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ELECTRICITY NETWORK TARIFF REFORM HANDBOOK

DRAFT FOR CONSULTATION APRIL 2016

KPMG SCOPE

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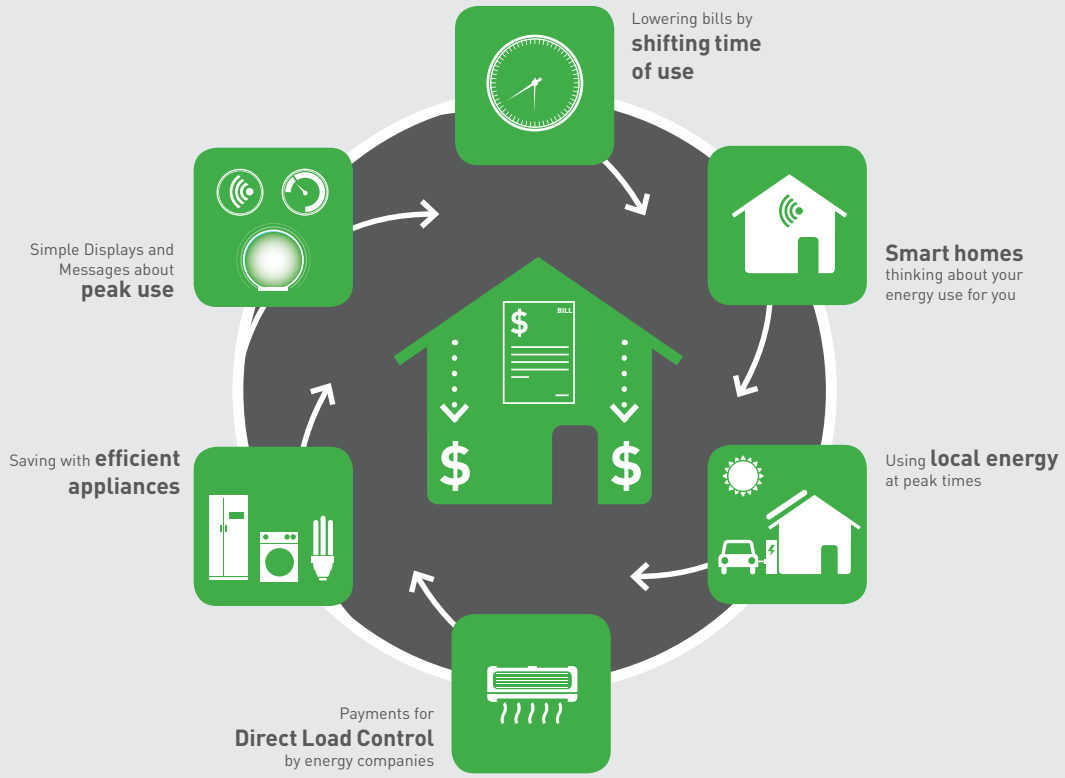


EXECUTIVE SUMMARY

The electricity industry is transforming as customers embrace new technologies and rethink how they source and use electricity.

Australia's electricity networks are agents of change in this transformation. They have an important responsibility to work with other stakeholders to help customers unlock the full benefits of the new technologies, while promoting safety, reliability and efficiency important to all customers.

Tariff reform has a vital role to play in the transformation and there is strong consensus from industry, government and customer advocates that current pricing frameworks are now outdated.

The first priority is to introduce distribution network tariffs so that prices to customers are more reflective of the network costs. Today's highly volumetric charges lead to substantial cross-subsidies from some customers to others which are not intended by government policy or based on need. More cost-reflective prices can promote fairness between customers in the short-term. Over the longer term, network costs will be lower than they otherwise would have been because more cost-reflective prices will reward customers who use electricity outside of peak hours, reducing future investment requirements.

For electricity network providers, such changes are 'revenue neutral' as they meet their universal responsibility to all customers to price network services and share cost recovery in a fair and efficient way. These 'first wave' changes will be the foundation for future market development in distributed energy services. The ENA considers a 'second wave' of new services and incentives is likely. A range of options may emerge for customers to voluntarily participate in new markets or additional distribution network tariffs with locational and dynamic pricing. (See Figure 2, page 8 of the Handbook)

This Handbook has been developed to assist electricity distributors and industry stakeholders - including governments, customer advocates and retailers – to plan and implement successful tariff reform which delivers cost-reflective distribution network pricing. It recognises that successful reform will require more than a Rule change or a new tariff design.

Effective tariff reform will require:

- A clear identification of the desired outcomes.
- Robust analysis of customer response and management of impacts;
- Careful implementation through customer support, decisions tools and tariff and meter migration policies;
- Securing key prequisites for effective tariff reform including: a *Social Licence*; a *Supportive Regulatory Framework;* and a constructive *Engagement of Energy Retailers.*

To meet these requirements, tariff reform programs must incorporate:

- Close collaboration across multiple stakeholders on the tools and communication provided to customers;
- Recognition by all stakeholders of the respective value each stakeholder could provide to customers;
- Choice in the range of different supporting tools reflecting the different needs of customers;
- Information that is simple, clear and engages with customers; and
- Easy-to-access feedback loops for customers on how their response has delivered savings for them.

It is important that the tools provided to support customers' decision making give them control of their consumption.

The Handbook is intended as a toolbox for networks and others to use to realise the benefits of tariff reform by removing existing inequities, delivering lower prices long term and enabling customers to use new technologies efficiently.

The Handbook is informed by a range of analyses, including traditional and behavioural economic studies and the experience of tariff reform programs in Europe, Canada and the United States of America, which are presented among 11 Case Studies. Domestic and international analysis and experience strongly supports tariff reform to introduce cost-reflective pricing by Australia's distribution networks.

In the Handbook, customers are placed at the centre of reform process. It proposes four key outcomes of tariff reform which benefit customers:

1. **Customers understand and can respond to network tariff signals;**
2. **Customers receive fairer prices;**
3. **Tariffs signal efficient investment in network and Distributed Energy Resources (DER); and that**
4. **Effects of reform on vulnerable customers are managed.**

The Handbook sets out the National Electricity Rules' principles of good tariff design. These principles are consistent with longstanding work of James Bonbright and more recent studies by the Rocky Mountain Institute in the United States of America.

Network tariffs should be designed to promote:

- **Economic efficiency** (tariffs 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 that network costs are recovered over time)
- **Simplicity** (tariffs are easily understood so that customers can use electricity to manage minimise their charges 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);
- **Cross-subsidies between customers are minimised** (noting that the introduction of new levels of cross-subsidy is a major risk with the deployment of DER under existing tariffs).

Many customers could be reluctant to adopt new tariffs notwithstanding strong evidence that they will benefit financially from doing so. Behavioural economics offers insights into how the implementation of tariff reform should consider the customer response and preferences. Well-recognised human factors such as risk aversion, inertia and a tendency to over-weight the prospect of losses compared to benefits should be considered. Distributors recognise that they must engage with customer and make tariff design choices which align with customer behaviour so they can respond to tariff signals.

It is essential that distributors understand the impacts of proposed tariff reform on their customers. The Handbook discusses options for distributors to evaluate the effects of proposed cost reflective tariffs on customers, including quantifying the effects of existing cross-subsidies, modelling the long term outcomes of different tariff design options and analysing the effects on the bills of different groups of customers. Distributors recognise the importance of discussing the results of this analysis with customers and other stakeholders as a means of not only building customers' understanding but also assisting longer term planning of reform implementation.

There will be customers who are vulnerable to price changes and less able to benefit from greater choice or new technologies. The Handbook identifies approaches to supporting vulnerable customers and the opportunity for distributors to collaborate with governments, retailers and customer advocates.

The Handbook sets out possible "transition paths" to cost –reflective network pricing as it has occurred internationally. It provides insights to the effectiveness of alternative options such as customer assignment, 'opt-out' and 'opt-in' frameworks. International experience suggests that assignment and opt-out approaches deliver more certain and quicker transitions to cost-reflectivity, at a time of rapid change in technology and the potential for increasing cross-subsidies under current tariffs.

Effective engagement between distributors and retailers is a prerequisite of successful tariff reform. In the Australian market, most customers' network costs are bundled with energy and other costs by their retailers, so how retailers include network costs in their tariffs could influence the effectiveness of tariff reforms by affecting choices customers take. Retailers have their own commercial and regulatory drivers, which distributors need to consider when developing their network tariffs to maximise the prospect of successful tariff reform. A well-designed and intensely competitive retail market can constructively support network tariff reform.

Tariff reform also requires a supportive regulatory environment. Australian Energy Ministers endorsed the shift to cost-reflective pricing through tariff reform in November 2014, lending support to new National Electricity Rules made by the Australian Energy Market Commission which require distributors to transition to cost-reflectivity over time. The regulatory environment will need to continue to be supportive of a reform which will take several years to implement and deliver its full range of benefits to customers.

Distributors must obtain and preserve a social licence to implement network tariff reform as reform has the potential to affect every electricity customer. Distributors recognise that to develop and maintain this social licence to help undertake this reform they must:

- Explain the case for change and the customer benefits it will deliver;
- Work closely with other stakeholders and be open, transparent and equitable in all of their dealings (including equipping customers to reap the benefits of reform); and
- Be willing and able to adapt and change over time, including as new learnings emerge from the staged implementation of the reform.

The ENA welcomes feedback on the issues in this Handbook and further engagement with all stakeholders with an interest in the energy transformation and customer outcomes.

HAVE YOUR SAY

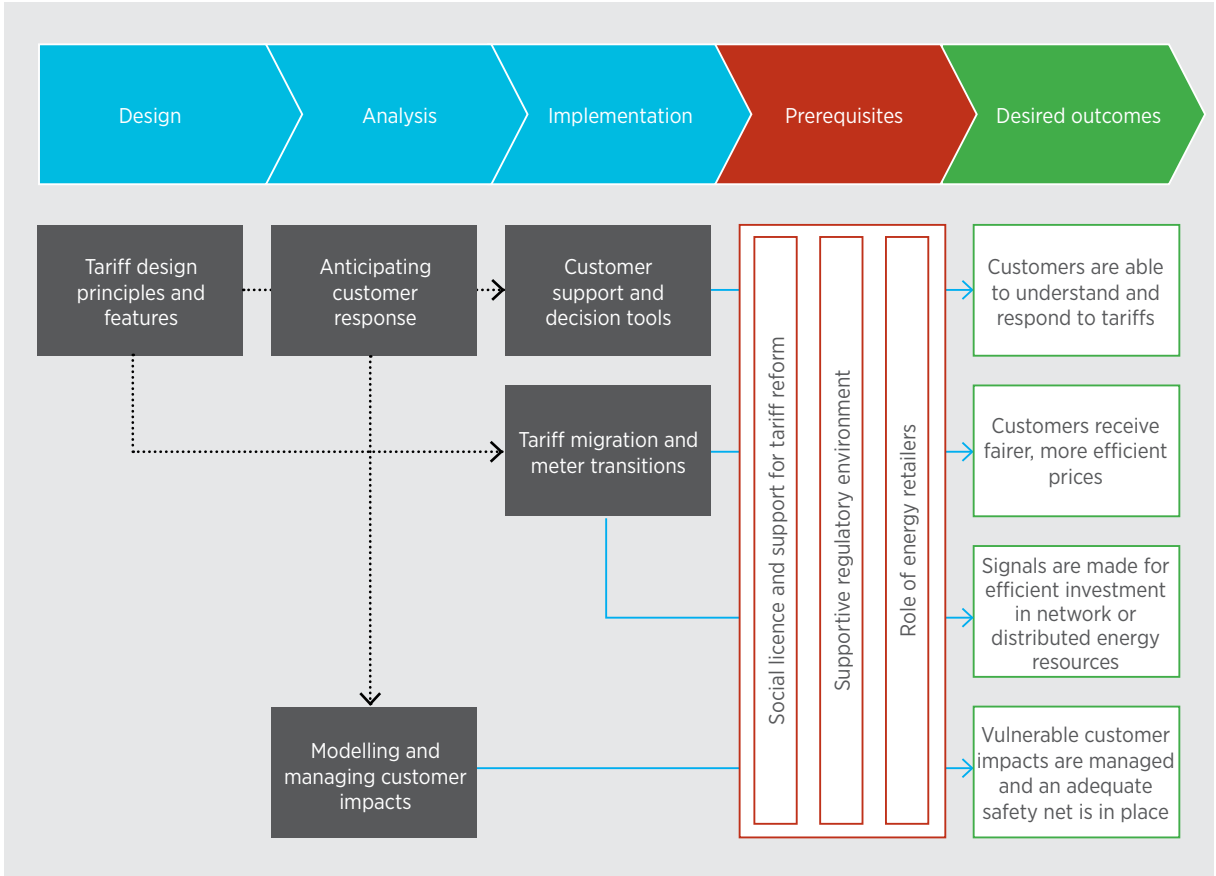
ENA is interested in your views about the case studies and suggestions provided in the Draft Network Tariff Reform Handbook.

The Draft Handbook has been released for feedback and we would welcome views on:

- Desirable Outcomes
- Network Tariff Design Principles
- Analysing Customer Impacts
- Customer Support and Decision Tools; and
- Managing tariff migration and metering transitions
- Securing prerequisites such as social licence for tariff reform, supportive regulatory frameworks and cooperation by retailers and other parties.

Please contact us at **info@ena.asn.au** to provide your feedback or arrange a discussion.

INTERACTION BETWEEN ELEMENTS OF SUCCESSFUL TARIFF REFORM



SECTION 1 PURPOSE AND SCOPE

The electricity industry is embarking on an era of transformational change as customers embrace new technologies and rethink how they source and use electricity.

Distributors see themselves as agents of change in this transformation with important responsibilities to work with other stakeholders including governments, retailers and consumer advocates to help customers unlock the full benefits of the new technologies.

The Energy Networks Association (ENA) and the CSIRO are partnering to develop an Electricity Network Transformation Roadmap to help Distributors and other stakeholders to navigate these changes. The goal is to foster innovative electricity systems that focus on better serving the needs and aspirations of future customers.

Under any scenario of future transformation, there is a need to introduce fairer and better ways to charge customers for their use of electricity network services.

Existing distribution network tariffs were developed and appropriate under different electricity market conditions. However, with the development of new energy technologies and changes in customers patterns of energy use, network tariffs are no longer sufficiently efficient or fair, and they will not facilitate efficient integration of new technologies into Australia's electricity supply system. Current tariffs create significant cross subsidies between customers, promote inefficient and unfair deployment of airconditioning, solar PV and storage, do not encourage electricity use at times of low network cost and provide no incentive for new energy markets and services (see Figure 1). Distributors recognise that these issues require the reform of distribution network tariffs so they better reflect the costs of providing network services.

Cost reflective distribution network tariffs will play a crucial role in the transformation through facilitating choice in new technologies and providing efficient incentives for customers to optimise their electricity production and consumption.

Recent studies have estimated that the implementation of cost reflective network tariffs could by 2034:[1]

- Deliver up to $17.7 billion of savings to Australian customers from more efficient investment in network and distributed energy resources (DER) capacity;
- Avoid the growth of cross-subsidies of up to $655 per customer per year; and
- Save customers on average up to $250 per year on their residential electricity bills through reduced network investment.

The need for network tariff reform is urgent.

Distributors fully embrace tariff reform and are supported in its implementation by the Australian Energy Market Commission's (AEMC) 2014 change to the National Electricity Rules.[2] This introduced obligations on distributors to structure their tariffs to reflect better the efficient costs of network services so that customers can make more informed decisions about their electricity usage.

Along with distributors, a range of stakeholders – governments, retailers and customer advocates – are actively participating in this tariff reform process.

The charges issued by distributors (referred to as network use of system charges) include the costs associated with both the distribution network and a number of other costs,[3] including transmission charges. The 2014 Rule change places new obligations on distributors for their network use of system charges, including identifying in their Tariff Structure Statements (TSS) how they will pass on other costs, including transmission charges, to their customers.

To support the successful implementation of these reforms, the ENA has written this Handbook. It sets out the range of actions and prerequisites for reform of distribution tariffs which will deliver significant benefits to customers.

1 Energeia Report to ENA, Network Pricing and enabling metering, December 2014

2 Details of the AEMC's Rule change are available at - www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements

3 The Rules refers to these as: "designated pricing proposal charges", which include TUOS charges, inter-distribution charges and avoided TUOS and "Jurisdictional scheme cost recovery", which include rebates paid for premium feed in tariffs and transitional feed in tariffs.

The Handbook presents desired outcomes of distribution network tariff reform and, by drawing from both Australian and international examples, identifies good practice across the stages of tariff design and implementation.

This Handbook outlines a potential path for achieving successful reform of *distribution network tariffs*.

This Handbook does not address initiatives in reforming transmission charges. Transmission prices are set according to the Cost Reflective Network Pricing (CRNP) or modfified CRNP methodologies in Chapter 6A of the National Electricity Rules. The transmission CRNP methodology has been in place from the start of the National Electricity Market. Transmission pricing provides important incentives, particularly for large commercial and industrial customers. Opportunities to improve transmission pricing will be evaluated in the Network Transformation Roadmap project in 2016.

INTEGRATED, NATIONAL APPROACH TO TARIFF REFORM

This Handbook is aimed at all stakeholders participating in network tariff reform. By releasing this Handbook, the ENA is seeking to promote an integrated, national approach by fostering a common understanding of the steps and components needed for successful tariff reform.

Distributors cannot implement network tariff reform on their own. They recognise that close collaboration and alignment across stakeholders will be important for network tariff reform to be successful. This Handbook provides a framework for distributors to work with all stakeholders to build the prerequisites for successful tariff reform.

The successful implementation of network tariff reform requires more than just distributors setting cost-reflective network tariffs through their TSSs that are now required under the National Electricity Rules – although this will be an important contribution.

Rather, there is a need for buy-in from, and cooperation between, governments, retailers, distributors and customer advocates to:

- Support customers to make informed choices, including controlling their consumption cost effectively and selecting a tariff which suits their circumstances;
- Manage price impacts on customers; and
- Provide appropriate protections for customers who could be vulnerable to the effects of network tariff reform.

This integrated approach will help to ensure that the significant benefits for households and small businesses can be realised.

This Handbook only considers reforms of network tariffs and not the other cost components of a customer's bill. Across Australia, network tariffs (including both transmission and distribution costs) represent about 40 to 50 per cent (depending on location) of the total bill paid by residential customers.

How retailers represent the changes to network tariffs in their offerings to customers could influence the effectiveness of tariff reforms and affect the choices customers make. Retailers will have their own commercial and regulatory factors to consider in this regard.

The extent to which retailers reflect cost reflective network tariffs through their own retail tariffs that are paid by end customers is a consideration for distributors when developing their network tariff structures.

FUTURE PATHS OF NETWORK TARIFF REFORM

As the industry transforms over time, the opportunities and challenges in network pricing will also change.

The initial program of cost reflective tariff reform currently being developed by distributors can be thought of as a "first wave" – by which distributors will meet their universal responsibility to all customer segments to price network services and share cost recovery, in a manner that is fair and efficient.

Fairer, more efficient electricity network prices can provide significant benefits in lower electricity bills, avoided cross-subsidies and stronger incentives for efficient investment in network infrastructure, DER and smart technologies.

In the short term, total network costs and therefore regulated revenue will not change. This means that in the near term a benefit of tariff reform is to reallocate costs among customers to drive more equitable customer outcomes - customers will pay fairer shares of network costs. However, the AEMC estimated that around 70 to 80 per cent of customers would have lower network bills in the medium term.[4]

4 AEMC, Distribution Network Pricing Arrangements Rule Change, November 2014

This first wave focuses on the recent AEMC Rule changes and the need for customers to be able to make more informed decisions about how they use electricity. The implementation of this first wave of reform may be refined in the short term as more information and learnings on customer preferences and responses are gathered.

Although these reforms will provide improved signals for customers and new service providers, the full optimisation of DER and smart technologies, along with the growing diversity of customers electricity consumption and production, might require a "second wave" of tariff and incentive reforms through to 2025.

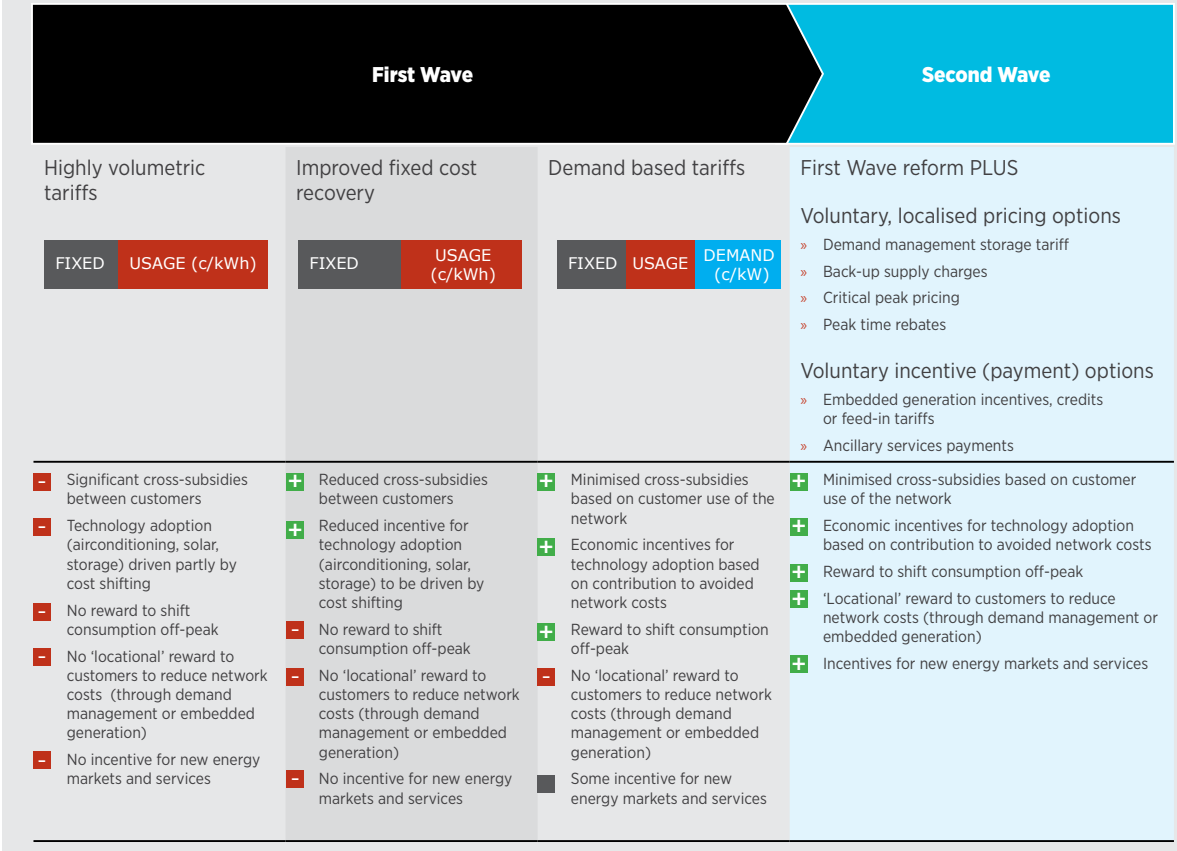
This second wave might see a greater range of opportunities for customers to maximise the value of how they choose to use electricity. The more effective the integration of DER and smart technologies into the network, the greater the opportunity to reduce future network costs while ensuring grid resilience and reliability for the ultimate benefit of customers.

Figure 1 demonstrates these two waves of tariff reform to 2025.

It is uncertain which reforms will be implemented under any second wave. The options presented in figure 1 cover a wide range of network tariff refinements and other measures – which might or might not occur.

Some of the options are mutual substitutes and not all will be appropriate in all circumstances. Some are market developments which might emerge and some are network tariffs options – such as location specific and dynamic tariffs – which could be requested by customers. Any reforms under this stage would be developed through consultation with customers and evaluated under the regulatory framework.

Figure 1 Two "Waves" of tariff reform to 2025



The first wave of reforms is foundational and provides the platform for any future changes. It is essential to implement the current reforms successfully. In the future it will be harder to transition to greater customer choice and to integrate new technologies effectively, if existing cross subsidies become even more entrenched.

This Handbook seeks to support the implementation of the first wave by describing the behaviours and gateways, which distributors consider could best enable these reforms to be effective.

FOCUSING ON THE CUSTOMER

The evidence of benefits is clear. However, there are challenges in communicating to customers the benefits of a reform that will result in households and small businesses being charged for a proportion of their bill based on the timing of peak demand, rather than focusing on their usage as has traditionally been the case. Although charging based on peak demand is new for these customers, some distributors have been charging commercial and industrial customers on this basis for many years.

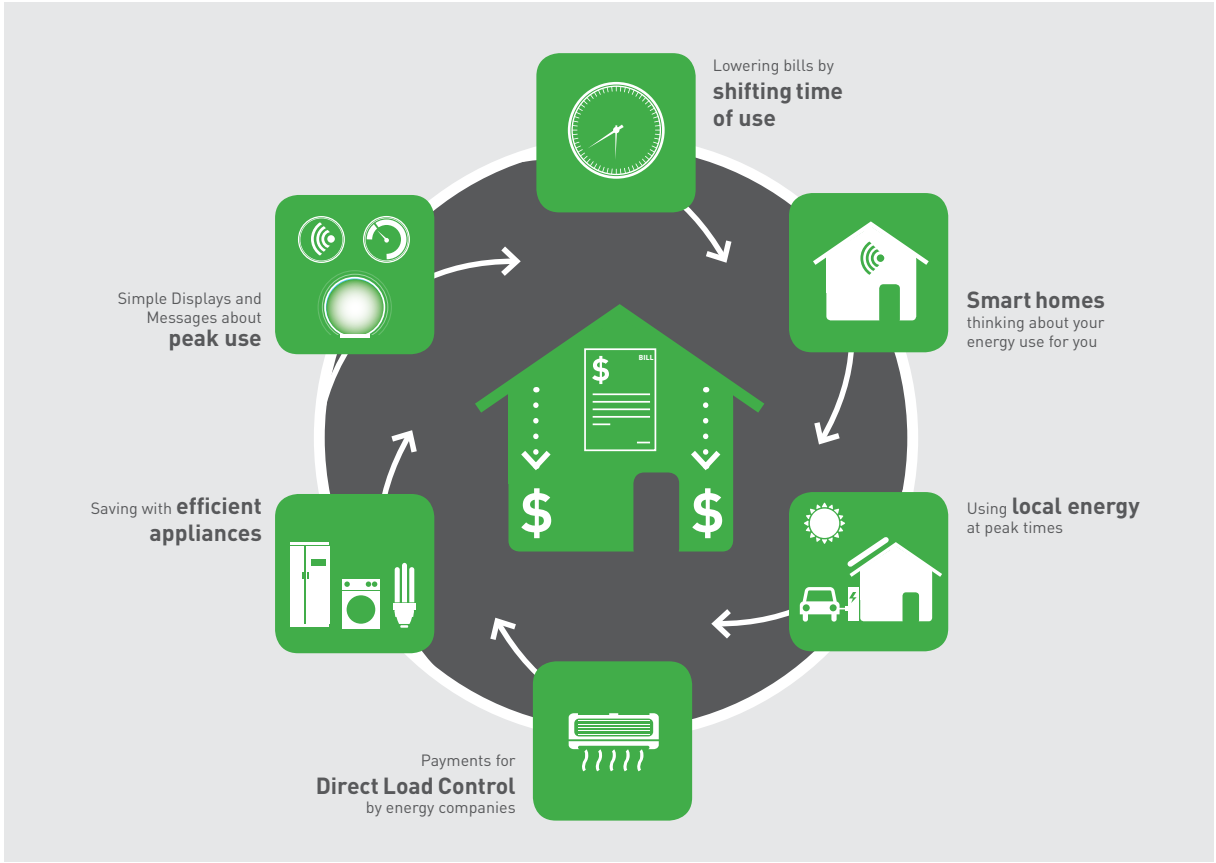
To be successful, tariff reform needs to focus on the customer. This requires effective engagement supported by customer impact analysis, recognising the increasing diversity in customers' use of electricity services.

The Australian Energy Regulator (AER) currently caps the revenues that distributors can recover from customers through their network charges. Network tariff reform is therefore revenue neutral – that is, it will determine how network costs are shared among customers, but will not alter the amount of regulated revenue. In other words, the introduction of new tariff structures has no inherent profit benefit for distributors.

Rather, the aim of tariff reform is to give households and small businesses the tools and options to make efficient decisions about how best to produce and consume electricity. Figure 2 depicts the wider range of efficient energy management choices customers will have as a result of tariff reform.

By doing so, tariff reform will facilitate the efficiency, fairness and long-term sustainability of the shared network infrastructure required by customers. It will assist the industry to become more resilient and to foster future transformation.

Figure 2 Rewarding Customers for Smart Energy Use



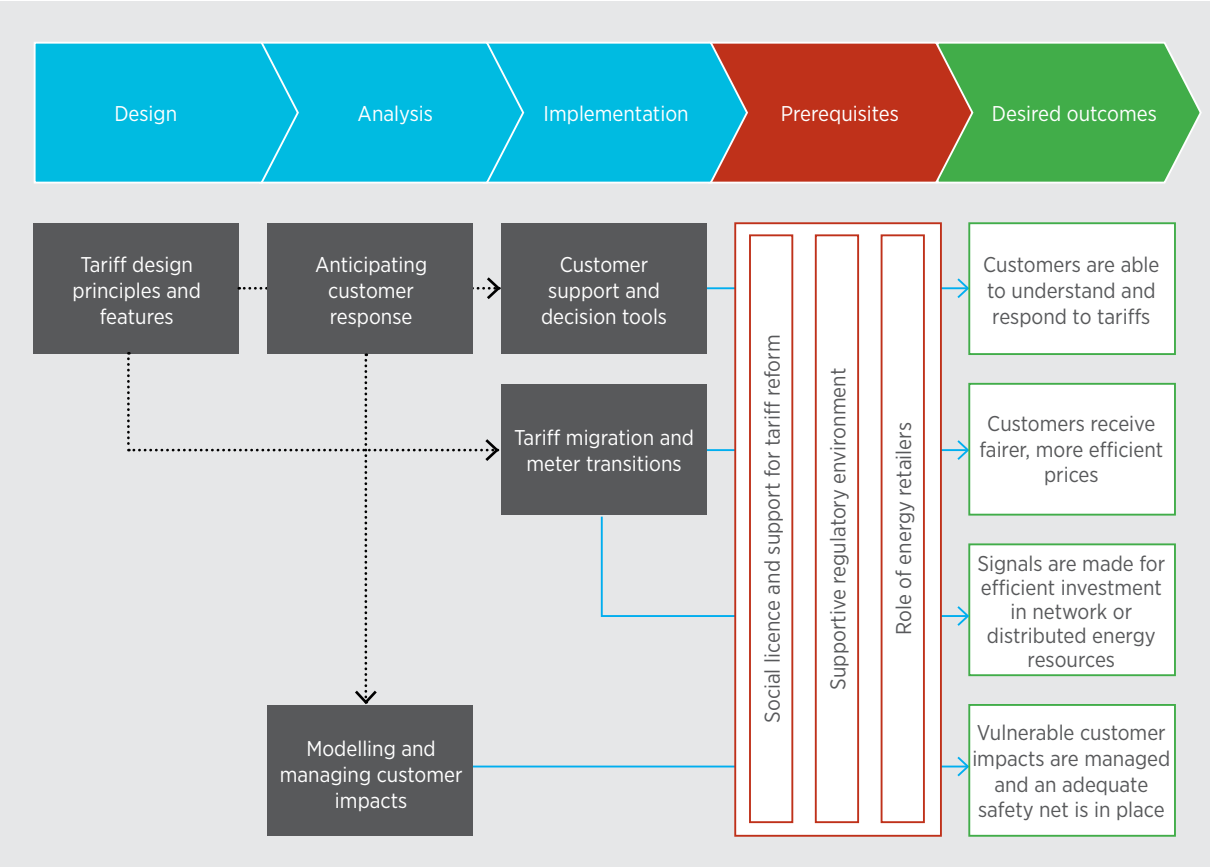
STRUCTURE OF HANDBOOK

This Handbook examines the elements of successful network tariff reform in three parts:

- Section 2 presents desirable outcomes of network tariff reform;
- Sections 3 to 5 cover the three steps of design, analysis and implementation of tariff reform; and
- Section 6 identifies prerequisites needed for the desired outcomes of tariff reform to be achieved. This includes the social licence and backing for network tariff reform, a supportive regulatory environment and effective engagement with energy retailers.

Figure 3 illustrates the relationship between these elements. It highlights that tariff reform will involve a continuous process of analysis and adaptation. It will also require distributors to work together with retailers, governments, customers and their advocates. This reflects the shared benefits of achieving a sustainable, efficient and equitable electricity system for customers.

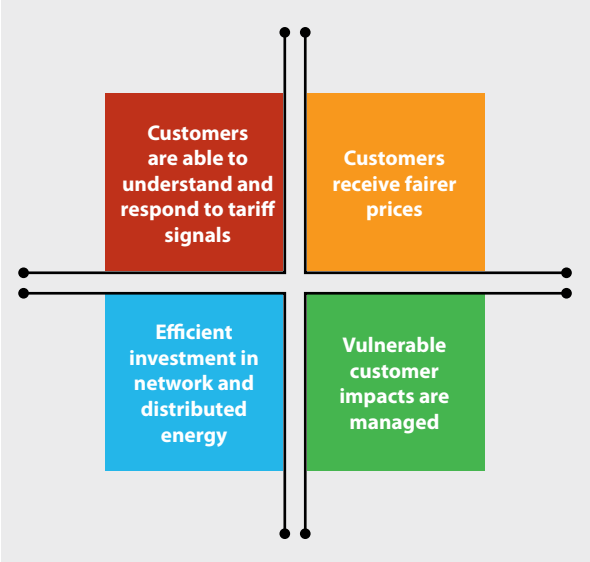
Figure 3 Interaction between elements of successful tariff reform



SECTION 2 DESIRABLE OUTCOMES

Figure 4 illustrates four key outcomes being sought from effective network tariff reform. These outcomes are benefits to society, rather than just to distributors. Industry and community buy-in and support are essential to achieving these outcomes.

Figure 4 Desirable outcomes for network tariff reforms



The delivery of these outcomes will depend upon the particular characteristics of each network and could differ across networks and evolve over time.

OUTCOME 1 – CUSTOMERS UNDERSTAND AND CAN RESPOND TO NETWORK TARIFF SIGNALS

The first desired outcomes of network tariff reform are that:

- Customers understand how they can manage and control their electricity network charges, by using information and tools to respond to prices which reflect the cost of providing the service to them. This requires that customers have meaningful, user-friendly information about their tariff options to inform their decisions about consuming and producing electricity; and
- Customers have access to suitable advice, data and support tools to assist them to choose their tariffs.

Distributors and retailers have important roles in providing information to customers to support the uptake of cost reflective tariffs:

- Distributors are important because they develop the network tariffs and are seeking to provide signals about the costs of using their networks; and
- Retailers are important because they are typically the first point of contact with customers. Network cost reflective tariffs will send signals to retailers, who may or may not choose to pass these signals on to customers directly based on their customer offerings and preferences. How retailers present the network tariff structure in their retail offerings will determine the extent of the price signal received by customers.

A common understanding – and collaboration – between distributors and retailers of their respective roles in supporting customers will determine whether customers understand and can respond to the price signals sent through network tariffs.

OUTCOME 2 – CUSTOMERS RECEIVE FAIRER PRICES

The second desired outcome of network tariff reform is that:

- Network tariffs are cost-reflective and minimise unintended cross-subsidies between customers;
- Customers can make choices in their energy use, technologies and lifestyle that they value, including the use of on-site generation and storage. These choices are not distorted by cross-subsidies to, or from, other customers; and
- Network tariffs are equitable by reflecting the costs of servicing each customer.

In this way, network tariffs should make the true cost of their options transparent to customers and inform efficient decisions about future investment in both the network and new technologies.

Customers will receive more efficient price signals if the price signals from cost reflective network tariffs are passed through to them by retailers. Some customers might not change their energy use even during peak periods because they still see sufficient value at the cost reflective price. This is an efficient outcome. It also is important to note that the capacity utilisation of the electricity network can be improved because of the demand response of a limited number of customers.

What is important is not customers' responses, but their ability to choose whether or not to respond to the cost reflective signal. Even if customers do not respond, reforms of network tariffs will still have:

- Achieved fairer prices; and
- Provided an important step to enabling customers to make more informed decisions about how they use electricity.

OUTCOME 3 – TARIFFS SIGNAL EFFICIENT INVESTMENT IN NETWORK AND DISTRIBUTED ENERGY RESOURCES

The third desired outcome of network tariff reform is that:

- Network tariffs provide signals to encourage efficient investment in the electricity network and in DERs.

The long-term future of Australia's electricity system is likely to see responsibility for key investment decisions about electricity infrastructure move from a few large entities, like generators and network service providers, to millions of individual customers. Customers will have greater choice about how they produce and consume electricity and will make decisions whether to invest in DERs, like solar or storage, or access them (for example through community schemes) based on financial and other benefits they value.

Most analysts expect this more dynamic energy services market to continue to rely on electricity networks as enabling platforms for how customers generate, store, sell and use electricity. The success of such a transformation will depend upon customers receiving efficient signals about the true cost of their choices for energy usage and sourcing.

Network tariff reform is critical to ensuring the fair and efficient operation of electricity networks as customers either continue to rely on centralised generation or acquire DERs and use the network as an integrated enabling platform. The more efficient the integration of DERs into the network, the greater will be the opportunity to reduce future network costs while maintaining grid reliability for the ultimate benefit of customers.

This third desired outcome of network tariff reform therefore involves customer choices influencing efficient future investment in network capacity. Where customers respond to cost-reflective network tariffs by:

- Increasing their reliance on network capacity, then distributors will increase their efficient investment in the network to continue meeting peak demand; or
- Decreasing their reliance on the network and instead acquire or access DERs, then distributors will efficiently decrease their investment in the network.

Network tariff reform will therefore inform efficient decisions about future investment in both the network and new technologies as the relative costs and benefits of each are made transparent. Customers will be provided with the opportunity for greater control over the extent of network investment and ultimately, the level of network tariffs.

In this way, successful tariff reform will promote informed energy choices by customers and contribute to a stronger, more robust electricity system. This system will be characterised by greater customer choice, efficient investment, rewards for efficient behaviour and benefits from new technologies.

Network tariff reform has an important contribution to make to demand management – sometimes called "negawatts". However, it is not "the only game in town" in relation to demand side participation (DSP). Other management tools can also deliver benefits to customers, including rebates, direct load control and embedded generation. Some customer advocates suggest the use of education campaigns and communication tools to drive behavioural change, citing experience in reducing water demand during major droughts.

These non-price DSP options do not obviate the need for cost reflective pricing. There is an important interaction between the availability of cost reflective prices and these non-tariff-based DSP options. The size of the reward necessary to encourage a customer to participate in these non-tariff-based DSP options is largely dependent upon the customer's retail tariff. In the absence of cost reflective prices, the efficiency and effectiveness of such non-price options will be limited.

Cost reflective pricing complements non-tariff-based DSP options by correctly signaling the cost of new investment and therefore the value of demand management.

OUTCOME 4 – VULNERABLE CUSTOMER IMPACTS ARE MANAGED

The fourth desired outcome of network tariff reform is that:

» Vulnerable customer impacts are managed with an adequate safety net in place for those who need it most.

International and Australian research has shown that vulnerable customers could benefit proportionately more from network tariff reform than other customers through lower electricity bills.

Fairer prices would result in a more equitable distribution of costs between customers. For instance, there is evidence to suggest many vulnerable customers have a relatively "flat" load profile and would be better off immediately under a demand-based tariff even without a change in their behaviour. Dynamic pricing trials in the USA found that 80 to 90 per cent of low-income customers would benefit from moving away from flat or inclining block rates to dynamic pricing rates.[5]

Studies in Australia have made similar findings. A study by AGL of 160,000 households in Victoria found that customers who could be characterised as being in hardship would gain most from moving from flat rate tariffs to cost reflective tariffs (see Case Study 1 below).

This finding is supported by a 2014 independent report that drew on the outcomes of the Australian Government's $100 million *Smart Grid, Smart City Program* which found that:

» Greater financial vulnerability increases a customer's willingness to shift and reduce electricity load; and

» Behavioural changes are less disruptive for vulnerable households than other households.[6]

The *Smart Grid Smart City* trial found that financially vulnerable trial households were commonly more satisfied with cost reflective tariffs than other trial households and were more likely to recommend their product to a friend.

5 Faruqui, A, Sergici S. & J. Palmer (2010): "The Impact of Dynamic Pricing on Low Income Customers", IEE whitepaper. Available online at: www.edisonfoundation.net/IEE/Documents/IEE_LowIncomeDynamicPricing_0910.pdf

6 SmartGrid, Smart City: Shaping Australia's energy future, Executive Report, July 2014, page 36 – available at http://industry.gov.au/Energy/Programmes/SmartGridSmartCity/Documents/SGSC-Executive-Report-National-Cost-Benefit.pdf

This suggests that vulnerable households have a greater desire for control (through necessity) over their bills and are more likely to appreciate benefits offered by cost reflective tariffs.

Distributors also recognise that demand charges will be new to many small business customers. Care will need to be taken in designing tariffs and considering transitional arrangements to assist small businesses to adjust to the introduction of more cost reflective network tariffs.

It is not possible to be certain in advance how network tariff reform will affect vulnerable customers as this will depend on their individual circumstances, needs and behavioural responses.

Appropriate customer support arrangements should be in place for the introduction of cost reflective tariffs so that customers who experience energy affordability problems can manage their energy use and control their bills.

Network tariff reform is not, by itself, the best means of promoting energy affordability. Instead, there needs to be greater awareness and co-ordination between the design of retail tariffs (that customers directly pay) and government support mechanisms.

Case Study 1: Impact of cost reflective pricing on vulnerable customers[8]

AGL undertook a study in 2014 of inter- and intra-segment wealth transfers arising from existing flat-rate tariffs, in the context of power systems experiencing deteriorating load factors.

The study contrasted existing flat rate tariffs with more cost-reflective time-of-use and critical peak tariffs, using data from 160,000 smart meter customers in Victoria. In particular, the study focused on the effect on households in financial hardship, of flat-rate tariffs and of the extent they can benefit from moving to more cost-reflective tariff structures.

The study's initial analysis found that under flat-rate tariffs, half of the customer base was being overcharged, while the other half was benefiting from a cross-subsidy. It found that although cross-subsidies occur within and across all segments, the "Parent at Home" cohort received the highest level of cross-subsidy – this was being funded by "Households in Hardship" and "Working Couples" amongst others.

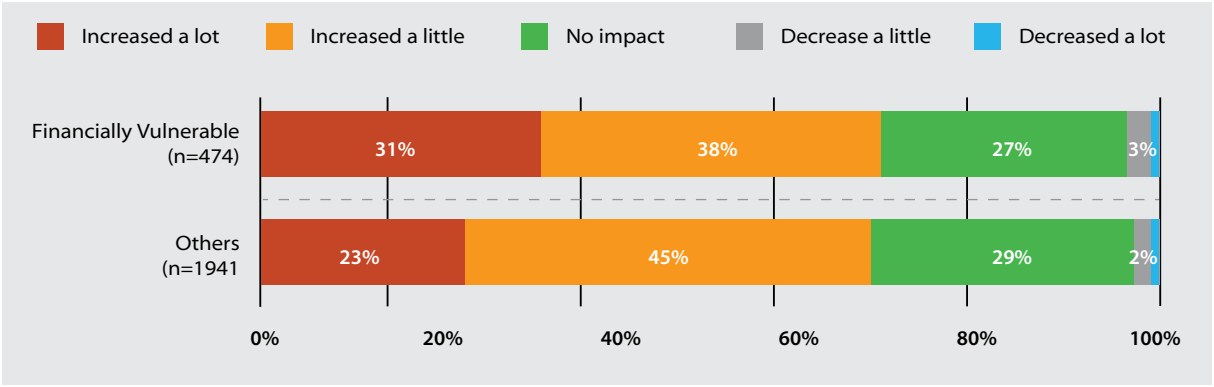
The study then examined the effect of moving to time-of-use and critical peak prices. It found that they caused a 19 per cent reduction in aggregate household peak load on critical event days. This was largely associated with load shifting rather than a reduction in consumption and only reduced industry revenues by 2.4 per cent before tariff rebalancing.

The study found that 75 per cent of customers were better off, with the largest of that cohort, Households in Hardship, moving from 65 per cent to 87 per cent, while the most prevalent of the worse off cohort, Parent at Home, shifting from 33 per cent to 67 per cent. After taking into account the impact of network tariff rebalancing, the study found that 64 per cent of customers were better-off, with the cohorts that gained the most being Households in Hardship, Working Couples and then Concession & Pensioners.

The study found that, relative to the status quo, 95 per cent of "worse off" households faced bill increases of no more than 5 per cent or $58.40 on average, after taking into account demand response and tariff rebalancing. However, the remaining 5 per cent of worse off households faced increases of up to 16 per cent or $440 per annum.

The study concluded that the Households in Hardship cohort would be overwhelmingly better off after tariff reform.

Figure 4 Smart Grid Smart City trial results – ability of participants to reduce electricity use[7]



Source: SGSC, National Cost Benefit Assessment: Executive Report, Section 6.5, figure 10

7 The legend refers to the extent of trial customers' ability to reduce their electricity bill in response to the introduction of cost reflective tariffs.

8 Simshauser, P. and Downer, D., On the inequity of flat-rate electricity tariffs, AGL Applied Economic and Policy Research, June 2014

One example of the interaction between network tariff reform and government support is the possible introduction of a social tariff through retail prices[9]. However, network tariffs charged to all customers tend to be a relatively blunt tool for managing electricity affordability. This is due to:

- The difficulty in accounting for individual financial capacity in pricing frameworks;
- It will be up to retailers whether to pass through social tariffs to customers; and
- The concern identified by some customer advocates that vulnerable customers who might benefit from cost reflective tariffs requiring a smart meter might not be a "target market" for metering providers in a contestable market.

The ENA recently commissioned independent analysis by HoustonKemp, *Supporting Vulnerable Energy Customers*[10], which identified opportunities to improve assistance for vulnerable customers so that the "safety net" works for those who need it most.

Governments, rather than distributors, are responsible for managing societal transfers and for determining how impacts on vulnerable customers are best managed. It is therefore appropriate that governments – rather than distributors or retailers acting independently – determine the nature and form of the customer safety net.

HoustonKemp's report identifies a range of potential options to improve the assistance by governments to vulnerable customers. These are detailed in Box 1. Equally, there are options for energy companies to assist vulnerable customers, particularly as they participate in competitive markets or during a transition to more efficient tariffs.

THERE ARE A NUMBER OF OPTIONS FOR ENERGY COMPANIES TO ASSIST VULNERABLE CUSTOMERS, PARTICULARLY AS THEY PARTICIPATE IN COMPETITIVE MARKETS OR DURING A TRANSITION TO MORE EFFICIENT TARIFFS

Distributors are aware that there might be some customers who are particularly vulnerable to tariff reform because they are both unable to shift their times of consumption from the network peak demand and financially stressed by the demand charge. Distributors support a national review of energy concessions by the Council of Australian Governments to ensure there is an adequate "safety net" which captures such customers.

This issue is discussed further in Section 6, which describes the prerequisites for successful tariff reform.

Box 1: Options to support vulnerable customers

1. Harmonise the value of financial assistance across jurisdictions, addressing gaps in assistance and replacing lump sum concession payments with payments based on a percentage of the energy bill.
2. Assess whether eligibility for financial assistance needs to be more targeted.
3. Provide financial assistance for household or community investments (e.g., insulation, smart metering and other technology to manage their use, energy efficiency). This could be in place of paying financial assistance.
4. Provide greater support and access to information for all customers (vulnerable and non-vulnerable alike) that will enable them to make more informed choices and choose the most appropriate retail tariff for their circumstances.
5. Consider the case for and against social tariffs, as an option to assist vulnerable customers, and their potential usefulness in enabling the transition to more cost reflective network pricing.

Distributors are committed to:

- Working with retailers and customer advocates to assist governments to understand and quantify the impacts of cost reflective tariffs on vulnerable customers and to enable them to assess the appropriateness of any "safety net" over time; and
- Designing the implementation of cost reflective tariffs to manage customer impacts.

Some distributors also are exploring applying temporary measures to limit changes in customers' bills during the implementation of cost reflective tariffs. This issue is discussed further in Section 5 of this Handbook.

9 A social tariff is a tariff which contains terms, conditions, and charges that are designed to assist or benefit a defined group or groups of disadvantaged users or persons (i.e., it has a social purpose).This typically means vulnerable customers receive discounted energy prices.

10 Available at - www.ena.asn.au/sites/default/files/supporting_vulnerable_customers_-_houstonkemp_options_paper_final.pdf

SECTION 3 NETWORK TARIFF DESIGN PRINCIPLES

Network tariff design is guided by well-recognised principles, some of which can conflict and must be balanced. There is no single right answer in balancing these principles. Their application will differ by network and evolve over time as technology, market conditions and customers' preferences change.

The implementation of network tariff reform is more likely to succeed where the consideration of the principles has been transparent, informed by a practical understanding of customer behaviour and reflects the challenges emerging from the transformation of the industry.

Designing a cost reflective tariff is complex, requiring careful consideration of a range of factors. Importantly, the new design must provide customers with price signals giving them efficient incentives to optimise their electricity production and consumption.

Network tariff reform needs to be guided by well-recognised principles. These principles, are simplicity, stability of the customer experience, utility revenue recovery, fair distribution of cost among customers, and efficient energy sector investment, have become the foundation of network tariff design across the world.

This Section discusses how the principles should be incorporated into tariff reform, recognising the current emerging technologies and transformation of the industry. It also identifies a number of important features, which would promote the success of network tariff reform.

COST REFLECTIVE PRICING PRINCIPLES

In November 2014, the AEMC amended Chapter 6 of the National Electricity Rules. Distributors are now guided in setting tariffs by the "network pricing objective". This objective is that the tariffs which a distributor charges should reflect its efficient costs of providing its services to its customers. The network pricing objective is supported by pricing principles under the Rules. These principles are that:

- The revenue expected to be recovered from each tariff must be greater than the avoidable cost and less than the standalone cost of the service (i.e. standalone and avoidable cost principle);
- Each network tariff must be based on the long-run marginal cost (LRMC) of providing the service. LRMC is a measure of the network costs caused by using more energy, or the costs that could be saved by using less energy (i.e. LRMC principle);
- The revenue expected to be recovered from each network tariff must: reflect the distributor's total efficient costs of providing services to the customers assigned to that tariff; permit the distributor to recover its expected revenue in accordance with its regulatory determination; and be recovered in a way that minimises distortions to the pricing principles (i.e. total efficient cost principle); and
- Distributors also must give effect to a customer impact principle when developing their tariffs. This principle requires distributors to consider the impact on customers of changes in network charges and set tariffs that customers are reasonably capable of understanding (i.e. customers impact principle).

Network tariffs must also comply with any jurisdictional pricing obligations imposed by State or Territory governments.

The "network pricing objective" and network pricing principles are consistent with the following widely-accepted, enduring high-level pricing principles – referred to as the Bonbright principles – which have guided electricity pricing for the last half century:[11]

- Economic efficiency – this relates to network tariffs driving the efficient use of network services and alternative products and services;
- Equity – this has several dimensions, including:
  - Setting network tariffs to reflect the costs of providing services to customers;
  - Avoiding discrimination between customers in the network tariffs that they are charged;
  - Managing bill impacts on vulnerable customers; and
  - Recovering network costs fairly from customers over time (i.e. inter-generational equity).
- Simplicity – network tariff s should be easily comprehended by customers so they can respond to the price;
- Pricing stability –the number of unexpected changes to network tariffs which materially adversely affect existing customers must be minimised; and
- Viability of the network – distributors must have a reasonable opportunity to recover at least the efficient costs they incur in providing their services so they can continue to invest in providing the services sought by customers[12].

The Rocky Mountain Institute (RMI) has observed that the Bonbright principles remain relevant and appropriate for the transformational changes underway in electricity markets. However, it has proposed adding a new principle:[13]

- Minimisation of unintended cross-subsidies – network tariffs should reflect the costs of providing the related service rather than include other costs which then can distort the decisions of distributors, other service providers and customers'.

The RMI has noted that while cross subsidies have always been present in tariffs, they can be exacerbated as DER penetration grows, resulting in an undue burden being placed on certain groups of customers.

The new network pricing objective and pricing principles in the National Electricity Rules support the RMI's view that, while the Bonbright principles remain relevant, they need to be re-interpreted against the transformation of the energy industry and the current challenges being faced by distributors.

The National Electricity Rules require that each distributor must prepare a Tariff Structure Statement (TSS) which outlines the tariff classes, tariff structures, policies and procedures for assigning consumers to tariffs, and the approach to setting tariff pricing levels that it proposes to apply over the next regulatory control period. The TSS must comply with the pricing principles. However, distributors can depart from the three efficient cost principles (for standalone and avoidable cost, LRMC, and total efficient costs), to the extent necessary to meet the consumer impact and jurisdictional pricing obligation principles. If a distributor needs to make any such departure to meet jurisdictional pricing obligations then it must do so transparently and only to the minimum extent necessary.

11 Bonbright, J.C., Principles of Public Utility Rates, 2nd ed. Public Utilities Reports, 1988 (First published in 1961).

12 This principle is reflected, for example, in the Revenue and Pricing Principles in Section 7A of the National Electricity Law

13 Rocky Mountain Institute, Rate Design for the Distribution Edge, August 2014.

Case Study 2: Equity and pricing stability in Queensland's network tariffs[14]

A study by AGL in 2014 examined alternative network tariff structures in Queensland. The study had particular regard for electricity industry reforms and developments over the previous decade, including tightened network reliability standards, increased network capital expenditure, generous premium feed-in tariffs, a high take-up of solar PV, declining energy consumption and increasing maximum demand.

The study found that a two-part network tariff that has historically been used in Queensland – comprising a uniform fixed charge and uniform variable rate based on average cost – is well suited to a high-energy demand growth environment, a high inflationary environment, or both. However, it found that this tariff structure is not well suited to the rising cost, declining load environment in which Queensland found itself. This is because substantial tariff increases are required to return regulated revenue allowances. The study found that south-east Queensland's electricity network prices increased by 112.4 per cent between 2009/10 and 2014/15.

The study found that the instability of two-part network tariffs – and distortionary policy subsidy costs – resulted in substantial wealth transfers between households, depending on whether they had air-conditioning and/or solar PV. It identified wealth transfers to households with air-conditioners of $24.2 million per annum and to households with solar PV of $70.3 million per annum, with a total wealth transfer of $94.5 million per annum. At an individual household level, the study found that:

- Households with no air-conditioning and no solar PVs paid an extra $74.37 per annum and those with air-conditioning and no solar PVs paid an extra $70.78 per annum; and
- Households with no air-conditioning who had solar PVs paid $167.62 less per annum and those with air-conditioning and solar PVs paid $199.23 less per year.

The study compared these results under a two-part tariff against those under a time-of-use tariff and under an "optimal network tariff", being a three-part demand tariff, comprising a fixed charge to cover fixed operating costs, a time-of-use variable rate to cover nominal variable costs, and a demand charge to cover sunk costs based on coincident maximum demand.

The study found that the "optimal network tariff" would result in far greater price stability than the other two tariff structures. It found that it would substantially unwind hidden subsidies between households and better promote distributional equity and efficiency, albeit that eliminating distortions also requires redesigning policy funding arrangements (such as solar PV subsidies).

LEARNINGS FROM BEHAVIOURAL ECONOMICS

A range of known customer preferences can inform tariff reform and engagement by distributors, retailers and others with customers. Behavioural economics provides insights into how distributors might balance the trade-offs between the pricing principles in the National Electricity Rules.

Various studies, including by the CSIRO and the ENA in the context of the Electricity Network Transformation Roadmap, have identified customer preferences and behaviours that can inform approaches to network tariff reform and customer engagement. These include that, typically,:

- Customers will weigh financial losses more heavily and discount future (uncertain) financial benefits;
- Customers are risk averse and have a preference for certainty;
- Customer behaviour is high in inertia and as information increases, people tend to "stick to defaults";
- Customer decision making will generally deteriorate as information or options increase; and
- Message framing by service providers should be attentive to community norms and interests.[15]

Box 2: Behavioural Principles for tariff design

Opower, a global strategic adviser to utilities, has developed five principles for designing tariffs for energy customers which draw on findings from behavioural science. These five principles are that electricity (distribution and retail) businesses should:

- Design tariffs for how people actually behave – service providers should be experts in the science of human behaviour if they are trying to change it;
- Assume people don't care – people need a compelling reason to act;
- Always lead to action – people are more likely to complete an action if the first step is easy;
- Aim for lasting relationships – behavioural change takes time to happen so a long-term view is needed; and
- Build for everyone who receives an electricity bill – a large impact necessitates a broad customer reach.[16]

14 Simshauser, P. ibid, p.20

15 Fredericks, E, Stenner, K and Hobman, E "Household energy use: Applying behavioural economics to understand customer decision-making and behaviour" (January 2015) Renewable and Sustainable Energy Reviews

16 Opower, Designing for Action – Opower's five principles, 14 May 2013 http://www.slideshare.net/sawendel/opowers-5-principles-of-action-design-meetup-05-1413

EFFECTIVE ENGAGEMENT

It is important for distributors to explain how they have balanced the trade-offs between the pricing principles in the National Electricity Rules. This is because the implementation of network tariff reform is more likely to be successful where the process has been transparent, and customer and retailer preferences for tariff design – and the pace of change – have been taken into account, including through effective engagement.

Distributors when preparing their initial TSSs engaged extensively with customers, government, electricity retailers and interested stakeholders to develop proposed demand tariffs and customer impact analyses. These actions included:

- Developing customer engagement strategies;
- Preparing consultation papers that set out the distributor responses to stakeholder submissions;
- Commissioning research reports;
- Preparing reports based on stakeholder submissions and research; and
- Undertaking workshops, teleconferences and face-to-face meetings with stakeholders.

This process increased the transparency of distributor decision-making and enabled customer and retailer preferences to be reflected in tariff design.[17]

DESIGNING COST REFLECTIVE TARIFFS

This Section looks at how the pricing principles are being applied to introduce more cost reflective network tariffs, both internationally and in Australia. This covers both:

- Primary choices in network tariff design; and
- Choices within the preferred network tariff design.

Primary choices in Network Tariff Design

Existing flat rate tariffs and inclining block tariffs, with a high usage component and a low fixed component, are not cost-reflective. Inclining block tariffs are reasonably common in Australia and are offered in South Australia, New South Wales and Victoria. They are not cost-reflective because most of the largely fixed network costs are recovered from customers based on the amount of electricity they use.

Box 3 explains a number of tariff design options.

It is increasingly recognised – both internationally and in Australia – that demand tariffs are a more cost-reflective option and promote the pricing principles discussed above. This is because they:

- Recover network costs by charging customers for the amount of network capacity they use– the primary driver for network costs used during a billing period;
- Minimise cross-subsidies;
- Incentivise customers to shift their time of consumption to reduce their bills and the need for new network investment to supply peak demand;
- Reduce network costs through improving utilisation and load factors by encouraging peak shifting;
- Can be relatively simple for customers to understand and respond to; and
- Reduce prices at off-peak times and charge more at peak times, which gives customers an opportunity to respond by shifting consumption where practicable, and so manage their bills.

17 See for example: www.energex.com.au/about-us/corporate-responsibility/connecting-with-you/customer-engagement-strategy

Box 3: Types of network tariffs

Declining block tariffs

A declining block tariff is a more cost-reflective tariff than a flat rate tariff[18], and does not require a change in the electricity meter. A declining block tariff recovers most of the fixed costs in the first or second consumption block and, like a fixed component, achieves a better reflection of the cost structure of providing the service.

Declining block tariffs are now being used in New South Wales for residential and small-to-medium customers.

Time-varying (dynamic) tariffs

A time-varying tariff can be designed in a number of ways. The most common categories of time-varying rates are Time-of-Use (ToU), Critical Peak Pricing (CPP), Peak Time Rebates (PTR), and Real Time Pricing (RTP).

Generally ToU network tariffs recover network costs by charging higher rates for electricity consumption at peak times during the day, and may charge higher rates according to the season (depending on whether the network has a summer peak or a winter peak). Time of use tariffs can be based on either energy consumption or peak demand.

However, a ToU price signal may be too weak and imprecise to achieve changes in customer behaviour during the few days of the year when electricity demand on the network reaches its maximum. A critical peak price provides a stronger signal than a ToU tariff by charging high peak prices during critical peak periods and low prices at other times.

There may also be practical and implementation issues in applying critical peak pricing to residential and small-to-medium business customers across broad areas, where network operating conditions may vary. Further, it will depend on the metering technology available to customers.

Demand tariffs

Distributors can apply a demand charge ($/kW) in addition to collecting a monthly fixed charge ($/month) and a variable energy charge ($/kWh). A demand charge is based on a customer's maximum kW demand over a specified time period – for example, the monthly billing cycle. It is typically based on the customer's maximum demand across all hours of the month or on their maximum demand during peak hours of the month, or sometimes on both.

Currently demand tariffs are offered to significant numbers of large commercial and industrial customers across Australia, and will require smart meters to become available to residential and small-to-medium business customers.

Customers might be more likely to understand and respond quickly to demand tariffs compared to other options because:

- Demand tariffs are an additional component and are not a fundamental re-design of the existing tariff structure;
- Networks already apply demand tariffs for industrial and commericial customers and have expertise and well established practices for assisting customer understanding of such tariffs; and
- Stability in network peak periods results in stable demand tariffs.

Demand tariffs can also result in more equitable charges for customers placing a burden on the grid, provide customers with distributed generation with bill savings, and open up the potential for an improved customer experience using load management tools.

Demand tariffs are a promising step in the direction of more sophisticated rate structures which incentivise optimal deployment and grid integration of customer-sited DERs. Such tariffs will facilitate innovation in the form of battery storage, smart appliances, smart thermostats and home demand management systems, as customers are better rewarded for their efficient consumption and production decisions.

In addition, recovering the costs of network capacity through a demand tariff rather than solely through a fixed charge, avoids the challenge of automatically increasing bills for small customers, a common argument against high fixed charges.

In summary, a demand tariff can benefit all customers through reduced infrastructure investment and better integration of distributed generation.

The RMI recently assessed four different types of cost reflective tariff being applied in the US. The RMI found that, of the four cases analysed, residential demand tariffs have the largest potential to deliver significant per customer bill savings. This is explained in Case Study 3.

Similar conclusions were reached in a study by Energeia for the ENA. This study indicated that demand based tariffs are likely to perform better as they are more cost-reflective.

As shown in Figure 5, Energeia found that network price increases over the next 20 years are minimised under the scenario involving the introduction of a seasonal time-of-use maximum demand tariff. This is because demand tariffs provide signals for efficient investment in distributed generation, resulting in lower network costs.

18 Whether a declining block tariff is more cost reflective than an inclining block tariff will depend upon the relative design and structure of these tariffs.

Case Study 3: Relative value of residential demand charges in contributing to customer bill savings[19]

An August 2015 study by the RMI examined the "economics of demand flexibility" for residential customers under two scenarios, where two cases were analysed for each scenario.

The first scenario involved providing bill savings to customers by shifting energy use under granular utility rates. The RMI studied the use of:

- Residential real-time pricing by Commonwealth Edison in Illinois; and
- Residential demand charges by the Salt River Project in Arizona.

The second scenario involved improving the value of customer-sited distributed energy resources. The RMI studied the use of:

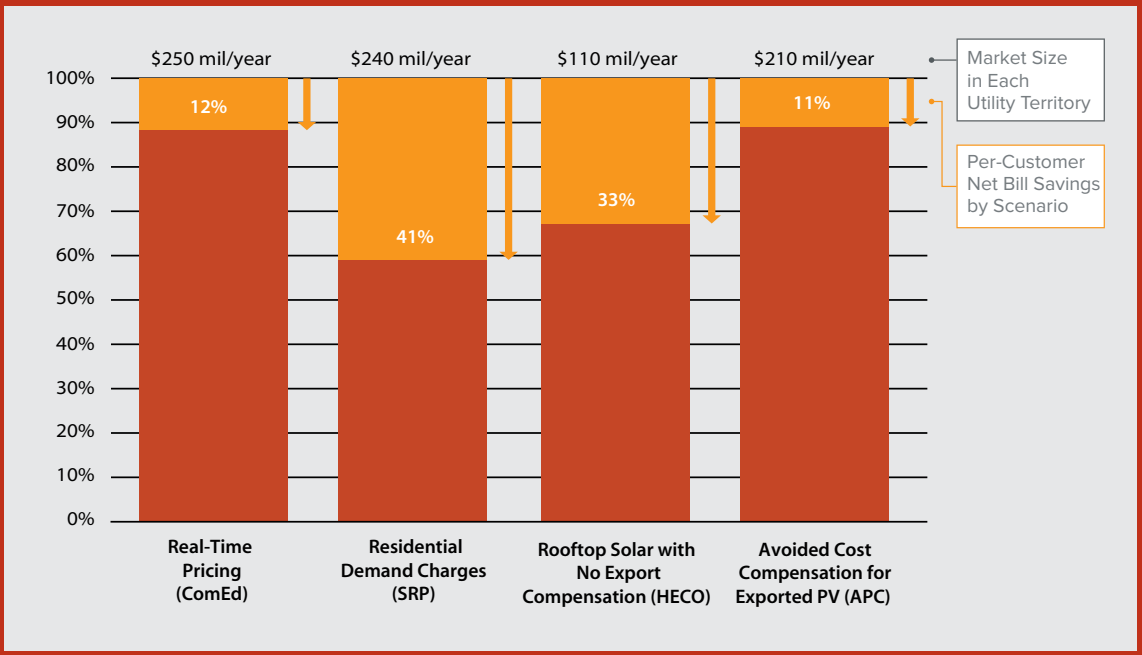
- A non-export option for rooftop PV by the Hawaiian Electric Company; and
- Reduced compensation for exported PV by the Alabama Power Company.

RMI found that, of the four cases analysed, residential demand charges have the largest potential to generate significant per customer bill savings. It found that participating customers can save US$1,100/year, or 41 per cent of total bills, net of the cost of enabling technology. This compared with savings of 11 per cent to 33 per cent under the other three cases.

The study recommended that to capture the benefits for customers, tariff design should:

- Be more granular by unbundling components of usage (e.g. energy, capacity, ancillary services) and adding temporal (e.g. peak / off-peak energy and capacity) and locational components;
- Not preference specific technologies in tariffs and instead reflect marginal costs;
- Enable customers to choose rate structures of varying granularities according to their preferences and the availability of technologies to enable cost reductions; and
- Introduce new default options based on alternatives other than just volumetric energy charges so that more customers can benefit from demand flexibility than are currently enrolled in opt-in arrangements.

Demand Flexibility Annual Potential By Scenario



19 RMI, The economics of demand flexibility - how "flexiwatts" create quantifiable value for customers and the grid, August 2015 - available at www.rmi.org/Knowledge-Center/Library/RMI-TheEconomicsofDemandFlexibilityFullReport

Energeia's analysis indicated declining block tariffs/fixed tariffs initially provide benefits but may drive customers from the grid inefficiently if used over the long-term. Energeia's analysis is explained in Case Study 4.

In November 2015, the Brattle Group reported that 19 USA utilities were offering residential peak demand charges.[20]

In May 2015, the RMI examined utilities in the USA that have implemented demand charge options for residential customers in what it foreshadowed as "the next big thing in electricity rate design". The Institute argued:

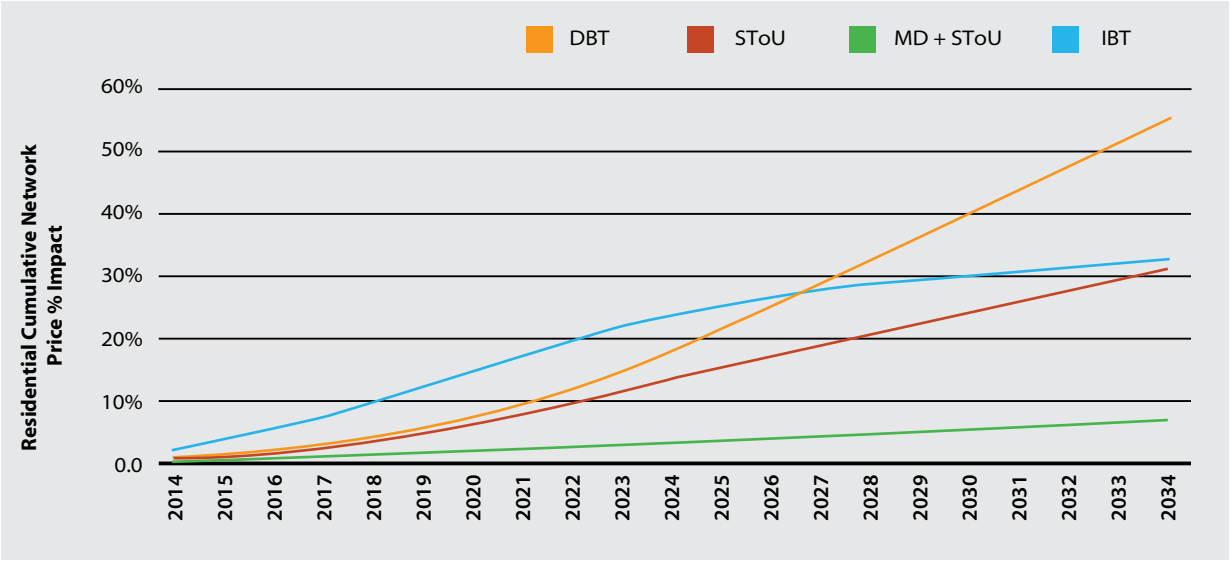
> Demand charges are a promising step in the direction of more sophisticated rate structures that incent optimal deployment and grid integration of customer-sited DERs. A demand charge more equitably charges customers for their impact on the grid, can reward DG [distributed generation] customers with bill savings, and opens up potential for an improved customer experience using load management tools. It can also benefit all customers through reduced infrastructure investment and better integration of renewable, distributed generation.[21]

Demand charges also have been introduced in a number of European countries including France, Italy and Spain. In Sweden, some distribution networks introduced a demand-based time-of-use tariff in 2006. This tariff comprised a fixed access charge and a variable demand charge calculated on the average of the five highest meter readings in peak hours. In off-peak hours (between 7pm and 7am) the demand charge is set to zero. In addition, the rate of the demand tariff varies between the summer and winter seasons.[22]

Studies into the introduction of demand-based network tariffs in Sweden have shown that the majority of households have benefited financially from the introduction of such tariffs. The studies also found that households were generally sympathetic to demand charges, given that the motive for introducing the tariff related to environmental issues.

These studies demonstrated that most households adjusted their behaviour by running appliances in the off-peak period, which resulted in a material decrease in the coincident peak in both winter and summer seasons.[23]

Figure 5: Energieia Modelling of Cumulative Network Price Increases by Tariff Scenario and Customer Class to 2034



20 The Brattle Group, The movement towards deploying demand charges for residential customers, 8 November 2015, page 3 – available at www.brattle.com/system/publications/pdfs/000/005/218/original/The_movement_towards_demand_charges_for_residential_customers_%2811-06-2015%29.pdf?1447203185

21 Rocky Mountain Institute, RMI Outlet - Are Residential Demand Charges The Next Big Thing in Electricity Rate Design?, 21 May 2015 – available at http://blog.rmi.org/blog_2015_05_21_residential_demand_charges_next_big_thing_in_electricity_rate_design

22 See, for example, "Estimating Response to Price Signals in Residential Electricity Consumption" by Yizhang Huang – available at www.diva-portal.org/smash/get/diva2:681554/FULLTEXT01.pdf

23 Rocky Mountain Institute, RMI Outlet - Are Residential Demand Charges The Next Big Thing in Electricity Rate Design?, 21 May 2015 – available at http://blog.rmi.org/blog_2015_05_21_residential_demand_charges_next_big_thing_in_electricity_rate_design

Case Study 4: Customer impacts of tariff design choices[24]

In 2014, the ENA engaged Energeia to assess the long-term effects on customer bills of the main options for cost reflective network tariff design. The tariff structures were assessed in terms of how efficiently they signaled the incremental network cost of supply (i.e. during peak) and the cost of the network service. Four network tariff design options were considered: inclining block tariff (IBT); declining block tariff (DBT); seasonal time-of-use energy (SToU); and seasonal time-of-use maximum demand (MD+SToU).

The study found that tariff design choices:

- Significantly influence customer behaviour, including DER investment patterns. Customers are more likely to invest in solar PV beyond efficient levels under the less cost reflective network tariffs, being the IBT and DBT tariffs. Customers are more likely to invest in residential storage under SToU than MD+SToU because of over-signalling of peak period network costs under the SToU, leading to storage becoming cost effective earlier, under SToU;
- Have different effects on network peak demand and avoided capex. It found that SToU and MD+SToU tariffs deliver almost twice as much network peak demand reduction and avoided capex as IBT and DBT tariffs. Further, it found that MD+SToU provides the same level of network benefits as SToU with about half the investment in residential solar PV and one fourth the investment in residential storage; and
- Impact the magnitude of network price increases, with MD+SToU providing the highest overall level of price stability. This is because it is the most cost reflective tariff and reductions in network costs are reflected in reduced network revenues.

The study also:

- Compared the community net benefits under IBT to the three other tariff options. It found that moving to the most cost reflective tariff - MD+SToU - could save customers $17.7 billion in present value terms over a 20 year analysis period;
- Found that by 2034, the passive customer could pay a third more for its electricity than the equivalent customer who adopts DER, although moving to MD+SToU tariffs would result in more equitable outcomes between customers with and without DER; and
- Found that the more cost reflective the tariff, the lower the cross-subsidy and more equitable the bill outcomes, with MD+SToU delivering the lowest cross-subsidies for residential customers.

CHOICES WITHIN DEMAND TARIFF DESIGN

A demand charge applies based on a customer's actual maximum demand in dollars per kilowatt (kW) or dollars per kilo-volt amp (kVA). There are various options within the design of a demand-based tariff.

Customers may be charged for capacity based on monthly or annual maximum demand, contracted capacity or on the extent to which the customer's demand coincides with system peak demand:

- A maximum demand charge is based on the actual maximum demand (kW/kVA) that is recorded between defined times;
- An average maximum demand charge is based on the average maximum demand (kW) that is calculated based on demand recorded across a defined period; and
- A capacity charge is based on the agreed or authorised maximum energy requirement at a connection point (in $ per kW or kVA) across a defined period.

Other design choices include:

- Time interval of demand measurement (i.e. 1 hour or 15 minutes) - there are tradeoffs between the degree of precision and customer acceptance of the particular tariff;
- Definition of peak demand period – the peak can differ by location across a network;
- Different rates for different types of customer – should the tariff vary by connection size or location of customer as a means to provide a more precise signal?
- Seasonality – is there a need to distinguish between summer and winter peak periods – is there a difference in the implications for network investment between these two peaks?
- Relationship to other charges, such as fixed charge or energy charge – what costs are being signaled through these different components and is there any over-lap?

An important question for the distributor to consider is the degree of granularity available in the demand tariff design – and whether certain customers can select a higher level of granularity in the tariff structure than other customers.

24 Energeia, Network Pricing and Enabling Metering Analysis - Prepared by ENERGEIA for the Energy Networks Association, November 2014 – available at http://www.ena.asn.au/sites/default/files/energeia_network-pricing-and-enabling-metering-analysis_november-2014_1.pdf

For instance, a "monthly maximum demand charge" may perform comparatively well against some of the design principles discussed at Section 3, such as simplicity and pricing stability. In addition, the design of such a tariff can help to ingrain behavioural change.

By contrast, a "maximum demand charge" assessed once annually may perform better against economic efficiency, by more closely reflecting the cost drivers, but may be more difficult for small customers to receive and respond to during the early stages of network tariff reform. Similarly, demand charges which are based on a system peak demand event – rather than the customer's own maximum demand – might be more efficient and take account of natural "diversity" across the customer base.

While there might be a preference for simple, bill stabilising choices for customers – which could be more appropriate for universal network tariff reform in the first wave – future reforms should not disregard the opportunity to progressively increase the granularity and diversity in the demand tariff in the long-term interest of customers. As illustrated in the two waves of Figure 1, there is a range of ways in which such signals could be introduced, including tariffs, rebates or other market mechanisms. When assessing the potential complexity of introducing highly granular options, the ability of customers to receive and respond to these tariffs needs to be considered.

Distributors will therefore need flexibility to engage effectively with their customers to determine demand tariffs, which best meet their customers' needs.

DEMAND TARIFFS IN AUSTRALIA

A number of distributors have identified demand tariffs as a preferred basis of charging for residential and small business customers in the "first wave" of tariff reform – noting that many larger customers have been charged on this basis for many years.

For example, United Energy introduced a residential seasonal demand time of use tariff on 1 July 2015 (see Case Study 5).

In their TSSs that they recently submitted to the AER, all distributors in the NEM, other than those in NSW, proposed new tariffs that include either a monthly or seasonal demand charge. These charges would change customers' incentives by encouraging them to consider reducing the maximum they take from the network during the peak period. Even if a customer still uses the same total energy, they would benefit financially if they can reduce their peak demand.

Case Study 5: United Energy's seasonal demand time of use tariff[25]

United Energy introduced a new seasonal demand time of use tariff on 1 July 2015 for its residential customers, as an initial step towards more cost reflective tariffs. The tariff comprises three elements: a peak demand charge; an anytime usage charge; and a fixed charge. The tariff, which is available to customers on an opt-in basis, seeks to better align individual customers' use profiles with their resultant network cost.

United Energy provided a 10 per cent discount on this tariff as an incentive to retailers and customers. United Energy's analysis shows that:

- 58 per cent of its customers would be automatically better off on this tariff; and
- Customers with a flatter demand profile generally benefit most from this tariff.

United Energy's intention is to provide a more cost reflective pricing structure that:

- Reduces cross-subsidies between different types of residential users;
- Reduces network investment as customers respond to price signals by shifting discretionary load to off peak periods and reducing load in peak demand periods; and
- Introduces cost-reflective signals for the next wave of technological change.

25 United Energy, Tariff Structure Statement 2017-20 – Shape our energy future together - available at https://uemg.com.au/media/46319/ue_tss_submission_20150925.pdf

SECTION 4 CUSTOMER IMPACT ANALYSIS

To be effective, tariff reform must apply detailed analysis of the likely impacts on network customers. This is essential for designing both the appropriate structure to the tariffs and the transition path – to help manage customer impacts and foster community support for the changes to the tariffs.

A foundation of any change to network tariffs is for distributors to conduct customer impact analysis before implementing any new tariff. The pricing principles in the National Electricity Rules address the potential impacts on customers of the transition to new network tariff structures.

As noted in Section 3, one principle in the NER requires distributors to consider the impact on customers of changes in network tariffs. This recognises that customers are more likely to be able to respond to price signals if those signals are consistent and apply for a reasonable period.[26]

The reason for conducting such detailed analysis is more than just understanding how best to foster demand response. It will also:

- Enable the distributor to engage transparently with stakeholders to develop a shared understanding of the reasons for network tariff reform, including the magnitude of the potential benefits; and
- Help to inform solutions and transition pathways to better manage customer impacts, including for vulnerable customers.

This Section 4 sets out some of the key features of effective customer impact analysis drawing on international and Australian experiences.

It is important to recognise that the quality of analysis will likely improve over time, as data availability improves with smart meters becoming more widely available, and real-life learnings are gathered and shared about how customers respond.

As new tariffs are introduced, distributors will start to gain actual data on customers' behavioural responses. distributors will not only glean information from their own experience about what has worked well, and less well.[27] They will also have the opportunity to learn from the experience of other distributors. However, caution is required in comparing movements in peak demand between different networks or in predicting how peak demand on one network may change on the basis of another distributors experience.

FEATURES OF EFFECTIVE CUSTOMER IMPACT ANALYSIS

Quantify starting position through analysing existing cross-subsidies

A clear understanding of the nature and extent of the cross-subsidies that are inherent in existing network tariffs will enable stakeholders to gauge the distortionary effect that these tariffs are having on investment in both the network and new technologies.

This analysis should quantify the current cross-subsidies as well as the future cross-subsidies, which are likely to exist including those arising from the take-up of DER. For example, the analysis described in Case Study 2 above, found cross subsidies of $95 million per annum for households with air-conditioners and solar PVs under the current network tariff structure in Queensland.

By providing the results of this analysis to governments, retailers and customers, distributors can promote a shared understanding of the problems with the current tariffs and of the need and rationale for network tariff reform.

26 AEMC, National Electricity Amendment (Distribution Network Pricing Arrangements) Rule 2014, Rule Determination, 27 November 2014, p. iii.

27 The ability of distributors to model such data fully may be limited if they do not also have certain customer data, for example on demographics and household technologies.

Case Study 6: Maximum Demand Tariff Analysis Report for Ergon Energy

In 2015, Ergon Energy engaged Energeia to analyse the potential for maximum demand based tariffs for residential and small to medium sized business customers, to achieve fairer and more affordable outcomes than the current tariff set.[28]

The study found that for Ergon Energy:

- Tariffs with a demand based element generally performed better than their current tariffs, with the greatest benefits arising for residential customers due to substantial savings in community costs and the removal of cross subsidies;
- Tariffs using more peak periods generally performed better than those tariffs using a single maximum demand period; and
- Tariffs that measure the average demand in the peak period over the top four peak demand days are more resistant to uneconomic bypass when combined with an off-peak demand charge and energy usage charge.

On this basis, the study recommended a tariff for Ergon Energy for its residential and small to medium sized business customers that comprises:

- An average top four demand days with extended daily peak charging mechanism; and
- A residual component with a combination of an off-peak demand charge with a minimum chargeable demand and consumption-based pricing.

Estimate long term outcomes of tariff design choices

In addition to analysing the short-term outcomes for customers of removing current cross-subsidies, there could also be value in modelling the long-term outcomes of tariff design choices for efficiency and equity.

This could include behavioural modelling supplemented by customer engagement to determine customer perceptions and awareness of tariff choices. This would provide insights into how customers might react to tariff changes and their capability and willingness to respond.

An important contribution to the design of the demand charge is identifying the appropriate time window for the peak demand period (see Case Study 6). This should be the time period during the day when peak demand places greatest constraints on the electricity network. Reducing peak demand at such times should lead to lower future network investment and hence electricity price savings for customers.

AN IMPORTANT FACTOR IN THE DESIGN OF THE DEMAND CHARGE IS THE TIME WINDOW FOR THE PEAK DEMAND PERIOD.

The timing of peak demand could vary across a distributor's network area depending on load profile, customer characteristics and climate conditions within different feeder areas. The timing of peaks could also vary by seasons, largely depending on whether winter heating load or summer air conditioning load predominates in a region. Electricity networks also typically have lower capability in summer.

Selecting the peak demand period will affect the estimates of the long-term benefits of reform through the forecast customer response. Having a long period could limit the ability of customers to shift consumption to off-peak periods. However, a shorter period might not capture all the peaks across the network therefore limiting the ability of a demand charge to defer future investment.

Given the complexity of these various factors, a sensible initial step in the transition might be to emphasise to customers the benefits of spreading out their consumption across time. That is, distributors and retailers could advise customers to not turn on all their appliances at once during the peak period. Customers might find this a simpler first step than an immediate and possibly significant shift in their time of consumption.

A further step might be to make the peak demand period to be dynamic, as load shifting might create another peak and move the window. This could potentially be managed by the period having some headroom at the extremities.

28 Energeia, Maximum Demand Tariff Analysis Report - Prepared by ENERGEIA for Ergon Energy, April 2015 – available at www.ergon.com.au/__data/assets/pdf_file/0006/261618/Energeia-Maximum-Demand-Tariffs-Analysis-Report.pdf

Analyse network bill impacts

The management of customer impacts requires quantitative analysis of the effects on diverse customer segments of moving from the current network tariffs to more cost-reflective tariffs. To maintain credibility and trust in the implementation of tariff reform, it is desirable for distributors to transparently identify customer impacts and provide a clear focus on transitional support for those customers who are likely to be "worse off" in transition.

This analysis could examine:

- The demographic characteristics of affected customers to understand, in particular, how vulnerable customers are likely to be affected by price changes. This will, in turn, inform any need to modify and adapt the proposed nature and timing of the network tariff reform and other supporting elements such as targeted customer support; and
- The potential for customers' demand response to reduce network bills over time.

For each customer segment, the impact of tariff changes could be simulated using real data and the best available models tailored to a network's system conditions. Sensitivity analysis could be performed in the course of such modelling to capture the range of uncertainty in forecasting impacts.

Estimating the potential customer response requires an understanding of the price driven customer response in the empirical studies and pilots, as well as the capability to tailor the information to a network's conditions. It will be affected by whether the tariff is applied on an opt-in or opt-out basis. Results also could be calibrated to take into account network characteristics such as weather conditions, load profile, penetration of air-conditioning and existing tariffs.

This analysis will take time to undertake and will be affected by the availability of metering data. Such modeling will help to inform the appropriate transition pathway to cost reflective tariffs. This is discussed further in the next Section.

One example of customer impact analysis is the research published by Energex as part of its proposed reforms (see Case Study 7). Energex found that 58% of its customers would be better off as a result, however its other customers would be worse off. The Case Study explains the assistance and transition measures Energex has developed or proposed for those customers.

Case Study 7: Energex residential customer impact study[29]

Energex prepared a Customer Impact Statement that quantifies the financial impact of its proposed new cost reflective network tariffs that form part of its TSS that was submitted to the AER on 27 November 2015. Energex's study, which it undertook in conjunction with the CSIRO, analysed 16 different residential customer cohorts using load profile data, in the absence of half hourly metering data. The following table details the annualised bill impact of all of Energex's sample customers.

Customers better off			Customers worse off		
>10%	5-10%	0-5%	0-5%	5-10%	>10%
31%	15%	12%	13%	10%	20%

Energex's analysis found that 12 of the 16 residential customer cohorts it examined are likely to have more customers that are positively impacted by tariff reforms than are negatively impacted, with the remaining four cohorts having more customers that are negatively impacted. However, Energex found that:

…..a significant number of customers in each customer group might be facing an increase in their annual electricity bill of 10 per cent or more. These results highlight the need to develop tools, such as education material, that will enable customers to mitigate some of the negative impact they might experience from demand tariffs.

Accordingly, Energex has developed tools to enable stakeholders to estimate average annual residential bills under tariff reforms. It is also proposing to apply a bill protection mechanism to mitigate the negative financial impact of demand-based tariffs to residential customers.

The analysis of network bill impacts across different customer groups can be used to consider how these effects can best be managed, including the appropriate transition pathway. There are various options available and the appropriate mechanism could differ by customer type and over time. These options are discussed in the next Section, which describes the enablers of successful network tariff reform.

Case Study 8 provides an example of analysis of customer load shifting following the mandated introduction of time of use tariffs in Ontario, Canada.

29 Energex, Customer Impact Statement - Tariff Reform - Energex Limited 2015 - 2020, 4 September 2015 – available at www.energex.com.au/__data/assets/pdf_file/0009/280287/Energex-Tariff-Reform-Customer-Impact-Statement-4-September-2015-2.pdf

Case Study 8: Impacts of time of use (TOU) tariffs on customer usage profiles[30]

In 2015, Ahmad Faruqui and others undertook a study that examined the impacts of TOU tariffs on customer usage profiles in Ontario, Canada, where, from 2009, local distribution companies (LDCs) began transitioning all of their regulated rate customers onto a regulated TOU rate. This transition was the result of a mandate by the provincial government, which also mandated the installation of smart meters.

The study examined four LDCs that represent about 50 per cent of the Ontario population. It examined residential customers for all four LDCs and the general service customers (with demands less than 50 kW) for two LDCs.

The study estimated load shifting impacts, energy conservation impacts, and conservation and substitution elasticities for the summer, winter and peak demand months (June, July and August).

The study found that there were negligible or insignificant overall impacts on overall energy conservation due to the TOU rates but:

- For residential customers there was evidence of load shifting across all LDCs, with reductions in usage in the peak and mid-peak periods and increases in the off-peak periods, with generally greater reductions in the peak than in the mid-peak periods; and
- For general service customers there was some evidence of load shifting across all LDCs, with small reductions in usage in the peak and mid-peak periods and small increases in the off-peak periods, but these were far smaller, and less distinct, than those for residential customers.

The study concluded that residential customers show more consistent patterns of load shifting behaviour under TOU tariffs than general service customers and that general service customers are less responsive to the TOU prices than residential customers.

Incorporate findings from engaging with customers

Modelling analysis of the effects of different tariffs on different customer types may provide only an incomplete picture of potential customer impacts. For the reasons discussed in Section 3, network tariffs should be designed with regard to current insights into customer behaviour and preferences trends. Otherwise, they might not give effect to the guiding design principles.

Such analysis should be supplemented by market research and engagement. This could inform tariff design in two areas:

- Customers' understanding of network tariff reforms; and
- Potential customer behaviour under different tariff options.

Assessing customers' conceptual understanding of the proposed new demand charges and the reasons for tariff reform will help distributors to plan and manage engagement with them on the structure of network tariffs.

This analysis also can inform the nature and extent of any transition, which might be required to facilitate implementation of network tariff reform. It also will indicate whether particular responses need to be developed for specific customer segments.

30 Faruqui, Sergici, Lessem and Mountain, Impact Measurement of Tariff Changes when experimentation is not an option - a case study of Ontario, Energy Economics 2015

SECTION 5 NETWORK TARIFF REFORM IMPLEMENTATION

The implementation of new tariffs will be a key driver of the success of tariff reform. Engaging and supporting customers through the implementation period is essential. This activity will include determining the best transition paths to cost reflective tariffs for different customer groups.

Successful network tariff reform requires coordination between distributors, governments retailers and customer advocates to engage, and seek buy-in from, customers.

How customers perceive and respond to the introduction of cost reflective tariffs will determine the success of the tariff reform. If the impacts of reform are not properly managed, or there is a lack of information and support provided to customers, there is a risk of a negative reaction from customers, which could impede future waves of tariff reform.

There are various ways distributors, governments and retailers could manage the impact of the network tariff reforms on customers' bills. These include:

- Providing tools and information to customers to equip them to make informed responses to the new tariffs;
- Considering alternative transition pathways that meet the needs of diverse customer segments and in particular, vulnerable customers;
- Sharing modelling and load profile analysis with stakeholders; and
- Ensuring there is appropriate customer protection for vulnerable customers in genuine need.

The mix of these responses that is likely to be required in implementing any network tariff reform will depend on the nature and diversity of customer load, the point in the investment cycle of the network and government policy.

As discussed in Section 4, detailed customer impact analysis supported by learnings from engaging with customers and behavioural theory, will be required to appropriately design the implementation stage of network tariff reform.

This Section considers the design of the implementation stage of tariff reform and discusses:

- The transition to cost reflective tariffs using either opt-in or opt-out approaches;
- Options to tailor the transition path to cost reflective tariffs;
- The interaction between the rollout of smart meters and the transition to cost reflective tariffs; and
- Supporting customers to make informed decisions.

This discussion on tariff implementation focuses on the aspects that are within the control of the distributor. The next Section discusses related elements, which rely on government and collaboration with other parties.

TRANSITIONING TO COST REFLECTIVE TARIFFS USING ASSIGNMENT, OPT-IN OR OPT-OUT APPROACHES

There are a number of broad approaches for transitioning customers to cost reflective tariffs. Where customers have a meter which enables cost-reflective pricing they could:

- Be assigned to a cost-reflective tariff;
- Be assigned to a cost-reflective tariff as the default rate and given a choice to opt-out; or
- Be given a choice to opt-in to a cost-reflective tariff.

There are also potential hybrid variations on these options in which a proportion of customers opt-in while others (such as residential customers with large loads) opt-out. In addition, customers who are mandatorily assigned to a cost-reflective tariff could be given the option to choose between variations in the design of the tariff.

Implementing tariff reform on an opt-in basis reduces the risk that customers will be surprised by a bill change but relatively few customers may actively choose to move to cost reflective tariffs under this option. A large body of empirical work and behavioural economics studies have shown that customers have strong attachments to their current default tariffs and do not want to risk a loss, regardless of whether they might be better off on a different tariff. This is commonly referred to as "default bias".

Where customers are assigned to cost-reflective network tariffs, with the ability to opt-out as a default, the evidence is that retention rates remain high and the benefits from tariff reform are high. Analysis by The Brattle Group of customer enrolment in time of use rate options across a number of US States found that:[30]

- On an opt-out basis, 80 per cent (or more) stay on the tariff; and
- On an opt-in basis, 25 per cent (or fewer) take it up.

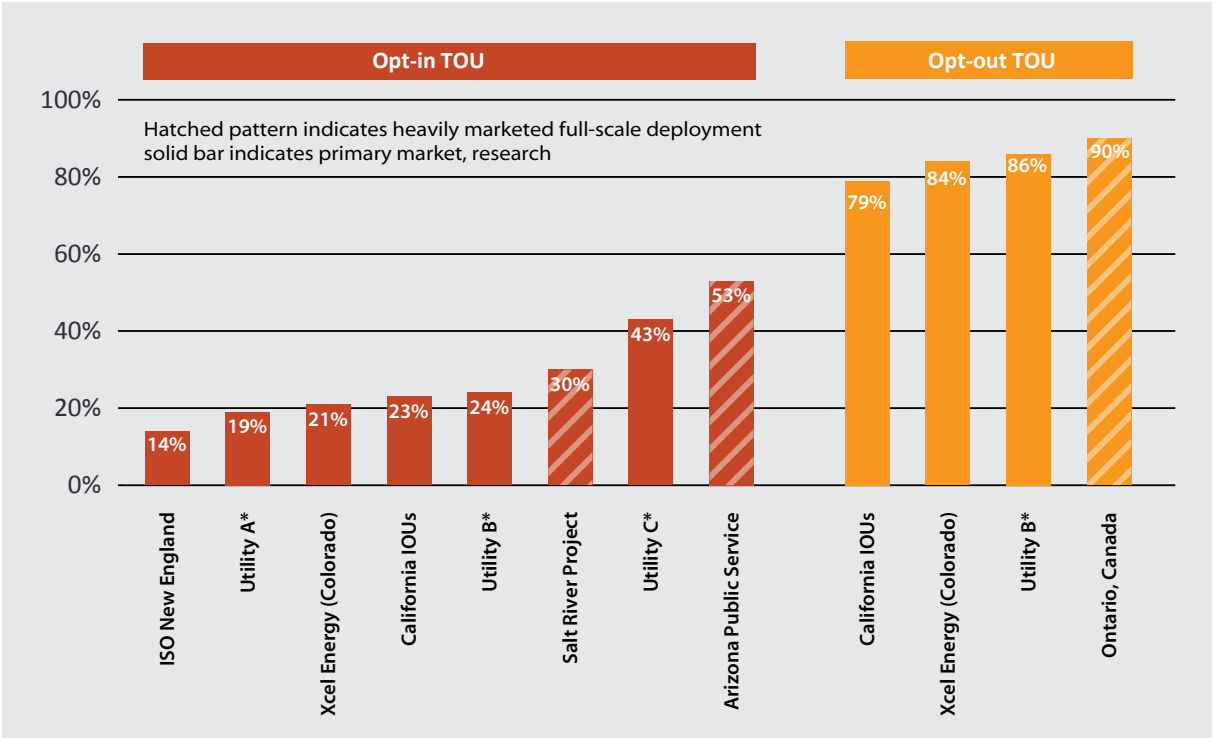
This US experience highlights the value of assignment or opt-out in supporting customers to capture the benefits of demand tariffs. Where customers are allowed to opt-in, the evidence points to the tariff reform suffering from low participation. This is despite the evidence that a significant proportion of customers would immediately be better off, and reflects the influence of customer preferences discussed in Section 3. This perpetuates existing cross-subsidies so that:

- Some customers are paying more than the cost of their service – regardless of whether they are more financially capable of bearing the burden; and
- Other customers are paying less than the cost of their service – regardless of whether they require such a subsidy.

Overseas evidence is typically based on an integrated distributor-retailer model. The separation of retail and networks businesses in Australia has implications for the transition pathway, and the effectiveness of an opt-in program. Under an opt-in approach, it will be the retailer who decides the tariff offered to the customer.

Network tariff reform should recognise that the engagement of customers with a cost-reflective tariff will be different under an opt-out or assignment model than an opt-in model. Under an opt-out approach, there will likely be a larger cohort of customers on the cost-reflective tariff with lower levels of engagement, including some who need supportive tools and information and others who do not engage because they are indifferent to the cost-reflective price signal.

Figure 7 US Residential TOU Enrolment Rates



Source: The Brattle Group, Rolling Out Residential Demand Charges, May 2015, slide 23

30 The Brattle Group, Rolling out residential demand charges – presented to EUCI Residential Demand Charges Summit – May 2015 – available at www.brattle.com/system/publications/pdfs/000/005/170/original/Rolling_Out_Residential_Demand_Charges_Hledik_EUCI.pdf?1431628444

The participation rate of opt-in programs could potentially be increased through the design of customer engagement and support mechanisms. The vertically integrated Arizona Public Service[31] has achieved an 11 per cent adoption rate for its residential demand charge and over 40 per cent for its voluntary TOU through:[32]

- Leveraging its retail point of sale to educate customers on their rate options and the best rate fit;
- Including load control technologies with the demand charge; and
- Retaining default inclining block rates.

The experience in Australia largely reflects the international experience. In Victoria, the mandated roll out of smart meters has been completed. The case for this roll out was premised on the value of the future benefits which the information collected by the meters could deliver through the design and application of more cost reflective tariffs. Many of these benefits are unlocked by cost reflective time of use tariffs.

This was recently highlighted by the Victorian Auditor-General, which highlighted the importance of the uptake of "flexible pricing" to realising the full benefits of the smart meter rollout.[33]

The Victorian Government has applied an opt-in policy so that customers need to choose to move to time-of-use pricing for it to apply to them. To date, fewer than 1 per cent of Victorian customers have opted-in to time-of-use pricing following the roll out of smart meters and the introduction of flexible pricing.

Local and international experience suggests that compulsory assignment of customers with smart meters to a demand tariff – either with or without allowing them to opt-out – will increase the benefits from network tariff reform (see Case Study 9).

There is potential to lose some control of the customer impacts of the transition under an opt-in approach when a distributor operates under a revenue cap. For example, if all "better off" customers transition to the new cost reflective tariff then the remaining customers must pay the residual to make up the revenue cap. This may result in effectively transitioning without controlling individual customer impacts.

Case Study 9: In favour of opt-out - the case for default time varying rates in the US[34]

Faruqui, Hledik and Lessem have estimated that US customers are paying about US$7 billion per annum more in electricity retail charges by virtue of default flat rate pricing than they would if they were paying based on time varying rates (TVR). They have also assessed that flat rate pricing is contributing to about US$3 billion in cross-subsidies between customers per annum.

They examined full scale deployments and market research studies in the US and elsewhere in order to analyse:

- The difference between residential time of use (ToU) enrolment levels under default flat rates (with the option to opt-in to ToU) and those under default ToU (with the option to opt-in to flat rates); and
- The difference between critical peak pricing (CPP) enrolment levels under default flat rates (with the option to opt-in to CPP) and those under default CPP (with the option to opt-in to flat rates).

The study presented results based on a hypothetical utility with 1 million residential customers and a coincident peak demand of 2,000 MW. It indicates that the reduction in peak demand increases from 34 MW under opt-in ToU to 57 MW under default ToU and from 72 MW under opt-in CPP to 149 MW under default CPP.

The authors concluded that changing the default tariff structure from one based on flat rates to one based on TVR will result in significant economic gains and reduce cross-subsidies between customers, whilst preserving customer choice.

31 Arizona Public Service is an integrated network and retail utility.

32 Residential Demand Rates: APS Case Study, Grabel, June 2015 - available at www.ksg.harvard.edu/hepg/Papers/2015/June%202015/Grabel%20Panel%201.pdf

33 Victoria Auditor-General, Realising the Benefits of Smart Meters, September 2015 – available at www.audit.vic.gov.au/publications/20150916-Smart-Meters/20150916-Smart-Meters.pdf

34 Faruqui, Hledik and Lessem, Smart by default – Time-varying rates from the get-go – not just by opt-in, Public Utilities Fortnightly, August 2014 – available at www.fortnightly.com/fortnightly/2014/08/smart-default

TRANSITION PATHWAYS TO COST REFLECTIVE TARIFFS

There are two important aspects of the transition pathway to cost reflective tariffs:

- The timeframe for moving from the current tariffs to cost reflective tariffs, and whether the efficiency signal is introduced gradually or in one change; and
- The tools to manage the customer impacts during that transition.

Progressively ramping up the cost-signal in the tariff could be an appropriate way to manage price changes and the proposed transition time could allow customers to understand new tariffs and take action to mitigate the impacts. Alternatively, network tariff reform could be staged to coincide periods of with lower prices.

The timeframe for the implementation of tariff reform needs to consider the market context for its implementation. This includes having regard to:

- The mix of advanced and accumulation meter stock;
- The level of customer knowledge and appetite for change;
- The extent of peak demand growth pressure; and
- The growth in DER, which will drive cross-subsidies – including those arising from prospective growth in solar, falling battery storage costs and the potential for rapid electric vehicle breakthrough deployment.

Distributors will need to evaluate the potential costs, benefits and risk to customers of alternative timings for the implementation of cost reflective tariffs – for example, a very delayed or gradual implementation. Protracted delays in introducing cost reflective pricing could increase the size of cross-subsidies and thereby make tariff reform all the more difficult in the future.

Customer and stakeholder engagement will be important as it will guide the distributor about customers' abilities to understand and preferences for engaging with cost reflective price signals. Also, it will inform the distributor about retailers' reactions to different speeds of implementation.

As discussed in Section 4, another key determinant of the timeframe for tariff reform is the outcome of customer impact analysis – especially for vulnerable customers.

In addition to staging and phasing the implementation of network tariff reform, the following are six ways of managing customer impacts from the introduction of cost reflective pricing – some of which are outside distributors' control and would need to be managed directly by retailers or governments:

- Providing customers with shadow bills during an interim period;
- Providing rebates for technology to assist customers to manage their peak demand levels (e.g. power factor correction equipment for industrial customers);
- Adopting innovative price paths to limit the effects on customers in the early stages and strengthen the signal over time (this might be particularly effective at a time of declining prices);
- Imposing tiered demand charges or ceilings on measureable peak demand (i.e. a maximum price) will limit some of the exposure that customers have to bill risk imposed by tariff reform;
- Applying bill capping to customers' network costs – typically, this would apply for a limited period of time only (see Case Study 10); and
- Providing an on-going "safety net", determined and administered by government.

Customer engagement and information provision will support the effectiveness of these measures.

This suggests that a careful but purposeful approach is required for an integrated, national approach to the implementation of cost-reflective pricing over the coming years – while at the same time retaining a clear understanding of the outcomes (detailed in Section 2) that the reform is seeking to achieve.

It also suggests that there is no single perfect means to design the transition to cost reflective pricing. The appropriate design will depend on a range of factors including government policy, metering technology, the level of customer understanding, and whether cost reflective tariffs are introduced through an opt-in or opt-out approach.

With an opt-out approach, a gradual transition could be more valuable as it will minimise annual bill changes and help avoid bill shock.

Energy management tools could be offered to customers to help them to understand and manage their electricity usage. At the simplest level, such tools should provide information on how much the size of the customer's bill is caused by various end-uses such as lighting, laundry, and air conditioning, and what actions will have the largest effect on their bill.

At the next level, customers can be assisted by a range of in-home tools. These might include:

- Simple "glowing orbs" which change colour to indicate to a household its peak demand consumption;
- The use of simple communications proposed by some customer advocates to broadcast advice to customers about peak demand events, similar to the social marketing used in strategies alerting the public to bush fire events or drought; or
- More complex, real-time in-home displays would disaggregate the customer's power consumption and explain how much they are paying by the hour.

Distributors evaluating these options may consider the insights on human interaction with decision support tools and information, which are available from studies in behavioural economics. These tools include devices that automate conservation (or spread out demand) during peak periods that can help insulate vulnerable customers who are not able to shift load by themselves. More generally, prioritising and subsidising vulnerable customers in the deployment of enabling devices will help them to mitigate bill risk. As discussed in Case Study 1, many customers in hardship could be better off after cost reflective tariff reform.

Case Study 10: Energex financial risk mechanism to support peak demand tariff implementation

Energex in its TSS is proposing a new peak demand tariff comprising a fixed component, a usage component and a monthly maximum demand charge ($/kW/day). The demand charge will be based on the customer's maximum half hourly demand during the 4pm-8pm time period measured on workdays only.

In the next regulatory period, the new tariff will be voluntary and Energex is proposing to introduce a financial risk reduction mechanism (FRRM) as a transitional measure.

The FRRM would apply:

- A cap to the chargeable quantity of 5kW of demand;
- To those residential customers with annual consumption of up to 10MWh; and
- To customers in their first year of adopting the tariff.

INTERACTION WITH THE ROLL OUT OF SMART METERS

The transition to cost reflective pricing will be affected by other factors including inter-jurisdictional differences in metering and customer protection policies, which have developed over time, as well as the extent to which retailers could avoid cost reflective network tariffs.

The roll-out of smart meters for residential customers is complete in Victoria. The Victorian distributors proposed in their 2015 TSS the gradual phase-in of a demand component into their network tariffs in order to manage customer impacts, which then would be followed by a gradual ramp-up in the importance of this component over time. However, distributors will resubmit their TSSs following the Victorian Government's policy decision to retain an opt-in approach to implementing cost reflective pricing in that State.

In other States, there are increasing percentages of customers on meters with remotely read interval capability, especially in the Ausgrid, ActewAGL and TasNetworks' network areas. However, this growth is off a low base; over 70 per cent of residential customers remain on accumulation meters which are unable to record the time of energy use.

In these jurisdictions, there will be a "market-led" rollout of smart meters from the end of 2017. Under the framework, the uptake of smart meter technology is expected to be driven by customer choices of products and services. A new minimum standard will require all new and replacement meters to be capable of delivering smart meter services, including cost-reflective network pricing. The new framework is designed to promote innovation and investment in smart meters that deliver the services valued by customers and market participants at a price they are willing to pay.

In these jurisdictions, decisions will be required about the network tariffs that will apply to the following classes of small customers:

- The current majority of existing customers who have accumulation meters from the outset of the network tariff reforms;
- The current minority of existing customers who will have smart meters from the outset of the network tariff reforms;

- The existing customers who elect in the future to have a smart meter installed;
- The existing customers who in the future are required to have their meter replaced with a smart meter; and
- The future new customers who are required to have a smart meter installed.

In this context, there is the potential for the take-up of DER to drive the significant deployment of smart meters if they are needed for customers to capture the full value of rooftop solar PV and energy storage. Independent analysis commissioned by the ENA has previously suggested there could be up to 7 million extra solar installations by 2034.[35] Similarly, AEMO's National Electricity Forecast 2015 indicated commercial and residential installed solar capacity could increase by approximately 500 per cent by 2034-35.[36] Advanced meters would better enable the customer to capture the value of investment in DER.

Distributors should encourage the installation of smart meters where it is economic to provide benefits to network customers. Alternatively, customers may seek to install an smart meters as part of a cheaper service.

Where customers install a meter that supports cost-reflective pricing, the decision for policymakers is whether customers should be assigned to a cost-reflective tariff (and allowed to opt-out) or given a choice to opt-in.

The desired outcomes of tariff reform (as discussed in Section 2) are more likely to be achieved through assigning such customers to a default demand tariff and providing them with the option to opt-out.

If customers do not face cost reflective pricing when their smart meter is installed then:

- Individual customer investment decisions will be distorted by the cross-subsidy that the current tariff creates, including by incentivising greater takeup or oversizing of DER equipment; and
- It will be harder to transition to cost reflective tariffs later as the cross-subsidies increase and the incentives to install solar to access the cross-subsidy becomes greater.

This suggests that the transition to cost reflective tariffs will become harder the longer that its implementation is deferred, whether due to the implementation strategies of distributors or retailers, or an inability to secure the prerequisites discussed in Section 6.

Customers remaining with accumulation meters should be assigned to a more cost-reflective tariff – such as declining block tariffs - in order to provide the efficient price signals and remove cross subsidies. This will promote efficient consumption and investment decisions, including the choice about whether to elect to have their existing meter replaced with a smart meter.

SUPPORT FOR CUSTOMERS TO MAKE INFORMED CHOICES

Tariff reform should be introduced in a way that supports customers to make decisions which best satisfy their needs. This includes being able to understand new tariffs, how tariffs affect their own circumstances and being in a position to respond to the price signals a tariff sends them. The Council of Australian Governments (COAG) Energy Council made this point in its December 2015 communique. It noted that such support must include a range of supporting tools and targeted communication.[37]

The COAG Energy Council has also recognised that there are shared responsibilities across networks, retailers and governments to provide the required support and communication to customers. [38]

The characteristics of a successful tariff reform program are:

- Close collaboration across multiple stakeholders on the tools and communication provided to customers;
- Recognition by all stakeholders of the respective value each stakeholder could provide to customers;
- Choice in the range of different supporting tools reflecting the different needs of customers;
- Information that is simple, clear and engages with customers; and
- Easy-to-access feedback loops for customers on how their response has delivered savings for them.

35 Energeia, Network Pricing and Enabling Metering Analysis Prepared by ENERGEIA for the Energy Networks Association, November 2014 – available at www.ena.asn.au/sites/default/files/energeia_network-pricing-and-enabling-metering-analysis_november-2014_1.pdf

36 AEMO (2015) *National Electricity Forecasting Report* – available at – www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report

37 COAG Energy Council – National Energy Productivity Plan: Work Plan December 2015, p.2.

38 COAG Energy Council, Meeting Communique, Adelaide 11 December 2014, page 2 – available at https://scer.govspace.gov.au/files/2014/05/COAG-Energy-Council-Communique-11-Dec-2014-FINAL2.pdf

It is important that the tools provided to support decision making by customers give them control of their consumption.

An example of this is the support mechanisms provided by Black Hill Power in the US for residential customers opting for its demand charge, as detailed in Case Study 11.

Case Study 11: Black Hills Power support tools assisting the introduction of a demand charge

An example of an international utility providing a customer support tool for its demand charge is Black Hills Power in South Dakota and Wyoming. It offers a demand charge option for all residential customers.

In order to help customers to manage their electricity demand, maximise operational benefits to the grid and minimise their monthly bills, Black Hills Power promotes a demand controller program. This program connects load control devices to heating and cooling systems, hot water heaters, clothes dryers, and hot tubs to cycle these appliances on and off in 15-minute cycles to help customers manage demand charges. The controller is owned and operated by the customer rather than the utility, leaving ultimate decision making over appliance control to the customer. Instead, the customer is provided with relevant clear information and support options on the controller.

Customers might not need complete information on their hourly consumption patterns to respond effectively to new tariff structures. Customer could have a general understanding that avoiding the simultaneous use of electricity-intensive appliances could readily reduce their maximum demand without the customers necessarily knowing when network peak coincident demand occurs.

Distributors have an active role to play in supporting customer decision making and to maximise the benefits of tariff reform. In this regard, Australian distributors have introduced a range of supporting tools, including portals, information and call centres, to assist their customers.

Distributors can be a valuable and accessible source of independent and well-informed advice, data and support tools for customers to assist them to make informed choices. However, retailers also will play a critical role in the implementation of cost reflective tariffs, given their existing relationships with end use customers.

Once the new tariffs have been implemented, DNSPs, working with retailers, would continue to engage with customers to:

- Critically assess the effectiveness of the new distribution tariffs in achieving the desired outcomes; and
- Obtain constructive feedback from customers about their views and experiences so that they can continually refine and improve its distribution tariffs in future waves.

SECTION 6 PREREQUISITES FOR ACHIEVING BENEFITS OF NETWORK TARIFF REFORM

There are three prerequisites, for an integrated national approach to network tariff reform. They are: a social licence and community support for tariff reform, a supportive regulatory environment and an aligned role for energy retailers.

There are three prerequisites for an integrated national approach to network tariff reform, which allows the benefits of cost reflective tariffs to be unlocked for the benefit of all customers.

PREREQUISITE 1 – SOCIAL LICENCE FOR NETWORK TARIFF REFORM

Network tariff reform has the potential to affect every electricity customer. Given this, there must be broad public support for network tariff reform for it to be implemented successfully. This in turn, requires customers – and their agents – to:

- Understand what the reform is seeking to achieve, why it is important, what the benefits will be and how the impacts will be managed, particularly for vulnerable customers;
- Have confidence that the stakeholders they entrust to implement the reform – governments, retailers, customer advocates and distributors – will work together for the benefit of all customers; and
- Have confidence they have the tools and the decision support information to allow them to control their energy use and respond to the new cost reflective tariffs.

Distributors are seeking a social licence to play their role in implementing this reform to achieve the outcomes in Section 2 by promoting the principles in Section 3. Distributors see this as part of the important facilitative role that they play in the electricity supply chain to support a broad range of customer benefits, including economic efficiency, fairness and network resilience to customers' technology choices.

Distributors have a role to play in providing information and tools to help customers understand and engage with the new network tariffs. This is critical for customers' confidence in their ability to exercise control prior to the introduction of new tariffs. Distributors will undertake this role cognisant of how retailers engage with customers and reflect the new network tariffs in their offerings.

Distributors recognise that to develop and maintain this social licence to help to undertake this reform they must:

- Explain the case for change and the customer benefits it will deliver;
- Work closely with other stakeholders and be open, transparent and equitable in all of their dealings – including in equipping customers to reap the benefits of the reform; and
- Be willing and able to adapt and change over time, including as new learnings emerge from the staged implementation of the reform.

This Handbook and the materials that distributors have prepared as part of the "first wave" of tariff reforms – including their TSSs – are all aimed at gaining and retaining this social licence. However, as this Handbook explains, there is much more work to do in order to implement the reforms successfully.

Tariff reform is most likely to be successful in meeting the desired outcomes set out in Section 2 if customers themselves become advocates for change and drive the reforms and choices available.

As noted above, this likely to require not only understanding of the reforms and confidence of key stakeholders. It also will require customers to have confidence in the tools and supporting information to take control of their energy use.

On-going role of a "safety net"

It is important that an appropriate "safety net" exists to support vulnerable customers to manage their energy bills. This is necessary for the industry to gain the social licence for network tariff reform.

With around one in four Australian households receiving concessions or hardship assistance to meet the costs of electricity, and increasing cost-of-living pressures, all stakeholders should collaborate to improve support for vulnerable customers.

Distributors support a COAG Energy Council national review of energy concessions and assistance to ensure that there is an adequate "safety net" for those customers who need it most, and that customers can manage and take control of their energy bills.

A national review would build on the COAG Energy Council's leadership in the 2012 energy market reform package – "Putting Consumers First". There would be benefits in assessing assistance measures and their effectiveness against a consistent framework. The national review could consider issues including:

- The effectiveness of current assistance measures, including whether they are reaching those most in need;
- The appropriate eligibility criteria for customers requiring assistance;
- The basis for energy concessions, whether as a percentage of the energy bill or a flat rate;
- The forms of assistance that could be provided; and
- The advantages and disadvantages of harmonising eligibility for assistance and the value of assistance across jurisdictions.

The COAG Energy Council could seek to have the national review completed in advance of the 2017 commencement of cost reflective network pricing.

PREREQUISITE 2 – SUPPORTIVE REGULATORY ENVIRONMENT

The regulatory environment will affect both the design of new network tariffs and the sequencing of the transition during the implementation of such tariffs.

It is important that distributors regulatory obligations do not constrain their ability to develop efficient tariffs which are consistent with customers' preferences and best manage customer impacts. In considering regulatory obligations, governments and regulators should assess whether they will assist achieveing the desired outcomes discussed in Section 2 of this Handbook.

In December 2014, while noting industry's and governments' shared responsibilities, the COAG Energy Council endorsed the need for network tariff reform, to enable customers to realise the full benefits of emerging technologies:

> The Council supports consumers' right to take up new technologies, but recognises that this should not be on the basis of cross-subsidies from other end users. The Council supports tariff reform as an essential next step in this process as a means of providing better price signals to consumers and notes that new Distribution Network Pricing Arrangements will enable distribution businesses to set prices that reflect the efficient costs of providing network services to each consumer. This will allow consumers to make informed decisions about their electricity usage and help to deliver better signals for efficient investment in distribution network capacity.[39]

As Energy Ministers noted, the November 2014 Distribution Network Pricing Arrangements Rule change to the National Electricity Rules provides a supportive national regulatory framework for the introduction of cost-reflective pricing. Distributors provided input into the development of the new network pricing objective and distribution pricing principles in the new Rule.

As noted in Section 3, distributors could be subject to jurisdictional pricing obligations. This was recognised in the new Rule which states that if network businesses need to depart from the principles to meet jurisdictional pricing obligations, they must do so transparently and only to the minimum extent necessary.

In this regard, good alignment between the Rule and jurisdictional obligations will promote the effectiveness of the new reforms.

39 COAG Energy Council, Meeting Communique, Adelaide 11 December 2014, page 2 – available at https://scer.govspace.gov.au/files/2014/05/COAG-Energy-Council-Communique-11-Dec-2014-FINAL2.pdf

There is a need for the regulatory framework to continue to remain responsive to the changing nature of networks and the emergence of new technologies.

Also within the customer engagement and consultation framework, distributors need the flexibility to apply network tariffs which promote best outcome given their network circumstances and feedback from customers and stakeholders.

It also is important that the regulatory framework for retailers and retail pricing does not constrain their ability to reflect cost reflective network tariffs in their retail offerings.

PREREQUISITE 3 – ENGAGEMENT WITH ENERGY RETAILERS

Retailers are the conduit through which network pricing signals are sent to customers. Network tariff reform is more likely to be successful where the process has been transparent, and customer and retailer preferences for tariff design and the pace of change have been taken into account.

Retailers develop retail tariffs to match the preferences of their customers. This includes retailers making decisions about the extent to which the network pricing signals will be reflected in their retail tariffs, for some or all customers, or whether retailers will use other demand response products or services to ensure that network costs are recovered from their customer base. Retailers assess the preferences of their customers in deciding how to pass through network and other input costs.

Retailers will make commercial decisions on how best to structure their retail offerings to recover their costs. In this regard, network tariffs are one input into retailers' considerations. Retailers will also consider their own operating costs and the cost of wholesale electricity.

The alignment of network peak periods and wholesale peaks could affect how retailers pass through the network signal in their offerings. If the network definition of peak period differs from the wholesale peak, this might lead to a different construction of prices.

In addition, the benefits of network tariff reform are more likely to be realised when distributors and retailers align communications to customers about how to manage their peak demand and control their electricity bills. This is more likely to occur when the distributors take into account retailers' views and commercial objectives. Retailers have multiple factors to manage, which might influence how they wish to communicate network elements to customers.

Distributors and retailers should work together to promote:

- Consistency in language, in describing new tariffs;
- A framework for engaging effectively with each other – and sharing information – during the tariff reform process; and
- Coordination in the support and decision tools provided to customers to enable them to make informed choices.

These discussions are likely to be assisted by discussions with energy customer advocates.

The more competitive the retail market, the more likely it is that customers will receive the full benefits of network tariff reform.

Box 4: Retailer feedback on tariff reform

The ENA has been conducting a number of workshops with retailers on tariff reform. Some of the issues raised by retailers include:

1. **The number and complexity of network tariffs affects retailers costs** – the greater the variation in network tariffs the greater the expense in IT, in maintaining customer engagement material and processes.
2. **Networks adopt multiple methodologies to determining demand tariffs** – having different tariff structures and approaches makes it more difficult for retailers to pass through the price signal as retailers have to properly understand and assess each methodology.
3. **Objectives for cost reflective network tariffs are not totally clear** – having greater clarity about the objectives and explaining how different tariff structures can achieve the same objectives would assist constructive engagement.
4. **Tariff design will affect both customer uptake and retailers' preferences towards network tariff changes** – significant volatility in bills under some tariff designs would limit customer adoption and make it hard for retailers to engage with customers on such tariffs.
5. **Impacts on vulnerable customers** – this needs to be properly managed in conjunction with government.

SECTION 7 CONCLUSIONS AND RECOMMENDATIONS

It is challenging to deliver cost-reflective network tariffs which send meaningful and comprehensible price signals to customers while also managing customer impacts.

Electricity pricing and incentives will be critical to delivering societal benefits not least because they will help customers optimise their own energy production and consumption. An integrated national approach to the process of implementing network tariff reforms, supported by all stakeholders, is necessary to deliver better long-term customer outcomes.

The first wave of reforms must be implemented successfully to provide the platform for greater customer choice and the efficient integration of new technologies. If not, the problems with the current tariff structures will become more difficult to fix in the future.

Electricity networks are experiencing a scale of change not seen for many years as customers embrace new technologies and change how they procure, use and think about electricity.

As discussed in the Electricity Network Transformation Roadmap interim report, this transformation is initially being driven by the mass adoption of DER (mostly in the form of rooftop solar PV cells), together with broad community acceptance of energy efficiency initiatives. The Roadmap identifies that the next decade has the potential for subsequent "waves" of technological and business model transformation, driven by further, widespread adoption of energy storage, electric vehicles and community energy solutions.

Tariff reform is essential to the successful transformation of the industry. Australia's current electricity distribution network tariff structures are increasingly outdated, inefficient and unfair. They do not reflect either customers diverse use of the network or the drivers of network costs. The diversity of customer load profiles will continue to grow as the use of air-conditioning, energy efficiency, solar panels and other technology increases.

The growth of energy storage and other DER should be driven by the value they create instead of transferring costs between users. Until electricity network tariffs better reflect the cost of providing network services, technology adoption in Australia will be at least partly constrained by the hidden cost transfers between network users that are in place today.

It is important to successfully implement the current reforms. In the future it will be harder to use cost reflective pricing to enable greater customer choice and integrate new technologies efficiently because, if left unchecked, the size of existing cross subsidies will grow and entrench more deeply in the market.

Distributors consider that tariff reform needs to focus on customers by giving them the tools and options to make efficient decisions about producing and consuming electricity, including whether to invest in their own generation and/or storage capacity. Tariff reform will be successful only if it helps customers to maximise the value of their energy decisions in a way that delivers long-term societal benefits.

This Handbook recommends an integrated national approach to the process of implementing network tariff reforms with collaboration across multiple stakeholders. It needs to be supported by appropriately targeted energy affordability measures.

Customers' actions are leading the electricity transformation. This Handbook emphasises the importance of effective engagement and customer impact analysis for successful tariff reform. Having a strong understanding of customer impacts will inform tariff design and foster stakeholder support for tariff reform.

As the electricity market transforms, the drivers of efficient tariff reforms will change. Distributors consider that the nature of network tariff reform will itself evolve from removing inefficient cross-subsidies to supporting customer decision making through to greater innovation and diversity in tariff design.

Australia's electricity system is undergoing an historic transformation. If effectively implemented, network tariff reform is likely to be a critical ingredient to enabling this transformation which unlocks more choice and control for customers, with efficiency and fairness.

HAVE YOUR SAY

ENA is interested in your views about the case studies and suggestions provided in the Draft Network Tariff Reform Handbook.

The Draft Handbook has been released for feedback and we would welcome views on:

- Desirable Outcomes
- Network Tariff Design Principles
- Analysing Customer Impacts
- Customer Support and Decision Tools; and
- Managing tariff migration and metering transitions
- Securing prerequisites such as social licence for tariff reform, supportive regulatory frameworks and cooperation by retailers and other parties.

Please contact us at **info@ena.asn.au** to provide your feedback or arrange a discussion.