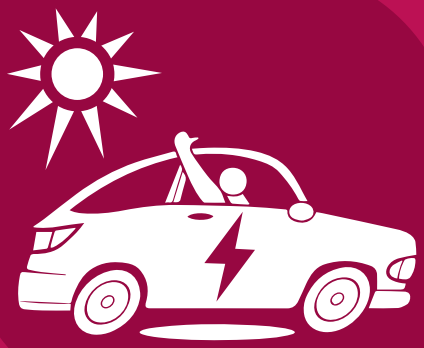
SDAPP
Sustainable Design Assessment in the Planning Process
10 Key Sustainable Building Categories

WHITEHORSE CITY COUNCIL

6.1



Electric Vehicles

Electric vehicle integration in new developments

What's included in this fact sheet:

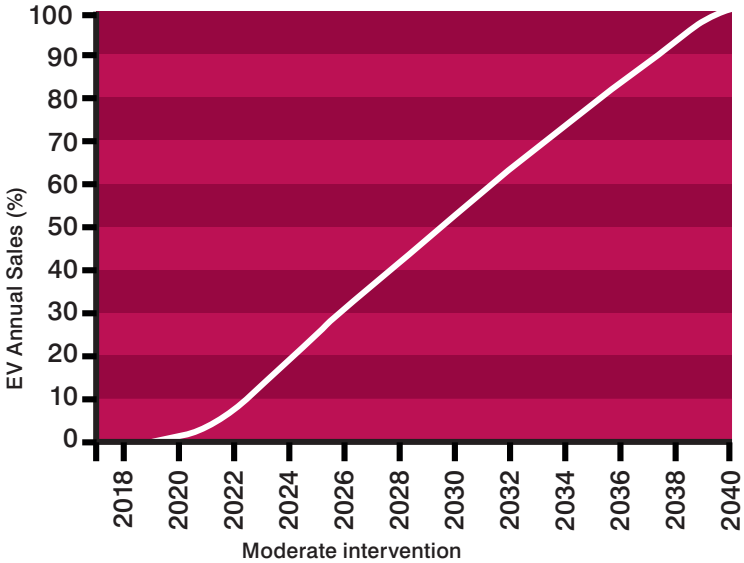
This fact sheet discusses the expected uptake of electric vehicles in Victoria and outlines ways in which electrical vehicle infrastructure should be incorporated into your building design.

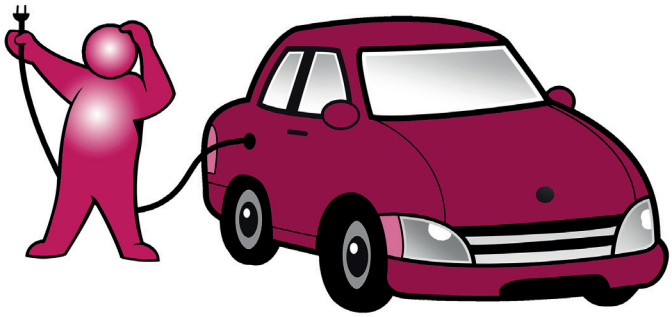
Within the coming decades it is expected that buildings incorporating support for electric vehicles, will be in higher demand and provide higher returns to those which have not. This fact sheet outlines the essential electrical infrastructure that should be incorporated into your new building design to enable easy future electric vehicle integration.

Is the future electric vehicles?

An increase in supply and demand for electric vehicles is expected in the coming decade, with research by the Australian Energy Market Operator (AEMO) indicating that by 2040 approximately half of all vehicles on our roads will be electric. There are a number of challenges and high costs associated with retrofitting a building to provide electric vehicle charging infrastructure. However, it is relatively simple and low cost to provide the underlying infrastructure at the time of construction in order to facilitate charger installation in the future.

It is important to provide the necessary electrical infrastructure to enable easy electric vehicle integration into new developments. This is essential to support the expected transition to electric vehicles and the transformation of the energy sector. It is expected that this investment will increase property value and ensure the long-term ability for buildings to easily adapt to the projected increasing demands of occupants for electric vehicle integration.





Australian EV Adoption Outlook

Under the Energeia Moderate intervention scenario, EV sales (both Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs)) are forecast to reach 615,000 vehicles per annum by 2030, increasing to 1.89 million annual new vehicle sales by 2040, or 49% and 100% of sales respectively.

There is a relatively steady increase in EV sales to around 28% per annum by 2026 driven by falling EV prices supported by falling battery prices, increased model availability, and an increasing differential between electricity and petrol prices.

Managing increased demand for electricity

The current electricity network is not designed to support the expected increase in demand for electric vehicle charging. However, research has shown that effective management of how, when and where electric vehicles are charged can avoid costly electrical upgrades for a building and undue strain on the electrical supply. Peak energy usage in most buildings typically occurs during the day, particularly on very hot or very cold days when high power levels are required for cooling or heating. The energy usage data for a typical office building on a hot day shows that there is spare electrical capacity overnight, when most electrical appliances are switched off or running at low levels.
This also indicates the value of vehicle to building and vehicle to grid capability at times of peak demand.

Why electric vehicles, EV vs Petrol Vehicles

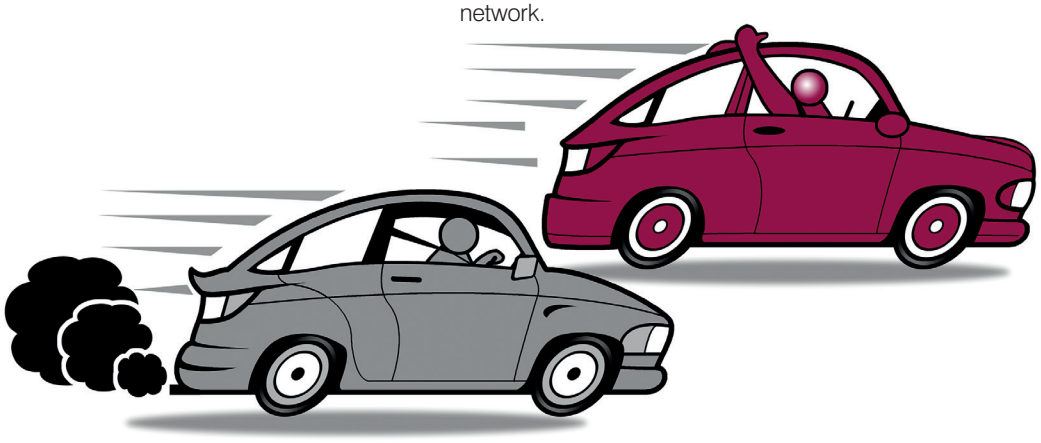
- Electric Vehicles when powered by renewable energy are completely emissions free and widely regarded as the future of transport
- Electric vehicles do not produce tailpipe emissions so they can significantly improve urban air quality by replacing petrol and diesel cars that produce a range of toxic pollutants, providing associated health and amenity benefits
- The source of electricity for electric vehicles can be 100% renewable
- 500km range depending on manufacturer, vehicle model and driving conditions - this is anticipated to improve as technology and innovations progress
- Costs of electricity to travel 100km is far less than a petrol vehicle

Cost Item (based on 2021 costings)	**Electric Vehicle**	**Fossil Fuel Vehicle**
Comparable vehicle costs	$45,000	$35,990
Vehicle registration duty	$900	$1,080
Registration costs	$258.40	$328.60
kWh/100km	15	-
Litres per 100km	-	7.6
Electricity cost ($/kWh)	$0.25	-
Fossil fuel cost ($/L)	-	$1.42
$/100km	$3.75	$10.80
Annual fuel savings over 13,300km	$937	
Stamp duty and registration savings over 5 years	$531	
Total operational savings in 5 years	$5,248	

What is electric vehicle integration?

Electric vehicle integration is a term used for a building which has incorporated the electrical infrastructure to support the future installation of electric vehicle charging in all parking bays, as well as active grid integration to enable Vehicle to Grid and Vehicle to Building power supply. Electric vehicles, as well as needing to be charged, are also seen as potentially being an active player in the wider power network.

Remarkably, the significant combined power in car batteries can be used to provide power to buildings or be used by electricity network providers to supply power when needed. This emerging technology could allow a building or the grid operator, to 'export' power from a car battery during the day, when there is high electrical demand, thus providing an instant power supply when needed.



Electric Vehicle Ready Developments

Load management

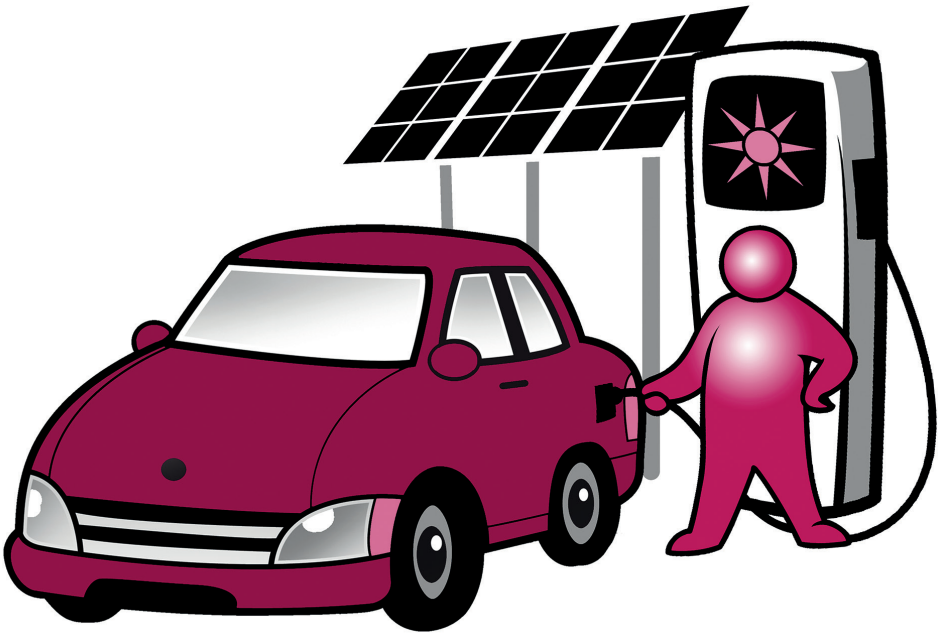
Controlling how electric vehicles are managed can assist in avoiding costly electrical upgrades and pressure on the electricity network. Load management includes a control system to schedule charging to ensure there is no undue strain on a building's electrical supply. As previously highlighted, most buildings have sufficient capacity outside of peak energy usage time, to support electric vehicle charging, if the charging is scheduled using a load management system.

Load management systems include a communications gateway which is connected via a building automation network to a control system.
The network collects a range of data, including the main incoming electrical supply, so that minute-to-minute spare electrical capacity in the building can be calculated.

The load management system can also export energy usage data to the body corporate or strata manager, to allow tracking and reporting of which vehicle charger is using energy and when. Such a system should be designed by the development's electrical engineer.

It is likely that as electric vehicles become more common, many innovative 'smart' solutions will become available to support load management.

> "The solar array on our roof provides ample energy to charge our electric vehicle as well as our home. This makes the vehicle cheap to run and 100% emissions free!"



Allowing for Electric Vehicle Integration into your development

To allow for easy future provision of electric vehicle integration, all car parking areas within a residential development and a minimum 20% in a non-residential development, should be set up to be 'electric vehicle ready'.

Providing all of the infrastructure listed below into the building design, will enable individual tenants to easily install a single charging unit and individual circuit wiring to the distribution board for their designated parking space.

The infrastructure required is as follows:

- One or more distribution boards within each level of car parking, with capacity for the future installation of 2 pole Residual Current Circuit Breakers with Overcurrent Protection (RCBOs) sufficient to supply one 'fast charge' electric vehicle charger for each parking space.
- A scalable load management system. This will ensure that electric vehicles are only charged when the building electrical load is below the nominated peak demand. Building electrical peak demand calculations can therefore be undertaken using the assessment methodology (AS/NZS3000:2018, clause 2.2.2.b.i), thus not increasing building electrical peak demand requirements beyond business as usual.
- Electric vehicle bays located in highly visible, priority locations.This will ensure that tenants are aware, encouraged and have an incentive to shift to an electric vehicle. Marking bays as 'electric vehicle ready' even where no chargers are yet installed will communicate to the users that they are designed and ready to transition to an electric vehicle relatively easily.
- For townhouses, units and stand alone houses simply ensure that there is wiring to the garage and space in the distribution board with (RCBO) circuit protection.
- Wiring from the main switchboard to the distribution boards
- Provisions for a cable tray to hold future individual outgoing circuits to electric vehicle chargers.

Electric Vehicle Ready Developments

Considerations for Electric vehicle integration in non-residential developments

Based on the assumption that people drive to work, and vehicles are therefore typically parked at a workplace between 8am and 6pm, which is when a non-residential building is generally using its existing electrical supply, it is unlikely that there will be as much spare electrical capacity as there is at a residential building overnight.

However, in the context of innovative future mobility options emerging, although non-residential buildings may offer limited ability to charge vehicles during the day, there are a number of other significant potential benefits from electric vehicle-compatible non-residential buildings, including the following:

- The significant off-peak (overnight and weekend) capacity which could support innovative solutions. For example, automated vehicles could be charged in vacant car parking bays within a building or residents could even have access to these bays to charge vehicles where they may not otherwise have access to charging.
- These services could open up a whole new value proposition and income stream to non-residential buildings which are currently 'dead resources' overnight and on weekends.
- Electric vehicles have the potential to be an active player in the wider power network, through the provision of power to buildings or being used by a electricity network provider to supply power when needed. Building owners or tenants could potentially generate income, reduce their electricity costs and have more reliable power supply through the provision of vehicle to grid and vehicle to building power supply's.
- Fleet vehicles also provide an excellent opportunity for electric vehicle integration. These vehicles are typically parked at the workplace overnight and the vehicles can be fully charged overnight in preparation for use the next day. Ensuring the necessary infrastructure to charge the vehicles is provided to these facilitates will allow the utilisation of electric vehicles as an option for fleet vehicles.
- There are also a number of development types that operate outside of your typical 8am-5pm workday, such as hotels, cinemas, restaurants etc. Consideration on how to best implement the availability of electric vehicle charging facilities into these developments should also be given.

Provision of infrastructure to enable future installation of electric vehicle integration to at least 20% of the car parking bays within a non-residential development is currently considered an appropriate outcome that achieves 'best practice' and will balance the future proofing of the building with capital costs.

This is based on the typical load profile of non-residential buildings, projections of electric vehicle owners without access to charging at home and current international best practice. This includes a European Union Directive for all new non-residential buildings to provide pre-wiring for a charging point for at least 20% of parking bays.

This does not mean that 20% of the car parking bays must be fitted with chargers, but that the underlying wiring infrastructure is in place to allow future owners and tenants to easily install a charger without the additional burden of retrofitting and installing the necessary underlying infrastructure.

Council's Design Advice

Council's Best Practice Standards

- All car parking areas in a residential development to be electric vehicle ready.
- 20% of parking within a non-residential development to be electric vehicle ready.
- Provisions for infrastructure as per the guidance in this factsheet.
- Show electric vehicle ready car parking areas clearly marked on plans.
- Unsure car park ceiling heights can accommodate cable trays for electrical cabling.

Where can I find out more?

Fleet Europe:
https://bit.ly/3m8TIwR

The state of electric vehicles in Australia:
https://bit.ly/3q1wJ9q

Other existing CASBE Sustainable Design Fact Sheets
www.casbe.org.au/what-we-do/sustainability-in-planning

Australian Government Green Building Guide
https://bit.ly/39t523F

Australian Renewable Energy Agency
https://bit.ly/3lawdID

Electric vs petrol vehicles
https://bit.ly/3mai35E

Other Fact Sheets in this series are available to provide guidance on Transport and Energy Efficiency. Those Fact Sheets are entitled:

- 2.0 Energy Efficiency
- 6.0 Transport

ACKNOWLEDGEMENT: The MAV acknowledges the five IMAP (Inner Melbourne Action Plan) councils – the Cities of Yarra, Port Phillip, Melbourne, Stonnington and Maribyrnong – for their leadership in producing this suite of Fact Sheets to enable a more liveable and sustainable built environment.