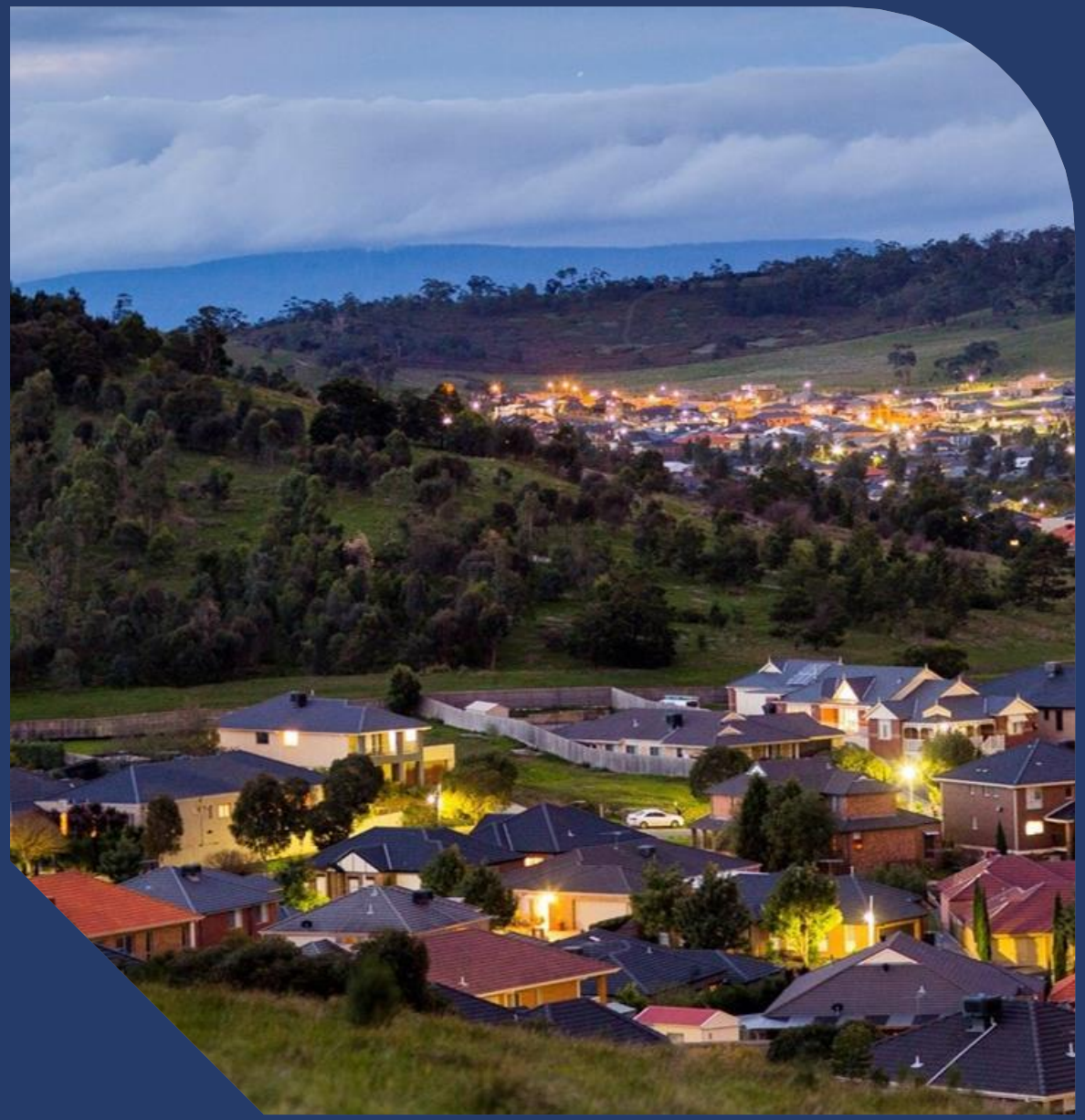
AusNet

Ballarat North PSP
Energy Assessment

For Ballarat City Council

AusNet | October 2024



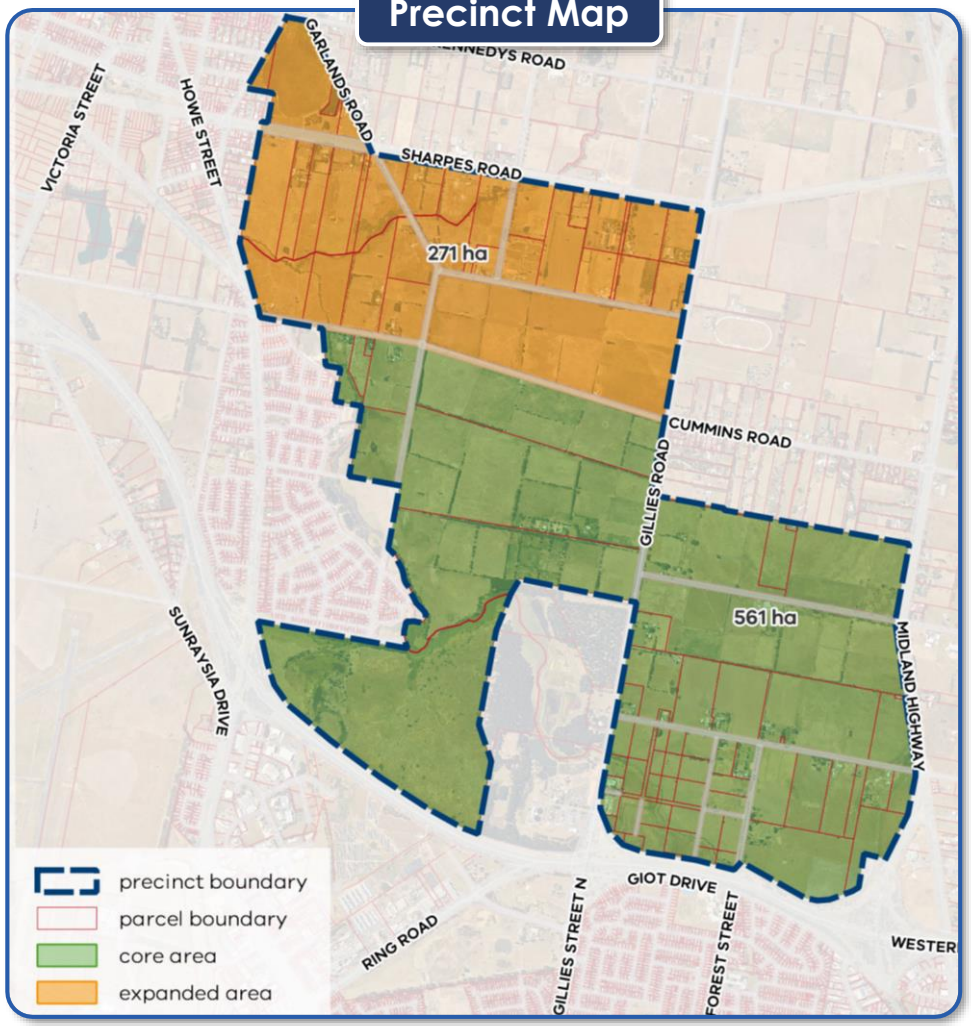
Contents

Source: www.visitballarat.com.au

01 *Basis, Objective, Design Approach*

AusNet have completed the Ballarat North Precinct Energy Analysis to support the City of Ballarat target their sustainability objectives

Precinct Map



The assessment and analysis completed within this document primarily refers to the '**core area**' above unless otherwise stated.

Project Summary

Ballarat North is an **upcoming 561 ha residential precinct** with ~6,688 dwellings and ~18,726 additional residents

City of Ballarat Council and Victorian Planning Authority (VPA) are interested in **introducing requirements** and recommendations to ensure the precinct can **better meet sustainability objectives**

AusNet have **completed supporting analysis** to allow the Council to better make informed decisions regarding Energy in the precinct.

The **sustainability focus** for this analysis is **Net Zero Emissions**, determined in a visioning workshop with Council (Workshop result summary shown on following page)

CITY OF BALLARAT

Victorian Planning Authority

AusNet

An AusNet Guided Visioning Workshop was used to determine the Council's sustainability focus for the upcoming precinct

Main Sustainability Focus

Net-Zero Emissions was determined as the **main sustainability focus** for the Ballarat North Precinct:

Renewable #1

Transitioning to renewable energy to achieve renewable ambitions, through one of two pathways:

Net-zero emissions *OR* **100% renewable**

Benefits

- Enhanced brand and climate change mitigation
- Common primary objective for entities with ambitious renewable targets or mandates

Example

Generation *Storage* *Energy Mgmt*

For each applicable site

Solar PV and BESS assets sized to align to site energy requirements or slightly oversized to account for energy growth over time.

Additional Sustainability Drivers

Additional drivers of renewable energy were **considered, but not prioritised** in the design of the precinct solution

#2 Reliability — Grid stability to mitigate momentary outages and disruptions

#3 Resilience — Ability to conduct critical functions during extended power outages

#4 Revenue — Leveraging Distributed Energy Resources (DERs) to generate revenue or cost savings

The Project Delivery Methodology

Project Approach and Process

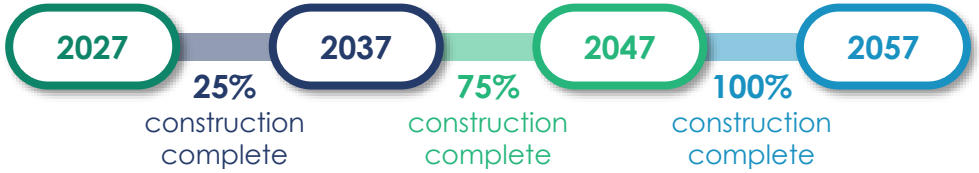
Engage	Assess	Analyse	Advise
Engagement with key stakeholders to obtain and collate required inputs, including stakeholders such as:	Solidification of assumptions and conversion of **engagement data into modelling inputs**, including:	**Analysis of modelling and data** to identify appropriate options to achieve required objectives, including:	**Presentation of key findings to key stakeholders**, addressing feedback where required, including:
Ballarat City Council	**Precinct Load**	**Result Validation**	**PSP Clauses** **Stakeholder Workshops**
Powercor	**Solar Potential**	**DER Requirements**	**Deliverable Material**
VPA (Victorian Planning Authority)	**EV Uptake**	**Implementation**	**Feedback, Updates and Iteration**
Developers	**Energy Modelling**	**Operating Consideration**	

02 Energy Demand

Ballarat North Precinct will require 88 GWh of electricity per year

Precinct Energy Requirements Basis

Precinct Timeframe



The analysis presented within this document are regarding the point of 100% construction completion – as of writing this is **2057**.

Inclusions

The **load sources** for the precinct include:

- 6,688 x Residential Dwellings
- 5 x Schools
- 2 x Activity/Shopping Centres
- 3 x Sports Facilities
- 2 x Community Centres
- Public Lighting
- Residential EV Charging

Exclusions

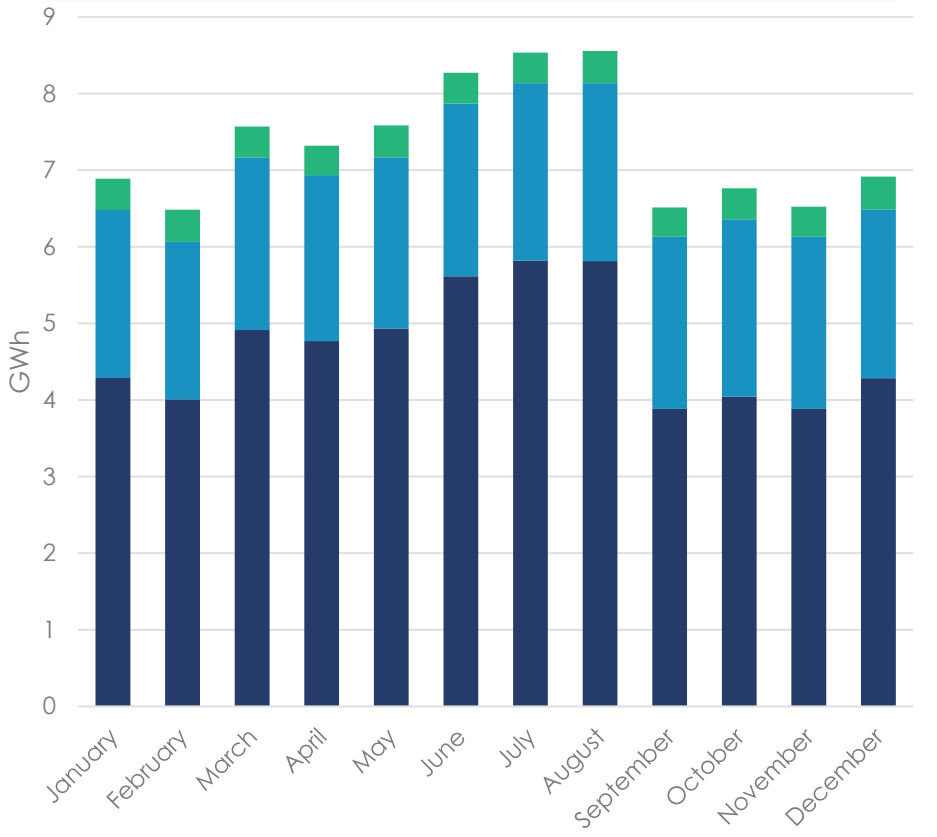
The following **load sources** were excluded from the precinct energy requirements:

- Emergency Services
- Health Services

The **basis** of the energy requirements within this analysis consider the **'core area' of the precinct***.

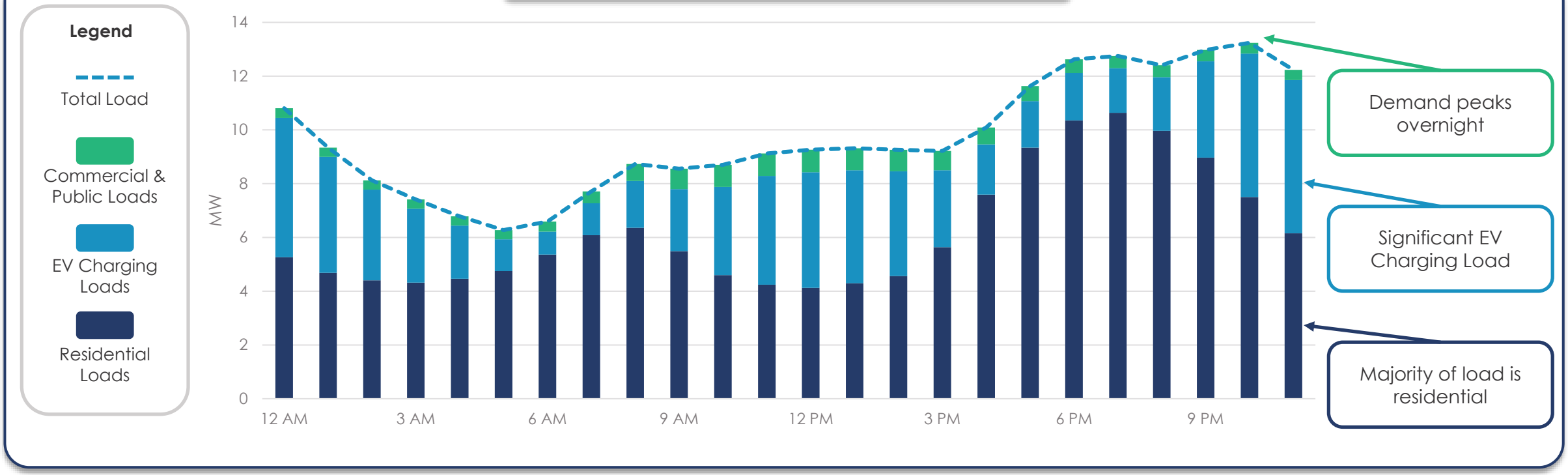
*See Appendix for energy analysis of the entire precinct, including the 'expanded area'

Precinct Energy Requirements per Month



An Average Day's Energy Usage In the Precinct

Precinct Average Daily Load (2057) per Hour



Precinct Load Characteristics

17 MW
Average Maximum Demand

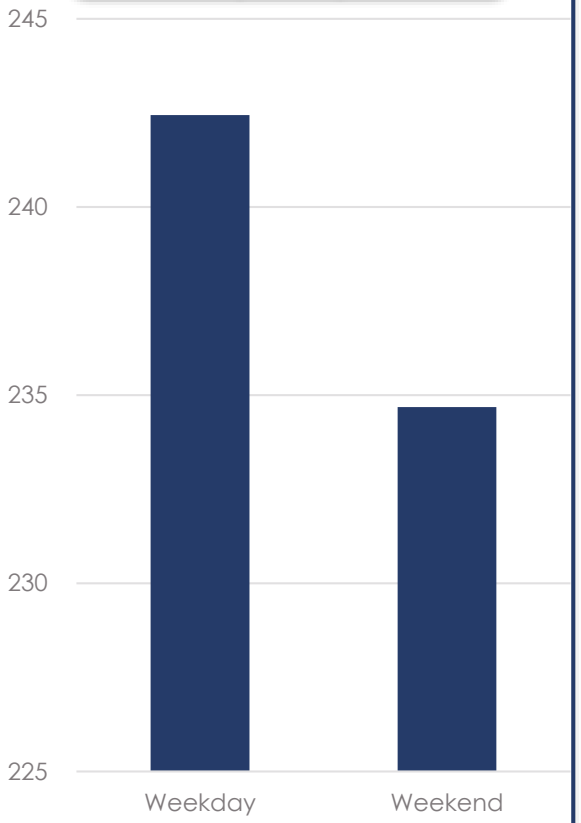
10 MW
Average Demand

233 MWh
Average Daily Energy

33 MW
Residential ADMD
- From Powercor

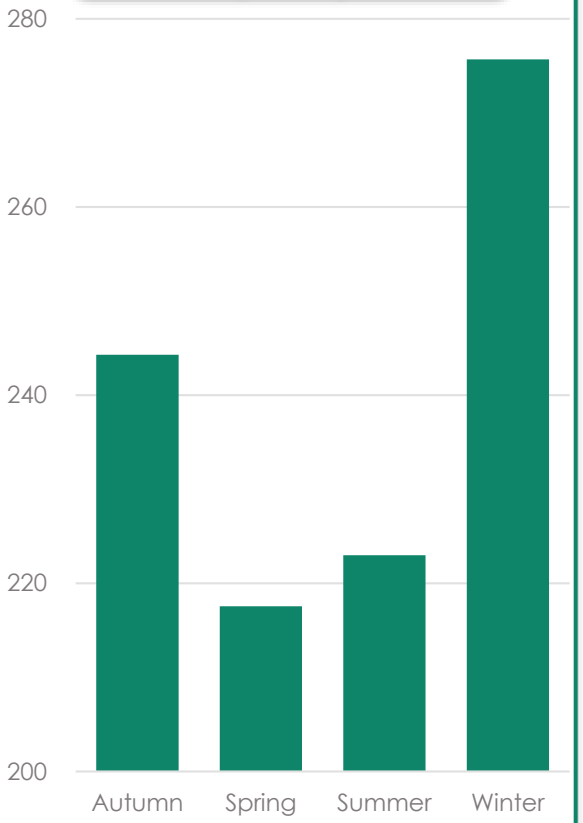
The daily energy of the precinct has the following features…

Per Day Type (MWh)



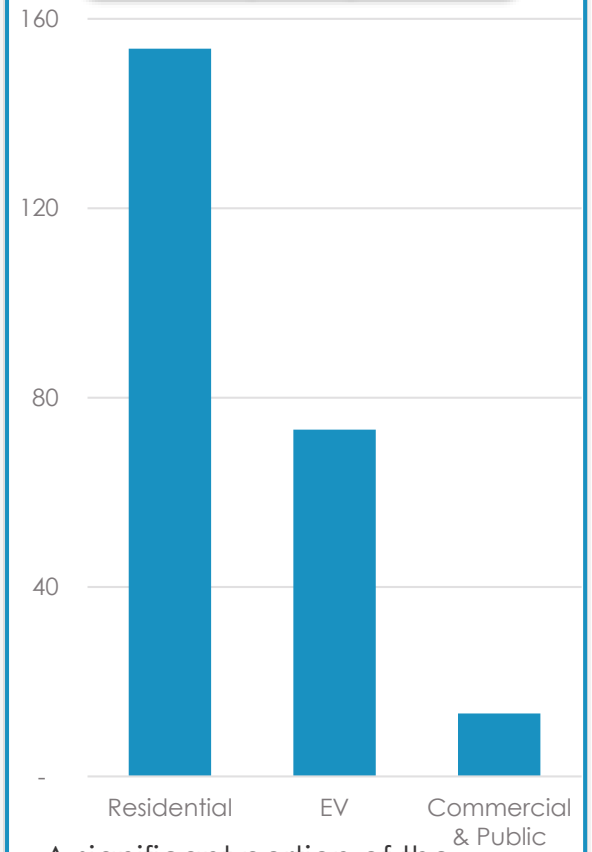
Energy usage within the precinct is **3% lower on weekends** compared to weekdays.

Per Season (MWh)



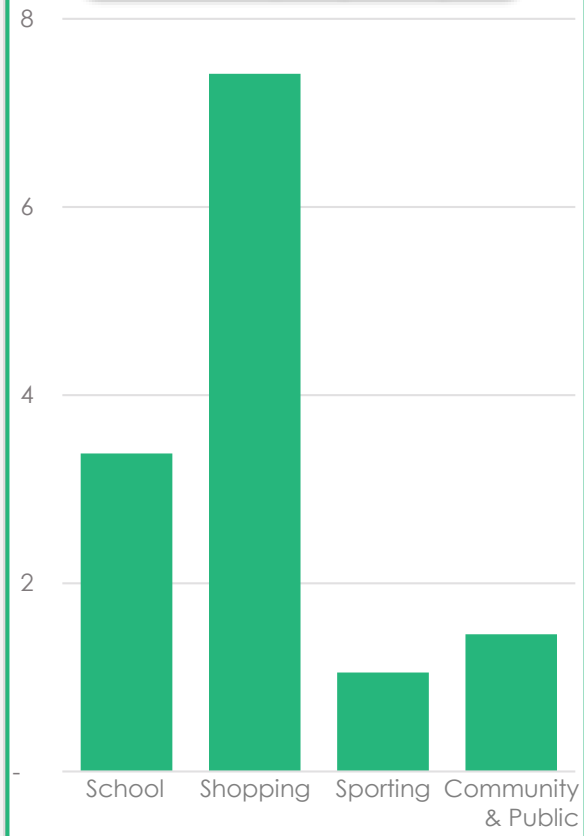
Usage across the seasons varies. For example, Winter energy usage is ~27% higher than in Spring.

Per Load Source (MWh)



A significant portion of the precinct load is **residential and EV charging loads**.

Commercial & Public Load Split (MWh)

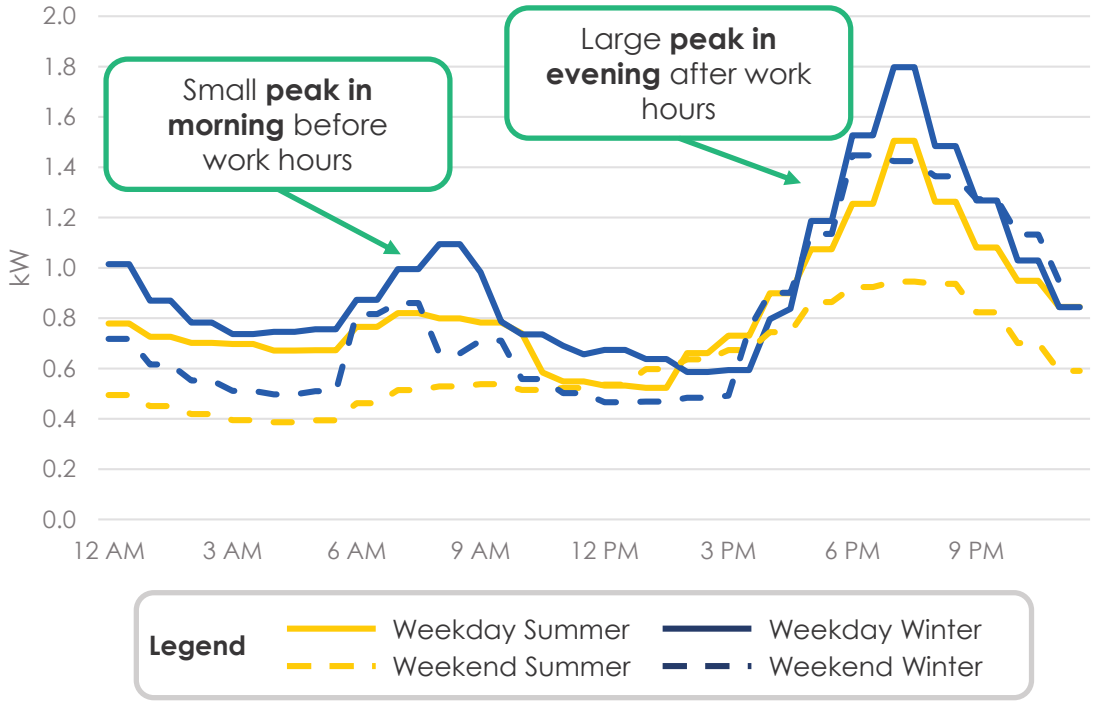


~54% of the commercial and public load is made up of **shopping centre loads**.

Examples of underlying load buildup*: Residential and EV Charging

Average Daily Residential Load Profile

AusNet has developed a **residential profile** for the precinct based on **2020 AER Benchmark** and adjusted to suit the precinct. **Similar dwelling types** were determined across the precinct.



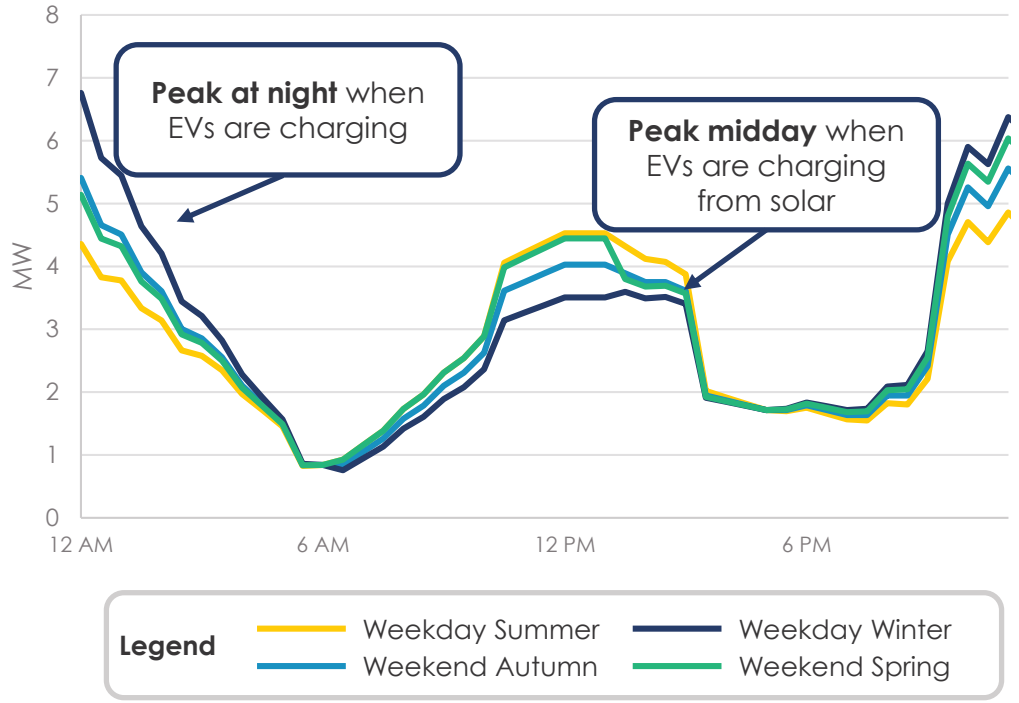
6.2 MW *Average Demand*

25.5 MW *Maximum Demand (ADMD)*

149 MWh *Average Daily Energy*

Weekday Average Aggregate EV Load Profile

AusNet has developed an **EV charging profile** for the precinct using the findings of **ARENA EV charging trials.** The profile **considers** seasonal impact, weekday vs weekend, charging and control methods, and dwelling types.



3 MW *Average Demand*

7.5 MW *Maximum Demand (Winter Weekend)*

71 MWh *Average Daily Energy*

*Further detail of the energy assessment can be found in the appendix

03 *Solar & Battery Assessment for the Precinct*

For the Ballarat North Precinct to reach net zero, solar generation and battery storage needs to be implemented

Solar

Solar is a **generation asset** that utilises solar irradiation to directly **generate electricity locally**.

67.4 MW
Solar Generation

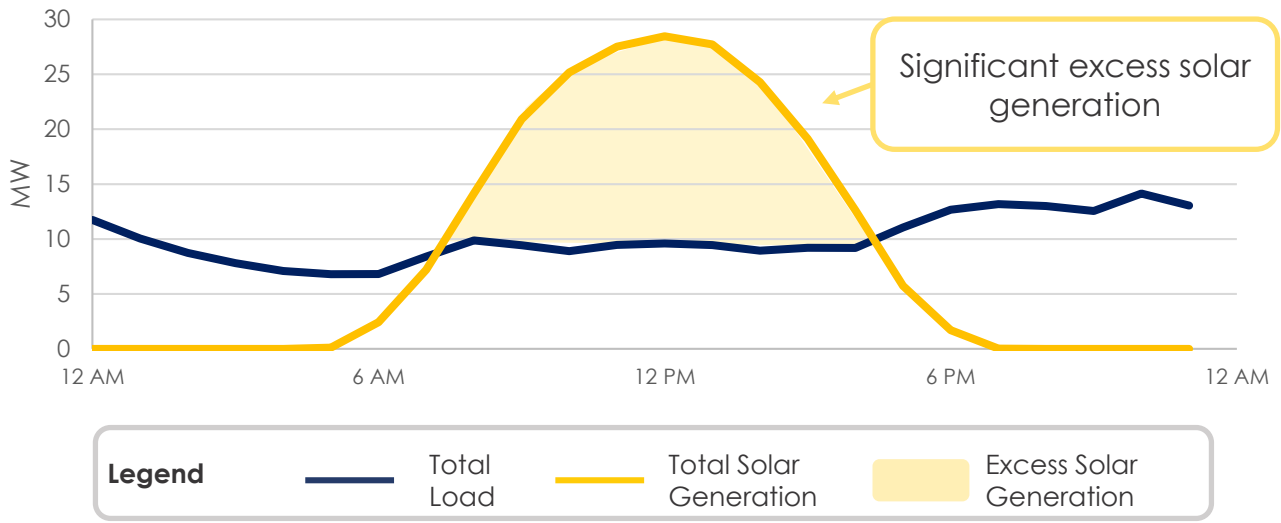
Battery

Energy **storage asset** that allows storing of **localised** generation for later use.

90.6 MWh
Usable Energy Storage

To reach Net Zero in the Ballarat North Precinct, 67.4 MW of Solar Generation will be required

Average Load and Generation Profile



Energy Characteristics

55.3 GWh / year
Grid Purchases

67.4 MW
Solar Required for Net Zero

79.2 GWh (2057)
Energy Production

46.8 GWh (2057)
Energy Exports

59%
PV Energy Exported

204 MWh / day
Energy Export in Summer

54 MWh / day
Energy Export in Winter

Large variation between seasons due to **reduced PV generation** and **increased energy usage** in Winter

Precinct Solar and Assumptions

The Solar Generation profile for the precinct was determined considering the following assumptions:

- **No curtailment** assumed for the modelling solar size
- For each **1kW** of Solar, **3.67 kWh is generated** per day
- **PV Degradation has been considered** over the 30 year build period

*Further detail of the energy assessment can be found in the appendix

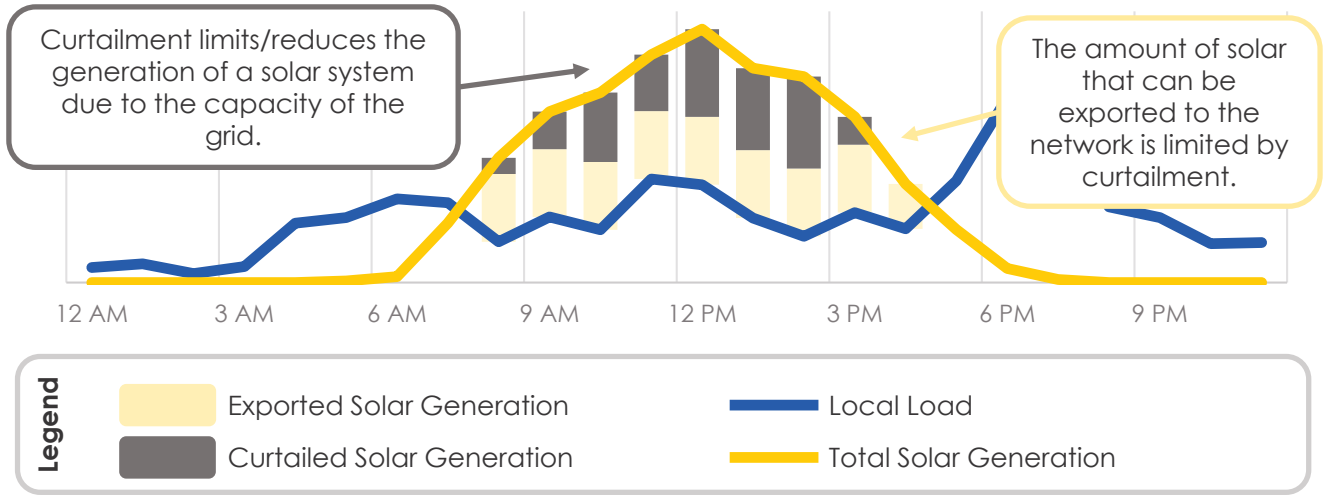
Solar energy generation can be used more effectively when DER systems are orchestrated

Solar Curtailment

Solar curtailment describes the event where **solar generation is purposefully reduced** below its maximum potential. This may be done due to safety, compliance, or other reasons.

The Ballarat North Precinct is expected as an area of high solar penetration, and may be subject to **methods of curtailment:**

- **Export Limits** set by the DNSP, which limit the generation which can be exported to the network, to maintain network reliability
- **Inverter Compliance Settings** (defined by Australian Standards) to ensure safe grid connected operation.



Battery Energy Storage Systems (BESS)

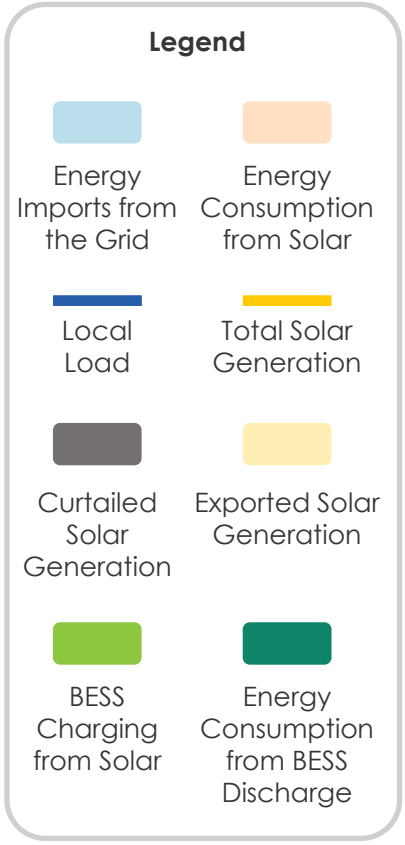
In a community with **high renewable generation**, Controllable Energy Storage is an important component that **addresses the variability** of distributed generation and peaks in energy demand.
Its correct operation allows for **community energy needs to be more efficiently met**.

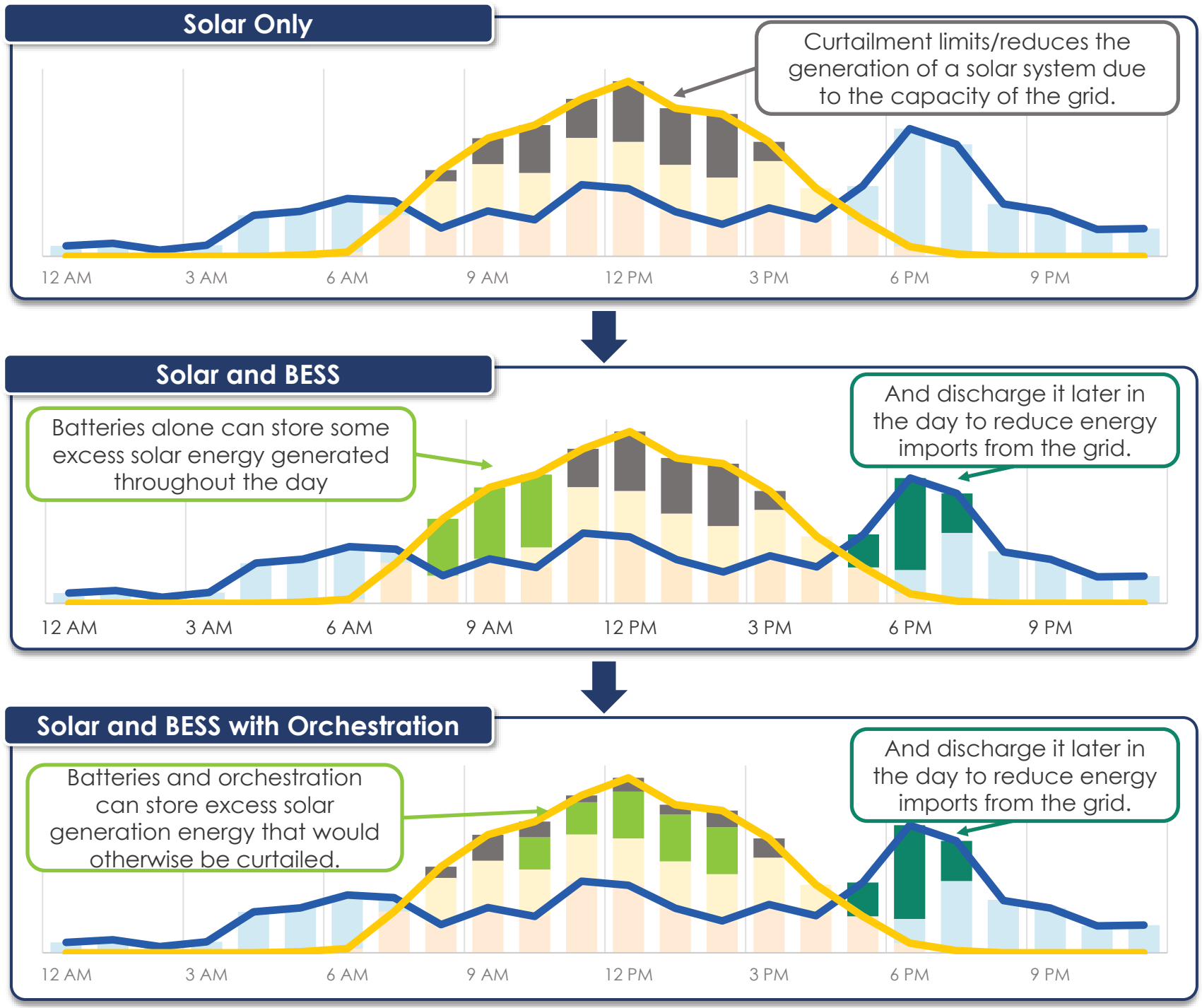
Battery Energy Storage can also **support solar** in places where the high penetration of solar causes generation to **curtailed** due to too much energy in the network.

Orchestration

Orchestration is the **dispatch of controllable resources** in order to most efficiently **address the requirements** of the overall system.
This is particularly important in energy systems where the **energy resources are not centralised** but all impact the big picture.

Implementing batteries and orchestration can reduce solar generation that is curtailed and reduce peak demand





When accounting for solar curtailment, the solar generation of the precinct is *reduced* by approximately 3.8 GWh

Curtailment Modelling

The **dynamic nature** of curtailment results in a difficultly in estimating the **magnitude of curtailment** that the Ballarat North Precinct may encounter.
As such, multiple scenarios (available in the Appendix) are modelled to determine a suitable model for solar curtailment.

Curtailment Base Scenario*

The selected scenario assumes the precinct will experience curtailment equivalent to:

75% of systems curtailed to an export limit of **5kW output** (standard offer from Powercor)

25% of systems curtailed to an export limit of **0kW output** as consideration for when 5kW limit isn't possible as well as for the required inverter settings that automatically curtail the system to maintain grid integrity

A Comparison of Solar Generation Characteristics

Scenario without curtailment:	*Scenario with curtailment:*
55.3 GWh / year *Grid Purchases*	**55.3 GWh / year** *Grid Purchases*
79.2 GWh / year *Energy Production*	**79.2 GWh / year** *Energy Production*
46.8 GWh / year *Energy Exports*	**43 GWh / year** *Energy Exports*
Not applicable *Maximum Daily Curtailment*	**15.7 MW** *Maximum Daily Curtailment*

Up to **3.8 GWh** of solar will be **curtailed annually** in the modelled scenario.

*A summary of all curtailment scenarios modelled is available in the Appendix.

90.6 MWh of Usable Energy Storage Is Required for Net Zero

Energy Storage Modelling

The storage requirement can be estimated **based on the modelled curtailment and export** that occurs in the precinct.

Export occurs ~**100**% of Year

Curtailment occurs ~**40**% of Year

The storage capacity refers to the **'Usable Storage'** required, which **does not account for** losses, depth of discharge, etc.

Curtailment Base Scenario

The selected scenario assumes the precinct will experience curtailment equivalent to:

75% of systems curtailed to an export limit of **5kW output**

25% of systems curtailed to an export limit of **0kW output**

A Comparison of Solar Generation Characteristics

The following table shows potential values that can be used to determine an energy storage requirement based on the average and maximum modelling results.

Daily	Summer	Autumn	Winter	Spring
Avg. Grid Purchase	115.7 MWh	156.9 MWh	205.2 MWh	126.8 MWh
Avg. Export	179.3 MWh	92.5 MWh	54.0 MWh	146.3 MWh
Avg. Curtailment	24.4 MWh	2.2 MWh	0.003 MWh	16.2 MWh
Max. Export	249.8 MWh	199.7 MWh	136.9 MWh	258.3 MWh
Max. Curtailment	76.1 MWh	34.2 MWh	0.2 kWh	**90.6 MWh**

Storage Capability

- **90.6 MWh** of **usable energy storage** has been selected for the storage requirement of the precinct.
- This is selected to **address the desired Net Zero** objectives, as **curtailment needs to be zero to enable Net Zero**.
- This would also address solar export for approximately **40**% of the year

04 *Precinct Structure Plan*

PSP Clauses Development Process

PSP Clauses

- AusNet have **drafted potential PSP clauses** based on the completed energy analysis results and engagement with Ballarat City Council regarding options and preferences
- This section is set out to **assist council** with meeting one of their **sustainability objectives** for the new precinct, specifically to **achieve Net Zero operational emissions during the 30 year precinct build period**
- It is expected that this section will be used for **discussion purposes** for the Council and could be updated/adjusted based on feedback (preferences, wording, information, etc.) before implementation

Clause Development Process

Elevating ESD Targets & Relation to Project

Elevating ESD

Council Alliance for a Sustainable Built Environment (CASBE)* :

*"… maintain a **well-established framework**, tools and guidance material (including BESS and the Sustainable Design Fact Sheets) to help councils and industry deliver ESD in new developments. This is supported by the local ESD Policies held by a number of CASBE member councils, as well as other sustainability measures in the planning scheme.*
*The **Elevating ESD Targets planning scheme amendment** is the next step in this journey. "*

**Source: https://www.casbe.org.au/elevating-esd-targets/*

Ballarat City Council is a **Project Partner**

The **Elevating ESD Targets** can be found online at https://factsheets.bess.net.au/elevating-esd-targets.html

Ballarat North Precincts Analysis

- ESD - Environmentally Sustainable Development
- 'Elevating ESD Targets' is a current **proposed planning scheme** amendment that includes **many topics in common with this project** such as solar and EV charging.
- It is important to highlight that the energy analysis that has been completed in this document is **specific to the Ballarat North Precinct and is not based on the 'Elevating ESD Target'** works.
- AusNet **have not completed** a review of the Elevating ESD Targets for suitability with the new Precinct

#1 Process

PSP Inputs

1A (Requirement)

An application to **develop or subdivide land** must be accompanied by a **Zero Carbon Operational Energy Plan**…

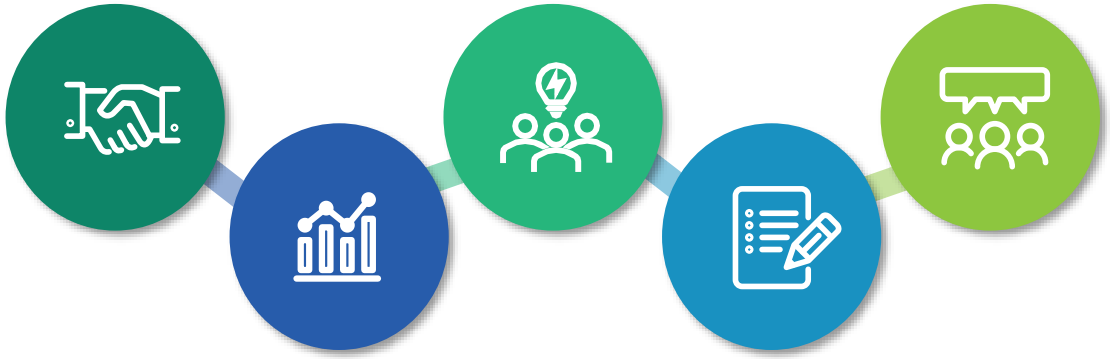
1B (Requirement)

Any application for subdivision or development of **commercial or mixed-use buildings** must commit to the use of a **best practice environmental performance rating tool**, such as a Green Star Buildings rating of minimum 5 stars, or an equivalent rating achieved through a similar tool…

1C (Recommendation)

Opportunities for **alternative infrastructure and utility delivery models** that achieve **best practice ESD** and support the development of a carbon neutral neighbourhood are encouraged

Basis



Reason for proposing PSP Inputs

- Proposed in order to support the inclusion of new clauses
- Clarifies mechanism utilised during planning stages
- Streamlines the review and approval process

Note:

- The current text shown for 1A is referenced from the Geelong Creamery Road ESD Provisions R47. Similarly
  1B is referenced from R24
  1C is referenced from G46

#2 Solar

PSP Inputs

2A (Requirement)

Developers must install a minimum **10 kW of solar** within the precinct per proposed dwelling, unless agreed otherwise with responsible authority.

2B (Requirement)

The solar shall **not be installed on south facing rooftops**.

2C (Recommendation)

The **minimum solar** install requirement can be **reduced** by demonstrating that the community energy requirements are met **through other means**. **For example:** another form of added renewable energy generation, increased energy efficiency measures, or reduced demand, etc.

Basis

Net Zero
PV: 67.4 MW

6,688
Dwellings

~10kW DC /
Dwelling

Reason for proposing PSP Inputs

- Solar is the proposed energy generation source for reaching net zero due to its accessibility to communities
- Solar installed is estimated to be able to meet the Net Zero requirement over the 30 year build period of the precinct

Note:

- Clause wording that was more prescription regarding individual dwelling requirements was also considered but determined not suitable.
- Solar requirement is based on historic energy benchmark and doesn't consider 7-star standard

#3 Energy Storage

PSP Inputs

3A (Requirement)

An **equal amount of room** to as what is allocated for DNSP Kiosk Transformers is provided next to the transformer for future community battery.

3B (Recommendation)

13.6 kWh of usable storage per 10kW DC solar installation within the precinct.

3C (Recommendation)

Provision of **neighbourhood scale battery storage** and **virtual power plants** for excess renewable energy produced within the precinct is strongly encouraged.

Basis

Usable Storage to address curtailment: 90.6 MWh

6,688 Dwellings

~13.6kWh/ Dwelling

Reason for proposing PSP Inputs

- Energy Storage required to address solar curtailment
- Community batteries more efficiently meets requirements

Note:

- It is difficult to set batteries as a general requirement due to the operation and maintenance that is associated with the installation
- The current text shown for 3C is referenced from the Geelong Creamery Road ESD Provisions G48.

#4 Efficiency

PSP Inputs

4A (Requirement)

Solar Installed to meet PSP requirements are **not considered in NatHERS Whole of Home Energy Assessment** required by NCC, unless agreed otherwise with responsible authority.

Basis

Reason for proposing PSP Inputs

- Clauses proposed to ensure that new home appliance selection is not disincentivise to be less efficient

Note:

- Whole of home assessment method potentially allows for energy score to be augmented by solar, or in reverse, allows for solar to 'increase energy budget'

#5 Commercial

PSP Inputs

5A (Requirement)

Commercial or mixed-use buildings must be **installed with solar** up to a practical limit agreed with a responsible authority.

5B (Requirement)

Commercial or mixed-use buildings must be **installed battery storage** up to a practical limit agreed with a responsible authority.

5C (Recommendation)

A **practical limit** can include items such as roof limitations, system costs not achieving a payback period, safety, etc.

Basis

10 Commercial Buildings

2 Activity Centres
With Multiple Businesses

Reason for proposing PSP Inputs

- Council have more input into commercial and mixed used facility development, allowing them to better achieve energy objectives on a bespoke basis.

Note:

- Minimum green star rating proposed in #1B

#6 EV Chargers

PSP Inputs

6A (Requirement)

All **new dwellings** allow for future provision of **EV charging point**. Minimum one 7kW 32A EVCP per dwelling

6B (Requirement)

A minimum of **5% of all off-street parking** provided for non-residential subdivision or development exceeding 5,000 square metres must have **EV charging** infrastructure and signage installed. This must be shown on a plan submitted as part of any permit application for subdivision.

Unless otherwise approved in writing by the Responsible Authority, at least **20%of all off-street parking** spaces (or a minimum of one space) must be capable of supporting the provision of an appropriate **moderate speed EV charging** outlet. Appropriate EV infrastructure and cabling must be provided to ensure peak demand is managed for example, distribution use metering systems, scalable load management systems, and cable trays or conduit installation.

Basis

CSIRO: 100% EV by 2051

30% of Precinct Load is EV

Avg. 1-2 Cars per Dwelling

Reason for proposing PSP Inputs

- EV uptake expected to exponentially grow over precinct build period
- No hard requirement for residential due to EV penetration currently being low

Note:

- The current text shown for 6A is referenced from the Geelong Creamery Road ESD Provisions R47. Similarly 6B is referenced from R55
- Both of these requirements are based on the Elevating ESD Targets which Ballarat is also a partner to

#7 Demand Management

PSP Inputs

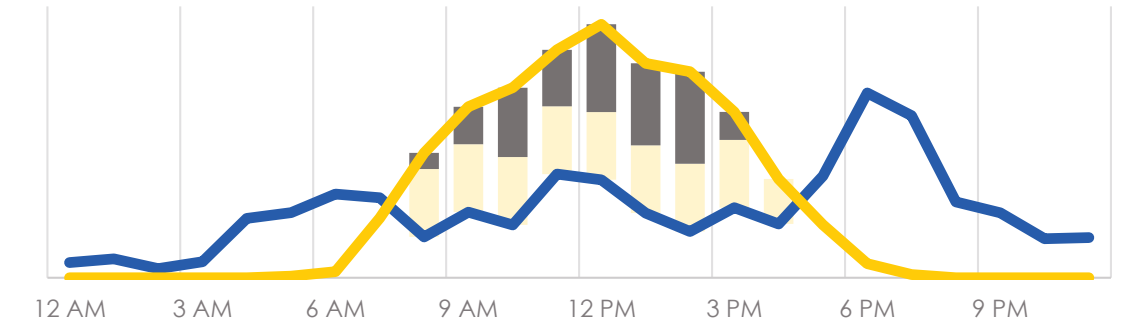
7A (Recommendation)

Every solar, battery, and EV charger system will be integrated with an **energy management device** capable of monitoring and control.

7B (Recommendation)

An energy management device or system installed at a site is **capable of interfacing with all DER** installed at the site concurrently.

Basis



Reason for proposing PSP Inputs

- The potential high solar installation means that there is a likely chance that generation will be curtailed.
- Clauses recommended to help address the excess solar in other ways besides installing battery storage

Note:

- These remain recommendations since they are reliant on other aspects of the dwelling

#8 Electricity Network

PSP Inputs

8A (Requirement)

Distribution Kiosk Transformers are installed with **Autotap functionality** sufficient for operating in **100% solar** penetration network

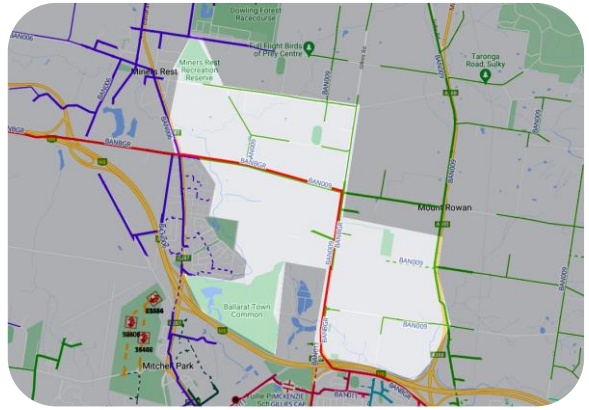
8B (Requirement)

DNSP makes available a local operating envelope that maximises generation for aggregators orchestrating assets in the precinct

8C (Recommendation)

Distribution network conductors are sized to **accommodate high solar** penetration.

Basis



Reason for proposing PSP Inputs

- Powercor as the DNSP are capable of activities that support Net Zero unavailable to other stakeholders
- Requirements are also added as a method to gauge Powercor feedback in an official capacity

Note:

- Where an asset isn't yet defined by Powercor they must create the standards for its design and operation
- Potential equity issues considering network costs are typically covered by all connected customers

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Thank You

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Appendix 1
Energy Demand

The DNSP (Powercor) was consulted as a key stakeholder

The Role of the DNSP

Distribution Network Service Provider (**DNSP**) are **custodians of the lower voltage network** that brings electricity to customer homes.

DNSP's **are responsible for the operations and maintenance of the network** to ensure it's safe and compliant running.

Powercor are the DNSP for the **Ballarat** region.

Many DNSP's are preparing to become **Distribution System Operators (DSO)** to better manage their networks that have increasing penetrations of DER such as solar, batteries, electric vehicles, and flexible loads. A DSO acts to **ensure reliable and efficient operation** of DER while **maintaining network stability and compliance.**

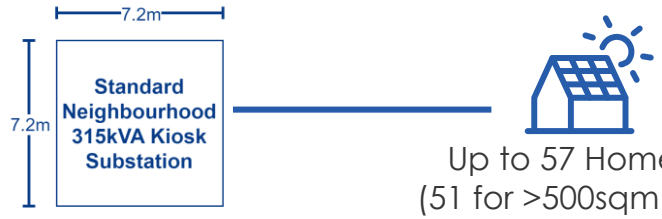
DNSP Engagement

Powercor Engagement

Powercor were engaged during the project to discuss the **net zero implications for the local network** and its operation. Discussions with Powercor were completed through a mix of emails and online meetings.

Powercor Precinct Information

- The estimated **ADMD** (after diversity maximum demand) for the precinct residential is 33MVA
- Ballarat North will **be supplied primarily** by BAN ZSS^ potentially with assistance from upcoming BAE ZSS+
- New ZSS* **may be required** to service the new development and surrounding areas
- DNSP provided **no specific feedback** for net zero objectives or future high DER penetration operations



*ZSS: Zone Substation
^BAN ZSS: Ballarat North Zone Substation
+BAE ZSS: Ballarat East Zone Substation

Precinct Energy Profile Buildup Process

Residential & Commercial

- **Load characteristics** were obtained as input from council and stakeholders during early engagement
  Type of loads, size, amount, etc.
- **Reference data** was obtained that can be used to inform energy profile assumptions in precinct
  e.g. Historic load profiles for relevant neighbourhoods obtained from DNSP GridView Portal
- **Average energy profiles** for the different loads were created to represent the precinct

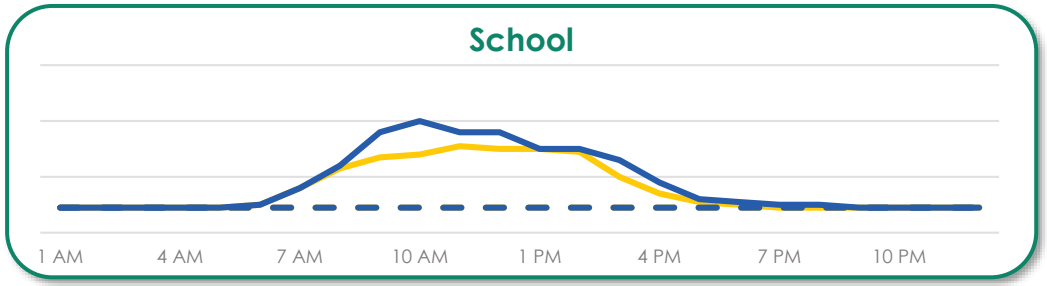
EV Charging

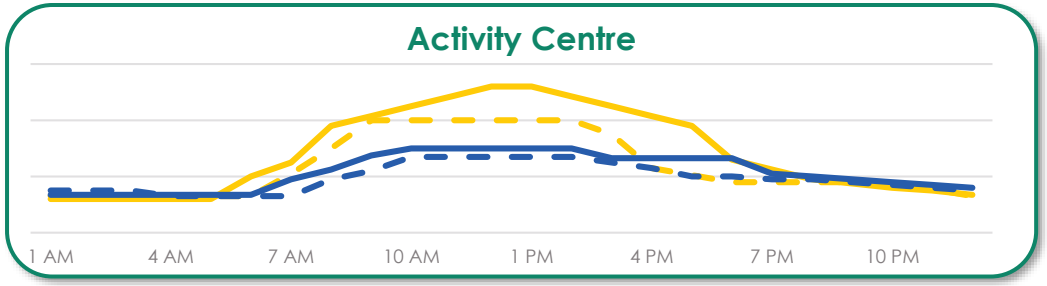
- AusNet has developed an **EV charging profile** for the Ballarat North precinct using the research findings of various **ARENA EV charging trials**. Using the data from these trials a baseline and smart charging load profile were developed and combined to estimate the precinct EV charging profile
- **The profile considers** seasonal impact, weekday vs weekend, charging and control methods, and dwelling types.

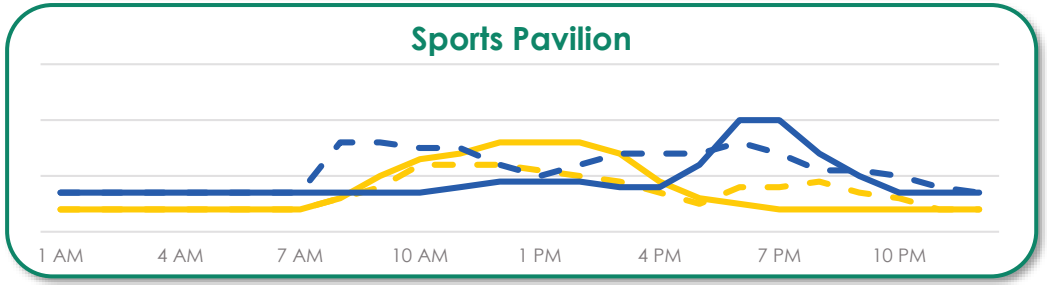
Ballarat North Precinct

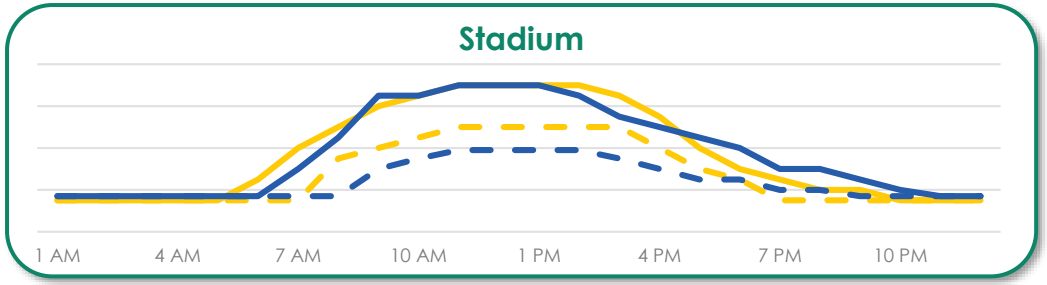
- **Profiles shared with council** for feedback and adjustments are made based on feedback and/or further analysis
- Whole of precinct energy profile is created based on **underlying profiles** and is then utilised for further precinct net zero analysis

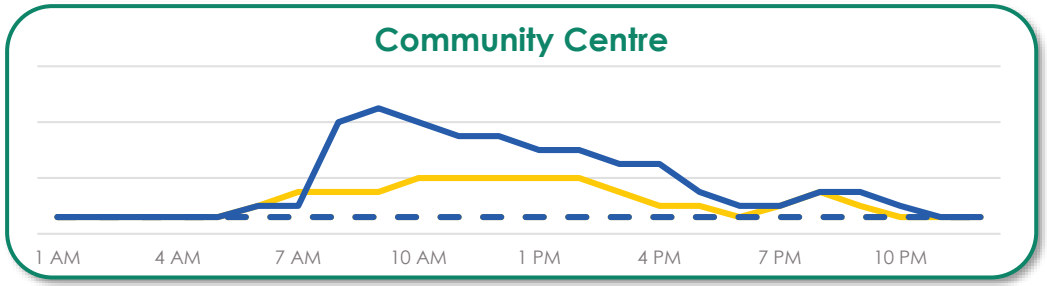
The Ballarat North Precinct load is built up from underlying load profiles

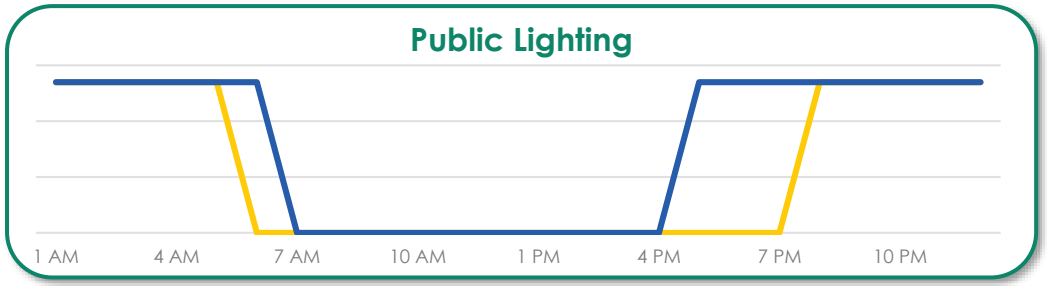


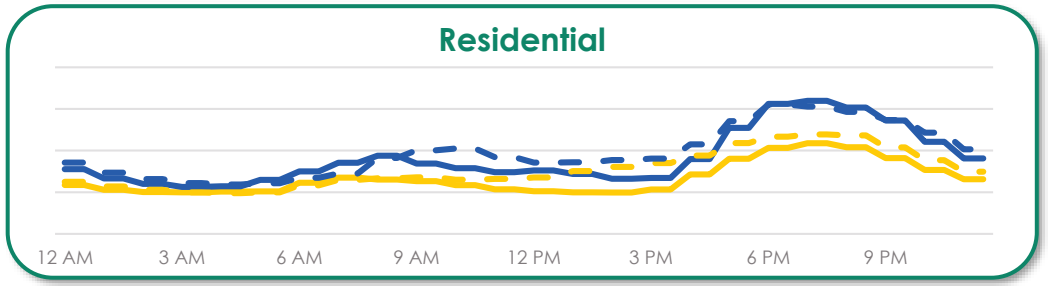


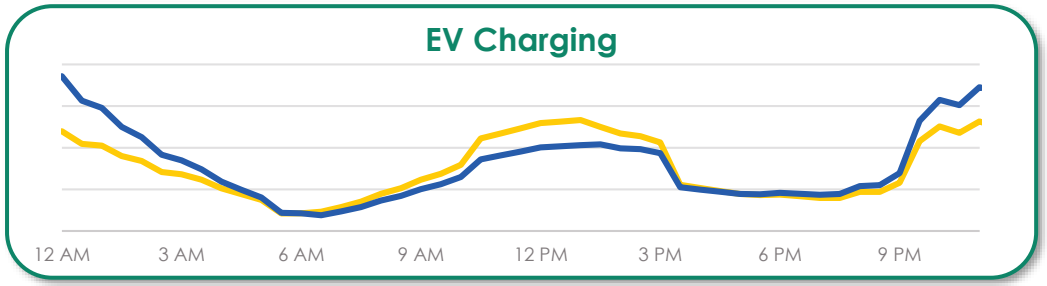


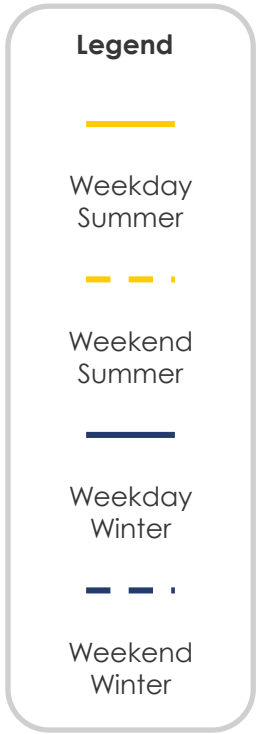










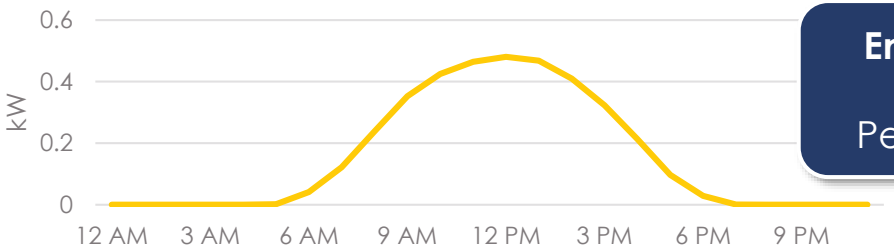


Appendix 2
Solar & Battery

How much solar potential is there in Ballarat North?
Each 1kW of Solar PV can generate 3.67 kWh of energy per day

Generation for the Precinct

Solar Photovoltaics (PV) is the **most accessible form of DER** for residents, communities and businesses.
For energy analysis, an **average solar profile** for Ballarat North was created. A **Solar Generation profile was calculated for 1kW (DC) of Solar** and scaled as required.



Energy production:
3.67 kWh/day
Per 1 kW of Solar PV

Precinct Solar and Assumptions

The Solar Generation profile was determined considering the following assumptions:

- **Weather dataset**: TMY, 10km Grid, Meteonorm 8
- **DC:AC Ratio:** 1.2
- **Performance ratio:** ~81%
- **PV panel tilt**: 15 degree

Rooftop orientation breakdown:
Planned precinct layouts of the development were used to determine the orientation of each lot's rooftop. A sample was taken to determine an assumption for use with wider precinct.

Roof Orientation	Proportion of Precinct
North	22%
South*	22%
East	28%
West	28%

*Assumes no installation on south facing roof surface

Curtailment Scenarios Modelled

Solar Curtailment

Solar curtailment describes the event where **solar generation is purposefully reduced** below its maximum potential. This may be done due to safety, compliance, or other reasons.

The Ballarat North Precinct is expected as an area of high solar penetration, and may be subject to **methods of curtailment:**

- **Export Limits** set by the DNSP, which limit the generation which can be exported to the network, to maintain network reliability
- **Inverter Compliance Settings** (defined by Australian Standards) to ensure safe grid connected operation.

Curtailment Modelling

The **dynamic nature** of curtailment results in a difficultly in estimating the **magnitude of curtailment** that the Ballarat North Precinct may encounter.
Various scenarios have been modelled to determine a basis for solar curtailment.

Curtailment Scenario	Annual Export (MWh)	Max. Daily Curtailment (MW)	Max. Daily Export (MW)
No Curtailment	46,801	0	41.4
50% 5kW / 50% 0kW	35,780	24.0	17.5
75% 5kW / 25% 0kW	**42,929**	**15.70**	**25.7**
100% 5kW	46,211	7.4	34.0
Transformer Rating	46,801	0.5	40.9

Curtailment Base Scenario

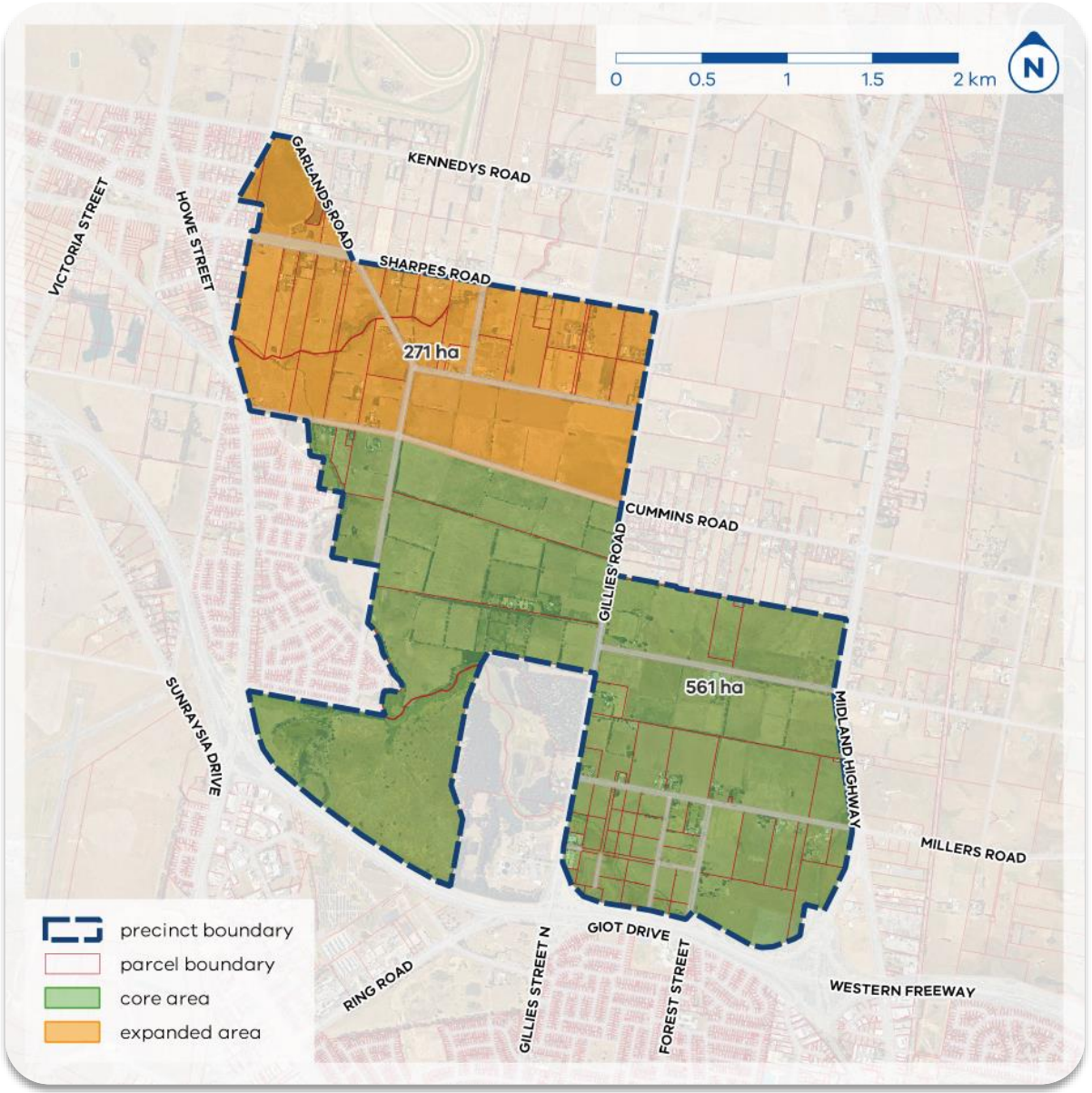
The selected scenario assumes the precinct will experience curtailment equivalent to:

75% of systems curtailed to an export limit of **5kW output** (standard offer from Powercor)

25% of systems curtailed to an export limit of **0kW output** as consideration for when 5kW limit isn't possible as well as for the required inverter settings that automatically curtail the system to improve grid integrity

Appendix 3
Expanded Area

Ballarat North Precinct Includes 271 ha of 'Expanded Area'



Precinct with 'Expanded Area' requires 123 GWh of electricity per year

Precinct Energy Requirements Basis

The **basis** of the energy requirements within this Appendix consider both the **'core area' and the 'expanded area' of the precinct***.

Inclusions

The **load sources** for the precinct include:

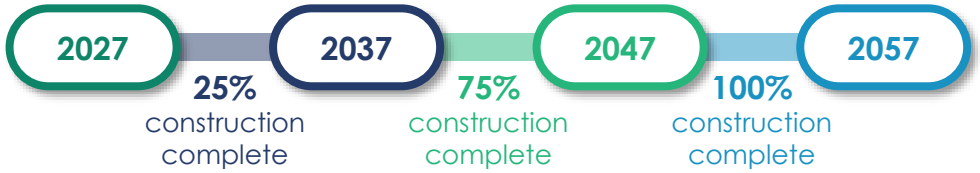
- 6,688 x Residential Dwellings ('Core Area')
- **Additional 2,600 x Residential Dwellings ('Expanded Area')**
- 5 x Schools
- 2 x Activity/Shopping Centres
- 3 x Sports Facilities
- 2 x Community Centres
- Public Lighting
- Residential EV Charging (including **EV load for the additional 2,600 dwellings)**

Exclusions

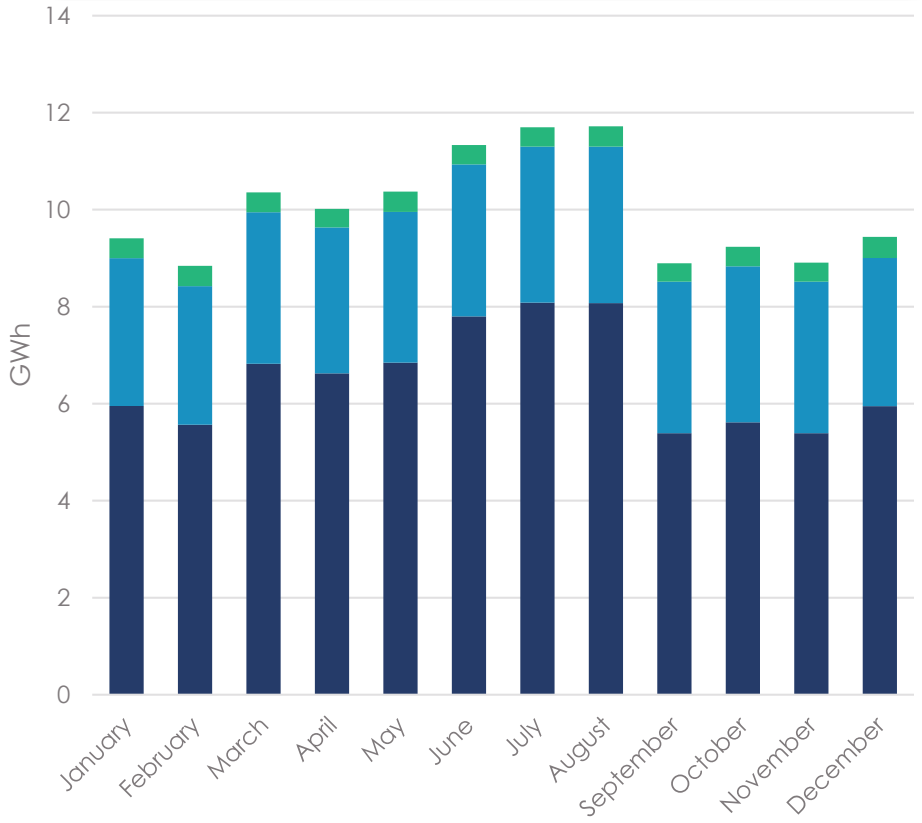
The following **load sources** were excluded from the precinct energy requirements:

- Emergency Services
- Health Services

Project Timeframe



Precinct Energy Requirements per Month

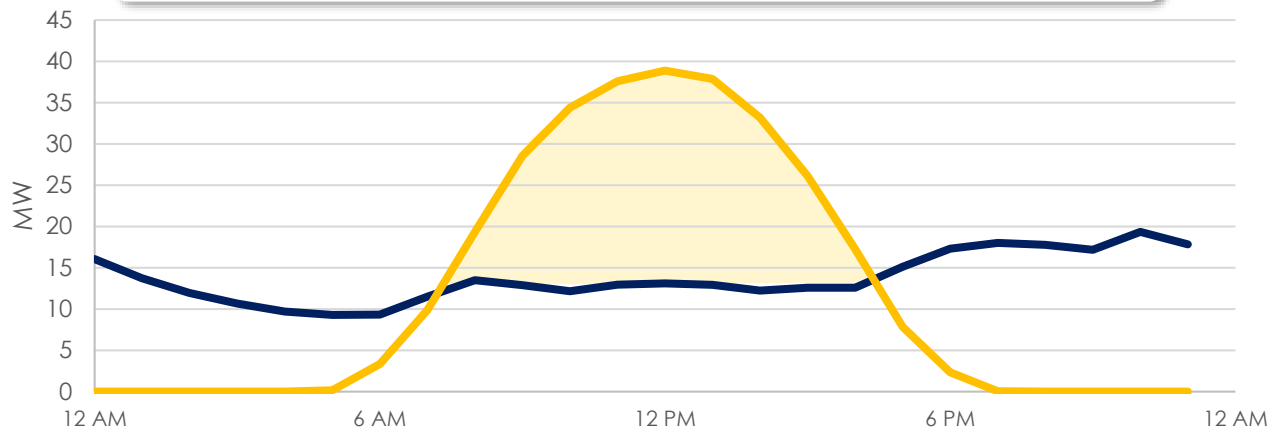


Total energy requirement: **123 GWh**

Legend
- Commercial & Public Loads
- EV Charging Loads
- Residential Loads

To reach Net Zero for the precinct with the 'Expanded Area', 92 MW of Solar will be required

Average Load and Generation Profile – Expanded Area



Precinct Solar and Assumptions

The Solar Generation profile for the precinct was determined considering the following assumptions:

- **No curtailment** assumed for the modelling
- For each **1kW** of Solar, **3.67 kWh is generated** per day
- **Core Area analysis as base** with extrapolating to Expanded Area

Solar Generation Characteristics

The results for the expanded area have **scaled linearly** by the number of increased dwellings.

92 MW
Solar Required for Net Zero

109 GWh / year
Energy Production

64.3 GWh / year
Energy Exports

59%
PV Energy Exported

Large variation between seasons due to **reduced PV generation** and **increased energy usage** in Winter

279 MWh / day
Energy Export in Summer

74 MWh / day
Energy Export in Winter