

# **PATIKARI POWER PVT LTD**

## **2 X 8 MW**

### **Mandi District, Himachal Pradesh**



*Annual O&M Report*

*FY 2013-14*

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## ***1 Introduction***

16 MW Patikari Project, implemented by Patikari Power Private Limited, is a run of the river hydro power project developed on Bakhli Khad, a tributary of Beas River and is located in Mandi district of Himachal Pradesh, India. Two (2) generating Units driven by horizontal shaft Pelton Turbines, each having a rated output of 8.0 MW (having 15% CMR), are installed in the Power Station. The Design Energy of the Power Plant is 78.81 million KWh of electrical energy based on the 90% Dependable Discharge and rated output of 16 MW.

Patikari HE Project harnesses energy of the water in Bakhli Khad River diverted through a Diversion Weir and led to Desilting Tanks. After flushing the silt, if any, clean water is then fed to the Water Conductor System comprising of 3.6 km Head Race Tunnel including two (2) Aqueducts enroute, followed by Surface Steel Surge Shaft and 715 m long Penstock feeding water under pressure for driving two (2) hydro-generating Units in the Power House. After passing through the Turbines, water is led back to Bakhli Khad through Tail Race Channel.

Each of the two (2) Generating Units in Patikari Hydropower station comprises horizontal Pelton Turbine to which synchronous Generator is directly coupled, generating rated power of 8.0 MW at 11kV. Besides appropriate Unit and Station Auxiliaries, state of the art Control and Monitoring System (SCADA) has been installed in the Power Station to ensure optimum generation there from.

Power so generated is then being stepped up to 33kV through two (2) 11MVA Step-up Transformers and evacuated through one (1) double circuit 11km long 33kV Transmission Line terminating at the other end in 33kV Substation of HPSEB at Pandoh which is part of the HPSEB network. Patikari Power Private Limited have entered into a long term Power Purchase Agreement dated 5th July 2004 with HPSEB envisaging delivery of power from the Project at 33kV Substation of the Board at Pandoh in Mandi district of Himachal Pradesh. Tariff for the electricity to be supplied by the Project to the Board at this Delivery Point is Rs. 2.25 per kWh (fixed).

Design Energy of the project, based on the 90% Dependable year Discharge as adopted in the Detailed Project Report and without taking into account mandatory release of 15% discharge during lean discharge period, is 78.81 MU. However, discharge trend in Bakhli Khad as actually observed

since commissioning of the project, does not match with above said Design discharges especially during eight lean discharge months even in years with normal monsoon rains. As a result, actual annual energy generation from the Project till date has been less than that of the Design Energy even during years with normal monsoon rains and in spite of both the units having been run at around 15% overload during monsoon months.

## 2 Plant Performance

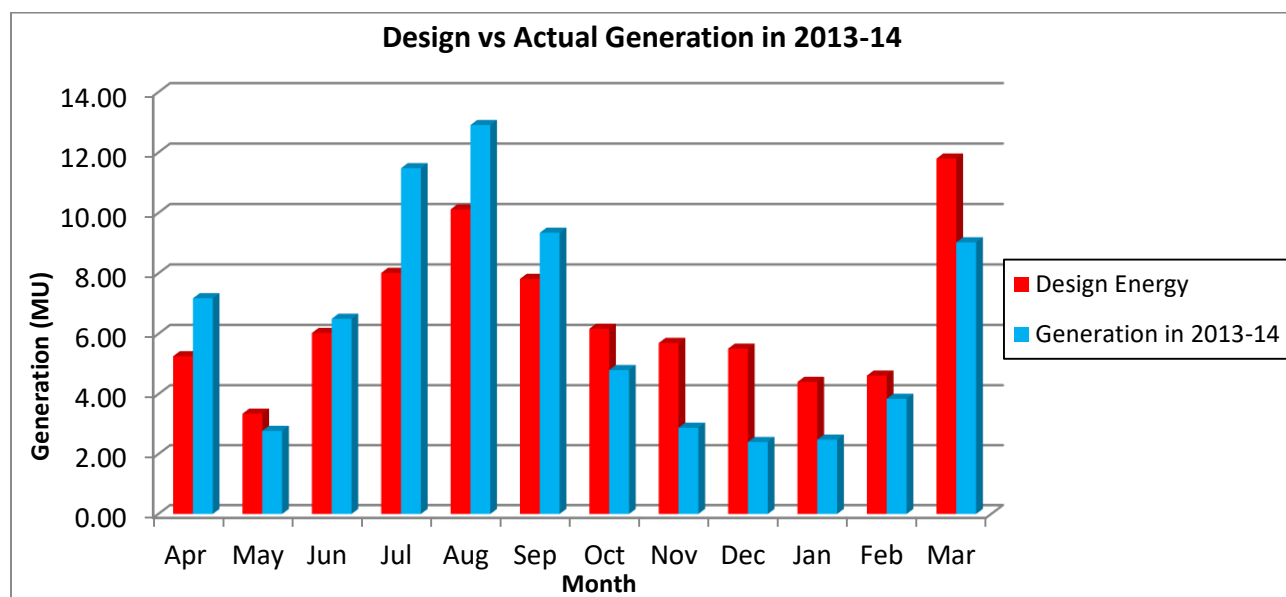
### 2.1 Generation Data during the Year:

Month wise Design Energy and corresponding actual generation from the Project during 2013-14 and reasons for variations between the two are tabulated hereunder.

Month	Design Energy (90% Dependable Year in MUs)	Actual Generation (MUs) during 2013-14	Actual Vs Design Energy %	Remarks
Apr	5.26	7.178	136.46	
May	3.35	2.775	82.84	Due to Low Discharge
Jun	6.03	6.498	107.76	
Jul	8.02	11.482	143.17	
Aug	10.12	12.909	127.56	
Sep	7.82	9.345	119.50	
Oct	6.17	4.802	77.83	Due to Low Discharge
Nov	5.70	2.879	50.51	
Dec	5.51	2.403	43.61	
Jan	4.41	2.482	56.28	
Feb	4.62	3.844	83.20	

<b>Mar</b>	<b>11.80</b>	<b>9.028</b>	<b>76.51</b>	
<b>Total</b>	<b>78.81</b>	<b>75.625</b>	<b>95.96</b>	

As evident from above, against Design Energy of 78.81 MU based on 90% Dependable Year Discharges, Project generated 75.625 MU during the financial year 2013-14. The Generation during financial year 2013-14 was thus 95.96 % of the Design Energy. It is the record generation so far during a financial year since commissioning of the Plant. The earlier highest annual generation was 72.60 MU during FY 2008-09.



## 2.2 Generation during six years of Operation since commissioning:

Month	Design Energy (90% Dependable Year in MUs)	Actual Gen. (MUs) during 2008-09	Actual Gen. (MUs) during 2009-10	Actual Gen. (MUs) during 2010-11	Actual Gen. (MUs) during 2011-12	Actual Gen. (MUs) during 2012-13	Actual Gen. (MUs) during 2013-14
Apr	5.26	3.08	2.28	1.29	5.859	4.32	7.178

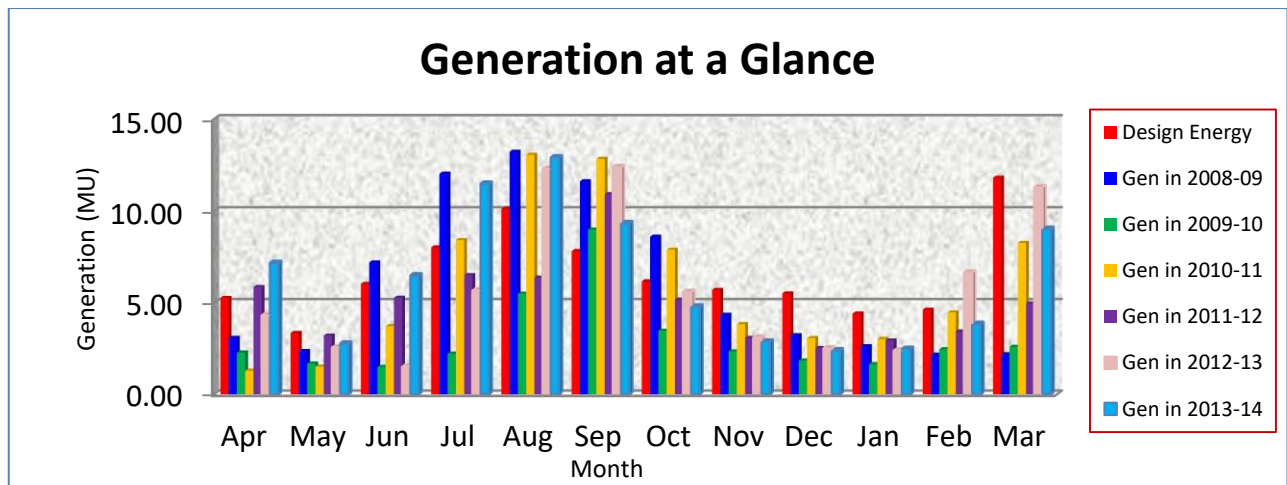
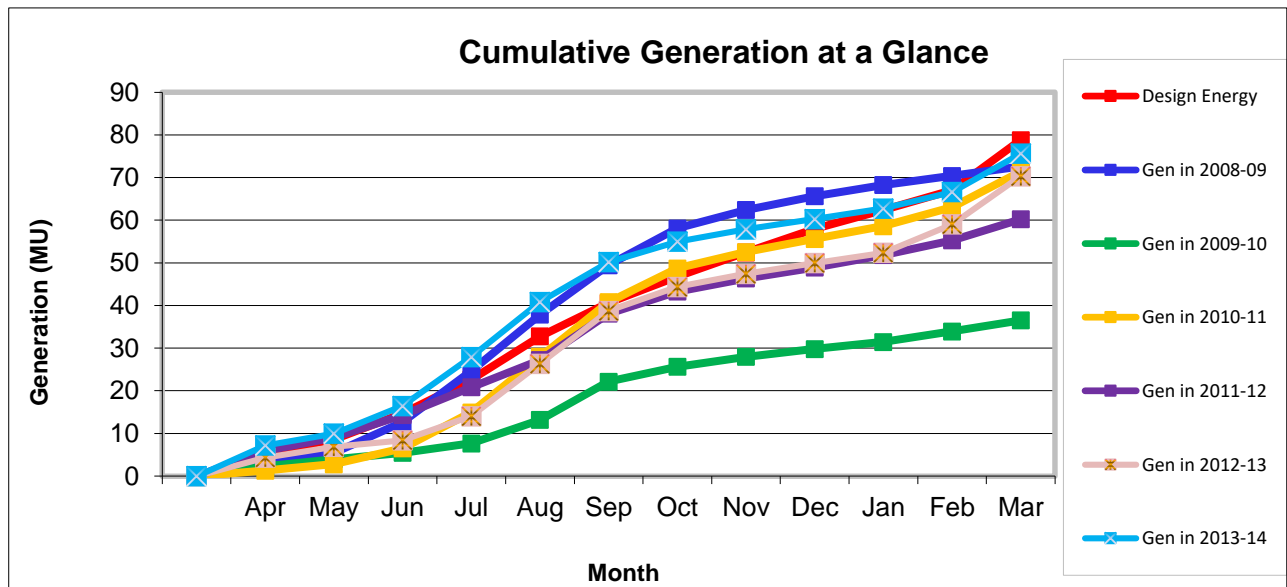
May	3.35	2.36	1.68	1.51	3.20	2.56	2.78
Jun	6.03	7.20	1.50	3.72	5.27	1.52	6.498
Jul	8.02	12.02	2.22	8.42	6.51	5.68	11.482
Aug	10.12	13.21	5.49	13.05	6.37	12.296	12.909
Sep	7.82	11.61	8.99	12.82	10.913	12.392	9.345
Oct	6.17	8.60	3.47	7.90	5.17	5.60	4.80
Nov	5.70	4.34	2.34	3.83	3.08	3.10	2.88
Dec	5.51	3.22	1.84	3.07	2.53	2.52	2.40
Jan	4.41	2.62	1.65	3.03	2.94	2.40	2.48
Feb	4.62	2.16	2.46	4.47	3.43	6.660	3.84
Mar	11.80	2.18	2.59	8.26	4.96	11.292	9.03
<b>Total</b>	<b>78.81</b>	<b>72.60</b>	<b>36.52</b>	<b>71.36</b>	<b>60.23</b>	<b>70.327</b>	<b>75.625</b>

Quarter wise performance of the Plant during the year is tabulated hereunder:

<b>Quarter</b>	<b>Design Energy (MU)</b>	<b>Actual Generation (MU)</b>	<b>Actual/Design Energy (%)</b>
1st Quarter (April 13 to June 13)	14.64	16.451	<b>112.37</b>
2nd Quarter (July 13 to Sep 13)	25.96	33.736	<b>129.95</b>
3rd Quarter (Oct 13 to Dec 13)	17.38	10.084	<b>58.02</b>
4th Quarter (Jan 14 to Mar 14)	20.83	15.354	<b>73.71</b>
<b>Total for the year 2013-14</b>	<b>78.81</b>	<b>75.63</b>	<b>95.96</b>

As is evident from above table, generation during 1<sup>st</sup> and 2<sup>nd</sup> quarters was above the Design Energy but the generation during other two quarters was comparatively less because of poor river discharges during corresponding months.

Generation during the first quarter i.e. April-13 to June-13 was 16.415 MU i.e.112.37 % of the Design Energy of 14.64 MU which is the highest achieved so far for this quarter since commissioning of the project.



### 2.3 Discharge actually observed in the Bakhli Khad after commissioning:

Discharges actually observed in Bakhli Khad during lean discharge months after commissioning of the Project are much lower than the corresponding Design Discharges and many a times even less than the lowest monthly discharges recorded before commissioning as per DPR.

A comparison of discharges actually observed in Bakhli Khad after commissioning of the Project vis-a vis Design and earlier lowest recorded monthly discharges from 1984-85 to 1995-96 taken into account in the DPR is given below.

Month	90% Dependable Year Discharge	Lowest Monthly Discharge Observed from 1984-85 to 1995-96	Actual Discharge during 2008-09	Actual Discharge during 2009-10	Actual Discharge during 2010-11	Actual Discharge during 2011-12	Actual Discharge during 2012-13	Actual Discharge during 2013-14
Apr	2.45	1.79	1.80	1.12	0.69	2.87	2.29	3.46
May	1.52	1.29	1.03	0.76	0.76	1.60	1.25	1.48
Jun	2.81	1.23	4.84	0.74	2.40	3.52	0.78	6.09
July	6.15	3.47	5.98	1.02	5.34	6.73	2.95	14.24
Aug	4.56	4.56	8.01	3.03	12.55	10.05	15.12	13.76
Sep	3.65	3.65	5.90	6.32	9.44	6.65	7.84	4.62
Oct	2.79	2.70	3.72	1.54	3.67	2.43	2.62	2.27
Nov	2.66	1.77	2.08	1.15	1.87	1.55	1.58	1.52
Dec	2.49	1.43	1.48	0.88	1.49	1.25	1.31	1.19
Jan	1.99	1.16	1.25	0.82	1.48	1.53	1.25	1.24
Feb	2.26	0.89	1.15	1.28	2.44	1.78	3.74	3.74
Mar	6.46	1.79	1.07	1.18	3.87	2.44	5.57	5.57



#### 2.4 Revenue Generation / Realization

Project delivered 64,870,080 Units of electricity to HPSEB during financial year 2013-14 after accounting for 12% Free Power to the Home State. Against the energy supplied and billed for the year 2013-14 amounting to INR 14,59,57,680/- HPSEB released payments amounting to INR 155,632,752/- including the payments for Feb & March-13 amounting to INR 13,120,272 & INR 21,783,168/- released during April & May-13 respectively . Details about the monthly billings and receipts are tabulated hereunder:

<b>Financial Year 2013-14</b>				
<b>Revenue Generation/Realization during Financial Yr 2013-14</b>				
<b>S.No.</b>	<b>Period</b>	<b>Total Saleable Energy (kWh)</b>	<b>Bill Raised (INR)</b>	<b>Amount Received (INR)</b>
1	-----	-----	-----	13,120,272*
2	-----	-----	-----	21,783,168*
3	01/04/13 to 01/05/13	6,085,728	13,692,888	13,692,888
4	01/05/13 to 01/06/13	2,363,328	5,317,488	5,317,488
5	01/06/13 to 01/07/13	5,711,904	12,851,784	12,851,784
6	01/07/13 to 01/08/13	9,802,848	22,056,408	22,056,408
7	01/08/13 to 01/09/13	10,944,384	24,624,864	24,624,864
8	01/09/13 to 01/10/13	7,942,176	17,869,896	17,869,896
9	01/10/13 to 01/11/13	4,119,456	9,268,776	9,268,776
10	01/11/13 to 01/12/13	2,480,544	5,581,224	5,581,224
11	01/12/13 to 01/01/14	2,066,592	4,649,832	4,649,832
12	01/01/14 to 01/02/14	2,140,512	4,816,152	4,816,152
13	01/02/14 to 01/03/14	3,376,032	7,596,072	-----**
14	01/03/14 to 01/04/14	7,836,576	17,632,296	-----**
	<b>Total</b>	<b>64,870,080</b>	<b>145,957,680</b>	<b>155,632,752</b>

\* Payments against Feb & Mar-13 Energy bill amounting to Rs. 13,120,272 & Rs. 2, 17, 83,168 were released in April & May-13 respectively.

\*\* Payments against Feb & Mar-14 Energy bill amounting to Rs. 7,596,072 & Rs. 17,632,296 were released in April & May-14 respectively.

### **3 Preventive Maintenance**

To minimize the plant outages and consequent avoidable generation loss of the project, periodic preventive maintenance schedules for all the equipments have been prepared & are being complied with. These periodic maintenance schedules are listed below.

- Daily maintenance schedule
- Weekly maintenance schedule
- Monthly maintenance schedule
- Quarterly maintenance schedule
- Half-Yearly maintenance schedule
- Yearly maintenance schedule

Apart from the above schedules, cleaning of both desanders at weir site & cooling water pit in power house prior to, during and after monsoons is being carried out.

### **4 Annual Maintenance and Overhauling Works**

Equipment wise maintenance schedules viz. Generator, Turbine & MIV, Power Transformers, Switchyard equipments, weir site structures etc. have already been issued to the Project. These maintenance schedules are strictly adhered by the project on regular basis. Maintenance of the following equipments/structures was carried out as per the maintenance schedule.

- Generator
- Generator Transformers & other Transformers
- Turbine & MIV
- Switchyard equipments

- EOT Crane
- Weir site structures

Following major Annual Maintenance and restoration works of the Power Plant were carried out during the year:

- Cleaning of Cooling Water pit, MIV filter, Generator cooler filter
- Cleaning of cooling water Filters of both the Units
- Cleaning of Back Flushing Filters of both the Units
- Cleaning of Trash Rack at weir site
- Maintenance of GT-2 feeder breaker
- Repair of approach road of power house

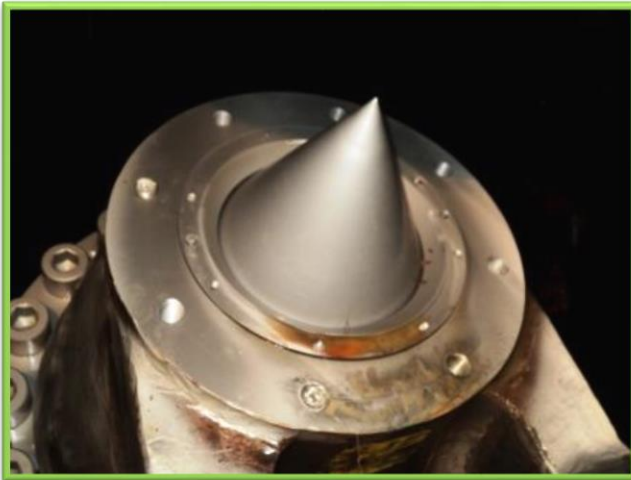
## ***5 Unit-II : Breakdown due to Buckler failure***

On July 24 at 14.36 hrs, both machines were tripped due to grid failure from Pandoh sub- station. After restoration of the grid, both the units were started with normal starting procedure but an abnormal sound was observed which was coming from turbine of Unit-II. Therefore Unit-II was stopped manually through push button in Governor Panel and inspection cover of the turbine was opened to investigate any abnormality. During inspection, it was found that the flange with buckler was missing from its position and found in the tail race. The bolts of the nozzle head and the shaft of the deflector servomotor were also found in broken condition.

The photographs of the damaged components are below:



*Damaged Flange with Buckler*



*Damaged bolts of the nozzle*



*Damaged Deflector Servomotor shaft*

## **6 Loss of Generation - Causes and Corrective steps**

Loss of Generation due to various reasons viz. plant outages, forced Grid outages & repair works during the year under report was to the tune of **2.69 MU** out of which, Generation loss of **1.15 MU** was attributable to the forced grid outages.

There are following two main factors responsible for the loss of generation from the Project in general:

- External Evacuation Constraints
- Plant Outages

### ***External Evacuation Constraints***

External constraints mainly comprise of the Grid outages in the HPSEB networks & back down instructions. Generation loss due to grid/HPSEB transmission lines tripping incidents during financial year 2013-14 was to the tune of 1.15 MU. This issue of grid/HPSEB transmission lines tripping incidents had been persistently followed up with the Board to eliminate such outages to the maximum extent possible and remove all evacuation constraints being faced by the project.

### ***Plant Outages***

The factors such as silt flushing duct choking, trash rack choking, cooling water filter choking, failure of 11/33kV breakers etc. were major cause for the plant outage. The matter of choking of silt

flushing ducts was referred to civil design wing for their suggestions on the further improvements in the existing de-silting arrangements to obviate the problems of choking.

Below Photographs depict the choked silt flushing duct and cleaning activities:



*Choked silt flushing duct*



*Cleaning of silt flushing duct*



*Silt flushing duct after cleaning*

## **7 Inventory Management**

Adequate optimum stocks of spares are being maintained in the Plant stores to cater for any preventive as well as other maintenance requirements of the Power Station. The consumption of Electrical, Mechanical & General store material is being regularly reported and monitored on monthly basis.

## **8 Safety Measures**

Safety Manual had been issued to the Plant & the Safety measures as per the manual had been strictly complied. Safety charts had been displayed in the power house area. Mock drills related to Fire Protection / Flood Protection / any other natural calamity Protection had been arranged annually in & around power house area to ensure preparedness for such exigencies.

## **9 Employees Welfare Measures**

Various Employees Welfare measures being undertaken from time to time by the Company Management are as under:

- ✓ **Review of Annual wages** – Review of the annual wages of the O&M staff is carried out based on the performance of the employee & accordingly they are being compensated.

- ✓ Employees are also appreciated with incentives on achievement of certain target of generation.
- ✓ **Training of O&M Staff** – Various trainings related to operation & maintenance of small hydro plants & interpersonal relationships are being imparted to the employees from time to time.

*The End*

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