Empower

DISTRICT COOLING 2018 CONFERENCE - DUBAI

Background Info.

- AC in the gulf area is a necessaty. (It's not a luxury as temperature in summer raise upto Dry Bulb: 123.8˚F(51˚C))
- When conventional AC (Window & Split Type AC), 70% of the power requirement in summer was allocated for AC.
- By introducing DC, the KW/TR requirement has been drastically reduced from 1.8/1.5 to 0.9. (Around 50% saving of power for AC which is 35% of overall power requirement)
- By introducing TES further power requirement reduction has been considered as further will be illustrated in the powerpoint.

Using TES To Save Both DC Operating And Capital Costs

DISTRICT COOLING 2018 CONFERENCE - DUBAI

Presented By: SAOUD ALDODSARI

Objective:

01 - THERMAL STORAGE

- Information on what is Thermal storage.
  - Stratified TES & Its Function

02 - OPERATION STRATEGY

- Information on the time period TES is being used.
- Benefits of using TES.

03 - DIFFERENT APPLICATION

- Providing examples to illustrate that TES can be implemented in different senarios.

Introduction:

District Cooling is a centralized production and distribution of chilled water from a service provider (EMPOWER) to several customers within a district. It consists of

District Cooling Plant (DCP)
(With TES or Conventional chiller)

Distribution Network DCDN

Energy Tranfer Station (ETS's)

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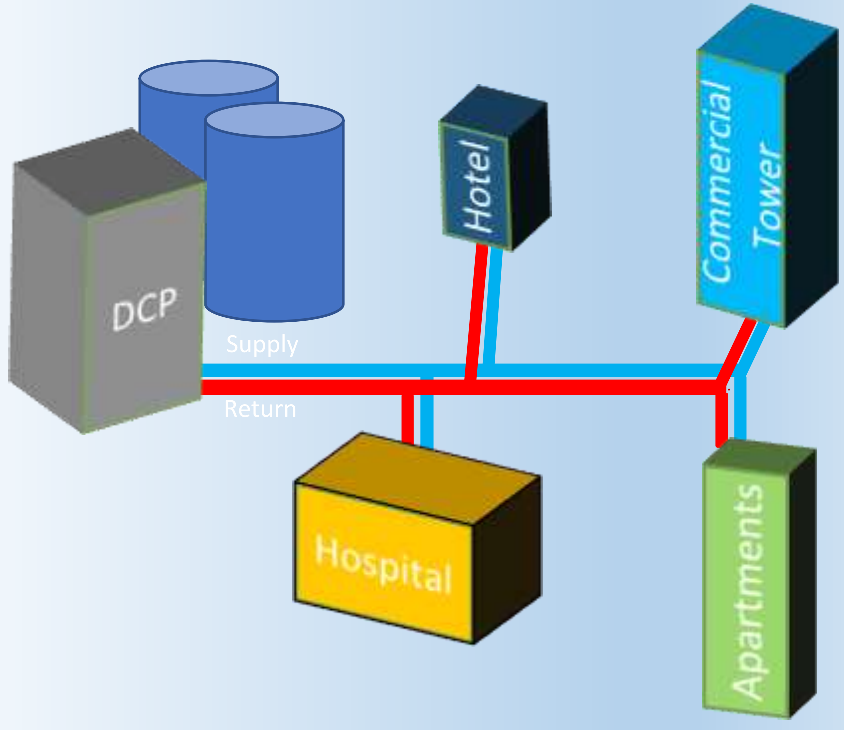

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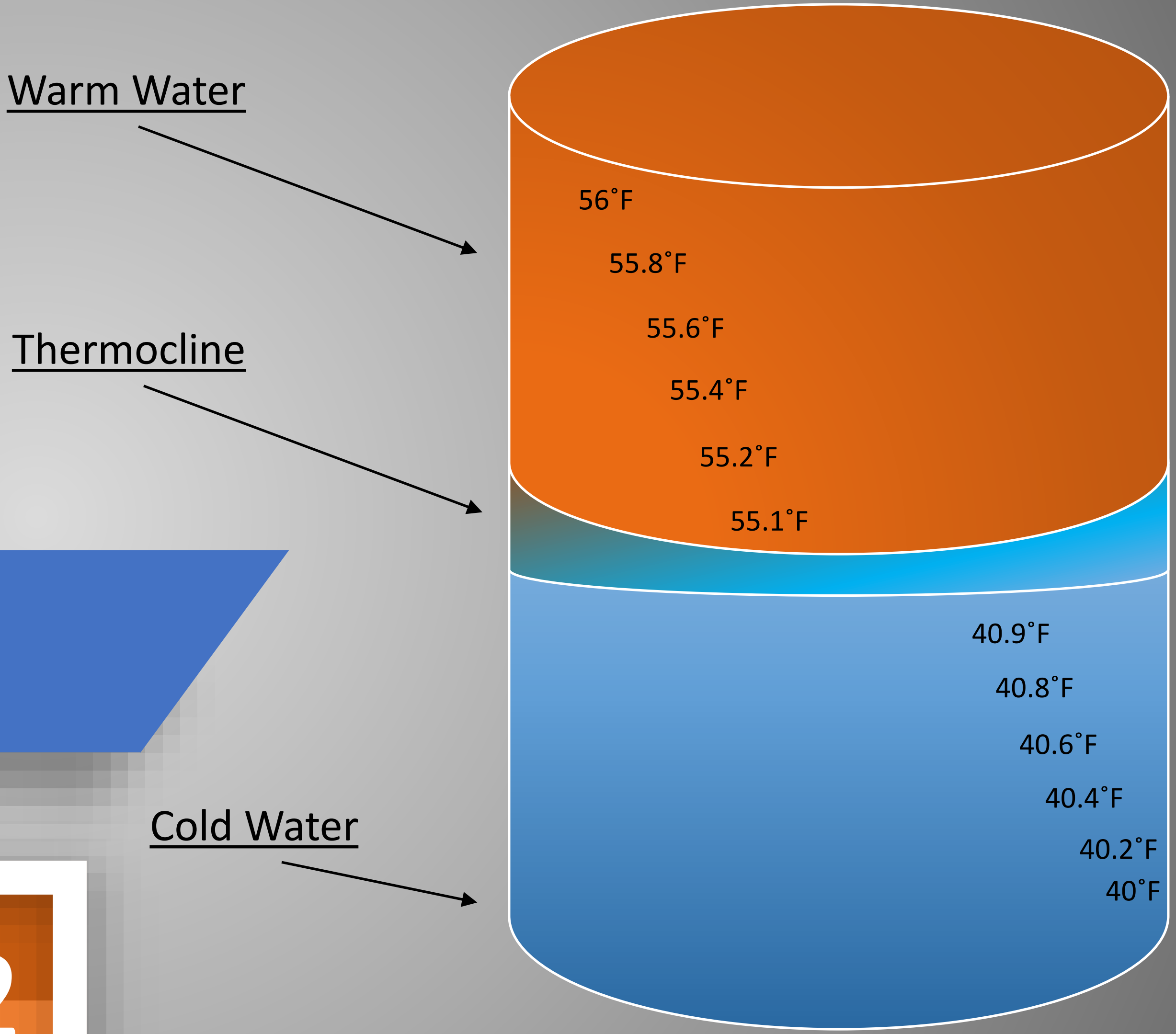
TES (Stratified):

Thermal Energy Storage: Where energy is being stored in a tank to be discharged at a later desired time.

Two Modes:

01 CHARGING

02 DISCHARGING



Load Profile:

This load profile is a graphical representation of the variation in the thermal load versus time.

1 **Peak Load**

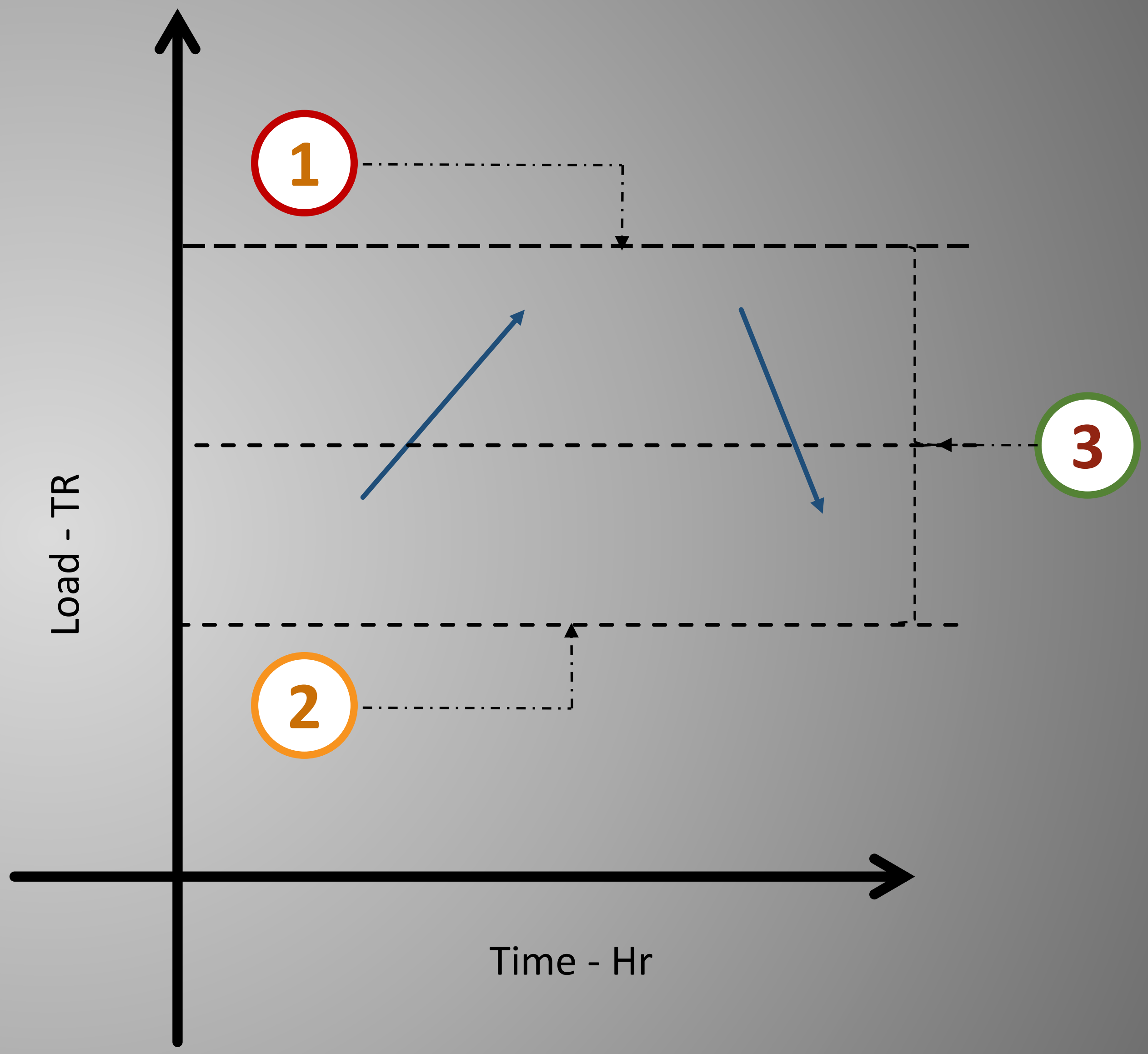
Peak Load is simply the highest demand that has occurred over a specified time period

2 **Base Load**

Base load is the minimum continuous daily load requirement.

3 **Load Variation**

Load variation is transition in demand from base load to peak load & vice-versa.



TES In DCP's:

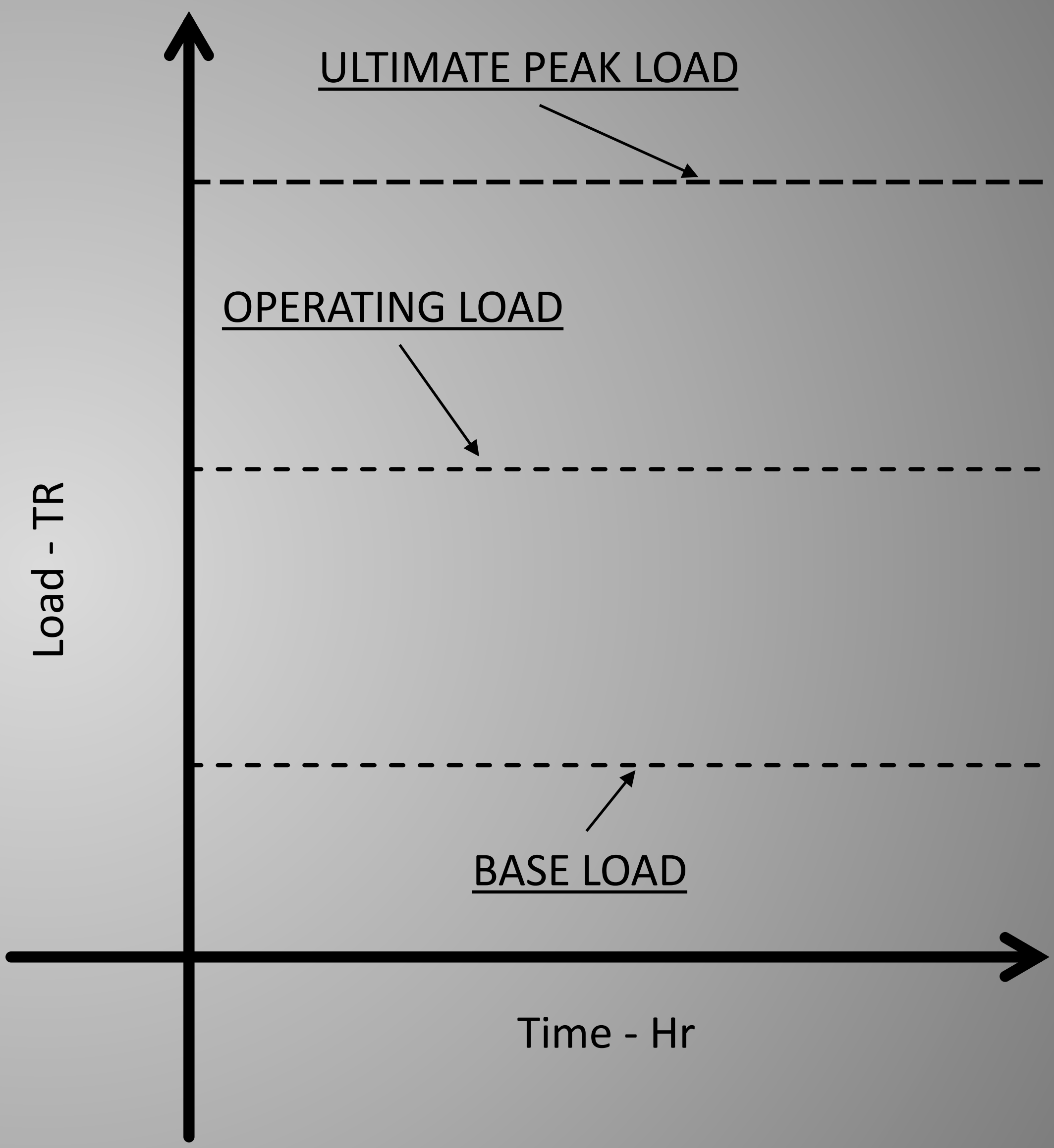
The optimum operational strategy is to charge the TES in off peak hours and to discharge the stored energy in peak hours.

Electrical Demand

TES shifts the cooling load to off peak hours and reduce demand power on Central electrical grid of DEWA.

Energy Demand

TES system shifts energy usage to a later period (Off-Peak) to reduce overall energy demand.



Benefits of TES:

1- Saving on Capacities of; chillers, cooling Towers, process pumps and related power requirements

2- DEWA Connection charges reduced.

3- CAPEX cost of TES is considerably lesser than Chillers & its auxiliaries.

4- OPEX is reduced since charging of TES is done during night time where we have low WBT (i.e., Compressor lift is reduced)

TES vs Conventional Chiller Capacity

Adding Chiller Cost Breakdown (%)	
6,000 TR Chiller	27%
Mechanical work – Supply & Installation / Primary pump / condenser pump / Cooling Tower/ piping & accessories	31%
Electrical work- Supply & Installation	28%
DEWA - Connection Charge for 6 MW	13%
Site Work	0.33%
Concrete Work	0.33%
Metal Work	0.23%
Labor	0.18%
	18,153,996 AED

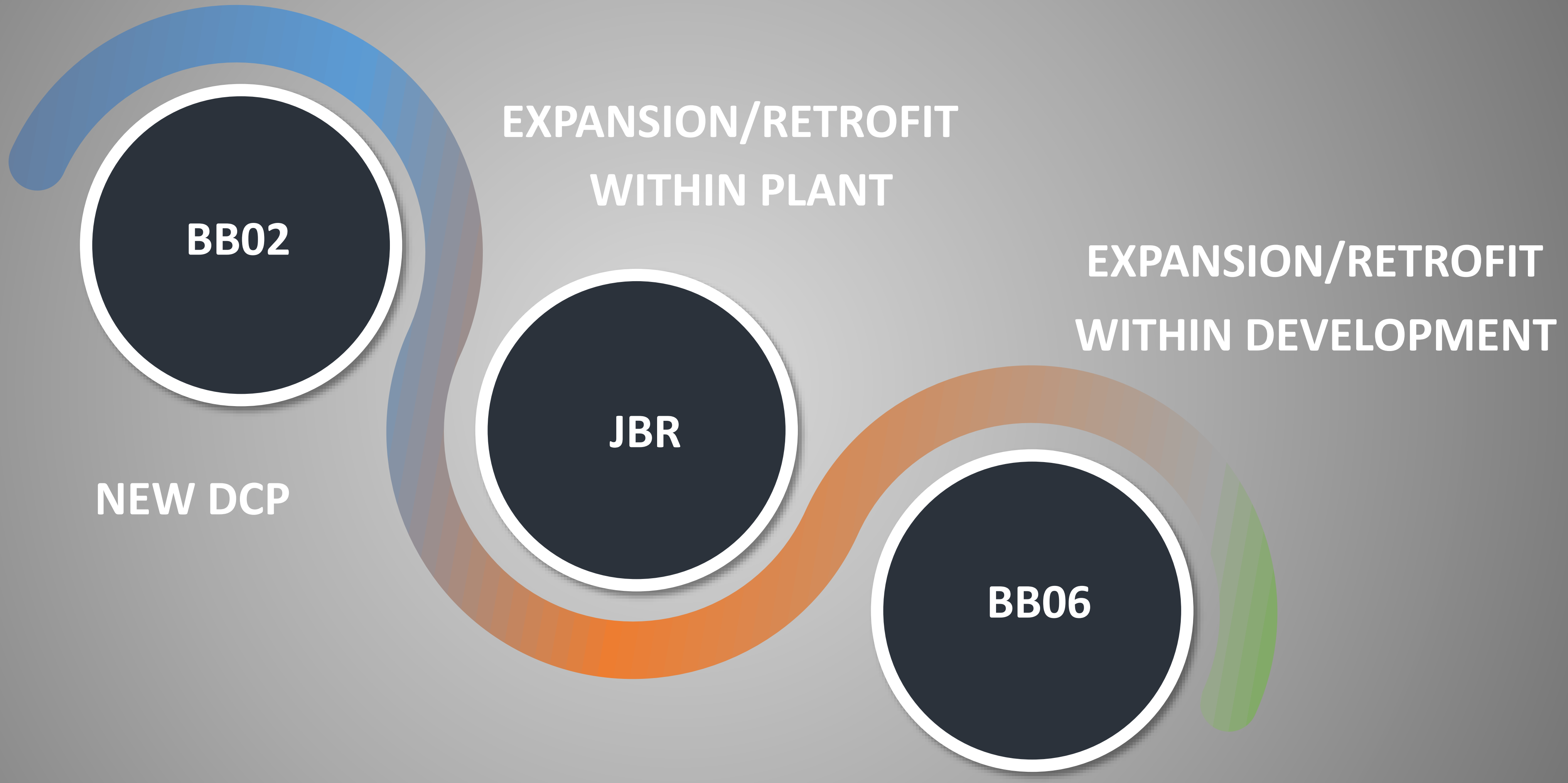
TES vs Conventional Chiller Capacity

TES Cost Breakdown (%)		
TES Tank capacity (Approximately 6000 TR ≈ 33,000TRH)	≈	63%
Mechanical Work – Supply & Installation	≈	16%
TES Tank Foundation - civil Work	≈	12%
Pumps- flow / Capacity * 1.5 GPM/TR @ 50 ft	≈	4%
Electrical Work supply & installation	≈	4%
Control & Instrumentation (Control valves & flow meter / Temperature sensors etc)	≈	1%
		≈12,479,000 AED

TES vs Conventional Chiller Capacity

Cost AED/TR				
TES Capacity of 6,000 TR	12,479,000 AED	Cost=AED/TR	≈	2,080
Conventional 6,000 TR Chiller	18,153,996 AED	Cost=AED/TR	≈	3,026
Cost Saving From 6,000 TR TES	≈	5,674,996	AED	

TES Implementation:

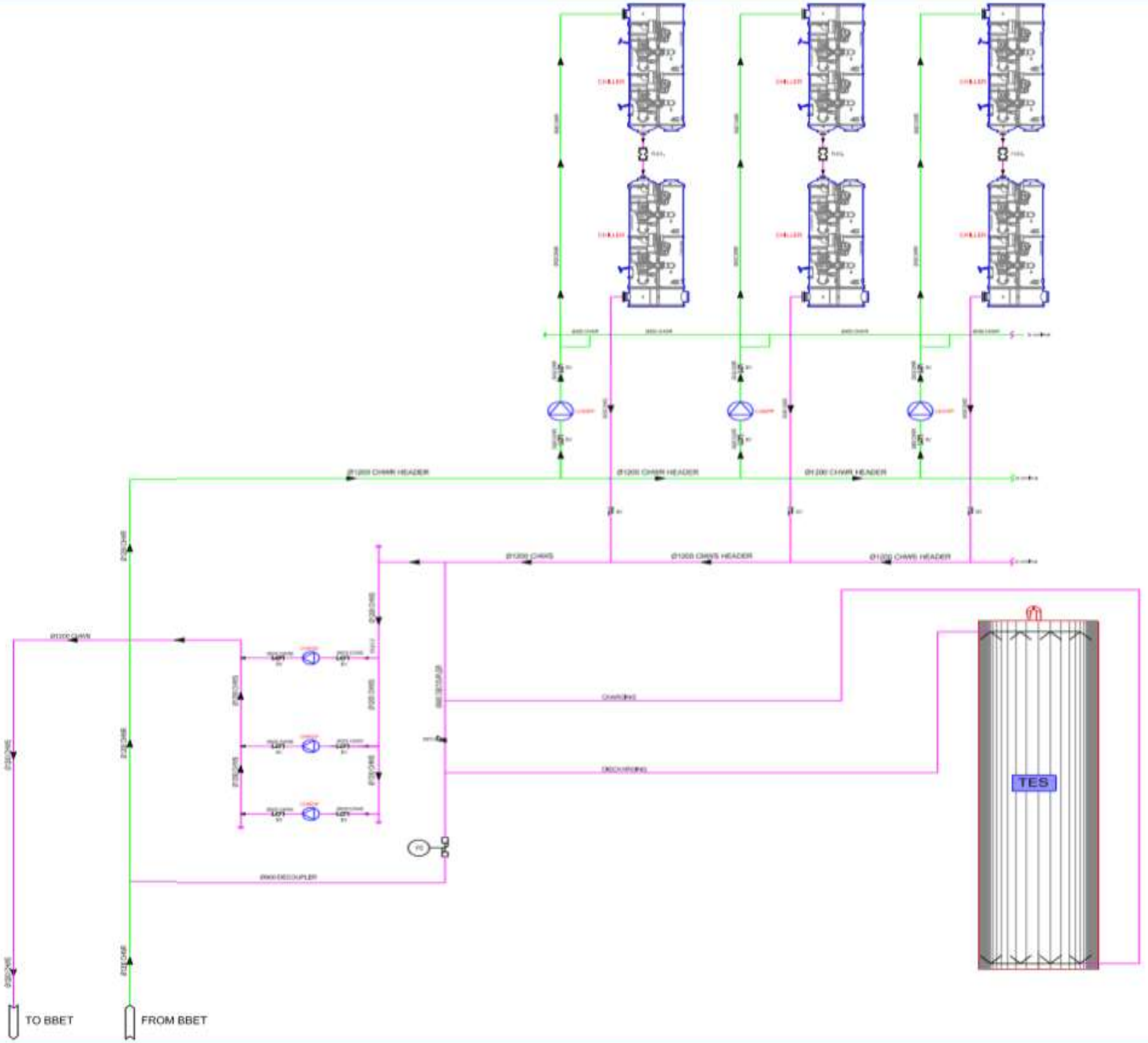


BB-02 is Design and built with TES with storage capacity of 48,000 TRH.

Ultimate capacity of BB-02 is 43,750 TR where Conventional chillers are in total 35,000 TR and TES is 8,750 TR.

BB-02 Thermal Energy Storage systems has reduced 7.8 MW of Electrical Demand Load on DEWA power stations.

BB-02 : Direct Benefits
2 * 4,375 TR capacity chillers & related axillaries reduction.



BUSINESS BAY TES SCHEMATIC

JBR Plant

A

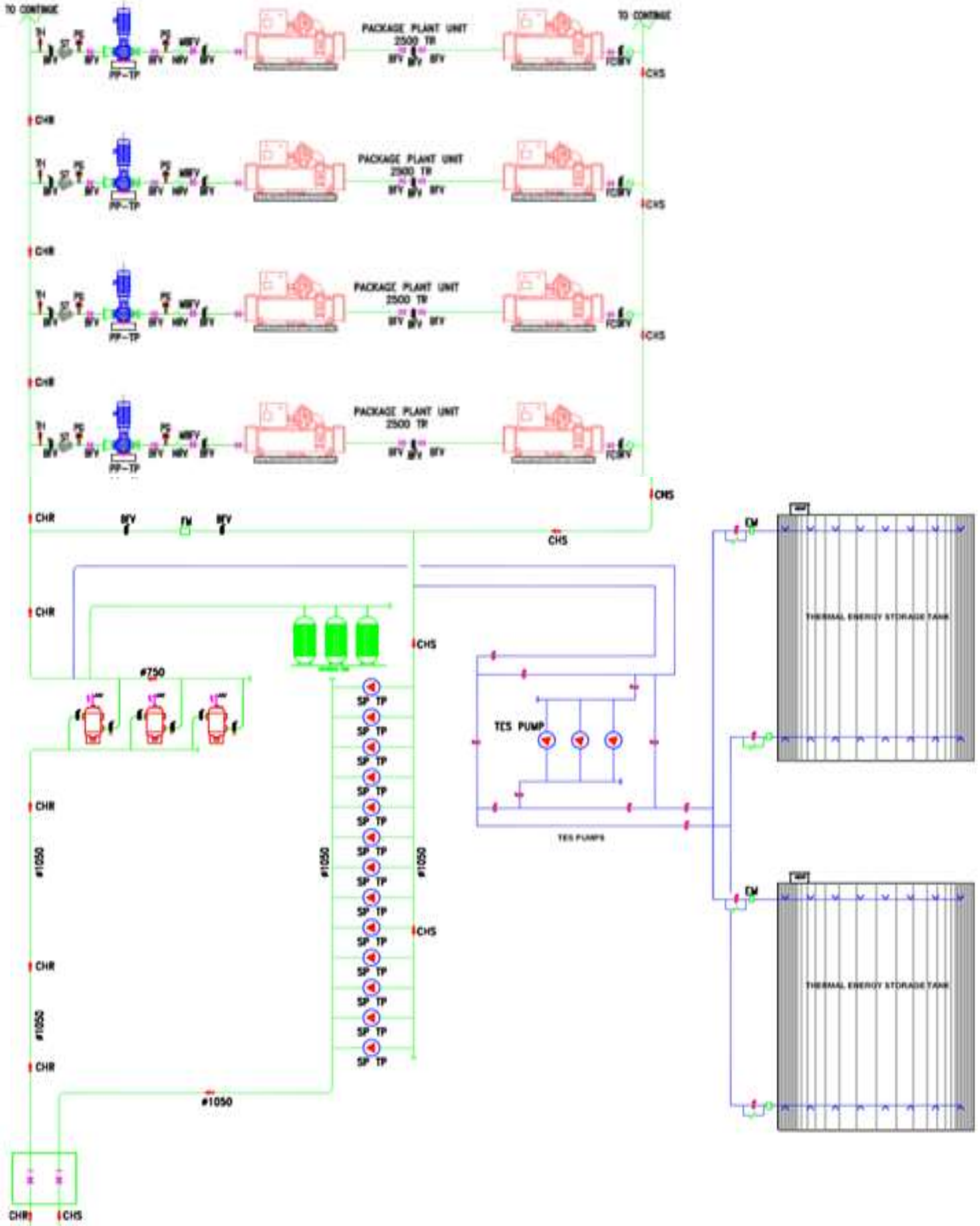
JBR existing capacity is 60,000 TR. Empower is working on adding an extra capacity of 7,000 TR. TES option is considered.

B

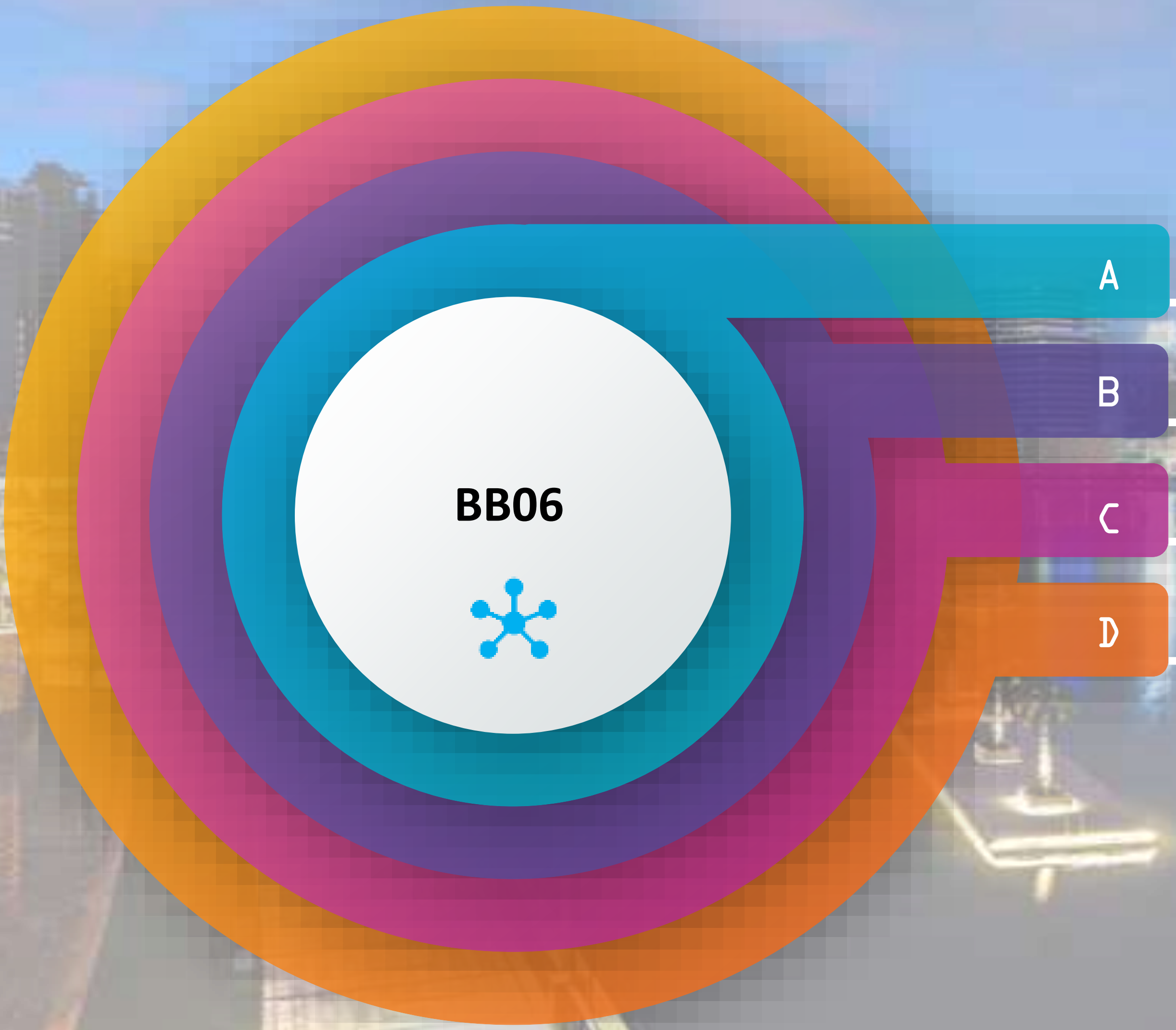
In-house detailed design development of Two TES tanks equivalent to 3,500 TR each with storage capacity of 38,000 TRH is currently on going.

B

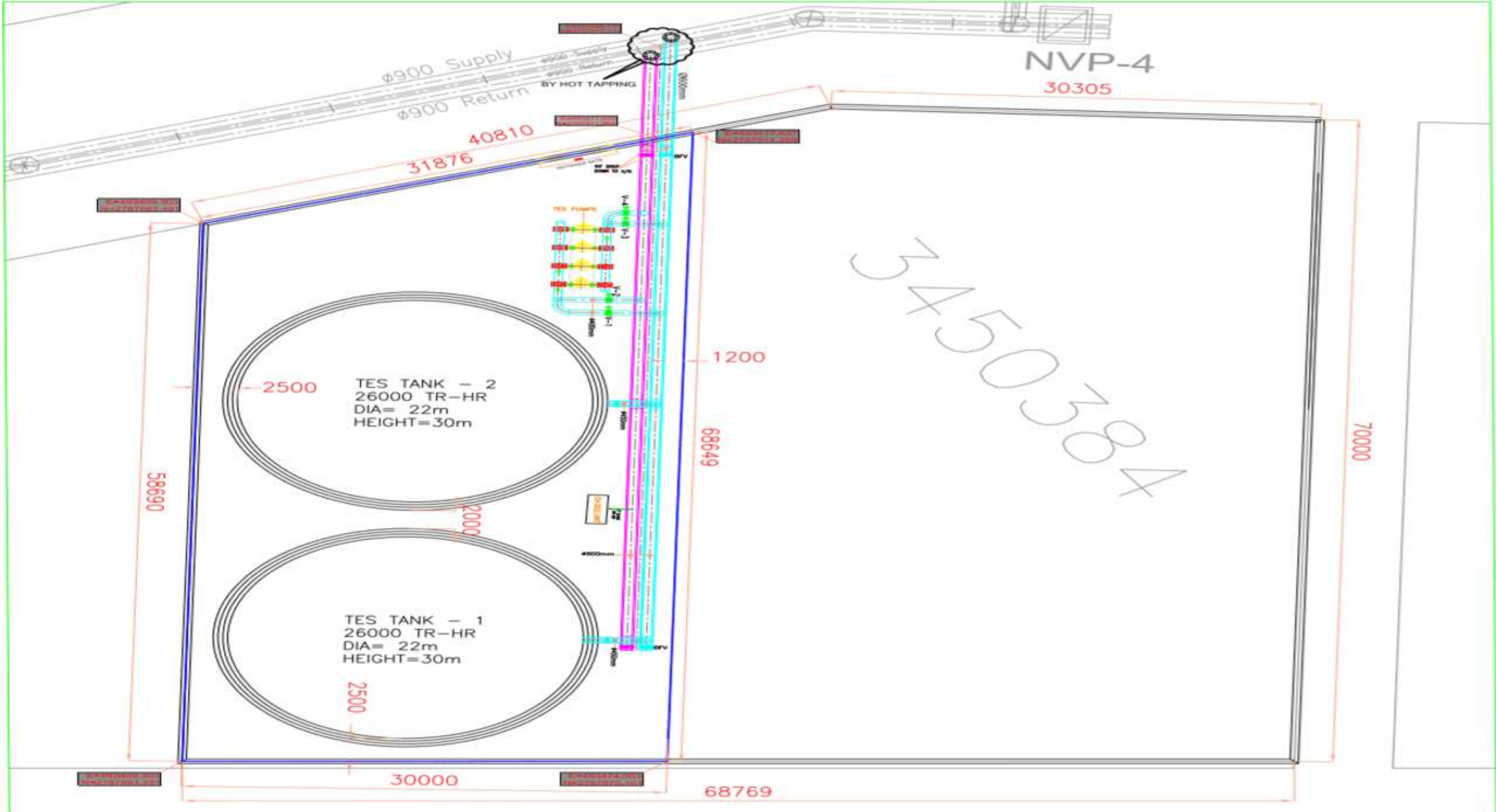
Such TES has potential to reduce 6.3 MW of Electrical Demand Load on DEWA power stations.



JBR- DCP TES SCHEMATIC



- BB upper network is served by two plants: BB03 having TES system & BB01 (40,200 TR) having no TES system, accordingly having redundant chillers capacity at part load.
- Empower opted to utilize the redundant capacity of BB01 by adding a remote TES system coupled to the upper BB network.
- In-house detailed design development of Two TES tanks having a total storage capacity of 52,000 TRH is currently on going.
- Such TES has potential to reduce 8.5 MW of Electrical Demand Load on DEWA power stations.


NVP-4
ø900 Supply
ø900 Return
BY HOT TAPPING
TES PUMPS
40810
31876
30305
1200
2500
TES TANK – 2
26000 TR–HR
DIA= 22m
HEIGHT=30m
TES TANK – 1
26000 TR–HR
DIA= 22m
HEIGHT=30m
2000
2500
58690
68649
70000
345038 4
30000
68769

BB-06 DCP TES

Q&A