

Characteristics of KPSPP and Its Components

	Unit	Caliraya Reservoir	Lumot Reservoir
Upper Reservoir			
Catchment Area	Km ²	92	37
High Water Level	masl	EL.288.00	EL. 290.00
Low Water Level (4 Units)	masl	EL.286.00	EL. 286.00
Effective Storage Capacity	10 ⁶ m ³	22.0	22.0
Total Storage Capacity (Approx.)	10 ⁶ m ³	80	40
Dam			
Type		Upstream side concrete protected earth-filled	Upstream side concrete protected earth-filled
Crest Elevation	masl	EL.292.00	EL.294.00
Spillway			
Type		Gated Ogee	Morning Glory
Ogee Crest Elevation	masl	EL. 284.46	-
Max. discharge volume	CMS	>500	-
Diameter x Length	m	-	4.0 x 175
Lower Reservoir (Laguna Lake)			
HWL	masl	EL. 3.24	
LWL	masl	EL. -0.36	
Total Storage	10 ⁶ m ³	2,250 (ave. vol.)	
Upper Canal			
Water Surface Width @288 masl	m	67.1	
Bed Width	m	45.0	
Bed Elevation	masl	EL. 281.50	
Penstock			
Surface Portion (Dia. x Length x Lines)	m	6 to 5.5 x 1,213 x 1	6 to 5.5 x 1,066 x 1
Tunnel Portion (Dia. x Length x Lines)	m		5.5 x 219 x 1
Bifurcation Portion (Dia. x Length x Lines)	m	U1= 3.3 x 108 x 1 U2= 3.3 x 102 x 1	U3= 3.3 x 33 x 1 U4= 3.3 x 30 x 1
		KPSPP I	KPSPP II
Pump-Turbine			
Type		Reversible vertical Francis type	Reversible vertical Francis type
Number	unit	2	2
		As turbine/As pump	As turbine/As pump
Rated Input/ Output (BROT)	MW	177/147	177.5/147
Rated Net Head	masl	286.50/289.5	286.50/289.5
Rated Discharge	m ³ /s	69.6x2/48.1x2	69.1x2/48.1x2
Nominal Speed	rpm	300	300
Motor- Generator			
Type		3-ph, AC, Synchronous generator-motor	3-ph, AC, Synchronous generator-motor
Number	unit	2	2
		Generator/Motor	Generator/Motor
Rated Apparent Power	MVA	183/159	206/179.3
Frequency	Hz	60	60
Pump-Up Starting System		Pony motor, SVFC and back to back start	SVFC and back to back start
Main Transformer			
Type		Outdoor, 3-phase, oil immersed	Outdoor, 3-phase, oil immersed
Number	Unit	2	2
Continuous Rating	MVA	183	243.1
Frequency	Hz	60	60
Rated High Voltage (No Load)	kV	230	230

Location Map of CBK Hydroelectric Power Plants



CBK COMPLEX CAPACITY

COMPONENT	ORIGINAL CAPACITY (MW)	GUARANTEED NET CONTRACTED CAPACITY (MW)	CURRENT NET CONTRACTED CAPACITY (MW)
KPSPP - I	300.00 (2X150.00)	336.00 (2X168.00)	366.00 (2X183.00)
KPSPP - II	-	348.60 (2X174.30)	370.00 (2 x 185.00)
CHEPP	32.00 (4X8.00)	22.60 (2X11.30)	37.00 (2 x 18.50)
BHEPP	17.00 (2X8.00+1.00)	20.80 (2X10.00+0.80)	*22.35 (10.76+10.78+0.81)
TOTAL	349.00	728.00	795.35

*2011 NCC Test

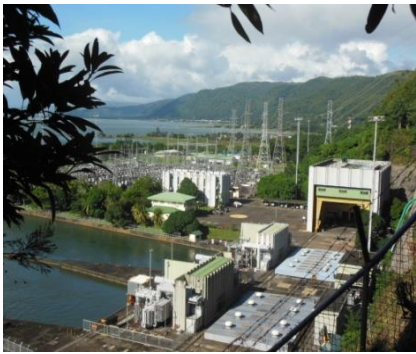


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Kalayaan Pumped
Storage Power Plant
Phase I & II

THE KALAYAAN PUMP STORAGE POWER PLANT (KPSPP) is the



first of its kind in Southeast Asia. Located in Kalayaan, Laguna, the plant lies along the eastern part of Laguna Lake and is situated near Metro Manila, the largest consumption center of power in the country. KPSPP's

main purpose is to supply peaking power to the Luzon Grid. It utilizes excess power during times when there is low power demand to pump water from a lower reservoir (Laguna Lake) for storage in an upper reservoir (the Caliraya Lake) at night. During times of high power demand, the stored water in the upper reservoir is released and used to generate power as it returns to the lower reservoir.

THE UPPER CANAL

Upper Canal connects the Caliraya Reservoir with the intake structure of KPSPP. It is an excavated unlined channel having a trapezoidal shape, 45 m bottom width, and bank slope of 1.7:1 horizontal against the vertical. The canal, about 1

km long with maximum water depth of 6.5 m.



The **KALAYAAN INTAKE** is located at the end of the forebay area and consists of a concrete gravity structure 32 m high and 115.26 m long, having crest at elevation 294 masl. Like the upper canal and the forebay, the intake

structure was built to serve KPSPP.

The intake is provided with mouth opening and equipped with trash racks, hydraulically operated wheel-mounted gates, and a water level recording device.

THE SERVICE BUILDING

Located on the right side of the powerhouse, has an area of 48.7m x 26.2m and height of 23.3m. It is composed of a steel frame structure braced by external concrete shaped walls. The Service Building was designed to ensure the housing of the necessary services for all the future expansion of KPSPP. At present, the building houses facilities like offices, a warehouse, oil treatment depot, various workshops, machinery, an emergency diesel generator, and the emergency 1 MW Pelton Turbine.



THE CONTROL BUILDING

Adjacent to the powerhouse shaft and in front of the service building, it is a conventional reinforced concrete structure with external shaped walls developed on the three floors plus the basement. The building houses various offices and the TRANSCO (now NGCP) Substation Control Room.



THE POWER HOUSE

Each Powerhouse contains two Francis vertical and synchronous generators with a total Guaranteed Net Contracted Capacity (GNCC) of 336 MW for KPSPP I and 348.6 MW for KPSPP II. It is a vertical shaft, horse-shoe shaped structure, excavated below the ground level. The main access is located at El.+6.50 masl, through the Ventilation Building in which at El.+9.90 masl. are located the ventilation equipment for each unit and the elevator room.



initially. (Black Start Function)

1-MW MINI – HYDRO POWER UNIT

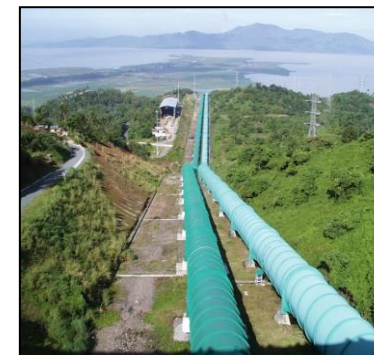
It is a Pelton turbine type small hydro unit which can provide station service power even during the entire grid power failure so that the Kalayaan Pump Storage Power Plant can energize the grid



1-MW DIESEL GENSET

Serve as an additional station service power source in case of emergency. It can provide enough power to start Kalayaan Units during blackstart operation.

THE PENSTOCKS – I & II



The **Penstock-I** is located in the excavated section of trapezoidal shaped open trench, having a bottom width of 32.7 m. The penstock has a diameter of 6m which reduces to 5.5m. The pipe is embedded in 6 concrete anchor blocks located at each

slope change and is supported by saddles spaced at regular intervals of around 24m.

The **Penstock-II** is approximately 1,300 m long, composed of two sections: above-ground and underground. The former section is laid on an open trench and the underground portion, which passes beneath the National Highway, has a bifurcation at the end that feeds two pump-turbine units. The lay-out and dimensions of the Stage-II Penstock are the same those of Stage I