

# Adaptation to Climate Change: Issues for Business

Summary Report

August 2010

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This paper is a summary report of a more detailed piece of work which can be found on [www.forfas.ie](http://www.forfas.ie)

## Executive Summary

Credible international scientific evidence has confirmed that human activities have begun to modify our climate and that such change will have significant social and economic implications. An effective response to climate change must combine both mitigation - avoiding the unmanageable - with adaptation, managing the unavoidable.

In recognising the need to ensure that our society and economy are resilient to the realities of a changing climate, Irish policy is now considering how we can adapt to climate change. Forfás is inputting business issues into this process. This paper summarises the key enterprise issues arising.

### A changing climate can impact on business

A number of key pieces of research have shown that Ireland's climate is changing and that in the future, temperatures will continue to rise, winters will become wetter and summers drier, floods will become more likely and storms will become more intense. While not all business sectors will be equally impacted, these climate changes will impact on Irish businesses through changing markets, impacts on premises and processes, increased vulnerability of supply chains, and may have implications for investments, insurance costs and stakeholder reputation.

### Climate changes can bring business opportunities as well as risks

Changes in climate can also bring opportunities as well as risks for Irish businesses. This is particularly the case as Ireland is expected to be relatively less affected by climate change than a number of key global trading partners/ competitor countries. Properly managed, Ireland can have competitive advantages through access to significant water resources, an ongoing temperate climate, etc. These advantages can be marketed to inward investors and act as a competitive advantage for indigenous firms.

### There are likely to be costs for businesses and the economy

Climate change can have significant costs. As an indication of what the potential vulnerabilities to climate change might be, the insured property cost of the November 2009 floods totalled €244m. Beyond property damage, the floods also impacted the economy through inability of workers to access work, water shortages, impacts on water quality and power-outs. Such losses of sectoral output and infrastructure damage on an increased basis can have persistent negative impacts on economic growth.

### **Business planning will be central to realising potential opportunities and minimising risks**

Planning ahead by businesses can reduce costs and help realise opportunities. At present, many Irish businesses are not including climate risks or opportunities into their business planning. Building awareness and capacity amongst these businesses of climate risks and opportunities will be central to ensuring successful business adaptation in Ireland.

### **Adapting business infrastructure and the policy framework will also be key to successful adaptation**

Critical pieces of business infrastructure (such as water and energy) will be impacted by climate change. Owners/ public authorities that manage critical infrastructures will need to plan to ensure that these pieces of infrastructure are climate resilient. The policy framework and regulatory structure are also key to ensuring that businesses in Ireland can minimise climate risks and realise potential opportunities and a range of policy measures will have to incorporate changes in climate.

Our central conclusion is that, properly prepared, adaptation can provide opportunities for businesses in Ireland and that the threats can be managed.

## **1. Introduction**

### **An effective response to climate change will have to combine adaptation with existing mitigation measures**

Credible international scientific evidence has confirmed that human activities have begun to modify our climate and that such change will have significant social and economic implications. To date, the policy response to this climate change has focused largely on mitigation measures by reducing greenhouse gases emissions through energy efficiency measures, the Kyoto Protocol, emissions trading schemes, etc. While it is of utmost importance that such mitigation measures are continued, there is now recognition that regardless of the success of mitigation measures, the global climate will continue to change and that adaptation measures are needed to manage the unavoidable. An effective response to climate change must combine both mitigation - avoiding the unmanageable - with adaptation, managing the unavoidable.

### **Irish policy is now considering adaptation and Forfás is inputting business issues into this process**

The Department of Environment, Heritage and Local Government has committed to developing a National Adaptation Plan. There are a number of strands involved in the preparation of this plan and Forfás has and is providing research and advice on enterprise policy aspects in conjunction with the Department of Enterprise, Trade and Innovation (DETI) at each of the following stages:

- Ongoing participation on the National Climate Change Impacts and Adaptation Steering Group.

- Work which is currently being finalised by the Environmental Protection Agency (EPA) on national climate change adaptive capacity and is due for publication in September 2010.
- The draft Climate Change Bill which is expected to require the publication of a National Adaptation Plan within 12 months of enactment of the Bill. The Climate Change Bill will also require a number of sectors - including enterprise - to produce sectoral adaptation action plans. The Forfás adaptation project is expected to form a key basis of the sectoral action plan for enterprise.
- The production of an initial framework document for the National Adaptation Plan which is expected to be published in Quarter 3 2010.

### The research process in which Forfás has engaged

In preparing this work, Forfás has undertaken an extensive literature review and engaged with its sister agencies (IDA Ireland and Enterprise Ireland), a range of business interests (including an IBEC business workshop, one-to-one engagements with businesses, utility providers, industry representative organisations and the UK Carbon Disclosure Project) and policy stakeholders (including the Department of Enterprise, Trade and Innovation, the Department of Environment, Heritage and Local Government, the EPA, Sustainable Energy Authority of Ireland, Irish Academy of Engineering and the UK Climate Impacts Programme)<sup>1</sup>.

## 2. How the climate is changing

### Some climate change is unavoidable for Ireland

A range of institutions are engaging in research on climate change impacts for Ireland<sup>2</sup>. This research to date has shown conclusively that, in line with global patterns, Ireland's climate has changed over the past 100 years. Importantly, these climate change impacts are projected to increase in the coming decades and during the rest of this century. The research

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<sup>1</sup> Specific inputs on the draft have been directly received from the enterprise development agencies (IDA Ireland and Enterprise Ireland), policy stakeholders (such as the Irish Academy of Engineering, UK CIP, EPA, SEAI), utility providers (such as the ESB and Eirgrid), business representative bodies (such as IBEC) and businesses in a range of sectors (including Glen Dimplex, Ecocem, APCC, EMC and 4Front Energy & Environmental). Forfás is very grateful for the inputs provided.

<sup>2</sup> Key pieces of research and weblinks on climate impacts for Ireland include:

- A Summary of the State of Knowledge on Climate Change Impacts for Ireland, EPA, November 2009. [http://www.epa.ie/downloads/pubs/research/climate/CCRP1\(low\).pdf](http://www.epa.ie/downloads/pubs/research/climate/CCRP1(low).pdf)
- Ireland in a Warmer World, UCD/ Met Eireann/ C4I, June 2008 [www.c4i.ie/docs/IrelandinaWarmerWorld.pdf](http://www.c4i.ie/docs/IrelandinaWarmerWorld.pdf)
- Irish Climate Analysis and Research Units (ICARUS), National University of Ireland Maynooth (NUIM). [www.icarus.nuim.ie](http://www.icarus.nuim.ie)
- Ensembles. <http://ensembles-eu.metoffice.com/>

points to the following changes of climate which are likely to bring resulting challenges to which Ireland’s economy and society will have to adapt:

- **Temperatures: the Irish climate will continue to warm.** Estimates of the scale of increase in temperatures from different pieces of research range from one to four degrees Celsius by the end of the century. All seasons are expected to be warmer with some research indicating that the greatest warming will occur in the summer and autumn seasons. The south and east of the country are predicted to be the warmest regions.
- **Rainfall: rainfall patterns are expected to change with wetter winters and drier summers.** Regional modelling points to wetter winters in the west and drier summers in the south-east.
- **Floods: flood events - both coastal and riverine - are likely to become more frequent.** Sea levels are conservatively predicted to rise by 60 cm by the year 2100. Changes in sea levels are predicted to magnify impacts of changing storm surges and wave patterns in coastal areas. Changes in precipitation and temperature are likely to lead to a rise in winter stream flows (increasing the risk of flooding) and a reduction in summer flows.
- **Storms: more frequent and severe stormy weather is predicted.** Ocean modelling results indicate an increase in the frequency of storm surge events around Irish coastal areas.

### What are the likelihoods of climate risks?

Likelihoods of events are key drivers in helping businesses make decisions on the extent to which they wish to adapt. Although significant improvements have been made in improving climate models, there will always be uncertainties associated with climate projections. The robustness of the most recent trends and projections in the main climate variables for Ireland have all been expressed in “medium” confidence levels which at this point, translate to about 50% confidence in being correct in line with the definitions set out in the UNFCCC Fourth Assessment Report<sup>3</sup>.

**Table 1: Projected changes and current confidence projections**

Climate Variable	Projected Changes	Confidence Projection
Air temperature	1-3°C to 2100, compared to the 1961-2000 average.	Medium (5 out of 10 chance of being correct)
Heat waves	Increased frequency of heat waves.	Medium (5 out of 10 chance of being correct)

<sup>3</sup> Guidance Notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties, Intergovernmental Panel on Climate Change, July 2005. Available at <http://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf>

Cold snaps/ frost days/ nights	Decreased frequency.	Medium (5 out of 10 chance of being correct)
Precipitation	Wetter winters in the west, Drier summers in the south-east.	Medium (5 out of 10 chance of being correct)
Extreme weather	Slightly fewer storms, but more intense. Northward shift in storm tracks.	Medium (5 out of 10 chance of being correct)
Ground- and surface-water runoff	Increased flow to rivers in winter and less in summer.	Medium (5 out of 10 chance of being correct)

Source: EPA Summary of the State of Knowledge on Climate Change Impacts for Ireland (2009)

**Impacts vary globally, but Ireland is expected to be relatively less severely impacted than many of our key trading partners/ competitors**

The severity of impacts of climate change is likely to vary by region and within regions<sup>4</sup>. All countries are likely to be impacted in some way by climate change:

- **Europe:** Southern Europe, the Mediterranean Basin, outermost regions and the Arctic are the most vulnerable to rising temperatures. Furthermore, mountain areas (in particular the Alps), islands, coastal and urban areas and densely populated floodplains are facing particular problems.
- **North America:** Significant sea-level rise and storm surges will adversely affect coastal cities; water supplies will become increasingly scarce in a number of regions (such as the southwest United States); severe flooding due to sea-level rise and heavy downpours are likely to occur more frequently in regions such as mid-west and north-east America; agricultural production in key regions such as mid-west America are likely to be adversely affected. Parts of Northern Canada may experience increased navigability of Arctic marine waters. Some impacts could be beneficial for some key Canadian economic sectors, including hydroelectricity and forestry. There will likely be increased shoreline erosion in some key areas of social and economic activity.
- **Asia:** Increased frequency, intensity, and duration of heat waves are likely in East Asia and Korea; heavily-populated coastal regions, including the deltas of rivers such as the Ganges and Mekong, are likely to be at risk of increased flooding; forecast changes in temperature and rainfall are likely to reduce crop yields overall.
- **South America:** Sea level rise is very likely to bring flooding to low-lying regions such as the Rio de la Plata estuary; changes in rainfall patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation; drier areas are likely to see salinisation and

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<sup>4</sup> Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007.



desertification of agricultural land, with falling crop yields and livestock productivity reducing food security.

- **Australia and New Zealand:** The length and frequency of dry spells over Australia and New Zealand is expected to increase, with increased seasonable droughts over many mid-latitude continental interiors; ongoing water shortages, notably in southern and eastern Australia, are likely to get worse by 2030; increased risk of coastal storms and flooding; temperature rises of 1°C-2°C are likely to bring benefits to cooler areas, such as New Zealand, in the form of longer growing seasons and reduced energy demand.
- **Middle East:** The Middle East is particularly vulnerable to climate change. It is one of the world's most water-scarce and dry regions; with a high dependency on climate-sensitive agriculture and a large share of its population and economic activity in flood-prone urban coastal zones.
- **Russia:** Many parts of Russia's massive territory will experience increases in the availability of water bringing certain positive impacts but also problems, such as springtime ice-clogged floods. As growing seasons become longer and precipitation patterns change, using lands for agricultural purposes that previously would have been too far north will become possible. Milder and shorter heating seasons may also lead to reduced demand for Russian energy.

Overall, Ireland stands to be less severely impacted relative to a number of other competitor countries/ trading partners. This can present opportunities for indigenous companies to realise competitive advantages and for IDA Ireland to promote Ireland as a relatively low risk location for business activity. The National Adaptation Plan should aim to capitalise on these opportunities.

### 3. Implications for businesses in Ireland

#### There are climate risks for businesses in Ireland

Although less severely impacted relative to a number of other countries, Ireland is expected to remain exposed to a number of climate risks. Competitive advantages will only be realised if these risks are managed in a systematic way. The following are potential business areas which climate change may impact:

- **Markets:** climate change could change demand for goods and services.
- **Logistics:** climate change could increase vulnerability of supply chains, utilities (in particular water and energy), transport arrangements and communications.
- **Premises:** climate change (such as more frequent flooding events, storms, coastal erosion, etc.) could impact on location, materials, building design, construction, maintenance and facilities management.
- **Finance:** climate change could have implications for investments, insurance and stakeholder reputation.

- **People:** climate change could have implications for workforce, customers and changing lifestyles.
- **Processes:** climate change could have impacts on production processes (in particular cooling requirements) and service delivery.

These potential climate change impacts can be flagged with business decision makers by business representative bodies, trade associations and enterprise development agencies.

### There are likely to be costs for businesses and the economy

Information on the costs and benefits of adaptation remains limited and this is an area which will need to be focused on as research in Ireland develops. Some evidence is available of rising economic losses associated with extreme weather events. At a macro level, research from the European Central Bank estimated that extreme weather events could impact on the public finances of developed countries by a minimum of 0.23% of GDP annually<sup>5</sup> (translating into approximately €370 million per year for Ireland based on current GDP projections).

As an indication of what the potential vulnerabilities to climate change might be, figures from the Irish Insurance Federation (IIF) show that the insured property cost of the November 2009 floods stood at €244 million. The main financial impact of the floods was localised within three counties (Cork, Galway and Clare) resulting in property insurance claims between commercial and household property of over €141 million, €23 million and €16 million respectively. Beyond property damage, the floods also impacted the economy through inability of workers to access their workplace, water shortages, impacts on water quality and power-outs. Such losses of sectoral output and infrastructure damage on an increased basis can have persistent negative impacts on economic growth<sup>6</sup>.

### Early adaptation measures can reduce these costs

Some adaptation measures for business or critical business infrastructure may have no or minimal cost implications (e.g. more careful location planning to avoid the risk of flooding, moving sensitive business equipment to a higher floor, etc.). At the same time, certain levels of investment may be required (in areas such as the water supply network or flood protection infrastructure) to ensure that key parts of Ireland's current and future infrastructure are climate resilient. Research from Munich Re and the Confederation of British Insurers has estimated that additional investment of 5 to 20 per cent of cost would be needed in 2030 to

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<sup>5</sup> The Impact of Extreme Weather Events on Budget Balances and Implications for Fiscal Policy, Working Paper Series No. 1055, European Central Bank, May 2009. Available at <http://www.ecb.int/pub/pdf/scpwps/ecbwp1055.pdf>

<sup>6</sup> On Climate Change and Economic Growth. Samuel Fankhauser and Richard S. J. Tol. Resource and Energy Economics, Vol. 27, No. 1, January 2005, pp. 1-17.

adapt new infrastructure vulnerable to climate change<sup>7</sup>. Several sources have indicated that the costs of taking action to address climate change (including mitigation and adaptation measures) will be much lower than the costs of inaction over the medium to long term<sup>8</sup>. Early consideration of the need to adapt to climate change can ensure that risks are minimised at least cost.

### **There will also be opportunities as well as risks for business**

A key point is that given the likely scale of investment in climate change adaptation, businesses will be presented with commercial opportunities as well as risks. Incorporating climate change into business planning and ensuring that the policy framework for business is as facilitative as possible will help businesses in Ireland to realise these commercial opportunities.

## **4. Assessment of Climate Risks and Opportunities for Key Sectors of the Irish Economy**

### **Some business sectors will be more exposed than others**

Some locations are likely to be more impacted by climate change than others. Similarly, it's clear that not all businesses and business sectors will be equally exposed to climate risks. Some of the firms and sectors that are expected to be most exposed to the impacts of climate change include:

- Sectors currently affected by weather events (e.g. food and drink, construction);
- Sectors making long-term investment decisions (e.g. utilities, pharmaceuticals);
- Sectors heavily reliant on transport/ infrastructure in (global) supply and demand chains (e.g. ICT/ pharmaceuticals); and
- Sectors that are global in nature and are particularly exposed to adaptation internationally (e.g. financial services).
- Sectors that need a lot of high quality water such as pharmaceuticals, ICT (wafer manufacturing), food and drink.

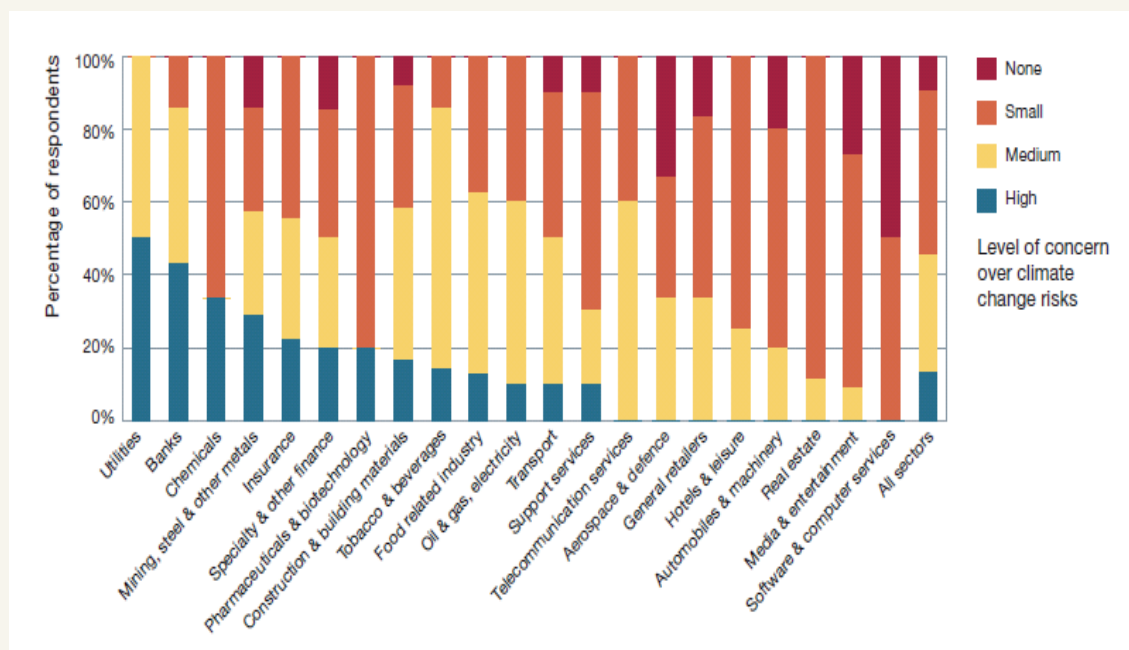
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<sup>7</sup> The Financial Risks of Climate Change, ABI Research Paper No 19, Association of British Insurers, November 2009. Natural Disasters, Annual Review of Natural Disasters 2006, Munich Reinsurance Company, 2007.

<sup>8</sup> Economic Aspects of Adaptation to Climate Change, OECD, 2008. The Stern Review of the Economics of Climate Change, HM Treasury, 2006.

Although not available for Irish companies, the below figure from the UK Carbon Disclosure Project survey gives an indication of the extent to which individual sectors in the UK are concerned about the impacts of climate change.

**Figure 1: Sectoral concern over risks posed to companies by the impacts of climate change in UK**



Source: Carbon Disclosure Project UK

### Climate risks and opportunities for key sectors of the Irish economy

Based on the literature review undertaken, a business workshop organised through IBEC, engagement with the UK Climate Impacts Programme and the Carbon Disclosure Project, as well as other business consultations, an assessment has been undertaken of some of the potential risks and opportunities from climate change for key sectors of the Irish economy. The table below gives an overview of some of these potential sectoral opportunities and risks. It is important to note that some of the risks may be generic risks which companies in other countries may also be exposed to. Thus, in certain areas (in particular risks associated with temperature rises which are expected to be relatively less extreme in Ireland), Irish companies may be in a stronger position to manage these risks when compared with international competitors.

**Table 1: Sectoral Opportunities and Risks of Climate Change**

	Opportunities	Risks
<b>Food and Drink</b>	<p>Increase in global demand due to global climate challenges (e.g. drought).</p> <p>Properly managed, Ireland will remain relatively ‘water rich’ which should support competitiveness of food and drinks sector vis-à-vis ‘water poor’ regions.</p> <p>Ireland’s relatively low temperatures may mean lower impacts on grass-based meat and dairy production when compared with other countries.</p> <p>Longer growing season, shorter growing times and warmer summer temperatures can improve productivity.</p> <p>There may also be opportunities to leverage research in food production by research bodies such as Teagasc.</p>	<p>Extreme weather events can impact transportation and refrigeration of raw materials, such as milk.</p> <p>Interruption of water availability could affect agriculture operations.</p> <p>Warmer weather may support new diseases, insects and competing plants.</p> <p>Current production methods and market standards (e.g. supermarket washed produce) are water and energy intensive, and will become increasingly expensive.</p> <p>Lower river flows could lead to restrictions on water abstractions and discharges of high-temperature water.</p>
	Opportunities	Risks
<b>Chemicals, Pharmaceuticals and Medical Technologies</b>	<p>Growing opportunities to address global healthcare issues that arise as a result of climate change.</p> <p>Properly managed, Ireland can exploit its relative lower temperatures and potential ‘water richness’.</p> <p>Strong existing commercial reputations of companies in this sector may be an opportunity on which to capitalise.</p> <p>Pharma companies using synthetic materials to produce their products may have opportunities over those using natural materials of which there may be less.</p>	<p>Rising ambient air temperatures, variations in water quality, and the availability of cooling water can have an effect on chemical processes.</p> <p>Many chemical and pharmaceutical industries are based on the coast, particularly in Cork Harbour and the Shannon Estuary which may be prone to rising sea levels and flooding.</p> <p>There are considerable regulatory risks to consider. Handling, transmission and storage safety standards may be compromised.</p> <p>The vulnerability of supply chains to weather events may lead to shorter supply chains, increases of transportation costs and additional materials storage capacity</p>

		<p>requirements.</p> <p>Lower river flows could lead to restrictions on water abstractions and discharges of high-temperature water.</p>
	<b>Opportunities</b>	<b>Risks</b>
<b>ICT Manufacturing and Services</b>	<p>ICT hardware and software offers huge potential to support climate change adaptation in areas such as sensor networks, more efficient power distribution and transmission, making buildings more climate resilient, business support (continuity and back-up recovery), etc.</p> <p>Lower temperature increases in Ireland relative to other countries may mean that Ireland retains a competitive advantage in locating data centres and running other energy intensive manufacturing processes.</p> <p>Ireland has already made some progress in certain research and development areas. There may be other opportunities to establish world class R&amp;D in areas which need to adapt to climate change, such as efficient motors, electricity generation/distribution, sea transport, etc.</p>	<p>Increases in demands for electricity for cooling may place strains on the grid. This is likely to be a global phenomenon which will increase pressures for competitively priced electricity.</p> <p>The software and computer services sector is particularly vulnerable to any disruption in global supply chains or manufacturing processes.</p> <p>Higher indoor temperatures can compromise high technology and precision engineering processes.</p> <p>Water needs for cooling data centres may be compromised if the availability of water declines.</p> <p>Climate change will increase the risk of subsidence damage to communications masts and storm damage to overhead cables, disrupting operations and processes.</p>
	<b>Opportunities</b>	<b>Risks</b>
<b>Financial Services (including insurance)</b>	<p>Climate risk management may provide significant business opportunities in a number of areas (such as carbon auditing and trading; consultancy on infrastructure vulnerability/ risk management; insurance- related opportunities; development of specialist risk-transfer financial instruments, etc.).</p> <p>Investment funds risk levels may increase (equities, corporate and government debt) if capital</p>	<p>The financial services sector is a truly global industry, and as such will be affected by both domestic and global extreme events.</p> <p>The insurance sector is highly sensitive to weather and climate risks as shown by recent spikes in pay outs caused by recent floods and freezes in Ireland.</p> <p>Financial services companies rely heavily on data processing systems, global communications networks and</p>

	<p>investments are made in assets that are vulnerable to climate change.</p> <p>There may be some specific insurance sector opportunities such as new insurance products which spread climate risks.</p>	<p>human interaction. If any of these systems do not operate properly or are disabled or if weather events disturb the ability for staff to get to facilities or impact the facility itself, financial losses, disruption of businesses or reputational damage could ensue.</p> <p>Climate change may challenge limits of capacity of global financial markets to absorb risk, in particular with regards to reinsurance capacity.</p>
	<b>Opportunities</b>	<b>Risks</b>
<b>Tourism</b>	<p>A warmer, more reliable summer season in Ireland could support an extension of the peak tourist season into April and October.</p> <p>The relative attractiveness of other regions (e.g. Mediterranean) may also weaken due to weather extremes.</p> <p>Potential to extend tourist products - in particular water-based holidays.</p> <p>Potential to build on “green” brand of Ireland and further sustainability perceptions (which is already a key element of Tourism Ireland’s overseas marketing of the island of Ireland).</p>	<p>Extremes in Irish weather could impact on tourist products (e.g. marine ecosystems, coastal erosion, hiking, golf, heritage monuments etc.).</p> <p>Potential disturbances of travel routes from extreme weather events.</p> <p>Extreme weather events and infrastructure failure could affect Ireland’s image through negative feedback from visitors.</p> <p>Heavy rainfall, floods and drought could result in conservation challenges for our built and cultural heritage (in particular those located in coastal areas).</p> <p>Water activities likely to be impacted by climate change through both high and low flow situations and impacts on water quality. Beach use may be restricted by coastal erosion. There is potential for increased competition between leisure activities and commercial shipping in ports.</p>
	<b>Opportunities</b>	<b>Risks</b>
<b>Construction and Building Materials</b>	<p>Consumers and regulatory bodies may require better performance from buildings as climatic conditions change, providing an opportunity for early movers to gain competitive advantage.</p> <p>Opportunities for design of new-</p>	<p>Delays to construction and maintenance programmes, poor internal environment and mould growth, slope instability, damage to building fabric and cladding, and structural damage from wind and precipitation events.</p> <p>Flooding, especially flash flooding may</p>

	<p>builds and maintenance of existing buildings.</p> <p>Opportunities associated with the development of climate-proof materials and concrete.</p> <p>More opportunities in areas such as air-conditioning, water management and drainage.</p> <p>Clients may require increased maintenance of existing buildings.</p>	<p>disrupt transport for site deliveries.</p> <p>The construction industry needs clarification of design standards in the face of changing climate and performance indicators of well-adapted buildings.</p> <p>Risk of flooding to properties and building sites, provision of cooling through installation of air-conditioning will increase capital costs, running costs and emissions of greenhouse gases; poor working conditions on site including on-site huts particularly in higher summer temperatures.</p> <p>Implications for insurance (of buildings, professional indemnity, employer’s liability) for existing buildings, new buildings and during the construction process.</p>
	<b>Opportunities</b>	<b>Risks</b>
<b>Environmental Goods and Services (EGS)</b>	<p>Increased demand and rapidly growing global market for “adaptation” products and services (such as water-saving technologies and services, hard and soft engineering solutions for flood protection, innovations in energy end-use, etc.).</p> <p>Potential synergies between EGS and other sectors which are expected to have adaptation opportunities (e.g. ICT and sensors).</p> <p>Potential business opportunities generated through green public procurement plans which incorporate adaptation.</p>	<p>Weak buy-in from enterprise sector regarding climate change adaptation.</p> <p>Lack of clear policy or investment which promotes adaptation for certain sectors such as waste, water and wind energy.</p> <p>Climate risks (such as flash flooding or lower river water levels) could impact the operation and reputations of key EGS sectors such as water and waste treatment if services are disrupted or curtailed.</p> <p>Risk-averse public procurement could embed non climate resilient technology.</p>
	<b>Opportunities</b>	<b>Risks</b>
<b>Retail, Wholesale and Distribution</b>	<p>Retailers are less exposed than other sectors but face knock-on impacts in terms of supply chains and distribution, premises, and changing structures of market demand.</p>	<p>Supply chain interruption and inefficiency of the distribution network.</p> <p>Damage to products during transport and warehousing.</p>



	<p>New product and service opportunities.</p> <p>Increased passing trade in retail sector during longer warmer summers.</p>	<p>Consumer goods companies will need to educate consumers on the benefits of products that can reduce climate change impacts.</p> <p>Potential loss of competitiveness due to lack of responsiveness to changes in consumption patterns.</p> <p>Rising sea levels/ storms might interrupt the predictable flow of materials from overseas suppliers.</p>
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## 5. Business Adaptation

### Awareness of the need for Irish businesses to adapt varies

Adaptation for business is often difficult. Potential future impacts on business are longer term and often unclear. Businesses often lack information or awareness of climate impacts. Some businesses lack the ability to respond to climate change because of financial or other constraints (such as organisational and cultural or institutional constraints). In addition, the costs of adapting may be high. These difficulties may be reflected in the reluctance of certain businesses to prioritise adaptation measures. While some multinationals which operate in Ireland are factoring physical impacts of climate change into global business planning, the majority of companies (in particular, indigenous companies) appear less concerned with the physical effects of climate change when compared with other risks, particularly the risks associated with regulations and higher energy prices resulting from mitigation efforts. This assertion is backed up by findings and the low response rate from the first Carbon Disclosure Project (CDP) Ireland report which was published in 2009<sup>9</sup>.

### A higher level of awareness among businesses encourages autonomous adaptation

Without a proper understanding about their current vulnerabilities and the likely consequences of climate change, it is difficult for businesses to manage the risks and opportunities of adaptation. Some specific responses that could develop business awareness in Ireland of the need to plan for adaptation include:

- Climate change research that is being undertaken in Ireland should be developed and tailored for businesses through an information campaign aimed at businesses and consulting services. The proposed EPA Climate Change Information System should be

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<sup>9</sup> Carbon Disclosure Project 2009, Ireland Report, Written for Carbon Disclosure Project by KPMG. 33% of Irish corporations responded compared with the Global 500 response rate of 81%. Of the responding Irish companies, 64% saw physical risks (compared with the global response rate of 78%) while 43% of responding Irish companies saw physical opportunities (compared with the global response rate of 63%).

developed to provide appropriate information, tools and links on measures businesses can take to minimise risks and maximise opportunities.

- Geographic maps and warning systems such as the OPW's Flood Maps website and the Geographical Survey of Ireland's database of past landslide events should continue to be supported. Enterprise development agencies and business representative bodies will play an important role in promoting this information.
- There is potential for business representative bodies to raise business awareness of specific climate change adaptation issues through seminars, guest speakers, local fora, etc.

### Developing business capacity to deal with adaptation

Some businesses may lack the ability to respond to climate change because of financial or other constraints. Some specific responses that could develop business capacity to deal with adaptation could include:

- There is a need to develop and apply business planning tools to help business adaptation. Specific business tools, such as the UK Climate Impacts Programme Business Areas Climate Impacts Assessment Tool (BACLIAT) are open source and can be readily promoted to Irish companies by business representative bodies, trade associations and enterprise development agencies. Work is also being done in National University of Ireland Maynooth on tools for Co-ordination, Communication and Adaptation for Climate Change in Ireland (Cocoadapt) which could incorporate business planning tools. Such business tools as well as a qualitative screening process for the degree of business vulnerability should also be considered for inclusion in the EPA's proposed Climate Change Information System.
- Ensuring that both new and existing professionals have developed the skills necessary to respond to climate change and keep pace with policy and technology advancements will be an important policy response. The Expert Group on Future Skills Needs is currently undertaking work on actions required to ensure that the supply of skills in the environmental goods and services sector will be sufficient to meet the future skills needs of enterprise. As this work is looking at key adaptation areas such as ICT applications/ software, environmental consultancy and eco-construction, implementation of the impending recommendations from this work are likely to be an important step in assisting successful business adaptation.
- Sector organisations (business representative associations and professional bodies) will also be key in creating, gathering and sharing sector-specific information on adaptation as well as developing appropriate, training, accreditation and support programmes.
- As financial constraints are one of the main barriers to successful business adaptation, there may be merit in assessing current business supports and capital allowances to understand their potential to support business adaptation. The possibility of using revenue generated from auctioning allowances under the EU's Emissions Trading Scheme for business adaptation purposes could also be considered.
- The enterprise development agencies (and IDA Ireland in particular) should continue to incorporate climate change adaptation research and considerations (in particular

avoiding purchase of sites on flood plains) in their expansion of greenfield developments and future industrial estates/ business parks.

## 6. Adapting business infrastructure and the policy framework

### Ensuring that critical pieces of business infrastructure are climate resilient

A range of infrastructures are essential for the efficient functioning of a society and an economy. As infrastructures have long pay-back periods and can also take a long time to build, it is vitally important that investments are resilient to climate change in order to support economic development. The National Adaptation Plan is seen as essential to ensuring that an overall policy position on climate change adaptation is taken with regards to infrastructure plans and the development of critical pieces of infrastructure for business. As part of Forfás's work which is due to feed into the development of this National Adaptation Plan, a high-level assessment of the physical implications of climate change on the following critical pieces of infrastructure for enterprise has been undertaken.

#### Water Supply and Quality

Water is the natural resource that stands to be most critically affected by climate change and has recently been identified by the World Economic Forum as a key concern for global business over the next 20 years. Climate impacts, such as increased vulnerability of water supply infrastructure to flooding or lower river flows in summer, can impact on the quantity and quality of water available to key business sectors in Ireland. Water is a significant resource for the economy, and in order to realise any competitive advantages that may arise from Ireland's relatively abundant water resources, Forfás recommends:

- That a well-resourced single National Water Authority should be introduced with overall responsibility for system planning, delivery and maintenance. This authority should take a long-term strategic approach to water services policy and planning, incorporating climate risks and the needs of current and future enterprise development.
- Additional capital investment will be required in particular for additional water storage capacity; to transmit water from areas rich in water (i.e. the west), to areas not able to meet demand (i.e. the east); and to interconnect the country's water networks. There is thus a need to continue to prioritise water and waste water investment programmes particularly in key regional centres and those expected to face capacity shortages in the next five years (Dublin, Athlone, Galway, Letterkenny, Mallow and Wexford) to ensure that these locations can accommodate future enterprise development needs<sup>10</sup>.

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<sup>10</sup> As recommended by the Forfás report, Assessment of Water and Waste Water Services for Enterprise, November 2008.

- The introduction of volumetric, treated water charges for domestic users and more transparent, fully reflective charges for non-domestic consumers would create incentives to use water more efficiently and thereby create a market for water efficiency goods and services with future export potential. Continuing to enhance awareness of the need for water conservation is also an important adaptation response.
- Improving real time monitoring of water quality and implementation of the Water Framework Directive, the Water Services Investment Programme 2010-12 and the Rural Water Programme.
- Rainwater harvesting represents an opportunity to reduce demand for produced water nationally while giving enterprises greater independence in case of water shortages. Measures to encourage rainwater harvesting and the re-use of grey water should be encouraged.

### Flood Protection

The damage flooding can cause to businesses and infrastructure, such as transport or utilities like electricity and water supply, can have significant detrimental impacts on local and regional economies. To limit the potential risks of flooding to business, Forfás recommends that:

- The outputs of the assessment of flooding risks carried out by the Office of Public Works (OPW) (such as [www.floodmaps.ie](http://www.floodmaps.ie), Catchment Flood Risk Assessment and Management (CFRAM) studies and the forthcoming Flood Asset Database) should continue to be supported and promoted to businesses through business representative bodies, enterprise development agencies and trade associations. Such inventories will need to continue to include business sites which suffer the most from floods and should include general plans for businesses on how to manage flood risks.
- All planning authorities should continue to recognise the need to minimise business development on flood plains. Draft guidelines on “The Planning System and Flood Risk Management” which have been developed by the OPW to ensure that risks of future flooding are integrated into the planning process, will need to be enforced and mainstreamed, and applied to business location decisions.
- Investment in OPW programmes which reinforce existing protective facilities and drainage for key business sites should continue to be prioritised.
- Owners of critical pieces of infrastructure for business (energy, water, transport, communications and waste) should be required to undertake an asset risk assessment of potential flood risks.
- There is a need to implement an island-wide and integrated coastal zone management policy, the objective of which should be to establish sustainable levels of social and economic activities while still protecting the coastal environment.

### Energy Infrastructure

Climate changes could impact on the security of supply of energy for business in Ireland through interruption of transmission networks and overhead cables due to extreme weather

events, flooding of coastal coal-fired, oil-fired and gas-fired power-generation stations, etc. To limit potential risks to businesses energy needs, Forfás recommends that:

- Adaptation to climate change needs to be incorporated into the long-term planning of the main actors involved in Ireland's energy sector. An important starting point would be for the Department of Communications, Energy, and Natural Resources/ Commission for Energy Regulation to require owners of energy infrastructure to carry out a climate risk assessment for critical infrastructure assets.
- Energy providers should continue to ensure that they have robust contingency plans in place to minimise the impact of possible energy supply disruptions for business, especially electricity, in extreme weather conditions.
- Research which monitors climate change trends and impacts on existing energy infrastructure should continue to be developed (for example in areas such as the preparation of wind and wave atlases for renewable energy generation in future scenarios or codes and standards for the design of structures, power plants, electricity and gas network substations).
- Higher average temperatures are expected to reduce the need for heating in winter and increase the need for cooling in summer. In district cooling, the energy in district heating water is used to produce comfort cooling<sup>11</sup>. The establishment of district cooling is at present not directly included in the National Energy Efficiency Action Plan. As the technology and uptake develops, the use of district heating systems to produce district cooling could be considered by the Department of Communications, Energy and Natural Resources/ Sustainable Energy Authority of Ireland for industrial estates where the loads are sufficiently large and consistent.

## Transport and Communications

Infrastructure for transport and communications are vulnerable to climate risks, and therefore businesses that use these infrastructures are also at risk. In light of Ireland's geographic location and our dependence on export markets, planning for climate risks of Ireland's transport and communications infrastructure are vital to the competitiveness of the productive sector of the economy and to the country's prosperity. To limit potential risks to necessary transport and communications infrastructure, Forfás recommends that:

- Impacts of climate change are incorporated into the long-term planning, design, investment and maintenance of all actors in the transport and communications sector. As a starting point, owners/ regulators of critical pieces of infrastructure should be required to assess the risks, disturbances and structural impacts caused by climate

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<sup>11</sup> District heating is a system for distributing surplus heat generated from electricity production, fuel and biofuel-refining and from other different industrial processes in a centralised location for residential and commercial heating requirements. As with district heating, district cooling aims to use centralised local resources that otherwise would be wasted or difficult to use as an alternative to conventional electricity or gas-driven air conditioning systems. Strategic resources include natural cooling from deep sea, lakes and rivers or conversion of surplus heat from industry, Combined Heat & Power and waste incineration.

change in each form of transportation (road transportation, sea traffic, railways and air traffic) and the communications network.

- The general principle of flood-sensitive areas avoidance should be introduced into planning of transport and communications networks. Investment should be prioritised in win-win options or in resources with high adaptive value.

### **Waste Management**

There is significant potential for climate change to impact on waste management processes (such as landfill degradation rates) and operations (through disruptions to supporting infrastructure, etc.). To limit potential risks to necessary waste management infrastructure, Forfás recommends that:

- Policy makers and regulators should continue to engage with climate change research and ensure that emerging waste management policies and regulatory activities incorporate the need to respond to climate change risks that may affect waste management.
- Waste management industry bodies and local authorities should ensure that waste management providers and disposal operators have a good understanding of potential climate change impacts and how they could affect their operations, service delivery responsibilities and contractual commitments.

### **Providing a policy framework which helps businesses reduce risks and realise opportunities**

A clear policy framework is necessary to provide certainty for business adaptation planning. Ensuring that the policy framework allows for flexible and quick responses within Government as the impact of climate change becomes clearer is also an important consideration. A number of key policy areas which impact on enterprise are likely to be considered in Ireland's proposed National Adaptation Plan. From a business perspective, the below are seen as priority policy areas which can help business reduce the risks and maximise the opportunities of climate change.

#### **Spatial policies**

Spatial policies are an essential means of reducing the negative socioeconomic consequences of climate change and should always reflect and adapt to the risks and possibilities brought on by climate change. There is clearly a strong role for local and regional authorities to play in spatial policy as it is impacted by climate change, and indeed the ongoing work to refresh the National Spatial Strategy in informing business (and broader constituencies) about the potential implications of climate change. It would seem that planning authorities in particular, having access to centralised data on flood plains, river basins, coastal risks etc. could form part of an efficient information dissemination process which could be of assistance to businesses. From a legislative perspective, as noted above in previous sections, draft guidelines on "The Planning System and Flood Risk Management" which were published by the OPW in 2009 - as well as earlier guidelines such as Development Plan Guidelines 2007 and the Sustainable Residential Development Guidelines 2008 - will have to be enforced effectively

and communicated to businesses. Planning authorities will also need to continuously evaluate whether there is a requirement for a follow-up with further legislative restrictions on new building in risk areas.

### **Built environment**

The need to incorporate climate change, including extreme phenomena, into long-term planning, standards and regulations (such as the Building Regulations) concerning existing buildings and the use of building materials is an important consideration from a business risk reduction perspective. It is also a potential significant opportunity for the domestic construction sector. Further industry guidance and design criteria are needed which incorporate climate change allowances in design. Coadapt in NUIM are currently undertaking work on potential impacts on construction and building standards. Adaptive responses which will be recommended from this and other research will need to be considered and, where appropriate, incorporated into legislation as soon as possible. Business representative organisations and enterprise development agencies will need to ensure that this research is adequately communicated to businesses that can avail of opportunities.

### **Insurance**

Access to insurance payouts can lessen the net adverse impact of climatic events on business policy holders. At the same time, insurance is also an instrument for incentivising business adaptations aimed at reducing climate risks. Thus, the benefits of covering climate risks will need to continue to be promoted to business. As climate changes and historical weather records become less useful, the insurance sector will have to develop new ways of assessing risk. Little is currently known about the insurance-related impacts of climate change for businesses and other property owners in Ireland. There is a need to develop a knowledge base of the potential insurance implications of climate change for business. Irish insurance companies or the Irish Insurance Federation could develop risk assessment research for business insurance in Ireland according to different climate change scenarios. Besides ensuring that Government policy systematically addresses the risks of climate change through measures such as spatial planning and investment in flood defences, there is scope for insurers and Government to continue to co-operate to ensure that insurable risks are kept to a manageable level and that coverage remains wide.

### **Regulations**

In response to climate change, it is possible that new or existing regulations which incorporate adaptation considerations will increase in number and influence in areas such as building quality standards, use of water, health and safety, etc. To minimise impacts on business competitiveness, any proposed new measures should be well justified in terms of the risk probability. It is equally important that upon introduction of such measures, businesses are enabled to meet new regulations in a manner that minimises costs and that information on what is required of companies to comply is strongly promoted by business representative bodies and enterprise development agencies. The use of existing regulatory instruments and environmental planning tools such as Strategic Environmental Assessments, Environmental Impact Assessments and Regulatory Impact Assessments to incorporate adaptation concerns is seen as one way to minimise potential impacts. In order to drive opportunities for companies

engaged in the green economy, emerging research and regulations will need to involve and be communicated to companies that can avail of potential opportunities.

### **Institutional**

A strong institutional framework is central to the mainstreaming and co-ordination of climate change adaptation policy responses across government departments, critical infrastructure providers and a range of stakeholders. The draft Climate Change Bill is attempting to put in place such a structure through its proposed Expert Advisory Body and sub-committees. It is vital that these bodies have the structures to properly implement policies and measures on a cross-sectoral and cross-departmental level and in a manner which adequately takes into account business risks and opportunities and national competitiveness concerns. To provide confidence and visibility for the enterprise sector, at least one member of the Advisory Body should possess strong business and economic competitiveness expertise.

### **Research and information**

Research and development and technology transfer will be a key aspect in meeting the adaptation challenge. Publicly funded research which helps improve business understanding of climate change risks should continue to be supported and promoted to businesses. Business stakeholders should continue to be involved to identify and agree adaptation research priorities. A significant proportion of the climate change research undertaken in the short-to-medium term should address areas of potential business opportunities such as adaptation technologies, design standards, building materials and techniques, food production, etc.

### **Procurement**

Annual expenditure on goods and services by the Irish Government amounts to circa €10 billion with a further €7 billion on works. Given the time period for a range of infrastructure projects, decisions about public infrastructure will have significant, long-term consequences for resilience to climate change. The work currently being undertaken by Department of Environment, Heritage and Local Government to develop a Green Public Procurement Action Plan could incorporate climate change adaptation into public procurement. This would help improve the resilience of critical business infrastructure to climate change and also assist companies in Ireland to realise opportunities arising from climate change adaptation.



## 7. Conclusions

There is recognition that the global climate will continue to change and that as a result, economies and societies will have to adapt to manage the unavoidable. This work has attempted to identify some of the issues for businesses and the business environment in Ireland that may arise from future changes in climate. In doing so, the following key messages have emerged.

### **For businesses**

- Climate impacts are likely to be felt across a wide range of business areas, not just the more apparent ones;
- Changes in climate will bring business opportunities as well as threats;
- Planning ahead by businesses can reduce costs and help realise opportunities in Ireland and globally; and
- Existing systems are in place (such as research and business planning tools) which can be used to help businesses incorporate climate risks.

### **For the enterprise development agencies**

- Climate change adaptation can create a range of new market opportunities;
- The development agencies can build on potential competitive advantages for indigenous firms and market the fact that the impact of climate change on Ireland will be limited relative to that in competitor countries - thus reducing risks for investors; and
- Properly managed, Ireland can remain relatively 'water rich', thus providing a strong competitive advantage to a range of sectors.

### **For critical infrastructure for business**

A number of pieces of critical infrastructure which are essential to the functioning of Ireland's business environment may be affected by climate change. Early planning and incorporation of climate risks by the owners of critical infrastructures or public authorities that manage them is essential to ensure that these pieces of infrastructure are climate resilient.

### **For policy**

A clear policy framework is necessary to provide certainty for business adaptation planning. Ensuring that the policy environment minimises climate risks for business and allows businesses to avail of opportunities are key policy objectives.

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## **Forfás**

Wilton Park House  
Wilton Place  
Dublin 2

Tel: +353 1 607 3000

Fax: +353 1 607 3030

[www.forfas.ie](http://www.forfas.ie)