Submission in response to the Australian Energy Market Commission (AEMC) draft paper
The pricing review - Electricity pricing for a consumer-driven future

By Dr Richard Tooth[1]

1 Introduction and summary

This submission focusses on the network pricing components of the AEMC pricing review.[2]

I believe this is an important and timely review. Not because I believe changes in the rules are a priority. But rather because the review brings attention to very significant issues with electricity network pricing. As I outline in this submission:

1. Current network pricing is inefficient, with significant negative consequences for consumer investments in, and use of, consumer energy resources (CER).

2. The pricing should be addressed quickly to support the energy transition and prevent further inefficient investment.

   a. Rule changes are **_not_** required to address the most significant problems.

   b. The inefficiency of current pricing is in conflict with the existing rules.

3. On efficiency, equity, and fairness

   a. Consistent with the guiding legislation, the AEMC and Australian Energy Regulator (AER) should focus on efficiency in the long-term interest of consumers. Social objectives are better addressed through alternative policies.

   b. Fairness of pricing changes is an important consideration. However, this can be achieved through applying a stable framework for cost allocation.

4. Future pricing directions

   a. A combination of dynamic and fixed charges is preferable. A clear and stable framework is needed to determine how these charges work together.

   b. A rule change to enable dynamic charges based on short run marginal cost (SRMC) is desirable.

   c. How residual costs are recovered through fixed charges is a critical issue to resolve.

   d. DNSPs should focus on pricing for retailers; however, there is some nuance to consider.

As a priority I encourage the AEMC to work with the AER to ensure that appropriate analysis is conducted and that network prices are moved towards efficient prices as soon as possible.

The remainder of this submission elaborates on the key points.

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[1] I make this submission as a private individual. I am a Director with Sapere Research Group (www.srgexpert.com) and currently an independent external member on Ausgrid's pricing working group. I have experience and expertise in utility regulation and in particular the pricing of regulated services.

[2] I have not time to provide detailed comment on the first four proposed reforms. However, I am wary of the costs and unintended consequences of these. Such interventions come with costs that are ultimately borne by consumers. It would be preferable to more clearly articulate (and analyse/quantify) the market failures that are considered justification for the recommendations.

2 Current network pricing is inefficient

Despite the National Electricity Objective (NEO) and the pricing rules emphasising efficient pricing, network usage prices are inefficient.

Network tariffs can be categorised as usage tariffs (i.e. based on energy consumed or other measure of usage) and fixed charges (independent of usage). While there is chatter of consumers going off grid, I believe it is generally accepted that the level of fixed charges has negligible influence on behaviour and thus from an efficiency perspective the focus is on ensuring usage prices are efficient; that is, set to encourage efficient use and investment.

Setting usage prices to marginal cost is the 'golden rule' for encouraging efficient use. A price above marginal cost can discourage people from using more even when their benefits outweigh the cost. Vice-versa, a price below marginal cost can encourage consumers to use more despite their being a net social cost.

The rules require Distribution Network Service Providers (DNSPs) to set prices based on the long run marginal cost (LRMC). Alas, as discussed in an Attachment ('Revisiting electricity network pricing') provided at the end of this submission:

- the common method for calculating LRMC is flawed leading to an upward bias
- DNSPs have often erred on pricing above LRMC exaggerating the upward bias
- the rule **6.18.5(f)1** that regard be given to the "**costs and benefits** of calculating, implementing and **applying** the LRMC method" appears to have been ignored.

The implications of the above are significant. Current network pricing has encouraged consumers to invest in CER and change behaviours to reduce their network charges by more than the benefit of reducing network cost. Consequently, their investments have been subsidised by shifting the burden of the cost of the network to other consumers.

The societal costs appear significant. Potentially quantifiable costs include:

- over investment in CER – in effect, high network usage charges reduce connection charges and subsidise a consumer's decision to invest in CER, leading to investments where the societal benefits are outweighed by the costs
- inefficient energy use
    - network charges discourage customers from using energy at times when there is excess supply (and supply is being curtailed)
    - blunt peak network usage charges give consumers insufficient incentive to respond to reduce actual network congestion
- inefficient use of batteries
    - network usage charges discourage battery owners from charging from the grid at times when the network is not congested
    - blunt peak network usage charges give battery owners insufficient incentive to discharge at the times of network congestion
- excess instability in DNSP revenue
    - a greater reliance on variable charges results in greater financial instability in DNSP revenue. This increases the DNSPs costs in managing revenue volatility, which are inevitability passed through to consumers.

There are other less-tangible social costs. For example, these may include:

- perceptions of inequity from those who cannot or have not invested in CER to reduce their bills
- perceptions of a failure of the energy transition as the energy bills increase for those who have not invested in CER
- further sub-optimal policy responses. For example, the Government bill relief and the proposed Solar Share Offer (SSO) scheme may be considered a patch to counter the issues.

Alas, despite the requirements of rule **6.18.5(f)1** to consider costs and benefits of the method, there has been no public analysis of the above costs. This should change.

In summary, it appears very likely (but the costs and benefits has not been assessed) that, consistent with AEMC's view, efficient tariffs would require *'tariffs that are predominantly fixed'* (but with a dynamic charge element).

3 Managing the transition

The need for speed

There are reasons to think a fast transition to address the pricing inefficiencies is desirable.

A key issue with a slow transition is that consumers are making investments based on inefficient price signals. The longer the inefficient pricing remains, the greater the level of inefficient investment (in CER and appliances) and the more significant the pain (and presumably resistance) when the problem has to be addressed.

The issue is becoming particularly important to deal with the rapid uptake of home batteries, which will enable households to more easily avoid contributing to network charges.

A fast transition also appears desirable to reduce other costs. These include:

- inefficient decisions in the use of energy
- inefficient decisions in the use of CER
- increasing transfer of costs to non-CER users.

Further analysis is required to determine the optimal tariff structure and levels. However, there is little doubt as to the direction in which tariffs need to move in the interests of efficiency.

I understand the AEMC envisages a long, staged implementation. However, addressing the issue should not wait. The AEMC can help to address this problem by working with the AER to ensure that the significance of the issues and the full cost of delays in reform are understood.

Incentives for change

The AEMC discusses incentives for networks to design and implement efficient tariffs.

In this regard it is worth noting that, consistent with the NEO, the pricing rules require DNSPs to develop efficient tariffs. It is thus perhaps an issue of enforcement. The issues might have been detected earlier if there had been adherence to rule 6.18.5(f)1 that requires, in setting tariffs, DNSPs have regard to the "costs and benefits of calculating, implementing and applying the LRMC method."

Nevertheless, I recommend strengthening rule **6.18.5(f)1** to explicitly require DNSPs to demonstrate that they have considered and evaluated as appropriate the costs and benefits of alternative tariff structures (inclusive of all societal costs and benefits) and provided adequate justification for the chosen tariff structure and levels.

4 On equity and fairness

The terms equity and fairness (or variations thereof) are used frequently in the AEMC report.

However, the national energy objectives including the National Electricity Objective (NEO), which provide the foundation to the legislation governing and guiding the AEMC, focus on efficiency and the Distribution Pricing Rules (Rule **6.18**) themselves make no mention of equity or fairness. So why are these terms used? And if equity and fairness are to be considered, how should they be defined and assessed? There are many conceptions of equity and fairness and the AEMC paper does not define these terms or explain how they would be evaluated.

4.1 Equitable distribution

It should be clear that social objectives such as equitable distribution of resources should not be of concern to this review. As recently summarised in a recent KC's legal opinion on an AER draft decision:[3]

30. *It is clear that the NGO and NEO are not concerned with the achievement of broader social or environmental objectives. In the Second Reading Speech of the Minister for Mineral Resources and Development (South Australia) for the National Electricity (South Australia) National Electricity Law (Miscellaneous Amendments) Amendment Act 2007 (SA), referred to in the PIAC decision, the Minister observed that:[4]*

   > *The purpose of the National Electricity Law is to establish a framework to ensure the efficient operation of the national electricity market, efficient investment in, and the effective regulation of electricity networks. As previously noted, the national electricity objective also guides the Australian Energy Market Commission and the Australian Energy Regulator in performing their functions. This should be guided by an objective of efficiency that is in the long term interests of consumers. Environmental and social objectives are better dealt with in other legislative instruments and policies which sit outside the National Electricity Law.*

There are good reasons for this. Issues of equity can be better dealt with via the welfare system, which incorporates considerations of financial means and other individual circumstances. We might rightly ask what relative advantage do the energy institutions (including the AEMC, AER and the DNSPs) could have in managing issues of equity? Furthermore, there are many examples where considerations of equity have led to tariffs which are neither efficient nor equitable.[5]

4.2 Fairness of pricing changes

Another important concept of fairness relates to fair changes in pricing. Inevitably changes in price structures will create winners and losers. This issue is important and is reflected, in rule 6.18.5 (h) which states that DNSPs 'must consider the impact on retail customers of changes in tariffs from the previous regulatory year'.

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[3] See https://www.aer.gov.au/documents/evoenergy-hon-john-middleton-am-kc-appendix-32-legal-opinion-aers-draft-decision-january-2026

[4] Legislative Council, South Australia, 16 October 2007, Hansard, page 883.

[5] An example is the use of increasing block tariffs. See https://srgexpert.com/2024/03/12/ibt-utility-pricing-to-block-or-not-to-block/

There are good reasons for this rule. I believe it is noncontroversial to state that, all else being equal, consumers will prefer stable prices over prices that vary. But more importantly consumers make decisions that will be in part based on an expectation of energy prices. These include decisions to invest, or not invest, in appliances, processes and CER that affect their energy use. It is inefficient, and presumably frustrating for consumers, if pricing changes unpredictably.

Given that there will be times when it is efficient to change pricing levels and structures, it is preferable to have a clear framework that guides how prices will vary.

Given the lack of an existing framework, the DNSPs will need to undertake the painful exercise of determining what is a fair and acceptable pricing change and framework for allocating costs.

There is some useful relevant research literature on what people consider is fair.[6] I would expect DNSPs to consider such literature and where appropriate conduct their own research leveraging the body of knowledge that has been developed and the AER to review whether this has been conducted appropriately.

Having established a framework for allocating costs (including consideration of revenue from usage charges) concerns over pricing changes should lessen. However, it is unlikely that any framework will be comprehensive in resolving issues, in which case it would seem appropriate that DNSPs conduct the consumer research as to what is fair and appropriate.

4.3 Other conceptions of fairness

There are, of course, other conceptions of fairness. A common expectation and requirement (including in the rules) is that there is fair process. This should not be controversial and does not appear a relevant issue for this review.

The AEMC and other organisations may also be concerned over what is perceived to be fair having consideration of what is politically acceptable. In my opinion, such concerns might be noted but that the long-term interests of consumers are best served if institutions focus on efficient outcomes.

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[6] A seminal paper is Kahneman, D., Knetsch, J. L., & Thaler, R. (1986). Fairness as a constraint on profit seeking: Entitlements in the market. *The American economic review*, 728-741. https://www.jstor.org/stable/1806070. A more recent paper I recommend is Biggar D. (2010) *Fairness in Public-utility Regulation: A Theory*. https://www.jstor.org/stable/43199612.

5 Future pricing directions

5.1 The tariff structure

An efficient cost structure that meets the requirements of cost recovery (while also being administratively simple) aligns within AEMC's proposed broad structure of comprising:

> *1. a dynamic charge – a charge or reward that varies depending on network conditions*

> *2. a fixed charge – that is, a fixed amount per fortnight, month, or some other period, that does not vary depending on the amount of electricity consumed.*

The dynamic charge is, of course, a type of usage charge; but one that allows a more targeted signal to manage network congestion from peaks in demand and export. Relative to current tariffs (e.g. time of use) this has a dual benefit of increasing the incentive to reduce demand in peak times and removing the disincentive to reduce demand when there are no network constraints; that is, relative to current tariffs, a dynamic charge increases the benefits and reduces the costs (as discussed in the Attachment).

The fixed charge is essentially the residual costs that need to be recovered. While the fixed charge is not expected to change behaviour, it is important to have a clear framework for how fixed charges and dynamic charges work together. Dynamic charges could be resisted if their application is not perceived as fair. Furthermore, it is desirable to have a framework that is robust to future change.[7]

A simple approach which facilitates bill stability and perceptions of fairness while providing efficient incentives, is to set charges so that the total charge allocated to a customer in a customer group[8] is as follows:

$$Total\ charge_i = Fixed\ charge + \sum_t Dynamic\ charge_{i,t}$$

Where subscript i represents and individual customer and subscript t represents time and:

$$Dynamic\ charge_{i,t} = Usage\ price_t \times Usage_{i,t} - Rebate_t$$

$$Rebate_t = Usage\ price_t \times Aveage\ usage_t$$

And therefore, the total charge allocated to customer i is:

$$Total\ charge_i = Fixed\ charge + \sum_t Usage\ price_t \times \left(Usage_{i,t} - Aveage\ usage_t\right)$$

Under this structure:

- the DNSP's sum of charges for the customer group is constant regardless of usage
- similarly, the *average* customer charge is constant
- the charge for any individual customer depends on the customer's usage relative to the group average

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[7] The problem of designing dynamic charges is common to all public congestible assets. This includes other network infrastructure (including roads, water networks) and other infrastructure (e.g. dams) and natural assets (e.g. water supplies).

[8] A customer group could be all customers of particular type within a particular location.

- efficient incentives are passed through to retailers for their customers to reduce congestion
- the risk to retailers of high usage charges is mitigated by the rebates that are applied.

Refinements to this structure can be made to accommodate different types of customers (with different demands) within the customer group. For example, the structure can be refined so that the customer's usage charge is based on their usage relative to an allowance tailored to their needs.[9]

5.2 The usage price

5.2.1 What marginal cost

Prices are set to marginal cost to encourage efficient usage. If dynamic prices are applied, the issues discussed in the Attachment largely disappear. Nevertheless, there are still debates as to how best to calculate marginal cost.

The question has been raised as to whether to shift from pricing based on LRMC or SRMC. The rules are clear in specifying that pricing should be based on LRMC and thus a rule change is clearly required to change from this practice.

My interpretation of these terms is that in practice:

- SRMC is the immediate per-unit cost of congestion in the network
- LRMC is the per-unit cost estimated over a future time period that includes investment to manage the congestion.

The two measures are, of course, related. An increase in congestion results in higher SRMC and brings forward (thereby increasing its present value) the investment cost to manage the congestion. The *expected* values of each should follow a saw-tooth patten over time whereby the value increases steadily and then drops suddenly after investment. The rate of increase and then size of fall will be larger with SRMC. Under certain conditions the LRMC will be similar to the SRMC averaged over a period of time.[10]

I expect there are efficiency gains from pricing based on SRMC rather than LRMC because some customers will be able to respond to price signals in close to real time, thereby reducing the costs of congestion and reducing the need for future investment in capacity. Furthermore, there appears to be little downside to enabling pricing based on SRMC. If retailers believe the gains from short run price signals are minimal, then they can set the usage prices to resemble LRMC.

Regardless, I expect the efficiency gains to be less than gains from addressing the current inefficiencies with the application of LRMC, including the flaws identified in the Attachment and the lack of locational pricing.

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[9] In effect, rural water markets approach delivers this outcome. Consumers (e.g. farmers) purchase water entitlements, which provide them with an allocation (i.e. an allowance of water). They can use more or less than their allocation by purchasing or selling allocations at the market price (i.e. usage price).

[10] For a discussion of and a review (including an analytical comparison) of how SRMC and the different methods of LRMC relate to each other see Tooth, R.(2025) *Determining long run marginal cost for pricing* Available at https://srgexpert.com/wp-content/uploads/2025/10/Tooth-LRMC-for-Pricing-Revised-Oct2025.pdf

5.2.2 Location based pricing

I understand that congestion in the network varies by location and consequently there would be efficiency gains to location-based pricing. There does not appear to be any reason why location-based pricing cannot be implemented today.[11] If the pricing structure described in section 5.1 is implemented at a locational level, then average network charges for customers at any location will not change with congestion.

5.3 The allocation of residual costs

The problem of residual costs

The AEMC does well to recommend 'clarifying how residual costs should be allocated…'. This is a critical issue that has yet to be resolved. As the AEMC notes that (in accordance with common principles and rules[12]) residual costs should be recovered in a manner that minimises distortions to behaviour, which implies residual costs should be recovered through fixed charges.

A move towards more efficient tariffs would see a reduction in recovery from usage charges and consequently an increase in the residual costs to be recovered from fixed charges.

However, the current rules do not require DNSPs to articulate how residual costs should be allocated across different customers or provide any guidance in this regard. This is not an issue when pricing is stable but is invariably an issue when there are significant changes in pricing (relative levels and/or structure) and a potential barrier to pricing reform.

A clear stable framework for allocating the costs can facilitate pricing changes and reform. Where there is uncertainty over how costs (and benefits) are to be allocated there will invariably be debates that can delay or derail the pricing reform. Conversely, a clear framework for allocating residual costs (inclusive of usage charge revenues)[13] helps remove uncertainty and consequently debates. The tariff structure described in Section 5.1 describes how charges should vary in response to changes in usage prices. However, it does not establish how the fixed charges should be set by customer group should there be a greater recovery via fixed charges.

From an efficiency perspective, there is no clear guidance on how to allocate the residual costs. We know it is inefficient to charge any individual customer less than the incremental costs and more than the standalone costs of servicing that customer.[14] This can leave a considerable gap.

While the simplest approach would be to increase existing charges in the same proportion, I expect there will be resistance to doing so. In my opinion issues of equitable distribution should not be considered in the allocation of fixed charges. As discussed in section 4.1 these are better addressed via other policy measures. Care will be required to ensure that the approach taken does not lead to other inefficiencies.

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[11] I understand that some networks have participated in market integration trials that prove the concept can be made practical.

[12] As the AEMC notes NER clause 6.18.5(g)(3) states that tariffs should be set '[i]n a way that minimises distortions to the price signals for efficient usage of the relevant service […]'. This principle aligns closely with commonly applied pricing principles in other settings.

[13] Potentially there will be situations, where efficient pricing (based on marginal cost) leads to excessive revenue being collected, and residual revenues need to be allocated.

[14] For network costs, there is also the consideration that some costs are recovered through developer charges.

5.4 The relationship between DNSPs and the retail market

The AEMC's sixth draft recommendation focusses on the relationship between DNSPs and retailers and recommends that network tariffs are developed and designed for energy service providers.

The AEMC has suggested "potentially removing the 'customer impact' and 'customer understanding' principles that are creating a focus on the consumer, rather than the energy service provider.

I do not believe these changes are necessary or warranted. While current rules may be worded more clearly and refined, the key issue has been with the interpretation of the current rules.

The issue of customer impact

The issue of 'customer impact' arises in Rule 16.8.5 (h) which requires that a DNSP

> *must consider the impact on retail customers of changes in tariffs from the previous regulatory year ...*

Expecting DNSPs to focus on Retailers may seem to make this customer impact requirement redundant. However, there is a problem. DNSPs are not just passing through usage costs; they are also responsible for the allocating the residual costs among all customers (as considered in section 5.1). For this reason, DNSP's need to consider the impact on the electricity consumers by ensuring that any price changes are consistent with an established framework for allocating residual costs.

However, to implement such a framework DNSPs do not need to consider matters such as consumer affordability and other customer characteristics unrelated to the tariff structure. This current practice appears wasteful and risks harming the long-term benefits to consumers.

The issue of customer understanding

With respect to understanding, the current relevant rule 16.8.5 (i) states:

> *The structure of each tariff must be reasonably capable of:*
>
> *(1) being understood by retail customers that are or may be assigned to that tariff (including in relation to how decisions about usage of services or controls may affect the amounts paid by those customers) or*
>
> *(2) being directly or indirectly incorporated by retailers or Small Resource Aggregators in contract terms offered to those customers,*
>
> *having regard to information available to the Distribution Network Service Provider ... which may include:*
>
> *(3) the type and nature of those retail customers;*
>
> *(4) the information provided to, and the consultation undertaken with, those retail customers; and*
>
> *(5) the information provided by, and consultation undertaken with, retailers and Small Resource Aggregators.*

This rule appears to have been interpreted as requiring DNSPs to design tariffs with retail customers in mind and develop tariffs that can be understood by retail customers. However, such an interpretation ignores that rule 16.8.5 (i) can be satisfied by meeting clause 16.8.5 (i) (2) which requires tariffs can be

> *reasonably capable of...being ... indirectly incorporated by retailers ... in contract terms offered to those customers.*

Thus, while clause 16.8.5 (i) (1) may be redundant it is not binding.

Clause 16.8.5 (i) (2) seems appropriate. It is inevitable that residual costs will be allocated based on factors that include some customer characteristics, which retailers will then need to incorporate into their tariffs. It also does not appear to be an onerous requirement and appears to be one that would naturally occur if the DNSPs priced with the interests of retailers in mind.

Other considerations

I understand that there are also reasons why DNSPs may need to engage directly with end users and seek to provide financial incentives to make efficient use of local resources. I assume the rules should not prevent this.

Attachment A:
Revisiting electricity network pricing

By Richard Tooth Published on LinkedIn October 8, 2025 available at
https://www.linkedin.com/pulse/revisiting-electricity-network-pricing-richard-tooth-vaxqc

The pricing of electricity networks is receiving a lot of attention. The Australian Energy Market Commission (**AEMC**) is undertaking a **review** focusing on retail market competition and the network tariffs that distribution network service providers (DNSPs) charge retailers.

There appears to be broad agreement that current network tariffs are inefficient, and reform is needed to encourage greater use of network capacity. This may be surprising given DNSP pricing is regulated under a framework with **objectives** and **rules** that focus heavily on efficiency. So how did we get here? In this note, I examine some issues with network pricing that appear to have contributed to the concerns.

Economics of network usage pricing

Setting usage prices to marginal cost is the 'golden rule' for encouraging efficient use. A price above marginal cost can discourage people from using more even when their benefits outweigh the cost. Vice-versa, a price below marginal cost can encourage consumers to use more despite their being a net social cost.

For distribution networks the costs of meeting additional demand mostly[15] relate to the additional investment in capacity needed to meet the demand. To ensure prices reflect these costs it is common, and **required** in Australia, to set prices based on the long run marginal cost (LRMC). In practice, LRMC for energy networks is estimated as a per-unit cost (e.g. $/kW) of a permanent increase in *annual maximum* demand estimated over a long-period.[16]

A key challenge is that demand and capacity, and consequently LRMC, varies greatly by time and location. This implies that a usage price based on LRMC should also vary by time and location. However, due to a lack of time of use (TOU) meters and/or social and political considerations, uniform pricing across periods and locations is often applied.

The common approach setting usage prices in Australia is to follow the guidance of a 2014 AEMC commissioned **paper** and calculate the usage price in kWh as the LRMC averaged over a set of time periods, which for 'flat tariffs' is all 8760 hours in the year. That is:

$$\text{Usage price (flat tariff)} = \frac{LRMC\ (\$/kW)}{Hours\ in\ year}$$

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[15] The marginal costs of greater demand on the network also include marginal **energy losses** which increase with network use and congestion costs associated with greater use.

[16] LRMC may be expressed in $/kW or $/KVa (as in the 2014 paper) and converted to $/kW by dividing by an average power factor. See this **paper**, for a discussion of the broader issues of calculating LRMC including an analytical comparison of the main methods for estimating LRMC.

This method is widely quoted and used. But is this the efficient price? For any location, an averaged uniform price will be above the true LRMC at times with excess capacity and below that in the critical peak times.

The challenge of finding the optimal price for a flat tariff is illustrated using the figure below which considers an increase in the usage price to reduce the need for additional investment. The figure shows for electricity usage (in per unit terms, i.e. per kWh) the demand (in green), LRMC (red), and price (blue) for a critical peak period that drives the investment and the average across all periods. An increase in the usage price drives a decrease in critical peak demand and average period demand. The decrease in critical peak demand saves a cost (marked by area A) equal to the investment that would be needed if peak demand wasn't reduced. However, the increase in the usage price also reduces average use and consequently the benefit that consumers receive from energy use. The loss of benefit from reduced usage (averaged over all periods) is equal to the area B. If there are N periods then this loss of benefit is equal to $N \times B$ and the net benefit of the price change is equal $N \times B - A$. (Note that while consumers will pay more in usage charges overall, they'll also pay less in fixed charges thus $N \times B$ is the net impact to consumers).
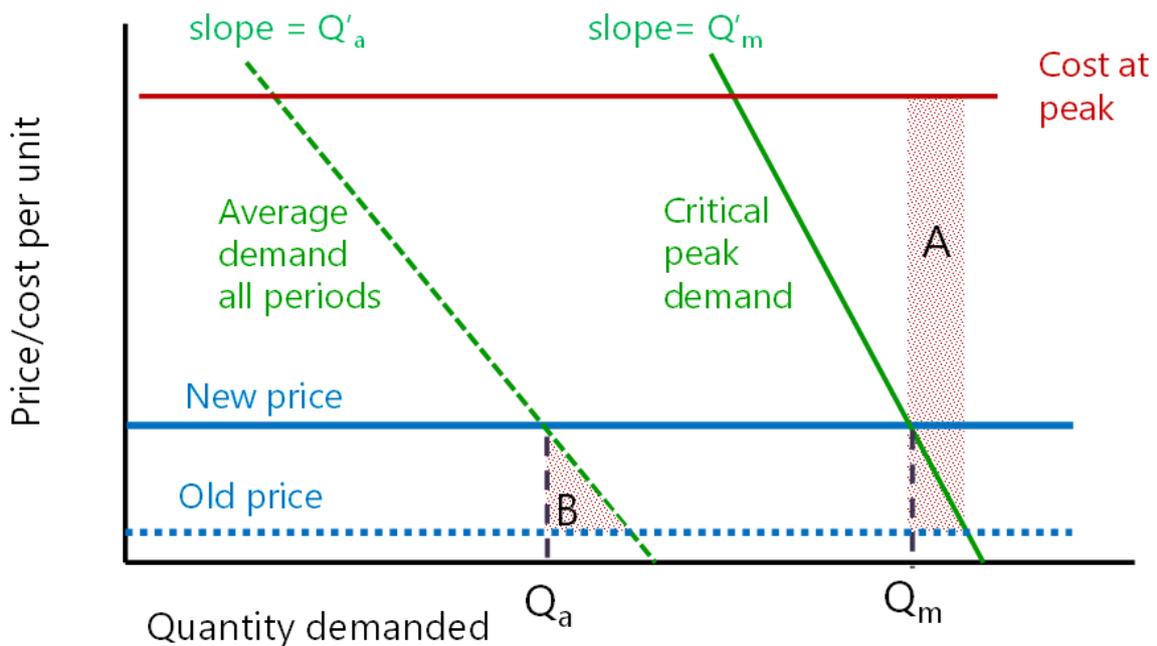
The optimal price that maximises the net benefits can be found using a bit of algebra (see the appendix). From this we can see that the **common approach is not accurate**, rather for the flat tariff the optimal price is:

- the usage price calculated using the common approach

- **multiplied** by the ratio (hereafter the 'demand response ratio') of the responsiveness of demand to price in the critical peak period to the average responsiveness across all periods.

The responsiveness of demand to price is reflected in the slope of the green lines in the figure – the flatter the slope, the greater the response. The demand response ratio is ratio of the slope of the solid green line to the slope of the dashed green line.

The intuition for the responsiveness of demand in the formula can be found with a simple extreme example. Imagine if consumers responded to price in all periods but the critical peak period. In such case, the network usage price provides no benefit in reducing network costs and the optimal price that maximises the net benefits would be zero.

Note that, as shown in the appendix, the adjustment to the common approach can also be expressed a function of the ratio of the price elasticity of demand (a measure of the response in percentage terms) and the load factor (the ratio of average demand to maximum demand). Using this formula can be seen that if the price elasticity of demand in the critical peak is the same as the average across all periods, then the optimal usage price is the common approach divided by the load factor. This is consistent with the formula used in the UK to determine network usage charges.[17]

Implications

The implications of correcting the common approach depend on the demand responsiveness. If the demand responsiveness to price is the same in the critical peak period and the average period (i.e. the demand response ratio = 1) then the common approach formula would yield an optimal price. However, there are reasons to think that this is not the case and that the bias caused by not adjusting for the demand responsiveness has changed over time.

The size of demand response ratio is an empirical question. Unfortunately, it appears there is limited research to provide a clear answer. While there is substantial research on the responsiveness of demand, most research focusses on short-term responses.[18] Nevertheless, we might be able to infer the direction of any bias by drawing on the existing available research and by considering how consumers use energy and the availability of responses.

We know that consumers can reduce their electricity use by investing in more energy efficient appliances, by investing in consumer energy resources and/or by simply turning off (or down) appliances. We might assume the demand response in the critical peak might be more than the average because there is greater opportunity to reduce use when usage is greater and because an investment in energy efficient appliances (in response to price) will have a greater impact during the peak times when the appliances are used. A 2004 study found evidence to this effect.[19] In such case, the optimal price would be greater than that estimated using the common approach.

Nevertheless, there are reasons to think the reverse applies; that is, the demand response in the critical peak period is small relative to the average. First, the nature of the critical peak is that it coincides with when consumers most wish to consume. Given a choice as to when to reduce their usage (e.g. by changing the setting on the air-conditioner), it would be unsurprising if

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[17] The approach used in the UK involves inflating the demand tariff by dividing by the load factor, which is the average load divided by the maximum aggregate load (see **Common distribution charging methodology report**, p. 20).

[18] **Kahn-Lang et al (2025)** conduct a recent meta-analysis of the impact of time-based electricity rates. They found the studies they reviewed 'overwhelmingly' analysed short-term responses.

[19] **Bushnell and Mansur (2004)** examined the case found a 14% reduction in peak demand and average demand of only 6% following a large increase in the flat tariff rate in San Diego in 2000. Based on the data provided the ratio of the demand response is around 3.7; that is, at the time the efficient network usage price would be 3.7 times greater than that calculated using the common approach.

consumers chose non-critical peak periods to reduce demand when the benefits from energy use are less.[20]

Second and more significantly, there have been important shifts in how consumers respond to energy prices due to rise of roof-top solar. Appliance efficiency is largely driven by standards and at the margin, now plays a small part in reducing average network demand compared to roof-top solar. With roof-top solar consumers can significantly reduce their average energy demand. However, due to the high existing penetration of solar, additional solar does little to reduce demand at the critical peak. Consequently, due to rooftop solar the demand response ratio may be so small as to make the optimal usage price negligible.

Going forward, the impact of consumer batteries may affect the relative demand responsiveness. Batteries enable consumers to more easily reduce peak network demand. However, it is unclear the extent to which they would reduce demand at the critical peak times that drives network costs. For example, the critical peak may occur after most batteries are fully discharged. Furthermore, batteries suffer from the same problem as solar – their marginal benefit to the network declines with greater penetration of batteries of a similar type. Again, there appears to be a lack of analysis on this issue.

A brief word on TOU tariffs

TOU meters enable time-varying alternatives to the flat tariff. These include the commonly applied TOU tariff with higher usage prices in peak periods and lower usage prices outside of the peaks. The common approach for setting the TOU peak price again uses a simple average:

$$\text{Usage price (TOU tariff)} = \frac{LRMC\ (\$/kW)}{Hours\ in\ 'peak\ periods'}$$

As with the flat tariff, if uniform prices by period (peak, shoulder etc) were applied, it would be more efficient to adjust the formula for the demand response.

Nevertheless, the TOU tariff approach of uniform rates by period is clearly inefficient relative to alternative time-varying tariffs[21] that more accurately align the usage price to the time-varying LRMC. Relative to these alternatives the TOU tariff involves setting a price below LRMC in the critical peak period and above LRMC in other periods. Not surprisingly, there is substantial evidence[22] that more refined tariff structures are more effective in reducing critical peak demand.

A bias towards higher usage prices

Rather than make an adjustment for the relative demand response ratio, DNSPs have erred on inflating usage prices for both flat and TOU tariffs well above LRMC.[23]

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[20] Some evidence for this is provided in a study of the price elasticity of demand for electricity, which was supporting **Ausgrid's 2018 Tariff Structure Statement.** The study find that demand was significantly less elastic during peak TOU periods than in shoulder periods.

[21] These include critical peak pricing and peak time rebates. See **Kahn-Lang et al (2025)** for a discussion.

[22] *Ibid* section 2.

[23] As an illustration **Western Power (2022, p. 7)** in setting its tariffs stated "*[…] the efficiency benefits of a LRMC-based price, smoothed across the entire day, is minimal. Consistent with the approach applied by other networks in the NEM, we **therefore add a mark-up** to the LRMC-based price […]*". The mark-up for TOU tariffs is illustrated in the **AEMC Discussion Paper** (Appendix D).

Why this bias towards higher usage charges? It appears to be largely related to fairness of recovery of the residual costs. For example, the Australian Energy Regulator (AER) in its **submission** to the AEMC pricing review stated it was that 'residual costs are often embedded in variable usage-based charges for simplicity and to align contribution with perceived fairness (i.e. higher users pay more).'

A contributing factor appears to be that there is a lack of appreciation of the inefficiency of excessive usage prices, including their impact on curtailing consumer energy use and on the uptake of solar. For example, in its submission, the AER notes the approach (of inflating usage prices) may have a range of unintended consequences (relating to 'diluting marginal signals', 'undermining pricing consistency', and 'perceived fairness with inequitable outcomes') but does not mention inefficiency. Furthermore, rule **6.18.5(f)1** requires that in setting tariffs regard is given to the "**costs and benefits** of calculating, implementing and **applying** the LRMC method." There appears little demonstration of this the tariff structure statements and supporting documents developed by DNSPs.

Conclusion

The commonly used formula for determining DNSP flat tariffs (and TOU tariffs) is inaccurate because it does not account for how consumers respond to price. This inaccuracy appears to have contributed to network usage prices being inefficiently high and effectively subsidising roof-top solar. It is unclear how the growing use of household batteries will affect the issue. This would appear to be an important area for future research.

The issue could be addressed with more efficient time-varying tariffs enabled by the rollout of TOU meters. However, the identified problem also applies to how TOU tariffs are determined.

Regardless, there appears to be a deeper more concerning issue with the process of tariff setting. The focus of the rules is clearly on efficiency and the rules are prescriptive in requiring tariffs to be based on LRMC and that regard be given to costs and benefits of the methods used. It is thus surprising that neither the guidance paper produced for the AEMC, nor any papers since examined whether the commonly applied formula is efficient.

Appendix: Finding the optimal network usage price (flat tariff)

Consider the challenge of optimal pricing when the cost of servicing is driven by the demand during a peak period, but the price must be the same for all periods.

Assume:

- there are N periods each denoted by subscript i.

- demand in period i is $Q_i = Q_i(P)$ with inverse demand function, $P_i = P_i(Q)$. Q_m is the demand in the period m with maximum demand that drives additional investment and Q_a is average demand ($Q_a = \sum_{i=1}^{N} Q_i(P)/N$).

- C is the LRMC (i.e. annualised cost per additional unit) of maximum demand.

The total net benefits (net surplus, S) is equal to:

- the benefits being the area under the demand curve (= $\sum_{i=1}^{N} \int_0^{Q_i} P_i(Q) dQ$)

- less the costs of the system ($Q_m C$).

The optimal price (P^*) (which maximises total net benefits) occurs when the marginal costs equal the marginal benefits. This can be found by differentiating and equating costs and benefits with respect to price:

$$\sum_{i=1}^{N} \frac{dQ_i}{dP} P^* = C \frac{dQ_m}{dP}$$

And therefore, the optimal price (P^*) is simply:

$$P^* = \frac{C}{N} \times \frac{Q'_m}{Q'_a}$$

where $Q'_m = \frac{dQ_m}{dP}$, $Q'_a = \frac{dQ_a}{dP} = \sum_{i=1}^{N} \frac{dQ_i}{dP}/N$

That is, the optimal price =

- the price calculated using the common approach (C/N)

- *multiplied* by the ratio of the demand response to price in the critical peak period to that averaged across all periods (Q'_m/Q'_a).

This can also be written as the optimal price =

- the price calculated using the common approach (C/N)

- *multiplied* by the ratio of the price elasticity of demand in the critical peak period to that averaged across all periods ($\frac{Q'_m}{Q_m} / \frac{Q'_a}{Q_a}$)

- *divided* by the load factor ($\frac{Q_a}{Q_m}$)