

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 graduated 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. Duration of the Grant:** from October 15<sup>th</sup> 2014 until April 14<sup>th</sup> 2015 (06 months duration, eventually to be renewed till the end of the Project).

**2. Activities and Workplan:** The main goal is to undertake research work in the area 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 the European Union. 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 on-going 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 minutes), 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:

T4 – Players' negotiation and remuneration

T5 – Integration, validation, and simulation studies.

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.

**3. Supervision:** The candidate to be selected will be scientifically supervised by Professor Zita Vale.

**4. Academic Degree:** Graduation in Electrical Engineering or similar

Minimum profile required: 1) solid background in Power Systems with previous experience dealing with distributed energy resources and electricity markets; 2) some experience in power system modelling and simulation; 3) writing and speaking proficiency in English.

Preferred profile: 1) 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; 2) background in the use of relevant applications in the power system area (including, power system analysis software, and PSCAD); 3) background in using optimization packages (namely GAMS, TomLab and Lingo); 4) good programming skills (namely in MatLab and C), 5) experience in artificial intelligence based computer applications.

**5. Monthly maintenance stipend:** As defined by FCT (€ 745.00/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.

**6. Workplace:** The workplace is at GECAD – the Knowledge Engineering and Decision-Support Research Center in the following address:

Rua Dr. António Bernardino de Almeida, 431  
4200-072 Porto – Portugal

**7. 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. – 2013.

**8. Candidate selection methodology:** Only candidates that have presented the complete set of application documents and showed evidence of having the required minimum profile will be admitted. The selection method will take into account the graduation classification (50%) and the curriculum vitae evaluation (50%). In case of doubts, an interview can be undertaken, and it will be conducted in English. In this case, the following elements will be taken into consideration: the graduation classification (25%), the curriculum vitae evaluation (50%), and the interview (25%).

**9. Evaluation panel:** Prof. Zita Maria Almeida do Vale (panel coordinator), Prof. Maria Goreti Carvalho Marreiros and Prof. Isabel Cecília Correia Silva Praça Gomes Pereira. Members of the substitute panel: Prof. Sérgio Filipe Carvalho Ramos and Prof. Carlos Fernando da Silva Ramos.

**10. Results publication and notification:** Candidates will be individually notified by email message on the final evaluation results.

**11. Application documents:** Curriculum vitae; graduation diploma; document 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\_2014-03**) 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) and additionally they may also be sent to GECAD to the following address:

GECAD (Knowledge Engineering and Decision-Support Research Center)  
ISEP/IPP  
Rua Dr. António Bernardino de Almeida, 431  
4200-072 Porto – Portugal

**12. Application period:** from August 18<sup>th</sup> until September 10<sup>th</sup> 2014

**13. Additional information** can be obtained by phone +351-22-8340511 or by email [zav@isep.ipp.pt](mailto:zav@isep.ipp.pt).