Climate change: understanding the impacts and mitigating the change

Diana Ürge-Vosatz

CENTER FOR CLIMATE CHANGE
AND SUSTAINABLE ENERGY POLICY

CENTRAL EUROPEAN UNIVERSITY

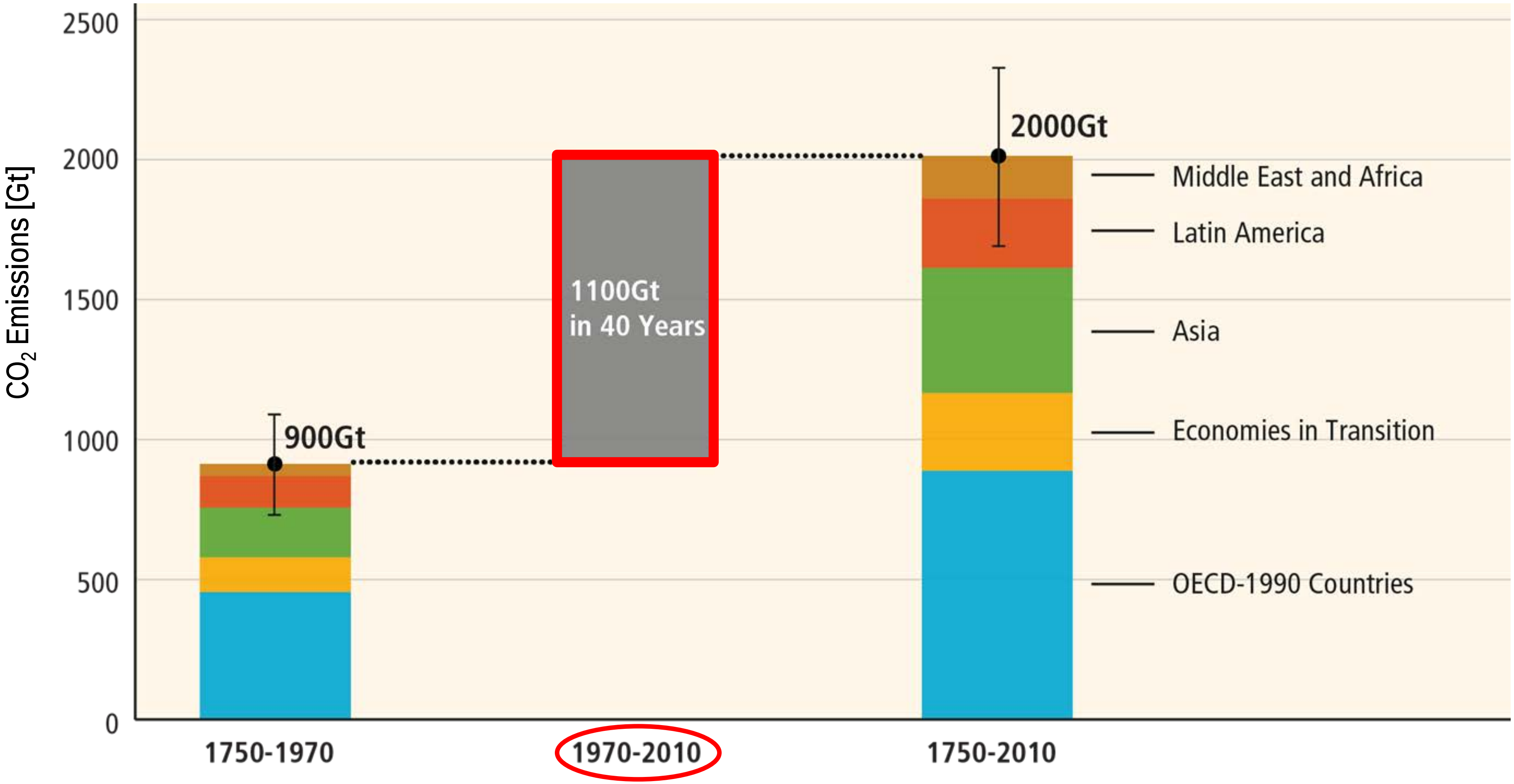
Regional Dialogue of the EU, the Candidate Countries and the Potential Candidates On Intended Nationally Determined Contributions (INDCs) to the 2015 Climate Agreement

28 April 2015, Istanbul, Turkey

Content

- Key new insights by the IPCC's AR5
- Major climate impacts in Europe and the region
- It is not too late to act
- ….but strong, immediate action is required
- Opportunities for action in the region actually have large development benefits

About half of the cumulative anthropogenic CO_2 emissions between 1750 and 2010 have occurred in the last 40 years.

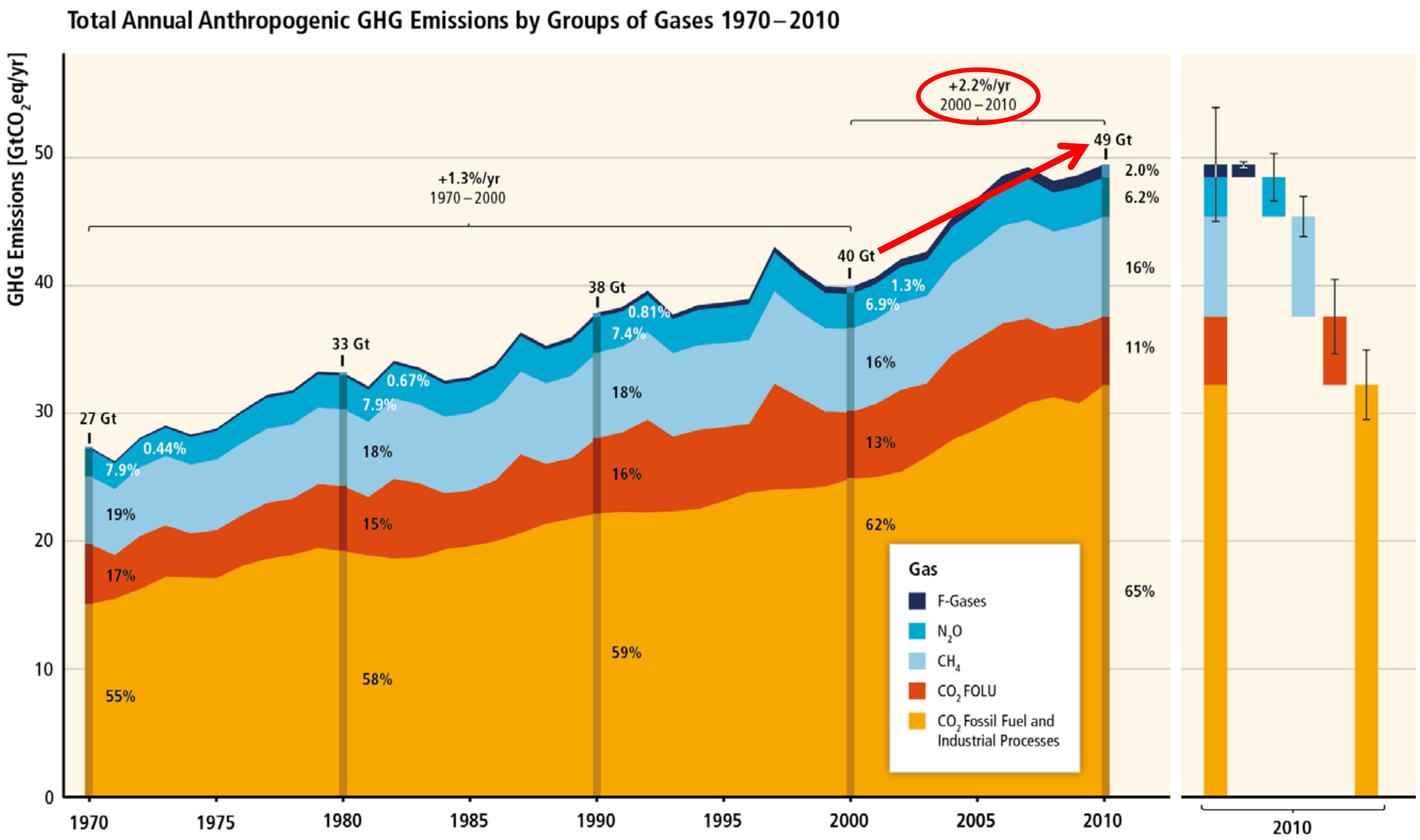


IPCC, 2014

GHG emissions growth has accelerated despite reduction efforts.

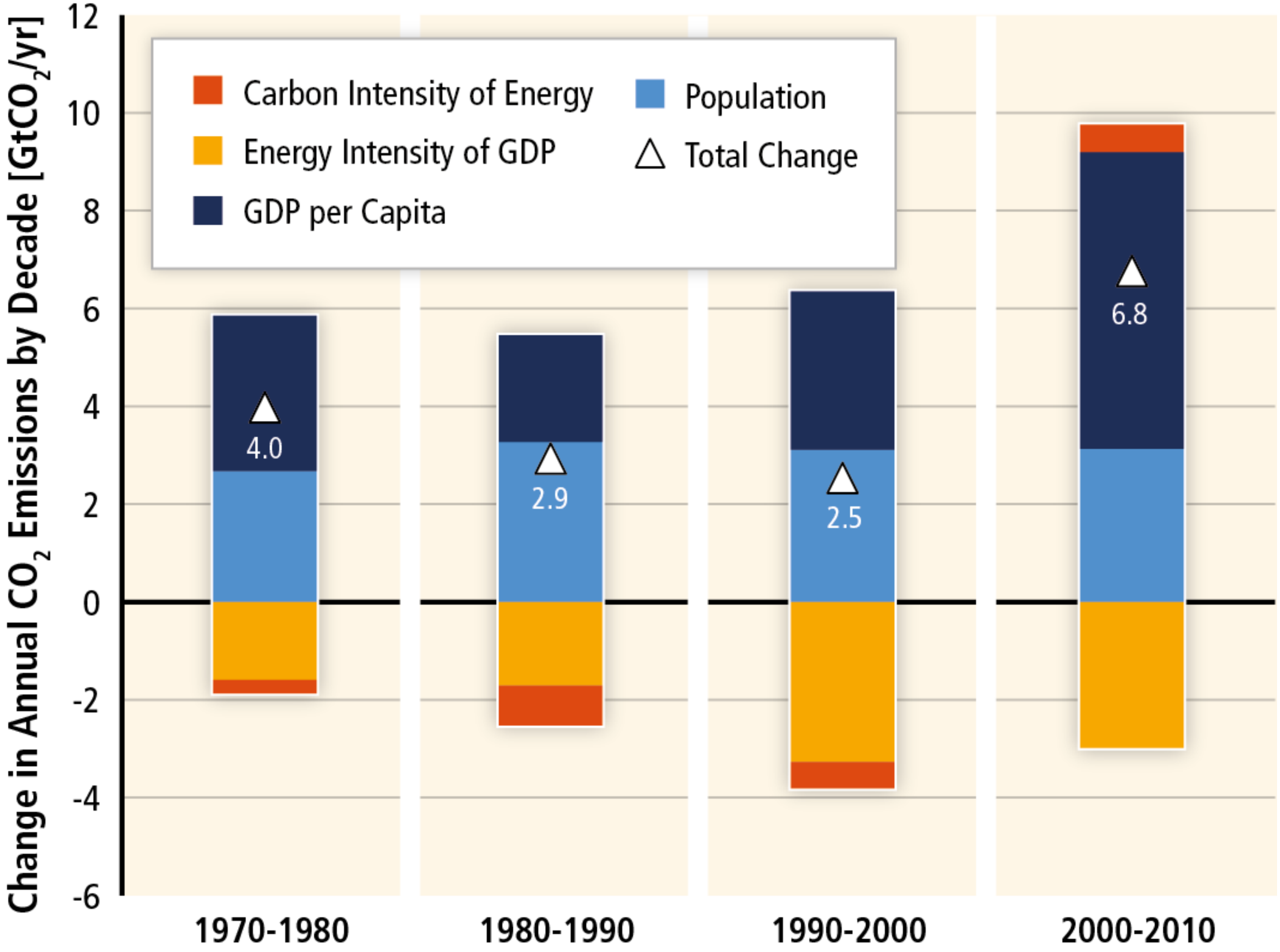
IPCC, 2014

Between 2000 and 2010 global GHG emissions increased by <u>2.2% p.a.</u>; at a higher rate than any decade since 1970.



IPCC, 2014

GHG emissions rise with growth in GDP and population: long-standing trend of decarbonisation of energy reversed.

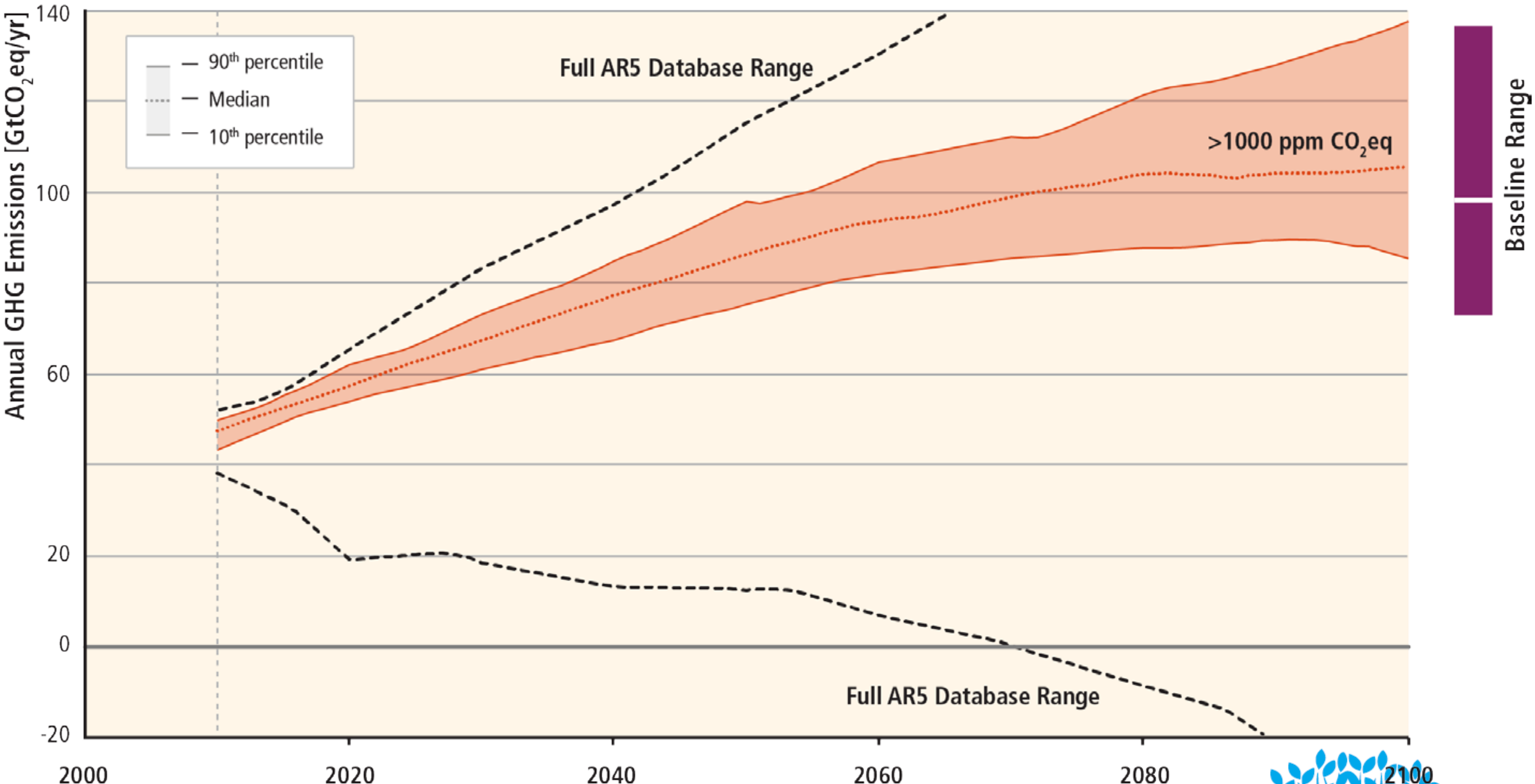


IPCC, 2014

3CSEP

Limiting warming to 2°C involves substantial technological, economic and institutional challenges.

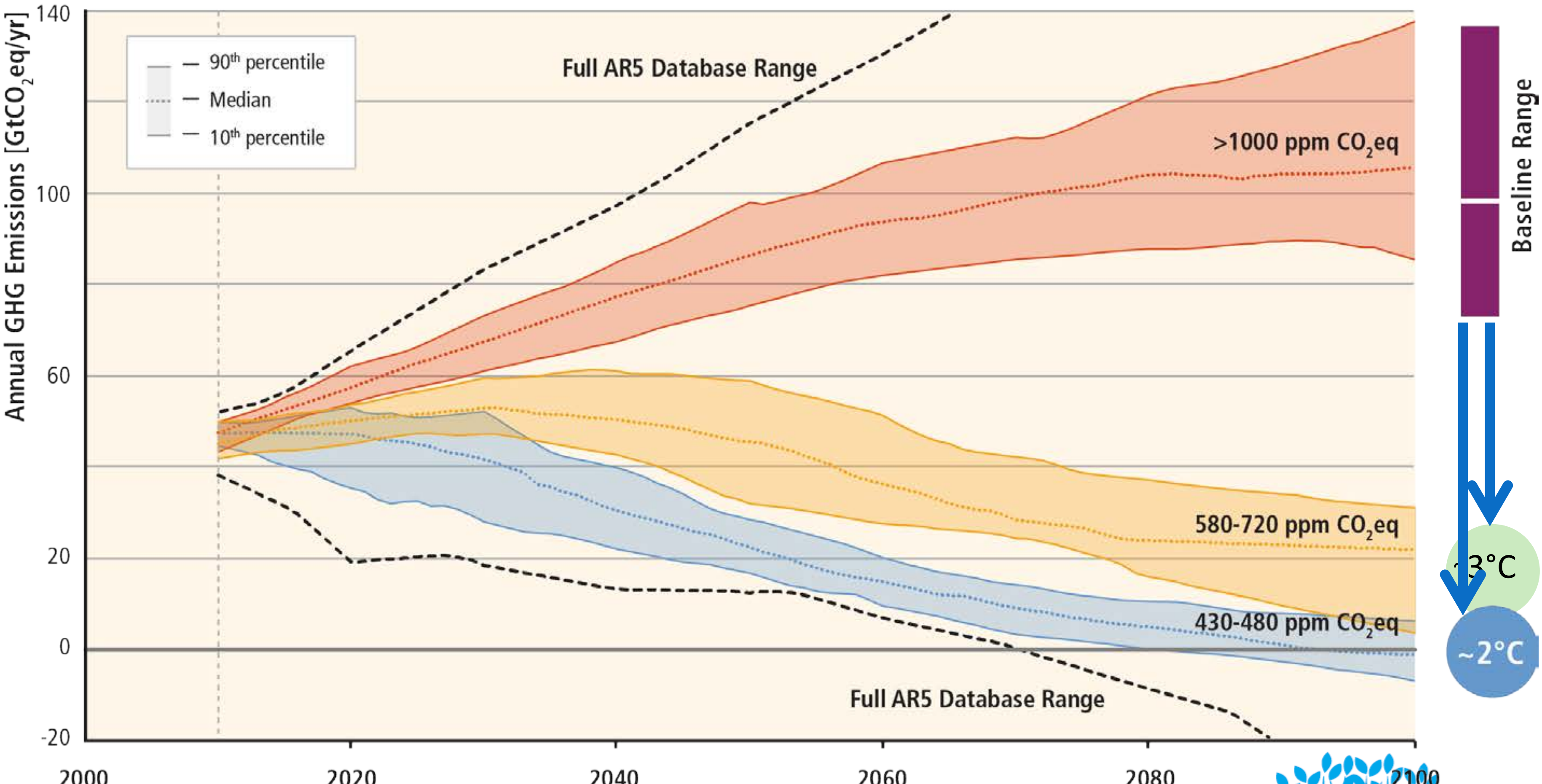
Stabilization of atmospheric GHG concentrations requires moving away from business as usual.



Based on Figure 6.7

3CSEP

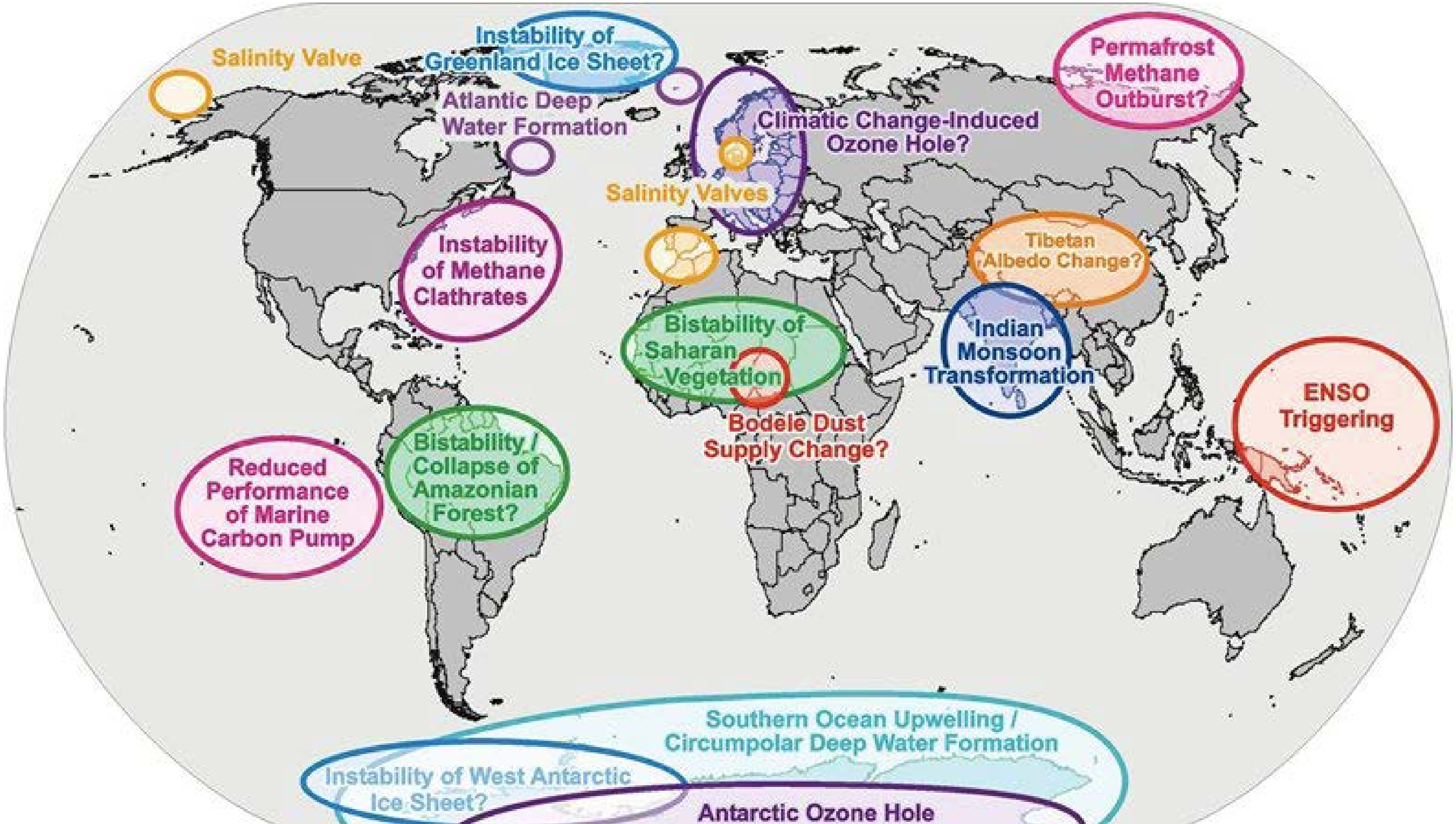
Lower ambition mitigation goals require similar reductions of GHG emissions.



Based on Figure 6.7

3CSEP

Climate tipping points



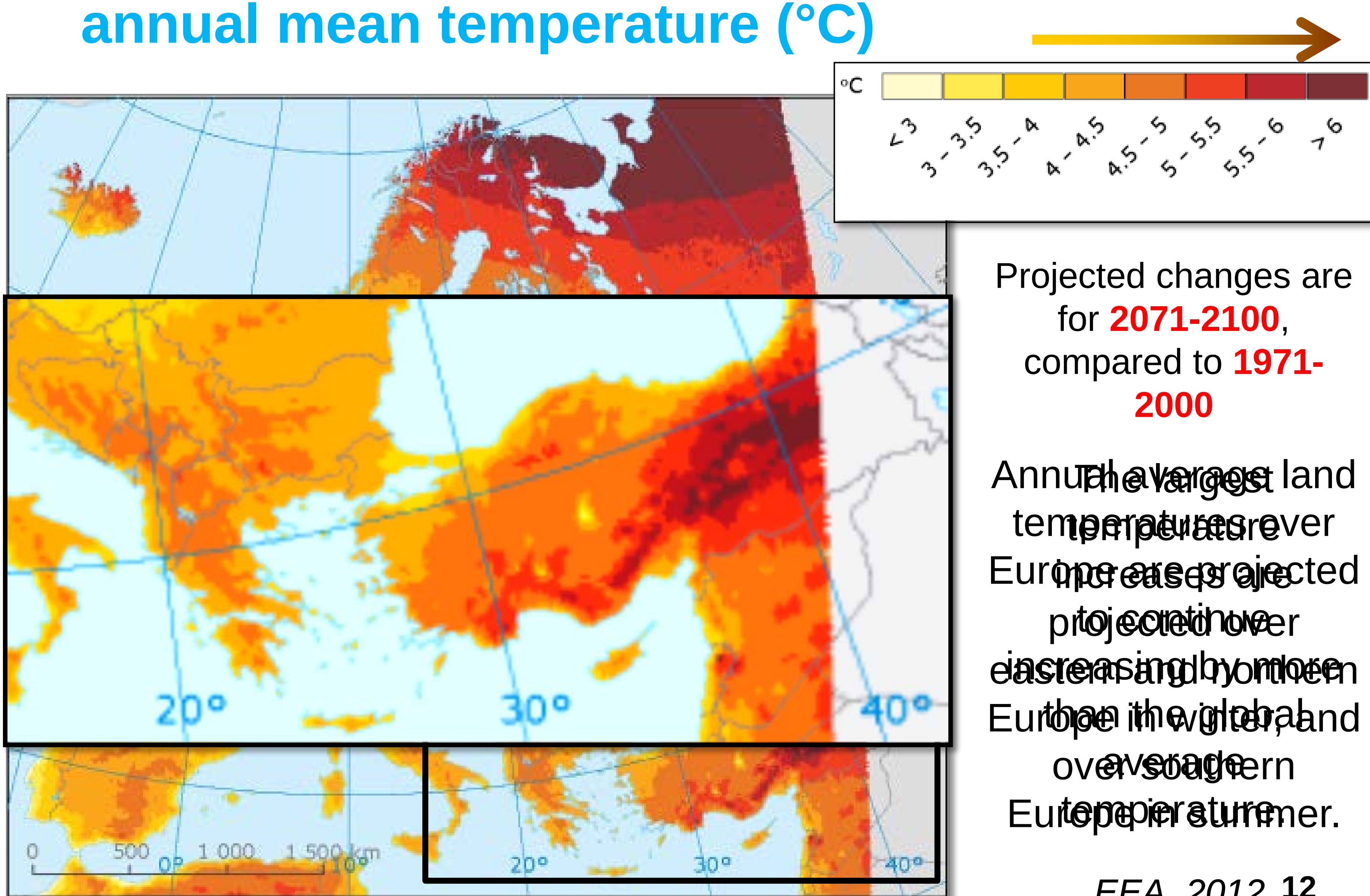
3CSEP

Climate impacts in Europe and the region

CENTER FOR CLIMATE CHANGE
AND SUSTAINABLE ENERGY POLICY

CENTRAL EUROPEAN UNIVERSITY

Projected changes in annual mean temperature (°C)



Source: European Environment Agency (EEA)

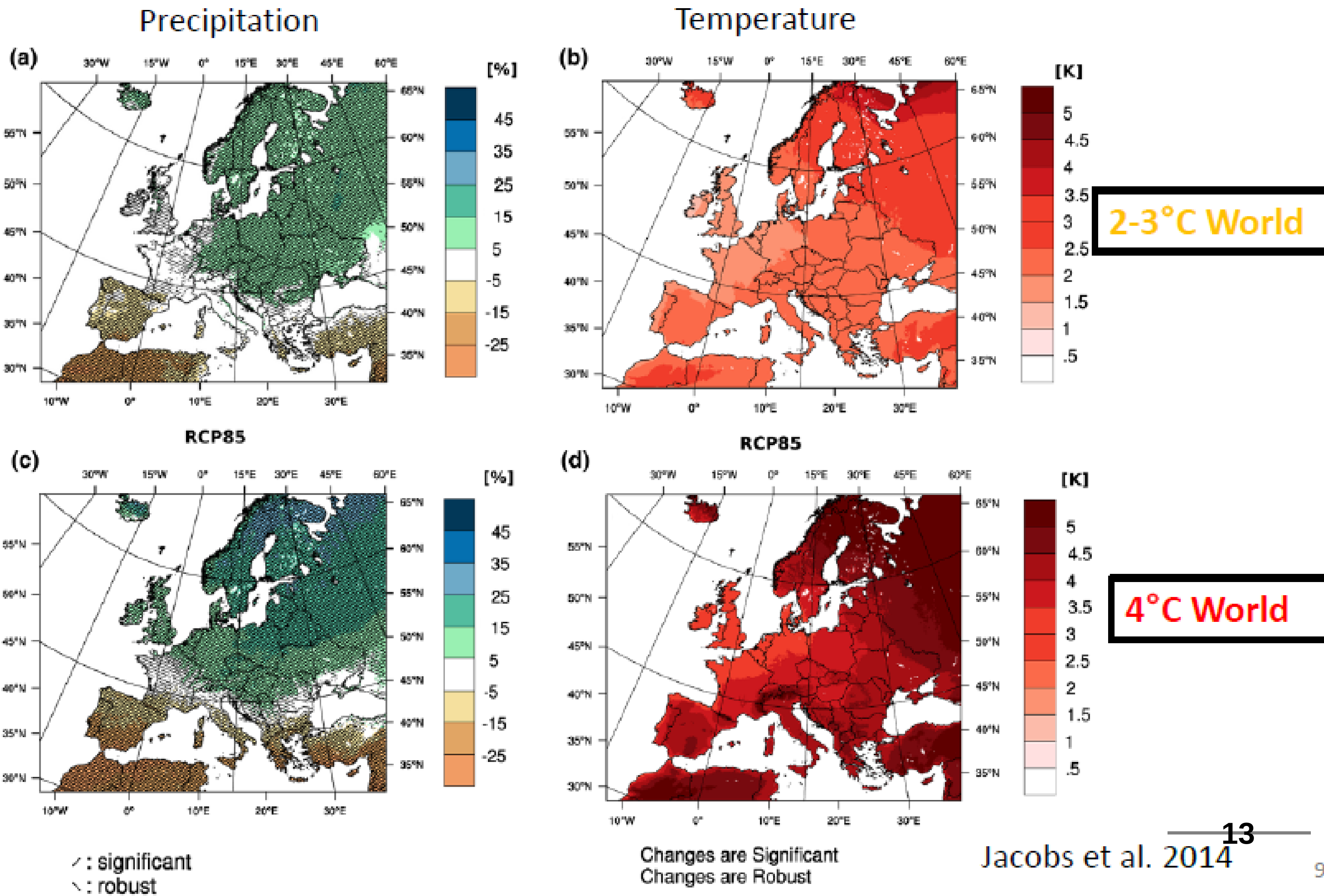
Projected changes are for **2071-2100**, compared to **1971-2000**

Annual average land temperatures over Europe are projected to continue increasing by more than the global average temperature.

The largest temperature increases are projected over eastern and northern Europe in winter, and over southern Europe in summer.

EEA, 2012

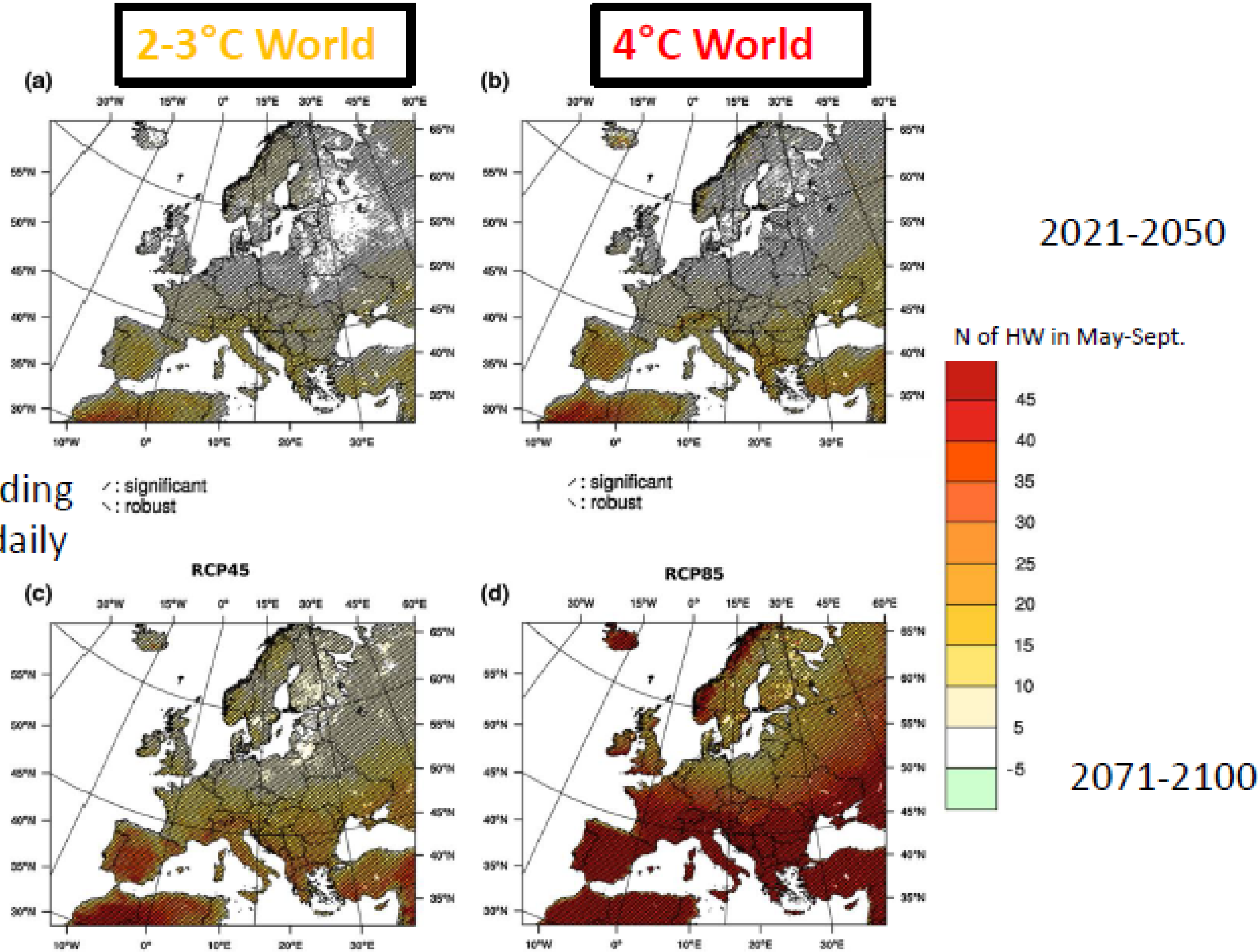
The region will be particularly hit by climate impacts



Jacobs et al. 2014

Increasing heat waves

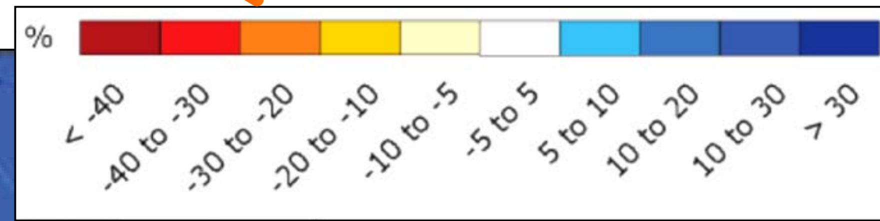
Heat waves = >3 consecutive days exceeding the 99th percentile of daily maximum temperature (May to September)

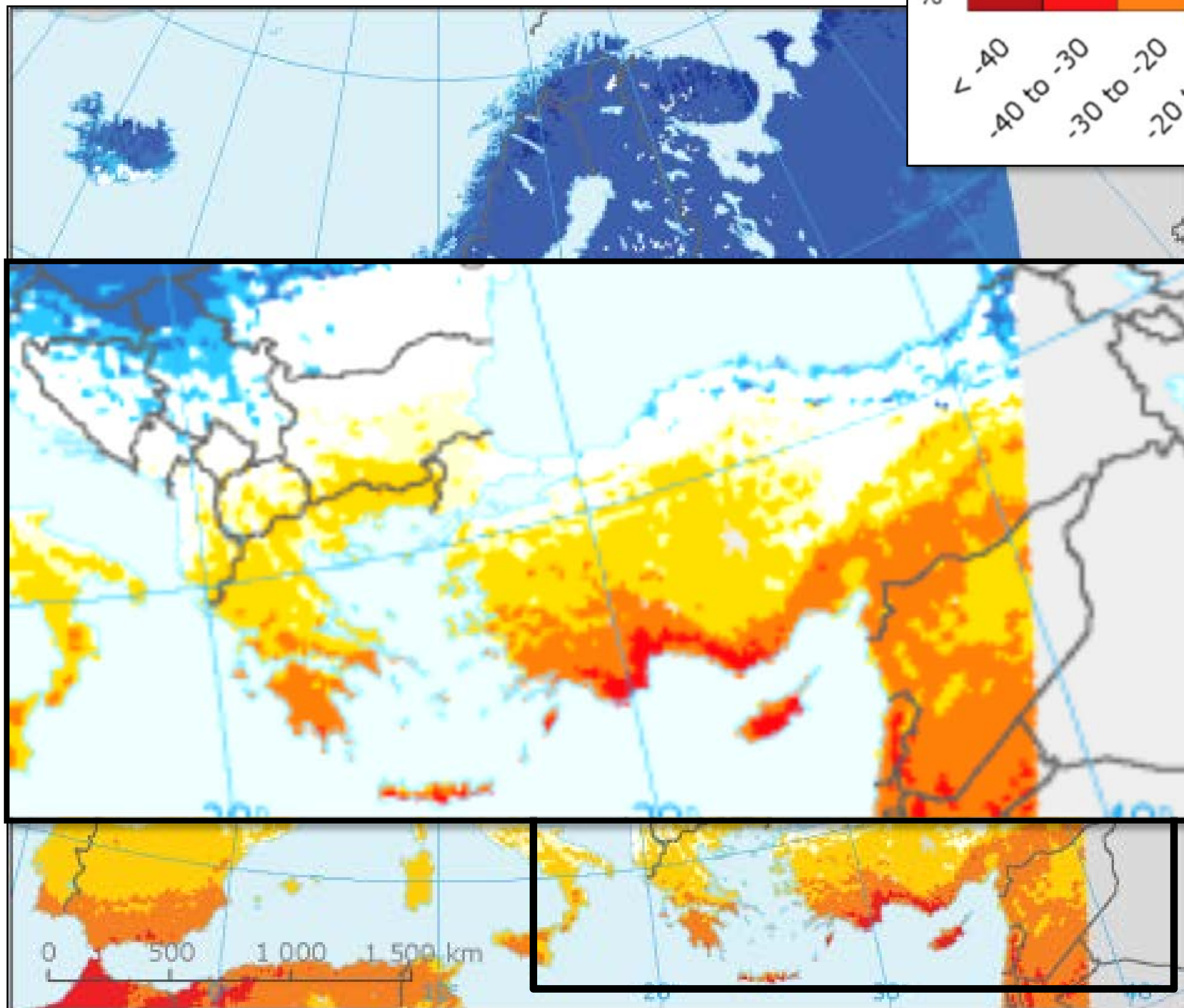


Jacobs et al. 2014

reyer@pik-potsdam.de

Projected changes in annual precipitation (%)





Projected changes are for **2071-2100**, compared to **1971-2000**

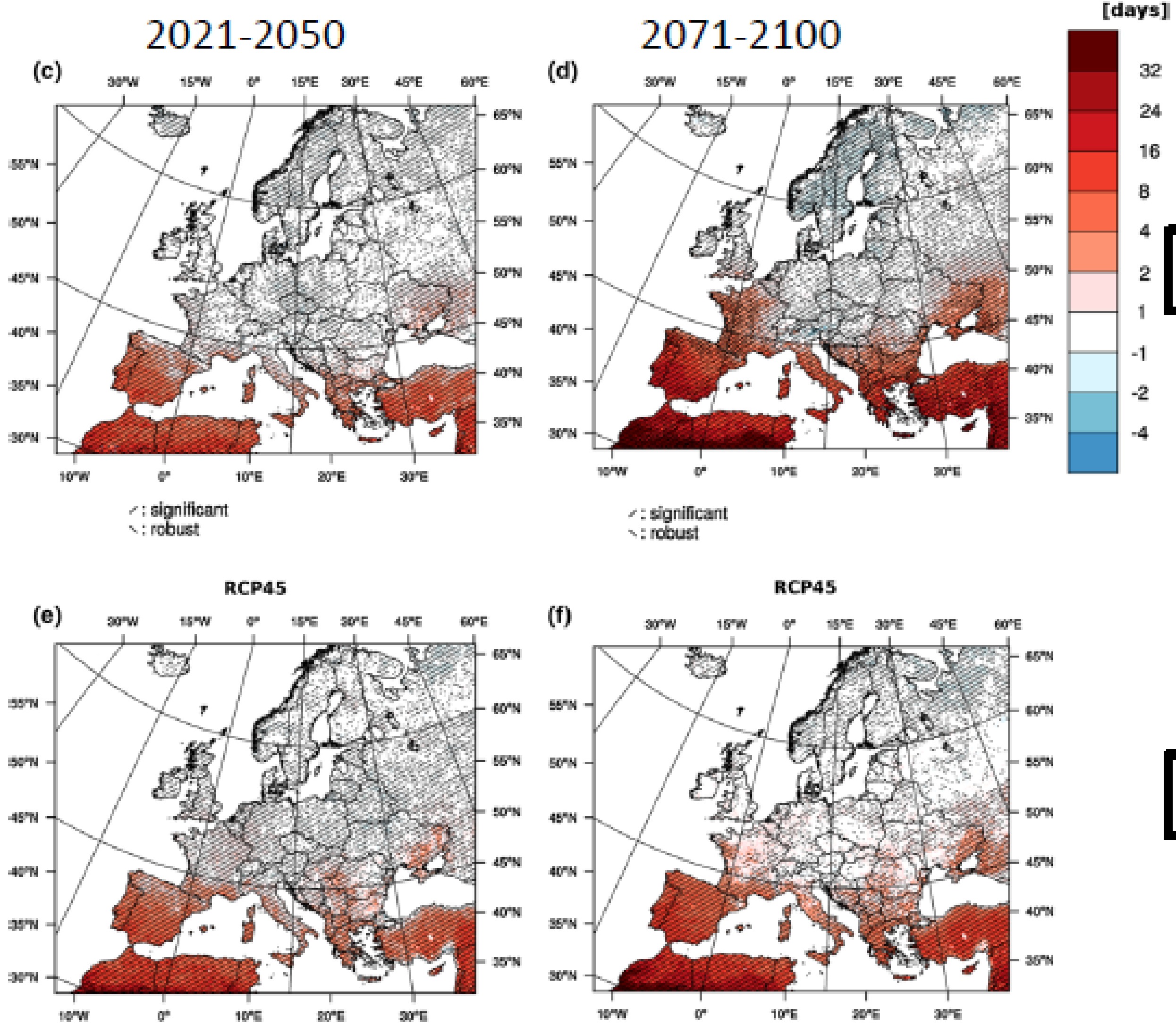
Annual precipitation is generally projected to increase in northern Europe and to decrease in southern Europe.

EEA, 2012

Source: European Environment Agency (EEA)

Longer dry spells

Dry spells= 95th percentile of the length of all identified dry spells (at least 5 consecutive days with daily precipitation below 1 mm)



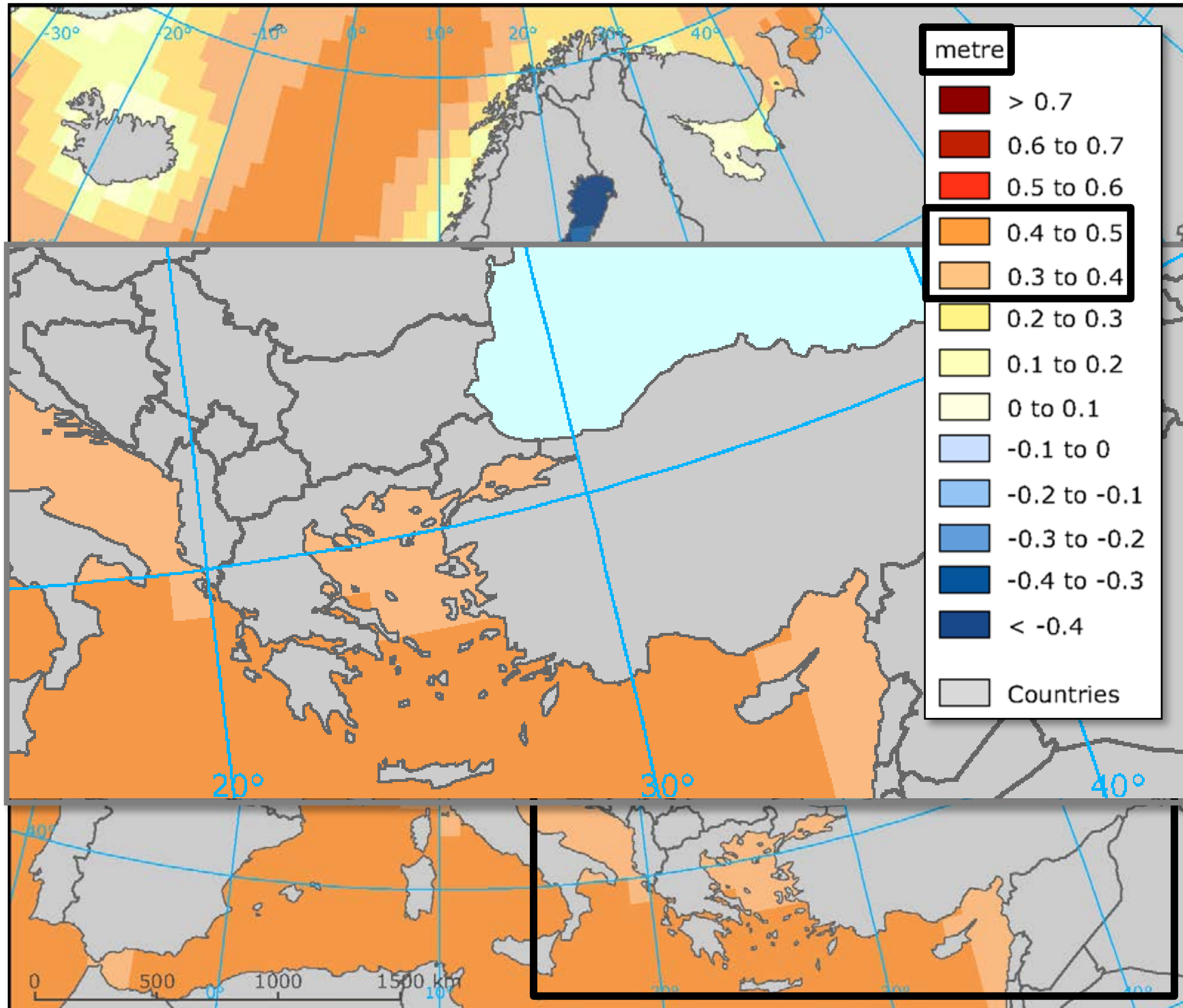
4°C World

2-3°C World

Jacobs et al. 2014

reyer@pik-potsdam.de

Projected changes in relative sea level (m)



Source: European Environment Agency (EEA)

Relative sea level in **2081-2100** compared to **1986-2005**

for the **medium-low emission** scenario RCP4.5 based on an ensemble of CMIP5 climate models

Data: ICDC University of Hamburg

Climate Impacts in Europe:
high emissions and no adaptation scenario

- **heat-related deaths** would reach about 200 000 per year;
- the cost of **river flood damages** would exceed EUR 10 billion/year;
- every year **forest fires** would affect an area about 800 000 ha;
- people affected by **droughts** would increase by a factor of seven to about 150 million per year;
- welfare loss due to **sea-level rise** would more than triple to EUR 42 billion/year

Ciscar et al., 2014; JRC PESETA II. Project

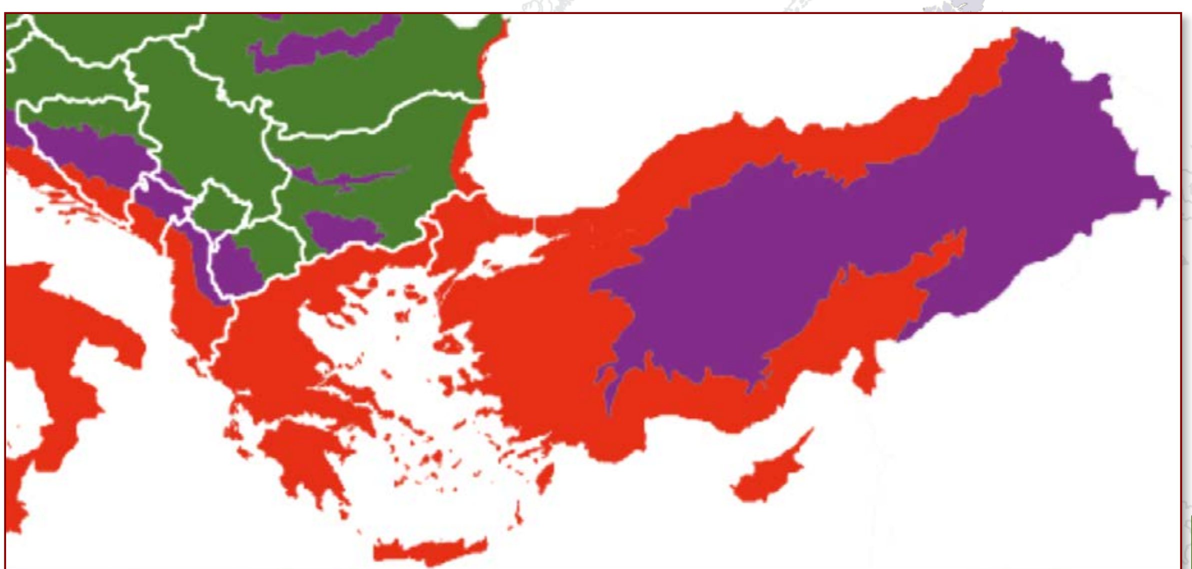
Storm floods Balkans, Serbia declares emergency

“A massive storm has dumped record rainfalls on the Balkans, causing severe flooding, especially in Serbia, and parts of Bosnia. Schools have been closed in Serbia, where several people have drowned. Croatia is on alert.”

15.05.2014, Deutsche Welle

Elvis Barukcic
AFP, Getty Images

Key **observed** and **projected** impacts from climate change for the main regions in Europe

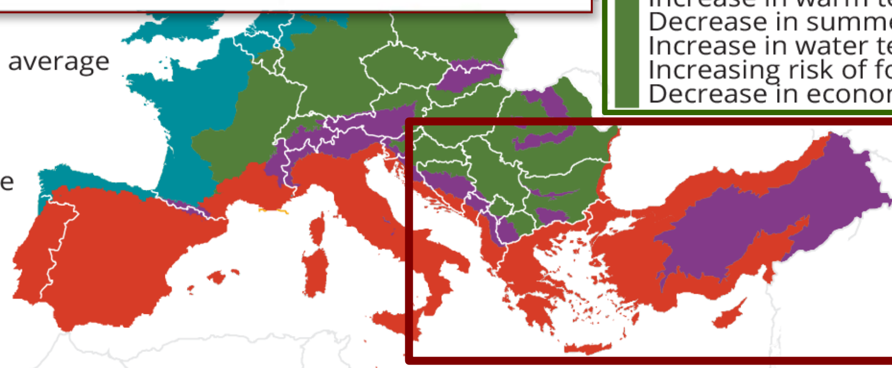


Northern Europe
Temperature rise much larger than global average
Decrease in snow, lake and river ice cover
Increase in river flows
Northward movement of species
Increase in crop yields
Decrease in energy demand for heating
Increase in hydropower potential
Increasing damage risk from winter storms
Increase in summer tourism

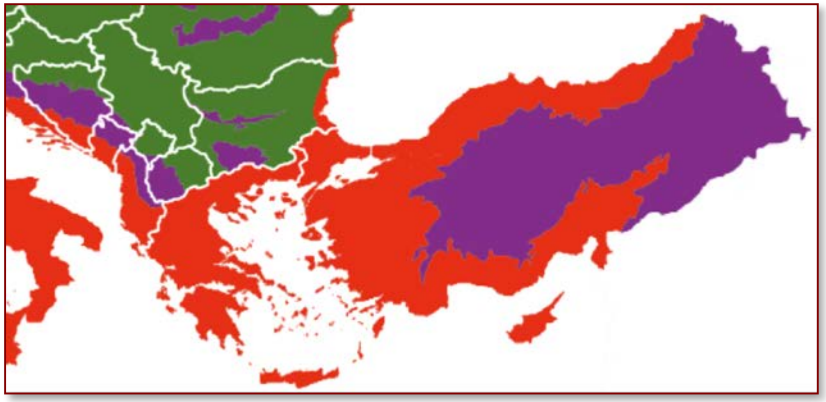
Mountain areas
Temperature rise larger than European average
Decrease in glacier extent and volume
Decrease in mountain permafrost areas
Upward shift of plant and animal species
High risk of species extinction in Alpine regions
Increasing risk of soil erosion
Decrease in ski tourism

Central and eastern Europe
Increase in warm temperature extremes
Decrease in summer precipitation
Increase in water temperature
Increasing risk of forest fire
Decrease in economic value of forests

Mediterranean region
Temperature rise larger than European average
Decrease in annual precipitation
Decrease in annual river flow
Increasing risk of biodiversity loss
Increasing risk of desertification
Increasing water demand for agriculture
Decrease in crop yields
Increasing risk of forest fire
Increase in mortality from heat waves
Expansion of habitats for southern disease vectors
Decrease in hydropower potential
Decrease in summer tourism and potential increase in other seasons



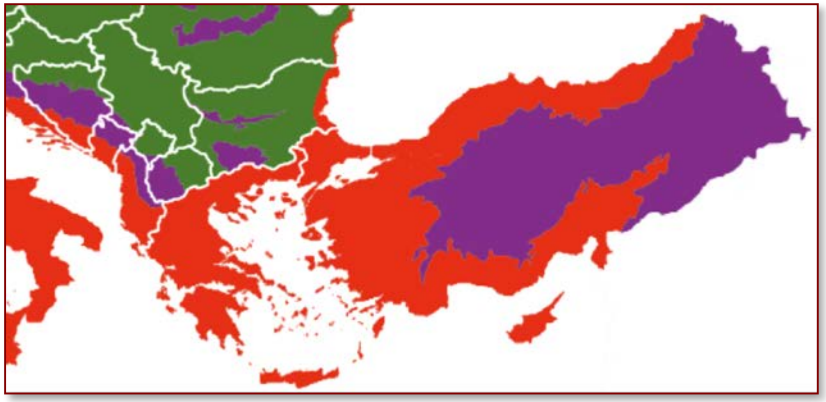
Source: European Environment Agency (EEA)



Central and eastern Europe

- Increase in warm temperature extremes
- Decrease in summer precipitation
- Increase in water temperature
- Increasing risk of forest fire
- Decrease in economic value of forests

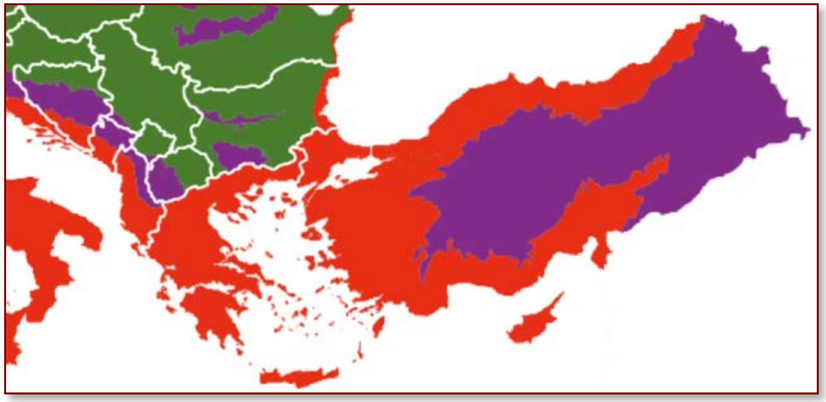
Source: European Environment Agency (EEA)



Mediterranean region I.

- **Temperature rise larger than European average**
- **Decrease in annual precipitation**
- **Decrease in annual river flow**
- **Increasing risk of biodiversity loss**
- **Increasing risk of desertification**
- **Increasing water demand for agriculture**
- **Decrease in crop yield**

Source: European Environment Agency (EEA)



Mediterranean region II.

- Increasing risk of forest fire
- Increase in mortality from heat waves
- Expansion of habitats from southern disease vectors
- Decrease in hydropower potential
- Decrease in summer tourism and potential increase in other seasons

Source: European Environment Agency (EEA)

3CSEP

Risk of decreasing water availability in West Balkan

- Water availability threatened in summers and as temperatures rise toward 4°C.
- Shifts in the timing of water flows lead to a higher risk of drought, with consequences for crop yields, urban health, and energy generation.
- Winter and spring flood risk is expected to increase slightly along the Danube, Sava and Tisza rivers.

Western Balkans

Agriculture

- In the Western Balkans, the **increasing occurrence of droughts** has been identified as a major threat to agricultural production under climate change (Giannakopoulos et al. 2009b; Gocic and Trajkovic 2013, 2014; Kos et al. 2013; UNDP 2014).
- The risk of increasing droughts for this region was also cited in the latest IPCC publication (Kovats et al. 2014).
- The **dominance of rain-fed agriculture** in the Western Balkans makes the agricultural sector especially vulnerable to changing precipitation patterns and increasing temperatures.
- The increasing appearance of **extreme rain and flood events** also poses risks to agriculture in the region (Sutton et al. 2013a).

The World Bank (2014) Turn Down the Heat

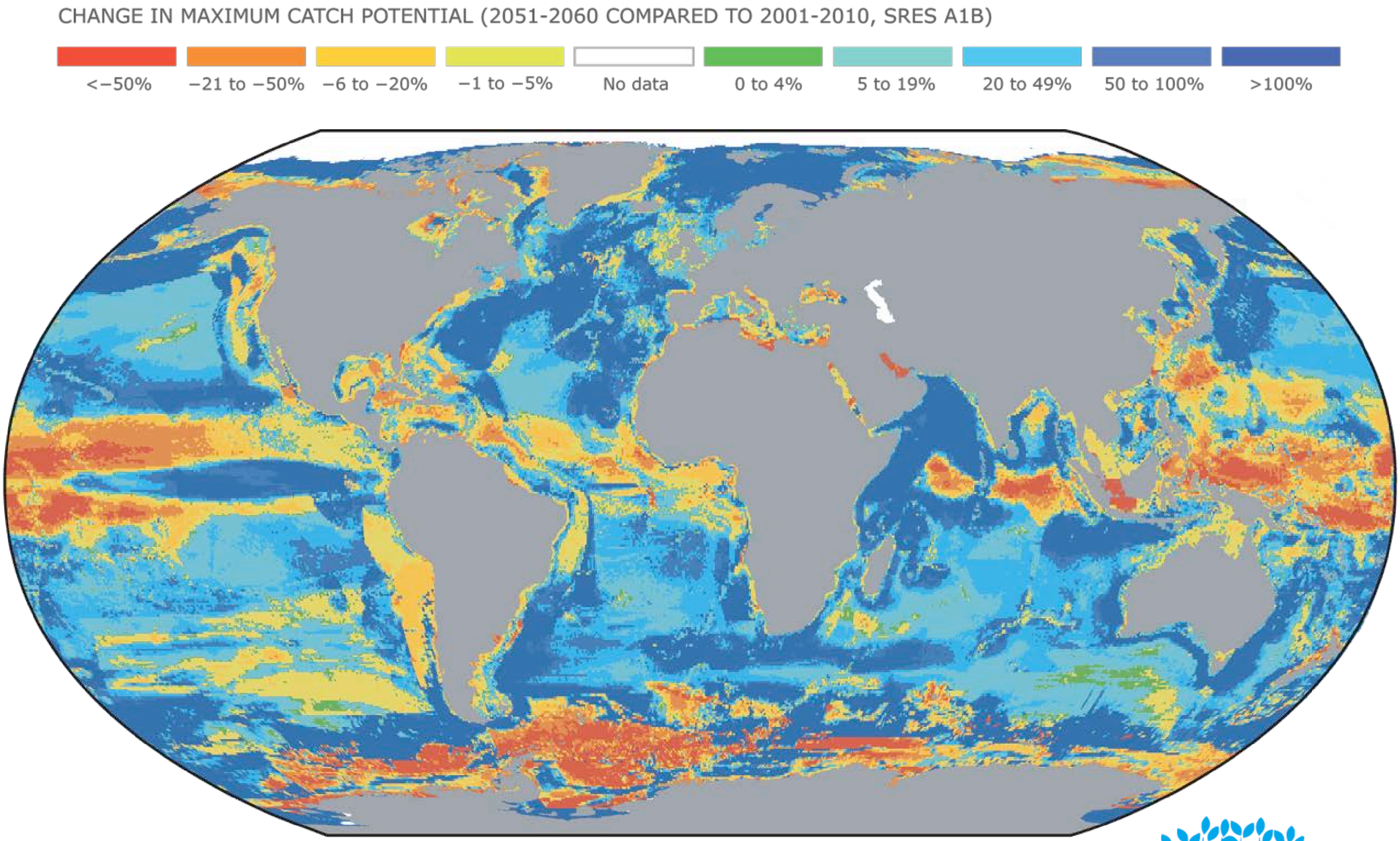
Risks to agricultural productivity

- Yield losses of up to 50% for maize, wheat, vegetables and grapes at 2°C warming in Macedonia
- Maize (-11%), grapes (-20%) or olives (-20%) at 2°C warming in Albania
- The risks of reduced crop yields and production losses increase rapidly above 1.5°-2°C warming.
- Increasing droughts and flooding events represent a major risk for agriculture in the Western Balkans.
- ➔but also yield increases ➔depending on region and crop modelling methods!
- ➔lack of studies for livestock

Western Balkans
Food security

- The availability of suitable arable land and water resources is expected to decline simultaneously, changes in the type and intensity of pests and diseases will occur, influencing the available productive and adapted crop varieties and animal breeds (Meyers et al. 2012).
- Heavy rainfall events and storms may occur more often, increasing the risk of erosion from wind and water and leading to the degradation and desertification of scarce, valuable arable land (Christmann et al. 2009).

The World Bank (2014) Turn Down the Heat



IPCC, 2014

3CSEP

Western Balkans
Energy systems

- It has been projected that **decreased production** and **power generation disruption** induced by lower runoff and increased air and water temperatures will lead to an **increase in electricity prices** (McDermott and Nilsen 2014).
- As the majority of the countries in the region are strongly dependent on thermal electric production, climate change is projected to increase their vulnerability by affecting the supply of electricity to both households and industry.

The World Bank (2014) Turn Down the Heat

energy

- Heterogenous energy mix in Western Balkan countries
- Thermal power plants: higher river water temperature & altered river flows ➔decreased production
- Hydropower: decreased production (southern Europe & Croatia)

Human Health

- spread of Tick-Borne Encephalitis
- Dengue & Chikungunya fever → increasing climatic suitability for *Aedes Albopictus*
- Higher temperatures increases risks of salmonellosis, although general trend is declining
- Mortality from heat waves

It is not too late to act

Center for Climate Change
and Sustainable Energy Policy

Central European University

Meeting the 2C target is still possible

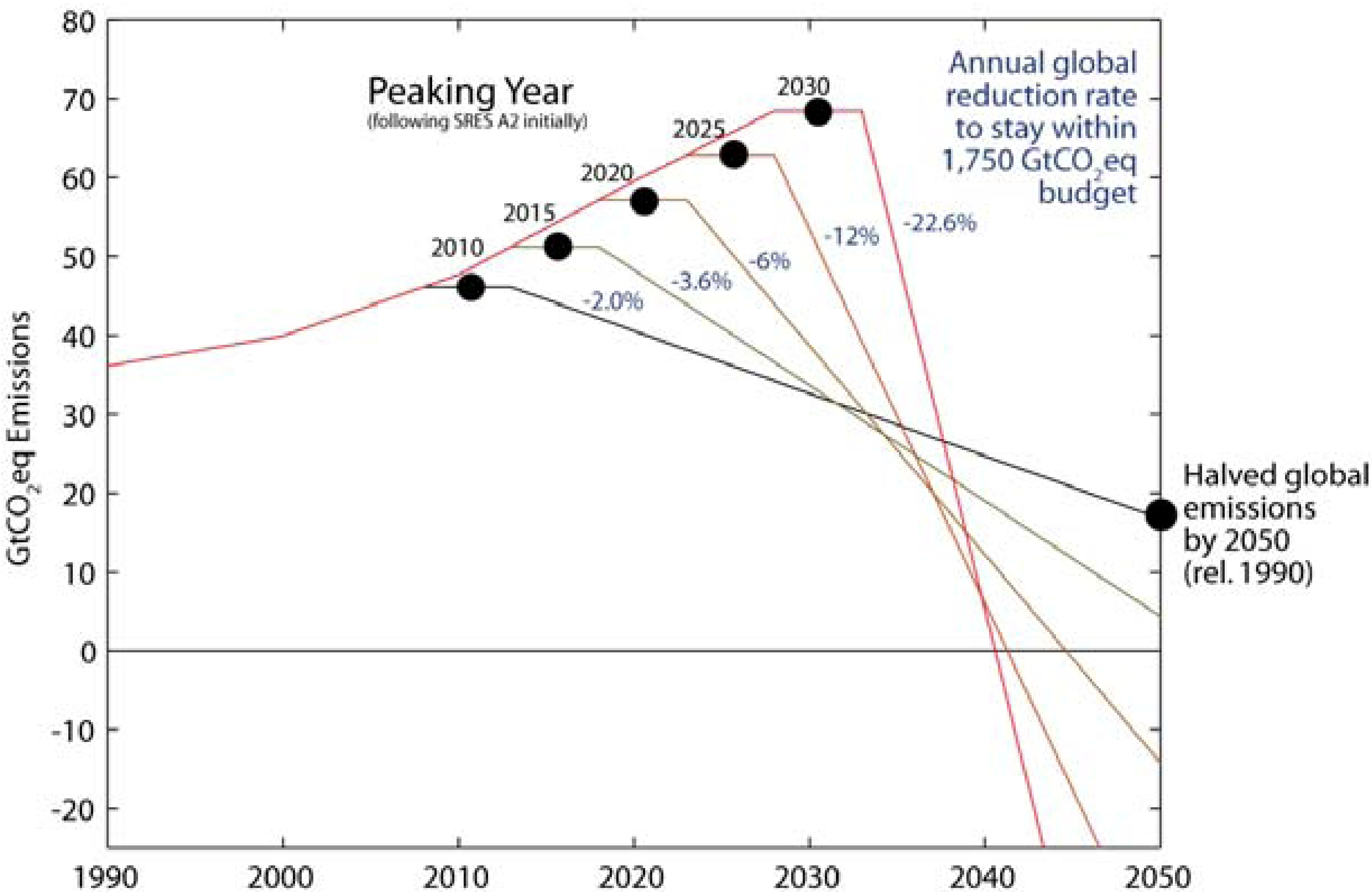
Mitigation cost estimates vary, but do not strongly affect global GDP growth.

Nothing is lost yet

- Meeting the 2°C (even 1.5°C) target is still possible.
- Mitigation is affordable, meaning a 0.04-0.14% loss in annual GDP growth (business-as-usual baseline: 1.6-3.0% GDP growth).
- Delay makes mitigation more costly, less likely to succeed and leaves less options.

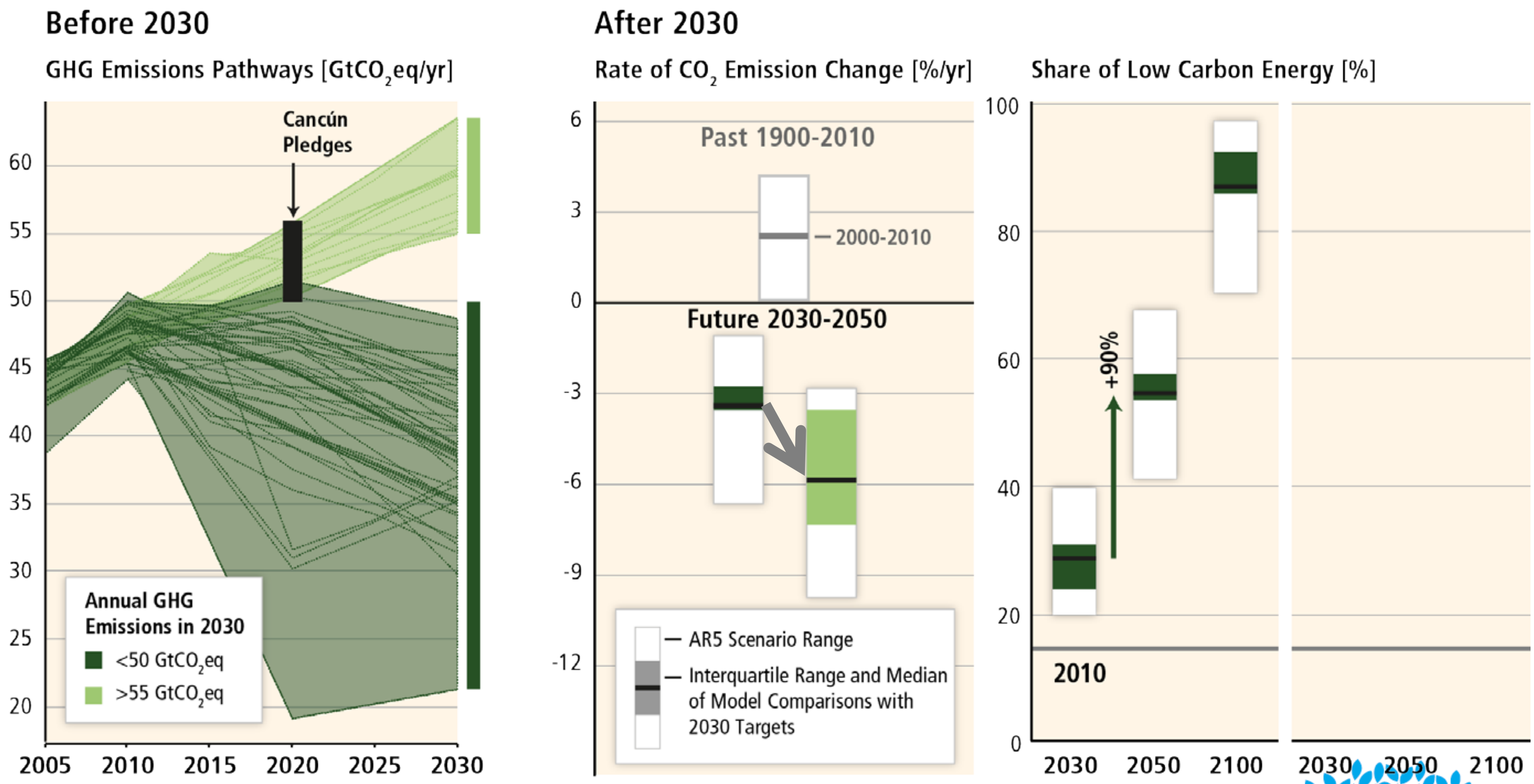
Feiler, 2015; ECRAN Training

Delay in peaking of emissions



3CSEP

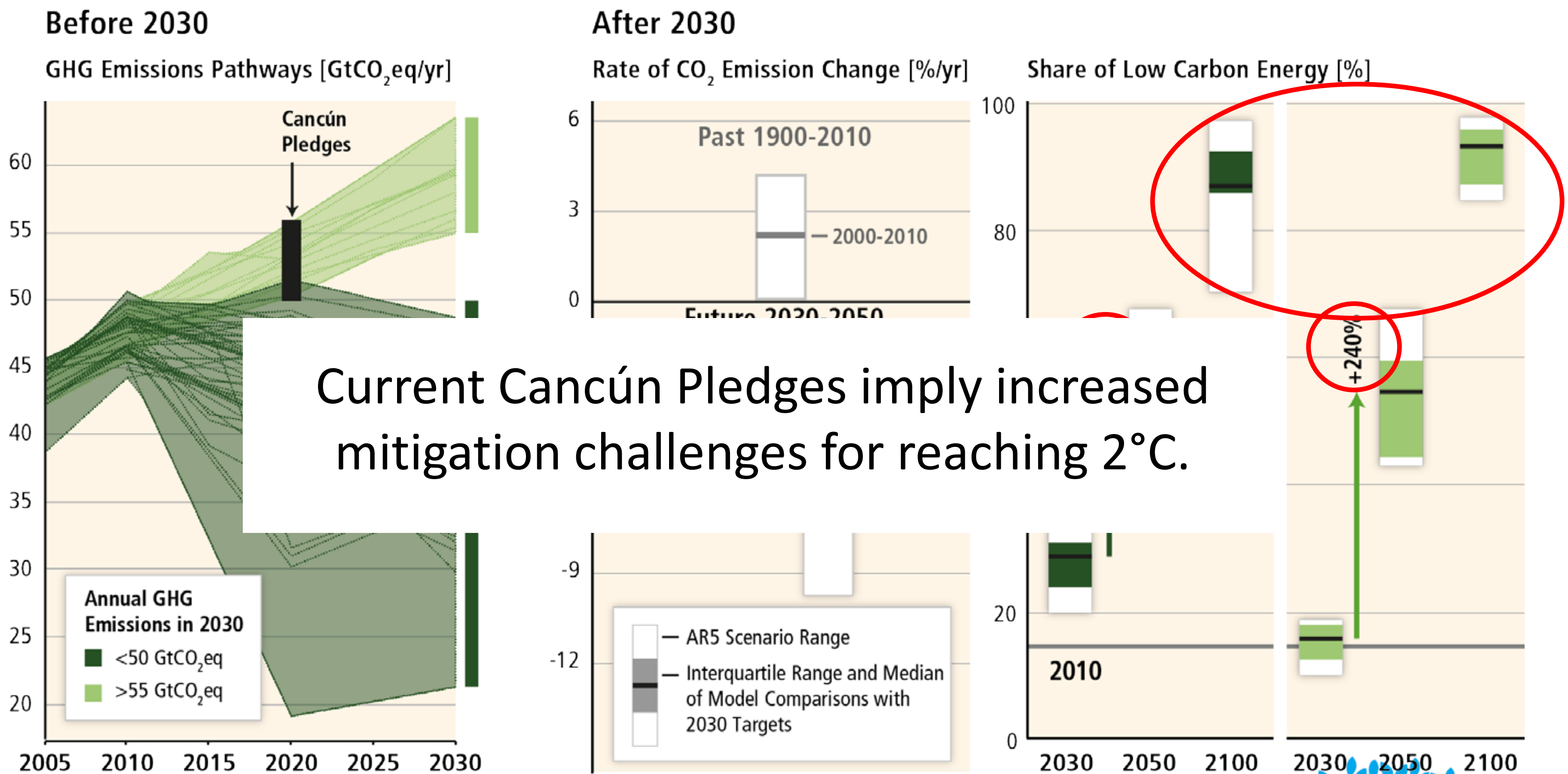
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.



Based on Figures 6.32 and 7.16

3CSEP

Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.



Current Cancún Pledges imply increased mitigation challenges for reaching 2°C.

Based on Figures 6.32 and 7.16

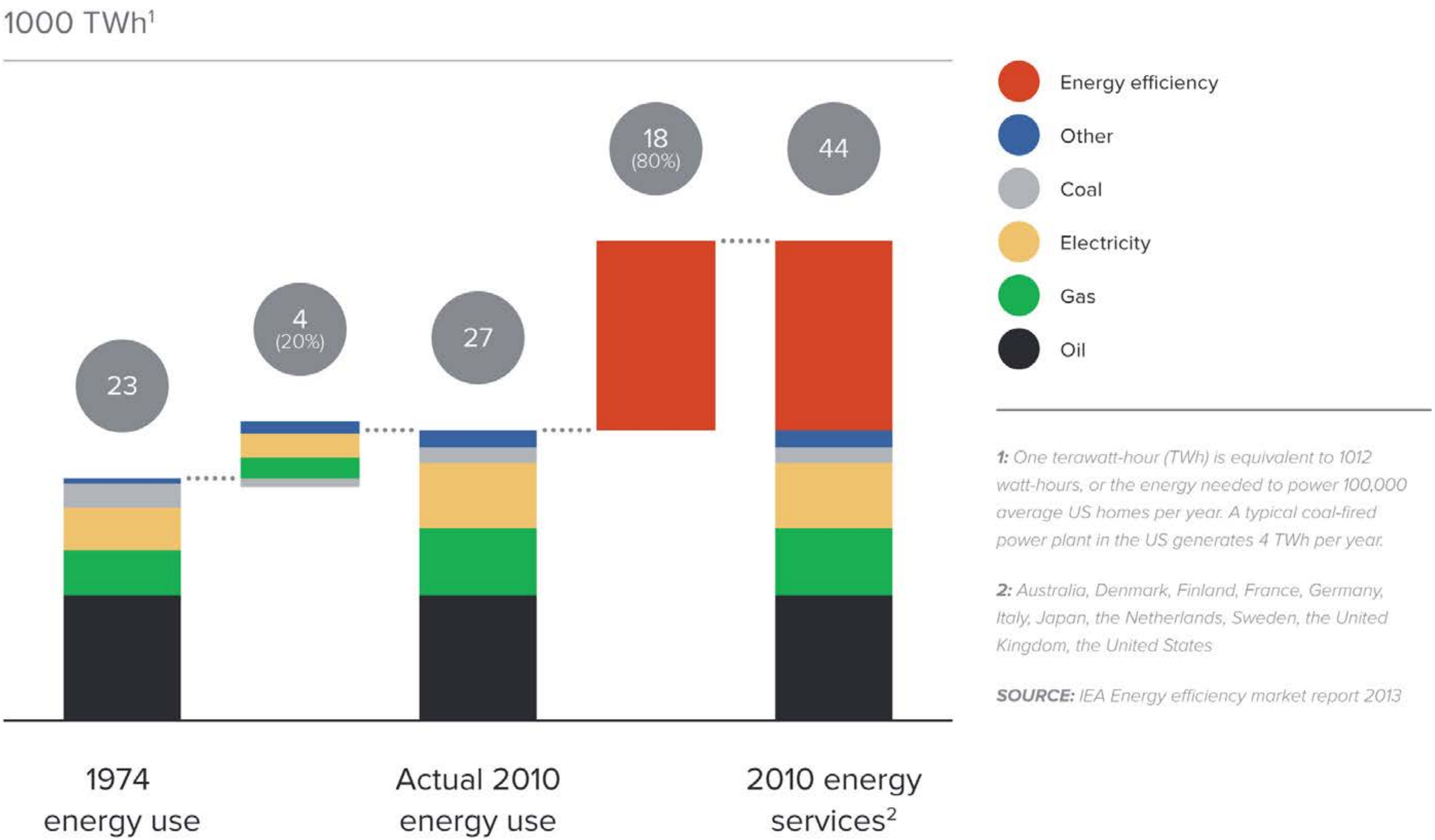
3CSEP

Opportunities in mitigation

- Economic growth and climate mitigation can be achieved together. We do not need to choose.
- A growing number of businesses, cities and countries are demonstrating this. Recent technological and policy developments mean that even more opportunities are available today.
- About US$ 90 trillion will be invested in infrastructure to 2030 – need to choose if it is low-carbon and climate resilient. Low-carbon would not cost much more, and fuel savings could fully offset additional investment costs.
- But if we lock-in the wrong path, we risk significant economic and social impacts of climate change. Need to act urgently.
- There are multiple economic benefits of action, e.g. reduced health costs from air pollution, less congestion & road deaths, enhanced energy, water and food security. In many cases these will outweigh the costs of action.

The New Climate Economy Report

EFFICIENCY: Energy efficiency can be the biggest (and cheapest) energy "source"



1: One terawatt-hour (TWh) is equivalent to 1012 watt-hours, or the energy needed to power 100,000 average US homes per year. A typical coal-fired power plant in the US generates 4 TWh per year.

2: Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, the United States

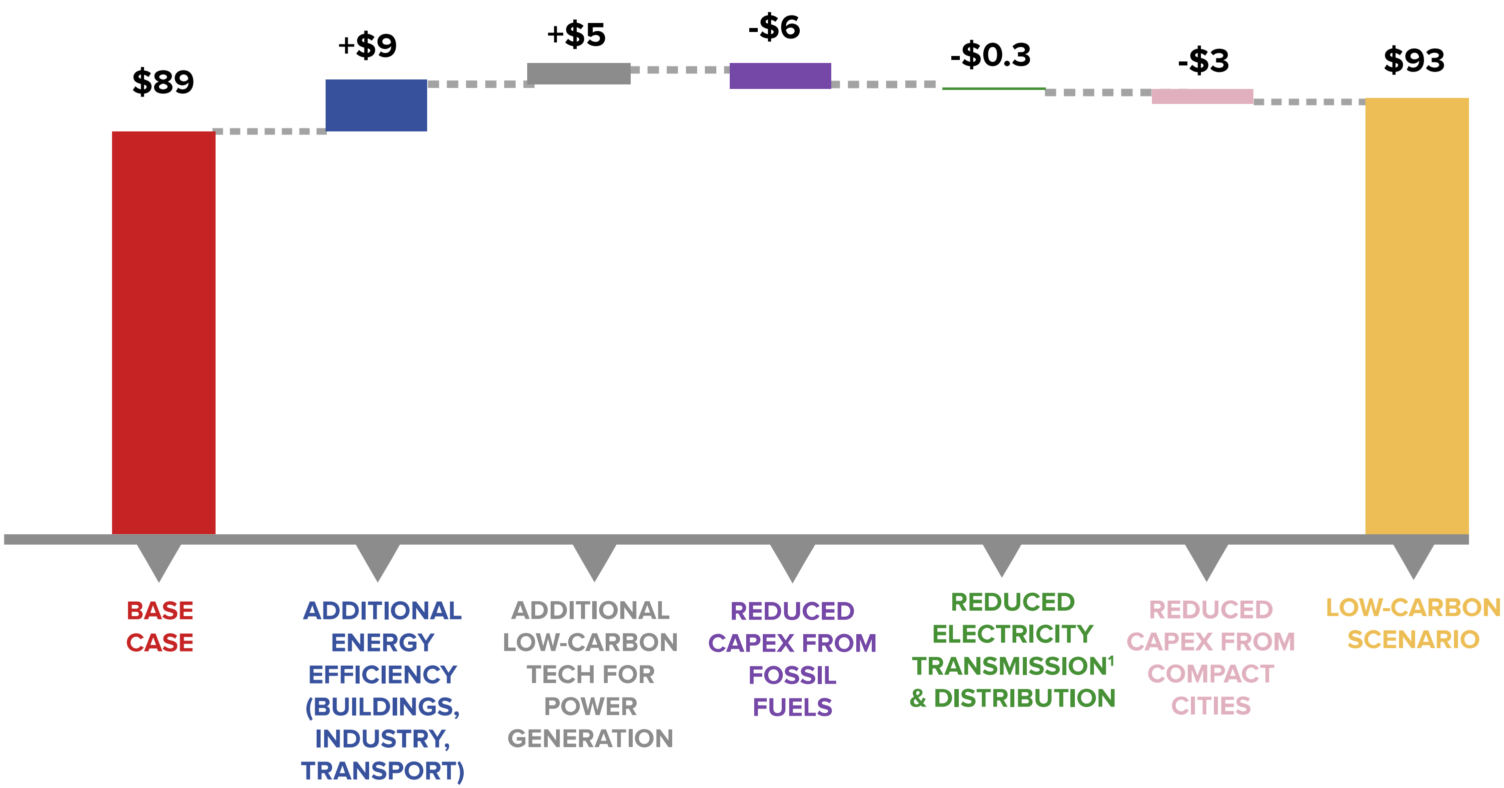
SOURCE: *IEA Energy efficiency market report 2013*

Source: IEA, 2013: *Energy Efficiency Market Report 2013 – Market Trends and Medium-Term Prospects*

INVESTMENT: Infrastructure capital spend is estimated to be marginally higher in a low-carbon scenario

GLOBAL INVESTMENT REQUIREMENTS; 2015 TO 2030, US$ TRILLION, CONSTANT 2010 DOLLARS

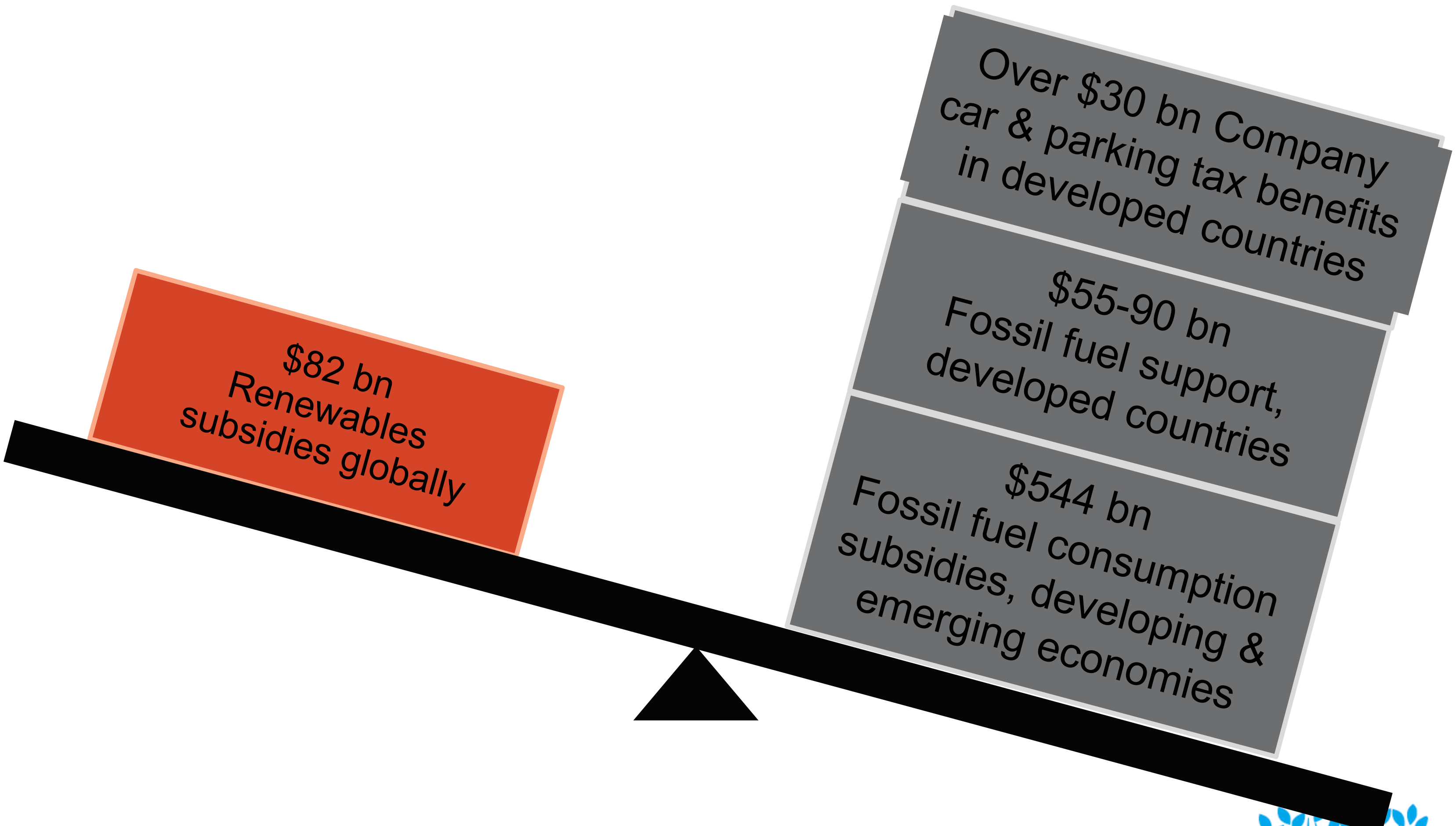
Indicative figures only
High rates of uncertainty



INCLUDING OPERATING EXPENDITURES WOULD LEAD TO A FURTHER REDUCTION OF US$5 TRILLION, FOR A POTENTIAL SAVING OF US$1 TRILLION.

Source: OECD (2006, 2012), IEA ETP (2012), modelling by Climate Policy Initiative (CPI) for New Climate Economy, and New Climate Economy analysis.

POLICIES: There are significant subsidies to the high-carbon economy



Sources: OECD (2013), Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels; IEA (2013), World Energy Outlook; IEA (2013), OECD (2014, forthcoming)

Substantial opportunities in mitigation

Co-benefits of energy-efficiency measures are substantial:

- increased national energy security/self-sufficiency,
- less exposure to price volatility and supply disruptions
- Eliminated fuel/energy poverty
- decreased poverty
- improvements in air quality and related public-health benefits

Feiler, 2015; ECRAN Training

Climate change is a global commons problem

International cooperation

- It requires **international cooperation**, with equitable effort-sharing and effective national and subnational policy implementation.

- Effective mitigation **will not be achieved if individual agents advance their own interests independently**.

Feiler, 2015; ECRAN Training

Thank you for your attention

Diana Ürge-Vorsatz Diana

Center for Climate Change and Sustainable Energy Policy (3CSEP), CEU

http://3csep.ceu.hu   www.mitigation2014.org

Email: vorsatzd@ceu.hu

ADDITIONAL SLIDES

ADDITIONAL SLIDES TO THE BALKANS IMPACT SECTION

PARTLY OVERLAPS WITH SLIDES 16-23

OVERLAPS WITH SLIDES 24-31

TURNING DOWN THE HEAT

Western Balkans
Water resources

- Under a regional warming of ~**2°C** by the **2050s,** the impacts of climate change on the natural flow characteristics of most Balkan rivers will be “medium”;

- for the rivers of southern **Serbia**, **Kosovo**, and **FYR Macedonia**, the impacts will be “severe” (Schneider et al., 2013).

The World Bank (2014) Turn Down the Heat

Western Balkans
Water resources

- Dakova (2005) projected a decrease in long-term **annual mean runoff** for **Serbia** of

  - approximately 12 percent, by **2025**, and

  - approximately 19 percent by **2100**,

  due to a projected decrease in annual precipitation and an increase in temperatures.

The World Bank (2014) Turn Down the Heat

Western Balkans
Water resources

- **Albania**'s **water resources** are projected to decline by between 14 percent (Chenoweth et al. 2011) and 40 percent (Dakova 2005) by the end of the **21st century**.

The World Bank (2014) Turn Down the Heat

Western Balkans
Water resources

- Results from a global study show severe decreases in **annual discharge** in the Western Balkans of

  - up to 15 percent in a **2°C world** and

  - more than 45 percent in a **4°C world** (Schewe et al. 2013).

The World Bank (2014) Turn Down the Heat

Western Balkans
Agriculture

- In the Western Balkans, the **increasing occurrence of droughts** has been identified as a major threat to agricultural production under climate change (Giannakopoulos et al. 2009b; Gocic and Trajkovic 2013, 2014; Kos et al. 2013; UNDP 2014).

- The risk of increasing droughts for this region was also cited in the latest IPCC publication (Kovats et al. 2014).

The World Bank (2014) Turn Down the Heat

Western Balkans
Agriculture

- The **dominance of rain-fed agriculture** in the Western Balkans makes the agricultural sector especially vulnerable to changing precipitation patterns and increasing temperatures.

- The increasing appearance of **extreme rain and flood events** also poses risks to agriculture in the region (Sutton et al. 2013a).

The World Bank (2014) Turn Down the Heat

Western Balkans
Food security

- The various threats to food security from climate change in Central Asia and the **Western Balkans** are indicated in the literature as follows:
  - Increasing temperatures and changes in precipitation and patterns of river runoff are serious risks for agricultural production (Meyers et al. 2012).

The World Bank (2014) Turn Down the Heat

Western Balkans
Food security

- The various threats to food security from climate change in Central Asia and the **Western Balkans** are indicated in the literature as follows:
  - The availability of suitable arable land and water resources is expected to decline simultaneously, changes in the type and intensity of pests and diseases will occur, influencing the available productive and adapted crop varieties and animal breeds (Meyers et al. 2012).

The World Bank (2014) Turn Down the Heat

Western Balkans
Food security

- The various threats to food security from climate change in Central Asia and the **Western Balkans** are indicated in the literature as follows:
  - Heavy rainfall events and storms may occur more often, increasing the risk of erosion from wind and water and leading to the degradation and desertification of scarce, valuable arable land (Christmann et al. 2009).

The World Bank (2014) Turn Down the Heat

Western Balkans
Food security

- The various threats to food security from climate change in Central Asia and the **Western Balkans** are indicated in the literature as follows:
  - Sensitivity thresholds of crops might be exceeded more often with rising average temperatures and the increased risk of temperature extremes (Lioubimtseva and Henebry 2012; Teixeira et al. 2013)

The World Bank (2014) Turn Down the Heat

Western Balkans
Food security

- The various threats to food security from climate change in Central Asia and the **Western Balkans** are indicated in the literature as follows:
  - Eastern Europe and parts of the Balkan region will suffer from decreasing water availability, leading to yield reductions (Meyers et al. 2012)

The World Bank (2014) Turn Down the Heat

Western Balkans
Energy systems

- It has been projected that **decreased production** and **power generation disruption** induced by lower runoff and increased air and water temperatures will lead to an **increase in electricity prices** (McDermott and Nilsen 2014).
- As the majority of the countries in the region are strongly dependent on thermal electric production, climate change is projected to increase their vulnerability by affecting the supply of electricity to both households and industry.

The World Bank (2014) Turn Down the Heat

Western Balkans
Energy systems

- In addition, **economic development** and a **growing population** are expected to **increase energy demand**, thereby putting thermal electric power plants under increasing pressure.
- In the **absence of adaptation measures**, climate change, economic development, and population growth may together contribute to a rise in electricity prices and increase the risk of electricity shortages in the region.

The World Bank (2014) Turn Down the Heat

Western Balkans
Human health

- **Dengue fever** and **Chikungunya fever**, transmitted by Aedes **mosquitoes**, are already present in Europe (ECDC 2013).

The World Bank (2014) Turn Down the Heat

Western Balkans
Human health

- Climatic conditions in the Balkans have become more suitable over the last two decades for one of the potential vectors of dengue and Chikungunya, A. albopictus, also known as the **Asian tiger mosquito** (Caminade et al. 2012).

The World Bank (2014) Turn Down the Heat

Western Balkans
Human health

- It is currently found in most of **Albania** and **Montenegro**, and in northwestern areas of **Serbia** and **Bosnia and Herzogovina**.

- This is related to wetter and warmer conditions favoring the winter survival of the mosquito.

The World Bank (2014) Turn Down the Heat

Western Balkans
Human health

- A study from the European Centre for Disease Prevention and Control (2012), points to **increasing climatic suitability** for A. albopictus in the Western Balkans with climate change.

- Caminade et al. (2012) also projected an increased suitability from 2030–2050 in the Balkans with about 1.5°C global warming, and an associated **lengthening of the mosquito's activity window**.

The World Bank (2014) Turn Down the Heat

Western Balkans
Human health

- **Heat waves** can impact human health in direct ways (e.g., heat stress) and indirectly (e.g., aggravating respiratory and cardiovascular conditions).

- In the Western Balkans, **Albania** and **FYR Macedonia** are considered particularly vulnerable to heat waves (ENVSEC and UNEP 2012).

The World Bank (2014) Turn Down the Heat

Western Balkans
Security and migration

- The **projected increase in the intensity and frequency of natural catastrophes** (e.g., forest fires, heat waves, floods and landslides) (Adger et al. 2014) is likely to result in population movements that, in turn, could generate frictions in such politically sensitive countries as **Albania**, **Bosnia and Herzegovina**, and **Kosovo** (Maas et al. 2010).

The World Bank (2014) Turn Down the Heat

Western Balkans
Security and migration

- If it is assumed that the **Western Balkans** will exhibit similar reactions to those of Southeast and Eastern Europe, the increased risk of disasters will result in **decreasing economic opportunities** and provide incentives for migration (Maas et al. 2010).

The World Bank (2014) Turn Down the Heat

Western Balkans
Rural-urban migratory patterns

- **Migration** in the Western Balkans has already led to severe demographic changes; coupled with the general demographic trend toward an **aging population**, this is expected to cause increased regional climate change sensitivity and decreased adaptive capacity as an aging population is more sensitive to heat (EEA 2012).

The World Bank (2014) Turn Down the Heat

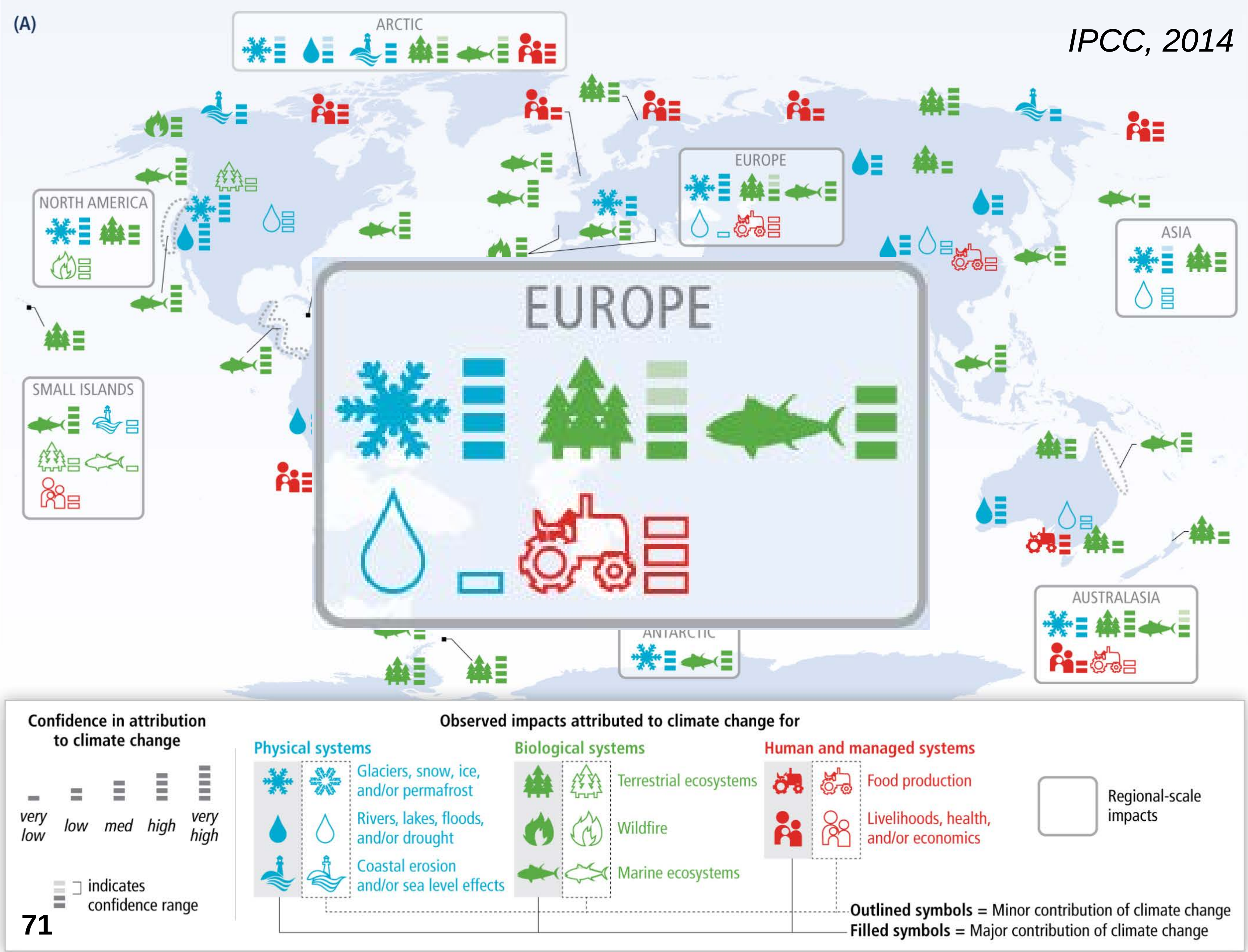
Turkey

- The WB report contains hardly any specific information on Turkey.

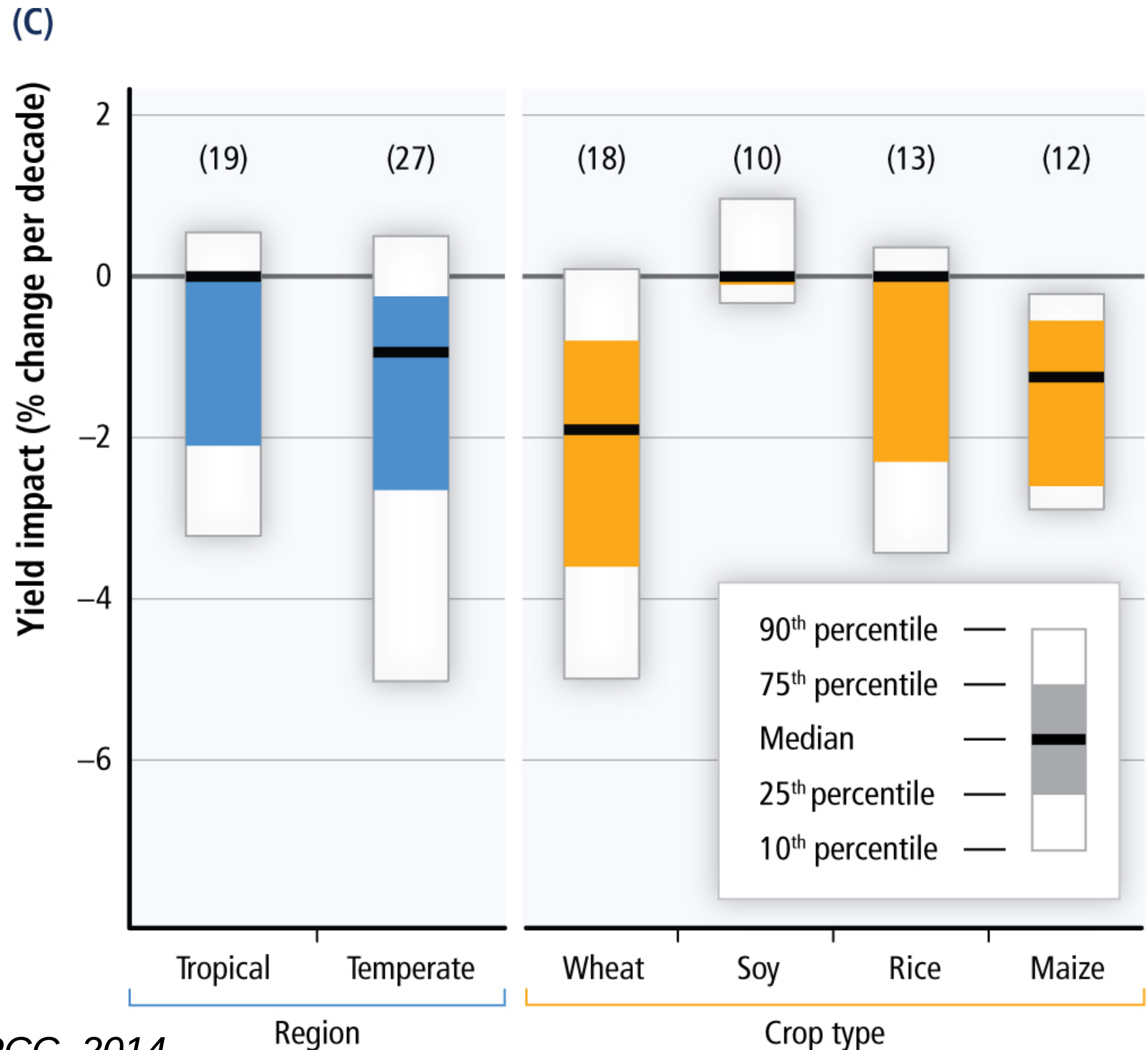
The World Bank (2014) Turn Down the Heat

ADDITIONAL SLIDES FOR THE FIRST SECTION: THE GLOBAL PERSPECTIVE (I.E. SLIDES 1-16)

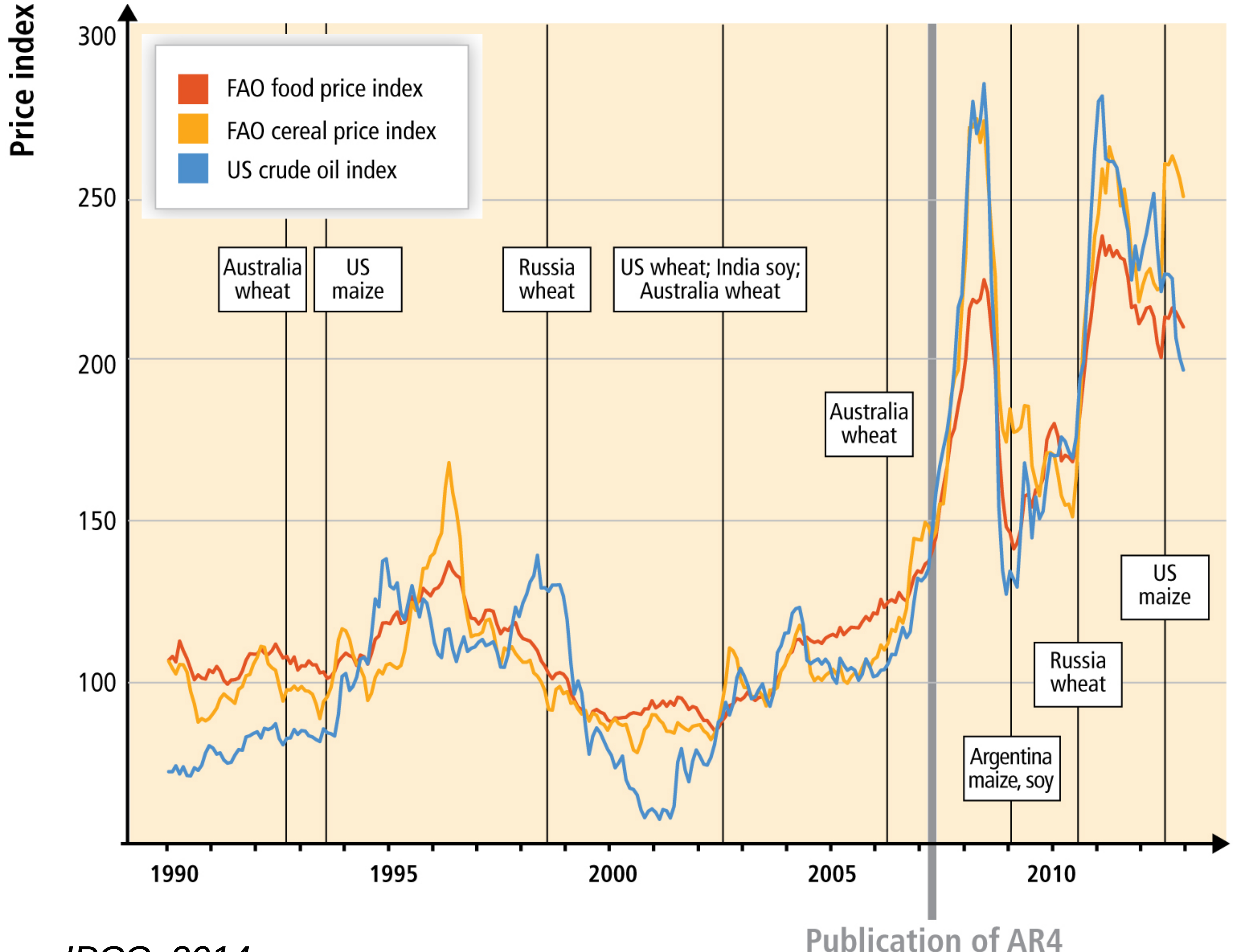
IPCC AR5 SLIDES: MAPS


(A)
ARCTIC
NORTH AMERICA
EUROPE
ASIA
SMALL ISLANDS
EUROPE
ANTARCTIC
AUSTRALASIA
Confidence in attribution to climate change
very low
low
med
high
very high
indicates confidence range
Observed impacts attributed to climate change for
Physical systems
Glaciers, snow, ice, and/or permafrost
Rivers, lakes, floods, and/or drought
Coastal erosion and/or sea level effects
Biological systems
Terrestrial ecosystems
Wildfire
Marine ecosystems
Human and managed systems
Food production
Livelihoods, health, and/or economics
Regional-scale impacts
Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

IPCC, 2014


(C)
Yield impact (% change per decade)
2
0
−2
−4
−6
(19)
(27)
(18)
(10)
(13)
(12)
90th percentile
75th percentile
Median
25th percentile
10th percentile
Tropical
Temperate
Wheat
Soy
Rice
Maize
Region
Crop type

IPCC, 2014



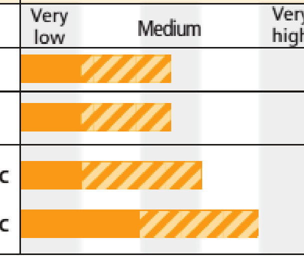
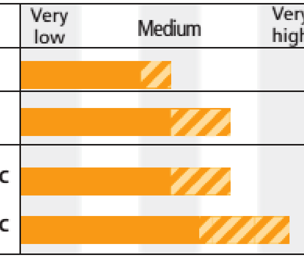
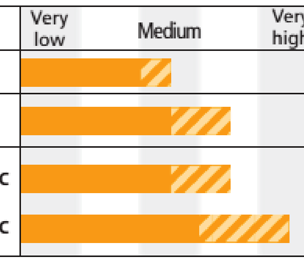
Price index
300
250
200
150
100
FAO food price index
FAO cereal price index
US crude oil index
Australia wheat
US maize
Russia wheat
US wheat; India soy; Australia wheat
Australia wheat
US maize
Russia wheat
Argentina maize, soy
1990
1995
2000
2005
2010
Publication of AR4

IPCC, 2014

ADDITIONAL SLIDES TO THE EUROPE SECTION (SLIDES 16-23)

IPCC AR5 SLIDES: SUMMARY TABLES

IPCC AR5 WG2 SPM

Europe				
Key risk	**Adaptation issues & prospects**	**Climatic drivers**	**Timeframe**	**Risk & potential for adaptation**
Increased economic losses and people affected by flooding in river basins and coasts, driven by increasing urbanization, increasing sea levels, coastal erosion, and peak river discharges (*high confidence*) [23.2-3, 23.7]	Adaptation can prevent most of the projected damages (*high confidence*). • Significant experience in hard flood-protection technologies and increasing experience with restoring wetlands • High costs for increasing flood protection • Potential barriers to implementation: demand for land in Europe and environmental and landscape concerns		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	
Increased water restrictions. Significant reduction in water availability from river abstraction and from groundwater resources, combined with increased water demand (e.g., for irrigation, energy and industry, domestic use) and with reduced water drainage and runoff as a result of increased evaporative demand, particularly in southern Europe (*high confidence*) [23.4, 23.7]	• Proven adaptation potential from adoption of more water-efficient technologies and of water-saving strategies (e.g., for irrigation, crop species, land cover, industries, domestic use) • Implementation of best practices and governance instruments in river basin management plans and integrated water management		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	
Increased economic losses and people affected by extreme heat events: impacts on health and well-being, labor productivity, crop production, air quality, and increasing risk of wildfires in southern Europe and in Russian boreal region (*medium confidence*) [23.3-7, Table 23-1]	• Implementation of warning systems • Adaptation of dwellings and workplaces and of transport and energy infrastructure • Reductions in emissions to improve air quality • Improved wildfire management • Development of insurance products against weather-related yield variations		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	

IPCC AR5 WG2 SPM

Observed impacts attributed to climate change reported in the scientific literature since the AR4

Europe	
Snow & Ice, Rivers & Lakes, Floods & Drought	• Retreat of Alpine, Scandinavian, and Icelandic glaciers (*high confidence*, major contribution from climate change) • Increase in rock slope failures in western Alps (*medium confidence*, major contribution from climate change) • Changed occurrence of extreme river discharges and floods (*very low confidence*, minor contribution from climate change) [18.3, 23.2-3, Tables 18-5 and 18-6; WGI AR5 4.3]
Terrestrial Ecosystems	• Earlier greening, leaf emergence, and fruiting in temperate and boreal trees (*high confidence*, major contribution from climate change) • Increased colonization of alien plant species in Europe, beyond a baseline of some invasion (*medium confidence*, major contribution from climate change) • Earlier arrival of migratory birds in Europe since 1970 (*medium confidence*, major contribution from climate change) • Upward shift in tree-line in Europe, beyond changes due to land use (*low confidence*, major contribution from climate change) • Increasing burnt forest areas during recent decades in Portugal and Greece, beyond some increase due to land use (*high confidence*, major contribution from climate change) [4.3, 18.3, Tables 18-7 and 23-6]
Coastal Erosion & Marine Ecosystems	• Northward distributional shifts of zooplankton, fishes, seabirds, and benthic invertebrates in northeast Atlantic (*high confidence*, major contribution from climate change) • Northward and depth shift in distribution of many fish species across European seas (*medium confidence*, major contribution from climate change) • Plankton phenology changes in northeast Atlantic (*medium confidence*, major contribution from climate change) • Spread of warm water species into the Mediterranean, beyond changes due to invasive species and human impacts (*medium confidence*, major contribution from climate change) [6.3, 23.6, 30.5, Tables 6-2 and 18-8, Boxes 6-1 and CC-MB]
Food Production & Livelihoods	• Shift from cold-related mortality to heat-related mortality in England and Wales, beyond changes due to exposure and health care (*low confidence*, major contribution from climate change) • Impacts on livelihoods of Sámi people in northern Europe, beyond effects of economic and sociopolitical changes (*medium confidence*, major contribution from climate change) • Stagnation of wheat yields in some countries in recent decades, despite improved technology (*medium confidence*, minor contribution from climate change) • Positive yield impacts for some crops mainly in northern Europe, beyond increase due to improved technology (*medium confidence*, minor contribution from climate change) • Spread of bluetongue virus in sheep and of ticks across parts of Europe (*medium confidence*, minor contribution from climate change) [18.4, 23.4-5, Table 18-9, Figure 7-2]

IPCC AR5 SLIDES: PHOTOS


ipcc
INTERGOVERNMENTAL PANEL ON climate change


ipcc
INTERGOVERNMENTAL PANEL ON climate change


ipcc
INTERGOVERNMENTAL PANEL ON climate change


ipcc
INTERGOVERNMENTAL PANEL ON climate change

THESE SLIDES ARE GOOD FOR THE “NOTHING IS LOST YET”/MITIGATION SECTION OF THE ORIGINAL PRESENTATION

SLIDES 73 AND 83 MIGHT BE THE MOST USEFUL FROM THIS SECTION

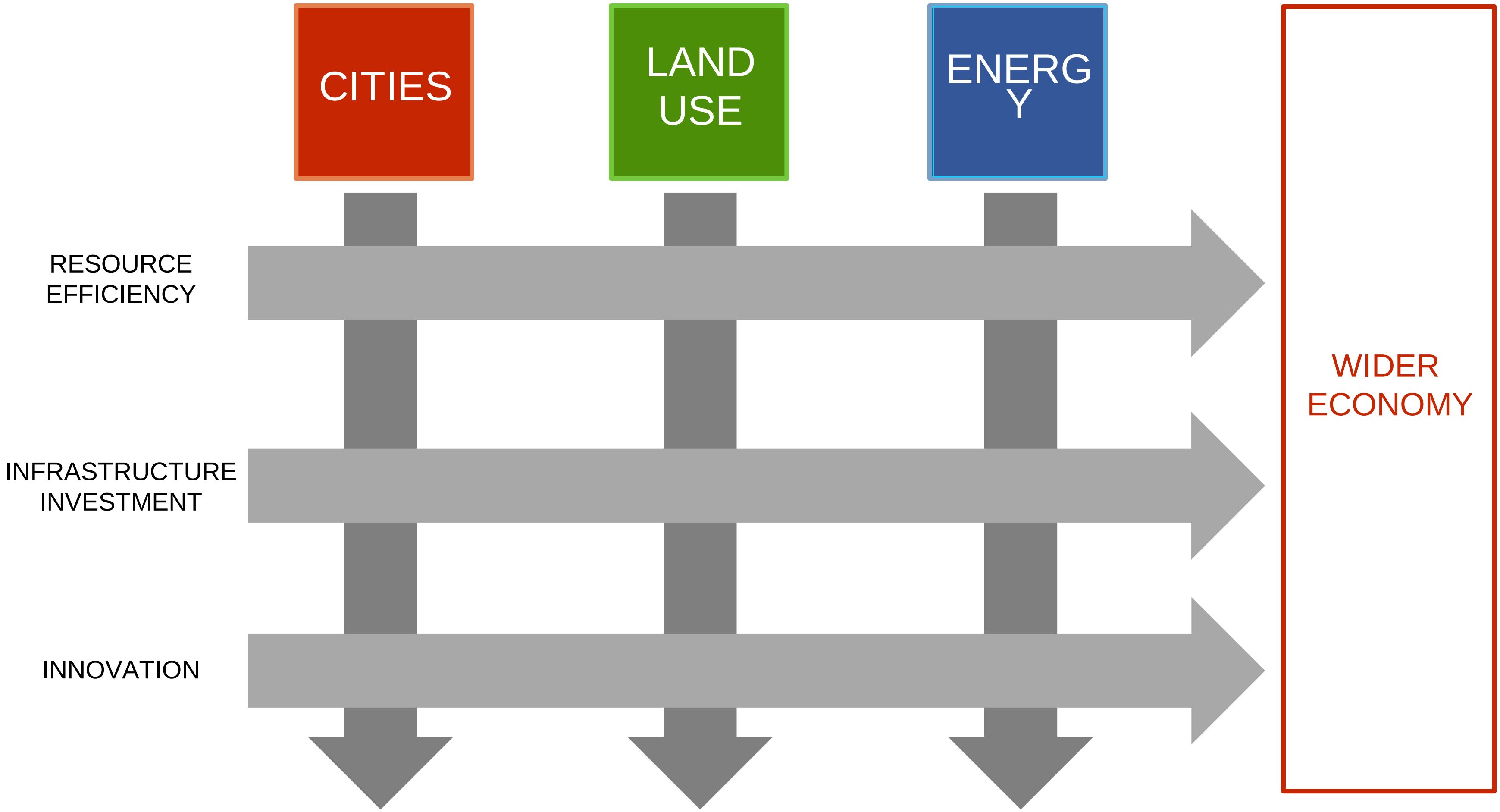
THE GLOBAL COMMISSION ON THE ECONOMY AND CLIMATE

Main findings of the Commission

- Economic growth and climate mitigation can be achieved together. We do not need to choose.
- A growing number of businesses, cities and countries are demonstrating this. Recent technological and policy developments mean that even more opportunities are available today.
- About US$ 90 trillion will be invested in infrastructure to 2030 – need to choose if it is low-carbon and climate resilient. Low-carbon would not cost much more, and fuel savings could fully offset additional investment costs.
- But if we lock-in the wrong path, we risk significant economic and social impacts of climate change. Need to act urgently.
- There are multiple economic benefits of action, e.g. reduced health costs from air pollution, less congestion & road deaths, enhanced energy, water and food security. In many cases these will outweigh the costs of action.

The New Climate Economy Report

Key drivers of growth and climate performance



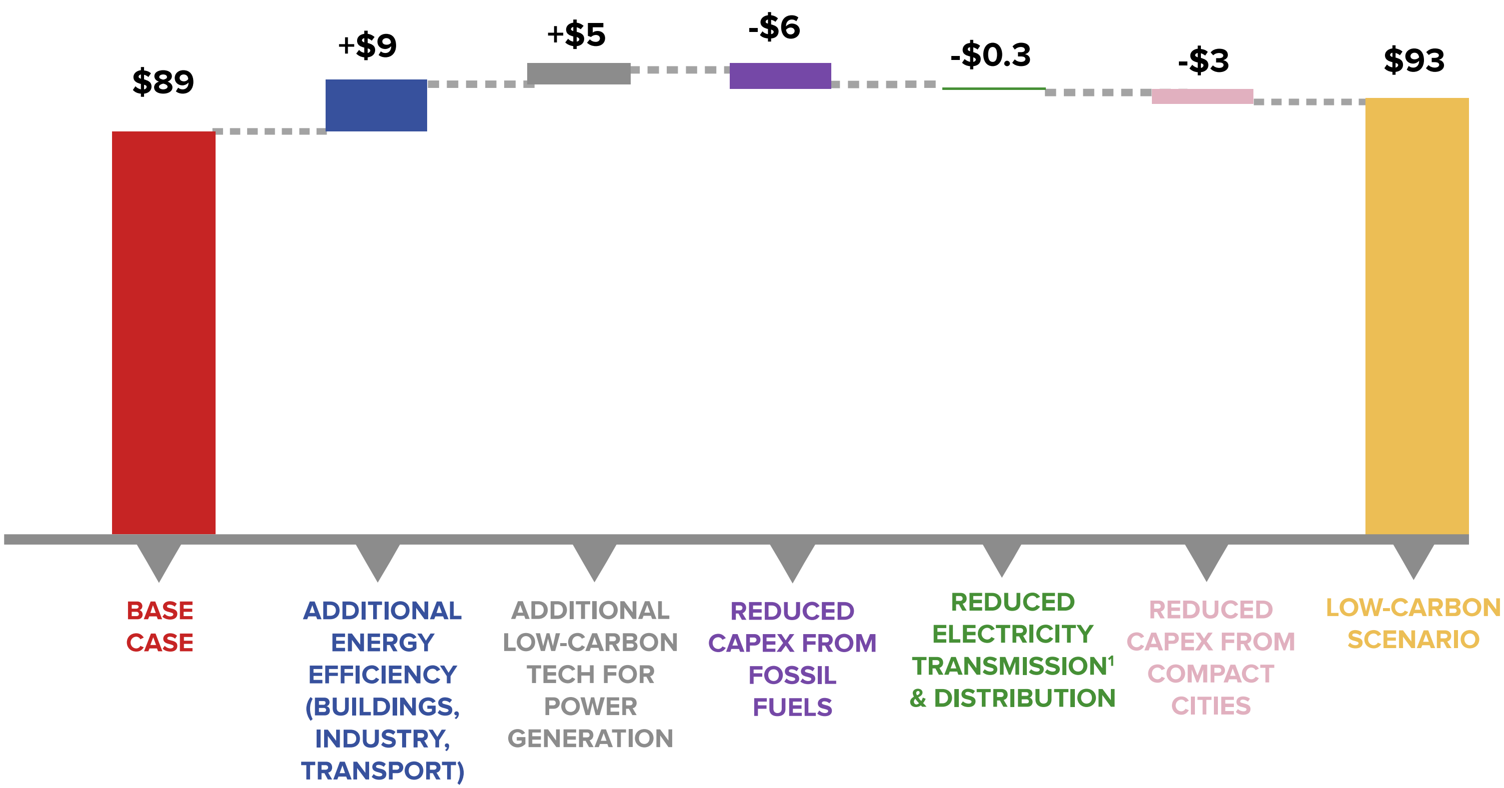
HIGH QUALITY, RESILIENT, INCLUSIVE = BETTER GROWTH

The New Climate Economy Report

INVESTMENT: Infrastructure capital spend is estimated to be marginally higher in a low-carbon scenario

GLOBAL INVESTMENT REQUIREMENTS; 2015 TO 2030, US$ TRILLION, CONSTANT 2010 DOLLARS

Indicative figures only
High rates of uncertainty



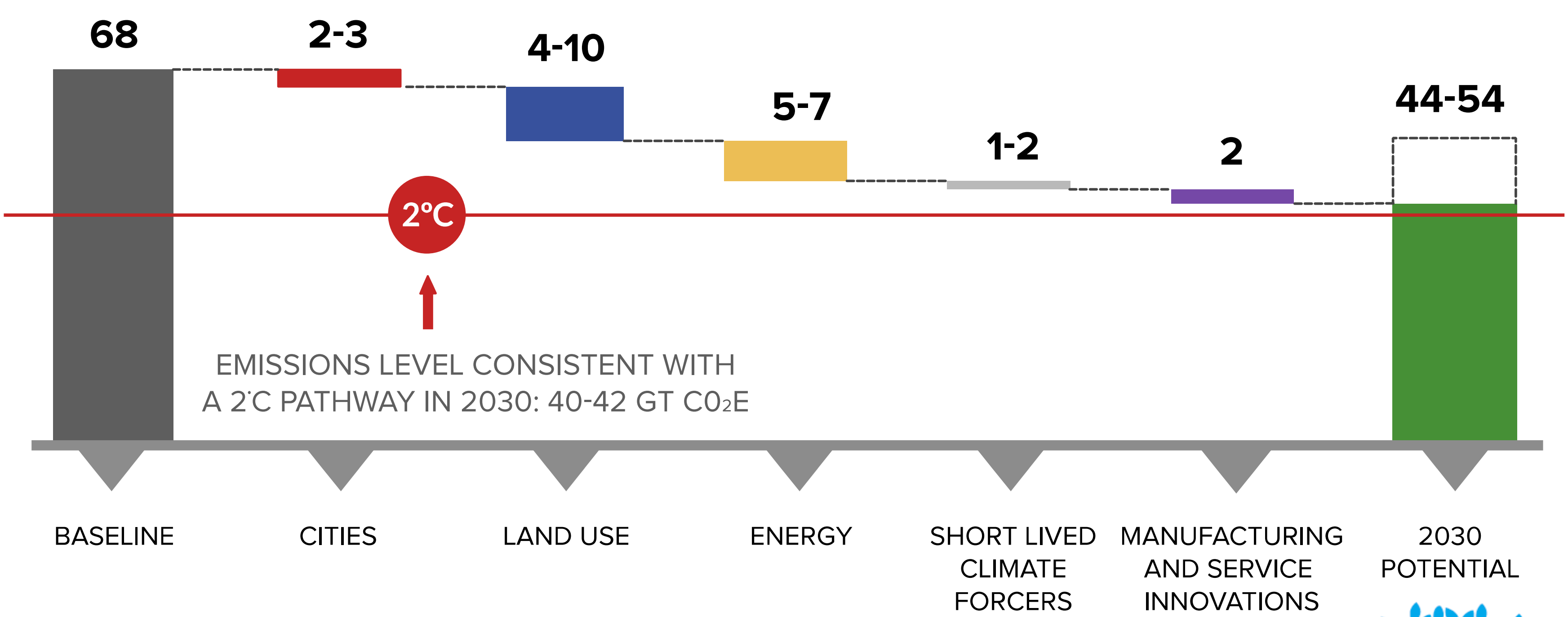
INCLUDING OPERATING EXPENDITURES WOULD LEAD TO A FURTHER REDUCTION OF US$5 TRILLION, FOR A POTENTIAL SAVING OF US$1 TRILLION.

Source: OECD (2006, 2012), IEA ETP (2012), modelling by Climate Policy Initiative (CPI) for New Climate Economy, and New Climate Economy analysis.

POLICIES: Actions with economic benefits could deliver most of the greenhouse gas abatement needed by 2030

GHG EMISSIONS AND ABATEMENT POTENTIAL FROM SELECTED MAJOR LEVERS: 2030

Gigatonnes of CO_2 equivalents

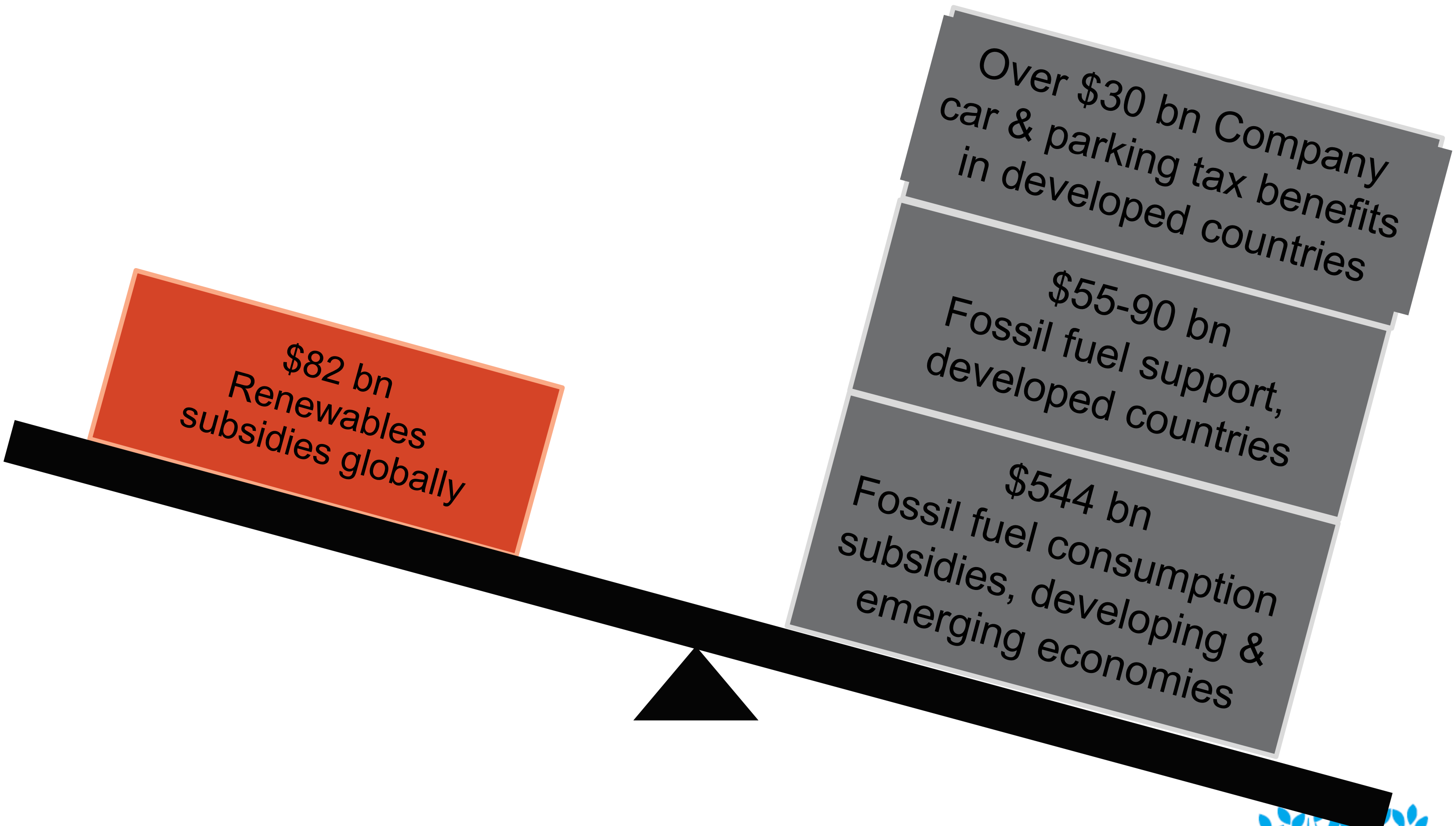


Source: Emissions estimates: IPCC AR5; New Climate Economy analysis based on expert input and multiple data sources

The New Climate Economy Report

3CSEP

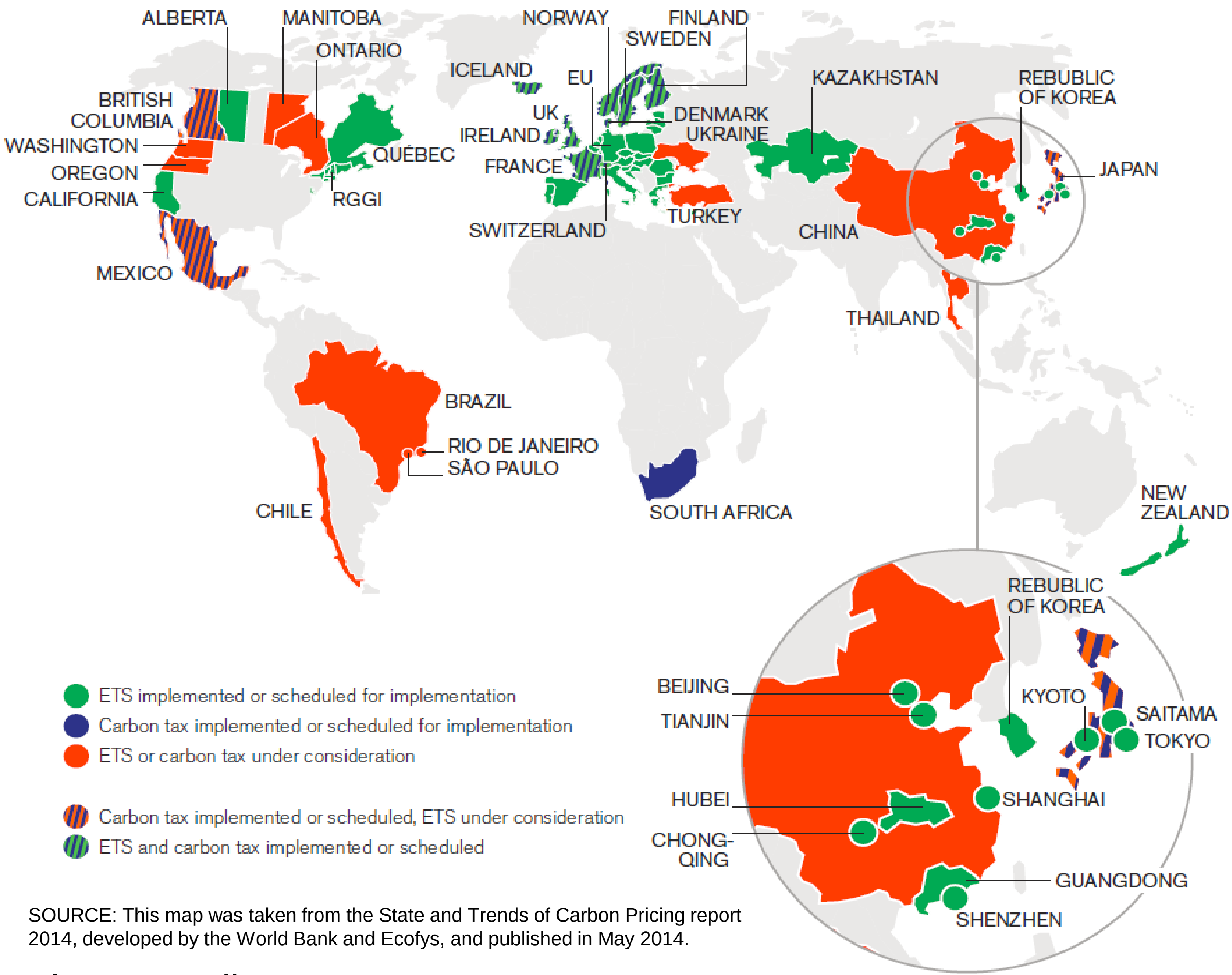
POLICIES: There are significant subsidies to the high-carbon economy



Sources: OECD (2013), Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels; IEA (2013), World Energy Outlook; IEA (2013), OECD (2014, forthcoming)

The New Climate Economy Report

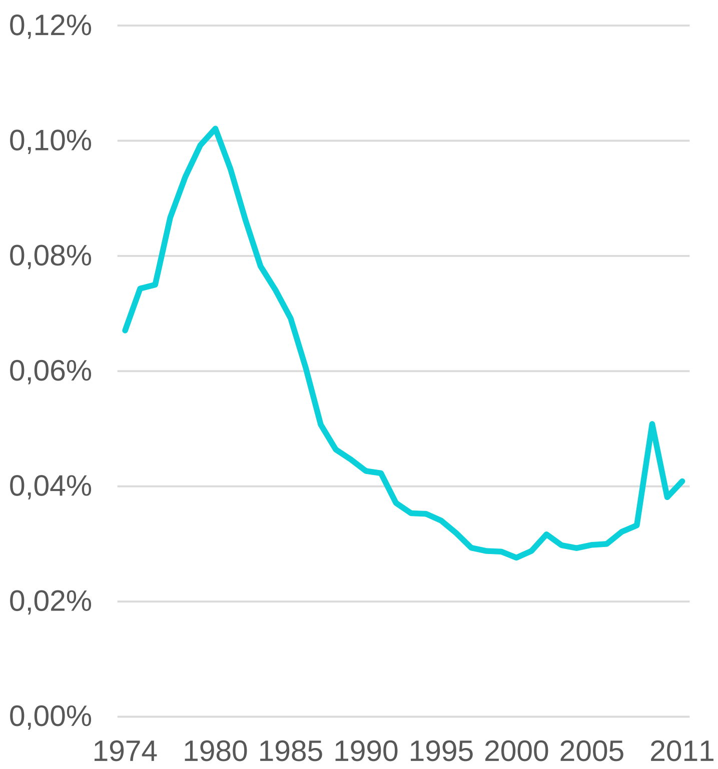
POLICIES: Global growth of carbon pricing



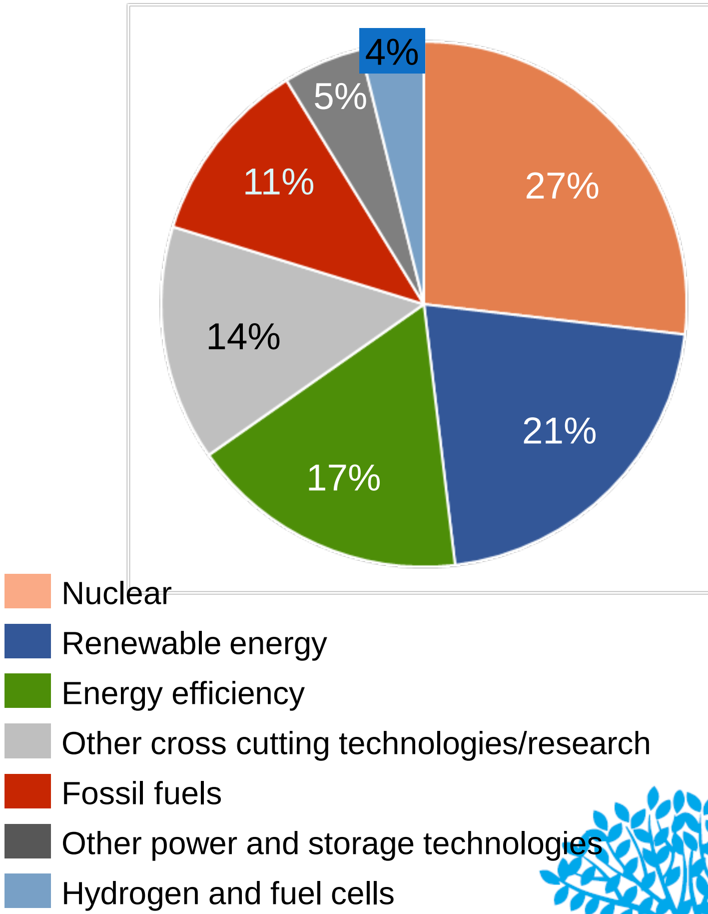
SOURCE: This map was taken from the State and Trends of Carbon Pricing report 2014, developed by the World Bank and Ecofys, and published in May 2014.

POLICIES: Energy R&D as a percent of GDP has been falling in most developed countries since the 1980s

Energy R&D as % of GDP in IEA member countries[1]

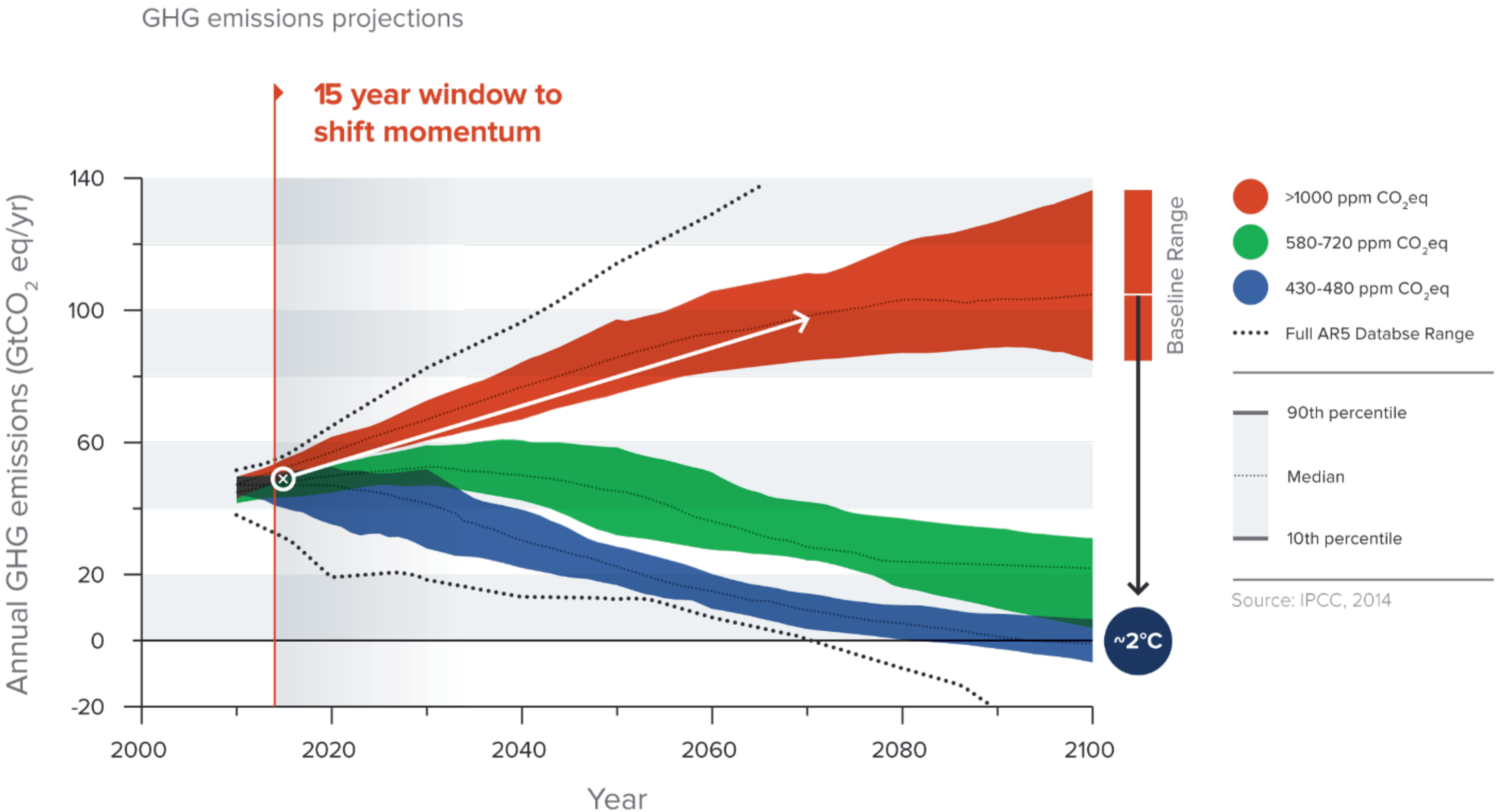


Energy R&D split in 2011



Source: R&D figures and split from International Energy Agency (2013), Tracking Clean Energy Progress 2013, OECD/IEA, Paris, GDP figures from World Development Indicators 2014, adjusted for inflation from 2005 to 2010

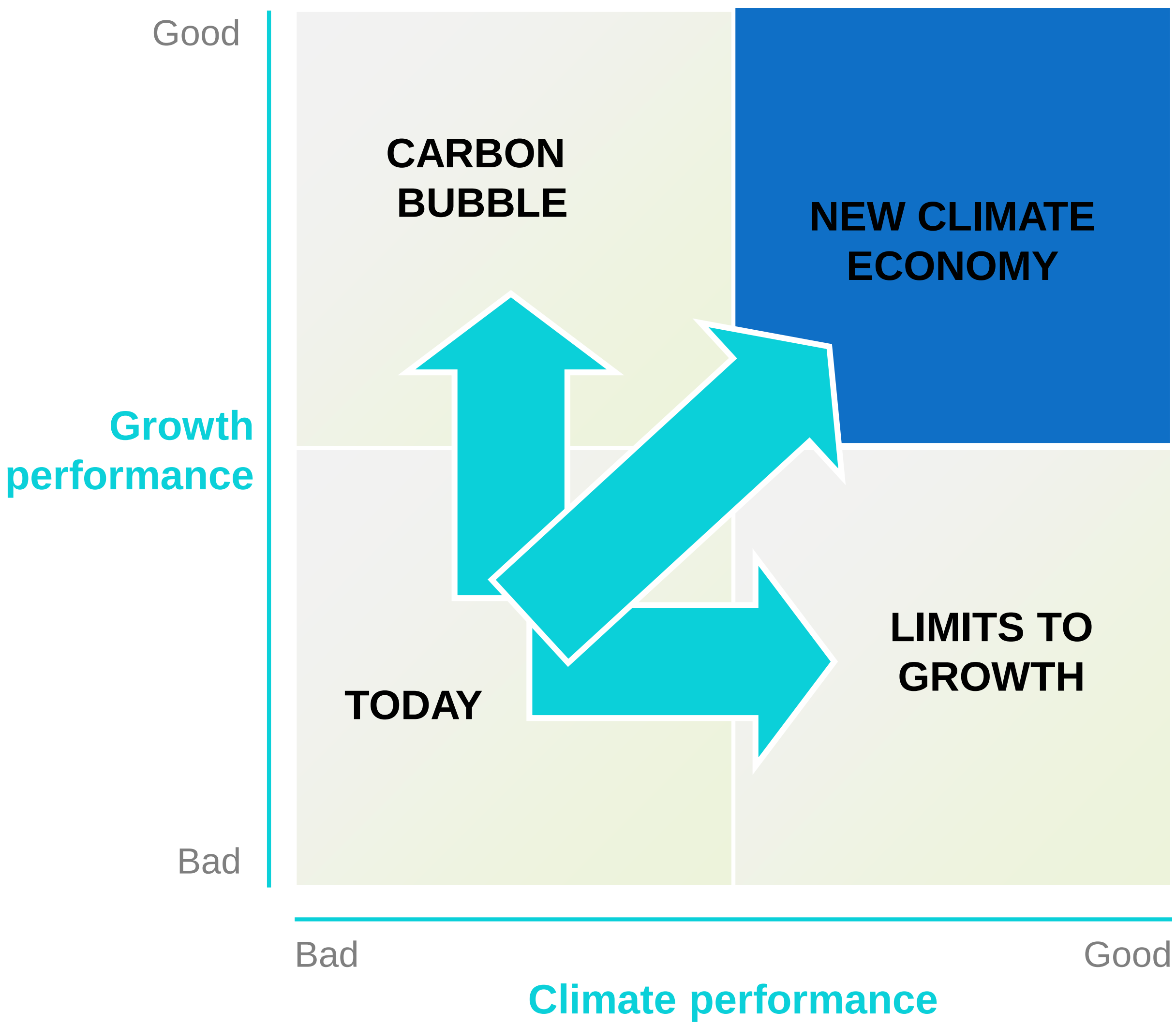
Climate performance off track: next 15 years critical



Source: IPCC

The New Climate Economy Report

A different growth pathway



The New Climate Economy Report

3CSEP

The Global Commission recommends 10 transformative actions

Next steps

1. Integrate climate risk into strategic decisions
2. Secure a strong international climate agreement
3. End perverse subsidies
4. Price carbon to send a clear market signal
5. Scale-up low-carbon innovation
6. Reduce the cost of capital for low-carbon investment
7. Move toward connected and compact cities
8. End deforestation
9. Restore degraded lands
10. Phase out unabated coal fast

Source: NCE. For details please see the NCE Global Action Plan (2014)

The New Climate Economy Report

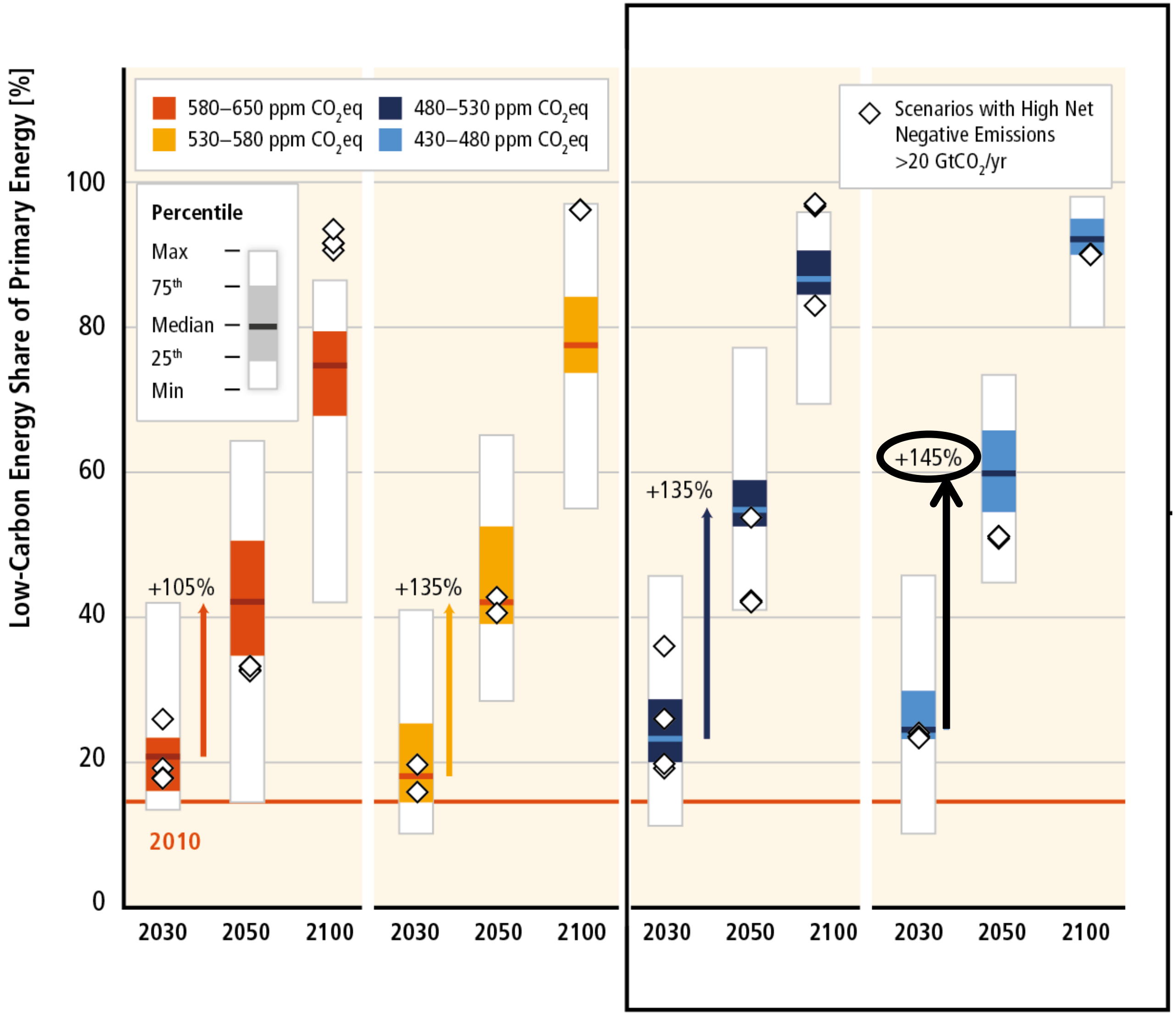
The inertia of the system

- In the long term, the magnitude and rate of climate change will depend on **future global GHG emissions**.

- However, even if GHG emissions were to stop today, climate change would continue for many decades as a result of **past emissions** and the **inertia of the climate system**.

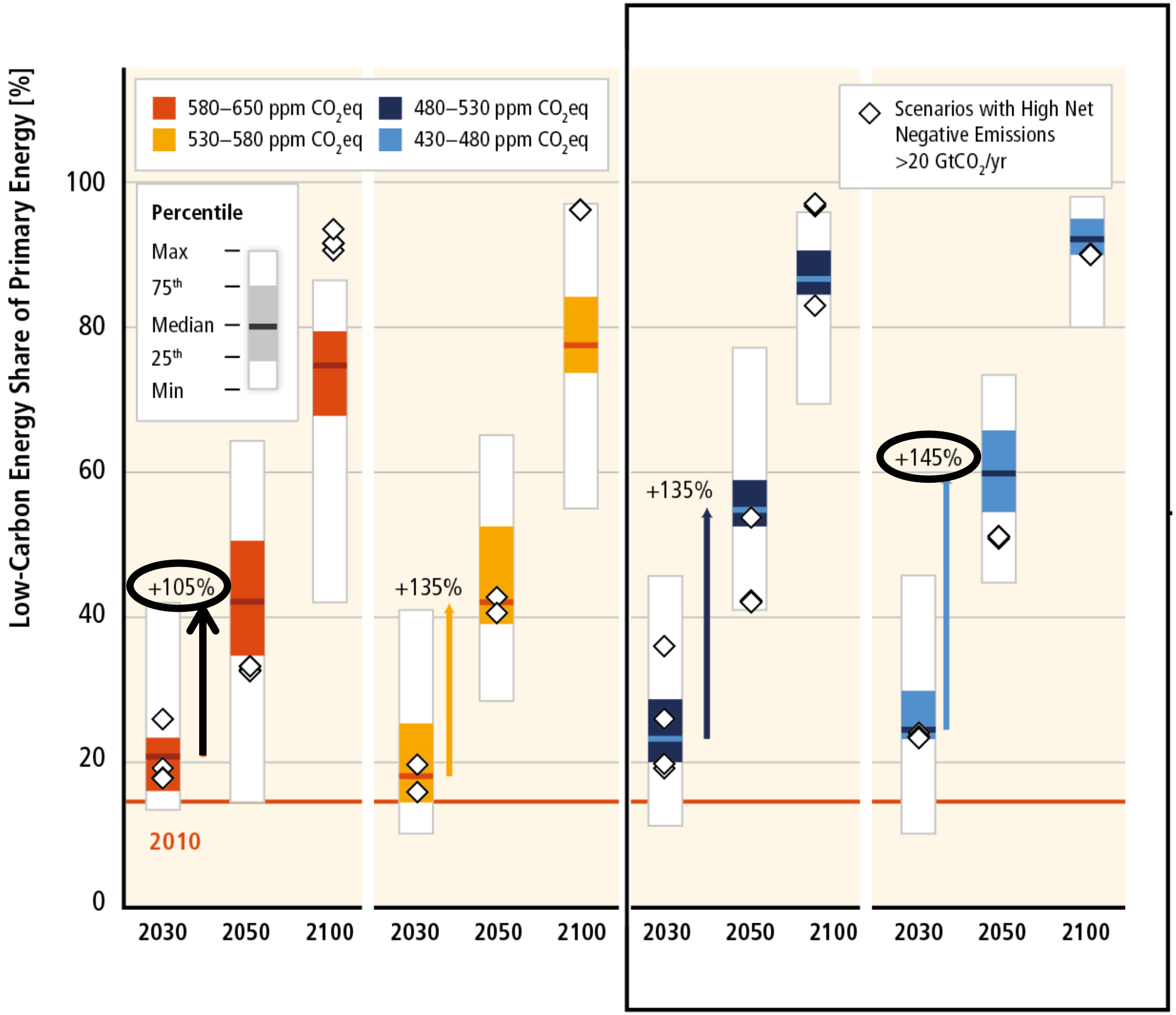
IPCC, 2013

Mitigation involves substantial upscaling of low-carbon energy



IPCC,

Mitigation involves substantial upscaling of low-carbon energy



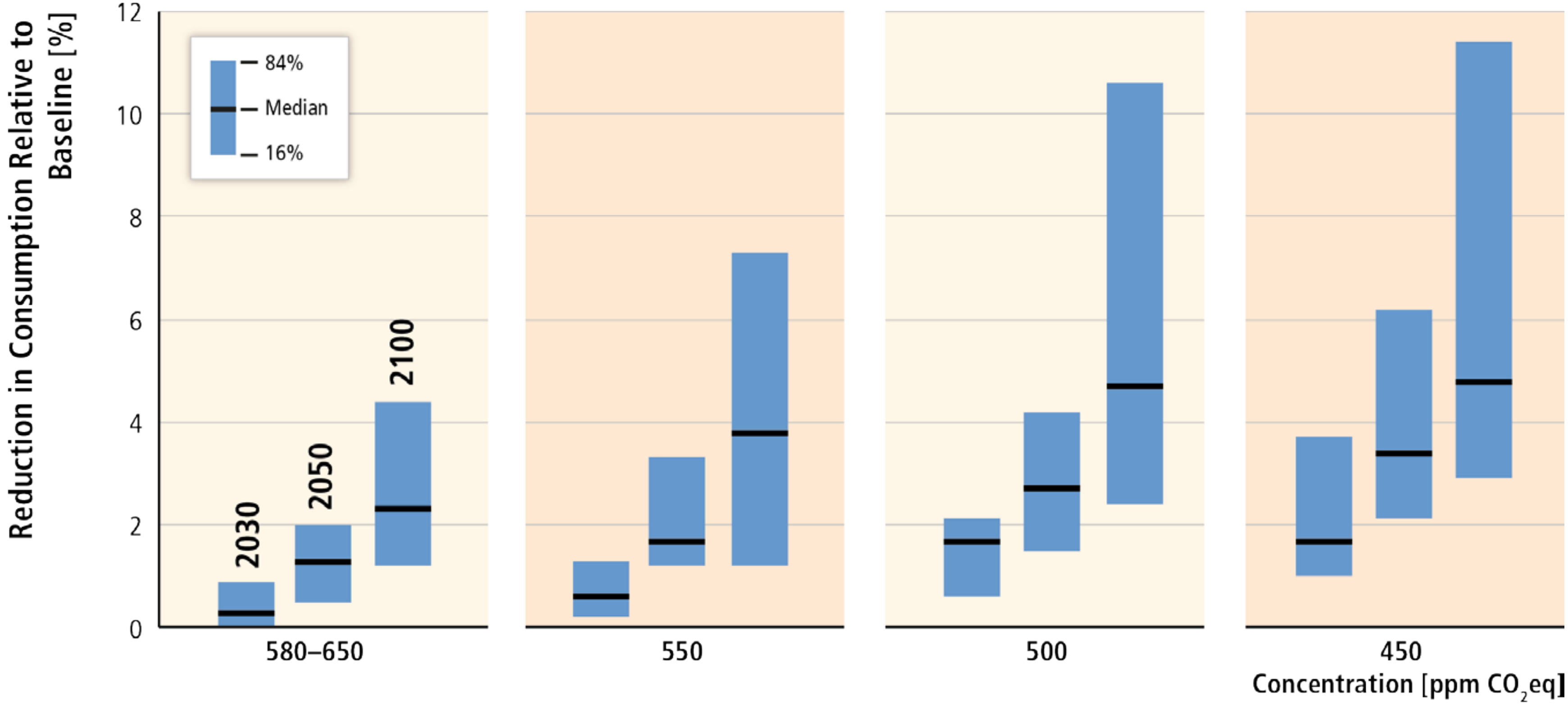
IPCC,

Top priority

- We are facing a **serious problem**, which requires **immediate action**.

- At the same time, due to the magnitude of the task at hand, **thorough planning** is of paramount importance in addressing climate change.

Global costs rise with the ambition of the mitigation goal.

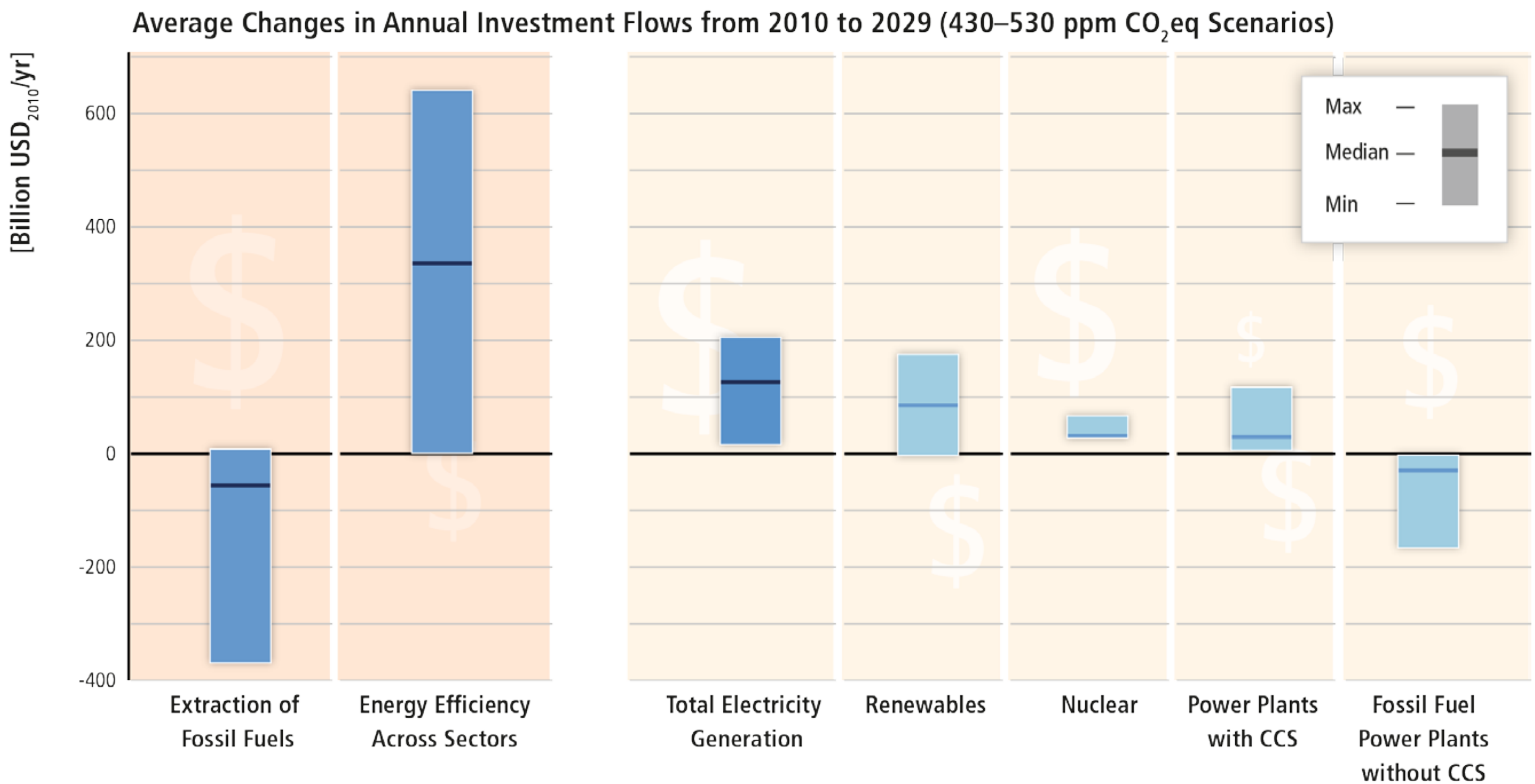


Percentage Point Reduction in Annualized Consumption Growth Rate over 21st Century			
0.03 (0.01-0.05)	0.04 (0.01-0.09)	0.06 (0.03-0.13)	0.06 (0.04-0.14)

Based on Table SPM.2

3CSEP

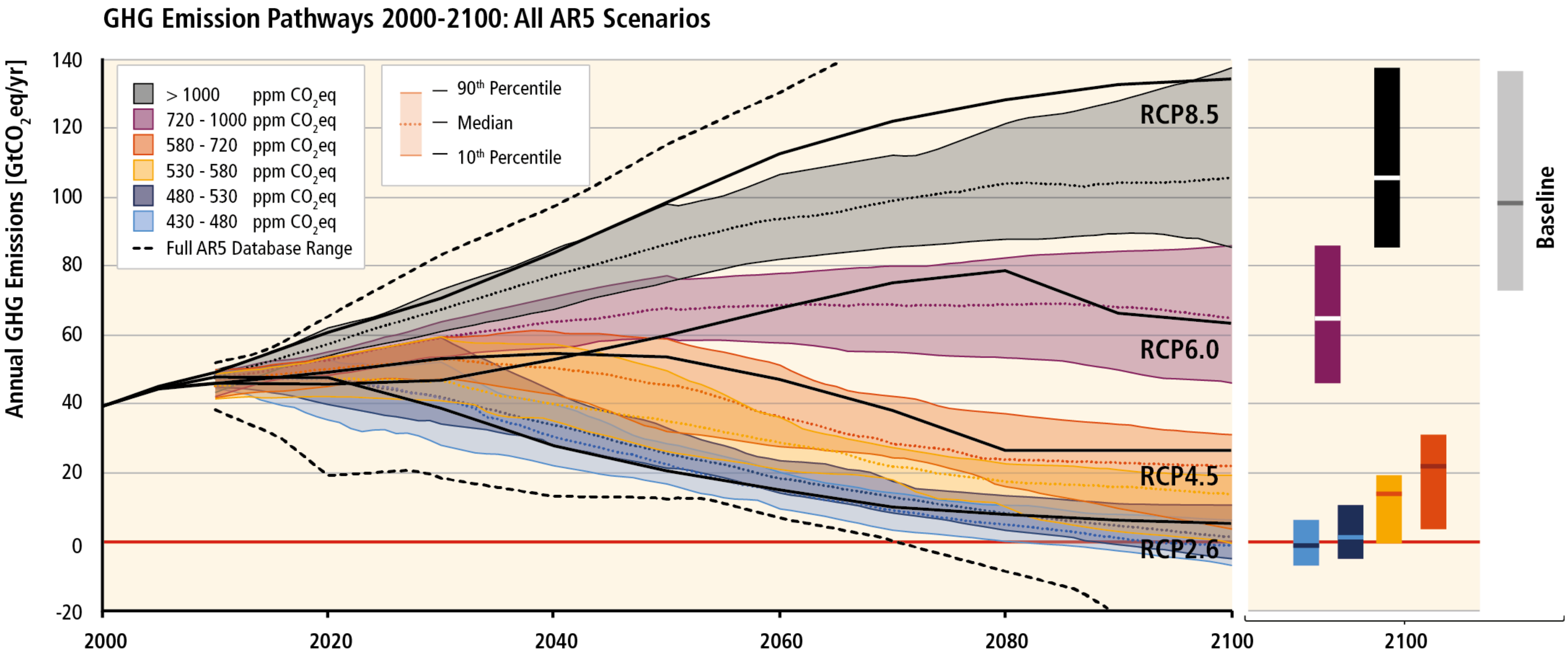
Substantial reductions in emissions would require large changes in investment patterns and appropriate policies.



Based on Figure 16.3

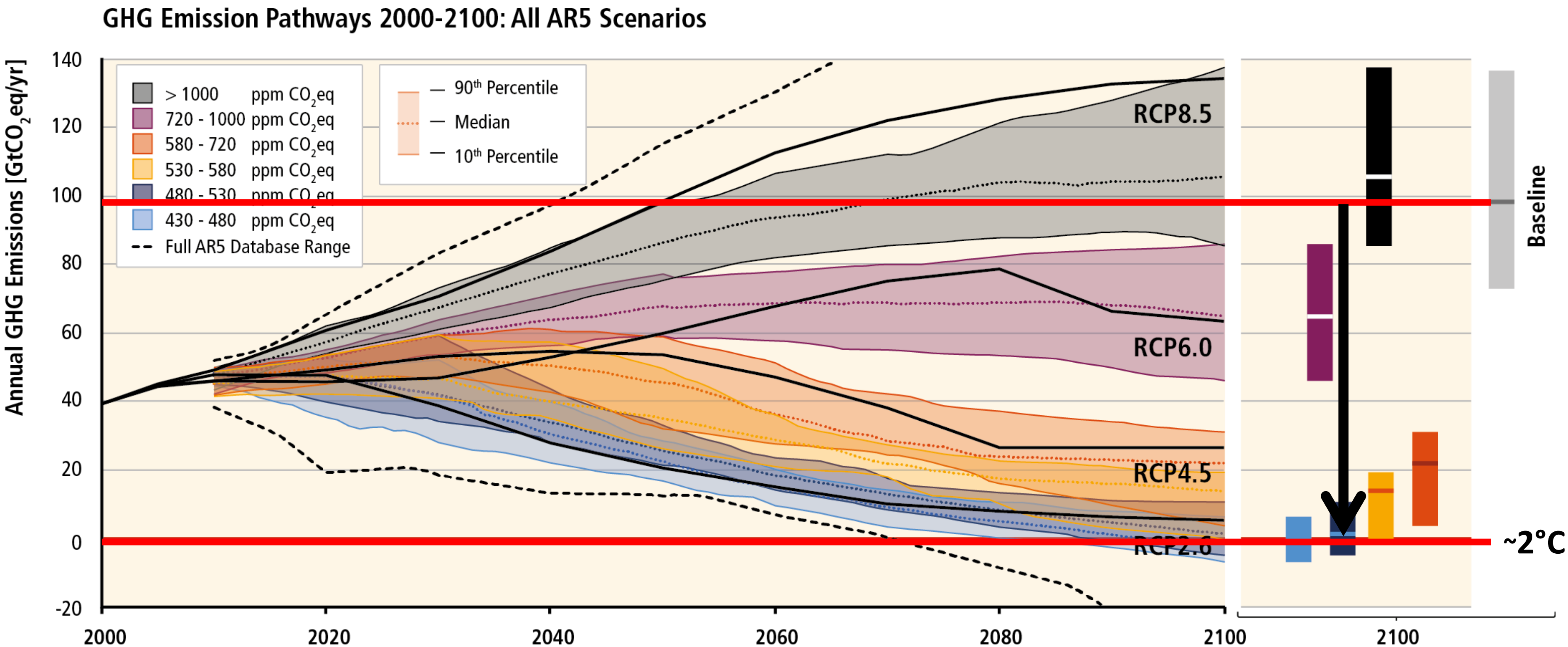
3CSEP

Without more mitigation, global mean surface temperature might increase by 3.7° to 4.8°C over the 21st century.



IPCC, 2014

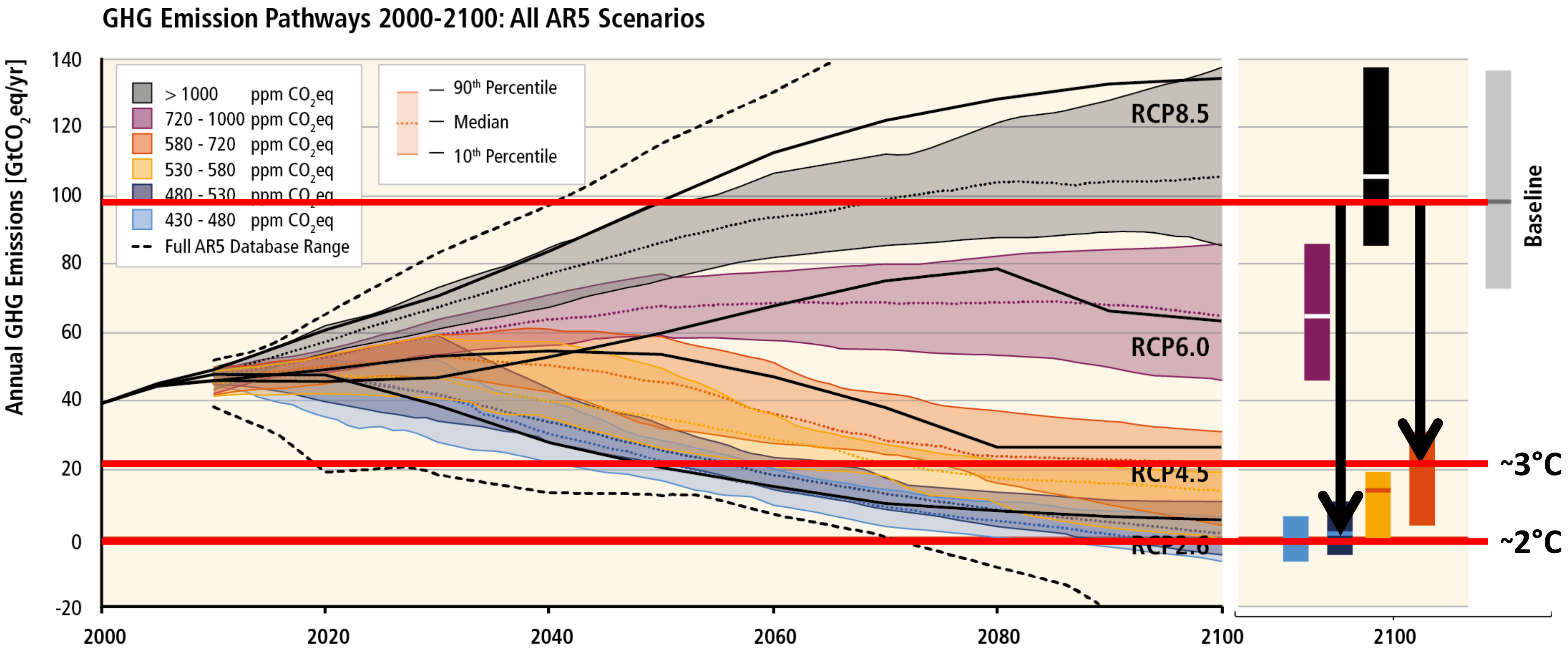
Stabilisation of atmospheric GHG concentrations requires moving away from business as usual.



IPCC, 2014

3CSEP

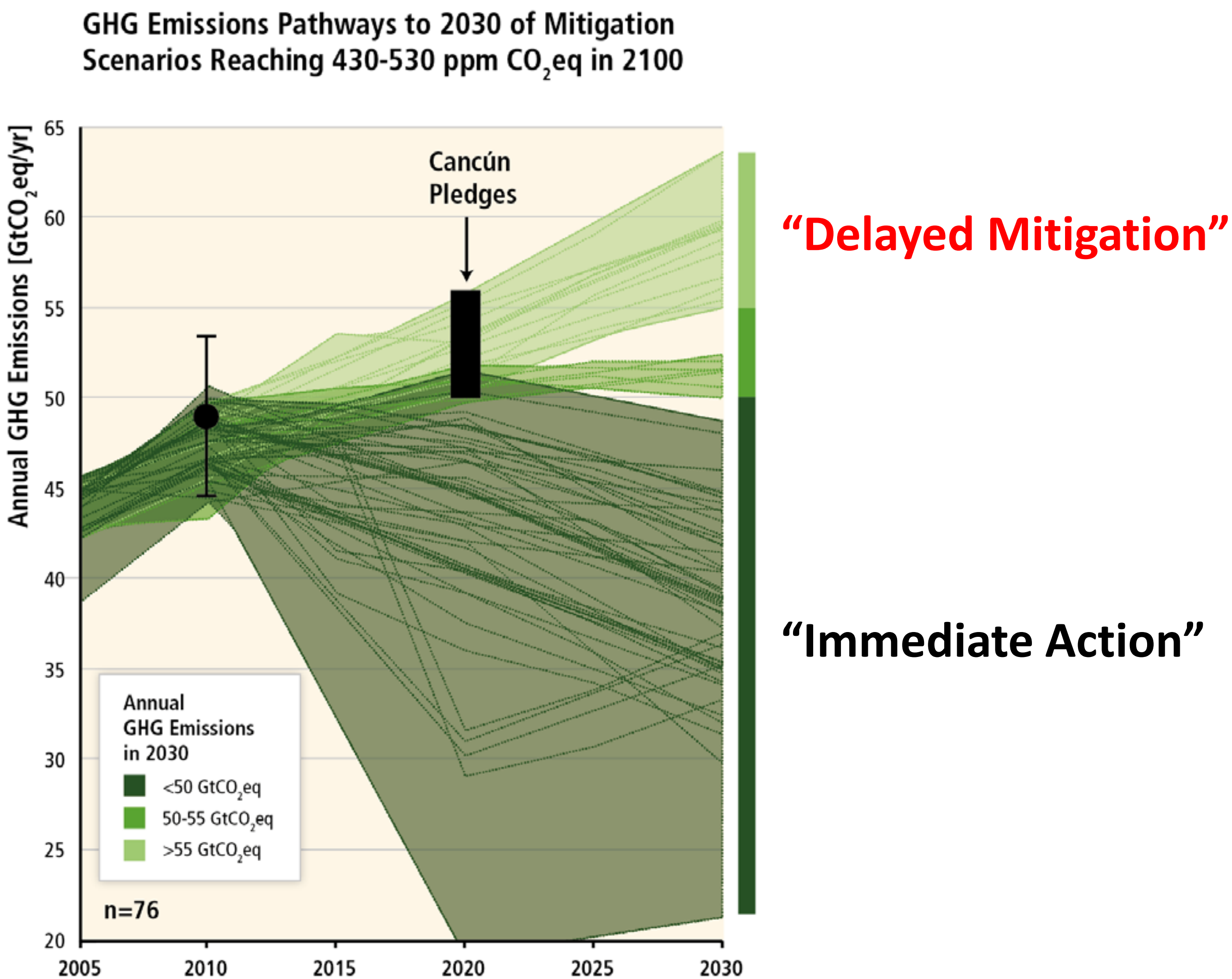
Lower ambition mitigation goals require similar reductions of GHG emissions.



IPCC, 2014

3CSEP

Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.



IPCC, 2014

Climate Impacts in Europe

- The European Union is committed to limiting global temperature increase to **below 2 °C above the pre-industrial level**.

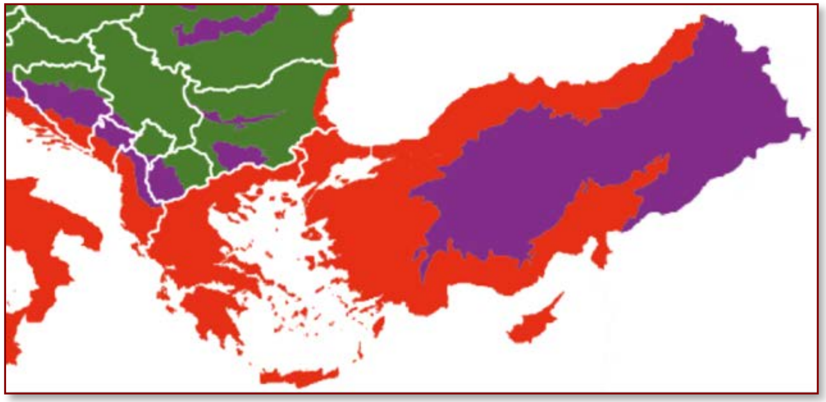
- However, the projected rise in global average temperatures over the 21st century is
  0.3 °C–1.7 °C for the lowest emission scenario, and
  2.6 °C–4.8 °C for the highest emission scenario.

IPCC, 2013

Climate Impacts in Europe

According to a recent study (JRC PESETA II. Project), under a **high-emission scenario** and in the **absence of adaptation actions**, some climate impacts would roughly double by the end of this century.

Ciscar et al., 2014; JRC PESETA II. Project

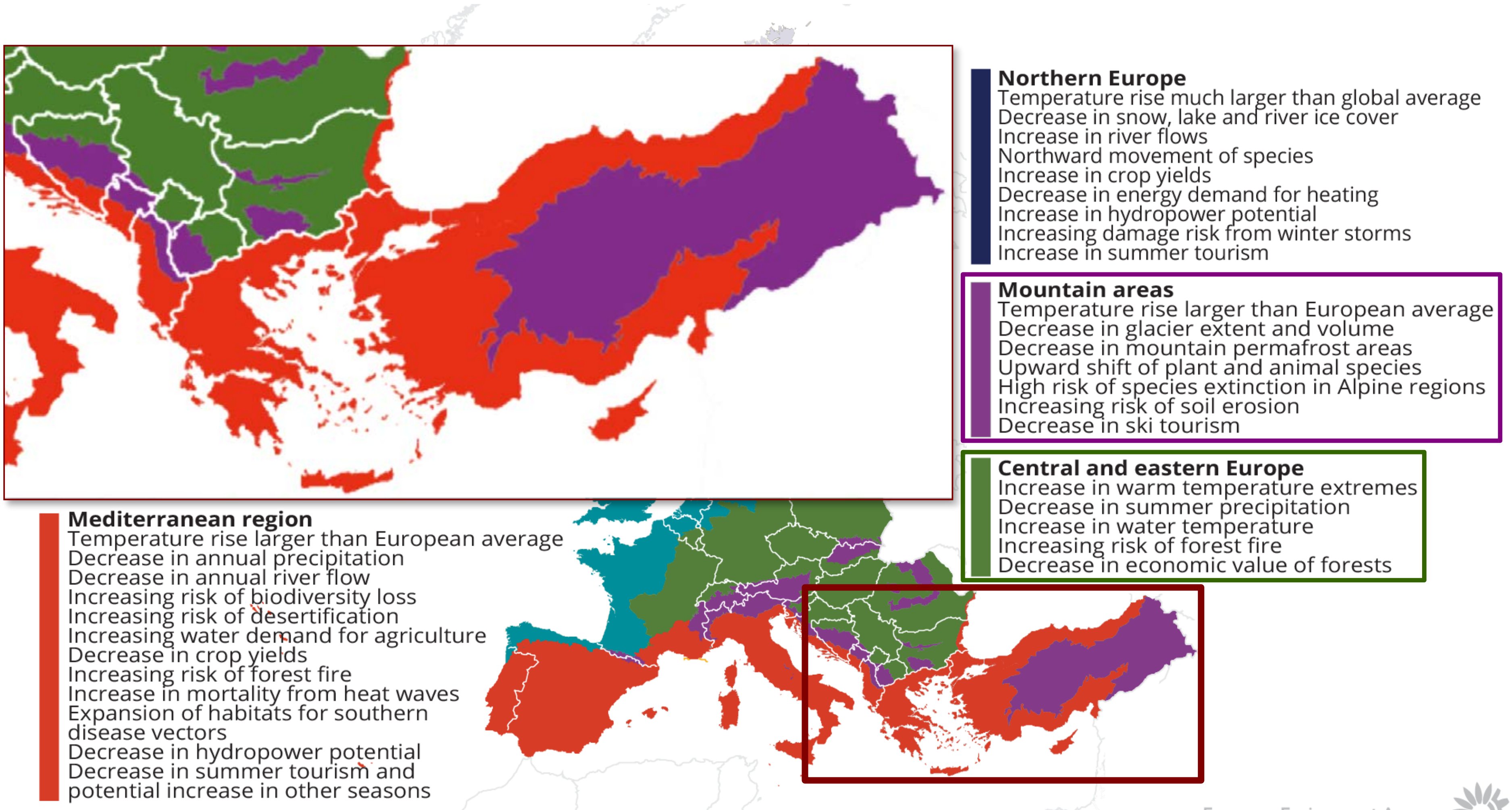


Mountain areas

- Temperature rise larger than European average
- Decrease in glacier extent and volume
- Upward shift of plant and animal species
- High risk of species extinction in Alpine regions
- Increasing risk of soil erosion

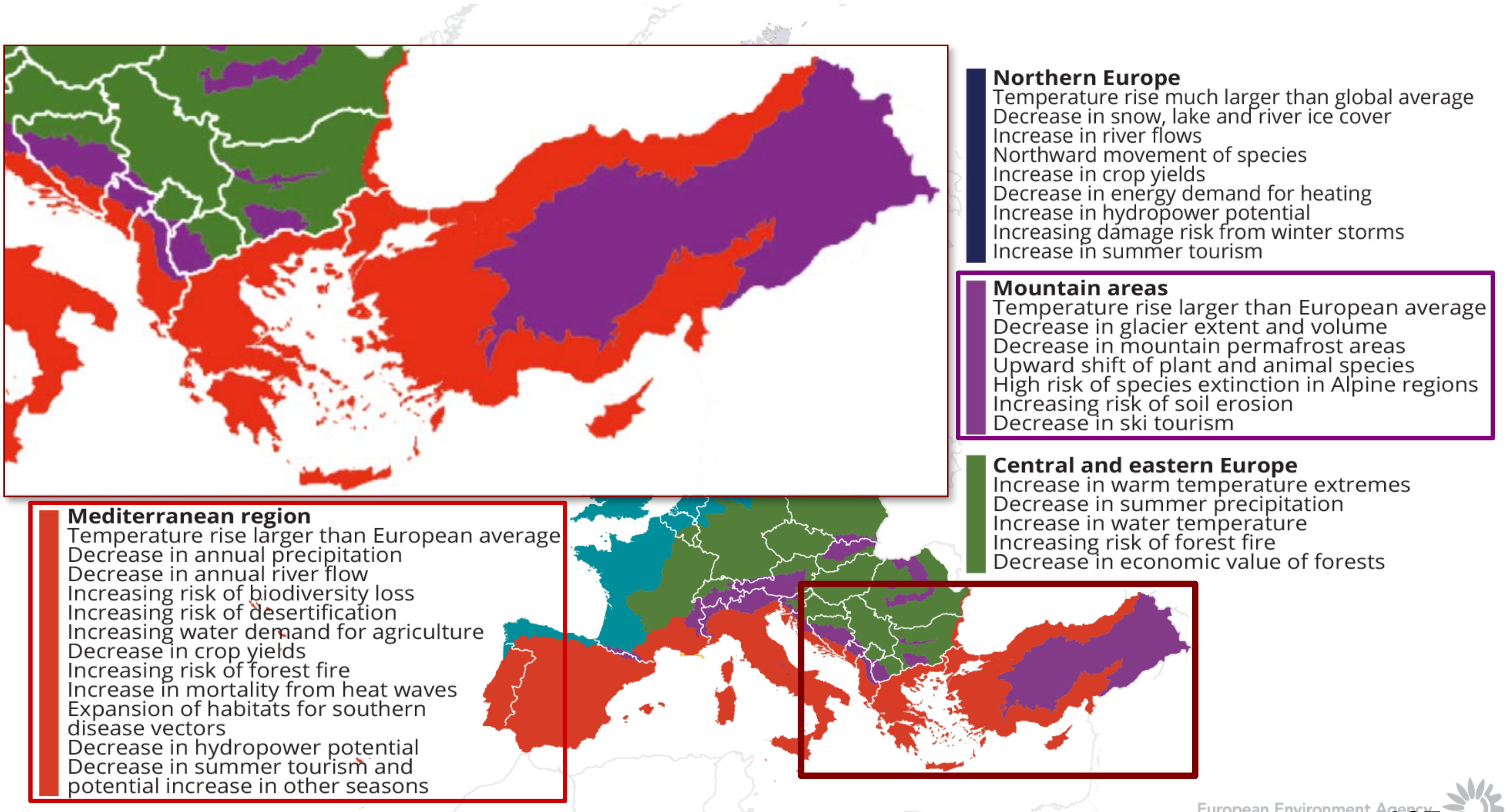
Source: European Environment Agency (EEA)

Key **observed** and **projected** impacts from climate change for the main regions in Europe



Source: European Environment Agency (EEA)

Key **observed** and **projected** impacts from climate change for the main regions in Europe



Source: European Environment Agency (EEA)

Western Balkans
Food security

- The various threats to food security from climate change in Central Asia and the **Western Balkans** are indicated in the literature as follows:
  - Sensitivity thresholds of crops might be exceeded more often with rising average temperatures and the increased risk of temperature extremes (Lioubimtseva and Henebry 2012; Teixeira et al. 2013)

The World Bank (2014) Turn Down the Heat

Western Balkans
Energy systems

- In addition, **economic development** and a **growing population** are expected to **increase energy demand**, thereby putting thermal electric power plants under increasing pressure.
- In the **absence of adaptation measures**, climate change, economic development, and population growth may together contribute to a rise in electricity prices and increase the risk of electricity shortages in the region.

The World Bank (2014) Turn Down the Heat

Nothing is lost yet

Increases in emissions can be counteracted by **reducing the carbon and energy intensity** of the economy.

Increasing energy efficiency:

- makes supply-side transformation easier,
- reduces the required pace of low-carbon supply deployment,
- avoids lock-in effect,
- increases the cost-effectiveness of transformation;
- maximises co-benefits.

Feiler, 2015; ECRAN Training