



OPPORTUNITY

17

SCOPE VISIONARY

UNCERTAINTIES

Technology, Nature

MEGATRENDS

Pushing the Boundaries of Energy

TRENDS

Transforming Energy  
Mobilising Innovation  
Net zero  
New Materials

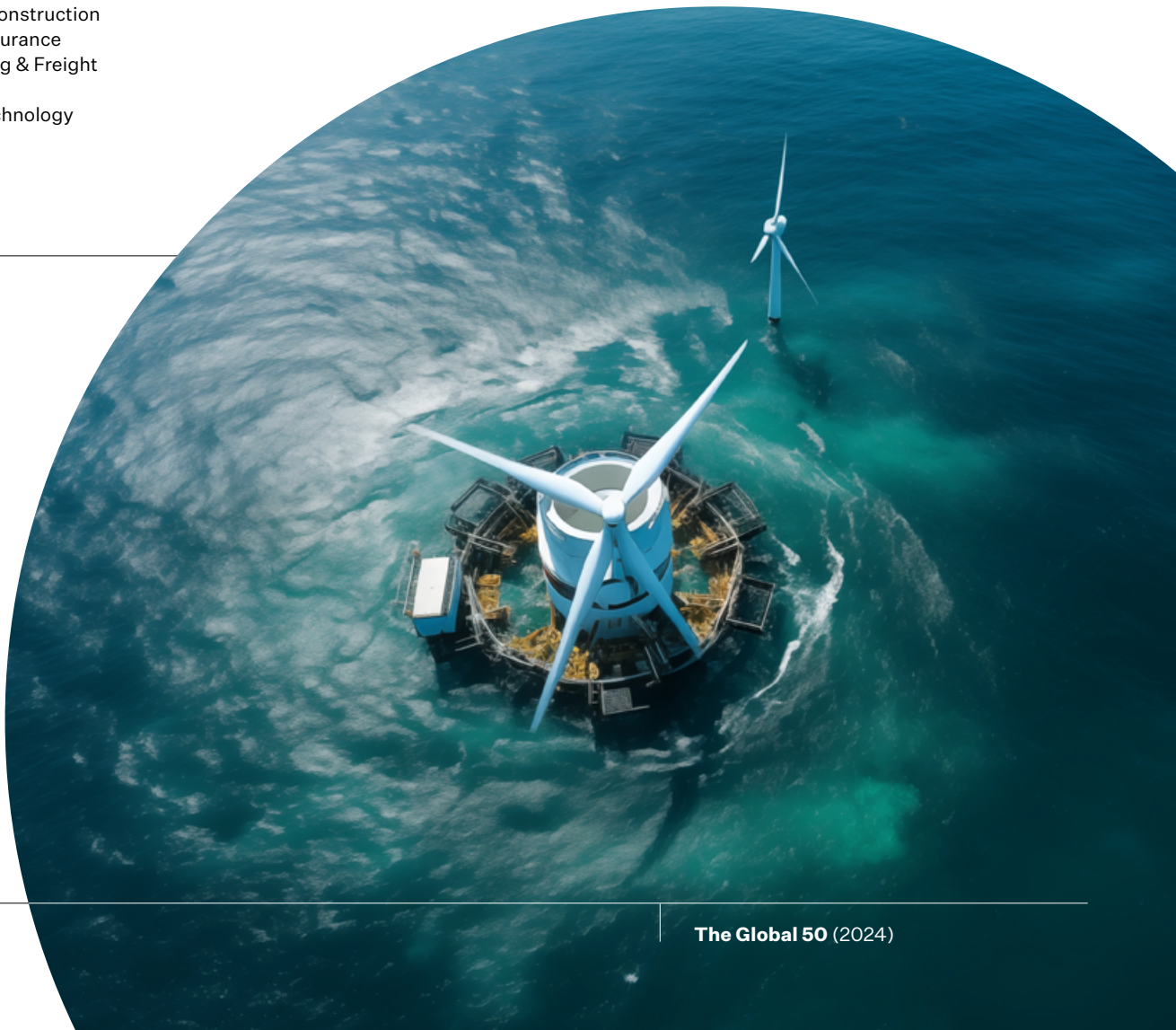
SECTORS IMPACTED

Agriculture & Food  
Consumer Goods, Services & Retail  
Energy, Oil, Gas & Renewables  
Financial Services & Investment  
Infrastructure & Construction  
Insurance & Reinsurance  
Logistics, Shipping & Freight  
Manufacturing  
Materials & Biotechnology  
Metals & Mining  
Real Estate  
Travel & Tourism  
Utilities

What if tidal energy took over solar and wind?

# TIDALS OF ENERGY

Advances in turbine technology with advanced machine intelligence enhance tidal energy's cost-effectiveness and its resilience against rising sea levels, making it a sustainable and scalable power source.





## WHY IT MATTERS TODAY

Over 2.4 billion people around the world live within 100km of the sea.<sup>453</sup> Depending on the scenario,<sup>M</sup> global electricity demand is expected to rise by between 75% and 150% by 2050<sup>454</sup> to nearly 41,508TWh per year.<sup>455</sup> System flexibility is essential to meet that demand, a challenge for just solar and wind power, for which intermittence is a problem without massive advances in storage solutions.<sup>456</sup>

Tidal energy generators convert energy from tides into electricity.<sup>457</sup> The gravitational effects of the sun and the moon, the Earth's rotation, and the structure of the continental shelf result in semi-diurnal or diurnal tides, with typical water-level ranges of up to 12m, creating a continuous source of energy.<sup>458</sup> Like wind turbines, tidal turbines placed in tidal streams use rotating blades to generate electricity,<sup>459</sup> but unlike wind or solar, tidal energy generation is predictable and not dependent on weather conditions.<sup>460</sup>

However, the cost of tidal energy per unit is currently a multiple of solar or wind costs.<sup>461</sup> Building and maintaining tidal capacity at sea is more expensive than wind.<sup>462</sup> Tidal energy technologies today use tidal streams, dams or lagoons. New designs, such as dynamic tidal power,<sup>463</sup> which uses long tidal dams (30km to 60km), have bidirectional turbines that can double generation capacity. Long dams also require less tidal variation, making them suitable for more sites.

<sup>M</sup> Existing policies stated by governments (STEPS), the ambitious scenario of achieving net zero by 2050 (net-zero emissions), and announced pledges (APS) – see the IEA for further descriptions.



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## OPPORTUNITY

A combination of advanced machine intelligence and advances in turbine and transmission technologies can improve the cost-effectiveness and deployability of tidal energy generators. In addition to tidal energy's potential as a niche renewable energy source, particularly for coastal areas, these systems are engineered to be resilient to rising sea levels.

While some research shows that sea-level rises could impact on tidal power sites,<sup>464</sup> advanced machine intelligence could also better inform site selection. Lightweight, high-strength, and corrosion-proof materials,<sup>465</sup> combined with improved efficiencies in underwater cable conductivity, ensure that tidal energy infrastructure is affordable, scalable, and future-proof.

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## BENEFITS

Tidal power provides constant energy and coastal protection, fostering employment, mobility, and sustainable development in global coastal communities.

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## RISKS

Poorly designed installations can impact on marine ecosystems and shift erosion patterns.

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