Section J Case Study series: Verification method pathways

The decision-making journey of an office building

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INTRODUCTION

Prior to 1996, the Australian building code was a prescriptive code[1] requiring designers to demonstrate compliance with Deemed-to-Satisfy provisions —there was little ability within the Code for designers to exercise creativity to innovate new design solutions.

In 1996, the Australian Building Code Board (ABCB) launched the performance-based building code, which is what we know in Section J as Section *JP1 Performance Requirement*.

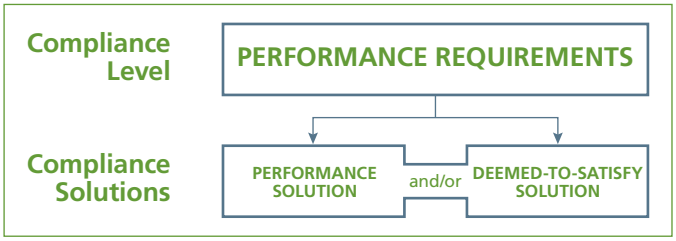

Figure 1: NCC Compliance Option Structure (Source: ABCB).

It is also relevant to understand the regulatory framework that gives the National Construction Code (NCC) legal effect in Australia.

The Planning Regulations for each state or territory cite the NCC and its referenced documents, including any variations to the NCC provisions, which gives it legal status. It is enforced through jurisdiction-specific approval processes. In practice, a building services professional will often be required to produce documentation proving compliance to DTS requirements, which is verified by accredited building certifiers who are licensed to certify the building by the state/territory planning department.

Where the development team are not using DTS as a compliance pathway, the development team can demonstrate compliance to the Performance Requirement using acceptable Performance Solutions.

Volume One of the National Construction Code covers Class 2 to 9 commercial buildings, which is the focus of our case study.

There are a number of ways that Section J Volume One compliance with the Performance Requirements can be demonstrated – either via the specified Verification Methods JV1, JV2, JV3 and JV4 in the NCC Volume One, or, through any other Performance Solution meeting the requirements of NCC Section A2.2.

- **JV1** is the NABERS Energy for Offices pathway, and is currently only valid for Class 5. It can be used when the building has registered a 5.5-star NABERS Energy for Offices base building NABERS Commitment Agreement.
- **JV2** is the Green Star pathway for all building classes except Class 4 (dwelling within commercial building) and the sole-occupancy units in a Class 2 building (individual apartments). It can be used when the building has registered for a Green Star – Design & As-Built rating.
- **JV3** is the Verification using a Reference Building pathway, which can be used for all building classes except Class 4 (dwelling within commercial building) and the sole-occupancy units in a Class 2 building (individual apartments). It is not reliant on any third-party certification scheme – all requirements are contained within the NCC Volume One Section J.
- **JV4** is the Verification Method for air leakage that can be used for all building classes, but only in certain climate zones. The air-tightness test method references the AS/NZS ISO 9972 Method 1.

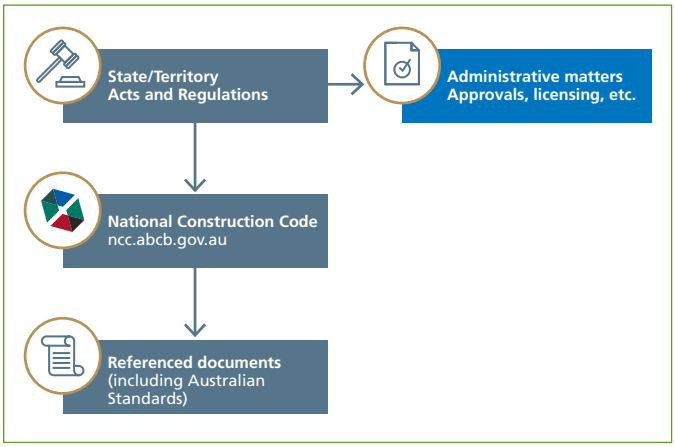

Figure 2. NCC Regulation framework (Source: ABCB).

THE CASE STUDY

This case study follows the story of a fictional new 1,500m² office building development in Canberra seeking to determine which Performance Solution it should use to demonstrate compliance.

The building developer has been advised by the investor that they are considering committing to a base building NABERS energy target of 5.5 stars without Green Power and a 4-star Green Star Design & As-Built rating.

They are seeking advice on which Verification Method pathway they should use.

OPTION 1— JV1 NABERS Energy for Offices (Class 5)

Although NABERS Commitment Agreements are available for other building types such as hotels, data centres, apartments (with expansion to other building types under way), JV1 is only valid for Class 5 office buildings.

The client is yet to secure a tenant for the office building. Because it is an office building larger than 1,000m², it is subject to the Commercial Building Disclosure (CBD) program where the NABERS energy rating and tenancy lighting assessment results must be disclosed for any advertisement or lease/sale transaction.

Therefore, the client is planning to conduct regular base building NABERS energy ratings when the building is operational.

The process flow using the JV1 compliance option is shown in Figure 3.

To secure tenants, the client also wants to advertise a target NABERS energy rating. It is also only possible to use the NABERS trademark with a certified NABERS rating or NABERS Commitment Agreement certificate. As such, the client is prepared to pay for:

- NABERS Commitment Agreement registration fee
- A modeller to conduct energy and thermal modelling based on the proposed design for construction.
- A NABERS Independent Design Review (IDR) panel member to review the design and modelling report.
- Engage an accredited NABERS Assessor after the building is operational and pay the NABERS administration fee.

From a modelling perspective, the JV1 pathway does not require comparison of the proposed building to a reference building. As such, only one model is required for compliance purposes.

The client wants to use existing documents collected through the NABERS Commitment Agreement for Section J

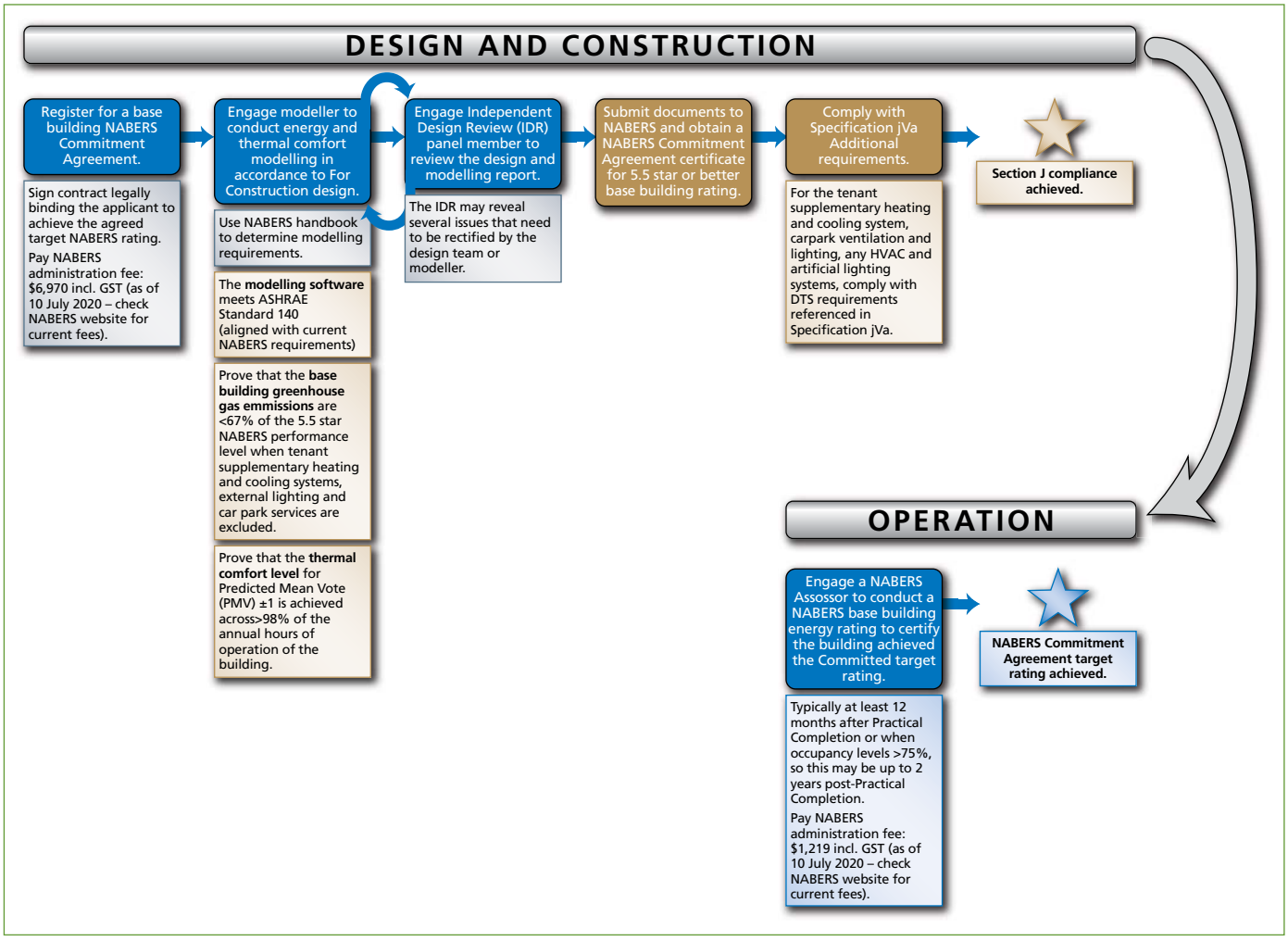

Figure 3: JV1 process flow.

Section J Requirement	Description	Outcome
5.5-star NABERS Commitment Agreement certificate obtained.	NABERS has issued a NABERS Commitment Agreement certificate for 5.5 stars base building NABERS Energy for Office.	Compliant
Comparison to benchmark	The modelling report shows that the software package used has been certified against ANSI/ASHRAE Standard 140. The base building CO_2 emissions are less than 67% of the 5.5-star NABERS emissions (obtained using the NABERS reverse calculator), when the emissions for the tenant supplementary heating and cooling systems, external lighting and carpark services are subtracted. Onsite renewable generation can be used to offset building electricity consumption, but export to the grid must be discounted from total generation.	Compliant
Thermal comfort	The modelling report references calculations showing that the PMV is ±1 across >95% of floor area in occupied zones, at least 98% of the time.	Compliant
Specification JVa requirements met	The additional requirements, typically related to installation quality and that minimum standards are met for Specification JVa and(1), JVa(2) and JVa(3). Building sealing requirements in Part J3 must also be met (if compliance is not demonstrated using JV4 – described later in this case study).	Compliant

Checklist 1

compliance. These are shown as yellow shaded boxes in the process flow in Figure 3 above. Section J compliance is checked using Checklist 1 above.

If the target NABERS rating is not achieved during the operation phase, the building owner may need to invest in rectification or additional modelling works to determine why the achieved rating is falling short of target, and what additional works are required. However, note that non-achievement of the NABERS Commitment Agreement target during the post-occupancy phase does not affect the compliance requirements of the National Construction Code (NCC). As the NCC is a design assessment, compliance is assessed based on the design; post-occupancy performance is regulated by the legal conditions as laid out in the NABERS Commitment Agreement.

Option 2— JV2 Green Star

Green Star is a voluntary sustainability rating tool administered by the Green Building Council of Australia. The Green Star Design & As-Built compliance option is available for all building classes covered under Volume One apart from class 2 sole-occupancy units (subject to NaTHERS) and class 4 buildings.

This rating tool assesses the sustainability attributes of a project through impact categories. The holistic approach considers management, indoor environment quality, energy, transport, water, materials, land use and ecology, emissions and innovation. The JV2 pathway recognises the inputs and outputs from the Green Star Design & As-Built Energy category as a verification method to demonstrate Section J compliance, where a building has registered for a target rating.

Registration and certification of a Green Star Design & As-Built rating is only available to target ratings at 4 stars or above (maximum is 6 stars at time of writing). This is not an issue for this building as the client is prepared to target a 4.0 Green Star Design & As-Built rating – corresponding to attainment of at least 45% of points.

The process flow using the JV2 compliance option is shown in Figure 4. It must be noted that the Section J requirements only tackles the conditional credit related to the Energy category – the full Green Star Design & As-Built rating encompasses other credits such as engagement of an independent commissioning agent, sustainable transport initiatives, use of sustainable construction materials, and the like.

Under the JV2 compliance pathway, an energy model must be prepared using modelling parameters described in Specification JVb – it is critical that the energy modeller is aware of this requirement and any differences in modelling detail between Specification JVb and the Green Star Energy Consumption and Greenhouse Gas Emissions Calculation Guide.

Specification JVb requires the reference and proposed building to use the same building services and domestic hot water usage, whereas the Green Star rating dictates what the reference HVAC system and domestic hot water usage should be. This means that the Green Star-compliant model may need to be modified to meet Specification JVb requirements – this requirement is currently under review and may be modified in the next iteration of the National Construction Code. Functionally, the proposed building is must be considered from client and modelling perspectives.

From the client perspective, this means monetary investment to pay for:

- Green Star Design & As-Built registration fee
- Engage a Green Star Accredited Professional to coordinate submission and target credits. This process typically starts in the design stage and continues until the Defects and Liability Period.
- A modeller to conduct energy and thermal modelling based on the proposed design for construction. It is noted that the modeller may need to conduct up to five models to meet both Green Star and Section J requirements.
- Any additional professionals that may be required as part of target credits e.g., independent commissioning agent and building tuning consultants.

From a modelling perspective, the JV2 pathway requires comparison of the proposed building to a

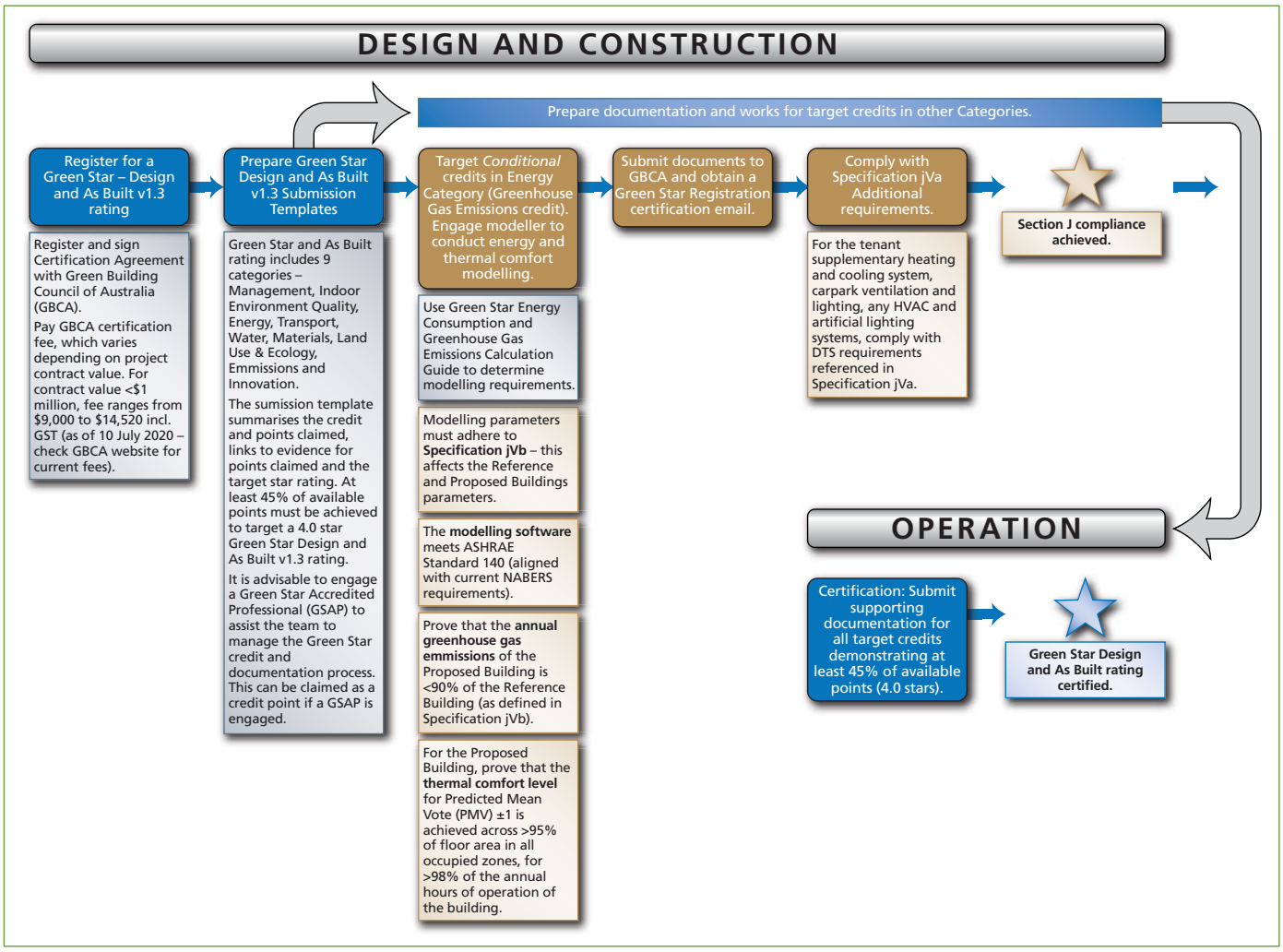

Figure 4: JV2 process flow.

reference building. As such, two models are required for compliance purposes (though additional models are required for the Green Star rating).

The energy model created for the Green Star Design & As-Built rating can be modified for Section J compliance. These are shown as yellow shaded boxes in the process flow in Figure 3 above. Section J compliance is checked using Checklist 2 below.

Similar to the JV1 NABERS Commitment Agreement compliance pathway, NCC compliance is not affected by non-achievement of the Green Star Design & As-Built rating during the post-occupancy phase. Because the NCC is a design assessment, compliance is assessed based on the design. Achievement of the final Green Star Design & As-Built rating, as registered with the GBCA, is regulated by the legal conditions laid out in Green Building Council of Australia Certification Agreement.

Section J Requirement	Description	Outcome
Registered for Green Star Design & As-Built	Green Star has issued the Green Star Design & As-Built registration certificate for 4.0 stars.	Compliant
Comparison to reference building	The modelling report shows that the software package used has been certified against ANSI/ASHRAE Standard 140. The annual greenhouse gas emissions of the proposed building are <90% of the annual greenhouse gas emissions for the reference building. The modelling report confirms that HVAC plant and domestic hot water inputs for the reference building has been adjusted to meet Specification JVb requirements. 100% of onsite renewable generation can be used to offset proposed building energy consumption.	Compliant
Specification JVb requirements met	The modelling report describes the modelling parameters for all systems, explicitly demonstrating that it is compliant with the Specification JVb requirements.	Compliant
Specification JVa requirements met	The additional requirements, typically related to install quality and minimum standards are met for Specification JVa and(1), JVa(2) and JVa(3). Building sealing requirements in Part J3 must also be met (if compliance is not demonstrated using JV4 – described later in this case study).	Compliant

Checklist 2

Section J Requirement	Description	Outcome
Comparison to reference building	The modelling report shows that the software package used is has been certified against ANSI/ASHRAE Standard 140. The annual greenhouse gas emissions of the proposed building are less than the reference building when: 1. The proposed building is modelled using the same services as the reference building; AND 2. The proposed building is modelled using the proposed services. The modelled annual greenhouse gas emissions of the proposed building can be offset by renewable energy generated and used onsite, or, via another process such as reclaimed energy used on site. Export to the grid must be discounted from total generation. The second model (2) above is not required if the proposed services is the same as the reference building as model (1) and (2) will be the same.	Compliant
Specification JVb requirements met	The modelling report describes the modelling parameters for all systems, explicitly demonstrating that it is compliant with the Specification JVb requirements.	Compliant
Thermal comfort	The modelling report references calculations showing that the PMV is ±1 across >95% of floor area in occupied zones, at least 98% of the time.	Compliant
Specification JVa requirements met	The additional requirements, typically related to install quality and minimum standards are met for Specification JVa and(1), JVa(2) and JVa(3). Building sealing requirements in Part J3 must also be met (if compliance is not demonstrated using JV4 – described later in this case study).	Compliant

Checklist 3

Option 3— JV3 Verification using a Reference Building

In cases where an existing Green Star Design & As-Built energy model is already available, or, where a project has not committed to any external rating system, the project may want to consider using the JV3 verification method. A Verification Method is only required where the DTS requirements are not met.

In this scenario, the building in this case study is relatively small at 1,500m2 and meets all DTS requirements in Parts J1 to J8. As such, it is not necessary for the building to use a verification method such as JV2 or JV3 to meet Section J compliance requirements. However, the project brief may be modified to use a curtain wall construction, which is typically harder to comply with Section J Part J1.5 walls and glazing DTS requirements due to the large amount of glass present. As such, JV3 may be considered.

Under a JV3 pathway, all compliance activities occur and are completed within the design and construction phase. There is no requirement for a follow up rating or certification after Practical Completion. As such, the client only needs to pay for:

- A modeller to undertake JV3 modelling and preparation of an energy report.

Section J compliance is checked using Checklist 3 above.

JV4 BUILDING ENVELOPE SEALING

JP1(e) requires the building to have features appropriate to sealing the building envelope against air leakage. JV4 is a verification method which is deemed to meet the requirements of JP1(e). Another method to demonstrate compliance with JP1(e) is the DTS requirements in Part J3.

Under JV4, the building may prove compliance by undertaking a building tightness test in accordance with Method 1 of AS/NZS ISO 9972 proving that for the code-specified air permeability rates are met. Method 1 is the test of the building in use where the natural ventilation is closed, and the whole building mechanical ventilation or air conditioning openings are sealed.[2]

It should be noted that JV4 is not applicable to all climate zones or building classes – some building classes in certain climate zones does not qualify for JV4. The relevant air permeability rates are as follows:

Building class	Climate zones	Maximum air permeability rate at 50Pa ($m^3/hr.m^2$)
2	All	10
4	All	10
3, 9c, 9a ward area	1, 3, 4, 6, 7 and 8	5
5 6, 8, 9a (except ward area), 9b	1, 7 and 8	5

As this case study building is in Canberra (climate zone 7), the air permeability requirement for this building is $5m^3/hr.m^2$ at 50Pa. The client will engage an ATTMA (Air Tightness Testing & Measurement Association) accredited tester to conduct this air tightness test once construction is complete and the building is fully sealed. It should also be noted that the air tightness consultant has been involved at the design stage to conduct a "red-pen test" to detail all air barrier locations on the building envelope.

FINAL DECISION

The decision process flow shown in Figure 5 was used to guide the client as to which Section J compliance pathway would be best suited for this client.

The client decided to use the JV1 pathway combined with JV4 for the following reasons:

- The NABERS Commitment Agreement allows the leasing team to market the target NABERS rating when they are seeking a tenant for the space, especially tenants who

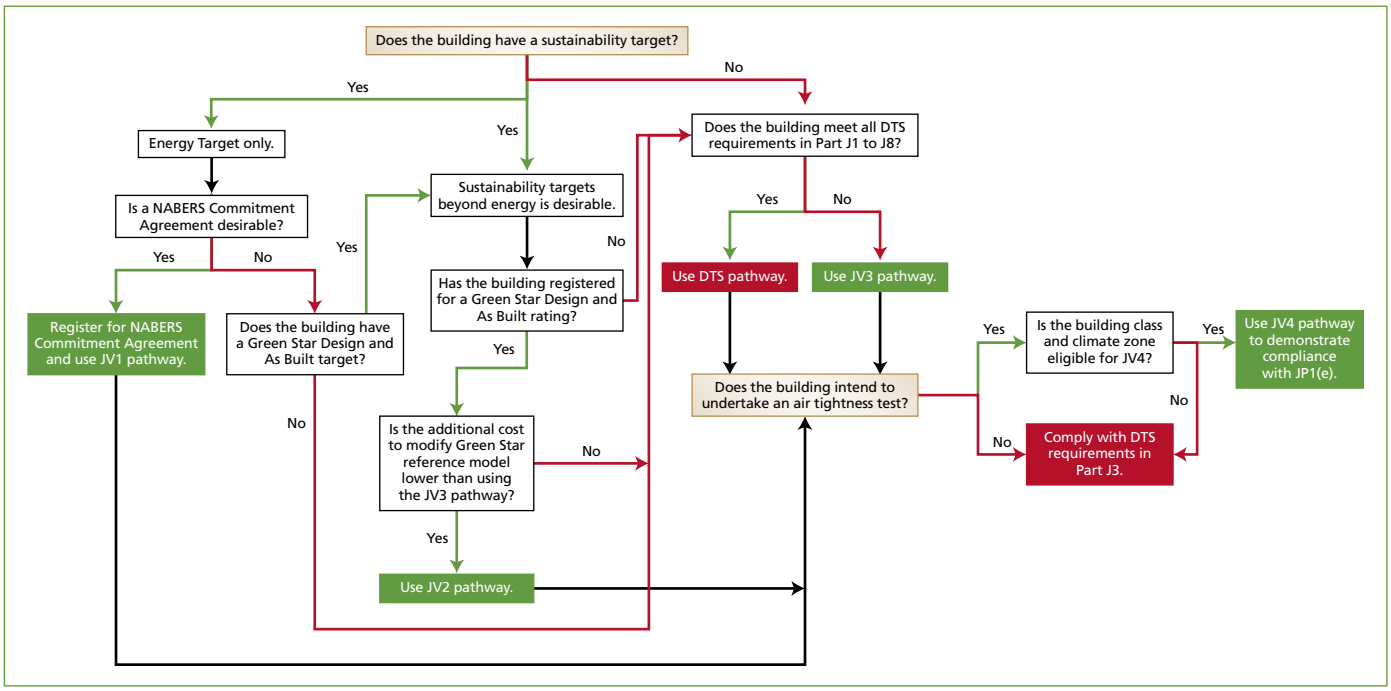

Figure 5: Compliance pathway decision tree for the client.

are obliged to procure highly rated office space as part of corporate social responsibility obligations. Because the same model can be used for JV1 (without modification), the additional modelling costs are limited.

- The building is already subject to the BEED Act (affecting buildings >=1,000m^2), which obliges the building to undertake an annual NABERS rating for any commercial transaction during the operational phase. Therefore, there is no additional cost incurred during the building operational phase due to using the JV1 compliance pathway.
- The builders already intend to conduct an air tightness test prior to handover to prove build quality. Because the building is class 5 located in climate zone 7, the building is eligible to use JV4 to demonstrate compliance with JP1(e) in lieu of relevant DTS provisions in Part J3. Therefore, there is no additional cost associated with the use of JV4 compliance pathway.

CONCLUSION

This case study has discussed how Section J Verification Methods JV1, JV2, JV3 and JV4 can be applied from the perspective of the client. Using the example of a small office building in Canberra, it proposes a decision-making framework in Figure 5 that practitioners can use to decide which compliance pathway to use. This decision is a dependent on any pre-existing client commitments to sustainability ratings or building air tightness testing, the additional costs and effort required from the perspective of the client, and whether the building is able to meet all DTS requirements in the National Construction Code.

It should be noted that this case study only covers the verification methods and DTS pathways – the National Construction Code also permits alternative Performance Solutions generated using other NCC assessment methods. Eligibility for Performance Solutions are specified in Section A2.1 and A2.2 of the 2019 National Construction Code Volume One.

REFERENCES

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Grace Foo, M.AIRAH, is principal consultant at DeltaQ, a boutique energy management and sustainability consultancy. Foo was a key technical coordinator behind the updates to the NCC 2019 energy efficiency requirements (Section J). She led a large interdisciplinary team conducting research, energy modelling and economic analysis in the fields of building fabric, lighting, and HVAC systems. In the past decade, she has delivered successful energy efficiency projects, with the capability to convert technical recommendations into cost-effective and commissionable projects where investment performance can be measured and proven. Grace is also experienced in delivering policy work for several projects commissioned by federal government agencies, state and local governments, and various government-owned corporate entities. Foo has Climate Active Carbon Neutral qualifications, is a Certified Measurement and Verification Professional (CMVP), Certified Energy Efficiency Leader, NABERS Auditor, Supervisor and Trainer, and Independent Design Review panel member. She is currently undergoing WELL Accredited Professional accreditation.