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## Commentary

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### **Horizon 3 planning: meshing liveability with sustainability**

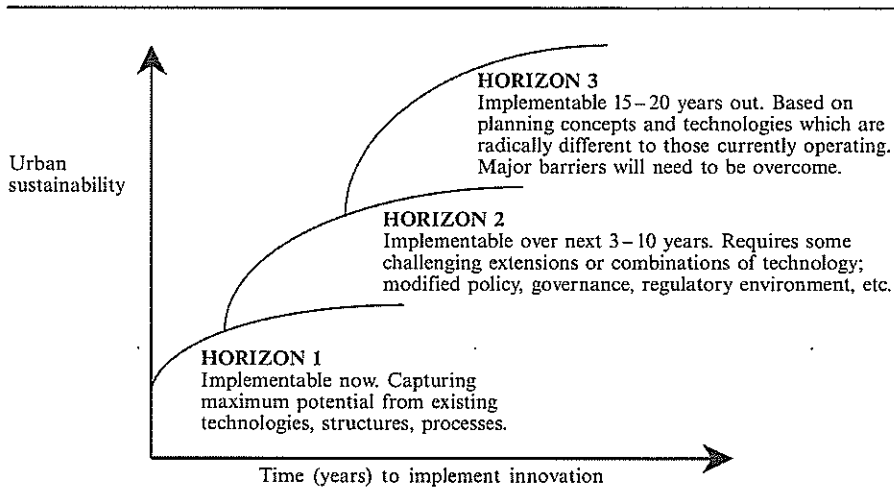
Three successive Australian State of the Environment Reports on Human Settlements (Newton, 2006) have revealed an escalating pattern of urban consumption that should now be classed as unsustainable both locally and globally. Ecological footprints of what are seen as Australia's highly liveable capital cities (The Economist Intelligence Unit, 2004), if translated globally, would necessitate 4-planet living (Environment Planning Authority, 2007).<sup>(1)</sup> The level of per capita greenhouse gas emissions from urban Australia and fossil fuel exports also represent a significant contribution to global warming and climate change. The reputation that Australian cities have attained for liveability does not equate to their sustainability.

Current Australian urban lifestyles are based on increasing rates of per capita resource consumption—for example, water use at 115 L/year (2000–01; 3.2% per year increase over 1996–97 level), energy use at 266 GJ/year (2003–04, with a forecast increase of 2.2% per year to 2019), waste generation of approximately 1 tonne/year and increasing in most states, mobility by car of 8000km/year (with vehicle kilometers travelled forecast to be one-third higher by 2020 in capital cities than in 2002), CO<sub>2</sub> generation of 27.5 tonnes/year, and the floor area of new dwellings has increased at a rate of 2.2% per year over the 10-year period to 2003–04 (where the average was 239 square metres). In all instances, annual rates of change in per capita consumption are well above the rate of Australia's population growth (which in turn is double that of the OECD) and, in combination, these twin factors are driving growth in Australia's total consumption and associated footprint.

While affluence is part of the reason for above average consumption rates, the high rate of urbanisation and types of urban development are also contributing factors. A significant proportion of Australia's total annual urban resource consumption is actually designed into its cities and housing. Where people live within a city and the types of dwellings they occupy will exert an impact over and above that of an individual's discretionary consumptive behaviour. Household consumption has also now become a key engine of contemporary economic growth, and consumption landscapes are as distinctive within our cities as production landscapes. Yet at the same time, Australia's increasing level of total consumption is a major factor behind looming vulnerabilities facing the nation's cities in areas related to water supply, greenhouse induced climate change, transport congestion and mobility costs, and housing affordability.

In order to accommodate the levels of urbanisation and resource consumption unfolding in developing countries such as China, and to address the consumption-driven vulnerabilities of cities and their populations in countries such as Australia requires access to a pipeline of innovations that are capable of delivering radical transformation, given the enormity of the transitions required to produce sustainable urban systems this century. These innovations can be seen to occupy three

<sup>(1)</sup>Based on the ecological footprint metric created by Wackernagel and Rees, 1996 and applied locally by the Environment Planning Authority, the average Australian requires of the order of seven and a half to eight hectares of land to support his or her contemporary lifestyle, compared with approximately two hectares per person globally. If all the world's population aspired to a similar level of consumption to that of Australia, then four earths would be required to support it.



**Figure 1.** The three horizons of planning.

horizons (figure 1). The three horizons of planning and urban development innovation are a concept that originated in business management (Baghai et al, 2000). The authors of the concept argue that, for an enterprise to be sustainable, it must have a stream of new products, ideas, and processes capable of being substituted for those that are mature and possibly declining in market attractiveness and profitability. In a like manner, 21st-century cities need to be able to appropriate a pipeline of innovative technologies, products, designs, and processes that can be substituted when existing ones begin to show signs of failure. Some indicative H1, H2, and H3 innovations are listed below (table 1).

Horizon 1 innovations include products capable of immediate implementation as a result of their relative maturity of development and demonstrated superior performance (eg compact fluorescent lighting); pricing strategies in which environmental externality costs are incorporated; policy innovation such as the introduction of targets for renewables and CO<sub>2</sub>, and incentives for purchase of green products that may have a higher capital cost than existing alternatives; and more generally the range of action items that feature on most 'green' websites.

Horizon 2 innovations are those capable of bridging from the present situation until sustainable infrastructure and processes can be widely implemented (H2 occupies the next generation—up to twenty years from now). In the energy sector this will involve a greater utilisation of natural gas, which has a greenhouse signature half that of coal for electricity generation, and the diffusion of distributed energy systems which open up the current centralised system to a supply of (surplus) electricity produced for the most part from renewable energy devices embedded in separate buildings. For our present (19th-century-based) linear urban water and wastewater systems, the introduction of sewer mining and water-sensitive urban design represents the first step towards the emergence of closed loop systems, in which water is extracted from effluent, treated, and reused. H2 innovations that focus on waste reduction will centre primarily around single enterprise manufacturing initiatives in which it is possible to manage the entire supply chain, as in automobile, computer, and whitegoods manufacturing, among others. The *Factor 4* ecoefficiency revolution advocated by von Weizsacker et al (1997) could be classed as Horizon 1–2 innovation, but is likely to fall short of delivering the outcomes needed for sustainable urban development. More is needed.

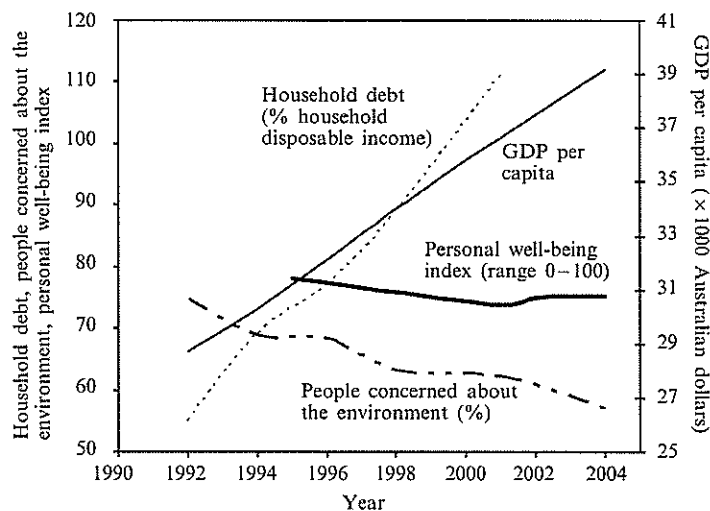
**Table 1.** The three horizons of planning and urban development innovation.

Urban environmental domain	Horizon 1	Horizon 2	Horizon 3
Energy	Energy efficiencies in housing and industry; house energy rating	Distributed renewable energy; methane bridge	Solar-hydrogen economy
Water	Water-smart appliances	Sewer mining; water-sensitive urban design	Integrated urban water systems (recycled stormwater, wastewater)
Buildings	Check-box system for green building design (eg LEED)	<i>n</i> bottom-line real-time life cycle sustainability performance assessment during design—via 3D CAD and GIS	Ultra-smart buildings and linked infrastructures; imbedded intelligence
Waste	Product stewardship; kerbside recycling	Extensive cradle-to-cradle production	Ecoindustrial clusters as new engines for mega metro economies
Transport	Road pricing; telepresence via broadband communications	Hybrid vehicles; smart planning	Intelligent transport systems (ITS)

Horizon 3 innovations are where radical change to the performance of our human settlements will need to occur. H3 innovations enable a step change in system performance, but currently face significant barriers to take-up and diffusion. For example, a solar-hydrogen economy is one based solely on renewable energy that is capable of supplying the needs both of the built environment and of transport, without the impost of CO<sub>2</sub> and air pollution. However, there are a number of current barriers—which include comparative cost, immaturity of fuel cell technologies, and lack of a hydrogen infrastructure—that need to be overcome. Transport congestion in the future should be less of an impost on family time budgets or a cost to the economy if the combination of smart planning (integrated transport and higher density mixed land-use development), road pricing, telepresence, and ITS are successfully introduced. Cities in catchments that have vulnerable water yields have the potential for drought proofing when stormwater and wastewater—both currently disposed to receiving waters but representing a volume 1.5 times in excess of present water use for cities such as Sydney and Melbourne—are utilised via closed loop integrated urban water management systems. Zero waste is a potential goal for those urban regions that are capable of recognising waste streams as potential resource streams and that cities are our mines of the future. At present, however, there is negligible mapping of urban waste streams and their chemical characterisation, much less linking them to transformative processing technologies capable of spawning a generation of new ecoindustrial clusters based on industrial ecology principles. H3 buildings will have had the benefit of multiple comprehensive sustainability assessments through their design stage as a result of automated real-time performance assessment of building models by a ‘design checker/adviser’—the architect’s equivalent of ‘spell checker/thesaurus’. H3 buildings and linked infrastructure will also be sensor rich, a key factor in delivering sustainable

buildings 'as operated' as well as 'as designed', via real-time feedback to occupants. All Horizon 3 innovations bring with them significant challenges for urban planning, which is possibly one reason why they do not seem to feature in the strategic planning documents for most metropolitan regions, where H1 and, at best, H2 thinking tends to dominate. Implementation of innovation in greenfield settings represents less of a challenge than in urban redevelopment (Batty, 2007), but it is in established built-up areas where the key sustainability transitions are waiting to be realised (Newton, 2007) and where H1, H2, and H3 innovation needs to be introduced and managed as a concurrent process.

The ultimate H3 transition is not on the supply side. Rather it involves individuals and their attitudes towards consumption and the environment. As revealed in the 2006 State of the Environment Report on Human Settlements, over the past decade, the wealth of individual Australians as measured by gross domestic product per capita has continued to rise (Australian Bureau of Statistics, 2005a, figure 2). Consumption aspirations have, however, risen faster for many sections of the population, and this is reflected in the rapid growth of personal debt, now at record levels and consistently in advance of GDP per capita since the late 1990s (La Cava and Simon, 2003). 'Affluenza' has been nominated as the latest disease to afflict the Australian population (Hamilton and Denniss, 2005). Despite growth in material assets, 'happiness', as measured through surveys of personal well-being, remains flat (Cummins et al, 2005; Leigh and Wolfers, 2005). Indeed, the last two rounds of tax cuts in 2006 and 2007 provided no political bounce whatsoever in the polls to the federal government. And, over this same period, Australians' concern for the environment as measured annually via Australian Bureau of Statistics Household Surveys has tracked consistently lower (Australian Bureau of Statistics, 2005b, figure 2). Consuming more but caring and conserving less is how some colleagues have characterised this particular bifurcation. The key challenge for societies similar to Australia is to encourage a transition in attitude and behaviour among the population from viewing the planet as a 'magic pudding' which is able to endlessly supply wants and needs (Lindsay, 1918), to adopting



**Figure 2.** The three faces of Australia. Plotted as a function of year: (left axis) household debt as a percentage of household disposable income, percentage of people concerned about the environment, personal well-being index (range 0–100); (right axis) GDP per capita ( $\times 1000$  Australian dollars). Sources: Australian Bureau of Statistics (2005a; 2005b); Cummins et al (2005); La Cava and Simon (2003); Leigh and Wolfers (2005).

lifestyles that are less materialistic and consumptive. When attitude and behaviour change is coupled with H3 innovation, it then becomes possible to consider adding a third equation to the two outlined towards the end of Al Gore's (2006) *An Inconvenient Truth*:

*Old habits + old technology = predictable consequences.*

*Old habits + new technology = potential for dramatically altered consequences.*

*New habits + new technology = prospect for a sustainable planet earth.*

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#### References

- Australian Bureau of Statistics, 2005a *Year Book Australia 2005* (Australian Bureau of Statistics, Canberra)
- Australian Bureau of Statistics, 2005b *Environmental Issues: People's Views and Practices* (Australian Bureau of Statistics, Canberra)
- Baghai M, Coley S, White D, 2000 *The Alchemy of Growth: Practical Insights for Building the Enduring Enterprise* (Perseus, London)
- Batty M, 2007, "The creative destruction of cities" *Environment and Planning B: Planning and Design* 34 2–5
- Cummins A, Okerstrom E, Woerner J, Tomy A, 2005, "Australian unity wellbeing index: survey 13", Australian Centre on Quality of Life, Deakin University, Melbourne, <http://acqol.deakin.edu.au>
- Environment Planning Authority, 2007, "Australia's and Victoria's ecological footprint", <http://www.epa.vic.gov.au/footprint>
- Gore A, 2006 *An Inconvenient Truth* (Paramount Pictures)
- Hamilton C, Denniss R, 2005 *Affluenza: When Too Much Is Never Enough* (Allen and Unwin, Sydney)
- La Cava G, Simon J, 2003, "A tale of two surveys: household debt and financial constraints in Australia", Research DP 2003-08, Reserve Bank of Australia, Sydney), <http://www.rba.gov.au/rdp/RDP2003-08.pdf>
- Leigh A, Wolfers J, 2005, "Happiness and the human development index: Australia is not a paradox", DP 505, Centre for Economic Policy Research, Australian National University, Canberra
- Lindsay N, 1918 *The Magic Pudding* (Angus and Robertson, Sydney)
- Newton P W (Ed.), 2007 *Transitions: Pathways Towards Sustainable Urban Development in Australia* (CSIRO Publishing, Melbourne) in press
- Newton P W, 2006, "Human settlements: theme commentary prepared for the 2006 Australian State of the Environment report", Department of the Environment and Heritage, Canberra, <http://www.deh.gov.au/soe/2006/commentaries/settlements/index.html>
- The Economist Intelligence Unit, 2004, "Melbourne world's top city" *The Age* 6 February, <http://www.epa.vic.gov.au>
- von Weizsacker E, Lovins A, Lovins L H, 1997 *Factor 4: Doubling Wealth, Halving Resource Use* (Allen and Unwin, Sydney)
- Wackernagel M, Rees W, 1996 *Our Ecological Footprint: Reducing Human Impact on the Earth* (New Society, Gabriola Island, BC)