

SCIENCE FOR GLOBAL TRANSFORMATION
ENERGY TRANSITION PROCESS: RENEWABLE ENERGIES, SOCIAL AND ECONOMIC CONSIDERATIONS
Task Force 3 - Preliminary Document

Introduction

Goal 7 of the Sustainable Development Goals (SDGs) points the need to “ensure access to affordable, reliable, sustainable and modern energy for all”¹. The energy transition is essential for achieving this goal, being a crucial shift in how we generate and consume energy, driven by the global imperative to combat climate change, address resource depletion, and enhance energy security. At its core, the energy transition involves departing from fossil energy sources, including oil, coal, and natural gas, and adopting renewable energy sources to establish a more sustainable and resilient future. This transition not only promises to reduce our environmental impact but also carries significant social and economic implications.

Although the results of COP28 were below the expected outcome, countries made a commitment to triple renewable energy capacity and double energy efficiency by 2030, moving away from fossil fuels in energy systems. Renewable energy, encompassing sources like solar, wind, and hydropower, represents a beacon of hope in our pursuit of a sustainable energy future. Unlike finite fossil fuels that contribute substantially to greenhouse gas emissions, renewable energy sources are characterized by their abundance and reduced environmental impact during electricity generation.

The increasing utilization of hydrogen, biofuels, and ocean energy introduces a new perspective to the renewable energy landscape. Hydrogen, with its versatility and clean energy potential, can be produced through various methods, including electrolysis or by reforming natural gas with carbon capture and storage. Its significance lies in its capacity to efficiently store and transport energy, making it invaluable for mitigating the intermittency of renewable sources like wind and solar power. Hydrogen also holds great potential for decarbonizing sectors like transportation and heavy industry. In industries such as steel manufacturing, hydrogen can replace carbon-intensive processes, resulting in substantial reductions in greenhouse gas emissions. Biofuels, derived from organic materials like crops, algae, and waste biomass, provide a renewable and low-carbon alternative to fossil fuels. They can be used in existing internal combustion engines and play a crucial role in reducing emissions in the transportation sector. Ethanol and biodiesel, for example, are already widely used and embraced as means to decrease the carbon footprint of the transportation sector.

Ocean energy sources, including tidal, wave, and ocean thermal energy, harness the power of the world's oceans to generate electricity. These sources have the advantage of being highly predictable, as ocean tides and waves follow natural patterns. Unlike wave and tidal energies, the ocean thermal energy is reasonably constant. Notably, ocean energy offers high energy density, contributing significantly to the renewable energy mix. Additionally, ocean energy projects can be integrated with other coastal infrastructure, such as desalination plants, providing a more comprehensive approach to sustainable development.

¹ United Nations – Goal 7 of the Sustainable Development Goals (SDGs) (https://sdgs.un.org/goals/goal7#targets_and_indicators)

Perspectives on Energy Transition

Incorporating hydrogen, biofuels, and ocean energy into the energy transition is essential for diversifying the energy mix and achieving a more sustainable and resilient future. These technologies complement traditional renewable sources like solar and wind power, offering solutions for energy storage, transportation, and baseload power generation. Moreover, the energy transition can foster energy independence. Renewable energy sources are more evenly distributed across the globe compared to fossil fuels, which are often concentrated in specific regions. This decentralization of energy production helps reduce dependence on a few energy-exporting countries, enhancing energy security and reducing geopolitical tensions.

An important economic benefit of the energy transition is job creation. The renewable energy sector has emerged as a significant source of employment opportunities, spanning from the manufacturing and installation of renewable energy systems to their ongoing maintenance and research and development. These opportunities extend beyond highly industrialized nations, contributing to local economies and fostering growth in regions that need it the most.

The transition to renewable energy sources also drives technological advancements. As governments and businesses invest in research and development, innovations in energy storage, efficiency, and grid management become more prevalent. These technological breakthroughs not only benefit the energy sector but also have far-reaching impacts on various industries and society.

Social considerations are paramount in the energy transition. It is crucial to ensure that everyone has access to clean and affordable energy, addressing the persisting issue of energy poverty in many parts of the world. The transition offers an opportunity to rectify this imbalance and uplift people from poverty. Community engagement is another crucial dimension of the transition. Renewable energy projects often take place at the local level, providing communities with the chance to be actively involved and empowered. Community-owned renewable energy projects enable residents to have a stake in their energy production, share the benefits, and take control of their energy future.

A fair transition is critical in the energy transition process. As we move away from fossil fuels, it is essential to consider the well-being of workers in the fossil fuel industry. An unbiased transition involves providing support, retraining, and alternative employment opportunities for those affected by the decline of fossil fuel industries, ensuring that the transition is equitable for all. Environmental justice is a central issue in the energy transition. Vulnerable communities have historically borne the brunt of pollution and environmental degradation associated with fossil fuel production. The transition to renewable energy can help rectify these injustices by reducing pollution and protecting marginalized communities.

The renewable energy sector has the potential to stimulate economic growth. Direct job creation is just one facet of this growth, as the industry also stimulates demand for materials, equipment, and services. Furthermore, the increasing affordability of renewable energy technologies contribute to augmenting the financial resources available to individuals and businesses by means of decreased energy expenditures, thereby fostering economic expansion.

Likewise, the energy transition reduces the economy's vulnerability to price volatility and supply chain risks associated with fossil fuels. By diversifying the energy mix, economic resilience can be enhanced reducing the impact of global energy market fluctuations. The intermittency of certain renewable energy sources, such as wind and solar power, depends on weather conditions, which can be unpredictable. This presents several opportunities for the development of new technologies in energy storage and grid infrastructure to guarantee a consistent energy supply.

Political and regulatory obstacles need to be addressed to avoid hindering the energy transition. Some governments may resist change due to vested interests in the fossil fuel industry or a lack of understanding of the benefits of renewables. Overcoming these obstacles requires strong political will and the development of supportive regulatory frameworks.

Social acceptance is another hurdle. While many communities embrace renewable energy projects, others may resist them due to concerns about aesthetics, noise, or perceived impacts on property values. Public education and stakeholder engagement are essential to address these concerns and gain community support.

Challenges

“Coal still supplies just over a third of global electricity generation even though it is the most carbon-intensive fossil fuel. While coal is being gradually replaced in most countries for power generation, it will continue to play a crucial role in iron and steel production until newer technologies are available. (...) To have a place as a cleaner energy source in the decades to come, governments and the coal industry need to develop and deploy less polluting and more efficient technologies, including but not limited to carbon capture, utilization, and storage”².

Brazil brings back for discussion some points already raised during previous S20 editions, especially in India, in order to speed up the process of energy transition. S20 needs to undertake a coordinated, concerted effort to provide sufficient resources for scientific breakthroughs to catalyze exponential energy technologies.

Intermittent renewable energy generation technologies, such as solar and wind, is most dependent on efficient storage, so energy storage technologies like batteries and green hydrogen need to be further developed and have their costs reduced, so that solar and wind generation can be made dispatchable.

Final Remarks

Bioenergy, ocean energies (tidal, wave, and thermal), hydrogen, solar energy, wind energy, biomass, and other potential sources of renewable energy are mandatory fields of research and technological development to promote energy transition. This process is driven by the need to address climate change, enhance energy security, create economic opportunities, and promote social and environmental justice. While challenges exist, the benefits of the energy transition far outweigh the obstacles, offering us a pathway to a sustainable and resilient future. This transition is not just a necessity; it is an opportunity for a better world for all.

² International Energy Agency – Coal (<https://www.iea.org/energy-system/fossil-fuels/coal>).