



# **Demand Side Management A model driven approach to promote energy self-consumption**

Alexandre Rio, Yoann Maurel, Olivier Barais, Yoran Bugni

## **► To cite this version:**

Alexandre Rio, Yoann Maurel, Olivier Barais, Yoran Bugni. Demand Side Management A model driven approach to promote energy self-consumption. Colloque de l'institut Mines Télécom, Jun 2018, Rennes, France. hal-02317918

**HAL Id: hal-02317918**

**<https://hal.science/hal-02317918>**

Submitted on 16 Oct 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



**IMT Atlantique**  
Bretagne-Pays de la Loire  
École Mines-Télécom

# Demand Side Management

A model driven approach to promote energy self-consumption

## Stakeholders



## Authors

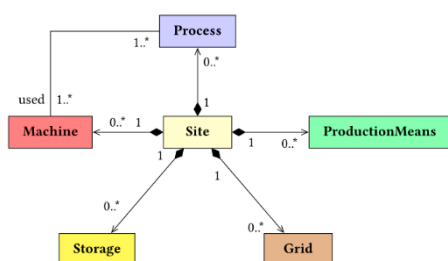
Alexandre RIO  
Yoann MAUREL  
Olivier BARAIS  
Yoran BUGNI



Agricultural exploitation using solar tracker  
Credit: GAEC du Faisan

## Case study: Industrial site self-consumption

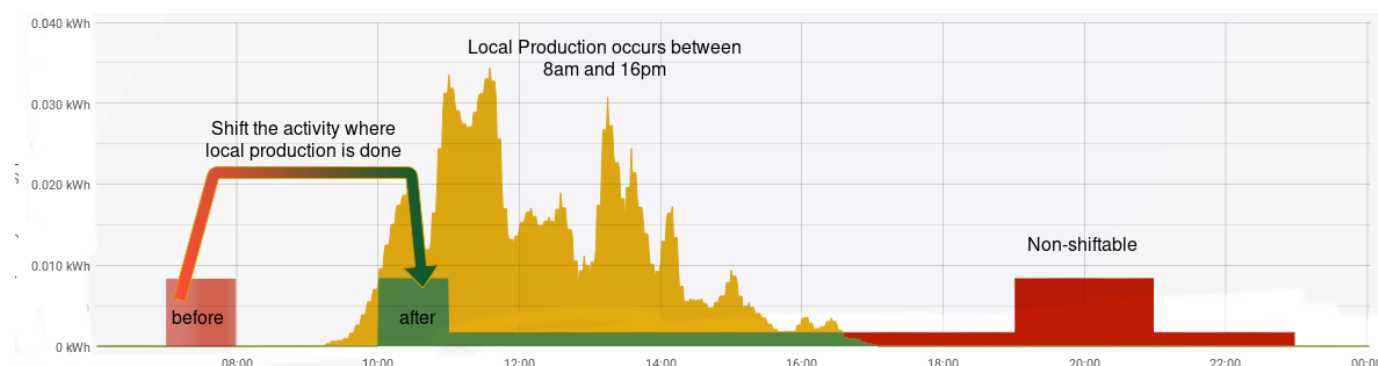
- ▶ **Self-consumption** of renewable energies is defined as electricity that is produced from renewable energy sources
- ▶ The **autonomy** of sites with micro-generation capabilities is greatly increased by self-consumption of locally produced energy
- ▶ One of the keys is thus to **align production and consumption** either by planning processes differently or by relying on storage capabilities.
- ▶ Help for “What-if/” “what-for” questions:
  - How to **size** local renewable energy production units or storage to meet a site's energy consumption
  - Which **region** would be the most interesting for the expansion of a business?
  - What **organization of activities** enables the best autonomy and self-consumption?



Simplified version of our metamodel

## Proposal: Simulator and Domain Language

- ▶ Model Driven Engineering (MDE) approach to address variability
- ▶ **Energy Management System** (EMS) in simulation or using real sensors
- ▶ Domain Specific Language (DSL) to represent an industrial site
  - Production, consumption, storage
  - Activities and constraints modeling
- ▶ Description files are used by a simulator.
- ▶ Simulator can be extended by experts, through **plugins**, to model complex devices behavior



Shifting of an activity to increase the autonomy for the day from 9% to 20%

## Experiences

### Evaluation: Activity shift recommendations

- ▶ Simulator can use third-party prediction to estimate future events: solar production, device usage
- ▶ Recommend actions based on context: battery state, user activity to **optimize autonomy** and self-consumption
- ▶ Take into account process constraints and flexibility and battery cycle usage
- ▶ Improve autonomy from 30% to 50% or 70%