Sustainable building using Passive Houses Principles Training program

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01 Acknowledgements

The Awarding Bodies

The Fellow sincerely thanks the Victorian Skills Authority (VSA) for providing funding support for the ISS Institute and for this Fellowship.

The ISS Institute plays a pivotal role in creating value and opportunity, encouraging new thinking and early adoption of ideas and practice by investing in individuals. The overarching aim of the ISS Institute is to support the development of a 'Better Skilled Australia'. The Institute does this via the provision of Fellowships that allow Australians to undertake international skills development and applied research that will positively impact Australian industry and the broader community.

The ISS Institute was founded in 1991 by a small group of innovators, including Sir James Gobbo AC, CVO, QC, and former Governor of Victoria, who had a vision of building a community of industry specialists who would lead the up skilling of the Australian workforce.

The Fellowship program builds shared learning, leadership, and innovation across the broad range of industry sectors worked with. Fellows are supported to disseminate learning and ideas, facilitate change and advocate for best practices by sharing their Fellowship learnings with peers, colleagues, government, industry, and community. Since its establishment, ISS Institute has supported over 580 Fellows to undertake skill and knowledge enhancement across a wide range of sectors which has led to positive change, the adoption of best practice approaches and new ways of working in Australia.

The Fellowship programs are led by our partners and designed to achieve the needs and goals desired by the partners. ISS Institute works closely to develop a Fellowship program that meets key industry priorities, thus ensuring that the investment will have a lasting impact.

For further information on ISS Institute Fellows, refer to www.issinstitute.org.au

Governance and Management

Sponsor – the Victorian Skills Authority

The Victorian Skills Authority works in partnership with the International Specialised Skills Institute by funding the VET International Practitioner Fellowships. The Fellowship program focuses on developing opportunities within the VET sector to assist in building an Education State in Victoria that produces excellence and reduces the impact of disadvantage. In addition, the program is funded to support the priorities of Skills First, including developing capacity and capability, innovative training practices and increasing teacher quality within the VET sector as well as building industry capability and developing Victoria's current and future workforce.

Fellow's Acknowledgements

The success of this fellowship is credited to the following companies and individuals who have helped me along this journey.

Kangan Institute, who have provided the opportunity to apply for this fellowship. Education managers, Tony Lea and Carole Petchell, at Kangan Institute have played a major role with supporting the program and provided ongoing mentorship.

GEO Corrections supported the concept of training prisoners to develop their skills in environmentally-friendly construction within the Cert II Construction course. GEO has seen the potential in rehabilitating prisoners with the skills of the future, and have taken a key interest in the development process.

The International Special Skills (ISS) Institute has given me the opportunity to implement an idea that would have stayed a dream. The continuous support and directions from Wendy, Dion and Katrina is the key to outcome of this fellowship.

Jenny Sims, from Structural Insulated Panels (SIPs) WA, provided all of the vital information on SIPS Industries and training modules. Jenny also played a key role in networking current project owners/ builders/architects to develop hands-on building experiences. These meetings provided insights into the construction methods, challenges as well as solutions to potential issues as they arise.

Passive House and Smart Plus Academy, in helping with Passive House Consultant and Passive House Trade certification process in Australia. Smart Plus Academy provide a scholarship for the Passive House Trade course to add to the benefits of the fellowship program.

Thanks to the Australian Asian Corrections Education Association (ACEA) for the opportunity to present on the fellowship program at the 2021 conference held in Melbourne. The conference created responsiveness to implement the program across other states, with particular interest in the probability to run a pilot program in remote Aboriginal areas.

02
Executive summary

This ISS Institute fellowship looks at Passive House building principles in relation to sustainable and energy efficient construction in Australia. The fellowship provided the opportunity for Michael to obtain certification as a Passive House Consultant and as a Passive House Tradesperson. The course is based in London England, but due to COVID restrictions, the course has been completed online. The Passive House Consultant certification has provided the skills to develop a course on Passive House Construction that can be taught within the prison sector.

The purpose of this fellowship is to develop a training program that can be introduced to upskill prisoners studying construction and fill a labour gap within building industry for skilled construction workforce with Passive House knowledge.

The Victorian education sector has designed the construction qualification with the ability to integrate sustainable building modules as part of training package. Passive House principles can be introduced to provide skills in sustainable building practices.

Michael has chosen this topic because sustainable building principles need to be an integral part of construction and Passive House is a solid foundation for sustainable, energy efficient construction skills required to fill the gap within the construction sector.

Passive House is a concept born in Germany and is prominent across Europe. Michael chose to travel to England to get certified as a Passive House consultant but due to COVID was able to complete the certification online.

Some of the research findings include the following:

- Victoria and Tasmania are the perfect locations to implement Passive House buildings to combat the cold conditions. However, with the rapid changes in temperatures warmer locations such as Northern Territory and Northern parts of Queensland could benefit from Passive House buildings to cope with the heat and humidity. *Passipedia (2018). Passive houses in tropical climates*
- The construction course could easily dedicate a module to Passive House principles providing insights to apprentices or construction students on sustainable construction. *Mary J North (2015) The underlying, preexisting work Defining the Nearly Zero Energy Building: Passive House + Renewables.*
- The demand for skilled Passive House trade workers is extremely high because when building a Passive House, the recommendation by PassiveHaus (the Passive House Governing Body) is to have Certified Passive House consultants and trades complete the project. *Tom-Pierre Frappé-Sénéclauze (2017) Growth in Passive House buildings: A sign of market transformation underway.*

- According to the Sentencing Advisory Council in 2019 -2020, 37% of prisoners released returned to prison within two years. *Cynthia Marwood (2020-21) Sentencing Advisory Council, Annual Report.*

The goal is to produce a rehabilitated prisoner with the skills to enter the workforce with an advantage over the general labour group. There is demand for trades certified with Passive House qualification in the construction sector. The concept of integrating a hands-on approach to structured learning by i) link the theory of Passive House principles with the Certificate in Construction ii) introducing sustainable building practice to prisoners as part of the rehabilitation and iii) producing good job opportunities in the field on release is the key to reducing reoffending and return to prison. This proposed model of structured learning as part of the rehabilitation will be the first progressive step in helping this cohort enter the workforce with solid skills and hands-on experience on release.

03 Findings

Michael's travel plan to England to complete the Passive House course was cancelled due to COVID, therefore Michael completed the course online and had many an opportunity to discuss the challenges and new technologies implemented in other countries. The course was challenging and difficult for people without a mathematics and physics background. As a result, teaching Passive House concepts would be near impossible to a cohort with low LLN.

Based on research, Passive House building is still new to Victoria and Australia, compared to Europe where there are more extreme temperatures and aware of the technology. The building industry, government and communities as a whole are pushing towards stricter policies with energy ratings and industry standards with governing bodies such as NatHERS (Nationwide housing energy rating scheme) who used to certify sustainability aspect of new builds. NatHERS extends far beyond home energy ratings. It symbolises a collective commitment to a more energy efficient, net zero future. *NatHERS Star (19th Dec 2023) Year in Review – NatHERS turns 30!*

A "Passive House is a building standard considered the most rigorous voluntary, energy and health-based standard in the design and construction industry today, resulting in buildings that consume as much as 90% less heating and cooling energy compared to conventional buildings." *Talina Edwards (2019) A Guide to Passive House Building.*

The benefits of a Passive House design are as follows: healthier living with better air quality, comfort driven by thermal balance and affordability as they eliminate the running costs of heating and cooling. *Grove-Smith, J., Feist, W., & Krick, B. (2016). Balancing energy efficiency and renewables*

The intention of the fellowship is to use advancements in building design, building technology (products) in conjunction with energy efficient construction standards; in this case Passive House principles to develop a training module to educate the labour workforce.

International Vs Victoria

During the research process, and while completing the course, one of the major contrasts between Victoria and countries in Europe was the application of the Passive House principles to different climate zones. The Passive House principles were exactly the same, but the difference in the specifications were substantial. *M. Economidou, V. Todeschi, P. Bertoldi, D. D'Agostino, P. Zangheri, L. Castellazzi (2020) Review of 50 years of EU energy efficiency policies for buildings: Energy Build*

An example of the climatic conditions, in Europe or America where Passive house is predominately implemented, is in colder climate zones with temperature ranging from -50C to 10C for 30 to 40 percent of the year. Comparatively in Australia, the coldest states are Victoria and Tasmania with minimum temperatures in parts of these states falling

below 0C during the winter period. *Talina Edwards, 2019, A Guide to Passive House Building*

To address this difference in temperature, there needed to be a realignment of the Passive House Principles such as insulation thickness, window specification, positioning of the building, size of heating unit within the Heat Recovery Ventilation (HRV) system, size of heat pump, cooling unit and air tightness of the building envelop. *Feist, W. (2013). Energy concepts—the passive house compared.*

The second point of difference is that the construction code in Europe or America does not align with the National Construction Code (NCC) in Australia. This will be challenging because NathHERS is designed to focuses on the outcome and Passive House Principles is designed to focus on the process. Matthew Carland, 2019 *What is it like to live in a passive house in Melbourne* for example, the energy efficiency standard used in Australia is developed based on a different set of parameters compared to Europe or America. Furthermore, the Passive House principles need to be realigned to suit the (National Construction Code) NCC. The lack of uniformity within the construction code from one state to another creates barriers for specifications. For example, the wind rating aspect in Queensland is invariably higher than Victoria. This is due to the size of Australia, with different climate zones in the different regions in comparisons to countries in Europe. *Andy Marlow, (20 Nov 2020) Passive House design and Construct*

National House Energy Rating Scheme (NatHERS) energy guidelines for construction in Australia have no direct integration with Passive House principles. Therefore, understanding the international implications of the Passive House principles was key to developing a link between the principles and the NatHERS energy guidelines for Australian recognition.

Therefore, the proposed training program will be developed to Australian standards using a combination of the NatHERS checklist and the Passive House building principles as the foundation.

Link to Vocational Training and Education (VET) sector

The Certificate II in Building and Construction Pre-apprenticeship that is delivered within the prison sector is made up of 16 modules. These modules comprise different tasks that form the foundations of construction. Within the construction qualification there is a specific module that focuses on energy efficiency and sustainable building. Appendix 2 and appendix 3 present an overview of the module outline and competencies.

Michael will use the learnings of Passive House Principles and introduce them into the energy efficiency module as part of the learning and assessment process. The competencies of the module will be aligned to the 5 core building principles of Passive House, and the assessments will encompass the application of the Passive House Principles to sustainable construction practices as covered in the National Construction code (NCC).

Benefits to the industry sector and organisation

This fellowship has given Michael the opportunity to become formally qualified as a Passive House Consultant and identify gaps in the industry sector for specific skills development in sustainable building using Passive House Principles. Working as a teacher in the correction sector provides a solid sample of mature learners with different levels of construction experience to further develop their knowledge and skills in Passive House Principles. Therefore, on release these students will be absorbed into the workforce thereby encouraging them to stop reoffending.

04
Considerations and next steps

Research challenges

The biggest challenge that was faced during the fellowship was the stark contrast between the building codes locally in Australia versus other parts of the world. Michael found that it was difficult to develop a construction training program due to contrast in regulations and building practices. Therefore, Michael will only focus on the National Construction Code (NCC) to develop the training program.

Future plans

- The objective is to develop a training program that will give prisoners the skills to enter the workforce with qualification and skills for future growth by career development in the construction sector.
- As part of the program present the big picture on the impact of the course. For example: Understanding the direct impact of sustainable energy efficient homes in proportion to lower energy costs/ living costs.
- This module will be a good starting point for industry bodies like VBA, HBA, Master Builders, NatHERS and training providers to work together towards a common goal.
- The course is designed to use new technologies and building systems/products to achieve the same outcome, some of the driving factors include:

a. Cost of production can be described as dollar value of the product in relation to product life, carbon footprint and living standards. For example: bricks are cost effective with a long lifespan, but the energy used in production causes a lot of greenhouse gases and bricks are poor insulators. *H. Rodrigues, F. Gaspar, P. Fernandes, A. Mateus (Eds.), (2020) Sustain. Autom. Smart Constr.*

b. Decomposition and/or ability to recycle the product, evaluates the lifespan and the decommissioning cost. For example: mud brick, has great insulation properties, they do not emit any chemical fumes and can be manufactured with relatively low costs and energy. The key trump card here is the ability to return this product to its original state (mud). *S.B. Sadineni, S. Madala, R.F. Boehm: (2011) Passive building energy savings: a review of building envelope components*

c. Waste management: the ability to use a product that eliminates/reduces waste. For example, hemp fibre is considered a positive carbon product as it grows within 12 weeks, requires minimal soil quality (improves soil), produces oil and other medical extracts. In relation to building, the waste is shredded into

fibre and mixed with mud to build houses. The end product is extremely strong due to the fibre composition and has no chemical in the manufacturing process. *Angeliki Kylili., Milos Ilic., Paris A. Fokaides., (2015) Whole-building Life Cycle Assessment (LCA) of a passive house of the sub-tropical climatic zone*

d. Quality of living: understanding the direct impacts the products used within construction on the health and lifestyle of the resident. For example, the difference between a passive house and a conventional home is no different visually. The difference is felt after living in the house. The mechanics used to control air quality and temperature to the optimal setting, balanced with the ideal flow of natural light and being enclosed in a well-insulated environment is the underlining difference.

- This program will address the housing crisis across the state, research states that: Over 48,000 Victorians are looking for a place to live – and 25,800 households require urgent assistance. Women over 55 years are the fastest growing group experiencing homelessness. Victoria has the lowest proportion of social housing in Australia at 3% of all dwellings. The National average is 4.2%; and even this is low by international standards. There is a chronic shortage of affordable private housing properties. Few are dedicated to helping residents out of social housing and into their own home. *Lord Mayor's Charitable Foundation (February 2021) Greater Melbourne 2020 Vital Signs Report. Homes Victoria - Sector Consultation Paper.*

The increased cost of living has impacted the demand for affordable homes resulting in low-income earners unable to enter the housing market. As a result, dual income family, as well as single income families will be faced with challenges in entering the housing market. This imbalance in society where working-class struggle with housing affordability will result in follow-on effects such as being is a state of continuous poverty (like third-world countries, the children of these families will be disadvantaged and the drift between the population will be based on socio-economic classes for generations). *Aiv Puglielli, Sarah Mansfield (2023) Inquiry into the rental and housing affordability crisis in Victoria: Legislative Council Legal and Social Issues Committee.*

The future plan is to address the housing crisis and issues with global warming faced in Australia by providing a skilled labour force that will solve this problem one home at a time.

Next Steps

- Short-term:This fellowship has focused on direct short-term results (2 years), and development and implementation of a training program to help prisoners enter the work force with specialised skills in energy efficient construction using modern advanced building products. The training will focus on the Passive House principles as a building standard and understanding the five core elements and their relations to energy efficient building. Michael intends to use SIP's (Structurally Insulated Panels) as the building medium to teach concepts of prefabricated building to Passive House standards. The goal is to help prisoners understand the application from a real-world perspective by hands-on building practices integrated into the Certificate II in Building and Construction Pre-apprenticeship program currently operating within the prison sector.
- Long-term, sustainable, achievable solutions: this fellowship addresses the underlining issues the people experience as a society:

  a. Increased cost of living

  b. Housing demand and unaffordability

  c. Climate change

  d. Recidivism

  e. Long term industry with prisons

Step 1: fellowships goal is to develop a skillset that is driven by economic demand and environmental impacts, ensuring that all prisoners who leave with the qualification/skills can enter the workforce with

a unique advantage and skill in the construction sector.

Step 2: once within the industry, the hands-on application of the Passive House principles will open doors into future career development and increased responsibility. This is driven by demand and the lack of human resources that understand energy efficiency from a building perspective.

Step 3: there are opportunities that can be implemented within the prison, like projects in Europe and America where prefabricated homes are built within factories and shipped to site. The benefit is cost, speed and quality control are maintained within solid workflows, for example:

a. The designs are specified to minimum load ratings keeping costs down in timber sizes
b. Trades directly employed by the building company (in-house) thereby not dependent on third-party contractors
c. Efficiencies are maintained by stock on-hand and constant workflows
d. Construction is not impeded by weather conditions

Step 4, during the research process, Michael discovered one of the biggest issues from the production companies was the inability to keep up with production due to the lack of raw materials, continuous shift in pricing, and the inability to find qualified staff/trades.

One of the companies was interested to see if the SIPs product could be manufactured in the prison if the company invested in machinery. Based on Michael's experience, the opportunity to manufacture SIPs within the existing construction warehouse is an easy transition. This would create an industry within the prison to supply a specialised product to the construction sector. *(This could be considered as a separate followship program as the viability has been assessed)*

Considerations for Policy Makers and Victorian Skills Authority

Michael will need to partner with the Department of Education and Training and the Victorian Skills Authority to develop and implement a new module specific to Passive House principles within existing modules of the Certificate in Construction course. This process would involve conducting a review in collaboration with construction teachers and course developers at Kangan TAFE in the Fulham corrections centre. This review would go hand-in-hand with implementing the learnings and outcomes that Michael has completed in the Passive House qualification certified by the Passive House Institute in Germany.

Energy efficiency and sustainable home design is the driver for future construction standards. Michael's fellowship has helped develop insights into different energy standards implemented across England and other European countries by networking with companies such as SIPs at Clays, Airboss Dan, Valley workshop and SIPs industries during the fellowship journey. The goal is to assess Passive House principles in comparison to the NatHERS energy rating regulations in Victoria. This comparison will identify specific areas in the building code that can be adjusted for larger energy efficient outcomes closing the skills gap. A perfect example of this is the introduction of double-glazed windows based on understanding heat transfer/loss from windows, the outcome was the opportunity to close the skills gap for manufacture of double glaze windows. Aspects such as airtightness, membranes and thermal break in concrete slabs could be examples for new skills to be developed in the construction sector. Based on the specific areas of skills development there is opportunity to integrate with industry bodies and business with Victorian Skills Authority in the training and assessment development process so they align with specific on the job skills. An example of this is the opportunity to team up with Valley Workshop, a SIPs manufacturer, to set up a SIPs manufacturing facility in the prison industry sector.

The cohort within the correction sector is a perfect training sample to trial new concepts of Passive House principles as part of the sustainability module within the Certificate II construction package. These learnings will be introduced in the form of classroom-based activities, project and question and answers assessments to the existing students studying construction at Fulham campus. The process of teaching, compliance and assessment will be reviewed and validated by the two construction teachers and one engineering teacher to ensure that the training and assessment on Passive House principles are in line with the key competencies and that the assessments meet the criteria of being i) Valid ii) Fair iii) Flexible and iv) Reliable. The follow on from this stage is to implement the program at the other Kangan Correction sites like Ravenhall, Barwon, Beechworth and Port Phillip and conduct a review with the construction teachers at those sites.

The Victorian Skills Authority will be part of the development program to help prisoners complete their rehabilitation and leave with specialised skills that will be recognised by industry. The goal is to present opportunities for people leaving a correctional facility thereby giving them an advantage to enter the workforce and reduce recidivism. By having alliances with business these students can be monitored in the work place by the employer and to evaluate if these skills have directly impacted on the job. This fellowship builds a link with the student, the concept of sustainable construction, the training organisation, the Victorian Skills Authority and industry to ensure that all parties are working towards a common goal of sustainable construction and to reduce recidivism.

Recommendations

Limitations

Some of the limitations that will need to be addressed are:

- Working within a prison environment, will impact accessibility to raw materials in and out of the premises. The checking procedure is stringent and can hold up materials going in and out. Some of these materials could be used as a weapon or used as drug consumption e.g. glue and other adhesives
- The cost of purchasing raw materials; corrections operate on a tight budget and obtaining raw materials to teach could be a challenge. In this case, the cost of a truck load of SIPs could be approximately $40,000 and attaining the funding for this will require time and permits.
- Quality control, while a large percentage of the cohort are keen learners there are a few that would be problematic and require weeding out.
- Follow-on support is critical for released prisoners because a direct link between the prisoners, job opportunities, the employer, and the teacher is key to long-term development and progress. Due to privacy issues, teachers are not allowed to follow up the prisoner development and progress on release.
- Sometimes there is the challenge of obtaining a job with a prison record, employers should have the opportunity to ask the teachers for references prior to employment.
- Poor LLN, in most cases prisoners have below average LLN skills, this could cause a loss of confidence and be a hindrance to entering the workforce. Considering the nature of this qualification LLN does not play a key role in completing the work.

Ability to replicate the training program will be challenging, once developed the training program must be designed to transfer across other facilities. To have a seamless transition teachers need to be trained and have access to continuous support.

05
Impact of Fellowship

Personal

This fellowship has given Michael the opportunity to obtain formal certification as a Passive House Consultant. As a result, Michael will be in a position to provide advice on topics such as energy efficient living, and ecofriendly design. The knowledge gained from this fellowship has provided him with a new appreciation for the environment and the belief that every person can make a difference in the greater goal of reducing the consumption of energy thereby reducing their carbon footprint.

Professional

The fellowship has provided opportunities to engage with other professionals and evaluate different presentation approaches. The teaching process in European countries are different from Australia. For example: one of the direct changes in delivery that Michael has replicated is to make the student create a need to understand the topic, this can be implemented by either linking the topic to their day-to-day life (application) or developing an importance for the topic: impact to the students' interests (impact). For example, 'Building Passive Homes': understanding the health benefits of living in a Passive House (application) or the direct impact of Passive House on climate change (impact). This change in the delivery has been an eye opener in student engagement.

Organisational

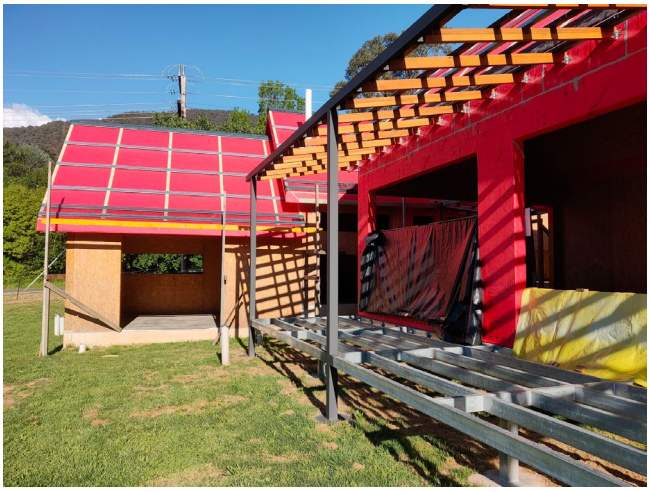
The outcome of the fellowship is to provide Kangan Institute with a training program that can be implemented across the current site and transferred across other sites. Kangan Institute has helped Michael complete evaluation and validations to understand the existing key elements and performance criteria that can be linked to the principles of Passive House design.

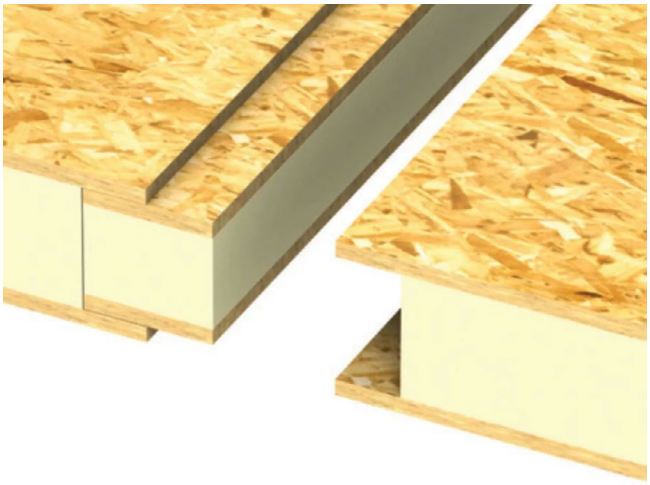
Broader Vocational Education and Training (VET) Sector

As a result of this fellowship the VET sector will have the opportunity to add a specialised module on Passive House Principles to the construction certificate. The assessment will also be presented to an internal audit group within Kangan Institute to ensure that the training and assessment program meets the required standard. All audit feedback will be reviewed and modifications completed in line with the recommendations.

The pilot program will be validated using the existing students enrolled in the Certificate II in construction program at the Fulham correction centre. The learning development will be measured as part of the assessment to check the knowledge and skills obtained from the course. The long-term goal is to create and replicate the training program within all prison sectors and continuously improve the course to suit changes in the demand and environmental regulations

The future plan is to create and replicate the training program within all prison sectors and continuously improve the course to suit changes in the demand and environmental regulations. This program will monitor any developments in the field by tracking job opportunities and positions filled by completing the course; this is to provide real statistics on the validity of the program.





06

Sector Engagement (Dissemination)

The first step to achieving the end goal was certification. Michael was registered to be in the UK, due to COVID the course was completed online. In June and July 2020, Michael successfully completed the Passive House Trade and Consultant certification from the Passive House Institute (London, England). The plan was to visit SIPs at Clays factories in the UK to understand the manufacturing process of structurally insulated panels, the goal was to obtain knowledge on the logistics and installation process. This meeting was cancelled due to COVID as well and was moved to online and telephone communications.

SIPs at Clays referred Michael to sister company called SIPS Industries Australia based in Fremantle WA, this became a key contributor in the next steps of the learning phase. Jenny Ritz from SIPS industries worked closely with Michael and referred a lot of the Victorian based projects and obtained access to the development sites during installation.

Over the period from January 21 to August 22, Michael worked with Tim Slater (owner builder) who was constructing a Passive House in Wandiligong (near Bright VIC). This project was the first Passive house build for Tim who had an IT background and a great learning experience for both parties.

In December 2021, Jenny Ritz refereed Michael to Alex Corbeanu who worked for BUILD Group Commercial Developments. Alex has an engineering background and was working on the Latrobe Regional Hospital extension. Alex introduced Michael to the engineering aspects of Passive House construction with engineering computations. This stage was a mile stone in understanding the direct benefits of Passive house with the large-scale spans, and the implemented strategies to maintain the strict Passive House requirements for certification. Alex provided samples of SIPS products for teaching purposes and to help the students understand the concept of splicing (connecting 2 panels together with 100% airtightness). SIPs walls can be spliced together with either two laminated timber studs or a SIP spline (a narrow short SIP that slots in the main SIP recesses) the SIP splice provides better insulating qualities as well. *Corbeanu, A., (2021) An introduction to building with structural insulated panels: Radar Communications.*

The development of the training resources has been an ongoing process between the period of July 2021 to August 22. John Crocker and Rob Sandell, both construction teachers in Fulham correction centre helped with resource development and simulated testing on some of the Passive House Principles. This stage being the most challenging as materials entering a correctional facility needed to meet strict regulations. For example: Construction of SIP's panels within the construction and engineering prison industry sector was a great introduction program, as the students would be exposed to first stage of construction. The finished product could be sold to

the industry and opportunities tied to prisoners on release to stay with the builders. However, this idea was disregarded because i) the glues used to make the panels did not meet the prison regulations, ii) the initial set up cost of forty thousand dollars was not feasible and iii) the facility did not want to employ more staff to help with the supervision of the process.

In April 2021, Michael completed a training session with 'Airboss Dan' in the steps to membrane a building. A Passive House is completely airtight hence if there is an imbalance in the temperature, this will result in mould growth. The membrane stage plays a key role as the building will have a lot of moisture to release and the membrane needs to be waterproof yet adaptive to releasing the moisture. For example, a cold glass of water will have moisture on the outside of the glass due to the temperature difference inside versus outside the glass, this is the same physics with a building.

Michael was a key note speaker at the "Innovation in Interesting Times" 14th International Australasian Corrections Education Association (ACEA) Correctional Education and Training Conference 2021. The fellowship project was presented focusing on areas such as i) the link between the training program and recidivism. ii) application of the training program in the construction industry iii) dealing with LLN challenges specific to Passive House-training principles.

At this conference key note speaker: Pat Dodson., Shadow Assistant Minister for Indigenous Affairs and Aboriginal and Torres Strait Islanders, presented challenges faced with housing within Indigenous communities in the Torres Strait and the potential opportunities to build sustainable accommodation in remote regions using local communities and training on the job. This conference presented the opportunity to talk about the fellowship and the direct link to the challenges faced in the Torres Strait.

The key to a successful fellowship is the people with like-minded interests that cross paths along the way. The network built during this stage provides experience into potential challenges and methods to combat the issues that arise along the journey.

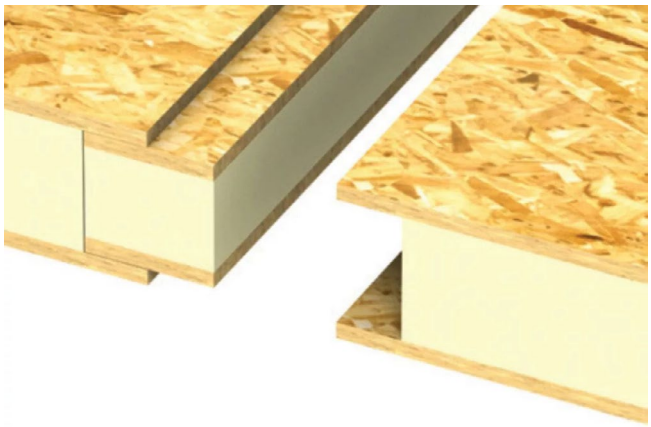
Apart from the above list of industry experts, Michael has engaged with social communities living with a minimal carbon footprint to understand the day-to-day difference experienced living in sustainable communities. An example of one of these communities is 'The Cape: Australia's most sustainable estate', about a hundred and fifty kilometres south east of Melbourne.

07
Conclusion

Michael has used the fellowship to address some gaps within the corrections education sector. The goal of the fellowship here is to help prisoners develop specialised knowledge and skills within the construction sector to address the demand in social housing coupled with Passive House Principles.

The idea is to help reform prisoners by giving them the tools to obtain employment and progress in an industry sector facing high growth and skills shortages, and to emphasise sustainable building practices.

This fellowship also focuses on reducing recidivism in the prisons sector, by making sure that the skills obtained via training will present opportunity in a market segment that has continual growth and demand. Therefore, the prisoner will have a progression plan tied in with continuous improvement and personal development aligned. This development process is aligned with better job opportunities, and increased responsibilities within the current role presenting a clear road map of progression with certification in construction that is recognised Australia wide.



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09 Appendices

APPENDIX 1

Overview

This 5-day training course helps learners to achieve the Certified European Passive House qualification. The course prepares you for the Passive House exam which is set by the Passive House Institute.

It is delivered by a certified trainer from the University of Strathclyde's Energy Systems Research Unit (the BRE Centre of Excellence in Energy Utilisation) in partnership with the BRE Academy. The course provides you with the knowledge and skills needed to pass the Passive House exam as well as giving you a head-start for contributing to the design of residential Passive House projects.

You are required to undertake self-study of several online modules (video material plus exercises – approximately 26 hours in videos and quizzes plus 3-6 hours for a PHPP project) prior to attending the one week's intensive classroom training. It is important to complete this work to improve your understanding of Passive House and to maximise your benefit from the classroom training. You will also undertake mock exams to gauge your progress

Please note: As part of this training course, you are required to purchase the PHPP 9 (2015) software. This can be purchased from https://www.aecb.net/product/passive-house-planning-package/ at a cost of £160 + VAT for non-members and is required for the online modules. *(Please allow 7 working days for delivery of manual and disc.)*

The course includes detailed topics covering:

- Passive House facade details
- Construction heat bridges
- Passive House windows
- Air-tightness and Blower Door Test (demonstration)
- Thermography (demonstration)
- Ventilation & MVHR (design, commissioning and testing)
- Summer comfort
- Utilisation of residual heat
- Quality Assurance during planning, on site and commissioning
- Passive House Planning Package (PHPP)
- Financial calculations for PH decision making

There is also the opportunity to engage with BRE experts.

The course cost includes your Passive House examination fee. The exam is taken a few weeks after the training course to give time for learners to consolidate their learning. If an exam retake is required, then an additional fee is charged.

RIAS/RIBA/CIBSE/AECB/ CIAT/Passivhaus Trust members can receive 15% discount. Please enter the code PH2020 when prompted on the booking page.

Monday	Fundamentals	Building Services Day 1 incl. site visit
Tuesday	Science Day 1 incl. site visit	Building Services Day 2
Wednesday	Science Day 2	Passivhaus Planning Package (PHPP) Day 1
Thursday	Construction	Passivhaus Planning Package (PHPP) Day 2
Friday	No session	Revision day

APPENDIX 2

Guiding you through the process of becoming a Certified Passivhaus Designer/Consultant and giving you the confidence to tackle UK Passivhaus projects.

The course is aimed principally at building professionals in the UK and prepares delegates for taking the Certified European Passivhaus Designer qualification. It introduces the principles behind the Passivhaus standard and methodologies, and the use of the Passivhaus Planning Package (PHPP) for achieving low-energy performance, with the teachings firmly based on UK building examples. The AECB CarbonLite Programme is designed to prepare delegates, not only for the exam, but for future involvement in very low-energy building projects.

Audience:

Our course is aimed at architects, builders, building engineers and others who want to learn how to design and deliver real low-energy buildings. To successfully complete the full course and exam, you will need to have some knowledge of UK construction systems, an ability to read building plans and an understanding of algebra. Delegates who do not wish to take the exam can opt to take specific modules only to enhance their learning in particular areas.

Programme:

Additional: Online Term course (1 year’s access included in price)

Course Syllabus:

Fundamentals of Passivhaus (1 day)

This course introduces the principles behind the Passivhaus standard and methodologies for a variety of building types, and the use of the Passivhaus Planning Package (PHPP) for achieving low-energy performance.

Science of Passivhaus (2 days)

This course addresses the fundamental physics of heat loss and gain, and shows how each of the required values can be calculated. It also looks at what is necessary for thermal comfort. It deals with the energy balance of windows, the energy balance of the whole building, and how to calculate the remaining heating requirement. The course deals with the primary energy requirement for the whole building, i.e. hot water, appliances and lighting. This is a course for those who want to understand the physics of energy in buildings.

Construction of Passivhaus (1 day)

How do I build a Passivhaus? How is it different from normal construction? This course answers these questions, along with some specific guidance on achieving the level of airtightness and thermal bridge-free construction required by the standard. It also looks at the contractual side and suggests ways that care in the allocation of responsibility can help achieve your goal.

Building Services for Passivhaus (2 days)

The course majors on all aspects of ventilation design, from concepts through to calculation. It then moves on to the choice of heating system, the provision of hot water, and calculations of lighting appliances and Primary Energy, with reference to the inputs required in the Passivhaus Planning Package (PHPP).

PHPP (2 days)

This practical, hands-on course will provide energy consultants, technical building designers and architects with the skills necessary to design low energy/CO2 buildings to Passivhaus/AECB standards using the Passivhaus Planning Package (PHPP). The course alternates between teaching with the use of presentation slides and a guided class exercise where participants enter an example house into the software.

Exam and Revision (1.5 days)

The revision course is an opportunity to consolidate your understanding by working through calculation tasks as a group, and to ask questions about specific aspects that you need further help on. The revision course and the exam are included in the fee for the Passivhaus Designer course. Please contact us for prices for retaking the exam.

Week 1:	2nd – 5th November
Week 2:	16th – 20th November
Exam:	4th December
Location:	Saint Gobain Multi Comfort Visitor Centre, Great Portland Street, London W1W 7NY

APPENDIX 3

CPCCBC4020 Build thermally efficient and sustainable structures

Modification History:

Release 2 This version first released with CPC Construction, Plumbing and Services Training Package Release 5.1.

Element 1.2 changed to allow for continuing compliance with NCC.

Release 1 This version first released with CPC Construction, Plumbing and Services Training Package Release 5.0.

Supersedes and is equivalent to CPCCBC4020A Build thermally efficient and sustainable structures. Updated to meet the Standards for Training Packages 2012.

Application:

This unit of competency specifies the skills and knowledge required to apply sound principles of thermal efficiency as part of the implementation of sustainable building and construction processes in response to the need to respond to growing consumer demand for sustainable buildings and environmentally friendly developments.

It applies to National Construction Code (NCC) classifications:

- Residential - Class 1 and 10 buildings (maximum two storeys)
- Commercial - Class 2 to 9, Type C only constructions.

This unit of competency supports the needs of builders, site managers and forepersons, and estimators in the building and construction industry.

Completion of the general construction induction training program specified by the model Code of Practice for Construction Work is required for any person who is to carry out construction work. Achievement of CPCCWHS1001 Prepare to work safely in the construction industry meets this requirement.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit:

- Nil.

Unit Sector:

- Building and Construction

Elements and Performance Criteria:

Elements describe the essential outcomes.	**Performance criteria describe what needs to be done to demonstrate achievement of the element.**
1 Apply legislative and planning requirements for thermal efficiency to the building process.	1.1 Identify current relevant state, territory and council requirements for building thermally-efficient structures.
	1.2 Identify factors that contribute to the construction of a star-rated dwelling identified within the NCC, and assess the impact of regional climate differences.
	1.3 Identify and negotiate client needs and expectations for the design and construction of thermally-efficient structures.
	1.4 Gather expert design and other advice as part of the planning and construction process.
	1.5 Consult relevant Australian Standards to identify the implications for the conduct of the building project.

2 Review design solutions for effectiveness and compliance.	2.1 Identify impact of radiation, convection, conduction and evaporation on the thermal comfort of residents.
	2.2 Evaluate orientation of the building, location and size of glazing, and use of thermal mass as design features for effectiveness and compliance with planning and other regulatory requirements.
	2.3 Evaluate, cost and communicate effective strategies for insulating the structure to the client.
	2.4 Assess building designs for their compliance with the energy efficiency requirements of the NCC.
	2.5 Consult designers and clients to ensure final construction plans are effective, efficient and compliant.
3 Manage the building process to ensure an effective outcome.	3.1 Establish effective communications between designers, architects and clients to ensure effective thermal performance is embedded from the design to construction phase.
	3.2 Confirm effective quality assurance processes are in place to evaluate and implement the building of a five-star dwelling.
	3.3 Assess and communicate to client, cost-effective strategies to achieve desired level of thermal performance.
	3.4 Assess and negotiate life cycle costs of various construction approaches with the client.

Foundation Skills:

As well as the foundation skills explicit in the performance criteria of this unit, candidates require technology skills to:

- use digital tools and devices to communicate and collaborate effectively with others
- use equipment and programs to access and extract information and develop relevant documentation.

Unit Mapping Information:

Supersedes and is equivalent to CPCCBC4020A Build thermally-efficient and sustainable structures

Links:

Companion volumes to this training package are available at the VETNet website - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=7e15fa6a-68b8-4097-b099-030a5569b1ad

APPENDIX 4

CPCSUS4002 Use building science principles to construct energy efficient buildings

Modification History:

Release 1 This version first released with CPC Construction, Plumbing and Services Training Package Release 5.0.

Supersedes and equivalent to CPCSUS4002A Use building science principles to construct energy efficient buildings. Updated to meet the Standards for Training Packages 2012.

Application:

This unit of competency specifies the skills and knowledge required to incorporate building science principles into the construction of energy-efficient buildings. It includes the ability to research, use constructive thinking and problem-solving processes to identify appropriate sustainable solutions.

This unit of competency applies to those who apply building science principles to construction of energy efficient residential and commercial buildings.

This unit of competency is suitable for those using specialised knowledge to complete routine and non-routine tasks and using their own judgement to deal with predictable and sometimes unpredictable energy efficient building problems.

Completion of the general construction induction training program specified by the model Code of Practice for Construction Work is required for any person who is to carry out construction work. Achievement of CPCCWHS1001 Prepare to work safely in the construction industry meets this requirement.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit:

- Nil.

Unit Sector:

- Sustainability

Elements and Performance Criteria:

Elements describe the essential outcomes.	**Performance criteria describe what needs to be done to demonstrate achievement of the element.**
1 Determine the building envelope expectations.	1.1 Identify type of use and energy efficiency expectations of the building.
	1.2 Identify risks associated with occupants' indoor activities and health and safety considerations.
	1.3 Determine environmental and climatic conditions that impact the resilience of building materials.
	1.4 Identify construction methods that factor in durability of materials.
	1.5 Consult relevant legislation, standards, regulations and codes to identify minimum energy efficient standards to be met.
	1.6 Consult relevant domestic and international codes, standards and examples of best practice that meet or exceed current energy efficient standards.

2 Assess energy efficiency construction.	2.1 Research building science principles supporting energy efficiency.
	2.2 Review embodied energy of the specified products or materials to evaluate the energy efficiency.
	2.3 Research heating, ventilation and air conditioning (HVAC) systems to identify levels of energy efficiency, ventilation and indoor air quality.
	2.4 Review mechanical ventilation systems and equipment to aid air flows for appropriateness and operational costs.
	2.5 Research and identify durability and appropriateness of moisture and vapour barriers to gain high levels of energy efficiency.
3 Decide on method of construction.	3.1 Identify site location and building position to maximise energy efficiency relating to environmental factors, climatic conditions and use of building.
	3.2 Identify and assess energy efficiency of thermal energy, heating and cooling, air and moisture flows throughout the building.
	3.3 Develop strategies to minimising unwanted air leakages.
	3.4 Evaluate and select mechanical ventilation systems and equipment for appropriateness to the site and operational costs.
	3.5 Evaluate and select materials for interior and exterior barriers for energy efficiency, durability and appropriateness for building site climate.

Foundation Skills:

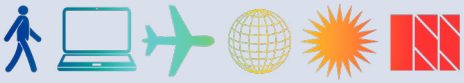
As well as the foundation skills explicit in the performance criteria of this unit, candidates require technology skills to:

- use digital tools and devices to communicate and collaborate effectively with others
- use technology and programs to access and extract information and develop relevant documentation.

Unit Mapping Information:

Supersedes and is equivalent to CPCSUS4002A Use building science principles to construct energy efficient buildings.

Links: Companion volumes to this training package are available at the VETNet website - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=7e15fa6a-68b8-4097-b099-030a5569b1ad



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