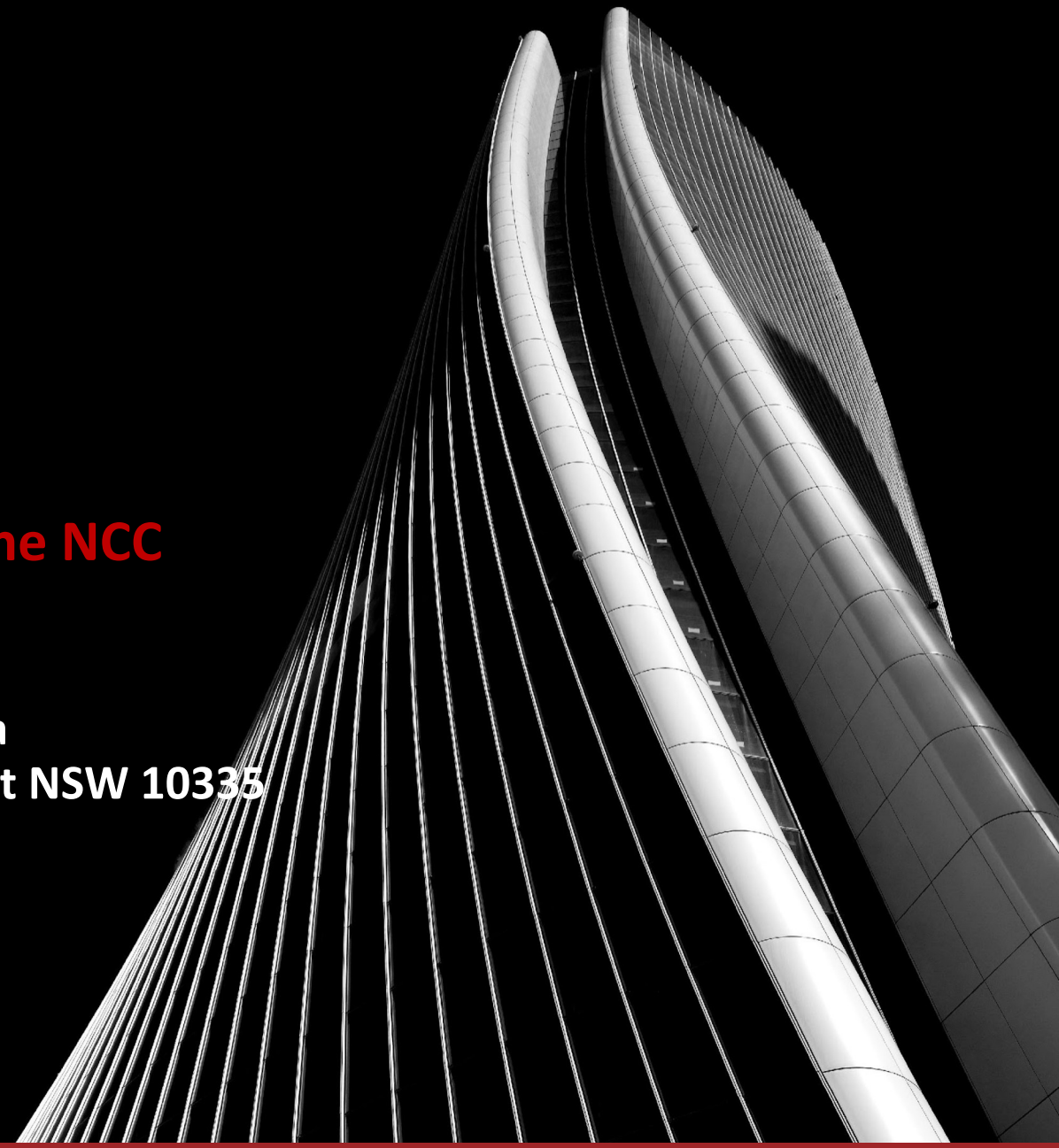
Understanding Energy Efficiency in the NCC

Architects Accreditation Council of Australia
Presenter: Jenna Rowe, Registered Architect NSW 10335



About the Presenter

Jenna Rowe

FRAIA, Registered architect NSW 10335

Jenna is an architect working in Sydney, graduating from her Master of Architecture from the University of Tasmania with First Class Honours in 2011. Jenna has spent the last ten years working in both the public and the private sectors, the latter for prominent Australian architectural practices – prior to working for herself as a sole practitioner in 2019. Jenna also tutors Professional Practice, Construction, and is a studio leader in both undergraduate and postgraduate subjects at the University of Technology Sydney and the University of New South Wales.

In 2014 Jenna was awarded a position on the coveted Dulux Study Tour and has given a lot of her time to the Institute. She sat as an elected Chapter Councillor in NSW for two terms, and previously sat on the NSW education committee, and was a Co-Chair of both EmAGN NSW and EmAGN TAS. Jenna has been a PALS presenter and tutor since 2017, and was most recently elevated to Fellow of the Australian Institute of Architects in 2021.

Who are the AACA?

AACA is the national voice for architect registration boards around Australia. AACA owns the National Standard of Competency for Architects.

The National Standard underpins all assessment processes including the accreditation of architecture programs leading to registration as an architect in Australia.

The Role of the ABCB

We'd like to thank and acknowledge the Australian Building Codes Board, responsible for writing the National Construction Code.

2021 NSCA Performance Criteria Relevant to the NCC

PC 12: Provide independent, culturally responsive and objective advice in accordance with relevant building codes, standards, technical specifications and guidelines, and planning regulations, including climate change implications, across all aspects of architectural practice.

PC 20: Be able to assess project budget and timeframe against project requirements and objectives, relevant legislation, statutory planning requirements, building codes and standards.

PC 45: Be able to nominate and integrate quality and performance standards with regard to selected materials, finishes, fittings, components and systems, considering the impact on Country and the environment, and the whole life carbon impact of the project. This includes integrating life cycle

PC 46: Be able to produce project documentation that meets the requirements of the contract and procurement process and complies with regulatory controls, building standards and codes, and conditions of construction and planning approvals.

PC 58: Complete documentation – including specifications, drawings, schedules, reports, certification and approvals – and other project information for issue to the client and relevant authorities, as required under the construction contract and relevant building and planning codes.

2021 NSCA Performance Criteria Relevant to Sustainability

PC 3: Demonstrate understanding of the principles of project planning, considering implications for Country, environmental sustainability, communities, stakeholders and project costs.

PC 10: Demonstrate understanding of the whole life carbon implications of procurement methods, materials, components and construction systems

PC 28: Be able to draw on knowledge from building sciences and technology, environmental sciences and behavioural and social sciences as part of preliminary design research and when developing the conceptual design to optimise the performance of the project.

PC 31: : Be able to identify, analyse and integrate information relevant to environmental sustainability – such as energy and water consumption, resources depletion, waste, embodied carbon and carbon emissions – over the lifecycle of a project

PC 33: Be able to investigate, coordinate and integrate sustainable environmental systems – including water, thermal, lighting and acoustics – in response to consultants' advice.

2021 NSCA Performance Criteria Relevant to Sustainability (Continued)

PC 35: Be able to assess operational and embodied carbon implications of materials, components, construction systems and supply chains (including transport) to achieve net zero whole life carbon when developing design concepts. This includes integrating relevant consultant expertise and advising on the impact of chosen materials, components and systems on carbon outcomes.

PC 45: Be able to nominate and integrate quality and performance standards with regard to selected materials, finishes, fittings, components and systems, considering the impact on Country and the environment, and the whole life carbon impact of the project. This includes integrating life cycle assessments and other expertise and advice from consultants.

PC 53: Be able to provide advice to clients on the impact of a selected procurement method on cost, time, life cycle implications and quality control during the construction phase.

What to expect from this presentation

1. Understanding Energy Efficiency in the NCC
2. Using the Energy Efficiency provisions of NCC Volume One
3. Using the Energy Efficiency Provisions of NCC Volume Two

1. Understanding Energy Efficiency in the NCC

1.0 - What you will learn

- What energy efficiency means
- Why energy efficiency is important
- Key energy efficiency concepts & terminology
- How to achieve energy efficiency
- Energy efficiency requirements in the NCC
- Other resources

1.1 – What do we mean when we talk about building energy efficiency

Building energy efficiency in the NCC

- Reducing the energy required to operate a building according to its purpose
- Two key aspects:
  - Minimising the use of mechanical heating and cooling to maintain a comfortable temperature within a building
  - Efficient use of power to operate a building's services
- Performance Requirements for both 'commercial' (Class 2-9) buildings and 'domestic' buildings (Class 1 and Class 10)
- Specific performance required depends on factors such as the location of the building

1.1 – What do we mean when we talk about building energy efficiency

"Energy efficiency is the use of less energy to perform the same task or produce the same result"

— Office of Energy Efficiency & Renewable Energy, (2023*) Energy Efficiency* https://www.energy.gov/eere/energy-efficiency

"…the ratio between the energy used compared to the energy service actually provided, and is usually expressed as a percentage. In other words, energy efficiency is how efficiently the energy is used to provide the end-use service"

— Transformed Pty Ltd, Study materials for the Certificate IV in NatHERS Assessment

"…using energy wisely and economically to sustain everyday life, live comfortably and support wellbeing"

— Russell-Bennett, R., McAndrew, R., Gordon, R., Mulcahy, R. and Letheren, K. (2019). Effectiveness of Household Energy Efficiency Interventions in Advanced Economies – what works and what doesn't. Final Report. Brisbane: Queensland University of Technology.

"…[reducing] the need for energy consumption (electricity, natural gas, etc.) for heating, cooling and lighting"

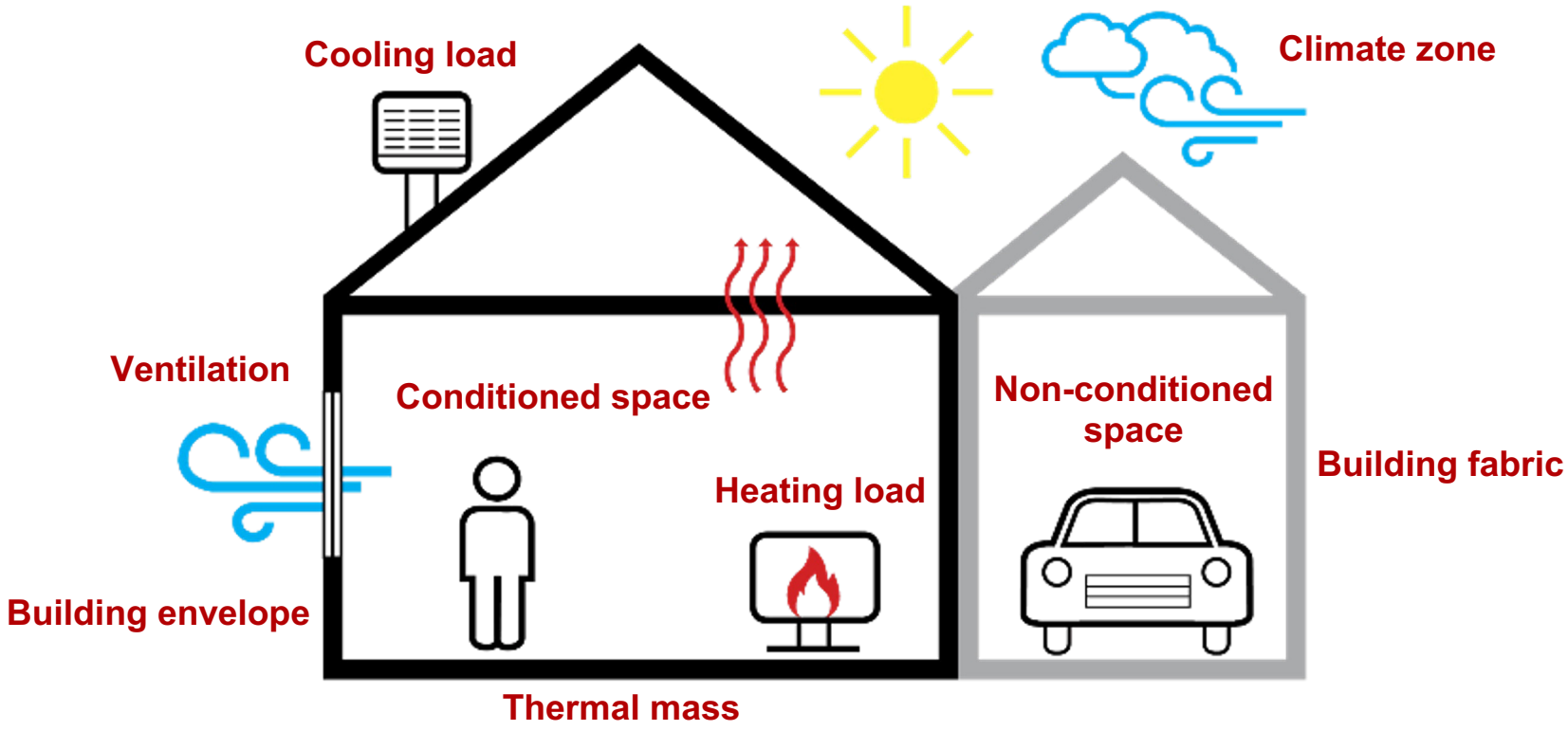
— City of Fremantle (2021) *Energy Efficient Building Design*, https://www.fremantle.wa.gov.au/sites/default/files/DBH12%20-%20Energy%20Efficient%20Building%20Design%20-%20D.B.H12.pdf

1.2 – Why is energy efficiency important?

- Human induced climate change arising from greenhouse gas (GHG) emissions is a concern.
- Australia's building and construction sector is having an increasing impact on society and on our environment
- Energy used in buildings accounts for around 20% of all energy related greenhouse gas emissions.

https://www.environment.nsw.gov.au/resources/energyefficiencyindustry/130588-energy-efficiency-action-plan.pdf) Accessed 9 January 2021.

1.3 – Key Energy Efficiency Concepts 01



1.3 – Key Energy Efficiency Concepts 01
1.3.1 Climate Zones

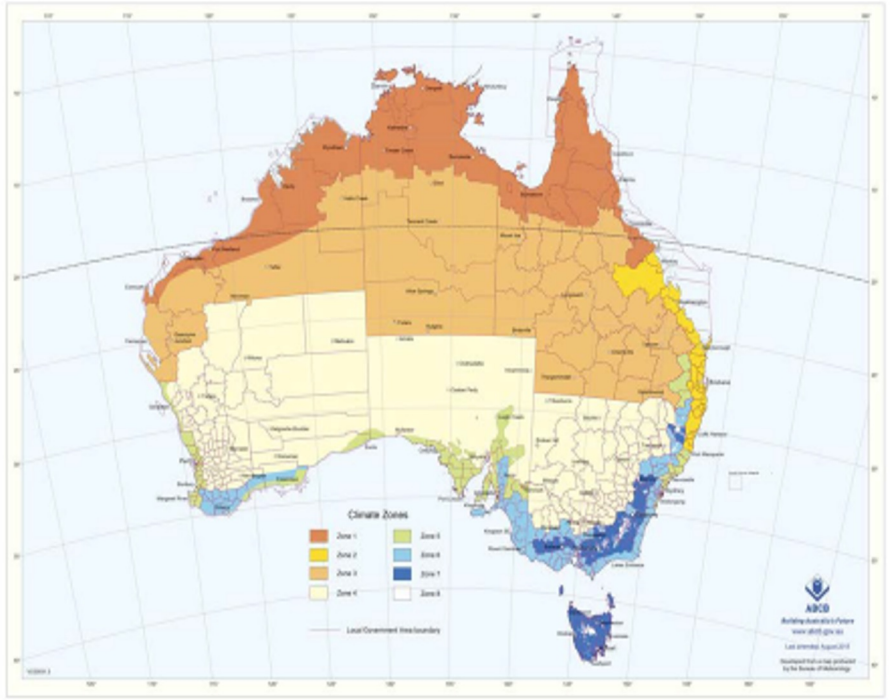
The NCC recognises 8 different **climate zones** across Australia.

They reflect areas with similar climates, such that similar building design features can be used to improve the energy efficiency of buildings in each zone.

The specific requirements of the NCC energy efficiency Performance Requirements vary by climate zone.

Climate zones are described in Schedule 1 Definitions in any Volume of the NCC.

Figure 2 Climate zones for thermal design

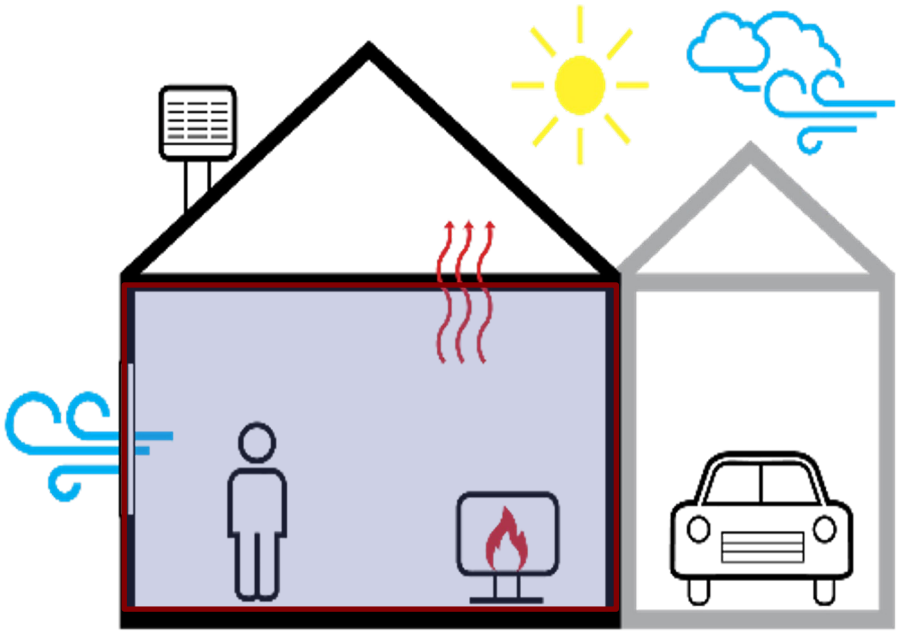


1.3 – Key Energy Efficiency Concepts 01
1.3.2 Conditioned vs Non-conditioned space

A **conditioned space** is essentially a space within a building which is heated or cooled by the building's services, for example, a heating system, a cooling system or some other form of air-conditioning.

Therefore, a **non-conditioned space** is basically any space within a building that is **not** expected to be heated or cooled by the building's services.

Note that the definition of conditioned space is slightly different between Volume One and Volume Two.

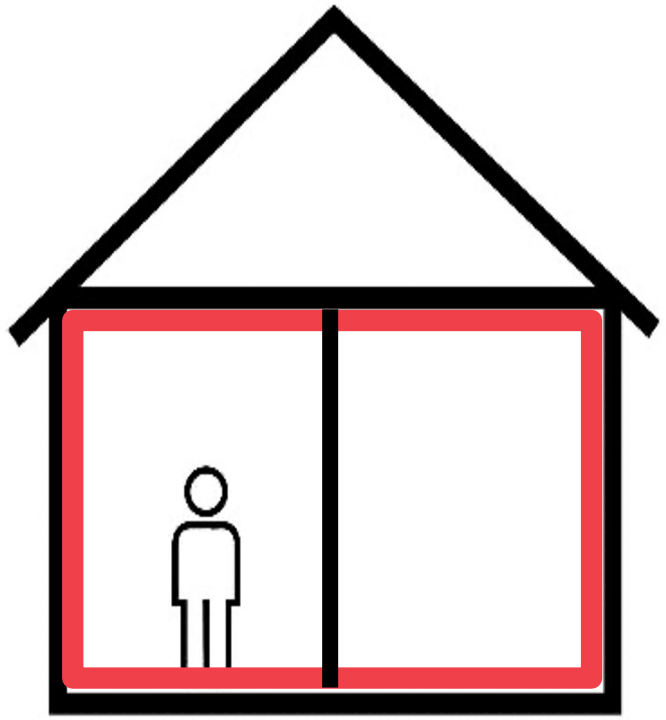


1.3 – Key Energy Efficiency Concepts 01
1.3.3 Building fabric/envelope:

A **building's fabric** is all the structural elements and other components used to make the building, which includes the roof, ceiling, walls, glazing and floors.

The **building's envelope** consists of the parts of a building's fabric that separate conditioned spaces from non-conditioned spaces, including other spaces inside the building and the environment outside the building.

Note that the definition of the building envelope is slightly different between NCC Volume One and NCC Volume Two.



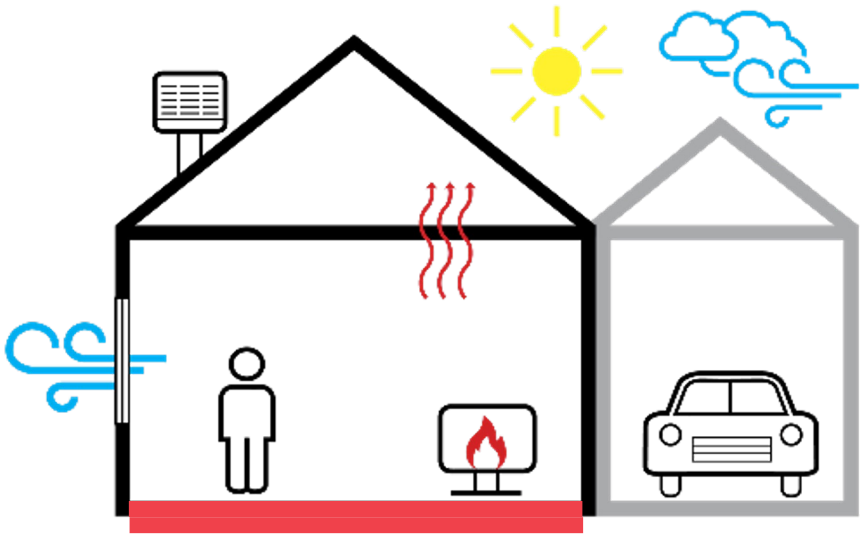
1.3 – Key Energy Efficiency Concepts 01
1.3.4 Thermal Mass

Thermal mass is a term used to describe how well a building material stores heat.

Materials with high thermal mass absorb heat from the environment and then release that heat slowly when the surrounding ambient temperature goes down.

Thermal mass exposed to winter sun warms during the day, and will warm the space it is in as it cools. Cool the thermal mass down overnight in summer and it will cool the space as it heats during the day.

Effective use of thermal mass, combined with good solar orientation, can greatly reduce the need for mechanical heating and cooling.



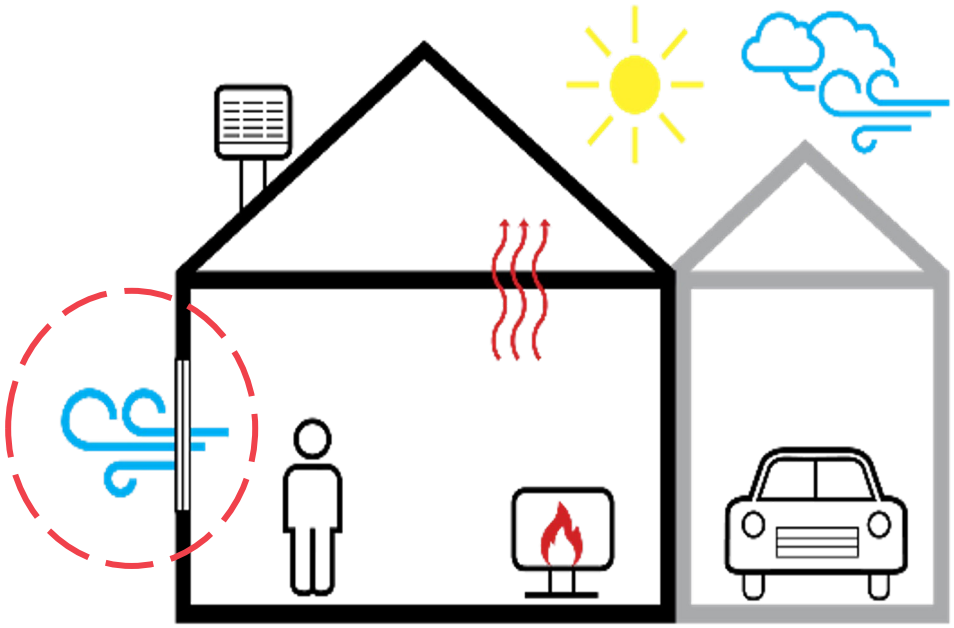
1.3 – Key Energy Efficiency Concepts 01
1.3.5 Ventilation

Ventilation refers to the natural movement of air into or out of a building through an opening designed for that purpose.

This could be a:

- permanent opening, such as a vent
- part of a window that can open, in the wall or roof, or
- door or other device that can be held open.

Good ventilation can help to cool a building naturally without the use of artificial means/energy.



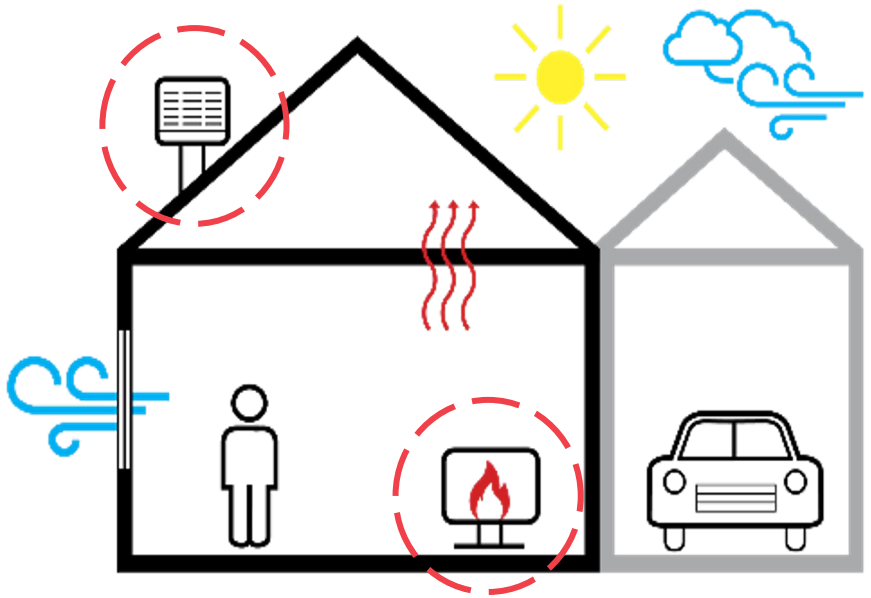
1.3 – Key Energy Efficiency Concepts 01
1.3.6 Heating/Cooling Loads

A building's **heating load** is "the calculated amount of energy delivered to the heated spaces of the building annually by artificial means to maintain the desired temperature in those spaces."

A building's **cooling load** is "the calculated amount of energy removed from the cooled spaces of the building annually by artificial means to maintain the desired temperature in those spaces."

In other words, heating and cooling loads are calculations of the amount of energy used to maintain the temperature in the conditioned spaces of a building.

A building's calculated heating and cooling loads are used to determine its energy efficiency rating.

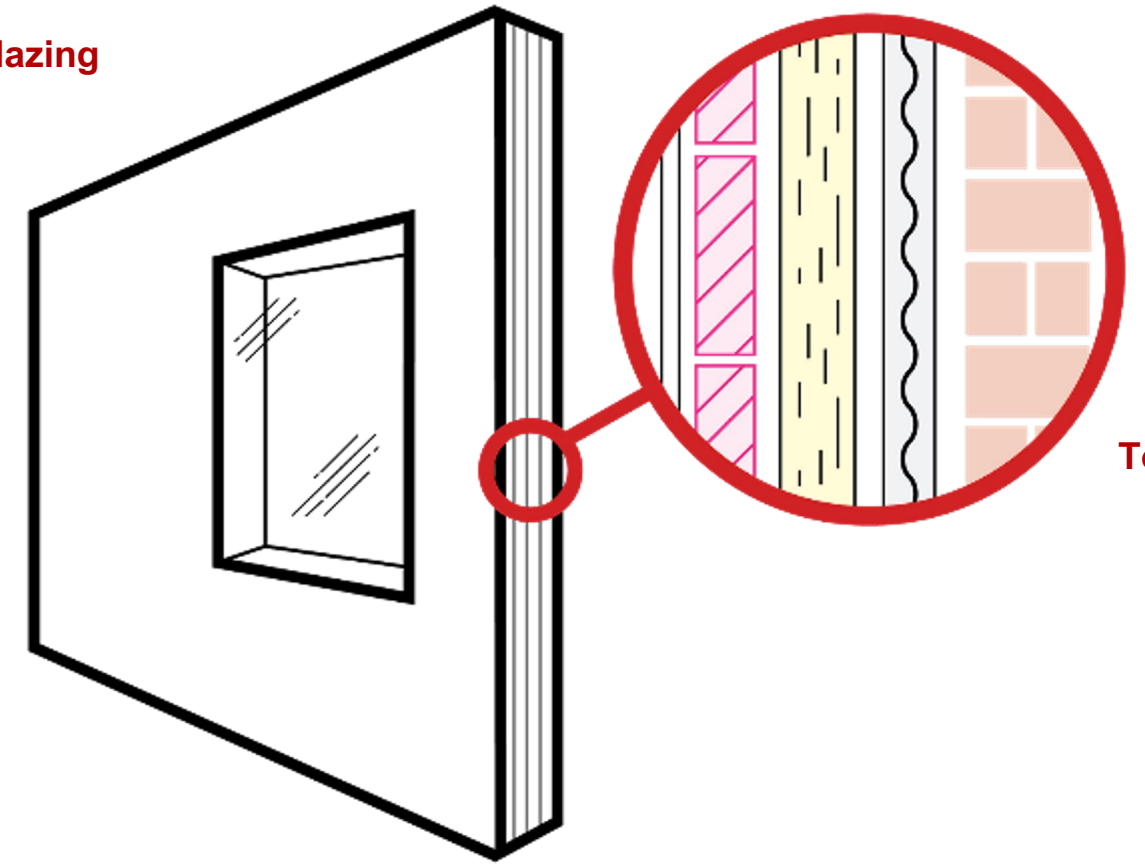


1.4 – Key Energy Efficiency Concepts 02

Glazing

SHGC

Total System U-Value



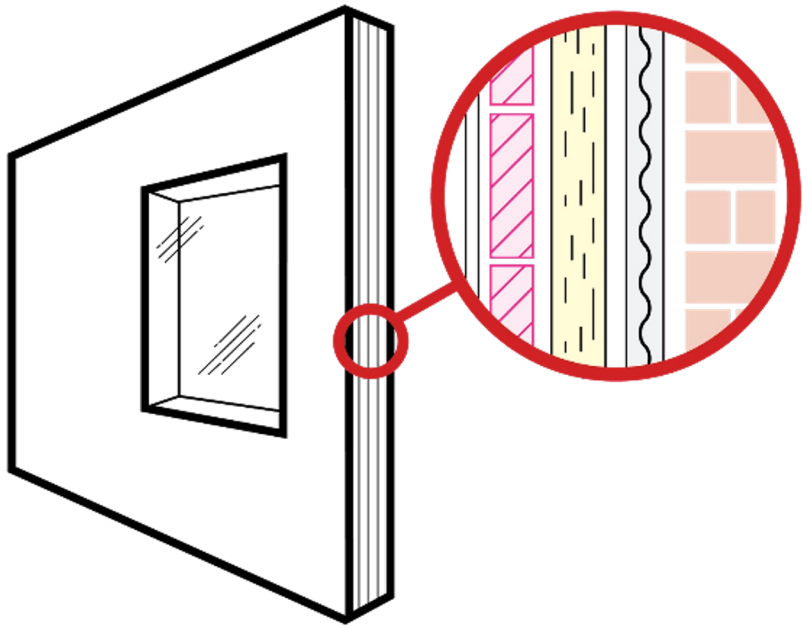
Total R-Value

1.4 – Key Energy Efficiency Concepts 02
1.4.1 Glazing

- In the NCC, the term **glazing** is used to refer to glass and the frame associated with it, in the building envelope
- It can apply to windows and doors in walls, and some roof windows
- There are many different types of glazing available, with different properties that can influence the energy efficiency of a building
- Appropriate glazing can contribute to managing the temperature of a building, and can greatly reduce the heating and cooling load

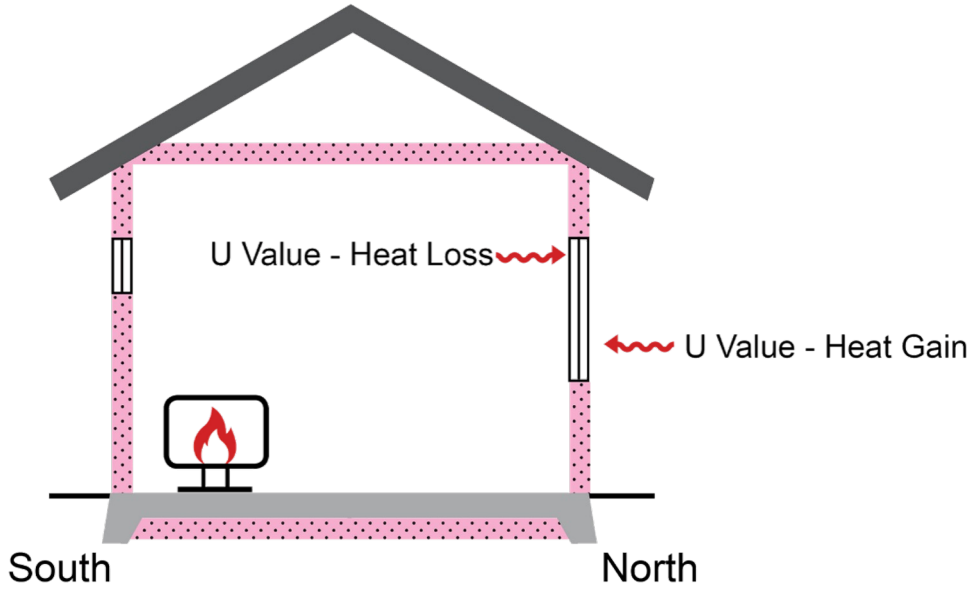
1.4 – Key Energy Efficiency Concepts 02
1.4.2 Total R-Value

- **R-Value** is a measure of how well a material or building element insulates
- It measures the material's *thermal resistance*
- The higher the R-Value, the better the material is at insulating and the less easily it transmits heat
- **Total R-Value** of a building component or assembly is a calculation of the sum of the R-Values of the individual component layers in an composite material or assembly
- Total R-Value includes any building material, insulating material, air spaces and associated surface resistances



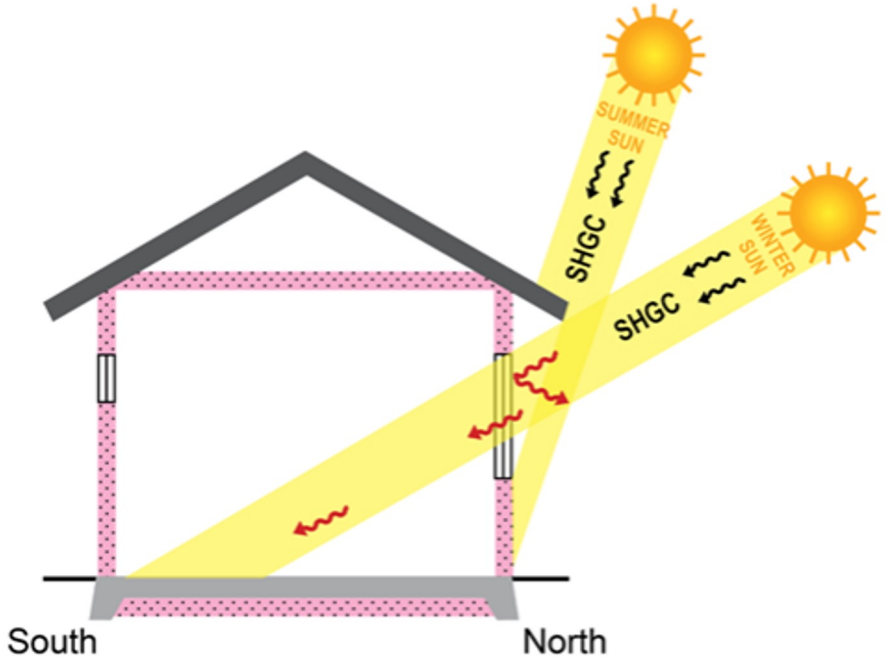
1.4 – Key Energy Efficiency Concepts 02
1.4.3 Total System U-Value

- **U-Value** is a measure of how easily a material or building element transmits heat
- It measures the material's *thermal conductance*
- The higher the U-Value, the more easily the material transmits heat. The lower the U-Value, the better the material insulates
- **Total System U-Value** of a building component or assembly is a calculation of the sum of the U-Values of the individual layers in that component or assembly
- Total System U-Value includes glazing, frame, air spaces and surface resistances



1.4 – Key Energy Efficiency Concepts 02
1.4.4 Solar Heat Gain Coefficient - SHGC

- **SHGC** is a measure of the proportion of solar energy (or solar radiation) that passes through a glazing system (the glass and the frame)
- It measures the *solar admittance* of the glazing
- A high SHGC means that the glazing system allows more solar energy/heat into a room
- A low SHGC means that the glazing system allows less solar energy/heat into a room
- Selecting glazing with appropriate SHGC measures can help to manage the temperature of a building and reduce heating and cooling loads



1.5 – How do we achieve energy efficiency?

- Passive solar design, e.g.:
  - optimal orientation
  - appropriate use of:
    - thermal mass
    - ventilation and shading
    - glazing, insulation and other materials in the building fabric
- Adequate building sealing to minimise air leakage
- Efficiency of building systems and appliances

- Requires consideration during building:
  - design
  - approval, and
  - construction
- Shouldn't be an afterthought - integral to design of building to ensure efficient operation
- Harder and more expensive to retro-fit after construction

1.6 – Energy efficiency in the NCC

Volume One

- Thermal performance of the building fabric
- Building sealing
- Energy efficiency of building services, e.g. air-conditioning, lighting, hot water, swimming pool/spa plant
- Facilities for energy monitoring

Volume Two

- Thermal performance of the building fabric
- Building sealing
- External glazing
- Air movement
- Energy efficiency of domestic services, e.g. air-conditioning, lighting, hot water

Volume Three

- Requirements to reduce the greenhouse gas emissions associated with heating water in buildings
- Energy efficiency of water heating appliances, and the source of energy to heat water

1.7 – Other Resources

- Optional, non-mandatory ABCB energy efficiency calculators
  (https://www.abcb.gov.au/resources/filter/calculators-and-maps)
- **Volume One calculators:**
  - Façade
  - Fan systems
  - Glazing (SOUs)
  - Lighting
  - Pump systems
- **Volume Two calculators:**
  - Glazing
  - Lighting
  - Whole-of-home

- Many other useful resources available from the ABCB energy efficiency resource library:
  (https://www.abcb.gov.au/Resources/All-Resources?topics=%7bD9C50C31-2F9C-4634-B8BA-D44955EC2DC0%7d)
  - Interactive climate zone map
  - Videos,
    e.g. how to use some calculators
  - Case studies
  - Handbooks

1.8 – Key Points

Energy efficiency provisions in the NCC aim to reduce the energy required to operate a building, and therefore the GHG produced by buildings in Australia

Focus on the building envelope to minimise the use of mechanical heating and cooling to maintain a comfortable temperature within a building

Encourages:

- Efficient use of energy to operate a building's services, including heated water services
- Use of low GHG energy sources

Different requirements for buildings in different climate zones and of different building classifications

2. Using Energy Efficiency provisions in Volume One

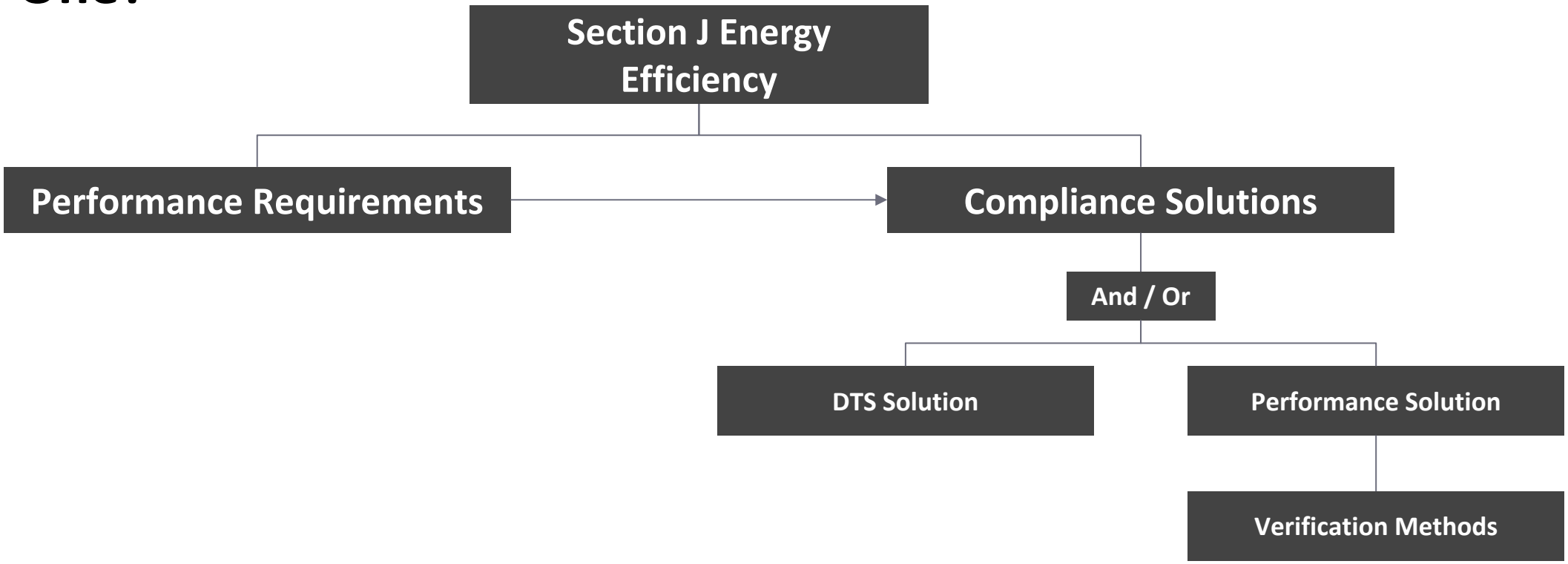
2.0 What you will learn

- Energy efficiency Performance Requirements in Volume One
- Compliance solutions for energy efficiency in Volume One
- Energy efficiency ratings for SOUs
- Energy efficiency DTS Provisions in Volume One
- Assessment Methods for energy efficiency
- Other useful resources

2.1 Where is energy efficiency covered in NCC Volume One?

Section J Energy Efficiency

2.1 Where is energy efficiency covered in NCC Volume One?



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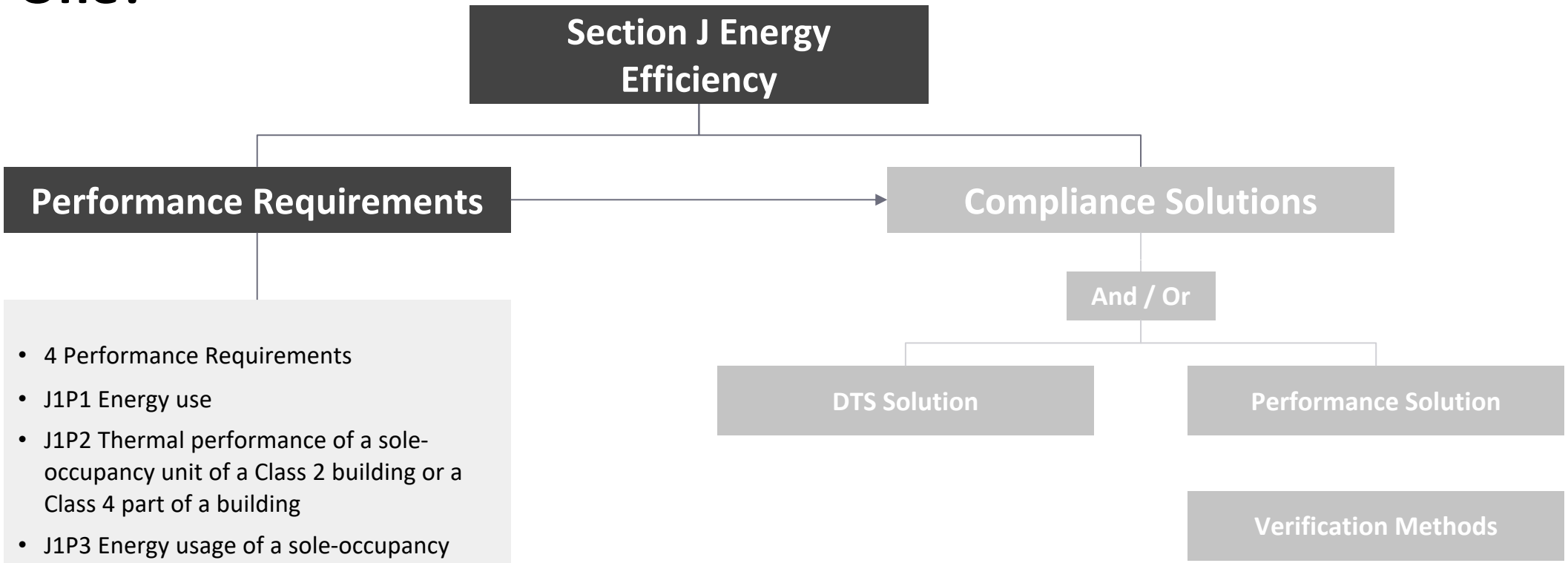

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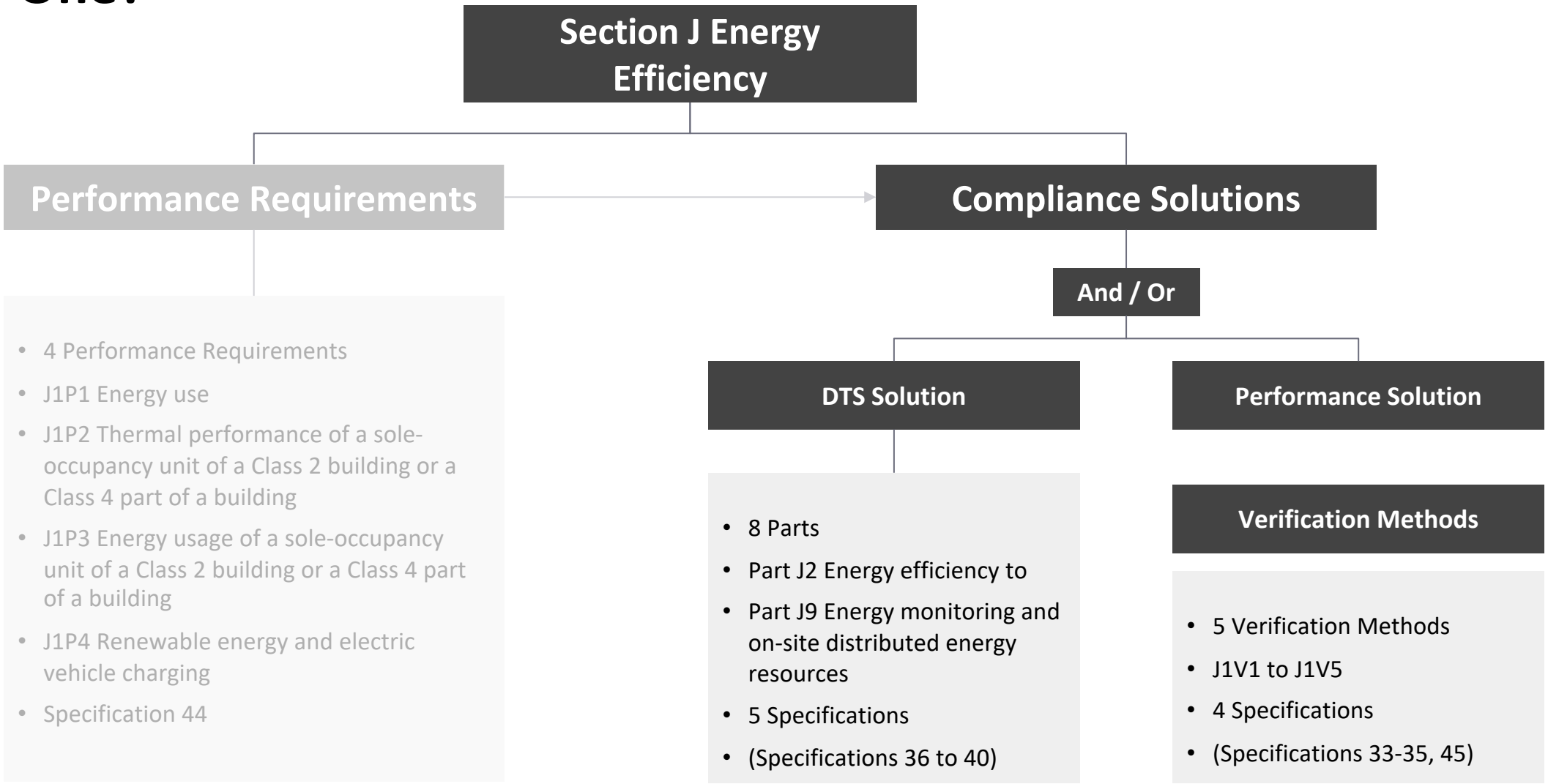


2.1 What are the energy efficiency Performance Requirements in NCC Volume One?

The overall objectives of the Performance Requirements in Section J are to:

- reduce energy consumption and peak energy demand
- reduce greenhouse gas emissions
- improve occupant health and amenity.

2.1.2 - J1P1 Energy Use

- **J1P1**
- J1P2
- J1P3
- J1P4

Requires a building, other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building, including its services, to have features that facilitate the efficient use of energy.

These features would be appropriate to:

- the function and use of the building
- the level of human comfort required for use of the building
- use of solar radiation for heating and minimising use of energy for cooling
- energy source of services
- sealing of the building envelope against air leakage
- achieving the required regulated level of energy consumption for a conditioned space, specific to the building classification concerned.

2.1.3 - J1P2 Thermal Performance of a sole-occupancy unit of a Class 2 building or a Class 4 part of a building

- J1P1
- **J1P2**
- J1P3
- J1P4

- Sets total thermal energy load, heating and cooling load limits for habitable rooms and conditioned spaces
- Applies to a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Refers to Specification 44 – the method of calculating the heating load limit, cooling load limit and thermal energy load limit for this Performance Requirement.

2.1.4 - J1P3 Energy usage of a sole-occupancy unit of a Class 2 building or a Class 4 part of a building

- J1P1
- J1P2
- **J1P3**
- J1P4

- Sets out requirements for energy values of domestic services supplying a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Aim is to enable efficient use of energy and reduce energy usage
- Domestic services include heating, ventilation and cooling appliances, and gas water heaters
- Also sets out maximum lighting power densities for all internal spaces provided with artificial lighting

2.1.5 - J1P4 Renewable energy and electric vehicle charging

- J1P1
- J1P2
- J1P3
- **J1P4**

Requires buildings to have features that enable the future installation of:

- onsite-renewable energy generation and storage
- electric vehicle charging equipment.

2.2 The building envelope in Section J

Envelope

For the purposes of—

(a) Section J in NCC Volume One, the parts of a building's fabric that separate a conditioned space or habitable room from—

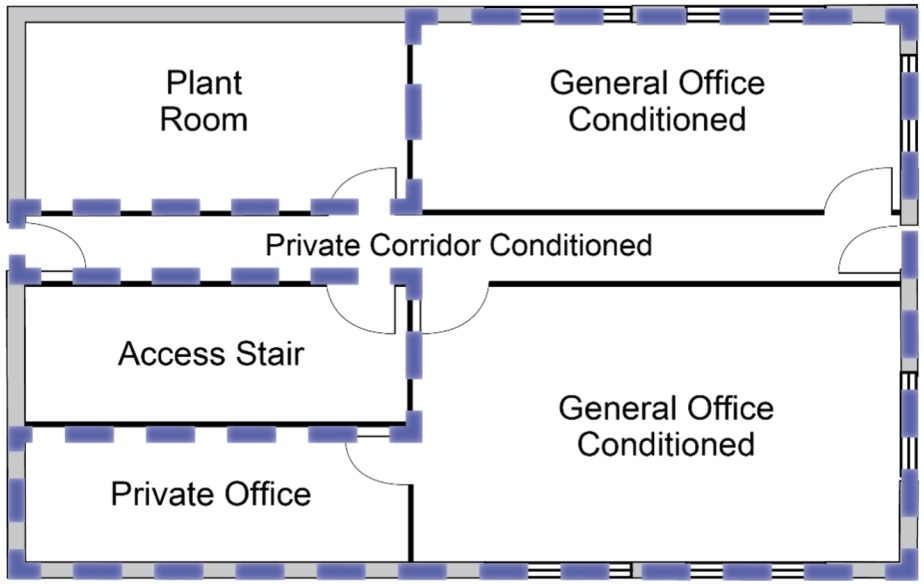
(i) the exterior of the building; or

(ii) a non-conditioned space including—

(A) the floor of a rooftop plant room, lift-machine room or the like; and

(B) the floor above a carpark or warehouse; and

(C) the common wall with a carpark, warehouse or the like; or



2.3.1 How can we comply with the energy efficiency Performance Requirements of NCC Volume One?

J1P1 Energy use applies to all Class 2 to Class 9 buildings.

J2D2 Application of Section J

(1) For a Class 2 to 9 building, other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building, *Performance Requirement* J1P1 is satisfied by complying with—

(a) Part J4, for the building *fabric*; and

(b) Part J5, for building sealing; and

(c) Part J6, for *air-conditioning* and ventilation; and

(d) Part J7, for artificial lighting and power; and

(e) Part J8, for heated water supply and *swimming pool* and spa pool plant; and

(f) J9D3, for facilities for energy monitoring.

J1P1 does not apply to a sole-occupancy unit of a Class 2 building or a Class 4 part of building.

2.3.2 How can we comply with the energy efficiency Performance Requirements of NCC Volume One?

J2D2 Application of Section J

(2) For a *sole-occupancy unit* of a Class 2 building or a Class 4 part of a building, *Performance Requirement* J1P2 is satisfied by complying with—

(a) J3D3, using *house energy rating software*; or

(b) the following—

(i) J3D4, for ceiling fans; and

(ii) J3D5, J3D6, J4D3, J4D7(3), J4D7(4) and Part J5, for general thermal construction; and

(iii) J3D7, for roofs; and

(iv) J3D8 and J3D11 to J3D13, or J3D9, for walls and *glazing*; and

(v) J3D10, for floors.

J1P2 only applies to a sole occupancy unit of a Class 2 building or a Class 4 part of building.

2.3.3 How can we comply with the energy efficiency Performance Requirements of NCC Volume One?

J1P3 only applies to a sole-occupancy unit of a Class 2 building or a Class 4 part of building.

J2D2 Application of Section J

(3) For a *sole-occupancy unit* of a Class 2 building or a Class 4 part of a building, *Performance Requirement* J1P3 is satisfied by complying with—

(a) for the net equivalent energy usage—

(i) J3D14, for a *sole-occupancy unit* of a Class 2 building or a Class 4 part of a building with a total floor area not greater than 500 m^2; or

(ii) J3D15, using *house energy rating software*; and

(b) Part J6, for *air-conditioning* and ventilation; and

(c) Part J7, for artificial lighting and power.

(4) For a Class 2 to 9 building, *Performance Requirement* J1P4 is satisfied by complying with J9D4 and J9D5.

J1P4 applies all Class 2 to 9 buildings.

2.3.4 How can we comply with the energy efficiency Performance Requirements of NCC Volume One?

All options for compliance must be:

- Supported with suitable evidence and/or documentation to demonstrate that compliance has been achieved, and
- Assessed and approved by the Approval Authority.

2.4 DTS Provisions in Section J of NCC Volume One

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

2.4.2 Part J2 Energy Efficiency

- **Part J2 Energy efficiency**
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- Explains the overall application of the DTS Provisions in Section J for all building classifications and types of buildings (J2D1 and J2D2)

2.4.3 Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building

- Part J2 Energy efficiency
- **Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building**
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- This Part sets out DTS Provisions for the insulation of building fabric and the energy efficiency of domestic services of a sole-occupancy unit of a Class 2 building or a Class 4 part of a building.
- It covers the different DTS pathways including the NatHERS energy rating option.

2.4.4 Part J4 Building fabric

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- **Part J4 Building fabric**
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- Building fabric provisions, primarily based on insulation and glazing requirements
- Covers thermal construction, including:
  - roof and ceilings
  - glazing, including roof lights
  - walls and floors
- Applies principles aimed at reducing:
  - heat gain and loss
  - the need to condition spaces within buildings.

2.4.5 Part J5 Building sealing

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- **Part J5 Building sealing**
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- Building sealing to minimise unwanted air leakage
- Covers:
  - roof lights, windows and doors
  - construction of ceilings, walls and floors
  - chimneys and flues
  - exhaust fans and evaporative coolers
- Provisions are designed to work as a system to ensure the building achieves the desired level of energy efficiency

2.4.6 Part J6 Air-conditioning and ventilation

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- **Part J6 Air-conditioning and ventilation**
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- Air-conditioning and ventilation systems and their associated components, covering:
  - air-conditioning and mechanical ventilation system control
  - fan systems, pump systems, space heating, refrigerant chillers, unitary air-conditioning equipment, heat rejection equipment
  - pipework insulation and ductwork insulation and sealing
- Applies to all Class 2 to 9 buildings, including SOUs in Class 2 buildings and Class 4 parts of a building **except** a Class 8 electricity network substation
- Part F6 also contains ventilation system provisions

2.4.7 Part J7 Artificial lighting and power

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- **Part J7 Artificial lighting and power**
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- Artificial lighting and power, including:
  - limiting energy used for artificial lighting while maintaining adequate lighting levels
  - power supply to certain equipment, including lifts and escalators
- Includes adjustment factors for different controls that increases the amount of lighting a space can have above the usual baseline (Table J7D3b)
- Applies to all Class 2 to 9 buildings, including SOUs in Class 2 buildings and Class 4 parts of a building
- Some clauses do not apply to a Class 8 electricity substation

2.4.8 Part J8 Heated water supply and swimming pool and spa pool plant

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- **Part J8 Heated water supply and swimming pool and spa pool plant**
- Part J9 Energy monitoring and on-site distributed energy resources
- Specifications

- Covers:
  - using low greenhouse intensity energy sources
  - reducing the energy used for pumping and heating
- For:
  - heated water supply
  - swimming pool and spa pool plant
- Applies to all Class 2 to 9 buildings, including SOUs in Class 2 buildings and Class 4 parts of a building
- See Part B2 of Volume Three for provisions for heated water supply for food preparation and sanitary purposes

2.4.9 Part J9 Energy monitoring and on-site distributed energy resources

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- **Part J9 Energy monitoring and on-site distributed energy resources**
- Specifications

- Sets out requirements for the monitoring of energy use (other than for billing purposes) and facilitate easy retrofit of renewable energy and electric vehicle charging equipment
- Buildings must have energy meters that enable individual time-of-use energy data recording
- Applies to all Class 2 to 9 buildings, except:
  - to a sole-occupancy unit of a Class 2 or Class 4 part of a building
  - a Class 8 electricity network substation

2.4.10 Specifications

- Part J2 Energy efficiency
- Part J3 Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building
- Part J4 Building fabric
- Part J5 Building sealing
- Part J6 Air-conditioning and ventilation
- Part J7 Artificial lighting and power
- Part J8 Heated water supply and swimming pool and spa pool plant
- Part J9 Energy monitoring and on-site distributed energy resources
- **Specifications**

- 10 Specifications provided to assist with complying with Section J, 6 relate to the DTS Provisions
- Specifications address:
  - material properties
  - calculation of U-Value and solar admittance
  - thermal performance of spandrel panels, soils and sub-floors
  - lighting and power devices
  - calculation of heating and cooling load limits and thermal energy load limits
  - parameters and extra requirements for Verification Methods.

2.5 Energy efficiency ratings for SOUs/apartments

- NatHERS rating based on annual energy load
- Numerical star rating from 0 to 10
- Individual apartments must achieve a 6 star minimum rating
- A collective average energy rating across all SOUs in a building must be 7 stars

2.5 Energy efficiency ratings for SOUs/apartments

- NatHERS rating based on annual energy load
- Numerical star rating from 0 to 10
- Individual apartments must achieve a 6 star minimum rating
- A collective average energy rating across all SOUs in a building must be 7 stars
- Separate heating and cooling load limits also apply in some climate zones
- ABCB *NatHERS heating and cooling load limits* Standard (2022)
- Must be completed:
  - By an accredited assessor
  - Using an accredited software tool

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- Separate heating and cooling load limits also apply in some climate zones
- ABCB *NatHERS heating and cooling load limits* Standard (2022)
- Must be completed:
  - By an accredited assessor
  - Using an accredited software tool

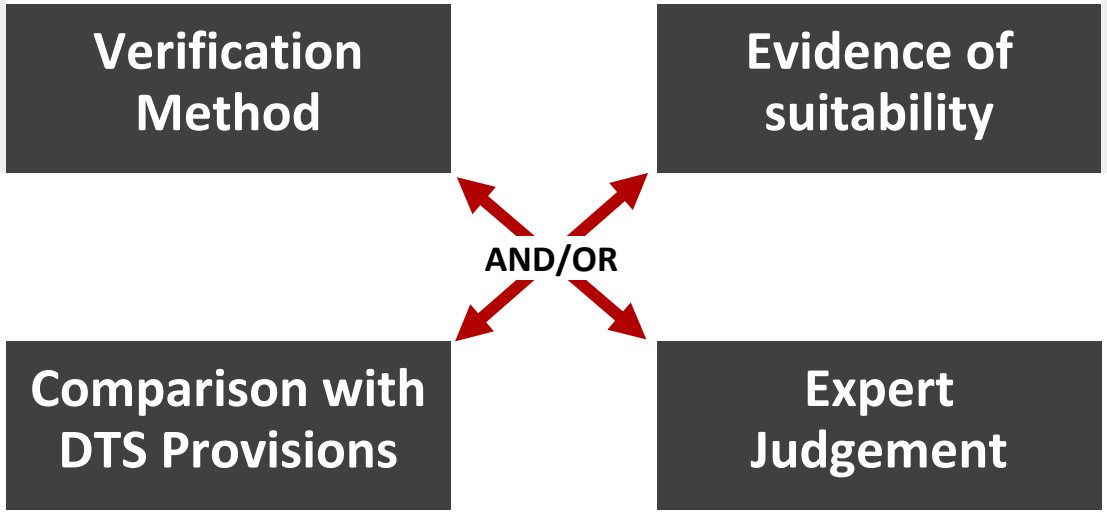
- NatHERS can be used to comply with Whole-of-Home requirements (J1P3).
- Additional DTS requirements also need to be met (e.g. building sealing, lighting).
- NSW BASIX rating uses a similar approach, to meet the same performance.

2.6 Energy efficiency Assessment Methods

Using one of the VMs in Section J:

- J1V1 NABERS Energy
- J1V2 Green Star
- J1V3 Verification using a reference building
- J1V4 Verification of building envelope sealing
- J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

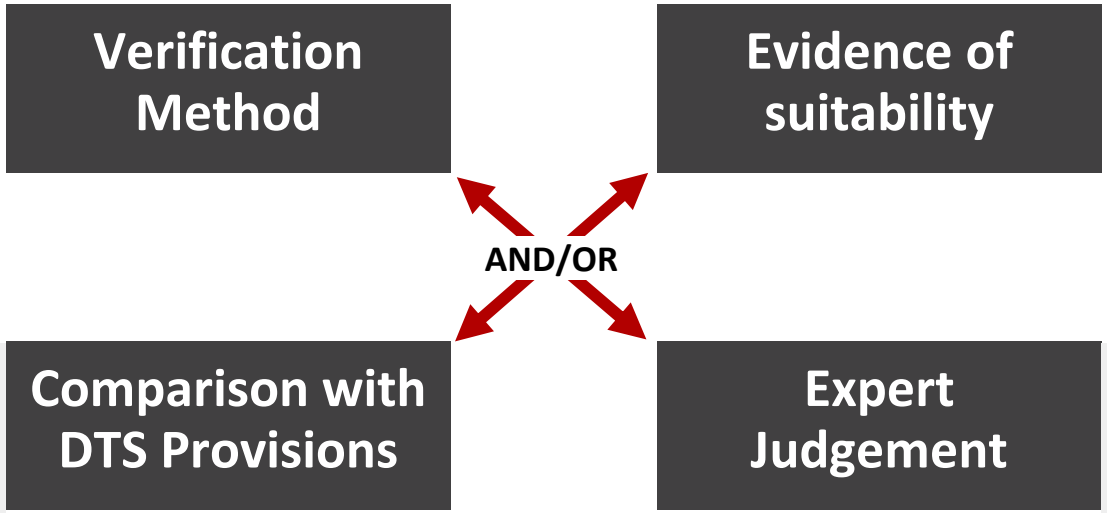
Using another VM such as an overseas code or standard



Meeting the requirements of an energy rating option in the DTS Provisions of Section J

Meeting the prescriptive requirements of all the relevant DTS Provisions of Section J

2.6 Energy efficiency Assessment Methods



Using a Performance Solution that is compared to the Deemed-to-Satisfy Provisions of Section J

Using the judgement of a suitably qualified expert/s

Expert must have demonstrated knowledge of technical issues and peer recognition

2.7 Understanding Verification Methods for energy efficiency in Volume One

- J1V1 NABERS Energy
- J1V2 Green Star
- J1V3 Verification using a reference building
- J1V4 Verification of building envelope sealing
- J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

2.7.1 - J1V1 NABERS Energy

- **J1V1 NABERS Energy**
- J1V2 Green Star
- J1V3 Verification using a reference building
- J1V4 Verification of building envelope sealing
- J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

- An energy modelling framework that benchmarks a building's energy use against a 6 star scale.
- Can only be used for Class 3, 5 and 6 buildings, and common areas of Class 2 buildings.
- Building developers must:
  - Enter into a NABERS Energy for Offices base building Energy Commitment Agreement. Target star rating is dependent on building classification.
  - Model the energy efficiency of the building using the NABERS based energy model.
- Additional thermal comfort targets and other DTS Provisions also apply.

2.7.2 – J1V2 Green Star

- J1V1 NABERS Energy
- **J1V2 Green Star**
- J1V3 Verification using a reference building
- J1V4 Verification of building envelope sealing
- J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

- Rating tool that compares a proposed building to a reference building compliant with the DTS Provisions in Section J
- Can be used for Class 3, 5, 6, 7, 8 or 9 buildings or common areas of Class 2 buildings
- The Green Star – Design and As-Built or Green Star Buildings rating needs to comply with the simulation requirements and be registered
- Additional thermal comfort targets and other DTS Provisions also apply.

2.7.3 - J1V3 Verification using a reference building

- J1V1 NABERS Energy
- J1V2 Green Star
- **J1V3 Verification using a reference building**
- J1V4 Verification of building envelope sealing
- J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

- Compares annual greenhouse gas emissions of a proposed building to that of a reference building
- The reference building is based on satisfying the DTS Provisions
- If the greenhouse gas emissions of the proposed building do not exceed that of the reference building, J1P1 is satisfied
- Can be used for Class 3, 5, 6, 7, 8 or 9 buildings and common areas of Class 2 buildings
- Additional thermal comfort targets and other DTS Provisions also apply

2.7.4 - J1V4 Verification of building envelope sealing

- J1V1 NABERS Energy
- J1V2 Green Star
- J1V3 Verification using a reference building
- **J1V4 Verification of building envelope sealing**
- J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

- Building sealing is essential for facilitating the energy efficiency of a building
- J1V4 provides a method of demonstrating compliance with the building sealing requirements in J1P1(e) and J1P2
- It can be used for Class 2, 3, 4, 5, 6, 8 or 9 buildings
- J1V4 provides an option for complying with the prescriptive building sealing requirements in Part J5

2.7.5 - J1V5 Verification using a reference building for a Class 2 sole-occupancy unit

- J1V1 NABERS Energy
- J1V2 Green Star
- J1V3 Verification using a reference building
- J1V4 Verification of building envelope sealing
- **J1V5 Verification using a reference building for a Class 2 sole-occupancy unit**

- This Verification Method can be used to verify compliance with J1P2 and J1P3 for a Class 2 sole-occupancy unit.
- The method compares the proposed solution with a reference building that complies with the DTS Provisions (Specification 45).
- The calculation method needs to comply with ANSI/ASHRAE Standard 140 – *can't use a NatHERS tool*.
- J1V5 covers:
  - heating loads and cooling loads
  - energy value of the domestic services
  - additional requirements (Specifications 33 and 45 as applicable).

2.8 True or False?

For an SOU in a Class 2 building, a minimum 6 star energy efficiency rating is **not** sufficient to demonstrate compliance with J1P1.

2.8 True or False?

For an SOU in a Class 2 building, a minimum 6 star energy efficiency rating is **not** sufficient to demonstrate compliance with J1P1.

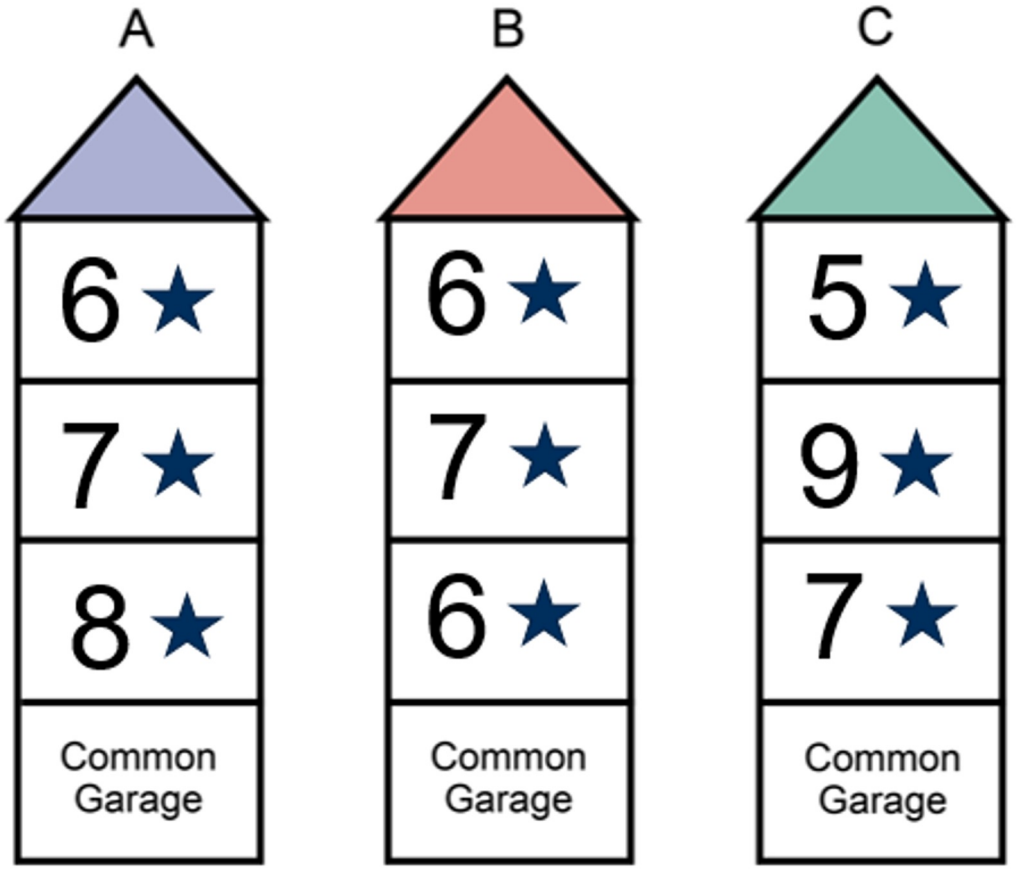
True

A minimum 6 star rating for an SOU only demonstrates compliance against some of the energy efficiency Performance Requirements.

You also need to demonstrate compliance with other DTS Provisions for things like thermal breaks and building sealing.

2.9 Which of the following meets requirements?

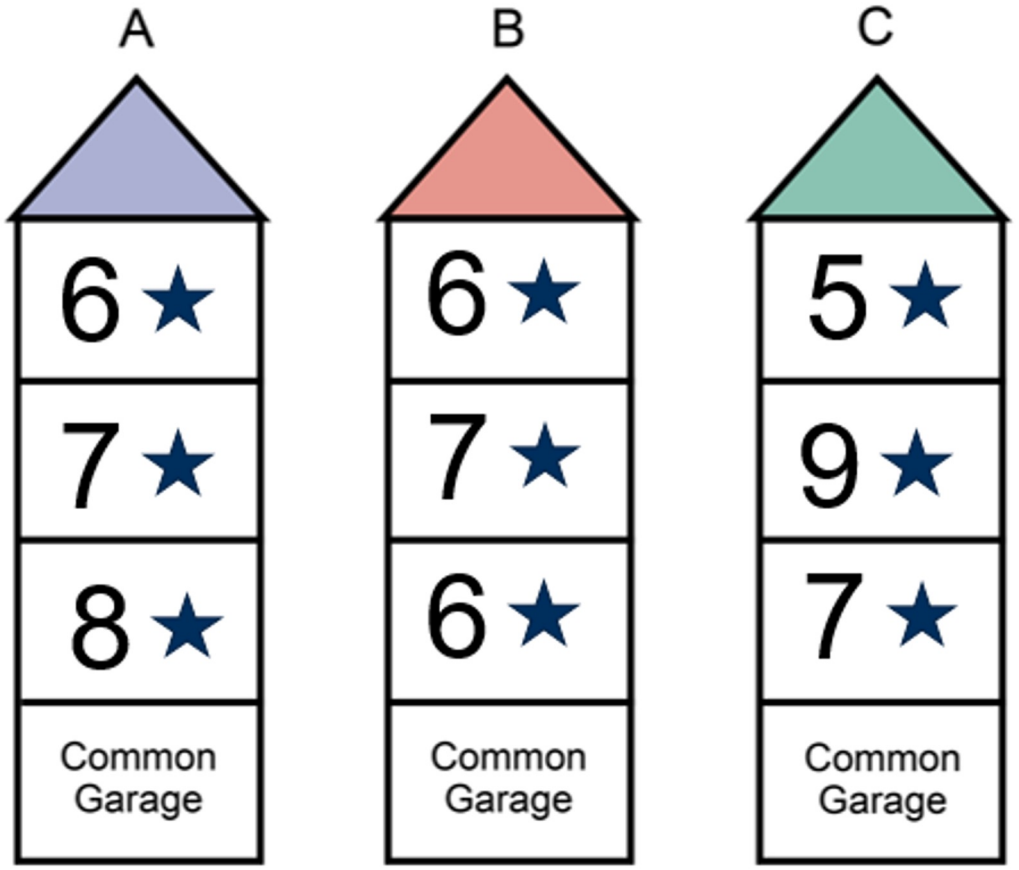
Which of the Class 2 buildings shown on the right meets the minimum energy efficiency ratings required by Section J of NCC Volume One?



2.9 Which of the following meets requirements?

Which of the Class 2 buildings shown on the right meets the minimum energy efficiency ratings required by Section J of NCC Volume One?

- Building A meets the minimum NatHERS energy efficiency star rating requirements
- Building B does not meet requirements because the average rating is less than 7.
- Building C does not meet requirements because one SOU has not achieved the minimum 6 star rating.



2.10 Other useful resources

ABCB Calculators

- Help with the calculations used in
  DTS Provisions:
  - Facade calculator
  - Fan systems calculator
  - Pump systems calculator
  - Lighting calculator
- Non-mandatory
- Guidance tools to assist practitioners

ABCB Handbook

- Non-mandatory guidance to assist in understanding and applying the energy efficiency requirements

ABCB Videos

- YouTube tutorials are also available to explain the provisions and show you how to use the calculators

Access them at the ABCB website.

2.11 Summary

Section J Energy Efficiency	DTS Provisions	Different DTS Provisions apply to:
• 4 Performance Requirements • 5 Verification Methods	• 9 Parts in Section J • DTS Provisions. • 10 Specifications supporting Section J • 6 of these Specifications support DTS Provisions.	• Sole-occupancy units in Class 2 buildings and a Class 4 part of a building • Common areas of these buildings and other Class 3, and 5-9 buildings

2.12 Key points

- Overall aim is to reduce greenhouse gas emissions from commercial buildings in Australia
- Heating and cooling loads are key, and evidence of compliance is commonly provided through some kind of energy rating
- Compliance with requirements reduces energy used to maintain a comfortable temperature and operate the building
- Other elements must be met using DTS Provisions or a compliant Performance Solution

3. Using Energy Efficiency provisions in Volume Two

3.0 What you will learn

- Energy efficiency Performance Requirements in Volume Two
- Compliance solutions for energy efficiency in Volume Two
- House energy ratings
- Assessment Methods for energy efficiency for Volume Two
- Energy efficiency in the ABCB Housing Provisions
- Other useful resources

3.1 Energy efficiency in NCC Volume Two: Section H

Part H6 Energy Efficiency

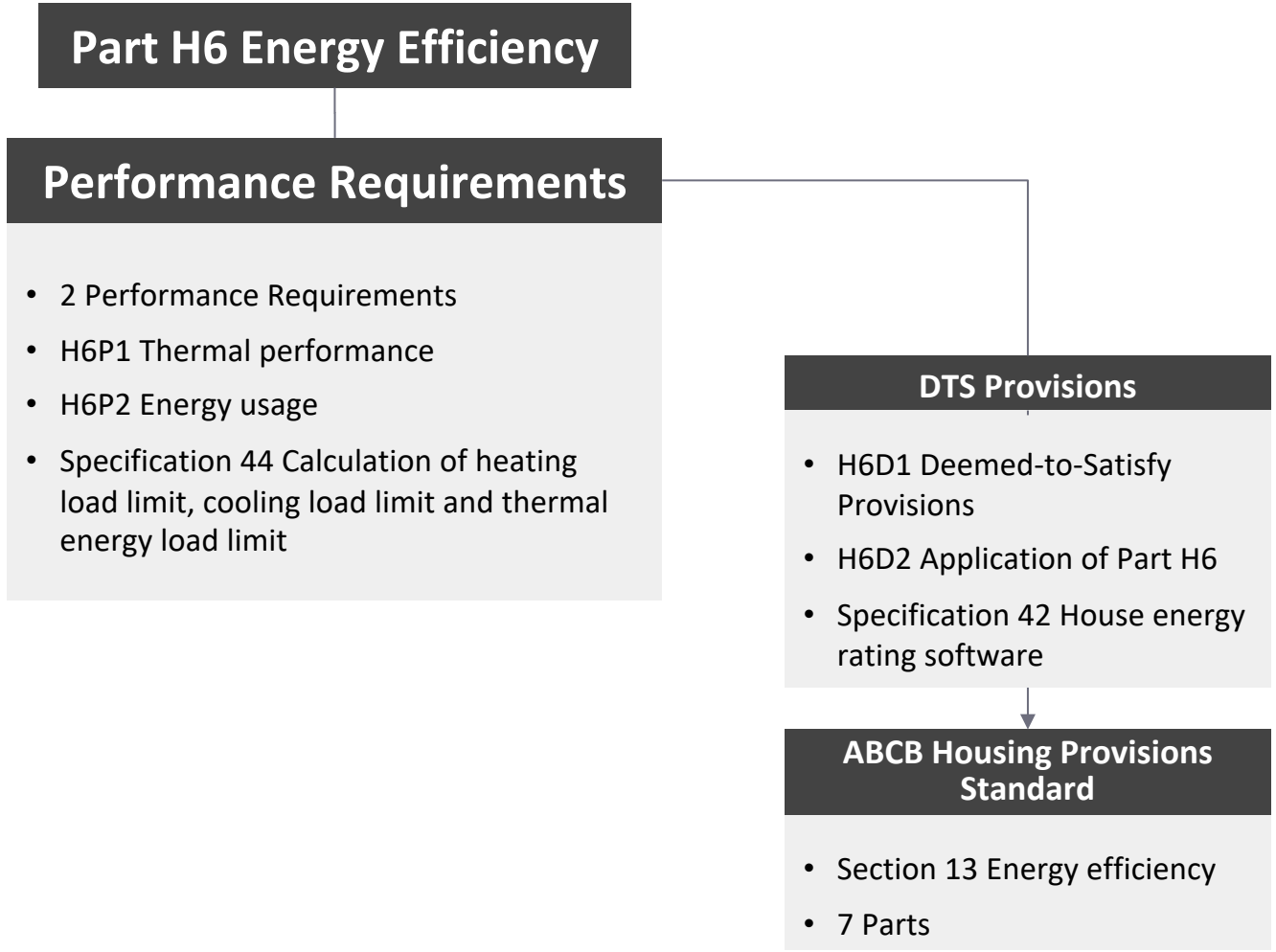
3.1 Energy efficiency in NCC Volume Two: Section H

Part H6 Energy Efficiency

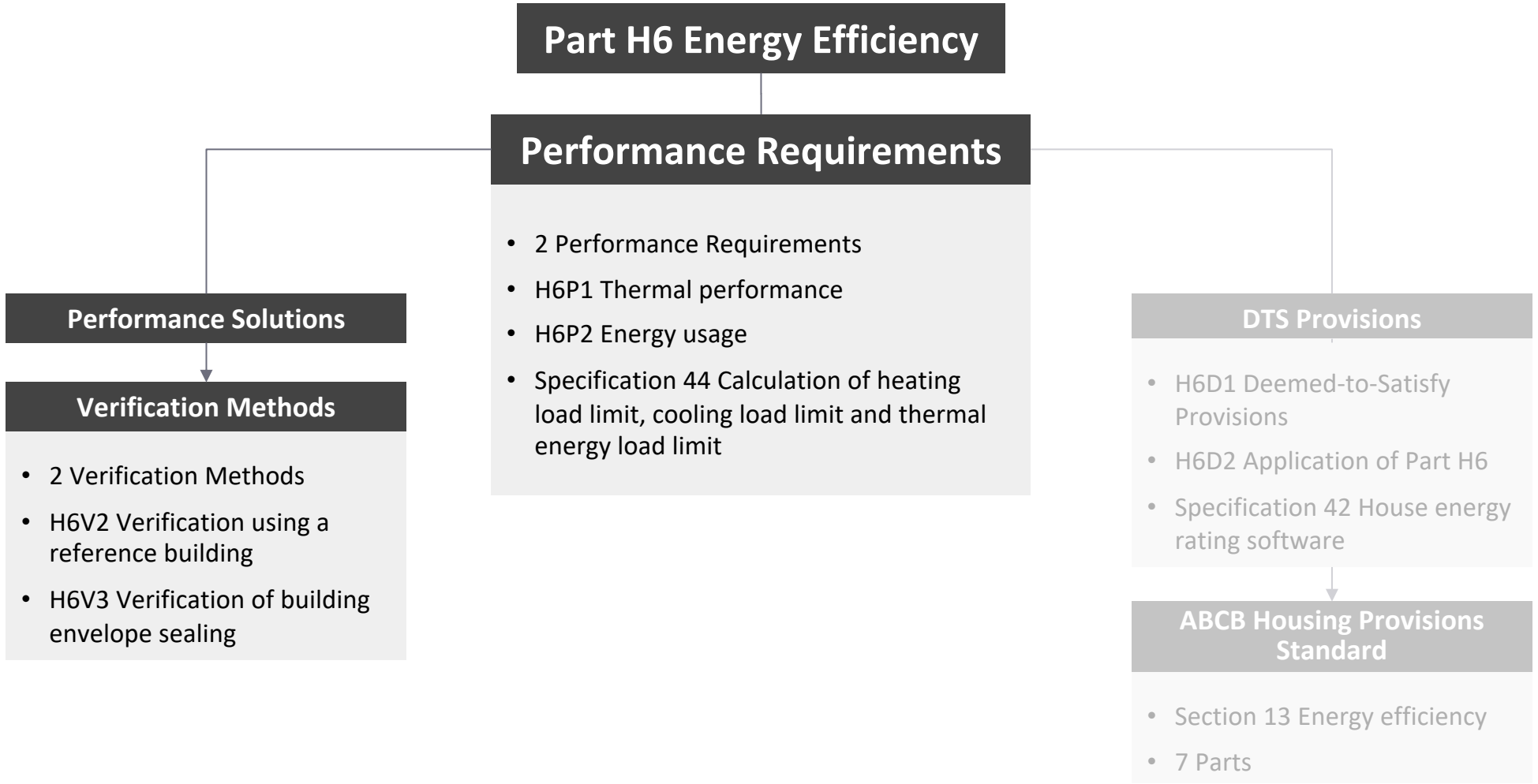
Performance Requirements

- 2 Performance Requirements
- H6P1 Thermal performance
- H6P2 Energy usage
- Specification 44 Calculation of heating load limit, cooling load limit and thermal energy load limit

3.1 Energy efficiency in NCC Volume Two: Section H



3.1 Energy efficiency in NCC Volume Two: Section H



3.2 What are the energy efficiency Performance Requirements in NCC Volume Two?

H6P1
Thermal Performance

H6P2
Energy Usage

3.2 What are the energy efficiency Performance Requirements in NCC Volume Two?

H6P1 Thermal Performance

H6P1 Thermal Performance

(1) The total *heating load* of the *habitable rooms* and *conditioned spaces* in a building must not exceed the *heating load* limit in Specification 44.

(2) The total *cooling load* of the *habitable rooms* and *conditioned spaces* in a building must not exceed the *cooling load* limit in Specification 44.

(3) The total *thermal energy load* of the *habitable rooms* and *conditioned spaces* in a building must not exceed the *thermal energy load* limit in Specification 44.

3.2 What are the energy efficiency Performance Requirements in NCC Volume Two?

H6P2
Energy Usage

H6P2 Energy usage

(1) The *energy value* of a building's *domestic services* must not exceed 70% of the *energy value* with—

(a) a 3-star ducted heat pump, rated under the 2019 GEMS determination, heating all spaces that are provided with heating; and

(b) a 3-star ducted heat pump, rated under the 2019 GEMS determination, cooling all spaces that are provided with cooling; and

(c) a 5-star instantaneous gas water heater, rated under the 2017 GEMS determination, providing all domestic hot water; and

(d) a lighting power density of 4 W/m^2 serving all internal spaces that are provided with artificial lighting.

(2) *Domestic services*, including any associated distribution system and components must, to the degree necessary, have features that facilitate the efficient use of energy appropriate to—

(a) the *domestic service* and its usage; and

(b) the geographic location of the building; and

(c) the location of the *domestic service*; and

(d) the energy source.

3.3 Variations to energy efficiency Performance Requirements in NCC Volume Two

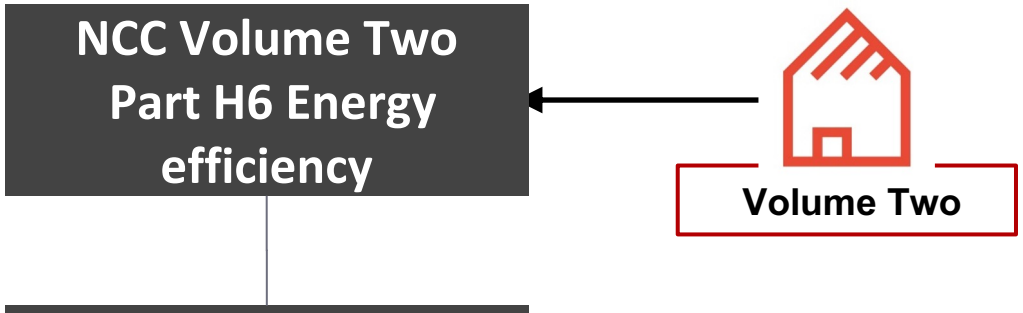
- In NSW, Part H6 does not apply.
- NSW requires a BASIX sustainability rating for new homes and renovations (7 star equivalent)
- NSW Variations in Schedule 5 have other measures to support and complement BASIX

3.3 Variations to energy efficiency Performance Requirements in NCC Volume Two

- In NSW, Part H6 does not apply.
- NSW requires a BASIX sustainability rating for new homes and renovations (7 star equivalent)
- NSW Variations in Schedule 5 have other measures to support and complement BASIX

- In the Northern Territory, Part H6 is replaced with NT Part H6 Energy efficiency (5 stars)
- In Tasmania, Part H6 is replaced with BCA 2019 Amendment 1 Part 2.6. (6 stars)

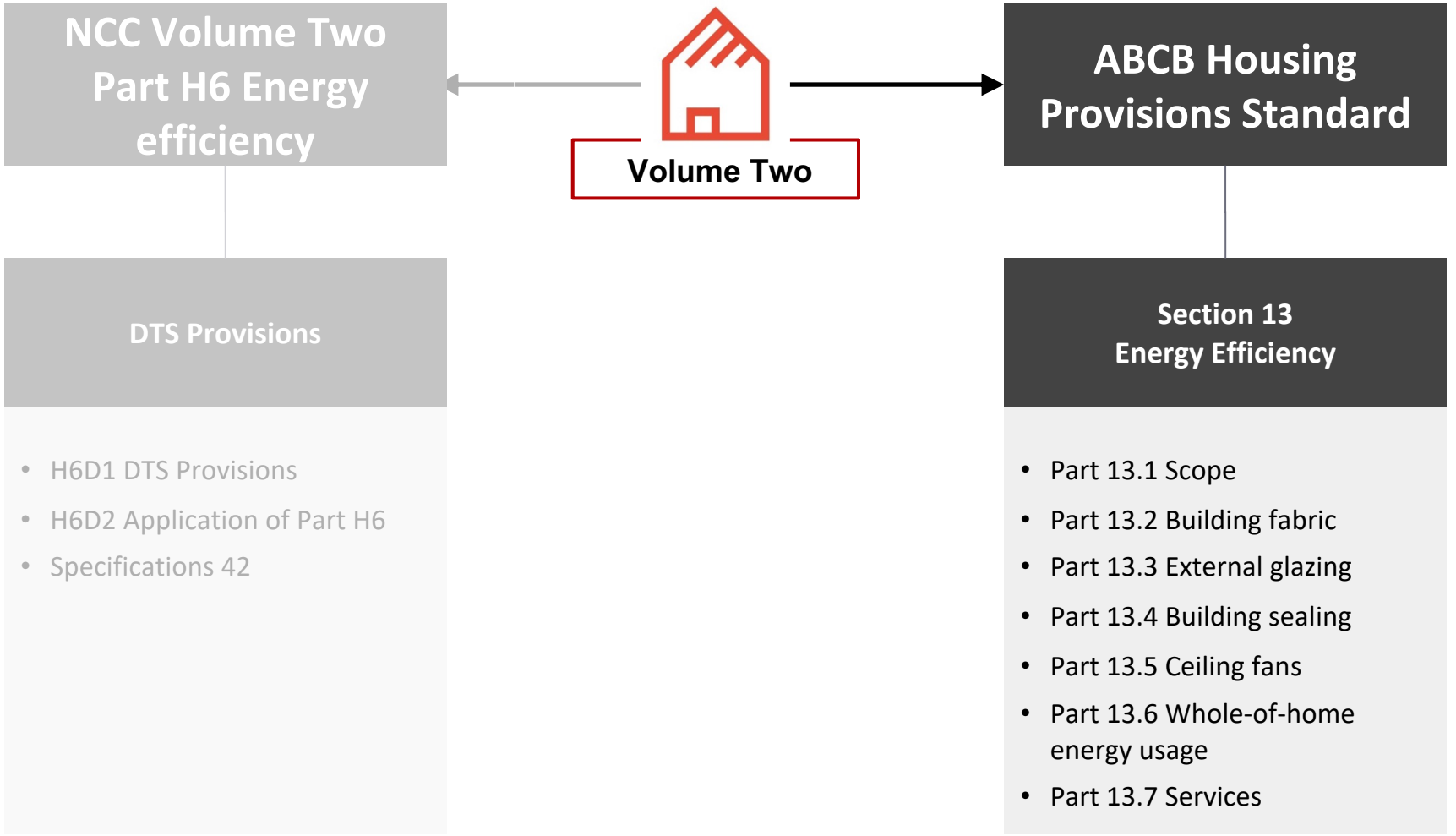
3.4 DTS pathways for compliance



DTS Provisions

- H6D1 DTS Provisions
- H6D2 Application of Part H6
- Specifications 42

3.4 DTS pathways for compliance



3.5 How can we comply with the energy efficiency Performance Requirements of NCC Volume Two?

All options for compliance must be:

- Supported with suitable evidence and/or documentation to demonstrate that compliance has been achieved, and
- Assessed and approved by the Approval Authority.

3.6 Application of Part H6: NatHERS energy rating

Option 1: NatHERS energy rating →

H6D2 Application of Part H6

[2019: 3.12.0]

(1) *Performance Requirement* H6P1 for the thermal performance of the building is satisfied by—

(a) complying with S42C2, using *house energy rating software* and S42C4(1); or

(b) complying with the following parts of the ABCB Housing Provisions—

(i) Part 13.2, for the building *fabric*; and

(ii) Part 13.3, for the external *glazing* and shading; and

(iii) Part 13.4, for building sealing; and

(iv) Part 13.5, for ceiling fans.

(2) *Performance Requirement* H6P2 for the energy usage of the building is satisfied by—

(a) complying with S42C3 using *house energy rating software* and S42C4(2); or

(b) complying with Parts 13.6 and 13.7 of the ABCB Housing Provisions for a building with a total floor area not greater than 500 m².

3.7 Reference: Specification 42

S42C2 Heating and cooling loads

(1) A building must achieve an energy rating, including the separate heating and cooling load limits, using *house energy rating software*, of greater than or equal to—

(a) 7 stars; or

(b) for a building in *climate zones* 1 or 2, 6.5 stars if the building has an outdoor living area as described in (3) which is fully covered with an impervious roof having a *Total R-Value* greater than or equal to 1.5 (for downward heat flow); or

(c) for a building in *climate zones* 1 or 2, 6 stars if the building has an outdoor living area as described in (3) which—

(i) is fully covered with an impervious roof having a *Total R-Value* greater than or equal to 1.5 (for downward heat flow); and

(ii) has at least one permanently installed ceiling fan.

(2) The heating and cooling load limits in (1) are specified in the ABCB Standard for NatHERS Heating and Cooling Load Limits.

3.8 NatHERS energy ratings

- NatHERS rating based on annual energy load
- Numerical star rating from 0 to 10
- 7 star minimum requirement
- Concessions for houses in climate zones 1 and 2, which have suitable outdoor living areas

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- ABCB NatHERS heating and cooling load limits Standard (2022)
- Must be completed:
  - By an accredited assessor
  - Using an accredited software tool

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- Numerical star rating from 0 to 10
- 7 star minimum requirement
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- Separate heating and cooling load limits also apply in some climate zones
- ABCB NatHERS heating and cooling load limits Standard (2022)
- Must be completed:
  - By an accredited assessor
  - Using an accredited software tool

- NatHERS can be used to comply with Whole-of-Home requirements (H6P2).
- Additional DTS requirements also need to be met
- (e.g. building sealing and services).
- NSW BASIX uses a similar approach, to meet the same performance.

3.9.1 What are the DTS Provisions in Section 13 Energy efficiency of the Housing Provisions?

Part 13.2 Building fabric

Part 13.3 External glazing

Part 13.4 Building sealing

Part 13.5 Ceiling fans

Part 13.6 Whole-of-home energy usage

Part 13.7 Services

- Building fabric provisions ensure an effective means of resisting unwanted heat flow
- Total R-Value for different insulation locations is specified
- Total R-Value of external walls are tailored for different climate zones
- Different requirements for different construction types
  - i.e. lightweight vs masonry or suspend floors vs slab on ground.
- Concession where heating or cooling is solely used in a bathroom or amenity area
- Requirements to adjust insulation Total R-Value where there are penetrations of gaps in insulation

3.9.2 Part 13.3 External glazing

Part 13.2 Building fabric

Part 13.3 External glazing

Part 13.4 Building sealing

Part 13.5 Ceiling fans

Part 13.6 Whole-of-home energy usage

Part 13.7 Services

- Part 13.3 is about controlling the amount of heat entering or leaving a building through glazing
- There are 5 key factors affecting heat transfer in glazing:
  - location of the building
  - area of glazing
  - degree of sun exposure – orientation and shading
  - if the building is air-conditioned
  - the type of frame and glass used as this determines the *Total System U-Value* and *Solar Heat Gain Coefficient* for the glazing system

3.9.3 Part 13.4 Building sealing

Part 13.2 Building fabric

Part 13.3 External glazing

Part 13.4 Building sealing

Part 13.5 Ceiling fans

Part 13.6 Whole-of-home energy usage

Part 13.7 Services

- Part 13.4 Building sealing DTS Provisions address:
  - chimneys and flues
  - roof lights
  - external windows and doors
  - exhaust fans
  - construction of ceilings, walls and floors
  - evaporative coolers.
- Provisions are designed to restrict the unintended leakage of outdoor air into the building and loss of conditioned air from a building.
- Overall, DTS Provisions encourage ventilation that can be controlled by occupants to use outside air where appropriate.

3.9.4 Part 13.5 Ceiling fans

Part 13.2 Building fabric

Part 13.3 External glazing

Part 13.4 Building sealing

Part 13.5 Ceiling fans

Part 13.6 Whole-of-home energy usage

Part 13.7 Services

- The intention of Part 13.5 is providing requirements for the installation of ceiling fans for cooling in suitable climates.
- It applies in climate zones 1, 2 and 3, and climate zone 5 in New South Wales and Queensland.

3.9.5 Part 13.6 Whole-of-home energy usage

Part 13.2 Building fabric

Part 13.3 External glazing

Part 13.4 Building sealing

Part 13.5 Ceiling fans

Part 13.6 Whole-of-home energy usage

Part 13.7 Services

- Provide a collective budget for energy use in a building.
- The whole-of-home energy budget covers a number of factors:
  - floor area of the home
  - main heating/cooling equipment
  - main water heater
  - swimming pools
  - spas, and
  - on-site PV.
- Can trade between the efficiencies of the components.

3.9.6 Part 13.7 Services

Part 13.2 Building fabric

Part 13.3 External glazing

Part 13.4 Building sealing

Part 13.5 Ceiling fans

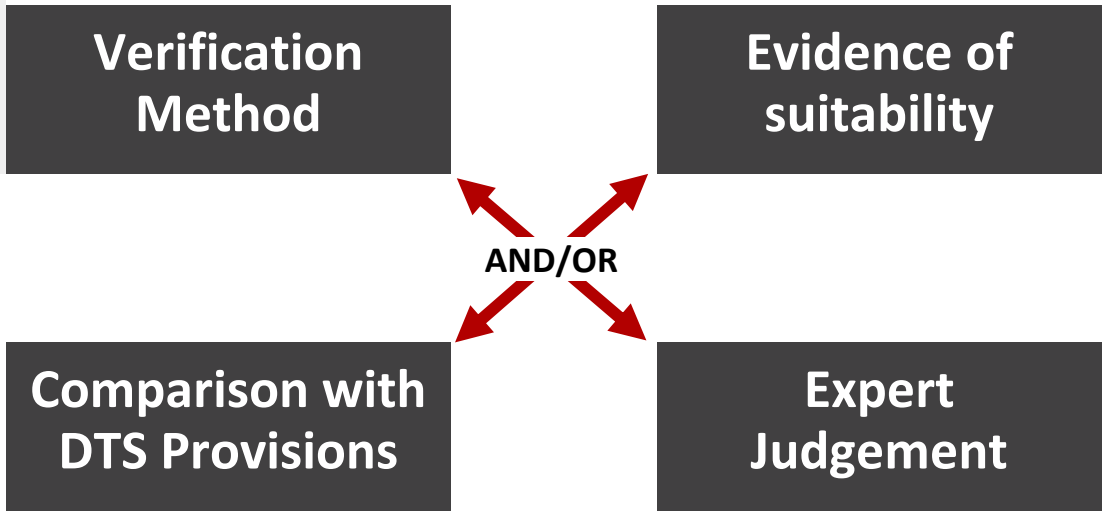
Part 13.6 Whole-of-home energy usage

Part 13.7 Services

- Part 13.7 aims to minimise energy lost through the operation of:
  - air-conditioning
  - central heating
  - lighting
  - heated water supply
  - pool and spa heating and pumping.
- The requirements range from:
  - insulation of services
  - limiting the use of electric resistance space heating
  - limiting the W/m^2 allowed for lighting
  - placing restrictions on certain energy sources for both heated water heating and swimming pool and spa heating.
- Requirements for heated water supply systems, including their energy efficiency are located in NCC Volume Three Part B2.

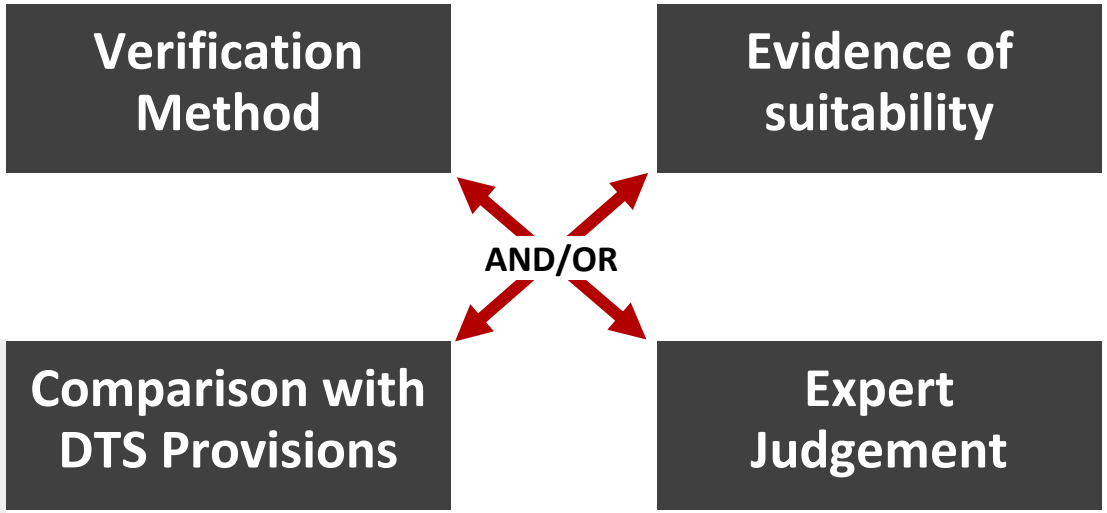
3.10 Energy efficiency Assessment Methods

- Performance Solution
- Two Verification Methods (H6V2, H6V3)
- Can use other suitable Verification Methods
- (if accepted by the appropriate authority).

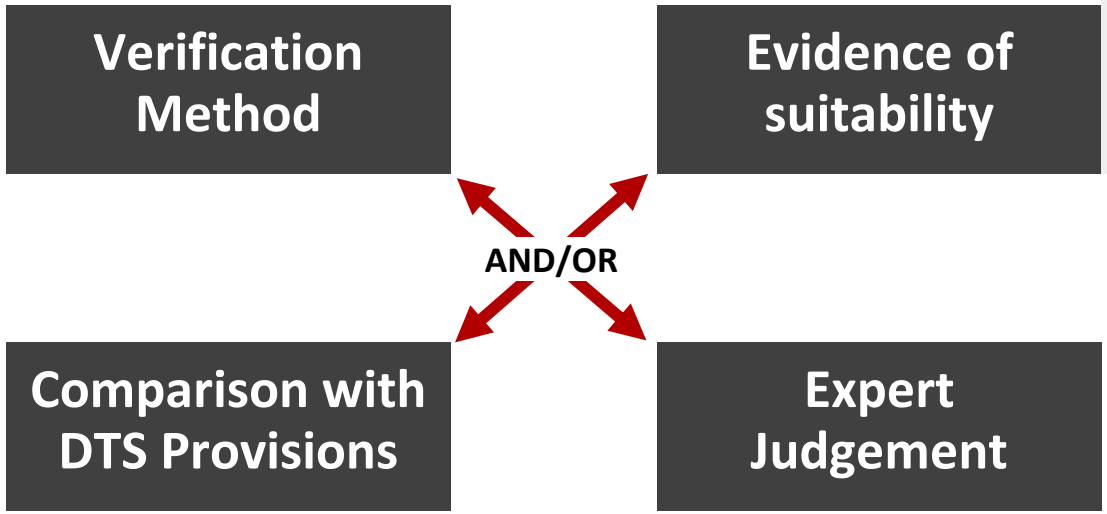


3.10 Energy efficiency Assessment Methods

- Comparing a Performance Solution with the Deemed-to-Satisfy Provisions of the relevant Part



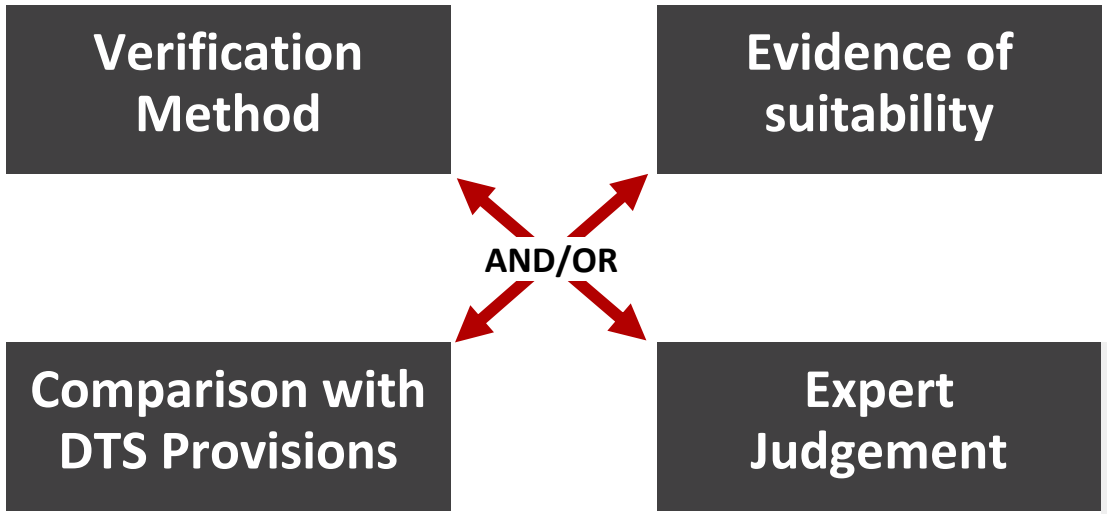
3.10 Energy efficiency Assessment Methods



Can be used for a Performance Solution or DTS Solution. Consists of such examples as:

- A certificate of conformity
- A certificate from a professional engineer
- A report from an accredited testing laboratory
- Other forms of evidence deemed suitable by the appropriate authority

3.10 Energy efficiency Assessment Methods



Using the expert judgement of a suitably qualified person

- Expert must have demonstrated knowledge of technical issues and peer recognition
- For example, a qualified and experienced fire safety engineer

3.11 True or False?

To meet the NCC energy efficiency Performance Requirements, all newly built Class 1 buildings in Australia must use the same amount of energy for heating, cooling & other energy requirements.

3.11 True or False?

To meet the NCC energy efficiency Performance Requirements, all newly built Class 1 buildings in Australia must use the same amount of energy for heating, cooling & other energy requirements.

False.

- All newly built Class 1 buildings must achieve a similar standard of energy efficiency.
- But the allowed energy use differs in different climate zones and because of other factors.

3.11 True or False?

Every new Class 1 building in Australia must have a NatHERS energy rating to demonstrate that it meets the NCC energy efficiency Performance Requirements.

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Every new Class 1 building in Australia must have a NatHERS energy rating to demonstrate that it meets the NCC energy efficiency Performance Requirements.

False.

- A designer or builder can demonstrate compliance against each of the elemental DTS Provisions instead of doing a NatHERS energy rating
- In NSW, BASIX ratings are used instead of NatHERS energy ratings
- A different approach may be used through a Performance Solution

3.12 Other useful resources

- ABCB calculators can help with the calculations used in elemental DTS Provisions:
  - Glazing Calculator NCC 2022 Volume Two
  - Lighting Calculator NCC 2022 Volume Two
  - Whole-of-home calculator
- Non-mandatory
- **Not** a Verification Method

- Housing energy efficiency handbook
- Non-mandatory guidance
- Helps to understand and apply the housing energy efficiency requirements
- YouTube tutorials are also provided to explain the provisions and show you how to use the calculators

3.13 Summary

Performance Requirements	DTS Provisions	Common DTS Solutions
• Part H6 Energy efficiency in NCC Volume Two • H6P1 Thermal performance • H6P2 energy usage	• Part H6 Energy efficiency in NCC Volume Two • H6D1 DTS Provisions • H6D2 Application Part H6 • Section 13 Energy efficiency in the Housing Provisions (i.e. elemental DTS Provisions)	• House energy efficiency rating plus some elemental • DTS Provisions, OR • All elemental • DTS Provisions • (Note: Performance Solutions can be developed)

3.14 Key points

- Overall aim is to reduce greenhouse gas emissions from domestic buildings in Australia
- Heating and cooling loads are key and evidence of compliance is commonly provided through energy rating – either NatHERS or BASIX in NSW
- Compliance with requirements reduces energy used to maintain a comfortable temperature and operate the building
- Other elements must be met using DTS Provisions or a compliant Performance Solution

Thank you

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