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Professor Halil Ibrahim Bulbul

Gazi University, Ankara, Türkiye



Abstract

Title: The Future of Renewable Energy in Numbers

As the global demand for energy continues to rise alongside the urgency of addressing climate change, renewable energy has emerged as a cornerstone of the world's energy transition. This tutorial presents a data-driven exploration of the future of renewable energy, using key statistics, projections, and technological trends to illustrate the scale and speed of this transformation.

We begin by analyzing the current global energy mix as of 2025, where renewable sources such as solar, wind, hydro, and geothermal collectively account for approximately 30% of global electricity generation. Special focus is placed on the remarkable growth of solar and wind energy, which are outpacing fossil fuels in both adoption rates and investment.

Looking ahead, we examine projections up to 2050, highlighting expected milestones such as:

- Renewables supplying up to 70% of global electricity by 2030,
- Annual investments in clean energy surpassing \$2 trillion,
- A projected 38 million jobs in the renewable energy sector by 2030.

The tutorial also covers technological advancements that will enable and accelerate the shift, including:

- The rapid scaling of battery storage capacity,
- The development of smart grids and decentralized energy systems,
- Innovations in offshore wind and green hydrogen.

Economic and social implications are addressed, showing how falling costs of renewable technologies are making clean energy more accessible worldwide, particularly in developing regions. At the same time, challenges such as energy storage limitations, grid modernization needs, and regulatory bottlenecks are acknowledged as critical areas for innovation and policy reform.

Through clear visualization of global data and scenario-based modeling, this tutorial aims to equip learners, policymakers, and professionals with a deeper understanding of how numbers tell the story of a renewable-powered future. The evidence is compelling: renewable energy is not only environmentally necessary, but also economically inevitable and technologically achievable.