



CENTRE FOR RESEARCH INTO  
ENERGY DEMAND SOLUTIONS

# Price-driven approaches to Demand Management: Effective or not?



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# Demand Management

Ruling paradigm:

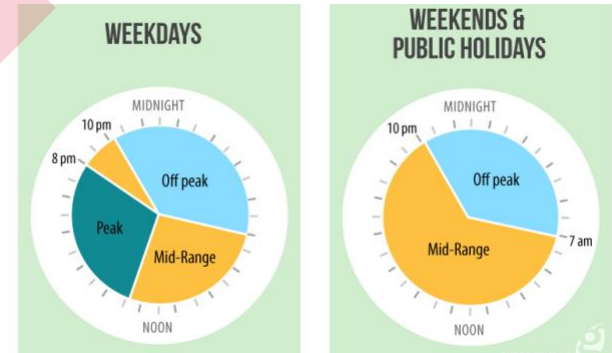
Rational Choice Theory

Main assumptions:

- Individual consumers are ideal decision-makers
- Always act with complete rationality, and in a consistent manner
- Have perfect access to information
- Will always attempt to maximise their utility for both monetary and non-monetary gains

Resulting approaches:

- Purely price-driven interventions  
e.g. Time of Use pricing



# Demand Management

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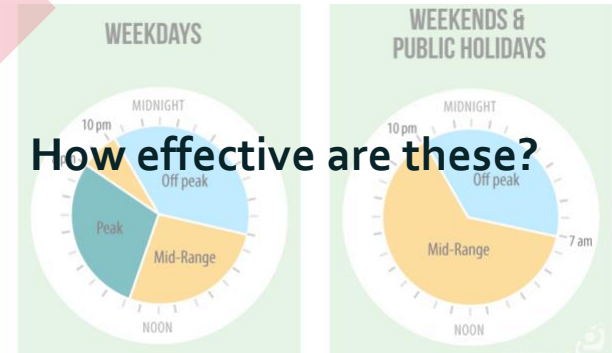
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# What the evidence says

Effectiveness of Time of Use pricing:

Commonly measured in terms of Price Elasticity of demand

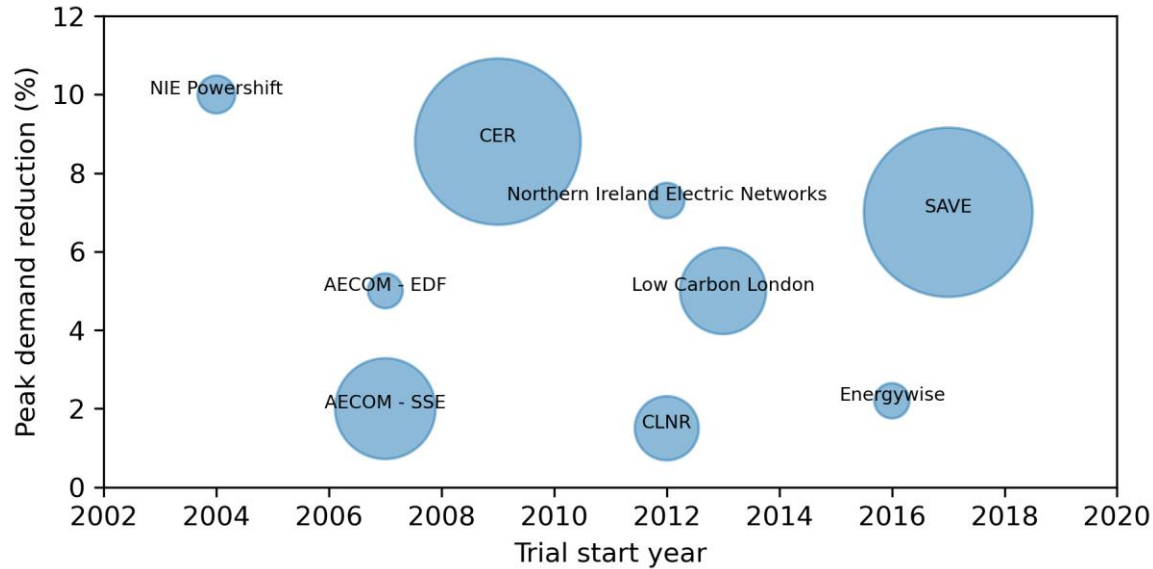
What do the Price Elasticity estimates show?

Consumer responses to Time of Use pricing are all over the place

Price-based Demand Management approaches:

A blunt tool to incentivise shifts in demand

# What the evidence says



Discrepancies across ToU tariff trials' findings

# Literature

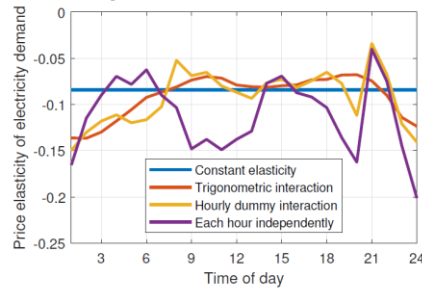
- Intra-day and annual **variation in electricity demand** is driven by **differences in basic needs** instead of by differences in prices.  
(Brännlund and Vesterberg, 2021)
- Electricity demand is **inelastic**.  
(Vesterberg and Krishnamurthy, 2016; Lanot and Vesterberg, 2021)
- Price-based demand response can be relied upon. Respond to **peak to off-peak ratios**.  
(Faruqui et al., 2017)
- Price elasticity of **substitution statistically significant**, price elasticity of **demand mostly not significant**.  
(Filippini, 2011; Sergici et al., 2020)

# Can ToU tariffs help unlock flexibility potential?

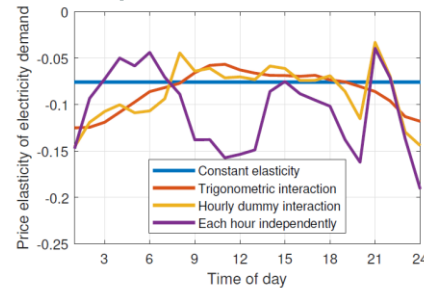
- What is the attitude of consumers towards **changes in electricity prices**, and does this vary throughout the day?
  - Yes. Intra-day patterns have been estimated.  
(Fan and Hyndman, 2011; Knaut and Paulus, 2016; Kulakov and Ziel; 2019)
- The literature agrees that agents are **less reactive** to price signals for **shorter terms**.
  - ToU and other time-varying pricing mechanisms are very short term.

# Some recent estimates

- Intra-day price elasticity of wholesale electricity demand in Germany (2016)



(a) Linear



(b) Log-linear

- Price elasticity is **quite small**.
- *Orange and yellow lines*: Demand is **least** elastic during waking hours, very slightly less so during morning and evening peaks.
- *Purple line*: Demand during waking hours is **more** elastic around peaks.
- Demand is **most** elastic between midnight and 0100hrs.



# Strength of price signals

- Strength of signal here could refer to
  - Monetary **value** of signal (£/MWh value)
  - How **aware** consumers are of the signal
- E.g. **ToU** vs **Event-based pricing**

ToU	Event-based pricing
Ongoing	Specific (critical) events
Smaller price signal	Larger price signal
No special publicity	More media coverage

# Complexity of price signals

- Residential consumers can be “overwhelmed” by **complex pricing**.  
(Jacobsen and Stewart, 2022)
  - Unable to **monitor** price variations?
  - Unable to mentally **filter and process** price signals?
  - Unable to **take advantage** of price variations?

# What to expect on a more individual basis?

- Time-of-use pricing is **not complex**.
- Evidence to suggest that on average, all consumers have the **same ability and willingness** to make changes to consumption patterns when on ToU compared to standard rates.

Similar consumption patterns between residences from voluntary and mandatory adoption of ToU pricing (Baladi et al., 1998)

- Main obstacle is inability to **seize opportunities** to benefit from price variations.
  - Too much effort
  - Too little attention
- Technology, automation, or **rhythms**

# Timing of demand and the role of Social Practices

- Demand patterns are a result of the socio-temporal organisation of daily practices
  - Institutional rhythms
  - Everyday activity patterns
  - Routines and habitual behaviours
- Study of changes in the timing of energy demand involves the study of changes in the way social practices intertwine and how this process unfolds over time
- Results from Smart energy systems pilots:

While time-varying prices matter when it comes to (re)shaping practices, responses should not be analysed in isolation as such responses to economic (dis)incentives “will always be closely interlinked with other elements of engagement, devices and competences that are decisive for the actual effect of the pricing scheme” (Christensen et al., 2020).

# A more lenient view of (disadvantaged) consumers

- Behavioural economic perspectives:
  - Consumers have bounded rationality and are susceptible to cognitive biases
  - Setting the 'right' price and providing the 'right' information are not sufficient for people to make the 'right' decisions when it comes to energy demand flexibility
- Feasibility obstacles:
  - Overhead required to manage monetization of socially-derived flexibility capital
  - Lack of flexibility stemming from other everyday life aspects (e.g. inflexible work schedules)

# References

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Based on the paper:

[The price is not right! Energy demand, Time of Use tariffs, values and social practices - CentAUR \(reading.ac.uk\)](#)

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Thank you