

# Task XI

## Time of Use Pricing and Energy Use for Demand Management Delivery

Demand Response Workshop  
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# What is DSB/DR/Demand Elasticity?

- Some customer demand non-essential
- Some demand will not be taken if rewarded
- Saves generation capacity, spinning reserve and increases supply security
- Many issues:
  - Large customer demand
  - Small customer demand
  - Work through suppliers/ESCO
  - How to motivate DR by customers
  - How to deliver DR for Supplier/SO
  - How to validate DR for settlements/payment

# Difficulties for smaller customer market participation

- Energy not of much interest to smaller customers
- Customers don't like inconvenience
- Profile settlements
- Demand side validation

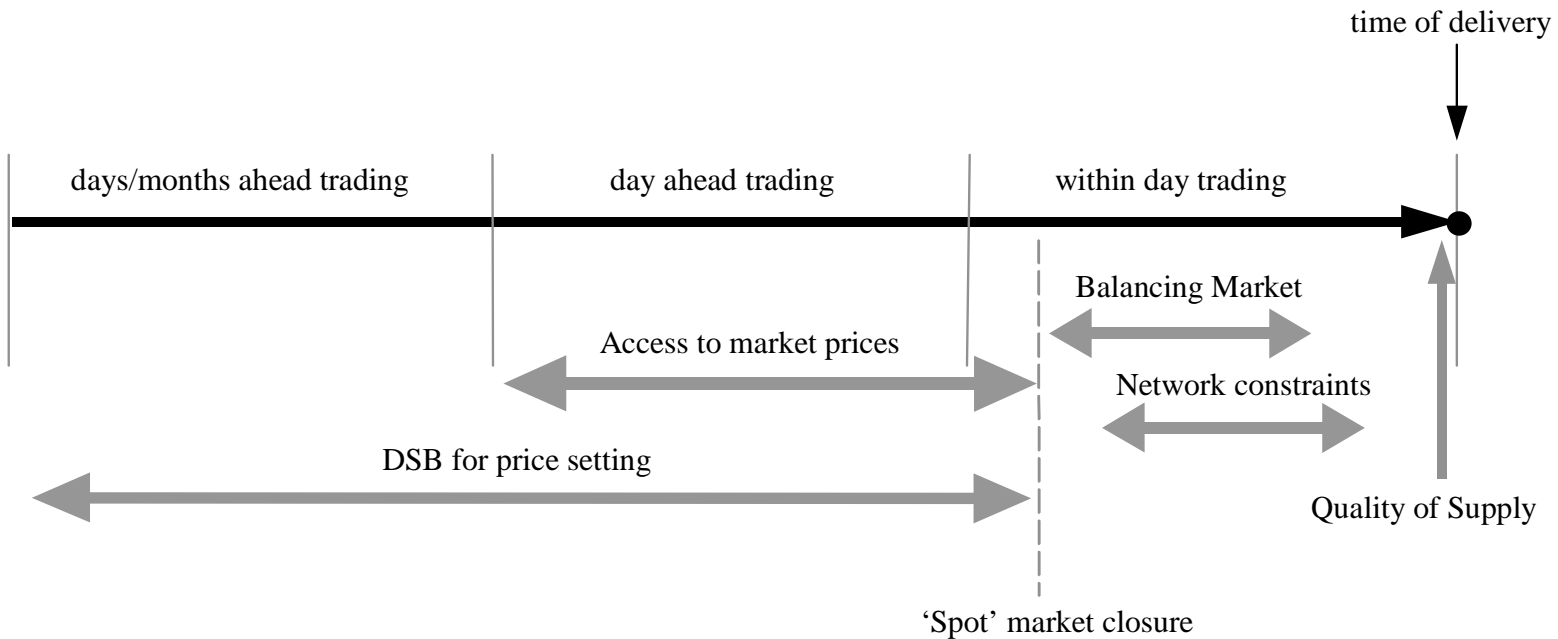
# Definition of Smaller Customer

- Smaller customers use “profiles” for settlements or residential and small businesses

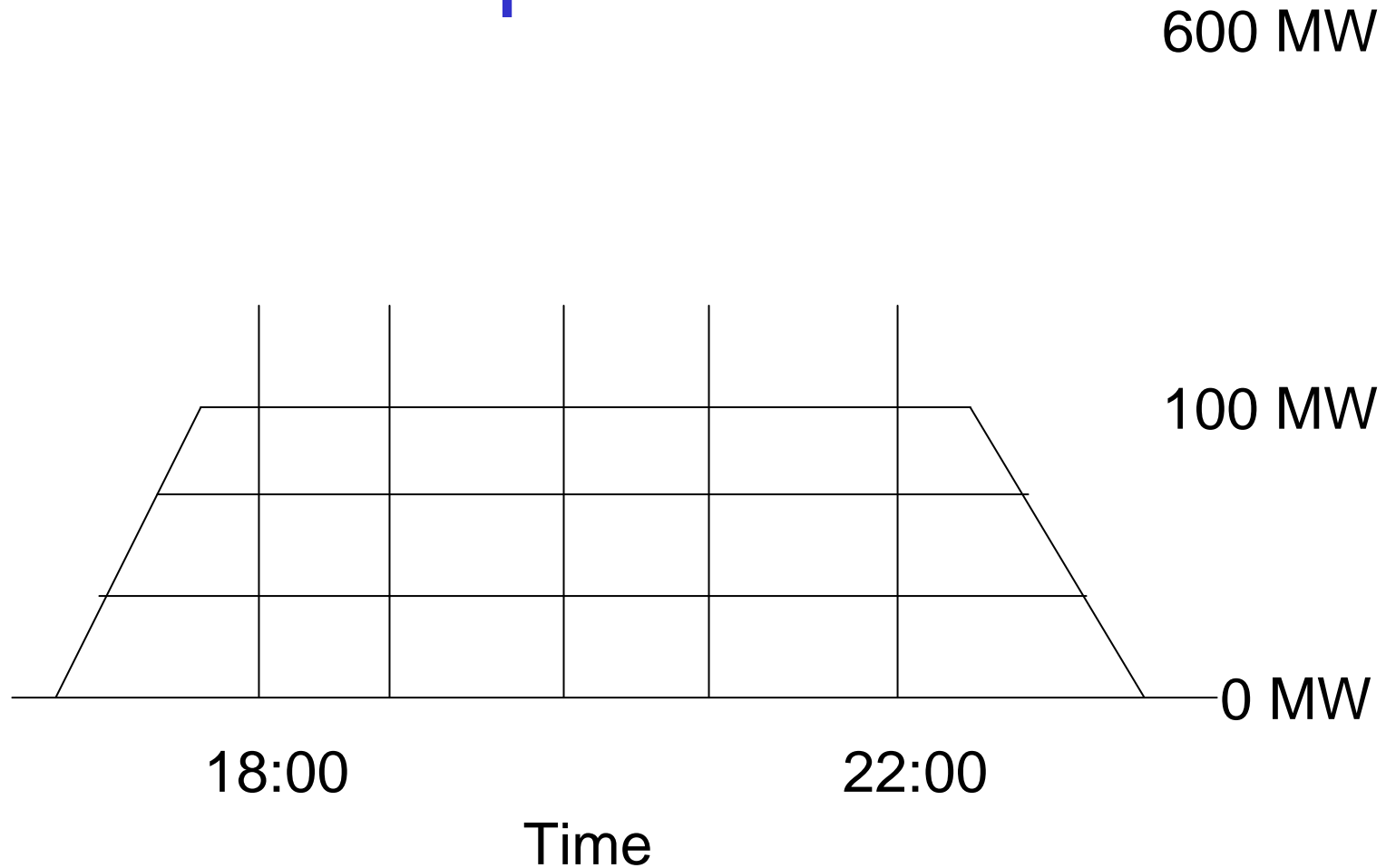
# Critical issues from System Operator perspective

- Is demand available for reduction at right time and place?
- Will demand reduce when price increases?
- Will demand return when price reduces?
- Is reliability and predictability of process acceptably high?

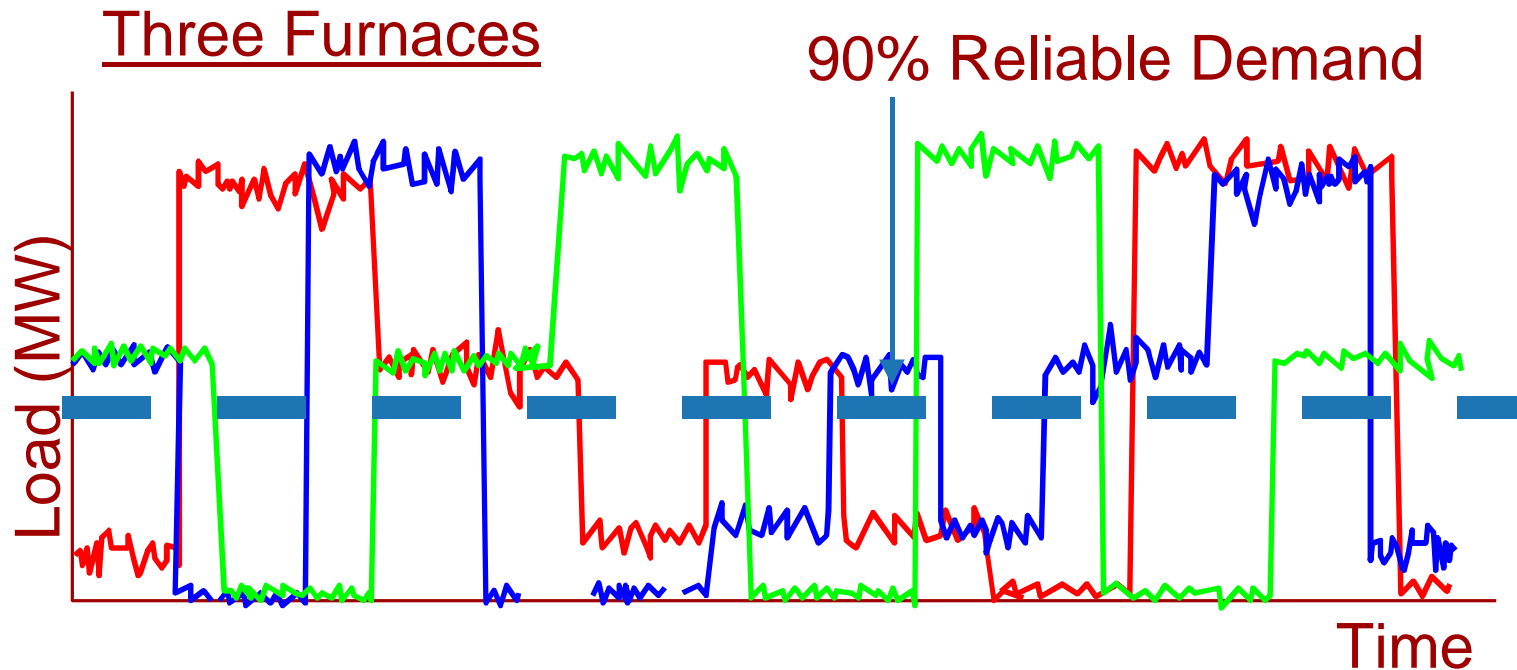
# Time-frame for different DSB categories



# Aggregated DSB, BMU in position



# Fast acting frequency response - probabilistic

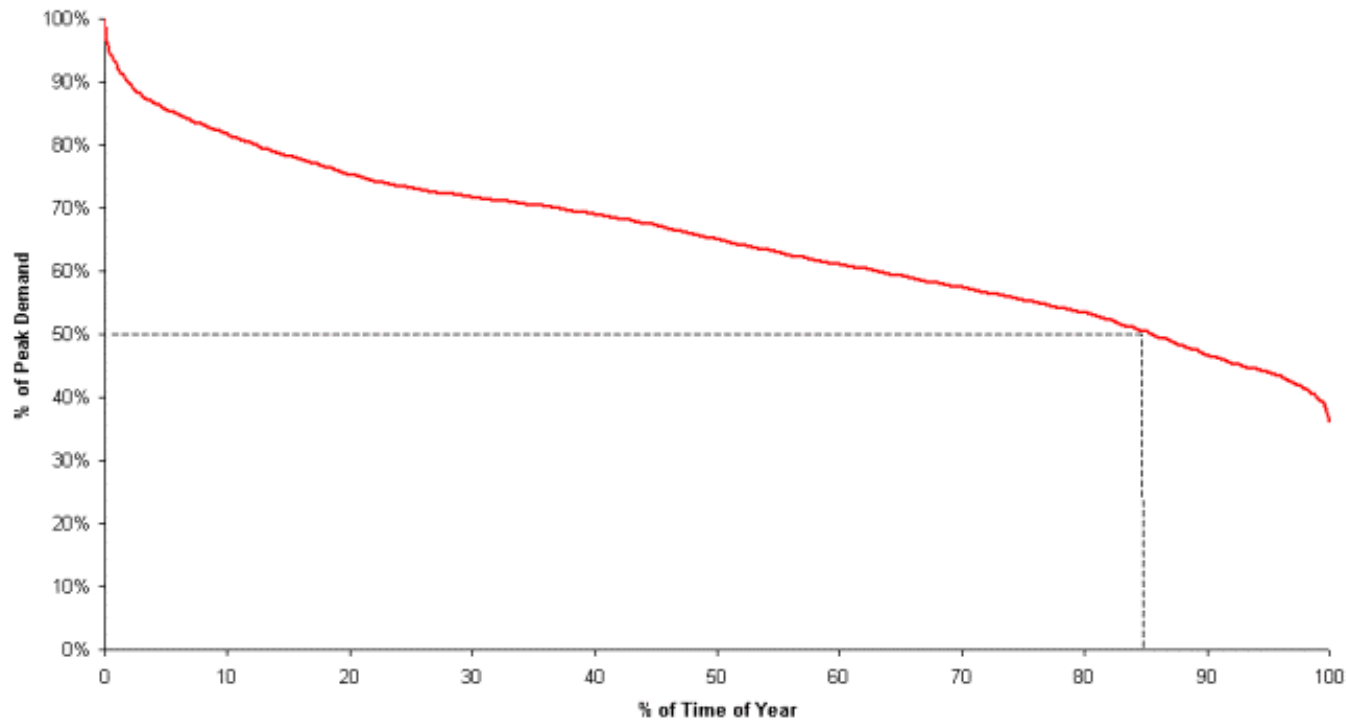




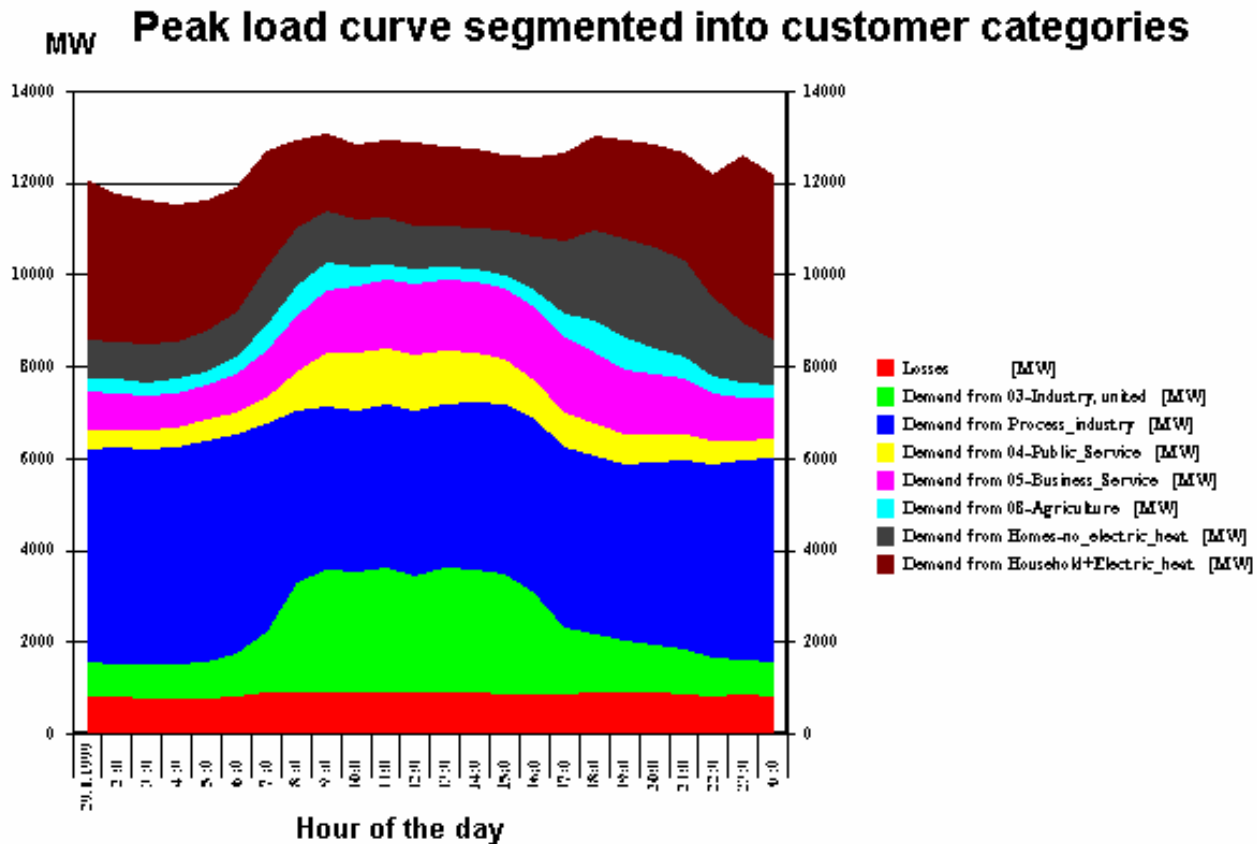
# DSB service payments

- Demand availability fee:
  - Euro 15,000 (whole month)
- Demand position fee:
  - 4 hours @ Euro 150/hr = Euro 600
- Window initiation fee:
  - 1 hour @ Euro 200/hr = Euro 200
- Despatch of Fast Reserve paid at Offer price

# Load duration curve for England and Wales in 2003



# Finland



# IEA Project (Task XI)

- Started April 04
- 7 countries participating
  - Denmark
  - Finland
  - Greece
  - Netherlands
  - Spain
  - Sweden
  - UK

# Objective of Task XI

- Save energy/CO2 and increase security by identifying and quantifying methodologies for smaller customers to reduce demand and participate in markets using their demand/generation elasticity.

# Subtasks 1,2,3

- Subtask 1 - Quantify demand disaggregation/ feedback methods, benefits and viability
- Subtask 2 - Quantify impact of time of use pricing for smaller customers
- Subtask 3 - Quantify bidding, validation and control mechanisms for smaller customer DSB

# Customer Perspective

- **Subtask 1 EUMF**
  - Requires general policy to reduce use of most expensive energy items
- **Subtask 2 TOU/RTP**
  - Requires customer to make conscious decisions to move optional or controlled demand to low price periods
  - Day ahead prices?
  - Tariff
- **Subtask 3 DSB**
  - Requires customer to plan and bid optional demand and be prepared to move demand at relatively short notice (hours)

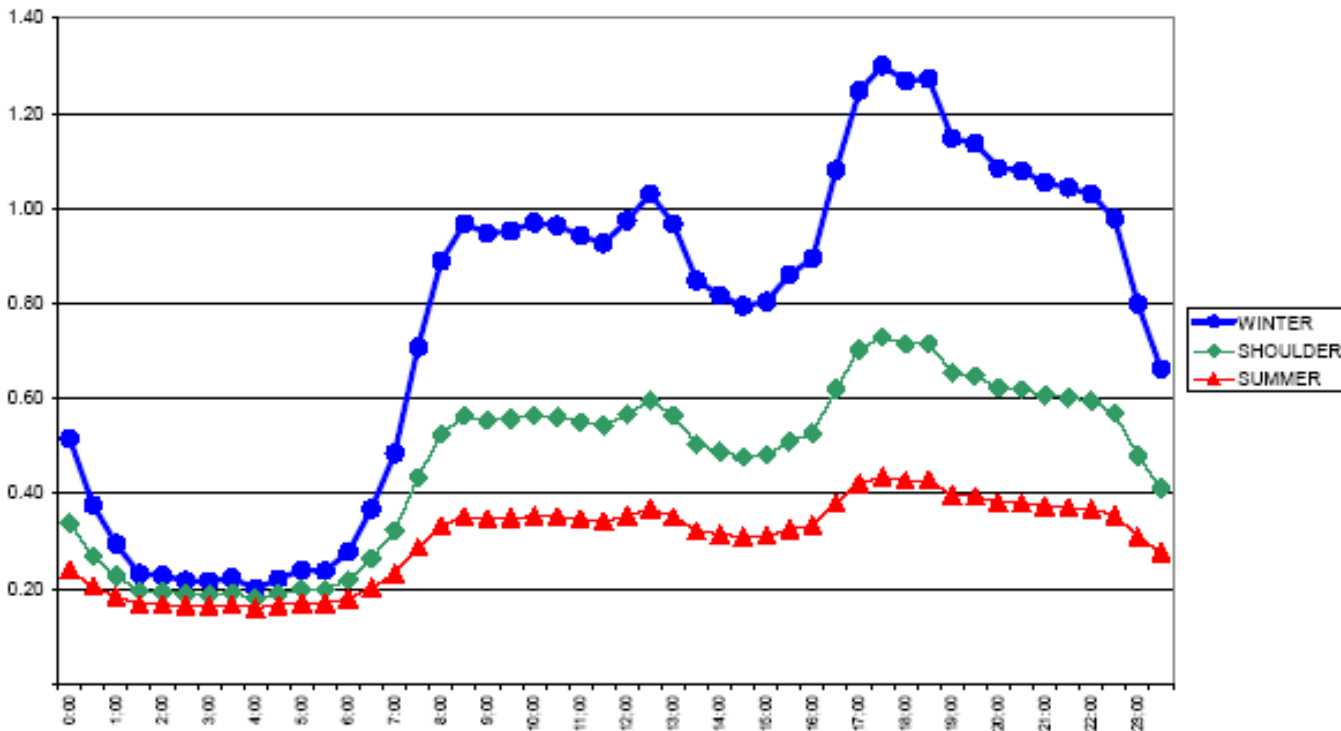
# Subtask 2 “TOU Pricing and Demand Management Delivery”

- What has been done:
  - Analysis of TOU method (Tariff, Dynamic, Real Time)
  - Availability of customer end use demands (obtrusive/non obtrusive)
  - Linking of TOU methods to each end use demand (customer categories)
  - Impact on profile settlements (dynamic profiles)
  - Costs of implementing EU management
  - Value of implementing EU management
  - National generation peak %
  - Dynamic demand changes with single rate metering?
  - Customer override option/metering

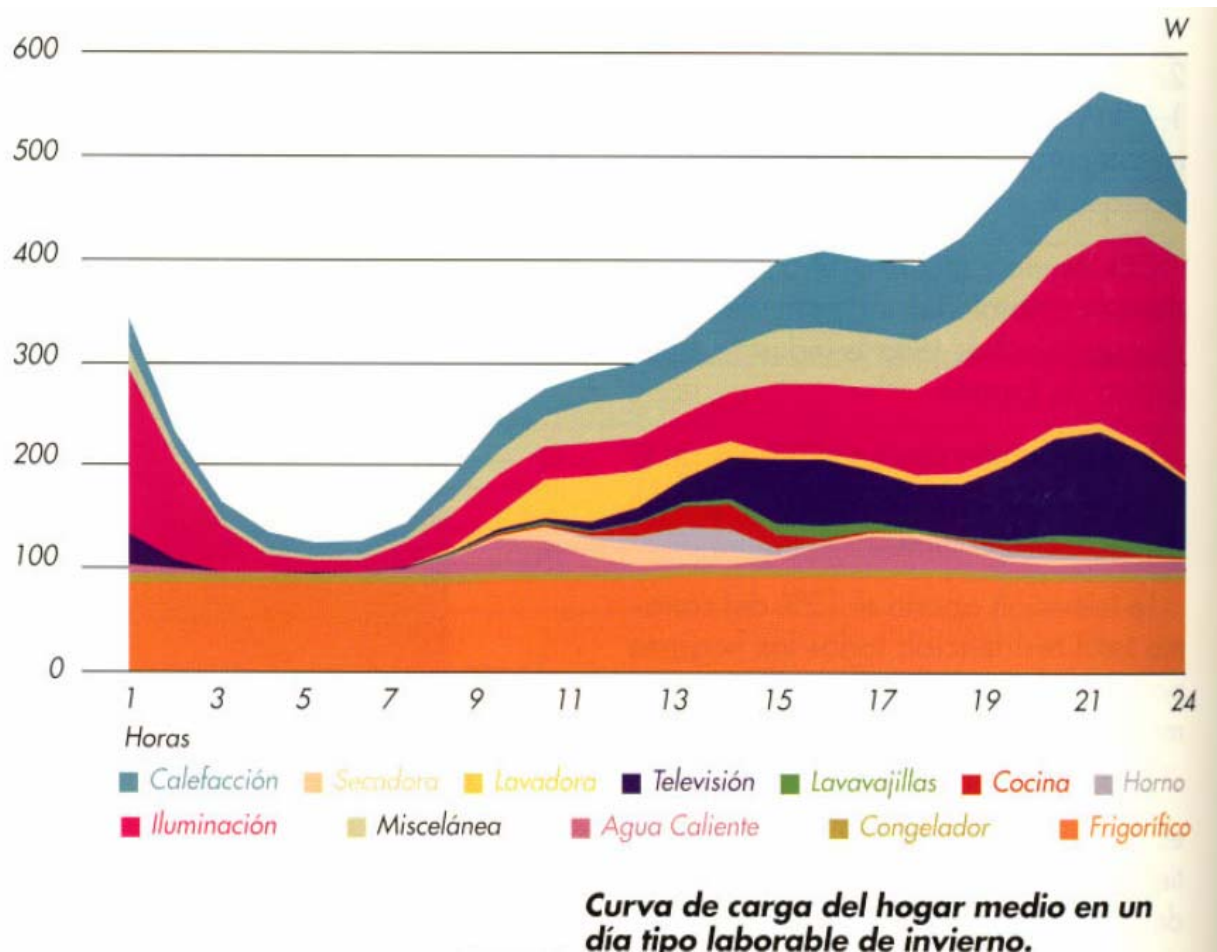


# After diversity Demand of Typical UK Household

Seasonal profiles (After diversity)



# Individual End Use Contribution to Peak Demand



# TOU Pricing Mechanisms

- Tariff TOU pricing - fixed times
- Dynamic TOU pricing - variable times
- Real Time TOU pricing - notice time
- Variable durations
- No notice times
- Customer override option
- TOU Metering?

# Applications and Technologies for TOU Pricing

- Potential loads are:
  - Storage heating, cooling and water heating (switch energy “in”/”out”)
  - Direct space heating (modify thermostat settings)
  - Direct water heating (modify thermostat settings)
  - Direct space cooling (modify thermostat settings)
  - Embedded generation (start out of heat led regime)
  - Fridges and freezers (switch off for short period)
  - Washing machines (disable for period, change time schedule)
  - Cooker (disable for period)
  - Sauna, car heaters (disable for period)
  - Direct electric showers (disable for period)

# Override Inhibits

- Providing customer with override options to automatic demand switching needs careful consideration
- Providing the number of times demand is switched with no override option is small, it may be accepted by customers

# Summary of Tariff, Dynamic, Real Time Pricing and Switching

- All customers can move some appliance and lighting from peak to off peak (1-2 kW)
- Direct space and water heating, air conditioning controlled by reducing thermostats or heating in selected rooms
- Dynamic pricing can be applied to all demand by providing 24 hour notice of price changes
- Direct space, water heating and air conditioning can respond automatically to real time pricing signals

# Summary of Tariff, Dynamic, Real Time Pricing and Switching

- Microgeneration can respond to real time prices and generate outside normal heat led times
- Appliances and lighting controlled by inhibits
- Complex control algorithms implemented successfully in trials.
- Systems cannot be switched on by customers at high price times/single rate metering is used
- If no override option, then single rate metering possible

# Summary of Tariff, Dynamic, Real Time Pricing and Switching

- Dynamic pricing/switching deals with unscheduled and scheduled peaks
- Direct electric space and water heating, air conditioning, lighting and appliances reduce peak demand by a few kW per customer
- Real time pricing sends right messages to demand by SO (similar to generation)



# Costs and Benefits of TOU Pricing

- Capital cost of 2000MW of generation/transmission/distribution, Euro 2000 million
- Capital cost of removing 2000 MW of demand using demand management is Euros 435 million
- Are savings sufficient to motivate 2kW of demand reduction for 9 hours per year?

# Conclusions

- Tariff, Dynamic and Real Time TOU pricing viable for direct space, water heating thermostat control
- May be viable for central air conditioning, microgeneration, saunas and direct electric showers
- Local balancing of renewables
- May be possible to inhibit demand for short times for each customer but apply to larger population in sequence

# Conclusions

- Dynamic and Real Time TOU demand switching can replace scheduled generation
- Communication not major technical constraint
- Difference between TOU methods unclear if no override option is allowed and single rate metering

# Subtask 3

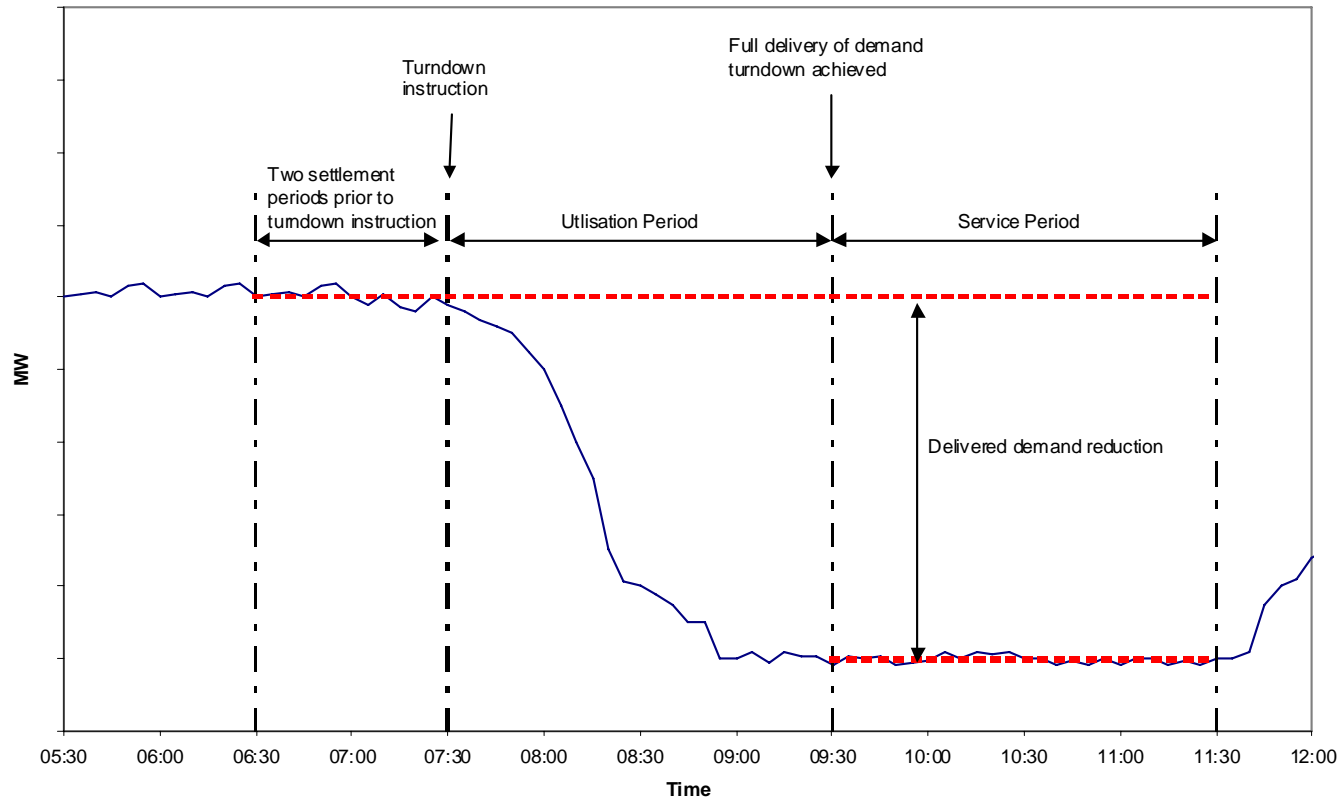
## Demand Side Bidding

- Bidding aggregated demand in market (shift)
- Moving demand for payment
- Existing for larger customers
- Metering and energy contracts to validate
- How can it work for smaller customers?
  - Aggregation
  - Bidding
  - Validation

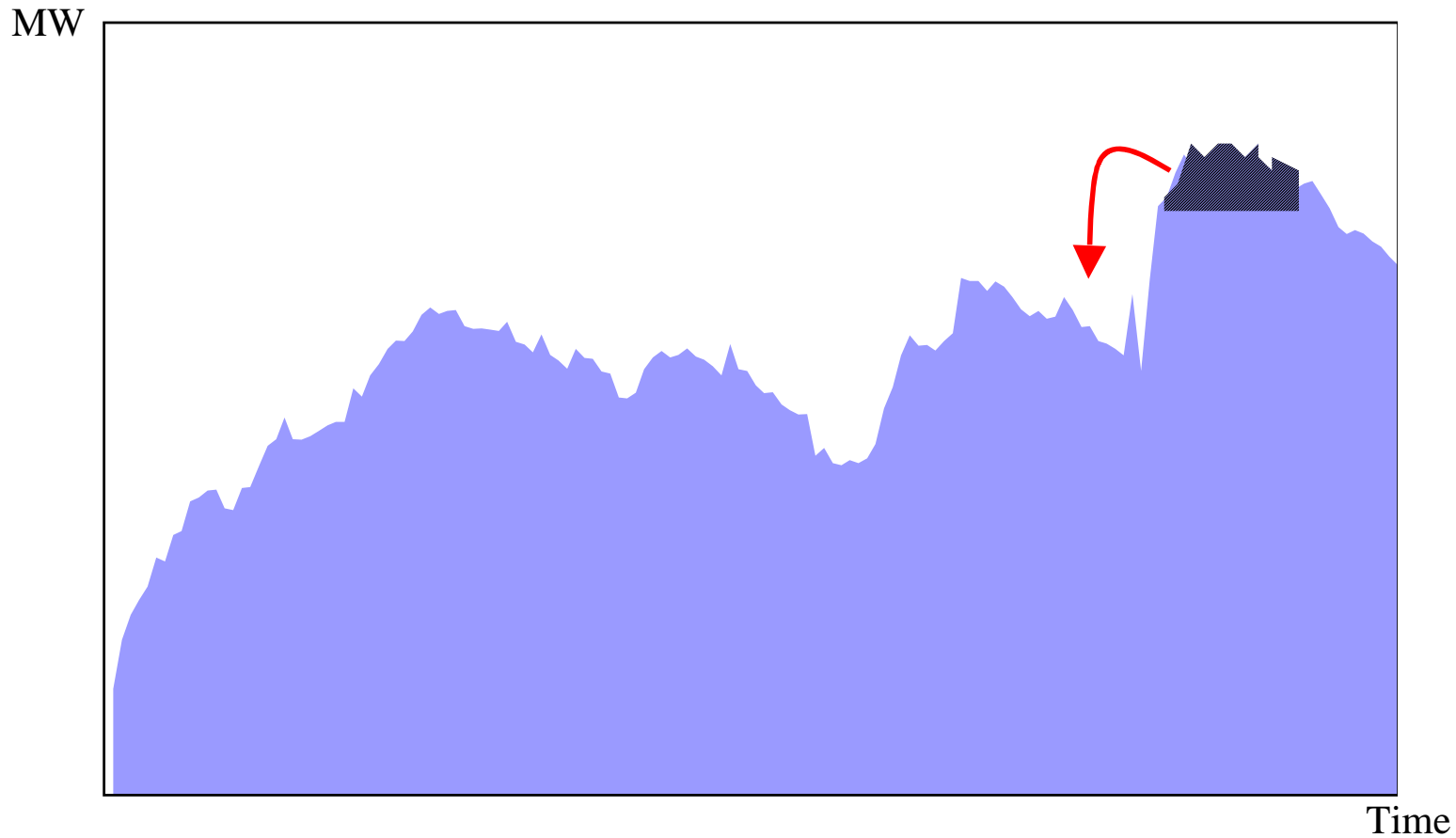
# Smaller Customer Demand Bidding

- Remote switched domestic storage demand now bid by suppliers
  - Grid metering and command validation used
  - Payment to suppliers and ESCOs
  - Demand bidding of other loads?
  - Remote disable of end uses? (communication)
  - Frequency relays on end uses?
  - Remote enabling of generation
  - Metering?

# Metering demand reduction delivered in the Demand Turndown Trial

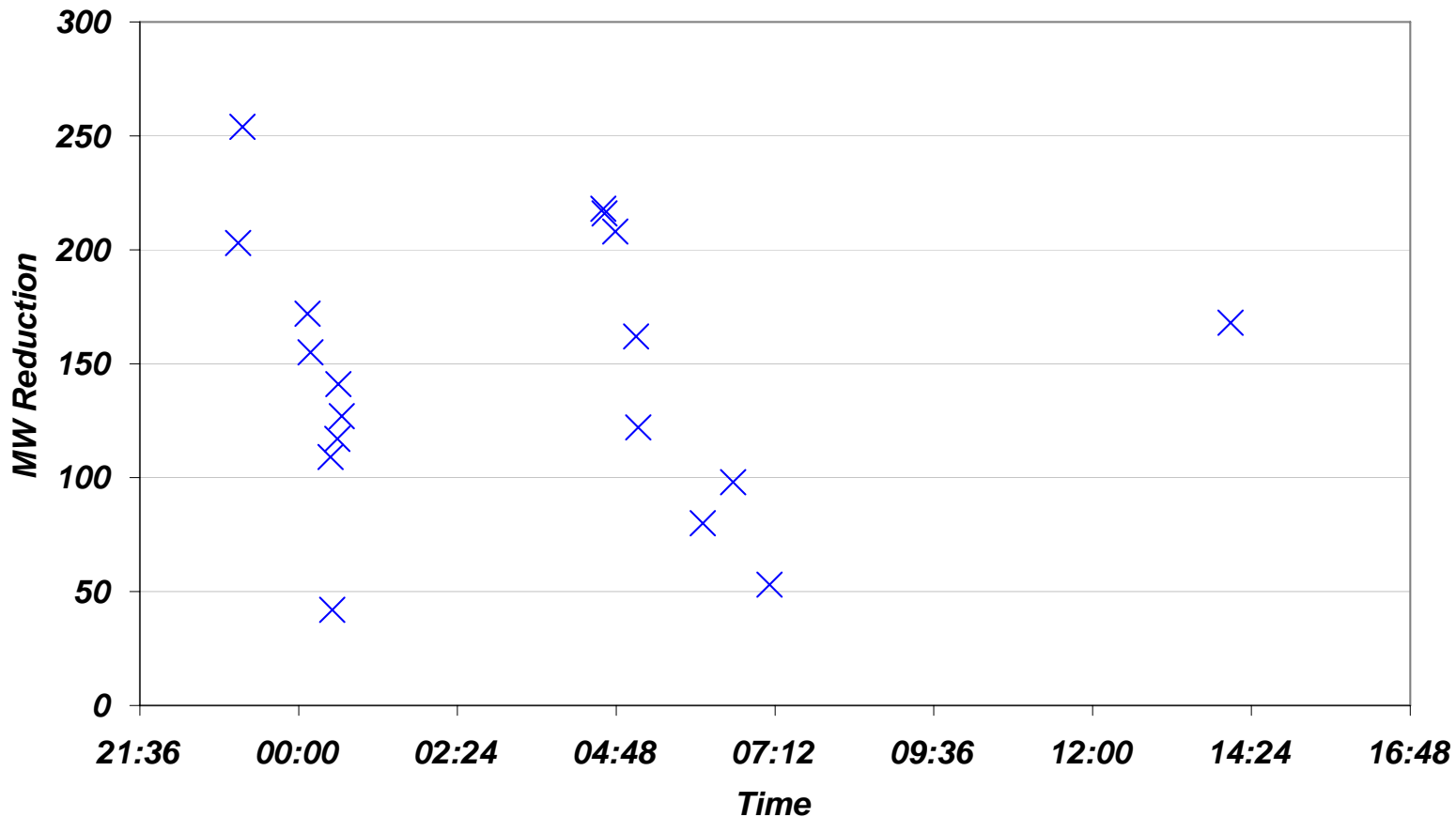


# Schematic of the demand profiling trial



# Results of NGC Radio Teleswitch Trial

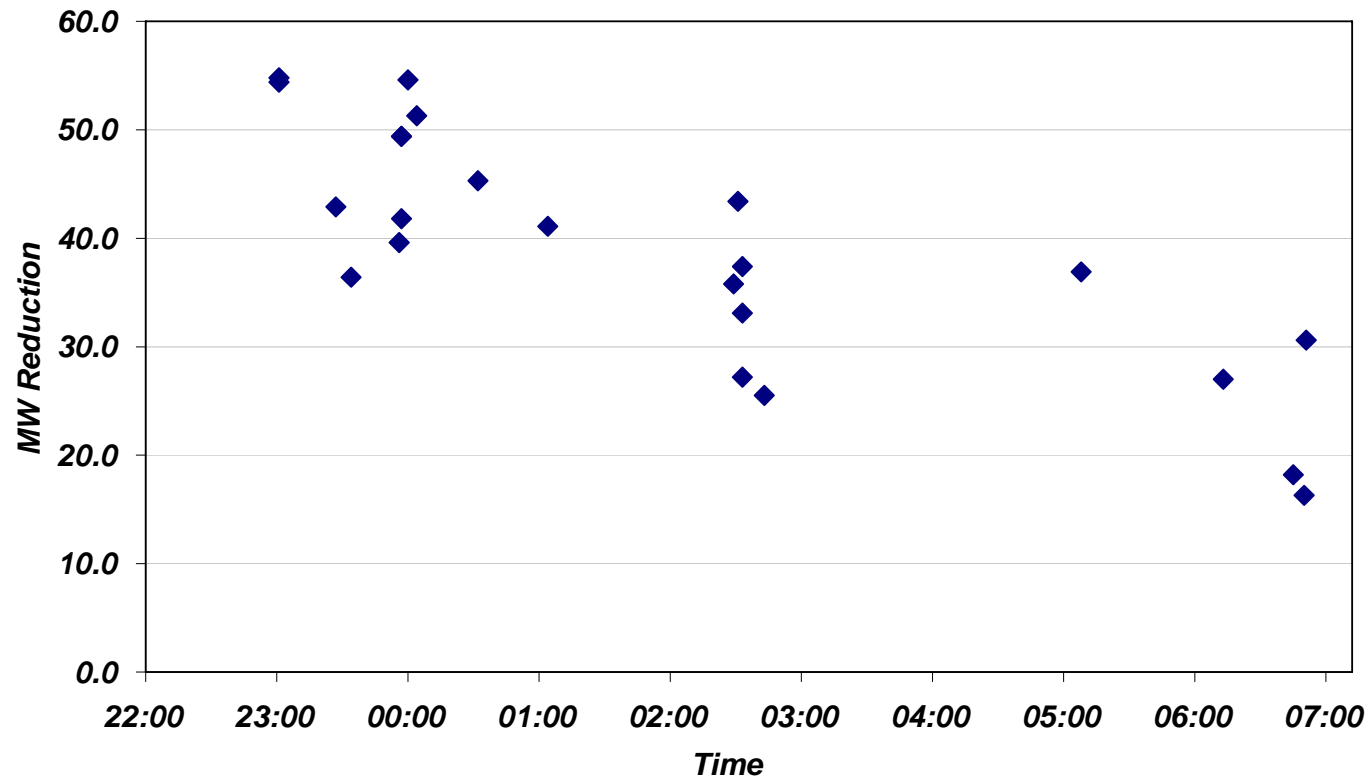
*Correlation of MW achieved vs Time of Call off*





# NGC Cyclo-Control Trial Results

*Correlation of MW Achieved vs Time of Call off*



# DSM Delivery by TOU and DSB

- Dynamic TOU pricing
  - Modifies demand manually/automatically in response to price
  - TOU metering if override option
  - Single rate metering if automatic and no override option
  - Statistical delivery of demand change
  - Result is uncertain demand change in response to SO/Supplier request
  - Payment via tariff
  - “Profile” settlements issues

# DSM Delivery by TOU and DSB

- Formalises TOU pricing/switching methodology
- Aggregator contracts for delivery of demand block
- Provides SO with guaranteed demand/equivalent generator
- Remote switching required
- “Validation” needed to meet contract
- Payments by SO for delivery

# DSM Delivery by TOU and DSB

- Aggregator contracts with SO for statistical demand shift
- Aggregator has portfolio of statistical demand delivery blocks
- Customer paid through tariff (single rate metering)
- Aggregator paid via GSP validation
- Dynamic “Profiles”

# Task XI Status and Direction

- Studies and Reports delivered
- New Proposals for developing implementation routes
- Subtasks 4 & 5, “Smaller Customer Participation in Dynamic Demand Shifting”