

Project IMaDER – Intelligent Short Term Management of Distributed Energy Resources in a Multi-Player Competitive Environment (PTDC/SEN-ENR/122174/2010), (FCOMP-01-0124-FEDER-021489) is recruiting 1 young researcher owning a Master’s Degree (MSc) in Electrical Engineering or similar, with solid background in the area of Power Systems. This call concerns research activity in the area of intelligent short term management of distributed energy resources in a multi-player competitive environment. This project is funded by Portuguese funds through FCT/MEC (PIDDAC) and co-funded by “Fundo Europeu de Desenvolvimento Regional” (FEDER) through COMPETE – “Programa Operacional Factores de Competitividade” (POFC). The following conditions are applied to this recruitment process:

1. SCIENTIFIC AREA

Electrical Engineering

2. EDUCATION

Master’s Degree (MSc) in Electrical Engineering or similar, with solid background in the area of Power Systems.

3. DURATION

From August 1, 2013 until January 31, 2014 (6 months duration, eventually to be renewed till the end of the Project).

4. ACTIVITIES AND WORKPAN

The main goal is to undertake research work in the area of intelligent short term management of distributed energy resources in a multi-player competitive environment.

Distributed Generation (DG) mainly based on Renewable Energy Sources (RES) has been increasing, bringing new challenges to Power Systems (PS) and leading to the Smart Grid (SG) concept. There are already PS for which the RES based generation is very significant, but DG must still increase at a high rate to attain energy policy targets, namely in EU. In the future, DG and other Distributed Energy Resources (DER) are likely to be used in an intensive way, making future PS accommodate a huge number of DER of different types: DG, storage, Demand Response (DR) and Electric Vehicles (EV).

In some cases the investment made in RES based generation plants is not used in its full extent as some peak generation periods correspond to off-peak demand, causing significant wind curtailment. Currently, the operation planning methods used are not adequate for the characteristics of most of DER and even with a lot of ongoing research work some problems remain unsolved. This is the case of DER management which should take into account all the relevant technical and economic issues.

DR and EV (namely gridable vehicles, usually referred as V2G) can be very useful to enable a more efficient management providing the means to increase load demand when there is a generation surplus, and decreasing it, at a controlled cost, when there is a generation shortage or when the operation costs are higher than acceptable. This can be achieved by connecting V2G to the electric grid, discharging their batteries in peak-load periods. DR programs can be used in a more flexible way guaranteeing that the most costly generation resources are managed, so that operation costs are kept within acceptable limits.

Large-scale integration of DER cannot be done with traditional PS methods or with the presently used business models. The new context includes a large number of players of several types (electricity consumers, V2G and DG owners, aggregating entities such as Virtual Power Players (VPP), car parks, and system operators) acting in competitive Electricity Markets (EM).

IMaDER will contribute to overcome this situation conceiving, developing and implementing methodologies adequate for Energy Resource Management (ERM) in the context of future PS. The proposed methodologies are based on the characteristics of the problem and of the involved resources and players. Due to the difficulties of having accurate forecasting for natural resources, the final scheduling of Energy Resources (ER) should be undertaken with little anticipation. This leads to the proposal of a two-phase short-term ER scheduling, with different time anticipations (1 hour and 5 min), each one considering the most updated forecasts, the already established contracts and market transactions and the market opportunities. This method considers, in each phase, all the available resources (DG, DR, storage, and EVs) respecting their technical limits and contracts. Market price and context are taken into account by considering the contracted transactions (bilateral, day-ahead, and intra-day, if any) and the existing opportunities.

IMaDER focuses on short-term ER scheduling as day-ahead scheduling is a simpler problem, already addressed by the team in previous projects. IMaDER proposes a heuristic optimization approach, partially based on optimization methods refined by the project team so that their performance is as required.

IMaDER also addresses the issue of players' negotiation and remuneration, based on two distinct and combined approaches: a multi-level negotiation mechanism for VPPs supported by a multi-agent based simulation platform and a LMP based remuneration approach that supports decisions concerning one of the negotiation levels and also the remuneration method for the aggregated players.

IMaDER will result in an intelligent short-term ERM software application that considers all the relevant data and constraints, including the technical limits inherent to the electric equipment and network. This application implements the two-phase approach being available to support ERM in a real context. The multi-level negotiation and the LMP based remuneration methodologies will result in two other applications. All these applications will be integrated with MASCEM, resulting in an enhanced EM simulator.

The candidate to be selected will participate in the following project tasks:

- T1 – State of art of Virtual Power Producers (VPP)
- T2 - Model and Simulation of VPP operation
- T3 - Multi-Agent Systems and Agent Coalitions
- T4 – Virtual Power Producers: Formation and operation
- T5 – Virtual Power Producers: Market Negotiation.

The selected candidate work includes:

- Upgrade of previously developed models, methodologies and applications;
- Design, implementation, test, and use of the models and methodologies proposed in the scope of the project;
- Preparation of case studies and result analysis;
- Technical reports and scientific papers preparation and writing.

This work includes the design of the foreseen methodologies, their implementation, and test

## 5. LEGISLATION AND REGULATIONS

“Estatuto do Bolseiro de Investigação Científica”, approved by Law no. 40/2004, of 18 August, modified and e republished by Decree-law no. 202/2012, of 27 August and modified by Decree-law no. 233/2012, of October and by Law no. 12/2013, of 29 January; Regulation no. 405/2010, May.6.2010 (published in “Diário da República” no. 88, II Serie, 06.May.2010); “Despacho IPP-P-002-2013 - Regulamento de Bolsas de Projetos”; “Regulamento de Bolsas de Investigação da Fundação para a Ciência e a Tecnologia, I.P. – 2012.

## 6. SUPERVISION AND WORKPLACE

The candidate to be selected will be scientifically supervised by Professor Zita Vale.

The workplace is at GECAD – Knowledge Engineering and Decision Support Research Center in the following address:

Instituto Superior de Engenharia do Porto  
Rua. Dr. António Bernardino de Almeida, 431  
4200-072 Porto – Portugal

## 7. REMUNERATION

As defined by FCT (€ 980.00/month), according to the table of stipends of the country (available in <http://www.fct.pt/apoios/bolsas/valores.phtml.en>), paid by bank transfer).

## 8. CANDIDATE SELECTION METHODOLOGY AND EVALUATION PANEL

Only candidates that have presented the complete set of application documents and showing evidence of having the required minimum profile required will be admitted. The selection method will take into account the following components: BSc (20%) and MSc graduation classification (30%), curriculum vitae evaluation (50%). To clarify the candidates' motivation and profile, according to the fellowship requirements, an interview may be undertaken; it will be conducted in English. In this case, the following components will be taken into consideration: BSc graduation classification (10%), MSc graduation classification (20%), curriculum vitae evaluation (50%) and interview (20%).

The evaluation panel includes: Prof. Zita Vale (panel coordinator), Prof. Goreti Marreiros and Prof. Isabel Praça.

## 9. RESULTS PUBLICATION AND NOTIFICATION

The candidates will be individually notified by email message on the final evaluation results.

## 10. APPLICATION

Minimum profile required: Solid background in Power Systems with previous experience dealing with distributed energy resources and electricity markets. Some experience in artificial intelligence techniques, namely heuristic optimization, modeling, and simulation. At least 2 years of experience in scientific research activities. Author of at least 2 scientific papers written in English. Writing and speaking proficiency in English.

Preferred profile: Previous work experience in research activities in the area of Power Systems with intensive use of distributed resources, considering a competitive electricity market environment, using meta-heuristic optimization and multi-agent based approaches. Background in the use of relevant applications in the power system area (including, power system analysis software, and PSCAD). Background in using optimization packages (namely GAMS, TomLab and Lingo), good programming skills (namely in MatLab and C), and experience in artificial intelligence based computer applications.

## 11. DEADLINE AND APPLICATION DOCUMENTS

The application periods occurs from June 21st until July 4th 2013.

Curriculum Vitae; graduation diplomas; documents with courses marks; copy of any previously published works that are relevant for the application evaluation. An application letter with the fellowship reference (ref. **IMaDER\_2013-03**) should be included, indicating clearly the motivation of the application and the full contact information (as minimum: email address, mobile phone number, postal address) of the candidate. All the documents prepared by the candidate for the application should be written in English. Documents should be sent to [zav@isep.ipp.pt](mailto:zav@isep.ipp.pt). Additionally, they should also be sent to the following address:

### GECAD

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A/C Professor Zita Vale  
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