Inovação na Energia @ IN+ /IST

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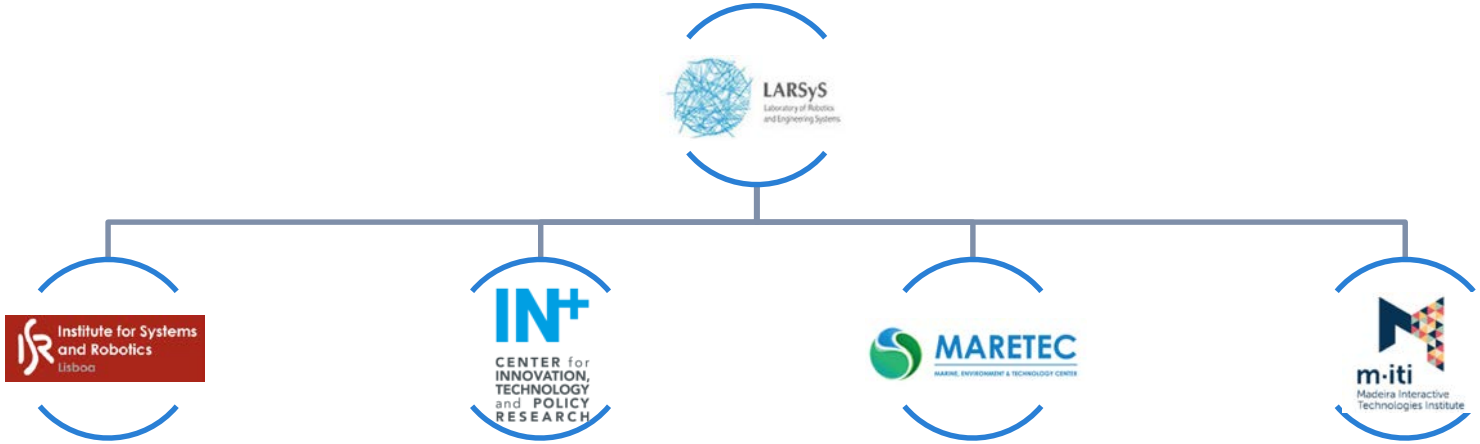
TÉCNICO LISBOA

IN+ CENTER for INNOVATION, TECHNOLOGY and POLICY RESEARCH

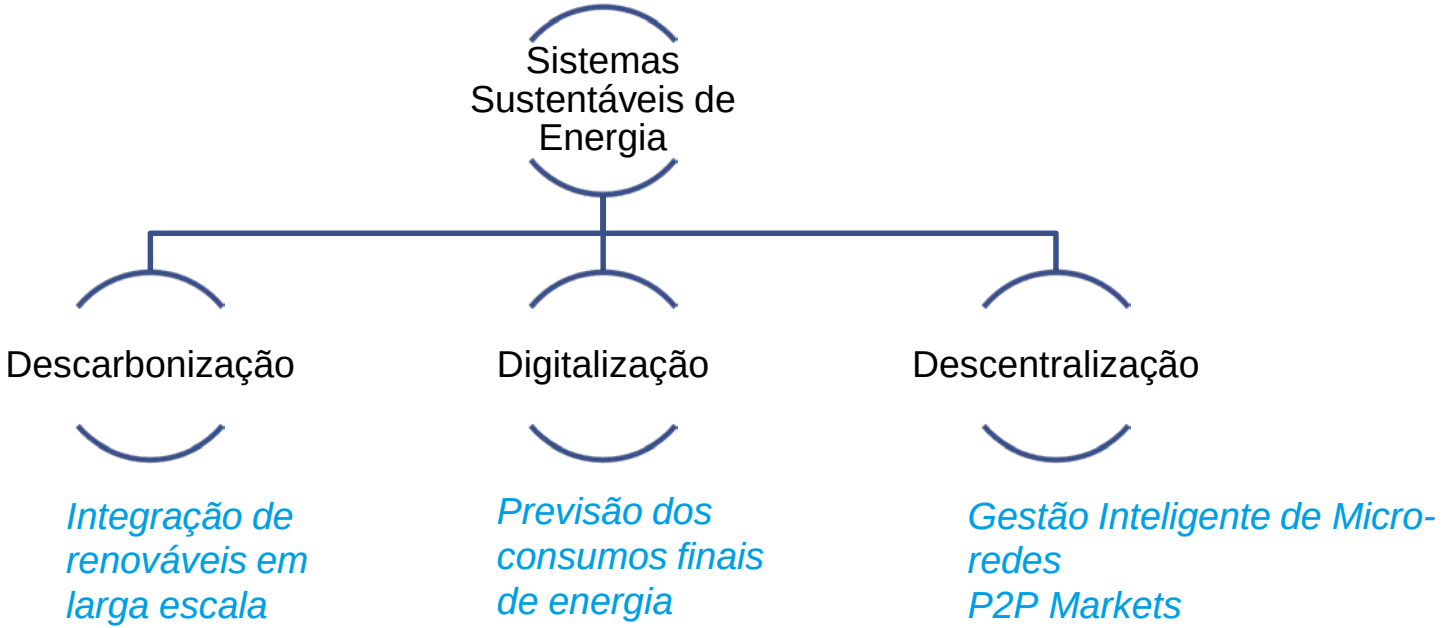
LARSyS Laboratory of Robotics and Engineering Systems

IN+ Centro de Estudos em Inovação, Tecnologia e Políticas de Desenvolvimento

LARSyS - Laboratory of Robotics and Engineering Systems



Linhas de Investigação



Digitalização

Como é que os consumidores utilizam energia

- Modelação dos usos eléctricos em Energyplus
- Previsão com integração de dados (smart meters)

Catarina Pargana & C. Sousa Monteiro (PhD)

Abordagem metodológica

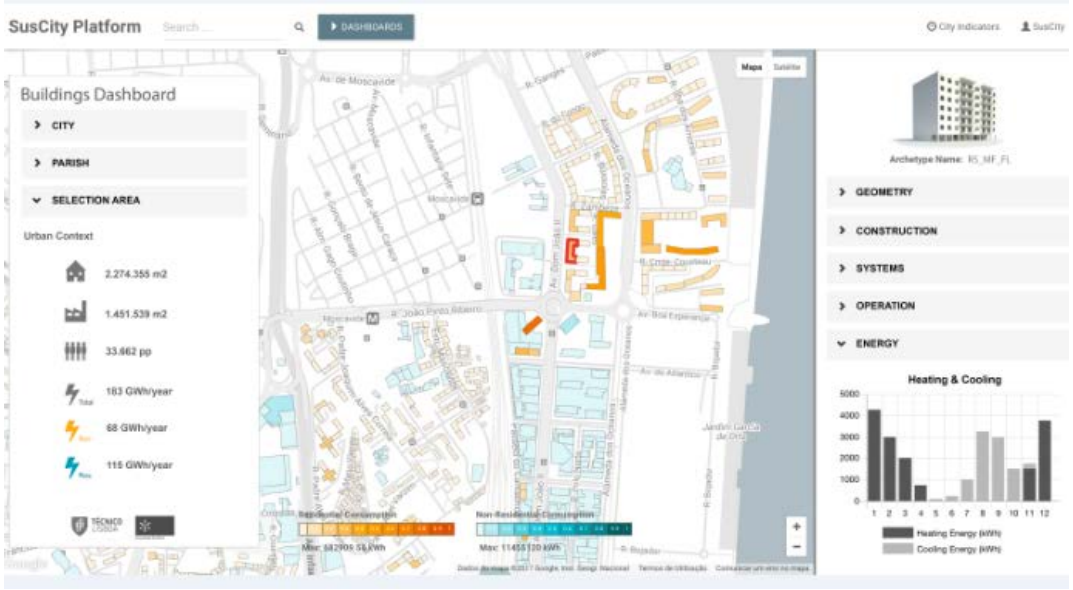
- Combinação de modelos físicos com modelos de dados

  - Modelos físicos (*infraestrutura*)
    - Usos de energia
    - Sistemas
  - Modelos de Dados (*Comportamento*)
    - Consumo de energia
    - Variáveis de contexto (Censos, Certificados Energéticos)

Modelo Físico: Arquétipos de edifícios

Modelação dos edíficios

- Geometria
- Soluções Construtivas
- Sistemas



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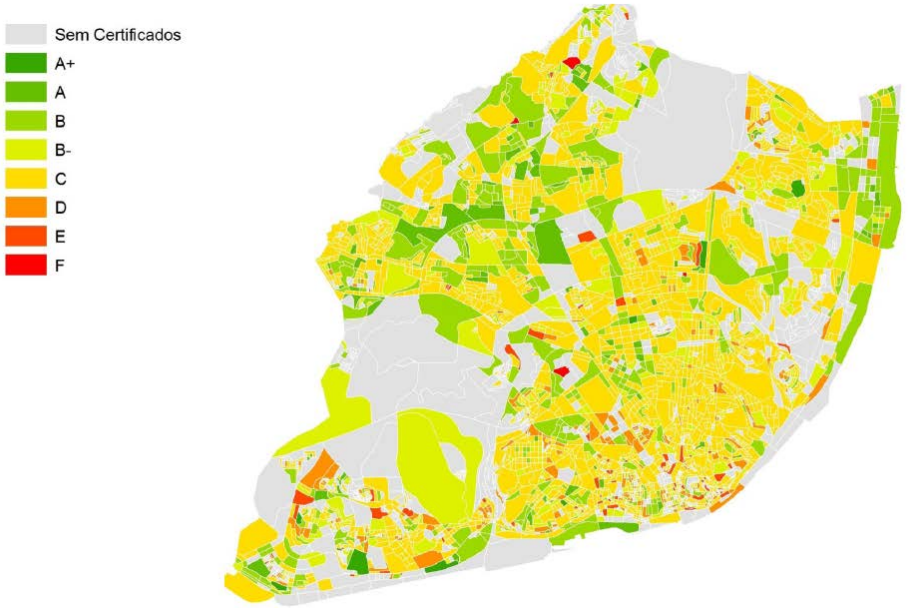
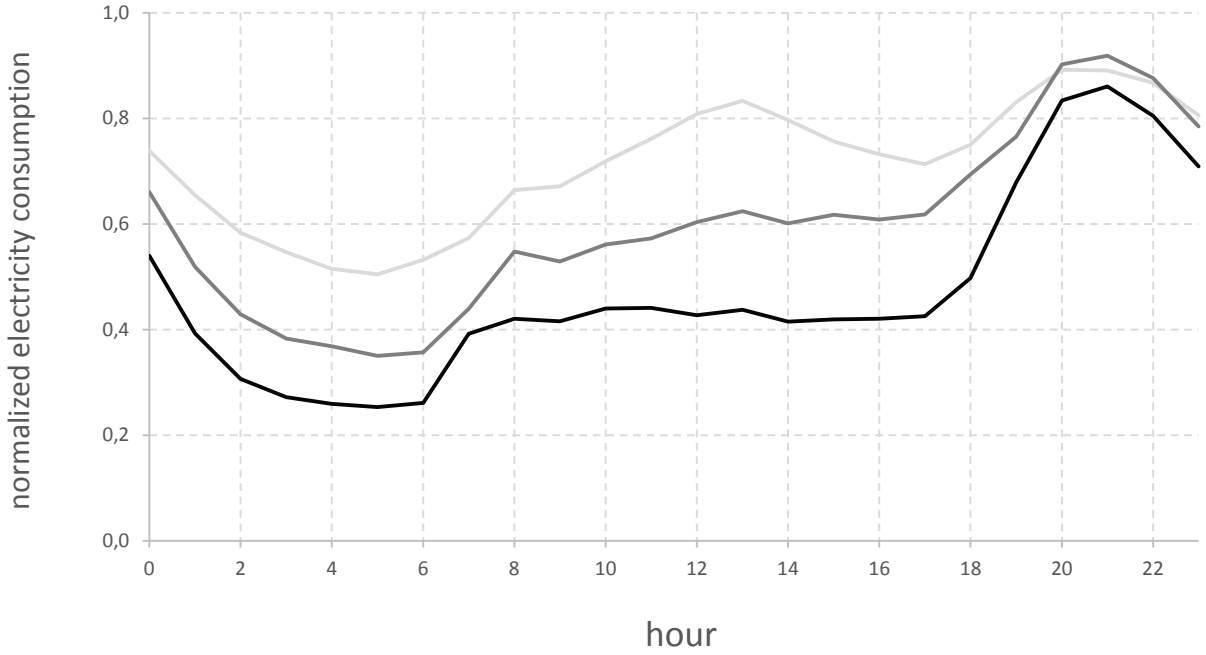
Fontes de dados

Carta do potencial solar para Lisboa (Lisboa Enova)



Certificados energéticos para Lisboa (ADENE)

Modelo baseado em dados: Clustering



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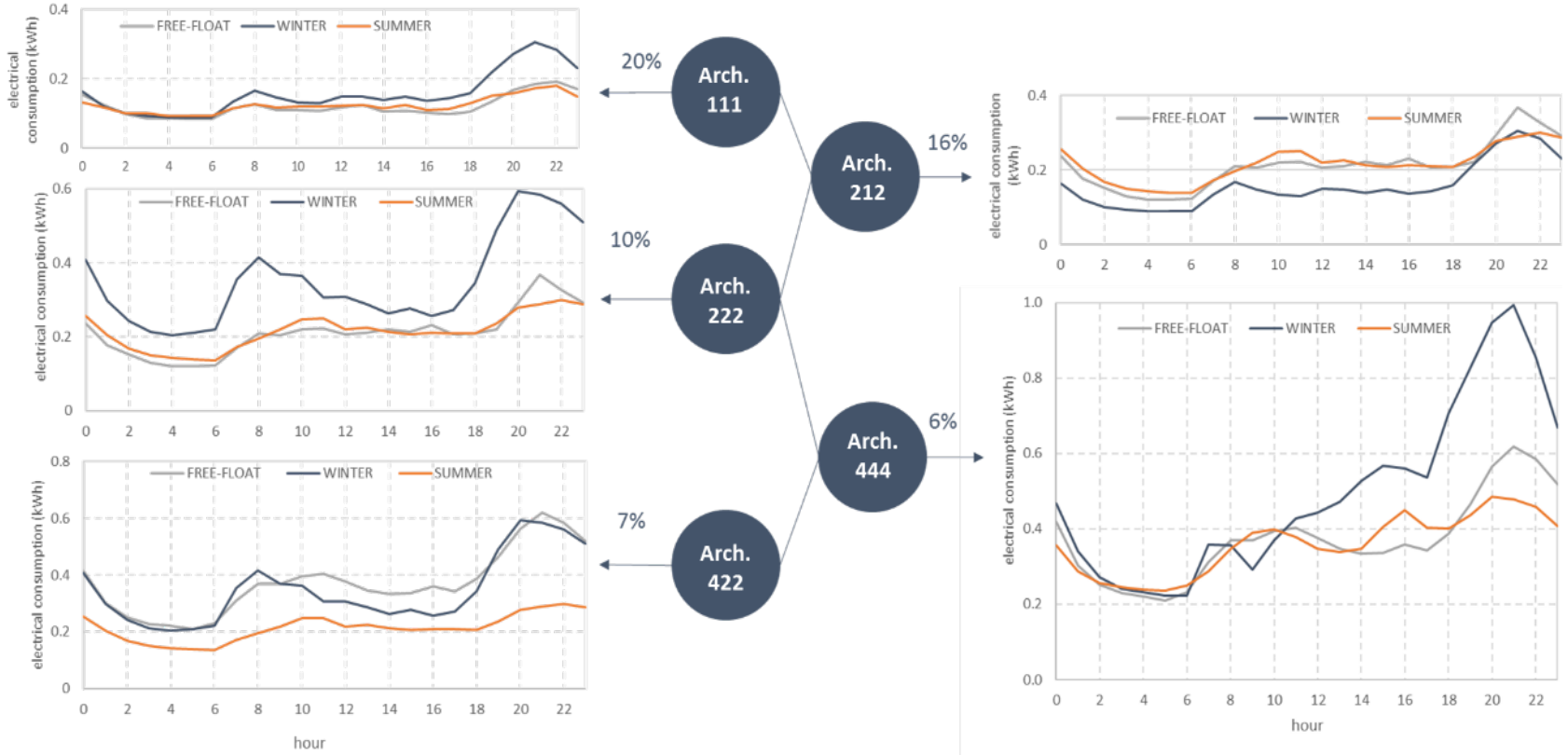
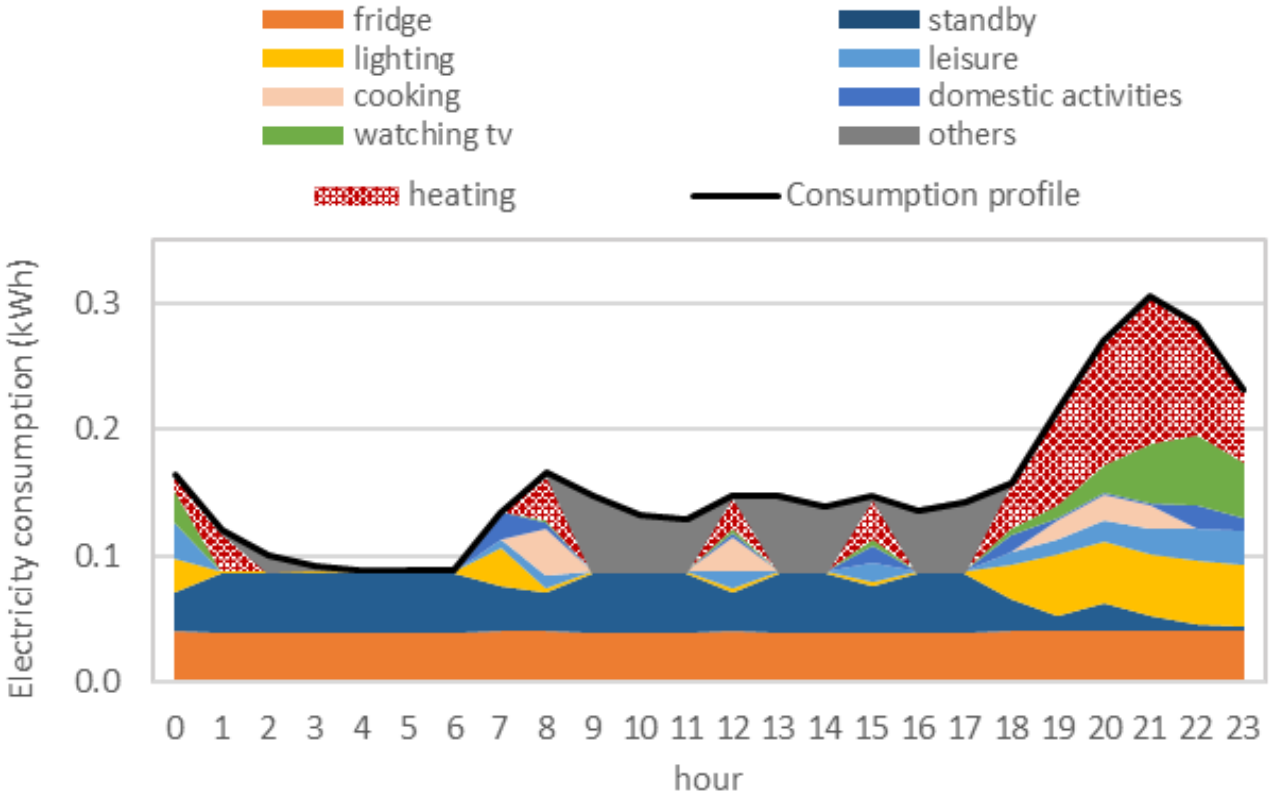
Arquétipos de Consumo



Modelo de desagregação de usos



Descarbonização

Onde devemos instalar a produção distribuída? Qual o impacto que pode ter na rede?

- Modelação dos usos eléctricos em Energyplus
- Calibração de modelos com dados de contadores inteligentes

C. Sousa Monteiro (PhD) & Sónia Cunha

Building
electricity consumption

Maximum building
electricity production

Building net
electricity consumption

Descentralização

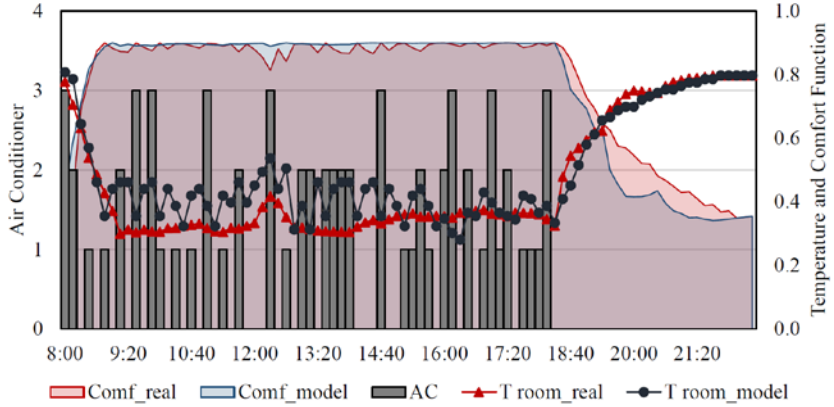
Como gerir a produção descentraliada tendo em conta as preferências dos utilizadores

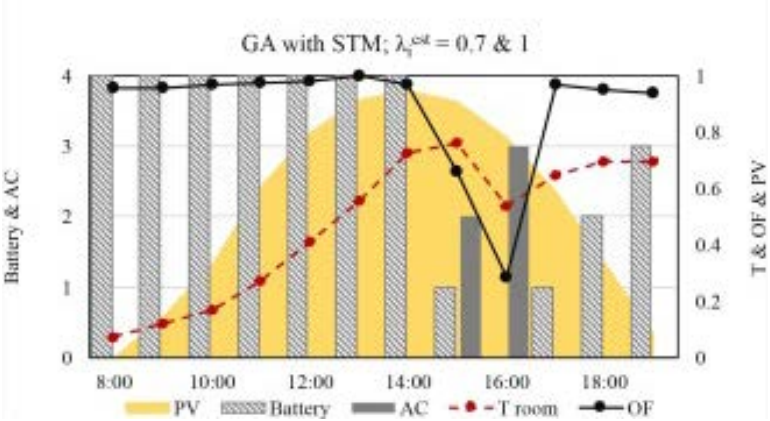
- Modelos físicos e de conforto com Energyplus
- Optimização multi-objectivo com Algorítmos Genéticos

Henrique Pombeiro (PhD)

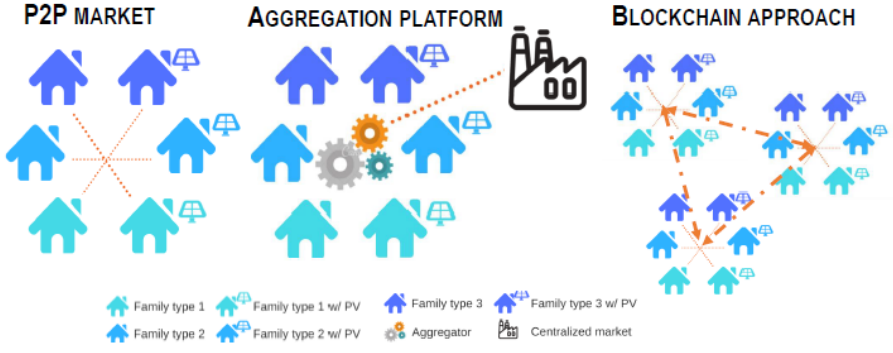
Gestão Inteligente de micro-redes

- Controlo de AVAC e Iluminação
- PV+Bateria | PV+Bateria+Rede

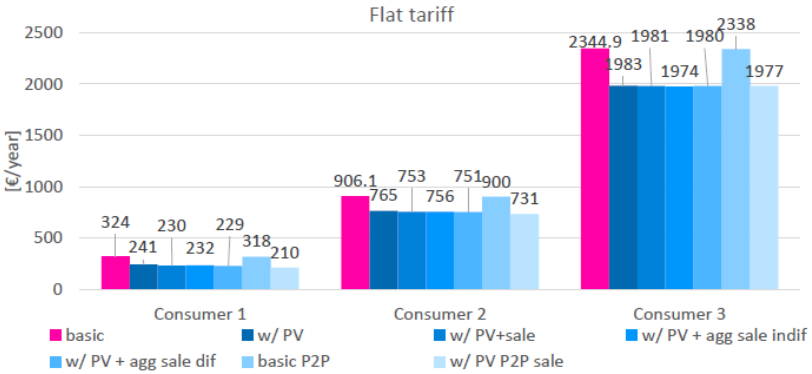


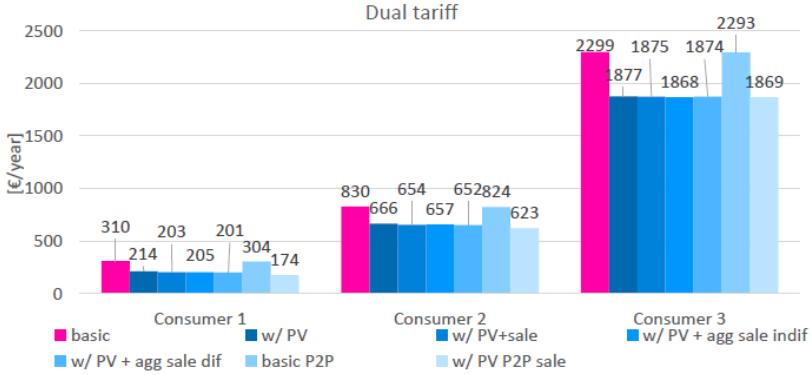


P2P markets



	Self sufficiency Rate [%]	Energy absorbed [kWh/year]
Consumer 1 Working couple Home at night PV capacity: 500 Wp	25.6	244.2
Consumer 2 Working couple + 2 kids Home at night PV capacity: 750 Wp	15.6	263.7
Consumer 3 Working couple + 3 youth Presence at home PV capacity: 1500 Wp	15.4	44.1





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Investigação e Inovação em Energia no IST

Consumer efficiency impacts on grid adequacy and evolution

- Distributed generation and energy efficiency are changing the load profile at the various layers of grid aggregation.
- Today's profile is different: has high volatility and its shape has high variance, with a high power peak and a low energy level.
- Optimizing for grid efficiency alone cannot lead to satisfactory results -- as such optimal solutions would not be adequate for security of supply.
- Thus, one has to explicitly optimize for security of supply as well. The resulting planning problem is much harder.
- One needs high computational power, plenty of data to characterize the loads adequately, and powerful stochastic optimization techniques.

Research challenges

- In INESC-ID/IST we went through the process of exploring this new planning challenges, a planning able to ensure security of supply, of optimizing for capacity and efficiency, with risk controlled decision support.
- We have evolved metering data analytics to classify consumption and production profiles and to model then as stochastic processes (with Markov chains).
- We innovated simulation to handle loads as stochastic processes and to evaluate decisions based on probabilistic synthesis of simulation results.
- We have explored optimal investment deferral as a trade-off dimension enabled by the increasingly important, complementary role of demand-side response.

Conclusions

- Digitalization
  - Include behaviour in the models
  - As important as energy data is context data
  - Complement physical models and not replace them
- Decarbonization
  - Integration of technologies (Demand Response, Storage)
- Decentralized
  - Intelligent operation

Thanks!

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