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WORLD ENERGY COUNCIL | FUTURE ENERGY LEADERS ARMENIA

9th European Energy Forum

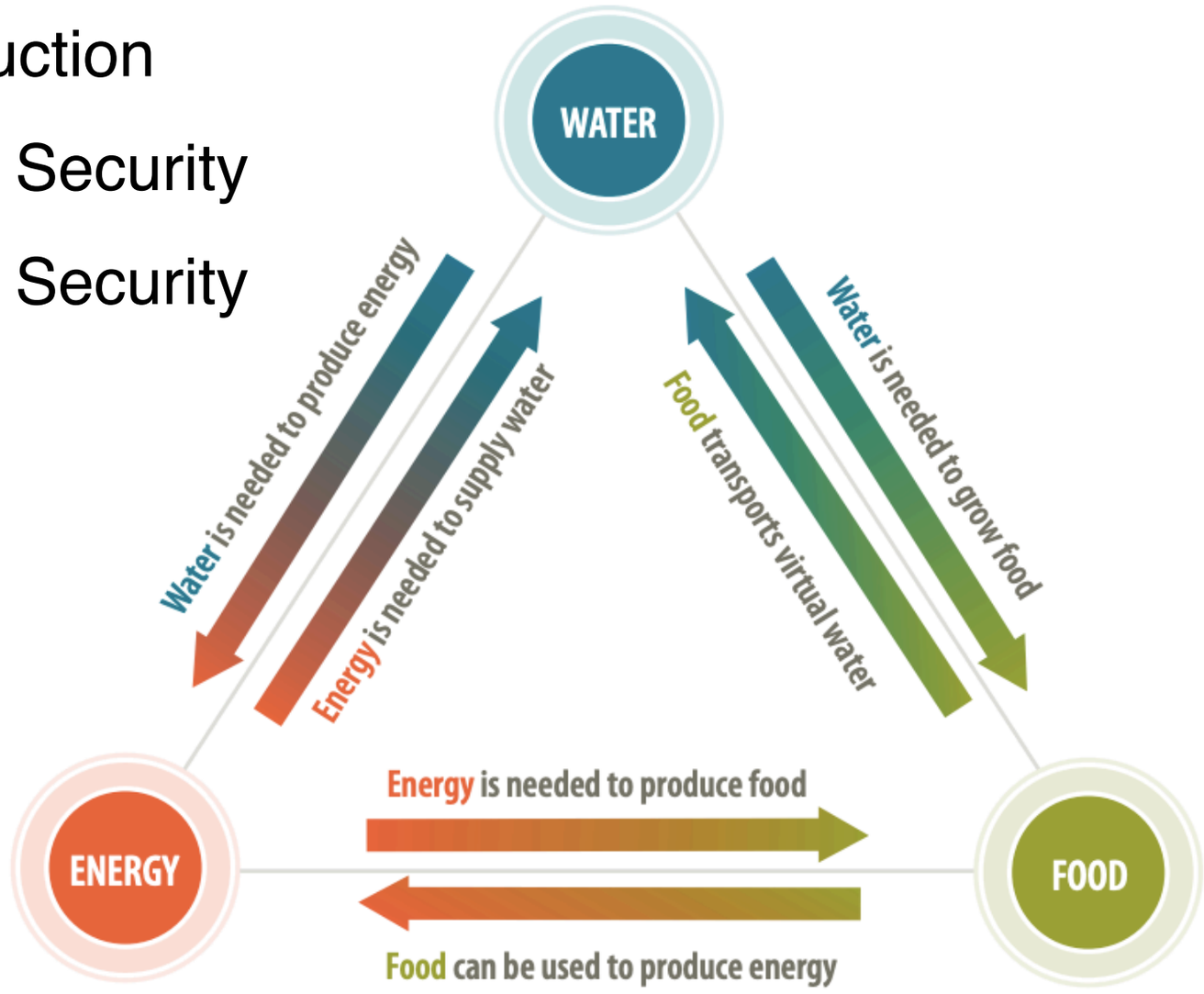
Hasmik Barseghyan

President, European Youth Parliament for Water - EYPW

WATER SCARCITY AND ENERGY SECURITY

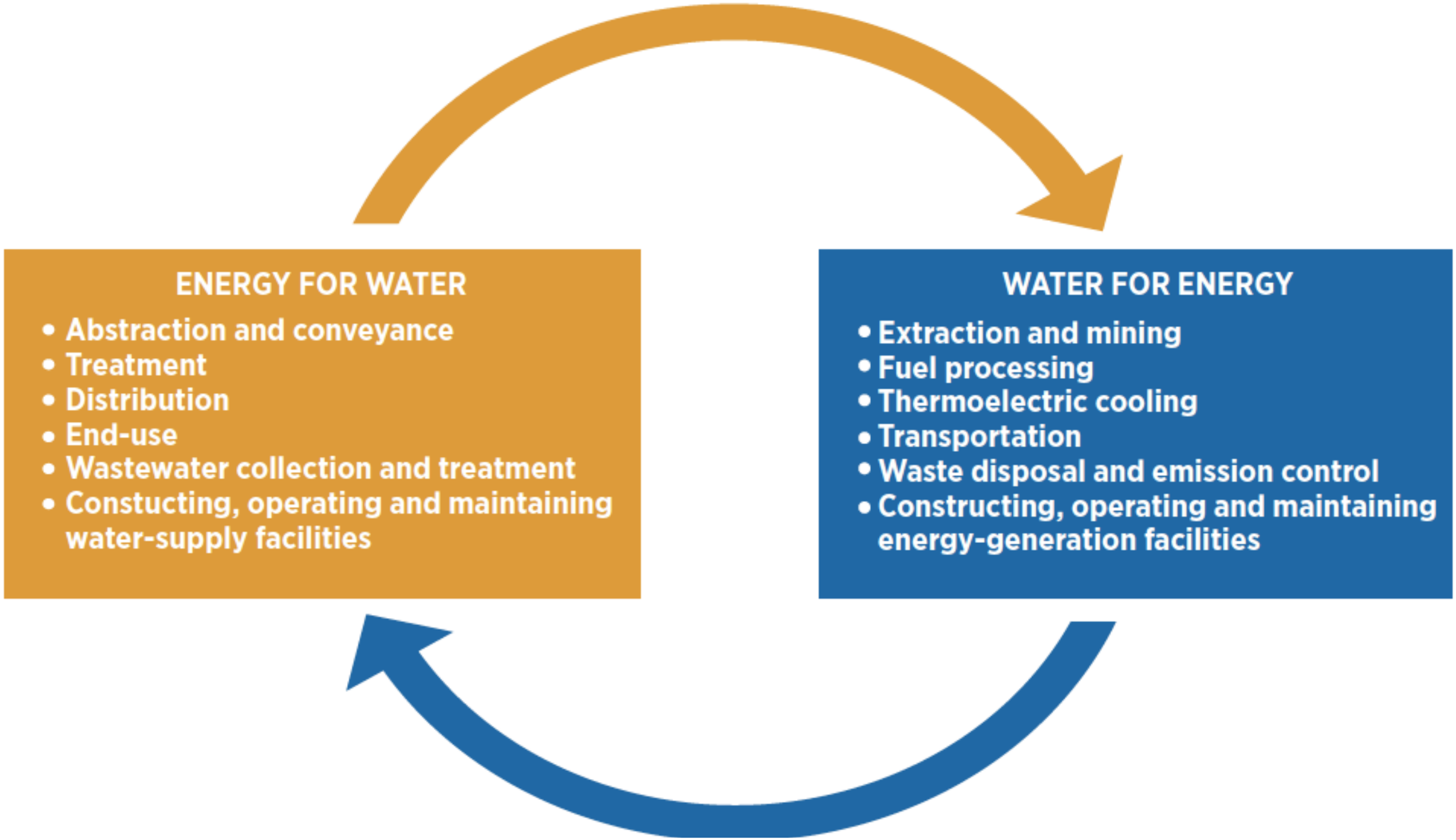
CONTENT

- Water-Energy Nexus
- Water Stress in Europe
- Water Use for Electricity Production
- Water-related Risks to Energy Security
- Energy-related Risks to Water Security



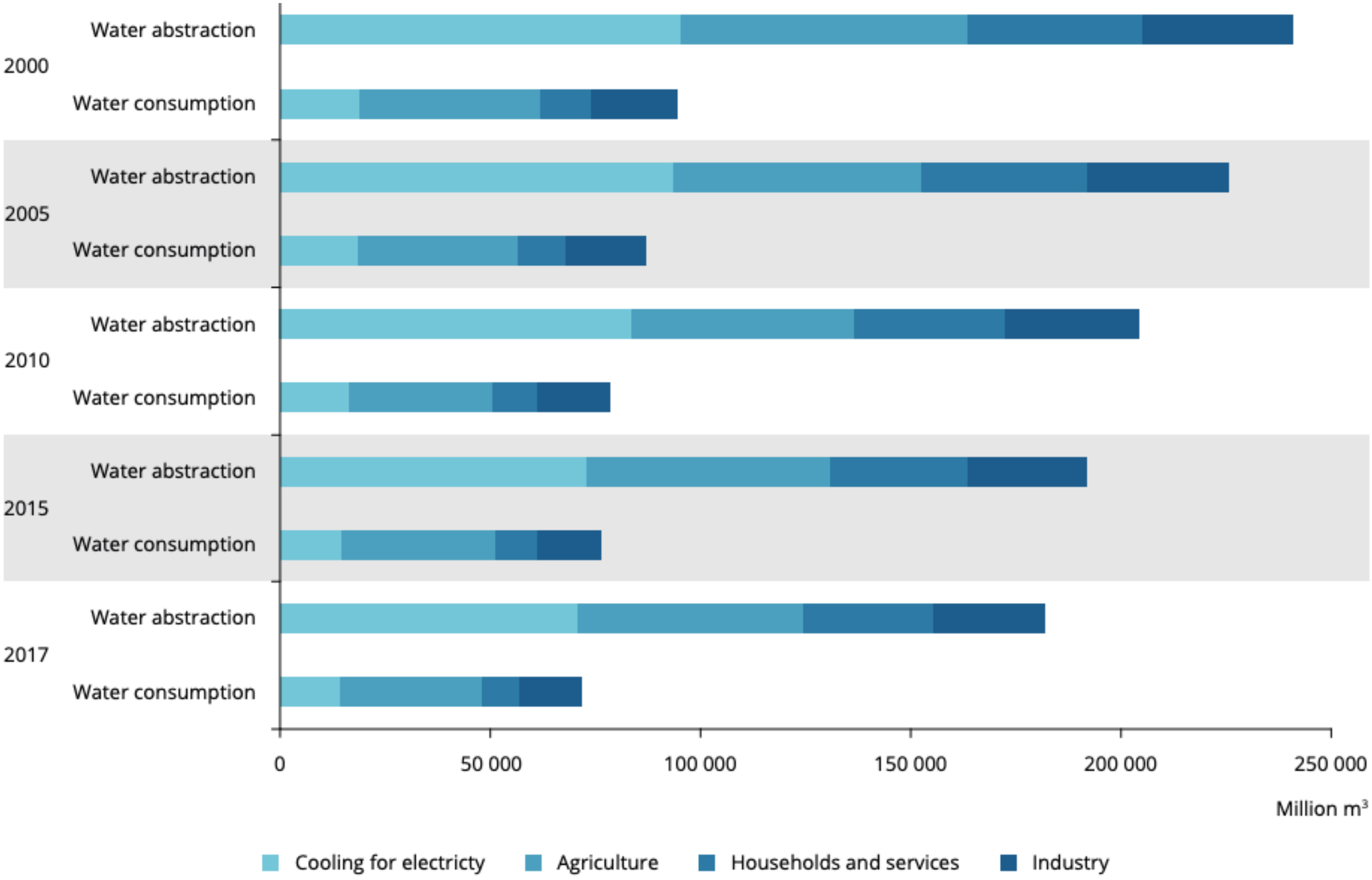
Source : : UNU-FLORES UNU-FLORES. The Nexus Approach (2018). Available at: https://flores.unu.edu/en/research/nexus

WATER - ENERGY NEXUS



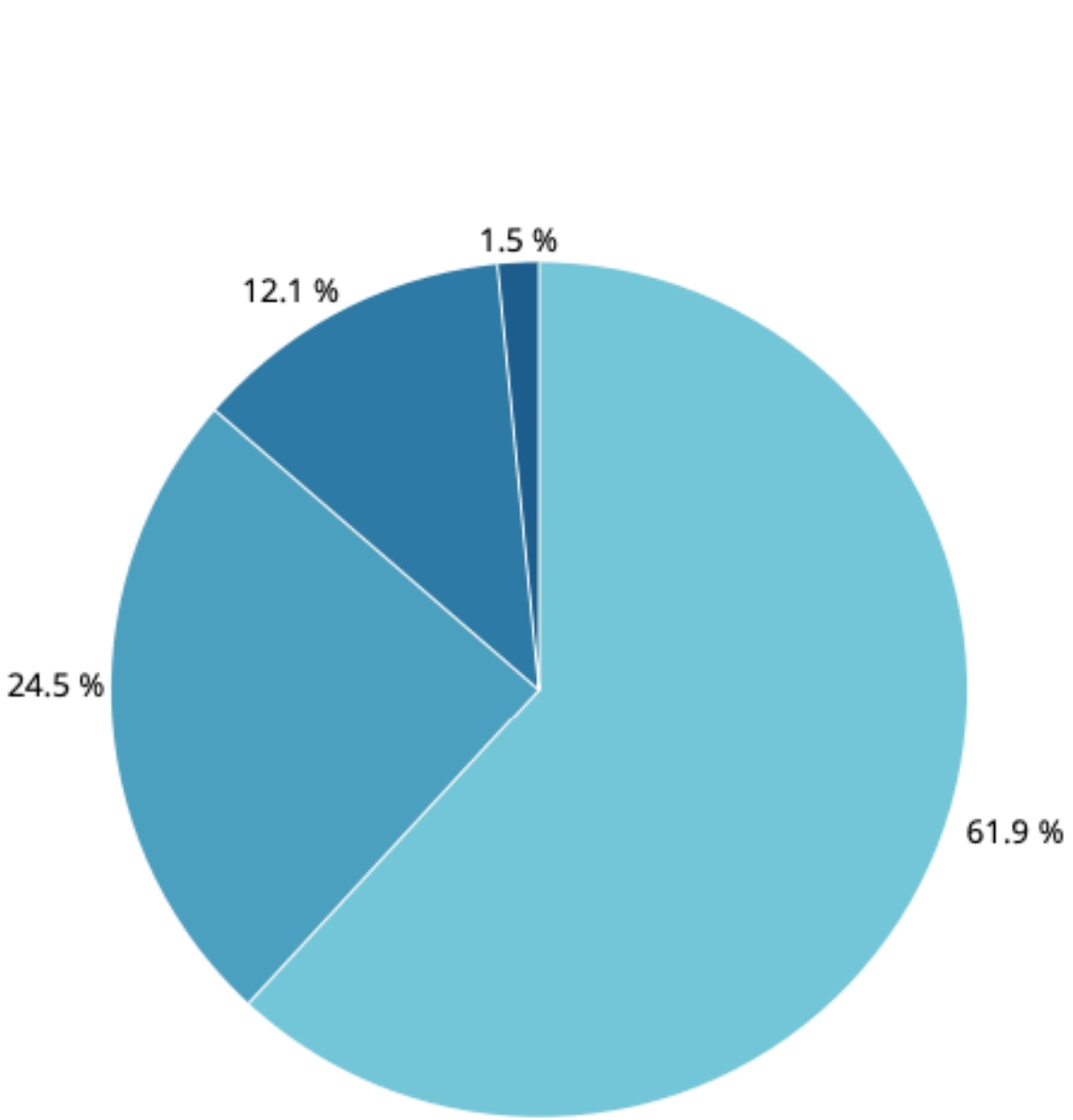
Source : World Bank, 2013

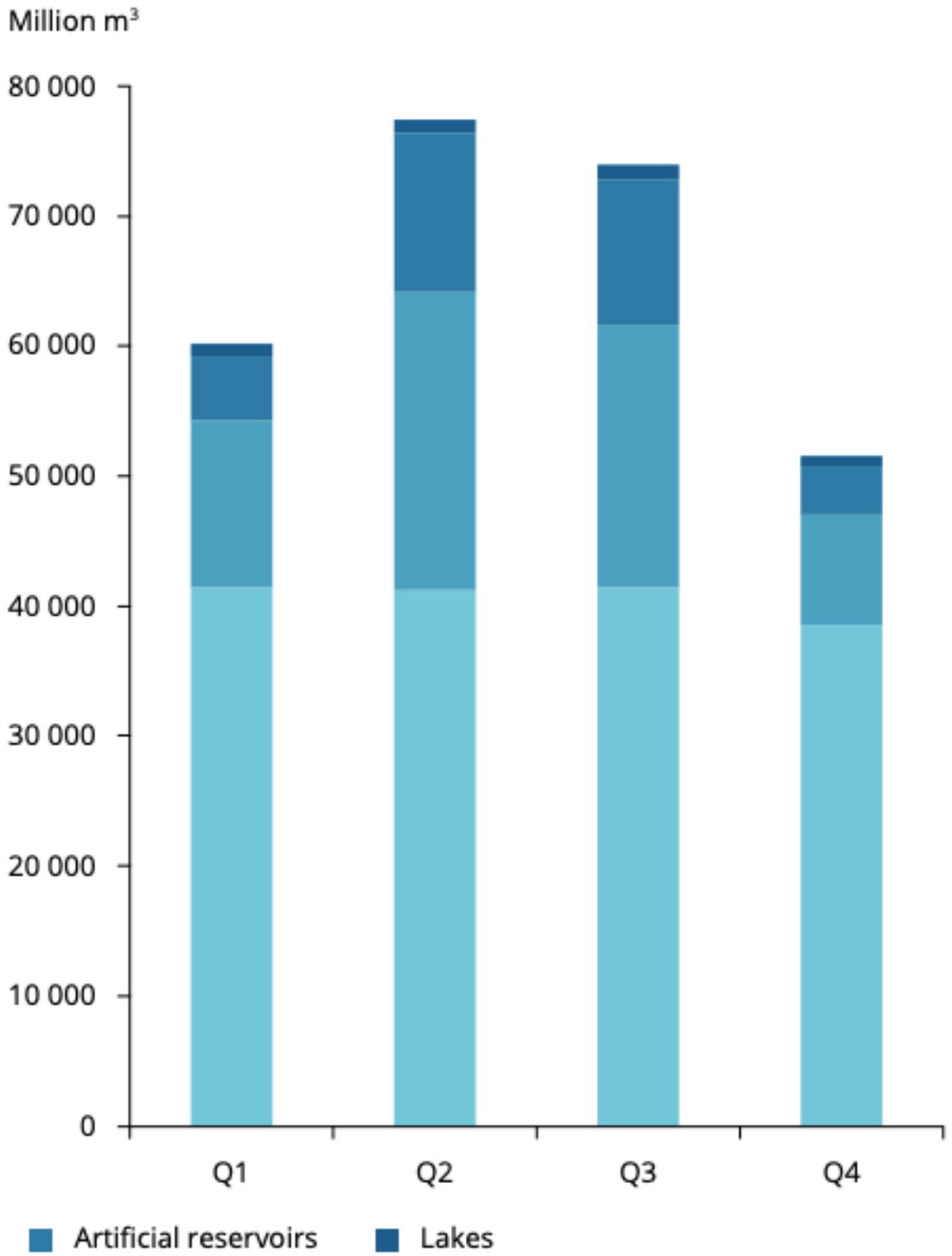
WATER ABSTRACTION AND WATER CONSUMPTION IN EUROPE



Source : EEA (2019), (2021), Eurostat (2020)

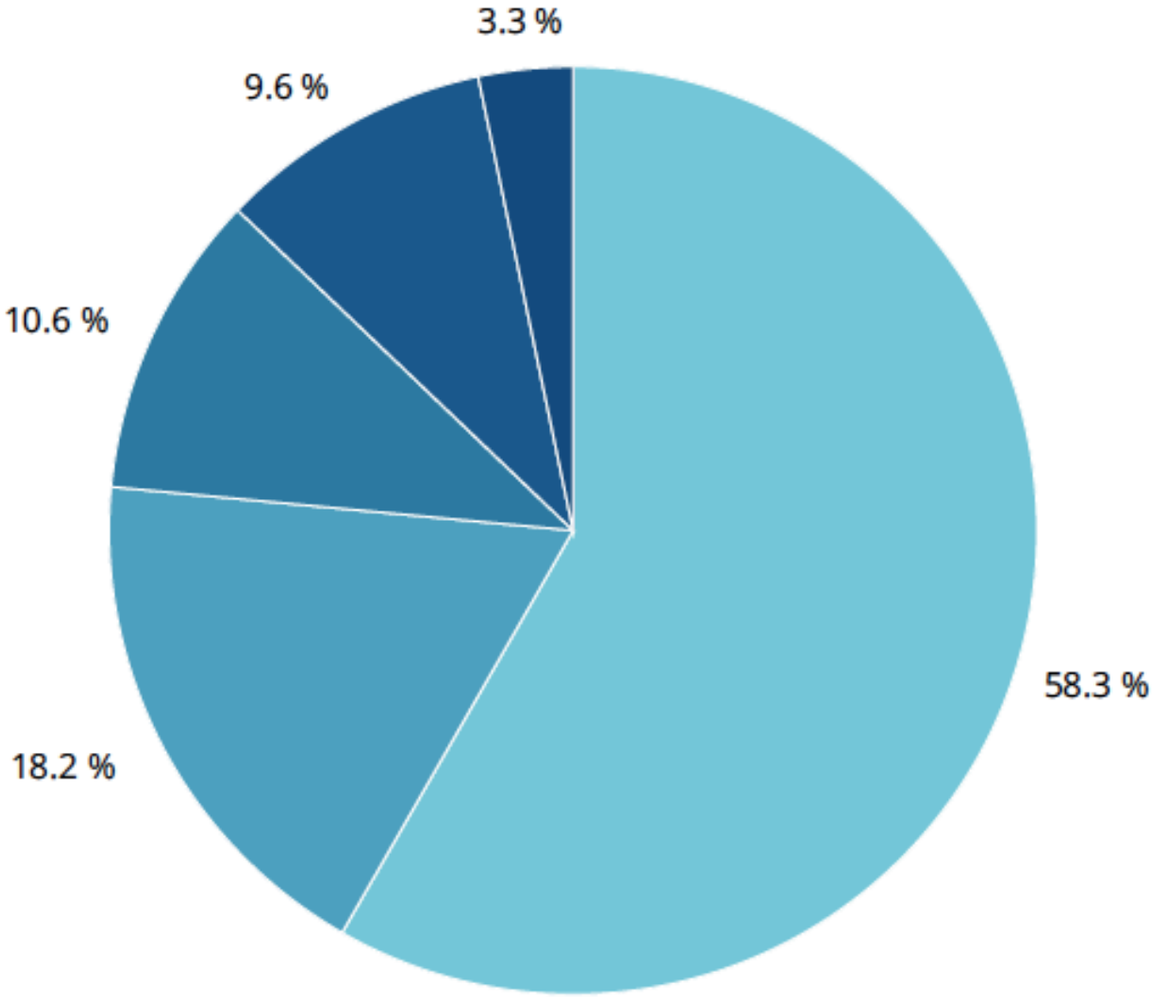
ANNUAL AND SEASONAL FRESHWATER ABSTRACTION BY SOURCE OF FRESHWATER IN EUROPE, 2017

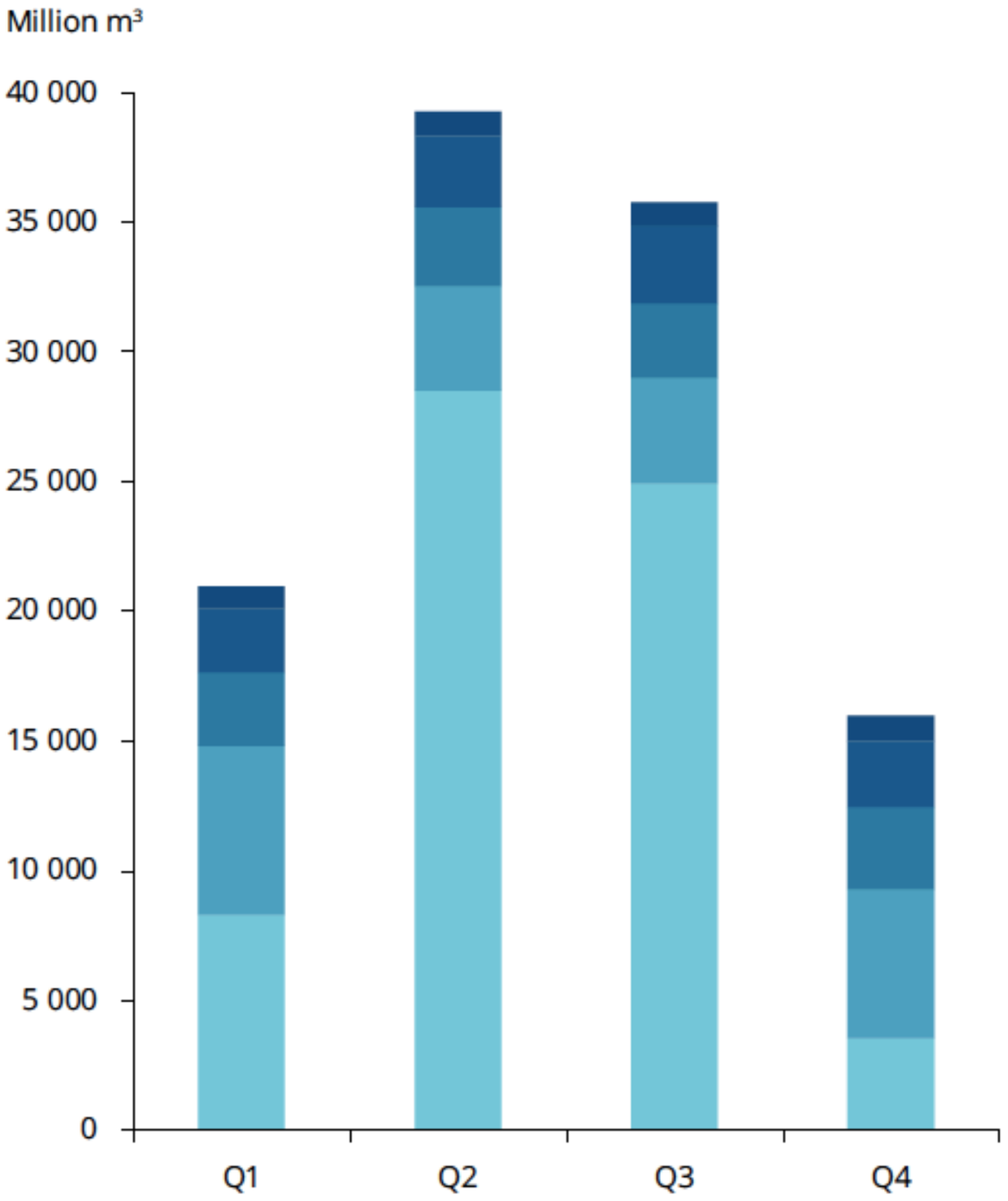




Source : EEA (2018)

FRESHWATER CONSUMPTION BY SECTOR IN EUROPE, 2017





Source : EEA (2018)

WATER STRESS IN EUROPE

Water stress is a situation where there is not enough water of sufficient quality to meet the demands of people and the environment. Water stress causes deterioration of fresh water resources in terms of quantity (aquifer over-exploitation, dry rivers, etc.) and quality (eutrophication, organic matter pollution, saline intrusion, etc.) - FAO

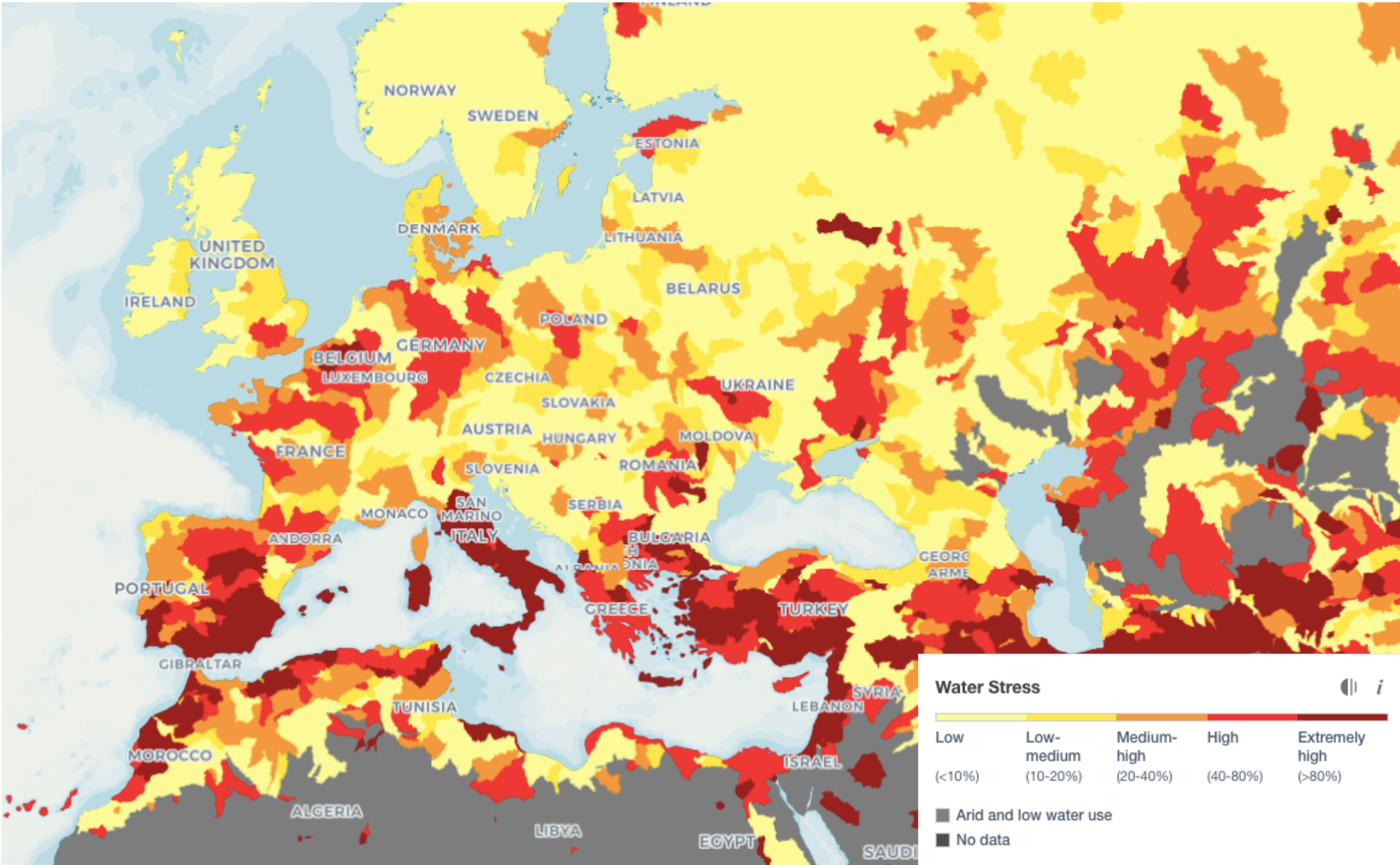
Beaumont du Gatinais, not far from Paris, France, August 8, 2022

Photo source : https://www.euronews.com/my-europe/2022/08/11/desperate-for-water-european-drought-crisis-in-pictures

BASELINE WATER STRESS

Source : WRI, Aqueduct, 2022

Baseline water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies.



WATER STRESS IN EUROPE

The European Environment agency reports that about 20 % of the European territory and 30 % of Europeans are affected by water stress during an average year. The cost of economic damage caused by droughts is between 2 to 9 billion euros per year, not counting the unquantified damage to ecosystems and their services.

A view of a dry lake bed near the village of Conoplja, 150 kilometers north-west of Belgrade, Serbia. August, 2022.

Photo source : https://www.euronews.com/my-europe/2022/08/11/desperate-for-water-european-drought-crisis-in-pictures

WATER STRESS IN EUROPE

Southern Europe is the worst affected region, with approximately 30 % of its population living in areas with permanent water stress and up to 70 % of its population living in areas with seasonal water stress during summer.

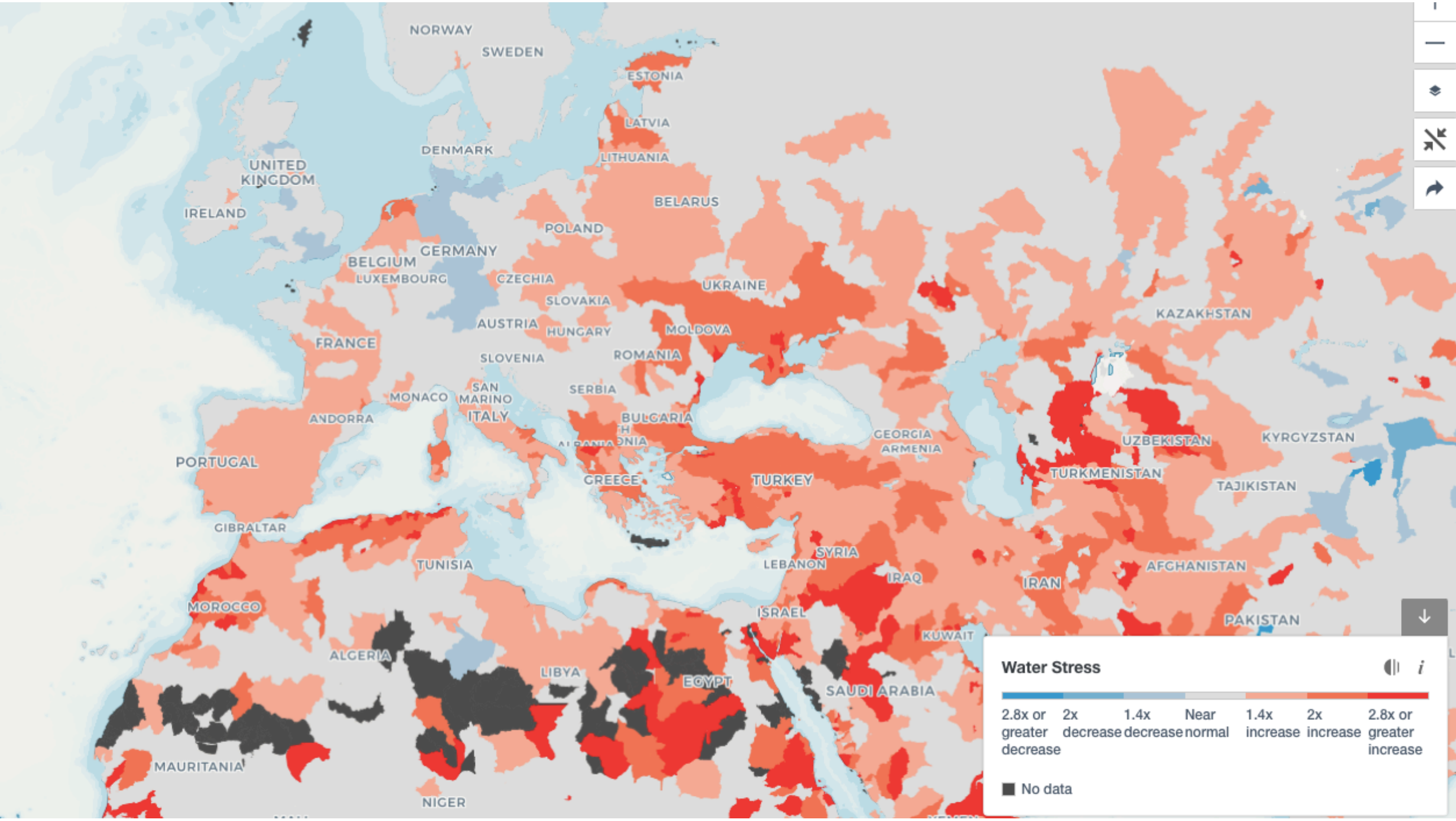
This aerial photograph shows houseboats sitting in the dry riverbed of the Waal river near Beneden-Leeuwen in the Netherlands. August, 2022

Photo source : https://www.euronews.com/my-europe/2022/08/11/desperate-for-water-european-drought-crisis-in-pictures

PROJECTED CHANGES IN WATER STRESS BY 2030

Source : WRI, Aqueduct, 2022

Projections of water stress under BAU (business as usual) scenario



WATER STRESS IN EUROPE

For an increase in global temperature of 3 °C, in the southern and south-western Europe river discharge during summer could decline by up to 40% including areas in Belgium, Bulgaria, France, Germany, Poland and Romania.

Reduced streamflow will significantly reduce the amount of electricity Hydropower plants generate. Reservoirs having large surface areas make them more susceptible to evaporation than rivers.

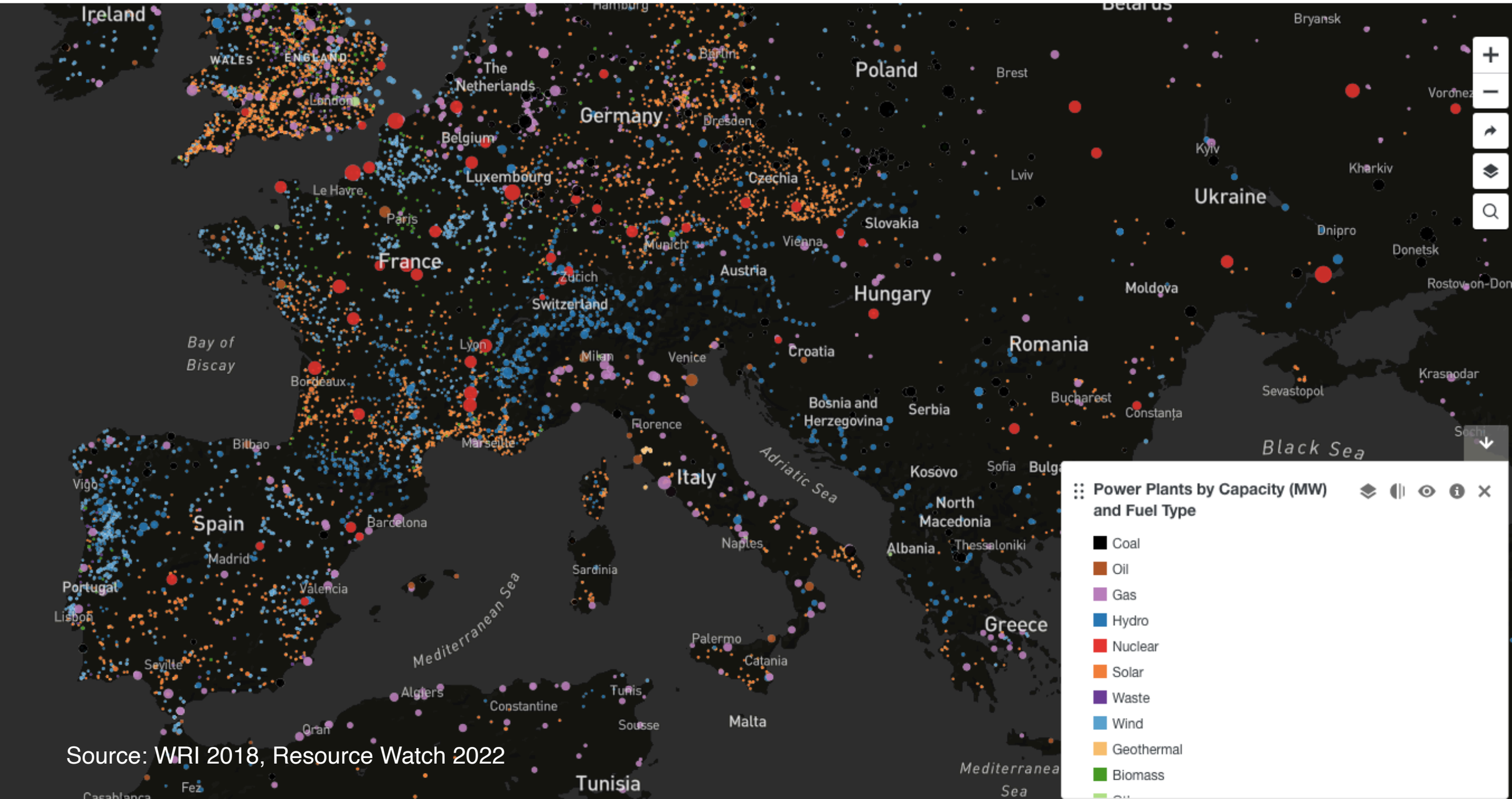
The duration of seasonal water stress is projected to increase by up to a month, with the highest increase expected in Spain, Portugal and other parts of the Mediterranean.

A dead fish laying on the cracking earth of a dry lake bed near the village of Conoplja, 150 kilometers north-west of Belgrade, Serbia, August, 2022

Photo source : https://www.euronews.com/my-europe/2022/08/11/desperate-for-water-european-drought-crisis-in-pictures

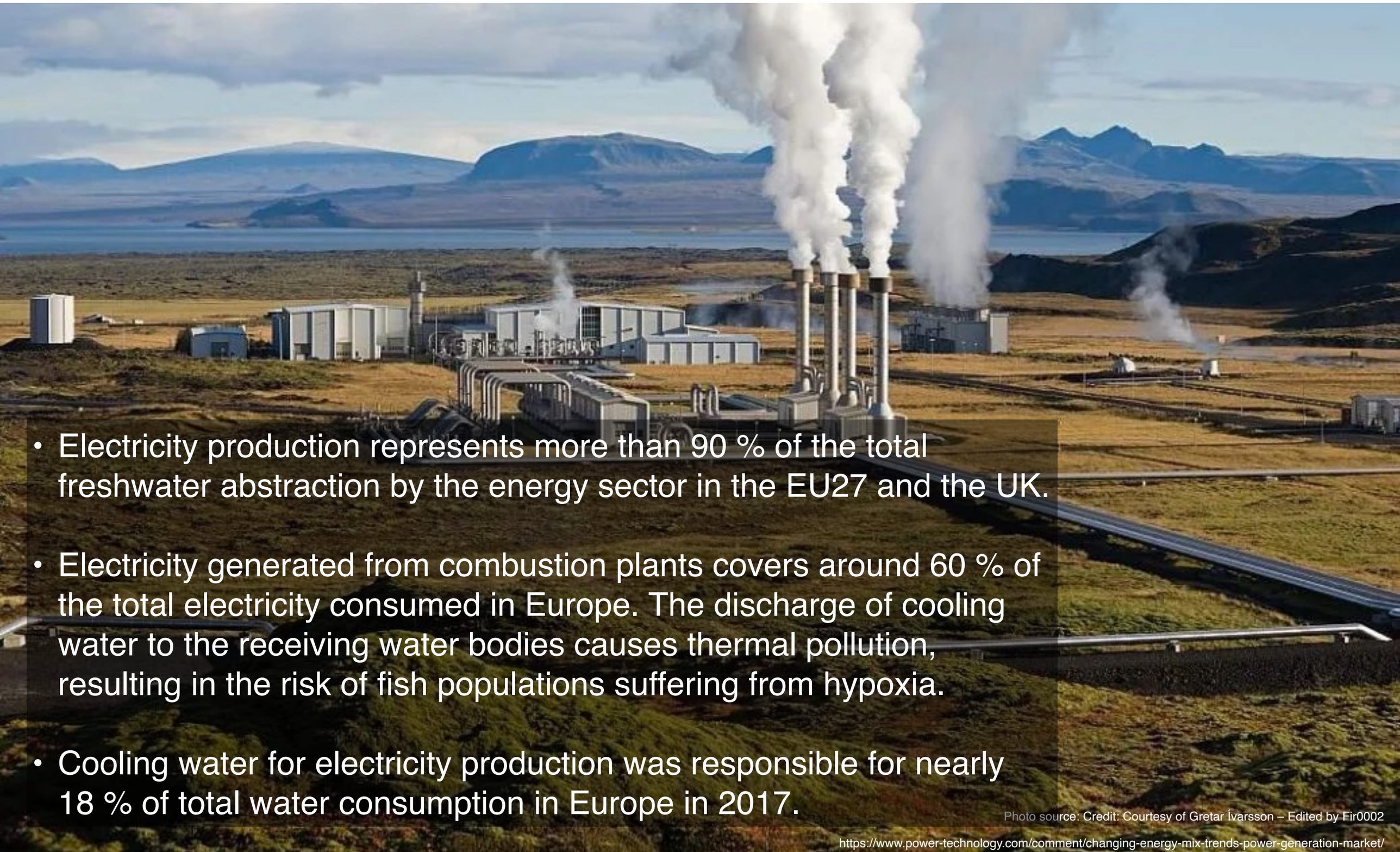
WATER USE IN THERMAL POWER PLANTS

47% of the world's thermal power plant capacity—mostly coal, natural gas and nuclear—and **11% of hydroelectric capacity** are located in highly water-stressed areas.
Both thermal and hydroelectric power are highly dependent on water to produce electricity. (WRI)



Source: WRI 2018, Resource Watch 2022

WATER USE FOR ELECTRICITY PRODUCTION IN EUROPE



- Electricity production represents more than 90 % of the total freshwater abstraction by the energy sector in the EU27 and the UK.

- Electricity generated from combustion plants covers around 60 % of the total electricity consumed in Europe. The discharge of cooling water to the receiving water bodies causes thermal pollution, resulting in the risk of fish populations suffering from hypoxia.

- Cooling water for electricity production was responsible for nearly 18 % of total water consumption in Europe in 2017.

Photo source: Credit: Courtesy of Gretar Ívarsson – Edited by Fir0002

https://www.power-technology.com/comment/changing-energy-mix-trends-power-generation-market/

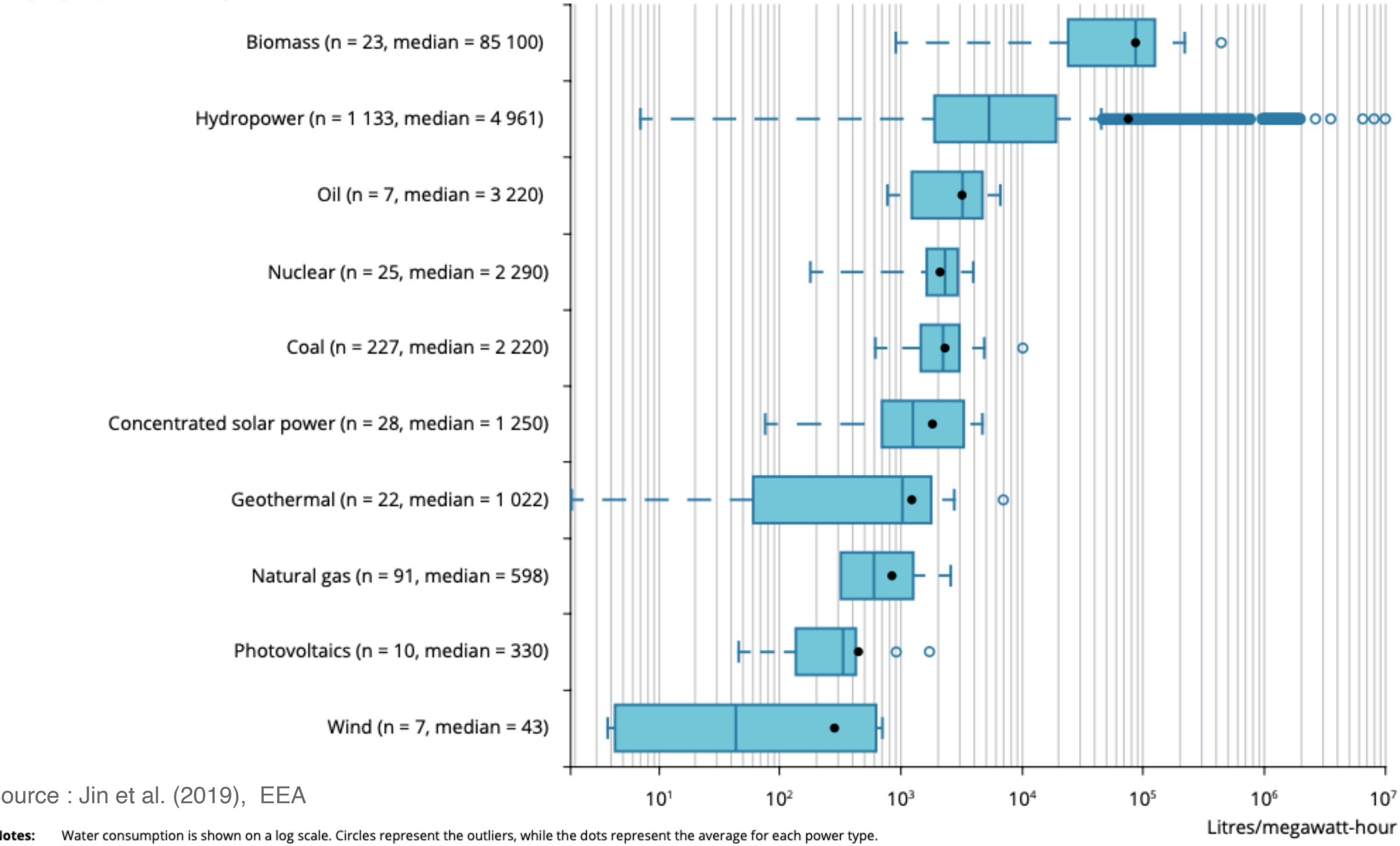
WATER USE FOR ELECTRICITY PRODUCTION IN EUROPE

- Hydropower plants provide approximately 12 % of the total energy production
- Virtually all of the water used in hydropower plants is directly returned to the water bodies. Throughout the life cycle of a dam installation, part of the reservoir water evaporates.
- Significant hydromorphological impacts, as they impede the natural water and nutrient cycles, and they create obstacles for the transport of freshwater biodiversity, sediments and substances.

Roselend Dam, La Bathie hydropower plant, Savoie Alps,

Photo source: https://www.andritz.com/hydro-en/hydronews/hn-europe/france

WATER CONSUMPTION PER UNIT OF ENERGY GENERATED DURING THE LIFE CYCLE OF DIFFERENT TYPES OF ENERGY SOURCES



Source : Jin et al. (2019), EEA

Notes: Water consumption is shown on a log scale. Circles represent the outliers, while the dots represent the average for each power type.

CSP, concentrated solar power; mdn, median value of water consumed; PV, (solar) photovoltaic.

WATER QUANTITY RISK TO ELECTRIC POWER

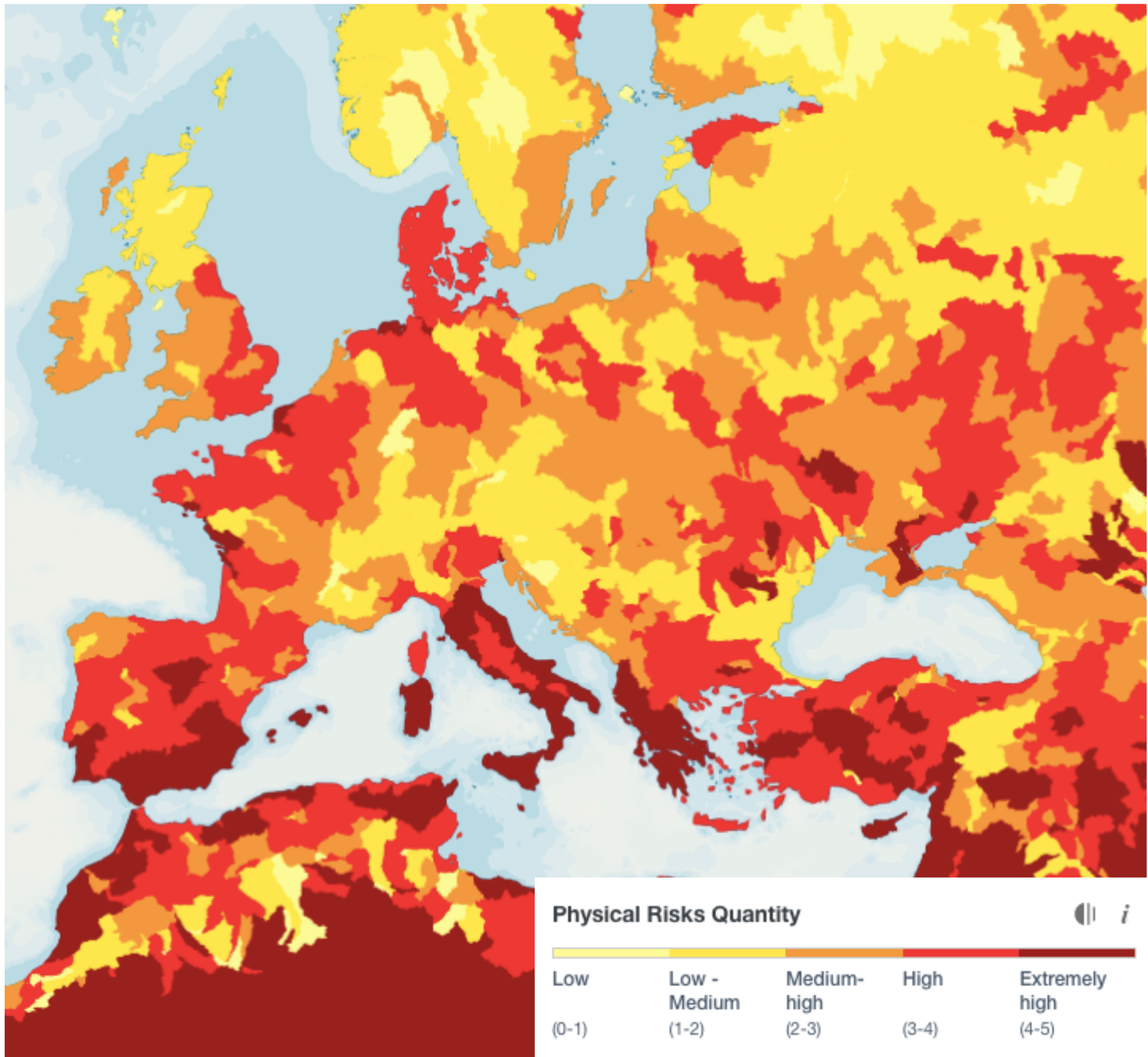
Source : WRI, Aqueduct, 2022

Water Quantity Risk

Electric Power

91% Water Quantity Risk
5% Water Quality Risk
3% Regulatory and Reputational

Overall water risk measures all water-related risks, by aggregating all selected indicators from the Physical Quantity, Quality and Regulatory & Reputational Risk categories. Higher values indicate higher water risk.



WATER-RELATED RISKS TO ENERGY SECURITY

Summary of risks and impacts within the water-energy nexus

	RISKS	IMPACTS
Water-related risks to energy security	Shifts in water availability and quality due to natural or human-made reasons (including regulatory restrictions on water use for energy production/ fuel extraction)	• Reduced reliability of supply and reliance on more expensive forms of generation • Possibility of economic pricing of water and therefore higher costs of energy production • Reduced availability of water for fuel extraction and processing stages, leading to reduced outputs
	Increase in energy demand for water production, treatment and distribution	Strains on the energy system and reduced efficiencies given the different demand profiles for water and energy

Source: IRENA (2015)

ENERGY-RELATED RISKS TO WATER SECURITY

Summary of risks and impacts within the water-energy nexus

	RISKS	IMPACTS
Energy-related risks to water security	• Limited or unreliable access to affordable energy necessary to extract water • Re-allocation of water resources from other end-uses to energy	• Disruption in water supply to end-users or diversion of resources away from other core activities such as agriculture • Changes in delivery cost of water due to fluctuating costs of energy inputs
	Contamination of water resources due to energy extraction and transformation processes	Water resources, including for drinking purposes, rendered unsuitable due to contamination, often requiring additional treatment

Source: IRENA (2015)

CLIMATE CHANGE IMPACTS ON THE ENERGY SECTOR

- Elevated water and air temperatures reduce the efficiency of power plant generation
- Climate change is projected to decrease water availability in many semi-arid and arid regions. Thermoelectric power generation, oil and gas production, and renewables such as hydropower and bioenergy are vulnerable to reduced production due to water dependent processes
- Extreme weather events are a current and growing threat to energy security, major blackouts
- Increasingly numerous and intense floods in areas close to energy plants can cause severe harm to power production and energy delivery infrastructure, and can result in more frequent blackouts in regions where power plants are constructed close to surface water resources.
- These risks do not exist in isolation, and converging factors can cause additional challenges.

La Fernandina dam near La Carolina, south-eastern Spain. July 2022.

Photo source : https://www.euronews.com/my-europe/2022/08/11/desperate-for-water-european-drought-crisis-in-pictures

SOME RESOURCES

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13. World Economic Forum (2022), Global Risks Report 2022 : https://www.weforum.org/reports/global-risks-report-2022
14. Euronews (2022), Desperate for water: European drought crisis in pictures : https://www.euronews.com/my-europe/2022/08/11/desperate-for-water-european-drought-crisis-in-pictures etc…

Photo : Yerevan, Armenia

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