

SUSTAINABLE ENERGY SOLUTIONS FOR FUTURE ENERGY NEEDS

Harjap Gosal

Energy is a vital element in transportation, industrial development and economic stability of any nation and plays an important role in the improvement of living standards. Given the swelling global population, rising industrialisation in developing nations, and improving standards of living, it has been projected that the world will continue to have a massive increase in the demand of energy in the coming years. The key energy sources are fossil fuels, nuclear power, biofuels, hydro, and other renewables such as solar, wind and geothermal energy with fossil fuels contributing currently about 80% of the total energy demand (1,2). However, many current sources of energy, such as fossil fuels, nuclear energy, are not sustainable forms of energy and have a limited inventory on this earth. The extensive consumption rate of these energy sources is going to make them extinct soon. Furthermore, the major part of energy we use today is turning out to be harmful and its uncontrolled consumption is causing a lot of damage to humans and our planet. Therefore, the focus is there on alternative and sustainable energy solutions for a sustainable future and better living environment. Technological development is critical for ensuring that the world gets the energy it needs while mitigating environmental harm. The successful energy transition for newer solutions will require new and robust policies aligned with infrastructure development and substantial new investments on a global platform.

The global energy demand has been projected to continually grow in the next few decades and there are many factors that contribute to this growth. The huge population growth in the future is bound to raise the demand and usage of different energy resources with the world population projected to grow close to 10 billion people by 2050 (3). The U.S. Energy Information Administration (EIA) projects that world energy consumption will grow by nearly 50% between 2018 and 2050 and most of this growth would come from countries where strong economic growth is driving it (4). The industrial sector accounts for the largest share of energy consumption of any end-use sector and as consumption of goods would increase, world industrial sector energy use is projected to increase by more than 30% between 2018 and 2050. The energy consumption is projected to increase by nearly 40% in the transportation sector and by 65% in the buildings sector between 2018 and 2050 (4).

The economic and social development problems faced by the society are deeply linked to the issues surrounding energy (5). More than half of our energy comes from fossil fuels (coal, crude oil, and natural gas) extracted from deep within the Earth's crust and the problem with the fossil fuel energy sources is that their procurement takes an enormous toll on our landscapes, nutrient-leached land and ecosystems. The consumption of fossil fuels further causes harmful emissions inducing global warming, immense water and air pollution, damage to public health, wildlife and habitat loss (1). Since the beginning of commercial oil drilling in the 1850s, it has been estimated that more than 135 billion tonnes of crude oil has been drilled. The rising levels of greenhouse gases in Earth's atmosphere, a leading contributor of climate change, has been directly linked to the burning of coal, oil and gas (6). There is a kind of agreement among the world's scientists that this is a path towards disaster and it can only be halted by getting rid of fossil fuel habits. Non-fossil fuels are receiving increasing attention within the context of addressing global climate challenges.

The United Nations General Assembly (UNGA) in 2015, adopted the Sustainable Development Goals (SDGs) to provide a framework for international cooperation to achieve a sustainable future for the planet (7). On the energy front, the global goal on energy (SDG 7) focuses on three key targets: ensure affordable, reliable and universal access to modern energy services; increase substantially the share of renewable energy in the global energy mix; and double the global rate of improvement in energy efficiency (8). The World has witnessed a lot of technological advances in every sphere of life including the energy sector. The energy industry has seen a lot of theoretical and practical development of innovative technologies focussing on the energy trilemma "energy efficiency – energy security – environmental sustainability (9). The progressive development of the energy industry is of a new technological order based on scientific developments in biotechnology, genetic engineering, informatics, microelectronics, as well as intensive space exploration and creation of new types of raw materials, resources, and energy (9). The technological change, economics, access to resources, or superior energy service for consumers, all these factors drive the energy transitions (10). With the advancement of technology, our race to find and develop sustainable energy sources has become more enabling. The new sources of energy (primarily renewable energy sources such as wind, solar, hydro and geothermal) have already been providing around a fifth of the world's primary energy supply. This sector is growing each year with hydroelectric power has been the main source of renewable energy and wind being the fastest growing. The new advances in solar panel technology that allow us to generate power even in overcast conditions, have seen a surge in the amount of energy being produced using the sun.

There are different ideas and solutions that are being promulgated today to create sustainable energy. The grids that distribute the electricity bigger create "supergrids".

The idea of sharing energy over a wider area by creating “supergrids” is one such envisaged solution (11). These schemes support connecting the energy grids of several countries together so electricity can be optimally shared between nations. Recently there have even been calls for a global energy grid, an idea supported by Chinese State Grid, which set up the Global Energy Interconnection Development and Cooperation Organization. The new underwater connections to energy grids are already being built by the UK connecting with France, Denmark, Belgium, Ireland and Norway (6). As new technology is developed it will shift the geopolitics of energy. The hydroelectric dams can provide some of the solution to concern about what to do when the sun is shining and the wind is blowing but the electricity demand is low. The excess electricity is used to pump water to the top of the dams where it is stored as potential energy and when it is needed, the water is released to drive turbines. The other viable alternatives to fossil fuels are biogas and biofuels but burning these fuels will not halt the release of greenhouse gases into the atmosphere (6). With the increasing extraction of shale oil and gas in many parts of the world, it seems that we will be continuing to rely on fossil fuels for some time to come with many sources projecting that we will still be getting 75% of our energy from fossil fuels by 2050. The suggestions are there that the problems with renewable energy could be overcome in more direct ways, such as closer monitoring of individual households’ energy consumption and the use of metal ions, which avoids the need to heat the chemical mixture (6). The new ideas that different stakeholders, such as companies and governments, are coming up will boost the chances of finding some permanent solutions.

The experience has shown that any energy transition takes time, typically half a century from market introduction to major market share (12) and predicting the timing and the extent of energy transitions is not that straightforward having examples of projections that have not proven accurate. Currently the speed of energy transition is not commensurate with the agreed sustainable development goals and for transition of renewable energy more efforts are needed. The world is not on track to meet the global energy targets for 2030 set as part of the Sustainable Development Goals, but real progress is being made in certain areas (13). Financing for both energy generation capacity and infrastructure will also be crucial through carefully drafted policies that create a credible, predictable and transparent investment environment. There is a need to mobilise public and private sector resources and develop innovative financing models that can mitigate investment risks. To encourage the creation of the clean and reliable energy infrastructure that the world needs, energy producers will need to work with local, regional, national, and international regulators.

CONCLUSION

With the global population swelling and industrialisation on the rise in developing nations, the demand for energy has reached unprecedented levels. The current major sources of energy such as the fossil fuel energy sources are adversely affecting our landscapes and ecosystems, with issues such as global warming, water and air pollution, damage to public health, wildlife and habitat loss. The alternative and sustainable energy sources for a sustainable future and better living environment are the path forward to tackle these challenges. The theoretical and practical development of innovative technologies in the energy industry has been focussing on new sustainable energy solutions such as renewable energy. For energy transition for these sustainable energy solutions, the policy decisions will need to be aligned with the development of enabling infrastructure and early infrastructure planning is required. Though the progress towards sustainable energy is slow but it is definite and there is mounting evidence that with the right approaches and policies, countries can make substantial in clean energy and energy access, and improve the lives of millions of people.

REFERENCES

1. Our Energy Needs: World Energy Consumption & Demand | CAPP [Internet]. CAPP. [cited 2020 Jul 30]. Available from: <https://www.capp.ca/energy/world-energy-needs/>
2. Denchak M. Fossil fuels: The dirty facts [Internet]. 2018. Available from: <https://www.nrdc.org/stories/fossil-fuels-dirty-facts>
3. World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100 | UN DESA | United Nations Department of Economic and Social Affairs [Internet]. UN DESA | United Nations Department of Economic and Social Affairs. 2017 [cited 2020 Jul 30]. Available from: <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html>
4. EIA projects nearly 50% increase in world energy usage by 2050, led by growth in Asia – Today in Energy – U.S. Energy Information Administration (EIA) [Internet]. [cited 2020 Jul 30]. Available from: <https://www.eia.gov/todayinenergy/detail.php?id=41433>
5. Chen J, Wu Y, Xu C, Song M, Liu X. Global non-fossil fuel consumption: driving factors, disparities, and trends. *Management Decision*. 2019 Jan 1;57(4):791–810.
6. Gray R. The biggest energy challenges facing humanity. BBC [Internet]. [cited 2020 Jul 30]; Available from:

<https://www.bbc.com/future/article/20170313-the-biggest-energy-challenges-facing-humankind>

7. Gielen D, Boshell F, Saygin D, Bazilian MD, Wagner N, Gorini R. The role of renewable energy in the global energy transformation. *Energy Strategy Reviews*. 2019 Apr 1;24:38–50.
8. Affairs UND of EAS, United Nations Department of Economic and Social Affairs. Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all [Internet]. *The Sustainable Development Goals Report 2018*. 2018. p. 22–3. Available from: <http://dx.doi.org/10.18356/7065ed9f-en>
9. Dudin MN, Frolova EE, Protopopova OV, Mamedov O, Odintsov SV. Study of innovative technologies in the energy industry: nontraditional and renewable energy sources [Internet]. Vol. 6, *Entrepreneurship and Sustainability Issues*. 2019. p. 1704–13. Available from: [http://dx.doi.org/10.9770/jesi.2019.6.4\(11\)](http://dx.doi.org/10.9770/jesi.2019.6.4(11))
10. Cherif R, Hasanov F, Pande A. *Riding the Energy Transition: Oil Beyond 2040*. International Monetary Fund; 2017. 42 p.
11. Supergrids – an overview | ScienceDirect Topics [Internet]. [cited 2020 Jul 30]. Available from: <https://www.sciencedirect.com/topics/engineering/supergrids>
12. Sovacool BK. How long will it take? Conceptualizing the temporal dynamics of energy transitions. *Energy Research & Social Science*. 2016 Mar 1;13:202–15.
13. Progress on global energy goals slow, but strong gains in countries show promise – News – IEA [Internet]. IEA. [cited 2020 Jul 30]. Available from: <https://www.iea.org/news/progress-on-global-energy-goals-slow-but-strong-gains-in-countries-show-promise>