

**ELECTRIC DEMAND SIDE OPERATION**

**DSO MADRID FORUM**

**RED ELÉCTRICA DE ESPAÑA**

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# **CUSTOMER ORGANIZATION**

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## **1. INTRODUCTION**

## **2. PROCESS SUITABILITY**

## **3. DEMAND ORGANIZATION**

## **4. CONCLUSIONS**

# CUSTOMERS

**DEMAND RESPONSE WILL COME OUT FROM THE FLEXIBILITY ASSOCIATED TO THE END USER PROCESSES THE CAPABILITY OF THE CUSTOMER TO ASSIGN ENERGY USES TO PRICES**

**THIS PROCESSES AS WELL AS THE EQUIPMENT TO SUPPLY THE REQUIRED SERVICE LEVELS HAS TO BE INVESTIGATED IN ORDER TO DETERMINE THE AVAILABLE DEMAND RESOURCES**

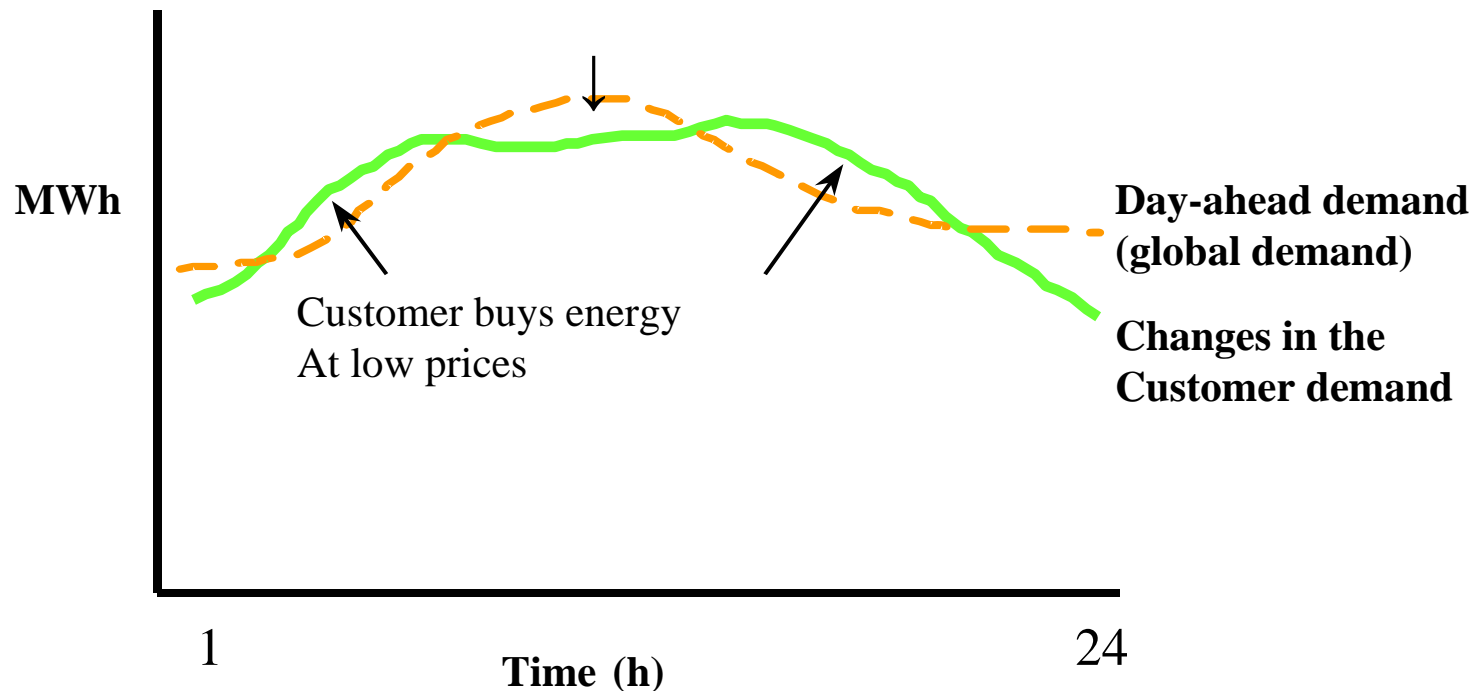
**DEMAND RESPONSE CAN COME FROM CUSTOMER BY TWO MECHANISMS:**

- **IDENTIFICATION OF ENERGY REQUIREMENTS AND ITS ASSOCIATED BENEFITS (BIDS)**
- **IDENTIFICATION OF THE OPPORTUNITIES TO GIVE UP OR DELAY OF SOME ENERGY CONSUMPTION AND ITS ASSOCIATED COST (OFFERS).**

**OPPORTUNITY TO MAKE PROFITS FROM THE CUSTOMER FLEXIBILITY**

## CUSTOMER RESPONSE IN DR PROGRAMS

- TWO TYPES OF DEMAND STUDIES:
  - TOTAL DEMAND OF A CUSTOMER:
    - » BILATERAL CONTRACT
    - » ELECTRICITY MARKETS
  - CHANGE IN THE DEMAND
- CUSTOMER TASK: TO ARRANGE ITS DEMAND INTO **DEMAND PACKAGES** TO BE OFFERED OR BID



# CUSTOMERS

- **PARAMETERS OF A DEMAND PACKAGE (DP):**
  - **TRIGGER PRICE: F (CUSTOMER, END USE)**
  - **SIZE AND SHAPE OF THE DP BLOCK: (CUSTOMER, LOAD)**
  - **THE NOTICE REQUIRED FOR THE CHANGE IN THE DEMAND**
  - **ADDITIONAL LIMITATIONS: NUMBER OF PARTICIPATIONS IN A DAY, MONTH OR YEAR**

| Type of customer   | Capability to reduce demand  |  |
|--------------------|--|--|
|                    | Controllable loads   |  |
| <b>Industrial</b>  | <ul style="list-style-type: none"> <li>■ <b>Process independent</b></li> <li>■ <b>Sequential</b></li> <li>■ <b>Process interlocked</b></li> <li>■ <b>Storage capability</b></li> </ul> |  |
| <b>Residential</b> | <ul style="list-style-type: none"> <li>■ <b>Storage capability</b></li> <li>■ <b>Non storage loads</b></li> </ul>  |  |
| <b>Commercial</b>  | <ul style="list-style-type: none"> <li>■ <b>Storage capability</b></li> <li>■ <b>Non storage loads</b></li> </ul>  |  |

## **METHODOLOGY FOR DP CREATION:**

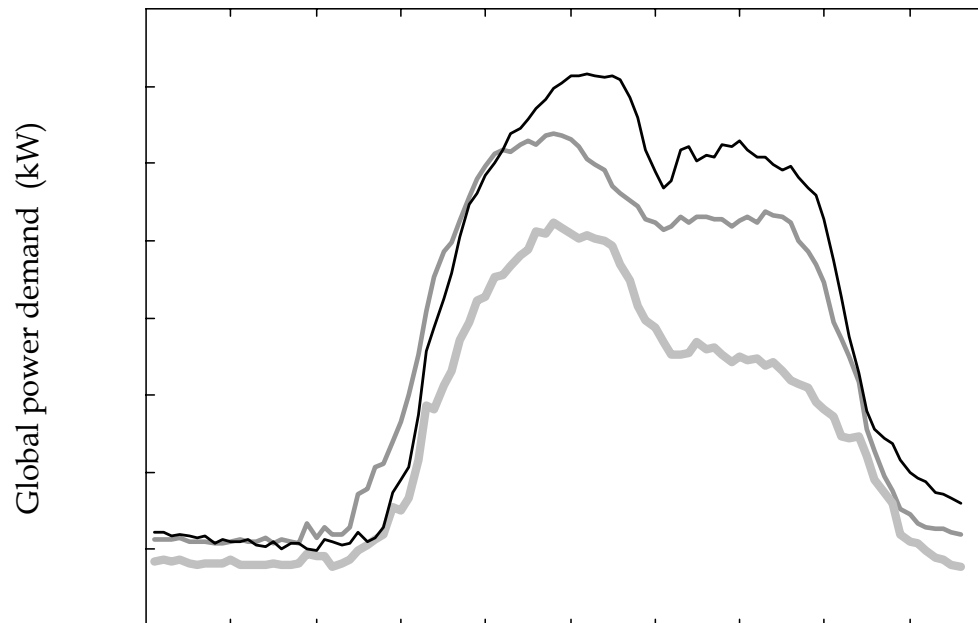
### **COMPREHENSIVE ANALYSIS OF THE CUSTOMER END-USES AND PROCESSES**

- **SEVERAL FACTORS ARE RELEVANT TO ASSES LOAD FLEXIBILITY**
  - A. **FINAL SERVICE SUPPLIED BY THE ELECTRIC LOAD**
    - **HEAT, COOL, ILLUMINATION, PRODUCTION**
    - **DUAL FUEL SYSTEMS**
  
  - B. **STORAGE CAPACITY: PARTIAL, TOTAL**
    - **ELECTRICITY**
    - **THERMAL ENERGY**
    - **PRODUCT**
    - **HYDROGEN, ETC**
  
  - C. **RATE OF LOAD SWITCHING: NATURAL ON/OFF LOAD SWITCHING**
  
  - D. **LOAD DISPATCH AVAILABILITY**

# CUSTOMERS: EXAMPLE

## EXAMPLE OF CUSTOMER LOAD ORGANIZATION

- End uses identification:
  - By analyzing the total load curves in different periods
  - By non intrusive load monitoring (electronic, HAVC and lighting loads)
  - By laboratory experiences: offices and classrooms



# CUSTOMERS

## CLASSIFICATION OF COMMERCIAL AND RESIDENTIAL LOADS ACCORDING TO THEIR SUITABILITY FOR A FLEXIBLE CONTROL

- H: High; M: medium; L: low

| Load                                 | DP<br>(medium term) | DP<br>(short term) | DP<br>(real time) | Bid<br>duration |
|--------------------------------------|---------------------|--------------------|-------------------|-----------------|
| <b>Dimmable lighting</b>             | <b>H</b>            | <b>M</b>           | <b>H</b>          | <b>Hours</b>    |
| <b>HVAC:</b>                         |                     |                    |                   |                 |
| ■ <b>Direct</b>                      | <b>M</b>            | <b>H</b>           | <b>H</b>          | <b>Hours</b>    |
| ■ <b>Partial storage</b>             | <b>H</b>            | <b>M</b>           | <b>M</b>          | <b>Hours</b>    |
| ■ <b>Full storage</b>                | <b>H</b>            | <b>H</b>           | <b>M</b>          | <b>Hours</b>    |
| <b>Irrigation and swimming pumps</b> | <b>H</b>            | <b>M</b>           | <b>L</b>          | <b>Hours</b>    |
| <b>Water Heater</b>                  | <b>H</b>            | <b>H</b>           | <b>M</b>          | <b>Hours</b>    |
| <b>Fridges</b>                       | <b>L</b>            | <b>M</b>           | <b>M</b>          | <b>Min.</b>     |
| <b>Freezers</b>                      | <b>H</b>            | <b>M</b>           | <b>M</b>          | <b>Hours</b>    |



# CUSTOMERS: EXAMPLE

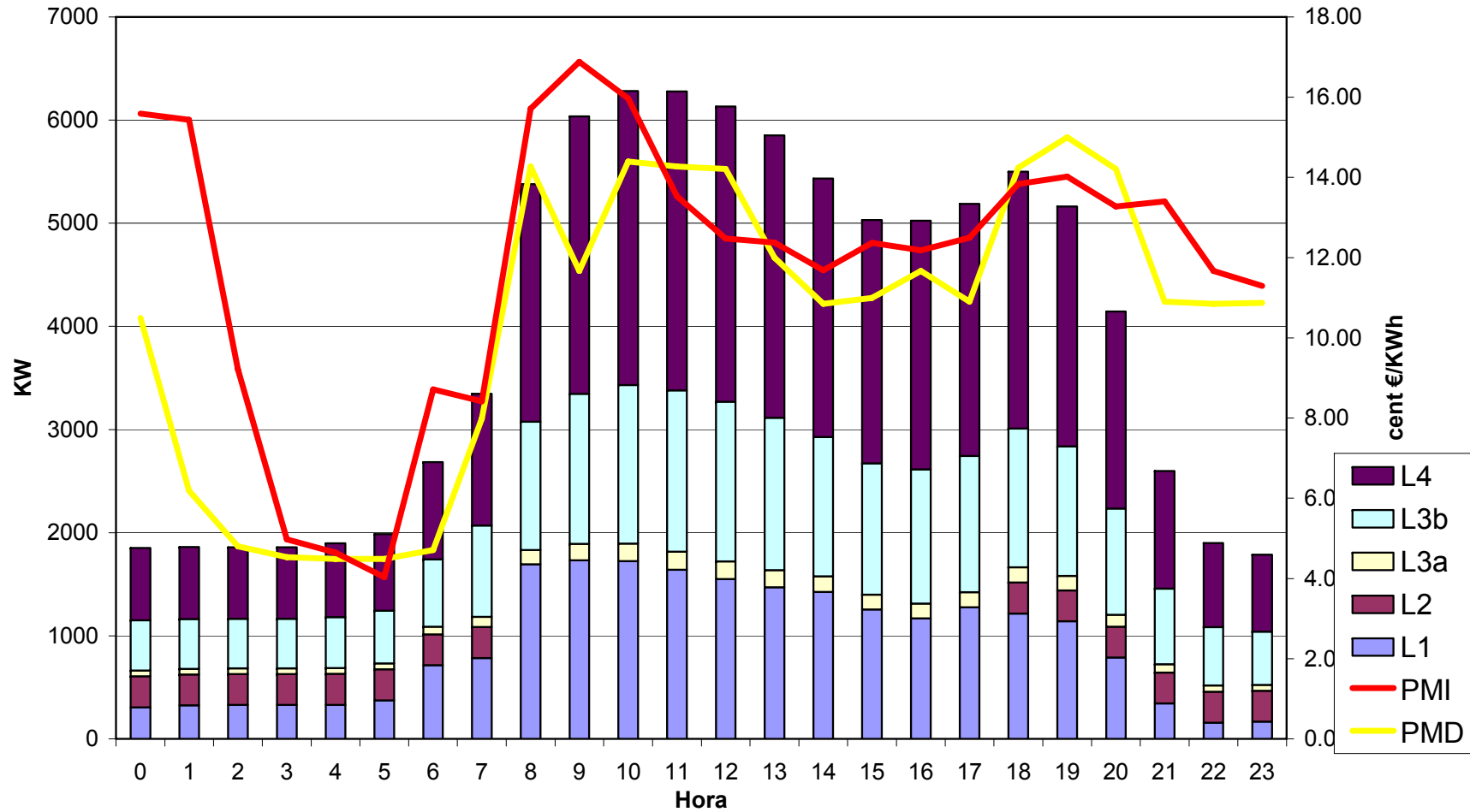
## CUSTOMER LOAD ANALYSIS :WINTER PEAK

| End use                             | Demand      | Considerations   |
|-------------------------------------|-------------|--|
| <b>Space heating</b>                | <b>35%</b>  | <b>HP + Conventional electric heaters (5%)</b>         |
| <b>Air conditioning</b>             | <b>2%</b>   | <b>Individual AC, split units and compact 3p units</b> |
| <b>Lighting</b>                     | <b>28%</b>  | <b>300kW external<br/>150kW dimmable</b>               |
| <b>Electronic loads</b>             | <b>15%</b>  | <b>No response available</b>                           |
| <b>Teaching and Labs equipments</b> | <b>10%?</b> | <b>No response available</b>                           |
| <b>Other demands</b>                | <b>10%</b>  | <b>Emergency lighting, freezers chambers, etc.</b>     |
| <b>Distributed Gen.</b>             | <b>4MW</b>  | <b>Not considered</b>                                  |

| <b>Demand Package</b> | <b>Description</b> | <b>Price (€/kWh)</b> |
|-----------------------|--------------------|----------------------|
| L1                    | Space conditioning | 0.5                  |
| L2                    | External Lighting  | 3                    |
| L3a                   | Internal Lighting  | 3                    |
| L3b                   | Internal Lighting  | 1                    |
| L4                    | Other loads        | 3                    |

COST OF THE ENERGY BOUGHT IN DAILY MARKET: 7,075 €/DAY

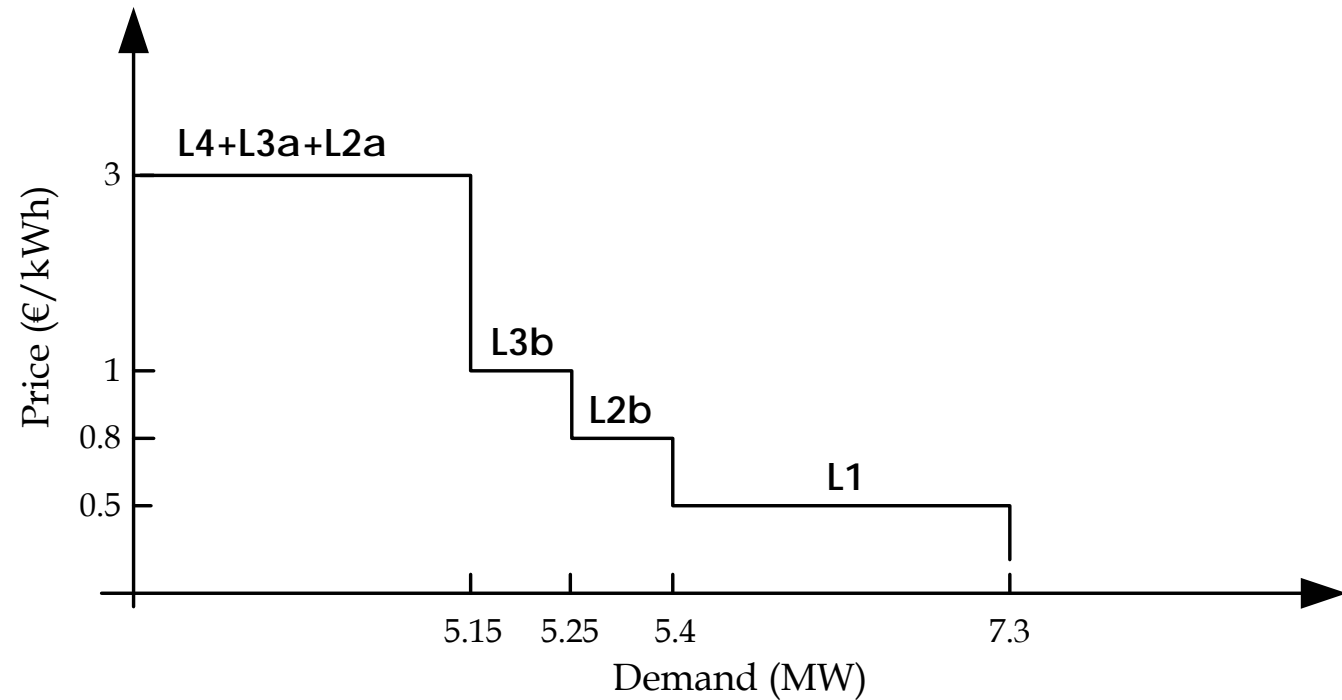
# DEMAND AND ENERGY PRICES



# CUSTOMERS: EXAMPLE

## GENERATION OF DEMAND BIDS

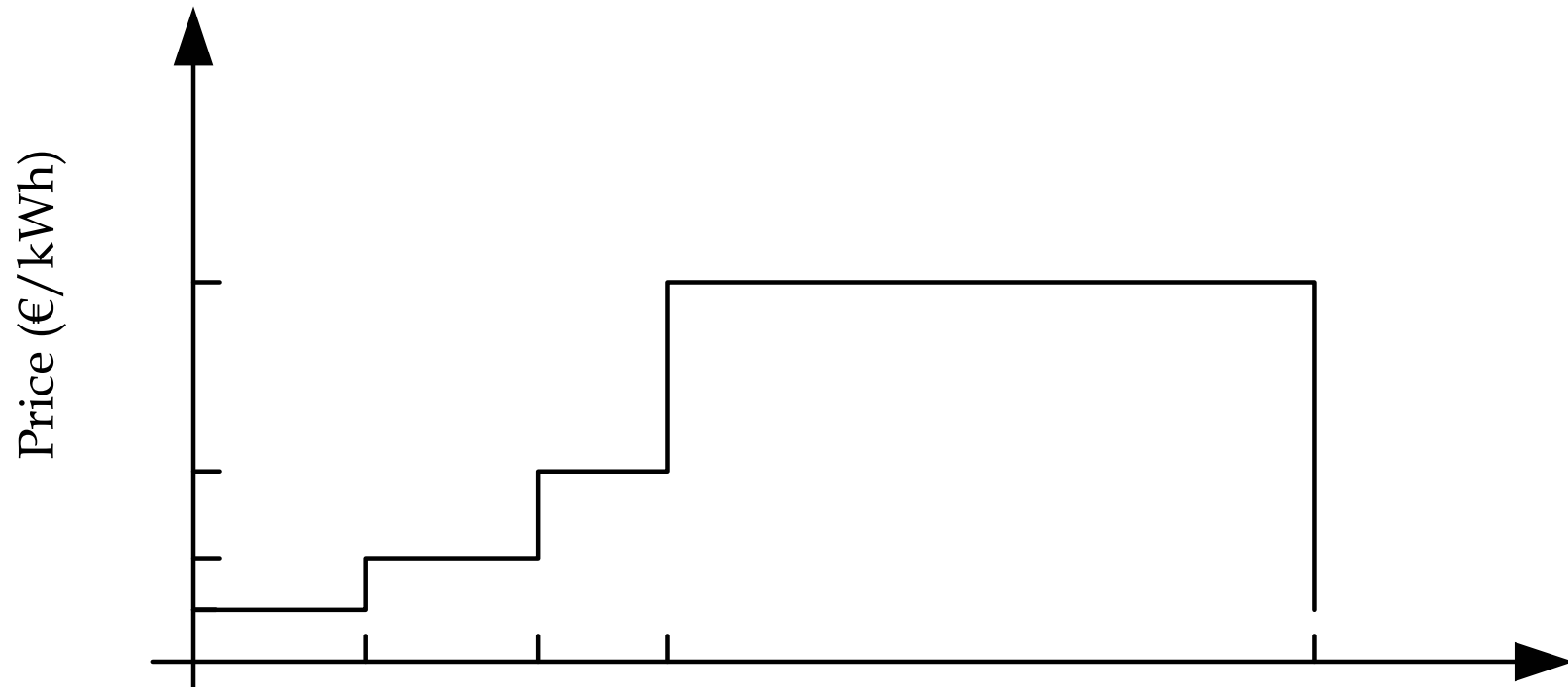
- UPV BIDS FOR THE DAY-AHEAD ENERGY MARKET
  - WINTER PEAK (JANUARY 29, 2002. BID FROM 12 TO 13H)



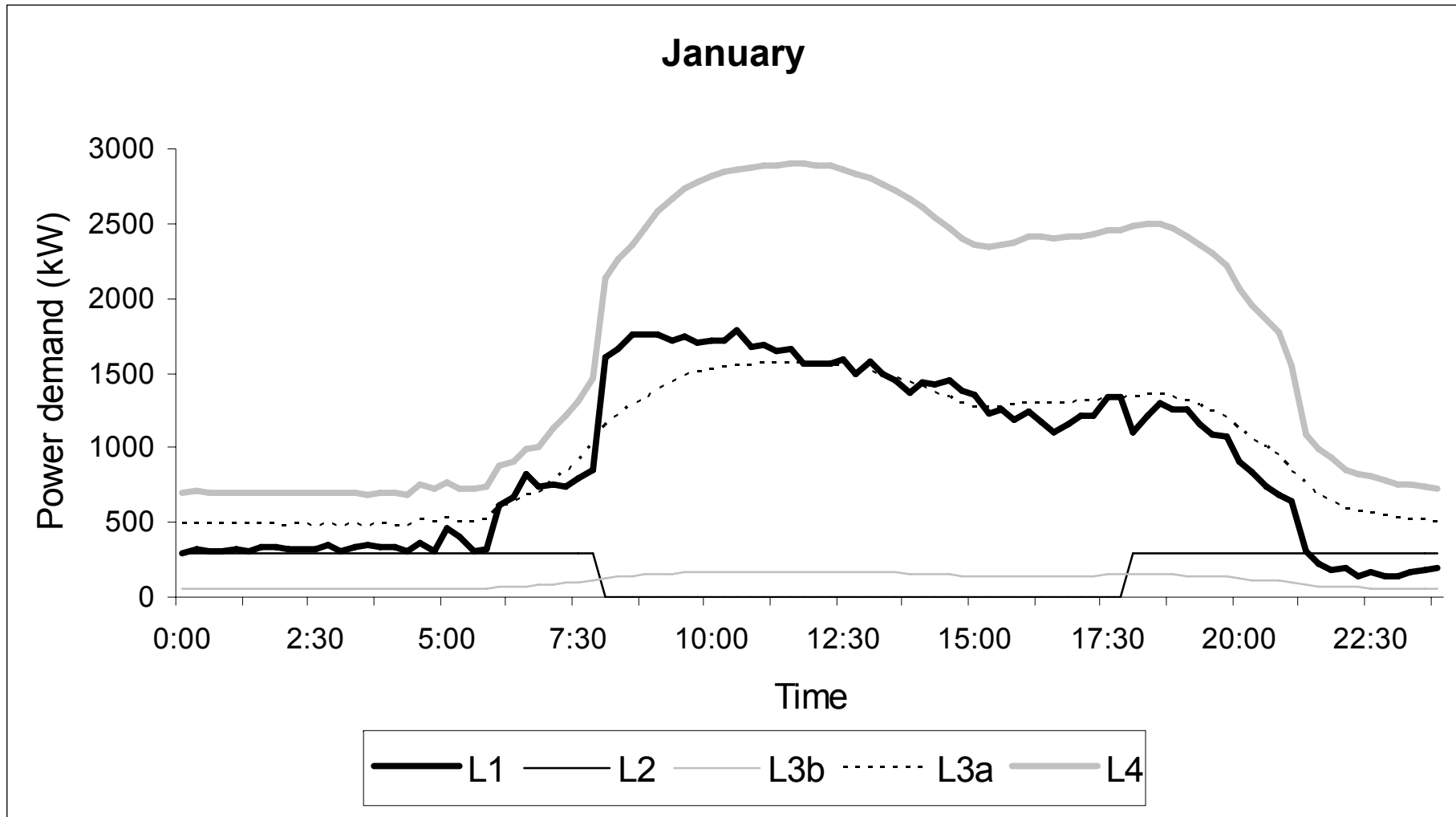
# CUSTOMERS: EXAMPLE

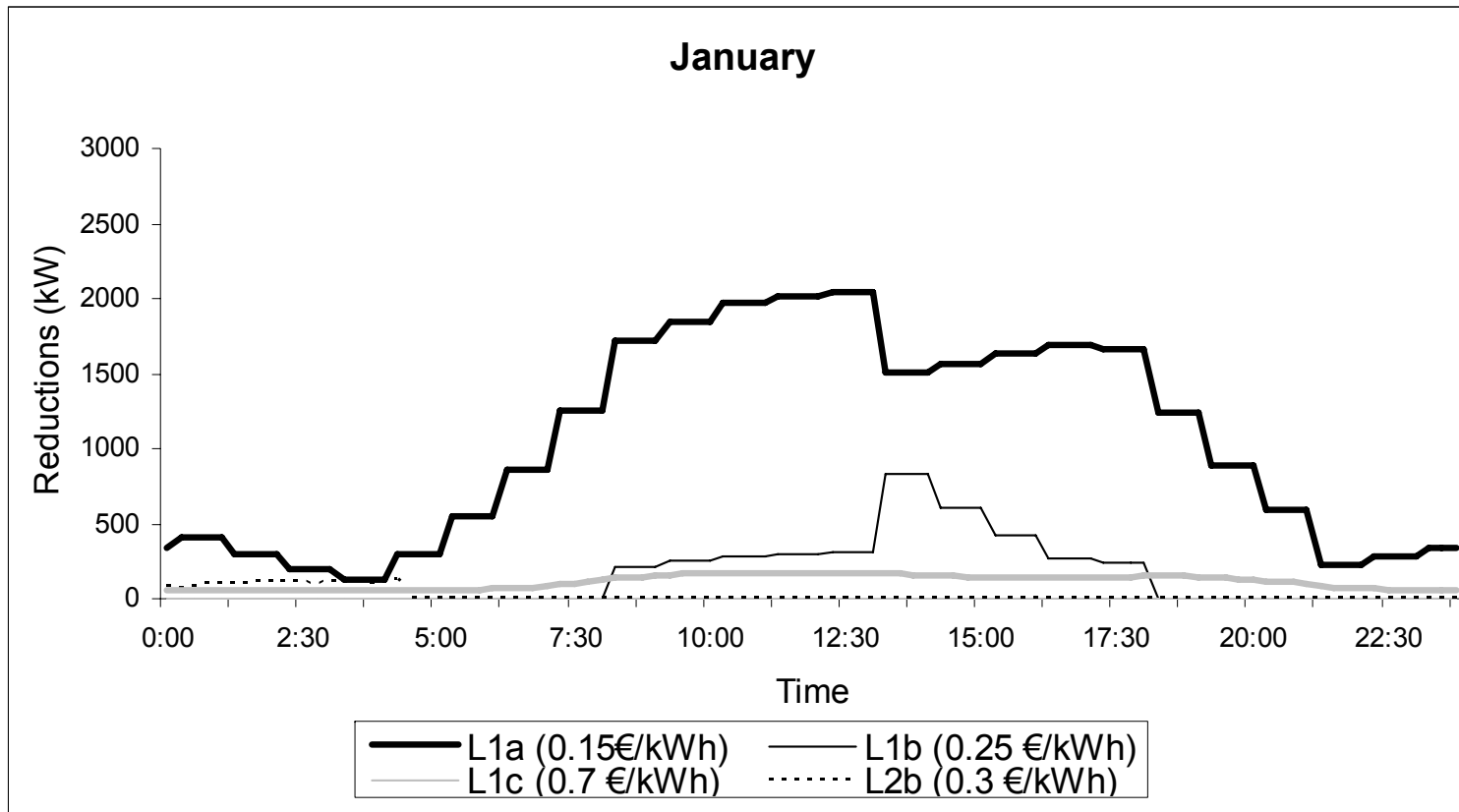
## DEMAND-SIDE OFFERS

- SIMULATION RESULTS: COST-DEMAND CURVE
  - SUMMER PEAK, JULY 9, 2002. HOUR: 13-14H



# EVOLUTION OF FLEXIBLE LOADS

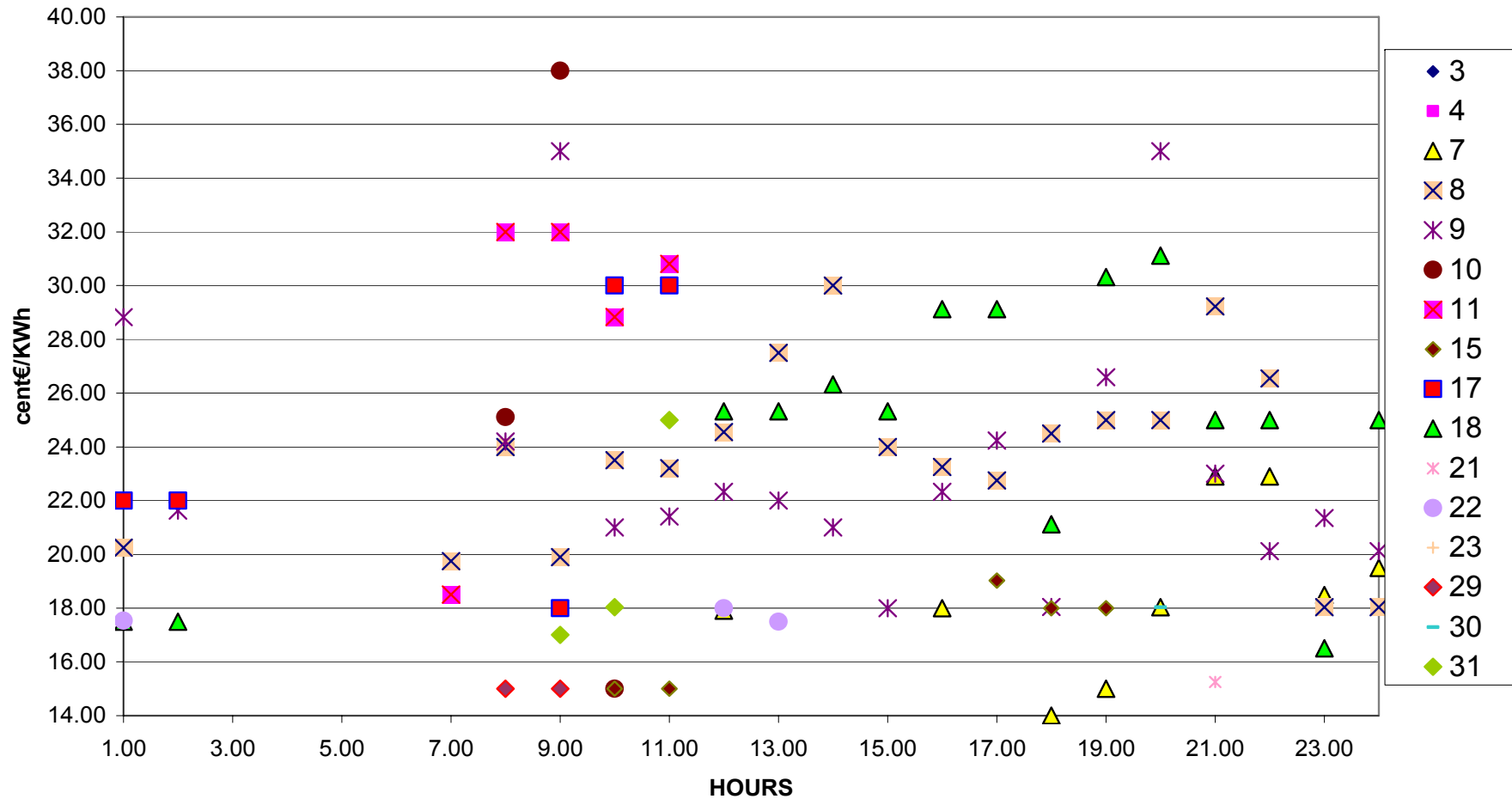




| Price<br>(P)€/KWh | participations |
|-------------------|----------------|
| $0.15 > P$        |                |
| $0.25 > P > 0.15$ | 75             |
| $P > 0.25$        | 33             |

# ESTIMATED LOAD CHANMCES IN BALANCING MARKETS (JANUARY 2003)

Balancing prices for January



ESTIMATED INCOME FOR JANUARY 8TH 2003: 5,874.52 €



# **CUSTOMER PARTICIPATION: CONCLUSIONS**

# CONCLUSIONS

- **BENEFITS OF RETAIL-LOAD PARTICIPATION:**
  - **REDUCTION OF PRICE VOLATILITY (DUE TO DEMAND ELASTICITY).**
  - **THE CONSUMER MANAGE ITS PROFITS AND COSTS:**
    - **DEMAND IS FLEXIBLE**
    - **PRICE OPPORTUNITIES**
  
- **DEMAND ≠ GENERATION**
  - **RECOVERY, LOAD CHANGES,.. → ADVANTAGES AND DRAWBACKS**

# CONCLUSIONS

- **OPERATORS SHOULD FACILITATE THE PARTICIPATION OF THE DEMAND:**
  - **ENERGY MARKETS**
  - **ANCILLARY SERVICES AND NETWORK CONSTRAINTS**
  
- **IT IS NECESSARY TO PERFORM EXTENSIVE RESEARCH TO FIND THE DEMAND RESPONSE RESOURCES**
  - **IDENTIFICATION OF CUSTOMER SEGMENTS**
  - **LOAD RESPONSE MODELS**
  - **PRICE AND COST EVALUATION TOOLS TO PERFORM OFFERS AND BIDS**

# Áreas de actividad

