Rate Setting for an Electrified World

BY JACKIE NOCK

Abstract

Electrification to meet decarbonization goals is a significant new risk facing regulators and utilities. This paper identifies potential changes to regulatory rate setting processes that could help lower the cost of electrification, including addressing regulatory siloes, aligning utility employee incentives, competitive pricing (such as rate discounting), and congestion pricing.

INTRODUCTION

Utility regulation has been designed since the 1950s to address the natural monopoly position of energy utilities – to protect the public from potential monopolistic behaviour on the part of a public utility while ensuring the continued quality of utility service.

This continues to be an important goal, but is this the only problem that regulators should address?

Professor Malcolm Sparrow states in his book 'Fundamentals of Regulatory Design':

> *Regulatory agencies exist primarily to control risks to society. …*
>
> *The programs, or course, were designed as solutions to the set of risks that existed at the time the programs were created, and may be successful in achieving their design purpose. But major programs, once created, tend to ossify over time, and lack the flexibility to cover the shifting landscape of risks.*

Professor Sparrow encourages all regulatory agencies to allocate resources to 'problem-centric' work in order to identify new risks that might not be addressed by existing programs. The regulator can then evaluate each new risk to determine if it should allocate resources to address it.

This paper puts forward a new risk that was not around when regulatory programs were established – electrification to meet decarbonization goals. It then suggests changes to existing programs (with a focus on rate setting) that may be needed to address this new risk.

This paper assumes the regulator has determined that supporting electrification of transportation, buildings and industrial processes is both within the regulator's mandate and in the public interest. and that the regulator is starting the process of updating regulatory programs to support a cost-effective and equitable transition.

This paper is not intended to demonstrate that electrification is a new risk for all regulators, or that it is the only new risk that existing programs may not address (for example, cybersecurity and extreme weather are other new risks), or that the suggested changes are the optimal approaches.

Instead, the purpose of this paper is to serve as an illustrative case study to show potential outcomes that could result from an increased focus on 'problem-centric' work.

Jackie Nock is a regulatory specialist with over 20 years' experience in utility regulation in New Zealand and North America. Jackie can be reached at familynock@yahoo.ca

NEW RISK: ELECTRIFICATION

Multiple studies have identified that electrification of buildings (along with transportation and many industrial end-uses), combined with decarbonization of power generation, is critical to achieving deep decarbonization goals. (Billimoria, 2018; Davis, 2021)

This creates a new risk for regulators as electrification impacts natural gas utilities, electric utilities, and their customers.

For example, if utility rates and programs discourage customers from fuel switching to electricity when they are replacing their existing gas equipment, this could increase the cost of the clean energy transition.

If poorly planned, electrification could also result in the cost of the gas network and the more expensive clean gas substitutes being borne by those least able to exit the gas network (such as low-income customers and renters). It could also result in unnecessarily high electric costs (or reduced reliability) to serve the new uncertain load.

NEW RATE SETTING APPROACHES

This paper identifies four changes to regulatory approaches that could be used to lower the cost of electrification to meet decarbonization goals, with a focus on rate setting:

1. Address regulatory silos (between gas and electric filings)
2. Align utility employee incentives (bonuses)
3. Competitive pricing (gaining new electrification load)
4. Congestion pricing (integrating electrification load)

This paper is not intended to include all the changes that may be needed (such as long-term planning), but merely be a starting point for discussion.

1. Address Regulatory Silos

Regulatory processes are still generally structured around the 1950s monopoly utility 'problem definition', with regulators generally agnostic regarding customer fuel choices. Gas and electric utilities file their rate design applications separately and they are reviewed independently from one another.

However, when making investment decisions (such as replacing heating equipment) customers compare

offerings from the gas and electric utility – which can include utility retail rates, energy efficiency incentives and extension policy. Where electrification is the lowest cost way for society to achieve emission reduction targets, shouldn't the pricing signals utilities send support this outcome (or at least not discourage it)?

This may seem like an obvious approach to customers (who may expect that regulators are doing this already) but it is not an approach generally used by regulators due to the siloed nature of regulatory proceedings.

To address this, regulators could move from the existing siloed approach - where gas and electric utility rate design, energy efficiency and extension policies are reviewed separately from each other - to a holistic view.

Utility revenue requirement applications would still be undertaken separately, with total rates/revenues set to allow a fair return for the utility and fair cost recovery between customer classes. However, when it comes to rate design, energy efficiency programs and extension policies, the regulator would combine all these gas and electric filings. The regulator would then review this bundled filing from the perspective of the end use customer by looking at the service being provided, such as:

- transportation,
- building heating/cooling and
- industrial processes

This would allow the regulator to identify whether, for each service, electrification is a likely outcome of the clean energy transition. If yes, the regulator could then determine whether existing gas and electric pricing signals discourage electrification (and so could increase the cost of the energy transition), and if so, propose changes to address them.

For example, for buildings the regulator may determine that energy efficiency programs encouraging customers to invest in gas equipment are not in the public interest, or that utility contributions under its extension policy should be reduced or removed where there is concern that the customer will not be there for the economic life of the utility asset.

This approach could also support better visibility into the size of the potential electrification load. It could then help start a discussion into how electric utilities can cost-effectively serve this load, and how to equitably address gas utility rate impacts resulting from a loss of load.

Transportation also requires a holistic approach as the electric service provided to any one transportation customer can occur at many different metered locations. Specifically, while the majority of a customer's electric vehicle (EV) charging occurs at home, EV owners also make use of public EV charging stations at their workplaces and when travelling longer distances.

The starting point for a review of residential electric transportation rates would therefore be an amalgamation of the revenues from public EV charging stations and home charging (in addition to EV incentive programs offered by the utility). Residential bills do not typically separate out EV charging from other services, however estimations could be made.

Under this approach, even if revenues from public EV charging stations do not recover their costs, they could be considered fair overall if total transportation revenues recover total costs.

2. Align Utility Employee Incentives

The decarbonization of the energy sector can have a significant impact on gas and electric utilities, and their customers. We will need talented utility employees to bring their best ideas forward to ensure an efficient and just transition. Is there more regulators can do to support this?

Electric and gas utilities are generally regulated under cost-of-service regulation, where the utility's allowed income is directly linked to the size of the investments made by the utility (referred to as 'rate base').

Electric utilities under cost-of-service regulation therefore do not have a clear financial incentive to propose time-of-use rates that reduce the need for supply-side investments. A gas utility would also have no incentive to design rates that encourage electrification. In both cases, these actions would reduce the utility's rate base and so decrease their allowed income.

Strides have been made in many jurisdictions to address this disincentive through alternative forms of regulation, such as performance-based regulation. However, it can be difficult to fully remove the incentive to invest in supply-side assets.

This paper proposes an additional tool that regulators could consider. It starts with the recognition that there is more than one way to incentivize a service provider. Consider restaurants – you pay the bill at the end of the meal, but also tip your server. The same approach could be considered for utilities.

Instead of only using broad brush tools to incent the utility, regulators could expand their toolbox to include an additional incentive that is specifically used to fund utility employee bonuses.

Critics could argue that this will result in an additional cost to customers, over and above the amount the utility is already allowed to earn on its rate base. However, this could be a relatively low-cost way of mitigating the bias towards supply-side investments, and so result in lower costs to customers overall.

There could also be a concern of regulatory overreach - regulators do not typically micromanage utility employee incentive programs. However, this option provides utility employees with an opportunity to increase their earnings, while preserving the ability of the shareholder to earn a fair return on existing assets. It could also mitigate shareholder stranded asset risk by discouraging unnecessary supply-side investments. Utilities may therefore not be opposed to this proposal.

In addition, the UK regulator, Ofgem, already uses a similar 'employee bonus' approach. Ofgem asks utilities to demonstrate how they intend to align the structure of pay and reward within the organisation to the delivery of their business plan commitments. (Ofgem, 2018)

Electric Utilities

For electric utilities, the incentive pool could be tied to achieving electrification targets and cost-effectively integrating the new load. This could encourage staff to bring forward innovative ideas that might not otherwise have been supported within their organization.

For example, many gas and electric utilities already have energy efficiency staff who have a great understanding of their customers' energy uses. If these staff were given bonuses (linked to electrification targets) and pricing flexibility, this could significantly accelerate electrification.

If bonuses were also provided for initiatives that cost effectively integrate this new load (for example, using 'smart grid' solutions), these could have further benefits for customers.

Gas Utilities

For gas utilities, managing a transition away from natural gas will require all of the expertise and skill of the gas utility's employees. There will need to be a strategy in place to ensure the costs of the energy transition are not borne by those least able to afford it and that the safety/reliability of the gas system is not compromised.

However, under cost-of-service regulation, the utility is instead incented to grow the rate base. It could also be discouraged from requesting mitigation approaches (such as accelerated depreciation) as this reduces the utility rate base. Instead, it may propose exit fees which could delay electrification and so increase the costs of the transition.

The problem here is not with the gas utility, but with the regulatory incentive structure it is working under. The best way to address it is to fix the incentives.

An incentive pool for gas utility employee bonuses could link bonuses to specific action items, such as developing and implementing a plan to support strategic pruning of the gas network, equitable cost recovery of existing assets, and an employee retention strategy to ensure safety and reliability is not compromised during the transition. The regulator may also want to include an incentive pool linked to reducing methane leaks and helping customers electrify.

The regulator's ability to 'find important problems and fix them' can be significantly enhanced if we ensure that the utility executive management and supporting staff are incentivized to do the same.

3. Competitive Pricing

Regulators have traditionally been agnostic about customers' fuel choices and so rate designs (other than bypass rates) did not consider customers' competitive options.

However, where electrification is the least societal cost option, shouldn't regulators also ensure that (to the extent possible) it is the least priced?

Bonbright, author of 'The Principles of Public Utility Rates' (Bonbright, 1988) and often considered the father of rate design, addressed a similar issue.

In the 1980s telecom utilities were facing competitive pressure. Bonbright (p. 592) stated that when there is competition in the market, the *least-cost provider should be the least-priced supplier*.

To achieve this outcome, for rate designs the variable charge for natural gas costs might be increased relative to the fixed charge, while for electricity rates the opposite could occur.

The electric utility could also discount its rates to obtain this new load. Bonbright (p. 620) provides pricing principles for utilities seeking to attract/retain load in a competitive environment:

> *Prices should be allowed to be set with incremental cost at the minimum. At the maximum, prices for regulated services should be set at standalone cost. Prices that are set at levels between those two economic benchmarks will not involve cross subsidy. Within these bounds, considerable pricing flexibility should be allowed*.

This approach could allow the electric utility to obtain new profitable load that it would not otherwise be able to obtain under the regulated tariff. It should therefore benefit all customers (some contribution to fixed costs being better than none).

For larger customers, this could result in a move from standardized tariffs to negotiated contracts, and for residential and commercial customers it could result in discounted rate options for customers switching to EVs or heat pumps.

There could also be areas where electrification is considered the lowest cost option from a societal perspective, but where the electric price (even when set at incremental cost) is still too high to incent the customer to fuel switch. An example could be large industrial customers where a significant investment in new transmission infrastructure is needed.

In these cases, government may want to provide funding to 'bridge the gap' or put in place codes/standards to require the customer to fuel switch. This approach ensures that the cost of electrification to meet decarbonization objectives is not disproportionately borne by electric utility ratepayers.

4. Congestion Pricing

A key issue with electrification is how to efficiently integrate this new load.

One option is to use time-of-use pricing to encourage customers to shift load away from peak periods. A question for rate design analysts then becomes how to set the peak/off-peak pricing differential.

Bonbright (p. 511) states that the peak/off-peak differential should reflect the utility's marginal costs. However, this is easier said than done given the lumpy (and regional) nature of network investments. In addition, customers do not always respond efficiently to efficient pricing signals.

Utilities could easily end up in a circular situation of designing rates with only a small peak/off-peak differential on the basis that the customer response will be too small to defer network costs.

The experience of Orion (an electricity distribution network located in New Zealand) is illustrative of an alternative approach to setting the peak/off-peak differential. This is referred to as congestion pricing.

Around 1990 Orion was facing a congested network and so put in place pricing signals to encourage customers to shift to off-peak periods. Orion describes its approach as follows:

> Like roads, electricity networks have 'rush hours' where loading levels peak and capacity is fully utilized.
>
> Orion's rush hours typically occur on cold winter mornings when residential load coincides with the start of the business day, and again on cold evenings when people arrive home from work and turn on their lights, heaters, and cook their evening meal. ...
>
> One solution to cope with these relatively short periods of high loading is to expand our network's capacity - much like making roads bigger to handle more traffic. But this is very expensive, especially given that the additional capacity is not needed 98% of the time, and would mean price increases.
>
> We think it makes better sense to promote other cheaper options, such as load management, where we reduce the electrical load on our network during periods of peak demand. We can do this by heating hot water cylinders at off-peak times, and through pricing that encourages off-peak electricity use.

Orion's peak/off-peak differential for residential and small commercial customers is around 3:1, and by 2010 this resulted in a reduction of peak demand of around 10% (with direct load control contributing an additional 10%). This resulted in a significant cost benefits for all customers.

Orion did not base its peak/off-peak differential on a marginal costing study. Instead, Orion's approach was based on the differential needed to elicit an efficient customer response.

This is consistent with Bonbright's (p. 383) efficiency rate design principle:

> *Discourage the wasteful use of public utility services while promoting all use that is economically justified.*

The congestion rate would still have to be evaluated against all the rate design principles (Bonbright, p. 383), but at least a rate design that could defer the need for new supply-side investment would be evaluated. Additional rate design considerations are described below (AUEB, 1996):

> *Before making a change in [rate] design, the Board would need to be satisfied, on the basis of clear and convincing evidence, that greater efficiencies or cost savings would accrue to the benefit of [customers] overall. The Board would also need to be satisfied that the magnitude of the changes to affected parties are acceptable and that benefits in the broad public interest would result. The Board would also look for transitional measures designed to manage such changes.*

In addition, as an important impact of pricing occurs when customers are replacing their plant, congestion pricing may need to be put in place well in advance of the actual need for demand response in order to defer the network investment.

CONCLUSION

Professor Sparrow encourages all regulatory agencies to allocate resources to 'problem-centric' work to identify and address new risks.

There are significant new risks facing the energy industry that were not around when existing regulatory processes were first designed. For example, electrification of transportation, buildings, and industrial processes to meet decarbonization goals can have a significant impact on utilities and their customers.

This paper aims to highlight the need for allocating regulatory resources to 'problem-centric' work by identifying potential changes to existing regulatory rate setting processes that could help lower the cost of electrification.

Professor Sparrow notes that 'problem-centric' work can be both difficult and intellectually challenging, but by working together (and with sufficient resources) we should be able to provide good solutions and great pathways going forward.

Disclaimer

This paper was prepared by Jackie Nock in her personal capacity. Views, thoughts, and opinions expressed in this paper belong solely to the author and not to the author's employer.

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