



What if energy was limitless,  
at room temperature?

# Energy Without End 2.0<sup>m</sup>

GenAI

## UNCERTAINTIES

Systems, Technology

## MEGATREND (Most significant)

Energy Boundaries

## TRENDS

Cross-Sectoral Partnerships  
Government Agility  
Mobilising Innovation  
New Materials  
Transforming Energy

## TECHNOLOGIES

Advanced Computing  
Next-Gen Energy

## SECTORS IMPACTED

All Sectors

## KEYWORDS

Deuterium  
Energy Demand  
Energy Security  
Nuclear Fusion  
Renewable Energy

Within Reach

Transitional

Visionary

Breakthroughs in room-temperature fusion offer unlimited, sustainable and clean energy, transforming the global energy landscape.

<sup>m</sup> This opportunity builds on Opportunity 6 in the 2022 edition of The Global 50 report.





## WHY IT MATTERS TODAY

In 2023,

# 750 million

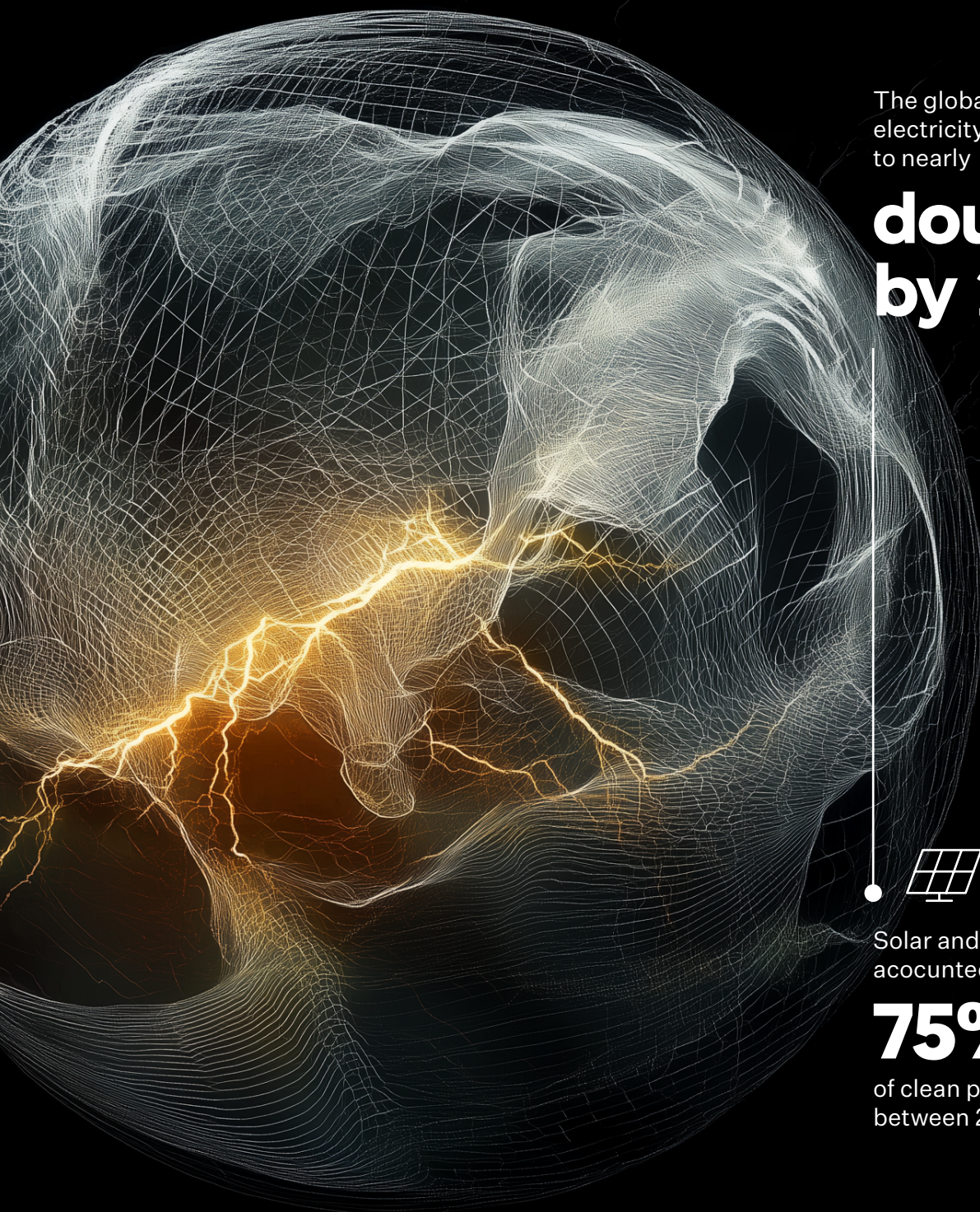
people still lacked access  
to electricity



Energy security – from diversified sources – is a global priority. The global demand for electricity is expected to nearly double by 2050, reaching 50,000 TWh (from 26,000 TWh in 2023).<sup>1120</sup> Between 2010 and 2030, solar photovoltaic and wind energy grew 40 times and 6 times respectively,<sup>1121</sup> while renewables have increased by 3% per year since 2013 globally.<sup>1122</sup> Nuclear power currently provides 9% of global electricity supply, with more nuclear reactors also under construction.<sup>1123</sup> Additionally, small modular reactors are being considered, with the first projects outside China and Russia set to be implemented from 2030.<sup>1124</sup>

Global inequality is exacerbated by energy poverty. In 2023, 750 million people still lacked access to electricity.<sup>1125</sup> In Europe alone, between 50 million and 125 million people are living in energy poverty, highlighting the significant scale of this issue even in wealthy regions.<sup>1126</sup>

Technology is at the heart of the future of energy.<sup>1127</sup> From the Internet of Things (IoT) and big data to AI and renewable energy systems, technology is critical for improving energy infrastructure quality and sustainability.<sup>1128</sup> At the same time, while AI (for example) can optimise approaches to the sustainable energy transition, the computational power needed for AI doubles approximately every 100 days, with the energy demand expected to surpass Iceland's 2021 usage by 2028.<sup>1129</sup>



The global demand for electricity is expected to nearly

**double  
by 2050**



Solar and wind energy accounted for

**75%**

of clean power growth between 2010 and 2023



## THE OPPORTUNITY



### BENEFITS

Decentralised energy production; abundant clean energy; off-grid energy availability; support for remote and disaster-affected areas; potential propulsion system for space exploration.



### RISKS

Engineering feasibility and stability; complexity of safety mechanisms; economic scalability; unforeseen environmental impacts; inequitable global implementation.

In October 2024, the National Aeronautics and Space Administration (NASA) announced progress towards nuclear fusion at room temperature.<sup>1130</sup> Fusion – the bringing together of hydrogen atoms – has the potential to provide unlimited energy through reactions without hazardous materials such as plutonium or uranium. While fusion reactions are initiated at temperatures exceeding 100 million degrees Celsius,<sup>1131</sup> achieving this reaction at room temperature would be significant, eliminating barriers that currently make fusion a challenge to achieve.

Replicating the process found in the Sun, deuterium atoms – a special form of hydrogen that is abundantly found in seawater – fuse together to generate a massive amount of energy.<sup>1132</sup> NASA's recent achievement was through irradiating with gamma rays deuterium that was densely packed within a specially treated metal lattice.<sup>1133</sup> A single gram of deuterium–tritium fuel could generate energy equivalent to 2,400 gallons of oil,<sup>1134</sup> i.e. nearly 95 MW of power,<sup>1135,n</sup> roughly equivalent to the average annual capacity produced by nearly 28 wind turbines in the United States in 2023.<sup>1136</sup>

**Replicating the process found in the Sun, fusion reactions initiated at room temperature** have the potential to provide unlimited energy at room temperature instead of temperatures exceeding 100 million degrees Celsius

<sup>n</sup> 1 barrel of crude oil = 42 gallons = 5,689,000 Btu; 1 kW of electricity = 3,412 Btu; 1 MW = 1,000 kW.