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SETTLEMENTS AND INFRASTRUCTURE

Position paper: towards a National Climate Change Adaptation Framework for the built environment

Node 3 ACCARNSI

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Executive Summary

Climate change adaptation in the built environment is an emerging policy field. Adaptation planning scenarios such as those being developed by the Victorian Centre for Climate Change Adaptation and Research help to clarify and drive proactive, anticipatory policies and longer-term strategic planning initiatives for vulnerable settlements and infrastructure. Adaptation policies for the built environment also entail transformations of the Australian economy and international treaty commitments to reduce greenhouse gas emissions.

Purposes of this positioning paper:

Many adaptation initiatives and multiple approaches are already happening in the built environment space at local and state government levels. However, members of the ACCARNSI network are concerned about a lack of consistency in these approaches, nationwide. This position paper identifies the need to work towards a national policy framework for adaptation in built environments that provides a clearer sense of purpose and cohesion. The framework of provisional policy goals, drivers, and instruments outlined below provides a basis for working towards adoption of consistent strategic plans, institutional reforms and improved governance arrangements that encourage innovations to capitalise on opportunities. Hence the purposes of this positioning paper are to:

- build the case for a nationally consistent policy framework;
- identify challenges and wicked problems;
- harness key drivers to accelerate the policy-framing processes; and
- provide decision makers with a suite of provisional policy goals, instruments and implementation pathways to consider, that build adaptive capacities and enhance social and ecological resilience.

Stages of policy making and implementation that address the complexities of climate change adaptation in built environment contexts include problem-framing the key challenges, clarifying policy goals, drivers and instruments, and recommending implementation priorities and pathway options. These stages are reflected in the structure and intent of this positioning paper.

Policy framing challenges:

Policy challenges are presented from different perspectives and include: asymmetric responsibilities; long-term time scales required to achieve net-benefit outcomes; difficulties finding the right spatial scales, moving from macro to meso to micro; uncoordinated legislation and inconsistent planning codes; and achieving the right kind of strategic planning codes that also encourage innovation.

CSIRO and the Bureau of Meteorology (BoM), Geoscience Australia and the Climate Commission have produced updates of current trends and projected impacts of temperature increases and sea level rises on vulnerable locations. These challenges are summarised. ACCARNSI's Impact Factsheets for the Built Environmental, Coastal Settlements, Infrastructure and Planning provide further detail and are accessed through the NCCARF webpage.

Policy goals, instruments and measuring tools:

Key tasks for national policy-makers include setting goals to drive efficient adaptation strategies and practices in building design, construction and risk management industries. Four provision policy goals are recommended for 'starting up' the policy framing process:

i. Identify complementary key roles for each spatial scale of government to facilitate effective adaptation strategies and practices in building design, construction and management.
ii. Provide incentives and decision frameworks to underpin the level and timing of appropriate climate change adaption responses.
iii. Partner ongoing research into the drivers and barriers to framing and implementing nationally consistent planning policies and strategies.
iv. Incorporate adaptive learning cultures and practice-based adaptive change in built environment industries, in partnership with the teaching and research functions of built environment/design faculties.

Recommended priorities and strategies:

A robust national climate change adaptation policy framework will include socio-economic modelling and market-focused policy instruments to assess socioeconomic impacts. Other recommended implementation priorities include:

i. Decide which key vulnerabilities in built environments require national strategic planning initiatives;
ii. Investigate local and regional costs of projected adaptation planning for scenarios of sea level rises at least up to 1.1 metres by 2100;
iii. Identify risks to buildings, transport, water, communication, energy and mining infrastructure, and insurance protection from an increase in extreme weather events; build the business case for adaptation;
iv. Go for 'green light' adaptations.

Implementation pathways:

The most crucial implementation pathway is longer-term strategic planning. Appropriate ways to reach towards this outcome and other recommended policy priorities and options, in the next year or so, include:

i. Lobbying for a national advisory body for adaptation in the built environment, akin to Infrastructure Australia
ii. Tabling this position paper at the new COAG Ministerial Council to address climate change issues (to be convened in the second half of 2011)
iii. Publication as an on-line issues paper open for comments and feedback
iv. Dissemination through relevant professional associations
v. Liaison with Local Government Associations
vi. Stakeholder roundtables enabling thought leaders from industries, institutions, and research centres to meet with community champions, explore future scenarios and decide adaptation strategies within the national policy framework.

1. Purposes and context of this positioning paper

> "The term *policy* carries many meanings. It can refer to a document, a strategy, legislation, a program, an agenda, a decision outcome, or an institution. In its broadest sense, policy is about connecting ends with means" (Harding et al 2009: 4).

Climate change adaptation in the built environment is an emerging policy field. Adaptation planning scenarios such as those being developed by the Victorian Centre for Climate Change Adaptation and Research (VCCCAR) clarify and drive proactive, anticipatory policies and longer-term strategic planning initiatives for vulnerable settlements and infrastructure. Adaptation policies for the built environment also entail transformations of the Australian economy and international treaty commitments to reduce greenhouse gas emissions.

This positioning paper outlines the need for a nationally consistent policy framework to address climate change adaptation in the built environment. It aligns with the Australian Government's broader position paper released in 2010, *Adapting to Climate Change in Australia,* which sets out the policy agenda for coordinating national efforts. Its purposes are to provide a useful starting place for the policy community to engage with the challenges of:

i. Framing key drivers to adaptation in built environments
ii. Identifying barriers including ad hoc responses at local, regional or state levels that indicate the need for national leadership and consistent solutions
iii. Providing decision-makers with a suite of provisional policy goals, priorities and instruments to consider
iv. Accelerating policy implementation along strategic pathways.

Stages of policy making and implementation that address the complexities of climate change adaptation in built environment contexts include problem-framing the key challenges, clarifying policy goals, drivers and instruments, and recommending implementation priorities and pathway options (Dovers 2005). These stages are reflected in the structure and intent of this positioning paper.

Agreed definitions of key adaptation concepts – including adaptive capacities, resilience, agility, vulnerability and risk - are needed to provide a firm basis for negotiating policy goals and delineating responsibilities for implementation (Levina and Tirpak 2006:3). A glossary is provided in **Appendix A**.

1.1 Context: addressing a significant national policy gap

The building sector contributes a third of overall energy-related green house gas (GHG) emissions worldwide (Price et al. 2006). This sector is responsible for 23 per cent of Australia's total GHG and its energy use continues to grow rapidly (ASBEC, 2009; Garnaut 2010b). The global impacts of GHG emissions from cities and the vulnerabilities of built environments to climate change were underscored by the expert panel convened by the Intergovernmental Panel on Climate Change (IPCC) to scope key adaptation approaches for the forthcoming Fifth Assessment Report, due in 2013:

> "Cities and other human settlements are at the forefront of climate change. As large emitters of GHG emissions, they significantly contribute to climate change. Simultaneously, due to their concentration of population and infrastructure assets, cities

> are especially vulnerable to the impacts of climate change. Infrastructure investments in the near future will determine the emission paths of cities in the long-run." (IPCC 2009:2).

The United Kingdom, Finland, France and other countries have developed national adaptation policy frameworks, instruments and tools for vulnerable built environments (see **Appendix E**). However, these have been slow to develop in Australia. In the meantime, various State and Territory departments, voluntary regional organizations of councils including the Sydney Coastal Councils Group (SCCG) and individual councils are conducting spatial mapping and scenario planning to initiate adaptation strategies for their most vulnerable coastal zones and low-elevation settlements. Some of these initiatives are partnered with CSIRO's National Research Flagships program for Sustainable cities and coasts.

The Australian Local Government Association (ALGA) is concerned that councils are operating in a national policy vacuum, reflecting unclear priorities and leadership[1]. Consequently their strategic plans are felt to be often ad hoc and inconsistent with adaptation initiatives in neighbouring councils, and other States and Territories. ALGA has previously reported similar findings to the Local Government and Planning Ministers Council (LGPMC)[2].

Similar concerns about the lack of an overarching national policy framework to address vulnerabilities to climate change are shared by City Futures Research Centre at UNSW, Griffith Urban Research and Climate Change Response Programs and professional and industry organizations including the Green Building Council, the Australian Sustainable Built Environment Council (ASBEC), the Australian Institute of Landscape Architects (AILA) and the Australian Academy of Technological Sciences and Engineering (ATSE). The Australian Council of Built Environment Design Professionals (BEDP) has issued a *Call to Action* to address these concerns – see **Appendix B**.

1.2 Towards a national policy framework

The significant policy gaps outlined above provide the drivers for working towards a national adaptation policy for built environments that:

- Enables the development of consistent adaptation goals, strategies and an agreed protocol on targets (see Appendix B: Call to Action from BEDP)
- Builds adaptive capacities and enhances social and ecological resilience in built environments
- Encourages innovation to capitalise on opportunities including institutional reforms
- Enables agreements on implementation plans, pathways and reporting requirements delivered through COAG and professional bodies
- Fosters adaptive learning.

Writers on urban sustainability regard climate change adaptation as a high order goal in securing sustainable built environments (Giradet 1999; Hester 2006; McManus 2005; Newman and Jennings 2008; Graham and Booth 2010). Successful adaptation for cities will require medium term *structure plans* and long-term *strategic plans* with temporal scales of

[1] Key findings from a national workshop convened by ALGA and ACCARNSI, 19 Dec 2010, Adelaide
[2] ALGA (2009) 'Towards a national planning framework for climate change mitigation and adaptation' (unpublished)

100+ years, and 250+ years for essential infrastructure (Engineers Australia Infrastructure Report Card 2010). Strategic plans to enable adaptive and resilient cities, regional centres and towns under a changing climate would be more effective if coordinated across national, state and local levels of government. Multiple approaches tailored to local and state/ territory contexts are also essential. However, a national research strategy is required that informs the development of these strategic plans and approaches (DIISR 2009; ATSE 2010).

Innovation and **institutional reform** are framed largely as issues of encouraging policy leadership and good governance, primarily at the city-level. Innovative policy responses to climate change are not limited to promoting hard infrastructure such a sea walls or energy efficient technologies. They encompass *soft infrastructures* which include *adaptive learning cycles, evaluative thinking skills* and *scenario planning strategies* (VCCCAR 2011) to build social-ecological resilience in urban design and identify opportunities for emerging forms of productivity and prosperity (Chen and Graham 2010). *Institutional reforms* that enable adaptation are linked to policy-making drivers that encourage leadership and effective governance at local, regional, state and national levels.

1.2.1 Scope of key objectives

A. Benchmark what is happening at local to international scales:

i. Provide a targeted literature review of international and national examples of climate change adaptation problem-framing, policy drivers, challenges and solutions.

ii. Inform decision-makers, key stakeholders and communities of key concerns and issues, based on current scientific findings and transdisciplinary research in urban planning, building design and construction, risk management and so forth.

B. Clarify provisional policy goals, priorities and options that build on current initiatives:

i. Review policy goals and priorities, and clarify feasible options for developing a national policy, as a crucial *soft infrastructure* (Chen and Graham 2010) to guide adaptation in the built environment arena

ii. Foster communities of practice[3] to develop and share adaptive learning cultures and good knowledge management processes.

iii. Foster a policy evaluation methodology that facilitates innovation, adaptive learning and resilience thinking.

C. Outline available policy instruments:

i. Conduct an audit of internationally and nationally available policy instruments.

ii. Identify policy instruments to address built environments that are as most vulnerable to climate change impacts.

D. In conclusion, provide key recommendations and advise on targeted implementation pathways including:

i. COAG ministerial council agreements on institutional and structural reforms;

ii. professional associations and networks; and

iii. emerging networks and innovative pathways.

[3] A network to share a common interest in a specific area over a period of time to build on shared knowledge and practice. (Land and Water Australia 2006: 28; Wenger 1998)

1.3 Policy making as an adaptive learning process

Environmental sustainability policies, especially those aimed at addressing climate change, are "uncertain interventions of an experimental nature in complex, interdependent natural and human systems" (Dovers 2005: 36). The nexus of social-ecological, economic and governance systems constitutes a very complex and evolving policy arena (Bovens et al 2006).

1.3.1 Stages of policy making reflected in this positioning paper

"Although the policy process might be messy, it is typically conceptualized as a cycle composed of various stages from identifying issues, analyzing problems, assessing policy instruments, consulting and coordinating with different stakeholders, making a policy decision, and then finally implementing and evaluating that decision." (Harding et al 2009:5)

Box 1: Cyclic Stages of Policy-making

Problem-framing: the policy community, professional associations and communities of interest and practice debate key issues and concerns, appraise research findings and gather other information to arrive at a construction of the policy problem.

Policy-framing: guiding principles are identified from relevant disciplines or dimensions of sustainability (social, ecological, economic and governance), a policy position is developed and policy goals defined.

Implementation: policy instruments are selected, resources allocated, and a communications strategy/media campaign devised to engage the public and encourage voluntary support rather than punitive compliance.

Evaluation: ongoing monitoring *and* evaluation methods are "integral extensions of policy implementation … a central function rather than an add-on to the main game." (Adapted from Dovers 2005: 37-59 and Bovens et al 2006).

Policy-making processes to address climate change adaptation are likely to be more effective if structured into cyclic rather than linear stages of problem framing, policy framing, policy implementation and evaluation, summarized in Box 1 above. *Policy communities* - comprised of key stakeholders in industry, institutions and professional networks, and communities of practice, place and interest - collaborate best on the basis of provisional trust.

1.3.2 Melding policy evaluation and adaptive learning

The evaluation of adaptation policy options for the built environment entails wide-ranging assessments of many sectors including urban planning and environmental law, emergency management, urban and rural landscape management, insurance and financial planning (McDonald, in Bonyhady et al 2010: 2). Adaptive learning, resilience thinking and agile problem-solving are essential ingredients in evaluating the complexity of both sustainability and climate change concepts and issues. Evaluating innovative policies and pilot programs also entails a shift of priorities from outcomes-based reporting towards adaptive learning approaches where the implementation of decisions is viewed as an experiment from which future projects can learn (Harding et al 2009).

1.3.3 Evaluation approaches to policy making

The *Realist* evaluation methodology provides useful pragmatic tools to generate evidence-based policy by asking 'What works for whom, why, and under what circumstances?' (Pawson 2002a, 2002b, 2008; Pawson and Tilley 2005).

The *Developmental Evaluation* approach (Patton 2008, 2010; Rogers and Funnell 2011) is a collaborative decision making enterprise designed to support continuous improvement, adaptation and intentional change. As a member of a team tasked with formulating innovative responses to thorny strategic policy and program development issues, the evaluator plays a key role in elucidating team discussions with evaluative questions and facilitating evidence-based decision-making in problem-framing and goal-setting stages. "Constituted" policy making questions include: 'Are we doing the right thing with this policy initiative'? 'How do we know it's the right policy response to the key issues'? (Pulwarty 2011). The evaluator also in assists the policy implementation stage by applying program theory and facilitating *evaluative thinking* skills that include sense-making and reality-testing, and providing evaluative feedback to decision makers in real time (see **Appendix C** for a fuller explanation of real time evaluation techniques).

Developmental Evaluation methodology applies complexity concepts to enhance policy innovation and program design. These concepts include *resilience thinking* (Gunderson and Holling 2002), ecological systems dynamics (Capra 2005), *recursive logic loops* rather than linear logic, and the *precautionary principle* (Harding et al 2009). These same complexity concepts and methods for built environments and infrastructure also underpin *social learning for sustainability* (Keen et al 2007; Wals 2007) and transdisciplinary approaches to managing natural and social resources (Harding et al 2009). See Appendix C for wider applications of Developmental Evaluation to sustainability policy making.

2. Framing the complex challenges of adaptation

> "The focus of adaptation policy and strategies to date has been on understanding at finer spatial and temporal scales the projected impacts of climate change on particular regions, sectors or vulnerable communities. The constraints of such an approach are obvious: climate science has not been able to provide the level of certainty that policy and decision makers seek… nor is it likely into do so in the foreseeable future." (McDonald, in Bonyhady et al 2010: 2)

The **problem-framing stage** entails dealing with the complexities of *post-normal science* that characterizes climate change, whereby scientists struggle to deal with situations where 'facts are uncertain, values in dispute, stakes high, and decisions urgent' (Funtowitz and Ravetz (1991:138). The Victorian Centre for Climate Change Adaptation Research (VCCCAR) highlights how "policy makers and practitioners face a number of challenges, which highlight the deficiencies of traditional linear planning and decision strategies. These include:

- Understanding and managing complex risks and uncertainty;
- The long time frame over which climate change will occur;
- Diversity of potential impacts; and

- Complexity of interacting social, economic, political and environmental drivers."[4]

Framing an adaption policy for the built environment entails encounters with an array of *wicked problems*[5] across many domains and disjunctions between levels of government – federal, state and local - including urban planning, sustainable population targets and health reforms. Wicked problems that do not lend themselves easily to technocratic solutions include: climate change denial and other behavioral obstacles; funding constraints; institutional and organisational inertia; lack of coordination between state/territory planning regimes; information barriers; and longer climate cycles that do not synchronise with three-year election or research cycles (Hulme *et al* 2007; 1st PEER Report 2009; Harding et al 2009:21-23; ICLEI 2009).

This section unpacks some of the "diabolical" challenges (Garnaut 2008; Garnaut 2010a) to framing a climate change adaptation policy for the built environment at a national scale. Adaptive learning and systems thinking approaches are required for problem-framing and problem-solving, which are more likely to be successful if approached on this basis: 'What will it teach us if we work to solve these problems?' Barriers are obstacles that can be overcome with concerted effort – they are not insurmountable. Where possible, potential solutions are offered.

2.1 Projected impacts of climate change on built environments

CSIRO and the Bureau of Meteorology (BoM), Geoscience Australia and the Climate Commission have produced updates of current trends and projected impacts of temperature increases and sea level rises on vulnerable locations. These challenges are summarized below. ACCARNSI's Impact Factsheets for the Built Environmental, Coastal Settlements, Infrastructure and Planning provide further detail and are accessed through the NCCARF webpage.

Temperature increases

Australian average temperatures are projected to rise by 0.6 to 1.50C by 2030. If global greenhouse gas emissions continue to grow at rates consistent with past trends, warming is projected to be in the range of 2.2 to 5.00C by 2070. Warming is projected to be lower near the coast and in Tasmania; but higher in central and north-western Australia. These changes will be felt through an increase in the number of hot days. Decreasing rainfall is anticipated especially in southern areas of Australia during winter, in southern and eastern areas during spring, and in south-west Western Australia during autumn. An increase in the number of dry days is expected across the country, however it is also anticipated that there will be an increase in intense rainfall events in many areas (CSIRO & BoM State of the Climate Report 2010; Climate Commission 2011 Ch 2. Risks associated with a changing climate).

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[4] <http://www.vcccar.org.au/content/pages/scenarios-climate-adaptation> Accessed 15 April 2011)

[5] "*How might you identify a wicked problem? The thing to look for is divergence. If requirements are volatile, constraints keep changing, stakeholders can't agree and the target is constantly moving… [and] considerable time and effort has been spent but there isn't much to show for, there is probably a wicked problem lurking somewhere*." www.popendieck.com/wicked.htm Accessed 10 October 2010

Sea level rise

'Cities and coastal communities' and 'infrastructure' are comprehensively identified by Preston and Stafford-Smith (2009) as the most vulnerable sectors of Australian built environments, under climate change impacts. Sea levels have steadily risen rapidly around Australia's coastline from 1993 to 2009 (Steffan 2009) from between 1.5 and 3mm per year in the south and between 7mm and 10mm in the north. CSIRO, BoM and Geoscience Australia are projecting a sea level rise of 1.1 metres by 2100. Low elevation cities, towns and infrastructure are especially vulnerable, along with coastal communities and their livelihoods (IPCC 2009, IPCC 2007a; IPCC 2007b: 522).

Almost 90 per cent of Australians live in cities and large regional towns; and 80 per cent live within the coastal zone. Geocience Australia's recently completed National Coastal Vulnerability Study and its National Coastal Landform and Stability Mapping Tool (*Smartline*) show that a sea-level rise of 1.1 metres will accelerate coastal recession especially along the 63 per cent of the coast composed of sandy or muddy shorelines. Applying the Bruun Rule, (Bruun 1962) the risk-averse scenario anticipates coastal recession of 100 metres; and 50 metres in the risk-tolerant scenario. These statistics generate profound strategic planning and legislative issues (Gates et al 2010) for built up coastal areas situated in *zones of potential Instability* (ZPI), and worsened by the pressures of continuing rapid population growth along the seaboard (Ausgeo news 2011).

Continuing urbanization

Australia is a highly urbanized society and the impacts of climate change on our cities will have profound socio-economic consequences. Growing populations, increasing urbanisation and urban lifestyles are likely to increase the vulnerability of communities and individuals (ATSE 2010). Many current housing and workplace models are inadequate and out-dated: they do not deal with the immense challenge of transforming the built environment by incorporating climate-sensitive, performance-based principles for buildings in a broader framework of 'eco-infrastructure' and ecosystem services for cities and communities. However, utilization of existing 'smart' technologies would enable significant immediate emission reductions at zero cost or even net savings to our economy, with the likelihood of further savings as new and more efficient technologies come on stream (ASBEC 2008; ASBEC 2010).

Uncertainty and vulnerability

The unpredictability of climate change adds new dimensions of uncertainty, vulnerability and higher risk levels to dynamic and complex built environments, including security of water supplies, housing, transport and food (PMSEIC 2007). Hospitals and other essential health infrastructure are also vulnerable, yet these facilities are most needed by communities in extreme events (Australian Academy of Science 2010). This need is the focus of research work being undertaken in a Climate Change and Health Infrastructure ARC Linkage project at UNSW.

Whether or not the extreme weather events since 2009 – Victorian bushfires, floods in the Riverina, Queensland floods coupled with Cyclone Yasi, driest summer on record in southern Western Australia – are *attributable* to global warming, the thing to note is that they have raised public awareness of impacts on property values, investment decisions, and both the price and availability of insurance via disclosure of increased hazards, vulnerabilities and risks.

The challenges to managing built environments and infrastructures that are most vulnerable to coastal erosion, storm surges and tidal inundation are being addressed by several research organizations including the Built Environment and Coastal Settlements nodes in ACCARNSI, CSIRO's Urban Systems program, City Futures Research Centre at UNSW, Griffith Urban Research and Climate Change Response Unit, and by a standing committee in the House of Representatives[6]. A summary of vulnerable built environment sectors and adaptation responses is tabled in Appendix D.

2.2 Key policy challenges to address

Different sets of challenges, seen from the perspectives of two research organizations and an industry body, provide a grasp of key issues that need to be addressed in a nationally consistent policy framework:

Griffith Climate Change Response Unit: Steele and Burton (2010) are concerned with the complexities of spatial scaling required to adapt cities, the challenges/barriers posed by capital flows, inertia of fixed assets, long contractual commitments in public-private partnerships (PPPs), and the backlogs in existing policy implementation.

City Futures briefing for DIISR - a multi-stakeholder roundtable was convened by City Futures in 2008 to provide a policy brief for the Department of Innovation, Industry, Science and Research (hereafter 'DIISR Briefing'). The roundtable identified complex challenges facing an innovation policy including integrated spatial decision-making, moving to scale, shaping behaviour change, and leadership and governance issues, elaborated below in Box 2:

Box 2: Adapting to Climate Change

Presently, there is a relative lack of publicly accessible information on the impacts of climate change on Australian built environments, with only limited incorporation of human settlement features in climate change models...

An engineering solution is only a partial one: preparing for and living with climate change will require a more *responsive* built environment, and one in which residents adapt in terms of expectations and behaviours. In terms of meeting the challenge for built environment responsiveness, architects may be expected to seek passive design solutions rather than reacting through reliance on hermeneutically sealed structures; planners to have the remit and information to rigorously adopt 3BL principles; and landscape architects to take a lead role in transforming our parks, nature corridors and open spaces into climate regulators as much as amenity space. The collective task requires our built environment to move from being a resource drain towards being an energy generator, water and waste recycler and emissions mitigator. (DIISR 2008: 9)

The Australian Green Infrastructure Council: Lees (2010) highlights these key challenges from the perspective of AGIC:

- The first challenge is to avoid continuing **maladaptations** i.e. a supposed solution to one problem that engenders further problems, inefficient resource allocations, and poor or wasted investment decisions.

[6] '*Managing our coastal zone in a changing climate: the time to act is now*', Section 3: Climate change and the coastal zone: adaptation strategies and practices to promote resilience pp. 131-2. House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts, Final Report, 2009

- Risk assessment tools in Australia and New Zeeland are too preoccupied with risk controls and do not lead to commensurate concerns with adaptation **strategies.**
- Impacts are assumed to occur only in singularities, not as complex ensembles.
- Time frames for adaptation are arbitrarily set at 20-, 50- and 100-year spans. This stymies thinking about the transformational processes and impacts in between times, and beyond.

2.2.1 Unpacking key challenges

i. Impacts and responsibilities for built environments are asymmetric

Sea level rises, storm events and flooding will affect low-lying inland and coastal settlements and infrastructure more than elevated sites (Climate Commission Ch 2: Risks associated with a changing climate). Urban heat island effects are metropolitan phenomena. Temperature extremes impact differently on bushfire-prone cities and towns. Planning responsibilities for emergency services fall more heavily on some administrations, especially local governments, than others.

ii. Long-term time scales are required to achieve net-benefit outcomes

Decisions to invest in adaptive capacity building require clear understandings of costs, expected benefits and accompanying time frames of the investment flows. Decision makers must navigate investment factors and estimated long-term payback benefits of early interventions, in the half-light of limited research on estimated costs-benefit analyses of adaptation measures, where the precise rate and characteristics of climate change are hard to project. Underestimations may lead to choices that fail to deliver appropriate adaptation responses. Concomitantly, overestimation may result in over-preparedness and wasted allocation of resources (Lees 2010).

iii. Finding the right spatial scales – moving from micro to meso and macro

The DIISR Briefing (Box 3) highlights the need to **scale up** site-based thinking from 'lighthouse' projects (exemplary 6-star buildings and new DCPs developed by leading-edge local governments) to consistent city wide applications:

Box 3: Beyond Individual Building and Site-Based Thinking

"[F]ocusing solely on building risks obviates the harder challenge of fostering and integrating innovation across the range of spatial scales relevant to how our cities function. Innovation is required to take site-based responses further and provide frameworks that respond to the drivers of change at the scale at which they will be experienced (CABE, 2007a). We need to take advances seen in building technologies, financing and operation and move them 'to scale': citywide and neighbourhood mechanisms will be required to meet these challenges in a strategic fashion…

Should carbon ratings be tied to the building or site, or should neighbourhoods or cities as a whole be measured, so that gains and opportunities in certain developments or sectors can offset those where transformation will be harder?" (DIISR 2008:16)

iv. Uncoordinated legislation and inconsistent planning codes

People cannot be expected to implement adaptation policies effectively if faced with overlapping administrations, poor coordination across departments, and inconsistent

planning codes and regulations. The DIISR Briefing accentuates these key research findings on barriers from stakeholder interviews: policy issues/concerns for the built environment are stretched across too many portfolios and the fragmented, disjointed governmental structures within which the built environment industry operates. And the multitude of players and scales at which the built environment operates means that there are interfaces government at all levels, from national to local. Policy consistency is requisite.

From a European perspective, the 2nd PEER Report on *Climate Policy Integration, Coherence and Governance* (Mickwitz et al 2009:25) describes similar barriers and difficulties that multi-level governance and federal structures pose for EU member countries, attempting to harmonise legislation, policies and planning codes.

i. How to ensure consistent planning codes yet encourage innovation?

Enabling innovation in the built environment is a key challenge for national policymakers. They have to capture current thinking from the marketplace of ideas, and devise regulatory frameworks that achieve a balance between national consistency in building codes and planning statutes, and freedom to innovate. Ways to meet this double challenge include encouraging adaptive learning cultures and practice-based innovation in built environment industries, in conjunction with new research partnerships and courses on climate change adaptation in built environment faculties[7].

3. Clarifying provisional policy goals

> "Goals will shift over time, as climate change impacts become more pronounced or better understood and short-term options lose their efficacy." (McDonald, in Bonyhady et al 2010: 11)

A national framework for adaptation in built environments should aim to become an aspirational document that promotes agreed policy goals.

3.1 Recommending provisional national goals

These four 'start-up' policy goals are recommended for consideration:

i. Identify complementary key roles for each level of government to facilitate effective adaptation strategies and practices in building design, construction and management.
ii. Provide incentives and decision frameworks to underpin the level and timing of appropriate climate change adaption responses.
iii. Partner ongoing research into drivers and barriers to implementing nationally consistent planning policies and strategies.
iv. Incorporate adaptive learning cultures and practice-based change in built environment industries, in partnership with teaching and research functions of built environment/design faculties.

[7] A key point discussed at the Leadership Networks for Climate Change national workshop convened at UNSW as an initiative of the Australian Learning and Teaching Council, Sydney, 15 November 2010.

3.2 Problematic goal-setting issues

Deciding other appropriate national policy goals may be made problematic by the complexities of national negotiations on setting consistent industry standards that match international best practice, and Australia's international treaty obligations on climate change mitigation and adaptation. Adding to this complexity is the status of Sydney and Melbourne as cities of global stature (Steele and Burton 2010). Problematic goal-setting include whether to:

i. Apply the subsidiarity principle to adaptation?

The *subsidiarity principle* forces attention on locating power and responsibility for sustainability strategies and actions to the lowest appropriate spatial scale of governance[8]. Put simply, this principle asserts that the closer governance and decision-making are to grass roots issues/concerns and contexts, the better for relevance and buy-in through community engagement (Dovers 2005:167). However, this assertion is challenged by the prevailing significance of national priorities and international concerns and agreements. National decision frameworks, strategies and incentives that underpin the level and timing of appropriate drivers may need to tread a middle path between providing top-down guidance and consistency across local and state governments, and bottom-up approaches that devolve risks and responsibilities to regional and local authorities.

ii. Decide which kinds of national policy leadership are required?

At issue is whether to show strong policy leadership or a less overt, coordinating role in policy development? From the perspective of local governments, national leadership could help to alleviate *ad hoc* decision-making (Smith, Brooke et al 2008). And it could also help decision-makers at all levels of government to resolve the struggle between those who advocate 'just-in-time' decisions versus those who want to be more pro-active and think long-term. The DIISR roundtable identified '**Leading from the Front**' as a key requirement of adaptation:

> … Leadership is required in promoting integration, facilitating education and research, and driving an effective regulation, tax and subsidy framework to promote change. However, responsibilities for the built environment are fragmented within national government itself, with a number of Ministers and departments having specific responsibilities for aspects of policy that impact on the built environment." (DIISR Briefing 2008: 27)

iii. Continue with cities fragmented by LGAs, or push for metropolitan commissions with over-arching planning powers?

The issue of appropriate spatial scales of governance is also crucial to climate change adaptation and, more generally, to sustainable urban development (Dovers 2005: 167; DIISR 2008; Steele and Burton 2010). City-wide spatial scales of government - e.g. encompassing the Sydney Metropolitan Region, or everything within Melbourne's Urban

[8] Dovers (2005:167) points out that subsidiarity should not be confused with *devolution* of authority to lower levels of government seeking more powers from higher levels; or conversely when responsibility for "irksome" policy issues such as management of coastal erosion zones and funding to meet landowners' compensation claims are foisted on to local governments.

Growth Boundary - seem necessary for developing consistent and effective policies and strategies. Yet they run the risk of generating an unwanted fourth layer of bureaucracy.

4. Policy-framing: principles and key drivers

What are the key principles and policy-framing drivers to consider, in framing a national adaptation policy for the built environment?

Policy-framing principles and drivers are scoped from national and international sources. Key drivers advocated by Australian thought leaders, researchers and industry partners reflect urban planning, sustainable building design and construction, and environmental engineering perspectives.

4.1 Principles for framing a climate change adaptation policy

Five principles that assist in framing sustainability policies (Box 4) are valid for climate change adaptation:

Box 4: Policy framing Principles

i. ***Persistence*** - climate change adaptation will require longevity and persistent efforts otherwise policy success will be difficult to achieve.
ii. ***Purposefulness*** – in addressing goals and objectives, and applying principles and measures that are widely understood and endorsed by the policy community.
iii. ***Information-richness and sensitivity*** – in the face of uncertainty, place a premium on the current highest quality information and *provisional* but credible knowledge that can be disseminated within research and policymaking networks.
iv. ***Inclusiveness –*** so that the logic of the policy measures and impacts are understood and can be influenced by a wide range of participants – and thereby trusted. This also involves inclusive modes of public discourse that are not labeled as '*Father tongue*' i.e. patriarchal and aloof government-speak
v. ***Flexibility*** - "…the ability to alter policy and institutional responses in the face of new knowledge or changed circumstances, and so that persistence and purposefulness do not develop into rigid and unchangeable patterns". (Adapted from Dovers 2005: 37).

4.2 Global perspectives on policy drivers

The following notable international organizations inform policy-makers of the key initiatives and key drivers of their multi-disciplinary stakeholders:

- World Business Council for Sustainable Development Energy Efficiency in Buildings program focuses on policy scenarios for transitions to zero emissions < www.wbcsd.org>
- ICLEI's Resilient Cities program provides a global platform for learning, cooperation and networking on all aspects of urban resilience and adaptation to climate change <www.resilient-cities.iclei.org>
- Clinton Climate Initiative <www.clintonfoundation.org/.../clinton-climate-initiative/what-we-ve- accomplished>

- UNEP Sustainable Building and Climate Initiative www.unpe.org/sbci is a partnership between UNEP and major public and private sector organizations, and NGOs. Its goals are:

  - **Provide a common platform for the stakeholders:** Provide a global platform for dialogue and collective action from buildings sector stakeholders to address sustainability issues of global significance, especially climate change;
  - **Develop tools and strategies:** Develop tools and strategies for achieving a wide acceptance and adoption of sustainable building practices throughout the world;
  - **Establish baselines:** Establish globally acknowledged baselines based on the life cycle approach, with a first focus on energy efficiency and CO2 emissions;
  - **Demonstrate through pilot projects:** Participate in, influence and support policy developments recognizing the role of buildings for mitigation and adaptation to climate change at local, national and/or global levels.

- UN-Habitat Cities and Climate Change Initiative seeks to enhance climate change mitigation and climate change preparedness of cities in developing and least developed countries.
  www.unhabitat.org/content.asp?typeid=19&catid=271&cid=6003

4.2.1 IPCC expert group for AR5

The IPCC expert group for AR5 has identified the need to develop revised policy frameworks for building and infrastructure codes that encourage adaptation *response capabilities,* low carbon intensity, and three more drivers relevant to the Australian context:

i. Design buildings and infrastructure that are "climate impact proof":

Focus on adapting to the increased probability of extreme weather events, and avoiding economic and social costs that can take out a significant percentage of regional employment - sometimes as high as 25% - and hence annual regional GDP (IPCC 2007b: 359).

ii. Consider adaptation to climate variability as a transitional driver:

As a **transitional** ''no-regret'' policy driver, develop adaptation strategies aimed at producing immediate benefits by reducing vulnerability to climate variability but which also have a longer-term benefit of reducing vulnerability to climate change. Both types of adaptation strategies are so similar that they mutually reinforce each other (Klein et al 2005: 580).

iii. Longevity of building and infrastructure stock is a key planning and investment issue:

The physical capital of buildings and infrastructure is slow to change. The planning horizon for refurbishing major infrastructure in Australia is typically 10 to 30 years; and major upgrades and replacements have an anticipated lifetime of 50 to 100 years (PIA, 2004). The IPCC expert group for AR5 accentuates the issue of *longevity:*

"A distinguishing feature of infrastructure assets such as buildings, roads, energy and water networks is their longevity. Once investments are made they determine the emission level for decades. This has implications for the necessary policy design as well as for owners of infrastructure assets and for investments in new infrastructure (private or public),

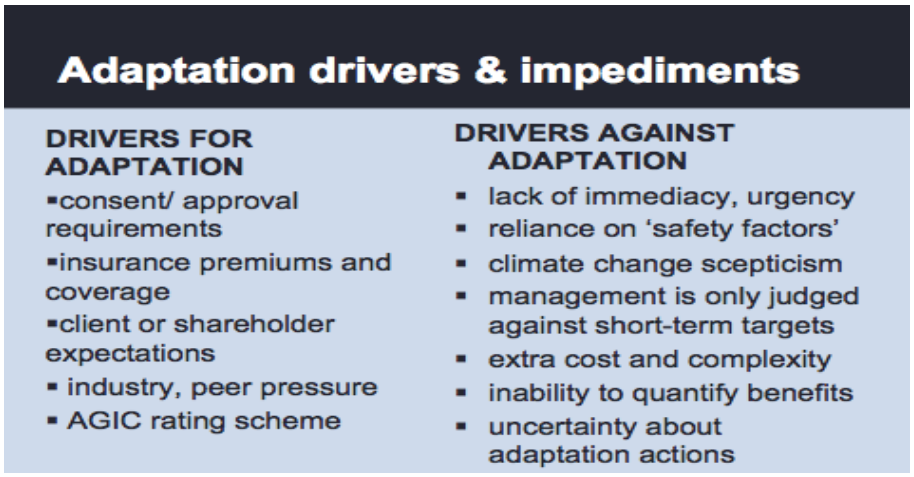
respectively. That is, structural change requires reliable long-term policies and land-use planning in order to avoid premature capital depreciation. From an investor's point of view, these long investment cycles bear an additional regulatory risk in addition to the risk that emerges from the impacts of climate change itself." (IPCC 2009:2)

4.3 National policy drivers

The National Australian Built Environments Rating Scheme (NABERS) requires mandatory disclosure of energy-related GHG emissions from new buildings. However, effective adaptation policy responses for the built environment must go beyond being synonymous with energy policy, to encompass holistic considerations of social and ecological concerns.

i. From the Australian Green Industries Council perspective:

Lees (2010) provides a perspective on adaptation drivers and impediments that concern environmental engineers and related industries and professions:



(Graphic courtesy of Parsons Brinckerhoff Australia)

ii. From an urban planning perspective:

The DIISR Briefing (Box 5) identifies climate change as one of seven key drivers[9] that will shape our cities and towns, requiring policy innovation and leadership:

> **Box 5: Climate change as a key driver in cities and towns**
>
> …Movement towards more 'carbon constrained' economies presents both challenges and opportunities to our cities and our built environment industries, and ensuring that Australia takes a lead in understanding, facilitating and delivering sustainable urban change will be central to continued global competitiveness. Many of the changes likely to be seen will be incremental, but transformation in a number of areas will be required. Given the timescales involved in financing, designing and delivering the built environment, decisions made over the coming years will be fundamental in establishing frameworks for next generation best practice. (DIISR p.2)

[9] Other drivers are peak oil, demographic change, urban densification, social inclusion and social equity, information technology and global competitiveness

4.3.1 Unpacking the key policy-framing drivers

i. Reduce the energy hungry nature of built environments:

The Australian Sustainable Built Environment Council (ASBEC) identifies the 'energy hungry' nature of Australian build environments and the need to achieve low carbon intensity in new buildings and retrofits (see *'The Second Plank – Building a Low Carbon Economy with Energy Efficient Buildings' 2010)*. These crucial factors need to be reflected in policy instruments including planning approaches to encourage energy efficient buildings and construction methods, increase the proportion of renewable energy sources to run buildings and infrastructure, and reduce urban heat islands (UHI).

ii. Build resilience to flood and drought cycles:

CSIRO and BoM warn that the exact nature of impacts in Australia, and regions most likely to be affected, are inherently difficult to predict because of our flood-and-drought cycles.

iii. Protect investments and assets:

The wealth invested in Australia's homes, commercial buildings, airports, seaports and other physical assets is approximately double the GDP (IPCC 2007b: 521). Coastal tourism industries and assets warrant special protection efforts. Regional economies are closely linked with climate-sensitive resources. Other economic Impacts are likely to include: water security problems for urban settlements, intensifying in southern and eastern Australia; and the mismatch of ongoing coastal development and population growth, especially along the eastern seaboard, exacerbating vulnerability and risks of coastal flooding from sea level rise and severe storms.

5. Portfolio of policy instruments and measures

Which pragmatic policy instruments can drive adaptation in the most appropriate areas, and get measurable actions happening?

Integrated strategic planning (ISP) is the most important policy instrument for state and local governments. However, the Constitution does not empower the Federal Government to mandate a nationally consistent planning code to drive adaptation[10]. In the meantime, it can produce a policy paralleling *Our Cities, Our Future: a national urban policy for a productive, sustainable and liveable future*, developed by the Major Cities Unit in the Department of Infrastructure and Transport. National policy instruments and tools to drive structural reforms across the States and Territories are limited largely to market-based mechanisms including tradable permits and economic incentives including tax deductions, offsets and credits.

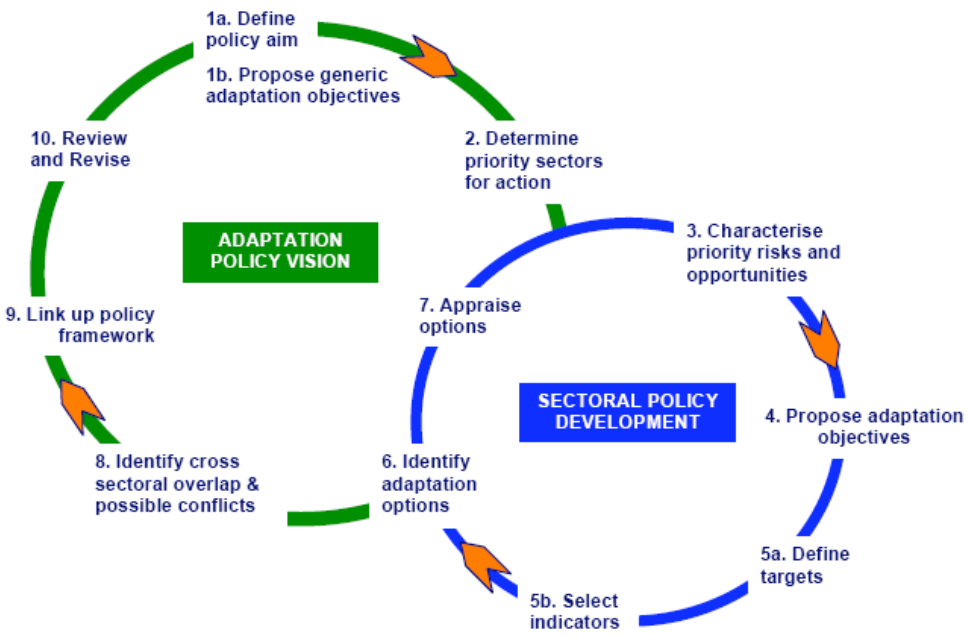
[10] Unless and until a) the Constitution is reformed; b) the Federal Government derives a 'head of power' by ratifying a future international convention enabling "an integrated regulatory approach and the capacity to adapt pre-existing environmental laws to deal with the novel problem of climate change" (Peel and Power, 2010); or c) an accord on ISP is reached through Cooperative Federalism that surpasses the 1992 Inter-Governmental Agreement on the Environment (IGAE) that initiated and implemented a national approach to environmental protection (Bates 2010: 527).

The adaptation policy instruments and measuring tools for the Australian built environment arena listed below are drawn from international and national sources. They assist decision-makers to:

- Apply systems thinking approaches to unlock capacities for adaptation (CATSS Report 2010: 4)
- Identify and appraise adaptive options to manage risks;
- Choose measures that are no-regret or low-regret, incremental and build adaptive capacities; and
- Determine which adaptive options require a local or regional approach.

However, there is a proviso: some of these adaptation policy instruments and measuring tools will need to be coordinated at all governance levels – national, state, regional, municipalities, enterprise, individual – to enable cost-effective implementation strategies (Bruņeniece and Bisters 2007).

5.1 Tool to link policy vision, sectoral development and review



Source: 'Objective setting for Climate Change Adaptation Policy' AEA Technology Environment and Stockholm Environment Institute, 2005

The policy-framing tool shown above, devised by AEA Technology Environment and Stockholm Environment Institute, links cycles of policy **vision** and sectoral policy **development** and fosters a systems thinking approach. Its policy instruments assist in determining adaptation objectives, prioritising risks and courses of action, selecting targets, and appraisal processes.

5.2 International/national instruments and measuring tools

Policy instruments and measuring tools are needed to drive adaptation in each of seven priority areas highlighted by the IPCC expert group for AR5:

i. introduction of advance warning systems;
ii. public awareness and capacity building;
iii. institutional structures facilitating collective action;
iv. economic systems allowing access to alternative[s];
v. contingency planning;
vi. risk management; and
vii. financing and investment in physical infrastructure to increase resilience.

International benchmarking tools are tabled in **Appendix E.** These include:

i. impact assessments;
ii. portfolio planning – developing parallel strategies and strategic options appraisals i.e. assessing each option through life-cycle costs, energy and water footprints, regulatory hurdles and so forth
iii. scientific evidence bases; and
iv. iterative stakeholder engagement processes
v. multi-criteria analyses
vi. cost-benefit analyses
vii. state-contingent and event-tree analyses (UK-CIP2)
viii. on-line spatial planning tools linked to GIS data e.g UKCIP Tool Wizard
ix. scenario analysis and scenario planning strategies – elaborated below.

However, note the quantitative tools require rigorous information as input for analysis, where the magnitude and probability of future events are uncertain. In addition two tools drawn from other disciplines warrant consideration:

x. Environmental Management tools: can be incorporated into policy instruments including cost-benefit analyses (CBA), GIS and multi-criteria analysis (MCA) (Harding et al 2009: 211-218).
xi. *Relationship maps*: these are a Developmental Evaluation tool (Patton 2008: 377) where an intended policy or program outcome is to develop new relationships between key stakeholder groups operating in complex and evolving open systems including managing shared natural resources such as urban water catchments.

5.3 Scenario planning

Scenario planning is emerging as a significant policy instrument and decision making tool, used by an increasing range of national and international governments and NGOs to cut through the complex challenges and messages of climate change, and drive adaptive responses (van Vuuren et al 2011). Agencies and organizations can link scenarios to scorecards and 'traffic lights' (see section 6.1) to frame early response strategies.

In a series of Special Reports on Emissions Scenarios (SRES), the IPCC has utilised scenarios and storylines to communicate the impacts and policy implications of projected temperature rises i.e. 2^0 C as the target at Copenhagen and Cancun for international agreements to curb emissions; and 4^0 C as the threshold for "game over, global economic wipeout"[11]. The most recent scenarios were published in IPCC Technical Paper VI-2008.

[11] John Barnett, 'Linking adaptation and maladaptation,' presentation to NCCARF Masterclass, 20 May 2011, Southbank Brisbane

Climate change researchers are now using integrated scenario analyses as a methodology to explore complex and uncertain future relationships between the key factors of GHG emissions, different mitigation targets, and requisite adaptation strategies to deal with impacts on important foci including populations, water and food resources, built environments and infrastructure, landuse planning, economic trends, and governance (van Vuuren et al 2011; Ison et al 2010, Jones 2010). Scenario approaches portray projected climate change *trends,* build shared understandings of the impacts (e.g. exposure, sensitivity, vulnerabilities), and provide a focus on *drivers and determinants* affecting the adaptive capacity and resilience of places, population groups, infrastructure and institutions. Scenario planning strategies also crystallise longer-term policy responses (and implications of failing to respond) and decision making by:

- Clarifying key trends and risks;
- Engaging citizens and stakeholders;
- Provoking and informing debate;
- Developing common understandings;
- Expanding the range of options to be considered; and
- Evaluating likely policy impacts

VCCCAR researchers also highlight how scenario planning provides an instrument for policy makers and practitioners to avoid the deficiencies of traditional linear planning and decision strategies. To maximise its value, policy makers need to understand the aims and outcomes that scenarios can deliver within the strengths, weaknesses, risks and opportunities of this method, and apply a scenario approach that best fits their purpose.[12]

5.3.1 Scenario typologies and enhancement criteria

Borjeson et al (2006) have developed a typology of scenario strategies:

- **Predictive scenarios (what is *likely* to happen)**: Scenarios that represent a range of probable futures, developed using quantitative data, expert advice and assessments of probability.
- **Exploratory scenarios (what *could* happen)**: Scenarios that represent potential future events and conditions. Not constrained by probability assessments, they draw upon diverse opinion, knowledge and experience and incorporate novel elements and high levels of uncertainty. They can be useful in testing the assumptions and mental models of scenario stakeholders.
- **Normative scenarios (what *ideally should* happen)**: Scenarios that represent ideal outcomes, such as successful adaptation. Their aim is to provoke exploration of the conditions and decisions needed to make the vision in question a reality.

For longer-term policy framing, plausible **exploratory** scenarios are preferable to predictive scenarios. They free up minds to contemplate broader ranging policy and strategic solutions, and escape from the mind-set that dictates: “If the predicted future trends, impacts, cost-benefits and so forth cannot be quantified, then we can’t go there” (Lempert 2011).

The plausibility of policy scenarios can be enhanced by three criteria proposed by Cash et al (2003) for successfully communicating key messages. These same criteria have been adopted by Preston (2011) to communicate climate change adaptation strategies and

[12] <http://www.vcccar.org.au/content/pages/scenarios-climate-adaptation> Accessed 15 April 2011

options:

- ***Salient*** – the scenarios address intersecting key factors and significant issues/concerns in international, national and regional domains.
- ***Legitimate*** – the scenarios are grounded in the weight of scientific evidence and/or in sustainability principles and planning codes.
- ***Credible*** – projected policy changes are based on internally consistent premises and cogent postulates.

5.4 Open access tools to communicate vulnerability

National and local vulnerability assessments can also function as policy communication instruments. Geoscience Australia has recently developed two open access on-line tools: *Smartline* which shows the projected sea level rise of 1.1 metres by 2100 as a superimposed yellow line above the existing coastline, nationwide; and *NEXIS* (the National Exposure Information System). CSIRO's *OzClim* on-line tool assists planners, communities and residents to grasp impacts on their specific locations.

6. Next steps: deciding implementation priorities

This section provides decision-makers with a suite of recommended implementation priorities and options that will be informed by further research and by the emergence of *policy windows* i.e. new opportunities for policy innovation. Experiences in environmental policy-making show that strategic action is more likely to be achieved when risks are known and resources are available to minimize them (Dovers 2005; Bovens 2006; Harding et al 2009). However, high levels of uncertainty also require a paradigm change from 'managing risk' scenarios to 'adaptive co-management' aimed at learning and prospering through change (Chen and Graham 2010). Keep knowledge management and decision-making processes moving forward in the face of scientific uncertainties. Not all the policy priorities are risk-based – it is also essential to build adaptive capacities and resilience.

6.1 Priority areas for policy implementation

Bring all policy instruments, including economic incentives and enabling laws, into effect to speed up adaptation processes. Policy implementation priorities include:

i. Decide which key vulnerabilities in built environments require national strategic planning initiatives. Prepare comprehensive assessments of adaptation options that provide guidance for managing hazards in high-risk areas including frequent flooding, bushfires, and coastal inundation.
i. Build the business case for adaptation: a robust policy framework will include socio-economic modelling to assess impacts.
ii. Produce better guidelines to enable adaptation planning to develop beyond its current infancy
iii. Investigate local and regional costs of projected adaptation planning for scenarios of sea level rises of 1.1 metres by 2100.

iv. Identify risks to buildings, transport, water, communication, energy and mining infrastructure, and insurance protection from an increase in extreme weather events.
v. Re-evaluate probable maximum precipitation and 1-in-250 year flood impacts on dams, bridges, and major urban infrastructure.
vi. Other policy priority issues to address include:
- Expand green spaces including green roofs and walls
- Improve urban food production
- Enhance regional and urban water supply
- 'Future proof' hospitals and other emergency services buildings
- Enhance thermal properties – reducing urban and regional heat island effects
- Promote public transport and bicycle networks.

6.2 Policy implementation strategies

Policy implementation strategies include fostering resilience thinking, flexible policy reviews, advocating new collaborative governance processes, engaging with early adopters and champions, and persuasive communication tools.

i. Apply 'resilience thinking' to the built environment

Current decision-making processes for climate adaptation are predominately based on risk management. These help us to plan for worst-case scenarios but resilience-based approaches encourage positive outcomes, and open up possibilities of better understanding, adapting and prospering from changes - a case of hope overcoming despair (Chen and Graham 2010). Apply resilience thinking skills and problem-solving agility to planning for vulnerable built environments using performance criteria focused on the amount of shock that the built environment can absorb while providing basic services; degree to which the built environment is capable of self-organizing; and degree to which citizens in their built environments can learn through change (Chen and Graham, 2010).

ii. Adaptive decision-making and flexible policy reviews

Maintain policy *flexibility* to "alter policy and institutional responses in the face of new knowledge or changed circumstances, so that persistence and purposefulness do not develop into rigid and unchangeable patterns" (Dovers 2005:37).

iii. Explore collaborative governance processes

The DIISR Briefing highlights the concept of *network governance* as "an emerging feature of the 21st Century Australian city, capturing innovation taking place as well as providing an enabling framework for further change." *Collaborative governance* (CG) approaches involve public agencies and non-government actors in collective decision-making: "As with collaborative learning, the key attribute of CG is not simply to reach an agreement, but rather to develop understanding and long term relationships between previously opposing actors" (Harding et al 2009:77).

Discourse arenas[13] resolve tensions between experts' technical knowledge vis-à-vis local citizens' lay knowledge of adaptive management issues. Locals are enabled through stringent facilitation to speak on par with scientists and environmental managers, without feeling intimidated by technical jargon and rank. It is a collective learning process rather than a dispute between parties where each side assumes possession of the necessary facts (Ison 2004).

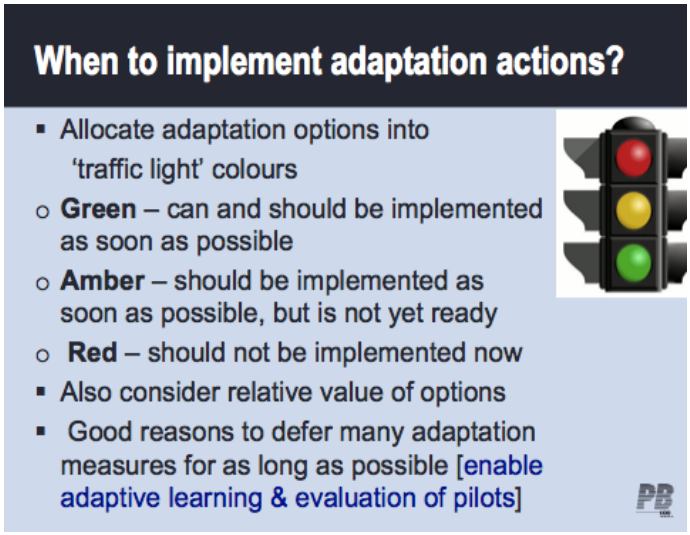
iv. Engage early adopters and champions

Adaptation policies are unlikely to be effective without support from early adoptors and champions across the built environment arena, whose involvement grows from a clear understanding that policy objectives are comprehensive, coordinated and make good sense. Focus areas for persuasive key messages include strategies to get around the "irritation" felt by a significant percentage of Australians who deny anthopocentic climate change, and other emotional barriers (Leviston and Walker 2011; Walker et al 2011).

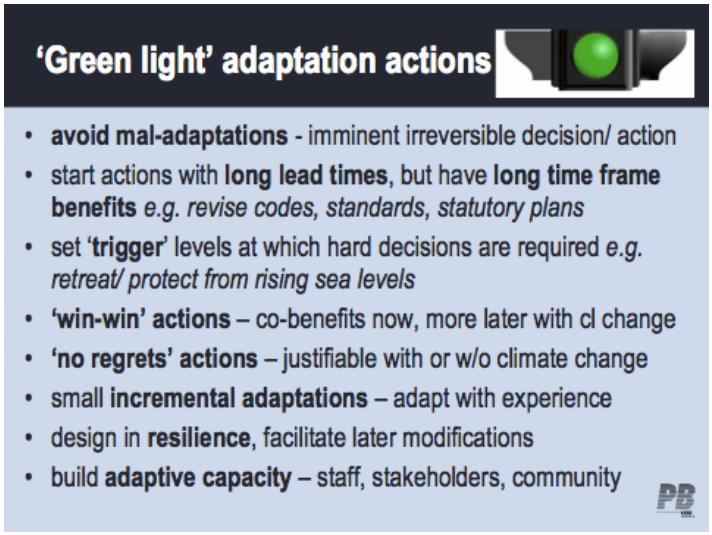
v. Use spatial maps and visuals to communicate priorities and solutions

Take advantage of emerging visual communication tools to inform and engage communities in adopting green building designs. Spatial mapping and modelling tools show how various strategies for buildings and urban landscape design can ameliorate extreme weather events (CATTS Report 2010). Use networks and communities of practice foster the practical knowledge of local trades people and indigenous communities. Improved remote broadband via the NBN will enable rural communities to access adaptation knowledge and see case studies.

vi. Decide on the right moments to implement 'green light' actions



[13] Facilitated in the European Water Commission's Social Learning and Integrated Catchments program (SLIM) after technical experts failed to foresee and manage a series of catastrophic floods, droughts and river ecosystem collapses across Europe (van der Brugge and van Raak, 2007; Pahl-Wostl, Sendzimir et al, 2008).



(Green lights graphics courtesy of Parsons Brinckerhoff Australia)

6.3 Reassess priorities through adaptive learning

Research and evaluation methods to scope emerging opportunities for implementation pathways include in interviews and surveys of influential thought leaders to gain their insights on emerging trends and innovations (Patton 2010: 330) and subsequently engage them as champions of a preferred implementation pathway. Ongoing reassessments of national policy goals, priorities and options for the national policy framework can be guided by adaptive learning and evaluative thinking questions, including:

- Does the *internal logic* of the intended policy goals, priorities and options stack up? Are the internal logic statements – i.e. *If we do this* $\Rightarrow$ *then it should yield this and that* - derived from preceding empirical or social research, or are we entering the realm of uncertainty?
- Who are the key stakeholders and target audience(s)? Are they the *right targets*?
- Will this policy and its implementation program really *make a difference*? Do the aims and intended outcomes cut through to central issues /concerns – or are they peripheral?
- If it's a very innovative or different policy to the status quo, then is it a *feasible* change? What or whose resistance (barriers to change) must be overcome?
- Are we likely to get *value* from the resources invested?

7. Conclusion: Pathways to Implementation

The most crucial implementation pathway is longer-term strategic planning. Appropriate ways to reach towards this outcome and other recommended policy priorities and options, in the next year or so, include:

vii. Lobbying for a national advisory body for adaptation in the built environment, akin to Infrastructure Australia

viii. Tabling this position paper at the next LGPMC meeting and at the new COAG Ministerial Council to address climate change issues (to be convened in the second half of 2011)

ix. Publication as an on-line issues paper open for comments and feedback

x. Dissemination through relevant professional associations including the BDEP, ASBEC, AILA and ATSE

xi. Liaison with Local Government Associations in each State and Territory and ALGA

xii. Stakeholder roundtables enabling thought leaders from industries, institutions, and research centres to meet with community champions, explore future scenarios and decide on adaptation strategies within the national policy framework.

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Appendix A: Glossary of key adaptation concepts

'Climate change', 'adaptation' and 'vulnerability' are defined differently by international organizations including the IPCC, UNDP, UNFCC and OECD. They may also differ from meanings ascribed by the Department of Climate Change and Energy Efficiency (DCCEE) and other agencies in Australia.

Both DCCEE and UNFCCC distinguish **anthropogenic** climate change from naturally occurring climate **variability**. In this position paper '**climate change'** refers to human activities that are directly and indirectly altering the atmospheric composition to create *radiation forcing* - more commonly known as global warming (Preston and Stafford-Smith 2009:16). Whereas **climate variability** refers to impacts of natural phenomena including fluctuations in solar radiation, volcanic activity, meteor collisions, and different degrees of tilting in Earth's axis causing ice ages and interglacial periods.

Adaptation: The UNDP considers adaptation as a *process* of developing, implementing and enhancing strategies to moderate, cope with and take advantage of the consequences of climatic events. Other organizations and national programs including the United Kingdom's second-generation Climate Initiatives Programme (UK-CIP_2) emphasise *outcomes* that reduce risks of harm, and opportunities to realise benefits from prescient adaptations. Levina and Tirpak draw attention to the implications of these differences in meaning for policy-making, funding and accountability:

> "Expectations from adaptation as an **outcome** might be much higher than expectations from it as a **process**. Funding aspirations and evaluation of achieved results would also vary accordingly…The IPCC broadens this definition by distinguishing various types of adaptation (e.g., anticipatory, reactive, public, planned adaptation, etc.) and focuses not only on technical adaptation measures but also on institutional responses… These varied interpretations could have **serious financial implications**." (Levina and Tirpak 2006:5 – bold added)

Adaptation may be anticipatory or reactive, planned or autonomous, public or private. "*Anticipatory* or proactive adaptation occurs before impacts are experienced and is preferable where impacts are irreversible or catastrophic, and where the costs of prevention are lower than remediation or reactive adaptation. *Planned* adaptation is the result of a deliberate policy decision, whereas *autonomous* adaptation is an individual response… triggered by ecological or environmental changes in natural systems or by market or welfare changes in human systems." (McDonald **i**n Bonyhady et al 2010: 8 – italics added)

Adaptive capacities – the ability to respond successfully to climate variability and change including planning strategies, laws and other "adjustments in behaviour, resources and technologies. It is comprised of a society's or system's financial, human, technological, infrastructural, institutional and natural capital… Institutions that are resistant to change… can operate as barriers to adaptation, especially where transformational shifts are required." (ibId p.11)

Resilience is often used interchangeably with, or in preference to *adaptation*. This concept is drawn from adaptive cycles seen in natural systems (Holling and Gunderson, 2002). *Resilience* ascribes the ability of both natural and human systems to maintain core functions through feedback loops and to reorganise following disturbance, through *coping*

capacities. Natural and human systems have a *coping range* up to a critical threshold. Beyond this *tipping point* is an undesirable state of no return where coping capacities fail, often irreversibly, and the system is fundamentally altered or destroyed (Capra 2005; Harding et al 2009; Walker et al 2002).

Agility is used in the contexts of adaptive management and adaptive learning to describe agile responses, nimble thinking skills and rapid problem solving approaches to complex issues. Jackson et al (2010: 80) have coined the term s*ustain**agility*** to "emphasise the importance of developing strategies for adaptive capacity and transformability that consider trade-offs at multiple scales. This is in contrast to simply sustaining the present conditions or systems through increased resilience, that is, the capacity of a system to experience shocks while retaining essentially the same functions and structures."

Vulnerability: is the degree to which complex geophysical, biological and socio-economic systems are **susceptible to or unable to cope** with adverse climate change impacts. Key vulnerabilities include food supply, infrastructure, health, water resources and coastal systems. Identification of potential key vulnerabilities in built environments should guide decision-makers in determining critical systems thresholds (IPCC 2007b: 781).

Risk combines the **magnitude** of an impact with the **probability** of its occurrence. Thus *risk* captures the degree of uncertainty in anticipating and assessing climate change exposure, impacts and adaptation. In IPCC, CSIRO and BoM parlances, *likelihood* of a risk equates with 2 chances in 3 (66%), while *very likely* equates to 4 chances in 5 (90%) of occurring.

McDonald cautions that a purely risk-based approach that ignores underpinning causes of vulnerability or that cannot be implemented because of limited capacity is bound to fail. Policies will need to demonstrate an understanding of major risks, introduce some risk-specific measures (ibid p.11)

Jones (2010) makes these distinctions between ***tame*** and ***complex*** risks:

- *Tame* risks have agreed framings, bounded values, agreed processes for calculating risks, and processes to reconcile perceived and calculated risks. They can be 'fixed' by timely actions.
- *Complex* risks have multiple frames, unbounded values, 'deep' uncertainties and risks attached to acting and not acting

Appendix B: Call to Action from BEDP

The Australian Council of Built Environment Design Professions (BEDP) is calling on the federal and state governments to develop an overarching sustainable settlement policy as a matter of national priority. In the face of international recognition of the emerging threats posed by abrupt and irreversible damage to the climate of our planet, governments around the world are increasingly adopting aggressive mitigation portfolios in their policy approaches to:

- current sustainability challenges relating to developments across the spectrum of metropolitan, suburban, coastal, regional and remote settlements,
- those settlements being planned for the future generations as cities expand, and
- those settlement areas requiring urgent retrofitting to deal with current climate change impacts.

Within Australia, significant leadership has been demonstrated across all levels of government in relation to sustainable settlement, through a wide range and scale of initiatives targeting carbon pollution reduction, energy efficiency, emissions trading, renewable energy, infrastructure and water. The national Sustainable Settlement policy should build on such existing initiatives and provide support to them—by locating them within an integrated national framework. The national Sustainable Settlement policy would provide:

- An overarching and integrated strategy by which Commonwealth, State and Local Government policy initiatives can operate within a national/state framework.
- A framework that links and integrates other urban related policies such as 'smart cities', urban design, sustainability charters, built environment policies and sustainable communities.
- Guidance in the development of capital city strategic planning systems, (currently under coordination and review by COAG), as well as decision-making support for other COAG initiatives, including focus on national climate adaptation response, housing supply and affordability.

Appendix C: Developmental Evaluation and policy making

Developmental evaluation is a collaborative decision making enterprise designed to support continuous improvement, adaptation and intentional change. As a member of a team tasked with formulating innovative responses to thorny strategic policy and program development issues, the evaluator plays a key role in elucidating team discussions with evaluative questions and logic, applying program theory and facilitating evidence-based decision-making.

The Developmental Evaluation methodology can be applied to all stages of policy making and program design. Five applications are relevant to framing a climate change adaptation policy and scaling-up for national implementation:

Applying Developmental Evaluation to policy making

i. ***Ongoing development* to adapt a policy**, strategy, program or another kind of innovation to new conditions in dynamic systems.
ii. ***Adapting effective principles to a local context*,** as ideas and innovations are taken from elsewhere and developed into a new setting by a combination of bottom-up and top-down drivers.
iii. ***Pre-formative development of a potentially broad-impact, scalable innovation,*** to a point where it is ready for traditional formative and summative evaluation methods.
iv. ***Major systems change and cross-scale developmental evaluation***, providing feedback on where, how and why an innovation needs adjusting to optimize impact.
v. ***Developing a rapid response in the face of major change or a crisis*** such as a financial meltdown, epidemic or natural disasters – catastrophic bushfires, prolonged heat waves, earthquakes, tsunamis… (Adapted from Patton 2010: 194-5)

Provisional findings on policy/program implementation strategies are presented to decision-makers in *real-time* i.e. as they emerge and in context rather than waiting for conclusive findings on whether intended outcomes were delivered, from an end-of-program evaluation. Developmental evaluation also contributes to the *formative* stage of evaluating policy/program piloting and scaling up for full delivery (Scriven 1991; 1993; Weiss 2007; Davies 2009). A mandated *summative* evaluation, set within a prescribed timeframe, brings rigour and accountability to the final stage of policy review.

Real Time evaluation

> "[P]erhaps even more than evaluations of programs and direct services, evaluations of advocacy and policy change can benefit from real-time reporting. Most advocates' strategies for achieving their policy visions evolve without a predictable script. Consequently, advocates regularly adapt their strategies in response to changing variables and conditions. To make informed decisions, advocates need timely answers to the strategic questions they regularly face. Evaluators who provide real-time feedback need to stay on top of advocacy strategies and focus less on their own predetermined reporting timelines and more on the timelines of who or what is being evaluated (in this case advocacy and policy change efforts). Their evaluations, at least in part, need to build in flexibility, so that when a strategy changes or a critical event occurs, the evaluation can adjust with it…
>
> The purpose of real-time reporting is to position the evaluation to inform ongoing decisions and strategy. True real-time reporting requires more than providing feedback at regular

> intervals. It means giving feedback quickly after a significant event or action occurs… evaluators very literally expect the unexpected and reserve part of their evaluation design for "rapid response research." These methodologies are not planned up front but are designed and implemented as needed to address emerging strategy-related questions." (Heather Wiess, The Harvard Exchange, XIII (1) Spring 2007: pp. 1-3)

Appendix D: Vulnerable built environment sectors and adaptation responses

Sectors at risk	Potential impacts	Adaptation responses	Key reports and legislation frameworks
Cities and Coastal Communities	Provision of basic services is challenged: water, energy supply, transportation etc Coastal areas under threat of inundation & erosion, especially major infrastructure damaged due to increased storm & cyclone intensity/ frequency & associated socioeconomic loss. Coastal development affected by investment uncertainties & stricter limitation on developers in vulnerable areas. Possible scenarios: - Insurance companies refuse to insure properties in seaside towns. - State govts ban new dwellings in identified vulnerable coastal areas.	Current coastal line management in Australia is fragmented; needs a consistent national policy to coordinate new coastal building codes & relocation plans; periodically revise evacuation enforcement plans. Consistent planning measures needed: setback lines, planned retreat, building designs & new regulations that account for projected sea-level rise Regulate urban sprawl in vulnerable areas through zoning & land use control Educate and inform communities about possible climate change impacts. National Sea Change Taskforce recommends development of a collaborative, national approach between all levels of government to manage population growth in non-metropolitan coastal areas; & enhance funding to local authorities with special focus on vulnerable coastal communities Community Coast Care Program to better protect coastal environment (Dept CC) Great Barrier Reef Rescue Plan to help	'Managing our coastal zone in a changing climate: the time to act is now' (House Standing Committee on Climate Change, Water, Environment and the Arts, Final Report 2009) *Recommendation 22*: Building Code of Australia, including cyclone building codes, be revised with the objective of increasing resilience to climate change. 'National Coast Assessment-Climate Change Risks to Australia's Coasts (Dept Climate Change, Nov 2009)' 'Mapping Climate Change Vulnerability ' (Sydney Coastal Council Groups and CSIRO 2008) 'Case studies of Adaptive Capacity: Systems Approach to Regional Climate Change Adaptation Strategies (SCCG and CSIRO 2008) Implications of climate change for Australia's World Heritage properties - Australian National University to assess the exposure, potential impacts & adaptive capacity of our World Heritage sites to climate change & identify major knowledge gaps.

		secure the Reef from climate change & declining water quality (DCC)	
Infrastructure	Climate change impacts are likely to exceed the designed criteria for extreme events Adapting existing infrastructures to climate change impacts facing challenges due to the long life span of the designed infrastructure and the lagged climate-related extreme evens consideration Increased damage likely for built environments, telecommunications & energy supply.	For new infrastructure projects, integrate climate change impacts into infrastructure design guidelines Conduct adaptation plans as well as socio-economic-ecological cost and benefit analysis for the long life span of existing infrastructure.	Assessment of Impacts of Climate Change on Australia's Physical Infrastructure (Australian Academy of Technological Sciences and Engineering (ATSE), 2008 Impact of Climate Change on Infrastructure in Australia and CGE Model Inputs, Garnaut Climate Change Review (prepared by Maunsell Australia and CSIRO Sustainable Ecosystems)

Appendix E: International review of policy tools

Types of Tools	Countries & Programs	Tools	Further information
UN, EU & National Strategies	United Kingdom	**National Adaptation Policy Framework**	<www.defra.gov.uk/environment/climatechange/adapt/policy frame.htm>
	Finland	**National Strategy for Adaptation to Climate Change:** Priorities identified for increasing adaptation capacities for the next 5 to ten years include: (i) mainstreaming climate change impacts and adaptation into sectoral policies; (ii) targeting long-term investments; (iii) coping with extreme weather events; (iv) improving monitoring systems; (v) strengthening research and development; and (vi) international cooperation.	Finnish Ministry of the Environment's web page on the National Strategy for Adaptation to Climate Change: www.ymparisto.fi/default.asp?contentid=172203&lan=en
	France	**Strategie nationale d'adaptation au changement climatique**	<www.developpement-durable.gouv.fr:IMG:ecologie:pdf:Strategie_Nationale_2.17_Mo-2.pdf>
Vulnerability, Risk, and Impact Assessments	United Kingdom	**Regulatory Impact Assessment:** Assesses the vulnerability of a proposed policy to a variety of risks, one of which is the predicted effects of climate change.	Department for Business, Enterprise and Regulatory Reform web site: <www.berr.gov.uk/> Direct access to the Impact Assessment Toolkit: <www.berr.gov.uk/bre/policy/scrutinising-newregulations/ preparing-impactassessments/ toolkit/page44199.html> UKCIP web site: <www.ukcip.org.uk/> Direct access to the UKCIP Tools portfolio: <www.ukcip.org.uk/index.php?option=com_content&task=view&id=74&Itemid=187>
	United Kingdom Climate Initiatives Program – UKCIP2	**Business Assessment Tool**: Helps users explore implications of climate change for a particular business or sector.	
		Local Climate Impacts Profile: Resource that local authorities can compile to better understand their exposure to *weather* and *climate*.	
Probabilistic Scenarios	UK ClP2	**Scenario Gateway**: Provides climate change data for a range of possible future scenarios. **Socio-Economic Scenarios**: Explore possible futures & consider how socioeconomic changes could modify people's vulnerability & affect adaptation responses.	UKCIP web site: <www.ukcip.org.uk/> Direct access to the UKCIP Tools portfolio: <www.ukcip.org.uk/index.php?option=com_content&task=view&id=74&Itemid=187>
	Sustaining Knowledge for Climate Change (SKCC)	**SKCC Briefing Paper 2**: Applying probabilistic climate information for the built environment & infrastructure – issues & challenges	
	Finland	**Integrated assessment modeling of global change impacts and adaptation**: Web tool for planners & researchers allows users to investigate possible impacts of climate	Direct access to web tool: <www.finessi.info/finessi/

		change in Finland on chosen impact areas & different time periods in 21st century.	
	France:	**Local Future Climate Change Scenarios** Observatoire National sur les Effets du Rechauffement Climatique (ONERC)	ONERC web site: <www.ecologie.gouv.fr/-ONERC-.html>
Guidance to help develop a CCA strategy &/or action plan	United Kingdom Climate Initiatives Programme (UKCIP)	**UKCIP Adaptation Wizard**: Intro>Themes>Buildings>menu includes: - Climate impacts on BE - Adaptation responses BE - Urban Design UKCIP Adaptation Wizard: tool to help determine vulnerability to climate change, identify options to address relevant climate risks, and develop a CCA strategy. **Risk, Uncertainty and Decision- Making Framework**: step-by-step iterative process to help decision makers judge the significance of CC risk compared to the other risks. Enables users to decide most appropriate adaptation measures. **Nottingham Declaration Action Pack**: Web-based tool provides guidance for producing action plans covering mitigation & adaptation to climate change. **UKCIP Adaptation Resources**: range of tools providing guidance for organizations to identify adaptation options	UKCIP web site: <www.ukcip.org.uk/> Direct access to the UKCIP Tools portfolio: <www.ukcip.org.uk/index.php?option=com_content&task=view&id=74&Itemid=187>
	UNFCCC-National Adaptation Programmes of Action (NAPAs)	**NAPA Guidelines**: provides guiding elements to prepare a NAPA, which helps least developed countries identify priority actions to respond to their current vulnerability to climate change.	UNFCCC web site: <http://unfccc.int/adaptation/napas/items/2679.php> NAPA Data Base web site provides a knowledge base for preparation & specific tools for NAPA support: <www.napa-pana.org>
Costing Impacts	UKCIP2	**Costing the Impacts of Climate Change**: A methodology for calculating the costs of climate impacts. Explains how to compare with costs of adaptation measures.	UKCIP web site: <www.ukcip.org.uk/> Direct access to the UKCIP Tools portfolio: <www.ukcip.org.uk/index.php?option=com_content&task=view&id=74&Itemid=187>
Indicators	France/ONERC	Indicators of observed climate change scenarios	<http://onerc.org/listAllIndicators.jsf>
	Finland	Indicators of observed climate change	Finnish Ministry of the Environment's web page on the National Strategy for Adaptation to Climate Change: <www.ymparisto.fi/default.asp?contentid=172203&lan=en>