

5. JOINT RESEARCH CENTRE FOR FUTURE ENERGY TECHNOLOGIES

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The Future Energy Technologies Research Centre offers the possibility of financed research stays (from 12 months to 24 months)

The [Future Energy Technologies \(FETECH\) Research Centre](#) is a joint research centre between the Automatics and Industrial Informatics (ai2) Institute of the Technical University of Valencia and Universitat Jaume I of Castelló.

Fetech Centre includes 14 researchers from the aforementioned institutions and has the mission of developing technologies to provide environmental and economically sustainable energy supplies.

Our main lines of research are HVDC grids, integration of off-shore wind power plants, Grid forming converters, Wind and solar short term forecasting, BESS for power applications (including grid forming control) and degradation and characterisation of BESS.

The three main drivers of Fetech research in renewable energy are LCoE reduction, increased renewable energy penetration and provision of additional services. Fetech has a large experience on the evaluation and development of novel technologies for grid integration of wind power plants, including grid forming control of type-3 and type-4 WTG (both synchronous and induction generators).

Since, 2000, the technical solutions put forward to improve WTG and WPP include:

- machine side converter dc-link control for type 4 IG wind turbines [1]
- the use of local storage within wind turbines [2]
- connection of DFIG based wind power plants to line commutated converters [3]
- connection of grid forming type-4 wind power plants to HVDC diode-rectifiers [4], [5],
- grid forming control for connection of off-shore wind farms to VSC-HVDC links, including islanding operation [6], [7],
- wind power plant integration to HVDC-grids [8],
- grid forming control of DFIG based wind turbine generators [9], [10],
- interaction between wind power plants and HVDC links [11],
- optimisation of MML power converters for use with HVDC diode-rectifier connections [12]
- use of new DC-DC HVDC modular multilevel power converters with fault blocking capability [13]

We have also worked on the design and validation of grid forming wind turbine and power plant controllers for black-start, islanding operation and fast re-connection of WPPs during system recovery, holding several patents on grid forming control of wind power converters.

Since 2006, we have worked on the aforementioned topics in more than 10 projects with the main Spanish renewable energy developers, National and European funded competitive research projects. Additionally, we have led the tasks related to WPP grid integration and to black start operation using grid forming converters in the H2020 project PROMOTioN.

Moreover, we have worked for with Taiwan Power Company to adapt the Taiwan grid code to cope with a large penetration of renewable energy.

Fetech has state of the art Real Time simulation facilities that allow the detail CHiL simulation of complete wind power plants, with up to 23 individual wind turbines, including possible STATCOMs, BESS, MMC HVDC connection and actual protection relays.

UPV is an active member of Cigré WG C4.49 “*Multi-frequency stability of converter-based modern power systems*” and Cigré WG B4.81 “*Interaction between nearby VSC-HVDC converters, FACTS devices, HV power electronic devices and conventional AC equipment*”, and also an expert member of the International Electrotechnical Commission study committee IEC/SC 8A “*Grid Integration of Renewable Energy Generation*” .

Relevant recent projects:

Advanced Control Systems for Large Wind Power Plants Connected to HVAC and HVDC grids.

Spanish Ministry of Economy and EU FEDER Funds. PI: Ramón Manuel Blasco Giménez. 1/7/2019 – 30/6/2021.

Advanced control of wind and PV power plants.

(GJIDI/2018/A/247) Valencian Government Agency of Science and Technology and the European Commission (FEDER Fund)

PI: Ramón Manuel Blasco Giménez. 15/10/2018 – 15/10/2019

Advanced converter control for electric systems with electronic power penetration close to 100%.

(IDIFEDER/2018/036) Valencian Government Agency of Science and Technology and the European Commission (FEDER Fund)

PI: Ramón Manuel Blasco Giménez. 01/01/2018 – 31/3/2021

Advanced control of wind power plants

(AEST/2018/018) Valencian Government Agency of Science and Technology and the European Commission (FEDER Fund)

PI: Ramón Manuel Blasco Giménez: 01/01/2018 – 31/12/2019

PROMOTioN – Progress on Meshed HVDC Offshore Transmission Networks (EU-H2020)

(691714 — H2020-LCE-2015-3) European Commission. 2016 – 2020 PI – UPV: Dr. Ramón Blasco Giménez.

Converter-converter and grid-converter interaction in HVAC and HVDC grids with high renewable energy penetration.

(DPI2017-84503-R) Spanish Ministry of Economy and EU FEDER Funds. D.G. De Investigacion. 1/1/2018 – 30/9/2021 PI: Dr. Ramón Blasco Giménez

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