D. Tsiamitros,
D. Stimoniaris,
N. Poulakis,
E. Dialynas

Supply-side Ancillary Services at a Microgrid-based Smart Grid Topology

Overview

- Introduction
- Description of the smart distribution grid topology
- PV plant active power control technique and algorithm
- Experimental Results

Introduction

- Ancillary services of Supply-side or demand-side of the future electricity grid → added value
- Ancillary services: fast active power compensation, voltage regulation, back-up supply.
- controlling the active and reactive power of PV facilities is of great interest.

Introduction

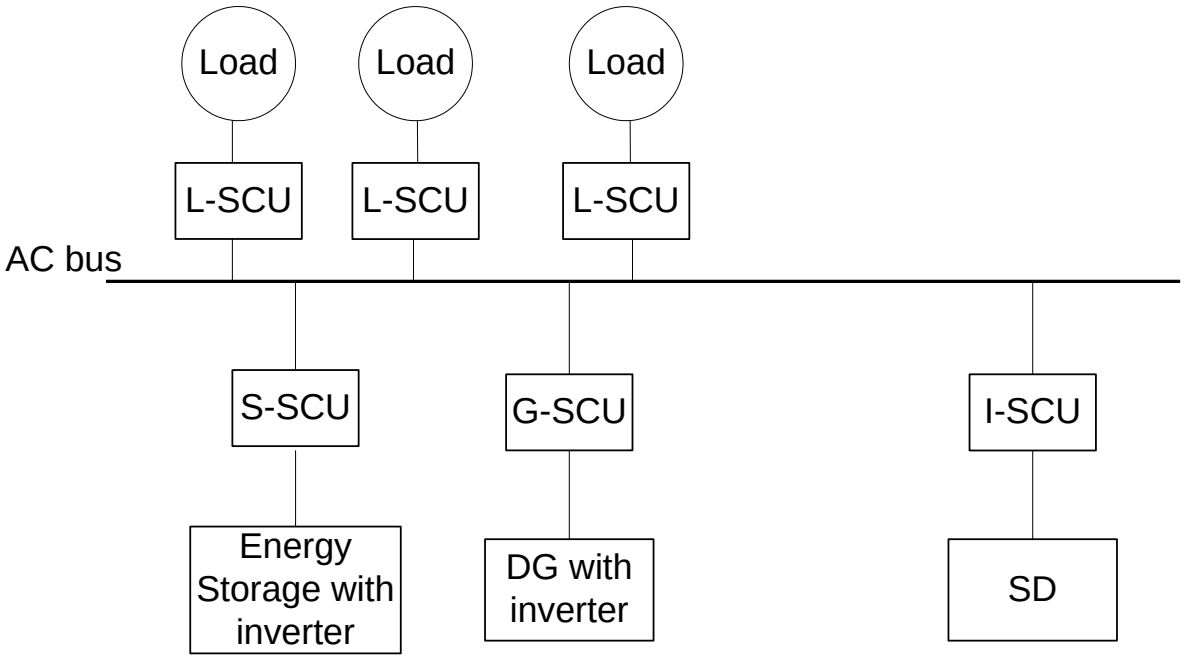
- Controlling the active and reactive power of PV facilities:

✓Changes inside PV inverter (expensive for existing facilities).
✓control circuits between PV-inverters and PV strings

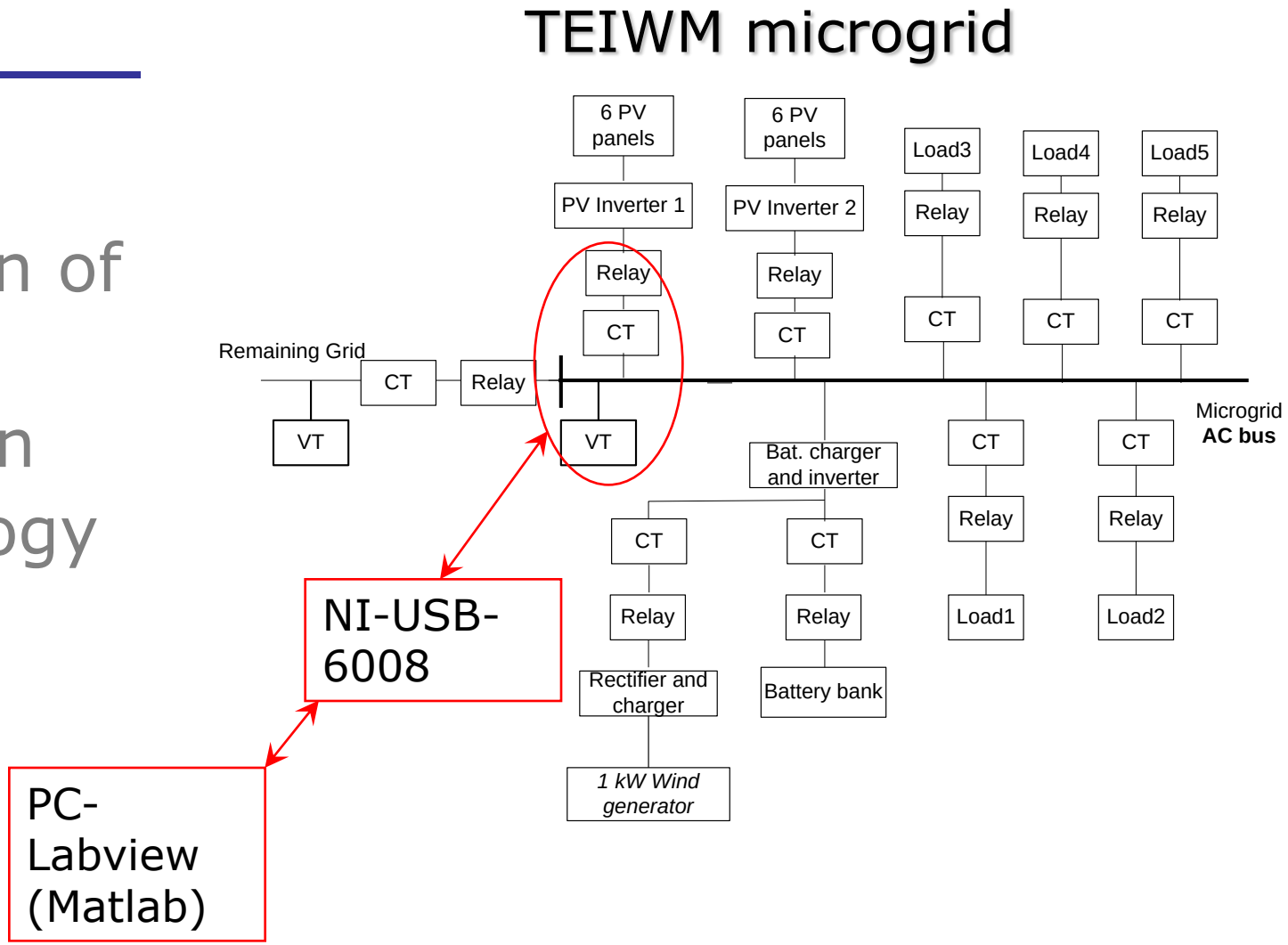
✓Here: a PV active power control technique and the respective algorithm.

Description of the smart distribution grid topology

➢ A microgrid-based smart grid topology

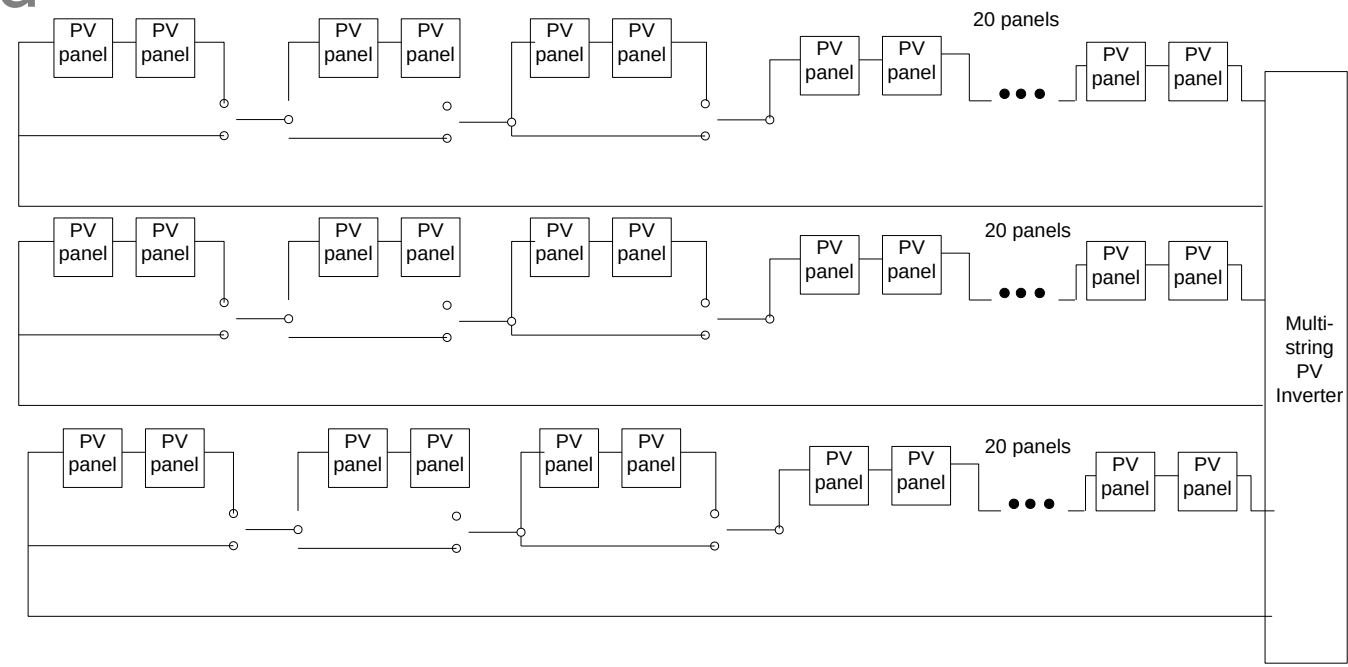


Description of the smart distribution grid topology



PV plant active power control technique and algorithm

- Proper actuator-relay combinations are applied at the PV strings circuits (6 PV panels).



PV plant active power control technique and algorithm

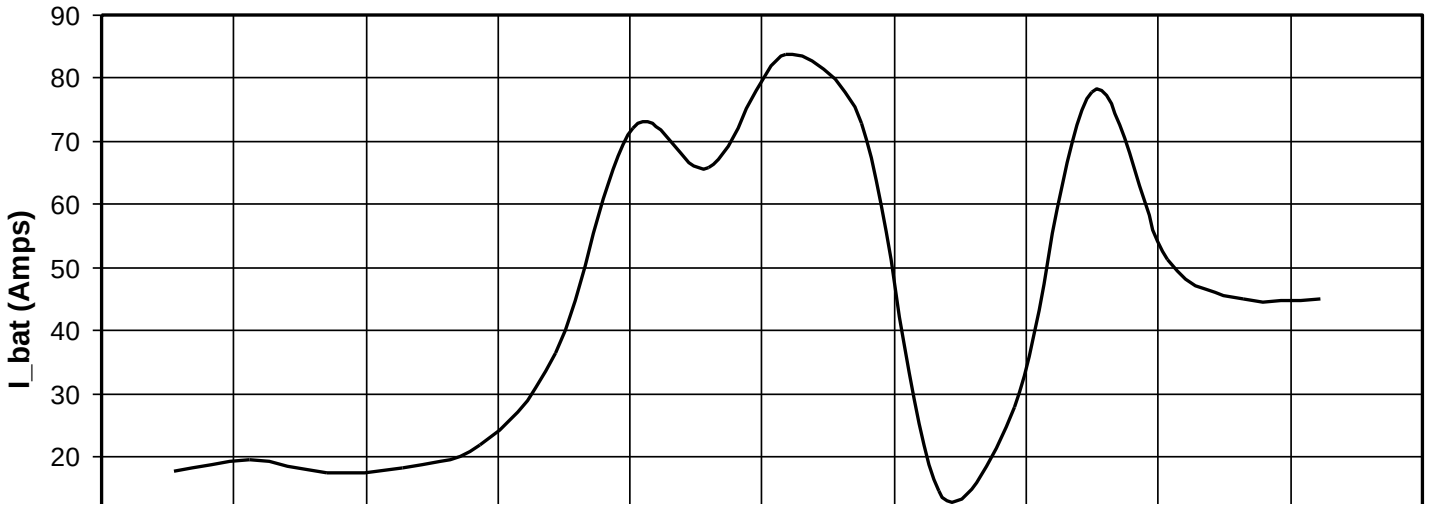
- Continuous PV power supply due to the dc-side capacitors of the PV inverters
- Drawback: Due to the MPPT, the exact output power cannot be predicted.
- The iterative algorithm that controls the microgrid makes the necessary correction in the next step (after 1 duty-cycle)

Experimental Results

- Lower voltage operation limit of the PV inverters is 150 V
- One (1) actuator is installed at equal number of the six panels of each string.
- Each relay of the PV-strings is triggered by the respective digital output of the DAQ cards

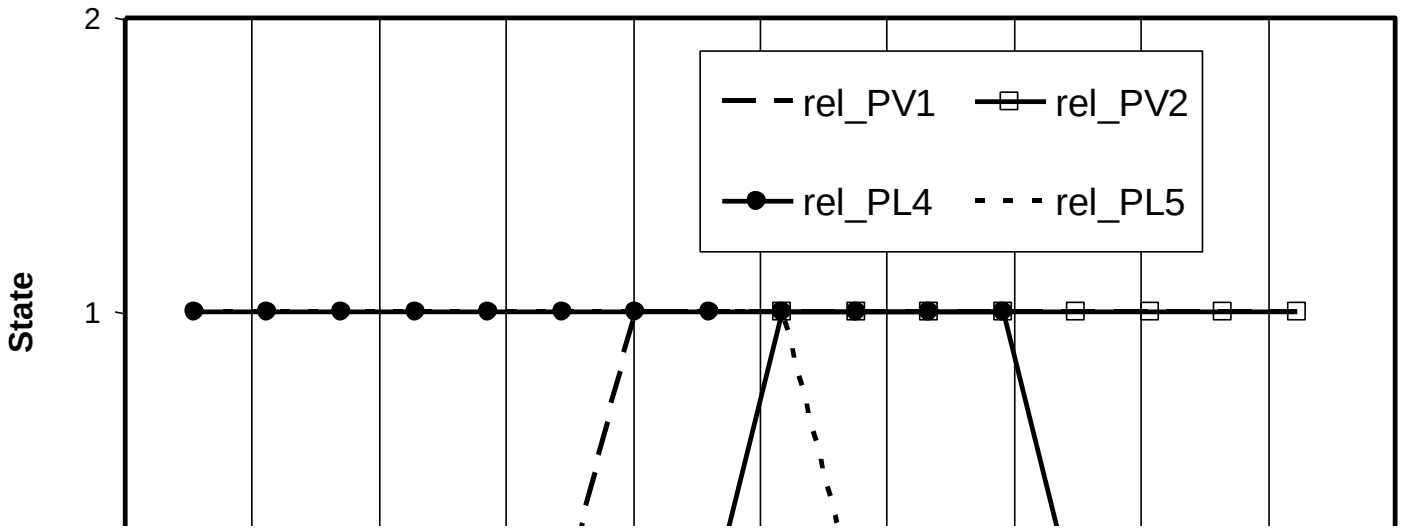
Experimental Results

Battery discharge current – 70 A upper limit (for testing)



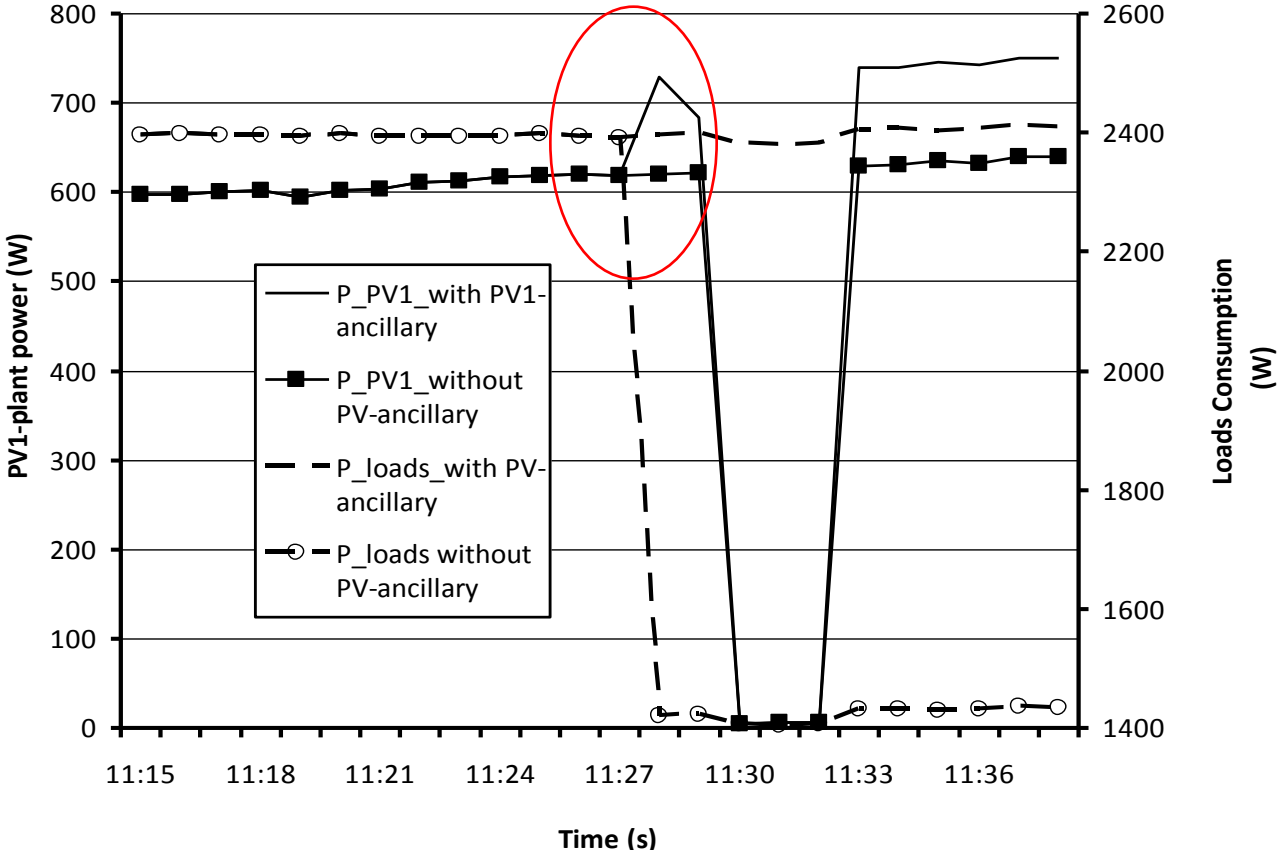
Experimental Results

Actuators state over time



Experimental Results

Actuators state over time



THANK YOU!