



# THE MANKULAM MICRO HYDROELECTRIC POWER PLANT

## Utilizing the Small Hydropower Potential in Kerala

In order to meet its growing energy and power requirements, Kerala, also referred to as God's own country, has decided to allow greater private investment in setting up power plants from hydel sources. Along with active participation of the local people, the Energy Management Centre, Thiruvananthapuram, has been instrumental in setting up environment-friendly systems of development of power. In this article, **G Anil** presents a detailed description of the small hydro power project currently in operation in the state.

**K**erala, with a population of 33 million, faces numerous challenges to meet its energy requirements in a sustainable manner. The current production of electricity is far too insufficient to meet the growing demand of the consumers. The state has enormous renewable energy potential and more than 3,000 MW of exploitable hydropower capacity. Renewable Energy Technologies (RETs) have neither attracted the requisite level of investment nor tangible policy commitment. Although some resources have been allocated for developing, adapting, and disseminating RETs in rural areas, the total impact is still insignificant and very marginal.

The aims and objectives of establishing the UNIDO project at the Energy Management Centre (EMC) is to further strengthen the Small Hydro Power related activities of the Centre. With the establishment of the UNIDO Centre, several renewable energy-related awareness building and training programmes would be conducted in order to promote and accelerate sustainable development. It will facilitate the design of cost-effective RETs, using locally manufactured equipment, materials, and labour and organizing consultancy services on comprehensive aspects of renewable energy systems and small hydro power development.

The first off-grid 110 kW micro hydel project and connected Community Development Centres in Mankulam Panchayat (Local Body) in Idukki District in Kerala was commissioned during 2004. The Hon'ble Minister for Power, Government of Kerala, Mr Aryadan Muhammed inaugurated the project on October 28, 2004, at 1600 hrs at Mankulam. The Community Development Centre was inaugurated by Mr A J J Rwenderie, Managing Director, UNIDO, Vienna, Austria.

The UNIDO Regional Centre (RC) for Small Hydro Power (UNIDORC) at the Energy Management Centre (EMC), Trivandrum, initiated such an endeavour in Mankulam, the only unelectrified Panchayat and an agriculture resource-rich village in the Idukki district of Kerala, devoid of communication facilities. This was done in association with the local self-government of this Panchayat.

More than six waterfalls are available in this panchayat, all of them with power generation potential. During 2001, with the objective of generating power for the lighting needs of the local community, the Panchayat initiated implementation of a 110 kW micro hydropower scheme at Pampunkayam, with a catchment area of 8 sq. km. After construction



of the penstock line by around 2002, this project was held up due to various reasons, including lack of finance for purchase of the turbine sets.

It was in this context that the UNIDO RC at EMC identified this scheme as the potential power source for its community development initiatives in this Panchayat. The RC stepped in and brought two turbine generators of 55 kW, each from China, through UNIDO's International Centre—the ICSPH. The Panchayat and EMC raised resources and created a 4 km stretch of 11 kV line and the RC completed the distribution network to provide power to about 250 families and other 50 establishments, including the upcoming telephone exchange, in the

first phase. Limit switches are provided to help optimize the power usage within 150 watts to 175 watts, which is sufficient to provide the basic lighting and entertainment services to the local community. Picture 1 shows the front view of power house—Mankulam MHP.

The total cost of this project is about ₹6.7 million and the power generation cost works out to be ₹1.63 per unit, without transmission and distribution network (₹2.5 million). In addition, the RC has provided 10 computers, VSAT Internet link, and computer publications to help create a computer education centre as part of the CDC programme. UNIDO supported the establishment of five CDCs in the Panchayat. The RC will also be involved in facilitating creation of cottage/tiny industrial units in this Panchayat as its second phase, followed by further expansion of the electrical system.

In fact, this symbiotic association between a worldwide organization, UNIDO, and the local self-government made possible through the Regional Centre at EMC, Trivandrum, has given a great model to the developing world. Also, this CDC programme driven by



Picture 1: Front view of power house—Mankulam MHP

environmentally benign power utilizing local resources has rekindled the once forgotten but still relevant concept of self-sustenance of our rural villages, as envisioned by Mahatma Gandhi, the Father of the Nation.

The Panchayat also has the rare distinction of generating power for its own use. The project commissioned in 2004, however, lasted only for two years. Once the utility's (Kerala State Electricity Board Limited or KSEBL) power supply reached this region, the project lost its relevance and the distribution network, along with transformers, was surrendered to the KSEB by the Panchayat. The power house was idle for almost six years since 2004.

The Energy Management Centre (EMC), under the Department of Power, Government of Kerala, technically supported the Mankulam Grama Panchayth (near Munnar in Idukki District, Kerala, India) and completed the revamping and grid interfacing work of 110kW (2x55kW) Mankulam (Pampumkayam Falls) Micro Hydro Electric Project as a deposit work. The Hon'ble Minister for Power, Government of Kerala, Mr Aryadan Muhammed dedicated the project on May 10, 2012, at 1200



Picture 2: Mankulam Power house—inside view

hrs at Mankulam, thus, becoming the first local body in India to sell power to the state utility—KSEB—through a Power Purchase Agreement (PPA). The plant is synchronized to the 11kV grid of KSEB through a step up transformer. The cost involved for the overhauling and grid connectivity is ~₹15 lakh.

The powerhouse has two turgo impulse turbines, which can each generate 55 kW of power daily. It is located near the Pambumkayam waterfalls, just a kilometre away from Mankulam town.

This panchayat, however, lacks connectivity and lags behind in development. It has around 3,250 families, including those living in seven tribal villages. One-third of the population is made up of tribal people.

The plant has a net head of 70 m and a discharge of 0.1 cumecs each. The local people have been trained to run the plant, thus, generating employment opportunities, in addition to the voltage improvements in the locality, and thereby reducing losses to the utility. The revenue thus generated

by the Panchayat would be utilized for the developmental activities of the Panchayat.

The overall production estimated from the two generators is around 5.5 lakh units/year. The power purchase agreement (PPA) was signed by the Panchayat with the state utility—KSEBL, with the approval of the Kerala State Electricity Regulatory Commission (KSERC).

With the Energy Regulatory Commission fixing the rate at ₹4.8/ unit, the Panchayat is set to earn a gross revenue of around ₹26.4 lakh, annually, minus the costs incurred for the local operators (3 x ₹7,500/operator per month x 12 months) and annual maintenance charge of ~4 per cent.

The Panchayat is also planning to develop the area as a tourist spot by directing the water from the power house into an area proposed for a lake. Picture 2 shows Mankulam Power house—inside view. **AU**

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# WORLD'S LARGEST 11.5 MWp SINGLE ROOFTOP SOLAR POWER PROJECT

The world's largest 11.5 MWp single rooftop solar power project has been commissioned at Dera Beas, District Amritsar in two phases—7.52 MWp in April 2014 and 12 MWp in December 2015. This project is India largest in campus with a total capacity of 19.5 MWp. The project has been set up in record period of six months. It is evacuating power through 132 kV transmission system and is feeding power to 132 kV PSTCL grid substation Beas. The project abates 26,135 tonnes CO<sub>2</sub> annually.

7,000 residents. Annually, 50 lakh people visit the place, which creates awareness about solar power green energy among the general public.

- The Government of India has set a target of 40,000 MW to be achieved by 2022 and this project is a role model, which shall encourage replication of such large rooftops on buildings/sheds.
- This project is a major catalyst for encouraging replication in other large buildings, rooftops in the country.

## IMPACT OF THIS UNIQUE PROJECT

- Dera, as it is generally known, is a mini-township with

Features of this project are summarized in the table below **AU**

Project capacity	19.52 MWp (7.52 + 12)
Location	Beas (District Amritsar)
Area covered	82 acres of rooftop
EPC company	L&T and Tata Power Solar
Capital cost	156 crore
Project commissioning	April 2014 (7.52 MW) and December 2015 (12 MW)
Roof type	11.5 MWp installed on single roof of ACC sheets and remaining 8 MW installed on multiple roofs
Modules type	Poly/multicrystalline
Module wattage	250 Wp
Inverter rating	500 kW/850 kW (central type)
Grid evacuation voltage	132 kV
No. of solar PV modules	78,102
132 kV substation	11 kV /132 kV
Grid connectivity	To PSTCL 132 KV S/S

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