9th Issue

# NEPAL ELECTRICITY AUTHORITY

## Generation Operation & Maintenance Business

MARCH, 2013 (CHAITRA 2069)

DURBAR MARG, KATHMANDU, NEPAL

Replacement Works of GIS CT in Marsyangdi Hydropower Station

Overhauling of Unit No. 1 of Modi Hydropower Station

Complimentary Copy

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Front Cover Photo: Overhauling of Unit No. 1 in Kaligandaki 'A' Hydropower Station

Back Cover Photo: Indra Sarovar with Sloping Intake at the Background

This issue is a continuation of previous 8th issue of Generation covering previous two fiscal years 2010/11 and 2011/12.

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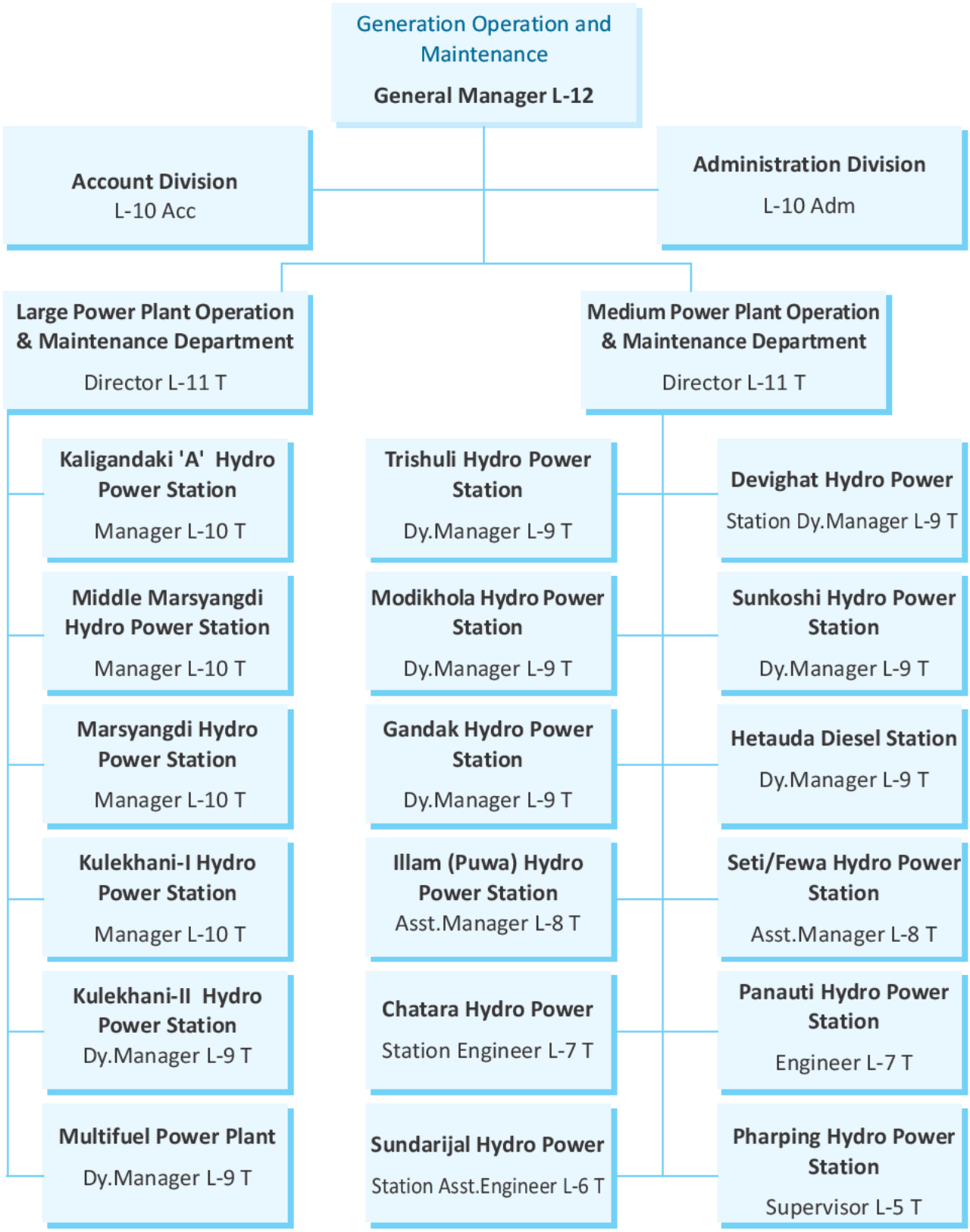
# NEPAL ELECTRICITY AUTHORITY

## Generation Operation and Maintenance

### Corporate Organization Structure



# GENERATION OPERATION AND MAINTENANCE BUSINESS GROUP

## Brief Overview

Generation Operation and Maintenance (GO&M) Business is responsible for the optimum operation and maintenance of the seventeen (17) hydropower stations and two (2) thermal power plants owned by NEA. 'Generation of energy by optimally utilizing the resources available while undertaking periodic overhauling, major maintenance works and rehabilitation projects of the generating stations'; that approximately describes the mission of the GO&M Business Group.

One hundred years have passed since Nepal, in 1911, started producing hydro-electricity from Pharping power station. The erstwhile Bijuli Adda has found its continuity in various forms of government agencies and is presently the Nepal Electricity Authority. In this way, GO&M business can be called to possess the heritage of a hundred years of operation and maintenance of power stations.

The total installed capacity of hydropower stations and thermal power plants under this business group now has reached a humble 469.29 MW and 53.41 MW respectively. This Business Group is structured into two departments, namely, Large Power Plant and Medium Power Plant Operation & Maintenance Departments.

## Operational Performance

There has not been any capacity addition in this year nor the preceding year to the installed capacity of 469.29 MW of hydropower stations. Despite it, the GO&M business has strived to increase total production of energy year on year basis, without accounting for the thermal energy that has been kept minimal due to its high operating cost. The year-on-year increase of total generation of F.Y. 2010/11 had been a modest increase of 0.6%. The same resources have been maximally used to generate 2,351.53 GWh in 2011/12 which represents again a 10.99% increase over the previous year. Hydro-energy of NEA claimed a share of 2114.945 GWh and 2,349.97 GWh of the total with a mere 3.682 GWh and 1.56 GWh from thermal respectively in 2010/11 and 2011/12.

The generation targets set for the fiscal years 2010/11 and 2011/12 were 2,244.67 GWh and 2,344.55 GWh respectively which have been closely contested in 2010/11 and exceeded the following year. The bars were expected to further raise at the beginning of this fiscal year with the same power plants in hand, placing more demand on optimum operation and maintenance practice so as to fulfill the targets, while trying to reduce the load-shedding torment of the nation. However, since the generation is fully dependent on the incident rainfall and with the reduced rainfall trend of this fiscal year 2012/13, it may be expected that the generation forecast will not be surpassed. The run-off river (ROR) generating units operated at only 64.61% plant factors whereas Kulekhani-I and Kulekhani-II, the two storage hydropower stations in cascade, showed the aggregate plant factor of 26.64% in 2011/12. It was even lesser 59.47% for ROR and 18.53% for only storages in the previous year. The maximum water-level of the Kulekhani reservoir were recorded at 1521.34 masl and 1530.50 masl respectively in 2010/11 and 2011/12 whereas it was recorded at 1530.34 masl this year on 25 October 2012 as a consequence of late-monsoon heavy downpour in the region. The drawdown from Kulekhani reservoir had been cautiously limited to 1495.22 masl and 1497 masl minimum level in the previous two years.

## Maintenance Activities

The business group has continued to work on the repair and maintenance activities, periodic

overhauling and rehabilitation projects in assistance with Government of Nepal and multilateral agencies. After the successful completion of Renovation, Modification and Upgradation (RMU) project in Devighat in fiscal year 2010/11, the generation has been satisfactory which has been limited only by the obstacles in generation faced by upstream Trishuli Hydropower Station in one of its unit, in which the replacement of stator and repair of rotor assembly are already underway. The first overhauling of Middle Marsyangdi Hydropower Station since its commissioning in 2008 was carried out from November 17, 2010 to December 8, 2010 to rectify the defects identified during defect liability period (DLP) under contractual obligations. The breakdown of 66 kV XLPE cable in Y-phase in November, 2012 was temporarily brought into service in an emergency measure. The breakdown was likely due to progressive breakdown during wet aging in solid insulating materials, which could be the area for further research. The engine overhauling of all the seven DG sets of Hetauda Diesel Plant was completed in 2011/12 and currently in operation at a capacity of 10 MW. The overhauling of all the six Wartsila DG sets of Multifuel power plant, which was started in 2066/67 has been successfully completed this year. This project together with the procurement of spare parts for DG sets of Hetauda Diesel Plant from Man Diesel, UK was funded by World Bank under PDP and the project cost was Euro 7.7 million. These plants contribute to generation mix and provide some degree of operational flexibility and strengthen system reliability. The plants have great importance in minimizing load shedding hours to some extent but exorbitant fuel prices and vulnerable supply chain restrict their operation. The GON has assured to compensate the difference that results from the operation of this plant and the average energy tariff that NEA charges to its consumers. Presently, MOE has issued directive to operate these plants at full capacity for as many hours in an effort to restrict the ongoing load shedding within 12 hours.

The Business Group acknowledging the recommendations made by the committee on monitoring of the NEA-owned power stations chaired by former Minister of State, Energy has implemented the recommendations and is working on broader implementation framework to address long term goals and objectives. Concerted efforts have been made to upgrade available manpower at floor level and at engineer level so that the maintenance activities could be carried out with minimal external assistances.

## Rehabilitation Projects

The Rehabilitation of Kaligandaki 'A' Hydropower Plant Project previously funded by PDP World Bank has undergone comprehensive revision to include modified scope of works, which now includes headworks modification, dam safety & instrumentation, technical assistance and capacity-building and revised electromechanical works. The project is estimated to cost US Dollar 30.6 million and funded by World Bank (IDA Credit) scheduled to be completed by April, 2016.

Marsyangdi Hydropower Station has two ongoing projects-Marsyangdi Power Station Excitation System Rehabilitation and Weir Control Modernization and Modification. Both the projects are part of Energy Access and Efficiency Improvement Project, which are jointly funded by Asian Development Bank (Loan No. 2587-NEP (SF), GON and NEA. The equipments have been delivered to the site for weir control modernization and modification project and price negotiation is underway with excitation equipment manufacturer, Voith Hydro GmbH & Co. KG for excitation system rehabilitation project.

The unsatisfactory operation of Modi Khola Hydropower Station compared to other identical hydropower stations are expected to improve after the rehabilitation project. The proposed rehabilitation project includes civil, hydro-mechanical and electromechanical renovation and modification works. The cost estimate of the project is NRs. 337 million. The initial study and project preparation works have been completed

and the bids are invited for civil and hydro-mechanical works. The rehabilitation works are expected to be completed by 2013/14.

The rehabilitation of electromechanical components of Sundarijal Hydropower station is underway under the joint assistance from ADB, GON and NEA. Nepal Electricity Authority has received loan (Loan Number 2808-NEP, Grants 0270-NEP and 0271-NEP) from Asian Development Bank (ADB) towards the cost of Power Efficiency Improvement as part of Electricity Transmission Expansion and Supply Improvement Project. The project is scheduled to complete by July, 2015.

The procurement of trash rack cleaning machine at the intake section is jointly funded by ADB (Loan No. 2587-NEP (SF)) under Energy Access and Efficiency Improvement Project (EAEIP), GON and NEA. The project is expected to improve the plant factor to 19.2% and increase the energy generation by 28.2% compared to the average energy generation over the last ten years. The works are expected to be complete by 2013/14.

## Other Activities

There has been some remarkable progress in the reclamation of land against encroachments especially in Panauti, Sunkoshi, Pharping, Kulekhani-I, Kulekhani-II, Chatara and Panauti Hydropower Stations. The Business Group has succeeded to acquire the land ownership certificate (Lal Purja) of 35,792.83 $m^2$ in Panauti whereas the land transfer is in progress in Chatara Hydropower Station from Sunsari-Morang Irrigation Project. The Business Group is continuously working with stakeholders to resolve this contentious issue while issuing directives to concerned power stations to determine and register the land occupied by NEA facilities. The land measurement is underway in concerned power stations whereas it has been completed in Sunkoshi Hydropower Station. The Business Group now possesses 7,805,032.37 $m^2$ of land area with land ownership certificate (Lalpurja) whereas 543,446.25 $m^2$ of land year is yet to acquire the land ownership certificate (Lalpurja). However, the total area of land that the Business Group currently possesses with and without land ownership certificates (Lalpurja) is 8,348,478.61 $m^2$.

The Business Group has auctioned scraps, obsolete items and remains from the completion of project and repair and maintenance activities in most of the power stations whereas the process of auction of old and unused vehicles has been initiated.

## Challenges & the Way Forward

Ageing generating stations resulting in increased operation and maintenance costs coupled with inadequate skilled workforce, unavailability and exorbitant price of spare parts are the challenges ahead for the Business Group. Soaring fuel price restricts the continuous operation of thermal power plants, which clearly requires subsidy to recover the imbalance between energy costs and the revenue that it generates. Advanced technologies continue to find applications in the power plants demanding trained and skilled workforce. Efforts have been made towards this, but more disciplined approach is required supported by corporate commitment. Despite the challenges, the Business Group continues to find the way forward for:

- Preparation of standard norms while drafting technical specifications and cost estimates especially in the procurement of electromechanical goods, plants and services augmented by performance assessment measures during implementation
- Capacity building through training at various levels whereas occupational health and safety concern will continue to top the priority.
- Asset management based on enterprise resource planning basically for optimal allocation of resources within the Business Group
- Enforcement of prudent operation practices, rehabilitation, periodic overhauling, repair and maintenance of the power stations with an objective to achieve design generation capacities
- Reduction of outages and increase of reliability for quality power supply

# CENTRAL INITIATIVES OF BUSINESS GROUP

## Training & Support

The training programs especially for personnel involved in operation and maintenance activities of the power stations are organized to impart in-house skill and knowledge in an initiative to enhance productivity and capacity. The details of the training conducted in fiscal years 2068/69 and 2069/70 are shown in the table below. The training programs have resulted in active participation and constructive feedback from the participants. The basic and refresher course of the training program covered fundamental concepts in power plant operation and maintenance, workplace safety, record keeping and documentation. The PLC hardware and software with field interfacing

Refresher Training for Power Plant Operators in Kulekhani-II Hydropower Station

| Training Title | Training Venue | No. of Participants | Training Year |
|---|---|---|---|
| Refresher and Orientation Training for Operation & Maintenance | Kulekhani-II | 14 | 2068/69 |
| Refresher and Orientation Training for Operation & Maintenance | Kulekhani-I | 19 | 2068/69 |
| Basic Training for Operation & Maintenance | Marsyangdi | 25 | 2068/69 |
| Basic Training for Operation & Maintenance | Middle Marsyangdi | 25 | 2068/69 |
| Basic Training for Operation & Maintenance | KG 'A' | 15 | 2068/69 |
| PLC hardware and software with field interface training | Middle Marsyangdi | 9 | 2068/69 |
| PLC hardware and software with field interface training | Kaligandaki 'A' | 16 | 2068/69 |
| Proficy Machine Edition-Logic Developer PLC & Proficiy HMI/SCADA CIMPLICITY Fundamentals | Pune, India | 9 | 2068/69 |
| Refresher Training for Power Plant Operators | KL-II | 19 | 2069/70 |

training was useful for fundamental concepts in PLC hardware and software. The PLC training in Pune, India had theoretical and laboratory works largely on GE Fanuc PLC series covering control system overview and GE Intelligent Platforms. Advance training in special field of maintenance is planned for this year and will be reviewed each year to make them effective and useful based on feedbacks from the participants. The Business Group is working on overseas/domestic trainings in core-competency areas to keep pace with the technology.

The Business Group provides central level support to the power stations and coordinates in acquiring intra/inter-group services or even expatriate expertise to ensure the smooth functioning of power plants. The concept of rapid response team is also emerging to deal with emergencies in the power stations. The team will assist in expediting the decision making process in emergency situations.

Refresher Training for Power Plant Operators in Marsyangdi Hydropower Station

## Monitoring

The Business Group has central level monitoring unit for periodic monitoring of operation and maintenance activities in the power stations and help Management in establishing prudent operating and maintenance practices as well as sound financial discipline. The monitoring unit is a watchdog that assesses the maintenance activities, keeping of records, inventory management, procurement, disbursements, staffing, occupational health & safety and implementation of Enhanced Performance Reward (EPR). The unit reports on the activities and makes recommendations to the Management and assist the Business Group to remain vigilant. The Unit has made first round of inspection in July, 2012 to different power stations in which the unit was tasked to monitor EPR, store inventory, record keeping, reporting and energy audit. The Unit has submitted the report to the departments and the departments have channelized the recommendations to concerned power stations. The follow-up is planned this year to assess and evaluate progress and compliance.

## Annual Budget & Program

The Business Group affords to considerable effort and time for the realistic preparation of annual budget and program. The preparation begins with an assessment of the annual capital budget as well as operation and maintenance budget and programs of significance at the central level. The power stations propose annual budget and program to cover capital investments and operation and maintenance expenditures. The Business Group subsequently involves the power stations and customizes their needs to produce an annual financial plan. The financial plan guides to the optimum allocation of available funds to achieve the common goals of the Business Group. The Business Group works with the Central Finance, NEA for administration of funds to those set programs and timely disbursements. The Business Group also provides support during the preparation of technical specifications, procurement process, contract administration and management at the central and issue directives to establish sound financial discipline. The Business Group is working towards cut down of operation and maintenance expenses contributing to the overall objective of NEA.

## Human Resource Management

Human Resource Management is considered as a critical and crucial factor in an organization. Only a motivated skilled manpower can inspire physical, financial and other resources from being idle. The nature of works in this Business Group demands

professionally competent human skills with specialized knowledge and experience. This can be achieved by talent hunting, right man in right place, imparting skills and knowledge through continuous training and development. The Business Group, hence, has worked continuously in the formulation of plans and programs to develop and transfer knowledge and skills for both the technical and administrative staffs through on/off the job trainings, workshops, seminars and abroad trainings. The Business Group is currently considering for the implementation of standard practices of assigning job description, performance contracts, benchmarking, periodic review of the performances and productivity measurements in the power stations.

The focus here is mainly in diversified trainings for the targeted groups requiring specialized skills and competency with an objective to acquire have skilled manpower to some extent and also minimize the staff turnovers. The Business Group is working closely with the central human resource department for the placement of qualified manpower at all levels in the power stations during recruitments with a view of smooth succession in the future. The Group also facilitates power stations in intra-group short term transfers of the staffs depending upon requirements.

Sub-optimal fringe and benefits, globalization and associated social and economic issues are some of the widely accepted concerns for recruitment and retention of skilled manpower, which can possibly be addressed to some extent by periodic revision in salary and perks commensurate with social status.

There are currently 750 technical and 263 administrative staffs totaling 1,013 staffs working under this Business Group while the approved positions are 859 for technical and 340 for administration with a total of 1199 positions. The gap between the approved positions and incumbents especially in assistant level positions is huge. There is also significant deficit of incumbent officer level staffs in both the services. The summary of approved and incumbent employee status of the Business Group is shown in the following table.

| Level | Service | Approved Position | Incumbent | Deficit |
|---|---|---|---|---|
| Officer Level | Technical | 132 | 99 | 34 |
| Assistant Level | | 727 | 651 | 146 |
| | Total Technical | 859 | 750 | 180 |
| Office Level | Administration | 44 | 34 | 11 |
| Assistant Level | | 296 | 229 | 74 |
| | Total Administration | 340 | 263 | 85 |
| **Total (Technical + Administration)** | | **1199** | **1013** | **265** |

## Rehabilitation Project under Generation Operation and Maintenance

The following is the short description of ongoing projects under this Business Group jointly funded by multilateral agencies and/or Government of Nepal/Nepal Electricity Authority.

## Kaligandaki 'A' Rehabilitation Project

Kali Gandaki A HPP is a 144 MW peaking run-of-river plant, located on Kali Gandaki River in Syangja, three hours drive from Pokhara. The dam is located just below the confluence of Kali Gandaki and Andhi Khola. The plant was largely funded by the Asian Development Bank and commissioned in 2002 at a cost of US$453 million. Today, it is the largest hydropower station in Nepal, and it supplies nearly 40% of NEA's total annual electricity generation and represents a quarter of the country's total annual electricity generation. The plant of this significance, presently, confronts with the following problems and awaits major rehabilitation.

Severe damages were observed in critical plant equipment, including the main inlet valve (MIV), guide vane, and turbine runners caused by both erosion and cavitation. The erosion is caused by increased sediment concentration dominated by Quartz particles in the water passing through these parts of the power generation units. Reduced efficiency of the sediment handling facilities at the headwork was identified as a significant cause in increase in sediment concentration. In addition to erosion, the electro-mechanical equipments are affected by cavitation caused by decrease in the tail water level. The damages from erosion and cavitation are on the rise prompting reduced efficiency and reliability, and thereby threatening the safety of the plant. Lowering sediment concentration in the water within reasonable operating boundaries through proper settling before the water passes through the power generation equipment is one of the keys to keep the damages within acceptable range. The original designs recommended monitoring sediment concentrations and shutting down the plant when the concentrations exceeded total suspended sediment concentration of about 10,000 ppm in the river, equivalent to a sand concentration of about 4,000 ppm in the river at discharges of approximately 2,000 $m^3/s$. This has never been practiced in Kali Gandaki 'A' simply because the country is continuously facing power deficit. Physical model test was performed to assess the performance of headworks and sedimentation handling facilities.

Currently, there are two safety risks at Kali Gandaki 'A'. First, severe damage to the MIV that functions as a safety device is already posing serious safety threat to the plant and needs urgent repairs. Sediment deposition in the lower part of the valves hinders complete closure of the MIV. The valves themselves are also eroded by sediments. The MIVs involve some modifications in the greasing system and the servomotors to ensure proper closing and opening operation. Secondly, there are also dam safety issues consisting mainly of improper maintenance and negligence of dam safety instrumentation. There is no dam safety plan including an emergency preparedness plan.

Fortunately, the cavitation problem may be easily addressed by physically increasing the level of the tailwater by installing a concrete sill at the junction with the river bed. The upcoming Project will address these issues and some other sectors of improvement.

The project is the continuation of the previous rehabilitation project funded by PDP, World Bank. The project has undergone comprehensive review and now comprises modified scope of works and encompasses broader areas of concern and a dedicated organizational setup for effective implementation as shown below.

## Project Components

i) **Component A: Civil Works** will address the main items related to civil works and will consists of the following sub-components.

- **Sub-Component A1 Headworks modifications.** Under this sub-component, modifications will be made to the headworks including the intake and the settling basins. **Sub-Component A2 Improving Dam Safety &Instrumentation.** Under this sub-component, instruments installed in the project will be repaired and others added as necessary to meet state of the art requirements. An operation and maintenance manual will be prepared which will include an instrumentation plan. Real-Time sediment monitoring instrument will be installed.
- **Sub-Component A3 Maintenance Works.** Under this sub-component, maintenance of the headworks and the powerhouse areas, including the stabilization of the slope in the headworks area and the modifications to the tailrace to address cavitation.

ii) **Component B: Electro-Mechanical Works.** This component consists of mechanical and electrical works divided into two sub-components.

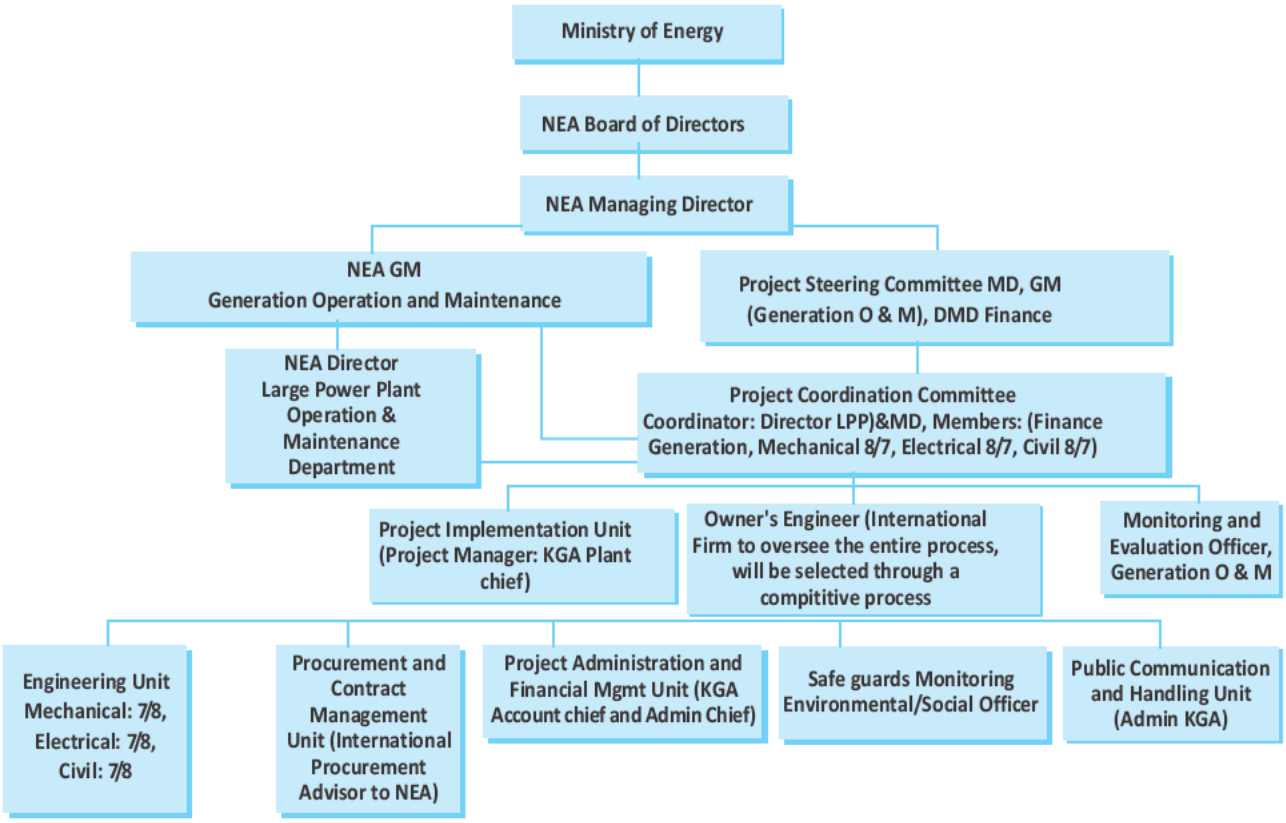
- **Sub-Component B1: Mechanical Works**. Under this sub-component the mechanical parts in the powerhouse and the intake will be repaired and upgraded.

- **Sub-Component B2: Electrical Works.** This consists of repair and upgrade of the control system of the power house and the dam.

iii) **Component C: Technical Assistance and Capacity-Building.** This component consists of the following four sub-components.

- **Sub-Component C1: Consulting Firm** (Consulting Services for Dam Safety, Civil & Electro Mechanical works**).** Under this sub-component, technical advisory services will be provided to NEA through a consulting firm, for overseeing all the three components of the Project. The consultant will also provide the detailed technical design, held NEA with implementation and procurement, and help prepare the Operation and Maintenance Manual, Emergency Preparedness Plan and the Instrumentation Plan (IP).
- **Sub-component C2 Asset Management.** Under this sub-component technical assistance will be provided to NEA to improve and upgrade their asset management systems.
- **Sub-Component C3: Safeguard Implementation.** This sub-component will provide technical assistance to NEA in implementing the Environmental Management Plan (EMP), Community Support Program and the Vulnerable Community Development Plan, including monitoring and evaluation.
- **Sub-Component C4: Capacity-Building.** This sub-component will provide training to increase NEA's capacity in asset management, sediment management, safeguard implementation, and operations and maintenance of specialized fields of electro-mechanical equipment and safety instruments.

## Organizational Structure of Kaligandaki 'A' Rehabilitation Project



## Marsyangdi Power Station Excitation System Rehabilitation and Weir Control Modernization and Modification

The Marsyangdi Power Station Weir Control Modernization and Modification (Contract No: MPS-067/68-01 (R)) project is a part of Energy Access and Efficiency Improvement Project and jointly funded by Asian Development Bank (Loan No. 2587-NEP (SF), GON and NEA. It is implemented as International Competitive Bidding turnkey-design construct contract. The total contract value of the project is NRs 30 million and the Contractor is Rittmeyer Ltd., Switzerland. The scope of work under this project includes the design, manufacture, erect, commissioning and training services of automatic control of spillway, flushing and sluice gates at weir and their remote monitoring and control. The equipments have been already delivered to the site and the installation will commence shortly. The project is scheduled to be completed this year.

The Rehabilitation of Excitation System also is a part of Energy Access and Efficiency Improvement Project and jointly funded by Asian Development Bank (Loan No. 2587-NEP (SF), GON and NEA. The work is planned to be implemented as direct contracting turnkey-design construct contract. The original equipment manufacturer of excitation system is Voith Hydro GmbH & Co. KG. NEA is in price negotiation with Voith Hydro GmbH & Co. KG to finalize the contract price (1.8 MUSD).

### Kulekhani-I Digital Governor and Digital AVR

The design, supply and install of combination panel of digital governor and digital AVR are underway in Unit no. 1. This is the continuation of previous design, supply and install project which has seen the completion in Unit No. 2. The scope of works consists of replacement of electrical control along with renovation of distribution and control valves of Governor and modernization of AVR. The project is estimated to cost NRs. 74.5 million and is jointly funded by GON and NEA. The project is administrated as direct contracting turnkey-design install. The original manufacturer of equipments under consideration is Fuji Electric Ltd., Japan. The preliminary works of contract administration have been completed and bilateral technical meeting was held at Fuji Electric Ltd., Japan in September, 2012 attended by both the parties. The supply and delivery of equipments are scheduled this year whereas the installation works are scheduled for middle of next year.

### Multi-fuel Power Plant Rehabilitation Project

The overhauling of engines of all the six units of Multi-fuel power plant was started in fiscal year 2066/67 (2009/10). NEA signed the contract agreement with the Contractor Wartsila on 10 April, 2010. The project was jointly funded by World Bank under Power Development Project (PDP), GON and NEA. The estimated project cost was 7.7 Million Euro. The overhauling of Wartsila DG sets has been successfully completed this year. The main works of this project was the overhauling of 6 x 6.5 MW Wartsila DG sets. The details of which were low $NO_X$ modification, $CO_2$ cleaning of alternators, engine block and cylinder liner machining, turbo charger repair and balancing of all the 5 engines except DG5, installation of new booster unit for DG3 and DG4, installation of new silencer for DG1, DG2, DG3 and DG4, cleaning of all auxiliaries components; Charge air cooler, PHE, cooling tower and repair of hydrophore pump system. Additionally, rusting in crankshafts of DG1 and DG6 has been discovered and hence additional machining works were sought at site.

### Modikhola Hydropower Station Rehabilitation Project

The Modi Khola Hydropower Station rehabilitation largely consists of comprehensive civil, hydro-mechanical and electro-mechanical rehabilitation. The electromechanical rehabilitation basically constitutes the procurement of spare parts, upgradation of SCADA software and the modification of cooling water system.

The rehabilitation works in Modi Khola Hydropower Station consists of demolition of upstream boulders, repair of diversion weir, replacement of trash rack panels, construction of new concrete gravity wall, construction of new emergency spillway incorporating the gravel trap, installation of fixed jet system with pressure tank, pumping house, piping and valve arrangement in the de-silting basin, incorporation of a bye-pass steel pipe system on the right bank of the regulating pondage, repair and modification of hydro-mechanical parts in headworks area, procurement of spare parts, upgrading/updating of SCADA software and modification of cooling system of the diversion weir. The tentative cost of the above works(civil, hydro-mechanical and electromechanical) has been estimated to be NRs. 336,856,753.05 inclusive of Contingencies (incentive, training, supervision overhead, stationeries, site office set up etc all complete). The total estimate budget of civil and hydro-mechanical works is 180 Million without VAT and Contingencies. The initial study and project preparation works have been completed and the bids are invited for civil and hydro-mechanical works. Presently, the bids are under evaluation are expected to be complete by the end of January, 2013. The rehabilitation works are expected to be completed by 2013/14.

The requirement of spare parts under consideration is for electrical and mechanical items as well for general and special tools. Some spare parts are replaced immediately and some are kept in an inventory and used for the repair or replacement of failed parts in future. Spare parts are important for sustainable operation of the power plant. The spare parts could be procured from the original equipment manufacturer (OEM) and/or International Competitive Bidding (ICB). In addition to the recommended spare parts, the following upgrading or modifications are required:

The existing SCADA system requires the upgradation/updating of SCADA software deployed at the central control room. The SCADA software is required to be compatible with existing S7-300 controller, digital governor and AVR and field bus as per the site configuration. The cost estimate for this work is NRs. 5 million including taxes as a preliminary budgetary provision.

Modi Khola has high content of abrasive sediments. Due to inadequate existing sediment handling devices and unsatisfactory performance of facilities, abrasive sediments pass through and cause significant erosion in the cooling water and allied facilities. The modification in existing cooling water filtration is proposed, which consists of additional rough strainer with automatic back-flush in series with the existing strainer.

## Sundarijal Rehabilitation Project

The rehabilitation of this power station is underway under the joint assistance from ADB, GON and NEA. Nepal Electricity Authority has received loan (Loan Number 2808-NEP, Grants 0270-NEP and 0271-NEP) from Asian Development Bank (ADB) towards the cost of Power Efficiency Improvement as part of Electricity Transmission Expansion and Supply Improvement Project. NEA intends to apply a portion of the proceeds of this loan for Rehabilitation of Sundarijal (640 kW) hydropower plant. The proposed rehabilitation works largely consists of electromechanical rehabilitation and the recruitment of international individual consultant in intermittent assignment for design and implementation support for Part C: Rehabilitation of Small Hydropower Plants. The TOR, short listing and ranking of the consultants have been finalized and the recruitment will take place as soon as no objection from ADB is received. The project is scheduled to be completed by July, 2015. The project is estimated to cost 4.86 MUSD including taxes and duties, physical and price contingencies and interest charged during implementation out of which ADF loan is 2.3 MUSD and GON/NEA counterpart funding is 2.56 MUSD.

# LARGE POWER PLANT OPERATION & MAINTENANCE DEPARTMENT

The Department overlooks the operation and maintenance of five (5) hydropower stations and one (1) thermal power plant above 30 MW owned by NEA, with a total of 414.90 MW of installed capacity. The generation from the power plants have been very satisfactory over two years excluding the Multi-fuel power plant which is dictated by the high fuel costs. Overhauling of generating unit is a regular practice normally carried out in the lean season avoiding energy loss. This ensures that design capacity is available during wet season.

Annual overhauling and repair works were carried out in Kaligandaki A, Middle Marsyangdi and Marsyangdi power plants. Kulekhani-I and Kulekhani-II being reservoir type power plants do not experience erosion problems and hence, only regular preventive maintenance exercises are undertaken. Kaligandaki A power plant is shutdown for few hours periodically during early monsoon due to overload of floating debris at its intake, which also reduces the desander efficiency. Model studies have been made which have suggested modification in the intake that can significantly improve the performance. Works for such modification as well as repair and rehabilitation and spares purchase are included in Kaligandaki 'A' Rehabilitation Project. The cost estimate of the project is US Dollar 27 million and funded World Bank loan (IDA Credit). Underwater works to repair the stoplog gate seal beams and concrete were carried out in Gate No. 3. Valuable experience has been gained and such works may be necessary to apply in future installations.

Urgent left bank repair of Middle Marsyangdi dam side was carried out within 2 weeks of plant shutdown. It has revealed need for further structural improvements. Bathymetric survey and model study will be carried out this year to determine the works. Stoplog gates were placed in undersluice of Marsyangdi weir requiring drawdown of water and plant shutdown for nearly 4 days. Further efforts shall be made this year to bring the Undersluice gate to operation and carry out flushing. Technical support from Fichtner GmbH for operation and maintenance of Middle Marsyangdi is being availed under KfW loan program for improving the maintenance practices, imparting training and providing technical advice where found necessary.

The replacement of control system of governor and AVR in excitation system have been completed in Unit No. 2 and underway in Unit No. 1 in KL-I. The breakdown of 66 kV XLPE cable in Y-phase in KL-I was temporarily brought into service in an emergency measure in November 2012 and later following a second failure in January 2013, the joints were repaired with cable jointing experts using 66 kV straight-through cable jointing kit. The breakdown was possibly due to progressive breakdown during wet aging in insulating materials. In Kulekhani-II, one 132 KV power transformer was damaged due to lightning and resulting fire. The transformer is sent to NEA workshop in Hetauda for possible repair while necessary cable and busbar repair was carried out to bring the unit in service within 4 days. The 26/37.8 MVA, 6.6/132 kV three phase step-up power transformer has been planned to procure as a replacement for the existing single phase transformers.

Present power system faces transmission bottleneck in the Bharatpur-Hetauda line which limits the power production of Kaligandaki A during off-peak hours. Possible solutions were explored to improve voltage profile around this network area so as to reduce congestion during off-peak and produce maximum by Kaligandaki

A. Major power plants as Kulekhani-I and Kulekhani-II, Marsyangdi and Middle Marsyangdi now contribute to their capacity in boosting the reactive power generation and improving voltage profile in Hetauda and Bharatpur area. Test operation in Synchronous capacitor mode of Kulekhani-I pushing approximately 38 MVar to the system was done recently to demonstrate the reactive support possible from this plant during periods when it is not generating. Together with Kulekhani-II, it is in nodal position to support the system voltage and frequency. In an initiative to overcome transmission bottleneck in 132 kV Marsyangdi-Bharatpur and Marsyangdi-Suichatar transmission lines, NEA has engaged Alstom Grid, Germany to replace 400/1 Amp existing GIS CT's by 600/1 Amp.

The rehabilitation project of Multi-fuel Power Plant funded under Nepal Power Development Project in loan assistance from World Bank has been successfully completed this year. Wartsila has started handover of DG sets from 23 July, 2012 and completed on 31 December, 2012. The units are expected to operate at rated capacities albeit emergence of teething problems. The exorbitant fuel price and supply chain remain the biggest challenges for its operation.

Further to the repair works and operation of power plants, capacity building efforts were initiated in-house from May 2012 in all five hydro-power stations. The dire need to transfer knowledge to the lower level technicians is recognized and the best means for doing that is in-house. Short training courses of one week duration were carried out by the engineers and supervisors of the plant to their own junior colleagues, bolstered with some external resource persons as well. Following very encouraging results, this initiative will now be pursued vigorously in the coming year.

View of Headworks of Kaligandakin 'A' Hydropower Station

# KALIGANDAKI 'A' HYDROPOWER STATION

## Introduction:

Kaligandaki 'A' Hydropower Station, located at Beltari, Syangja is the largest power station in Nepal with installed capacity of 144 MW and 3 units each having capacity of 48 MW. It is a six hours peaking run-of-river type power station having annual design generation of 842 GWh which was commissioned in 2002. Aided by favorable river discharge and increasing load in the western region, it exceeded the target and design generation in FY 2011/12. This also indicated that with rigorous operation practice in intake area, timely repair activities and proper operational support, generation can be increased even further.

The cumulative generation of the station till F/Y 2011/12 has reached 6,960.431 GWh from the first run. The plant recorded the highest generation of 860.754 GWh so far in F/Y 2011/12 which is an increase of 11.0% compared to that of previous year and has a share of 20.57% of the total energy in INPS in FY 2011/2012.

## Present status:

Unit no. 1 was overhauled in FY 2011/12. Other major works included underwater repair works at radial gates in dam side, steel liner replacement of gates, epoxy application in ogee surface, 132kV GIS repair and maintenance works and timely replacement of balancing pipes of Unit 2 which helped to postpone the Plant shutdown and MIV seal repair.

Installation of New PT at Unit # 1 Transformer Bay.

Rehabilitation Project scope under World Bank finance underwent comprehensive review and modification while the PDP project itself was concluded in December 2012. The scope of work and cost estimate under rehabilitation project is now finalized. Bid Documents for the works are prepared and now waiting bridging of the loan program so that the works can be concluded by December 2014.

### Major Repair and Maintenance works carried out in FY 2010/11

- Replacement of the AVR operating terminal interface cable in the Unit No. 1.
- Installation, testing, commissioning and charging of new 5 MVA, 132/11kV transformers.
- Replacement of power supply module in optical star controller
- Repaired & replacement of DC/DC convertor and loading the program on the 145 kV Controller
- Repair and maintenance of internal communication system
- Loading the main program of weir control controller
- Loading the software in the new MMI for Unit No. 2
- Repair and maintenance of VCB synchronizing breaker in Unit No. 3
- Replacement of new 11 kV VCB in Mirmi feeder

### Major Repair and Maintenance Works Done In FY 2011/12

- During overhauling of unit No. 1
  - Removal of all the RTD and Vibration probe of turbine pit

- Measurement of air gap between stator and rotor
- Meggering of generator and rotor
- Repair and maintenance of synchronizing breaker
- Inspection and cleaning of speed signal generator (SSG)
- 5.64mm Jacking-up of rotor
- Functional test of the alarm and trip setting parameters in temperature monitoring device
- Checking of setting parameters in the excitation AVR, MCR and generator differential relay
- Cleaning, meggering and ratio test of excitation transformer & neutral grounding transformer
- Re-connection of RTD and oil level measuring units of turbine pit
- Di-electric test of 56.5 MVA power transformer oil
- Replacement of runner, wicket gates, lower & upper stem bushes, balancing pipes etc
- Repairing of lower & upper facing plates, lower & upper wearing-rings
- Dry and wet test

- Solving the problem related to cooling by partitioning of cooling desander tank. This has reduced the plant outage required to clean the deposited sand.

UHF PD Measurement of Line and Unit Bay

- Construction of new balancing line in unit No. 1.
- Replacement of HV bushing for phase 1V of Unit No. 1 56.5MVA Power Transformer
- Replacement of new VCB (synchronizing breaker) in Unit No. 2, Bridge controller (GENI) in unit No. 1 & 2, DC/DC converter in KKL control panel, power supply & optical star module like IR 130 & IR 13 in the Optical star control panel, cooler RTD in Unit No. 1 & 2, Dial type LV winding temperature sensor in 56.5 MVA power transformers of unit No. 3, MCR operating terminal interface cable in the Unit No. 3.

Removal, Evacuation and Refilling of SF6 Gas in Butwal #1 Line Bay PT.

- Solving of problem in the excitation system of Unit No. 1 by replacing of CPU and loading the program of AVR controller.
- Major works done in the 145 kV GIS.
  - Fitting of CT and PT pressure gauge indication pipes of Rural transformer Bay
  - Replacement of new annunciator & power supply card of Rural transformer Bay
  - Replacement of GCB breaker operating hydraulic pump of Unit No. 1 in Butwal.

## Underwater Repair Works

The underwater repair works applying underwater construction technology carried out in the headworks is the first of its kind in Nepal. The technology finds its application without the

shutdown. The stop-log bottom part-civil and mechanical components I-beam, SS plate and concrete surface were being washed out for the last few years. Again, the radial gate-3 bottom parts were also eroded deeply causing its concrete washed out, reinforcements to bend, eject from original surface lacking bonding with adjacent surface.

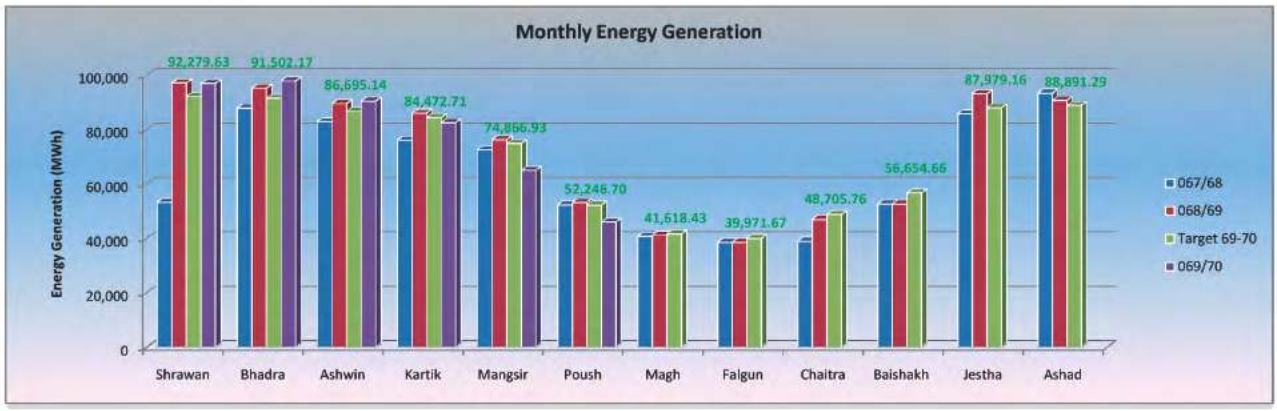
Water leakage from the orifice between the damaged portions was discovered during underwater repair works. This had caused generation loss especially during winter season with subsequent financial loss. The repair works were successfully carried out by underwater construction technology without plant shutdown.

Preparation for Underwater Repair Works

## Works Planned for FY 2012/13

1. Upgrading of SCADA & controller.
2. Repair and maintenance of P/H and Dam site inverters, dam site gate control controller.
3. Replacement of 550AH, 110VDC lead acid battery at dam site.
4. Installation of air admission system in Unit No. 1.
5. Metaceram coating in 1nos of spare repaired runner
6. Runner replacement in Unit No. 1.
7. Changing of Main, Maintenance seal and necessary repairing of Unit No. 1, 2 and 3
8. Overhauling of Unit No. 2 & 3.
9. Protection of left-bank of reservoir at dam site.

| SALIENT FEATURES OF KALIGANDAKI HYDROPOWER STATION | |
|---|---|
| Type | Peaking Run-of-river |
| Location | Shree Krishna Gandaki VDC, Syangja |
| Installed capacity | 144 MW |
| Average annual generation | 842 GWh |
| Maximum gross heat/net head | 130 m / 115 m |
| Catchment area | 7,618 $km^2$ (Kaligandaki river) and 476 $km^2$ (Andhikhola river) |
| Live storage volume | 3.1 million $m^3$ |
| Total length of waterways | 183 m power conduit, 5,905 m headrace tunnel |
| Penstock | 1 Nos., 243 m long, Ø 5.25 m, inclined steel lined |
| **Turbine:** | |
| Number & Type | 3 Francis |
| Output | 48 MW |
| Rated flow | 44.86 $m^3/s$ |
| Rated speed | 300 rpm |
| **Generator:** | |
| Rated output | 56.5 MVA |
| Rated voltage | 13.8 kV |
| Rated frequency | 50 Hz |
| Rated power factor | 0.85 |
| Excitation | Static |
| Power transformer | 56.5 MVA, 13.8/132 kV, 3 phase, 3 nos. |
| Transmission line | 132 kV, 104.6 km (Single circuit of 65.5 km to Pokhara |
| sub-station and | double circuit of 39.1 km to Butwal sub-station) |




| Kaligandaki A Hydropower Station | | | | | | | | | | | | | (MWh) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Asoj | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashar | Total |
| 058/59 | - | - | - | - | - | - | - | - | 13,137.00 | 39,413.00 | 35,629.00 | 29,835.00 | 118,014.00 |
| 059/60 | 27,416.00 | 30,223.00 | 31,011.00 | 30,875.00 | 56,208.00 | 53,015.00 | 42,455.00 | 41,836.00 | 47,077.00 | 55,907.00 | 51,817.00 | 44,749.00 | 512,589.00 |
| 060/61 | 52,681.00 | 50,793.00 | 38,641.00 | 47,427.00 | 52,353.00 | 49,833.00 | 41,811.00 | 38,545.00 | 45,445.00 | 48,534.00 | 43,094.00 | 18,488.00 | 527,645.00 |
| 061/62 | 37,812.00 | 43,189.00 | 37,565.00 | 35,781.00 | 50,501.00 | 51,423.00 | 44,156.00 | 38,680.00 | 40,784.00 | 50,484.00 | 63,889.00 | 57,388.00 | 551,652.00 |
| 062/63 | 54,885.00 | 52,762.00 | 51,050.00 | 46,313.00 | 62,455.00 | 51,237.00 | 42,590.00 | 38,487.00 | 42,325.00 | 50,026.00 | 63,337.00 | 65,881.00 | 621,348.00 |
| 063/64 | 72,058.00 | 63,670.00 | 49,506.00 | 56,461.00 | 61,716.00 | 50,050.00 | 38,141.00 | 45,451.00 | 60,445.00 | 64,899.00 | 67,596.00 | 77,753.00 | 707,746.00 |
| 064/65 | 76,311.00 | 78,497.00 | 69,083.00 | 66,687.00 | 71,406.00 | 53,445.00 | 40,849.00 | 39,388.00 | 39,539.00 | 59,890.00 | 78,783.00 | 85,124.00 | 759,002.00 |
| 065/66 | 89,321.00 | 86,044.00 | 82,606.00 | 83,169.00 | 70,734.00 | 46,916.00 | 40,746.00 | 34,545.00 | 37,985.00 | 49,995.00 | 59,477.00 | 71,830.00 | 753,368.00 |
| 066/67 | 80,051.00 | 79,966.00 | 80,250.00 | 73,734.00 | 74,531.00 | 51,286.00 | 39,437.00 | 36,700.00 | 44,896.00 | 52,461.00 | 75,593.00 | 71,336.00 | 760,241.00 |
| 067/68 | 53,269.00 | 87,880.00 | 82,943.00 | 76,109.00 | 72,479.00 | 52,327.00 | 40,719.00 | 38,588.00 | 38,994.00 | 52,656.00 | 85,843.00 | 93,365.00 | 775,172.00 |
| 068/69 | 97,146.00 | 95,179.00 | 89,537.00 | 86,031.00 | 76,345.00 | 53,209.00 | 41,116.00 | 38,628.00 | 46,979.00 | 52,635.00 | 93,203.00 | 90,746.00 | 860,754.00 |
| 069/70 | 96,909.00 | 97,864.00 | 90,407.00 | 82,537.00 | 64,932.00 | 46,001.00 | - | - | - | - | - | - | 478,650.00 |
| | | | | | | | | | | | Till Date Generation, MWh | | 7,426,181.00 |

Flushing of Reservoir during Monsoon

# MIDDLE MARSYANGDI HYDROPOWER STATION

## INTRODUCTION

Middle Marsyangdi Hydropower Station located at Bhoteodar, Siundibar, Lamjung with installed capacity of 70 MW is a peaking run-of-river type scheme with daily pondage for five hours and annual design generation of 398 GWh. It was commissioned in December 14, 2008 and uses latest technology amongst all power stations of NEA. Powerhouse and headworks of MMHPS are located at a distance of 27 km and 34 km respectively from Dumre. Dam site is located between Udipur and Chiti and the sub-surface powerhouse is situated on the right bank of the Marsyangdi River at Siundibar, Bhoteodar VDC.

The cumulative generation of the station has reached 1574.84 GWh till 2011/12 with maximum generation of 425.34 GWh in the same year exceeding the designed generation of 397.59 GWh and target generation of 399.31 GWh. It has contributed 10.16 % of the total energy share in INPS in FY 2011/12.

### Plant Operation

| UNIT No. | F.Y. 2011/12 | | From its first run till January 2013 | |
|---|---|---|---|---|
| | Running Hour | Energy Generated GWh | Running Hour | Energy Generated GWh |
| 1 | 7291.7 | 221.80 | 28467.7 | 807.94 |
| 2 | 6658.7 | 203.54 | 26410.0 | 766.90 |
| Total | 13950.40 | 425.34 | 54877.70 | 1574.84 |

## MAJOR PROBLEMS ENCOUNTERED DURING FY 2010/11 & fy 2011/12

### PLC Fault in Unit 2

In July 2011, a fault occurred in Desander Controller's CPU and 'Water Ready' signal from dam was lost in the DCS system, causing Unit 2 startup pre-condition block. Expert from Alstom was consulted immediately and the problem was solved in seven (7) days during which Unit 2 was down.

In July 2012, a fault, possibly due to voltage fluctuation in flow sensor, was identified in one input and two output cards of cell controller of Unit 2. The faulty input card was replaced; however, the output cards could not be replaced. This caused abnormal startup of the unit with huge surge of output in the range of 25-30 MW. This lowered surge tank level to minimum thereby tripping both units triggering grid collapse. This problem was later rectified by replacing output cards.

### PLC Fault in Unit 1

A fault has been identified in primary cell controller due to corrupt software in CPU of the controller and has not been resolved yet. Presently, operation of unit 1 is controlled by standby secondary cell controller. There is risk of complete shutdown of the unit if secondary cell controller goes faulty too. Proposed remote support service contract from Alstom is expected to rectify this problem.


Fault Indication in PLC of Unit No. 1

Due to GPS System failure, system time is not synchronized in all associated panels and computers and event/fault recorder time differs in various panels and computers.

## Cooling System Fault

Frequent fault in the closed circuit cooling system due to dysfunctional frequency converter was rectified by replacing the same with completely protected DOL system. The redundant frequency converter, primarily for speed control of the squirrel cage induction motor, was not found satisfactory and standby one was already down, thereby depriving from automatic changeover. This required manual changeover and rapid operator intervention to reset faults. If resetting of faults were delayed, it could lead to unit trip.

## REPAIR AND MAINTENANCE OF CIVIL WORKS

### Left Bank Rip Rap

Maintenance of left bank rip rap by constructing gabion wall was carried out on December 2010 during two (2) weeks plant shutdown. This has prevented sliding down of left bank riprap during rainy season and drawdown of reservoir.

Maintenance Works at Left Bank Rip Rap

On January-February 2012, maintenance of left bank rip rap was carried out by constructing gabion wall during twelve (12) days plant shutdown. During this period, accumulated sand at upstream of dam was taken out and collected at dam site area.

### Reservoir Flushing

Task of reservoir flushing is important and so is its timing. The station used an opportunity of plant shutdowns for two (2) weeks in December 2010, twelve (12) days in January-February 2012 and 6-8 hours in October, 2012 to carry out reservoir flushing.

Plant was forced to shut down for approximately 6 and 8 hours due to unexpected high flood, muddy water in the Marsyangdi River on June and July 2012 respectively.

Removal of Reservoir Accumulated Sand

## REPAIR AND MAINTENANCE OF MECHANICAL WORKS

Inspection and minor maintenance of Unit No. 2 Runner applying Belzona on head-cover facing plate and bottom ring facing plate was performed in December 2010.

### Turbine Runner

Emergency repair works were carried out in Unit 1 & 2 with soft coating application in the runners.

Refurbishment work of Unit No. 1 turbine carried out in January-February 2012 was completed in forty (40) days. The works included replacement of runner, head cover and bottom ring facing plate, guide vanes, bushes. Emergency repair was done in Unit no. 2 with replacement of lower bushes.

Inspection of Eroded Trailing Edge of Runner

Maintenance Works during Overhauling Period

Regular maintenance and replacement of Upper and Lower Cartridge were done during rainy season. Maintenance of sump pump in the sump gallery was also performed.

## CWS Pump Installation

Due to leakage of water in closed circuit cooling water system, motor pumps and hose pipe assembly were fitted to compensate for loss in pressure pumping water into the balancing tank. Previously, it took plenty of time to compensate for pressure leakage by manual hand pump, which occasionally caused startup delays to make case worse.

Abrasive content in filthy water inflicted erosion in heat exchange plates thereby making way into closed circuit and in turn into coolers of different equipments. Eroded heat exchanger plates were immediately replaced to avoid further damage.

Highly Eroded Bottom Facing Plate due to Silt

Repair and maintenance of spillway radial gates' SS sill beam and bottom rubber seal were carried out before start of monsoon in both fiscal years to ensure proper functioning during rainy season. These gates were painted by epoxy up to 2 m from bottom to avoid weather action.

Repair of service gate was successfully carried out by VA-Tech including modification in design and replacement of sand sensors of all the three desander within twelve (12) days plant shutdown on January-February 2012 as part of contractual obligations.

New Runner after Installed in Unit No. 1

# REPAIR AND MAINTENANCE OF ELECTRICAL WORKS

## Generator & Excitation

Meggering of Unit No. 1 generator stator winding, visual inspection of rotor & rotor poles, 11 kV VCBs and other preventive maintenance activities in different electrical components were performed. Eroded carbon brush (originally of 65 mm reached 25 mm due to erosion) in slip ring compartments were replaced for both units.

## Shaft Seal Cooling Water Fault

Tripping of units occurred due to failure of shaft seal caused as a result of choking of shaft seal filter by filthy water especially during rainy season. Special care and attention is required during rainy season to avoid intrusion of abrasive water content due to erosion in shaft seal SS pipe and filters in which water is fed directly from penstock.

## Dam Site

Cleaning of trash rack and desander, greasing of roller gates, cranes, replacement of side seal of stop log, repairing of desander No. 2, sluice gate SS sill beam were carried out during December 2012.

Divers (Gotakhor) for Checking Underwater Obstacles at Spillway Gate No. 1.

The faulty oil discharge sensor fitted in cooler pipes for Unit No. 2 generator lower guide bearing and cooling fan motors deployed in redundant bridge rectifier of excitation system were replaced.

## Transformers

Oil filtration and topping up of oil in all six numbers of single phase, 14.5 MVA, 11/132 kV power transformers along with functional test on auxiliary system were carried out. Damage of oil level gauge was identified and was promptly repaired.

Oil Filtration of 14.5 MVA Power Transformers

The 33 kV bushing in 5 MVA, 33/132 kV transformer was damaged in October, 2011, possibly due to moisture that resulted unscheduled load shed in local distribution. However, the maintenance personnel improvised transformer bushing promptly and power was restored. Similarly, breakdown of 33 kV cable head of 400 kVA transformer in dam site, possibly due to short circuit, was rectified.

Meggering of Generator Stator in Unit No. 1

## Switchgear

Inspection and functional test of different electrical equipments of 132 kV switchyard were performed. Damaged input card of level indication at dam site, possibly due to lightning, was replaced. The servicing and maintenance of all 400 V circuit breaker used for station supply were also performed.

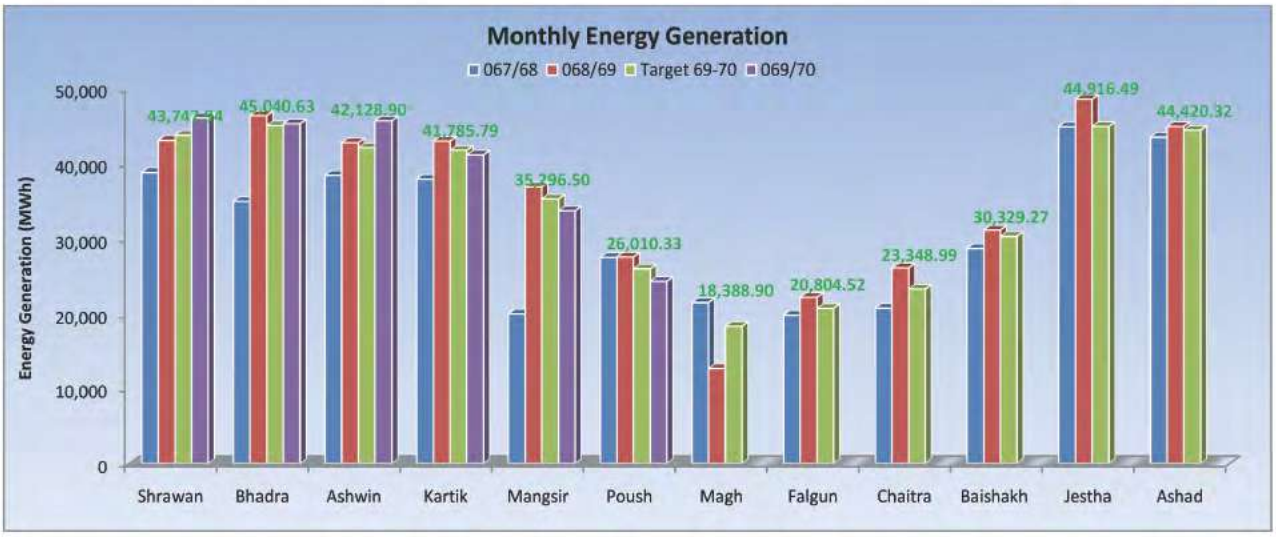
## Inverter & Power Supply

The HMI Power Supply Converter cards of dam site control panel and Unit No. 1 control panel in powerhouse were repaired in the workshop and re-installed.

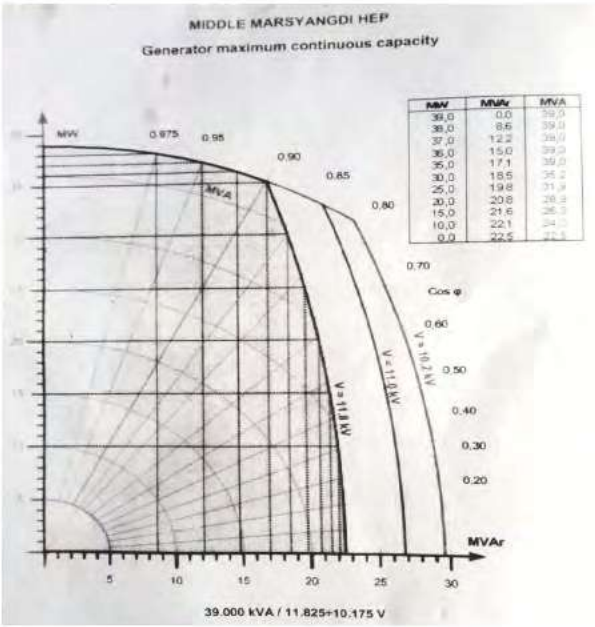
One single phase inverter out of six inverters was damaged and maintenance is underway. The supply is resumed from another standby inverter.

Maintenance Works in 132 kV Switchyard

| SALIENT FEATURES OF MIDDLE MARSYANGDI HYDROPOWER STATION | |
|---|---|
| Type | Run-of-river with daily poundage for 5 hours peaking |
| Location | Phalia Sanghu (Headworks) / Siudibar (Powerhouse) |
| Installed capacity | 70 MW |
| Annual average energy | 398 GWh |
| Maximum gross head / Net head | 110 m / 98 m |
| Catchment area | 2,729 $km^2$ |
| Average annual flow | 99.5 $m^3/s$ |
| Live storage volume | 1.65 million $m^3$ |
| Dam | Combined concrete gravity and rock fill dam, crest length 95 m |
| Total length of the waterways | 5,940 m |
| Penstock | 1 no., concrete cased steel pipe, 212-218 m length, Ø 4.60 m |
| **Turbine** | |
| Number and Type | 2 Francis, vertical shaft |
| Rated discharge | 40 $m^3/s$ |
| Rated output | 35.9 MW |
| Rated speed | 333.33 rpm |
| **Generator** | |
| Rated output | 39 MVA |
| Rated voltage | 11 ± 7.5% kV |
| Rated frequency | 50 Hz |
| Power factor | 0.85 - 0.90 |
| Power transformer | 6 + 1 spare, single phase, 14.5 MVA each, 11/132 ± 2*2.5% kV, ONAN |
| Transmission line | 132 kV, 38.2 km, conductor CARDINAL |




| Middle Marsyangdi Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 065/66 | - | - | - | - | - | - | 13,567.40 | 25,998.80 | 22,049.70 | 30,667.10 | 36,794.70 | 39,922.30 | 169,000.00 |
| 066/67 | 37,991.85 | 40,565.50 | 34,276.82 | 37,728.29 | 36,810.44 | 27,101.30 | 21,344.30 | 19,092.30 | 23,992.00 | 32,187.90 | 40,017.70 | 38,929.70 | 390,038.10 |
| 067/68 | 38,821.40 | 34,967.10 | 38,460.50 | 37,942.20 | 20,057.90 | 27,531.70 | 21,542.80 | 19,874.80 | 20,831.30 | 28,733.20 | 44,877.40 | 43,511.00 | 377,151.30 |
| 068/69 | 43,085.60 | 46,377.90 | 42,804.70 | 43,003.00 | 36,903.30 | 27,596.30 | 12,596.80 | 22,233.67 | 26,137.00 | 31,159.25 | 48,525.43 | 44,921.25 | 425,344.20 |
| 069/70 | 46,076.26 | 45,292.52 | 45,674.04 | 41,152.02 | 33,758.00 | 24,383.88 | - | - | - | - | - | - | 236,336.72 |
| | | | | | | | | | | | Till Date Generation, MWh | | 1,597,870.32 |




Generator Capability Curve

Bird's View of Headworks

# MARSYANGDI HYDROPOWER STATION

## INTRODUCTION

Marsyangdi Hydropower Station is a peaking run-of-river power station with installed capacity of 69 MW, three units of 23 MW each and its annual design generation is 462.5 GWh. It is located at Aanbu Khaireni, Tanahun in the central region about 114 km west of Kathmandu on the Prithivi Highway and lies on the right bank of Marsyangdi River. It was commissioned in 1989 AD and developed with the assistance from IDA, KFW, KFED, SFD, ADB and GON at a cost of USD 22 million.

Generation in FY 2011/12 was highest for more than a decade although handicapped with increased tailrace bed. The cumulative generation of Marsyangdi HPS has reached 9,416.31 GWh. It generated 423.16 GWh of energy in FY 2010/11 and 445.9 GWh of energy in FY 2011/12 registering an increase of 5.37% over the previous year's generation. It contributed 10.65 % of the total energy to the INPS in FY 2011/12.

## Repair and Maintenance Activities during FY 2010/11 & FY 2011/12

### Civil Maintenance:-

- Repair of Stilling Basin during FY 2010/11 and 2011/12
- Application of epoxy on OGEE surface of Gate No. 1, 3 & 5 in FY 2010/11 and Gate No. 4 on FY 2011/12.
- Remaining fencing work along the Dam.

### Mechanical Maintenance:-

- Repair of Sill Beam of Radial Gate No. 2.
- Overhauling of Turbine parts of Unit No. 2 in FY 2010/11.
- Overhauling of Turbine parts of Unit No. 1 in FY 2011/12. Runner efficiencies after many years of overhauling and repair need to be tested to determine further ways of increasing the generation.

Maintenance Works in Bottom Ring

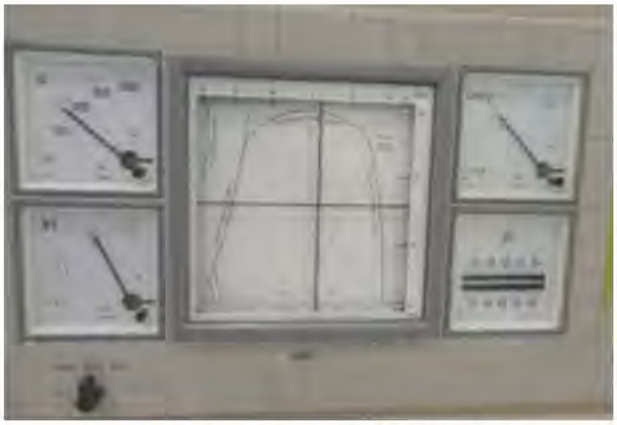
- Maintenance works during overhauling
  - Repair of seal ring and replacement of rubber seal of Butterfly Valve of unit 2 & 3 in FY 2011/12
  - Repair of broken arm of Sluice gate in FY 2010/11.
  - Repair of Shaft Seal of all three units during last two fiscal years.

### Electrical Maintenance:-

- Replacement of six numbers of 400/1 Amp existing CT's towards Suichatar and Bharatpur 132 kV transmission line by 600/1 Amp CT's in FY 2011/12.
- Inspection of CT during installation at GIS
- Installation of new dewatering pump in Drainage Gallery in FY 2011/12.

Inspection of GIS CT during Installation

- Maintenance of 132/11 kV power transformer of unit no. 2 in FY 2010/11.
- Maintenance of 132/11 kV power transformer of unit no. 1 in FY 2011/12.



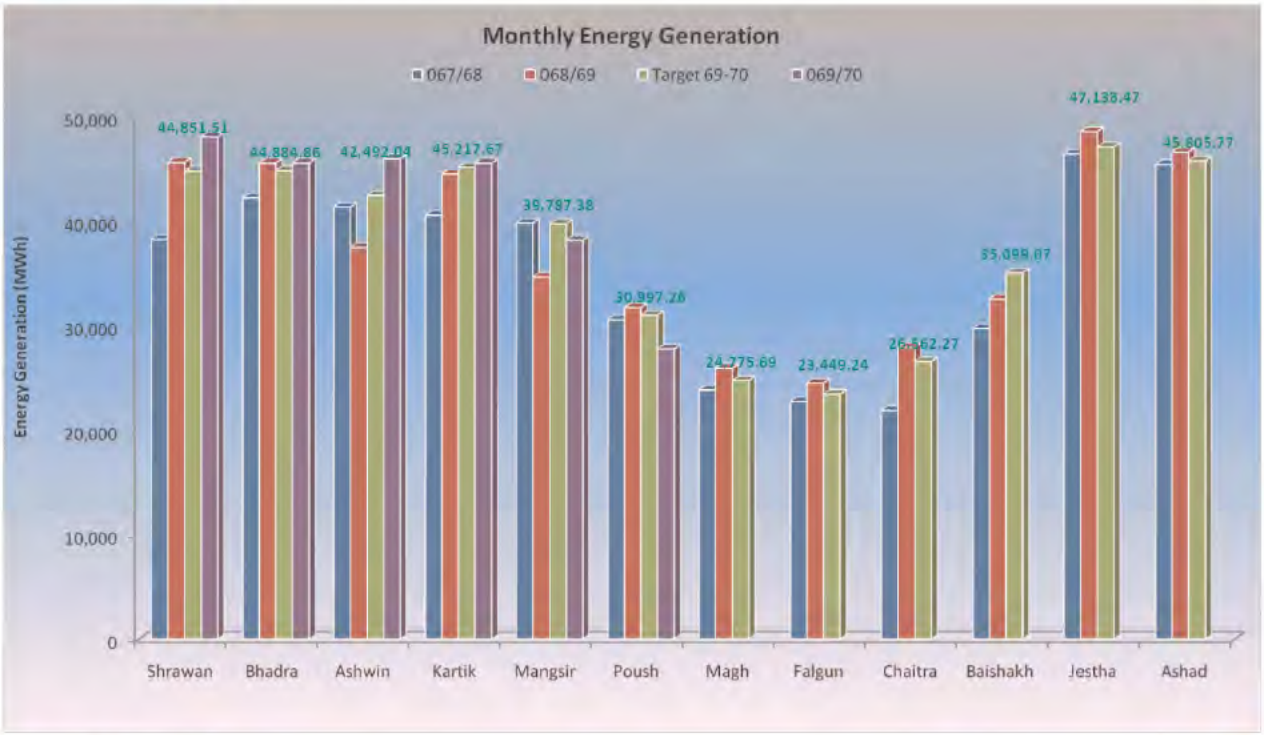
Power Diagram Indicator In Control Room

- Maintenance of unit no 2 and 1 generator in FY 2010/11 and FY 2011/12 respectively.

## ONGOING ACTIVITIES:

- Weir Control Modernization and Modification project is on progress. Its equipments are already delivered to the site and erection will commence shortly.
- Rehabilitation of Excitation System under EAEIP funded by ADB is underway
- Refurbishment of GIS is under consideration with Alstom Grid, Germany.
- Repair of spare runner is on progress at Machhapuchhre Metal Workshop, Pokhara.

| SALIENT FEATURES OF MARSYAGNDI HYDROPOWER STATION | |
|---|---|
| Type | Peaking-run-of-river |
| Location | Aanbu Khaireni VDC, Tanahun |
| Installed capacity | 69 MW |
| Average annual generation | 462.5 GWh |
| Catchment area | 3,850 Sq. Km |
| Average annual discharge | 210 $m^3/s$ |
| Live storage volume | 1.5 million $m^3$ |
| Rated net head | 90.5 m |
| Weir | 102 m long, Concrete |
| Head race tunnel | 7,199 m, Ø 6.4 m, concrete lined |
| Penstock | 75 m long, Ø 5 m, steel lined |
| **Turbine** | |
| Number and Type | 3, Vertical Francis |
| Rated discharge | 30.5$m^3/s$ |
| Rated output | 26 MW |
| Rated speed | 300 rpm |
| **Generator** | |
| Capacity | 30 MVA |
| Rated voltage | 11 kV |
| Rated Frequency | 50 Hz |
| Power factor | 0.85 |
| Excitation | Thyripol Self Excitation |
| Power transformer | 10 MVA, 11/132 kV, 9 (+1 Spare) Single phase |
| Transmission line | 132 kV, Total 108 Km (Balaju 83 Km + Bharatpur 25 Km) |




**Marsyangdi Hydropower Station** — MWh

| FY/Month | Shrawan | Bhadra | Asoj | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jesth | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 046/47 | - | - | 444.70 | 11,896.80 | 22,510.50 | 28,116.90 | 25,507.50 | 24,130.50 | 25,666.90 | 34,226.60 | 29,583.30 | 30,349.90 | 232,433.60 |
| 047/48 | 33,375.70 | 23,836.90 | 20,794.50 | 20,642.20 | 34,756.10 | 29,639.50 | 23,932.40 | 22,322.40 | 25,147.90 | 32,177.00 | 41,010.70 | 41,246.80 | 348,882.10 |
| 048/49 | 42,177.40 | 42,583.80 | 42,056.40 | 39,535.50 | 35,882.60 | 29,617.60 | 24,502.40 | 23,092.60 | 23,529.90 | 27,935.70 | 39,833.40 | 42,615.50 | 413,362.80 |
| 049/50 | 38,733.10 | 39,966.10 | 36,649.70 | 38,437.70 | 37,042.20 | 28,547.20 | 23,796.10 | 22,425.90 | 21,045.20 | 34,875.70 | 41,785.90 | 38,716.10 | 402,020.90 |
| 050/51 | 34,855.00 | 37,374.90 | 43,013.90 | 42,888.70 | 41,574.80 | 28,664.30 | 25,274.70 | 22,114.60 | 28,609.00 | 29,135.70 | 45,457.50 | 44,546.50 | 423,509.60 |
| 051/52 | 42,553.90 | 42,356.90 | 47,124.00 | 47,767.60 | 35,703.90 | 28,376.00 | 23,108.00 | 22,647.20 | 27,335.70 | 40,949.70 | 47,651.30 | 44,234.30 | 449,808.50 |
| 052/53 | 46,231.70 | 46,607.30 | 49,076.70 | 47,068.70 | 43,083.60 | 33,579.60 | 28,052.10 | 27,757.60 | 30,042.70 | 39,525.90 | 47,603.60 | 45,298.70 | 483,928.20 |
| 053/54 | 48,743.50 | 47,271.10 | 46,848.20 | 45,794.00 | 44,132.00 | 32,711.70 | 26,893.20 | 24,401.00 | 26,803.70 | 35,100.40 | 44,465.30 | 42,111.10 | 465,275.20 |
| 054/55 | 44,569.10 | 39,568.60 | 11,889.90 | 47,279.40 | 40,728.70 | 34,435.80 | 28,250.90 | 25,853.30 | 31,546.80 | 44,755.90 | 52,012.20 | 49,068.70 | 449,959.30 |
| 055/56 | 46,104.70 | 46,214.60 | 49,488.60 | 50,929.70 | 41,708.80 | 32,712.70 | 25,394.30 | 22,896.10 | 23,925.90 | 39,232.60 | 45,308.80 | 48,008.70 | 471,925.50 |
| 056/57 | 45,906.70 | 46,655.10 | 44,736.60 | 48,756.20 | 42,962.10 | 32,644.70 | 25,838.10 | 23,430.40 | 26,830.80 | 35,728.50 | 47,235.80 | 36,943.00 | 457,668.00 |
| 057/58 | 45,847.60 | 44,408.50 | 39,654.70 | 44,548.70 | 40,844.40 | 30,556.80 | 24,655.70 | 22,956.10 | 21,290.10 | 30,835.20 | 41,439.20 | 43,949.30 | 430,986.30 |
| 058/59 | 43,499.00 | 34,592.90 | 37,313.40 | 35,842.70 | 37,262.10 | 29,183.40 | 26,187.90 | 22,505.20 | 27,786.60 | 31,768.70 | 29,918.00 | 30,273.30 | 386,133.20 |
| 059/60 | 26,983.30 | 24,753.20 | 23,938.10 | 27,047.60 | 34,847.60 | 31,181.90 | 25,028.30 | 24,589.30 | 27,192.90 | 30,028.60 | 28,443.10 | 29,887.10 | 333,921.00 |
| 060/61 | 15,470.90 | 22,506.40 | 12,237.00 | 19,045.50 | 18,980.70 | 22,216.20 | 21,190.30 | 18,843.90 | 13,842.30 | 27,826.00 | 27,567.60 | 24,925.00 | 244,651.80 |
| 061/62 | 28,925.90 | 32,193.60 | 26,408.40 | 23,161.80 | 32,249.10 | 29,490.40 | 25,621.20 | 22,803.80 | 23,326.20 | 25,836.60 | 30,886.10 | 34,814.70 | 335,717.80 |
| 062/63 | 36,259.00 | 34,169.40 | 29,468.90 | 26,496.90 | 35,501.20 | 28,848.60 | 24,506.80 | 22,229.70 | 23,994.80 | 30,074.50 | 39,820.50 | 38,046.00 | 369,416.30 |
| 063/64 | 37,623.90 | 40,458.60 | 36,556.30 | 33,373.20 | 33,066.90 | 27,813.80 | 22,784.20 | 21,473.40 | 27,534.80 | 34,846.00 | 41,072.50 | 44,964.70 | 401,568.30 |
| 064/65 | 40,121.30 | 40,088.50 | 35,308.60 | 32,214.10 | 38,180.50 | 31,449.40 | 23,738.50 | 23,429.80 | 23,424.40 | 36,860.30 | 44,995.00 | 42,989.40 | 412,799.80 |
| 065/66 | 42,275.90 | 34,515.50 | 34,108.30 | 43,177.80 | 39,697.20 | 28,720.90 | 23,340.40 | 20,425.50 | 24,087.40 | 33,865.60 | 39,735.90 | 40,854.80 | 404,805.20 |
| 066/67 | 38,039.70 | 39,339.30 | 38,800.80 | 37,211.20 | 39,229.80 | 28,733.10 | 23,229.60 | 21,430.00 | 24,728.30 | 34,223.20 | 41,188.90 | 38,851.00 | 405,004.90 |
| 067/68 | 38,272.10 | 42,258.30 | 41,360.20 | 40,607.20 | 39,868.40 | 30,600.30 | 23,859.00 | 22,755.80 | 21,900.40 | 29,757.00 | 46,449.00 | 45,473.60 | 423,161.30 |
| 068/69 | 45,669.20 | 45,602.40 | 37,491.70 | 44,563.40 | 34,698.00 | 31,715.70 | 25,909.20 | 24,523.90 | 27,934.20 | 32,558.20 | 48,613.00 | 46,620.50 | 445,899.40 |
| 069/70 | 48,103.80 | 45,592.60 | 45,991.70 | 45,590.00 | 38,193.30 | 27,769.20 | - | - | - | - | - | - | 2,51,240.60 |
| | | | | | | | | | | | Till Date Generation, MWh | | 9,444,079.60 |

# KULEKHANI-I HYDROPOWER STATION

## INTRODUCTION

Kulekhani-I, located at Dhorsing, Makwanpur, is the only reservoir type hydropower station in Nepal with installed capacity is 60MW having two units each of capacity 30 MW. This station was designed as a peaking power station but it is often operated to the system requirements for voltage improvement & system stability. The annual designed energy generation capacity is 165GWh as primary energy and 46 GWh as secondary energy. This project was constructed with financial assistance of World Bank, Kuwait Fund, OPEC Fund, UNDP & the Overseas Economic Co-operation Fund (OECF) of Japan & Government of Nepal. Total cost of the project was US$ 117.843 million and accordingly the project was transferred to NEA with a capital cost of approximately NRs. 1,550 million. The tele-metering system installed for the measurement of rainfall, water level etc. cost around NRs. 137.4 million. The cost of road check dams and inclined tunnel is about 23 crores. Its first unit was commissioned on May 14, 1982 and the power station was inaugurated on December 8, 1982 (B.S. 2039-Marga-23). In 1994, an overhauling work of the power station was performed with the grant assistance of Japan.

The cumulative generation of Kulekhani-I HPS has reached 4,277.96 GWh. It station generated 98.89 GWh of energy in FY 2011/12 and 143.28GWh of energy in FY 2011/12, which registered an increase of 44.9% over the previous year's generation. It contributed 3.42% of the total energy to the INPS in FY 2011/12. The maximum and minimum water-level of Kulekhani reservoir in FY 2010/11 was recorded as 1521.34 masl and 1495.22 masl and in FY 2011/12 was recorded as 1530.38 masl and 1497.33 masl. During monsoon season, sand bags of 50 cm height were placed in the spillway crest to increase the water storage.

The interruption of Unit No. 1 due to breakdown of 66 kV XLPE cable in Y-phase in November, 2012 was brought into service in an emergency measure. The breakdown was possibly due to progressive breakdown during wet-aging in solid insulating materials

### Repair and Maintenance Activities during FY

66 kV Heat Shrinkable Straight Through Jointing in Progress

### 2010/11 & 2011/12

### Civil Maintenance:

- Civil repair works to protect the reservoir storage capacity was carried out, including excavation and gabion works in Chakhel intake and in the tributaries pouring to Indrasarovar
- Maintenance of staff colony & army colony
- Protection work for debris control in Chakhel dam, Palung River and different river by Gabion check wall
- Road protection, drain maintenance work along power house

- Removing of deposition & gabion check wall for debris control at Chakhel dam
- Gabion check-wall at different location around (Indrasarovar) Kulekhani Dam
- General Civil work of power house, Control Room, Staff Quarter & Dam site

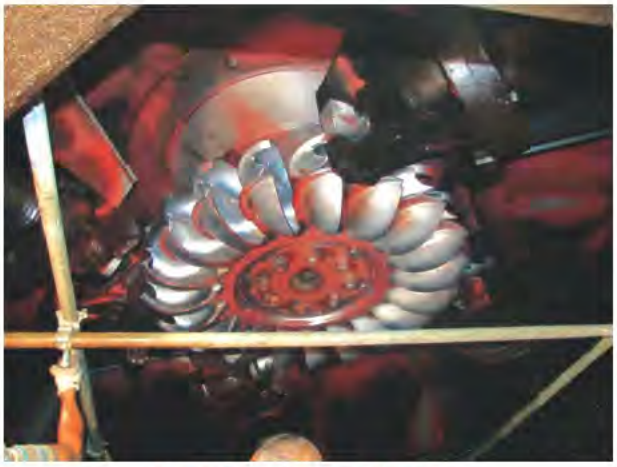
### Electrical Maintenance:

- Installment of a new 350 kVA D.G. set and replacement of two number of air compressor system was carried out in the FY 2011/12.
- Regular check-up of generator and turbine is carried out including cleaning of stator coils of both units.

Inspection of Generator Stator

## Electro Mechanical Work:

- Overhauling of unit no. 2 under the supervision of Fuji Electrical Japan.
- The unit no 2 is renovated with digital governor and Automatic Voltage regulator (AVR).
- Repair & Maintenance of damage gate valve & swing check valve of cooling system unit No 2.
- Installation of a new 350 kVA D.G. Set.
- Installation of 66 kV heat shrinkable straight through joint for 66 kV single core, unarmoured, XLPE Power Cable.



Inspection of Pelton Runner

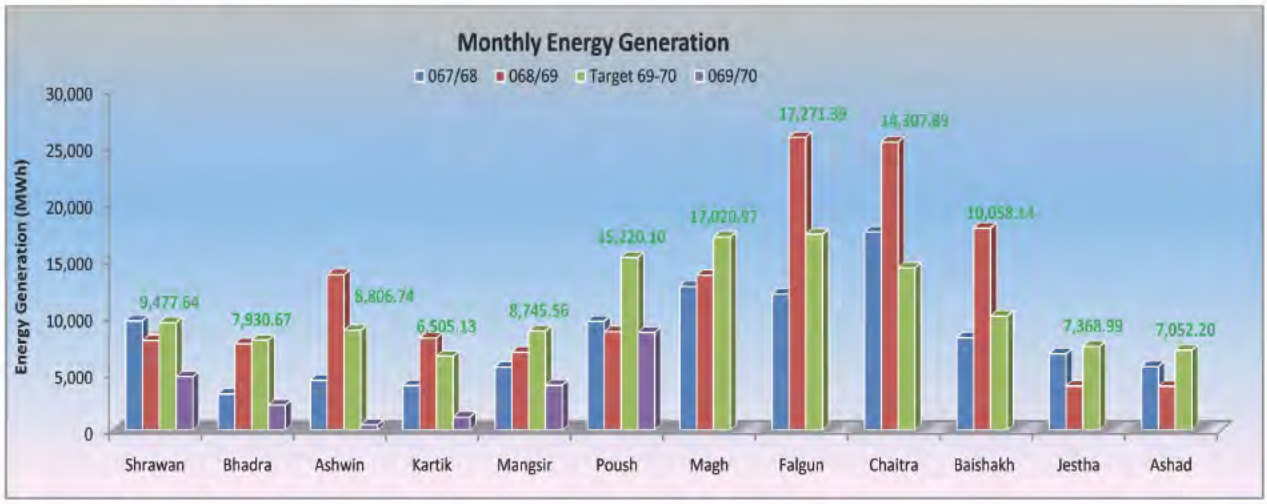
- Replacement of old damaged two numbers of high pressure air compressor system
- Replacement of damage bottom seal & repair side seal of both radial spillway gate of Kulekhani dam & Chakhel dam gate.
- Repair and maintenance of central AC system of Control room and Power house
- Replacement of old damage Air Handling Unit Evaporation of Power House A/C system
- Replacement of damage water flow relay & pressure meter of both unit No. 1 & 2.
- Repair and maintenance of distribution panel & gate operational panel of dam site.
- Replacement of tube light set By CFL Light set at Power house access tunnel
- General electrical maintenance of power house, Control Room & Switchyard

### ONGOING ACTIVITIES:

- NEA has applied for Japan's Grant Aid General for modernization work of electrical control panels & Cubicles and substation equipments.
- Replacement of 4 sets of MOCB with VCB switchgear with Control and Relay Panel.
- Design, supply and install of combination panel of digital governor and digital AVR in Unit No.

| SALIENT FEATURES OF KULEKHANI-I HYDROPOWER STATION | |
|---|---|
| Type | Storage |
| Location | Dhorsing, Makwanpur |
| Installed Capacity | 60 MW |
| Rated Head | 550 m |
| Catchments Area | 126 $km^2$ |
| Design Discharge | 12.1 $m^2$/sec |
| **Turbine** | |
| No. and Type | Two, Vertical Shaft Pelton |
| Rated Output | 31 MW |
| Rated Speed | 600 rpm |
| **Generator** | |
| Rated Capacity | 35 MVA |
| Generating Voltage | 11 kV |
| Frequency | 50 Hz |
| Dam | Zoned Rock Fill Dam with Inclined Core, 114 m high, 406 m crest length |
| Headrace Tunnel | Circular Section, Ø 2.5 m x 6,233 m in long |
| Penstock | Ø 2.0-1.5 m, 1324 m length |
| Main Transformer | Two, 35 MVA, 11/66 kV |

Power Transformer Condition Monitoring in Progress




**Kulekhani I Hydropower Station**

| FY/Month | Shrawan | Bhadra | Ashoj | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jesth | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 038/39 | - | - | - | - | - | - | - | - | 11,023.00 | 16,411.00 | Shutdown | Shutdown | 27,434.00 |
| 039/40 | 661.00 | 3,318.00 | 4,194.00 | 2,964.00 | 7,462.00 | 11,007.00 | 12,477.00 | 10,932.00 | 10,261.00 | 10,607.00 | 7,958.00 | 5,576.00 | 87,417.00 |
| 040/41 | 5,058.00 | 3,074.00 | 3,636.00 | 2,595.00 | 7,518.00 | 11,681.00 | 11,287.00 | 9,342.00 | 10,263.00 | 7,240.00 | 5,527.00 | 5,072.00 | 82,293.00 |
| 041/42 | 9,047.00 | 5,594.00 | 4,715.00 | 6,154.00 | 7,756.00 | 13,578.00 | 10,601.00 | 8,275.00 | 9,256.00 | 10,608.00 | 8,316.00 | 10,112.00 | 104,012.00 |
| 042/43 | 12,940.00 | 13,222.00 | 9,020.00 | 8,437.00 | 10,020.00 | 15,062.00 | 18,512.00 | 18,999.00 | 20,453.00 | 15,848.00 | 15,866.00 | 16,032.00 | 174,411.00 |
| 043/44 | 17,572.00 | 15,344.00 | 12,146.00 | 13,319.00 | 14,462.00 | 17,260.00 | 17,440.00 | 19,250.00 | 19,206.00 | 15,971.00 | 12,914.00 | 15,511.00 | 190,395.00 |
| 044/45 | 15,831.00 | 17,780.00 | 14,897.00 | 14,478.00 | 17,825.00 | 18,740.00 | 19,192.00 | 17,068.00 | 16,487.00 | 16,402.00 | 14,037.00 | 15,340.00 | 198,077.00 |
| 045/46 | 16,808.00 | 15,482.00 | 17,011.00 | 12,135.00 | 13,273.00 | 17,985.00 | 15,563.00 | 15,431.00 | 12,139.00 | 10,019.00 | 11,219.00 | 13,818.00 | 170,883.00 |
| 046/47 | 17,250.00 | 18,641.00 | 16,134.00 | 10,800.00 | 12,011.00 | 13,251.00 | 10,828.00 | 8,331.00 | 5,902.00 | 6,573.00 | 7,262.00 | 5,611.00 | 132,594.00 |
| 047/48 | 3,358.00 | 10,097.00 | 11,687.00 | 13,194.00 | 12,254.00 | 25,818.00 | 27,183.00 | 21,002.00 | 15,798.00 | 10,598.00 | 5,082.00 | 7,339.00 | 163,410.00 |
| 048/49 | 7,903.00 | 8,981.00 | 8,081.00 | 6,418.00 | 10,551.00 | 18,133.00 | 19,607.00 | 15,286.00 | 9,750.00 | 4,424.00 | 3,352.00 | 4,617.00 | 117,103.00 |
| 049/50 | 7,438.00 | 5,155.00 | 4,659.00 | 3,481.00 | 5,064.00 | 9,951.00 | 12,935.00 | 9,911.00 | 5,329.00 | 2,098.00 | 2,486.00 | 2,785.00 | 71,292.00 |
| 050/51 | 353.00 | Shutdown | Shutdown | Shutdown | Shutdown | 11,709.00 | 19,997.00 | 17,296.00 | 17,423.00 | 25,476.00 | 10,929.00 | 4,598.00 | 107,781.00 |
| 051/52 | 6,304.00 | 4,303.00 | 7,044.00 | 4,959.00 | 11,499.00 | 21,778.00 | 17,108.00 | 15,651.00 | 8,803.00 | 4,562.00 | 4,367.00 | 6,670.00 | 113,048.00 |
| 052/53 | 10,845.00 | 17,147.00 | 11,833.00 | 6,492.00 | 8,314.00 | 13,445.00 | 15,550.00 | 14,488.00 | 26,664.00 | 15,781.00 | 14,195.00 | 12,443.00 | 167,197.00 |
| 053/54 | 9,904.00 | 10,694.00 | 14,945.00 | 11,385.00 | 16,612.00 | 26,676.00 | 26,586.00 | 20,735.00 | 14,542.00 | 10,996.00 | 372.00 | 4,538.00 | 167,985.00 |
| 054/55 | 7,712.00 | 6,714.00 | 16,513.00 | 7,816.00 | 4,436.00 | 7,474.00 | 15,104.00 | 13,610.00 | 10,124.00 | 9,847.00 | 11,336.00 | 10,885.00 | 121,571.00 |
| 055/56 | 15,562.00 | 31,986.00 | 13,346.00 | 8,025.00 | 13,204.00 | 19,380.00 | 18,481.00 | 16,867.00 | 20,205.00 | 11,864.00 | 7,649.00 | 19,168.00 | 195,737.00 |
| 056/57 | 33,355.00 | 34,278.00 | 21,139.00 | 14,836.00 | 11,962.00 | 19,307.00 | 26,333.00 | 26,755.00 | 20,815.00 | 11,148.00 | 12,322.00 | 17,430.00 | 249,680.00 |
| 057/58 | 9,023.00 | 17,107.00 | 16,103.00 | 9,072.00 | 15,161.00 | 18,242.00 | 24,925.00 | 25,096.00 | 19,588.00 | 5,554.00 | 5,717.00 | 10,164.00 | 175,752.00 |
| 058/59 | 10,551.00 | 10,315.00 | 8,885.00 | 6,617.00 | 8,098.00 | 15,108.00 | 21,475.00 | 19,134.00 | 20,027.00 | 8,026.00 | 8,070.00 | 9,115.00 | 145,421.00 |
| 059/60 | 12,147.00 | 15,542.00 | 14,250.00 | 8,293.00 | 8,106.00 | 16,177.00 | 30,871.00 | 29,963.00 | 13,435.00 | 8,533.00 | 7,189.00 | 5,520.00 | 170,026.00 |
| 060/61 | 10,517.00 | 9,086.00 | 11,329.00 | 9,850.00 | 9,566.00 | 20,508.00 | 19,192.00 | 19,540.00 | 16,577.00 | 11,986.00 | 9,578.00 | 12,880.00 | 160,609.00 |
| 061/62 | 16,627.00 | 10,798.00 | 11,960.00 | 10,665.00 | 9,223.00 | 18,091.00 | 23,347.00 | 20,983.00 | 18,940.00 | 17,813.00 | 8,448.00 | 6,890.00 | 173,785.00 |
| 062/63 | 7,953.00 | 7,188.00 | 7,091.00 | 5,623.00 | 9,062.00 | 13,560.00 | 17,132.00 | 18,371.00 | 5,886.00 | 6,777.00 | 7,012.00 | 9,045.00 | 114,700.00 |
| 063/64 | 8,954.00 | 7,407.00 | 6,348.00 | 6,697.00 | 12,319.00 | 20,838.00 | 20,412.00 | 10,226.00 | 15,124.00 | 14,271.00 | 9,091.00 | 6,361.00 | 138,048.00 |
| 064/65 | 3,742.00 | 5,672.00 | 15,260.00 | 8,382.00 | 8,412.00 | 16,467.00 | 23,738.00 | 20,110.00 | 21,113.00 | 9,013.00 | 10,518.00 | 10,589.00 | 153,016.00 |
| 065/66 | 10,316.00 | 8,097.00 | 3,654.00 | 2,131.00 | 8,295.00 | 12,487.00 | 6,195.00 | 10,214.00 | 2,381.00 | 3,313.00 | 4,421.00 | 3,610.00 | 75,114.00 |
| 066/67 | 4,290.00 | 4,756.00 | 5,156.00 | 4,595.00 | 6,612.00 | 12,642.00 | 10,268.00 | 9,495.00 | 11,040.00 | 6,576.00 | 5,884.00 | 5,682.00 | 86,996.00 |
| 067/68 | 9,633.00 | 3,171.00 | 4,396.00 | 3,927.00 | 5,545.00 | 9,594.00 | 12,680.00 | 11,999.00 | 17,468.00 | 8,149.00 | 6,726.00 | 5,598.00 | 98,886.00 |
| 068/69 | 7,888.00 | 7,611.00 | 13,698.00 | 8,112.00 | 6,866.00 | 8,683.00 | 13,638.00 | 25,823.00 | 25,403.00 | 17,814.00 | 3,884.00 | 3,864.00 | 143,284.00 |
| 069/70 | 4,704.00 | 2,205.00 | 464.00 | 1,148.00 | 3,958.00 | 8,608.00 | - | - | - | - | - | - | 21,087.00 |
| | | | | | | | | | | | Till Date Generation, MWh | | 4,299,044.00 |

# KULEKHANI-II HYDROPOWER STATION

## Introduction

Kulekhani-II Hydropower Station, located at Nibuwatar, Makwanpur, is a cascade of Kulekhani-I with installed capacity of 32 MW and annual design generation of 104.6 GWh. It was commissioned in 1986 AD and developed in assistance from OCEF Japan and Government of Nepal at a cost of NRs. 124 million

Power House and Switchyard

The Plant, boosted with water intake from Mandu and Rapti pumping, has faithfully cascaded the generation of Kulekhani-I while also . Every year Mandu intake is cleaned after the wet season to allow filtered water to the intake pond. Survey was carried out to explore the possibility of addition of Mandu and Rapti in an extensive scale such that one unit could run while Kulekhani-I is not operated for storage of water.

The cumulative generation of Kulekhani-II HPS has reached 1711.87 GWh. It generated 50.47 GWh of energy in FY 2010/11 and 71.45 GWh of energy in FY 2011/12, which registered an increase of 41.57% over the previous year's generation. It contributed 1.71% of the total energy in the INPS in 2011/12.

## Major Activities during FY 2010/11

- Filter material replacement of Mandu dam
- Construction of check wall in Mandu dam downstream

Maintenance of Transformer

- Repair of water level transducers in Mandu Substation
- Replacement of batteries of Mandu substation
- Replacements of overall limit switches of Inlet valve and governor controls
- Repair of Control valve of inlet valve of unit No. 1
- Adjustments of proximity switches

## Major Activities during FY 2011/12

- Top layer deposition cleaning of Mandu dam collecting basin
- Slide protection and check wall construction in downstream of Mandu dam weir

Turbine Floor

Repair of 6.6 kV Power Cable of Transformer.

- In April 2012, one 132 kV Y-phase power transformer bushing was damaged by lightning strike, possibly due to ageing, resulting into insulation coordination failure . The transformer was sent to NEA workshop in Hetauda for possible repair while necessary cable and busbar repair was carried out to bring the unit in service within 4 days.
- Replacement of Main power transformer B-phase with spare
- Breakdown of HV bushing of R-phase Main power transformer
- Replacement of HV Bushing of R- Phase Main Power transformer
- Installation of CO2 fire extinguishing system of generators
- Refresher Training Program of Power station maintenance and operation personnel

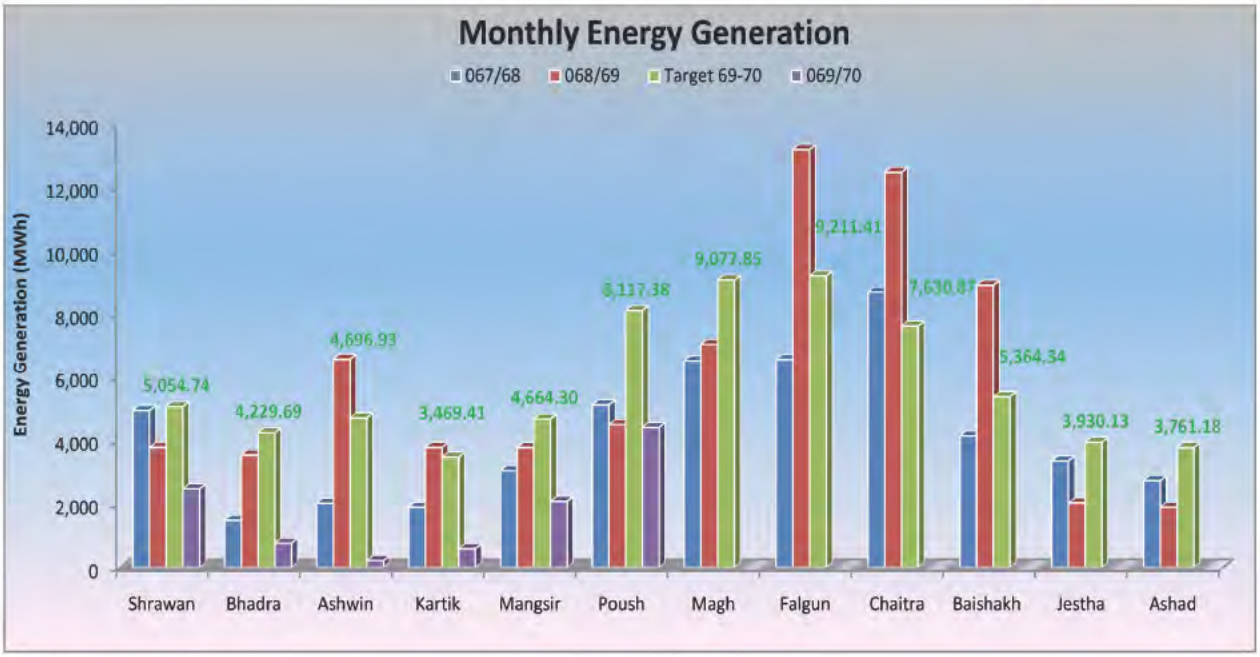
## Major Activities during FY 2012/13

- Replacement of control valves of Unit no.2
- Refresher Training program of Power station operation personnel

## ONGOING ACTIVITIES:

- NEA has applied for Japan's Grant Aid General for modernization work of electrical control panels & Cubicles and substation equipments
- Procurement of 12.6 MVA , 132/6.6 kV three phase power transformer

| SALIENT FEATURES OF KULEKHANI II HYDRO POWER STATION | |
|---|---|
| Type of project | Cascade plant of Kulekhani hydropower/ Peaking power station |
| Location | Bhainse VDC, Bhainse, Makawanpur |
| Installed Capacity | 32 MW |
| Maximum Gross/ Net head | 310/284.1 m |
| Power tunnel | Ø 2.5 m, 5847.8 m long |
| Penstock | 1 no., steel pipe, Ø 2.1-1.5 m, Length: 843 m |
| **Turbine** | |
| Number and Type | 2, Vertical Francis Turbine. |
| Rated discharge | 16.65$m^3/s$ |
| Rated output | 16500 kW |
| Rated speed | 750 rpm |
| **Generator** | |
| Rated output | 18.8 MVA |
| Rated Voltage | 6.6 kV |
| Rated Frequency | 50 Hz |
| Power Factor | 0.85 lag |
| Excitation | Brushless 3 phase rotating armature |
| Power Transformer | 12.6 MVA , 132/6.6 kV, 3 nos., single phase |
| Transmission Line | 132 kV, Hetauda line-7.9 km, Siuchatar line- 33.4 km |




**Kulekhani-II Hydropower Station** — MWh

| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 043/44 | - | - | - | - | 5,209.90 | 8,756.50 | 8,606.00 | 9,567.60 | 9,407.30 | 8,188.20 | 6,572.80 | 9,040.10 | 65,348.40 |
| 044/45 | 10,935.20 | 11,319.30 | 7,860.40 | 7,503.90 | 8,624.00 | 8,987.40 | 9,023.80 | 8,033.20 | 7,827.60 | 7,871.40 | 6,777.20 | 8,875.50 | 103,638.90 |
| 045/46 | 10,111.20 | 10,605.30 | 9,002.90 | 5,121.30 | 5,844.70 | 7,970.40 | 6,880.90 | 6,866.60 | 5,433.60 | 4,555.90 | 5,222.00 | 7,597.00 | 85,211.80 |
| 046/47 | 10,334.10 | 10,065.50 | 8,788.80 | 4,783.50 | 5,211.30 | 5,628.50 | 4,592.40 | 3,602.90 | 2,496.90 | 2,693.80 | 3,012.80 | 2,689.80 | 63,900.30 |
| 047/48 | 2,259.40 | 6,098.10 | 6,619.50 | 5,687.70 | 4,780.80 | 10,837.40 | 11,354.80 | 8,624.00 | 6,482.40 | 4,162.70 | 1,828.70 | 3,163.90 | 71,899.40 |
| 048/49 | 3,781.00 | 4,789.20 | 3,737.60 | 2,546.80 | 4,307.00 | 7,490.10 | 8,134.20 | 6,207.90 | 3,750.80 | 1,797.80 | 1,420.80 | 1,850.50 | 49,813.70 |
| 049/50 | 3,458.00 | 2,253.90 | 1,973.20 | 1,334.40 | 1,895.40 | 3,805.20 | 5,038.60 | 3,848.60 | 1,880.40 | 825.20 | 948.90 | 1,181.00 | 28,442.80 |
| 050/51 | - | - | - | - | - | 4,299.60 | 7,447.90 | 6,657.90 | 6,809.50 | 10,506.30 | 3,945.70 | 1,353.50 | 41,020.40 |
| 051/52 | 1,969.80 | 1,487.10 | 3,030.90 | 2,191.20 | 5,392.20 | 10,591.90 | 8,447.50 | 7,838.80 | 4,265.30 | 2,155.10 | 2,047.30 | 2,988.20 | 52,405.30 |
| 052/53 | 4,908.90 | 8,015.50 | 5,419.40 | 2,824.80 | 3,741.70 | 6,508.40 | 7,592.60 | 7,003.80 | 13,190.70 | 7,820.70 | 6,679.20 | 5,814.40 | 79,520.10 |
| 053/54 | 4,158.80 | 4,562.30 | 6,796.50 | 5,082.00 | 7,647.20 | 13,177.20 | 13,210.00 | 10,290.80 | 6,981.90 | 5,347.40 | Shutdown | 706.50 | 77,960.60 |
| 054/55 | 3,261.90 | 2,971.70 | 8,061.90 | 3,600.10 | 2,092.00 | 3,686.00 | 7,617.60 | 6,922.90 | 5,017.90 | 4,694.50 | 5,449.60 | 5,270.40 | 58,646.50 |
| 055/56 | 7,000.50 | 15,169.10 | 5,955.90 | 3,661.70 | 6,481.10 | 9,975.90 | 9,525.60 | 8,614.00 | 10,488.40 | 5,990.50 | 3,837.10 | 9,189.40 | 95,889.20 |
| 056/57 | 15,450.90 | 15,853.50 | 9,467.20 | 6,456.40 | 6,323.40 | 9,980.10 | 13,560.40 | 13,886.00 | 11,027.10 | 5,740.20 | 6,334.40 | 8,678.00 | 122,757.60 |
| 057/58 | 3,850.30 | 7,235.30 | 6,908.70 | 3,868.10 | 6,873.80 | 9,014.50 | 12,478.40 | 12,264.40 | 9,664.30 | 2,660.50 | 2,587.70 | 4,404.60 | 81,810.60 |
| 058/59 | 4,325.00 | 4,282.70 | 3,369.00 | 2,665.50 | 3,402.30 | 6,927.30 | 10,879.40 | 9,187.60 | 9,721.80 | 3,759.30 | 3,478.80 | 3,694.20 | 65,692.90 |
| 059/60 | 4,357.00 | 6,405.50 | 5,734.50 | 2,935.50 | 3,213.10 | 7,160.20 | 14,674.30 | 14,489.70 | 6,333.50 | 3,786.70 | 2,975.00 | 2,035.10 | 74,100.10 |
| 060/61 | 3,898.30 | 3,048.50 | 4,229.30 | 3,903.80 | 3,972.40 | 9,045.10 | 8,488.20 | 8,934.70 | 7,506.10 | 5,118.40 | 3,537.30 | 3,896.00 | 65,578.10 |
| 061/62 | 6,380.50 | 3,759.70 | 4,740.00 | 4,142.40 | 3,727.70 | 7,784.90 | 10,352.10 | 9,257.80 | 8,237.40 | 7,634.30 | 3,317.10 | 2,758.30 | 72,092.20 |
| 062/63 | 3,252.70 | 2,855.70 | 2,616.70 | 2,139.67 | 3,659.66 | 5,632.66 | 7,638.10 | 8,132.03 | 2,376.32 | 2,755.03 | 2,766.61 | 3,504.70 | 47,329.88 |
| 063/64 | 3,451.08 | 2,730.00 | 2,276.87 | 2,564.70 | 4,842.16 | 8,862.73 | 8,938.57 | 4,359.00 | 5,604.40 | 5,453.81 | 3,632.31 | 2,276.55 | 54,992.18 |
| 064/65 | 1,358.57 | 1,934.36 | 4,883.82 | 2,495.20 | 2,736.47 | 6,152.70 | 3,964.62 | 5,255.31 | 8,280.74 | 4,192.96 | 5,145.41 | 5,045.12 | 51,445.28 |
| 065/66 | 4,630.96 | 3,772.43 | 1,657.01 | 1,005.09 | 4,293.80 | 6,414.22 | 3,226.61 | 5,273.75 | 1,217.41 | 1,633.70 | 2,177.92 | 1,631.73 | 36,934.63 |
| 066/67 | 2,063.35 | 2,092.75 | 2,434.03 | 2,241.65 | 3,497.47 | 6,541.80 | 5,022.24 | 5,041.34 | 5,408.92 | 3,448.49 | 2,833.17 | 2,893.35 | 43,518.56 |
| 067/68 | 4,932.56 | 1,477.54 | 2,016.09 | 1,892.44 | 3,035.70 | 5,108.52 | 6,529.30 | 6,566.41 | 8,700.85 | 4,132.94 | 3,348.07 | 2,727.71 | 50,468.13 |
| 068/69 | 3,770.64 | 3,531.99 | 6,577.05 | 3,765.23 | 3,763.92 | 4,488.72 | 7,047.39 | 13,195.85 | 12,473.07 | 8,913.30 | 2,026.90 | 1,894.32 | 71,448.38 |
| 069/70 | 2,467.94 | 761.29 | 213.26 | 585.18 | 2,072.20 | 4,396.20 | - | - | - | - | - | - | 10,496.07 |
| | | | | | | | | | | | | Till Date Generation, MWh | 1,722,362.01 |

# MULTIFUEL POWER PLANT

## Introduction:

Multi fuel power plant is the largest thermal power plant in Nepal. It is located in Bansbari Morang, Biratnagar, which happens to be one of the largest industrial areas in Nepal. In the first phase, 4 units each of 6.5 MW were installed with financial assistance from Finland Government in FY 1990/91. Later, 2 more units of same capacity were installed in FY 1997/98 to complement the energy deficit during winter and evening peak, which was also financed by Finland Government reaching the total capacity of 39 MW.

The cumulative generation of Multifuel Power Plant has now reached generated 578.69 GWh from its first run. It generated 23.49 GWh of energy in FY 2010/11 and mere 0.62 GWh in FY 2011/12.

A major overhauling of engines of all six units of Multifuel power plant started in FY 2009/10 and a contract agreement with Wartsila took place on 10 April, 2010. The overhauling has been successfully completed this year. The project was jointly funded by World Bank under Power Development Project, GON and NEA. The project cost was USD 7.7 million. Main works of this project was the overhauling of 6x6.5 MW Wartsila DG sets.

## Repair and Maintenance Activities:

The following activities were accomplished during 2010/11 and 2011/12.

### Important activities during ENGINE OVERHAULING

- Overhauling of all 6 DG sets
- Low NOx modification
- $CO_2$ cleaning of alternators
- Rusting in crankshaft has been found in DG 1 and DG6, so in situ machining has been done.
- Engine block and cylinder liner machining
- Turbo charger repair and balancing of 5 engines, except DG5
- Installation of new booster unit for DG3 and DG4
- Installation of new silencer for DG1, DG2, DG3 and DG4

Engine Overhauling

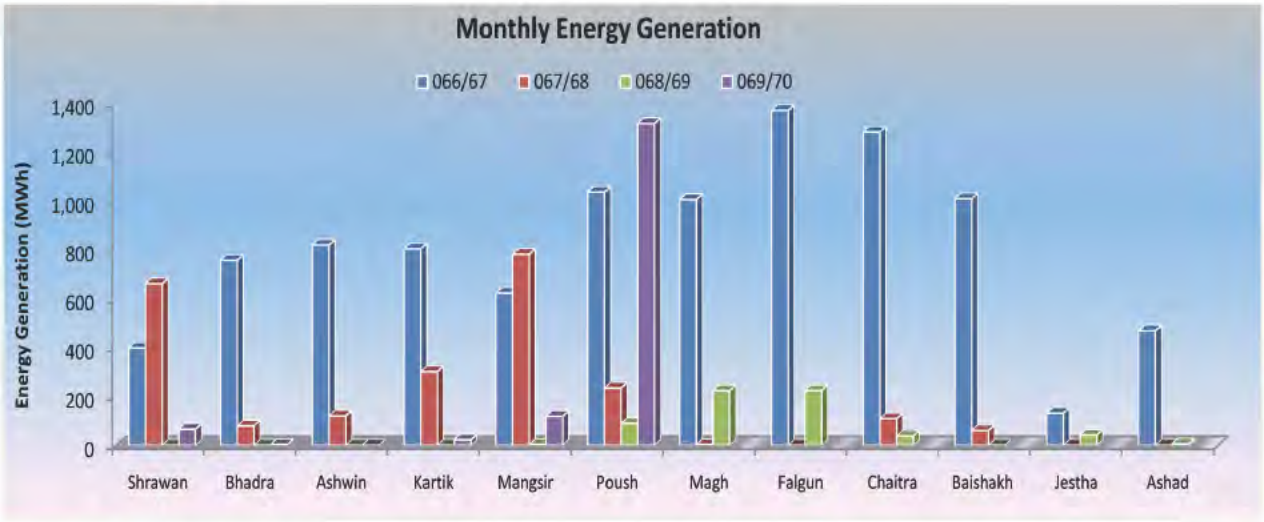
- Cleaning of all auxiliaries component; Charge air cooler, PHE, cooling tower
- Repair of hydrophore pump system

## Schedule of DG Sets Handover to NEA by Wartsila

| DG Set No. | Completion Certificate Date | Operational Acceptance Date |
|---|---|---|
| DG 1 | 17 Dec, 2012 | 31 Dec, 2012 |
| DG 2 | 11 Dec, 2012 | 23 Dec, 2012 |
| DG 3 | 12 Dec, 2012 | 24 Dec, 2012 |
| DG 4 | 15 Dec, 2012 | 30 Dec, 2012 |
| DG 5 | 07 May, 2011 | 23 July, 2012 |
| DG 6 | 22 Dec, 2012 | 27 Dec, 2012 |

Governor Repair

| SALIENT FEATURES OF MULTI FUEL POWER PLANT | |
|---|---|
| Type | Thermal |
| Location | Bansbari, Morang |
| Installed capacity | 39 MW |
| Engine set | 6 Nos., 6.5 MW |
| **Generator** | |
| Number and type | 4 nos. of 7.5 MVA capacity from Leroy Somer France<br>2 nos. of 8.144 MVA capacity from Alstom, France |
| Rated voltage | 11 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.85 (4 Units), 0.8 (2 Units) |
| Rated speed | 750 rpm |
| Excitation | Brushless |
| Power Transformer | 11/33 kV, 16 MVA, 3 Nos. |
| Transmission line | 4 km long, 33 kV Double circuit |




| Multifuel Power Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 047/48 | - | - | - | - | - | - | - | - | - | - | - | - | 268.20 |
| 048/49 | - | - | - | - | - | - | - | - | - | - | - | - | 20,249.43 |
| 049/50 | 1,111.03 | 1,416.56 | 556.22 | 679.69 | 2,096.50 | 5,057.84 | 4,857.69 | 4,596.45 | 5,937.62 | 3,932.12 | 3,222.88 | 2,856.53 | 36,321.13 |
| 050/51 | 3,943.40 | 4,432.39 | 4,159.63 | 3,477.92 | 5,192.86 | 5,925.97 | 5,241.31 | 6,585.82 | 7,347.53 | 3,635.07 | 3,620.09 | 3,100.35 | 56,662.34 |
| 051/52 | 3,237.66 | 2,767.38 | 2,921.34 | 5,811.13 | 9,868.98 | 7,541.43 | 9,802.40 | 8,958.52 | 8,467.92 | 8,266.18 | 6,301.35 | 2,321.81 | 76,266.10 |
| 052/53 | 1,078.75 | 823.41 | 2,330.85 | 3,094.18 | 4,325.42 | 6,318.72 | 4,737.23 | 1,105.55 | 1,617.98 | 1,050.54 | 660.52 | 1,490.95 | 28,634.10 |
| 053/54 | 3,063.08 | 2,451.07 | 1,382.90 | 1,602.48 | 1,291.98 | 1,055.30 | 1,062.50 | 4,305.79 | 3,384.78 | 2,564.10 | 3,195.60 | 3,987.97 | 29,347.55 |
| 054/55 | 6,297.44 | 6,293.95 | 8,306.28 | 3,587.63 | 6,628.37 | 9,942.32 | 14,140.34 | 10,078.38 | 9,584.85 | 2,344.15 | 3,874.06 | 4,585.90 | 85,663.66 |
| 055/56 | 1,529.63 | 1,408.49 | 3,845.79 | 4,074.81 | 4,866.75 | 7,707.28 | 9,783.25 | 13,648.86 | 13,771.55 | 10,903.60 | 10,502.73 | 4,172.33 | 86,215.07 |
| 056/57 | 2,099.25 | 1,988.65 | 2,511.73 | 1,542.03 | 3,641.33 | 9,667.74 | 8,263.59 | 9,844.27 | 6,035.13 | 5,602.40 | 1,412.22 | 709.27 | 53,317.61 |
| 057/58 | 941.10 | 1,214.29 | 868.73 | 1,076.86 | 1,550.24 | 2,037.67 | 1,603.82 | 1,512.48 | 6,390.17 | 1,826.36 | 264.32 | 24.24 | 19,310.28 |
| 058/59 | 963.09 | 1,243.02 | 789.95 | 522.12 | 1,493.08 | 2,693.64 | 2,479.31 | 2,332.11 | 964.37 | 163.19 | 4.24 | 4.42 | 13,652.54 |
| 059/60 | - | - | - | 105.22 | 484.02 | 512.26 | 1,088.70 | 758.76 | 865.19 | 59.68 | 141.44 | 134.00 | 4,149.27 |
| 060/61 | 637.68 | 645.63 | 440.32 | 635.49 | 623.12 | 766.89 | 775.26 | 878.97 | 1,224.35 | 1,098.84 | 489.34 | 526.99 | 8,742.88 |
| 061/62 | 726.36 | 540.11 | 292.06 | 283.20 | 534.83 | 634.85 | 1,241.72 | 1,648.62 | 1,493.71 | 1,965.33 | 1,351.56 | 430.13 | 11,142.48 |
| 062/63 | 963.89 | 933.33 | 582.70 | 432.39 | 1,042.37 | 2,063.71 | 1,954.24 | 1,827.91 | 1,625.27 | 402.29 | 329.76 | 430.16 | 12,588.02 |
| 063/64 | 443.35 | 1,031.13 | 1,282.43 | 1,092.83 | 1,485.95 | 1,983.65 | 223.30 | - | 293.91 | 741.33 | 774.38 | 940.64 | 10,292.90 |
| 064/65 | 566.76 | 780.24 | 899.62 | 728.76 | 980.28 | 1,090.76 | 1,149.06 | 530.75 | 751.62 | 332.07 | 52.27 | 4.20 | 7,866.39 |
| 065/66 | - | 23.64 | 530.24 | 227.97 | 331.11 | 663.65 | 719.56 | 530.34 | 703.45 | 645.43 | 307.17 | 639.81 | 5,322.37 |
| 066/67 | 397.98 | 756.86 | 819.13 | 803.50 | 622.65 | 1,035.61 | 1,005.71 | 1,370.55 | 1,282.05 | 1,009.27 | 131.04 | 468.30 | 9,702.65 |
| 067/68 | 661.12 | 79.67 | 119.68 | 301.23 | 781.68 | 234.02 | 2.71 | - | 108.73 | 60.02 | - | - | 2,348.86 |
| 068/69 | - | - | - | - | 2.46 | 89.21 | 223.33 | 223.20 | 37.99 | - | 41.70 | 5.64 | 623.53 |
| 069/70 | 65.97 | 2.92 | - | 22.06 | 118.18 | 1,317.06 | - | - | - | - | - | - | 1,526.19 |
| | | | | | | | | | | | Till Date Generation, MWh | | 580,213.55 |

# MEDIUM POWER PLANT OPERATION AND MAINTENANCE DEPARTMENT

The department is responsible for operation and maintenance of NEA owned medium & small power stations with installed capacity less than 30 MW. There are 12 Hydropower & 1 Thermal power stations under this department.

The total generation from Medium Hydropower stations were recorded at 390.05 GWh & 403.24 GWh in 2010/11 and 2011/12 respectively with 3.26% increment compared to previous year, while particular note is made of the record generation by Sunkoshi power station in 2011/12. The generation from Hetauda Diesel Power Plant, the only thermal plant under this department, was kept minimal at 2.27 GWh in aggregate for two years. The generation targets assigned during 2010/11 and 2011/12 were 460.44 GWh and 462.43 GWh respectively. The target set for this year is 473.35 GWh.

The AVR and field circuit cabinets in all the units of Trishuli Hydropower Station have been replaced with new static digital excitation system. The damages inflicted in generator stator and rotor of Unit No. 1 & 6 in July 2012 due to the failure of the relays to trip the main breakers has been recovered for Unit No. 1 after the replacement of damaged stator windings. The Unit No. 6 which shared the major proportion of damage is yet to recover as the repair and maintenance works in stator and rotor are underway by the Contractor Multipower Hydroelectric Development Corporation (MHDC), China. The overhauling of Unit No. 2 of Gandak Hydropower Station has been completed and along with Unit No. 3 is generating satisfactorily. The major overhauling is required in generator and turbine runner assembly of Unit No. 1 to bring back into operation. The proposed installation of trash rack cleaning machine (TRCM) and construction of under-sluice channel at intake are expected to relieve choking of trash rack with debris and silt that flow unabated from the headworks thereby increasing available capacity of the plant during peak and off-peak hours.

The functioning of headworks of Modi Khola Hydropower station has been a concern since its commissioning. The proposed civil, hydro-mechanical and electromechanical renovation and modification works are expected to resolve underlying problems. The tentative cost of rehabilitation project is estimated to be NRs. 300 million including civil and hydro-mechanical complete works. The bidding process has been completed for civil and hydro-mechanical lot and detail documentation is being prepared with detail design, specifications and cost estimates for electromechanical lot. The Renovation Modernization Upgradation (RMU) project for rehabilitation of Devighat Hydropower Station, consisting of design, manufacture, testing and supply of 3 numbers of improved capacity Turbine, completed in 2010/11 and is performing satisfactorily. The generation of Sunkoshi Hydropower Station has been quite satisfactory and recorded the highest generation in 2011/12 in its forty years history and presently all the units are in excellent condition especially after the overhauling of Unit No. 2 last year. In Ilam (Puwa Khola) Hydropower Station, the penstock repair work between Anchor Block No. 3 & 5 has been completed to keep its alignment intact as fragile geology in the vicinity prompted anchor blocks to shrink. All possible temporary measures with crack filling, repair works with high strength concrete in forebay, head tank, improving penstock support blocks etc. have been undertaken.

In Chatara Hydropower Station, Unit No. 1 is in operation while Unit No. 2 needs major electrical and mechanical overhauling works to be carried out in its Bevel Gear Bulb turbine assembly. The outsourcing of the overhauling works to experienced firms in these types of turbines could be an option. The competitive bidding process is already underway to replace remaining MOCBs with VCBs. The station also lacks necessary spare parts. The replacement of stator winding of Unit No. 2 and repair and maintenance of switchgear

and protection system has been completed in Panauti Hydropower Station. The rehabilitation of Unit No. 1 & 3 is likely to be completed this year for which the initial bidding process is completed. All the three units of Seti Hydropower Station are in operation. The equipments have been delivered at the site for renovation of excitation and switchgear system of Seti Hydropower Station and as soon as the shutdown schedule is finalized with LDC the installation works will commence.

In Fewa Hydropower Station, Units No. 1, 2 & 3 are in operation while remaining Units No. 4 have problem in generator turbine coupling and is not in operation. Efforts are being made to bring the unit into operation as soon as possible. However, operation of only two units at a time is possible due to inadequate canal inflow. The rehabilitation of electromechanical components of Sundarijal Hydropower station is underway under the joint assistance from ADB, GON and NEA. Nepal Electricity Authority (NEA) has received loan (Loan Number 2808-NEP, Grants 0270-NEP and 0271-NEP) from Asian Development Bank (ADB) towards the cost of Power Efficiency Improvement as part of Electricity Transmission Expansion and Supply Improvement Project. The project is scheduled to complete by July, 2015. Both the units are in normal operation at the moment. Pharping Hydropower Station is a century old, the first power station in Nepal. It is not in schedule operation at the moment. The station operates only for an hour a day as water that feeds the turbine is being used for drinking water supply. A master plan has been prepared to develop the site as Live Museum with construction and establishments including model power station of wind, solar and hydro and as a centenary celebration memorial.

Engine overhauling in all the seven units were carried out successfully last year in Hetauda Diesel Plant. The spare parts required for engine overhauling were procured from Man Diesel, UK funded by World Bank under PDP. The MOCBs with electromechanical relays have been replaced by VCBs with numerical relays and control panel. The proposal for up gradation of AVR of existing excitation system is under consideration.

Key challenges for increasing generation from power stations remain the enforcement of maintenance schedule, reduction of maintenance outages, imparting skills and operating prudence and deficient skilled workforce to name a few.

Scenic View of Pondage of Pharping Hydropower Station

# TRISHULI HYDROPOWER STATION

## Introduction:

Trishuli Hydropower Station, located at Trishuli, Nuwakot, previously with installed capacity of 21 MW consisting of 7 units each of 3 MW commissioned in 1967 AD and developed jointly by Government of India and Government of Nepal at a cost of INR 140 million. It was rehabilitated in 1995 AD and upgraded to 24 MW with 6 units each of 3.5 MW and one unit of 3 MW. It is a peaking run-of-river hydropower station with annual design generation of 163 GWh. The power station is in continuous operation since commissioned around forty five (45) years ago.

The cumulative generation of Trishuli HPS has reached 4,449.31 GWh till 2011/12 from its first run. It has generated 128.25 GWh in FY 2010/11 and 134.77 GWh in FY 2011/12 with an increase of 5.09%. It contributed 2.22 % of the total energy in the INPS in FY 2011/12.

## Present status:

Damages inflicted in stator and rotor of Unit No. 1 & 6 in July 2012 due to the failure of the relays to trip main breaker have been recovered in Unit No. 1 after the replacement of stator windings. Unit No. 6 which shared the major proportion of the damage is yet to recover as repair and maintenance works in stator and rotor are underway. Decision has been made to replace the generator protection relays in all the units for which the contract has been already executed. Replacements of old excitation systems in all the units with static digital excitation system were completed in 2010/11. Governor control system has also been replaced in Unit No. 3, 4, 5& 7. Currently six (6) units are in operation.

## Repair and Maintenance Activities:

The following activities were accomplished during FY 2010/11 & 2011/12.

## Mechanical Works:

- Overhauling of Unit No. 2, 3 & 7
- Replacement of seal and bearing in head gate
- Replacement of oil cooler and bearings in Unit No. 5 & 3
- Repair and maintenance of radiators of Unit No. 3 & 5
- Replacement of governors in Unit No. 1, 2 & 3 including servomotor in Unit No. 3
- Replacement of screw shaft de-silting flushing gate

Erosion of Seal Beam in Gate

## Electrical Works:

- Installation of new AVR and field breaker cabinets in Unit No. 5 & 7
- Retrofitting of all the existing SF6 breaker trolleys with VCB trolleys
- Replacement of electrical control cabinet of governors in unit No. 1, 2 & 3
- Repair and maintenance of generator stator winding and rotor of Unit No. 6
- Installation of 66 kV SF6 Breaker in Balaju-2 Feeder

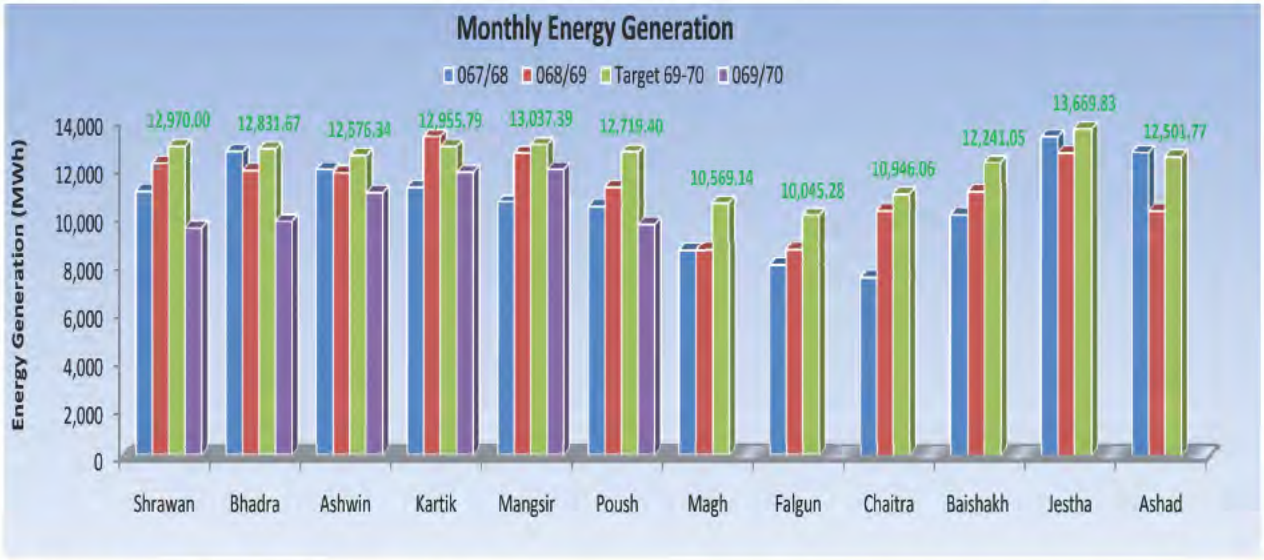
## Civil Maintenance Works:

- Removal of sand deposits from B 0 Trash Rack
- Headworks gate maintenance to control water leakage by replacing I-beam and S.S. plate
- Cleaning, painting civil maintenance works
- Protection works of buildings and civil structures
- Gabion wall protection against landslide in nearby areas

Control Desk

Replacement of Stator

| **SALIENT FEATURES** (after upgradation) | |
|---|---|
| Type | Peaking-run-of-river |
| Location | Trishuli, Nuwakot |
| Installed capacity | 24MW (peaking capacity 21MW) |
| Annual average energy | 163 GWh |
| Maximum gross head / Net head | 51.4 m |
| Catchment area | 2,600 $km^2$ |
| Average annual flow | 45.66 $m^3/s$ |
| Dam | 139.6m length |
| Total length of the waterways | 4,792 m |
| Penstock | 71.66 m long, Ø 2.3 m, 3 Nos., steel lined<br>89 m long, Ø 1.5 m, 1 No., steel lined |
| **Turbine** | |
| Number and Type | 7, Francis |
| Rated discharge | 7.8 $m^3/s$ |
| Rated output | 3,620 kW |
| Rated speed | 500 rpm |
| **Generator** | |
| Rated output | 3,889 kVA |
| Rated voltage | 6.6 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.90 |
| **Power Transformer** | 5 MVA, 6.6/66 kV, single phase, 6 Nos. |
| Transmission line | 66 kV, 27.36 km, Double circuit |




| Trishuli Hydropower Station from its first run | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 024-40 | Monthly Distribution is not Available | | | | | | | | | | | | 1,155,949.32 |
| 040/41 | - | - | - | - | - | - | - | - | - | 8,092.80 | 8,396.09 | 9,403.32 | 25,892.21 |
| 041/42 | 9,216.76 | 8,305.88 | 6,699.17 | 6,023.96 | 7,226.77 | 7,958.23 | 7,616.40 | 7,999.08 | 8,278.73 | 7,154.83 | 6,683.88 | 5,949.79 | 89,113.48 |
| 042/43 | 5,033.73 | 5,995.40 | 7,551.82 | 6,398.16 | 7,832.35 | 8,011.07 | 8,501.50 | 6,341.39 | 6,508.15 | 8,736.65 | 8,328.35 | 8,704.70 | 87,943.27 |
| 043/44 | 8,794.05 | 9,247.21 | 9,411.34 | 8,720.15 | 8,074.15 | 8,155.30 | 8,230.85 | 6,202.30 | 6,761.47 | 9,114.78 | 9,107.90 | 9,373.61 | 101,193.11 |
| 044/45 | 8,898.62 | 8,667.80 | 9,580.49 | 9,336.48 | 8,991.59 | 8,955.16 | 8,250.32 | 8,660.71 | 8,805.34 | 8,126.28 | 9,219.78 | 9,143.23 | 106,635.80 |
| 045/46 | 9,682.14 | 9,220.45 | 9,305.25 | 9,276.30 | 8,893.20 | 8,545.92 | 8,501.65 | 9,101.48 | 9,260.01 | 9,202.39 | 9,184.45 | 8,879.30 | 109,052.54 |
| 046/47 | 8,455.35 | 8,584.09 | 8,450.87 | 9,006.38 | 8,203.52 | 6,938.50 | 7,462.77 | 7,660.63 | 7,977.77 | 6,348.63 | 8,421.48 | 8,670.32 | 96,180.31 |
| 047/48 | 9,010.73 | 9,255.42 | 9,737.60 | 9,698.40 | 8,695.60 | 8,156.24 | 8,093.61 | 7,955.11 | 8,083.65 | 8,858.64 | 8,536.88 | 9,014.07 | 105,095.95 |
| 048/49 | 8,210.84 | 7,956.71 | 8,298.65 | 8,399.25 | 9,056.52 | 9,737.00 | 8,647.70 | 8,335.12 | 8,014.75 | 9,336.16 | 9,545.92 | 9,539.02 | 105,077.64 |
| 049/50 | 9,340.72 | 9,372.06 | 9,412.65 | 9,637.75 | 9,161.10 | 9,353.58 | 8,621.42 | 8,565.50 | 8,122.35 | 9,774.50 | 9,665.99 | 9,557.91 | 110,585.53 |
| 050/51 | 9,787.13 | 10,000.67 | 9,872.20 | 9,883.05 | 9,452.25 | 7,776.40 | 8,684.23 | 7,888.45 | 5,220.65 | shut down | 1,843.18 | 7,651.82 | 88,060.03 |
| 051/52 | 8,042.30 | 7,574.64 | 795.81 | shut down | shut down | 2,480.80 | 6,767.30 | 7,404.43 | 8,657.85 | 8,517.05 | 6,882.01 | 9,625.64 | 66,747.83 |
| 052/53 | 8,614.36 | 8,621.61 | 9,398.04 | 10,438.66 | 12,446.38 | 12,760.04 | 11,405.89 | 10,522.56 | 10,779.29 | 12,447.67 | 14,219.92 | 14,128.89 | 135,783.31 |
| 053/54 | 14,318.06 | 12,545.84 | 13,381.80 | 14,004.20 | 13,394.20 | 12,920.50 | 11,616.75 | 10,850.76 | 10,789.94 | 13,095.60 | 14,512.10 | 12,994.00 | 154,423.75 |
| 054/55 | 14,069.77 | 14,074.03 | 14,044.40 | 14,216.60 | 14,212.15 | 12,918.35 | 10,959.25 | 9,659.45 | 11,735.15 | 11,827.97 | 2,629.07 | 2,928.80 | 133,274.99 |
| 055/56 | 6,699.70 | 6,480.30 | 7,612.70 | 7,708.50 | 7,999.70 | 8,289.30 | 8,174.30 | 8,565.63 | 9,837.85 | 13,135.92 | 12,750.48 | 12,112.65 | 109,367.03 |
| 056/57 | 11,497.55 | 13,196.64 | 13,477.21 | 13,865.75 | 13,690.00 | 14,175.85 | 11,219.75 | 9,899.70 | 10,676.80 | 12,853.60 | 14,166.70 | 12,788.10 | 151,507.65 |
| 057/58 | 14,472.80 | 13,680.40 | 13,074.50 | 13,843.00 | 13,235.00 | 11,423.00 | 10,107.00 | 10,234.20 | 9,863.35 | 10,576.35 | 12,057.60 | 8,991.70 | 141,558.90 |
| 058/59 | 10,934.30 | 11,620.15 | 10,506.85 | 9,694.20 | 12,056.80 | 11,196.40 | 10,565.00 | 9,765.90 | 11,210.50 | 11,328.45 | 8,948.25 | 10,411.30 | 128,238.10 |
| 059/60 | 9,087.30 | 8,896.70 | 7,726.85 | 6,878.50 | 9,772.60 | 11,666.25 | 9,882.20 | 9,485.80 | 10,867.70 | 12,382.00 | 12,085.90 | 8,914.50 | 117,646.30 |
| 060/61 | 8,197.70 | 4,435.60 | 3,676.90 | 4,697.70 | 6,594.85 | 11,610.85 | 9,876.00 | 9,362.60 | 9,869.00 | 10,479.30 | 9,530.50 | 8,569.10 | 96,900.10 |
| 061/62 | 9,601.60 | 9,099.20 | 8,906.60 | 6,990.50 | 8,972.50 | 10,886.00 | 10,700.40 | 9,755.10 | 9,834.80 | 12,656.40 | 13,720.00 | 11,821.50 | 122,944.60 |
| 062/63 | 11,811.70 | 12,126.40 | 11,493.20 | 10,075.90 | 12,593.50 | 11,597.00 | 10,159.20 | 9,272.10 | 9,550.70 | 11,773.00 | 11,649.70 | 12,361.05 | 134,463.45 |
| 063/64 | 10,427.35 | 11,184.10 | 11,388.90 | 11,041.20 | 11,645.90 | 10,950.30 | 8,736.90 | 9,071.40 | 11,206.40 | 10,933.60 | 12,318.80 | 10,121.00 | 129,025.85 |
| 064/65 | 11,281.80 | 12,415.50 | 11,784.20 | 10,264.40 | 11,057.80 | 12,844.90 | 10,474.20 | 9,489.60 | 9,101.30 | 11,795.00 | 12,132.40 | 10,750.00 | 133,391.10 |
| 065/66 | 9,675.30 | 9,398.20 | 6,677.70 | 7,990.10 | 10,126.60 | 10,287.10 | 9,840.10 | 8,930.20 | 8,751.60 | 8,555.40 | 12,655.90 | 12,050.60 | 114,938.80 |
| 066/67 | 12,562.00 | 12,061.50 | 12,577.30 | 11,646.80 | 11,848.20 | 11,224.90 | 8,961.30 | 8,026.20 | 9,644.30 | 10,976.50 | 12,780.30 | 12,993.20 | 135,302.50 |
| 067/68 | 11,091.60 | 12,732.20 | 11,976.10 | 11,248.70 | 10,631.50 | 10,455.30 | 8,644.00 | 7,974.60 | 7,446.10 | 10,063.10 | 13,316.90 | 12,666.90 | 128,247.00 |
| 068/69 | 12,251.90 | 11,939.10 | 11,856.40 | 13,358.50 | 12,665.40 | 11,262.60 | 8,626.10 | 8,627.20 | 10,240.50 | 11,047.80 | 12,657.70 | 10,239.60 | 134,772.80 |
| 069/70 | 9,557.50 | 9,826.30 | 11,014.20 | 11,866.00 | 11,988.80 | 9,687.20 | - | - | - | - | - | - | 63,940.00 |
| | | | | | | | | | | | Till Date Generation, MWh | | 4,513,253.25 |

# GANDAK HYDROPOWER STATION

## Introduction:

Gandak Hydropower Station, located at Surajpura, Nawalparasi having installed capacity of 15 MW and annual design generation of 106.38 GWh was commissioned in 1979 AD and developed in assistance from Government of India and Government of Nepal with the total cost of NRs. 170 million. The project is initially developed with a dual purpose of hydropower and downstream irrigation in Uttar Pradesh, India. The station is canal drop type and the first low head (6.09m) power plant in Nepal.

Machine Hall

Its weir is regulated by Bihar State Government and canal is shutdown twice in a year for regular repair and maintenance. Its operation is hence, affected by irrigation in Bihar and Uttar Pradesh.

It cumulative generation has reached 878.61 GWh till 2011/12 from its first run. It has generated 11.33 GWh in FY 2010/11 and 13.08 GWh in FY 2011/12 with an increase of 15.41%. It contributed 0.31 % of the total energy in INPS in 2011/12.

## Present status:

Overhauling of Unit No. 2 has been completed and along with Unit No. 3 is generating satisfactorily. A major overhauling is required in generator and turbine runner assembly of Unit No. 1 to bring it back into operation. The retrofitting work of six (6) numbers of VCB trolleys is underway as a consequence of frequent breakdown of interrupters and operating mechanism of existing switchgear system. The proposed installation of trash rack cleaning machine (TRCM) and construction of under-sluice channel at intake are expected to relieve choking of trash rack from debris and silt hence thereby increasing available capacity of the plant during peak and off-peak hours. Procurement of trash rack cleaning machine at the intake section is underway with a loan financing from ADB (Loan No. 2587-NEP (SF)) under Energy Access and Efficiency Improvement Project (EAEIP) and is expected to be completed by 2013/14.

Main project components of the scheme consists of Trash Rake Cleaning Machine coupled with

Kaplan Turbine Runner Hub

Grappler, separate gantry crane, hydraulically operated silt flushing gate, flushing channel for continuous disposal of silt and a one-time removal of silt accumulated for many years. This comprehensive solution package will help to address the concern prevailing at intake section since many years.

## Repair and Maintenance Activities:

Following activities were performed during FY 2010/11 & 2011/12.

## Mechanical Works:

- Major overhauling of Unit No. 2
- Repair of high pressure oil system of the governor

Trash Rack at Intake

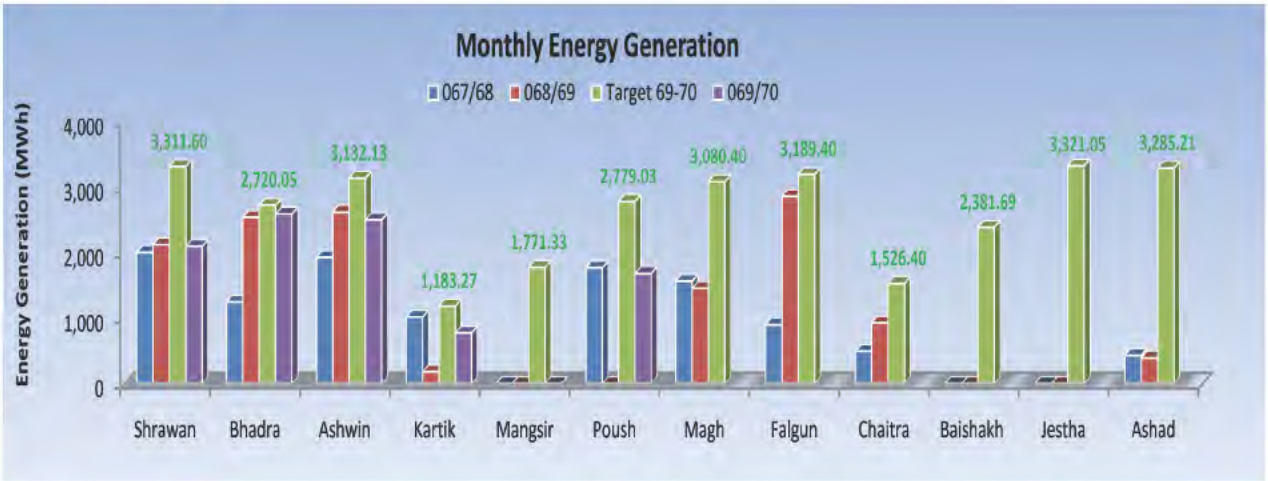
## Electrical Works:

- Repair and maintenance of excitation cubicles
- Battery backup replacement.

## Civil Maintenance Works:

- Maintenance of head pond, regular diving and maintenance of tailrace.

| SALIENT FEATURES OF GANDAK HYDROPOWER STATION | |
|---|---|
| Type | Canal drop |
| Location | Surajpura VDC -5, Nawalparasi |
| Installed capacity | 15 MW |
| Annual average energy | 106.38 GWh |
| Maximum gross head / Net head | 7.59 m, 6.09 m |
| Total length of the waterways | 18 km canal |
| **Turbine** | |
| Number and Type | 3, Kaplan |
| Rated discharge | 103.84 $m^3/s$ |
| Rated output | 5.6 MW |
| Rated speed | 107 rpm |
| **Generator** | |
| Rated output | 5.9 MVA |
| Rated voltage | 6.6 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.85 |
| **Power Transformer** | 10 MVA, 6.6/132 kV, 2 Nos. |
| Transmission line | 132 kV, 20 km (Balmikinager),18 km (Bardaghat), single circuit |




| Gandak Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 037/38 | | | | | | | | | | | | | 18,800.00 |
| 038/39 | | | | | | | | | | | | | 31,843.00 |
| 039/40 | | | | | | Monthly Distribution is not Available | | | | | | | 27,304.00 |
| 040/41 | | | | | | | | | | | | | 23,506.00 |
| 041/42 | | | | | | | | | | | | | 36,400.00 |
| 042/43 | 2,533.10 | 2,116.60 | 3,636.30 | 3,985.30 | 4,444.20 | 4,382.00 | 4,474.40 | 4,068.70 | 1,404.60 | 2,149.00 | 4,570.60 | 5,314.50 | 43,079.30 |
| 043/44 | 5,029.90 | 4,368.60 | 4,501.60 | 5,090.20 | 5,631.50 | 5,760.90 | 4,774.80 | 4,207.40 | 1,910.95 | 2,081.65 | 5,790.30 | 3,124.90 | 52,272.70 |
| 044/45 | 2,971.00 | 3,116.00 | 4,415.80 | 5,192.10 | 4,991.20 | 5,638.80 | 3,280.40 | 3,061.00 | 1,480.60 | 2,967.30 | 6,254.90 | 3,856.60 | 47,225.70 |
| 045/46 | 2,823.30 | 1,122.80 | 1,354.90 | 4,878.70 | 5,336.50 | 5,555.40 | 5,953.40 | 5,137.55 | - | - | - | - | 32,162.55 |
| 046/47 | 4,059.35 | 3,248.60 | 4,968.80 | 5,183.40 | 5,319.20 | 4,284.34 | 3,822.30 | 3,654.40 | 2,938.40 | 1,388.90 | 5,221.30 | 4,970.30 | 49,059.29 |
| 047/48 | 4,911.10 | 4,376.70 | 3,736.40 | 3,494.90 | 3,843.20 | 3,496.30 | 2,624.20 | 2,667.90 | 1,011.90 | - | 3,096.16 | 3,476.10 | 36,734.86 |
| 048/49 | 4,344.70 | 2,777.80 | 4,769.40 | 4,710.20 | 4,339.50 | 3,146.70 | 2,362.10 | 2,760.50 | 1,462.00 | 965.40 | 4,615.00 | 3,660.10 | 39,913.40 |
| 049/50 | 4,024.90 | 1,637.70 | 2,838.20 | 3,712.60 | 4,085.60 | 3,183.80 | 3,401.80 | 2,935.40 | 1,476.80 | 2,433.80 | 2,966.60 | 2,296.20 | 34,993.40 |
| 050/51 | 471.00 | 994.90 | 2,803.60 | 2,591.30 | 2,752.10 | 3,290.10 | 3,880.90 | 3,737.10 | 1,887.50 | 1,428.90 | 3,833.10 | 4,035.20 | 31,705.70 |
| 051/52 | 2,935.00 | 2,626.40 | 3,325.70 | 3,314.80 | 2,122.80 | 2,255.80 | 2,468.70 | 2,707.90 | 1,185.40 | 1,937.10 | 2,460.10 | 1,217.00 | 28,556.70 |
| 052/53 | 1,491.10 | 1,556.70 | 2,412.80 | 2,780.00 | 2,557.50 | 2,520.80 | 3,111.30 | 3,946.50 | 812.90 | 1,196.60 | 3,357.30 | 3,035.00 | 28,778.50 |
| 053/54 | 2,203.10 | 1,133.70 | 3,324.10 | 2,906.50 | 5,301.20 | 4,822.60 | 4,288.70 | 3,214.70 | 1,206.60 | 1,174.40 | 4,165.30 | 2,044.00 | 35,784.90 |
| 054/55 | 1,551.10 | 845.40 | 1,120.20 | 1,192.80 | 2,610.60 | 2,702.30 | 2,590.60 | 2,747.10 | 1,354.40 | 517.00 | 2,089.20 | 2,463.10 | 21,783.80 |
| 055/56 | 1,118.60 | 287.50 | - | - | 1,174.30 | 4,356.60 | 4,286.10 | 4,018.80 | 2,118.10 | 954.90 | 3,847.50 | 2,891.90 | 25,054.30 |
| 056/57 | 1,312.80 | 3,674.90 | 4,026.50 | 4,001.30 | 3,862.80 | 4,226.50 | 3,336.00 | 2,943.50 | 1,230.70 | 1,375.00 | 4,278.50 | 3,554.80 | 37,823.30 |
| 057/58 | 3,183.60 | 3,771.00 | 4,191.00 | 3,486.30 | 3,396.60 | 3,021.30 | 2,551.60 | 2,192.00 | 740.80 | 188.90 | 1,395.10 | 2,169.10 | 30,287.30 |
| 058/59 | 125.40 | 519.80 | 1,285.60 | 2,554.90 | 3,008.40 | 3,678.70 | 3,009.90 | 2,267.00 | 1,311.60 | 188.90 | 798.70 | 277.70 | 19,026.60 |
| 059/60 | - | - | 193.60 | - | - | 790.00 | 1,699.50 | 1,548.80 | 327.20 | 9,140.00 | 8,817.28 | 7,615.72 | 30,132.10 |
| 060/61 | 31.10 | 69.70 | 54.50 | 420.40 | - | 1,046.00 | 1,776.00 | 2,123.60 | 956.80 | 16.30 | 1,123.30 | 628.30 | 8,246.00 |
| 061/62 | 1,376.50 | 550.20 | 1,529.10 | 945.10 | 543.20 | 2,867.90 | 2,184.00 | 2,791.60 | 2,162.40 | 49.10 | 3,027.20 | 2,691.10 | 20,717.40 |
| 062/63 | 3,467.20 | 2,905.80 | 2,516.00 | 918.00 | - | 2,345.10 | 3,432.10 | 2,687.60 | 2,060.10 | 63.20 | 3,133.90 | 3,513.30 | 27,042.30 |
| 063/64 | 3,500.20 | 1,479.90 | 1,575.30 | 1,744.20 | 796.60 | 3,654.00 | 3,664.80 | 2,851.50 | 3,303.90 | 293.10 | 2,901.70 | 4,836.60 | 30,601.80 |
| 064/65 | 2,014.80 | 2,399.80 | 2,149.70 | 392.70 | - | 4,039.70 | 3,746.90 | 3,147.10 | 1,360.20 | - | - | 1,228.30 | 20,479.20 |
| 065/66 | 2,435.50 | 2,459.90 | 3,218.80 | 470.10 | - | 1,853.00 | 2,472.90 | 1,985.70 | 1,473.90 | 55.20 | 1,905.00 | 2,195.20 | 20,525.20 |
| 066/67 | 2,530.80 | 898.80 | 1,140.80 | 595.30 | 982.40 | 1,907.60 | 1,132.90 | 1,825.90 | 886.20 | 195.60 | 1,140.10 | 1,769.90 | 15,006.30 |
| 0 67/68 | 2,000.90 | 1,245.40 | 1,922.90 | 1,014.00 | - | 1,766.00 | 1,561.70 | 896.60 | 493.90 | - | - | 430.00 | 11,331.40 |
| 068/69 | 2,119.40 | 2,535.70 | 2,614.60 | 177.60 | - | - | 1,455.10 | 2,856.50 | 926.40 | - | - | 392.40 | 13,077.70 |
| 069/70 | 2,092.90 | 2,587.90 | 2,499.30 | 773.80 | - | 1,679.10 | - | - | - | - | - | - | 10,633.00 |
| | | | | | | | | | | Till Date Generation, MWh | | | 888,244.70 |



*Removal of Sand from Forebay*

# MODI KHOLA HYDROPOWER STATION

## Introduction:

Modikhola Hydropower Station is a run of river hydropower station, located at Dimuwa, Parbat with installed capacity of 14.8 MW and annual design generation of 92.5 GWh. It was commissioned in 2000 AD and developed in assistance from EDCF (Korea), Government of Nepal and NEA at a cost of USD 30 million.

Performance of the plant is largely unsatisfactory during rainy season compared to other identical hydropower stations in spite of being a relatively new plant. Modi Khola has high content of abrasive sediments. Due to reported sub-optimal design of the headworks, the existing sediment handling facilities are inadequate prompting intrusion of abrasive sediments into turbines and thereby eroding turbines, butter-fly valves, and wicket gates along with other allied facilities such as combined bearing coolers. Station also lacks adequate spare parts to carry out the repair and maintenance works. Ongoing rehabilitation project is expected to address these problems.

Control Room

The cumulative generation of the station has now reached 610.41 GWh till 2011/12 from its first run. It has generated 59.96 GWh in FY 2010/11 and 34.61 GWh in FY 2011/12 with a decrease of 42.28%. The generation from the station contributed 0.83% of the total energy in the INPS in 2011/12.

Headworks Intake

## Present status:

Presently, Unit No. 2 is in operation whereas overhauling of Unit No. 1 is underway after the span of six years. The unsatisfactory performance of the hydro-mechanical facilities has compounded the problems of vibration, cavitations and erosion in draft tubes, runner blades and wicket gate assembly. The erosion prompts water leakage, thereby creating the difference of pressure across the inlet valve and making it difficult to open. This has been observed in Unit No. 1 prompting to operate at lower capacity.

Two sets of digital AVR have been procured and installed while digital governor and spare runner are procured but yet to be delivered at site. Initial study and project preparation works of the rehabilitation project have been completed and bids for civil and hydro-mechanical works are under evaluation and the project is expected to be completed by 2012/14. The initial cost of the project is estimated NRs. 300 million and NEA is funding from its internal resources.

Overhauling of Unit No. 1 is in progress which includes repair of turbine runner, head cover, bottom ring and replacement of wicket gates, facing plates and wearing rings as well as the turning of turbine shaft bearing collar.

The generation during 2011/12 was adversely affected largely due to high sedimentation content thereby damaging thrust bearing and the oil coolers of combined bearing in Unit No. 1 & 2. Increased debris and sludge in the Modi Khola has been observed possibly due to ongoing rural road construction works prompting landslides in the surrounding areas. High deposition of sand at intake especially in box culvert and regulation pond this year was due to under sluice repair works, which took almost three months for completion. Choking of the trash rack and desander basin continued this year as well, which highly affected the flow of water into the turbine. At the beginning of the fiscal year 2011/12, a rupture was discovered in oil cooler in Unit No. 1 thereby damaging thrust bearing and thrust collar, which augmented the generation loss this year.

## Repair and Maintenance Activities:

The following activities were accomplished during FY 2010/11 & 2011/12:

Draw Out of Rotor of Unit No. 1 during Overhauling

## Mechanical Works:

- Replacement of combined bearing oil cooler in Unit No. 2
- Repair of Butterfly valve and replacement of its seal in Unit No. 1
- Repairing of passenger elevator at power station and replacing the necessary parts
- Repair of bypass pipelines and replacement of bypass valves in Unit No. 1 & 2
- Replacement of packing of shaft sleeve in Unit No. 1 & adjustment of GV in Unit 1 & 2
- Repairing of thrust bearing and turning of thrust bearing collar in Unit No. 1
- Repairing and maintenance of gates of sand purging and desander basin.

## Electrical Works:

- Replacement of AVR by Digital AVR in Unit No. 1 & 2
- Replacement of 200 Ah, 110 V Battery Bank in power station
- Replacement of operating cabinet in 33 kV and 132 kV SF6 breaker
- Replacing of spring and repairing of operating mechanism in 33KV ABB make SF6 Gas circuit breaker.
- Replacement of LG make GCB trolley in Unit No. 1

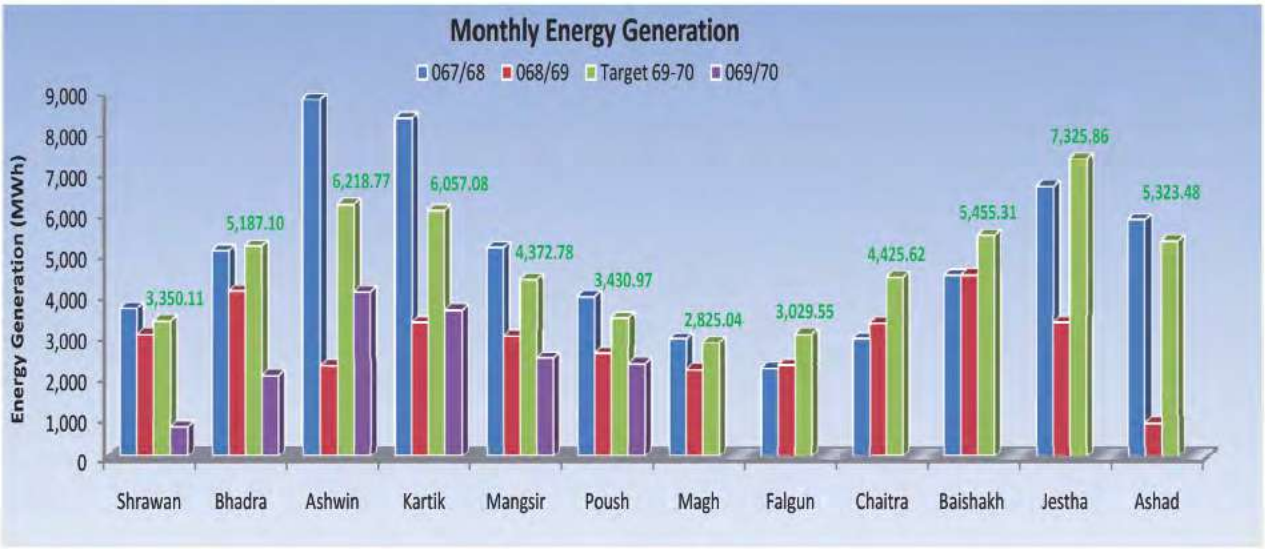
## Civil Maintenance Works:

- High strength concreting works on the downstream of under-sluice to support wing wall from overturning.
- Construction of R.C.C. cum plum concrete retaining structure to replace the failure retaining structure.

Intake Trash Rack Choke

- Control of undermining problem due to extension of gabion launching apron at downstream of weir.
- Cleaning, painting and incipient civil maintenance works.
- Repair and maintenance of cracks developed on open canal.
- Repair of ladder and painting works in power house.
- Construction of main gates and metallic bridge on Bhairu Khola at weir site.

| SALIENT FEATURES OF MODI KHOLA HYDROPOWER STATION | |
|---|---|
| Type | Run-of-river |
| Location | Dimuwa, Parbat |
| Installed capacity | 14.8 MW |
| Annual average energy | 92.5 GWh |
| Rated Net head | 66.96 m |
| Catchment area | 510km$^2$ |
| Average annual flow | 25 m$^3$/s |
| Total length of the waterways | 61.0 m (canal), 2071 m (tunnel) |
| **Turbine** | |
| Number and Type | 2, Francis |
| Rated discharge | 12.5m$^3$/s |
| Rated output | 7.6 MW |
| Rated speed | 428.6 rpm |
| **Generator** | |
| Rated output | 8260 kVA |
| Rated voltage | 6.6 kV |
| Rated frequency | 50Hz |
| Power factor | 0.9 |
| Power transformer | 7.8/8.3 MVA, 6.6/132 kV, 3 phase |
| Transmission line | Single circuit 132 kV, upto Lekhnath s/s |




| Modi Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 057/58 | - | - | - | 6,059.90 | 5,167.90 | 3,994.20 | 3,316.90 | 2,585.90 | 2,319.00 | 5,144.00 | 9,439.80 | 3,418.90 | 41,446.50 |
| 058/59 | 2,418.20 | 2,567.90 | 5,000.30 | 5,049.20 | 5,750.10 | 3,513.90 | 3,152.60 | 2,684.70 | 4,166.40 | 5,781.20 | 7,099.90 | 3,989.60 | 51,174.00 |
| 059/60 | 2,925.90 | 5,785.20 | 4,915.90 | 4,475.00 | 5,140.30 | 3,985.50 | 3,142.30 | 2,878.80 | 3,866.50 | 5,282.30 | 6,965.70 | 5,011.60 | 54,375.00 |
| 060/61 | 2,223.90 | 992.40 | 5,147.20 | 5,986.40 | 4,913.80 | 3,853.40 | 2,945.50 | 2,923.20 | 3,836.30 | 4,624.40 | 5,303.10 | 2,676.90 | 45,426.50 |
| 061/62 | 3,030.60 | 1,098.00 | 5,486.30 | 5,506.00 | 4,990.10 | 3,704.60 | 1,649.70 | 2,372.10 | 2,106.30 | 3,898.10 | 5,056.40 | 3,282.40 | 42,180.60 |
| 062/63 | 2,064.90 | 3,651.40 | 4,567.80 | 4,173.10 | 4,419.70 | 4,190.90 | 3,551.60 | 3,451.10 | 3,638.80 | 4,136.70 | 4,569.70 | 4,037.60 | 46,453.30 |
| 063/64 | 3,413.50 | 7,894.60 | 9,335.50 | 6,693.90 | 4,840.80 | 3,941.30 | 3,058.20 | 3,501.30 | 5,126.50 | 6,366.00 | 7,370.60 | 5,806.70 | 67,348.90 |
| 064/65 | 3,182.20 | 4,179.10 | 6,157.80 | 7,452.10 | 5,600.50 | 4,320.00 | 3,054.30 | 3,023.90 | 3,332.40 | 5,351.80 | 6,551.70 | 1,696.10 | 53,901.90 |
| 065/66 | 1,923.90 | 5,419.10 | 9,293.80 | 8,187.10 | 5,684.70 | 3,846.90 | 3,307.20 | 2,754.90 | 3,133.50 | 5,107.60 | 6,215.40 | 7,646.60 | 62,520.70 |
| 066/67 | 5,941.20 | 3,913.80 | 4,312.90 | 4,974.70 | 4,813.70 | 3,735.70 | 2,667.50 | 2,426.60 | 4,013.70 | 4,823.00 | 4,989.60 | 4,400.50 | 51,012.90 |
| 067/68 | 3,661.30 | 5,073.20 | 8,786.20 | 8,321.80 | 5,153.80 | 3,955.90 | 2,917.90 | 2,199.05 | 2,923.40 | 4,475.70 | 6,653.30 | 5,839.80 | 59,961.35 |
| 068/69 | 3,021.10 | 4,081.90 | 2,257.30 | 3,313.10 | 2,976.10 | 2,564.00 | 2,165.20 | 2,269.10 | 3,300.70 | 4,491.10 | 3,313.80 | 855.00 | 34,608.40 |
| 069/70 | 750.70 | 2,013.30 | 4,060.30 | 3,612.60 | 2,444.10 | 2,309.00 | - | - | - | - | - | - | 15,190.00 |
| | | | | | | | | | | Till Date Generation, MWh | | | 625,600.05 |

Tranquilizer of desanding basin

View of Power House and Switchyard

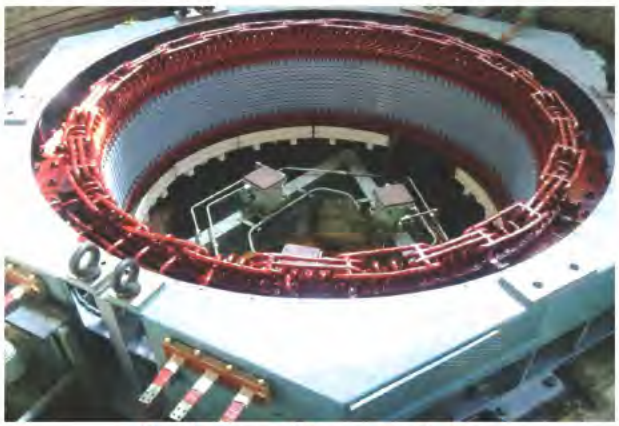
# DEVIGHAT HYDROPOWER STATION

## Introduction:

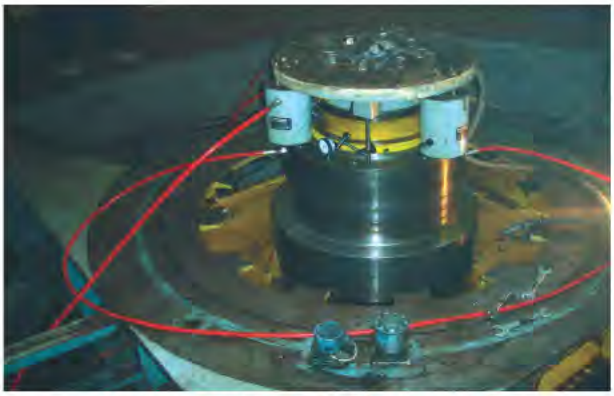
Devighat Hydropower Station is a cascade power station of Trishuli Hydropower Station. It is located at Devighat, Nuwakot with installed capacity of 14.1 MW and annual design generation of 144 GWh. It was commissioned in 1984 AD and developed in assistance from Government of India and Government of Nepal with total cost of NRs. 750 Million including transmission line. The rehabilitation of all the three units at a cost of INR 338.15 million was successfully completed by the contractor BHEL and handed over to NEA on July 13, 2011. Capacities of the units are improved and presently, all the three units are in normal operation. Its operational capacity is based on the availability of the flow released from the upstream of Trishuli Hydropower Station.

After the successful completion of RMU project in Devighat in fiscal year 2010/11, its generation has been satisfactory and is limited only by the obstacles in generation faced by upstream plant of Trishuli in one of its unit.

The cumulative generation of Devighat Hydropower Station has now reached 2309.38 GWh till 2011/12 from its first run. It generated 74.13 GWh in FY 2010/11 and 105.09 GWh in FY 2011/12 with an increase of 41.76%. It contributed 1.92 % and 2.51% of the total energy to the INPS in FY 2010/11 and 2011/12 respectively.



Overhauling of Generator Stator



Hydraulic Jacking to Uplift Thrust Collar

## Present status:

Presently, all the units are in normal operation. Major electromechanical repair and maintenance works have not been performed after the station underwent rehabilitation in 2010/11. However, preventive repair and maintenance works is continuously performed with special care and attention to rectify teething problems that normally emerge in new units.

## Repair and Maintenance Activities:

The following activities were carried out during FY 2010/11 & 2011/12.

## Mechanical Works:

- Repair and maintenance of drain valves in penstock pipe.
- Repair and maintenance of slice gate and tailrace gate
- Replacement of shaft-seal in Unit No. 1 & 3

## Electrical Works:

- Installation of 33 kV and 66 kV SF6 breaker with C&R Panel in Dhading and Trishuli-Devighat feeder respectively
- Installation of 6.5 MVA, 6.6/66 kV step-up transformer in Unit No. 1

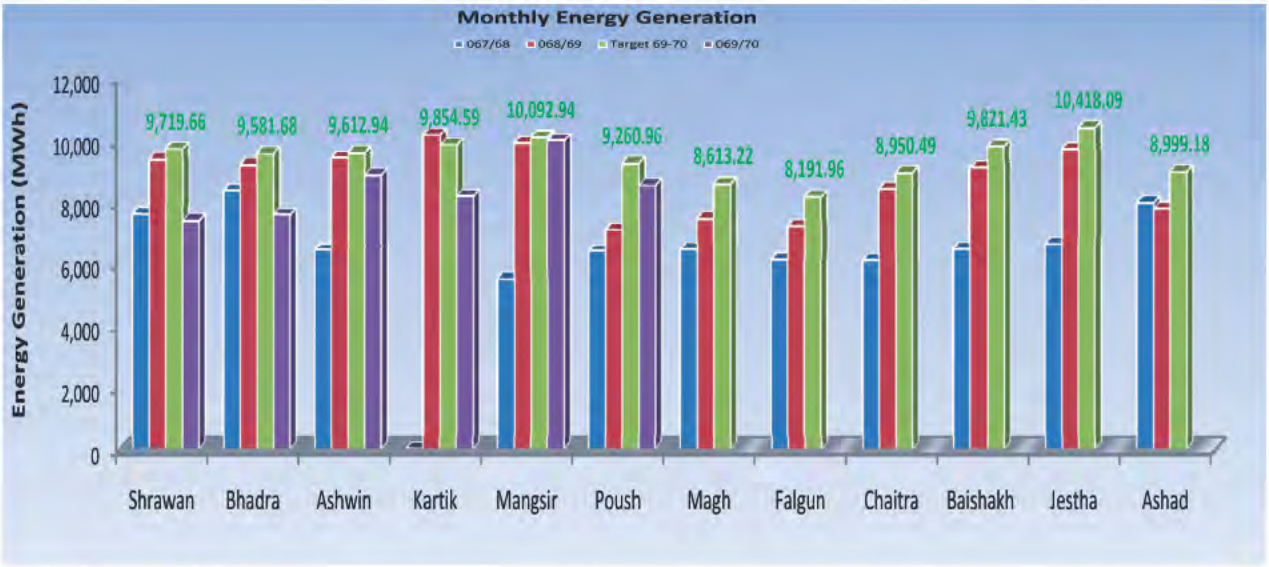
## Civil Maintenance Works:

- Removal of deposited sand in the forebay
- Protection works at Samari site
- Repair and maintenance of canal structure

| SALIENT FEATURES DEVIGHAT HYDROPOWER STATION | |
|---|---|
| Type | Cascade of Trishuli Hydro Power Station |
| Location | Charghare VDC, Battar Municipality, Nuwakot District |
| Installed capacity | 15 MW (after rehabilitation) |
| Annual average energy | 114GWh |
| Maximum gross head / Net head | 40.5m, 39m |
| Catchment area | 4,150 $km^2$ (upto Trishuli diversion) |
| Average annual flow | 45.3 $m^3/s$ |
| Live storage volume | |
| Dam | |
| Total length of the waterways | 4.5 km from Trishuli HPS tailrace to Devighat HPS forebay |
| Penstock | 3 Nos., Ø2.5 m, steel lined |
| **Turbine** | |
| Number and Type | 3, Vertical Francis |
| Rated discharge | 14.3 $m^3$/sec |
| Rated output | 5.03 MW |
| Rated speed | 333.3 rpm |
| **Generator** | |
| Rated output | 6.25 MVA |
| Rated voltage | 6.6 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.8 |
| Power transformer | 6.3 MVA, 6.6/66 kV, 3-phase, 3 Nos. |
| Transmission line | 66 kV, 37k m(Devighat -Chabel), 28 km(Devighat - Balaju), Double circuit |

Removal of Sand from Forebay

Generator during Overhauling




Devighat Hydropower Station — MWh

| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 040/41 | - | 2,835.10 | 2,625.00 | 3,804.30 | 1,992.20 | 3,222.40 | 3,499.70 | 3,435.40 | 3,112.98 | 3,399.32 | 4,158.25 | 3,305.00 | 35,389.65 |
| 041/42 | 125.20 | 3,935.55 | 4,222.80 | 3,925.10 | 4,389.40 | 5,078.60 | 4,917.68 | 5,164.83 | 5,458.69 | 4,420.62 | 4,225.15 | 3,607.52 | 49,471.14 |
| 042/43 | 3,144.52 | 3,495.73 | 3,294.55 | 2,982.13 | 4,781.25 | 5,545.74 | 4,653.82 | 3,358.16 | 4,245.29 | 5,610.56 | 5,168.85 | 5,287.40 | 51,568.00 |
| 043/44 | 5,385.18 | 5,271.85 | 5,812.12 | 5,619.71 | 5,715.19 | 5,661.14 | 5,565.48 | 6,670.70 | 2,795.79 | 6,077.45 | 6,054.55 | 6,138.69 | 66,767.85 |
| 044/45 | 5,214.46 | 5,131.31 | 6,442.38 | 6,728.55 | 6,505.83 | 6,591.94 | 6,038.65 | 6,247.78 | 6,414.62 | 5,805.55 | 6,435.76 | 5,887.09 | 73,443.92 |
| 045/46 | 6,217.51 | 5,993.43 | 6,496.47 | 6,711.29 | 6,569.77 | 6,509.43 | 6,532.72 | 6,914.63 | 7,122.62 | 6,967.96 | 6,855.79 | 6,065.98 | 78,957.60 |
| 046/47 | 6,074.70 | 6,047.44 | 6,248.65 | 6,871.90 | 6,116.67 | 5,253.66 | 5,820.13 | 5,933.01 | 5,922.57 | 4,724.78 | 6,250.43 | 6,233.16 | 71,497.10 |
| 047/48 | 6,335.16 | 6,513.77 | 7,022.45 | 7,139.80 | 6,528.58 | 6,264.77 | 6,018.15 | 6,096.91 | 6,061.39 | 6,659.40 | 6,383.29 | 6,630.31 | 77,653.98 |
| 048/49 | 5,809.95 | 5,736.05 | 5,989.42 | 6,129.58 | 6,397.64 | 6,875.76 | 6,254.30 | 6,029.70 | 6,020.70 | 6,769.75 | 6,618.47 | 7,082.58 | 75,713.90 |
| 049/50 | 6,633.95 | 5,762.08 | 6,921.47 | 7,434.90 | 6,751.20 | 7,150.55 | 6,444.25 | 6,435.60 | 6,256.12 | 7,381.01 | 7,082.96 | 7,029.51 | 81,283.60 |
| 050/51 | 7,028.48 | 6,689.97 | 7,338.35 | 7,584.10 | 7,231.70 | 5,836.70 | 6,709.90 | 6,098.70 | 3,731.02 | - | 1,257.78 | 4,486.90 | 63,993.60 |
| 051/52 | 5,673.60 | 5,532.31 | 590.59 | - | - | 1,596.15 | 5,139.40 | 5,594.70 | 6,593.95 | 6,564.88 | 5,090.82 | 6,820.80 | 49,197.20 |
| 052/53 | 6,105.50 | 6,142.87 | 6,855.78 | 7,388.81 | 8,870.19 | 9,138.85 | 8,250.20 | 7,673.56 | 7,975.08 | 8,798.26 | 8,472.17 | 7,137.23 | 92,808.50 |
| 053/54 | 6,427.67 | 7,010.48 | 8,067.25 | 9,254.30 | 9,301.43 | 8,990.90 | 7,936.87 | 7,660.01 | 7,948.96 | 9,460.45 | 10,396.57 | 9,242.46 | 101,697.35 |
| 054/55 | 9,743.00 | 9,332.53 | 9,833.82 | 9,889.06 | 9,871.59 | 9,301.35 | 8,068.10 | 7,113.85 | 8,583.53 | 8,957.46 | 2,043.15 | 2,037.92 | 94,775.36 |
| 055/56 | 4,674.48 | 4,374.84 | 5,201.62 | 5,481.32 | 5,536.54 | 6,231.39 | 6,450.30 | 6,652.19 | 7,287.66 | 9,746.40 | 9,380.70 | 7,564.80 | 78,582.24 |
| 056/57 | 8,053.35 | 9,125.60 | 9,417.09 | 9,594.15 | 9,322.21 | 9,837.55 | 8,347.45 | 7,009.48 | 7,927.17 | 9,602.33 | 10,113.85 | 7,927.47 | 106,277.70 |
| 057/58 | 9,750.65 | 9,290.38 | 9,133.67 | 9,746.13 | 9,996.00 | 8,308.50 | 7,403.29 | 7,364.28 | 7,058.90 | 7,254.60 | 8,789.25 | 1,967.55 | 96,063.20 |
| 058/59 | 7,831.52 | 8,188.30 | 7,500.63 | 7,108.15 | 8,365.30 | 8,115.50 | 7,258.00 | 7,055.80 | 8,188.10 | 8,311.08 | 6,267.33 | 7,335.94 | 91,525.65 |
| 059/60 | 6,304.05 | 5,983.25 | 5,230.75 | 4,651.30 | 7,082.90 | 8,367.06 | 7,121.79 | 6,933.63 | 7,958.52 | 8,846.42 | 8,495.65 | 7,343.20 | 84,318.52 |
| 060/61 | 5,543.22 | 2,962.26 | 2,491.75 | 3,263.53 | 4,690.30 | 8,436.55 | 7,167.20 | 6,918.61 | 7,192.51 | 7,775.23 | 6,997.25 | 5,142.95 | 68,581.36 |
| 061/62 | 6,494.95 | 6,406.85 | 6,047.87 | 5,183.15 | 6,565.73 | 7,935.28 | 7,784.27 | 7,132.05 | 6,400.75 | 6,084.75 | 9,611.80 | 8,360.90 | 84,008.35 |
| 062/63 | 7,937.80 | 8,091.05 | 8,096.75 | 7,225.65 | 9,095.98 | 8,254.47 | 7,180.60 | 6,758.20 | 7,070.10 | 8,493.60 | 8,223.40 | 8,643.55 | 95,071.15 |
| 063/64 | 7,191.00 | 7,814.55 | 8,081.98 | 8,004.37 | 8,208.40 | 7,836.95 | 6,250.00 | 6,618.00 | 8,056.30 | 8,061.30 | 9,040.15 | 7,386.25 | 92,549.25 |
| 064/65 | 7,854.40 | 8,632.20 | 8,177.60 | 7,337.15 | 7,905.05 | 9,132.60 | 7,546.60 | 6,966.90 | 6,314.60 | 8,204.65 | 8,771.50 | 4,642.45 | 91,485.70 |
| 065/66 | 6,644.10 | 6,630.55 | 4,621.60 | 5,875.25 | 7,234.65 | 7,388.60 | 7,222.95 | 6,456.10 | 6,586.55 | 6,444.45 | 8,292.25 | 8,040.75 | 81,437.80 |
| 066/67 | 8,652.00 | 8,486.35 | 8,838.85 | 8,375.65 | 8,592.95 | 7,910.45 | 6,476.40 | 5,991.95 | 7,006.75 | 7,934.70 | 8,787.60 | 8,987.70 | 96,041.35 |
| 067/68 | 7,617.80 | 8,379.30 | 6,449.70 | - | 5,487.20 | 6,394.20 | 6,458.00 | 6,133.30 | 6,083.10 | 6,478.20 | 6,659.83 | 7,992.00 | 74,132.63 |
| 068/69 | 9,393.40 | 9,206.60 | 9,455.10 | 10,169.90 | 9,903.10 | 7,109.10 | 7,499.10 | 7,248.30 | 8,425.90 | 9,139.80 | 9,736.30 | 7,802.60 | 105,089.20 |
| 069/70 | 7,407.60 | 7,608.80 | 8,895.20 | 8,194.90 | 9,992.90 | 8,547.60 | - | - | - | - | - | - | 50,647.00 |
| | | | | | | | | | | | Till Date Generation, MWh | | 2,360,029.85 |

# SUNKOSHI HYDROPOWER STATION

## Introduction:

Sunkoshi Hydropower station, located at 81 km east from Kathmandu, in Sindhupalchowk district, is a run-of-river daily pondage power station with an installed capacity of 10.05 MW and annual design generation of 70 GWh. This station has 3 units of 3.35 MW each. The powerhouse was commissioned in January 1972 with a friendly cooperation of the Water Conservancy and Electric Power Ministry of the People's Republic of China and Government of Nepal. Cost of the project was approximately NRs. 109.4 million including transmission line up to Kathmandu.

The cumulative generation of the station has reached 2,027.46 GWh in 2011/12 from the first run. It has generated 60.36 GWh in FY 2010/11 and 66.38 GWh in FY 2011/12 with an increase of 9.99%. It has a share of 1.59% of the total energy in the INPS in 2011/12.

Dismantling of Upper Bracket During Overhauling

The power station has continuously performed well augmented by favorable hydrological condition and prudent operating practices. It went on to put a record generation of 66.38 GWh in 2011/12. The rehabilitation of switchgear and protection system along with governor and excitation system carried out few years back has significantly reduced the outage hours in recent years.

Dismantling of Upper Guide and Thrust Bearing

## Present status:

Presently, all the three units of the station are in operation. The water leakage from gates in headworks is minimized after the application of RCC high strength concrete and replacement of seals in barrage gates. The years old 6.3 MVA, 6.3/66 kV power transformer is recently replaced and existing ones were repaired by Nepal Hydro & Electric Ltd., Butwal and NEA Transformer Workshop in Hetauda. The station has kept on with the regular preventive maintenance works thereby increasing the machine running hours and reducing the outage hours.

## Repair & Maintenance Activities:

The following activities were performed during FY 2010/11 & 2011/12.

## Mechanical Works:

- Overhauling works of Unit No. 2
- Cable trench maintenance works on backside of power house.
- Civil repair and maintenance works on Power house, Colony and Dam site.

Dismantling of Runner

- Replacement of seals in base plate of Barrage Gate No. 6.
- Replacement of steel rope in Barrage Gate No. 3, 4, 5 and 6 and Gallery Gate No. 1 at dam site.
- Replacement of trash rack at intake Gate No. 1(bypass canal) of dam site.

## Electrical Works:

- Overhauling of One Power Transformer (6.3 MVA, 6.3/66 kV) at NEA Transformer Workshop, Hetauda.
- Repair of oil indicating meter of conservator tank in new power transformer.
- Replacement of relays and switches, cables and wires on intake service Gate No. 2.
- Meggering of generator stator winding and 6.3 kV busbar of Unit No. 2.
- Tightening of core and body of Unit No.1 excitation transformer to reduce its humming.
- Mounting of MCCBs on gallery gates of dam and powerhouse intake.
- Repair and maintenance works in diesel generator dam site.
- Installation & replacement of meters in Switchgear room.
- Repairing of air conditioner in powerhouse.
- Installation of additional pump at sump in turbine floor.
- D/O sets are replaced at Colony and Dam site Transformers.
- Replacement of overhead ACSR conductors with ABC cables in Colony and office distribution line.
- Replacement of wall mounted R-phase CT possibly broke down by insulation failure.

Generator Rotor During Overhauling

## Civil Maintenance Works:

- Application of high strength concrete in under sluice portion at head works.
- Epoxy application on pier of Barrage Gate No. 3, 4, 5 & 6..
- Canal protection works near Lapse Khola.
- Barber wire boundary fencing work around the station.
- Cable trench maintenance works on backside of power house.
- Civil repair and maintenance works on Power house, Colony and Dam site.

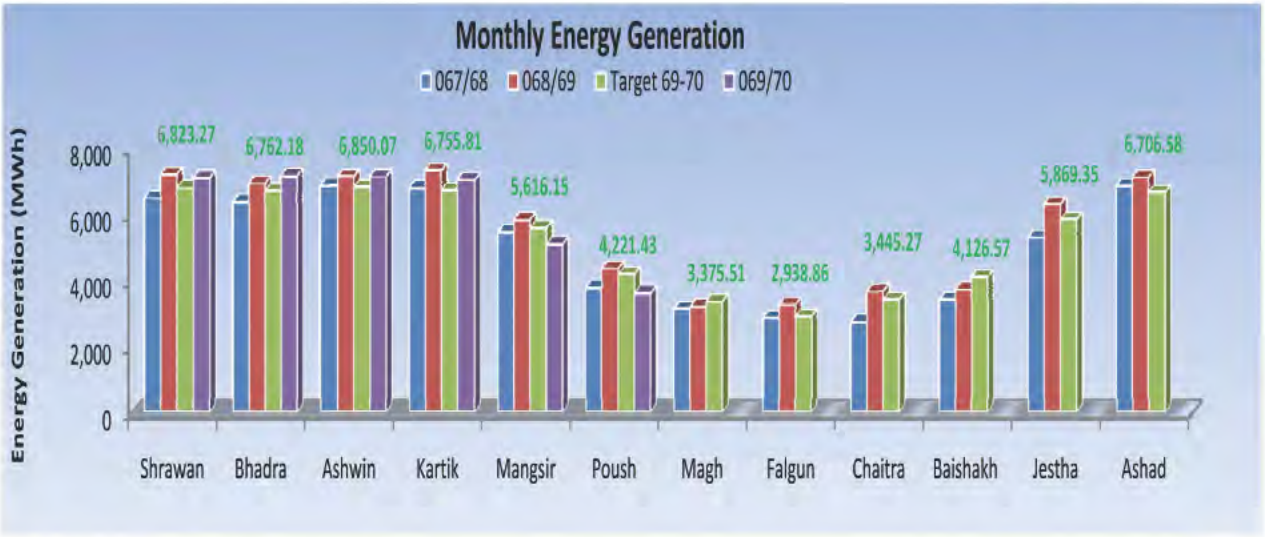
Maintenance of Gate no. 2 at Dam Site

View of Forebay during Plant Shutdown

| SALIENT FEATURES OF SUNKOSHI HYDROPOWER STATION | |
|---|---|
| Type: | Run-of-river |
| Installed Capacity: | 10.05 MW |
| Designed Head: | 30.5 m |
| Design Discharge: | 39.9 $m^3/s$ |
| Length of Canal: | 2.653 km |
| Diameter of Penstock: | 2.54 m, 3 Nos. |
| Turbine Generator Set: | 3 |
| Shaft Configuration: | Vertical |
| **Turbine:** | |
| Type: | Francis (Model: HL123a-LJ-140) |
| Output: | 3530 kW |
| Speed: | 300 rpm |
| **Generator:** | |
| Type: | Synchronous, 3 phase (Model: TS 325/36-20) |
| Capacity: | 4,000 kVA |
| Rated Voltage: | 6.3 kV |
| Rated Current: | 361 A |
| Rated Power Factor: | 0.85 |
| Transmission Line | 66 kV, Single Circuit |
| Project Inception Date: | End of 1968 |
| Project Placed in Service: | January 1972 |
| Project Financed by: | People's Republic of China and Government of Nepal |
| Project Cost: | NRs. 109.37 million (including transmission line) |

## DESIGN, TARGET AND ACTUAL GENERATION IN FY 2010/11 & 2011/12

| Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Design Generation (MWh) | 6818.01 | 6818.01 | 6818.02 | 6505.51 | 5267.93 | 4042.98 | 3235.31 | 2776.13 | 3340.14 | 4514.27 | 5850.54 | 6700.05 | **62686.90** |
| Generation Target (MWh) for 2068/69 | 6518.60 | 6521.37 | 6742.79 | 6640.30 | 5659.07 | 4144.38 | 3487.12 | 3128.39 | 3349.33 | 4137.65 | 5657.63 | 6620.37 | **62607.00** |
| Actual Generation (MWh) for 2068/69 | 7213.60 | 6965.40 | 7160.60 | 7348.80 | 5852.60 | 4391.40 | 3224.40 | 3298.10 | 3700.50 | 3744.80 | 6335.10 | 7147.8 | **66383.10** |
| Generation Target (MWh) for 2067/68 | 6466.11 | 6533.10 | 6532.33 | 6341.59 | 5516.55 | 4140.90 | 3431.24 | 3030.61 | 3398.94 | 4053.44 | 5352.05 | 6191.11 | **60987.98** |
| Actual Generation (MWh) for 2067/68 | 6500.80 | 6400.60 | 6902.10 | 6819.60 | 5480.90 | 3789.60 | 3163.00 | 2888.70 | 2776.60 | 3433.60 | 5314.20 | 6885.70 | **60355.40** |




| Sunkoshi Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY | 028/29 | 029/30 | 030/31 | 031/32 | 032/33 | 033/34 | 034/35 | 035/36 | 036/37 | 037/38 | 038/39 | 039/40 | 040/41 |
| Generation | 3,416.19 | 31,968.48 | 35,429.50 | 33,714.75 | 31,200.93 | 33,267.94 | 49,056.78 | 54,250.26 | 55,595.84 | 57,778.03 | 52,817.74 | 59,133.60 | 49,291.68 |
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 041/42 | Monthly Distribution is not Available | | | | | | | | | | | | 42,816.96 |
| 042/43 | 5,729.38 | 5,208.96 | 6,385.44 | 6,718.46 | 5,788.80 | 4,503.84 | 3,343.20 | 3,063.84 | 3,093.12 | 3,990.72 | 4,991.04 | 4,591.68 | 57,408.48 |
| 043/44 | 4,802.40 | 4,178.40 | 5,940.48 | 4,809.12 | 4,607.52 | 4,152.96 | 3,003.36 | 2,534.40 | 3,288.00 | 3,272.16 | 2,865.12 | 1,529.76 | 44,983.68 |
| 044/45 | Not in operation due to damage by flood | | | | | 865.28 | 2,222.56 | 1,168.32 | 1,696.32 | 1,750.56 | 2,185.44 | 1,751.04 | 11,639.52 |
| 045/46 | 2,858.88 | 3,874.52 | 3,535.20 | 4,270.08 | 4,057.44 | 4,196.16 | 4,058.88 | 3,545.28 | 4,022.88 | 4,654.12 | 4,733.76 | 4,770.72 | 48,577.92 |
| 046/47 | 4,269.12 | 4,410.24 | 4,446.24 | 5,513.28 | 4,380.00 | 3,034.56 | 2,960.16 | 3,038.40 | 3,255.36 | 3,376.32 | 774.24 | 2,503.68 | 41,961.60 |
| 047/48 | 4,549.92 | 4,441.44 | 5,308.80 | 5,692.32 | 3,965.28 | 3,191.04 | 3,041.28 | 2,767.20 | 3,015.84 | 3,636.96 | 4,212.96 | 4,243.68 | 48,066.72 |
| 048/49 | 4,445.28 | 5,049.12 | 6,165.12 | 5,892.96 | 4,094.40 | 3,682.08 | 3,012.00 | 2,767.68 | 2,849.28 | 3,044.16 | 3,983.04 | 4,613.28 | 49,598.40 |
| 049/50 | 4,516.80 | 4,745.28 | 4,573.92 | 4,875.84 | 5,106.24 | 3,861.12 | 3,072.96 | 2,664.00 | 2,693.76 | 4,491.84 | 5,375.04 | 6,446.88 | 52,423.68 |
| 050/51 | 6,000.00 | 6,650.40 | 6,679.68 | 6,441.12 | 5,185.92 | 3,627.84 | 3,196.80 | 2,797.92 | 1,920.96 | 3,528.96 | 6,100.32 | 6,456.96 | 58,586.88 |
| 051/52 | 6,968.64 | 6,914.40 | 7,080.00 | 6,479.04 | 4,602.24 | 3,505.92 | 2,984.64 | 2,855.52 | 3,367.68 | 4,591.20 | 6,115.24 | 6,085.48 | 61,550.00 |
| 052/53 | 6,141.60 | 6,484.80 | 6,975.36 | 6,516.96 | 5,258.40 | 4,247.04 | 3,644.64 | 3,468.00 | 3,728.16 | 4,785.60 | 5,902.56 | 5,846.88 | 63,000.00 |
| 053/54 | 5,525.76 | 5,726.40 | 5,776.80 | 6,566.88 | 5,496.00 | 4,080.48 | 3,200.64 | 2,961.60 | 2,952.96 | 2,892.96 | 4,983.84 | 5,398.08 | 55,562.40 |
| 054/55 | 3,967.20 | 5,180.64 | 6,457.92 | 6,340.80 | 5,385.12 | 4,097.28 | 3,102.24 | 3,040.32 | 3,804.96 | 5,533.44 | 6,466.20 | 5,989.92 | 59,366.04 |
| 055/56 | 5,430.24 | 6,509.76 | 6,383.52 | 6,591.84 | 5,055.36 | 3,977.76 | 3,362.88 | 2,972.16 | 2,900.16 | 3,418.56 | 1,438.56 | 6,711.36 | 54,752.16 |
| 056/57 | 6,804.96 | 7,261.92 | 7,057.44 | 6,986.40 | 6,209.28 | 4,695.84 | 3,362.88 | 3,036.00 | 3,374.88 | 4,134.72 | 6,459.84 | 6,804.00 | 66,188.16 |
| 057/58 | 6,442.08 | 5,617.44 | 5,773.44 | 5,976.00 | 5,158.08 | 3,974.88 | 3,149.28 | 2,833.92 | 2,783.52 | 3,471.36 | 4,239.84 | 4,861.44 | 54,281.28 |
| 058/59 | 5,542.56 | 4,260.00 | 5,604.96 | 5,013.12 | 4,890.24 | 3,785.76 | 3,280.32 | 2,733.60 | 3,024.96 | 3,868.32 | 4,088.16 | 4,728.48 | 50,820.48 |
| 059/60 | 5,343.84 | 5,426.88 | 5,999.52 | 5,411.52 | 940.80 | 3,651.36 | 3,109.44 | 3,098.88 | 3,454.08 | 4,291.68 | 6,051.36 | 6,015.84 | 52,795.20 |
| 060/61 | 5,537.28 | 4,536.96 | 4,199.52 | 5,566.56 | 4,980.48 | 3,947.52 | 3,168.96 | 2,822.40 | 2,729.76 | 3,359.04 | 4,783.68 | 4,549.44 | 50,181.60 |
| 061/62 | 5,595.84 | 5,120.16 | 5,423.52 | 4,398.24 | 4,736.16 | 4,049.32 | 3,436.59 | 3,254.59 | 3,461.83 | 4,129.48 | 5,744.83 | 884.21 | 50,234.77 |
| 062/63 | 4,739.47 | 4,502.41 | 4,357.76 | 3,863.95 | 4,593.01 | 3,879.40 | 3,354.79 | 2,924.04 | 3,378.33 | 4,419.53 | 5,878.11 | 5,437.85 | 51,328.66 |
| 063/64 | 5,467.43 | 4,559.52 | 5,412.63 | 5,577.42 | 5,410.49 | 4,187.63 | 3,524.46 | 3,486.95 | 4,169.47 | 3,873.49 | 5,560.20 | 5,374.30 | 56,603.99 |
| 064/65 | 5,365.10 | 5,570.70 | 5,453.20 | 4,710.40 | 4,835.20 | 4,032.60 | 3,370.00 | 3,070.70 | 2,774.80 | 3,264.80 | 5,100.60 | 5,536.20 | 53,084.30 |
| 065/66 | 6,402.80 | 6,161.80 | 6,683.80 | 6,952.50 | 5,477.70 | 3,967.50 | 3,183.00 | 2,721.30 | 2,983.60 | 3,673.80 | 5,702.70 | 6,683.10 | 60,593.60 |
| 066/67 | 6,695.60 | 6,815.40 | 6,779.60 | 6,514.60 | 5,230.90 | 3,761.20 | 2,957.00 | 2,588.30 | 2,805.10 | 2,983.80 | 4,284.70 | 5,969.20 | 57,385.40 |
| 067/68 | 6,500.80 | 6,400.60 | 6,902.10 | 6,819.60 | 5,480.90 | 3,789.60 | 3,163.00 | 2,888.70 | 2,776.60 | 3,433.60 | 5,314.20 | 6,885.70 | 60,355.40 |
| 068/69 | 7,213.60 | 6,965.40 | 7,160.60 | 7,348.80 | 5,852.60 | 4,391.40 | 3,224.40 | 3,298.10 | 3,700.50 | 3,744.80 | 6,335.10 | 7,147.80 | 66,383.10 |
| 069/70 | 7,131.40 | 7,194.40 | 7,152.20 | 7,063.20 | 5,115.50 | 3,636.90 | - | - | - | - | - | - | 37,293.60 |
| | | | | | | | | | | | Till Date Generation, MWh | | 2,064,745.70 |

# ILAM (PUWAKHOLA) HYDROPOWER STATION

## Introduction:

Puwa Khola Hydropower Station, run of river type, located at Golakharka, Ilam having installed capacity of 6.2 MW and annual design generation of 48 GWh was commissioned in 1999 AD. It was jointly developed by Government of Nepal and NEA at a cost of USD 15.7 million. It is the only sizable hydropower plant NEA has in the Easten part of Nepal. The station has two units each with 3.1 MW.


Machine Hall

The cumulative generation of the station has reached 357.13 GWh till 2011/12 from its first run. The station has generated 31.55 GWh in FY 2010/11 and 28.33 GWh in FY 2011/12 with a decrease of 10.2%. It contributed 0.68% of the total energy in INPS in 2011/12.

## Present status:

Presently, both of the units are in normal operation. Frequent faults in 33 kV transmission line between Anarmani and Ilam has hampered in the operation of the plant. The penstock repair work between Anchor Block No. 3 & 5 has been completed to keep its alignment intact as fragile geology in the vicinity prompted anchor blocks to shrink. All possible temporary measures with crack filling, repair works with high strength concrete in forebay, head tank, improving penstock support blocks etc. have been undertaken.

## Repair and Maintenance Activities:

The following activities were accomplished during FY 2010/11 & 2011/12:

## Mechanical Works:

- Replacement of needle, nozzle, oil-cup seal during overhauling of Unit No. 1 & 2
- Replacement of screw pump and non-returning valve of pressure device tank
- Repair and maintenance of penstock pipe between Anchor Block No. 3 to 5

## Electrical Works:

- Repair and maintenance of primary contacts VCBs
- Replacement of lightning arrester
- Installation of 33/0.4 kV, 100 kVA dedicated supply for head tank gate operation

Pelton Turbine

5 and 6 at dam site.

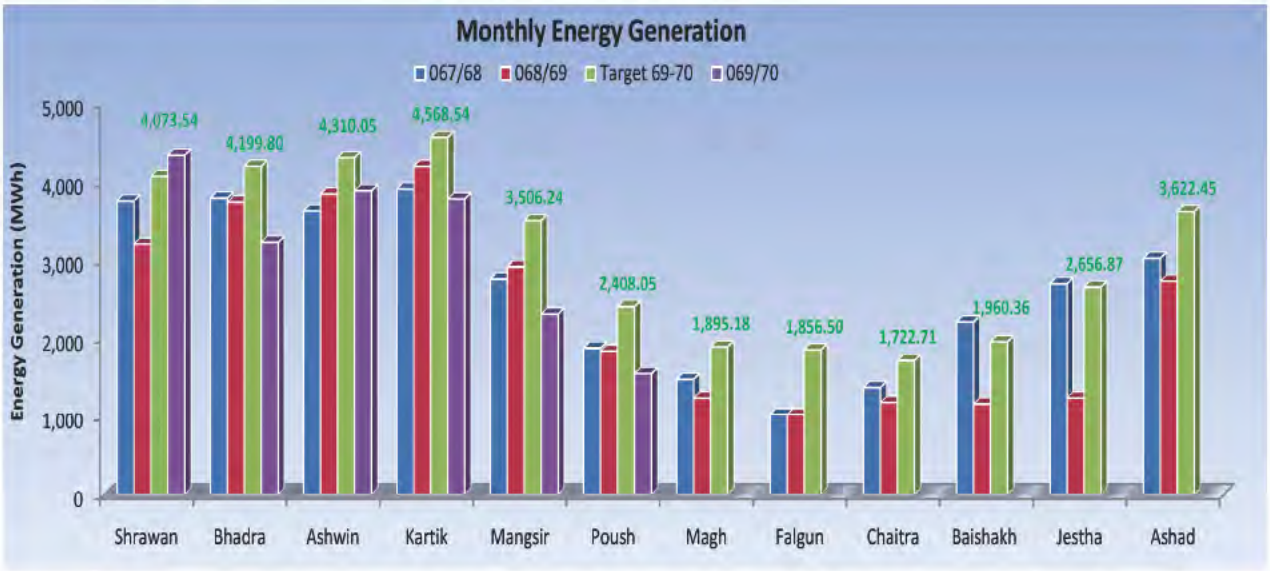


Ciruit Breakers with Control and Relay Panel

## Civil Maintenance Works:

- Protection works against landslide on the way to the power house
- Repair and maintenance of head tank reservoir and forebay
- Repair and maintenance of weir at dam site
- Protection works against landslide in penstock line at Anchor Block No. 3

| SALIENT FEATURES OF ILAM (PUWAKHOL) HYDROPOWER STATION | |
|---|---|
| Type | Run-of-river |
| Location | Ilam |
| Installed capacity | 6.2 MW |
| Annual average energy | 48 GWh |
| Maximum Net head | 304 m |
| Catchment area | 125.1 $km^2$ |
| Average annual flow | 2.5 $m^3/s$ |
| Live storage volume | 2,057 $m^3$ |
| Dam | Diversion Weir Type, 30.4 m Crest Length |
| Total length of the waterways | 3.7 km |
| Penstock | 1 No., 1001 m Long, 1.10-0.60 m, Steel Pipe |
| **Turbine** | |
| Number and Type | 2, Horizontal Pelton |
| Rated discharge | 1.25 $m^3/s$ |
| Rated output | 3.3 MW |
| Rated speed | 600 rpm |
| **Generator** | |
| Rated output | 3.7 MVA |
| Rated voltage | 6.6 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.85 |
| **Power transformer** | **8 MVA, 6.6/33 kV, 3 Phase, 1 No.** |
| **Transmission line** | **33 kV, 3.5 km, Single Circuit** |




| Ilam (Puwakhola) Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 056/57 | - | - | - | - | - | - | - | - | 421.73 | 1,847.65 | 2,367.41 | 2,478.72 | 7,115.51 |
| 057/58 | 2,628.29 | 2,518.90 | 2,035.06 | 2,077.97 | 2,146.08 | 1,890.38 | 1,166.98 | 1,548.59 | 965.22 | 1,160.06 | 1,735.15 | 1,424.37 | 21,297.04 |
| 058/59 | 1,971.70 | 2,325.70 | 2,844.05 | 2,809.31 | 2,476.13 | 2,173.29 | 1,875.70 | 1,404.58 | 1,494.05 | 1,743.87 | 1,831.92 | 1,208.30 | 24,158.58 |
| 059/60 | 2,075.86 | 2,696.64 | 2,952.38 | 3,343.01 | 2,845.97 | 2,102.69 | 1,753.10 | 1,927.78 | 2,046.14 | 1,325.95 | 1,767.62 | 1,328.06 | 26,165.20 |
| 060/61 | 3,007.44 | 3,095.28 | 2,665.54 | 3,540.96 | 3,421.92 | 2,470.51 | 2,117.23 | 1,677.07 | 1,627.61 | 1,640.60 | 3,350.45 | 2,741.82 | 31,356.43 |
| 061/62 | 3,316.80 | 3,187.59 | 3,338.33 | 3,660.24 | 3,247.06 | 1,464.05 | 1,851.84 | 1,382.30 | 1,711.73 | 1,785.31 | 1,392.48 | 3,040.13 | 29,377.86 |
| 062/63 | 3,676.80 | 3,741.26 | 4,164.24 | 3,558.61 | 2,431.33 | 1,572.97 | 1,327.99 | 1,169.05 | 1,058.28 | 1,507.48 | 2,385.29 | 2,337.56 | 28,930.86 |
| 063/64 | 2,011.76 | 2,074.18 | 3,098.59 | 3,904.87 | 3,105.39 | 2,081.66 | 1,672.91 | 2,702.60 | 1,853.35 | 2,503.26 | 3,416.93 | 4,047.99 | 32,473.49 |
| 064/65 | 3,374.65 | 3,972.89 | 3,614.03 | 3,895.59 | 3,341.40 | 2,215.96 | 2,018.26 | 1,828.18 | 1,601.96 | 1,573.84 | 3,559.66 | 3,644.51 | 34,640.93 |
| 065/66 | 4,335.25 | 3,881.78 | 3,865.54 | 4,111.40 | 2,727.56 | 2,070.11 | 1,572.28 | 1,188.46 | 1,353.81 | 1,242.44 | 1,888.35 | 3,446.00 | 31,682.98 |
| 066/67 | 3,672.97 | 3,526.06 | 3,821.13 | 3,930.76 | 3,002.19 | 2,047.17 | 1,373.22 | 1,030.71 | 915.80 | 1,423.78 | 1,547.19 | 3,767.11 | 30,058.07 |
| 067/68 | 3,757.73 | 3,794.36 | 3,629.72 | 3,910.51 | 2,759.77 | 1,877.91 | 1,480.84 | 1,021.18 | 1,374.88 | 2,212.69 | 2,700.74 | 3,027.51 | 31,547.81 |
| 068/69 | 3,205.89 | 3,743.02 | 3,846.84 | 4,197.49 | 2,916.64 | 1,839.38 | 1,239.85 | 1,019.31 | 1,182.94 | 1,163.55 | 1,240.52 | 2,734.57 | 28,329.99 |
| 069/70 | 4,341.68 | 3,228.63 | 3,888.38 | 3,783.06 | 2,312.64 | 1,553.41 | - | - | - | - | - | - | 19,107.80 |
| | | | | | | | | | | | Till Date Generation, MWh | | 276,242.54 |

# CHATARA HYDROPOWER STATION

## Introduction:

Chatara Hydropower Station, a canal drop type power station, is located at Chatara, Sunsari with installed capacity of 3.2 MW and annual design generation of 6 GWh. It was commissioned in 1996 AD in assistance from Government of India at a cost of NRs. 162.6 million and was handed over to NEA by Sunsari Morand Irrigation Project (SMIP) on 29 March, 1999. Presently, Unit No. 2 is not in operation due to problems related to turbine runner assembly and electrical controls whereas Unit No. 1 is in normal operation. However, the power station has not undergone any major overhauling since the plant was brought into operation in 1996. The inconveniences to access the turbine assembly and the inability of gates and stop logs to seal the water have restricted the regular maintenance of the units. Team of in-house experts after visiting the site has given recommendations in connection with the repair and maintenance of the turbines. Based on recommendations, the power station has planned to carry out the overhauling of Unit No. 2 this year after procuring the additional spare parts and in coordination with Sunsari-Morang Irrigation Project, Biratnagar.

Turbing Hood

The cumulative generation of Chatara HPS has reached 43.0 GWh. It has generated 4.1 GWh in the FY 2010/11 and 3.03 GWh of energy in FY 2011/12 with a decrease of 26% compared to the previous year generation. Generation from this station contributed 0.07% of the total energy in the INPS in 2011/12.

Switchyard

## Present status:

One of the two generating units is capable to operate in its full capacity. Turbines of this power station are Bevel Bulb type, in which NEA lacks in-house competency for repair and maintenance. The sharing of water inflow with Sunsari-Morang Irrigation Project, Biratnagar for irrigation purposes restrains the normal operation and maintenance of this plant. MOCB switchgears have been replaced by VCBs at different phases in previous years. The remaining MOCBs will be replaced by VCBs this year for which bids have been already invited under National Competitive Bidding Procedure.

## Repair and Maintenance Activities:

The following activities were performed during FY 2011/12.

## Mechanical Works:

- Repair and maintenance of overhead gantry crane
- Replacement of turbine shaft oil seal
- Repair of governor high pressure oil system
- Replacement of hydraulic pressure pipe
- Preventive/ Schedule maintenance and inspection have been carried out for each and every part regularly.

Turbine Hub Dismantling

## Electrical Works:

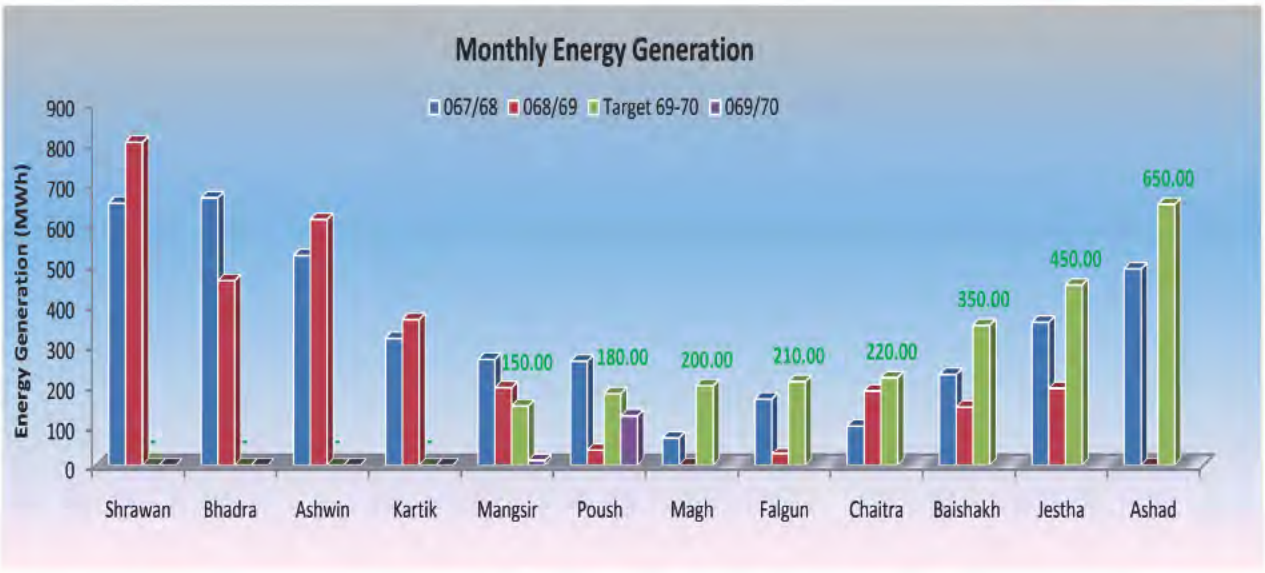
- Generator maintenance, insulation and protective gear maintenance have been thoroughly carried out for the protection panel.
- Replacement of MOCBs by VCBs has been done for four pairs and three of them will be carried out on FY 2012/13.
- Other regular electrical maintenance, Relay testing, meggaring and inspection.
- The MOCB switchgears have been replaced by VCBs at different phases in previous years. The remaining MOCBs will be replaced by VCBs this year for which the bids have been already invited under National Competitive Bidding Procedure.

## Civil Maintenance Works:

Various civil works performed during FY 2068/69 are summarized below:

- Cleaning, painting and incipient civil maintenance works.
- Maintenance of main canal, cleaning of the head pond and maintenance of headwork and tailrace on regular routines.
- Protection of buildings and civil structures etc.

| SALIENT FEATURES OF CHATARA HYDROPOWER STATION | |
|---|---|
| Type | Canal |
| Location | Sunsari Morang |
| Installed capacity | 3.2 MW |
| Annual average energy | 6 G Wh |
| Maximum Net head | 5.38 m |
| **Turbine** | |
| Number and Type | 2, Kaplan |
| Rated speed | 165 rpm |
| **Generator** | |
| Rated output | 1627 kW |
| Rated voltage | 11 kV |
| Rated frequency | 50 Hz |
| Power transformer | 3500 kVA, 11/33 kV |
| Transmission line | 33 kV, 14 km |




Chatara Hydropower Station — MWh

| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 052/53 | - | - | - | - | - | - | - | - | - | - | - | 23.00 | 23.00 |
| 053/54 | 143.25 | 121.75 | 190.50 | 75.50 | 170.50 | 202.00 | 132.50 | 209.75 | - | - | 121.50 | 63.75 | 1,431.00 |
| 054/55 | 98.75 | 46.00 | 62.75 | 33.50 | 44.25 | 30.75 | 11.50 | - | - | 1.25 | 42.50 | 119.50 | 490.75 |
| 055/56 | 113.25 | 109.50 | 33.00 | - | - | - | - | - | 47.00 | 283.75 | 310.25 | 290.75 | 1,187.50 |
| 056/57 | 352.50 | 509.25 | 672.50 | 377.50 | 362.50 | 183.00 | 301.00 | 213.00 | 191.75 | 138.75 | 313.00 | 638.25 | 4,253.00 |
| 057/58 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 058/59 | 125.00 | 23.75 | 60.50 | - | - | - | - | - | - | - | - | - | 209.25 |
| 059/60 | - | - | - | - | - | - | - | - | - | 17.75 | 428.50 | 532.25 | 978.50 |
| 060/61 | 683.50 | 666.50 | 602.25 | 317.50 | 247.75 | 285.25 | 173.75 | 3.75 | 123.25 | 327.00 | 429.75 | 644.00 | 4,504.25 |
| 061/62 | 746.00 | 590.50 | 458.25 | 457.00 | 182.50 | 112.75 | 213.00 | 92.00 | 108.75 |  | 420.25 | 734.00 | 4,115.00 |
| 062/63 | 1,008.00 | 933.50 | 621.75 | 310.75 | 303.00 | 106.75 | Not run | Not run | 35.25 | 69.75 | 554.00 | 620.50 | 4,563.25 |
| 063/64 | 707.25 | 759.00 | 765.75 | 435.75 | 341.00 | 239.75 | 8.00 | 285.75 | 299.50 | 338.25 | 479.25 | 560.50 | 5,219.75 |
| 064/65 | 462.75 | 673.75 | 659.25 | 287.75 | 78.25 | 284.25 | 163.50 | 110.25 | 168.25 | 292.25 | 370.00 | 289.00 | 3,839.25 |
| 065/66 | 609.25 | 383.75 | 110.50 | 113.25 | 113.25 | 91.75 | 181.00 | 133.00 | 109.00 | 138.25 | 376.25 | 279.00 | 2,638.25 |
| 066/67 | 163.00 | 213.50 | 396.25 | 197.25 | 172.25 | 100.50 | 49.25 | 27.50 | 79.00 | 172.00 | 349.25 | 504.75 | 2,424.50 |
| 067/68 | 653.25 | 666.25 | 522.75 | 317.25 | 265.00 | 260.75 | 70.75 | 167.00 | 99.75 | 227.75 | 357.50 | 489.75 | 4,097.75 |
| 068/69 | 804.25 | 460.75 | 612.75 | 364.25 | 195.00 | 39.75 | - | 28.75 | 187.25 | 146.75 | 193.25 | - | 3,032.75 |
| 069/70 | - | - | - | - | 11.25 | 125.00 | - | - | - | - | - | - | 136.25 |
|  |  |  |  |  |  |  |  |  |  |  | Till Date Generation, MWh |  | 43,144.00 |

# PANAUTI HYDROPOWER STATION

## Introduction:

Panauti Hydropower Station is a run of river hydropower plant and is located at Khopasi, Panauti, 35 km east of Kathmandu with installed capacity of 2.4 MW and annual design generation of 6.97 GWh. It was commissioned in 1965 AD and developed jointly by Soviet Union Government and GON at a cost of NRs. 27 million.

The station was initially developed with dual purpose of hydropower generation and irrigation in the vicinity. However, water in the canal in recent years has also been used for drinking purposes as well.

The cumulative generation of the station has reached 121.16 GWh till FY 2011/12 from its first run. The station has generated 2.73 GWh in FY 2010/11 and 1.28 GWh in FY 2011/12 with a decrease of 53.09%. It contributed only 0.03% of energy in INPS in FY 2011/12.

## Present status:

The ongoing rehabilitation project of this station consists of electromechanical renovation and modernization of all the units under the assistance of GON. The project cost was estimated at NRs. 30 million. The replacement of stator coils and switchgear system in Unit No. 2 have been successfully completed recently. The electromechanical rehabilitation of remaining units is underway from the assistance of GON and is scheduled to be complete by next year. The project was initially designed for operation of only two units simultaneously and one unit as standby.

View of Power House and Substation

Lifting of Stator during Overhauling

The unilateral decision of Banepa/Dhulikhel/ Panauti Municipality to implement the project called Kavre Valley Integrated Drinking Water Project funded by ADB for consumptive use of water from the resources of Roshi Khola in Kavre, Dhulikhel and surrounding areas could impact its long term operation.

## Repair and Maintenance Activities:

The following activities were carried out during FY 2010/11 & 2011/12.

## Mechanical Works:

- Repair and maintenance of side cover rings, bearing housing of Unit No. 2
- Repair of commutator of Unit No. 2
- Repair of four number of link arms in Unit No. 3

## Electrical Works:

- Rewinding of generator stator winding in Unit No. 2

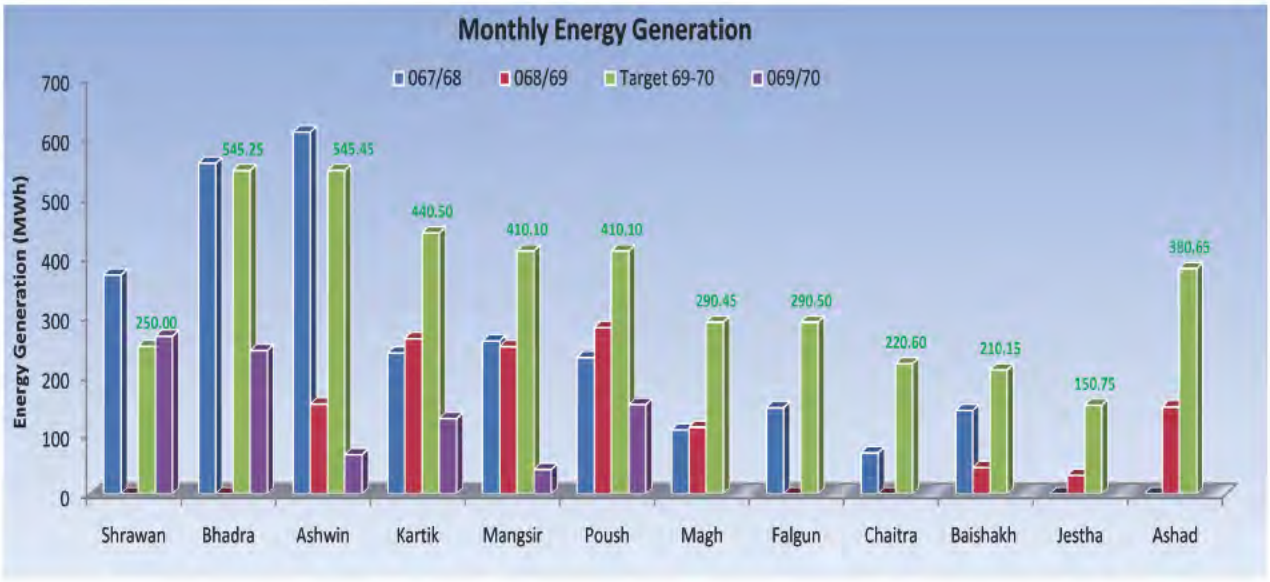
High Voltage Test carried out in newly installed Stator of Unit No. 2

- Installation of new VCB with Control and Relay Panel in Unit No. 2
- Repair of generator winding of Unit No. 3

## Civil Maintenance Works:

- Construction of boundary wall in the power house premise
- Cleaning of drainage in office building and power house
- Construction of temporary shed at dam
- Repair of canal

| SALIENT FEATURES OF PANAUTI HYDROPOWER STATION | |
|---|---|
| Type | Run-of-River |
| Location | Panauti Municipality-12, Khopasi |
| Installed capacity | 2.4 MW |
| Annual average energy | 6.97 GWh |
| Maximum gross head / Net head | 66m /60 m |
| Catchment area | |
| Average annual flow | 3.2 $m^3/s$ |
| Live storage volume | 50,000 $m^3$ |
| Dam | |
| Total length of the waterways | 3.721 km |
| Penstock | 1 No., 370 m long, 1.4m |
| **Turbine** | |
| Number and Type | 3, Horizontal Francis |
| Rated discharge | 1.61 $m^3/s$ |
| Rated output | 0.85 MW |
| Rated speed | 1,000rpm |
| **Generator** | |
| Rated output | 1000 kVA |
| Rated voltage | 6.3 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.80 |
| Power transformer | 1550 kVA, 6.3 kV/33 kV, 3 phase, 2 Nos. |
| Transmission line | 33 kV, 20 km, single circuit |




| Panauti Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY | 2032/33 | 2033/34 | 2034/35 | 2035/36 | 2036/37 | 2037/38 | 2038/39 | 2039/40 | 2040/41 | 2041/42 | 2042/43 | 2043/44 | 2044/45 |
| Generation | 3,895.10 | 2,848.58 | 3,062.96 | 3,338.75 | 3,721.35 | 4,599.00 | 4,484.16 | 3,827.00 | 4,539.06 | 3,838.34 | 3,360.34 | 3,249.72 | 3,964.50 |
| FY | 2045/46 | 2046/47 | 2047/48 | 2048/49 | 2049/50 | 2050/51 | 2051/52 | 2052/53 | 2053/54 | 2054/55 | 2055/56 | 2056/57 | 2057/58 |
| Generation | 3,782.70 | 2,721.89 | 2,371.86 | 2,501.11 | 2,600.02 | 3,123.53 | 4,007.52 | 3,727.08 | 4,349.16 | 3,559.38 | 1,976.41 | 2,437.92 | 3,891.24 |
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 058/59 | 427.32 | 581.76 | 683.10 | 590.04 | 428.04 | 331.02 | 275.22 | 206.82 | 196.38 | 225.54 | 306.72 | 402.84 | 4,654.80 |
| 059/60 | 550.80 | 330.66 | - | - | - | - | - | - | - | - | 81.18 | 458.82 | 1,421.46 |
| 060/61 | 594.90 | 567.36 | 442.44 | 426.96 | 416.16 | 355.32 | 253.26 | 163.80 | 123.48 | 156.78 | 203.04 | 98.10 | 3,801.60 |
| 061/62 | 555.66 | 607.86 | 611.64 | 463.86 | 358.38 | 281.16 | 218.52 | 118.80 | 121.68 | 127.98 | 56.88 | 162.00 | 3,684.42 |
| 062/63 | 437.22 | 512.64 | 473.04 | 430.74 | 300.42 | 195.66 | 96.30 | 81.90 | 77.04 | 194.58 | 236.16 | 39.24 | 3,074.94 |
| 063/64 | 394.38 | 539.28 | 529.56 | 280.98 | 309.60 | 194.76 | 147.96 | 187.02 | 50.76 | - | 29.28 | 234.97 | 2,898.55 |
| 064/65 | 281.16 | 272.88 | 359.40 | 390.42 | 318.42 | 311.76 | 205.20 | 186.30 | 135.72 | 143.64 | 175.50 | 297.54 | 3,077.94 |
| 065/66 | 336.60 | 236.70 | 234.72 | 237.24 | 255.78 | 209.70 | 95.94 | 64.98 | 78.48 | 86.18 | 37.76 | 5.47 | 1,879.55 |
| 066/67 | 399.92 | 643.81 | 538.70 | 373.72 | 277.65 | 193.46 | 72.92 | 103.92 | 35.66 | 101.07 | 18.77 | 119.72 | 2,879.31 |
| 067/68 | 369.85 | 557.42 | 609.79 | 238.54 | 258.74 | 230.84 | 107.18 | 146.39 | 68.56 | 141.91 | - | - | 2,729.22 |
| 068/69 | - | - | 152.64 | 262.80 | 249.30 | 281.34 | 111.78 | - | - | 43.74 | 30.78 | 147.78 | 1,280.16 |
| 069/70 | 266.76 | 242.82 | 65.52 | 126.18 | 40.65 | 151.85 | - | - | - | - | - | - | 893.78 |
| | | | | | | | | | | Till Date Generation, MWh | | | 122,054.41 |

# SETI HYDROPOWER STATION

## Introduction:

Seti Hydropower Station is a run of river type with installed capacity of 1.5 MW and design generation of 9.8 GWh consisting of 3 units each 0.5 MW. It is located at Nadipur, Pokhara and was commissioned in 1985 AD with assistance from Government of People's Republic of China and Government of Nepal. Power canal for this power station is jointly used for irrigation purposes looked after by Department of Irrigation and hence, the operation of this power station is affected by irrigation as well.

Overview of Generating Units

The cumulative generation of Seti HPS has reached 254.77 GWh till 2011/12 from its first run. The station has generated 11.62 GWh in FY 2010/11 and 10.41 GWh in FY 2011/12 with decrease of 10.37%. The station contributed 0.25% of the total energy in the INPS in 2011/12.

## Present status:

Presently, all the three units are in normal operation and the station has the ability to operate at its full capacity round the year. Unprecedented flood level in Seti River in March last year disrupted the operation of this station for a week. The disastrous flood inflicting significant damages elsewhere was subdued due to alert maneuver from the station avoiding any significant damages to hydro mechanical structures. However, major repair and maintenance works are required in headworks area in the near future. Any deferral is not warranted.

## Repair and Maintenance Activities:

Overhauling of Unit No. 3

## Mechanical Works:

- Maintenance of governor and high pressure oil system
- Repair of governor air oil pressure in Unit No. 3
- Overhauling of Unit No. 3 (new runner, side plate)
- Repair of de-silting basin gate at Jaubari
- Replacement of steel rope at dam site

## Electrical Works:

- Inspection of generator stator, rotor and checking of insulation and protective gear.

Maintenance of Brake system

- Relay testing, meggaring and inspection.
- Rewinding of step-up transformer No.-2
- Oil filtration and insulation improvement in transformers.
- Replacement of 11kV XLPE cable with cable termination
- Rewinding of magnetic amplifier and phase compound transformer of excitation panel of Unit No. 2.

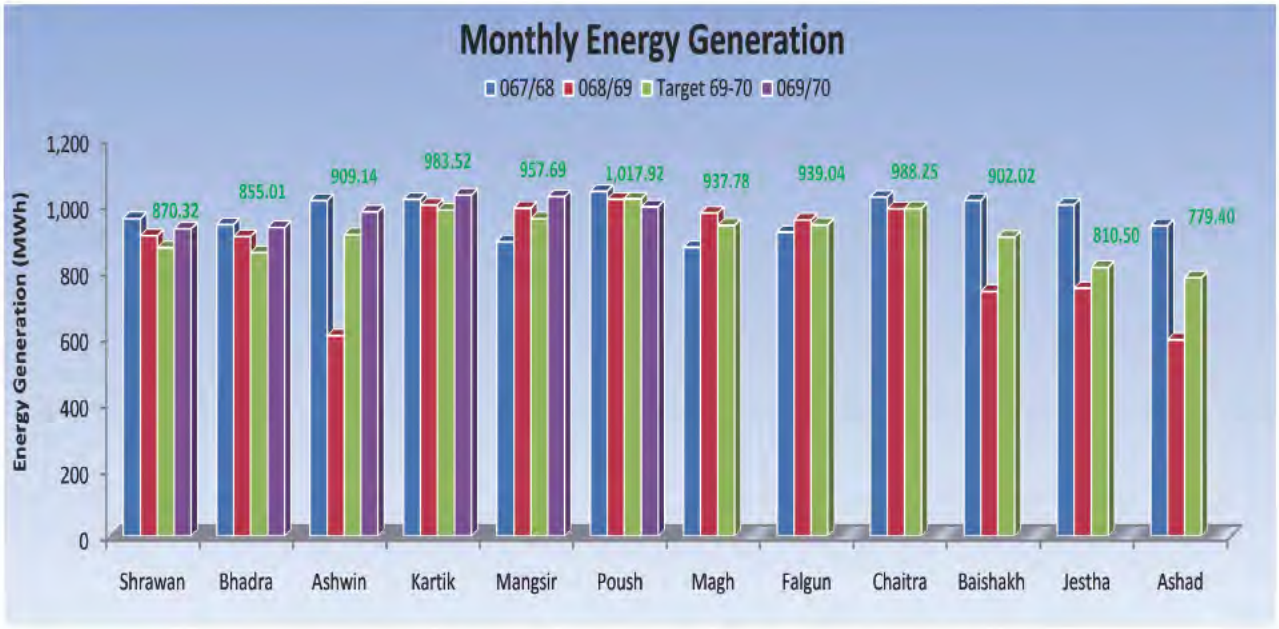
## Civil Maintenance Works:

- Cleaning, painting civil maintenance works.
- Protection works in old buildings and civil structures
- Temporary diversion works at intake of headworks.
- Relocating desander basin flushing gate to original position.
- Removal of huge deposition of debris, logs and silt during flood at power canal

## ONGOING WORKS

The ongoing modification and renovation works of excitation system and replacement of existing MOCBs with VCB and Control and Relay system will be completed by this year. The equipments have been delivered at the site and as soon as the shutdown schedule is finalized with LDC, installation works will commence. Renovation of switchgear system is a part of Rehabilitation Project of Power Stations jointly funded by GON and NEA. The station has also planned major repair and maintenance works at headworks, funding for which has not been finalized yet.

| SALIENT FEATURES OF SETI HYDROPOWER STATION | |
|---|---|
| Type | Run of River |
| Location | Nadipur, Pokhara |
| Installed capacity | 1.5MW |
| Annual average energy | 9.8 GWh |
| Maximum Net head | 22.5 m |
| Total length of the waterways | 7.7 km |
| Penstock | 1 No., 90 m long, 2.4 m, steel lined |
| **Turbine** | |
| Number and Type | 3, Horizontal Francis |
| Rated discharge | 2.96 $m^3/s$ |
| Rated output | 543 kW |
| Rated speed | 500 rpm |
| **Generator** | |
| Rated output | 625 kVA |
| Rated voltage | 6.3 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.80 |
| Power transformer | 650 kVA, 6.3/11 kV, 3 Nos. |
| Transmission line | 11 kV |




| Seti Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | - | - |
| Generation | 2160.54 | 7940.34 | 9479.16 | 9285.48 | 10017.09 | 8503.29 | 8572.59 | 9825.39 | 10799.1 | 10903.59 | 10533.52 | - | - |
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 053/54 | 786.59 | 819.69 | 899.54 | 921.16 | 949.25 | 927.82 | 968.11 | 903.40 | 914.64 | 905.21 | 924.37 | 635.77 | 10,555.55 |
| 054/55 | 759.42 | 784.23 | 874.04 | 786.17 | 664.25 | 700.21 | 814.81 | 450.46 | 274.33 | 609.84 | 658.71 | 610.79 | 7,987.26 |
| 055/56 | 745.38 | 640.53 | 747.81 | 921.69 | 868.32 | 893.97 | 841.77 | 693.99 | 687.17 | 699.75 | 794.60 | 770.93 | 9,305.91 |
| 056/57 | 786.87 | 809.07 | 811.44 | 877.68 | 819.39 | 831.28 | 715.63 | 650.61 | 686.56 | 875.45 | 821.77 | 660.96 | 9,346.71 |
| 057/58 | 800.28 | 807.33 | 814.47 | 927.54 | 902.43 | 752.22 | 600.93 | 772.37 | 670.83 | 663.93 | 788.76 | 804.52 | 9,305.61 |
| 058/59 | 732.33 | 857.50 | 721.53 | 708.03 | 770.67 | 685.89 | 525.06 | 477.45 | 647.28 | 728.10 | 639.99 | 543.87 | 8,037.70 |
| 059/60 | 681.48 | 783.81 | 869.22 | 910.80 | 875.79 | 824.76 | 693.27 | 793.08 | 833.22 | 612.90 | 686.25 | 635.13 | 9,199.71 |
| 060/61 | 690.84 | 746.64 | 714.78 | 848.34 | 761.04 | 582.03 | 557.37 | 518.31 | 648.37 | 861.48 | 884.88 | 766.08 | 8,580.16 |
| 061/62 | 751.23 | 809.55 | 826.11 | 888.93 | 827.82 | 726.48 | 820.44 | 735.48 | 679.95 | 650.79 | 793.44 | 642.24 | 9,152.46 |
| 062/63 | 703.17 | 698.67 | 940.86 | 913.41 | 933.93 | 898.56 | 880.29 | 457.11 | 808.47 | 866.52 | 731.43 | 826.83 | 9,659.25 |
| 063/64 | 931.77 | 963.18 | 920.07 | 940.41 | 913.14 | 965.70 | 891.27 | 916.56 | 909.90 | 692.91 | 782.19 | 877.68 | 10,704.78 |
| 064/65 | 798.57 | 700.56 | 932.58 | 916.29 | 918.90 | 995.94 | 940.23 | 976.23 | 1,008.45 | 1,032.84 | 1,035.99 | 566.19 | 10,822.77 |
| 065/66 | 918.45 | 854.64 | 888.03 | 999.09 | 967.59 | 920.25 | 955.26 | 740.07 | 902.34 | 852.93 | 921.87 | 949.59 | 10,870.11 |
| 066/67 | 757.35 | 767.81 | 1,076.49 | 1,045.35 | 1,088.10 | 1,070.46 | 1,011.15 | 931.86 | 1,012.50 | 1,033.83 | 487.80 | 915.03 | 11,197.73 |
| 067/68 | 957.87 | 940.12 | 1,012.59 | 1,016.91 | 887.85 | 1,040.58 | 871.20 | 917.10 | 1,022.85 | 1,012.77 | 999.36 | 936.99 | 11,616.19 |
| 068/69 | 906.03 | 903.60 | 603.99 | 998.64 | 989.55 | 1,016.91 | 974.70 | 953.46 | 987.57 | 737.73 | 747.18 | 591.93 | 10,411.29 |
| 069/70 | 927.00 | 930.96 | 978.03 | 1,029.24 | 1,024.20 | 993.87 | - | - | - | - | - | - | 5,883.30 |
| | | | | | | | | | | | Till Date Generation, MWh | | 260,656.58 |

# FEWA HYDROPOWER STATION

## Introduction:

Fewa hydropower station is a canal drop type power station having an installed capacity of 1.0 MW and located at Pardi, Birauta, Pokhara with an annual design generation of 6.5 GWh. It consists of 4 units each 0.25 MW. It was commissioned in 1969 AD and developed jointly by Government of India and Government of Nepal. The public encroachment of power canal leading to power house is a concern for normal operation regardless of the availability of generating units.

Machine Hall

The cumulative generation of the station has reached 82.57 GWh till 2011/12 from its first run. It has generated 1.91 GWh in FY 2010/11 and 1.87 GWh in FY 2011/12 with a decrease of 2.16%. It contributed only 0.04% of the total energy in INPS in FY 2011/12.

## Present status:

Presently, only Unit No. 1, 2 & 3 are in operation at rated capacity while remaining Unit No. 4 has problems in generator turbine coupling. Efforts have been made to bring all the units into operation as soon as possible. However, operation of only two units at a time is possible due to insufficient canal inflow.

## Repair and Maintenance Activities:

The following activities were performed during FY 1010/11 & 2011/12.

## Mechanical Works:

- Maintenance of governor, excitation system, high pressure oil system.
- Repair maintenance of draft tube of Unit No. 1

## Electrical Works:

- Replacement of 11kV lightning arrester and drop out fuses
- Replacement of 11 kV, 200-400 A load disconnecting switches
- Replacement of damage and old pin insulator of 11KV line.

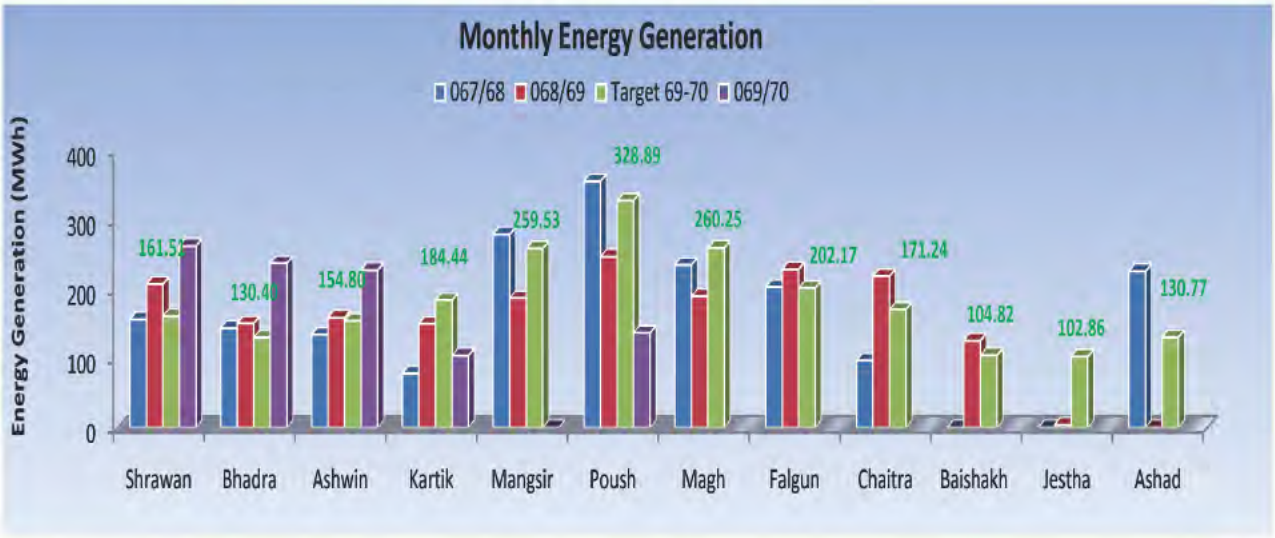
## Civil Maintenance Works:

- Repair maintenance of forebay gate
- Protection works of old buildings and civil structures
- Repair and maintenance of approximately 300 m power canal

Canal Repair Works

| SALIENT FEATURES OF FEWA HYDROPOWER STATION | |
|---|---|
| Type | Canal Drop |
| Location | Baidam, Pokhara |
| Installed capacity | 1.0 MW |
| Annual average energy | 6.5 GWh |
| Maximum Net head | 74.68 m |
| Total length of the waterways | 1.0 km |
| Penstock | |
| **Turbine** | |
| Number and Type | 4, Horizontal Francis |
| Rated speed | 1,000 rpm |
| **Generator** | |
| Rated output | 288 kW |
| Rated voltage | 400 V |
| Rated frequency | 50 Hz |
| Power transformer | 350 kVA, 0.4/11 kV, 4 Nos. |
| Transmission line | 11 kV |

Operation Panels




| Fewa Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 |
| Generation | 326.66 | 615.16 | 819.72 | 1013.17 | 1254.45 | 1738.81 | 1488.87 | 2961.13 | 3410.38 | 3919.47 | 3761.97 | 2884.24 | 2247.54 |
| Year | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 |
| Generation | 1371.48 | 3433.32 | 1682.71 | 1035.21 | 1579.49 | 2061.91 | 1599.45 | 2532.68 | 1986.69 | 843.56 | 489.16 | 2104.02 | 1849.52 |
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 2051 | | | | | | | | | | | | | 2,012.91 |
| 2052 | | | | | Monthly Distribution is not Available | | | | | | | | 2,404.10 |
| 053/54 | 115.46 | 97.09 | 97.85 | 460.10 | 431.19 | 305.30 | 265.75 | 0.00 | 0.00 | 97.17 | 519.23 | 478.59 | 2,867.73 |
| 054/55 | 87.47 | 41.47 | 127.91 | 174.31 | 188.83 | 462.04 | 395.45 | 199.44 | 40.03 | 0.00 | 209.43 | 300.05 | 2,226.43 |
| 055/56 | 168.12 | 57.26 | 136.19 | 266.40 | 425.59 | 482.13 | 293.79 | 285.73 | 28.00 | 0.00 | 0.00 | 315.69 | 2,458.90 |
| 056/57 | 97.56 | 6.29 | 11.65 | 268.47 | 383.28 | 313.48 | 260.25 | 192.22 | 110.56 | 265.25 | 214.08 | 107.41 | 2,230.50 |
| 057/58 | 26.15 | 46.11 | 64.51 | 250.05 | 52.15 | 338.22 | 207.52 | 113.92 | 2.80 | 0.00 | 0.00 | 0.00 | 1,101.43 |
| 058/59 | 0.00 | 13.17 | 0.00 | 156.58 | 229.58 | 296.02 | 193.90 | 176.19 | 120.52 | 63.22 | 0.00 | 0.00 | 1,249.18 |
| 059/60 | 0.00 | 0.00 | 0.00 | 0.00 | 303.16 | 354.28 | 272.18 | 197.20 | 139.49 | 169.91 | 188.15 | 120.54 | 1,744.91 |
| 060/61 | 109.16 | 97.59 | 135.38 | 75.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 109.68 | 527.27 |
| 061/62 | 56.23 | 103.74 | 159.73 | 65.02 | 238.71 | 234.24 | 230.18 | 117.88 | 20.87 | 1.81 | 35.76 | 88.24 | 1,352.41 |
| 062/63 | 202.22 | 274.01 | 278.35 | 152.22 | 319.45 | 329.12 | 267.23 | 190.58 | 226.24 | 96.77 | 0.00 | 37.28 | 2,373.47 |
| 063/64 | 164.44 | 165.50 | 194.42 | 96.86 | 377.00 | 405.45 | 273.45 | 287.60 | 105.23 | 0.00 | 117.43 | 217.87 | 2,405.25 |
| 064/65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 182.61 | 207.58 | 140.77 | 268.69 | 170.55 | 113.19 | 132.72 | 1,216.11 |
| 065/66 | 261.07 | 151.78 | 210.11 | 203.19 | 377.26 | 411.02 | 300.52 | 172.64 | 89.72 | 2.50 | - | - | 2,179.81 |
| 066/67 | - | - | 110.05 | 188.69 | 336.95 | 356.29 | 285.86 | 124.03 | - | - | - | 23.31 | 1,425.18 |
| 067/68 | 156.62 | 144.19 | 134.62 | 78.41 | 280.06 | 356.88 | 235.70 | 203.54 | 96.98 | - | - | 226.49 | 1,913.49 |
| 068/69 | 207.86 | 150.90 | 159.24 | 150.18 | 187.72 | 247.65 | 190.22 | 229.24 | 219.13 | 125.96 | 4.11 | - | 1,872.21 |
| 069/70 | 263.05 | 238.12 | 228.16 | 104.25 | - | 137.34 | - | - | - | - | - | - | 970.92 |
| | | | | | | | | | | Till Date Generation, MWh | | | 83,542.98 |

# SUNDARIJAL HYDROPOWER STATION

## Introduction:

Sundarijal Hydropower Station, located at Sundarijal, 15 km northeast of Kathmandu with installed capacity of 640 kW and annual design generation of 4.77 GWh was commissioned in 1934 AD in a grant from British government. Both the Pelton units, each with 320 kW, are in normal operation and have the capacity to operate in full load when required. The penstock and station flows are part of the water supply system to Kathmandu Valley looked after by Kathmandu Upatayaka Khanepai Limited (KUKL).

The cumulative generation of the station has reached 99.95 GWh till FY 2011/12 from its first run. It has generated 4.12 GWh in FY 2010/11 and 4.35 GWh in FY 2011/12 with an increase of 5.43% compared to previous year generation. It contributed 0.10 % of the total energy in the INPS in FY 20111/12.

Power House

## Present status:

The rehabilitation of this power station is underway under the joint assistance from ADB, GON and NEA. Nepal Electricity Authority (NEA) has received loan (Loan Number 2808-NEP, Grants 0270-NEP and 0271-NEP) from Asian Development Bank (ADB) towards the cost of Power Efficiency Improvement as part of Electricity Transmission Expansion and Supply Improvement Project. NEA

Turbine Nozzle

intends to apply a portion of the proceeds of this loan for Rehabilitation of Sundarijal (640 kW) hydropower plant. The proposed rehabilitation works largely consists of electromechanical rehabilitation and the recruitment of international individual consultant in intermittent assignment for design and implementation support for Part C: Rehabilitation of Small Hydropower Plants. The TOR, short listing and ranking of the consultants have been finalized and the recruitment will take place as soon as no objection from ADB is received. The project is scheduled to complete by June, 2016.

## Repair and Maintenance Activities:

The following activities were accomplished during FY 2010/11 & 2011/12:

## Mechanical Works:

- Repair and maintenance of runner buckets in both the units
- Penstock repair and maintenance works
- Repair of oil cooler of Unit No. 1

## Electrical Works:

- Rewinding of excitor of Unit No.1
- Replacement of 3.3 kV XLPE cable from generator to step-up transformer and 11 kV

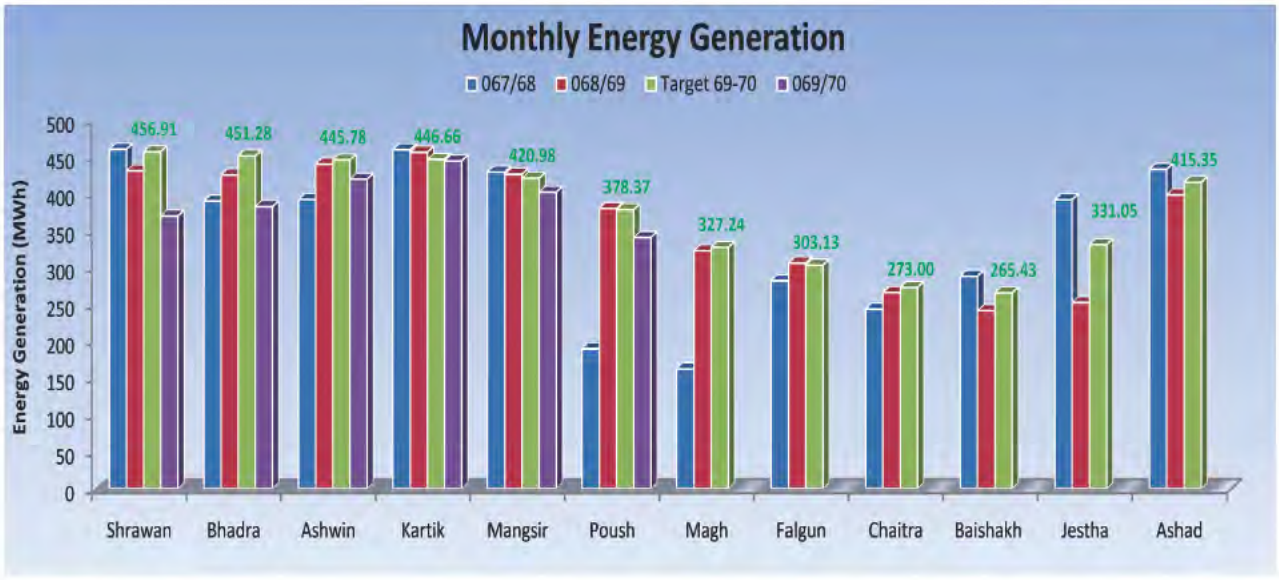
cable from switchyard to pole with cable termination kit

### Civil Maintenance Works:

- Repair of canal from Nagmati to Bagmati forebay
- Cleaning of balancing reservoir
- Construction of four numbers of penstock support pillars near Bhattedanda
- Construction of single storey new staff quarter

Balancing Reservoir

| SALIENT FEATURES OF SUNDARIJAL HYDROPOWER STATION | |
|---|---|
| Type | Run of river |
| Location | Sundarijal, Kathmandu |
| Installed capacity | 640 kW |
| Annual average energy | 4.77 GWh |
| Maximum Net head | 750 m |
| Penstock | 1700 m long, 0.61 m |
| **Turbine** | |
| Number and Type | 2, Horizontal Pelton |
| Rated output | 485 kW |
| Rated speed | 900 rpm |
| **Generator** | |
| Rated output | 377 kVA |
| Rated voltage | 3.3 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.85 |
| Power transformer | 3.3/11 kV, 2Nos. |
| Transmission line | 11 kV |




| Sundarijal Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| Till 057/58 | Monthly Distribution is not Available | | | | | | | | | | | | 56,320.37 |
| 058/59 | 236.00 | 401.00 | 415.33 | 399.66 | 385.66 | 394.33 | 407.33 | 338.00 | 300.33 | 265.33 | 205.66 | 225.66 | 3,974.29 |
| 059/60 | 308.33 | 344.33 | 179.33 | 230.66 | 216.33 | 231.00 | 228.33 | 223.33 | 233.00 | 238.00 | 298.66 | 427.33 | 3,158.63 |
| 060/61 | 415.66 | 398.33 | 358.00 | 285.00 | 357.33 | 406.00 | 380.33 | 303.66 | 255.33 | 253.33 | 373.66 | 306.33 | 4,092.95 |
| 061/62 | 429.00 | 438.66 | 410.33 | 409.66 | 408.66 | 414.66 | 362.66 | 325.66 | 297.66 | 260.00 | 224.66 | 230.00 | 4,211.62 |
| 062/63 | 231.33 | 236.55 | 250.99 | 226.55 | 200.31 | 232.33 | 254.00 | 194.33 | 195.00 | 195.00 | 240.66 | 155.33 | 2,612.39 |
| 063/64 | 345.00 | 378.66 | 420.21 | 434.33 | 406.33 | 404.00 | 354.00 | 225.32 | 238.66 | 294.33 | 401.00 | 453.66 | 4,355.50 |
| 064/65 | 450.33 | 447.54 | 448.66 | 456.66 | 443.33 | 424.88 | 186.67 | 296.83 | 235.66 | 240.00 | 308.66 | 406.66 | 4,345.89 |
| 065/66 | 444.66 | 448.33 | 415.66 | 438.33 | 370.00 | 252.33 | 269.00 | 282.98 | 253.66 | 219.66 | 303.66 | 364.00 | 4,062.27 |
| 066/67 | 506.58 | 486.66 | 474.51 | 385.00 | 432.33 | 404.33 | 302.33 | 267.33 | 225.33 | 217.00 | 217.00 | 431.33 | 4,349.73 |
| 067/68 | 460.33 | 390.00 | 392.00 | 459.66 | 429.33 | 189.66 | 162.33 | 282.00 | 243.66 | 288.00 | 391.66 | 432.99 | 4,121.61 |
| 068/69 | 431.00 | 425.33 | 440.00 | 456.33 | 426.33 | 380.00 | 322.66 | 306.00 | 266.00 | 241.33 | 252.33 | 398.33 | 4,345.62 |
| 069/70 | 369.66 | 382.33 | 419.66 | 444.33 | 402.00 | 340.66 | - | - | - | - | - | - | 2,358.64 |
| | | | | | | | | | | Till Date Generation, MWh | | | 102,309.50 |

# PHARPING HYDROPOWER STATION

## Introduction:

Pharping Hydropower Station, commissioned in May, 1911 is the first power station in Nepal which was inaugurated by the late king Prithivi Bir Bikram Shah Dev on Monday, 22 May, 1911 (B.S. 1968, 9 Jestha, Monday) at 6:30 PM more than 100 years back by switching on lights in Tundikhel, Kathmandu.

The power station located in Pharping of Kathmandu district, nearly 12 km south from the heart of the city is considered to be the second oldest hydropower station in Asia. It utilizes spring water from Satmule and Shesh Narayan area. There are two units each with a rated capacity of 250 kW totaling installed capacity of the power station to be 500 kW.

## Historical Background:

After visit of Britain by Rana Prime Minister Chandra Samser in 1964 B.S. (1907 AD), a hydro power station was proposed to be constructed. A committee was formed under executive engineer Col. Kishor Narasingh Rana for planning of the hydropower station. The committee selected Pharping site for the Power Station and preliminary work started.

View of Power House

An electrical engineer, Mr. Barnau Ponte from Britain arrived for detail estimate and to proceed the work further. Another engineer, Mr. Linzale from General Electric Co. arrived for erection and installation of equipments. Nepali executive engineer Col. Kishor Narsingh Rana, superintending engineer Col. Kumar Narsingh Rana and other Nepali overseers, technicians and a few technicians from India too were engaged in the construction/erection works. The construction works were completed in mere 20 months and 15 days.

## Project Cost:

For the construction and erection of Pharping hydropower station, various costs were incurred by Government of Nepal, which are as follows:

1. Pipeline / Head works / Reservoir - 196,324.84
2. Powerhouse/Colony/Tailrace and widening of Bagmati River - 56,778.31
3. Substation / Office / Store - 36,175.80
4. Transmission Line/Street Light/ Distribution Line and Telephone Line - 11,049.50
5. London to Calcutta Transportation/ packing/Commission of Agent - 28,699.26
6. Calcutta to Bhimphedi Transportation - 40,311.79
7. Bhimphedi to Site - 40,372.32
8. Salary/ Wages - 103,565.00

**Total - 713,273.82**

The costs of equipments (Generators, Turbines etc.) are not included in the above cost. They seemed to be given on grant by British Government to Nepal. Out of the total cost of Rs. 7, 13,273.82 borne by the Government of Nepal of which Rs. 3, 67,984.00 were spent locally inside Nepal.

## Operation and Maintenance:

Pharping Hydropower Station was generating energy till 1982 AD (2038 B.S.). During the year, there was drinking water crisis in Kathmandu valley and surplus electricity was observed after completion of Kulekhani-I Hydropower Station. So, the water from the reservoir was used for consumptive use with temporary diversion from penstock just before entering into the power station. Till date priority is given for drinking water due to water crisis in the valley.

Machine Hall

After 25 years of shutdown of the Power House, equipments like Turbines, Governors, Control Panels, Control and Protection circuits, Transformer, DC-Supply System etc. were repaired and overhauled in Fiscal Year 2062/63 (2005/2006 AD) and both units were tested and commissioned with local load. It was synchronized with Integrated Nepal Power System (INPS) again on December 20, 2006 (Poush 05, 2063). The power station has been running for about an hour every day to keep the equipments of historic Power Station in operational condition. Recently, Unit No. 1 is brought into normal operation whereas Unit No. 2 requires repair and maintenance of governor.

Currently, there are 9 employees working in the Power Station.

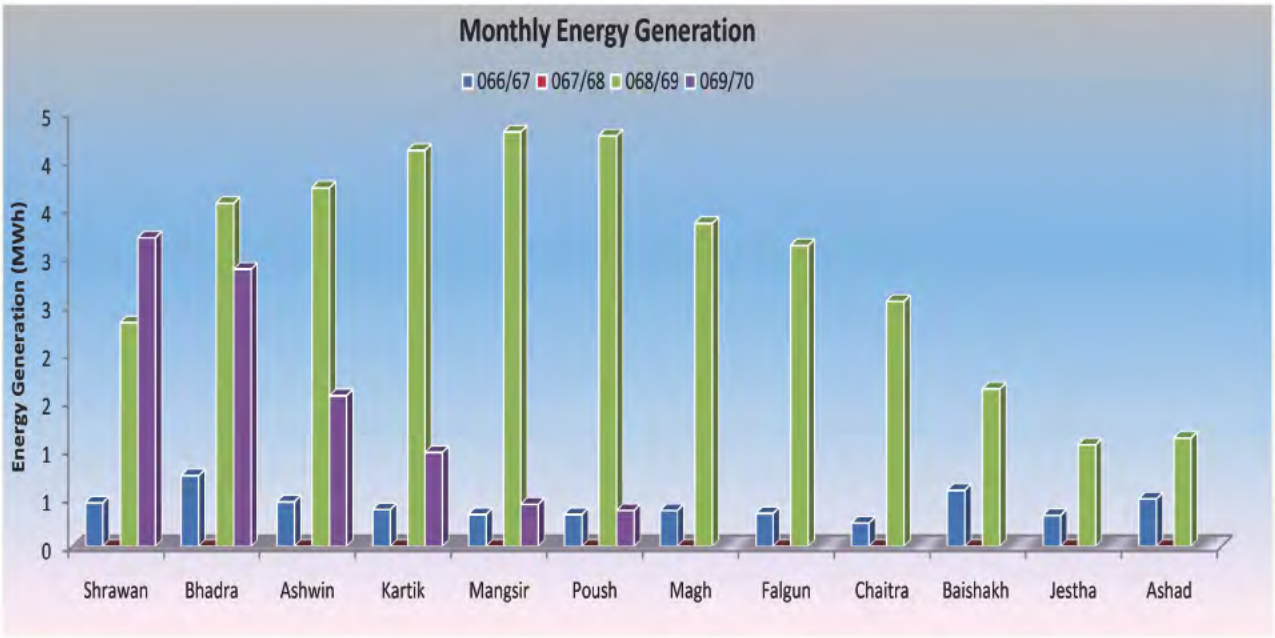
## Centenary Celebrations and Master Plan:

After completion of 99 years of operation of the Power Station in 2010, a week long program starting from May 21, 2010 was performed to mark centenary celebration. A committee has been formed to develop the power plant area with nearly 20 hectares of land as "Live Energy Museum" and to promote as a destination for eco-tourism, religious tourism, agro-tourism, site for natural fresh water along with a scientific research centre.

A master plan has been prepared by the committee to develop the area. According to the plan, Nepal Government and NEA will spend about NRs. Four hundred million in 5 years with various construction and establishments which include model power station of wind, solar and hydro; two view towers, two entrance gates , swimming pool, fun park, picnic area, centenary celebration memorial, scientific research center etc. The Government of Nepal has decided to celebrate 9 Jestha as the National Energy Day to mark the start of Hydropower Development in Nepal.

## SALIENT FEATURES OF PHARPING HYDROPOWER STATION:

| | | |
|---|---|---|
| 1. | Reservoir | |
| | Diameter | 200 ft |
| | Depth | 18 ft |
| | Total Storage Capacity | 5, 28,783.00 cu. ft. |
| 2. | Penstock Pipe | |
| | Diameter (internal) | 20 inch |
| | Total length of pipes | 2538 feet |
| 3. | Power Station General | |
| | Design Head | 682 feet |
| | Installed Capacity | 500 kW |
| | Number of units | 2 |
| 4. | Turbine Generator Sets | 2 |
| 5. | Shaft Configuration | Horizontal |
| 6. | Turbine | |
| | Type | Pelton |
| | Revolution | 600 rpm |
| | Manufacturer | Hydraulic Engineers, USA |
| 7. | Generator | |
| | Type | Synchronous, 3 Phase |
| | Capacity | 312.5 kVA |
| | Power Factor | 0.8 |
| | Rated Voltage | 3.3 kV |
| | Rated Current | 54.8 A |
| | Configuration | Y |
| | Excitation Voltage | 37 V |
| | Excitation Current | 169 A |
| 8. | Transformer | |
| | Capacity | 350 kVA |
| | Voltage Level | 3.3/11 kV |
| | Numbers | 2 |
| 9. | Breaker Type | MOCB all |
| 10. | M/C Synchronized | 11 kV |
| 11. | Overhead Transmission Line | |
| | Length | 6 miles |
| | Poles | Steel |
| | Type | Wooden |
| | Two major crossings on Bagmati River 600 ft & 800 ft long | |




| Pharping Hydropower Station | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 063/64 | After Rehabilitation, this powerstation was synchronized with INPS on 2063/09/05 | | | | | | | | | | | | 4.26 |
| 064/65 | 1.51 | 5.60 | 1.02 | 10.96 | 6.99 | 5.54 | 2.74 | 3.50 | 3.60 | 3.44 | 2.07 | 1.68 | 48.65 |
| 065/66 | 2.46 | 3.25 | 3.60 | 4.27 | 2.98 | 2.13 | 0.46 | - | 0.30 | 0.71 | 0.56 | 0.26 | 20.98 |
| 066/67 | 0.45 | 0.73 | 0.46 | 0.38 | 0.33 | 0.33 | 0.37 | 0.34 | 0.24 | 0.58 | 0.32 | 0.49 | 5.02 |
| 067/68 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 068/69 | 2.32 | 3.56 | 3.72 | 4.11 | 4.30 | 4.26 | 3.35 | 3.12 | 2.54 | 1.63 | 1.05 | 1.12 | 35.08 |
| 069/70 | 3.20 | 2.88 | 1.56 | 0.97 | 0.43 | 0.37 | - | - | - | - | - | - | 9.41 |
| | | | | | | | | | | | | Till Date Generation After Rehabilitation, MWh | 123.40 |

Recently Built Centenary Memorial

# HETAUDA DIESEL POWER PLANT

## Introduction:

Hetauda Diesel Power Plant, with installed capacity of 14.41 MW is located at Hetauda, Makawanpur. The first phase with three sets of English Units was commissioned in 1963 and the second phase with four sets of Russian Units was commissioned in 1980 in assistance from British Government and Government of Nepal.

Diesel Engine

The World Bank under PDP has assisted in procurement of spare parts from Man Diesel, UK for replacement of worn out parts. The plant operates during peak, however, the soaring fuel price has made its operation costlier compared to that of hydropower stations. The plant contributes to generation mix and provides operational flexibility and strengthens system reliability and hence, has great importance in minimizing load shedding hours to some extent. However, the exorbitant fuel price restricts its operation and NEA has to receive some sort of subsidy from GON as compensation for its operation. Presently, the plant has been operating at capacity of 10 MW for minimum of 10 hours a day.

The cumulative generation of the plant has now reached 140.14 GWh from its first run. The station has generated 1.33 GWh in FY 2010/11 and 0.94 GWh in FY 2011/12 with a decrease of 29.44% compared to that of previous year generation.

## Present status:

The worn out parts in all the DG sets were replaced during the overhauling of the units, which was successfully completed last year. The MOCBs with electromechanical relays have been replaced by VCBs with numerical relays and control panel. The proposal for up gradation of AVR of existing excitation system has been put forward for three units in first phase.

## Repair and Maintenance Activities:

The following activities were accomplished during FY 2010/11 and 2011/12:

## Mechanical Works:

- Engine overhauling in all the units
- Repair and maintenance of exhaust pipe
- Repair of turbocharger
- Repair of governor in Unit No. 7

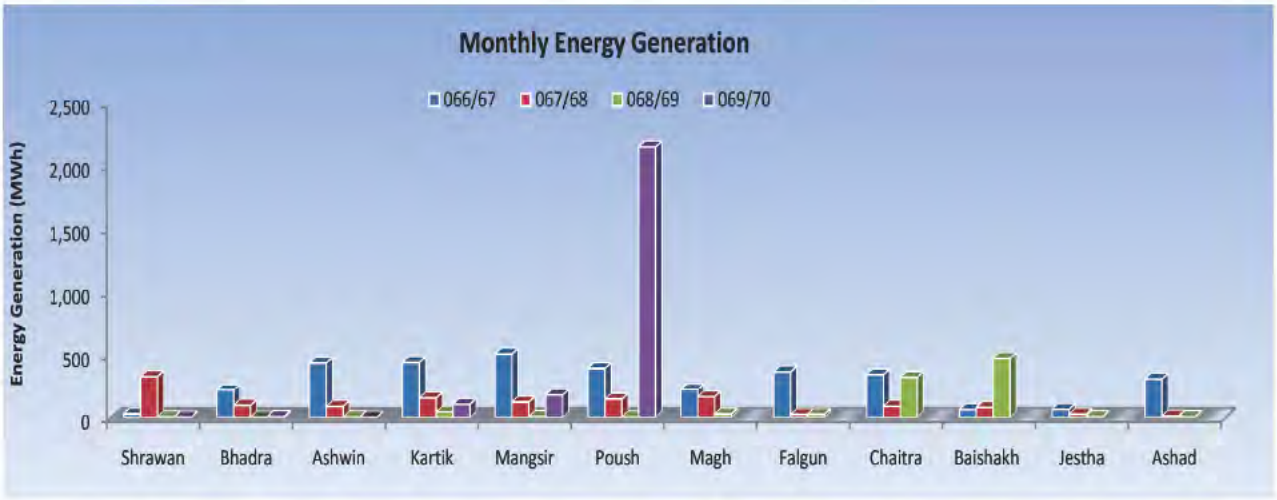
## Electrical Works:

- Repair of VT in Unit No. 2
- Renovation and modification of switchgear system which included replacement of MOCBs by VCBs with control and relay panel in all the units

Recently Installed VCB with Control and Relay Panel

| SALIENT FEATURES OF HETAUDA DIESEL POWER PLANT | |
|---|---|
| Type | Thermal |
| Location | District Makwanpur, Hetauda W.N.-1 |
| Installed capacity | 14.41 MW |
| Average annual generation | 922.24 MWh |
| Engine set | 4 Nos. of 2.5 MW<br>3 Nos. of 1.47 MW |
| Fuel used | High Speed Diesel (HSD) |
| **Generator** | |
| Number | 4 Nos. of 3125 kVA<br>3 Nos. of 1862.5 kVA |
| Rated voltage | 11 kV |
| Rated frequency | 50 Hz |
| Power factor | 0.80 |
| Rated speed | 750 rpm |
| Excitation | AC exciter of 6.5V |

Heat Exchanger




| Hetauda Diesel Power Plant | | | | | | | | | | | | | MWh |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total |
| 043/44 | - | - | - | 8.62 | - | - | - | - | 18.70 | 1.30 | - | - | 28.62 |
| 044/45 | 86.10 | - | - | - | - | - | - | - | - | - | - | 12.80 | 98.90 |
| 045/46 | - | - | - | 628.80 | 1,142.50 | 1,818.90 | 2,009.30 | 1,810.90 | 607.40 | - | 423.90 | 274.50 | 8,716.20 |
| 046/47 | - | 19.40 | 42.20 | - | 41.20 | - | - | - | 27.90 | - | - | - | 130.70 |
| 047/48 | 88.30 | 33.70 | 72.80 | - | - | 7.30 | - | 0.20 | - | - | - | - | 202.30 |
| 048/49 | - | - | - | - | 4.50 | 927.70 | 1,944.50 | 2,321.20 | 2,387.30 | 2,392.30 | 893.40 | 131.80 | 11,002.70 |
| 049/50 | - | 87.50 | 248.50 | 575.50 | 1,529.10 | 2,071.40 | 1,492.60 | 1,366.40 | 1,696.80 | 1,094.90 | 432.70 | 537.10 | 11,132.50 |
| 050/51 | 248.80 | 344.20 | 426.50 | 200.90 | 742.30 | 1,590.90 | 820.80 | 473.80 | - | - | - | - | 4,848.20 |
| 051/52 | - | - | - | - | - | - | - | 146.40 | 806.00 | 571.80 | 1,020.80 | 1,331.00 | 3,876.00 |
| 052/53 | 841.40 | 512.30 | 769.30 | 1,000.60 | 714.90 | 1,028.00 | 996.10 | 619.30 | 523.30 | 279.80 | 119.90 | 281.60 | 7,686.50 |
| 053/54 | 503.00 | 511.20 | 259.20 | 300.60 | 451.40 | 476.80 | 389.80 | 881.30 | 1,287.60 | 1,039.40 | 1,536.30 | 1,729.70 | 9,366.30 |
| 054/55 | 1,519.20 | 1,732.50 | 1,800.30 | 922.60 | 1,178.80 | 1,311.60 | 1,888.10 | 2,050.00 | 1,974.90 | 1,106.20 | 1,266.30 | 1,931.30 | 18,681.80 |
| 055/56 | 316.10 | 415.38 | 689.02 | 1,033.10 | 1,606.50 | 3,186.20 | 3,516.20 | 3,544.64 | 2,989.20 | 2,386.90 | 3,056.30 | 1,464.10 | 24,203.64 |
| 056/57 | 382.40 | 389.85 | 293.70 | 539.90 | 985.25 | 1,141.75 | 1,452.30 | 2,119.35 | 1,610.89 | 1,715.90 | 317.05 | 117.30 | 11,065.64 |
| 057/58 | 8.50 | 63.10 | 78.10 | 27.30 | 246.55 | 282.55 | 294.00 | 363.55 | 1,871.70 | 1,159.00 | 478.90 | 323.80 | 5,197.05 |
| 058/59 | 234.50 | 348.40 | 209.50 | 252.30 | 435.10 | 526.65 | 512.50 | 386.20 | 134.50 | 5.40 | - | - | 3,045.05 |
| 059/60 | 1.55 | 2.95 | 1.10 | 6.25 | 66.90 | 1.00 | 1.80 | 82.85 | 69.15 | 11.40 | 22.80 | 1.55 | 269.30 |
| 060/61 | 10.30 | 59.70 | 43.75 | 69.95 | 1.45 | 186.85 | 301.05 | 63.90 | 266.00 | 91.05 | 25.35 | - | 1,119.35 |
| 061/62 | - | 9.40 | - | - | - | 188.34 | 349.15 | 202.77 | 158.09 | 424.12 | 774.40 | 86.55 | 2,192.82 |
| 062/63 | 284.05 | 396.30 | 167.00 | 69.35 | 372.95 | 667.69 | 418.58 | 491.28 | 401.41 | 181.70 | 57.92 | 12.53 | 3,520.76 |
| 063/64 | 60.63 | 288.78 | 291.15 | 248.21 | 363.47 | 467.22 | 454.48 | - | 55.17 | 270.67 | 278.72 | 242.67 | 3,021.17 |
| 064/65 | 82.85 | 341.69 | 122.95 | 89.70 | 55.96 | 42.90 | 329.94 | 21.57 | 116.14 | 43.14 | 20.33 | 41.55 | 1,308.72 |
| 065/66 | 25.98 | 146.90 | 343.47 | 127.16 | 138.30 | 522.92 | 605.43 | 1,058.08 | 181.83 | 45.80 | 131.48 | 407.02 | 3,734.37 |
| 066/67 | 28.43 | 220.39 | 439.00 | 443.84 | 511.16 | 396.45 | 224.29 | 369.01 | 346.39 | 61.85 | 63.87 | 312.18 | 3,416.85 |
| 067/68 | 332.70 | 96.12 | 87.62 | 155.06 | 122.28 | 145.12 | 163.72 | 23.85 | 88.54 | 79.80 | 25.91 | 12.26 | 1,332.97 |
| 068/69 | 5.74 | 2.60 | 5.75 | 43.92 | 9.00 | 4.80 | 27.48 | 24.83 | 325.72 | 476.01 | 6.94 | 7.74 | 940.53 |
| 069/70 | 3.46 | 7.31 | 2.40 | 104.53 | 178.21 | 2,150.86 | - | - | - | - | - | - | 2,446.76 |
| | | | | | | | | | | | Till Date Generation, MWh | | 142,585.72 |

# Salient features of Independent Power Producers (IPPs)

## 1. KHIMTI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Dolakha and Ramechhap |
| Installed Capacity | 60 MW |
| Average Annual Energy | 350 GWh |
| Design head | 660 m |
| Design discharge | 10.75 $m^3/s$ |
| Turbine | 5 Nos., Pelton, 750 rpm |
| Generator | - |
| Transformer | 10.5/132 kV |
| Transmission | 132 kV |

## 2. BHOTEKOSHI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Phulpingkatti VDC, Sindhupalchok |
| Installed Capacity | 36 MW (45 MW) |
| Average Annual Energy | 246 GWh |
| Design head | 134 m |
| Design discharge | 36.8 $m^3/s$ |
| Turbine | 2, Vertical Francis |
| Generator | 25 MVA, 11 kV, 134 m, 18.4 $m^3/s$ |
| Transformer | 25 MVA, 11/132 kV, 3-phase, 2 Nos. |
| Transmission | 132 kV, 28 km (Lamosanghu), Single circuit |

### 3. CHILIME HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River with peaking pondage |
| Location | Syafrubesi, Rasuwa |
| Installed Capacity | 22.1 MW |
| Average Annual Energy | 137 GWh |
| Gross head | 351.5 m |
| Design discharge | 7.5 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Pelton, 11.28 MW, 7.5 $m^3/s$ |
| Generator | 13 MVA, 11 kV |
| Transformer | 4.25 MVA, 11/66 kV, Single Phase, 7 Nos. |
| Transmission | 38 km, 66 kV, Single Circuit |

### 4. JHIMRUK HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Pyuthan |
| Installed Capacity | 12 MW |
| Average Annual Energy | - |
| Design head | 205 m |
| Design discharge | 7 $m^3/s$ |
| Turbine | 3 Nos., Horizontal Francis, 4,200 kW, 1,000 RPM |
| Generator | 4,000 kW, 6.6 kV, brushless |
| Transformer | - |
| Transmission Line | 132 kV, 41 km |

### 5. INDRAWATI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Sindhupalchowk |
| Installed Capacity | 7.5 MW |
| Average Annual Energy | - |
| Design head | 60 m |
| Design discharge | 15 $m^3/s$ |
| Turbine | 3 Nos., Horizontal Francis, 2.63 MW, 750 rpm |
| Generator | 2.5 MW, 6.6 kV, brushless |
| Transformer | - |
| Transmission | 28 km, Single Circuit |

## 6. ANDHIKHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Syangja |
| Installed Capacity | 5.1 MW |
| Average Annual Energy | 61.093 GWh |
| Design head | 250 m |
| Design discharge | 2.7 $m^3/s$ |
| Turbine | 3 Nos, Horizontal Pelton, 2.2 MW, 500 rpm |
| Generator | 1700 kW, 6.6 kV |
| Transformer | 12 MVA, 6.6/33 kV, 3 phase |
| Transmission | 33kV, 22 km, single circuit |

## 7. KHUDI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Lamjung |
| Installed Capacity | 3.45 MW |
| Average Annual Energy | 24.73 GWh |
| Design head | 105.4 m |
| Design discharge | 9.8 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Turgo, 1.79 MW, 500 rpm |
| Generator | 2,100 kVA, 3.3 kV |
| Transformer | 5 MVA, 3.3/33 kV, 2 Nos. |
| Transmission | 33 kV, 7 km |

## 8. PILUWAKHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Chainpur VDC-1, Sankhuwasabha |
| Installed Capacity | 3.0 MW |
| Average Annual Energy | 19.547 GWh |
| Design head | 112.5 m |
| Design discharge | 3.5 $m^3/s$ |
| Turbine | 2 Nos., Turgo Impulse, 1721 kW |
| Generator | 2000 kVA, 0.69 kV |
| Transformer | 4000 kVA, 0.69/33 kV, 3 phase |
| Transmission | 33 kV, 495 m |

## 9. SUNKOSHI SMALL HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Sindhupalchowk |
| Installed Capacity | 2.5 MW |
| Average Annual Energy | - |
| Design head | 124.50 m |
| Design discharge | 2.7 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Turgo, 1.25 MW, 750 rpm |
| Generator | 1250 kW, 6.3 kV |
| Transformer | - |
| Transmission | 6.3 km |

## 10. THOPPAL KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Nalang, Kumpur and Salang VDC, Dhading |
| Installed Capacity | 1700 kW |
| Average Annual Energy | 11.347 GWh |
| Design head | 56.6m |
| Design discharge | 3.50 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Francis, 950 kW |
| Generator | 850 kW, 0.4 kV, Brush type |
| Transformer | 1250 KVA, 3-phase, 2 Nos. |
| Transmission | 33 kV, 9.7 km |

## 11. CHAKU KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Sindhupalchowk |
| Installed Capacity | 1.5 MW |
| Average Annual Energy | - |
| Design head | 124.50 m |
| Design discharge | 2.7 $m^3/s$ |
| Turbine | Horizontal Francis, 2 Nos. |
| Generator | - |
| Transformer | - |
| Transmission | 11 kV |

## 12. PATI KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Parbat |
| Installed Capacity | 996 kW |
| Average Annual Energy | - |
| Design head | 181 m |
| Design discharge | 0.7 $m^3/s$ |
| Turbine | 2 Nos., Pelton, 530 kW |
| Generator | 592 kVA, 400 V, brushless |
| Transformer | 0.4/33 kV |
| Transmission | 33 kV, 3 km upto Modi P/H |

## 13. PHEME KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Pancthar |
| Installed Capacity | 995 kW |
| Average Annual Energy | 8.0 GWh |
| Design head | 100.5 m |
| Design discharge | 1.17 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Francis, 490 kW, 750 rpm |
| Generator | 575 kVA, 0.4 kV |
| Transformer | 1250 kVA, 0.4/33 kV |
| Transmission | 33kV |

## 14. BARAMCHI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Baramchi, Sindhupalchok |
| Installed Capacity | 4200 kW |
| Average Annual Energy | |
| Gross/net head | 615 / 545 m |
| Design discharge | 0.870 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Pelton, 1 MW; 3.2 MW, 1,000 rpm |
| Generator | 990 kW, 0.66 kV; 3200 kW, 6.3 kV |
| Transformer | 0.66/6.3 kV-1250 kVA; 6.3/33 kV-5000 kVA |
| Transmission | 33 kV, 15 km upto Lamosanghu s/s |

## 15. SETI-II HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Kaski |
| Installed Capacity | 979 kW |
| Average Annual Energy | - |
| Design head | 25.6 m |
| Design discharge | 4.55 $m^3/s$ |
| Turbine | 2 Nos., Francis, 520 kW, 750 rpm |
| Generator | 624 kVA, 0.4 kV, brushless |
| Transformer | - |
| Transmission | 11 kV, 4.5 km |

## 16. SISNE KHOLA SMALL HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Dobhan VDC, Palpa |
| Installed Capacity | 750 kW |
| Average Annual Energy | 4.597 GWh |
| Design head | 504.28 m |
| Design discharge | - |
| Turbine | 1 No., Pelton, 770 kW, 1500 rpm |
| Generator | 1000 kVA, 0.4 kV |
| Transformer | 1000 kVA, 0.4/33 kV |
| Transmission | 33 kV, 3 km upto Jhumsa substation |

## 17. SALINADI SMALL HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Lapsiphedi VDC, Kathmandu |
| Installed Capacity | 232 kW |
| Average Annual Energy | 1.45 GWh |
| Design head | 183.0 m |
| Design discharge | - |
| Turbine | 1 No., Pelton, 250 kW |
| Generator | 300 kVA, 0.4 kV, brushless |
| Transformer | 300 kVA, 0.4/11 kV |
| Transmission | 11 kV |

## 18. SYANGE HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Syange, Lamjung |
| Installed Capacity | 183 kW |
| Average Annual Energy | 0.57 $m^3/s$ |
| Design head | 43 m |
| Design discharge | 0.57 $m^3/s$ |
| Turbine | 1 No., Crossflow, 195 kW |
| Generator | 1 nos. 183 kW |
| Transformer | - |
| Transmission | 11 kV, 4.5 km |

## 19. MATHILLO HANDI KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Thanpalkot VDC, Sindhupalchok |
| Installed Capacity | 991 kW |
| Average Annual Energy | 8.169 GWh |
| Gross head | 250.9 m |
| Design discharge | 0.50 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Pelton, 533 kW |
| Generator | 500 kW, 0.4 kV, Brushless |
| Transformer | 630 kVA, 0.4/11 kV, 3-phase, 2 Nos. |
| Transmission | 11 kV, 7 km |

## 20. RIDI KHOLA HYDROPOWER STATION

| SALIENT FEATURES OF RIDI KHOLA HYDROPOWER STATION | |
|---|---|
| Type | Run-of-River |
| Location | Ruru VDC, Gulmi |
| Installed Capacity | 2400 kW |
| Average Annual Energy | 15.733 GWh |
| Gross head | 91.22 m |
| Design discharge | 3.86 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Turgo, 1300 kW |
| Generator | 1550 kW, 0.69 kV, brushless excitation |
| Transformer | 3100 kVA, 0.69/33 kV |
| Transmission | 33 kV |

## 21. MARDI KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Rivan VDC-9, Kaphalbot Khet, Kaski |
| Installed Capacity | 3,100 kW |
| Average Annual Energy | - |
| Design head | 176.45 m |
| Design discharge | 2.112 $m^3/s$ |
| Turbine | 2 Nos., Pelton, 500 rpm |
| Generator | 1,600 kW, 6.3 kV, brushless |
| Transformer | 4,000 kVA, 6.3/33 kV |
| Transmission | 33 kV, 5.5 km |

## 22. MAI KHOLA SMALL HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Rajduwali, Godak VDC, Ilam |
| Installed Capacity | 4,455 kW |
| Average Annual Energy | 27.53 GWh |
| Gross head | 50.65 m |
| Design discharge | 12.0 $m^3/s$ |
| Turbine | 3 Nos., Horizontal Francis, 1570 kW |
| Generator | 1.5 kW, 6.6 kV, brushless |
| Transformer | 4.0 MVA +2.0 MVA, 6.6/33 kV |
| Transmission | 33 kV, 3.5 km to Tilkehi substation |

## 23. INDRAWATI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Jaljala VDC, Sankhuwasava |
| Installed Capacity | 4500 kW |
| Average Annual Energy | 26.044 GWh |
| Design head | 126.7 m |
| Design discharge | 4.5 $m^3/s$ |
| Turbine | 3 Nos., Horizontal Turgo, 1600 kW, 600 rpm |
| Generator | 1875 kVA, 6.3 kV, brushless |
| Transformer | 4000 kVA+ 2000 kVA, 6.3/33 kV |
| Transmission | 33 kV, 7.25 km, Single circuit |

## 24. SIURI KHOLA HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Bhulbhule VDC, Lamjung |
| Installed Capacity | 5,000 kW |
| Average Annual Energy | 30.70 GWh |
| Design head | 452.42 m |
| Design discharge | 1.4 $m^3/s$ |
| Turbine | 2 Nos., Horizontal Pelton, 2,650 kW, 1000rpm |
| Generator | 3150 kVA, 6.3 kV, brushless |
| Transformer | 2100 kVA, 6.3/33 kV, 3+1 Nos. |
| Transmission | 33 kV, 8 km |

## 25. CHARNAWATI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Bhimeshwor Municipality-8,9 and 11, Dolakha |
| Installed Capacity | 3600 kW |
| Average Annual Energy | 20.529 GWh |
| Gross head, Net head | 199 m, 186 m |
| Design discharge | 2.19 $m^3/s$ |
| Turbine | 2 Nos., Horizontal axis Pelton, 1875 kW |
| Generator | 2,250 kVA, 6.3 kV |
| Transformer | 4,500 kVA, 6.3/33 kV, 3 phase, 1 No. |
| Transmission | 7 km, 33 kV |

## 26. LOWER MODI HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Parbat |
| Installed Capacity | 10.0 MW |
| Average Annual Energy | 60.538 GWh |
| Gross head, Net head | 48 m, 42.74 m |
| Design discharge | 27 $m^3/s$ |
| Turbine | 2 Nos., Francis, 500 rpm |
| Generator | 6,000 kVA, 6.6 kV |
| Transformer | 12,000 kVA, 3 phase |
| Transmission | 7 km, 132 kV |

## 27. BIJAYAPUR HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Kaski |
| Installed Capacity | 4.5 MW |
| Average Annual Energy | 29.083 GWh |
| Gross head | 66.9 m |
| Design discharge | 8.3 $m^3/s$ |
| Turbine | 2 Nos. Horizontal axis, Fransis, 2,250 kW |
| Generator | 2,552 kVA, 0.4 kV, 2 Nos. |
| Transformer | 2 Nos., 2,850 kVA, 11/0.4 kV |
| Transmission | 4 km, 11 kV |

## 28. SIPRING HYDROPOWER STATION

| SALIENT FEATURES | |
|---|---|
| Type | Run-of-River |
| Location | Khare, Gauri Sankar, Dolakha |
| Installed Capacity | 10 MW |
| Average Annual Energy | 53.505 GWh |
| Gross head, Net head | 438.5 m, 433.45 m |
| Design discharge | 2.61 $m^3/s$ |
| Turbine | 2 Nos., Pelton, 5MW |
| Generator | - |
| Transformer | - |
| Transmission | 33 kV, 10 km to Singati Bazaar |

# Nepal Electricity Authority

## Generation Operation and Maintenance

### Annual Energy Generation per Installed capacity (GWh / MW)

| Fiscal Year \ Power Stations | Kaligandaki 'A' | Mid-Marsyangdi | Marsyandi | Trishuli | Gandak | Modi | Devighat | Sunkoshi | Puwa | Chatara | Panauti | Seti | Fewa | Sundarijal | Kulekhani I | Kulekhani II | Pharping | Multifuel | Hetauda Diesel |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Installed Capacity (MW) | 144 | 70 | 69 | 24 | 15 | 14.8 | 15 | 10.05 | 6.2 | 3.2 | 2.4 | 1.5 | 1.0 | 0.64 | 60 | 32 | 0.5 | 39.90 | 14.10 |
| 2041/42 | | | | 3.71 | 2.43 | | 3.30 | 4.26 | | | | | | | 1.73 | | | | |
| 2042/43 | | | | 3.66 | 2.87 | | 3.44 | 5.71 | | | | | | | 2.91 | | | | |
| 2043/44 | | | | 4.22 | 3.48 | | 4.45 | 4.48 | | | | | | | 3.17 | 2.04 | | | 0.002 |
| 2044/45 | | | | 4.44 | 3.15 | | 4.90 | 1.16 | | | | | | | 3.30 | 3.24 | | | 0.007 |
| 2045/46 | | | | 4.54 | 2.14 | | 5.26 | 4.83 | | | | | | | 2.85 | 2.66 | | | 0.618 |
| 2046/47 | | | 3.37 | 4.01 | 3.27 | | 4.77 | 4.18 | | | | | | | 2.21 | 2.00 | | | 0.009 |
| 2047/48 | | | 5.06 | 4.38 | 2.45 | | 5.18 | 4.78 | | | | | | | 2.72 | 2.25 | | 0.007 | 0.014 |
| 2048/49 | | | 5.99 | 4.38 | 2.66 | | 5.05 | 4.94 | | | | | | | 1.95 | 1.56 | | 0.508 | 0.780 |
| 2049/50 | | | 5.83 | 4.61 | 2.33 | | 5.42 | 5.22 | | | | | | | 1.19 | 0.89 | | 0.910 | 0.790 |
| 2050/51 | | | 6.14 | 3.67 | 2.11 | | 4.27 | 5.83 | | | | | | | 1.80 | 1.28 | | 1.420 | 0.344 |
| 2051/52 | | | 6.52 | 2.78 | 1.90 | | 3.28 | 6.12 | | | | | 2.01 | | 1.88 | 1.64 | | 1.911 | 0.275 |
| 2052/53 | | | 7.01 | 5.66 | 1.92 | | 6.19 | 6.27 | | 0.00 | | | 2.40 | | 2.79 | 2.49 | | 0.718 | 0.545 |
| 2053/54 | | | 6.74 | 6.43 | 2.39 | | 6.78 | 5.53 | | 0.23 | | 7.04 | 2.87 | | 2.80 | 2.44 | | 0.736 | 0.664 |
| 2054/55 | | | 6.52 | 5.55 | 1.45 | | 6.32 | 5.91 | | 0.08 | | 5.32 | 2.23 | | 2.03 | 1.83 | | 2.147 | 1.325 |
| 2055/56 | | | 6.84 | 4.56 | 1.67 | | 5.24 | 5.45 | | 0.19 | | 6.20 | 2.46 | | 3.26 | 3.00 | | 2.161 | 1.717 |
| 2056/57 | | | 6.63 | 6.31 | 2.52 | | 7.09 | 6.59 | 1.15 | 0.69 | | 6.23 | 2.23 | | 4.16 | 3.84 | | 1.336 | 0.785 |
| 2057/58 | | | 6.25 | 5.90 | 2.02 | 2.80 | 6.40 | 5.40 | 3.44 | - | | 6.20 | 1.10 | | 2.93 | 2.56 | | 0.484 | 0.369 |
| 2058/59 | 0.82 | | 5.60 | 5.34 | 1.27 | 3.46 | 6.10 | 5.06 | 3.90 | 0.03 | 1.94 | 5.36 | 1.25 | 6.21 | 2.42 | 2.05 | | 0.342 | 0.216 |
| 2059/60 | 3.56 | | 4.84 | 4.90 | 2.01 | 3.67 | 5.62 | 5.25 | 4.22 | 0.16 | 0.59 | 6.13 | 1.74 | 4.94 | 2.83 | 2.32 | | 0.104 | 0.019 |
| 2060/61 | 3.66 | | 3.55 | 4.04 | 0.55 | 3.07 | 4.57 | 4.99 | 5.06 | 0.73 | 1.58 | 5.72 | 0.53 | 6.40 | 2.68 | 2.05 | | 0.219 | 0.079 |
| 2061/62 | 3.83 | | 4.87 | 5.12 | 1.38 | 2.85 | 5.60 | 5.00 | 4.74 | 0.66 | 1.54 | 6.10 | 1.35 | 6.58 | 2.90 | 2.25 | | 0.279 | 0.156 |
| 2062/63 | 4.31 | | 5.35 | 5.60 | 1.80 | 3.14 | 6.34 | 5.11 | 4.67 | 0.74 | 1.28 | 6.44 | 2.37 | 4.08 | 1.91 | 1.48 | | 0.315 | 0.250 |
| 2063/64 | 4.91 | | 5.82 | 5.38 | 2.04 | 4.55 | 6.17 | 5.63 | 5.24 | 0.84 | 1.21 | 7.14 | 2.41 | 6.81 | 2.30 | 1.72 | 0.01 | 0.258 | 0.214 |
| 2064/65 | 5.27 | | 5.98 | 5.56 | 1.37 | 3.64 | 6.10 | 5.28 | 5.59 | 0.62 | 1.28 | 7.22 | 1.22 | 6.79 | 2.55 | 1.61 | 0.10 | 0.197 | 0.093 |
| 2065/66 | 5.23 | 2.41 | 5.87 | 4.79 | 1.37 | 4.22 | 5.43 | 6.03 | 5.11 | 0.43 | 0.78 | 7.25 | 2.18 | 6.35 | 1.25 | 1.15 | 0.04 | 0.133 | 0.265 |
| 2066/67 | 5.28 | 5.57 | 5.87 | 5.64 | 1.00 | 3.45 | 6.40 | 5.71 | 4.85 | 0.39 | 1.20 | 7.47 | 1.43 | 6.80 | 1.45 | 1.36 | 0.01 | 0.243 | 0.242 |
| 2067/68 | 5.38 | 5.39 | 6.13 | 5.34 | 0.76 | 4.05 | 4.94 | 6.01 | 5.09 | 0.66 | 1.14 | 7.74 | 1.91 | 6.44 | 1.65 | 1.58 | - | 0.059 | 0.095 |
| 2068/69 | 5.98 | 6.08 | 6.46 | 5.62 | 0.87 | 2.34 | 7.01 | 6.61 | 4.57 | 0.49 | 0.53 | 6.94 | 1.87 | 6.79 | 2.39 | 2.23 | 0.07 | 0.016 | 0.067 |
| 2069/70 Forecasted | 5.87 | 5.95 | 6.54 | 6.13 | 2.11 | 3.85 | 7.54 | 6.32 | 5.93 | 0.75 | 1.73 | 7.30 | 2.19 | 7.05 | 2.16 | 2.16 | - | - | - |
| 2069/70 Energy Forecast (GWh) | 845.88 | 416.22 | 451.06 | 147.06 | 31.68 | 57.00 | 113.12 | 63.49 | 36.78 | 2.41 | 4.14 | 10.95 | 2.19 | 4.52 | 129.77 | 69.21 | - | - | - |

# Nepal Electricity Authority
## Generation Operation and Maintenance



**Proposed Generation Declaration/Forecast for FY 2067/68 (FY 2010/11 A.D.)**

*Unit: MWh*

| S.N. | Power Stations | Installed Capacity (MW) | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kaligandaki A | 144.00 | 81,299.07 | 79,399.27 | 76,451.67 | 74,058.60 | 72,410.13 | 51,772.60 | 41,315.20 | 40,355.07 | 50,126.33 | 57,604.73 | 74,444.40 | 76,948.27 | 776,185.33 |
| 2 | Middle Marsyangdi | 70.00 | 47,840.00 | 47,110.00 | 46,980.00 | 42,225.00 | 20,265.60 | 21,410.00 | 15,990.00 | 14,610.00 | 17,565.00 | 26,305.00 | 39,615.00 | 47,135.00 | 387,050.60 |
| 3 | Marsyngdi | 69.00 | 41,882.39 | 41,441.55 | 41,045.99 | 40,878.51 | 40,165.64 | 30,760.69 | 25,000.13 | 23,661.76 | 27,009.68 | 37,651.01 | 44,854.55 | 43,020.29 | 437,372.20 |
| 4 | Kulekhani I | 60.00 | 5,159.79 | 4,847.32 | 5,489.68 | 4,014.26 | 11,125.67 | 18,172.27 | 18,896.00 | 17,713.73 | 16,270.93 | 5,846.94 | 9,711.73 | 5,164.48 | 122,412.80 |
| 5 | Kulekhani II | 32.00 | 3,146.27 | 2,853.87 | 2,956.89 | 2,227.26 | 5,309.13 | 8,813.27 | 8,484.86 | 8,381.11 | 7,725.73 | 3,727.77 | 4,307.15 | 3,273.09 | 61,206.40 |
| 6 | Trisuli | 24.00 | 12,728.81 | 12,524.22 | 12,468.65 | 12,022.36 | 12,504.92 | 12,260.53 | 10,070.80 | 9,278.29 | 10,343.44 | 11,639.71 | 13,199.94 | 12,925.75 | 141,967.41 |
| 7 | Gandak | 15.00 | 3,450.13 | 2,434.78 | 2,743.24 | 2,203.82 | 2,323.23 | 3,476.13 | 3,325.41 | 3,154.34 | 2,002.32 | 3,152.34 | 3,924.51 | 4,031.43 | 36,221.67 |
| 8 | Modi Khola | 14.80 | 5,062.51 | 5,606.67 | 6,793.99 | 6,485.99 | 5,211.89 | 4,020.89 | 3,115.62 | 2,986.49 | 4,329.73 | 5,448.67 | 6,789.60 | 5,588.20 | 61,440.25 |
| 9 | Devighat | 15.00 | 8,686.17 | 8,583.27 | 8,745.34 | 8,542.77 | 8,932.12 | 8,617.54 | 7,253.05 | 6,741.25 | 7,532.38 | 8,502.95 | 9,269.05 | 8,590.10 | 99,995.99 |
| 10 | Sunkoshi | 10.05 | 6,466.11 | 6,533.10 | 6,532.33 | 6,341.59 | 5,516.55 | 4,140.90 | 3,431.24 | 3,030.61 | 3,398.94 | 4,053.44 | 5,352.05 | 6,191.11 | 60,987.98 |
| 11 | Ilam (Puwa Khola) | 6.20 | 3,807.50 | 3,646.06 | 3,899.36 | 3,974.13 | 3,115.23 | 2,171.75 | 1,694.46 | 1,772.37 | 1,439.53 | 1,859.07 | 2,555.44 | 3,754.58 | 33,689.47 |
| 12 | Chatara | 3.20 | 735.77 | 636.65 | 462.32 | 279.73 | 225.77 | 180.53 | 194.15 | 185.96 | 182.23 | 226.20 | 452.00 | 487.92 | 4,249.22 |
| 13 | Panauti | 2.40 | 454.89 | 576.23 | 549.63 | 435.46 | 332.69 | 256.62 | 157.27 | 145.19 | 102.52 | 143.90 | 141.66 | 239.31 | 3,535.36 |
| 14 | Seti | 1.50 | 836.99 | 842.65 | 1,034.86 | 1,017.87 | 1,046.84 | 1,037.03 | 985.98 | 904.15 | 984.44 | 987.82 | 771.88 | 897.23 | 11,347.77 |
| 15 | Fewa | 1.00 | 128.87 | 130.76 | 182.33 | 258.99 | 350.09 | 391.77 | 316.08 | 198.25 | 135.56 | 106.40 | 188.45 | 194.71 | 2,582.27 |
| 16 | Sundarijal | 0.64 | 469.58 | 457.62 | 450.34 | 409.95 | 415.37 | 390.93 | 327.62 | 286.23 | 251.77 | 248.18 | 304.06 | 415.73 | 4,427.38 |
| | **Total** | **468.79** | **222,157.32** | **217,629.62** | **216,790.23** | **205,387.27** | **189,257.86** | **167,878.98** | **140,560.60** | **133,408.29** | **149,404.14** | **167,507.56** | **215,883.56** | **218,858.87** | **2,244,724.30** |

# Nepal Electricity Authority
## Generation Operation and Maintenance

Actual Generation for the FY 2067/68 (FY 2010/11 A.D.)

*Unit: MWh*

| S.N. | Power Stations/Month | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kaligandaki 'A' | 53,269.00 | 87,880.00 | 82,943.00 | 76,109.00 | 72,479.00 | 52,327.00 | 40,719.00 | 38,588.00 | 38,994.00 | 52,656.00 | 85,843.00 | 93,365.00 | 775,172.00 |
| 2 | Mid-Marsyangdi | 38,821.40 | 34,967.10 | 38,460.50 | 37,942.20 | 20,057.90 | 27,531.70 | 21,542.80 | 19,874.80 | 20,831.30 | 28,733.20 | 44,877.40 | 43,511.00 | 377,151.30 |
| 3 | Marsyandi | 38,272.10 | 42,258.30 | 41,360.20 | 40,607.20 | 39,868.40 | 30,600.30 | 23,859.00 | 22,755.80 | 21,900.40 | 29,757.00 | 46,449.00 | 45,473.60 | 423,161.30 |
| 4 | Kulekhani I | 9,633.00 | 3,171.00 | 4,396.00 | 3,927.00 | 5,545.00 | 9,594.00 | 12,680.00 | 11,999.00 | 17,468.00 | 8,149.00 | 6,726.00 | 5,598.00 | 98,886.00 |
| 5 | Kulekhani II | 4,932.56 | 1,477.54 | 2,016.09 | 1,892.44 | 3,035.70 | 5,108.52 | 6,529.30 | 6,566.41 | 8,700.85 | 4,132.94 | 3,348.07 | 2,727.71 | 50,468.13 |
| 6 | Trishuli | 11,091.60 | 12,732.20 | 11,976.10 | 11,248.70 | 10,631.50 | 10,455.30 | 8,644.00 | 7,974.60 | 7,446.10 | 10,063.10 | 13,316.90 | 12,666.90 | 128,247.00 |
| 7 | Gandak | 2,000.90 | 1,245.40 | 1922.9 | 1,014.00 | - | 1766 | 1561.7 | 896.6 | 493.9 | - | - | 430.00 | 11,331.40 |
| 8 | Modi | 3,661.30 | 5,073.20 | 8,786.20 | 8,321.80 | 5,153.80 | 3,955.90 | 2,917.90 | 2,199.05 | 2,923.40 | 4,475.70 | 6,653.30 | 5,839.80 | 59,961.35 |
| 9 | Devighat | 7,617.80 | 8,379.30 | 6,449.70 | - | 5,487.20 | 6,394.20 | 6,458.00 | 6,133.30 | 6,083.10 | 6,478.20 | 6,659.83 | 7,992.00 | 74,132.63 |
| 10 | Sunkoshi | 6,500.80 | 6,400.60 | 6,902.10 | 6,819.60 | 5,480.90 | 3,789.60 | 3,163.00 | 2,888.70 | 2,776.60 | 3,433.60 | 5,314.20 | 6,885.70 | 60,355.40 |
| 11 | Puwa | 3,757.73 | 3,794.36 | 3,629.72 | 3,910.51 | 2,759.77 | 1,877.91 | 1,480.84 | 1,021.18 | 1,374.88 | 2,212.69 | 2,700.74 | 3,027.51 | 31,547.81 |
| 12 | Chatara | 653.25 | 666.25 | 522.75 | 317.25 | 265.00 | 260.75 | 70.75 | 167.00 | 99.75 | 227.75 | 357.50 | 489.75 | 4,097.75 |
| 13 | Panauti | 369.85 | 557.42 | 609.79 | 238.54 | 258.74 | 230.84 | 107.18 | 146.39 | 68.56 | 141.91 | - | - | 2,729.22 |
| 14 | Seti | 957.87 | 940.12 | 1,012.59 | 1,016.91 | 887.85 | 1,040.58 | 871.20 | 917.10 | 1,022.85 | 1,012.77 | 999.36 | 936.99 | 11,616.19 |
| 15 | Fewa | 156.62 | 144.19 | 134.62 | 78.41 | 280.06 | 356.88 | 235.70 | 203.54 | 96.98 | - | - | 226.49 | 1,913.49 |
| 16 | Sundarijal | 460.33 | 390.00 | 392.00 | 459.66 | 429.33 | 189.66 | 162.33 | 282.00 | 243.66 | 288.00 | 391.66 | 432.99 | 4,121.61 |
| | **Total (Hydro)** | **182,156.10** | **210,076.98** | **211,514.26** | **193,903.22** | **172,620.15** | **155,479.14** | **131,002.70** | **122,613.46** | **130,524.33** | **151,761.85** | **223,636.96** | **229,603.44** | **2,114,892.58** |
| 18 | Multifuel | 661.12 | 79.67 | 119.68 | 301.23 | 781.68 | 234.02 | 2.71 | - | 108.73 | 60.02 | - | - | 2,348.86 |
| 19 | Hetauda Diesel | 332.70 | 96.12 | 87.62 | 155.06 | 122.28 | 145.12 | 163.72 | 23.85 | 88.54 | 79.80 | 25.91 | 12.26 | 1,332.97 |
| | **Total (Thermal)** | **993.82** | **175.79** | **207.30** | **456.29** | **903.96** | **379.14** | **166.43** | **23.85** | **197.27** | **139.82** | **25.91** | **12.26** | **3,681.83** |
| | **Grand Total** | **183,149.92** | **210,252.77** | **211,721.55** | **194,359.51** | **173,524.11** | **155,858.28** | **131,169.12** | **122,637.31** | **130,721.60** | **151,901.67** | **223,662.86** | **229,615.69** | **2,118,574.40** |

# Nepal Electricity Authority
## Generation Operation and Maintenance



**Proposed Generation Declaration/Forecast for FY 2068/69 (FY 2011/12 A.D.)**

*Unit: MWh*

| S.N. | Power Stations | Installed Capacity (MW) | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kaligandaki A | 144.00 | 81,299.07 | 84,990.47 | 79,587.87 | 76,836.67 | 72,394.40 | 52,192.27 | 41,617.80 | 40,991.13 | 47,936.93 | 57,845.07 | 81,714.80 | 88,870.53 | 806,277.00 |
| 2 | Middle Marsyangdi | 70.00 | 38,683.14 | 37,766.30 | 37,763.22 | 37,906.55 | 36,810.44 | 27,459.97 | 21,509.72 | 22,509.63 | 22,371.43 | 30,483.50 | 43,439.36 | 42,603.22 | 399,306.48 |
| 3 | Marsyngdi | 69.00 | 42,094.06 | 42,953.81 | 42,691.88 | 42,951.20 | 40,669.65 | 31,499.87 | 25,166.75 | 24,138.77 | 25,927.42 | 36,141.11 | 47,049.82 | 45,723.00 | 447,007.33 |
| 4 | Kulekhani I | 60.00 | 10,237.38 | 8,066.56 | 9,649.49 | 7,132.21 | 11,414.81 | 19,964.20 | 20,314.82 | 17,196.91 | 18,605.50 | 11,453.33 | 10,155.61 | 8,825.18 | 153,016.00 |
| 5 | Kulekhani II | 32.00 | 5,297.99 | 3,870.25 | 4,276.62 | 3,287.48 | 5,932.69 | 10,662.69 | 8,922.54 | 8,540.41 | 9,416.02 | 6,079.77 | 5,523.74 | 4,697.79 | 76,508.00 |
| 6 | Trisuli | 24.00 | 12,190.67 | 12,788.18 | 12,300.45 | 11,967.85 | 11,968.55 | 11,927.88 | 9,864.02 | 9,174.59 | 9,470.40 | 11,221.25 | 13,489.95 | 12,837.38 | 139,201.15 |
| 7 | Gandak | 15.00 | 3,175.75 | 2,439.62 | 2,964.40 | 2,349.79 | 1,995.77 | 3,390.32 | 3,343.65 | 2,725.17 | 1,767.14 | 3,082.93 | 3,335.55 | 3,379.24 | 33,949.31 |
| 8 | Modi Khola | 14.80 | 4,408.97 | 6,087.92 | 8,566.31 | 7,923.17 | 5,374.20 | 4,078.62 | 3,156.84 | 2,827.17 | 3,918.60 | 5,355.51 | 7,483.07 | 6,188.11 | 65,368.50 |
| 9 | Devighat | 15.00 | 8,686.17 | 8,583.27 | 8,745.34 | 8,542.77 | 8,932.12 | 8,617.54 | 7,253.05 | 6,741.25 | 7,532.38 | 8,502.95 | 9,269.05 | 8,590.10 | 99,995.99 |
| 10 | Sunkoshi | 10.05 | 6,518.60 | 6,521.37 | 6,742.79 | 6,640.30 | 5,659.07 | 4,144.38 | 3,487.12 | 3,128.39 | 3,349.33 | 4,137.65 | 5,657.63 | 6,620.37 | 62,607.00 |
| 11 | Ilam (Puwa Khola) | 6.20 | 3,841.15 | 3,739.03 | 3,799.92 | 3,990.84 | 3,056.32 | 2,135.66 | 1,740.52 | 1,759.33 | 1,613.66 | 2,169.05 | 2,960.99 | 3,554.04 | 34,360.52 |
| 12 | Chatara | 3.20 | 726.78 | 713.00 | 593.13 | 348.17 | 273.82 | 247.13 | 155.42 | 199.15 | 183.45 | 266.57 | 432.65 | 549.45 | 4,688.72 |
| 13 | Panauti | 2.40 | 440.38 | 550.42 | 582.44 | 377.59 | 323.61 | 271.42 | 169.41 | 163.64 | 112.93 | 154.00 | 119.66 | 196.79 | 3,462.28 |
| 14 | Seti | 1.50 | 929.51 | 916.19 | 1,018.34 | 1,015.29 | 977.02 | 1,036.54 | 938.72 | 929.90 | 1,005.64 | 990.55 | 960.26 | 911.89 | 11,629.87 |
| 15 | Fewa | 1.00 | 178.04 | 170.16 | 180.94 | 217.31 | 328.50 | 393.82 | 297.26 | 225.62 | 159.26 | 99.95 | 188.45 | 275.05 | 2,714.37 |
| 16 | Sundarijal | 0.64 | 469.43 | 435.63 | 432.24 | 451.37 | 429.64 | 316.53 | 274.84 | 296.96 | 261.13 | 278.04 | 372.35 | 434.79 | 4,452.96 |
| | **Total** | **468.79** | **219,177.08** | **220,592.19** | **219,895.39** | **211,938.56** | **206,540.60** | **178,338.83** | **148,212.49** | **141,548.02** | **153,631.22** | **178,261.21** | **232,152.95** | **234,256.94** | **2,344,545.47** |

**Note:**

1. The generation outages attributed to scheduled Short-and intermediate-term shutdowns are disregarded in the current study because of uncertainty of their time and duration. The given forecast can be subsequently amended by incorporating real-time generation loss; however, these shutdowns would not incur generation loss and, hence, would not affect the given forecast provided they are carried out during lean inflow periods viz. February to April.
2. The generation loss due to short duration schedule and unscheduled (forced & maintenance) outages, hydrological conditions and unit availability over a period of time are spontaneously reflected in the historical time series generation data. The current Generation Declaration/Forecast is basically based on recorded historical generation data.

# Nepal Electricity Authority
## Generation Operation and Maintenance

**Actual Generation for the FY 2068/69 (FY 2011/12 A.D.)** *Unit: MWh*

| S.N. | Power Stations/Month | Shrawan | Bhadra | Aswin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kaligandaki 'A' | 97,146.00 | 95,179.00 | 89,537.00 | 86,031.00 | 76,345.00 | 53,209.00 | 41,116.00 | 38,628.00 | 46,979.00 | 52,635.00 | 93,203.00 | 90,746.00 | 860,754.00 |
| 2 | Mid-Marsyangdi | 43,085.60 | 46,377.90 | 42,804.70 | 43,003.00 | 36,903.30 | 27,596.30 | 12,596.80 | 22,233.67 | 26,137.00 | 31,159.25 | 48,525.43 | 44,921.25 | 425,344.20 |
| 3 | Marsyandi | 45,669.20 | 45,602.40 | 37,491.70 | 44,563.40 | 34,698.00 | 31,715.70 | 25,909.20 | 24,523.90 | 27,934.20 | 32,558.20 | 48,613.00 | 46,620.50 | 445,899.40 |
| 4 | Kulekhani I | 7,888.00 | 7,611.00 | 13,698.00 | 8,112.00 | 6,866.00 | 8,683.00 | 13,638.00 | 25,823.00 | 25,403.00 | 17,814.00 | 3,884.00 | 3,864.00 | 143,284.00 |
| 5 | Kulekhani II | 3,770.64 | 3,531.99 | 6,577.05 | 3,765.23 | 3,763.92 | 4,488.72 | 7,047.39 | 13,195.85 | 12,473.07 | 8,913.30 | 2,026.90 | 1,894.32 | 71,448.38 |
| 6 | Trishuli | 12,251.90 | 11,939.10 | 11,856.40 | 13,358.50 | 12,665.40 | 11,262.60 | 8,626.10 | 8,627.20 | 10,240.50 | 11,047.80 | 12,657.70 | 10,239.60 | 134,772.80 |
| 7 | Gandak | 2,119.40 | 2535.7 | 2614.6 | 177.6 | - | - | 1,455.10 | 2,856.60 | 926.40 | - | - | 392.40 | 13,077.80 |
| 8 | Modi | 3,021.10 | 4,081.90 | 2,257.30 | 3,313.10 | 2,976.10 | 2,564.00 | 2,165.20 | 2,269.10 | 3,300.70 | 4,491.10 | 3,313.80 | 855.00 | 34,608.40 |
| 9 | Devighat | 9,393.40 | 9,206.60 | 9,455.10 | 10,169.90 | 9,903.10 | 7,109.10 | 7,499.10 | 7,248.30 | 8,425.90 | 9,139.80 | 9,736.30 | 7,802.60 | 105,089.20 |
| 10 | Sunkoshi | 7,213.60 | 6,965.40 | 7,160.60 | 7,348.80 | 5,852.60 | 4,391.40 | 3,224.40 | 3,298.10 | 3,700.50 | 3,744.80 | 6,335.10 | 7,147.80 | 66,383.10 |
| 11 | Puwa | 3,205.89 | 3,743.02 | 3,846.84 | 4,197.49 | 2,916.64 | 1,839.38 | 1,239.85 | 1,019.31 | 1,182.94 | 1,163.55 | 1,240.52 | 2,734.57 | 28,329.99 |
| 12 | Chatara | 804.25 | 460.75 | 612.75 | 364.25 | 195.00 | 39.75 | - | 28.75 | 187.25 | 146.75 | 193.25 | - | 3,032.75 |
| 13 | Panauti | - | - | 152.64 | 262.80 | 249.30 | 281.34 | 111.78 | - | - | 43.74 | 30.78 | 147.78 | 1,280.16 |
| 14 | Seti | 906.03 | 903.60 | 603.99 | 998.64 | 989.55 | 1,016.91 | 974.70 | 953.46 | 987.57 | 737.73 | 747.18 | 591.93 | 10,411.29 |
| 15 | Fewa | 207.86 | 150.90 | 159.24 | 150.18 | 187.72 | 247.65 | 190.22 | 229.24 | 219.13 | 125.96 | 4.11 | - | 1,872.21 |
| 16 | Sundarijal | 431.00 | 425.33 | 440.00 | 456.33 | 426.33 | 380.00 | 322.66 | 306.00 | 266.00 | 241.33 | 252.33 | 398.33 | 4,345.62 |
| 17 | Pharping | 2.32 | 3.56 | 3.72 | 4.11 | 4.30 | 4.26 | 3.35 | 3.12 | 2.54 | 1.63 | 1.05 | 1.12 | 35.08 |
| | **Total (Hydro)** | **237,116.18** | **238,718.15** | **229,271.63** | **226,276.32** | **194,942.26** | **154,829.11** | **126,119.85** | **151,243.59** | **168,365.69** | **173,963.94** | **230,764.45** | **218,357.20** | **2,349,968.37** |
| 18 | Multifuel | - | - | - | - | 2.46 | 89.21 | 223.33 | 223.20 | 37.99 | - | 41.70 | 5.64 | 623.53 |
| 19 | Hetauda Diesel | 5.74 | 2.60 | 5.75 | 43.92 | 9.00 | 4.80 | 27.48 | 24.83 | 325.72 | 476.01 | 6.94 | 7.70 | 940.49 |
| | **Total (Thermal)** | **5.74** | **2.60** | **5.75** | **43.92** | **11.46** | **94.01** | **250.81** | **248.03** | **363.71** | **476.01** | **48.64** | **13.38** | **1,564.02** |
| | **Grand Total** | **237,119.60** | **238,717.19** | **229,273.66** | **226,316.13** | **194,949.42** | **154,918.86** | **126,367.31** | **151,488.40** | **168,726.87** | **174,438.32** | **230,812.03** | **218,369.46** | **2,351,532.39** |

# Nepal Electricity Authority
## Generation Operation and Maintenance



**Proposed Generation Declaration/Forecast for FY 2069/70 (FY 2012/13 A.D.)**

*Unit: MWh*

| S.N. | Power Stations | Installed Capacity (MW) | Shrawan | Bhadra | Aswin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Asar | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kaligandaki A | 144.00 | 92,279.63 | 91,502.17 | 86,695.14 | 84,472.71 | 74,866.93 | 52,246.70 | 41,618.43 | 39,971.67 | 48,705.76 | 56,654.66 | 87,979.16 | 88,891.29 | 845,884.24 |
| 2 | Middle Marsyangdi | 70.00 | 43,747.94 | 45,040.63 | 42,128.90 | 41,785.79 | 35,296.50 | 26,010.33 | 18,388.90 | 20,804.52 | 23,348.99 | 30,329.27 | 44,916.49 | 44,420.32 | 416,218.58 |
| 3 | Marsyngdi | 69.00 | 44,851.51 | 44,884.86 | 42,492.04 | 45,217.67 | 39,787.38 | 30,997.26 | 24,775.69 | 23,449.24 | 26,562.27 | 35,099.07 | 47,138.47 | 45,805.77 | 451,061.22 |
| 4 | Kulekhani I | 60.00 | 9,477.64 | 7,930.67 | 8,806.74 | 6,505.13 | 8,745.56 | 15,220.10 | 17,020.97 | 17,271.39 | 14,307.89 | 10,058.14 | 7,368.99 | 7,052.20 | 129,765.43 |
| 5 | Kulekhani II | 32.00 | 5,054.74 | 4,229.69 | 4,696.93 | 3,469.41 | 4,664.30 | 8,117.38 | 9,077.85 | 9,211.41 | 7,630.87 | 5,364.34 | 3,930.13 | 3,761.18 | 69,208.23 |
| 6 | Trisuli | 24.00 | 12,970.00 | 12,831.67 | 12,576.34 | 12,955.79 | 13,037.39 | 12,719.40 | 10,569.14 | 10,045.28 | 10,946.06 | 12,241.05 | 13,669.83 | 12,501.77 | 147,063.73 |
| 7 | Gandak | 15.00 | 3,311.60 | 2,720.05 | 3,132.13 | 1,183.27 | 1,771.33 | 2,779.03 | 3,080.40 | 3,189.40 | 1,526.40 | 2,381.69 | 3,321.05 | 3,285.21 | 31,681.57 |
| 8 | Modi Khola | 14.80 | 3,350.11 | 5,187.10 | 6,218.77 | 6,057.08 | 4,372.78 | 3,430.97 | 2,825.04 | 3,029.55 | 4,425.62 | 5,455.31 | 7,325.86 | 5,323.48 | 57,001.66 |
| 9 | Devighat | 15.00 | 9,719.66 | 9,581.68 | 9,612.94 | 9,854.59 | 10,092.94 | 9,260.96 | 8,613.22 | 8,191.96 | 8,950.49 | 9,821.43 | 10,418.09 | 8,999.18 | 113,117.13 |
| 10 | Sunkoshi | 10.05 | 6,823.27 | 6,762.18 | 6,850.07 | 6,755.81 | 5,616.15 | 4,221.43 | 3,375.51 | 2,938.86 | 3,445.27 | 4,126.57 | 5,869.35 | 6,706.58 | 63,491.05 |
| 11 | Ilam (Puwa Khola) | 6.20 | 4,073.54 | 4,199.80 | 4,310.05 | 4,568.54 | 3,506.24 | 2,408.05 | 1,895.18 | 1,856.50 | 1,722.71 | 1,960.36 | 2,656.87 | 3,622.45 | 36,780.28 |
| 12 | Chatara | 3.20 | - | - | - | - | 150.00 | 180.00 | 200.00 | 210.00 | 220.00 | 350.00 | 450.00 | 650.00 | 2,410.00 |
| 13 | Panauti | 2.40 | 250.00 | 545.25 | 545.45 | 440.50 | 410.10 | 410.10 | 290.45 | 290.50 | 220.60 | 210.15 | 150.75 | 380.65 | 4,144.50 |
| 14 | Seti | 1.50 | 870.32 | 855.01 | 909.14 | 983.52 | 957.69 | 1,017.92 | 937.78 | 939.04 | 988.25 | 902.02 | 810.50 | 779.40 | 10,950.60 |
| 15 | Fewa | 1.00 | 161.51 | 130.40 | 154.80 | 184.44 | 259.53 | 328.89 | 260.25 | 202.17 | 171.24 | 104.82 | 102.86 | 130.77 | 2,191.66 |
| 16 | Sundarijal | 0.64 | 456.91 | 451.28 | 445.78 | 446.66 | 420.98 | 378.37 | 327.24 | 303.13 | 273.00 | 265.43 | 331.05 | 415.35 | 4,515.18 |
| | **Total** | **468.79** | **237,398.38** | **236,852.46** | **229,575.20** | **224,880.91** | **203,955.77** | **169,726.87** | **143,256.05** | **141,904.63** | **153,445.43** | **175,324.30** | **236,439.46** | **232,725.60** | **2,385,485.07** |
| | | | | | | | | | | | | | **Deduction of 37324.8 MWh for Planned Outage of KGA** | | **37,324.80** |
| | **Net** | | | | | | | | | | | | | | **2,348,160.27** |

**Note:**

1. The generation outage of 37,324.8 MWh in KGA owing to Plant Shutdown (12 days) for Remedial work of the Spindle Seal of inlet valve and Replacement of main seal of main inlet valve of Unit No. 2 or Unit 3 can be deducted in the proposed generation declaration/forecast of KGA."
2. The targets for Shrawan, Bhadra, Ashwin, Kartik for Chatara are not provided, however, if it comes early in the month of Ashwin, its target for Ashwin and Kartik shall be 582.93 MWh and 343.40 MWh respectively.

# Nepal Electricity Authority
## Generation Operation and Maintenance

**Actual Generation for the FY 2069/70 (FY 2012/13 A.D.)** *Unit: MWh*

| S.N. | Power Stations/Month | Shrawan | Bhadra | Aswin | Kartik | Mangsir | Poush | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Kaligandaki 'A' | 96,909.00 | 97,864.00 | 90,407.00 | 82,537.00 | 64,932.00 | 46,001.00 | 478,650.00 |
| 2 | Mid-Marsyangdi | 46,076.26 | 45,292.52 | 45,674.04 | 41,152.02 | 33,758.00 | 24,383.87 | 236,336.71 |
| 3 | Marsyandi | 48,103.80 | 45,592.60 | 45,991.70 | 45,590.00 | 38,143.30 | 27,769.20 | 251,190.60 |
| 4 | Kulekhani I | 4,704.00 | 2,205.00 | 464.00 | 1,148.00 | 3,958.00 | 8,608.00 | 21,087.00 |
| 5 | Kulekhani II | 2,467.94 | 761.29 | 213.26 | 585.18 | 2,072.20 | 4,396.20 | 10,496.07 |
| 6 | Trishuli | 9,557.50 | 9,826.30 | 11,014.20 | 11,866.00 | 11,988.80 | 9,687.20 | 63,940.00 |
| 7 | Gandak | 2,092.90 | 2,587.90 | 3,499.30 | 773.80 | - | 1,679.10 | 10,633.00 |
| 8 | Modi | 750.70 | 2,013.30 | 4,060.30 | 3,612.60 | 2,444.10 | 2,309.00 | 15,190.00 |
| 9 | Devighat | 7,407.60 | 7,608.80 | 8,895.20 | 8,194.90 | 9,992.90 | 8,547.60 | 50,647.00 |
| 10 | Sunkoshi | 7,131.40 | 7,194.40 | 7,152.20 | 7,063.20 | 5,115.50 | 3,636.90 | 37,293.60 |
| 11 | Puwa | 4,341.68 | 3,228.63 | 3,888.38 | 3,783.06 | 2,312.64 | 1,553.41 | 19,107.80 |
| 12 | Chatara | - | - | - | - | 11.25 | 125.00 | 136.25 |
| 13 | Panauti | 266.76 | 242.82 | 65.52 | 126.18 | 40.65 | 151.85 | 893.78 |
| 14 | Seti | 927.00 | 930.96 | 978.03 | 1,029.24 | 1,024.20 | 993.87 | 5,883.30 |
| 15 | Fewa | 263.05 | 238.12 | 228.16 | 104.25 | - | 137.34 | 970.92 |
| 16 | Sundarijal | 369.66 | 382.33 | 419.66 | 444.33 | 402.00 | 340.66 | 2,358.64 |
| 17 | Pharping | 3.20 | 2.88 | 1.56 | 0.97 | 0.43 | 0.37 | 9.41 |
| | Total (Hydro) | 231,372.45 | 225,971.85 | 222,952.51 | 208,010.73 | 176,195.97 | 140,320.57 | 1,204,824.08 |
| 18 | Multifuel | 65.97 | 2.92 | - | 22.06 | 118.18 | 1,317.06 | 1,526.19 |
| 19 | Hetauda Diesel | 3.46 | 7.31 | 2.40 | 104.53 | 178.21 | 2,150.86 | 2,446.76 |
| | Total (Thermal) | 5.74 | 2.60 | 5.75 | 43.92 | 11.46 | 94.01 | 3,972.95 |
| | **Grand Total** | **237,119.60** | **238,717.19** | **229,273.66** | **226,316.13** | **194,949.42** | **154,918.86** | **1,208,797.03** |

**Note:**
Provisional figures subjected to final audit

**Energy Utilization, Self Sufficiency Ratio and Station Loss for FY 2067/68 (2010/11 A.D.)**

| S.No. | Power Stations | Generation (MWh) | Backfeed (MWh) | Available Energy (MWh) | Station and/or Internal Consumption (MWh) | Local Distribution (MWh) | Grid Transmission (MWh) | Net Grid Transmission (MWh) | Utilized Energy (MWh) | Self Sufficiency Ratio | Station Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C=A+B | D | E | F | G=F-B | H=D+E+F | I=(E+F)/C | J=(C-H)/C |
| 1 | Kaligandaki 'A' | 775,172.00 | 2,537.00 | 777,709.00 | 1,794.00 | - | 773,356.03 | 770,819.03 | 775,150.03 | 99.44% | 0.33% |
| 2 | Mid-Marsyangdi | 377,151.30 | 7,872.10 | 385,023.40 | 1,258.10 | 1,493.70 | 374,893.20 | 367,021.10 | 377,645.00 | 97.76% | 1.92% |
| 3 | Marsyandi | 423,161.30 | 374,988.96 | 798,150.26 | 1,368.74 | 216.75 | 786,475.20 | 411,486.24 | 788,060.69 | 98.56% | 1.26% |
| 4 | Kulekhani I | 98,886.00 | 115,383.22 | 214,269.22 | 657.28 | 8,596.53 | 203,789.18 | 88,405.96 | 213,042.99 | 99.12% | 0.57% |
| 5 | Kulekhani II | 50,468.13 | - | 50,468.13 | 200.36 | - | 49,256.70 | 49,256.70 | 49,457.06 | 97.60% | 2.00% |
| 6 | Trishuli | 128,247.00 | - | 128,247.00 | 461.49 | 13,403.74 | 113,863.61 | 113,863.61 | 127,728.84 | 99.24% | 0.40% |
| 7 | Gandak | 11,331.40 | 20,563.58 | 31,894.98 | 457.19 | 30,888.34 | 494.41 | (20,069.17) | 31,839.94 | 98.39% | 0.17% |
| 8 | Modi | 59,961.35 | 7,862.60 | 67,823.95 | 185.40 | 7,711.15 | 58,307.00 | 50,444.40 | 66,203.55 | 97.34% | 2.39% |
| 9 | Devighat | 74,132.63 | 74,736.01 | 148,868.64 | 604.18 | 9,396.73 | 135,089.90 | 60,353.89 | 145,090.81 | 97.06% | 2.54% |
| 10 | Sunkoshi | 60,355.40 | 6,339.70 | 66,695.10 | 469.05 | 14,429.30 | 51,101.60 | 44,761.90 | 65,999.95 | 98.25% | 1.04% |
| 11 | Puwa | 31,547.81 | 2.83 | 31,550.64 | 113.88 | - | 31,260.74 | 31,257.91 | 31,374.62 | 99.08% | 0.56% |
| 12 | Chatara | 4,097.75 | 362.80 | 4,460.55 | 137.72 | 1,846.49 | 2,427.20 | 2,064.40 | 4,411.41 | 95.81% | 1.10% |
| 13 | Panauti | 2,729.22 | 1,573.93 | 4,303.15 | - | 3,151.61 | 1,138.66 | (435.27) | 4,290.27 | 99.70% | 0.30% |
| 14 | Seti | 11,616.19 | - | 11,616.19 | 50.50 | - | 11,534.73 | 11,534.73 | 11,585.23 | 99.30% | 0.27% |
| 15 | Fewa | 1,913.49 | 5.21 | 1,918.70 | 25.47 | - | 1,869.37 | 1,864.16 | 1,894.83 | 97.43% | 1.24% |
| 16 | Sundarijal | 4,121.61 | - | 4,121.61 | 10.88 | - | 4,110.74 | 4,110.74 | 4,121.62 | 99.74% | - |
| | Total (Hydro) | 2,114,892.58 | 612,227.93 | 2,727,120.51 | 7,794.22 | 91,134.34 | 2,598,968.26 | 1,986,740.33 | 2,697,896.83 | 98.64% | 1.07% |
| 17 | Multifuel | 2,348.86 | 849.00 | 3,197.86 | 750.07 | - | 2,219.10 | 1,370.10 | 2,969.17 | 69.39% | 7.15% |
| 18 | Hetauda Diesel | 1,332.97 | - | 1,332.97 | 4.83 | - | 1,328.12 | 1,328.12 | 1,332.95 | 99.64% | 0.00% |
| | Total (Thermal) | 3,681.83 | 849.00 | 4,530.83 | 754.90 | - | 3,547.22 | 2,698.22 | 4,302.12 | 78.29% | 5.05% |
| | Grand Total | 2,118,574.41 | 613,076.93 | 2,731,651.34 | 8,549.13 | 91,134.34 | 2,602,515.48 | 1,989,438.54 | 2,702,198.95 | 98.61% | 1.08% |

**Energy Utilization, Self Sufficiency Ratio and Station Loss for FY 2068/69 (2011/12 A.D.)**

| S.No. | Power Stations | Generation (MWh) | Backfeed (MWh) | Available Energy (MWh) | Station and/or Internal Consumption (MWh) | Local Distribution (MWh) | Grid Transmission (MWh) | Net Grid Transmission (MWh) | Utilized Energy (MWh) | Self Sufficiency Ratio | Station Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C=A+B | D | E | F | G=F-B | H=D+E+F | I=(E+F)/C | J=(C-H)/C |
| 1 | Kaligandaki 'A' | 860,754.00 | 1,400.00 | 862,154.00 | 1,667.00 | 897.59 | 857,029.40 | 855,629.40 | 859,593.99 | 99.51% | 0.30% |
| 2 | Mid-Marsyangdi | 425,344.20 | 10,544.28 | 435,888.48 | 1,071.68 | 2,438.15 | 424,482.25 | 413,937.97 | 427,992.08 | 97.94% | 1.81% |
| 3 | Marsyandi | 445,899.40 | 424,780.00 | 870,679.40 | 1,430.77 | 154.00 | 855,438.20 | 430,658.20 | 857,022.97 | 98.27% | 1.57% |
| 4 | Kulekhani I | 143,284.00 | 95,206.22 | 238,490.22 | 702.20 | 8,317.30 | 228,022.19 | 132,815.97 | 237,041.69 | 99.10% | 0.61% |
| 5 | Kulekhani II | 71,448.38 | - | 71,448.38 | 225.54 | - | 69,918.71 | 0.02 | 70,144.25 | 97.86% | 1.83% |
| 6 | Trishuli | 134,772.80 | - | 134,772.80 | 405.08 | 13,586.00 | 120,183.69 | 0.00 | 134,174.77 | 99.26% | 0.44% |
| 7 | Gandak | 13,077.80 | 26,655.01 | 39,732.81 | 487.29 | 32,667.13 | 6,371.76 | (20,283.25) | 39,526.18 | 98.25% | 0.52% |
| 8 | Modi | 34,608.40 | 10,167.00 | 44,775.40 | 125.34 | 9,798.75 | 33,634.00 | 23,467.00 | 43,558.09 | 97.00% | 2.72% |
| 9 | Devighat | 105,089.23 | 78,395.45 | 183,484.68 | 368.09 | 14,323.30 | 165,249.52 | 86,854.07 | 179,940.91 | 97.87% | 1.93% |
| 10 | Sunkoshi | 66,383.10 | 742.60 | 67,125.70 | 508.92 | 3,090.71 | 63,161.10 | 62,418.50 | 66,760.73 | 98.70% | 0.54% |
| 11 | Puwa | 28,329.99 | 6.77 | 28,336.76 | 48.10 | - | 28,178.86 | 28,172.08 | 28,226.96 | 99.44% | 0.39% |
| 12 | Chatara | 3,032.75 | 920.64 | 3,953.39 | 107.64 | 1,911.36 | 1,898.00 | 977.36 | 3,917.00 | 96.36% | 0.92% |
| 13 | Panauti | 1,280.16 | 2,098.90 | 3,379.06 | - | 3,218.72 | 291.31 | (1,807.59) | 3,510.03 | - | - |
| 14 | Seti | 10,411.29 | - | 10,411.29 | 29.30 | - | 10,369.07 | 0.00 | 10,398.37 | 99.59% | 0.12% |
| 15 | Fewa | 1,872.21 | 2.40 | 1,874.61 | 24.82 | - | 1,838.40 | 0.01 | 1,863.22 | 98.07% | 0.61% |
| 16 | Sundarijal | 4,345.62 | - | 4,345.62 | 14.58 | - | 3,932.80 | 0.09 | 3,947.38 | 90.50% | 0.61% |
| | Total (Hydro) | 2,349,933.32 | 650,919.27 | 3,000,852.60 | 7,216.36 | 90,403.01 | 2,869,999.25 | 2,014,647.42 | 2,967,618.61 | 98.65% | 1.11% |
| 17 | Multifuel | 623.53 | 712.26 | 1,335.79 | 536.44 | - | 586.90 | (125.36) | 1,123.34 | 43.94% | 15.90% |
| 18 | Hetauda Diesel | 940.53 | - | 940.53 | 3.68 | - | 936.85 | 0.00 | 940.53 | 99.61% | 0.00% |
| | Total (Thermal) | 1,564.06 | 712.26 | 2,276.32 | 540.12 | - | 1,523.75 | (125.36) | 2,063.87 | 66.94% | 9.33% |
| | Grand Total | 2,351,497.38 | 651,631.53 | 3,003,128.91 | 7,756.47 | 90,403.01 | 2,871,523.00 | 2,014,522.06 | 2,969,682.49 | 98.63% | 1.11% |

# Nepal Electricity Authority
## Generation Operation and Maintenance

**Energy Utilization and Station Loss for the FY 2069/70 (FY 2012/13 A.D.) (Shrawan-Poush)**

| S.No. | Power Stations | Generation (MWh) | Backfeed (MWh) | Available Energy (MWh) | Station and/or Internal Consumption (MWh) | Local Distribution (MWh) | Grid Transmission (MWh) | Utilized Energy (MWh) | Station Loss |
|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C=A+B | D | E | F | G=D+E+F | H=(C-G)/C |
| 1 | Kaligandaki 'A' | 478,650.00 | 338.00 | 478,988.00 | 990.00 | 340.50 | 476,371.88 | 477,702.38 | 0.27% |
| 2 | Mid-Marsyangdi | 236,336.71 | 6,885.44 | 243,222.15 | 635.95 | 421.15 | 238,025.75 | 239,082.85 | 1.70% |
| 3 | Marsyandi | 251,190.60 | 237,661.00 | 488,851.60 | 701.10 | 62.43 | 478,009.20 | 478,772.73 | 2.06% |
| 4 | Kulekhani I | 21,087.00 | 72,632.40 | 93,719.40 | 218.84 | 4,836.95 | 88,267.43 | 93,323.22 | 0.42% |
| 5 | Kulekhani II | 10,496.07 | - | 10,496.07 | 81.39 | - | 10,237.23 | 10,318.62 | 1.69% |
| 6 | Trishuli | 63,940.00 | - | 63,940.00 | 148.06 | 7,030.76 | 56,502.98 | 63,681.80 | 0.40% |
| 7 | Gandak | 10,633.00 | 8,655.95 | 19,288.95 | 401.05 | 16,536.45 | 1,608.83 | 18,546.34 | 3.85% |
| 8 | Modi | 15,190.00 | 27,190.06 | 42,380.06 | 103.06 | 15,253.93 | 25,457.55 | 40,814.53 | 3.69% |
| 9 | Devighat | 50,647.00 | 36,864.14 | 87,511.14 | 214.22 | 10,877.61 | 74,832.10 | 85,923.93 | 1.81% |
| 10 | Sunkoshi | 37,293.60 | 1.50 | 37,295.10 | 258.29 | 701.10 | 36,132.40 | 37,091.79 | 0.55% |
| 11 | Puwa | 19,107.80 | 1.64 | 19,109.44 | 26.08 | - | 19,051.37 | 19,077.45 | 0.17% |
| 12 | Chatara | 136.25 | 1,020.08 | 1,156.33 | 31.49 | 1,004.05 | 34.08 | 1,069.62 | 7.50% |
| 13 | Panauti | 893.78 | 946.49 | 1,840.27 | - | 1,669.24 | 163.77 | 1,833.01 | 0.39% |
| 14 | Seti | 5,883.30 | - | 5,883.30 | 14.26 | - | 5,863.95 | 5,878.21 | 0.09% |
| 15 | Fewa | 970.92 | 6.96 | 977.88 | 12.66 | - | 961.71 | 974.36 | 0.36% |
| 16 | Sundarijal | 2,358.64 | - | 2,358.64 | 6.43 | - | 2,352.21 | 2,358.64 | - |
| | Total (Hydro) | 1,204,814.67 | 392,203.66 | 1,597,018.33 | 3,842.88 | 58,734.17 | 1,513,872.43 | 1,576,449.48 | 1.29% |
| 18 | Multifuel | 1,526.19 | 361.80 | 1,887.99 | 346.26 | 15.29 | 1,447.10 | 1,808.66 | 4.20% |
| 19 | Hetauda Diesel | 2,446.76 | - | 2,446.76 | 2.77 | - | 2,443.99 | 2,446.76 | - |
| | Total (Thermal) | 3,972.95 | 361.80 | 4,334.75 | 349.03 | 15.29 | 3,891.09 | 4,255.41 | 1.83% |
| | **Grand Total** | **1,208,787.62** | **392,565.46** | **1,601,353.08** | **4,191.90** | **58,749.47** | **1,517,763.52** | **1,580,704.89** | **1.29%** |

# Nepal Electricity Authority

## Generation Operation and Maintenance

**Generation Related Statistics and Performance Factors**

| S.No. | Power Stations | Total Installed Capacity (MW) | Total No. of Units Installed | Actual Generation (MWh) | | Maximum Generation in a year till date/year (MWh) | Design Generation (MWh) | Generation Target (MWh) of FY 2068/69 | Total Unit Running Hours of FY 2068/69 | Backfeed (MWh) of FY 2068/69 | Net Transmission to Grid (MWh) of FY 2068/69 | Plant Factor (%) of FY 067/68 | Plant Factor (%) of FY 068/69 | Performance Factor of FY 2068/69 | Current No. of Employees |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FY 2067/68 | FY 2068/69 | | | | | | | | | | |
| 1 | Kaligandaki 'A' | 144.00 | 3 | 775,172.00 | 860,754.00 | 860,754.00 (2068/69) | 842,000.00 | 806,277.00 | 18,564.21 | 1,400.00 | 855,629.40 | 61.45 | 68.24 | 106.76% | 165 |
| 2 | Mid-Marsyangdi | 70.00 | 2 | 377,151.30 | 425,344.20 | 425,344.20 (2068/69) | 398,000.00 | 399,306.48 | 12,528.70 | 10,544.28 | 413,937.97 | 61.51 | 69.36 | 106.52% | 66 |
| 3 | Marsyandi | 69.00 | 3 | 423,161.30 | 445,899.40 | 483,928.20 (2052/53) | 462,500.00 | 447,007.33 | 19,421.21 | 424,780.00 | 430,658.20 | 70.01 | 73.77 | 99.75% | 97 |
| 4 | Kulekhani I | 60.00 | 2 | 98,886.00 | 143,284.00 | 249,680.00 (2056/57) | 211,000.00 | 153,016.00 | 6,408.52 | 95,206.22 | 132,815.97 | 18.81 | 27.26 | 93.64% | 112 |
| 5 | Kulekhani II | 32.00 | 2 | 50,468.13 | 71,448.38 | 122,757.00 (2056/57) | 104,600.00 | 76,508.00 | 6,298.78 | - | 69,918.71 | 18.00 | 25.49 | 93.39% | 61 |
| 6 | Trishuli | 24.00 | 6+1 | 128,247.00 | 134,772.80 | 154,423.75 (2053/54) | 163,000.00 | 139,201.15 | 46,867.10 | - | 120,183.69 | 61.00 | 64.10 | 96.82% | 94 |
| 7 | Gandak | 15.00 | 3 | 11,331.40 | 13,077.70 | 52,272.70 (2043/44) | 106,380.00 | 33,949.31 | 3,491.08 | 26,655.01 | (20,283.25) | 8.62 | 9.95 | 38.52% | 51 |
| 8 | Modi | 14.80 | 2 | 59,961.35 | 34,608.40 | 67,348.90 (2063/64) | 92,500.00 | 65,368.50 | 9,952.18 | 10,167.00 | 23,467.00 | 46.25 | 26.69 | 52.94% | 42 |
| 9 | Devighat | 15.00 | 3 | 74,132.63 | 105,089.20 | 106,277.70 (2056/57) | 114,000.00 | 99,995.99 | 22,366.63 | 78,395.45 | 86,854.07 | 56.42 | 79.98 | 105.09% | 82 |
| 10 | Sunkoshi | 10.05 | 3 | 60,355.40 | 66,383.10 | 66,383.10 (2068/69) | 70,000.00 | 62,607.00 | 18,151.85 | 742.60 | 62,418.50 | 68.56 | 75.40 | 106.03% | 57 |
| 11 | Puwa | 6.20 | 2 | 31,547.81 | 28,329.99 | 34,640.93 (2064/65) | 48,000.00 | 34,360.52 | 9,782.01 | 6.77 | 28,172.08 | 58.09 | 52.16 | 82.45% | 38 |
| 12 | Chatara | 3.20 | 2 | 4,097.75 | 3,032.75 | 5,219.75 (2063/64) | 6,000.00 | 4,688.72 | 4,915.00 | 920.64 | 977.36 | 14.62 | 10.82 | 64.68% | 33 |
| 13 | Panauti | 2.40 | 3 | 2,729.22 | 1,280.16 | 4,654.80 (2058/59) | 6,970.00 | 3,462.28 | 2,707.42 | 2,098.90 | (1,807.59) | 12.98 | 6.09 | 36.97% | 24 |
| 14 | Seti | 1.50 | 3 | 11,616.19 | 10,411.29 | 11,616.19 (2067/68) | 9,310.00 | 11,629.87 | 19,359.05 | - | 10,369.07 | 88.40 | 79.23 | 89.52% | 29 |
| 15 | Fewa | 1.00 | 4 | 1,913.49 | 1,872.21 | 3,919.47 (2034/35) | 2,200.00 | 2,714.37 | 11,038.95 | 2.40 | 1,838.40 | 21.84 | 23.36 | 68.97% | 13 |
| 16 | Sundarijal | 0.64 | 2 | 4,121.61 | 4,345.62 | 4,355.50 (2063/64) | 4,770.00 | 4,452.96 | 11,922.48 | - | 3,932.80 | 73.52 | 77.51 | 97.59% | 29 |
| 17 | Pharping | 0.50 | 2 | 21.95 | 35.08 | 48.65(2064/65) | - | - | - | - | - | 0.50 | 0.80 | - | 8 |
| | Total (Hydro) | 469.29 | 48 | 2,114,914.53 | 2,349,968.28 | 2,349,968.28(2068/69) | 2,641,230.00 | 2,344,545.47 | 223,775.17 | 650,919.27 | 2,219,082.37 | 51.45 | 57.16 | 100.23% | 1001 |
| 18 | Multifuel | 39.90 | 6 | 2,348.86 | 623.53 | 86,215.07 (2055/56) | - | - | 170.90 | 665.46 | (83.96) | 0.67 | 0.18 | - | 49 |
| 19 | Hetauda Diesel | 14.10 | 4+3 | 1,332.97 | 940.53 | 24,203.64 (2055/56) | - | - | 708.14 | - | 936.85 | 1.08 | 0.76 | - | 40 |
| | Total (Thermal) | 54.00 | 13 | 3,681.83 | 1,564.06 | - | - | - | 879.04 | 665.46 | 852.90 | 0.78 | 0.33 | - | 89 |
| | **Grand Total** | **523.29** | **61** | **2,118,596.35** | **2,351,532.34** | **-** | **2,641,230.00** | **2,344,545.47** | **224,654.21** | **651,584.73** | **2,219,935.27** | **46.22** | **51.30** | | **1090** |

# Transmission at 11 KV, Local Distribution is same

# Nepal Electricity Authority

## Generation Operation and Maintenance

**Operation and Generation Cost for FY 2067/68 (FY 2010/11 A.D.)** *(Nrs. in Thousand)*

| S.No. | Name of Powerstation | Installed Capacity (MW) | Generation (MWh) | Fixed Assets | O&M Expenditure | Royalty | Depreciation | Interest | Overhead | | Total Cost | Operation Cost. Rs/Unit | Genertion Cost. Rs/ Unit | Transfer Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Generation | Head Office | | | | |
| A | B | C | D | E | F | G | H | I | J | K | L=F+G+H+I+J+K | M = F / D | N = L / D | O= (L-K)/D *1.1 |
| 1 | Kaligandaki A | 144.00 | 775,172.00 | 23,003,737.35 | 218,445.09 | 98,079.50 | 509,835.35 | 1,432,143.65 | 32,107.98 | 111,606.19 | 2,402,217.76 | 0.28 | 3.10 | 3.25 |
| 2 | Middle Marshyangdi | 70.00 | 377,151.30 | 28,298,844.90 | 43,129.54 | 47,871.64 | 803,612.33 | 1,110,532.34 | 15,621.78 | 54,300.75 | 2,075,068.38 | 0.11 | 5.50 | 5.89 |
| 3 | Marshyangdi | 69.00 | 423,161.30 | 5,941,434.19 | 73,769.11 | 297,189.77 | 155,403.76 | 223,930.31 | 17,527.53 | 60,925.09 | 828,745.57 | 0.17 | 1.96 | 2.00 |
| 4 | Kulekhani I | 60.00 | 98,886.00 | 2,702,681.56 | 70,908.44 | 113,141.74 | 57,904.72 | 11,574.00 | 4,095.90 | 14,237.21 | 271,862.01 | 0.72 | 2.75 | 2.87 |
| 5 | Kulekhani II | 32.00 | 50,468.12 | 845,895.74 | 45,841.92 | 59,194.86 | 18,792.87 | 22,264.09 | 2,090.41 | 7,266.20 | 155,450.35 | 0.91 | 3.08 | 3.23 |
| 6 | Trishuli | 24.00 | 128,247.00 | 1,819,041.78 | 82,637.00 | 90,131.96 | 42,497.78 | 65,330.19 | 5,312.04 | 18,464.49 | 304,373.46 | 0.64 | 2.37 | 2.45 |
| 7 | Devighat | 15.00 | 74,132.50 | 429,758.81 | 49,397.50 | 53,778.82 | 12,133.67 | - | 3,070.60 | 10,673.30 | 129,053.89 | 0.67 | 1.74 | 1.76 |
| 8 | Sunkoshi | 10.05 | 60,355.40 | 201,428.40 | 51,878.14 | 42,448.52 | 5,103.54 | - | 2,499.94 | 8,689.73 | 110,619.87 | 0.86 | 1.83 | 1.86 |
| 9 | Gandak | 15.00 | 11,331.40 | 229,420.64 | 22,074.46 | 20,882.95 | 68,733.66 | - | 469.35 | 1,631.45 | 113,791.87 | 1.95 | 10.04 | 10.89 |
| 10 | Puwakhola | 6.20 | 31,547.81 | 1,061,921.29 | 32,923.46 | 4,021.15 | 23,747.18 | - | 1,306.72 | 4,542.12 | 66,540.63 | 1.04 | 2.11 | 2.16 |
| 11 | Modi Khola | 14.80 | 59,961.80 | 2,138,625.54 | 34,821.96 | 7,867.81 | 56,174.82 | 55,339.37 | 2,483.64 | 8,633.06 | 165,320.66 | 0.58 | 2.76 | 2.87 |
| 12 | Panauti | 2.40 | 2,729.22 | 22,924.43 | 11,700.79 | 3,806.67 | 4,250.24 | - | 113.04 | 392.94 | 20,263.68 | 4.29 | 7.42 | 8.01 |
| 13 | Chatara | 3.20 | 4,097.75 | 173,893.93 | 14,786.43 | | 3,563.99 | - | 169.73 | 589.97 | 19,110.12 | 3.61 | 4.66 | 4.97 |
| 14 | Seti Fewa | 2.50 | 13,529.68 | 27,820.77 | 23,414.38 | 9,866.46 | 1,052.85 | - | 560.40 | 1,947.94 | 36,842.03 | 1.73 | 2.72 | 2.84 |
| 15 | Sundarijal | 0.64 | 4,121.61 | - | 7,037.81 | - | - | - | 170.71 | 593.41 | 7,801.93 | 1.71 | 1.89 | 1.92 |
| 16 | Pharping | 0.50 | - | - | 1,916.80 | - | - | - | - | - | 1,916.80 | - | - | - |
| 17 | Multifuel | 39.90 | 2,348.86 | 1,685,655.16 | 68,799.70 | - | 42,206.76 | 52,004.82 | 97.29 | 338.17 | 163,446.74 | 29.29 | 69.59 | 76.39 |
| 18 | Hetauda | 14.10 | 1,332.97 | 63,662.05 | 45,289.59 | - | 1,490.02 | - | 55.21 | 191.91 | 47,026.73 | 33.98 | 35.28 | 38.65 |
| | **Total** | **523.29** | **2,118,574.72** | **68,646,746.54** | **898,772.12** | **848,281.85** | **1,806,503.54** | **2,973,118.77** | **87,752.27** | **305,023.93** | **6,919,452.48** | **0.42** | **3.27** | **3.43** |

Note: O/H (40% of Head Office and GM Office) have been loaded to 18 power stations only according to their actual generation.

Source: Central Account, Central Payment Section, Account Division - Generation

# Nepal Electricity Authority

## Generation Operation and Maintenance



**Operation and Generation Cost for FY 2068/69 (FY 2011/12 A.D.)**

*(Nrs. in Thousand)*

| S.No. | Name of Powerstation | Installed Capacity (MW) | Generation (MWh) | Fixed Assets | O&M Expenditure | Royalty | Depreciation | Interest | Overhead | | Total Cost | Operation Cost. Rs/Unit | Genertion Cost. Rs/ Unit | Transfer Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Generation | Head Office | | | | |
| 1 | Kaligandaki A | 144.00 | 860,754.00 | 23,003,066.82 | 203,141.81 | 107,353.21 | 508,793.73 | 1,432,143.66 | 16,884.10 | 134,697.06 | 2,403,013.57 | 0.24 | 2.79 | 2.90 |
| 2 | Middle Marshyangdi | 70.00 | 425,344.20 | 28,298,225.37 | 58,656.46 | 53,106.29 | 802,518.01 | 1,108,522.40 | 8,343.33 | 66,560.96 | 2,097,707.45 | 0.14 | 4.93 | 5.25 |
| 3 | Marshyangdi | 69.00 | 445,899.40 | 5,943,768.96 | 123,816.61 | 309,457.53 | 155,412.92 | 208,015.53 | 8,746.53 | 69,777.59 | 875,226.71 | 0.28 | 1.96 | 1.99 |
| 4 | Kulekhani I | 60.00 | 143,284.00 | 2,707,426.40 | 98,478.52 | 137,136.75 | 57,890.50 | 12,923.89 | 2,810.58 | 22,422.12 | 331,662.36 | 0.69 | 2.31 | 2.37 |
| 5 | Kulekhani II | 32.00 | 71,448.38 | 848,214.92 | 46,144.96 | 70,531.56 | 18,613.15 | 27,737.65 | 1,401.49 | 11,180.76 | 175,609.57 | 0.65 | 2.46 | 2.53 |
| 6 | Trishuli | 24.00 | 134,772.80 | 1,826,500.56 | 94,709.97 | 93,692.94 | 42,816.96 | 59,924.08 | 2,643.63 | 21,090.23 | 314,877.80 | 0.70 | 2.34 | 2.40 |
| 7 | Devighat | 15.00 | 105,089.20 | 1,120,282.64 | 62,375.04 | 70,654.12 | 34,798.91 | - | 2,061.38 | 16,445.12 | 186,334.57 | 0.59 | 1.77 | 1.78 |
| 8 | Sunkoshi | 10.05 | 66,383.10 | 201,642.38 | 77,961.20 | 45,687.93 | 4,962.78 | - | 1,302.14 | 10,388.11 | 140,302.16 | 1.17 | 2.11 | 2.15 |
| 9 | Gandak | 15.00 | 13,077.70 | 243,751.76 | 36,325.99 | 21,811.41 | 6,867.39 | - | 256.53 | 2,046.49 | 67,307.81 | 2.78 | 5.15 | 5.49 |
| 10 | Puwakhola | 6.20 | 28,329.99 | 1,064,840.37 | 33,255.94 | 3,680.10 | 22,943.10 | - | 555.71 | 4,433.28 | 64,868.13 | 1.17 | 2.29 | 2.35 |
| 11 | Modi Khola | 14.80 | 34,608.40 | 2,139,397.68 | 44,551.45 | 5,131.07 | 58,770.91 | 55,339.38 | 678.86 | 5,415.77 | 169,887.44 | 1.29 | 4.91 | 5.23 |
| 12 | Panauti | 2.40 | 1,280.16 | 30,226.41 | 14,994.61 | 3,023.31 | 462.78 | - | 25.11 | 200.32 | 18,706.14 | 11.71 | 14.61 | 15.90 |
| 13 | Chatara | 3.20 | 3,032.75 | 171,280.35 | 15,871.10 | 4,782.48 | 3,583.88 | - | 59.49 | 474.58 | 24,771.52 | 5.23 | 8.17 | 8.81 |
| 14 | Seti Fewa | 2.50 | 12,283.50 | 27,938.64 | 25,380.97 | 9,204.10 | 718.94 | - | 240.95 | 1,922.21 | 37,467.17 | 2.07 | 3.05 | 3.18 |
| 15 | Sundarijal | 0.64 | 4,345.62 | 2,829.69 | 9,977.33 | - | 83.74 | - | 85.24 | 680.03 | 10,826.34 | 2.30 | 2.49 | 2.57 |
| 16 | Pharping | 0.50 | - | 193.90 | 2,361.02 | - | 2.23 | - | - | - | 2,363.25 | - | - | - |
| 17 | Multifuel | 39.90 | 623.53 | 1,685,727.92 | 36,628.16 | - | 42,133.73 | 48,022.24 | 12.23 | 975.74 | 127,772.10 | 58.74 | 204.92 | 223.69 |
| 18 | Hetauda | 14.10 | 940.53 | 76,721.37 | 57,883.04 | - | 1,719.97 | - | 18.45 | 147.18 | 59,768.63 | 61.54 | 63.55 | 69.73 |
| | **Total** | **523.29** | **2,351,497.26** | **69,392,036.14** | **1,042,514.16** | **935,252.80** | **1,763,093.63** | **2,952,628.83** | **46,125.75** | **368,857.55** | **7,108,472.72** | **0.44** | **3.02** | **3.15** |

**Note:** O/H (40% of Head Office and GM Office) have been loaded to 18 power stations only according to their actual generation.

**Source:** Central Account, Central Payment Section, Account Division - Generation

## Nepal Electricity Authority

**Actual Annual Energy Generation of Tatopani Small Hydropower Station**

*Unit: kWh*

| Month | FY 064/65 | FY 065/66 | FY 066/67 | FY 067/68 | FY 068/69 | FY 069/70 | Grand Total |
|---|---|---|---|---|---|---|---|
| Shrawan | 356,319.00 | 153,041.00 | 130,144.00 | Not Available | 215,170.00 | 148,894.00 | 1,003,568.00 |
| Bhadra | 247,085.00 | 137,534.00 | 206,836.00 | | 259,325.00 | 156,909.00 | 1,007,689.00 |
| Ashwfn | 170,731.00 | 170,825.00 | 174,383.00 | | 431,185.00 | 171,515.00 | 1,118,639.00 |
| Kartik | 288,508.00 | 456,283.00 | 367,607.00 | | 613,635.00 | 353,250.00 | 2,079,283.00 |
| Marg | 352,833.00 | 502,820.00 | 511,365.00 | | 628,710.00 | 334,455.00 | 2,330,183.00 |
| Poush | 326,854.00 | 247,324.00 | 358,975.00 | | 363,920.00 | 239,750.00 | 1,536,823.00 |
| Magh | 272,306.00 | 288,959.00 | 414,917.00 | | 263,825.00 | - | 1,240,007.00 |
| Falgun | 333,079.00 | 440,962.00 | 366,262.00 | | 356,245.00 | - | 1,496,548.00 |
| Chaitra | 316,648.00 | 217,969.00 | 369,516.00 | | 417,187.00 | - | 1,321,320.00 |
| Baishakh | 381,551.00 | 226,424.00 | 274,896.00 | | 267,025.00 | - | 1,149,896.00 |
| Jestha | 305,432.00 | 202,383.00 | 231,987.00 | | 235,848.00 | - | 975,650.00 |
| Aasad | 155,788.00 | 297,881.00 | 131,472.00 | | 185,415.00 | - | 770,556.00 |
| **Total** | **3,507,134.00** | **3,342,405.00** | **3,538,360.00** | | **4,237,490.00** | **1,404,773.00** | **16,030,162.00** |

## Nepal Electricity Authority

**Actual Annual Energy Generation of Tinau Hydropower Station**

*Unit: kWh*

| Month | FY 054/055 | FY 055/056 | FY 056/057 | FY 057/058 | FY 058/059 | FY 059/060 | FY 060/061 | FY 061/062 | FY 062/063 | FY 063/064 | FY 064/065 | FY 065/066 | FY 066/067 | FY 067/068 | FY 68/069 | FY 069/070 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shrawan | 308,400 | 226,940 | 250,850 | 172,710 | 314,690 | 453,200 | 259,200 | 303,480 | 435,830 | 280,370 | 371,130 | 361,210 | 397,660 | 120,350 | 177,570 | 188,930 |
| Bhadra | 339,840 | 264,470 | 330,520 | 253,300 | 335,490 | 359,420 | 288,890 | 293,790 | 352,130 | 211,370 | 415,930 | 420,780 | 340,920 | 59,850 | 196,830 | 171,590 |
| Ashwfn | 341,740 | 325,030 | 381,700 | 252,050 | 335,780 | 535,600 | 366,800 | 192,730 | 285,420 | 128,040 | 462,530 | 524,420 | 289,680 | 209,810 | 118,800 | 202,800 |
| Kartik | 369,950 | 360,950 | 455,780 | 295,670 | 357,410 | 562,710 | 451,260 | - | 108,050 | 455,140 | 622,780 | 605,340 | 449,780 | 266,850 | 123,460 | 317,550 |
| Marg | 382,720 | 375,610 | 507,060 | 402,650 | 448,360 | 555,140 | 471,300 | - | 404,460 | 493,220 | 611,860 | 490,370 | 413,820 | 288,140 | 149,210 | 366,800 |
| Poush | 343,660 | 406,470 | 525,390 | 405,750 | 464,730 | 541,800 | 532,910 | 155,700 | 383,510 | 519,020 | 652,840 | 464,660 | 458,670 | 307,580 | 183,510 | 388,970 |
| Magh | 383,200 | 439,370 | 479,940 | 418,270 | 448,670 | 429,020 | 416,050 | 423,280 | 386,020 | 634,770 | 608,660 | 491,420 | 427,420 | 335,500 | 209,260 | - |
| Falgun | 368,600 | 339,370 | 412,850 | 440,580 | 433,860 | 569,230 | 321,250 | 454,290 | 367,750 | 619,050 | 586,380 | 564,660 | 400,990 | 305,950 | 235,630 | - |
| Chaitra | 371,550 | 291,290 | 360,920 | 327,890 | 392,420 | 564,490 | 231,480 | 430,580 | 319,990 | 502,880 | 475,330 | 427,320 | 285,950 | 341,490 | 219,050 | - |
| Baishakh | 305,120 | 288,810 | 281,680 | 304,430 | 260,040 | 421,410 | 193,220 | 325,750 | 244,180 | 419,400 | 408,400 | 327,300 | 356,430 | 318,130 | 212,880 | - |
| Jestha | 242,210 | 250,620 | 140,140 | 114,100 | 164,320 | 234,130 | 234,180 | 249,010 | 225,090 | 385,670 | 306,760 | 215,520 | 225,830 | 266,920 | 177,890 | - |
| Aasad | 196,340 | 247,340 | 115,080 | 139,870 | 383,630 | 229,690 | 173,830 | 382,060 | 178,810 | 81,710 | 171,250 | 325,140 | 301,280 | 110,410 | 137,340 | - |
| **Total** | **3,953,330** | **3,816,270** | **4,241,910** | **3,527,270** | **4,339,400** | **5,455,840** | **3,940,370** | **3,210,670** | **3,691,240** | **4,730,640** | **5,693,850** | **5,218,140** | **4,348,430** | **2,930,980** | **2,141,430** | **1,636,640** |

## Nepal Electricity Authority

**Statement of Energy Received from IPP in the F/Y 2067/68 (FY 2010/11 A.D.)**

| S.No. | NAME OF IPP | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total Received Energy (kWh) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Alliance Hydro power | 428,704.00 | 654,719.30 | 954,790.50 | 998,984.60 | 742,132.00 | 489,930.00 | 401,276.00 | 339,657.00 | 280,972.00 | 196.748.0 | - | 380,069.00 | 5,867,983.16 |
| 2 | Arun Valley HP Dev co | 1,752,909.00 | 1,837,046.00 | 1,995,542.00 | 199,722.00 | 1,715,985.00 | 1,437,661.00 | 1,051,436.00 | 853,728.00 | 744,503.00 | 916,617.00 | 1,201,146.00 | 1,867,656.00 | 17,361,453.00 |
| | Metered as per annex6A | 1,714,967.47 | 1,714,968.00 | 1,864,325.00 | 1,860,638.00 | 1,557,605.00 | 1,279,281.00 | 1,051,436.00 | 853,728.00 | 744,503.00 | 916,617.00 | 1,201,146.00 | 1,867,656.00 | 16,616,870.47 |
| | Excess energy as per annex6B | 37,941.50 | 122,076.00 | 131,217.00 | 136,586.00 | 158,380.00 | 156,380.00 | - | - | - | - | - | - | 744,582.53 |
| 3 | Bhotekoshi power co. | 24,312,250.00 | 23,811,930.00 | 23,173,280.00 | 23,746,650.00 | 17,339,790.00 | 13,920,390.00 | 11,525,510.00 | 11,164,900.00 | 11,123,550.00 | 14,125,000.00 | 21,634,020.00 | 23,880,260.00 | 219,759,530.00 |
| | Chargeable energy | 24,312,250.00 | 23,811,930.00 | 23,173,280.00 | 23,746,650.00 | 17,339,790.00 | 7,954,870.00 | 11,525,510.00 | 11,164,900.00 | 11,123,550.00 | 14,125,000.00 | 21,634,020.00 | 23,880,260.00 | 213,794,010.00 |
| | Excess energy | - | - | - | - | - | 5,965,520.00 | - | - | - | - | - | | 5,965,520.00 |
| 4 | Butwal power co | 8,140,800.21 | 5,943,521.00 | 9,739,028.47 | 8,881,668.00 | 9,046,316.84 | 8,784,875.00 | 6,954,165.60 | 5,811,400.98 | 4,408,607.08 | 2,782,678.98 | 1,788,474.22 | 4,252,288.23 | 76,533,864.61 |
| | Total energy received (metered) | 8,140,800.21 | 5,943,521.00 | 9,739,028.47 | 8,881,668.00 | 9,046,316.64 | 8,784,875.00 | 6,954,185.60 | 5,811,400.98 | 4,408,607.08 | 2,782,678.98 | 1,788,474.22 | 4,252,288.23 | 76,533,864.61 |
| | Excess energy | - | - | - | - | - | - | - | - | - | - | - | | - |
| 5 | Center for power dev & Services | 428,927.48 | 240,336.38 | 491,905.00 | 401,440.06 | 459,768.37 | 391,956.25 | 247,404.35 | 233,983.59 | 132,445.42 | 120,610.18 | 96,770.91 | 363,642.41 | 3,609,190.40 |
| 6 | Chilime HP co | 13,986,813.00 | 13,987,000.00 | 13,987,000.00 | 13,536,000.00 | 11,057,073.67 | 8,682,000.00 | 6,919,000.00 | 6,680,000.00 | 7,417,000.00 | 12,109,000.00 | 16,073,000.00 | 16,376,000.00 | 140,809,886.67 |
| 7 | Gandaki HP co | 1,560,872.59 | 1,772,595.45 | 1,367,007.84 | 1,700,318.36 | 1,822,415.89 | 1,593,511.20 | 1,067,317.94 | 1,100,718.94 | 1,016,997.30 | 948,415.10 | 1,202,182.60 | 1,740,417.37 | 16,892,770.58 |
| 8 | Gautam buddha HP co | 466,419.00 | 473,931.00 | 494,679.40 | 478,722.00 | 407,080.00 | 264,965.00 | 141,536.00 | 145,107.00 | 76,667.00 | 93,190.00 | 90,118.00 | 459,744.00 | 3,592,158.40 |
| 9 | Hlmal power limited | 41,230,000.00 | 41,220,000.00 | 41,220,000.00 | 39,890,000.00 | 35,966,610.00 | 26,955,540.00 | 19,950,620.00 | 18,444,944.00 | 16,030,930.00 | 21,207,840.00 | 30,949,870.00 | 42,550,000.00 | 375,616,354.00 |
| | Chargeable energy | 41,230,000.00 | 41,220,000.00 | 41,220,000.00 | 39,890,000.00 | 26,100,000.00 | 17,070,000.00 | 14,500,000.00 | 13,450,000.00 | 14,030,000.00 | 18,000,000.00 | 30,949,870.00 | 42,550,000.00 | 340,209,870.00 |
| | Excess energy | - | - | - | - | 9,866,610.00 | 9,885,540.00 | 5,450,620.00 | 4,994,944.00 | 2,000,930.00 | 3,207,840.00 | - | - | 35,406,484.00 |
| 10 | Kathmandu small HP co | 104,956.00 | 136,790.00 | 128,560.00 | 86,629.00 | 42,885.00 | 28,668.00 | 13,514.00 | 17,930.00 | 10,094.00 | 20,887.00 | 47,672.00 | 113,119.00 | 751,724.00 |
| 11 | Khoranga HP co | 508,271.06 | 584,905.70 | 598,438.87 | 600,776.99 | 588,364.93 | 516,052.83 | 453,618.81 | 309,612.11 | 285,585.35 | 321,570.54 | 310,545.36 | 416,480.55 | 5,494,223.10 |
| 12 | Khudi HP co 2,231,036.46 | 2,516,204.76 | 2,513,177.12 | 2,551,000.00 | 2,012.000.00 | 1,611,195.00 | 1,164,550.27 | 1,013.716.75 | 1,070,958.84 | 1,252,263.38 | 1,417,780.90 | 1,999,363.02 | 21,353,248.50 | |
| 13 | National Hydro power co | 4,909,420.00 | 4,642,510.00 | 4,801,500.00 | 4,772,660.00 | 3,982,430.00 | 3,062,790.00 | 2,144,690.00 | 1,991,030.00 | 1,678,720.00 | 1,872,690.00 | 3,069,960.00 | 4,334,130.00 | 41,262,530.00 |
| | Based deemed energy | 3,334,000.00 | 3,334,000.00 | 3,334,000.00 | 3,227,000.00 | 3,086,000.00 | 3,062,790.00 | 2,144,690.00 | 1,991,030.00 | 1,678,720.00 | 1,872,690.00 | 3,069,960.00 | 3,442,000.00 | 33,576,880.00 |
| | Additional / excess energy | 1,575,420.00 | 1,308,510.00 | 1,467,500.00 | 1,545,660.00 | 896,430.00 | - | - | - | - | - | - | 892,130.00 | 7,685,650.00 |
| 14 | Rairang HP co 24,965.00 | 165,129.00 | 103,981.00 | 88,163.00 | 100,297.00 | 70,033.00 | 51,759.00 | 37,756.00 | 27,013.00 | 18,912.00 | 18,030.00 | 34,490.00 | 740,528.00 | |
| 15 | Ridikhola HP co 1,427,196.00 | 1,380,426.00 | 1,402,166.00 | 1,488,274.00 | 1,424,374.00 | 1,316,600.00 | 863,123.00 | 650,763.00 | 666,514.00 | 1,079,945.00 | 898,212.00 | 1,350,929.00 | 13,948,522.00 | |
| | Chargeable energy | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Excess energy | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 16 | Sanima Hydro sower co | 1,581,230.00 | 1,582,010.00 | 1,635,667.47 | 1,582,904.00 | 1,011,653.40 | 863,092.00 | 904,880.60 | 594,059.25 | 142,269.00 | 526,492.00 | 772,879.00 | 1,500,907.00 | 12,698,043.72 |
| | Metered | 1,581,230.00 | 1,582,010.00 | 1,635,667.47 | 1,582.904.00 | 1,011,653.40 | 800,445.52 | 656,468.00 | 594,059.25 | 142,269.00 | 526.492.00 | 772,879.00 | 1,500,907.00 | 12,386,984.64 |
| | Excess energy | - | - | - | - | - | 62,646.48 | 248,412.60 | - | - | - | - | - | 311,059.08 |
| 17 | Syange HP co | 79,572.00 | 111,599.00 | 111,650.00 | 117,809.00 | 111,942.00 | 85,921.00 | 63,232.00 | 53,019.00 | 52,807.00 | 49,476.00 | 57,723.00 | 75,850.00 | 970,600.00 |
| 18 | Task Hydro power co | 479,100.00 | 479,920.00 | 414,300.00 | 576,432.00 | 534,043.70 | 583,539.96 | 605,660.00 | 496,490.69 | 500,639.03 | 545,455.33 | 607,135.00 | 604,430.00 | 6,427,145.71 |
| 19 | Thoppal Khola HP co | 935,101.00 | 1,050,707.48 | 1,107,984.00 | 945,459.00 | 617,601.00 | 336,172.00 | 237,422.00 | 206,252.00 | 34,774.00 | 73,873.40 | 356,268.00 | 870,962.00 | 6,772,575.88 |
| 20 | Unified Hydropower co ( Patikhola) | 639,260.00 | 647,982.00 | 724,456.00 | 680,400.00 | 569,099 00 | 417,090.00 | 313,667.00 | 281,835.00 | 227,512.00 | 218,046.00 | 181,210.00 | 574,996.00 | 5,475,553.00 |
| 21 | Unique Hydro power co( Baramchi) | - | - | - | 140,200.00 | 1,088,940.00 | 758,250.00 | 511,000.00 | 453,070.00 | 351,150.00 | 316.570.00 | 390,610.00 | 735,410.00 | 4,745,200.00 |
| 22 | Himal Dolakha Hydro (Maikhola) | - | - | - | - | - | - | - | 740,805.95 | 760,876.16 | 938.406.07 | 1,302,770.00 | 1,375,470.00 | 5,118,328.20 |
| | **Total** | **105,227,802.80** | **103,241,283.14** | **106,965,114.08** | **105,261,734.29** | **90,640,801.80** | **72,170,252.24** | **5,585,402.57** | **51,620,781.26** | **47,040,584.20** | **59,734,685.98** | **82,466,376.99** | **105,846,613.58** | **985,801,412.93** |

**Note:**

IPP: Independent Power Producer

## Nepal Electricity Authority

**Statement of Energy Received from IPP in the F/Y 2068/69 (FY 2011/12 A.D.)**

| S.No. | NAME OF IPP | Shrawan | Bhadra | Ashwin | Kartik | Mangsir | Poush | Magh | Falgun | Chaitra | Baishakh | Jestha | Ashad | Total Received Energy (kWh) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Alliance Hydro power | 935,911.00 | 910,529.00 | 986,881.00 | 969,304.00 | 646,427.00 | 525,067.00 | 371,727.00 | 294,672.00 | 218,779.20 | - | - | - | 5,859,297.00 |
| 2 | Arun Valley HP Dev co | 1,752,909.00 | 1,837,046.00 | 1,995,542.00 | 199,722.00 | 1,715,985.00 | 1,404,141.00 | 1,144,800.00 | 810,375.00 | 816,250.00 | 816,640.00 | 1,505,000.00 | 2,055,908.00 | 18,013,762.00 |
| | Metered as per Annex -6A | 1,770,289.00 | 1,714,968.00 | 1,864,325.00 | 1,860,638.00 | 1,557,605.00 | 1,279,281.00 | 1,019,940.00 | 810,375.00 | 816,250.00 | 816,640.00 | 1,505,000.00 | 1,931,037.00 | 16,946,348.00 |
| | Excess Energy as per Annex-6B | 144,562.00 | 122,078.00 | 131,217.00 | 136,586.00 | 158,380.00 | 124,860.00 | 124,860.00 | - | - | - | - | 124,871.00 | 1,067,414.00 |
| 3 | Barun Hydropower (Hewakhola) TCE | 1,075,258.80 | 2,643,443.20 | 2,594,540.70 | 2,335,245.90 | 1,460,578.83 | 1,072,471.09 | 784,654.46 | 648,824.81 | 593,269.78 | 706,826.20 | 1,576,694.53 | 2,370,348.00 | 18,062,356.00 |
| | i) Contract energy (CE) | 634,764.39 | 1,639,808.00 | 1,586,910.97 | 1,585,229.00 | 1,460,578.83 | 1,072,471.09 | 784,654.46 | 648,824.81 | 593,269.78 | 706,826.20 | 1,576,694.53 | 1,694,387.00 | 13,984,619.00 |
| | ii) Additional contract energy (ACE) | 440,494.41 | 1,203,635.20 | 1,007,629.73 | 750,016.92 | - | - | - | - | - | - | - | 675,961.00 | 4,077.74 |
| 4 | Baneswor Hydro power (Lower piluwa) | 450,343.34 | 305,215.15 | 543,687.55 | 561,640.63 | 552,797.42 | 381,057.94 | 303,148.75 | 247,961.11 | 160,937.14 | 195,829.78 | - | - | 3,702,618.81 |
| 5 | Bhotekoshl power co. | 24,519,860.00 | 24,198,880.00 | 23,567,670.00 | 23,719,920.00 | 19,010,900.00 | 15,398,240.00 | 12,583,670.00 | 12,246,410.00 | 8,084,560.00 | 14,521,710.00 | 22,131,710.00 | 26,109,900.00 | 226,093,430.00 |
| | Chargeable Energy | 24,519,860.00 | 24,198,880.00 | 23,567,670.00 | 23,719,920.00 | 19,010,900.00 | 15,398,240.00 | 12,583,670.00 | 12,246,410.00 | 8,084,560.00 | 14,521,710.00 | 22,131,710.00 | 26,109,900.00 | 226,093,430.00 |
| | Excess Energy | - | - | - | - | - | - | - | - | - | | | | - |
| 6 | Butwal Power Co. | 5,792,927.25 | 5,926,078.38 | 9,264,786.50 | 9,150,536.54 | 9,522,658.04 | 8,800,622.95 | 7,402,946.00 | 5,755,782.95 | 3,965,933.50 | 2,499,316.00 | 1,048,045.51 | 4,246,004.49 | 73,375,638.11 |
| | Total Energy Received (Metered) | 5,792,927.25 | 5,926,078.38 | 9,264,786.50 | 9,150,536.54 | 9,522,658.04 | 8,800,622.95 | 7,402,946.00 | 5,755,782.95 | 3,965,933.50 | 2,499,316.00 | 1,048,045.51 | 4,246,004.49 | 73,375,638.11 |
| | Excess Energy | - | - | - | - | - | - | - | - | - | | | | - |
| 7 | Himal Dolakha Hydropower Co. (P) Ltd Malkhola | 1,690,133.46 | 1,210,466.92 | 2,225,284.00 | 2,289,866.80 | 1,611,940.34 | 1,146,385.98 | 885,404.14 | 663,952.16 | 712,886.87 | 698,715.60 | 1,108,234.83 | 1,660,146.30 | 15,903,417.40 |
| 8 | Himal Power Limited | 42,560,000.00 | 41,220,000.00 | 39,890,000.00 | 39,890,000.00 | 37,242,340.00 | 28,147,540.00 | 21,361,470.00 | 18,077,100.00 | 17,630,920.00 | 16,722,400.00 | 21,356,990.00 | 40,280,990.00 | 364,379,750.00 |
| | Chargeable Energy | 42,560,000.00 | 41,220,000.00 | 39,890,000.00 | 39,890,000.00 | 26,100,000.00 | 17,070,000.00 | 14,500,000.00 | 13,448,000.00 | 14,033,000.00 | 16,722,400.00 | 21,356,990.00 | 40,280,990.00 | 327,071,380.00 |
| | Excess Energy | - | - | - | - | 11,142,340.00 | 11,077,540.00 | 6,861,470.00 | 4,629,100.00 | 3,597,920.00 | - | - | - | 37,308,370.00 |
| 9 | Center for Power Development & Services | 553,151.65 | 403,281.20 | 366,495.36 | 481,796.76 | 448,971.28 | 301,751.81 | 145,247.58 | 194,159.42 | 115,195.04 | 199,753.00 | 176,591.00 | 225,000.00 | 3,611,394.10 |
| 10 | Chillme HP Co. | 14,438,000.00 | 13,987,000.00 | 13,536,000.00 | 13,536,000.00 | 11,814,512.67 | 9,529,000.00 | 7,209,000.00 | 6,603,000.00 | 10,827,000.00 | 12,680,000.00 | 16,934,000.00 | 13,987,000.00 | 145,080,512.60 |
| 11 | Gandaki HP Co. | 1,650,681.74 | 1,709,604.43 | 2,086,163.00 | 2,086,163.00 | 1,811,295.45 | 1,561,603.05 | 1,298,481.75 | 1,160,674.92 | 1,210,582.44 | 1,153,857.91 | 1,709,904.35 | 1,925,000.00 | 19,364,012.00 |
| 12 | Gautam Buddha HP Co. | 512,540.00 | 495,631.00 | 478,722.00 | 478,722.00 | 280,206.00 | 65,127.00 | 141,461.00 | 130,831.00 | 83,881.00 | 70,469.00 | 54,601.00 | 65,000.00 | 2,857,191.00 |
| 13 | Kathmandu Small HP Co. | 135,011.00 | 131,901.00 | 132,010.00 | 111,025.00 | 78,615.00 | 32,714.00 | 18,178.00 | 12,524.00 | 14,427.00 | 6,531.00 | 4,850.00 | 2,249.00 | 680,035.00 |
| 14 | Khoranga HP Co. | 568,029.21 | 458,950.55 | 183,475.10 | 611,568.35 | 554,703.88 | 542,079.99 | 414,785.91 | 328,718.81 | 271,628.52 | 244,480.26 | 304,368.31 | 476,808.25 | 4,959,597.14 |
| 15 | Khudi HP Co. 2,492,249.05 | 2,296,120.89 | 2,591,079.87 | 2,179,232.36 | 1,126,114.97 | 1,351,693.81 | 1,114,633.53 | 1,169,062.24 | 1,318,556.88 | 1,496,470.05 | 1,433,941.42 | 1,538,798.03 | 20,107,953.10 | |
| 16 | National Hydro Power Co. | 4,306,720.00 | 4,776,160.00 | 4,056,770.00 | 4,753,620.00 | 3,937,380.00 | 3,020,860.00 | 2,189,690.00 | 1,916,410.00 | 2,107,900.00 | 2,168,230.00 | 1,571,270.00 | 4,570,110.00 | 39,375,120.00 |
| | Based Deemed Energy | 3,495,000.00 | 3,334,000.00 | 3,227,000.00 | 3,227,000.00 | 3,119,000.00 | 3,020,860.00 | 2,189,690.00 | 1,916,410.00 | 2,107,900.00 | 2,168,230.00 | 1,571,270.00 | 3,387,000.00 | 32,763,360.00 |
| | Additional/Excess Energy | 811,720.00 | 1,442,160.00 | 829,770.00 | 1,526,620.00 | 818,380.00 | - | - | - | - | - | - | 1,183,110.00 | 6,611,760.00 |
| 17 | Rairang HP Co. | 75,450.00 | 70,495.00 | 82,815.00 | 78,571.00 | 86,428.00 | 65,856.00 | 36,665.00 | 19,750.00 | - | 15,582.00 | 17,309.00 | 21,122.00 | 570,043.00 |
| 18 | Ridikhola HP Co. | 1,586,156.00 | 1,487,630.00 | 1,476,546.00 | 1,452,195.00 | 1,283,248.00 | 1,162,790.00 | 863,123.00 | 825,814.00 | 718,631.23 | 541,096.00 | 348,705.00 | 1,060,146.00 | 12,806,080.23 |
| 19 | Sanima Hydro Power Co. | 1,479,848.00 | 1,313,056.00 | 1,582,904.00 | 1,578,683.00 | 1,237,152.00 | 800,445.52 | 618,555.00 | 574,947.00 | 490,012.00 | 443,666.00 | 431,978.00 | 629,292.00 | 11,180,538.52 |
| | Metered | 1,479,848.00 | 1,313,056.00 | 1,582,904.00 | 1,578,683.00 | 1,011,653.40 | 800,445.52 | 618,555.00 | 574,947.00 | 490,012.00 | 443,666.00 | 431,978.00 | 629,292.00 | 10,955,039.92 |
| | Excess Energy | - | - | - | - | 225,498.60 | - | - | - | - | - | - | - | 225,498.60 |
| 20 | Syange HP Co. | 82,869.00 | 98,576.00 | 75,507.00 | 102,329.00 | 100,026.00 | 80,814.00 | 61,572.00 | 59,609.00 | 53,986.00 | 56,894.00 | 65,253.00 | 75,754.00 | 913,189.00 |
| 21 | Task Hydro Power Co. | 620,410.00 | 598,390.00 | 546,770.00 | 563,480.00 | 534,043.70 | 534,884.48 | 561,390.00 | 587,100.00 | 565,260.00 | 456,240.00 | 454,005.00 | 496,000.00 | 6,517,973.18 |
| 22 | Thoppal Khola HP Co. | 915,246.00 | 633,959.00 | 756,323.00 | 570,714.00 | 494,087.00 | 434,748.00 | 272,556.00 | 152,958.00 | 59,180.00 | 5,452.00 | 580.00 | 597,336.00 | 4,893,139.00 |
| 23 | Unified Hydropower Co. (Palikfkola) | 278,958.00 | 363,390.00 | 354,891.00 | 264,035.00 | 452,433.00 | 428,257.00 | 335,792.00 | 277,247.00 | 222,755.00 | 187,835.00 | 136,747.00 | 336,000.00 | 3,638,340.00 |
| 24 | Unique Hydro Power Co. (Baramchi) | 1,353,050.00 | 2,101,260.00 | 1,993,900.00 | 1,447,250.00 | 1,018,120.00 | 720,090.00 | 510,230.00 | 197,170.00 | 279,050.00 | 303,850.00 | 283,350.00 | 1,250,000.00 | 11,457,320.00 |
| | **Total** | **108,300,110.36** | **106,228,405.37** | **108,230,534.83** | **108,312,235.81** | **95,007,587.33** | **76,054,711.59** | **59,541,377.91** | **52,058,267.50** | **49,767,374.68** | **55,289,187.82** | **71,077,433.42** | **101,608,564.07** | **1,013,402,707.83** |

**Note:**
IPP: Independent Power Producer

# Nepal Electricity Authority

## Energy Import from India

*Unit: MWh*

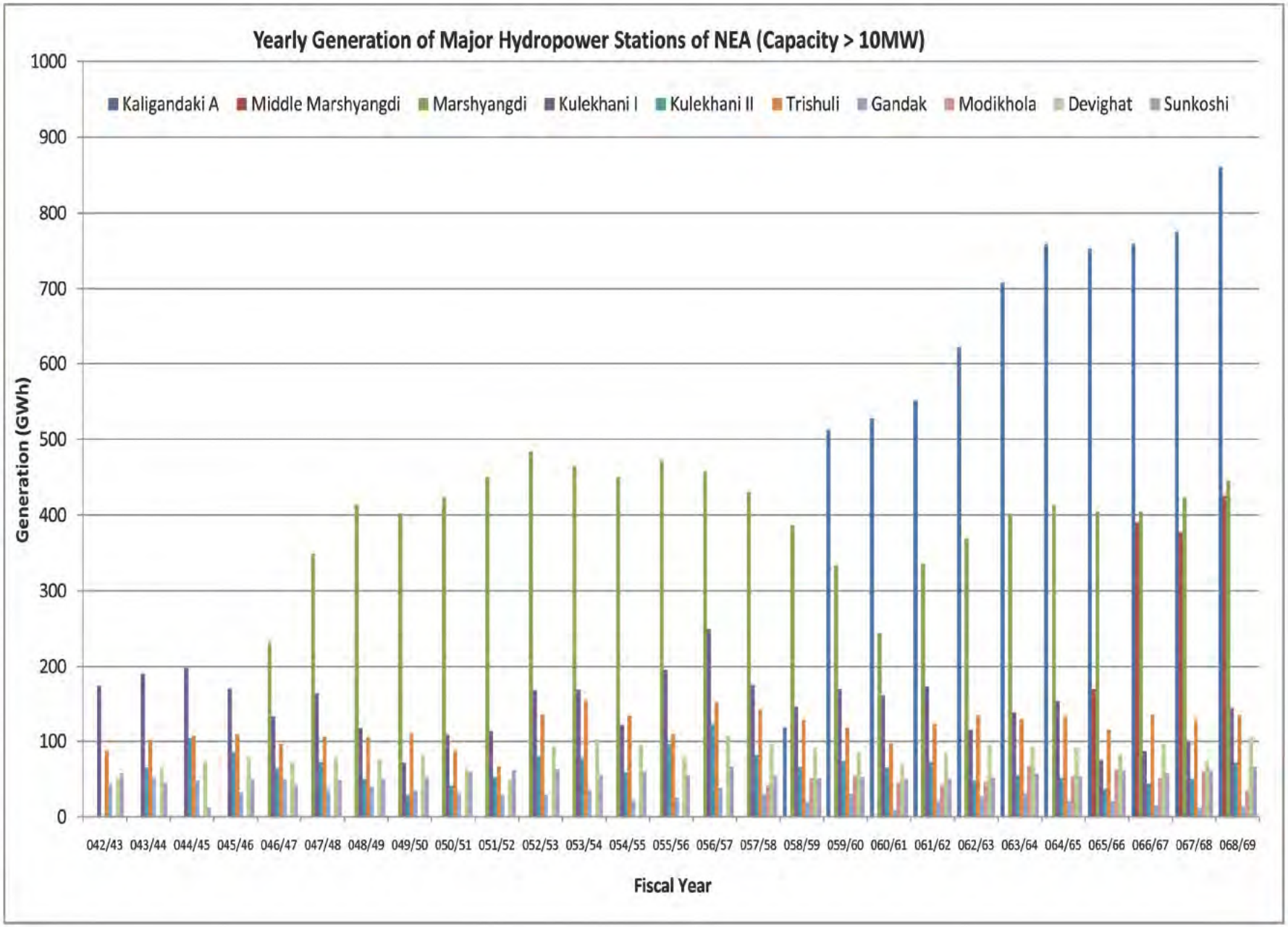
| Month | FY 2066/67 (2009/10 AD) | | FY 2067/68 (2010/11 AD) | | FY 2068/69 (2011/12 AD) | | FY 2069/70 (2012/13 AD)* | |
|---|---|---|---|---|---|---|---|---|
| | BSEB | PTC | BSEB | PTC | BSEB | PTC | BSEB | PTC |
| Shrawan | - | - | 38,679.88 | - | 36,957.32 | - | 44,147.84 | - |
| Bhadra | - | - | 42,489.80 | - | 43,353.36 | - | 38,925.76 | - |
| Ashwin | 26,863.09 | - | 42,184.86 | - | 37,442.44 | - | 36,948.44 | - |
| Kartik 24,841.42 | - | 37,865.94 | - | 29,169.40 | - | 30,207.28 | 7,228.56 | |
| Mangsir | 25,843.70 | - | 35,592.70 | - | 28,139.56 | 7,101.54 | 34,571.02 | 5,413.46 |
| Poush | 37,308.62 | 4,510.44 | 50,451.12 | 5,279.84 | 49,925.84 | 14,751.12 | - | 2,039.70 |
| Magh 42,183.46 | - | 51,366.32 | 11,158.40 | 55,386.16 | 14,812.56 | | - | |
| Falgun | 44,160.84 | - | 45,807.72 | 10,064.40 | 53,309.63 | 13,763.56 | - | - |
| Chaitra | 48,488.84 | 9,847.99 | 50,345.80 | 11,166.31 | 58,269.11 | 14,946.96 | | |
| Baishakh | 33,046.96 | 17,389.73 | 37,134.20 | 5,642.88 | 51,489.76 | 7,252.80 | - | - |
| Jestha | 38,298.44 | - | 31,586.32 | - | 54,974.09 | - | | |
| Asar 40,734.24 | - | 36,955.40 | - | 48,414.98 | - | - | - | - |
| Total 361,769.61 | 31,748.16 | 500,460.06 | 43,311.83 | 546,831.65 | 72,628.54 | 184,800.33 | 14,681.72 | |
| **Grand Total** | **393,517.77** | | **543,771.90** | | **619,460.19** | | **199,482.05** | |

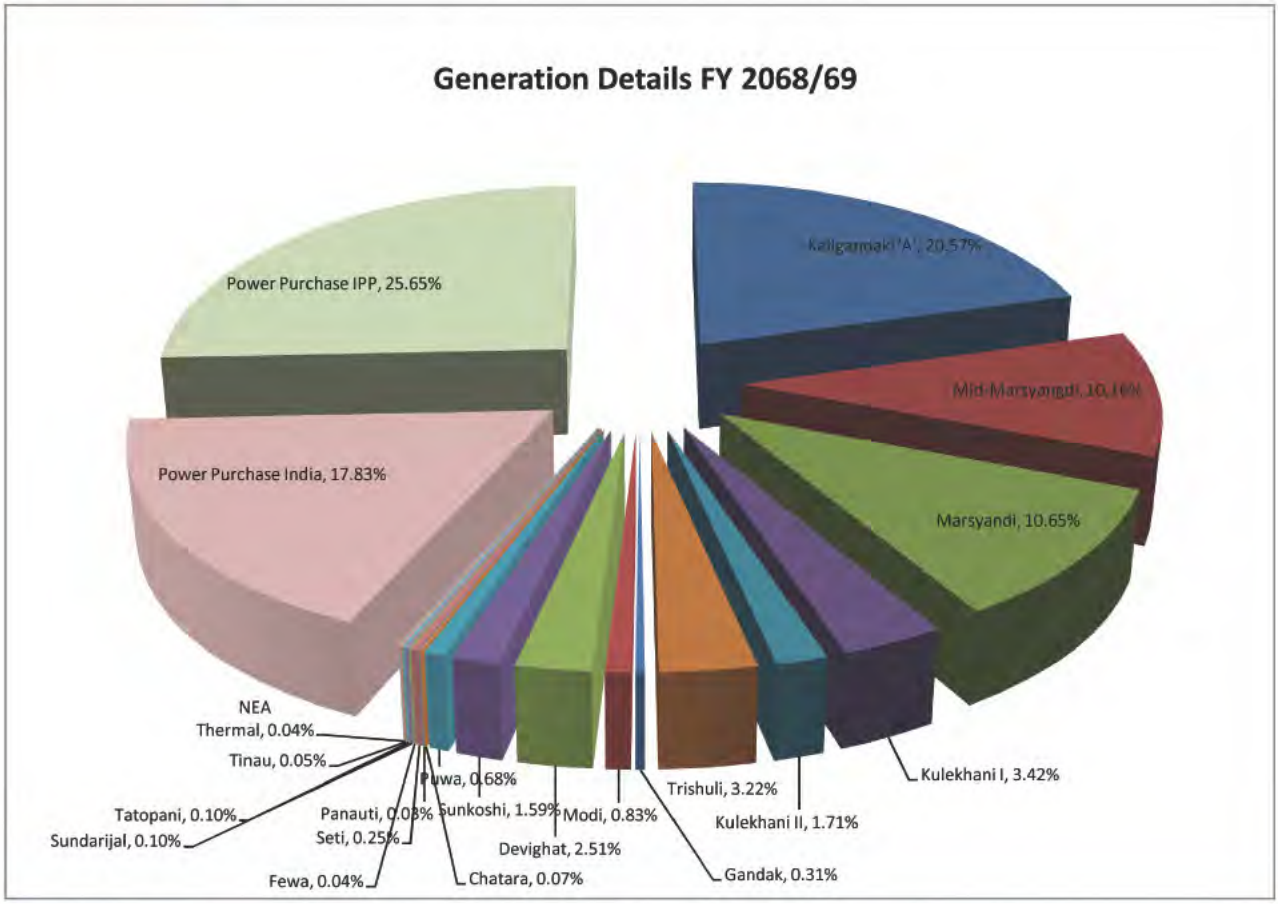
**Note:**

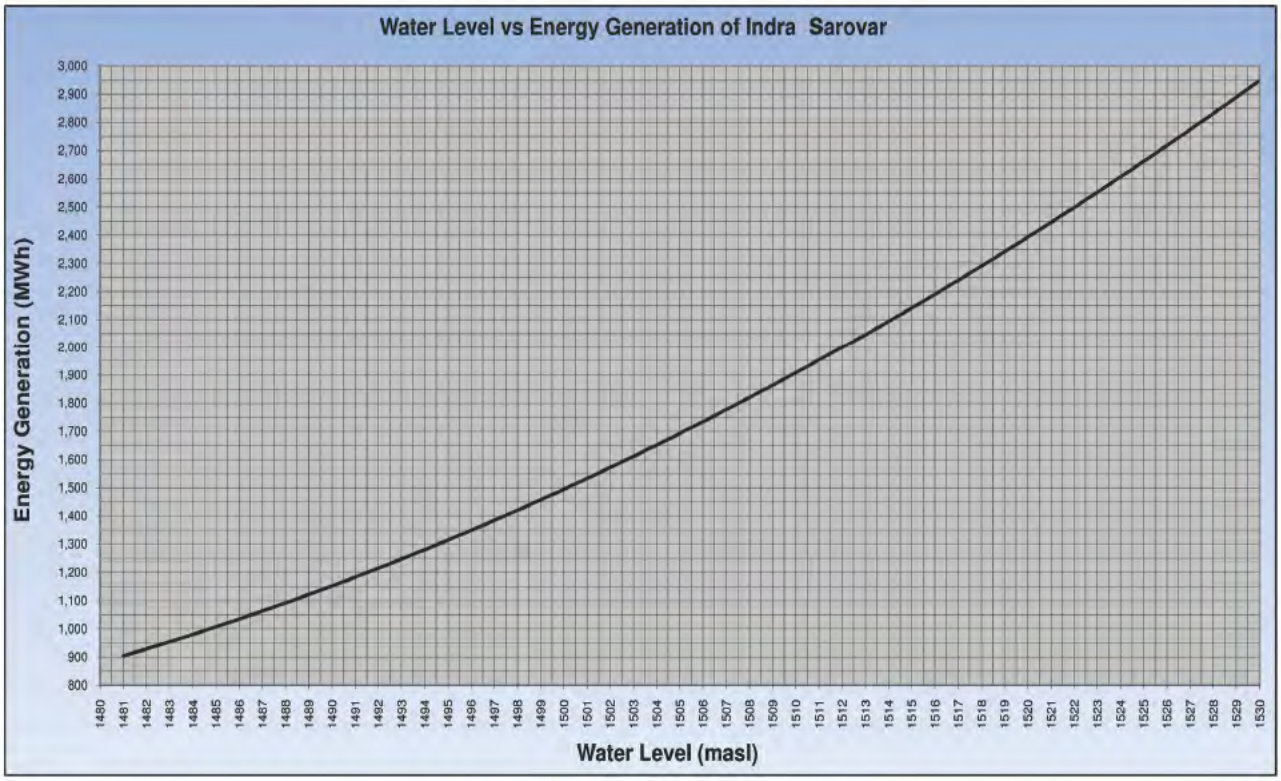
BSEB: Bihar State Electricity Board, India

PTC: Power Trade Corporation Ltd., India

***Provisional figures subjected to final audit***


Yearly Generation of Major Hydropower Stations of NEA (Capacity > 10MW)
Kaligandaki A
Middle Marshyangdi
Marshyangdi
Kulekhani I
Kulekhani II
Trishuli
Gandak
Modikhola
Devighat
Sunkoshi
Generation (GWh)
1000
900
800
700
600
500
400
300
200
100
0
042/43 043/44 044/45 045/46 046/47 047/48 048/49 049/50 050/51 051/52 052/53 053/54 054/55 055/56 056/57 057/58 058/59 059/60 060/61 061/62 062/63 063/64 064/65 065/66 066/67 067/68 068/69
Fiscal Year


Generation Details FY 2068/69
Power Purchase IPP, 25.65%
Kaligandaki 'A', 20.57%
Mid-Marsyangdi, 10.16%
Power Purchase India, 17.83%
Marsyandi, 10.65%
NEA
Thermal, 0.04%
Tinau, 0.05%
Puwa, 0.68%
Trishuli, 3.22%
Kulekhani I, 3.42%
Tatopani, 0.10%
Panauti, 0.08%
Sunkoshi, 1.59%
Modi, 0.83%
Kulekhani II, 1.71%
Sundarijal, 0.10%
Seti, 0.25%
Devighat, 2.51%
Fewa, 0.04%
Chatara, 0.07%
Gandak, 0.31%


Water Level vs Energy Generation of Indra Sarovar
Energy Generation (MWh)
Water Level (masl)

# NEPAL ELECTRICITY AUTHORITY

## Generation Operation and Maintenance
## Office of the General Manager
## Contact Number

| S.No. | Designation | Office | Name | Office Tel. No. | Fax No. | Internal No. | Email |
|---|---|---|---|---|---|---|---|
| 1 | General Manager | GO&M | Mr. Mahendra Lal Shrestha | 4153014 | 4153016 | 1304/1303 | mahensth@gmail.com |
| 2 | Director | GO&M | Mr. Bal Krishna Shrestha | - | - | 1402 | baladgrt@yahoo.com |
| 3 | Director | MPPO&MD | Mr. Bindu Prakash Joshi | 4153017 | 4153081 | 3404 | binprajos@hotmail.com |
| 4 | Director | LPPO&M D | Mr. Hitendra Dev Shakya | 4153070 | 4153071 | 3101/5009 | hitendradev@hotmail.com |
| 5 | Joint Director | GO&M | Mr. Tularam Giri | 4153172 | 4153172 | | tularamgiri@yahoo.com |
| 6 | Manager | LPPO&MD | Mr. Sachchidananda Mishra | 4153030 | | | er_snmishra@gmail.com |
| 7 | Deputy Director | GO&M | Mr. Rajan Raj Bista | 4153170 | 4153171 | - | rajan_bista@hotmail.com |
| 8 | Deputy Manager | MPPO&MD | Mr. Ashok Tuladhar | - | - | 2310 | - |
| 9 | Deputy Manager | GO&M | Mr. Durga Kumar Gurung | 4153030 | - | | durgakumargurung@yahoo.com |
| 10 | Deputy Manager | MPPO&MD | Mr. Rastra Bhusan Pradhan | - | - | 3407 | rbhupradhan@hotmail.com |
| 11 | Asst. Manager | MPPO&MD | Mr. Dhruba Kumar Uprety | 4153068 | - | - | dhrubakumar_upreti@yahoo.com |
| 12 | Asst. Manager | LPPO&MD | Mr. Pashupati Raj Gautam | | - | 3111 | prgautamj@yahoo.com |
| 13 | Asst. Manager | LPPO&MD | Mr. Keshab Shrestha | 4153032 | - | 2211 | keshabshr@gmail.com |
| 14 | Asst. Director | MPPO&MD | Mrs. Shova Joshi | 4153081 | 4153081 | 3402 | - |
| 15 | Engineer | LPPO&MD | Mr. Shivaram K.C. | 4153068 | - | 5065 | shiva_2057@yahoo.com |
| 16 | Engineer | MPPO&MD | Mr. Sushil Paudel | - | - | 3407 | sushil347@gmail.com |
| 17 | Engineer | LPPO&MD | Ms. Sarita Panthi | 4153032 | - | 2211 | saritapanthee@gmail.com |
| 18 | Engineer | LPPO&MD | Mr. Sajan Shrestha | 4153032 | - | 2211 | sajan@nea.org.np |
| 19 | Account Officer | GO&M | Mr. Rajesh Chandra Luitel | 4153195 | 4153171 | - | rajeshc88@yahoo.com |
| 20 | Asst. Admin. Officer | GO&M | Mr. Shuka Dev Ghimire | 4153172 | 4153172 | 5031 | gshukadev@yahoo.com |
| 21 | Asst. Admin. Officer | GO&M | Mr. Damodar Pokharel | 4153014 | 4153016 | 1303 | pokharel_damodar36@yahoo.com |
| 22 | Asst. Computer Officer | GO&M | Mr. Mohan Bahadur Basnet | 4153172 | 4153172 | 5031 | basnetmohan94@yahoo.com |
| 23 | Asst. Computer Officer | GO&M | Mr. Deepak Raj Wagle | 4153172 | 4153172 | 5031 | chabahilbahal@gmail.com |
| 24 | Asst. Admin. Officer | LPPO&MD | Mrs. Pashupati Lamsal Paudel | 4153081 | 4153081 | 3402 | |

Note:

GO&M: Generation Operation and Maintenance

MPPO&MD: Medium Power Plant Operation and Maintenance Department

LPPO&MD: Large Power Plant Operation and Maintenance Department

# NEPAL ELECTRICITY AUTHORITY

## Generation Operation and Maintenance

## Power Station Contact Number

| | | | | |
|---|---|---|---|---|
| Kaligandaki 'A' | Name | Abdhesh Kumar Singh | Kedar Prasad Dhital | Kul Raj Khanal |
| | Office No. | 063-403204 (Control Room)/403201/4301983 | 063-403203 | 063-403203 |
| | Fax No. | 063-403202 | 063-403202 | 063-403202 |
| | Email | aksingh@yahoo.com | | krjthada@gmail.com |
| Middle Marsyangdi | Name | Ram Kumar Yadav | Krishna Chandra Joshi | Sanjay Karki |
| | Office No. | 066-400073 | 066-400073 | 066-400073 |
| | Fax No. | 01-4274218 | 01-4274218 | 01-4274218 |
| | Email | kmrydv@yahoo.com | kcjoshi_2003@hotmail.com | sanjay@nea.org.np |
| Marsyangdi | Name | Chandra Shekhar Chaudhary | Bhesh Prasad Dhakal | Tika Ram Ghimire |
| | Office No. | 065-540077, 01-4301697 | 065-540077 | 065-540089 |
| | Fax No. | 065-540088 | 065-540088 | 065-540088 |
| | Email | chaudharycs@yahoo.com | | |
| Kulekhani-I | Name | Rabindra Mahaseth | Hari Prasad Ghimire | Ganesh Dutta Bhatta |
| | Office No. | 01-4284201 | 01-4284201 | 01-4284201 |
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| Multi-Fuel | Name | Baburaja Maharjan | Bhoj Raj Poudel | Riddhi Raj Karki |
| | Office No. | 021-421243/ 420858 (Control Room) | 021-421243 | 021-420651 |
| | Fax No. | 021-420025 | 021-420025 | 021-420025 |
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| Kulekhani-II | Name | Krishna Prasad Yadav | Sarada Bikram Malla | Gokarna Thapa |
| | Office No. | 057-621545/01-4289014 | 057-621545 | 057-621545 |
| | Fax No. | 01-4289014 | 01-4289014 | 01-4289014 |
| | Email | kultwo@gmail.com | - | - |
| Trishuli | Name | Aftab Alam | Bhola Singh | Debu Prasad Dahal |
| | Office No. | 010-560099/560423/560005 (Control Room) | 010-560423 | 010-561025 |
| | Fax No. | 010-560099 | 010-560099 | 010-560099 |
| | Email | thpsnea@gmail.com | - | - |
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| | Fax No. | 078-520782 | 078-520782 | 078-520782 |
| | Email | tiwarinj@gmail.com | - | - |
| Modikhola | Name | Kapil Dev Manjan | Surendra Sharma | Birendra Kumar Singh Thapa |
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| Hetauda Diesel | Name | Rajesh Kumar Pandey | Bharat Kumar Bhandari | Ganesh Bhandari |
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| Devighat | Name | Manohar Kumar Rajbhandari | Bishnu Prasad Acharya | Kuber Bahadur Pudasaini |
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| | Email | - | - | p.kuber01@yahoo.com |
| Sunkoshi | Name | Badri Prasad Foyal | Nanikaji Thapa | Purushottam Prasad Bhandari |
| | Office No. | 011-681128 (Control Room)/011-482155 | 011-482155 | 011-482155 |
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| | Email | bfoyal@yahoo.com | - | - |
| Ilam (Puwakhola) | Name | Ramakanta Dev | Tika Prasad Bhattari | Sitaram Rimal |
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| | Fax No. | 27520351 | 27520351 | 27520351 |
| | Email | devramakant@gmail.com | jamunali@gmail.com | - |

| | | | | |
|---|---|---|---|---|
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| | Office No. | 011-440056 | 011-440056 | 011-440056 |
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| | Fax No. | 061-551245 | 061-551245 | 061-551245 |
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| | Email | - | - | - |

Reservoir Flushing and Sanbd Removal during Repair Work Carried Out in February 2012 in Middle Marsayangdi Hydropower Station

Replacement of Single Phase 132 KV Power Transformer, 'B' Phase by Spare Transformer in Kulekhani-II Hydropower Station

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# NEPAL ELECTRICITY AUTHORITY

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