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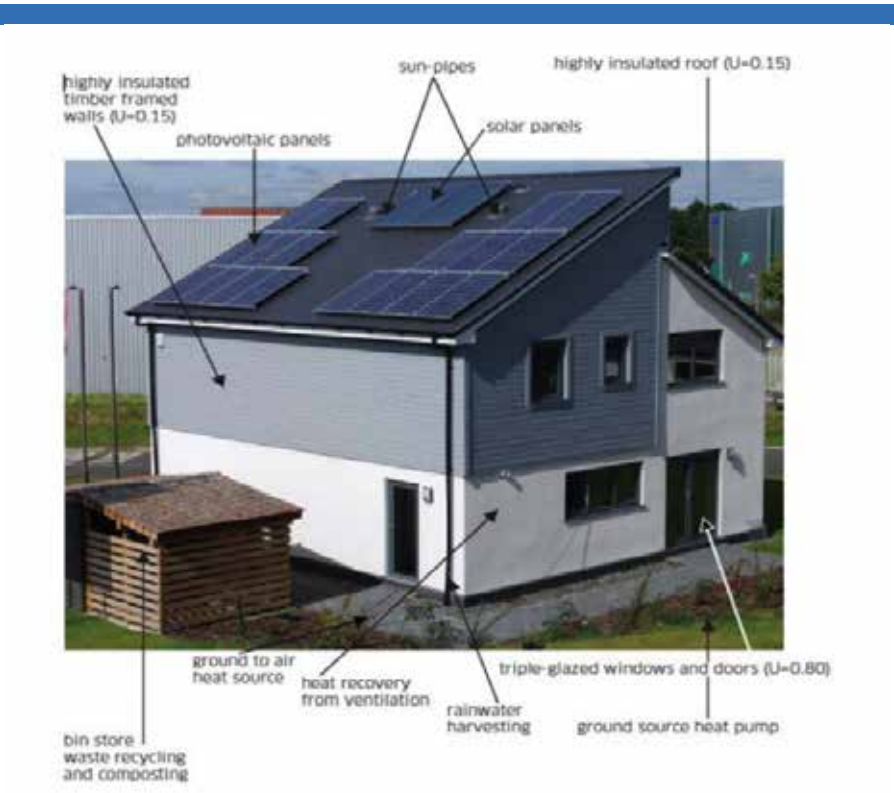

Building Practices for a Sustainable Construction Industry

Michael Hick

2013 Higher Education & Skills Group Fellowship

An International Specialised Skills Fellowship

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i. EXECUTIVE SUMMARY

The Fellowship was separated into two parts:

1. To investigate current VET practices being delivered to apprentices and the education on sustainability and sustainable products that are currently used in the construction industry. To explore the connections between Government, the Building Industry and the Education sector on matters of sustainability and the reduction of the carbon footprint of homes.
2. Investigate what current energy saving/sustainable products are being used internationally as standard and what new products are being developed to be used in commercial and residential building. To gain an understanding of how Green councils operate and how they work with Governments, Industry and Education.

The Fellow will be gathering information on building practices that are used internationally to investigate how other countries insulate and reduce their carbon footprint and energy bills. There will be a focus on double/triple glazing, wall insulation, insulation of roof and attic spaces and to an extent the use of solar panels and power storage units.

A large percentage of residential and commercial buildings in Europe use mechanical heat transfer units. Double glazing is also used in most European countries as a standard and in the UK the building regulation requires double glazing to be used on new builds and in the case of damage to a single pane of glass window, the window will be replaced with a double glazed unit.

During the Fellowship it was inspiring to see in some countries that Governments are working with Education and Industry to come up with sustainable solutions for the future employment industry of sustainable products and energy manufacturing. Glasgow Kelvin College is working with Industry and Government to help with such solutions. They have identified that renewable energy will be the industry of the future. These ideas are driven by taking into account, government policies, people and culture, the environment and employment opportunities. Scotland's oil industry is drying up with approximately 15 years of North Sea oil in reserve (Sir Ian Wood) developing a new sustainable and cheap energy source will be the industry of the future for Scotland with hopes that they will be able to sell electricity to neighbouring countries.

How sustainable building products and renewable energy technology can come together to make something amazing, although seemingly futuristic, is actually available now. The Aurora House at South Lanarkshire College has been developed by the College and over 50 commercial partners to develop an energy efficient house. The home runs on approximately 36 cents a day. The main components of the house are solar panels, ground source heating, timber frame, rain water tanks, heat recovery from ventilation and triple glazing for the windows. This house simply proves that with more attention towards insulation and renewable energy technology we can reduce costs of heating and cooling and also reduce every houses carbon footprint.

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ii. ACRONYMS & ABREVIATIONS

AEU	Australian Education Union
AGGA	Australian Glass and Glazing Association
C-value	A material's thermal conductance
CPSISC	Construction and Property Services Industry Skills Council – now trading as Skills Oz
DGNB	German Sustainable Building Council
GKC	Glasgow Kelvin College
HIA	Housing Industry of Australia
LEED	Leadership in Energy and Environmental Design
MBAV	Master Builders Association of Victoria
mm	Millimetres
R value	Thermal resistance of a material
RPL	Recognition of Prior Learning
RTO	Registered Training Organisation
SAIT	Southern Alberta Institute of Technology
SME	Small and Medium Enterprise
SQA	Scottish Qualifications Authority
SVQ	Scottish Vocational Qualification
TAFE	Technical and Further Education
UK	United Kingdom
USA	United States of America
VET	Vocational Education and Training
VIT	Victorian Institute of Teachers

iii. DEFINITIONS

Apprenticeship

A system of training regulated by law which combines on-the-job training and work experience while in paid employment with formal (usually off-the-job training). The apprentice enters into a contract of training or training agreement with an employer which imposes mutual obligations on both parties.

Competency

Competency is the consistent application of knowledge and skill to the standard of performance required in the workplace.

Competency Based Completion

Apprenticeships and traineeships can be completed before the scheduled end date of the training contract if the apprentice or trainee has been assessed as competent and issued with a qualification by their training organisation. This is known as competency based completion.

Fracking

The process of injecting liquid at high pressure into subterranean rocks, boreholes, etc. so as to force open existing fissures and extract oil or gas.

LEED

LEED, which stands for Leadership in Energy and Environmental Design, is a certification program focused primarily on new, commercial-building projects and based upon a points system. The more points you earn, the higher your rating.

R Value

The R value, or thermal resistance of a material, expresses the ability of a particular thickness of that material to resist heat flow. The definition of R value is the reciprocal of the material's thermal conductance (C value).

Vocational Training

Training that emphasises skills and knowledge required for a particular job function or a trade.

1. ABOUT THE FELLOW

Name Michael Hick

Employment Design and Technology Teacher, Alamanda College

Carpentry and Joinery Teacher, Trades College, Victoria Polytechnic (Formally Victoria University, TAFE Division)

Designer/Manufacturer/Installer, MSP Stairs, Melbourne, Victoria

Qualifications

- Graduate Diploma of Technology Education, La Trobe University, 2016
- Diploma of Vocational Education and Training (VET), Victoria University, 2010
- Certificate III in Cabinet Making (Wood Machinist), Victoria University, 2010
- Certificate IV in Workplace, Training and Assessment, Victoria University, 2004 (Upgrades 2009, 2013)
- Certificate III in Carpentry and Joinery (Apprenticeship), Victoria University, 2000 (Upgrades 2009-2012)

Memberships

- Australian Education Union (AEU)
- Victorian Institute of Teachers (VIT)

Biography

After completing Year 12, Michael Hick was uncertain which direction his career was going to take. He tried his hand at electronics, however struggled in the second year and knew that it was not a good fit. As he was really not sure of what was out there that would suit him, he took some time to think about what the rest of his family (close and extended) were doing and found a common thread being trades.

Michael Hick visited Victoria University's Newport TAFE campus at the age of 20 and asked what courses were available. That was the start of his Carpentry and Joinery career. He completed a pre-apprenticeship and from that, was successful in obtaining an apprenticeship. He had finally found a fit and something that he thoroughly enjoyed. At Victoria University, Hick received the first awards he had ever been given in his life: 'Best Pre-apprentice' and 'Best Overall Apprentice'.

At the age of 27, he started a small business with his father and brothers but at the same time was invited back to Victoria University TAFE by former trade teachers to do some sessional teaching in Carpentry and Joinery. What started out to be a few week's work turned into a ten-year career in teaching pre-apprentices and apprentices in the Building and Construction Department of Victoria University TAFE Division. Michael Hick believes the key to his success has been through a passion and enthusiasm for working in the construction industry. He has always been in secure employment and his way of giving back to the industry is through teaching others the skills to build a career in an industry he loves.

2. AIM OF THE FELLOWSHIP PROGRAM

The overall aim of the Fellowship is to investigate sustainability retrofitting skills currently being practiced internationally in order to apply new sustainable building practices to Australia's current VET training delivery and industry.

In particular, the Fellowship provided the opportunity to acquire knowledge on:

- Double and triple glazing of doors and windows and their impact on sustainable building
- Retrofitting of double and triple glazing of doors and windows to increase residential/commercial buildings energy ratings and reduce the carbon footprint
- Use of recyclable materials for the production and manufacture of doors and windows
- Government incentive schemes available for sustainably retrofitting buildings
- A range of new, cost-effective sustainable building products in the market (cladding, insulation, etc.)
- The delivery of building sustainability and retrofitting training in colleges and technical schools internationally.

3. THE AUSTRALIAN CONTEXT

The idea for the Fellowship originally stemmed from the Fellow's role as an Assessor with Victoria University's Skilled Migration Assessment Service and conducting visa assessments for Carpentry and Joinery applicants. During his technical interviews with applicants, the Fellow discovered that many countries (particularly the UK and Ireland) are implementing new building practices and products and achieving a greater energy efficiency rating in their buildings. Due to their climate and building conditions there is a greater need for these new sustainable advancements and they have proven to be successful in achieving a higher green star rating.

In Australia, we build to a price and not necessarily to the best energy rating possible. The idea of building sustainable homes and retrofitting older homes has become more prevalent in recent times due the increase in energy bills and the push towards reducing Australia's carbon footprint. The recent government policy of introducing the carbon tax to industry on the commodity of carbon means that the quickest way for industry to off-set this new tax is to push the costs onto the consumers. The idea of sustainably retrofitting older buildings with green building products such as double/triple glazed windows and doors will reduce household energy requirements and costs - ultimately, reducing a household's carbon footprint. The same theory applies to the incorporation of green building products into new builds.

There is currently limited knowledge in Australia on sustainable retrofitting and the Fellowship aims to find the best products available that are both competitively priced and cost effective. Most people will not go for the long term benefits if the initial cost is too high to get their project started with the cost of building already just out of reach for some people. Therefore, investigating the most cost effective and energy efficient products already available on the international market and implementing these in Australian training delivery and industry will generate significant environmental impact.

SWOT analysis of current practises and training

Strengths

- Reduction on the demand for non-renewable resources.
- Reduction on household/industry energy bills.
- Competitive build costs to make it more attractive to incorporate sustainable retrofit products.
- Decrease the carbon footprint per person.
- Development of Victoria/Australia as a leader in sustainable building practices.

Weaknesses

- Limited existing knowledge.
- Initial outlay costs involved.
- Lack of industry support due to costs.
- Materials used e.g. Can UPVC withstand the Australian conditions?
- Sustainable building retrofitting is a skilled job.

Opportunities

- Development of new training and education programs to train the upcoming workforce for sustainably retrofitting buildings.
- Potential to establish Licensed Retrofitters.
- Manufacturing industry aligns with the demands for sustainable building products.

3. THE AUSTRALIAN CONTEXT

Threats

- Australia unable to reduce its carbon footprint in comparison to the rest of the world.
- Increase in energy bills for consumers and industry.
- Increase in the dependence of non-renewable fossil fuels.

4. IDENTIFYING THE SKILLS AND KNOWLEDGE ENHANCEMENTS REQUIRED

1. Record and investigate new sustainable building practices and products to facilitate sustainable fit-out and retrofitting of buildings

- Identify and assess new products in the manufacturing of windows and doors - including double/ triple glazing – in residential buildings and determine if it is still common place to use single pane glass windows (commercial buildings use a double glazed system).
- Identify and assess new energy efficiency products and building techniques for the installation of walls, roofs and sub-roofs.
- Source new opportunities for the building industry to utilise recycled materials for the construction, insulation and manufacture of buildings and evaluate their effectiveness compared with non-recycled products.

Action: *Document new sustainable and alternative building products and practices in Canada/USA/ UK and Europe (location dependent).*

Action: *Based on this research, develop a draft list of recommendations to implement new and sustainable building practice and products in the industry.*

2. Record and investigate how new building products can be effectively installed to sustainable retrofit existing houses at minimal cost, impact and time.

- Evaluate the effectiveness of new products/practices (particularly double/triple glazing of windows and doors) in terms of reducing energy and costs.
- Investigate new sustainable retrofitting skills/policies/incentive schemes to introduce to consumers and industry.

Action: *Observe, assess and document the financial and environmental benefits of sustainable building retrofits and determine why they are being used (i.e. impact on energy bills, carbon footprint, etc.).*

3. Identify new opportunities and ways to implement these sustainable building retrofitting skills into VET curricula (Certificate III in Carpentry/Joinery).

- Canvass the views of technical schools and colleges overseas on sustainable building practices that are currently taught.
- Determine what the benefits of this training are to industry and consumers.
- Determine if this training can be transferred to the Australian context.

Action: *Develop a draft list of recommendations to influence the development of training package units including the addition of sustainably retrofitting double and triple glazed doors and windows, as well as roof, wall and sub floor insulating.*

Action: *Recommend the implementation of these new green building practices and products in the building of the transportable houses that are constructed at Victoria University by our pre-apprentice students to show case better building design and sustainability.*

5. THE INTERNATIONAL EXPERIENCE

The purpose of the overseas experience in parts of Europe and America and Canada (Accrington, Glasgow, Stuttgart, Madrid, Copenhagen, Calgary and Nebraska) was to identify and explore the skill development opportunities in sustainable practices within Education and the Construction Industry identified by the Fellow. The Fellowship research included meetings with training providers and University staff within Europe, Canada and America as well as Architects and Construction companies.

The research and information obtained will enable the Fellow to provide advice on best practice in VET, particularly trade apprenticeships and within the Construction Industry and Green councils, with a focus on:

- Education and training in sustainable practices in VET/TAFE
- Best practice in the construction of energy efficient housing with a focus on the structure
- Alternative products
- Industry participation for sustainable construction.

Visit One – Accross Accrington and Rossendale College, Lancashire, UK

Destination

Accross is an award winning school with a large trades centre. The school provides a wide range of full and part-time study programs. Accross is also one of the largest providers of construction training in the Midlands.

Contact

Marc Wilkinson, Teacher, Construction (Carpentry and Joinery) and Recognition of Prior Learning (RPL), provided invaluable information to the Fellow during his tour of Accross.

Objectives

To tour Accross College's facilities and training areas. The Fellow also aimed to gain an insight into Accross' delivery of sustainability units of competency and the programs they have developed to teach apprentices and their links with employers and industry.

Outcomes

The Fellow gained an overview of the structure of how sustainability was taught within apprenticeship training. The training was centered on Government initiatives/incentives and regulation in regards to insulation and ratings of materials used in the construction of new dwellings as well as the requirements on renovations. In relation to renovations, these need to be in line with new home efficiency regulations, such as if a single pane window is broken and needs to be replaced the currant regulation stipulates that it must be replaced with a double glazed window.

The Fellow had the 'Green Deal' explained and what it means for the construction industry. At the time of the Fellowship the Green Deal was a Government program that made funds available for property owners to help make their homes more energy efficient.

5. THE INTERNATIONAL EXPERIENCE

This includes:

- Insulation, e.g. solid wall, cavity wall or loft insulation
- Kingspan insulation panels for the roof
- Mechanical heat/cool transfer device
- Draught-proofing
- Double glazing
- Renewable energy generation, e.g. solar panels or heat pumps
- Ground source heating.

Visit Two: Glasgow Kelvin College, Glasgow, Scotland

Destination

Glasgow Kelvin College (GKC) delivers qualifications under the Scottish Qualifications Authority (SQA) which are well recognised by employers and other learning organisations.

Contact

John Kinlay, Senior Curriculum Manager, provided invaluable information to the Fellow during his tour of GKC.

Objectives

The Fellow interviewed John Kinlay to gain an insight on how units of sustainability were developed and delivered in the classroom.

Outcomes

The Fellow gained an insight into how GKC develops their programs for sustainability in the Construction Industry. The College works closely with Government and Industry. John Kinlay spoke about the Sir Ian Wood report on North Sea oil (with approximately 15 years of oil left) and how Scotland needed to move to a different energy production model and building practice. The plan is an investment into a wave generator, creating a new energy Industry and being capable of on selling to Europe.

GKC has an excellent VET delivery system – they are building on their strong foundation so that more people are able to access the right learning for them, increasing their qualifications and leading them into employment outcomes for a more sustainable building Industry.

5. THE INTERNATIONAL EXPERIENCE

Visit Three: DGNB German Sustainable Building Council, Stuttgart, Germany

Destination

The German Sustainable Building Council (DGNB) is a central knowledge platform for sustainable building. To promote sustainable building, the non-profit organisation has established a certification system for the assessment of buildings and urban districts with a particular focus on environmental impact, use of resources, efficiency and user comfort.

Contact/s

Dominic Church, Team Leader International projects, provided invaluable information to the Fellow.

Objectives

The Fellow aimed to talk about sustainable building practices and retro fitting in Germany and the requirements of new building to be more energy efficient.

Outcomes

At the DGNB, the Fellow was introduced to the idea that sustainability of a building is put to an integrated life cycle cost analysis (projected over 50 years). This includes:

- Cost analysis on non-renewable resources, water and soil protection
- Double and triple glazing is a standard for the thermal efficiency of a building. Although double glazing isn't a regulation, due to the rating a wall must have for insulation and double/triple glazing to be able to make the efficiency of the wall rating
- New buildings in Stuttgart are required to have a green roof (moss type plants for helping to remove moisture from the air and insulation)
- New building in Stuttgart will be required to have solar panels on roof spaces
- Retro fitting of double/triple glazed windows into heritage buildings have caused a lot of public debate – at present it isn't a law
- Most new buildings are pre-fab, offering a variety of sustainable options.

It was found that 70 per cent of the German housing market are rentals with most Germans never owning their own homes. Due to this fact most rental owners are not prepared to outlay the money to make their properties more energy efficient as the renovations cost would be pushed onto the tenants. The push for more environmentally friendly ways of creating energy in Germany has come in part from the Fukashima nuclear accident in Japan.

Visit Four: Spain Green Building Council, Madrid, Spain

Destination

Spain Green Building Council, is the Pioneer Organisation in Europe, founded in 1998, to promote sustainability in the built environment, the structure of Green Building Councils and the LEED Certification system.

Contact

Aurelio Ramirez, Chairman and Founder, Spain Green Building Council.

Objectives

The Fellow aimed to discuss sustainable building practices and retro fitting in Spain and the requirements of new building to be more energy efficient.

Outcomes

Spain has had retro fitting in place for over 30 years due to high density building and construction, with a large portion of Spain's population living in high rise apartments. Buildings use shared resources such as a boiler for the buildings' heating and double glazing to help with the reduction of energy costs.

Spain does not have large forests or plantation woods (most of the forests were cut down during the Armada era) and as such during its retro fitting it has replaced many timber products with steel and concrete. Another main reason for this is the high density building practices as timber construction would be too much of a fire risk.

In the last 10 to 15 years (pre 2008) Spain has had to look for alternatives for its energy, as Spain has no natural oil deposits it is dependent on importing oil. Spain imports approximately 50 per cent of its energy. Spain has had a massive investment into wind and solar to help try and meet its energy need.

In 2008 the world was drawn into another Global Financial Crisis (GFC) which has left Spain short on capital as it has invested heavily in wind and solar. At present in Spain, people are paying tariffs three times higher than that in the USA for its energy as the government seeks to regain its losses from the setup of wind and solar farms (2013).

Before 2008, only ten commercial buildings took up the challenge to build sustainable energy efficient buildings and only two actually completed the challenge. After the GFC in 2008 the Green challenge was taken up by 200 buildings. One reason for this was that each company had to make their building stand out from the crowd and a green energy efficient building puts them ahead of the pack.

The belief in Spain is that domestic green building will only become more attractive after the commercial building sector has fine-tuned its own green practices. Spain has been investigating the potential of Fraking for gas as Spain has no natural oil deposits.

5. THE INTERNATIONAL EXPERIENCE

Visit Five: Green Building Council Denmark, Copenhagen, Demark

Destination

Green Building Council Denmark is a non-profit organisation that manages environmental certification system DGNB in Denmark. The organisation works to promote sustainable construction and to create a benchmark for this in terms of DGNB system.

Contact/s

Lau Raffnsøe, Technical Adviser, Green Building Council Denmark.

Objectives

The Fellow discussed sustainable building practices and retro fitting in Denmark and the requirements of new building to be more energy efficient.

Outcomes

Denmark produces approximately 48 per cent of its own energy from wind turbines and is aiming to phase out Bio-mass and coal stations by 2050 with alternative energies.

When selling a house in Demark, part of the information that is disclosed to potential buyers is the energy efficiency of the property. Some products that are used frequently in homes are mechanical ventilators with heat recovery systems, double glazing and extra insulation for walls and attic space.

The GBCD use a life cycle and cost analysis when calculating the efficiency of a house. Double glazing is common. To be able to get the energy efficiency of an external wall with a window you are compelled to use double glazing to reach the rating for the wall efficiency.

Visit Six: SAIT (Southern Alberta Institute of Technology) Polytechnic, School of Construction, Calgary, Canada

Destination

SAIT (Southern Alberta Institute of Technology) Polytechnic, School of Construction aims to meet the diverse needs of the modern construction sector and offers more than 20 full-time programs that are continuously reviewed and updated by expert advisory committees. These industry partnerships ensure a relevant, career-focused education.

Contact/s

Dan Weinert, Academic Chair, Wood trades, School of Construction.

Objectives

To tour SAIT Polytechnic School of Construction's facilities and training areas. The Fellow also aimed to gain an insight into SAIT's delivery of sustainability units of competency and the programs they have developed to teach apprentices and their links with employers and industry.

Outcomes

SAIT Polytechnic is a $400 million dollar building and delivers many trades such as carpentry, automotive, cabinetmaking and building studies. Sustainability is not really touched on in it curriculum for apprentices. In sustainability terms Canada is quite a few years behind Europe. Domestic builders only have to give a one-year warranty on new builds. Builders are still using traditional building practices and are not taking into account environmental considerations. In Alberta they have a high moisture problem which causes a lot of issues in the external walls of domestic buildings.

Canada uses very minimal energy created by wind and solar; they are still using approximately 90 per cent coal. SAIT Polytechnic has its own Green build research and innovation service. They work with the building code and recommend how they can bring it up to LEED levels (Leadership in Energy and Environmental Design).

Tom Jackson works at SAIT Green build research and innovation service. The service has its own practice building working on new and efficient building techniques to cope with Alberta's climate. Tom was talking about different types of energy that Canada was looking into such as Fracking. He mentioned that Oklahoma USA is a large Fracking area and they have just experienced a 4.4 magnitude earthquake in what is traditionally a non-earthquake zone. Tom Jackson believes that Fracking is not the answer for Canada energy needs.

Recommendations for Building of new homes in Canada was:

- Double glazing or smaller window openings
- Reduce the size of the homes
- Increase insulation in the walls
- Increase insulation in the roof
- Make the homes air tight
- Mechanical ventilation with heat recovery (this will also help with moisture and condensation problems).

5. THE INTERNATIONAL EXPERIENCE

Visit Seven: Millard Lumber, Omaha, Nebraska, USA

Destination

Millard Lumber, Omaha was founded in 1948 and initially catered to a rural farming community of fewer than 400. Millard Lumber provided a center for the farmers to sell grain, buy coal and of course, purchase lumber. As time passed the focus of the business moved towards building materials and products that supplied both professional contractors and do-it-yourself homeowners. Millard Lumber was an early manufacturer of roof trusses, pre-manufactured wall sections and pre-hung doors and has stayed in the forefront of advanced building techniques since that time.

Contact

Rick Russell, President and owner of Millard Lumber.

Objectives

To get an understanding of building and construction in the USA, taking into account sustainable building practices.

Outcomes

Millard Lumber is one of the largest lumber and pre-fabricated home builders in the Mid-west. Millard have a truss factory for roof, wall and floor construction. The timbers that they use are plantation and their machines optimise every piece of timber that is used so there is very little waste.

Wall construction in Millard's Pre-fabricated walls have been increased from 90mm to 150mm so there is more space for insulation. Double glazing is used to achieve the wall value rating; it increases the efficiency of the home, reduces condensation and noise.

Millard Lumber has and regularly donates building and construction materials to Habitat for Humanity. At one of the construction sites the Fellow visited, Habitat for Humanity had a house that was donated to them by the bank. In the USA when a house is foreclosed on it is not the same as in Australia. Often the houses cannot be sold as there is a glut of houses on the market or it's in a poor area. The house visited was being gutted and retro fitted to make it more energy efficient for the new owners. The new owners are people of limited income. The house was having extra timbers added to the external frame to increase its depth to 150mm as more insulation could be added to the wall. On the outside of the building another layer was being added, approximately 30mm of insulation board then cladding was added on top of this. Double glazing had also been installed.

At present in the Mid-west, solar hasn't been taken up as for the average home owner it was too expensive. The Fellow visited a house where the owners had added eight panels at a cost of US$12,000. They had invested in solar as a conscience decision and there are some rebates from the power company during the day when power is fed back into the grid. At present, however, panels and converters are still expensive and out of reach for the average American.

Habitat for humanity are retrofitting/renovating this repossessed house that had been donated by the bank. The renovations that are taking place are the increase in the external stud wall, a ply board that covers the outside wall, then a Styrofoam wrap before the external Cladding is added on. The job will have double glazed windows and a mechanical heat transfer unit. The idea by Habitat is to make the house as sustainable as their budget will allow. This house will be for a family with a limited income. By making the house as insulated and air tight as possible this will have a direct impact on reducing the energy bills for the new owners.

5. THE INTERNATIONAL EXPERIENCE

Visit Eight: Joslyn Institute for Sustainable Communities, Lincoln, Nebraska, USA

Destination

Created in 1996 by the University of Nebraska College of Architecture, the Joslyn Institute for Sustainable Communities focuses on the built environment to promote sustainable development.

Contact

W. Cecil Steward, President and CEO of the Joslyn Institute.

Objectives

To get an understanding of building and construction in the USA, taking into account sustainable building practices, with a focus on a case study driven by Cecil Stewart.

Outcomes

Nebraska has a population of approximately 1.8 million people and is a large agricultural area. Nebraska uses wind and solar energy with a goal of producing at least 20 to 30 per cent of green energy over the next 20 years. Nebraska has one Nuclear power plant and two Coal power plants.

Cecil Steward has spent a great deal of his life working on sustainable alternatives. This started with him spending a large part of his career trying to change architects' approaches to building and design, taking into account energies and efficiency of buildings and incorporating aesthetics rather than the design of the building being based purely around its visual attraction or uniqueness.

Cecil's Steward's case study involves five domains:

- Public policy
- Environmental
- Social-cultural
- Technological
- Economic.

The idea is that if change is made on a grand scale for sustainability, these five domains must be taken into account. Without these five domains being adhered to an informed and conscious change of the community involved will not happen. The main recommendations for domestic building are:

- Building orientation
- Double glazing
- Increased insulation in the walls and roof
- Make the house air tight
- Mechanical ventilation and heat exchange.

6. KNOWLEDGE TRANSFER: APPLYING THE OUTCOMES

The key outcomes of this Fellowship include:

- Being able to observe some of the training by VET providers using new insulation technologies such as Kingspan insulated roof panels
- Understanding of how better insulation of a dwelling will reduce its carbon footprint. In the Australian context it would help reduce carbon footprint in a passive way
- Understanding of how each country encourages/ or gives incentives to reduce household bills by incorporating sustainable products in their homes
- Understanding of energy costs being reduced by making houses air tight and using a mechanical heat/ cool transfer
- Positive reinforcement of what Australian VET providers are currently doing well with new sustainable products
- Increasing knowledge and awareness of successful VET business and industry engagement models (Scotland)
- Developing a network of international VET contacts to share resources and strategies with that can benefit VET in Australia, VU and industry in general.

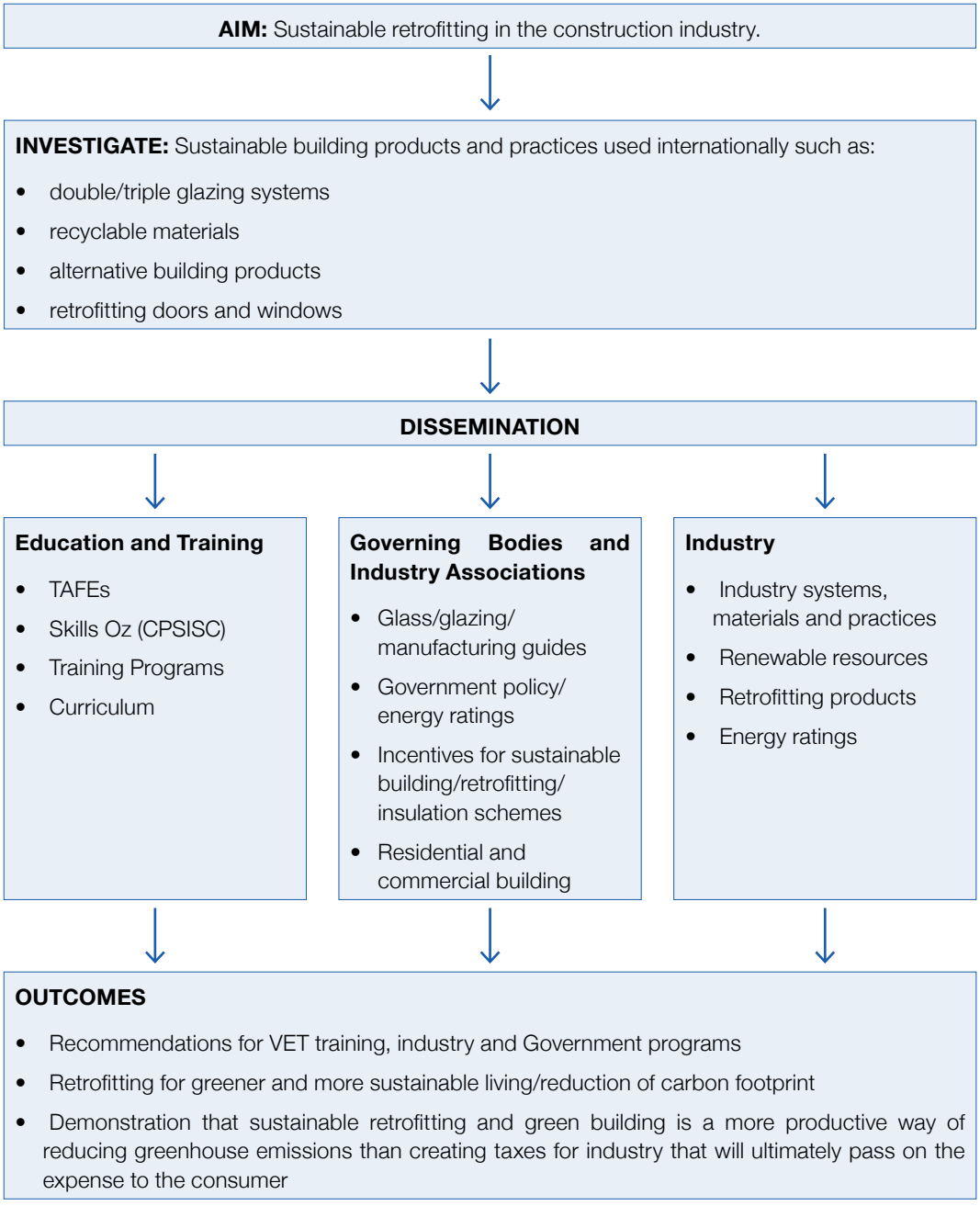
The Fellow's research will be disseminated to VET providers to help give an insight into how Sustainability is an issue that needs close connections between Governments, Education and Industry.

In order to convey the above findings as well as the recommendations outlined in the following section, the Fellow will disseminate his research findings through presentations to a variety of stakeholders including government, industry associations, industry and education and training facilities. The Fellow also deems that communication and linkages with community organisations such as Rotary International is important to mobilise community thinking around sustainable practices and building. He will aim to give presentations to local clubs and networking with them to move the information on through their newsletter and websites.

The diagram on the following page outlines the Fellowship process and key dissemination points.

6. KNOWLEDGE TRANSFER: APPLYING THE OUTCOMES

Fellowship Process



7. RECOMMENDATIONS

Education and Training

- Create a closer connection between training organisations, government and industry, working with Skills Oz (formerly CPSISC) to review current training programs and develop new topic areas to ensure students are aware of current/future regulations.
- These groups can work collaboratively by introducing a think tank on how best to introduce energy saving features into standard building practices.
- Training in sustainability and sustainable practices must be imbedded in all training and courses related to the building and construction industry - ranging from Certificate I –V in Building and Construction.
- Training Institutes to offer courses on new products and training of the correct installation techniques, such as Kingspan, roof insulation and external wall insulation.

Industry Associations

- Encourage sustainable building practices.
- Houses and building when being sold should have an energy rating to show the energy efficiency of the building.
- Increase the external stud size of domestic homes from 90mm to 150mm to increase the area for insulation.
- Double glazing to be phased in over a short period of time to be the standard.
- When single glazed windows are to be replace or are damage they will need to be replaced with double glazing.
- Increase roof insulation, on a truss roof the bottom cord can be increased in size from 90mm to 120mm or 150mm to accommodate the insulation.
- Aim to make new buildings air tight with a mechanical heat/cool transfer.
- Solar Panels to be installed on every new domestic roof.

Government

- Analyse what the need would be for the forestry industry to be able to provide larger sections of timber for the construction of the external walls and timber window frames.
- Look into an incentive scheme or rebate scheme for new home owner to consider better insulation for their homes and double glazing.
- Look into increasing the R value of external walls to compel new homes being built to include double or triple glazing.
- Research better energy storage for solar power for residents.
- Town Planning can review the setup of new housing estates to take into account positioning of dwellings on a property to optimise sun exposure.
- Solar panels to be incorporated into the design of new homes as this will help with the Victorian Government's target of 40 per cent renewable energy by 2025.

ISS Institute

ISS Institute can provide contacts where needed to help the Fellow's findings reach a greater audience than those stated.

8. REFERENCES

Articles and Reports

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Millard Lumber

http://www.millardlumber.com/

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Accrington and Rossendale College

http://www.accross.ac.uk/

Glasgow Kelvin College

http://www.glasgowkelvin.ac.uk/best-for-everyone/

Green Omaha Coalition

http://www.greenomahacoalition.org/

The Joslyn Institute for Sustainable Communities

http://www.ecospheres.com/index.html

Habitat for Humanity Omaha

http://habitatomaha.org/

9. ACKNOWLEDGEMENTS

The Fellow would like to thank the following individuals and organisations who generously gave their time and their expertise to assist, advise and guide them throughout the Fellowship program.

International Specialised Skills Institute (ISS Institute) – The Awarding body

The ISS Institute exists to foster an aspirational, skilled and smart Australia by cultivating the mastery and knowledge of talented Australians through international research Fellowships.

The International Specialised Skills Institute (ISS Institute) is proud of its heritage. The organisation was founded over 25 years ago by Sir James Gobbo AC CVO QC, former Governor of Victoria, to encourage investment in the development of Australia's specialised skills. Its international Fellowship program supports a large number of Australians and international leaders across a broad cross-section of industries to undertake applied research that will benefit economic development through vocational training, industry innovation and advancement. To date, over 350 Australian and international Fellows have undertaken Fellowships facilitated through ISS Institute. The program encourages mutual and shared learning, leadership and communities of practice.

At the heart of the ISS Institute are our individual Fellows. Under the International Applied Research Fellowship Program the Fellows travel overseas and upon their return, they are required to pass on what they have learnt by:

- Preparing a detailed report for distribution to government departments, industry and educational institutions
- Recommending improvements to accredited educational courses
- Delivering training activities including workshops, conferences and forums.

The organisation plays a pivotal role in creating value and opportunity, encouraging new thinking and early adoption of ideas and practice. By working with others, ISS Institute invests in individuals who wish to create an aspirational, skilled and smart Australia through innovation, mastery and knowledge cultivation.

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

Governance and management - 2016

Patron in Chief: Lady Primrose Potter AC

Patrons: Mr Tony Schiavello AO and Mr James MacKenzie

Founder/Board Member: Sir James Gobbo AC, CVO

Board Chair: John Baker

Board Deputy Chair: Rosemary O'Connor

Board Treasurer: Jack O'Connell AO

Board Secretary: David Wittner AM

Board Members: Professor Amalia Di Iorio, Bella Irlicht AM, Jon Onley, Camilla Roberts and Alisia Romanin

CEO: Louisa Ellum

9. ACKNOWLEDGEMENTS

Fellowship Sponsor - The Higher Education and Skills Group

The Victorian Government, through the Higher Education and Skills Group (HESG) of the Department of Education and Training, is responsible for the administration and coordination of programs for the provision of training and further education, adult education and employment services in Victoria and is a valued sponsor of the ISS Institute. The Fellow thanks them for providing funding for this Fellowship.

Supporters

The Fellow acknowledges the following Industry Supporters:

- Joan Whelan, Project Manager, (Construction and Property Services Industry Skills Council (now trading as Skills Oz) – activities now managed by Artibus Innovation.
- Joe Schiavello, Director / Head Site Supervisor, Schiavello Group of Companies Melbourne, Victoria.
- Tony O'Loughlin, Team Leader, Sustainability Victoria, Melbourne, Victoria.

Employer Support

The Fellow acknowledges the following Employer Supporter:

- Kath Curry, (Former Dean, VET College, Victoria Polytechnic - formerly known as Victoria University)
- Peter Jacobson, Director of Training, Trades, Hair and Beauty, Victoria Polytechnic
- Murray Millar, Education Manager, Victoria Polytechnic
- Daryl Spalding, Former Education Manager, Victoria Polytechnic

The support that Mr. Hick has been shown by his Managers, Director and the Dean of Victoria Polytechnic (Formally Victoria University – TAFE Division) was overwhelming. The Fellowship was considered highly important to the University, the education sector as well as the Construction Industry. The time away from work to take part in the Fellowship has been deemed Professional Development and has counted towards keeping my currency in my trade as well as in my position as a Building and Construction teacher.

Organisational Impact by the Fellowship

Government

The Fellowship will look at the economic value of sustainable building practices and retrofitting in order to reduce greenhouse emissions and the carbon footprint created by the domestic, commercial and industrial building industries.

Instead of saying that "Climate change threatens our existence" change it to "Climate change threatens our economy". The Fellow believes that if we are able to build more sustainably we will directly impact on Australia's carbon emissions and make the reduction, without imposing large taxes on 'big business' as most taxes on large corporations simply get passed onto the consumer. Through the Fellow's position at Victoria University, training can be established to create an entirely new industry of sustainably retrofitting older buildings.

The Fellow will report back on the types of Government assistance programs that are in place in other countries to promote green/sustainable building practices and building codes for insulating homes and ratings for the Australian context.

Government areas impacted by the Fellowship:

- Australian/State Government
- Sustainability Victoria
- Local Councils.

Industry and Community

The Fellowship will identify new sustainable building products available to the market and a new way in which they are energy rated. It will also investigate recyclable materials and products that are being used in other countries and how they can be incorporated into Australian conditions. Additionally, different types of glass used in fire prone areas will be investigated in order to introduce into the Australian context.

Industries impacted by the Fellowship:

- Schiavello Constructions
- Building and Construction Companies (large and SME)
- Service Clubs (Rotary International, Free Masons)
- General Public interested in sustainable building renovations.

Professional Associations

The reporting of findings such as international energy ratings for glass/glazing and the introduction of triple glazing, will be disseminated to relevant professional associations such as:

- Master Builders Association of Victoria (MBAV)
- Housing Industry Association (HIA)
- Australian Glass and Glazing Association (AGGA)
- Jims Building Inspections.

Education and Training

The Fellowship will influence the development of training package units including the addition of retrofitting double and triple glazed doors and windows, as well as roof, wall and sub floor insulating.

Organisations impacted by the Fellowship:

- Skills Oz (Formerly CPSISC)
- Victoria University
- Gordon Institute of TAFE
- Melbourne Polytechnic (formerly known as NMIT – Northern Metropolitan Institute of TAFE)
- Swinburne University
- Holmesglen Institute.

10. ATTACHMENTS