

# Introduction of Whole of Home Energy Efficiency Standards into the Australian National Construction Code



**Prepared By Robert Foster**  
**Energy Efficient Strategies**

October 2024

# What this paper is about

Subject: Australia's "Whole of Home" (WoH) minimum energy performance regulations for residential buildings

What we will look at:

- The context surrounding the new regulations
- The scope of the regulations
- The metrics used and stringency levels adopted
- The main pathways available for achieving compliance
- The basis for modelling of performance
- The important role of on-site renewables (PVs) and batteries
- Some key challenges faced and conclusions

# Context 1: Regulatory Environment

- Residential Energy Efficiency standards in Australia are formulated at a national level in: **The National Construction Code of Australia(NCC)** but enacted at State level
- The NCC is a performance-based code that sets minimum required levels for safety, health , amenity, accessibility and **sustainability**
- Effectively 9 Governments (Commonwealth + 8 states/territories) of different persuasions have to agree on a path forward - so some degree of compromise is usually a feature



# Context 2: History -The Course of EE Regulation



The long and winding road .....

# Context 3: The Case for Regulation




How regulation of WoH performance was justified:

- Market Failures
  - Unpriced externalities (primarily carbon cost)
  - Information asymmetry (impacts the consumer's capacity to make informed choice)
  - Split incentives (builder is not usually the owner, doesn't bear the operational cost)
- Policy Drivers
  - Paris Climate Agreement: 26-28% reduction on 2005 emissions by 2030, Net Zero 2050
  - National Energy **Productivity** Plan (NEEPP): 40% improvement on 2015 by 2030
- Cost Effectiveness
  - Analysis showed that the proposed regulations would deliver a B/C ratio = 1.3

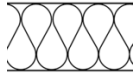
# Whole of Home - what it covers

- The performance of the building fabric (now 7 star minimum)
- New - The efficiency of fixed energy-using equipment
  - Heating and cooling equipment
  - Water heating
  - Lighting
  - Pool and spa pumps
- New - On-site renewable energy generating systems, such as rooftop solar panels – offsetting and exporting electricity
- New - Batteries (offer increased offsetting of grid supplied electricity)
- New - Accounting for time of use impacts on energy costs

# The Metric Adopted

- The old metric (heating and cooling loads) no longer suitable:- so a new “Societal Cost” (SC) metric was developed. It encompasses:
  -  energy costs to the building user
  -  costs to the environment in terms of greenhouse gas emissions
  -  time-of-use cost impact on energy networks (relates to electricity).
- All 3 components of SC are resolved into a \$ cost so they can be combined.
- The new WoH requirements allow trading between the efficiency of energy-using equipment, as well as offsetting through energy generated onsite

# Setting the Stringency



**7 Star building shell performance (e.g. Heat/Cool Load 100 MJ/m<sup>2</sup>/annum in Melbourne)**



**Heating = ducted heat pump with COP = 4.5 (GEMS 3 star)**



**Cooling = ducted heat pump with EER = 4.5 (GEMS 3 star)**



**Hot Water = Gas instantaneous (≈80% burner efficiency) (5 star)**



**Lighting = 4 W / m<sup>2</sup> power density**

**Benchmark Set**  
According to House Size and  
Climate Zone



**Example:** Assume Benchmark SC = \$1000 (given floor area and climate)

- Apartment buildings must meet the benchmark (i.e.  $\leq$  \$1000 SC)
- Detached dwellings must meet 70% of the benchmark (i.e.  $\leq$  \$700 SC)



# Main Compliance Pathways

## 1. ENERGY RATING OPTION (Simulation) (Nationwide Home Energy Rating Scheme)

**Nationwide House Energy Rating Scheme®**  
NatHERS® Certificate No. #000000000-00

Generated on [date] using [software and version]  
[other boilerplate text other boilerplate text other boilerplate text other boilerplate text other boilerplate text other boilerplate text]

**Property**  
Address: [00 Street, Suburb, State/Territory, Postcode]  
Lot/DP: [number]  
NCC class\*: [number]  
Floor/all Floors: [dwelling entrance floor] of [total no. of floors] floors  
Type: [new/renovation/existing]

**Plans**  
Main plan: [plan number, version & date]  
Prepared by: [name of preparer of plans]

**Construction and environment**  
Assessed floor area (m<sup>2</sup>): [0000.0]  
Conditioned\*: [000.0]  
Unconditioned\*: [0.0]  
Total: [0.0]  
Garage: [0.0]  
Exposure type: [exposure]  
NatHERS climate zone: [number, town/suburb]

**Accredited assessor**  
Name: [assessor name]  
Business name: [business name]  
Email: [email address]  
Phone: [00 0000 0000]  
Accreditation No.: [0000 000 0000]  
Assessor Accrediting Organisation: [name of Assessor Accrediting Organisation]  
Declaration of Interest: [declaration]

**NCC Requirements**  
BCA provisions: [Volume 1/Volume 2]  
State/Territory variation: [Yes/No]

**National Construction Code (NCC) requirements**  
The NCC allows the use of NatHERS accredited software to comply with the energy efficiency requirements for houses (Class 1 buildings) and apartments (Class 2 sole-occupancy units and Class 4 parts of buildings). The applicable requirements for houses are detailed in Specification 4.2 of NCC Volume Two. For apartments the requirements are detailed in clauses J003 and J0015 of NCC Volume One.  
NCC 2002 includes enhanced thermal performance requirements for houses and apartments. It also includes a new whole-of-home annual energy use budget which applies to the major equipment in the home.  
The NCC, and associated ABCB Standards and support material, can be accessed at [www.abcb.gov.au](http://www.abcb.gov.au).  
Note, variations and additions to the NCC energy efficiency requirements may apply in some states and territories.

**Thermal performance star rating**  
7.0  
The more stars the more energy efficient

**NATIONWIDE HOUSE ENERGY RATING SCHEME**  
107.9 MJ/m<sup>2</sup>  
Includes an air energy vector heating and cooling based on standard occupancy assumptions.

**Thermal performance (MJ/m<sup>2</sup>)**  
Limits taken from ABCB Standard 2022.1  
Heating: [0000.0]  
Cooling: [0000.0]  
Modelled: [0000.0]  
Load limits: [0000.0]

**Features determining load limits**  
Floor type: [Type]  
Lowest conditioned area: [Y/N/N/A]  
NCC climate zone 1 or 2: [Y/N/N/A]  
Outdoor living area: [Y/N/N/A]  
Outdoor living area ceiling fan: [Y/N/N/A]

**Whole of Home performance rating**  
60 out of 100

**Verification**  
To verify this certificate, scan the QR code or visit <https://natheers.gov.au>.  
QR Code: [QR Code]

\* Refer to glossary.  
Generated on [date] using [software] for [address].  
Page 1 of 10

Thermal Performance Star Rating  
7 Star Min

Whole of Home Performance Rating  
Detached = 60  
Flats = 50

## 2. ELEMENTAL DTS OPTION (simple on-line calculator)

**Whole-of-home (V2.0 release)**

Home details

Your Project Name	Test
State/Territory	VIC
NCC Climate zone	6
Total Floor area (m <sup>2</sup> )	186
NCC Building classification	1

Net equivalent energy usage

Allowance	2.9
Actual	2.9

Equipment details

Space heating/cooling

If using a heat pump specify rating type > Seasonal Star Rating (2019)

Type	Star Rating
Main space conditioning - HEATING	Ducted gas 4.5 to < 6
Main space conditioning - COOLING	Non-ducted heat pump 2.25 to < 3

Pools and spas

Pool volume (L)	45,000
Pool pump star rating	3
Spa volume (L)	0

Water heating

Main water heater type	Gas instantaneous
------------------------	-------------------

Photovoltaics

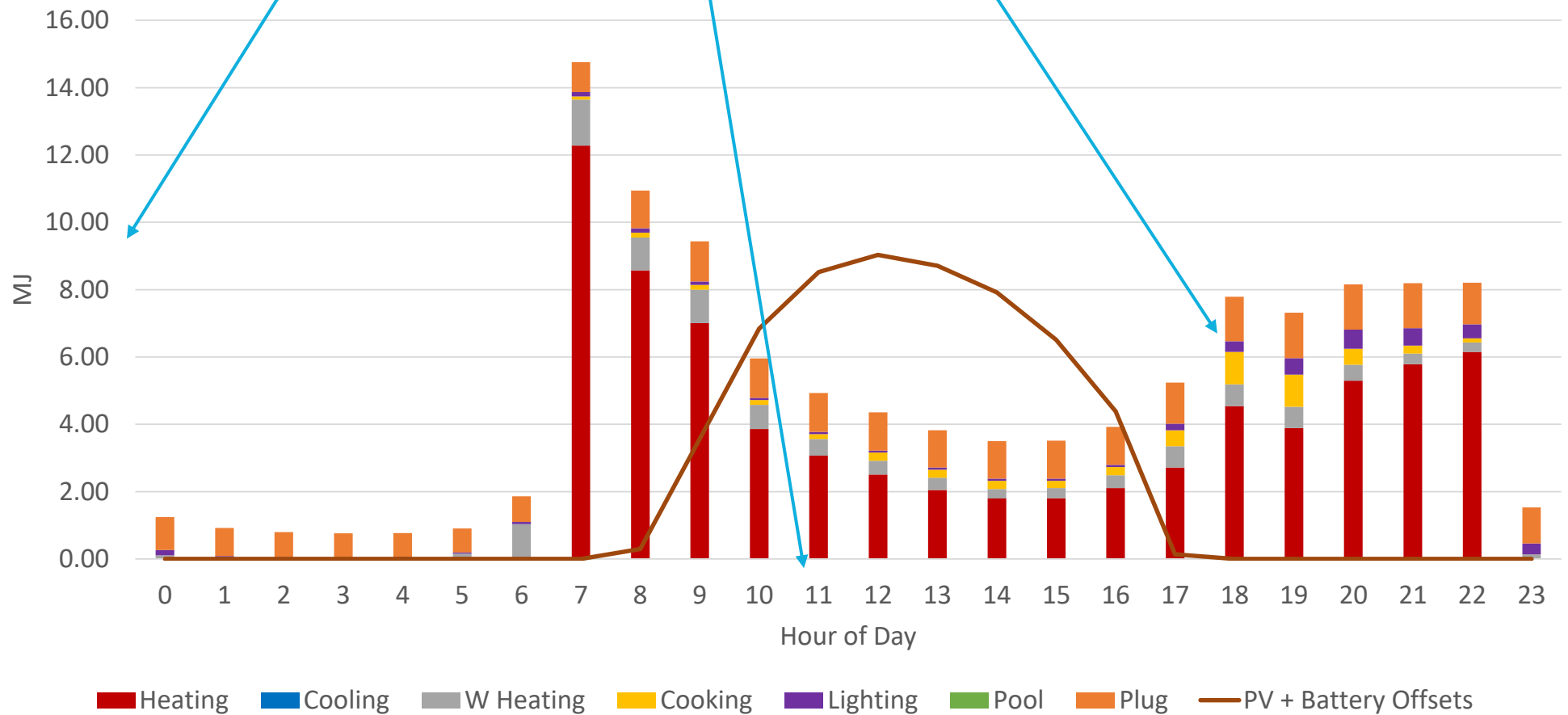
Photovoltaic capacity (kW)	3.9
----------------------------	-----

Notes:

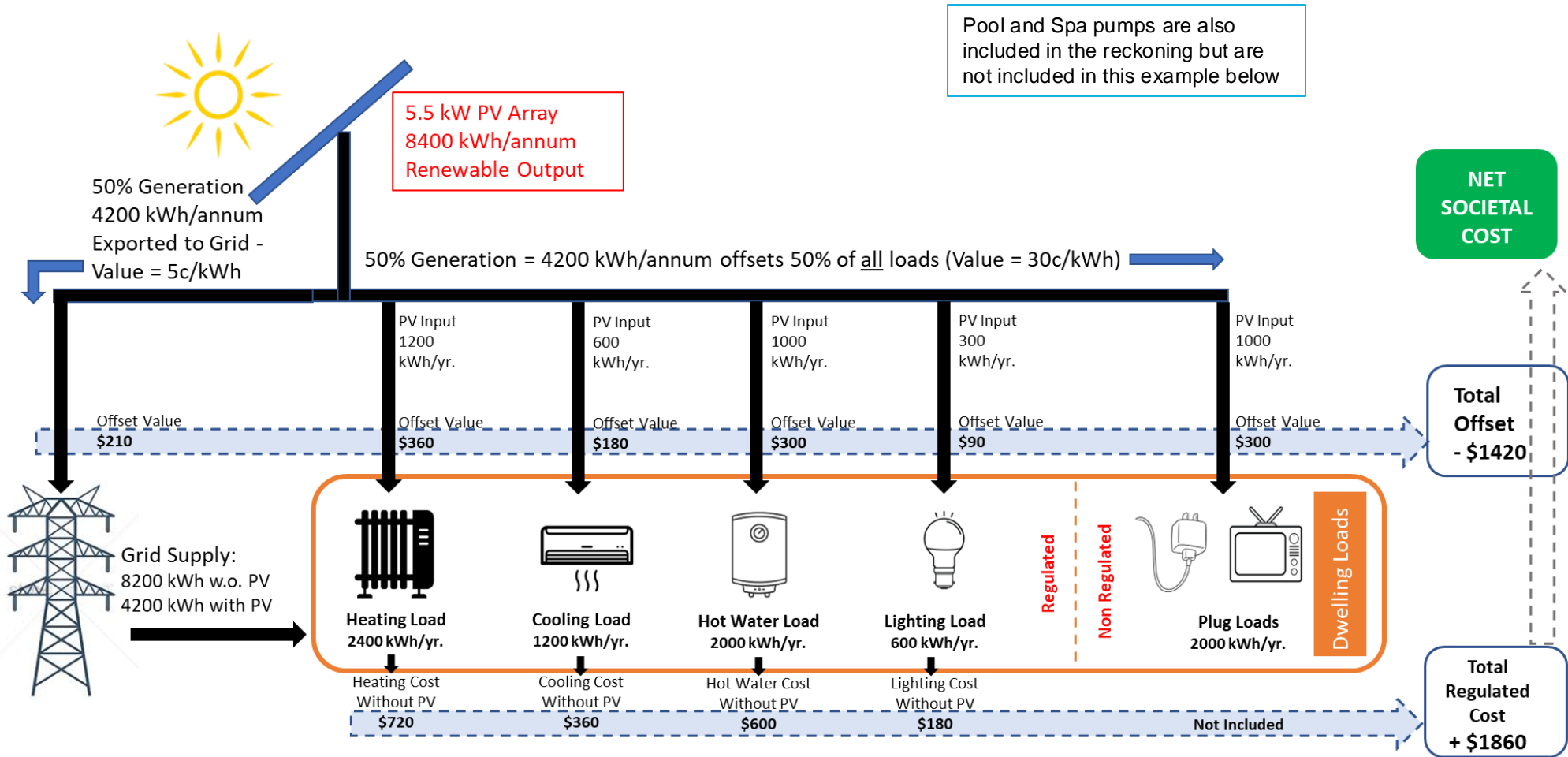
# Basis for Modelling 1: Hourly assessment

Model uses Energy (MJ), Hour of operation and fuel type to determine societal cost

June : Base Case - Energy - 5 kW PV / 0 kWh Battery



# Basis for Modelling 2: Societal Cost Accounting



# Basis for Modelling 3: PVs and Batteries

- Theoretical PV hourly output calculated taking into account:
  - Climate data in location (hourly) – direct and indirect radiation, azimuth and altitude of the sun, ambient temperature
  - Tilt and orientation of the PV array
  - Rated output of the array (kW)
  - Losses
    - Ambient temperature
    - Soiling
    - DC wiring losses
    - Conversion losses
  - Capacity limits of the inverter
  - Capacity limits of the grid connection
- Batteries modelled as simple energy storage tanks with a basic control system (not responsive to expected future load profiles or network price signals)

# Role of On-site Renewables & Batteries

## PVs (main form of renewables)

- Australia has one of the highest PV ownership levels in the world (1 in 3).
- PVs offer an easy compliance solution that is appealing to consumers
- PVs can help to offset “extras” such as pools and spas
- PVs will be increasingly important as stringency standards are increased

## Batteries

- Batteries consume energy but a \$SC based metric allows for batteries to realise credits (Excess PV generation stored then used to offset on-site demand (30 c/kWh), rather than be exported to the grid (5 c/kWh))
- Batteries will become a more important solution as:
  - Battery costs decline
  - The value of exported PV generation (the feed-in tariff) declines further
  - When the stringency of the regulations are increased in the future
- PV diverters to hot water systems can also gain credits

# Some of the Challenges

- Australia had no accredited WoH rating software to facilitate modelling
- Societal cost metric is dynamic (fuel costs, carbon value, feed in tariffs..)

## Pros

- More accurately reflects policy objectives
- As the metric settings change over time, it sends the right signals to the market
- Incentivises battery technologies

## Cons

- Relatively complex / not well understood
- Change in settings over time could prove challenging for industry

- SC Calculations are complex – not well suited to an Elemental DTS method
- Apartment buildings:
  - PVs present challenges: limited roof space, more costly to install, complicates metering arrangements, can create common property ownership issues (but not insurmountable)
  - Use of stand-alone heat pump technologies present challenges: Outdoor units of split systems may be difficult to site. (but can be designed for in a new development)

# Conclusions

- New standards have been successfully adopted by more than half the jurisdictions in Australia with most of the remaining states and territories to adopt by mid 2025 – Success!
- The stringency of the standard as currently codified is relatively modest but the required regulatory framework is now in place to pave the way to regulate for net zero (cost/emissions) dwellings in Australia
- Full evaluation of the regulations is warranted in the coming years incl. :
  - Actual compliance costs versus modelled
  - Actual savings in energy costs and emissions compared to modelled
  - Levels of non-compliance
  - Preferred compliance pathways / uptake of PVs in new housing
  - Review of the societal cost metric settings
  - Consideration of the use of a national societal cost value rather than individual jurisdictions
  - Comparison of outcomes between elemental method and simulation method

**THE END**