THE WIRES THAT BIND- Electrification and Renewal: SAUL GRIFFITH (Quarterly Essay 89: 2023)

Preface

In a 1951 interview, the French poet and playwright Jean Cocteau was asked, "Suppose flames were consuming your home and time was precious. What one thing would you carry away?"
The famously agile Cocteau replied, "I would carry away the fire."
And so it needs to be with climate change. We need to carry away all of the little fires in our lives, all the blue flames, all the fires burning from fossil fuels, all of which create the global heating that in Australia literally threatens so many of our homes with incineration.
We should carry away the fire. We can do all the things that fire can do with electricity. This is what I mean when I say we must electrify everything. With clean electricity, we can not only cook, heat, drive, refrigerate, make steel, even fly, but we can do these things with no emissions. But we can't do it individually, we can't rely on the market to change fast enough, and we can't wait for governments to take action.
We have to do it ourselves, in our homes and, especially, in our communities.

The Wires That Bind: Electrification and Community Renewal

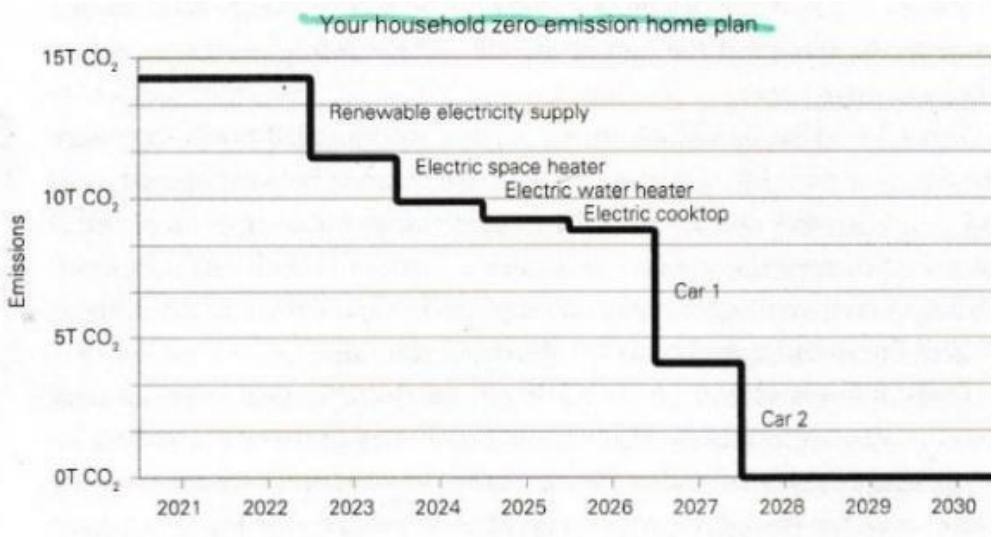
- The Australian electricity network is the largest machine Australia has ever built. It physically links every single household and every single Australian… It exists because of our common need for energy… (These wires) also connect you to the future of our energy system, and to our principal solution in tackling climate change: the electrification of everything.
- To make the transition we must make, we need not just new physical infrastructure but also new ways of leading and particularly of organising at a community level.
- We tend to talk about climate change as a choice between dystopia and utopia, but neither idea is very helpful in getting us to a better future… (Kevin Kelly) believes that we are constantly seeking a *protopia* … always trying to make the future a little better for our descendants.

Electrify It When It Ends

- Although people want change, they want change that doesn't disrupt everything.
- To make the transition to an all-electric economy, we have to carry away all the fossil-fuel machines… (W)e have made such changes throughout history… Remember the iceman.
- Merely getting industry to decarbonise isn't enough: we need industry to decarbonise while also making clean electric machines to replace our cars and appliances.
- If we add everything up… there are about 1 million supply-side and industrial machines, and around 60 million demand-side residential and commercial machines burning fossil fuels.
- In addition to needing a new infrastructure, every home will need a Home Energy Management System (HEMS).
- If we want to hit better than 2^0C as a global climate target, we've got to go with 100% replacement at end of life. If we want to achieve anything like a 1.5^0C outcome, which is what our coral reefs, glaciers and children demand of us, we really need a combination of early retirement of the heaviest emitters, combined with mandated end of life. Our cars last 20 years; our appliances about the same. If, starting this year, we had perfect replacement at end of life, that means 2043 before we are almost zero emission, and even so there will be some stragglers.
- Every Australian household needs a plan, and the plan needs to replace the things in their life that emit $C0^2$.

- We can optimise the building codes, train the workforce, provide regulatory certainty and phase out dates that provide market certainty. We can reform the tax code around these purchases, and build these ideas into the way we design social housing and low income assistance… We can make this project go faster, and get a better climate outcome, or let it go slower and get a worse one… (W)e've got 10 million households to get to zero.

Household zero emission home plan



Electrification is Anti-Inflationary

- Given that the likely result for fossil fuels through this energy transition is increased price volatility… the electrification of households makes energy costs predictable and stable far into the future… If we generalise the numbers … to the national level Australians will be saving up to $40 billion a year.
- *The largest wealth transfer in human history*: Electrification can have a profound effect in keeping wealth in our households and communities… The losers will be centralised (fossil fuel) energy companies… The winners will be in the localised, decentralised energy economy.
- *The US Inflation Reduction Act (2022)*: It could release close to US$900 billion in demand-side electrification incentives… The IRA directly engages with American households. Each will have access to an average of $14,000 in up-front discounts to switch to electric appliances in their home.
- The IRA poses a threat if Australia isn't at least as ambitious… Unless Australia matches its intensity and ambition, it could find itself the dumping ground of last century's technologies as corporations focus their supply chains across the United States.
- Australia could legislate rather than just direct spending. We could legislate improved building codes, zero-emission vehicle standards and sunset dates for fossil fuel machines.
- Australia has many natural advantages that can make it a leader in the decarbonisation economy. It leads the world in rooftop solar, household batteries and the digital integration of these assets.
- If we were to spend pro-rata what the US did in tis IRA, we'd be legislating to invest $40 -50 billion over ten years, half in incentives directly to households and small businesses, and the other half to the industrial and supply side.

- Best of all would be government backed loan guarantees or similar mechanisms that help every Australian take the electrification journey and reap the benefits.

Neo-Capitalist Communism

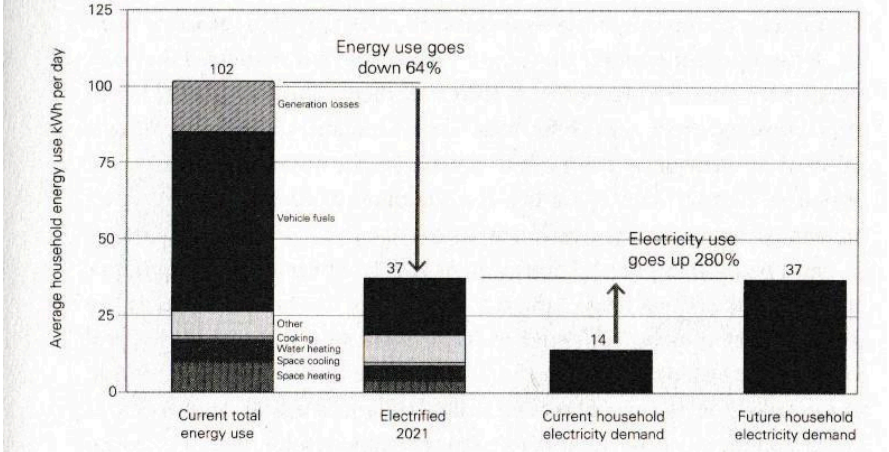
- "True leadership calls for the setting forth of the objectives and the rallying of public opinion in support of these objectives."(Franklin D. Roosevelt)
- I don't think we can kill or reform capitalism in time to save the planet, and we need capitalist signals, market structures, investment mechanisms and entrepreneurship to give us solutions and to finance them. But I also believe that we need a stronger focus on communities and a reorganisation of the capitalist economy around communities… The politics of climate change need a politics of the collective more than the politics of the individual. We can only succeed together; we are inextricably linked by the carbon levels in our atmosphere. No matter how wealthy we are, climate disruption will find you, as the poor already know. The electricity network is both our social and technological way to address these elevated carbon levels. It is a human made solution to a human made problem, but the answer only works at a collective level. They are the wires that bind.

Municipals: Back to the Future

- Since the privatisation of electricity and gas supply industries and the introduction of the National Energy Market (NEM) in 1998 , "we have seen nothing but increasing prices."
- What will give Australian households the cheapest electricity going forward?

All told, when electrified, an Australian household will need about 37kWh of electricity daily.

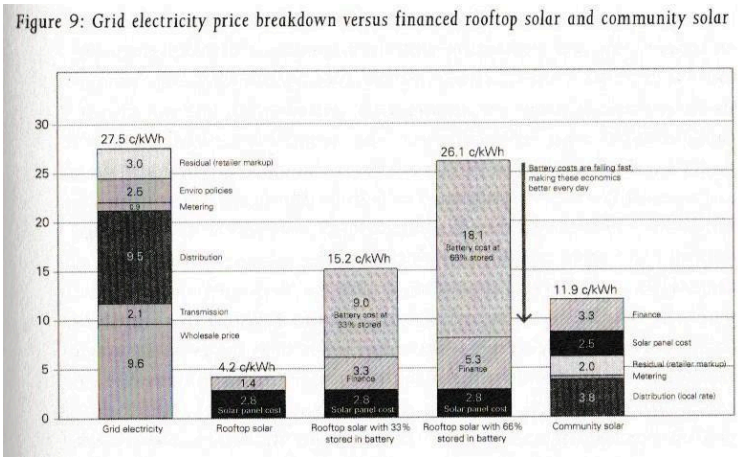
Figure 8: *Australian household energy use – current fossil-fuel mix versus electrified household*



More electrons will make the (distribution) grid cheaper:

	• Column 1 shows the average cost of retailed electricity. • Column 2 shows the estimated cost of Australian rooftop solar – cheapest in the world? • Column 3: If you only need to store one third (via battery) because you are charging the car and heating your water during the day, it pencils at about half of the grid cost.

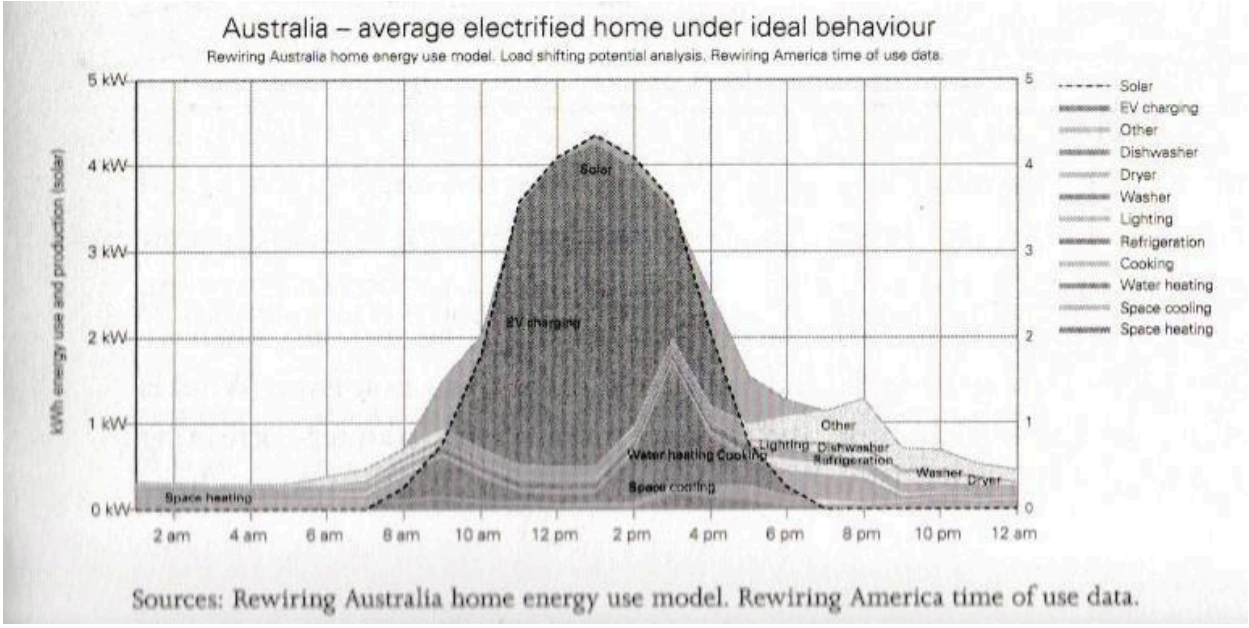
Figure 9: Grid electricity price breakdown versus financed rooftop solar and community solar



- Column 4: If you need to store two-thirds of that sunshine to run the house and charge the cars in the dark, you'll pay just under what you currently pay on the grid.

We have crossed that magic threshold where battery-backed solar is cheaper than the grid in most of Australia. The cost is only going to fall further. Moreover, we are developing better technologies to manage our loads through demand response, which will be managed by the local distribution grid talking to the Home Energy Management System (HEMS).

Energy management: The graph below tells the story of what we need to do to co-ordinate appliances, vehicles, households and solar energy… The challenge for Australia's electricity system is in this image: how many of the things that we do can we squeeze into the "solar window" (between 8am and 6pm)? In the perfect world, we 'd charge all our cars during this solar window, heat our water during the day, pre heat or pre cool our homes when it is sunny and keep the heat until later in our well insulated homes. We would schedule the washers and dryers to run during the day and use batteries to soak up the rest of the sunshine and power the things we need to do at night… Of course, we don't have to be this perfect at energy management, because the future will have much more wind on the grid, and Snowy 2.0 and other pumped hydro projects around the country will provide electricity at different times and store it in huge reservoirs for use later.



Rooftop solar for the win: We need to design Australia's electricity system :

- To incentivise everyone to design their household use not just for their average electrical load, but for their future middle-of-winter load, including their electric vehicles.
- To be 150% renewable, not 100% renewable. In a recent paper in *Nature,* one of the world's most respected journals, it was shown that with 150% of the generation capacity we need, 12 hours of storage and approximately a 50/50 mix of wind and solar, Australia would have 100% reliability of electricity supply all year round.

We need to reject fear campaigns about why it won't work and embrace an abundance agenda and an attitude of just making it work – for all of us.

Our Cheapest electricity – a community energy tariff: We know that the cheapest electricity in the future will be that on the rooftop, because it doesn't require moving electricity over great distances. The second cheapest could be that of your neighbour, who is generating more electricity than they need, and it only has to travel a short distance down the street to you. We also know that with increased electrification we will utilise our distribution systems better and these costs will go down, which – assuming better regulation – should lower overall costs. Additionally we know we can build community generation assets, such as solar on our schools and public buildings, and solar over our car parking spaces, and again, because that electricity is local, we know that it could be cheaper than what we have today. We also know that batteries are getting cheaper and batteries on four wheels (electric vehicles that do vehicle to grid or vehicle to home charging) are coming fast. It's an important conceptual shift to think about things such as cars and hot water tanks as batteries. We know, finally, that we will use modern control systems and HEMS to shift a bunch of those loads to the right times of day, and incentives such as cheaper car charging around noon to shift our behaviour. We also know we will generate more than we need and have giant national batteries in our pumped hydro systems.

With all that, we can envisage a situation where one-third, and maybe even one-half, of our electricity comes from our roofs and is much cheaper than it is today. Another quarter or third might come from the local community, or more if you are in a rural location. The remainder will come from the existing and expanded national network… The electricity should be abundant and cheap. In fact, it will be free or close-to-free some hours of the day and during the summer months.

But that outcome isn't certain, and the existing regulatory environment and rate structures don't support it, and there is some cause for pessimism as we start to restrict feed-in tariffs for rooftop solar. I hope you can see by now that the regulatory environment is as important as the physical one…

A community energy feed-in tariff would promote the use of local resources, local charging and locally built infrastructure, effectively keeping more money in a community while also minimising the costs of energy for the community…

We can calculate a future cost of energy of $1980 a year, one-third of what it costs us in the fossil world of today…

We need to be loud about the desire of Australians and the potential for communities to participate in this bonanza.

The stakes are high, but what we can be sure of is the critical role of households and communities in the future of Australian energy supply. Because of physical proximity they will be the lowest-cost generators.

Planes, Trains and Automobiles

The biggest emitter of CO^2 in the current Australian economy is the burning of coal for electricity production. This will end; we'll use 150% renewables. The second largest source of CO^2 is our use of cars and truck for moving us and our stuff around. There was a brief hope about twenty years ago that some cars would be powered with hydrogen, but as with much hope with hydrogen, that has faded. Hydrogen will be more expensive and less efficient and the likelihood we will build out separate hydrogen-refuelling infrastructure *and* electric-charging infrastructure over the whole country is enormously unlikely. There will always be a place for some diesel, and biodiesel and new technologies will easily fill that niche. It is pretty definite at this point: the great majority of cars will be electric.

Public transport: Melbourne trams are all electric and one of the most efficient transit systems in Australia, netting out about 100 Wh/passenger-km.

Lighter is better: In 1949, the Japanese government created a new category of vehicle, the Kei car. The category was designed to limit engine size, length, width, height and, consequently, weight… The all-electric Nissan Sakura Kei car has a top speed of 130km/h, by all reports is a hoot to drive and uses only 125 Wh/km to get from A to B.

It is unlikely that Australia will make full sized electric vehicles, though maybe we will assemble some. But it would be a good idea to adopt the Kei car standard here or write our own.

Tax the tyres: People worry about how we will pay for roads once the fuel excise goes away… If you were designing systems to pay for our road infrastructure, it would be most scientifically done by charging by the weight of the vehicle and the number of kilometres it travels… What we should do is tax the tyres, which would have the same effect. Heavier cars doing more kilometres go through more tyres faster. It would be a way of taxing the system that pays for roads, which would push the system to evolve to smaller, lighter vehicles.

Community First

Talking with my mother helped me realise how much Australia's rural development shaped its national character. She explained there had been a shortage of women for the first century of white settlement. Women were often starting completely fresh, cut off from their traditional family structures and extended family help. They had to be incredibly resilient and self-sufficient and had an unusual amount of control over their lives in many cases, as their partners were at war or working away from home for days or weeks at a time overseeing livestock. Women ran households that were often remote, and managed finances when their men were at war or working away from home shearing or mining. The School of the Air meant that country women could access education for their children, and by extension themselves as they supervised.

Women fought to gain entry to Australia's prestigious universities and enrolled, beginning in 1879. These capable women organised groups such as the Women's Suffrage League and the Women's Christian Temperance Union as a way gaining a political voice for a range of social values that they felt were unrepresented in parliament. Women in South Australia placed their first votes in 1894; voting at the federal level came in 1902, making Australia the second nation in the world where women won that right… Women played a powerful role in Australian labour history as well, founding the first women's trade union in 1882…

Today, we find women leading our community-based climate solutions. The men make the headlines still, but women are doing most of the work. They have left their egos and V8s at the door and are fighting for

their constituents and communities. It made complete sense. Women had civilised the young colony and were continuing the tradition.

The Fight Isn't Over

To be sure, the oil and gas industry, and to a lesser extent the coal industry, are still fighting, and will fight to the death. We need to be clear about their motives, and that they continue to cast doubt on things like electric versus gas stoves, and feed anxieties such as how far electric cars will go. These industries also have the ear of government, and they will look for every handout, every dubious scheme, to squeeze every last dollar from their industry. It can no longer be claimed they don't know what is causing climate change…

The Albanese government hopes to make part of its signature climate action a "safeguard mechanism" compelling industry to lower its emissions by 30% by 2030 with binding caps. It is not unreasonable policy in theory, but in practice it can be gamed, especially by the gas industry…

For the gas industry companies, change is more of an existential risk, because they don't want to imagine a future without gas. They should be getting into the electrification business and retraining their workforce and changing their business models. Instead, they would like to meet emissions caps by purchasing carbon offsets while selling fantasies about green hydrogen and carbon capture that are very unlikely to manifest in reality and even if they do succeed will be more expensive than the all-electric alternatives.

On-going problems according to Michael Mann in his book *The New Climate War*:

1. Carbon credits are difficult to validate, and indeed there is evidence of gaming the system and overestimating the actual carbon sequestered.
2. Carbon capture can really only be applied on big stationary facilities such as gas generation plants, since we don't have, and no-one has even imagined, ways to capture the carbon dioxide spewing out from your gas heaters and gas cooking appliances. So carbon capture simply isn't a solution for a big, profitable piece of the gas industry – sending gas to homes around the country.
3. Selling the idea that hydrogen will power our cooktops or water heaters or space heaters is a lie. The gas industry gets away with this by generally associating green hydrogen as a drop in replacement for natural gas – which it won't be. The reality is that our gas networks cannot support hydrogen because the metallurgy of our pipes is not suitable. They could support perhaps a blend of 20% hydrogen and 80% gas, but that won't ever get us to zero emissions and it won't make it any cheaper. Further, it is implied you will just be able to run your appliances as they are, which is not true. Hydrogen is a much smaller molecule, leaks more easily and isn't compatible with existing burners – we'd have to change all those gas appliances to new, more expensive ones.
4. Concessions the gas industry have already been granted will make decarbonising harder. One is the disconnection and abolishment fees that the Australian Energy Regulator has allowed the gas companies to charge… These fees are an outrageous imposition on Australian families trying to do the right thing and make the transition to zero-emission, all electric homes. It could cost Australian households as much as $10 billion collectively over the next 20 years to disconnect. We paid the gas industry lots of money to create this carbon dioxide problem. We should not have to pay them to stop.
5. The arbitrary definition of what counts as a carbon offset. We could define a more rigorous, more robust carbon offset that achieves two goals: eliminating future emissions and providing incentives for Australian households to electrify…

We need to find every possible way of reducing the up-front cost of switching to all electric homes and vehicles and make this a just transition that every household can afford.