

We are *not on track* to meet the Paris Agreement's objectives. What should we do?

World Energy Markets
Observatory 2024 | 26th Edition

Capgemini 

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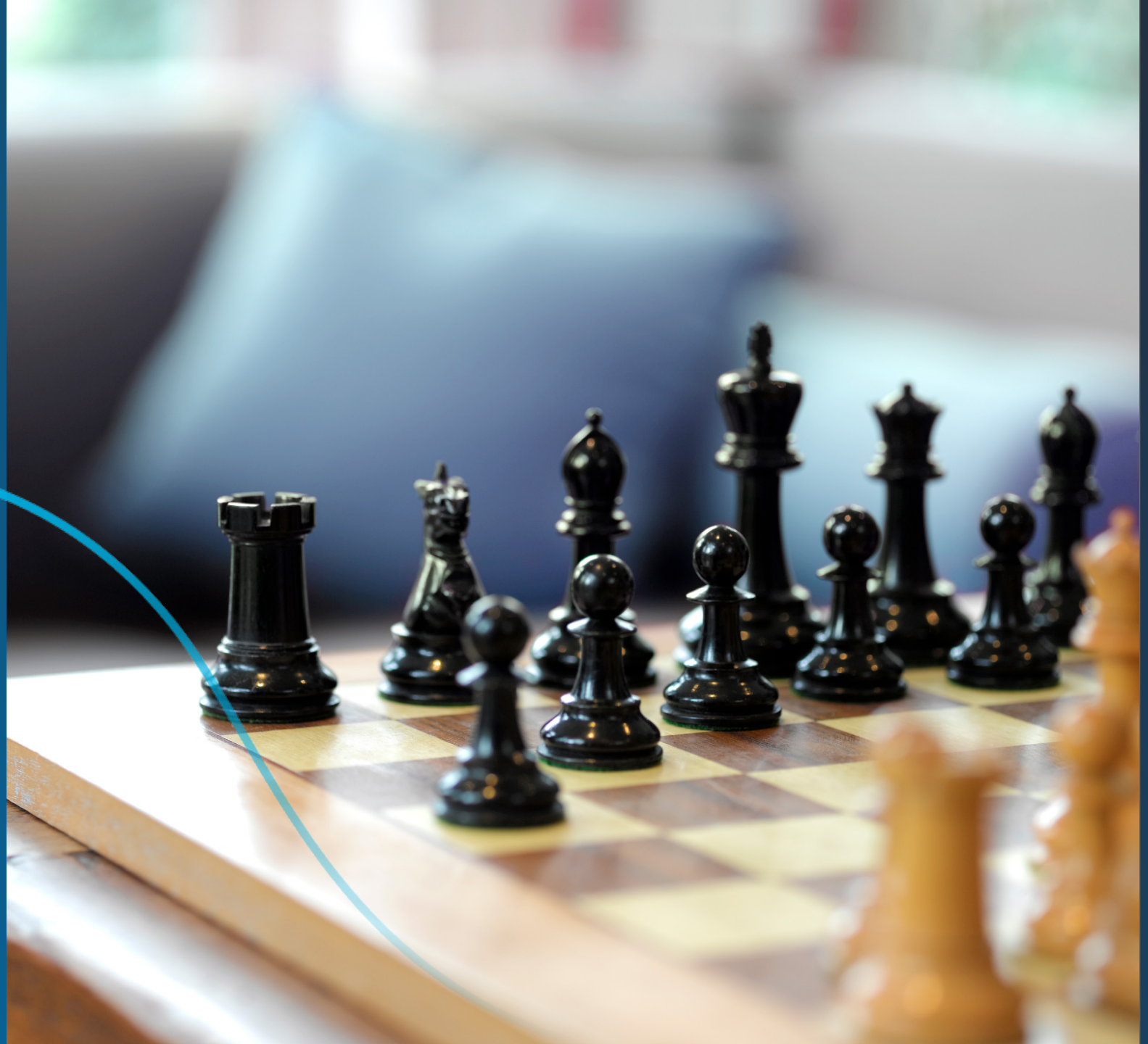
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*Geopolitical
impacts*
will maintain
uncertainty in
energy markets





Philippe Vié

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Philippe has led the Capgemini Energy sector and now serves as an advisor for Capgemini, as well as large utilities or equipment suppliers. Philippe has been observing the market for many years and has sponsored the WEMO survey for more than a decade.

1. Not a day passes without news about physical or cyber energy infrastructure attacks.
2. In response, sovereignty measures are being taken daily by regions and countries to protect against geopolitical tensions or market uncertainties.
3. In 2024, there are many national elections, the results of which can impact the country's energy transition strategies.
4. Key questions include:
 - What are the actual situations and threats on the energy systems?
 - How are states and players managing these risks?
 - What are the consequences, notably on supply chain, continuity of energy supply and energy prices?
 - How should we move forward fast enough to decarbonate the planet with such uncertainties?
 - How do we achieve a fair and balanced path to decarbonization while also achieving both sovereignty and affordable energy prices?

Geopolitical events and uncertainties will impact the pace at which we can decarbonize the energy system, as more money is diverted to ensuring sovereignty and security of supply.

Introduction

The world needs certainty to build large energy assets. Growing and decarbonizing energy systems to meet demand means building large electricity assets, such as power plants, energy storage systems, and energy infrastructures. Large asset construction requires policies and regulation stability, supply chain continuity, and the ability to secure private and public funding, which annually requires trillions of dollars in investments. Demand-side flexibility is also becoming critical as use of intermittent renewable generation grows, which needs positive consumer engagement enabled by governments.

However, the world is currently facing conflicts, such as Russia's invasion of Ukraine and the Israel-Hamas conflict, where energy assets are frequently targeted. Additionally, tensions between China and the USA are leading developed countries to implement energy sovereignty measures, often using the U.S.'s Inflation Reduction Act as a model.

Finally, elections taking place this year in many countries highlight different black and green energy visions from the candidates, which also leads to uncertainty.





Wars are impacting energy systems

- Physical and cyberattacks on vital energy systems are becoming more and more frequent.
- Energy and utilities players are reinforcing physical and cyber protections.
- Governments and regulators are acting to put requirements for protections in place. For example, the European Union Network and Information Security 2 (NIS2) policy requires increased levels of cybersecurity across sectors.

The economics of energy are becoming more volatile

- Costs of borrowing are increasing for energy players, where costs for large clean tech assets (renewables, nuclear, hydrogen, grids, batteries) represent about 80%+ CAPEX, 20%- OPEX.
- Commodities and equipment prices are becoming more volatile and are generally increasing.
- Investment payback uncertainties are slowing down investment decisions (FIDs) and project development, leading to slightly higher energy costs to consumers and a slower path to decarbonization.

Sovereignty is becoming a priority

- Concentration of energy technologies and resources in China: China now leads all low-carbon technologies markets, thanks to a very large domestic market combined with low labor costs and protectionist policies.
- Energy markets principles to encourage inward investment must be reinvented; they must also encourage flexibility to balance renewables.
- Protectionist measures are being developed in the USA and Europe.



Tensions, threats and uncertainties

Attack multiplication, physical and cyber

Physical attacks



Kakhovka Dam (2023/06)



Nord-stream II (2022/09)

Cyberattacks (extract)

- 2015/12: Ukrainian electric network hacked by Russia.
- 2018/03: The U.S. Department of Homeland Security revealed that Russia was regularly penetrating its energy network since 2017.
- 2024/01: Schneider Electric's sustainability business division experienced a ransomware attack and data breach.
- 2023: Iranian gas stations network hacking.
- 2023/08: The monespaceprime.engie.fr website, managed by an Engie subcontractor, experienced a data breach. The personal data of 110,000 clients was stolen.
- 2022/03: In Germany, remote maintenance of wind turbines was compromised after the KA-SAT network, operated by the American company Viasat, was attacked by Russia.
- 2021/07: Hackers infiltrated the IT systems of the U.S. Colonial Pipeline, a network spanning 8,850 kilometers that transports 2.5 million barrels per day. As a precaution, Colonial shut down the pipeline following the ransomware attack, which was launched by the DarkSide gang.
- 2017: Hackers used the Triton virus to remotely take control of the security systems of a Saudi Petrochemicals plant and shut it down.
- 2022: A large-scale cyber-espionage campaign targeting Chinese gas fields and offshore parks has been carried out by the cybercriminal group TA423.
- 2024/02: The hacktivist group LulzSec has claimed responsibility for stealing data from EDF's retail branch, affecting 500,000 B2B and B2G client accounts. EDF has confirmed about 20 unauthorized client access incidents and has advised these clients to change their account access details.

Energy & Utilities sector reports that hacktivists (69%) and state-sponsored actors from foreign powers (62%) pose a greater cyber threat than criminals, terrorists, or vandals.





EDF European net zero scenario: a pivotal step towards energy sovereignty and net zero Emissions in Europe (1/2)



Catherine Bauby

EDF Group Strategy Director

Since more than 20 years, Catherine has held many management positions in the EDF Group, including transformation director for the finance direction. Catherine is also board member of Enedis and UFE.



EDF European net zero scenario for 2050. Balancing decarbonization, sovereignty and competitiveness

Being net zero by 2050 in Europe is a given for EDF, which has published this spring 2024, its recommended technico-economically optimized energy transition scenario. Europe is starting from a final energy consumption of ~60% fossil fuels, mostly imported, and 20%+ electricity, with a still carbonized electricity mix (coal and gas power plants). The EDF scenario relies on two main pillars:

“Consume less, consume better” by:

- changing behaviors (10%)
- electrifying energy uses (60%)
- being energy efficient (30%)

-40% final energy demand vs 2021

Central role of electricity

- 60% final energy demand coverage (from 20%+ today)
- a fully decarbonized electricity mix made of renewables (77%), nuclear (16%), and decarbonized thermal

100% decarbonized electricity to cover 60% of the energy demand

With this share of intermittent and distributed electricity generation, developing grids and enabling enough flexibility at various time scales (from intraday to seasonal) are critical.

Governments have a key role to enable any optimized net zero scenario. It includes :

- Aligning policies on what is required : heat pump and EV fast development for instance.
- Also supporting large assets investments in renewables, nuclear, grids and storage notably.
- Setting CO₂ meaningful price signals, and reinvesting collected climate taxes to support vulnerable consumers and industries competitiveness.



[To discover more about EDF net zero scenario](#)

EDF European net zero scenario: a pivotal step towards energy sovereignty and net zero Emissions in Europe (2/2)



What should Europe do to increase its energy sovereignty?

The EDF net zero scenario brings sovereignty:

- **Fossil fuels**, mostly imported, are declining in the energy mix from 63% today to about 4% gas CCS-equipped.
- **Electricity** produced locally in the 2050 mix, covering 60% of energy demand.
- Europe has the potential to maintain or strengthen its industrial leadership in several key technologies: nuclear energy, wind turbines, heat pumps, and electrolyzer factories now, and battery gigafactories in the near future.

Industrial issues:

Europe depends on imports, particularly from China, for certain technologies and resources like solar panels and critical raw materials. However, it has the potential to boost its resilience in the future, for example, through recycling initiatives as proposed by the European Critical Raw Materials Act.

The Energy Transition presents a significant development opportunity for European industry, provided it is supported by proactive industrial policies at the European level. This includes the effective implementation of the NZIA package and strong support for European champions in the energy sector—companies need to be large enough to compete internationally. This approach requires an evolution of current European competition policies.

Finally, **the energy technologies industries are creating jobs between now and 2050, including:** 530K total FTEs for nuclear; 320K for offshore wind; 650K for solar; 160K for heat pumps; 150K for batteries in the 2030s, and many more for electrolyzers, gigafactories, and electric grids.





Tensions, threats and uncertainties

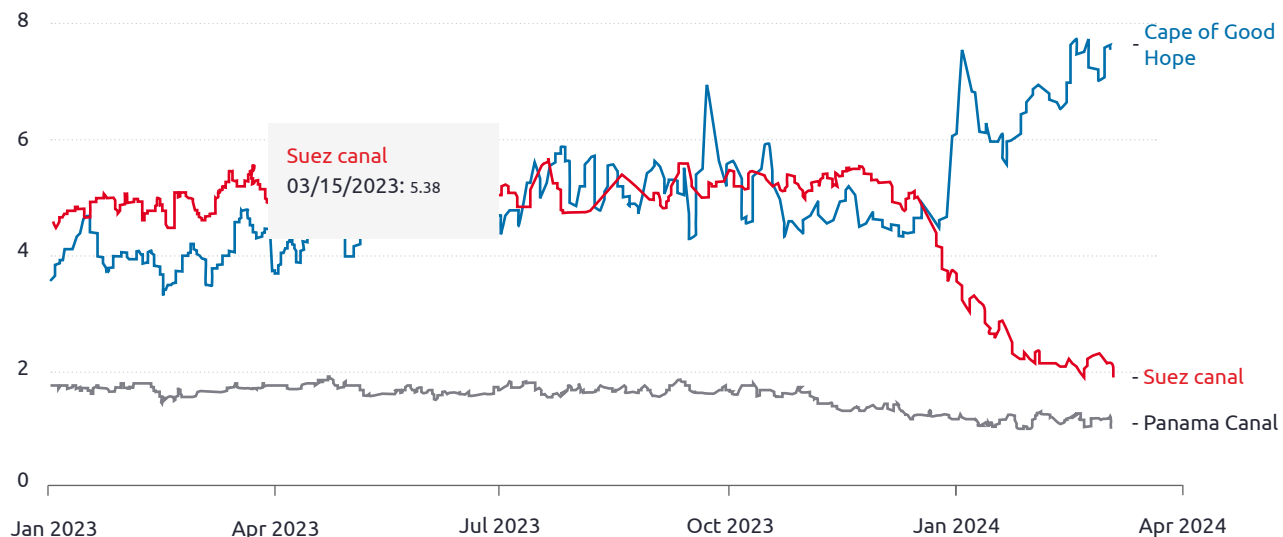
Supply chain disruptions

Attacks in the Red Sea are disrupting the LNG supply chain and increasing slightly the gas transportation price.

FIGURE 1

Daily transit trade volume

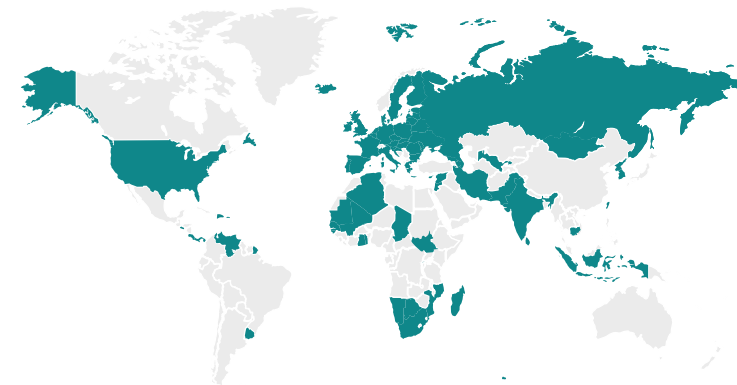
(million metric tons, 7-days moving average)



Source: UN Global Platform, IMF PortWatch

Elections could influence the energy policies

National elections are scheduled or expected in at least 64 countries in 2024, as well as the European Union, which together represent almost half of the global population.



Source: <https://time.com/6550920/world-elections-2024/>

Politicians are generally elected for 4 to 5 years and have the power to completely shift energy policies, when an energy asset lifetime is counted in multiple decades. And their planning and construction may take 10 to 20 years.



Sovereignty initiatives and impact on final prices

The 2022 **Inflation Reduction Act** in the USA aims to boost low-carbon energy and the American economy, with support exclusively for USA-based companies. The goal is also to lower local energy prices, though there are ongoing debates about the actual impact of this regulation on electricity price reductions. Additionally, the USA has implemented taxes to curb the influx of Chinese electric cars and diminish the competitiveness of Chinese solar panels.

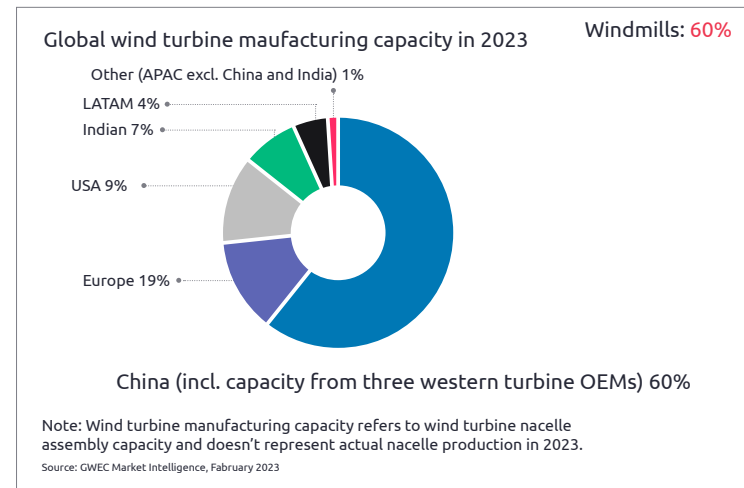
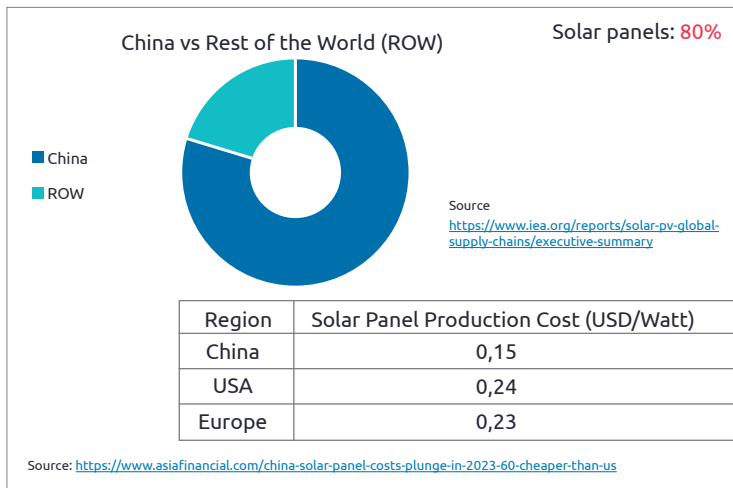
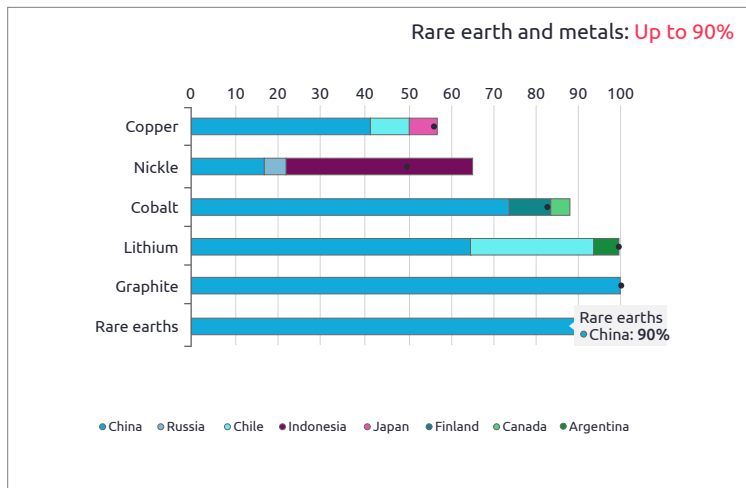
- Europe has voted on many regulation packages devoted to climate change, energy and industry, notably:
- **Fit for 55** (decarbonation)
- **Net zero Industry Act** (revitalizing European industry from a climate change perspective)
- REPowerEU (managing the Ukraine/Russia war consequences and securing European energy supply)
- **Energy Market Reform**

Europe is more advanced than the USA in terms of energy transition. However, the USA is showing the way forward as it relates to **sovereignty**. The USA, which is largely self-sufficient and even an exporter of fossil fuels, is successfully attracting low-carbon projects such as gigafactories. In contrast, European sovereignty measures, which are significantly less robust than those in the USA, are likely to result in higher energy prices for consumers.





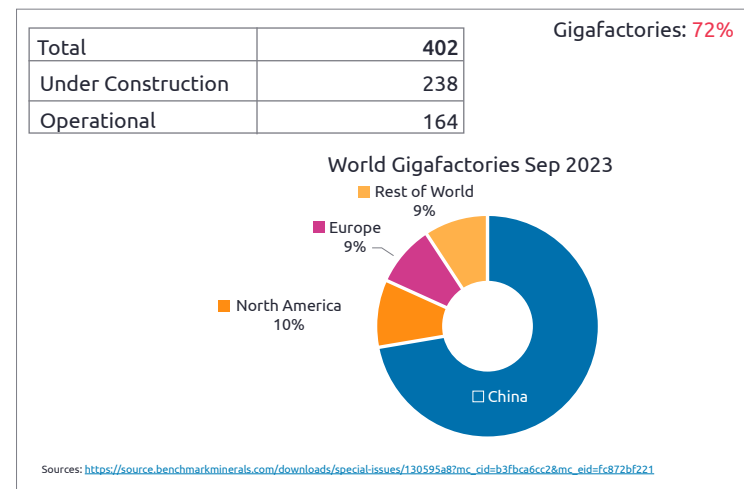
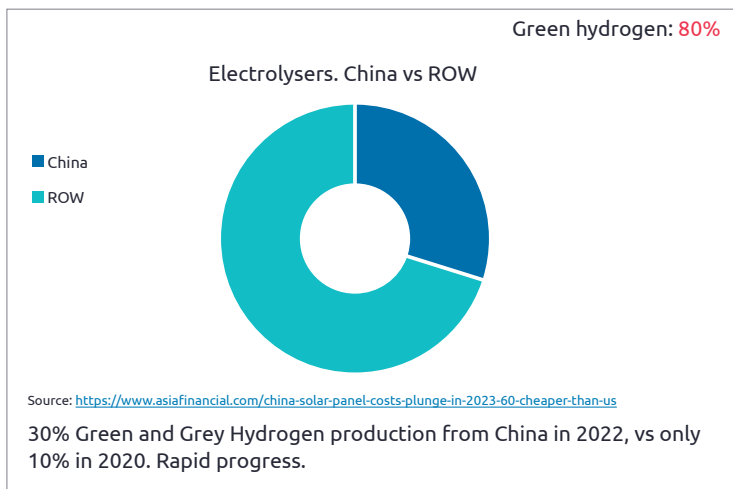
China's dominance in low-carbon technology is so significant that the world relies on China for the energy transition.



Nuclear 3rd generation reactors

Country	Units	Status	Chinese tech?
China	2 (Taishan 1 and 2)	Operational	Yes
France	1 (Flamanville 3)	Under construction	No
Finland	1 (Olkiluoto 3)	Operational	No
UK	1 (Sizewell C)	Planned	No
UK	1 (Hinkley Point C)	Under construction	No

3rd generation technology (EPR) dominating up to now is coming from French EDF and AREVA. China currently has the second-largest nuclear fleet across all generations (after the USA and ahead of France) and is on track to become the largest in the near future.





Energy conservation and flexibility have been forgotten

Expanding large assets to ensure sovereignty is only one side of the coin. Building new assets comes with costs, which ultimately affect the customer's bill. Reducing energy consumption through extensive conservation programs and efficiency measures is a clear strategy to limit demand and the need for capital expenditures. Recent experiences, particularly with price increases due to the Russia-Ukraine conflict, have demonstrated conservation results ranging from **10% up to 30%** in optimal conditions.

Flexibility is another issue that can limit assets development. Flexibility varies from one location to another, depending on the demand (on public grids), the generation potential reserves (gas plants, hydro dams, etc.), the processes interruption or shifting reserves, as well as the storage capacities. Here also, a peak shaving potential can go up to 15%, combining the three major levers of customer participation, tariff signals and automation, in an aggregated perspective. This enables use of distributed and small resources.

Enough compensated capacity markets are to be organized.

Flexibility means new services enabled by system operators and regulation rules and tools, such as capacity markets. These services must be integrated for capacity reserve mechanisms, procurement, use and remuneration of capacity. There are no silver bullets here—only the willingness of authorities to get and set appropriate remuneration. Each market will have its own customized solutions.

Our Convictions

- Geopolitical tensions will continue, resulting in uncertainty remaining in energy systems and markets.
- A tough balance needs to be found between energy sovereignty (independence) and affordable energy for customers in an accelerated net zero pathway.
- All levers are necessary to fight against climate change:
 - Clear and stable policies are critical for new energy asset development, at least at the regional level, and must be rock solid;
 - Energy system long-term planning is highly recommended, with government support;
 - Energy conservation and flexibility are becoming crucial.
- It's important to put in place mechanisms and tools to:
 - Stimulate investments in the chosen dimensions (long-term contracting mechanisms, CfD for instance, public support);
 - Enable energy conservation and flexibility;
 - Support market relevant principles (wholesale, flexibility, carbon markets) preventing price volatility and a significant shift from local reality to prices formation
- Acceleration innovation in energy technologies is essential – wind, solar, smart grids, and batteries.

About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2023 global revenues of €22.5 billion.

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