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Submission

National Energy Efficient Building Project (NEEBP) issues paper

Submission by AIRAH

Prepared by:

The Australian Institute of Refrigeration Air Conditioning and Heating

AIRAH Strategic aim #1 – *Claim the sustainability space*

AIRAH Strategic aim #3 – *Inform regulation and policy decisions*

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About AIRAH

AIRAH is the recognised voice of the Australian air conditioning, refrigeration and heating industry. We aim to minimise the environmental footprint of our vital sector through communication, education and encouraging best practice.

AIRAH – Strategic Aims

Claim the sustainability space

Through its conferences, publications, manuals and training, AIRAH will educate and motivate the HVAC&R industry and related fields about achieving sustainability. Our aim is to be the HVAC&R organisation whose values are aligned with sustainability in a practical sense

Close the skills gaps

At a time of rapid change of new technology and standards and a shifting regulatory landscape, AIRAH will provide appropriate and relevant professional development for the HVAC&R industry, and work alongside government and other providers to ensure the voids in formal training are filled.

Inform regulation and policy decisions

As the key industry organisation representing HVAC&R in Australia, it is essential AIRAH collaborate with government at both the state and federal levels. The Institute's skills and specialist knowledge can better inform the decisions that affect society in general and the HVAC&R industry in particular.

Build and engage membership

AIRAH will become the institute of choice for HVAC&R professionals in Australia. This means ensuring that formal connection with AIRAH provides benefits – actual and intangible – that are valuable, worthwhile and attractive to our members throughout their professional lives.

Disclaimer

AIRAH submission to NEEBP issues paper

1. Introduction

There are four essential aspects to delivering truly energy efficient buildings

1. A well-informed or intelligent client with a strategic interest in energy efficiency/sustainability, who drives the whole process; they set a clear brief, stay engaged, understand what they want and know how they want the building to be used.

2. A design team that is commissioned on the right basis with defined responsibilities through all building phases, a team that is knowledgeable and responsive to the client requirements and who are also creative and innovative in energy efficiency technologies and practices.

3. A construction team who takes care of the quality within the construction, to ensure the design intent is carried through the construction process and achieved for the end user.

4. An occupier, who understands and correctly uses the building, learns and takes the time to understand what the design intent was.

The question needs to be asked, how can building regulations/regulators try to ensure that these four aspects are optimised?

One of the unintended consequences of a building supply chain not fully trained and proficient in accommodating energy efficient innovation is that we can end up designing sometimes complex HVAC&R systems to accommodate inadequacies within the design of the building, i.e. HVAVC&R added to make a building work. In practice, these complex systems often don't come close to meeting design intentions in terms of either energy or indoor air quality.

There are several steps or focuses that Australian Building regulators can take to improve this situation

By focusing on improving the air tightness of buildings, while ensuring that indoor air quality is provided effectively and condensation controlled, we are potentially making buildings more productive, healthy and energy efficient than they would otherwise be. Requirements for building air tightness should be developed in isolation to controlled ventilation systems, heat recovery, building thermal properties and the like.

By focusing on the orientation and fabric of the structure to develop passive solutions to reduce cooling, heating and ventilation loads, we are reducing dependency on HVAC&R systems. Building regulations need to push building designers to design building forms for energy efficiency (orientation, glazing, natural ventilation, shading, thermal mass etc) and not simply attempt to squeeze an energy efficient HVAC system into a poorly designed or developed building concept.

By focusing on mixed mode and hybrid systems that can provide for different outcomes in different climates we are providing new energy saving comfort options for end users.

By focusing on commissioning of the building and its systems and training (of occupants and operators) we are ensuring that buildings are operated in the way that designers intended them to be operated. Training for technical service providers in low-emission practices and technology is a must, not negotiable, design and construction skills need to be underpinned by energy efficiency skills maintenance and continuing professional development.

Market forces work well and create a higher order need. The NABERS and CBD programs have ensured a focus on commissioning and building tuning without the need to specifically regulate those items. The application of NABERS and CBD is limited however and consideration should be given to how best to extend and market those schemes to the wider building market. Mandatory regulation enforces minimum standards whereas voluntary schemes like NABERS and best practice schemes like Green Star reward those who demonstrate the commercial viability of innovative new energy efficient or low-emission practices and technologies.

The regulatory focus of the NCC is limited to new buildings and major additions or refurbishments. This addresses only a small percentage of buildings in any year. Any new approach to energy efficiency regulation must fully address existing Buildings. Mandatory Disclosure of carbon, energy and water performance at point of lease or sale should be central to any new regulatory approach. An innovative new assessment tool to benchmark existing air conditioning and refrigeration systems in both new and existing buildings would be highly beneficial. The industry needs to build up data and benchmarks for this highly intensive energy use within buildings.

2. Specific pressure points for change

2.1. Architecture

Architects should take energy responsibility for orientation, fabric, glazing, passive features etc, and not just rely on HVAC to make a building work. NCC should put more emphasis on this or establish minimum performance standards.

Many architects still do not understand the requirements of Section J and in particular how insulation works leading to incorrect specification of incorrect insulation types.

2.2. Design/Delivery

Are the right incentives in place to encourage best practice design and delivery for energy efficiency? Much of the focus is on large scale commercial office buildings. How can best practices be passed down the chain to lower grade or less sophisticated projects? AIRAH believe that Mandatory Disclosure of carbon, energy and water performance at point of lease or sale should be central to any new regulatory approach for building energy efficiency.

2.3. Building sealing

Air tightness of buildings for energy efficiency with a focus on Indoor Air Quality (IAQ) issues including condensation and mould. The industry needs to build tighter buildings but also needs to incorporate requirements to mitigate any negative impacts of air tightness including; controlled mechanical supply and exhaust ventilation systems, heat recovery, building thermal properties and the like. NCC could address this.

2.4. Complexity

Poor building design leads to high loads which lead to overly complex HVAC solutions and ultimately overly complex regulations to contain it.

There appears to now be a default to performance based JV3 analysis which allows tradeoffs within the design of the building services systems, is this because the DTS is so complex and restrictive?

Architects find complying with the DTS provisions too difficult while also achieving their design aesthetic.

2.5. Commissioning

AIRAH believe that mandatory requirements for integrated building commissioning should be addressed in future building regulation. The time for viewing commissioning as a quality control process is long past. Commissioning must be used to validate a buildings compliance with regulation and design intent but also to validate a buildings energy and carbon and water performance over the first few years of a building life. Perhaps an extended process defined for handover and transition to operation with a focus on energy monitoring and tuning.

Building Tuning, Recommissioning, and retrocommissioning are also essential aspects of building and services management if a building is to be as efficient as it can be across the life cycle. AIRAH DA27 on Building Commissioning provides a good overview and explanation of these processes.

2.6. Skills and knowledge

Mixed mode and hybrid solutions, and the knowledge base needed to make these mainstream. Energy efficiency focus for maintenance, recommissioning, retrocommissioning and refurbishment. Lack of industry focus or incentives for skills maintenance and continuing professional development.

2.7. Compliance

Who is checking these buildings, i.e. the Section J details not the overview (no one as self certification is the norm?), are there issues with the self certification system? Self certifiers (engineers, architects) need to do certify or they may be liable to litigation claims. There is a trade off as to the detail to go to because there is only a probability that non-compliances will be found out. Building Certifiers are often not continuously commissioned for these checks from design all the way through to construction.

Without any accreditation or training requirements for assessors, it is difficult to know what is being passed off as "compliant". Most building surveyors don't understand Section J well enough to be able to independently assess.

How are passive features (shade and thermal mass) checked for compliance and the building fabric?

The NCC and other regulations need to be more explicit and transparent about what they are trying to achieve and there should be some measure of how well they meet their objectives.

Deemed to satisfy minimum requirements tend to become adopted as industry best practice. How can better performance be incentivised by building regulations? Market drivers such as the Green Star rating schemes have driven best practice performance in some sectors.

2.8. Data

Who is assessing the outcomes of the NCC performance requirements? (DTS and alternative solutions) - no one, as ABCB is not responsible for administration, which is a state based function. Who is collating compliance data and providing feedback to building regulators? (no one). Do we know anything at all about 2010 compliant projects? Record keeping and administration differs in every jurisdiction.

2.9. Buildings in use

How much effect does user behaviour have on building energy consumption? How can good behaviour be facilitated through good practice building design/delivery. How could NCC address actual as-built energy use (Commissioning and handover requirements?). Can requirements and standards for metering and sub metering delineate the various responsibilities and facilitate better energy management practices going forward?

2.10. Licensing

National single occupational licence coverall all refrigeration and air conditioning, all refrigerants, with links to skills maintenance and continuing development based on low emission technology and practices.

2.11. Residential air conditioning

There should be an energy efficiency based Australian Standard for the sizing, installation, control and maintenance of residential air conditioning systems with a strong focus on on-going energy efficiency and direct and indirect emissions reduction. There is a strong agreement among industry stakeholders about the many potential benefits of an energy efficiency focussed national standard for residential air conditioning and yet no progress has been made developing such a standard.

3. Relevant programs and initiatives

3.1. PRIME – Low-emission HVAC&R

The HVAC&R industry have been considering ways for Australia to transition to low-emissions technology and practices. These discussions have resulted in the PRIME initiative.

PRIME is an initiative that has been developed by a coalition of stakeholders from within the Australian Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC&R) industry. PRIME is the name given to a series of industry driven collaborative actions and goals designed to help the HVAC&R industry transition to low-emission practices and technologies.

In March 2013, AIRAH published an industry discussion paper looking at ways the HVAC&R industry could reduce it carbon emissions. The 200+ solutions suggested in the discussion paper were considered by a summit of industry stakeholders resulting in a series of goals and actions that the industry agreed were necessary to help the Australian HVAC&R industry make the transition to low-emission practices and technologies.

The outcome of the industry summit and review process is a list of around 60 high priority actions and 60 secondary or lower priority actions that could usefully be undertaken by industry or government to facilitate the transition to a low-emission industry. This PRIME Action plan outlines these priority and secondary projects in each of the PRIME pathways; Professionalism, Regulation, Information, Measurement, and Emission abatement.

In addition, the PRIME action plan also outlines a proposal for moving the PRIME work forward and into the implementation phase. The first step of the PRIME Action plan consists of establishing an industry-based Steering Group to oversee and drive the PRIME program.

AIRAH strongly recommend that all levels of government, Federal, state/territory and local, engage with this industry-driven initiative so that a truly collaborative and holistic approach to building energy efficiency can be developed and implemented for Australia.

3.2. Calculating Cool

The Heating, Ventilation and Air Conditioning High Efficiency Systems Strategy (HVAC HESS) aims to drive long term improvements in the energy efficiency of HVAC systems through whole of life improvements in HVAC system efficiency, encompassing design, manufacture, installation, operation and maintenance. The HVAC HESS Calculating Cool Project is intended to create a benchmarking

and diagnostic tool to assist professionals in the HVAC industry to save energy, take effective control and extend the life of HVAC systems.

The tool will be designed, not only to encourage best practice design of HVAC systems, but also to recognise the importance of thorough commissioning, tuning and ongoing management and maintenance of the systems throughout the life of the buildings in which they are situated. The tool will be written with a focus on both new and existing office buildings, centred on the following key objectives:

- For new HVAC system designs – To encourage and reward good/best practice design of HVAC and specification of system installation and commissioning including instrumentation and controls, operational and maintenance documentation, performance reporting, system modification control strategies and practices that result in energy efficient new HVAC system designs. In particular, the tool will be able to be applied to HVAC final design models, i.e. systems that have not been constructed yet but for which the design has been finalised.
- For new HVAC system installations- – To encourage and reward good/best practice design, installation and commissioning of HVAC, including instrumentation and controls, and documented operational, maintenance, reporting and system modification control strategies and practices that result in energy efficient new HVAC systems.
- For existing HVAC systems – To reward good/best practice upgrade, recommissioning, tuning, and ongoing operational, maintenance, documentation, reporting and system modification control strategies and practices that result in energy efficient existing HVAC systems. In particular the tool will recognise and reward existing HVAC systems that are "the best that they can be" given that the system design and installation has been inherited.

AIRAH recommends that all levels of government engage with and support the development and rollout of the final "Calculating Cool" HVAC benchmarking and diagnostic tool.

3.3. ABCB review of Section J

The Australian Building Codes Board is conducting a review of the current Part J5 requirements with a view to removing complexity and improving clarity "of the existing requirements". This project is a work in progress, with outcomes likely reflected in NCC 2015/2016.

4. AIRAH responses to the specific questions in the issues paper

4.1. National Construction Code

Comments on the questions posed in the issues paper:

1. Is the 'pyramid' hierarchy and overall structure of the Code too complex? Does this contribute to difficulties in complying?

The pyramid structure of the BCA is clear at an overall hierarchy level; however, at an individual part level the NCC is very difficult to follow the interrelationship of the clauses from objectives and functional statements through to the performance requirements and deemed to satisfy provisions. This makes things look more complex than they are and tends to cause confusion / difficulties.

2. Is it sufficient to assess the energy performance of buildings 'as designed', or should there also be some consideration of the actual energy performance 'as built'?

Consider as built/delivered performance at commissioning stage.
Cost of the electricity and gas is the incentive for buildings to perform well. Many tenants are now very aware of NABERS ratings and have minimum requirements (as applicable now to all government office buildings) Astute owners and tenants recognise that prices will continue to rise even though the carbon price has been removed, this is one factor in their decision making (other examples: corporate reporting requirements, management and staff expectations); accordingly, they are attracted to buildings with better star ratings. However, the driver of energy costs and energy star levels varies from sector to sector and additional drivers that enable actual operational energy performance are necessary.

3. Do 'Deemed to Satisfy' (DTS) provisions tend to erode or support good energy efficiency practice and outcomes?

Minimum DTS tend to become defacto industry standard practice. As such, they support good energy efficiency, but only if they are actually implemented to the intent of the NCC.

4. How widely used are 'Alternative Solutions', and how effective are they in encouraging innovative designs while meeting energy performance requirements?

Alternative solutions are often used to get around the complexity of DTS compliance.
It would be helpful to have access to specific performance benchmarks of similar buildings.
Alternative solutions can be very complex and achieving a specified performance benchmark may be a more efficient approach.
Quite possibly, the more significant innovation here is in finding ways to make the current or typical building orientation, massing and aesthetic paradigm meet the NCC performance requirements through better glazing performance, insulation and building services. Where mandatory disclosure of energy is in place, actual improved operational energy performance outcomes are effective.

5. Should the energy performance requirements be more transparent? If so, how could this be achieved?

Yes be transparent about what they are trying to achieve, quantify the outcomes you want in simple measurable terms.
This could be achieved or communicated via performance benchmarks from existing efficient buildings.

6. Are jurisdictional and climate zone variations in the NCC generating confusion or energy efficiency loopholes'?

Yes, state variations and climate variations add to the complexity.

Climate zone variations are important energy considerations and are complex in nature. We need to continue to consider different climatic zones (tropics are vastly different to Tasmania or Victoria). Lighter construction applies to hot regions and heavier to cold regions. There is scientific reason for such differentiation in the first place. How climate variations are presented within the NCC could be simplified.

Jurisdictional issues are confusing and can lead to non-compliance. There is also the issue of local planning authorities imposing minimum building requirements that creates more confusion.

7. Is there scope to improve energy efficiency outcomes at the building design and development approval stage? If so, how?

Better integrated design process for architecture/HVAC&R, minimum architectural energy performance standards, validation and verification of energy efficiency compliance.

It is well known fact that buildings can have good design yet perform poorly due to lack of tuning and proper commissioning and due to lack of skills and knowledge of building operators, who often do not understand the equipment and often take a reactive (to complaint) approach with temperature and control settings, leading to significant energy inefficiencies.

Mandatory disclosure of energy performance (i.e. CBD) impacts on all stages of the process. So having a robust energy star rating approach and nominating minimum levels would improve outcomes in design. It may be that there is an approach to constructing and metering that better defines actual performance to the respective parties (if a building is performing poorly was it the design, the construction or the operation; with the current construction and metering approaches there is no information).

8. Are the energy efficiency rating tools used by building designers and assessors giving robust and reliable depictions of the actual energy performance capabilities of the completed building?

Harmonisation of the technical basis and defaults embedded within each tool is important.

As stated above the capability will require a professional tuning/calibration and commissioning.

Given that the NCC separates fabric from systems it is unknown if the results are robust, but in reality you can only measure the overall energy performance.

This is not well understood for the residential sector, particularly as there are large differences in how dwellings are occupied, used and managed.

9. What is the scope for 'user error' in the application of the ratings tools or 'expert judgement', and how frequently does this occur?

There is a large scope for error and judgements in the application of the ratings tools.

Most tools are complex and inaccurate often require huge amount of paperwork as opposed to application of good engineering practice and common sense.

Errors and misapplication are likely a significant factor. Except for some sectors (e.g. Green Star accredited projects or NABERS Commitment Agreements) guidelines are often poor and, if they exist, are not well policed.

Rating tools (like FirstRate5) require accreditation and there are strict guidelines in their use. It is the DTS and JV3 methods that need more guidelines on scope and application.

10. Do you have any other comments to make on the use of rating tools?
NABERS assesses true performance, the protocols are very complex and assessments of the same building by two different assessors may vary. Tools should continue to be developed to improve the extent of coverage and to cater for complexity and to reflect true performance whilst becoming easier to use and more consistent. The market will police itself if there are regulated performance requirements such as CBD mandatory disclosure.

FirstRate5 doesn't give any indication of which areas of the building or fabric are not performing which makes it difficult to improve the rating in a timely manner. Perhaps these rating tool scan be upgrade to be more proactive in generating advice for energy efficiency interventions or modifications?

11. Other issues you would like to raise?

Building regulations need to take a holistic approach to the specification of energy efficiency building standards. The material in Appendix A is appended to provide a pump manufacturers view of the current mechanisms for addressing pump power and efficiency within HVAC&R and Section J. Many manufacturers share this view that energy efficiency needs to be addressed right through the supply chain whereas current regulatory approaches tend to focus on plant or equipment rather than incentivising best practice design and energy efficiency innovation.

4.2. Planning design certification

Comments on the questions posed in the issues paper:

1. What are the key challenges you meet when dealing with materials and equipment that impact energy efficiency? Do the impacts vary by location / climate / different building types?

Local skills and knowledge, service availability and "value engineering" or cost cutting at construction stage where inferior materials and equipment are substituted for specified materials and equipment for a variety of project related reasons.

The market works on low price tendering generally, this is well served by repeating previous solutions, cost saving innovations notwithstanding. Therefore, there is resistance (or inertia) toward innovation and new materials / equipment unless there is a clear cost saving including in materials, labour and operational risks. Even if innovative materials and equipment make it through the design

stage, there is a new set of dominant actors in construction and the materials / equipment run the risk of not being implemented.

2. What are your key interactions with other planning / design / certification professionals that impact energy efficiency? Does the answer vary for different building types, or different locations, or other factors?

Architect – builder- engineers – cost planners and certifiers all need to integrate their approach to building energy efficiency. There is a wider list of professionals that are rarely engaged in this discussion, for example: real estate and marketing professionals. If the broader group can be more engaged they will assist recognition of benefits (e.g. improved building value, reduced risk to rising energy costs, carbon pricing (when it returns), etc.).

3. How important are planning rules, schemes and requirements in determining the energy performance of buildings? Do you think the planning and building requirements/systems could work better together? How?

They should be consistent, building regs are national planning regs are state based with local variations either within, or beyond the documented planning schemes (Each Council can set its own planning requirements, in some states at least).

There is a strong drive amongst sustainability professionals and local government to use the planning processes (in Victoria at least) to increase sustainability requirements (in particular: energy, water, materials, bicycle parking) beyond the NCC requirements. Yes, the whole system could work better if it was integrated together and harmonised.

4. Are the building inspection and certification processes providing sufficient scrutiny of construction practices, and robust assessments of compliance with energy efficiency provisions of the NCC?

There is only self certification and validation of the self certification. There is no independent validation or verification of technical details, even on a sample basis.

Large professional companies elect to carry an independent verification of complex designs. Perhaps smaller players are using shortcuts.

The Victorian Building Regulations have various mandatory notification stages for inspection, these are only 4 such stages: the first 3 are specifically related to structural inspections (energy related items are not likely installed at these inspections) and the 4th is a final inspection (when energy related items are generally covered up.

5. How active are regulators in enforcing energy efficiency standards and practices in construction?

Not active, regulators typically rely on self certification. Regulators often don't understand the technical complexities of Section J themselves.

Building Certifiers are very conscious of their liabilities and scrutinise consultants certificates, but are not qualified to verify correctness of the complex calculations. Independent verification may be the answer, but will add a cost and time to the project.

6. Do the arrangements, in your state or territory, work to maintain the quality and independence of building certification?

No, for much of the market place particularly small developments. For larger developments that employ larger firms, these large professional firms do not risk their reputation and liabilities by not adhering to regulatory requirements.

7. What improvements could be made to the inspection and certification system in particular jurisdictions?

Perhaps there is not enough experienced experts, i.e. in Fire Engineering, who can certify alternative solutions to those prescribed by the BCA.

Introduction of additional one or two mandatory notification stages for inspection related to building insulation and building services fitout would assist.

Accreditation of assessors (similar to that required for FirstRate5) would also assist.

4.3. Construction phase

Comments on the questions posed in the issues paper:

1. Are NCC energy efficiency requirements and practices, detailed in Section 2.6 and Part 3.12 (Class 1 and 10) and Section J (Class 2–9) clear and well understood by builders, tradespeople and other building professionals?

Certain sectors of the industry (architects, builders, tradespeople) find that they are complex and confusing; probably because of an industry culture that does not value energy efficiency and therefore is not trained and does not spend the time (or are not paid) to understand. Many engineers are motivated, trained to understand these sections well, but are not engaged to influence projects. This may be addressed by ABCB in 2015/2016, in a current project to simplify Section J5.

It is not understood why certain impractical DTS requirements are in place; however, building design professionals generally understand the alternate solution approach can resolve such impracticalities. For example: in accordance to DTS requirements each building lift shaft would require insulation, which is highly unusual in certain circumstances (e.g. commercial construction). Therefore nobody complies with that requirement and this is an example of why JV3 performance based analysis is prevalent in certain areas of the market.

2. How much importance and attention to detail is devoted to delivering on NCC energy efficiency requirements?

Varies across building types, scales and through the various stakeholders. For example:

- Class 1 and small class 2 (residential) developments there is generally little importance placed on the detail other than meeting the bare minimum on the most favourable interpretation (there is usually no advertising of the energy star rating in this market).
- Commercial developments often see energy efficiency as important, so they extend beyond the minimum and advertise NABERS ratings.

- Large developments with a suite of professionals through briefing stages and design, place much more importance to detail than small developments that do not have this professional backup.
- Builders, tradespeople, architects, cost consultants, etc do not place high importance on energy efficiency and are therefore not trained and do not spend the time (or are not paid) to understand. Many engineers are motivated, trained to understand these sections well, but are not engaged to influence projects.

3. Are there major gaps or uncertainties in the NCC energy efficiency provisions that are causing problems for builders and service providers in delivering structures as specified and in line with energy performance standards?

Yes, lack of knowledge on new materials, practices and technologies for low emission alternatives. Certain aspects are excessively difficult to comply with, refer to AIRAH 2010 submission to the ABCB. This may be addressed by ABCB in 2015/2016, in a current project to simplify Section J5.

4. Where are these gaps or uncertainties most severe?

New materials, practices and technologies for low-emission alternatives; trusted validation of manufacturer/supplier performance claims.

There is a lack of understanding of how building materials (e.g. insulation and glazing) work and the implications of substituting one material for another. All glass is not the same, all insulation is not the same, the performance required from these elements must be carried through from design through installation into operation.

Regarding uncertainties, refer to AIRAH 2010 submission to the ABCB. This may be addressed by ABCB in 2015/2016, in a current project to simplify Section J5.

5. What are the key reasons for design standards of energy efficiency not being met?

No transparency of the actual energy result that is the objective of the regulated requirements.

No motivation or incentive to verify the performance of DTS as built systems or buildings.

Non-compliance during construction – material substitution for cost or buildability reasons.

Ostensibly, any certified building must meet section J requirements. In a high level sense, therefore, there should not be any malpractices. However, there are certain aspects that are excessively difficult to comply with, refer to AIRAH 2010 submission to the ABCB.

6. Do commercial pressures play an important role in non-compliance? How so?

Yes. Market failures around commissioning and verification. Lack of clarity on certification and compliance with building passive features and fabric.

Building operators are not qualified enough to efficiently operate the building. Most building owners do not have budgets for periodic tune-ups.

Virtually the entire market is based on competitive bidding. See question 1 under Planning design certification.

Material substitution for commercial-pressure (cost cutting) reasons is common, for example in the construction process specified glazing with necessary performance qualities is often "too expensive" and is substituted with a cheaper lower-performance brand.

7. What proportion of building projects (within a particular building class) embody significant deviations from design specifications that are likely to materially affect targeted levels of energy performance?

Anecdotally – most.

Industry does not have access to this data, state administrations may do but they do not share it.

8. Are availability and timeliness of delivery of energy efficient materials and products (e.g. insulation, high performance double glazed windows, hot water and HVAC systems) a major problem?

No this should be factored into the construction time-line, although specialised glazing does have a long lead time. Time is also used as a justification for substitution with an inferior product.

9. How common is substitution of below-specification energy efficiency material or products?

Anecdotally – a lot.

Industry does not have access to this data, state administrations may do but they do not share it.

10. Could the 'building requirements system' improve final performance? Could it, for instance, influence better 'tuning' practice?

Yes, commissioning is an essential stage for energy efficiency, building tuning during the handover and transition to operation period, as well as the other aspects of building commissioning, could be addressed by building regulations.

The 'building requirements system' has many aspects, for example, mandatory disclosure of actual operational energy performance impacts on improved NCC performance because there is a driver for the owner to ensure implementation at least to the NCC requirements and potentially beyond.

11. Is there scope to address these problems through amendments to the National Construction Code (please provide details), state building regulations, local planning provisions, information and training support, or in other ways?

Yes amendments to the National Construction Code as well as additional energy efficiency information and training support.

Extended commissioning and tuning including post occupancy evaluation as per the "soft landings" approach is the answer for good performing buildings post Practical Completion.

If mandatory disclosure is not an option, then policing needs to be improved. This would be via state building regulations that need to focus also on energy efficiency in additional to occupant and public safety, accessibility and the protection of neighbours. The risks of non-compliance need to be increased for the various stakeholders to promote energy efficiency to a higher level of action.

4.4. Renovations and additions

Comments on the questions posed in the issues paper:

1. Are the circumstances and thresholds that describe when Section 2.6, Part 3.12 and Section J provisions apply to renovations clear and reasonable?

No, they differ from jurisdiction to state jurisdiction; there should be a clear national approach. Practice Note 55 for residential additions and alterations is almost impossible to interpret.

2. When a threshold is passed, is it then clear which energy performance requirements apply, to which energy-using systems? How much discretion is exercised by building surveyors in determining answers to these questions?
No this should be made explicit in the regulations. Building surveyors seem on the ball with this issue. They demonstrate good judgment in using their discretionary powers regarding what items need to comply and which don't.

In Victoria, if the renovation passes the threshold, then full compliance with the regulations is required. For energy, like other aspects, this may be very difficult or impossible from a DTS perspective and alternate solutions are needed, even then, total compliance may not be feasible. The relevant building surveyor may consent to partial compliance but only from a structure, egress and fire perspective. This is an instance where regulation needs to update to ensure clarity.

3. Are there valid reasons why thresholds (for the application of Code energy efficiency requirements) should be applied by planning authorities rather than at a higher level, such as in the Code itself?

Can't think of any valid reason. If left to planning authorities there will be many varied requirements and this will not be efficient or effective.

4. How much do these thresholds vary from location to location and from building type to building type?

Unsure due to the complexity of individual jurisdiction rules.

5. Are 'Deemed to Satisfy' approaches a satisfactory mechanism for streamlining compliance while still upholding energy efficiency aims?

Yes, but they need to be transparent (in what they are trying to achieve), simple, believed and understood. We do not believe that the current DTS achieves this.

DTS is inherently more difficult for renovations and additions due to the variations in the starting point (i.e. the existing building itself). An approach that takes account of the best an individual building could be, and performance requirements some way toward that end may work; but this would be complex, expensive and require significant tool development.

6. Are energy rating and estimation tools well suited to the assessment of renovation projects?

Please note the comment above. A simple approach to setting the minimum requirement for assessment purposes would potentially make some upgrades unfeasible even though it may be best to upgrade this stock rather than demolish it.

Care needs to be taken with tools to ensure they cover/balance the important aspects in relation to the decisions being made from them. For example, per the above paragraph, if it is not feasible to make a building comply to an energy star benchmark, then this may be a factor in not upgrading or demolishing it; but non of the tools currently take account of the embodied energy.

Rating tools aren't generally well designed for renovations.

4.5. Information and training

Comments on the questions posed in the issues paper:

1. Does information or education products exist that assist you to comply with the energy efficiency requirements of the Code?

Yes AIRAH run courses for our members and industry professionals. The courses are designed for mechanical engineers and associated building professionals and are not well subscribed by technicians or builders.

It would be appropriate to ensure this question is answered by as wide a group as possible, for example: master builders, electrical and plumbing trades and professional associations such as architects, cost planners, project managers.

- Is the information provided accurate and sufficient? If not, please describe or list the inaccurate or insufficient materials.

ABCB guides and learning modules are very out of date (this is a current ABCB review project)

- If they do not exist, are they under development? By whom?

ABCB and others

2. What are the major barriers to increased implementation and compliance based on accessible and accurate information?

Lack of incentives for skills maintenance and continuing professional development for all participants.
Low risk of non-compliance.

3. What are the most effective information sources that you are currently using?
- Examples - building modelling software or factsheets

AIRAH training guides
Accessibility (cost) of the NCC / BCA.

4. What required information is missing in order to successfully comply? What are the gaps in the available information or training which need to be addressed?

Low-emission materials, practices, technologies and independent validation of performance claims.

Costing information for materials and labour. People will default to what they know and have seen proven in practice rather than risk a new approach. Information could be made available on a relative rather than absolute basis. Programming implications (what is the impact on others and the construction sequence/programme of various materials, practices and technologies).

5. What new information or materials do you need developed to support compliance or to go beyond compliance?

Low-emission materials, practices, technologies, application guides and technical guides.
Costing and programming information per above.

6. What are the most effective communication and engagement methods?
Y information only (brochure or technical manual)
Y industry-led informal information (trade or professional night)
Y online or mobile education
Y online tools or calculators
Y modelling tools and assessment programs
Y informal on-the-job training (peer to peer or mentoring)
Y product-based on-the-job training (manufacturer or supplier demonstration)
Y vocational education accredited training or short course (assessed) face-to-face
Y higher education program (assessed) face-to-face
Y industry short course (assessed) face-to-face
Y a mix of the above.
Yes to all, delivery methods need to be flexible, different methods for different cohorts.

7. Which providers are effectively engaging you in professional development to enable you to meet the energy efficiency regulations? Please describe your engagement, including the title of the program, provider and/or the engagement methods.

AIRAH: various division events, formal training, site visits.
Green Building Council of Australia: various CPD event, training, site visits.
Building Designers Association of Victoria: various CPD events and training.
Victorian Building Authority: various training.
AIA provide CPD training.

8. What upstream or downstream job roles or subsectors negatively or positively impact on your requirements to comply the energy efficiency requirements of the Code? Please describe who and the cause and effect scenario. How can this be improved?

Value engineering, cost consultants, project managers, etc for reasons of product substitution during construction phasae.

Upstream:
- Developers and owners often do not value energy efficiency and do not brief clear/strong requirements;
- Architects generally design to a similar paradigm as previously with the expectation that technology (better glass, more insulation, more efficient HVAC) will get them across the line.

Downstream:
- Builders and Contractor assumptions during tender that changes to specifications will be acceptable based on prior experience.

- Building Management that does not have a focus or need to ensure energy efficiency.

Project Managers often do not understand the above upstream and downstream impacts.

9. What is the preferred length of an information or education session? Please include which day(s) of the week and time of the day?

Varies for different delivery methods.

10. What influences contribute to you attending or engaging in further professional development?

All voluntary at this stage or as a membership of a professional institution. There should be more incentives for CPD uptake.

Appendix A – The perspective of an equipment manufacturer

Contractors often provide pump manufacturers with a list of Section J Table 5.4a, tabled maximum energy consumptions against scheduled duties, however these are often impossible to achieve. i.e.; the work required to move the water at the required flow and pressure, exceeds the allowable energy consumption, even if the machine doing the work, did so at parity / 100% efficiency!

The only ways to achieve the section J, or indeed exceed the requirements of section J is to Increase the pipe diameters or change the system layouts by compartmentalising the secondary / tertiary loops, combining new technologies, such as intelligent pumps and BMS controls.

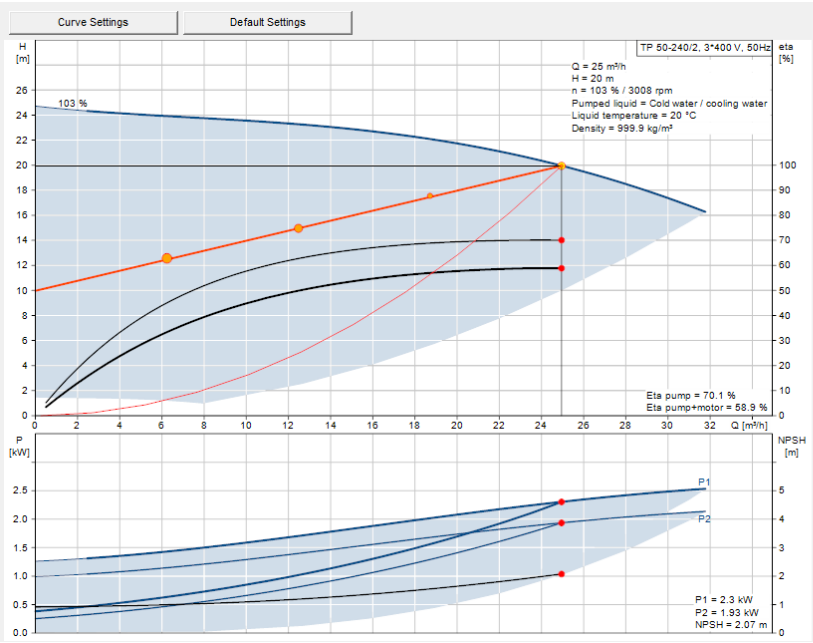
Thus section J compliance is often out of the control of the pump supplier. Though the selection of pumps should still have one primary focus. To be the most efficient pump for the application over its life cycle.

To do this we see 3 steps in the right direction

1. A good start would be to separately schedule the actual design duty and the selection duty inclusive of margin (as discussed in AIRAH DA01), thus making clear to all parties involved, the margin included in calculations to prevent further margins being applied unnecessarily, as we are all aware 99% of pumps are significantly oversized.
2. The next leap forward would be to schedule the peak duty point and the mean duty point, or alternatively phrased, the capability duty point and the actual duty point (both again scheduled with visible margins documented) this would allow for a pump manufacturer to ensure the pump is selected to run at its most efficient point at the duty where it will run for the longest period, but is still capable of achieving the peak load where it runs for 1 or 2 days a year.
3. The ultimate would be to have visibility of the full load profile for the pump, thus enabling the pump manufacturer to truly select the most efficient pump for the life cycle of the system. This combined with full testing of every pump to an appropriate standard prior to deliver will negate any further discussion about when should a drive be used, etc

Below is an example of two possible selections for the same peak duty, with the current selection criteria under section J we would probably select the TP pump, at a pump efficiency of 70.1%

However when one looks at the example, with arbitrary load profile and the resultant KWhr per annum it would actually be preferable to select the multistage CR pump which has a headline efficiency at peak duty of only 64.7 but due to different hydraulic profile and flatter efficiency curve, achieves a 7% lower electrical consumption per annum, a not inconsiderable amount.

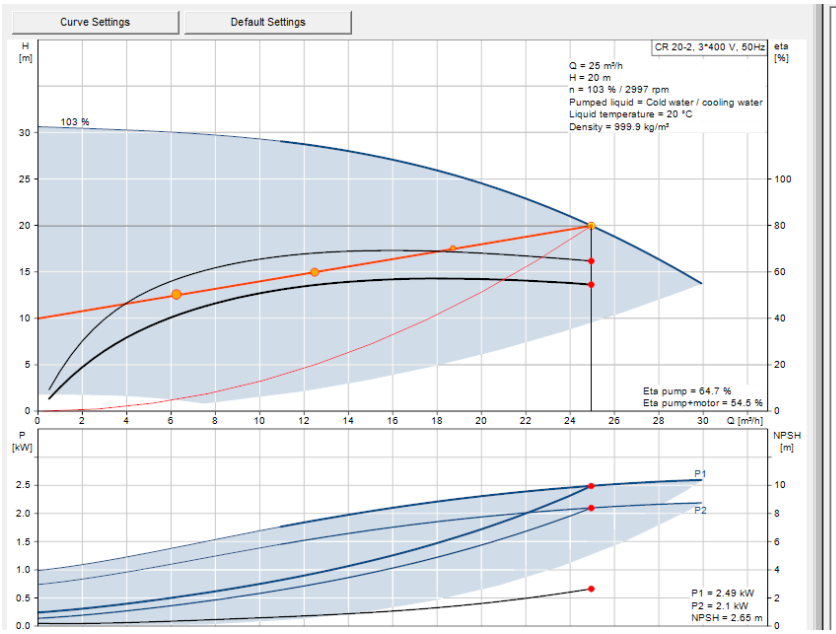


Type	TP 50-240/2
Quantity	1
Motor	2.2 kW

Flow	25	m³/h
Head	20	m
Power P1	2.3	kW
Power P2	1.93	kW
Eta pump	70.1	%
Eta motor	84.0	%
Eta pump+motor	58.9	% =Eta pump * Eta motor
Eta total	58.9	% =Eta relative to the duty point
Energy consumption	2418	kWh/Year
CO2 emission	1380	kg/Year
Price	On request	
Price + energy costs	On request /15Years	

Load profile

	1	2	3	4	
Flow	100	75	50	25	%
Head	100	88	75	63	%
P1	2.3	1.56	1.02	0.634	kW
Eta total	58.9	57.0	49.9	33.4	%
Time	144	360	840	1056	h/a
Energy consumption	331	562	856	670	kWh/Year
Quantity	1	1	1	1	



Type CR 20-2
Quantity 1
Motor 2.2 kW

Flow	25 m³/h
Head	20 m
Power P1	2.49 kW
Power P2	2.1 kW
Eta pump	64.7 %
Eta motor	84.3 %
Eta pump+motor	54.5 % =Eta pump * Eta motor
Eta total	54.5 % =Eta relative to the duty p
Energy consumption	2248 kWh/Year
CO2 emission	1280 kg/Year
Price	On request
Price + energy costs	On request /15Years

Load profile

	1	2	3	4	
Flow	100	75	50	25	%
Head	100	87	75	63	%
P1	2.49	1.56	0.936	0.514	kW
Eta total	54.5	57.1	54.3	41.2	%
Time	144	360	840	1056	h/a
Energy consumption	358	561	786	543	kWh/Year
Quantity	1	1	1	1	

Now we have seen the capability of a modern pump selection program, providing real pump curve data, combined with easy to read energy and life cycle data, we must also highlight another area that requires significant attention.

Anyone can claim high efficiency on their published curves, historically one pump of this type has been 'type tested', often after significant fettling and polishing to achieve very good efficiency on the one off occasion, but having carried out testing of unnamed pumps all over the world we know that the reality of the pumps received by customers is far from that on the published performance data. Fortunately or unfortunately depending on your perspective, this rarely gets noticed as so many pumps are vastly oversized due to rules of thumb, margins and margins on margins etc. We thoroughly advocate that all pumps and motors should be tested prior to leaving the pump manufacturers' factory to prove compliance to the published performance standards. There is of course a cost to administer this, but a cost that is negligible to the client, and providing it is legislated correctly will apply evenly to all pump suppliers and installing contractors, not disadvantaging anyone, except those that are stretching reality in their published data.

Other big hurdles in the creation of information flows and practices to enable best practice efficiency pumps and systems are:-

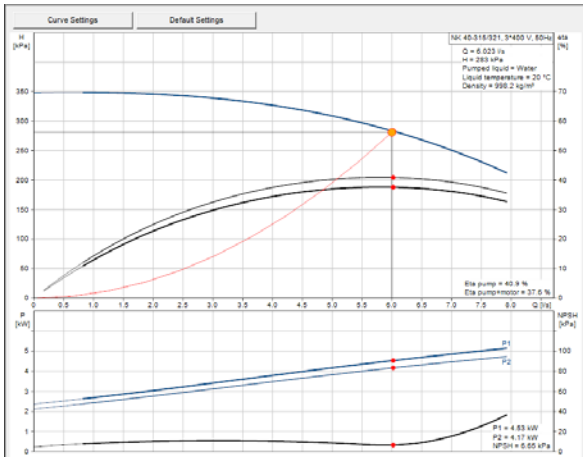
- Many pump specifications by default are a product of their own evolution with many conflicting clauses, because it is often possible to request a new clause to be added to a specification, yet engineers are not inclined to remove a clause, thus causing, conflict of information, inconsistency of interpretation. Historically this has been dealt with using unwritten rules of engagement. However where efficiency is a key driver, these erroneous clauses cause detriment to a proper pump selection, typical example of these causes are:-
    - 1) Pump must not operate above 24Rps of 1450Rpm
    - 2) Pumps must be long coupled end suction back pull out
    - 3) pumps efficiency must be above 70%

- 4) Pumps must be sized on mid size impeller and must have at least one impeller size above and the motor must be sized to cover the largest impeller.

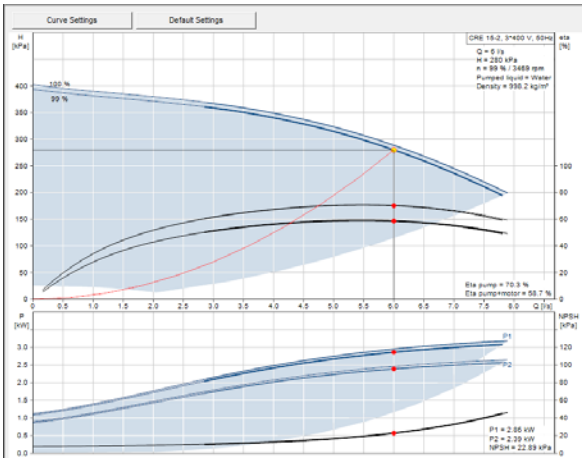
Take a pump required to achieve 6l/s @ 280Kpa
Selection A (NK40-315) complies with clause 1, 2 & 4 but not the efficiency clause
Selection B (CRE15-2) Does not comply with clause 1, 2, or 4(as it is not this type of pump) but it is over 70% efficient and compliant with clause 3 (30% more than the previous selection) saving 1.67Kw per hour at this duty.

Due to this ambiguity and openness to interpretation, as well as an element of resistance to newer technologies quite often the pumps selected are not the most efficient for the application as would most probably have happened in the below example.

Selection A



Selection B



In conclusion to move the market forward towards realisation of true energy efficient pumped systems utilising best practice and innovative solutions. We need:-

- Legislation to require 100% of pumps tested prior to shipment from pump manufacturer with matched driver, anyone can claim high efficiency, but to repeatedly produce pumps that are compliant with these claims requires quality and consistency which has cost associated with it. A cost that is often cut in favour of cheap install.
- A consistent method of scheduling duties, featuring the load profile of the pump and placing emphasis on the life cycle energy consumption, rather than the peak duty / peak Kw currently used.
- Industry bodies, legislators, consulting companies, need to push for a return of increased responsibility to the specifying consultants, enabling retention of design responsibility for installed equipment etc, thus maintaining focus upon quality, efficiency, and other long term goals that protect the client / building occupants for the future. The commercial pressure that is placed on builders and contractors to perform economically over the short term construction and defects liability period of a project, effectively forces them to seek loopholes or accept lack of compliance to achieve, lowest capital expenditure, and maximise profit. This ultimately negatively affects the long term cost of running the building, and progression of building efficiencies at a pace with other markets where consultants still retain their design responsibility and sign off powers.

End of AIRAH submission