

## Essays

# Innovative Strategies for Solving Environmental Problems in the Context of Recent Policy Changes

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The environmental crisis is not just the challenge of the future - it is a challenge of the present. Loss of biodiversity with natural resources, climate change, and pollution threaten both countries' national and international security. Recent shifts in the United States' environmental policy toward energy sovereignty and fossil fuel extraction demand a more balanced approach. This paper examines various strategies for the transition to sustainable energy through tax incentives for the emission reduction of CO<sub>2</sub>, the expansion of renewable energy sources, and the application of market-based mechanisms for the reduction of carbon footprint. Modernizing the waste recycling system, introducing rare earth extraction technologies, and developing hydrogen energy and biofuels in the agricultural sector are all considered key innovative and ecologically focused initiatives for the shift to a cleaner future. In addition, particular attention is given to the prospects of developing small modular reactors (SMRs) as an environmentally friendly energy solution. The use of digital technology and artificial intelligence (AI) is also prioritized for energy efficiency improvement and electric grid operations. Only by combining different aspects of trade, politics, and technology, the current environmental situation be improved. Consequently, the U.S. has the opportunity to lead global sustainability efforts and enhance its competitiveness by achieving a balance between economic growth and environmental protection legislation.

For the United States and for the entire world, environment-related concerns jeopardize not only national security but even international security. Loss of biodiversity, depletion of natural resources, water and air pollution, and climate change top the urgency lists in current times. All these issues have a direct impact on citizens' living standards, public health, food security, and the economy. Recent political moves to pull out of a range of international conservation programs, such as the Paris Agreement and "climate finance," have radically altered U.S. direction in environmental policy. Now, the emphasis is on fossil fuel development, minimizing environmental restrictions, and highlighting American "energy sovereignty." However, as environmental challenges are still unresolved and only getting worse, this viewpoint needs to be modernized through an integrated and balanced strategy.

Despite the present administration's emphasis on conventional energy sources like coal, oil, and gas, a shift to sustainable energy is necessary for long-term economic prospects. As a result, businesses that upgrade their machinery and use renewable energy sources to cut CO<sub>2</sub> emissions ought to automatically see their tax rates lowered. The tax deduction would be proportional to the amount of reduced CO<sub>2</sub> emissions. For example, \$50 for each ton of CO<sub>2</sub> reduced compared to the previous year. A government

platform or accredited environmental auditors may be established to monitor the provision of emission data. Moreover, market-based emission control mechanisms can also be used. To regulate the "carbon footprint" created by industry, transport, and energy, a "carbon tax" can be introduced with a refund to the public. Such a mechanism is based on the principle that enterprises pay for carbon emissions, and the funds raised are redistributed among citizens in the form of tax refunds or payments. Companies will be urged to make investments in clean technology and reduce emissions without sacrificing economic expansion or the standard of living for people.

When it comes to recycling waste, the U.S. trails well behind the other developed nations. The U.S. Environmental Protection Agency (n.d.) estimates that in 2022, the nation's recycling rate was about 32%, whereas in Germany, it is over 65%. Limited recycling infrastructure is linked to an excessive number of landfills, which deteriorates economic possibilities and pollutes the environment. In order to upgrade the recycling infrastructure and offer financial advantages to investors and businesses that use recycled materials, a public-private partnership (PPP) must be established. The formation of "green industrial zones," where recycling will serve as the primary focus of economic expansion, could be another development effort. Digital plat-

forms like blockchain and artificial intelligence (AI) can also be used to track and optimize recycling processes. This innovation will enable citizens and companies to see which waste is being recycled, increasing the system's transparency. With the improvement of waste recycling infrastructure, a secondary market for rare earth elements (REE) can also develop. The extracted valuable minerals, like neodymium, europium, and terbium, from electronic waste can be used in recycled form to produce batteries, microchips, and electric vehicles. According to the U.S. International Trade Commission (2020), investments in REE extraction technologies from coal waste will help the United States reduce its dependence on imports, where 78% comes from China.

The United States is gradually losing its leadership in the "peaceful atom," however, this particular area, together with modern small modular reactors (SMR), can become an environmentally friendly and safe solution. It can be an excellent replacement for diesel generators at a military base, such as in Alaska, reducing fuel costs and making the energy supply more reliable. The initiative can be implemented through public-private partnership programs. For instance, in the Power Purchase Agreements (PPA) model – the government pre-buys electricity from SMR for military bases or remote settlements. In addition to traditional uranium-based SMRs, thorium and sodium reactors, which are considered safer and produce less waste, can be funded. To accelerate the development of these technologies, the United States can create government research laboratories, as did the Chinese Academy of Sciences, which is already building a thorium reactor. Another way to accelerate the SMR development process is to simplify the regulation and licensing of small reactors. Currently, modern safety standards in the United States have been developed only for large nuclear power plants. To give an example, NuScale's first SMR took six years for the Nuclear Regulatory Commission (NRC) to certify through a lengthy licensing process in 2020.

The transportation sector alone is responsible for more than 27% of all greenhouse gas emissions in 2023, making it one of the biggest CO<sub>2</sub> emission contributors in the United States, as stated by the U.S. Environmental Protection Agency (n.d.). Although electric vehicles are growing in popularity, most trucks and agricultural equipment are still powered by diesel and gasoline. The adoption of "greener" fuel sources, such as hydrogen and biofuels, is slowed down by a variety of factors. However, farmers find it difficult to switch due to the high cost of "green" hydrogen, which is roughly \$5 per kilogram compared to \$1.5 for gray hydrogen. Another barrier is the limited number of hydrogen refueling stations. The majority of the stations are located in California, and there are less than 100 stations nationwide. Furthermore, there is little conversion of agricultural waste into biofuels. A program for the development of hydrogen hubs throughout the country, with a priority on industrial zones, logistics centers, and ports, can serve as a proposal to solve these problems. Oil and gas companies will be involved in the development of hydrogen infrastructure, using existing gas pipelines to transport H<sub>2</sub>. Also,

the introduction of bio-refineries that process corn stalks, straw, wood waste, and organic waste into bioethanol and biodiesel can enhance the development of biofuels from agricultural waste. Federal subsidies and grants can be launched for the stimulation of the transition of freight and agricultural transport to biofuels and hydrogen. Moreover, similar to the Toyota & Kenworth project in the port of Los Angeles, there can be an expansion of the development of hybrid hydrogen-electric trucks. An innovative solution could be the use of solid oxide fuel cells (SOFCs) in data centers, hospitals, and coordination centers for autonomous power supply. As Amazon is already testing hydrogen fuel cells for warehouses, and scaling the project will reduce emissions by millions of tons of CO<sub>2</sub>. Another proposal could be to finance projects such as Airbus ZeroE and Universal Hydrogen, which are developing hydrogen engines for aviation.

Energy use can be optimized using the current state of AI and Big Data research. High losses, little flexibility, and an overreliance on fossil fuels are all problems facing the American energy system. According to analysis by the Department of Energy (2024), transmission and distribution can result in energy loss of up to 8%. Now power consumption is at its peak – during daytime hours, the load increases, causing network congestion. Therefore, the development and implementation of smart substations (Smart Grids) will help manage the supply of electricity in real-time. The use of AI to control turbines and generators can increase the efficiency of gas and coal plants for dynamic pricing purposes and help reduce the load during peak hours. Big Data can be used to predict energy consumption for large companies and assist with their energy demand. At the same time, the use of digital counterparts of power grids can reduce accidents. The increased development and introduction of "smart" energy management systems will improve the regulation of air conditioners, heating, and lighting. The idea of connecting thousands of households with solar panels into a single network can develop virtual power plants. As a result, peer-to-peer (P2P) energy trading will become a reality, with solar-equipped homes using the blockchain to sell extra energy to nearby neighbors.

In order to achieve environmental change in the United States, a combination of market mechanisms, government initiatives, and technical innovation is needed, in addition to an integrated and strategic approach. In today's conditions of growing global climate challenges and increasing competition for resources, the country cannot stay away from the transition to a sustainable economy. The creation of government assistance programs for businesses engaging in low-carbon technologies, the upgrading of tax laws, and the encouragement of waste recycling may be the main forces for change. The introduction of hydrogen technologies, the expansion of biofuels, and the use of Big Data and artificial intelligence in the energy sector will all reduce emissions and increase energy efficiency. Additionally, the development of compact modular reactors has the potential to improve energy security and increase the United States' leadership in the field of peaceful nuclear energy.

The future of the nation and its competitiveness in a global economy rely on present choices. Instead of acting as a barrier, environmental policy ought to promote technical advancement and sustainable prosperity. Thus, the United States must strike the ideal balance between environmental preservation and economic growth with the aim to preserve its competitiveness, raise the standard of living for its people, and significantly contribute to the stability of the world climate. It must not be forgotten that the future of the Earth is not determined by how many resources are ex-

tracted from it but by how skillfully humanity can preserve, restore, and reuse them. Sustainable innovation is a way to improve the process, and it's not just a technology but a whole responsibility.

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