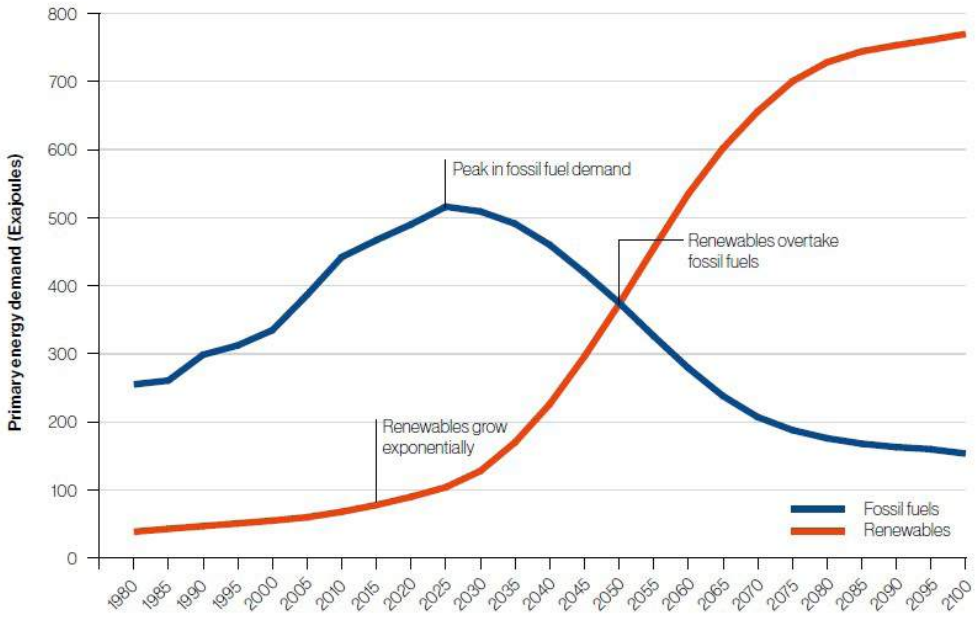
Geopolitics of Renewables: Thinking ahead towards Smart Renewable Integration

Dr G. M. R. I. Godaliyadda

Geopolitics and how it shapes the international landscape

There are many natural resources of critical importance to a nation's economy that are geographically unevenly distributed. This, while forming the underlying basis for trade and diplomacy, has also led to numerous conflicts throughout history. Further, at various stages of human history technological innovation led to the discovery of new resources or new applications for existing resources. This means that the relationships of nations with mutually beneficial economic and political interests continued to evolve through the ages as a consequence. The dynamics of these relationships shaped history in many ways. For example, the age of exploration and imperialism of the early modern age, which triggered at the backdrop of the renaissance and the industrial revolution, are a result of how nations with conflicting strategic interests reacted to the monumental shifts in the political landscape that were happening alongside technological revolutions.

Geopolitics is the study of



Note: This data is taken from the Shell Sky Scenario (2018), which has the merit of forecasting to 2100 and therefore projects the nature of the energy transformation over the course of the century. Other energy transition scenarios usually have shorter time horizons. The Sustainable Development Scenario (SDS) of the International Energy Agency (IEA), for example, only looks forward to 2040. IRENA's REmap scenario goes to 2050. Shell's forecast share of renewables and fossil fuels is similar to that of the IEA SDS scenario for 2040 as well as the DNV GL and Equinor Renewal scenarios for 2050. The IPCC 1.5 degree median scenario and IRENA REmap scenario anticipate a substantially larger share of renewables by 2050 with an earlier peak in fossil fuel demand.

Source: Shell Sky Scenario, 2018.

Figure 01 : Primary energy demand forecast to 2100

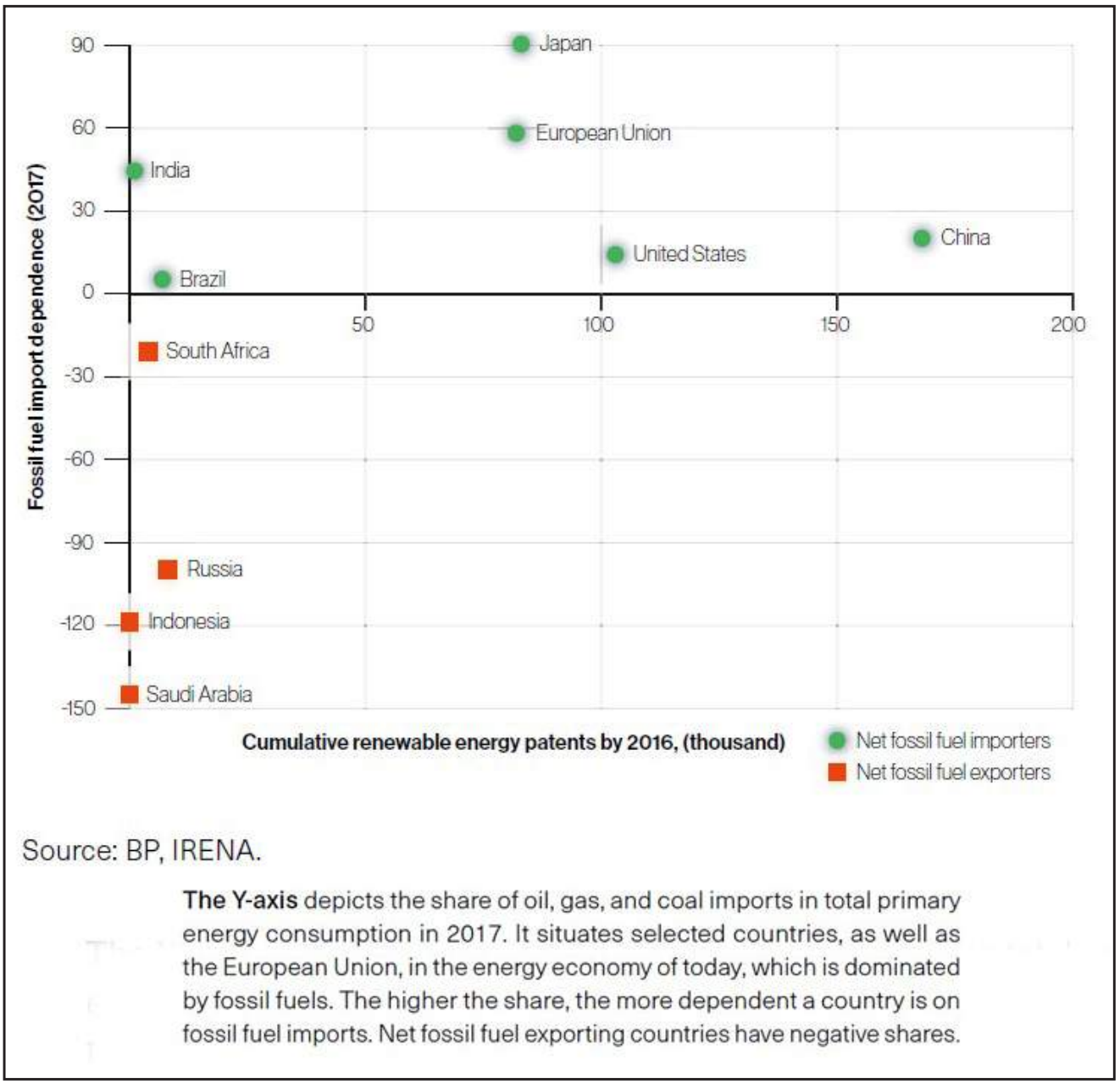


Figure 02 : Fossil fuel dependence vs renewable energy patents – Who is better prepared

'relationships of nations' based on their geography. In this context, the term 'geography' not only relates to factors such as area, natural resources, climate, and topography, but also to factors such as demography, culture, technological resources and history. These factors shape each nation's foreign policy looking outwards, while, also having a significant impact on its own internal national policy. In the recent past, due to the significant cost of war, many nations have also focused on geo-economics, a branch of geopolitics that focuses primarily on the more non-military economic aspects of international relationships based on how geographical resources are spread out in the world. Therefore, by adjusting one's national policy based on current Geopolitical and Geo-economic trends, a nation can stay ahead of the curve and reap benefits from this.

To explore this further, let us take a simple hypothetical example of how geopolitics can affect two countries looking to improve their economic output by use of free trade. Let us assume Britain and Brazil over produce Textile and Coffee, respectively. The surplus would be made available for export

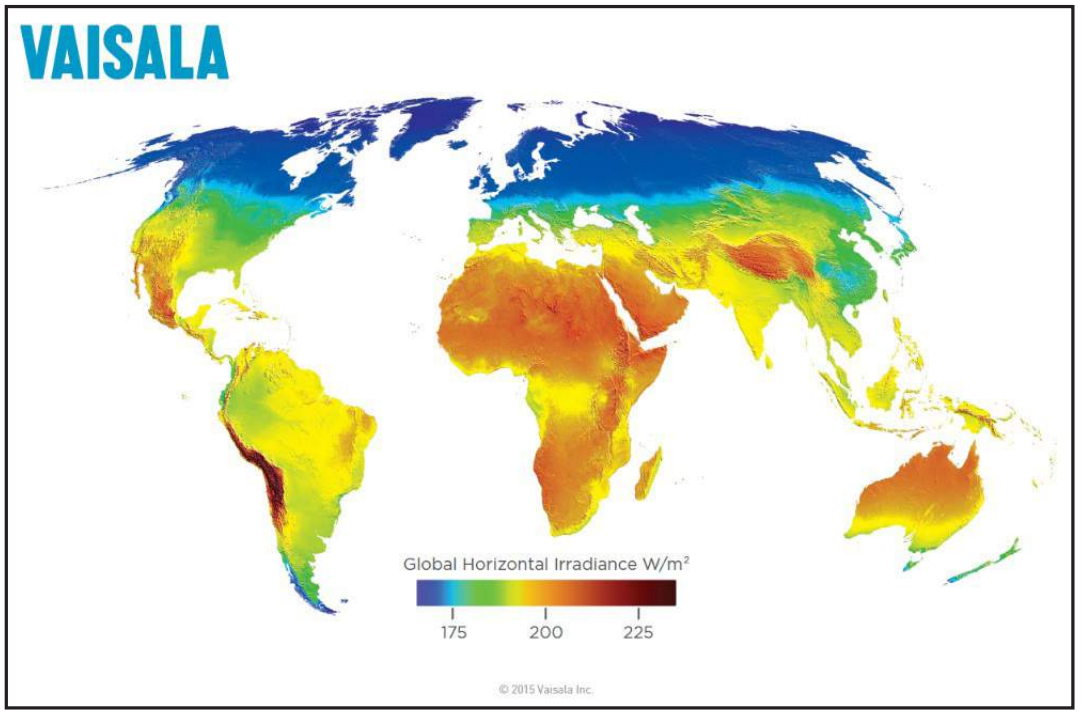


Figure 03 : Global solar resource potential map

trade between the two countries. Hence, both countries will have access to both products at a lower price compared to what it would have cost each country to produce sufficient quantities of both products in-house. This is because of the per capita resource gain of each country that results from its specialization in manufacturing one product, as explained by the Ricardian model (named after 19th century British political economist) in economics. Hence, in this oversimplified scenario it would seem both countries would benefit from free trade. However, one should also consider the long-term effects of this arrangement. As time passes, Britain would get richer in this model compared to Brazil as Textile is what is called a "Gateway industry" that leads to industrialization, automation, mechanization, urbanization and also many other derivatives or related industries such as chemicals, machine tools. As a result, it stimulates industrial growth in Britain, enabling it to yield higher profits in the long term. Furthermore, Britain can invest these profits in more innovative production techniques in Britain itself and elsewhere, for example, in Brazil.

The above example relates to the Geopolitical situation of the 18th and 19th centuries that led to the rapid industrialization of many western countries. This in turn created a massive shift in the Geopolitical forces of the time, leading to vast differences in the quality of life and economic situations of countries all over the world. However, such shifts happen in waves and have continued to occur throughout the 20th century leading up to this very day. Geopolitical landscape shifts have occurred even more frequently as we approached the later part of the 20th century due to the exponential growth of engineering and technology. Hence, identifying and responding to key factors that can significantly impact geopolitical machinations, increases the versatility of nations under such volatility.

Geopolitical Trends of Energy with the advent of Renewables

The impact of Energy on the geopolitical landscape significantly increased post-industrial revolution. For almost the entirety of the 20th century the Geopolitical landscape of the world in terms of energy was defined by fossil fuels, namely, oil and gas. Many of the wars waged in the recent past as well as on-going conflicts and alliances were shaped largely through the Geopolitics of oil and gas. This is due to the fact that a significant portion (more than half) of energy used for industrial and transport sectors are from fossil fuel sources. The high oil prices of the 1970s and the more recent lowering of oil prices were the obvious result of geopolitical maneuvering.

However, most recent projections show that renewable energy would become the leading source of primary energy consumption by 2050 (Figure 1). This is in part due to the 2015 Paris agreement which called for dramatic changes to the global energy mix by encouraging its signatories to incentivize the growth and development of low-

or zero- carbon energy producing technologies. Renewables have made significant inroads into the energy mix of many countries including the major energy consumers such as India, China, USA and Western Europe. This is due to the policy incentives and growth in China, energy emission policies in Western Europe, and declining renewable costs and policy in India. Hence, the place of renewables in the Geopolitical landscape is set, what remains is to predict how they reshape it.

There are several mechanisms that can affect the way renewables might shape the Geopolitical landscape. As was the case with the fossil fuel industry, 'critical raw material' has a high geopolitical strategic value while requiring low capital. The rare earth minerals, such as Neodymium used for magnets in wind turbine generators and motors of electric vehicles, Lithium and Cobalt used for energy storage, and others such as Indium that is used for solar cells, have the potential to create cartels around them, as was the case for the oil and gas industry.
The need for continuous growth in the renewable energy sector has resulted in numerous technological innovations, and increased investment in research and development (R&D) in the area. Countries rich in capital such as China, US, EU and Japan have invested heavily in clean energy technological innovations, with the goal of staying ahead of the curve in the midst of shifting geopolitical dynamics. This has led to a rapid increase in renewable energy related patents in those countries (Figure 2). Higher efficiencies in solar photovoltaic (PV) modules, taller wind turbines, are examples of such innovations that have led to increased productivity in this sector.

As the need for efficiency increase paved the way for initial innovation, the investment in R&D spurs on more innovation in new frontiers relating to renewables. The early research focused mainly on supply-side efficiency growth as mentioned above. Lately the focus has shifted to adapting consumption-side behaviour towards clean energy.

Electrification of 'hard to electrify' sectors such as transport and heavy industry is one such new frontier of research that focuses on consumption-side adaptation. The integration of renewables to the grid has resulted in the need for smart and versatile mechanisms for integration of generation and distribution in energy systems. This in turn has led to the exploration of applying new technologies such as smart grids, the internet of things (IoT), Artificial Intelligence (AI), and Big Data to the energy industry. Further, the electrification of transport systems as well as the volatility in renewable energy supply has generated interest in energy storage systems.

How can Sri Lanka look ahead?

Countries that make use of geopolitical strategy and foresight to react to shifts in the geopolitical landscape, as history has taught us, are in a better position to reap the rewards of the incoming change. Already, major powers are investing heavily in R&D for the

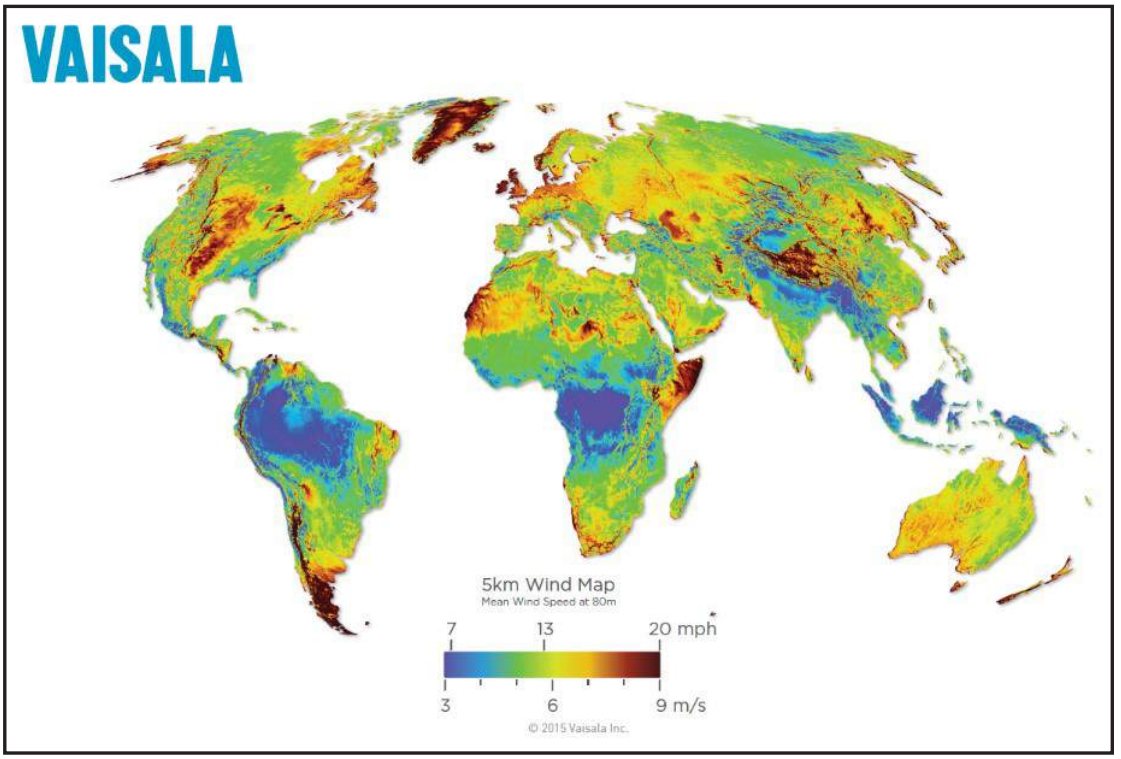


Figure 04 : Global wind resource map

energy sector, which has resulted in them obtaining a large number of patents in this field. This not only gives them access to profit through intellectual property, with the rapid growth of the renewable energy sector, but also gives them significant leverage in the geopolitics of energy.

However, the fact that energy politics are shifting, presents new opportunities for a nation such as Sri Lanka as well. The geopolitics of renewable energy are clearly tied to technological innovation as discussed earlier. New frontiers of research yet untapped or at an infant stage continue to open up in areas such as IoT, AI, Big Data and the Smart Grid and can lead to innovation even with the limited capital that we possess. Mainly because R&D creates a positive feedback loop of investment and growth leading to a cycle of growth if tapped into at the correct time. Furthermore, the geographical placement of Sri Lanka puts it at an advantage in terms of solar and wind resource availability (Figures 3 and 4). This is in addition to the hydro-electrical resources the country already possesses. A clear national initiative towards R&D in the energy sector can stimulate the country towards a positive growth cycle even with the relatively low capital we possess.

There is a clear argument for focusing the initial phase of R&D activities on fields such as smart grids, and application of new technologies such as AI, IoT and Big Data as a support system to its implementation. Current status of R&D activities in Sri Lanka include, development of software and hardware-based technologies for the Smart Grid, production of graphene and activated carbon for energy storage devices, to name a few. These will not require the 'rare critical raw material' that would otherwise hinder progress or leave us at the mercy of a supplier. In addition, steering the national energy mix towards renewables would also remove dependencies over fossil fuel producers. This would hopefully trigger the positive feedback loop of innovation and investment.

What is interesting about technology driven geopolitical waves is that they have always given the opportunity to countries not rich in natural resources to become players in the geopolitical stage. They also lead to the growth of new derivative industries that create new employment opportunities for the populace. For example, an energy grid enriched by AI or IoT would create employment in communications, electronics and computing. This would modernize the education sector leading to further sustainable growth.

A proactive approach towards this is paramount because once the renewable energy sector grows beyond a certain point the geopolitics would have already shifted. Thus, resulting in cartel like behaviours from the new suppliers, making investment in renewables even more expensive. This in turn leads to complete dependency on those geopolitical players. On the flipside, innovation leads to partnerships between nations opening up more opportunities for growth and knowledge sharing.

The most significant difference between renewable energy and fossil fuels is its availability in one form or the other in most countries, resulting in less energy choke points. In addition, renewables are inexhaustible energy flows as opposed to fossil fuels, which are storable stocks that are more susceptible to price maneuvering. Finally, they are more decentralized in generation making monopolization difficult.
It is blatantly obvious that the power balance of geopolitics can therefore shift with the growth of renewable energy.

Countries that respond well to this shift with investment towards technological innovation in related fields and modify national policy to accommodate clean energy initiatives are highly probable to have a better placement in the race.

Dr G. M. R. I. Godaliyadda
Senior Lecturer,
Department of Electrical and Electronic Engineering,
Faculty of Engineering,
University of Peradeniya
roshangodd@ee.pdn.ac.lk