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Paris Agreement leading towards Cleaner Energy:

Scope for India-Japan Cooperation

Abstract

This paper uses Nationally Determined Contributions (NDCs) as submitted by India to the United Nations Framework Convention on Climate Change (UNFCCC) as a research tool to assess the success of India's path towards renewable energy. It maps the blueprint India has been following to achieve its NDCs and traces the shortcomings and challenges for the same. This analysis has then been compared with Japan's evolution of Energy Policy, with specific emphasis on post Fukushima disaster energy transition, and in lieu of Japan's own NDCs. By using a comparative analysis framework, it has been shown how and in which broad policy areas there emerges a mutual scope for cooperation between the two countries, which are not only on the same path of diversifying their energy mix but are also looking at the role of green leadership in future in the Asian region as well as globally.

Keywords*: Paris Agreement, Renewable Energy, India, Japan, NDC, Energy policy.*

As the world population rises and the strife towards economic development deepens, the basic requirement across the globe is that of energy. Barack Obama, former President of United States of America, states that "a nation that cannot control its energy sources can't control its future". This statement correctly lays emphasis on the intrinsic relationship between energy sources, politics, economics and thus the future of any nation.

According to International Energy Agency's (IEA) Global Energy and CO2 Status Report, global energy demand grew by 2.3 per cent, the fastest pace in a decade, leading to 1.7 per cent increase in energy related CO2 emissions. As the relevance of energy continues to expand, the source of energy, i.e. renewable or not, has also become important. One of the major reasons for this has been the awareness of the ill effects on climate change of carbon-based fuels. Over the past decade, the energy sector has remained the largest contributor to emissions over any other sector, contributing 72 per cent of global emissions in 2013.

The world is thus undergoing what can be called an "energy transformation" wherein a majority of the states across the world are recognizing and accepting the need for change. This transformation is characterized by a move towards renewable energy sources with their promise of enabling access to affordable, reliable and cleaner sources of energy. Renewable energy has been defined as the energy obtained from naturally repetitive and persistent flows of energy occurring in the local environment (Twidell and Weir 2015:3).

It was the 1973 oil crisis which, portrayed the immense dependence on oil for energy requirements, and exemplified that any hindrance to its procurement would have extensive repercussions. Today, Foreign Policy has a new dimension of Energy Diplomacy, which helps a country promote and safeguard its energy security through diplomatic means of coordination, collaboration and sometimes even

coercion. Also, embargos, sanctions and military intervention have become tools for covert politicization of energy and energy interests.
Nevertheless, even though there is emerging consensus among nations towards the requirement of an energy transformation, there is no single consensus as to the path leading towards it. There is a divergence among countries depending upon their geographical location, stage of development, availability of resources, cultural history and ruling governments, among other reasons. More so the rampant race towards economic growth across the world along with an increasing world population has a direct bearing upon the demand for energy. It is within this dynamic process of energy transformation, accelerated due to the looming ecological crisis and affected by factors like energy security, that India and Japan find themselves on the path of diversifying their energy mix.

This paper thus begins by briefly introducing the Paris Agreement and NDCs and what it entails. India's NDCs are then charted along with an analysis of the success as well as shortcomings pertaining to the set targets as well as future ambitions. This is followed by a similar assessment of Japan's NDCs. By comparing the blueprints of energy policies of both the countries, scope for cooperation in the energy sector towards clean energy has been charted out.

UNFCCC, Paris Agreement and NDCs

"The only way forward, if we are going to improve the quality of the environment, is to get everybody involved."
- Richard Rogers

Richard Rogers, an Italian-British architect, perfectly encapsulates the intention behind international agreements such as the Paris Agreement[1] through the abovementioned quote. Getting everybody involved in an issue which concerns the whole planet, is one of the driving forces of the Paris agreement of United Nations Framework Convention on Climate Change (UNFCCC). Being the most recent major international agreement undertaken towards mitigating climate change, the nationally determined contributions (NDCs) laid forth as part of Paris Agreement have been used in this paper as an analytical tool to chart energy transition of Japan and India in the near future, while searching for potential areas of cooperation for the two countries. It has further been suggested by Resources for Future Report 2018, that NDCs can reveal a country's preferences regarding climate policy, economic development, and other priorities.

A unique aspect of the Paris Agreement is that instead of prescribing specific mitigation actions or emission level targets to be achieved in a specified time; it focuses on individual NDCs. These would then be assessed for their success every five-years, which is legally binding. It thus establishes the Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) principle.

The collective responsibility towards a sustainable future and protecting the environment from continued adverse human impact have become common accepted goals of the international community. Such a realization creates a

[1] Paris Agreement or Accord de France is an international commitment agreement under the United Nations Framework Convention on Climate Change (UNFCCC). It is a multilateral treaty in which both developed and developing countries have come together to work towards the global goal of keeping global temperature "well below" 2°C while also pursuing effort to stay below 1.5°C. As of August 2019, it has been ratified by 185 Parties of the 197 Parties to the Convention

favourable environment for bringing together the strengths of each country to combat the common challenges ahead. This creates a space for countries to strive together towards their ambitions, as shall be seen in the case of India and Japan.

India's NDC and Path towards Renewable Energy

India while putting forth its Intended Nationally Determined Contributions (INDCs)[2] has chosen traditional cultural links of the Vedic period as a point of initiation in order to invoke a sense of historical linkage towards sustainable development. It further goes onto reemphasize the fact that India was not part of the creators of the challenge Earth faces today in terms of climate change and global warming. Being energy import dependent and a climatically vulnerable nation, energy security and climate change are seen to be as intricately linked policy challenges for India.

The India's NDC submission explicitly mentions that while "the per capita emissions of many developed countries vary between 7 to 15 metric tonnes, the per capita emissions in India were only about 1.56 metric tonnes in 2010". This seems to indicate a rather guarded stance of India while taking up the responsibility for future turn of events. Nevertheless, it goes onto mention the imperative task ahead of all nations for securing a sustainable planet for the future generations. In order to achieve this India has stated its objective to follow an equitable, inclusive and sustainable model of growth which it intends to foster and facilitate by a collaborative approach among the developing and the developed countries. The stated aspiration of the INDCs is thus that of "Development without Destruction". A list of India's INDCs has been provided in Figure 1.1.

Institute for Sustainable Development and International Relations (IDDRI) Study of 2015 has termed India's NDCs as "very ambitious", also Climate Watch data refers to India's targets as "fair and ambitious". While on the other hand Climate Action Tracker (CAT), which is an independent scientific analysis produced by three research organizations, has placed them within their "2°C compatible" rating i.e. NDCs indicating a lack of utilizing full potential of policies and actions being undertaken. Thus, India is being accused of underplaying and putting in comparatively less effort by setting for itself relatively easier targets as well as targets which would not substantially contribute towards the larger goal as suggested by Intergovernmental Panel on Climate Change (IPCC), of limiting global warming to under 1.5°C, above pre industrial levels. Similarly, it has been suggested (Mittal et. al 2019: 5) that India's NDC is inadequate to achieve the reduction required to transit to low-carbon pathways pegged with a stringent 1.5°C stabilization goal.

However, India on 2 October 2016 ratified the Paris Agreement and further committed itself to lower the emissions intensity of gross domestic product (GDP)[3] by 33% to 35% by 2030 below 2005 levels, to increase the share of non-fossil based power generation capacity to 40% of installed electric power capacity by 2030 (equivalent to 26–30% of generation in 2030), and to create an additional

[2] INDC is converted to a Nationally Determined Contribution (NDC) when a country formally joins the Paris Agreement by submitting an instrument of ratification, acceptance, approval or accession, unless a country decides otherwise.

[3] Emission Intensity of GDP is the ratio of greenhouse gas emissions produced to the GDP of the country

(cumulative) carbon sink of 2.5–3 $GtCO_2e$ through additional forest and tree cover by 2030. For 2020, India has earlier put forward a pledge to reduce the emissions intensity of GDP by 20% to 25% by 2020 below 2005 levels.

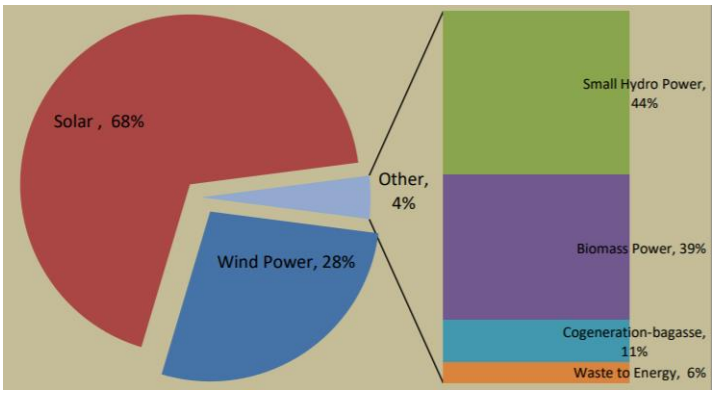
Figure 1.1

1. To put forward and further propagate a healthy and **sustainable way of living** based on traditions and **values of conservation and moderation**.
2. To adopt a **climate friendly and a cleaner path** than the one followed hitherto by others at corresponding level of economic development.
3. To **reduce the emissions intensity of its GDP** by **33 to 35 percent by 2030** from **2005 level**.
4. To achieve about **40 percent cumulative electric power installed capacity** from **non-fossil fuel based energy resources** by **2030** with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).
5. To **create an additional carbon sink of 2.5 to 3 billion tonnes** of **CO_2 equivalent** through additional forest and tree cover by **2030**.
6. To **better adapt** to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
7. To mobilize **domestic and new & additional funds** from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
8. To **build capacities**, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.

Source: India INDC to UNFCCC

IDDRI Study of 2015 had indicated that in achieving India's INDC target, the power sector will have to play a critical role. The potential attractiveness of renewable energy-based power generation can be estimated through Ministry of New and Renewable Energy (MNRE) data, which places solar potential in the country as high as 68% (Figure 1.3). This however raises the question of whether India is taking steps in the right direction so as to optimize this existing potential. It has been said (Mittal et. al 2019:6) that a major shift in the primary energy mix is not witnessed in the NDC scenario, and the share of fossil fuels is expected to be high during the entire assessment period. Government of India (2005) estimates state that in order to provide for a sustained growth of 8 per cent through 2031, India would need to grow its primary energy supply by 3 to 4 times at least and its electricity supply by 5 to 7 times of 2006 consumption levels; thereby by 2031-32 power generation capacity would have to increase to about 778095 MW.

Figure 2: Source wise estimated potential of renewable power in India as on 31.03.2018



Source: Energy Statistics 2019- Ministry of Statistics and Programme Implementation, Government of India)

A watershed moment in India's renewable energy thereby came with the first National Action Plan on Climate Change (NAPCC) in 2008, which outlined India's existing and future policies and programmes directed towards climate change mitigation and adaptation. The plan outlines "Eight National Missions", out of these the National Mission for Enhanced Energy Efficiency and National Solar Mission directly influence Renewable energy whereas the National Mission on Sustainable Habitat and National Mission for a "Green India" can be regarded as supporting mechanisms for renewable energy. Due to these efforts India achieved 4th global position in wind and renewable power and 5th global position in solar power deployment respectively and the renewable power deployment has more than doubled in last five years i.e. from April 2014 to March 2019.

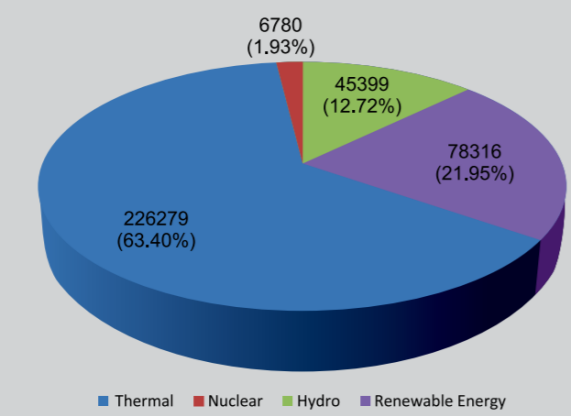
As India receives about 5000 trillion kW/year equivalent of energy through solar radiation, the emphasis on the National Solar Mission, being the first mission to be operationalized under the NAPCC, was thus palpable. It set the goal of increasing production of photovoltaics to 1000 MW per year, deploy at least 1000 MW of solar thermal power generation, establish a solar research centre, increase international collaboration on technology development, strengthen domestic manufacturing capacity, and increase government funding and international support. Using a three-phase approach, the mission's objective is to establish India as a global leader in solar energy, by way of creating the policy conditions for solar technology diffusion across the country as quickly as possible. This mission was extended and elaborated through the Jawaharlal Nehru National Solar Mission, 2010. As a result, solar power capacity has increased by more than 11 times in the last five years from 2.6 gigawatt (GW) to 28.18 GW in March 2019; the 2022 target of 175 GW is not just within reach but is set to be exceeded (MNRE Annual Report 2018-19:3).

In this regard, development of solar parks has been one of the major schemes propagated by the government to further its renewable energy ambitions. Under the scheme, the government authorities offer developers a 'plug-and-play model' for project development through the organisation of land and evacuation infrastructure in exchange for a fee, support decline in renewable power pricing and investment decisions for new projects. However, it has yet to reach its potential as only 16% of the 40 GW target for solar park projects by the end of fiscal year (FY) 2019-20 were awarded by the end of 2017 (IEA June 2018:4). Moreover, according to IEA estimates, a paltry 1.2 GW of new solar park capacity

has been sanctioned under the scheme by the MNRE since the announcement of the revised solar park targets in March 2017. Nonetheless World Resources Institute (WRI) estimates that with rapidly falling solar tariffs, solar energy is poised to attain grid parity and might also outplace thermal power in India.

A capacity of 78.31 GW has been set up by March 2019 constituting 21.95 per cent of the total installed capacity (Figure1.3). This shows that India is largely in line with meeting its targets. Furthermore, in 2017 investment in renewable power, at nearly USD 20 billion, topped that for fossil fuel-based generating capacity for the first time. It has been estimated that renewable-based power capacity will increase from 47 GW in 2010 to 500 GW in 2050 in the NDC scenario (Mittal et. al 2019:9). This further highlights the growing importance of the renewable energy sector.

Figure 1.3: India Source wise Installed Power Generation Capacity (MW) as on 31.3.2019



Source: Ministry of New and Renewable Energy, Government of India – Annual Report 2018-19

Nevertheless, despite having a reasonably sound policy framework for development of renewable energy, what has been persistently lacking is effective implementation in certain areas. Recently as per the Global Energy and CO_2 Status Report, India's CO_2 emissions from energy rose by 4.8% in 2018, largely driven by emissions from coal power plants. It has been further estimated by S. de la Rue du Can, et al. (2019) that according to India's forecasted economic growth, emissions will almost quadruple by 2050. Independent studies (M. den Elzen et al 2019) project that India will reduce emissions farther than required by the intensity target with current policies, but it is still uncertain what emission level would be reached as emission projections highly depend on future economic growth.

Coal fired power generation is one of the major reasons for such emissions. CAT estimates that it accounted for 75% of India's total power generation in 2015 which results in an emissions intensity of power supply (767 gCO_2/kWh) far higher than the global average (475 gCO_2/kWh). There is also a significant uncertainty over the future of coal power capacity in India as National Electricity Plan (January 2018) foresees coal-fired power capacity additions of 46 GW between 2022 and 2027. Taking into account both capacity additions and retirements, India's coal power capacity will reach 238 GW in 2027, which is a net increase of 46 GW from the installed capacity in 2017. Further, due to uncertainties on its future power demand, India has neither set a cap on its total coal use, nor a peak date.

As per CAT estimates, this is not in line with the Paris Agreement, as in order "to reach full decarbonisation globally, no new coal plants should be built, and emissions from coal power should be reduced by at least 30% by 2025." Furthermore, as per Energy Statistics 2019, the gross import of coal increased at 9.07% whereas the export has decreased by 15.23% and net import of coal increased at 9.30% in 2017-18 over the previous year. Furthermore, NITI Aayog, a government think-tank in its Draft National Energy Policy and the Three-Year Action Agenda (2017–18 to 2019–20) has recommended increasing domestic production and distribution of coal, oil and gas, which, if adopted, will prove to be a significant threat to India's climate goals.

Moreover, coal is increasingly seen as paradoxical for development due its growing cumulative impact on air quality, land use, and water availability in water-stressed regions. As a result, IDDRI Report has indicated that, "government has been retiring large numbers of old and inefficient coal plants, delaying domestic coal production expansion plans, setting biomass co-firing objectives, requiring that new plant be super-critical and use dry cooling technologies, implementing stricter coal quality standards, increasing coal taxes, and is aggressively pursuing alternative energy technologies, such as solar, wind, hydro and nuclear."

This must further be substantiated with the Indian reality of coal subsidies. The GST Compensation Cess (previously coal tax) which is effectively a carbon tax levied at source on coal produced and imported, generated tax revenues of USD 12 billion between 2010-2018 while subsidies to coal amounted to USD 2.3 billion in 2016 alone. Moreover, National Institute of Public Finance and Policy assessment noted that allocations made by the National Clean Energy Fund (NCEF), such as environmental pollution remediation projects and support for deployment of renewable energy, were not in line with the main objective, which was to stimulate R&D in clean energy. Also being housed in the Ministry of Finance, the NCEF does not have a dedicated team of its own. In this regard, CAT states that "India could become a global climate leader with a "1.5˚C compatible" rating if it abandons plans to build new coal-fired power plants." Thus, coal would continue to feature prominently in the energy mix and shall have repercussions upon India's energy policy as well as ecological ambitions.

Another continued criticism against India has been the apparent lack of transparency in its targets, which provide no details. For example, as CAT points out, there is lack of clarity in terms of "greenhouse gas and sectoral coverage, and metric for the intensity target (e.g. constant or nominal GDP) as well as the way it envisages it will achieve the non-fossil power capacity target." India also does not specify if the emissions intensity target in its NDC includes emissions from Agriculture, Forestry and Other Land Use sectors (AFOLU). WRI have also highlighted the need for further transparency so as to support robust greenhouse gas (GHG) accounting.

Moreover, the recent Draft National Electricity Policy by NITI Aayog states that by 2040 a likely capacity of 597-710 GW within renewable energy sector is expected to be achieved. Tariff policy support for financial strengthening of the sector as well as role of state governments and technological advancement has been highlighted by NITI Aayog while charting the future course of renewable energy in the country. However, no specific targets beyond 2022 have been announced to date.

The Indian transport sector currently accounts for 10 per cent of total GHG emissions in the country and in order to arrest this growth, the government has introduced a range of interventions in the passenger as well as freight transportation segments (WRI 2017). This sector has direct and indirect implications not only upon climate ambitions but also upon the energy sector. Thus in 2013, the Indian government set up the National Electric Mission Mobility Plan (NEMMP) 2020. The Faster Adoption and Manufacturing of Electric Vehicles in India (FAME – II) scheme is a key component of this mission which came into effect in April 2019. It provides incentives to purchase electric vehicles, while also including provisions to ensure adequate charging infrastructure. The state-owned Energy Efficiency Services (EESL), announced its plans to replace 500,000 government cars with electric cars, but recent reports claim that government employees are refusing to use electric vehicles procured through EESL, citing concerns over mileage and performance. Studies (Dhar, et al.) indicate that the need to focus on the structural transformation of the transport sector should be consistent with the "below 2˚C" scenarios.

Financial feasibility and availability of funds would play a pivotal role in determining the viability and success of any climate and energy policy, especially for a developing country like India; this has even been underlined in India's NDC. According to IEA Clean Energy Investment Trends 2018 Report, India is primed to become one of the largest renewable energy markets in the world in the coming years. Thus financial cooperation is another area which has been discussed in the following sections, so as to further India-Japan bilateral cooperation.

Therefore, we find that while various studies like those by CAT, S. de la Rue du Can, et al. (2019), M. den Elzen et al. (2019), etc. have reaffirmed the belief that India would be able to achieve its NDCs by following the present climate policies, at the same time it has been noted that the ongoing policies need to be enhanced to fill the emissions gap vis-à-vis India's optimal emissions mitigation response to stabilize climate at 'well-below 2 ˚C' global ambition. Climate Watch Data further reiterates the essentiality of appropriate technologies and adequate finance in order to enable developing countries like India to achieve as well as enhance their climate targets. It is here that a developed country like Japan can play a major role and a strong partner, an argument further explored in the following sections.

Japan's NDC: An Assessment

Before identifying mutually beneficial areas of cooperation between India and Japan, it is essential to identify the path Japan is charting for itself in the realm of renewable energy in particular and its NDC's in general. Japan submitted its INDCs on 17 July 2015. Japan geographically being a country with extremely limited fossil fuel resources, has always placed energy security as a key issue in designing its energy mix. Also, as Japan's Long term Strategy under the Paris Agreement states, energy-related CO2 accounts for approximately 90% of Japan's GHG emissions, making the energy sector keystone for any future climate policy.

Japan's NDC target is that of 26% below 2013 emission levels i.e. 18% below 1990 levels, by 2030. In the energy mix provided by Japan used for calculating the emission reduction target (table given below) it places renewables at about 22-24% and nuclear power close to it at 22-20%. Within renewables maximum share has been given to hydro power which is expected to stand at 8.8-9.2% followed by solar

at 7%.

Figure 1.4: Energy mix used for the bottom-up calculation of the emission reduction target

	FY 2030
●Final energy consumption	326 M kl
(Energy efficiency measures)	50 M kl

●Total power generation	approx. 1065 billion kWh
Renewables	approx. 22-24%
Nuclear power	approx. 22-20%
Coal	approx. 26%
LNG	approx. 27%
Oil	approx. 3%
(within renewables)	
Solar	approx. 7.0%
Wind power	approx. 1.7%
Geothermal	approx. 1.0-1.1%
Hydro power	approx. 8.8-9.2%
Biomass	approx. 3.7-4.6%

Source – UNFCCC, Submission of Japan's INDC

Climate Watch Data has termed Japan's NDC as "highly transparent and concrete", given that it has been drawn by accumulating tangible policies and measures for major sectors along with clear breakdowns. It is expected that this would promote sector specific actions, leading to fair and efficient reductions of global emissions, as has been seen in the cement and steel sectors, which today can boast of high energy efficiency. Climate Watch Data therefore finds Japan's NDC as being consistent with the long-term emission pathways up to 2050 to achieve the 2 degrees Celsius goal. CAT on the other hand, has rendered Japan's NDCs as "inadequate" claiming that if other countries were to follow similar targets, global warming would most likely exceed 3-4 degree Celsius, which is in stark contrast to the desired aim.

IDDRI Study 2015 also stated Japanese INDC as "feasible as long as a significant restructuring of the Japanese energy system is achieved." In the submitted document, one of the first mentioned intentions of Japan is to utilize its "leading technologies" to reduce GHG emissions and supporting developing countries in the same. This showcases the priority Japan places on the role of technology not only to achieve its domestic energy targets but also as a tool for diplomacy. Further Japan has also mentioned Fukushima disaster and its impact leading to "reviewing" and rebuilding" their energy strategy from scratch. After the disaster, Japan retracted from the previous goal of 25% emissions reduction from the 1990 levels by 2020, which was to be supported by a plan to generate more than 40% of electricity with nuclear power. In July 2015 the Japanese Government finalized a "Long-term Energy Supply and Demand Outlook", which formed the basis of the Japanese INDC. Renewable energy production has grown by 56% from 2005 to 2015, which has resulted mainly from new solar and wind sources since 2012 (IEA 2016). In April 2019, the Act of Promoting Utilization of Sea Area in Development of Power Generation Facilities Using Maritime Renewable Energy Resources was enacted to encourage more offshore wind power in the future. Meanwhile Japan's solar capacity now stands at over 49 GW, however, solar prices remain higher than in

many other countries (Carbon Brief Profile: Japan 2019). The Japanese Photovoltaic Energy Association targets 200 GW of new solar PV capacity installations by 2050 and Japan's Ministry of Economy, Trade and Industry (METI) approved almost 20GW of solar PV project each year between 2014 and 2018. The solar energy sector nonetheless continues to face challenges as Feed in Tariff (FIT) scheme[4] fails to meet its objective and 95 solar company bankruptcies were witnessed in 2018 (Gunjan 2019).

The Basic Energy Plan of July 2018 does not indicate any vision or strategy on how Japan can go beyond its 22–24% by 2030 renewable electricity target, which is likely to be achieved with existing policies. Instead it focuses on matters like whether new nuclear reactors could be constructed by 2050 and how to reduce the economic costs resulting from the renewable electricity support scheme.

The long-term strategy under Paris Agreement, which was adopted by the Cabinet on 11 June, 2019, mentions the long-term temperature goal of reducing GHG emissions by 80% by 2050. Nevertheless, CAT has termed this as being "far from the ambition required to achieve the Paris Agreement's long-term temperature goal" given that the strategy shies away from committing to a complete phase-out of coal-fired power generation, even in the long term.

Like in India, coal continues to feature prominently in Japan's energy mix; coal accounted for 34% of Japan's electricity production in 2017, up from 27% in 2010 (Carbon Brief Profile: Japan 2019). Climate Analytics Report 2018 suggests that Japan must shift its focus to mostly phase out all coal plants by 2030, so as to align with Paris Agreement goals. Further, the report stated that with Japan's current policies and plans for new coal-fired power generation, levels of carbon pollution would almost be three times what is consistent with the Paris Agreement between now and 2050. Japan has also been a major funder of coal-fired power plants overseas, alongside China and South Korea. Global Coal Finance Tracker mentions that Japan's public financial institutions have financed at least 19 GW of coal plants overseas, and may finance at least 11 GW in the future. While Japan's public finance institutions haven't changed their stance on coal, the private sector is showing a sign of change. Since May 2015 several major firms in the financial sector have announced a shift away from investing in coal power plants.

CAT also highlights a major flaw in the emissions accounting method used by Japan. It states that Japan has excluded land use, land use change and forestry (LULUCF) from the base year emissions, but has included them in the target year emissions. Thus, when accounting for LULUCF credits in the base year, this target is reduced to 23% below 2013 (or 15% below 1990) levels of GHGs. The CAT analysis suggests that in order for Japan to reach a "medium" rating it would require an emission level of 936 $MtCO_2e$ in 2030 or 24% below 1990 emission level, and for a "sufficient" rating it would require an emission level of 137 $MtCO_2e$ in 2030 or 89% below 1990 emission levels.

Japan in 2012 also implemented a carbon tax on oil, gas and coal imports, with its revenues going towards measures to curb CO_2 emissions, but the price of this

[4] A feed-in tariff is a policy mechanism designed to accelerate investment in renewable energy technologies, by offering long-term contracts to renewable energy producers, typically based on the cost of generation of each technology. The goal of feed-in tariffs is to offer cost-based compensation to renewable energy producers, providing price certainty and long-term contracts that help finance renewable energy investments.

remains very low at under $3 per tonne CO_2e (The Carbon Brief Profile: Japan 2019). Thus given the present policy stance of Japan, it can be expected that it would not be able to achieve a low carbon economy.

However, one major positive policy development is in the transport sector, as the Japanese Government together with all major car manufacturing companies is planning to set a long-term target of reducing tank-to-wheel CO_2 emissions by 90% below 2010 levels by 2050 for new passenger vehicles, assuming a near 100% share of electric vehicles. Further Japan plans to showcase its "hydrogen society" vision which includes a target of putting 40,000 hydrogen-powered vehicles on the road by 2020 and doubling the number of fuelling stations to 160. Such combined efforts are expected to have a positive impact not only on reducing carbon emissions but also to create a carbon neutral economy in the near future.

With regard to climate financing, Japan is obliged to provide climate finance to other countries, due to its Annex II status under the UNFCCC and it has pledged $1.5bn to the Green Climate Fund (GCF), which in effect makes Japan the largest donor to GCF (The Carbon Brief Profile: Japan 2019). This reiterates Japan's commitment not only towards achieving its own climate ambitions but assisting other countries do the same, thereby paving the way for enhanced climate financial cooperation between India and Japan.

IDDRI Study 2015 suggests that implementing the Japanese INDC could lead to a significant improvement in energy security, measured in terms of import dependency and import bills. On the other hand while CAT believes that Japan will overachieve its 2020 pledge regardless of the future role of nuclear power, it states that Japan might fall short of achieving its 2030 target in the NDC if no additional measures are implemented. Others, like Kuramochi et al. (2017) point out that Japan's NDC mitigation target is not a sufficient contribution to the global effort to keep global warming within 2°C. Furthermore, UNEP Emissions Gap Report of 2017 states that Japan's mitigation effort was "likely to require further action to meet their NDCs".

Therefore, we find that there is scope for further expansion of ambitions of Japan, and energy sector continues to be the most prominent and most challenging sector for the country. It is thus herein that bilateral cooperation with India might act as an impetus to enhance respective energy mix goals.

India-Japan Cooperation: A Renewable Energy Driven Future

Japan-India relations have historically been very positive despite some brief challenges in their bilateral relationship. As a result, India and Japan today share what has been termed as a "Special Strategic and Global Partnership", which encompasses a wide array of areas for cooperative assistance and mutual development of both the countries. The Tokyo Declaration signed by Prime Minister Abe and Prime Minister Modi in September 2014 recognizes the critical dependence of both the economies on energy imports as well as the volatility and vulnerability it creates.

Also, both the countries are driven directly or indirectly by costs of energy which guide their energy policy. A correlation can be seen between political backing to renewable energy and its declining costs. As the awareness regarding environmental crisis broadens and consumers begin demanding green energy, the

governments would be coerced to take stronger action. According to Pew Research Centre 2015 polls, three-quarters of Indians are very concerned about global warming, the highest share of all the Asian countries surveyed. Similarly, polls show that 45% of the Japanese population considers climate change to be a very serious problem, in the middle of the range for the world's major economies (The Carbon Brief Profile: Japan 2019). Such views, as they gain momentum, act as an impetus towards changing socio-political discourse prompting governments towards climate friendly policies.

By analysing the NDC's of both countries, we discovered that shortcomings prevail in their respective policy blueprints, albeit varying in their nature. However, a scope for confluence also evolves as both the countries might be able to assist each other in overcoming the challenges they might be facing. In this regard, the areas of broad mutual convergence which emerge are:

- Technological cooperation

Innovation is central to a sustainable energy path and in this regard, Japan being a technological leader in past decades, can resume its position by utilizing its scientific knowledge combined with human resource and market access within India to further renewable energy affordability and accessibility. India's NDC also calls for enhanced international actions on technology development and transfer to accelerate low carbon technology diffusion in the country. This can be done especially in areas of energy storage, mini and micro grid technologies, electronic passenger and commercial vehicles, among others.

Japanese approach towards environmental policy has largely been technological and the same was seen with respect to the energy sector. In 2004 Japan was estimated to have a 20 per cent share of the world market for environmental technology (Vinger 2008). However Japan has lost its leadership position to countries like China and Germany which have taken advantage of raw material availability as well as technological advancement. However, the Long Term Strategy under Paris Agreement, 2019 also mentions intention towards international collaborations within this arena. In 2017, global R&D spending in energy reached around USD 115 billion – an increase of 2.5% in real terms, but most of it came from the private sector (IEA 2019:22). International Energy Agency Report 2019 on Technology Innovation to Accelerate Energy Transitions has also reiterated the need for government partnerships between stakeholders at the most advanced knowledge frontier (like Japan) as well as from markets with highest potential for innovative technology adoption (like India). The National Energy and Environment Strategy for Technological Innovation towards 2050 which has been put forth in line with Paris Agreement by Japan, and can act as a bridge between the two countries to promote technological innovation.

Technological advancement especially in energy efficient and low-cost PV manufacturing can help Japan import these from India at lower costs to enable comparable costs of generation given the challenges Japan's Feed in Tariff scheme faces today with rising financial burden. Moreover, world's first floating solar plant was built in Japan, in Aichi Prefecture in central Honshu and is among the world leaders in the technology, as India embarks to undertake similar projects, the two can collaborate towards project optimization.

- Financial cooperation

As Japan intends to "lead the global rule-making for information disclosure relating to climate change, and change the global financial flow" as per the Long term strategy, financial collaboration in the energy sector can prove to be conducive. Japan has a well-established system of ODA through Japan International Cooperation Agency (JICA) and India is its oldest receiver of such assistance. This relationship can be harnessed so as to enhance renewable energy in India to aid its growth and development as well as to meet the aim of 100% rural electrification with quality infrastructure. Areas of investment may include solar parks, PV manufacturing units, etc.

The New Climate Report 2018 highlighted that 71% countries considered cost of implementation as the key issue while considering raising NDC ambition. As India is yet to layout its long term strategy under Paris Agreement as of September 2019, bilateral advances with Japan in this regard may assist India in aspiring for more ambitious goals. While India has received by far the highest level of single-country funding ($725m) approved by multilateral climate funds in absolute terms from 2013 to 2016, its per-capita funding was relatively low, at just $0.56 per person (The Carbon Brief Profile: India 2019).

Furthermore, it has been estimated that even to achieve the NDC target in 2030, India needs investments of around 2.5 trillion USD in the next 15 years. Herein the potential role of JICA can be brought into play as JICA and India have had a long-standing relationship and one of the prime sectors of investment for Japan in India has been the energy sector.

The overview of JICA's assistance towards the energy sector includes the strengthening of electricity supply, energy efficiency and conservation. From the perspective of climate change, JICA also supports energy efficiency and conservation, and renewable energy. Japan understands the importance of developing a strong energy sector as it itself relied heavily on its energy sector during industrializing years. At a glance it is seen that by 2015, JICA's cooperation for power sector in India had contributed about 1.1 trillion Japanese Yen (US$ 11 billion) in finances and 25% of JICA's total commitment was to India and as a result about 5% of total generation capacity has been generated wherein JICA has focused on transmission and distribution in recent years, but is now also looking towards strengthening its assistance to generation, including coal-fired power and renewable energy (Ichiguchi 2015). Moreover, around ₹3600 crore has been committed since 2011-18, for 36 subprojects in wind, solar, and small hydro (Sakamoto 2018).

It is through JICA's ODA loan support that Indian Renewable Energy Development Agency (IREDA) has been providing innovative and customized financing to renewable energy projects in various sectors including solar, wind, small hydro and cogeneration. Since such projects entail high investment and a gestation period, 'soft loans' (with low interest and long repayment period) from JICA have enhanced the viability of such projects. In addition to funding, JICA has been facilitating training of Indian government personnel in Japan on adoption of energy efficient systems and processes. Since 2008 the Training Program in Japan has included 250 Indian experts who were invited to Japan in cooperation with Bureau of Energy Efficiency (BEE) (Sakamoto 2018).

The achievements of JICA projects in the energy sector stand with the fact that such projects have contributed about 9.3 GW to India's total installed capacity (1GW renewable energy) of about 350 GW by 2019, however this value has stayed the same since 2016 (JICA 2019, 2016). Thus, the foundations of a conducive and successful energy collaboration between the two countries has already been laid. Even though this convergence has explored various dimensions, we have seen that renewable energy sector remains a potential almost unexplored. The number and scale of projects are small and largely based on one-way Japanese investment; the possibility of two countries becoming equal partners in enhancing renewable energy capacity continues to be unexplored.

- Policy cooperation

Both the countries are striving to strike an equilibrium which helps achieve the right balance between dependence on conventional sources as well as sustainable energy. Domestic and international pressures are mounting and India and Japan must take charge of their responsibilities by adhering to the NDCs set by them respectively. Enhancing existing forums like the Bilateral Energy Dialogue can prove to be the first step towards cooperative policy brainstorming.

The Japanese have had tremendous success in realizing energy efficiency as well as cutting costs and making business out of it by utilizing technology policy and this can be used in the energy sector especially in countries like India which are in need for fast evolving low-cost technologies that can also simultaneously aid economic growth. This has led the two countries to affirm strengthening their energy cooperation through Japan- India Energy Dialogue.

The recent 9th India-Japan Energy Dialogue held in New Delhi in 2018 reinstated the resolve to transition towards “reliable, clean and economical energy” as pertinent for economic growth. Further both countries agreed to initiate discussion on electric vehicles by collaborating on "Policy dialogue on next generation/Zero emission vehicles" while working together to promote well-functioning energy markets. IDDRI Report- Beyond the Numbers: Understanding the Transformation Induced by INDCs states that the transport sector of India will need 4 times more energy in 2031 compared to 2006. Thus, electric vehicles could prove to be a promising potential sector of cooperation also aligned with Japan’s “Well-to-Wheel Zero Emissions policy” which ultimately reduces GHG emissions from energy production and vehicle travel to zero.

While both Ministers noted the possibility of new energy transition in lieu of NDC’s the Joint Statement of 9th India-Japan Energy Dialogue –India-Japan Energy Partnership Initiative 2018 seems to be more focused upon enhancing clean coal technologies and LNG market instead of furthering standard renewable energy mechanisms. The document is more of a broad outline rather than a detailed blueprint for future. However, the India-Japan Energy Transition Cooperation Plan which was launched in 2017 is expected to be further expanded in the upcoming Energy Dialogues, this can pave the way for a more proactive plan of cooperative action between the two nations.

Moreover, International Renewable Energy Agency in its report titled RE-thinking Energy 2017: Accelerating the global energy transformation, states that globally, jobs in solar energy have witnessed fastest growth since 2011 among various renewable energy sectors and that Asia has harnessed the maximum i.e. 60%

employment potential. According to the budget of 2019-20, the installed solar generation capacity in India has increased by 10 times in the last 5 years. Hence India must look at competitive manufacturing of full chain of PVs along with training facilities, both areas where Japan can perform a crucial role given its expertise and experience.

- International cooperation

Despite being members of same international organizations/agreements working towards expanding renewable energy like IRENA, Paris Agreement, International Solar Alliance, etc; the two countries haven't had a unified stand on issues. This could change if both can further understand the similarities in their objectives. Utilizing the platform created by International Solar Alliance, existing forums like G-7 as well as enhanced cooperation in other developing nations may prove to be beneficial to both.

Moreover, since the 1980s international cooperation has been central to India's renewable energy strategy, a continuation of which has been seen in references to the same in India's NDCs. Already as many as 35 bilateral/multilateral cooperation frameworks between India and other countries for new and renewable energy have been signed between 2007 and 2015. Also Japan's 3L Policy – Low Cost, Low Carbon, Low Risk, as is being implemented in Africa's Energy Sector Development, can be adapted to meet Indian requirements as well. An Indian version of recently launched Japan Climate Initiative, which is a network of non-state actors actively involved in climate action, might also help both nations push domestic efforts towards their NDC ambitions, which at a later stage may be converted into a multilateral forum engaging local governments. The Table 1.1 summarizes the areas of probable collaboration as well as benefits these would entail to both India as well as Japan

The World Energy Outlook projections of India suggest that, India would move to "the centre of global energy affairs, accounting for 25% of the rise in global energy use to 2040." It would not only be a major player in renewable energy but also the second-largest solar market in the world. This would prove to be a golden opportunity not only for India but also for investing countries like Japan which can capitalize on the economic gains by catering to such an extensive market. Japan, given the present scenario, would also tremendously benefit by the economic gains through increased renewable energy investments. An estimated (World Energy Outlook India Special Report 2015:139) $2.8 trillion in investment would be required by India, which comes to an average of $110 billion per year, in order for it to meet the supply projections of its New Policies Scenario. Out of this 75% would be in the power sector, and an additional $0.8 trillion in improving energy efficiency.

Japan's enhanced collaboration with India would also help create a more amicable image of both the countries within South East Asian region. Historically both countries have faced some backlash for their policies such as Japan's chequebook diplomacy and India's big brother attitude. Economically India is a huge market where despite facing competition from China, Japan might be able to create a niche for itself. The Global Commission on the Geopolitics of Energy Transformation has predicted that China is set to become the world's renewable energy superpower, along with its unavoidable presence in contemporary geopolitical realm. Rather than competition, Japan, China and India could come together with

their own strengths in the renewable energy sector and present to the world what might be termed as the "*Asian green energy economy*".

Table 1.1

Area of cooperation	Benefit to India	Benefit to Japan
Technological cooperation	Diverse local and rural areas would benefit from technologically advanced climate friendly energy systems	India provides a huge potential market and sample base to innovate varying technologies applicable in differing setups. These can then be patented and utilised by other developing countries in the region
Financial cooperation	Meeting financial crunch towards expanding energy related climate ambitions	Abiding by its International obligations as an Annex II UNFCCC country
Policy cooperation	• Furthering intentions set under Bilateral Energy Dialogue • Learning from past experience of a developed nation • Transport sector leader Japan can assist a still nascent EV Transport sector of India	• Furthering intentions set under Bilateral Energy Dialogue • Utilizing strategic relations with trusted ally to strengthen energy security • Boost stagnant economy by tapping market potential through favourable policies
International cooperation	• Optimal utilization of existing forums like ISA, G20, IRENA, etc • Furthering Green Leadership aspirations	• Optimal utilization of existing forums like ISA, G20, IRENA, etc • Furthering Green Leadership aspirations

What Asian green energy economy entails is a broad rewiring of the energy mix of Asian nations led by countries like India, Japan and China, bringing together the advantages they have in terms of market share, size of economy, technological and environmental leverages. By altering their own energy mixes towards increasingly greater shares of renewable energy they can become green leaders and pave the way for cheaper options and greater acceptance of renewable energy within the region. Though it would not be an easy task but it is definitely something which we must be strive for considering the exponentially rising threats of climate change to the planet.

With USA taking a step backwards and China and Germany venturing extensively into green economy, it falls upon countries like India and Japan to define the roles they would like to play. Japan being a developed nation with traditional emphasis on respect for nature and ethical business practices possesses tremendous potential to lead the path towards a renewable based future. While India at the helm of socio-political transformation, with its approaching peak of demographic dividend, enhanced international leadership role as well as exponentially rising

energy needs, and must set an example for other developing countries on the path to a renewable energy future.

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