DEVELOPMENT POLICY LOAN (DPL) TO PROMOTE INCLUSIVE GREEN GROWTH AND SUSTAINABLE DEVELOPMENT IN HIMACHAL PRADESH

THE WORLD BANK

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Abbreviations	
BAU	Business As Usual
BPL	Below Poverty Line
CAT	Catchment Area Treatment
CEA	Central Electricity Authority
CEIA	Cumulative Environment Impact Assessment
CO2	Carbon Dioxide
CTF	Clean Technology Fund
DEST	Department of Environment and Science Technology
DoE	Department of Energy
DPL	Development Policy Loan
DPR	Detailed Report Report
EIA	Environment Impact Assessment
FAC	Forest Advisory Committee
FY	Financial Year
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoHP	Government of Himachal Pradesh
GOI	Government of India
GW	Gigawatt
HDI	Human Development Index
HPDP	Himachal Pradesh Development Policy
HPDPL	Himachal Pradesh Development Policy Loan
IBRD	International Bank for Reconstruction and Development
IPP	Independent Power Producer
Kwh	Kilo Watt Hour
LADF	Local Area Development Fund
Mn Tons	Million Tones
MoEF	Ministry of Environment and Forestry
MoU	Memorandum of Understanding
MW	Mega Watt
Mwh	Mega Watt Hour
NTPC	National Thermal Power Corporation
PGCIL	Powergrid Corporation of India Ltd.
PIA	Pre-Implementation Agreement
PLF	Plant Load Factor
RE	Renewable Energy
SCOD	Schedule commercial Operation Date
SJVNL	Satluj Jal Vidyut Nigam Limited
TEC	Techno-Economic Clearances
ToR	Terms of Reference
VRE	Variable Renewable Energy

LIST OF CONVERSIONS USED:

1 USD = Rs.54.5 (www.oanda.com accessed on 22nd March 2013)

1GWh = 1000 MWh

CO_2 Emission/MWh = 0.78 ton of CO2 (As per CEA's CDM – CO_2 Baseline Database)

1 Lac = 1, 00,000 (One Hundred Thousand)

1 Crore = 10,000,000 (Ten Million)

SUMMARY OF INDICATIVE IMPACTS OF THE DPL SERIES

Key Indicators	Incremental Regional Impact (CTF/ World Bank Project – DPL by 2018-19)	Incremental Regional Impact (CTF/ World Bank Project – DPL)	Incremental National Impact(CTF/World Bank Leveraged Project DPL)
Hydropower generation capacity (MW)	2832 by 2018-19	10831 by 2032	33544 by 2032
Power generation (GWh/yr)	11164	42695	132230
Avoided CO2 over lifetime (MTCo2 Eq.)	20.72 (by 2018-19)	333.30(by 2032)	698.66(by 2032)
Average Annual CO_2 savings during the lifetime (MT CO2 eq.)	4.144	17.54	36.77
Financing/Leveraging Amount (Mn USD)	4357 Mn USD *(100 Mn CTF, 100 Mn IBRD, 1247 Mn Equity Financing, 2910 Mn Debt Financing)*	15898 Mn USD *(100 Mn CTF, 100 Mn IBRD, 4769 Mn Equity Financing, 11129 Mn Debt Financing)*	49438 Mn USD *(100 Mn CTF, 100 Mn IBRD,14771 Mn Equity Financing, 34467 Mn Debt Financing)*
CTF Investment Leverage Ratio (for every $1 invested)	1:41.57	1:159.98	1:492.38
CTF Cost Effectiveness US$ (per ton of CO2 avoided)	4.81	0.30	0.143
Environmental co-benefits	- Lower local pollution due to savings in GHG emissions from avoided thermal power generation and increase in variable renewable energy (VRE) generation as hydropower serves as a balancing reserve.		
Improved energy security	- Increased hydro share. - Increase in VRE share: India would have significantly high renewable energy share in the overall generation mix by 2032 as hydropower serves as a balancing reserve thereby promoting the deployment of VRE.		
Co-benefits	- Avoided reduction in coal imports by ~8% considering the current ratio of domestic and imported coal by 2032 - Savings of ~1610Mn USD in terms of coal imports annually by 2032. - Savings of ~6504 Mn USD in terms of transportation expenses of domestic coal due to avoided thermal capacity annually by 2032. - Revenue for the state in form of sale of free power royalty. - Replicability at other basins and states resulting in fast paced hydropower development		
Other non-quantifiable benefits	- Development of local industry - Increased employment - Cost reduction of electricity (only if the projects commission on time) - Positive impact on women and children by enabling access to modern energy services		

I. INTRODUCTION

1. Himachal Pradesh (HP) has some specific characteristics that set it apart from other Indian states. It faces development challenge arising from its high elevation, topography, resource dependence, and ecological vulnerability—as well as from a changing and more competitive international environment. The Government of India (GoI) has given HP the status of a "special category" state in recognition of these unique constraints, under which the state is the recipient of special central grants and incentives that have been instrumental to its development.

2. Despite its structural disadvantages, HP has performed remarkably on many measures of human development. The state has some of the best indicators for development in India and from its inception in 1971; it has had a higher per capita income and better social indicators than much of the country. This has been made possible by supportive government policies, a transparent and accessible administration, an implicit social compact and cohesion, and high levels of investment in human capital. But challenges do remain – notably that of promoting inclusive development for disadvantaged groups in remote areas.

3. However, the past pattern of development in HP raises concerns about the efficiency of natural resource use, and the sustainability of development. Following the development template used in the rest of the country, the hill states have attempted to attract industries that are at times highly polluting and resource intensive (such as cement, chemicals, and pharmaceuticals), through a variety of tax incentives, concessions and subsidies. The ability to further diversify the economy is limited by topography and poor market access, which render large scale industrialization costlier and more difficult than elsewhere in India. The economic benefits of the current growth strategy – one that is dependent on public spending, financed by borrowing and central assistance – may have reached its limits.

4. The sustainability of HP's success for the future will depend on addressing three major transitions. This has implications for other hill states/countries in the region. The first is to shift the growth strategy in HP from one that is still far too heavily dependent on public expenditure, to an increasing focus on the broad-based contribution from other sources of growth, for instance, its natural resources and tourism sectors, with an enabling environment for the private sector. The second is to create productive employment opportunities for HP's youth and increasingly educated labor force, so that reliance on the public sector as an employer of last resort goes down. A better growth strategy and improvements in the investment climate will play a crucial role, as will efforts to strengthen the quality and skills base of the state's labor force in order to ensure the outcome of good jobs that the state needs to sustain incomes. The third critical transition that HP will need to make is to better manage its environment and natural resources. This must take several key directions. The potential for hydropower development has to be judiciously and prudently managed to support the desired fiscal outturns and to invest in the future of the state. At the same time, the downside effects of hydropower development on the environment, especially reduced water for downstream uses, will require much improved attention to ensure that society as a whole benefits, and that development is sustainable.

Furthermore, a broader environmentally sustainable strategy will be essential, for forestry development, community projects, urban management, and water supply. Failure to take action against environmental degradation in a society dependent on its natural resource base could ultimately threaten future growth prospects. It is critical to address these challenges before they start to impact on the state's successful socio-economic performance.

5. Climate change is affecting and will continue to affect hydropower development. Presently, increased glacier melt is providing some additional flows but this will likely be offset by reduced contribution from snow fall in the medium term and by likely reductions in glacier melt flow in the longer term (ADB, 2010). Silt in the rivers is a major problem (silt levels during flood in the Satluj river exceed 100,000 ppm) and will become more serious as rainfall intensity increases. Many hydropower projects run at low load factors which may reduce further under future climatic conditions. Hydroelectric plants have to close when silt levels get too high as it happened during the recent unseasonal rainfall in June.[1]

6. The hydropower potential of the state is estimated to be about 27,436 MW i.e. about twenty five percent of the national hydropower potential. The drainage system of Himachal is composed both of rivers and glaciers. The state provides water to both the Indus and Ganges basins. The drainage systems of the region are the Chandra Bhaga or the Chenab, the Ravi, the Beas, the Sutlej and the Yamuna. **Himachal Pradesh is naturally suited for hydropower generation and accounts for over 30% of India's total hydropower potential in the Northern Region.**

7. The state government has been according hydropower the highest priority for its development, since hydropower generation can meet the growing needs of power for industry, agriculture and rural electrification. The abundance of perennial rivers enables Himachal to sell hydropower to other neighboring states such as Delhi, Punjab and Rajasthan, etc. It is also the largest source of income to the state. **The GoHP is developing a comprehensive policy and institutional framework through the Programmatic Inclusive Green Growth DPL series that would facilitate the development of overall 10 GW[2] of hydropower by 2020.**

8. The GoHP recognizes the importance of hydropower in bringing prosperity to Himachal Pradesh. The pace of development of hydropower in Himachal Pradesh has been much faster in comparison to other states however, can still be improved through institutional provisions mentioned later in this report. Till 1991, generation was only in the hands of central and state agencies. Post liberalization of the economy, Himachal Pradesh was the one of first states to allot a project to the private sector.[3] The Himachal Pradesh

---

[1] Recently, a sequel to the 2012 report - Turn down the Heat: Climate Extremes, Regional Impacts and the Case for Resilience - was released. The report looks at the likely impact of warming on agricultural production, water resources, coastal and mountain ecosystems and cities across three regions - South Asia, Sub-Saharan Africa, and South East Asia. The 2013 report finds that if the world warms by 2°C - which may happen within the next 20 to 30 years - widespread food and water shortages could unfold, together with prolonged droughts, unprecedented heat-waves, more intense rainfall and flooding, and a significant threat to energy production.

[2] 10 GW inclusive of existing installed capacity in Himachal Pradesh

[3] The 300 MW Baspa-II project in Kinnaur was completed by the Jaypee Group in the year 2003.

Government has since given a major fillip to hydropower development by allotting projects to central public sector undertakings, public-private partnerships and the private sector through MOUs and competitive bidding route respectively. Today much of the capacity has been allocated and is in implementation stages. It is important, however, to ensure that all on going hydropower projects in the state are completed in time so that both cost and time overruns are avoided and benefits reaped at the earliest. The state has so far allotted 22,500 MW hydropower potential out of its total potential of 27,436 MW through competitive bidding and it is important to ensure from economic and environmental perspectives that the projects are developed on a timely basis and in a sustainable manner, since the consequences of delays and deviations are enormous.

9. **Himachal Pradesh is emerging as a model in the country and for the region and seeks to attain the objective of becoming a "powerhouse" of the nation aiming to provide adequate, clean, reliable and quality power at competitive rates to consumers with the objective of promoting economic growth while sustaining the high Human Development Index (HDI). It has achieved its objective and is committed to improving it further.**

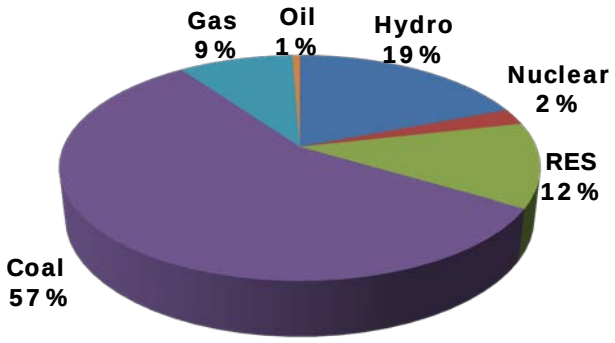
10. **At the same time, GoHP wants to ensure that the development of hydropower happens in an environmentally sustainable, socially responsible and climate resilient manner (GoHP State Climate Change Strategy and Action Plan, 2012). As a step forward in ensuring environmental sustainability and climate resilience, the state is moving to an an integrated and basin catchment area treatment approach including: (i) cumulative mitigation measures for soil erosion and landslide hazards; (ii) Redressal measures to address the problem of silt and debris load; (iii) continuous monitoring of sediment load from the tributaries directly discharging into the reservoir; and (iv) promoting scienfic approach to catchment area treatment. On social sustainability, GoHP has adopted an innovative revenue sharing scheme that pays annuities to local communities living in the affected villages during the operational life of hydropower projects.**

11. **Also, a key part of the revised strategy has been to identify the possible directions to assess and plan hydropower development in a more integrated approach. This includes assessment of possible multipurpose uses of some of the hydropower dams as well as examining ways to improve efficiency, sustainability, and reduce environmental impacts.**

12. **Hydropower potential in India is substantial and remains one of the few immediate options to address energy shortages and reduce the emissions intensity of the power sector at scale.** Coal has been the mainstay of India's power generation and continues to be the primary fuel source, **as India lacks sufficient alternate sources of domestic energy. India's current installed generation capacity (~211 GW) out of which about 67% thermal (57% coal, 9% gas and 1% oil) followed by 19% hydropower. Over the years the contribution of hydropower to the generation mix - more than 45% in 1980 - has been worsening steadily an**

unbalanced hydro thermal mix, with serious consequences for the Indian power system.

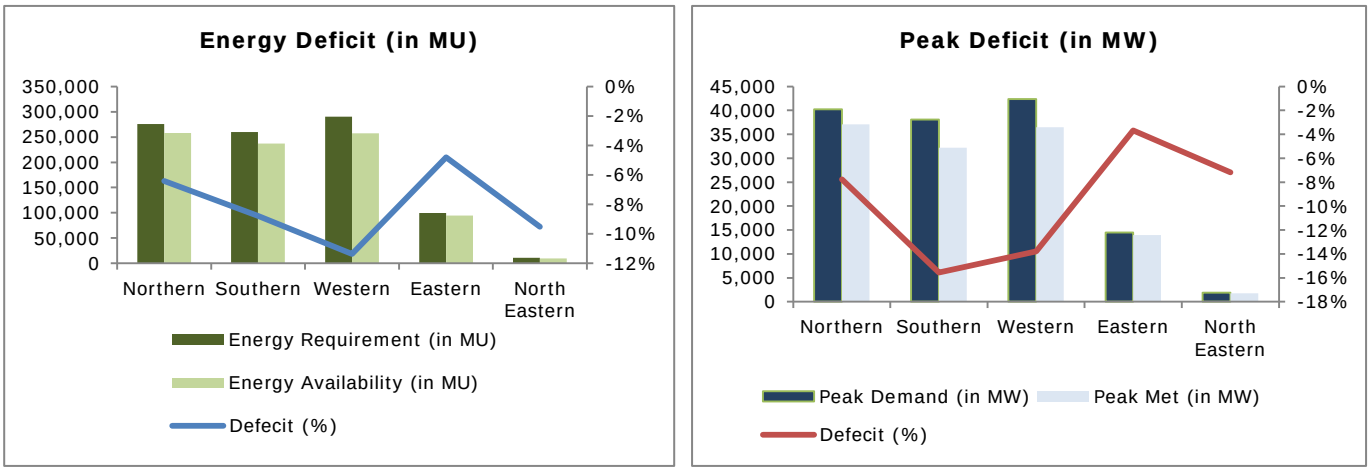
Figure 1: Fuel-mix by Installed Capacity (as of January 2013)



Source: Central Electricity Authority (CEA), 2013

13. With a total potential of 148,700 MW (in terms of installed capacity), hydropower remains one of the critical options to address the energy/peak shortages, limit the carbon intensity of the power sector and achieve the objective of diversification of energy sources and address energy/peak shortages in the country.[4] Ability of hydropower plants to respond quickly to demand fluctuations makes them the ideal electricity source to cope with demand peaks and help stabilize system frequency. Hydro generation also counterbalances the carbon intensity of the power sector and mitigates the risk of global climate change. In FY 2011-12, the country witnessed a peak power shortage of 10.6 percent and an energy deficit of 8.5 percent. Figure 2 indicates the power supply position in FY 2011-12.

Figure 2: Regional Power Supply Position (Energy and Peak), March 2012



[4] Government of India is committed to cut its carbon intensity by 20-25 per cent from 2005 levels by 2020.

Source: CEA Power Supply Position, 2012

14. Apart from serving the peaking power requirements of the country hydropower serves as a balancing reserve for the system. With increased contributions from variable renewable energy sources like wind and solar there is an urgent need for a larger base of system flexible and fast response balancing resources. In addition, hydropower in Himachal Pradesh is located close to the high demand states of Delhi, Punjab, Haryana and Rajasthan, thus avoiding long distance power transmission and its consequences in terms of system losses and voltage drops. If India has to address its growing energy needs in an environmentally sustainable manner, and has to achieve its intent of incorporating renewable energy on a large scale as envisaged in policy (30 GW of RE is proposed to be installed in the 11th Five Year Plan between 2012 and 2017, with sharp increases thereafter), corresponding large scale hydropower development is an inescapable reality.

15. In the backdrop of these local and national advantages, Himachal Pradesh also faces significant barriers to its hydropower development. Specific development challenges arising from its high elevation, topography, resource dependence, and ecological vulnerability need to be addressed. Despite allotting large number of hydropower projects for execution, the pace of their development in Himachal Pradesh has remained sluggish, slipping from agreed schedule due to the following key fundamental issues arising at various stages of development of a project. **It is envisaged that the HP IGG Programmatic DPL series supported by IBRD and CTF will significantly leverage policy and institutional reforms which in turn will help remove a number of barriers.** Annexure A nicely summarizes the measure being taken by GoHP through the Programmatic DPL series to ease a number of such barriers.

a. **Long processing time for obtaining statutory clearances:** Development of a hydro power project requires a large number of consents and clearances right from the initial conceptualization of the project to the plant commissioning, which includes the environmental and forest clearances. The lack of a predictable and comprehensive regulatory framework leads to significant delays in attaining such clearances.

b. **Delays from civil society and stakeholder concerns and grievances:** Lack of an enabling policy and legislative framework to build consensus on the State's hydropower policies among civil society and communities is another major barrier. Although there are mechanisms that deliver benefits to local communities from hydropower development, they are not often discussed and disclosed often leading to specific grievances at times lead to significant delays.

c. **Lack of appropriate project identification**: In the past, project identification has often suffered due to projects being identified on the basis of topographical sheets in an ad hoc manner without assessing the river basin as a whole and without proper ground level verification. This results in inadequate attention to environmental concerns about riparian distance and about ecologically sensitive areas and improper assessment of hydropower potential. When such issues are raised this often results in developers getting dissatisfied with sites identified for project location, leading to disputes and frequent requests for change of project domain.

d. Emerging environmental and social challenges: The Government both at the center and states such as HP have taken a number of measures in recent years to accelerate hydropower development (of special relevance to private developers are the preparation of a shelf of well investigated projects, which could substantially reduce risk perceptions), streamlining of the clearance procedures, the provisions of open access and trading as per Electricity Act 2003, etc. Efforts are also being made to make long-term debt available. This has generated substantial interest from the private sector in investing in run-of-the-river hydro projects resulting in a record number of applications and allocations. At the same time, the upsurge in investments has also brought with it new set of environmental and social challenges that both the governments (center and state) are trying to address. **While climate change presents additional risks to the state and especially to hydropower development, it is not expected to have any immediate impact. Most models project changes happening in the 20-40 year timeframe and hence will not be a major factor in GoHP or GoI reaching their Co2 emission reduction targets (in the next 5-10 years).** A number of new policies and regulations are being contemplated which the developers' worry may cause further delays in the clearance process. Some of the new issues are:

- Requirement of minimum "Riparian Distance" of 1-2 Km between two Projects.
- Conducting the river basin studies as a requirement for granting the final forest clearance
- Enhanced quantum of discharge required to be released downstream of the diversion structure by the Developers (to 20% in place of minimum flow of 15% as per the current policy).
- More stringent environmental impact assessment requirements for obtaining forest clearance.
- Enhanced requirements for preparation of Catchment Area Treatment (CAT) Plans.
- Continuous and enhanced monitoring of mountain ecosystem and in particular the state of glaciers.[5]
- Recognition of community rights in the project areas.

e. Other Issues:

- **Land acquisition and contractual problems**: A number of projects have been getting delayed due to land acquisition and contractual problems.
- **Geological surprises:** Geological surprises such as flash floods, rockslides and landslides often impede the development process of the project.

[5] Both the National Action Plan on Climate Change and HP State Strategy and Action Plan on Climate Change give particular importance to maintaining and sustaining Himalayan ecosystem.

- **Absence of adequate power evacuation and transmission infrastructure:** Uncertainty in availability of transmission lines by the time of completion of projects. **Also there are cost allocation issues for planning basin wide transmission corridors for multiple projects where the project's commissioning is staggered over a period of time.**
- **Non availability of centralized and reliable hydrological database:** Non-availability of topo sheets of project area by the government to private developers remains a key issue affecting development
- **Lack of access infrastructure:** Development of roads & bridges to have easy access to the project sites is crucial for expediting the execution of projects and needs special attention as a large part of hydro power potential in the country is in Himachal Pradesh where accessibility to project sites is a problem due to difficult terrains and geography of the state.
- **Cost of Funds:** Investor confidence in hydro projects is fragile on account of the long gestation period, high initial capital costs, and unbalanced risk profile of the projects on account of information gaps, inherent project risks and local development issues.

A number of these constraints will be addressed by the programmatic HP IGG DPL series.

16.Time & Cost Overruns:

In addition to the above constraints, most hydro projects in the state face cost and time-overruns due to a variety of reasons. Table 1 shows the time and cost overruns of projects delayed on account of various reasons in the business as usual (BAU)[6] scenario. This has implications not only to the developers but also for state finances.

Table 1: Time & Cost Overrun of Delayed Plants in the BAU scenario

Name of the Plant	Capacity (MW)	Scheduled year of commissioning	Anticipated year of commissioning	Original Cost (Mn USD)	Anticipated Cost (Mn USD)	Cost overrun (Mn USD)	Time Overrun (Years)
Kol Dam	800	2008-2010	2014-15	830.7	1166.8	336.1	5
Parbati-III	520	2010-2011	2012-2014	422.8	498.3	75.6	3
Parbati – II	800	2009-2010	2016-2017	719.2	984.6	265.4	8
Uhl-III	100	2006-2007	2014-15	79.2	172.6	93.4	7
Sawra Kuddu	111	2010-2011	2014-15	102.5	216.9	114.4	4

Source: CEA 2012

a. Impact on Revenue for the state

According to the Hydropower Policy of 2006, the GoHP is entitled to royalty from hydropower projects, in the form of 12 per cent of power generated by the project for the first 12 years of project operation, 18 per cent of power generated by the project free power

[6] BAU scenario refers to a scenario without the DPL

for the next 18 years, and 30 per cent of power generated by the project free power after 30 years of project operation. Subsequently, after 40 years of operation, the project reverts to the state free of cost. The state has also retained the right to take up equity in the new hydropower projects. In the case of JV projects, in addition to the 12 per cent royalty power, GoHP also has an entitlement of additional power proportionate to their equity stake at the regulated tariff that it can either use within the state or sell to other states.

17. Revenues from hydropower are thus a major contributor to the revenue of the state. As mentioned above, there is significant untapped hydropower potential in HP on account of the state's water supply through five perennial rivers. Judicious exploitation of the unrealized potential in an environmentally sustainable manner and accelerated development of projects under implementation assumes particular significance, not just as a source of "green energy" that can help alleviate the power shortage in the Northern Grid, but also as a critical source of non-tax revenue for the state. As shown in table 2 the delay in commissioning of hydropower projects has resulted in significant loss of revenues for the GoHP leading to a tenuous fiscal situation. The following table highlights the loss of revenues for GoHP and the project developers. These losses have been calculated on the basis of the units of generation (free power + LADF[7] = 13% free power) lost due to delay in commissioning of the plant and subsequent delays in returns.

b. Impact on Revenue for the developer

18. Delays in commissioning of the hydropower projects impact the revenue for the developer as well. Indeed, the loss of revenue on the developer will be much higher than government. Long payback periods coupled with unbalanced risk profile skewed towards the developer make hydropower project unattractive for investment. Table 2 below shows the revenue losses for the developer. These losses have been calculated on the basis of the units of generation (apart from the free power given to HP i.e. 12% and 1% as LADF) lost due to delay in commissioning of the plant and subsequent delays in returns.

[7] LADF: Local Area Development Fund: The Hydropower Policy was adopted by GoHP in 2006 to improve basic amenities and infrastructure facilities in the project affected villages of hydropower projects. The Policy provides for a contribution by project developers to a LADF based on final construction costs.

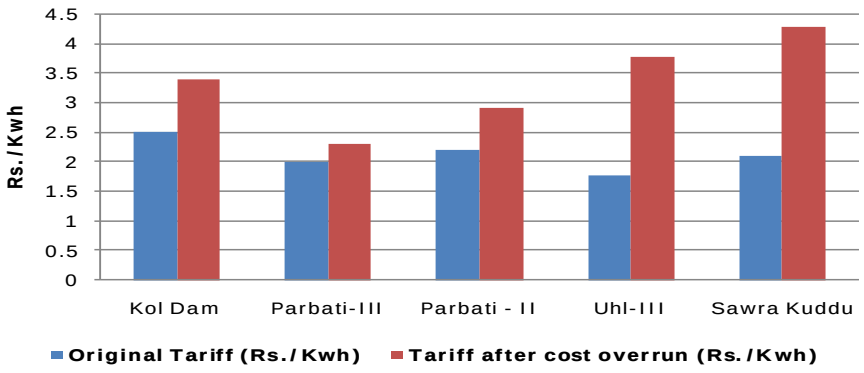
Table 2: Cumulative Loss of Revenue[8] due to delay in commissioning of hydropower projects in HP

Name of the Plant	Revenue Loss in Mn USD (GoHP.)	Revenue Loss in Mn USD (Developer)	Time Overrun (years)
Kol Dam	86.8	636.5	5
Ram pur	31.5	230.8	4
Parbati-III	27.1	198.6	3
Parbati – II	122.2	896.2	8
Uhl-III	10.8	79.3	7
Sawra Kuddu	8.1	59.1	4
Sainj	5.1	37.3	2
Total	**291.5**	**2137.7**	

Source: AF-Mercados EMI Analysis (Refer Table 1)

19. Delay in commissioning of hydropower plants also impacts the resultant tariff. Since delays cause increase in the overall cost and loss of revenue from the plant (as shown in the table 1 and 2 above), this leads to an increase in tariff in cases where the regulatory dispensation allows for pass-through of the cost overruns. In case of private sector projects where such a dispensation is not available, the project viability is seriously impacted, resulting in financing delays that further affect viability.

Figure 3: Estimated Impact of Delays on Tariff[9]



Source: AF-Mercados EMI Analysis (Refer Table 1)

[8] The Revenue loss has been calculated by estimating 1st year tariff after considering the cost overruns as shown in table 1.

[9] The computations are based upon the difference in tariff as a result of delay in commissioning of hydropower plants.

20. For reasons of ecologically and socially secure development, early monetisation of projects for financial benefits, containment of tariffs to reasonable levels and retaining project viability, there is an urgent need to institute mechanisms and support systems that limit hydro development and construction delays. Establishment of an institutional mechanism for sustainable hydropower development including integrated basin-wide planning and monitoring and implementation of environment management activities related to hydropower development will help ensure that the project development activities happen in a timely and environmentally and socially sustainable manner.

21. Within the above context, the GoI has requested policy-based budget support as a Development Policy Loan to assist the Government of Himachal Pradesh (GoHP) to promote inclusive green growth and sustainable development and undertake a paradigm shift towards the sustainability of the main engines of growth. **The programmatic HP IGG DPL series** will ensure that project development is facilitated adequately by resolving some of the development barriers articulated earlier, while simultaneously ensuring that the environmental and social safeguards are adequately in place.

22. Himachal Pradesh is richly endowed with natural resources and this program is designed to unleash its comparative advantage of generating growth through improved stewardship of its natural assets. The program will assist GoHP in its efforts towards inclusive green growth, with transformative actions across the key engines of economic growth – energy (hydropower), watershed management, industry and tourism.

A significant number of these barriers particularly those related to environmental approvals and social issues as described above in (a), (b), (c) and (d) will be addressed through the DPL.

II. PROJECT DESCRIPTION

23. GoI has secured US$100 million from International Bank for Reconstruction & Development (IBRD) resources to finance the first in a series of two Development Policy Loans (DPLs), and is seeking an additional US$ 100 million of Clean Technology Fund (CTF) resources for the second DPL in the series. This is consistent with the practice to leverage CTF resources with funds from multilateral agencies in addition to resources that will be put forth by the state. Through this Program, GoHP will promote inclusive green growth and the environmental and social sustainability of hydropower in HP, which is consistent with the objectives of the CTF. The DPL series complements a range of initiatives that the State of Himachal Pradesh has been actively pursuing to support its policy objective of promoting environmentally sustainable growth. Several of these are currently at a stage where they need to be supported by investments on the ground to ensure their continuity. Additionally, several new interventions will need to be planned to accelerate the pace hydropower development in the state. The overall investment quantum is large. Several alternate funding avenues are being considered in this regard. The initial investments made to support these programs will be critical in catalyzing the respective programs and have transformative impact on the segment that the respective programs seek to achieve.

24. Through this Program, GoHP will promote inclusive green growth and the environmental and social sustainability of hydropower in HP, which is consistent with the objectives of the CTF. This operation will also promote the public disclosure of the State's comprehensive Action Plan on Climate Change and support the introduction of a novel scheme to the benefit sharing policy that would provide an annuity payment to affected households during the lifetime of hydropower projects, as well as other forms of compensation. To address the environmental challenges of hydropower, there is a commitment to adopt a river basin approach to risk assessment and management, address cumulative impacts and establish transparent and publicly verifiable mechanisms to assure adequate ecological (environmental) river flows. At the end of the series, a policy and institutional framework will be in place to contribute to achieving the objective of reducing greenhouse gas (GHG) emissions intensity; to ensure compliance with environmental flow requirements including measures to address any issues of non-compliance; the completion of cumulative impact assessment for at least one river basin; and the implementation of a benefit sharing mechanism as illustrated by the issuance of cash transfers in one hydropower project and commissioning of works mandated by community based program. Together these represent a far reaching policy transformation in the way in which hydropower projects are implemented in Himachal Pradesh and have potential for broader application and replication.

25. The measures under HP IGG DPL series have been initiated by IBRD funding and the CTF funding would leverage and support GoHP in timely completion and effective implementation of this initiatives. Therefore, the DPL operation as a whole needs to be considered as the changes in totality resulting through this process will all be influencing improvement from sustainability aspect of hydropower projects in Himachal Pradesh which in turn may reduce the time of completion. Further, while IBRD and CTF funding would be contributing in equal proportion in implementation of initiatives in Himachal Pradesh, without the latter investment, the initiatives triggered would faces hurdles in completion and execution.

Scope of Activities under DPL

26. The aim of this DPL is **to promote environmental and social sustainability of run-of-river hydropower** by addressing the first four barriers (para 12) identified above, and to permit timely project development with adequate safeguards. Success of such hydropower development in HP would bring added benefits and will serve as a template not only for mid-Himalayan states in India, but for other countries in the South Asia region (such as Bhutan and Nepal), since most of the developers in the state are active regionally in these countries and would utilize their experience and expertise globally. **The CTF co-financing will take forward the measures initiated as a part of the $100 Mn funded DPL financed by World Bank as discussed below. CTF co-financing is of vital importance. The initiatives are of significant nature and need to be sustained beyond initial DPL. Thus, this programmatic DPL series will help in bringing about policy reforms which will further facilitate institutional capacity building, strengthening and sustaining the existing initiatives/decisions being undertaken by the GoHP for hydropower development and eventually lead to several benefits as elaborated below:**

27. The activities undertaken and proposed by GoHP as a part of the DPL are as follows:

a. An online web based monitoring mechanism for real time effective monitoring of various milestones of implementation of Hydropower projects in Himachal Pradesh, which have been rationalized and timelines for achieving these milestones have been fixed as per actual inputs from the projects under implementation. The provision of penalties is added for defaulters. At the same time the government has been made more accountable by fixing timelines and for accordance of TEC at State level.

b. Facilitating hydropower project developers (especially IPPs) in cases where extra-ordinary delays have occurred due to various reasons for instance, in cases when the IPP's were not able to take time extension as there was no provision for time extension in their agreements. The government created a provision for time extension by levying well defined extension fee;

c. Formulation of Domain change policy and policy for enhancement of allotted capacity;

d. Periodic monitoring of status of project implementation and issuance of notices for defaulting companies on regular basis to avoid delay in implementation of the allotted capacity,

e. Expediting the process of obtaining environmental clearances through discussions with various authorities at State and GOI level.

The main milestones are indicated as under:

- Upfront premium.
- Signing of pre Implementation Agreement (PIA)
- Freezing of components and submission of PFR
- Submission of Detailed project Report (DRP)
- Signing of the Implementation agreement (IA)
- Techno-Economic Clearances (TEC)
- Zero date and Start of construction work
- Schedule commercial Operation Date (SCOD) of the project
- Commercial Operation Date (COD) Actual Commercial Operation
- Handing over of the project to the Government free of cost

The monitoring of these milestones shall be effective to the extent that the delay in achieving these milestones shall be checked automatically and would be helpful to take immediate necessary steps to facilitate the developers in achieving the requisite milestones for smooth and effective implementation of the Projects. The financial milestones module is being developed and will be incorporated subsequently

f. Digitization of Basins Wise Plans, exploration of new potential, identification of balance potential and preparation of IPs. This will help avoid misidentification of project sites in addition to help maintain adequate riparian distance between projects.

g. Moreover to ensure quality and safety of all ongoing projects in the State, the Government has constituted a committee of empanelled technical experts from different fields, to conduct inspection of project sites.

h. To ensure development of Transmission facilities, the State Transmission Utility (STU) has been constituted and committee meeting regularly held to sought out all evacuation problems.

i. While climate change is not going to impact hydropower production in the immediate short term (it is longer term 20-40 year issue) GoHP is seriously studying the linkages between trends in climate and trends in glacier extent (length, area, volume, and melt volumes) and its implications for future water resources of the state.

j. The State Government is in process of carrying out various studies in the river basins for the assessment of impacts due to projects implementation like CEIA, Basin carrying capacity assessment.

- Optimization of potential studies for each basins.
- Cumulative Environment Impact Assessment (CEIA) Studies.
- Local Area Development Fund Impact Studies.
- Basin carrying capacity studies.

DPL resources will be targeted at initiating several actions proposed above and also to maintain/strengthen the initiatives and structures already in place.

28. Adoption of a river basin approach to risk assessment and management, address cumulative impacts and establish transparent and publicly verifiable mechanisms to assure adequate ecological (environmental) river flows. The DPL series is intended to facilitate interim review of the ongoing Satluj CEIA (Cumulative Environment Impact Assessment) study leading to the development of concurrent action plan. **The co-financing will help leverage and effectively implement the measures in –Ravi, Beas and Yamuna river basins, thus enhancing the scale of development.**

Expected Benefits

29. If successfully implemented, with due care for social and environmental impacts, the planned hydropower expansion could alter the baseline trajectory for emissions from the power sector, because it offers the sole economically feasible clean alternative to both base load and peaking fossil-based power generation plants. If this expansion were to fall short, India would most likely be compelled to further expand its coal-based generation capacity, and also forego a large proportion of proposed RE capacity additions for reasons elaborated upon subsequently in this annex.

30. DPL will also facilitate the following Local benefits/ State benefits: The specific benefits to the state and its populace include the following:

a. GoHP will be able to promote inclusive green growth and environmental and social sustainability of hydropower in Himachal Pradesh.
b. Supporting the initiative of developing and distributing Local Area Development Fund, which is a community based benefit sharing program administered by local development authorities, and financed by 1.5 percent of project construction costs paid by project developers.
c. Benefit sharing based on direct cash transfers to beneficiaries: support the introduction of a novel scheme to the benefit sharing policy that would provide an annuity payment to affected households during the lifetime of hydropower projects (annual revenues equivalent to 1 percent of power sales from the project are shared during the lifetime of the project), as well as other forms of compensation thereby contributing in alleviating poverty. This will cover the following:

    i. 85% equally among the resident families Project Affected Area (PAA) on the date of allotment of the Project.

    ii. 15% to, all the Below Poverty Line families in the PAA. This amount will be in addition to the amount received by these families as stated above subject to the condition that the maximum amount payable to the BPL families does not exceed 1.5 times the amount' payable- to all families.

    iii. The Developer will be entitled to claim compensation for the delays and financial losses (in commissioning. of the Project) due to work stoppage on account of agitation 'by local people during construction of the Project. The Project proponent shall submit the details of the stoppages on account of agitations the locals and these delays (in number of days) shall be approved by the State Level Committee in, consultation with District Authorities. The financial loss to the Developer will be worked out for the accepted number of days of delay(s) with reference to the annual generation (Design Energy and will be deducted from the revenue which shall accrue from 1% free power and will be paid to the Developer.

    iv. A new proposal for distribution of Post Commissioning LADF is under consideration by the Government wherein it has been proposed that 50% of the total revenue will be distributed to all the families of PAA while the remaining 50% will be distributed on the Land Basis i.e. on the basis of Land Acquired for the implementation of the Project. The list if beneficiary families in the Project Affected Area shall be finalized and published by the concerned Deputy Commissioner. A redressal mechanism to address the grievances arising out on

the selection of the beneficiary and of disbursement and management of LADF on this account has been constituted by GoHP.

v. For implementation of LADF Contribution as a Pilot Project Chamera-III (231 MW) has been taken up computation on the above proposed arrangement of distribution of LADF i.e. 50% to all families while balance 50% in proportionate to the Land acquired for the Project on the basis of the details of the families in PAA.

d. A policy and institutional framework will be in place to contribute to achieving the objective of reducing GHG emissions intensity.

e. Risk assessment and management at river basin level rather than by individual projects, and risk-based assessment of environmental flow requirements.

f. Local economy benefits – Hydropower development provides additional non-tax revenue for the state and therefore remains fiscally attractive. Calculations suggest that should GoHP be successful in achieving its objective of developing hydropower resources, the revenues from the sale of royalty power together with dividends, could be more than 35 percent of HP's current revenues and could be more than 87 percent of the states non-tax revenues by FY2015-16.

g. Build investor confidence in the projects and in the state agencies by opening avenues for financial institutions to develop their credit portfolio in the hydropower sector.

With this Program, HP will be the foremost state in making a tangible contribution to the GoI objective on GHG emissions intensity.

III. CTF INVESTMENT PLAN FOR INDIA

The Government of India proposes to access the Clean Technology Fund (CTF) to help remove barriers and scale up the deployment of renewable energy and energy efficiency and support the country's voluntary objective to lower carbon intensity by 20 to 25 percent by 2020 against a 2005 baseline.

Since the CTF can address only certain select barriers based on its mandate and given that the goals of "transformative" and "leverage impacts" nature of interventions that the CTF is mandated to cater to, the selected interventions that are being proposed for CTF co-financing in Phase 1 are:

i. **Renewable Energy Development in the State of Himachal Pradesh** - The objective of this priority activity is to provide a Development Policy Loan to the State of Himachal Pradesh, which will be focused on policies to establish a framework for local benefit sharing, and sound watershed management, that will promote the social acceptability and environmental sustainability of renewable energy, including hydropower development, and result in increased deployment of renewable energy with shorter lead time.

ii. **Implementation support to activities under the NMEEE** - The objective of this support is to provide concessional finance for implementation support of NMEEE. The NMEE proposed innovative and market approach-based programs that covers demand side and supply side energy efficiency measures. IBRD and Climate Investment Funds (CIFs) would provide resources for incentive mechanisms that encourage market making efforts. This intervention would support two key schemes of NMEEE (a) Perform, Achieve and Trade; and (b) Super- Efficient Appliance Deployment (SEAD).

iii. **Partial Risk Guarantee Scheme -** Partial Risk Guarantee scheme for new technologies in renewable energy and energy efficiency - The objective of this priority activity is to help extend the reach of private financing by mitigating perceived risk and encourage private sector involvement in these sectors; this facility will act as a risk-sharing mechanism that will provide commercial banks with partial coverage of their risk exposure, thereby helping investors get lower cost debt. The fund would be available in case of default only, i.e., it will be paid out to participating banks in the event of a loss or default, as specified in the structure of the PRG mechanism.

iv. **Implementation support to activities under the JNNSM –** The objective of this support is to provide financing support to new and innovative technologies which have not been financed under Phase I; help lower the cost of financing and facilitating technology transfer in the establishment of solar parks and contribute to a concessional financing pool for projects under 300 MW of phases I and II of the Mission, to help overcome high up-front capital and lack of access to long term credit at attractive rates. Concessional finance will be critical to bring down the initial costs in adoption of CSP technologies while the ecosystem to the support solar power is being developed. Also the private sector developers under the first phase are mostly opting for the most developed and proven technology of parabolic trough. The Ministry wants to examine

avenues for supporting pilot projects using CSP technologies other than trough technologies, which are not fully commercial yet have high replicable potential for India. They are also unlikely to receive private sector financing in the normal course, since these are high technology risk projects, and would need concessional financing. Multilateral development assistance is being extended to the GOI in developing several solar parks comprising multiple utility scale solar generating plants, transmission systems, and associated infrastructures being developed taking a PPP approach.

The co-financing plan for the different priority activities have been summarized in the table below.

Table 3: Financing Plan

Priority Activities	CTF Financing (Mn USD)
DPL for Himachal Pradesh	100
NMEEE	100
Partial Risk Guarantee Scheme	25
JNNSM	550

Source:*https://www.climateinvestmentfunds.org/cifnet/sites/default/files/India%20Presentation%20to%20CTF%20Committee.pdf*

IV. ASSESSMENT OF THE PROPOSED PROJECT WITH CTF INVESTMENT CRITERIA

A. POTENTIAL FOR GHG EMISSIONS SAVINGS

31. Harnessing of the state's large run-of-river hydropower potential represents perhaps the only opportunity for HP to promote clean energy at scale, and, in the Government's estimation, is a critical way to contribute to India's growing energy demand, in particular for peak energy demand. Thus there is little doubt hydropower expansion would have to proceed irrespective of the external involvement as this is very much a part of GoHP's own development and fiscal agenda, but this DPL series (both IRBD and CTF funded) seeks to ensure that the hydropower development is done in an environmentally and socially sound manner. The DPL would also help in fast-tracking the existing hydropower development in HP through host of new institutional measures and further strengthening the existing set up.

32. The state is likely to add an incremental hydropower capacity of 10831 MW by 2032. This capacity is being added through various hydro projects in the under-construction and pre-construction phase across the five rivers in HP. The untapped potential in the state is also expected to be harnessed majorly located at the Satluj, Chenab and Beas basins. CTF intervention through DPL is likely to advance the development of this capacity by instituting various measures that accelerate the development of these projects relative to the business as usual scenario.

33. Hence for the purpose of computing the CO_2 emission savings, the incremental hydropower capacity during each year (10,831 MW by 2032 as shown in Annexure - C) that will come up as a result of accelerated development of projects through execution of reforms under DPL has been taken into consideration. This is explained below.

Annual Incremental Hydro Power Capacity (during each year) = *(Annual Hydro Power Capacity Addition after DPL) – (Annual Hydro Power Capacity Addition in the Business as Usual Case (without CTF))*

34. The detailed calculation based on the above explanation is shown in Annexure C, Table D.

Reforms planned under the DPL would result in advancement of the hydro power capacity likely to be commissioned during each year. While initial set of measure under the DPL were introduced through the IBRD funding, the introduction of remaining measure and sustaining them over longer term would require additional funds targeted under the CTF. Thus, the CTF investment would serve as a catalyst to such development and would target investment to strengthen institutional mechanism and institute measure for fast paced development. Being a policy lending instrument, CTF fund is likely to have strong leverage value much beyond the individual project and state level, to national and regional level.

35. The detailed methodology for computation of CO2 emission reduction is shown in Annexure – C for both BAU and DPL Scenario as defined below:

a. The BAU scenario can be defined as a baseline case, which assumes that future hydropower development would be similar to the past and existing trends shall continue. Further it assumes that the incremental demand in the region would be met mainly through thermal and hydro power.

b. DPL Scenario can be defined as a case wherein hydropower development accelerates through introduction of policy and institutional measures (through CTF funding) that promote fast paced development. As a result of this loan, the development of future hydropower capacity in the region will be advanced resulting timely commissioning of hydropower projects. This in the long run will also attract new investments.

36. For the purpose of this study, the grid emission factor as per CEA's Report on "Baseline Carbon Dioxide Emissions from Power Sector – Version 8" released in January 2013 has been considered to be 0.78 tCO2/MWh for the lifetime of the project. The grid emission factor has been kept constant for the lifetime as this depends on the GCV of coal used in various thermal power stations. The GCV/quality of coal used in India has been varying due to increased use of blended coal (mix of domestic and imported coal) and uncertainty in the availability of domestic coal. This trend makes it difficult to predict any specific blending mix over a period of 20 years. Hence, for the sake of convenience a static figure has been used.

In the BAU scenario, the annual GHG emissions are likely to reach ~1367 Mn Tones of CO_2 equivalent for the power sector by 2032 as shown in Annexure C, Table A. With the support of DPL, the proposed development of hydro power capacity, under various stages of constructions, will reduce the projected annual CO_2 emission level from~1367 to ~1334 Mn Tones of CO_2 equivalent resulting into an annual savings of ~33 Mn Tones of CO_2 by 2032 (with average annual savings of ~17.5 MT CO_2 eq). Moreover, over the lifetime of the project (by 2032), the cumulative GHG emissions savings of ~333 Mn Tones [10] of CO_2 eq by 2032 can be achieved as shown in Annexure C, Table D. This has been assessed based on the avoided coal based generation as shown below:

Table 4: CO_2 emissions in BAU Scenario and with DPL

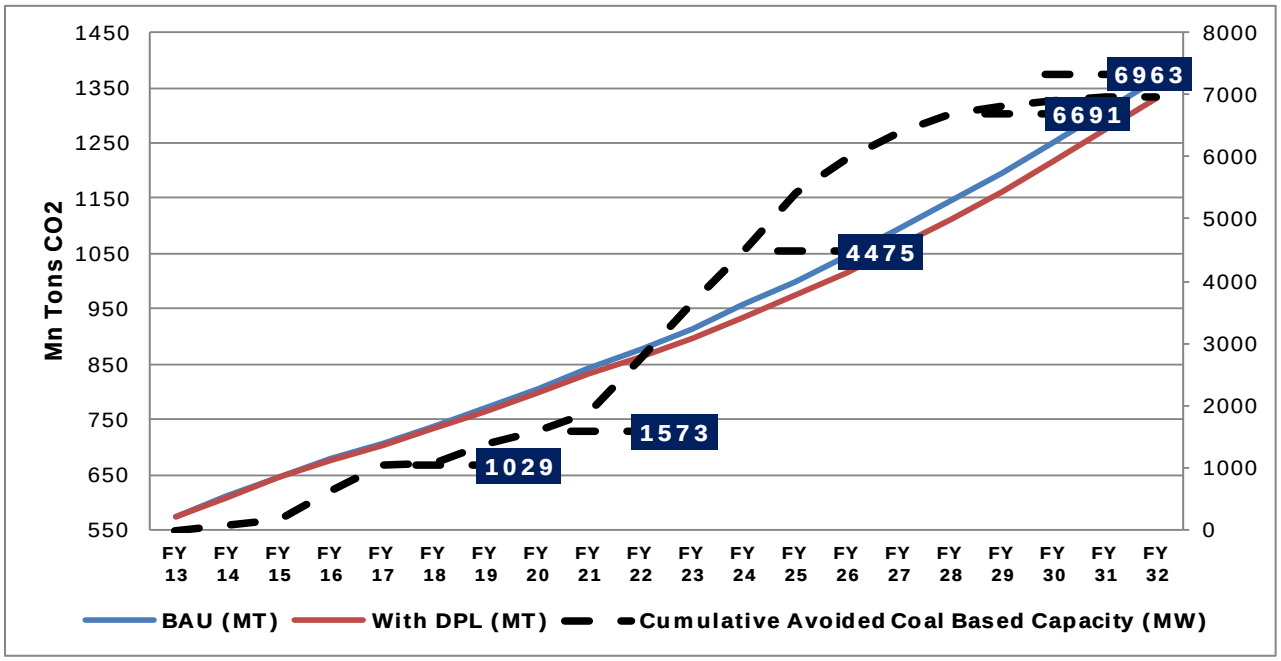
Parameters	FY 13	FY 17	FY 21	FY 25	FY 29	FY 32
BAU (Mn Tons of CO2 equivalent)	572.59	707.77	842.61	1000.15	1195.46	1366.58
With CTF co-funding (Mn Tons of CO2 equivalent)	572.59	702.85	833.51	974.17	1162.93	1333.28
Annual Emission Savings as a result of CTF co-financing (Mn	0.00	4.84	8.96	25.58	32.03	32.79

[10] Considering the plant load factor of 45% for hydro power project and a grid emission factor of 0.78 tCO2 Eq/MWh as per CEA.

Parameters	FY 13	FY 17	FY 21	FY 25	FY 29	FY 32
Tons of CO2 equivalent)						
Cumulative Emission Savings as a result of CTF co-financing (Mn Tons of CO2 equivalent)	0	8.88	36.77	113.45	235.25	333.3
Cumulative Avoided Coal Based Capacity (MW)	0	1029	1903	5431	6801	6963

Source: AF-Mercados EMI Analysis

Figure 4: Comparison of CO_2 emission levels in the BAU scenario and in the DPL scenario



Source: AF-Mercados EMI Analysis

37. The above table and the graph show the comparison between the CO_2 emission in Business as Usual (BAU) scenario and DPL scenario. From the above graph it can be inferred that with DPL the emission levels would decrease in comparison to the BAU scenario. This would result in avoidance of cumulative thermal capacity of 6963 MW by 2032 as shown in (refer table 3). Run-of River hydropower plants do not cause net emissions of GHG except the comparatively small amounts of such gases released as a result of manufacturing of equipment and construction work, including transportation. As per the study[11] conducted by the World Bank, the rough estimate indicate that without forest clearance the specific emission of CO_2 would be in the order of 1g/kWh.

[11] Review of Greenhouse Gas Emissions from the Creation of Hydropower Reservoirs in India, Background Paper on "India: Strategies for Low Carbon Growth" dated July 2008.

Technology Development Status

38. Hydropower technology is mature both nationally and internationally. The main impact that the DPL will have is on reducing the delays in commissioning of the hydropower projects rather than having a direct impact on technology.

B. COST-EFFECTIVENESS

39. **The CTF investment per ton of CO_2 reduction would be ~$0.295 at the regional level and ~$0.143 at the national level by 2032**. The above numbers have been computed from the resulting emission reduction on ~333 Mn Tones of CO2 at regional and ~699 Mn Tones at national level respectively by 2032. Therefore, it can be inferred that the CTF investment in implementation of the DPL would result into a significant support for the State's Action Plan on Climate Change.

40. Hydropower technology is a mature technology and hence there is limited scope for scale effect of technology deployment contributing to a reduction in the cost of hydropower. However, the outcome of the DPL series will be in the form of faster implementation of hydro power projects, thereby resulting in reduced cost of generation, and environmentally benign electricity production. The reduced cost of power and reliability would support the country's objective of faster growth in a sustained manner.

Instituting the above initiatives and policies will also have tremendous replicability value for the projects in the state and for other hydro rich states.

C. DEMONSTRATION POTENTIAL AT SCALE

41. India's power sector emissions are expected to reach ~1367[12] Mn Tones of CO_2 eq by 2032 due to increasing coal based power generation. The changing hydro thermal mix and the increasing share of thermal energy in India's generation basket is likely to continue in the short and medium term. In this particular scenario Variable Renewable Energy (VRE) such as Solar and Wind power and Hydro power would play an important role in reducing CO_2 emissions. Implementation of the DPL project will give immense benefits in terms of avoided CO_2 emissions by 2032. The table below shows the reduction of CO_2 emission as percentage of total emissions in the country.

Table 5: Future trend of CO_2 Emissions as % of total emissions

Parameters	FY13	FY17	FY21	FY25	FY29	FY32
Annual Reduction of CO2 emission (Mn Tons)	0.00	4.84	8.96	25.58	32.03	32.79
as % of total emissions	0.00 %	0.68%	1.06%	2.56%	2.68%	2.40%

Source: AF-Mercados EMI Analysis

[12] As explained Annexure C , Table A.

42. The aim of this DPL is to promote the environmental and social sustainability of hydropower. The development in hydropower that get facilitated through the DPL support would encourage other hydro rich states like Uttarakhand, Arunachal Pradesh and Sikkim to replicate and learn from the policy reforms. The DPL would facilitate in exploitation of the unallocated potential of hydropower in Himachal Pradesh on various rivers through CEIA studies. This development will percolate to other hydro rich states that benefit from these river basins thereby leading to a reduction in the dependence on thermal power.

43. Success of hydropower development in HP would bring added benefits and will serve as a template not only for mid-Himalayan states in India, but for other countries in the South Asia region (such as Bhutan and Nepal), since most of the developers in the state are active regionally in these countries and would utilize their experience and expertise globally.

44. The post project replication pathway would be:

a. Accelerate the development of hydropower in Himachal Pradesh and other hydro rich states of the northern region through policy and institutional reforms.
b. Displace the development of thermal power capacity.
c. Use hydropower as a balancing reserve for variable renewable energy and meeting peak energy demands both at the regional and the national level.
d. Promote basin-wide risk assessment and management through Cumulative Environment Impact Assessments to overcome geological and other risks.
e. Leverage existing studies in other hydro rich states at the national and the regional level.
f. Leverage the competencies and build institutional capacity.

45. Success factors that are necessary for project results to contribute to transformation:

a. Commissioning of the hydropower projects as close as possible to schedules.
b. Accelerated development of projects to cover up the backlog.

Transformation potential

46. The DPL project would alone contribute to development in the state of Himachal Pradesh. The results arising due reforms planned under DPL in HP can be evaluated after some years as the gestation period of hydropower projects is reasonably high. Hence, the replication of such reforms in the country could be taken up only after the initial results of this DPL. The replication potential of this project would be high and would accelerate the hydropower development in other resource rich states like Sikkim, Uttarakhand, and Arunachal Pradesh etc thus encouraging newer investments. The trajectory of emissions from DPL alone in HP over the lifetime of 20 years would result into a CO_2 emissions reduction of ~333 Mn Tones. The replication of similar DPL in other states in the country would result into higher magnitude of CO_2 emission reduction. For computing the impacts of replication, the capacity in the pre-construction and under construction phase have been considered in various hydro rich states of the country as

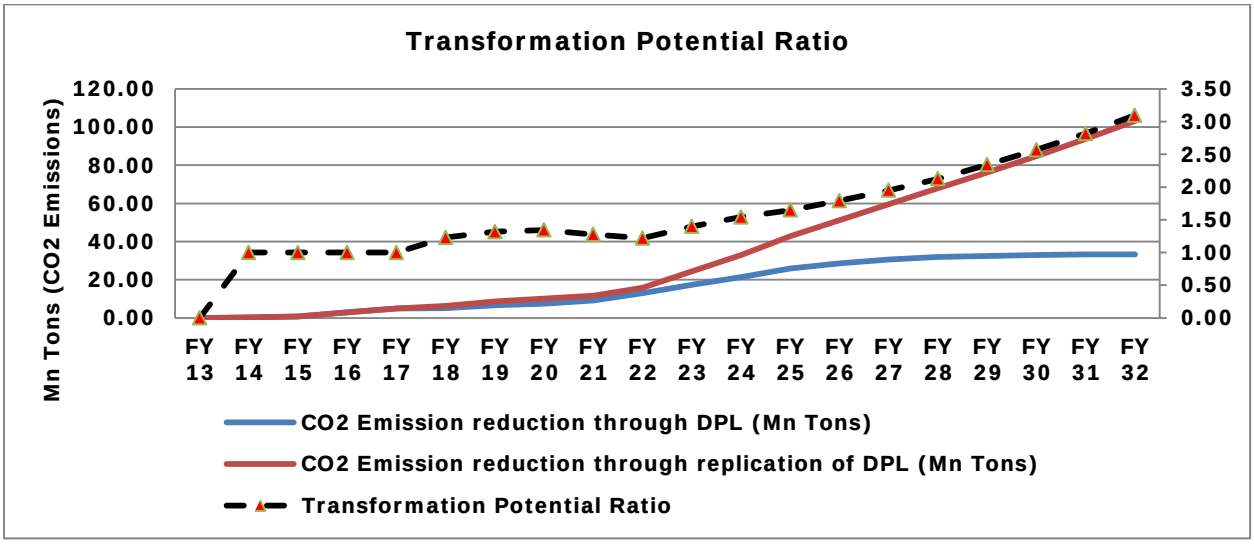
discussed above. The ratio between trajectory of reduced emissions that would result directly from the DPL alone and trajectory of reduced emissions that would result if the DPL project were to be replicated throughout the targeted area, region or sector have been summarized below.

Table 6: Transformation Potential Ratio

Parameters	FY 13	FY 17	FY 21	FY 25	FY 29	FY 32
CO2 Emission reduction through DPL (Mn Tons)	0.00	4.84	8.96	25.58	32.03	32.79
CO2 Emission reduction through replication of DPL (Mn Tons)	0.00	4.84	11.60	42.82	76.16	103.14
Transformational Ratio	0.00	1.00	1.29	1.67	2.38	3.15

Source: AF-Mercados EMI Analysis

Figure 6: Transformation Potential Ratio



Source: AF-Mercados EMI Analysis

47. As observed from the table above the transformation potential ratio is going to be high with the DPL project. The ratio between the reduced emissions of the replication of the DPL project and the DPL project alone is likely to increase throughout the life of the project. The harnessing of this potential would result in an additional capacity of around ~23000 MW of hydro power at national level.

48. Moreover, since the DPL is a policy lending instrument it will have much higher leverage than conventional investments. Therefore, in order to consider the leverage of CTF investment, the incremental hydropower capacity due to preponement of the projects in pipeline overtime has been considered for the purpose of computation of incremental CO_2 emission savings.

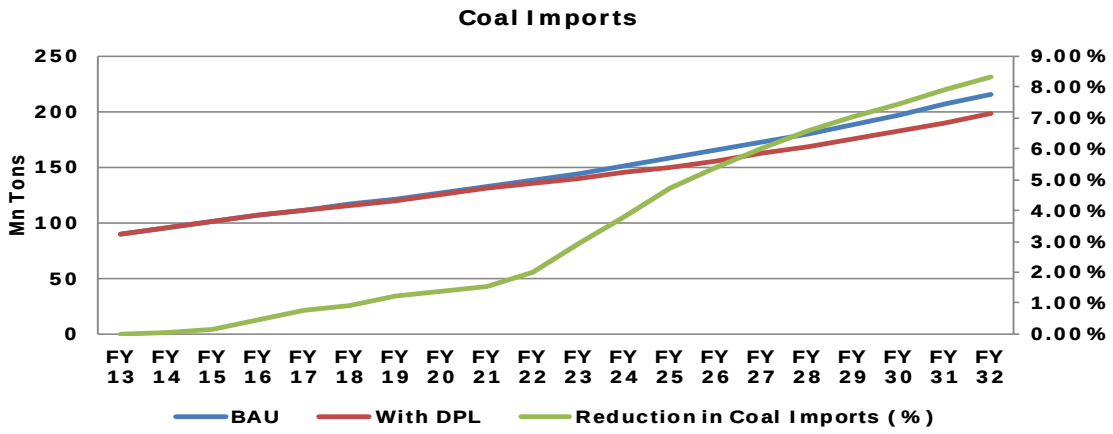
D. DEVELOPMENT IMPACT

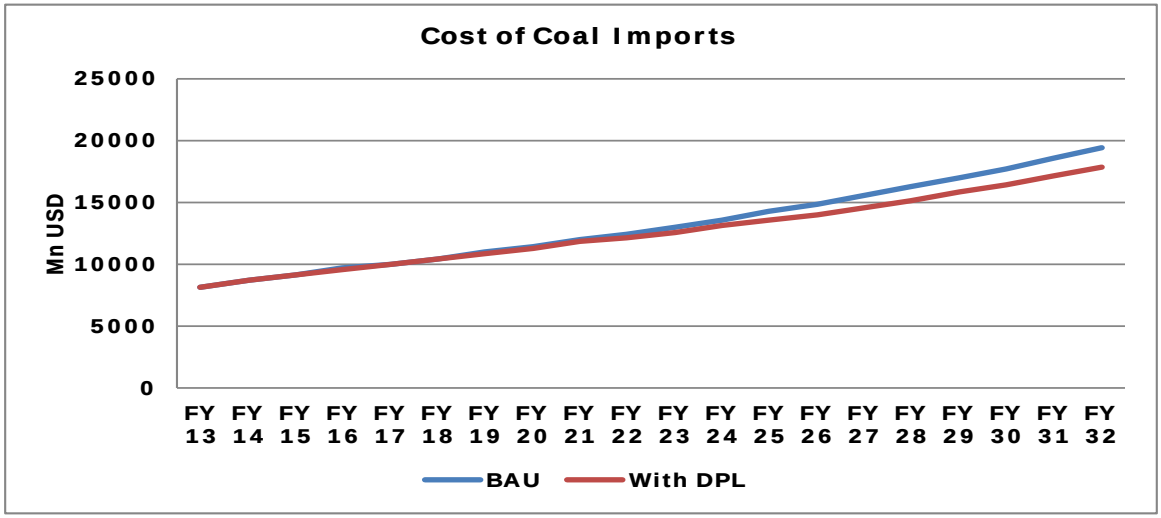
49. The policy-level budget support to GoHP through the DPL will facilitate hydropower development at an accelerated pace minimizing the issues currently faced by various stakeholders. Since this intervention will affect the supply-side of the energy balance of the country, it will not have a direct impact on the reduction of energy intensity of GDP. However, this intervention will have a significant impact on the reduction in the carbon intensity of GDP because of the expected reductions in GHG emissions. The DPL will help GoHP avoid reliance on alternate (polluting) sources of revenue from industry, which will help promote a sustainable ecology and social development in the mountain state.

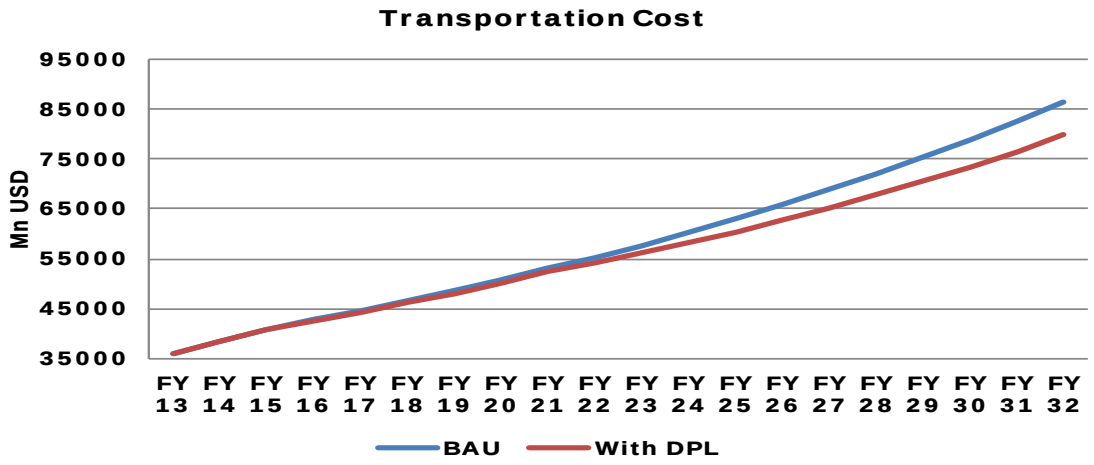
50. **DPL would help in reducing coal imports for meeting the country's increasing demand for electricity:** Though the Government is taking measures to reduce supply risk and Indian companies are expanding the number of countries they source fuel supplies from, it is necessary to focus on diversification of the energy sources and also development of hydropower which unlike thermal helps meet the peak demand. Power sector in India is already importing coal**. A further surge in fuel imports is likely to strain public and private finances and foreign exchange reserves and widen fiscal and trade deficits.** The contribution from hydropower and renewable energy generation is the only option available for the country in order to reduce the cost of generation and build reliability to mitigate the peak deficits of the nation.

The coal imports have started to hamper the current account deficits of the country which stand at a level of 5.2% of the GDP as per recent update. Therefore, there is need to reduce the imports of fossil fuel and develop alternative sources of energy. The following graphs illustrate the likely impact that the HP DPL can make at the national level. The country is likely to have a coal based capacity of ~285GW by 2032 increasing the cost of power. The cost increase is likely to be due to the price of imported coal and the transportation cost of fuel from pithead and ports to the demand centres.

Figure 5: Benefits of reduction in consumption of coal







Source: AF Mercados EMI Analysis

51. Post implementation of the CTF co-financed project, it is likely that the share of hydropower will increase in the overall generation mix of the country. If built on time, power generated from hydro plants is relatively cheaper than power generated from thermal power plants. Increasing prices of domestic coal and the use of imported coal to overcome the fuel availability constraints in the country will automatically lead to an increase in the price of the power thus generated. Since thermal power plants are used to serve baseload demand only, hydropower on the contrary has the ability to serve not only the baseload demand but also peak demand additionally it can also act as a spinning/balancing reserve. Harnessing the potential would help relieve the coal dominated and VRE intensive power system. A reasonable mix of hydro and gas in the system would help in maintaining the grid frequency and in turn ensure power reliability and grid stability.

52. The average cost of power generated by coal fired power stations to serve the base load is around 7 cents/kWh and the peak load is around 13 cents/kWh. The development of hydro power and reducing cost of renewable generation would result in reduction of cost

of serving the base load by 1 cent/kWh and 4 cent/kWh during the peak load. As also mentioned earlier, **hydro power would also play a vital role in form of flexible and fast response reserves to maintain the system stability in a power system featuring high proportion variable renewable sources. It would serve as balancing power to absorb the variable nature of wind and solar energy, thereby accelerating the growth of renewable energy across the country. Power reliability is intended to improve significantly with this development.**

53. In addition, the innovative benefit sharing policy is expected to have a direct impact on poverty alleviation for host communities. The Poverty and Social Impact Analysis prepared by the Bank for the DPL series will monitor ex-post the success of these policies.

Environmental and Social co-benefits

54. The environmental and social co-benefits resulting from the HP DPL have been summarized below.

- Significant reduction in CO_2 emissions;
- Promote environmental and social sustainability;
- Promote climate resilience
- Implementation of benefit sharing policy as illustrated by issuance of cash transfers in one hydropower project and commissioning of works mandated by community based program;
- Compliance with environmental flow requirements and completion of cumulative environmental impact assessment for one river basin, and support of such assessments in other river basins which will facilitate future capacity;
- Creation of the Department of Environment, Science and Technology (DEST) promoted under the first fiscal DPL (2007), with additional earmarked resources.

55. Hydropower projects consider community development initiatives concerning issues of health, poverty, economic development and gender. Hydropower projects can impose social and economic costs on local populations early in the planning and construction process. These can include loss of land, other assets (such as houses, wells, etc.) and livelihoods due to land acquisition, physical relocation of communities, stress on ecosystems, possible migration of workers and exposure of crops (and people) to construction waste. On the other hand, the benefits from better or cheaper access to hydropower are spread over the long-term and subject to uncertainties stemming from the physical challenges in power distribution in mountainous regions or simultaneous growth in the supply of and the industrial demand for energy.

56. Hydropower projects help in the creation of jobs and a corresponding increase in income of the families. This helps in alleviating poverty and thus raising the standard of the families. Amongst others, the power policy of the state attempts to address aspects like access and availability, affordability and assured employment to people of Himachal. The employment opportunities so created would provide women with equal opportunities to earn and access to modern energy services thereby reducing their time and effort. Further, the free power available to GoHP will aid on providing continuous, reliable

electricity to the citizens of the state with maximum benefits accruing women and children.

E. IMPLEMENTATION POTENTIAL

57. The implementation of the measured proposed above strongly depend on the existing state policy and the institutional wherewithal to implement the policy provisions. The current policy and institutional structure in Himachal Pradesh provide a conducive environment for hydropower development.

58. The pace of hydropower development in Himachal Pradesh has been faster than any other state in the region/country. This has been due to the conducive central and state level policy support and implementation. Initiatives undertaken by the Government of Himachal Pradesh include formation of DEST, introducing penalty framework for hydropower project developers, attempt to balance the risk profile of the project to attract private sector investment, etc. In order to provide further impetus to hydro power development in the state and to address the issues faced by the states, several amendments have been made ever since it was issued in 2006. Implementation of policy happens in the context of policy and institutional framework that has already been created and such policies exist both at the national and the state level.

59. GoHP's **Hydropower Policy 2006** lays down the regulating framework and provides guidelines to hydropower project developers with regard to bidding for hydropower projects, incentive and penalty framework, etc. With changing scenarios these policies have been amended from time to time to ensure that they are in line with the requirements of the changing environment.

60. Hydropower development in India received impetus with the introduction of the **Hydropower Policy 1998** at the central level. Basin wise development of hydro potential was envisaged and significant emphasis was accorded to private sector participation. **Further in 2002, CEA carried out preliminary ranking studies** of about 400 schemes in the six river basins of the country. Subsequent to this, in 2003, the Prime Minister's **50,000 MW Hydro Power Initiative was launched in which** PFRs (pre-feasibility reports) of 162 new projects having an aggregate capacity of 47,930 MW were prepared which were spread across 16 states. The Electricity Act that was notified in 2003 which provided a framework for development of new capacity on a competitive basis and placed statutory responsibility on regulators for market development. The Electricity Act 2003 has opened up significant investment opportunities in the generation sector by de-licensing electricity generation. This has enabled setting up power plants at optimum locations and transmitting power to the power deficit states using open access in transmission. In other words, the Act mandates competition and choice, which were non-existent in the pre-Electricity Act 2003 era. Subsequently, the **National Electricity Policy** was notified in **2005** and it encourages hydropower development through private participation and stresses on the need for successful models for Public Private Partnership. In 2006, the **National Tariff Policy was notified; the Integrated Energy Policy** was announced in the same year, followed by the **National Policy on Resettlement and Rehabilitation in 2007. The**

National Hydro Power Policy was notified in **2008** which brings the state level policies in close coordination with central policy and facilitates new project development through price regulated contracts. In 2009, the **National Water Mission was announced under the National Action Plan on Climate Change and the Mega Power Project Policy was announced which further encouraged hydropower development in the country.**

61. The policies at the central and the state level provide an enabling framework for accelerated development of hydropower. Accelerated hydropower development through the DPL would help creating an enabling environment for effective implementation of the policies, and lead to a balance in the risk profile between the project developer and the host entity. This would attract investment/sources of finance from different multilateral and bilateral sources. The HP DPL support will lead to a) cost reduction, b) creation of enabling social infrastructure and c) construction being de-risked and accelerated. With these developments, equity co-financing becomes available. Hence, HP DPL will provide confidence to equity investors and hydropower projects will get access to both debt and equity financing.

62. In addition to the above policies GoHP has undertaken consultations with stakeholders to align this operation of hydropower development with State plans and priorities, in an effort to promote inclusion in policy making. Careful consideration has been given to political economy factors in the design of the policy reforms and sequencing of DPL. Moreover, there is multi-party support among the major parties and a growing consensus that a paradigm shift towards a sustainable economic growth model would be universally beneficial for the State and would enhance the economic self-interest of its population. For reference Letter from Chief Secretary Himachal Pradesh has been attached in Annexure B.

Expected Co-Financing

63. Hydropower projects in Himachal Pradesh are owned by the Central, State and the Private sector. Multiple sources of funding are available to these sectors and the ratio of debt to equity varies on project to project basis which is usually 70:30 but in several projects this ratio has even been 50:50; 65:35; 75:25; etc. Sources of Debt funding typically include Banks, Non-Banking Financial Companies (NBFC), Multilateral/Bilateral agencies including IFI's and private sector lenders or combination of these sources while Equity is generally available from Central/State Government; public utilities, capital markets, domestic and international private investors, etc.

The DPL does not directly finance the projects but would accelerate the availability of financing for hydropower projects. Further, in the current case, the CTF leverage ratio has been calculated based on the incremental capacity addition of hydro power projects.

64. The DPL would be supported by co-financing from IBRD for a 100 Mn USD along a CTF funding of 100 Mn USD. With this DPL supported through CTF, the state is likely to accelerate development of ~10415 MW bringing in an investment of ~15488 Mn USD further broken down into ~4586 Mn USD in form of equity financing and ~10702 Mn USD through debt financing. Much of this investment will come from private sector

equity investors and commercial banking channels. The CTF investment leverage ratio would be **1:158.98** through implementation of DPL in the targeted area alone and **1:492.38** through its replication at regional and national level for every $1 invested through CTF. Hence, the HP DPL will crowd-in/ attract adequate quantity of finance and at reasonable costs. This will lead to creation of a virtuous cycle.

65. The project development accelerated by the DPL would result into financing support from various sources as tabulated below:

Table 7: Proposed Financing Sources for Hydropower Projects in Himachal Pradesh

Sr. No.	Sector	Proposed allocation	Remarks
1	State	17%	For execution of these projects, Funds arranged/being arranged from PFC, REC, multilateral funding from ADB and bilateral funding from KFW German Development Bank. Equity share for these projects is being provided by Govt. of Himachal Pradesh to HPSEB Ltd., HPPTC Ltd. and HPPC Ltd.
2	Central & Joint	39%	From their own resources and loan from different agencies including World Bank etc.
3	Private above 5 MW	38%	From their own resources and loan from different agencies
4	Private upto 5 MW	6%	From their own resources and loan from different agencies

F. ADDITIONAL COSTS/RISK PREMIUM

66. Delays during implementation of hydropower projects on account of clearances, land acquisition, etc affect the project developer especially the private ones. GoHP has set incentives and a penalty framework on achieving/not achieving the development milestones of the project. Delays lead to accumulation of monetary losses on the developers making the returns/project unattractive. The multiple risks associated with hydropower projects affect the developer the most since the risk sharing mechanism between the Government and the project developer is unbalanced. This makes hydropower projects unattractive for investment in the face of large and varied risks.

67. As articulated in preceding sections of this annex, the tariff impact of the delays can be severe (if cost variations due to development delays and additional cost incidence) if allowed to be passed through. If the costs are to be absorbed by the developer, the delays lead to non-viability of the project, lack of finance (or additional costs as risk premium), and in certain cases can lead to abandonment of the project by the developer. The DPL would help in bringing about policy reforms that will reduce the risks and the subsequent delays in the commissioning of the projects.

68. Despite allotting large number of hydropower projects for execution, the pace of their development in Himachal Pradesh has remained sluggish, slipping from agreed schedule due to the key fundamental issues arising at various stages of development of a project.

The DPL series complements a range of initiatives that the State of Himachal Pradesh has been actively pursuing to support its policy objective of promoting environmentally sustainable growth. Several of these are currently at a stage where they need to be supported by investments on the ground to ensure their continuity. Additionally, several new interventions will need to be planned to accelerate the pace hydropower development in the state. The overall investment quantum is large. Several alternate funding avenues are being considered in this regard. The initial investments made to support these programs will be critical in catalyzing the respective programs and have transformative impact on the segment that the respective programs seek to achieve**.**

Moreover, since the DPL is a policy lending instrument it will have much higher leverage than conventional investments.

ANNEXURE A

	Envisaged Barriers of Hydro Development (baseline)	Steps to address Barriers by Government of Himachal Pradesh (GoHP)
1.	**Long processing time for obtaining statutory environment and forest clearances**: Development of a hydro power project requires a large number of consents and clearances right from the initial conceptualization of the project to the plant commissioning, in particular environmental and forest clearances. The lack of a predictable and comprehensive regulatory framework leads to significant delays in attaining such clearances. The processing time is of prime importance for hydropower projects as they have the longest gestation period and higher land requirement compared to all other categories of power projects. In some cases, projects face serious challenge to their viability despite being a clean source of energy, thus adversely affecting the targets planned for12th and 13th Five Year Plans.	As a part of **HP IGG DPL II supported by CTF** the Department of Energy will introduce a web based real-time monitoring of project milestones, including those relating to environment and social parameters and environmental flows. The real-time monitoring will be effective in identifying delays in achieving project milestones and help GoHP to take immediate necessary steps to facilitate the developers in achieving the requisite clearances for smooth and effective implementation of the Projects. This will also help in identifying key systemic barriers in implementation. Moreover to ensure quality and safety of all ongoing projects in the State, the Government has constituted a committee of empanelled technical experts from different fields, to conduct surprise inspection of project sites.
2.	**Project identification** has often suffered due to projects being identified on the basis of topographical sheets in an ad hoc manner without assessing the river basin as a whole and without proper ground level verification. This results in inadequate attention to environmental concerns including about riparian distance and about ecologically sensitive areas and improper assessment of hydropower potential. When such issues are raised this often results in developers getting dissatisfied with sites identified for project location, leading to disputes and frequent requests for change of project domain.	As a part of **HP IGG DPL I GoHP** has carried out the digitization of entire basins in the state and also estimated using optimization techniques the hydropower potential in the state. The full digital maps for all the river basins have been prepared. From the digital mapping, the potential hydropower in the state has been estimated at a 27,436 MW. The digitized maps will now help in ensuring that environmental issues including concerning riparian distance are identified while granting licenses for hydropower plants.
3.	**Delays from civil society and stakeholder concerns** and grievances due to lack of an enabling policy and legislative framework to build consensus on the State's hydropower policies among civil society and communities is another major barrier. Although	Innovative and transparent benefit sharing arrangements: As a part of **HP IGG DPL I**, GoHP issued a public notification regarding the amendment to Local Area Development Fund (2to

	there are mechanisms that deliver benefits to local communities from hydropower development, they are not often discussed and disclosed often leading to specific grievances at times lead to significant delays.	include a long-term benefit sharing policy to provide annuities to affected communities during the lifetime of hydropower projects within the state. Cash transfers are expected to commence as a part of CTF supported **HP IGG DPL II**. This is in addition to the existing scheme that involves contributions (1.5 percent) of project costs to be paid by developers to a Local Area Development Fund, 2009 (LADF) during the construction phase for undertaking local area development activities. All the beneficiaries will be publicly disclosed in DOE website. The State has recently adopted a Policy for "Compensation for Damage to Crops during construction of Power Projects" to recompense for loss of production or income on account of incidental damage to crops on land not acquired for project construction. **Such a generous benefit sharing policy does not exist in any other state in India**.
4.	**Emerging Issues**: The Government both at the center and states such as HP have taken a number of measures in recent years to accelerate hydropower development (of special relevance to private developers are the preparation of a shelf of well investigated projects, which could substantially reduce risk perceptions), streamlining of the clearance procedures, the provisions of open access and trading as per Electricity Act 2003, etc. Efforts are also being made to make long-term debt available. This has generated substantial interest from the private sector in investing in run-of-the-river hydro projects resulting in a record number of applications and allocations. At the same time, the upsurge in investments has also brought with it new set of environmental and social challenges that both the governments (center and state) are trying to address. A number of new policies and regulations are being contemplated which the developers' worry may cause further delays in the clearance process. Some of the new issues are: o Requirement of minimum "Riparian Distance" of 1-2 Km between two Projects. o Conducting the Basin studies prior to grant of final forest clearance o Enhanced quantum of discharge required to be released downstream of the diversion structure by the Developers (to 20% in place of minimum flow of 15% as per the current policy).	GoHP has anticipated a number of these emerging issues and through the **HP IGG DPL series** is addressing them in a proactive manner. This in turn will ensure that when the policies becomes effective, HP will already be ahead in facilitating its developers a speedy clearance process. (a) To understand basin issues from environmental and social perspective, Cumulative Environmental Impact Assessments (CEIA) of all River Basins was initiated as a part of **HP IGG DPL I**. HP IGG DPL II supported by CTF will ensure that an implementation plan for Satluj Basin study is ready and studies are progressing for other basins. (b) HP is the **only state in India** to have mandated environmental flows of a minimum of 15 percent (of the average lean flow) in all hydropower developments

	o Stronger environmental impact assessment requirements for obtaining forest clearance. o Enhanced requirements for preparation of Catchment Area Treatment (CAT) Plans. o Continuous and enhanced monitoring of mountain ecosystem and in particular the state of glaciers o Recognition of community rights in the project areas.	for eco-systems, and to provide for the riparian rights of downstream communities. To assure compliance with this Policy, the installation of real time online e-flow monitoring instruments in all new projects is being mandated as a part of **HP IGG DPL II** supported by CTF. (c) The State is moving towards a river basin approach to the development and implementation of Integrated Basin wide Catchment Area Treatment (CAT) Plans– deemed global best-practice for managing impacts. The State prepared and finalized an integrated CAT Plan for the Sutlej basin under **HP IGG DPL I** and similar work is in progress for three other river basins based on high quality disaggregated baseline data on forest cover and quality, erosion intensity, and silt load. A monitoring framework has been put in place to ensure the proper disposal of muck and debris – a visible concern in previous hydropower developments. **HP IGG DPL II** supported by CTF is strengthening these efforts on completion of scientific planning of CAT Plans in all the basins of the state but also on monitoring the silt and erosion so as to improve life of reservoirs of hydro project. These efforts will significantly reduce the concerns associated with forest clearance and speed up the process.

5.	**Absence of adequate power evacuation and transmission infrastructure**: Uncertainty in availability of transmission lines by the time of completion of projects. Also there are cost allocation issues for planning basin wide transmission corridors for multiple projects where the project's commissioning is staggered over a period of time.	To ensure development of Transmission facilities, the State Transmission Utility (STU) has been constituted and committee meeting regularly held to sought out all evacuation problems.
6.	**Other Issues**: **Land acquisition and contractual problems**: There are a number of projects getting delayed due to land acquisition and contractual problems. **Geological surprises**: Geological surprises such as flash floods, rockslides and landslides often impede the development process of the project. **Non availability of centralized and reliable hydrological database**: Non-availability of topo sheets of project area by the government to private developers remains a key issue affecting development **Lack of access infrastructure**: Development of roads & bridges to have easy access to the project sites is crucial for expediting the execution of projects and needs special attention as a large part of hydro power potential in the country is in Himachal Pradesh where accessibility to project sites is a problem due to difficult terrains and geography of the state. **Cost of Funds**: Investor confidence in hydro projects is fragile on account of the long gestation period, high initial capital costs, and unbalanced risk profile of the projects on account of information gaps, inherent project risks and local development issues.	While GoHP has tried to address a number of barriers to hydropower development in the state through **HP IGG DPL Series**, a number of issues still remain some of which are beyond GoHP's control. But GoHP is making sincere efforts to improving the investment climate and remove infrastructural bottlenecks to remove some of these additional bottlenecks. In the long run, economic development steered by hydropower development will provide impetus to accelerate development of sustainable hydropower in the state.

ANNEXURE B

Sudripta Roy, IAS
Chief Secretary

Government of Himachal Pradesh Shimla-171002
Tel: (O) 0177-2621022
Fax: 0177-2621813
E-mail: cs-hp@nic.in

DO No. PS/Pr. Secy/2012-Finance
Dated: the 20th July, 2012

Subject: **Himachal Pradesh Development Policy Loan to Promote Inclusive Green Growth and Sustainable Development-reg.**

Dear Sir Gopalan,

You are aware that the Government of Himachal Pradesh has requested Development Policy Loan of US $ 200 million with the assistance of World Bank. In the above context, several rounds of discussions have been held with the World Bank team, and a list of prior actions for the loan were mutually finalized. The State Government has successfully completed the prior action points which have been identified by the World Bank as 'condition precedent' for the phase-I in the series.

The State Government is seeking this DPL to support the policy reform program of the State and to promote a paradigm shift towards a more sustainable economic development model that would gel with the State's comparative advantage and abundant natural resources. The objective of the proposed Development Policy Loan (DPL) is to support Government of Himachal Pradesh to undertake critical policy actions with monitorable results, particularly with regard to the energy sector, tourism, industrial and rural development. As requested by the Department of Economic Affairs (DEA), the DPL has been designed to able to access the IBRD and the Clean Technology Fund (CTF).

The program of reforms undertaken by the Government of Himachal Pradesh is aimed at generating growth through the improved management of its natural assets across growth engines of the economy and to promote inclusive green growth and sustainable development. It is anticipated that this DPL will further deepen the reform program, and contribute to several outcomes. In the energy sector, the reforms will enable the State to harness hydropower potential in a sustainable and environment friendly manner. Himachal Pradesh will also implement an innovative benefit sharing scheme based on annuity payments to affected communities during the lifetime of each hydropower project.

1/2

The watersheds of the major north Indian rivers sustain life and support the agrarian economy of over 200 million people in Haryana, Punjab, Uttar Pradesh and Rajasthan. As part of the DPL, the GoHP intends to promote micro-water watershed conservation and development approaches that would contribute to alleviating rural poverty and improve water pondage, crop diversification, productivity and water efficiency in at least one Gram Panchayat per Block.

Managing emissions from industry and promoting cleaner forms of economic growth will be essential to meet the inclusive green growth and sustainable development goal of the State. Himachal Pradesh also has considerable unrealized ecotourism potential for developing these cleaner sources of growth. The reforms will also enable the use of economic instruments for pollution control in the State.

There is strong ownership of the proposed reforms across the departments in the State, and teams have been mobilized to implement the same. In addition, the State is committed to monitor the results and adjust the program as may be required from time to time.

Given the above context, we request that the Ministry of Finance to give us full support to pursue our policy reforms through the Development Policy Loan from the World Bank. Considering that the technical discussions have been undertaken with the Department of Economic Affairs, Ministry of Finance, Ministry of Environment & Forests, Government of India and the World Bank team, and all prior actions have been met by the State Government, I would, therefore, request you for early approval and disbursement under this DPL.

With deep regards,

Yours faithfully,

(Sudripta Roy)

Sh. R. Gopalan, IAS
Secretary,
Department of Economic Affairs, Ministry of Finance,
North Block, New Delhi.

Endst. No. As above Date: Shimla-2 the 20th July, 2012

Copy to Mr. N. Roberto Zagha, country Director, India for the World Bank, 70 Lodhi Estate, New Delhi-10003.

Chief Secretary to the
Government of Himachal Pradesh

ANNEXURE C

Methodology for computation of CO_2 Emissions

According to the current methodology, the CO_2 Emission savings have been calculated using the following approach for a period of 20 years (FY13-FY32):

BAU Scenario:

The BAU scenario can be defined as a baseline case, which assumes that future hydropower development would be similar to the past and existing trends shall continue. Further it assumes that the incremental demand in the region would be met mainly through thermal and hydro power. The following inputs have been considered:

Category	Existing Capacity	Capacity addition till 2022	Capacity addition beyond 2022
Thermal	CEA Generation, March 2012	As per XII and XIII Plan targets of Govt. of India.	Past growth trends (Since no official target exists)
Hydro	-	As per the projects allocated by GoHP.	As per plans of GoHP.

- Existing thermal capacity has been taken from the CEA Generation Report for March 2012.
- For future years, the coal based capacity addition has been taken to compute the thermal generation and respective CO_2 emissions as per the 18th EPS and as per the 12th and 13th plan targets of Govt. of India till 2022 and then after the growth rate has been assumed as per past CAGR.
- Under the BAU Scenario, the projects allotted get commissioned by 2022. Beyond 2022, considering the same trend on average basis, a total capacity of 3883.3 MW could be added. However, considering the delays and issues being faced in the projects allotted, there is highly likely that the condition worsens. Hence, it is assumed that only ~75% of this capacity would be added.
- Based on this capacity addition, the energy generation has been computed and on further applying the grid emission factor of 0.78 tCO2/MWh as per CEA Baseline Data for CO2, January 2013, the carbon emissions have been computed.

DPL Scenario:

DPL Scenario can be defined as a case wherein hydropower development accelerates through introduction of policy and institutional measures (through CTF funding) that promote fast paced development. As a result of this loan, the development of future hydropower capacity in the region will be advanced resulting timely commissioning of hydropower projects. This in the long run will also attract new investments. The following inputs have been considered:

- For the purpose of future capacity additions of hydropower in HP, the hydropower potential for various basins has been taken. Further this potential has been sub-divided into 3 different categories:

    a. Commissioned
    b. Allotted/Under Construction
    c. Untapped Potential.

- The hydropower capacity addition has been taken based on the allotted projects/untapped potential in various basins in line with priorities set by GoHP to harness basin-wide potential.

- Further, based on the energy generation (considering a PLF of 45%) from hydro capacity, the avoided thermal capacity has been computed (considering the PLF of 70% and 365 days of operation).

- In order to compute the lifetime carbon emission savings, the avoided coal based capacity due to the incremental hydro power has been considered to compute the lifetime carbon emission savings and cumulative incremental carbon savings have been taken to arrive at the number of 333 MT of CO2 eq. as shown in the calculation below.

The detailed calculation has shown in the section below:

Ex-ante calculation of emission reductions

Baseline Emissions:

CO_2 Emission in BAU Scenario = Cumulative Thermal Power Capacity in 2013* 24 * 365 * 70% (PLF)* 0.78 tCO_2/MWh

= (119715.38 MW * 24 * 365 * 70% * 0.78)/10^6

=573 MT CO_2 Eq.

Similarly, the CO_2 emissions till 2032 have been computed on annual basis as shown below.

Table A: CO2 Emission in BAU Scenario

Parameters	2013	2016	2019	2022	2025	2028	2032
Cumulative Thermal Capacity (MW)	119715	141724	161083	182922	209107	239040	285719
Generation (MWh) @ 70% PLF	734094710	869053898	987763286	1121680034	1282244062	1465792190	1752029224
Carbon Emission Factor (tCO2 - /MWh)	0.78	0.78	0.78	0.78	0.78	0.78	0.78
CO2 Emission (Mn Tons)	573	678	770	875	1000	1143	1367

Baseline CO_2 Emission Savings as a result of current pace of hydro power development:

CO_2 Emission Reduction in BAU Scenario = Hydro Power Capacity Addition in 2013* 24 * 365 * 45% (PLF)* 0.78 tCO_2/MWh

= (301 MW * 24 * 365 * 40% * 0.78)/10^6

= 0.93 MT CO_2 Eq.

Similarly, the CO_2 emissions till 2032 have been computed on annual basis as shown below.

Table B: CO_2 Emission Savings in BAU Scenario from Hydro Power Capacity

Parameters	2013	2016	2019	2022	2025	2028	2032
Cumulative Hydro Power Capacity (MW)	301	1883	2983	3883	4538	5699	6781
Generation (MWh) @ 45%	1186542	7422471	11758671	15306471	17889806	22481842	26729475
Carbon Emission Factor (tCO2 /MWh)	0.78	0.78	0.78	0.78	0.78	0.78	0.78
CO2 Emission (Mn Tons)	0.93	5.79	9.17	11.94	13.95	17.54	20.85

In case of DPL, the incremental hydro power capacity has been considered as shown below:

Annual Incremental Hydro Power Capacity during the year = Annual Hydro Power Capacity Addition after DPL – Annual Hydro Power Capacity Addition in the Business as Usual Case (without CTF)

Table C: Incremental Hydro Power Capacity Addition as a result of DPL in Himachal Pradesh

Parameters	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Hydro Power Capacity in BAU Scenario (MW) (A)	301	306	772	504	250	450	400	200	500	200	189	233	233	349	408	408	349	291	233	204
Hydro Power Capacity in DPL Scenario (MW) (B)	301	412	933	1197	890	505	894	498	1013	1486	1612	1526	1720	1205	1043	877	520	440	330	210
Incremental Hydro Power Capacity (MW) (B-A)	0	106	161	693	640	55	494	298	513	1286	1422	1293	1487	855	636	470	170	149	97	6

Parameters	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Cumulative Incremental Hydro Power Capacity (MW)	0	106	267	960	1600	1655	2149	2447	2960	4246	5668	6962	8448	9303	9939	10409	10579	10728	10825	10831

Baseline CO_2 Emission Savings as a result of DPL for hydro power development:

CO_2 Emission Reduction in BAU Scenario = Incremental Hydro Power Capacity Addition in 2013 * 24 * 365 * 45% (PLF)* 0.78 tCO_2/MWh

= (106 MW * 24 * 365 * 45%* 0.78)/10^6

= 0.32 MT CO_2 Eq.

Similarly, the CO_2 Emission Savings as result of DPL can be seen in table below:

Table D: CO_2 Emission Reduction as a result of DPL

Parameters	2014	2016	2019	2022	2025	2028	2032
Incremental Hydro Power Capacity (MW)	106	693	494	1286	1487	470	6
Generation (MWh) @ 45%	106	960	2149	4246	8448	10409	10831
Carbon Emission Factor (tCO2 /MWh)	417931	3784438	8471476	16737900	33303391	41031583	42694191
CO2 Emission Reduction (Mn Tons)	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Annual CO_2 Emission Reduction (Mn Tons)	0.32	2.91	6.51	12.86	25.58	31.51	32.79

The Summary table for above calculations is shown below:

S. No	Year	Gross Energy with DPL (MWh)	Gross Energy of Non-DPL hydro (MWh)	Auxiliary Consumption** (MWh)	Energy Export to grid with DPL(MWh)	Energy Export to grid during Non-DPL phase (MWh)	Emission Factor (tCO2 eq/MWh)	Baseline Emission (Mn tons CO2)	Project Emission (tCO2)	Leak-age (tCO2)	Non-DPL Emissions Reductions (Mn tCO2) (A)	DPL Emissions Reductions (Mn tons CO2)	Net Emissions Reduction DPL$^{\$\$}$ (Mn tons CO2)	Remarks (Projects Commissioning Schedule)
1	**2013**	1,186,542	1,186,542	18,154	1,168,388	1,168,388	0.78	0.91	-	-	0.91	0.91	-	Karcham Wangtoo (1 Unit), Other small hydro projects
2	**2014**	2,810,725	2,392,794	43,004	2,767,721	2,356,184	0.78	2.16	-	-	1.84	2.16	0.32	Rampur (Unit - 1&2)
3	**2015**	6,489,951	5,436,018	99,296	6,390,655	5,352,847	0.78	4.98	-	-	4.18	4.98	0.81	Parbati - III (2 Units), Sawra Kuddu (Unit 2), Kol Dam (3 Units)
4	**2016**	11,207,224	7,422,786	171,471	11,035,754	7,309,217	0.78	8.61	-	-	5.70	8.61	2.91	Sawra Kuddu (1 Unit), Parbati - III (2 Units), Parbati -II (2 Units), Uhl-III, Sorang, Sainj, Kol Dam (1 Units)
5	**2017**	14,715,604	8,408,286	225,149	14,490,456	8,279,639	0.78	11.30	-	-	6.46	11.30	4.84	Parbati - II (2 Units), Kashang - II & III (Unit - 1), Tidong - 1, Shongtong Karcham (2 Units), Kashnag – I
6	**2018**	16,706,314	10,182,186	255,607	16,450,708	10,026,399	0.78	12.83	-	-	7.82	12.83	5.01	Kashang - II & III (Unit - 1), Shongtong Karcham (1 Unit), Tangnu Romia - 1, Kuther
7	**2019**	20,230,462	11,758,986	309,526	19,920,936	11,579,074	0.78	15.54	-	-	9.03	15.54	6.51	Dhaula Sidh, Luhri
8	**2020**	22,193,578	12,547,386	339,562	21,854,017	12,355,411	0.78	17.05	-	-	9.64	17.05	7.41	Seli, Chatru, Dhamwari

S. No	Year	Gross Energy with DPL (MWh)	Gross Energy of Non-DPL hydro (MWh)	Auxiliary Consumption** (MWh)	Energy Export to grid with DPL(MWh)	Energy Export to grid during Non-DPL phase (MWh)	Emission Factor (tCO2 eq/MWh)	Baseline Emission (Mn tons CO2)	Project Emission (tCO2)	Leak-age (tCO2)	Non-DPL Emissions Reductions (Mn tCO2) (A)	DPL Emissions Reductions (Mn tons CO2)	Net Emissions Reduction DPL$^{\$\$}$ (Mn tons CO2)	Remarks (Projects Commissioning Schedule)
														Sunda
9	**2021**	26,186,233	14,518,386	400,649	25,785,584	14,296,255	0.78	20.11	-	-	11.15	20.11	8.96	Tinget, Bajoli Holi, Chirgaon, Kashang IV, Rupin, Bara Bangal
10	**2022**	32,044,686	15,306,786	490,284	31,554,402	15,072,592	0.78	24.61	-	-	11.76	24.61	12.86	Miyar, Chango Yangthang, Bara Bhangal, Ropa, Sach Khas, Unallocated Potential harnessed
11	**2023**	38,397,613	16,052,992	587,483	37,810,129	15,807,381	0.78	29.49	-	-	12.33	29.49	17.16	Tidong II, Purthi, Bardang, Teling, Unallocated Potential harnessed
12	**2024**	44,414,435	16,971,399	679,541	43,734,894	16,711,737	0.78	34.11	-	-	13.04	34.11	21.08	Dugar, Shangling, Unallocated Potential harnessed
13	**2025**	51,193,197	17,889,806	783,256	50,409,941	17,616,092	0.78	39.32	-	-	13.74	39.32	25.58	Jangi Thopan (2 Units), Yangtang Khab (1 Unit), Unallocated Potential harnessed
14	**2026**	55,941,779	19,267,417	855,909	55,085,870	18,972,625	0.78	42.97	-	-	14.80	42.97	28.17	Jangi Thopan (2 Units), Yangtang Khab (2 Unit), Malana - III, Tandi, Rashil,

S. No	Year	Gross Energy with DPL (MWh)	Gross Energy of Non-DPL hydro (MWh)	Auxiliary Consumption** (MWh)	Energy Export to grid with DPL(MWh)	Energy Export to grid during Non-DPL phase (MWh)	Emission Factor (tCO2 eq/MWh)	Baseline Emission (Mn tons CO2)	Project Emission (tCO2)	Leak-age (tCO2)	Non-DPL Emissions Reductions (Mn tCO2) (A)	DPL Emissions Reductions (Mn tons CO2)	Net Emissions Reduction DPL$$ (Mn tons CO2)	Remarks (Projects Commissioning Schedule)
														Unallocated Potential harnessed
15	**2027**	60,054,517	20,874,629	918,834	59,135,683	20,555,248	0.78	46.13	-	-	16.03	46.13	30.09	Khab (2 Units), Sumte Kothang, Unallocated Potential harnessed
16	**2028**	63,513,425	22,481,842	971,755	62,541,670	22,137,870	0.78	48.78	-	-	17.27	48.78	31.51	Khab (3 Units), Unallocated Potential harnessed
17	**2029**	65,563,068	23,859,453	1,003,115	64,559,953	23,494,403	0.78	50.36	-	-	18.33	50.36	32.03	Khab (1 Units), Unallocated Potential harnessed
18	**2030**	67,296,957	25,007,462	1,029,643	66,267,313	24,624,847	0.78	51.69	-	-	19.21	51.69	32.48	Unallocated Potential harnessed
19	**2031**	68,596,634	25,925,869	1,049,529	67,547,106	25,529,203	0.78	52.69	-	-	19.91	52.69	32.77	Unallocated Potential harnessed
20	**2032**	69,423,666	26,729,475	1,062,182	68,361,484	26,320,514	0.78	53.32	-	-	20.53	53.32	32.79	Unallocated Potential harnessed
Total Emission Reduction								**567**	**-**	**-**	**234**	**567**	**333**	

** Auxiliary Consumption = 1.53% of the total generation.

$$ Computed after taking into consideration the auxiliary consumption.

REFERENCES

- Central Electricity Authority Website
- Development Policy Loan (DPL) to promote inclusive green growth and sustainable development in Himachal Pradesh prepared by World Bank – IBRD
- Project Appraisal Document
- Paper on Energy Intensive Sectors of the Indian Economy: Path to Low Carbon Development.
- Climate Investment Plan of Government of India.
- Report on Green Corridors prepared by PGCIL.
- The Report of Working Group on Power for Eleventh Plan (2007-12)
- Government of Himachal Pradesh, 2012, State Climate Change Strategy and Action Plan.
- Asian Development Bank, 2012, Climate change adaptation in Himachal Pradesh: Sustainable strategies for water resources.