Electricity Network Charging for Flexibility

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General principles of network charging

- Electricity service involves the delivery of both power (kW), energy (kWh) and power quality (e.g. voltage, frequency, interruptions) at a particular location.
- Consumers value each of these attributes directly and it is possible to charge for each of these dimensions of service.
- However customers have traditionally faced bundled prices.
- Some network charges should be targeted on supply side to provide correct signals.

New developments

- Automated network management (ANM) of DG, demand side response (DSR) or electrical energy storage (EES). These are distributed energy resources (DERs).
- The arrival of smart meters (SM) at the household and small businesses (SMEs).
- New sources of demand such as EVs or Air Source Heat Pumps.
- <u>Considerable potential for 'tax' arbitrage given existing price structures.</u>

Alternative network charging principles

- Cost reflective charging
  - see Bohn et al. (1988) and Hogan (1992).
- Traditional public service pricing
  - see Bonbright (1961) and Stigler and Friedland (1962).
- Platform market pricing
  - see Weiller and Pollitt (2013), State of NY DPS (2014)
- Customer focused business model pricing
  - See Teece (2010) and Oseni and Pollitt (2016)

- First two and last two models are related.

Platform market pricing

- Focuses consideration of what is the unique service provided by the regulated network and what are the services that are sold across the platform between the two-sides of the market.
- Example of credit card (e.g. Mastercard) platform.
- A transparent and simple platform user charge could serve to promote use of the platform (e.g. by flexibility providers) and more importantly increased overall trading value in a way that finely tuned cost reflective pricing may not.

Customer focused business model pricing

- It should be remembered that manipulating network charges to send price signals to DERs is only one of several sources of cost and benefit for DER investors and it may not be decisive.
- DNOs and transmission companies should also be incentivised to innovate uses for their platform and are in a good position to respond to potential future uses of their own networks, subject to a requirement not to disadvantage their current customers.

Some issues in network charging

- Fixed costs of networks need to be recovered from some customers, which is like a tax.
- Hence, difficulty of avoiding differences between producer and consumer prices, which over-incentivise inefficient own production.
- Posted prices need not be the same as actual prices, discounts for flexibility providers can be offered, whatever the posted prices.
- Network charges bundled by retailers so lack of exposure to these for final customers, so sophisticated price structures may be irrelevant.

The problem of fixed cost recovery

- All network users do derive option value from potential use, whatever their actual use.
- Costs are fixed and vary per kW and per kWh.
- Fixed costs only vary in the long run (87% of all WPD costs fixed, TNEI, 93% of UoS charges, 34% of opening revenue sunk in financing past investment) and the core network cost needs to be funded with marginal cost pricing capable of recovering part of the total economic cost.
- Need to worry about over-rewarding flexibility providers, such that no net benefit to network users who have paid for existing network.

Ramsey pricing principles

- Welfare weight adjusted Ramsey pricing suggests that more fixed costs should be recovered from richer/price-inelastic customers, with a trade-off between these two characteristics.
- Thus it would be possible to apportion fixed costs by income, property value, kW connection capacity or another indicator of income (or ability to pay, such as possession of an EV charging point), which did not result in distortion of the use of electricity.

Further issues with fixed costs

- Bad debt, insurance and policy costs are also included in bills, these are a form of taxation and are recovered via the current charging basis.
- Any change to the basis of charging would change how these costs are recovered.
- Any sudden change to the use of the network could significantly reallocate the distribution of who pays for the network fixed costs (and other system costs).

The impact of significantly increased DERs

- There clearly are system advantages to encouraging DERs where these reduce whole system costs.
- It is possible that total system costs come down and that total fixed costs are reduced and / or system marginal costs are reduced.
- This is where the division of who gets such benefits is important. If total system costs fall the question is who should benefit from this? New users or existing users.

New charging opportunities

- There is clearly an opportunity to introduce new dimensions to the charging regime, such as a maximum kW export charge, based on the design rating of their PV, for small pro-sumers.
- This would have the advantage of mitigating the impact of existing charging basis on users with unchanged network use and a grand-fathered network access right.
- Can always incentivise new forms of flexibility directly such as NGET's enhanced frequency response (EFR) product.

How existing network charges can become a problem: the impact of solar PV in South Queensland, Australia

	Household A *No air-con* *No Solar PV*	*Household B* *Air con* *No Solar PV*	*Household C* *No air-con* *Solar PV*	*Household D* *Air-con* *Solar PV*
Maximum Demand (kW)	1.41	2.14	1.40	2.09
Metered import (kWh)	6253.4	7560.6	3820.1	4707.1
Solar Export (kWh)	0	0	2259.1	1838.8
Gross Demand (kWh)	6253.4	7560.6	6253.4	7560.6
Number of customers	283849	694643	26151	235357
% of customers	23%	56%	2%	19%
Base Network Tariff	$1006.14	$1171.37	$698.57	$810.69
Differences	A-C	B-D		
	$307.57	$360.68		

Note: Solar PV took off in 2009; 22% of households with solar PV in 2014. charging basis 20% fixed, 80% per kWh import. 1 AUD = 0.53 GBP.
Source: From Simshauser (2014), p.22, Table 3. Modeled impact for 2014.

Clearly there is a case for regulatory action to change charging basis.

Questions raised

- Is the current charging methodology is efficient and fair (85% per kWh, rest per day)?
- Does the apportionment of charges between fixed, per kW peak and per kWh use of system charges need to be changed?
- Does the advent of a significant new technology at a particular voltage level on the network mean that a new type of charge needs to be introduced at that voltage level (e.g. kW peak export tariff)?

A salutory tale from Germany

- If the total subsidy cost is apportioned through per unit charges then clearly recovering subsidies through metered consumption results in shift of subsidies towards households that have not taken them up.
- A new tax charge on own consumption of solar of 4.4 euro cents /kWh was proposed for industrial and commercial companies in Germany to partly correct the tax arbitrage incentive (under the EEG charge), but this was later dropped.
- This shows the difficulty of reversing historic charging concessions.

Conclusions - Problems

- The principles of how to charge for electricity networks are various.
- Any charging methodology for an electricity network has to deal with fixed cost recovery.
- The rise of DERs offers increased opportunities to exploit the existing system of network charges in ways not originally envisaged.
- A final significant issue is the danger of letting new investors in flexibility capture such a large share of the system benefits that they produce that no net benefit to the existing customers.

Conclusions - Solutions

- New uses of the network creates opportunities for reallocating charges to new users and away from existing users who may be poor and/or vulnerable.
- In many cases we are simply seeing the extension of well-known issues from higher to lower voltages on the network.
- Hence new dimensions to network charging (such as per maximum kW export / import tariffs) which already exist at the transmission level at lower voltages, can be introduced.

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