Adaptation to the future climate in Denmark

ClimateChangeAdaptation

Adaptation to the future climate in Denmark - about the Information Centre for Climate Change Adaptation
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The climate is changing

The earth's climate is changing. The Intergovernmental Panel on Climate Change has assessed that there is a more than 90 percent probability that greenhouse gases released by human activities have caused most of the observed global warming over the past 50 years.

Over the next decades, Denmark will experience increasing temperatures and sea levels, and new patterns in temperature, precipitation and wind will lead to more extreme weather conditions. Some of these changes are already noticeable today.

PHOTO: THE DANISH COASTAL AUTHORITY

Breakwaters are used as coastal protection at Aargab south of Hvide Sande in the western part of Jutland.

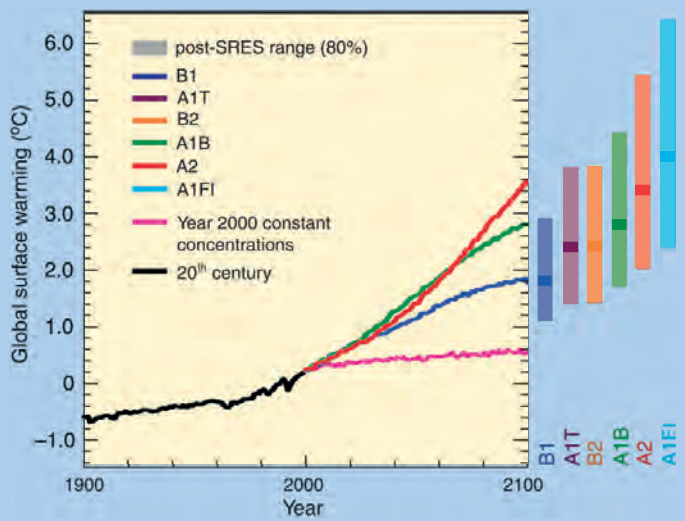
Anthropogenic greenhouse gas emissions are causing climate change, especially the burning of coal, oil and gas. Therefore, focus has been, and should continue to be, on reducing emissions of greenhouse gases.

However, even if we were able to stop emissions altogether, the warming would continue over many decades to come as a result of past emissions.

Due to climate change, we must adapt and continue to make an effort, both now and in the coming decades. For instance, our coasts should be protected against rising sea levels and more powerful storms, and roads must be able to manage larger quantities of water. Buildings must be able to withstand storms and flooding, and farming must be protected against new kinds of pests.

The Danish government has established the Information Centre for Climate Change Adaptation to ensure that Danish preparation for future climate challenges is efficient, well-informed and coordinated.

This brochure includes information about climate change adaptation and climate change impact in Denmark. Furthermore, it describes how the Information Centre can be used to support efforts by municipalities, people and industry.



Surface temperatures from 1900 to 2000 and IPCC temperature scenarios from 2000 to 2100. Temperatures are relative to the period from 1980 to 1999. The scenario names are abbreviations for various future scenarios that predict future economic growth, population development and development of new technologies. The Danish government has recommended that municipalities use the medium scenario, the A1B scenario, in their planning up to 2050. (Figure based on IPCC data, 2007)

Warmer, wetter and more extreme weather in Denmark

The Danish climate will be affected by global climate change. The Danish Meteorological Institute (DMI) has scaled down global climate change scenarios to Danish conditions. The result can be found at www.klimatilpasning.dk, the Danish Portal for Adaptation to Climate Change:

More precipitation

Denmark will very likely see an increase in annual precipitation. The largest increases will be in the winter, with possible increases of 20-40%. Smaller increases will occur during spring and autumn, while precipitation in summer will remain unchanged or decrease slightly. Extreme precipitation will generally become more extreme and the most extreme rainfall events will increase the most. An increase in heavy downpours can especially be expected during the summertime.

Milder winters

Milder and wetter winters. Winter temperatures in Denmark are expected to increase by approximately 3°C , which will prolong the growing season of plants. At the same

The mercury is rising
Global temperatures will increase. However, it is still uncertain how big this increase will be. Temperature changes will depend on the success of international efforts to reduce greenhouse gas emissions in the future.

Scientists use scenarios in their work with climate projections. Some scenarios predict greater changes than others, but the majority point in the same direction. The weather in Denmark will most likely become warmer, wetter and more extreme in this century.

The Danish government's strategy for adaptation to a changing climate is based on IPCC scenarios. In addition to these scenarios another scenario is included, which is based on an international political agreement that global temperatures must not increase by more than 2°C above pre-industrial levels. The scenarios run to the end of this century.

As the scenarios only deviate slightly from each other up to 2050, the A1B scenario is recommended for adaptation in Denmark.

time it is expected that there will be greater variation between individual years.

Warmer summers
Danish summers will become warmer as well. Summer temperatures in Denmark are expected to increase by approximately 2°C and the variation in summer temperatures is also expected to increase.

Higher sea levels
The effect of the rising sea level for Denmark will be an increase of between 0.1 and 1.2 meters by the end of this century. However, the increase may be higher.
Various studies project larger global sea level increases. However, local and regional conditions will affect the change, including increasing westerly winds that will lead to rising sea levels on coasts facing west, particularly on the western coast of Jutland. However, post-glacial rebounds will cause sea levels in the northern part of Denmark to decrease.

More wind
Average wind speeds will increase by a few percent, and storm strengths by up to 10%; both with considerable local variations.

More extreme weather
Altogether, the weather will become more extreme. The number of heat waves will increase, powerful storms will become more extreme, and heavy downpours will yield 20% to 30% more water than today.

Future climate challenges

Here is a list of the sectors that will be affected the most by climate change and how we can adapt to these changes. We should adapt on an ongoing basis as the

SECTOR	CHANGE
Coasts	Rising sea levels and an increased number of gales will have an adverse impact on coasts and dykes and piers. Risk of erosion and flooding. Increased risk of flooding in ports.
Buildings and infrastructure	Heavy downpours can flood basements and have an adverse impact on installations and constructions such as sewers, roads, railways, bridges and tunnels. Warm summers and wet winters may cause problems with regard to indoor climate. Gales can have an adverse impact on houses and bridges.
Water supply	Changes in precipitation affect water catchment. Dry summers may reduce possibilities to use groundwater for drinking water. Conversely, a larger quantity of winter precipitation may result in greater groundwater recharge and rising groundwater levels.
Energy supply	Need for less heating in winter and more cooling in summer.
Agriculture	Longer and warmer growing seasons allow for increased production, but also an increased need for fertilisation, pesticides and irrigation. This could exacerbate environmental problems such as deoxygenation.
Forestry	Not all tree species are equally sturdy and there will be greater risks of falling trees in strong winds. Changing growing seasons due to temperature changes. Increased risk of tree diseases.
Fisheries	Rising water temperatures as well as increased precipitation and changing wind patterns could lead to changes in marine ecosystems. Risk of deoxygenation due to increased temperatures. Changes are projected in the composition of oceanic fish species, marine food chains, fish stocks and ecosystems.
Nature	The diversity of animal and plant species could be impaired if they fail to adapt to a changing climate. Changed composition of plant and animal species due to changing temperatures.
Planning	The risk of flooding is increased due to rising sea levels and increasing precipitation.
Health	Heat waves may lead to increases in disease and deaths. A warmer climate may result in an increase in allergies due to more pollen in the air. Increased risk of more as well as new types of infections due to flooding from sewers of residential areas and indoor climate problems due to mould and house dust mites.
Rescue preparedness	Powerful storms, storm surges, torrential rain, drought and wildfires all lead to an increased need for rescue services.
Insurance	Torrential rain and powerful storms can make weather insurance more expensive and result in changed insurance terms.

climate changes. On the basis of socio-economic analyses, the Danish government is continuously assessing which measures require political decisions.

	ADAPTATION
	Continuous monitoring of the need for changes to coastal protection and possible adaptation of coastal protection, including dykes, if needed. Continuous updating of emergency and flood preparedness. Incorporation of climate change in the planning of coastal and port construction.
	Alternative solutions for rainwater drainage. There is a need to conduct clarifying socio-economic analyses and risk assessments for climate adaptation. When the results are available, they will provide the basis for assessing needs for adaptation.
	Gradual adaptation and reorganisation of water catchment.
	Reorganisation of the energy supply.
	Gradual shift to more sturdy tree species and crop systems.
	Gradual shift to more sturdy tree species and crop systems.
	Development of new methods for managing fish stocks. Research and development to promote sustainable fisheries and aquaculture.
	Protection of exposed species and habitats. For instance conversion of river valleys to wetlands, preservation, nature restoration, plans to combat invasive species and establishment of green corridors.
	Better planning with regard to building and construction in low-lying areas. To improve planning EU Member States must draw up maps to pinpoint areas that are prone to flooding.
	Health measures improved as new disease patterns emerge. Information about new health problems and how to prevent them. Research and stronger partnership between housing and health experts on climate issues.
	Adaptation of emergency services, for example new equipment as the need arises.
	Knowledge about climate change must be taken into consideration to make it easier to set premiums according to risk.

PHOTO: DITTE VALENTE

Warmer summers and milder winters may mean more airborne pollen and the pollen season may be prolonged. If you are allergic to pollen you are likely to experience more and stronger symptoms. Furthermore, more people may develop pollen allergies.

The waterworks in Odense bought seven flood-prone houses and demolished them. Today, there are beautiful lakes in the area where the houses used to be. From klimatilpasning.dk

PHOTO: KLIMATILPASNING.DK

What kind of support does the Information Centre for Climate Change Adaptation provide?

The Information Centre for Climate Change Adaptation was established as part of the Danish government's strategy for climate change adaptation. The Information Centre provides information for municipalities, people and businesses on climate change adaptation via the portal, klimatilpasning.dk. The portal is updated regularly, and it provides easy access to information about possibilities for climate change adaptation. Information is available about climate change and its impact on society.

Information available at klimatilpasning.dk

The portal provides information such as:

- Data and maps, e.g. on future temperatures, precipitation and groundwater levels
- Analyses and assessment tools for public and decision-makers, including an interactive map of Denmark with information about adaptation measures of municipalities and a coastal planner tool that can be used to screen the physical conditions of Danish coasts.

PHOTO: DITTE VALENTE

Green channels for rainwater drainage in Ørestad near Copenhagen.

- Articles and guidelines on areas affected by climate within the various sectors
- Examples of climate change adaptation
- Information about the latest research and development within climate change adaptation.

Tools for climate change adaptation

The Information Centre for Climate Change Adaptation develops screening tools for climate change adaptation. In the course of 2011 there will be a tool that can be used to draw up a local climate change adaptation profile, an interactive guide to climate change adaptation of houses and a guide to methods used for mapping the risk of flooding. Finally, there will be a screening tool that can be used to identify coasts that are prone to sea flooding.

The Information Centre for Climate Change Adaptation organises seminars targeted municipalities and water supply companies, to inform users about tools available on the portal and to open up for closer dialogue on users' need for information and tools.

The Information Centre regularly carries out projects that aim to expand general knowledge on climate change adaptation. For example, a questionnaire survey was carried out in Danish municipalities to find out what climate change adaptation efforts are being conducted locally.

The Information Centre for Climate Change Adaptation is part of the Danish Ministry of Climate and Energy and cooperates with the following authorities and associated institutions on the content of the portal

Danish Ministry of Finance
Danish Ministry of Defence, Emergency Management Agency
Danish Ministry of the Interior and Health
Danish Ministry of the Environment
Danish Ministry of Food, Agriculture and Fisheries
Danish Ministry of Science, Technology and Innovation
Danish Ministry of Transport
Danish Ministry of Economic and Business Affairs

The Coordination Unit for Research in Climate Change Adaptation at Aarhus University (AU)
The Geological Survey of Denmark and Greenland (GEUS)
The University of Copenhagen
The Technical University of Denmark (DTU)

Local Government Denmark (LGDK)
Danish Regions

DMI
Ministry of Climate and Energy

The Information Centre for Climate Change Adaptation

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PHOTO: COLOURBOX