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METHODOLOGY TO OPTIMISE ELECTRICITY DEMAND IN THE RESIDENTIAL SECTOR THROUGH EFFICIENT LOAD MANAGEMENT

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Introduction

The current energy model requires a transformation based on a **sustainable model**, **accessible to all**, focused on the **needs of citizens** and **committed to the planet.**

The **main factors** impacting on the new energy model are:

- European 2030 targets for the reduction of emissions and the promotion of renewable energy.
- New power generation technologies and smart grids.
- Previous projects on energy management.
- Changes in the current electricity regulations.

Methodology

To create a **tool tailored** to the needs and priorities of the small domestic consumer, which helps in energy management and sustainable energy planning, whether a consumer of energy from the grid or a prosumer self-consuming their own energy.

Input parameters

- Energy demand and generation history.
- Updated energy prices.
- Priorities in the use of household appliances, to be defined by the user.
- Technical specifications for generation and storage technologies.
- Type of electricity tariff of the dwelling.

Figure 1. Overview of the methodology

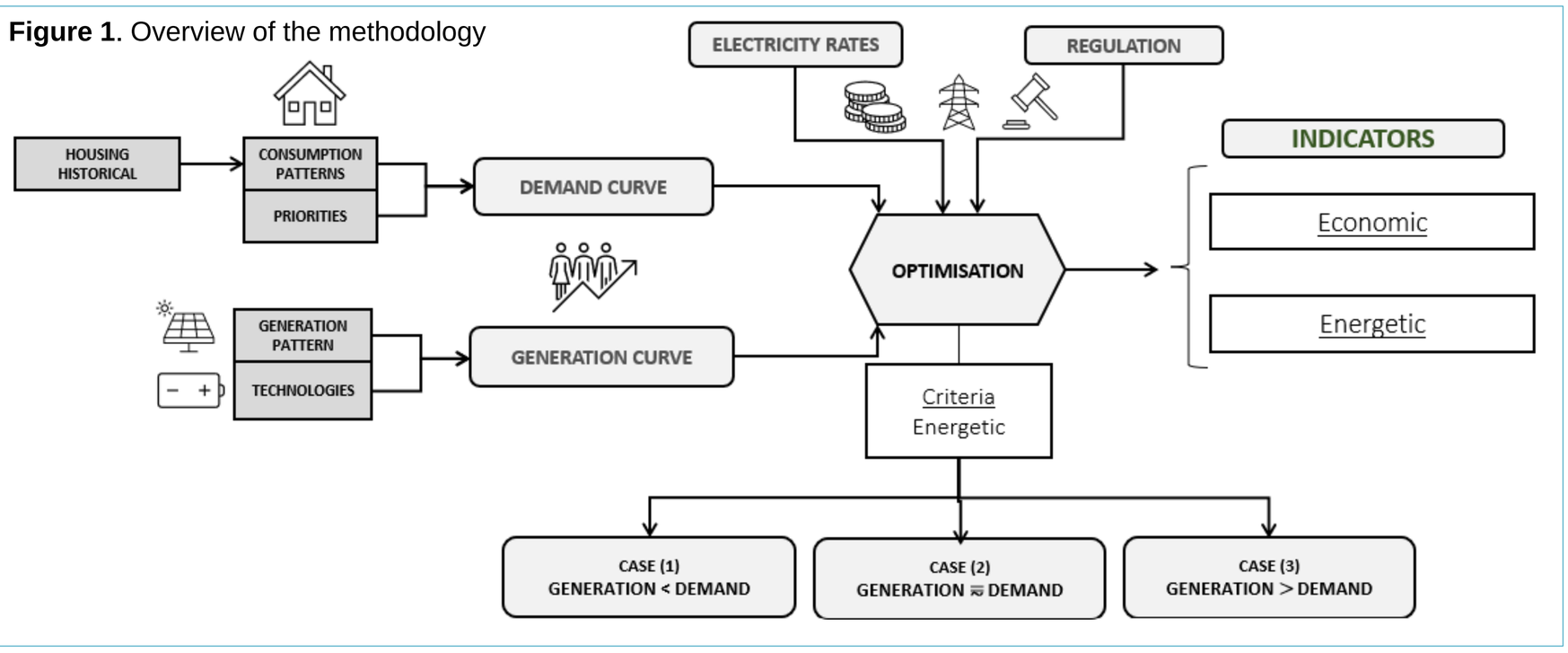

Table 1. Possible time cases in the hourly optimisation

POSSIBLE CASES HOURLY		
Case 1	Generation < Demand	Instantly only part of the demand can be supplied and it should be studied whether there is energy stored in the batteries to supply the demand completely.
Case 2	Generation ≈ Demand	The demand may be fully supplied but there will be no energy surplus.
Case 3	Generation > Demand	The consumer's demand can be fully supplied and there will be a surplus of energy.

Operating algorithm

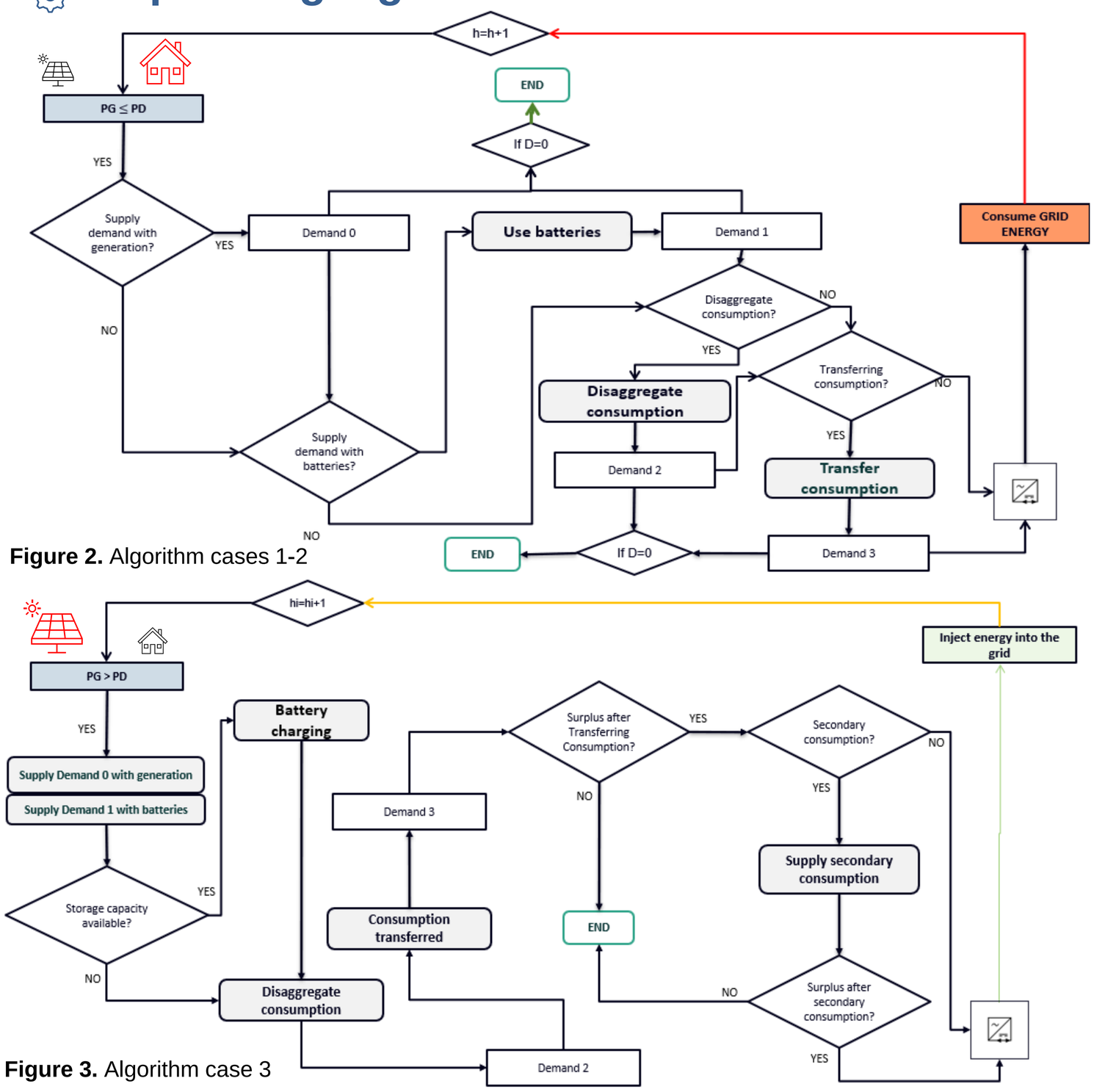

Figure 2. Algorithm cases 1-2

Figure 3. Algorithm case 3

Results

Table 2. Energetic indicator results

SUPPLIED DEMAND (%)					
PROPOSED MEASURES		SUMMER		WINTER	
		WORKING	HOLIDAY	WORKING	HOLIDAY
Renewable source	Generation	57%	63%	18%	5%
	Batteries	30%	32%	30%	30%
	Disaggregate	0%	0%	3%	3%
	Trans. Batteries	1%	1%	0%	0%
Total renowable		88%	96%	51%	38%
Purchase Grid		12%	4%	49%	62%

Table 3. Economic indicator results

SAVINGS ON ENERGY PURCHASES (%)			
SUMMER		WINTER	
WORKING	HOLIDAY	WORKING	HOLIDAY
94,98%	95,97%	55,66%	46,98%

Conclusions

- **Domestic consumer** as a major actor in **active demand management.**
- **Energy optimisation methodology** adapted to the consumer.
- Its implementation allows an average **saving of 70%** in the annual cost of the **electricity bill.**
- The **use of renewable energies** allows a minimum of **38% to be supplied** for the most unfavourable day of the winter.