

# The Hydro Power Development in India- Challenges and Way Forward



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## Abstract

*It is now a well-recognized fact that availability of electric power is an essential requirement for the development of a nation and the fact is very much applicable to India. As on 30<sup>th</sup> Nov'14, the total installed generating capacity of Power in India is 255012.78MW out of which Hydro Power accounts for approx 16.0% (40,798.76 MW). The percentage of Hydro Power has come down from 45% in 1970 to less than 18 % in 2013. Today the ratio is about 16:86 which is too less as to have efficient and balance grid for operation of all types of plants. The Hydro Power and Renewable sources of power are the best form of energy security. The water and other forms of renewable sources are getting wasted every day by not utilizing them, as these sources cannot be stored for future use. Whereas, with the continuous extraction of fossil fuels, the sources are getting depleted fast. These sources could be saved for the future generations to come and could be made use of at the time of need and emergency.*

*Indian Rivers carry more than two third of their annual flow in three monsoon months. We are wasting this huge amount of water flowing continuously which can be converted to energy. Can we afford to waste the bulk of the Energy of water by letting it flow down the drain unutilized in the monsoon months?*

*Dams and reservoirs are designed to last over hundred years. Which other type of energy source has such a long life? They provide us inexpensive energy.*

*Therefore, there is a need to increase and shift dependence on hydro power for the development and prosperity of the nation. Therefore, to meet country's energy demand at a faster pace and make up for the lost time, development of Mega hydropower projects is essentially required.*

*This also warrants the need of sustainable development of water resources to ensure the continuous availability of water for hydropower generation and other activities and also for the flood moderation for the population living downstream.*

*Nevertheless, there are number of practical obstacles to the realization of this potential which needs to be tackled through socio-political intervention.*

*This paper addresses the current scenario of Hydro Power development in India, the obstacles which this sector is facing and the need for future action plan for encouraging development of Hydro Power sector.*

## Hydro Power Potential in India

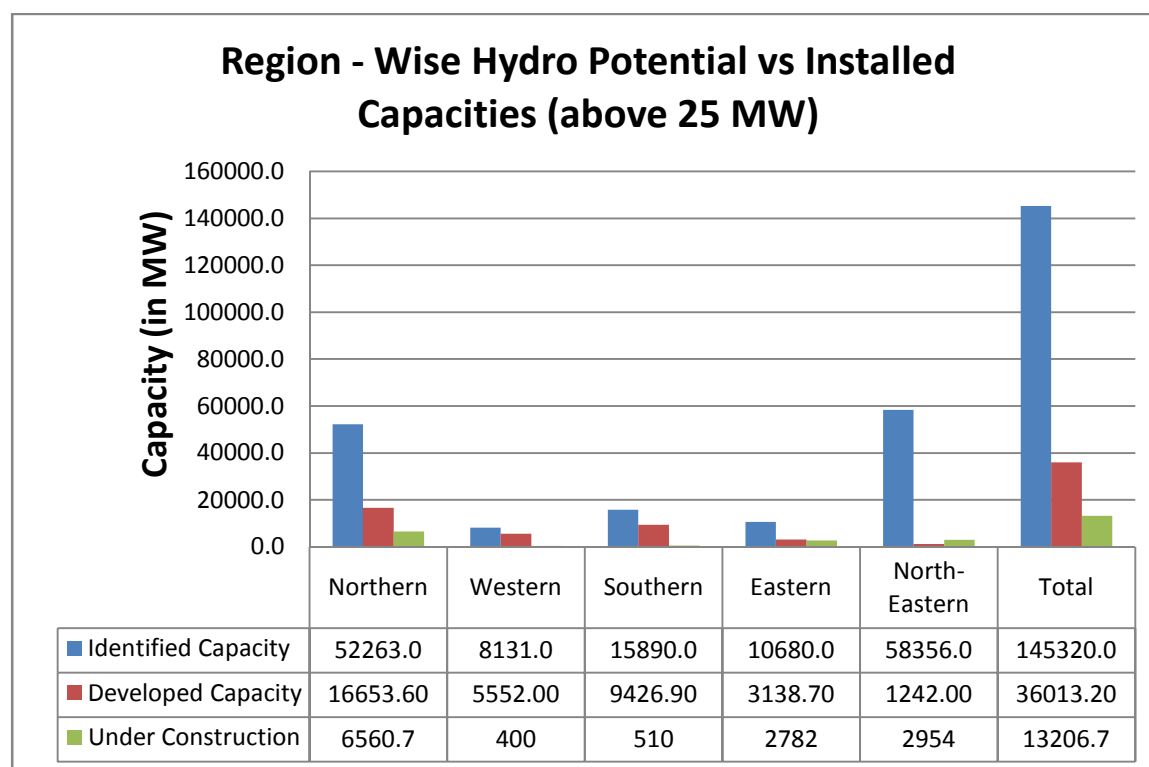
India has a vast untapped resource of HEP. The total hydro potential assessed by CEA is approximately 1,48,701 MW, of which Economic Potential works out to 84,044 MW at a PLF of 60%.

**Table 1: Basin Wise Hydro Power Potential in India**

Basin / River	Economic Potential at 60% Load Factor (MW)	Probable Installed Capacity (MW)
Indus	19,988.00	33,832
Ganga	10,715.00	20,711
Central Indian Rivers	2,740.00	4,152
West Flowing Rivers	6,149.00	9,430
East Flowing Rivers	9,532.00	14,511
Brahmaputra	34,920.00	66,065
<b>TOTAL</b>	<b>84,044.00</b>	<b>1,48,701</b>

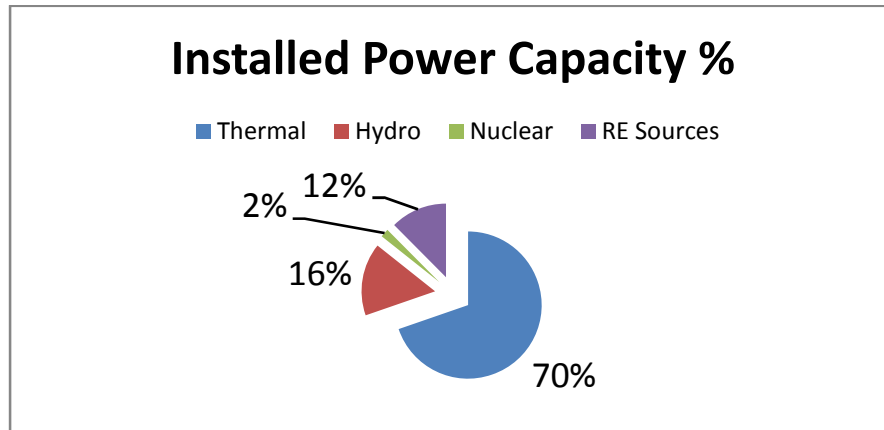
The above Hydro power potential has been assessed by CEA from 845 economically feasible schemes in different river basins with likely annual generation of 600 billion units including seasonal energy variation. As on 30.09.2014, about 49 schemes having an aggregate potential of about 14,630MW are under execution for 12<sup>th</sup> Plan & beyond (excluding projects < 25 MW).

**Fig. 1 – Region – Wise Hydro Potential vs Installed Capacities (above 25 MW)**



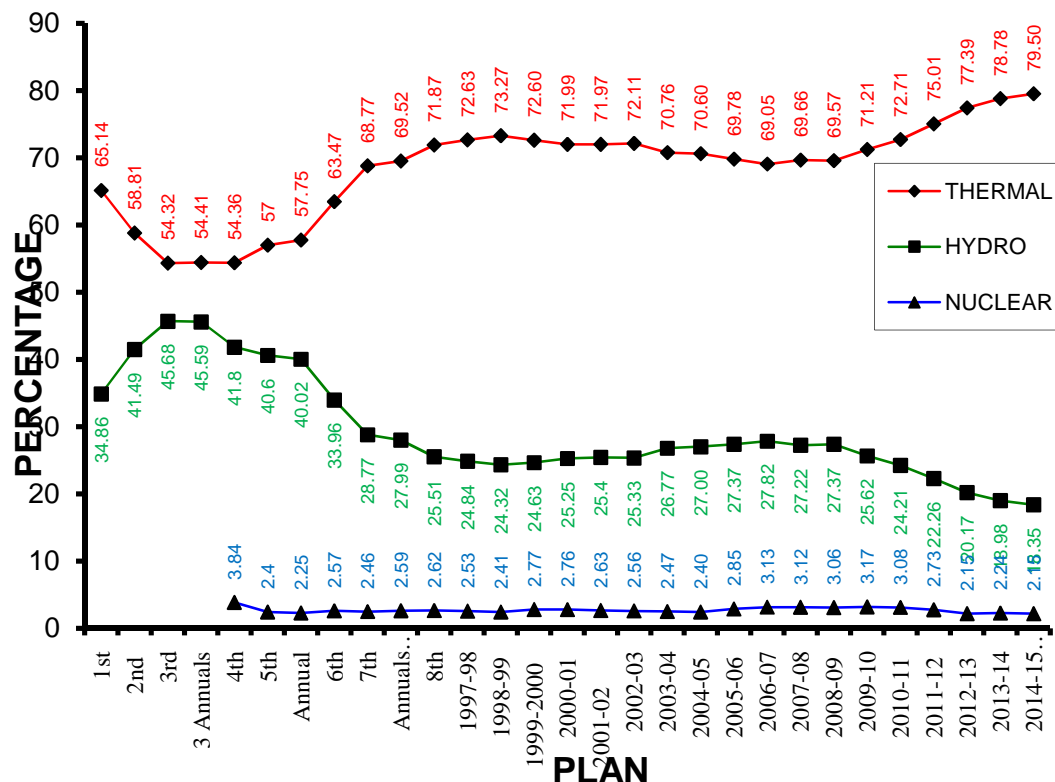
India is a power starved nation, for the month of Aug '14 the peak energy deficit (MU) in India was 4.3% and peak power deficit (MW) was 6%. On one hand Indian government is building Ultra-Mega thermal Power Projects (UMPP) and encouraging wind and solar power projects; but on the other hand a step-child treatment is being meted out to hydro power plants. Following chart gives the status of source-wise installed capacity in India.

**Fig. 2 - All India Generating Installed Capacity (MW) (As on 30-11-2014)**



The following graph shows the trend of capacity addition from 1<sup>st</sup> Five Year Plan onwards.

**Fig. 3 - Trend of Capacity Addition From 1<sup>st</sup> Five Year Plan Onwards as % of total (Hydro Thermal Mix)**



The percentage of Hydro has come down from 42% in 1970 to 18% in 2014. Decline in hydropower capacity ratio has been distressingly continuous since its peak in 1962-63(45.68%). At the beginning of liberalization of the sector in 1990's, its share in the power position was 28.77% which reduced to 25.51% by the end of 8th five year plan (1992-1997) and 25.40% by the end of 9th five year plan, the capacity addition of hydro-power was only to the tune of 4,538 MW against the target of 9,818MW. During 10th five-year plan, a capacity addition of 41,110 MW was envisaged out of which 14,393 MW was planned from hydro-sector. It is generally accepted that while the central sector will remain a key developer, a significant amount of contribution needs to come from the private sector. In the Eleventh Plan target was 15,627 MW, out of which achievement was 5,544 MW; 35.48% of the planned. In line with an optimistic GDP growth of 9-10 per cent, the plans for the subsequent two five year periods have been revised as:

**TABLE 2:Twelfth & Thirteenth Five Year Plans.**

<b>SECTOR</b>	<b>12th Five Year Plan (up to Aug' 2014)</b>	<b>13th Five Year Plan (Target)</b>
Hydro (Target / Achievement)	10,897 / 1,826.35	12,000
Nuclear (Target / Achievement)	5,300 / 0.00	18,000
Thermal (Target / Achievement)	72,340 / 44, 939.90	49,200
<b>TOTAL</b>	<b>88,537 / 46, 766.25</b>	<b>79,200</b>

<b>SECTOR</b>	<b>12th Five Year Plan</b>	<b>13th Five Year Plan</b>
Wind	15,000	11,000
Solar	10,000	16,000
Other RES	5,000	3,500
<b>RES - TOTAL</b>	<b>30,000</b>	<b>30,500</b>

With planned addition of 10,897 MW & 12,000 MW by the end of 12th and 13th five year plan respectively, the share of hydro is expected to increase to 25.14%. The long-term goal is to increase the share of hydropower capacity from the present level of 20% to 40% of total Installed Capacity.

### **Advantages of Hydro Power**

- ❖ Helps in the fighting Climate Change & Sustainability issues, helps in bringing down carbon emissions & carbon footprint.
- ❖ Environment friendly & Non Polluting – Unlike Nuclear and Thermal Power Plants, Hydro Power Plants hardly discharge any form of solid, liquid or gaseous wastes into the eco-system.
- ❖ Relatively longer useful plant life.
- ❖ Run- of -River (ROR) projects have comparatively low environmental damage.
- ❖ Helps in providing inexpensive power, especially once the Project achieves financial breakeven/depreciates its assets as Operations & Maintenance costs are much lower & consistent (independent of cost escalations in fuel) as compared to Thermal Power Plants.

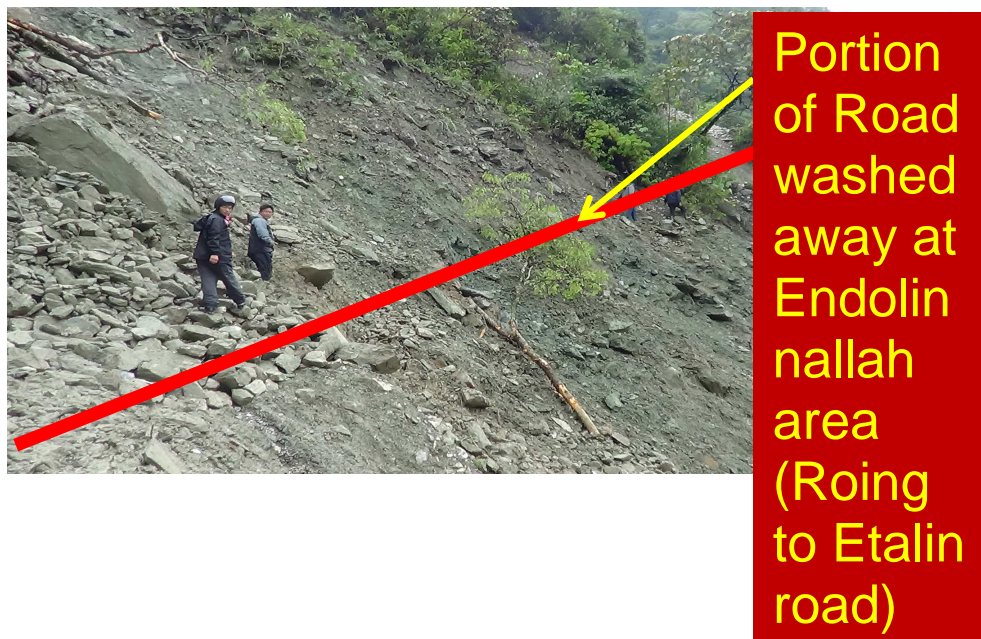
- ❖ Offloads the pressure on current account deficit as it helps in lowering fuel Import bills for the country.
- ❖ Helps in sustainable usage of coal for power demands of the country.
- ❖ Helps in meeting the peak power demand in the country, enhancing power system stability.
- ❖ Improved Plant Load Factor of thermal units- Grid stability and Peak Load Management.
- ❖ Spontaneous starting, stopping and load variation ability.
- ❖ Hydropower provides high level of service to power system (reliability, flexibility, efficiency).
- ❖ Many International studies consider hydropower as the best available option for reducing GHG emissions and present as a good candidate for CDM benefits.
- ❖ Remote area development- Improves infrastructure of interior areas and local population gets manifold advantages including better economy, job opportunities, education & healthcare facilities and connectivity & communication facilities.
- ❖ Multipurpose Hydro power projects- Help in flood moderation, irrigation, navigation and drinking water requirement.
- ❖ Catchments of river basins get developed as Catchment Area are treated by the Hydro Project Developers. This helps in curtailing massive soil erosion & checking landslides in mountainous regions.
- ❖ With relative independence from international market like oil prices, hydropower involves no extra foreign exchange outgo.
- ❖ Hydropower is a no-inflation power as Water- the 'raw material' for power generation is free of inflation.

### **Challenges in Hydro Power Development**

1. Hydro Power Projects are Site specific.
2. Location disadvantage- Projects are located in far flung areas having very little infrastructure and communication facilities. For instance, in Arunachal Pradesh. it takes at least 2 days for a normal passenger to reach project sites& if there are multiple landslides, hundreds of vehicles could easily get stuck for days together without access to basic amenities such as food & water. In such conditions, one could easily imagine how difficult it would be to transport project equipment, machinery, etc via such routes. And if by chance there aren't much of landslides, locals / student bodies of neighboring districts and states normally calls Bandhs and block the roads at their whim.
3. Lengthy process of preparation of DPR and clearances having uncertainty of time line and shortage of people with clearing agencies. e.g.
  - Land Acquisition, Environment, Forest & Wildlife clearances& Forest Rights Settlement
    - ✓ Project features, layout plan, land requirement and certain environment management plans are required for forest clearance. Details for a Hydro Electric Project are known after investigations and preparation of DPR and EIA/EMP reports.
    - ✓ The biggest problem with such clearances is the dynamic nature of changing requirements for obtaining these clearances.

- ✓ Improper circulation of such dynamic changes to the Project Proponents & general public. Improper circulation/notification of Intermittent changes in law and new notifications.
  - ✓ Non adherence to a fixed Guideline/Checklist by Govt. personnel at the lower levels due to their overconfidence of knowledge of clearance process & document requirements, which causes rework in the clearance process.
  - ✓ One of the most complex problems experienced in Arunachal Pradesh is non-availability of land record with the land & revenue department. Project developer has to pay land compensation amount to the Local Community as well as State Forest Department thereby bearing double financial burden for same piece of land.
  - ✓ Another major issue is the shortage of manpower with the State Govt. of Arunachal Pradesh. It has been observed that Number of Government Officials at lower level are very few. A project can be checked & cleared by the official only after clearing previous projects in the pipeline. This results in time & cost overrun. Many a times, certain time bound activities get lapsed leading to start whole process afresh.
  - ✓ Fulfilling Statutory requirements of Central & State Govt.
  - ✓ Identification of Land for Compensatory Afforestation (CA) –In accordance with Forest Conservation Act, 1980, CA shall be done over double the area for diversion on Degraded or non-forest land. It is a well known fact that the State of Arunachal Pradesh has the second largest forest cover in the country. Out of the total geographical area of 83,743 Sq. Km, the forest cover accounts for 68,000 Sq. Km (approx.) making 81.20% of the State under forest cover. Thus, finding a large non-forest area or degraded forest area for CA in the State is very difficult & time consuming for the developer.
4. Scarcity of Result Oriented Reputed Contractors / Skilled technicians/ workers.
  5. Non-Availability of Grid Power during Construction phase of Project.
  6. Creation of new sanctuaries and national parks by Forest Department without consulting the Hydro Power Department of State.
  7. Security concerns – Vast hydro potential of the country is available in the areas affected by insurgency and militant problems. The law and order problem in such areas lead to delay in execution of the project as well as cost over runs.
  8. Inadequate infrastructure / Lack of Communication system – As Hydro Projects are located in interior far flung areas, hilly terrain, landslides, hill slope collapses, road blocks particularly during monsoon season because of heavy rains and unprecedented floods cause severe setbacks in construction leading to time and cost over-runs. Non-availability of approach road to Project site – The cost of approach road, if included within the Project infrastructure, results in increase in overall project cost. Apart from poor road connectivity, the region has extremely poor or no mobile connectivity.





Roing- Etalin Road "Water Falls- Directly discharging on the Road having No Culverts



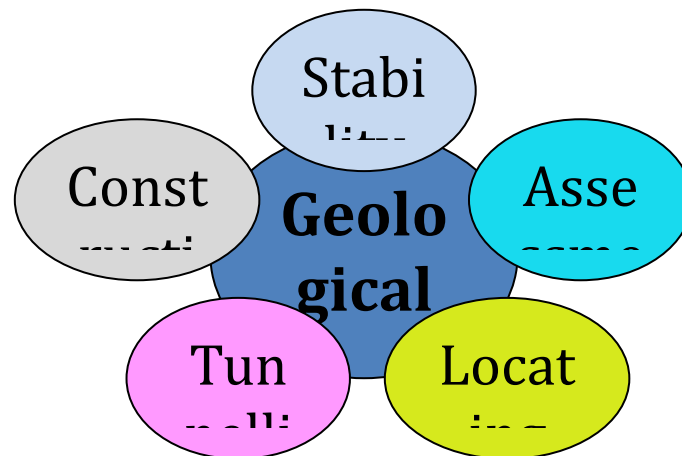


Roing – Etalin Road- Sinking Area

9. Evacuation of power from remote generation sites.
10. Hydro Power Projects located in far flung areas of Arunachal Pradesh also suffers from the local mindsets. Project developers frequently encounter many types of demands from the locals of these areas. This is obviously over & above the various compensations planned under various regulations. Such illegitimate demands if not met, by the Project Developers, may lead to a total unrest between the local population & the Project Head.
11. Inter-state disputes –
  - ✓ Under Indian Constitution, water is a state subject. No Objection Certificate is required from each downstream state for getting sanction even for run-of-the-river projects which is a time consuming job. If all major rivers are made National resources and its water is distributed by Centre keeping requirement of States in mind, the time could be saved.
  - ✓ Inter-state issues are not limited to State Govt. but also the local populous. For instance, in case of Hydro Power Projects in Arunachal Pradesh which has rich Hydro Power Potential with nearly 50,000 MW of potential, compared to Assam which has significantly low Hydro Power Potential of merely 650 MW. Any Hydro Power Development in Arunachal Pradesh is an object of envy by the neighboring states such as Assam. Any development happening in Arunachal Pradesh has to make its way through Assam. Whenever trucks/ trailers carrying equipment or other essentials pass through Assam, they are blocked enroute, trucks & payloads destroyed & in some cases drivers beaten up and sent back to their starting points for example Lower Subansiri Project.
12. Public awareness- There is inadequate public involvement during the project planning stage conducted by the Government Agencies and limited or no effort is taken to gain public acceptance through public involvement and transparency.
13. Intermittent stoppage of projects due to local agitations & frequent bandhs in entire North-Eastern states resulting in time and cost overrun.



14. Geological surprises: The features of the hydro electric projects, being site specific, depend on the geology, topography and hydrology at the site. The construction time of a hydro project is greatly influenced by the geology of the area and its accessibility. It is, therefore, essential that state-of-the-art investigation and construction techniques are adopted to minimize geological risks as well as the overall gestation period of hydel projects. Even if, extensive investigation using new techniques of investigations are undertaken, an element of uncertainty remains in the sub-surface geology and the geological surprises during actual construction cannot be ruled out.



15. Hydrological Challenges – River discharge observations are made available to the developers on pretext of confidentiality to the concerned government department only after the approval of the Ministry of Water Resources, GoI. Considerable time is lost in getting the approvals and the data.
16. Storage Vs ROR Projects – There is a lot of controversy in the development of Hydro Projects as Storage vs R-O-R. Most of the distress caused by storage schemes occurs in the hill states whereas the benefits are largely in the states in the plains which are perceived to be more prosperous. Therefore, hill states prefer R-O-R schemes. For the maximization of benefits in a basin, the judicious blend of both type of schemes (Storage/ROR) needs to be considered.
17. Till the late nineties Hydro Power Development was undertaken by Public Sector Undertaking companies or Govt. of India/State Govt. owned companies. These companies had relatively easy access to huge debt capital required to develop Hydro Projects, as these companies had sovereign/state guarantees. But as the Hydro Power Sector has started to open up for the Private Developers access to such huge debt capital is not easy as project financing under such risk prone environment for hydro project development is hardly available and these Private Developers would certainly not like to have such huge debt on their balance sheet as full-recourse funding option. Therefore, debt financing of Hydro Power Projects for Private Players is a big challenge.

**The New Land Acquisition Act** (The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013). The Act, which replaces the century-old Land Acquisition Act, 1894, proposes a unified legislation for acquisition of land and adequate rehabilitation mechanisms for all affected persons.

## **Key Features of the Act**

### **➤ Land acquisition:**

- Consent of 80 per cent of landowners required in case of land acquired by private companies and 70 per cent for land acquired under Public Private Partnership (PPP) model for public purpose.
- Compensation up to four times the market value in rural areas and twice in urban areas.
- Mandatory Social Impact Analysis (SIA) to assess nature of public interest and estimation of socio-economic impact prior to acquisition for all projects except irrigation projects.
- Land cannot be vacated until the entire compensation is awarded to the affected parties.
- No irrigated multi-cropped land shall be acquired under this Act.
- Companies can lease the land instead of purchasing it.
- If the acquired land has been unused for 5 years from the date of the possession, then it shall be returned to the original owner or owners or their legal heirs or to the Land Bank. If any unused acquired land is transferred to another individual within five years of it being acquired, 40% of the appreciated land value shall have to be shared amongst the original land owners or their legal heirs.
- The award or agreement made under this Act shall be exempt from stamp duty and Income Tax and fees.
- The Act had a retrospective clause saying compensation must be paid in line with the proposed law for ongoing projects (except irrigation projects) where the money has not been disbursed or possession of land has not been taken up.
- In every project those losing land and belonging to the SC or ST will be provided land equivalent to land acquired or two and a one-half acres, whichever is lower (this is higher than in the case of non-SC/ST affected families). The land for land clause has been relaxed for irrigation projects, where land is not available.
- Government also moved the amendment to specify that either compensation or Rehabilitation and Resettlement (R&R) will be given to farmers whose land is acquired for irrigation projects

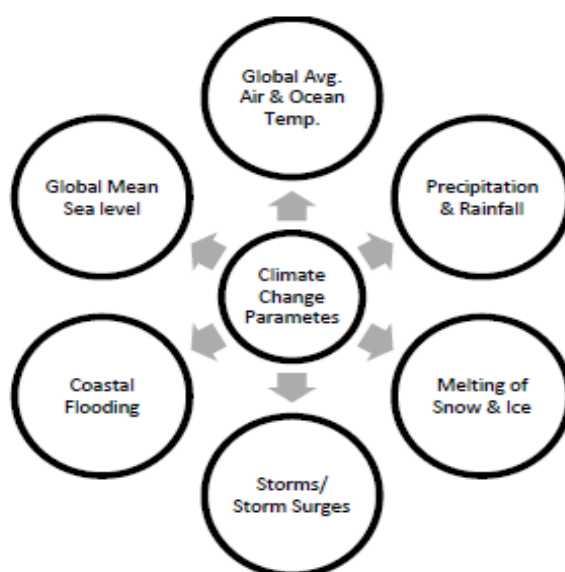
### **➤ Resettlement and Rehabilitation (R&R):**

- The provisions relating to R&R under this Act shall apply when (a) Private companies acquire / purchases land through private negotiations which is equal to or more than such limits in rural & urban areas, as may be prescribed by the appropriate government in accordance with provisions of Section 46& (b) Private companies requests appropriate Govt. for acquisition of a part of an area so prescribed for a public purpose.
- Affected families include land owner, farm labour, tenants, sharecroppers and workers on the piece of land for three years prior to the acquisition.
- Compensation includes house, Land for Land, Choice of Annuity / Employment, Subsistence grant for one year, Transportation grant, Grant against Cattle shed/ Petty shops, One time grant to Artisans / Small traders / others, Fishing Rights and One time Resettlement allowance .

## Climate Change & Hydro Power Development with special emphasis on recent floods in Uttarakhand

The discharge in the Himalayan River generally consists of two parts, one which is derived from melting of glaciers and another resulting from the monsoon rainfall in catchment areas. The discharges derived from the melting of snow make the rivers perennial. The excessive melting of glaciers, due to climate change may increase river flow for next few decades and may subsequently boost power generation in these Himalayan Rivers. On the contrary if we look at the future prospect, the fast melting of glaciers would lead to decrease in snow cover and subsequently decrease in run-off rate of all rivers. The perennial rivers could be changed to seasonal streams which results in water scarcity.

Further, Climate change is evident from the observations (as shown in Fig) of increase in global average air and ocean temperatures, precipitation and extreme rainfall, widespread melting of snow and ice, storms/storm surges/coastal flooding and rising global mean sea level. In future, Climate change is expected to increase the frequency and intensity of current extreme weather/hydro-meteorological events, greater monsoon variability and also the emergence of new disaster i.e. sea level rise and new vulnerabilities with differential spatial and socio-economic impacts on communities. This unprecedented increase is expected to have severe impact on the hydrological cycle, water resource (drought, flood, drinking water, forest & ecosystems, sea level / coastal area / losses of coastal wetlands and mangroves), food security, health and other related areas.



**Fig : Climate change Parameters.**

### Uttarakhand Floods 2013

During June 2013, there was a deadly flood in the state of Uttarakhand which raised many issues on the development of Hydro power. Although the fact remains and accepted by all that hydro power projects were nowhere involved or were responsible for this kind of tragedy but the entire blame was put on the hydro power development in the state. As a matter of fact Hydro power storage dams and large dams were the savior of the towns and cities in the downstream.

Now the recent flood in States of Assam, Bihar and UP is an example that the Hydro power projects are not the reasons for these kinds of natural disasters since there are no hydro power projects in Nepal which are responsible for floods in Assam, Bihar and UP states.

Some of the identified reasons for this kind of disaster could be due to:

- Unseasonal heavy and torrential rain unexpected increase in the water level in the rivers.
- Cloud burst causing a sudden increase in water level.
- Besides rain fall, huge quantity of water was released into the river from melting of ice and glaciers due to high temperatures during the months of May and June.
- The surface air temperatures of Indian Himalayas have increased by one degree Celsius in the past decade.
- Consequently, some of the Himalayan glaciers are rapidly melting causing Glacial Lake Outburst Floods (GLOFs) without any warning and several new glacial lakes are forming.
- A climate change is occurring due to global warming. Evidence of climate change includes the instrumental temperature record, rising sea levels, and decreased snow cover in the Northern Hemisphere. According to the Intergovernmental Panel on Climate Change (IPCC), most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in human greenhouse gas concentrations.
- Constructions of hotels and guest house in and around the river beds and near river banks without proper planning.
- Rise in uncontrolled tourist traffic, travelling with AC vehicles to Hill Shrines causing rise in Temperature of the area.

Sadly, there is a widespread misunderstanding that Hydro projects only contributed to this kind of disaster. Whereas the fact is that the Hydro power Projects not only provide protection from floods, it also assures a steady supply of water for irrigation and drinking and controls the Floods. In India, the rivers carry more than two third of their annual flow in three monsoon months. Can we afford to waste the bulk of the water power by letting the water of the rivers flow unutilized in the monsoon months?

Dams and reservoirs are designed to last over hundred years. Which other type of energy source has such a long life? They provide us inexpensive energy. Even in current times of inflation and high prices, the State of Uttarakhand is getting energy at an average rate of 72.0 paisa/unit, from its old power stations.

The fact that hydro projects help mitigate the fury of floods can be gauged from the fact, that had Shrinagar and Tehri Dam not withheld 90 per cent of the flood inflows during the June'3 floods, the Rishikesh and Hardwar would have been washed away. Had there been a dam of the size of Tehri on Alakananda, the people downstream of the dam would not have suffered any harm at all.

Countries, whose leaders and people had vision enough to develop their hydro resources before going for other options, enjoy the highest standard of living in the world (example; Canada, Norway, Sweden and Switzerland).

Our neighbors like Bhutan too has realized the importance of converting hydro power potential into catalyst for economic development and the results are here to see. They have higher per capita income than India.

### **The Way Forward**

1. The growing power demand in India warrants the need of increase in power generation which can be fulfilled by development of reliable energy sources such as Hydropower. Presently, the existing Scenario of Hydropower in India demands an urgent need of accelerated hydropower development.
2. The public at large must be made aware that there is no alternative to the increased availability of energy in generating economic growth commensurate with the target of welfare and up-liftment desired by them and the sources of power that are capable of providing them without perpetual cost liabilities in terms of environmental degradation.
3. The involvement of private sector and joint ventures with the neighboring countries can go a long way towards achieving the goal of “power to all” in the coming years.
4. To counter the problem of location disadvantage, The GoI in collaboration with The State Govts. and selected Project Developers should priorities stretches of approach roads to select priority project sites. These roads could be constructed on PPP or BOOT model, with Viability Gap Funding or Grants. Better security forces should be deployed in priority based interior areas, so as to nullify the impacts of local extremist groups.
5. Amendments in Acts, Rules, Regulations, etc. should be methodically publicized by the various Ministries of Government of India / State Government. Strict adherence to Checklists of various clearances should be mandated from the Ministries thereby, keeping a check on the processes followed and documents required by the Clearing agencies for various clearances. Various Ministries, in collaboration with State Govt. Departments & Project Developers could organize regular workshops on new changes & amendments in Acts, Rules & Regulations so that all stakeholders have the same understanding of the clearance procedures & processes. The lowest level govt. officials actually working on clearance process & proposal files should be given good incentives on timely delivery of intermediate & final clearances. Such incentives could be funded by clearance fees to be submitted by Project Developers at intermediate & final clearances.
6. Inter-state issues could be solved by conducting relevant stakeholder dialogues, understanding their core issues and addressing these issues through various modes of discussions, negotiations, arbitrations or at last legal proceedings.
7. The Stringent Evaluation process for clearance of a selected project has to be accepted by all authorities and stake holders. Even though the process of TEC and EAC & FAC are stringent, but still if more aspects are required to be added for clearance shall be added to satisfy all the stake holders.
8. Bankable DPR should be examined considering all aspects so that it is accepted by financial institutions. Financial institutions may be consulted before hand for examination so that it becomes a valid document pre examined for getting debt.



9. After considering all technical & geological aspects at the time of TEC and consultation with stake holders at the time of public hearing, no midway stoppage of the project on any account shall be permitted. Once construction starts the project shall be treated as project of national importance.
10. In principal approval on the feasibility report of the project must be given by MoEF so that later on project is not rejected on account of number of trees to be felled. MOEF may even give a formula every state and district wise about what number of trees would be allowed to be felled per hectare considering the density of the forest.
11. Wild life areas and national parks or national reserves should be identified & Eco-sensitive zones well defined by respective state governments before handing over of the project to the developer.
12. There should be two public hearings; one before the main Public Hearing where all doubts are cleared before hand, so that it is clearly known that public is in favour of or against the project. The second Public Hearing to be conducted on the due date when all the presentations are made and public views are heard.
13. Tariff determination for hydro project must be relooked to provide adequate return to the developer.
14. HPO (Hydro Power Obligation) of 10% to 15% should be provided as incentive so that it becomes mandatory for the large industrial consumers procure power from Hydro sources.
15. For Regulatory and Control Aspect, strict monitoring of all conditions imposed during clearances to be monitored strictly.
16. Respective Government to Provide support and subsidy for development and up gradation of roads and bridges, railway sidings, river jetties etc or develop infrastructure on cost sharing basis so that one project in the basin does not feel the pressure.
17. Construction of Balancing Reservoirs intermittently in the large river basins so as to provide continuous water flow required for the bio diversity mechanism.
18. Construction of Storage Dams for creating buffer storage in the technically feasible areas.
19. Sustainability analysis shall form a part of the project development and should be carried out by identified and experienced agency before start of the project so as to strengthen confidence with respective Government and stake holders.
20. PPA has become another difficult area for Private Developers. Central / State Govt should extend all necessary help in signing of PPA for Private Hydro Projects.

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