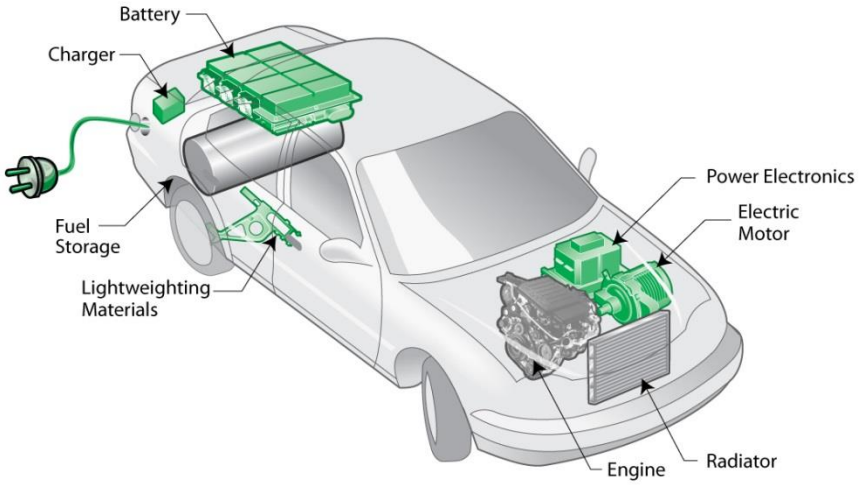

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Research that matters.

Tasmania in pole position for electric car industry

The potential of electric vehicles in Tasmania

Around the world, governments are using policy to embrace electric vehicles. This paper examines the technology's suitability for Tasmania.

Discussion paper

Leanne Minshull
September 2017

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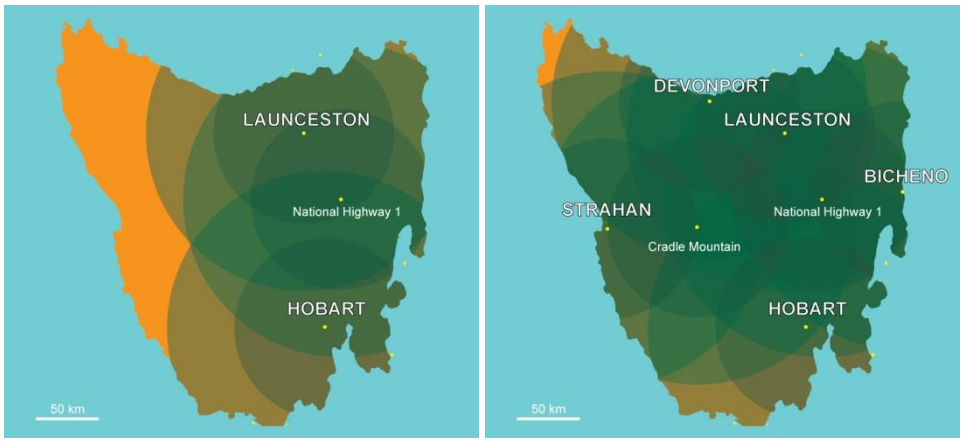
Summary

Around the world, governments are recognising the benefits of wide-scale electric vehicle use and are supporting their uptake through policy.

Thanks to its compact geography, Tasmania would encourage people to purchase electric vehicles by providing even just a handful of public vehicle charging stations. This paper explores two options for providing coverage to a large part or most of the state, with three or six charging stations. These options cover the most travelled routes and the most popular tourism areas. They could be built for approximately $1 million or $2 million respectively.

Hobart/Launceston option and Touring option



An electric vehicle fleet would use electricity sourced largely from the state's hydroelectric generators, which produce almost zero carbon emissions. This allows the fuel source for electric vehicles to be considerably cleaner than elsewhere, which would help reinforce Tasmania's international reputation as a "clean and green" tourist destination.

No other Australian state has taken a strong lead with electric vehicles. This hesitation represents an opportunity for Tasmania, as the capital cost of supporting the electric vehicle market's expansion is substantially lower than other states. Tasmania's population density, size and booming tourist industry all serve as competitive advantages that the state could exploit.

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Introduction

Electric vehicles are popular with both sides of Tasmanian politics. In June 2015, Tasmanian Opposition Leader Bryan Green announced Labor's $10 million electric car initiative, consisting of:[1]

- $3 million dedicated to a partnership between Hydro Tasmania and the University of Tasmania to identify the state's infrastructure and technology requirements for an electric vehicle rollout;
- $2 million dedicated to a pilot project rolling out electric vehicles throughout state government vehicle fleets; and
- $5 million to finance the conversion of existing Metro buses from conventional fuels to electric power.[2]

Electric vehicles have enjoyed bipartisan support in Tasmanian state politics, for a number of years. In 2015, Liberal Party State Growth Minister Matthew Groom confirmed that the government was actively involved with partners Hydro Tasmania and TasNetworks to build the business case for deploying electric vehicles in Tasmania.[3]

While Tasmania's interest in electric vehicles is strong, both amongst the public and within its politics, the momentum to take it forward has stalled. Questions exist over the technology's suitability to the state's geographic conditions and commercial viability of the market itself. This paper examines the opportunities for Tasmania to develop a fleet of electric vehicles, the obstacles that must be overcome, and recommends strategies to maximise the state's opportunities in a cost-effective, market-oriented manner.

ELECTRIC VEHICLES: A BACKGROUND

Electric vehicles are most easily differentiated from internal combustion engine (ICE) vehicles by their fuel source. Electric vehicles (or EVs) rely on a charged internal battery to power an electric motor to generate velocity. The battery is charged with an

[1] Bryan Green, "Electric Cars a Natural Fit for Tasmania," *Hobart Mercury*, June 25, 2015.
[2] Bruce Mounster, "Buzz Grows on Car Plan," *Hobart Mercury*, October 29, 2015.
[3] Ibid.

external source of electricity, sourced either from the electricity distribution network ('grid') or from an off-grid, independent generation source, such as a solar panel.[4]

Unlike "hybrid" vehicles, which rely on both an electric motor and a backup internal combustion engine, battery-powered electric vehicles are powered by an electric motor and battery alone.[5] Just as the range of traditional ICE vehicles is determined by its fuel efficiency and its tank capacity, the range of an EV is contingent on both its efficiency and its battery size.

The battery is drained with use, and must be recharged to recover. To do so, EVs can rely on three broad strata of charging infrastructure, the details of which are outlined in the table below:

[4] Anthony M. Vassallo, Philippe Gomme, and John E. Blik, "The Potential Influence of Electric Vehicles on the Transmission Network Serving Sydney," trans. School of Chemical & Biomolecular Engineering, TransGrid Powering Sydney's Future - Electric Vehicles (Sydney: University of Sydney, 2014).

[5] Australian Energy Market Operator, "National Electricity Forecasting Report," Emerging Technologies Information Paper (Melbourne: Australian Energy Market Operator, 2015).

Table 1: Electric vehicle charging infrastructure

Level	Voltage	Amperes	Power (kW)	Charging speed	Availability	Compatability
Level 1 (Nominal)	240 A/C	10	2.4	3 to 8 km equivalent per hour	Universal; account for most household power outlets	Universal; vehicle does not require additional technology[6]
Level 2 (Fast)	240 A/C	30	7.2	16 to 30 km equivalent per hour	Moderate; account for most public charging stations, most private home garage chargers	Universal; requires additional charging equipment
Level 3 (Superfast)[7]	400-600 D/C	125	> 50-75	95 to 130 km equivalent in 20 minutes	Limited; competing standards and proprietary technologies[8]	Limited; not compatible with all plug-in vehicles, and not all vehicles accept the power it requires.

Source: Australian Energy Market Operator[9]; Electric Vehicle Infrastructure Training Program and Clean Cities Alternative Fuels Data Center[10]

There are a number of electric vehicle models in Australia, though the market is much less developed than elsewhere internationally. Market penetration remains limited. Only three models of electric vehicles are sold in Australia. These are the Nissan LEAF, BMW i3, and Tesla Model S. The estimated prices and range of each model are reproduced below:

[6] Ethan N. Elkind and Anne Ku, "Electric Vehicle Paradise: How Hawai'i Can Lead The World in Deployment" (University of Hawai'i Maui College: University of California Berkeley School of Law, September 2013).

[7] Also referred to as 'Supercharger', 'DC Level 2'.

[8] Cunningham, Wayne, "Slow, Fast, and Faster: Where to Charge Electric Cars," *CNET*, October 1, 2013.

[9] Australian Energy Market Operator, "National Electricity Forecasting Report."

[10] Electric Vehicle Infrastructure Training Program and Clean Cities Alternative Fuels Data Center, "Plug-In Electric Vehicle Handbook for Public Charging Station Hosts" (United States Department of Energy, 2012).

Table 2: Comparison of currently-available electric vehicles in Australia

Model	Price ($AUD)	Range (kms)
Nissan LEAF	$39,990	175
BMW i3	$65,900	310
Tesla Model S	$100,800	502

TOURISM INDUSTRY

Tasmania's tourism industry is a valuable and fast-growing sector of the state's economy. Tourism in Tasmania directly and indirectly contributes around $2.55 billion or 9.9 per cent to Gross State Product (GSP). The sector directly contributes $1.17 billion and is a major employer.[11]

The health of the tourism sector relies heavily on the state's reputation as clean, pristine and naturally beautiful[12]. A 2010 report into the consumer sentiments of Tasmania's visitors found the state's wilderness experiences have the strongest emotional associations, the greatest appeal and are the most potent motivators to shift travel intention to Tasmania.[13]

Despite this growth in demand for eco-tourism, consumer research suggests the market is yet to fully mature, with the number of survey respondents indicating they wish for their next travel experience to be more focused on the natural world dwarfing current demand.

A 2013 survey by Roy Morgan found one in five Australians want a "total ecotourism experience" for their next holiday, whereas only one in one hundred had such an experience.[14] This suggests the market has not yet expanded to meet latent demand. Survey data compiled by Tourism Tasmania indicates that, in the minds of visitors, Tasmania remains closely associated with scenery, nature, and the environment.[15]

This consumer preference for environmental sustainability sits comfortably with the state's electricity generation profile, which is much cleaner than the national average.

[11] Tourism Tasmania fast Facts https://tourismtasmania.com.au/industry/facts

[12] T21. "The Tasmanian Visitor Economy Strategy 2015-2020." Hobart: Government of Tasmania, 2015

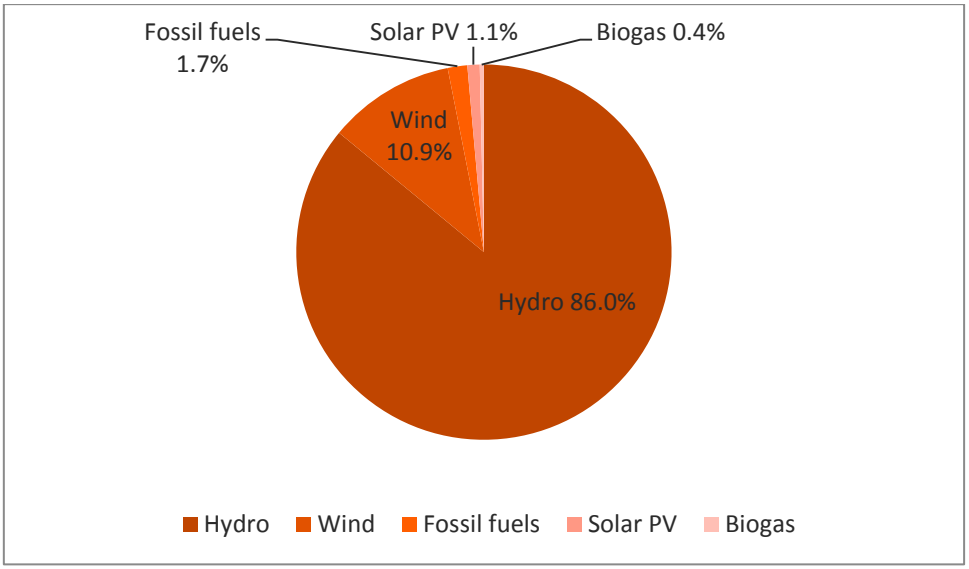
[13] Tourism Tasmania, "Appeal Triggers and Motivations for Tourism in Tasmania" (Hobart: Government of Tasmania, 2010).

[14] Roy Morgan Research, "Ecotourism Remains a Dream for Too Many," *Finding No. 5037*, 2013.

[15] Ibid.

The profile of Tasmania's electricity generation is highly unusual in that it features no coal-fired electricity generation capacity[16]. This contrasts with coal's 53 per cent of generating capacity throughout the National Electricity Market (NEM).[17] A breakdown of the components of Tasmania's electricity generation is provided below:

Figure 1: Tasmanian electricity generation by fuel source, 2014-15, (GWh; share of generation)



Source: Office of the Chief Economist [18]

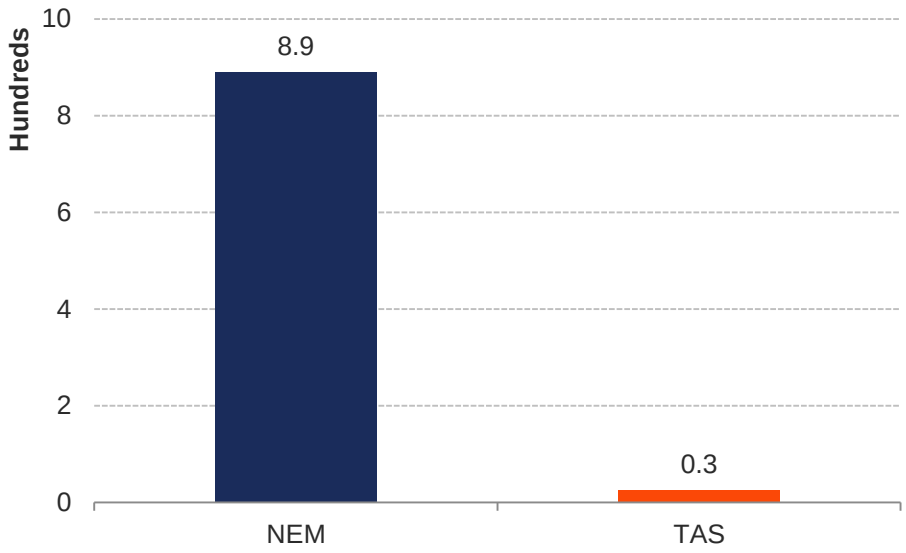
As a result of this electricity generation profile, Tasmania's emissions of carbon dioxide-equivalent, or CO2-e, are far lower per giga watt hour (GWh) than that of the NEM more broadly. The comparison is provided below:

[16] Tasmania does import coal generated power from Victoria

[17] Australian Energy Regulator, "State of the Energy Market 2014" (Melbourne: Australian Competition and Consumer Commission, December 19, 2014).

[18] Office of the Chief Economist, "Australian Energy Statistics 2016" (Canberra: Department of Industry, 2016).

Figure 2: Average tonnes CO2-e emitted per GWh electricity generated, 2014



Source: Australian Energy Market Operator[19]

For firms seeking to promote their environmental credentials, Tasmania provides a unique and valuable opportunity to simultaneously exploit high levels of electricity without facing criticism for this input's environmental consequences. As recent visitor surveys attest, the tourism industry could be a major beneficiary of that advantage.

Transport serves as both a large cost to consumers as well as a large component of Tasmania's emissions. Transport accounts for 24 per cent of Tasmania's total carbon emissions.[20] As EVs emit zero tailpipe emissions, and do not rely on the burning of fossil fuels for their energy, widespread adoption of this transport option could comfortably reduce Tasmania's contribution to global warming.

The emissions resulting from the burning of fossiled carbon in fuels accumulate in the atmosphere, contributing to the absorption of warmth and heating of the planet.[21] Tasmania's electricity generation is dominated by renewable sources. This lowers the emissions profile of Tasmania's electricity, relative to the national average.

[19] Australian Energy Market Operator, "CDEII Summary Results 2014" (Australian Energy Market Operator, 2014).

[20] Tasmanian Climate Change Office, *Low Carbon Tasmania: Issues Paper 2013*.

[21] Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge: Cambridge University Press, 2007).

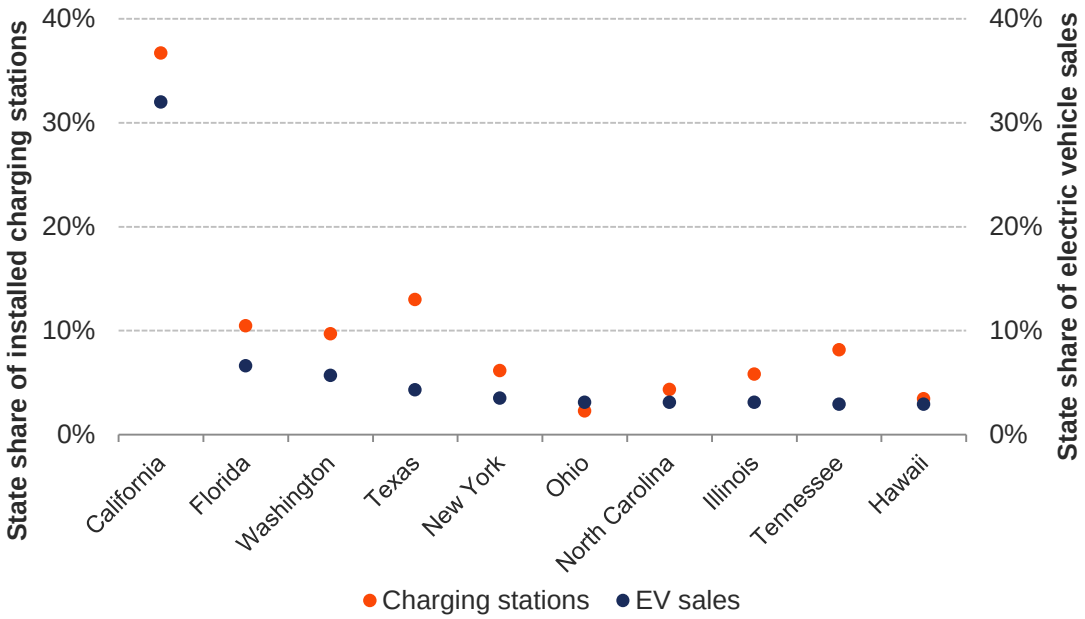
How could Tasmania do it?

In its 2015 forecast of electricity trends, the Australian Electricity Market Operator (AEMO) noted the low number of electric vehicles in Australia. It suggested that there are three barriers to the EV sector's expansion in Australia:

1. A lack of "significant policy incentives for consumers" to encourage EV purchase
2. The high capital cost of providing the means for an expansion
3. Consumer perception barriers, including a lack of awareness, concerns over effective range, and a lack of public infrastructure[22]

As is evidenced by the spotted pattern of expansion of electric vehicles in the United States, the availability of public charging infrastructure is a significant factor in the scale of electric vehicle uptake. States with the greatest availability of EV charging stations have seen the greatest expansion of their EV fleet, as illustrated in the figure below:

Figure 3: Share of sales of electric vehicles and share of installed electric vehicle charging station, by state, USA



Source: Miller[23]

[22] Australian Energy Market Operator, "National Electricity Forecasting Report."

Tasmania's compact geography makes the state an ideal environment for electric vehicles. An electric vehicle could drive from Hobart to Launceston and back to Hobart on a single charge.[i]

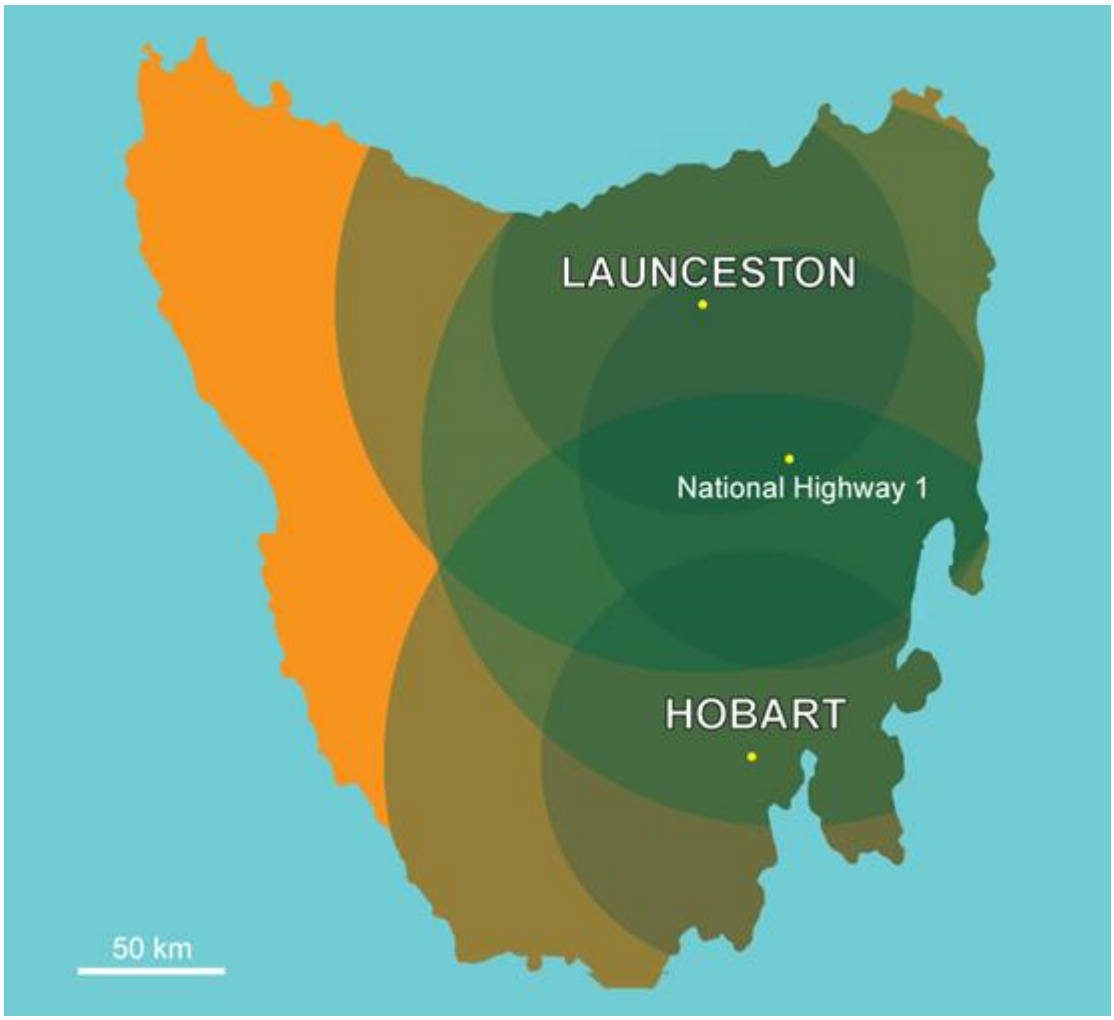
To date, only one supercharger has been installed in Australia. While the cost of its installation are commercial-in-confidence, the cost to install a supercharger in the United States ranges from $140,000 USD ($182,000 AUD) to $175,000 USD ($228,000 AUD).[24] Allowing for premiums on Australia's labour costs, materials and planning, we conservatively estimate the cost to install one Tesla supercharger at $307,000. Two potential options for a Tasmanian supercharger network are provided below.

Table 3: Supercharger map legend

Circle	Radius represented (km)	Diameter represented (km)	Charge required to travel from epicentre to boundary and return (%)
Small circle	62.5	125	24.9
Large circle	125	250	49.8

[23] Jennifer Miller, "Electric Vehicle Tourism," White Paper (Phoenix: Arizona State University, 2014).
[24] Office of Codes Enforcement, "Construction Report by Category" (Auburn: State of Alabama, 2014).

Figure 4: Hobart/Launceston option

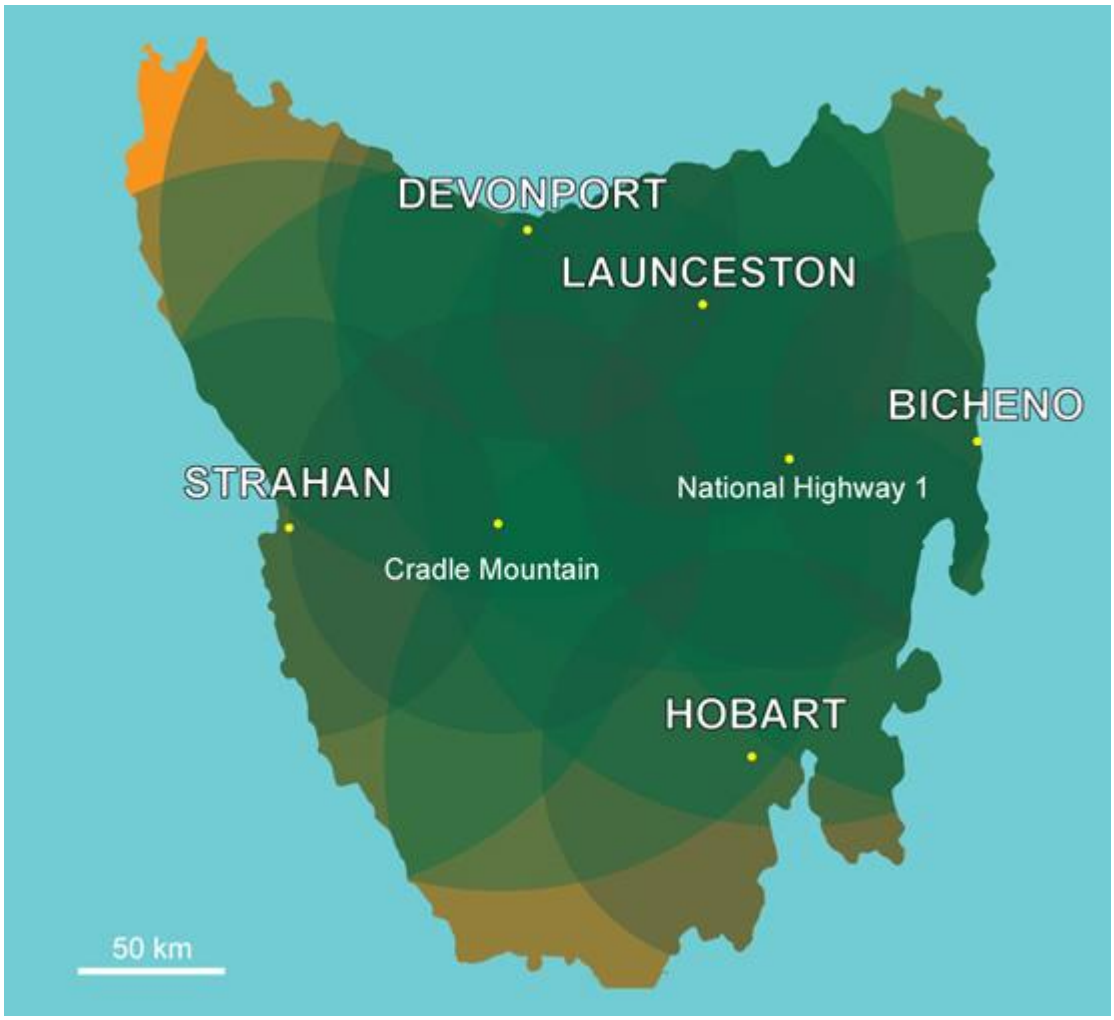


The first option features chargers in:

- Launceston
- Hobart
- National Highway 1

This option uses only thee charging stations to support some of Tasmania's most dense vehicle routes. The cost of installation is estimated at $921,000.

Figure 5: Blanket coverage option



The second option features superchargers in:

- Strahan
- Derwent Bridge
- Hobart
- Devonport
- Launceston
- Bicheno
- National Highway 1

This option is designed to support an electric vehicle network that connects some of Tasmania's most popular eco-tourism destinations to the most densely-travelled regions of the state. In doing so, this option allows for near-blanket coverage of regions and provides an opportunity for an electric vehicle eco-tourism industry to develop. The cost of installation is estimated at $2.15 million.

The risks of fragmentation

The electric vehicle market is currently fragmented between charging technologies that are not mutually compatible. Some manufacturers use different charging technology to others, and there is as yet no standardised uniform charging type. As a result, one charger cannot be used by all electric vehicles, and a standardised rollout would favour one series of manufacturers over another series. The result, then, would be to provide one manufacturer with a natural monopoly over future rollout. To the extent that this is uncompetitive and promotes inefficiency, it is not preferred.

This market fragmentation means that governments must balance the promotion of a competitive market against the promotion of the industry itself. With market players adopting different technologies, government assistance for one may prove the death knell for the other. For whichever technology becomes dominant, a natural monopoly threatens to develop.

Natural monopolies occur when it is cheaper for one firm to provide a service to the market than for two or more firms to do the same. It is prohibitively expensive, for example, for every phone company to construct its own communications network of cables, wires and satellites. The dilemma is that without such a network, no market can exist in the first place. The first firm to construct the network incurs all of the associated costs, while its competitors can simply piggy-back off the capital costs of the market's establishing firm. To avoid this 'first-mover' disadvantage, the company that invests in creating such a network will hope to protect its sole right to use it. In this way, its sole right to use becomes a monopoly. The first-mover locks out its competitors, and enjoys increasing returns to scale from its increase in production. The barriers to entry are so vast that no competing firm can hope to enter the market without digging deep into its own pockets.

Technological innovations can create similar natural monopolies. Companies that own the intellectual property over their product restrict their competitors from establishing the same innovation.

Facebook's key advantage over its rivals is the network effects it enjoys through its share of the social media market. People visit Facebook because their friends are visiting Facebook. There is no legal prohibition from a third party setting up its own rival to Facebook, and even if it delivers a superior product, it cannot deliver Facebook's audience. Any company can offer you access to their network through a simple registration – but only one can offer you access to Facebook's.

Tesla's charging technology is incompatible with most other electric vehicles in Australia. In Australia, most electric vehicle models utilise a J1772 plug technology, while Tesla utilises a Type 2 Mennekes technology. These plug types cannot be used interchangeably, so a rapid rollout of one will have significant impacts on the expansion rate of one share of the market over another.

Though the challenge facing the governmental regulation of electric vehicles is very different to those posed by Facebook's growth, the threat of natural monopoly remains the same. There is nothing to stop any electric vehicle company from establishing itself in Tasmania, and constructing its own network of charging stations to service its fleet. But if any electric vehicle can use the same product, then there is little incentive for a single private firm to take on the capital costs of establishing a charging network. Any costs will be its own to bear, while any benefits will be shared with its competitors.

Any firm establishing its own network of vehicle chargers has an incentive to shut the door behind it, restricting its rivals any access to their newly constructed series of charging stations. A private firm controlling the charging infrastructure of an electric vehicle grid has the capacity to control access to the market, by requiring any competitor to construct their own, rival network, with no guarantee that consumers will welcome the investment.

There are options for government

Governments therefore face a challenge with no simple solution. It is recognised that government support is necessary for the potential of the nascent electric vehicle industry to be realised; yet to support the industry in its currently fragmented state means favouring one technology over another (and, in doing so, support those manufacturers who support that technology).

For the government to avoid facilitating a natural monopoly through its intervention in the market, it must allow consumers and firms to trade without favour. The disadvantage with government directly providing charging infrastructure is that doing so benefits one technology over another, rather than letting consumers determine their preferred technology (and associated brands and products).

One alternative may be to subsidise the cost of charging stations, either by making available low-interest loans to prospective businesses, supplying grants, hiring contractors to provide for the construction labour, or with some other mechanism that allows the private firm to engage the government with an application and for the government to support that application, no matter the technology involved.

Such an approach, while more supportive of the market's unfettered allocation of winners and losers, would find the government inevitably supporting a technology that becomes unpopular and eventually falls into disuse. It may also artificially extend the time required for the market to reveal a clear consumer preference. By reducing the private sector costs of expanding a firm's charging network, the government could find itself subsidising technologies that are out of favour with the public, even if the firm has not yet realised its losing position in the market.

To compensate for this risk, the government should impose an assistance package with a clear approval window. Once this window expires, the government can review the market and close its doors to further entrants. This strategy allows the post-assistance market to settle, and for private firms to consolidate market share following the rapid expansion made possible by the government's assistance.

The longer the market is left without support, the more apparent winners and losers will become. Recent international developments suggest that the market fragmentation of charging technology is diminishing. In January 2013, the European Commission announced its adoption of "Type 2" electric charging plug technology as Europe's common standard.[25] Governments must be cautious not to allow natural monopolies to develop, nor to allow the opportunities afforded through innovation to lapse.

[25] Siim Kallas, "EU Launches Clean Fuel Strategy" (European Commission, January 24, 2013).

Conclusion

Tasmania is uniquely placed to profit from electric vehicles.

Electric vehicles have limited range, relative to ICE vehicles, limiting their application in some geographic climates. Thankfully, due to the land mass of Tasmania, a fully-charged electric vehicle can travel from one coast to the other on a single charge.

Similarly, Tasmania enjoys a valuable international reputation for its well-preserved natural environment and surroundings. Electric vehicles provide an opportunity to capitalise on this reputation without sacrificing the environment standards that are so valuable to the state's tourism industry and broader economy.

Internationally, the degree of success an electric vehicle rollout program experiences has been contingent on availability of public charging infrastructure, similar to petrol stations. Tasmania can provide this infrastructure with relatively low cost, and support broad coverage of a future fleet of electric vehicles.

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[i] Based on the driving distance of a Tesla 2012 Model S Automatic (A1), which has a range on a full charge of 426 km, as measured by the United States Environmental Protection Agency. Route distance is based on the route utilising the National Highway 1 in both legs of the trip, and the trip origin and destination is in each city centre respectively. The total route distance is 399 km, which is 27 kilometres less than the range of the vehicle on a full charge.