

Perspectives in Smart Grids research in the context of INCT-EREEA

Samuel Luna de Abreu



Summary

- INCT-EREEA
- Smart – grid projects
 - Florianópolis - SC

- “National Institute of Science and Technology for Renewable Energies and Energy-Efficiency in the Amazon Region

Coordinated by Prof. João Tavares Pinho - UFPA

- Energy needs and resources with emphasis in solar, wind, hydro and biomass;
- Hybrid systems for minigrids and isolated consumers;
- Small and medium size distributed generation;
- Energy-efficiency in electrical systems and buildings;
- Equipment qualification and certification;
- Human resources capacity building in all levels.

INCT-EREEA





Floating hybrid system for electricity generation



Solar boat



Solar ice-maker

- 120 grid connected solar roofs
- Solar stadiums
- Solar PV powerplants
- PV-Module certification
- Solar measurements

SMART-GRID PROJECTS

- *Photovoltaic Solar Energy integrated to urban buildings, electric vehicles and air conditioning systems in the context of smart grids*

Objective:

- Develop, adapt and evaluate equipments and energy management strategies (hardware e software) using photovoltaic systems integrated to urban buildings, electric vehicles, intelligent meters and outlets, smart air conditioning systems following smart-grids concepts.
- Design a positive-energy photovoltaic building with demand control and connection to the public grid providing energy during the peak hours.

CIM - Centro Integrado Multiusuário

Coordinated by Prof. Ricardo Rüther - UFSC

- *“Integrated Multi-user Center”*
- *Human resources capacity building in photovoltaics*
- *Intelligent positive-energy building*
- *Located at the “Sapiens Park”*
 - *Inovation and Technology park*
 - *4.3 mi m²*



INSTITUTO FEDERAL
SANTA CATARINA

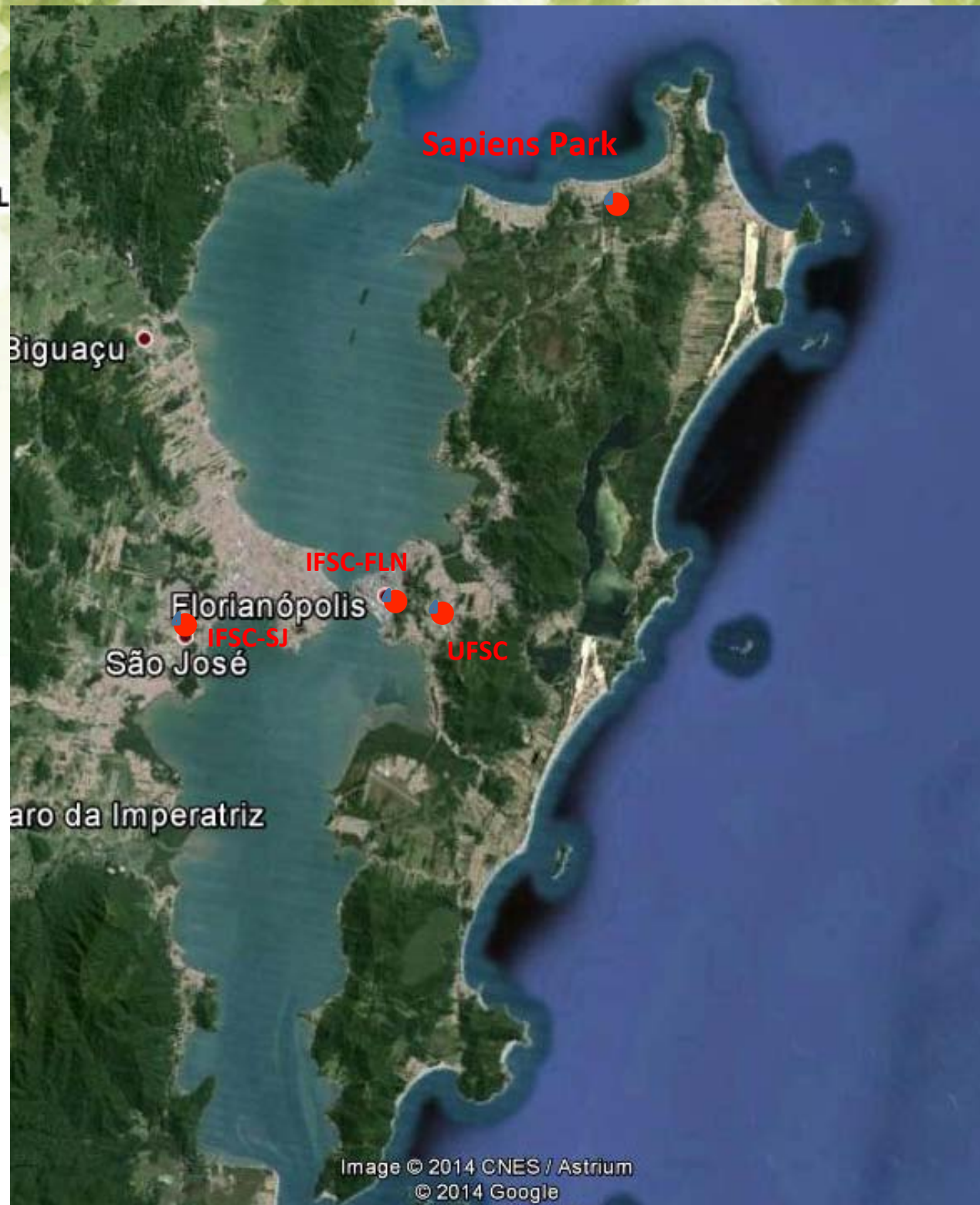


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Sapiens Park



Empreendimentos em:



Operação



Implantação



Desenvolvimento

01. **Marco Zero** – Sede e Incubadora
02. **Estúdio de Cinema** – Polo de Animação
03. **Arena Sapiens** – Complexo de Cultura, Eventos, Lazer e Esportes
04. **Circuito Multiuso** – Eventos Esportivos
05. **Centro de Congressos e Convenções de Florianópolis**
06. **Espaço Multiuso** – Eventos Culturais
07. **Lagos Sustentáveis** – Preservação Ambiental
08. **InovaLab** – Centro de Inovação dos Núcleos de Cluster do Sapiens
09. **INPETRO** – Instituto de Petróleo, Gás e Energia
10. **CRF** – Centro de Referência em Farmacologia Pré-Clinica
11. **Infraestrutura Fase Zero** – Sistema Viário, Energia e Saneamento
12. **Centros Empresariais** – Sede da Softplan
13. **Centros Empresariais** – Parcerias com a Reason, Sustentar Engenharia e Neoway
14. **Novas Parcerias** – UFSC, UDESC e SENAI
15. **Via Sapiens** – Edital para Centros Empresariais e Comerciais
16. **Consulta Pública** – Consulta ao mercado para atração de investimentos privados

MASTER PLAN



sapiens
parque

- Área total: 4,3 milhões m²
- 257 unidades condominiais
- Potencial construtivo: 1,3 milhões m²

CIM - Integrated Multi-User Center



CIM - Integrated Multi-User Center



- auditorium
- classrooms
- offices:
professors,
students
- meeting room

- Building A
- 460 m²

CIM - Integrated Multi-User Center

- Outdoor and indoor laboratories
- workshop



- Building B
- 280 m²

CIM - Integrated Multi-User Center



CIM - Integrated Multi-User Center



CIM - Integrated Multi-User Center

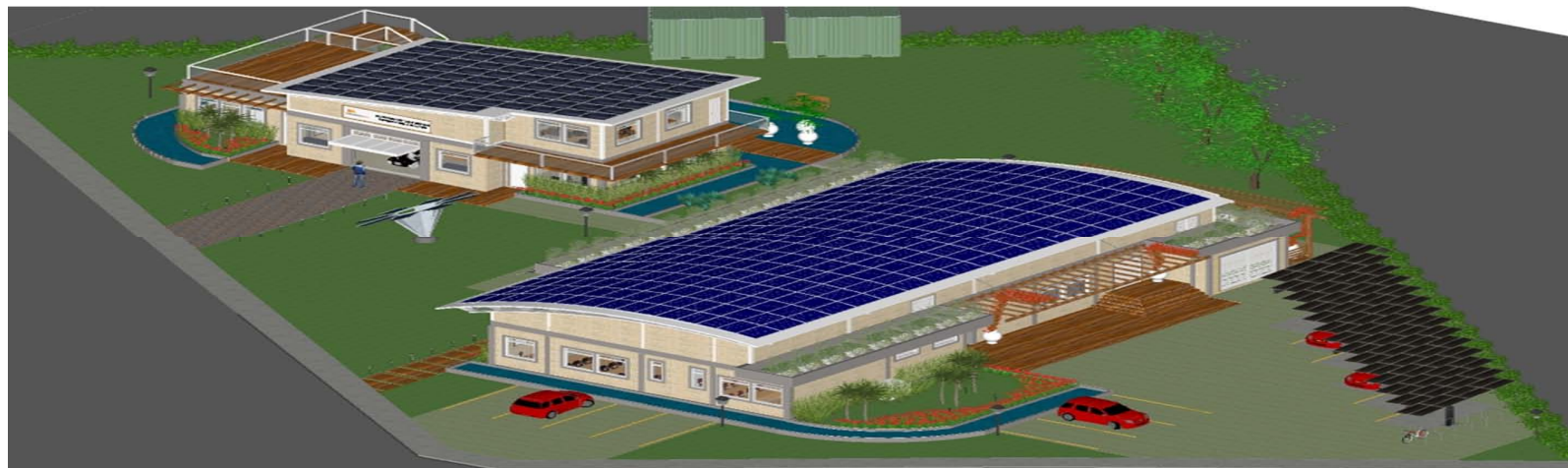


CIM - Integrated Multi- User Center



CIM – Research Facilities

- 3 grid-connected PV-systems
 - 62 kWp – polycrystalline silicon
 - 2.2 kWp – cadmium telluride
 - 13.5 kWp – microcrystalline silicon
- Electrical vehicle
- Monitoring of all electrical equipment
- Complete weather station

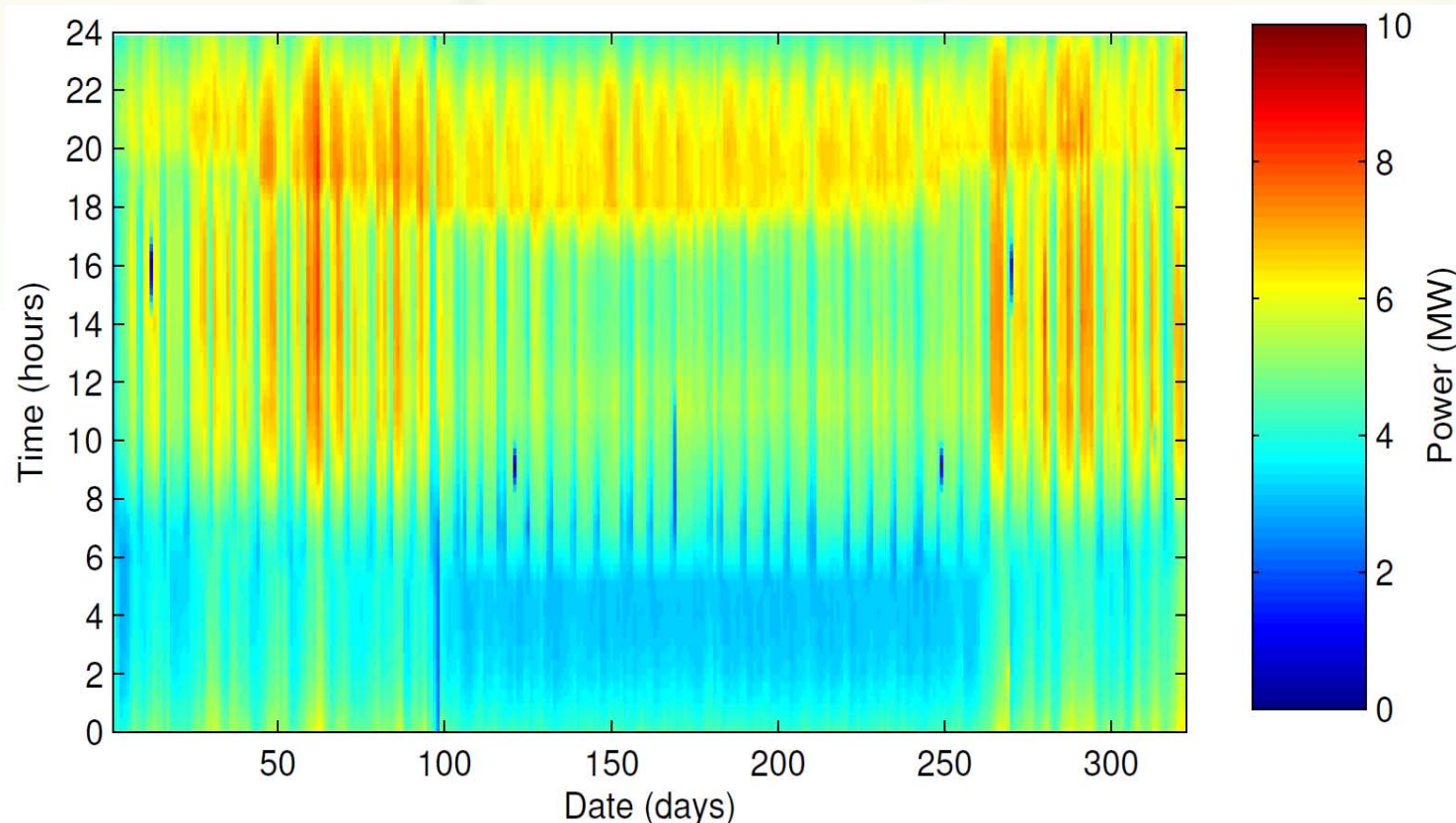


Ongoing research

- Develop the concept of a urban building integrated PV-system with positive-energy balance in Florianópolis, with short term acumulation, smart meters, outlets and air conditioning;
- Adapt all electrical installation in order to enable the building to manage its loads and control the injection/consumption of energy in/from the grid during the peak hours;

Ongoing research

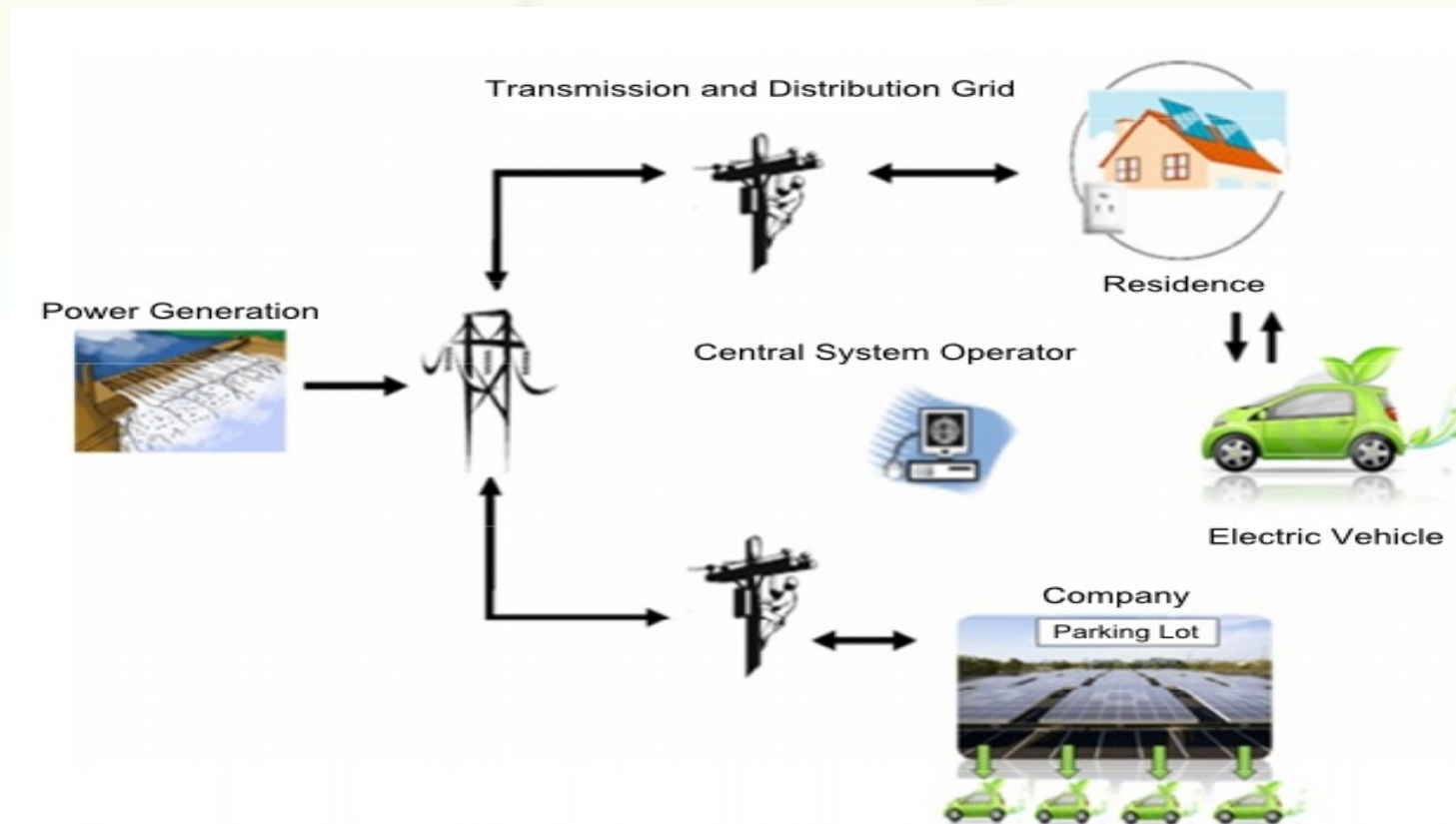
- Evaluate demand curves for urban feeders in Florianópolis and their correlation with PV generation and building demand profile



Energy demand profile of the urban feeder TDE05 (in MW) in Florianópolis for the 8784 hours of the year. (Rüther, Portolan and Drude, 2014)

Ongoing research

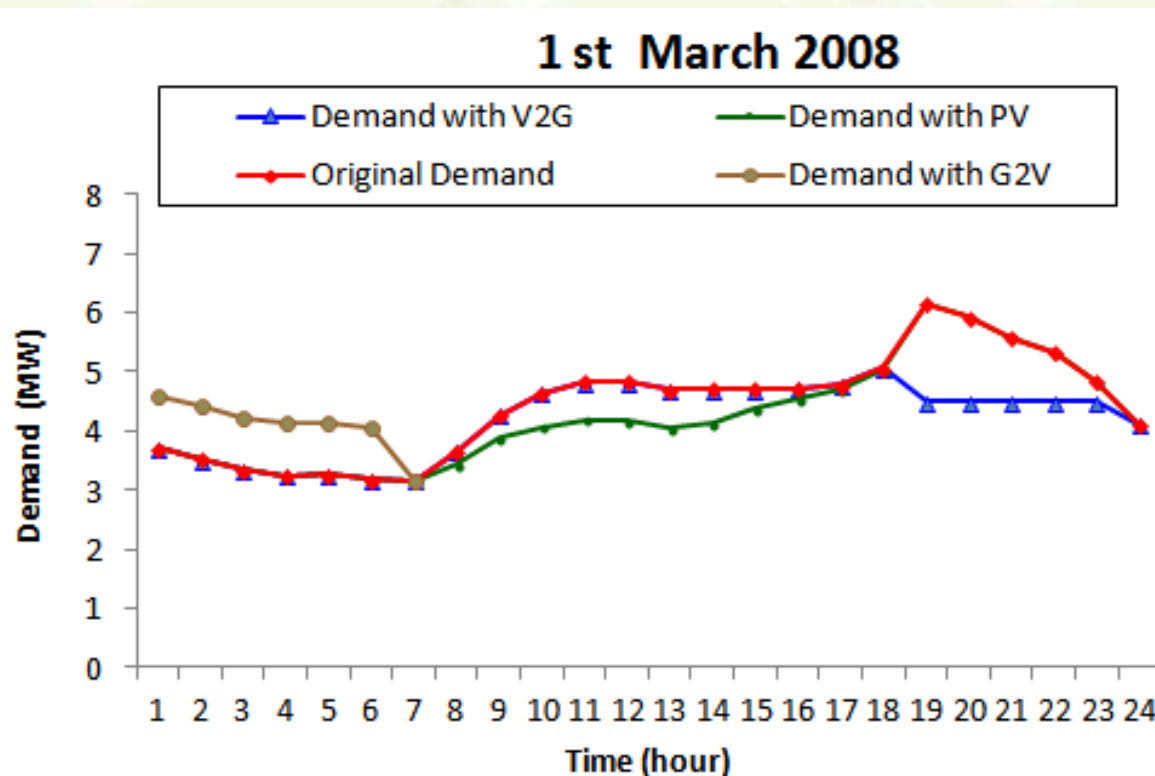
- Charge and discharge simulation of EV as strategies to support the grid using “Vehicle-to-Grid” (V2G) ;



Schematic diagram of the interaction of solar PV generators and PEVs with the public electricity grid in a smart-grid environment. (Rüther, Portolan and Drude, 2014)

Ongoing research

- Charge and discharge simulation of EV as strategies to support the grid using “Vehicle-to-Grid” (V2G) ;

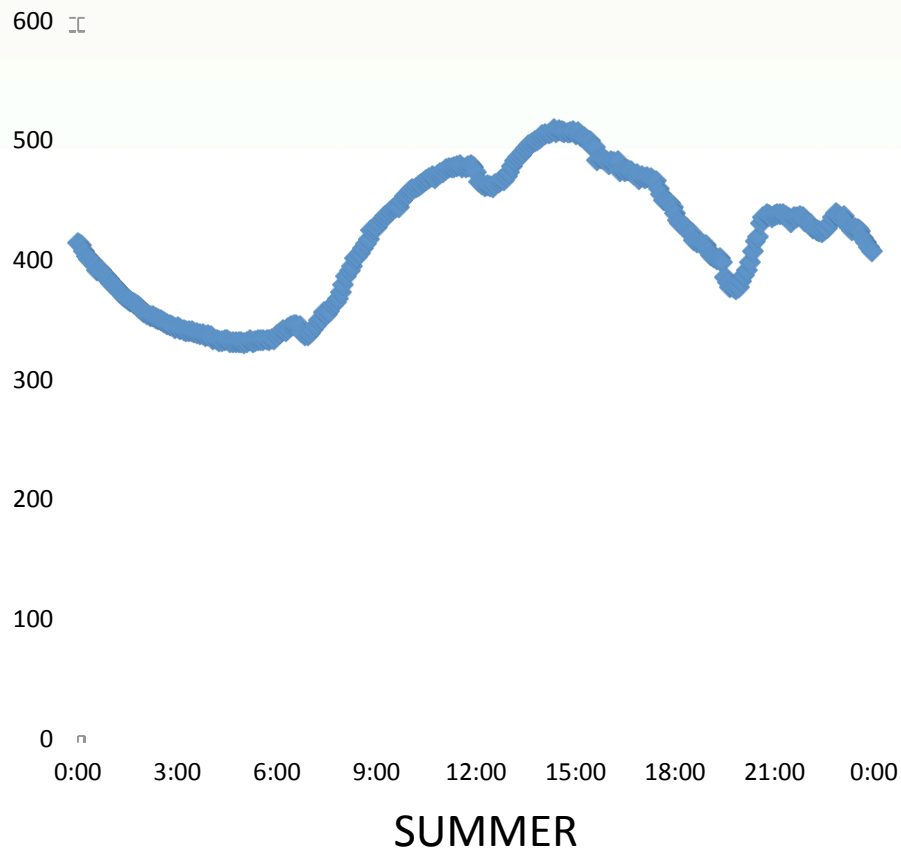


Original demand profile for the distribution utility feeder TDE05 in Florianópolis – Brazil (red circles), and the potential contribution of PV (green diamonds) for daytime hours peak-shaving, PEVs for evening hours peak-shaving (blue triangles), and the corresponding load for PEV recharging in the early hours (brown circles). (Rüther, Portolan and Drude, 2014)

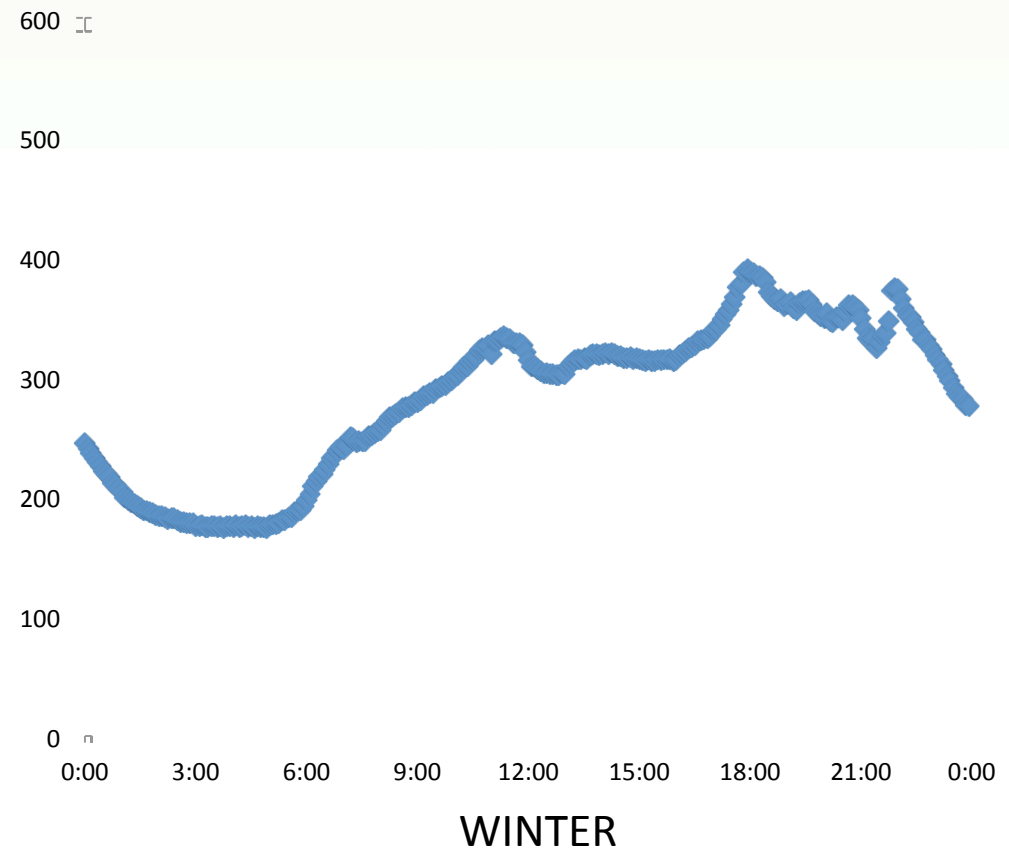
Ongoing research

- Impact of climatic variations on the electricity consumption of air-conditioning systems and propose operating strategies in the context of the building smart grid;

Power (MW) - 27/01/2011



Power (MW) - 29/06/2011



Ongoing research

- Demonstrate to the operator of the main grid (ONS), GTD companies and appliances industries the potencial of building integrated PV-systems in the context of smart grids. Evaluate the economic feasibility of the proposed solutions.

Thank you!

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