

Lord, give me carbon restraint, but not yet: Australia and the energy transition

En este artículo se examina la experiencia australiana en su transición global hacia fuentes de energía menos centradas en el carbono y el petróleo. En primer lugar, el artículo expone la actual situación energética de Australia y los patrones actuales de uso y dependencia energética. A continuación se explica que los sistemas de transporte urbano australianos dependen en gran medida del petróleo y se describen las consecuencias sociales de estos patrones. En tercer lugar, el artículo expone la política nacional energética y la importancia de las exportaciones energéticas para la configuración de esta política. Por último, el artículo evalúa los planes metropolitanos ante los imperativos energéticos y describe las medidas públicas recientemente tomadas para acelerar el avance hacia una transición energética.

Artikulu honetan Australiako esperientzia aztertzen da, karbonoaz eta petrolioaz bestelako energia-iturriak bultzatzearen alde aurrera eramaten ari den trantsizio globalari dagokionez. Artikuluan, lehendabizi, Australiako egungo egoera energetikoa azaltzen da, eta energia-erabilerari eta -mende-kotasunari lotutako egungo patroiak zehazten dira. Jarraian, Australiako hiri-garraioen sistemak, neurri handi batean, petrolioaren mende daudela aipatzen da, eta patro horiek gizartean dituen ondorioak ere deskribatzen dira. Hirugarrenik, artikulan energiaren arloko politika nazionalaren berri ematen da, eta politika horri eusteko energia-esportazioek duten garrantzia nabarmentzen da. Azkenik, energia-beharrei erantzuteko abiarazi diren metropoli-planak ebaluatu, eta trantsizio energetikoan aurrera egiteko prozesua bizkortzeko berriki hartu diren neurri publikoak zehazten dira.

This paper examines the Australian experience of a global transition towards less carbon and petroleum intensive energy sources. First the paper sets out Australia's current energy situation and the current patterns of energy use and dependence. The paper then identifies how Australian urban transport systems are highly oil dependent and describes the social consequences of these patterns. Third, the paper then considers national energy policy and the balance significance of energy exports in shaping this policy. Finally the paper assesses how metropolitan plans responding to energy imperatives and describes recent local government moves to accelerate progress on energy transition issues.

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1. INTRODUCTION

This paper focuses on the significance of the 'energy transition' to Australia at the national and metropolitan scales. The past half-decade has witnessed the growing international recognition that the historical trajectory of global energy consumption is no longer sustainable on the basis of current energy sources. The weight of scientific opinion suggests that global consumption of fossil fuels has generated a level of carbon dioxide emissions that now threatens to alter the global climate. Yet the future consumption of these fossil petroleum fuels has been simultaneously placed in doubt by concerns over the depletion of reserves and wider constraints in the production and processing stream. Increasing appreciation

of the unsustainable use of fossil carbon fuels and the potential for the depletion of global petroleum reserves has led to increasing calls for an 'energy transition' in which national economies would take a range of steps to reduce reliance on greenhouse gas intensive energy sources while simultaneously reducing energy consumption and facilitating greater use of low carbon intensity energy sources.

The progress of an 'energy transition' agenda among developed nations has to date been both faltering and highly uneven. However some prominent examples have emerged that illustrate early attempts to restructure national energy economies for a transition away from excessive greenhouse gas pollution and towards reduced petroleum dependence. Perhaps the most

deliberate and comprehensive articulation of an energy transition strategy has been the Swedish government's commitment to 50 percent of national energy consumption drawn from renewable sources and a 40 percent reduction in national greenhouse gas emissions (Swedish Government 2009). A more recent example of a national commitment to reduced energy consumption and petroleum reliance has been U.S. President Obama's proposal to reduce national oil dependence and increase the use of alternative energy sources such as biofuels, wind and solar (White House 2009). The development and pursuit of a comprehensive energy strategy at the national scale is, for most nations, highly contingent on contextual factors which shape the imperatives for action on energy matters. Sweden's strategic decision to seek a much lower reliance on petroleum appears, in part, driven by the lack of an indigenous petroleum supply and a history of favouring energy conservation measures in public policy.

Cities must also be a focus of any energy transition strategy because the majority of the world's population dwells in cities. Cities are also highly energy intensive forms of human settlement and thus offer opportunities for reducing carbon emissions at the mass scale. Cities also depend heavily on transportation networks for economic and social exchange. The transport systems of many cities, especially Australian cities, are highly dependent on private motor vehicle transport which in turn relies upon petroleum fuels. Car dependent urban transport systems such as Australia's face considerable uncertainty under any energy transition. While there is a considerable body of scholarship explaining the risks and calling for reductions in the petroleum dependence

of urban transport systems, many cities remain highly vulnerable to adverse consequences of declining energy security. In Australian cities such risks are not only economic – urban social systems and the distribution of social resources and opportunities are intertwined with household urban mobility. Any constraint on households' capacity to traverse urban space, especially where such constraint differentially affects particular social groups, could have adverse implications for social equity and fairness. There is an urgent need to better understand how social equity may be affected by any energy transition, especially in the area of urban transport.

The remainder of this paper has three objectives. First it identifies Australia's patterns of energy consumption at the national and metropolitan level. Next it reviews current Australian responses to emerging energy imperatives nationally and within cities and assesses the extent to which these form a coherent response to the 'energy transition' challenge. The paper concludes with observations about Australia's likely future energy trajectory and the implications for the sustainability of Australia's major metropolitan regions.

2. THE AUSTRALIAN ENERGY AND TRANSPORT CONTEXT

Australia's economy is highly dependent on energy both as a production input and as an income earning commodity. Australia is well endowed with coal and uranium. The country possesses eight percent of global coal reserves which ranks it fifth in the world. Australia also has 40 per cent of global uranium reserves – more than any other nation (DPMC 2004). Australia

benefits considerably from exports of these energy sources. While it is the world's fourth largest coal producer, it is the world's largest coal *exporter* (DPMC 2004). The recent strong economic growth of China has generated rapid growth in coal exports and contributed \$22 billion to national income in 2007 (ABARE 2008a). By contrast, Australia holds modest reserves of other conventional energy resources with just 0.3 per cent of global oil reserves and two per cent of global natural gas reserves (DPMC 2004). The result is that Australia is a net importer of petroleum fuels which is a significant issue given the heavy reliance of transportation systems on petroleum.

Australia also has abundant solar energy resources due to daily sunshine of six hours or more falling across most of the continent. Australia has some hydroelectric capacity and extensive wind resources, however the production of energy through these sources is modest. In 2006-2007 a little more than 1 per cent of Australia's total energy production came from renewable sources (ABARE 2008b). Renewable energy has fared better as a proportion of domestic energy consumption contributing slightly more than five per cent of this total. While renewable energy sources are growing rapidly at around three per cent per year, this is a lower growth rate than for any other conventional energy source (ABARE 2008b). And there is a relative imbalance in Australian government support for renewable energy compared to conventional energy. Riedy (2007) calculated that approximately \$9.5 billion in subsidies were provided to the coal, oil and gas sector in 2006 compared to approximately \$325 million for the renewable energy sector.

The Australian transport sector is heavily reliant on conventional liquid fuels. The

transport sector accounts for 36 per cent of national energy consumption from all sources (Syed et al. 2007) and is responsible for more than 70 per cent of national petroleum consumption (DRET 2008). Over 97 per cent of Australian transport is powered by petroleum fuels in the form of petrol, diesel, aviation gasoline or liquefied petroleum gas. Road vehicles accounted for 75 per cent of Australian transport fuel consumption and passenger vehicles comprise 62 per cent of this total (Syed et al. 2007). Considerable absolute demand growth is projected from the automotive sector. In Australia's fastest growing urban region, South East Queensland, the use of motor vehicles is predicted to increase some 48 per cent by 2026 (Office of Urban Management 2005). Based on current technology, such growth will add to the petroleum reliance of the Australian transport sector. Any attempt to achieve a national energy transition must address the problem of rising transport oil dependence.

3. AUSTRALIAN URBAN TRANSPORT SYSTEMS

In Newman and Kenworthy's (1989) groundbreaking comparison of transport energy use in cities, Australia's five largest cities were found to be among the most car dependent and thus petroleum dependent in the world. Newman and Kenworthy (1989) demonstrated that Australian cities were less car dependent than most US cities, on a par with Canadian cities, but much worse than Europe and Asian cities. Newman and Kenworthy have argued that these patterns are due to differing urban densities between cities. Newman and Kenworthy (1996; 1999) argue that high density cities, such as those typically found

in Asia or Europe, exhibit much lower energy use per capita because the closer proximity of their populations and land-uses means reduced travel distances and an urban form that supports walking, cycling and public transport.

The relationship between the transport energy patterns and urban form claimed by Newman and Kenworthy has proven controversial, especially in Australia. Perhaps the most significant counterpoint to this proposition is Mees' (2000) study of public transport service quality. Mees argued that differences in levels of transport energy consumption between cities are in part due to differing levels of provision for automobile travel and associated levels of support for public transport. Thus European cities which have restricted urban freeway development while providing high quality public transport exhibit moderate transport energy consumption while U.S. cities which have followed pro-freeway development patterns and neglected public transport display high transport energy intensity. Australian cities, which have introduced urban freeways yet retained basic public transport systems, fit between the U.S. and European patterns. Other scholars have criticised the implications of the perceived relationship between transport energy use and urban density in terms of total household energy use. Troy and others (1996; 2003) have consistently argued that transport energy use cannot be viewed in isolation from energy consumption due to the embodied and operational energy of different building designs. Myors, O'Leary and Heelstroom (2005) have shown that high rise apartments are currently the poorest performing dwelling type in energy consumption terms. The densest zones in Australian cities also exhibit the greatest level of total household energy

use due to the high consumption lifestyles of the wealthy residents of these areas (Lenzen et al. 2004). Such findings cast doubt over the view that higher density development per se will perform better from a total greenhouse emissions perspective. This area of research remains highly controversial in Australia however, with little sign of a consensus, although Gray and Gleeson (2007) and Rickwood, Glazebrook and Searle (2008) indicate a degree of settling within the literature.

Australia's urban planning practitioners have been far more convinced by the proposed energy-density debate than the nation's scholars. 'Compact city' policies have been pursued within Australian metropolitan plans for over two decades under the local descriptor of 'urban consolidation'. While reducing urban transport energy has been a key justification of urban consolidation in Australia, such policy is also aimed at a wider set of urban objectives including limiting consumption of ex-urban land, reducing infrastructure servicing costs and widening housing choice beyond the conventional Australian detached dwelling. To date, urban consolidation has had, at best, mixed success. Patterns of urban expansion, infrastructure delivery and housing affordability remain fraught with ecological degradation (Low Choy et al. 2008), high infrastructure costs and increasing rents and house purchase expenses (Productivity Commission 2004).

4. URBAN TRANSPORT ENERGY USE AND SOCIAL EQUITY

Aggregate national depictions of transport energy use often miss important differences in the transport energy dependence of

Australia's urban households. Levels of transport energy dependence can be sharply differentiated because of the variations in spatial location or household socio-economic status. Differences in petroleum dependence for transport could have considerable implications for social equity under an 'energy transition'.

Differences in household dependence on petroleum can be revealed through travel data. Sydney provides a useful example because it has the best travel data and is also generally representative of Australian urban structure comprising a very dense central business district surrounded by moderate density inner suburbs with an expansive low density suburban zone beyond. In Sydney, private motor vehicles are used by residents of the inner urban areas for approximately 56 percent of travel, while those in the distant outer suburban growth corridors use private vehicles for almost 80 percent of their travel (Department of Planning 2006). Those living in Sydney's outer suburban zones also travel greater distances each day compared to middle and inner urban residents. Thus households in the city's outer areas report average daily 'vehicle kilometres travelled' (VKT) of approximately 30 km, while those in the inner areas travel on average about 12 km (Department of Planning 2006).

Travel is not the only point of transport differentiation in Australian cities. High levels of outer suburban car dependence are also associated with high rates of car ownership. Residents of inner Sydney have an average of 1.16 cars per household compared to those in the outer areas where car ownership levels average 1.75 cars per household. Higher daily VKTs and household car ownership rates imply higher operating costs for households in suburban zones compared

to those in inner areas. The NRMA motoring association (2007) estimates that the annual cost of car ownership can range between \$6,200 for a light hatchback car to \$13,600 for a large Sports Utility Vehicle (SUV). Comparable spatial patterns are found across other Australian cities (Morris et al. 2002; Currie and Senbergs 2007) and have implications for the social distribution of vulnerability to declining petroleum security.

Dodson and Sipe (2007; 2008) have examined the links between household socio-economic status, transport and urban location through spatial indexes that measure relative household vulnerability to higher petroleum prices. Dodson and Sipe (2007) examined the links between socio-economic status and car dependence, using Australian census data to map the distribution of socially disadvantaged households who were highly car reliant. Their results demonstrated marked differences in household vulnerability to higher fuel prices which varied based on urban location and access to public transport infrastructure. In general, higher socio-economic status households, who tend to live in the high value housing markets of the inner areas of Australian cities, were less vulnerable to oil shocks because of their lower car dependence levels. In contrast, lower socio-economic status households were typically located in outer suburban zones where they experienced high levels of car dependence and poor access to public transport.

Similar patterns were found for the link between household socio-economic status and households with mortgages. Dodson and Sipe (2008) developed another index focusing on households within the home ownership tenure category to measure vulnerability to both petroleum and

mortgage credit shocks. This index revealed similar but differently distributed patterns compared to the index examining just income. Households who were highly vulnerable to petrol and credit shocks were predominantly low income and highly car dependent. Their homes were typically purchased in outer suburban zones, especially new development areas. In contrast, households with low vulnerability to such shocks were typically found in wealthier inner urban localities. Dodson and Sipe's analysis was intended to assist in assessing of the effects of the 2004-2008 oil price shocks, but their results show that Australian urban structure may exacerbate social divisions in the context of unmanaged future energy price increases.

While the general socio-spatial structure of the Australian cities differs from metropolitan regions in other developed nations, the lessons of this work show that that there is likely to be considerable differentiation in the effects of an energy transition. The remainder of this paper examines policies that can be understood as contributing to an energy transition at the national and city-region scale with particular focus on the extent to which they represent a pro-active response to the adjustment challenge. The focus is on energy issues but where relevant climate change mitigation policy is also noted.

5. AUSTRALIAN NATIONAL ENERGY TRANSITION POLICIES

Australian governments have been slow to respond to the changing global energy environment, in part because of the economic significance of the conventional energy sector and the revenue stream it

provides. Governments have been reluctant to introduce strong demand management policies for fear of forcing behavioural shifts on populations who have historically been unreceptive to energy conservation messages, let alone energy transition concepts. However the past few years have seen the emergence of growing public demand for active government intervention on energy consumption and greenhouse emissions. This shift is due to increasing public awareness of climate issues, through the 2007 Intergovernmental Panel on Climate Change (IPCC) reports and the *Inconvenient Truth* documentary plus sustained drought conditions during 2003-2008 that approximate some global warming scenarios. A Labor national government was elected in 2007 on a platform which included a promise of active intervention on climate issues.

Since 2007 a number of Australian government inquiries, reports, policies and programs have signalled the emergence of a broad, if uneven, strategic approach to energy and climate issues that can discerned as representing a initial phase in the evolution of a more deliberate 'energy transition' program. The more significant policies and documents are set out in Table 1. The intent here is to address the most significant reports from an 'energy transition' standpoint. Among these, the most significant (highlighted in Table 1) are the 2007 Senate Inquiry and the 2008 Garnaut Review of Climate Change in combination with the Carbon Pollution Reduction Scheme.

The 2007 Senate Inquiry into Australia's future oil supply and alternative transport fuels (Australian Senate 2007) was significant for two reasons. First, it represented a political response to the higher oil prices

Table 1

Energy and Climate Change Policy Development, Australia 2004-2009

Analysis Type	Year	Title	Energy Issue
Strategy	2004	National Energy Strategy	Energy strategy
Senate Inquiry	2007	Australia's Future Energy Supply	Energy security
Garnaut Review	2008	Garnaut Review of Climate Change	Climate change
Green Paper	2008	Carbon Pollution Reduction Scheme	Climate change
White Paper	2008	Carbon Pollution Reduction Scheme	Climate change
Major Report	2008	Report to Australian Council of Governments	Infrastructure
Major Report	2009	Liquid Fuels Vulnerability	Climate change
Strategic Assessment	2009	National Energy Security Assessment	Climate change
White Paper		National Energy Strategy	Energy Security

Source: Made by the authors.

between 2004 and 2008 and it signalled a growing recognition among policy commentators of concerns about the sustainability of global oil supplies. The second significance was its single bi-partisan report which contrasted with the usual majority/minority split in opinion between the two main political blocs. The Senate Inquiry agreed that global energy security was likely to decline over the long run due to petroleum depletion and that a national energy strategy was required to address the problem. While it took a conservative stance on energy security relative to other international official assessments (Government Accountability Office 2007; Hirsch 2007) its report nonetheless affirmed that peak oil was likely before 2030. Hence:

[i]n the committee's view the possibility of a peak of conventional oil production before 2030 should be a matter of concern. Exactly when it occurs (which is very uncertain) is not the important point. In view of the enormous changes that will be needed to move to a less

oil dependent future, Australia should be planning for it now. (Australian Senate 2007, p. 33)

Since the Senate Inquiry there has been relatively little national government action on energy security, beyond the development of new national strategies. The nation's status as a major global energy exporter exerts considerable influence over its overall energy policy. This influence is apparent in the documents emerging from the post-2007 Labor administration. For example, the *Liquid Fuels Vulnerability Report* (ACIL Tasman 2009) has downplayed the significance of global petroleum production constraints arguing that:

...information from authoritative sources suggests that this peak is still some decades away and will occur beyond 2020... ...From a policy perspective, the best preparation for the time when the peak does occur is for governments to encourage transparency of price signals in order for the necessary adjustments to occur in good time. (pp. xi-xii)

Such a statement signals a disinterest in government action to address declining petroleum security other than to allow 'market processes' to operate transparently. It is a call for inaction, not action. In contrast the discussion paper prepared as part of the *National Energy Security Assessment* (DRET 2009) has identified the following as a likely scenario by 2023:

Tight global supply/ demand balance returns with ongoing demand growth and mature field decline. Development of more difficult geological and geo-political regions continues...

In 2023, the key issue expected to reduce liquid fuels security is access to reliable and affordable crude oil. (pp. 8, 13)

While the government agencies concerned with a national perspective on energy security have been conservative and largely passive in their assessments of declining petroleum security, other agencies with long-term infrastructure planning responsibility have been less optimistic. For example the Infrastructure Australia agency which is charged with selecting and funding priority national infrastructure has acknowledged (Infrastructure Australia 2008):

At best, the world will reach an oil production 'plateau' by 2015; at worst, there will be a production peak by 2013, with reserves declining rapidly thereafter.... .. Governments can do more to encourage private sector investment in less carbon-intensive energy and transport infrastructure. (p. 33)

Such a pessimistic statement contrasts sharply with those of the national agencies discussed above. There is clearly little consensus among Australian government officials concerning the rate and magnitude of change within the global energy security context and the degree of urgency with which

governments need to respond by recourse to explicit 'energy transition' policies.

This difference also contrasts with the Australian government's active stance on greenhouse gas emissions. Climate change policy was a key point of political differentiation at the 2007 national election and the Labor Party commissioned a senior academic economist to undertake a review of national climate change policy (Garnaut Climate Change Review 2008). The key conclusions of the Garnaut Review included a target of a 25 per cent reduction in Australian greenhouse emissions by 2020 if a new global emissions accord was achieved and only five per cent in the absence of such an accord. This target was to set the volume of emissions tradable through permits with the number of permits being reduced over time. Permit revenue would be used to aid households and firms to lower their emissions and support research into climate friendly technology.

Since the release of the Garnaut Review the global financial crisis has caused the Australian government to moderate its climate emissions policy to limit the carbon impact on households and businesses. In its White Paper response to the Garnaut Review, the government suggested a greenhouse emissions reduction target in the 5 to 15 percent range by 2020 depending on the content a new international emissions agreement (Department of Climate Change 2008). Furthermore this policy only establishes the target emissions cap for a trading scheme rather than direct measures to reduce carbon emissions. The White Paper is notable for its lack of reference to cities or urban issues. The sole acknowledgement of urban climate change issues is a reference to complementary non-market interventions:

measures targeted at sectors of the economy where price signals may not be as significant a driver of decision making (e.g. land use and planning). (p. xc)

In contrast, Infrastructure Australia has made considerable reference to climate concerns in a planning discussion report released near the time of the White Paper. For example, the 2008 IA report has noted:

To date, there are few signs that Australia's transport and transport infrastructure policies have recognised the constraints posed by reducing Australian and global greenhouse emissions, long term increases in oil prices expected to accompany peak oil pressures and the adaptations required to cope with unavoidable climate changes. (p. 36)

The IA report went on to acknowledge the similarities in policies required to address declining global energy security and climate change, especially within urban contexts. Transport issues were identified as being among the more significant urban problems with links clearly drawn to energy and climate problems. For example, the IA report has acknowledged the distributional inequities associated with the spatial patterns of car dependence. The IA report identified the need to improve urban land-use and transport integration while boosting public transport networks and lamented the lack of national government involvement in supporting urban public transport. Clearly there is a need to better link the national energy and climate priorities with urban transport imperatives. Unfortunately the Australian national government has historically had little involvement in urban public transport. While the IA report indicates a likely shift in this pattern given the looming challenge posed by the energy transition, the main responsibility for both urban and transport planning lies with state governments, primarily through their

metropolitan planning powers. The remainder of the paper examines these schemes and their capacity to support the energy transition.

6. AUSTRALIAN URBAN PLANNING STRATEGIES AND ENERGY

Since 2002 the governments of Australia's five most populous states have prepared metropolitan plans to manage the development and growth of their capital city-regions. Metropolitan planning in Australia has a long, if uneven, history and the plans that have emerged since 2002 have been considered significant for their commitment to sustainability and to planning principles such as land use and transport integration. The remainder of this section questions the extent to which these metropolitan plans support an energy transition. The discussion covers Australia's largest three metropolitan areas – Melbourne, Sydney and Brisbane (South East Queensland).

6.1. Melbourne

The *Melbourne 2030 Metropolitan Strategy* (Department of Infrastructure 2002b) seeks to regulate urban development to achieve sustainability objectives. The plan contains little discussion of growth in transport energy use and its implications for future sustainability. Global energy constraints are not addressed nor how declining energy security might affect heavily car dependent outer suburbs. The Integrated Transport Plan accompanying *Melbourne 2030* notes to 'over-reliance' on the private car for travel (Department of Infrastructure 2002b, p. 3) and suggests that expanding road capacity

is not a long-term solution to transport problems (p. 7). The Integrated Transport component of the plan also notes the significance of climate change due to carbon emissions, including from transport.

Despite the rhetorical commitments to reducing car dependence the interventions proposed in the implementation plans are weak. The main approach is to integrate land-use and transport planning through activity concentration at a set of public transport nodes throughout the city. Most of the activity centre sites are in inner and middle suburban areas that are already well served by public transport and thus offer little to redress the problems of wider suburbia. Some improvements to the main public transport network are mooted, although no minimum service standards are specified (Department of Infrastructure 2002a, pp. 16-17). Suburban growth areas receive some attention but again there is little to indicate that genuine action will be taken to resolve the climate and energy security problems they face. In contrast, the plan made a commitment to build a major freeway through Melbourne's eastern suburbs despite the recognition of climate emissions and the well understood relationship between road capacity expansion and increasing motor vehicle use (Zeibots 2005). Melbourne's metropolitan policy has thus taken a minimal approach to energy transition issues, to the extent that the policy barely reflects such energy imperatives

6.2. Sydney

The *Sydney City of Cities Metropolitan Strategy* (Department of Planning 2005) emerged as global oil prices had risen beyond historical trends. But petroleum security was

not addressed in the plan, although the issue of transport fuel costs was mentioned in passing (Department of Planning 2005, p. 22). The plan recognised the transport fuel cost burden on suburban households and calculated that household petrol bills had risen 31 per cent between 1999 and 2004 (p. 30). However, Sydney's planners barely noted the changing energy security context and almost completely ignored the oil vulnerability of the city's suburban areas. The plan gives no consideration to either declining energy security or rising oil vulnerability. Development patterns are also insensitive to energy constraints. For example, projections of residential development relative to public transport show that while 74 per cent of total new dwellings between 2005 and 2013 will be produced in existing urban areas of Sydney (Department of Planning 2005, p. 133) only 66 per cent of those new dwellings will be situated near high quality public transport (p. 131). Thus, more than a third of Sydney's new residential growth in the 2005-2013 period may be vulnerable to rising fuel prices because it is not well served by public transport.

Like the Brisbane and Melbourne plans the Sydney strategy identifies a set of 35 urban nodes at which new development will be concentrated with the majority situated on the heavy rail network (Department of Planning 2005, pp. 93, 95). These centres are to be connected by a network of 43 'strategic bus corridors' (p. 169) operating at relatively high frequencies. However the ability of the government to provide high quality public transport to new urban growth areas remains in question. The problem will be greatest in the outer western areas of Sydney where car dependence is currently high and where local public transport is poor (Mees 2000). Dodson and Sipe (2007;

2008) identified these areas as the most oil vulnerable to transport energy shocks. The Sydney metropolitan strategy therefore contains very little that indicates a deliberate attempt to respond to the imperatives of an energy transition, a problem that may have very adverse consequences.

6.3. South East Queensland (Brisbane)

The 2005 South East Queensland Regional Plan (SEQRP) (Office of Urban Management 2005) marked a new engagement with planning by the Queensland state government in a context of rising concern over the coordination of urban development in the region. The SEQRP covers not only Brisbane City, but the rapidly urbanising areas of the Sunshine Coast, Gold Coast and Ipswich-Toowoomba corridor. The SEQRP does not directly address oil vulnerability as a planning issue. However the plan does seek to reduce travel demand and energy usage through a more compact urban form (OUM 2005, p. 8). This is to be achieved by supporting activity centres planned around efficient and well-utilised public transport (OUM 2005, p.23) and the rollout of eight 'transit oriented developments' (OUM 2005, p. 75). Low energy consumption is also identified as a sustainability characteristic in a general rather than transport specific sense.

While the integrated transport section of the SEQRP (OUM 2005, pp. 106-119) contains a number of objectives relating to public transport such as supporting transit communities and ensuring new development supports walking, cycling and public transport these are not justified by reference to 'energy transition' issues. The plan does refer to a requirement for local

governments to prepare Integrated Local Transport Plans (ITLP), but these are not accompanied by any further detail and there are no requirements to consider energy challenges. Thus their capacity to ameliorate oil vulnerability remains untested.

The SEQRP was accompanied by the South East Queensland Infrastructure Plan and Program (SEQIP) (OUM 2005a) which provides a high level of certainty about the infrastructure to be built from 2006 to 2026. The majority of the transport funding under the SEQIP is for major roads. Public transport, walking and cycling receive only 27 per cent of the Greater Brisbane transport funding. (OUM 2005a, p. 15). The SEQIP gives very limited attention to transport services that do not involve large infrastructure projects, such as local bus services and bus stops. From an oil vulnerability perspective, the SEQIP is relatively weak because it focuses on large regional scale transport infrastructure projects with most funds going to roads.

The draft update of the SEQRP released in 2008 indicates that energy issues have captured some policy attention (Department of Infrastructure and Planning 2008). This is due to a range of factors, including greater public awareness of energy issues, an active local peak oil advocacy group, greater engagement by planning officials and local scholarship identifying energy impacts. It is notable that Queensland also saw strong energy transition leadership from the Minister for Sustainability, Climate Change and Innovation, including the development of a Queensland oil vulnerability strategy (see below for more discussion). The result is a section in the revised 2009-2031 regional plan identifying 'rising oil prices' as a planning issue (Department of Infrastructure and Planning 2008, p. 40). However despite this

recognition the actual policies to address higher fuel costs differ markedly from those recommended by scholarship (Newman; Dodson and Sipe). The only measures promoted are support for walking and cycling with no mention of public transport, or any discussion of wider urban issues. There is no reference to other policy areas, such as road planning, to ensure these are aligned with energy security issues. While the revised draft SEQRP offers an initial step in the incorporation of energy transition issues into metropolitan plans it does not offer a comprehensive urban or energy transition strategy.

7. OTHER PLANNING AND POLICY EFFORTS

7.1. State policy

While state governments will likely retain their status as the main metropolitan planning authorities in Australian cities, there are signals that selected state and local governments are beginning to respond to the energy transition imperatives. The most significant policy on energy transition in Australia has been the Queensland state government's Oil Vulnerability Taskforce Report (Queensland Government 2007) and a draft Oil Vulnerability Mitigation Strategy. The Oil Vulnerability Taskforce was established in 2005 at the urging of a few members of Queensland's Labor government. The Taskforce produced a report which identified oil depletion as a major challenge for Queensland and recommended that the government develop an oil vulnerability strategy to prepare the state for declining global energy security. This strategy is still in preparation. A discussion report produced as part of the

strategy development provides some insight into the direction of the eventual document (Waller 2008). The main thrust of this advisory report was that Queensland's vast reserves of coal and gas meant it was well positioned for a decline in global petroleum security on the basis that rising prices would improve the viability of coal-to-liquid or gas-to-liquid fuel production. Similarly, the demand for such energy would produce a strong revenue stream to the state. The main challenge for government, the report argued, was to manage the social adjustment process for households who were located in urban sub-regions which either did not benefit economically from the energy boom or who had few alternatives to private motor vehicle use. Such an assessment, in which coal liquefaction provides the solution to declining petroleum security, is unlikely to satisfy the expectations of an energy transition in which societies and economies reduce their dependence on carbon-intensive energy sources. The attempt at an oil vulnerability strategy for Queensland reflects the wider Australian national conundrum of a country endowed with considerable fossil energy wealth that is unwilling to accept the devaluation of that wealth through a transition to a low-carbon energy future.

7.2. Local government policy

The past two years has seen the emergence of a few reports and strategies by local governments which address climate change and oil vulnerability. The most significant of these is a report by Australia's largest municipality, Brisbane City Council (BCC 2007) in an assessment of climate change and energy challenges. The report recommendations included reducing

Brisbane's petroleum consumption by 50 per cent by 2026 (p. 35), achieving zero net household greenhouse emissions, including car use, by 2020 (p. 36). The report also recommended partnering between local, state and federal governments to address climate and energy issues and that the Brisbane City Council should seek economic opportunities associated with the energy transition, including attracting sustainable energy industries to the city.

Other, smaller municipalities have undertaken analyses of the implications for peak oil in their jurisdictions. In the Melbourne metropolitan area, the Maribyrnong and Darebin Councils have both begun developing peak oil policies that will seek to align council development and operational plans to address the effects of petroleum depletion. Of these only Maribyrnong has yet developed a specific policy on planning for peak oil (Maribyrnong City Council 2008). Darebin is currently preparing a Peak Oil Strategy which will achieve a similar purpose. The Maribyrnong policy addresses a range of peak oil implications across council operations, housing, employment and transportation. Specific recommendations include a three per cent cumulative annual reduction in Council's oil use and a 50 per cent reduction by 2025 (pp. 13-14). The policy also commits the council to developing a much more comprehensive peak oil adaptation strategy in the near future.

8. CONCLUSIONS

This paper has examined the extent to which Australia is experiencing an energy transition and the implications of any shift. The overall picture is one of a nation whose

heavy dependence on conventional fossil energy sources makes it unwilling to alter strategic trajectories, even in the face of a looming global energy crunch or the environmentally debilitating implications of climate change. While there are some glimmers of recognition among Australian policy makers that this pattern is grossly unsustainable, there seems little likelihood of a major shift in the trajectory of current policy, in the absence of a catastrophic climatic event that could galvanise public momentum. Most of the current policy development that is offering accelerated progress on energy (and climate) transition issues is situated within a few local government areas within the major cities. Local government is the weakest level of government and is incapable of influencing significant policy change beyond its boundaries.

The outlook for cities within this wider set of national policy settings is particularly risky. Cities will be among the key zones in which the effects of higher energy prices due to carbon restraint are most likely to be hardest felt. There are some attempts being made by planners to address the level of fossil carbon dependence of Australian cities by managing transport networks and land uses. However, these attempts are unlikely to occur at an extent and rate to significantly reduce either greenhouse gas emissions or limit vulnerability to global petroleum security shocks. Australian cities are therefore dirty, vulnerable and exposed to the adverse consequences of a rapid global energy transition.

Australia appears as a poor exemplar of a nation embarking on an energy transition and a global laggard. Australia exemplifies the dangers and pitfalls faced by energy intensive developed nations coping with a rapidly shifting energy landscape. Endowed

with energy resources that far exceed its consumption needs and hooked income generated by energy exports to major polluting nations, such as China, Australia is resisting the increasingly forceful pressure of a global community that is anxious and concerned about the pattern of global energy use. While it continues to retain a conservative position on energy modernisation and transition to low-carbon energy production, Australia risks missing out on the low-carbon upside of a global energy transition. This could include the development of new low-carbon technologies such as solar, solar thermal,

geothermal and wind power. A rapid shift in the energy technology priorities of economically more powerful nations, such as the U.S., away from fossil carbon energy in the context of a global program to restrain greenhouse gas emissions could leave Australia poorly positioned to take advantage of a global energy transition. Australian cities will feel the full force of any abrupt forced energy transition. As they take a 'not yet' approach to carbon restraint they remain highly exposed to the social and economic upheaval of an accelerated global energy transition.

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