

Focus on electricity tariffs:

experience and exploration of different charging schemes

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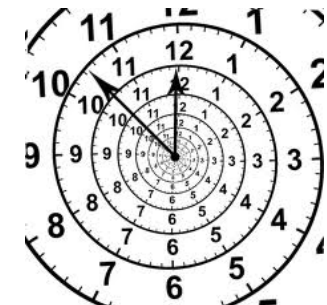
Electricity systems are changing: the timing of demand matters more

Managing seasonal variation: overall demand reduction (kWh). Can also limit load (kW)



Weekly/daily variation: reduce regular demand peaks with time-of-use pricing/ provide back-up supply

Hours, minutes: with new renewable generation, need rapid response to shifts in supply. Real-time pricing and/or direct load control



Policy background

Smart metering systems should **include advanced tariff structures** ... *This, together with [customer feedback] ... is a force for empowering the consumer and for improving efficiency of the supply system...*

and



...allow remote on/off control of the supply and/or flow or power limitation. *This ... is needed for handling grid emergencies. It may, however, introduce additional security risks ...*

- EC Recommendation on preparation for smart metering systems, March 2012

.....

UK government business case for smart meter rollout assumes that 20% of residential el consumers will adopt static Time-of-Use tariffs by 2030, in addition to ~15% who are already using a 2-band tariff. Meter specification for a range of ToU tariffs.



Research problem

Electricity tariffs [and load control schemes] are devised by experts but used by non-experts. We don't understand much about what different tariff types mean in terms of everyday practices.

Research questions

How complicated should an electricity tariff be, to be accepted by the public while encouraging effective demand reduction / shifting?

What do different tariff types mean in terms of 'workability'?

The focus groups

1. All-electric customers
2. Prepayment
3. Early adopters, solar PV/ electric vehicles/ heat pump
4. Experience of 3-band time-of-day tariff
5. Credit customers, had switched supplier in previous year
6. Credit customers, hadn't switched supplier for at least 5 years.



After a general discussion of time-of-use pricing, each group was shown 6 tariff options in turn

1. 'Static' TOU tariff, to moderate demand at specified times when high demand routinely occurs
2. 'Critical day' tariff to reduce demand at times of prolonged shortage of supply
- 3, 4, 5. Real-time tariffs, reflecting wholesale spot prices
6. Standing charge that varies in relation to contracted peak demand - a capacity-related tariff rather than time-related.

Time-of-use tariff: three price bands, all year round

[Voting box]

20p /unit
4-7pm Monday-Friday

12p /unit
8am-4pm and
7-12pm, weekdays

12 p
8am
-7pm w/
ends

8p/unit
Midnight – 8am every
night

8p
7-12pm
w/ends

Fridge magnet reminds you about prices at different times of day. Meter measures how much you use during each period.

Day-by-day tariff



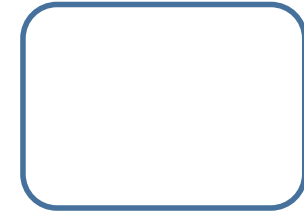
41p daytime, 15p 11pm-8am
22 days a year, up to 5 days at a time (but
never weekends or public holidays)

9p daytime, 7p 11pm-8am
43 days a year (but never Sundays)

6p daytime, 5p 11pm-8am
300 days a year

Display panel tells you what
the current price is, and
every evening it tells you
whether it will be the following
day will be red, yellow or
green.

Real-time (flexible) price with day-ahead notification



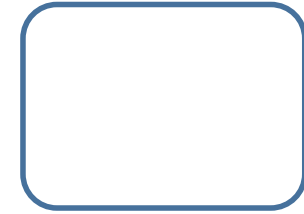
Price varies hour by hour, according to demand and cost of supply

Hourly price is forecast each evening for the day ahead, online. You also get a text or email alert if cost is likely to go above 17p/unit.

Price may go high without much warning

Guarantee that you won't lose out financially. If you need to pay more than you would have done on your previous tariff for the same number of units, your supplier refunds the difference.

You pay a standing charge according to how many appliances you want to be able to switch on at once



The standing charge depends on your 'peak' load - how much you use *at once*. For example, £55 a year if you don't go above 3kW at a time (electric kettle = ~2kW), £85 if you stay below 9kW, £170 below 15kW, £425 below 30kW.

A display tells you what your load is at any time, with an alarm if you are getting close to your limit.

If you go over your agreed load, then the power cuts out and you have to switch one or more appliances off. Then you can reconnect your supply using the trip switch by the meter.

[illegible]

Overall voting for the tariffs

	Static TOU	Critical day pricing	Real time pricing, day-ahead notice	RTP + cashback on smart appliances; DLC + manual override	RTP+ programmable apps; user sets cut-off prices	Capacity- related standing charge
NO	2	12	29	34	27	28
MAYBE	9	25	12	8	20	10
YES	36	10	6	5	0	9

Group-by-group decisions

	Yes	Maybe	No	Total votes
Banbury all-electric	13	8	27	48
Banbury prepayment	6	18	24	48
London new tech	9	21	18	48
Belfast TOU tariff	10	17	21	48
Banbury switchers	15	11	22	48
Banbury non-switchers	13	9	20	42
Total	66	84	132	282

Some quotations (1)

Predictability and availability. *People ... run electricity round their lives. Whereas where we seem to be heading is, we'll run our lives round electricity.*

Trust and complexity. *... is this [Option 2] something that the power company is really going to take on board, and get rid of the 5 million other tariffs, or is it just an extra one to confuse us with?*

At the end of the day, that is hitting us, who don't have a choice, and lining the pockets of the shareholders. Because it's a company that makes millions and millions of pounds of profit...

Privacy and control. *Isn't [direct load control] sort of an invasion into your personal life? ... That's taking decisions out of your hands.*

Visibility and enabling tech. *I would hope ...that manufacturers... would put timers on all of your appliances so that you can set them. And... if it was that clear [e.g. a fridge magnet showing price bands], I would do my washing, my tumble drying, from midnight.*

Time-sensitivity. *30 minutes can give you 80% of your [EV] battery charge, so if you really have to go out... and if it's switched off for 20 minutes ... that'd be a nightmare.*

Qualitative points (2)

Safety. *I don't like... having appliances on in the middle of the night, because I was told that it's a fire risk.*

Equity. *We have four children, we've grandchildren, often all in the house at the same time... we get visitors . whereas my next door neighbour is a gentleman on his own...he's got a very good pension... to be penalised [by a high standing charge for high peak demand] because we've got a busy household... I don't think that's fair...*

Some acceptance. *Is this the way forward, to try to get people to use their electric more wisely?*

You might say, ... number 6'd be good if you've got two people in the household who don't work, ... this tariff is not recommended for people who are at home all day, or for old age pensioners... you might want to consider this if you've got two children ...

I think if you're going to be late for a meeting because the washing machine's going to be off for 20 minutes, you seriously need to buy more pants.

Conclusions

A new tariff needs to be simple and visible - easily displayed.

Utilities - or whoever sets the tariffs - need to gain and maintain trust.

Static TOU tariffs were the most popular, mostly because they were predictable and fitted with existing routines. Some willingness to reduce usage at critical times in response to price or other signals, and interest in enabling technologies.

Non-financial, social and educational factors affect adoption of new tariffs and new technologies – not just price response.

Customers need time to understand the reasons for new tariffs, and get used to them.

A risk that customers are seen as necessary to operate the system 'we'll run our lives round electricity', rather than contributing to a system that serves them. This raises questions about the scale, nature and governance of smart grids.

Acknowledgement

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- <http://www.eci.ox.ac.uk/people/darbysarah.php>
- http://www.researchgate.net/profile/loana_Pisica/

