

**Surveying the Future Landscape  
of the  
Australian Built Environment**

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### Introduction to the Foresight Industry Workshop

One of the project's research aims is to develop a strategic roadmap for the future of the Australian built environment industry by assessing the likely future landscapes that R&D investment will both respond to and anticipate. In the process of developing the roadmap, the research is taking the Construction 2020 report as a starting point and extending the analyses conducted there to include wider macro-social 'sectors and factors' (as defined in Voros 2009) that may have a significant impact on this critical Australian industry. The sectors and factors are like a map of alternative building blocks in the wider macro-social landscape. Scenarios can be developed from combining these sectors and factors in many different ways to allow for the consideration of a very wide variety of plausible futures landscapes. The map then becomes a way of scanning for and measuring future developments (Voros 2009).

The outcomes from the four workshops will help to determine research priorities and will form part of project reports. Industry thought leaders are needed to think deeply and creatively on how they will respond to a small number of carefully selected scenarios in a workshop session constructed from the alternative building blocks. Participants will then select a range of possible technologies that fit into these plausible future worlds. Participants' thinking will give rise to a deeper understanding of the main research priorities of this industry and will be used to develop technological roadmaps for the industry. The workshops will also help to ensure that nothing has been missed, that systemic linkages are identified, and will be a chance to verify the research findings.

There are benefits from adopting the approach of this research and it is critical that industry thought leaders are involved. One of the benefits from involving industry thought leaders in this research approach is that the developed map of the macro-social landscape provides a range of alternative settings consistent with the range of world views and competing agendas of the different industry stakeholders that help shift people's views to the interactions between the industry and the wider macro-social environment (Voros 2006). Another benefit of the approach is that thought leaders can help to engage the mutual interests of people in the industry in alternative futures scenarios to move their focus beyond their preoccupations and concerns of present day issues — this is particularly important for a sector that is traditionally short-term project focused and reactive in their approach to the future (Harty et al 2007). The built environment is a crucial element in several global grand challenges and the real estate and construction industry play an essential role in balancing natural cycles and societies' consumption of resources (Koukkari 2011).

On the following pages are:

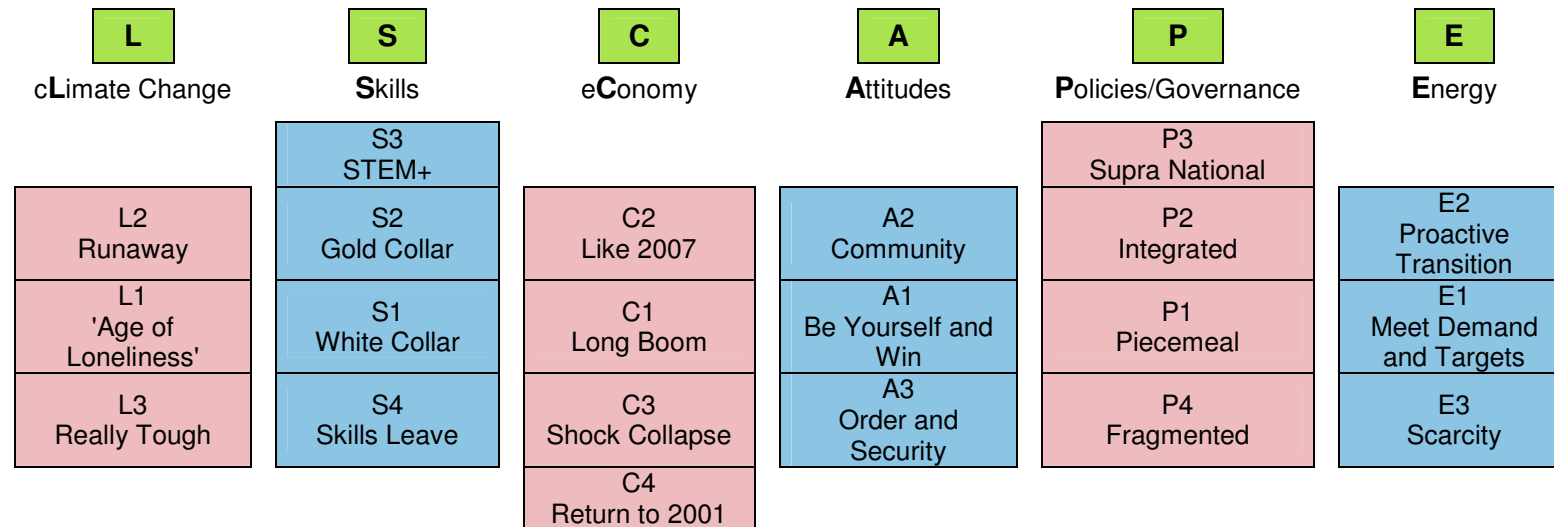
1. A summary diagram of the landscape of the macro-social environment in which the Australian industry is engaged showing a selection of important sectors and their corresponding factors.
2. Descriptions of each of the sectors and corresponding factors.
3. Important assumptions.
4. References.

Note: The future conditions described on these pages are plausible future states and not predictions.

### A Map of Macro-social 'Sectors and Factors'

Research has identified a number of macro environmental drivers or forces in the Australian landscape that impact on the industry. In this research we refer to these drivers or forces as sectors. The diagram below shows six macro-social sectors, for example C refers to the 'Economy' sector. If these sectors are visualised as blocks from which Australia is constructed, then these blocks would have specific textures and colours that give all of Australia the specific character that it has at a particular time. Taken together the sectors make up a more complete picture of the whole character of Australia.

For each sector the research identified between three and four factors. A factor is one plausible colour or texture which that sector may be like at some time in the future, for example C1 refers to an economy that is experiencing a long boom. The sectors and factors are described in more detail on the following pages.



### Important Assumptions

1. Australian population will add about 0.46M per year to reach 27.24M at 2026 and 31.08M at 2040 (straight line interpolation based on ABS 3222.0).
2. At 2040 two senior generations will make up about 21.2% of the population with the younger senior generation at 17.3% of the total (ABS 3222.0).
3. Greenhouse gas emissions and climate change are causally related in some way.

The term 'climate change' (CC) refers to the effects from a warming earth atmosphere as a result of increasing concentrations of greenhouse gases (GHGs) in the atmosphere. The greenhouse effect produced by GHGs is a natural process and plays an important role in making the Earth hospitable to the many life forms that inhabit it.

### L Climate change

The term 'climate change' (CC) refers to the effects from a warming earth atmosphere as a result of increasing concentrations of greenhouse gases (GHGs) in the atmosphere. The greenhouse effect produced by GHGs is a natural process and plays an important role in making the Earth hospitable to the many life forms that inhabit it.

However current human activities (e.g., changing patterns of land use and urbanisation) are exerting an influence on the climate through an enhancement of the greenhouse effect (Bureau of Meteorology 2011). Different atmospheric temperatures impacts global and local weather patterns and have consequences for natural phenomena such as rainfall, sea levels and extreme weather events. These effects in turn impact on people and nature: key sectors in Australia at high risk to climate change impacts are Australia coastal zones (Department of Climate Change 2009), fire regimes (Williams et al 2009), warming, rainfall changes, fire weather, drought, storms, severe weather (CSIRO 2007), and water availability, sealevel rise, coastal flooding, specie loss, heatwaves, storms and floods (Cleugh et al 2011). Every action and non-action to respond to or adapt to climate changes or to reduce GHG emissions have implications for someone else in the world.

According to 2010 data, the two global sectors that have dominated continued growth in CO<sub>2</sub> emissions are the power generation and road transport industries (the third sector is international transport), and Australia had the highest per capita tonnes of CO<sub>2</sub> emissions (Olivier et al 2011). Social patterns are implicated in the causation, rate and magnitude of climate change.

The severity of climate change, as an outcome, is relevant in relation to the dispositions of people and the responses of people in the present to future climate change disasters as they make their living in the changing environmental conditions and disruptions resulting from climate change (Pielke 2008). To understand the impacts societies from climate change hazards requires giving attention also to the other determinants of their adaptive capacity, such as socio-economic and gender equity, governance structures, development and more (UNHSP 2011).

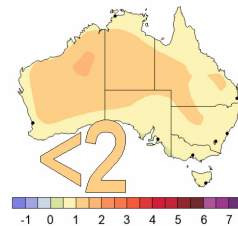
The concentration of GHGs varies naturally all the time, but since the start of the industrial revolution the concentrations of CO<sub>2</sub> and some other GHGs have been rising and this is the crux of the issue. If the CO<sub>2</sub> emissions attributed to human

sources are cut back then that will reduce the rate of rise observed in the atmosphere, although there are delays in the system to consider. According to the Lynas "the world could become two degrees warmer by 2100, for instance, or it could hit that level as early as 2030." (2008, p. 21-22).

### The range of factors

The plausible range of factors is divided into three according to degrees of temperature increase<sup>†</sup>: L1 'The Age of Loneliness' for temperature increases up to 2 degrees, L2 'Runaway' for temperature increases above 2 degrees but below 4 degrees, and L3 'Really Tough' for temperature increases above 4 degrees. The descriptions below make liberal use of descriptions in the book *Six Degrees: Our future on a hotter planet* by Mark Lynas (2008); other specific references are Wet Tropics Management Authority 2008; Great Barrier Reef Marine Park Authority 2009; Idris and Fünfgeld 2010; Pinnegar et al 2008.

<sup>†</sup> Relative to 1980-1999 average.



### L1 'Age of Loneliness'<sup>†</sup>

Average global temperatures are up to 2 degrees higher. Australians are managing the changed weather patterns and consequences by bumbling along without needing to adapt. Some of the impacts are:

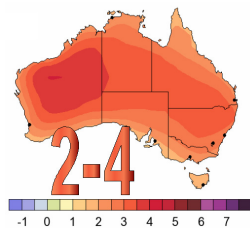
Biodiversity is seriously affected by loss of habitat, changed plant reproduction, changed fire regimes, storm surges, gradual rise in sea surface temperature, ocean acidification, increased intensity of cyclones, fragmentation of finely tuned ecosystems, and changes in rainfall intensity. A third of all species world wide are on their way to extinction, adding to the sixth mass extinction of life.

Parts of the Southern Ocean and Pacific are becoming too acidic to support marine organisms with calcium carbonate shells, in particular plankton. Marine deserts are spreading. Rising sea surface temperatures affect every aspect of the Great Barrier Reef, affecting every aspect of the reef namely the species living there (eg fish distribution is shifting southward), the habitats the reef provides (eg islands and cays) and the Queensland and Australian communities and industries dependent on the reef (eg fishing and tourism).

Half of summers are now warmer and there are not sufficient cooler times for the body to recover from the heat stress suffered during very high temperatures. Outside movement is becoming very dangerous during the hottest parts of the day. But not only people are affected; rivers and vegetation and crops are drying up or dieing. Hundreds of species are moving to keep up with shifting temperature zones or changing their breeding or natural cycles in response to earlier springs and other changes in seasons.

Unfortunately, at the speed at which the annual temperature is changing, not all species can adapt quickly enough, and some are in a sense being outrun by climate change.

‡ *E.O. Wilson suggested the next era might be called the Eremozoic era, the Age of Loneliness.*



### L2 Runaway

Average global temperatures are more than 2 and less than 4 degrees higher. Australians have had to adjust their lives. Adaptive leadership has had to step forward. Some of the impacts are:

At three degree super El Niño is a near-permanent feature of the ocean currents of the Pacific that brings drought to Australia and Indonesia, floods to Peru's Atacama Desert. A tipping point is reached that reverses the carbon cycle to one where CO2 is released rather than where CO2 is absorbed by vegetation and soil. This positive (runaway) cycle will result in a 4 to 5.5 degree rise in temperature by the end of the century.

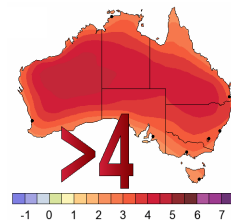
Up to 50 percent of the Earth's surface with unique climates is vanishing: simply because they have nowhere to go fast enough. Much of the Queensland Wet Tropics rain forest that used to be rich in biodiversity is now lost.

The Kogarah City Council south of Sydney is under extreme pressures from sea level rise that is also affecting the nearly 85% of Australia's people that lived within 50 km of the coast in 2010. All Australia's capital cities are experiencing increases in their 35+C days and extreme weather days are now much more frequent than before.

In New South Whales days of temperatures above 35 degrees are now occurring two to seven times more frequently, droughts are three times more likely and average rainfall is down 25 percent. Victoria is on the way to losing 40 percent of its rain and Southwestern Australia and Tasmania are also experiencing declining rainfall. In WA the drop in annual rainfall is severely reducing wheat growing productivity. Reports indicate that wheat can only be farmed in the furthest southern parts and closest to the coast of in South Australia. The Murray-Darling River Basin has at a quarter to half of its 2011 flows. The Australian interior can simply not support life due to the scorching temperatures and reliable rainfall is restricted to Tasmania and the Northern parts are Australia.

Once three degrees is passed, it leads inexorably to four degrees. Global sea levels are half a meter or more higher. Coastal zones are constantly changing. The world is moving toward a time of no ice.

Key agricultural areas of the world are lost although some new parts may be able to take over but not replace the production. Only the extreme northern parts of Tasmania can support significant agricultural production. Deserts are spreading. Only tiny remnants of glaciers are left in places above 4,000 meters.



### L3 Really Tough

At average temperatures more than 4 degrees higher, Australians have lost the ability to adapt to the consequences of the changed weather. They are just chasing their tails. Some of the impacts are:

The world is for the most part unrecognisable from the world of 2011. Rain forests are gone, deserts have expanded and new deserts have appeared, new monsoonal areas have appeared, seas are changing coastlines in dramatic ways and inland temperatures are more than 10 degrees higher. The weather is dramatically more extreme, whether that is in relation to precipitation or drought or temperatures that cause fires.

The deep oceans do not contain dissolved oxygen to support oxygen breathing life: the GHG chain reaction is flipping the Earth into a new greenhouse state. Human settlements and other live have contracted to the Earth poles: humans are colonising the Antarctica Peninsula and Tasmania and New Zealand's South Island offer a temperate home for some.

### S Skills

The workplace, the people at work, their skills, competencies and aptitudes, and the way their skills are used, are central to the Australia's economy and contribute to people's well being. Over time there are changes to employment and work participation patterns, the sets of skills required, and the leadership, culture and management practices that are deployed. At the same time issues arise such as ageing populations and skills immigration that impact on the way Australians participate in work and the skills needed and used.

#### The range of factors

The plausible range of factors has been divided into four according to the conditions created by the broad sets of skills that Australians have acquired in response to their perceptions of the skill sets most rewarded and desired by society and employers. Three main skill sets are considered: trades, services, and STEM. STEM is an acronym for Science, Technology, Engineering, and Mathematics.



### S1 White Collar

The general perception in Australia is that a job is an educated job, not a skilled job. In other words Australians find it sufficient to obtain a university degree in order to be employed. This means that careers in the trades and STEM disciplines are not sought

after nor are employees interested in adding on trade or science or technology related skills. For employers this means that when skills gaps occur, importing people with the required trade or STEM skills obtained in other countries must fill the gaps. Consequently employers only need to train employees on basic work skills and do not skill up or grow talent internally. The result is that working Australians educated in Australia have skills sets suited to the services fields such as travel and accommodation, office work, business services, wholesale and retail, sport and fitness, recreation, restaurants and catering, community, and beauty.



### S2 Gold Collar

Two factors work together to encourage Australians to obtain skills in the trades and professions (STEM and services): firstly

Australian businesses are considered high road employers and secondly the education system has been reformed considerably. Employers have completely reorganised work and jobs configurations since the early 2000s. Work environments are characterised by high innovation and also high mobility between trades and services since workers are able to take up opportunities wherever they present, be it in the trades, or professions. In education and training and in the workplace no class structure separates the trades from the professions.



### S3 STEM+

There has been strong evolution in science and engineering capabilities in Australia and in the supporting areas such as training and education. Australian workers are highly motivated to and rewarded for pursuing careers in the STEM fields (not the trades or other areas). Not only do they enter STEM fields but also in their work they are eager and highly proficient in using technology. This has raised productivity across many areas not only labour productivity. For instance, workers are able to assimilate and adopt new technologies very quickly and use them to their fullest extents and as springboards for further innovation. Scientific discoveries are rapidly converted into technologies although some technologies turn out to have unforeseen negative consequences. There is no problem of too little incentive to innovate at the coalface. The STEM focus extends beyond the workers to the Australian community. In general everyone knows about and is engaged in scientific pursuits. Everyone understands the benefits of technology and science and rapidly seeks out new scientific innovations to technological applications.



### S4 Skills Leave

Australia is described as a 'no collar' country. There are no benefits for anyone with skills to remain in Australia, indeed, there is disincentive to stay. Hence, Australians who acquire trade or professional skills leave Australia. Those people arriving in Australia with skills, whether imported to fill gaps or for other reasons, do not stay either. There are consequences for training and education as well since there is no one to go into teaching positions; a vicious circle has been created such that the situation is getting worse all the time.

Specific references: Alford and Johnston 2011; National Science Foundation; 2011; Pinnegar et al 2008; Questacon 2010.

### C eConomy

The wealth of the Australian people, in monetary terms, is measured by the economic system and the state of the economic system is dependent on a powerful and complex array of economic forces both internally and externally to the country. While the global economy is still coming to terms with the 2008 Global Financial Crisis, the Australian economy is experiencing record terms of trade from its buoyant mining sector. Favourable terms of trade times contributes to prosperity by giving more purchasing power to Australian income. Terms of trade refers to the ratio of the price of Australian exports relative to the price of imports.

#### The range of factors

The plausible range of factors has been divided into four according to Australia's wealth and growth relative to the rest of the world as seen through Australia's terms of trade: C1 'Long Boom' where Australia's terms of trade only slowly declines from it's heights of 2011, C2 'Like 2007' where the world economy returns to the high growth period just before the 2008 financial crisis, C3 'Shock Collapse' where Australia's terms of trade collapses and the rest of the world experiences ever lower growth, and C4 'Return to 2001' where Australia's terms of trade collapses but the rest of the world experiences healthy growth.



### C1 Long Boom

Just like industrialisation of the Western world increased economic productivity and prosperity and living standards of citizens, so China and India are experiencing a continual increase in living standards. With this comes increased

domestic consumption, for individuals and in total. Hence, the demand for Australian resources from China and India continue to fuel high Australian terms of trade figures (6% or higher). In contrast, the developing countries continue to struggle under high debt levels built up during and following the 2008 financial crisis. These countries' governments can but apply delaying tactics such as a variety of financing packages every few months hoping that their economies would recover and erase the debt; unfortunately and inevitably nothing is changing.



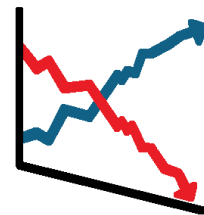
### C2 Like 2007

The global economy is operating on all cylinders, just as it did in 2007 before the financial crisis of late 2008. The emerging economies, India and China, are on the rise and developed countries in Europe and the USA have recovered from their financial woes and are showing renewed economic growth. This is good news for the Australian economy even though its terms of trade are fluctuating as usual.



### C3 Shock Collapse

Earlier in the century China's manufacturing exports drove demand for Australian resources. However, Europe and America's fragile financial markets have not recovered from the depths of the aftermath of the 2008 global financial crisis and consequently China's exports have slowly dried up too. The developing and emerging economies are in similar positions to China with ever-lower growth. Australia's resources export volumes have been reduced to a trickle and the Australian terms of trade has plummeted into negative territory not seen before. And a recovery is not in sight.



### C4 Return to 2001

The developing and emerging worlds are riding a super charged wave of development after resources and energy consumption were decoupled from economic development and from environmental deterioration. It means the amount of resources and energy consumed decline for increasing production (much greater efficiency). It has required significant changes in policies, technology and in business and consumer behaviour. This is very bad news for Australia's terms of trade results given its reliance on resources exports; the terms of trade are at their lowest on record. As a result the Australian economy is not developing at the same rate as others and is falling further and further behind.

Specific references: Diewert & Lawrence 2006, Hajkowicz et al 2010, UNEP 2011.

### A Attitudes

People's values, interests, motivations, commitments, needs, and how they go about fulfilling those are loosely collected under the heading of attitudes. Attitudes play a role in how people view their problems, why they make the choices they do, the solutions they develop to solve the problems for themselves, their families, communities and for institutional or enterprise systems. People's attitudes play a role in what they believe they can, should or should not change. Attitudes also play out in the Australian cultural conditions, values, institutions and the style of leadership people adopt.

#### The range of factors

The plausible range of factors has been divided into three according to specific principles that underpin people's attitudes: A1 'Be Yourself and Win' points to principles of growth and success in a scientific rational world, A2 'Community' points to principles of an awakening to human diversity and community beyond growth, and A3 'Order and Security' points to principles of order and control for the sake of higher causes.



### A1 Be Yourself and Win

Australian is a country full of opportunity and gain for those who believe in their own ability to make progress. When you are confident and prepared, fast to react to early trends, one step ahead, have clever branding and brilliant leadership then you cannot fail to be wealthy and grow your business. Australians face the millennium that will provide them with the technology and life styles beyond their wildest imaginations. Companies have an incredible ability to get you what you want before you even realised that you needed it. The real winners develop new ways of managing knowledge and taking calculated risks. Leisure time and the size of one's balance sheet show that you have been able to make it for yourself. The secret is to spread your risks by beating the markets. Australia has what you need to go where you want, buy what you want, live where you want, have access to the services you need, and low income tax rates because Australians are worth it. A new world order is emerging and institutional power is weakening. Australians are building a new world and making lasting choices with radically new ways of thinking.



### A2 Community

Australians are re-connecting across communities, local and international, to form extended communities. Every citizen and every company actively contribute for a more equal world. Relationships are nurtured, employers have high regard for employees, workplaces are team oriented characterised by cooperation, partnership based dialog and tasks are mastered together. Information is shared between participants in industries and best practices are shared between industries and countries. Everyone takes their responsibilities to the workforce, the local community and the extended community seriously. People are working together to achieve major improvements. Diversity and equality of opportunity is an important contributing factor to the success of Australian organisations. Leadership is by the people, with the people: solutions to issues are by the people, with the people. The best possible training and education is provided in safety and health.



### A3 Order and Security

Australians vote for strong leadership in governments and in their organisations. Leaders help to bring order to a world that is very chaotic and uncertain. To bring order to the world requires banning of the activities of those who do not have the interests of Australia at heart but want to damage the country. Benchmarking processes are developed to monitor progress and then become standard practice with the knowledge captured in guides and in the systems developed. Leaders have authority to expose criminals and to limit the fraudulent activities of those who wish to trade in the goodwill of Australians. The solution to problems is to enforce order and to provide a prosperous future to future generations by stopping the extinction of Australian icons. Australians have a master plan that sets out clear directions that give hope and they have leaders that enforce Australian ideals to stop those who are telling lies and who want to divert national attention from doing what is right and good for this country. People are taught how to be healthy and how to ensure safety at home and at work. The government provides for all the things that people need to live a decent and secure life, to have access to the resources and facilities they need, and a safety net for those that need it when things are tough.



### **P** Policies / Governance

The nature of a political system is concerned with how people are governed and who can decide. The systems are usually supported by a legal process and actual decision making institutions and structures which impact the extent to which a government is active in decision making and implementation of decision. The systems are also reflective of the extent to which a government is or can be responsive to industry. No country is governed in isolation from the rest of the world or from the people in the nation locally where they live.

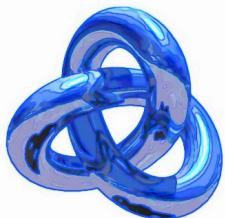
#### The range of factors

The plausible range of factors has been divided into four according to the level of integration between the different levels of governance from the local to the global: P1 'Piecemeal' refers to little integration except where pockets of leadership exist, P2 'Integrated' refers to strong integration between the local and the global, P3 'Supra National' refers to governance directed from a global level, and P4 'Fragmented' refers to atomised governance with local interests only.



### **P1** Piecemeal

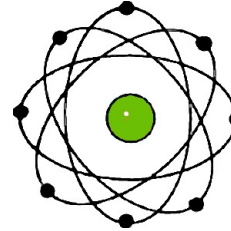
There is little or no integration or cooperation between levels of government. However, small pockets of real governance and real leadership can be seen here and there. This leads to local solutions for problems and issues unless an issue extends across boundaries and people are eventually unable to solve it without involving neighbouring areas. Where the pockets of real leadership exist there are clear examples of innovative thinking and cooperative action to resolve the bigger picture issues.



### **P2** Integrated

A governance structure has been found that integrates the very local with the global through intermediary levels that preserves diversity and at the same time finds commonality at the global level for the bigger picture issues.

Interdependencies are recognised. There is harmonisation of regulations, both between states or nations and between different levels of government.



### **P3** Supra National

Regulations are prescribed in a top-down manner from supra-national governance sources. While the Australian governments at all levels are enacting their local duties, it is the global governance systems that are driving the Australian government priorities from a global level. It is the global governance systems that determine directions, priorities, strategies, and that set the constraints on actions, particularly for big picture issues.



### **P4** Fragmented

While it is still possible to do things and lead productive lives, it is at the governance level where there is little interest in cooperation to resolve problems that cross boundaries. There is little or no recognition, in governance terms, of the whole. Government is atomised and there is no will or ability to deal with bigger picture issues, it provides for local solutions only, and any previously regional, global and national structures have disintegrated. Many independents are elected at state and national level, bringing local issues to the national agenda, but it is very difficult if not impossible to find agreement in an overall sense.

### E Energy

People anywhere on Earth need *usable* energy for the things they must do and desire to do. Some forms of energy when used produce GHGs that contribute to climate change and there are concerns globally about the levels of GHG emissions. Another concern for coming years relates to finite oil supplies and uncertainties over those supplies. At the same time, the Australian Government's energy forecasting body has projected an average rate of increase of energy consumption that is significantly more than the expected rate of increase in population (ABARE 2005).

#### The range of factors

The range of factors has been divided into three based on the overall response to the issues of energy supply, energy demand, and whether there are greenhouse gas (GHG) emission targets and whether the targets are being met: E1 'Meet Demand and Targets' refers to meeting energy demand while staying within GHG targets (as they change), E2 'Proactive Transition' refers to a full conversion to green energy (mitigated and sustainable energy), and E3 'Scarcity' refers to the situation where Australia is the only country not meeting emissions targets.



### E1 Meet Demand and Targets

As the population increases and their wealth increases, so energy demand increases. Energy production is such that it meets the demand, but only to the extent that GHG emissions are maintained at or within set targets (whatever the targets may be). This means that energy production has to come from the right mix of energy sources in order to meet the demand while remaining within GHG targets. As GHG targets change so energy production and consumption must adjust. GHG targets are changed at times when it is found that the targets are not sufficient to reduce global rises in temperature. If the target changes are relatively large, the effect is to produce step changes in the supply and use of GHG producing sources of energy.



### E2 Proactive Transition

Australia has been fully converted to green energy. There are no longer GHG emitting fuels or energy sources being used that are not being fully mitigated. Even where unmitigated GHG fuels or energy sources could be used or supplied, there is no market for it. The fraction of renewable forms of energy supply to the total supply of energy is at its highest possible and all other GHG energy supply is fully mitigated. This means that energy demand is only constrained by the total green energy supply. Emissions targets are no longer in use since there is no requirement for it.



### E3 Scarcity

Australia is the only country that is not meeting tight and severe global greenhouse gas emissions targets. As a consequence the world has imposed sanctions on Australia. Australia can only export if they demonstrate that the exports meet very strict requirements of low carbon content verified through detailed measurements. Since Australians are ignoring targets, they are meeting their energy demand from both clean and green energy sources as it suits them.

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