CHAPTER 5

PROMOTING COMPETITION IN ELECTRICITY RETAIL: INSIGHTS FROM BEHAVIOURAL ECONOMICS

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Introduction

Since 1995, the electricity industry in Singapore has been privatised and progressively deregulated. The driving force in this journey has been the belief — consistent with standard economic principles — that a competitive energy market will be more efficient as profit-maximising producers strive to reduce production costs and compete for customers. Any remaining monopoly power in the market can be controlled through proper design of the market structure as well as rules that prevent anti-competitive behaviours.

The journey towards full competition in the electricity industry began in 1995 when the government corporatised its electricity and gas holdings. In 2000, the government went a step further and separated utilities into two segments: the natural monopolies (the electricity grid and gas pipeline companies) and the contestable markets (the generation companies and retailers). The latter segment was opened up for competition, and the Energy Market Authority (EMA) was established to regulate the electricity industry.

In 2003, the government set up a wholesale market where generation companies would compete with one another to sell electricity to the grid. As predicted by standard economics, the introduction of competition has led to lower costs, both from more efficient operations as well as cheaper fuel alternatives such as natural gas.[1] This switch has helped to moderate the rise in electricity tariffs at a time of sharply rising fuel oil prices.

As for the electricity retail market, this was liberalised in phases from 2003, beginning with the largest consumers. By 2007, about 10,000 accounts, representing about 75% of the electricity consumed in Singapore, could choose from competing electricity retailers. EMA's goal is to eventually extend retail competition to the remaining 25%, or 1.2 million domestic or small commercial consumers.

On the whole, retail competition has benefited consumers in Singapore. Besides the price moderation discussed above, electricity retailers have also innovated and introduced new products as they competed for customers. These include fixed price contracts that help consumers to hedge against price volatility and valueadded services such as online portals that allow consumers to view and manage their consumption on a real-time basis. Similar consumer benefits have also been demonstrated in the liberalised energy markets of the United Kingdom (Ofgem 2007) and Australia (Australian Energy Market Commission 2008a and 2008b).

The drive for full retail competition in Singapore is taking place alongside the emergence of smart grid technologies. Both trends have the potential to advance energy efficiency and conservation in Singapore and to help consumers make better electricity consumption decisions.

This chapter looks at how behavioural economics can provide useful ideas for energy regulators in promoting competition in the electricity retail market. The central argument is that while full retail competition will give consumers more choice over their electricity retailers and plans, this alone is not sufficient to ensure good consumer outcomes. By providing insights on how consumers decide when faced with complicated choices, in which the

[1] By 2009, 81% of electricity generated in Singapore came from burning natural gas, with another 15% from fuel oil. This compares with only 18.5% natural gas and 77.3% fuel oil in 2001 (Energy Market Authority of Singapore).

information needed is often not salient or timely, behavioural economics provides useful inputs to energy policymakers, particularly on how to structure choices in a way that improves individual consumption decisions and enhances overall energy efficiency.

Insights from Behavioural Economics

Providing Information to Overcome the Status Quo Bias

An important consideration when implementing full retail competition is to determine how consumers choose their retailers and pricing plans. One model is the "big bang" approach, which is to open up the entire customer market at one go for retail competition. Since consumers may not actively exercise choice, this approach requires the authorities to assign default retailers and plans to consumers. Behavioural economics predicts that many consumers are then unlikely to switch out of the default plan for them, even if it is in their best interests to do so — an effect known as the status quo bias. In their paper "Behavioural Science and Energy Policy", Allcott and Mullainathan (2010) provide possible reasons for this bias: procrastination, the endowment effect (people's implicit preference for their existing plans), and the costs of acquiring information about alternative options. Status quo bias contradicts the predictions of conventional economics which predicts that consumers will switch as long as switching is cheap and saves them money. It can result in markets with a low overall churn rate (i.e. the rate of consumers switching retailers), which in turn could undermine the efficiency of a fully competitive electricity market.

Are there ways to counter people's status quo bias? A smart metering trial conducted by the EMA for about 400 customers in 2009 provides evidence for cautious optimism. In this trial, participants were offered a choice of packages that reflects how retailers may price their packages in a competitive environment (see Exhibit 1).

Behavioural economics suggests that participants would likely stay with their existing plan, due either to the status quo bias or to consumers' unfamiliarity and fears that they could be made worse off if they switched. To address this, the trial included a "recommended offer" package that was made available to all participants. The system would calculate the least-cost option based on that particular household's consumption profile from the previous month and recommend the appropriate package to them. For example, the system would recommend Pricing Plan A to a household which consumes most of its electricity in the evenings. This feature was made possible by smart meters installed in the homes of the trial participants, which recorded household consumption in half-hourly intervals and enabled the system to determine the "recommended offer".

	Peak Electricity Price (7 am–7 pm)	Off-peak Electricity Price (7 pm–7 am)
Status Quo (Current Regulated Tariff)	25 cents/kWh	25 cents/kWh
Pricing Plan A	30 cents/kWh	20 cents/kWh
Pricing Plan B	20 cents/kWh	35 cents/kWh

Exhibit 1: Packages offered to participants in EMA smart metering trial.

As a result of this feature, about 95% of the participants opted for either Pricing Plan Aor B, instead of staying with the status quo plan. This suggests that providing a "recommended offer" option, made possible by smart metering technologies that identify the plan that is most suitable for the user, may be sufficient to overcome consumers' status quo bias. Even consumers who may not be well-informed of the options available to them might switch if they are told that they would enjoy savings under a different plan.

Factoring Loss Aversion in the Design of Pricing Schemes

Governments and utility companies around the world have begun to provide electricity consumers with the means to change their consumption patterns so as to achieve a more efficient power system. In particular, they seek to shift consumers' electricity demand away from the day (when system demand typically peaks) to the nights (when system demand is lower). Such a shift would allow power companies to run fewer peaking plants during the day, thereby lowering the overhead costs of the power system and achieving savings for consumers. One of the most important ways of achieving this is to differentiate electricity prices by timing, through charging higher prices for electricity in peak periods of the day and lower prices for periods at night when demand for electricityis lower.

In designing pricing schemes, behavioural economics suggests that we should be mindful of people's loss aversion. Conventional economics says that people are symmetric in their responses to gains and losses of the same size. In other words, a person's increased utility as a result of gaining $X is the same as his reduced utility from losing $X.

However, behavioural economics suggests that consumers tend to be loss averse, also known as the phenomenon in which the "disutility of giving up an object is greater than the utility associated with acquiring it" (Kahneman et al. 1991, p. 194). In other words, people value losses more than improvements or gains of the same magnitude.

This loss aversion effect was vividly demonstrated in the Smart Meter Pilot Program conducted by PowerCentsDC, a power utility company in the United States. In the pilot, consumers were placed (without choice) on a variety of price plans: a critical peak pricing (CPP) scheme in which consumers were charged significantly higher during peak periods of the year, a critical peak rebate (CPR) scheme in which consumers earned rebates for reduced consumption below a certain baseline during critical periods, and an hourly pricing (HP) scheme in which consumers were charged the hourly prices of the electricity wholesale market. Details and the results of the trial are shown in Exhibits 2a and 2b respectively.

While the CPP and CPR pricing schemes provided identical monetary incentives for consumers to use electricity during offpeak periods, the results were significantly different. Consumers under the CPP responded more positively (i.e. they switched more of their usage from peak to off-peak) than those placed under the CPR. People are much more likely to switch from peak to off-peak usage when they are under a plan that charges them a high price for peak usage than if they are under one which gives them a high rebate for switching. This is consistent with what loss aversion predicts — that people try to avoid losses more than they try to pursue gains.

Price Plan	Description	Example Prices per kWh	High Price/Rebate Event Hours
CPP	Slight discount during 8700 hours per year; much higher price during critical peaks (60 hours per year)	Critical peak: about 75¢; most times: 10.9¢	2 pm-6 pm summer weekdays (12 events per summer); 6 am-8 am and 6 pm-8 pm winter weekdays (3 events per winter)
CPR	Rebates earned for reduction below baseline during critical peaks	Rebate: about -75¢; most times: 11¢	Same as for CPP
HP	Prices change hourly, following wholesale prices	Range from 1¢ to 37¢	High prices typically occur on summer weekday afternoons and winter mornings/evenings

Exhibit 2a: Design of the trial by PowerCentsDC: Electricity pricing plans.
Source: PowerCentsDC Final Report (2010).

Price Plan	Peak Reduction – Summer	Peak Reduction – Winter
CPP	34%	13%
CPR	13%	5%
HP	4%	2%

Exhibit 2b: Results of the trial by PowerCentsDC: Average percentage energy usage reduction during critical peak hours (comparing treatment and control group).
Source: PowerCentsDC Final Report (2010).

This example suggests that policymakers face an important trade-off when designing such dynamic pricing schemes: a scheme that leans on "carrots" or rebates to encourage people to switch may be more popular, but "using the stick" or appealing to people's loss aversion may achieve a better policy outcome. Finding the balance will then be a challenge for decision makers in regulatory agencies and utility companies alike.

Increasing Energy Efficiency through Saliency and Social Norms

Promoting energy efficiency and energy conservation among consumers is another important policy objective of many governments. While the power system has traditionally been built around a "supply follows demand" approach, where generation capacity is typically invested ahead of demand, studies have suggested that it is cheaper to invest in energy efficiency than to invest in energy generation, such as building a new power plant (Lovins 2007).

Standard economics suggests that to achieve higher levels of energy efficiency, energy prices will have to be raised (for instance, through an energy tax). Higher prices create a stronger incentive for consumers to reduce their usage, while signalling to energy companies to develop and implement energy efficiency solutions. Conventional economics also assumes that individual consumers are rational beings who optimise their consumption regardless of how the information is presented.

Behavioural economics suggests an alternative approach. It argues that presenting information that is salient to the choices and framing that information appropriately can go a long way in influencing consumers' behaviour. Allcott and Mullainathan (2010, p.3) also suggest that "appealing to social norms can be another powerful non-price behavioural lever. People may conform to others' behaviour because they believe in [the] wisdom of crowds, i.e. that others took an action because they had more or different information about its benefits, or because there is some external approbation or inner comfort from conformity”.

Currently, some aspects of this are already employed in the promotion of energy conservation in Singapore. SP Services, which manages the utilities accounts of all households, provides information in utility bills on the household’s electricity consumption in relation to similar households in Singapore (see Exhibit 3). The intent is to nudge consumers who are consuming above the national average for their housing type towards reducing their energy use.

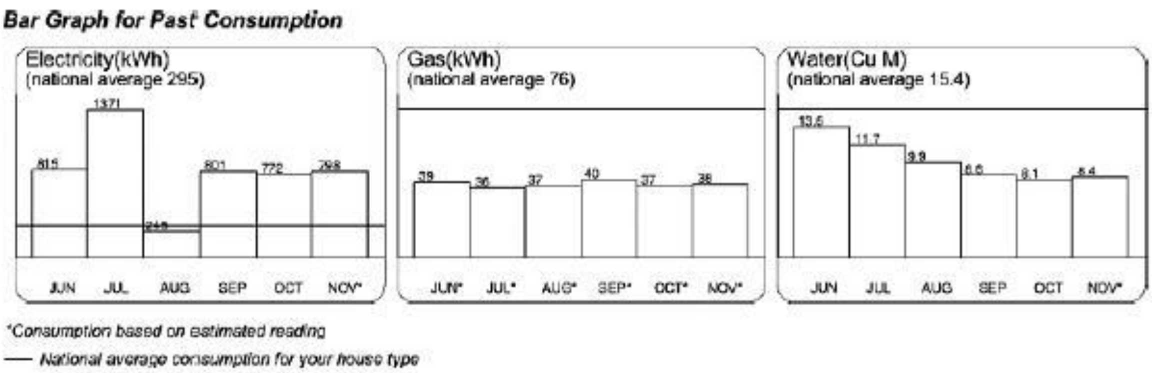

Exhibit 3: Extract from sample utilities bill displaying relative consumption of electricity, gas and water.

Source: SP Services.

In an experiment, Cialdini et al. (2008) studied the impact of different messages to encourage hotel guests to reuse their towels. Various messages such as “Save the Environment”, “Preserve Resources for the Future”, and “Partner with the Hotel to Save the Environment” were printed on cards which were visible to hotel guests. The outcome of this study was that the card with the message “Join Your Fellow Citizens in Helping to Save the Environment”, which provided the information that 75% of hotel guests reused their towels, increased towel reuse by the largest margin of 39.2% — a clear indication that appealing to social norms can make a stronger impact on consumers’ behaviour. Thaler and Sunstein (2008) in their book *Nudge: Improving Decisions about Health, Wealth and Happiness*, termed such conformity with social norms as the herd phenomenon, or the tendency of people to care about what others think of them.

Another barrier to energy conservation is that consumers find it difficult to know how much energy they are using at any point in time. This is exacerbated by the typical time lag of about a month between their actual consumption and their receipt of the monthly utility bills. This lag reduces the immediacy and saliency of the information, and weakens the motivation for consumers to change their habits.

Technological advances such as smart meters make it possible to provide consumers with more information and control over their energy consumption patterns. The question of interest to energy regulators is whether making available real-time information enabled by these technologies (see Exhibit 4) can promote energy conservation and modify usage patterns to a degree significant enough to justify their large-scale deployment.

Promoting Competition in Electricity Retail: Insights from Behavioural Economics

Exhibit 4: In-home display unit providing real-time consumption information.

Source: Energy Market Authority.

How might the information be presented in a way that impacts energy consumption levels? What is the right level of detail? And are the changes to consumer behaviour permanent and sustainable? Consider the following options to frame the consumption information which households can see on their in-home display units that provide "live" information on their electricity usage (see Exhibit 5).

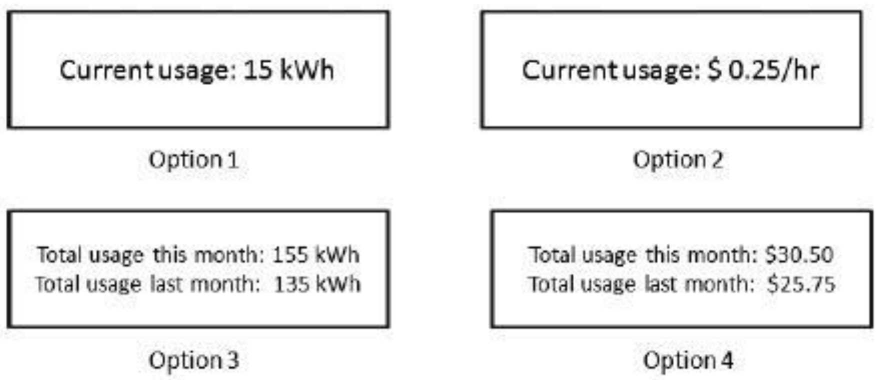

Exhibit 5: Framing electricity consumption information.

Source: Energy Market Authority.

Behavioural economics suggests that showing consumers their usage in monetary terms (Options 2 and 4) will have a greater impact than showing them the units of electricity used (Options 1 and 3), as the former makes more intuitive sense. It also suggests that showing consumers their consumption level on a real-time basis (Option 2) may be more effective than showing them their cumulative usage over the month (Option 4), since the former provides current, rather than backward-looking information.

Another possibility is to make use of ambient displays which alert consumers of high levels of electricity consumption through changes in colours or light displays (Darby 2006). Martinez and Geltz (2005) described an experiment where electricity consumers were provided with a device called an "Energy Orb", a globe that changes its colour according to the time-of-use tariff in operation. The study indicated that the flashing alert of higher tariffs resulted in higher overall savings and more load-shifting, strengthening the case for visual cues as long as they are cost-effective.

The key challenge then in designing any electricity information system is to identify the signals that are the most effective in inducing behavioural change, all the while bearing in mind the risk of "information overload". Psychologists have documented a reduced sense of individual efficacy when people are overwhelmed by the choices presented to them. When consumers are faced with too many choices, such as too many pricing plans or too much information and fine print, they are often paralysed by confusion and indecision and end up not taking action at all. The key takeaway for regulators and utility companies is to calibrate the number of choices and the amount of information to provide consumers. They should also ensure that the choices presented to consumers are clear and easy to understand.

Singapore's Intelligent Energy System Pilot

In Singapore, full retail competition is still work-in-progress. The eventual aim is to give consumers greater say over their electricity retailers and pricing plans and to harness the full range of available technologies to improve Singapore's energy efficiency.

Since 2010, the government has been pilot-testing the Intelligent Energy System (IES). Involving 4,500 residential, commercial and industrial customers, the pilot aims to provide consumers with more information, choice and control over their electricity usage. For instance, smart meters will provide consumers with real-time information on consumption and prices, giving them greater control over their energy consumption decisions, for example by shifting their demand from costly peak periods to cheaper off-peak periods. The ideas that are being tested range from different pricing models to the design of smart display units to be installed in consumers' homes. Through the IES pilot, EMA will also be able to assess how to apply the ideas from behavioural economics to shape consumer behaviour and increase energy efficiency.

Conclusion

While standard economics still underpins the formulation of energy policies in Singapore, behavioural economics provides additional insights in explaining consumer behaviours and in formulating energy policies. The introduction of full retail competition will increase choice for consumers but simply expanding the range of options may not result in good decisions by consumers. The technological advancements that the IES offers will allow utility companies and energy regulators to provide salient and timely information to consumers. By combining the insights of behavioural economics with these new technology solutions, policymakers can devise creative measures that help consumers save money and promote energy efficiency.

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