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Addressing Energy Needs and Climate Change

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Foreword

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Energy-related issues have been central to human civilisation's material growth. The Industrial Revolution in Europe made energy one of its centrepieces, projecting the region on to the global stage. While the search for energy resources in West Asia and Africa contributed to mutual inter-dependence, it also brought into acute focus the sustainability and affordability of energy supplies to distant consumers. Recent developments have added another layer: that of environmental issues, given the link to increased energy consumption, specifically coal and oil, to carbon emissions. Many a country today is concerned about the sharp variations in global energy prices, distribution networks and environmental issues.

As rising powers, India and China have, for the past three decades, sought the right mix for their energy baskets in their respective models of development. This dilemma has resulted in intense debate about the appropriate energy policies to be adopted, programmes to be followed, and mechanism to be implemented – a theme constantly and competently explored by the paper presenters in this seminar.

Traditionally, both India and China have been heavily dependent on coal for their energy needs, although in recent decades, the oil mix in their energy basket has increased. China's energy import dependence in 2016 was over 64 per cent, increasing from 334 million tonne (mt) in 2015 to about 360 mt in 2016. This is only expected to increase to over 66 per cent by 2020, i.e. to over 390 mt. Much of these imports will come from Saudi Arabia and Angola, although for the first time, Russian exports accounted for 23 per cent of total Chinese imports, displacing Saudi Arabia. India consumed 165 mt of oil in 2015 and 183 mt in 2016, and consequently, its oil import dependence increased from 78 per cent in 2015 to 81 per cent in 2016 – importing 202 mt of crude oil in 2016 at a cost of USD 64 billion. Much of these imports are from Saudi Arabia and other West Asian countries, although, unlike China, these

import destinations are closer for India – suggesting lesser transportation costs and the attendant vulnerabilities.

The exploration of renewable energy resources – a recurring theme in this seminar – has been a major driver in Indian and Chinese policies, given concerns regarding environmental degradation. Indeed, both India and China announced ambitious policies to enhance the renewable content in their energy baskets as reflected in missions related to solar power, hydro-power and wind energy. Both have also embarked on expanding their civilian nuclear power potential despite the setbacks following Fukushima.

Focusing thus on this important topic, the objective of this seminar was to highlight the diversified policies being adopted by India and China in changing their energy mix, and also provide policy choices for the decision-makers. As their material strength is enhanced, it is clear that India and China will continue to address these energy issues for years - and decades - to come.

India's Energy Policy: Energy Needs and Climate Change

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Energy security is becoming increasingly important for India and for the world. In India, for instance, the population is crossing 1.25 billion (which is 18 per cent of world population) but consumes only 5 per cent of the world's energy. To put this into perspective, the US, with less than 5 per cent of global population consumes around 17 per cent of the commercially traded primary energy sources. If India's per capita energy demand too grows to the US' levels, the country would exert huge pressure on the global energy market. This is an alarming situation especially because consumption of petroleum sources would also be responsible for a remarkable level of Green House Gases (GHG) emissions.

India is a fast growing economy and according to the latest national economy survey, the Indian economic growth during 2016 period was around 7.1 per cent. It is expected that the Indian economy will grow at about 7.5 per cent in 2017-18. This population and economic growth means the country's energy demand will be significantly increasing in the years ahead.

India's energy mix includes conventional energy such as oil, gas, coal and biomass and non-conventional sources such as renewable energy (RE). The country's consumption of fossil fuels has been heavily increasing. The RE sector has witnessed a remarkable growth over the past years and has been contributing an increasing share in the country's energy mix. However, unfortunately, production at the current rate is able to meet only a fraction of our growing energy demands (and mainly in the urban regions). It is often forgotten that over 60 per cent of India's population lives in rural areas and they do not have access to clean energy. If demand from the rural areas also grows to the same levels as those in the urban region, that itself will be a huge policy responsibility for India.

How can such energy productivity be achieved? What are the implications of India's energy production?

India has domestic sources and it also imports from overseas regions; the domestic supply sources include oil, coal and other RE facilities. India also has been depending on solar and wind energy. India currently houses the largest solar power plant in the world, which is a huge achievement in the country's clean energy front.

Oil and gas (hydrocarbons) are modern energy sources and fuel the country's urban facilities and military sector. A major share of the total petroleum consumption (oil and gas) in India comes from imported sources. This means our external supplies can be vulnerable to any geopolitical volatility in the supply routes or producing regions. Any geopolitical turbulence in the international market can challenge India's security and will have severe impact on the Indian economy.

The domestic sector too faces challenges that are mostly related to efficient infrastructure towards supply and distribution of electricity for our consumption. However, the biggest concern remains the energy basket itself.

In India, oil constitutes 27.9 per cent of total commercially traded primary energy resource; gas constitutes 6.5 per cent and coal constitutes about 58.1 per cent. Nuclear energy contributes to only a small per cent in the basket – unfortunately, compared to the huge energy demand in India, the country's 19 nuclear power reactors do not make any significant contribution in the energy basket. Compare this with Lithuania, which had only one nuclear reactor that was able to meet over 70 per cent of its domestic energy needs.

Therefore, there is reason to be concerned. 92.5 per cent of India's energy requirements are being met through hydrocarbons or fossil fuels. There is a direct impact of this on the environment; and particularly concerning is the high GHG emissions. Interestingly,, if we look at the global GHG emissions, the majority of these emissions currently come from the energy sector; the electricity and heat production contributes 25 per cent of emissions; while industry

contributes 21 per cent; and the transport sector is responsible for about 14 per cent of these emissions.

China, with 28 per cent of the global emission share, tops the list of the highest GHG and CO2 emitters in the world, followed by the US, which contributes 16 per cent; and then India and Russia, who contribute nearly 6 per cent each to the total emission.

Although India is not much behind China in ranking, the difference in the quantum of emissions between the two Asian countries is vast (India emits around 6 per cent while China emits around 28 per cent of the GHG). These emissions have a severe impact on human health and on the environment in the form of global warming.

The other challenge we face with our present consumption pattern is the over-reliance on conventional energy sources like oil, coal and gas and the impact of price fluctuations on the economy. In 2003, oil prices were about USD 28 per barrel, which then increased to USD 147 per barrel in 2008. How does one deal with these price fluctuations on the domestic front? Price fluctuations have an adverse impact on the domestic economic health.

Given all these implications and in light of the ongoing global debate on climate change, there need to be plans and policies in place to address these challenges on energy and emission concerns.

One the most important policy steps India has undertaken towards addressing energy security concerns in the country was the efforts to ensure coordination among various ministries and their activities. The 2006 Integrated Energy Policy (IEP) document was successful in presenting the possibilities of coordinating the different energy sectors managed by five different ministries: the Ministry of New and Renewable Energy; the Department of Atomic Energy; the Ministry of Coal; the Ministry of Power; and the Ministry of Petroleum and Natural Gas. Often, the work of these ministries was seen as highly compartmentalised without a single guideline that coordinated their actions. To some extent,

the IEP was successful in bringing various government machineries to make plans and work together through an integrated approach.

Addressing Energy Security and Climate Change

India has prescribed several policies and actions over the past decade to address national energy related issues and climate change concerns.

Domestically, India has several legal provisions on this front. The two important legal tools have been the 2001 Energy Conservation Act, and the 2003 Electricity Act. Both these legal instruments have contributed remarkably to energy conservation and RE contribution in India's energy sector.

Specifically on climate plans, after the 2007 United Nations Framework Convention on Climate Change (UNFCCC) in Bali, India formed the Prime Minister's Council on National Action Plan on Climate Change and the first report detailing India's plans for actions, the 'National Action Plan for Climate Change (NAPCC), was released in June 2008. Through the NAPCC, India has been able to develop climate change related actions in tune with its long term development objectives. The NAPCC highlights that Indian actions are motivated by a strong domestic will to address climate change issues rather than under any international pressure that contradict national interests.

In 2009, India committed to reduce carbon emissions intensity to 20 to 25 per cent (from 2005 levels) by 2020. In 2015, India set its Nationally Determined Contribution goals to reduce emissions further to 33 to 35 per cent by 2030 from the 2005 levels.

India cannot depend solely on conventional fossil fuel sources. How can we balance our energy demand with our environmental health? Plans for low carbon energy development were proposed through various policy initiatives. The Indian Planning Commission had taken

a lead in the talks about the need for low carbon development in India (reflected in a 2011 report by the Planning Commission).

There have been several plans in the commercial sector, including energy efficiency improvement plans based on the Perform, Achieve and Trade Scheme (PAT), which is a policy tool designed to address the energy efficiency and emissions trading in the Indian Industries. The Indian industry is a large consumer of commercially traded fossil fuels. There is a need to address the issue of emissions from the industry sector by reducing our dependency on fossil fuels. Similarly, in the residential sector too, several plans have been made to address energy concerns. This includes policies to promote star rating of energy efficient appliances, prescription of building codes to improve efficiency etc.

Ideally, we should not be using lights in a meeting room at 11:30 in the morning. The failure to make an energy efficient design for a building necessitates the use of lighting. Unfortunately our system is such that we think of the aesthetics and design of the building but we have not been considering energy conservation as a necessary step. Buildings are designed in such a way that sunlight cannot be utilised for lighting, which is an entirely a wrong approach we have been following.

To address these problems, plans are being promoted at the residential sector to encourage the use of LED lights, which can significantly bring down energy consumption and emissions. Often, nearly 50 per cent of a household's energy needs are for lighting and if energy can be saved while lighting, that would be a significant step forward.

India has also made plans to enhance the renewable energy generation in the country. Apart from policies and economic tools to support renewable energy, the government initiated a market mechanism to improve the commercial level generation of RE sources. The programme, known as the 'Renewable Energy Certificate' (REC) is a remarkable step towards the energy transition in the country.

Discussion

- Of the total oil India has been consuming, roughly two-thirds comes from abroad. This indicates that overseas sources are also important to run key economic activities in the country. So, imported energy sources play a strategic role in India's energy landscape
- Sea Lines of Communication (SLOCs) do affect our energy security situation. Any major international event like accidents in oil producing region, oil spills, etc will have a large-scale and huge impact on many countries
- There is reason to be pessimistic about the India-Pakistan-Iran (IPI) or Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas pipeline plan. The type of difficult terrain these pipelines will have to pass through and the geopolitical vulnerability these regions can pose to the safety of the supply routes will play a critical role in deciding the realisation of the same. It also means that every cubic meter of gas transported through these pipelines will certainly demand for higher price because of the cost incurred in providing security to these lines
- In terms of climate collaborations, India has been working with China as well as other country groupings like the Like Minded Developing Countries (LMDCs)
- Unlike what US President Donald Trump believes, there is merit in the climate change debate and there is a need to look at the statistics associated with this debate to understand the real importance of timely action towards climate mitigation
- Today, building a nuclear reactor could demand around USD 5 to 12 billion and even if the country decides to build a nuclear reactor, finding a location can be a difficult process. The public protests against the Kudankulam nuclear power plant caused hindrances to the nuclear industry
- There is undeniably an opportunity for nuclear energy sector to flourish if Small and Modular Reactors (SMRs) are considered. SMRs can find a market in India because the country is investing heavily in smart cities projects and Special Economic Zones (SEZs), which demand uninterrupted energy supplies.

The above is a transcript of the talk delivered at the workshop.

China's Energy Policy: Energy Needs and Climate Change

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Introduction

The rise of the Chinese economy, and its energy reserves and their by-products fuelling this growth, have been an issue of major debate since the late 20th century. China has abundant reserves of coal, oil, gas and hydropower. However, this energy basket has often been juxtaposed with varying availability of exploitation and exploration, subject to environmental sustainability.

China's energy policies have been functioning in tandem with its government's priorities since the country's liberation in 1949 and can be divided into three phases: 'pre-reform' (1949-1980), reform (1978-2001), and 'after-reform' (from 2001 onwards). This demarcation of phases implies change in two aspects: financial, and the exploration of one or more energy reserve.

'Pre- Reform' Period: 1949-1978

China's 'pre-reform' era was marked by high levels of centralisation. Government documents from the time prove that it was an era of command economy with the objective of achieving self-sufficiency (also called *zi ji zi zu* 自给自足).[1] However, the end result was large-scale inefficiency, wastage of resources and environmental destruction.[2]

[1]Wang Yanxing, Wang Heibo and Fan Liuyan September 2012. "Zhongguo Nengyuan Zhengce de Yanbian Ji Qushi 中国能源政策的演变及趋势 [The Evolution and Trends of China's Energy Policies]," Lilun Xuekan 理论学刊 [Theory Journal] 9 (223) (2012): 70-73.
[2]Jianjun Ji, Jinrong Weiji Xia Zhongguo Nengyuan Zhengce Xuanze Yanjiu 金融危机下中国能源政策选择研究 [A Research on Choices of China's Energy Policies during the Financial Crisis, Specialised Master's Dissertation](Xi'an: Xibei Daxue [Northwest University], 2011).

This was a period of "intensive resource exploration strategy."[3] China wasted about 3550 million tonnes of standard coal energy, amounting to a GDP loss of 5.85 billion yuan (1980 rate). This was a colossal loss not only in terms of financial and natural resources, but also the psychological and emotional efforts that had been invested. China, one of the few countries to have had its priorities sorted right from the First Five Year Plan, had managed to take over 156 projects under the guidance of the Soviet Union.[4] Yet, its energy policies failed to achieve their objectives because it simultaneously adopted policies harmful to the development of its energy security mission.

China has had the tendency to provide a greater documentation of the efforts to develop its heavy industry, while providing negligible information on the status of its small-scale industries. However, even in its initial years just after independence, China developed rudimentary forms of small-scale industry based on renewable energy, like methane pools, solar cooking stoves and so on.[5] Despite the good intentions behind these initiatives, most of them were haphazard and disjointed in nature and could not lead to the development of a systematic energy security policy. It has been pointed that circumstances outwitted intentions at that time as poor technology, financial shortages, myopic domestic policies as well as strained relations with the Soviet Union robbed China of laying the policy foundation for a strong energy base.[6]

Reform Period: 1978-2001

The reform period, which officially began in 1978, laid more stress on the politics of economy rather than the politics of ideology. As a result, China began to take steps towards the opening up its economy and political system. There is a general perception that the Chinese pursuit of economic development was at the expense of many other sectors like energy and

[3]Shoubo Xu. "Gaige Kaifang 30 Nian Zhongguo Nengyuan Fazhan Zhanlue De Biange" 改革开放 30 年中国能源发展占率的变革 [On The Transformation of China's Energy Development Strategy in the Past 30 Years of Reform and Opening Up], Beijing Jiaotong Daxue Xuebao (Shehui Kexue Ban) 北京交通大学学报（社会科学） [Journal of Beijing Jiaotong University (Social Sciences Edition) 7(3) (2008): 8-14
[4]Jianjun Ji, n.2
[5]Ibid
[6] Ibid

environment. However, this is an incorrect assumption. China, during this period, placed great emphasis on its energy security policy. In fact, it was perhaps the first time that energy became an important factor for China's policy-makers.

Major price reforms were issued in the fossil fuel sector, and most of the ministries were converted into national oil companies.[7] This marked the birth of CNPC, Sinopec and CNOOC; energy conglomerates that later expanded to become the face of China's international prowess, especially in the energy sector. Today, China's national oil companies are rivalled by its US and European counterparts, and the Chinese government is utilising them to enhance its comprehensive national power as well as to showcase its open door policy (*dui wai kaifang 对外开放*). This was the time that China began to focus on not just energy exploration and exploitation but also energy conservation.[8] The Sixth Plan put energy saving at par with, if not higher than, energy exploration. This was also a period when papers and documents were devoted to the formation of laws and guidelines for energy conservation.[9] For instance, the Energy Conservation Law was passed during this period (*zhong hua renmin gonghe guo jieyue nengyuan fa 中华人民共和国节约能源*). Several stipulations related to the development of thermoelectric output, administrative methods of legalising conservation products, plans for building standard residential houses with energy conservation among others, were also put in place during this period.[10]

China held its first energy summit as early as 1979, which acknowledged the wasteful consumption of fuel at the village and urban levels.[11] The threat posed by China's energy consumption pattern against its ecological balance was also acknowledged during this

[7]Dangdai Zhongguo Ed 当代中国 [Contemporary China], 1988. Dangdai Zhongguo De Shiyou Gongye 当代中国的石油工业 [Contemporary China's Oil Industry], Beijing: Dangdai Shehui Kexue 当代社会科学 [Contemporary Scientific Society]

[8] Jimin Zhao, "Reform of China's Energy Institutions and Policies: Historical Evolution and Current Challenges," *BCSIA Discussion Paper 2001-20, Energy Technology Innovation Project, Kennedy School of Government, Harvard University*, 2001

[9]Wang Yanxing, Wang Heibo and Fan Liuyan, n.1.

[10] Ibid

[11]Wang, Qingyi. "Zhongguo Xuyao Changqi Wending de Nengyuan Zhengce 中国需要长期稳定的能源政策 [China Needs a Long-term Stable Energy Policy]." 25-29

period. Consequently, various economic incentives were introduced, including subsidy allowances, tax revenues, assured prices, credit guarantees, and leasing of land.

These economic incentives had two consequences. First, it led to an increase in the intake of renewable energy. Second, it began to shift the spotlight from fossil fuels to renewable energy, which eventually led to the formulation of a framework of a renewable energy policy. China's energy sector was under the National Development and Reform Commission (NDRC) at the time and despite not having a full-fledged ministry, it began to function in its truest form by introducing various laws and guidelines that would eventually make the energy sector both accountable and autonomous. By the Ninth Five Year Plan, China was formulating policies that catered not only to its economic and social requirements but also its environmental and ethical needs.[12]

After-Reform Period: Tenth Plan Onwards

The 'after-reform' period is China's natural evolution from a closed and underdeveloped to a fast developing economy. This evolution was accompanied by China's transition, beginning around 1993, from an energy-sufficient economy to a net oil importing country. China has a largely coal-based energy reserve, but it has been judiciously using other forms of energy, like petrol, nuclear energy and hydroelectricity.

The 'after-reform' period started at the turn of the 21st century, which coincidentally also marked the beginning of the Tenth Five Year Plan in 2001. Like the previous plans, the Tenth Plan also continued the pattern of energy conservation by investing in clean coal technologies and transportation of energy from the western areas (primarily Tibet and Xinjiang) to the industrially developed eastern areas.[13] During this period, the energy structure was maintained through energy exploration, conservation, and efficiency. Perhaps that is why the Renewable Energy Law was passed in 2005. A conference on renewable energy was held the same year, where then president Hu Jintao advocated for "international cooperation" on environment and energy issues. He also called for a Beijing protocol that

[12] Jianjun Ji, n.2
[13] Ibid

would focus both on China's economic rise and energy efficiency.[14] In fact, on this basis, it can be argued that China in its Twelfth Five Year Plan called for a four-pillared energy structure (*si wei yi ti* is 四位一体): a secure, stable, economical and clean environment.

During China's Eleventh Five Year Plan, a policy related to long-term scientific and technological development (*guojia zhongchang qikexuehe jishu fazhan guihua gangyao* 国家中长期科学技术发展规划纲要) was promulgated.[15] In fact, the Eleventh Plan vociferously advocated for technologies like hydropower, nuclear energy, and wind and solar, which would augment the non-fossil fuel sector. It did not just limit itself to paperwork and even tried to ensure that such technologies were made available for both production and consumption purposes.

It is often a misnomer that China's energy policies are subservient to its economic goals or that they have merely been an appendage to its financial ambitions. Energy has undoubtedly fuelled China's economy and in the process has put its ecological health at stake. Yet, the subtle purpose it has served in trying to strike the right balance between ecology and economy cannot be ignored. The contribution of China's energy policies are highlighted below:

- They have been able to moderate the ambitions of China's energy companies by capping bids on their financial advances and environmentally lethal programmes. Chinese companies are expected to adhere to the norms established by NDRC, which tries to adopt a judicious mix of environmental concerns and economic ambitions in its energy policies.

- Although China has often been ridiculed for its declining environmental quality, it has in fact been able to portray its energy policies as a political trump card on the basis of its contribution to resolving conflicts that have arisen out of the exploration and exploitation

[14]Wang Yanxing, Wang Heibo and Fan Liuyan, n. 1
[15]Jianjun Ji, n. 2

of global energy resources. These energy policies have been instrumental in reducing doubts about China's foreign policy initiatives that have often been supportive of environmentally threatening programmes.

- At the domestic level, China's energy policies have been instrumental in building an agenda to procure and produce renewable technology. China is a major investor in the research and development of renewable technologies. These energy policies have managed to encourage China into developing energy saving technologies as well as bringing in innovation.

Clearly, China's energy policies have adopted a *fang* and *shou* approach, through which it has resisted the shortcomings of its economy and allowed monetary investment in energy issues that emphasise sustainability.

Using the case study of electricity, Lu Yinzhong[16] attempted to analyse China's energy consumption pattern over a span of three decades. According to his study, coal consumption accounted for 60-70 per cent of China's total energy consumption. Hydroelectricity is at its maximum possible potential of 19-20 per cent. Petrol, on the other hand, was a big achievement for China. After the Daqing excavations, and since its automobile market was not too flooded with foreign imports, China continued to use petrol for electricity generation until as late as 2000.

There are two observations worth noting with regard to petrol-generated electricity. First, China became a net importer of oil by 1993. This, however, did not deter it from utilising petrol for electricity generation until 2000. Second, despite continuing to use petrol for this purpose, China started feeling the impact of the reduced quantities of crude oil and petrol for electricity generation - in 1980, petrol accounted for 17.7 per cent of the materials used for

[16]Lu Yinzhong,"Cong Wo Guo Nengyuan Xuqiu Yuce Kan Nengyuan Zhanlue Shang De Ji Ge Wenti,"从我国能源需求预测看能源战略上的几个问题 [A Few Questions About China's Energy Strategy From The Estimates of China's Energy Needs]." 30-34

electricity generation, which dropped drastically to 1.6 per cent by 2000 and was eventually completely phased out by 2010. Nuclear energy was not utilised at all for electricity production till the turn of the century, but its usage was gradually expanded: it increased from 4.2 per cent in 2000 to 18.6 per cent in 2010.

Twelfth Five Year Plan: Looking Towards the Future

China's Twelfth Five Year Plan (2011-2015) has often been touted as the 'green plan', where the focus shifted, for the first time, from 'Made in China' to 'Designed in China'.[17] The Chinese, by 2011, were well aware of their strengths, which they dubbed the old pillar industries, such as electricity, oil, coal, airlines, national defence, telecommunications and so on. These industries enabled China's economic rise.[18]

However, in order to sustain itself for the future, China required investment in certain Strategic and Emerging Industries (SEI), including energy saving and environmental protection, next generation information technology, biotechnology, high end manufacturing (aeronautics, high speed rail), new energy (nuclear, solar, wind, biomass), new material (special and high performance composites), and clean energy vehicles (phevs and electric cars).[19] These were meant to reduce energy intensity targets by 16 per cent as per the Twelfth Five Year Plan.[20] This is a huge target, especially given China's economic growth rates, and since reducing energy intensity at such a high rate would involve many stringent steps, such as closing inefficient industries and retrofitting existing industries, which could affect this growth rate.[21]

[17]"China's 2011 National People's Congress: Fine Tuning the Economy with an Eye on Social Stability," *APCO Worldwide*, 2011accessed December 20, 2012, http://www.apcoworldwide.com/content/PDFs/npc_briefing_2011.pdf.
[18]Lewis Joanna "Energy and Climate Goals of China's Twelfth Five Year Plan," *Center for Climate and Energy Solutions*, 2011, accessed: December 21, 2012, https://www.c2es.org/international/key-country-policies/china/energy-climate-goals-twelfth-five-year-plan.
[19] Ibid
[20]Keanfong Wee, "China's Latest Energy Consumption Data Reveals New Challenges and Opportunities," *ChinaFAQs,* November 5, 2012,accessed: December 21, 2012, http://www.Chinafaqs.org/..../chinas-latest-energy-consumption-data-reveals-newopportunities-and-challenges-0.
[21] Ibid

China's major investment departments, for example, China Energy Conservation Investment corporation (CECIC), State Energy Conservation Information Dissemination Centre (SECIDC), Energy Saving Corporation (ESCO), State Development Planning Commission (SDPC), State Science and Technology Commission (SSTC) and Ministry of Science and Technology (MOST), have been involved in various programmes such as leasing of conservation equipment, and formulating and executing programmes like the integrated resource programme, demand-side management, issuing guidelines on the renewable energy programme (1996 to 2010) and so on.[22]

Despite China's achievements in this field, its energy policies have also raised questions about its intentions and integrity regarding energy conservation and environmental sustainability. China's efforts, since the reform era, to build a market economy, and at times, of conflict giving preference to economic policies over environmental policies, cannot be ignored. It has more often been a 'Hobson's choice' for China, since evaluation is frequently based on numbers rather than intentions, and China's rise was based on the evaluation of its GDP rates.

Decentralisation, which started post-1978, also hindered the growth of China's energy conservation. The lack of centralised authority and decline of macro control has not only provided more autonomy but also loosened China's authority over provincial officials due to which the desired objective has not been achieved in its truest form. Another aspect that has affected the efficacy of energy policies is the abolishment of various ministries that were considered redundant. However, China inadvertently also abolished those ministries that were doing the seemingly redundant task of collecting data yet providing solid back-office support. Moreover, energy-saving incentives like low interest loans and tax subsidies were too random and too few in number to be able to accelerate the impact of the energy conservation programme. Finally, various laws and guidelines that were made to augment the case of energy conservation collapsed because of ambiguous statements, which

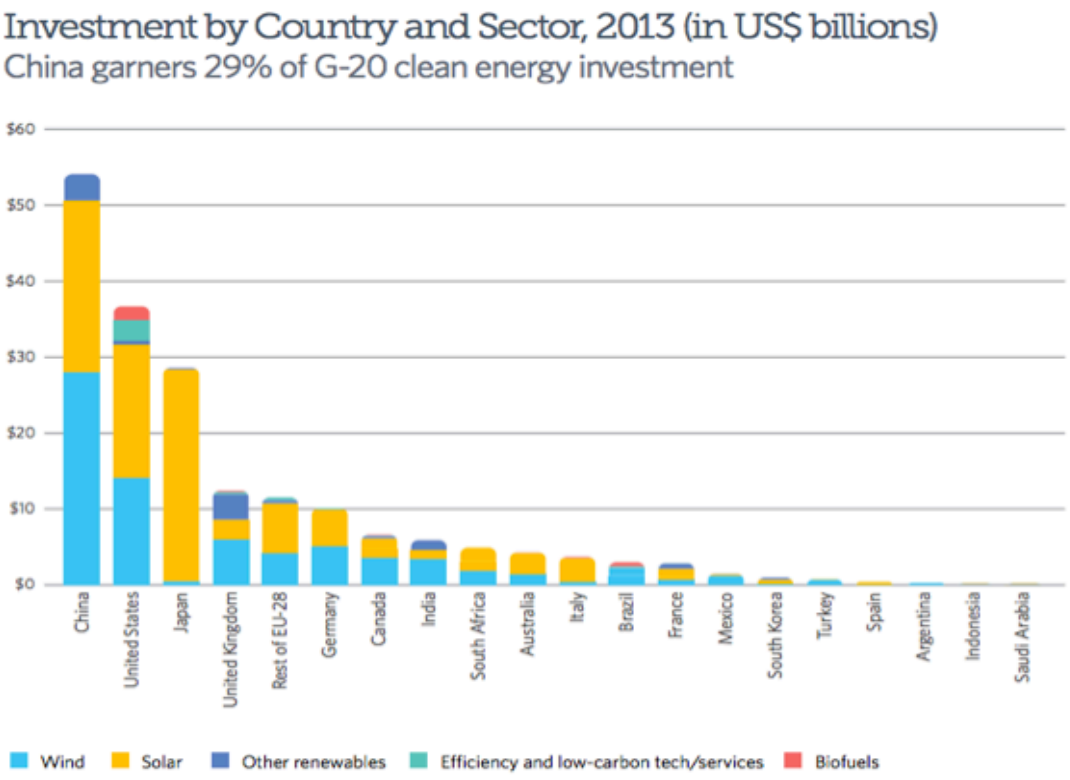
[22]Zhihong Wei, "Economic Development and Energy Issues in China," Working Paper prepared for 1st KEIO-UNU-JFIR Panel Meeting, Tokyo, February 13-14, 2004

provided enough loopholes to 'polluters' to wrangle themselves out of the stringency of energy policies.[23]

Current Scenario

As per the Twelfth Five Year Plan, China was to become the largest investor in clean energy, which it achieved by increasing its investment from 118 billion yuan in 2008 to 252 billion yuan in 2014. In fact, China's investment in clean energy has been gradually increasing, taking the largest proportion of the total energy investment. Data reveals that the share of investment has increased by 32 per cent from 2007 to 2011.[24]

Figure 1: Investment by Various Countries in Clean Energy Sector for 2013



Source: Pew Charitable Trusts (2014:14)[25]

[23] Ibid

[24] Mathews, John and Hao Tan "China's Green-Energy Revolution," *Project Syndicate*, May 8, 2015, accessed February 20, 2017 https://www.project-syndicate.org/commentary/china-green-energy-revolution-by-john-a--mathews-and-hao-tan-2015-05.

[25] "2013 Who's Winning the Clean Energy Race?," *The PEW Charitable Trust*, 2014, http://www.pewtrusts.org/~/media/assets/2014/04/01/clenwhoswinningthecleanenergyrace2013pdf.pdf.

The figure above reveals the break-up of clean energy investment made by various countries. It clearly highlights China's superiority in this regard. In 2013, China invested more than 50 billion dollars in clean energy as compared to the US, which invested less than 40 billion dollars. China also has major chunks of investment in wind and solar energy, while the US has had scattered investment across different sectors of clean energy that includes bio-fuels and low carbon technology services.

Presently, China's renewable energy capacity is 378 GW, which is estimated to be more than double the entire current capacity of renewables in the US. However, China has not achieved self-sufficiency, which was part of its First Five Year Plan.[26] For that to be achieved, China has to still generate 800 to 1000 GW of zero emission facilities so that by 2030, 20 per cent of its energy consumption comes from non-fossil fuels. [27] Dominic Waughray, Head of Public-Private Partnership and Member of the Executive Committee at the World Economic Forum (WEF implied in his address at the WEF, published on 17 February 2017, that China should stretch the concept of environment and climate beyond ethics, and advocate it from a strategic perspective.

China has already asserted its desire at the Paris Summit to assume a global leadership role in handling climate change, and has also been filling leadership gaps in areas where the US is unprepared to do so. Perhaps this is why the US sent a representative to the Summit while China was represented by its head of state. Waughray backs Asian bonhomie with China as the leader, through policies oriented towards climate change, which he calls the 'Fourth industrial revolution for environment'[28] Margareth Sembiring, senior analyst at the Centre for Non-traditional Security Studies at Nanyang Technological University in Singapore, prefers to call it 'climate diplomacy'. She claims: "Climate diplomacy can improve relations among Asian nations. China has established a 20 billion

[26]"China's Climate and Energy Policy: Leadership Efforts on the Road to Low Carbon Future," *Climate Nexus*, accessed February 19, 2017, http://climatenexus.org/learn/international-actions/chinas-climate-and-energy-policy.

[27]"China's Fast Track to a Renewable Future,"*The Climate Group,* 2015, accessed February 21, 2017 https://www.theclimategroup.org/sites/default/files/archive/files/Re100-China-briefing-ENGLISH-jv-final.pdf.

[28]"New Partnership Aims to Boost China's Environmental Policies and Circular Economy," *Modern Diplomacy*, February 17, 2017,accessed February 19, 2017, http://moderndiplomacy.eu/index.php?option=com_k2&view=item&id=2261:new-partnership-aims-to-boost-china-s-environmental-policies-and-circular-economy&Itemid=178

yuan climate fund to assist the developing world in mitigating greenhouse gas emissions and adapting to climate change."[29]

Figure 2: Estimates of China's Thirteenth Five Year Plan

2020 Targets	SEAP (2014-2020)	National 13FYP	Energy 13FYP	2015 actual levels
Energy Consumption Cap	about 4.8Gtce	5Gtce	no more than 5Gtce	4.3Gtce
Coal Consumption Cap	4.2Gt	N/A	less than 4.1Gt	3.96Gt
Energy Consumption/GDP	N/A	-15% from 2015 level	N/A	-18.2% from 2010 level
CO2 Emissions/GDP	N/A	-18% from 2015 level	N/A	-20% from 2010 level
Coal in primary energy consumption	62%	N/A	58%	64%
Non-fossil fuel in primary energy consumption	15%	15%	more than 15%	12%

Source: Ma, 2017[30]

The figure above reveals the data of the Thirteenth Five Year Energy Plan, which not only has new sub-headings - such as energy consumption cap - but has also targeted the increase of non-fossil fuel in primary energy consumption to 15 per cent from the actual level of 2015's 12 per cent. This shows that China's renewable energy investment is here to stay, and more R&D investment in this sector can be expected.

However, in order to achieve these targets, China has to overcome three major pitfalls:[31]

- Export of pollution abroad to weaker developing countries
- Overcapacity
- Curtailment

[29]Coco Liu, "The Real Reason for China's U-Turn on Climate Change," *South China Morning Post* February 4, 2017 accessed February 19, 2017,http://www.scmp.com/week-asia/geopolitics/article/2067189/real-reason-chinas-u-turn-climate-change.

[30]Tianjie Ma, "China Outdid Itself Again in Setting 2020 Low-Carbon Targets," *China Dialogue zhong wai dui hua* 中外对话, January 5, 2017 accessed February 21, 2017, https://www.chinadialogue.net/blog/9113-All-eyes-on-China-s-13th-Five-Year-Plan-for-energy/en.

[31] Ibid

The question of climate diplomacy draws criticism when China continues to give primacy to economics over the environment and funds more than half of its coal projects operating in developing countries. This shows that while China tries to champion the cause of climate change in political circles, it acts as a colonial investor at the grass roots level. The second issue China is struggling with is the overcapacity of fossil fuels, especially coal. The global economic meltdown has had an impact on China, evident from the fall in its economic growth. Also, the declining demand of electricity due to slashing of energy-intensive industries has made large power generation facilities redundant.

The situation is worsened by the fact that during such times of 'depressed gains', China continues to build its coal-powered generation facilities, several of which were approved when the Chinese economy was in a better condition. Thus, carrying the burden of past policies in a declining demand market has led to the overcapacity of China's fossil fuels, compelling it to continue funding coal power projects in developing countries. Moreover, China's renewable energy is facing problems at both the production as well as the transmission levels. While generation-level problems can be sorted out through R&D, the problem of renewable energy transmission, especially from western China to the eastern areas, is a big challenge. The prevention of fossil fuel usage coupled with non-availability of renewable electricity has made China outsource its pollutants to developing countries, forming a vicious circle.

Conclusion

China's energy policies have grown from the 'pre-reform' stage to the current, more mature stage. In this process of evolution, it has made various mistakes, learnt from them, and then set its agenda back on track. The changing circumstances and demands have reflected in China's energy policy priorities. China started with the motto of self-sufficiency, but in the process derailed its conservation mechanism. When it focused on conservation, it lost out on self-sufficiency and became a net importer. Energy has been viewed differently by China at different stages: during the 'pre-reform' era, it was seen as a commodity; it became a part of the policy discourse during the reform era; and has now finally became a part of China's strategic calculus. After several trials and tribulations,

China has realised that it is in its best interest to make energy band with ethics rather than the economy.

China's energy policies are currently reflective of both its present needs and future goals. After developing fossil fuels for a long period of time, China has realised the importance of environmental protection for its future economic development - hence the massive investment in wind and solar energy. However, China needs to emerge from the investor mindset and think of larger goals that would fulfil its global ambitions. For that to happen, it must engage not just with the economy of energy but also with its ethics.

Energy Security and Climate Change: Prospects for Cooperation between India and China

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Introduction

Energy security and climate change are important issues that have come to assume centre-stage in the international security landscape over the last two decades. Although these issues have been discussed at length for decades, what is new is the stark visibility of the anthropogenic changes that have occurred from the exploitation of hydrocarbon-based energy sources which threaten the existence of countries and their peoples irrespective of their geographic location.

India and China together are home to approximately 2.7 billion people. They are two of the fastest growing economies in the world. As per the World Bank's Global Economic Prospects (2015), India leads the Bank's growth chart of major economies with a growth rate of 7.5 per cent while China has maintained a steady growth rate of 7.1 per cent; as per the International Monetary Fund's (IMF) predictions, India will accelerate its growth further while China will decelerate. However, both countries remained at the top in terms of Gross Domestic Product (GDP) growth for at least a decade, with China's economy remaining much larger than India's. This growth story has pertinent ecological implications. China and India have emerged as the largest and the fourth largest emitters of green house gases (GHG), respectively[1] and their demand for energy will continue to rise to support their respective growth pattern. The nature of this link is a matter of concern for policy makers in both countries. Both countries are heavily dependent on coal and oil for energy generation. They are making efforts to set foot on a trajectory of low carbon

[1]Mohan, Vishwa . "Greenhouse gases: India fourth biggest emitter, but lags far behind top three." The Times Of India, June 25, 2015. Accessed March 18, 2017. http://timesofindia.indiatimes.com/home/environment/global-warming/Greenhouse-gases-India-fourth-biggest-emitter-but-lags-far-behind-top-three/articleshow/47807927.cms

development with varying degree of success.[2] Many agree that the degree to which China and India consume natural resources within and beyond their boundaries will largely determine future environmental, social, and economic outcomes**.** The impact of the economic policy choices made by these countries will have environmental consequences across regions. Both countries have however decided to invest in renewable energy sources for energy generation, albeit with variation in approach.

Both countries have also realised the possibility for cooperation with each other on the issue of climate change, the comradeship of which is visible through paper work and joint declarations, but there has been nothing substantial in terms of joint research or financial cooperation. However, it is appreciable that independent studies like the one commissioned by the United Nations Development Programme (UNDP) and Shakti Sustainable Energy Foundation have managed to bring experts from both the countries together to study the issue of climate change in India and China. This study, titled 'Low carbon development in China and India: Issues and Strategies',[3] has recommended the way for both countries to cooperate with each other. It was directed toward developing specific strategies for low carbon development in crosscutting areas such as financing, technology and innovation policy, and sub-national initiatives. Based on this study, The Energy and Resources Institute (TERI) published a book which listed some of the recommendations for cooperation between India and China on climate change and in the renewable energy (RE) field. Many more collaborative projects like these should be sanctioned and the governments of both countries should take a foremost role in financing such projects.

The window for cooperation on climate change has narrowed due to the varying degree of economic development that both countries have witnessed in the past decade. While India can be classified as a developing country, China would be a developing country with developed country characteristics. This implies that both countries have asymmetric

[2]Kedia, Shailly. "Approaches to low carbon development in China and India." Advances in Climate Change Research 7, no. 4 (2016): 213-21. doi:10.1016/j.accre.2016.11.001.
[3]Low Carbon Development in China and India: Issues and Strategies (Advance Publication). The Energy and Resources Institute, National Centre for Climate Change Strategy and International Cooperation (NCSC), Central University of Finance and Economics (CUFE), Zhejiang University and the United Nations Development Programme (UNDP), Teri Press, 2014

resources to actually invest in climate change projects. Also, China is likely to achieve its Intended Nationally Determined Contribution (INDC) goals quicker than India and is then likely to move to the developed countries bloc in the climate change negotiation process.

Today, both countries have set high targets to generate electricity from RE and are undertaking one of the largest RE expansion programmes based on solar and wind energy. Here lies immense opportunity for cooperation from both the commercial as well as knowledge sharing perspectives, as installations of solar panels and wind turbines are taking place at diverse topographies with different challenges to face. Knowledge-sharing will decrease the losses involved. These prospects for cooperation in RE and climate change can be cemented only through the presence of strong political will and not through mere political rhetoric.

Energy Security and Climate Change

The Paris agreement was recently concluded. 196 countries with almost 20,000 individuals attended the summit.[4] The summit was attended by participants from diverse backgrounds. This proves that climate change and energy security are no longer issues of 'low politics' in international relations. Policy-makers in India and China view India-China relations mostly through the lens of traditional security issues and therefore understandably, suspicion governs bilateral ties. The Realist school of thought has flooded the discourse on national security with phrases like 'prospects of war', 'security dilemma', 'cheating', 'border dispute' and others. However, national security is no longer a prerogative of the traditional security discourse alone. Over the past two decades, scholars studying non-traditional security issues have highlighted the importance of 'non-traditional security' in defining the overall national security paradigm for a country. Taking from Glaser's argument[5] that "the international environment does not create a general tendency for states to adopt competitive policies; (and that) cooperation will sometimes be a state's

[4]Howard, Emma. "Paris climate summit in numbers." Guardian, November 30, 2015. Accessed March 18, 2017. https://www.theguardian.com/environment/2015/nov/30/paris-climate-summit-in-numbers.
[5]Glaser, Charles L. Rational theory of international politics: the logic of competition and cooperation. Princeton, NJ: Princeton University Press, 2010

best option," cooperation between India and China on climate change and RE would be mutually beneficial. The prospects for cooperation are detailed in the following section.

The definition of security evolved and broadened after the end of the Cold War when non-traditional security scholarship emerged in response to societal needs. Caballero-Anthony observes that "security threats have in recent times evolved from military confrontations to non-military conflicts such as food security, water security, climate change, human trafficking, pandemics, cross-border conflicts and energy security."[6]

However, Realists generally believe that with the incorporation of several issues (other than military) in the definition of national security, the concept itself gets diluted and loses relevance. Hence, the definition should be strictly restricted to military issues. Then, ‘‘whose security are we referring to?’’ becomes the primary question; the answer to which need not lie in a binary of state and people. Energy security qualifies as an issue of national security in all circumstances. History is testimony to the fact that many modern wars and military confrontations took place mainly to secure energy needs for domestic consumption.

The understanding of energy security varies by country and region, and by a country’s economic status. According to the International Energy Agency (IEA), energy security refers to the ‘‘uninterrupted physical availability at a price which is affordable, while respecting environment concerns’’.[7] Others such as MH Brown have defined energy security in terms of a resilient energy system which is able to withstand security threats.[8] From these, a general definition to suit the context for both India and China can be drawn. Energy security could then be defined as access to an adequate, affordable and sustainable supply of energy to meet the needs and aspirations of people, and the provision of this supply in a way that is environment-friendly. The elements of sustainability that incorporate clean energy sources and continuing availability for future generations is a

[6]Caballero-Anthony, Mely, Ralf Emmers, and Amitav Acharya. Non-traditional security in Asia: dilemmas in securitisation. Aldershot: Ashgate, 2006.
[7]"What is energy security?" International Energy Agency. Accessed March 18, 2017. http://www.iea.org/topics/energysecurity/subtopics/whatisenergysecurity/.
[8]Brown, Matthew H., Christie Rewey, and Troy Gagliano. Energy security. Denver, CO: National Conference of State Legislatures, 2003

recent development. Energy security is intricately linked with development issues, as acknowledged in the UN's shift towards Sustainable Development Goals (SDG) from Millennium Development Goals (MDG). The noticeable difference is that MDG goals were meant for developing and least developed countries while SDG goals are meant for all countries.

A Critical Examination of Cooperation in Climate Change and Renewable Energy

Cooperation in Climate Change

India and China's rise as important powers in the global world order means that they now have the tools and platforms to interact with each other and discuss issues of national, regional and global importance. India and China have continuously fought for a fair and just international climate change deal. Their engagement with issues of climate change has reflected their respective capacities and national circumstances. They have invoked the principles of equity, historical responsibility and common but differentiated responsibilities; they have strongly argued that the primary responsibility of cleaning up the carbon mess must lie with the developed economies given their historical culpability. The result of such *jugalbandi* can been seen in the form and nature of the current climate change regime where the Intended Nationally Determined Contribution (INDC) goals, that are voluntary in nature, were accepted over the fixed cap proposal to reduce carbon emission.

A critical overview of past cooperation between the two countries is helpful to understand how much these countries see eye-to-eye in terms of climate change issues and to identify the right direction for future cooperation. Bilateral cooperation between the two countries on both climate change and environment has been implicitly or explicitly observed on many occasions. In 1993, during the Indian Prime Minister Narasimha Rao's visit to China, both countries had acknowledged common environmental problems which could be addressed better by formulating joint programmes and regular information exchanges; both sides agreed to forge closer ties in the areas of waste management, pollution control, environmental impact assessment, environmental education and legislation, and wildlife

conservation.[9] The two countries also arrived at the historic India-China climate change agreement in October 2009 for a period of fiveyears. Under the agreement, they agreed to establish the 'India-China Partnership on Combating Climate Change' to strengthen their bilateral dialogue and practical cooperation on climate change.[10] They also established an 'India-China Working Group on Climate Change', which was entrusted with the responsibility of holding annual meetings to exchange views on matters concerning "international negotiation on climate change, respective domestic policies and measures and the implementation of related cooperative projects';[11] India and China also underlined several areas of cooperation on mitigation policies, programmes, and technology development relating to GHG emission reduction. These are energy conservation and energy efficiency, renewable energies, clean coal, methane recovery and utilisation, afforestation and sustainable management of forests and ecosystems, transportation, sustainable habitat, etc.[12] Continuing to promote close camaraderie on the issue of climate change, India and China signed yet another Memorandum of Understanding (MoU) on green technology in December 2010, agreeing to jointly explore low-carbon technology solutions to drive their fast-growing economies.

Indian Prime Minister Narendra Modi's visit to Beijing in early May 2015 saw the reiteration of the two countries' commitment to advance their cooperation on the issue of climate change. Releasing a joint statement on climate change, China and India reaffirmed their intent to collaborate on the issue which they deem to be mutually beneficial. The two sides agreed to "promote bilateral partnership on climate change and enhance the role of this partnership in their overall strategic cooperation partnership" on climate change.[13] The joint statement also maintained that the neighbours would "enhance high-level bilateral dialogue on domestic climate policies and multilateral negotiations and to further strengthen practical bilateral cooperation, including in areas of clean energy technologies,

[9]Robert Mizo, 'India, China and Climate Cooperation', India Quarterly 72(4) 375–394 SAGE Publications sagepub.in/home.nav
[10]India. Government of India.The Ministry of Environment & Forests (MoEF). Agreement On Cooperation On Addressing Climate Change Between The Government Of The Republic Of India And The Government Of The People's Republic Of China.
[11] Ibid.
[12] Ibid.
[13]India. Government of India. Press Information Bureau. May 15, 2015. Accessed March 18, 2017. http://pib.nic.in/newsite/PrintRelease.aspx?relid=121754

energy conservation, energy efficiency, renewable energy, sustainable transportation including electronic vehicles, low-carbon urbanisation and adaptation." [14] This joint declaration could be an outcome of practical recommendations made in the report, 'Low carbon development in China and India: Issues and Strategies', the study that was commissioned by the UNDP and Shakti Sustainable Energy Foundation in 2014.[15]

Cooperation in Renewable Energy

India and China first signed an MoU to enhanced cooperation in the field of RE in June 2003 when then Indian Prime Minister Manmohan Singh visited China and signed a declaration on principles for relations and comprehensive cooperation between India and China. The declaration proposed four principles that China and India would abide by for the promotion of a long-term constructive and cooperative partnership, and on that basis, the installation of "qualitatively new relations."[16] The MoU in the field of RE was signed between the Ministry of Non-Conventional Energy Sources, Government of the Republic of India and the Ministry of Water Resources, Government of People's Republic of China. This MoU seeks to establish cooperation in the field of small hydropower, wind power and other areas of renewable energy through joint research and development activities, exchange of technical expertise and information networking. The MoU was a formal diplomatic document; it was an action guide for cooperation in the field of RE. Unfortunately, the commitment for cooperation has not translated into any serious achievements in this field. Summarily, the India-China cooperation has remained weak in the field of RE.

On 15 May 2015, PM Modi visited China and met Chinese premier Li Keqiang. Both leaders issued a joint statement in this meeting which explicitly featured cooperation in RE. They decided to enhance cooperation in clean energy technologies, renewable energy,

[14] Ibid.
[15] Low Carbon Development in China and India: Issues and Strategies (Advance Publication). The Energy and Resources Institute, National Centre for Climate Change Strategy and International Cooperation (NCSC), Central University of Finance and Economics (CUFE), Zhejiang University and the United Nations Development Programme (UNDP), Teri Press, 2014.
[16] Liming, Huang, 2009. "Financing rural renewable energy: A comparison between China and India," Renewable and Sustainable Energy Reviews, Elsevier, vol. 13(5), pages 1096-1103, June.

electronic vehicles and low-carbon urbanisation. PM Modi also announced USD 23.5 billion worth of bilateral business deals.[17] This represents company collaborations and avenues for increasing levels of investment and trade between China and India. For example, the Adani Group plans to set up an integrated Photo Voltaic (PV) industrial park in the Mundra Special Economic Zone (SEZ) in a joint venture with Chinese green energy major Golden Concord Holdings, a deal worth upwards to USD 3 billion.

A Zone of Contention

On the issue of climate change some differences stemming from the obvious economic asymmetries between the two Asian giants can be found. Both countries are identified as developing countries but their actual worth and potential is widely uneven. India's per capita income is less than half of China's; China's carbon dioxide (CO2) emission is 4.75 times higher than India's emission. Moreover, India has about 300 million people living below the poverty line, a number almost twice that of China.[18]

The two countries have also differed over concepts of historical responsibility and per capita emissions. Jyoti Parikh observes, "China is talking more about historical responsibility, while India is focused on per capita approach.'[19] An interesting turn of events affecting India-China climate diplomacy was the so-called 'historic' climate deal signed between China and the US in 2014. The boundary issue remains a bone of contention between India and China and the military modernisation taking place in both countries is making the situation worse. However, while some Indian experts believe that the PLA modernisation is not Indian-centric, the ambiguity in Chinese intentions raises legitimate concerns in the minds of Indian policy-makers. India is concerned about the implications of China's rise in South Asia. Moreover, the levels of trust between Indians and Chinese also appear to be dwindling. A survey conducted by the Pew Global

[17]Kumar, Arun. "Deals worth USD 23.5 billion likely to be signed during PM Modi's China visit ." The Economic Times, May 15, 2015. Accessed April 4, 2017. http://economictimes.indiatimes.com/news/politics-and-nation/deals-worth-23-5-billion-likely-to-be-signed-during-pm-modis-china-visit/articleshow/47290256.cms?intenttarget=no.
[18]Siddiqi, Toufiq . "China and India: More Cooperation Than Competition in Energy and Climate Change." Journal of International Affairs Vol. 64, no. 2 (2011).
[19]Robert Mizo, 'India, China and Climate Cooperation', India Quarterly 72(4) 375–394 SAGE Publications sagepub.in/home.nav

Research shows that only 25 per cent Indians held a favourable view of China in 2011, down from 34 per cent in 2010 and 57 per cent in 2005. 27 per cent Chinese held a favourable view of India in 2011, which also fell from 32 per cent in 2010.[20]

China's diplomatic pragmatism was witnessed in 2014 when it signed a climate deal with the US. According to this deal, the US had agreed to reduce its GHG emissions by 26 to 28 per cent below the 2005 levels by 2025. China pledged to peak its greenhouse gas emissions by 2030 and then start reducing it. According to Janaki Lenin, this was a secretly negotiated deal and must have been a shock for India.[21] This comes as a nudge for Indian policy-makers who has mistakenly assumed that China's negotiating position would remain fixed and in line with that of India's.

Prospects for Cooperation

KJ Holsti highlights four major reasons that bring states to cooperate with each other: to reduce costs, to increase efficiency, to address common threats or problems, and to lower the adverse consequences that their actions have on others. He argues that environmental threats are transnational and therefore, warrant cooperation at least at a regional level to be addressed effectively.[22] There is a need for certain conditions to be present for cooperation to succeed. According to Harris, there are two such important conditions: states tend to successfully and continually cooperate under the presence of a guarantee of "joint gains and reciprocity from others" and "if all parties gain from cooperation, the likelihood of it occurring and being effective is increased dramatically."[23]

Cooperation in Clean Coal Technology

[20]Malik, Mohan. "China and India Today: Diplomats Jostle, Militaries Prepare." World Affairs, July &aug. 2012. Accessed March 18, 2017. http://www.worldaffairsjournal.org/article/china-and-india-today-diplomats-jostle-militaries-prepare.
[21]Lenin, Janaki. "US-China climate deal's ambition fails to impress India." Guardian, November 18, 2014. Accessed March 18, 2017. https://www.theguardian.com/environment/india-untamed/2014/nov/18/indians-not-impressed-with-us-china-climate-deal.https://www.theguardian.com/environment/india-untamed/2014/nov/18/indiansnot-impressed-with-us-china-climate-deal.
[22]Robert Mizo, 'India, China and Climate Cooperation', India Quarterly 72(4) 375–394 SAGE Publications sagepub.in/home.nav
[23] Ibid

Energy consumption in both India and China is coal-dependent. Coal is abundantly available and is the most affordable fuel in both countries. Coal accounted for 64 per cent of China's primary energy consumption in 2015.[24] China has become the world's leader in coal-fired generation in 2014 with 846 GW of installed capacity measured in that year. In India, coal and lignite accounted for almost 47 per cent of total energy consumption.[25] PM Modi has also announced plans to increase coal consumption to 1 billion tonne in the next five years. Although both countries are increasing the share of RE in energy generation, coal has remained the dominating fuel type. Given their heavy dependence on coal, India and China had both decided a long time ago to employ clean coal technologies in their thermal power plants, albeit with varied success.

India's coal plant standards have dropped in comparison to China, despite both economies being at the same standard a decade ago. China's National Energy Association released an action plan to significantly increase its first fleet of thermal plants by 2020.[26] Overall, China is expected to install over 500 GW of clean coal capacity between 2016 and 2025.[27] While India's clean coal capacity is virtually not existent and installation capacity is at a nascent stage, its power sector is expected to add over 103 GW of clean coal generation between 2016 and 2025.[28] The capacity addition will be done through the construction of more efficient supercritical and ultra-supercritical installations, as well as by incorporating some supercritical technology in existing plants.

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[24]"China to cap coal consumption at 4.1 bln tonnes by 2020." XINHUANET, January 17, 2017. Accessed April 4, 2017. http://news.xinhuanet.com/english/2017-01/17/c_135990689.htm.

[25] Energy statistics 2016, Central Statistics Office, Ministry Of Statistics And Programme Implementation, Government of India, http://mospiold.nic.in/Mospi_New/upload/Energy_statistics_2016.pdf

[26]Rote, Morgan, Reyna Askew, Lingyan Yu, Rachel Estrada, James Grant, Brandon Yeh, Ryan Bender, Colleen Howe, Megan Hyndman, and DeebaYavrom. Beyond COP21: Opportunities for China-India Climate Collaboration. Report. school's Energy, Resources, and Environment department, Johns Hopkins University.

[27] "China Adopts Clean Coal Technologies While Installed Capacity Exceeds 800GW," Global Data, February 10, 2015, http://energy.globaldata.com/media-center/press-releases/power-and-resources/china-adopts-clean-coal-technologies-while-itsinstalled-coal-capacity-exceeds-800-gigawatts-in-2014-says-globaldata

[28]"India Will Add Over 100 Gigawatts of Clean Coal Capacity between 2016 and 2025, says Global Data." Global Data. May 3, 2015. Accessed April 4, 2017. http://energy.globaldata.com/media-center/press-releases/power-and-resources/india-will-add-over-100-gigawatts-of-clean-coal-capacity-between-2016-and-2025-says-globaldata.

In India the challenges are at the technological level; the coal is of low quality (high ash content) and coal power plants do not incorporate clean technology. On the other hand, in China, the challenges are at the governance level, which include balancing conflicting priorities.[29] Knowledge-sharing and technology transfer between India and China in this area will be mutually beneficial: India can make gains from China's experience, and Chinese clean coal technology manufacturers will get access to the wider Indian market.

Renewable Energy

Although India and China run large RE expansion programmes, the sector is yet to receive its due in their respective economies. This is primarily due to a lack of infrastructure and poor Public Private Partnerships (PPP). While there is a clear window of cooperation in clean coal and energy efficiency, the opportunities in RE field are still rising. In both countries, electricity generation from renewables is on the rise with strong government support. When announcing national policies on different platforms, India and China also agree that RE represents a path toward sustainability while satisfying the energy demand and providing access to remote regions.The carbon emission in both countries would have been much higher if renewable sources of energy generation would not have been incorporated in the current energy mix. This has helped them attain low carbon development. However, a long journey lies ahead.

China recently increased its renewable energy targets to 150-200 GW of solar power and 250 GW of wind power, each to be achieved by 2020. It aims to spend more than USD 360 billion by 2020 on renewables.[30] India has also made considerable progress building its renewables portfolio. In 2000, non-hydro renewables represented only 2 per cent of India's power generation, but today this figure stands at 13 per cent.

[29]Rote, Morgan, Reyna Askew, Lingyan Yu, Rachel Estrada, James Grant, Brandon Yeh, Ryan Bender, Colleen Howe, Megan Hyndman, and Deeba Yavrom. Beyond COP21: Opportunities for China-India Climate Collaboration. Report. school's Energy, Resources, and Environment department, Johns Hopkins University.
[30]Forsythe, Michael. "China Aims to Spend at Least USD 360 Billion on Renewable Energy by 2020." The New York Times, January 5, 2017. Accessed April 4, 2017. https://www.nytimes.com/2017/01/05/world/asia/china-renewable-energy-investment.html?_r=2.

The dramatic growth in China and India's renewable energy sectors is nonetheless limited by several factors, including lack of financing options and technological barriers. For example, around 30 to 50 per cent of electricity production in China's western provinces like Xinjiang and Gansu has been curtailed due to weak local demand, lack of grid connectivity to higher demand centres, grid construction that cannot keep pace with the construction of renewable energy plants, and occasional grid stress caused by turbines producing power levels that exceed demands.[31] As for India, PM Modi's mission to "electrify India" through renewables is expected to face considerable challenges. Critics argue that the goal of 266 GW of additional renewable capacity is not feasible, given that the subcontinent's total installed capacity stands at 250 GW combined.[32]

Many of these challenges are country-specific and must be dealt with at the domestic level. However, there lies a window of cooperation for India and China to overcome these challenges through collaboration on management strategies and knowledge-sharing. However, allowing a Chinese company to improve or develop the power transmission sector in India will have implications for national security. Breakthroughs in the efficiency and affordability of power-saving technology will be critical to achieve the ambitious goals that both countries have outlined. India and China should aim to collaborate on renewable development through joint business ventures, knowledge-sharing, joint RD&D projects, and increased trade opportunities. It has also been observed that for India and China, international cooperation in the RE sector is primarily focused on sharing experiences and expertise with other countries, promoting cooperation in scientific research on technologies, and promoting human resource development in the field of RE,[33] which both have benefited from.

Since both countries have similar needs and expectations from RE, they can initiate joint projects to share best practices with developed countries like the US and major European

[31]Morgan Rote, Reyna Askew, Lingyan Yu, Rachel Estrada, James Grant, Brandon Yeh, Ryan Bender, Colleen Howe, Megan Hyndman, and DeebaYavrom " Beyond COP21: Opportunities for China-India Climate Collaboration"
[32]Tweed, Katherine . "India's Lack of Wholesale Markets and Grid Investment Could Hinder Ambitious Renewables Commitments." Greentech Media. March 04 , 2015. Accessed April 5, 2017. https://www.greentechmedia.com.
[33] Liming, Huang, 2009. "Financing rural renewable energy: A comparison between China and India," Renewable and Sustainable Energy Reviews, Elsevier, vol. 13(5), pages 1096-1103, June.

countries to supplement their domestic strategies. Toward this, education exchange programmes and industry partnerships may be useful ways to encourage dialogue between scientists, engineers, and business people. At present, programmes like the Mission on Strategic Knowledge on Climate Change (MSKCC), a part of India's National Plan on Climate Change, exist to facilitate discussions on climate change within the country. Similar bodies could potentially be formed to create opportunities for Indian and Chinese researchers to collaborate on renewable development.

South-South Cooperation and Finance

India-China cooperation in RE can be boosted through private players. The availability of cheaper finance at lower rates of interest for the RE sector from China could also be an incentive for India. The Chinese government's 'South-South Cooperation Climate Fund' is an important venue to look at to boost bilateral cooperation. On 25 September 2015, President Xi Jinping announced that China would offer USD 3.1 billion to the fund.[34] Western countries do not have grants available in the fields of capital and technology transfer as they used to. China, on the other hand, has both grants and technology to transfer to developing countries. Chinese technology is still not at par with technologies from developed countries but the former is quite cheap and fits into India's budget. India has a huge market to offer to China in return.

Reviving the PPP model in RE is critical for India. In China the government-RE industry nexus is so intertwined that poor infrastructure and lack of finances do not hinder the process. It is important for the country to mainstream PPP projects by easing out the rigidities in contractual agreements, providing for a quick redressal mechanism, and creating a pool of long-term financing for the sector. This will need work on several fronts, including energy sector reforms, pushing for easing of WTO norms on RE subsidies and building sustained finance for the sector.

[34]Nelson, Colleen Mccain , and William Mauldin. "U.S., China Announce Steps on Climate Change, USD 3.1 Billion Contribution." THE WALL STREET JOURNAL, September 25, 2015. Accessed April 4, 2017. https://www.wsj.com/articles/u-s-china-announce-steps-on-climate-change-3-1-billion-contribution-1443197680.

To continue this trend of economic and trade collaboration between India and China, both governments should look at reducing trade barriers to low-carbon goods and technology. As indicated in a 2007 World Bank study, the potential for liberalisation in the area of low-carbon goods could lead to a real increase in trade flows.[35] Existing barriers such as complicated applications and approval procedures, sector-based limits on FDI, and anti-dumping import bans issued by India against China should be reduced.[36] In addition, China and India could alleviate low-carbon trade barriers by liberalising their cross-border procurement rules. For example, many state-funded projects in China currently require that 80 per cent of technologies be sourced domestically. Expanding this preferential treatment to Indian firms (and vice versa) could help build an efficient and integrated market.

Conclusion

Energy is a strategic commodity for any country in this globalised world. Energy security has become a pre-condition for development. It is also true that climate change, as is being are witnessed today, is a byproduct of several decades' of combustion of hydrocarbons for energy needs. Cooperation between India and China, two of the world's largest emerging economies, is much needed to address climate change. Reports from IPCC have also concluded that the two countries face imminent threats in the form of ecological degradation, food and water scarcity, agricultural shifts, health hazards, etc. Bilateral cooperation will help both countries move towards achieving their climate commitments. However, the bulk of the challenges come from the implementation part.

A comparison of both countries' efforts to deal with climate change and environment leads to the conclusion that that China is visibly doing a better job than India. This reflects the success of government policies in China, while in India a success story is yet to be seen. The concern in India's strategic and academic community is that China will outpace India in achieving its INDC goals and move on to the developed countries bloc in the climate

[35]Climate Change and Trade on the Road to Copenhagen. Geneva, Switzerland: International Centre for Trade and Sustainable Development (ICTSD), 2008.
[36]Nayyar, Dhiraj . "India and China Should Let Trade Do the Talking." Bloomberg View, September 15, 2014. Accessed April 4, 2017. https://www.bloomberg.com/view/articles/2014-09-15/india-and-china-should-let-trade-do-the-talking.

change negotiation process. India should act swiftly in this regard. Many issues regarding India-China cooperation in RE have not been adequately explored and implemented. India and China must construct strategies based on the vast pool of experience and knowledge. The ultimate objective, with the crucial involvement of private players, should be to commercialise the result of cooperation already present in the MoU signed between India and China, and help create business opportunities and facilitate a sustainable market.

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