EXECUTIVE SUMMARY

INTRODUCTION

M/s Pioneer Genco Limited (PGL), a sister company of the leading cement manufacturer M/s Penna Cement Industries Limited (PCIL), has business interest in developing mini hydel schemes in Karnataka. PCIL, through its various sister companies and subsidiaries, has set up cement and power plants in South India including a 17.4 MW gas based power plant in the neighbouring state of Andhra Pradesh.

PGL intends to set up a mini hydel project of 21 MW (3 x 7 MW) capacity across the Cauvery river near Shivasamudram Village in Malavalli Taluk of Mandya District in Karnataka. The project, called Someshwara Mini Hydel Project (SMHP), has been allotted to PGL by Government of Karnataka (GoK).

PROPOSED PROJECT

The proposed mini hydel project intends to utilise the flows in the Cauvery river and a gross head of around 17 m available in the river, for power generation. The river water with the help of an intake structure will run three turbines of 7 MW capacity each. After power generation the water will be released back into the river. The generated power will be evacuated from the powerhouse to Static Frequency Converter (SFC) switching station of the Karnataka Power Transmission Corporation Limited (KPTCL).

OBJECTIVES

The proposed SMHP is expected to achieve following major objectives and benefits.

- **Satisfying power demand in the region**

The proposed power project is designed to generate 21 MW of electric power, which can be utilised to partially satisfy the increasing power demand in the region.

- **Lower cost for power generation**

The proposed project is a mini hydel project with simple design of turbines, generators and civil works. Also, it does not need use of any fuels which involve substantial expenditure towards their procurement (indigenously or import) and transportation. As a result, the cost of generation of power will be much less compared to thermal power.

- **Minimal environmental impacts**

Hydropower is a free gift of nature – clean, economical, perennial and inexhaustible i.e., renewable. The small hydel projects are considered to have minimal impacts on the surrounding environments due to small area of submergence, no gaseous emissions and solid waste generation such as fly ash.

- **Socio-economic benefits**

Setting up the proposed SMHP will provide direct employment to about 15 persons during operation phase. Also, during the construction phase, approximately 90 construction workers will be employed for a period of about 27 months, thus providing a direct employment potential to the area. Moreover, indirect employment will be generated due to the power project in view of creation of secondary supporting job opportunities.

PROJECT SITE LOCATION

The proposed SMHP is situated on the Cauvery river at about 2 km downstream of Shivasamudram Village, in Malavalli Taluk of Mandya district in Karnataka State. The site is located in a gorge upstream of the confluence of the Handi halla and the Gaganachukki branch of Cauvery river. A 60 MW hydro power station of Vishweswarayya Vidyut Nigal Limited (VVNL) and a mini hydel project of 6 MW capacity are located about 500 m upstream of the proposed diversion structure of SMHP. The geographical co-ordinates of the project site are Latitude $12^0$18'32" N and Longitude $77^0$10'45"E.

The project site is about 130 km from Bangalore by road. It can be reached by road either by State Highway SH-58 from Bangalore by taking a deviation at Maddur or by the Bangalore-Dindigul National Highway (NH-209). The Shivasamudram village is connected to the NH-209 by a pucca road of 2 km length. The nearest road to the project site is near Shivasamudram village with a straight distance of about 1.3 km. The nearest railway station to the project site is at Maddur, approximately 40 km from the site. The Bangalore Airport is the nearest operational airport to the project site.

ALTERNATIVE SITES CONSIDERED

A hydel project is a site specific project for the following reasons.

- There should be sufficient flow of water in the stream to generate power.
- There should be sufficient water head available for running the turbines.
- The project site should be located in a river valley as it is an ideal site for construction of diversion structure.
- The site should be easily accessible.
- Power evacuation facilities should be available within a short distance.

Since the proposed project site at Shivasamudram satisfies the above criteria and has been allotted by the GoK accordingly, no alternative sites were considered for the project. In addition to the above, the proposed project site offers following advantages.

1. **There is no submergence of land and no displacement of population**.

2. **The project does not involve any additional acquisition of land for construction of power transmission facilities avoiding associated negative environmental impacts.**

3. There is **no submergence of private or forest land** after implementation of the project as this project is proposed in the river course and the banks of the river are very high. Hence, there is **nil/minimum impact on the economic and ecological status of the area**.

4. Required infrastructure facilities for the mini hydel project are available near the proposed project site.

5. There is no major human habitation near the proposed project site except at the Shivasamudram village which is about 2 km from the proposed project site.

In view of the above, the proposed project site at Shivasamudram has been considered most appropriate for construction of the mini hydel project.

DETAILS OF THE HYDEL SCHEME

Power Generation

The proposed project is a hydroelectric power generation facility which will use the water flow in the Cauvery river for generation of electricity. Water will be diverted from the river to a 110 m long **Power Canal**. Three numbers of **Penstocks**, provided after an intake at the end of the power canal, will convey water from the power canal to the turbines in the **Powerhouse**. The powerhouse accommodates 3 no. **Turbine Generator** (TG) units with an installed capacity of 7 MW each. After power generation, the water is released back into the river through a 500m long **Tailrace Canal**.

The total installed capacity of the proposed SMHP is 21 MW. The average annual energy for the total installed capacity of 21 MW is estimated at 75 Mu whereas the net energy available after accounting for the station auxiliary consumption and non-availability exigencies of grid will be about 72.75 Mu.

The generated power will be evacuated from the powerhouse to Static Frequency Converter (SFC) switching station of the Karnataka Power Transmission Corporation Limited (KPTCL) located at about 2 km to the west of the proposed project site, by a double circuit, 66 KV transmission line.

Source of Water

The proposed mini hydel scheme is designed to utilise the flows in the Cauvery river and a gross head of around 17 m available in the river due to the presence of rapids, for power generation. The nearest gauging station for measuring daily flows in the river is at Dhanagere anicut about 13 km upstream of the SMHP. The flow data at Dhanagere gauged by the Central Water Commisison (CWC) indicates a minimum flow of 8.5 m^3/sec (March 94) to a maximum of 5620 m^3/sec (July 94) in the river between 1984-85 to 1995-96. The river is perennial and there will be lean flows of about 10 m^3/sec due to mandatory releases.

Infrastructure Requirement

The proposed SMHP will require following infrastructure for construction, operation and maintenance of the hydropower station.

Land

Total land requirement for the proposed project is estimated as 45 acres.

It is estimated that out of the 45 acres, about 25 acres of land will be required for dumping of the material excavated during construction of the project civil works in the gorge. This activity keeps the environment very clean and the river course intact. The land will be acquired near Shivasamudram village. Accordingly, no excavated material will be dumped either inside or adjacent to the river course. Similarly, about 2 acres of KPTCL's land will be acquired for construction of the approach road from the SFC substation near Shivasamudram village to the powerhouse. For colony and offices, around 2 acres will be acquired.

Water

Water requirement at the facility will be for construction and domestic purposes apart from power generation. Water will also be required for fire-fighting during an emergency. The water used for power generation will be immediately released back into the river. There will be no loss of water in the power generation process. Water requirement during construction phase is estimated to be about 9500 liters per day. A dedicated fire water storage of 165 m^3 will be maintained at the facility. Water for construction purpose will procured by constructing a borewell at the site. Potable water for the PGL in the operation phase will be obtained from borewell.

Power

It is proposed to derive the construction power supply and temporary lighting arrangement from a 220-kVA emergency DG set proposed for the plant. This DG set will later be used as plant emergency DG set. The operation phase power requirement will be satisfied by the same power project.

Approach Roads

There is no approach road at present to reach the project site from the existing road at Shivasamudram village. It is proposed to provide a 2.5 km long approach road connecting the existing road to the project site for all construction activities and approach during operation phase of the scheme.

Service Roads

A service road is proposed adjacent to the power canal and the tailrace canal. The lengths of the service roads for the power and tailrace canal are 110m and 500m respectively. The service road for the power canal will also facilitate the construction of the diversion structure and the head regulator.

Bridge

A 60 m long bridge is proposed across the Handi halla to connect the service road of the tailrace canal with the approach road to the power house.

Manpower

Man-power requirement for the proposed project during its construction stage will be approximately 90, whereas about 15 personnel will be employed during the operation phase of the proposed project. The operation of the SMHP will be in three shifts.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

PGL has retained the services of Centre for Symbiosis of Technology, Environment & Management (STEM) to carry out a Rapid Environmental Impact Assessment (REIA) study of their proposed Mini Hydel Project near Shivasamudram village. The objective of the REIA study is to identify, predict and evaluate the likely environmental impacts of the proposed hydel project during its construction and operational stages. The REIA study also aims at developing an appropriate Environmental Management Plan (EMP) for mitigating adverse environmental impact of the proposed project, if any.

Baseline Environmental Status

Air environment

Mandya district is endowed with comfortable climatic conditions throughout the year with an average annual temperature of 24^{o}C. The baseline scenario was established based on the micrometeorology data of last five years (1997-2001) collected from the Mandya Observatory of Indian Meteorological Department, and the ambient air quality monitoring carried out in the study area during December, 2002. Based on the meteorological data predominant wind direction in the study area is from W & SW during April to October, and from E & NE during winter i.e. November to January. The average relative humidity in the study area at 0830 hrs was in the range of 72% to 90% whereas that at 1730 hrs was in the range of 30% to 81%. Similarly, the monthly mean temperature recorded varied from a minimum of 14.6°C to a maximum of 36°C. This shows sober weather conditions in the study area.

To establish the baseline scenario of ambient air quality in the study area, ambient air quality monitoring was carried out at two locations. The results of ambient air quality monitoring showed that the air quality at all the monitoring locations in the study area is within applicable CPCB standards.

Noise level

To establish the baseline noise scenario, noise level monitoring was carried out at two locations in the study area. Comparison of standards with the monitored noise data shows that the average noise levels during day and night time at the monitoring locations conform to the applicable standards.

Water environment

The Cauvery river at the proposed project site is the major surface water body within the study area. Also, there is a small stream named, Handi halla which joins the Cauvery river about 100 m downstream of the proposed SMHP. Water supply in

most of the villages in the study area is either through tap water or well water. Borewells have also been provided in the villages of the study area.

In order to establish the baseline status of water quality in the study area, water samples were collected from the surface and ground water sources and analyzed for their drinking water quality.

The water quality in the study area conforms to IS:10500 drinking water quality standards.

Land environment

The proposed project site is located in a valley/gorge at the bottom of a hill, along the river course. Based on the 1991 census, the landuse pattern in the study area indicates that major portion of the land is unirrigated and not available for cultivation.

Terrestrial ecology

Forest

The study area of 10 km radius circle with respect to the proposed project site, partially covers the Basavanbetta Reserve Forest, Dhanguru State Forest and the Chikkayalur Reserve Forest. The Basavanbetta Reserve Forest and the Chikkayalur Reserve Forest are situated on the outskirts of the study area.

Flora

The vegetation in the study area is generally regarded as deciduous and scrub type with exception of the valleys and a majority of species inhabiting these areas exhibit xeromorphy. The ground vegetation mainly consists of herbacious form and a covering of grasses such as Apluda muinica, Argemone dactylon, Rragrostis cilianesis and Ochlandra aravancorica. Details of the commonly found vegetation in the study area are given in the relevant chapter of this report.

Fauna

The various types of animals, birds and reptiles found in the study area are elephants, gaur, deer, sambar, fox, hare, cobra, russel viper, rat snake etc. Detailed list of the fauna found in the study area is given in the relevant chapter of this report. The fauna in the vicinity will not be affected, as this is a non-consumptive use project.

Aquatic ecology

The river at the proposed project site is the major surface water body within the study area. Also, there is a small stream named, Handi halla, which joins the present river course downstream of the proposed SMHP. There are not any significant fishing activities taking place at the project site. However, fishing activities occur upstream and downstream of the project site. List of the commonly found fish species is given in the relevant chapter of this report. As the ecology will not be affected, fish species will not be affected.

Socio-economic factors

For assessing the baseline socio-economic data, information from secondary data sources i.e. the 1991 Census data has been considered. The 2001 census data has

not been published yet. However, the present socio-economic status of the study area has also been assessed on the basis of the field observations and interviews during the site visits. . Based on the 1991 census data, total population of the study area is 45357, of which 23500 are males and 21857 are females. Average population density in the study area is approximately 176 persons/km^2. The overall literacy rate in the study area is 35.9% whereas male and female literacy rates are 44.35% and 26.81% respectively. Educational facilities in the rural part of the study area are only upto middle school level. However, good educational facilities are available at Malavalli, Maddur and Mandya. Overall employment in the study area is 35.45% whereas the male and female employment rates are 55.63% and 12.67% respectively.

Basic infrastructure facilities such as drinking water supply, electricity supply and transportation were found to be adequately available in the study area. Most of the villages in the study area are served by private medical practitioners. Good medical facilities are available at Malavali (about 16 km by road from project site), Maddur (about 40 km by road), and Mandya (about 50 km by road). Modern communication facilities such as STD telephone were found to be available at Shivasamudram village during the site visit.

Potential Environmental Impacts and Mitigative Measures

Based on the REIA study, the environmental impacts during the operation phase of the proposed SMHP on various environmental components in the study area are summarised in the following **Table 1** and **Table 2** respectively for ready reference.

Table 1
Construction Phase
Potential Impacts and Mitigative Measures

Sr. No.	Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
1.	Air quality	Increased SPM concentration in ambient air.	Construction equipment, vehicular traffic, excavation, concreting, *etc*.	Vehicular check; water spraying for dust suppression;	Minor negative but temporary & localised
2.	Noise	Increased noise levels	Construction equipment, various construction activities	Equipment selection & maintenance; usage of ear plugs/muffs by the construction workers	Minor negative impact
3.	Water	Demand of water supply in addition to extraction from borewells. Local increase in suspended solids	Construction equipment cooling, concrete mixing & curing, cleaning, workers' domestic needs, dust suppression etc. Erosion due to excavation activities	Equipment selection, steam curing, high pressure hose for cleaning. Plantation around site before construction.	Minor negative impact
4.	Land	Construction wastes, unstable slopes, soil erosion	Construction waste	Appropriate waste disposal measures; slope stabilisation and greenbelt development.	Beneficial on land use. Minor negative on soil quality
5.	Terrestrial Ecology	Impact on top soil & existing ecosystem in the vicinity of the site.	Construction activities	Low noise generating equipment, soil binding vegetation, greenbelt development	Minor negative impact

Sr. No.	**Environmental components**	**Potential impacts**	**Source of impacts**	**Mitigative measures**	**Remarks**
6	Aquatic Ecology	Loss of habitat, change in flow, increase in suspended solids and TDS	Construction activity of power house & penstock and power canal	Providing rocky boulders/structures near the power house to restore the original habitat to the extent possible.	Short term Minor negative impact
7.	Socio-economic factors				
(i)	Population	No impact	Construction jobs	Employing local people, Providing proper facilities and community services for the wokers	No impact
(ii)	Education	No impact	None	Employing local people	No impact
(iii)	Employment	Increase in employment opportunities	Construction jobs to the local manual labourers and professionals	-	Beneficial
(iv)	Infrastructure facilities & Community services	Medical & transportation facilities	Increased project & social need for infrastructure	-	No impact

Table 2
Operation Phase
Potential Impacts and Mitigative Measures

Sr. No.	Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
1.	Air quality	None	Occasional vehicular movement	Green belt development, usage of good quality fuel	No impact
2.	Noise	Increased noise levels but below the prescribed standard.	Operation of noise generating equipment such as turbines, pumps & compressors located within the power plant	These equipment will be provided with noise reduction measures such as acoustic barriers, vibration pads etc. Green belt development.	Minor negative
3.	Water	None	None	Minimise water usage by water conservation measures such as reuse of treated sewage for greenbelt irrigation.	No impact
4.	Land	None	Project activities	Development of a systematically managed green belt to maintain ecology of the area. Appropriate disposal of solid waste, garbage.	No impact
5.	Terrestrial Ecology	Minor loss of habitat, obstruction to animals to access the river.	Project activities	Greenbelt development. Providing suitable access to river for animals.	Minor negative
6.	Aquatic ecology	Loss of habitat, change in flow	Diversion of flow	Mesh of appropriate size will be provided at the inlet points of the intake canal to prevent entry of fish alongwith water into the turbines.	Minor impact

Sr. No.	Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
7.	Socio-economic factors				
(i)	Population	Small increase in population.	Direct / indirect job opportunities, secondary services	Employment of local people to the extent possible	No impact
(ii)	Education	None	None	Employment of local people to the extent possible	No impact
(iii)	Employment	Better employment opportunities	Operation phase direct & indirect project and social requirements	Employment of local people to the extent possible	Beneficial
(iv)	Infrastructure facilities & Community services	Improvement in infrastructure requirements	Operation phase project and social requirements	-	Beneficial
8	Population displacement and rehabilitation	None	No displacement of population	-	No impact
9	Aesthetics	None	Project structures	Structures architecturally compatible with existing structures in the surrounding.	No impact