International Journal of Trade & Commerce-IIARTC
January-June 2017, Volume 6, No. 1 pp. 82-96
ISSN-2277-5811 (Print), 2278-9065 (Online)

UGC Approved Journal in Social Science Category; Journal No. 48636
COSMOS (Germany) JIF: 4.242; ISRA JIF: 3.957; NAAS Rating 3.55; ISI JIF: 3.721

India's Energy Security Challenges and Policy Options

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Abstract

Among the various non-traditional threats that India is currently facing, energy security is one of them. Today, India suffers from a serious energy crisis. Energy security has become one of the serious issues of India's Foreign Policy owing to certain factors such as growing energy demand, Carbon dioxide emissions and the issue of climate change, security of energy supplies and depleting fossil fuels. With the population of our country growing day by day, the demand for energy would also simultaneously increase. The situation is most likely to become worse due to the growing imbalance between the demand for energy and the supply from its indigenous sources.

I observed that Indian energy security policies need to take into consideration the ever increasing global interdependence rather than the narrow centric remote approach. In addition to this, there is a requirement of precise and comprehensive energy policy inspiring the much needed economic and social development through supply of reliable energy. Ensuring economic and social development with an aim to overcome energy poverty should be the priority for India in addition to its commitment of mitigating climate change. Therefore, effective energy governance is the need of the hour in India in order to find solutions and methods to control the ever increasing energy demands and needs.

Key words: *Non-traditional threats, territorial integrity, energy security, national security, urbanisation.*

PAPER/ARTICLE INFO
RECEIVED ON: 02/01/2017
ACCEPTED ON: 30/05/2017

Reference to this paper should be made as follows:

Sanjay Kumar (2017), "India's Energy Security Challenges and Policy Options", *Int. J. of Trade and Commerce-IIARTC*, Vol. 6, No. 1, pp. 82-96

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1. INTRODUCTION

Traditionally, national security has been looked at in terms of the ability of a state to protect its national interests such as territorial integrity, sovereignty and independence from outside intervention. However, with the fading of Cold War, the concept of security underwent significant transformation. There emerged an increasing acceptance that the state-centric paradigm, which defined security purely in relation to military preparedness and force, is outmoded. This is owing to the fact that the traditional security paradigm does not comprehensively address the rapidly growing non-traditional threats to security like, "the struggle for resources embedded in the pursuit of energy security, food security, climate change, water security, environmental degradation, forced migration, terrorism, insurgency, drug trafficking, arms smuggling and money laundering."[1]

Among the various non-traditional threats that India is currently facing, energy security is one of them. Today, India suffers from a serious energy crisis. Energy security has become one of the serious issues of India's Foreign Policy owing to certain factors such as growing energy demand, Carbon dioxide emissions and the issue of climate change, security of energy supplies and depleting fossil fuels. With the population of our country growing day by day, the demand for energy would also simultaneously increase. The situation is most likely to become worse due to the growing imbalance between the demand for energy and the supply from its indigenous sources.

Former Indian Prime Minister Manmohan Singh has identified energy security as one of the major challenges to the national security of India.[2] Presently, India account for just 3.5 per cent of the world energy. The future of India's national security is intertwined with that of a secure energy supply. Access to adequate energy supplies for all is necessary to build and sustain the favorable world order that is a cornerstone of India's national security. Keeping this in mind, the policy makers of India need to adopt both short-term and long-term measures to meet the demands of various sectors within the country. The paper argues that if adequate measures were not taken in time then it would derail the economic progress of the country and foil India's great power ambitions.

Energy security threat to India arises not just from the uncertainty of availability and price of imported energy but also from the possible disruption in its imports or shortfalls in domestic production. The primary challenges facing India's energy sector are coal depletion and pollution, rising oil imports, increasing natural gas demands, inefficient electric system, energy related water shortages and limited nuclear energy etc. It has become essential for India to reduce its energy import dependency and it should diversify its energy supply sources and resources of energy to be energy secure in future. From the long term point of view, meeting the increasing demand of India's energy security lies in self-sufficiency and for that India has to change its energy mix by increasing the share of nuclear energy and renewable resources.

India is the only country that uses coal to any appreciable degree and that has made some progress in exploiting renewable energy resources. The paper seeks to outline the seriousness of the energy security challenges facing by India and the policy options available to tackle it. In doing so, I have first made an overview of this vital problem. Moreover, strategy on how to deal

with the increasing energy demand has also been discussed. The paper further argues that energy security holds the key to India's progress in the standing among the world's economic power.

2. DEFINING ENERGY SECURITY AND ITS LINKAGE WITH NATIONAL SECURITY

The World Energy Assessment under the United Nations Development Programme (UNDP) report has defined energy security as, "the continuous availability of energy in varied forms in sufficient quantities at reasonable prices."[3] The Planning Commission of India defines energy security as, "We are energy secure when we can supply lifeline energy to all our citizens irrespective of their ability to pay for it as well as meet their effective demand for safe and convenient energy to satisfy their various needs at competitive prices, at all times and with a prescribed confidence level considering shocks and disruptions that can be reasonably expected."[4] According to former Indian President, APJ Abdul Kalam, energy security is based on conservation, secure access to all sources of energy globally and access to reliable, affordable and environmentally friendly energy. He further defined energy security as "ensuring that our country can supply lifetime energy to all its citizens, at affordable costs at all times."[5] The above definitions show that energy security occupies an important place in India's national security.

One may ask a question as to how energy security is relevant to national security. Since the threat to peace and security of a nation comes from both outside and within. And if security means freedom from fear, danger and others then energy security means meeting the increasing energy requirement of the society. There is a close relevance between energy security and national security. Because, national security means not just defence but must encompass development. And it is being said that defence and development are the two sides of the same coin. Development of a nation cannot be done without energy security. Therefore, the fundamental duty of nation is not just providing security of the societies from military attack by other countries, but also entails securing freedom from the fear of disruption of energy supplies either through domestic production or by importing from other countries. Our capacity to preserve and build lasting peace for all Indians will depend on the strength of our military to defend our borders and the potential of our economy. This is further supported by the fact that energy is the engine of economic growth.

Energy is required for both civil and military purposes. Energy is required in every activity of our daily lives in the fields of agriculture, industry, generating electricity, infrastructure such as public transformation, schools, hospitals, water supply and in military and defence operations. Military applications of nuclear energy or nuclear material are essential in areas such as nuclear weapons or military nuclear reactors.[6] None of these activities could work undisturbed if there are not enough energy reserves, which are ultimately lead to national economic retreat. Supply disruptions, price spikes, the indirect costs of maintaining sea-lines of communication for oil transport, have all had profound effects on the economic well-being and national security of India. Therefore, India cannot remain silent on the growing challenges of energy security and needs to pay special attention to make sufficient arrangement of energy security in order to become major powers of the world.

3. SIGNIFICANCE OF ENSURING ENERGY SECURITY

Why do we need to ensure energy security? India's economic growth is directly linked to its capabilities to ensure unrestricted energy supplies. Rapid economic growth has offered employment opportunities to the growing population resulting in rapid urbanisation which puts additional strain on energy resources.[7] Ensuring energy security is crucial to nation's growth, security and overall development in a globalised world. From the Indian point of view, ensuring energy security becomes very crucial due to the following reasons:

- growing population and increasing urbanization.
- sustain high economic growth.
- sustain agricultural growth.
- industrial growth in areas such as steel, cement, etc.
- boom in service sector.
- improve the standard of living.
- means of transport and transport infrastructure.[8]

4. INDIA'S ENERGY SCENARIO: AN OVERVIEW

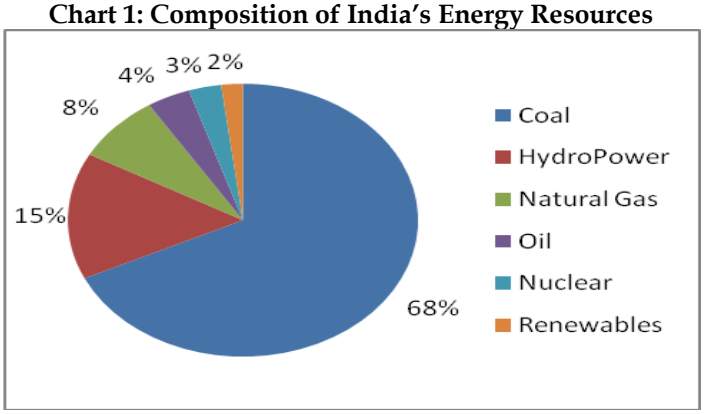
India, the second largest population in the world known for its significant economic growth has been facing the challenges arising out of the growing energy demands to meet its growing population. In this context, assessing the energy situation of India becomes very important. There is a close linkage between energy consumption and both economic growth and human development. India, with over a billion people is holding less than 0.5 percent of the world's hydrocarbon resources. To meet its increasing energy demands, India depends on unclean coal for more than half which can be highly dangerous for environmental and health reasons.[9]

At present, India is the sixth largest energy consumer in the world and is projected to emerge as the fourth largest consumer after the United States, China and Japan in the coming decades or so. Its economy is projected to grow 7 per cent to 8 per cent over the next two decades, and in its wake there will be a substantial increase in demand for oil. For India to sustain this projected economic growth and eradicating poverty would require solving energy problem. For more than a decade, India's energy consumption has grown at a faster pace than its economy and it appears that this trend will continue in the years to come. Moreover, even if India reduces the use of oil in its power and manufacturing sectors, the demand for oil in the transport sector shows no sign of dwindling. Due to stagnating domestic crude production, India imports approximately 70 per cent of its oil. Its dependence on imported energy resources is growing rapidly. The World Energy Outlook, published by the International Energy Agency (IEA), projects that India's dependence on oil imports will grow to 91.6 per cent by the year 2020.[10]

India currently suffers from a serious shortfall in electricity supply, estimated at 15 per cent and and expected to grow further. Presently, only 3 per cent of the country's electricity is generated from nuclear power plants. About two-thirds (68 per cent) is generated from coal, 15 per cent from hydropower, 8 per cent from natural gas, 4 per- cent from oil and 2 per cent from renewables. However, due to difficulties in procuring uranium, they together operate at less than 50 per cent capacity (Refer to Chart 1). The seriousness of energy security can be gauged from the fact that only 660 billion KWh of electricity is what India produce and over 600 million populations equal to the combined population of USA and European Union (EU), have no access

to electricity, and a limited access to other clean, modern fuels such as Liquefied Petroleum gas (LPG) and kerosene. Lack of adequate energy assess is reflected in human development index (HDI) of India. India's HDI is very serious when compared with other countries such as Canada, United States, Norway, United Kingdom, Japan, etc.[11]

Chart 1: Composition of India's Energy Resources



***Source*:** Elspeth Thomson and Dickson Yeo, "India and the Nuclear Supplier Group", *Energy Studies Institute Bulletin Article on Energy Trends and Development*, vol. 2(3), December 2009, p. 4, available at <*www.esi.nus.edu.sg/.../091231_India_and_the_Nuclear_Suppliers_Group.pdf*>.

India has to import 75 percent of its oil needs from other countries while accounting 25 percent of its oil needs from its domestic productions. The imported oil is then largely reserved for its transportation sector. It has some hydroelectric potential left and fast-deploying renewable energy. However, such renewable energy requires larger sustainable footprints (solar, wind, bio fuel), and this in the long run could compete with India's much-needed improvements in agriculture and food production technologies.[12]

5. MOUNTING INDIA'S ENERGY OBLIGATION

With the increase of population in our country, the demand for energy would also increase simultaneously (See Table 1). India's energy demand is likely to be among the highest among the large countries in the world including the United States and China. As per projections by the International Energy Agency (IEA), China is expected to account for 40 per cent of energy demand growth from 2011- 2025, and India is expected to drive the same after 2025.

With the sharp increase in the use of personal vehicles on account of the growth of the middle class is expected to contribute substantially to oil demand growth. According to Facts Global Energy (FGE), India will be fourth after China, the Middle East and Latin America in oil demand growth in the next few years and is likely to account for anything between 100,000 barrels per day (bpd) and 150,000 bpd, which is an increase of 8-12 per cent over current demand of 1.2 million bpd.[13] According to other projections, by 2040, India will be among the world's largest oil consumers and importers with domestic oil product demand projected to be 9.8 million barrels per day (mmbd) and crude oil imports in excess of 7 mmbd (a 100 percent increase over 2015).[14]

At present, India's proven oil reserve is 5.8 billion barrels. When the production of crude oil in 2008-09 was around 36.1 MT, the demand was four times more than the production that stood at

around 135.0 MT.[15] The majority of India's domestic oil production is from western off-shore fields, most notably the Mumbai High Basin, which in 2015, accounted for roughly 40 per cent of India's total crude oil production. It is also available in significant amounts in the onshore Cambay Basin in India's northwest and the Arakan Basin in the Assam state of Northeast India.[16]
India's domestic natural gas production has increased steadily over the last few years. In 2014, India produced 31.7 bcm of natural gas whish was far below its domestic demand of 50.6 bcm, despite having proved reserves at 1.4 trillion cubic meters (50.4 trillion cubic feet). Currently, domestic production is concentrated offshore with the Mumbai High Field and the Krishna-Godavari Basins as the primary domestic production zones. The production of onshore gas is mostly in Gujarat, Andhra Pradesh, and Assam.[17]

Table 1: Populations Projections (in millions)

Year	2000	2005	2010	2015	2020
Under 15	361	368	370	372	373
15-64	604	673	747	819	882
65+	45	51	58	65	76
Total	1010	1093	1175	1256	1331

***Source**: Report of the Committee on 'India Vision 2020', Paper Prepared for Planning Commission, Government of India, New Delhi, December 2002, p. 29, available at <http://planningcommission.nic.in/reports/genrep/pl_vsn2020.pdf>.*

According to International Energy Agency (IEA), Indian total primary energy demand is estimated to increase from 669 million tonnes of oil equivalent (mtoe) in 2009 to 1464 mtoe in 2035.[18] The demand for oil, which is likely to increase by 3.4 per cent annually (from 3.3 million barrels per day (mb/d) in 2010 to 7.4 mb/d in 2035) is widening the gap between oil demand and domestic oil supply.[19] India produces 35.4 million tonnes (mt) or 0.9 per cent of the world's total oil production while it consumes 3.8 per cent or 148.5 mt of oil, which underscores the dependence on oil imports. Oil imports are likely to rise from 76.4 percent (2010-11 figures) to 80.5 percent in 2016-17 and are estimated to reach 92 percent in 2035. India's currently imports are 74 percent of its crude oil from countries in West Asia.[20]
It has been projected that the total coal demand will nearly double, and both oil and gas demand will triple (as shown in table 2) in the coming decades. Expanding domestic production capacity will require substantial investments, while increasing dependence on imported forms of energy will increase vulnerability to fluctuations in global energy prices. Total demand for power is expected to increase by another 3.5 times or more in the next two decades, which will necessitate a tripling of installed generation capacity from 101,000 MW to 292,000 MW by 2020.[21] The important question that comes to my mind when 9 look at the projected energy demand for India in the coming decades is whether it would derail the prospects of India's economic growth and the development plans.
Hydro carbons constitute 42 per cent of India's commercial energy consumption. In the coming decades too, it will be the only primary fossil fuel to meet the country's growing energy demands in the transport and manufacturing industry sector. According to vision 2025 document, the share of oil and gas in the total energy supply will be 45 per cent (Oil 25 percent and Gas 20 per cent) by the year 2025. While the demand for crude oil and petroleum products are expected to grow to

190 million tons in 2012 and 364 million tons in 2025.[22] This would require India to look for serious long-term security arrangements for its increasing energy demands.

Table 2: Projected Fuel Demand

	Coal	Oil	Gas
1997	311	83	21.5
2020 BAU	688	245	70.8
2020 BCS	538	195	64.7

Note: BAU- Business-as-usual encompassing Industry, transport, commercial, agriculture and residential. And BCS refers to Best-case scenario.

Source: Report of the Committee on 'India Vision 2020', *Paper Prepared for Planning Commission, Government of India*, New Delhi, December 2002, pp. 71, available at <http://planningcommission.nic.in/reports/genrep/pl_vsn2020.pdf >.

6. ROLE OF NUCLEAR POWER IN INDIA'S ENERGY SECURITY

Assessing the role of nuclear power becomes very important when there is a growing awareness among the countries of the world on the need to exploit the nuclear power for meeting energy challenges. Nuclear power would help increase energy security during a time of unstable competition and surging demand. Nuclear power holds the key to reducing global emissions of carbon dioxide (CO_2) and sulphur dioxide (SO_2). The 17 per cent reduction in emissions due to reduced coal-fired generation being taken up by nuclear (and renewable generation) is equivalent to 12 percent of UK emissions and 8 percent of emissions from the EU-25 countries. The civil nuclear agreement is important for India because it helps to achieve its long-term nuclear technology thrust, reduction in coal transport congestion and emission reduction targets. Increased share of nuclear power in the Indian energy mix will help to diminish the reliance on fossil fuels and reduce carbon emissions from India.[23] (Also Refer to Chart 2).

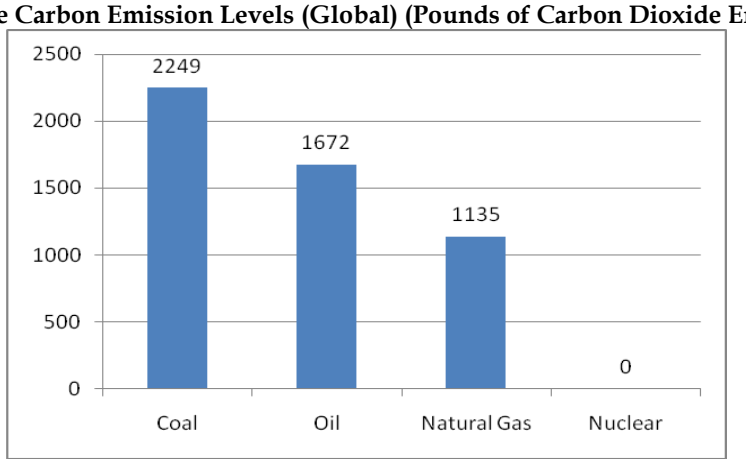
The growing nuclear renaissance should also attract the attention of the Indian government and its policy makers when it depends on other countries to meet its increasing energy needs. Despite of this, many of its households are without electricity. Nuclear power has a key role to play to providing electricity to more than 500 millions people. Today, about 17 per cent of the world's electricity is generated from over 441 nuclear reactors operating in 32 different countries. Besides, another 32 reactors are under construction, and many more are on the drawing board. Nuclear power in the coming decades would make significant contribution to global supply of electricity.[24]

At present the contribution of nuclear energy to India's electricity requirement is very meager. India is planning to increase the present share of around 3 per cent to 10 per cent by 2022 and 26 per cent by 2052. This translates to an increase in installed nuclear power generation capacity from the current level of 4,780 MW to 40,000 MW by 2020 and 250,000 MW by 2050. To meet these targets, India will need to invest $65 billion between 2010 and 2020 in new power plants. Significant investments will also be required to secure fuel for the existing nuclear reactors, almost all of which are based on the Pressurized Heavy Water Reactor (PHWR) technology.[25]

Other factors that makes nuclear energy more viable option is that hydrocarbon resources are yet to prove themselves as viable alternatives. In addition, renewable sources have only been able to supplement and not replace the fossil fuel requirements as mentioned above. No doubt,

renewable energy sources are attractive but powerless. Moreover, they are capital and land intensive.[26]

Chart 2: Average Carbon Emission Levels (Global) (Pounds of Carbon Dioxide Emission MWh)



Source: Bhupendra Kumar Singh, *India's Energy Security: The Changing Dynamics* (New Delhi: Pentagon Press, 2010), p. 32.

7. CIVIL NUCLEAR COOPERATION AND INDIA'S ENERGY SECURITY

With the operation of Kaiga nuclear power reactors, India became sixth in the world to have 20 or more nuclear reactors under operation. Despite the increase of both ranking and the number of reactors, the contribution of nuclear power to generating electricity is still very limited. Lack of cooperation with other countries and limited uranium reserves of low quality are the main reasons behind the poor show. Given this fact, there are increasing needs for civilian nuclear cooperation with other countries, thereby helping India to meet its huge and growing energy needs. All of these reasons have compelled the present government to invest lot of energy in ensuring the successful conclusion of the civil nuclear cooperation agreement with the United States. As per the Department of Atomic Energy predictions, by 2000, there should have been 43 500 MW of nuclear-generation capacity in the country. But only 3310 MW (megawatts) has been realized, which is less than three per cent of the installed electricity generation capacity.[27]

The civilian nuclear cooperation should be looked at it broadly in terms of India's growing energy deficit. Efforts have been made in the past to increase the contribution of nuclear power to generating electricity and meeting India's growing energy demands, but could not achieve as projected. The Nuclear Suppliers Group waiver allows India to buy uranium for its existing reactors, as well as technologies to reprocess spent fuel and help reduce radioactive waste from supplier countries. The NSG waiver was a prerequisite for India's nuclear trade with supplier countries and increasing India's installed nuclear power generation capacity. The paper further argues that successful waiver from NSG holds the key to India's progress in the generation of electricity from nuclear energy and meeting the challenges of climate change.

At present, India has about 54,000 Megaton (MT) of developed uranium reserves with a processing capacity of about 220 MT per year. Another 23,000 MT can be developed but is facing environmental assessment as well as local opposition. However, India's thirteen reactors alone

need about 300 MT per year. This has resulted in its nuclear plants running at reduced plant capacity factors from 90 percent in 2003 to 81 percent in 2004 to 76 percent in 2005. Therefore, the successful conclusion of the civilian nuclear with the United States would result in more uranium imports to keep these plants running.[28]

Despite repeated commitments in the past, currently India's nuclear power generation capability stands at around 3,300 megawatts. With the successful implementation of the civil nuclear initiative, the Indian nuclear power capacity is projected to generate 10,000 MWs, 20,000 MWs, and 150,000 MWs by 2010, 2020 and 2050 respectively. How India is planning to increase the level of nuclear power generation capability is shown in Table 3 and Table 4. The more India cooperates with nuclear energy and fuel-supplying countries, the easier will be the path for India to produce more nuclear power to meet its growing energy security challenges. Achieving the projected target would require transfer of tons of uranium from other supplier countries because the uranium available in our country is of low quality. Besides exchange of technology and fuel for nuclear power generation, there would also be cooperation for clean-coal with other countries.[29]

Table 3: Nuclear Reactors: Operational and Planned

Reactor Type	Capacity
18 reactors at 6 sites under operation: Tarapur, Rawatbhata, Kalpakkam, Narora, Kakrapar, Kaiga and Raps-5 & 6 (2x220 MW). Total-20 reactors	4, 780 MW
4 PHWRs under construction at Kaiga (2x 220 MW) to be operational very soon	440 MW
2 LWRs under construction at Kudankulam (2x1,000 MW) to be operational during 2010-11	2,000 MW
PFBR under construction at Kalpakkam (1x500 MW) to be operational by 2012	500 MW
Projects Planned Till 2020	
PHWRs (8x700 MW), FBRs (4x500 MW), LWRs (6x1000 MW) and AHWR (1x300 MW)	13,900 MW
Total by 2020	**21,620 MW**

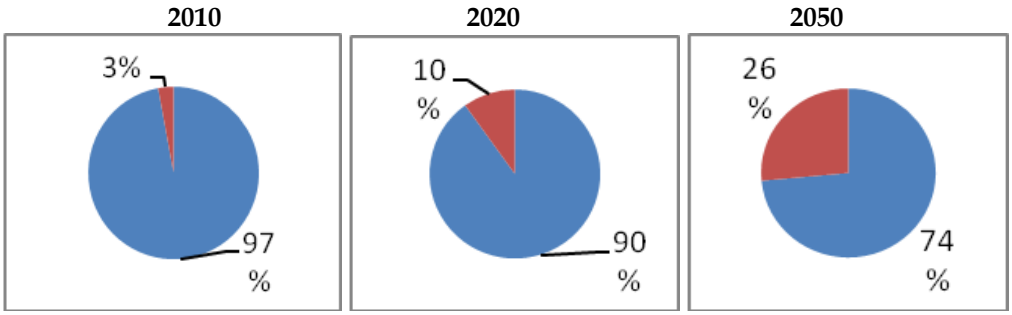
Source: "Raise Uranium Supply for Energy Security", *Economic Times* (Pune), 11 February 2010 and "India Ranks Sixth in Nuclear Power Generation", available at <http://timesofindia.indiatimes.com/india/India-ranks-sixth-in-nuclear-power-generation/articleshow/7001693.cms>.

Table 4: How India Plan to Increase Nuclear Power Capacity

Year	Installed Capacity
2010	4,780 MW (20 reactors under operation) (3 %)
2012	7,280 MW
2017	10,080 MW
2020	20,000 MW (10 %)
2032	63,000 MW
2050	150,000 MW (26 %)

Source: Refer to "India Ranks Sixth in Nuclear Power Generation", available at <http://timesofindia.indiatimes.com/india/India-ranks-sixth-in-nuclear-power-generation/articleshow/7001693.cms>.

Chart 3: Projected Share of Nuclear Energy in Power Generation in the year 2010, 2020 and 2050.



Source: *Prepared using data of Table 4.*

While India lacks abundant indigenous supplies of oil and gas, it is loaded with coal, and 70 percent of the coal mined in India goes into producing electricity. India ranks fourth in the world in terms of coal reserves, and is the world's third largest coal producer behind the U.S. and China. However, coals that are available in India are of poor quality and malpositioned. Moreover, with 35 percent ash and low energy-content, India has already resorted to importing cheaper, higher-quality coal, adding to congestion at its ports. Without 'clean-coal' technology, an increased use of coal would add to India's already significant problems relating pollution. While coal will continue to dominate as a fuel for India's electric power sector, the country's leaders are anxious to shift to cleaner means of generating electricity.[30] The successful culmination of the civil nuclear deal would open the way for the exchange of advanced technology of the times that was restricted in the past due to U.S.-India nuclear proliferation issue.

In a bid to raise the contribution of the nuclear power to energy generation, India plans to install another 25-30 nuclear reactors in the next three decades that is expected to fulfill its plans for 65,000 MW energy.[31] By 2020 and 2050, India is expecting that the nuclear energy would account for 10 per cent and 26 per cent reflecting a significant increase and many more to come in the years to follow (Refer to Chart 3). This does not mean that nuclear energy would replace coal, but to some extent it would reduce the burning of fossil fuel and low quality coal, thereby reducing environmental deterioration. Moreover, in the long run nuclear energy would be economical and environment friendly than any other alternatives.

8. CHALLENGES BEFORE NUCLEAR POWER

Without nuclear power, achieving energy security will be much more difficult; and without nuclear security, nuclear power is destined to failure. Nuclear security is an important component of achieving energy security. It is the duty of the Governments to ensure the safety and security of using nuclear power as a source to meet growing energy challenges. Nuclear technology suffers from genuine problems of safety and waste management. Mainly for this reason, the civil application of nuclear energy has become a matter of serious controversy. If nuclear energy is not generated adhering to the highest standards of safety, there is possibility of catastrophic accidents such as Chernobyl, Three Mile Island and the deaths owing to improper disposal of Cobalt 60 in New Delhi. The recent nuclear disaster in Japan is a serious case of concern for all those adopting nuclear power generation. However, to stop nuclear power generation for the fear of nuclear

accident would be a wrong move and instead they should focus on ensuring the safety of the nuclear power generation (in particular to India). These incidents have influenced many countries to take up safety measures.

Certain steps need to be taken to ensure the safety and security of using nuclear power. This includes:

- ensure maintenance of the skills base
- maintain continued effective safety regulation
- foster progress on facilities for waste disposal and management must be given serious consideration.
- maintain and reinforce international non-proliferation arrangements.[32]

A newsletter of the Levin Institute, The State University of New York states that current forecasts predict that one severe accident will occur every 100 years in network of nuclear plants such as that possessed by the United States, and there is

much debate about whether this level of risk is acceptable. To encourage confidence among the suppliers of technology and materials, a Nuclear Liability Act has been put in place to limit their liability in line with the international norms. Besides, India has also signed the Convention on supplementary compensation to provide for additional resource for assistance seeking indemnification for loss and injury for a nuclear installation. The costs and risks to public safety are so enormous that government must take an active role in supporting, regulating and monitoring nuclear industry.[33] India is also having a very good record in the context of nuclear accident.

9. INDIA'S STRATEGY TO TACKLE THE ENERGY CHALLENGES

There is no short cut route to energy security. However, there must a well-defined strategy to tackle the challenges posed by the increasing imbalance between growing energy consumption and energy demand. At present, India pursues a holistic approach toward meeting its energy needs. This strategy attempts to integrate commercial, economic and development needs with geo-political, military and strategic considerations. The present Indian strategy seeks to ensure optimal utilization of domestic energy resources, development of adequate infrastructure- both upstream and downstream, acquisition of energy assets and diversification of imports of energy resources, development and harnessing of renewable energy resources, increase of energy efficiency, promotion of energy conservation and encouragement of innovation and development of technology.

For India, Coal will continue to dominate in the future of power generation. Too much of dependence on coal raised serious issue over health and environmental concerns. One of the solutions is to adopt clean coal technologies for power generation, which would not only reduce pollution. We need to extend close cooperation with countries that have advanced technology such as the United States, Canada, France, etc.

This strategy also attempts at diversifying the types of energy being utilized, including increasing consumption of oil, natural gas, nuclear power and renewable power, as well as improving energy efficiency and conservation. With respect to oil and gas, India has diversified sources by increasing domestic exploration and production and importing from numerous regions, as well as protecting itself against oil price volatility with the development of strategic petroleum reserves,

and investing in equity oil. India has also attempted to secure supply-chain resources by expanding and upgrading its oil and gas pipelines, railway infrastructure and tanker and refinery capacity.[34]

While relying on coal and oil, at the same time we need to diversify the sources of supply in terms of uranium from other country that can help increase the contribution of nuclear energy. This is not to say that replace coal by nuclear energy immediately, but allow nuclear energy to expand its role in the contribution of India's energy mix as part of fuel substitution programme.

There is a need to consider optimum use of available energy sources to ensure energy security for sustainable development. The author also argues that nuclear power is not the immediate solution to energy security, but in the long run, it can be prove to be very effective. This is also due to an increasing pressure from the developed world to reduce green house emissions. Besides, nuclear power, we need to keep all other options alive such as deepening its energy links with countries of Central Asia, Africa, Southeast Asia, Middle East and the South Asia. However, stable and secure energy supplies can be ensured only if energy relations are part of a broader framework that encompasses trade and investment, cultural contact and deeper diplomatic relations.

As part of its Strategy, India in July 2010 had signed a 35-year power import deal with Bangladesh whereby India will import up to 500 megawatts beginning in late 2012. India also imports some electricity from Bhutan and Nepal.[35] In addition, India plans to install an incredible 175 GW of renewable capacity by 2022.[36]

The policy options available before India includes - increasing domestic production of primary fuels; securing necessary imports of primary fuels at relatively stable prices; attracting investment across all segments of the energy sector; investing in new energy technologies; reducing the carbon intensity of energy use and lowering local pollution; increasing access to modern energy to the marginalised sections of the society; and diversifying the primary fuel basket to increase energy security.

Above all, there is an ultimate need for effective implementation of energy policies through the improvement of bureaucratic and administrative processes to assure a timely completion of energy projects. The existing intra-ministerial and inter-governmental (between central and state governments) coordination should be enhanced. Besides, truly integrated and consistent energy policy is critical to guide and direct India's energy sector and ensure investment. Strong political will is a prerequisite to successfully cope with energy sector challenges.

10. CONCLUSION

The lack of holistic energy policies as well as the lack of effective leadership and political will has so far failed to produce desired outcomes for India as far as energy and sustainable development is concerned. Over the last many decades, there exists a serious energy shortage and growing pressure on imports. India's energy sector is increasingly unable to deliver a secure supply of energy amid growing demand and fuel imports. In this regard, securing long-term energy supplies to power expanding economies and meet the rising aspirations of a growing populace has become a intimidating task for our country. India's ambitions to become a global power in the coming years will rely heavily on its ability to achieve and maintain energy security. India's energy demands will continue to present it with difficult choices as the country attempts to

balance its development and growing power with a host of environmental and political issues. Ensuring energy security has over the last more than one decade been given the highest care in the country's foreign policy priority lists so as to ensure uninterrupted energy supply and, therefore, its economic growth. There is no immediate solution to the growing energy needs. It is impossible to imagine sustainable economic development without an increase in the role of nuclear power in India's energy production. Nuclear Energy is a sustainable source of energy that has the potential to limit greenhouse gas production, to conserve fossil fuel, and to increase nation's energy independence. In order to garner these benefits, we need to develop new approaches to nuclear power that solve the safety, waste management, and proliferation risks that we face today.

Given the increasing number of population, no single energy resource or technology would address all issues related to availability of fuel supplies, environmental impact, particularly, climate change, and health effects. Therefore, it is necessary that all non-carbon emitting resources become an integral part of an energy mix – as diversified as possible – to ensure energy security for our country in the coming decades. Available sources are low carbon fossil fuels, renewable and nuclear energy.[37] Nuclear energy will enable us to meet the twin challenges of energy security and environmental sustainability. It will also have major spin-offs for the development of our industries, both public and private. India has to continue to work towards development of emerging nuclear energy technologies to address its long-term energy requirements, which are indeed very large.

Indian energy policies need to take into consideration the ever increasing global interdependence rather than the narrow centric remote approach. In addition to this, there is a requirement of precise and comprehensive energy policy inspiring the much needed economic and social development through supply of reliable energy. Ensuring economic and social development with an aim to overcome energy poverty should be the priority for India in addition to its commitment of mitigating climate change. Therefore, effective energy governance is the need of the hour in India in order to find solutions and methods to control the ever increasing energy demands and needs.

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