Direct Load Control Decision Model

applied to

Electric Vehicle Charging Points

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Context

- ELECTRIC Vehicles are becoming an alternative to combustion engines due to their low emissions, high energy efficiency and competitive autonomy range.
- Electric Vehicles (EV) and Plug-in Hybrid Electric Vehicle (PHEV) are two current available technologies
- Coming 5-10 years PHEV/EV will be part of the urban vehicle market [1]

Challenges

- One of the main difficulties of this kind of vehicles is related to its **long battery charging process**.
  - Fixed charging stations at parking garages provide a possible solution when the plug-in vehicles number is reduced
  - However, to cope with an increasing number of plug-in vehicles is necessary to reinforce the electric cable installation providing individual electric infrastructure per plug-in vehicle at parking garages
  - Charging management policies should be designed and implemented to deal with simultaneous vehicle loadings at high concentrated charging points

The work to be done. First part

- Use mathematical programming to design **electric vehicle charging policies** subject to different objectives:
  - Complying with technical constraints of
    - Time schedules (arrival and departures)
    - Vehicles (energy, power, discharging rates,)
    - Charging Point Capacities (power and number of vehicles)
  - Optimizing charging costs based on hourly energy prices
  - Analyzing possible energy interchange
    - among vehicles (Vehicle to Vehicle - V2V)
    - with Electricity Retailer (Vehicle to Grid - V2G)

The work to be done. Second part

- Obtain optimal **electric vehicle charging policies** using a mathematical programming language GAMS [2]

- Analyze charging policies obtained varying parameters:
  - Discharging rates
  - Energy price variations
  - PHEV/EV percentages

- Analyze different electric vehicle uses:
  - Residential
  - Business
  - Mixed

References

[1] http://www.idae.es/index.php/mod.pags/mem.detalle/id.407/lang.uk
[2] http://www.gams.com/docs/intro.htm

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