INQUIRY INTO ECOLOGICAL CARRYING CAPACITY OF THE ACT AND REGION

ACT Legislative Assembly Standing Committee on Climate Change, Environment and Water

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Contact: Vesna Strika
Director, Canberra Division, Engineers Australia
11 National Circuit Barton ACT 2600
Tel: 02 6270 6555
Email: vstrika@engineersaustralia.org.au

or

Andre Kaspura
Policy Analyst, International & National Policy, Engineers Australia
11 National Circuit Barton ACT 2600
Tel: 02 6270 6581
Email: akaspura@engineersaustralia.org.au
www.engineersaustralia.org.au

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Executive Summary

Engineers Australia believes there is significant discordance between the different infrastructure and environmental plans issued by ACT Government agencies and it is far from clear that status quo policies will achieve the sustainability objectives articulated by the ACT in its 2009 sustainability policy.

Engineers Australia believes the required remedy is improved integration and coordination between ACT strategic planning documents, coupled with regular and transparent reporting of progress against specific elements of those plans. Improved sustainability requires fundamental attitudinal changes by households, individuals and businesses and this will only be achieved if the measures used to assess policy progress meaningfully connect policy and their everyday lives.

Ecological carrying capacity, or ecological footprint, is a measure of sustainability that has attracted growing attention, particularly on the internet. As a means of drawing attention to the unsustainability of modern lifestyles and the need for change, the ecological footprint is undoubtedly successful. However, the complexity of the construct and the character of the assumptions required to apply it, means that applying the ecological footprint to assist the achievement of improved sustainability in the ACT is limited. This submission argues that adoption of the ecological footprint will attract the controversy associated with it in the academic literature. This will focus attention on the measure itself rather than on the real objective, improved sustainability.

Engineers Australia is convinced that sustainability objectives will only be achieved when improved sustainability is integrated into mainstream policies on economic infrastructure, water supply and consumption, stationary energy and transport and Canberra's physical footprint. Present strategic policies in these areas lay claim to sustainability objectives but failure to integrate and coordinate these and other objectives and to connect objectives to what is expected from ACT citizens is a major problem.

Engineers Australia is prepared to provide further advice and comment to the Committee on how the integration of sustainability into infrastructure policies and planning can be achieved.

1. Introduction

Engineers Australia is the peak body for engineering practitioners in Australia, representing all disciplines and branches of engineering. Membership is now approximately 89,000 Australia wide and Engineers Australia is the largest and most diverse professional engineering association in Australia. All Engineers Australia members are bound by a common commitment to promote engineering and to facilitate its practice for the common good.

Engineers Australia has had a strong commitment to sustainable development principles and practices for over 20 years. Sustainable development is an integral component of Engineers Australia's code of ethics, a code that binds all members. Engineers Australia has agreed a sustainability charter as a high level statement of its commitment to sustainable development principles and this charter underpins other Engineers Australia policies and views, including those expressed in this submission.

The notion of ecological carrying capacity, or ecological footprint, as it is sometimes called, has received significant and growing attention as communities around the world become more conscious of the criticality of sustainable development. It is always difficult to present complex ideas involving multiple issues and resources usage in a simple message that is readily communicated to others. The success of the ecological footprint has been in its application for this purpose and the role the measure has played in developing awareness about the unsustainability of modern lifestyles and the need for change. Engineers Australia is supportive of the ecological footprint as a tool for raising awareness about unsustainable practices and the need for change.

Measures of ecological footprints have been used in two ways. First, to provide the backdrop for broad policy development. This submission argues that there are limits to this application of the ecological footprint and for a jurisdiction like the ACT more specific attention should be given to the integration and coordination of strategic infrastructure, land use and sustainability plans. At present there is significant discordance between the different plans issued by ACT Government agencies and it is far from clear that the status quo will achieve the sustainability objectives articulated by the ACT Government.

Second, the ecological footprint has been used to inform and persuade individuals that their behaviour needs to change. An aspect of the growing popularity of the ecological footprint has been that researchers have now focused on the specific message that the footprint conveys to individuals and have found that most internet calculators used to demonstrate the need for change, frequently convey doom-sayer scenarios irrespective of how environmentally friendly the current behaviour of users. It is feasible to develop calculators that show users that by changing their existing consumption patterns and habits, they will make useful contributions to social objectives, but extensive work will be necessary to particularise a calculator of this type to ACT circumstances and policy situation.

Engineers Australia is of the view that when pushed beyond the limits of broadly alerting the community of the need for change to become more sustainable, the simplifying assumptions and methodology used to construct the ecological footprint introduce controversy that provides needless distraction from the central objectives set out in the ACT sustainability policy. As well there is little association between the ecological footprint as a measure and the behavioural changes individuals and businesses need to make to become more sustainable.

Engineers Australia believes that a more practical approach to achieve the objectives of the ACT sustainablility plan is improved integration and coordination between ACT strategic planning documents coupled with regular and transparent reporting of progress against specific elements of those plans. Reporting should be regular and use measures that individuals and businesses can readily relate to everyday activities.

It is the way these activities are undertaken that must change for the ACT to become more sustainable. Unless and until individuals see the connection between what they are doing now and what is necessary for improved sustainability, change will be difficult to achieve. The submission develops this view in respect to water supply and consumption, stationary energy and transport energy and Canberra's physical footprint and suggests a range of measures that can be considered.

2. Carrying Capacity and Sustainable Development

Engineers Australia has a long standing commitment to sustainable development principles and members have agreed to this commitment as part of the Engineers Australia Code of Ethics. Engineers Australia has agreed a Sustainability Charter and this provides the high level foundation for all other policies supported by Engineers Australia.

Engineers Australia notes that the ACT Government committed to a sustainability policy in 2009[1]. The "guiding principles" set out in this document have much in common with Engineers Australia's Sustainability Charter and provides suitable high level statements of what the ACT Government means by sustainable development and the broad directions for future policy development. Moving the ACT community towards greater sustainability requires a paradigm shift in how all manner of resources are used. Attitudes need to change in all sectors of the community, including individuals, businesses, government and government institutions.

The ACT Sustainability Policy document makes a start on these issues by identifying a work program that stresses the importance of community engagement and projects with both social and economic outcomes. This program is supported by a web-site that provides some measures of progress. Engineers Australia believes that these steps indicate a decisive commitment to sustainable development by the ACT Government, but weaknesses in planning arrangements and in measuring progress towards sustainability limit translation of good intentions into on-the-ground outcomes that are relevant to the daily lives of ACT residents.

The terms of reference for the present Inquiry by the Standing Committee on Climate Change, Environment and Water into the ecological carrying capacity of the ACT and region focus on measures of sustainable progress. Engineers Australia strongly supports evidence based policy. Real progress can only be achieved if objectives are clearly and transparently stated and actions taken to achieve objectives are measured to verify the degree of success. Sustainable development calls for changed behaviour by all individuals, households and businesses and accordingly it is vital that actions proposed to achieve greater sustainability (and the measures used to verify this) are relevant to their daily activities. Without this connection the changes in attitudes necessary are unlikely to occur.

[1] ACT Government, People, Place, Prosperity, The ACT's Sustainability Policy 2009, www.cmd.act.gov.au/__data/assets/pdf_file/003/119730/people_place_prosperity.pdf

Ecological carrying capacity, more often referred to as ecological footprint[2], has received significant attention as a measure of sustainability, particularly on the internet. The most recent report, released by the World Wildlife Fund (WWF), applying this concept shows that Australians lifestyles require the 8th highest resource use out of 152 countries reviewed and that, collectively, all countries are using resources equivalent to 1.5 planets[3]. The value of a measure like the ecological footprint is that a complex issue involving a multitude of factors and resources, many countries and millions of people, can be summarised in a way amenable to a simple message that current lifestyles are not sustainable and that change is essential.

Engineers Australia agrees that such simple messages are essential to begin the conversation about the need for change, providing that their limitations are acknowledged. The ecological footprint was first put forward in 1996[4] and over time the methodology employed has been significantly improved. The WWF Report cited above, employs the most recent revisions released by the Global Footprint Network[5] in 2008. The methodology requires the application of a number of important simplifying assumptions and statistical protocols to establish equivalence of resource use in different situations. Critiques of the ecological footprint stem primarily from these assumptions and have resulted in the ecological footprint becoming surrounded by controversy that must be overcome in situations where practical policy depends on such a measure.

Measures of ecological footprints have been used to provide the backdrop for broad policy development and to inform individuals that their behaviour needs to change. The Appendix to this Submission reviews a number of critiques of the use of ecological footprints as a broad indicator of sustainable development. The issues raised show that a choice to base an ACT sustainability policy on an ecological footprint measure means first engaging in a debate to settle the controversies surrounding the measure and its application. This may have academic merit, but its practical policy value in moving the ACT towards greater sustainability escapes Engineers Australia. In Australia generally, and in the ACT in particular, there is growing acceptance that change is essential to ensure lifestyles are sustainable. To the extent that reinforcement is necessary, the broad messages in the WWF report are valuable but constructing ACT level estimates of an ecological footprint would distract attention away from the key issues - taking practical steps to change community attitudes and then to action these new approaches.

The second way that the ecological footprint has been used, especially through numerous internet calculators, has been to persuade individuals and businesses about the need for change. Franz and Papyrakis[6] show that most common calculators, available on-line, used to demonstrate the need for change, frequently convey doom-sayer scenarios irrespective of how environmentally friendly the current behaviour of users. It is feasible to develop calculators that show users that by changing their existing consumption patterns and habits, they will make useful contributions to social objectives, but extensive work will be necessary to particularise a calculator of this type to ACT circumstances and policy situation.

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[2] Ecological footprint is the terminology used in this submission.
[3] WWF Living Planet Report 2010, www.wwf.org.au
[4] M Wackernagel and W Rees, Our Ecological Footprint: Reducing Human Impact on the Earth, New Society Publishers, 1996, Gabriola Island.
[5] B Ewing, A Reed, S M Rizk, A Galli, M Wackernagel and J Kitzes, Calculation Methodology for the National Footprint Accounts, 2008 Edition, Oakland, Global Footprint Network, www.footprintnetwork.org
[6] J Franz and E Papyrakis, Reconsidering the 'Ecological Footprint' index: Does it promote sustainable behaviour? European Society for Ecological Economics 2009, www.esee.2009.si/papers/Papyrakis-An Evaluation of Ecological.pdf

In view of the arguments set out in the Appendix, Engineers Australia sees little merit in estimating ACT specific versions of the ecological footprint. Instead, Engineers Australia believes that it would be more useful to develop measures of progress towards sustainability that relate directly to the ACT and its policy environment and that show the ACT community the connection between Government policy and actions taken to progress the Territory towards more sustainable development. The challenges involved in improving the ACT's sustainability are significant and needless debate about esoteric measures will distract attention and slow progress.

Engineers Australia believes that action on two fronts is essential to bolster current ACT sustainability policy. First, long term planning arrangements, particularly those relating to economic infrastructure, require significant improvement. Key areas of change in improving ACT sustainability include water, energy, transport and Canberra's physical footprint. Without long term planning of economic infrastructure, emphasizing the objective of sustainability, change will be difficult, if not impossible. Second, measures of progress towards sustainability require significant development to inform the community about the status quo, to demonstrate the need for change and to demonstrate what has been achieved as a result of policy action. The following two sections of the submission set out Engineers Australia's views on these issues.

3. Strategic Planning, Coordination and Integration

The ACT has embraced sustainable policy development and is to be commended for doing so. But, as identified in the Engineers Australia 2010 Infrastructure Report Card for the ACT[7], there are serious deficiencies in the ACT's strategic infrastructure planning even though the situation has improved over the past 5 years. Key challenges include:

- Ensuring that plans balance productivity, liveability and sustainability goals and transparently identify the trade-offs necessary to achieve balance.
- Strategic plans should be geared to the inevitability that required forecasts of the future turn out to be inaccurate. Regular updates of plans to bridge the gap between forecasts and actual events are essential to ensure the vision set out in plans is achieved.
- Planning should provide for both public and private sector participation in the provision of economic infrastructure, in particular separation between strategic planning of economic infrastructure and infrastructure operations is essential to avoid conflicts of interest and to ensure competition and complementarity in the provision of infrastructure services.
- Planning should fully incorporate developments in Queanbeyan and border regions generally and there should be planning integration between ACT and national capital interests.

Trends in ACT engineering construction of economic infrastructure show that the ACT has benefited from the availability of high quality economic infrastructure built prior to self government. As outlined in the Infrastructure Report Card, much of this infrastructure has aged and will need to be replaced and/or augmented in the near future. Although this presents important capital provision challenges, it also presents opportunities for new approaches to infrastructure provision that recognise the paradigm shift necessary for a more sustainable ACT community. More of the same is simply not good enough because it repeats unsustainable practices embodied in past

[7] Engineers Australia, Infrastructure Report Card 2010, Australian Capital Territory, www.engineersaustralia.org.au

approaches. Engineers Australia believes that a revitalised approach to strategic infrastructure planning for the ACT is the best way forward to avoid this mistake.

The ACT's strategic planning for economic infrastructure should have a focus on implementing practical sustainability actions. Particular issues that should be taken into account include:

- Recognition that economic infrastructure decisions lock the ACT into the sustainability parameters of the built infrastructure for the whole of its life, typically between 20 and 50 years and in some cases as long as 100 years.
- Infrastructure design must be sufficiently flexible and adaptable to operate under changed rainfall, temperatures and wind speeds resulting from changing climate.
- Particular care must be applied to ensure that sustainability principles are embodied into infrastructure design and construction and into infrastructure operating plans.
- Infrastructure design should be scaleable with minimum disruption so as to meet both current needs and future needs. This characteristic emphasises the criticality of embodied sustainability principles.

A key tenet of sustainable development is that the services of economic infrastructure should be provided to users at full economic social costs, including the costs of externalities. This principle ensures that only as much infrastructure as is optimal is built and that existing infrastructure is optimally utilised. In the ACT infrastructure service provision should be based on economic costs to the community at large and not based on the financial returns to infrastructure owners.

Economic infrastructure in the ACT has been the preserve of the public sector, including Government owned monopolies. In a small jurisdiction such as the ACT, public infrastructure provision is likely to remain the backbone of the Territory's infrastructure for many years. However, Infrastructure Australia and the Productivity Commission support private sector participation in some infrastructure services to ensure that all options are competitively assessed. Both the Federal Government and Opposition have expressed support for the concept of "infrastructure bonds" to finance future infrastructure projects. The purpose of infrastructure bonds is to provide the financial flexibility required to, on the one hand, meet the long term financing requirements of infrastructure owners, and on the other, to meet the short term, day-to-day flexibility required by many financial entities, including superannuation funds. Reform of the ACT's infrastructure planning to incorporate the principles discussed above will ensure that this new financial avenue can be exploited to provide much needed infrastructure renewal, but within a sustainability paradigm.

4. Sectoral Issues and Measures of Sustainable Development

This section considers particular challenges impeding progress towards sustainable development that should be incorporated into augmented infrastructure strategic planning, including how progress can be measured.

Water Supply and Consumption

Although the ACT professes adherence to integrated urban water cycle management (IWCM), the predominant water supply paradigm in the ACT is now an out-moded one pass approach to water supply. Engineers Australia strongly supports integrated water cycle management (IWCM) as a

complement to centrally provided water services. Engineers Australia has articulated its views on IWCM in a guide called Australian Runoff Quality[8]. IWCM is consistent with sustainable development principles and recognises that all water streams should be optimised to supply the demand for water on a fit for purpose basis.

IWCM has been included in inter-governmental water reform agreements, most recently in the agreed COAG principles for urban water planning. There are examples of IWCM in many large urban centres, including in Canberra, but in the main are "icon", "demonstration" or "experimental" projects or confined to new suburbs instead of being applied to all relevant water supplies. Engineers Australia believes that until the two key problems discussed below are addressed the status quo will continue.

Water supply and demand options should be managed on an economically efficient systems basis. Although cost-benefit studies are now generally used to support new projects, the ennumeration of costs and benefits reflects attitudes and practices conditioned by the traditional one pass approach to water management. IWCM requires that the costs and benefits of potable water, waste water and stormwater options are considered simultaneously and not independently from each other because costs in one segment may be a benefit in another.

When this is done[9], it can be shown that innovative IWCM techniques have the capacity to contribute sufficiently to water supplies so that investment in headwater supply infrastructure can be deferred for decades. Further, investment in aging waste water treatment infrastructure can be deferred by offsetting declining efficiency by taking some of the load and improve the security of water supplies while reducing energy use. In addition, IWCM techniques move the management of water supplies towards an on-going sustainable basis. Engineers Australia believes these benefits cannot be ignored because cost benefit studies are arbitrarily limited under existing institutional arrangements.

The second problem that must be overcome is the institutional structure of urban water planning. There are many weaknesses in current arrangements because urban water planning is largely undertaken by existing water utilities resulting in the perpetuation of status quo practices and methodologies and serious conflict of interest. Engineers Australia believes that urban water planning and the procurement of water solutions should be undertaken by an independent agency in each jurisdiction and that water planning and the delivery of water service operations should be separated. Engineers Australia believes that the backbone of future sustainable water systems will continue to be current water utilities, however, separation of planning and operations opens the way for private sector participation in some elements of an integrated system, bringing with it

[8] Engineers Australia, Australian Runoff Quality, A Guide to Water Sensitive Urban Design, 2006, www.engineersmedia.com.au

[9] See the detailed arguments in Peter Coombes, Generic Guidelines for an Eco-efficient Approach to the Development of Water Infrastructure, December 2009, prepared for The Water Security Section, Environment and Development Division, UNESCAP, pcoombes@bonacciwater.com ; P J Coombes and M E Barry, The Relative Efficiency of Water Supply Catchments and Rainwater Tanks in Cities Subject to Variable climate and the Potential for Climate Change, Australian Journal of Water Resources, Vol 12 No 2, pp 1-16; P J Coombes, Integrated Water Cycle Management: Analysis of Resource Security, Water, March 2005, pp21-26: A Barton, P Coombes and A Sharma, Impacts of Innovative WSUD Intervention Strategies on Infrastructure Deterioration and Evolving Urban Form, 5th International WSUD Conference, 21-23 August 2007, Sydney; P J Coombes, Energy and economic impacts of rainwater tanks on the operation of regional water systems, Australian Journal of Water Resources, Vol 11 No 2, 2007, pp 177-190

competition and innovation. It will also ensure that all water options are fully assessed and not arbitrarily discarded because of prevailing attitudes.

Engineers Australia believes that measuring progress on sustainable water use is vital. At present a single measure, water used per ACT property, is used. Although the "measuring our progress" web site clearly acknowledges that water restrictions were in place for most of the reporting period, the evident fall in water consumption is reported as improved sustainability. In reality the measure shows the combined influence of severe water restrictions due to drought and and the impact of relatively high (by national standards) water prices. The decline in water use is not a measure of sustainability and should not be so represented.

There are alternative measures available, particularly within an IWCM framework. Engineers Australia suggests the following measures that emphasize IWCM and sustainability to contribute to community education and to the development of a sustainable water use culture:

- When no water restrictions are in place; the levels of water used by each ACT household and water used by ACT businesses. Ideally, reporting should be on a broad geographic basis and in the case of businesses by business size (number of employees) and type.
- The volume and proportion of recycled waste water used to replace potable water used by households, by businesses and for the irrigation of urban landscape and parks.
- The volume and proprtion of recycled stormwater used to replace potable water used by households, by businesses and for the irrigation of urban landscape and parks.
- The volume of rainwater tank water used to replace replace potable water used by households, by businesses and for the irrigation of urban landscape and parks.
- The suburbs and the proprtion of Canberra's urban area covered by IWCM solutions to water management.

Sustainable water use will become increasingly important in coming decades. This is emphasized by the sustainable drawing limits proposed by the Murray-Darling Basin Authority in its current consultations on the water plan for the Basin overall. The ACT is not immune to reduced water rights and will need to prepare itself for a different water future in line with what will be expected of all Basin water users. Measures like the ones proposed can assist the adaptation process by promoting and educating the community about sustainable water use as well as measuring the progress of Government policies in a way readily understood by the whole community.

Stationary Energy

Climate change mitigation concerns will be the key drivers of sustainable stationary energy use in the ACT. In this submission stationary energy includes ACT consumption of electricity generated in the ACT and in other jurisdictions and ACT consumption of non-transport natural gas. The ACT has been very active in setting ambitious greenhouse emission reduction targets for both the medium and the long term, but there is little connection between these targets and ACT Government energy policies.

Although only 2% of the ACT's electricity consumption is generated in the Territory (based on 2009 figures), the main emphasis of ACT Government policy has been directed at encouraging local electricity generation through the feed-in tariff and related mechanisms. As noted in the Engineers Australia 2010 Infrastructure Report Card for the ACT, the proportion of renewable energy in the ACT electricity supply, including greenpower purchased from outside of the jurisdiction, has

increased from 3.4% in 2004-05 to 7.2% in 2008-09. Engineers Australia has supported renewable generation for some years and sees considerable merit in policies that seek to decouple ACT electricity supplies from greenhouse intensive sources of supply sourced from other jurisdictions. There is also recognition in the ACT greenhouse reduction policies that natural gas offers lower emission intensity than other fossil fuels.

However, Engineers Australia believes that electricity and gas planning arrangements do not provide the necessary level of support to integrate greenhouse emission reduction targets and planning of electricity and gas supplies. For example, what proportion of the 2020 40% greenhouse reduction target is to be achieved by switching to renewable generation or to gas fired generation? How many household and business PV systems will be required and what are the implications for purchases of greenpower by the central electricity utility? Although the answers to these questions imply all the risks common in forward planning, they are essential ingredients in achieving the greenhouse emissions reduction target set.

Engineers Australia believes that sustainable stationary energy use requires a fresh approach to stationary energy supply in the ACT. Under present infrastructure planning arrangements ACTEWAGL is responsible for the planning and operations of the ACT electricity transmission and distribution systems and for the natural gas gas network. It is unclear who is responsible for planning the ACT's future electricity supply generation and how this is shared between existing fossil based sources, renewable electricity, natural gas and improved energy efficiency to avoid conflicts of interest.

The "measuring our progress" web-site measures per capita ACT greenhouse emissions, including from externally generated electricity consumption. This measure has its uses but households and businesses cannot easily relate progress in this measure to the policy elements articulated by the ACT Government. As was the case for water, progress towards more sustainable stationary energy use can be assisted by a set of measures more readily identified with policy measures. These could include:

- The number of PV systems installed in the ACT and their generating capacity and how these compare to aspirational target figures. Ideally distinguishing between households and businesses.
- Greenpower purchased from sources external to the Territory and how this compares to an aspirational target. Greenpower used by households and by businesses.
- Household natural gas supplied per household.
- Non-household natural gas supplied per supply point.
- Fossil fuel electricity consumed in the ACT by households and by businesses.

These suggestions are not exhaustive but make the point that to achieve progress targets and measuring progress towards them are essential. Without them the merit of ambitious greenhouse reduction objectives are under-mined.

Transport Energy and Canberra's Physical Footprint

The ACT Government's plans for sustainable transport have been extensively documented[10]. The Sustainable Transport plan for the ACT proposes modal shift targets that envisage the proportion of trips undertaken by walking, cycling and public transport to increase from 13.1% in 2001 to 20% in 2011 and then 30% in 2026. At present there are no indicators available on the "measuring our progress" web-site setting out progress towards these objectives, although statistics on progress to 2006 were reported in the ACT Government Integrated Transport Framework[11]. The presumption in this report was that the 2011 targets would be met but no evidence was offered to substantiate this claim. Engineers Australia believes that targets of this nature are vital in planning for improved sustainability in transport and commends the ACT Government for making a start in this area. However, achieving the stated objectives will mean that 70% of trips in 2026 will continue to be by private motor vehicle. With growth in trip numbers due to population and economic growth, this may mean that overall transport greenhouse emissions remain unchanged or even increase.

According to the ACT proposal to Infrastructure Australia seeking funding for a light rail proposal, ACT greenhouse emissions from passenger vehicle use in Canberra were 23% higher than the average for other Australian capital cities[12]. The reasons for this are the high use of private motor vehicles in Canberra, the low patronage of public transport and Canberra's low population density and high physical footprint. In general, the population densities of Australian capital cities is radically less than most global capital cities and Caberra's population density in turn is significantly lower than the densities in Sydney and Melbourne.

The greenhouse emission reduction targets set by the ACT Government do not exempt transport emissions. Although market mechanisms for greenhouse emissions, such as the Carbon Pollution Reduction Scheme considered by the Federal Government, allow for differential sectoral emissions reduction in proportion to emission reduction costs, the transport sector is expressly included. Other mechanisms now the subject of discussion Federally, such as a carbon tax, are more blunt in their impact because they apply equally to all sectors irrespective of adjustment costs in each sector.

Engineers Australia believes that present plans should be augmented in two ways. First, transport plans should publish indicative statistics on travel journeys, both direction and distance, by transport mode. Engineers Australia is broadly supportive of the principles embodied in the ACT's sustainable transport plans, but little can be said about implementation when the necessary information is unavailable. Second, a comprehensive set of transport indicators should be published to improve the community's awareness of transport sustainability issues and to measure the progress of specific transport measures. Some suggested measures include:

- ACT transport greenhouse emissions per capita, by transport mode, compared to Australia as a whole and to other capital cities.
- Passenger travelling by public transport in the Canberra region.

[10] See www.tams.act.gov.au for a range of documents including The Sustainable Transport Plan for the ACT (2004), ACT Government Integrated Transport Framework (2008) and Sustainable Transport Action Plan Progress report November 2009.
[11] Op cit, p6
[12] ACT Light Rail, Proposal to Infrastructure Australia, 2008, available from www.tams.act.gov.au

- Indicative peak hour and non-peak travel times, by mode of transport, from selected locations to Civic.

Engineers Australia also believes that there needs to be greater integration between land use planning (for example, the proposals in the Canberra Spatial Plan) and the ACT Sustainable Transport Plan. In particular, public transport services should be available from greenfields development areas like Molonglo ahead of residential occupation. Similarly, the infrastructure to encourage walking and cycling should be integrated into base infrastructure prior to residents taking up occupancy. These steps do not guarantee the use of sustainable transport facilities, but in conjunction with strong community education about the importance and value of sustainable transport, maximise the prospects of use before car habits become the norm.

Appendix: Critiques of the Ecological Footprint as a Measure of Sustainability

There have been a number of critiques of the ecological footprint as a measure of sustainability and most have been included in an overview by Fiala[13]. The key points made by Fiala are:

- The ecological footprint is dominated by energy with over 50% of the footprint of most high and middle income countries attributable to the amount of land required to sequester greenhouse gases. According to the Global Footprint Network data base (at the time), the world was consuming 25% more resources than the earth's biocapacity.
    - The ecological footprint presumes that all greenhouse gases will be sequestered.
    - It is not clear from environmental or economic arguments that all greenhouse gases must be sequestered to maintain the sustainable capacity of the earth. Fiala points out that if 50% of current greenhouse production is beyond the sustainable capacity of the earth, then the overall conclusion of the measure changes to world consumption being within the limits of sustainability as defined by the footprint.
- The application of national (regional or city) boundaries in the ecological footprint is arbitrary and ignores a basic tenet of economics that products are produced according to comparative advantage. This issue is fundamentally important because the methodology of the footprint multiplies average consumption within a boundary by work population and this is compared to the capacity of the earth. In other words, the dependence of the measure on boundaries means that ecological carrying capacity is somewhat of an artificial construct for the ACT.
- The technology assumption embodied in the ecological footprint is problemmatic, something that is acknowledged by its proponents[14]. This undermines its policy value because:
    - The ecological footprint provides a simple and intuitive measure of the production units necessary for a given consumption level but it does not measure the sustainability of consumption as it purports to do.
    - Technology change means the footprint cannot assist understanding the effects of future consumption growth.
    - Because the ecological footprint can only descibe production growth without technology, comparisons between human consumption and biocapacity, particularly in the future, are flawed.
    - The ecological footprint deals with extensive production (more of the same) adequately but cannot deal with intensive production (increased productivity) and history shows that most growth has resulted from the latter. Between 1961 and 2006, world cereal production increased by 2.17% pa and yield rates (intensive technology) increased by 2.06% pa. The increase in land devoted to cereal production (extensive technology) increased by only 0.09% pa.
- The ecological footprint is not able to capture land degradation, a result supported by regression analysis that shows little correlation between degradation, human development indices, ecological footprint measures and carbon.

[13] Nathan Fiala, Measuring Sustainability: Why the Ecological Footprint is Bad Economics and Bad Environmental Science, Ecological Economics, 2008, 67(4), also available from www.nathanfiala.com/Measuring Sustainability.pdf

[14] Either a world average or a composite measure based on a country's technology and the technologies in countries that it trades with are used. The relevant measure of technology to use in a globalised world is technology at the source of production.

While these are not the only criticisms of the ecological footprint identified in the literature, they serve to illustrate the point that serious reliance on this measure is likely to be controversial and result in lengthy and extensive debate about the value of the measure and so deflect attention from the real objective; moving to a more sustainable society.

One reason why the ecological footprint has increased in popularity as a measure of sustainability has been the increasing number of footprint calculators available on the internet. These calculators enable individuals and agencies to calculate their ecological footprint and so personalise the message that consumption is overshooting biocapacity. At a recent conference of the European Society for Ecological Economics, Franz and Papyrakis[15] examined the usefulness of ecological footprint calculators as a tool to assist the changed behaviour necessary for more sustainable development.

Franz and Papyrakis contend that the ecological footprint has been used almost exclusively as a measure of unsustainability rather than as a measure of sustainability. They examine a range of popular on-line calculators made available by conservation organisations, other non-government agencies and government agencies including the World Wildlife Fund, the Global Footprint Network, Best Foot Forward, BioRegional, the Austrian Ministry of Agriculture, Forestry, Environment and Water Management and Redefining Progress, to name the key ones featured in their article chosen on the basis that Google showed they had the highest returns.

The surprising result of this research was that even when the most environmentally friendly options are chosen, the calculators produce measures of ecological footprint that exceed the planet's biocapacity level. Their general conclusion was "the absence of options to fully offset one's environmental impacts is likely to reduce the credibility of the indices and renders them a doom-saying, off-putting instrument for individuals and policy makers".[16] Franz and Payrakis did not condemn ecological footprint calculators outright. They found that one major calculator (Redefining Progress[17]) offered a more comprehensive set of questions about consumption and resource use and, more importantly, the benefits of choosing more sustainable options were made clear and explained.

Based on this overview, Engineers Australia believes that the the use of an ecological footprint measure would mean engagement in extensive debate to overcome the research controversies surrounding the concept and the methodology used to operationalise it. This may have academic merit but its practical policy value in moving the ACT towards greater sustainability escapes Engineers Australia. The next challenge will be the deployment of the ecological footprint measure to persuade individuals and businesses to adopt more sustainable practices. As Franz and Papyrakis demonstrate, if an on line calculator is to be part of the process, it must be constructed so as to avoid the doom-sayer elements of most existing calculators and offer users the reassurance that if they do change their existing consumption patterns and habits, they are making useful contributions to social objectives. In the ACT local language and context will also be critical and off-the-shelf solutions are not likely to be satisfactory.

[15] J Franz and E Papyrakis, Reconsidering the 'Ecological Footprint' index: Does it promote sustainable behaviour? European Society for Ecological Economics 2009, www.esee.2009.si/papers/Papyrakis-An Evaluation of Ecological.pdf
[16] Franz and Papyrakis, op cit
[17] www.myfootprint.org