hinrich foundation
advancing sustainable global trade

Visualizing Asia's Water Dilemma

DATA-DRIVEN PERSPECTIVES ON THE ECONOMIC & POLITICAL LANDSCAPE

IN COLLABORATION WITH

VISUAL CAPITALIST

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01

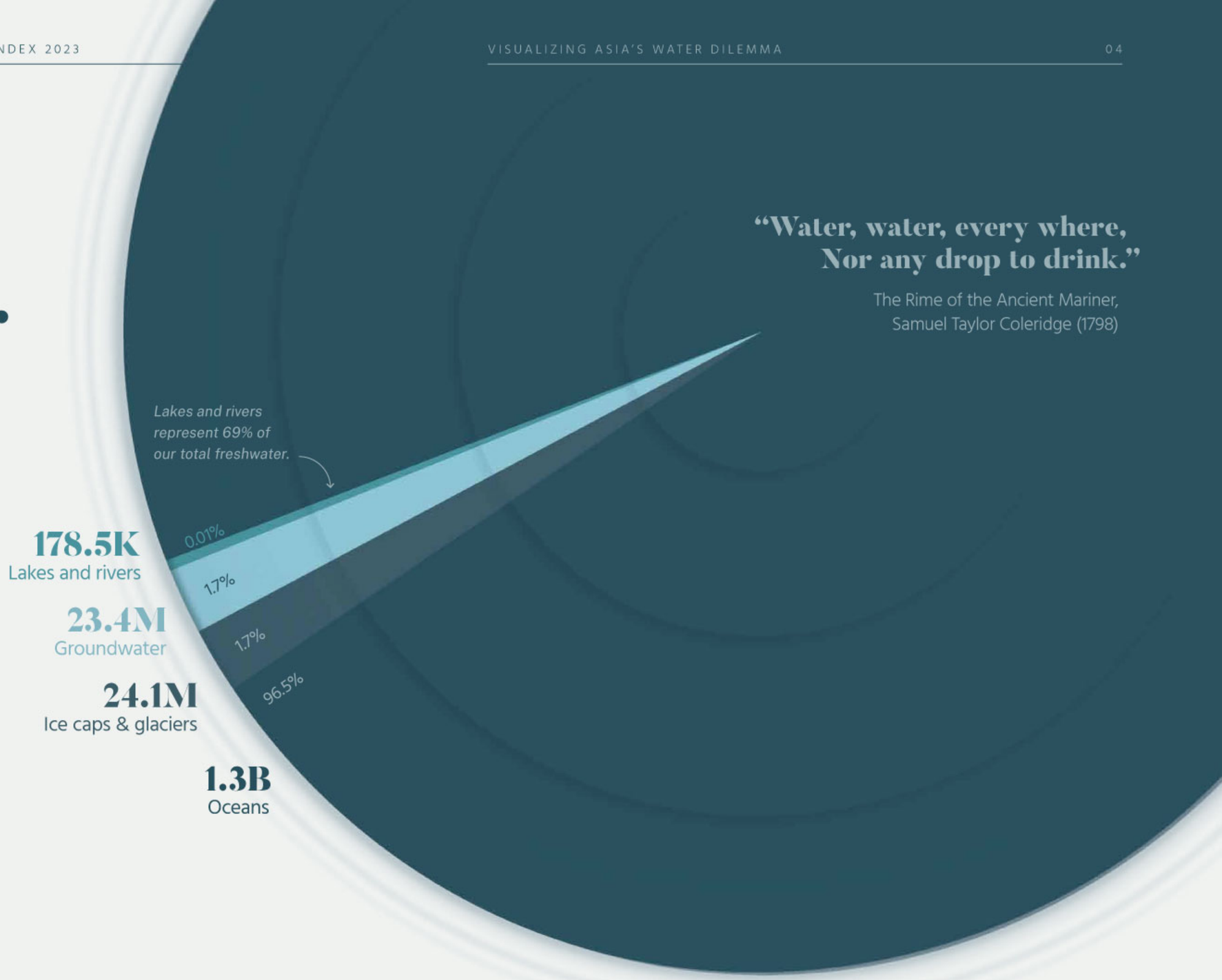
All of the World's Water

Water is an essential component of life, enabling everything from food production to electricity generation. Given this ubiquity, it's surprising to see how scarce water actually is.

For example, of the Earth's total freshwater, **69%** is trapped in ice and glaciers, and another **30%** is deep within the ground. Lakes and rivers, which supply most of our freshwater, account for **0.01%.**

The scarcity of freshwater

Volume of total water on Earth
Cubic kilometers, km^3



"Water, water, every where,
Nor any drop to drink."

The Rime of the Ancient Mariner,
Samuel Taylor Coleridge (1798)

Figures rounded.
Source: U.S. Geological Survey (2019)

WATER'S ROLE IN

Supply chains

In 1993, the British geographer John Anthony Allan coined the term virtual water, introducing a conceptual way to track the water "hidden" in everyday products and services.

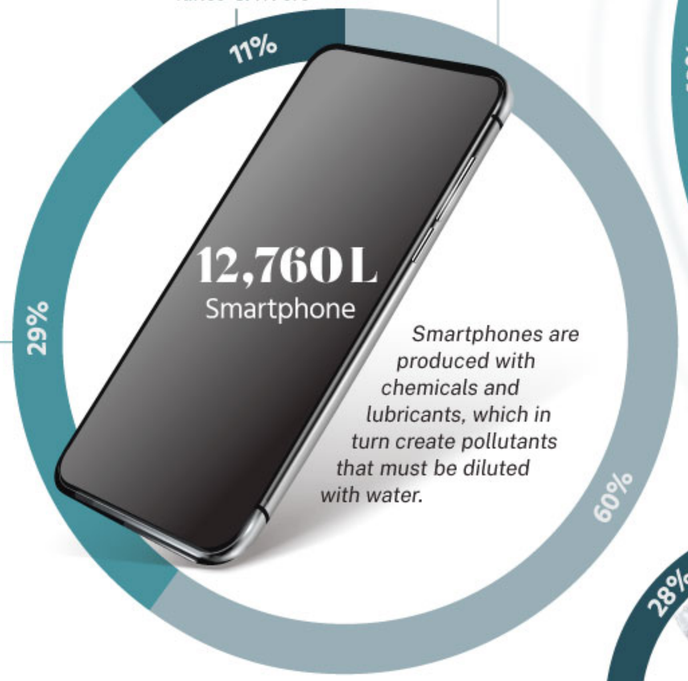
It reveals that water is deeply embedded throughout global supply chains, indispensable to the production, transportation, and transaction of nearly everything we use.

The water footprint of everyday products

Green water
Collected from rainwater

Blue water
Extracted from groundwater, lakes & rivers

Grey water
Water needed to dilute pollutants



Smartphones are produced with chemicals and lubricants, which in turn create pollutants that must be diluted with water.

Liter measurements refer to the amount of water needed to produce one unit of each product.

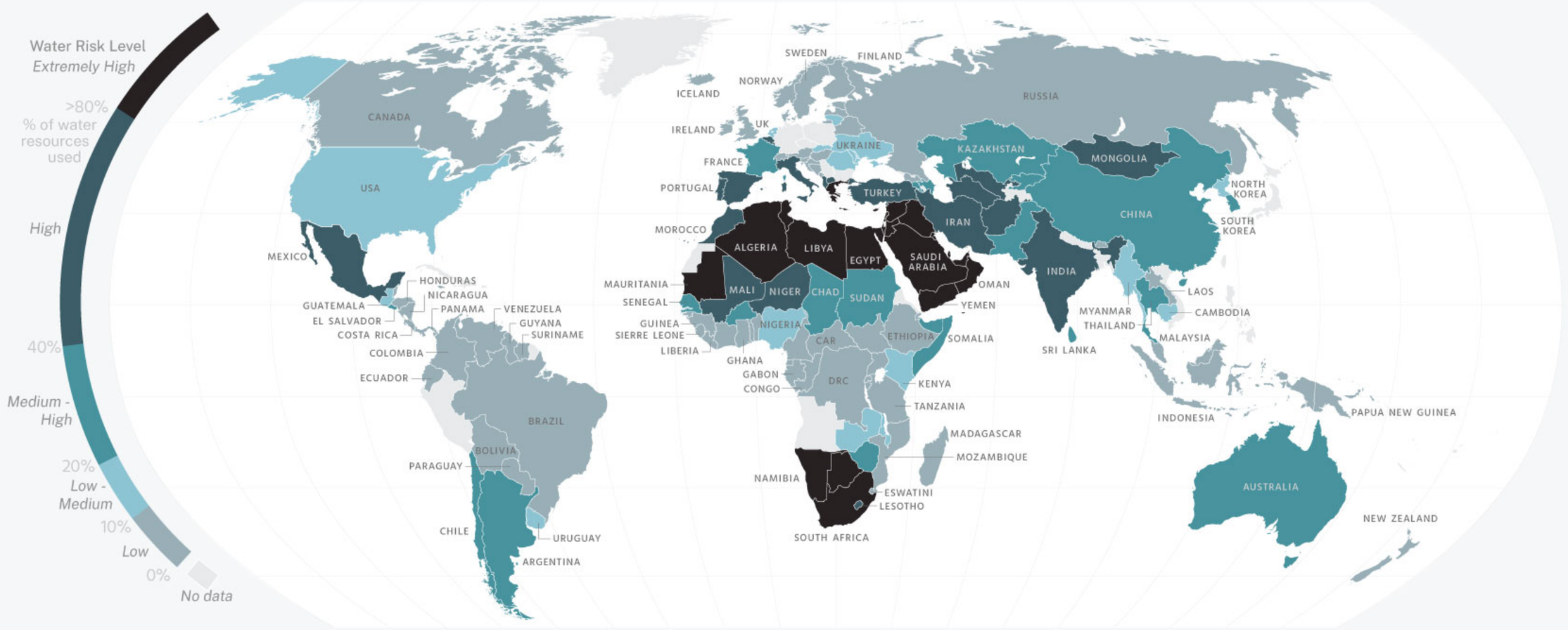
Source: Burley, H. (2015). The Land and water footprints of everyday products. Mind your step. Friends of the Earth Trust.

Mapping global water scarcity

Due to variations in geography, population density, and economic activity, the threat of water scarcity is more pronounced in some places than others. According to the World Resources Institute, **30%** of countries will face high or extremely high levels of water stress by 2050.

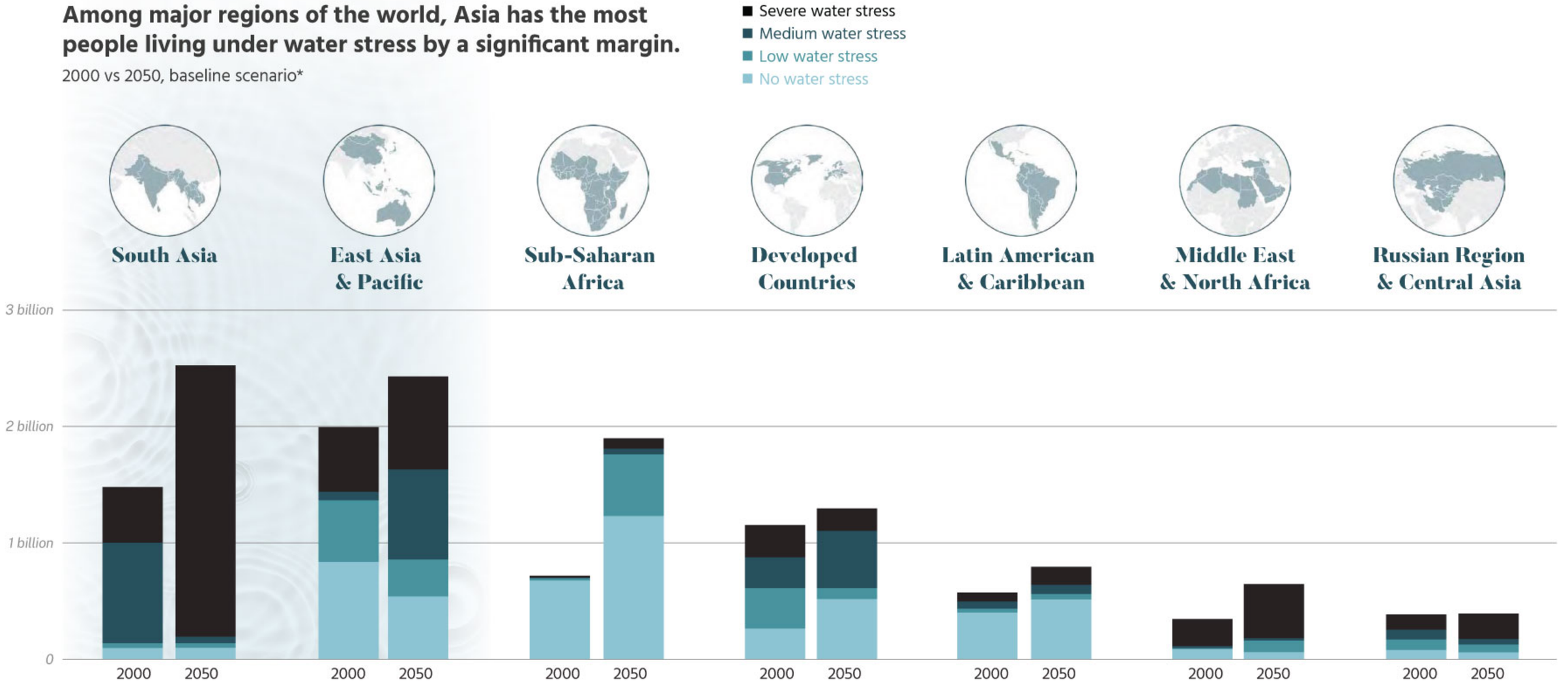
Water stress level 2050 projections based on a "business as usual" scenario

Source: World Resources Institute Aqueduct 4.0 (2023)



Among major regions of the world, Asia has the most people living under water stress by a significant margin.

2000 vs 2050, baseline scenario*



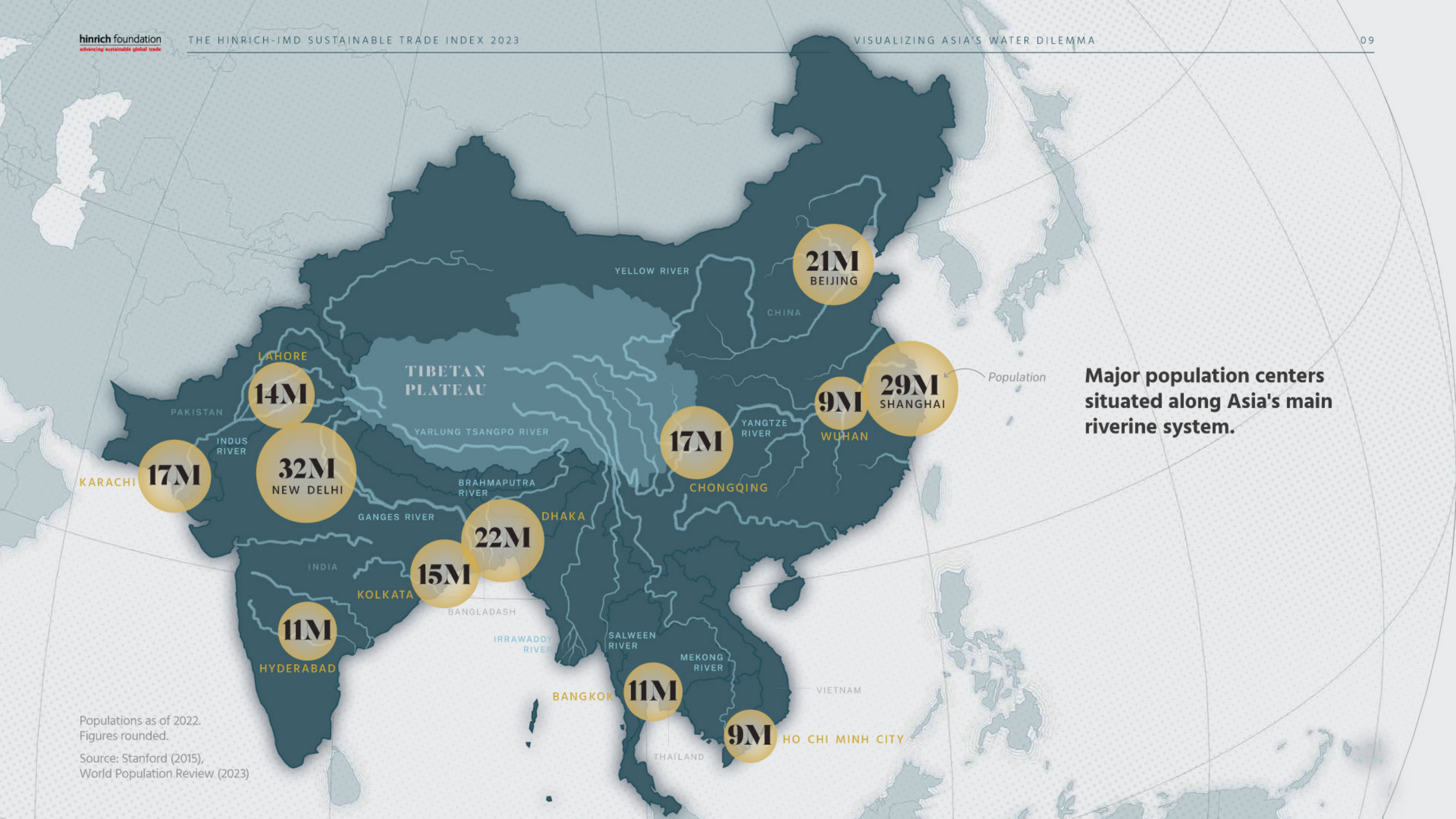
*The baseline scenario assumes that no new policies are introduced.

Source: UN Water (2020)

Asia's Water Landscape

Asia is home to a complex network of rivers that originate within China's borders, in an area called the **Tibetan Plateau**. From there, these rivers deliver water to many of the world's most populous countries including India, Pakistan, and key economies in Southeast Asia.

This geographic reality means that each river acts as an important lifeline for billions of people.



Major population centers situated along Asia's main riverine system.

Populations as of 2022.
Figures rounded.

Source: Stanford (2015),
World Population Review (2023)

CONTROLLING THE FLOW

Asia leads the world in dam building

Humans have been building dams for thousands of years, with the earliest examples dating back to 3000 BC. In Asia, this ancient practice has evolved dramatically, with the region boasting some of the world's largest and most complex dam projects ever built.

Asia has the most dams in the world.

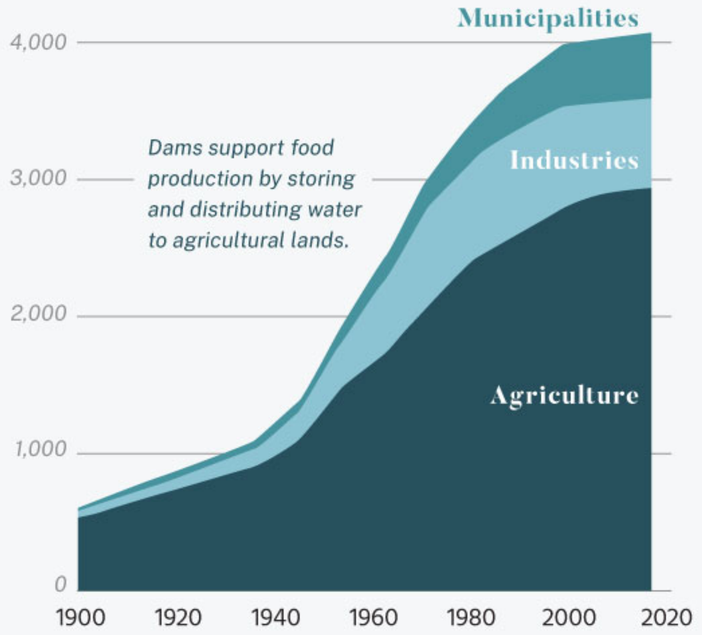
Population figures as of 2022.
Source: Zhang, A.T., Gu, V.X. Global Dam Tracker: A database of more than 35,000 dams with location, catchment, and attribute information. Sci Data 10, 111 (2023).

Why do we build dams?

Dams can be built for many purposes, ultimately allowing countries to assert greater control over their water resources. However, permanently altering the flow of rivers can introduce **environmental and geopolitical implications**, especially in a region as intertwined as Asia.

Irrigation

WATER WITHDRAWALS BY SECTOR KM³/YEAR

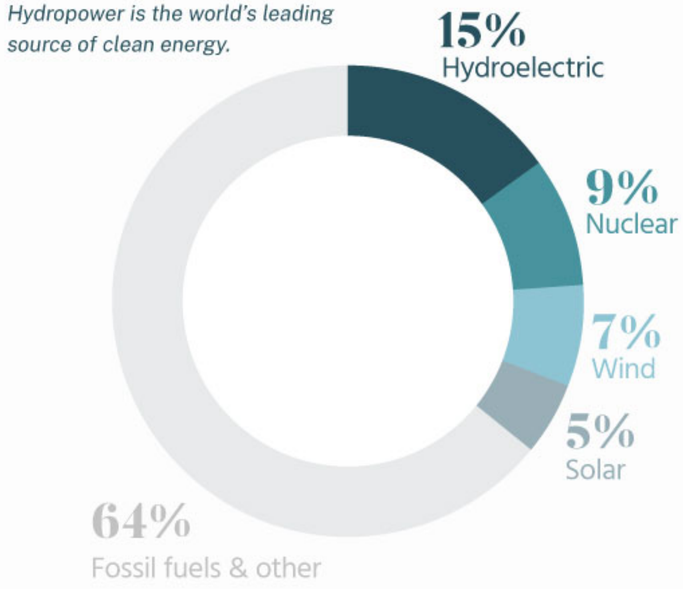


Source: UN Water (2023)

Electricity Generation

ELECTRICITY SOURCE BY FUEL 2022

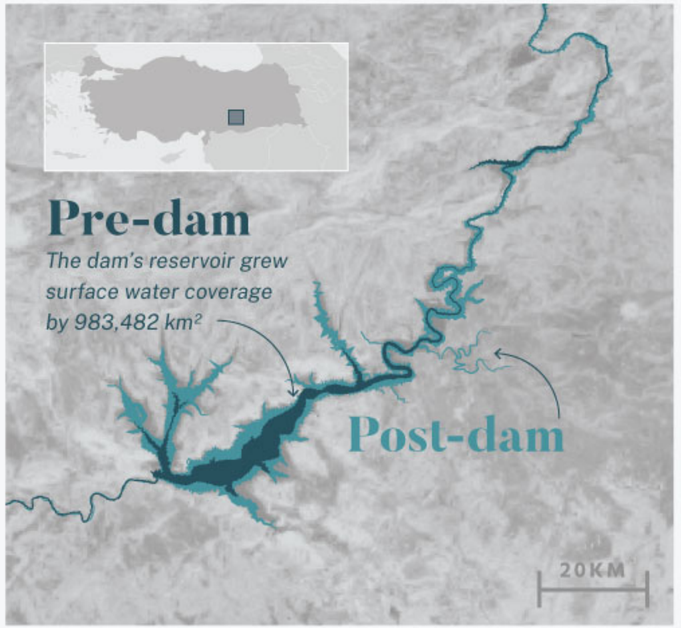
Hydropower is the world's leading source of clean energy.



Source: Statistical Review of World Energy (2023)

Flood Control & Water Storage

THE IMPACT OF TURKEY'S ATATÜRK DAM 1992



Source: Zhang, A.T., Gu, V.X. Global Dam Tracker: A database of more than 35,000 dams with location, catchment, and attribute information. Sci Data 10, 111 (2023).

03 All Rivers Lead to China

Thousands of dams have been built along Asia's transboundary rivers, even though there are no multilateral water-sharing agreements in place. This means that countries are not obligated to minimize the impact that their dams have on neighbors.

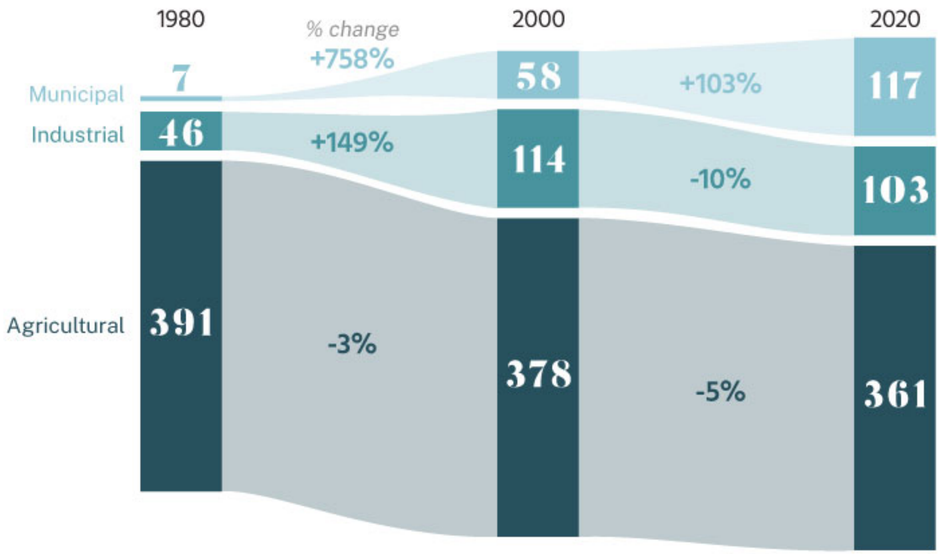
This dynamic has given upstream nations, particularly China, significant leverage over downstream countries like India and Thailand, exacerbating natural inequalities in water access.

WATER SECURITY IN

Asia's biggest economy

As the third-largest country by area, China has a diverse landscape with an **uneven distribution of water.** Southern China experiences intense rainfalls and flooding, while northern China—the center of the nation's agricultural activities—struggles from frequent droughts.

China's water withdrawals by sector



Source: UN FAO

Total water resources by province

0 billion m³ >200 billion m³

Northern China is home to half the country's population, but only one-fifth of water resources.

Source: World Resources Institute (2020), The Diplomat (2022)

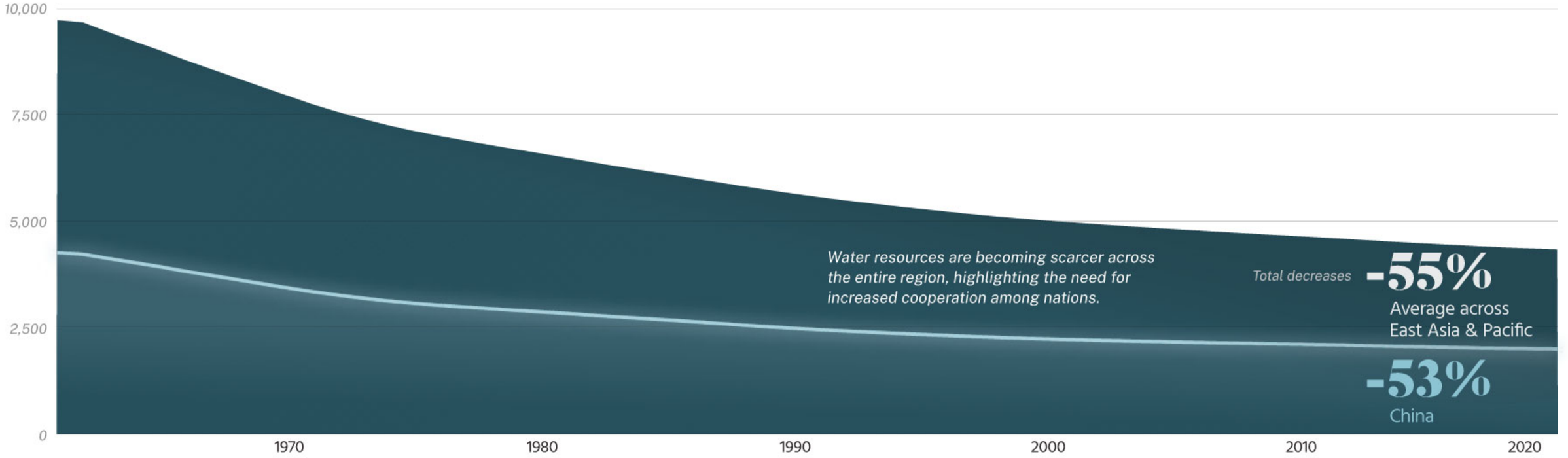
UNILATERAL POLICY

China's drive for self-sufficiency & water sovereignty

With water becoming scarcer, Chinese policymakers have chosen to treat water as a sovereign asset, rather than one that should be shared equally across the region.

While inequitable to neighboring countries, this policy ensures that China has enough water to support the needs of its enormous economy.

Renewable internal freshwater resources per capita cubic meters



Renewable internal freshwater resources refer to river flows and groundwater from rainfall within a country.

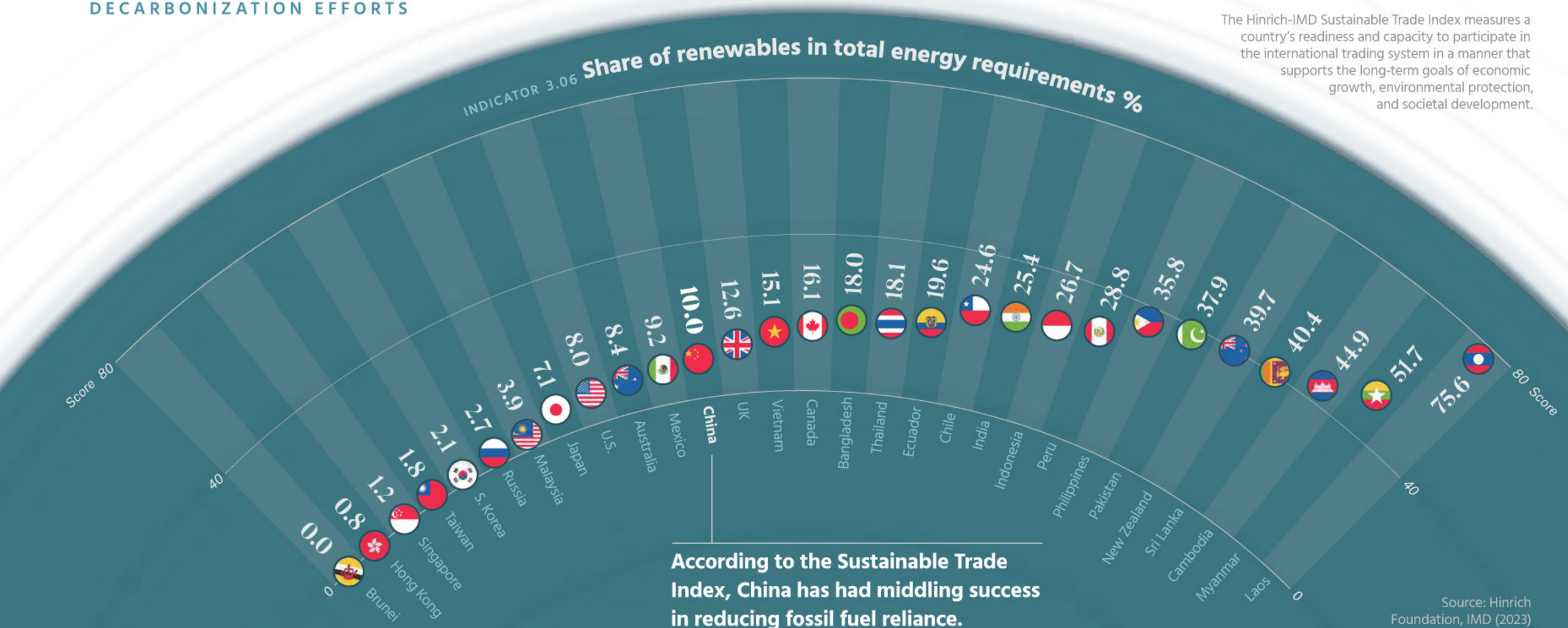
Source: World Bank (2020)

Hydropower

A CORNERSTONE OF CHINA'S DECARBONIZATION EFFORTS

Evidence of China's unilateral approach can be seen through its heavy investment in hydroelectric dams, many of which are built on transboundary rivers like the Mekong.

The Hinrich-IMD Sustainable Trade Index measures a country's readiness and capacity to participate in the international trading system in a manner that supports the long-term goals of economic growth, environmental protection, and societal development.



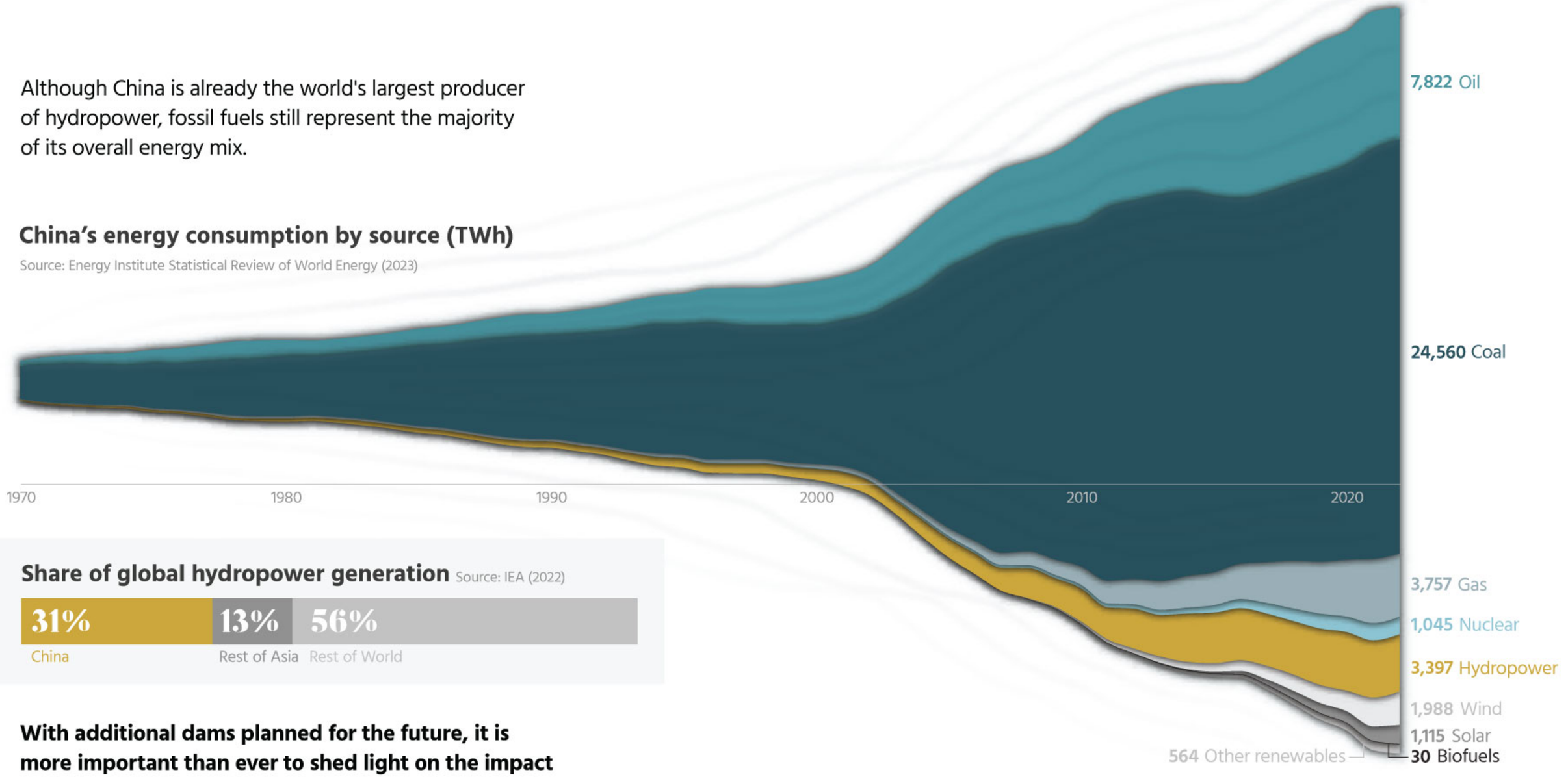
According to the Sustainable Trade Index, China has had middling success in reducing fossil fuel reliance.

Source: Hinrich Foundation, IMD (2023)

Although China is already the world's largest producer of hydropower, fossil fuels still represent the majority of its overall energy mix.

China's energy consumption by source (TWh)

Source: Energy Institute Statistical Review of World Energy (2023)



Share of global hydropower generation Source: IEA (2022)

With additional dams planned for the future, it is more important than ever to shed light on the impact that these structures have on downstream nations.

04

Case Study
Mekong River

The Mekong is the world's 12th longest river spanning over 4,000 km. Originating in the Tibetan Plateau, it runs through southern China and into Myanmar, Laos, Thailand, Cambodia, and Vietnam.

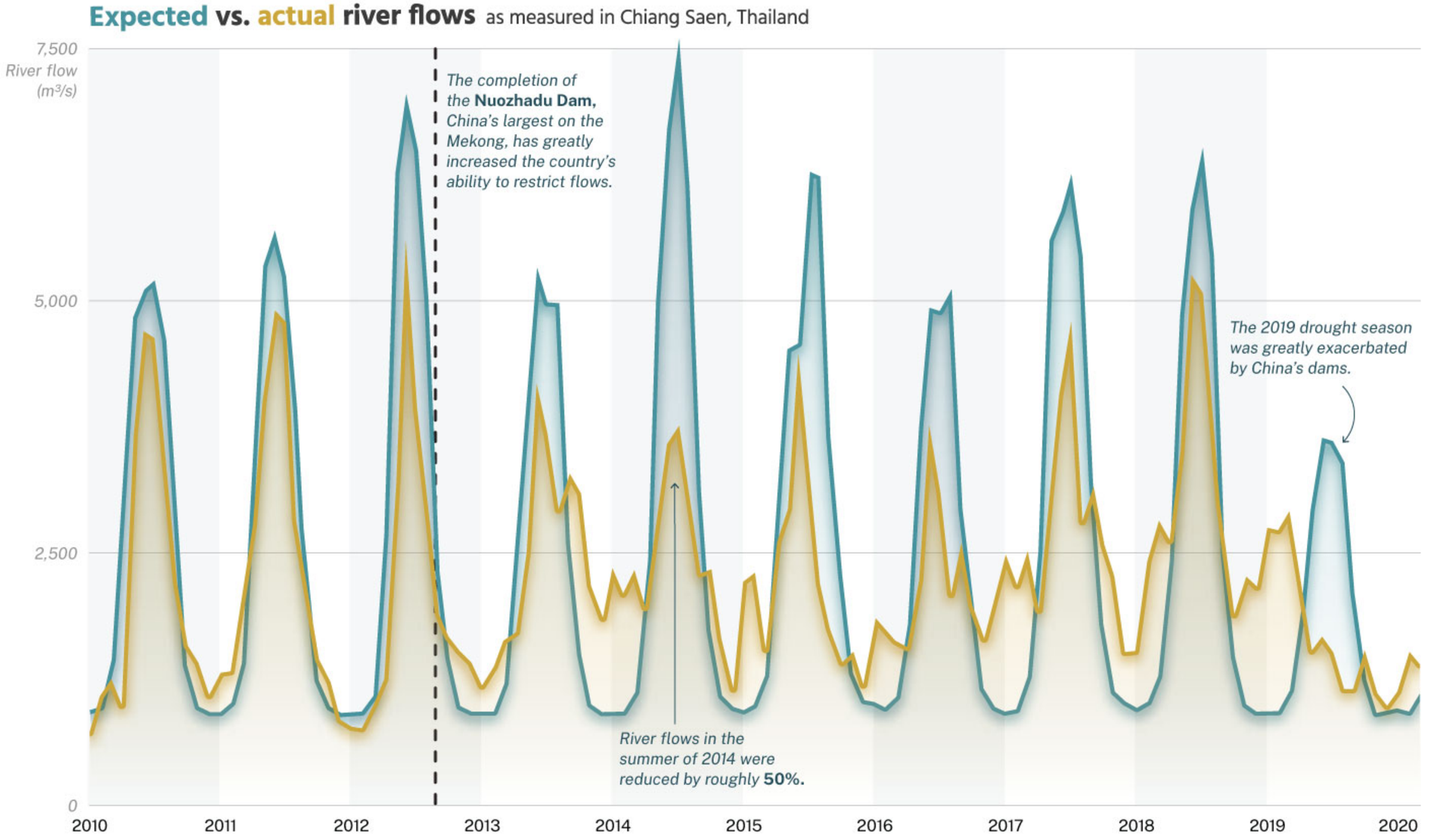
Between 1993 and 2019, China has built 11 mega dams along its section of the Mekong, for a combined water storage capacity of **48 trillion liters.**

Source: Stimson (2020)

This chart shows how China's dams are regularly compromising flow rates in the Lower Mekong:

During **dry seasons**, China releases water to produce hydropower, resulting in higher than normal flows.

During **wet seasons**, the dams restrict water to build up reserves, resulting in below-expected flows.

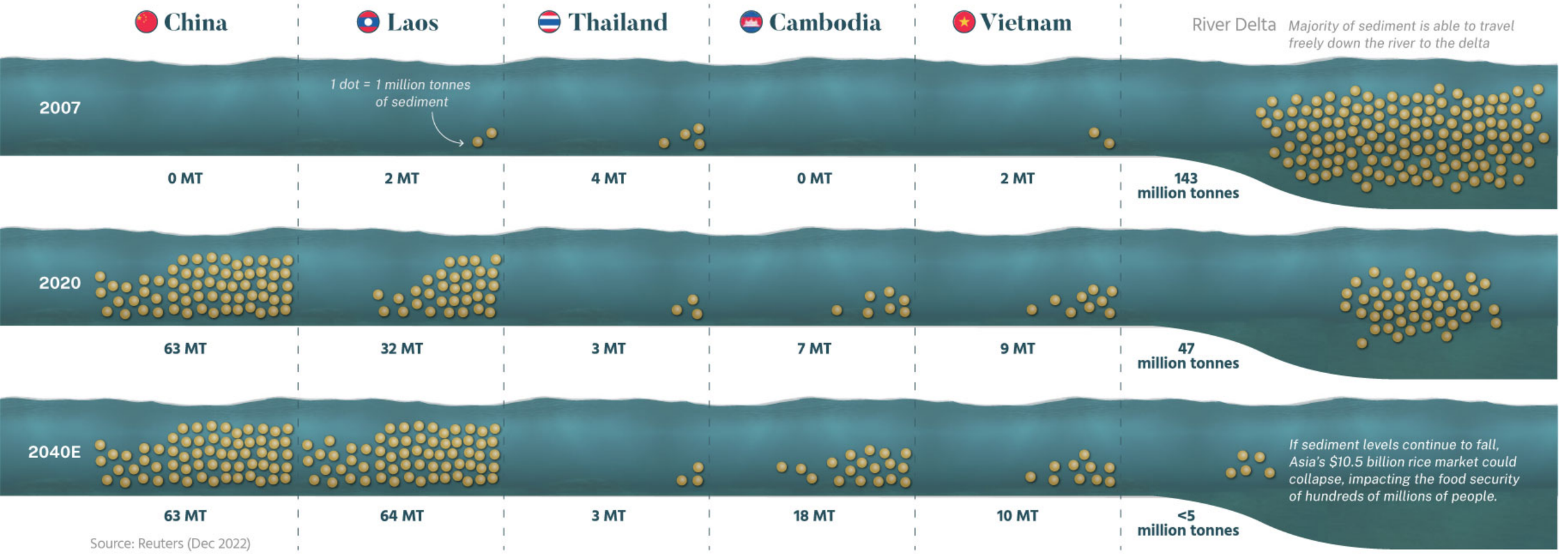


Source: Mekong Dam Monitor; Mekong River Commission (Accessed via The Stimson Center)

Downstream Impact

Erratic changes in the Mekong's water levels have had crippling effects on many of Asia's biggest rice exporters. According to the Stimson Center, **8 of the last 10** major droughts in the lower Mekong basin have occurred since China's first dam began construction.

Droughts aren't the only concern, though. Recent satellite data has shown that dams along the Mekong are **withholding nutrient-rich sediments that are essential for soil fertility.**



Source: Reuters (Dec 2022)

05 Looking Ahead

"If the wars of this century were fought over oil, the wars of the next century will be fought over water—unless we change our approach to managing this precious and vital resource."

Dr Ismail Serageldin, former Vice President of the World Bank (1995)

The water wars heat up

The Mekong is not the only transboundary river in Asia experiencing challenges. Another is the **Brahmaputra**, which provides **30%** of India's freshwater resources, and **70%** for Bangladesh.

China is building over 20 dams along its section of this river, with the most concerning being a **60-gigawatt mega dam** just 30 km from India's borders. For reference, China's Three Gorges Dam is currently the world's largest with a capacity of 22.5-gigawatts.

22.5 GW
Three Gorges Dam

60 GW
Proposed Brahmaputra Dam

In response, India is planning several of its own dams, including a potential 10-gigawatt dam in the northeastern state of Arunachal Pradesh.

Source: Nikkei Asia (2023), Al Jazeera (2020)

Climate change puts Asia on thin ice

The effects of climate change are adding even more pressure to this delicate situation. According to the International Centre for Integrated Mountain Development, glaciers in the Tibetan Plateau will shrink by **30% to 40% by 2100**, not only exacerbating water scarcity, but also fueling geopolitical disputes between nations.

According to a 2019 study published by Nature, meltwater from these glaciers protects 800 million people against water stress.

Source: Nikkei Asia (2023), Pritchard, H.D. Asia's shrinking glaciers protect large populations from drought stress. Nature 569, 649–654 (2019)

06 About Us

hinrich foundation
advancing sustainable global trade

The Hinrich Foundation is a unique Asia-based philanthropic organization that works to advance mutually beneficial and sustainable global trade. It supports original research and education programs that build understanding and leadership in global trade.

HINRICH-IMD
Sustainable Trade Index 2023

The Hinrich-IMD Sustainable Trade Index (STI) measures the capacity of 30 major global economies to participate effectively and sustainably in trade. The 2023 Index points to the rising fragmentation of the global trade landscape.

Download the STI 2023 resources

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