ENERGY TRANSITION

Engaging with Equity, Justice and Democracy Concerns

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Just Energy Transition

India-Energy Policy

Introduction

Energy/Electricity in India: Current Status, Trends, Transition Possibilities and Challenges

Energy is one of the key inputs for all kinds of activities - economic, welfare-oriented, industrial, and recreational. Right from the global to national to personal, access to affordable and safe energy is one of the critical issues that determine to a large extent - the state of well being of a society or parts of it. This has been true from the dawn of civilization, and recently, in September 2015, the UN adopted Sustainable Development Goals (SDGs) have put this as the Goal no.7 ("Ensure access to affordable, reliable, sustainable and modern energy for all").

Out of all the forms that we consume energy in, 'modern' electricity is one of the most convenient, and yet in our country (as in those in similar "developmental stage"), electricity generation, transmission and access is one of the most hotly debated and contested areas of public discourse and actions. With increasing urbanization and average income in India, both the absolute amount of per capita energy & electricity consumption (with glaring disparities between states, regions and across economic classes) and the percentage of electricity in the total energy consumption basket - are increasing steadily, and so are the debates and contestations.

Increased availability of energy in general and electricity in particular, have undeniably created many economic and social opportunities for a large section of our people, while Electricity production, transmission and distribution also have a large number of associated Rights, Pollution, Denials, Equity and Justice issues connected with them, right from mining coal or damming a river, where and what kinds of power plants are built, to where the transmission lines go through, to who gets how much of this electricity and who pays all the associated costs in terms of damaged life and livelihood-support systems, health costs etc. In case of nuclear power, there are the added complexities of international negotiations and secret dealings, nancial burdens and accident risk as well as massive public perceptions.

Picture 1: www.pinterest.com

These have given rise to a large number of people's opposition / resistances to such massive projects, and often led to confrontational situations between government, communities and corporate entities pushing these projects. Though only a small portion of India's total energy consumption is consumed in the form of electricity, a very large part of the deprivations and unrest are around such projects, making these issues important to understand and address. Also, electricity projects in their entirety are not only

dependent on the energy source, but also on large tracts of land, often forests and also large amounts of water, thus often impinging on marginal livelihoods in a heavy manner. The fast increasing privatization of electricity generation and distribution, particularly post the 2003 electricity act, has also changed the social function nature of electricity and added more complexity to the multiple conflicts.

On the other hand, a very large section of India is becoming increasingly dependent on availability of more amounts of electricity at 'affordable' rates, for an increasing number of economic, industrial, social and personal activities. With about 32% of the population living in urban areas (projected to go up to about 50% by 2050 or so) and the annual per capita income reaching close to Rs.100,000 (with the disturbing trend of huge and increasing disparities within), the demand and consumption of electricity in India has grown rapidly over the past two and half decades, from an installed capacity of about 63,000 MW in 1991 to about 310,000 MW in 2016. In 2013-14, India became the 3rd largest electricity producer in the world, after China and USA, and per capita electricity production reached about 1000 KWhr per year in 2014-15.

As on 31st January 2018, India has a total installed electricity capacity as under (CEA)

Total Installed Capacity	308834.28 MW	100%
Installed Coal Power	187802.88 MW	60.81%
Installed Gas Power	25282.13 MW	08.19%
Installed Diesel Power	918.89 MW	0.3%
Installed Total Thermal	214003.90 MW	69.29%
Installed Hydro Power	43133.43 MW	13.97%
Installed Renewables	45916.95 MW	14.86%
Installed Nuclear Power	5780.00 MW	1.87%

Though the population has grown from around 85 crores (850 million) in 1991 to about 130crores now – an increase of about 1.5 times, the increase in installed electricity capacity of about 4.76 times - has not resulted in all people in the country getting access to reasonable gures, over one-fourth of levels of electricity! As per government the households still lack a basic electricity connection, with another one-third getting only a miniscule amount due to only occasional availability in the local grid. A poor state like Bihar is kept in the dark - with nearly half its households (80% of rural households in Bihar are un-electrified) lacking this basic service. Taken in with the most un-electrified populous state Uttar Pradesh, where about 40% of rural households are yet unconnected by March 2016, this shows the extremely unequal, unjust and discriminatory nature of electricity growth in

India. And if we consider that nearly 68% of our electricity generation is from coal power plants, and a very large part of the coal mining (with its associated displacement, deforestation, pollution, water depletion & contamination etc) is done in the seven states of Jharkhand, Odisha, Chhattishgarh, West Bengal, Madhya Pradesh, and Maharashtra - one finds it very hard to explain how four of these have some of the lowest household electrification rates in India!

The electricity scenario in India has indeed changed dramatically in the recent past. From being described as perennially short of this essential service, the recent statement of the union power minister that 'India is now electricity surplus', sounds discordant, particularly with the massive deprivations as outlined in the last section. By the figures of the Ministry of Power, India became 'Electricity surplus' by 2015, and this trend is continuing in 2016. With an installed capacity of over 300,000 MW, India's projected peak demand in 2016-17 is only about 165,000 MW, and the projected generation - about 170,000 MW (MoP). The present domestic coal production of around 570-580 million tons is attempted to be ramped up to over 1000 million tons per annum by 2020, while the reality is that - due to lack of current demand, Coal India is said to be looking for exports to countries like Bangladesh! Several already completed power plants are running at low PLF (plant load factor) due to lack of electricity demand, financial ill-health of the state electricity boards etc.

As a result of the drastic drop in international oil and gas prices, many idling gas based power plants in India are generating at costs not too high, for part of the year. On top of this, the government has announced (and also submitted to UNFCCC last October, as its climate action plan - INDC/NDC) an 'ambitious' plan of installing 176,000 MW of renewable electricity capacity by 2022, from the current (March 2016) RE capacity of about 44,000 MW (an addition of 132,000 MW, with Solar PV alone contributing another 92,500 MW, from its current capacity of 7,500 MW!). This is even more incongruous with the fact that - facing this 'electricity surplus and large idling capacity', the government has further plans to add anywhere between 400,000 to 500,000 MW of 'conventional' electricity capacity (coal, nuclear, big hydro) in the next 15 years or so!

This high-projection of massive installed capacity need by 2030/32 is probably being pursued on the basis of obsolete and outdated models of a continuing GDP growth of 8-9%, of invalid models of electricity input versus GDP growth, and completely ignoring the changed dynamics and economics of renewable electricity vis-à-vis conventional sources. The plain economic considerations of coal power vs solar photo-voltaic (PV) and wind power has also changed dramatically over the last 10 odd years, with much lower impact (translating to lower externalized cost) wind and solar PV now costing anywhere between Rs.3.6 to Rs.5.5 per KWHr, and cost of solar PV falling continuously. As a result, the world has seen more total investment in these renewable power capacity creation than

investments in coal or other thermal power, over the last two years. The seriousness of the climate change threat and the urgency of moving away from fossil fuels as soon as possible, has likely added to this shift, and must form an important contributing factor in our electricity plans.

Thus it is very clear that this is an area requiring far more engagement, enquiry, analysis and understanding. Taking the steps in that direction, some of our groups (Beyond Copenhagen, Centre for Financial Accountability and DSG together) have tried to engage with a large number of grass-roots groups around central, western, eastern and north-eastern parts of India, over the last one and a half years - who are seized of these issues from different perspectives. This was attempted through organizing seven workshops and two meetings in these regions, engaging well over 300 people belonging to over 100 groups from these states.

As the next step, we are inviting a wider community of organizations and individuals who have engaged with and worked on the electricity issues in India over the years, for a national level consultation. The objective of this consultation is to share our various perspectives, understanding etc, and try to enrich our collective understanding of India's power/ electricity scenario, its recent evolution, the trends and the possibilities & challenges for technical, political and economic transition.

ENGAGING WITH GRASSROOTS STRUGGLES AND RESISTANCE MOVEMENTS: THE ORIGIN OF OUR DISTRIBUTED WORKSHOPS APPROACH

BACKGROUND

Energy is not only one of the main driving forces of societies and economies, access to or lack thereof, the level of accumulation and the disparities in access, public or private control over energy resources, the various means to convert and distribute energy – all these and more issues often also determine what kind of societies we are living in. As a result, energy in its multiple forms and its control and ownership, have always played critical roles in the transformative processes in our societies. This hold true in the historically first large scale land privatization to control & own grown bio-energy, to the first industrial revolution's massive accumulation and expansion of energy use through the mining and exploitation of coal, which also played a strong complimentary role in the evolution of forms of capital and the rise of industrial capitalism.

Picture 2: Practical Action

CHANGE IN ENERGY SCENARIO IN INDIA

India today is not only a transition economy in the financial economic arena, there is also a fairly rapid transition underway over the last 20-25 years in multiple dimensions. These are in the areas of a very contested transition in Indian society in the level of energy use, the increasing disparity in access to energy (and the material goods this produce), sharply rising privatisation of those energy resources what was largely state owned and controlled, massive dispossession of agrarian and forest communities for the sake of rapid increase in exploitation rate of energy resources, exposure of large communities – both rural and urban - to the externalities of energy extraction and conversion etc. All these are being driven by a fast increasing liberalisation, privatisation and globalisation push, seen in the areas of – amongst others – rapid rise in private electricity projects post 2003 Electricity Act, processes to reverse coal nationalisation, massive oil and gas fields being literally handed over to private oligarchs, dilution and /or dismantling of environmental laws and regulations that are 'seen to hinder' this push, undermining of rights frameworks to promote 'ease of business' for mega corporations etc. Rivers for hydroelectricity, forest or agricultural lands for the coal (and other) minerals that lie underneath, large tracts of forest land for growing 'bio-energy' under private corporate initiatives, huge coastal belts for mega industrial and export-import terminals – the massive energy push for the rich, powerful and the creamy layer is evident everywhere.

As one consequence of these, innumerable protest and resistance movements have started raising their voices against these economic policies and actions that are unjust, unsustainable, highly discriminatory towards both the nature and the lower half of human society, as well as towards the coming generations. At the forefront of these resistance struggles are those whose food & energy producing land is being taken away, those who are deeply dependent on natures myriad gifts. People and communities losing land – and sometimes their water resources, have often faught on these local issues, and mostly with the demand of NIMBY (Not In My Back Yard). The multiple connections many of these energy projects and the underlying high energy, high carbon energy paradigm has with national and global issues have hardly been integrated into these struggles. The massive health impacts and pre-mature mortality and morbidity that coal use is causing, the tremendous inequity in energy access resulting from centralized production and access, the effective destruction of rural bio-energy bases to build the coal-energy infrastructure, the climate change impacts our own agrarian, mountain and coastal communities are facing due to global warming, the close connections between fossil fuel industries and capitalist exploitation, the tremendous losses suffered by river-dependent local economies and by river ecology – due to mega hydro-energy projects. Very few of these find any prominent place in the grassroots struggles articulation or strategies. On top of these, there is a large and vocal section of rising and aspirational society who enjoy the benefits of the high

energy push, but are alienated from the realities of the humongous costs of this pathway, and thus aloof to the sufferings and the struggling voices of dissent.

Today, a majority of the people's movements in India are around/ against large energy projects. Of late, many of these struggles and movements in India have started asking questions about many of these larger issues, leading to the basic questions of what really is development, who gains at whose costs for what kind of energy pathways, what are the larger national and global consequences etc. Globally also, many such people's movements have effectively raised these larger question and got connected to many larger movement collectives around these issues, to positively strengthen their own movements and pose tougher challenges to the capitalistic fossil energy lobby and their systemic designs.

It was from such churnings that several state-level and regional/ national consultations began a few years ago on the larger energy justice question. While several large CSOs and a few movement groups got into these deliberations, a very large number of grassroots /local resistances who could not - were trying to grasp the connections and to understand the larger nature of threats and what and how they can effectively enrich and enhance their strategies of resistances. Another demand often came from these resistance struggles, and that was of understanding the possible alternatives – both in terms of energy sources and the other societal forms of energy production, control and use. This was also felt to be necessary to broaden the bases of supporting communities, from the often limited directly affected and the traditional solidarity groups, by answering and convincing genuine doubts about a democratic and just transition.

As these large numbers of groups are located across Indian geography, the local participation is always stronger and more representative near the location of the resistance, and the multiple problems of bringing diverse & large number of people in central interaction sites, a strategy was adopted to start multiple interactions with these grassroots groups, through distributed workshops closer to their locations. A collaborative approach between several facilitating agencies was also adopted for better coordination and results.

Changing Power Consumption Patterns in Indian Society

‘Power’ Changed Social Equations - Society Needs to Reclaim Equitable Power

Throughout modern history, human society has revolved around gaining access to and controlling power - Political, Social, Economic, Physical. It is an indication of the importance of Electricity in our present-day society that we often call electricity as POWER.

The first article in this issue looks at how different sectors of the society in India and it’s economy has gained or lost access to ‘power’ and flourished or waned as a result. This also analyses the actual power--progress relationship in India over the last 60 odd years, countering some of the faulty mainstream narratives of corporates and the ‘powerful’.

This power or electricity is an enabling, uplifting force if used in the right way at the right place, but has several negative impacts in the entire chain of the acquisition of its inputs /mining, production of power, its transmission and end use. The devastating impacts of fly-ash from coal power plants - brought out in the article by Rajkumar Sinha, is just one aspect of this high and inequitable price paid, often by people who gain the least from the electrical power chain.

The deeper understanding of all these is essential if people at large are to reclaim the power they lost to the ‘power’ brokers, and therein fits our continuing modest efforts at educating, awareness building, equipping the ‘grassroots’.

We are already seeing the early results of our modest collaborative efforts, but may a thousand flowers bloom.

How changes in a society are reflected in its electricity consumption pattern: Case India

It is an oversimplification to state that India has grown economically at a higher pace in recent decades, and so has its electricity installed capacity and consumption. While basically correct – India's installed electricity capacity has grown from about a paltry 1370 MW at the time of its independence to over 320,000 MW today, at the end of April 2017 – this overlooks some interesting changes in the societal consumption patterns. More significantly, while the installed capacity grew to about 87,000 MW in the first 50 years, the next 20 years saw it nearly quadruple. Of course, starting on a very low base and near non-existent industrial base, the over 60 times increase in the capacity in the first 50 years, tells a story of resolute government actions in this sector (whatever be the adverse impacts, of which there are many). It also shows that the present government's claims that the earlier governments have done little in their 60 years of rule, is far from the truth, as all indicators of main-stream economic indicators show, along with the backbone of that kind of 'development' – electricity.

Picture 3: Google

As many scholars have pointed out, the economic liberalization, privatization and globalization process actually started in India sometime in the 1980s, and this brought in a strong wave of consumerism. Take a look at the percentage of domestic electricity consumption in our country. In the first 40 years after independence, till around 1986-87, the share of domestic electricity consumptionincreased marginally, by a mere 2-3 percentage points. In the next 30 years of "liberalized" India, this increased by over 10 percentage points, or nearly doubled! This was largely because of the flooding of power intensive consumer appliances like air-conditioners, refrigerators, microwave ovens & OTGs, washing machines and the like, which not only became standard features in

upper class homes, but became essential possessions in most middle class homes too. This also busts another myth, that an increase in energy efficiency will decrease overall energy consumption, and by consequence – carbon emissions. In the last three decades, the energy efficiency of all sectors – including domestic lighting, appliances etc - increased significantly, but the total consumption, even in per capita basis also sharply increased, along with our total and per capita carbon emissions. And of course, the usual discriminatory story holds true - of the upper 25% getting most of the benefits of power, with the lower 75% bearing most of the brunts, and the lowest 25% still unconnected / un-served.

The industries that produced these power-intensive white goods, kept contributing less and less to economic growth, to employment and to overall contribution to the economy! At the same time, the percentage of Industrial electricity consumption, which was nearly two-thirds of the total in the beginning, fell to roughly half in the first 40 years, further reducing to just over one-third now. India's early economic model stressed on job creation and essential goods and services provision through indigenous industrial activity, and that required building up a large industrial base for a newly independent nation – whose industrial base had been deliberately destroyed by the colonial British rulers. Industry traditionally has created most of the lower and middle level jobs, along with lower end services – that was needed to absorb the surplus work force from more power-dependent and mechanized agriculture (this is not a judgment on desirability of any particular model of development, merely a statement of what has happened). The major growth in Indian economy has come from the services sector in the last three decades, which now contributes to about 55% of the Gross Value Added (GVA), compared to about 28-29% by industry and only 16-17% by Agriculture and allied sectors (from a much higher 25% three decades ago).Thus, with nearly 50% of our people still dependent on agriculture and allied sectors, their economic and social plight has only worsened.

An interesting analysis is – while contributing increasingly to the GDP growth and to well over half of India's GDP and/or GVA, the services sector consumes only about 15-17% of total electricity consumption (add commercial + traction + a little more), while industry consumes over one-third of the electricity contributing less than 30% of the GDP/GVA. The Indian planners / energy policy establishment have failed to understand this, and are pushing for some obsolete model of high electricity inputs for every unit of economic growth. The question of the complex relationship between Human Development and pure economic growth is at another level, which they are neglecting – either deliberately or out of ignorance. If services and agriculture are providing most of the economic growth, employments and human survival opportunities, at a far lower electricity input than

demanded by “modern industry”, shouldn’t we discard the old models of GDP to high-Electricity input, that the erstwhile planning commission used to project a 800,000+ MW installed electricity capacity requirement by 2032 (end of the envisaged 17thfive-year plan) ? Only recently, the NITI Ayog and the Central Electricity Authority seem to be waking up to these realities of Indian economic story, though not fully comprehending the consequences as yet.

The remarkable growth in Indian food grain production has been accompanied by a very sharp growth – about five times – in the percentage of agriculture sector’s power consumption within the total. Interestingly, the growth in food grains production is also a shade over five times in the last 70 odd years, while the population increase is just over four times (table below). Thus, a more ‘powered agriculture’ has not only been able to maintain food supply for a rapidly increasing population, it actually increased the per capita food grains supply (the real picture for other kinds of food and nutrition will require a different analysis). The 2016-17 food grains production is projected to be over 270 million tons, about 5.5 times that immediately after independence. While there is enough scope to increase the energy (and water-use) efficiency of the agriculture sector, going back to a manual and animal model – as prevalent in the first half of the 20th century – do not seem to be feasible.

Growth of population, GDP and food grain production, India: 1950-51 to 2010-11.

YEAR	POPULATION (millions)	GDP at facto cost (at constant price in Rs. Crore)	Output of foodgrains (million tons)
1950-51	361	2,24,786	50.8
1960-61	439	3,29,825	82.0
1970-71	548	4,74,131	108.4
1980-81	683	6,41,921	129.6
1990-91	846	10,83,572	176.4
2000-01	1,028.7	18,64,300	196.8
2010-11	1,210.2	44,93,743	218.2

Sources: GDP & output of foodgrains from Economic Survey,2010-11. GDP (quick estimates) & foodgrain production (4th advance estimate) correspond to 2009-10.

Source: SharatHanda, ‘Population Growth and Economic development in India’, University of Agricultural Sciences, Dharwad.

The other failure in the Indian economy in its last three odd decades of change – particularly in view of the climate change threat now being faced by a large section of the population, is increasing over dependence on liquid fossil fuels for transportation /mobility. The traction sector actually has been stagnant (or seen negative growth) in terms of its percentage share of electricity consumption over the last 70 odd years. Though the railways – both urban and trunk has transformed itself to run largely on electricity, massive percentage share in both goods and passenger transportation have been lost to the much more energy and carbon intensive road sector. This will need urgent corrective measures – if we are to respond to the quadruple challenges of climate change, massive import bills, massive air and water pollutions from fossil fuel burning and looming-on-the-horizon peak oil.

Hope we wake up and act in time.

Pattern of Electricity Consumption (Utilities) (per cent)

Year	Domestic	Commercial	Industry	Traction	Agriculture	Others
1	**2**	**3**	**4**	**5**	**6**	**7**
1950-51	12.6	7.5	62.6	7.4	3.9	6.0
1960-61	10.7	6.1	69.4	3.3	6.0	4.5
1970-71	8.8	5.9	67.6	3.2	10.2	4.3
1980-81	11.2	5.7	58.4	2.7	17.6	4.4
1981-82	11.6	5.8	58.8	2.8	16.8	4.2
1982-83	12.7	6.1	55.4	2.8	18.6	4.4
1983-84	12.9	6.4	55.8	2.6	17.8	4.5
1984-85	13.6	6.1	55.2	2.5	18.4	4.2
1985-86	14.0	5.9	54.5	2.5	19.1	4.0
1986-87	14.2	5.7	51.7	2.4	21.7	4.3
1987-88	15.2	6.1	47.5	2.5	24.2	4.5
1988-89	15.5	6.2	47.1	2.3	24.3	4.6
1989-90	16.9	5.4	46	2.3	25.1	4.3
1990-91	16.8	5.9	44.2	2.2	26.4	4.5
1991-92	17.3	5.8	42.0	2.2	28.2	4.5
1992-93	18.0	5.7	40.9	2.3	28.7	4.4
1993-94	18.2	5.9	39.6	2.3	29.7	4.3
1994-95	18.5	6.1	38.6	2.3	30.5	4.0
1995-96	18.7	6.1	37.8	2.3	30.9	4.2
1996-97	19.7	6.2	37.2	2.4	30.0	4.5
1997-98	20.3	6.5	35.4	2.3	30.8	4.7
1998-99	21.0	6.4	33.9	2.4	31.4	4.9

1999-00	22.2	6.3	34.8	2.6	29.2	4.9
2000-01	23.9	7.1	34.0	2.6	26.8	5.6
2001-02	24.7	7.5	33.3	2.5	25.3	6.7
2002-03	24.6	7.5	33.9	2.6	24.9	6.5
2003-04	24.9	7.8	34.5	2.6	24.1	6.1
2004-05	24.8	8.1	35.6	2.5	22.9	6.1
2005-06	24.3	8.7	36.8	2.4	21.9	5.9
2006-07	24.4	8.8	37.6	2.4	21.7	5.1
2007-08	24.0	9.2	37.5	2.2	20.6	6.5
2008-09	24.7	10.2	37.1	2.2	20.4	5.4
2009-10	24.9	10.4	36.7	2.2	21.0	4.8
2010-11	25.2	10.4	36.5	2.2	20.5	5.4

https://data.gov.in/resources/pattern-electricity-consumption-utilities/download

Data support: Ravina Dhonchak.

Primary Energy Consumption in India

Climate Goals Brooks No More Coal

It has been said umpteen number of times - the Earth's climate systems are in danger of very serious systemic failures, and the continued and massive-scale use of fossil fuels are primarily responsible for that crisis. For more than 250 years, the dead-plant fossils, or Coal in its various forms, have kept the fires of the global industrial engine burning, along with later entrant Petroleum and 'newbie' natural Gas. This has become so much of an addiction for the world's energy hungry industries and enterprises, that even the grave threats to earth and human society have not persuaded them from trying to "Kick The Habit" (borrowing from a UNEP publication).

The facts are clear - humans are burning over 8000 million tons of coal each year, more than double the amount we burnt in the early 1980s. Coal burning is the largest source of climate threatening greenhouse gases, accounting for over 45% of the 33-34 Gt (3300 crore tons) of Carbon dioxide emitted annually from fossil fuel burning (petroleum contributes 33 % and gas - 21%). The world is already 1 C warmer than the pre industrial times, and the results are showing up in vastly increased climatic disasters and their sharply rising human and economic costs. In India, the last few years severe droughts have devastated millions of farmers lives.

There are several factors - political, economic, social and moral - falling into place now, calling for an end to the fossil fuel era. The Paris Agreement - however inadequate it might be - at least made a public commitment to keep the global temperature rise below 2 C from pre industrial, and try to limit that to within 1.5 C. The unit cost of Solar and wind energy - both for installations and for produced power - have drastically come down, in many countries - to levels below coal-produced power (even without accounting for the vast social & environmental costs of coal burning). The massive air pollution from coal (and other fossil fuel) burning is killing over four million people globally, every year, and rising, with most affected being young children. And unless we stop burning coal very soon, the climatic disasters are going to be far worse. The Indian government has committed to an aggressive renewable energy target, and the Central Electricity Authority agrees (in its recent report) that we will not need any more coal plants for years to come.

In this background, this issue takes a look at this engine of early industrial civilisation and see where we are in India.

Primary Energy Consumption in India

Most of our daily routine activities depend on three primary energy sources that are coal, oil and natural gas. Their combustion causes emissions of greenhouse gases like CO2, the gas mainly responsible for global warming. India is among the top emitters of carbon dioxide. Transport sector (major consumer of oil) emits oxides of nitrogen and sulfur which cause air pollution and acidic rains. Worsening air conditions are believed to be the main reason for 1.1 million premature deaths (Times of India, Feb 2017) in India in 2015.

India is the third largest energy consumer (surpassing Russia in 2015) in the world after China and USA. Total energy consumption of India in 2016 stood at 37013.08 Petajoules (884 Mtoe) while that of China and USA was 130760 Petajoules (3123 Mtoe) and 92281.48 petajoules (2204 Mtoe) respectively (Source: Global Energy Statistical Yearbook 2017). Total energy consumption of India has increased by 2.7 times from around 13312 Petajoules during 1991-92 to 37013.08 Petajoules in 2016. Even though it is the third largest consumer of energy, India's per capita energy consumption is just one third of the world average.

Coal production has increased by approximately 2.83 times over the last two and half decades. Similarly the increase in coal consumption during the same period is around 3.58 times. The demand of coal is more than its domestic production and it is met by import of coal. Domestic production of coal during 1991-92 was 232.81 Million Tonnes which increased to 659.27 Million tonnes in 2016-17.

Major source of total energy consumed in India during 2015-16 was coal (70.25%), followed by Crude oil (11.24%) and natural gas (9.02%). Electricity and lignite contributed 5.87% and 3.62% respectively. Major share of coal goes to electricity generation followed by steel industry. Coal produced in India is majorly used in thermal power plants and imported coal is used for industrial sectors like cement industry.

The domestic crude oil and natural gas production increased 1.19 times and 1.17 times respectively from being 30.34 Milltion Tonnes in 1991-92 to 2015-16. Crude oil production was 30.34 Million tonnes and natural gas production was 18.64 Billion Cubic Meters (BCM) during 1991-92. In the year 2016-17 production of natural gas was 31.89 BCM and that of oil was 36.01 Million Tonnes.

Consumption of Conventional Energy (1991-2016)

Year	Coal (Million Tonnes)	Crude Oil (Million Tonnes)	Natural Gas (Billion Cubic Meters)
1991-2001			
1991-92	232.33	51.42	14.42
1992-93	241.75	53.48	16.11
1993-94	256.32	54.29	16.34
1994-95	269.17	56.53	17.33
1995-96	284.03	58.74	18.09
1996-97	298.62	62.87	18.63
1997-98	306.82	65.16	21.51
1998-99	313.47	68.53	22.48
1999-2000	315.04	85.96	26.88
2000-2001	339.30	103.44	27.86
2001-2011			
2001-02	349.58	107.27	28.03
2002-03	361.833	112.559	29.96
2003-04	379.28	121.84	30.90
2004-05	407.41	127.11	30.77
2005-06	433.27	130.11	36.39
2006-07	462.35	146.55	37.60
2007-08	502.82	156.10	39.80
2008-09	549.57	160.77	39.81
2009-10	585.30	186.55	48.34
2010-11	589.87	196.99	52.02
2011-2016			
2011-12	642.64	204.12	60.68
2012-13	688.75	219.21	53.91
2013-14	724.18	222.50	48.99
2014-15	821.85	223.24	46.95
2015-16	832.46	232.87	47.85

Source: Ministry of Statistics and Planning

(Note: The data on energy statistics from various sources did not completely match)

National Energy Policy targets increase in domestic coal and oil production and per-capita consumption. Increasing demand in energy will be met mainly by fossil fuels. The true cost

of this demand is the negative impact on environment and society. In 2016 India was one of the major emitters registering a growth in its greenhouse gas emissions while China and USA observed a decline in their CO_2 emissions. According to British Petroleum's statistical report 2017, India's CO_2 emissions mainly from coal and oil increased by 5%. To cut coal imports, Coal ministry aims at increasing domestic coal production to reach the target of 1 billion tonnes annual production by 2020 and 1.5 Bn Tonnes by 2022. Electricity generation increased from 1.336 billion GWh in 2015-16 to 1.433 billion GWh in 2016-17, with a growth rate of 7.27%. The installed capacity of renewable power has gone up to 18.18% in January 2018 and coal based capacity has come down to 58.32%. But till date more than 80% of electricity generation comes from coal based power plants. With ever increasing dependence on fossil fuels it is debated that our coal reserves will last for around 70 years. But even before the complete exhaustion of these resources, air pollution will be increased many folds. As the above data clearly shows that our reliance on fossil fuels is nowhere near to a slowdown.

- **Ravina Dhonchak**

Hydro Power in India

The Answer is Blowin' in the 'News'

(WITH APOLOGIES TO BOB DYLAN)

Some of the biggest issues and challenges to humanity in the 21st century are the threat of irreversible climate change, the massive pollutions of air, water and soil, the emerging water crisis in many countries and very discriminatory access to energy and services leading to poverty and deprivations. Fossil fuel burning contributes to the biggest share of GHG emissions, are also the biggest contributor to pollutions, and both fossil fuels and Nuclear power are biggest water guzzlers, apart from being inherently accumulative and non-equitable. Thus all of these massive challenges have a deep connection to one Big Question – What Energy Future do we Visualise and How Fast can we Transition to a new clean and safe energy regime?

And the Answer, my friends, is really blowing in the News. "Solar energy prices dropped to record low", "25000 MW of coal power is stressed and there are no buyers", "Large hydropower operators are looking at default", "Centre gives INR 16,000 crores bailout to hydropower sector", "34,000MW of planned coal power capacity cancelled", "nuclear power companies Westinghouse goes bankrupt", "solar and wind power installations increasing the fastest the world over", "Germany generated 100% of its electricity from renewables on ….",

It's no longer in the future, no more ifs and unless' are the constant accompaniments. The Answer, and Choice should be crystal clear now. The age of Coal and fossil fuels is coming to an end, and renewables are taking over. Nations and governments will be judged in future on how fast, how equitably and with just measures they go for this transition.

The Changing role and contribution of Hydro-power in India's electricity sector

From the time of its independence, India has made tremendous progress in all sectors, and the power sector is no exception. Starting with a meagre installed capacity of 1362 MW and per capita availability of a measly 16.3 KWH/year, we have reached an installed capacity of over 330,000 MW (an increase of over 240 times) as on May 2017 (table below from Central Electricity Authority –CEA - presentation, Ministry of Power, Govt of India), and the per capita availability now is over 1100KWHr (about 67 times). In this same time, the population has increased from about 340 million (34 crores) to 1320 million (132 crores), or an increase of 3.88 times. This increased availability of power has helped grow more food (by enabling more irrigation, more fertilizer & pesticides production, more wide-spread collection and distribution etc), provided many millions of jobs by powering industries and commerce, lighted up a billion homes, enabled a billion people move on jobs and leisure in electrified railways, helped better health care and education,…….

Table 1
PLAN-WISE GROWTH OF ELECTRICITY SECTOR IN INDIA
UTILITIES

Sl. No.	As on / during financial year ending with	Installed Capacity (MW)	No.of villages electrified	Length of T & D Lines (Ckt. kms.)(#)	Per Capita Consumption (kWh)($)
1	31.12.1947	1362	N.A.	23238	16.3
2	31.12.1950	1713	3061	29271	18.2
3	31.03.1956(End of the 1st Plan)	2886	7294	85427	30.9
4	31.03.1961(End of the 2nd Plan)	4653	21754	157887	45.9
5	31.03.1966 (End of the 3rd Plan)	9027	45148	541704	73.9
6	31.03.1969(End of the 3 Annual Plans)	12957	73739	886301	97.9
7	31.03.1974(End of the 4th Plan)	16664	156729	1546097	126.2
8	31.03.1979(End of the 5th Plan)	26680	232770	2145919	171.6
9	31.03.1980(End of the 2 Annual Plans)	28448	249799	2351609	172.4
10	31.03.1985(End of the 6th Plan)	42585	370332	3211956	228.7
11	31.03.1990(End of the 7th Plan)	63636	470838	4407501	329.2
12	31.03.1992(End of the 2 Annual Plans)	69065	487170	4574200	347.5
13	31.03.1997(End of the 8th Plan)	85795	498836	5141413	464.6
14	31.03.2002(End of the 9th Plan)	105046	512153	6030148	559.2
15	31.03.2007 (End of 10th Plan)	132329	482864	6939894	671.9
16	31.03.2012 (End of 11th Plan)	199877	556633	8726092	883.6
17	31.03.2013(End of Ist year of 12th Plan)	223343	560552	9080556	914.4
18	31.03.2014(End of IInd year of 12th Plan)	245259	572414	9534584*	957.0
19	31.03.2015(End of IIIrd year of 12th Plan)	271722	577629*^	10558177@	1010

N.A. Not Available. (*) Provisional. (^) As per revised definition of village electrification and 2001 Census.
(#) Includes 440 Volts Distribution Lines. @ Estimated
$ Per Capita Consumption=Gross Electrical Energy availability/Mid year Population

1

Different sources of power or electricity played different roles in these 70 years of independent India. In the year 1947, out of the total installed capacity of 1362 MW, hydropower contributed 508 MW, or 37.3% of the total. In the first four 5-year plans, hydropower was given high importance in meeting the rapidly increasing electricity needs of a large country emerging from centuries of colonial devastation. The actual cost of large dam based hydropower costs were not generally accepted as very high in these initial decades. But as the number of large dam-based hydropower plants increased, and their immense submergence of fertile lands-homes-forests, massive displacements, other social and environmental costs started becoming more prominent, there were many serious questions raised about the enthusiasm about these so called clean energy sources. A brief look at how the percentage contribution of hydropower changed in the total installed capacity in India (table constructed by author, from CEA data), is a good lesson –

Year	Marker	Hydropower MW	Total power MW	%age of hydro
1947	Independence	508	1362	37.3 %
1956 March	End of 1st 5-year plan	1061	2886	36.76
1961	End of 2nd plan	1917	4653	41.2
1966	End of 3rd plan	4124	9027	45.69
1974	End of 4th plan	6966	16664	41.80
1985	End of 6th plan	14460	42585	33.96
1997	End of 8th plan	21658	85795	25.24
2007	End of 10th plan	34654	132329	26.19
2012 March	End of 11th plan	38990	199877	19.51
2015 March	3rd year of 12th plan	41267	271722	15.19
2017 May	Latest figure	44594	330260	13.50

Thus it is very clear that after the first 25 odd years of India's independent existence and development, hydropower's contribution to the total electricity has continuously declined. This has several other reasons, the large scale displacement in an increasingly high

population density country being one major factor. The large scale devastation of social and local economic structures that these big reservoir based hydro power plants caused is also causing strong pushbacks by the large affected populations. The enormous capital costs and long gestation periods of such projects are other factors that must have worked for this change. In a scenario where solar and wind energy projects can be installed within a year, and their costs of produced power are now lower than new coal power plants (and far lower than nuclear power plants), the economic considerations are becoming more important.

Another consideration that we must seriously evaluate is the effects of global warming and climate change. Our earlier calculations of available flows in rivers in different seasons have to be modified, given how drastically the glacial-melt and precipitation-origin water in-flows into rivers have changed. Complicating the matter is the increased irregularity of rainfall /precipitation, causing disasters in dammed river valleys (destruction of several dams in the Uttarakhand disaster of June 2013 is still vividly etched in memory). The continuing erosion of the importance of hydropower in meeting India's electricity needs is even more starkly shown by the loss of hydropower's share in total generation. Whereas the installed hydropower has come down to about 14% of total installed capacity now from 37.3% in 1947, hydro contributed only 11.69% of the total generated power in 2016-17, compared to 53% in 1947 (1947 – 2195 GWHr by hydro out of a total of 4076 GWHr, 2015 – 129244 GWHr by hydro, out of 1105448 GWHr total generated) ! The signals are all reasonably clear, the relative importance of hydropower in India's growing electricity needs are on a continuous downward path.

Today, a large no of privately owned hydropower projects are unable to generate enough revenue and turning to stranded assets – if not NPAs (non-performing assets) – causing huge problems for lending banks and other financial institutions. The union government has just announced a bailout package of INR 16000 crores (about USD 2.5 billion) for the troubled hydropower sector, but bailouts can only work when the inherent strength remains strong, not when the basic energy economics is turning against the continuation and promotion of suffering sectors. The hydropower sector is neither a big employer to be nurtured with such huge doles, nor a critical sector for the country's economy, with surplus production and excess installed power capacity being the norm for the last three years running.

Picture 4: Matu Jan Sangathan

The Vishnuprayag dam was completely destroyed by the 2013 Uttarakhand floods. At the Vishnuprayag Hydroelectric Project on the Alaknanda River, floodwaters surged over the 55-foot tall dam and boulders buried it in 60 feet of rubble.

Picture 5: Soumya Dutta

Teesta Low Dam Stage IV: By stopping the silt, these are contributing to fast erosion of downstream river islands and river bank villages.

All India hydropower installed capacity (in MW) of power stations (as on 31.05.2017) (utilities)

Region	Ownership	Installed Capacity(MW)
Northern Region	State	8543.55
	Private	2502.00
	Central	8266.22
	Total	**19311.77**
Western Region	State	5480.50
	Private	447.00
	Central	1520.0
	Total	**7447.50**
Southern Region	State	11739.03
	Private	0.00
	Central	0.00
	Total	**11739.03**
Eastern Region	State	3537.92
	Private	291.00
	Central	1005.20
	Total	**4834.12**
North Eastern Region	State	402.00
	Private	0.00
	Central	860.00
	Total	**1262.00**
Islands	State	0.00
	Private	0.00
	Central	0.00
	Total	**0.00**
All India	State	29703.00
	Private	3240.00
	Central	11651.42
	Total	**44594.42**

http://www.cea.nic.in/reports/monthly/installedcapacity/2017/installed_capacity-05.pdf

State-wise InstalledCapacity (MW) As on 31.05.2017

S.No.	State/ UT	Installed Capacity (MW)
1.	Andhra Pradesh	1747.93
2.	Arunachal Pradesh	97.45
3.	Assam	431.23
4.	Bihar	110.00
5.	Chhattisgarh	120.00
6.	Goa	0.00
7.	Gujarat	772.00
8.	Haryana	1948.21
9.	Himachal Pradesh	2798.48
10.	Jammu & Kashmir	2278.98
11.	Jharkhand	191.00
12.	Karnataka	3599.80
13.	Kerala	1881.50
14.	Madhya Pradesh	3223.66
15.	Maharashtra	3331.84
16.	Manipur	88.93
17.	Meghalaya	367.19
18.	Mizoram	34.19
19.	Nagaland	53.37
20.	Odisha	2150.92
21.	Punjab	3781.65
22.	Rajasthan	1930.97
23.	Sikkim	715.00
24.	Tamil Nadu	2203.20
25.	Telangana	2306.60
26.	Tripura	62.38
27.	Uttar Pradesh	3231.03
28.	Uttarakhand	1815.69
29.	West Bengal	1396.00
30.	Andaman & Nicobar	0.00
31.	Chandigarh	101.71
32.	Daman & Diu	0.00
33.	Dadra & Nagar Haveli	0.00
34.	Delhi	723.09
35.	Lakshadweep	0.00
36.	Puducherry	0.00

http://www.cea.nic.in/reports/monthly/installedcapacity/2017/installed_capacity-05.pdf

Identified Hydro Power Potential: State-wise: H.E. Projects in Operation: (Above 25 MW)

Andhra Pradesh				
Sl.No.	**Name of Project**	**Agency**	**Installed Capacity (MW)**	**Year of Commissioning**
1	Upper Sileru I	APGENCO	120	1967-68
2	Upper SileruSt.II	APGENCO	120	1994-95
3	Srisailam	APGENCO	770	1982-87
4	Lower Sileru	APGENCO	460	1976-78
5	N.J. Sagar RBC	APGENCO	60	1983
6	N.J. Sagar RBC Ext.	APGENCO	30	1990
7	N.J. Sagar TPD	APGENCO	50	2017
Arunachal Pradesh				
1	Ranganadi	NEEPCO	405	2001-02
Assam				
1	KarbiLangpi (L. Borpani)		100	2006-07
2	Kopili		100	1988
3	Khandong		75	1984
4	KopiliExtn		100	1996-97
Chhattisgarh				
1	HasdeoBango	CSPGCL	120	1994, 95
Gujarat				
1.	Ukai		300	1974-76
2.	SardarSarovar-CPH		250	2002-03, 04-05
3.	Kadana St. I&II		240	1990-98
4.	SardarSarovar		1200	2005-06
Himachal Pradesh				
	Satluj Basin			
1	i) Bhakra (L)		540	1960, 61
2	ii) Bhakra (R)		785	1966, 68
3	Dehar		990	1977-83
4	Pong		396	1978-83
5	Rampur		412	2014
6	Kol dam (NTPC)		800	2015-16
7	KarchamWangtoo		1000	2011-12
8	Kashang-I (Satluj Basin)		65	2016-17
9	Kashang-II & III(Satluj Basin)		130	2016-17

10	NathpaJhakari		1500	2003-04
11	Baspa-II		300	2002-03,03-04
12	Sanjay		120	1989
13	Shanan&Extn		110	110
	Ravi Basin			
1	BairaSiul		180	1980, 81
2	ChameraSt.I		540	1994
3	ChameraSt.II		300	2003-04
4	Chamera St-III		231	2012-13
5	Budhil		70	2012-13
6	Chanju-I		24	2017
	Beas Basin			
1	ParbatiSt.III		520	2014
2	Bassi		66	1970-81
3	Malana-II		100	2011-12
4	Larji		126	2006-07
5	Malana		86	2001
6	AllainDuhangan		192	2010-11
	Yamuna Basin			
1	Giri Bata		60	1978
Jammu and Kashmir				
1	Salal-I		345	1987
2	Salal-II		345	1993-95
3	Uri		480	1996
4	Dulhasti		390	2006-07
5	Sewa-II		120	2010
6	Chutak		44	2012-13
7	Uri-II (NHPC)		240	2013-14
8	NimooBazgo		45	2013
9	Lower Jhelum		105	1978-79
10	Upper Sindh st-II &Extn		105	2000, 01-02
11	Baglihar-I		450	2008-09
12	Baglihar-II		450	2015-16
Jharkhand				
1.	Subernrekha I&II (Sharda)		130	1977,80
2.	Panchet (Dhauliganga)		40	1959 & 90
Karnataka				
1	Sharavathy	KPCL	1035	1964-77
2	Lingnamakki	KPCL	55	1979-80

3	Bhadra (L) (R) (RBC)	KPCL	39.20	1962-63
4	Kalinadi	KPCL	855	1979-84
5	Kalinadi-I (Supa DPH)	KPCL	100	1985
6	Varahi	KPCL	230	1989, 90
7	Ghatprabha	KPCL	32	1992
8	Kalinadist II (Kadra)	KPCL	150	1997, 99
9	Kalinadist II (Kodasil)	KPCL	120	1998, 99
10	Sharavathy TR	KPCL	240	2000-02
11	Almatti dam	KPCL	290	2003-04,04-05
12	VarahiExtn	KPCL	230	2008-09
13	Jog	KPCL	139.2	1947-52
14	Sivasamudram	KPCL	42	1922, 34
15	Munirabad	KPCL	28	1962-65
16	T.B.Dam	APGENCO	36	1957-64
17	Hampi	APGENCO	36	1958-64
Kerala				
1	Idukki		780	1976 & 1985-86
2	Sabaragiri		300	1966-67
3	Kuttiadi		75	1972
4	Sholoyar		54	1966-68
5	Sengulam		48	1954, 55
6	Nariamanglam&Extn.		70	1961-63
7	Pallivasal		37.5	1940-51
8	Poringalkuttu		32	1957-60
9	Panniar		30	1963-64
10	Idamalayar		75	1987
11	Lower Periyar		180	1996-97
12	Kakkad		50	1999
13	KuttiyadiExtn		50	2001
14	KuttiyadiAddlnExtn		100	2010
Madhya Pradesh				
1.	Indira Sagar (NHDC)	NHDC	1000	2003-04,04-05
2.	Omkareshwar (NHPC)	NHDC	520	2007-08
3.	Gandhi Sagar	MPPGCL	115	1960-66
4.	Bargi	MPPGCL	90	1988
5.	Ban Sagar Tons-I	MPPGCL	315	1990, 92
6.	Rajghat	MPPGCL	45	1999
7.	Bansagar Tons PH-III	MPPGCL	60	2001- 02
8.	Bansagar Tons PH-II	MPPGCL	30	2001-02
9.	Madhikhera	MPPGCL	60	2006-07
Manipur				
1	Loktak	NHPC	105	1983

Maharashtra				
1	Koyna I & II	MAHAGENCO	600	
2	Koyna III	MAHAGENCO	320	
3	Koyna DPH	MAHAGENCO	36	
4	Vaitarna	MAHAGENCO	60	
5	Bhira Tail Race	MAHAGENCO	80	
6	Tillari	MAHAGENCO	60	
7	Koyna St-IV	MAHAGENCO	1000	
8	Bandhardhara-II	DLHP(Private)	34	
9	Bhira	Tata (Private)	150	
10	Bhivpuri	Tata (Private)	75	
11	Khopoli	Tata (Private)	72	
12.	Pench	MPPGCL	160	
Meghalaya				
1	Kyrdemkulai		60	1979
2	UmiamSt.I		36	1965
3	Umiam-UmtruSt.IV		60	1992
4	Myntdu		126	2011
Nagaland				
1	Doyang	NEEPCO	75	2000-01
Odisha				
1	Hirakud I (Burla)		275.5	1956-63, 90
2	Hirakud II (Chiplima)		72	1962-64
3	Balimela		360	1973-77
4	Rengali		250	1985-92
5	Upper Kolab		320	1988-93
6	Upper Indravati		600	1999, 2000-01
7	BalimelaExtn		150	2007-08
8	Machkund		114.75	1955-59
Punjab				
1	Ganguwal	BBMB	77.65	1952, 62
2	Kotla	BBMB	77.65	1956, 61
3	Mukerian St-I	PSPCL	45	1983
4	Mukerian St-II	PSPCL	45	1988-89
5	Mukerian St-III	PSPCL	58.5	1989
6	Mukerian St-IV	PSPCL	58.5	1989
7	A.P. Sahib St.I	PSPCL	67	1985
8	A.P. Sahib St.II	PSPCL	67	1985
9	RanjitSagar (Thein Dam)	PSPCL	600	2000
Rajasthan				
1	R.P. Sagar	RRVUNL	172	1968-69
2	J. Sagar	RRVUNL	99	1972-73

3	Mahibajaj I	RRVUNL	50	1986
4	Mahibajaj II	RRVUNL	90	1989
Sikkim				
1	Teesta- V (NHPC)	NHPC	510	2007-08
2	Chujachen (Pvt)	GIPL	99	2013
3	Jorethang Loop(pvt)	DEPL	96	2015
4	Rangit-III	NHPC	60	1999
5	Teesta-III (Pvt)	TeestaUrja Ltd	1200	2017
Tamil Nadu				
1	Aliyar		60	1970
2	BhawaniKatlai Br-III		30	2013
3	BhawaniKatlai Br-II		30	2006-07
4	BhawaniKatlai Br-I		30	2006-07
5	Kodayar I&II		100	1970-71
6	Kundah I-V		555	1960-88
7	LowerMettur. I-IV		120	1988-89
8	Mettur Dam Tunnel		250	1937-66
9	Moyar		36	1952-53
10	Papanasam		32	1944-51
11	Parson'sValley		30	2000
12	Periyar		161	1958-65
13	Pykara		59.2	1932, 54
14	Pykara Ultimate		150	2005-06
15	Sarkarpathy		30	1966
16	Sholayar I & II		95	1971
17	Suruliyar		35	1978
Telangana				
1.	N.J. Sagar	TSGENCO	110	1978-85
2.	N.J. Sagar LBC	TSGENCO	60	1991, 92
3.	Pochampad	TSGENCO	27	1987, 88
4.	Pridarshanijurala	TSGENCO	234	2007-08
5.	Lower Jurala	TSGENCO	240	2015-16
1.	Srisailam LBPH		900	Pumping Mode-Working.
2.	NagarjunaSagar		705.60	Pumping Mode-Not Working. Works of Tail pool dam completed
Uttar Pradesh				
1	Rihand		300	1962-66
2	Obra		99	1970-71

3	Matatilla		30.6	1965
4	Khara		72	1992
Uttarakhand				
1.	Tanakpur	NHPC	Sharda	94.2
2.	DhauligangaSt.I	NHPC	Dhauliganga	280
3.	Tehri	THDC	Bhagirathi	1000
4.	Koteshwar	THDC	Bhagirathi	400
5.	Dhakrani	UJVNL	Yamuna	33.75
6.	Dhalipur	UJVNL	Yamuna	51
7.	Kulhal	UJVNL	Yamuna	30
8.	Chibro	UJVNL	Tons	240
9.	Khodri	UJVNL	Tons	120
10.	Ramganga	UJVNL	Ramganga	198
11.	Chilla	UJVNL	Ganga	144
12.	ManeribhaliSt.I	UJVNL	Bhagirathi	90
13.	Khatima	UJVNL	Sharda	41.4
14.	ManeriBhali-II	UJVNL	Bhagirathi	304
15.	Vishnu Prayag	JPVL	Alaknanda	400
16.	Shrinagar	GVK	Alaknanda	330

http://www.cea.nic.in/reports/monthly/hydro/2017/state_power-03.pdf

Growth of Renewable Energy in India

Moving Towards Cleaner Energy

Growing concerns over global warming due to fossil fuel burning has made it imperative to look for cleaner and sustainable energy sources. In Paris Agreement, 2015, India committed to achieve certain targets to combat climate change and they are to achieve 40% cumulative electric power installed capacity from non-fossil-fuel-based energy resources by 2030; reducing country's emissions intensity by 33-35% by 2030, compared with 2005 levels and to create an additional (cumulative) carbon sink of 2.5–3 GtCO2e through additional forest and tree cover by 2030. By setting the renewable energy target of 175 GW (100 GW solar, 60 GW wind, 10 GW bio-energy and 5 GW small hydro) to be fulfilled by 2022, Indian government is pushing renewable energy to achieve the Paris targets.

With increasing global population electricity demand is increasing fast. In the year of 2016, India's electricity demand rose to 1142 billion units (1142 billion KWh). Major part of our electricity demand is still being met by coal powered power stations. Installed capacity of India crossed 330 Giga Watts (1000 MW) in the month of May 2017. Thermal (coal, gas, and diesel) based installed capacity accounts for more than half that is 66.8% at 193 GW while solar accounts for 3.98% at 13.11 GW and the share of wind energy is 9.8% at 32.5 GW. Total Renewable energy (solar, wind, bio-energy, small hydro) contributes 17.7% to the total installed capacity of India.

In 2010 solar tariff was too high to be seen as feasible by solar power developers but this year solar tariffs dropped to a level (Rs 2.44/unit bidding for Bhadla solar power project, Rajasthan) where its per unit cost is lower than the per unit cost of coal based electricity. Wind power tariffs also hit a new low when companies recently offered a tariff of Rs 3.46 per unit.

India is endowed with huge solar and wind potential. India's total solar power potential is 772.88 GWp (estimated by National Institute of Solar Energy in 2014) and total wind potential stands at 298.909 GW (according to MNRE). Few states with high solar installed capacities are Tamil Nadu, Rajasthan, Gujarat, Andhra Pradesh, Telangana, Madhya Pradesh, Punjab, Karnataka, Maharashtra and Uttar Pradesh. Some of the largest solar parks of India include Kurnool Ultra Mega Solar Park (Andhra Pradesh) with 1000 MW installed capacity, and Bhadla Phase III (Rajasthan) with 1000 MW installed capacity.

On shore installed capacity in the country is facilitated by on shore winds. A 100 MW off shore wind energy project is in the pipeline. Muppandal windfarm (Tamil Nadu) with 1500 MW installed capacity and Jaisalmer Wind Park (Rajasthan) with 1064 MW installed capacity are among the largest wind parks in India. Gujarat, Maharashtra, Telangna, Karnataka and Andhra Pradesh also have high wind energy potential.

CAGR (Compounded annual growth rate) for renewable energy installed capacity from 2007 to 2017 is 24.9%. In 2007 the installed capacity of renewable sources was 6190.86 MW which increased to 57244.23 MW 2017.

Renewable energy sector creates more employment than thermal power sector. According to Council on Energy Environment & Water and Natural Resources Defense Council, renewable projects are likely to create around 3 lakhs jobs in India by 2022.

INDIA: Renewable Installed Capacity as on 31st August 2017

Renewable Energy Source	Installed Capacity(MW)	Percentage of total Installed capacity (%)
Solar	13114.85	3.98
Wind	32508.17	9.87
Small Hydro	4384.55	1.33
Bio-power	8295.78	2.51
Total	58303.35	17.70

Source: CEA

Installed Capacity of Renewables as on 31st March (MW)

Year	Solar	Wind	Small-Hydro	Bio Energy	Total RES (Excluding Hydro)*	(Hydro)*
2017	12288.83	32279.77	4379.86	8295.78	57244.23	(44478.42)
2016	45924.04	26777.40	4273.47	8110.33	45924.04	(42783.42)
2015	3743.97	23354.35	4055.36	7805.48	38959.1	(41267.43)
2014	2631.93	21042.58	3803.68	7509.81	34988.00	(40531.41)
2013	-	-	-	-	27541.71	
2012	-	-	-	-	24503.45	
2008	-	-	-	-	11125.41	
2007	-	-	-	-	7760.60	
2006	-	-	-	-	6190.86	

Source: CEA

- India’s renewable energy resources were underutilized in the initial years and thermal and hydro-power were the main sources of electricity generation.

India’s Renewable Energy status

		Potential (MW)			**Installed Capacity (MW)**			
No.	**State**	Solar (2014)	Wind	Small Hydro	Solar (as on January 2017)	Wind(as on March 2016)	Small Hydro (as on March 2014)	Biomass Power AS ON 01.04.2016)
1.	Andhra Pradesh	38440	44229	978.40	979.65	1431.45	221.030	380.75
2.	Arunachal Pradesh	8605		1341.38	0.27		103.905	
3.	Assam			238.69	11.18		34.110	
4.	Bihar	11200		223.05	95.91		70.700	43.42
5.	Chattisgarh	18270		1107.15	135.19		52.000	279.9
6.	Delhi	2050			38.78			
7.	Goa	880		6.50	0.05		0.050	
8.	Gujarat	35770	84431	201.97	1159.76	3948.61	15.600	56.3
9.	Haryana	4560		110.05	73.27		70.100	45.3
10.	Himachal Pradesh	33840		2397.91	0.33		638.905	
11.	J&K	111050		1430.67	1.00		147.530	
12.	Jharkhand	18180		208.95	17.51		4.050	
13.	Karnataka	24700	55857	4141.12	341.93	2869.15	1031.658	872.18
14.	Kerala	6110	1700	704.10	15.86	43.5	158.420	
15.	Madhya Pradesh	61660	10484	820.44	850.35	2141.1	86.160	35
16.	Maharashtra	64320	45394	794.33	430.46	4653.83	327.425	1220.78
17.	Manipur	10630		109.13	0.01		5.450	
18.	Meghalaya	5860		230.05	0.01		31.030	
19.	Mizoram	9090		168.90	0.10		36.470	
20.	Nagaland	7290		196.98	0.50		29.670	
21.	Orissa	25780		295.47	77.64		64.625	20
22.	Punjab	2810		441.38	592.35		156.200	155.5
23.	Rajasthan	142310	18770	57.17	1317.64	3993.95	23.850	108.3

24.	Sikkim	4940		266.64	0.01		52.110	
25.	Tamil Nadu	17670	33800	659.51	1590.97	7613.86	123.050	626.9
26.	Telangana	2040	4244		1073.41	77.7		
27.	Tripura	2080		46.86	5.02		16.010	
28.	Uttar Pradesh	22830		460.75	269.26		25.100	842
29.	Uttarakhand	16800		1707.87	45.10		174.820	50
30.	West Bengal	6260		396.11	23.07		98.400	26
31.	A&N Islands	38440		7.91	5.40		5.250	

GLOBAL MARCH TOWARDS RENEWABLE ENERGY

At a time when the world is facing extreme natural disasters triggered by speedy climate change, every nation is trying to cope with it. Greenhouse gas emissions from coal based power stations have a huge role in increasing average global temperature thus prompting climate change at an unprecedented rate. Renewable energy targets are being sought after by nations to balance out the impacts of thermal based energy.

Countries with highest solar and wind installed capacity are China, Japan, Germany, USA, Italy, UK, India, Spain, France, Australia and Brazil. China is moving fast in achieving its renewable energy targets set for 2030. It has one of the largest floating solar panel facilities in the world. In July 2017 China's installed capacity for solar power reached 85 GW which was around 77 GW in 2016 and 198 MW in 2007. China became the world's biggest producer of solar power and it plans to expand it to 110 GW by 2022. It is also the largest exporter of solar modules.

Table 1 shows the worldwide installed capacity of renewable energy sources (Solar, Small-Hydro, Wind, Bio-energy and Geothermal). Asia has got the maximum installed capacity of 817125 MW* among all the regions. Asia's solar installed capacity in 2016 was 139726 MW with an increase in its CAGR from 38.45% (from 2006 to 2011) to 69.39% (during 2011 to 2016). Installed capacity for wind energy for Asia was 184602 MW.

Africa with a huge potential for solar energy has still a long way to go. The continent's installed capacity for solar reached 2973 MW in 2016 with Algeria, South Africa, Ghana, Egypt and Morocco with high installed capacity.

Europe's renewable energy installed capacity was 485465 MW in 2016. Germany, Italy, Netherlands and France have contributed the major share in Europe's solar and wind installed capacity. Germany got 49747MW solar installed capacity and 40988 MW wind installed capacity.

USA's renewable energy progress and targets are facing impasse because of President Donald Trump's announcement of withdrawing from the Paris climate change agreement and his aggressive promotion of coal and oil. America's installed capacity for solar and wind were 34711 MW and 81312 MW respectively in 2016.

Table 1: Renewable Energy Installed Capacity: (MW)

S.No.	Region	2006	2011	2016
1	Africa	22574	27344	38,285
2	Asia	254150	437232	817,125
3	Central American and Caribbean	6531	8418	13,273
4	Eurasia	64112	71559	91,136
5	Europe	245134	359608	485,465
6	North America	189810	242898	330812
7	Middle East	10499	13282	16,494
8	Oceania	16129	19785	26,650
9	South America	131852	151316	192, 912 *
10	World Total	940791	1331442	2012152

Table 2: Solar Installed Capacity: (MW)

S.No.	Region	2006	2011	2016	CAGR % (2006-2011)	CAGR (2011-2016)
1	Africa	61.79	405.4	2973	45.67	48.95
2	Asia	1969	10019	139726	38.45	69.39
3	Central	13.32	105.9	1054	51.38	58.33

	American and Caribbean					
4	Eurasia	2.60	7.82	952.4	24.63	161.28
5	Europe	3330	53253	104590	74.09	14.4
6	North America	1136	6180	37843	40.32	43.68
7	Middle East	1.80	227.5	1500	21.35	45.82
8	Oceania	67.03	1420	5321	84.16	30.23
9	South America	9.84	64.11	1974	45.47	98.4

Table 3: Wind Installed Capacity: (MW)

S.No.	Region	2006	2011	2016	CAGR % (2006-2011)	CAGR (2011-2016)
1	Africa	334.6	1035	3862	25.33	29.88
2	Asia	11060	67740	184602	43.68	22.20
3	Central American and Caribbean	125.14	460	1499	29.73	26.66
4	Eurasia	71.64	1807	5900	90.70	26.70
5	Europe	47980	94881	155342	14.61	10.36
6	North America	12853	51543	96948	32.01	13.46
7	Middle East	66.20	106.9	321.7	10.05	24.65
8	Oceania	1017	2801	5069	4.13	12.59
9	South America	287.3	1743	13598	43.41	50.81

Energy Finance

Financing Energy: changing global trends

Energy is the driver of all life and their immediate world, as well as the entire universe.For cosmic scale energy production and exchanges, an enormous storehouse is already out there, almost beyond human imagination of useable energy. When it comes to energy for human use, we have to depend upon facilities created for converting nature's huge energy stores to useable form, and that is dependent upon the other driver – finance for "buying" those stores and conversion facilities.

Historically, major energy finances shifted from land to wood to coal to oil & gas, with nuclear energy shining for a brief period in the 2nd half of the 20th century. Energy finance winds are changing again in the 21st century. Global energy investments in 2015 was US Dollar 1830 billion, down 8% from 2014, with financing of upstream energy supply at its lowest since 2010 (reasons are more than the global economic downturn). Global investment in the entire fossil fuel chain – from mining to power production was 55% of the total, down from 61% in 2014, while renewables got a marginal increase in value from 16 to 17% (much higher in terms of capacity, due to falling costs). Investments in Energy efficiency and supply both gained by about 2% from the previous year.

While other trends are not very pronounced, the decline in global fossil fuel investment is. Simultaneously, the New-Energy-Market countries are facing another reality – the rise of new "development banks", like the AIIB and NDB, for whom, financing energy infrastructure will be a major part of action. In this evolving scenario, this issue looks at a few aspects of energy financing emerging in our backyard. More will come in future issues.

Changing trends in global energy finance

The year 2015 was called a landmark year in terms of global environmental action. Two global agreements were reached and sealed – both critically concerned with the future environmental health of the earth and the sustainability of nature and human society. The adoption of the 17 Sustainable Development Goals (SDGs) in September 2015, followed by the Paris Agreement on limiting climate threatening temperature rise, in December 2015 – though not considered 'revolutionary' by many as they failed to turn the destructive run of human extraction and consumption – were at least successful at bringing global focus on urgent actions along with identifying what are actions needed.

As energy production and consumption is a major contributor to the GHG emissions and many other environmental and social impacts undermining sustainability, the 2015 global agreements should also have started a major and quick shift away from highly threatening sources and modes of energy operations to much cleaner ones. That also means a shift away from fossil fuels, and from the clearly dangerous nuclear fission process. New financing of energy projects should reflect whether that has started to happen, so let's take a 'brief look at energy financing trends globally', in 2015.

1. The first clear trend, though not as pronounced as it was envisaged, is the percentage reduction in global fossil fuel funding in 2015. At just about USD 1000 billion, it was 55% of the total global energy financing of all sorts, amounting to USD 1830, down from 61% of the total in 2014. This includes everything from mining-extraction to supply to consumption, and was before the two global agreements officially came into being (2016 data will be available a little later).
2. The total energy financing also came down by about 8% from about USD 2000 billion to about USD 1830 billion. This was for several reasons, including the continued economic downturn in Europe, slowdown in coal in China (the biggest player by far), the continued fall in prices of renewables – particularly solar photo-voltaic panels etc.
3. The other big fossil fuels, oil and gas saw the biggest drops in investments, by about 25% from the 2014 levels, and the 2016 preliminary data indicates another 20%+ fall in 2016. Despite these, this sector remains the biggest recipient of financing at about USD 583 billion in 2015. If 2017 also see a drop, that will be a first for this sector, a welcome one.

4. Renewable energy sector also saw an absolute fall in terms of investments, to about USD 312 billion, but in terms of new RE installed capacity, it was an increase from 2014. That continued in 2016 too. One reason is – again – the drastic fall in prices per unit capacity.
5. Energy efficiency investments also saw a healthy rise in its percentage share, reaching about USD 220 billion, from under USD 200 billion in 2014, taking about 12% share of total energy investments. 2016 is continuing this trend. The building sector, including more efficient lighting and appliances, received a hefty investment of about USD 118 billion. This has a much larger effect than investing the same amount in new renewable power.
6. The biggest threat to global climate and sustainability – in the energy sector – comes from coal, and though global coal use fell nearly 5% in 2015, nearly a third of all new power plants in the global pipeline, roughly 1161 GW out of 3165 GW, is still coal based.
7. Acting as a counter measure to the continued major presence of coal power, the renewable energy sector saw an investment of around USD 314 billion (including bio-fuels, solar thermal applications etc). Though this was not a big increase in dollar terms from 2014, the capacity addition was much larger due to falling unit cost. A larger increase in investment is indicated in 2016.
8. The total investment in the electricity generation sector was about USD 420 billion, with renewable electricity receiving about USD 288, or roughly 70% of the total.
9. Unfortunately, driven largely by Chinese investments, coal power financing increased to nearly USD 78 billion, a jump of well over 20%, while the comparatively cleaner fossil fuel, natural gas based power, saw a decline of nearly 40%, to about USD 31 billion. In 2015, China created new coal power capacity of about 52 GW by investing over USD 45 billion.
10. China and the USA remained the two big energy investment countries, despite a steep fall in investment in the USA. Chinese investment in the total energy supply chain touched USD 315 billion, a significant part of it in overseas coal and oil.
11. US investment in the entire energy supply chain dropped to about USD 280 billion – largely because a sharp drop in investment in oil and gas sectors. At the same time, the US investment in new power capacity was almost 90% towards renewable power, accounting for about USD 40 billion.
12. China remained the world's largest investor and installer of renewable energy based power, reaching over USD 90 billion, or about 60% out of its total power generation investment of about USD 146 billion. Wind energy in China received a big boost, and solar thermal reached a healthy figure of USD 15 billion.

13. Another big energy player, the European Union, invested over USD 85 billion in power generation, with renewables accounting for about USD 55 billion, or 85%. New wind power received about USD 30 billion of these.
14. Nuclear power capacity rose by over 10 GW, receiving about USD 21 billion in new investments. This is the highest investment in nuclear power in the last 20 years or so, with China alone accounting for about 32%. In the new nuclear construction also, China is investing over 50% of global total.
15. The networks to supply power or electricity, the grids, also received a big boost in financing, with USD 260 billion coming their way, a near 15% increase from 2014. With the rapid addition of variable renewable power, over USD 30 billion was invested in making grids compatible. Out of this USD 260 billion, about USD 90 billion or 35% was invested to upgrade old networks, as these are creating problems in integrating the renewable loads. The largest investors in grids / networks were China, USA, EU and India.
16. The newest kid in the network horizon is battery storage for variable renewable power, and at over USD 1 billion, it comprised of about 10% of total investments in electricity storage, the rest mostly going to pumped storage projects.With the emergence of Tesla's PowerWall, it is expected that this sector will grow fast, and help balance out some of the variations of renewable power, along with smart grids.
17. As a result of the shift to less carbon intensive power capacity addition, the new power capacity that came online is projected to have a carbon dioxide emission of less than 450 Kg CO2 /KWHr generated, a significant improvement over the existing overall power capacity with CO2 emission of close to 550 Kg/ KWHr. This need to be compared with about 800 Kg/KWHr from coal power plants, and close to 900 Kg/ KWHr from Indian coal plants. If anyone feels elated by this slow improvement, a sobering thought is that, for achieving the Paris Agreements climate target of even the 2 C limit, the global power fleet need to emit no more than 100 KG CO2/KWHr. A very long way to go indeed!

Sources – Multiple, WEI, Banktrack report, OilChange report

New Development Bank

A Preliminary Assessment of Financing Sustainable Development

The New Development Bank was set up in 2014 after an agreement was signed between the BRICS countries during their sixth Summit at Fortaleza (Brazil). The bank has its headquarters at Shanghai, China, and the ex-head of ICICI Bank – Mr K.V. Kamath was chosen as its first President. NDB was set up in the background of the developing country's dissatisfaction with the control of the developed countries over World Bank, Asian Development Bank etc, and also the changed global economic scenario of the so-called "emerging economies" having a much larger share of global GDP and economic activity. The NDB (also known as BRICS Bank) was set up with a subscribed capital of US Dollar 50 billion, or about Indian Rupees 325,000 crores (and an authorized capital of US Dollar 100 billion), the five BRICS countries (Brazil, Russia, India, China and South Africa) holding equal share. It aims to mobilize resources for infrastructure and sustainable development projects in BRICS and other emerging countries, as well as in developing countries.

The second Annual General Meeting of the Bank was recently held in New Delhi, from March 31 to April 02. On this occasion, several civil society consultations on the NDB and its various aspects were organized in different places of India. The People's Forum of BRICS got together a large no of CSOs, from India, Brazil and South Africa, and organized two consultative meetings.

BRICS countries are some of the biggest consumers of energy in the world, as many of these countries are attempting to expand their inadequate infrastructure rapidly, and expanding a country's infrastructure is often energy-intensive. Economic development often requires large-scale industrialization, which has led to a more prosperous economy but also large scale ecological degradation and much more pollution. All five of the BRICS countries rank in the top 20 polluter/polluted countries.

The bank states that it is focused on sustainable development and sustainable infrastructre and allocated 60% of its lending for renewable energy, and approved seven projects worth $1.6billion and six of them are renewable energy projects. Most of its financing being in the renewable energy / electricty sector, and PAIRVI / BCPH having an active program to engage with the energy and climate issues in all their manifestations, it is important for us to

engage with the NDB, do analysis of its policies and investments and possibly help monitor their impacts on the ground.

Renewable energy funding by NDB

Country	Loan Amount	Sector	Impact
India (Canara Bank)	USD 250 m	Renewable energy (wind, solar etc)	500 MW renewable energy/ Avoided 815,000 t CO2/year
China (Lingang)	USD 81 m	Renewable energy (solar rooftop PV)	100 MW Solar/ avoided 73,000 t CO2/year
Brazil (BNDES)	USD 300 m	Renewable energy (wind, solar etc)	600 MW renewable energy/ avoided 1,000,000 t CO2/year
South Africa (ESKOM)	USD 180 m	Renewable energy (transmission)	670 MW renewable energy evacuated (transmitted)/ avoided 1,300,000 t CO2/year
Russia (EDB/IIB)	USD 100 m	Renewable energy (hydro-power) + green energy	49.8 MW renewable energy/ avoided 48,000 t CO2/year
China (Pinghai)	RMB 2 bn (USD 298 m)	Renewable energy (wind power)	250 MW Wind avoided 869,900 t CO2/y

Ref: http://www.ndb.int/projects/list-of-all-projects/

The Bank seeks to promote mitigation and adaptation measures to address climate change, ensures that its financing and investments in infrastructure and sustainable development projects have minimal adverse impact on the environment and people.

CONCERNS

On a closer look at its policies, the crucial Environment and Social Framework (ESF) seems to have many half-way measures and undefined concepts. The operative part of the ESF is divided in two parts – Policies and Standards. It is clear lack of preparation that even the

standards do not have any benchmarks to go by! The other clear departure from established “Safeguards” practices (it is also a concern why the NDB decided to use the word Framework for its environment and social policies, rather than Safeguards) is the lack of a Compliance Mechanism. The NDB vaguely mentions that it will engage with the client in trying to ensure compliance, but do not offer a clear Mechanism (like the Inspection Panel of the WB, the CAO of the IFC, CRP of ADB etc).

As one of the major areas of the Bank’s financing is solar energy, and solar energy is highly land intensive (being a dilute / dispersed source of energy) -- forced displacements / “involuntary resettlements” are likely in many such projects. Thus, a strong “involuntary resettlement” policy and standards with defined compliance procedure was urgently needed, but is lacking. Another concern is about the Finacial Intermediary or FI category projects. For example, in the first round, NDB funded the Canara Bank to the extent of USD 250 million for renewable energy, but a look at the environmental sustainability policy of Canara Bank is very disappointing, with the usual CSR (Corporate Social Responsibility) occupying almost all space, with a splashing of the word – Sustainable Development added in several places. No clarity of any accountability mechanism, nothing on involuntary resettlement.

Main concerns raised by social groups gathered for the consultative meetings include lack of transparency, accountability, grievance redress mechanism etc. Renewable projects involve large scale displacement of people and infringement of human rights. Projects in the guise of sustainable development might destroy livelihoods of people. Bank has not even defined the concept of Sustainable infrastructure. This leaves the door open for investments which are purely profit oriented and not completely sustainable in nature. Another concern is that of 'Climate proofing of infrastructure' which protects the investments from the climate change not the people who are at the receiving ends.

It is still early days for the NDB and its possible impacts, but having started with big mandates, the likely impacts are also cause of concern. We hope that the civil society will keep a constant vigil on NDB, as it has done for other MDBs, and ensure that impacts of its infrastructure financing are minimized and sustainability benefits maximized.

COAL CURRENCY:

PEOPLE'S MONEY IS BEING USED TO OUST THEM

(Report by Centre for Financial Accountability)

Coal Currency report is based on research, it has done a mapping of coal project finance in India, in which it has focused on project finance aspect, like looking at financial institutions and loans provided to these coal projects by them. In the research, the project data was taken from MoEF website between years 2005 to 2015. The data shows that in this period MoEF blindly accorded the environment clearance (EC) to thermal power plants. The total number of coal power projects secured EC or ToR (Terms of Reference) between 2005 and 2015 are 794. Out of which details of 723, with total capacity of 686,119 MW are available. While these projects are built/coming up in a spread of 23 states, more than half the capacity (3,50,000 MW) is located in five states - Andhra Pradesh, Maharashtra, Madhya Pradesh, Gujarat & Tamil Nadu. That shows the crazy interest of the government and corporate towards coal and concerns towards climate change. This report is looking at projects with capacity of 1000 MW or above. The total number of such projects is 186. Despite using commercial database, annual reports, balance sheets and filing over 100 Right to Information applications, information about 61 projects were

unavailable. Hence the data provided in this report is that of 125 projects, with total capacity of 2,42,968 MW. These 125 projects are spread in 15 states. Of the 125, 57 are public sector projects and private corporations run 68 of them.

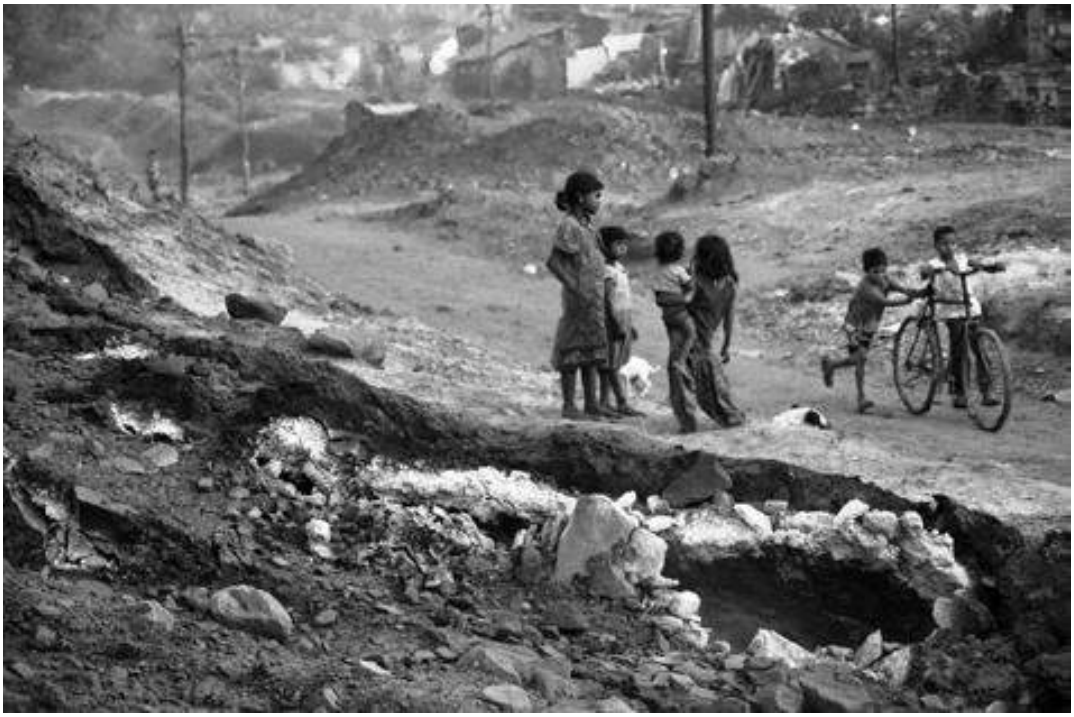
The *STATES*

As mentioned before, the 125 projects whose financial details are available are spread in 15 states. States with maximum number of mega projects are the coal rich states. Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Telangana and Maharashtra account for 99.08% of the total coal reserves in the country. Telangana has 3 projects, with a capacity of 5600 MW approved since the state was formed in 2014. Financial data of these projects were unavailable and hence is not included in this mapping.

State Name	Loan	No. of Projects	Total Capacity
Andhra Pradesh	83,377	14	30,670
Bihar	27,845	4	11,620
Chhattisgarh	89,676	18	35,720

Gujarat	43,750	6	15,380
Haryana	13,108	3	5340
Jharkhand	29,188	5	6010
Karnataka	27,082	6	11,740
Madhya Pradesh	83,958	13	28,850
Maharashtra	48499	12	24140
Odisha	34534	9	13970
Punjab	12737	3	5240
Rajasthan	34797	5	8740
Tamil Nadu	38905	10	15510
Uttar Pradesh	44768	11	20528
West Bengal	24635	6	9510
Total	636860	125	242968

The report is mainly looking into two parts, viz. one it is showing that number of projects above 1000 MW, out of which some projects already exist on ground. By adding the capacity will force them to grab more land and mining more coal, the upcoming projects will also grab thousands of acre land which will lead to large displacement, loss of livelihood, natural resources, and environmental degradation. And second part explains show which financial institutions are serving these projects which led to such calamities.



ENERGY PLAN OF INDIA

India is the 3rd largest electricity producer in the world after, China and the USA, with a production of 1,208,400 GWh (2014), though this is only about 22% of China's electricity production. As of March 2016, about 61% of the country's installed capacity was coalfired, 14% came from hydropower, 14% came from other renewables (mostly wind, small hydro, Solar photovoltaic and biomass), 8% from natural gas, 2% from nuclear, and 1% from diesel. In the name of electrifying and accessibility to all households over the next five years, the Government of India always considered coal as the main source of electricity and its security in country. While the Government of India is saying that by 2022 the country will not build any new coal fired plant, shifting its focus instead to install 175 GW renewable capacity. But it is not telling what it has done in the last many years. If we look at the last 10 years record of MoEF, and the Ministry of Power projection tells you a true story of colossal expansion of this capacity around 7,02,000 MW which is more than double of the current installed capacity. A Report tittle "Thermal Power Plants on The Anvil" says that the Ministry of Environment and Forest (MoEF) has "accorded environmental clearances to a large number of coal and gas-based power plants whose capacity totals 1,92,913 MW. Another 5,08,907 MW are at various stages in the environmental clearance cycle. It is extremely rare for a thermal power project to be denied Environment clearance. This means that there are around 7,01,820 MW of coal and gas plants waiting to be built in the coming years. Coal based plants account for an overwhelming 84% of these in pipeline projects. India's Declared plan is to add another 93000 MW from Solar power, 34,000 MW from Wind Power, 12,000 MW from other renewable power. If we take this repeatedly declared plan (also submitted to UN before the Paris summit on climate change as part of India climate action commitments), India does not need to build a single Coal, Nuclear or Big-hydro power plant till at least 2026-27, that is for at least another 10 years.

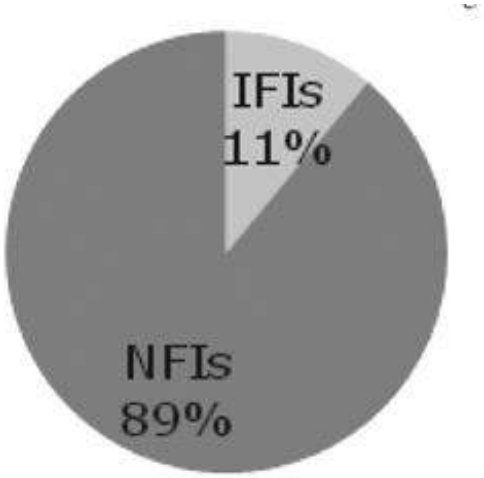
LENDING MONEY TO COAL PROJECTS

A coal fired power project of 1000 MW capacity needs huge volume of capital. The share of private playershas risen up more than twelve times in the last fifteen years in electricity sector. They are entirely dependent on large lenders, including national and international, commercial banks and export credit agencies, multilateral banks, private equity, bonds etc. Some researchers investigating into coal finance have brought forth the fact that commercial banking sector, operating at transnational level is very much keen on investing in such projects, especially in developing economies like China, India or Brazil. Multilateral agencies like World Bank, despite

making public announcements on not financing coal projects except in "rare circumstance" have been found continuing financing coal projects through financial intermediaries, or financing associated facilities. The Report shows that the total lending for 125 projects in

the last ten years is Rs. 6.31,574 cr. However, the details are only accessible for Rs. 4,82,648 cr. Out of the total available data, international financial institutions contributed Rs. 51,026 cr 11% while the share of national institutions – both commercial banks and non-banking financial institutions is 89%, totaling Rs. 4,31,622 cr. Out of the national institutions, non-banking institutions contributed Rs. 2,78,158 cr, while commercial public sector banks and private banks contributed Rs. 1,37,877 cr and Rs. 15,587cr respectively.

Share of IFIs and NFIs in Coal Financing



INTERNATIONAL FINANCE INSTITUTIONS IN COAL PROJECT FINANCE

The report shows that there are a total of 22 International finance Institutions financing for 63 projects, but data is accessible for only 58 projects, and their contribution is almost 11% (51,026cr) in the sector. The report says that top five IFIs include China Development Bank (15918 Cr), Japan Bank for International Cooperation (5242cr), US Exim Bank (4300cr), Korea Exim Bank (4064cr) and Royal Bank of Scotland(3842cr) respectively. The above data shows that major Investments are coming from Asia-based IFIs in the sector. Even lending amount of China Development Bank is bigger than other five institutions. It is almost little less than what other four institutions loan to the sector. It has been observed that Chinese financial institutions has increased their lending, especially Chinese commercial banks in the energy sector across world. Despite being there, lending data of Bank of China and Industrial Commerce Bank of China is out of reach from public domain. Also International financial institutions come with

certain conditions along with project finance, they want to tie up with their home country corporations for other services like supplying equipment and technical support in projects. Henceforth, it is important to look at their involvement in coal fired thermal power sector

in India. Export Credit Agencies, commonly known as ECAs and Export Import (ExIm) Banks are public agencies and entities that provide government-backed loans, guarantees and insurance to corporations from their home country that seek to do business overseas in developing countries and emerging markets. Hence lending from the ECAs comes with riders. For example,

The Japan Bank of International Cooperation's loan to NTPC included such a clause:

These loans are intended to finance the NTPC to purchase, from Toshiba JSW Power Systems Private Limited, which is a local subsidiary of the Toshiba Corporation (TJPS) in India, Toshiba Corporation (Toshiba) and Ebara Corporation (Ebara), system turbine generators (produced by TJPS and partially by Toshiba), and boiler feed water pumps (produced by Ebara) in order to construct supercritical coal fired power plants (3x800 MW) in the Kudgi district of the Karnataka state in Southern India.

When Exim Bank of US approved a loan of USD 917 million to Reliance for their 3,960 MW Sasan Ultra Mega Power Project, similar clauses were also in place. According to the agreement, Reliance was supposed to buy coal mining equipment from US companies like Bucryus.

The report says that China Development Bank might be the biggest investors in the sector but as far as investment in number of project is concerned, RBS which has invested in maximum number of 9 projects, totaling to Rs.3843cr. After RBS, it is SBI New York which has loaned 8 projects with loans amounting to Rs.1210.8cr. Subsequently, Barclays Bank has invested Rs. 1268 cr in 6 projects, just as Bank of Tokyo Mitsubishi also loaned to 6 projects amounting Rs.1358 cr. Sixth largest investor in the sector is Asian Development Bank and Kreditanstalt für Wiederaufbau (KfW), China Development Bank and JBIC are in top five investors in maximum number projects, four project each.

It is important to note that multilateral financial institution (World Bank-Rs.2200cr, ADB-Rs.3583cr) has financed less than what the above mentioned five institutions have lent to the sector, though their presence gives leverage to other financial institutions to invest in the sector.

NATIONAL FINANCIAL INSTITUTIONS PROJECT FINANCE IN COAL

National Financial Institutions are playing a key role in project financing in coal power plant in India. According to the report of Bank Track "Banking on Coal" since 2005 – the year the

Kyoto Protocol came into force, commercial banks have channelled almost 165 billion Euros to world's top coal mining companies. Out of this total, 74.4 billion Euros were provided through direct lending (corporate loan or revolving credit facilities) and 90.2 billion euros were provided through investment banking.

The report shows that total 51 national financial institutions of India which includes public and private commercial banks, non-banking institutions contribute almost 89% in the coal projects. After digging out number of reports and website, a tiny information of 49 institutions have their presence in the report, out of which 9 institutions have invested more than five thousand crore. 40 among them invest upto Rs. 5000 cr.

The report says that total 32 public sector commercial banks' lending is Rs.1, 37,877 cr in coal projects. One of largest public sector commercial bank, State Bank of India and associates have made investmentsof more than 14% of total amount, totaling Rs.69353cr, in the public sector commercial bank, almost 12.5% of total amount is financing by SBI alone to coal project, totaling 59650cr, which is more than IFIs loan, followed by IDBI and Punjab National Bank. India's banking industry has witnessed a surge in the level of NPAs in recent months, all these three banks figure in the top 10 public sector banks, with high non-performing assets (NPAs). In 2014, State bank of India was going to lend over INR: 6000 cr to Adani group for mining in Australia. It is essential to know that when the debt for this group was denied by more than six international banks,why did SBI show keen interestin providing loan to Adani.. In the same year SBI was worried due to investments worth INR 5 lakh crore are stuck in power projects, due to Supreme Court order to cancel 214 coal mines. The same mines were re-auctioned by current NDA government.

Public and private commercial bank often lead a consortium like the cost of construction of a 3960 MWs sasan coal fired UMPP own by Reliance power Ltd is INR23000 Cr equal to USD 4 billion in India. More than 16 national and international financial institutions have financed the Reliance Power and SBI is a lead lender in consortium of PFC, REC, IIFCL, Bank of Baroda, Corporation Bank, PNB, IDBI, United bank, Bank of India, Union Bank, Andhra Bank and Axis Bank.

Further, the report says that Power Finance Corporation and Rural Electrification Corporation, the two nonbanking institutions are highest investors in the coal power projects, both PFC and REC together share 58% of total amount loan to Coal Projects. The purpose of setting these institutions is to lend in the energy sector. It is important to note that where such institution are being paid from to lend to the sector. Other nonbanking institutions are HUDCO, LIC and SIDBI, whose purpose of setting was different, though they are investing in coal power projects.

However, Private commercial banks in India are small players when it comes to coal project financing. ICICI Bank contributes 2.5% of total investment in the sector, amounting Rs.12050 cr over the period of 2005-2015 in 5 projects. Despite investing in 6 projects, Axis Bank, which comes next in the list, is making only one fifth of ICICI's investment in the sector. In fact, other six including Kotak Mahindra Bank, HDFC, Karur Vysya Bank, Yes Bank, TMP and federal bank, taken together have loaned 2363.67 crs in the sector.

THE PROJECTS

Out of the 125 projects mapped in this report, further narrowing has been done to look closely at some big projects. Projects with capacity of 3000 MW and above are separately looked into. There are 17 of them. Private corporations own 9 of them and 8 of them are public sector projects.

Parent Company	**Project Name**	**Total Capacity (MW)**	**Project Cost (crore)**	**Loans (crore)**
Reliance Power Ltd.	Krishnapatanam UMPP	4000	17450	13,125
APPGCL	Vedarevu UMPP	4000	19804	6250
NTPC*	Barh STPP Expn	3300	16,041	8693
Jas Infra Power Ltd.	Jas Infra TPP	4000	10,602	7236
Jindal Power	O.P. Jndal TPP	3400	13,500	10,057
KSK Power Ltd.	Akaltara Mahanadi PP	3600	16,190	12,279
NTPC*	Lara Super TPP	4000	11,846	406
TATA Power	TATA Mundra TPP	4000	20,729	15,594
Adani Power Ltd.	Mundra Kutch TPP	4620	NA	11,018
NTPC*	Kudgi STPP	4000	15,166	2716
Reliance Power Ltd.	Sasan UMPP	3960	23,000	21,912
NTPC*	Vindhyachal TPP Expn	4260	5915	1426
NTPC	Gaarwara STPP	3200	11,638	295
Chitrangi Power Pvt. Ltd.	Chitrangi TPP	3960	20,000	15,000
Adani Power	Tirora Thermal Power Plant	3300	15,554	12,433
MAHGENCO*	Chandrapur TPP	3340	5500	1435

NTPC*	Rihand TPP	3000	6231	1358
Total		**63940**	**2,29,167**	**1,41,232**

* Expansion projects. While the additional capacity makes it above 3000 MW, project cost considered here is only for the additional capacity, not for the total project.

To conclude, a few points are noteworthy. A farmer takes a loan, before he gets loan in his hand; he has to spend his half of loan in commuting and pleasing the bank officers. Though, he never thinks during putting his money in the bank account. It is an alarm juncture where thousands of farmers are forced to suicide by Banks due to not paying tiny amount of loan. On the other hand same bank availing the loan to corporates, even though they are sitting on large amount of previous loan.

Whose money is it that the financial institutions are lending to corporates?, People should take stock of it and raise question, where such financial institutions are receiving money. For example, LIC receives money from people under various life insurance schemes. People deposit their hard earn money in their bank account. This means that indirectly people's money is being used for building such projects, or we can say that people's money is being used to oust them from their ancestral land, access to natural resources and to displace them and steal their resources. Despite using people's money, there is no accountability towards people and they do not have social and environment security policy to safeguard people's interest. Neither is there any strong central mechanism where people's voice can get space for such irresponsible finance by these financial institutions. International Financial Institutions at least have their own social and environment frameworks, where people's voice gets space, though implementation is very poor.

THE FOUR TIGERS

China, India, Indonesia and Vietnam have the world's four biggest coal power project pipelines. Together, they represent 82% of the 718 units globally under construction.

Table: Coal power plant projects, number of generating units

Country	**Proposed**	**In Construction**	**Total**
India	297	149	446
China	795	384	1,179
Indonesia	87	32	119
Vietnam	56	24	80
WORLD	1,739	718	2,457
All Four Countries			
Number of units	1,235	589	1,824
Share of world, %	71.02%	82.03%	74.24%

Source: Global Coal Plant Tracker, December 2015

Renewable Energy Finance

SOLAR FINANCE (TAKEN DIRECTLY FROM THE SOURCE)

FDI inflows in the Indian non-conventional energy sector between April 2000 and March 2017 stood at US$ 5.2 billion.

Some major investments and developments in the Indian renewable energy sector are as follows:

- The Cabinet Committee on Economic Affairs, Government of India, has approved the issue of 139 million fresh equity shares of Indian Renewable Energy Development Agency (IREDA) of Rs 10 (US$ 0.15) each through an Initial Public Offer.
- Tata Capital Ltd and International Finance Corporation (IFC) have invested Rs 200 crore (US$ 31.0 million) in their joint venture (JV), Tata Cleantech Capital Ltd (TCCL), to increase its loan book for investing in renewable energy projects.
- The Asian Development Bank (ADB) and the Punjab National Bank (PNB) have signed a financing loan worth US$ 100 million, which will be used to support solar rooftop projects on commercial and industrial buildings across India.
- India's first ever multi-modal electric vehicle project has been launched at Nagpur, which will bring together a fleet of 200 electric vehicles including taxis, buses, e-rickshaw and auto rickshaws, on cab aggregator Ola's app platform in Nagpur.
- Private equity (PE) investment firm, Actis LLP, is planning to invest about US$ 500 million in Solenergi Power Pvt Ltd, its second renewable energy platform in India.
- Larsen & Toubro (L&T) Construction bagged an order worth Rs 5,250 crore (US$ 814.6 million) from Qatar General Electricity and Water Corporation (Kahramaa) for electricity transmission and expansion of network.
- The Government of India and the Asian Development Bank (ADB) have signed a loan agreement for US$ 175 million to be provided to Power Grid Corporation of India Limited (PGCIL) for construction of interstate transmission systems for solar power projects which will enable the transfer of surplus solar energy to power-deficit states.
- The Government of India and the Government of UK plan to jointly invest up to GBP 240 million (US$ 298.95 million) in an India-UK fund, which will invest in India's energy and renewables sector.

- Greenko Energy Holdings has raised US$ 155 million from its existing investors, Abu Dhabi Investment Authority (ADIA) and Singapore's sovereign wealth fund GIC, which will be utilised for expanding its clean energy portfolio to 3 gigawatts (GW) from 2 GW at present.
- Renewable energy company ReNew Power has announced securing US$ 390 million debt funding from its existing investor Asian Development Bank (ADB), and will use the funds to develop and expand capacities of 709 megawatt (MW) across various states of India.
- International Finance Corporation (IFC), along with IFC Global Infrastructure Fund, the private equity fund of IFC Asset Management Company, has announced investment of US$ 125 million equity in Hero Future Energies, which will help the firm set up 1 gigawatt (GW) of greenfield solar and wind power plants.

Source: https://www.ibef.org/industry/renewable-energy.aspx

Just Energy Transition

The Energy Transition has Started: But is it Just and Sustainable?

Increasing Climate Change crisis, severe Air and Water Pollution, an emerging Public Health crisis, massive Water Depletion, wide-spread Deforestation and Displacements due to coal mining. There are a thousand urgent reasons to quickly change our energy systems from Coal, Oil and gas, to cleaner and safer renewable sources. And as this issue of our newsletter investigates - that part of the Energy Transition has started, probably in right earnest.

Is that all we wanted? The change that is happening fast, is also causing pains in other forms, to tens of thousands of small farmers, villagers and such. Solar energy being a diluted form, it requires large amounts of land for big capacities, and the people losing land by the thousands of hectares, are the same small farmers and villagers who lost land and water resources to coal mines and coal power plants! The companies taking this land for their plants, are also the same as those who used to take for big coal mines and power plants.

Why can't these farmers and village people be helped to form cooperatives to put up these solar plants, running them along with their other activities, on their own pooled lands? The commercial banks lend to big corporate solar companies, they can do so to these cooperatives as well. After all, it is our money, their money, and our power needs that are supposed to be met. Out of the 100,000 MW Solar PV target by 2022, 40,000 MW was supposed to be from grid-connected rooftop systems, which is not going ahead much. This is despite a drastic fall in PV panel prices - to about INR 54,000 per KW, the notification of Net-metering norms /rules in almost all states and empanelment of well over 1000 certified installers.

Yes, the Energy Transition has started, but it has to put communities and people's needs at the centre, and be much more inclusive to be just and sustainable. We need to rethink and re-plan the policies and implementation strategies. Else, the Goal 7 of SDGs will end in another farce, an energy market glut with millions of displaced, deprived energy-starved people all around. And the last few Energy Commons will end up as private property - a scary possibility.

Excerpts from TERI report: Transitions in Indian Electricity Sector (2017-2030)

The report titled, 'Transitions in the Indian Energy Sector - Macro Level Analysis of Demand and Supply Side Options' was released by Piyush Goyal, minister for power, coal, new and renewable energy and mines, at a conference organized by TERI. TERI is a Delhi-based think tank working on environment and energy issues. The project team was lead by A.K.Saxena.

The Indian electricity sector is presently going through a major transformation. The electricity supply potential is greater than the economic demand, a scenario witnessed never before in the history of the Indian electricity sector. The Energy and Resources Institute (TERI) has initiated a study to bring out possible transitions which could address the changing demand and supply scenarios.

INTRODUCTION

Per-capita consumption of electricity in the country (1,075 units in 2015–16) remains much less than the world average. For example, as per IEA statistics, per-capita consumption of electricity in India in 2011–12 was 884 units compared to the world average of 3,024 units.

Electricity consumption pattern in the country is set to witness further transition because of Government Initiatives, such as 'Power for All', 'E-mobility', 'Make in India', Demand Side Management, Energy Efficiency, and Energy Conservation measures.

The electricity generation in the country has also witnessed increased growth during the last few Plan periods with CAGR of 5.16% in 10th Plan (2002–07), 5.77% in 11th Plan (2007–12) and 6.0% in 12th Plan (2012 to 2015–16). The generation mix has also been witnessing a change with increasing penetration of renewables; the contribution of renewables becoming noticeable during the last five years and constituting about 5.5% of the total generation in 2015–16.

The energy choices in the country in the coming years are to be governed by INDC commitments, energy security, long-term sustainability, enhanced electricity access, reliability of power, and environmental and social considerations.

DEMAND PATTERN ANALYSIS AND FUTURE SCENARIO

The electricity sector in India has experienced considerable growth in the last two decades encompassing all consumer sectors from residential to industrial as well as agricultural. Growth in average per capita income levels, urbanization levels, improved electricity access, increased economic activity, and greater electrification impacting end use demands, such as agricultural practices, are some of the factors that have contributed significantly to the growth in electricity demand as well as changes in patterns of electricity consumption across the country.

DEMAND ANALYSIS

The analysis revealed that, in the past 15 years, electricity demand at the national level was strongly correlated with total GDP and its components and derivatives including industrial GDP, agricultural GDP, and per capita GDP. Analysis at state level however brought out findings which varied widely from the national-level results. This is particularly true at the sectoral level as the socio-economic parameters, and therefore, the sectoral activity level varies across states and leads to diverse demand patterns.

The total electricity requirement has been assessed to increase from 1,115 BU in 2015–16 to 1,691 BU in 2021–22 and 2,509 BU in 2026-27 with a CAGR of 7.66%. The per capita consumption increases from the prevailing level of 1,075 kWh to 1,490 kWh in 2021–22, 2,121 kWh per annum in 2026–27 and 2,634 units per annum in 2029–30.

SUPPLY SIDE ANALYSIS AND DEMAND – SUPPLY SCENARIO

The power sector in India has been heavily dependent on fossil fuels (mainly, coal, lignite, gas and diesel). In 2016, coal-fired power plants had a share of more than 60 per cent in the country's installed capacity mix, followed by hydro and renewables constituting ~ 14.2% each. Going ahead, it is expected that the share of renewable in the generation mix will significantly increase, given the programmed capacity addition of renewables. The

aggregate capacity of renewables is envisaged to increased 175 GW (PIB, 2015). As per this target, solar capacity is expected to increase from 5 GW in 2016 to 100 GW in 2022. Of this, 60 GW capacity is expected to be installed as ground mounted solar power plants and 40 GW is expected to be installed as rooftop solar. Installed wind capacity is expected to increase from 26.8 GW in 2015-16 to 60 GW in 2022. Moreover, capacity addition is also expected in bio-power (10 GW) and small hydro-power (5 GW).

METHODOLOGY

Two stylised scenarios have been considered to assess energy balance from 2017 to 2030. The first scenario takes into consideration higher capacity addition of renewables. Keeping in view the challenges associated with quantum jump in renewable capacity addition contemplated by the Government of India, another scenario with a lower trajectory of RE capacity addition has been considered. The study takes into consideration capacity addition and generation from wind and solar sources only, considering that the generation from bio power, small hydro and waste-to-energy is not substantial in the energy mix.

HIGH RENEWABLE GROWTH SCENARIO (HRES)

Under this scenario, renewable capacity addition is given higher priority than other sources of power. Considering the quantum of renewables planned to be added to the grid, it is here in that by 2027, issues pertaining to managing the variable and intermittent nature of renewable generation would get addressed. It is also assumed that energy storage technology would become viable beyond 2027 such that the price of electricity from renewable energy storage achieves parity with the price of electricity generated from domestic coal sources at prices below INR 5/kWh.

The high renewable energy scenario is based on the premise that capacity from renewable energy meets target capacity addition of 175 GW by 2022. Beyond 2022, a capacity addition of 25 GW per year has been assumed for renewables (wind and solar) until existing capacity meets anticipated demand.

Capacity of coal and lignite plants is expected to increase from ~185 GW in 2015–16 to ~248 GW in 2021–22, after accounting for retirement of 5200 MW inefficient coal-based thermal power plants which are more than 25 years old. Gas-fired thermal power plants are

expected to see a capacity addition of 126 MW in 2016-17 and a further capacity addition of ~4.3 GW.

LOW RENEWABLE ENERGY SCENARIO (LRES)

In this scenario, a lower trajectory renewable capacity has been assumed in view of the challenges to be addressed and lack of certainty about solar plus battery prices achieving grid parity.

IMPACT ON COAL

Considering the decreasing share of generation from coal-based power plants and the expected capacity addition until 2022, the PLF of coal power plants is seen falling from 62% in 2015-16 to ~54% in 2022. Beyond 2022, the PLF is seen increasing given the retirement of coal plants which are older than 25 years (CEA, 2016).

High Renewables Scenario

IMPACT ON RENEWABLES

In HRES, the share of coal-based installed capacity decreases from 49% of the total installed capacity in 2022 to ~18% in 2030, while the share of installed capacity of renewables increases from 32% in 2022 to 72% in 2030. The share of installed capacity of solar plant alone in 2030 comes to ~45% of the total capacity. The share of wind installed capacity meanwhile increases from 12% in 2022 to 27% in 2030. Considering that unmet demand from 2027 is met from renewables.

Table ES-1

	Generation (BU)						**Installed Capacity (GW)**					
	High RE Scenario			**Low RE Scenario**			**High RE Scenario**			**Low RE Scenario**		
	2021-22	2026-27	2029-30	2021-22	2026-27	2029-30	2021-22	2026-27	2029-30	2021-22	2026-27	2029-30
Renewable Energy	274	678	1102	186	379	511	160	470	853	110	210	284

(W+S)												
Non RE excluding Coal	236	303	310	236	303	310	98	114	114	98	114	114
Coal	1182	1528	1763	1270	1827	2354	248	218	218	249	218	474
Total	1692	2509	3175	1692	2509	3175	506	802	1185	457	542	872

Table ES-1 shows the generation and installed capacity in the period till 2030 under the two scenarios

CONCLUSIONS

The Indian electricity sector is witnessing a major transformation in respect of demand growth, energy mix and market operations. Analysis of the demand during the past 15 years shows that the demand is strongly influenced by various economic factors. These are also found to vary among states, depending upon the economic activity predominant in that state warranting detailed econometric studies for the states.

The results indicate that the energy that would be available from RE sources, storage hydro, nuclear and gas plants (existing as well as those planned/committed) would suffice for meeting the remainder of the demand for electricity at the national level during the next 7-8 years. This would in other words mean that no new coal plants would be needed and the plant load factor (PLF) of coal based plants would be in the range of 78-80% in 2024–25 and 2025–26.

Energy Statistics 2017

(Source: Ministry of Statistics & Planning)

1. Total estimated coal reserves (Proved, Inferred and Indicated) increased by 0.7% over the last year and were 308.80 billion tonnes (as on 31.03.2016).
2. Estimated reserves of crude oil in India were 621.1 Million Tonnes as on 31.03.2016 against 635.60 million tonnes on 31.03.2015 which shows a decrease of 2.28% over the year.
3. Estimated reserves of Natural gas in India were 1251.9 Billion Cubic Meters in 2015 which decreased by 1.97% over the last year and were 1227.23 Billion Cubic Meters as on 31.03.2016.
4. Total Potential for Renewable energy as on 31.03.2016 was estimated at 1198856 MW. Solar Power Potential was 748990 MW, Wind Power Potential was 405023 MW and Small Hydro Power Potential was 19749MW. On account of solar power potential, Rajasthan, Gujarat and Maharashtra have the highest share of renewable energy potential.
5. As on 31.03.2016 a total of 586065 villages were electrified* accounting for 98.1% of the total villages in the country.
6. Due to poor quality of Indian coal, import of coal has increased from 43.08 Million tonnes (in 2006-2007) to 199.88 Million Tonnes (2015-2016). Coal imports of India dropped to 160.16 Million Tonnes with a decline of 20% during 2016-2017
7. The gross import of electricity (from Bhutan) has increased with a CAGR 5.90% during the period of 2006-2007 (2957 GWh) to 2015-2016 (5244GWh). Export from India (mainly to Nepal and Bangaldesh) has increased from 216 GWh (2006-2007) to 5150 GWh (2015-2016).
8. Estimated Crude oil imports in 2006-2007 were 111.50 Million Tonnes which rose to 202.85 Million tonnes in 2015-2016. Import of crude oil has increased by 8.1% over the last decade.
9. With a decadal growth rate of 14.3% natural Gas imports rose from 6.81 Billion Cubic Meters during 2006-2007 to 16.58 BCM during 2015-2016.
10. Net electricity generated in India rose from 627077 GWh in 2006-2007 to 1088282 GWh in 2015-2016 which is an increase of 7.35% over the last decade..
11. Maximum consumption of raw coal is in electricity generation followed by steel industry then cement industry and iron industry.
12. Electricity consumption shows a decadal growth rate of 11.9% and it increased from 455749 GWh during 2006-2007 to 1001191 GWh during 2015-2016.

13. Of the total electricity consumption industry sector accounted for 42.30% followed by domestic (23.86%), agriculture (17.30%) and commercial sector (8.59%).
14. During 2015-2016 share of coal in primary energy supply was 53.91%.
15. Transport sector accounted for 7.33% of total energy consumption.

*Electrified villages do not reflect that every house in a village is getting electricity. It represents only infrastructural presence of electricity. According to Govt. of India, a village would be declared electrified if distribution transformer and lines are provided in the village and 10% of the total households of a village are electrified.

India-Energy Policy

Salient Features of draft NEP

1.1 With nearly 304 million Indians without access to electricity, and about 500 million people, still dependent on solid bio-mass for cooking, it may be acknowledged that the country has to still go a long way on securing its energy security objective.

1.2 The National Energy Policy (NEP) aims to chart the way forward to meet the Government's recent bold announcements in the energy domain. All the Census villages are planned to be electrified by 2018, and universal electrification is to be achieved, with 24x7 electricity by 2022. The share of manufacturing in our GDP is to go up to 25% from the present level of 16%, while the Ministry of Petroleum is targeting reduction of oil imports by 10% from 2014-15 levels, both by 2022. Our NDCs target at reduction of emissions intensity by 33%-35% by 2030 over 2005, achieving a 175 GW renewable energy capacity by 2022, and share of non-fossil fuel based capacity in the electricity mix is aimed at above 40% by 2030.

1.3.1 Changes in the energy mix

The world is moving away from overwhelming dependence on fossil fuel, and within the fossil fuels, away from coal and oil in favor of gas. Against an 88% total share of fossil fuels globally in the primary energy mix in the year 2005, the same fell to 86% in the year 2015.

1.3.4 Maturity of renewable energy technologies

The sharp decline in the prices of wind and solar technologies in the recent years by about 60% and 52% respectively between 2010 and 2015 (in kWh terms), has led to a change in the relative importance of energy sources.

Four key objectives:

1. Access at affordable prices: Considering poverty and deprivation in India, access to energy for all at affordable prices is of utmost importance. The policy aims to ensure that electricity reaches every household by 2022 as promised in the Budget 2015-16 and proposes to provide clean cooking fuel to all within a reasonable time.

2. Improved security and Independence: Improved energy security, normally associated with reduced import dependence, is also an important goal of the policy. India is heavily dependent on oil and gas imports while also importing coal. In so far as imports may be disrupted, they undermine energy security of the country. Energy security may be enhanced through both diversification of the sources of imports and increased domestic production and reduced requirement of energy.
3. Greater Sustainability: The policy lays heavy emphasis on de-carbonization through the twin interventions of energy efficiency and renewable energy.
4. Economic Growth: Efficient energy supplies promote growth. It is an important enabling factor of growth and its availability at competitive prices is critical to the competitiveness of energy-intensive sectors.

2.9.3 The policy focuses on two horizons: a short term horizon going up to 2022 and a medium term going all the way up to 2040. The time frame upto 2022 is short enough that it allows us to discuss interventions that are required right away while the period upto 2040 is long enough to contemplate bolder interventions that are required to fully modernize India's energy sector.

3.3 Energy consumption in India is characterized by low per capita level and a large disparity between urban and rural areas. In 2015-16, our per capita energy and electricity consumption at 670 kgoe and at 1075 KWh/year, respectively, are just one-third of the world average.

3.4. India Energy Security Scenarios

3.4.1 India Energy Security Scenarios or IESS 2047 allows us to predict energy consumption in the final year of the policy, 2040, under a range of two sets of assumptions: a baseline effort and a significantly more ambitious effort towards achieving energy efficiency and conservation. The baseline scenario (BAU) generates the higher demand bound and the ambitious scenario is represented by the lower bound.

3.4.2 In the ambitious scenario, energy consumption ends up being 17% below that in the baseline case illustrating the power of energy conservation and efficiency. In per capita terms, annual energy consumption rises from 670 kgoe in 2015-16 to 1055-1184 kgoe in 2040. Correspondingly, per-capita annual electricity consumption increases from 1075 KWh in 2015-16 to 2911-2924 kWh in 2040.

3.4.3 Buildings, industry and transport sectors together are the main gainers in both scenarios. The maximum efficiency gains accrue in transportation sector whose share in the total energy consumption in 2040 turns out to be 23% under the ambitious scenario compared with 25% in the baseline scenario.

Table 1: Actual energy consumption in 2012 and projected consumption under alternative scenarios in major sectors in 2022 and 2040

Sectors	2012	2022		2040	
TWh		BAU	Ambitious	BAU	Ambitious
Buildings	238	568	525	1769	1460
Industry	2367	4010	3600	8764	7266
Transport	929	1736	1628	3828	3243
Pumps& Tractors	237	423	388	728	592
Telecom	83	131	124	207	164
Cooking	1072	829	684	524	467
Total	4926	7697	6949	15820	13192
% reduction in energy demand in 2040			17%		

4.4.1 At the end of financial year 2016, domestic refining capacity was nearly 25% higher than the country's demand for petroleum products. This surplus capacity is a high foreign exchange earner and assures us energy security. In recent years, from 2010-11 to 2015-16, the pace of capacity expansion was at a CAGR of 3.5%, against a CAGR of 5.4% in demand for petroleum products. India may become a net importer of refined products in the near future.

4.4.3 Storage of crude and petroleum products has not grown in India in keeping with global practice, to assure crude supplies at times of supply disruption. Strategic stocks are available only for 5.33 MT against annual consumption of 183.5 MT of products in 2015-16, which is expected to keep rising. Stocking of crude and products is the norm in countries where market norms are the prevalent practice. The Government will encourage setting-up of 90-day consumption requirement of strategic and commercial storages, both for crude and petroleum products through innovative private investment strategies as has been successfully witnessed recently with Gulf suppliers for the Mangalore storage.

5.1 Coal based power generation capacity of 125 GW in 2012 is likely to go up to more than 330-441 GW by 2040 (192 GW in FY 2017). The demand for these plants is likely to be first met by domestic coal, which will require quick exploitation of our reserves.

5.2 The share of coal in India's commercial primary energy supply was 55% in 2015-16 and is expected to remain high at 48-54% in 2040. Imports contributed 25% of the supply in 2015-16, and could remain high unless domestic production grows rapidly. The thrust of the NEP will be on interventions required to optimally exploit our coal resources, while addressing the overall environmental concerns related to coal mining.

5.4.7 Corporatize the seven subsidiaries of CIL into independent companies and allow them to compete against one another in an open coal market. Progressively fresh production from new mines ought to come from private sector. These two steps will replace the current system of administrative allocation of coal by a vibrant coal market with prices performing the function of allocation.

5.4.8 A possible downside of market-determined coal supply may be its potential adverse impact on electricity price paid by vulnerable customers through an increase in the price of coal paid by generation companies. Protect the vulnerable electricity customers through direct benefit transfer (DBT).

5.6.4 The link between coal mining and adverse local environmental implication calls for efforts to mitigate the ill-effects. The Government has already announced a robust agenda for sharing of the sovereign income from the coal sector with the local bodies and communities for adequate safeguarding of the eco system.

6.8.1. Smart grids have already been taken up on pilot basis in the country. Now, this technology will be rolled-out across the country so as to provide an efficient electricity distribution system, which also supports Renewable Energy. There is a need to set up Renewable Energy Management Centres (REMCs) in all States to handle issues arising out of variable renewable electricity.

7.1 Nuclear energy, being the only base load power source offering green energy, needs to be promoted even if its share in the overall mix is not high enough now. In the recently concluded NDCs, India has indicated its intention to ramp up nuclear power capacity tenfold by 2030 to 63 GW. In the light of India's bold ambition, the National Energy Policy offers the strategy to achieve the target set for the country.

7.2. India has an installed nuclear power capacity of 6,780 MW (2016-17), which contributes to over 3% of total electricity generated. Construction of additional nine reactors is in progress, which will ramp up the nuclear capacity to 13,480 MWe of power.

THE POTENTIAL

Domestic Production

	2012	2022		2040	
BAU		Ambitious	BAU		Ambitious
Coal (Mtce)	582	904	1006	1190	1385
Oil (Mtoe)	38	44	46	54	61
Gas (BCM)	48	46	53	95	124

SOME KEY IMPLICATIONS (2040)

- Share of non-fossil fuel based capacity in electricity: 57%-66%
- Per capita energy demand1: 503 kgoe/capita in 2012 to 1055-1184 kgoe/capita in 2040.
- Energy related Emissions per capita: 1.2 tons of Carbon Dioxide Equivalent/capita in 2012 to 2.7-3.5 tons of Carbon Dioxide Equivalent/capita in 2040
- Per capita electricity con sumption2: 887 kWh in 2012 to 2911-2924 kWh in 2040
- CAGR of electricity supply (Ambitious scenario): 5.5% between 2012-2040
- CAGR of primary energy supply (Ambitious scenario): 3.6% between 2012-2040
- Overall Import dependence (including non-commercial energy): 31% in 2012 to 36%-55% in 2040.
- Reduction in emissions intensity: 45%-53% by 2030 from 2005 levels

COMMENTS & SUGGESTIONS ON THE 2017 DRAFT NATIONAL ENERGY POLICY

At the outset, we – a collective of Civil Society Organisations, who gathered in Delhi on the 12th of July, to review, analyse, comment on and give suggestions for improvement of the draft NEP, **express our appreciation to the NITI Aayog for bringing out this important policy draft**. Looking at the rapid and drastic changes in the energy scenario – both electricity in India and the global hydrocarbons scene – it was high time that the older Integrated Energy Policy was overhauled.

POLICY-WIDE COMMENTS

1. Looking at the importance of the energy issues for every group in India, there should be opportunity and time for extensive discussions in different regions of India. The time given is totally inadequate, also in the light of lack of proper channels of communication in peripheral regions, like the north-east. In this perspective, the **NITI Aayog should allow more time for public comments**, if it really wants to get valuable inputs from such a vast country.

2. **The Primary Assumption in the draft NEP, that Energy (and Electricity) inputs are directly and linearly proportional to GDP growth, human development etc, do not seem to hold true in many cases**. A clear example from our own neighbourhood is Sri Lanka, whose per capita electricity consumption at ~490 KWHr/year is just a little over half of India's per capita consumption of 900 KWHr (with per capita production od ~1100 KWHr). Its per capita total energy consumption is also much less – around 495 Kgoe to India's over 620 Kgoe. And yet, it has achieved a far higher HDI than India's, 0.715 to 0.609. Similarly, poor Bangladesh, with nearly one third of India's per capita energy consumption, has achieved a HDI which is not far behind India's.

   Thus, a fundamental shift in the energy policy is required, which directs energy services to achieving universal human development as priority, rather than create only markets for luxury consumption. The **NITI Aayog needs to do a realistic (based on current economic realities) SENSITIVITY ANALYSIS of energy input and GDP growth** and based on this, **a realistic and "GDP-efficient" recalculation of energy demands is needed** for the horizons of 2022, **(and 2030-**

for SDGs synchronization,) and 2040, which would most likely be much lower than the present demand figures.

3. The NEP (as was the earlier IEP) seems to be guided by the Chinese economic model of energy-intensive manufacturing based growth, rather than India's own recent experience of much-less energy input service led growth. Also, the underlying assumption of continuing high GDP growth seems to be invalid in the changed global macro-economic scenario. Even in the case of GDP oriented economic growth, India's own macro-economic experience shows that some sectors are far more "GDP-efficient" ie, more energy efficient in creating economic growth with lesser energy inputs. The services sector contributes over 55% of India's Gross Value Added (GVA) while consuming only 16-18% of the total energy, while the industrial sector consumes nearly 37% of the total primary energy, contributing only about 30% of GVA (out of which, more energy intensive manufacturing contributes only about 15%). And yet, the draft NEP mistakenly places more emphasis on manufacturing based growth. This lop-sided, energy-marketing oriented approach must change for India's own interest.

4. **In view of the very critical situations in the country in terms of both climate change impacts and air & water quality deterioration, all available options for lowest carbon-footprint sources of energy and those with minimal air and water pollution potential should have been prioritised**, putting more emphasis on these aspects than purely a limited financial sense.

5. **As the global and national energy scene is in a state of flux and changing fast, this policy document should be open to change /modification in every five years** or so. This will allow the maximisation / optimisation of best option in the national interest.

6. **The major emphasis in the draft NEP is on Energy Markets, or on commercial energy. This will not serve the purpose of Universal access to energy (and electricity), which is also one of the major Goals of the SDGs (Goal no 7)**. It has been shown by India's own experience that just increasing the market availability of energy do not serve the universal access objective – from around 66000 MW of installed electricity capacity in 1992, when the unconnected population was over 50%, the installed capacity in May 2017 has increased five times to 330,000 MW. Yet, over 22% of Indian people are still without electricity and another 30 odd % age of our people get miniscule amounts, not serving any productive purpose!

The NEP should have a clearly defined and targeted Universal Access Goal and Strategy, as this is also an important factor for achieving some other essential Sustainable Development Goals like poverty eradication, and others. The lifeline-energy-for-human-welfare approach, present – even in diluted forms - in earlier policies, needs not only to be brought back, but strengthened.

7. Between the short term horizon of 2022 and the medium term one of 2040, **falls the very important deadline of 2030, when the SDGs are supposed to be achieved**. Many of the SDGs are dependent on universal and affordable clean energy access. Thus, **it will be desirable to have an in-between horizon of 2030, particularly to match the SDGs horizon**. This is a global compact with India as a signatory, so this needs to be factored in with priority.

8. **The recent dramatic changes** – particularly in the electricity scenario in India, where both the national supply and almost all regional grids are haning surplus capacity and production for the 3rd year running -- as shown by the CEA report of December 2016 and TERI report of March 2017, calls for a review of the high power addition projections. Both the reports show the likely surplus situation to prevail for the next – at least 7-8 years. In view of this current surplus, another 92000 MW being in the pipeline, and the Indian commitment to add another 125000 MW of RE (over the existing 50000 MW) by 2022, clearly points to a situation of not requiring any more coal, nuclear or big-hydro power capacity addition. This has been completely missed out in the draft NEP.

9. **Acknowledging that all forms of Energy production, transmission and consumption has different degrees of environmental and social impacts, the NEP must more strongly emphasise on both Conservation and Efficiency**, much more than high demand projection and supply matching. Though these – conservation and energy efficiency – are mentioned in the draft NEP as objectives, serious attempts seems to be absent in maximising the benefits of these two parallel approaches. Promoting conservation will need policy level incentives, and often lifestyle changes, which **need both incentives and regulatory controls** (like high parking charges, road taxes etc to discourage private motorized transport and promoting fast-efficient-comfortable public transport as incentives to switch over). These kinds of socially desirable policies seem to be not pursued very seriously in the draft NEP.

Keeping this serious environmental, social and health impacts of energy pathways, it might not be out of place to consider an upper cap on per capita energy consumption. Even though this might sound impractical in today's market oriented thinking, we do not question this approach for critically important resources in short supply.

10. **No energy infrastructure can or will be built without the right financial backbone and logic. The huge projected increases in the energy infrastructure will also demand similarly massive financial investments**. The draft NEP does not seem to have put enough emphasis on this crucial aspect. Can India afford to raise and invest that much finance in an already surplus energy system and dwindling global finace/ capital, or should we invest a more modest figure in more productive efficiency, conservation and life-style change endevours? We **request that a separate chapter on energy Finance be included** after proper analysis and realistic assessments of the current and projected global and national financial scenario.

11. The **other financial reality of massive Stressed assets and NPAs (Non-Performing Assets) originating from the stressed power sector and with the banking sector (mostly from PSU banks),** has also not been addressed in the draft NEP. This NPAs are forcing the government to give unreasonable bailouts to the private sector power companies, from public finance (our, people's money). The recent happenings of over 25000 MW of coal power being put on the block but finding no buyers, the Rs.16000 crore public money bailout to the stressed hydropower sector (mostly private corporates), tens of thouands MW of coal power projects being abandoned in early project phase, the 24000 odd MW of gas based power plants running at low PLF for years – wasting huge public money ….. These are distressing signs of things being wrongly planned and executed poorly. Instead of wasting further massive amounts of public money on poorly planned energy infrastructure, investment guidelines for better suited systems need to be included in the NEP.

12. **In the NEP, clear and much more emphasis should be included on the EXTERNAL COSTS of any energy choice, as economic costs only do not reflect what the society pays for any such choice. These must include environmental, social and health costs.** Ultimately, the nation, its people and the society has to get the resources for addressing the degradations, health impacts, deforestation, water depletion….. This serious consideration seems to be missing from the draft NEP.

13. **Looking at the massive levels of biomass dependence in the poorer sections of Indian rural society, its wide-spread presence and the difficulties of providing imported gaseous cooking fuels to these sections, an aggressive policy promotion of more efficient and safer (healthier) biomass utilisation should have been a major component**. The policy-fixation with "modern" energy sources needs to be questioned, also because in India's case, most of these "modern" fuels are imported at huge cost and foreign exchange outgo. For a country which runs a big current account deficit, this is not a good policy option.

14. The **draft NEP seems to be totally oblivious of the major roles /contributions of Human Energy, Animal Energy and similar other forms of non-biomass non-mechanized energies prevalent in today's Indian society**. Right from the massive no of walking and cycling trips to work (Census data shows these to be over 50% of the total work-commutes), to rural and peri-urban dependence on these non-mechanized forms of energy, these must be accounted for and given centrality. **Given that these are also non-polluting, far less road-space-demanding and having co-benefits like cleaner air, healthier life-styles etc., these must get their due share in amodified NEP**.

15. In **an economy starving for jobs / employment creation, types of energy deployment, where the energy services are targeted etc, has a large social role. This Job-creating focus of Energy policy seems to be largely missing from the draft NEP**. The largest numbers of jobs / livelihoods are in the agriculture and allied sectors, to the tune of 50% or more, and yet the criticality of energy inputs for job/ livelihoods creation – has not been emphasised in the draft NEP. Several studies – particularly in the UK and EU countries – have also shown that renewable energy systems, particularly decentralized ones, are far better at job creation (with cleaner and less hazardous jobs as bonus) jobs than centralized coal, nuclear, hydro etc. This needs to be seriously reviewed and corrected.

16. The **regulatory framework for compliance with other laws – like EIA, Air and Water (prevention of pollution) Acts, MoEF&CC emission and water consumption norms…. Are extremely important for a sustainable energy system/ infrastructure**, The NEP seems to be giving no priority to this, while giving lip service to Sustainability. Even the electricity industry today – globally, are waking up to these critical needs and are sometimes welcoming reasonable new regulatory frameworks, as benchmarks. The NEP must include a clear

understanding and policy guidelines for environmental sustainability and social stability of energy infrastructure.

17. Every form of energy extraction-production-consumption has a land footprint. For example, increasing Coal production from the present 580 million tons to nearly 1200 million tons by 2040 – as projected by the draft NEP, would require millions of acres of land for additional coal mines. Most of the remaining coal deposits are also under thick forests, so the tremendous adverse impacts of this huge additional mining would be humongous. Similarly, each installed MW of solar PV needs about 5 Acres of land. Thus – the 60,000 MW of green field solar PV (rest 40000 MW being projected from rooftops) would require about 300,000 Acres of additional land, on top of coal mining land, coal power land, submergence land by new hydro power etc ! Whether India can afford to lose so much of arable / farm land, is a major question – not at all addressed in the draft NEP.

18. Similar to land, every form of energy generation has a particular water foot-print. Thus, every MWHr of coal power generated has a consumptive use of about 400 to 4500 litres of water, apart from thermal pollution of a much larger volume of water. In today's India – the average per capita water availability has come down to about 1150 CuM per year, from around 5000 CuM /person/year in the 1950s. The UN defines a country as water-scarce, if the per capita per annum availability comes to 1000 CuM or below, and India is periliously close to that danger mark. With a huge increase in both Coal & Nuclear power – both are massive water guzzlers – the severe impacts on agriculture, drinking water and other essential uses – have been totally ignored by the draft NEP. This critical aspect must be taken into consideration and a separate chapter on Land and Water impacts of the projected Energy figures must be calculated and provisioned for.

SECTORAL COMMENTS

3.1 **Energy Conservation is rightly identified as a policy goal, but this needs both attractive incentives and strong regulatory frameworks to work**. The last three decades energy consumption growth has been led largely by wasteful or luxury demand, as also indicated by the near doubling of the share of domestic electricity consumption, from around 12.7 of the total electricity consumption in 1983-84 to

over 25.2% in 2010-11. This luxury consumption by the moneyed classes has also absorbed a major part of the additional generation, increasing GDP, but creating massive inequities and social tensions due to large scale deprivations, apart from irrationally increasing class-based demand. Replacing energy consumption incentives like low electricity prices in richer urban areas, with conservation measures like white-roofs to reduce/ replace energy intensive space-cooling, passive solar heating to replace massive electric geyser use…..will help reduce demand, conserve natural resources and reduce environmental impacts.

3.3 **Policy of promoting energy consumption As Electricity cannot be universally good, as being projected in the NEP. Electricity is clean at the point of use, but not necessarily so in the entire chain.** As 68% of India's electricity comes from coal, which is the dirtiest source – both in terms of climate threatening CO2, and air & water pollution, the Policy of promoting energy consumption as electricity needs to be selectively questioned. Producing electricity at rural /forested areas and sending to major urban consuming centres also create the injustice of damaging the lives and livelihood supporting environment of those who consume little, for benefit of those who pollute the most. Clearly electricity is not always the best mode of energy consumption.

Also, the average overall efficiency of India's fleet of coal power plants is about 30% (coal's chemical energy to produced electricity), with another 22% lost in AT&C losses, thus getting only about 23-24% of coal's energy at the user point, a very poor "efficiency" for a "modern" energy source. Sometimes, direct use of the fuel, particularly oil and gas, in a clean technology system, might be much more energy efficient and have lower total impacts.

3.6 **Energy efficiency increase on a continuing basis is surely a desirable goal, but the NEP does not recognize the large differences of the result of demand side and supply side energy efficiency increases. While demand side EE has been emphasised more in the NEP (as in earlier IEP), it sometimes leads to increased energy demand – due to the Jevon's Paradox or its extreme form, Rebound effect**. The supply side EE has no such negative impact, and is often better suited for reducing environmental and social impacts also, by reducing actual extraction-production-transmission. This needs to be understood and incorporated in the NEP.

3.8 **Regulatory and legal barriers – Recognizing that energy cannot be considered just a commodity, as it has large environmental and social impacts in the entire chain,**

strong regulations on impact/ pollution levels of the entire chain (as in - from mines to distribution transformer), monitoring and rectification mechanisms on ongoing basis needs strengthening.

3.10 While acknowledging the critical role of good institutions, the **contribution of capable institutions outside the govt and industrial sectors, have not been envisaged**. Over the last 2-3 decades, institutions in the CSO sectors have played a commendable role, though sometimes critical (necessary in democracy), and this needs to be integrated in the national policy framework.

Rural Electrification –

The conclusion that "it is envisaged that the government will first endeavour to provide grid based supply to all households, and renewable based supply will be resorted only in exceptional circumstances.", is highly debatable*. Experience of the last 3-4 decades of rural electrification effort has shown the unreliability and difficulties of such an approach, with deadlines for complete rural electrifications pushed back many times. With the emergence of lower cost solar, biomass and wind based electricity in the last 5-6 years, and the government's target of 40% of Solar capacity from rooftop installations, there is a synergy and opportunity to target the incremental/ gap-filling new rural electricity to come from decentralized renewables – whether stand-alone or micro-grids or hybrids etc. In difficult rural situations, the higher reliability /availability of power from renewable have also been shown to be true, over unreliable grid power. This needs to be noted and implemented.*

Clean Cooking –

The emphasis on electricity and "modern fuels", though sounds good – is not supported by ground realities*. As described earlier (3.3 above), electricity is not really clean if a large part of it is coming from coal, neither is it efficient – coming through the thermal power route. Gas availability is always a question mark, as huge parts of this fuel is imported, from often volatile regions.* ***The improvement of technologies for much more efficient and safer biomass use cannot be overemphasised – both from self dependence, reliability (local energy security), wide-spread availability and cost angles.***

4.1 **The massive increase in both projected production potential and use, in both liquid and gaseous hydrocarbons – about 80% of which are imported today with actual increase in import dependence happening over the last two decades – points to a unstable, unrealistic and unreliable policy framework**. Demand side interventions mentioned are of course welcome and workable, and needs to be given higher priority. If the hydrocarbon imports go up as sharply as projected in the draft NEP, the massive amounts of foreign exchange that would be required, might have serious adverse impact on the entire Indian economy. For a country which is struggling with serious Balance of Payments problems whenever the petroleum prices staibilise, this is an un-wise policy path. We must turn more towards indigenous energy resources with least impacts – also on foreign exchange.

5.1 **Coal –** Even with the reality of coal being the mainstay of today's energy supply chain, the longer horizon should have looked at far less dependence on this dirtiest of energy sources. **With climate change and air & water pollution impacts already becoming critical, and deforestation due to coal mining at a high, the draft NEP should put increasingly less dependence on this fuel of the past centuries**. In case domestic coal production is actually increased (low possibility and even lower desirability) increased from less than 600 Mt to 1200-1400 Mt by 2040, the massive pollutions, land and forest degradation, and conflicts on the ground will massively increase.

It must be taken into account that coal related pollution and climate impacts are already taking a huge toll on India's economy and poorer people's lives and livelihoods. As per ASSOCHAM, the 2015 droughts sliced off a total of nearly US$100 billion from India's economy, which was close to 5% of the GDP at that time. With much increased coal use, we would face even higher, mind-boggling losses. This high Coal-dependence proposals in the NEP must be seriously reviewed and reworked. **If we have still nearlya 50% coal dependence in 2040, as projected in the draft NEP, and with other emerging economies also going the same way (how can we ex pect otherwise, if we are not ready to change), the Paris Climate Agreement targets can easily be forgotten, and people put to the catastrophic climate change gallows**. This is not a future scenario, but is already happening in our country – year after year.

6.1 **Renewable Energy** – While it is welcome that 175 GW by 2022 is being supported in the policy, it is somewhat regrettable that the projected 597-710 GW by 2040 are not being so favoured, and left to happen – "autonomously"! It is well known that RE has a far lower adverse impact (though not zero) on the environment and nearby

communities, the other more polluting / higher impact power /energy sources seem to be getting a higher policy support, which is strange. This needs to change, and a much higher RE to meet projected energy demands should be targeted in the policy beyond 2022 and supported with other policy measures, like preferential finance and some tariff advantage. The recent schemes of Net-metering, Central and difficult area subsidies, REC etc should be strengthened in the NEP, with appropriate policy measures.

6.3 **Large hydropower** – This is an area which has not been deeply looked into by the NEP. Contrary to assumptions of being zero-GHG, hydropower plants do emit large amounts of methane from their reservoirs and trapped biomass – through their anoxic decomposition. Methane being over 80 times as potent as CO2 in the short term (22 times over long term), this has serious climate change potential. Apart from that, the uncertainty of water availability in the Himalayan rivers, where most of the electricity oriented hydropower projects are planned, is not evaluated with proper scientific rigour. This has the potential of locking in massive amounts of public finance in non-productive power plants, increasing stresses on the banking system and mounting NPAs further. Needs serious review and reworking based on more scientific data.

7.1 **Nuclear power today supplies a miniscule percentage of India's power needs, just over 2.2%, and with about 2.05% of the installed capacity** - at enormous cost and after over 57 years of commercial nuclear energy development in India. This also carries huge risks – both from possible accidents and from the massive amounts of radioactive waste products they generate – which have to be stored isolated for tens of thousands of years, at huge additional cost. The equally large costs of post-life decommissioning have not been addressed yet in India. After Fukushima and Chernobyl, the public opinion is also crystallized against taking these unmanageable risks for tiny gains in power, for which far better alternatives exist already. The cost of produced nuclear power also is high, if all the subsidies are included. In this circumstance and in the changed scenario of lower cost, safe and wide-spread RE sources - the Nuclear Power option need to be forgone.

12 & 15 **Unconventional Gas and Oil** – The projected new technologies and sources of Shale oil and gas, though have succeeded in changing the oil and gas availability in the global markets – their adverse impacts are only now coming into knowledge. One of the primary impacts of Hydraulic Fracturing is large scale Ground Water Contamination. Apart from this, the Fugitive Emissions of methane contributes

largely to climate threatening GHGs. Any projection of high unconventional oil and gas, would have to address these questions.

Installed Capacity of Electricity, 31st January 2018 (CEA)

All India Installed Capacity reached 334399.83 MW in January 2018. Renewable energy installed capacity of India has gone up to 62846.90 MW. Contribution of Solar power is 17052.41 MW and that of wind and small hydro power is 32848.46 MW and 4418.15 MW respectively. Other sources of renewable energy based capacity include bio-power (waste to energy and biomass energy) whose share is 8527.88 MW. India's coal based capacity is around 57.96% of the total and renewable share in total capacity is around 18.79%.

Region	Ownership Sector	Thermal				Nuclear	Hydro	RES*	Grand Total
		Coal	Gas	Diesel	Total				
Northern Region	State	17098.00	2879.20	0.00	19977.20	0.00	8643.55	678.36	29299.11
	Private	22760.83	558.00	0.00	23318.83	0.00	2514.00	11613.33	37446.16
	Central	12630.37	2344.06	0.00	14974.43	1620.00	8266.22	329.00	25189.65
	Sub Total	**52489.20**	**5781.26**	**0.00**	**58270.46**	**1620.00**	**19423.77**	**12620.69**	**91934.92**
Western Region	State	21280.00	2849.82	0.00	24129.82	0.00	5446.50	311.18	29887.50
	Private	33985.67	4676.00	0.00	38661.67	0.00	481.00	18366.61	57509.28
	Central	14242.95	3533.59	0.00	17776.54	1840.00	1520.00	661.30	21797.84
	Sub Total	**69508.62**	**11059.41**	**0.00**	**80568.03**	**1840.00**	**7447.50**	**19339.09**	**109194.62**
Southern Region	State	18832.50	791.98	287.88	19912.36	0.00	11808.03	518.02	32238.41
	Private	12124.50	5322.10	473.70	17920.30	0.00	0.00	28539.24	46459.54
	Central	13425.02	359.58	0.00	13784.60	3320.00	0.00	491.90	17596.50
	Sub Total	**44382.02**	**6473.66**	**761.58**	**51617.26**	**3320.00**	**11808.03**	**29549.16**	**96294.45**
Eastern Region	State	6820.00	100.00	0.00	6920.00	0.00	3537.92	225.11	10683.03
	Private	6225.00	0.00	0.00	6225.00	0.00	399.00	802.55	7426.55
	Central	13876.64	0.00	0.00	13876.64	0.00	1005.20	10.00	14891.84
	Sub Total	**26921.64**	**100.00**	**0.00**	**27021.64**	**0.00**	**4942.12**	**1037.66**	**33001.42**
North Eastern Region	State	0.00	457.95	36.00	493.95	0.00	422.00	254.25	1170.20
	Private	0.00	24.50	0.00	24.50	0.00	0.00	22.45	46.95
	Central	520.02	1253.60	0.00	1773.62	0.00	920.00	5.00	2698.62
	Sub Total	**520.02**	**1736.05**	**36.00**	**2292.07**	**0.00**	**1342.00**	**281.70**	**3915.77**
Islands	State	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	8.26	8.26
	Central	0.00	0.00	0.00	0.00	0.00	0.00	5.10	5.10

	Sub Total	**0.00**	**0.00**	**40.05**	**40.05**	**0.00**	**0.00**	**18.61**	**58.66**
All India	State	64030.50	7078.95	363.93	71473.38	0.00	29858.00	1992.17	103323.54
	Private	75096.00	10580.60	473.70	86150.30	0.00	3394.00	59352.44	148896.74
	Central	54695.00	7490.83	0.00	62185.83	6780.00	11711.42	1502.30	82179.55
	Total	**193821.50**	**25150.38**	**837.63**	**219809.51**	**6780.00**	**44963.42**	**62846.90**	**334399.83**

*RES – Renewable Energy Sources, include small hydro power, solar power, wind power and bio-power

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- Swaraj Abhiyan, Madhya Pradesh
- Chutka Parmanu Virodhi Sangharsh Samiti, Madhya Pradesh
- Gramin Adhikar Manch, M.P
- Aapda Nivaran Manch, MP
- ISRD, Jabalpur

With some inputs provided for discussion by – PRAYAS Energy Group, Pune