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## Mechanical engineering's relevance in achieving long-term sustainability

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### Abstract

So far the development of the modern world has been dominated by science, engineering, and technology, and the role of an engineer is closely linked to the needs of society. But unfortunately, this modernization has given birth to many pressing challenges such as environmental pollution, depletion of resources, rapid population growth, and damaged ecosystem.

Due to these drawbacks, our environment is looking for a shift in the route that modernization has taken. As the demand for this transition is growing, several scientific divisions are turning to their origin for a solution, which is mechanical engineering. Mechanical engineering, being one of the oldest scientific disciplines, is expected to produce some effective solutions for these difficulties.

This article will explore the importance of mechanical engineering for this transition, and possible solutions with it.

**Keywords:** Engineers, mechanical, sustainable development, ecosystems, environmental pollution, society, economic resources, global challenges

### Introduction

Since the second industrial revolution, the world has been teetering on the brink of a disaster, owing primarily to injudicious consumption of natural resources over a short period. Although the formation of fossil fuels took millions of years, we humans have nearly depleted them in just two centuries. This easily explains how these fuels have punctured the interminable equilibrium of our ecosystem.

According to a report published by the Potsdam Climate Institute, if carbon emissions are not reduced by half till 2030, our environment may descend into chaos. So being only nine years away from the deadline, it is quite lucid that raising concerns in the society and asking the public to reduce their dependence on dirty fuels in the absence of a viable alternative, would not get success in our bags. To be successful, we must look beyond the horizon and create something new.

### Why action is needed from fields like mechanical engineering?

For the past 150 years, engineering practices have been based on a paradigm of controlling nature rather than cooperating with it. The majority of engineering achievements in the past did not consider the impacts of their creation on social, economic, and environmental systems, and an insufficient amount of attention was paid towards minimizing the risk and scale of unplanned perturbations in natural systems. Hence, in the control-of-nature paradigm, humans and the natural world have been divided, and humans have adopted an oppositional and manipulative stance toward nature.

As a result, the world is becoming more crowded every day, with more consumption and more pollution. To meet the increased demands for energy, food, land, water, transportation, materials, waste disposal, earthmoving, health care, environmental clean-up, and infrastructure, etc humans are extensively altering Earth's natural systems at all scales- from local to global- at unprecedented rates.

Hence after considering the negative impacts of these practices, it has become very important for technical fields, like mechanical engineering, to develop a solution and promote a holistic approach to these problems.

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### **What is mechanical engineering and what is its significance?**

Mechanical Engineering, also known as the mother of all the engineering branches, is the only engineering branch that combines the principles of physics and mathematics with material science, to design, analyze, manufacture, and maintain technical systems. It is one of the oldest and broadest branches of engineering.

Today many people believe that mechanical engineering is a dead field and is no longer productive. But they fail to realize that without mechanical engineering, our lives would've not been same as they are today. While we might not even realize it, every day we use something that is the product of this field. Due to so much involvement in our daily lives, mechanical engineering can help us to find the most suitable solution to the sprouting ecological problems. Mechanical Engineers have played and continue to play a key role in the future of sustainable development. Whether it is building new products or working on new technologies, they are instrumental in designing, contriving, and building the way products and services are delivered and consumed. They are the ones who carve the path to innovations and construct the base for solutions, which then are used by other branches to achieve them.

### **What is the relationship between our societal needs and Mechanical engineering?**

Mechanical Engineers plan, design, and create the physical structure through which society lives works, and plays. Therefore, to sustain our environment and society, we must understand the role of an engineer and examine the relationship between them and society. Then, perhaps 21st century engineers can develop a sustainable world in balance with the forces of nature to combat some of the inevitable global crises.

### **Solutions with mechanical engineering**

While mechanics are blamed for much of the pollution that contributes to global warming, they may also be the solution. Among the few doable options, the only one that is almost certain to succeed is to reduce our reliance on dirty fuels for energy. However, this can only become a reality if humans begin to use every clean potential energy resource that is available. Many things around us indeed have the potential to meet our energy needs, but lack of technical knowledge keeps us away from taking advantage of them.

I will use a simple example to explain this perspective.

Not known to many, driving a car or riding a bicycle can produce energy. This may appear to be paradoxical, but here is how it works:- When we press the accelerator of a car or pedal a bicycle, energy is applied and the wheels begin to rotate, causing us to move. When wheels begin to rotate, they generate a large amount of angular momentum and kinetic energy. With a simple technique, this energy can be conserved and used to generate electricity. It works in the same way that windmills do. A small generator has to be installed in axial positions inside the vehicle, which should be connected to a battery. As the vehicle moves, the wheels will rotate, causing the turbine inside the generator to spin and generate electricity.

Hence through a very simple technique, we can generate electricity from one of our daily routines. These solutions are not limited, and with proper knowledge, these can be created in many other parts of our routine.

For these solutions to become a reality the role of Mechanical engineering will be crucial. Being a technical field, it can directly impact these discoveries and precise technical capabilities may even boost their productivity. But efforts must be made to avoid the mistakes made by previous engineers. They must revisit their mind set and adopt a new mission statement that contributes towards building more equitable technologies which fulfil demands at various scales and expand the nature of economic growth rather than limiting it.

The mission statement should have a completely different attitude towards natural and cultural systems and reconsider interactions between mechanical disciplines and non-technical fields.

### **Some suggested missions that may impact are**

1. A major paradigm shift from control of nature to participation with nature
2. An awareness of ecosystems, ecosystems services, and the preservation and restoration of natural capital
3. A new mindset of the mutual enhancement of nature and humans that embraces the principles of sustainable development.
4. Designing system and infrastructure which integrate state of the art technologies into subsequent sustainability and enable information and statistics flow.
5. Analyzing problems to see how mechanical and thermal devices might help solve a particular problem or what changes the design or system as needed.
6. Play leadership roles like working to solve global challenges such as depletion of resources, pollution, ecosystem damage, and the effects of rapid population growth.

If these changes are adopted duly then they may boost the world's Sustainable Development Goals and will contribute to the vast chain of modern production and consumption of natural resources which would deliver services to the larger societies. They will also encourage engineers to find new sources and alternatives for a particular resource that appears to be running out and would embark on a worldwide transition to a more holistic approach to development.

### **Conclusion**

It is clear that a purely environmental approach is insufficient, and hence engineers are required to take a wider perspective including technical and non-technical fields along with goals such as poverty alleviation, social justice, and local and global connections. Sustainable strategies must join hands and work together for a better future. Emerging technologies must be harnessed to gather and ascertain valuable insights to build products that have a lasting positive social and environmental impact along with cost savings and business value. This way forward will support and growth mindsets that allow the engineering community to incorporate sustainability in every solution, product, or service.

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