DEPARTMENT ENERBAT

SCHOLAR INTERNSHIP 2014-2015
2nd year of a Master's degree (or equivalent)

SUPERVISORS

LAST NAME : VAN ISEGHEM FIRST NAME : Mike
LAST NAME : LINDSAY FIRST NAME: Amy
GROUP : E16-Photovoltaic Systems

Towards a guarantee on the output of solar panels

CONTEXT

Almost 2000 collaborators (research engineers & technicians) contribute to the Research & Development efforts at EDF. The Research & Development centre helps EDF in preparing current and upcoming challenges (through innovation, studies, software and services). The department EnerBAT (over 100 collaborators) focuses on energy efficiency issues. The group Photovoltaic Systems (a dozen people) works on the photovoltaic field as a whole, ranging from electrical systems to output prediction and from module characterization to ageing studies.

GOALS

A good estimation of the output of photovoltaic (PV) installations is highly valuable for the profitability of the group EDF. This estimation stems from performance measurements of solar panels in fixed conditions, and is completed by numerical models based on physics that allow a calculation of the specific output in a given location. Both of these steps contain uncertainties that need to be acknowledged, identified and reduced.

The goal of this internship is to build and validate a methodology for the calculation of the measurement uncertainties of our PV module characterization laboratory. Thanks to this methodology, the estimation of the solar panel's output would be better predicted (definition of a probability distribution). This would be a first step towards a guarantee on the output of solar panels. For instance, the work involved would include :

- The identification of the uncertain parameters that have an impact on the measurement uncertainties
- The identification of their variability (probability distribution?)
- The modelling of the whole of the measurement system
- The comparison of experimental data with the results of the model in order to validate and improve the model
- The calculation of the induced variability of the response of the model, due to the uncertainties on the input parameters. This would lead to the identification of the parameters with the biggest (or the smallest) impact on the output. The measurement uncertainties could thus be precisely quantified and identified (source of the uncertainty).
- The estimation of the impact of these uncertainties on the predicted output

This process requires a total understanding of the measurement device. The intern will work with the lab team in order to learn more about experimental data and data acquisition. He will take part in the modelling of the system, based on some existing models. The simulation environment and software is Dymola, which is used in the whole of the department EnerBAT. The intern will use tools developed by EDF R&D that are dedicated to statistical analysis, applied to the specific case detailed here-above. This could involve linking Dymola with the OpenTurns platform (Python library dedicated to the treatment of uncertainties.

Last but not least, the intern will be involved in our discussions with our collaborators within the International Energy Agency (IEA). Indeed, we contribute to the PVPS program (PhotoVoltaic Power System) of which one of the tasks is dedicated to guaranteeing the performance of solar panels and to taking into account the various underlying uncertainties.

IDEAL CANDIDATE

- 2nd year of a Master's degree (or equivalent)
- Thorough knowledge of the following : statistics, thermal science, radiation and electricity
- Former experience of object-oriented programming (e.g. Java or Matlab/Simulink)
- Fluent in English
- Strong capabilities for analysis and synthesis
- Autonomous, curious and prepared to take initiatives
- Knowing Dymola software or Modelica language would be an advantage
- As would be a previous experience in the world of solar panels

ADDITIONAL INFORMATION

Schools : 2nd year of a Master's degree (or equivalent)

Duration of the internship : 5 to 6 months

Full-time : ☒ Part-time : ☐

Address: EDF R&D - Département EnerBAT – batiment J24
Avenue des Renardières – Ecuelles – 77818 MORET SUR LOING CEDEX

Supervisors of the internship : Mike Van Iseghem & Amy Lindsay
E-mail : mike.van-iseghem@edf.fr, amy.lindsay@edf.fr