Micro grids: is it worth investing in storage equipment?

Scientific training period proposal

January 12, 2016

1 Organism, supervision and material conditions

Organism

Institute EFFICACITY
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Supervision and material conditions

Address:
CERMICS, École des Ponts ParisTech,
6 and 8 avenue Blaise Pascal, Cité Descartes, 77455 Marne la Vallée Cedex 2

Supervisors:
Michel De Lara (CERMICS, delara@cermics.enpc.fr, 01 64 15 36 21)

Number of students: 1

Material conditions: a financial gratification is offered

Dates: to be discussed

2 Proposal

Research domain

Mathematics, stochastic optimization, computer science, energy.

Subject

Imagine you manage a train station, and you wonder whether the braking energy could be retrieved for internal usage in the station (light, heat, escalators). Is it worth investing in storage equipment?

Imagine you manage a building, and you wonder whether you could satisfy both heat and energy needs with a combined heat and power (CHP) generator. Is it worth investing in CHP and in storage equipment?

These problems, and many others, share the following features:

- you have to decide among a limited array of investment options — battery models and sizes, generators — to make up a micro-grid;
- you have to compare the energy management, before, with the new optimized energy management that a micro-grid can offer.

To select the best option, we resort to optimization. However, optimization must be performed at two interdependent levels:

- with a fixed micro-grid equipement, you must find the best *day-to-day control strategy* to drive your train station, building, house, etc.;
- you must find the best micro-grid equipement, among a limited array of *investment* options.

The student will study such coupled *investment-control* optimization problems, and propose methods to solve them. A special emphasis will be given to the treatment of uncertainty, let it be in the economic macro-variables or in the day-to-day energy demands.

We expect the student to know the basics in optimization and in probability. Knowing stochastic optimization — either stochastic programming or stochastic dynamic programming — would be a plus.