
**Discussion Paper:
A New Distributed
Infrastructure and
Services Market**

*Assessing Australia's Future
Market Potential*

Draft 1.1

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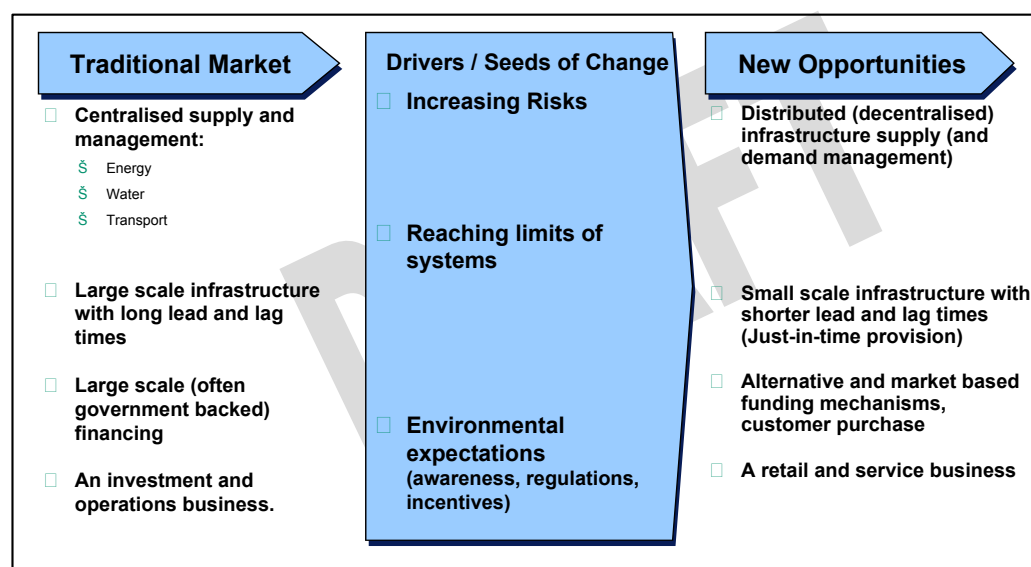
EXECUTIVE SUMMARY

This discussion paper was completed with the support of the Australian Council for Infrastructure Development (AusCID). It seeks to build the case, firstly, for change towards more distributed (or decentralised) infrastructure and service provision, and secondly for private sector involvement in that change, and thirdly for thinking about it from an industry perspective in terms of a new and very different ‘market’ with a wealth of different opportunities.

We are working to form a partnership between AusCID, ISF and other stakeholders to take the analysis to the next level and help to realise the opportunities identified. This work could involve assessing the nature and potential size of the market in distributed infrastructure and services, identifying and evaluating the opportunities within it, understanding the barriers and challenges in creating it and outlining some possible strategies to overcome those barriers.

Three key drivers are helping to create new opportunities and a ‘market’ in distributed infrastructure and services which looks very different to the traditional infrastructure market.

Centralised and Distributed Infrastructure Industry Characteristics Compared



We have defined this Distributed Infrastructure and Services (DIS) market as one involving products and services that:

- *increase efficiency and conservation* (for example products or services that reduce the need for energy use, water use, or large scale car based infrastructure);
- *provide distributed and decentralised supply* (for example smaller scale energy production, localised water capture and/or re-use); and
- *involve change to the system as a whole* (such as systems to enable a more distributed energy market, small bore and decentralised sewerage, or integrated land-use and transport planning).

These can be complementary to the existing infrastructure industry as well as offering new and very different opportunities. To help make the DIS opportunities a reality, we identified a need to understand the change and its potential from an industry perspective. We have started to do so in this discussion paper by examining the case for change in five categories:

- **The growth market:** *How real and quantifiable is this potential change?*
- **Product and service opportunities:** *What are the types of new products and services, their potential and their relative cost effectiveness?*
- **Competitor development and opportunity:** *What different business 'delivery' models for private sector engagement exist?*
- **Policy and economic incentives:** *What types of policy options are in place and being considered by government that will incentivise and impact the market?*
- **Existing business improvement:** *How do new products and services relate to existing infrastructure provision and specifically how could they help?*

The growth market? Studies in Australia and internationally have asked a number of questions regarding the potential for DIS in supplying our infrastructure needs. These studies and associated political commitments or considerations (such as commitments not to build any more dams, or to reduce GHG emissions to a certain level) demonstrate both the 'reality' of the potential change and that the market size is quantifiable. For example:

- **Water:** It is estimated that the DIS market potential in the Sydney region in 2030 makes up around a quarter of current water demand projections, or 200GL/a, (Figure 2, pg 14)
- **Energy:** Reducing GHG emissions by 50% in 2040 would require: products and services to help reduce energy demand by an estimated 20% and; distributed forms of electricity generation to grow from around 20% of the market to around 70% (Figure 3, pg 15)¹.
- **Transport:** In reducing GHG emissions from this sector by up to 80%, it is estimated that technological improvements – such as improvements to engine design – would contribute about half the total effort with the other half coming from demand-side and mobility management measures (Figure 4, pg 17).

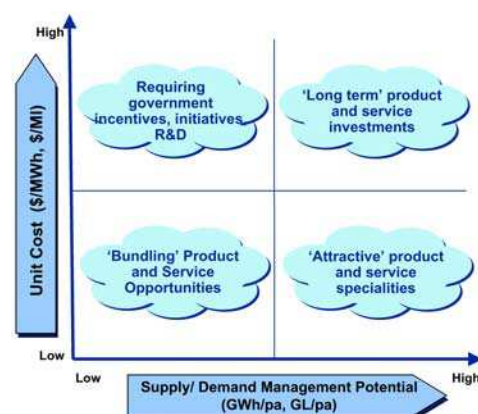
Quantifying and breaking down the DIS market from an Australia-wide perspective, would provide the context and the basis for a business case.

Product and service opportunities. We have defined the range of products and services as those which increase efficiency and conservation, provide decentralised or distributed supply and/or involve a change to the system as a whole.

The most attractive products and services to industry, customers and society as a whole are likely to be those that have the highest potential, in terms of savings or supply, at the least cost. For energy and water, we analysed available data on different DIS products and services based on these criteria. Groupings emerged:

¹ Biomass, wind, solar, co-generation and some parts of the natural gas sector are all assumed to be more distributed forms of electricity generation.

Product and Service Groupings identified for Energy and Water Examples.



Efficiency options, offer ideal ‘bundling’ opportunities for industry (they tend to fall into the ‘low cost but low potential bracket’). For example, quantified efficiency options in energy offer as much potential, at a lower unit cost than wind energy potential in NSW (Figure 5, pg 18).

Some products are comparatively attractive individually in either the short or long term (e.g. co-generation and biomass in energy, smart growth and rain-tanks in Water) (Figure 8, pg 18).

The vast range of more ‘distributed’ transport products and services can be evaluated using a similar ‘least-cost’ method. In this paper we outline the broad variety from smart technology, fleet management, and development that facilitates non-motorised travel (section 3.2.2, pg 19).

The many DIS products and services can be evaluated and assessed (comparatively, collectively and individually) to understand what would be required to make them viable investments.

Competitor development and opportunity. A number of different business models to serve this market have been, and could be, developed.

In particular, opportunities exist for larger corporate entities with the ability to bundle product and service offerings and gain economies of scale. Current competitors are small players who tend to be single product or service focussed. Over 70% of companies in the energy DIS market have fewer than 6 employees (Figure 8, pg 24).

Many different kinds of companies, organisations and institutions could be involved from specialist DIS providers, current service providers (expanding their current model), property developers, appliance and equipment vendors, or enabling businesses such as metering companies.

We have outlined three case studies of existing players: ‘Solar Energy Systems’, a specialist DIS provider; ‘UXC, Utility Services Group’, a large scale ‘enabling’ and service company; and ‘Integrated Transit Solutions (ERG & Motorola)’, a joint venture in transport technology provision (pg 25).

To identify the most viable options, different business models for delivering products and services could be evaluated on a number of different criteria: financial, environmental or social risk, environmental outcomes, institutional barriers to development etc.

Policy and economic incentives: We have outlined and provided examples of the suite of policy options, in place and/or available to government, that impact the DIS market. There are many of them. They range from:

- the more regulatory targets or caps or trading schemes that can directly limit the

existing centralised infrastructure market;

- to direct economic incentives such as *fund creation* or *direct government contracts*,
- to the more communicative building or product rating schemes or performance based schemes that impact on brand and customer demand from infrastructure providers.

Different policy options will suit different industry sectors and business models. In such a new market space there is opportunity to define the most appropriate set of policies for these different groups and identify key regulatory or institutional barriers to new business models.

Existing business improvement

DIS offers opportunities for existing infrastructure providers to change their profile. There are four key benefits of DIS for existing infrastructure businesses:

- Managing peak loads.
- Using modular and distributed capacity to meet or exceed service standards.
- Deferring large capital investment projects (modular development).
- Reducing the risk of 'stranded assets'.

These benefits often don't get considered due to the need for frameworks to assess traditional and DIS projects on an equal footing to ensure cost-effective service provision and sustainable outcomes, and to help co-ordinate public and private sector investment to get optimal investment outcomes.

We are working to develop partnerships with industry and other stakeholders to help realise the potential in this market by furthering the work to date. This could involve a focus in one or more of the following areas:

- Quantifying and breaking down the DIS market as a whole from an Australia-wide perspective to provide the context and the basis for a business case.
- Evaluating and assessing (comparatively, collectively and individually) the many DIS products and services, to understand what would be required to make them viable investments.
- Evaluating different business models on a number of different criteria, such as financial, environmental, social risk, environmental outcomes, institutional barriers/requirements etc.
- Defining the required policy mix in terms of outlining the most appropriate set of government policies for different industry groups, and identifying the key regulatory or institutional barriers to new business models.
- Developing frameworks to assess projects on an equal footing, to ensure cost-effective service provision and sustainable outcomes and to help co-ordinate public and private sector investment to get optimal investment outcomes.

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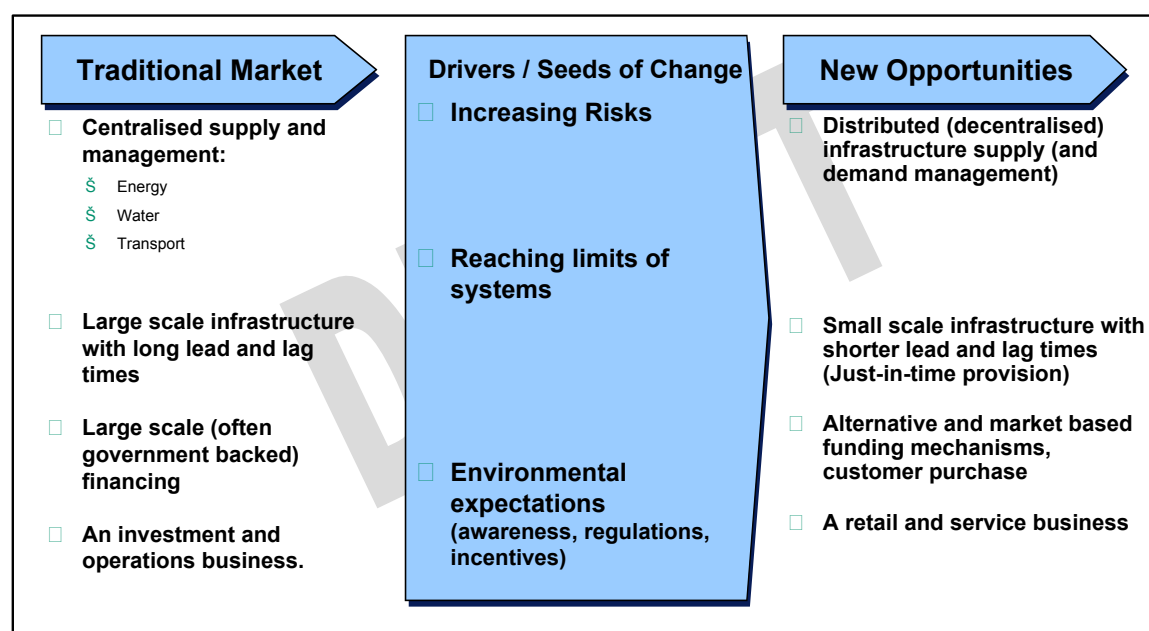
1. INTRODUCTION AND OBJECTIVES

1.1. Background

Traditional centralised and ‘supply-side’ focused infrastructure provision is changing to become more sustainable, demonstrated by moves towards; increased efficiency, renewable resource use, managing biodiversity impacts, reducing emissions, engaging stakeholders and acknowledging and actively managing labour practices and human rights. The AusCID “Sustainability framework for the future of Australia’s Infrastructure” handbook is helping to create this change.

At the same time, new opportunities in distributed infrastructure and services are opening up. This is being driven by a variety of factors and is creating a very different market for ‘infrastructure’. We have called this market the Distributed Infrastructure and Services (DIS) market.

Figure 1: Centralised and Distributed Infrastructure Industry Characteristics Compared



We have identified a need to further understand the DIS market from an industry perspective. By the term distributed infrastructure and services we mean products and services that:

- *increase efficiency and conservation* (for example products or services that reduce the need for energy use, water use, or large scale car based infrastructure);
- *provide distributed and decentralised supply* (for example smaller scale energy production, localised water capture and/or re-use,) and;
- *involve change to the system as a whole* (such as systems to enable a more distributed energy market, small bore and decentralised sewerage, or integrated land-use and transport planning).

1.2. Proposed research

We would like to form a partnership between AusCID, ISF and other stakeholders in order to further the research in this area for the benefit of the public and private sector. To do so we would hope to assess the nature and potential size of the market in distributed infrastructure and services, identify and evaluate the opportunities within it, outline the barriers and challenges in creating it, and suggest some possible strategies for industry, the government and the community for overcoming those barriers.

In order to achieve this, through the research we would aim to:

Define the potential new market in terms of products and services:

- For the energy, water, and transport sectors.
- Assess products and services, collectively, comparatively and individually.

Size the future market and its potential growth:

- Calculating the 'business case' for transport, energy and water distributed infrastructure and services.
- Sizing the potential environmental and social benefits.

Describe potential market players and their required capabilities:

- Assess the current and potential field of players, skills, and business models.

Describe potential customers for the products and services:

- Outlining the different customers across a new value chain.

Understand the challenges and barriers to be overcome:

- Equity, accessibility, cost-effectiveness, institutional barriers, regulatory requirements, education and awareness, technical limitations.

Outline possible roles and requirements to overcome the barriers:

- Understanding the possible roles and requirements for industry, government and NGOs
- Identifying a timeline, milestone requirements to meet goals and targets

1.3. Required involvement and outcomes

We would like to form a partnership between AusCID, ISF and other stakeholders in order to further the work. We are seeking in-kind and financial support to do so. Following an initial scoping study the work would focus on particular industries or issues (such as an assessment of the potential of different business models) that were identified with partners during the scoping study.

By meeting the objectives through working with industry and other partners ***we will create some momentum and change towards a more sustainable urban infrastructure future.*** The potential outcomes for such a study include:

- ***A holistic understanding of three major infrastructure sectors in the context of new drivers for change and the new requirements for cities from a systems and sustainability perspective.***
- ***A clear picture of the size and shape of a new distributed infrastructure and services market, the potential value of that market for businesses in various sectors, the potential role of DIS in the future and the challenges and barriers that need to be overcome to help create this new market.***

- *Information for industry and decision makers to help them understand how they can influence and are influenced by these changes and opportunities.*
- *A more informed debate and understanding of what these changes might mean in terms of infrastructure financing, and the new roles of the public and private sectors.*

1.4. Outline of this discussion paper

This discussion paper does not attempt to meet the deliverables outlined above but seeks to outline the case for change towards distributed infrastructure, for private sector involvement in that change and for thinking about the change in terms of new and very different 'market'.

It does so, first, by briefly outlining the key factors pushing the need for markedly different infrastructure systems, namely risks, the limits to systems and environmental expectations. Secondly, it outlines the key incentives that will help to pull industry into this market in the form of market growth, product and service opportunities, policy and economic incentives, competitor development and existing business improvement.

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2. 'THE PUSH FACTOR': DRIVERS FOR CHANGE

There is growing recognition amongst industry, government and the community that infrastructure systems of the future will be markedly different to the centralised systems that dominate today, and that decentralised or distributed systems and services will be of central importance. Three key drivers have led to this recognition:

1. Increasing Risks

- Centralised infrastructure involves large capital costs, which increasingly need to be balanced against fluctuating (and in the case of energy increasingly 'peaky') and uncertain demand. There is often a lack of flexibility once centralised infrastructure is in place.
- The security of supply of energy and water is increasingly important to consumers and industry, at the same time that certainty of supply is decreasing. Decentralised systems can increase reliability by providing consumer choice and control.
- The price for energy and fuel (and even water) is increasingly unstable and uncertain. In addition, there is now significant greenhouse gas liability that surrounds the development of new fossil fuel power generation. This is compounded by the possibility that emissions are currently undervalued, as the market for them is not yet developed sufficiently².
- The water industry is becoming increasingly privatised and market driven. This change and the scarcity of resource means that the price of water is likely to rise significantly.
- Increasingly intergenerational planning for infrastructure supply is taking into account the long-term environmental and social considerations.

These increasing risks lead to the need for 'future proofing' of infrastructure investment.

2. Reaching the limits of systems (demand outstripping supply)

- The state of natural resource depletion, degradation and pollution are increasingly widely acknowledged.
- Managing and balancing our water needs is recognised as one of the biggest issues facing Australia today.
- Balancing our energy needs with the availability of fossil fuels and our impact on the global environment through emissions is also recognised as a huge national as well as international issue. The science of the greenhouse effect is still being debated but much of the world and the business community has moved on and are looking at ways to manage that risk.
- In terms of transport, congestion costs and air quality impacts are significant in addition to its impact on GHG emissions. Land in Australian cities is increasingly valuable and it is estimated that 40% of all urban areas in Australia are made up of roads or other infrastructure to support car use³. It is also estimated that road congestion cost the

² Jones, Terry, 'The System Control Challenge' (CSIRO), February 2004, Australian Institute of Energy (AIE) Symposium.

³ Campbell, S.; White, S, 'Our Public Transport: a community view', November 2003

Australian economy \$6 billion in 1995 and will cost nearly \$9 billion in 2015⁴. In addition, Vehicle Kilometres Travelled (VKT) are increasing at more than double the rate of population growth.

Limits to existing systems drive the need for alternative types of supply infrastructure and the effective management of demand.

3. Environmental expectations (awareness, regulations)

- There is an increasing community, government, industry and other stakeholder awareness and pressure regarding the issues that need to be addressed.
- In energy, greenhouse benchmarks and renewable energy targets and schemes have been set by governments at a number of levels, and are being further considered.
- In water, clear expectations and objectives have been set regarding increasing environmental flows in our rivers which requires better management of water resources in both urban and rural areas.
- In transport, Vehicle Kilometres Travelled (VKT) targets have been set and growth boundaries around urban areas established. In addition, studies have shown “78% of residents believe Sydney has significant transport and traffic problems” and “70% of residents would support more public transport at the expense of the road budget”⁵.

‘Expectations’ in the form of awareness, regulations and incentives are changing and provide both drivers and opportunities for business and economic growth in this area.

These drivers and the new opportunities that are developing offer a number of incentives for a new form of infrastructure industry to develop.

⁴ Bureau of Transport and Regional Economics, Urban Transport – Looking Ahead, Information Sheet 14, 1999.

⁵ Glazebrook, Technology Business Review, April/May 2001

3. 'THE PULL FACTOR': INDUSTRY INCENTIVES AND OPPORTUNITIES

Numerous studies have outlined the economic benefits associated with distributed infrastructure provision, particularly in relation to energy. In "Small is Profitable", Lovins maps out in great detail more than 200 reasons why smaller (and decentralised) provision of energy services is, or can be profitable for business (Lovins, 2002). However, we also recognise that to create any significant change in the industry governments at all levels are likely to have to play a critical role in enabling and structuring a market for these new products and services. Incentives and opportunities already exist for industry to take the lead and engage with government to help create such a market. We have outlined these incentives and opportunities in this paper under the headings of:

- *The Growth Market?*
- *Product and Service Opportunities*
- *Policy and Economic Incentives – Making a Market*
- *Competitor development and opportunity*
- *Existing Business Improvement*

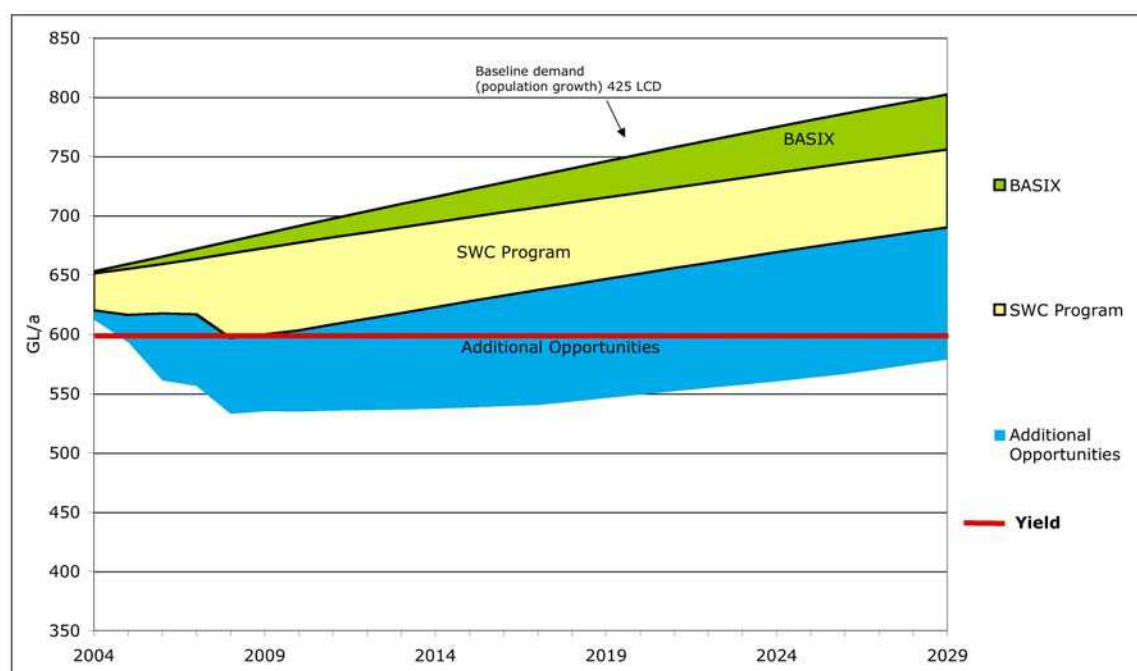
3.1. *The Growth Market?*

Arguably, due to the drivers outlined above, distributed infrastructure and services is one of *the* key long-term growth markets of the future. This could also be true in the short term to an extent, driven most notably by the 'environmental' (and other) targets and benchmarks being set by state and federal governments.

3.1.1. **Water**

As Figure 2 shows, in Sydney, there is a need (we already use more water from our dams than the sustainable yield), commitment (current SWC program commitments and BASIX requirements) and possibility (many additional opportunities) to manage growth in demand for potable water or provide alternative (distributed) supply options. There is a similar picture in a number of other areas and other states. Meeting the projected demand through centralised dams or large scale desalination plants can be both environmentally damaging (to river systems) and publicly and politically unpopular, but is also often more expensive and less flexible. This is not to argue that these centralised supply options should not be part of the planning process, only that the first options should be those that come at least economic cost to the community and at least 'cost' to the environment.

Figure 2: Sydney Water Demand Projections, Current Supply Yield, Conservation Commitments and Additional Opportunities Identified⁶.



3.1.2. Energy

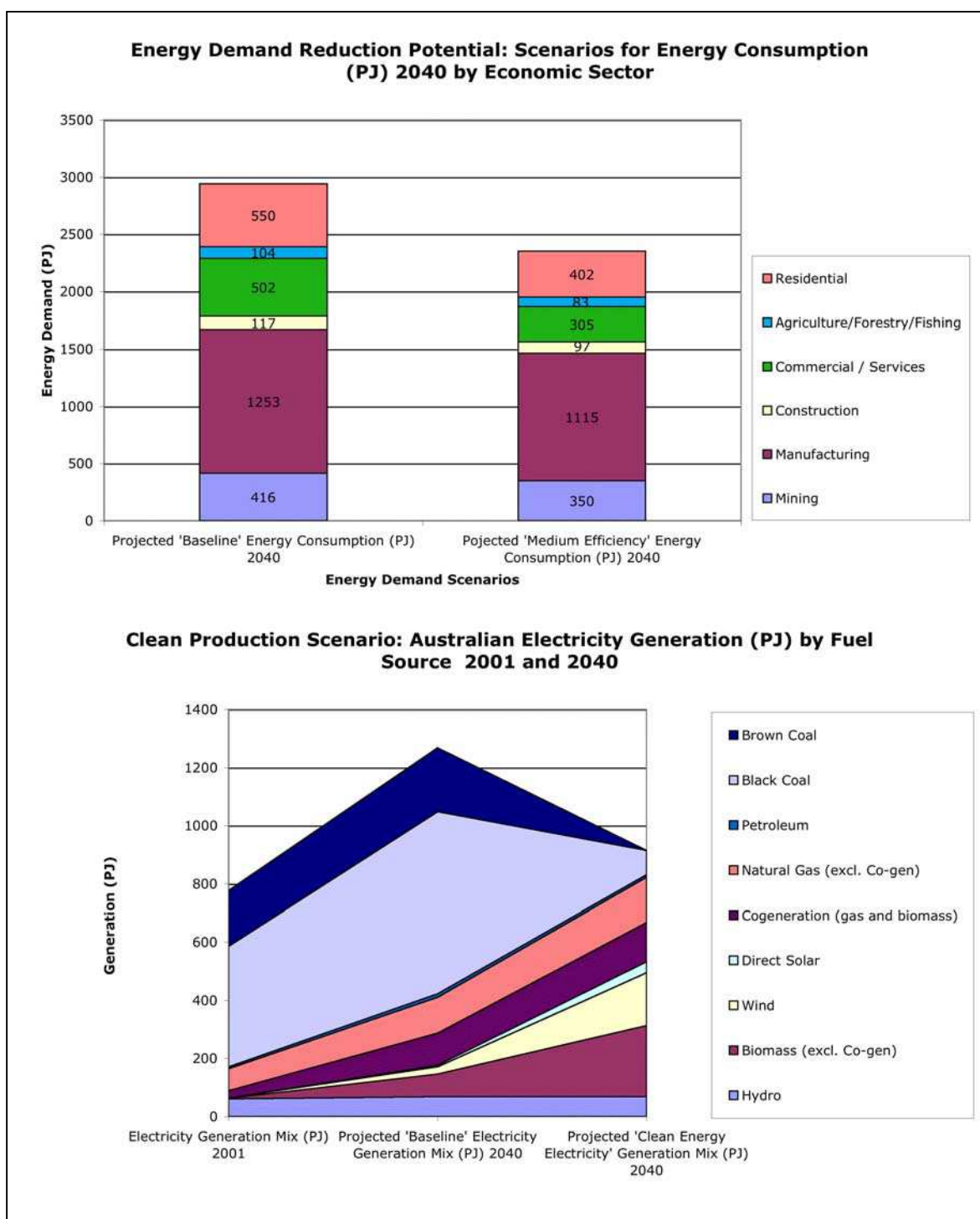
For energy, the current targets, including the NSW greenhouse benchmarks and the Kyoto target, are too weak to drive serious development of distributed infrastructure. However, there are significant risks associated with conventional power if stronger greenhouse policy such as emissions trading or a carbon tax is implemented. The Federal Government has sent strong signals that it believes large reductions in GHG emissions are needed over the 21st century. For example, Environment Minister David Kemp recently stated in Parliament that: *“By the end of the 21st century, if we are effectively going to address the issue of global warming, we will need to see a global reduction in greenhouse gas emissions of between 50 and 60 per cent”* (Commonwealth Government 2002, p.5212).

Other governments have made even stronger commitments. The UK Government is committed to a 60% reduction in GHG emissions by 2050 (UK Department of Trade and Industry, 2003) The Intergovernmental Panel on Climate Change has also called for 60 to 80% reductions in emissions.

Several authors have developed scenarios showing how emissions of this or a similar magnitude might be achieved. These scenarios both project that distributed forms of energy, including energy efficiency and decentralised natural gas and renewables, will provide most of the required emission reductions, while centralised forms of energy will decline. This is clearly shown in the recent report, ‘A Clean Energy Future for Australia’, and its scenario for reducing greenhouse gas emissions by 50% through a combination of cleaner supply and enabling reductions in demand. See Figure 3 below

⁶ Note: LCD, litres per capita per day. BASIX, Building and Sustainability Index, see www.basix.nsw.gov.au. Source: ISF Studies for Sydney Water and State Authorities

Figure 3: Scenario to reduce GHG emissions by 50% in 2040: Demand Reduction (Top Graph) and 'Cleaner' Electricity Supply(Bottom Graph)⁷



3.1.3. Transport

The Australian Government’s commitment to greenhouse gas (GHG) emission reduction has implications for transport service provision—transport is second only to stationary energy in

⁷ Source: H Saddler et al, 2004. Electricity generation is expected to make up about 35% of the energy demand by fuel type.

terms of GHG emissions and transport emissions are the fastest growing component of Australia's GHG emissions⁸.

Road transport will be a key focus in meeting these targets because it contributes more than 90% of transport related GHG emissions⁹. Further pressure on the traditionally dominant mode of travel (road-based private transport) comes from recent petrol price rises, especially because the prices are expected to remain over \$1/L in the medium-term¹⁰.

In addition, in the Australian context land use policy changes are rapidly being implemented. Melbourne has established a 'growth boundary'—a policy based limit to the land area available for urban development¹¹. As city populations continue to grow and their ability to expand geographically becomes limited, more innovative forms of transport infrastructure will be needed if they are to remain desirable and sustainable places in which to live and work.

Internationally, research indicates future transport service provision can change to meet the kinds of targets governments are pursuing. The kinds of changes that would be in the case study below discussing a scenario developed for the Organisation for Economic Co-operation and Development (OECD) in 1999/2000.

Scenario for Transport Emissions Reduction: OECD Case Study

In the case study developed for the OECD¹², 80-90% reductions in emissions from transport were considered possible with the following kinds of change:

- Activities are located close to each other to shorten trip distances and reduce passenger travel by 35%;
- Car use is reduced by 50% with trips being made instead by rail and remaining cars are hybrids (running on LPG or other gases);
- Long distance air transport is much more expensive and less frequently used as other technologies (including telematics and high-speed rail) become cost effective by comparison;
- Freight transport shifts massively from road to rail (reduced by more than 50%); and
- There is more local production of food to reduce transport distances.

Technological improvements—such as improvements in engine design – contribution to the scenarios was under half of the total effort. More than half of the effort came from demand-side and mobility management measures (Figure 4)¹³.

⁸ Australian Government (2003) Transport Sector, Greenhouse Gas Emissions Projections, Interdepartmental Greenhouse Projects Group, p12. Available online at:

<http://www.greenhouse.gov.au/projections/pubs/transport2003.pdf>. Essentially, stationary energy is any energy used in fixed locations such as buildings or industry. See also CSIRO Transport & Energy Sector Outlook 2020 Report.

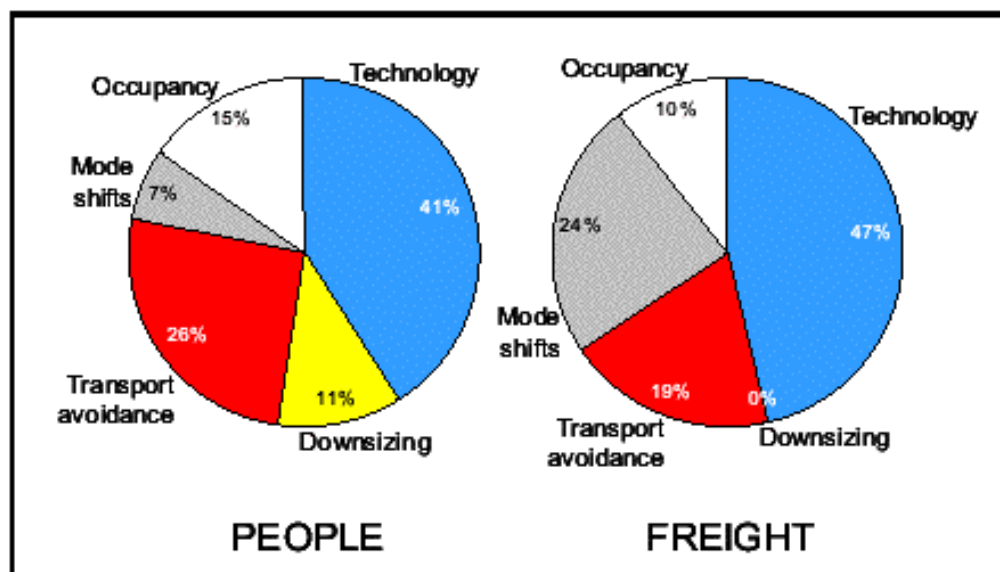
⁹ See Australian Greenhouse Office online at: <http://www.greenhouse.gov.au/transport/index.html> [Accessed 1.06.04]

¹⁰ Brian Robins quoting Ron Bowden of the Service Station Association in A Crude Shock, 22 May 2004, The Sydney Morning Herald

¹¹ Melbourne's Urban Growth Boundary is described as "a permanent, long-term limit to the growth (in land area) of the city or Melbourne" in Melbourne 2030.

See: http://www.dse.vic.gov.au/melbourne2030online/content/implementation_plans/02a_about.html#whatisit [Accessed 1.06.04]

¹² Geurs, K and van Wee, B (2000) Backcasting as a Tool to Develop a Sustainable Transport Scenario Assuming Emission Reductions of 80-90%, Innovation, 13 (1), p47-62.

Figure 4: Percentage contribution of different factors to attainment of the CO₂-reduction

3.2. Product and service opportunities

The kinds of products and services that do and could exist under the banner of distributed infrastructure include those:

- concerning efficiency and conservation (for example reducing the need for energy use, water use, or large scale transport infrastructure);
- involved with distributed and decentralised supply (for example smaller scale energy production, localised water capture and/or re-use) and;
- involving the change to the system as a whole (such as systems to run the distributed energy market, small bore and decentralised sewerage, and integrated land-use and transport planning).

The ‘retail and service’ orientation of distributed infrastructure (rather than the typical ‘investment and operations’ focus of centralised infrastructure) requires different capabilities from business in terms of bundling and packaging both the product, technical engineering, and service elements. End users will still want the services provided by water, energy or transport but distributed infrastructure requires and allows for a more individualised focus on how those services are provided. Economies of scale are gained through replication rather than centralisation.

The following sections outline a selection of the products and services likely within the DIS markets for energy water and transport.

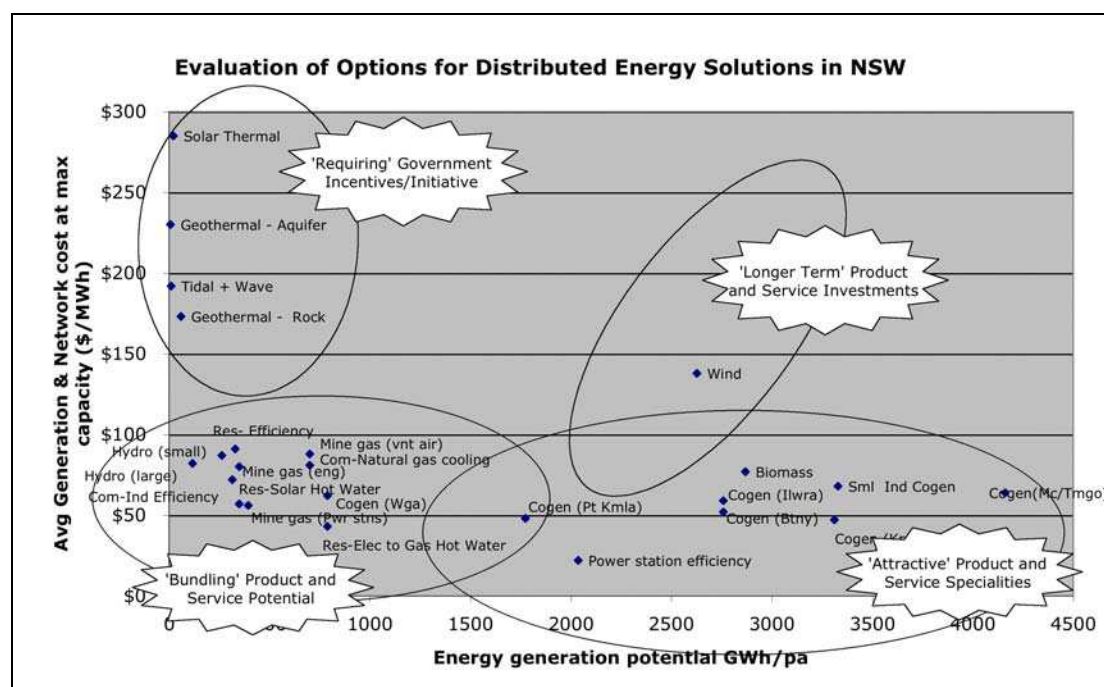
¹³ Organisation for Economic Co-operation and Development (OECD), “Policy Instruments for Achieving Environmentally Sustainable Transport”, 2002.

3.2.1. Energy and Water

In water and energy from a ‘whole of society’ (sustainability) perspective it is sensible to develop the market for these products and services capitalising on the ‘least-cost’ options first.

Those most attractive products and services to industry (and to customers) are likely to be those that have the highest potential in terms of savings or supply at the least cost. Figures 5 and 6 show examples for energy and water of the kind of product groupings that could be attractive based on these criteria. Tables in the appendix list examples of the kinds of products and estimates of the potential ‘market’ value for each taken from two NSW examples

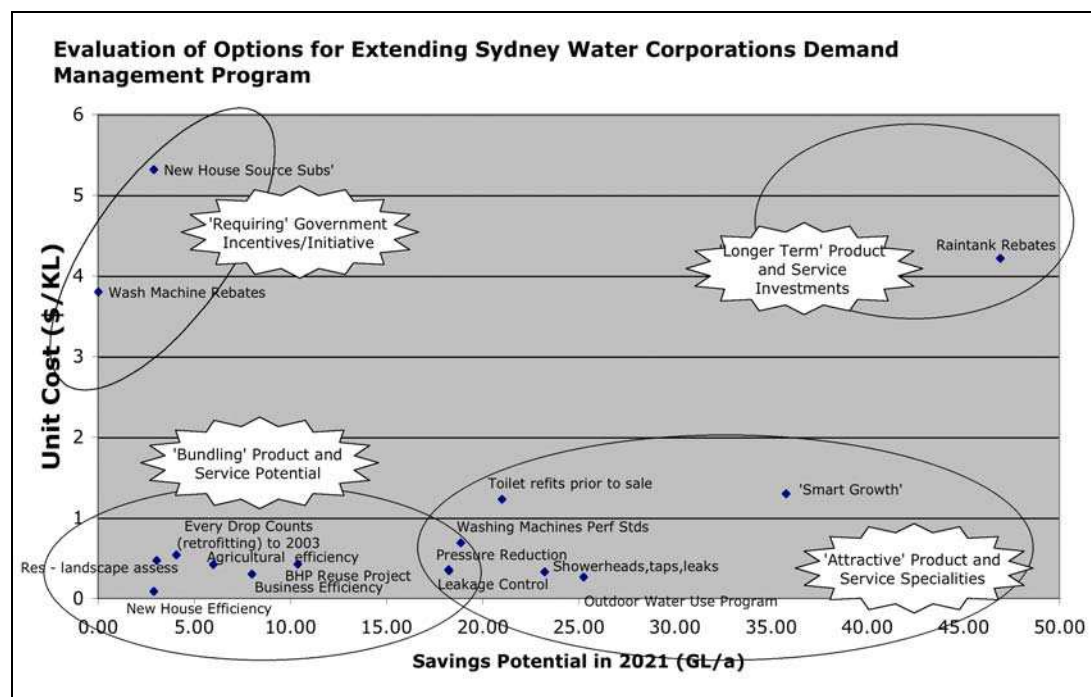
Figure 5: Energy: Comparison of GWh/a Savings/Supply Potential vs. Unit Cost of Distributed Infrastructure Options¹⁴



Bundling the critical efficiency (demand management) options (res. efficiency, res. solar hot water, com-ind. efficiency etc.) would push an ‘efficiency’ offering into an attractive product-service offering in terms of its energy ‘generation’ potential.

¹⁴ Sustainable Energy Development Authority (SEDA), “Distributed Energy Solutions: Cost and Capacity Estimates for Decentralised Options for Meeting Electricity Demand in NSW”, February 2002.

Figure 6: Water: Comparison of GL/a Savings/Supply Potential vs. Unit Cost of Distributed Infrastructure Options (\$/KL) ¹⁵

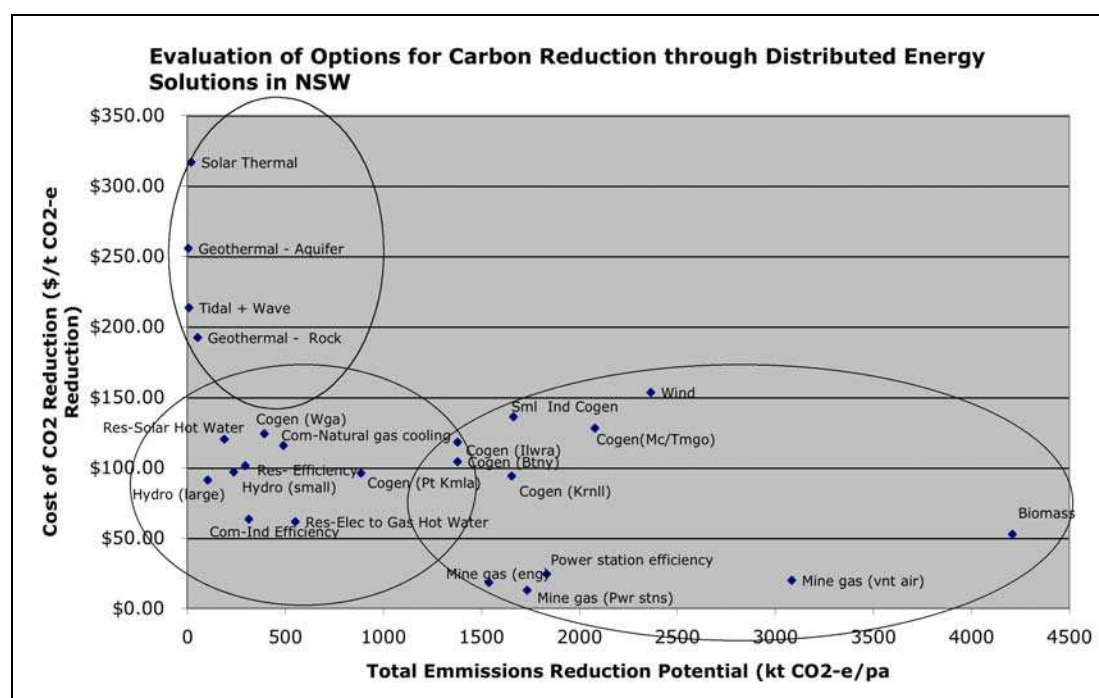


Again, bundling the critical water efficiency options (retrofitting showerheads, taps etc., landscape assessment, business efficiency programs, agricultural efficiency, leakage control) would push an ‘efficiency’ offering into an attractive product-service offering in terms of its water ‘provision’ potential.

For energy, if the related GHG emissions become a major financial driver then different products and services may become attractive (Figure 7).

¹⁵ Source: ISF Studies for Sydney Water Corporation and other State authorities.

Figure 7: Energy: Comparison of GHG reduction potential vs. Unit Cost of that reduction¹⁶



3.2.2. Transport

Products and services proposed to reduce greenhouse emissions from transport include a huge range from *infrastructure & technology*, such as high speed rail, hybrid motor vehicles and smart cards for public transport fares, to *economic instruments* including tradeable CO2 emissions permits, fuel taxes, road pricing, and subsidies for new vehicles and freight transport innovation. In addition, and perhaps more fundamentally, proposals also include land use planning to facilitate non-motorised modes (walking and cycling) and short trips.

In addition, radical changes to travel patterns are expected under transport emission reduction scenarios. The kinds of travel pattern changes are thought to come about through a new mix of products and services. For example the reduction in business related air travel depends largely on high speed rail infrastructure supported by a growing share of IT innovations to reduce the need for trips (including IT facilities in trains and other locations). At the workplace level, other innovations anticipated include employer sponsored travel programs incorporating transport access guides for staff and facilities management changes. This kind of change is outside the expertise of most employers and presents a unique opportunity for third party services.¹⁷ Fleet management also presents new service opportunities in the future including car sharing between work-places and the public – another niche for a third party.

Private travel patterns are also predicted to dramatically shift in response to increased service levels from passenger transport. In many cases, the traditional spectrum of public transport will be broadened to include modular, flexible public transport infrastructure and servicing. In Australia, this is vital to support new developments planned for our fast growing cities. For example, developers now propose to operate bus services temporarily in new developments providing excellent links to existing rail services and reducing new resident’s needs for travel

¹⁶ Sustainable Energy Development Authority (SEDA), “Distributed Energy Solutions: Cost and Capacity Estimates for Decentralised Options for Meeting Electricity Demand in NSW”, February 2002,

¹⁷ In NSW it is the RTA who currently leads the way in this kind of program.

by private motor vehicle. Once these bus services have established patronage, it is likely they could be transferred to private sector ownership and operation (see case study below).

Case Study: Transport distributed infrastructure and services

The more innovative and flexible approach to providing transport services is already proving successful for some operators. Baxter's Bus Lines for example operates a 'Flexi Bus' service¹⁸. The Monday to Friday, door-to-door service for residents of Holroyd in Sydney's west replaced a previously loss making service and increased patronage for the company.

Similar flexible approaches are used in Adelaide within the Metro's 'roam zone' where the bus service drops passengers at their door after 7pm¹⁹. That bus service has more than 38,000 passengers each year.

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¹⁸ See <http://www.baxtersbus.com.au/FlexiBus.html> [Accessed 1.06.04]

¹⁹ See <http://www.adelaidemetro.com.au/routes/roamzone.html> [Accessed 1.06.04]

3.3. Policy and economic incentives – Creating a market

Policy that influences the development of a market such as DIS can be described under three broad and overlapping categories; regulation (such as renewable energy targets or stipulated performance standards for water efficiency), education and engagement (for the general public and in support of programs for business such as Sydney Waters Every Drop Counts program), and economic incentives (such as rebate or direct grant schemes).

Most policies have some elements of two if not all three of these categories. Broadly, the policies that are currently impacting on the DIS market can be summarised as follows:

- *Targets or caps* on the use environmental resources:
 - Energy (as proposed globally in the Kyoto Protocol),
 - Water (such as the litres per capita per day target imposed on Sydney Water Corporation),
 - Transport (such as the, currently voluntary, targets for VKT reduction or the ‘caps’ on land available for urban development – see box below)

These policies will limit the existing centralised infrastructure market now and in the future.

- *Trading schemes* creation:
 - Water: tradeable permits such as in the Hunter River salinity scheme.
 - Energy: tradeable credits such as the ‘NSW Greenhouse Gas Abatement Certificates’ – NGACS or the ‘Renewable Energy Certificates’ associated with the national Mandatory Renewable Energy Targets (MRET).
 - Transport: such a scheme could possibly be developed around VKT levels. “In Victoria the government is consulting with stakeholders about the best mechanism to use to trade transport related GHG”²⁰.

These schemes provide new sources of revenue and competitive advantage to those who get involved.

- *Fund creation* to promote the development of DIS:
 - Water: such as the proposed ‘demand management fund’ (see box below)
 - Energy: such as the funds announced in the recent Australian energy policy White Paper (see box below.)
 - Transport: such as those created in NSW (see example in box below).

These policies provide direct financial incentive through a source of flexible funding.

- *Direct government contracts*:
 - Such as energy demand management contracts in localised areas where the network is most constrained.
 - Tenders such NSW DIPNR’s March 2004 tender for up to \$400,000 for a

²⁰ Victorian government sponsored Australia Emissions Trading Forum

strategy to reduce travel demand by households²¹

- Government purchasing power of premises (with efficiency requirements) or equipment (e.g. fleet vehicles, building leases, etc.)

These policies again provide direct financial incentive through direct business opportunities.

- *Rating schemes:*
 - Such as the National Australian Built Environment Rating Scheme (NABERS), GreenStar, or the National Home Energy Rating Scheme (NatHERS).

These policies impact on the 'brands' of those customers requiring infrastructure servicing.

- *Performance based regulation:*
 - On a product scale such as with performance standards for appliances
 - On a development scale, such as with the recently announced Building and Sustainability Index (BASIX) scheme, that provides a mixture of guidelines and targets in terms of the requirements for new housing in NSW.
 - Registration or taxation varied by vehicle type or vehicle fuel efficiency would provide similar incentives.

These policies have a direct impact on the customers needs from infrastructure providers.

3.3.1. Energy:

Broader funds creation in Energy

The recent White Paper "Securing Australia's Energy Future"²² outlines the potential for over \$800m in funding for distributed energy. A summary of the measures relating to DIS is as follows:

- Low Emissions Technology Demonstration Fund to "Support industry-led projects for large-scale demonstration of low emissions technologies" (including geo-sequestration) (\$1 government funding for every \$2 industry funding.) **\$500m** - to be spent up until 2020 (10 - 16 years).
- Renewable Energy Development Initiative to "Support strategically important renewable energy initiatives" - **\$100m** over 7 years (\$50m from the Commercial Ready programme)
- Solar Cities Program supporting "trials to gauge the benefits of use of solar power and energy efficiency combined with interval smart metering" - **\$75.3m** over 4 years
- Energy efficiency Program supporting "energy efficiency assessments of businesses using more than 0.5 pJ" - no mandatory action) - **\$16.9m** over 5 years and "general energy efficiency including Mandatory Efficiency Performance Standards (MEPS)" - **\$26.7m** over 4 years.
- Biofuels: **\$37.6m**

²¹ Source to be added

²² http://www.pmc.gov.au/energy_future. The summary of measures can be found at: http://energy.dpvc.gov.au/energy%5Ffuture/docs/energy_appendices.pdf

- Greenhouse Challenge Plus: **\$31.3m** over 4 years
- Local greenhouse action: **\$13.2m** over 4 years (already announced in budget)
- Storage systems from intermittent generation systems: **\$20m** over 5 years
- Wind forecasting: **\$14m**

3.3.2. Water:

Direct Intervention through fund creation in Water: A possible model for private sector involvement²³

A 'demand management' fund could be created for investment in low-cost demand management or alternative supply measures. "The Government is considering spending \$14million.

"A 1 per cent increase in water bills would fund the move, if the Independent Pricing and Regulatory Tribunal of NSW approved it" (other models that could / are being considered are tiered pricing or a revolving fund based on 'water savings'.)

Private sector companies could potentially bid for money from the fund via a tender scheme in return for savings in potable water demand.

Projects would be selected according to criteria such as cost-effectiveness, environmental outcomes, health factors, community preferences, and volume and certainty of water savings.

Analysis has shown that there is potential for the private sector to provide low-cost, innovative programs to help balance water demand with sustainable yield.

(In November 2003, Premier Carr announced the establishment of a Demand Management Fund for Energy).

3.3.3. Transport

Direct Intervention Policies in Transport

The land use policy changes such as Melbourne's 'growth boundary' – a policy based limit to the land area available for urban development²⁴ – provide indirect driver for new market development for alternative forms of transport provision. In addition, NSW is investing \$1.4M to develop centres of employment and recreation in outer metropolitan areas²⁵. In some of Sydney's recent developments, developer contributions for transport have been almost 40% of the total contribution.

²³ <http://www.smh.com.au/articles/2004/04/13/1081838723625.html?from=storyrhs>

²⁴ Melbourne's Urban Growth Boundary is described as "a permanent, long-term limit to the growth (in land area) of the city or Melbourne" in Melbourne 2030.

See: http://www.dse.vic.gov.au/melbourne2030online/content/implementation_plans/02a_about.html#whatisit [Accessed 1.06.04]

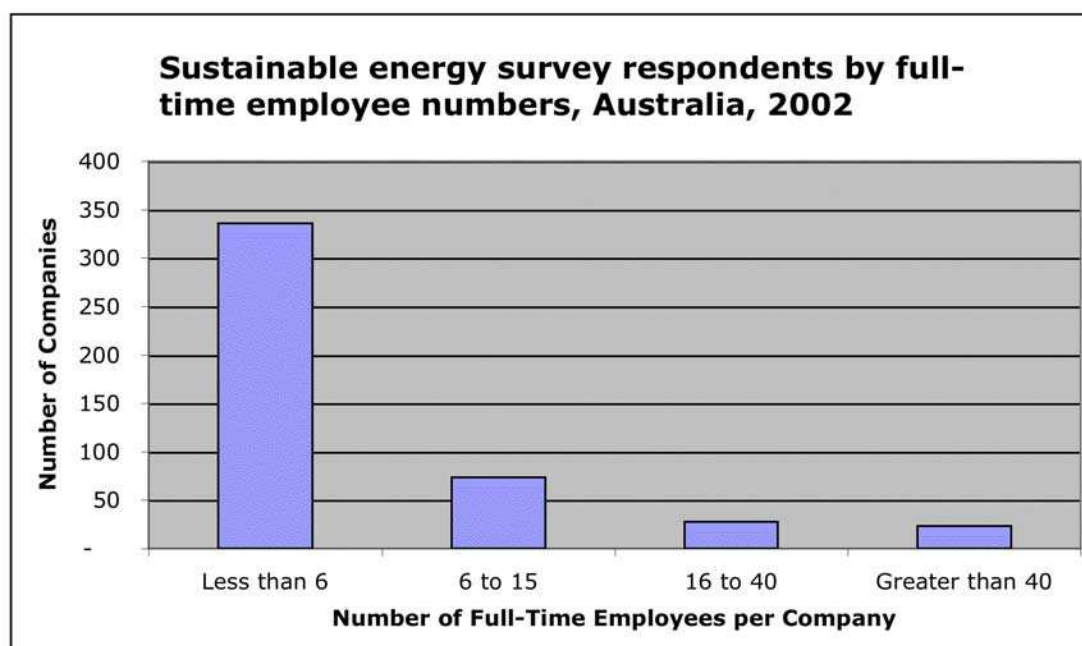
²⁵ Premier Carr, 19th May 2004, transcript available online at:

<http://www.metrostrategy.nsw.gov.au/dev/ViewPage.action?siteNodeId=61&languageId=1&contentId=-1> [Accessed 1.06.04]

3.4. Competitor development and opportunity

As would be expected in a fledgling market, the competitors currently involved in the DIS market are mostly small players and tend to be single service or product focussed. This is illustrated by the experience in energy shown in Figure 8. As previously discussed, there is an opportunity for larger players to start to bundle products and services and gain the benefits of economies of scale by doing so.

Figure 8: Relative size distribution of companies in the Sustainable Energy Industry²⁶



There are many different kinds of companies, organisations and institutions that could be involved in a DIS market. For example:

- specialist DIS providers (consultants / engineering firms)
- current retailers / service providers; (through a range of programs, like specialist DIS providers)
- property developers (by going beyond minimum appliance and building mandatory energy performance standards)
- appliance and equipment vendors (by marketing more efficient devices, or by marketing distributed supply equipment such as standby generator vendors and service providers);
- enabling businesses such as metering companies which enabling more cost-reflective pricing and monitoring;

There are a number of successful companies offering innovative and scalable products and services in terms of distributed infrastructure. The three case studies below highlight successful examples covering new distributed infrastructure products (solar energy and water), infrastructure services (utility services) and enabling technology (smart cards):

²⁶ Mark Ellis & Associates (2002), Australian Sustainable Energy Industry Survey, Estimating the Contribution of the Sustainable Energy Industry to the Australian Economy, December

Case Study: Distributed Energy and Water Systems (*Solar Energy Systems Ltd.*)

Solar Energy Systems Ltd. was incorporated in November 1998 and now provides a range of products and services in Australia (from its base in WA), Asia and Europe. Products and services include grid feed solar systems, solar water pumps, remote area power supply (solar) systems, battery saver technology, water purification systems, and rainwater tanks. The CEO has described SES's vision as "to provide decentralised water and power solutions that will improve the health of the planet and its people".²⁷ Forecast sales for 2004/05 are estimated at \$8million with a profit of ~\$1million. Access to capital, further acquisitions and continued organic growth indicate that SES will increase turnover to \$20 million for the 2005/06 financial year.²⁸

Case Study: Utility Services (*UXC, Utility Services Group*)²⁹

The Utility Services Group of UXC provides a huge range of services through a number of companies including Utility Asset Management, Utility Data Management, Skilltech and the recent acquisition of Fieldforce.³⁰ Services offered through these companies range from construction and maintenance of distribution infrastructure (with the asset inspection and maintenance service being predictive and preventative, aiming to minimize down-time, lost revenues and maintenance costs), vegetation management services (clearing vegetation around electricity and telecommunications infrastructure), to metering connection, management, reading and related services. Forecast revenues for 2003 were over \$30million for UAM and over \$10million for Skilltech.

Case Study: Smart Cards for Public Transport Fares (*ERG & Motorola*)

Accompanying new transport services will be modifications to existing public transport provision to enhance the service. One innovation already in progress is the development of smart cards for ticketing on Sydney's public transport network. The transport network currently handles 630 million passenger journeys each year and the time passengers spend paying for tickets onboard buses impacts significantly on the efficiency of the service. Not only will the smart cards avoid these delays but the use of the smart card across a range of public transport services will allow passengers a more streamlined trip even when using a range of services, e.g. trains, buses, ferries and light rail. The contract for developing the smart card technology including design, development and testing phases, is worth approximately \$320M. The NSW Government is working with Integrated Transit Solutions, a joint venture between smart card manufacturer ERG and Motorola. The project spans some 306 rail stations, 4000 buses and 50 ferries as well as 20,000 fare payment devices.

²⁷ "Solar Energy Systems is a Buy", Ethical Investor, Issue No.36, August 2004, pg 5.

²⁸ "Investor Update", Solar Energy Systems Ltd, July 2004, accessed from <http://www.sesltd.com.au/html/investor.htm>.

²⁹ Data taken from 1. Lay, Rodney, 'UXC Limited', Australian Research: Commissioned Equities Research, October 2002. 2. 'UXC Extends its Leadership in Data Services', Australian Stock Exchange: Company Announcements Platform: 29 July 2004. 3. other information. All accessed from www.uxc.com.au on 16/08/04.

³⁰ Other Utility Service Group companies are U-tel the marketing channel manager for Vodafone that offers total mobile communication solutions to its customers and neopurple which is a multi-discipline design and project management company whose services include web design and interactive technologies, graphic design and industrial design.

3.5. Existing business improvement

In addition to the potential of DIS being a new and growth market for those who choose to invest in it, there are a number of key drivers for existing infrastructure providers to develop distributed infrastructure to improve existing business performance. These fall under four categories:

1. *Peak load management:*
 - E.g. reduced exposure to spot market in NEM during price spikes (can be used to hedge power market risks)³¹
2. *Deferral of large capital investment projects (modular development)*³²:
 - E.g.: “Excluding energy savings, even a years deferral of a feeder upgrade costing \$1.5m could result in savings of \$80,000, while a years deferral of a substation upgrade costing \$8m would save \$400,000” (Watt et al, 2003)
3. *Reducing the risk of ‘stranded assets’:*
 - E.g. Washington Area Public Power Supply System
 - E.g. Sydney Airport Line
4. *Using modular and distributed capacity to meet or exceed service standards*³³:
 - E.g. mobile generating units (central dispatch of distributed resources owned by utility)
 - E.g. management of local area water demands, rainwater tanks for keen gardeners.

³¹ Amory B. Lovins, et al, 2002 “Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size”.

³² IPART DM Inquiry Report, Amory B. Lovins, et al, 2002 “Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size”.

³³ IPART DM Inquiry Report, Amory B. Lovins, et al, 2002 “Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size”.

4. WHAT NEXT?

This discussion paper sought to outline the case for change towards distributed infrastructure, for private sector involvement in that change and for thinking about change in terms of new and very different 'market' with a wealth of different opportunities.

There are obviously significant challenges and barriers that need to be overcome in order for such a market to develop into any kind of reasonable size and maturity. One such barrier is the chicken and egg problem of the absence of a strong DIS industry with adequate resources to demonstrate and promote demand management effectively. In comparison with the centralised supply industry the existing DIS industry is very small, fragmented and immature, and has no major dedicated corporate players.

In addition, the nature of the existing players gives them little negotiating leverage with the centralised service providers or those who set policy direction, on whom they rely in helping to operate and create their market (for example standby generators must negotiate connection agreements, and connection costs. Efficiency service providers, in general, must also negotiate the avoided costs for which they could be paid, including savings from system use charges (transmission of energy, pumping/treatment of water), and savings from avoided or deferred supply augmentation.

These particular challenges and barriers offer opportunity for industry to take a leadership role in the development of the market (notwithstanding the need for policies and practices to be developed to help create the market). We would like to form a partnership between AusCID, ISF and other stakeholders to examine further this opportunity by:

- Developing a clear picture of the size and shape of a new DIS market, and the potential value of that market for businesses in various sectors,
- Outlining the key challenges and barriers that need to be overcome to help create this new market, and the requirements of government, industry and community to do so,
- Understanding what these market changes might mean in terms of infrastructure financing
- Assessing alternative models for private sector engagement to establish the best approach.

5. ISF ORGANISATIONAL PROFILE

5.1. The Institute

As an independent research organisation, which is part of the University of Technology, Sydney, the Institute for Sustainable Futures offers a unique mix of applied research and consultancy. By working across traditional disciplinary boundaries and using teams of researchers with expertise in various fields including economics, science, engineering, social science and geography, our work explores a wide range of options to foster more sustainable development. We work with a variety of partners and the work is directed at, and can impact those in industry, government and the community.

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5.2. A note on the authors

Tom Berry is a Research Director at ISF. Since joining ISF in 2002, Tom has managed a variety of projects ranging from the technical to more strategic aspects of sustainability, for

all levels of government, and also the development industry and utilities in the private sector. For the 4 years prior to starting at ISF Tom worked as a Senior Strategy Consultant in the management consulting arm of Cap Gemini Ernst and Young (CGEY) in London. In this time he developed extensive range of project management, people management, and strategic research and analysis skills (in particular industry, market and sectoral analysis). Tom also led teams to help develop the business and organizational strategies for many blue chip and institutional clients. Prior to starting work Tom graduated with a BA Honours degree in Geography from Emmanuel College, Cambridge and worked on a project for the International Union for the Conservation of Nature (IUCN) in Islamabad, Pakistan.

Chris Riedy is a Research Principal and PhD Candidate at ISF. Chris has energy sector and greenhouse policy expertise, experience with futures tools and methods, and knowledge of participatory approaches to policy development. His doctoral research explores the behavioural, systemic, psychological and cultural barriers to sustainable energy futures in Australia. Prior to commencing his doctoral research in 2000, Chris worked as an environmental consultant and project manager in Australia, the United Kingdom and Qatar for five years. During this time, Chris worked closely with diverse stakeholders in the energy, water and waste management industries. [7 Sept 2004]

Sally Campbell is a Senior Research Consultant at ISF. Sally has expertise and a passion for sustainable transport and co-authored the Our Public Transport responding to the NSW Government's Inquiry in Sustainable Transport (the Parry Inquiry). She has also completed modelling and conducted least cost planning studies to compare a broad range of options to reduce water demand across sectors for a number of different authorities. She has a combined honours degree in Engineering (Civil & Environmental) and Arts (International Studies in German), and her prize winning thesis was titled "Sustainable Transport and Light Rail in the South Sydney Growth Centre".

Professor Stuart White is the Director of ISF. He is credited with introducing least cost planning to Australia's water industry and is widely recognized as one of Australia's foremost strategic thinkers in the water industry. He has been a researcher and consultant in the area of resource efficiency and community-based solutions to urban sustainability issues for many years. In 1998 he was appointed as a member of the NSW Task Force on Water Conservation. He is also a corresponding member of the National Working Group on Water Conservation and in 1997 was awarded a Churchill Fellowship to further his work on water efficiency programs and the development of appropriate regulatory systems. In 2001 he was appointed as a member of the Expert Panel on Environmental Flows for the Hawkesbury Nepean. In addition to his water expertise Stuart has undertaken a number of projects in the area of waste minimisation, energy conservation and sustainable urban transport.

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7. APPENDIX: PRODUCT AND SERVICE POTENTIALS IN ENERGY AND WATER

Table 1: Distributed Water Provisioning and Services Options³⁴

Options identified for Demand Management in the Hawkesbury Nepean (Sydney) Catchment	Volume, GL/a (supply or reduction) by 2021	Present Value Costs ³⁵ , \$million to 2021
Leakage Control	18	21
New House Efficiency Program	3	3
Business Efficiency Program	8	12
Retrofit Program: showerheads, taps, leaks	23	10
Outdoor Water Use Program	25	54
BHP Reuse Project	10	39
New House Source Substitution	3	158
Rain-tank Program (Rebates)	47	842
Pressure Reduction Program	18	40
Agricultural Water Use Efficiency	6	19
Residential landscape assessment	3	13
Washing Machines Performance Standards	19	61
New (6/3 litre) toilet fitting prior to re-sale of properties	21	129
Water Sensitive Urban Design / "Smart Growth"	36	165
TOTAL	241	1,566

³⁴ Options identified as part of the Hawkesbury Nepean River Management Forum work. Source: White, S, 2004, XXXX, Independent Expert Panel of the Hawkesbury Nepean River Management Forum proceedings.

³⁵ Indicative whole of community (no assumption of who pays) costs, capital and operating costs, not including benefits (e.g. water supply capital deferral, water supply pumping and treatment savings, wastewater treatment augmentation deferment, wastewater pumping savings, GHG savings)

Table 2: Distributed Energy Infrastructure Services Options

Options for Distributed Energy Solutions Identified for NSW	Type	Energy generation potential GWh/year	Potential increased capacity in MW	Present Value Cost \$million (Capital and Operating Cost)
Com'al-Ind'al Efficiency	Efficiency	350	100	
Com'al-Natural gas cooling	Gas Substitution	701	200	
Res'al- Efficiency	Efficiency	329	150	
Res'al-Elec to Gas Hot Water	Gas Substitution	788	300	
Industry - Small Cogen	Co-generation	3,329	400	
Alise (Botany) Cogen	Co-generation	2,759	350	
Sithe (Kurnell) Cogen	Co-generation	3,311	420	
Illawarra Eco-energy Park Cogen	Co-generation	2,759	350	
Wagga Wagga Cogen	Co-generation	788	100	
Duke/Pt Kembla Cogen	Co-generation	1,774	225	
MacGen/Tomago CCGT	New Gas	4,161	500	
Biomass	Biomass	2869	390	
Hydro (large)	Renewable	117	38	
Hydro (small)	Renewable	263	50	
Wind	Renewable	2,628	1000	
Res-Solar Hot Water	Renewable	315	120	
Tidal + Wave	Renewable	11	2	
Geothermal - Hot Dry Rock	Renewable	59	10	
Geothermal - Aquifer	Renewable	7	2.5	
Solar Thermal	Renewable	22	10	
Improved Power station efficiency	Power stn Efficiency	2037	250	
Mine waste gas in power stations	Mine gas	394	50	

Mine waste gas - Dedicated engine	Mine gas	350	50	
Mine waste gas - vent air technology	Mine gas	701	100	
Commercial-Industrial Standby Generation	Peak Clipping	9	100	
Commercial-Industrial interruptibles	Peak Clipping	19	220	
Solar PV (Grid connected)	Renewable	512	390	
TOTAL				

Source: Sustainable Energy Development Authority (SEDA), “Distributed Energy Solutions: Cost and Capacity Estimates for Decentralised Options for Meeting Electricity Demand in NSW”, February 2002, prepared for the IPART Demand Management Inquiry, Experts Forum and Discussion Paper on Economic and Financial Viability of Demand Management Options.

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