Danish adaptation to future climate

DANISH ENERGY AGENCY

Danish adaptation to future climate
– on the Danish strategy for adaptation to a changing climate
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Løgstør Harbour at sunset. A new sheet pile wall to safeguard against rising sea levels. Photo: Karl Johan Agesen.

THE CLIMATE IS CHANGING

The global climate is changing. The UN Intergovernmental Panel on Climate Change (IPCC) assesses that there is a 90 per cent probability or more that the global warming we have seen over the last 50 years is due to man-made greenhouse gases. In the decades to come, Denmark will see higher temperatures and higher sea levels, just as there will be new temperature, precipitation and wind patterns resulting in more extreme weather. Some of these changes are already visible.

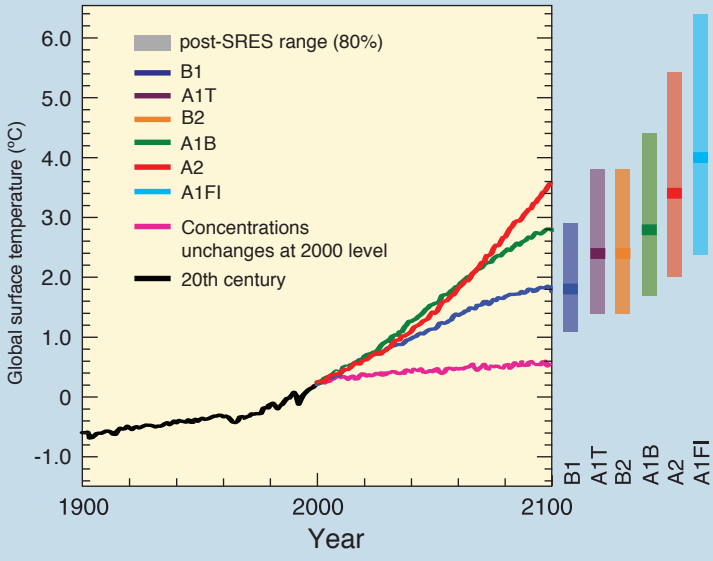
Man-made emissions of greenhouse gases, mostly from burning coal, oil and gas, contribute to climate change. Therefore, we need to continue focusing on reducing greenhouse gas emissions.

However, even if we stopped emissions completely, the climate would continue to change for many decades because of past emissions.

Climate change requires Danes to adapt and actively make an effort over the decades to come. The Danish coastline, for example, needs protection against higher sea levels and stronger storms; sewer systems should be redimensioned to cater for heavier rainfalls; buildings must be able to withstand storms and flooding; and the agricultural sector must protect itself against new types of pests.

Some of this adaptation will come automatically; some is already taking place, while some needs new initiatives. To ensure that Denmark prepares for the future climate in an effective and coordinated way, the Danish Government has prepared a *Strategy for adaptation to a changing climate.*

This leaflet presents the main contents of this Strategy.



IPCC scenarios for surface temperature 2000 to 2100. All temperatures are shown in relation to the period 1980 to 1999. B1 ... A1FI are abbreviations for various future scenarios that predict future economic growth, population trends and the development and spread of new technologies. The figure is adapted from IPCC, 2007.

DENMARK'S CLIMATE IN 60-90 YEARS' TIME

Global climate change will also result in a number of changes in the Danish climate.

Increased precipitation

We will see more rain, and the annual pattern of rainfall will change. During the winter, Denmark will have up to 40% more rain, but less during the summer, although summers will see heavier downpours.

Milder winters

Winters will be milder and more wet. Winter temperatures are expected to rise by 2-3°C. Among other things, this means that plant growing seasons will be 1-2 months longer.

Warmer summers

Summers will also be warmer. Summer temperatures will rise by up to 3°C.

THE CLIMATE OF THE FUTURE

The Earth is facing higher temperatures, but nobody knows exactly how much higher. Among other things, the extent of the changes depends on the success of international work to bring down future emissions of greenhouse gases.

Scientists use scenarios when they try to predict climate change. Some scenarios predict more severe changes than others, but most of them point in the same direction. In Denmark, the weather will most likely become warmer, wetter and more extreme during this century.

The Government's *Strategy for adaptation to a changing climate* builds on scenarios from the UN Intergovernmental Panel on Climate Change (IPCC), and on a scenario based on the European Union (EU) objective to limit global warming to no more than 2°C above the temperature in pre-industrial times.

Higher sea levels

Sea levels are expected to rise by between 15 and 75cm, and in extreme storm surge situations the maximum water on the west-coast may rise by between 45 and 105cm.

More wind

The average wind speed will rise by 1-4%, and the maximum storm strength will increase by 1-10%.

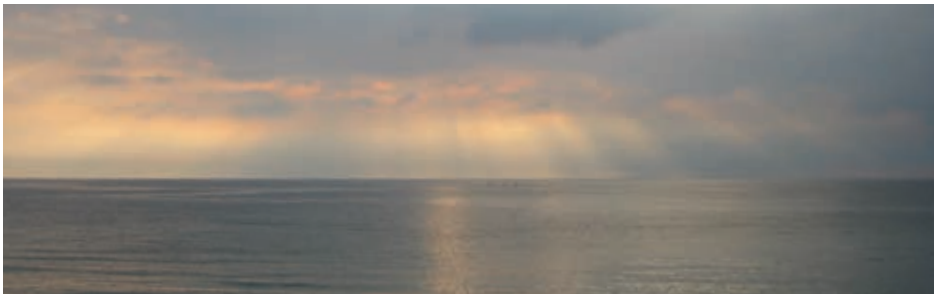
More extreme weather

All in all, the weather will be more extreme. The number of heat waves will increase, storms will be stronger, and heavy down-pours will give 20-30% more water than today.

FUTURE CLIMATE CHALLENGES

The sectors most influenced by climate change are listed here, as well as useful ways for these sectors to adapt. The Danish Government gives weight to autonomous adaptation in parallel with the ongoing climate change. This means that as far as possible reactions to climate change are expected to take place by authorities, businesses and citizens on their own initiative and in a timely manner. Based on socio-economic analyses, the Government will identify the measures that call for policy decisions.

SECTOR	CHANGES
Coastal management	Risk of erosion and flooding. In coastal towns the risk of flooding will increase. Rising sea levels and more storms damage coastlines and dykes.
Buildings and infrastructure	Heavy downpours can flood basements and affect installations such as sewers, roads, bridges, tunnels etc. Warmer summers and wet winters may pose problems for indoor climates. Stronger storms may affect houses and bridges.
Water supply	Changes in precipitation affect the possibilities for water extraction.
Energy supply	Need for less heating in winter and more cooling in summer.
Agriculture and forestry	Longer and warmer growing seasons provide opportunity for increased production, but also increase the need for fertilizer, pesticides and irrigation. This may add to environmental problems such as oxygen depletion. Not all trees will be stable in the future climate.
Fisheries	Changes in the combination of fish species in the sea.
Nature management	Animal and plant species are weakened if they do not adapt to changes in climate. Risk of unwanted invasive animal and plant species.
Land use planning	Because of higher sea levels and increased precipitation some areas become wetter with a resulting higher risk of flooding.
Health	Heat waves may result in an increase in illness and deaths. Warmer climate may bring more pollen and this may lead to more people suffering from allergies. Warmer climate may mean new and changed risks of infection. Warmer and more humid weather may lead to more indoor-climate problems, including more problems with moisture damage, mould and dust mites.
Rescue preparedness	Storms, storm surges, downpours, drought, and wild fires cause an increased need for rescue preparedness.
Insurance	Sudden downpours and storms may cause more expensive insurance against weather impacts and cause changes in insurance terms.



Increased precipitation is expected to affect the entire hydrological cycle in future. Increased runoff from land will contribute to more stratification in the sea and will affect fishing. Photo: Anne Mette Jørgensen/DMI.

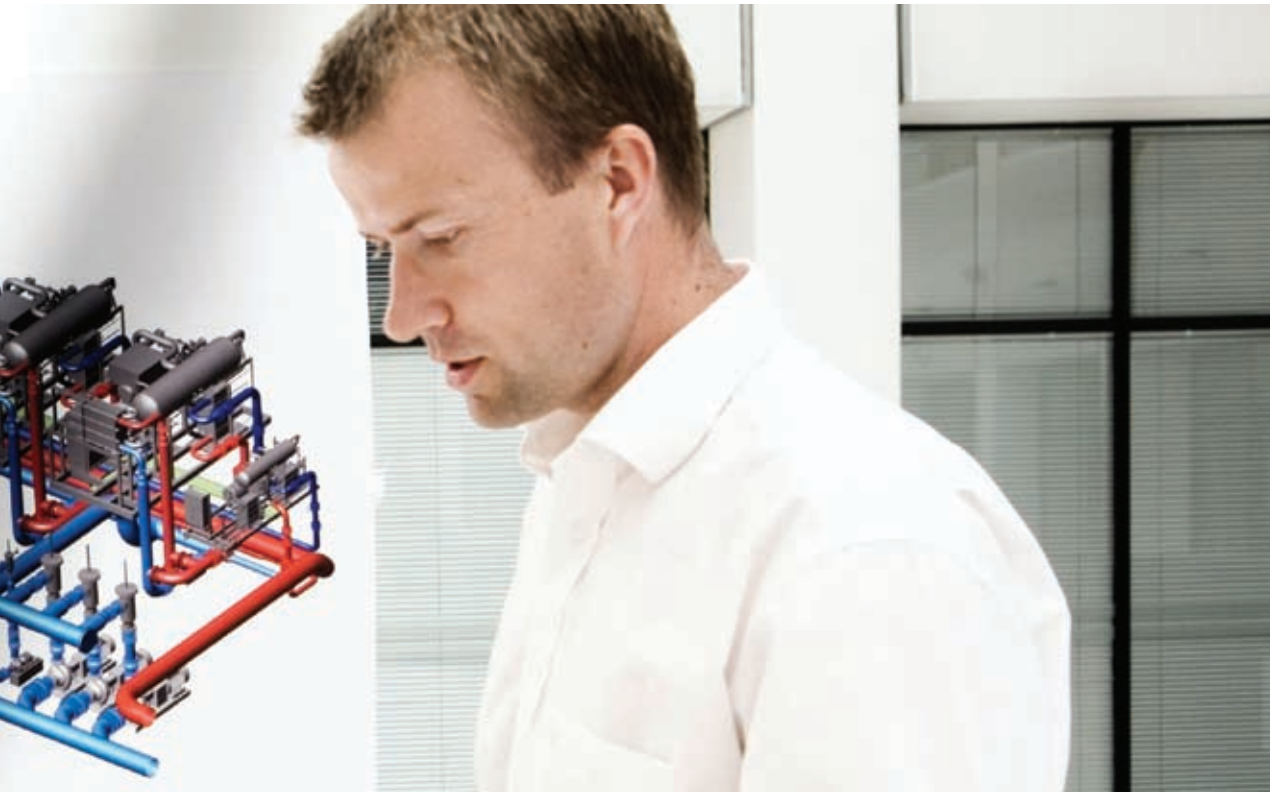
	ADAPTATION NEEDS
	Continuous monitoring of the need for changes to coastal protection and possible autonomous adaptation of coastal protection, including dykes. Continuous adaptation of emergency and storm surge measures. Incorporating climate change in planning coastal and harbour installations.
	Alternative solutions for rainwater drainage. There is need for clarifying socio-economic analyses and risk analyses on climate adaptation. The results of such analyses will provide a basis for assessing needs.
	Gradual adaptation and reorganisation of water extraction.
	Reorganisation of the energy supply.
	Development of new crops and technologies in agriculture. Gradual change to more stable trees species.
	Development of new methods for managing fish stocks. Research and development that will promote sustainable fisheries and fish cultivation.
	Help for species and natural areas under pressure. This can be through restoring river valleys to natural wetlands, preservation, nature restoration, planning against invasive species, and establishment of green corridors.
	Better planning of buildings in low-lying areas. EU Member States are to map areas that are at risk of flooding in order to improve planning.
	Health measures improved as new disease patterns develop. Information concerning new health risk problems and how to prevent them. Research and more cooperation between construction and health experts.
	Adaptation of rescue preparedness, for example new equipment, as new needs arise.
	Knowledge on climate change must be included in calculations of premiums to take account of risks.

FURTHER ACTIVITIES

Adaptation to climate change affects many sectors of Danish society. Therefore, the Danish Government has established three different bodies to ensure knowledge, coordination and research.

Coordination Forum for Climate Change Adaptation
A broad spectrum of bodies and institutions as well as municipalities and regions are represented in this Forum. This new forum monitors climate developments, research in the area, and the experience of other countries. The Forum will advise the Danish Government.

Information centre for climate change adaptation
The information centre will ensure that the initiatives from the Coordination Forum are implemented. The Centre is placed under the Ministry of Climate and Energy and will inform authorities, businesses and citizens about the Government's Strategy for adaptation to a changing climate and provide general information on climate adaptation, e.g. through the web portal www.klimatilpasning.dk.



A new district cooling plant is being planned by Copenhagen Energy. Photo: Ditte Valente.

Coordinating unit for research in adaptation

The Unit will coordinate research across the many research centres working with climate and also ensure updated data on the climate of the future.

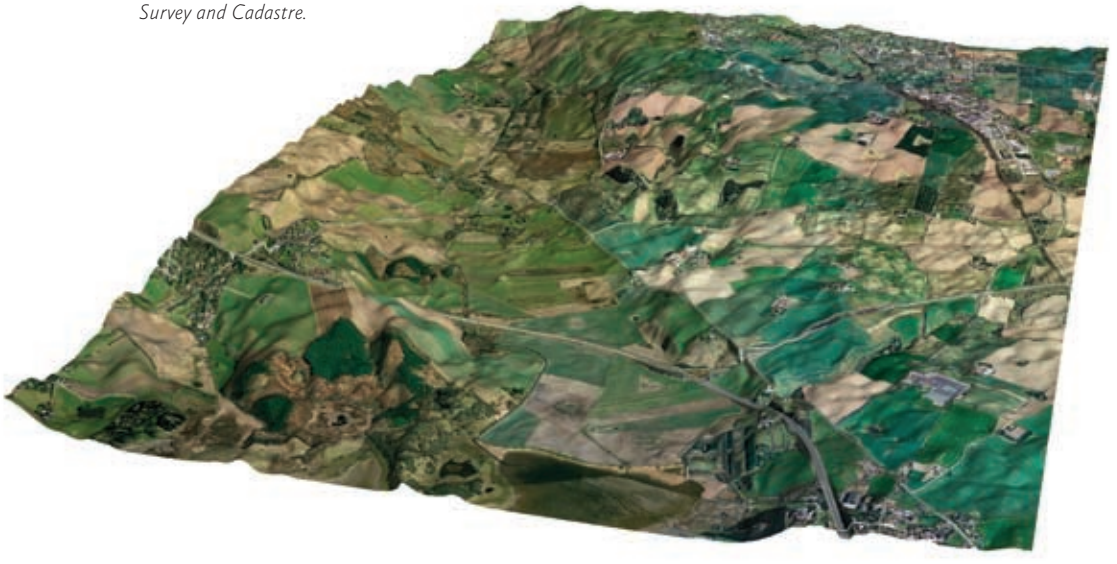
More research necessary

So far, research into climate change has mostly focused on showing that the climate is actually changing, that these changes are being caused by man, and the extent to which the climate will change. The opportunities to limit emissions of greenhouse gases have also been the subject of several studies.

This has created a good basis for the further assessment of our vulnerability to climate change.

But we need more research into ways of *adapting* to climate change. For example, there is a great need for economic tools which can take climate change into account when making decisions on climate adaptation.

A new digital elevation model constitutes an important basis for future land-use planning. The map shows lakes in blue and details of the landscape that can be flooded. Map basis and graphic: The National Survey and Cadastre.



WWW.KLIMATILPASNING.DK

For all Danish citizens to have access to updated information about adaptation to climate change, a web-portal is being established with information about climate change. The portal provides the public, authorities and businesses with easy access to information, and allows for timely adaptation to climate change.

The portal will present information about climate changes and their influence on society. Furthermore, it will give practical information about climate adaptation. The portal is under constant development and will include:

- Updated data and maps of temperatures, precipitation, sea and groundwater
- Articles and guidance about areas in various sectors affected by climate changes
- Practical advice on climate adaptation
- Examples of calculations of how climate change may be included as a basis for important decisions
- Useful analysis and assessment tools for the public and decision-makers
- Information about the latest research and development into adaptation to climate change.

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