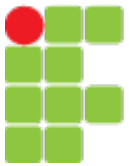
ELECON

ELECTRICITY CONSUMPTION ANALYSIS & ENERGY EFFICIENCY

# Consumer control in Smart Grids

Second ELECON Workshop

Institute of Electrical Energy Systems – Otto-von-Guericke-University, Magdeburg, Germany,



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Magdeburg – Germany, October 28-29, 2014.

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# Demand Side Management of Electricity aiming to Minimize Cost of Residential Consumers

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# Agenda

- Energy of Micro Photovoltaic Plants in Residences (Brazil)
- Demand Side Management
- Time-of-use Tariffs and *Net Metering for* Micro Photovoltaic Plants
- Case Study
- Conclusions

# Energy of Micro Photovoltaic Plants in Residences (Brazil)

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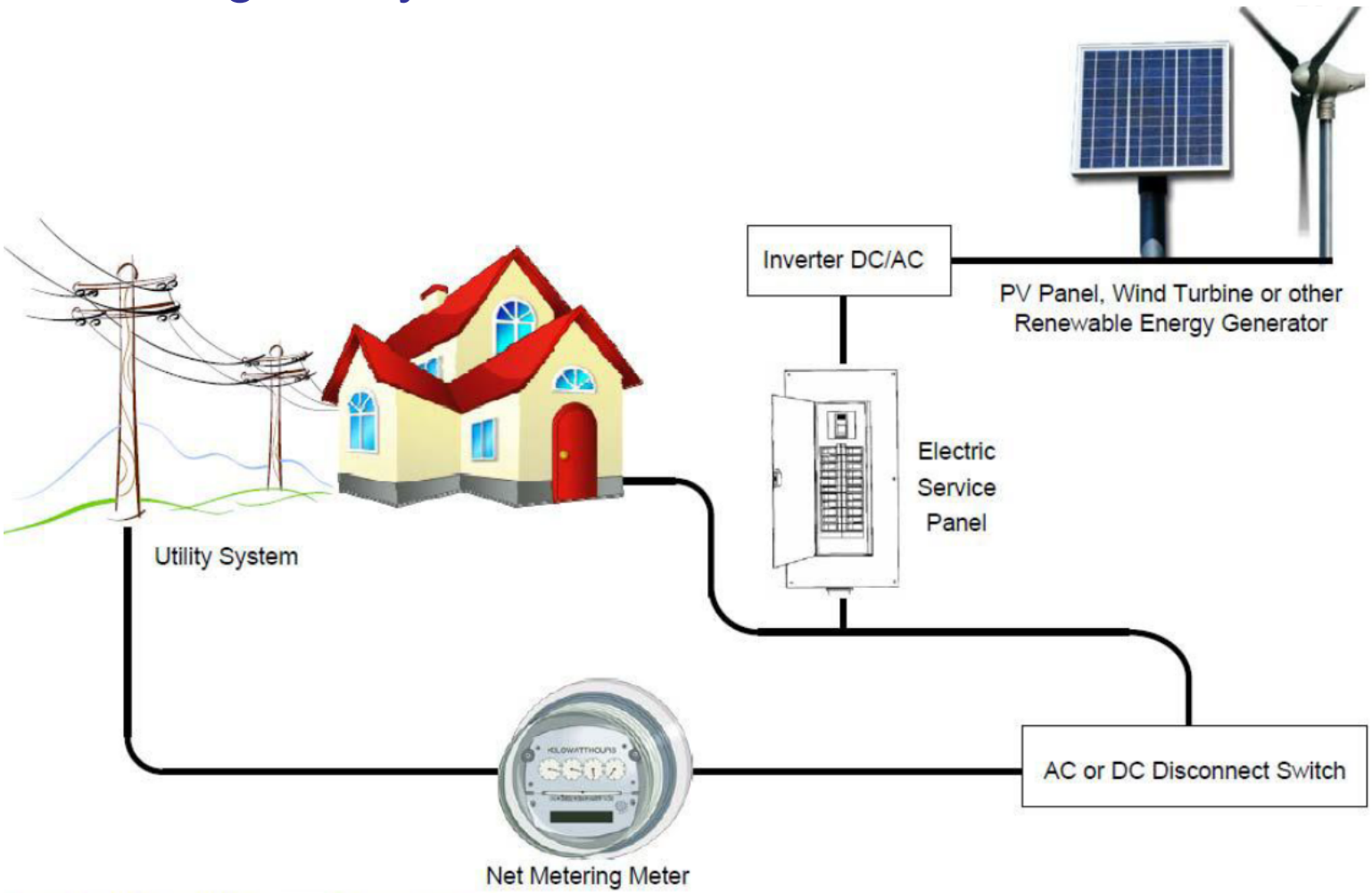
- advance of technology and the reduction of costs of the new sources of energy;
- Generation of electric energy from small generator units with low installed power - photovoltaic solar panels;
- Distributed Generation has become an option for countries that are in need of resources for generating energy;
- the use of distributed generation, reducing the costs of transport from the source to the load;
- In Brazil, this model of generation of energy is still in the initial stage.

# Demand Side Management

- Consumption Reduction through more Efficient Technologies;
- Different actions, such as changing appliances and changing habits, can promote residential efficiency, which is as good for the consumer as for the electric system in general;
- Inside residences, the appliances can represent a great change in energy consumption;
- Within the possible changes the highlights are: Illumination, air conditioning, electric showers, refrigeration, computers and stand-by lights (present in many devices, such as electric motors).

# Net Metering for Micro and Minigeneration

- Net Metering Policy



# The Proposal of the "Time of Use" Tariff and Net Metering for Micro and Minigeneration

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- Example: Net Metering System with PV Microgeneration (Real Data)

  - Microgeneration System:

As a source of microgeneration, data obtained from UFSC website, from a photovoltaic system with capacity of 2kWp, from SMA SOLARES TECHNOLOGY AG (2014) was used as a reference . This was the first system in Brazil connected to the public electric grid, with 68 photovoltaic amorphous silicon modules, 55 of this an opaque (32Wp) and 13 are semi-transparent modules (27 Wp).

These data were used as a reference for the present study, and the values can be different taking into consideration the particularities of each residence. The goal here is to promote a basis for evaluation of the payback of a low voltage working system with conventional tariffs and time-of-use tariffs.

# The Proposal of the “Time of Use” Tariff and Net Metering for Micro and Minigeneration

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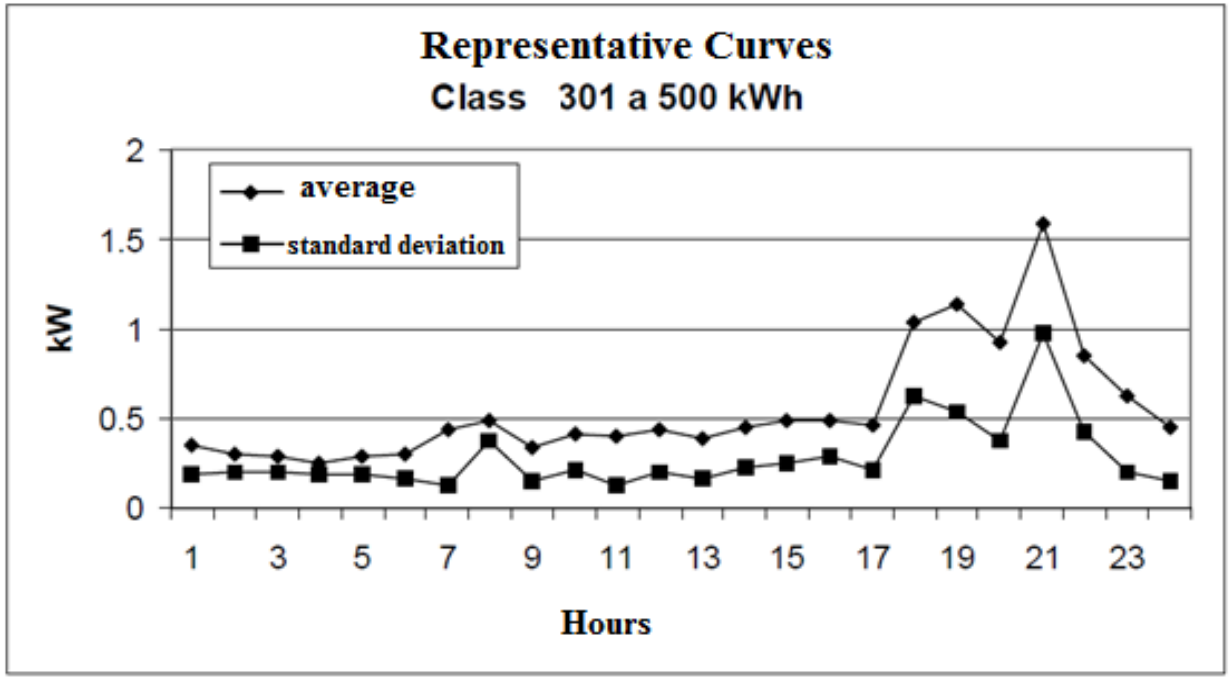
➢ Energy Tariff for Residential Consumer

After obtaining the load curves, it was necessary to find data about the energy tariff for the B1 Group (Residential Consumer). For this objective, data from CELESC - Distributor of Santa Catarina - Brazil was used.

| Energy Tariff for Residential Consumer B1 Group Type Low Voltage (380/220 V) (€/kWh) | | | |
|---|---|---|---|
| | Peak (18h-20h) | Intermediate (17h e 21h) | Out of Peak (other hours) |
| ¨Time of Use” Tariff | 0.2103 | 0.1365 | 0.0968 |
| Conventional Tariff | 0.1146 | 0.1146 | 0.1146 |

# The Proposal of the “Time of Use” Tariff and Net Metering for Micro and Minigeneration

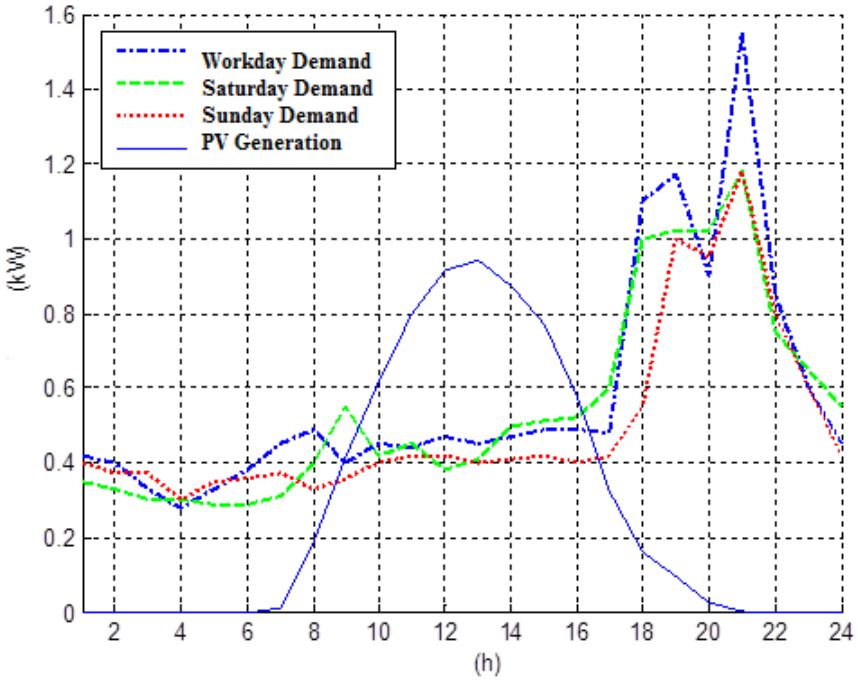
- Residential consumption demand based on the graph of load curves of two typical energy consumers



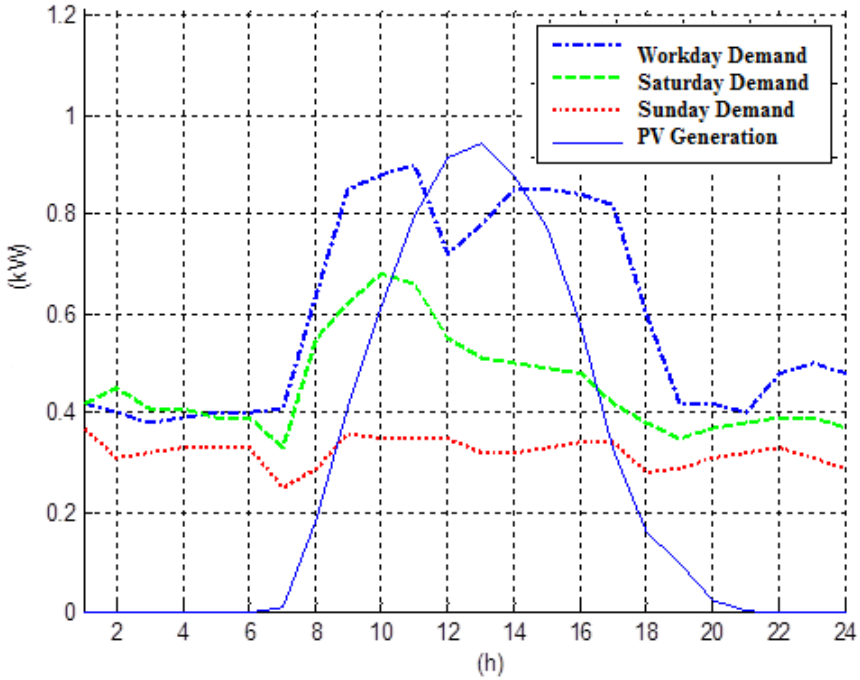

Typical load curve of the residential consumers on workdays.

# The Proposal of the “Time of Use” Tariff and Net Metering for Micro and Minigeneration

- **Results**: Net Metering with generation of photovoltaic (PV)



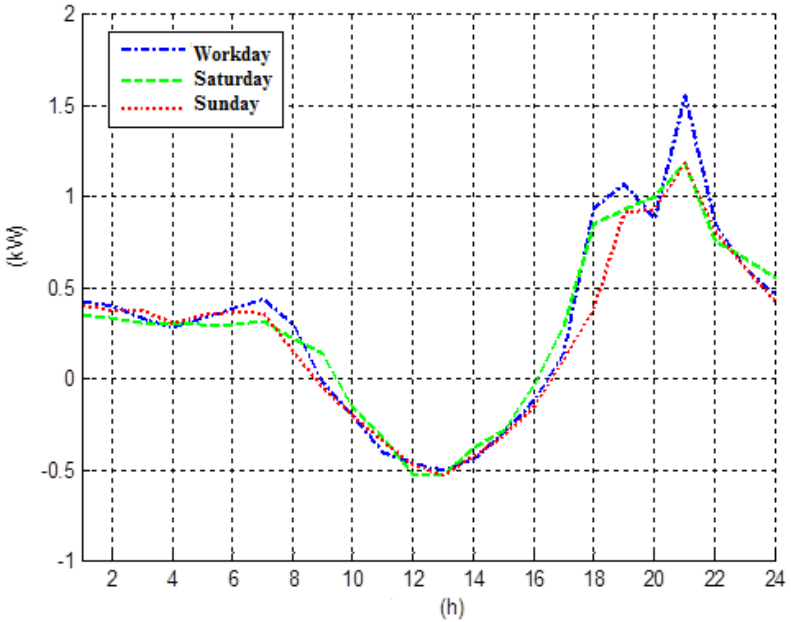

Demand of Consumer 1
And PV generation



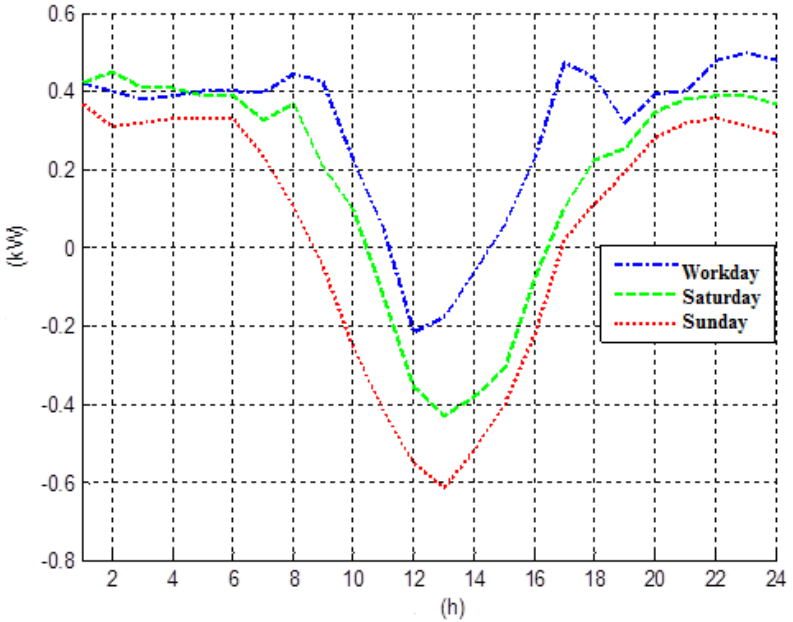

Demand of Consumer 2
and PV generation

# The Proposal of the “Time of Use” Tariff and Net Metering for Micro and Minigeneration

- Comparasion between demand and generation for both consumers, the net energy imported from or exported to the grid




Comparasion between demand and PV generation for Consumer 1




Comparasion between demand and PV generation for Consumer 2

# The Proposal of the "Time of Use" Tariff and Net Metering for Micro and Minigeneration

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- **Results of Example**: Net Metering System with PV Microgeneration - Monthly Tariff - Simulation

- Consumer 1 would suffer a penalty if it were to migrate to the Time of Use Tariff.
- Consumer 2, despite the higher consumption is at peak, has an attractive incentive to migrate to the Time of Use Tariff.
- The production of photovoltaics is not encouraged by the Time of Use Tariff due to the time stipulated by the distributor.
- The discounted payback method (rate of 6% per year) and with a life cycle of 20 years, the investment will be viable if the value of the acquisition and installation of the entire set is below € 3,000 (€ 8,300 – Case Study) .
- For the use of energy storage should be considered the relationship between the hourly tariffs.

| Monthly electricity bill (€) | | |
|---|---|---|
| | with photovoltaics | without photovoltaics |
| **Consumer 1 - Conventional Tariff** | 21.11 | 43.22 |
| **Consumer 1 - time-of-use Tariff** | 28.46 | 48.34 |
| **Consumer 2 - Conventional Tariff** | 19.14 | 41.15 |
| **Consumer 2 - time-of-use Tariff** | 20.23 | 40.11 |

# Conclusions

- The objective of this work was to consider ways in which a consumer could manage his energy consumption more efficiently, with a potential application of intelligent equipment together with the possibility of photovoltaic microgeneration based on the current tariff policies;
- The usage of photovoltaic generators in combination with a good system design can bring good economic results, but with these new tariff policies, this time could be drastically reduced, making this technology economically feasible;
- With the time-of-use tariff and the possibility of “selling” energy in watts, it is possible to export energy to the system during the day, and get it back during the night, with price adjustments being made, but at the same time saving money;
- The investment in the installation of a photovoltaic microgeneration system is not attractive yet with the current costs and regulation, because the payback time was calculated at more than 30 years, and the life cycle of the panels is around 25 years;
- The distributed generation is an important alternative for cleaner energy production, with lower risks of interruption and faults in the energy production, therefore promoting a robust system in all senses. Incentives for the scope of microgeneration through regulatory policies or new tariffs, such as as the time-of-use tariff, should continue in order to promote a more adequate and sustainable energy use by the consumers.

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# Obrigado!
# Thank You!

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