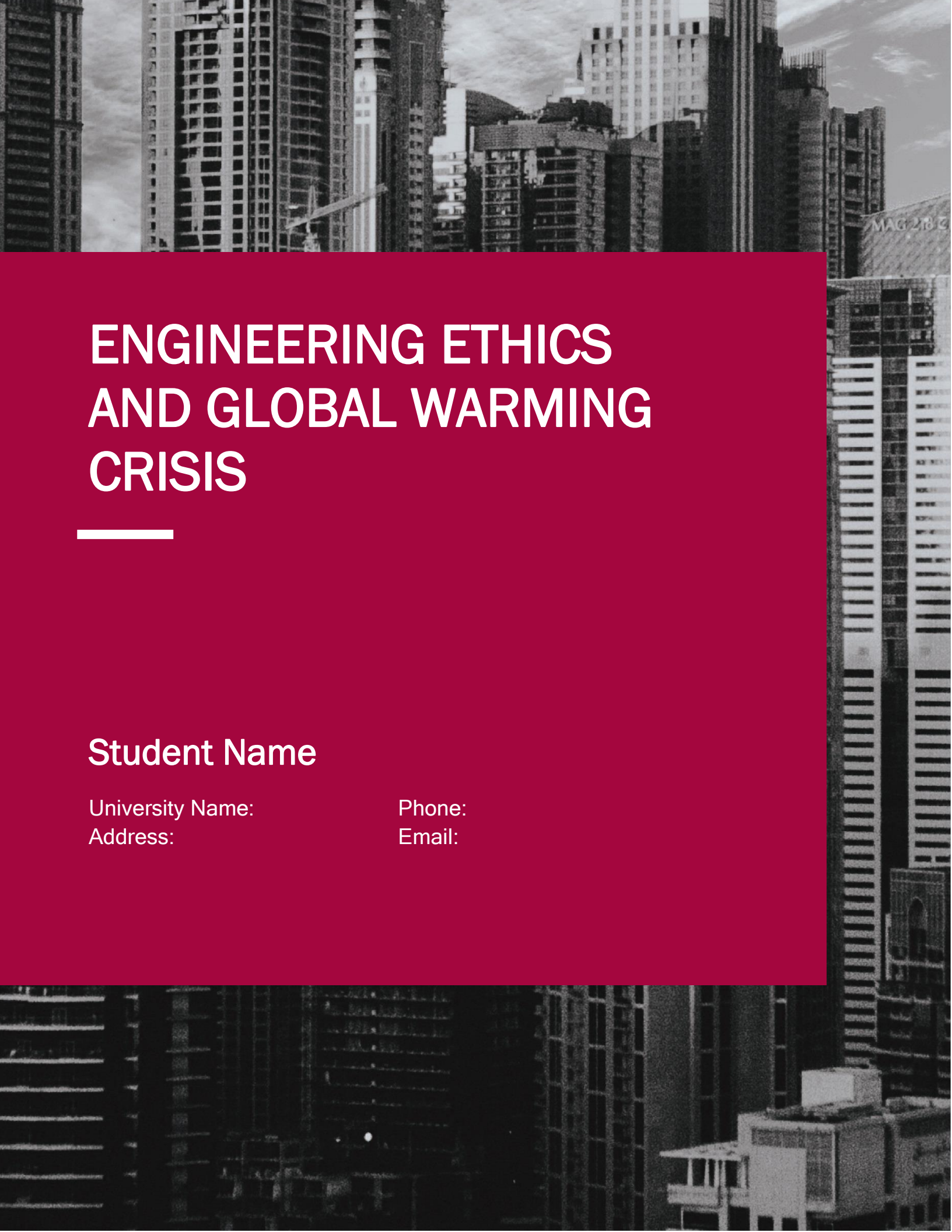


ENGINEERING ETHICS AND GLOBAL WARMING CRISIS

Student Name

University Name:
Address:

Phone:
Email:

Introduction

At the earlier stages of development, engineers have commonly looked for and executed specialized answers for cases presented by others and not considered ethical issues connected with the natural and social effects of taking care of these cases. [1] Engineering ethics has to a great extent been unsettling with incredible skill and obligation regarding specialized ability as opposed to more extensive social and ecological issues. This article considers the role and relevance of engineering ethics for engineers to meet the challenges posed by global warming. This report established a relationship how best the engineering profession can be encouraged to tackle global warming problem.

Increase in earth's average surface temperature is known as global warming. It is a global phenomenon that integrates with the subject and profession of engineering in significant ways. It is a quantitative and increasingly physical reality. For a variety of psychological, economical, developmental, and political causes, global warming has piqued the interest of the general society, professionals and their organization, legislators and policymakers. [2- 5]

Global warming, and the resulting vulnerability of millions of individuals to hazards which they did not cause, poses new ethical concerns for engineering decision-making. [6] Inundation of beaches and small islands, as well as increased frequent and severe extreme weather events, the development of illnesses such as malaria and dengue fever, and the eviction of lakhs of environmental refugees are among the dangers.

Fundamental concepts of common morality as kindness and impartiality, two essential concepts of common morality, necessitate mitigation and adaptation plans to global warming policies that involve engineering decision makers. [7] These measures are also necessary under the precautionary principle, as there are compelling reasons to believe that climate change would cause substantial and permanent harm (or equivalent), necessitating action despite a lack of comprehensive scientific consensus.

Review of engineering ethics

Although the words "ethics" and "morality" are sometimes used interchangeably, it is important to distinguish between morality and ethics. Morality is associated with right and wrong behavior and reasons, whereas ethics is concerned with the philosophy of morality. [8] Ethics may be defined as a "framework for investigating moral challenges and their solutions." [9] The study of moral dilemmas (Figure 1) and judgments confronting individuals and organizations in engineering and technological progress, including the design of technological and infrastructural policy, is referred to as engineering ethics.

Figure 1 Moral values related to engineering ethics

Ethical theory

The three ethical theories (utilitarian ethics, deontological ethics, and virtue ethics) are at the heart of normative ethics debates. It is critical, however, for public relations professionals to grasp how to use these notions in their day-to-day work. When the moral decision is evident, the fundamental purpose of engineering ethics is not to perform simple, straightforward, and rational things. However, the fundamental goal is to be able to handle complicated issues in the most ethical way possible, and it's likely that numerous ethical answers exist, all

of which are correct, as is the case with any problem. There are various options, but some are better than others.

Code of ethics

Engineering associations such as AAES, ABET, NSPE, IEEE, and AICTE have developed these codes of ethics to assist engineers in addressing moral difficulties in their profession. Following are the examples of code of ethics.

Review of global warming

Many distinct factors have changed as a result of the global warming. Seawater is among the things that has been changed by the global warming climate. Oceans have gotten warmer as a result of rising temperatures. As a result, ice in the ocean's cooler parts has melted. [10] Glaciers have declined in size, and ice sheets have reduced in size as well. This ice, however, does not melt into the atmosphere. Instead, it turns into water and contributes to the ocean. As a consequence, more water accumulates in the seas, raising sea levels. [11]

Whenever carbon dioxide as well as other suspended particles develop in the climate, they retain light and radiation from the sun that has skipped off the planet surface, causing an unnatural weather change. For the most part, this radiation ought to disappear to space, yet these impurities, which might continue in the air for years to hundreds of years, ingest intensity and influence the earth to warm. [12] Greenhouse gases are heat-trapping pollutants such as carbon

dioxide, methane, nitrous oxide, vapour, and synthetic fluorinated gases, and their impact is known as the greenhouse effect. This rise in sea level is predicted to have the greatest impact on coastal areas. Scientists predict that rising sea levels will have a significant influence on a variety of regions. [13]

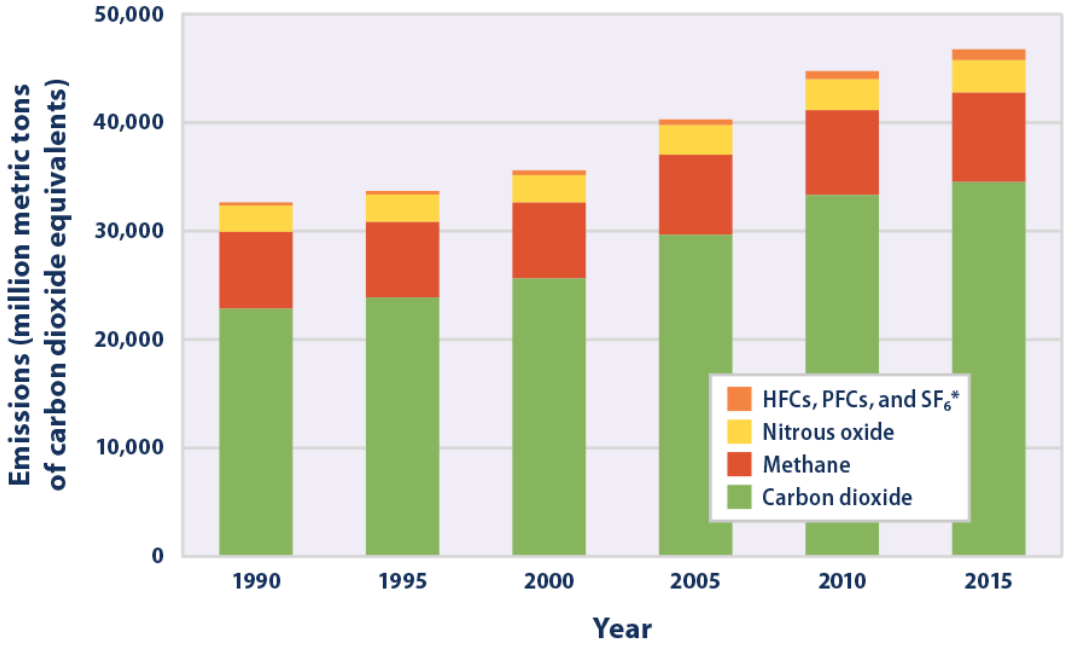


Figure 2 Increasing rate of greenhouse gases concentration [14]

Factors responsible for global warming

Because the death rate was high before the industrial revolution, the human population was low. When death rates began to decline as birth rates increased, this altered. [15] For begin, the Industrial Revolution ushered in significant agricultural progress. More food was produced as a result of modern farming practises such as crop rotation and improved technologies, some of which increased irrigation. Selective breeding increased the average size of each farm animal, resulting in more meat being available. Increased food and meat yields resulted in fewer famines and a healthier diet for humans, resulting in longer life expectancy. [16] Farmers were less needed as food yields increased, and the industrial revolution created numerous factory employment, culminating in urbanization. Many young individuals went to major cities because of the greater earnings and factory employment offered. The need for fuel, food, and space increased as the human population rose, putting a strain on the ecosystem.

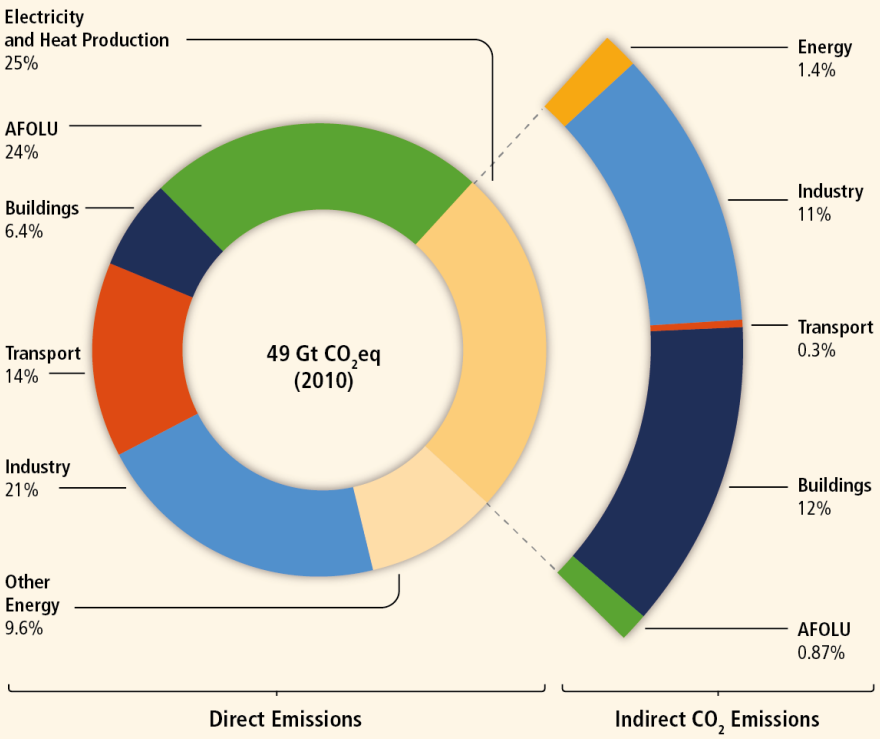


Figure 3 Factors responsible for greenhouse gas emission [17]

The degradation of Earth's tropical rain forests illustrates the rising demand for more food and space that is related with the world's growing population. Deforestation occurs for a variety of reasons, including growing urban sprawl, logging, roads, money, and agriculture. [17] The majority of the cleared land is used for agriculture. Plantations commonly use slash and burn tactics to remove woods. However, because it emits large quantities of carbon dioxide as well as aerosols into the atmosphere, this method is extremely unsustainable.

Interrelation between Engineering ethics and Global warming

Global warming detection relies heavily on technological advancements. [18] Engineers provide instruments to enhance the certainty of water supplies that are critical to human well-being, including rain - gauge to meteorological radars and satellites. (19-20) Engineers also use scientific and engineering concepts to

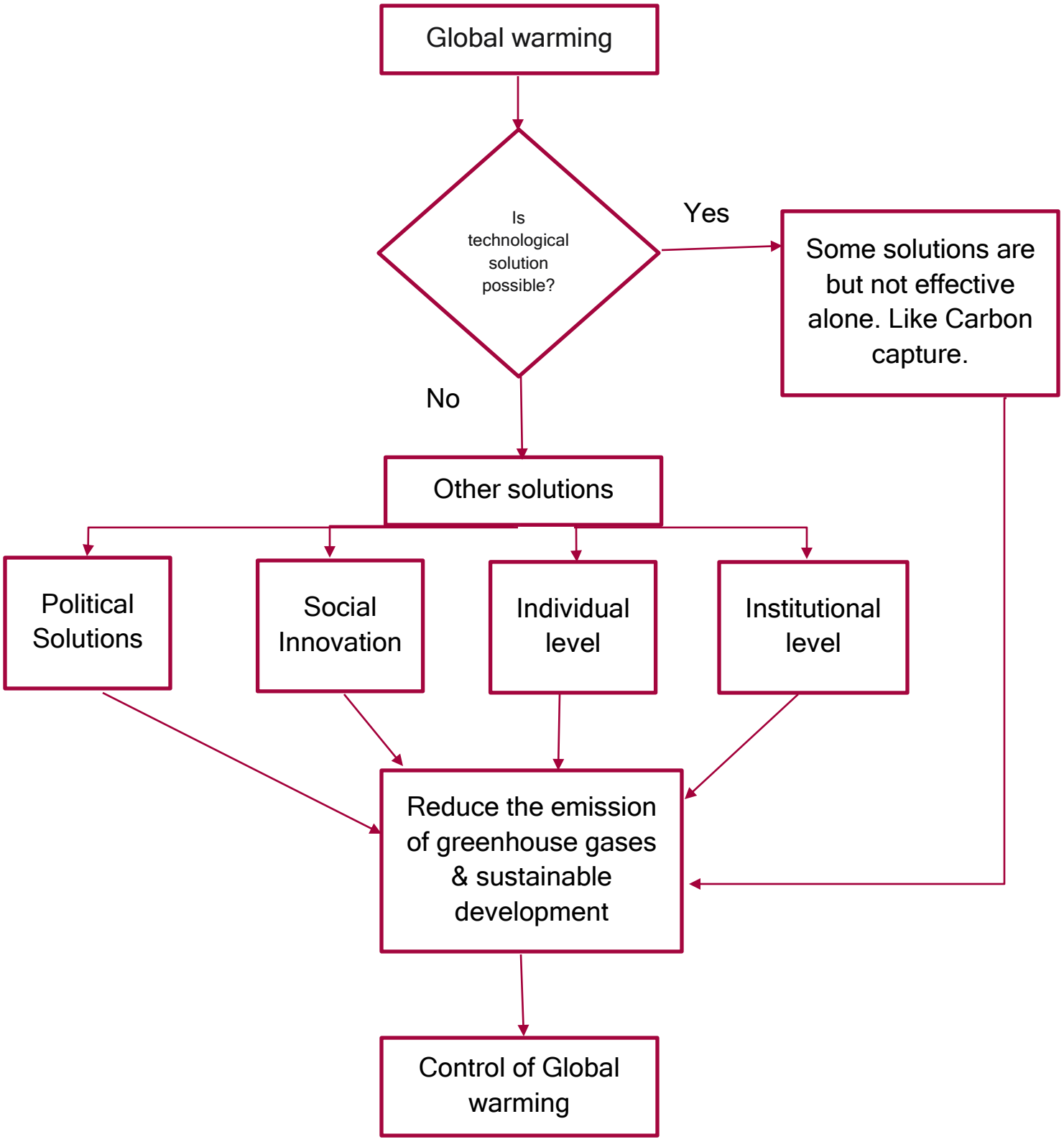
create solutions that help humans flourish in changing environments, such as constructing infrastructure, houses, and pipelines on permafrost in the Arctic or adjusting to a changing tundra. [21] It is vital to remember that technological advancements in general connect with social and psychological factors and processes.

The finest example of engineers and psychologists working together is signal detection theory. In uncertain information situations, the ability to identify a signal/target amid background noise is dependent on more than just the quality of the constructed physical detecting equipment. This argues that engineers might benefit from a greater understanding of consumers and also the social and economic consequences of their ideas. A good example of such an approach is portfolio-based water management, which tries to match management approaches with the behaviours of water consumers, system administrators, and regulators [20].

Responses to global warming involve a slew of ethical issues, which organizations like the UN Intergovernmental Panel on Climate Change (IPCC) are increasingly considering in their assessments of response alternatives. [22] Many choices are concerned with distributional difficulties associated to global warming is consequences and/or the expense of responding to or reducing it. One important ethical debate, which is frequently misrepresented as an economic debate by posing it as an enquiry about the acceptable rate, concerns governments' and other organizations' willingness to take responsibility for addressing climate change now rather than deferring it to future generations.

Philosophy and ethics also weigh in on the role of skeptical in keeping climate change science honest [23], instead of as a tool of special interests against initiatives that benefit the public. [24]

Flowchart of ethical problem



Limitations of Engineering Innovations

Because mitigation and adaptation need concerted effort on several fronts, global warming is a difficult challenge [25]. The bulk of the 16 climate stabilisation "wedge" solutions suggested by Pecala et al. [26] to maintain carbon dioxide concentrations below 400 ppm for the next 60 years need technological innovation, which is a domain of engineering. It is, however, only one front that must be integrated with political activity, social innovation, and individual, community, institutional, and company action.

Simple terms, there really is no magic solution—only silver buckshot [5, 20], which necessitates long-term, coordinated action. Unfortunately, even professionals cease exploring for solutions to problems after one has been implemented—a phenomenon known as "single action bias" among doctors and farmers [2]. Engineering solutions assist to reduce emissions intensity, boost energy efficiency, and produce cost-effective and safe renewable energy sources. Such creativity, however, will not suffice.

It is becoming clear that the silver bullet required for speed and scale will need technological and organizational breakthroughs in negative emissions technologies, including carbon capture and storage. [27]

Most of the other IPCC scenarios that limit average global temperature rises to 2°C by 2150 rely heavily on this technology. This makes the lack of attention and funding for R&D on such technologies even more unexpected, indicating maybe a general aversion to them. On the one hand, climate protection scientists and modellers say that these innovations will be needed soon and on a large scale, and that they should not be used in place of, but rather alongside, de-carbonization initiatives. Negative emissions technologies, on the other hand, appear to encourage the "wrong" thing, the ongoing use of fossil fuels, to many other parts of society. [28]

Conclusion

For decades, humans have been modifying the current and future climate as population, industrial production, and other human activities have increased energy demand, which, when met with fossil fuels, has resulted in fast increases in greenhouse gas emissions. To recognize the fact that human influence has become a significant impact on the world temperature and ecology, the current geological period has been dubbed "Anthropocene".

People and groups have different objectives, thus agreements and solutions must be sought in cooperative or competitive settings. Negotiation theory explains how to create jackpot solutions in such situations, and it demands both parties to be ready to actively explore goal conflict and to compromise on less important goals in order to obtain gains on more essential goals.

Reference

1. M. A. Hersh, "Environmental ethics for engineers," IEE Seminar on Engineering and the Environment - How It Affects You!, 1999, pp. 7/1-7/4, doi: 10.1049/ic:19990552.
2. Weber EU. 2015. Climate change demands behavioral change: What are the challenges? Social Research 82:561-81.
3. Weber EU. 2016. What shapes perceptions of climate change? New research since 2010. WIREs Climate Change 7:125-34.
4. Weber EU. 2017. Breaking cognitive barriers to a sustainable future. Nature Human Behavior 1:0013.
5. Weber EU, Bell RB. 2014. Focus on the habits: Applying behavioral insights to reduce greenhouse gas emissions. Boao Review, July.
6. Oppenheimer, M., Glavovic, B., Hinkel, J., Van De Wal, R., Magnan, A., Biesbroek, R., Buchanan, M., Abe-Ouchi, A., Gupta, K., Pereira, J., Oppenheimer, M., Glavovic, B., Hinkel, J., Van De Wal, R., Magnan, A., Abd-Elgawad, A., Cai, R., Cifuentes-Jara, M., Pörtner, H.-O. and Roberts, D. (2019). Sönke Dangendorf (Germany), Petra Döll (Germany), Virginie K.E. Duvat (France). [online] doi:10.1017/9781009157964.006.
7. Attfield, R. (2017). Engineering Ethics, Global Climate Change, and the Precautionary Principle. [online] Natural Resources Management: Concepts, Methodologies, Tools, and Applications. Available at: https://www.igi-global.com/chapter/engineering-ethics-global-climate-change-and-the-precautionary-principle/165295 [Accessed 10 May 2022].
8. Ethics Unwrapped (2013). Morals - Ethics Unwrapped. [online] Ethics Unwrapped. Available at: https://ethicsunwrapped.utexas.edu/glossary/morals.
9. Krishnamurthy, Prabhakar. (2011). An Introduction to Ethics. SSRN Electronic Journal. 10.2139/ssrn.1781502.
10. IUCN (2018). Ocean warming. [online] International Union for Conservation of Nature. Available at: https://www.iucn.org/resources/issues-briefs/ocean-warming.
11. Singh, B.R. and Singh, O. (2012). Study of Impacts of Global Warming on Climate Change: Rise in Sea Level and Disaster Frequency. [online] www.intechopen.com. IntechOpen. Available at: https://www.intechopen.com/chapters/39170.
12. MacMillan, A. and Turrentine, J. (2021). Global Warming 101. [online] NRDC. Available at: https://www.nrdc.org/stories/global-warming-101.
13. National Geographic Society (2012). greenhouse effect. [online] National Geographic Society. Available at: https://www.nationalgeographic.org/encyclopedia/greenhouse-effect/.
14. Denchak, M. (2019). Greenhouse Effect 101. [online] NRDC. Available at: https://www.nrdc.org/stories/greenhouse-effect-101.
15. Bavel, J. V. (2013). The world population explosion: causes, backgrounds and projections for the future. FVV in OBGyn,5(4), 281-291.
16. Turner, L. L. (n.d.). Did the Industrial Revolution Affect Human Population Size. Synonym.
17. Tinker, P., Ingram, J. S., & Struwe, S. (1996). Effects of slash-and-burn agriculture and deforestation on climate change. Agriculture, Ecosystems & Environment,58(1), 13-22. doi:10.1016/0167-8809(95)00651-6
18. Parkinson CL. 2020. Engineering in the detection of climate change. The Bridge 50(1):7-15.
19. Sorooshian S, Gorooh VA, Hayatbini N, Ombadi M, -Sadeghi M, Nguyen P, Hsu K. 2020. Predictability of hydro-meteorological extremes and climate impacts on water resources in semiarid zones: Expectations and reality. The Bridge 50(1):33-42.

20. Lettenmaier DP, Lund JR. 2020. How will climate change affect California's water resources? The Bridge 50(1):24-32.
21. Schnabel WE, Goering DJ, Dotson AD. 2020. Perma-frost engineering on impermanent frost. The Bridge 50(1):16-23.
22. Kolstad C, Urama K, Broome J, Bruvoll A, Cariño Olvera M, Fullerton D, Gollier C, Hanemann WM, Hassan R, Jotzo F, and 3 others. 2014. Social, economic and ethical concepts and methods. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the IPCC, eds -Edenhofer O, Pichs-Madruga R, Sokona Y, Farahani E, Kadner S, Seyboth K, Adler A, Baum I, Brunner S, Eickemeier P, and 6 others. Cambridge UK: Cambridge University Press.
23. Keira S. 2015. Have we been asking the wrong questions about climate change science? Why strong climate change ethical duties exist before scientific uncertainties are resolved. Rock Ethics Institute, Pennsylvania State University.
24. Hoggan J. 2010. Climate Cover-Up: The Crusade to Deny Global Warming. Vancouver: Greystone Books.
25. Grundman R. 2016. Climate change as a wicked social problem. Nature Geoscience 9(8):562-63.
26. Pacala S, Socolow R. 2004. Stabilization wedges: Solving the climate problem for the next 50 years with current technologies. Science 305(5686):968-72.
27. Wilcox J. 2020. The giving Earth. The Bridge 50(1):43-49.
28. Anderson K, Peters G. 2016. The trouble with negative emissions. Science 354:182-83.