



Enriching Lives



Green Energy with PICO (Spark) - PAT Turbine



Kirloskar Brothers (Thailand) Limited
Factory address: 700/711 Moo 1,
Amata City (Chonburi), Phase 8,
Phantong, Chonburi 20160, Thailand

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PICO and PAT Turbine

KBL has developed a pump wonder in the form of PICO, which can be operated in reverse as a turbine for generating electricity. PICO, like PAT, is designed for meeting energy requirements in industries. The cost-efficient pump set thus ensures better Return on Investment (Roi).

KBL duly understands the growing energy requirements in the industrial sector and, hence, produced energy solutions like PAT and PICO. The power generation capacity of both PAT and PICO is different. PICO is generally used for meeting smaller energy requirements while PAT can be used for meeting comparatively higher energy requirements.

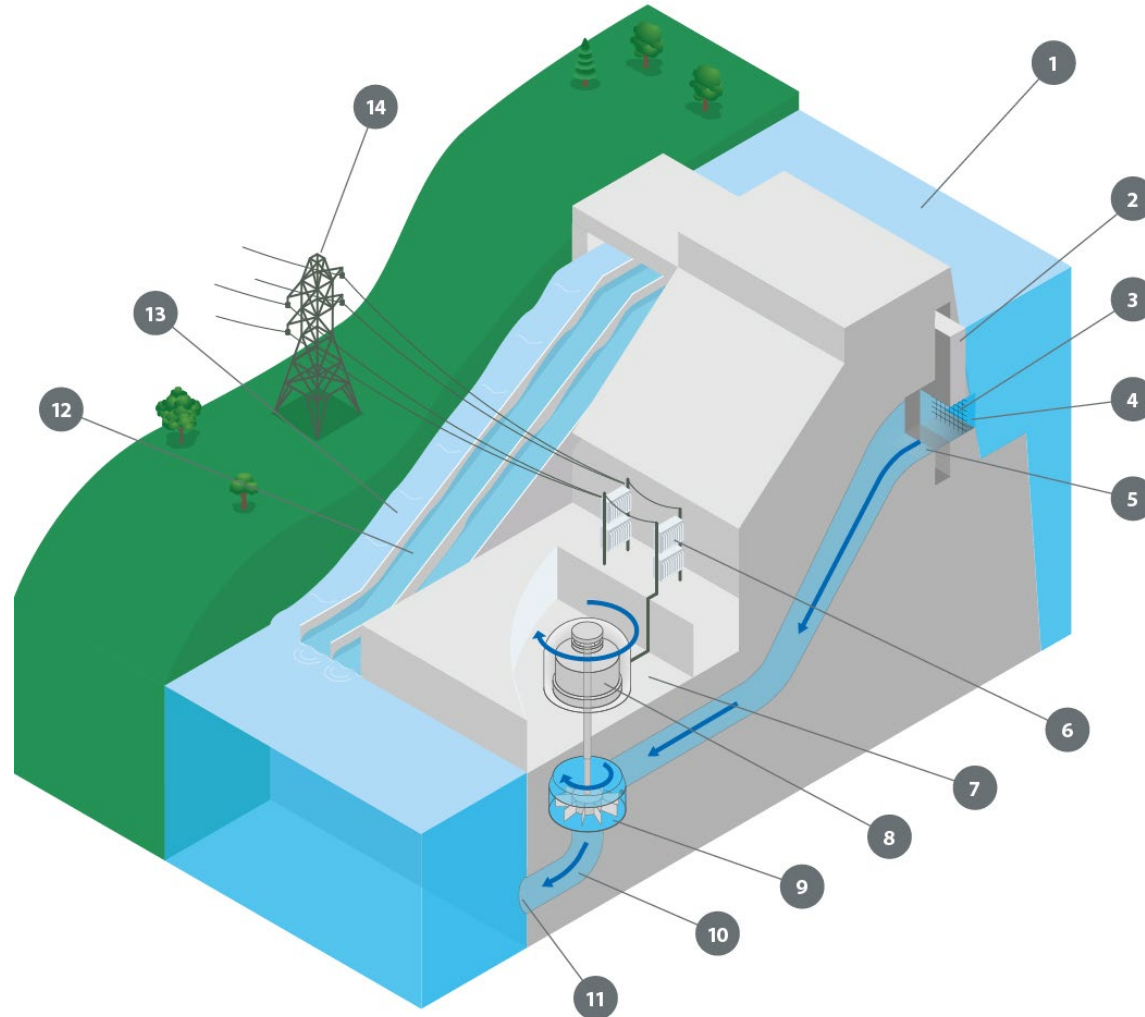


Overview of Hydro Power Generation



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1. Reservoir
2. Control Gate
3. Trash Rack
4. Intake
5. Penstock
6. Transformer
7. Powerhouse
8. Generator
9. Turbine
10. Draft Tube
11. Outflow
12. Spillway
13. Fish Ladder
14. Transmission



Types of Hydro Power Generation



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	Type	Power Output Range Unit
A	Micro Hydro	
a	PICO	1 – 5 kW
b	Micro	10 – 100 kW
B	Mini Hydro	100 – 1000 kW
C	Small Hydro	1000 – 15000 kW
D	Medium Hydro	15000 – 25000 kW
E	Large Hydro	More than 25000 kW



What is PICO and PAT Turbine

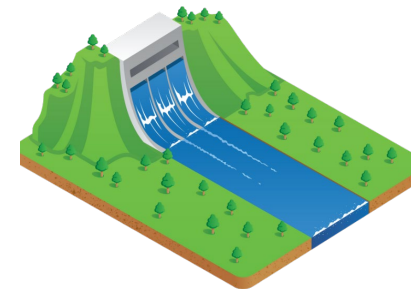
Turbine producing up to 5 kW (PICO) and 120KW(PAT) of electricity utilizing the hydraulic energy of water in motion. These installations can provide power to an industrial application, isolated home or small community for local consumption & utilization and even connecting it to grid.



High Rise Tower



Power Plant



Small / Micro Hydro



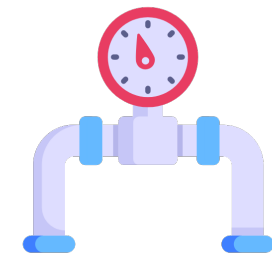
River / Stream



Water Supply



Industry



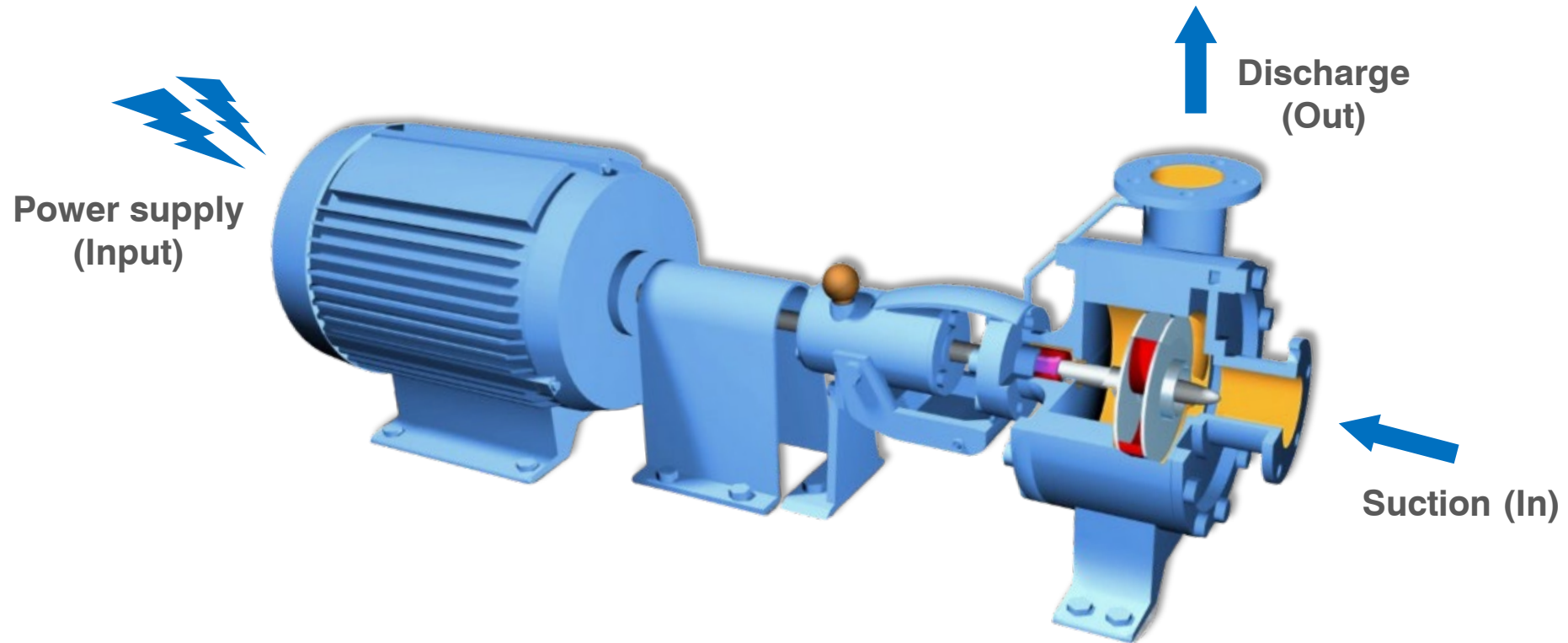
PRV

Working of PICO Turbine

Conventional CENTRIFUGAL PUMP operation

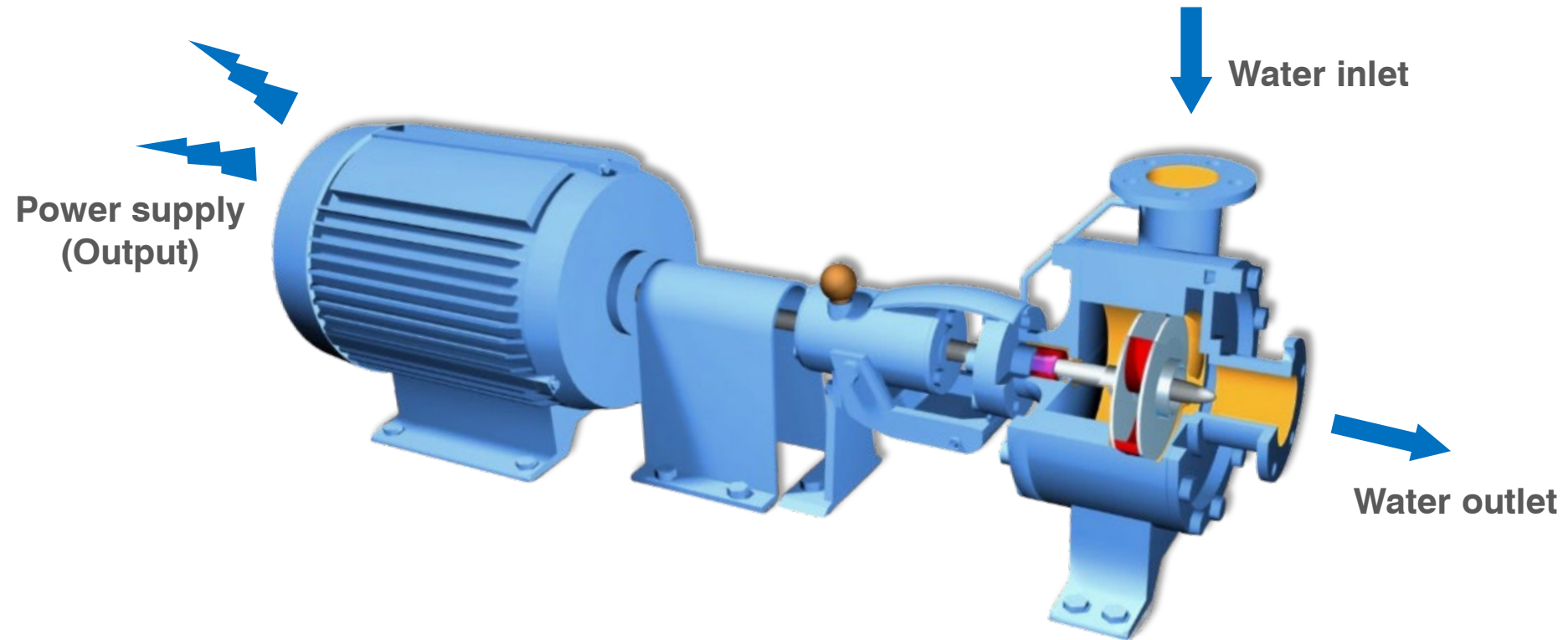


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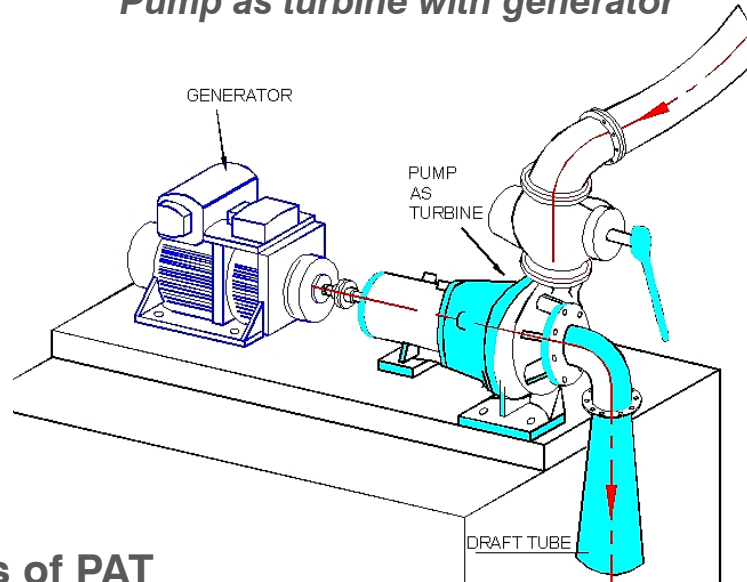
Working of PICO Turbine (Continued)

Pump as Turbine (PAT)

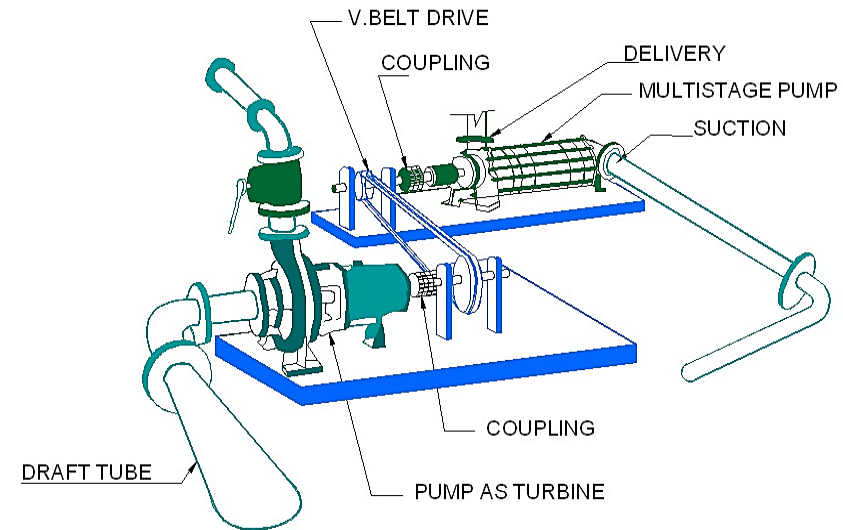


Multiple ways of Usage

Pump as turbine with generator



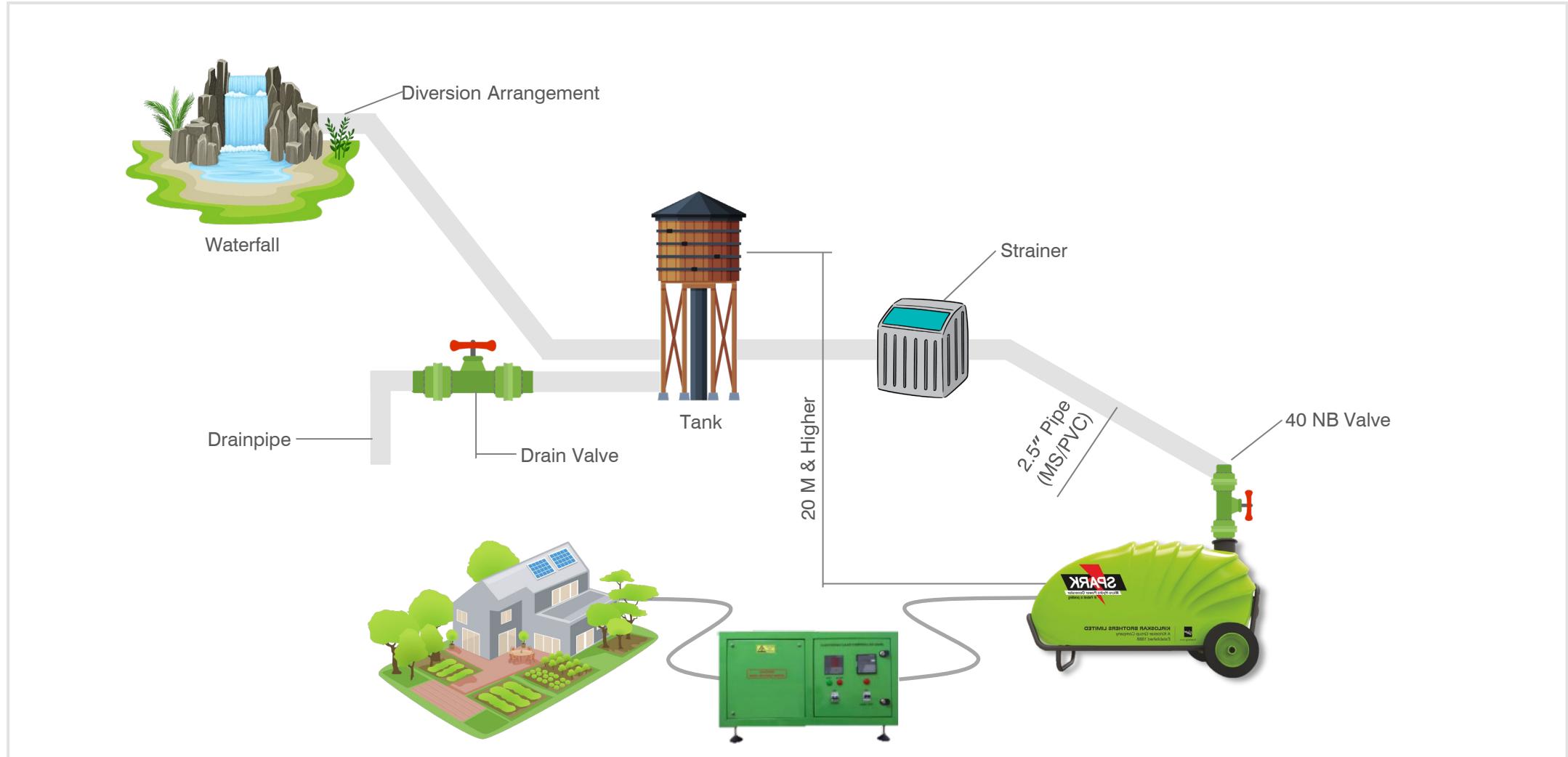
Pump as turbine driving multistage pump



Advantages of PAT

- Output up to 120 kW.
- Can be installed in rural and remote areas, water treatment pipelines, in industries by replacing PRV's and many more.
- Easy and economic to source
- Easy to install operate and maintain, simple and sturdy construction.
- Almost no adverse impact on environment.
- Off the shelf product-Low lead time.

Schematic Layout for PICO System





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KBL PICO Turbine – Standard Models

Sr.No.	Pico Model	Rated Output (kW)	Required Flow at Rated Output (m ³ /h)	Required Head at Rated Output (m)	Head Range (m)	Flow Range (m ³ /h)	Output Range (kW)
1	PE 216	0.5	34.5	21.5	20 – 28	30 – 45	0.2 – 1.4
2	PE 314	1	55	22	20 – 30	48 – 75	0.2 – 1.4
3	PE 318	1	43	29.2	25 – 32	35 – 48	0.2 – 1.4
4	PE 325	1	26	37	32.5 – 45	15 – 39	0.2 – 1.4
5	PE 538	1.5	31	45	35 – 55	18 – 38	0.5 – 3
6	PE 515	2	110	17.5	12.5 – 20	85 – 125	0.5 – 3
7	PE 527	2	50	35	25 – 41	28 – 61	0.5 – 3
8	PE 830	3	65	38	25 – 40	36 – 68	0.5 – 3
9	PE 837	3	52	45.5	35 – 50	33 – 56	0.5 – 4
10	PE 1040	4	66	44	25 – 48	30 – 70	0.5 – 4
11	PE 1030	4	100	30	20 – 32.5	65 – 105	0.5 – 5
12	PE 1331	5	112.5	32.5	20 - 32	85 – 115	0.5 – 5

Above parameters are for standard developed products / models. However, customized products can be offered on case-to-case basis.



PICO - Application Matrix

	Water Dams	Thermal and Hydro Power Plants	Water Distribution	Water Treatment Plants	General Industries	Irrigation
Applications	Discharge Pipe from where water is released into river or canal	In Open cycle the water is released back to river or seawater		Water intake to Ponds before treatment	Pressure Relief Valve in process line	Coffee and Tea Plantation
	Water Circuit at Downstream for pressure balancing	Construction Power	High pressure main line to distribution piping where BPT is used.	Location where pressure water flowing as waste or for environment release	Desalination filtered water leaving to storage tanks	Large water irrigation project, the land close to reservoir receive very high-pressure water and required to control through PRV
	Location where pressured water flowing out or for environment release	Excess water release from penstock tapings used for CW Line	Many PRV in high rise building can be replaced by PICO	Utility Piping excess water release	Location at pressured water flowing out or for environment release	Main line to dripping irrigation pipes the PRV is used to
	Water outlet pipe for City water usage use PRV	Environmental Release				

Advantages of KBL PICO/PAT Turbine

- Availability for a wide range of heads and flows.
 - Availability in large number of standard sizes.
 - Low cost
 - Easy availability of spare parts.
 - Easy installation.
 - Short Delivery Time
 - Easy to handle and transport
 - Eco- Friendly operation
 - Lowest maintenance and operation costs
- ❖ **Specific Advantages that comes from KBL**
- Efficient models, proven design and robust performance
 - Strong sales and service Network
 - Branded Product
 - In-house manufacturing and robust testing facility
 - Efficient post warranty service
 - Smart ELC Panel offered with remotely monitoring option



Power generation using the differential pressure

in the water network pipeline



KEY BENEFITS

- 350,000 kWh / year
- 24 x 7 operations
- Lightens @100 homes
- Saving of @INR 1.8 Mn/Year



Power Generation at KFDC Kerala

Open Streams & Waterfalls

Decentralised power generation for the camping sites of KFDC (Kerala Forest development Corporation) using water available in natural streams



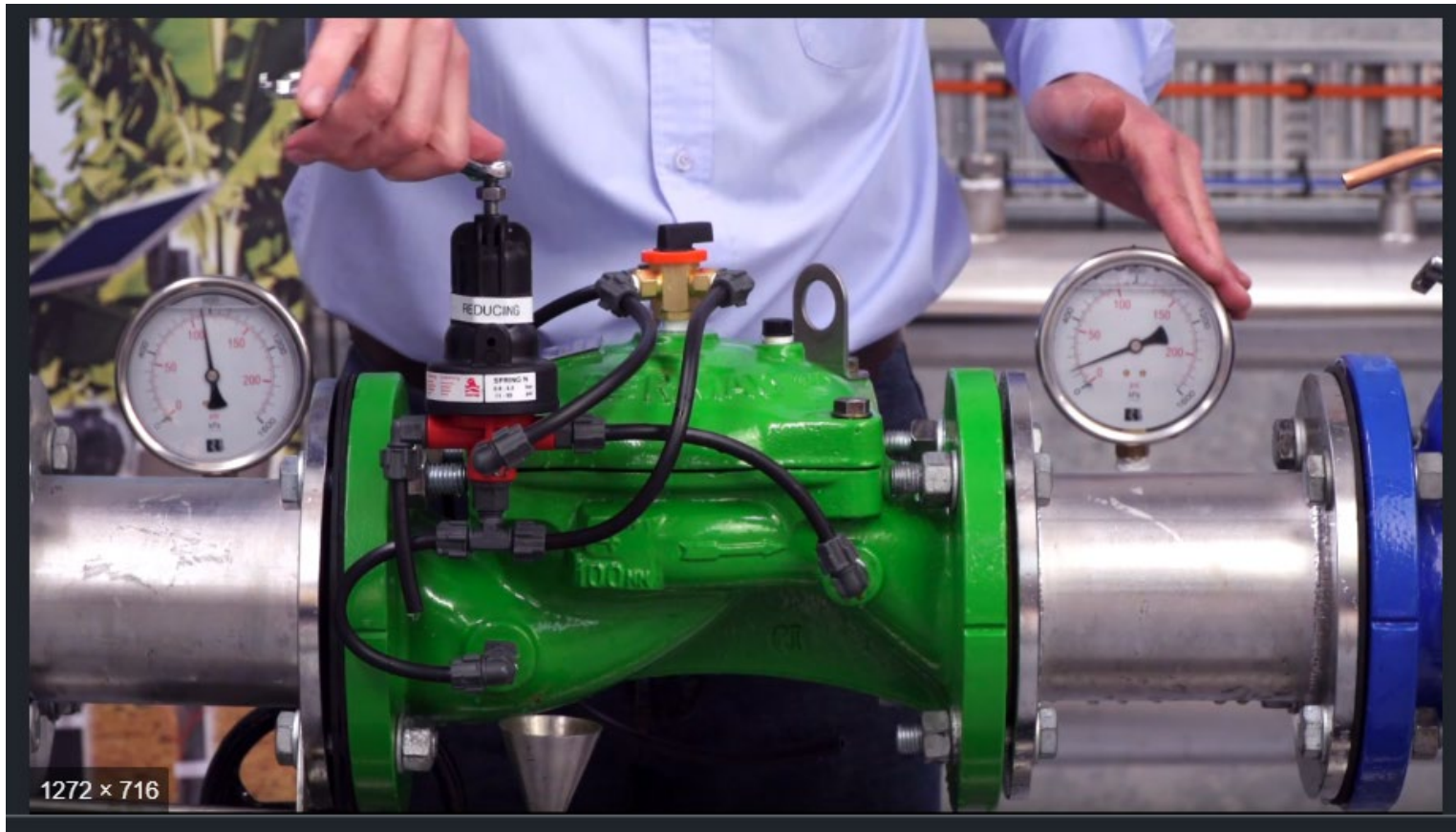
Project : PaT, 1x 5 kW
Location: Munnar, Kerala



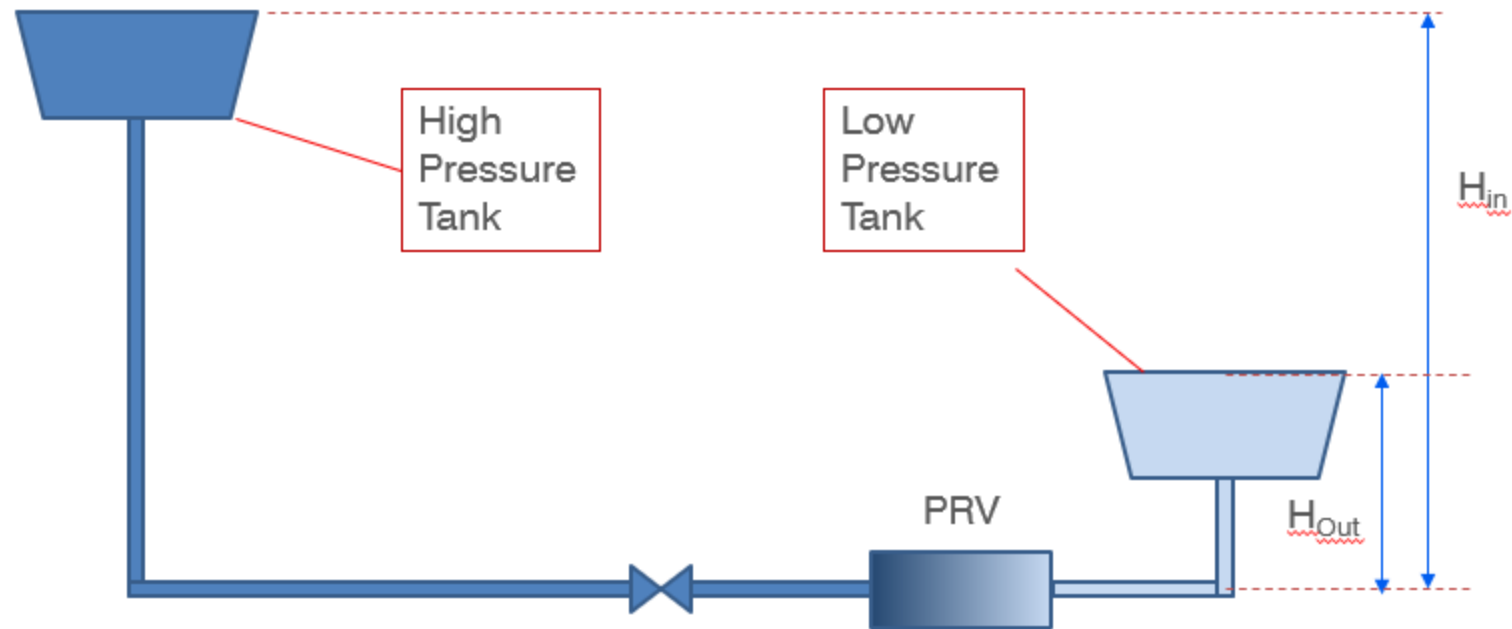
Project : PaT, 1x 11 kW
Location : Gavi, Kerala

PRV – Water Distribution & Industry

PRV is utilized in reducing/controlling the pressure from high pressure to low pressure line



Existing Site Layout



Available pressure for power generation, $H = H_{in} - H_{out}$

Power Potential (Approximated), $P = 7 \times H \times Q$

Where,

H is available head in meters.

Q is flow in m^3/s .

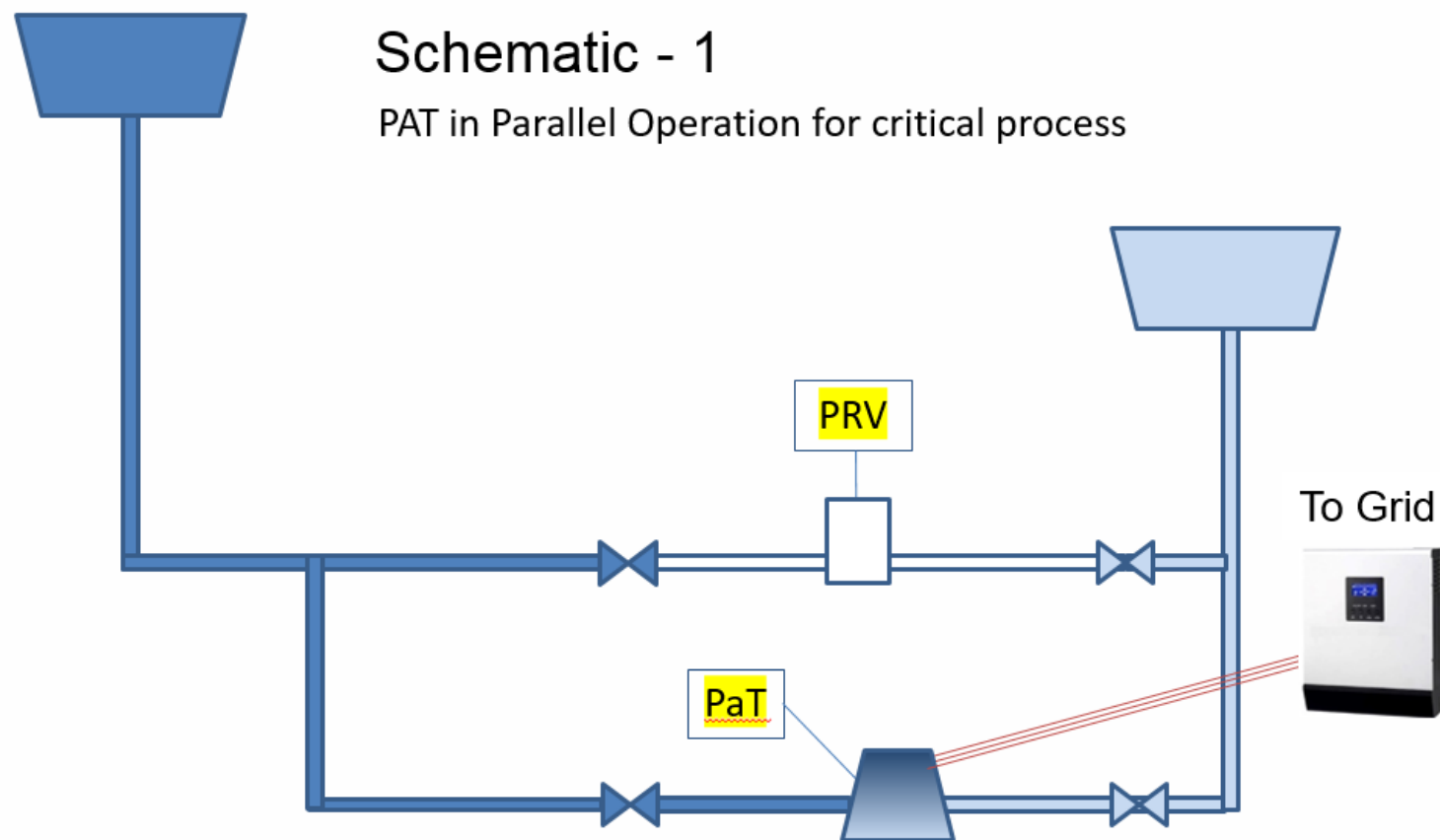
P is Approx. power output in kW



Modified Layout for PaT Installation



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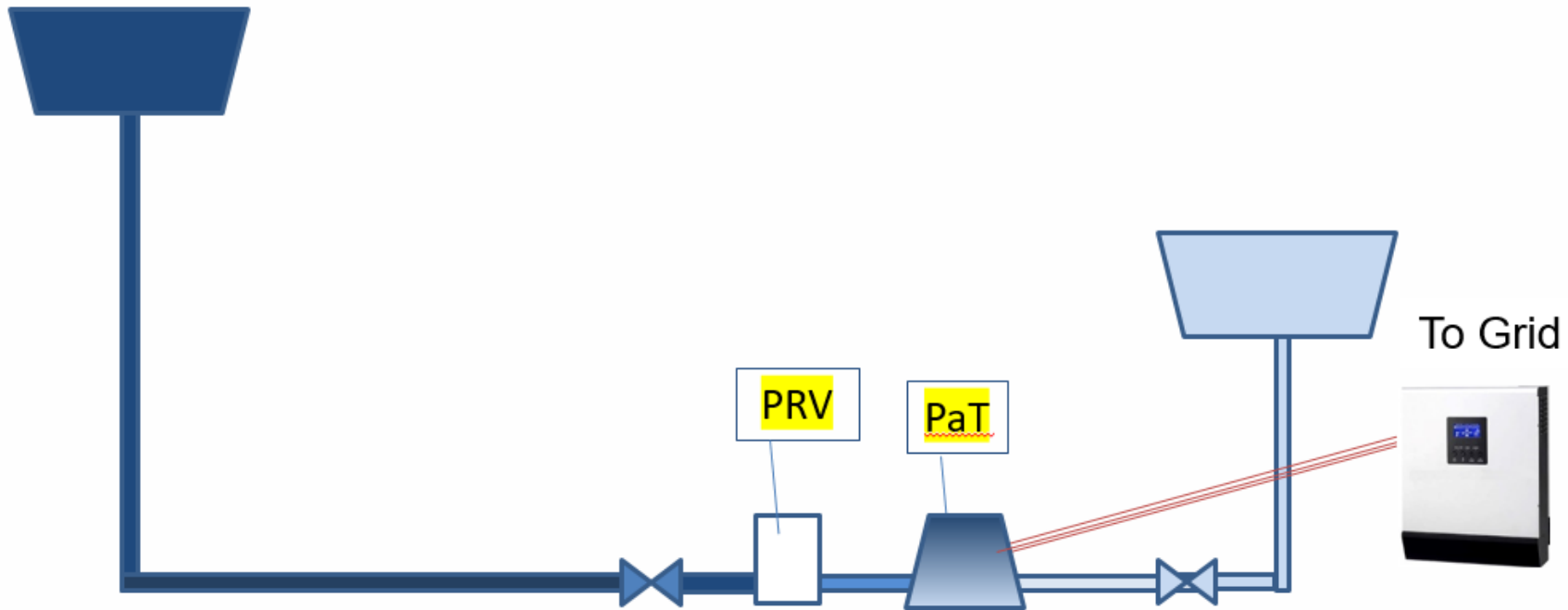
Modified Layout for PaT Installation



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Schematic - 2

PAT in series operation for extra high pressure line



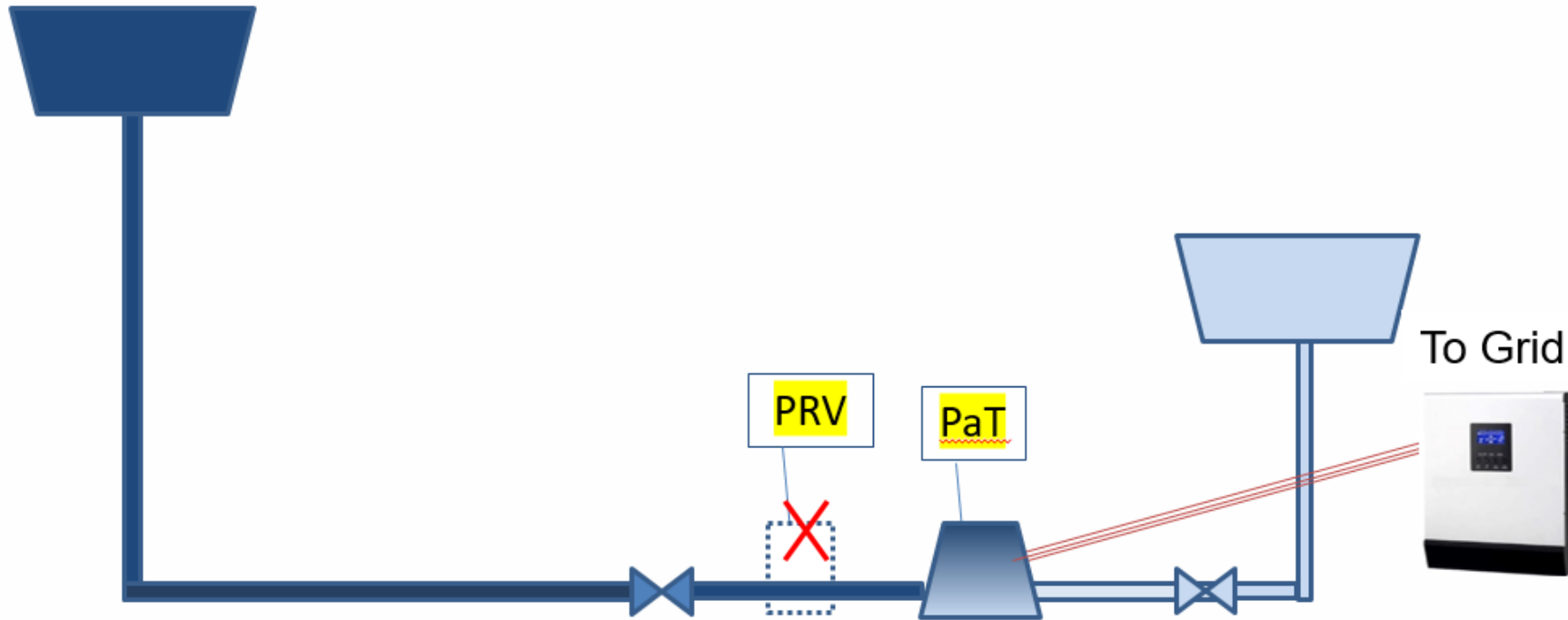
Modified Layout for PaT Installation



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Schematic - 3

PAT replacement to PRV in standard utility

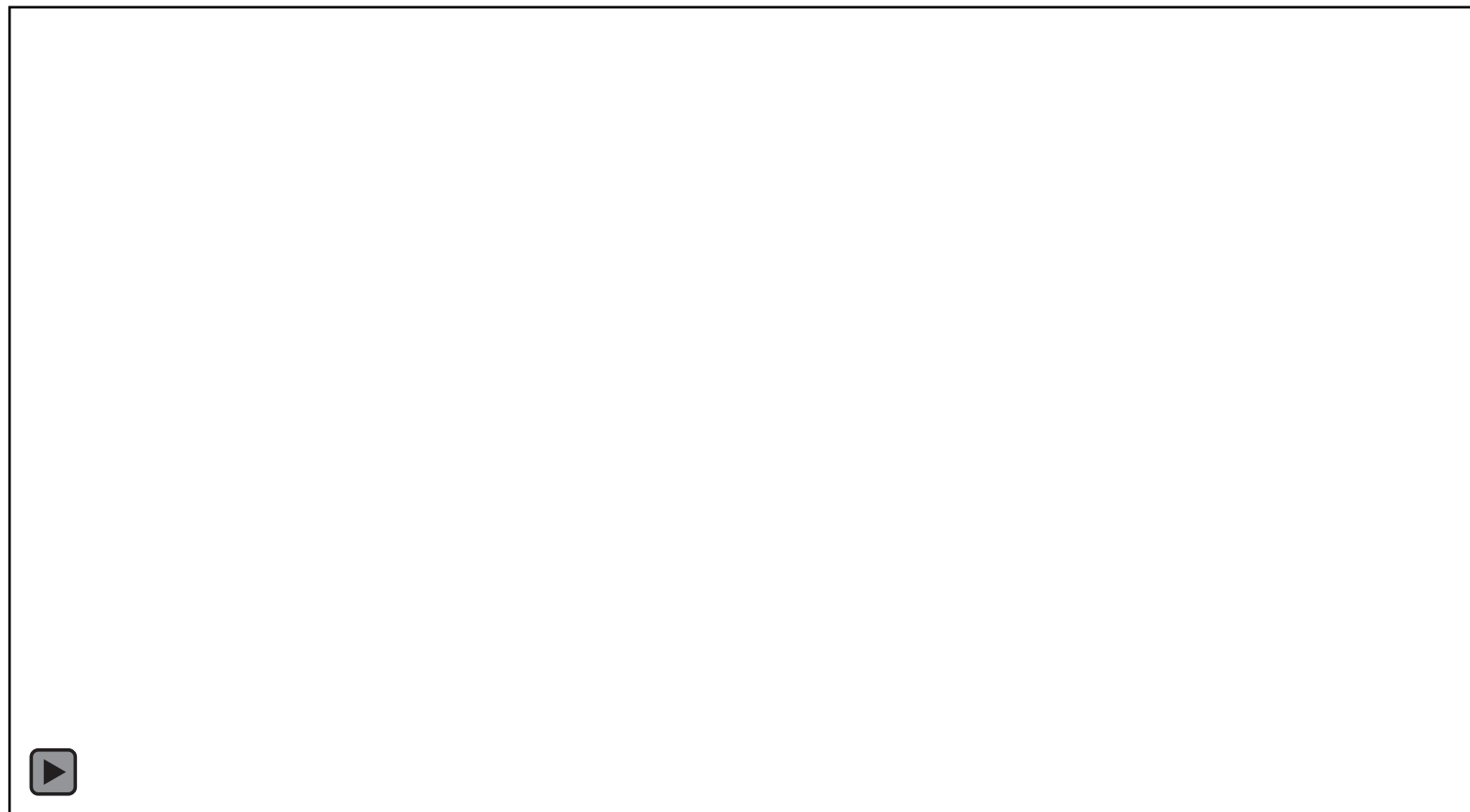




Pressure Reducing Valve – PICO Opportunity



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Success Story – Generation across PRV

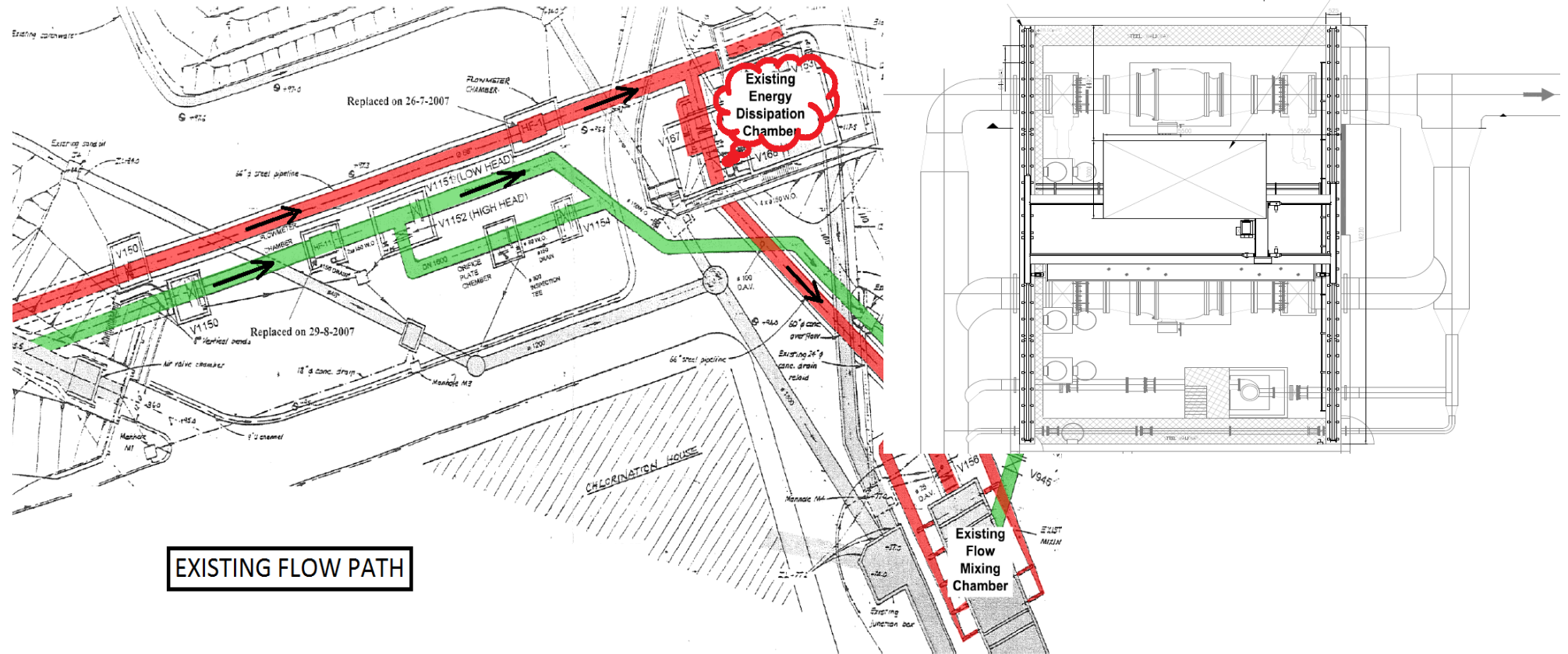
Power Generation by replacing the pressure reducing valve in industries.

Project : PaT, 1x 22 kW

Location : GNFC, Bharuch, Gujarat



Power generation using the excess energy in the Water Treatment plant



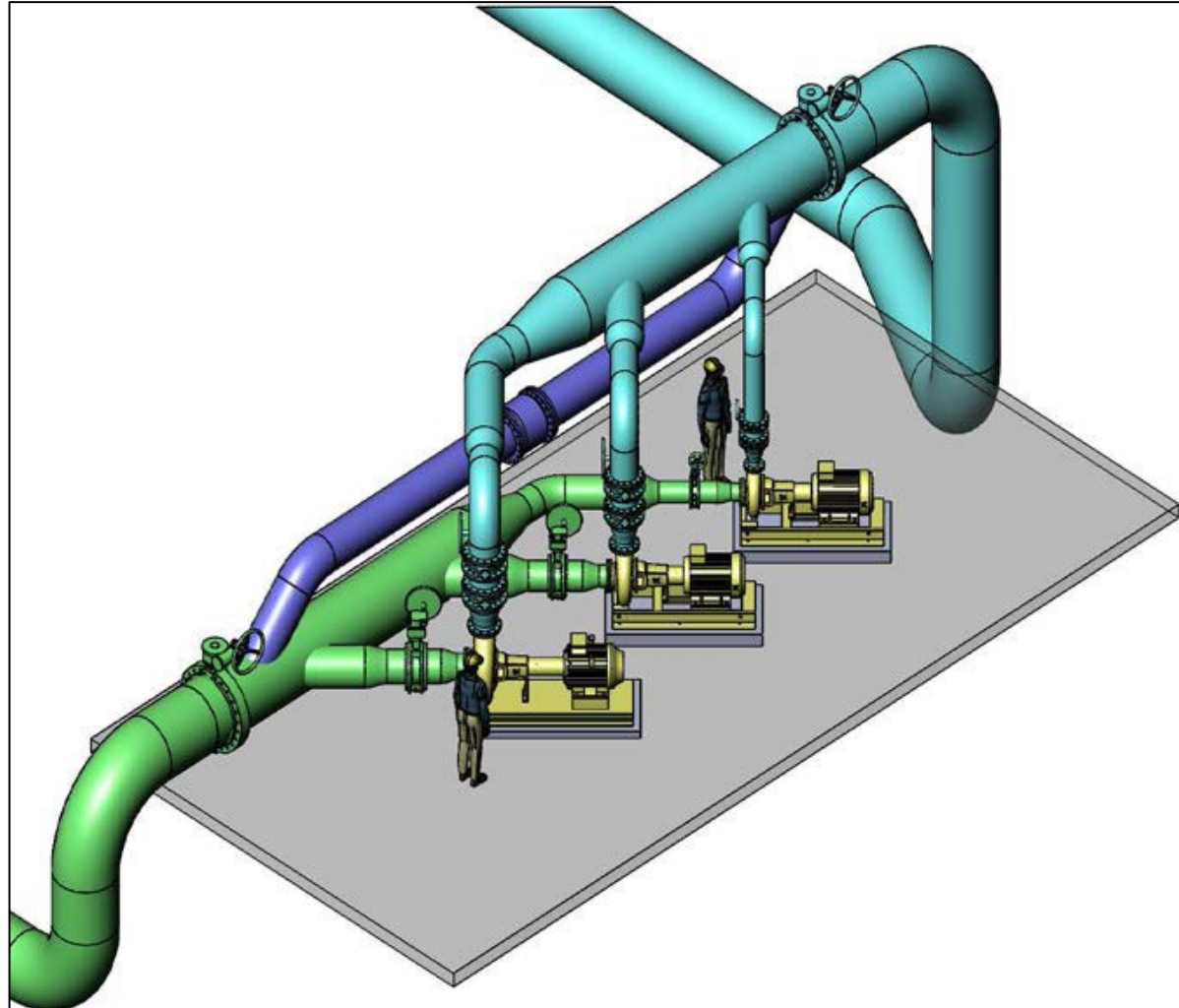
Project : PaT, 1x 65 kW
Location: SHA TIN, Hong Kong

Power generation using the excess energy *in the Water Treatment plant*



Project : PaT, 1x 65 kW
Location: SHA TIN, Hong Kong

PAT across the large volume flow



PAT Successful Testing at KOV

PAT Unit Testing at KOV of Vellakayam
(Kerala) Rating 2 x 45 KW



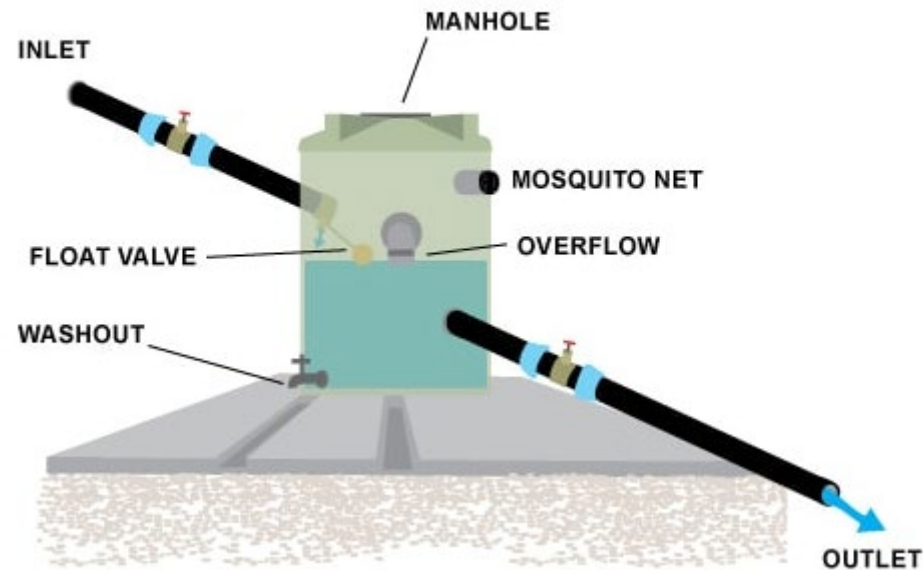


PAT – Installation References

Sr. No.	Client	Location	Capacity (kW)	Status	Application
1	Ottotractions	Munnar, Kerala	1 x 5 kW	Commissioned	Diverted stream
2	Ottotractions	Gavi, Kerala	1 x 10 kW	Commissioned	Diverted stream
3	MCGM	Tansa, Maharashtra	1 x 40 kW	Commissioned	Water supply
4	GNFC	Bharuch, Gujarat	1 x 22 kW	Commissioned	Fertilizer plant
5	Shatin	Hong Kong	1 x 65 kW	Under execution	WTP scheme
6	Y Sleebachen	Vellakayam Kerala	2 x 45 kW	Under execution	Green Field Power Generation Scheme

BPT – Break Pressure Tank

BREAK PRESSURE TANK



Application of Break Pressure Tank

1. It is constructed in an area where the flow of water in the pipeline is high and which may cause bursting of pipe.
2. It is used in the high altitude or hilly areas where the gravity system is commonly used to distribute water.

KBL offers PICO Green Energy - Spark

Product features and advantages of PICO

- PICO Micro hydro Power Generator with **Smart ELC Panel** offered with **remote monitoring option** (Industry 4.0)
- Easy to install operate, maintain and sturdy construction.
- No adverse impact on environment.
- Off the shelf product with Low lead time
- Power generation from 0.5 KW to 5.0 KW

For Rural and remote Installation

- A small self electrifying PICO unit can make a big difference to the people living in remote village to meet their daily requirement of power and can also be source for getting hot water for their daily utility and cooking
- Open water streams for rural electrification and hilly resorts

For Industry, Water Irrigation and Hydro Power Plants

- Any process or water transfer line having excessive pressure can be utilized, by installing PICO unit to generate power. PICO can be connected in parallel or replacement to Pressure reducing valve or control valve, Forebay and BPTs.
- PICO can generate power by utilizing pressure from cooling water line in hydropower plants taken direct from penstock and during the lean season it can be utilized as an alternate source for power generation



KBL Contribution to Hydroelectric Power

Way to Green Energy



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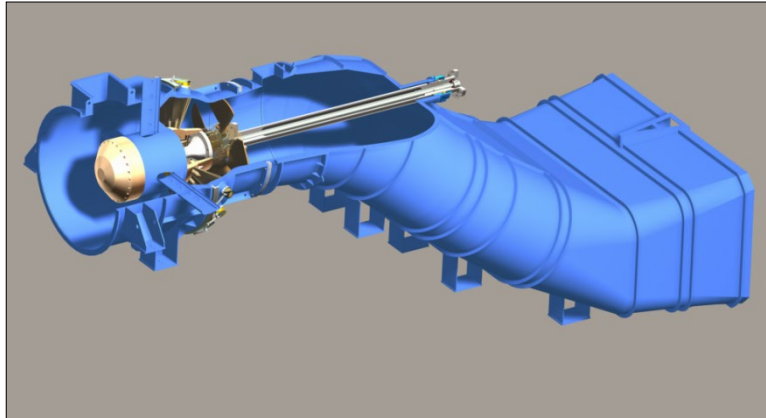
- Total installed capacity 170 MW
- 77 + Units delivered



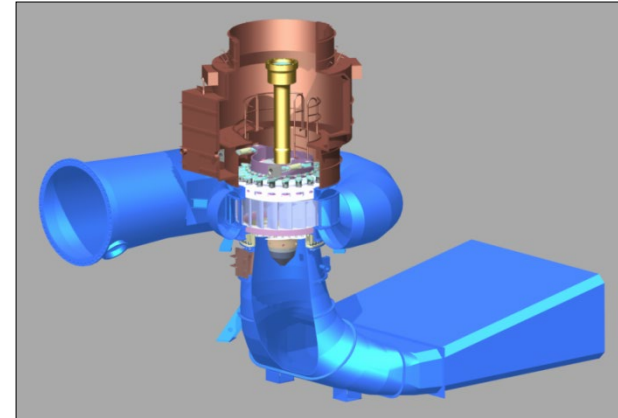
KBL Hydro Turbines : Technical Capabilities



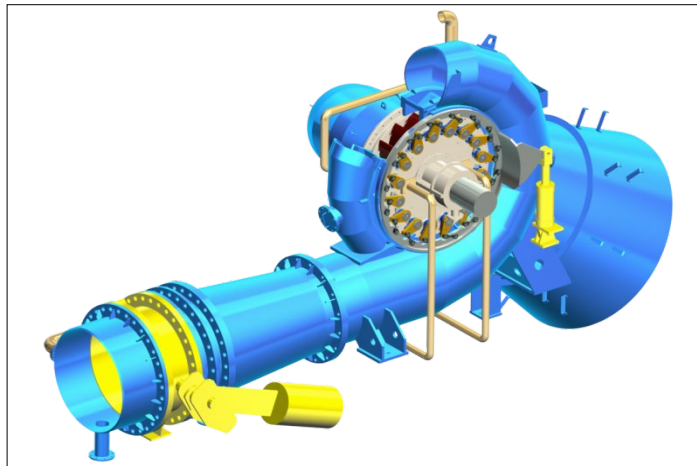
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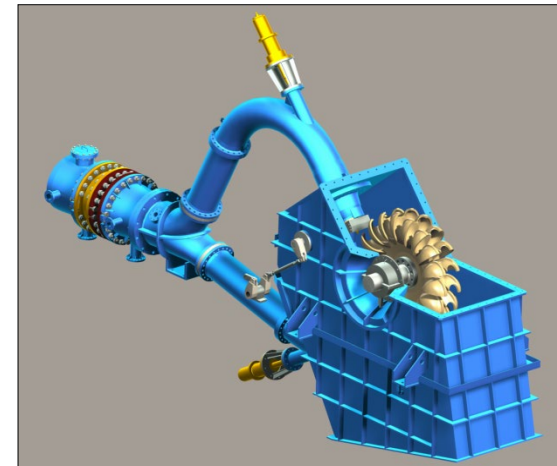
Horizontal Tubular Kaplan Turbine



Vertical Kaplan / Francis Turbine



Horizontal Francis Turbine



Horizontal Pelton Turbine



KBL : Contribution To Green Energy

Sr. No.	Type of turbine	No of Projects	No of Units	Total MW
1	Horizontal Francis	20	44	95.05
2	Vertical Francis	01	01	03.50
3	Horizontal Kaplan	12	24	37.10
4	Vertical Kaplan	04	06	30.11
5	Horizontal Pelton	01	02	04.00
	TOTAL	38	77	169.76 MW

Total capacity addition by KBL : 169.76 MW
Total capacity commissioned by KBL : 120.00 MW
Contribution to Green Energy : 317,091 CER
(Carbon Emission Reduction)

Leading the Green Initiatives

Location map of KBL Hydro Sites



Horizontal Francis Turbine



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Rajpur Small HEP

Capacity : 2 x 4.95 MW
Head : 100 m
Discharge : 11.97 m³/s
Runner Dia : 900 mm
Generator RPM : 750 rpm



Adyanpara Small HEP

Capacity : 2 x 1.5 MW + 1 x 0.5 MW
Head : 94 m
Discharge : 1.83 m³/s, 0.62 m³/s
Runner Dia : 610 mm, 395 mm
Generator RPM : 750 rpm, 1000 rpm

Horizontal Francis Turbine



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Sechi HEP
2 x 2250kW Horizontal Francis Runner
Dia. 660mm, Head 134.85 m



Nugu -II HEP
2 x 750 kW Horizontal Francis
Runner Dia. 780mm, Head 28 m

Horizontal S Type Tubular Kaplan Turbine

2 X 2 MW Ranni Perunad Small HEP

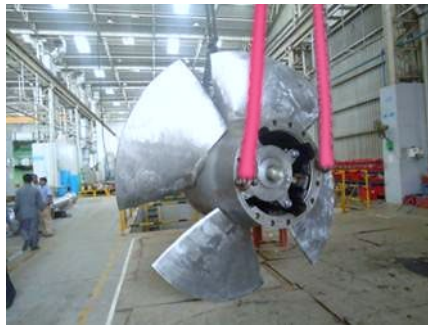


Head : 6.3M
Discharge : 39 m³/s
Runner Dia : 2800mm
Generator RPM : 750 RPM

(Gearbox-generator Assembly)

Horizontal S Type Tubular Kaplan Turbine

2 X 2.45 MW Darna Hydro Power Plant



Head	:	19.43m
Discharge	:	15.90 m ³ /s
Runner Dia	:	1600mm
Generator RPM	:	750

Q & A



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- Basic inputs from customer
- Concerns for the Returns on investments
- Warranty





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Smart Sustainable Pumping Solutions

KIRLOSKAR BROTHERS (THAILAND) LIMITED

A Kirloskar Group Company

Office: 50 Sukhumvit 21 Road, GMM Grammy Place Office Building, 18th floor, Unit 1805, Khlongtoey-nua, Wattana, Bangkok 10110

Factory: Amata Nakorn Industrial Estate (Phase 8), 700/711 Moo 1, Phan Thong, Phan Thong, Chonburi 20160

Email: ask@kirloskar.co.th