Level 8, 241 Adelaide Street
Brisbane QLD 4000

EnergyFlex Submission to Senate Economics Reference Committee Inquiry into Residential Electrification

Wednesday, September 27, 2023

Senate Economics References Committee

Inquiry into Residential Electrification

Parliament House

Canberra ACT 2600

Dear Committee Members,

Thank you for the opportunity to provide a submission to the Inquiry into Residential Electrification.

Our view of Residential Electrification

Full household electrification is a vital and unavoidable element of decarbonisation, but household electrification is not a universal good. If done appropriately, household electrification leads to lower energy costs, lower emissions, and a re-invigorated community. If done improperly, household electrification adds to the firming challenges facing the renewable energy transition. Costs soar, emissions rise, and the economic viability of renewable energy and industry is placed at risk.

The key is timing. In a renewable energy system, ***when*** you use power is more important than how much power you use.

Renewable energy is driven by the sun and modulated by the rotation of the earth. There is no viable technology or enforceable policy that can alter this fact.

As we move to a renewable energy system, we must recognise the fundamental characteristics of the system and design our society to fit within those limits. Those fundamental characteristics are variability (caused by the rotation of the earth), intermittency (caused by induced weather effects) and correlation (because everything is driven by the sun). The standard response to variability and intermittency is overbuild, but, when combined with correlation, these three factors threaten the economics of a renewable energy system if demand is kept constant. Shaping demand to flexibly fit within the available renewable profile is the only viable route to a sustainable, affordable, and reliable renewable energy system.

About EnergyFlex

EnergyFlex is a data company focussed on enabling the energy user side of the economy to adjust to the energy transition. We are a proudly Australian and veteran-owned and operated energy data, insights, and education solutions provider. Founded by two aerospace systems engineers, we have a different take on the energy transition challenge: one that prioritises timing over consumption.

At EnergyFlex, we believe that if we don’t change our energy habits, electricity prices will keep increasing, meeting net-zero emissions targets will become more challenging, and we’ll delay progress towards a sustainable and low-carbon future.

As more renewable sources are added to the mix, energy flexibility will become increasingly important, and collaboration and coordination will be crucial. We want to make it as easy as

possible for everyone to play their part in ushering in a greener energy future and becoming Renewables Ready, starting where they are with what they have got.

The remainder of this submission focusses on EnergyFlex's responses to the questions facing Australia's residential electrification efforts:

(a) the economic opportunities of household electrification, including but not limited to:

(i) long-term reduction of energy price inflation

If the renewable energy transition replaces fossil fuel with renewables while leaving demand unchanged, then energy price inflation is inevitable. The benefits of cheap renewable generation will be overwhelmed by cost of storage (firming) which, as arbitrage businesses, must leverage overall costs.

Typical household electricity use currently represents the worst possible profile for a renewable energy system. Household use peaks in the evening, as solar generation crashes and wind typically drops off, continues at a relatively high level overnight, peaks again just before solar generation kicks in and then drops off during the day. Household solar is the prime driver of low daytime demand and, when coupled with regulations that guarantee export, this contributes to daytime grid instability. Full household electrification, without a concurrent program to shift the residential use profile, will likely increase the evening peak. As this typically forms 40% of the total household cost of electricity, any increase will produce a cost multiple.

Household electrification with behaviour change can have the opposite effect. With solar, households minimise their cost by maximising their own energy utilisation. They manage their energy outcomes by adjusting their energy behaviour. With appropriate tariffs, every household can achieve a similar result. We call this "Virtual Solar".

From the householder perspective, the key to reduced energy cost through full electrification therefore rests on the energy behaviour of the householder themselves. This is primarily an education challenge, not a technical or even an economic challenge.

(ii) long-term employment opportunities

Our existing society has been shaped by the energy system that underpins it. One example of this is nightshift, which did not exist before we unleashed the benefits of fossil fuel. Likewise, as we change our energy system, we will discover as yet unimagined impacts on our society and how we live.

The energy transition will take us at least 30 years and the employment opportunities that emerge during this transition will be considerable. The key question is not whether household electrification will create employment but whether we change the system and forge a new energy future or demand things stay the same and choke our economic opportunity.

(iii) the scaling up of domestic capacity.

The COVID 19 pandemic highlighted the vulnerability inherent in our just-in-time, fully integrated, international economy. While the cost savings through economy of scale, massive production and

mass transportation are apparent, the risks of this 'all flow and no stock' type of arrangement became apparent when the continuous international transport system was interrupted. The conclusion from this is that our current fully integrated international trade system is completely reliant upon transport. And transport is one of the most difficult to abate sectors of the economy.

As decarbonisation of transport is almost certain to increase the cost of that transport, it is highly likely that this will translate into a competitive advantage for local manufacture and repair focussed manufacture. These factors provide an opportunity for domestic capacity to scale up to fill the incipient demand.

(b) the macro-barriers to increasing the uptake of home electrification.

Macro barriers to home electrification are cost (CAPEX and OPEX), capacity (supply and installation) and education. EnergyFlex's key offering is education: the main obstacle we face is a requirement for tariff reform.

Government rebates partially address the CAPEX issue, but the seemingly inexorable electricity price rises cast doubt on payback calculations in the mind of average consumers. Nothing in the public discourse suggests that electricity will become significantly cheaper in the near to medium term. Therefore, full household electrification 'feels' like it will be more expensive.

Our platform educates consumers to understand how their individual energy use behaviours impact their energy cost. By changing their energy use profile to match renewable generation, users can take advantage of cheap electricity each day and avoid expensive, high carbon, firmed electricity every night. This behaviour reduces retailer's cost and risk, but current tariff structures do not flow this value to the consumers who are willing to provide the service.

Our platform nudges consumers towards spot exposed, wholesale tariffs, educating them to be able to safely accept and manage the risk, but the chasm between the current tariffs, whether fixed or coarse time-of-use, is too great. New tariff structures that reward progressive acceptance of risk by consumers, balanced by consumer flexible energy use, are required to incentivise the full electrification of households.

(c) the total upfront cost and longer-term benefits of household electrification and alternative models for funding and implementation.

In order to be successful, household electrification must reduce the relative cost of electricity. This cost must be measured in absolute, not relative terms. For example, if current energy cost is 10% of household income, and future 'do-nothing' cost (the counterfactual) would be 20% of household income, but electrification would require only 15% of household income, this should be considered a 50% increase in energy costs, not a 25% reduction.

Government subsidies to defray the cost of electrification may be appropriate to kick-start change but cannot be supported in the long term. Because this change will impact the whole of the economy (residential, C&I and heavy industry) there is no unaffected sector that is available to cross subsidise any other sector. Therefore, electrification must pay for itself.

Electrification can pay for itself if the new equipment is used to increase flexible operations, thereby reducing rather than increasing the energy cost. Once again, full engagement of the demand side through self-interested flexible operations is the key to an electrified renewable energy system.

(d) the marginal cost of abatement for household electrification compared to alternative sectors and options to decarbonise the economy;

Analysis that pits decarbonisation of one sector of the economy against another is doomed to fail. The economy is a self-balancing system. As each sector de-carbonises the relative cost of the product of that sector will adjust the use of that product. For example, the rule of thumb for aluminium economics (in $2020) is as follows:

> If the price of aluminium is < $2000/t, the cost of electricity makes production unprofitable.
>
> If the price of aluminium is >$2700/t, manufacturers will substitute carbon fibre for aluminium.

Of course, economic conditions, inflation and technological advances will adjust the numbers, but the key point is that every commodity exists within an economic niche that is bounded by scarcity, production cost, sale price and substitution. Of these, substitution is often overlooked in low dimension analysis that holds the environment constant as the target variable is changed.

In general, electricity use is roughly split into thirds between the Residential sector, Commercial & Industrial, and Heavy Industrial sectors. All sectors must change. Rather. Instead of estimating the relative marginal cost of each sector, plans should focus on addressing the easiest and most valuable element of each sector in a round robin type arrangement.

(e) the optimal timeline for household electrification accounting for the likely timing of decarbonising electricity;

It has been said that the optimum time to plant a shade tree is twenty years ago, or today. Similarly, programs to incentivise household electrification should start immediately.

As stated above, we hold that the renewable energy transition will inevitably lead to intra-day price separation, i.e., prices will crash when renewables are generating and skyrocket when firmed power (whether from storage or flexible (CCS supported) fossil fuel generation). Spot prices in the NEM are already exhibiting this trend: in Queensland the price differential between daytime (solar generation) spot price and the evening peak routinely hit a ratio of 1:30 while the daytime: overnight ratio is already 1:4. As we reduce the available overnight coal fired generation this separation between day and night will increase. And because this takes place over as longer period, it is the overnight price (where bulk power supply must be firmed) that will drive the economics of flexible operations.

In conclusion, conditions are already ripe for flexible operations (if tariffs allow). Voluntary exposure dynamic pricing is the best incentive to change.

(f) the impacts and opportunities of household electrification for domestic energy security, household energy independence and for balance of international trade;

In a variable renewable energy system, energy security rests on the ongoing ability to match supply to demand. Under current regulations all demand is considered equal. This equates the demand of a lava lamp with the demand necessary to maintain operations of a hospital respirator: this is a farcical situation. In order to achieve energy security in a renewable energy system, demand must be prioritised. Critical demand, that which is necessary to maintain life, safety and security must always be met. Discretionary demand, which includes all entertainment, comfort and even production process demand, must be prioritised and met on an as available basis. The best method to achieve this is through safe exposure to the dynamic price of electricity.

In EnergyFlex view, pursuit of household energy independence is a wrong-headed idea. In order to attain full energy independence, a residence would have to dramatically over invest in generation and storage and simultaneously practice sufficient energy flexibility to ensure that the remaining load was able to exist within the available energy envelope. Appropriate connection of any such home to the grid would allow for resource sharing in generation and storage, benefiting both the homeowner and the community. The level of flexibility required would also be reduced. Flexibility, whether on an individual or community basis is the key to energy security.

The opportunity to scale local manufacturing and its impact on the balance of international trade is addressed at paragraph a(iii) above.

(g) the impacts of household electrification on reducing household energy spending and energy inflation as a component of the consumer price index;

Electrified appliances are typically more energy efficient in the home. But inappropriate time of use of appliances requires firming which, whether delivered through storage or flexible fossil fuelled generation, introduces system wide inefficiency. This system wide inefficiency overwhelms individual component efficiency, which results in increased whole system costs.

(h) solutions to the economic barriers to electrification for low-income households;

Low-income households are a perennial problem for the energy transition. Low-income households suffer the most from energy poverty and devote the greatest proportion of their income to energy. This limits their ability to outlay the funds necessary to change their appliances to increase efficiency. But, while low-income households may not be able to replace their appliances, they do have the ability to control their actions. By becoming flexible, low-income households can reduce their energy cost, thereby freeing up funds to progressively increase their flexibility and replace inefficient appliances.

In addition, low-income households and renters have been denied the opportunity to participate in the solar revolution, either through lack of funds or lack of ownership of the roof where solar can be installed. But, through flexibility supported by appropriate tariffs low-income households and renters are able to access electricity from solar on other people’s rooves, through a process we call ‘virtual solar’. Therefore, through flexibility, everyone can minimise their immediate costs and influence their future costs through their own actions.

(i) the effectiveness of existing Australian Federal, state and local government initiatives to promote and provide market incentives for household electrification;

Australian federal, state and local government initiatives have proven successful in sparking change. However, such programs should be carefully applied as they can quickly produce unintended consequences. For example, the initial residential solar incentives successfully kick-started residential solar installation, however, excessive feed-in tariffs and over-subscription to residential solar is a major source of the 'duck curve' including the low demand and firming challenges facing the energy transition at present. Also, as stated above, because this transition impacts all areas of the economy, there is not unaffected sector that can cross-subsidise the remainder. If one sector is subsidised, every other sector of the economy has a valid claim for similar subsidies.

Electrification initiatives without concurrent flexibility initiatives will increase use when it is most convenient to houses. This will have a negative effect overall. Therefore, household electrification with flexibility is required.

(j) Australia's current standing against international standards, particularly with respect to the uptake of rooftop solar, batteries and electric household appliances;

At present we cannot see any other jurisdiction that is properly involving the demand side in the equation, even though this is critical for the successful energy transition. Therefore, flexible household electrification represents an opportunity for Australia to lead the world.