

# Adaptation challenges and opportunities for the European energy system – key findings from a new EEA report

# Key information source: new EEA Report

EEA Report | No 01/2019

Adaptation challenges and opportunities  
for the European energy system  
Building a climate-resilient low-carbon energy system

ISSN 1977-8449



European Environment Agency



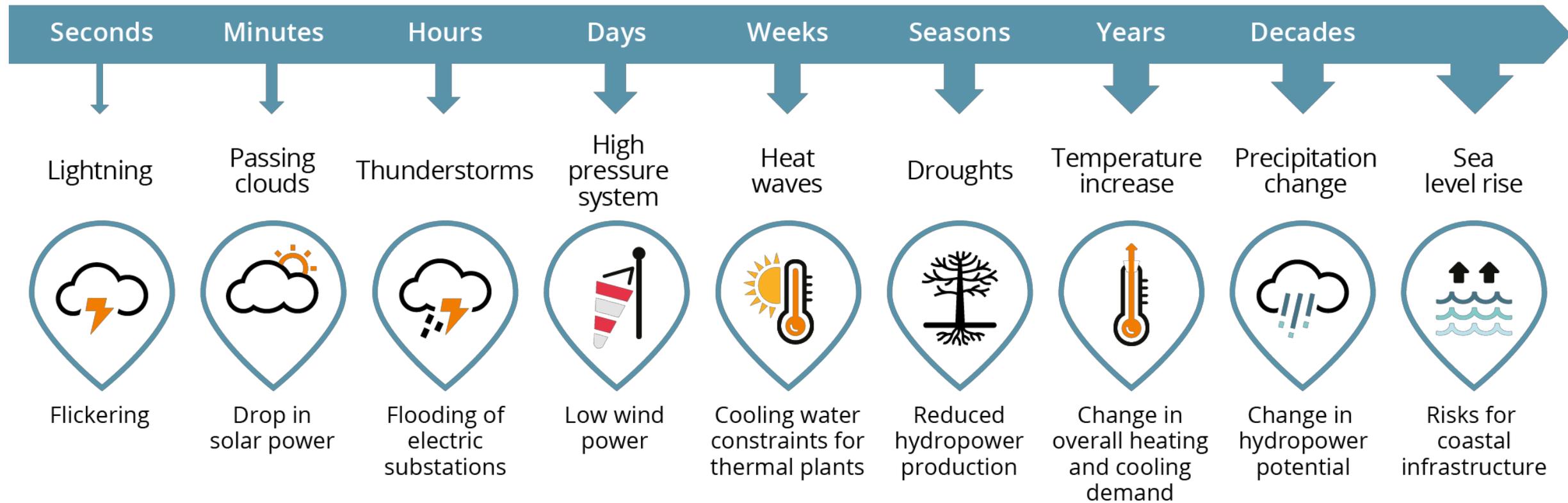
- Published on 18 June 2019:  
[eea.europa.eu/publications/adaptation-in-energy-system](https://eea.europa.eu/publications/adaptation-in-energy-system)
- Launch at EUSEW Policy Conference:  
[Session INT40: Preparing the European energy system for the impacts of climate change](#)
- First European-level overview of information on
  - climate impacts on the energy system,
  - the rapidly evolving policy framework,
  - activities of the most relevant stakeholders,
  - opportunities for further action
- Aims to help that the massive investments made in the clean energy transition are viable also in a changing climate

# Why is climate change adaptation in the energy system becoming increasingly important?

- 1. Climate change:** Changes in average climate as well as climate and weather extremes
- 2. Energy system change:** Rapid growth of renewable energy sources, most of which are climate-sensitive
- 3. Societal change:** Increasing dependence of modern economies and societies on a reliable energy supply



# A climate-resilient energy system needs to address weather and climate events at many time scales



# Overview of climate change impacts on the energy system

## British Isles

- Offshore energy production infrastructure (wind, oil, gas)
- Coastal energy infrastructure (power plants and refineries)
- Transmission and distribution grids
- Electrical substations
- Heating and cooling demand

## Northern Europe

- Hydropower
- Offshore wind power
- Biomass energy
- Oil and gas extraction
- Offshore energy production infrastructure (wind, oil, gas)
- Coastal energy infrastructure (power plants and refineries)
- Oil and gas transport
- Transmission and distribution grids
- Heating and cooling demand

## Central western Europe

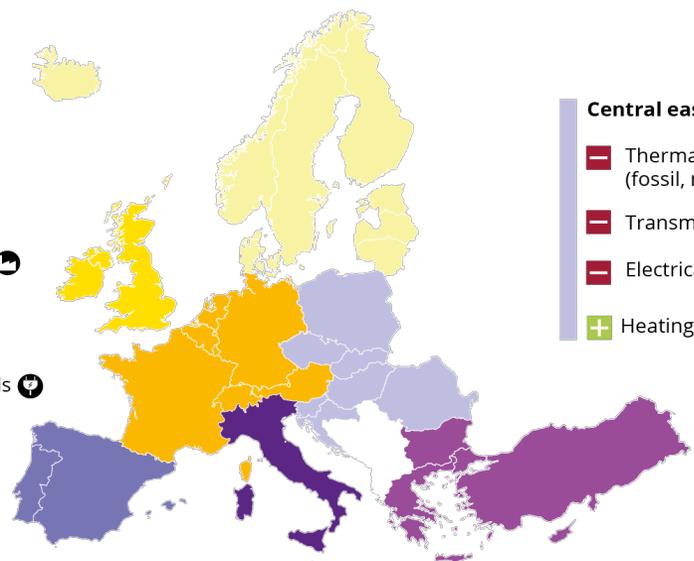
- Offshore energy production infrastructure (wind, oil, gas)
- Thermal power plants (fossil, nuclear and biomass)
- Transmission and distribution grids
- Electrical substations
- Heating and cooling demand

## Central eastern Europe

- Thermal power plants (fossil, nuclear and biomass)
- Transmission and distribution grids
- Electrical substations
- Heating and cooling demand

## Iberian Peninsula, Apennine Peninsula and South-eastern Europe

- Hydropower
- Concentrated solar power
- Biomass energy
- Thermal power plants (fossil, nuclear and biomass)
- Transmission and distribution grids
- Pumped hydro storage
- Peak electricity demand
- Energy demand for desalination



- All components of the energy system are vulnerable to climate change and/or extreme weather events
- Impacts differ across regions and energy sector components
- Southern European regions are most adversely affected

- Predominantly beneficial impacts
- Predominantly adverse impacts
- Impacts not classifiable as beneficial or adverse due to complex economic and environmental effects
- Renewable energy sources
- Fossil energy sources
- Other energy sources and carriers (nuclear, electricity, heating and cooling)



# EU policies increasingly support enhancing climate resilience in the energy system

- **EU adaptation strategy** (recently evaluated)
- Mandatory climate proofing of major EU-funded infrastructure
- European standardization organisations revise infrastructure standards
- **EU Regulation on the governance of the Energy Union and climate action** (including NECPs and European/national long-term strategies)
- **Regulation on risk preparedness in the electricity sector**
- Improving the knowledge base for adaptation (including **Copernicus Climate Change Service**)

# C3S supports building a climate-resilient energy system



[News](#) [Events](#) [Press](#) [Tenders](#) [Help & Support](#)

[ABOUT US](#)

[WHAT WE DO](#)

[DATA](#)

[SEARCH](#)

[WHAT WE DO](#) ► [SECTORAL IMPACTS](#) ► [SECTORAL SPECIFIC CHALLENGES](#) ► [ENERGY SECTOR](#)

SECTORAL INFORMATION

## Energy

Climate change is expected to affect both the supply and demand of energy. As the energy sector is increasingly relying on renewable sources, the relevance of climate variability and change also increases. It is vital that energy providers and policy makers have the climate information they need to make informed choices on the future energy mix. We support the energy sector by providing information related to weather (wind, solar and hydro) and energy (capacity factors, demand, volatility) forecasts at a regional and national level in Europe.

[DEMONSTRATOR PROJECTS](#) [SHOWCASES](#)

### Demonstrator projects



18TH JULY 2018

#### Operational service for the energy sector

The C3S Energy operational service will have the key elements of historical, seasonal forecast and projection periods for climate, electricity demand and the production of power, from wind, solar and hydro, with focus placed on Europe.



16TH DECEMBER 2017

#### European Climate Energy Mixes

ECEM is a tool that uses data to show how climate change impacts energy supply. Through ECEM we help energy providers to make informed choices on how to meet future energy demand.



16TH DECEMBER 2017

#### Climate Information for the Energy sector

CLIM4ENERGY brings together the expertise of climate research centres and energy practitioners to demonstrate the value chain from essential climate variables to actionable information in the energy sector.

### RELATED NEWS

23RD JULY 2019

#### Planning for the future: C3S provides early warning to the energy industry

15TH MAY 2018

#### Copernicus to launch operational service for energy sector

6TH DECEMBER 2017

#### Reanalysis as a valuable tool for the wind energy community

14TH OCTOBER 2016

#### Climate projection dataset release for the energy sector

[climate.copernicus.eu/energy](http://climate.copernicus.eu/energy)

1994-2019  
Environment Agency



# Many EU-funded research projects support climate service development relevant for the energy sector

- [CLARA](#): Climate forecast enabled knowledge services
- [CLIM2POWER](#): Translating climate data into power plant operational guidance
- [CLIM4ENERGY](#): Providing climate products tailored for the energy sector
- [ECEM](#): European Climatic Energy Mixes
- [IMPRES](#): Improving predictions and management of hydrological extremes
- [MARCO](#): Market research for a climate services observatory
- [PUCS](#): Pan-European urban climate services
- [S2S4E](#): Sub-seasonal to seasonal climate forecasting for energy
- [SECLI-FIRM](#): Added value of seasonal climate forecasting for integrated risk ass.
- [WINDSURFER](#): Wind and wave scenarios, uncertainty and climate risk assessments for forestry, energy and reinsurance



# Many national governments are already facilitating adaptation in the energy system

## Examples for national actions

- (Multi-)sectoral climate change risk assessments
- Sectoral adaptation plans
- Reporting obligations for infrastructure providers
- Guidance material for climate change risk assessments and resilience planning
- Weather and climate services

# Knowledge about national adaptation actions is limited

Country	Document					
	Climate change impact, vulnerability and risk (CCIV) assessments		National adaptation strategies (NAS) and plans (NAP)		Country fiches	UNFCCC
	Availability of national CCIV assessment	Coverage of the energy sector in national CCIV assessments	NAS and/or NAP adopted	Coverage of the energy sector in NAS and/or NAP	Adaptation measures implemented in the energy sector	
Austria						
Belgium						
Bulgaria						
Croatia						
Cyprus						
Czechia						
Denmark						
Estonia						
Finland						
France						
Germany						
Greece						
Hungary						
Iceland						
Ireland						
Italy						
Latvia						
Liechtenstein						
Lithuania						
Luxembourg						
Malta						
Netherlands						
Norway						
Poland						
Portugal						
Romania						
Slovakia						
Slovenia						
Spain						
Sweden						
Switzerland						
Turkey						
United Kingdom						

- **Leftmost columns:** Almost all countries have conducted climate change risk assessments for the energy sector
- **Central columns:** Most, but not all, national adaptation strategies and action plans address the energy sector
- **Rightmost columns:** The Country fiches (for EU Member States) and the UNFCCC National Communications provide at best limited evidence of the implementation of adaptation actions in the energy sector

# Adaptation case studies by European energy companies

Adapting overhead lines to increasing temperatures  
(United Kingdom)



Improved resilience of biomass fuel supply chain  
(United Kingdom)



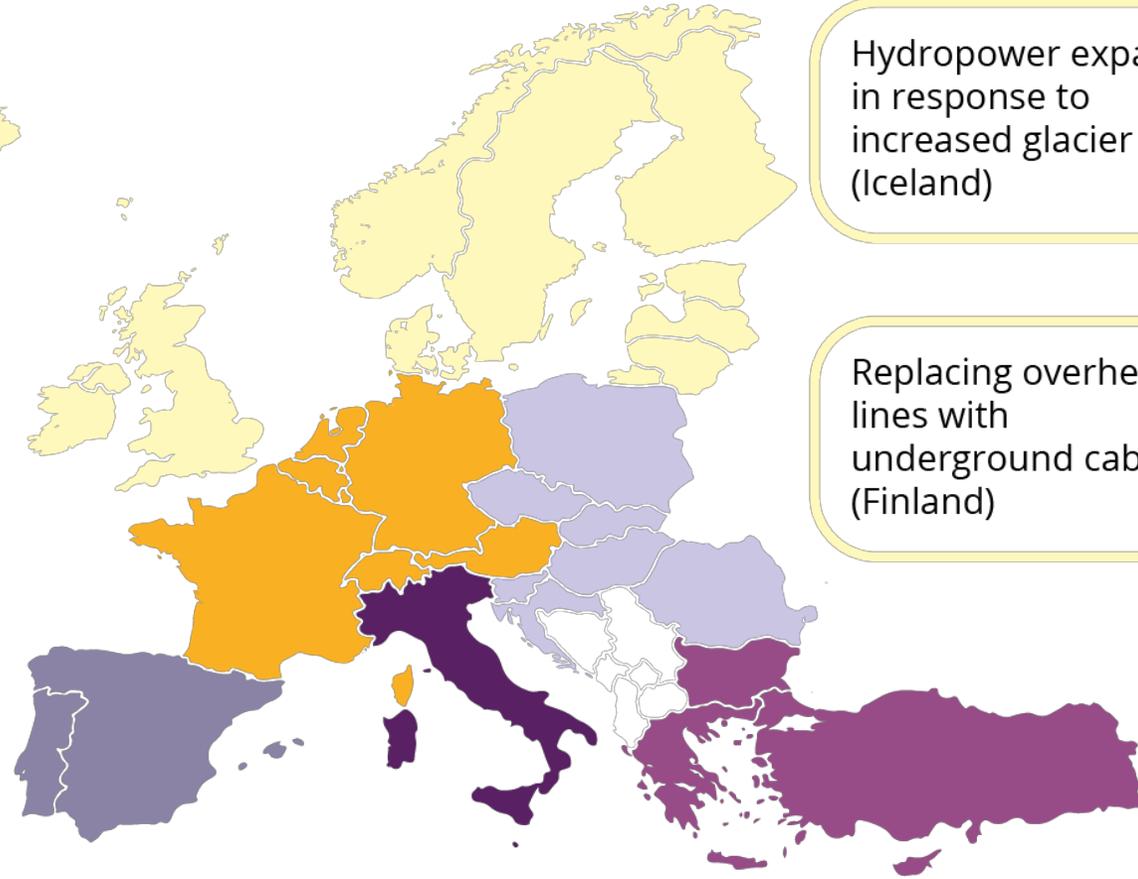
Flood risk management for hydropower plants  
(France)



Hydropower expansion in response to increased glacier melt  
(Iceland)



Replacing overhead lines with underground cables  
(Finland)



Further information is available on Climate-ADAPT:

[climate-adapt.eea.europa.eu/knowledge/tools/case-studies-climate-adapt](https://climate-adapt.eea.europa.eu/knowledge/tools/case-studies-climate-adapt)



# Conclusions and outlook (1)

1. There is an **increasing need for climate change adaptation** and strengthening climate resilience in the European energy system
2. There are **synergies and trade-offs** between climate change adaptation, mitigation and other sustainability concerns
3. Many policymakers and stakeholders are already addressing adaptation needs in the energy system, but **there is scope for further action**
4. The **development of the Energy Union** and the EU long-term strategy provide **important opportunities** for mainstreaming adaptation concerns in the planning and implementation of a decarbonised energy system

# Conclusions and outlook (2)

5. All **countries** should address climate change impacts on the energy system in the development of their national energy and climate plans, long-term decarbonisation strategies, and national adaptation action plans
6. **Governments can further facilitate adaptation by market actors** through:
  - appropriate regulation of energy markets,
  - 'soft' measures that focus on information provision and exchange,
  - potentially reporting requirements for critical infrastructure providers
7. **European and national climate services** can provide valuable information for building and managing a climate-resilient energy system
8. **Market actors** in the energy sector should see assessing and strengthening climate resilience as part of their core business