# Tribology & Sustainability: a Short Report

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**Abstract**
Tribology at mechanical interface of machines is dissipating ~23 percent of fossil fuel energy in pursual of mechanical work for encouragement of scientific inertia of energy saving mechanism with enhancement of mechanical efficiency. The promotion of green technology solutions and advancement of scientific innovation is an academic purpose for re-searching of nature inspired materials useful for engineering applications. The transport, energy, manufacturing, and buildings altogether evolve carbon loadings at interacting mechanical surfaces due to the inherent nature consciousness.

**Keywords:** Bio-Interfaces, Carbon Emission, Applied Thermodynamics, Surface Science, SDGs.

## 1. Introduction

The covid#19 pandemic is a paradigm for the promotion of sustainability and the advancement of scientific innovation at the science-policy-society interface [1-5]. The promotion of sustainable development goals (SDGs) and advancement of the digital economy has been realized during the 21st century through the achievement of 17 sustainable development goals highlighted by United Nations [6]. Global cities have big data of 55 percent population evolving 70% of global $CO_2$ emissions primarily from industries and fossil fuel based mechanical vehicles at the frontier of sustainable pattern of life of urban mobility likely to add 2.5 billion people by 2050 [7-8]. World Economic Forum white paper is a guideline for the smooth functioning of the fourth-generation industrial revolution and contributes to the achievement of qualitative engineered products [9]. The virtual laboratory during covid#19 pandemic for teaching, learning, and research for reducing social distancing as per the requirement of a synergistic general health is a scientific and technological boon for the advancement of Industry 4.0 and promotion of sustainability [10-11]. The capture, storage, and utility of atmospheric $CO_2$ are the socioeconomic domain of technology for producing products as per the requirement of environmental sustainability [12]. The rising trend of bioabsorbable materials based on cellulose fibres, polymer lactic acid monomers, bioavailability have been envisioned from the biomaterials/packaging oriented global markets useful for the advancement of science and technology [13-16]. The 2$^{nd}$ law of thermodynamics is included for prediction of mechanical work in assuming human body as a heat engine deliver mechanical work in an environment for work-life balance;

$$\text{Mechanical Efficiency} = \frac{\text{Mechanical Work}}{\text{Energy Input}} = \frac{W}{Q_i} \quad \text{(i)}$$

## 2. Scientific innovations & Governance

Where mechanical efficiency is a heat engine performance indicator, mechanical work during kinematics, and fuel energy input for rationalization of mechanical efficiency of source/sink reservoirs [17]. Applied thermodynamics is useful for rationalization of environmental reaction of evolved cytotoxicity due to supramolecular adhesion of charged particles at biological membranes. The green technology, bio-inspired science, energy balance against environmental reactions, and sustainability have been expressed as per the integrity of laws of thermodynamics for an environmentally friendly technological solution [18-19]. The transformation of conventional technology by green tribology is a viable solution to enhance machinery performance, and lifetime, reducing maintenance, and optimizing energy losses for strengthening the socioeconomic interface for an effective materials and energy balance [20-21]. The Paris Agreement is political binding treaty for technology development, transfer for resilience to climate change, reducing greenhouse gas emissions to limit global warming to 1.5°C above pre-industrial levels, and greenhouse gas emissions must decline 43% by 2030 [22]. Intergovernmental Panel on Climate Change (IPCC) working group expression to the Sixth Assessment Report (AR6) as part of the technical summary is designed on numerous lines of evidence such as understanding of biological, physiochemical, and climate systems [23]. The science and technology development in order to preserve a green planet, the promotion of green technology to limit global warming 1.5°C above pre-industrial levels in the Paris Agreement, and reach net zero carbon loadings shall be achieved by 2050 [24]. Green technology is influenced not only by the design and manufacturing of novel bionic contacts through the application of surface science and nature-inspired methodology but also by virtual activities in the rationalization of greenhouse emissions.

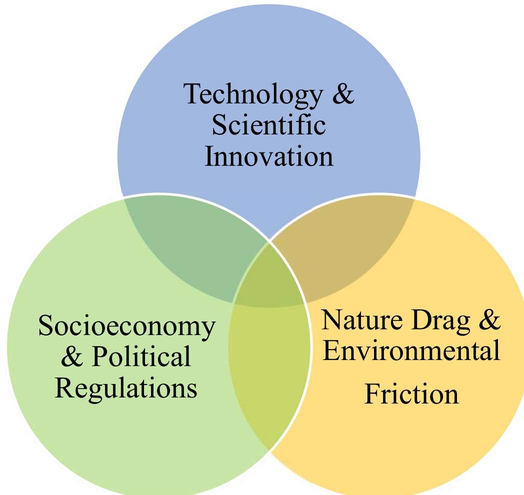


**Fig. 1** (a) Socioeconomy and political regulations, SDGs/Paris Agreement/IPCC, for qualitative and quantitative values with net zero economy by decarbonization (b) Technology and scientific innovation for minimizing environmental harm, effective materials and energy interface, and overlapping conventional interface by new materials for effective surface functionalization (b) Nature drag and environmental friction in situ presence from large field of planet to macro, micro, nanodomains, and theoretically "Zero" drag for vacuum

## 3. Conclusions

The materials and energy balance at the domain of 2$^{nd}$ law of thermodynamics is invincible for synchronization of losses at man and engineered spectrum. The rubbing mechanical contacts is being transformed during 21$^{st}$ century in saving energy, decreasing the levels of greenhouse gases emissions from engineering solutions, and ease in achievement of net zero scenario. The promotion of sustainability and advancement of scientific innovation have created a socioeconomic resilience for modulation of work-life balance.

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