



PV2GRID - A next generation grid side converter with advanced control and power quality capabilities

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Presentation Outline

- University of Cyprus KIOS Research Center
- The PV2Grid project
- Our capabilities and Solar-Era.Net Call IV





KIOS Research Center - Background

- KIOS Research Center for Intelligent Systems and Networks
- Founded in 2008
- The KIOS Research Center is part of the University of Cyprus
- Housed (mainly) at the KIOS Center Building (600 m²)
- Web site: <u>www.kios.ucy.ac.cy</u>
- About 70 researchers
 - > 8 faculty members
 - > 20 post-doctoral fellows
 - > 40 Ph.D. students
 - Several M.Sc. students and non-degree researchers





KIOS Research Center - Background

- The KIOS Research Center has participated in 54 research projects since it was founded in 2008
- The Center currently has 31 active research projects (10.5M euros share for the Center)
- The Center is funded completely from external sources (68% of the funding is from EU instruments)
- Collaborations with over 150 organizations worldwide
- Focus: Monitoring, Control, and Security of Critical Infrastructure systems
- One of the main threads: Electric power systems and integration of renewable energy sources





The PV2Grid Project – Partners and Aim

A next generation grid side converter with advanced control and power quality capabilities

- **KIOS Research Center University of Cyprus (Coordinator)**
- > Department of Energy Technology Aalborg University
- Quantum Energy Corporation Ltd



- ✓ This project aims to advance the technology related to the seamless grid integration of photovoltaic (PV) systems.
- ✓ Development of next generation power electronic Grid Side Converters (GSC) with advanced capabilities and innovative operational management approaches.









The PV2Grid Project – Objectives

- Design and develop new generation Grid Side Converters (GSCs) equipped with advanced control capabilities and novel operational mode approaches:
 - ✓ providing support to the grid when needed
 - $\checkmark\,$ enhancing the power system stability
 - \checkmark improving the power quality of the grid
 - $\checkmark\,$ reducing the network losses
- Design new current controllers with advanced operational capabilities under normal or abnormal voltage conditions.
- Develop experimental prototypes of GSCs including the current control techniques, the PQ controllers and the scheduling algorithm.
- Design an optimal scheduling algorithm considering a dynamic electricity-pricing environment and the presence of storage (prosumer profit maximization).





The PV2Grid Project – Main outcomes

- Advanced next-generation GSC for PV systems with new power operational management approach, extra functionalities, capabilities, and long lifetime with reduced cost of energy.
- Improved overall performance of PV plants by ensuring their efficient and effective grid integration under any grid conditions.
- A new multifunctional industrial product that will further assist the grid integration of renewable energy sources.
- Advanced single- and three-phase current controllers for enhancing the grid power quality by compensating the non-ideal loads of the prosumer.





Architecture of the Proposed GSC







Added Functionalities and Timeline for Commercialization



KIOS Research Center – Our Capabilities

- Deep knowledge of power system operation (generation, transmission, and distribution)
- Modeling and simulation capabilities of both the system and renewable sources (including our custom-made steady state and dynamic models of power system components and renewable sources)
- Expertise in power electronics and grid side converters
- Fully equipped laboratories for testing and development
- Owning and operating a real size grid-connected microgrid (rated at 200 kVA)
- Experience in leading both FP7 and H2020 projects





- Mainly interested in PV4.3: Grid integration and large-scale deployment of PV
- Can contribute to CSP4.2: Dispatchability through storage and hybridisation
- Open to coordinate or participate in proposals in the fourth call of Solar-Era.Net







Thank you!

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http://www.kios.ucy.ac.cy









