Dynamic Energy Management method with Demand Response interaction applied in an Office Building

Filipe Fernandes, Luis Gomes, Hugo Morais, Marco Silva, Zita Vale, Juan M. Corchado

gecad
Research Group on Intelligent Engineering and Computing for Advanced Innovation and Development
P.PORTO

zav@isep.ipp.pt
email.zitavale@gmail.com

RESEARCH GROUP BISITE .usal.es
VNIVERSIDAD D SALAMANCA
CAMPUS DE EXCELENCIA INTERNACIONAL
800 AÑOS 1218 - 2018

PAAMS

14th International Conference on Practical Applications of Agents and Multi-Agent Systems
University of Sevilla - Sevilla (Spain) | 1st-3rd June, 2016 |
www.paams.net

Presentation Plan

Agenda

- Dynamic Energy Management
  - SCADA Office Intelligent Context Awareness Management (SOICAM) System
- Case study
- Conclusions

Dynamic Energy Management

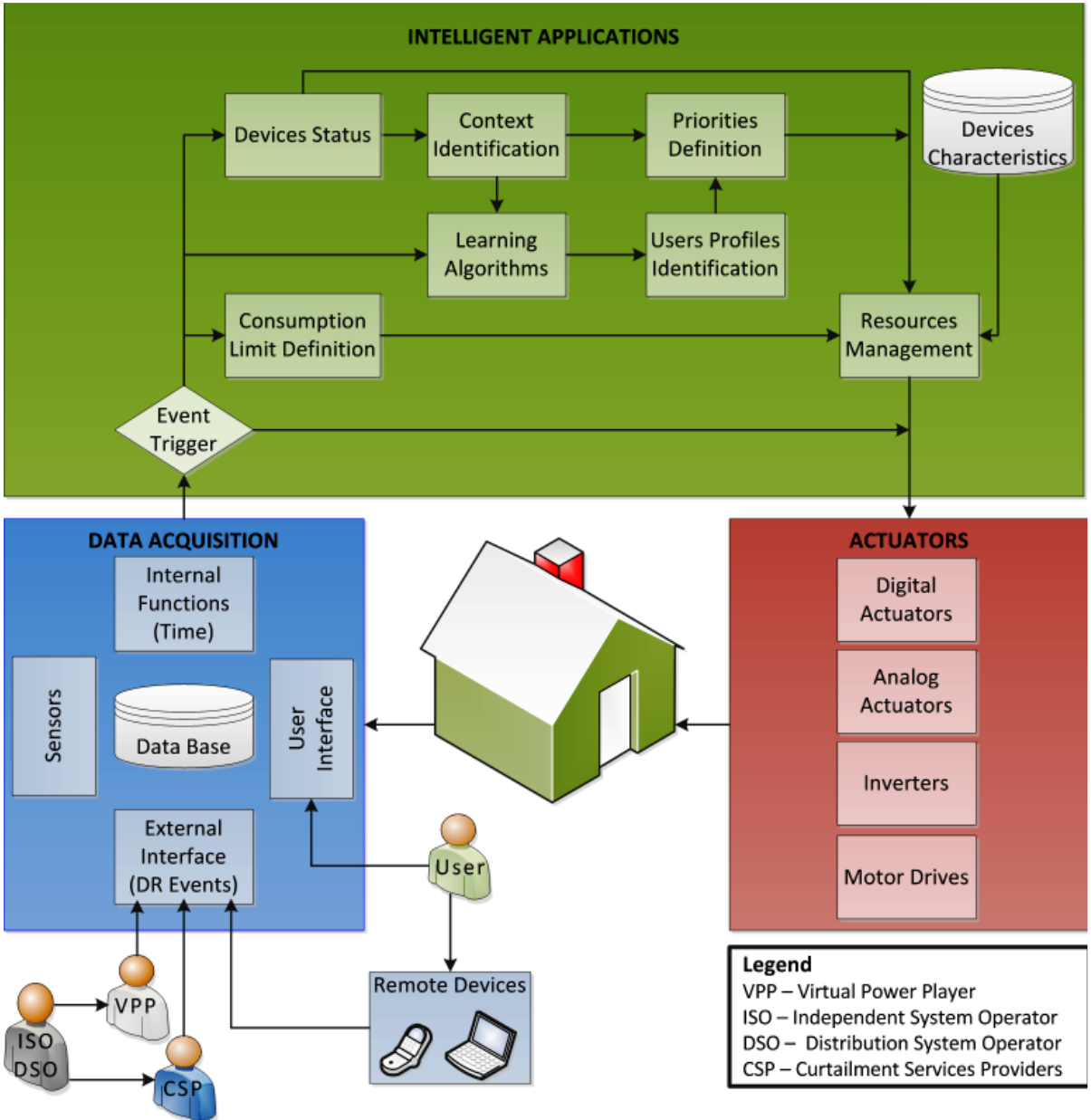
Intelligent management systems for electrical energy consumers

- In the scope of smart grids
- Demand response
  - In face of the consumer's own internal goals
  - Interaction with external entities through the automatic participation in demand response programs

Dynamic scheduling for all energy resources with little interference in the comfort of users

Dynamic Energy Management

SCADA House Intelligent Management (SHIM)



Dynamic Energy Management

SHIM is part of a real-time management and simulation platform based on multi-agent systems

Multi-Agent Smart Grid Simulation Platform (MASGriP) is a test platform that simulates a competitive environment in power systems

- Real-time data acquisition with energy analyzers
- Direct load control through Programmable Logic Controllers (PLCs)
- Physical and simulated loads can be included

Dynamic Energy Management

gecad
Research Group on Intelligent Engineering and Computing for Advanced Innovation and Development

RESEARCH GROUP BISITE .usal.es

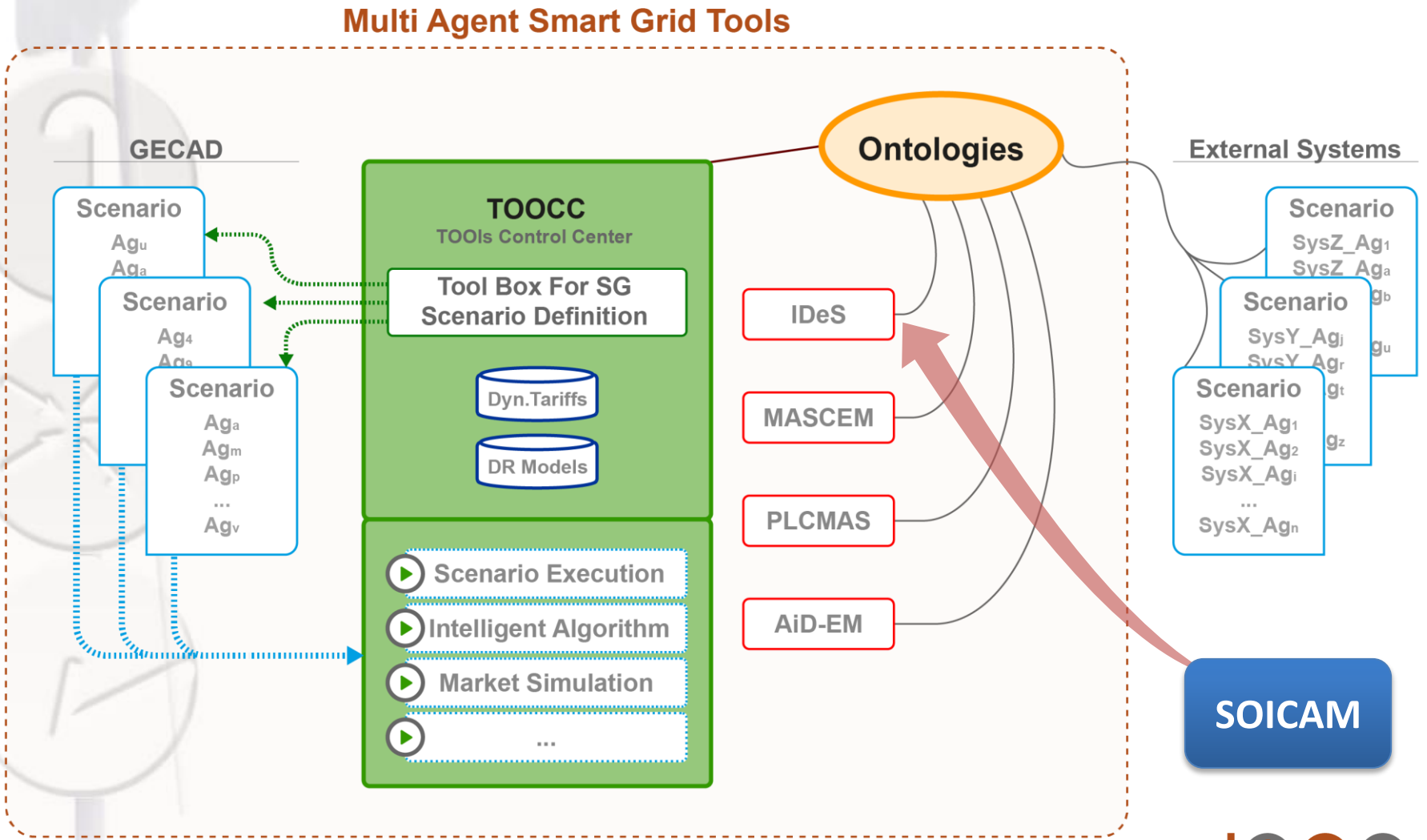
DREAM-GO

SCADA Office Intelligent Context Awareness Management (SOICAM) System

Dynamic Energy Resources Priority (DERP)

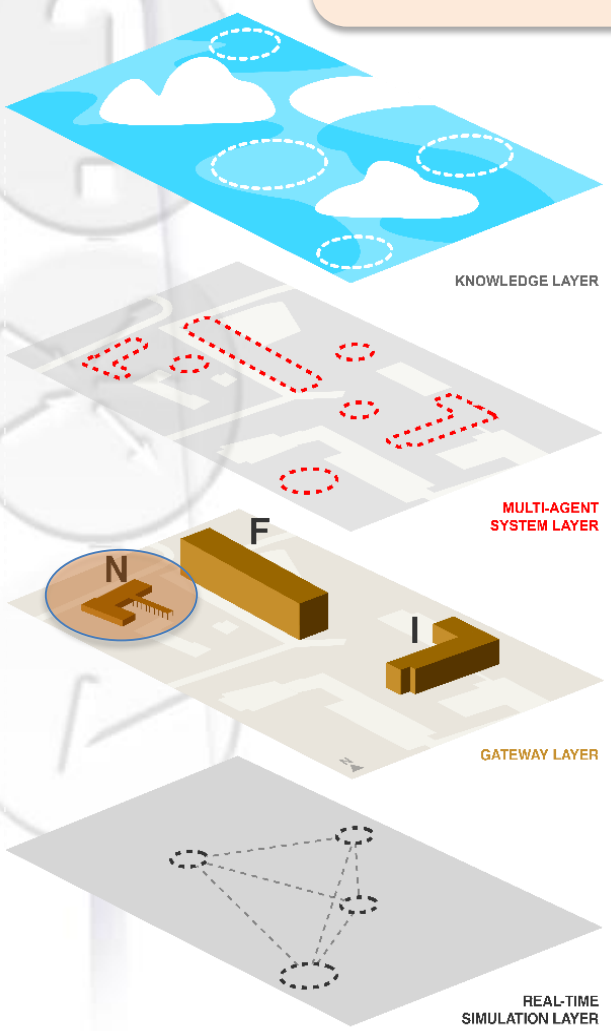
- Loads
- Distributed generation
- Suppliers
- Demand response events

Dynamic Energy Management



Case study

One Office Building in ISEP campus (30 users)



- Intelligent applications and services
- Multi-Agent System(s)
- Real buildings and equipment Developed gateways for real-time data acquisition and control
- Real-time simulator for all the components that we miss in our system

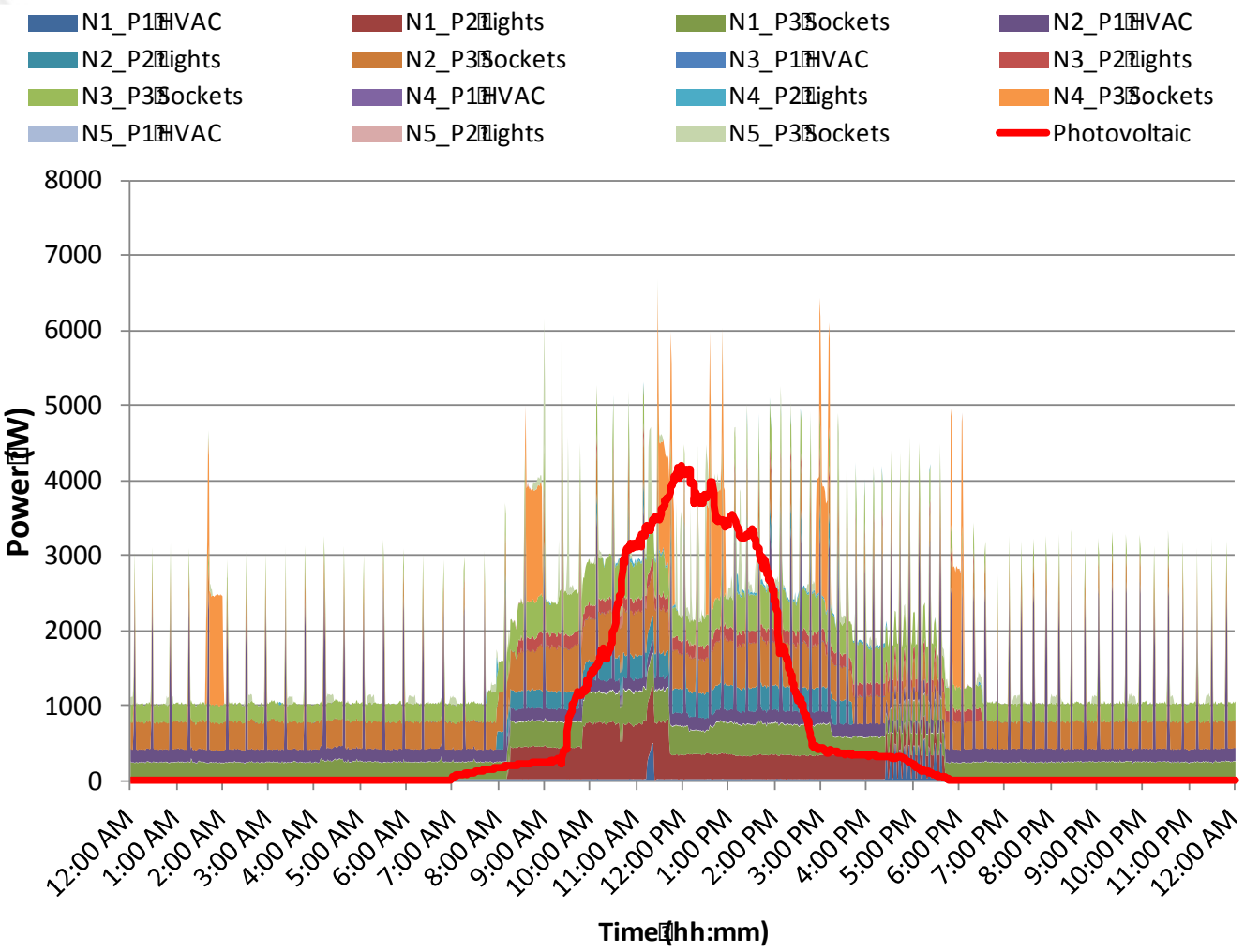
Case study

Dynamic Energy Resources Priority (DERP)

- 30 PV panels (250 Wp each)
- 5 analyzers -> real-time consumption data
  - 116 loads grouped in 3 types:
    - HVAC
    - Lights
    - Sockets

Case study

Consumption and generation data



Case study

Rooms and loads monitored by analyzer N1

Analyzer	Division	Type	Loads	Quantity	Total Power (W)	Electrical Circuit
N1	N101	Office	HVAC	1	1000	P1
			Fluorescent lamp	4	232	P2
			Compact lamp	2	36	P2
			Monitor	5	1357	P3
			Computer	2	950	P3
			Laptop	1	90	P3
	N102	Office	HVAC	1	1320	P1
			Fluorescent lamp	4	232	P2
			Monitor	8	2438	P3
			Computer	4	1900	P3
			Laptop	1	90	P3
	N103	Office	HVAC	1	910	P1
			Fluorescent lamp	4	232	P2
			Monitor	4	1311	P3
			Computer	2	950	P3

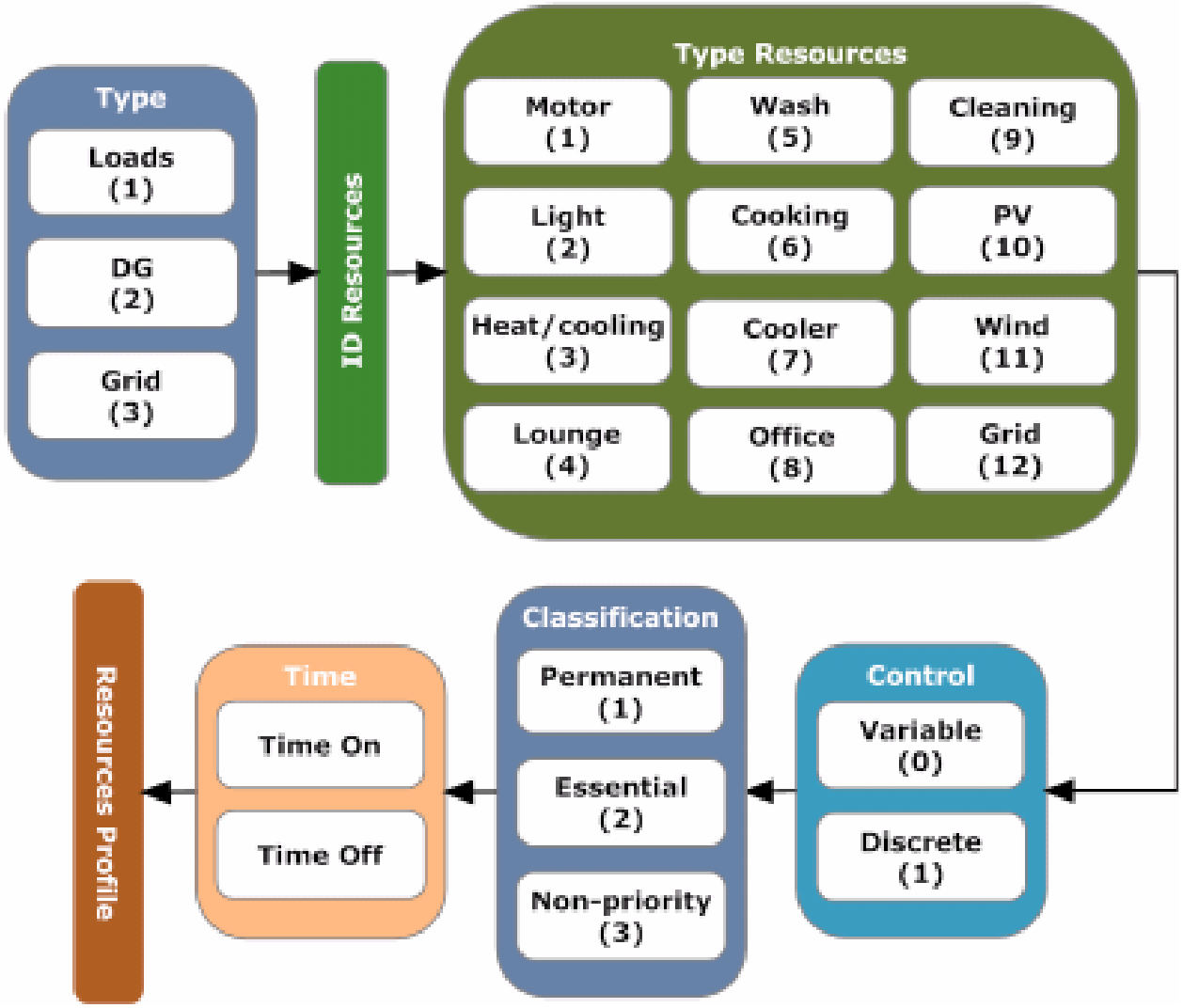
Case study

Rooms and loads monitored by analyzers N4 and N5

N4	Hall	Common Services	HVAC	2	1920	P1
			Fluorescent lamp	4	232	P2
			Compact lamp	2	36	P2
			Water heater	1	1500	P3
N5	N110	Kitchen	HVAC	1	1000	P1
			Halogen lamp	2	50	P2
			Compact lamp	1	14	P2
			Refrigerator	1	130	P3
			Coffe machine	1	1300	P3
			Kettler	1	2280	P3
			Microwave	1	2250	P3

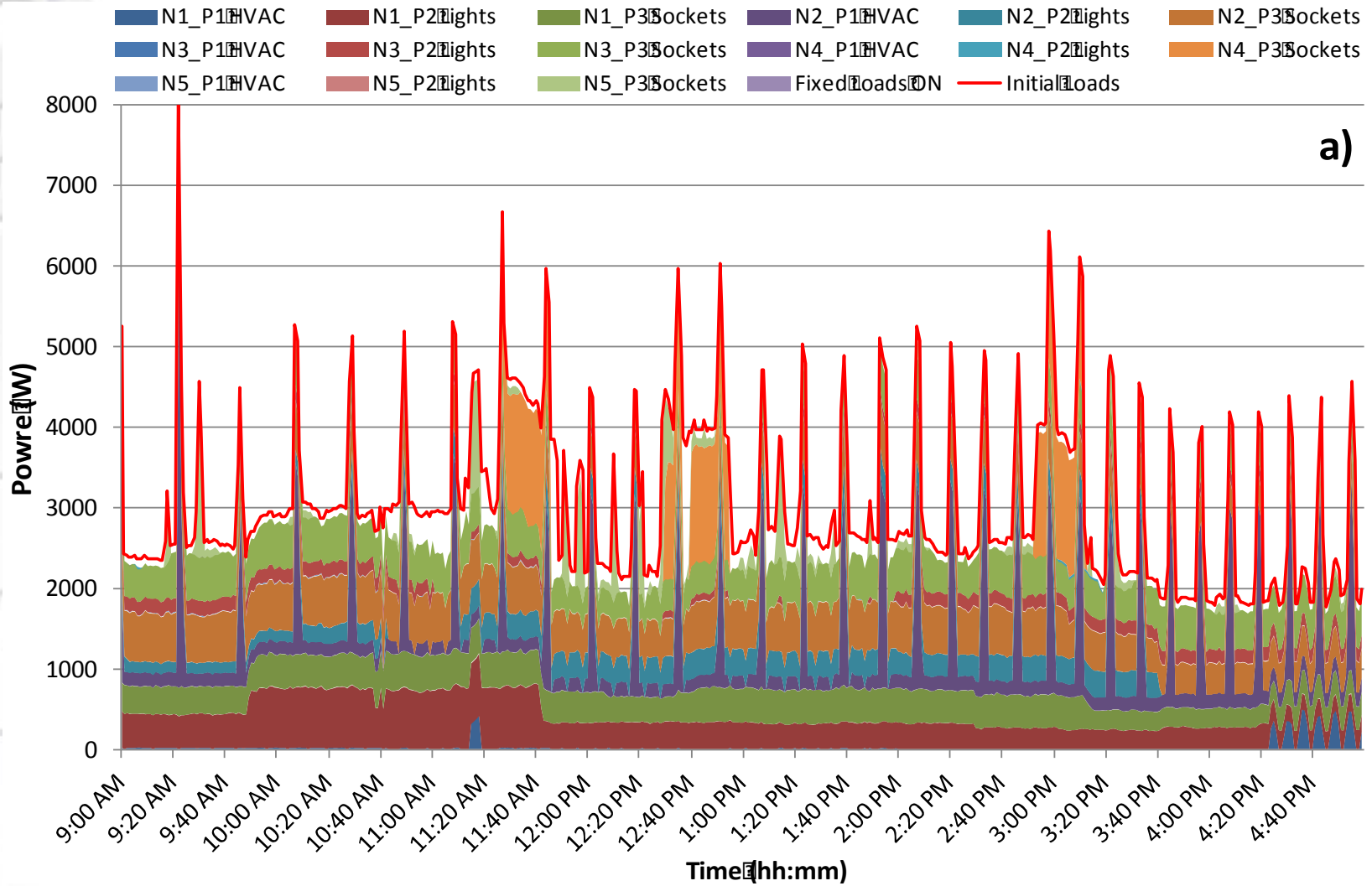
Case study

Characteristics of the energy resources



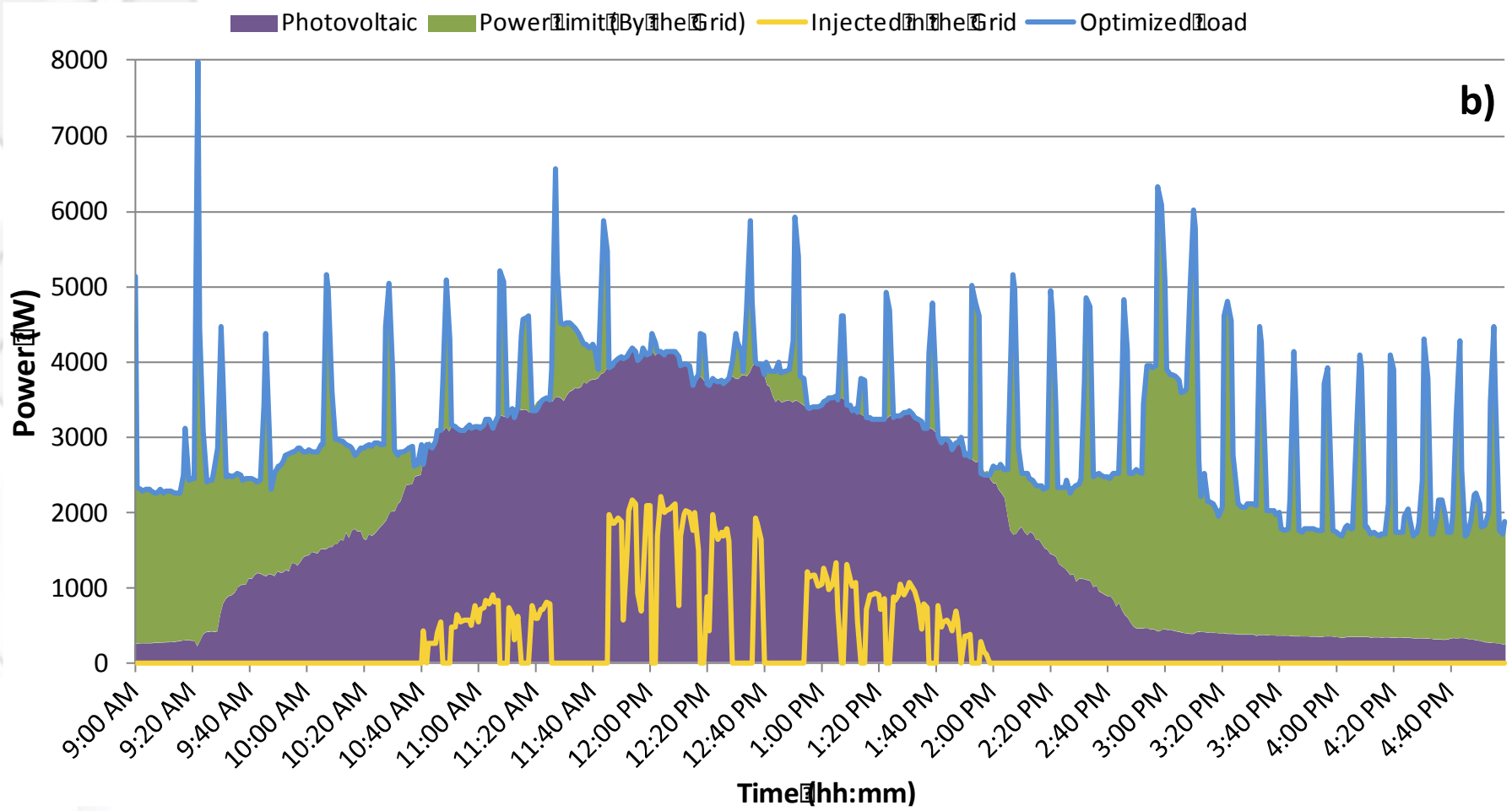
Case study

Resource scheduling during DR event: detailed scheduling for each type of load



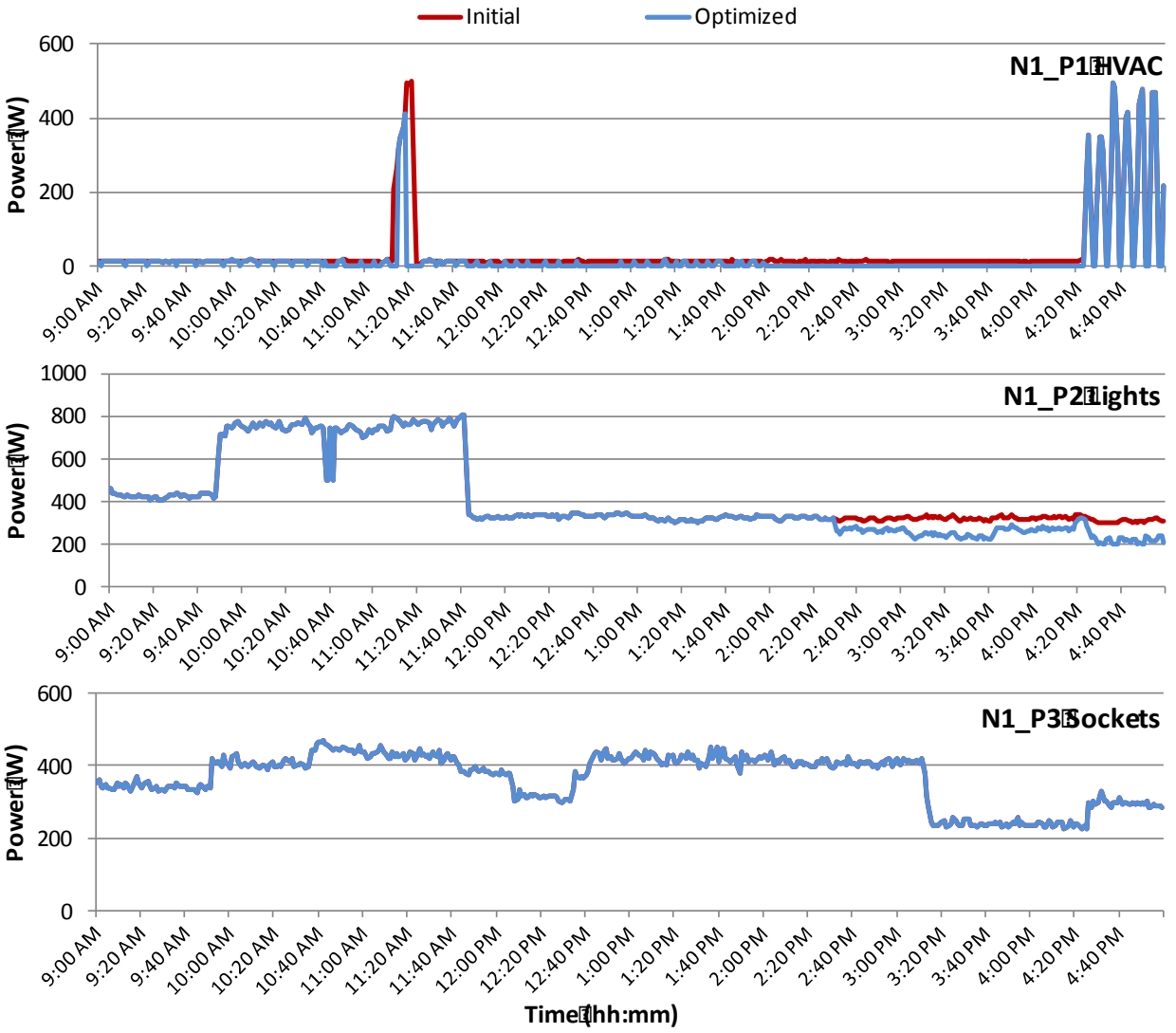
Case study

Resource scheduling during DR event: scheduling for each type of energy resource



Case study

Analyzer N1 : Initial and optimized consumption for each load group type



Conclusions

- Dynamic scheduling of the energy resources
  - The resources priority dynamically changes
  - Interaction between the building and the exterior (grid, suppliers, …) is considered enabling to minimize the operation costs
  - Interaction with external entities through the automatic participation in demand response programs

The energy management system improves the effectiveness of the consumer‘s

- **participation in demand response events**
- **Use of the available energy resources, according to dynamic load priorities**

Thank you

gecad

Research Group on Intelligent Engineering and Computing for Advanced Innovation and Development

Dynamic Energy Management method with Demand Response interaction applied in an Office Building

Filipe Fernandes, Luis Gomes, Hugo Morais, Marco Silva, Zita Vale, Juan M. Corchado

gecad
Research Group on Intelligent Engineering and Computing for Advanced Innovation and Development
P.PORTO

zav@isep.ipp.pt
email.zitavale@gmail.com

RESEARCH GROUP BISITE .usal.es
VNIVERSIDAD D SALAMANCA
CAMPUS DE EXCELENCIA INTERNACIONAL
800 AÑOS 1218 - 2018

PAAMS

14th International Conference on Practical Applications of Agents and Multi-Agent Systems
University of Sevilla - Sevilla (Spain) | 1st-3rd June, 2016 |
www.paams.net