The Fifth West Japan Model United Nations

Utilizing digital technologies for a steady transition to clean energy

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Overview

Utilizing digital technologies for a steady transition to clean energy has arisen to become a major global topic of discussion over the past few decades. As the international community enters an era where sustainability of scarce natural resources is deeply emphasized, the importance of turning away from the traditional form of energy production and leaning towards more sustainable, clean energy sources is emphasized. As digital technologies have rapidly developed over the past few decades, utilizing them to resolve the difficult issue of energy transition could be an effective solution.

Burning of fossil fuels like coal, oil, and natural gas has traditionally been the most common method of energy production. The growing accessibility and abundance of these fossil fuels have allowed them to remain the most common method of energy production, consisting of approximately 82% of the global energy mix in 2022 (Energy Institute). Despite its high energy density when burned, cost-effectiveness, and ability to be produced under well-developed infrastructure, there are a number of consequences to it. Fossil fuels are not renewable, and are finite. Climate change, air pollution, environmental degradation, and other threats to our planet are interconnected with the overconsumption of fossil fuels as a form of energy. The increase in fossil fuel consumption from 2022 to 2023 led to 40 gigatonnes of carbon dioxide (CO2) emissions, the highest level ever recorded (Statistical Review of World Energy). Construction of buildings also accounts for 40% of energy-related greenhouse gas emissions (UNDP).

Combating the global issue of non-renewable energy sources will rely on the development of 'clean' energy. The search for renewable, environmentally friendly and sustainable energy sources globally emerged in the late 20th century after an era of industrial growth. Solar, wind, hydropower, geothermal, and biomass energy are commonly considered as naturally replenishable and can be harnessed without depleting natural resources. Improved energy efficiency through such methods can provide 40% of the reductions needed to keep the 1.5°C goal in the Paris Agreement (2015) within reach. Some more economically developed countries (MEDCs) have begun transitioning to renewable energy sources, with most of their energy sources being reliant on them. For instance, 98% of Norway's energy sources are renewable, mainly consisting of hydropower (Climate Council). Iceland tops this with nearly 100% of its electricity production being hydropower and geothermal, making the nation one of top 10 global producers of geothermal energy (Climate Council). The renewable energy share of Costa Rica also reached 98% for eight years in a row until 2022 (Climate Council). The effectiveness of renewable energy and ability of countries to adapt to renewable energy is beyond doubt.

Digital technology has rapidly developed across the globe in the last few decades. The integration of Artificial Intelligence (AI), Internet of Things (IoT), smart grids, blockchain, and big data analytics has revolutionized how energy is generated, distributed, and consumed. The development of these technologies has allowed humans to have better access to and distribution of information across the globe. New inventions and innovations have been created using these technologies which have increased energy production and shifted more to eco-friendly energy. Electric vehicles (EVs) have been developed in many car industries and accounted for 2.6% of global auto sales in 2019 (IEA). Denmark, for example, has developed a smart grid system in its wind power energy production which ensures a balance between supply and demand in real-time, mitigating energy waste.

Utilization of modern digital technologies offers a promising and smooth transition to clean energy. Renewable energy sources are not only viable but also highly effective in reducing reliance on fossil fuels and other finite resources. The transition remains as a plight for some developing countries, but continues to be invested in across the globe.

Definitions of important terms

Artificial Intelligence (AI)

Information-processing technologies that perform tasks requiring human-like intelligence, such as learning, reasoning, problem-solving, and decision-making.

Artificial Intelligence (AI) in Energy

The application of machine learning and data analytics to improve energy efficiency, predict demand, automate grid management, and optimize renewable energy integration.

Biomass Energy

A renewable energy source derived from organic materials such as plants, agricultural and forestry residues, animal waste, and biodegradable municipal waste.

Blockchain for Energy Trading

A decentralized digital ledger that allows peer-to-peer energy transactions, enabling secure, transparent, and efficient trading of renewable electricity without intermediaries.

Carbon Neutrality

Achieving a balance between emitting carbon dioxide (CO_2) and absorbing an equivalent amount from the atmosphere, often through renewable energy use and carbon offset initiatives.

Digital Technology

Digital technology refers to electronic tools, systems, devices, and resources that generate, process, or store data. These include computers, mobile devices, software, artificial intelligence, blockchain, and the internet, which enhance communication, automation, and efficiency across industries.

Energy Efficiency

The practice of using less energy to perform the same task, reducing energy waste while maintaining economic growth and sustainability.

Energy Transition

The global shift from fossil fuel-based energy systems to low-carbon, renewable, and sustainable energy sources to mitigate climate change and achieve carbon neutrality.

Geothermal Energy

A renewable energy source that harnesses heat from within the Earth's crust to generate electricity or provide direct heating.

Hydropower Energy
A renewable energy source that generates electricity by harnessing the power of moving water, typically from rivers, dams, or tidal systems

Internet of Things (IoT)
a network of interconnected devices that can collect, exchange, and analyze data through the internet, enabling automation and improved decision-making.

More Economically Developed Countries (MEDCs)
countries which have a high standard of living. and a large GDP close GDP (Gross Domestic Product) is the measure of the market value of all final goods and services produced in a period of time within a country.

Renewable Energy
Energy derived from natural sources that are replenished at a higher rate than they are consumed. This includes solar, wind, hydropower, geothermal, and biomass energy.

Smart Grid
A smart grid is an electricity network that uses digital technology to monitor, control, and optimize the generation, distribution, and consumption of energy in a sustainable, efficient, and secure manner.

Solar Energy
Solar technologies convert sunlight into electrical energy either through photovoltaic panels or through mirrors that concentrate solar radiation.

Wind Energy
A form of renewable energy generated by converting the kinetic energy of wind into mechanical or electrical power through wind turbines.

Timeline of key events

The Paris agreement (2015)
This international agreement took place in Paris, France on December 12, 2015. It was adopted in COP 21, or UN Climate Change Conference by 196 parties. The main goal of this agreement was to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and to take an additional attempt to "limit the temperature increase to 1.5°C above pre-industrial levels.". To achieve such goals, greenhouse gas emissions must peak before 2025 at the latest and decline 43% by 2030.

UN High-Level Dialogue on Energy (2021)
Over 100 Member States inscribed to participate in the High-Level Dialogue on Energy initiated by the United Nations in New York, USA, in September 2021. The dialogue brought along two main outcomes: "a global roadmap with recommended actions and milestones to accelerate achievement of SDG7 by 2030" ; as well as "voluntary commitments from Member States and other stakeholders in the form of 'Energy Compacts', setting out actions planned to advance clean, affordable energy for all by 2030 and net zero emissions by 2050".

European Green Deal (2019)
The deal was set by the European Union in December 2019 to aim to have Europe become the first climate neutral continent by 2050. Over 1 trillion Euros were invested to sustain this deal. Main elements include climate action, clean energy, sustainable industry, and sustainable mobility. To achieve these goals the UN attempts to reduce their amount of carbon emissions and adapt more sustainable energy sources.

World Economic Forum (WEF) – Annual Meetings (Ongoing)
The WEF is an independent international organization headquartered in Geneva, Switzerland committed to improving global status. Mission states; "engages business, political, academic and other leaders of society to shape global, regional and industry agendas.". Individuals and political and business leaders are brought together each year to discuss significant issues that impact the global economy.

Position of key nations

Russia

Russia remains somewhat heavily dependent on non-renewable energy sources, with 52% of its national energy production being from natural gas, and the another 37% relying on oil and coal. Russia is slow in comparison to developed nations in digital adaptation due to regulatory gaps, dependence on foreign technology, and slow corporate adaptation. Investments continue to be made on the development of digital technologies.

United States

The United States also remains highly dependent on non-renewable energy, with 31.8% of its total energy production source being natural gas. Despite that, the proportion of renewable energy rose up to 22.3%, of which 9.6% are nuclear electric power. The U.S. set its sights on 100% carbon-pollution-free electricity by 2035. In 2013, Energy Systems Integration Facility (ESIF)'s Peregrine, the first high-performance computing (HPC) system was published, which will speed up the pace of energy transition at a much faster rate than ever imagined.

China

The growing demand for energy in China has allowed them to deeply invest in renewable energy sources in recent years, and between 2019 and 2024, China accounted for 40% of global renewable capacity expansion. Developments of solar, wind, and biofuel energy are most driven by improved system integration. However, coal still remains dominant in China's energy mix reaching 61%. Oil and natural gas behind with 17.8% and 7.8%. China is also the country with the most carbon emissions, reaching 11472.39 million MtCO2e in 2025. AI technologies like smart grid and systems like energy storage optimization continue to be developed for a smooth transition to clean energy whilst still meeting the surging demand for electricity.

Denmark

Denmark is one of the global leaders of renewable energy production, with well over half of their national energy mix consisting of renewable energy sources like biofuels, geothermal, solar, and wind. Denmark has reduced its carbon emissions by 47% from 2000 to 2022. Denmark's technological advancements have played a key role in the areas of offshore wind, biomethane and district heating. The government has deeply invested in these areas in order to adopt a strategic focus on carbon capture and storage (CCUS) and hydrogen. More research

continues to be made in digital technologies for a clean transition to renewable energy in Denmark.

Brazil

Brazil's energy sector remains one of the least carbon-intensive globally, with renewables meeting almost 45% of the primary energy demand. Out of which 80% are accounted for by hydropower plants. Developments on solar energy have stood out in recent years, and PV projects are said to dominate approximately 70% of all additions in the coming years. However in recent years oil supply and reliability on them has increased, and it is expected to continue growing. The utilization of digital technologies is expected to support the investments like PV in solar power in order for a smoother transition to clean energy.

France

The main national energy source of France is nuclear power, with it dominating 40.3% of the national energy mix. In its 2019 Energy and Climate Act, France legislated a net zero emissions target for 2050 and aims at reducing by 55% its greenhouse gas emissions by 2030. France's Multiannual Energy Plan (PPE) aims to modernize France's energy system and mentions the role of digital technologies in the process. Utilization of smart grids like AI and IoT are overlooked as important, as well as energy storage and grid flexibility. France continues to aim to accelerate its already-rapid transition to clean energy.

Suggested solutions

The international world has leveraged digital technologies to enhance the stability and efficiency of the clean energy transition. One of the most common solutions to more efficient transitions to clean energy has been the utilization of Smart Grids & AI-Powered Energy Management. Smart grids are defined as a network that moderates energy distribution and digital communication technology in a two-way flow of electricity and data. This enables producers of energy to consider the optimization of the generation, transmission, and distribution of electricity. AI and IoT-driven smart grids allow the balance of electricity supply and demand in real time, helping to balance supply and demand, integrating renewable energy sources, and improving energy efficiency. In 2016, Google's DeepMind demonstrated practical application of AI in real-world energy management scenarios, where it observed patterns in power plant data, andAI made tweaks to save energy, such as turning off water chillers for periods of time or adjusting temperatures by a few degrees. This system effectively supports the global transition to clean energy by supporting the energy production in renewable energy sources like wind and solar, as they can intermittently produce energy. These systems can help predict and manage the variability of renewable energy generation and forecast renewable energy production based on weather data and optimize the flow of electricity, allowing utilities to integrate more renewable energy into the grid without compromising stability.

Another common solution to this topic is blockchain for decentralized energy trading. The development of blockchain technologies provides opportunities for the preservation and development of renewable energy sources, allowing for a more steady transition. Blockchain is defined as a secure, digital ledger that records transactions in linked "blocks," ensuring transparency and data integrity. Its decentralized and transparent nature makes it a useful tool for addressing challenges in the energy transition. They can do so in ways such as tracking renewable energy production, carbon credits, and ensuring that emissions reduction efforts are properly documented and transparent. One way of utilizing blockchain is the peer-to-peer (P2P) energy trading system, where individuals or companies can trade renewable energy directly without intermediaries, encouraging more effective distribution of energies like solar and wind. Another effect is the easier access to renewable energy sources through the system. Blockchain in the energy sectors allows energy producers on a small scale to participate in the market for selling energy, such as small businesses or individual households. This increases the access to clean energy, even in rural areas or regions with little access to renewable energy sources.

The renewable energy sector continues its investment on digital technology-driven methods of energy production for a more smooth global transition to environmentally friendly alternatives.

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