Chapter 2
Sustainable Development Goals in Context to BRICS Countries

Bhabajit Baruah and Rakesh Nath

Abstract Sustainable Development Goals calls for a substantial increase in the share of solar energy in the global energy mix, as well as for a more efficient use of energy. With the considerable cost of degradation in the environment at USD80 billion annually, which is equivalent to 5.7% of GDP in 2009, a major constraint in sustaining future economic growth could be the environment (Griffith-Jones in A BRICS development bank: a dream coming true? (No. 215), 2014). In this present work, an attempt has been made to outline and focus on the goals set by BRICS countries with the aid of the major financial institutions and the socio economic groups for these five countries and the action plans taken as an initiative for the sustainable development of the energy sector at large and solar energy in specific. India is planning to increase the production of renewable energy by 40% within 2030 and in turn reduce emissions intensity by 33–35% over 2005 levels (Schmidt and Sewerin in Nat Energy 2(6):17084, 2017). China on the other hand intends to reduce emission intensity by 60–65% over 2005 levels by increasing its solar energy capacity from 43GW at the end of 2015 to 127GW by 2020. Russia's current emissions are around 40% lower than 1990 levels which are greater than the target set of 25–30% over 1990 levels. More emphasis is given in developing sustainable renewable green energy. Brazil is arguably in the best position to achieve its goals in renewable energy sphere, as in 2015, 74% of its energy came from renewable sources (Schmidt and Sewerin in Nat Energy 2(6):17084, 2017). South Africa has a very far way to go in the field of renewable energy as at present more than 90% of the energy are still generated from fossil fuels though the country has targets to commission another 17.8 GW of renewable energy capacity by 2020.

Keywords Smart grid · Renewable energy · Solar photovoltaic · Sustainable energy

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List of Symbols

GDP	Gross domestic product
USD	United States dollar
BRICS	Acronym for Brazil, Russia, India, China and South Africa
GW	Giga watt
MW	Mega watt
NDB	New Development Bank
SE for All	Sustainable energy for All
SDG	Sustainable development goals
HIO	High impact opportunities
PV	Photovoltaic
kWh	Kilowatt hour
IEEFA	Institute for energy economics and financial analysis
NOx	Nitrogen oxide
SO_2	Sulphur dioxide
PFF	Project financing facility
EDB	Eurasian Development Bank
CO_2	Carbon dioxide
T&D	Transmission and distribution
IRP	Integrated resource plan
RE	Renewable energy

2.1 Introduction

2.1.1 Economic Analysis

Sustainable Development Goals calls for a substantial increase in the field of renewable sources i.e. solar, wind, geothermal and hydropower in the global energy mix, as well as for more efficient use of energy. With the considerable cost of degradation in the environment at USD 80 billion annually, which is equivalent to 5.7% of GDP in 2009, a major constraint in sustaining future economic growth could be the environment (Griffith-Jones 2014). It is worthy to note that, it might be practically impossible or too expensive to clean up later. Certain model simulations indicate that policy interventions such as taxes in the environment could be used to render positive environmental and health benefits with minimum economic costs (Griffith-Jones 2014). In this context, BRICS energy ministers are committed to:

- Emphasizing for the use of natural resources;
- Reducing the use of fossil fuels by promoting energy efficient technologies;
- Strengthening energy security cooperation with the aid of joint research on strategic reserves, energy efficiency and renewable energy;

- Seeking investment opportunities for the New Development Bank (NDB) in the fields of energy efficiency and renewable energy.

Several initiatives were set up to pursue these goals. In 2017, countries launched an Energy Research Cooperation Platform to support their work on energy efficiency and energy more widely. Its purpose is to conduct research and analysis, contribute to implementing BRICS investment projects in the energy sector, develop cooperation on energy technology, and improve training for personnel in BRICS countries. The platform is supported by two additional initiatives: the BRICS Network University and the BRICS Think Tank Council. To mobilize investments, Energy and Green Economy Working Group was established to encourage public-private partnerships for energy-efficient technologies. The Working Group is part of the BRICS Business Council, which was created in 2013 with a vision to strengthen and promote business, trade, and investment amongst the BRICS business communities.

In 2014, the BRICS forum set up the New Development Bank to assist fund infrastructure in the BRICS countries. One of the key objectives of the NDB's job is to lay energy targets for the BRICS countries to provide reliable and sustainable investment for the BRICS countries to build their independent renewable energy capacity (Council 2015). The targets laid down by the NDB triggered the BRICS countries to develop plans and execute new and existing renewable capacity. In this regard to achieve these goals, the bank offer loans quickly and flexibly to the BRICS countries. It's a great step towards sustainability in the energy field. And these concerns of BRICS counties can lead to better cooperation between them in the future.

Though the NDB has brought remarkable advances in the field of renewable capacity for the BRICS countries, some of them have been seen to miss their targets. Thereby demand has been placed for the NDB and other multilateral development banks and financial institutions to increase investment such that the BRICS could have a massive impact on the environmental damage currently being created by their energy systems (Council 2015). One of the most perspective and rapidly developing fields in renewable energy is the Smart grid communications market. It has been predicted that the Smart grid communications market would reach USD 9.5 billion by 2020 among the BRICS countries (News on Renewable 2019). The market is expected to grow rapidly over the next eight years which would be followed by three distinct phases. In the first phase, a two-way communication system would be established between utilities and subscribers by the deployment of smart meters. That would be followed by the incorporation of the new sensors and other devices at prime junctures of the network. This would help the utilities to develop value-added services to aid their smart grid infrastructure (News on Renewable 2019; Trindade et al. 2017). The final phase would comprise of the development of new services and software for the optimization of smart meter establishment and overall grid.

2.2 BRICS: Role of India

The Sustainable Energy for All (SEforALL) report on India reflects that the Government has launched numerous schemes for its cities and villages to transform to meet the Sustainable Development Goals (SDGs) for energy. As per the report, over 300 million Indians in rural areas are having no power connections. The government of India had set a target for universal household electrification within December 2018. The report also identifies short, medium and long term High Impact Opportunities (HIO's) which would support sustainable energy for all sectors. Some of the HIO's include renewable energy sources, storage facilities of these energies and implementation of smart grids, solar energy efficient pumps for agriculture, etc.

India, being one of the fastest growing countries in the field of renewable energy, is planning to increase the production of renewable energy by 40% within 2030 (Chu and Majumdar 2012). This would increase the capacity of renewable energy to 175 GW. The incorporation of such huge capacity in the field of renewable energy would, in turn, reduce emissions intensity by 33–35% over 2005 levels (Solar Power in India 2019). To reach this rather ambitious aim India undertakes the following steps:

In June 2018, Siemens Gamesa, Renewable solution provider, addressed that it has bagged an order in the field of Wind Energy from India's largest renewable energy Independent Power Producer, Re New Power, for the construction of a 150 MW wind farm located in the Kutch district of Gujarat. Since 2009, Siemens Gamesa has installed over 5 GW of renewable energy in various parts of the country. One of the fastest developing energy sectors in India is Solar Energy. The Government of India had a target to increase the capacity by 20 GW by the year 2022. According to the report by the Indian Government, this target was fulfilled way before four years than the stipulated time and as of 31 March 2019; the country's solar installed capacity already reached 28.18 GW. With the increasing capture of the market by the solar sector, this target was raised to 100 GW of solar capacity by 2022 of which 40 GW was the target set for rooftop solar (News on Renewable 2019). The budget set for the total investment was USD100 billion. Following the target set, 3 GW of solar capacity was commissioned in 2015–2016, 5 GW in 2016–2017 and over 10 GW in 2017–2018 which bought down the price of solar electricity by 18% below the price of the electricity produced by coal (Solar Power in India 2019).

In addition to its solar photovoltaic (PV) large scale grid connection, India is expanding its off-grid solar energy local urban and rural energy needs. The rapid growth of solar energy has reduced drastically the use of kerosene in rural areas. Developer Azure Power has commissioned its largest solar-power project in the Indian state of Punjab, with a capacity of 150 MW (Goswami and Zhao 2009). The project occupies 713 acres of land and will cater to the power requirements of the local community while generating an estimated 1000 jobs within the community. The new plant constitutes a portfolio of three projects each with a capacity of 50 MW. The company noted that the weighted average tariff on these projects is INR 5.63 (USD0.083) per kWh and Azure Power will supply Punjab State Power Corporation

for 25 years. Achieving these impressive targets, additional funding was required. In this regard, Canara Bank came forward to finance renewable energy projects through Canara Renewable Energy Financing Scheme. The objective of the scheme was similar to that of the New Development Bank's (NDB) to provide green financing and increase the rate of renewable energy development. The loans provided for the infrastructural development of the renewable energy sector by NDB would be on-lent through Canara Bank to the renewable energy sub-projects that primarily include solar, wind, biomass, geothermal, small hydropower, waste-to-energy, and other projects. This will, in turn, mobilize long term financing to renewable energy projects. Canara Renewable Energy Financing Scheme is estimated to have an overall capacity of USD 500 million (New Development Bank 2019).

2.3 BRICS: Role of China

China's target to reduce emission intensity by 60–65% over 2005 levels (News on Renewable 2019) makes it even greater than any other country, according to the IEEFA report. China has targeted increasing its solar capacity from 43 GW at the end of 2015 to 127 GW by 2020, and wind capacity to 250 GW by 2020 from 145 GW in 2015. Since the forecasting of China's development of renewable energy is rather high, the issue of financing the majority of the deal is also significantly important which makes it unavoidable to turn to the NDB that is currently engaged in three big energy ventures in China. China follows its age-old tradition of driving the agenda forward, as the country edges closer to a more sustainable pattern of growth (Liu et al. 2010). China's desire for a significant rise in renewable energy in the energy mix market makes China's aim to increase the use of renewables to 15% of its energy consumption by 2020. By 2020, China should be declared as a nation of 50 GW solar powers as addressed by the National Energy Administration. In this context, roof-top solar power technology was designed and supported by the Lingang Distributed Solar Power Project. The project with the aid of the NDB has accelerated green financing and promotes clean energy (New Development Bank 2019).

The prime objective of this project is to promote roof-top solar energy by incorporating solar photovoltaic power technology for the generation of electricity in Shang-hai Lingang Industrial Area and reduce carbon emission. The project aims to generate electricity through 100 MW roof-top solar photovoltaic powers by reducing 73,000 tons of carbon emission every year. The project also aids in saving the cost of losses in potential transmission by importing energy from places outside Shanghai. Subsequently, the project has been divided into many sub-projects to be implemented within 3 years until the end of 2019. To prove the concept, an onsite 3 MW pilot project has already been implemented successfully. The agreement has been made and the state grid would procure the electricity generated from the roof-top by solar photovoltaic power technology. The project aligns with the NDB's focus to support projects that aim at developing renewable energy sources. The project also estimates to reduce carbon dioxide emissions by approximately 73,000 tons per year and NOx

emissions by 1300 tons per year. The project will meet the desire need of saving gas consumption by 23,000 tons per year and coal consumption by about 32,000 tons per year (New Development Bank 2019).

Putian Pinghai Bay Offshore Wind Power Project is the second major initiative of the Government of China to increase offshore wind power capacity and provides sufficient electricity supply to Fujian and to stimulate the development of offshore wind energy with technological advances. Its focus aligns with NDB to offer financial support to projects aiming at developing renewable energy sources. The NDB will also provide financial support to the cost incurred for the procurement of equipment and other civil works. The project has been estimated to provide an effective electricity generation of 3490 h per year. Apart from providing electricity of 873 million kWh per year to meet the increasing demand for power consumption in Fujian, the capacity would also have a total targeted capacity of 700 MW offshore wind power (New Development Bank 2019). The increasing demand for offshore wind power would help China to sustain a greener and healthier environment and thus reducing carbon emissions with a target of avoiding 869,900 tons of carbon emissions per year. Meanwhile, the project also estimates the elimination of harmful components of emissions such as 26,175 tons of SO_2, 13,090 tons of NOx, and 237,300 tons of flue gas. It would also avoid the consumption of coal by 314,100 tons. With a vision to create employment opportunities and help the local economy to grow, a new industrial cluster has been initiated keeping in mind the socio-economic aspects of the society.

The third project, the Jiangxi Industrial Low Carbon Restructuring and Green Development Pilot Project aims at upgrading the traditional industries to achieve energy conservation and reduce emissions. Financial assistance would be provided to the Project by NDB through a Project Financing Facility (PFF) loan of up to USD 200 million. The Project comprises lengthy sub-projects, which as a whole will promote conservation of energy, regeneration of waste and emission of pollutants will be reduced. It will also promote the reutilization of industrial water in the Jiangxi Province.

The approved subprojects will acknowledge the contribution to an energy saving level of 95,118 tons of coal equivalents per annum and a carbon emission reduction of 263,476 tons per annum on an aggregate level, through increased recycling ratios, upgraded factory machinery, increased utilization of heat waste and improved energy conservation.

2.4 BRICS: Role of Russia

Russia's advancement amongst other BRICS nations is slightly above par as it has already met the expectations defined in its annual forum. The goal was to reduce emissions over 1990 levels by 25–30%, and Russia's emissions are around 40% lower than 1990 levels currently. However, by the end of 2020, the country is planning a production hike of 4.5% in the amount of renewable energy. The progress is

predominantly sluggish as compared to what has already been predicted due to the lack of investment from the country itself. It has allocated a share of USD 1billion for renewable technologies in all 17 Russian states in 2014 (Cherepovitsyn and Tcvetkov 2017).

Russia accounts for untapped renewable resources of energy. The non-fossil fuel based energy of Russia contributes to only 3% of the total primary energy consumption of the country (Kutsenko 2015). Karelia, a federal subject of Russia, has a low capacity of energy generation. It is still not sufficient as it imports power from other regions of Russia. Hence, the Nord-Hydro model project is designed for the enhancement in the capacity of power generation in the region and to facilitate the development of renewable energy. The project in alignment with the New Development Bank has accelerated green financing and promotes clean energy development. Two loans will be provided by the NDB in order to support the Eurasian Development Bank (EDB) and International Investment Bank for renewable energy projects. The loans will accelerate the business scenario of the Nord-Hydro project to increase the supply of energy through the renewable energy source in the Karelia region. The Russian government supports the project with a preferential tariff. This project initiates the construction of a small dam and two hydroelectric, providing an installed capacity of 49.8 MW in total. As much as 48,000 tons of carbon dioxide emissions per year will be avoided with the proposed power generation.

Meanwhile, a rather challenging project is being developed in the Russian Federation Territory. The project is designed in January 2015 to run smart grids in Ufa which slated to continue till 2019 as was planned. Concerning the expectation, after the smart grids are deployed, the Bashkiria project implementation will raise the region's power supply to a whole new qualitative level without a surge in the investment planned. It is further expected to reduce power losses in Ufa by a factor of two which in money terms would translate to 400 million rubles annually (Cherepovitsyn and Tcvetkov 2017). The experience is extensive and can be replicated in any region where the power grid infrastructure properties are the same as Russia's. The prospects of exporting this technology are significant.

2.5 BRICS: Role of Brazil

Brazil, the energy surplus country, is undoubtedly in a comfortable position to achieve its goals in the renewable energy horizon. In 2015, about 74% of the total energy generated came from renewable sources. Brazil has been one of the largest nations since 2007, contracting renewable energy through auction bidding. A pool of sophisticated and new technologies has been adopted at regular intervals by the auction bidding mechanism (La Rovere et al. 2011).

According to the IEEFA's report, "Brazil's 2024 Energy Plan envisages an increase in total installed renewable capacity, including large hydropower, from 106.4 GW in 2014 to 173.6 GW in 2024." But the current political situation prevents the development of this field. With the declined GDP growth, the country had to witness a

major drop in electric power load projections. It has been predicted that the demand in energy load would reduce to an extent of 3480 MW in 2019 which can be reflected by the fall in electricity consumption by 0.9% in 2016. The dip in electricity consumption sends negative feedback to the industries. In December 2016, the solar and wind energy auction was canceled which seemed to shake the confidence of the investors as 1260 projects were registered for the auction out of which 841 numbers were under wind energy and 419 numbers were under solar photovoltaic (PV), totaling to 35,147 MW of installed capacity (New Development Bank 2019). The cancellation decision by the government brought doubt on the minds of investor's on the intention of the government to support energy projects which were going well forward. Since that was the only tender in the year for renewable energy, its cancellation brought a halt in the process of commissioning wind and solar capacity for that year. The investors felt that this decision rather would bring a long-term impact on renewable energy investment in the country and hence slowing down the investment process in that sector.

The New Development Bank hasn't financed any renewable energy project in Brazil since 2017 which also illustrates the complicities in the renewable energy field. With the growing pace, Brazil is expected to have a jump of 44% in solar installed capacity in 2019, which would enhance the solar capacity by another 3.3 GW. With an expected demand in electricity consumption between 2018 and 2022 at an average of 3.8% annually, the need for further investment in infrastructure in the renewable energy sector becomes more prominent (New Development Bank 2019).

Brazil has been a great supporter and promoter of renewable energy for years. But due to the inadequate infrastructure in transmission lines, several projects have been delayed. This made the Brazilian Government set prior conditions for the investors to have secure transmission lines before participation in the auctions. This would not only reduce the problem of delays due to insufficient transmission infrastructure but would also accelerate to drive the market for T&D equipment.

2.6 BRICS: Role of South Africa

The most developed economy in Sub-Saharan Africa is the Republic of South Africa, yet the slow growth is the strong headwinds the country is facing at present. Frequent disruption in the electricity seems to complicate and bring challenges for the economic growth of the country (Conway et al. 2015). Moreover, the grid facilities also need up gradation as they are outdated. As per the National Treasury of South Africa, if the issue of electricity shortage is well addressed, then GDP growth is expected to increase by 2% roughly. Therefore it has become a major matter of concern for the government to secure energy supply and develop renewable energy (Martin 2017).

As per the national commitment for the transition from high carbon to low carbon economy, IRP was formulated to set an ambitious target of 17 800 MW of renewable energy in 2010 to be achieved by 2030 (Wentworth 2014). About 5000 MW of renewable energy was planned to be operational by 2019 within this frame time of 20 years.

This would be followed by another 2000 MW of RE by 2020. Ministerial Determinations are entrusted for the proper implementation of the IRP 2010 that is being regulated by Act No. 4 of Electricity Regulations, 2006 (Kok 2014). It is through the bidding windows that the country has procured 6 422 MW of electricity from 112 Renewable Energy Independent Power Producers in 2017. By the end of June 2017, a total of 3 162 MW of electricity generation capacity was already connected to the national electricity grid. In this regard, the NDB's PFF supported the infrastructural development of the grid connection. With such an objective, NDB would provide a PFF loan to Eskom Holdings State Owned Company Limited of USD180 million. This would, in turn, reduce the dependency of the country on fossil fuels and thus would aid towards the sustainable development of energy and increasing electricity supply. Considering the volume of projects to be funded, the PFF has been divided into sub-projects. Currently, the sub-projects under commissioning include infrastructural development of expedited independent power producer project for Upington, the establishment of substation and transmission lines for Soweto area and Ankerlig-Sterrekus (Martin 2017). With the approval and selection criteria from NDB, future sub-projects would be proposed to ensure the overall development objective of the project.

Through the implementation of the project, Eskom is expected to generate a total of 670 MW of RE to the grid. This would meet 10% of the national target for RE capacity from 2020 to 202 (Solar Power in India 2019). Once the transmission lines are developed to meet the demand for electricity, prospects in the development of RE could be established.

It is to be noteworthy that out of all the BRICS countries, South Africa has a very far way to go in the field of renewable energy as at present more than 90% of the energy are still generated from fossil fuels through the country has targets to commission another 17.8 GW of renewable energy capacity by 2020 (Solar Power in India 2019).

2.7 Conclusion

In the context of the BRICS countries based on their geographic advantages shown by the perceptible economic growth in the early 21st century, the current piece of work tries to analyze the possibility of the BRICS countries for sustainable development and discussed the necessary conditions to be fulfilled. Every effort should be made to focus on the proper utilization of their abundant potential natural resources, land and population by effective technological advancement to encourage sustainable development. India, China, and South Africa being the energy deficit countries, has a great role to play in the field of solar renewable energy to overcome the shortage of energy in the context of the global energy mix. On the other hand, Brazil and Russia being the energy surplus countries could utilize the excess form of renewable energy in exporting to the other nations to meet the demand for energy in the global energy mix.

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