

China's Journey in Renewable Energy and Its Potential Spillover Effects through the CPEC in Pakistan

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ABSTRACT

The China-Pakistan Economic Corridor (CPEC) has provided Pakistan an opportunity to tap into its huge potential as a developing economy and progress towards the path of Newly Industrialized Economies (NIEs). It aims to open a new trading route, industrial zones and energy corridors to meet the country's ever growing needs and stimulate economic activity. Although, the CPEC is not restricted to renewable energy, with coal power plants a major part of the plan, there are significant opportunities to promote the renewable energy market, through various complementary policy measures. The research aims to draw lessons from China's journey in the renewable energy (RE) sector and the potential spillover-effects Pakistan will experience through CPEC. The fundamentals of China's renewable energy sector are relevant to Pakistan in light of the current global discourse on Sustainable and Low Carbon Development. Foreign Direct Investment (FDI) from china has the potential to be a catalyst for growth in the renewable energy sector. The transfer of knowledge and know-how can be achieved from this cooperation with China in the renewable energy domain, provided the state has adequate policies facilitating the flow of knowledge to the local industry. For this purpose, direct training programmes must be setup with China's cooperation. Win-win scenarios can be created, where low-cost local workforce can be equipped with the necessary skills and knowledge to work in the Chinese managed projects in Pakistan. Moreover, local production of renewable energy products and equipment needs to be promoted, through correcting market failures and incentivizing local manufactures.

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1 Introduction

The China-Pakistan Economic Corridor (CPEC) agreement involves four pillars of development, which include infrastructure, integrated communications sector, industrial development and the energy sector. The overall investment projects amount to \$46 billion, which is supported by the Chinese State Council, Chinese Communist Party (CCP), corporations and large banks from China¹. The officials in both countries will endeavour to highlight sustainable development through the energy corridor with \$34 billion of investment. The major lease of Gwadar Port, with a free-trade agreement (FTA) to China, also involves regional level oil and gas pipelines. It will also constitute economic and trade activity for Pakistan. This has transformed the scope of bilateral agreement in trade, which has broadened from \$1 billion in 1998 to 15.15 billion in 2015 (Vandewalle, 2015).

The major objective of this research study is to explore the potential benefits Pakistan will experience in its Renewable Energy (RE) Industry, through the CPEC. It looks to address the following questions:

- What are the lessons that can be learnt from China's progress in renewable energy?
- What role does FDI play in promoting the market of renewable energy and what does that entail for Pakistan?
- What are the potential spillover effects of CPEC upon the local wind and solar manufacturers?
- How can Pakistan maximize the benefits stemming from CPEC, and attempt to promote Low Carbon Development²?

In recent times, the economic corridor has been subject to considerable debate in the political and academic spheres of Pakistan. The scale of the investment is one reason for this, which is likely to leave a significant impact on the economy. The unprecedented nature of this investment and its potential impacts have driven the think-tanks and policy-makers to facilitate and engage in a series of active and open debates on the various impressions, this investment would leave on the economy. Moreover, it is also an opportunity that does not come by often. Therefore, the outcome of it should balance maximization of welfare coupled with inclusiveness, to yield the optimal results.

Methodology

¹ Khan, 28.5.2015.

² Low Carbon Development (LCD) aims to reduce carbon emissions, build resilience, support the development agenda and lift the living standards of those furthest behind without comprising on overall economic growth. LCD implies a needs-based approach that takes into account local specificities including the requirements, constraints and opportunities.

The research will analyse the renewable energy options under CPEC, and their potential impacts on Pakistan's energy sector and local industries. This study uses data from different sources to analyse the trends of renewable energy for China and Pakistan. The sources include, National Statistics of Pakistan, PBS, National Bureau of Statistics China, Reports and Publication from, but not limited to, United Nations, Organisation for Economic Co-operation and Development (OECD), Asian Development Bank (ADB) and United Nations Conference on Trade and Development (UNCTAD), World Bank Data and news reports. It explores diverse literature to draw lessons from China's progression in the renewable energy domain and how that can have an impact of Pakistan through FDI.

2 Literature Review

2.1 FDI as a source of Technology Transfer

This section aims to summarize the diverse literature; and research and debates on FDI as a source of technology transfer (TT) and associated development of the domestic industries.

McDougall (1960) was the first author, who systematically discussed external effects (spillovers) among the possible consequences of FDI (Blomstrom and Kokko, 2003). Other early studies (Corden, 1967; Caves, 1971) identified the costs and benefits of FDI.

More recent literature, however, has explicitly identified FDI as a source for transfer of technology. Lall (1993) explains FDI to be the most dominant form of resource and technology transfer from developed to developing countries. 'It is the most packaged form of technology transfer, combining the provision of capital with technical know-how, equipment management, marketing and other skills' (Lall, 1993, p.95). Therefore, technology transfer not only pertains to the transfer of equipment, but also the necessary know-how and other intangible skills that are essential to effectively manage and utilise the technology.

There is a significant amount of literature that explores the impact of Foreign Direct Investment (FDI) and multinational corporations (MNCs) on domestic firms' capabilities. However, the empirical literature has provided mixed results on it, despite the strong theoretical backing of positive spillover and knowledge flow from foreign to domestic firms. Some of the studies find that there are positive effects of FDI on the productivity and performance of domestic firms, which is indicative of them learning and adopting better methods of production (e.g. Caves, 1974; Globerman, 1979; Blomstrom and Persson, 1983; Blomstrom and Wolff, 1994; Kokko, 1994; Branstetter, 2006).

On the other hand, many studies have questioned this transfer of technology and know-how between foreign firms and their subsidiaries (e.g. Perez, 1998; Cantwell, 1989; Guiliani, 2008). They have stressed on governments focusing on broadening the local knowledge base, rather than relying on horizontal and backward linkages for local firms' up-gradation.

Aitken and Harrison (1999) analysed panel data on Venezuelan plants and found out that foreign investment in plants negatively affects the productivity of local firms. Haddad and Harrison (1991 and 1993) conclude from a Moroccan manufacturing study that spillovers do not take place in all industrial sectors. Blomstrom (1986) also concludes that foreign presence does not lead technology spillovers (Blomstrom and Kokko, 2003).

There is also a section of literature that is focusing on the factors that may influence the degree of spillovers in host countries. The recent literature on this suggests a pattern to the aforementioned studies and states that several host country factors influence the incidence of spillovers. For instance, the local level of education, local competition and legal barriers for foreign affiliates' operations, all have an impact on the extent of spillovers that take place (Blomstrom et al. 1994 and Kokko and Blomstrom, 1996, as cited in Blomstrom and Kokko, 2003).

Despite considerable research in this particular field, researchers in general are not at an agreement on whether FDI inevitably leads to better outcomes for the domestic producers. Further research is needed in this regard to weigh the costs and benefits of allowing FDI into an economy.

2.2 International Examples of Successful Renewable Energy Implementation

This section will explore the ways in which FDI can lead to promotion of renewable energy, locally. It will outline some successful examples of the countries, which have implemented renewable energy reforms. This brief analysis will provide us some global benchmarks on how renewable energy has been mainstreamed and successfully implemented. These examples are from Denmark and France that have significantly shifted over from predominantly fossil-fuel based energy to clean and renewable energy

Denmark

In 1994, coal accounted for 83% of Denmark's electricity generation. By 2014, it accounted for only 34% [(Energistyrelsen,2015, as cited in (Gass, Duan, & Gerasimchuk, 2016)]. Furthermore, as part of the country's coal strategy, Denmark committed to completely phase out coal-based energy. A lot of this has to do with the leadership, the country has offered in mitigating climate change. Denmark was the host of the COP 15 in 2010 as well, where the Copenhagen Accord was reached.

France

The coal industry was an important component of the French economy till the mid-20th century, when it produced around 60 million tons of coal and employed more than 150,000 people. The process of reducing reliance on coal had started, since 1960. Eventually, the decision to end coal mining was made by 1990. Consequently, France decided to move away from coal-based energy as well and by 2015, it had reduced coal-fired electricity generation by 60%. International climate commitments had a great role to play in this. As the host of the COP meeting in Dec 2015, Paris was under pressure to take action on climate change and reduce the consumption of fossil fuels. In response, the government committed to further reduce the consumption of fossil fuels by 30% and get 32% of its energy requirements through renewable sources.

2.3 Concluding the Literature

Literature is indicative of the fact that there are potential benefits to be harnessed by domestic firms in expanding their knowledge base from FDI. However, it must be said in the same breath that certain limitations and pre-conditions must be met to achieve this end. The general attitude of research has been, on the one hand critical of the role of government as an interventionist, whereas on the other hand, it has been critical of the activities of MNCs. There is a need to see beyond the simplified notion of 'liberal or conservative' arguments and look into the finer details that may lead to better outcomes stemming from foreign investments.

2.4 Literature Gap

There is currently a need to analyse the role of FDI in promotion of renewable energy to a larger extent. The existing body of literature does not sufficiently cover the contribution and impact of FDI in the renewable energy markets of developing countries. Given that the developing world relies heavily on either loans or FDI for large infrastructure projects, it is logical to investigate into the pre-conditions of promoting renewable energy projects.

CPEC is emerging as the single biggest investment by any country in Pakistan, since its existence. The impact of such an investment by China will have far-reaching consequences for the local market and industries. It is therefore very important to look at this from broader development frameworks in order to determine the various impacts it will have on the economy of Pakistan. This study is an attempt to analyse and gauge impact of the renewable energy investment planned in Pakistan by China, by considering dynamics of the domestic market.

3 Renewable Energy Projects under CPEC

The four main pillars of CPEC are **Gwadar port, communication infrastructure, energy infrastructure and industrial zones** (Rizvi, 2015). China has committed to invest around USD 46 billion, which makes roughly 20% of Pakistan's annual GDP. In totality, the energy projects will add 17,000 megawatts of electricity generation at a cost of USD 34 billion. The Chinese banks will provide concessional loans to the China's private companies for implementation of these projects. The government of Pakistan shall agree to buy energy from these companies at a pre-negotiated price, hence making the investment economically sound. These projects will be tentatively completed within three to 15 years, predominantly through the Chinese workforce deputed to Pakistan. To aid them, the Pakistan Army (primarily FWO) will also be working alongside civilian institutions and personnel.

'Early Harvest' Energy Projects are being implemented in response to the existing energy crisis, reflected by the gap between demand and supply and forecasted increases in demand (Planning Commission, 2016). The table below includes the 'Early harvest' renewable energy projects envisaged under the CPEC.

TABLE 1 EARLY HARVEST RENEWABLE ENERGY PROJECTS

'Early Renewable Projects	'Harvest' Energy	Capacity	Location
Quaid-e-Azam Solar Park		1,000 MW	Punjab
Suki Kinari Hydropower Project		870 MW (expected completion: 2020)	Khyber Pakhtunkhwa
Karot Hydropower Project		720 MW (expected completion: 2020)	Punjab
UEP Windfarm		100 MW	Sindh
Dawood Wind Power Project		50 MW	Sindh
Sachal Windfarm		50 MW	Sindh
Sunnec Windfarm		50 MW	Sindh

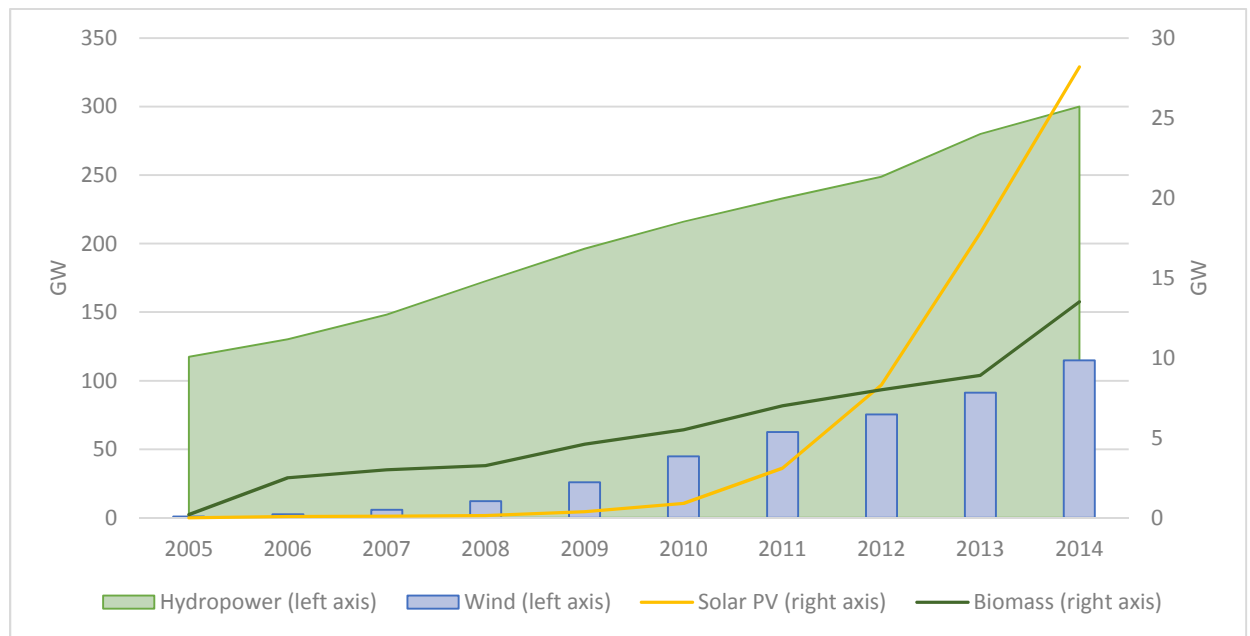
4 China's Journey in the Renewable Energy Sector and the Role of FDI

China's journey in renewables started in the late 1990s. Though, hydroelectric power had been part of China's energy mix, since long.

The renewable energy contribution over the years shows a remarkable turnaround and investment in the renewable energy generation projects. The decision to follow the path of

the ecological modernization theory (EMT), resulted in promotion of renewable energy generation and phasing-out of coal-powered electricity plants.

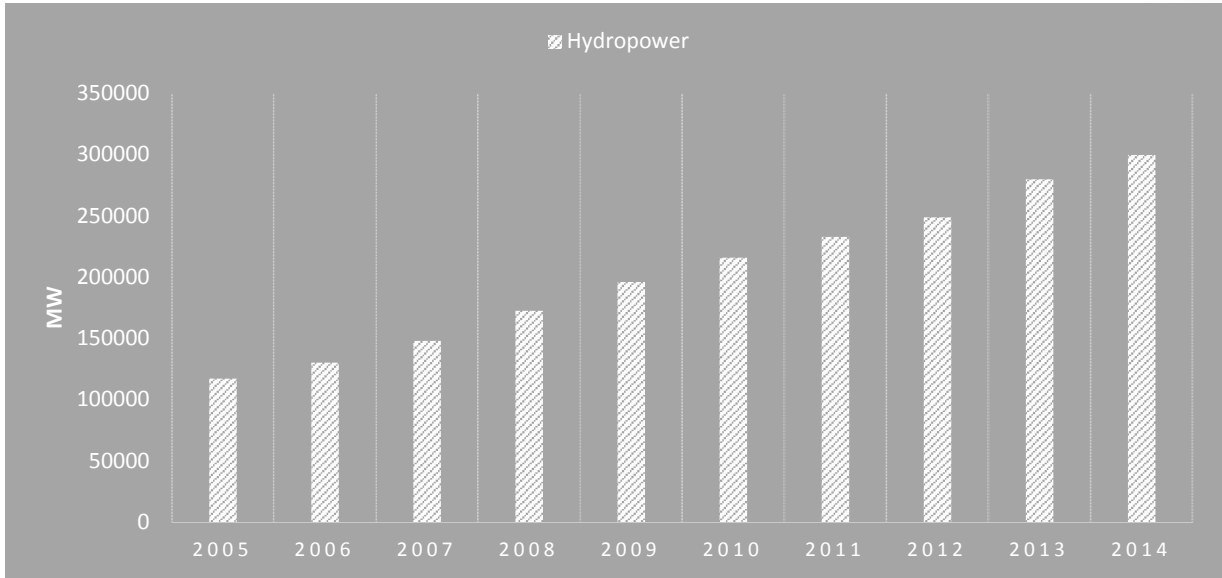
FIGURE 1 MAJOR RENEWABLE ENERGY TRENDS IN CHINA



There is also a greater focus on non-hydro (alternate) sources of renewable energy, most notably, wind and solar. In 2005, 117 Gigawatt (GW) was generated from hydro sources, with almost none from the other renewable energy sources. However, by 2012, 70GW of energy came from solar, wind and bio-mass sources. The contribution of Wind energy in the RE mix has significantly gone up, from less than 1% in 2005 to 25%, by 2014.

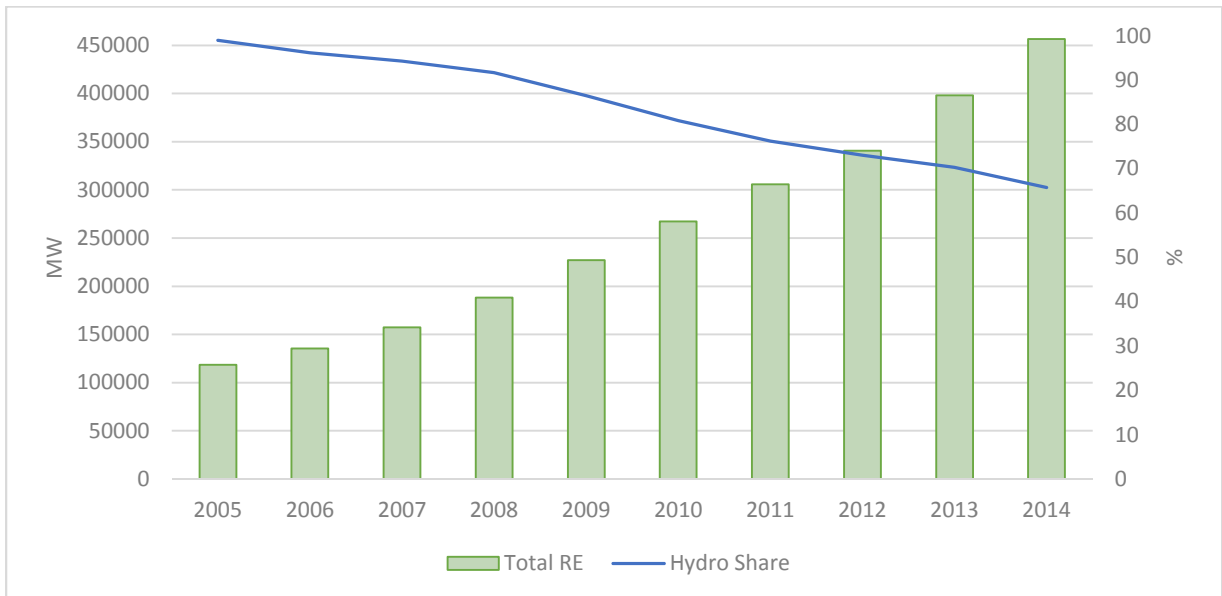
Since late 1990, China has substantially subsidized its FDI regime. It particularly encourages investment in the renewable energy sector. From 2002, China encouraged FDI in renewables and other high-tech sectors. This inclination was highlighted in its *Catalogue for the Guidance of Foreign Investment Industries*. Following 2002, the trend continued in 2004, 2007 and in 2011, wherein the *Catalogue* had environmentally friendly areas marked as 'encouraged' (Kennedy, 2013).

FIGURE 2 HYDROPOWER TRENDS AND SHARE IN THE TOTAL RENEWABLE ENERGY IN CHINA



(IRENA, 2014)

FIGURE 3 TOTAL RE PRODUCTION AND SHARE OF HYDRO POWER



(IRENA, 2014)

Figure 3 reflects that the share of hydro from the total RE mix has gone down from 98% in 2005 to 65% in 2014, despite persistent increase in hydro-power generation capacity.

The policies adopted by China are very interesting to note and the variations of their *techno-nationalism* in the face of international pressure, local capabilities and market-efficiency have several inherent lessons. Despite their intention of protecting the local industry, by nurturing indigenous innovation and hence removing foreign reliance, China's pragmatic approach entails the *eventual* removal of trade barriers and opening up to international competition. However, it is evident that in the initial development stages, China has aggressively supported its local *Strategic Emerging Industries*, thus recognizing their importance to the economy.

5 Potential of CPEC for Promoting Low Carbon Development in Pakistan

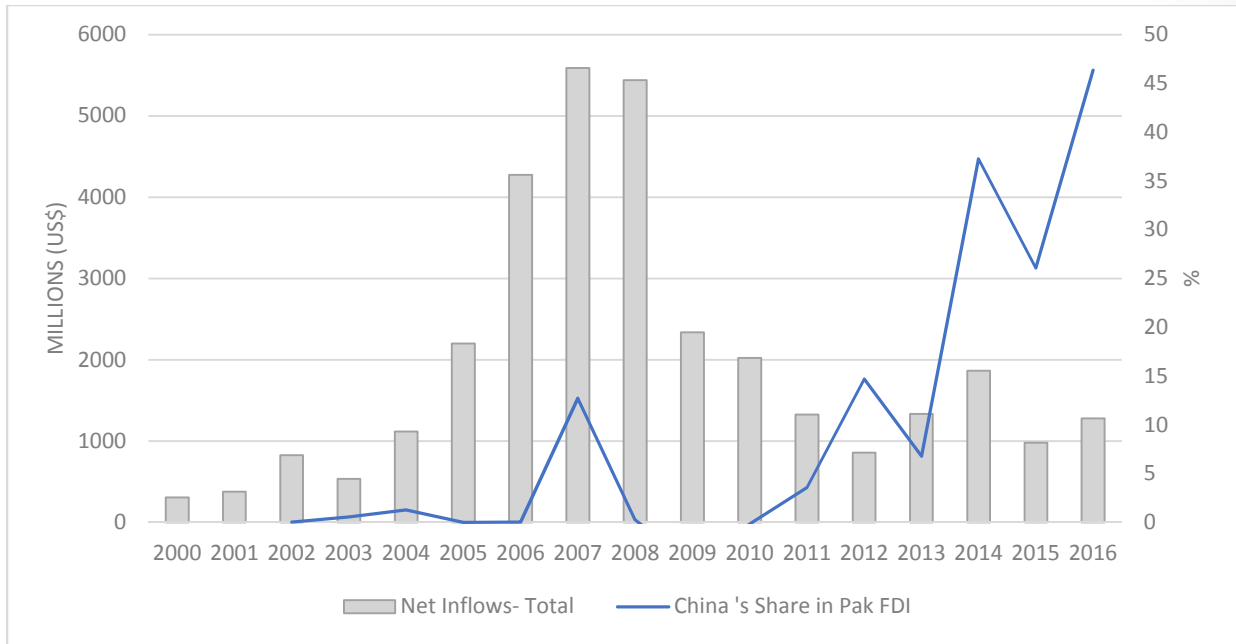
5.1 Role of Chinese Investment in the Economy of Pakistan

FDI has played an important role since the last two decades in promoting economic growth in Pakistan, and has led to improvement in various sectors of the economy, including telecommunication and other Information Communication Technology (ICT) related sectors.

In the energy sector, there has been a rapid increase in foreign investment in energy projects, from 2012 onwards. This has been, in part, due to the interest of the Chinese firms in Pakistan and the CPEC agreement's early harvest projects.

China's increased contribution in Pakistan's FDI, since 2010, along with parallel decrease in the overall foreign investments, has resulted in China emerging as the top contributor in Pakistan's FDI.

FIGURE 4 TOTAL FDI NET INFLOWS AND CHINA'S SHARE IN FDI



The increasing reliance on China for foreign investment is evident from figure 4, where according to latest figures, China is accounting for more than half of the foreign investments in Pakistan (The Express Tribune, 2016).

5.2 Spillover Potential Stemming from Renewable Energy Projects under CPEC

The renewable energy projects under CPEC will play a pivotal role in promoting low carbon development in the economy of Pakistan. As discussed earlier, the Chinese government consciously promoted renewable energy in China, realizing the negative impact of fossil-fuel based growth. Pakistan intends to invest in coal power generation facilities in Pakistan. Lessons from China’s journey in the renewable energy will definitely have a profound impact on Pakistan. At the onset, where Pakistan has initiated expansion in energy generation capacity, investments in solar and hydro power generation can be seen. Non-hydro renewable energy became a significant part of China’s mix only after 2005. For Pakistan, this has started at the very beginning of Chinese investments in energy, hinting towards the tacit transfer of wisdom between the economies.

Solar Photovoltaic (PV)

The planned ‘solar park’ in Cholistan near Bahwalpur district shall add 1,000MW of electricity generating capacity to the national grid. This solar park is said to be the largest in

the world and certainly the largest in Asia. There will be considerable impact of this investment on the local industry of renewables in Pakistan. As in the case of the 100MW pilot stage a Chinese company shall build the remainder 900MW of the solar farm. Repair and maintenance requirements of these panels will trigger the need for ancillary industries to spur into existence in the long-run. The scale of this project is very ambitious to the extent that some experts have cautioned entering into uncharted territory. Caution is indeed necessary under such circumstances, but openness unforeseen opportunities must also be kept in mind. This scale will also provide the local industry of Solar PV, a running model of producing and distributing electricity, to learn from and possibly replicate. Such conditions may result in the enhancement of local production capacities. Future projects by the government may even be sourced to local companies, provided they acquire the necessary know-how and skills.

Wind Energy

The scale of wind energy projects is smaller, when compared to the solar and hydro initiatives under the CPEC. However, for Pakistan, these would be among the first few major projects in wind energy, which may trigger further investment in this sector. There is much to learn from the Chinese experience in wind energy generation; considering their own revolution in this sector that has led them to become the largest producer of wind energy in the world. The pre-conditions, which led to investment in wind energy, must be considered by the policy-makers in Pakistan. The National Development Reform Commission (NDRC) of China had announced the Wind Power Concession Project in 2003. This project promoted the development of large-scale wind farms and stipulated a requirement of using 50% locally produced content in them (it was subsequently increased to 70%). From 2003 to 2010, the share of locally produced wind turbines increased to the extent that they controlled 85% of the local market by then (Kennedy, 2013). The Government of Pakistan must also incentivize local production of wind turbines, In order to promote local productions and encourage advancements in this sector.

Hydro Power

Pakistan is fairly experienced with respect to hydro power generation, with the earliest hydro power plants established in the 1960s. Hydro projects under the CPEC are shaping up to provide the greatest share in the renewable energy projects under CPEC, with an addition of 1,590MW being planned till 2020. China is continuing to expand its own production capacity of hydroelectric power; however, this is expected to slow-down by 2020, after which China would have exploited most of its hydro power potential. This is an important lesson for Pakistan. The growth of hydro power will eventually diminish due to the limited

resource potential for the larger scale hydro power projects. Climate change³ is another important aspect to consider, while projecting for water resources. Pakistan needs to be vigilant of this threat and possible opportunity, as it has the potential to increase or decrease hydro power resources in the country.

6 Conclusion

CPEC is shaping up to be one of the biggest foreign investments in Pakistan in the next five years. The economic corridor has immense potential for Pakistan's economy to benefit from.

The scale of investments is unprecedented, and therefore calls for all state institutions and think tanks to sit together and carve out a short-term, medium-term and long-term strategy to reap the greatest benefits from these investments.

The transfer of know-how and skills from the Chinese manufacturers of renewable energy to the local producers can be achieved through creating links and promoting cooperation of the highest degree. The government should ensure incorporating training programmes by the Chinese for the local manufacturers, through mutual negotiations, to enhance local capacities. Encouraging participation of the local workforce in the renewable energy projects is likely to enhance their knowledge, and result in transfer of know-how in the medium-term and long-term.

Learning from the Chinese experience, incentivizing and subsidizing local production of renewable energy (such as solar PV panels and wind turbines) is a pre-requisite to attaining growth in this sector. Adequate policy measures that first trigger local production and then look to promote it, are likely to lead to growth of the local manufacturers and create demand, given there are viable domestic and commercial applications.

Barriers to entry in the non-hydro renewable energy markets, such as access to finance, lack of ancillary industries and secondary markets, need to be addressed. Conducive conditions for carrying out business in this sector will lead to local benefits of Chinese investment accruing at a faster rate and domestic firms getting a foothold in the market of renewables sooner.

The Government of Pakistan is in the process of developing various policies and standards pertaining to non-hydro renewable energy. This process should take into account standards prevalent in China, and try to align the Pakistani policies and procedures with those in China,

³ Climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (UNFCCC).

as much as possible. This will reduce the lag time for Chinese firms, allow favourable operating conditions to the foreign investment, and enable Pakistan to reap benefits earlier.

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8 Annex

TABLE 2 FDI IN PAKISTAN COUNTRY AND SECTOR

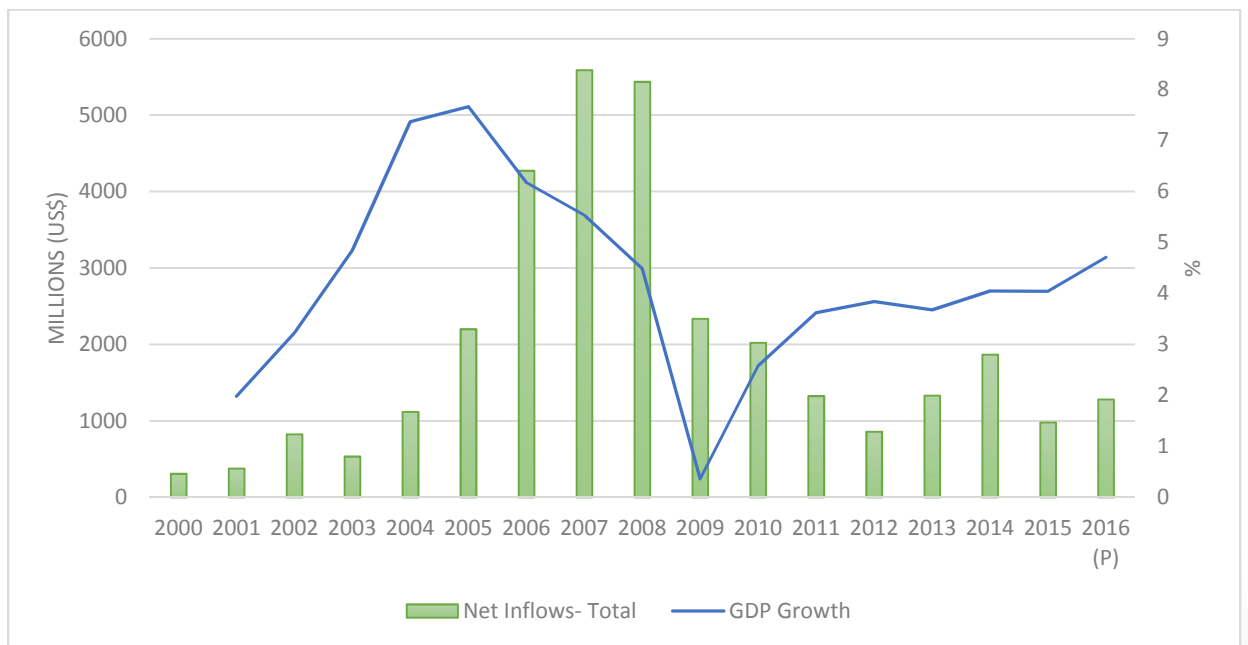
Country	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17 (July)
UK	460.2	263.4	294.6	207.1	205.8	633	157	174.3	79.8	9
U.A.E	589.2	178.1	242.7	284.2	36.6	22.5	-47.1	216.4	164.2	11.9
Japan	131.2	74.3	26.8	3.2	29.7	30.1	30.1	71.1	21.6	1.7
Hong Kong	339.8	156.1	9.9	125.6	80.3	242.6	228.5	83.4	130.9	0.6
Switzerland	169.3	227.3	170.6	110.5	127.1	149	209.8	2.8	76	2.2
Saudi Arabia	46.2	-92.3	-133.8	6.5	-79.9	3.2	-40.1	-64.8	(102..2)	-10.6
Germany	69.6	76.9	53	21.2	27.2	5.5	-5.7	-20.3	-33	0.6
Korea (South)	1.2	2.3	2.3	7.7	25.4	25.8	24.4	14.3	-18.6	-1.8
Norway	274.9	101.1	0.4	-48	-275	-258.4	-21.6	2.7	172.3	20
China	13.7	-101.4	-3.6	47.4	126.1	90.6	695.8	255.3	593.9	12.9
Others	2,005.20	1,964.20	1,019.60	631.3	289.7	285.5	224.4	261.7	90.4	12.1
Total including Pvt. Proceeds	5,409.80	3,719.90	2,150.80	1,634.80	820.7	1,456.50	1,667.60	851.2	1,281.10	64.3
Privatisation Proceeds	133.2	0	0	0	0	0	0	0	0	0
FDI Excluding Pvt. Proceeds	5,276.60	3,719.90	2,150.80	1,634.80	820.7	1,456.50	1,698.60	851.2	1,281.10	64.3

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17 (July)
Oil & Gas	634.8	775	740.6	512.2	629.4	559.6	502	246.1	261.6	7.2
Financial Business	1,864.90	707.4	163	310.1	64.4	314.2	192.8	256.4	28.2	10.2
Textiles	30.1	36.9	27.8	25.3	29.8	10	-0.2	43.9	21	4.3
Trade	175.9	166.6	117	53	25.3	5.7	-3.2	50	30.1	1.8
Construction	89	93.4	101.6	61.1	72.1	46	28.8	53.5	36.3	1.3

Power	70.3	130.6	-120.6	155.8	-84.9	28.4	71.4	201.7	566.6	8.6
Chemicals	79.3	74.3	112.1	30.5	96.3	71.6	94.9	55.3	64.6	2.6
Transport	74.2	93.2	132	104.6	18.7	44.1	2.7	6.2	36.8	2
Communication (IT&Telecom)	1,626.80	879.1	291	-34.1	312.6	-385.7	434.2	45.1	195.2	20
Others	764.5	763.4	586.3	416.3	282.2	765.5	375.2	-107	40.7	6.3
Total including Pvt. Proceeds	5,409.80	3,719.90	2,150.80	1,634.80	820.7	1,456.40	1,698.60	851.2	1,281.10	64.3
Privatisation Proceeds	133.2	0	0	0	0	0	0	0	0	0
FDI Excluding Pvt. Proceeds	5,276.60	3,719.90	2,150.80	1,634.80	820.7	1,456.40	1,698.60	851.2	1,281.10	64.3

(Board of Investment, 2016)

FIGURE 5 FDI AND GDP GROWTH



[(Board of Investment, 2016) and (Government of Pakistan, 2016)]

The goal that you presume is far and out of view: What else can be this life but zeal for endless strife?’ - Iqbal