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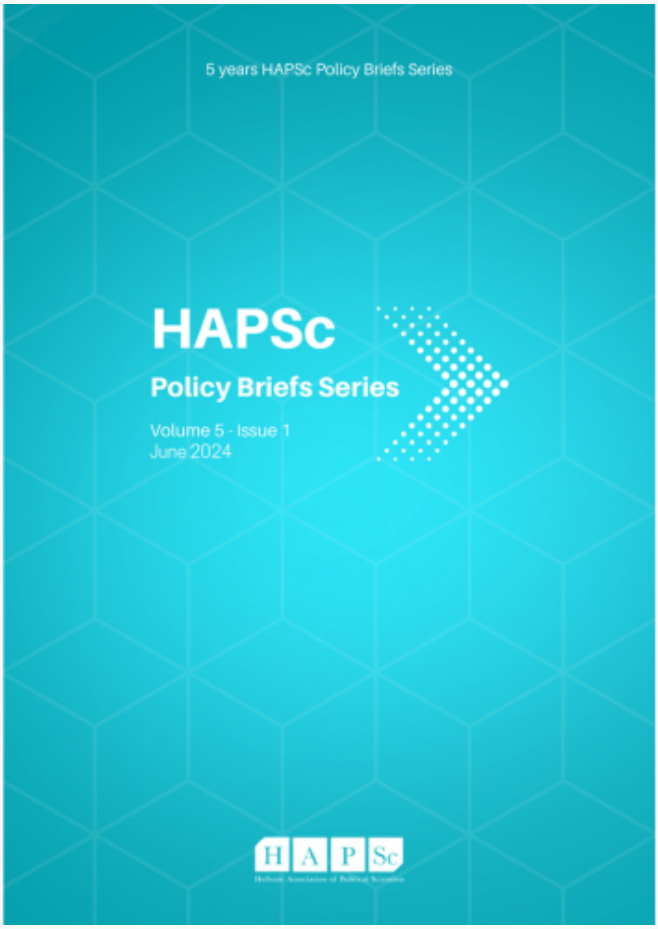

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The Impact of New Technologies in the Environment[1]

Nikolaos Tsoromokos[2], Eva Stefanou[3] & Panagiotis Kritikos[4]

Abstract

The impact of technology is present in every aspect of the world, including the environment and the people. New and emerging technologies have been invented, in an attempt to solve worldwide problems such as air and water pollution. Are those technologies really making a difference or is the problem enlarging? Questions like these are answered in this policy brief, focusing on solar energy, electric vehicles trying to rule the car industry, and hydrogen technology which leads the way for a much safer and environmentally friendly future. Even though there are drawbacks to every technology, the numerous efforts for a greener environment and new inventions, beneficial to new technologies are present. In this brief, a discussion on the benefits and drawbacks of these technologies is made, and best practices and are discussed to strengthen the benefits and manage any adverse effects.

Keywords: Renewable Energy Sources, Electric Vehicles, Solar Energy, Hydrogen.

Introduction

Questions like 'What makes technology what it is and makes it fit for the 21st century?' have been the major issue for researchers and policymakers nowadays, where environmental sustainability and clean production is hughly valued (Hu et al., 2022). Extensively, as stated by Edinburgh Sensors (2021), new technologies emerge with great power, transitioning to new bringing technological advancements but, also, damaging the processes, natural environment. The two considerable ways those technologies have damaged the world are pollution and depletion of natural resources. As WWE Australia (2017) notes, global developments in modern technologies are determining the way people live, with new approaches becoming necessary to solve the problem of climate change, scarce resources, urbanisation, and economic inequality. According to Irfan (2023), the United States has begun to move away from fossil fuels, having a law to deal with climate change, including $369 billion for climate priorities.

Into this policy brief are presented some of the existing problems which have been created due to the prevalence of traditional technologies worldwide, as well as the effort of new technologies and their predominance of the future, such as wind and solar energy. However, the drawbacks of those new and emerging technologies are not absent. A reference to electric cars and their attempt to dominate

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over traditional cars is made, as well as to hydrogen technology leading the way for a greener future.

The Impact of Technology on Air and Water Pollution

Beginning with air pollution, Song et al. (2023) stated that the percentage of the global population that breathes air that surpass WHO guideline limits is over 99%, with the air containing high levels of pollutants. In addition, the major global public health issues are the effect of poor air quality and has a result of over 6 million premature deaths yearly. According to Health Effects Institute (2020), the pandemic of Covid-19 and the restrictions of it, led many countries around the globe to experience blue skies and starry nights, possibly for the first time in years, having however significant societal and personal costs. Moreover, the cause behind the 20% of newborn deaths globally is air pollution, and in 2019 about 500,000 deaths were counted, among infants in their first month of life, due to air pollution.

In addition to air pollution, water pollution, according to Song et al. (2023) is a crucial public health issue in many nations. The 2016 Snapshot Report of the Worlds' Water Quality stated that 1/3 of rivers is affected by a few pathogenic pollutions, 1/7 by severe organic pollution, and 1/10 of water bodies by severe and moderate salinity pollution in the regions of Latin America, Africa, and Asia. As reported by Song et al. (2023), industrialization and urbanization demote the environment due to dangerous emissions and water pollutants, challenging policymakers aiming to develop sustainability.

According to Song et al. (2023), direct benefits to the environment could bring the use of robotics, reduce material loss in manufacturing and supply chain operations, and digitalize the environmental monitoring. As mentioned in the same research, industrial robots could improve labour productivity and efficiency of energy, leading to new inventions of cleaner production technologies. In addition to this, as BBC (n.d.) states, energy costs have been cut down by using more efficient products such as lowenergy light bulbs. Noted on the same article, is the global awareness that limits the levels of pollution and emissions of greenhouse gases, attempting to solve global warming and targeting renewable energy.

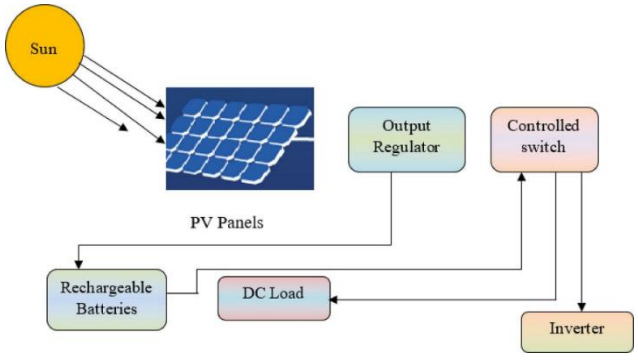
Drawbacks are not absent, as reported by Ledger (2020), since 4% of greenhouse gas emissions are the result of digital technologies, expecting to double by 2025, with energy demands increasing by 8% a year. As Edinburgh Sensors (2021) states, air pollution relates to the industrial revolution, which brought emerging technologies such as burning of fuels, factories, power stations, agriculture and vehicles. In addition to the same fossil mass research, the consequences of air pollution contain negative impacts on health for humans and animals, and global warming causing Earth's temperature to rise dramatically. Conceming water pollution, common water pollutants include domestic waste,

industrial sewage, insecticide, and pesticides, which all could lead to diseases, devastation of ecosystems and negatively affect the food chain.

Wind and Solar Energy

According to Summerfield-Ryan and Park (2023), wind energy has grown to a cost-competitive worldwide energy source, declining by 22% since 2010 with further declines predicted. Furthermore, Chaurasiya et al. (2023) state that wind energy has been a widely accessible energy-source globally gaining enormous interest, and in the future could prosperously be a substitute for traditional energy sources, accounting a sizable percentage of global energy demands. Moreover, Draxl et al. (2021) declare the mapping of a scenario for wind energy to supply 35% of the United States' electricity demands by 2050 created by the US Department of Energy's Wind Vision. Added to this, plans of wind energy on complex terrain are not stopping and will be continued for the satisfaction of that portfolio. Concerning solar energy, Hussain et al. (2023) highlight that 1% increase in wind and solar energy could reduce the ecological footprint by 3.1%, adding solar energy to a path of being more attached to electricity purposes. In the same research it is said that wind and solar energy have a restricted production since non-renewable energy resources dominate. Despite the dominance of those nonrenewable energy resources, the demand for low carbon energy resources, such as solar energy, has increased worldwide. To add to this view, Algarni et al. (2023) notes that solar energy units do not produce harmful emissions while in use, unlike controversial power plants, with safety to arise during production, installation, and disposal.

Figure 1: Renewable Energy Sources



Source: Algarni et al. (2023)

According to Algarni et al. (2023), renewable energy sources are possible to contribute to energy worldwide, economy, society, and environmental providing energy reducing emissions of pollutants and bringing sustainability, opportunities for local socioeconomic development. Moreover, Edinburgh Sensors (2021) reported that renewable energy technologies such as wind turbines and

solar panels are becoming cheaper, letting governments invest more, raising the installations of solar panels on rooftops in Australia from around 4.600 households to over 1.6 million, from 2007 to 2017. As Igini (2022) states, solar energy is a renewable energy source, plentiful, getting more efficient and cheaper and the life cycle of it leaves minimal greenhouse gas emissions.

Disadvantages are present, conforming to Algarni et al. (2023) who stated that power from renewable energy sources, without including hydropower, comes with more damage to the environment, and a lack of natural resources to be available per kilowatt-hour than traditional sources of energy. Also, according to Igini (2022), solar energy depends on weather, is costly for households, and solar power plants are not the best environmentally friendly choice.

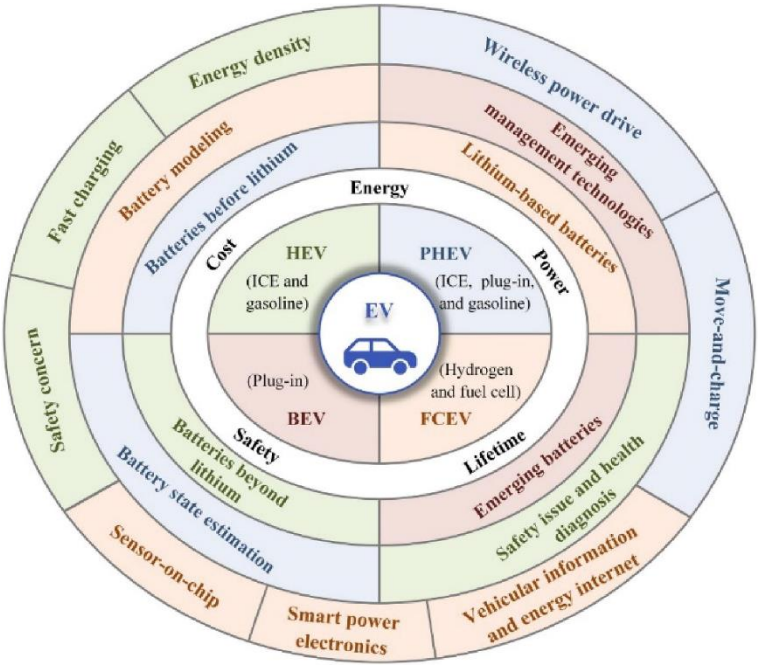
Electric Vehicles

The evolution of vehicles is being developed constantly, leading electric vehicles to be the future of transportation. More analytically, Das et al. (2023) mention that numerous electric vehicles (EVs) have been and being developed globally with the four types being hybrid electric cars (HEVs), plug-in hybrid electric vehicles (PHEVs), fuel cell electric vehicles (FCEVs), and fully battery electric vehicles (BEVs). Furthermore, some of the benefits of accepting electric vehicles are reduced fuel dependency and reduced emissions, miniature carbon footprint aiming toward carbon neutrality, preventing global warming, with a start of sustainable transport revolution. According to Edinburgh Sensors (2021), tax credits and inducements from governments have been used to encourage plug-in vehicles and to introduce the adoption of electric vehicles. As noted by IEA (2021), the number of electric vehicles that are on the road globally will reach ten million in 2020, expanding the availability of them, despite having Covid-19 as a barrier. The sales of EVs were estimated to be 4.6% worldwide, in 2020, with them gaining a notable of the total car sales number of support policies since then. The decade of 2020, according to the International Energy Agency (IEA, 2021), will mark the transition to EVs, requiring more action by both consumers and producers than the previous decade of 2010s, broadening the development and the use of them in the market.

According to Das et al. (2023), larger measures are required for speeding up charging and improving battery performance, with the leading disadvantage being the restricted mobility of electric vehicles. According to Lakshami (2023), mining the materials a battery requires for it to be built, has a high environmental cost, making the electric vehicle manufacturing procedure more demanding in energy than an internal combustion engine vehicle. In the same article it is said that the impact on the environment comes from the toxic fumes released in the mining procedure and the water-intensive nature of this process. Heilweil (2022) states that it can be determined that lithium mining is not

environmentally friendly, even though lithium mines are limited in their number, and in addition, other metals like cobalt are extracted in the Democratic Republic of Congo, which is linked with child labour. To sum up with electric vehicles, Li et al. (2022) emphasize the dramatic degradation of lithium-ion batteries at low temperatures, making EVs more untenable, until the difficulties are solved.

Figure 2: EVs, Various Battery Types and their benefits



Source: Das et al. (2023)

Hydrogen Technology

Dermihl and Riedel (2023) note that for a transition of clean energy to be accomplished, large amounts of low-carbon hydrogen and increasing share of renewable electricity is obligatory. Additionally, to have a decarbonized system there is a need for enormous amounts of climate neutral hydrogen, produced as efficiently and cost-effective as possible, since there is no fear of direct CO2 emissions. Actions such as the European Green Deal, and studies like the IEA's "World Energy Outlook 2021" both highlight the importance of hydrogen and the essentiality of this technology for a greenhouse-gasneutral energy future, with hydrogen storing the increasing share of renewable electricity over long periods, having the energy transportable and ready to use.

The benefits of hydrogen energy are noticeable with it being non-toxic, compared to other sources of energy like gas and coal (Rinkesh, 2013). In addition, hydrogen energy is capable of launching spaceships for exploration missions to space, having simultaneously a sustainable production system. Its production is made possible through the separation of water into hydrogen and oxygen called

electrolysis, in which electrolysers powered by renewable energy sources can be used for the system. After the separation, the separated hydrogen is used in a fuel cell to produce electricity, having non toxic waste.

Disadvantages are present even in hydrogen technology, with the production and storage of it being detrimental (Koons, 2023). The cost of producing and storing hydrogen is the direct effect of electrolysis, which is expensive to create and, also, energy demanding, with it having difficult conditions to store as hydrogen is a gas at room temperature. Furthermore, the lack of infrastructure makes the process even more complicated with the U.S. The Department of Energy reports only 48 hydrogen fueling stations in the United States by the middle of 2021. Alongside those cons, the density of hydrogen is three times greater than gasoline when converted into a liquid from gas, with the ratio becoming from 1L of hydrogen to one fourth of gasoline, to much greater than it, adding on some financial concerns.

Policy Recommendations

Renewable Energy Sources

As Energy5 (2023a) notes, a significant policy that is associated with solar energy is the solar investment tax credit (ITC), in which homeowners and businesses who have installed solar panels, and invested in solar energy, could receive a tax credit up to 26% of the total cost. ITC, first introduced in 2006, fosters the adoption of solar energy, making solar systems more affordable and obtainable. In addition by the same source, inducements such as tax credits, discounts, or grants are what governments have been carrying out to promote the use of renewable energy sources. Some strategies and action plans for renewable energy sources include identifying the obstacles and surmount them and involve national and local authorities. A good example of those policies, as stated by IEA (2018), are Denmark’s deep-seated approach to energy planning, which includes regional and local authorities. Moreover, data should be freely available to the public about renewable energy sources, and they should be developed for each renewable technology, and the costs of them, with the Kazakhstan wind atlas being a great example of this policy, notes the International Energy Agency (2018).

Electric Vehicles

Government's role, as Energy5 (2023b) notes, is important in fostering EVs and their batteries with specific policies such as battery recycling programs, supporting the recycling and reuse of EVs batteries, with the EU to require for car manufactures to accumulate at least 50% of produced batteries

and recycle them. In addition to this, financial motivation should be a part of the policies, encouraging the citizens to acquire an electric car, as UK has done with a plug-in car grant, reducing the final cost of the purchase of the EV. Moreover, awareness actions and education are significant policies, that governments should be attentive, educating the public and the importance of EV's battery management, as so as the disposal of them correctly (Energy5, 2023b).

The World Economic Forum (2023) highlights that along with recycling EV's batteries, the cost of the process will have to be reduced. This reduction could be made possible with the use of robotics and automations, in addition with battery passports which inform for the type, health and charge of the battery.

Hydrogen Energy Policies

According to the International Energy Agency (2023), needed for the transportation of hydrogen technology, which today infrastructure is is mostly produced and consumed in the same location. Adding from the same source, with the incremental demand for hydrogen pipelines are becoming the most efficient and inexpensive way for the transportation of it. An example of government investing in this technology is in the Netherlands, which in June 2022 invested EUR 750 million for the elaboration of a national hydrogen transmission network. Furthermore, the European Hydrogen Backbone (EHB, n.d.) was established to create a pan-European hydrogen infrastructure, with 32 energy operators. Under development is, also, infrastructure for hydrogen infrastructure storage, such as Hypster (Hydrogen Pilot Storage for large Ecosystem Replication) in France, which was Officially launched in January 2021 (HYPSTER Project, n.d.). The International Energy Agency (2023) notes that at the end of 2022, 32 governments had a strategy ready for hydrogen. Some of those governments have already implemented grants, loans, and tax breaks. United States announced a new tax credit, an investment credit and grant funding for projects specialized in hydrogen production, in addition to the Department of Energy opening a 7billion dollars call for regional clean hydrogen hubs in September 2022.

Conclusions

In conclusion, the rapid development and adoption of technologies such as electric vehicles (EVs), renewable energy sources, and hydrogen hold immense promise for addressing critical environmental and energy challenges. These innovations offer numerous advantages, including reduced greenhouse gas emissions, improved air quality, and energy security. They are pivotal in our transition toward a more sustainable and resilient future.

To harness the full potential of these technologies, comprehensive policies are essential. Governments must prioritize investments in infrastructure, incentivize research and development, and establish regulatory frameworks that encourage innovation and sustainability. Additionally, public awareness and education initiatives are crucial to ensure a smooth transition.

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