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**Environmental Impacts due to Construction of Substation in Hill Area“
A Case study on Gumma substation located in District Shimla,
Himachal Pradesh, India.**

DISSERTATION REPORT

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I hereby give my acceptance to guide the above student through the Dissertation work
‘Titled: “Environmental Impacts due to Construction of Substation in Hill Area” A Case
study on Gumma substation located in District Shimla, Himachal Pradesh, India., which
is a mandatory academic requirement for the award of the MBA degree.

Thanking You



Yours Sincerely,

Sanjeev Kumar

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Chapter 1

INTRODUCTION

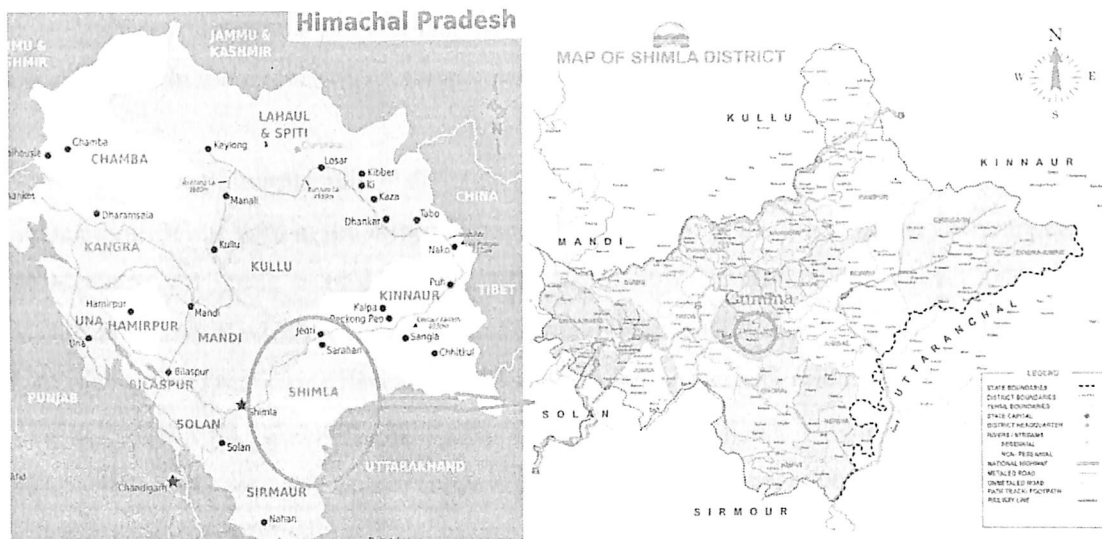
1.1 Overview:

Himachal Pradesh is mountainous state situated in the north part of India. The climate of the states usually varies from subtropical in valleys to temperate on higher slopes. The Himachal Pradesh is spread over 55,673 sq. km of area, which is around 1.74 % of the total area of India. The state is very rich in the different kinds of natural resources specially water and forest, as it has many glaciers, dense forest, mountain peaks and network of rivers – Satluj, Beas, Ravi, Chenab, Pabbar etc. A total of around 67 % of the cover under forest. The outer and lesser Himalayan watersheds of the state covering 28,970 sq. km area are good of great national importance, as entire northern India depends largely for water and power produced by run off from this region.

For improvement, strengthening of existing and building of new infrastructure for effective power evacuation, the Government of Himachal Pradesh (GoHP) through the Government of India (GoI), has requested the different types of banks and financial institution for a Multi-Tranche Financing Facility (MFF) to part finance the power sector investment program in the state. The investment program covers investments for transmission of clean energy to National Grid of India by construction of pooling substations and EHV transmission lines.

The millions of investments in the Multi Tranche Financing Facility (MFF) to be supported by funding agency KfW and other agency, that will contribute to the economic development in the different district including Gumma in the Himachal Pradesh, which will help power supplies from clean energy system sources and support a sustainable state electricity sector in the state. It will help to improve the different kinds of standards of environmental and social safeguards along with energy efficiency program for better power management program.

My Project, Environmental impact assessment due to construction of substation is located at Gumma in District Shimla of Himachal Pradesh. It's a 400/220kV pooling station. Locational details in the form of map and satellite imagery is given as follows.



Location Map of Gumma, Shimla, Himachal Pradesh



Satellite image of the project location

A substation is part of the electric grid and connects two or more transmission and/or distribution lines. Substations are designed to accomplish the following functions, although not all substations have all these functions:

- Change voltage from one level to another
- Regulate voltage to compensate for system voltage changes
- Switch transmission and distribution circuits into and out of the grid system
- Measure electric power qualities flowing in the circuits

- Control reactive kilovolt-amperes supplied to and the flow of reactive kilovolt-amperes in the circuits.

Generally, Substations are built in different types of locations in the hilly areas, it may be within agricultural fields, with in the different undeveloped areas. in the urban areas. Different types of Measures are going to be taken place for the study of environmental impact analysis of Gumma Substation which is in the district Shimla of Himachal Pradesh under the Green Energy Corridor scheme to provide the clean and green energy to national grid of India.

Due to their size the substations have several common features that includes the different types of concrete foundation that should support the necessary electrical equipment. a tall chain link fence used in the surrounding the equipment for their different kind of safety purposes and it is also required the access road from the nearest public road.

While finalizing the general location of a substation, initially it is determined by different kind of transmission requirement along with the different kind of transmission line routing. Selection of substation site depends mainly on the two factors. The land area required should be enough for the installation of different kind of equipment which usually requires the necessary clearance for the electrical safety along with the access to maintain the different kind of large and small equipment, such as transformer etc. Site selection should also have future expansion due to increasing load demand growth or planned transmission additions. Different types of environmental effects such as drainage, road traffics, noise etc. also need to be strongly considered.

While finalizing the construction of the substation on the proposed project expects that the executing agency should carry out an Environmental and social impact assessment study with a serious intention of identifying negative as well as the positive impacts to the environment. It is also required that an Environmental Impact Assessment should be carried out during the planning stages of any proposed undertaking. The scope of this Environmental Impact Assessment. therefore, covers: The baseline Environmental and Socio-economic conditions of the area. Description of the proposed project, Provisions of the relevant environmental laws. Public participation Identification and discussion of any adverse impacts to the environment anticipated from the proposed project. It is required to take appropriate mitigation measures along with the Development of an Environmental Management Plan. So it required to prepare Environmental Management Plan Implementation, Environment Monitoring Program during the

construction and operation of substation. These types of plans will help to minimize and eliminate the negative effects and its impacts along with scope and criteria for the environmental and social impact analysis.

The scope of assessment usually covers various activities of the proposed substation for the development which includes the works of civil, mechanical, electrical or other nature. Which are necessary for construction, commission and decommissioning of the project. Terms of reference: Establish the suitability of the proposed location to construct a substation A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project. A proper description of the technology, procedure and processes to be used while implementing the project Also required the description of materials which is going to be used in the construction and implementation of project. the Product and different kinds of by-products and wastages which is going to be generated by project. Need a description of potentially affected environment of the project including the social and cultural effects and the different kinds of direct, irreversible, short-term, cumulative and long-term effects need to be anticipated ,while recommending specific environmentally affordable waste management system requires. It is also requires to provide alternative technologies and processes which is available to be preferred the chosen technology and processes. Different kind of analysis of alternatives, which includes the project site with different types of design and technologies. Development of Environmental Management Plan need to propose the measures for eliminating, minimizing or mitigating different adverse impacts on the environment, which mainly includes the cost, timeframe and responsibility for implementing the measures. It is also required to provide an action plan for the prevention and management of the different types of foreseeable hazardous activities which can be cause of the project cycle along with different Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management of emergencies. An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.

Chapter 2

Literature Review

The literature review is conducted during this study for environmental impact on substation at hilly areas. In initial stages the study was more focusing on of construction of Substation in hill areas-based EIA (Environment Impact Assessment) studies. Main objective of this initial study is to identify the different kind of substation tools for construction used for EIA.

The second stage of study included the EIA rated to the Hill areas for identify the different features of this studies. Based on information searched the necessary detailed information was available to conduct the more and more objective oriented search. These kinds of search were mainly focused on the selection of different kind of research articles, which meet the highest number of combinations of the keywords used during this study. The selection was based on the content of the different kinds of article for which the title review is done and more research objectives in which this literature is going to review.

For the study of Environmental impact on construction of substation it will be required to go through the different documents and articles as study also suggested that it is always required the new and innovative way to deal with the environmental Impact study while constructing the substation in hill areas. Some of the author also suggested that both negative and positive impact analysis need to be done while starting the construction of substation in hill areas. The Environmental Impact Assessment (EIA) study also provide the different kind of impacts while studying components like physical, socioeconomic and biological. The physical component studies are mainly focusing on its subcomponents i.e. soil, water, air, etc. while others study subcomponent includes the aquatic life cultural, economic, educational along with other aspects.

Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003, requires that all EIA assessment undertake Public Consultation (PC) as part of the study. The aim of the PC is to identify all stakeholders in a proposed project such as project beneficiaries and the general public and provide them an opportunity to air their opinions which should be considered during project planning, design, construction, operation and decommissioning phase.

In the words of Bond, Sims and Dent (2013), the provision of electricity, as with gas, water and telecoms, is an accepted and essential precondition of modern life. Almost every aspect of our lives, both at home and in the workplace, relies on the availability of instant electricity; few of us actually consider the infrastructure needed to make this possible, however. The distribution of electricity from one place to another relies on a network of cables, some sited underground and some suspended from large metal structures known as pylons. It is the more visible aspect of electricity distribution (Bond, Sims and Dent, 2013).

In November 2013, Environmental Science Associates (ESA) conducted a literature review to research whether concerns about EMF have been shown to cause a decline in property values that would affect land use and housing. ESA reviewed EISs and other environmental impact analyses for various substation projects in both urban and rural settings. The literature review primarily found information relating to concerns about the health impacts of EMF or the aesthetics of placing a substation in an urban area. ESA found reference to only one study that covered the issues of the impacts of EMF on property values.

Chapter 3

Problem Statement

This study response to the fast-emerging energy demand, poor and unreliable supply and technical losses associated with supplying the area with long distance distribution lines. There is a necessity for strengthening and expanding the more reliable network. Himachal Pradesh is going to be the major investment hub for clean energy. My study is on the 220/400 kV GIS pooling substation at Gumma (Pragati Nagar) which will be LILO with 400 kV Jhakri – Abdullapur line. This line and substation will evacuate 111 MW power from Sawra Kuddu Hydro Electric Plant (HEP) funded by Asian Development Bank (ADB's) Himachal Pradesh's Clean Energy Development Investment Program (HPCEDIP) for Himachal Pradesh Power Corporation Limited (HPPCL). It is also recommended that Gas Insulated Switchgears (GIS) substations are proposed in place of the Air insulated Switchgears (AIS) substations to reduce the cost of civil works along with the development of the Land which covers the major capital cost in the hilly areas. It also reduces the major operation like Noise, Air etc. along with the reliable arrangement provides reliability to ensure the continuity of power.

The main work which basically involves construction of new 400/220 kV substation at Gumma (Pragati Nagar) in the Shimla district of Himachal Pradesh. The substation is proposed to be constructed on private land identified and acquired by HPPTCL.

Before start to the construction of the substation project local law and executing authority expects that the proper steps to be carried out for Environmental and social impact assessment study. Intention for this study is to identifying negative or positive impacts to the environment.

The ESIA need to propose adequate mitigation measures to address the negative or enhance positive impacts of the proposed activity.

Chapter 4

Need for Research

The entire State of Himachal Pradesh falls within the Himalayan Region, which is ecologically and environmentally one of the most fragile regions of the World. Being exceedingly fragile, even seemingly small changes can have far-reaching impacts. Mountain environment thus requires different approaches than those for the lowlands. Looking at these aspects a need of the Environmental impact studies arises and further a management plan be prepared so that impacts can be managed, and development be carried in sustainable way.

Chapter 5

Objective

Main Objective of this study is to understand the positive and negative impact of environment while constructing the substation in hill areas. Along with that it is also important to meet the rise in electricity demand is a concern for any organization. Study will also suggest how to be proactive, efficient and accurate in forecasting of demand, so that while constructing the new substation it is recommended to do the environmental impact study which requires long term study of data, cost analysis impact, capacity utilization, employment study etc. While working in this area makes me to understand, how all these studies can be implemented without affecting the environment.

So Successful resolution of compliance with environmental regulations may become major milestones in the process of constructing the new substations at hill areas. Utilities are increasing effort to satisfy their customers and to gain community acceptance for their facilities. As they have employed various environmental management systems and perform the various impact evaluation studies to address these important issues and to assess the impact of substations on the environment for long term access.

During the ESIA Study, it is necessary to Conduct an Environmental & Social Impact Assessment to identify both positive and negative impacts of the development activity and propose. Collect baseline socio-economic data of the project area and potential impacts expected from project during construction, implementation, operation and decommissioning; Identify and contact stakeholders to seek their views on the proposed project; Develop ideas for the Environmental Management. In short, objective of the study can be summarised as below;

- To assess Major Environmental Impacts due to substation construction activity.
- To suggest measures to avoid, minimise or mitigate/manage any impacts on environment due to construction of substation

Chapter 6

Research Methodology

This study is going to carry out through desktop studies, Literature review performed by some to this project study, Website, Site visits etc. During different kind of studies, field investigation, reconnaissance survey was conducted to gather information on biophysical and socio-economic aspects of the area and its environmental impact on constructing the substation in hill areas.

Following key activities undertaken during the environment impact assessment;

Interviews along with consultation will be carried with primary stakeholders nearby construction sites. In short; following methodology will be applied to carry out study.

- Research on the secondary data and its collection and documentation
- Identification of gaps in the secondary data
- Primary data generation that also includes data generation relating to the gaps identified

6.1 Description of Environment around Project affected Area

To study baseline environmental aspects of the Gumma Substation study area, 15 kms circumference around the project is taken. This covers almost complete Shimla district. Following are the baseline information of existing Environment around the project area.

6.1.1 Physical Resources

6.1.1.1 Geology

Shimla District which has intricate mosaic of high mountain ranges, hills and narrow deep valleys with altitude from 1000 to 3000 m above MSL. Gumma is a village panchayat located in the Shimla district of Himachal-Pradesh state, India. Gumma Substation is located an altitude of approximately 1570 meters above Sea level. Project The areas underlain by high hill ranges of Himalayas, most of the valleys are narrow and deep with steep slopes

6.1.1.2 Soil Regimes

The soils are found and vary the region wise in the Himachal Pradesh, basically in Shimla district have grey wooded podzolic soils. The state mainly has nine types of soil groups based on the basis of their physico-chemical properties and development.

6.1.1.3 Mineral

Nature has endowed Himachal Pradesh with a variety of minerals such as salt, gypsum, clays, mica, limestone, barytes, iron, pyrites and lead but of these salt and limestone and slate are of significance. Due different properties of the minerals, these minerals are scattered all over the state.

6.1.1.4 Climate

Himachal Pradesh has a variation of altitude due to its huge variation in climate also. For this reason, it can be mainly divided into four seasons. In Guma winter normally starts from mid-November and continues till mid-March. Generally, consider Mid of March to Mid of May most of the parts of the district is at its bloom, because of the delightful spring season and usually night is colder also. Summer season consider from Mid of May to Mid of July and climate is comparatively hot in these days. Rainy season usually starts from Mid of July to Mid of September. Autumn season is generally starts from mid-September to mid of November. Reason for the short duration is mainly extended rainy season and sometime due to early setting of winter season.

6.1.1.5 Temperature

Himachal Pradesh has a variation of altitude due to this temperature also varies considerably. Guma records the minimum temperature in negative during winter season and often exceeds approximately 32 to 34 degrees during the summer season.

6.1.1.6 Rainfall

Besides the seasonal variations, the climate of Himachal Pradesh varies at different altitudes. In winter, there is much less rainfall in Guma. This location is classified as Cwa by Köppen and Geiger. In Guma, the average annual temperature is 17.2 °C. The rainfall here averages 1150 mm.

6.2 Water Resources:

6.2.1 Surface Water

Himachal Pradesh has vast amount of water resources, as these water resources utilizes as the Drinking water and irrigation requirements along with the supplying hydroelectric power to the large population in this state. Most of the surface water resources of the state flow from perennial rivers which originate from glaciers.

6.2.2 Rivers and lakes

Water is one of the most vital natural resources of Himachal Pradesh. The state is richly endowed with a hilly terrain having an enormous volume of water from the catchment areas of Satluj, Beas, Pabbar, Ravi and Chenab rivers. Majority of district are drained by tributaries of Satluj River. District Shimla is drained by streams/rivers forming part of the drainage basins of the Satluj. due to this Gumma also has got the water from Satluj.

6.2.2.3 Ground Water Quality

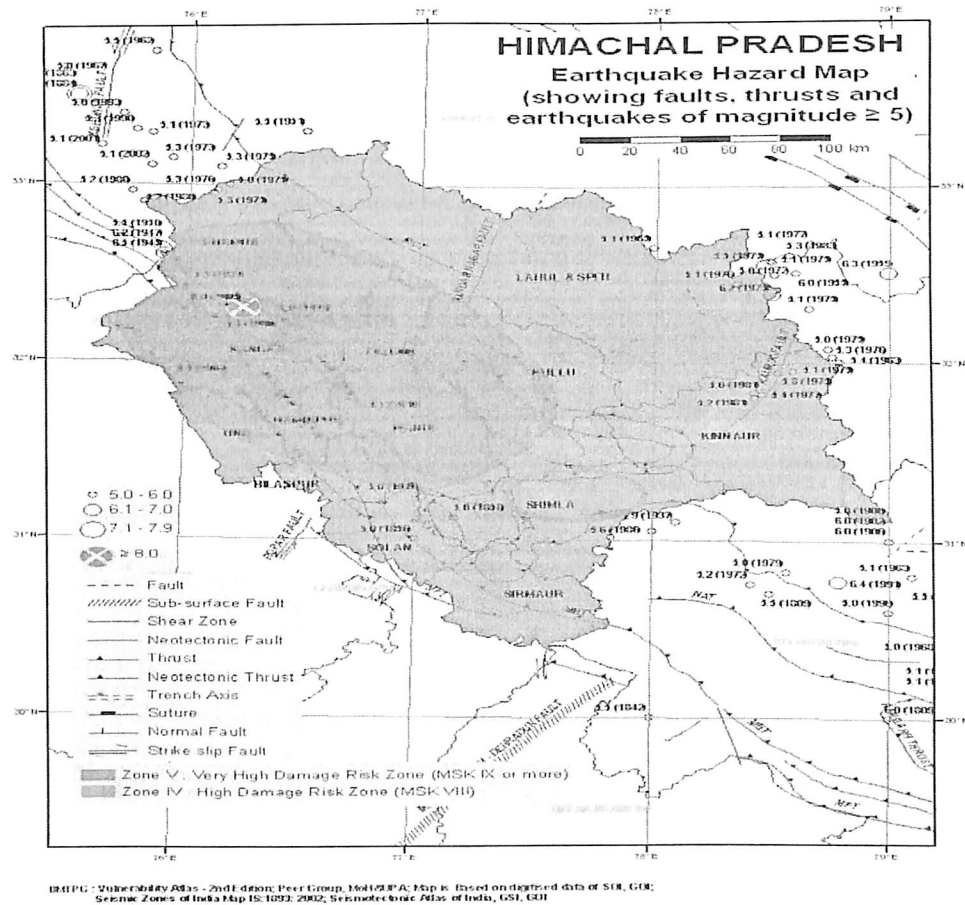
As per Ground Water Information Booklet, Shimla district. Himachal Pradesh, the chemical quality of ground water is generally alkaline in nature and suitable for both domestic and irrigation use all over the district. All the parameters of ground water were found well within the permissible limit of safe drinking water as per Bureau of Indian Standard (BIS). Gumma village is supplied water from ground water sources.

Due to poor potentialities in hilly hard rock areas and sloping hilly terrain, groundwater development is low. However, in these areas, major water supply and sources of water are ground water based viz., perennial springs, bowries and hand pumps. Springs are tapped at the source so that the water can be supplied under gravity.

6.3 Earthquake Zone

Himachal Pradesh lies almost entirely in the Himalayan Mountains. Because of its location and it weathers many mild and sometimes large earthquakes every year. Gumma which is in District Shimla is in the Zone IV so therefore it is require to take adequate measurement while designing to avoid any damage during the earthquake. Substations also fall in Seismic Zone –

IV and therefore the HPPTCL needs to take adequate measures while designing and installation of components of subprojects to avoid damage during earthquake.



6.4 Ecological Resources:

6.4.1 Forest:

Forests are an important resource of Himachal Pradesh. Although the area classified as "Area under Forest" is 67 percent of the total area of the Pradesh, yet the effective forest cover is much lower than this area, primarily on account of the fact that a very large area is either alpine meadows or is above the tree line.

The climatic conditions prevailing in Himachal Pradesh and varying elevations are most suitable for the growth of forests. The forests provide valuable timber, medicinal herbs, raw

material for industries and provide employment and play a vital role in conserving the soil and ensure timely rains.

For construction of Gumma substation barren land has been used so that impact on forest resources can be avoided.

The environmental impacts can be categorised from different activities as follows:

6.5 Impact on Physical Resources

6.5.1 Impact on Topography

During the construction phase of Gumma substation will have the less impact because it is constructed on the barren Private land. So, no topographical changes are envisaged during the operation phase of the substation and it is also recommended to utilise the existing routes during the operation and maintenance phase of the substation.

6.5.2 Impact on Climate

As Project area of Gumma substation have uncultivated (barren) private land which should not have any impact for any season. So, there will be not so much removal of trees and will have no impact on the climate condition in the proposed site during its operation and maintenance phases.

6.6 Impact on Environmental Resources

6.6.1 Impact on Air Quality

Gumma Substation the Construction activity mainly involve the excavation, movement of different types of vehicles which is required for carrying the construction materials.

These types of activity would usually give rise to the emission of different kinds of dust particle that will affect the air quality marginally at site. As this impact is usually transitory in nature. because of this it is assesses as of low significance. Dust emission at site can be reduced by covering the different stock piles, minimising or reducing the double handling and different types of drop loads along with the sprinkling of water during the excavation activity.

Construction of substation usually does not have any kind of negative impact on the air quality of that region in the operation phase.

6.6.2 Impact on Noise Levels

In Gumma Substation major sources of Noise pollution are the movement of different types of vehicles, which are carrying the construction material and equipment to the site during the construction phase. As most of the time the major construction work is carried out during the daytime.

Gumma Substation predominant land is barren (uncultivated) private land is going to use so there is less residential areas exposed to the noise generated during this phase and also noise generated also in negligible impact for the residents

Following measures can be taken up to avoid noise and vibration pollution or to bring it down to acceptable levels, which is required for the construction phase:

- Contractor can prefer the limited working time for the different kind of activities which causes the noise within normal waking hours of the public except for the construction site which is near public sensitive receptors.
- It is required to coordinate with relevant authorities and community to schedule well in advance where the construction activity will be carried out near the sensitive receptors.
- Different kinds of noisy equipment such as Generator, it should be sited away from the residential areas. All the contractor and suppliers which are supplying the construction materials should strictly implement noise control regulations stipulated by the noise Pollution (Regulation and Control Rules 2000) for all different kinds of construction vehicles and equipment.

At Gumma Substation site, Contractor should equipped with their different types of heavy construction equipment and plant with the good quality exhaust silencers, which it used for limiting the noise that should not be exceed 75 db (eg rollers. cranes and loaders) and they have to regularly maintain the different types of construction vehicles and machinery so they should meet the National Emission Standards.

6.6.3 Impact on Surface Water Quality

Gumma Substation Construction and Operation usually will not have major impact on the surface and ground water quality in that particular area. Mainly contamination of water bodies

mostly result of spilling of construction material and surface run off from the construction site which may join the water body. There may be temporarily increase in the chances of turbidity levels , where the main proposed alignment is crossing a watercourse and the surface runoff during the construction phase meets the river. So it is required the careful selection of site to avoid the surface runoff does not meet the river.

Usually during the construction phase activities which are proposed some times create a impact on the existing drainage system which mainly include the different kinds of irrigation canals, different kinds of natural flow paths along with the earth and line drains. It is possible to minimize the anticipated impact by incorporating the following measure which is mainly due to obstruction of natural flow paths and existing drainage:

- Temporary provision for the routing the ponds and drainage of particular location if the existing drains are obstructs during the construction activity.
- Do the Maintenance of all the drainage paths by avoiding or reducing the blockage for all the time.
- Contractor has to clear the Stagnant water and also minimize different kind of activities like excavation of beds of any streams, irrigation system and other water resources which in available near the construction area

Proper care should also be taken to locate the different temporary construction workers sheds away from different kinds of water bodies. Sanitary facilities, drinking water facility and drainage facilities should be provided to the temporary construction worker to restrict the surface water pollution. Also the provision for washing and toilet facilities should be made obligatory. These facilities should be the integral component in the planning stage before start of any construction activity at site.

6.6.4 Impact on Ground Water Quality

Mainly the ground water pollution in Gumma substation will be due to the different kinds of chemical substances and oily waste get leached by precipitation of water and percolate to the ground water label.

Due to the slit discharge from the different kind of earth work around different kinds of water bodies, oil, grease and fuel release from the different kind of construction vehicles and equipment and also spoil from the construction and other construction related activities like raw sewerage from worker accommodation sites usually mix with runoff water.

This kind of situation will increase during the rainy season and put a significant impact on the surface water along with the ground water. Following measures will be required in order to prevent different kind of deterioration of water from the construction and construction related different kind of activities of Substation:

- All the equipment and construction vehicles should be properly maintained without any damage and leakages.
- Contractor should be equipped with the all types of modern machinery and equipment to take silt traps and control measures where the construction activity is going to carry out near the water bodies to avoid entering of cement particles, rock and wastewater to the surroundings water bodies.
- During the construction of substation different kinds of digging activity should be done in the dry season and different kind of waste oil should be collected properly and disposed to the authorised and approved recyclers.

6.6.5 Impact on Soil and Geology

During the project activities at Gumma Substation which includes the excavation, cut and fill operation, excavation it may less impact on enhance the soil erosion during the rainy season and also mainly the no reduction of infiltration rate of water as it is a barren land and there is no removal of trees and green cover vegetation is going to take place. Also impact the soils due to the soil erosion due to construction of substation. When conducting the site survey for site selection the excavation activity and land clearance in the erosion prone areas have been minimised.

The following impact measure can be minimised the effect of excessive erosion and other civil works:

- Destruction and Obstruction of natural drainage should be avoided of surrounding area.
- Need to do proper arrangement for clearing and filling areas against the flow acceleration

- Contractor should be do the turfing work before the rainy season. Also need to make proper arrangement for the muck disposal plan for cut and fill operation for sharp and dep slope areas.
- Different kinds of pilling activity should be done in non-rainy season due to avoid the piled materials to spread closer to the water bodies.
- During the construction the Top soil (2-3 cm form the top of soil) , which is removed from cultivated land should be separately store and can be utilize in future.

6.7 Impact on Ecological Resources

As Gumma Substation is going to construct in vacant (barren) Private land. So, there is usually no displacement of people or animals. Most important point is that it will generally not cause the any disturbance to the life of people and local animals, birds etc. Some of the ecological impacts are briefly described as following:

6.7.1 Effect on Flora and Fauna

During the construction of substation, it not expected that any flora and fauna that are rare in nature, endangered, endemic or threatened will be affected. Also, the vibration, noise and emission from the different kind of construction and emission vehicles, equipment usually occur during the construction and planning of pre-construction stages in the temporary manner. Above mentioned activities are temporary in nature and can be mitigated through following measures:

- Need to pay strict attention on the worker force which are working on construction site related to the disturbance regarding the surrounding habitats, flora and fauna along with hunting animals and fishing in water bodies.
- Selection of location for storage of different kind of materials storage and labour caps should be away from environmental sensitive areas.
- Need to avoid entering the different kinds of construction waste (cement particles, rock, waste water etc) and sanitary waste to the surrounding water bodies.

6.7.2 Effect on Local Road Network

Gumma Substation is required a lot of large and heavy equipment for its operation like Transformer, substation equipment, iron bars, concrete material etc. This equipment needs to transport through provincial and different local road network to the project site. Due to transportation of large and heavy quantities of material using heavy vehicles usually exceed the

carrying capacity of the road. this may lead to physical damage of the road network. So, it is necessary to take necessary consent from the Public Works Department (PWD) or National highway Authority for using the local or national highway road prior to transportation. It is also recommended that contractor should maintain all the road section which is going to utilise for the different kinds of construction related activities.

There is positive aspect that parallel road is going to be construct which will widen and quality of construction material is going to use for long lasting, which help the contractor to freely move its equipment without disturbing the peoples day to day life. After completion this road can be utilized by the local people for their activities.

6.7.3 Disposal of Debris

During or after the construction activities of substation generally spoils and debris will be generated. Due to its improper disposal of the debris will have an impact on surrounding ecology, science beauty and public health. Following measures can be taken up to minimize the impacts which are generated from debris:

- Spoil materials (soil, sand, rock) which is usually generated from the construction and can be utilise such as site levelling, back-filling can be utilized.
- Also recommended that dismantled and demolished structural material should not be kept or dumped near or at agricultural lands.
- Contractor needs to take proper approval from the local authorities for the location of dumping grounds and landfills. for that it is recommended to prepare the Muck Disposal Management plan, which are closer to the residential, commercial and public sensitive areas. If it is not planned properly the dumped material can be interface with the drainage system, different kinds of water bodies, agriculture land or any environmental area.

6.8 Impact on Human Environment

6.8.1 Health and Safety

Gumma Substation Project activity may impact the health and safety of the working force and general public, usually in terms of risk of accidents and exposure to the electromagnetic fields along with the alignment .These kinds of accidents may cause due to the electro- cutting,

lightening, fires and explosions. Houses are not allowed within the RoW (right of way) of the project to avoid this kind of situation.

During Project activities it may create the accidental damage to general public and the construction workers and also contractor needs to take necessary measure to enhance the personal safety. Personal Safety can be enhanced with the following measure:

- Organization needs to conduct the awareness programmes relevant to personal safety of the workers and general public at regular interval.
- Proper Installation warning signs to the important locations.
- Need to provide Personal protective Equipment (PPE) such as safety belts, footwear, helmets, goggles, eye-shield and clothes to the worker depends upon the their work area and responsibility.
- First Aid Unit and Transport facilities arrangement should be provided to take the injured personal to the hospital.
- All the workers should be covered by the statutory workmen compensation or Building and Other Construction Work (BOCW) as per GoI laws by the contractor.

6.8.2 Agriculture

In Gumma substation private (barren) land is provided by HPPTCL. So there will be no impact on the agriculture activities.

6.8.3 Socio-economics Impacts

During the construction of substation of local employment during this period will increase socio-economic standards. As it is required a lot of skilled and unskilled labour for their construction period. It also helps to increase the business for local people as demand for day to day life along with different materials which are going to use in the substation will increase.

Hotel and near by tourism also going to develop so it will help to change the people's perception towards the competitive and healthy environment for the work.

6.8.4 Temporary Outage of the Electricity

During the construction activity of Gumma Substation, it is possible that temporary disconnection of power supply will occur. Due to the local people and industrial places, which are mainly

located near the construction site or project area, will face the short time inconvenience. To avoid this following measure can be taken:

- Need to prepare the plant in advance for utility disruption so that the notice can be given to the public well before in advance.
- Restoration of utilities should be done immediately to avoid any kind of public inconvenience.

6.8.5 Resettlement and Rehabilitation

Gumma Substation land acquisition is required. It is a uncultivated barren land so will be no impact on the resettlement and rehabilitation. Only necessary measures or approvals needs to be taken as per local law.

6.8.6 Cultural sites

Gumma substation there is no archaeological, historical along with the cultural sites have no impact. If during the excavation or in construction activity discover any archaeological features, GOI's (Government of India's) regulation shall be applied and it should be observed separately by the contractors.

6.8.7 Traffic and Transport

Gumma Substation construction activity of the substation it is recommended to minimise the traffic disturbance because the narrow road will not be suitable for the heavy equipment like transformer, so it can be avoided by constructing the parallel road with proper traffic signs. It will avoid the local road blockage, moving from high density area and damage and also provide the parallel road which can also be utilised by the local people during and after the construction of the substation.

6.9 Waste Disposal

6.9.1 Solid Waste Disposal

Gumma substation most of the solid waste material is metal scraps. wooden packing material, different construction materials which can be used by the contractor. It is required that waste should be minimized and recycled wherever possible. Final waste will be collected and disposed off in compliance with applicable GoI(government of India) /GoHP(Government of Himachal Pradesh) regulations and rules by the contractor.

6.9.2 Sanitary Waste Disposal at Construction Sites and Labour Camps

Gumma Substation for Construction activity it is required to have labour camp near the construction site. Usually the labour camp is temporary in nature. So these kind of places where the most of the labours are staying that is usually near to the hamlets which is the mainly community service for solid waste, water and sanitation.

The adequate planning of the different component like drinking water facilities, sanitary facilities and drainage in the temporary sheds for the construction worker should be the before the any commencement of construction activity. The following measures need to take during the construction phase:

- Need to provide proper provision of the solid waste disposal along with the sanitation and sewage facilities for the construction and labour camps to avoid minimise the different kind of hazards and related environmental pollution.
- It should be clear communication to the contractor that he should handle and manage the waste which is generated from construction site and Labour camps without contamination to the natural environment and also it should reduce the risk to the people who stay near that area.
- Contractor should also be responsible for the enhancement in the quality of environment and supply of adequate water for urinals, toilets and washroom of the worker accommodation.

6.10 Environmental Impacts Association

6.10.1 Electric Shock

While construction of Gumma Substation It may lead to the injury or death to the workers and public of the area. This can be minimised or avoided by:

- Security fences around substation
- Establishment of warning signs
- Careful design using appropriate technologies to minimise hazards.

6.10.2 Noise Generation

Gumma substation during the operation phase of the project, there may be different kind of noise from the equipment which are going to use in the substation, and it should meet the CPCB(Centre Pollution Control Board) standard for residential area.

6.10.3 Maintenance of Substation

While doing the maintenance of Gumma Substation it is a possibility of exposure to the electromagnetic interference during this activity. It is also require to provide proper sign and danger name plate sign board.

6.10.4 Oil Spillage

Substation transformers are located within secure areas. During the operation of transformer due to leakage or accident, contamination of water on the land or nearby water bodies. Proper drainage facilities should be constructed to avoid the over flow or contamination with natural flow path mainly during the rainy season. HPPTCL (Himachal Pradesh Transmission corporation Limited) will maintain account of the usage of oil, using technical methods and procedures for oil monitoring mechanism, and will have mitigation plan for any oil spillage.

6.10.5 Sulphur Hexa fluoride (SF6) Leakage

SF6 is a non-toxic greenhouse gas used as a dielectric in circuit breakers, switch gear, and other electrical equipment. Very high-grade sealing system and erection methodology to keep the loss of SF6 within 0.1% every year. SF6 handling is part of each contracts technical specifications and required design and routine test are done after manufacturing of the circuit breaker. SF6 gas handling system for evacuation and storage is always used for the maintenance of the circuit breaker. SF6 gas leakage records will be maintained in each substation. This allows tracking of any release of SF6 gas to the atmosphere.

Chapter 7

Source of data

There are different ways for data collection, depends on the type of data. There are two main types of data: primary and secondary.

Primary Data; Primary data will be collected by visiting site. Consultation will act as a major primary data source

Secondary data; Secondary data will be collected from sources like internet and other project reports.

Chapter 8

Sampling

Sampling will not be required for the study as there will be no statistical analysis for the study.

Chapter 9

Expected Outcome of the study

This Study basically centres around natural effects at the underlying or beginning period of the venture structure and arranging, so this investigation the most ideal ways and intend to diminish the unfavourable effects. In view of concentrate additionally help the activities to suit the neighbourhood condition alongside the present natural expectation which will help leader to get the choices. Likewise, above all attention to individuals about different positive and negative effects of the substation development movement will be one of the results of the investigation

A domain and social examination have been completed taking a gander at different criteria, for example, topology, air, clamor, water assets and water quality, biology, demography of the zone, atmosphere and characteristic natural surroundings, network and worker wellbeing and security and so on. The effect examination found that because of cautious thought of ecological and social perspectives during course and site choice by HPPTCL(Himachal Pradesh Transmission Transportation Enterprise) , no major unfavourable effects are normal. There is no unfavourable effect on the movement of environment, any characteristic existing area assets

and impact in the standard existence of individuals. Nature and social effect related with transmission line venture is constrained to the degree of development stage and can be alleviated through a lot of prescribed measures and sufficient arrangement for condition and social effects which spread checking, estimating and relief.

Condition The executives Plan has been readied. Open counsels have been led along the transmission hall. The outcomes show expansive help for the task dependent on saw financial and social advantages. Most effects are relied upon to happen during the development stage and are of a brief sort. The transmission hallway was deliberately chosen subsequent to experiencing an alternatives evaluation. This empowered the option to proceed arrangement to sidestep close by hold woodland zone, towns and significant water supplies and assets. The primary undertaking impacts are related with cutting of plantations, squander the executives and unearthing of soils.

In this way, a full Ecological Effect Appraisals (EIA) for the Undertaking isn't required. Alleviation estimates identified with development, as indicated in the EMP, will be fused into common works contracts, and their usage will be principally the duty of the temporary workers. The EA (Natural Evaluations)/IA(Impact Appraisals) of HPPTCL will anyway be liable for the general execution and examining of site-explicit EMPs.

9.1 Environmental Management Plan (EMP)

Gumma substation, a legitimate and committed structure the ecological appraisal of the undertaking exercises. Condition the board plan (EMP) should be produced for the venture to alleviate the antagonistic natural effect. EMP normally talk about the expectation of the effects and relief measures and checking prerequisites and mindful specialists to execute the EMP as for the accompanying stages: (I) pre-development, (ii) development, and (iii) activity and support. Point by point, site-explicit relief measures and checking plans were created and will be executed during the task usage stage.

- Environment Monitoring Plan

Gumma Substation, considering its area and accessible assets, various types of measures are proposed for Ecological Checking Plan, which is basically required for observing the diverse sort of natural parameters during the development and operational period of the undertakings.

This checking of ecological measure arranging ought to be finished by the Central Condition and RR, Master of Condition and Social Cell (ESC) of HPPTCL.

Venture supervisor for the substation is completely liable for the observing the work during the development stage. He ought to likewise bear that temporary worker do the various types of exercises like stockpiling of various materials, work camps alongside the removal of various types of garbage done in appropriate way to have its effect least.

It is the duty of the Ecological and social cell that, the Specialists working at site and every one of the temporary workers ought to go along the diverse kind off measures and systems distinguished in the EMP. The various types of exercises should be checked : All the Coordination, Arranging and the executives exercises that is essential to actualize to verify the various issues. It is require to appropriately distinguish the distinctive sort of preventive and remedial actions, records of wellbeing and security matters and preparing exercises; meetings with venture influenced individuals (as and when required, especially during the usage); input, inconvenience shooting and undertaking related complaints; planning of progress and checking reports as required by the financing organization and confirming the activities in general consistence with protect measures and its encouraging towards accomplishing the expected advance results.

Diverse sort of relief estimates identified with development as endorsed in the EMP is ought to be consolidated into the distinctive sort of common exercises and it is the duty of the temporary workers to actualize the equivalent. Contractual workers ought to likewise need to present the Month to month/Quarterly/Half yearly report for the execution of EMP measures to the PIU(Project Implementation Unit)/PMU(Project Monitoring Unit). PMU and HPPTCL will together answer to the financing office on the distinctive sort of progress to accomplish the EMP exercises alongside the diverse sort of Mile tone on Quarterly/half yearly premise. This Report primarily incorporate the advancement of various sort of usage exercises and its status, need to distinguish the actualizing organizations and give them the time calendar and undertaking the board plan alongside the expenses.

It is likewise necessitated that undertaking ought not furnish any negative effects alongside the its positive Effect which is fundamental for the execution of Venture with Subjective and Quantitative methodology. The diverse sort of checking venture exercises incorporate the site supervision, Observing the distinctive sort of soil, clamor , air and water quality. The PIU is

answerable for supervision of the temporary worker alongside the various kinds of good natural practices which predominantly incorporates the various sorts of fire and security hardware, strong waste administration and cleanliness condition.

Annex I Applicable Rules, Regulation, Policies and Procedures

I. National Environmental Laws

The Environmental regulations, legislation, policy guidelines that may impact this project, are the responsibility of a variety of government agencies. The principal Environment Regulatory Agency in India is the Ministry of Environment and Forests (MoEF). MoEF formulates environmental policies and accords environmental clearances for different projects.

II. Important environmental legislations in India

- (i) The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
- (ii) The Water (Prevention and Control of Pollution) Rules, 1975
- (iii) The Air (Prevention and Control of Pollution) Act 1981, amended 1987
- (iv) The Air (Prevention and Control of Pollution) Rules, 1982
- (v) The Environment (Protection) Act, 1986, amended 1991 and including the Following Rules/Notification issued under this Act.
 - The Environment (Protection) Rules, 1986, including amendments
 - The Municipal Solid Wastes (Management and Handling) Rules, 2000
 - The Hazardous Wastes (Management and Handling) Rules, 2003
 - The Hazardous Wastes (management, handling and transboundary movement) Rules 2009
 - The Bio-Medical Waste (Management and Handling) Rules, 1998
 - Noise Pollution (Regulation and Control) Rules, 2000,
 - Wild Life (Protection) Amendment Act, 2002
 - Ozone Depleting Substances (Regulation & Control) Rules, 2000.
 - The Biological Diversity Act, 2002:
 - The Environment Impact Assessment Notification, 1994: amended up to 2009:
 - Batteries (Management & Handling) Rules, 2001
 - The Environmental Clearance Notification, 1994
 - Environmental Standards of CPCB
- (vi) Noise Pollution (Regulation and Control) Rules, 2000
- (vii) The Indian Wildlife (Protection) Act, 1972, amended 1993

(viii) The Wildlife (Protection) Rules, 1995

(ix) The Indian Forest Act, 1927

(x) Forest (Conservation) Act, 1980, amended 1988 (National Forest Policy, 1988)

Forest (Conservation) Rules, 1981 amended 1992 and 2003

Guidelines for diversion of forest lands for non-forest purpose under the Forest (Conservation) Act, 1980

(xi) The National Environmental Appellate Authority Act, 1997

(xii) The National Green Tribunal Act, 2010

III. State Government Policies

Some of the Himachal Pradesh Government and HPPTCL's policies that are applicable to the sub-projects are:

The Himachal Pradesh Hydropower Policy 2007;

Himachal Pradesh Land Preservation Act (LPA);

HPPTCL Environment and Social Safeguards Policy, May 2011; and

Resettlement, Relief, Rehabilitation and Compensation Policy, May 2011.

IV. Other Acts

The policy framework consists of following main regulations:

1. The Electricity Act, 2003

2. National Resettlement & Rehabilitation Policy, 2007 (NRRP) (MoRD, DoLR).

3. Right of Way and compensation under Electricity Laws.

4. Land Acquisition Act. 1894.

5. The Indian Telegraph Act (ITA), 1885

Chapter 10

Bibliography

- <https://www.ausgrid.com.au/-/media/Documents/In-your-community/Construction-projects/Summerhill-substation-project/Main-document.pdf>
- http://www.seattle.gov/light/dennysub/docs/Denny_FEIS_January_22_2015.pdf
- https://www.adb.org/sites/default/files/institutional-document/179895/handbook_construction-techniques.pdf
- <https://www.adb.org/sites/default/files/project-document/81681/44444-013-eia-02.pdf>
- <https://www3.opic.gov/environment/eia/kipeto/transmission%20line%20seia/binder1.pdf>
- https://esa.afdb.org/sites/default/files/01%20ESIA_Menengai_Soil%20132kV%20TL.pdf
- <http://documents.worldbank.org/curated/en/724121468254077901/pdf/SFG1101-V1-EA-P103037-EIA-Substation-in-Kinagop-District-Box391459B-PUBLIC-Dislosed-05-19-2015.pdf>
- <http://documents.worldbank.org/curated/en/724121468254077901/pdf/SFG1101-V1-EA-P103037-EIA-Substation-in-Kinagop-District-Box391459B-PUBLIC-Dislosed-05-19-2015.pdf>
- https://en.m.wikipedia.org/wiki/Electrical_substation
- <https://simple.wikipedia.org/wiki/Environment>
- https://www.scribd.com/document/89221982/Very-Important-Substation?doc_id=89221982&order=484299485
- http://www.seattle.gov/light/dennysub/docs/Denny_FEIS_January_22_2015.pdf
- <https://web.njit.edu/~kebbekus/analysis/SAMPLING.htm>
- https://en.wikipedia.org/wiki/Environmental_monitoring
- <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-impact-assessment>
- https://www.researchgate.net/publication/320173274_A_LITERATURE_SURVEY_AND_ANALYSIS_OF_THE_IMPACT_OF_HIGHVOLTAGE_OVERHEAD_ELECTRIC_TRANSMISSION_LINES_ON_ADJOINING_PROPERTY_VALUES
- <https://himachalpradesh.pscnotes.com/himachal-pradesh-geography/minerals-in-himachal-pradesh/>