Environmentally friendly renewable energy sources

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Energy is sustainable if it "meets the needs of the present without compromising the ability of future generations to meet their own needs."[1][2] Definitions of sustainable energy usually look at its effects on the environment, the economy, and society. These impacts range from greenhouse gas emissions and air pollution to energy poverty and toxic waste. Renewable energy sources such as wind, hydro, solar, and geothermal energy can cause environmental damage but are generally far more sustainable than fossil fuel sources.

The role of non-renewable energy sources in sustainable energy is controversial. Nuclear power does not produce carbon pollution or air pollution, but has drawbacks that include radioactive waste, the risk of nuclear proliferation, and the risk of accidents. Switching from coal to natural gas has environmental benefits, including a lower climate impact, but may lead to a delay in switching to more sustainable options. Carbon capture and storage can be built into power plants to remove their carbon dioxide (CO2) emissions, but this technology is expensive and has rarely been implemented.

Fossil fuels provide 85% of the world"s energy consumption, and the energy system is responsible for 76% of global greenhouse gas emissions. Around 790 million people in developing countries lack access to electricity, and 2.6 billion rely on polluting fuels such as wood or charcoal to cook. Cooking with biomass plus fossil fuel pollution causes an estimated 7 million deaths each year. Limiting global warming to 2 ?C (3.6 ?F) will require transforming energy production, distribution, storage, and consumption. Universal access to clean electricity can have major benefits to the climate, human health, and the economies of developing countries.

Wind and solar market share grew to 8.5% of worldwide electricity in 2019, and costs continue to fall. The Intergovernmental Panel on Climate Change (IPCC) estimates that 2.5% of world gross domestic product (GDP) would need to be invested in the energy system each year between 2016 and 2035 to limit global warming to 1.5 ?C (2.7 ?F). Governments can fund the research, development, and demonstration of new clean energy technologies. They can also build infrastructure for electrification and sustainable transport. Finally, governments can encourage clean energy deployment with policies such as carbon pricing, renewable portfolio standards, and phase-outs of fossil fuel subsidies. These policies may also increase energy security.

     Energy is the golden thread that connects economic growth, increased social equity, and an environment that allows the world to thrive. Development is not possible without energy, and sustainable development is not possible without sustainable energy."

There is no universally accepted interpretation of how the concept of sustainability applies to energy on a

global scale.[7] Working definitions of sustainable energy encompass multiple dimensions of sustainability such as environmental, economic, and social dimensions.[6] Historically, the concept of sustainable energy development has focused on emissions and on energy security. Since the early 1990s, the concept has broadened to encompass wider social and economic issues.[8]

Cooking with polluting fuels such as wood, animal dung, coal, or kerosene is responsible for nearly all indoor air pollution, which causes an estimated 1.6 to 3.8 million deaths annually,[23][21] and also contributes significantly to outdoor air pollution.[24] Health effects are concentrated among women, who are likely to be responsible for cooking, and young children.[24]

Meeting existing and future energy demands in a sustainable way is a critical challenge for the global goal of limiting climate change while maintaining economic growth and enabling living standards to rise.[28] Reliable and affordable energy, particularly electricity, is essential for health care, education, and economic development.[29] As of 2020, 790 million people in developing countries do not have access to electricity, and around 2.6 billion rely on burning polluting fuels for cooking.[30][31]

Improving energy access in the least-developed countries and making energy cleaner are key to achieving most of the United Nations 2030 Sustainable Development Goals,[32] which cover issues ranging from climate action to gender equality.[33] Sustainable Development Goal 7 calls for "access to affordable, reliable, sustainable and modern energy for all", including universal access to electricity and to clean cooking facilities by 2030.[34]

Energy efficiency--using less energy to deliver the same goods or services, or delivering comparable services with less goods--is a cornerstone of many sustainable energy strategies.[36][37] The International Energy Agency (IEA) has estimated that increasing energy efficiency could achieve 40% of greenhouse gas emission reductions needed to fulfil the Paris Agreement"s goals.[38]

Efficiency improvements often lead to a rebound effect in which consumers use the money they save to buy more energy-intensive goods and services.[44] For example, recent technical efficiency improvements in transport and buildings have been largely offset by trends in consumer behaviour, such as selecting larger vehicles and homes.[45]

Renewable energy sources are essential to sustainable energy, as they generally strengthen energy security and emit far fewer greenhouse gases than fossil fuels.[49] Renewable energy projects sometimes raise significant sustainability concerns, such as risks to biodiversity when areas of high ecological value are converted to bioenergy production or wind or solar farms.[50][51]

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