

## Renewable Energy:

# EMERGING TECHNOLOGIES AND INNOVATIONS

Collaboration with Harvard Consulting on Business and the Environment

## The Challenge



**1 in 10** people in the world are without electricity<sup>1</sup>, predominantly in Africa and rural areas.



**17.7%** is the mere share of renewable energy in total energy consumption.<sup>2</sup>



**8 million** people died from fossil fuel pollution in 2018.<sup>3</sup>



**~1 million** stillbirths a year can be attributed to fossil fuel pollution.<sup>4</sup>

## Key Takeaways

After reading this brief, you will know more about

- The challenges, including pollution, are posed by the current energy system
- What opportunities arise in the job market and humanitarian sector through renewable energy
- Which innovations in the sector help advance the transition, such as solar textile or MGA blocks

## Context

SDG 7 of the 2030 Agenda for Sustainable Development calls to “ensure access to affordable, reliable, sustainable and modern energy for all”. SDG 7 lies at the heart of the Paris Agreement on Climate Change

The consumption of fossil fuels is driving environmental and climate crises globally and affecting people's health. An estimated 600,000 children under age 5 die each year from respiratory infections related to indoor and outdoor air pollution and second-hand smoke resulting from unsustainable energy practices.<sup>5</sup> The IPCC 2023 Synthesis Report predicts that major energy system transitions can result in rapid reductions in greenhouse gas emissions. But urgent action is needed now, the window of opportunity to enable climate-resilient development is narrowing rapidly.<sup>6</sup> Rapid advances in and proactive adoption of renewable energy technologies can reduce climate risks and greenhouse gas emissions (GHG)<sup>7,8</sup> and accelerate SDG 7 achievements.

# Findings

## Transitioning to our renewable energy futures

- Renewable energy is cheaper than fossil fuel in most countries. The International Energy Agency anticipates solar PV and wind will account for nearly 95 percent of global renewable capacity additions in 2027.<sup>9</sup>
- Researchers from Stanford University analysed the technical feasibility of energy transition in a range of different scenarios and geographies and concluded that energy for electricity, transport, and building heating or cooling can be supplied reliably with nearly 100 percent renewable energy at different locations worldwide.<sup>10</sup>

## Innovation

- Renewable energy technologies can be found across the **three horizons of innovation**. Horizon 1 technologies are immediate opportunities to be harnessed. Horizon 2 technologies (Next Generation) are at the proof-of-concept stage. Horizon 3 technologies are future possibilities where investment in early-stage research and development (R&D) is still needed.
- Innovations in the renewable energy sector are dominated by solar technologies, with a significant rise in patent applications for solar photovoltaics (PV) in the past decade.

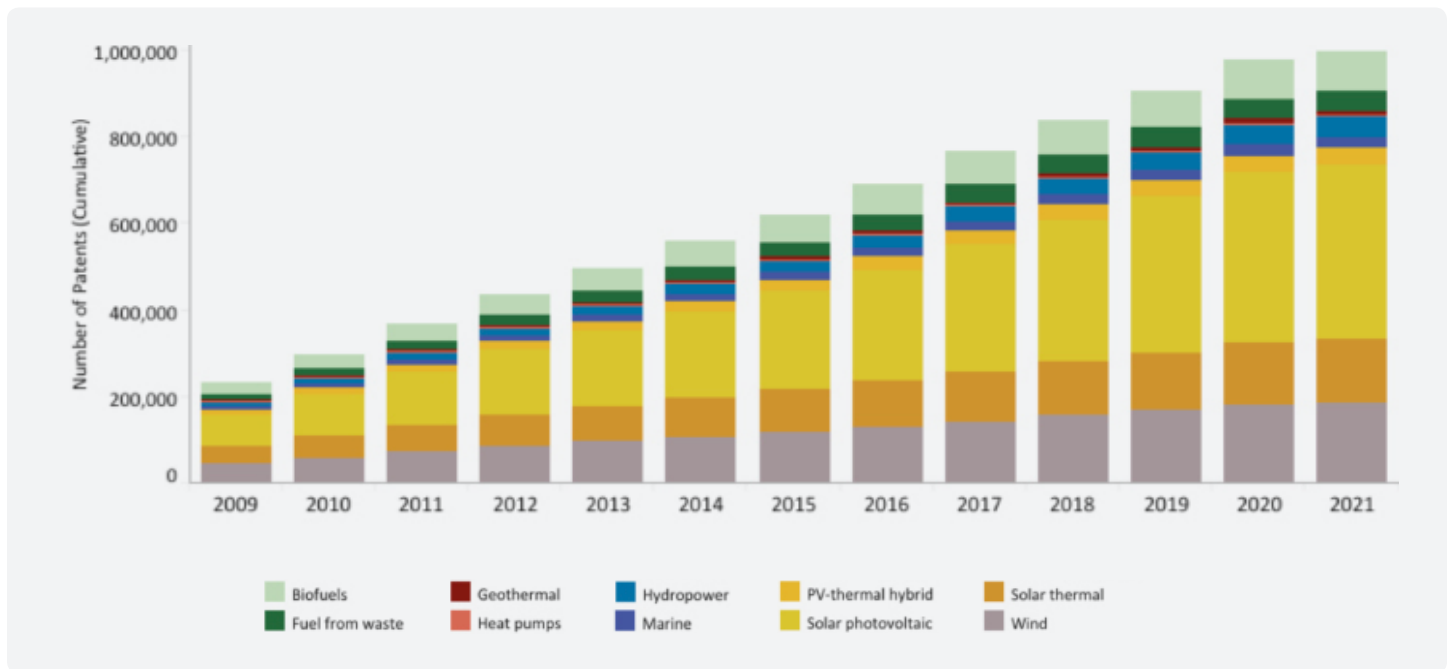


Figure 1 : Renewable Energy Patents November 2022

Source: IRENA INSPIRE ([www.irena.org/Inspire](http://www.irena.org/Inspire)) based on EPO PATSTAT 2021 Autumn edition, and on the Climate Change Mitigation Technologies (Y02) classification by EPO. ©IRENA

Note: This is not exhaustive information on patents filed for renewable energy worldwide and does not represent all inventive activity worldwide. Some inventors may choose to file individual patent applications.

## Innovation (continued)

- Solar cell technologies are the critical enablers for solar innovations. Emerging or third-generation solar cells such as perovskite cells are predicted to overtake silicon in the solar market in the coming decade and enable innovations such as solar textiles.
- Third-generation solar cells are remarkable because of their ability to make electricity that can be 'tuned' by controlling the kinds of molecules that are produced in the manufacturing process - a breakthrough in rapid energy transfer.<sup>11</sup>
- Distributed renewable energy systems, including off-grid and microgrids, are flexible, cost-effective, and modular alternatives to large-scale energy infrastructure for communities in Sub-Saharan Africa and South Asia that experience some of the world's biggest gaps in energy access.
- Quantum computing's predictive analytics capabilities can help solve the complex optimization problem of load scheduling - from power generation, transmission, and distribution to demand management - in distributed renewable energy systems.<sup>12</sup>
- The transition to renewables raises the need for long-duration storage. Thermal energy storage technologies such as the Miscibility Gaps Alloy (MGA) technology is a ground-breaking patented zero-carbon renewable energy storage for grid and industrial use.<sup>13</sup>

## Opportunities

- A child rights-based approach to clean, affordable, and sustainable energy can enhance services like education, universal healthcare, and safe water and sanitation.
- The acceleration of the renewable energy transition requires more investments in renewable energy innovations across multiple time horizons to adapt

## Impact

- Renewable energies present new employment opportunities for current and future generations. The International Renewable Energy Agency predicts the sector will create 42 million green jobs globally by 2050.<sup>14</sup>
- Sustainable energy solutions can empower girls and young women by increasing school attendance and opening opportunities for women to become energy entrepreneurs.
- As the transition to renewable energy accelerates, we need to address the risk of environmental and human rights impact of critical mineral extraction, development-induced displacement, and solar panel waste.

**See Insight Report No. 2** for more information, including the potential of next-generation solar PV technologies and the potential applications of novel renewable energy innovations for the humanitarian and development sector.

to changing conditions. Further, the adverse impacts on people and environment need to be managed proactively.

- The rise of new technologies such as solar PV demands innovative ways of waste management and repurposing of materials to close the loop in the material life cycle.

## Insights Briefs

**Innovation Nodes Insights Briefs** serve as resource for practitioners and decision makers to quickly get up-to-speed on new and unknown areas of potential innovation for children.

Publication produced by the Innovation Nodes aim to facilitate the exchange of knowledge and stimulate discussion. The findings, interpretations and conclusions expressed are those of the researchers and authors, and do not necessarily reflect UNICEF policies or approaches.

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## Notes

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