

**theFabric**

**Net Zero  
Energy Homes  
Milestone 2  
Knowledge Sharing Report**



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**The Fabric – Stage 1 Blackshaws Road Homes**

# Project Overview

The award-winning team at Mirvac has taken a considered and innovative approach to create 'The Fabric', a benchmark community of contemporary homes located at 188-198 Blackshaws Rd, Altona North VIC.

The Fabric community will include both townhomes and apartments and over 1 hectare of parks and open space in a fully integrated Mirvac build out model, designed by Mirvac Design and constructed by Mirvac Home Builders. The Fabric was successful in securing a funding agreement with the Australian Renewable Energy Agency (ARENA) in February 2019, under their Advancing Renewables Program.

The Fabric has committed to delivering minimum 7-star NatHERS rated, fully electric, Net Zero Energy Homes in Stage 1 of the project through incorporation of sustainability initiatives in design and construction. Mirvac has committed to meet the following design and build standards for each of the 49 homes in Stage 1:

- Minimum of 7-star NatHERS rating;
- 5kWp of solar PV for 3 and 4 bedroom homes and 3.8kWp of solar PV for 2 bedroom homes;
- 10kWh of battery storage;
- Smart home energy monitoring in real time or near real time which can be accessed by the occupant;
- LED lighting below 2.8W/square metre in living areas and 1.8W/square metre in bedrooms;
- Induction cooktop to be offered as the only option;
- Roof ventilation system;
- Dishwasher minimum of 4 energy stars;
- Hot water system with minimum COP of 4.2;
- Maximum of 8 air changes per hour as tested by a blower door test;
- Heating and cooling system with demand response enabled device with a minimum COP of 3.85 and energy ratio of 3.39;
- Electrical point in garage on a sub-circuit from the meter box with a safety switch for electric vehicle readiness; and
- Performance double glazing for all windows

The aim of the partnership between Mirvac and ARENA is to accelerate the Net Zero Energy Homes concept by providing feedback on cost effective design and construction opportunities in addition to live market testing to gauge the acceptance and sales strategies for these homes. Mirvac will also provide de-identified energy data to ARENA to review the impact of the Net Zero Energy homes in operation.

# ARENA Summary

|                           |  |
|---------------------------|--|
| <b>Activity Title</b>     | Net Zero Energy Homes  |
| <b>Reference</b>          | Milestone 2 – Knowledge Sharing Report                                       |
| <b>Reporting Period</b>   | 1 <sup>st</sup> May 2021 – 3 <sup>rd</sup> May 2023                          |
| <b>Contract Number</b>    | 2019/ARP   |
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| <b>Project website</b>    | <a href="https://thefabric.mirvac.com/">https://thefabric.mirvac.com/</a>    |
| <b>Date of submission</b> | 3 <sup>rd</sup> May 2023   |

# Executive Summary

Mirvac released Stage 1 (no. 49 lots) to the market in October 2019 and construction of the homes commenced in June 2021. Final settlements of the homes were completed in January 2023. The construction programme was heavily affected by the industry wide impacts of the COVID-19 pandemic including restricted numbers on site and labour shortages, procurement of materials, and cost escalation. Delivering 7-star NatHERS rated, Net Zero Energy homes at a masterplanned community scale is an emerging concept and resulted in additional design and construction costs to the project. However, through the ARENA trial and a detailed lessons learnt process, Mirvac has identified design and constructability efficiencies to reduce delivery costs and impact to programme for future stages of the project.

This report will provide industry stakeholders with some of the key technical, regulatory and financial challenges and lessons learnt during construction to deliver 7-star Net Zero Energy Homes.



**The Fabric – Stage 1 Lavender Boulevard Homes**

# Key Challenges and Lessons Learnt

## Technical:

### 1. Design and assessment process of 7-star NatHERS rated homes:

#### **Objective:**

To design and construct all 49 homes to achieve a minimum 7- star NatHERS rating.

#### **Challenge:**

Achieving a minimum 7-star NatHERS rating across multiple different house types with different orientations is a complex exercise. A portion of the Stage 1 homes were released to market prior to NatHERS assessments being finalised. Assessment of homes post sale resulted in design updates required to a small portion of homes, including placement and size of windows which resulted in additional customer communications and potential customer dissatisfaction.

#### **Key learning for future projects:**

Recommend early input from energy consultants and initial NatHERS assessments be completed prior to sales releases to avoid design updates post sale.

### 2. Additional building sealing:

#### **Objective:**

All 49 homes to achieve a maximum of 8 air changes per hour as tested by a blower door test.

#### **Challenge:**

The project upgraded the window specification to thermally broken windows to achieve the required SHGC and U values. Blower door testing was conducted for the homes, and it was identified that the glass sliding door systems were a key point of air leakage. Other weak points identified were internal cavity slider doors and the ducted heating and cooling system. Additional labour and costs were required for additional caulking around weak points.

#### **Key learning for future projects:**

Recommend requesting air tightness test results from suppliers prior to specifying their products on the project. Recommend projects utilise the air permeability testing method rather than the air changes per hour method in line with industry recommendations, since it provides more accurate results across different sized homes.

### **3. Procurement of materials:**

#### **Objective:**

All 49 homes to include performance glazing and a hot water system with minimum COP of 4.2.

#### **Challenge:**

The project specified thermally broken windows. At the time of construction tendering there were limited options of suppliers who could supply thermally broken windows that achieved the required U value and solar heat gain coefficient (SHGC) rating in a residential housing context. This resulted in less competitive pricing for procurement. There is also a risk of programme delay if there are supply issues and there are limited alternative products/suppliers in the market. The project specified the Rheem 270L heat pump hot water system which was a recent addition to Rheem's' product range.

#### **Key learnings for future projects:**

Recommend working with window suppliers on their capabilities to supply products that meet the required U value and SHGC at the early planning stages of the project. Recommend early procurement of the required hot water unit specification for a project of this scale. The location of the hot water unit should be assessed at an early design stage in a high-density townhouse project to ensure there is adequate space provided in the courtyards for the units.

### **Regulatory:**

### **4. Electrical Authorities:**

#### **Objective:**

All 49 homes to include electrical appliances only. There is no provision of gas to the project.

#### **Challenge:**

The absence of gas increases the electrical loads the homes require. The specified appliances within the homes collectively draw significantly more electricity than a standard gas provisioned home. This resulted in extensive consultation with the electrician and the electrical authority on strategies to maintain single phase 40amp supply to the homes (3-phase provision is not standard in Victoria). Future stages have now allowed for 3-phase power. In addition, the electrical authority would not consider the inclusion of the solar PV and battery system to the homes when determining the minimum electrical supply loads for the project. The electrical substation servicing the

stage 1 homes was required to be upgraded from 315 kVa to 500 kVa, resulting in additional cost to the project.

**Key learnings for future projects:**

Recommend early engagement with electrical engineers to determine the electrical loads the appliances require prior to specifying them in the homes. Recommend early engagement with the electrical authority to determine any impact to the size and number of electrical substations required for a fully electric project. Recommend industry wide discussions with electrical authorities around fully electric projects and the need for consideration of the inclusion of a solar PV and battery system to the homes when determining the electrical supply requirements for the project.

**5. Solar PV and battery storage system regulations:**

**Objective:**

All 49 homes to include a 10kWh solar battery storage system and 3.8kWp – 5 kWp of solar PV's.

**Challenge:**

At the time of design, the requirements for battery installation under the Australian Standards was not clearly defined with regard to clearance zones, protection measures and fire safety considerations. The capabilities of the battery system can also be complex for end users to understand and operate.

**Key learnings for future projects:**

The battery system was installed within the garage for all homes. Given the dense nature of the townhouses and tighter garage spaces it is recommended that the integration of the battery needs to be considered at an early stage during the design to ensure there is sufficient clearance from vehicles. This can result in the need for larger garage sizes and as the batteries were installed on habitable walls, non-combustible treatment was required, resulting in additional construction costs. Recommend engaging a reputable battery and solar installation company with capabilities to service any faulty batteries in a timely manner. The operation of the solar PV and battery system can be complex for end users to understand. It is recommended that the residents are supplied with an easy-to-follow operational guide at settlement to ensure they get the most out of their system and its capabilities.

**Financial:**

**6. Cost efficient design and construction of 7 – Star NatHERS rated homes:**

**Objective:**



To design and build all 49 homes to achieve a minimum 7- star NatHERS rating.

**Challenge:**

Achieving a minimum 7-star NatHERS rating can result in additional costs to the project. Understanding the design considerations to achieve 7-stars is critical to reduce construction costs by avoiding over specifying the homes to achieve this. In order to achieve design and construction efficiencies the project adopted a higher standard specification for the base build which included 140mm stud walls to achieve R4 wall types (90mm is standard, R2) and thermally broken windows for all homes. Whilst this resulted in a high proportion of the homes exceeding the 7-star target, it also increased the construction cost of the homes.

**Key learning for future projects:**

Recommend an assessment for each individual home is undertaken to meet 7-stars rather than adopting a base specification across all homes and only upgrade underperforming homes where required. Completing a unique specification for each individual home comes at a cost and results in design documentation and construction coordination inefficiencies. These considerations need to be balanced against each other. Design documentation and construction coordination issues are likely to be alleviated in future stages as the design, construction and trade teams build further experience in delivering 7-star NatHERS rated homes.



**The Fabric – Stage 1 Home**

# Conclusion

Delivering Net Zero Energy, 7 – star NatHERS rated homes at a masterplanned community scale adds additional cost and time to the project. In order to relieve construction and design costs it is recommended future projects;

- Seek early input from energy consultants and complete initial NatHERS assessments prior to sales releases to avoid design updates post sale.
- Request testing results from new suppliers at an early stage and work with them on their capabilities to supply products that meet the requirements.
- Determine an individual specification for each home to meet the 7-star NatHERS rating rather than applying a higher base specification to each home and only upgrade the individual home where required.
- Engage with the industry and electrical authorities around fully electric projects and the need for regulatory change for authorities to consider the solar PV and battery inclusion when determining the electrical supply requirements for the project.

With settlements of all 49 homes complete, The Fabric has become a thriving community and feedback from our residents has been overwhelmingly positive. Each home has been fitted with a smart energy data monitoring system and Mirvac will work closely with our residents to collect and supply ARENA with 24 months of de-identified operational data, to be submitted as part of Milestones 3 and 4. The data collection will provide industry with some valuable insights into the performance, costs and ongoing savings associated with high energy performance housing.

Mirvac understands the social and environmental importance of the industry furthering the Net Zero Energy homes concept and whilst the ARENA trial only includes Stage 1, Mirvac has committed to delivering all future homes at The Fabric to be fully electric, Net Zero Energy, minimum 7-star NatHERS rated homes. This offering has been a key point of difference for the project and has positioned Mirvac strongly against competitor projects in the local area. The Fabric's strong sales results can be attributed to the project's successful sales and marketing strategy around the inclusions and benefits of Net Zero Energy, 7-star homes. As part of this strategy Mirvac has retained a townhouse in stage 1 as an opportunity to showcase 'The Future Ready Display Home'. Signage located within the home explains the financial, environmental and health benefits of each inclusion and is utilised as a sales tool for future stages.

Refer - <https://thefabric.mirvac.com/future-ready-living/the-future-ready-display-home> for a virtual tour of the 'Future Ready Display Home'.

**Important Notice**

This report has been prepared by Mirvac for the purpose of fulfilling its knowledge sharing agreement with Australian Renewable Energy Agency (ARENA). The report has been prepared using information collected from multiple sources throughout the Milestone 2 phase of the project. While care was taken in preparation of the information in this report, Mirvac makes no warranty as to the accuracy, validity or completeness of the information provided. Mirvac accepts no responsibility or liability for any loss or damage that may be incurred by any person acting in reliance on this information or assumptions drawn from it.