



BUILDING REVOLUTION

Sustainable Australian prefabricated housing

The Greens' plan for Australian-made prefabricated housing and jobs

The Australian housing system is in crisis. The emerging sustainable prefabricated housing industry provides the opportunity we need to deliver affordable homes, at the scale and pace we need. The Greens will provide \$50m over five years to kick-start a 'home grown' supply chain from plantation to factory, and a new wave in manufacturing, innovation, design, skills and training as a crucial part of the transition economy

There is a new industrial revolution occurring in the way we create buildings, bringing together new digital technology, manufacturing, and construction skills. Unlike the advances made in other industries like energy, transport and health, housing and buildings are still being constructed in Australia in similar ways to medieval Europe: one brick at a time, and using incredibly resource-intensive materials and methods of production.

We simply cannot continue to use the same materials and construction methods to build and expect to meet current demand fast enough, or to provide an affordable product for low-median income Australians.

The Greens know prefabricated housing is faster, more sustainable, and more affordable to build. We also recognise its potential to support a new wave of Australian innovation, design, manufacturing and construction.

It is time to embrace the opportunities provided by the prefabricated housing industry.

> BUILDING A NEW WAY

The Australian Greens' National Affordable Housing platform provides an ambitious plan to fund construction of 200,000 new affordable rental homes by 2030, with a target of at least one third to be sustainable, fast build, prefabricated or modular homes.

The Australian Greens' \$50m package will guarantee:

- **A construction and delivery pipeline of 60,000 new prefabricated homes over the next 10 years** as part of our National Housing Affordability Plan
- **A \$50m sustainable prefabricated modular housing industry package** over 5 years to provide support for Research and Development, Innovation, Excellence in Design, skills and training, assistance establishing new

production and manufacturing facilities, and demonstration projects.

- **Direct opportunities for Aboriginal and Torres Strait Islander peoples** for training, trade qualifications, and employment across the prefabricated housing industry.
- **A strong 'Australian made' target** over the longer term, in collaboration with industry and sustainability stakeholders

This commitment is complementary to our **\$23 million Sustainable Wood Products and Industries initiative** which outlines a future for wood and paper industries based on plantations, farm forestry, recycled fibres and potentially other fibre crops, and includes working with the wood products industry to develop a roadmap for sustainable prefabricated building and insulated panel production in Australia.ⁱ The Greens also support the call for further investment into wood products research and have committed an **additional \$306.5million to CSIRO** over the next four years, who we believe is best placed to lead increased collaborative research efforts.

> NEW SKILLS AND JOBS

Prefabricated housing refers to a home that has been built off site in a factory and made in components that can be transported and assembled on site. This requires a unique blend of skills across the entire supply chain; encompassing research, design and manufacturing of component parts, forestry and harvesting, as well as fabrication and construction of the final dwelling.ⁱⁱ Prefabricated building factories resemble an auto-manufacturing plant. The workforce for modular building requires skills that are usually associated with auto manufacturing, rather than traditional building skills. This includes factors such as design upfront, proactive rather than reactive thinking, procuring materials upfront and warehousing components. There is a clear opportunity to up-skill the auto manufacturing industry to building manufacturing.ⁱⁱⁱ

Refurbishing old factories into functioning modular manufacturers has the potential to offer employment for those who may have lost their job as a result of recent closures of other factories and assembly plants.

Each stage of the prefabricated housing process has the potential to create new jobs and opportunities for skills development. This could help boost the economy at a time where the construction phase of the mining boom continues to slow.

> JUMP-STARTING INNOVATION

The Australian construction industry lags behind other types of industries with respect to technological advancement, adoption and integration. Global output from the prefabricated building industry was over \$90 billion in 2012, with Australia's share of this just 3%. Prefabricated buildings in Australia also represent just 3% of the residential housing market, compared with far higher numbers abroad, including 50% in Finland and 74% in Sweden.^{iv}

We are also lagging in terms of architecturally designed and sustainable buildings. Just 3% of all construction is via architectural solutions and 97% is by 'volumetric housing' (home and land packages produced in bulk via housing estates). Just 1% of all builders in Australia are operating as 'sustainable builders', using sustainably harvested materials or those creating less energy intensive methods.

While modular construction will never completely replace conventional building approaches, it will take a much greater share in the market, particularly for multi-storey buildings. This 21st century innovation offers a much more sustainable option for the construction sector. With similar factories now operating and popping up in other parts of the world including China, Thailand, and Malaysia,^v it's a vital time to create a roadmap for an Australian industry that can compete.

CASE STUDIES: AUSTRALIAN COMPANIES LEADING THE WAY

The first cross laminated timber (CLT) manufacturing plant is set to be established in Albury-Wodonga, by X-LAM, and will use the plantation resources of south-east NSW and north-east Victoria. X-LAM are specialists in the design and delivery of sustainable CLT structures across all construction sectors, from commercial and education projects to medium rise residential developments. The \$25 million operation is expected to create up to 54 jobs when it begins operations, scheduled for 2017.^{vi}

In Victoria, *Hickory* has established a modular factory which now employs more than 150 people and is producing more than 500 apartments every year, with many of the employees drawn from the depleted Victorian automotive manufacturing sector.

Examples of prefabricated housing

The London Terrace "Rational House": built in 11 days



The Hammersmith and Fulham Council is considering building up to 100 prefabricated terrace houses after this three-bedroom model was trialed last year. The homes fit into tight city spaces and are made of panels that fit together.^{vii} The council aims to create "a borough of housing opportunity, where local residents can purchase a property for a reasonable price", and will offer the homes at discounted market rates to first home buyers.^{viii}

The Melbourne Laneway "Little Hero" Development: completed on site in 10 days



A \$12m nine-storey, 63 apartment building in a narrow Melbourne CBD laneway, constructed by Unitised Building. It was completed in nine months – about twice as fast as traditional construction - and delivery of the pods was completed within ten days.^{ix}

The Dutch "I build affordable in Nijmegen" Program: a menu of homes delivered in six weeks



A new Dutch government program offers home owners a menu of 30 architecturally-designed prefab packages ranging from red brick terraced houses to timber cabins, starting at less than \$150,000. Low income earners are eligible for the loan and the cost and schedule of building the house is fixed.^x The components are assembled off-site and only take a month and a half to assemble.^{xi}

The world's tallest timber building, Melbourne's Lend Lease 'Forte' apartments



23 apartments over 10 storeys and ground floor retail, built from cross-laminated timber (CLT) delivered at a cost of \$11m and in just 9 months. CLT is described as strong, sustainable solid wood alternative to conventional structural materials, developed in Europe and used in cutting edge constructions overseas for more than 10 years.^{xii}

Habitech's sustainable 'panel' modular housing using plantation wood and recycled materials



Melbourne-based modular design and build company uses SIPs (Structural Insulated Panels) made from expanded polystyrene sandwiched between plantation-grown Australian plywood and magnesium oxide board cladding (made from 50 per cent recycled timber and sawdust) with magnesium oxide providing strength, durability fire, water, UV and mildew resistance.

Since inception, the factory has produced multi-storey modular residential and hotel projects across the country, and engineered a system that can achieve architecturally diverse high-rise buildings.

In Perth, BGC Modular has set up a new factory producing houses that can be built in a matter of weeks,^{xiii} and the Department of Housing has partnered with a modular housing company to build 77 affordable apartments as part of a transit-oriented development at Success in the 'Stella village'. This village, built in just 18 days, is much more sustainable than traditional building in terms of energy, carbon and building waste.^{xiv} Analysis by Curtin University found compared to traditional construction building approaches it achieved:

- 50 per cent less waste
- 40 to 50 per cent less construction time
- Vastly reduced inconvenience of impact on site and surroundings
- 10 to 12 percent less in construction costs, and
- 35 to 40 per cent less aggregate funding costs and improved return for investors

> BENEFITS

'The development of environmentally friendly mass-produced housing typology, which is both affordable and thermally comfortable, is one of the most critical determinants in the transformation of global sustainability'^{xv}

Prefabricated housing could revolutionise the construction industry with the potential to limit costs and reduce build times.

Prefabricated housing can be delivered in significantly less time and at up to half the cost of conventional housing and is unlimited by size, shape or design. In suburban Perth a one bedroom house was recently delivered in just 14 weeks from the time of order to delivery on site. At a cost of around \$75,000 it can be installed in 10 hours by four people.^{xvi}

The product is also much more sustainable in terms of energy, carbon and building waste, with:

- Up to 50-60% shorter build times
- Up to 70% less site waste
- 90% less energy consumed compared with a five star home due to high insulation properties
- Panels are better suited to extreme environments and cyclone-prone areas due to high structural resistance
- Extremely adaptable and able to be built to any design
- Assembly line techniques and in-factory manufacture reduce construction time and costs significantly

> FIXING THE SUPPLY GAP

The gap between demand and supply for housing in Australia has reached crisis proportions. There is an overall cumulative

supply gap of 243,700 new homes and a gap of 539,000 rental properties that are affordable and available to low to moderate income earners.^{xvii} Almost 200,000 applicants are waiting up to ten years on the social housing waiting list,^{xviii} and 105,237 people are experiencing homelessness on any given night.^{xix}

The scale of this housing supply gap is unacceptable in a modern, prosperous economy and has led to Australia having one of the world's most unaffordable housing markets. In 2010-2011 only 5% of homes sold or built nationally were affordable for low income households,^{xx} and in 2012 a household on the minimum wage paid 72% of its income on a median priced rental compared to 35% in 2003.^{xxi}

In 2004 the UK Housing Corporation set a target of at least 25% of new social housing it funds to be built using 'modern methods of construction', which gave a significant boost to prefabricated housing.^{xxii} It's way past time we took similar action.

Without a major commitment to a major building program, a burgeoning prefab industry cannot create production facilities, purchase major equipment or make investments they want to. The industry will not reach the scale we need to address the demand for affordable housing.

> SUSTAINABLE ECONOMIC FUTURES FOR RURAL COMMUNITIES

An Australian sustainable prefabricated housing industry is a package that will directly benefit our regions and rural communities.

The Greens support a broad range of sustainable economic activities to ensure jobs and stability for regional and rural communities and have announced a comprehensive plan for the economic sustainability and long-term jobs for communities living in our forest regions, including in forest management and recreation and tourism. We have already committed \$3 million of seed funding to contribute to the establishment of a national farm forestry cooperative for farmers, to expand the potential for farm forestry to contribute to supply of plantation wood products.

> SUSTAINABLE BUILDING MATERIALS

Buildings account for nearly half of all global greenhouse gas emissions. In the construction process alone, 3 per cent of the world's energy is used for making steel, and 5 per cent for concrete.

Sustainable plantations, farm forestry and recycled fibre coupled with innovation and processing are the solution to meeting our wood product needs. The Greens want to see a thriving wood products industry in Australia that does not source timber from destructive native forest logging practices.

FACT BOX: WHAT IS PRE-FABRICATED HOUSING?

Prefabricated housing refers to homes that have been built off site in a factory and whose components can be transported and assembled on site. There are generally three types of prefabricated housing: Panelised systems, modular housing and hybrid pod systems.

1. **Off-site pre assembly** refers to when materials and prefabricated parts are constructed together off site and transported to a site to be permanently erected.
2. **Hybrid systems (pods)** are fully prefabricated facilities which have all furnishings and finishes complete off site
3. **Modular housing** is pod-like buildings consisting of several rooms that include all furnishings, electrical works and plumbing and which are dropped on to the site in once piece.
4. **Cross laminated timber** is made by bonding together timber boards and is incredibly strong and verstatile.
5. **Panelised systems** are pre-manufactured structural systems using wooden, metal or gypsum skins, 'sandwiching' a core of high density foam.
6. **Structured Insulated Panels (SIPS)** are a particular type of Panelised system developed 30 years ago in the USA. SIPS are extremely strong and by definition do not rely on any additional framework, and in rigorous testing must withstand three different loadings. They have an expanded polystyrene filling – which is an oil waste product that would otherwise be disposed of. SIPS using wood are 100% recyclable and zero waste, and when plantation sourced timber is used as the skin they are recognised in the world as the lowest embodied energy product available to the building industry today.

With vision, we can complete the transition to a strong, plantation-based industry.

There is significant potential to increase the value of products coming from our plantation estate. This includes the use of wood for hardwood eucalypt plantations for sawn timber products, and cross laminated softwood timber products.

Plantation stocks used for modular housing (SIPs) create significant value-adding to timber products. Plantation woodchips return about \$10 per tonne to growers, but using it in pre-fabricated housing (oriented strand board) returns a 10 fold return to the grower.

State-of-the-art methods already exist based on super-compressed mass timber panels that can be used in single dwellings and even multi-storey apartments. The world's tallest wooden building, 'The Forte', was recently completed in Melbourne in just 11 months.^{xxiii} Sweden has already approved a 30-story wood tower.

There is a huge amount of plantation timber currently available in Australia, in WA, SA and Victoria. WA currently has 81,000 hectares of pine plantations for residential construction

purposes. These are located in Yanchep, Gngangara and Pinjarra, and are mostly managed by the WA Forest Product Commission (WAFC). There are also some Australian companies that manufacture, market or develop sustainable construction materials. This includes Papyrus Australia – a South Australian company that that creates wood-based panels, hardboard and veneer products from banana tree waste created after the bananas are harvested. No chemicals are used in their manufacture and minimal energy is used in the process.

> OTHER PARTIES

The Coalition abolished the previous government's \$500 million plan to establish up to 10 Innovation Precincts around Australia for established and emerging industries, which would have included modular and advanced housing.

The ALP have focused on reforming the negative gearing and capital gains tax system but have failed to take any positive steps to filling the gap in the affordable housing market.^{xxiv}

Both major parties have excluded housing and advanced manufacturing/construction from their long term plans for the transition economy.

The Greens believe the government has the potential to deliver housing outcomes not currently being delivered by the market. This is why we have developed a national affordable housing program that includes a target for prefabricated housing.

ⁱ See greens.org.au/sustainable-wood-products

ⁱⁱ <http://issinstitute.org.au/wp-content/media/2011/04/ISS-FEL-REPORT-G-DALY-low-res.pdf>

ⁱⁱⁱ Newman, P and Green, J (2015) *Prefabricated buildings: an industrial revolution*. Build Australia. January 2015.

^{iv} Newman, P and Green, J (2015) *Prefabricated buildings: an industrial revolution*. Build Australia. January 2015.

^v Newman, P and Green, J (2015) *Prefabricated buildings: an industrial revolution*. Build Australia. January 2015.

^{vi} See <http://www.xlam-alliance.com/>

And [http://www.abc.net.au/news/2016-05-24/albury-wodonga-to-get-\\$25m-cross-laminated-timber-plant/7440092](http://www.abc.net.au/news/2016-05-24/albury-wodonga-to-get-$25m-cross-laminated-timber-plant/7440092)

^{vii} <http://www.standard.co.uk/news/london/new-homes-built-and-ready-for-families-in-just-11-days-8367676.html>

^{viii} <http://www.standard.co.uk/news/london/new-homes-built-and-ready-for-families-in-just-11-days-8367676.html>

^{ix} <http://www.hickory.com.au/projects/little-hero/>.

^{xi} <http://www.gizmodo.com.au/2013/05/town-reinvents-homebuilding-with-flat-pack-houses-under-150k/>.

^{xii} <http://www.forteliving.com.au/>

^{xiii} <http://au.prefabium.com/2010/02/bgc-modular.html>

^{xiv} <http://www.dhw.wa.gov.au/news/Pages/Pioneering-housing-project-bound-for-success.aspx>

^{xv} LUTHER, M. 2012. A new paradigm for sustainable residential buildings. In: SB08: Proceedings of the 2008 International Scientific Committee World Sustainable Building Conference, 2012. [ASN Events], 1252-1258.

^{xvi} Cockburn Herald 'Pre-fabulous'. September 15 2012

^{xvii} See report by AIHW, *Housing Assistance in Australia* 2014.

^{xviii} Number as at June 2015, Productivity Commission (2016) *Report on Government Services, Volume G: Housing and Homelessness*.

^{xix} <http://www.homelessnessaustralia.org.au/index.php/about-homelessness/homeless-statistics>.

^{xx} National Shelter 2013 Housing Australia Factsheet

^{xxi} Community Housing Coalition of WA (2012) 'What is community housing', p14.

^{xxii} Boyd, Khalfan and Maqsood (2010) Off-site construction of apartment buildings: A case study. *Journal of Architectural Engineering*. March 14, 2012.

^{xxiii} <http://www.forteliving.com.au/#>

^{xxiv} <http://www.alp.org.au/negativegearing>