MedECC

Mediterranean Experts on Climate and environmental Change

Energy, climate and environmental change in the Mediterranean Basin

Wolfgang Cramer (CNRS)

http://www.medecc.org/

@Med_ECC

With financial support from the government of

Sweden Sverige

Plan Bleu

MÉTROPOLE AIX-MARSEILLE PROVENCE

PAYS D'AIX

Gouvernement Princier PRINCIPAUTÉ DE MONACO

IRD Institut de recherche pour le développement

ADEME

Aix*Marseille université

OSU OREME LABEX

Generalitat de Catalunya

Union for the Mediterranean
Union pour la Méditerranée
الإتحاد من أجل المتوسط

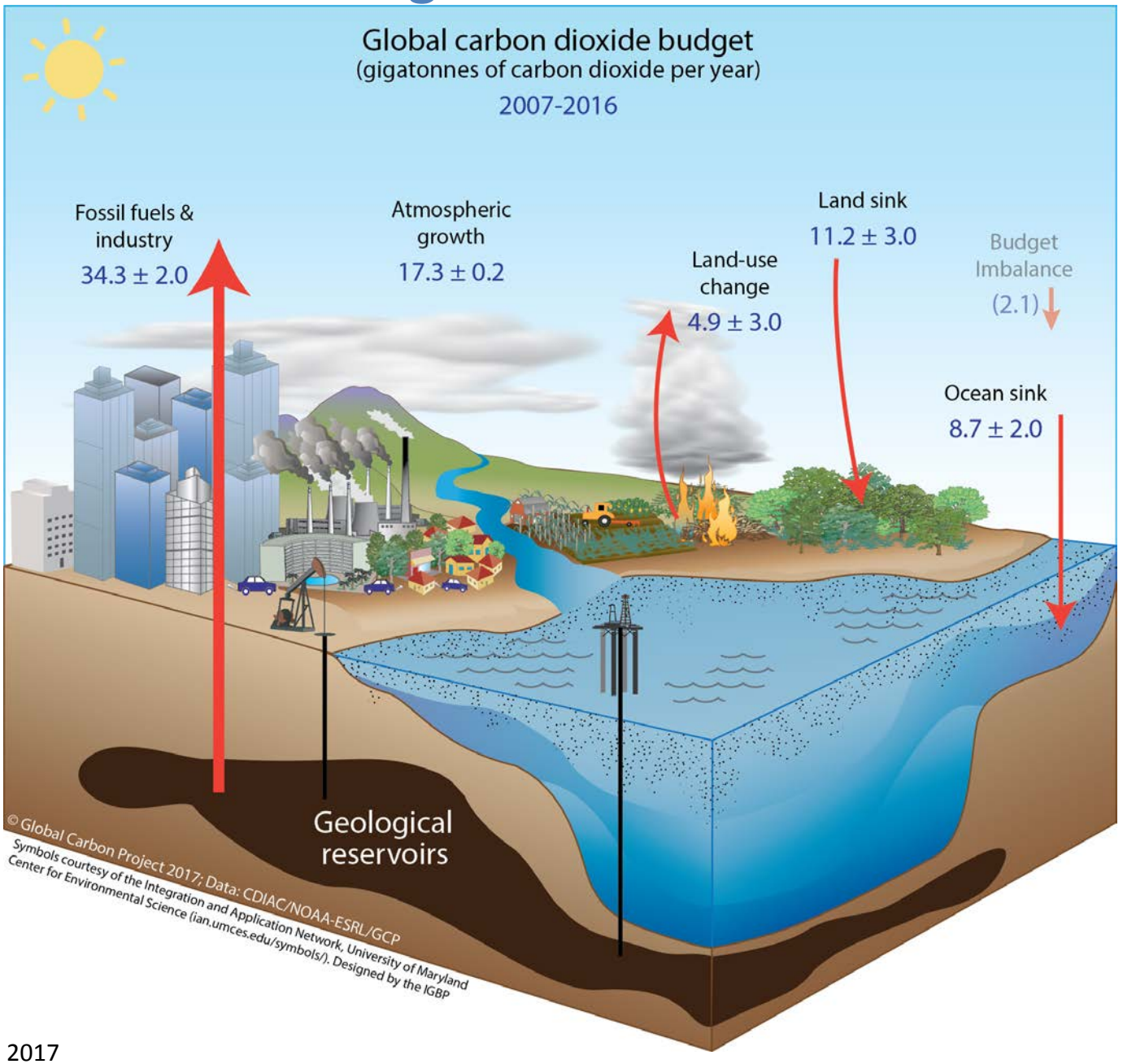
Energy, climate and environmental change in the Mediterranean Basin

1. Connecting climate, energy and the environment
2. Expected change in the Mediterranean energy system
3. Recent change in the Mediterranean environment and future risks for people
4. A transition towards sustainability?

Energy, climate and environmental change in the Mediterranean Basin

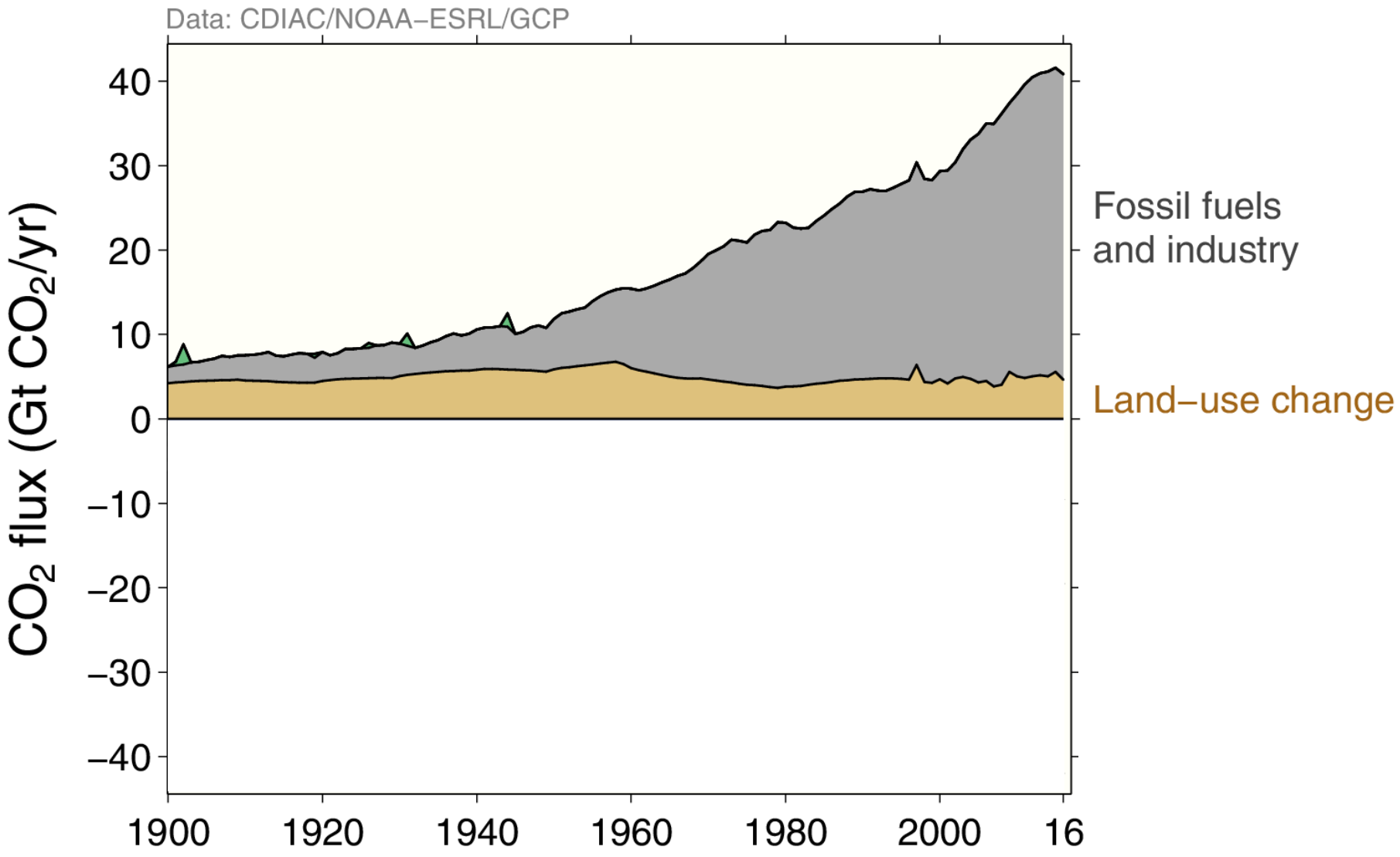
1. Connecting climate, energy and the environment
2. Expected change in the Mediterranean energy system
3. Recent change in the Mediterranean environment and future risks for people
4. A transition towards sustainability?

Energy and climate change

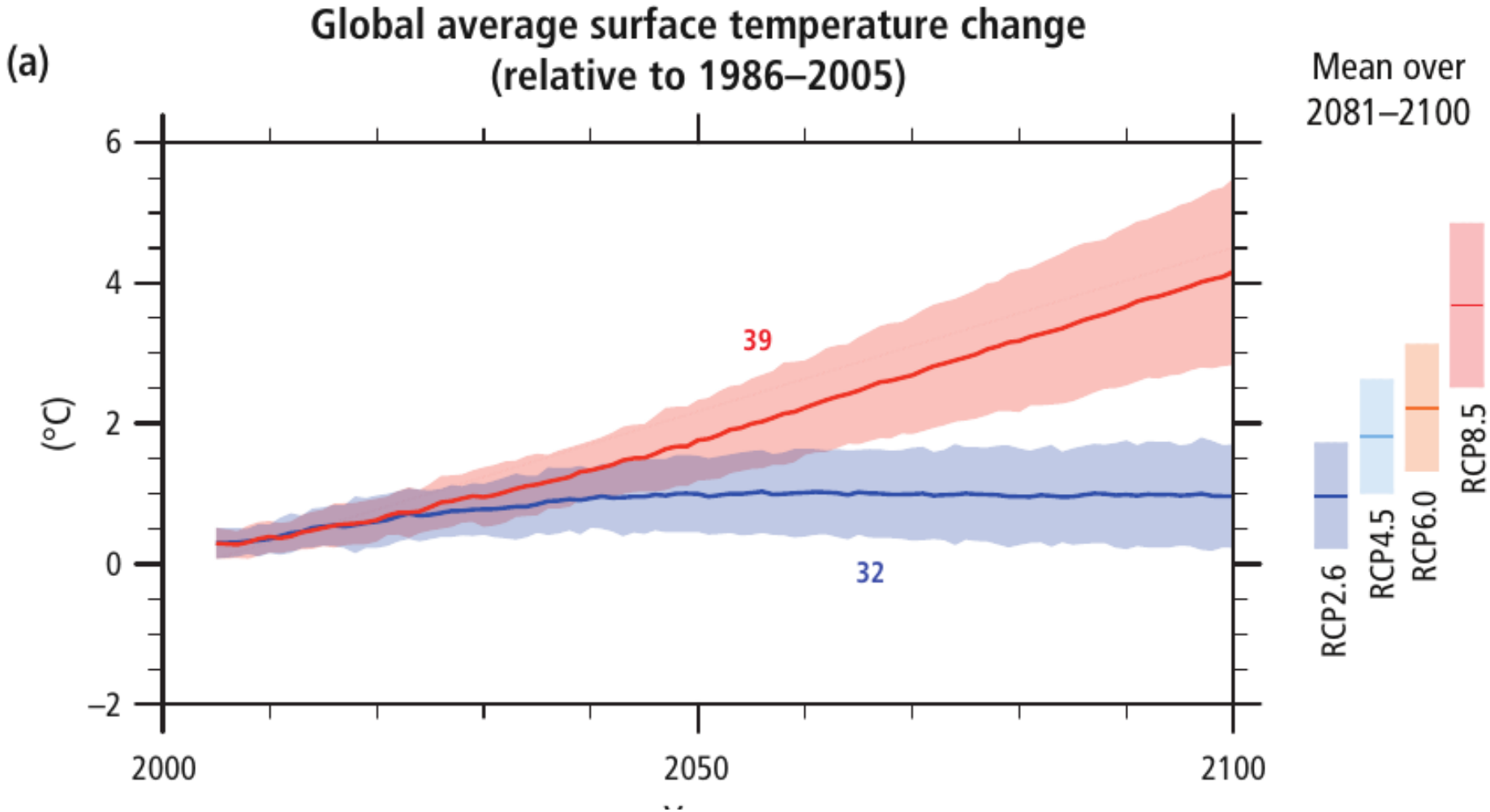


Global Carbon Project 2017

Energy and climate change



Energy and climate change



IPCC 2015

Energy, climate and environmental change in the Mediterranean Basin

1. Connecting climate, energy and the environment
2. Expected change in the Mediterranean energy system
3. Recent change in the Mediterranean environment and future risks for people
4. A transition towards sustainability?

2. Expected change in the Mediterranean energy system

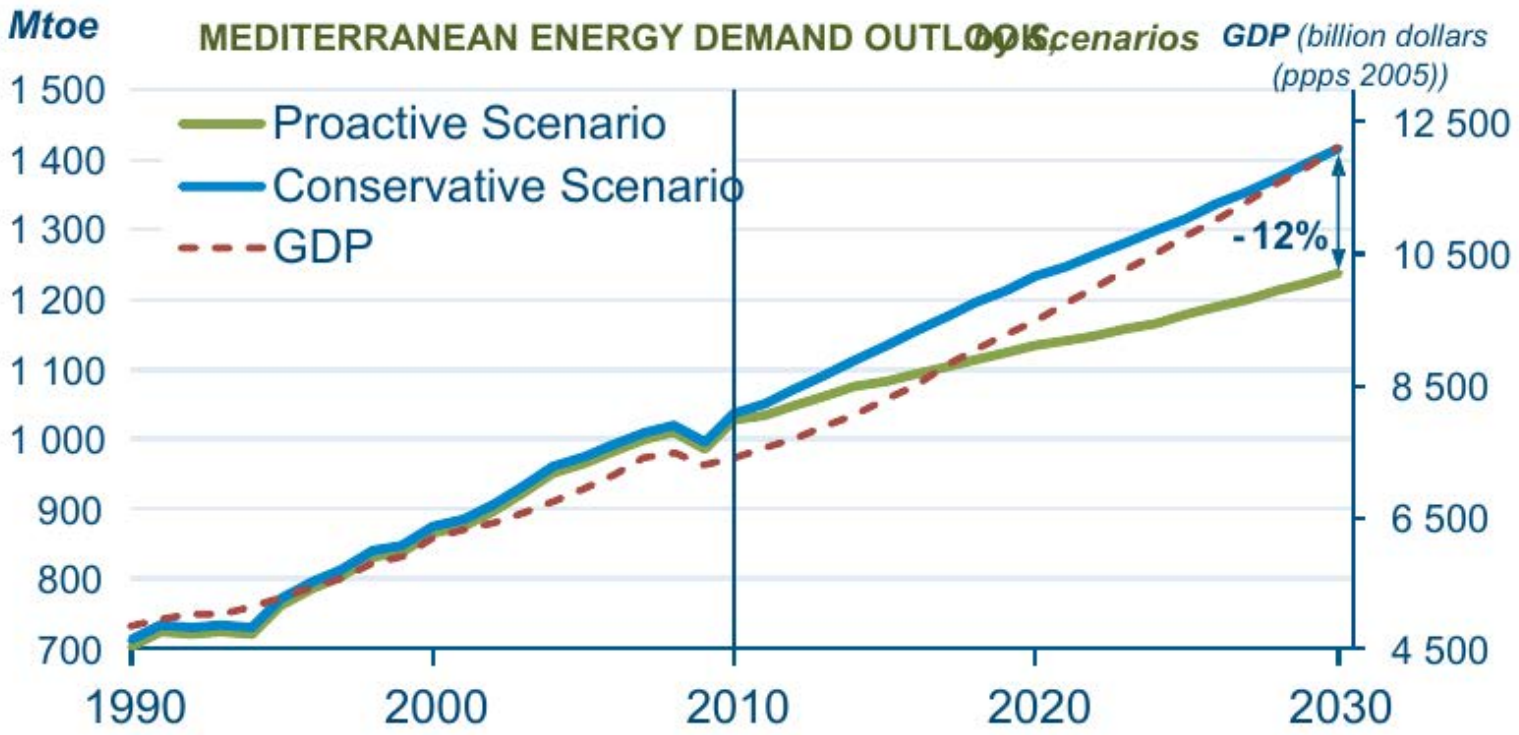
a) The industry perspective

b) A government perspective

c) Recent trends in fossil fuels

Industry expectations on energy

ENERGY DEMAND OUTLOOK



40% increase in overall demand by 2030.

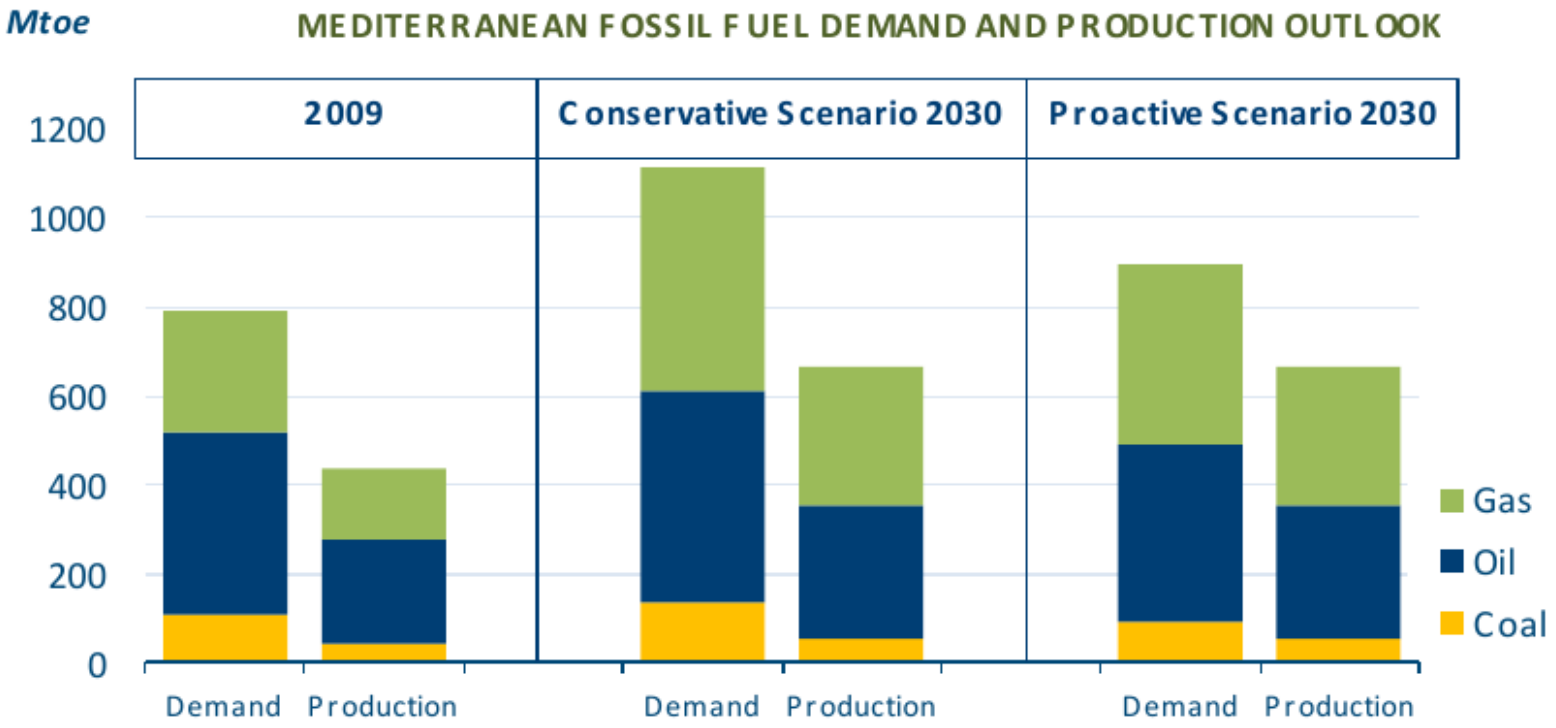
Just 20% increase if robust policies and measures are put in place.

Mtoe: megaton oil equivalent

Observatoire Méditerraneen de l'Energie 2014 (industry)

Industry expectations on energy

HEAVY RELIANCE ON FOSSIL FUELS WILL ENDURE



To 2030 the Mediterranean region will remain a net importer of fossil fuels regardless of the Scenario.

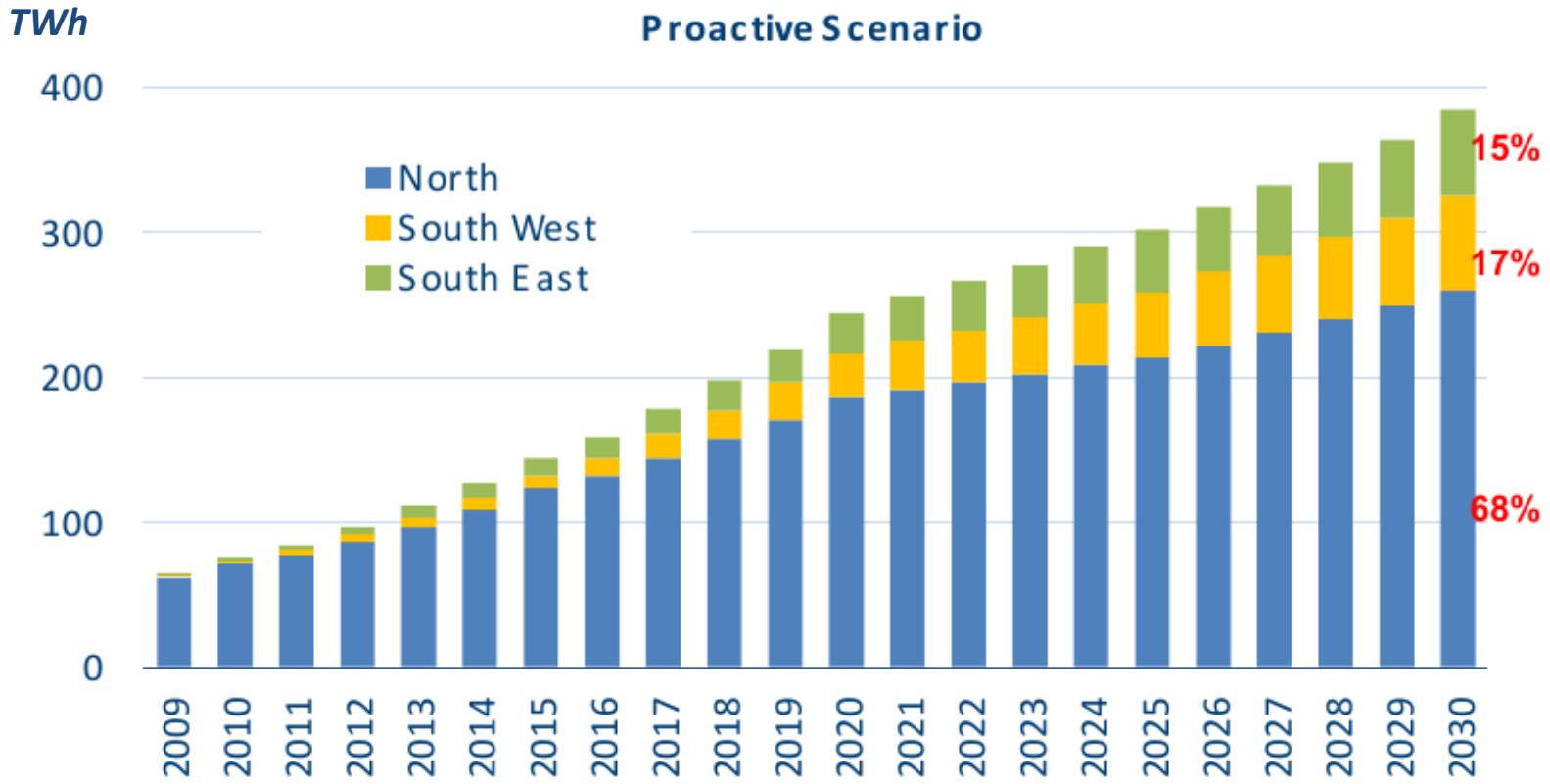
Gas production could nearly double and demand increase between 40% and 70% from 2010 to 2030

Mtoe: megaton oil equivalent

Observatoire Méditerraneen de l'Energie 2014 (industry)

Industry expectations on energy

MEDITERRANEAN WIND OUTLOOK

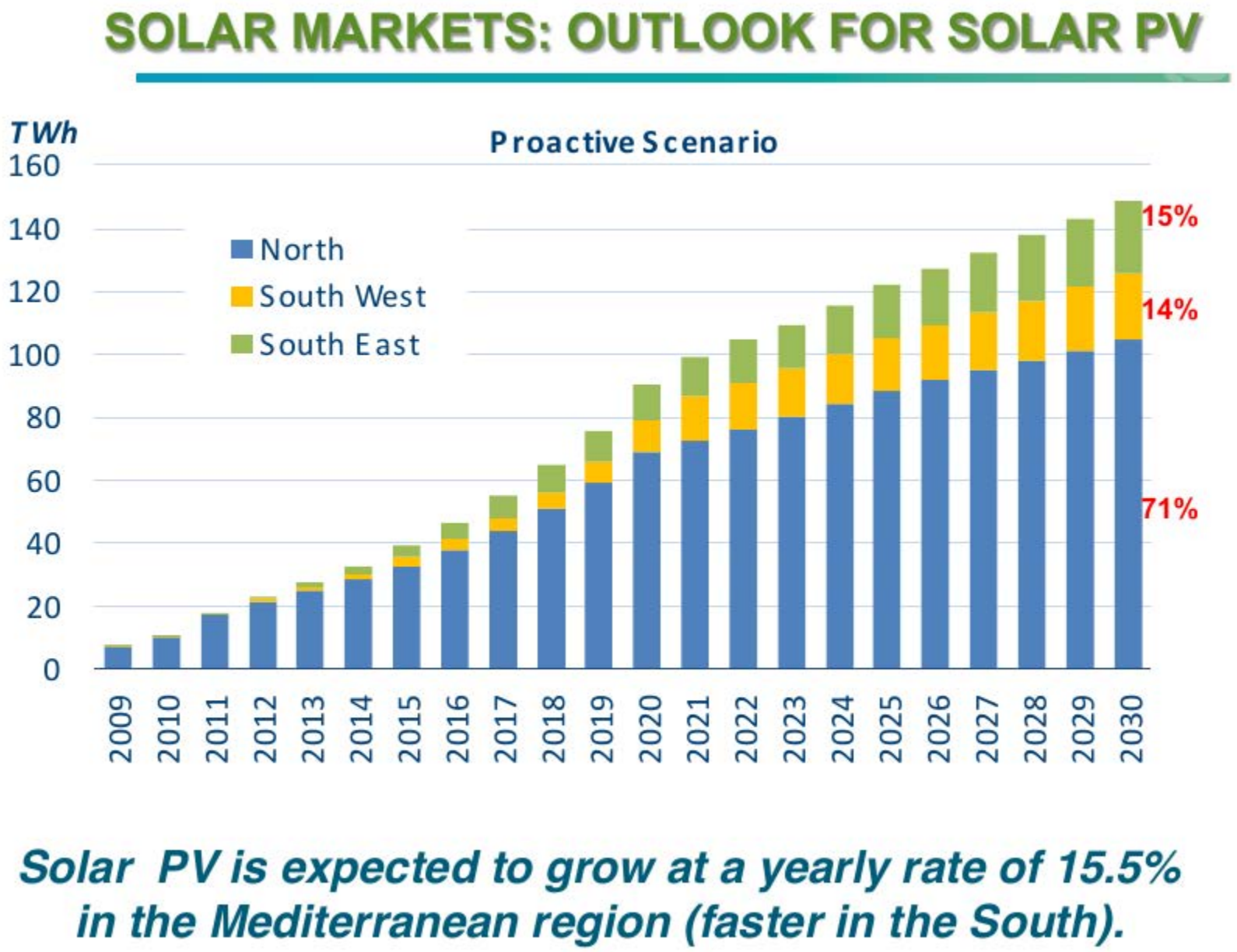


Wind generation to increase six fold and South to supply one third of the total by 2030.

TWh: Tera watt hours

Observatoire Méditerraneen de l'Energie 2014 (industry)

Industry expectations on energy

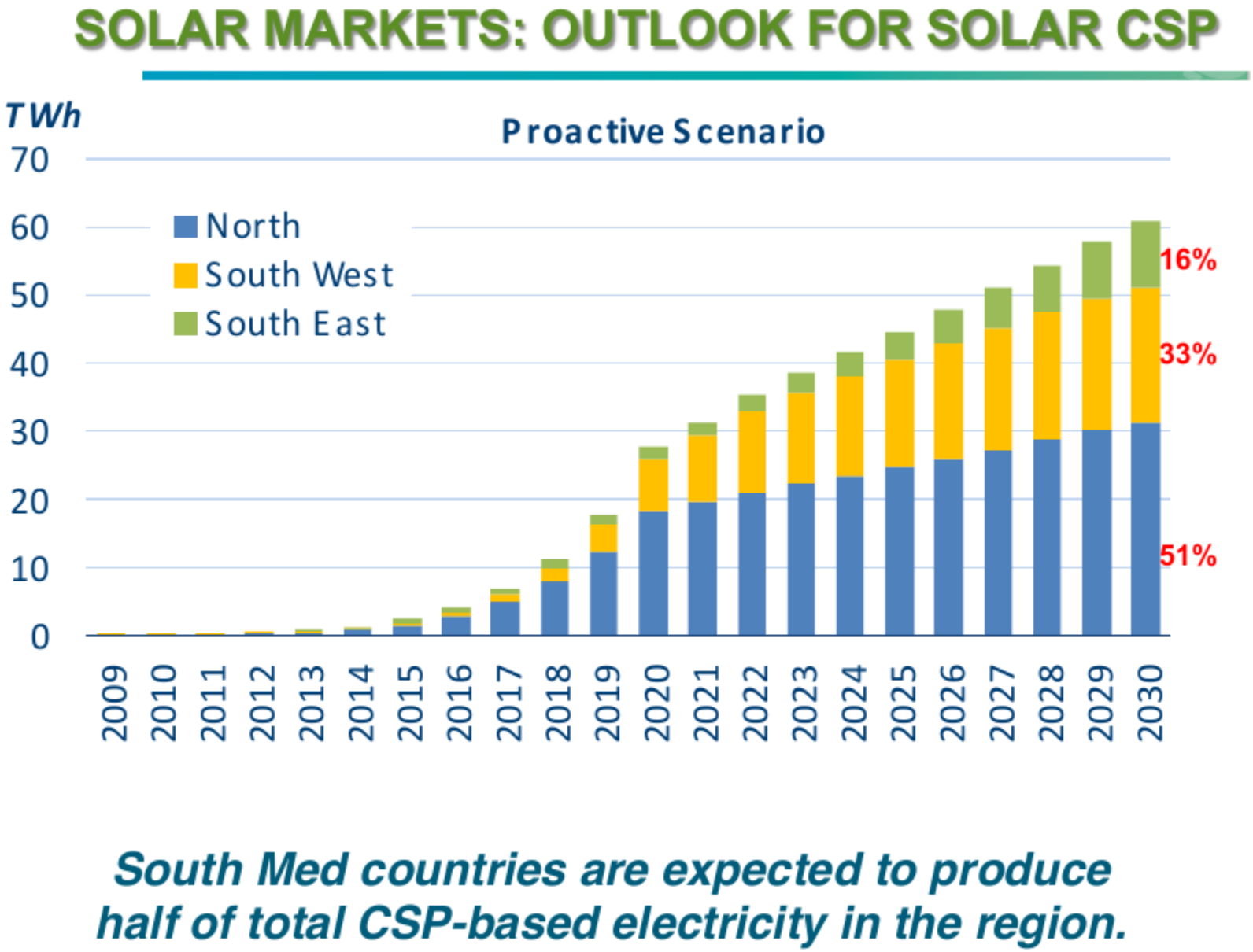


Solar PV is expected to grow at a yearly rate of 15.5% in the Mediterranean region (faster in the South).

PV: photovoltaics

Observatoire Méditerraneen de l'Energie 2014 (industry)

Industry expectations on energy



South Med countries are expected to produce half of total CSP-based electricity in the region.

CSP: concentrated solar power

Observatoire Méditerraneen de l'Energie 2014 (industry)

2. Expected change in the Mediterranean energy system

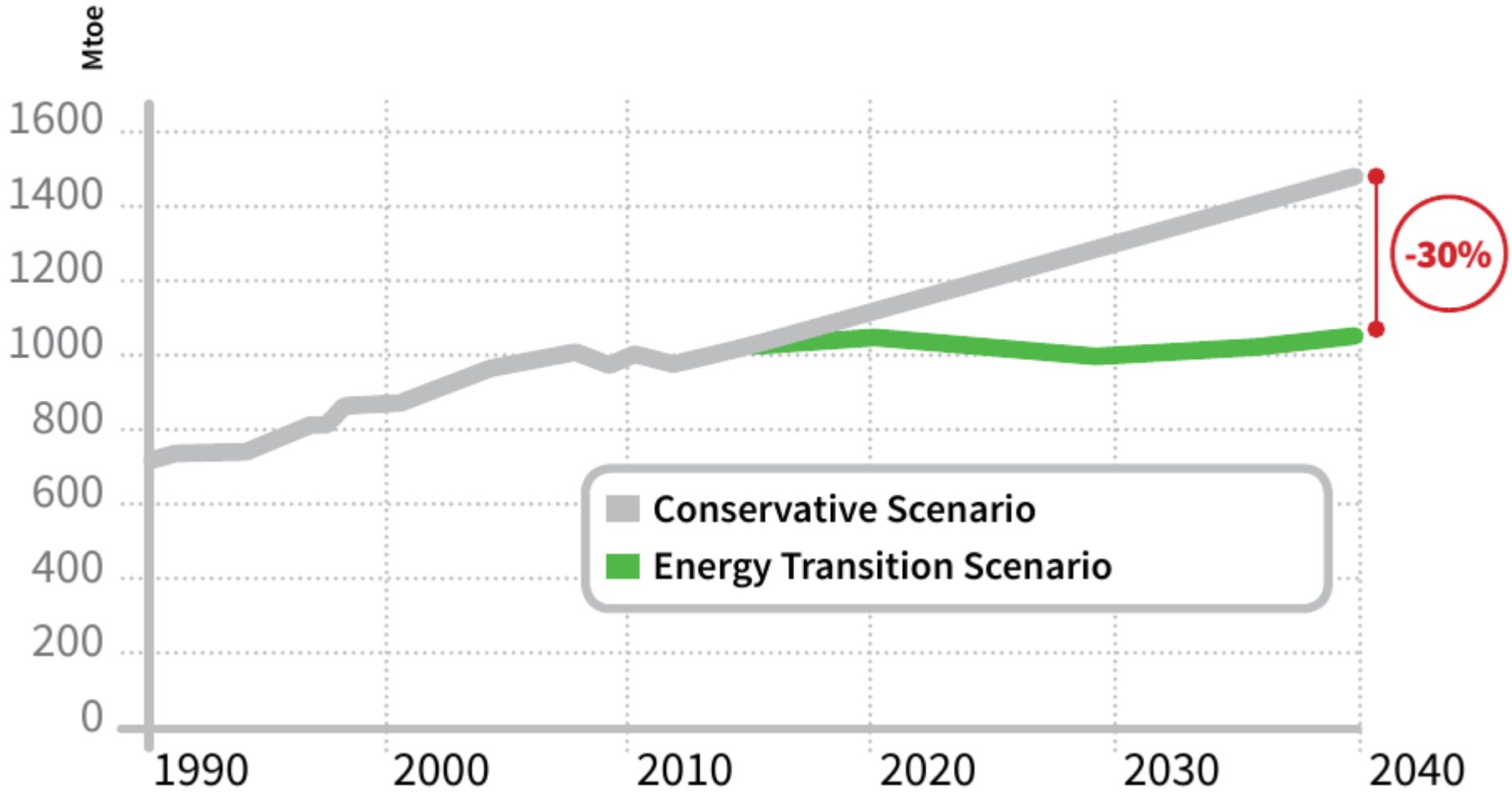
a) The industry perspective

b) A government perspective

c) Recent trends in fossil fuels

Government perspective on energy

FIGURE-2 **PRIMARY ENERGY DEMAND BY SCENARIO**

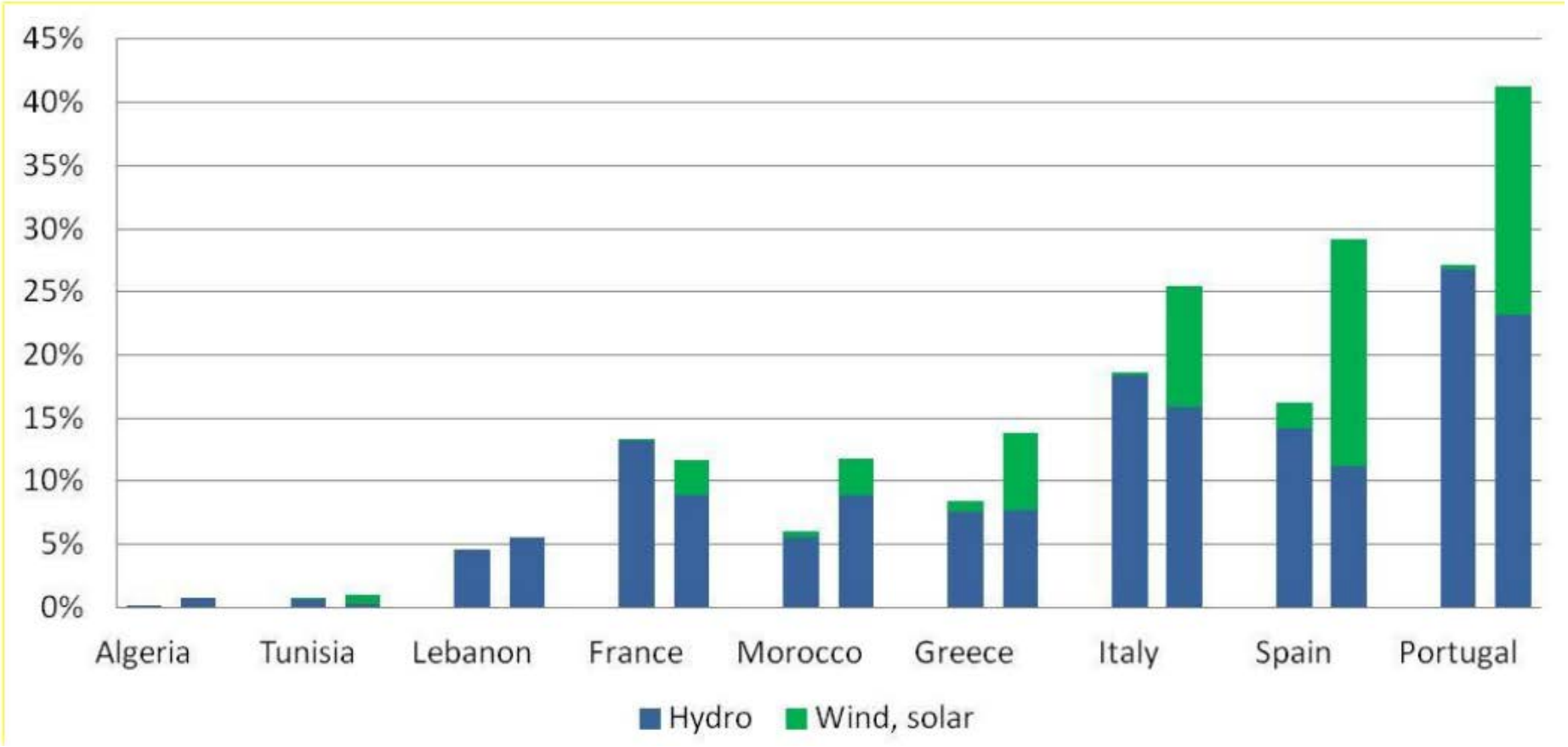


Source : MEDENER/OME, 2015.

MEDENER: Mediterranean Association of national agencies for energy conservation

Government perspective on energy

Figure 23 : Share of renewable sources in electricity generation (2000, 2010)

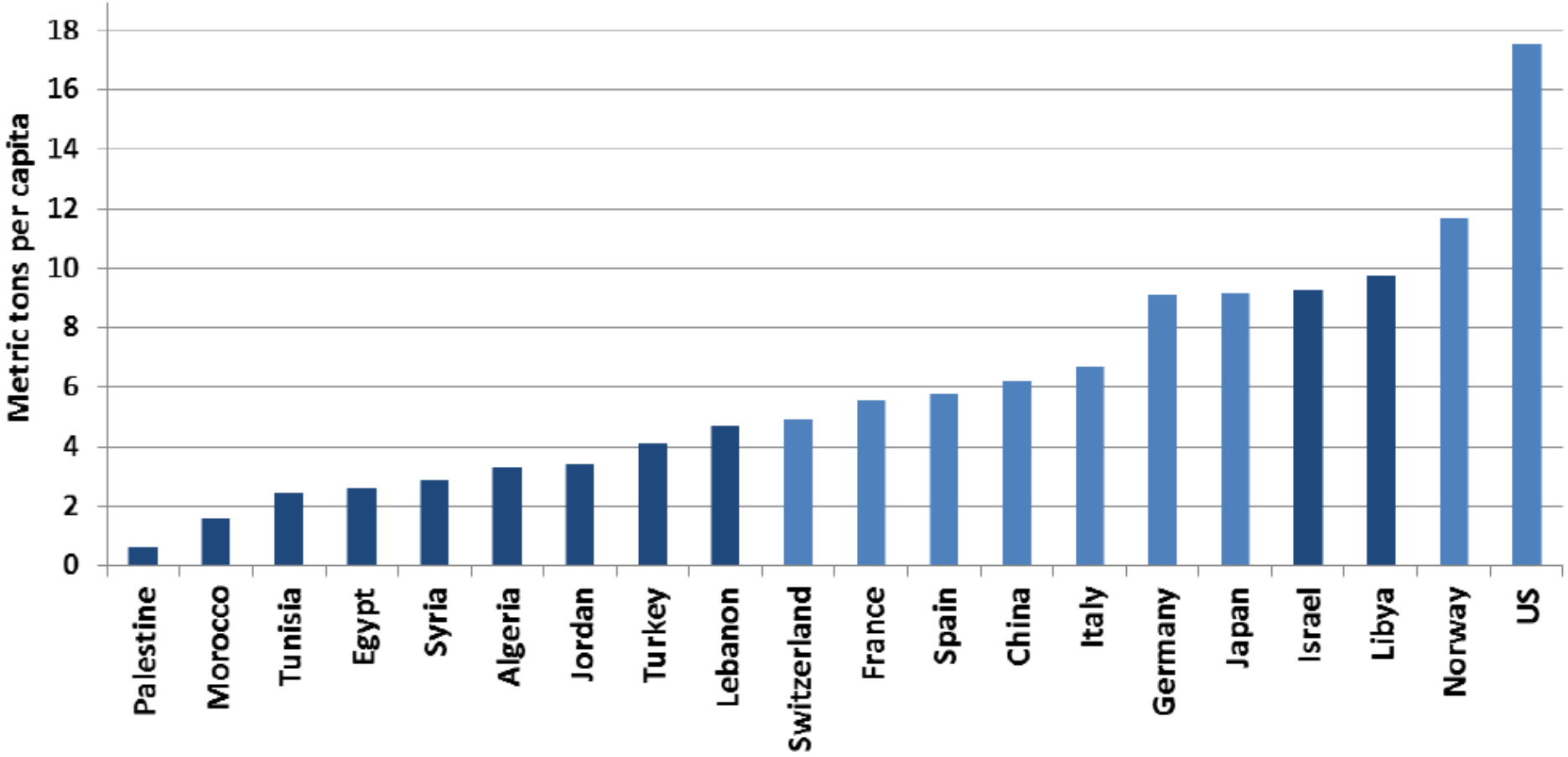


MEDENER: Mediterranean Association of national agencies for energy conservation

Government perspective on energy

FIGURE 23

Per capita CO_2 emissions by country (2010)

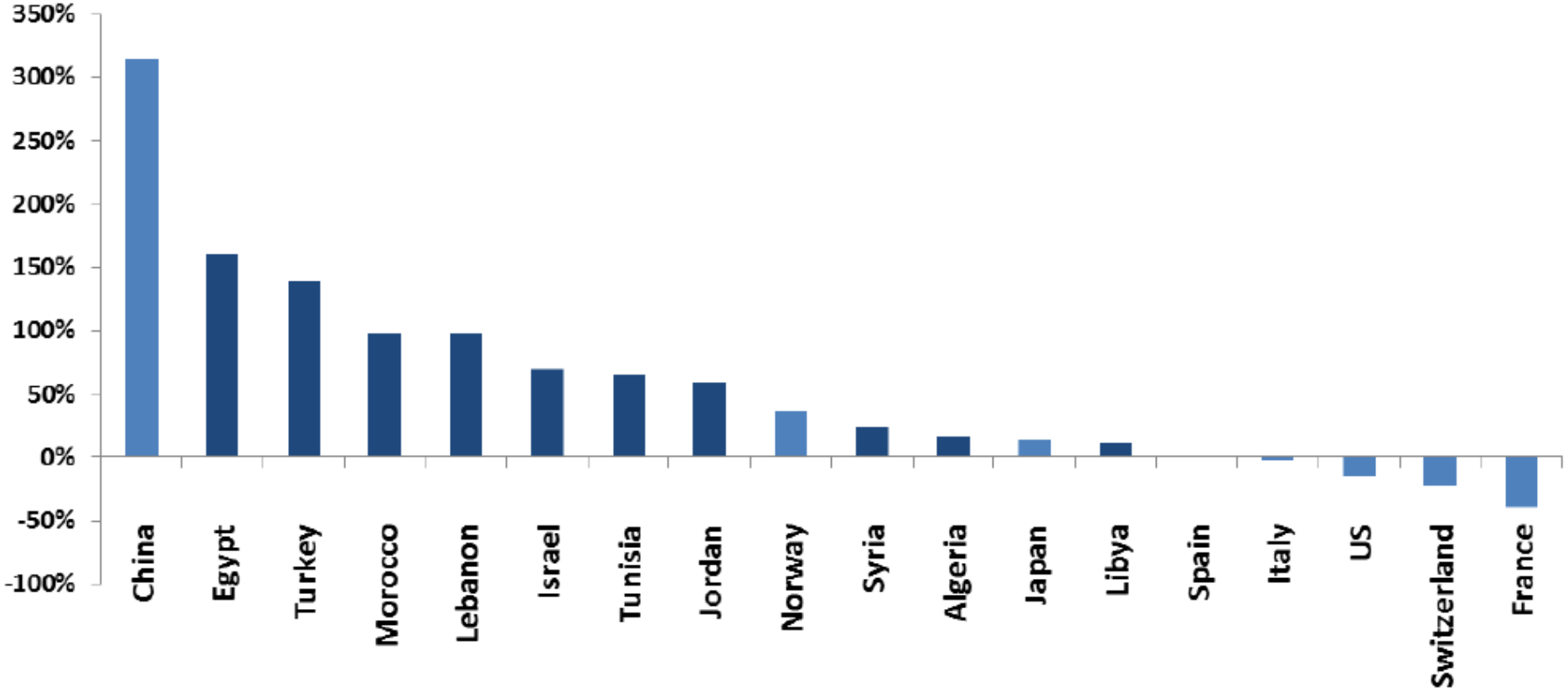


Source: own elaboration on World Bank,
World Development Indicators, accessed in May 2014.

Government perspective on energy

FIGURE 24

Trend in CO_2 emissions growth by country (1980-2010)



Source: own elaboration on World Bank, World Development Indicators, accessed in May 2014.

2. Expected change in the Mediterranean energy system

a) The industry perspective

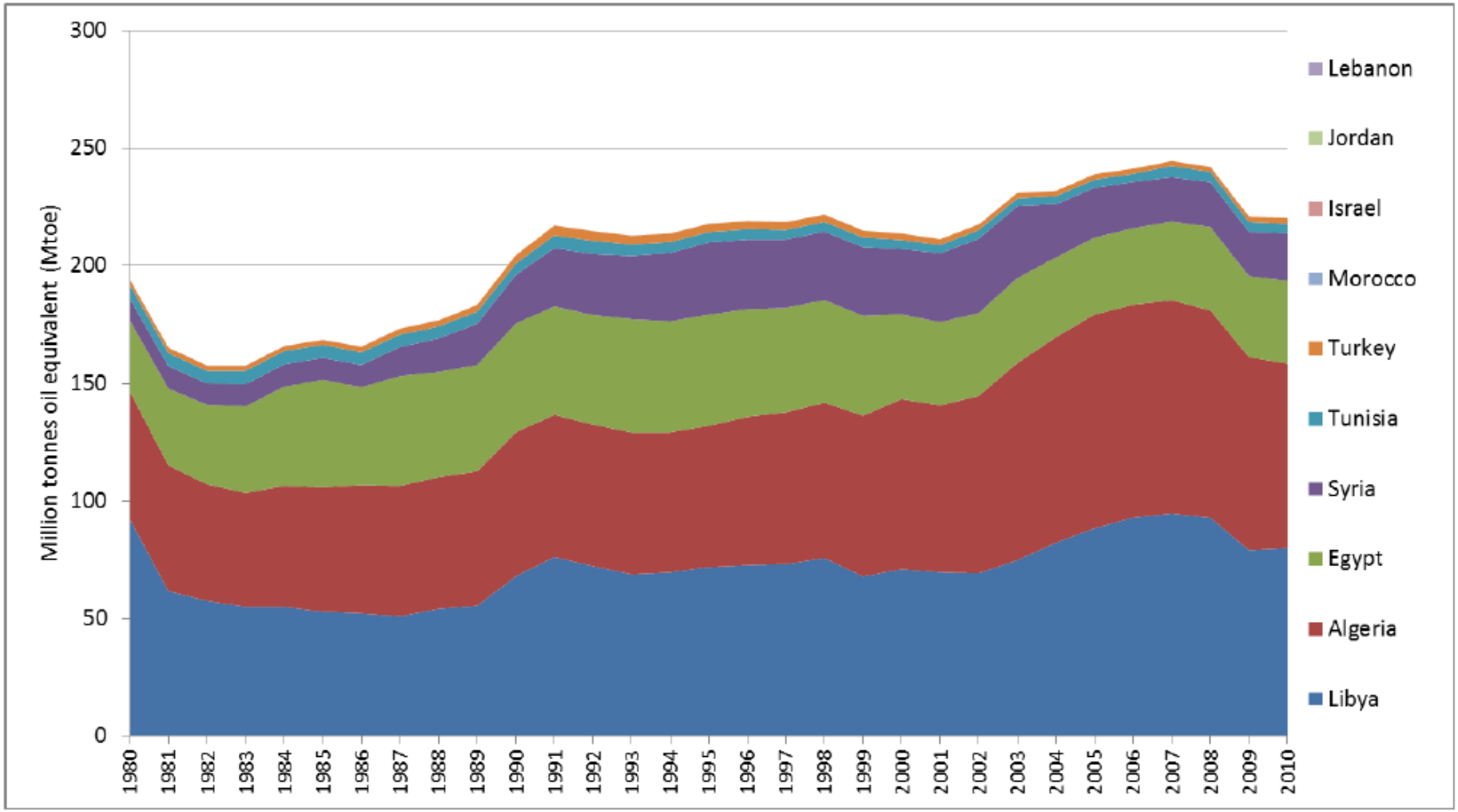
b) A government perspective

c) Recent trends in fossil fuels

Actual change in fossil fuel production

FIGURE 8

Total primary oil production in SEMCs (1980-2010)

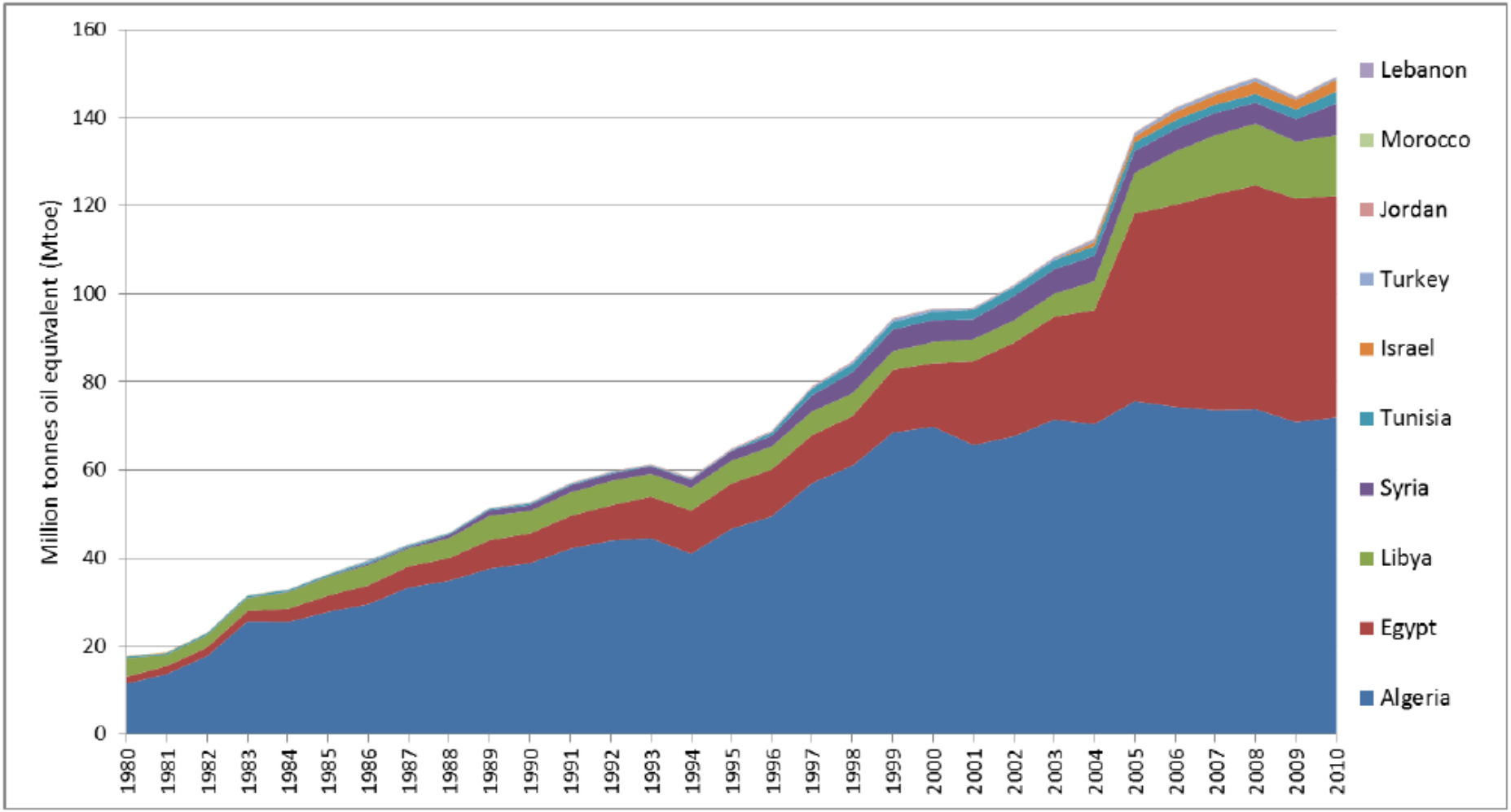


Source: own elaboration on International Energy Agency, Extended World Energy Balances Database, accessed in May 2014.

Actual change in fossil fuel production

FIGURE 9

Total primary natural gas production in SEMCs (1980-2010)



Source: own elaboration on International Energy Agency, Extended World Energy Balances Database, accessed in May 2014.

The battle for oil and gas

Search The Guardian International edition

Libya

Italian summit on Libya in disarray as Trump and Putin stay away

Diplomats try to salvage conference aimed at cementing Italy's role as power broker

Lorenzo Tondo *in Palermo and* **Patrick Wintour**

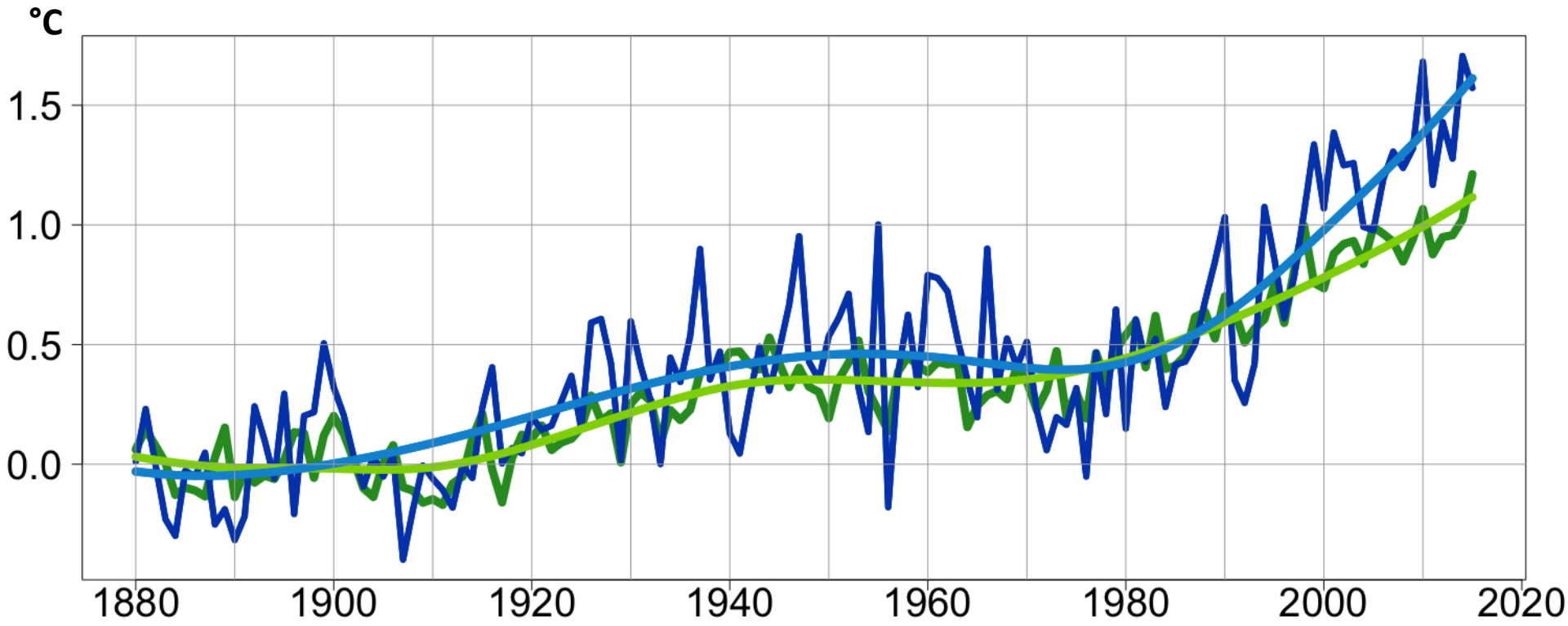
Mon 12 Nov 2018 20.38 GMT

Italy's prime minister, Giuseppe Conte, had planned to use the conference in Palermo on Monday to confirm his country as the leading European power broker in Libya and timed it to follow the weekend armistice ceremonies in Paris, in the hope that Donald Trump and Vladimir Putin would travel on to the Sicilian city.

Energy, climate and environmental change in the Mediterranean Basin

1. Connecting climate, energy and the environment
2. Expected change in the Mediterranean energy system
3. Recent change in the Mediterranean environment and future risks for people
4. A transition towards sustainability?

The Mediterranean basin warms faster than the world overall

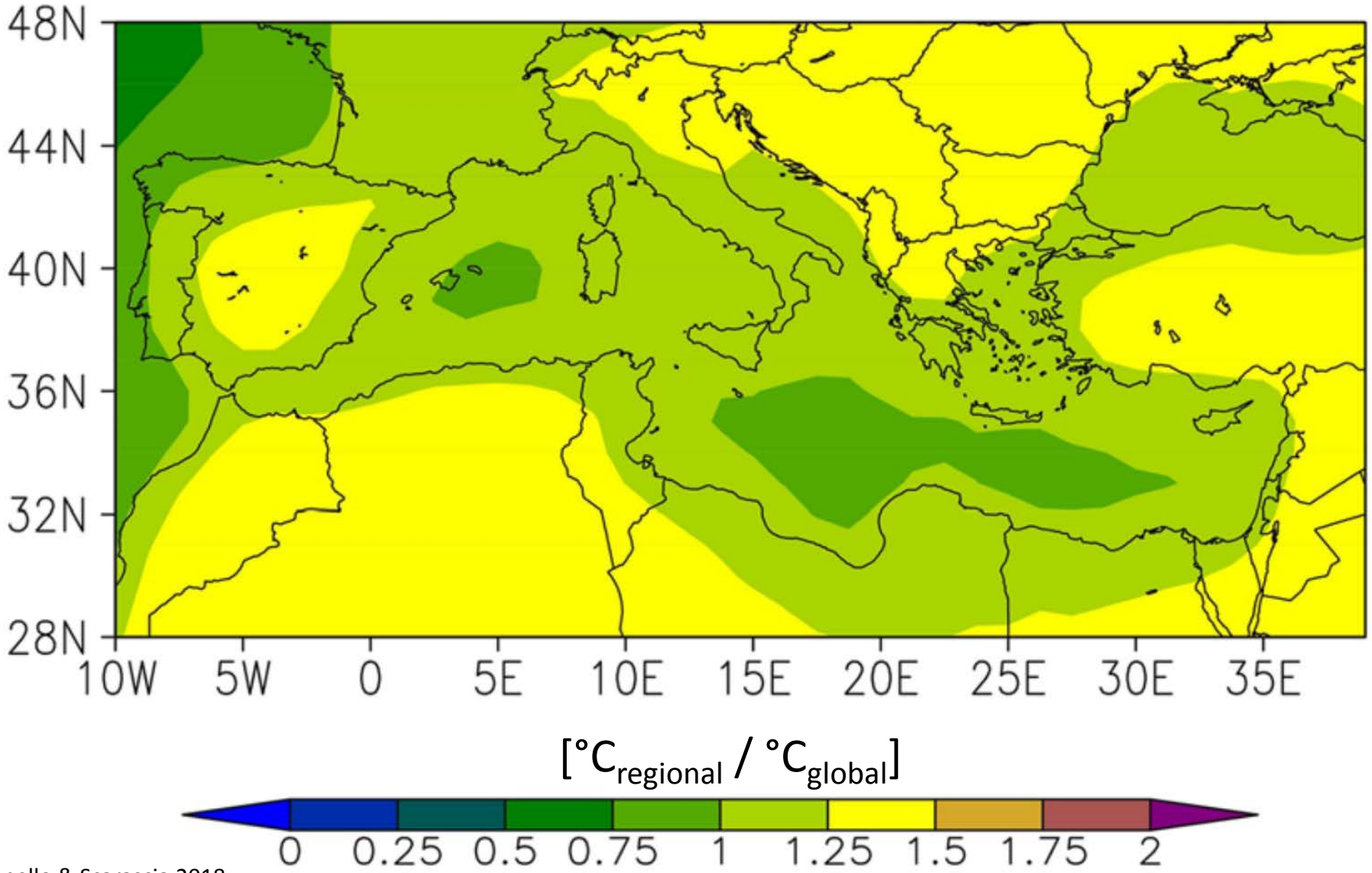


global mean temperature

regional mean temperature (Mediterranean)

Cramer et al. 2018 Nature Climate Change

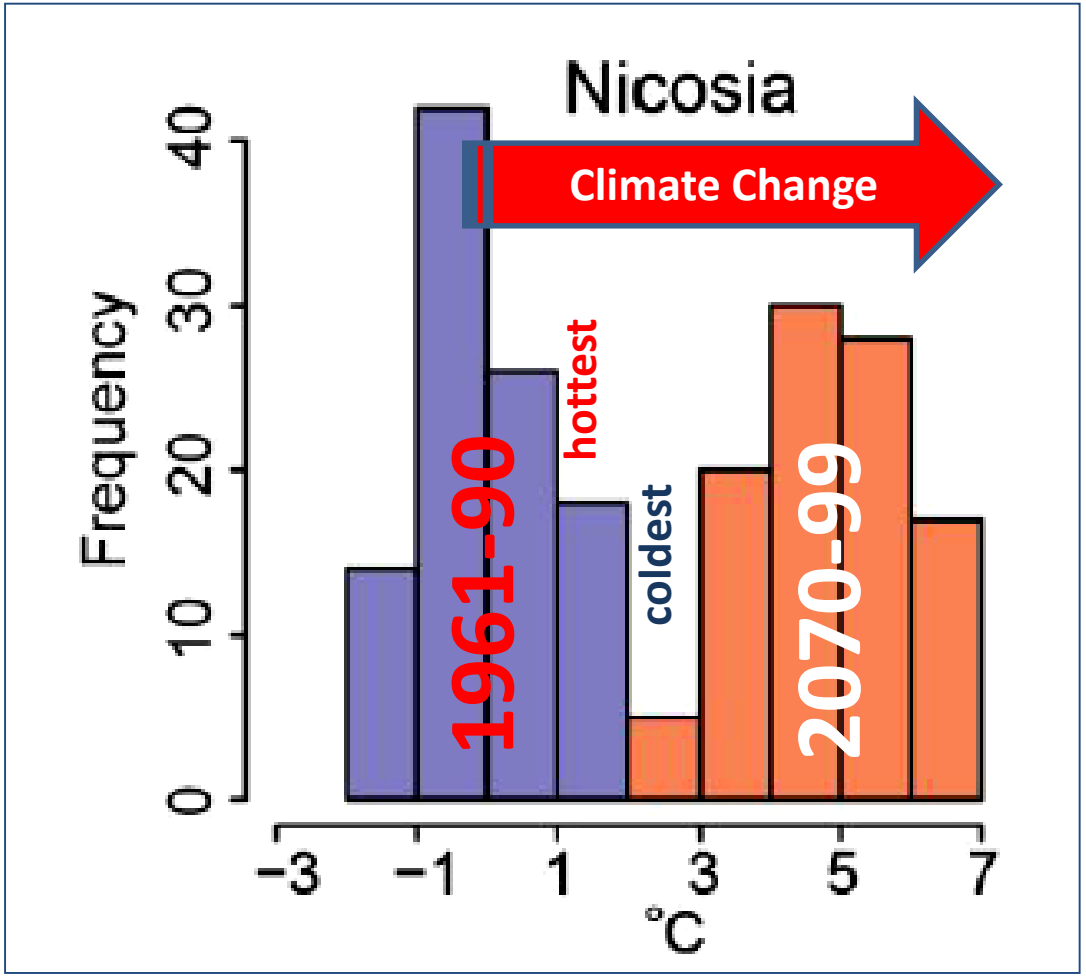
The Mediterranean basin warms faster than the world overall



Lionello & Scarascia 2018
Regional Environmental Change

Mediterranean warming makes people suffer

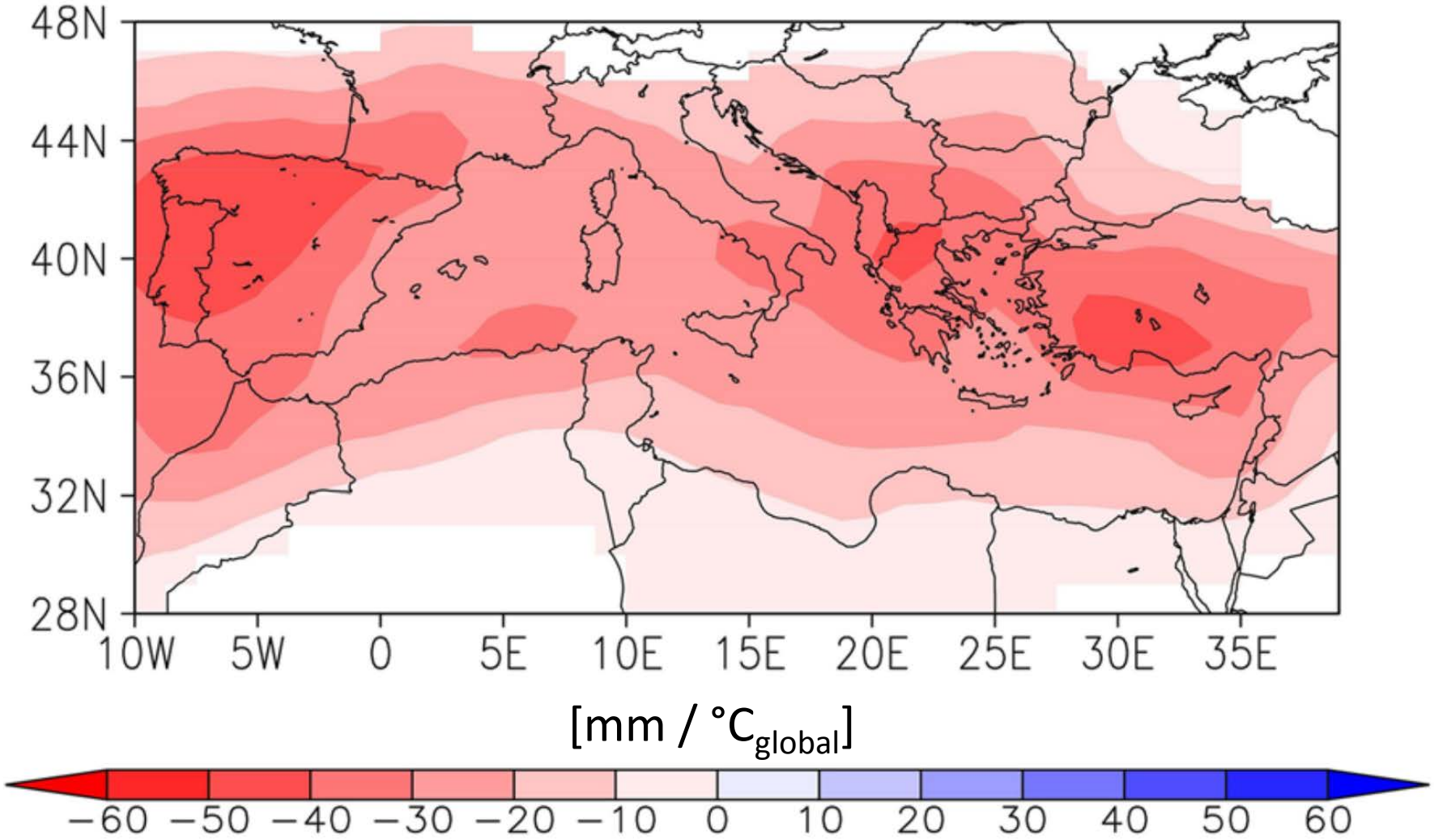
Climate models project particularly severe warming in large cities in the Eastern Mediterranean



Recent and end-of-century temperature anomalies. Model calculated frequency histograms (%) of **summer (JJA) daytime maximum temperature** (TX) anomalies relative to the period 1961-1990, based on the A1B scenario. Blue is for the period 1961-1990 (hence cantered around 0°C) and red for the period 2070-2099

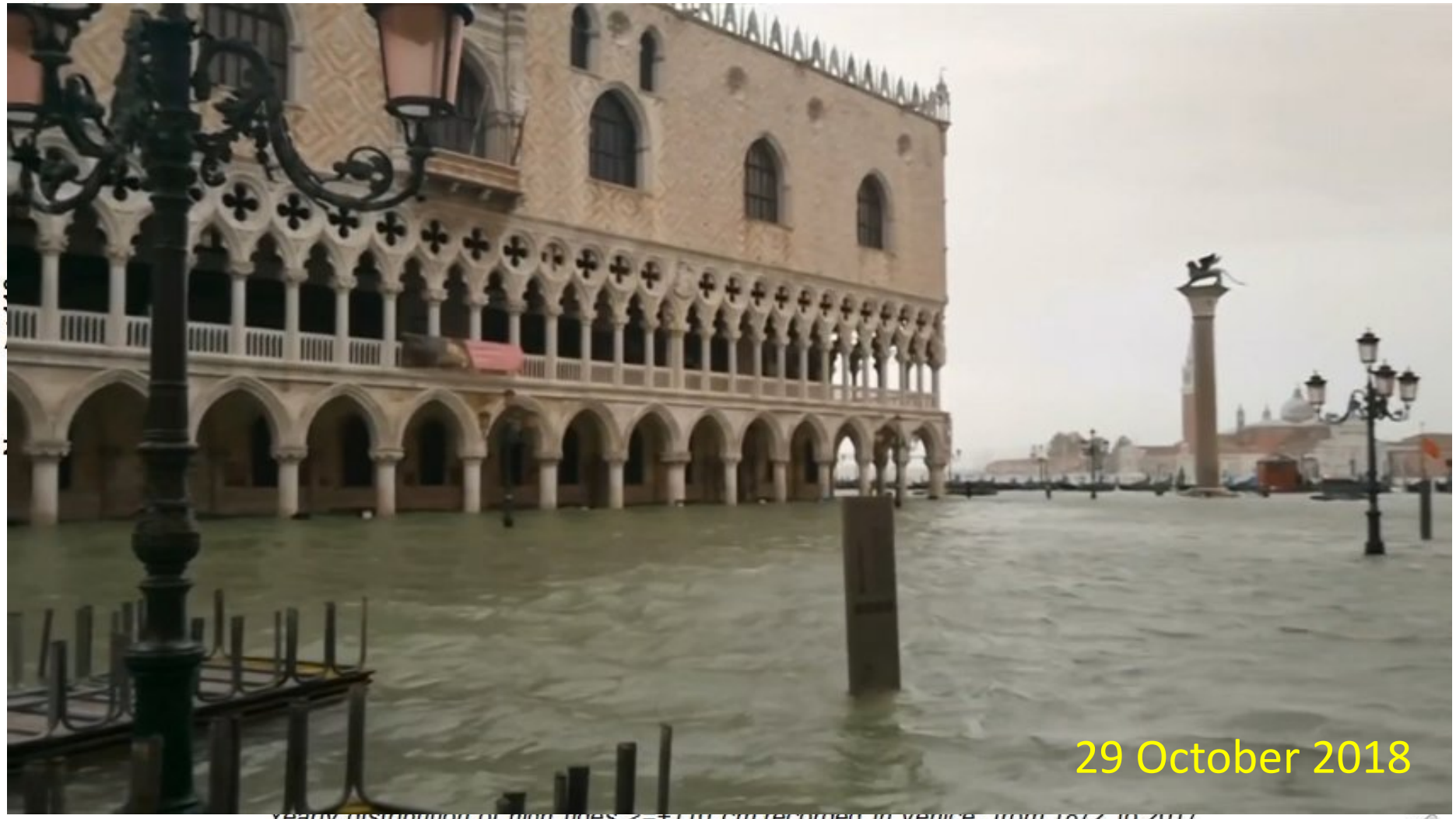
Lelieveld et al. 2014, Regional Environmental Change

For every degree of warming, Mediterranean rainfall declines



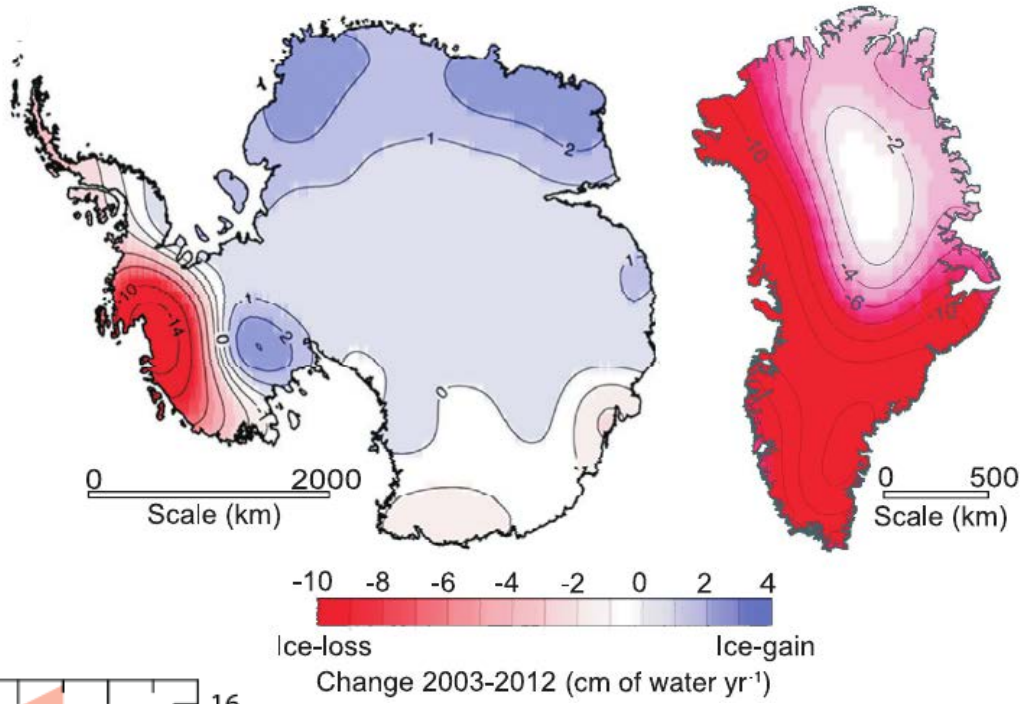
Lionello & Scarascia 2018,
Regional Environmental Change

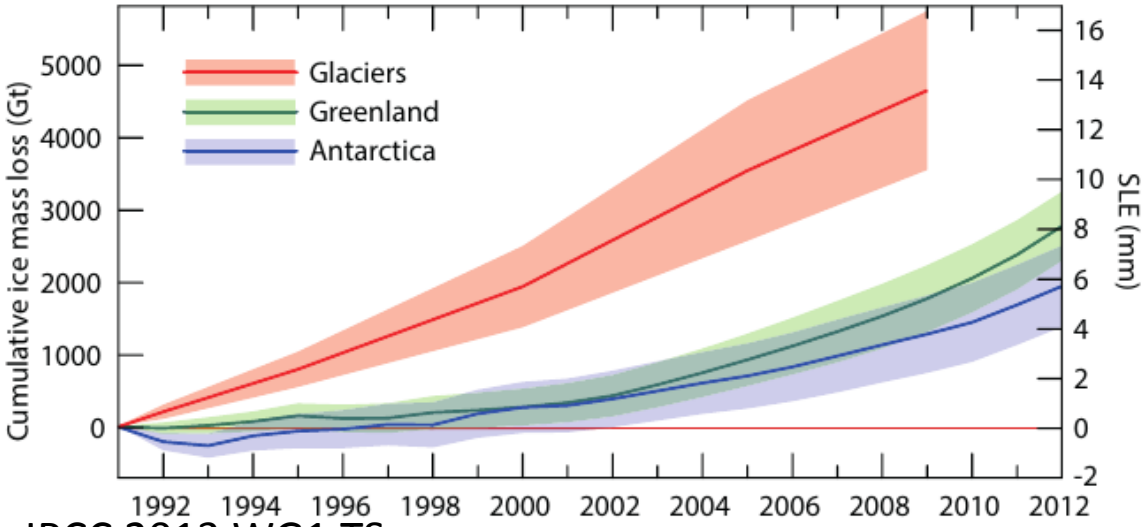
Sea-level rise accelerates, in the Mediterranean and worldwide



Yearly distribution of high tides >=+110 cm recorded in Venice, from 1872 to 2017

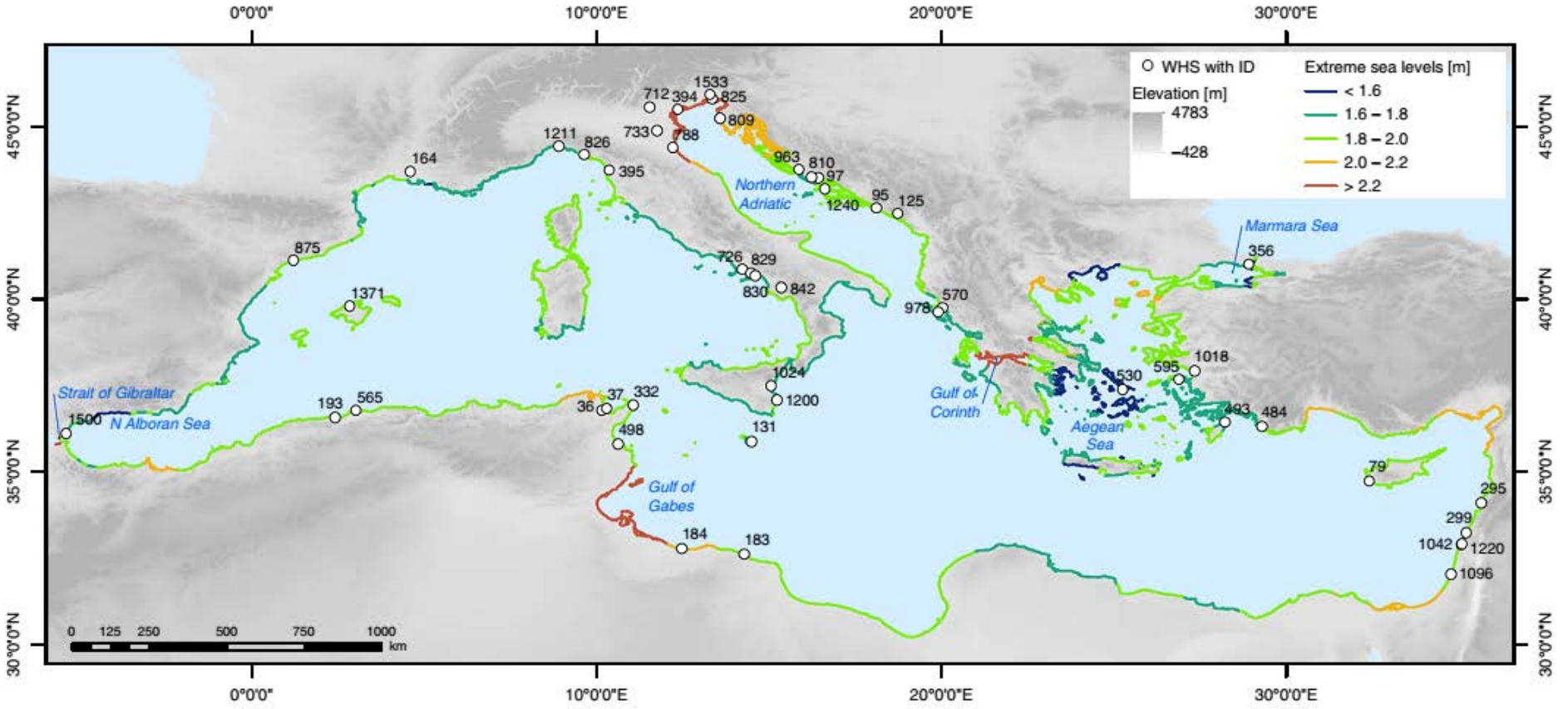
Sea-level rise accelerates, in the Mediterranean and worldwide





IPCC 2013 WG1 TS

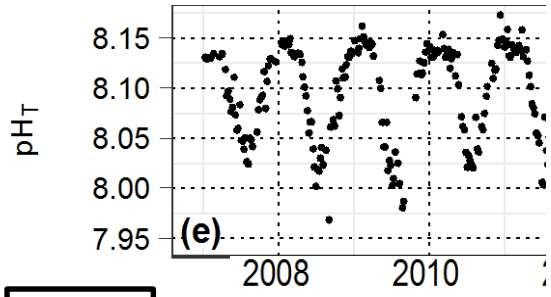
Coasts and world-heritage sites are at risk of flooding

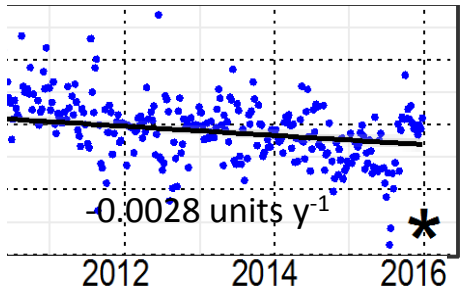


Reimann et al. 2018

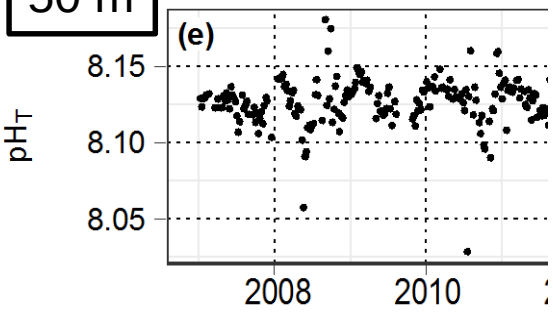
Sea-water becomes more acidic, in the Mediterranean and worldwide

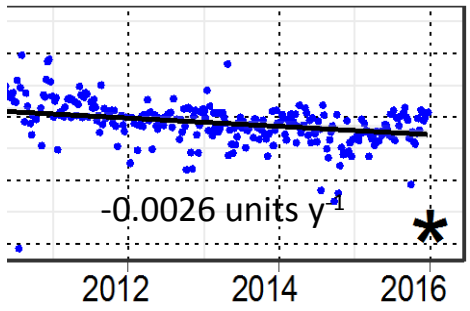
1 m





50 m





REVIEW ARTICLE
https://doi.org/10.1038/s41558-018-0299-2

nature climate change

Climate change and interconnected risks to sustainable development in the Mediterranean

Wolfgang Cramer[1*], Joël Guiot[2], Marianela Fader[3], Joaquim Garrabou[4,5], Jean-Pierre Gattuso[6,7], Ana Iglesias[8], Manfred A. Lange[9], Piero Lionello[10,11], Maria Carmen Llasat[12], Shlomit Paz[13], Josep Peñuelas[14,15], Maria Snoussi[16], Andrea Toreti[17], Michael N. Tsimplis[18] and Elena Xoplaki[19]

Recent accelerated climate change has exacerbated existing environmental problems in the Mediterranean Basin that are caused by the combination of changes in land use, increasing pollution and declining biodiversity. For five broad and interconnected impact domains (water, ecosystems, food, health and security), current change and future scenarios consistently point to significant and increasing risks during the coming decades. Policies for the sustainable development of Mediterranean countries need to mitigate these risks and consider adaptation options, but currently lack adequate information — particularly for the most vulnerable southern Mediterranean societies, where fewer systematic observations schemes and impact models are based. A dedicated effort to synthesize existing scientific knowledge across disciplines is underway and aims to provide a better understanding of the combined risks posed.

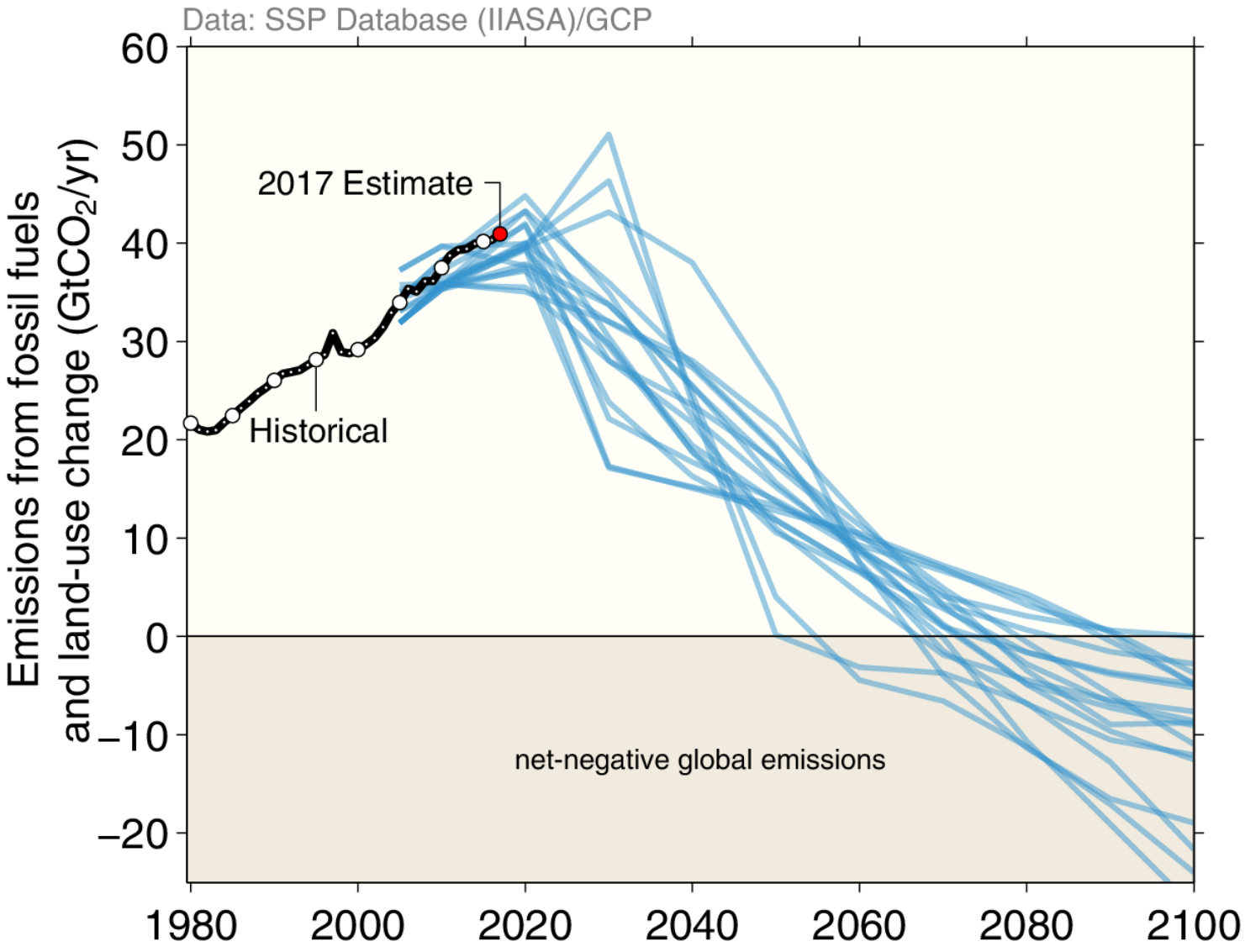
In the Mediterranean Basin, human society and the natural environment have co-evolved over several millennia, experiencing significant climatic variations and laying the ground for diverse and culturally rich communities. The region currently lies in a transition zone between mid-latitude and sub-tropical atmospheric eastern Mediterranean, heatwave return periods may change from once every two years to multiple occurrences per year[13]. A global atmospheric temperature increase of 2 °C will probably be accompanied by a reduction in summer precipitation of around 10–15% in Southern France, Northwestern Spain and the Balkans, and up

published 22.10.2018

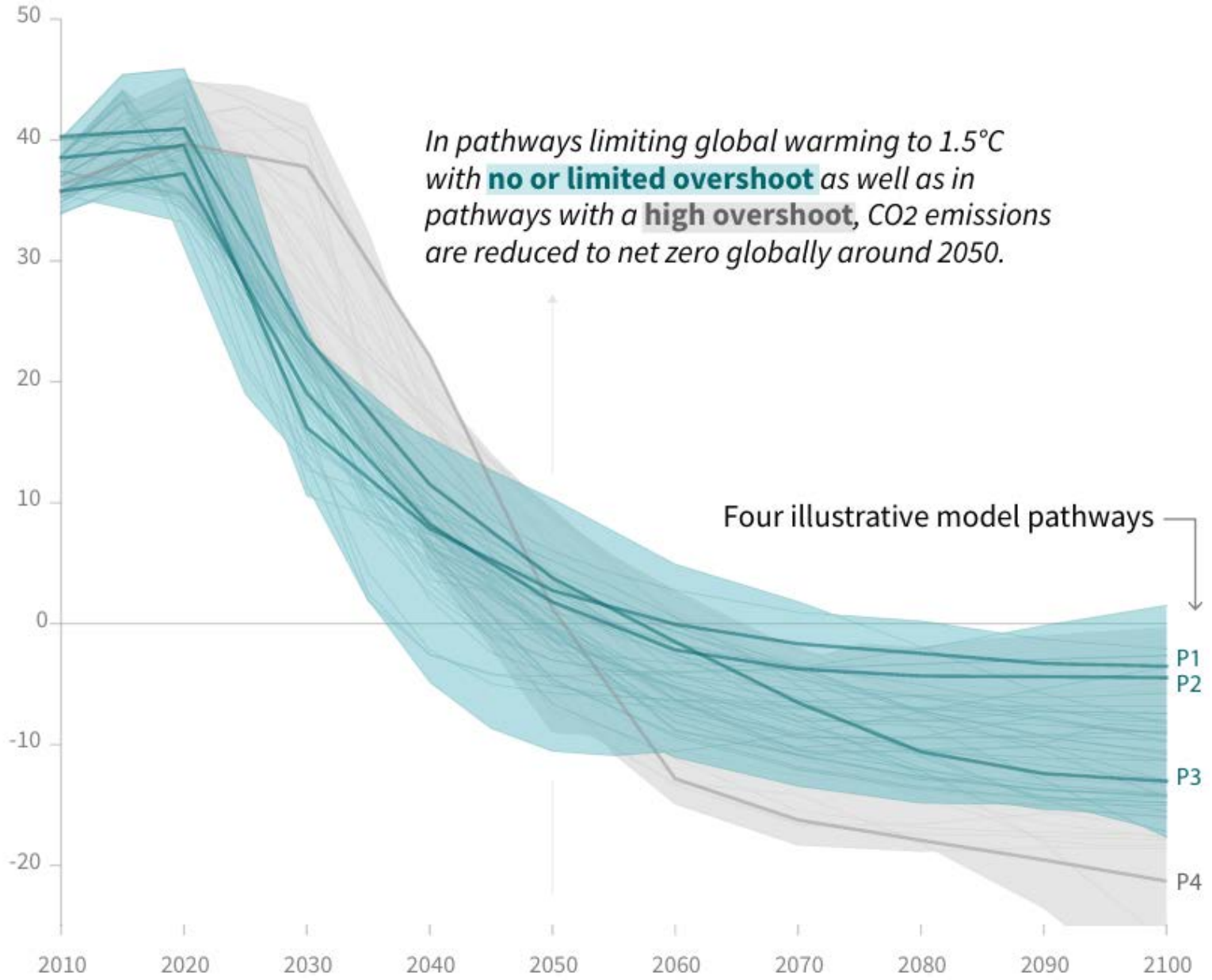
Energy, climate and environmental change in the Mediterranean Basin

1. Connecting climate, energy and the environment
2. Expected change in the Mediterranean energy system
3. Recent change in the Mediterranean environment and future risks for people
4. A transition towards sustainability?

A transition towards sustainability?

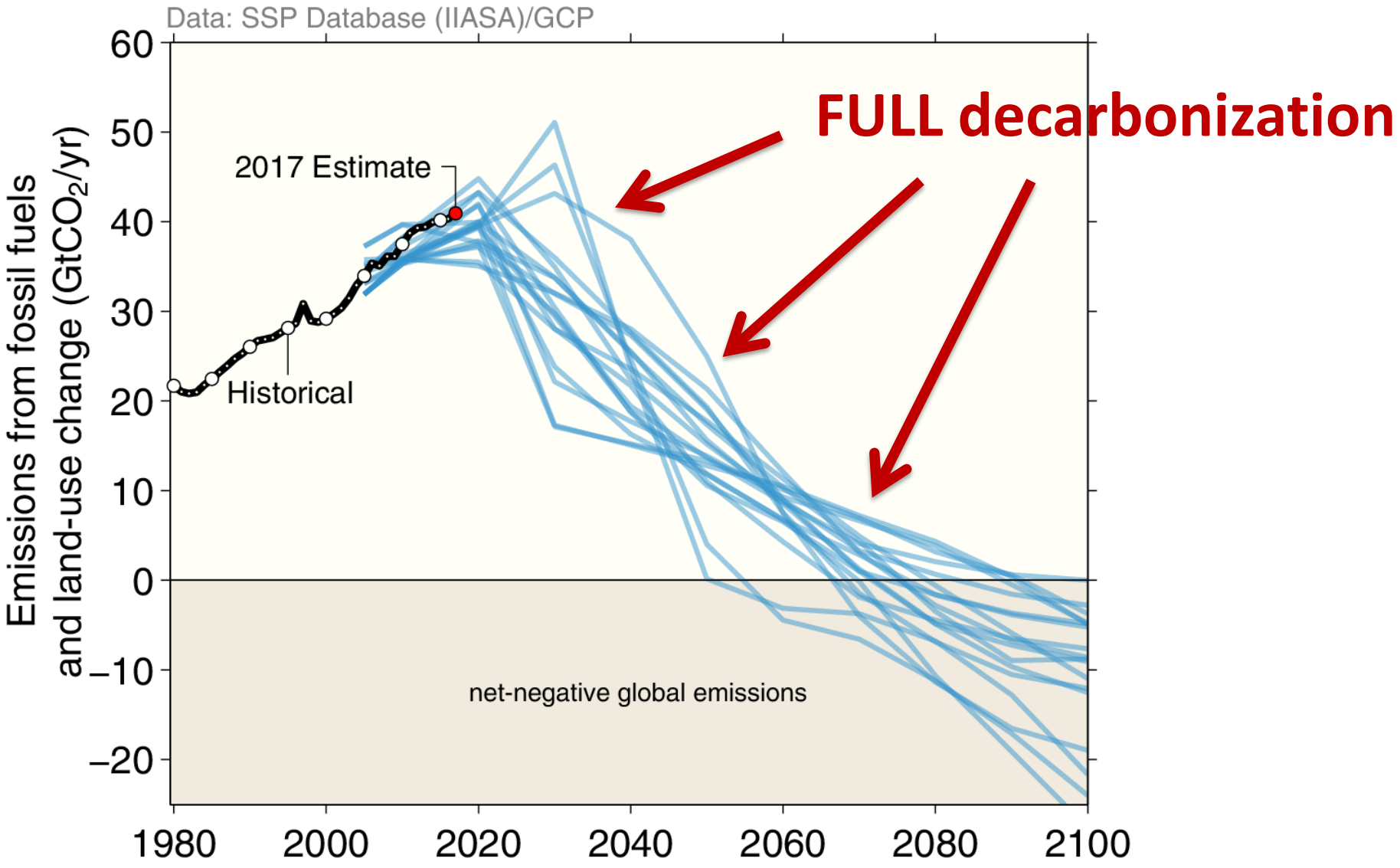


A transition towards sustainability?



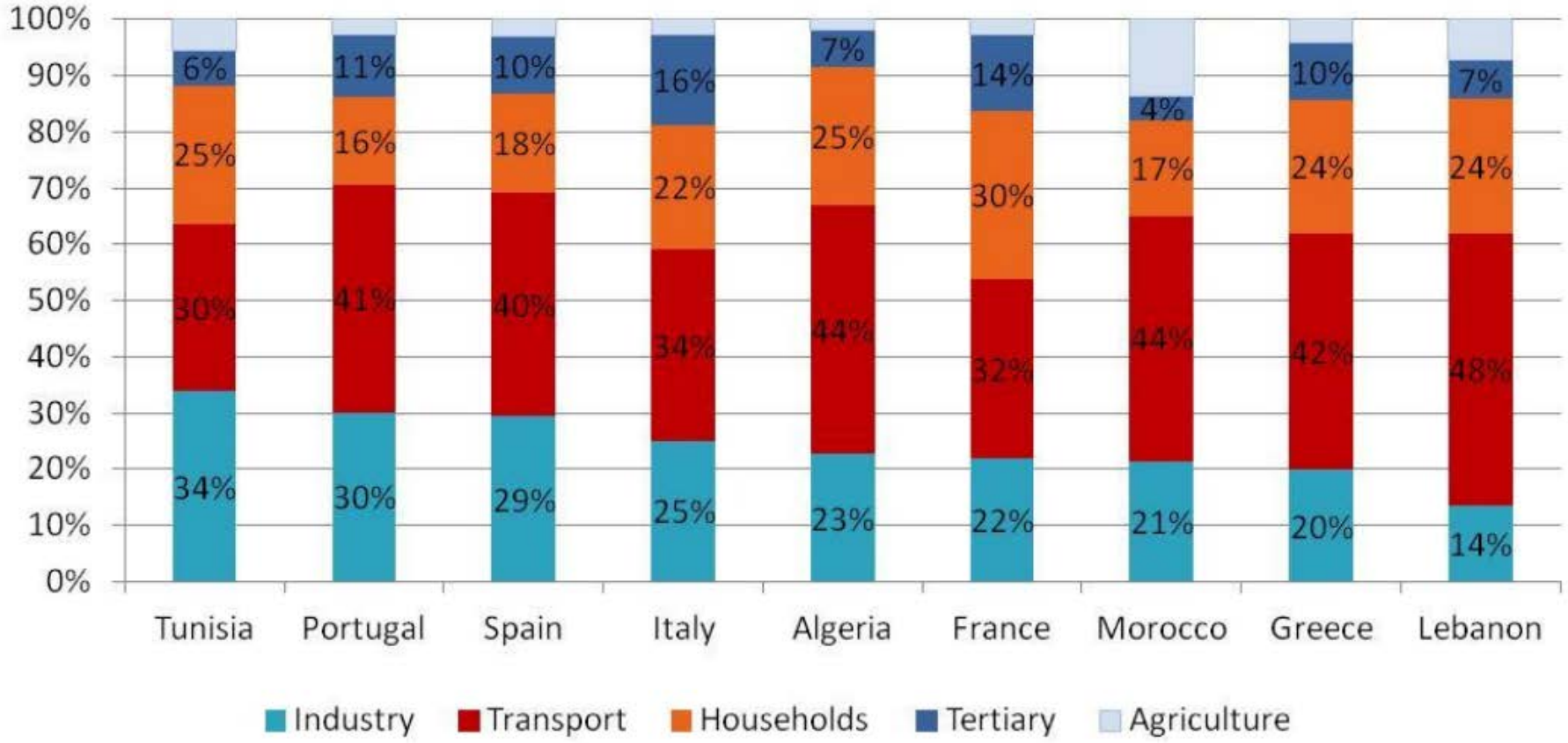
IPCC 2018

A transition towards sustainability?



How to decarbonize the Mediterranean?

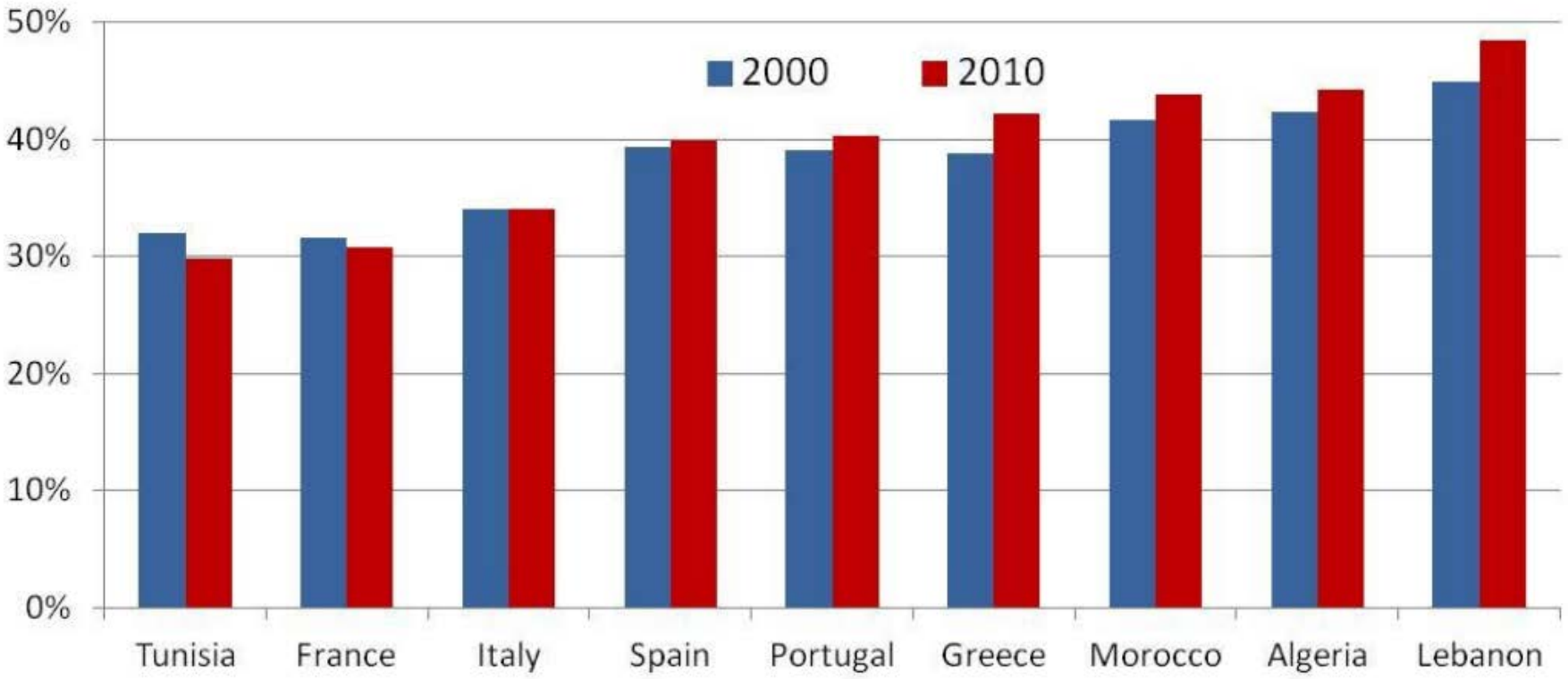
Figure 7 : Breakdown of final energy consumption by sector (2010)



MEDENER: Mediterranean Association of national agencies for energy conservation

How to decarbonize the Mediterranean?

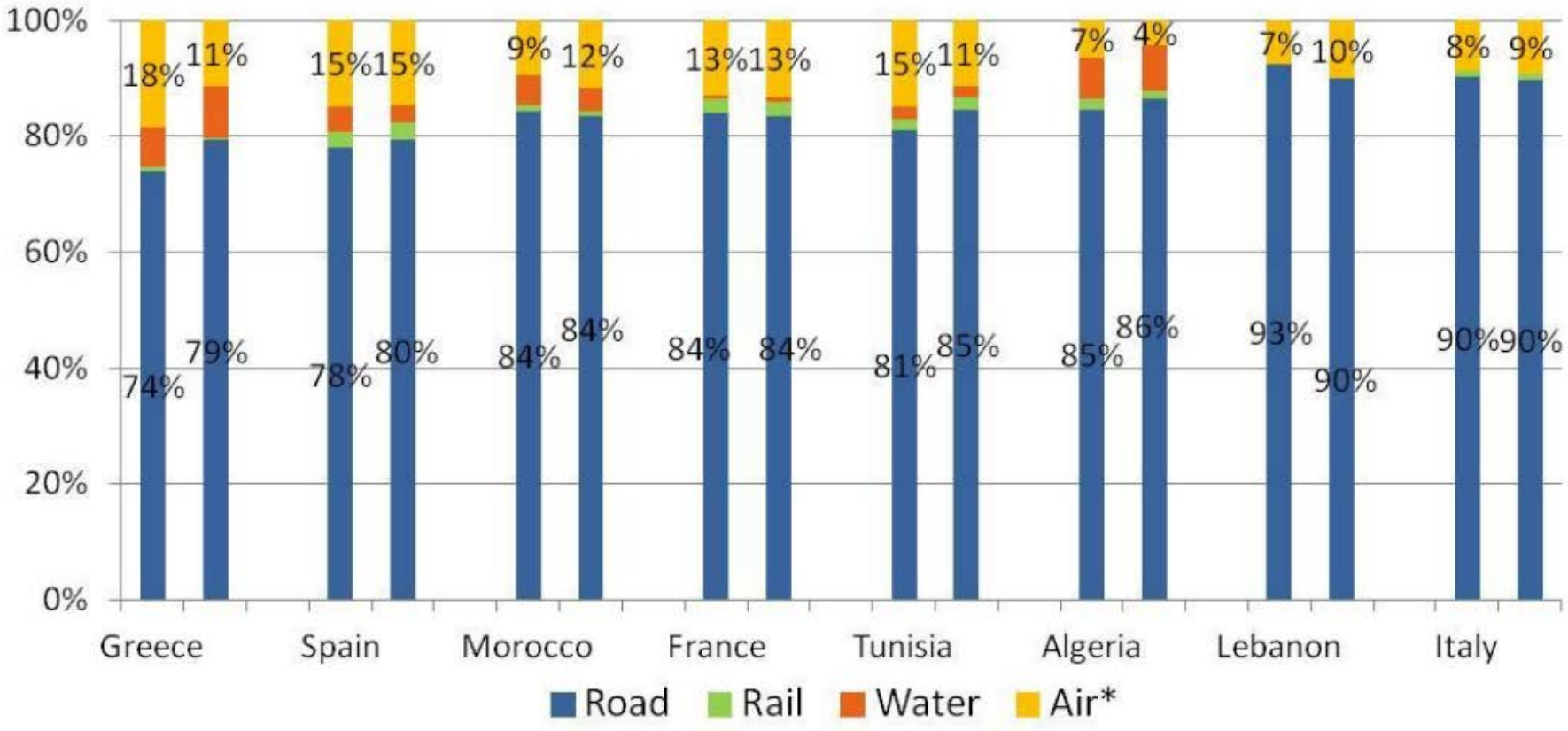
Figure 51 : Share of transport in final energy consumption



MEDENER: Mediterranean Association of national agencies for energy conservation

How to decarbonize the Mediterranean?

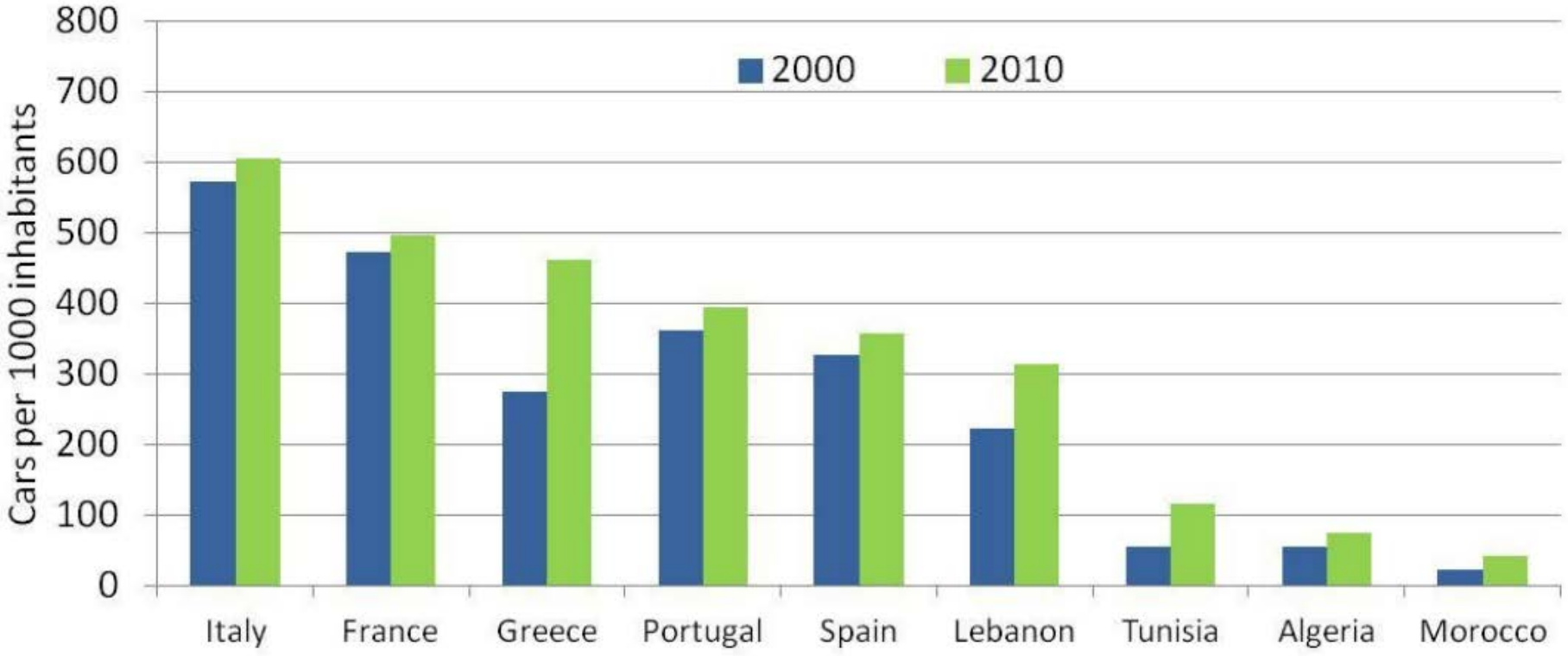
Figure 53 : Transport energy consumption by mode (2000, 2010)



MEDENER: Mediterranean Association of national agencies for energy conservation

How to decarbonize the Mediterranean?

Figure 55 : Number of cars per inhabitant



MEDENER: Mediterranean Association of national agencies for energy conservation

Search International edition
The Guardian

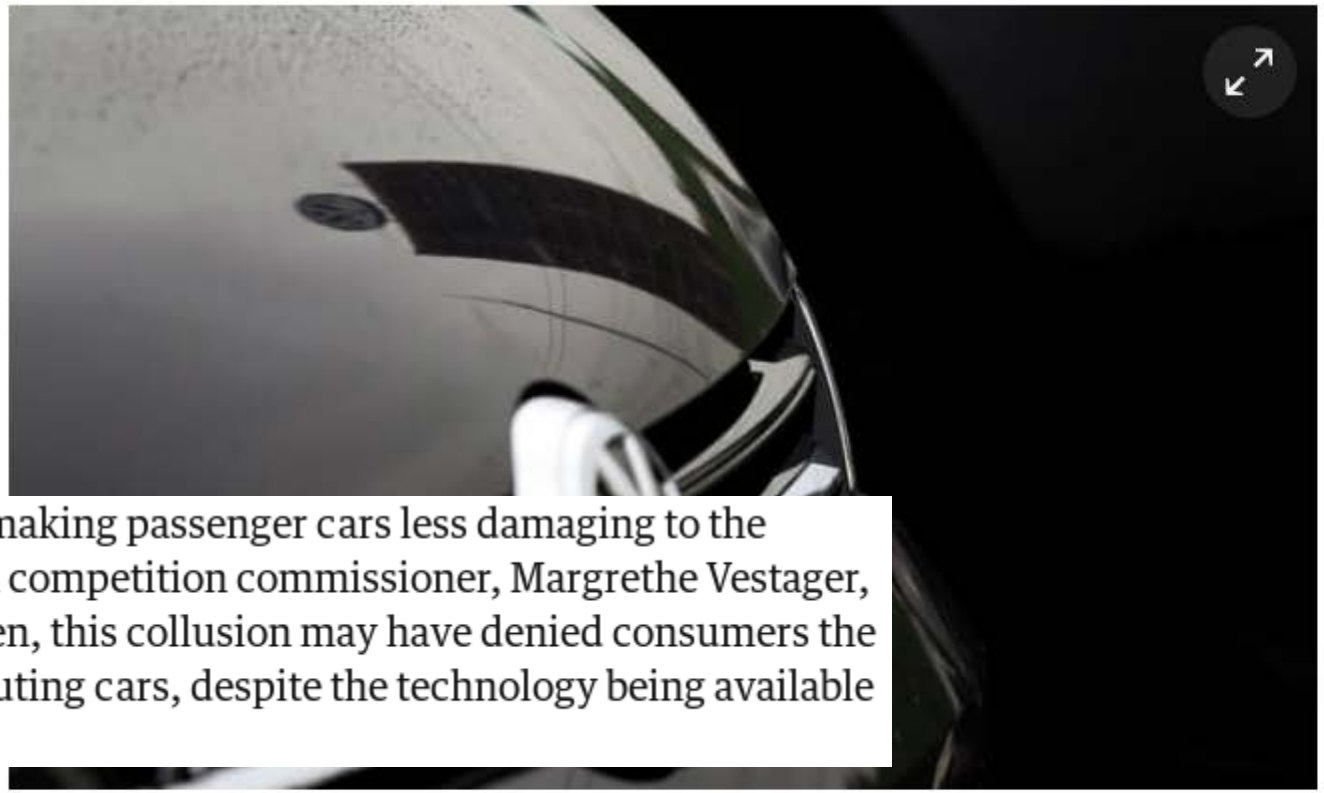
Automotive industry

German carmakers face EU anti-trust inquiry over emissions

BMW, Daimler, VW, Audi and Porsche suspected of colluding to limit clean technology

Daniel Boffey *in Brussels*

Tue 18 Sep 2018 14.22 BST

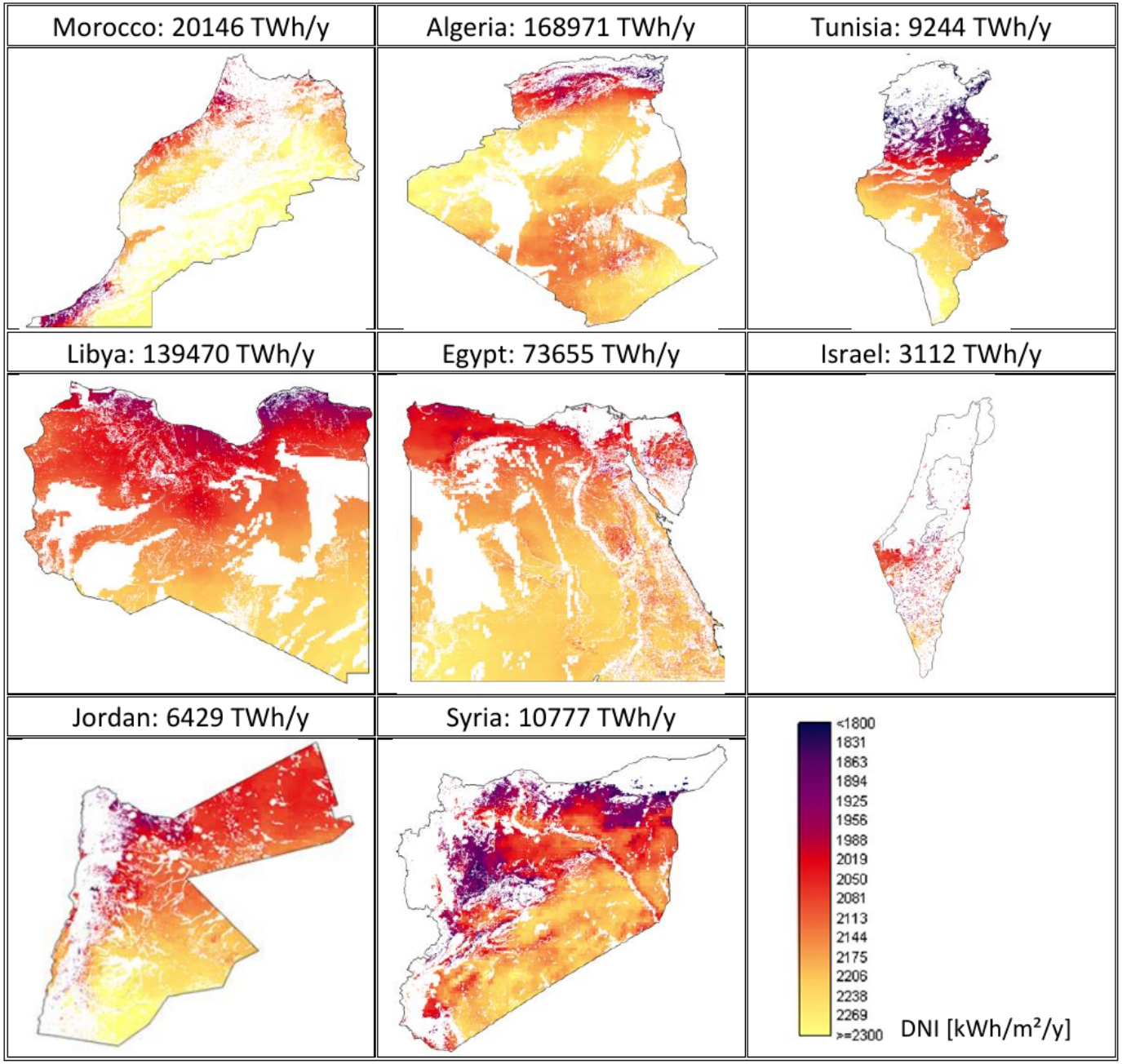


"These technologies aim at making passenger cars less damaging to the environment," the European competition commissioner, Margrethe Vestager, said in a statement. "If proven, this collusion may have denied consumers the opportunity to buy less-polluting cars, despite the technology being available to the manufacturers."

How to decarbonize the Mediter-ranean?

TABLE 2

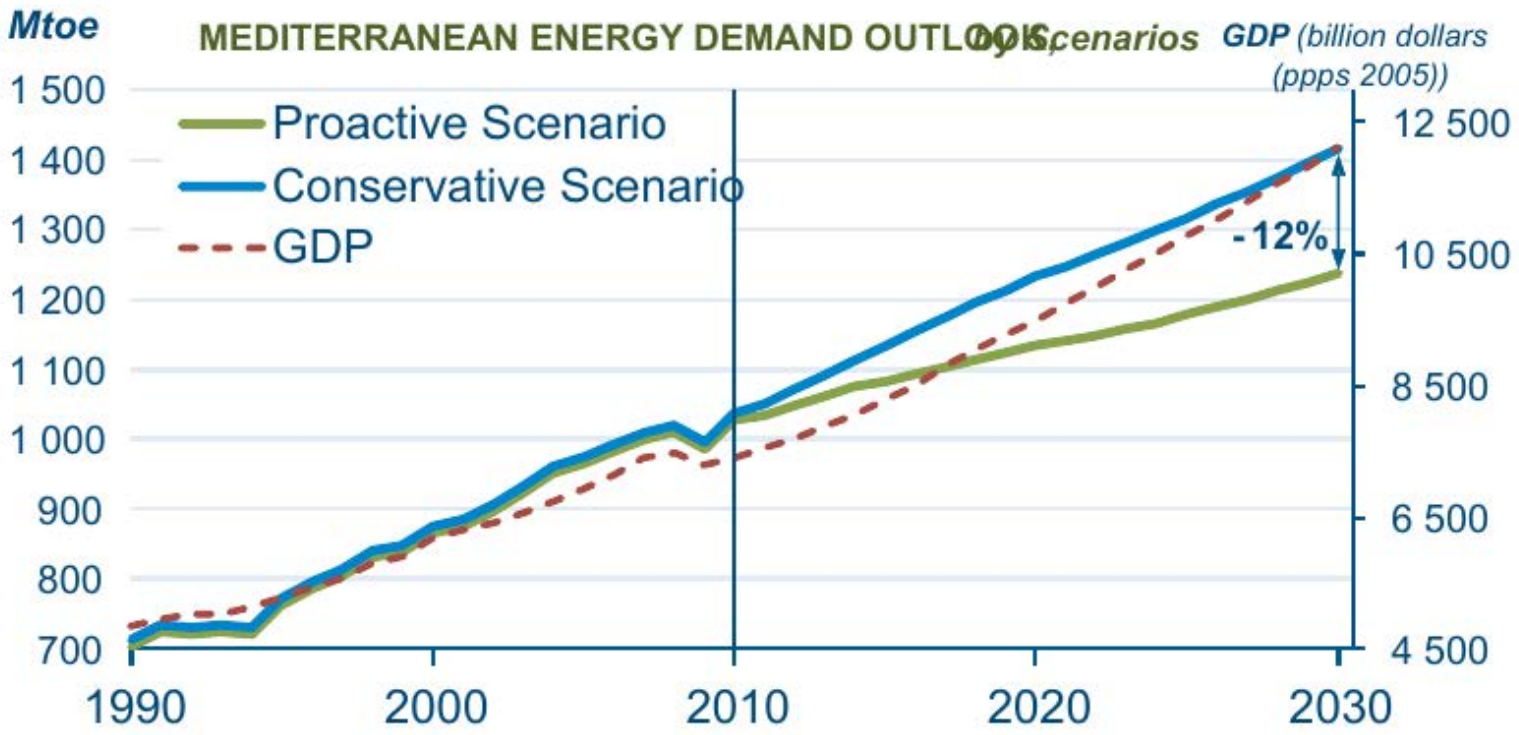
Economic potential of CSP in selected SEMCs (with related DNI maps)



Source: own elaboration on DLR (2005).

Industry perspective on energy

ENERGY DEMAND OUTLOOK



40% increase in overall demand by 2030.

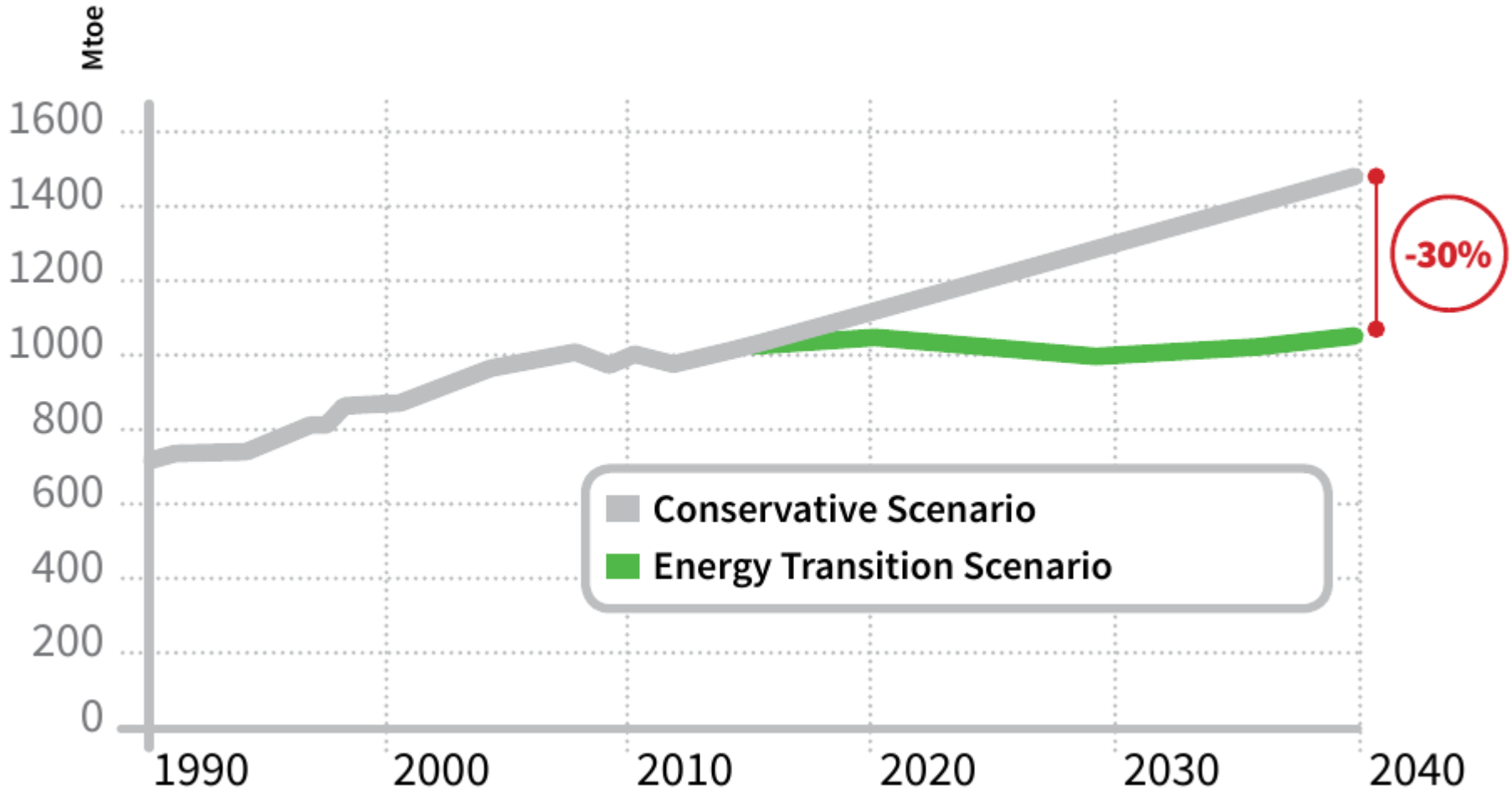
Just 20% increase if robust policies and measures are put in place.

Mtoe: megaton oil equivalent

Observatoire Méditerraneen de l'Energie 2014 (industry)

Government perspective on energy

FIGURE-2 **PRIMARY ENERGY DEMAND BY SCENARIO**



Source : MEDENER/OME, 2015.

MEDENER: Mediterranean Association of national agencies for energy conservation

Energy, climate and environmental change in the Mediterranean Basin

Conclusions

- Energy use is at the core of recent climate change
- Climate change is more intense in the Mediterranean than globally, posing severe risks for people in the future
- Current views on possible energy transition are inadequate and incoherent with the Paris Agreement
- Without full decarbonization by 2050, there will be no sustainable development in the Mediterranean
- Decarbonization requires significant reductions in energy use


Thank you very much for your attention!

The Mediterranean Experts on Climate and Environmental Change

- A network of 400 experts preparing a comprehensive risk analysis
- **medecc.org**

- follow **@Med_ECC @wolfgangcramer**