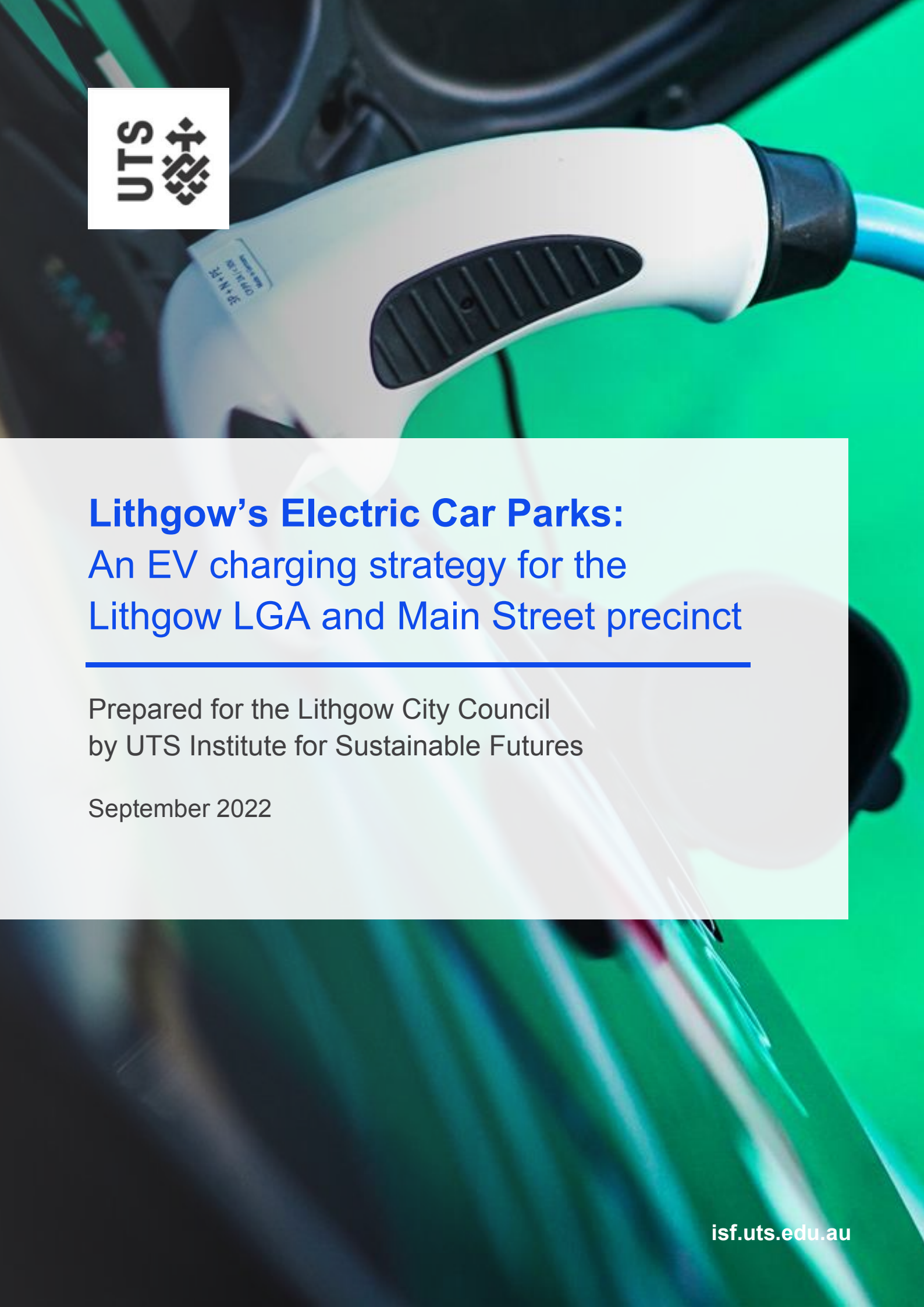

Lithgow's Electric Car Parks:
An EV charging strategy for the Lithgow LGA and Main Street precinct

Prepared for the Lithgow City Council
by UTS Institute for Sustainable Futures

September 2022

isf.uts.edu.au

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About the authors

The Institute for Sustainable Futures (ISF) is an interdisciplinary research and consulting institute been setting global benchmarks since 1997 in helping governments, organisations, businesses and communities achieve change towards sustainable futures.

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A foreword from Lithgow City Council Mayor

Lithgow is switched on to electric vehicles

With each year that passes, more of us will make the choice to drive electric vehicles (EVs). Maybe to avoid high petrol prices, or to take advantage of lower maintenance costs. Maybe to enjoy the superior drive quality or because EVs have zero emissions. Regardless of the reasons, your Council needs to act as the pace of EV adoption increases.

At the moment the numbers are only a trickle, but by 2026 – when new EVs are anticipated to cost the same as petrol driven vehicle equivalents – the numbers will begin to climb more rapidly. The Council is preparing for this future.

We asked: How will Lithgow people charge their vehicles when they are away from home? How can visitors to Lithgow recharge while going to local shops, businesses and events?

The Council secured funding from the NSW Government, and commissioned a local expert body, Lithgow Community Power Project Inc, to do the research.

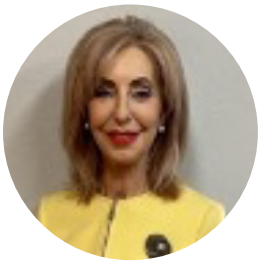
This EV Charging Strategy is the result, and I am very pleased to present it to the community.

As a first step, there is a detailed plan for 35 charge points near Main Street in Lithgow.

We are planning for public charge points to be available to residents and visitors across 21 of our town centres and villages. Both the NSW and Australian Governments provide support for local government initiatives of this kind.

I agreed with business owners that it is important to ensure high-turnover parking remains available in Main Street. Our advisers, Lithgow Community Power Project, identified the peripheral car parking bays as better options. We'll begin with enough charge points to meet projected demands, and increase the number as needs grow.

By working with our community, the approach identified in this strategy will meet everyone's needs. In this way, Lithgow will be well equipped to approach the future with confidence, and I thank the Lithgow Community Power Project for having provided such thoughtful and constructive technical support to the Council in order for us to achieve this.



Maree Statham
Mayor
Lithgow City Council

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Abbreviations

ARENA	Australian Renewable Energy Agency (Australian Government)
BEV	Battery Electric Vehicle
CBD	Central Business District
EU	European Union
EVE	Electric Vehicle Evaluation (model)
GPO	General Purpose Outlet
ICE	Internal Combustion Engine
LCC	Lithgow City Council
LCPP	Lithgow Community Power Project
LGA	Local Government Area
LOS	Level of Service
MSP	Main Street Precinct
NSW	New South Wales
PHEV	Plug-in Hybrid Electric Vehicle
RAP	Revitalisation Action Plan
TBI	to be investigated
TfNSW	Transport for NSW (NSW Government)
UTS	University of Technology Sydney
V2G	Vehicle to grid

Electric car parks: Help shape the future

Our community owes an enormous debt to the men, women and families of Lithgow who have worked in the coal and power industries, bringing wealth and security to so many, including regions far beyond our own.

Historically, alongside coal and power, Lithgow pioneered extraordinary new enterprises – a state-of-the-art shale oil refinery, the first powered shearing shed, a modern woollen mill, iron and steel production, small arms manufacturing and others – and many innovative activities and financial institutions as well as valuable agricultural production.

The Lithgow Community Power Project is a community-based association, championing ideas and technologies that encourage new industries and jobs in the Lithgow region for the benefit of our community.

Our region's tradition of innovative industry, agriculture and social institutions will serve Lithgow well, as the Australian economy transitions to greater local production, advanced technology and renewable energy.

In the next few years, transition in the transport sector will be highly evident, with the advent of electric vehicles and farm machinery, solar trains and hydrogen powered trucks and locomotives for hauling freight.

Australia currently imports over 70 per cent of its petrol and diesel, with imports costing close to 4 per cent of GDP and bowser prices climbing above $2 per litre. This is hurting households right across the country, making the shift to EVs an urgent priority. Powered by low-cost, domestically produced renewable energy, EV uptake provides an opportunity to eliminate household petrol bills and cut emissions. But to support this shift, public charging infrastructure needs to be provided – a priority of the Lithgow Community Power Project.

Working closely with Lithgow City Council and the Institute for Sustainable Futures at UTS, the Lithgow Community Power Project wants to position Lithgow to take full advantage of state and federal policies and grants that support EVs.

This strategy is the result, and we thank the Council, the Institute for Sustainable Futures and the NSW Government's Resources for Regions Program for their foresight in backing this initiative.

Lithgow City Council will be asking for comments and ideas relating to the strategy, and we encourage you to read the report and tell us what you think.

Lithgow Community Power Project would also welcome your thoughts on some of our other initiatives, including regular public forums on the future of our region, information and training in new energy technologies, and ways for Lithgow's major energy suppliers to keep the public well informed, to ensure a just transition to our new energy future.

Lithgow Community Power Project

Greg Mortimer OAM

David Peters

Jeremy Dawkins

Dr Michelle Zeibots

Introduction & overview

Why write a strategy for charging electric vehicles?

The uptake of electric cars across the world will have a major impact on local transport networks and infrastructure – necessitating universal access to charge points.

Lithgow needs a plan to enable any resident, business and visitor to charge their electric vehicle at a charge point in a public place. Unlike charge points in homes, businesses and private spaces, this is 'destination charging' that anyone can use. Users pay for the service, like paying at a parking meter.

Destination charging requires chargers that are faster than those typically used in homes and businesses. They may be the more costly medium-speed chargers called Level 2 chargers, or the expensive high-speed chargers called Level 3 chargers – they are both described on page 20.

Who produced the strategy?

Recognising the economic benefits of innovation, the NSW Government provided funding to enable local governments to respond to the uptake of EVs. Lithgow City Council in collaboration with the Lithgow Community Power Project successfully bid for funds to prepare a strategy and business case for the installation of EV charging infrastructure at key points within the Lithgow LGA.

Lithgow Community Power Project worked with the Institute for Sustainable Futures at the University of Technology Sydney to estimate the demand for charge points and the best ways to meet this demand.

Is the strategy really needed?

There is plenty of evidence to suggest that EVs will ultimately replace internal combustion engine (ICE) vehicles. It is widely predicted that, as soon as 2026, EVs will cost the same as ICE vehicles. The proportion of EVs on the road will rise rapidly after 2026.

The Institute for Sustainable Futures at UTS developed a model to provide cautious estimates of EV ownership rates by residents in the Lithgow LGA. The model is called the electric vehicle evaluation (EVE) model. Standards adopted by the European Union, where experience with EVs is greater due to higher uptake rates than in Australia, were used to estimate demand for relevant levels of EV ownership, leading to an estimation of the optimum number of charge points.

What is the strategy?

The Council's investments in infrastructure should be based on agreed principles, clear strategies and carefully considered policies and investments.

On pages 11 and 12, the conclusions of workshops, consultations and discussions are presented in the form of five principles and seven strategies relating to EVs.

On pages 13 to 15, the necessary actions to implement the seven strategies are listed under each strategy.

On pages 23 and 24, the first steps to implement the strategy are recommended as follows.

The early installation of sixteen medium-speed charge points in peripheral car parks near Main Street, supplemented by a further 16 medium-speed charge points by 2026.

By 2026, the installation of two high-speed charge points, to supplement the existing two NRMA high-speed charge points at the Workies.

Regular monitoring and evaluation of user responses to charge points until 2026, in accordance with detailed recommendations.

Installation of twenty-three medium-speed and two high-speed charge points in key towns and villages across the Lithgow LGA, following planning and community engagement and planning prior to 2026.

The transition

At a surprisingly fast pace, transport is going electric, becoming quieter, safer and ultimately cheaper. Vehicles will require less maintenance, use infrastructure more efficiently and have zero emissions. This applies not just to cars, but is already emerging in trucks, buses and farm machinery.

The challenge

Electric vehicles (EVs) need infrastructure, the most important being charge points. While up to 90 per cent of EV charging is expected to be done at home, 'destination charging' is essential when on the move. As demand increases, state and local governments will need to provide efficient public charge points, in sufficient numbers and in the right places.

Understanding the need

Lithgow City Council successfully applied for a Resources for Regions grant to engage the Institute for Sustainable Futures (ISF) at the University of Technology Sydney (UTS) to estimate future numbers of EVs, assess the need for public charge points, and develop a strategy to meet those needs.

Meeting the need

Lithgow currently has two high speed (Level 3) charge points installed by the NRMA in the Lithgow Workies car park and three medium speed (Level 2) charge points in the showground. This strategy identifies the need for the progressive installation of 32 medium speed (Level 2) charge points and two additional Level 3 charge points across six car parks serving Main Street by 2026 (see pages 17-24).

Comprehensive planning

The strategy identifies where destination charge points should be located, the type of charge points to install, how many to install, and when their installation should take place. The strategy calls for monitoring the performance of charge points once they are in use, to inform future planning. The principles and methods would then be applied to the progressive installation of charge points in twenty of Lithgow's towns and villages (see page 16). A second report provides background on the technology of EV charging (Nagrath et al, 2021a). A third report provides an overview of different business models for the provision of charge points (Nagrath et al, 2021b).

Vision and purpose

The strategy supports a vison of Lithgow as an innovative industrial city in a historic, productive and beautiful agricultural region. It is the 'gateway' between Greater Sydney and the Central West, located two-hours drive from Sydney where the only two arterial roads connecting the regions meet and motorists need to stop for a rest-break before continuing to more distant parts of the region. A far-sighted strategic plan for EV charging is an essential component of this vision given Lithgow's position, while ensure local businesses and residents have access to the charging services they need to support their daily life and business activities.

The strategy is based on five principles (see page 11)

- **Access to all** – Convenient and easy access irrespective of differences in mobility.
- **Equity** – Access to destination charging across the LGA, ensuring nobody is left behind.
- **Sustainability** – Economic, social and environmental outcomes without compromising future generations.
- **Economic opportunities** – Leveraging EV charging to attract customers to local businesses.
- **Participation in decision-making** – community input on charge point locations.

And seven implementation strategies (see pages 12-14)

- **Strategy 1: Leadership** – where the Council leads by example and adopts best practices.
- **Strategy 2: Planning** – an evidence-based approach to planning for EV charging.
- **Strategy 3: Infrastructure** – adequate charging infrastructure for all.
- **Strategy 4: Partnerships** – collaboration with electricity and EV charging service providers.
- **Strategy 5: Community** – collaboration with local communities in decision-making to ensure actions are appropriate and timely.
- **Strategy 6: Incentives** – appropriate incentives to promote EV adoption and benefits.
- **Strategy 7: Smart Technology** – maximise sustainability benefits for the community.

Part 1: Lithgow electric vehicle charging strategy

The need for EV destination charging infrastructure

The transport sector is on the precipice of a period of profound change with the growing demand and availability of EVs.

As more governments around the world place restrictions on emissions from vehicles powered by internal combustion engines (ICE), more car manufacturers are shifting their production to EVs. Many have set dates for when they will cease to manufacture ICE vehicles, which driving change, creating more choice and reducing prices for new EV owners.

While Australia does not have a significant domestic car manufacturing sector, international trends have significant implications for new car purchases in the Australian market. By 2026 to 2028, many EVs are anticipated to sell for the same purchase price as their ICE vehicle equivalents. After this time, EV uptake in Australia is expected to grow rapidly.

With rapid uptake, there will be a need to develop suitable charging infrastructure to support EV vehicle technology.

International experience has shown that the majority of EV charging currently takes place at home. For those motorists who must charge when away from home, charging will often need to take place at *destination* charge points. This includes charge points at work, shopping, recreational and visitor/tourist locations sited in public car parking bays at these destinations.

While most households in Lithgow have access to their own garage and power supply, some do not and will be reliant on publicly available charge points. Some residential dwellings in Lithgow are accessed by laneways and have limited or no off-street car parking, with 2-3 car households needing to use on-street parking. For this segment of the community, the availability of destination charging could be critical in determining the viability of EV ownership.

Destination charging facilities are also critical for people making long distance trips, visitors, guests, and tourists. Appropriate siting of the infrastructure will create economic and social opportunities for local businesses given the potential redistribution of pedestrian traffic as more motorists make choices based on the availability of charging services.

This strategy aims to ensure the Council is able to meet these needs of the Lithgow community and visitors to the region.

Scope

This EV Charging Strategy for the Lithgow LGA and Implementation Plan for the Lithgow Main Street precinct provides a framework for a consistent, community-driven approach to the deployment of EV destination charging infrastructure by Council and third-party service providers.

It sets out a long-term vision (10 years) with a short term (3 years) Implementation Plan for how publicly accessible EV charging infrastructure will be deployed within the Lithgow LGA for the benefit of residents, visitors, and businesses with an initial focus on the Lithgow Main Street precinct. The strategy has been prepared to ensure strategic alignment with other relevant policies, funding opportunities and plans at local, state and national levels.

Role of the Council

Local government has an important role to play in developing EV charging infrastructure because it is largely responsible for the management and implementation of parking policies, as well as the delivery and maintenance of many local car parking services. The nature of EV technology means that parking bays – both at home, at work and in the public domain – are where most EVs will be charged.

A key goal of Lithgow City Council is to ensure there is adequate charging infrastructure provision to meet EV charging needs as demand grows over time. As the local government, they can play a key role in determining the type and location of EV charging infrastructure at public car parking facilities.

Local governments around Australia are demonstrating leadership by transitioning their own vehicle fleets to electric, from passenger vehicles to refuse collection vehicles. This is helping to normalise and promote the benefit to their communities. Ex-council fleet vehicles will also be an important source of more affordable EVs via the second-hand car market.

Two-way or bidirectional charging is emerging which enables EVs to discharge as well as to charge. This means the owner can potentially power their home or sell power to the grid when demand is high and the EV has energy to spare, and incidentally balance the energy supply from intermittent sources such as solar and wind. Through fleet electrification and workplace charging, local governments will in the future be able to use bidirectional charging to minimise costs and generate new revenue streams, while helping increase the amount of renewable energy and supporting local energy systems.

Policy alignment

NSW has taken a leading role in developing a vision for the future of transport, and EVs are a key part of that future. The NSW Government is investing almost half a billion dollars in tax cuts and incentives to support the uptake of EVs by removing stamp duty and providing a $3000 rebate for all new EV purchases. At the Federal level of government, ARENA's *Future Fuels Fund* also aims to increase EV uptake through making an additional $16.5 million available to fund public fast charging infrastructure for EVs in capital cities and regional centres.

Lithgow City Council has a suite of plans and strategies that guide economic development and community engagement in the LGA. These plans embody many of the principles used to drive actions described in this strategy. This strategy provides the first explicit references to EVs and makes the case for investment in publicly available EV charge points. This considers the future transport needs of the community, as well as promoting economic development and enhancing tourism by enabling Lithgow City Council to build a reputation as a Council that supports residents, local businesses and visitors who own and operate EVs.

This EV charging strategy is well aligned with the funding opportunities, priorities and principles identified through these plans and will ensure investments in providing a public EV charging network align with regional and national investments.

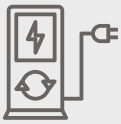
Principles for Lithgow's EV charging network

During a series of collaborations with the Council, the following principles were identified as important to Lithgow. These will be embodied in the deployment of EV destination charging infrastructure.

Principle	Explanation
Equity 	There is fairness in decision making, that includes allocation of resources, selection of providers that support relevant EVs and charging types.
Access 	All people (local community and tourists) have fair access to affordable, convenient charging services to meet their needs and improve their quality of life. The charging infrastructure is safe and accessible to all and reduces barriers to community movement and participation.
Economic opportunities 	There are enhanced economic opportunities provided by EV charging, such as increased visitation to tourist locations and shopping districts, and increased connection of people to local jobs and services.
Participation 	Community engagement and participation in identifying options are key approaches to seeking support on future EV charging site locations and charging infrastructure.
Sustainability 	There is a shift towards sustainable modes of transport in line with NSW's Future Transport Strategy, where electrification of vehicles, smart grid management and use of renewable energy are prioritised.

Strategies

The strategies articulate how to propel the Lithgow community and businesses towards the transition to EVs and more sustainable transport. These strategies are supported by actions to be implemented over the next ten years with 2026 marking an important milestone – the point at which purchase price parity between EVs and ICE vehicles is anticipated.

Strategy 1 	**Leading by example** Lithgow City Council will lead the way for a broader transition by moving its fleet to electric and positioning itself as an ambassador to reduce carbon emissions and protect the environment. This complements our ambition on providing environmental and sustainability leadership for the community.
Strategy 2 	**Adopting an evidence-based approach to planning** Lithgow City Council will adopt an evidence-based approach for planning and future decision-making on EV charging, with a focus on infrastructure that supports smart transport options for all parts of the community.
Strategy 3 	**Deploying charging infrastructure in the Lithgow Main Street precinct** Lithgow City Council will deploy appropriate charging infrastructure at their key sites in the Main Street precinct and facilitate deployment of critical public charging infrastructure at other locations to ensure a core network of charge points accessible to the public. We will work with partners and provide consistent guidelines, tools and resources to support businesses, residents and developers installing their own EV charging infrastructure.
Strategy 4 	**Fostering cross sectoral partnerships for building the charging network in Lithgow** Lithgow City Council will develop regional and cross sector partnerships to support our region's transition to EVs. This will enable us to coordinate the efforts of multiple parties to achieve a fit-for purpose, regional EV charging network and leverage collaborative opportunities.
Strategy 5 	**Engaging with local community and businesses to encourage uptake** Lithgow City Council will engage and inspire residents, businesses, and other local governments to take action and join the transition into the future of transport. It will ensure that everyone has a chance to participate and that all opinions are considered while decision making.
Strategy 6 	**Incentivising EV drivers and local businesses** Lithgow City Council will investigate incentives to encourage uptake of EVs among the Lithgow community and businesses. We will seek to attract economic opportunities for local businesses by encouraging tourists to stop, dine and discover.
Strategy 7: 	**Future proofing / Smart Charging** Lithgow City Council will ensure that EVs are charged using renewable energy, while also actively exploring the best ways to improve EV charging management. We will facilitate appropriate data sharing to improve charging outcomes.

Actions

Several actions were identified that embody the strategies listed above. The following table identifies who has responsibility for the action, within what timeframe the action should be carried out and where resourcing might come from where infrastructure installation is required.

Action	Primary Responsibly	Timing	Resourcing
Strategy 1: Leading by example			
Develop an EV charging strategy for the broader LGA, encompassing all 20 town and village centres	LCC Infrastructure Services	2022-2026	Federal and NSW Govt. grants with support from UTS
Develop a plan for 100% electrification of the Council's fleet by 2030, where appropriate electric models are available	LCC Infrastructure Services	2022-2023	LCC
Develop Council car parks to showcase best practice (e.g. signage, lighting, safety, access, etc.)	LCC Infrastructure Services	2022-2024	NSW Govt. grants with support from UTS
Share the Council's experience and benefits of using EVs; promote local ambassadors for the transition	LCC Infrastructure Services and LCPP	Ongoing	LCC
Strategy 2: Adopting an evidence-based approach to planning			
Collect and use EV charging data to inform the Council decisions and monitor progress	LCC Infrastructure Services	Ongoing	Service Providers with support from UTS
Review opportunities to support EV charge points in the Council's development control plan and guidelines	LCC Infrastructure Services	2023	LCC with support from UTS
Develop information and advice on the approval pathways and planning matters for the provision of charge points	LCC Infrastructure Services	2023	LCC
Develop and adopt best practice on safety and access of charge points	LCC Infrastructure Services	2023	LCC with support from UTS
Explore different business models and payment mechanisms for public charging in Lithgow	LCC Infrastructure Services	Ongoing	LCC with support from UTS

Strategy 3: Deploying charging infrastructure in the Lithgow Main Street precinct			
Deploy appropriately rated charge points at strategic locations identified	LCC Infrastructure Services	2023-2024	Federal and NSW Govt. grants
Incorporate universal design principles into design / technical specifications for infrastructure	LCC Infrastructure Services	2023-2024	TBI
Define clear signage and approach to parking enforcement	LCC Infrastructure Services and TfNSW	Ongoing	LCC and TfNSW
Ensure charge points are easy to locate on other Council facilities websites (tourism, aquatic centre) and EV charging location apps, with all relevant information available (good signage, number and availability of charge points, proximity to public toilets).	LCC Infrastructure Services and TfNSW	Ongoing	LCC and TfNSW
Strategy 4: Fostering cross sectoral partnerships for building the charging network			
Establish partnerships with ROCs, key infrastructure providers, transport operators, EV retailers and member-based organisations for joint procurement, efficient charge point placement, marketing, policy development opportunities	LCC Infrastructure Services	Ongoing	LCC
Work with tourism, retail and hospitality operators to install appropriate charging infrastructure	LCC Infrastructure Services	Ongoing	NSW Govt. grants with business contributions
Investigate opportunities with Council suppliers (e.g. Meals on Wheels, Health Services, etc.), taxi and tour operators to co-locate EV car charging at core sites	LCC Infrastructure Services	Ongoing	TBI
Encourage large local employers to offer workplace charging opportunities to their employees.	LCC Infrastructure Services and LCPP	Ongoing	NSW Govt. grants with business contributions
Seek funding and partnerships for deployments at other identified locations	LCC Infrastructure Services and LCPP	Ongoing	Federal and NSW Govt. grants

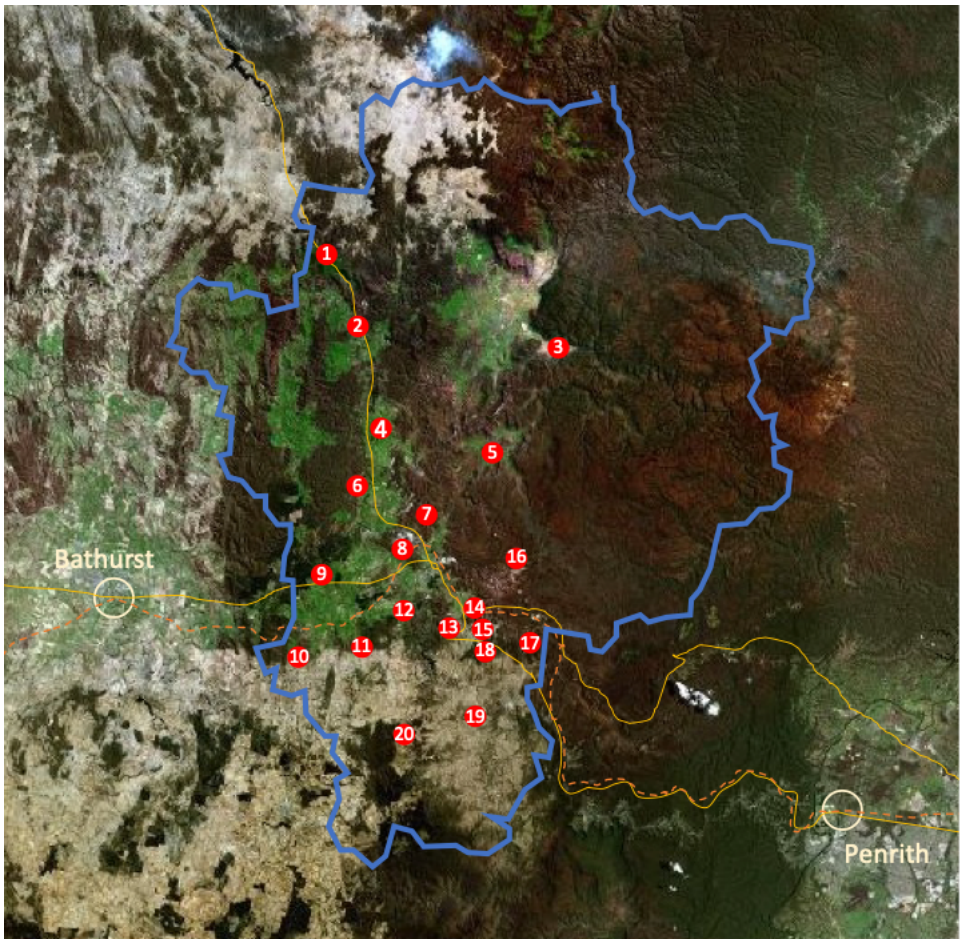
Strategy 5: Engaging with local community and businesses to encourage uptake			
Engage with stakeholders on how the location of EV charging infrastructure could support an expansion of travel choices	LCC Infrastructure Services	2022-2023	LCC with support from UTS CCE/FEIT
Encourage and support the community to achieve a shift towards sustainable transport modes e.g. EV community engagement program, displays and educational materials	LCC Infrastructure Services and LCPP	2022-2023	NSW Govt. grants
Explore opportunities for electric vehicle charging facilities, including electric bikes and scooters	LCC Infrastructure Services	Ongoing	LCC and NSW Govt. grants
Strategy 6: Incentivising EV drivers and local businesses			
Explore parking and driving privileges for EV drivers	LCC Infrastructure Services	Ongoing	LCC and TfNSW
Explore opportunities to encourage EV tourism and boosting patronage of local businesses e.g. Heritage walks (with EV parking), Local pub / café crawls, Theatre patrons, vouchers for local businesses, etc.	LCC Infrastructure Services	Ongoing	TBI
Strategy 7: Future proofing / Smart Charging			
Investigate smart energy management methodologies	LCC Infrastructure Services	Ongoing	TBI
Engage with local distribution network / electricity providers to explore locations to pilot smart and sustainable public EV charging e.g., solar panels to power charge points, fleet V2G trials, etc.	LCC Infrastructure Services	Ongoing	TBI

Part 2: Implementation

This section of the Strategy provides more detail about the publicly available destination charge points that the Council should look to deploy at various locations across the Lithgow LGA.

The figure below shows the locations of the town centres and villages that have been identified as locations where local residents and visitors to the Lithgow LGA would need and benefit from having access to destination charging infrastructure.

Figure 1 Locations across the Lithgow LGA selected for future EV destination charging



1. Capertee
2. Ben Bullen
3. Glen Davis
4. Gardens of Stone
5. Wolgan Valley
6. Portland
7. Lidsdale
8. Wallerawang
9. Meadow Flat
10. Tarana
11. Sodwalls
12. Rydal
13. South Bowenfels
14. Marrangaroo
15. Lithgow
16. Zig Zag Railway
17. Hartley Vale
18. Hartley
19. Kanimbla
20. Hampton

In selecting these sites, a primary aim has been to ensure all major arterial roads through the LGA – Great Western and Castlereagh highways in particular – will have access to charge points at regular intervals. Access at locations some distance away from arterial roads has also been considered. Local residents and businesses located in off-grid homes and business sites may from time-to-time be unable to carry out at-home charging. In which case they will need to access public destination charge points. Similarly, visitors to more remote areas within the LGA may be disadvantaged if unable to access destination charging (for instance, Glen Davis, Wolgan Valley, Kanimbla and Hampton).

An implementation strategy for each of these centres and villages will be developed by 2026 with reference to the following points of consideration:

- Where destination charge points should be located within the town or village. In larger centres such as Lithgow, multiple charge points will be needed. In small villages, it may be that only a single charge point is needed to ensure adequate services for local residents.
- What type of destination charge points, or mix of charge points, are needed. These would include consideration for Level 2 (medium speed) or Level 3 (fast and ultra-fast) charge points.

- How many charge points will need to be deployed. This may take place in stages as demand increases with the uptake of EV technology by the community. These numbers have been estimated using the Electric Vehicle Evaluation (EVE) model created at UTS.
- When these charge points should be installed. A relatively small number of charge points may be installed to begin, with a larger number proposed after 2026 when EV purchase prices reach parity with those for ICE vehicle equivalents and manufacturers begin to phase out production of ICE vehicles.

Transport for NSW has identified a total of nine regional areas across NSW for which Regional Transport Plans have been developed. Lithgow is located within Region 6 (Central West and Orana)'. An implementation strategy has been developed for the Lithgow Main Street precinct that is commensurate with Lithgow's regional role as the "Gateway between Greater Sydney and Region 6"[1]. Around 60 per cent of the population resides in Lithgow City, making it the area where the highest concentration of EVs is most likely to be located.

The implementation strategy for the Lithgow Main Street precinct demonstrates how the principles for EV charging infrastructure discussed in Part 1 can be made actionable by identifying the four key points of consideration listed above.

Implementation Plan for the Lithgow Main Street precinct (MSP)

Lithgow City is the first large town centre that people encounter when travelling from Greater Sydney to the Central West after passing through the Blue Mountains. It is located at the point where the only two arterial roads connecting Sydney to the Central West meet (Great Western Highway and Bells Line of Road) and the critical two-hour drive period from Sydney where motorists should stop for a rest-break before continuing safely to more distant parts of the region.

With an estimated population of almost 21,420 for the Lithgow LGA in 2020, 12,840 (60%) live in Lithgow City and 8,580 (40%) live within the towns and villages located in the remainder of the Lithgow LGA. The Lithgow Main Street precinct sits at the heart of Lithgow, hosting a wide variety of activities used by local residents, service employees and visitors to the area. The boundaries of the Lithgow Main Street precinct chosen for this strategy are shown below in Figure 2.

Figure 2 Lithgow Main Street precinct

[1] https://future.transport.nsw.gov.au/plans/draft-plans/draft-central-west-and-orana-transport-plan

Main Street in Lithgow is in the centre of a pedestrian friendly precinct that hosts the Lithgow Train Station, the majority of the city's pubs, cafés and nightlife venues, civic and public service functions as well as many of Lithgow's cultural and heritage listed buildings. It's concentration of 'ribbon strip' building facades provides high quality pedestrian amenity and access to shopfronts and services. The precinct plays a critical role in defining the identity and character of Lithgow.

Main Street is currently the subject of a revitalisation program, affording an opportunity to consider appropriate destination charging infrastructure at the same time to potentially reduce long term costs.

A series of parallel collector roads (Railway Parade and Mort Street) skirt the precinct and carry the bulk of through traffic, protecting the amenity of Main Street. The precinct contains nine areas of peripheral car parking that provides free public parking for unlimited time periods. These parking areas are currently underutilised and are accessed by car mainly from either Railway Parade or Mort Street. Access from these parking areas to Main Street is provided via laneways (highlighted by arrows in the Figure below), many of which have been the subject of revitalisation and beautification programs.

A diagram showing this structure of the Lithgow MSP is shown below in Figure 3.

Figure 3: Lithgow MSP parking facilities and access

Source: SGS Economics & Planning. 2010, *Business and retail strategy: final report.* Lithgow City Council. p. 41.

Kerbside parking is also available along Main Street with stay periods ranging from fifteen minutes to one hour. These parking bays have a high turnover and are used by people accessing shops and services on Main Street for relatively short stay periods.

While foot traffic is currently low as businesses recover from the recent pandemic, discussions with the NSW Government are taking place that would see InterCity Train Services that currently terminate at Mt Victoria extended to Lithgow. This has the potential to increase pedestrian activity within the Lithgow MSP while also increasing the number of people needing to park their cars at Lithgow to interchange with train services heading into Greater Sydney. Commuters parking to access the rail interchange usually make use of the peripheral car parking areas located to the north of Main Street.

In addition to providing adequate services for the Lithgow community, a second objective of the strategy is to support revitalisation of the town centre by strategic placement of facilities that will attract more local and visiting travellers to the precinct, creating greater foot traffic that will support local businesses located on Main Street.

The following four sections outline the reasons for the recommended *types* and *locations* of charge points in the Lithgow precinct. This is followed by a summary of the demographic analysis and modelling that led to the recommended *number* of charge points and the *timeframe* for their installation.

Where should charge points be located within the Lithgow MSP?

EV destination charge points need to be located in areas where motorists – local residents and visitors – can park their vehicles as part of their daily routine or special trip to Lithgow and destinations in the Central West.

Given the structure of the Lithgow Main Street precinct, the best locations for EV charge points are in currently underutilised peripheral car parking areas that have good pedestrian access to Main Street via laneways. Charge points in these locations will not disrupt the use of high turn-over car parking on Main Street, while still enabling easy access to Main Street shops in addition to other activities within the precinct. These positions are shown in Figure 4.

Figure 4 Locations suitable for destination charge points within the Lithgow Main Street precinct

Adapted from: SGS Economics & Planning. 2010, *Business and retail strategy: final report.* Lithgow City Council. p. 41.

At these locations, four principles described in Part 1 – Access to all, Equity, Sustainability and Economic Opportunities – can be achieved.

Some buildings are vacant with significant sections of underactive streetscape on the northern side of the precinct. Installation of destination charge points within these areas reduces the risk of conflict with the parking needs of motorists driving ICE vehicles. Peripheral parking areas located along the Main Street precinct also lend themselves to providing charge points that would support adjoining land-uses at Lithgow Council Chambers and other government administration buildings, Lithgow Public School, Lithgow Uniting Church and the public transport interchange at Lithgow Rail Station.

Feedback from Main Street business owners

During the development of this strategy, important feedback was received from business owners located in Main Street. The feedback expressed concerns at the prospect of locating EV charge points in the Main Street at kerbside parking bays that would potentially impact negatively on business turnover. This feedback changed the criteria used to identify the best locations for EV charge points, highlighting the importance of our fourth principle, Participation in decision-making.

What type of chargers should be used?

In a companion report to this strategy – *Lithgow's Electric Car Parks: summary report* (Nagrath et 2021a) – a description is provided of the three different types of EV charger technology, which can be briefly summarised:

- Level 1 chargers use simple GPOs that accept Australian 3-pronged plugs and work on alternating electrical current (AC). These typically charge at 10 or 16A and require an adaptor from the common GPO to the AC inlet plug of the car. A charge-time of around 9 hours would typically be required to add 100km of range to an EV.
- Level 2 chargers also use AC but are located on a dedicated circuit without competition from other appliances. They typically charge from 3.3kW if on a single-phase power supply but can charge at up to 22kW (32A), if operating on three-phase. A charge-time of 3 hours for a 7kW charger to under 1 hour for a 22kW charger would add 100km of range to an EV.
- Level 3 chargers use direct current (DC) and are known as fast or ultra-fast ranging from 50-475kW. The chargers look similar to a petrol bowser. A 50kW charger can add 100km of range in 25 minutes, a 120kW charger takes 10 minutes, while chargers rated at 350kW or more have charge-times similar to refuelling ICE vehicles at petrol stations.

A selected range of Level 1, 2 and 3 chargers are shown in Figure 5. Level 2 chargers that operate at high amperage rates and the full range of Level 3 chargers are potentially suitable for public destination charging. A significant difference between the two is the cost, with Level 2 chargers costing from around $2000–$3000 up to $25,000 per unit depending on whether three-phase power is available, while Level 3 chargers cost upwards from $50,000 per unit.

From a strategic perspective, there is a potential trade-off between the availability of charge points and the speed of chargers. Or in other words, if funding is limited, multiple Level 2 charge points can be supplied, which increases availability to multiple EV users needing to charge their vehicles at the same time. Or else a Level 3 charge point can be provided that will reduce charge-times for users, but with reduced availability during periods of high demand, requiring users to queue.

Figure 5 Level 1, 2 and 3 charge points

A Typical power cord used to charge an EV using a standard GPO power socket.

B 22kW Level 2 charger from ABB.

C 7kW Level 2 charger from Delta Electronics.

D 50kW DC fast charger from Tritium.

Source: Nagrath, K., Dwyer, S. & Zeibots, M.E. 2021. *Lithgow's Electric Car Parks: summary report*. Institute for Sustainable Futures, University of Technology Sydney, pp. 17-18.

With this trade-off in mind, Level 2 charge points, such as those shown in Figure 6, are suited to locations where vehicles are parked for moderately long time periods such as workplaces, shopping and recreational locations. These are similar to peripheral car parking in the Lithgow Main Street precinct. In these cases, long distance drivers can top-up their vehicle, stop for a break and fully recharge at their final destination.

Figure 6 Example of multiple on-street Level 2 charge points for longer term stay periods

Source: https://www.drive.com.au/caradvice/how-to-charge-your-electric-vehicle-if-you-live-in-an-apartment/

Tourists, visitors and motorists passing through and not wishing to stay in Lithgow would benefit most from access to multiple Level 3 charge points. A facility like this would most likely be provided by a commercial operator located on the Great Western Hwy, providing a service similar to that shown in Figure 7. With ultra-rapid 175kW charge points, these charge most cars to 80 per cent of battery capacity within 30 minutes.

Figure 7 EV charging station similar to a petrol station (Fulham, London)

Source: https://www.shell.com/energy-and-innovation/mobility/mobility-news/shells-growing-public-ev-charging-network.html

When approaching the question of what type of charge points should be located within the Lithgow Main Street precinct, a mix of Level 2 and 3 charge points would appear to be the most appropriate. This would reflect the land-use activities that take place within the precinct and the different types of users, while at the same time serving the needs of visitors to the area, stopping at Lithgow on their journey to other parts of the LGA or destinations within the Central West.

How many charge points should be installed within what timeframe?

If a mix of Level 2 and 3 charge points are to be installed within the Main Street precinct, the next point of consideration is how many and within what time frame. This might be easily answered if comparisons with other locations within Australia could be made. However, Australia currently has very low rates of EV adoption making international comparisons necessary.

In many countries throughout the European Union (EU), EV ownership rates are far higher than in Australia. The EU experience has enabled government bodies to learn and make recommendations as to what numbers of charge points are appropriate given EV ownership rates. **The standard for EU member countries is a ratio of 1:10 for Level 2 and 1:100 for Level 3 charge points** (see Nagrath et al 2021a, p. 25, for a more detailed explanation).

If EU standards are used as a guide, data on current EV ownership levels within Lithgow is needed in addition to projections for future EV ownership levels. A household microsimulation model developed at UTS has been used to estimate EV ownership rates within the Lithgow community (see Nagrath, et al 2021a, pp. 23-25 for a more detailed explanation of the model). Estimates for EV ownership for key milestones within Lithgow City are shown in Table 1.

Table 1 BEV and PHEV ownership rates for Lithgow City (2022-2040)

	EVE model estimates for BEV and PHEV component of total passenger car fleet Lithgow Statistical Area (SA2) – Lithgow City						
	Petrol and Diesel	BEV	BEV %	PHEV	PHEV %	Lithgow City only	Total vehicles
2022	9,073	18	0.19%	175	1.87%	193	9,331
2026	9,112	183	1.91%	169	1.77%	352	9,550
2030	8,923	512	5.28%	156	1.61%	668	9,700
2040	6,214	3,485	35.14%	108	1.09%	3,593	9,916

Source: Rose, J. 2021, Electric Vehicle Evaluation model outputs. School of Business, University of Technology Sydney.

While this part of the implementation strategy focusses on Lithgow City, access to destination charge points in the Lithgow City Centre has implications for the entire LGA as it is the largest centre and currently the primary source for charging. EV estimates for the many towns and villages located in Lithgow Region, outside Lithgow City, are shown below in Table 2.

Table 2 BEV and PHEV ownership rates for Lithgow Region outside Lithgow City (2022-2040)

	EVE model estimates for EV (BEV and PHEV) component of total passenger car fleet for Lithgow Region (SA2) – towns and villages outside Lithgow City in Lithgow LGA						
	Petrol and Diesel	BEV	BEV %	PHEV	PHEV %	Lithgow Region	Total vehicles
2022	6,049	12	0.20%	116	1.92%	128	6,177
2026	6,075	121	1.90%	112	1.76%	233	6,367
2030	5,949	341	5.27%	105	1.61%	446	6,467
2040	4,143	2,323	35.14%	72	1.09%	2,395	6,610

Source: Rose, J. 2021, Electric Vehicle Evaluation model outputs. School of Business, University of Technology Sydney.

As can be seen, around 60 per cent of EVs adopted by households residing in Lithgow are anticipated to be taken up by residents living in Lithgow City with the remaining 40 per cent by households located in towns and villages in other parts of the LGA.

If the number of Level 2 and 3 charge points located in Lithgow City and across Lithgow Region are to be supplied at levels in line with EU standards, the number required is shown in Table 3.

Table 3 Charge point estimates for Lithgow City and the rest of the Lithgow LGA needed to meet EU standards

	Charge point types and numbers needed in Lithgow City and Lithgow Region to meet EU standards						
	Lithgow City			**Lithgow Region**			**Lithgow LGA**
	EV total*	L2	L3	EV total*	L2	L3	Total vehicles
2022	193	19	2	128	13	1	15,552
2026	352	35	3-4	233	23	2	15,917
2030	668	66	7	446	45	4	16,167
2040	3,593	359	36	2,395	240	23	16,526

*Estimates for total EVs include both BEV and PHEVs.

The EV ownership estimates outlined above do not incorporate financial incentives from governments into the calculations, such as removing sales tax or providing rebates. The NSW Government currently offers a $3,000 rebate for all new EV purchases in addition to the removal of sales tax.

Nor do the estimates take into account impacts on demand resulting from high petrol prices due to restrictions and declines in global supply, suggesting that the number of charge points recommended above is cautious and likely to err on the low side of what actual demand will be. Given restrictions to the road network and Lithgow's role as gateway to the Central West, the demand from tourist and visitor traffic may also be higher than in many other parts of the region.

Lithgow currently has two Level 3 publicly available charge points located in the Lithgow Workies car park, enabling Lithgow to currently meet EU standards for Level 3 charge points. By 2026 however, an additional one or two Level 3 charge points will be needed.

In relation to Level 2 charge points, three are currently available to the public within the grounds of the Lithgow Showground, with user reports indicating that they are regularly out of order. Even if functional, there is a significant shortfall of Level 2 charge points, with an additional sixteen needed to reach the nineteen needed to meet EU standards for 2022, increasing to thirty-two to reach the thirty-five needed by 2026 when purchasing price parity between new EVs and ICE vehicle equivalents is anticipated.

Applying principles and charge point numbers to specific car parks

This section describes the specific car parking bays recommended for the installation of Level 2 EV charge points. These have been selected with reference to the principles on page 10, in particular ensuring access to all, and providing economic opportunities.

Figure 8, below, shows potential locations for the installation of the initial sixteen Level 2 charge points that would be distributed across four clusters.

These car parks have high capacities. Installing charge points in these car parks fulfills two aims: to maximise the likelihood of the parking bays being available to drivers of EVs because the drivers of ICE vehicles have many other options, and to ensure that the latter are not disadvantaged if EV parking bays are empty.

Figure 8 Locations for potential Level 2 charge points in peripheral car parks

Eskbank Street cark park (eight Level 2 charge points by 2022)

This location is within clear view of Eskbank Street in a position central to the Main Street precinct and public buildings such as Lithgow Council Chambers and Lithgow Public School. It has highly visible access to public toilets services by high quality footpaths. It is recommended that eight Level 2 charge points be installed to serve parking bays as shown in Figure 9.

Figure 9 Parking bays at western end of Eskbank St

Access to the main electricity supply is provided along the western side of Eskbank Street, requiring minor excavation to access subterranean power supply to the double row of car parking bays that run parallel to Eskbank Street shown in Figure 9. EV charge points could be located on the nature strip between the back-to-back parking bays, enabling access by cars parked along both sides of the nature strip. An EV charge point located next to the parking bay allocated for people with disabilities could potentially serve both.

Railway Parade (four Level 2 charge points by 2022)

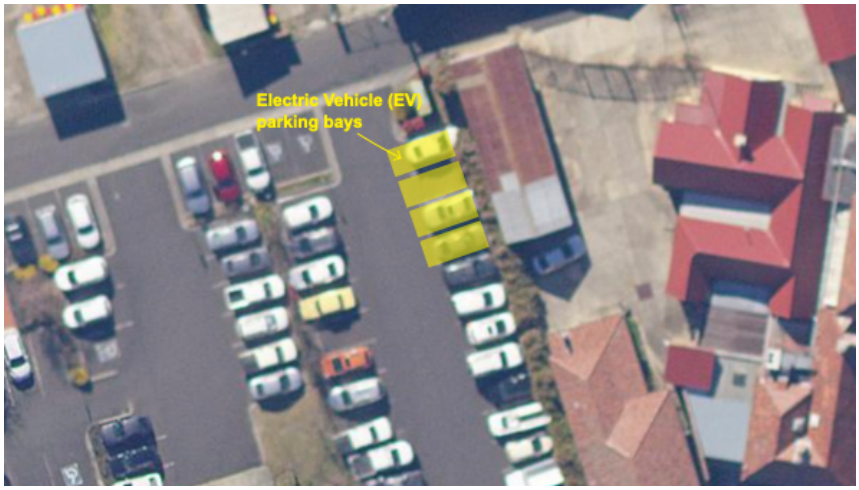
There are two rows of car parking bays that provide commuter parking along the southern side of Railway Pde to the east and west of Lithgow Rail Station. While direct access to the electricity mains supply is located on the northern side of Railway Parade, there is possible access within the rail easement that could also serve EV parking bays as shown in Figure 10. Electrification of these bays might be supported by commuter parking schemes that support public transport.

Figure 10 Parking bays to west of entry to Lithgow Rail Station from Railway Parade

Court House car park (four Level 2 charge points)

The Court House car park has direct access to the electricity mains supply with a distribution transformer located on the north-western corner of the car park — potentially enabling installation of Level 3 charge points. This car park does is not directly visibility from surrounding streets, but all areas are well lit and have high quality surfaces on footpaths enabling easy access for the elderly and people with disabilities.

Figure 11 Parking bays at the rear of Lithgow Court House to the eastern end of Lithgow Main Street precinct



Bank Lane car park (location for future EV parking bays)

This position is located next to Lithgow Police Station in a well-lit area, providing high levels of safety for EV drivers during the evening. The car park is on a sloping surface however, making it more difficult for people with mobility difficulties to use. A distribution transformer in the car park enables access to the electrical mains supply that could support Level 3 charge points. This public car park is located across a laneway from the car park used by Woolworth's customers. It is recommended that electrification of parking bays in this position be pursued in the future.

The next section describes how ongoing monitoring and evaluation should take place to identify future charge point needs, match the supply of charge points to demand using an evidence base.

Monitoring progress

As the uptake of EVs increases, monitoring the demand for destination charge point infrastructure will be critical to gauging how effective early implementation has been and what augmentation might be needed to maintain positive user experiences into the future. To do this, service providers will need to commit to sharing data on charge point usage rates. This will enable regular monitoring and evaluation used to inform decisions regarding additional charge point infrastructure.

Transport professionals throughout the world use Level Of Service (LOS) frameworks to monitor and evaluate the performance of a wide range of transport infrastructures.

Monitoring the effectiveness of the EV charging roll-out can be done using the Level Of Service (LOS) criteria devised for Lithgow, shown in Table 4 below. This use of LOS will monitor charge point availability – measured as the percentage of time EV charge points are in use.

Table 4 Level of Service for EV charging with respect to charge point availability

LOS	Time in active use	Customer experience	Service provider response
A	**0-20%**	Customers do not need to wait to gain access to a charge point	Ensure signage to destination charge points is clear to enable customers to easily find charge points within a precinct
B	**21-40%**	Customers may need to wait briefly to gain access to a charge point during peak use periods	Ensure systems are in place to advise customers of available charge point locations
C	**41-60%**	Customers may need assistance to identify available charge points and potentially wait for short time-periods to gain access to a charge point	Ensure systems are in place to advise customers of locations of available charge points. Assess LOS C duration and if additional charge points would stop service slipping into LOS D
D	**61-80%**	Customers will need assistance to identify available charge points and most likely need to wait for time-periods that interrupt planned activities to access a charge point	Ensure systems are in place to advise customers of locations of available charge points. Assess LOS D duration and plan provision for additional charge points to return system to LOS C or B
E	**81-100%**	Customers will need assistance to identify available charge points and queue for access	Ensure systems are in place to advise customers of available charge point locations. Assess LOS E duration and ensure provision for additional charge points to return system to LOS C or B
F	**>100%**	Customers must queue to gain access to a charge point	Ensure systems are in place to advise customers of available charge point locations. Assess LOS F duration and ensure provision for additional charge points to return system to LOS C or B

Source: Zeibots, M.E. 2022, *Level Of Service criteria for EV charging infrastructure with reference to charge point availability*. School of Civil & Environmental Engineering, University of Technology Sydney.

At LOS A, EV users do not need to wait to access a charge point as they are only being used for 20 per cent of the monitoring period. At LOS C and D charge points are in use for 41 to 80 per cent of time, with users potentially waiting to gain access. At these LOS, service providers should assess the data to gauge whether queueing is occurring and if further charge points are needed.

If Levels of Service E and F are regularly reached, further charge points should be added to the network.

Recommendations for the charge point array in Lithgow

It is recommended the following criteria be adopted for identifying and prioritising appropriate locations for EV charge points.

- **Parking bays available** The first preference is for the bays to be located in peripheral car parks that are currently underutilised, with easy and safe access.
- **Distance to Main Street** The destination charge points should be within easy walking distance from Main Street, enabling convenient access to businesses and services.
- **Capacity on electricity feeder** The electricity supply infrastructure capacity of the existing electrical supply network is suitable for supporting multiple Level 2 charge points, or can be reasonably upgraded to support Level 3 fast charging.
- **Existing EV charging vs demand** New charge points need to be balanced between existing facilities and demand.

It is recommended that the following considerations be applied when considering proposals for commercial EV charging stations and when designing and deploying EV charge points:

- Is EV charging permissible under the relevant legislation at the proposed location/s?
- Charging infrastructure should support, or be easily adapted to support, all types of EVs.
- Some or all charge points should support bidirectional charging now and in the future.
- Renewable energy should be used as the EV charging energy source (for example, accredited GreenPower, onsite solar, battery storage or a renewable power purchase agreement).
- Appropriateness of the location for Level 2 and Level 3 charge points given differences in the technology and differences in user needs at those locations.
- EV charge points need to be designed and constructed in accordance with relevant Australian Standards and current industry best practice as well as compliant with relevant Australian Standards and Regulations for occupational health and safety.
- Ancillary infrastructure (including signage, parking bays and charging infrastructure) is easily visible and accessible to all.
- Environmental constraints and characteristics need to be considered.
- Facilities are safe with adequate lighting, and have pedestrian and vehicular access available at all times of the day and night.
- Accessible to elderly people, people with disabilities and mobility constraints.

It is recommended Council aim to install thirty-two Level 2 charge points in Lithgow City by 2026 to meet EU standards (see pages 21-22) and a high proportion be located in peripheral car parking areas in the Lithgow Main Street precinct. Council should commit to progressive installation across six of the car parks serving Main Street (see pages 17-24).

References

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Lithgow Electric Vehicle Strategy on a page