A Net-Zero World, Climate Technology and Business Models

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Abstract

Technology and business model innovation are needed to build a net-zero world and doing so will open up new business opportunities for organizations that take initiative. A considerable economic transition will be required to achieve net-zero emissions. To maintain warming on a 1.5°C trajectory, developing, growing, and implementing climate technology will be essential.

The move to a low-carbon economy will expand some markets while endangering others. Businesses that can innovate swiftly and work together across value chains will be in a position to take advantage of several prospects for green growth. The 200-year history of industrial activity by humans is what led to the current trends and exchanges.

The transition to the new paradigm of a net-zero planet has a 30-year timeframe. Here, climate technology as well as commercial structures that enable this evolution enter the picture.

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1. Introduction

For the world to transition to a zero-carbon economy that respects nature, intellectual capital and innovation investments are required. By directing the "weightless" economy, which is characterized by ethereal knowledge-based services, toward the promotion of dematerialization and decarbonization, it is the main reason for the rise in total factor productivity and will determine how much more we can extract from the limited resources we have. The zero-carbon transition's sheer size creates significant network effects, (Dimitri Zenghelis, 2019, p. 11) and scale economies in manufacturing and research (Gerard van der Meijden and Sjak Smulders, 2017, pp. 1371-1415). These are so big that we always underestimate the potential for clean innovation to increase productivity (Emily Shuckburgh, 2020, p. 7).

For instance, reducing the CO2 emissions from its 250 million+ homes to zero or almost zero presents a significant task for Europe. Retrofitting this stock

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with prefabricated panels for the roofs and facades as well as solar panels to cover the residual (reduced) need for operational energy is one of the key choices. This presents a difficulty in in of itself because the housing stock varies widely, as do the available roof surfaces and the potential for energy generation in various temperature zones (Roland Rovers, 2018, p. 144).

To better understand how people and households use sustainable energy, numerous studies have been carried out. These research have mostly contributed to our understanding of the variables impacting daily energy-related practices and behaviours, such as recycling, taking shorter showers, and utilizing autos (Kristian S. Nielsen, Susan Clayton, Paul C. Stern, Thomas Dietz, Stuart Capstick and Lorraine Whitmarsh, 2018, pp. 130-144). Future research may examine how certain factors affect actions that have a high potential to minimize GHG emissions (Linda Steg, Goda Perlaviciute, Benjamin K. Sovacool et. al., 2021, pp. 14-16). With that strategy, there are too many blind spots that lead to unexpected results. For instance, businesses must slow down, if not invest in expensive modern technologies with dubious returns on investment, in order to accomplish the goal of fewer carbon emissions (Raquel Balanay and Anthony Halog, 2021, p. 5). As a low carbon energy source, nuclear power plants will probably continue to operate; however, the scope of their deployment is debatable given that the growth of renewable energy sources is predicted to lead to lower future costs (Sara Greenham, Emma Ferranti, David Jaroszweski, Lee Chapman, Andrew Quinn and Ruth Wood, 2021, p. 18).

2. Literature review

Low-carbon energy transitions, which are lengthy and multifaceted processes requiring structural changes in the built environment, industrial processes, transportation systems, and electricity generation, all promote energy efficiency, demand reduction, and the production and use of renewable energy sources. Even while decarbonizing energy is not the sole step necessary for the changes envisaged by existing global climate targets, it is believed that a carbon-free electrical system sooner rather than later will permit mitigation in other sectors and speed up the transition to a low-carbon society (Serafeim Michas, Vassilis Stavrakas, Niki-Artemis Spyridaki and Alexandros Flamos, 2018, pp. 1-21). It is believed that decarbonizing the electricity system will require both decreasing overall demand and increasing the usage of renewable energy (Joeri Rogelj, Gunnar Luderer, Robert C. Pietzcker et al., 2015, p. 519). Although the benefits of such a transition are acknowledged, there hasn't been enough research on the underlying challenges and potential drawbacks of the pathways encouraging a successful energy transition in the literature. Despite concentrating mostly on the difficulties in integrating intermittent sources with existing power networks, they also significantly depend on the national environment in which they are evaluated (Alexandros Nikasa, Vassilis Stavrakasb, Apostolos Arsenopoulosa et al., 2018, pp. 8-9).

Over the past 20 years, global warming has risen by almost 50% as a result of greenhouse gas pollution (Carlo Ingrao, Roberto Rana, Caterina Tricase, Mariarosaria Lombardi, 2015, pp. 75-88). Climate change is causing increasingly devastating and frequent hurricanes, forest fires, and floods, which are endangering the lives of millions of people worldwide. It suggests that we need to be well-organized and powerful enough to manage the effects of climate change. It will still be required even if we can keep global warming to a 2°C rise, as forecasted by the Paris Agreement. By the end of 2030, the United Nations (UN) projects that there will be 8.5 billion people on Earth (United Nations Department of Economic and Social Affairs, 2015). Given that there will be 5 billion urban dwellers worldwide by the year 2030, the rate of urbanization is another major global environmental issue (Marcel Ignatius, Nyuk Hien Wong and Kardinal Jusuf, 2015, pp. 121-135). Future cities must run more sustainably, more environmentally, and with greater health. The World Health Organization (WHO) estimates that more than 90% of people on earth breathe polluted air. Every year, 7 million more people would die if we don't take action to reduce air pollution and the prevalence of respiratory diseases (World Health Organization, 2018, pp. 23-27). Each year, 5 million people die as a result of water pollution, which also poses serious health hazards. The UN is still attempting to reduce the amount of raw sewage thrown into rivers and the ocean as well as the use of chemicals. It is estimated that a number of species that are in danger of extinction have lost 8% of their habitat over the past 25 years (Danica Schaffer-Smith, Jennifer Swenson and Antonio J. Bóveda-Penalba, 2016, pp. 221-230). Furthermore, an additional 22% of species worldwide face extinction due to poaching, the introduction of exotic species, and climate change. The UN has suggested significant actions for the preservation of our ecology and the safeguarding of natural resources (Hebin Shen, Syed Ahtsman Ali, Majed Alharthi et. al., 2021, pp. 23-25).

Environmental improvements promote increased energy effectiveness in industrial sectors (Xuejiao Ma, Yong Wang and Chen Wang, 2017, p. 942-970). Businesses must have an impact on green technologies in order to ensure environmentally friendly and sustainable government policies and administration (Guido Marseglia, Bianca Fernandez Vasquez-Pena, Carlo Maria Medaglia and Ricardo Chacartegui, 2020, 3330). We can first build an indigenous technological competency by including knowledgeable and talented technologists, academics, and personnel in the process of environmental innovations (Obadia Kyetuza Bishoge, Lingling Zhang and Witnes Gerard Mushi, 2018, pp. 70-88). There is no denying the challenge: to narrow the investment gap in the Sustainable Development Goals, a flow of “efficient” financial instruments and solutions is required. Investors and business owners need to understand the importance of these emerging frontier markets and be conscious of the challenges associated with doing business there. A driving factor behind important components of the sustainable development goals might be found in these markets (SDGs). This crucial development agenda needs to be implemented right now by the administration (Hebin Shen, Syed Ahtsman Ali, Majed Alharthi et. al., 2021, pp. 23-25). The

environmental risk that was most mentioned in the top ten country threats was the failure of climate action (Figure 1). The fact that many companies are launching separate climate change efforts also becomes a significant element. This offers a potential issue for corporate governance because boards of directors are responsible for monitoring and assessing such measures by their own companies (Hugh Grove, Maclyn Clouse and Tracy Xu, 2021, pp. 258-268).

Table 1. Regional environmental risk rankings: Environmental risks in the top 10 country risks

	Extreme weather	*Climate action failure*	*Natural disasters*	*Bio- diversity loss*	*Human-made environmental disasters*	
North America						
The United States			4			
Canada		6	10		9	
Europe						
Germany		9		10		
France		5			10	
The United Kingdom	3	5				
Sweden		8				
East Asia & Pacific						
China	8		4		5	
India				7		
Australia	5					
Eurasia						
Russia						
Kazakhstan						
South America						
Brazil						
Argentina						
Africa						
Nigeria						
South Africa		10				
Middle East						
Saudi Arabia	9				10	
Iran						
Average top 10 risk ranking	6.3	7.2	6	8.5	8.5	

Source: Impact of Climate Change on Global Economics, Lal, Agarwal

The realm of economics is directly and negatively impacted by all types of environmental degradation. The provision of ecosystem services and the jobs that depend on them are put in danger by environmental degradation. Climate change adaptation is a pressing issue that needs to be dealt with right away, despite the fact that mitigation efforts can help to lower future adaptation costs (Rattan Lal and Ankit Agarwal, 2020, p. 28).

3. Findings

The overuse of fossil fuels and growing industrialization around the world have caused greenhouse gases to be released, raising the global temperature, and posing environmental problems. Therefore, it is essential to achieve net-zero carbon emissions. While the majority still anticipates achieving carbon neutrality between 2050 and 2070, just 4.5% of countries have already done so. The

synergies between adaptation and mitigation measures, as well as their co-benefits, have also been limited by synergies between various countries (Lin Chen, Goodluck Msigwa, Mingyu Yang et al., 2022. pp. 16-17).

Materials from non-renewable resources are used in the built environment and its services, such as glass and concrete for construction, which need to be mined and extracted; medical equipment, which uses plastic generated from fossil fuels; ICT equipment, which relies on rare metals like gold and tungsten, which are routinely mined in methods that are damaging to the environment and workers; or in MRI machines, welding, lasers, and leak detection, all of which depend on. The scarcity and utility of some of these elements have all contributed to conflict, corruption, and the ongoing extraction of these materials from ever-more-intrusive places, and they probably will continue to do so. The mining industry addresses each SDG, therefore there is potential for improvements across the board (World Economic Forum, 2016). Consumers, product designers, advertisers, investors, and policy officials are all responsible for altering global market consumption patterns and lowering dependency on raw materials in favor of a more circular economy with nonrenewable resources designed out of the system (Didem Gurdur Broo, Kirsten Lamb, Richmond Juvenile Ehwi et. al., 2020, p. 109).

Large-scale manufacturing operations were developed during the 19th and early 20th centuries as a result of the second industrial revolution, which considerably increased the demand for energy because of their intensive energy usage (Sergey Filippov, 2018, pp. 20-33). Fossil fuels (FFs) were primarily utilized to enhance economic growth (GDP) and meet the demands of this industrial system in many nations, which resulted in the emission of large volumes of greenhouse gases (GHG) and climate change (Xiasong Zheng, Dalia Streimikiene, Tomas Balezentis et al., 2019, pp. 1113-1133). The greenhouse effect is brought on by GHG gases (also known as greenhouse gases), which capture more energy than they can reflect out [27]. Nitrous oxide (N2O), carbon dioxide (CO2), methane (CH4), and solid particles are among the air pollutants created by FF combustion that all contribute to the greenhouse effect and global warming (Intergovernmental Panel on Climate Change IPCC, 2018). GHG emissions are particularly detrimental to sustainability (Camilo Mora, Abby G. Frazier, Ryan J. Longman et al., 2013, pp. 183-187). Consequently, the IPCC's Fifth Assessment Report (AR5) confirmed that GHGs, particularly CO2 emissions, are the primary cause of global warming (Muhammad Shahbaz, Muhammad Zakaria, Syed Jawad H. Shahzad and Mantu Kumar Mahalik, 2018, pp. 282-301). Some climatologists believe that the acceptable upper limit for CO2 in the atmosphere should be 350 parts per million (ppm). With levels having above 400 ppm and coming near to 418 ppm in 2021, current levels are significantly over this value (Intergovernmental Panel on Climate Change IPCC, IPCC CC., 2014, p. 34). Keep the global atmospheric temperature below 2 degrees Celsius by 2050, and ideally below 1.5 degrees, according to the COP21 (2015 Paris Climate Conference) agreement (Helen Stolp, 2022, pp. 1275-1276). The replacement of FFs with zero net (lower or zero CO2) emissions energy sources, such as nuclear energy and renewable energies

(hydropower, solar, wind, biomass, tides, biofuels, and geothermal), has been proposed to reduce the level of GHG emissions for the electricity production sector as a result of the expansion of energy demand and rapid growth (NE) (United Nations Climate Change, 2015, France).

Today, almost all issues with socio-ecological sustainability are related to build environment design. However, ironically, through enhancing social and ecological life-support systems, construction will be crucial to achieving sustainability. Given the rates of loss of land, resources, water, and biodiversity, urban development must do more than only rehabilitate the natural environment. It must truly advance environmental and natural justice, not only in close proximity. Technology and design ideas required for development that benefits nature already exist. However, the bulk of sustainable building recommendations, specifications, and performance criteria simply aim to improve landscapes and increase the amount of nature in cities (Elaheh Shobeiri, Huan Shen, Filippo Genco and Akira Tokuhiro, 2022, p. 11).

Currently, 200 million tons of carbon dioxide are attributable to the iron and steel industry in the EU28 (see Janis Birkeland, 2022, p. 35) 5% of all CO2 equivalent (CO2e) emissions (see Bram Borkent, Jeroen de Beer, 2022, NL), to be precise (Bert Metz, Ogunlade Davidson, Leo Meyer, Peter Bosch, and Rutu Dave, 2007, UK and USA). These figures demonstrate how difficult it will be to transition heavy industries, including the iron and steel sector, to low carbon technologies. Austria's iron and steel industry also contributes significantly to greenhouse gas emissions. 2017 saw 8.1 million tons of crude steel produced in Austria (see Eurostat, 2017, EU), they account for roughly 16% of all greenhouse gas emissions (World Steel Association, 2018, BE). The advancement of technology has made it possible to decrease CO2 emissions and increase energy efficiency in this industry.

However, the fundamentals of steelmaking have not altered significantly throughout time. Over 91% of the crude steel produced in Austria in 2017 was generated in oxygen-blown converters that received their feed from blast furnaces as hot metal. The remaining portion came from electric arc furnaces (Andreas Zechmeister, Michael Anderl, Konstantin Geiger et al., 2019, Austria). According to the EU Roadmap 2050, CO2 emissions from the iron and steel industry must be reduced by over 85% (see Michael Anderl, Johannes Burgstaller, Bernd Gugele et al., 2018, Austria). A thorough switchover to low-carbon steelmaking methods is necessary to achieve this important objective (Martin Hammerschmid, Stefan Müller, Josef Fuchs and Hermann Hofbauer, 2021, pp. 169-187).

On the other hand, the production of cement and concrete, which is one of the major material flows and contributes significantly to greenhouse gas emissions, is required for construction for industry, commerce, and housing. The need to convert calcium carbonates into burnt lime, which releases the CO2 stored in the carbonates, as well as the inescapable energy expenditure, are some of the causes of this. However, replacing stone and concrete with other (organic) construction materials has energy advantages but also has drawbacks. For instance, the goal of limiting land consumption puts other claims to use in conflict with land use as well.

In addition, homes use around a quarter of all energy consumed in Europe, with two thirds of the energy going toward low temperature space heating (including about 20% for electrical appliances and lighting, 10% for hot water, and 5% for baking and cooking) (Odyssey Database 2017). Building insulation is still being used to its full capacity, despite the potential for considerable energy and heating cost reductions. Despite the absence of political will to take advantage of the potential savings (and the additional qualified jobs) from optimizing the building fabric, the behaviour-based contribution is typically undervalued. It accounts for up to 50% of household energy use (living room temperature, ventilation frequency, hot water usage, etc.), making the application of social innovations necessary (role models, friends, colleagues, communication).

One other problem is the continually increasing amount of living space per person, which is a result of both changing demographics (such as the growth in one-person families) and increasing demands on the quantity of available living space (Joachim Spangenberg, Werner Neumann, Heinz Klöser et al., 2021, p. 62). Natural environments are deteriorating, making them less liveable for communities.

"Repeated extreme and compound occurrences [may] promote the fragmentation of communities... and in some cases [lead to] migration," Kopp et al. caution in their report (Robert E. Kopp, Rachel L. Shwom, Gernot Wagner and Jiacan Yuan, 2016, p. 346-372). Therefore, creating appropriate response mechanisms is essential. Adopting measures to make public facilities more resilient-which might serve as refuge centers' will, for instance, improve rural communities and foster public confidence in governing structures. One strategy is to improve the stable energy supply to the structures during a crisis or catastrophe (see Sarah Niklas, Dani Alexander and Scott Dwyer, 2022, pp. 8-9) and in addition, direct air carbon capture prevents issues with food crop shortages, land use restrictions, and carbon capture and storage issues related to bioenergy and afforestation (Lin Chen, Goodluck Msigwa, Mingyu Yang et al., 2022, pp. 16-17).

In February 2021, 124 countries declared their intention to achieve carbon neutrality and net-zero emissions by 2050 or 2060 (Jing M. Chen, 2021, pp. 100-127). In order to accomplish the targets specified in the Paris Agreement and promote sustainable development, it is also important to remove CO2 from the atmosphere to achieve net-zero or negative carbon emissions using a variety of social, economic, environmental, and technological means. Carbon neutrality, or a state of net-zero carbon emissions, can be achieved by balancing the total amount of carbon dioxide or greenhouse gas emissions produced directly or indirectly by a country, company, product, activity, or individual over a certain period through carbon offset or removal initiatives (Lin Chen, Goodluck Msigwa, Mingyu Yang et al., 2022, pp. 16-17). In its special report on global warming of 1.5°C, the intergovernmental panel on climate change (IPCC) also emphasized the necessity of reducing and eventually ceasing the use of fossil fuels, increasing the use of renewable energy, and enhancing energy efficiency, as well as the significance of implementing these measures in cities to achieve carbon neutrality (Valérie Masson-Delmotte, Panmao Zhai, Hans Otto Pörtner, Debra Roberts et al., 2018).

4. Conclusions

For the world to transition to a zero-carbon economy that respects nature, intellectual capital and innovation investments are required. For a better understanding of how people and families use renewable energy, numerous research has been conducted.

This research has mostly contributed to our understanding of the variables impacting daily energy related practices and behaviours, such as recycling, taking shorter showers, and utilizing autos. As a low-carbon energy source, nuclear power plants are also likely to continue operating, however the scope of their deployment is debatable given that the development of renewable energy sources is anticipated to lead to lower pricing in the future.

According to UN predictions, 8.5 billion people will inhabit the planet by the end of 2030. Another significant environmental concern on a worldwide scale is the rate at which urbanization is expanding.

By 2030, it is anticipated that approximately 5 billion people will live in urban areas. Future cities must run more sustainably, more environmentally, and with greater health.

The World Health Organization (WHO) estimates that more than 90% of people on earth breathe polluted air. If we do not reduce air pollution to reduce the prevalence of respiratory diseases, there will be an additional 7 million fatalities per year.

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