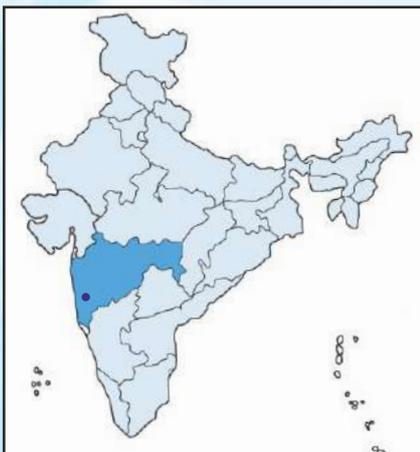


India's Least LCC (*Life Cycle Cost*) Pumping Stations at India's Oldest HEP (*Hydro Electric Power Station*)



Hydro Electric Power (HEP) is the Most Economical & Environment friendly source of generating Electricity.

Bhira Powerhouse commissioned in the year **1927**, is the largest HEP of the Tata Power Co Ltd. (TPC) & **India's Oldest HEP.**



The water for Power generation of main plant is taken from the **Mulshi Lake** in Pune district vide a masonry dam in surkhi lime mortar across the **Mula river** at the junction of Mula and **Neela rivers**. Bhira Powerhouse consists of 6 machines of 25 MW and one machine of 150 MW.

PLANT SIZE

300 MW

LOCATION

BHIRA, MAHARASHTRA

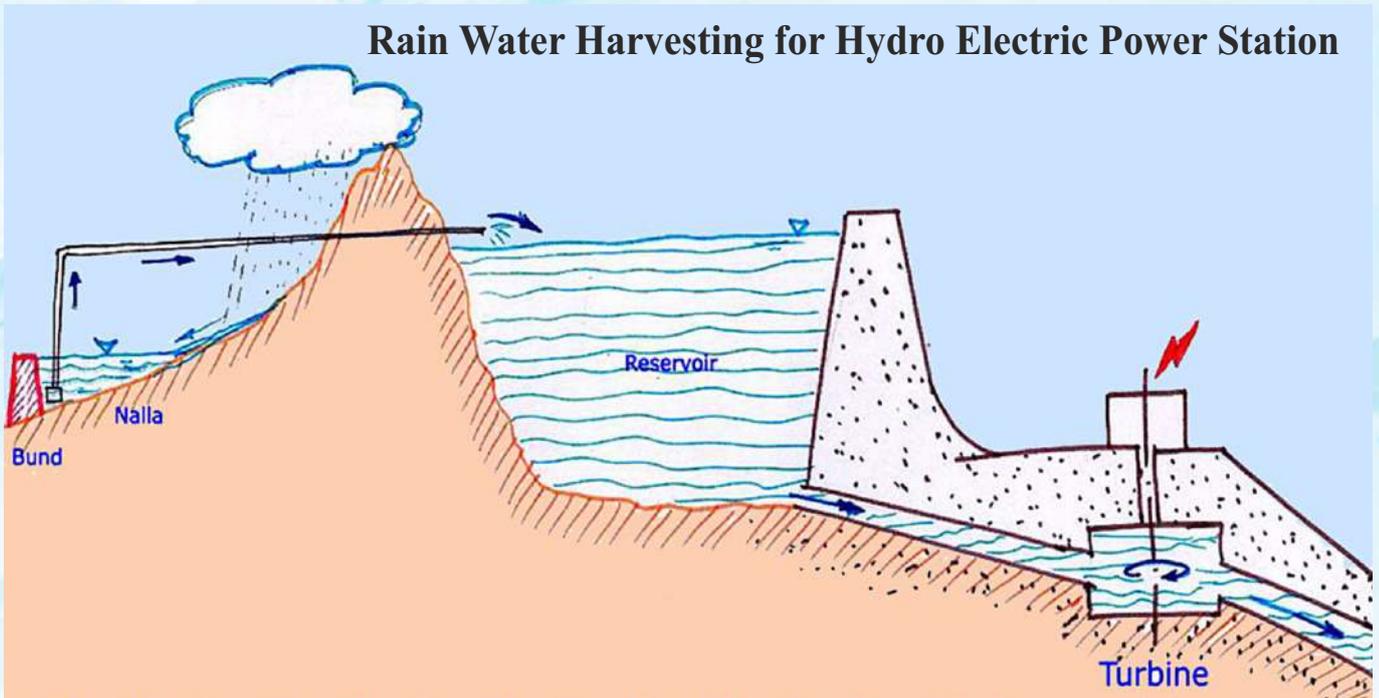
TYPE

HYDRO GENERATION

Completed in **1927**, the hydro plant's maximum output capacity is nominally **300 MW**, generated by six **25 MW** Pelton turbines & a **150 MW** pumped storage generator.

Situation

Rain Water Harvesting for Hydro Electric Power Station



HEP's involve **Huge Capital Cost** but require **Minimal Operational Cost** (*Mostly Water*) - hence it is **imperative** that they be operated for **as many days of a year as possible**. (to maximize profit & also save undesirable Carbon (from Coal burning Emissions)).

Unfortunately, after withdrawal of monsoon, the water quantity in Main Lake (*feeding the Turbine Generators*) is insufficient forcing TPL to stop the Hydro Electricity Generation (& shift over to **costly Coal** based generation) adversely impacting profits ...!

HEP's on such Non Perennial rivers (*especially those with many surrounding yet non-linked water bodies*) can benefit from **Water Harvesting** - water from small streams can be lifted into the main reservoir from where it shall feed the turbine thereby resulting in power generation – against a Minuscule Energy Spent in pumping, Large Energy is Re-Cuperated from the Turbine Generator **resulting into Net Energy Saving (Generation)** which helps reduce **Coal Consumption, Carbon Emissions & Improves Profits**.

During monsoon period from the month of Mid-June to September, there are many streams which drain water into the Arabian sea without serving mankind – TPL identified many such streams & came up with a revolutionary concept to pump lift these waters into the main lake from where it would spin the turbine like naturally precipitated rain water.

One of the many such feasible schemes identified was **NIVE NALLAH** across the **Kundalika** rivulet. The estimated water quantity available was about **8mcm** which can be diverted to the Mulshi dam without effecting the downstream users. The scheme consisted of building a simple cost effective, 3m tall Concrete Bund across the stream to dam up the otherwise fast flowing water for installation of submerged pumps.

About 1.5 km length Mild Steel pipes were laid from this bund to the Mulshi Lake.



Quandry...?



VT Pump based Lifting Station



SubCF Pump based Lifting Station

$$\text{Benefit-Cost Ratio} = \frac{\sum_{t=0}^n \frac{CF_t [\text{Benefits}]}{(1+i)^t}}{\sum_{t=0}^n \frac{CF_t [\text{Costs}]}{(1+i)^t}}$$

However, before embarking on any Capital Project (*Lifting Stations*), it's Benefit-Cost Ratio needs to be favorable - i.e. the Cost (*CAPEX + OPEX*) needs to be lower than the equivalent Benefits (*Cost of Coal saved as a result of additional hydroelectricity generated*).

Due to Very High CAPEX (*especially the Cost of Civil Structures*) & High OPEX (*Maintenance*) required by **VT Pumps**, it's Benefit - Cost ratio was **unfavorable**.

Solution

Aqua's SubCF pumps :

1) Don't require any Costly, Huge Civil structures & can be lowered into simple checkdams.



Huge Civil Cost & Time Savings



Ultra Low ManPower Requirement



2) Requires & NO Special Pre – Post / Ancillary-Auxillary Operations; like Operating & Maintaining the Forced Water Lubrication systems operation,

3) **Requires & No Periodic Consumables;** like :

- Oil,
- Grease,
- Gland Rope Packing,
- Coupling Rubber/ Pins,
- Sleeves, etc



4) **Requires & No Routine Maintenance;** like :

- Frequent Oiling,
- Re-Greasing,
- Gland Leakage Rate Checking, Tightening & Gland Rope replacement,
- Checking (& Correcting) Shaft Alignment, etc.



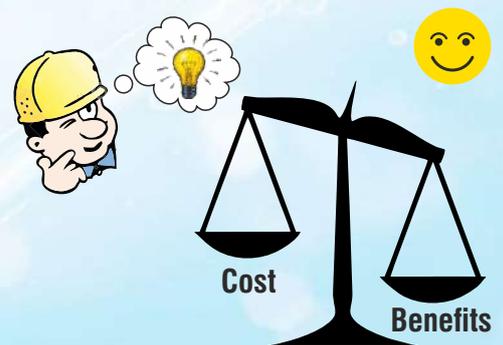
5) are Flood proof, silt & clog resistant (*due to extra heavy duty Basket Strainers*) & don't require Routine Operational Maintenance.

6) are Quick & easy to install

7) can be **shifted between multiple sites** thereby increasing the returns on their capital cost.

Hence, Aqua's SubCF pumps enable very Low CAPEX (*especially the Cost of Civil Structures*) & Low OPEX (*Maintenance*) making it's **Benefit - Cost ratio** very **favorable**.

M/s. TPL chose Aqua's Submerged Centrifugal pumps over Vertical Turbines (&/or Polder Bore Hole Submersibles).



SubCF Pump based Lifting Station



The pumps are used to cumulatively lift **upto 5.5 m³/s** of (*otherwise waste runoff*) monsoon water to the main reservoir which is ultimately used for hydro power generation. Due to time bound conditions put forth by m/s TPL, for the **Pilot scheme**; Aqua designed, manufactured & commissioned the pumps in **just 6 weeks..!**

Summary of Aqua Submerged CF pumps @ BHIRA Complex								
Motor Rating	Individual	hp	270	215	215	140	100	-
	Cumulative		1,620	430	860	560	800	4,270
Quantity		nos	6	2	4	4	8	24
Flow	Individual	m ³ /hr	750	990	1000	335	1000	-
	Cumulative		4,500	1,980	4,000	1,340	8,000	19,820
Head		mwc	60	60	40	70	40	-
Year of Commissioning		y	2004	2010				-

Benefits



Intelligent InBuilt Monitoring

Easily Remote Control[#] of your Pumpset's Health

[#]requires additional communication hardware



Plug & Pump

No base Plate or Coupling to align;

Long Life, Maintenance Free



Mechanical Seals

Two, Independent; Seals rated for atleast 16 / 25 bar pressure capability for L_{10H} life in excess of 50,000 hours &/or 5 years.



Robust Multiple (Duplex, Triplex or even Quadruplex) **DE Bearing arrangements, easily tolerate Heavy Thrusts** (emanating due to wide head variation) **for L10h exceeding 1,00,000h**



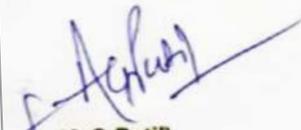
Ref. No. : P/AD-P2/295/135

Date : 14th March 2008

AQUA - PERFORMANCE CERTIFICATE

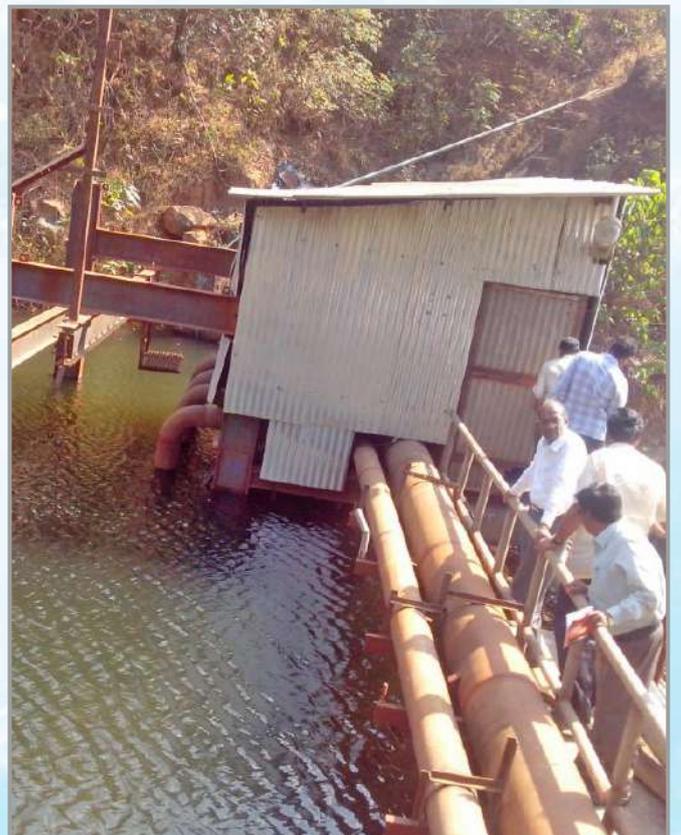
This is to certify that since June, 2004; we are using 6 nos. of "Aqua" make Submersible Pumps for Raw Water transfer at our Bhira Hydro Power Station. The pumps are of Single stage Volute Casing type with Dry Submersible Motor (270hp, IP68 enclosure) and rated at 750m³/hr x 60m head.

The pump's performance has been excellent and we recommend the use of "Aqua" make pumps (manufactured by M/s. Aqua Machinerics Pvt. Ltd. 3821, GIDC Phase 4, Vatva; Ahmedabad - 382445)


(A G Patil)
Manager (Bhira)

"At Aqua, we don't just make great pumps — we also help engineer simple, robust & cost effective pumping solutions."

D. R. Bhandarkar
Sr. Mgr.,
Application Engg.
M/s. AMPL



TATA

Ref: P/AD-P2/295/167
Date: 19th December 2020

AQUA - Performance Certificate

This is to certify that since June 2004, we are using 6 Nos of Aqua make submerged pump sets at our Bhira Hydro Power Station each of 750 m³/hr x 60m and equipped with Dry type Submerged (IP 68 enclosure) motor rated for 270hp.

The pump set's performance has been excellent over the years & based on our experience we recommend the use of Aqua make Submerged pump sets.

Ganesh Deshmukh
Head - Bhira

TATA

Date: 10.04.2021

Performance Certificate

This is to certify that since 2010, we are using of Aqua make Submerged Pump sets at our Bhira Hydro Power Station of following capacity:

HP :	215 HP	215 HP	140 HP	100 HP
Qty :	2 No	4 No	4 No	8 No
Flow :	990 m ³ /hr	1000 m ³ /hr	335 m ³ /hr	1000 m ³ /hr
Head :	60 m	40 m	70 m	40 m

The pump set's performance has been satisfactory over the years & based on our experience we recommend the use of Aqua make Submerged Pumpsets.

Head - Operations.

TATA POWER
The Tata Power Company Limited
Generating Station Bhira, P O Bhira, Taluka Mangam, District Raigad, Maharashtra-401 501
Tel: 022140126004, 262005, 260006
Registered Office: Bombay House, 24 Horns Mody Street, Mumbai-400 001
CIN: L28920MH1919PLC00567 Website: www.tatapower.com Email: tatapower@tatapower.com

“The Capital Cost & Complexity of such a scheme with conventional Vertical Turbine pumps (which require Large Intake Wells & Forebay); would adversely impact the Benefit/Cost ratio (BCR) of the scheme - but Aqua's Submerged Centrifugal pumpsets require simple, cost effective Civil works thereby improving the BCR dramatically without compromising on reliability or wasting energy (like Polder or Submersible pumpsets would).”

A. G. Patil
C.E.O., TPL

Aqua Machineries Private Limited

www.aquapumps.com

Registered Office & Manufacturing Plant

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