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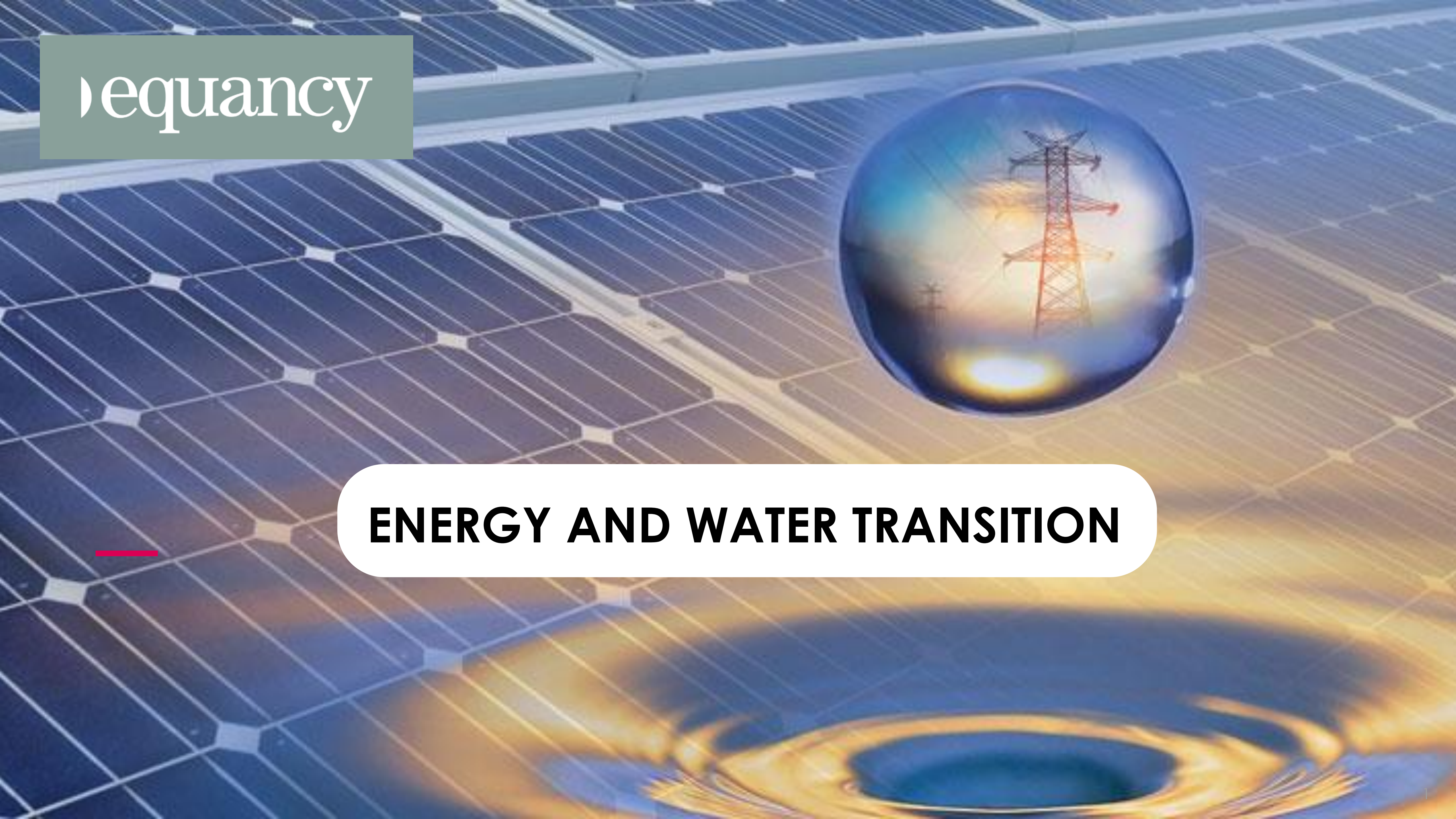


ENERGY AND WATER TRANSITION

I'm not going to talk today about energy transition solutions... what kind of energy needs to be developed, what are the ways forward.

I'm also not going to talk about water solutions for the global water shortage, which will become increasingly acute as a result of climate change.

What we do know is that energy requirements are set to rise sharply, and that we can probably save water and therefore reduce withdrawals.

Climate change is here and now, and energy transition away from fossil fuels is at the heart of climate solutions. Although the need for energy transitions is widely recognized, the role of water in those transitions needs more attention.

Thus, I would like to focus today on the role of water in the Energy transition.

Two critical, interdependent resources

Energy supply depends on water.
Water supply depends on energy.

The interdependency of water and energy is set to intensify in the coming years, with significant implications for both energy and water security.

Each resource faces rising demands and constraints in many regions because of economic and population growth and climate change.

Climate change will increase the water crisis…

The world has a water problem:

- **Nearly two-thirds of the world's population experiences severe water scarcity for at least one month each year**, and climate change will make water flows more erratic.

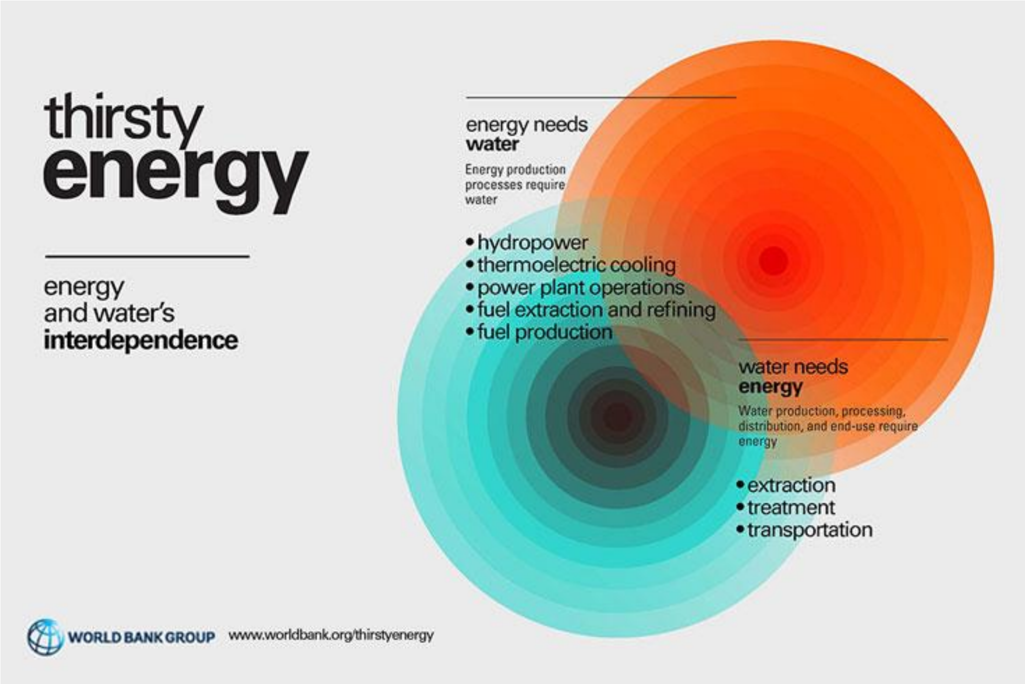
- **About a quarter of the global population does not have access to safe drinking water** and almost half lack proper sanitation services.

…and the energy sector needs to contend with it.

… and Energy is thirsty.

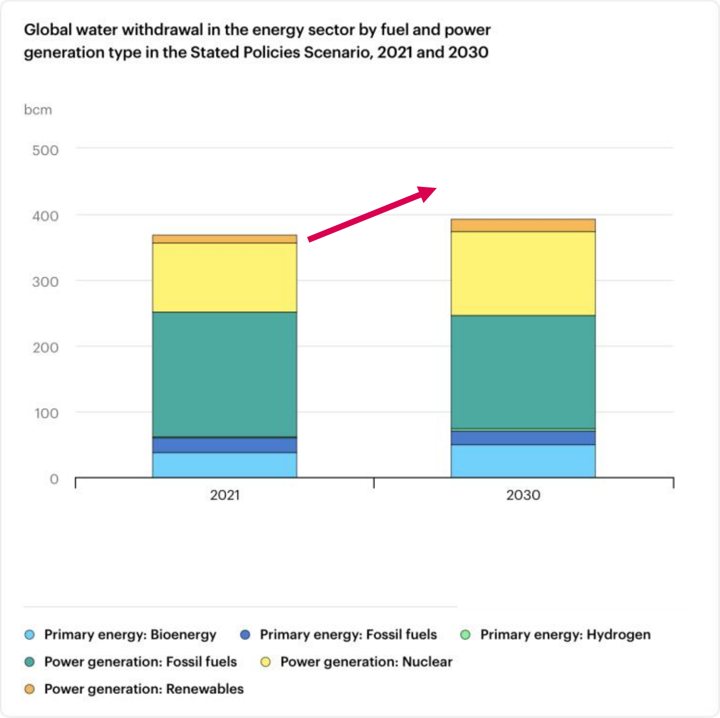
At the same time, **the global energy system used around 370 billion cubic metres (bcm) of freshwater in 2021**, or roughly **10% of total global freshwater withdrawals**. Water is essential for almost every aspect of energy supply, from electricity generation to fossil fuel production to biofuels cultivation.

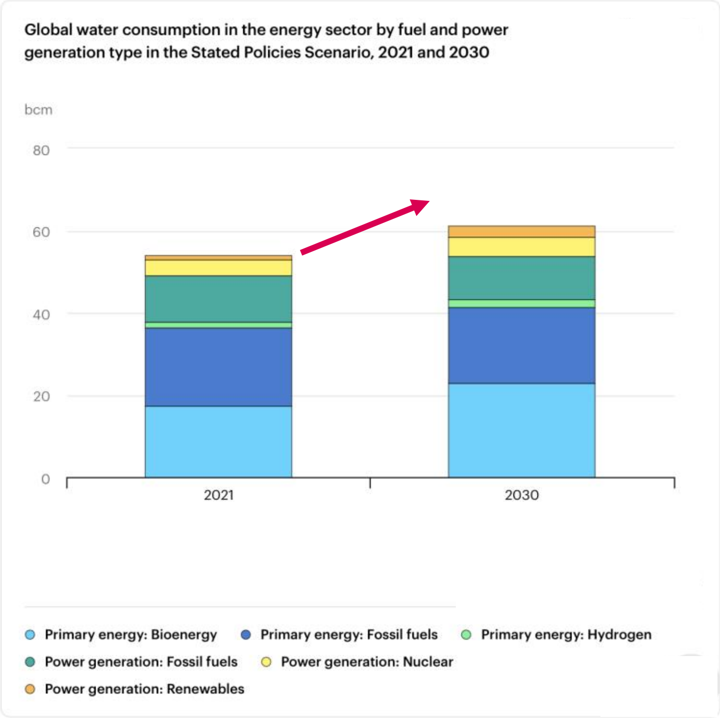
The choices we make for future energy pathways, the Energy transition, will have a major impact on our ability to achieve Sustainable Development Goals, including access to clean water and sanitation for all.



Energy is thirsty.

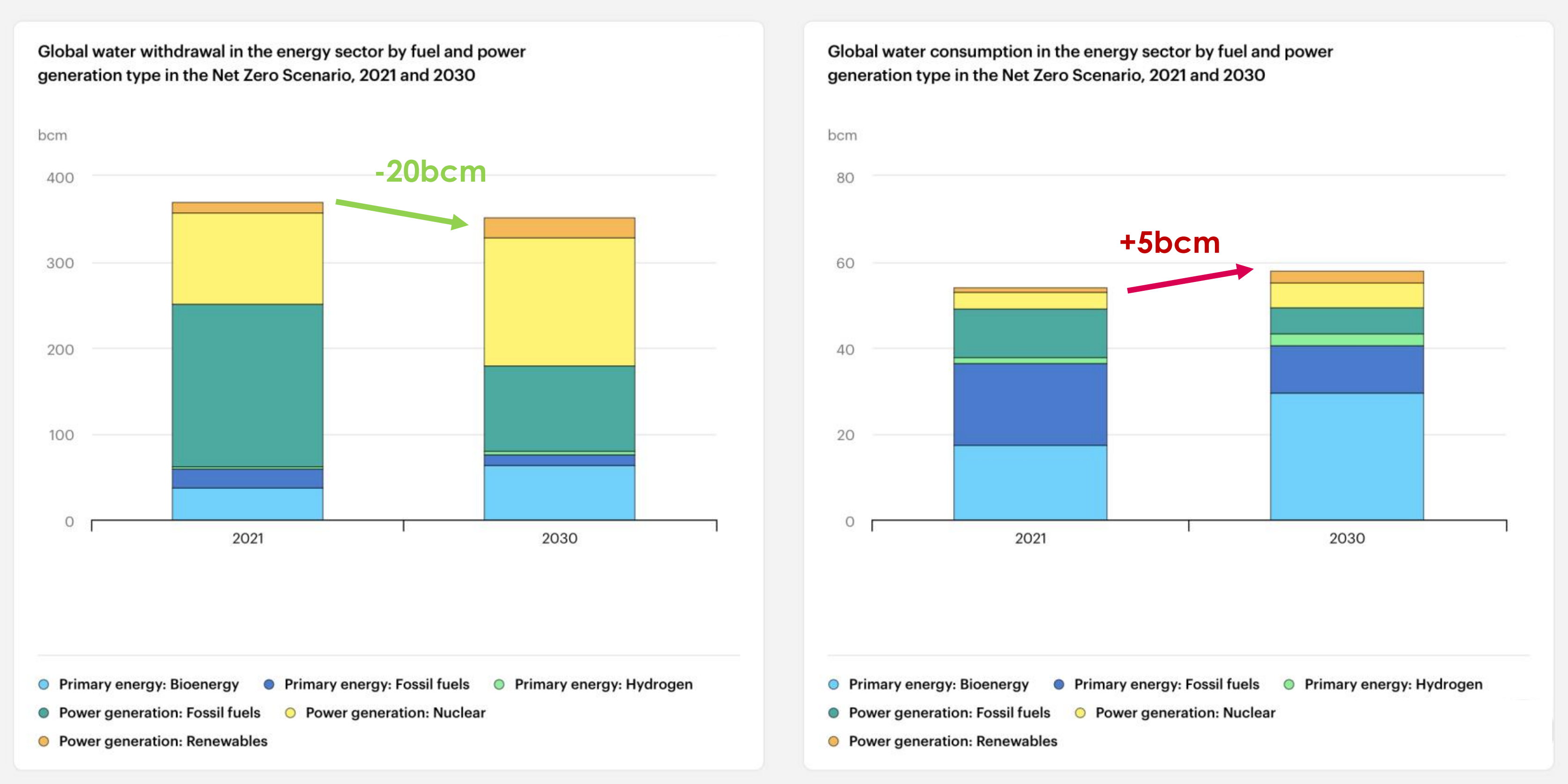
In the Stated Policies Scenario (STEPS), **energy's thirst for water continues to rise and reaches nearly 400 bcm by 2030**. This is mostly driven by a growth in **withdrawals for cooling nuclear power plants and to irrigate bioenergy feedstocks**. Some of this increase is offset by the shift from fossil fuels to solar PV and wind in the power sector.





Energy uses less water in a net zero emissions pathway

In the Net Zero Emissions by 2050 Scenario (NZE), water withdrawals by the energy sector decline by almost 20 bcm by 2030. The biggest reductions happen in the power sector, where withdrawals fall nearly 15% as coal-fired power generation is quickly replaced by solar PV and wind. **Greater energy efficiency** also plays an important role in reducing the volume of water needed to meet global energy demand. In this scenario, **water consumption increases by nearly 5 bcm from 2021 to 2030**.



Different pathways towards energy transition have different implications for water use.

Some low-emissions technologies such as biofuels, concentrated solar power, carbon capture or nuclear have high water requirements.
Without efforts to reduce water use in these technologies as well as in fossil energy supply, a pathway to lower emissions could exacerbate water stress or be limited by it.

Diminishing water needs for fossil energy are more than offset by **higher water use for bioenergy production**. While bioenergy supply increases by around 85%, related water consumption grows a slower 70%, mostly due to increasing use of organic waste and forest and wood residues, which have lower water requirements.

Different pathways towards energy transition have different implications for water use.

Water is also an important consideration for hydrogen. We estimate that current hydrogen supply consumes around 1.5 bcm of freshwater, less than 5% of the total consumed by the energy sector.
In the NZE Scenario, **a rapid growth in hydrogen production doubles this to about 3 bcm by 2030 (around 5% of the total).**

Meanwhile, the average volume of water consumed per tonne of hydrogen made from electricity decreases by over 25% due to a growth in wind and solar PV generation.
The production of electrolytic hydrogen in renewable-rich but water-stressed regions requires careful assessment, and in these places the use of desalination plants could help to limit the depletion of freshwater resources.

Water stewardship is critical for energy security

The power sector is particularly vulnerable to growing water stress, and increasing water shortages in dry regions are a major source of concern for energy security.
Hydropower generation could decline significantly in regions where water flows are likely to decrease, such as southern Europe, North Africa and the Middle East.

Fluctuations in hydropower output have already exacerbated the global energy crisis: **lower hydropower availability in Latin America in 2021 led to increased demand for liquified natural gas**, contributing to early pressure on natural gas prices. In 2022, a very poor year for hydropower in southern Europe added to the strains on gas and electricity markets caused by Russia’s invasion of Ukraine and the related cuts to pipeline gas deliveries.

Thermal power plants often require water for cooling. France’s Chooz nuclear power plant was closed for around two months when a severe drought hit in 2020, and several other plants had to reduce output in 2022 due to lack of cooling water.

Saving water or using water recycling for energy security

Some energy producers are turning to alternative water sources and water recycling to help reduce freshwater constraints.

There is also significant scope to lower water use by **improving the efficiency of the power plant fleet and deploying more advanced cooling systems for thermal generation**.

➔ An integrated approach to energy and water management can help reduce risks on both fronts. Energy and water stewardship should go hand in hand.

Many of the clean technologies being deployed to provide electricity can also be used to to help reduce freshwater constraints.
Mini-grids can power filtration technologies, such as reverse osmosis systems, to produce clean drinking water.
Also, water services can provide an "anchor load" for power generation and assist with balancing and storage. For example, irrigation can be shifted to periods of low electricity demand, while pumping to storage facilities can be reduced during demand peaks.

AI will accelerate the energy transition and will help to manage water stewardship

To-date, most of the energy sector’s transition efforts have focused on hardware: new low-carbon infrastructure that will replace legacy carbon-intensive systems.

Relatively little effort and investment has focused on another critical tool for the transition: **next-generation digital technologies, in particular artificial intelligence (AI).**

These powerful technologies can be adopted more quickly at larger scales than new hardware solutions, and can become an essential enabler for the energy transition.

Three key trends are driving AI's potential to accelerate energy transition in a sustainable way

1. Energy-intensive are at the beginning of historic decarbonization processes. Achieving net-zero emissions will require between $92 trillion and $173 trillion of infrastructure investments by 2050 ➔ **Even small gains in flexibility, efficiency or capacity in clean energy and low-carbon industry can therefore lead to trillions in value and savings**.

2. As electricity supplies more sectors and applications, **the power sector is becoming the core pillar of the global energy supply**. Ramping up renewable energy deployment to decarbonize the globally expanding power sector will mean more power is supplied by intermittent sources ➔ **new demand for forecasting, coordination, and flexible consumption to ensure that power grids can be operated safely and reliably**.

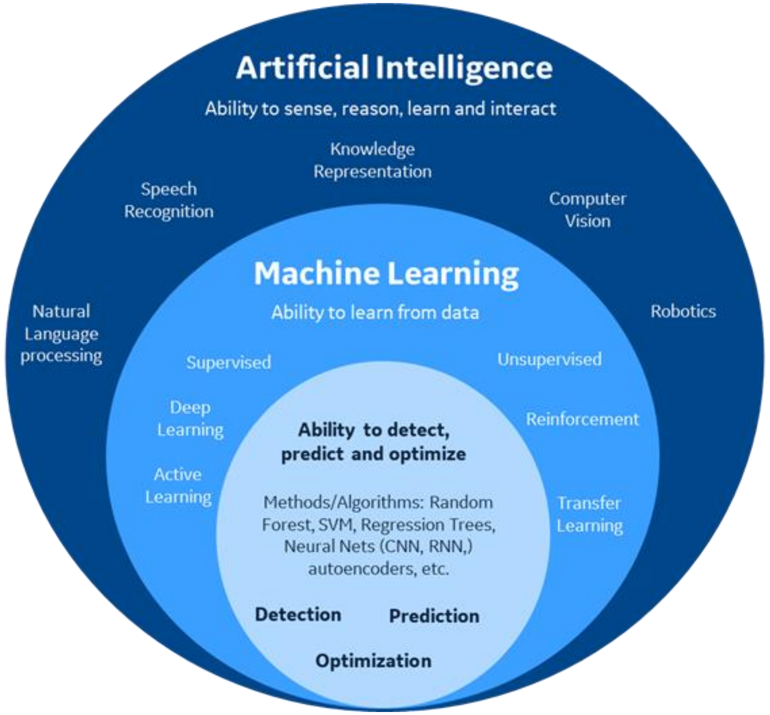
3. The transition to low-carbon energy systems is driving the rapid growth of distributed power generation, distributed storage and advanced demand-response capabilities ➔ need to be orchestrated and integrated through more networked, transactional power grids.

Navigating these trends presents huge strategic and operational challenges

This is where AI comes in:

- **by creating an intelligent coordination layer across the generation, transmission and use of energy,**
- **by helping energy-system stakeholders identify patterns and insights in data,**
- **by learning from experience and improve system performance over time,**
- **by predicting and model possible outcomes of complex, multivariate situations.**

AI is already proving its value to the energy transition in multiple domains, driving measurable improvements in renewable energy forecasting, grid operations and optimization, coordination of distributed energy assets and demand-side management, and materials innovation and discovery.



More AI is needed to achieve a sustainable energy transition

But while AI's application in the energy sector has proven promising so far, **innovation and adoption remain limited**.

This represents a tremendous opportunity to accelerate the transition to the **water-saving**, **highly efficient giving up with fossil fuels and interconnected energy system** we'll need tomorrow.