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ACT Climate Change Council submission on High-density Residential structures and sustainable infrastructure

Preamble

This paper provides an independent view on issues and potential technical and other solutions to ensuring apartment complexes are more sustainable and liveable in a changing climate. The issues raised in this paper reflect a range of current challenges that relate to the zero emissions transition for existing apartment buildings and important considerations for new developments.

We appreciate that many of these policy and implementation challenges are being faced by the ACT Government throughout its broader work related to the Integrated Energy Plan, Zero Emission Vehicles, Waste Management and Planning Reform related to housing and urban design. At the time of publication, the latest developments in this work remains subject to Ministerial and Cabinet consideration, so the Government's ongoing or planned activity to address these challenges is not yet publicly available. In this context, the Council hopes to highlight both the difficulties and importance of addressing these policy challenges particularly relating to climate change and high-density living, and reinforce the need to accelerate this work.

Executive Summary

The population of Canberra is expected to grow and more high-density housing is essential to accommodate this rising population. High density precincts accommodate about as many residents and commercial activities as an average Canberra suburb, while individual high-rise towers can house the equivalent of a small suburb or village. High density residences and mixed-use development can thus be considered as "Vertical Suburbs". Well placed and designed Vertical Suburbs reduce the need to convert large areas of green-field into suburban residences and significantly improve environmental outcomes; reduce the need for private vehicle use; improve social interaction, health and well-being.

However, current planning and regulatory structures are leading to developments that fail to achieve some of the potential benefits of high-density precincts and risk becoming a significant hindrance to the ACT's broader environmental and social goals. It is critical that these opportunities are not lost as the ACT climate, especially extreme weather events, is projected to become more severe as climate change progresses.



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To address these issues, it is recommended that an integrated policy package is developed that covers the following areas:

1. Increasing greenspace within vertical suburbs, both at ground level and roof level as well as consideration of green walls/vertical gardens.
2. Reservation of additional communal green space outside the development in a manner that provides equitable availability of such space between vertical and traditional suburb residents.
3. Incorporate the principles of active living into the design of such roof, ground and communal space to encourage regular physical activity and equitable access.
4. Provision of EV charging facilities in a manner such that vertical suburb residents (at a minimum) are not discouraged from EV ownership.
5. Active motivational, financial, technical and logistical support for the degasification of services in vertical suburbs.
6. Mandatory minimum standards for management of vertical suburb waste
7. Incentivisation of the use of low embodied emissions construction for new vertical suburb developments.
8. Incorporate community-driven design standards that will reflect desired community characteristics to ensure maximal/optimal use of this space for social benefits, health and well-being.

A policy package of this nature is necessary to ensure that Canberra's vertical suburbs are fit for purpose in a net zero GHG emissions city that values the social and environmental equity of its residents.

Background

High density residential and mixed purpose complexes include single multi-story tower blocks and "precincts" of such towers around common facilities. Urban densification and infill results in the building or refurbishment of these towers and precincts and is a vital component to deal with the anticipated population increase of Canberra. A single high-density precinct like 1.5 ha "Republic Precinct" in Belconnen can house the same population and commercial activity as a substantial suburb like Dickson or Forrest. Individual towers can house the equivalent population of a small suburb (e.g., Hume) or village (e.g., Hall) but only occupy the area of couple of traditional building blocks.

Such densification has significant theoretical environmental and economic advantages over more "traditional" low density or typical suburban developments. Many of these advantages directly or indirectly help reduce GHG emissions or aid adaptation to the projected stresses and impact of climate change. When well-designed and situated along major public transport arteries, high density developments can be highly energy efficient, reduce the relative need for private transport and improve social health and interaction. Such outcomes make a positive contribution to the emissions-reduction trajectory adopted by the ACT Government as part of its climate change response. The best ACT high density developments include examples of world's best



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practice, including access for residents to well lit and airy common spaces and the view or presence of nature or other biophilic elements from individual units. These elements can reduce some localised heat island effects, but can also reduce the social, psychological and physiological stress of extreme heat events.

The ACT has a number of progressive policies to support residents to reduce GHG emissions and adapt to climate change. Unfortunately, many of the policies and practices do not consider the unique characteristics of vertical suburbs, which introduces an equity issue as well as substantial missed opportunities.

Canopy and Heat Island

Occupants of high-rise developments lose the benefits of the ACT's 30% canopy policy. The Republic Precinct, as an example, was developed on a car park of approximately 1.5 ha. The car park was well treed with a canopy cover approaching 50% and a similarly high percentage of ground permeability (Figure 1a). Although small in area, this high canopy and permeability may have been locally significant as the Belconnen town centre has well below desirable levels of canopy cover. After development, the canopy area for the Precinct is less than 5% while the permeability area is essentially zero (Figure 1b). A few small garden tubs on the private Laneway (above three to five levels of underground parking) and a modest roof garden covering a small portion of the rooftop with a few small trees is all that is left of the living infrastructure. Other car parks in the vicinity are scheduled for similar infill and high-density development (e.g. Figure 2).

The loss of canopy and the increasing density of residents means that the heat island effect in the locale will increase, to the detriment of apartment cooling loads and capacity to cope with heatwaves. Vertical suburbs rely almost totally for building climate control on mass, insulation, double glazed windows and heat pumps/reverse-cycle air conditioning. Unlike high density buildings in countries like Singapore, opportunities for passive cooling via external shading, roof gardens, green walls and cross ventilation are rarely taken. Such passive cooling is feasible and effective for Canberra under current and predicted future climates. Extreme heat events are predicted to increase in frequency under climate change, and if electrical power is ever lost during such an event, the loss of heat pumps, absence of shaded gardens and lack of cross ventilation could put the entire population of vertical suburbs at risk. Vertical suburbs are also (currently) excluded from community battery initiatives, which could otherwise lessen this risk.

Community Green Space

While living canopies provide functional benefits in terms of shading and cooling, a broader benefit of greenspace includes its potential to maintain the social cohesion, mental health and physical wellbeing of residents. Support of such cohesion and wellbeing is particularly important when people and communities are stressed by extended periods of hot weather. However, access to greenspace from many vertical suburbs is limited and not expanding to meet the scale of development.



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For example, a number of high-density towers have been developed around Belconnen Town Center in the past decade which has added the equivalent of approximately three new suburbs the population of Dickson or Forrest. However, John Knight Park – as the only significant greenspace within walking distance - has remained relatively unchanged over this period while there are plans to build on more of the current green space around the Lake. If these 6,000+ new residents were housed in more traditional suburbs rather than vertical suburbs, the ACT Government would have included several hectares of additional green space, play areas and parks.

Extensive or intensive rooftop gardens within individual developments, as mandated in several European countries, can provide some mitigation of this loss of greenspace. Best practice high density residences include linked common spaces – both inside/under cover and outside, with extensive greenery and local tree canopies. Such spaces encourage a stronger community and can also be used as refuges from the adverse weather events predicted by climate change models for residents at risk and in units with below average environments. Community gardens in these community spaces may also encourage community cohesion and support local production of food thus reducing Scope 3 GHG emissions. Effective storage and use of water runoff from vertical suburbs is important to help maintain extensive greenery especially given the loss of soil water permeability in the precincts.

To maximise the diversity, effectiveness and longevity of climate change emission-reduction and adaptation benefits from urban planning it is important to engage the community members from the beginning. This process is important to identify local priorities for development that can enhance social health and well-being of residents, especially during heat extremes, as well as ensure that the benefits are equitable. Additional green spaces on vertical structures can positively impact community health and increase social cohesion through greater interaction among community members. When active living principles are incorporated into their design, there is considerable scope to improve mental and physical health.

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A) Pre-construction (Google maps 3D visualisation)



B) Post-construction (Note the non-utilised roof space and lack of plants and permeability) (GeoCon publicity photograph)



Figure 1: The Republic Precinct, Belconnen Town Centre

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Figure 2: Proposed development of the “Chandler” high-rise apartment. Canopy cover > 30%. (Google maps 3D image)

Transport

Siting vertical suburbs within easy walking distance of mass public transport (bus and tram) decreases the use of privately owned vehicles for daily commuting, which makes a positive contribution to reducing greenhouse gas emissions. However, many residents still require a private car for flexibility and although electric vehicles may be desirable, the high-density environment often makes charging at the residence inconvenient if not infeasible. Vertical suburbs have underground parking with some also having podium parking. Currently, no high-rise tower in the ACT includes EV charging for each individual car spot: some have 2 or 3 visitor charging spots, and at least one proposed development is advertising this feature, while ACT government policy requires all new towers to include at least some EV charging stations. Retrofitting charging stations for all parking spots in a vertical suburb is prohibitively expensive especially as it would, in most cases, require an upgrade to the power sub-station at the cost of owners in addition to extensive re-wiring of multiple levels of car park. In contrast, residents in traditional suburbs or even medium density housing can usually simply plug their EV into an extension cable from their house or garage and if too many do that for the suburb sub-station, ACTEW will upgrade. While changes to the National Construction Code in 2022 appear to be heading in the right direction to address this for new high-density developments, existing



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developments are likely to remain without adequate EV charging facilities for the foreseeable future.

There is also mounting concern over the safety of large numbers of EV's being charged in close proximity. Fires from damaged or faulty EV batteries are extremely difficult to extinguish and can "jet" along vehicles parked within 1 – 3 m of each other to cause further fires. Queensland regulations are prohibiting EV charging in underground situations as a fire safety precaution. Given the significant financial barriers and the presence of this unresolved safety question, it is unrealistic to currently expect existing high-rise towers to comprehensively address EV charging. This will quickly become a significant hindrance to the ACT Government's plans to electrify transport.

Electrification of Services

ACT government intent includes phasing out of gas and electrifying hot water and heating. Again, residents in suburbs with stand-alone housing can get assistance in the change over and schedule the conversion to suit themselves. Vertical suburbs in the ACT often have banks of gas heaters feeding into common hot water and heating infrastructure. These banks tend to be on rolling replacement schedules with, say, one-fifth replaced every 2 years. Gradual conversion to electric systems would not be feasible without disruption, and the most energy efficient systems (reverse cycle) would not be practical due to restricted roof space. Electric immersion heaters currently seem to be the only option for vertical suburbs but these are also potentially unavailable due to the need for additional space, hot water storage and electrical supply capacity. To meet the de-gasification mandate, vertical suburbs may need to impose a special levy on all owners to replace their entire system with sub-optimal heating even though part of the gas heating system would likely be relatively new. The communal decision-making structures of body corporates are unlikely to promote such actions on a voluntary basis (even when the technology change is feasible).

Garbage, recycling and compost

Vertical suburbs have a diversity of garbage and recycling systems, ranging from individual chutes leading to compactors in the basement to large bins in enclosures near the street for residents to walk to. Disposal is the responsibility of the Owners' Corporation who presumably contract to the lowest bid. Green waste / compost is rarely considered and is usually simply added to the general waste for landfill. Improved recycling separation and differentiation of compostable material is constrained by lack of space allocated, and some apartments (e.g., in Sydney) are excused from separating anything out from general landfill waste due to lack of space. Space for residents to sort their waste into landfill, recycling and organic waste, at a minimum, would future-proof vertical suburbs enabling reduced emissions from landfill due to organic waste and in reducing Scope 3 emissions in the economy through improved recycling. Attempts by some Executive Committees to reallocate space for compost often fail as such changes in common area use currently requires a Special Resolution, which has very high bars to success.



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Scope 3 emissions from construction activity

Almost all vertical suburbs in the ACT are currently constructed from steel and cement. Such construction materials are not climate change friendly, especially with respect to Scope 3 emissions. Tall wooden buildings, using composites for the whole structure or just around a cement/steel core are a more environmentally friendly building approach and there are now a number of “tallest”, “fastest” and “most-attractive” examples in Queensland, NSW and Victoria and many have been constructed overseas. Some countries require developers to include a “wood-based” option for proposed buildings due to their environmental advantages and reduction in Scope 3 emissions.

A Call to Action

The projected massive growth in Canberra’s population in conjunction with the ACT government’s decisions to limit greenfield development mean that vertical suburbs will become home for an increasing number of Canberrans. However, as discussed in this paper, the planning provisions as they stand are not delivering vertical suburbs that are compatible with climate change, broader environmental and wellbeing goals. As a result, a major policy revision is required. In developing such policy, the particular nature of the body corporate decision-making processes used in most vertical suburbs must be considered. Achieving change will require a combination of incentive mechanisms, finance mechanisms (including environmental loans recovered through rates) and mandatory requirements. As a result, any policy will need to be developed as an integrated whole rather than a series of *ad hoc* solutions.

Such a policy vehicle would need to cover:

1. Increasing greenspace within vertical suburbs, both at ground level and roof level as well as consideration of green walls/vertical gardens. This will make for more liveable, lower-emission structures.
2. Reservation of additional communal green space outside the development in a manner that provide equitable available of such space between vertical and traditional suburb residents. This will help residents cope with future extreme events.
3. Provision of EV charging facilities in a manner such that vertical suburb residents are not discouraged from EV ownership. This will reduce ACT GHG emissions.
4. Active motivational, financial, technical and logistical support for the degasification of services in vertical suburbs. This will also reduce ACT GHG emissions as well as operational costs.
5. Mandatory minimum standards for management of vertical suburb waste. This will reduce methane emissions from landfills and can help incipient food re-use industries.
6. Incentivisation of the use of low embodied emissions construction for new vertical suburb developments. This will reduce GHG emissions and increase long-term carbon storage.

Conclusions



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The development and equitable use of Vertical Suburbs is vital to accommodate the anticipated large population increase in Canberra whilst addressing climate change issues. While Vertical Suburbs have some theoretical environmental and economic advantages, there are challenges associated with their development especially in the context of mitigating and adapting to climate change. A coherent and integrated policy package is needed urgently to address the many overlapping issues that currently detract from the climate change mitigation and adaption, environmental and social benefits that can be achieved by vertical suburbs.