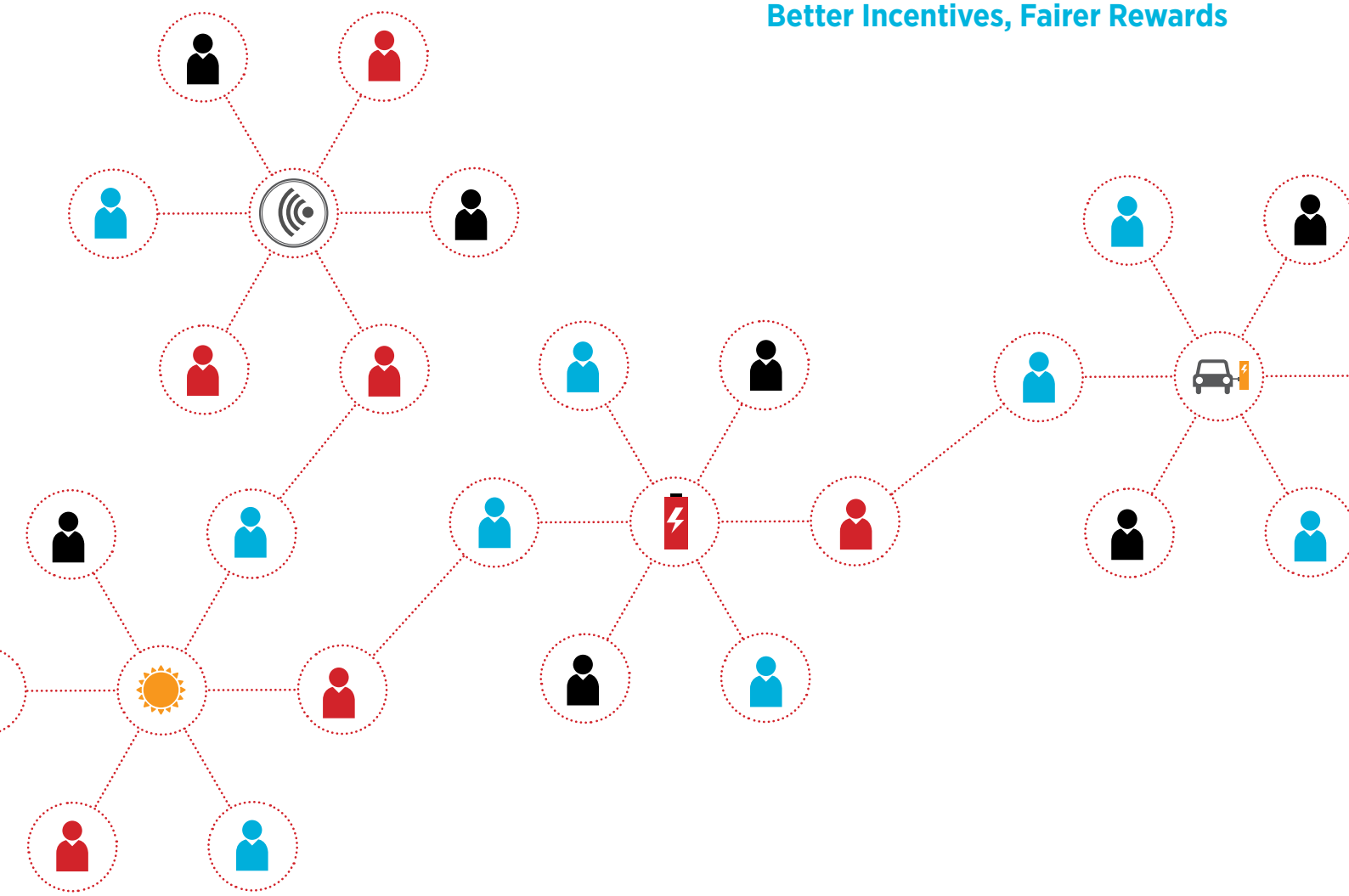
UNLOCKING VALUE FOR CUSTOMERS

Enabling New Services, Better Incentives, Fairer Rewards



ELECTRICITY NETWORK TRANSFORMATION ROADMAP

ena energy networks association

CSIRO

A partnership between ENA and CSIRO

Contact details

The Network Pricing and Incentives Reform report has been prepared by Energeia, for the Energy Networks Association and CSIRO as part of the Electricity Network Transformation Roadmap.

A copy of the full Energeia report is available at the Energy Networks Association website: www.ena.asn.au.

The Energy Networks Association and CSRIO value your feedback and welcomes comments on the modeling.

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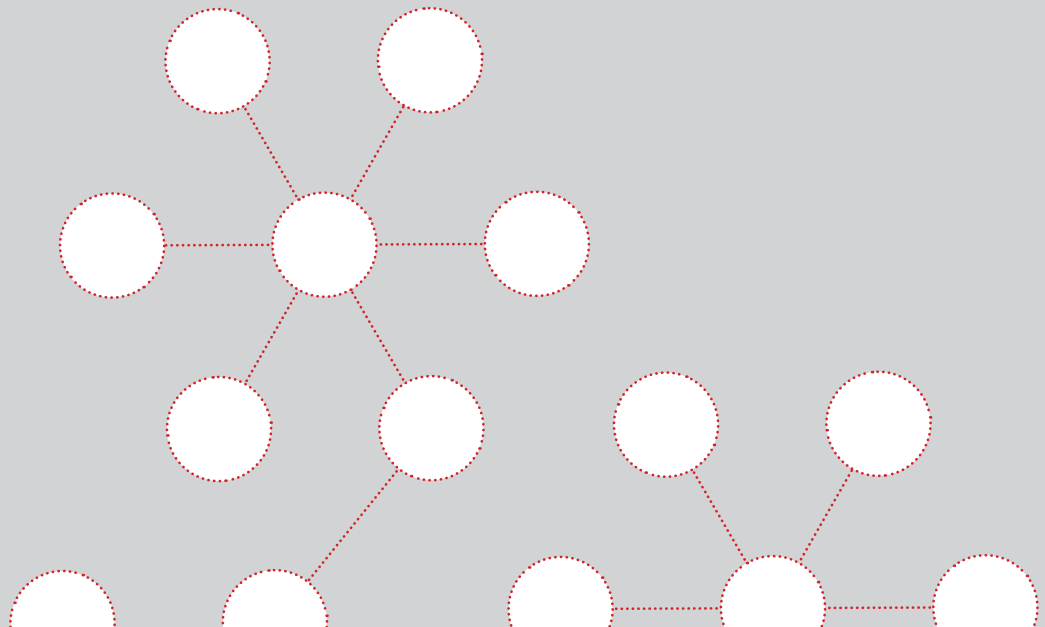

INCENTIVES FOR A SMARTER ENERGY SYSTEM

Electricity is an essential service for Australia's households, businesses and the community – and it is going through an historic transformation. Australia's per capita electricity consumption has fallen sharply in recent years; we lead the world in penetration of rooftop solar panels, and our nation is a global hotspot for other Distributed Energy Resources (DER) like battery storage, demand response and micro-grids.

The Electricity Network Transformation Roadmap Interim Report indicated that customers are in control of Australia's electricity future. Customers, rather than traditional utilities, are likely to determine more than $224 billion - or more than a quarter - of all system investment decisions between now and 2050. In more dynamic and diverse markets, there is the potential for millions of market actors, including households, to transact energy services. The incentives provided by network service providers will be vital to unlock the value of distributed energy resources for efficiency and better services. Prices and incentives can enable customer choice, provide fair rewards and cost recovery and support the future resilience of the energy system.

To inform the Roadmap, Energeia analysed six scenarios for managing pricing and incentives reform in electricity networks. These scenarios assessed diverse options relating to:

- Electricity network ***tariff structures***, including the replacement of current volume-focused tariffs with demand based tariffs in 'First Wave' pricing reform;
- ***Options to transition customers*** to demand-based tariffs enabled by smart meters, while enabling choice;
- The introduction of new incentives for customers to sell ***DER services to networks*** where more efficient than investment in network infrastructure, in 'Second Wave' reforms; and
- The introduction of new network products like a ***Stand Alone Power System (SAPS) tariff***, encouraging customers capable of self-supply to use the grid; where beneficial to them and others.

Key Findings

1. An earlier transition to demand based tariffs could save customers over 10% per year on average network bills by 2026 and achieve economic benefits of $1.8 billion.
2. Consistent with international studies, waiting for customers to "Opt In" to new network tariffs fails to achieve timely take up of fair and efficient tariffs, with 70% of customers remaining on legacy tariffs in 2026.
3. By contrast, customers can be assigned to demand tariffs, with a choice to "Opt Out" while achieving effective reform – less than 10% choose to return to legacy tariffs.
4. Smart meters are essential to enabling demand based tariffs and will require close monitoring by policy makers to ensure market-led deployments are effective.
5. Without actively assigning customers to demand-tariffs, 60% of forecast smart meters will remain unused for cost-reflective tariffs in 2050, resulting in $2.7 billion in under-utilised investment.
6. As technologies like batteries become smarter and cheaper, demand based network tariff structures will need to be refined further to be resilient and deliver greater benefits.
7. If Networks buy grid services from DER Customers, this 'orchestration' could replace the need for $16.2 billion in network investment, avoid cross subsidies, and lower average network bills by around 30% compared to today.
8. New pricing frameworks should allow customers with standalone power systems to remain grid connected in a way that benefits all customers

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3. By contrast, customers can be assigned to demand tariffs, with a choice to "Opt Out" while achieving effective reform – less than 10% choose to return to legacy tariffs.

The analysis indicates that, without changes to prices and incentives, customers are exposed to the risk of unnecessary investment in network infrastructure and DER, leading to higher average electricity bills and unfair cross-subsidies paid for by some customers.

The "Base Case" scenario continues the existing assignment policy in Australia where, in the majority of cases, customers remain on legacy tariffs unless they make a conscious decision to adopt a more cost reflective tariff (known as an "opt in" tariff). This is consistent with international empirical and behavioural studies finding most customers are very slow to actively change their tariffs, even where it can be demonstrated that they would be financially better off.

A tariff assignment framework that moves all customers to cost reflective tariffs, with the option to revert to the legacy tariff if they wish (opt out arrangements) achieves $1.4 billion in reduced network investment compared to opt in tariff assignment.

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A clear barrier to widespread adoption of better tariffs, is the existing lack of meter technology installed in some jurisdictions and the gap in tariff assignment policies in those network areas in which smart meters are available for use.

Requiring customers to actively 'Opt In' to demand tariffs under the Base Case scenario would see smart meter investment being under utilised. Even as far out as 2050, the Base Case scenario predicts only 40% of smart meter investment being utilised for efficient tariffs.

Energeia's preferred scenario would require a rapid uptake of smart meter installation to 2021. However this would enable substantial economic benefits and removal of cross subsidies as a result.

Figure 1: Customers on more cost reflective tariffs

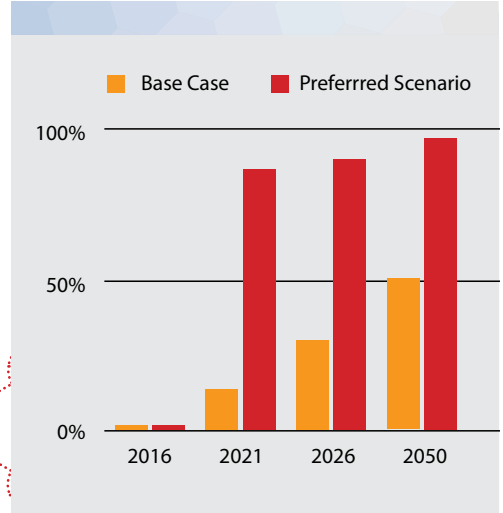
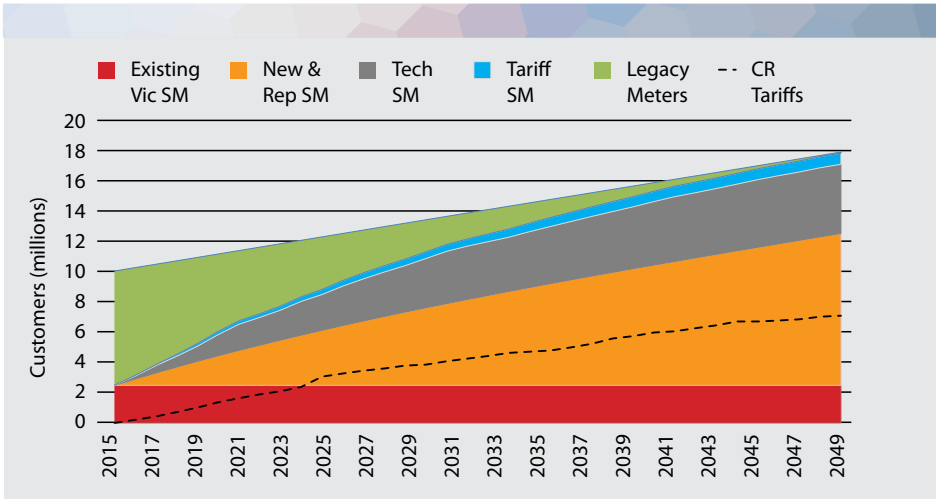


Figure 2: Cost Reflective (CR) Tariff Uptake and Smart Meter (SM) uptake (Base Case)

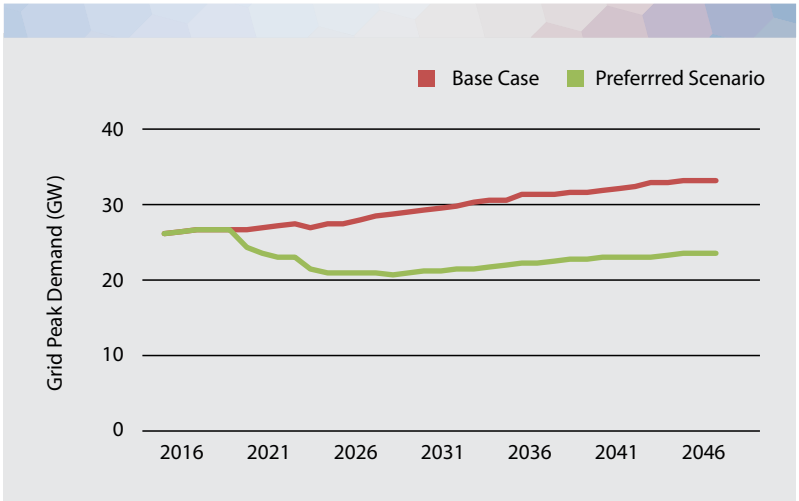


6. As technologies like batteries become smarter and cheaper, demand based network tariff structures will need to be refined further to be resilient and deliver greater benefits.

The analysis confirms that proposed demand-based network tariffs will perform better than the legacy volume-based tariffs by integrating distributed generation like rooftop solar more fairly and efficiently. However, these demand-based tariffs would still require refinement over time. On current projections, investment in battery storage is likely to reach a 'critical mass' before 2030 such that battery charging profiles could lead to new peak demand events without appropriate incentives or orchestration. The proliferation of distributed storage could expose limitations in current maximum demand tariff structures, and unintentionally impose higher system costs on other users, who would be effectively 'cross subsidising' the owners of storage.

This can be avoided by refining demand-based network tariffs to allow better integration of batteries, as storage technology becomes more affordable and smarter over time. Energeia suggests this can be achieved by options including: assessing the customer's peak demand across more than one peak period; and/or reducing the volume-based component of the non-peak charge; and/or incorporating mechanisms that increase diversity in battery charging outside of peak periods. All of these options would be 'revenue neutral' to the network, but would be intended to increase the fairness and efficiency of cost allocation between customers.

Figure 3: Total Network Non-Coincident Peak Demand (GW)



7. If Networks buy grid services from DER Customers, this 'orchestration' could replace the need for $16.2 billion in network investment, avoid cross subsidies, and lower average network bills by around 30% compared to today.

With the increase of new technologies in the energy system, early opportunities for buying and selling grid services are best served through agreements between customers and service providers to allow for dynamic and locational network orchestration of distributed energy resources where they can provide a lower cost solution to a traditional distribution service expenditure, to either augment or replace the existing grid (Figure 3).

Energeia's preferred scenario is for an additional layer of direct, targeted incentive signals to integrate new technologies at a locational level, to complement more efficient broad-based tariff structures. Under its preferred scenario, Energeia predicts a third of customers will participate in some type of additional incentive, either directly or through an intermediary.

The report outlines range of possible incentives and procurement methods could be applied, including contracting and transactional platforms which provide dynamic price signals.

8. New pricing frameworks should allow customers with standalone power systems to remain grid connected in a way that benefits all customers

Under the Base Case scenario, Energeia's model identifies customers choosing to go off-grid from 2030 and this increases to around 10% of customers by 2050. This is due to the improvement in standalone power systems to provide an economic alternative to some customers under the Base Case scenario. However, off-grid arrangements remove opportunities for the customer and the network to benefit from the integration of the standalone power system with grid services and other energy services in the future.

Energeia's preferred scenario introduces a tariff which acts as an alternative and more attractive option for customers who install sufficient DER to effectively be disconnected from the grid during peak times, or who would otherwise disconnect permanently.

UNLOCKING VALUE FOR CUSTOMERS - AT A GLANCE

2016 Prepare	2021 Deliver
6 GW solar	13GW solar, 7GWh batteries
17% customers with DER	27% customers with DER
99% residential customers on legacy tariff	13% residential customers on legacy tariff
Average network charge of $625 represents 42% of the average amount spent by customers on electricity	Average network charge of $571 represents 37% of the average amount spent by customers on electricity

- Consult on "future-proofing" network tariffs
- Retailers to develop new pricing arrangements for maximum demand tariffs
- Accelerate smart meter programs
- Trial new network tariffs for SAPS
- Trial of new locational/dynamic signals
- Ensure customer support and decision-making tools; well targeted concession schemes for vulnerable customers

- High penetration of smart meters
- Customers assigned to refined demand tariffs with the option to revert back to legacy tariff
- Retailers offer range of new pricing arrangements
- Networks establish DER information and locational value of DER

Key Findings

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Note: Figures sourced from Scenario 5 of the Energeia Network Pricing and Incentives Reform report

26 GW solar, 32GWh batteries	72GW solar, 87GWh batteries
42% customers with DER	61% customers with DER
11% residential customers on legacy tariff	<3% residential customers on legacy tariff
Average network charge of $550 represents 39% of the average amount spent by customers on electricity	Average network charge of $439 represents 23% of the average amount spent by customers on electricity

2026 Enhance

- Networks buy grid services (directly or indirectly) from DER customers for locational, dynamic benefits
- New locational programs allow customers to 'opt in' to sell DER services to networks
- One in three customers participate in dynamic incentive layer offered by networks
- 7% of customers with SAPS enjoy benefits of being on grid but with lower prices

2050 Benefit

- The majority of customers are subject to dynamic, locational incentives or standalone power system integration
- 31% of customers with SAPS enjoy benefits of being on grid but with lower prices
- Non-coincident zone substation demand is below 2016 levels

Realised Benefits of Reform

2026	2050
Average network bills over 10% lower than what they were in 2016	Average network bills around 30% lower than what they were in 2016
$1.4 billion of cross subsidies avoided	$18.6 billion of cross subsidies avoided
$1.4 billion of network investment avoided	$16.2 billion of network investment avoided
$1.8 billion of net economic benefit	$16.7 billion of net economic benefit

CUSTOMER-CENTRED REFORM

Customers are at the centre of electricity network tariff reform. In May 2016, the Energy Networks Association published an Electricity Network Tariff reform handbook, commissioned from KPMG which identified four outcomes of tariff reform which will benefit customers:

- Customers understand and can respond to price signals;
- Customers receive fairer prices;
- Tariffs signal efficient investment in networks and DER (like solar panels and battery storage); and
- The effects on vulnerable customers are managed.

Well-designed electricity network tariffs should promote:

- **Economic efficiency**
  Tariffs will drive efficient use of and investment in network services;
- **Equity**
  Tariffs are non-discriminatory with each customer's charges reflecting the costs their electricity use creates; effects on vulnerable customers are managed and network costs are recovered over time;
- **Simplicity**
  Tariffs are easily understood so customers can source and use electricity to minimise their costs if they so choose;
- **Pricing stability**
  Unexpected adverse tariff changes are minimised;
- **Network viability**
  Tariffs enable distributors to recover at least their efficient costs so they are able to maintain services;
- **Minimisation of cross subsidies between customers**
  Avoid introducing new levels of cross-subsidy with the deployment of DER.

Figure 3: Rewarding Customers for Smart Energy Use

ABOUT THE ENERGEIA NETWORK PRICING AND INCENTIVES REFORM REPORT

Energeia and CSIRO have developed a joint modelling capacity to test 7 broad scenarios of possible future tariff structure states across 14 distribution network businesses. For each scenario and each network, Energeia's model forecasts demand and consumption and the uptake of distributed energy resources for a sample of 2,600 customers every year to 2050. The modelling is detailed enough to provide these forecasts at each of the 1,800 zone substations across Australia, and can be aggregated at a network, state, NEM and national level.

The model represents the largest scale, network cost price forecast model undertaken in Australia. Importantly, it calculates for each year and is used to identify how different tariff structures and tariff assignment mechanisms affect customer decisions around the uptake and operation of new technology or new tariffs and the consequence of this for network expenditure, energy prices, customer impacts and overall economic efficiency.

Energeia's report outlines the 6 scenarios, beginning with scenario 1 (the "Base Case" scenario) where existing network tariff structures, tariff assignment policies and smart meter forecasts are locked-in until 2050.

Energeia makes recommendations in support of a "preferred scenario" which involves changes to current tariff settings and improved incentives for dynamic and locational integration of new technologies to support traditional network solutions.

Energeia's recommendations are the changes required now to provide the benefits to the community of the preferred scenario.

Assessing a range of customer impacts

In modelling for the Electricity Network Transformation Roadmap CSIRO selected from its customer profiles, sample customer profiles representing four household groups. Energeia modelled the outcomes of the same sample customer using two different assumptions. Firstly, Energeia assumed the customer was active in seeking distributed energy resources, including solar and batteries to reduce energybills. Secondly Energeia assumed the customer was passive and did not, or could not, seek to invest in distributed energy resources to reduce energy bills.

The outcomes for the four sample customer types are outlined below:

Figure 4: Outcomes for different customer types

	Base Case			Preferred Scenario		
	Active $	Passive $	The Gap $	Active $	Passive $	The Gap $
Working Couple	1,387	1,900	**513**	1,303	1,552	**248**
Medium Family	1,584	2,761	**1,177**	1,577	2,119	**542**
Large Family	2,722	4,339	**1,617**	2,655	3,206	**552**
Single, Retired	1,059	1,792	**733**	1,076	1,445	**370**

FREQUENTLY ASKED QUESTIONS

Why is tariff reform important?

The tariffs that most customers use today were designed at a time where residential and small business customers had similar usage patterns for energy which grew at a reasonably constant rate over time. With technological advances, the way the network is used has evolved and changed over time. Some of these technologies have benefited from existing tariff structures because they are not cost reflective and have resulted in some customers paying less for their energy service, at the expense of other customers. Network tariff reform is designed to make existing network tariffs fairer and more efficient – sending signals to enable customers to respond through energy use choices, but only where there is a likelihood of corresponding reductions in future costs.

What are demand based charges?

Most customers currently use anytime volume based charges, which are applied at a constant rate to the total energy consumed over time. Demand based charges could be used in conjunction with volume based charges. A rate is applied to a measure of electricity used in a given time period. This is often the highest half hour recorded in a period, but could also be applied to longer periods or an average of different periods.

Most new network tariffs for residential and small business customers apply a peak demand charge to the demand in a window of time that coincides with expected network peak demand.

Will networks make more from demand based charges?

Changes to tariffs or tariff structures are revenue neutral for network businesses in the short term – the network recovers the same amount of revenue and is neither better nor worse off as a result of that change. However, to the extent that customers respond to demand based charges and reduce demand at peak times, this should result in lower network costs (and therefore revenue) for network businesses.

What is a Distributed Energy Resource?

Distributed energy resources (DER) include diverse supply or demand-side resources which can provide energy, reactive power or capacity services to the system. They frequently include distributed generation (such as rooftop solar photovoltaics or micro-gas turbines), battery storage, demand response and Home Energy Management Systems (HEMS) and electric vehicles. They are usually small in scale, energy services and technology, distributed more widely, and located closer to customers, than traditional centralised energy resources. They can provide power to one customer or to a number of customers.

What are cross subsidies?

There are a recognised range of cross-subsidies within electricity network cost recovery. Current volume-focussed network tariffs do not reflect how customers use the network and key drivers of future network costs. For instance, customers using airconditioning at peak times may receive an unintentional cross subsidy from other users who don't. Customers using rooftop solar panels may pay less than the cost of providing the network service to them, a shortfall which is unintentionally paid for by other customers without solar. Of course, some cross-subsidies are intentional or required by Government policy, such as 'postage stamp' tariffs which provide the same network charge to small customers regardless of their location in the network. Network prices should be designed to minimise unintended cross-subsidies, such that the network charge reflects the cost of providing the service and rewards efficient use.

What does an average bill represent?

From the scenarios modelled the sum of the average (total cost divided by customer) network charges, retail charges, contribution of carbon price to the average bill and average technology cost.

What are dynamic locational initiatives?

This refers to the range of pricing signals and other incentives to integrate available DER with traditional grid services, spanning from control of discretionary loads or storage through to more sophisticated transactive mechanisms.

What is a stand alone power system?

A system capable of servicing a customer's energy needs without the need for additional energy transported by the shared network.

A copy of the full Energeia Report is available at the Energy Networks Association website at www.ena.asn.au.

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