

Master ParisTech REST

Renewable Energy Science and Technology

Graduate Degree STEEM

Energy Environment: Science Technology and Management

PHY661D 2017–2018

Stochastic and Decentralized Optimization
for the Management of Micro-Grids

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Outline of the presentation

Two examples of industry-driven R & D in applied optimization

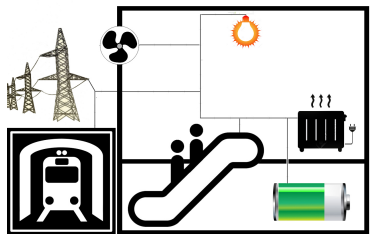
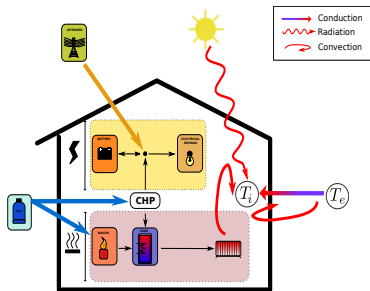
Planning of Master REST / Graduate Degree STEEM course

A sketch of the R & D SunHydrO project



- ▶ R & D SunHydrO project (FUI, public and private funding)
 - ▶ **design** and build a **pumping station** for **energy transfer** (10–12 MW)
 - ▶ with profit-making **business model** based upon operating in **energy markets** (day-ahead, reserve, capacity)
- ▶ ENSTA and ENPC are **advisors** for the **optimization** part
 - ▶ day-ahead market modeling
 - ▶ energy prices and sun supply stochastic modeling
 - ▶ formalization as a two-stage stochastic programming
 - ▶ resolution by scenario decomposition methods
 - ▶ risk handling

Two examples of micro-grid management problems at R & D institute for urban energy transition Efficacy



- ▶ Newly created R & D institute for urban energy transition, Efficacy
- ▶ Of a new kind, based on an action research approach and bringing together skills from both public and private sector
- ▶ ENPC advises Efficacy on optimization of micro-grids
 - ▶ micro-grids energy allocation modeling
 - ▶ demand and supply stochastic modeling
 - ▶ formalization as multi-stage stochastic control problems
 - ▶ resolution by stochastic dynamic programming

Planning of the course

- ▶ Days 1 and 2. Introductory talks on examples of micro-grid and virtual power plant management. Recalls on applied mathematics
 - ▶ Probability
 - ▶ Continuous optimization, convex optimization, duality
- ▶ Days 3 and 4. Modeling session on day ahead energy markets. Introduction to the scientific software Scicoslab
 - ▶ Auto-training computer session on Scicoslab
 - ▶ Computer session and project on *The newsvendor problem*
- ▶ Days 5, 6 and 7. Two-stage stochastic programming
 - ▶ Theory, decomposition algorithms
 - ▶ Computer sessions and project on *Sizing of reserves for the balancing on an electric market*
 - ▶ Exam
- ▶ Days 8, 9 and 10. Multi-stage stochastic control
 - ▶ Theory, stochastic dynamic programming algorithm
 - ▶ Computer sessions and project on *Dam optimal management under uncertainty*
 - ▶ Exam