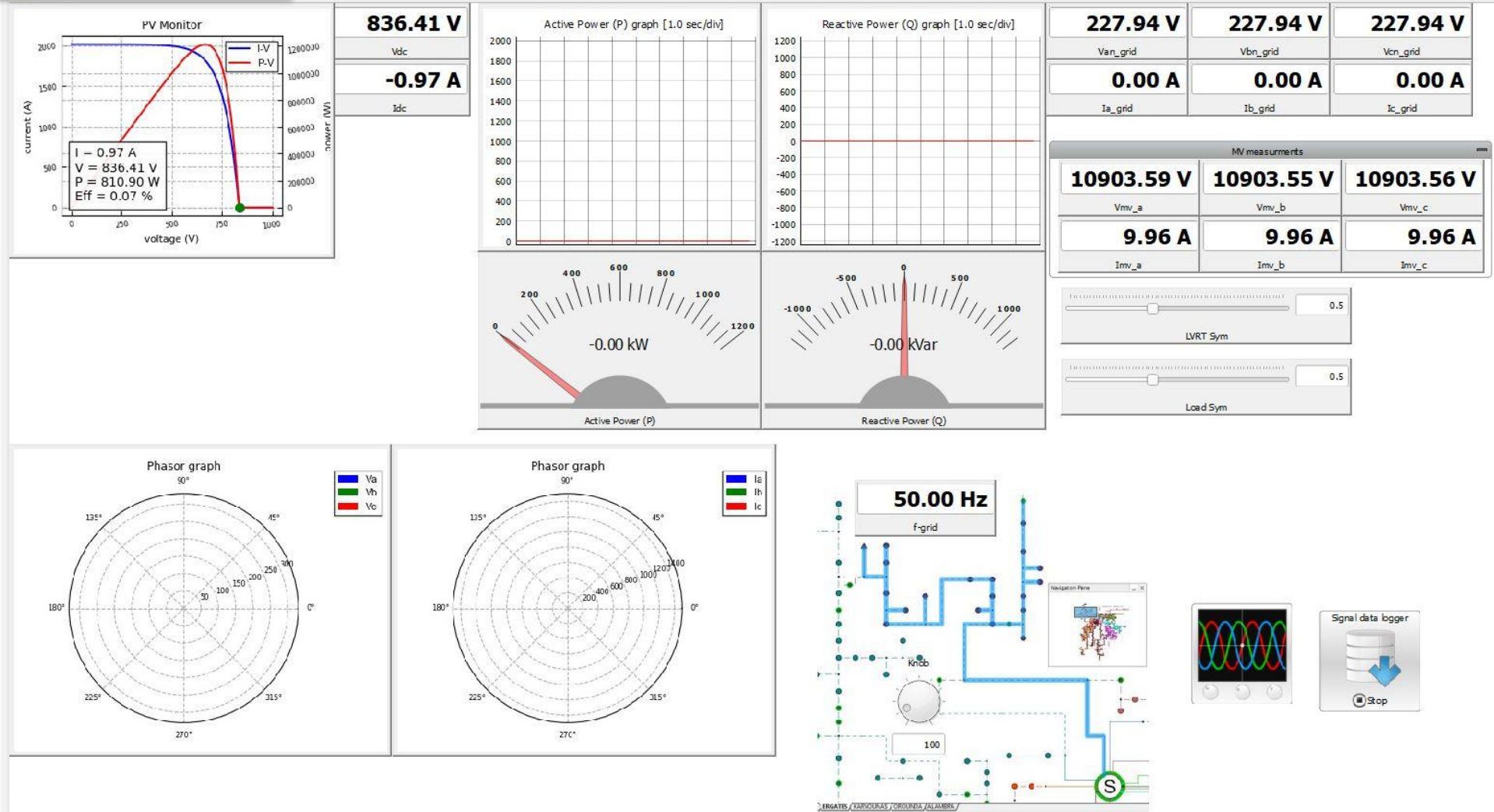




CHIL – Feeder Simulation

CYPrus grid optimal integration and control of RES ParkS

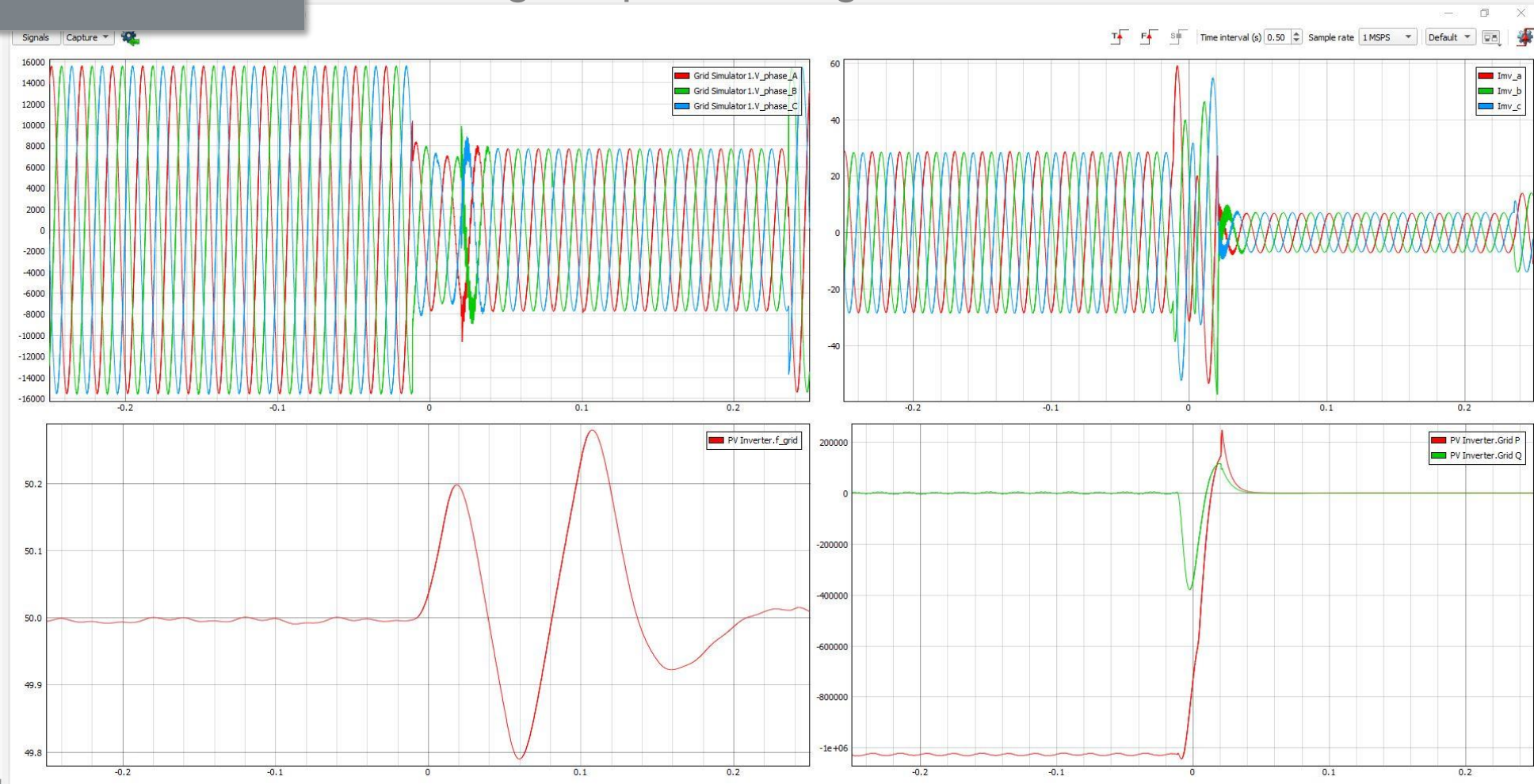
[ACTIVE] - CYPRESS GRID 3MW Ver.1.cus (c:\wpress\modelling\CYPRESS GRID 3MW Ver.1.cus) *(unsaved Panel)





CHIL – Feeder Simulation

CYPrus grid optimal integration and control of RES ParkS





Danke!

