

Securing suburbia: Oil vulnerability, planning practice and Australian cities

*Jago Dodson, Urban Research Program, Griffith University; and
Neil Sipe, School of Environment, Griffith University.*

Abstract

This paper investigates oil vulnerability in Australian cities and the implications of this problem for Australian urban planning and planning elsewhere. The paper has four objectives. First, the paper investigates the changing global petroleum supply context and potential future supply trajectories. Second, the paper uses the notion of 'oil vulnerability' to investigate how such a changing global petroleum context might impact on cities and suburbs, with a focus on the Australia setting. Third, the paper examines current Australian planning practice to test whether metropolitan plans are addressing global petroleum supply questions. The paper concludes by setting out the planning research and practice challenges and responsibilities for urban scholars and educators, both in Australia and elsewhere, in responding to the changing global petroleum context through engagement with pedagogy, policy and public debate.

Introduction

Between 2004 and 2009 the trajectory of global petroleum prices altered sharply. Oil prices became highly volatile, accelerating from low stable price levels to heights not seen for almost three decades. In early-2004 the price of oil was approximately US\$25 per barrel but increased to around US\$140 per barrel by mid-2008. Higher oil prices translated into much higher fuel costs and caused considerable anxiety among many economically advanced nations with widespread concern about the impacts of high oil costs on economic activity.

The sharp increase in oil prices also spurred renewed interest in global petroleum supply questions. There has been a florescence of commentary assessing the causes of the higher oil prices with explanations ranging across factors that include financial speculation, supply constraints, demand pressures and geopolitical anxieties. Further debate has surrounded the longer term sustainability of global oil supplies and the theory that oil production will 'peak' and subsequently begin to decline in the near future (Heinberg 2003; Roberts 2004; Campbell 2005; Huber and Mills 2005; Simmons 2005; Strahan 2007). This notion has proven particularly contentious with a flourishing literature of books, journals and blogs dedicated to debating future petroleum supplies and the implications for international security (Kleveman 2003; Klare 2005; Wesley 2005; Klare 2008). More recently this effort has been accompanied by increasing official interest in global petroleum security. For

example, the Australian Senate released a major report into energy security and future fuel supply in 2007 (Australian Senate 2007). Much of the energy security and peak oil literature recognises that petroleum provides the base input for most of the world's liquid fuels and in turn is a critical resource on which urban, national and international transport systems depend.

Any constraint on the availability of petroleum-based liquid fuels has considerable implications for petroleum dependent transport systems. The transport systems of Australian cities are highly dependent on petroleum because they are highly dependent on automobiles for travel. A sudden or sharp increase in oil prices could cause a high degree of stress for Australian cities. More significantly, Australian cities display marked internal spatial differentiation of levels of household car dependence. Individual and household reliance on cars is also socially patterned. The impacts of declining energy security will therefore be felt unevenly across Australian cities and will likely impact on some social groups more than others.

Planning has contributed to the problem of oil dependent cities and planners bear some responsibility to address this vulnerability through policies to avoid, remedy or mitigate the impacts of higher fuel prices on households, communities and cities. Yet there has been little debate within planning scholarship and research about the problem of petroleum security and its impact on cities. Similarly, there has been almost no policy attention given to the issue of oil depletion and its significance for local, metropolitan and regional planning (Dodson and Sipe 2008). Few planning programs or courses include content on energy security and petroleum depletion issues. The significance of these challenges for cities suggests this neglect should be urgently redressed.

This paper offers an Australian perspective on the problem of petroleum security and its implications for planning practice and research. The paper has four objectives. First the paper sets out the problem of declining petroleum security at the global scale. Second, the paper assesses how the likely impacts of higher fuel costs are likely to be distributed within Australian cities and outlines their potential social and economic consequences. Next the paper identifies what policy measures are needed to reduce the oil vulnerability of Australian cities and whether these are measures are apparent in contemporary local and metropolitan plans. Finally the paper sets out a need for planning pedagogy to be far more attentive to energy issues and identifies some ways in which this may be approached.

Global petroleum context

The period from 2004 to 2008 saw a remarkable shift in the global petroleum supply context. The price of oil had been relatively low and stable during most of the previous two decades but accelerated sharply and became highly volatile after 2004. Global oil prices increased from around US\$25 per barrel in early-2004 to beyond \$140 per barrel by mid-2008. The inflation-adjusted price of oil in 2008 far exceeded levels seen during the oil shocks of the 1970s (Government Accountability Office 2007). The factors underpinning the sharp rise in petroleum prices drew increasing attention to a range of challenges and constraints in petroleum production and the

escalating growth in demand for oil. Global petroleum consumption grew rapidly during the past decade, from 69.5 million barrels per day in 1995 to 82.5 million barrels per day by 2004 and 86 million barrels per day in 2007 . The International Energy Agency (IEA) (2008) projects that by 2030, global oil demand will be 116 million barrels per day, a 37 per cent increase on 2006 levels. High levels of economic growth in western nations up to late-2008 had combined with strong growth in the emerging economies of China and India added new demands for oil. China's economy, for example, grew by at least 9 per cent between 2002 and 2007 (International Monetary Fund 2007). The IEA has forecast that China's and India's demand will double by 2030, which will increase global oil consumption by an additional 13.8 million barrels per day (IEA 2007).

Geopolitical instability has been a further factor contributing to volatile global oil markets include. Geopolitical tensions have been most obvious in the Middle East, central Asia and the Niger River delta but include frictions between the United States and oil rich countries such as Venezuela and Iran. Some authors have argued that a new 'great game' is now being played between wealthy and powerful nations and those holding large petroleum reserves (Kleveman 2003; Klare 2008). Threats of terrorism against oil facilities or to shipping lanes also raised anxieties in this high-growth environment (EIA 2005). Prices were also pushed upwards by fears over the ability of many older oil production facilities to keep pace with growing demand. Anxiety also surrounds the availability of investment in new oil production facilities that will be needed – a concern amplified by the present financial crisis. In 2006, the IEA calculated that \$4.3 trillion of investment in oil wells, pipelines and refineries would be required to satisfy projected global oil demand by 2030 (IEA 2006). A 2008 estimate by a leading oil financier suggests that at least US\$50 trillion is needed (Simmons, quoted in Izundu 2008).

The sharp shifts in energy security conditions after 2004 also brought spreading awareness of doubts over the longer term capacity of oil production to maintain or surpass current levels. A growing number of commentators and scholars has raised questions about declines in global petroleum reserves. A sizeable literature suggests that continued and accelerating extraction of petroleum resources in a world of fixed reserves implies that output will inevitably reach a maximum 'peak' volume followed by declining production (Deffeyes 2001; Campbell 2003; Heinberg 2003; Heinberg 2004; Campbell 2005; Deffeyes 2005; Simmons 2005). This 'peak oil' situation is expected to eventuate as the greater effort required to extract oil from increasingly remote and complex remaining oil reserves proves insufficient to maintain present production levels. The problem of 'peak oil' has generated considerable controversy in the petroleum industry and within energy policy debates (see Deffeyes vs Huber 2005). Early proponents of the proposition of 'peak oil' initially comprised a small set of independent or dissident members of the petroleum sector (Campbell and Laherrere 1998; Simmons 2005). The uncertainty over peak oil generated an extensive independent literature, especially across the internet where a wide range of websites assessing and evaluating various dimensions of the oil depletion issue can be found with names such as The Oil Drum and The Energy Bulletin, among others. Recent years have witnessed a growing, albeit cautious, recognition by major oil companies and governments of the probability of a future fall, if gradual, in global oil supplies. In 2007 the Australian Senate held an inquiry which concluded that peak oil could be

expected by 2030 (Australian Senate 2007). The IEA's head of economic forecasting has recently suggested a peak in oil production by 2020 is probable (Biol, quoted in Monbiot 2008). Meanwhile the Chevron Oil Company has warned that 'the age of easy oil is over' (Chevron Oil Ltd 2005) and the chief of Shell Oil has cautioned that the international community risks a dangerous geopolitical 'scramble' for remaining oil reserves (van der Veer 2008).

A decline in global petroleum security, whether due to the depletion of oil reserves or to some other factor such as geopolitical tensions implies a destabilisation of the relationship between growing energy demand and global production capacity. There are presently few substitutes for liquid petroleum fuels, especially in transport where the portability of such fuels is a key factor in their useability. Declining petroleum supply therefore implies much higher oil prices, potentially far beyond the high levels experienced in 2008. In turn, such a recognition calls for planners and scholars to assess the effects of higher oil prices, especially for transport fuels, and the potential impacts of an oil production peak on cities and urban regions. To date there has been little research that has assessed the effects of higher oil prices on urban systems or on the longer term energy trajectory of urban development. Nor has there been much guidance provided by urban scholarship on the kinds of planning policies that will be needed to respond to higher fuel prices.

Oil vulnerability and cities: the Australian case

Any policy or planning response to the effects of higher fuel prices on cities must recognise the diverse internal geographic structure of cities which typically reveal an uneven distribution of social-economic patterns and infrastructure. While the precise effects of declining global petroleum security will play out quite differently between cities given internal and regional differences. Australian cities exhibit particular transport, housing and socio-economic patterns that can yield considerable insight into the challenges facing planners in crafting policy measures to address the problem of oil vulnerability.

The socio-economically uneven urban socio-spatial structure of Australian cities means that the distribution of adverse impacts from higher petrol prices will be highly differentiated. In general, the inner urban areas of Australia's large cities developed around historic public transport routes. Such areas have relatively higher densities than the contrasting suburban areas which spread beyond the central business district and the adjacent 'transit suburbs'. Australian suburbia, especially the parts which were developed after World War II, have a dispersed low density urban form and rely heavily on private motor vehicles for transport. Such patterns mean that Australia's five largest cities represent collectively the largest group of car-dependent regions beyond the United States (see Newman and Kenworthy 1999).

Car dependence is highly unevenly distributed within Australian cities. This differential distribution is important because the transport costs of car dependence are one of the main avenues by which higher global oil prices will impact on urban residents. Sydney provides a good example as it is generally representative of Australian cities and has good transport data. Residents of inner eastern and inner

western areas of Sydney use private motor vehicles for approximately 57 per cent and 55 per cent of travel, respectively, while residents of the city's northwest and southwest suburban corridors use private vehicles for approximately 80 percent per cent of their travel (Department of Planning 2006). Sydney's outer suburban residents also travel much further each day on average compared to those in middle and inner areas. Households located in the outer northwest and outer southwest development zones report average daily 'vehicle kilometres travelled' (VKT) of 27 km and 30 km, respectively, whereas inner eastern and inner western residents travel on average only 12 km and 13 km respectively (Department of Planning 2006). Households who are dependent on automobiles for travel will be much more exposed to higher fuel costs due to declining global petroleum security compared to those with low automobile dependence.

Spatial patterns of vehicle ownership and use in Sydney also reflect the availability of public transport services and infrastructure. In general, public transport in Australian cities is of good quality near the historic commercial core and declines in quality, density and frequency with increasing distance from the CBD. With the exception of Melbourne, Australia's cities replaced trams with buses in the 1960s and 1970s. Unfortunately these services have not been expanded to match urban growth. Buses in the newer more distant suburban zones are typically privately operated, undercapitalised, fragmented and poorly coordinated with state-owned rail systems. Middle and central zones where publicly managed bus services replaced the trams receive a much higher service quality. Sydney's woes cannot be tied to a lack of infrastructure as Mees notes:

Sydney, which has more electrified rail infrastructure, both track and rolling stock, than any other city of its size in the world, is plagued with an unreliable rail service and apparent capacity problems. (Mees 2000a)

The result is a core and middle suburban area well-served by public transport surrounded by a poorly served outer suburban periphery that reflects the socially polarising 'splintered' patterns of contemporary urban infrastructure distribution identified by Graham and Marvin (Graham and Marvin 2001). Access to good quality public transport, therefore, is a crucial dimension of socio-economic opportunity and inclusion (Lucas 2004; Currie et al. 2007).

Table 1: Travel patterns for Sydney metropolitan sub-regions

	Sydney City	Inner West	Inner East	Inner North	Inner South	North North	North East	West Central	North West	South West	Central Coast	Sydney SD
<i>Private Vehicle Mode Share (%)</i>	31.8	55.3	56.9	60.0	67.6	73.5	71.8	72.2	79.0	79.3	76.5	69.5
<i>PT Mode Share (%)</i>	64.7	43.4	41.1	37.8	30.9	25.5	26.0	27.1	20.4	20.4	22.4	29.3
<i>Avg Trip Length</i>	4.5	6.8	5.9	6.9	8.0	9.4	8.5	8.5	11.9	13.4	13.2	9.4

(km)

<i>Avg VKT/ person/ day (km)</i>	8.0	12.9	11.6	15.0	16.2	20.3	20.8	16.8	26.5	30.0	31.3	20.3
<i>Avg number of vehicle/ household</i>	0.70	1.24	1.16	1.32	1.39	1.72	1.57	1.45	1.78	1.73	1.46	1.46

The location of Sydney sub-regions is provided in Figure 1

Source: Department of Planning

Housing and socio-economic structure

The differences in transport behaviour described above intersect with the socio-economic structure of Australian cities to unevenly distribute household exposure to higher transport costs arising from higher oil prices. Socio-economic patterns are largely shaped by factors other than transport systems, but the spatial distribution of various socio-economic groups is heavily conditioned by spatial housing markets which intersect with the distribution of transport infrastructure. The intersection of housing markets and transport patterns is a key factor in shaping oil vulnerability in Australian cities.

Most Australian urban housing is provided through private housing markets. Public housing forms no more than five percent of total housing stock in most Australian cities. In general, the housing markets found in Australian cities are highly centralised with strong 'bid-rent' curves focused around the high value employment zones of the central business districts (CBDs). Land and house prices tend to be high in and around the city centre and decline with increasing distance from the CBD. The result is that most households are exposed to the 'bid-rent' effects of the housing markets. For most, their spatial housing options are conditioned by their capacity to pay, which in turn is heavily determined by income.

The result is that low or modest income households tend to be excluded from inner-urban residential zones. Those on very low incomes are more likely to be found in fringe suburban areas where land and house prices are lower than the metropolitan average. In contrast, wealthier households are more likely to locate in middle or inner suburban areas proximate to the high-value inner urban employment. These patterns are most readily observed in the aggregate however there is inevitably a degree of local spatial variation.

The result of this housing market and socio-spatial link in Australian cities is that households on lower incomes tend to be located in outer and fringe suburban areas where they are susceptible to becoming car dependent. In contrast, higher income households in Australian cities are more likely to be found in the 'transit-rich' inner urban zones where public transport services are of high quality and local streetscapes are more compact and 'walkable'. This effect means that Australian cities are highly regressive from an oil vulnerability perspective because the socio-economically weakest households are typically most exposed to the higher costs arising from

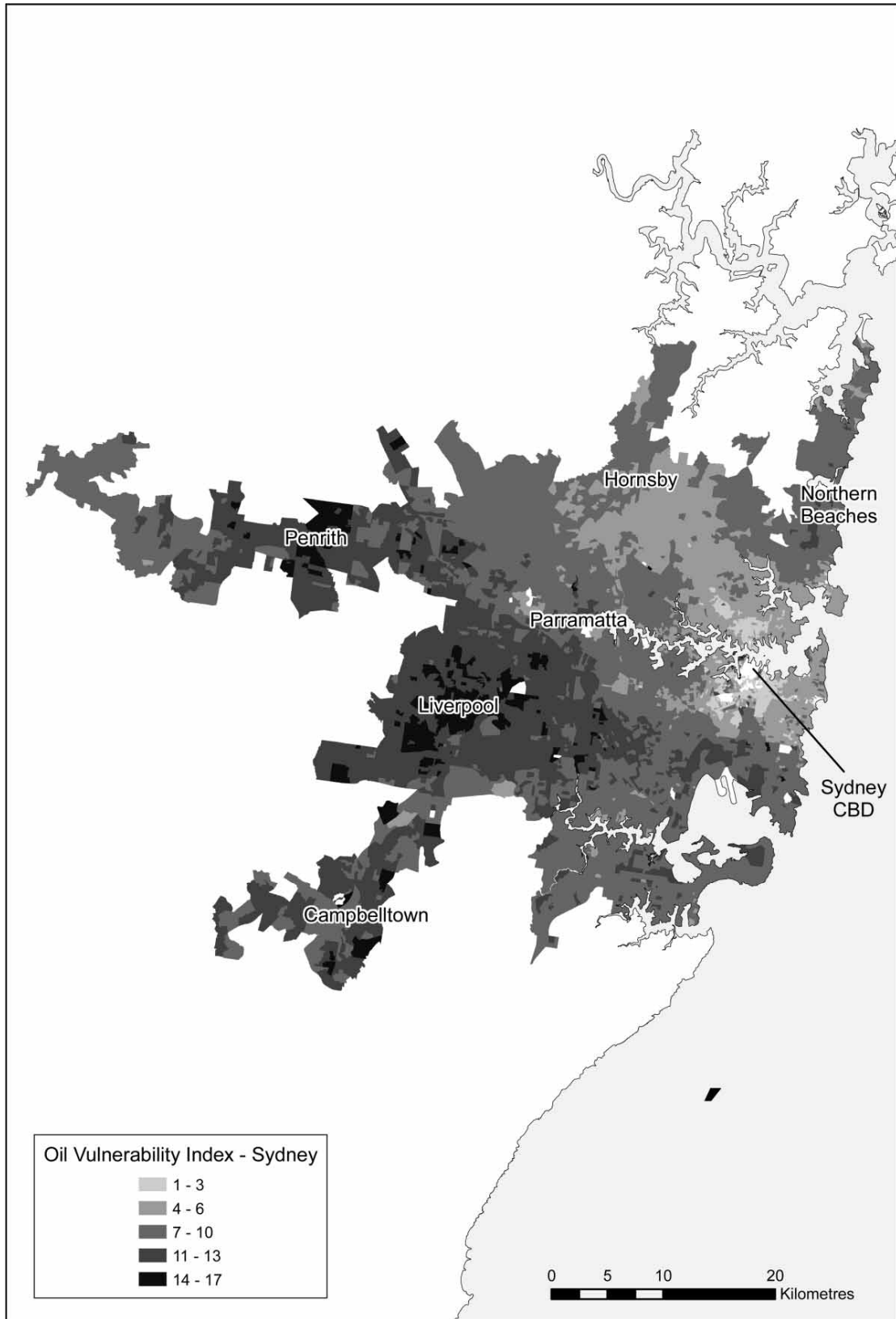
declining energy security due to their location in highly car dependent areas. This effect has been shown in research undertaken by Dodson and Sipe (2007; 2008) which examines the spatial distribution of 'oil vulnerability' in Australian cities.

Mapping the oil vulnerability of Australian cities

To investigate oil vulnerability in Australian cities, Dodson and Sipe (2007) constructed a spatial index to assess the relative risk faced by urban households arising from their socio-economic status and their degree of reliance on automobiles. Using Australian Census data at the local scale, Dodson and Sipe (2007) combined official measures of household socio-economic status with indicators of car dependence to evaluate household exposure to higher fuel prices. Their index – the 'vulnerability index for petroleum expenses and rises' (VIPER) – enabled very fine-scale local mapping of spatial household oil vulnerability in Australian cities.

Dodson and Sipe's (2007) analysis for Sydney is presented below (Figure 1). The effect of the transport and socio-spatial processes described above are clearly apparent in the VIPER map for Sydney. Households in the inner urban zones, especially the CBD and immediately adjacent areas to the east and the north exhibit low levels of exposure to the impacts of declining global energy security. Beyond these areas a wide zone of moderate oil vulnerability covers many of Sydney's middle suburban areas from immediately east of Hornsby, through Paramatta and south to the western reaches of Botany Bay. In contrast, the areas of highest oil vulnerability are found among Sydney's western suburbs especially the areas surrounding Liverpool and the urban growth corridors to the southwest and northwest. Especially strong clusters of highly oil vulnerable households are found in Liverpool and around Penrith.

Dodson and Sipe's work has shown that oil vulnerability in Sydney is highly spatially differentiated. Their analysis also demonstrates that oil vulnerability is a socially regressive phenomenon – the relatively weaker socio-economic households in Sydney's outer western suburbs are the most vulnerable to the adverse consequences of higher global petroleum prices. Other work by Dodson and Sipe (2008) investigated the link between transport patterns, socio-economic status, and households who have mortgages. This research revealed similar spatial patterns at work for such households, although the heavy representation of first homeowner households in greenfield housing estates means their distribution at the local scale differs slightly from the VIPER patterns. Nonetheless, the sharp distinction between the low oil vulnerability inner and middle suburban residents and the high oil vulnerability outer suburban households with mortgages was clearly apparent. Outer suburban households in Australian cities are clearly the most vulnerable to the adverse socio-economic impacts from declining global energy security. Their relatively weaker socio-economic position also means they are financially less capable of adapting to changing transport fuel costs whether through purchase of an alternative energy vehicle or moving to a more efficient position relative to public transport.



Source: Dodson and Sipe (2007)

Figure 1: The spatial distribution of relative household oil vulnerability in Sydney.

Implications for Planning Practice

Among its many responsibilities, planning has historically been expected to assess the risks arising from a wide array of potential future events and to manage cities in order to avoid, reduce or mitigate such risks. Historical examples include the dangers of poor housing for urban masses or the inefficiencies or uncontrolled urban growth. The problem of deteriorating global energy security and the possibility of a future decline in global petroleum production must rank among the most challenging problems with which planners will be expected to grapple. As a planning issue, oil vulnerability should be considered as important as climate change because of the central significance of oil to modern urban – and suburban – life. Around half of Australia's population lives in the middle and outer suburbs of the major cities (O'Connor and Healy 2004). The heavy reliance of Australian cities and suburbs on automobiles and the stark socio-economic differences hinging the socio-economic dimensions of this dependence imply an urgent need for robust planning policies that can reduce the impacts of declining petroleum security.

Given this functional and demographic significance, it might be expected that Australian cities would be implementing strong measures to reduce their exposure to the consequences of higher fuel prices. Further, the particular conditions in outer suburban areas might also be considered to be deserving of urgent attention. However this is not the case. In the remainder of this section we review recent urban policy making in practice and assess the extent to which it addresses oil vulnerability issues. In doing so, we assess the treatment of oil vulnerability issues in the recent metropolitan strategies for Australia's four largest cities – Sydney, Melbourne, Brisbane and Perth. Our focus is on four key points: recognition of global petroleum security problems; appreciation of the differentiated distribution of urban oil vulnerability within Australian cities and suburbs; dedicated policies to redress suburban oil vulnerability issues; and contrasting policies that will exacerbate oil vulnerability (summarised in Table 2). All of these plans, except Melbourne's, were prepared after the sharp 2004 rise in oil prices and the increasing appreciation of the changing global energy security context.

Petroleum security issues have not been addressed to any meaningful extent by the Australian metropolitan plans considered in this paper. While the *Melbourne 2030* plan was prepared before the 2004-2009 volatile oil price period a number of significant Australian planning scholars had already raised concerns about oil depletion (Newman and Kenworthy 1989; Newman and Kenworthy 1999; Mees 2000b). Sydney's *City of Cities* plan was released in 2005 after oil prices had begun to increase and mentioned the issue of higher petrol prices. Urban scholar Peter Newman participated in the Sydney planning process having been appointed Sustainability Commissioner by the New South Wales government in 2004. The Queensland government's *South East Queensland Regional Plan* (SEQRP), which covers Brisbane, doesn't discuss urban oil vulnerability or energy security issues. The plan indicates an intent to reduce car dependence but expects a future *Smart Travel Choices* plan to address this task; this latter document was released as a draft green paper in 2005 but has not yet been actioned by the Queensland government. The draft 2008 update to the SEQRP includes a section on 'petrol prices' which acknowledges oil supply constraints but its proposed actions are modest and amount to little more

than a suggestion that local governments should take the problem into account in their plans. Perth's 2004 *Network City* strategy notes the possibility of a constrained oil supply and the potential for future oil shocks (WAPC 2004, p. 69) although there is almost no discussion of the social or economic consequences. The problem is seen as a component of a wider set of planning challenges associated with automobile-based urban development rather than a superordinate planning issue. None of the strategies offer any comprehensive conception of energy security issues or the implications of higher fuel prices for urban households.

The negligible or limited attention dedicated to energy security problems and urban oil vulnerability in the Australian plans described above in turn influences the content of their land-use and transport planning measures. Given that the problem of oil vulnerability is not substantially recognised by the plans, it is not surprising that there are no dedicated strategies or measures to address the problem. To the extent that the plans even address the issue of car dependence in Australian cities, it is through the now familiar mix of 'sustainable' land-use and transport policies that Forster (2006) has termed the 'containment–consolidation–centres' approach of integrating higher density land-uses around public transport nodes. As Dodson and Sipe (2007; 2008a) and Dodson (2008) have argued, there are large areas of car dependent suburbia far beyond the few high density centres that exist in Australian cities which means the suburbs are unlikely to have their oil vulnerability reduced by a focus on concentrating development at existing public transport nodes. As Dodson and Sipe (2008b) have argued, there is a need for a strong expansion of public transport into the highly oil vulnerable zones identified by the VIPER analysis.

Table 2: Treatment of petroleum security issues in recent Australian Metropolitan plans.

	City			
	<i>Sydney</i>	<i>Melbourne</i>	<i>Brisbane</i>	<i>Perth</i>
Metropolitan Plan	<i>Sydney: City of Cities</i>	<i>Melbourne 2030 Metropolitan Strategy</i>	<i>South East Queensland Regional Plan</i>	<i>Network City: Community planning strategy for Perth and Peel</i>
Year	2005	2002	2005	2004
Petroleum security identified as planning issue	Brief mention of 'fuel supply and prices' influencing future travel demand (p. 159)	Not mentioned	None	Notes: "Vulnerability to changes in oil supply (potential for significantly more expensive oil and supply shocks within 5 or 10 years perhaps)" (p. 69)
Distribution of urban oil vulnerability recognised	Notes need to ensure Sydney 'doesn't keep expanding with suburbs that are car dependent.' (p. 156)	Notes car dependence as an issue	Notes car dependence as an issue	Notes car dependence as an issue
Policies to address	Generic	Generic	Generic	Generic 'sustainable'

suburban oil vulnerability (plus remarks)	'sustainable' transport planning	'sustainable' transport planning	'sustainable' transport planning	transport planning
Policies that may exacerbate oil vulnerability	Continued freeway expansion	Continued freeway expansion	Continued freeway expansion	Limited road expansion

A further problem is that even if Australia's planners were taking positive steps to ameliorate oil vulnerability in Australian cities and suburbs, they would also need to ensure that they were not simultaneously undertaking measures that might make the problem worse. In the case of Melbourne and Brisbane's metropolitan plans, modest improvements to public transport services have been dwarfed by considerable expansion of major road links, especially urban freeways. Indeed the largest infrastructure component of the *Melbourne 2030* plan was the Scoresby Freeway in the city's outer east (Dodson 2003). Similarly, 65 per cent of the infrastructure budget for Brisbane's passenger transport under the SEQRP was dedicated to major roads, thus encouraging car dependence, while just 35 per cent was dedicated to public transport. This contrast is not as stark in Sydney and Perth where public transport has fared better than roads. Perth's *Network City* plan is notable for the inclusion of a southern rail line linking the city centre with the satellite town of Mandurah which was constructed between 2004 and 2007. The Sydney plan proposes two new rail extensions to the northwest and southwest, respectively, along with a revamped 'bus network'. At the time of writing the status of each of these three of these projects was in doubt. While major public transport projects alone will be insufficient to address the oil vulnerability in existing car dependent suburbs, it might be expected that by moderating road capacity expansion, the Sydney and Perth plans are exacerbating oil vulnerability to a lesser degree than Brisbane and Melbourne. Overall however Australian urban planning has a massive task ahead in reshaping the mix and intensity of policy action to redress the problems of urban oil vulnerability, especially in the extensive post-WWII suburban areas situated far beyond the main rail -based public transport services.

Research, pedagogy and oil vulnerability

Oil vulnerability poses many challenges for Australian urban planning pedagogy. The growing body of research, corporate and official literature described above attests to the likelihood of a contraction in global petroleum supplies during the next two decades. Such a change in the availability of petroleum would generate new demands on planners to re-shape cities for an era of petroleum-constrained mobility. This would in turn raise expectations that planning pedagogy should exercise its responsibility to respond by introducing new content into planning programs that will equip new planners with sufficient intellectual and practical capacity to both comprehend the petroleum challenges facing cities and to respond across a range of areas in which planning engages, such as land-use and transport integration, economic vitality and social cohesion. We are not aware of any individual subject offerings specifically dedicated to energy security, peak oil and petroleum vulnerability within any Australian planning programs. Current consideration of this topic is typically

confined to one-off lectures within wider subject clusters. For example within Griffith teaching of the urban consequences of declining energy security, 'peak oil' and planning responses is largely restricted to a two-hour lecture within a third-year transport planning subject. Some official assessments (e.g. Infrastructure Australia 2008) suggest that a global peak in oil production could occur as early as 2012 which is easily within the four-year completion timeframe for planning students matriculating in 2009. Even the International Energy Agency appears to be settling on 2020 as a likely date for a global oil production peak (Birol, quoted in Monbiot 2008). The remainder of this paper sets out a basic outline for the inclusion of greater energy security, peak oil and oil vulnerability content within a four-year planning course

Energy science and policy literacy

There is an urgent need to increase planning students' aptitude in dealing with energy issues not solely for planning within a deteriorating energy security context, but to support understanding in related areas such as climate change and local/alternative energy production. Improved 'energy literacy' would equip planners to understand the following issues by being able to maintain their own knowledge base and identify future patterns and implications: the geological origins of petroleum and associated fossil fuels; the current state of petroleum and fossil energy resources, reserves and production capacity and the major issues associated with them; an understanding of the international geopolitical context within which energy and petroleum production is managed and distributed; the projected consumption trajectories of current fossil fuels at global, national, metropolitan and local scales; likely future oil (and liquid fuels) production scenarios and their probabilities including key projection methodologies used in scenario preparation; and current energy and petroleum policies at the international, national and metropolitan scale.

Energy security and cities

Planners will also need to comprehend the potential impacts of a serious decline in global petroleum energy security on cities. This requires an analytical capacity and detailed understanding of: urban consumption of energy, especially petroleum based fuels; the political economy of energy consumption at the national and metropolitan scale; internal urban differentiation in petroleum energy consumption, especially in relation to transport systems including the spatial distribution of transport infrastructure; internal social differentiation in petroleum energy consumption and links to urban structure, especially housing markets; the ability to assess the distribution of impacts of higher petroleum prices within cities in relation to transport systems, social patterns, housing markets and land-uses; and the capacity to assess demand for low-petroleum energy intensive urban transport and allied systems under various energy security/production scenarios. This understanding would support the development of policy responses to a declining energy security context.

Responsive measures – mitigation and adaptation.

The final component of a course on planning and energy security would equip planning students with the capacity to craft appropriate metropolitan and local policies to address energy security problems with robust support from the scientific

and policy literature. Such capacity would need to rigorously interrogate current policies to assess their suitability for this planning task. Such content would include: detailed empirically based assessment of the capacity of current transport and land-use measures to reduce oil vulnerability; alternative measures to reduce transport energy reliance through public transport delivery at conventional suburban densities (pace Mees forthcoming); accelerating urban consolidation processes to achieve suburban density benefits through market and non-market processes; responding rapidly to sudden petroleum supply shocks; reducing medium-term oil vulnerability through direct constraints on car-use; and accelerated roll-out of non-motorised travel modes. While some of this content may be covered in other planning courses, the emphasis would be on how planners can accelerate the introduction of policies to respond to declining energy security under conditions of urgency.

Beyond the classroom, planning scholars have a responsibility to support professional development of junior and mid-career planning professionals who will form the majority of the decision-making cohort for the foreseeable future. This may include specific short and conventional course offerings and capacity development opportunities through relevant professional bodies. There is also a need for planning scholars to support and advance public debate about the effects of petroleum energy security scenarios for cities through scholarly advocacy so that the wider citizenry can be sufficiently informed to and involved in future planning processes.

Conclusions

Cities depend on their transport systems for the mobility of people, goods and information. Australian cities like their comparators in North America are highly dependent on automobiles for urban transport, especially within their extensive suburban zones. That half of Australia's population lives within the middle and outer suburbs of its major cities means the oil vulnerability of these areas has considerable implications for the economic and social life of the nation as a whole. With increasingly pessimistic assessments emerging about the future security of conventional oil supplies there is an urgent need for planners to begin grappling with and planning for, the consequences of a petroleum constrained future.

This paper has argued that two tasks are particularly imperative for planning practice and research. First there is a pressing need to increase the level of global planning scholarship dedicated to energy security, petroleum depletion and urban oil vulnerability. This may happen as a matter of course but the current modest level suggests that governments, especially planning agencies, have a role to play in accelerating this process. Second, there is an urgent need to revise the metropolitan strategies governing the development of Australia's major cities to recognise and plan for a petroleum constrained future. This however cannot simply involve rhetorical amendment as is so often the case with sustainability claims in such schemes. These plans must be comprehensively rethought to alter the trajectory of Australian urban development and the patterns of planning practice away from petroleum dependent transport systems and towards public transport, walking, cycling. The chances of such a shift occurring in Australian planning practice are modest at present but there are indications that some local governments, are beginning to seek change at the

metropolitan scale. Cities elsewhere must learn from the Australian case and also grasp this challenge for planning practice.

The second key task for planning practice is to begin to equip planners to be able to respond competently and effectively to the consequences of declining petroleum security and the challenge of securing suburbia. While the debate about oil depletion is not yet fully settled the significance for cities of declining petroleum supply is so great that educating institutions must offer students the capacity to adapt cities to a lower energy future. This means including much greater content on energy topics into planning programs with specific attention to petroleum issues. Even if petroleum depletion were not to become a serious practical issue for another decade at least by that time a new generation of planners will have been schooled in its implications and planning responses. Perhaps by that time some of this new cohort will have attained positions of decision-making power within planning institutions so that the theoretical content they have been taught by an energy sensitised planning education will bring a change in practice, towards a petroleum secure suburbia, before the rather more brutal and wilder mechanism of global oil shortages forces such adjustment upon oil dependent cities and suburbs.

References

- Australian Senate (2007). *Inquiry into Australia's future oil supply and alternative transport fuels: Final Report*. Canberra, Australian Senate.
- Campbell, C. (2003). "The Peak of Oil: A geological and political turning point for the world." *Making Urban Transport Sustainable*. Low, N. and Gleeson, B. Basingstoke, Palgrave Macmillan: 42-66.
- Campbell, C. (2005). *Oil Crisis*. London, Multi-Science Publishing.
- Campbell, C. and Laherrere, J. H. (1998). "The End of Cheap Oil." *Scientific American* **278**(3): 78-83.
- Chevron Oil Ltd (2005). *Advertisement in The Economist magazine, 16 July, pp.6-7.*
- Currie, G., Stanley, J. and Stanley, J., Eds. (2007). *No Way to Go: Transport and Social Disadvantage in Australian Communities*. Melbourne, Monash University ePress.
- Deffeyes, K. (2001). *Hubbert's Peak: The Impending World Oil Shortage*. New Jersey, Princeton University Press.
- Deffeyes, K. (2005). *Beyond Oil: The view from Hubbert's peak*. New York, Farrar, Strauss and Giroux.
- Deffeyes, K. and Huber, P. (2005). The End of Oil - Oil is Here to Stay. *Time*. **13 October:**
<http://www.time.com/time/magazine/printout/0,8816,1122019,00.html>.
- Department of Planning (2006). *Transport and Population Data Centre Statistics for the Subregional Planning Process*. Sydney, New South Wales Government.
- Dodson, J. (2003). "Visions for 2030: Housing and Transport Planning in Labor's Metropolitan Strategy." *Visions for Victoria: Proposals to achieve public sector renewal in Australia*. Hayward, D. and Ewer, P. Melbourne.
- Dodson, J. and Sipe, N. (2008). "Planned Household Risk: Mortgage and Oil Vulnerability in Australian Cities." *Australian Planner* **45**(1): 38-47.
- Energy Information Administration (EIA) (2005). *World Oil Transit Chokepoints*. Washington, D.C., Department of Energy.
- Government Accountability Office (2007). *Crude Oil: Uncertainty about Future Oil Supply Makes It Important to Develop a Strategy for Addressing a Peak and Decline in Oil Production*. Washington, United States Government.
- Graham, S. and Marvin, S. (2001). *Splintering Urbanism: Networked infrastructures, technological mobilities and the urban condition*. London and New York, Routledge.
- Heinberg, R. (2003). *The Party's Over: Oil, War and The Fate of Industrial Societies*. Gabriola Island, BC, New Society Publishers.
- Heinberg, R. (2004). *Powerdown: Options and actions for a post-carbon world*. Gabriola Island, New Society Books.
- Huber, P. and Mills, M. P. (2005). *The Bottomless Well: The Twilight Of Fuel, The Virtue Of Waste, And Why We Will Never Run Out Of Energy*. New York, Basic Books.
- Infrastructure Australia (2008). *A Report to the Council of Australian Governments*. Canberra, Infrastructure Australia, Australian Government.
- International Energy Agency (IEA) (2006). *World Energy Outlook 2006*. Paris, International Energy Agency and Organisation for Economic Cooperation and Development.

- International Energy Agency (IEA) (2007). *World Energy Outlook 2007: Focus on China and India*. Paris, International Energy Agency and Organisation for Economic Cooperation and Development.
- International Energy Agency (IEA) (2008). *World Energy Outlook 2008*. Paris, International Energy Agency and Organisation for Economic Cooperation and Development.
- International Monetary Fund. (2007). "World Economic Outlook Database, April 2007." Webpage, from <http://www.imf.org/external/pubs/ft/weo/2007/01/data/download.aspx>.
- Izundu, U. (2008). "OTC speakers highlight offshore industry's future." *Oil and Gas Journal* **12 May**: 20.
- Klare, M. (2005). *Blood and Oil: The Dangers and Consequences of America's Growing Petroleum Dependency*. London and New York, Penguin Books Ltd.
- Klare, M. (2008). *Rising Powers, Shrinking Planet: The new geopolitics of energy*. New York, Metropolitan Books.
- Kleveman, L. (2003). *The New Great Game: Blood and Oil in Central Asia*. New York, Atlantic Monthly Press.
- Lucas, K., Ed. (2004). *Running on Empty: Transport social exclusion and environmental justice*. Bristol, The Policy Press.
- Mees, P. (2000a). *Rethinking Public Transport in Sydney; UFP Issues Paper 5*. Sydney, Urban Frontiers Program, University of Western Sydney.
- Mees, P. (2000b). *A Very Public Solution: Transport in the Dispersed City*. Melbourne, Melbourne University Press.
- Mees, P. (forthcoming). *Transport for Suburbia: Beyond the Automobile Age*. London, Earthscan.
- Monbiot, G. (2008). "When will the oil run out?", *The Guardian*, 15 December.
- Newman, P. and Kenworthy, J. (1989). *Cities and automobile dependence : a sourcebook*. Aldershot, Hants; Brookfield, VT, Gower Technical.
- Newman, P. and Kenworthy, J. (1999). *Sustainability and Cities: Overcoming Automobile Dependence*. Washington, Island Press.
- O'Connor, K. and Healy, E. (2004). "Rethinking Suburban Development in Australia: A Melbourne Case Study." *European Planning Studies*, **12**(1): 27-40.
- Roberts, P. (2004). *The End of Oil: The decline of the petroleum economy and the rise of a new energy order*. London, Bloomsbury.
- Simmons, M. (2005). *Twilight in the Desert: The coming Saudi oil shock and the world economy*. New Jersey, John Wiley and Sons.
- Strahan, D. (2007). *The Last Oil Shock*. London, John Murray.
- van der Veer, J. (2008). "Two Energy Futures." Webpage, Retrieved 18 March, 2008, from http://www.shell.com/home/content/aboutshell-en/our_strategy/shell_global_scenarios/two_energy_futures/two_energy_futures_25012008.html.
- Wesley, M., Ed. (2005). *Energy Security in Asia*. London and New York, Routledge.
- Western Australian Planning Commission (WAPC) (2004). *Network City: Community Planning Strategy for Perth and Peel*. Perth, Western Australian Government.