EMPOWER

IDEA 2019 110TH ANNUAL CONFERENCE & TRADE SHOW

Using TES To Save Both DC Operating And Capital Costs

IDEA 2019

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- **Background Info.**

- **AC in the gulf region is a necessity. (It’s not a luxury as temperature in summer raise up to Dry Bulb: 123.8˚F(51˚C))**

- **70% of the power requirement in summer is allocated for AC.**

- **By introducing DC, the KW/TR requirement has been drastically reduced from 1.8 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 power point.**

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 scenarios.

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 Transfer Station (ETS's)**

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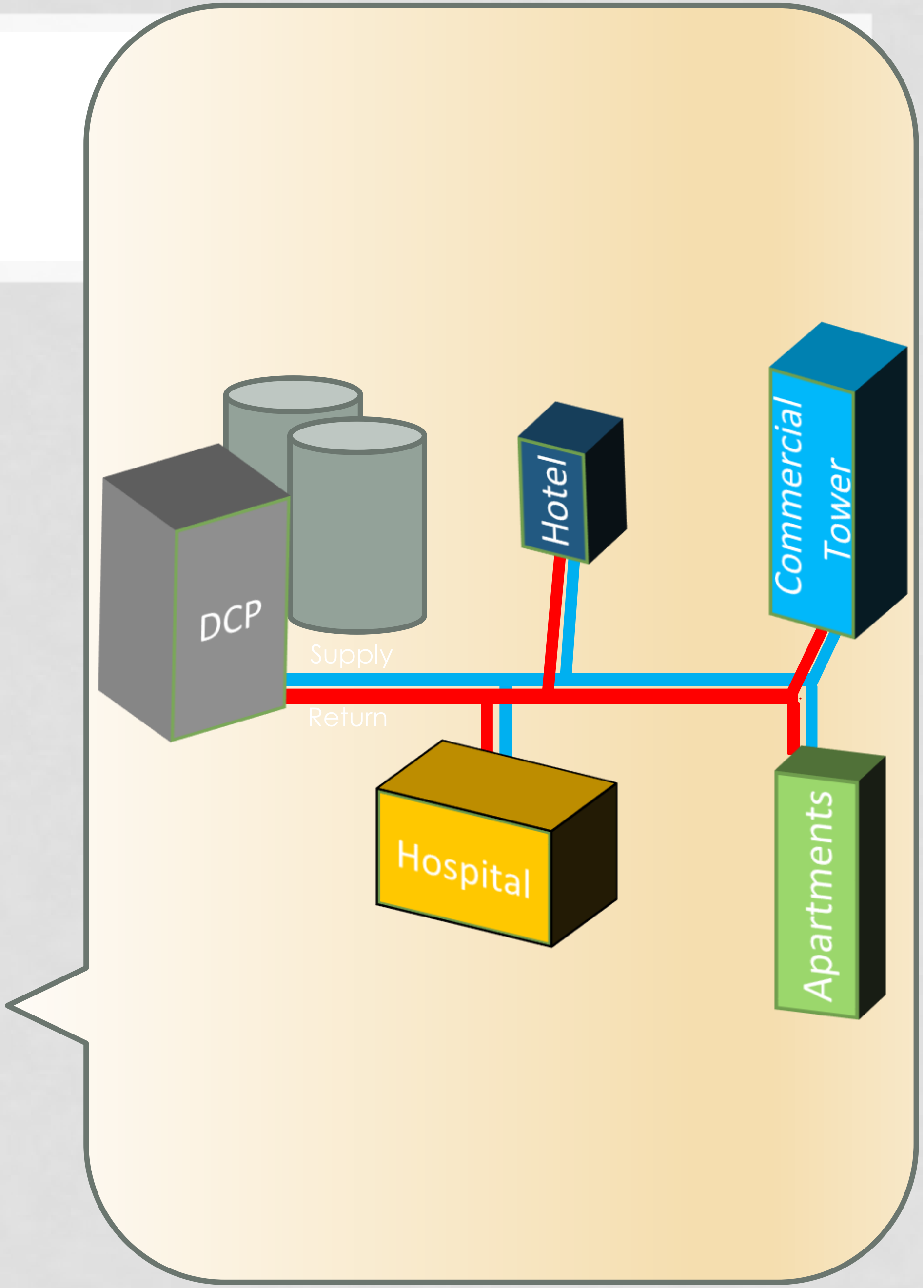

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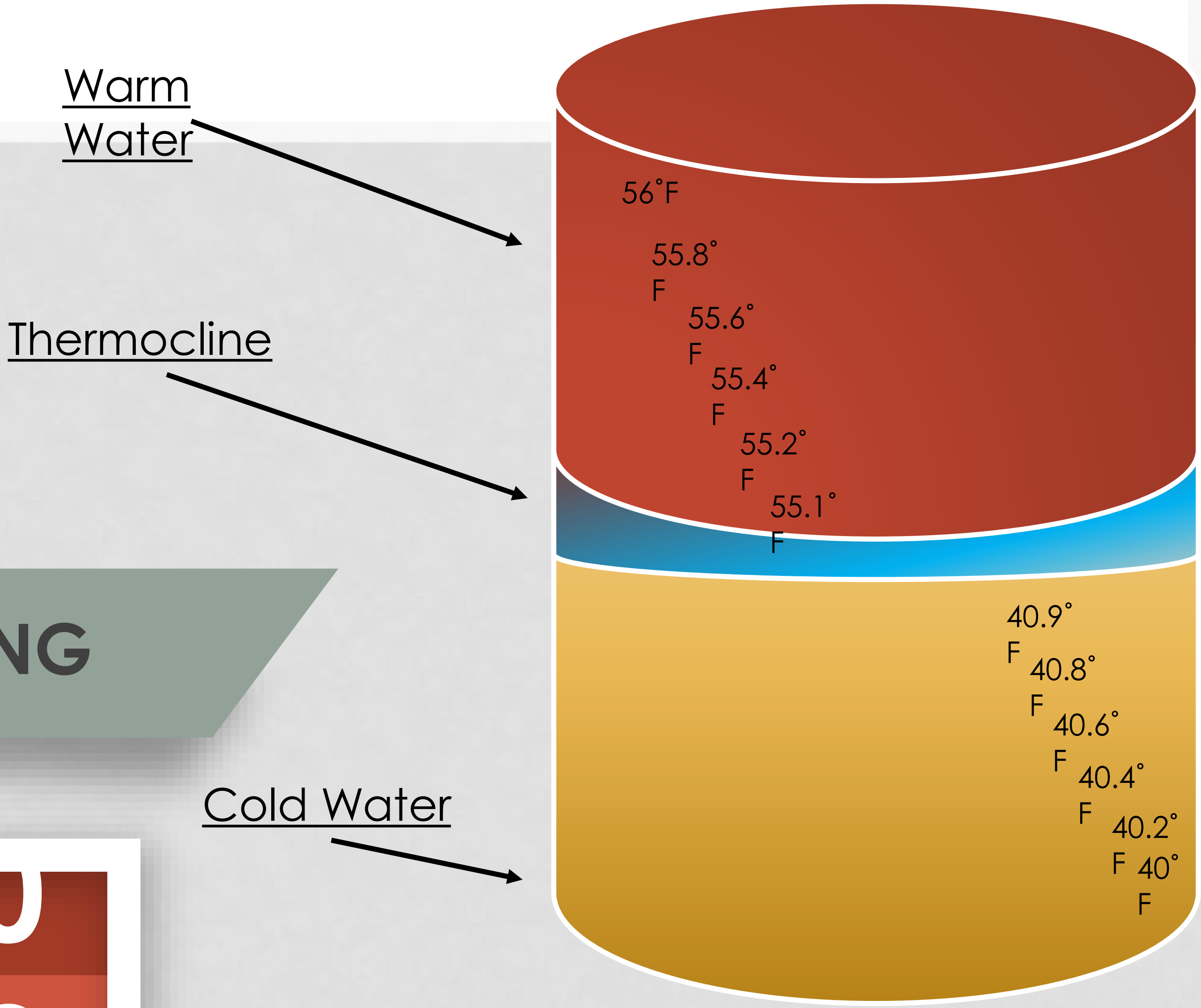
TES (STRATIFIED):

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

Two Modes:

01 CHARGING

DISCHARGING 02



LOAD PROFILE:

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

1 Peak Load

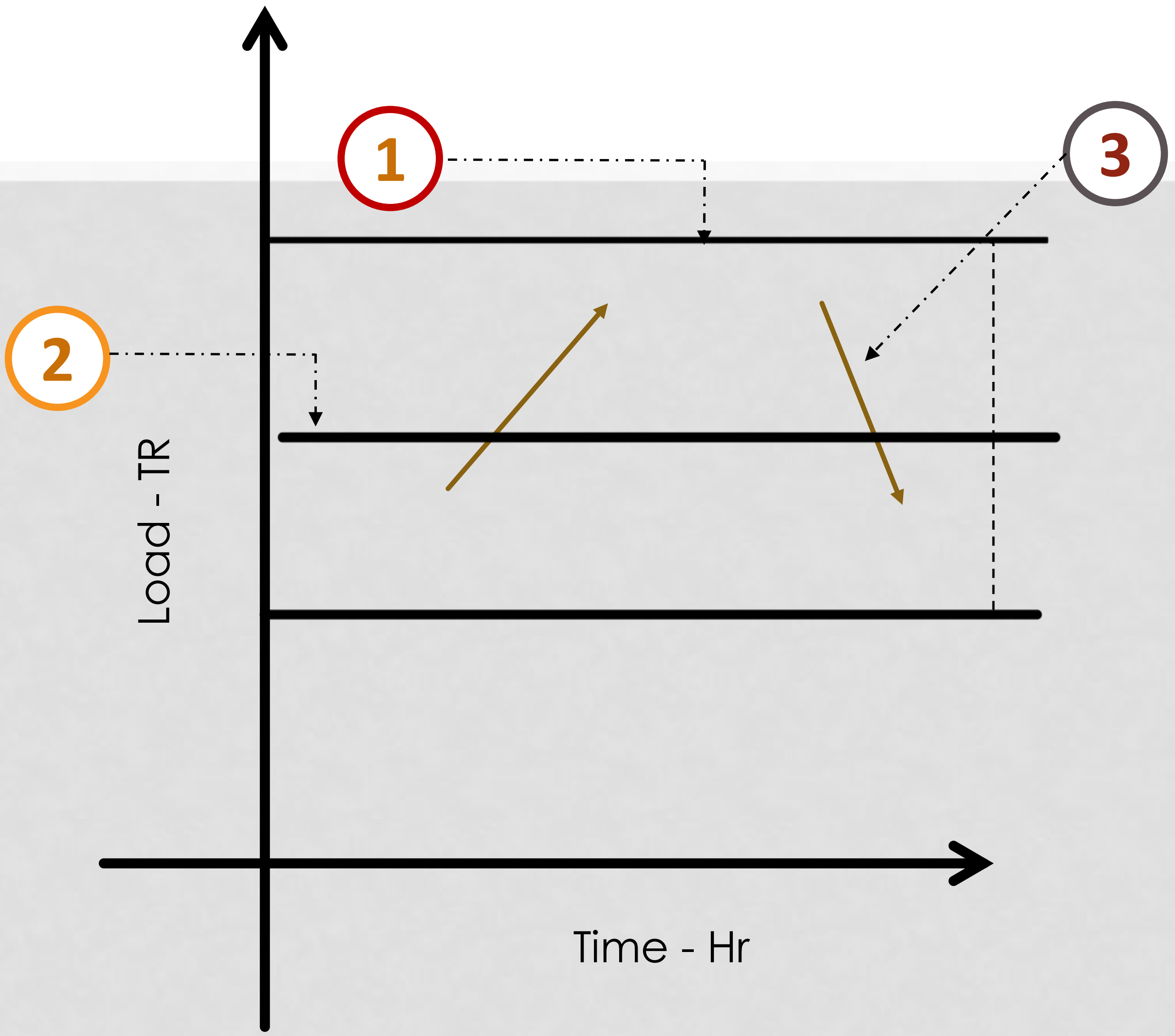
Peak Load is simply the highest demand that has occurred over a specified time period

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:

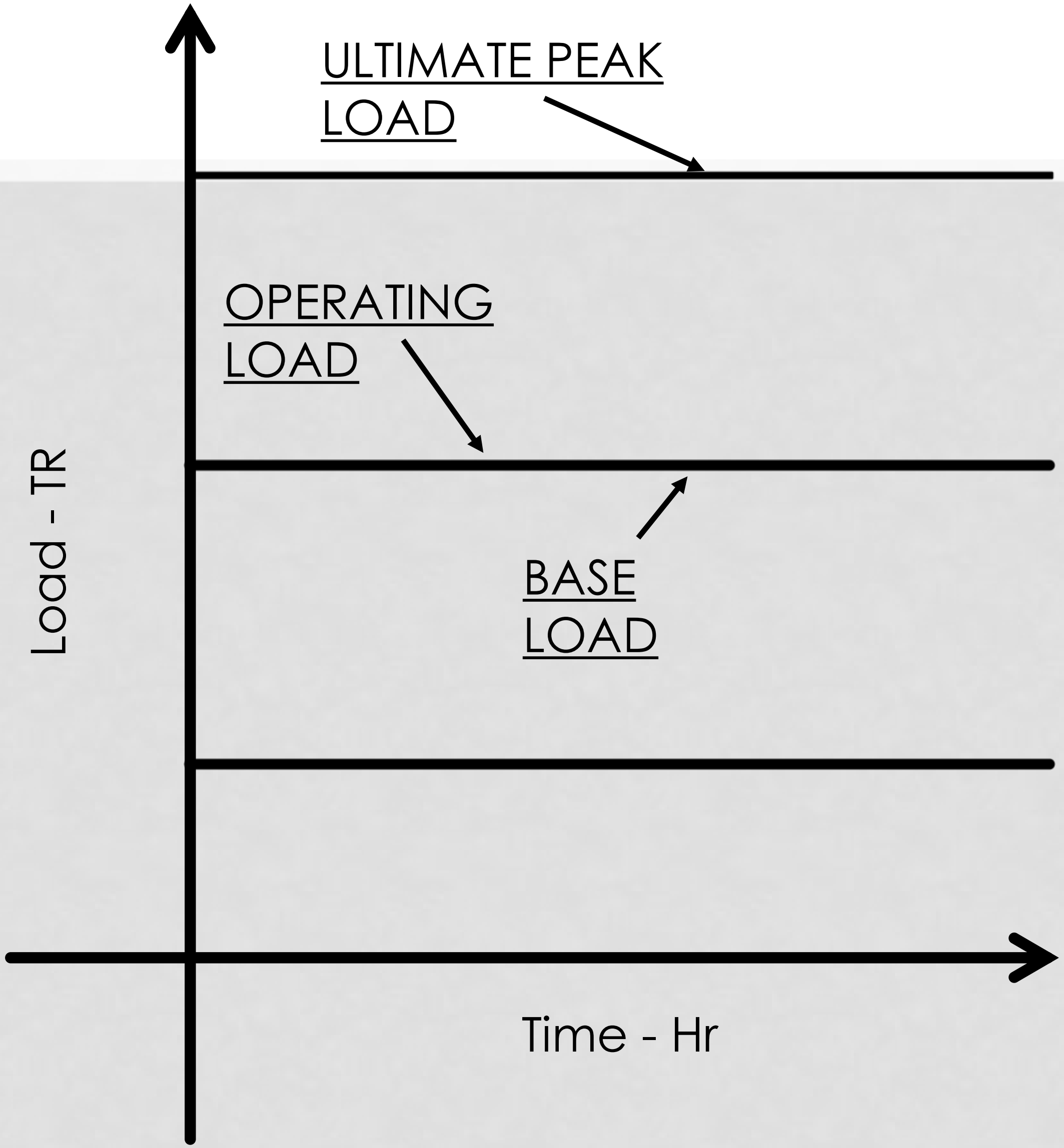
The optimum operational strategy is to charge the TES in off peak hours and to discharge the stored energy in peak hours.

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%

≈4,933,151 USD

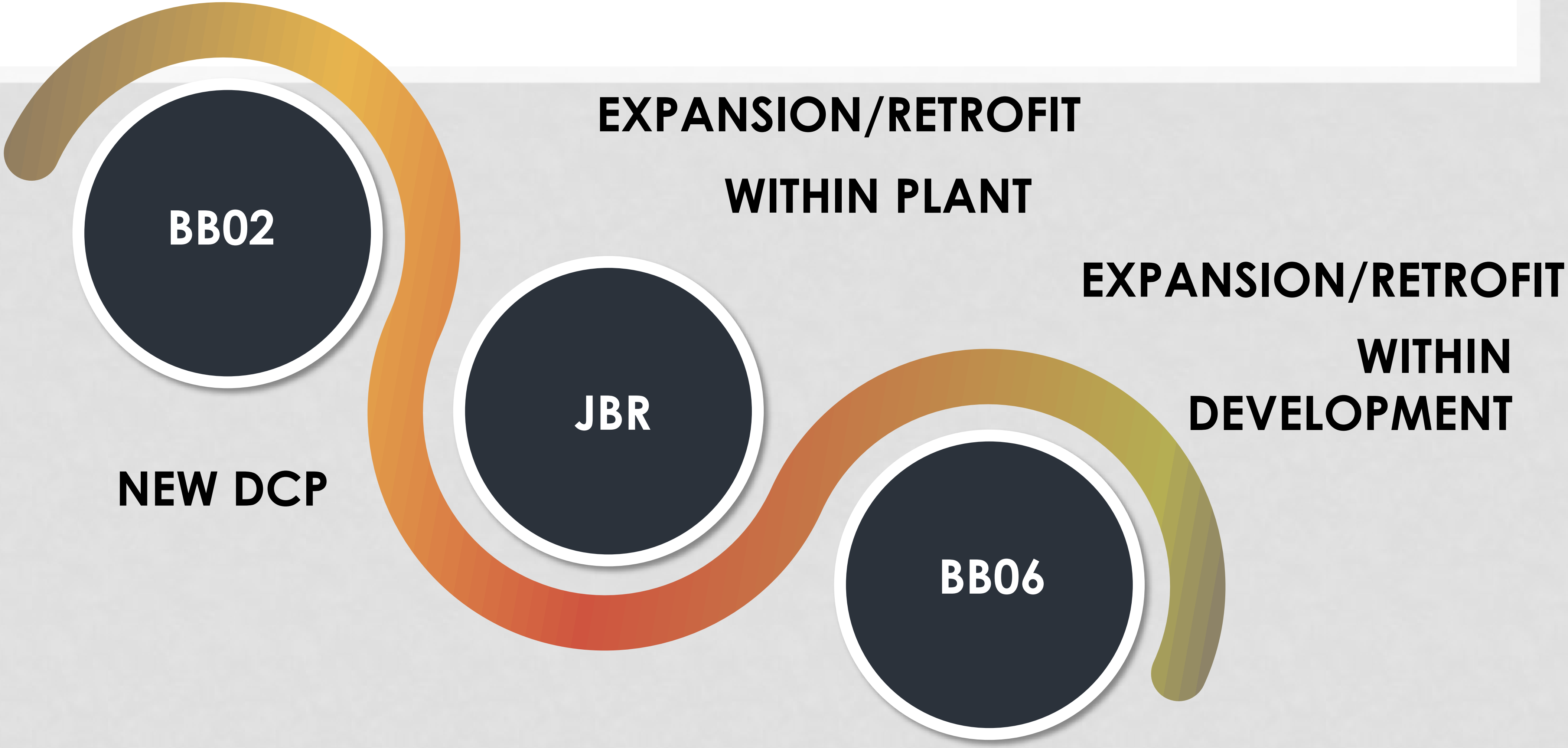
TES VS CONVENTIONAL CHILLER CAPACITY

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%
		≈3,391,032 USD

TES VS CONVENTIONAL CHILLER CAPACITY

Cost AED/TR			
TES Capacity of 6,000 TR	3,391032 USD	Cost=USD/TR≈	565
Conventional 6,000 TR Chiller	4,933,151 USD	Cost=USD/TR ≈	822
Cost Saving From 6,000 TR TES	≈	1,542,119 USD	

TES IMPLEMENTATION:

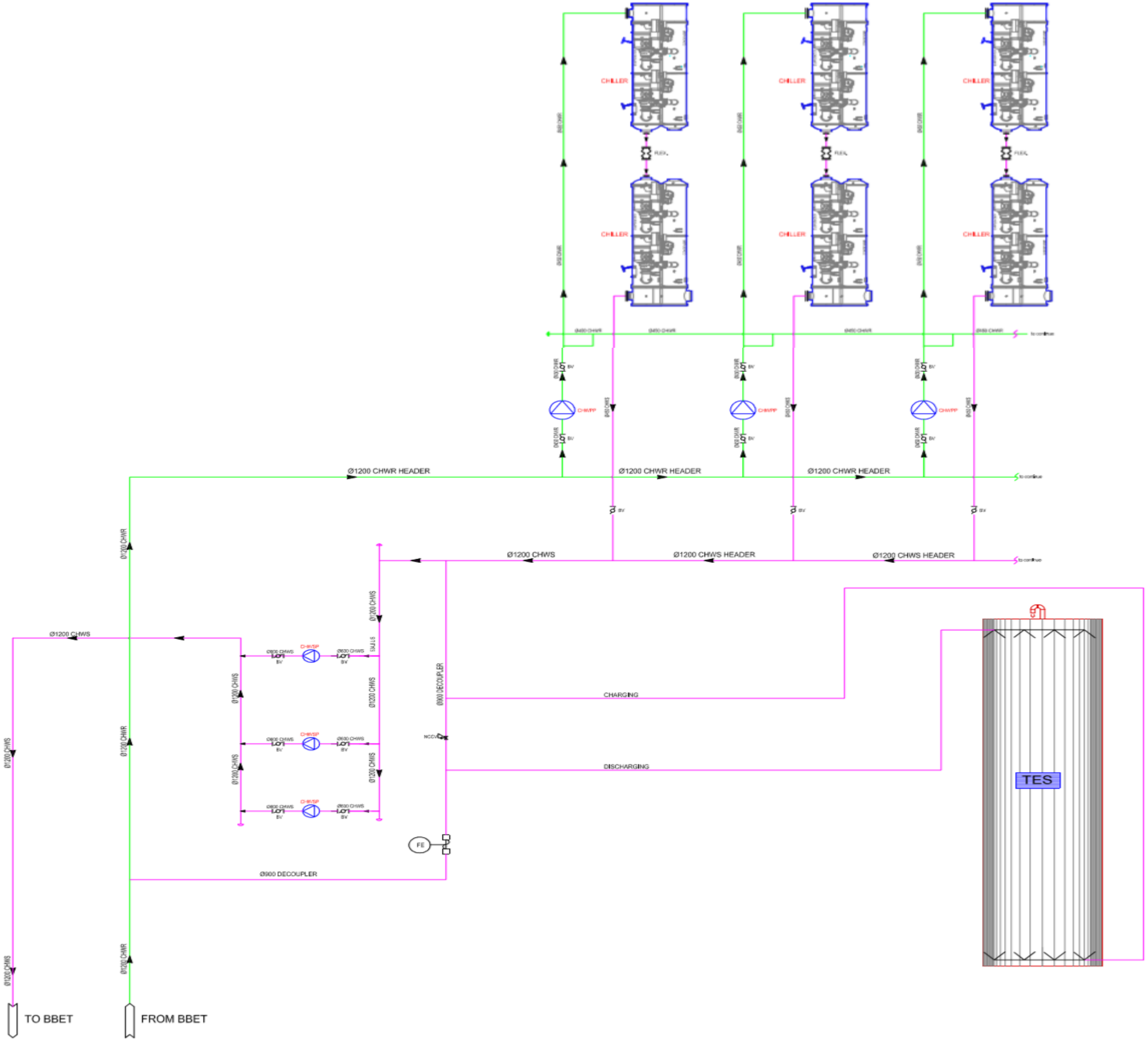


BB-02 is Design and built with TES with storage capacity of 48,000 TRH.

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.

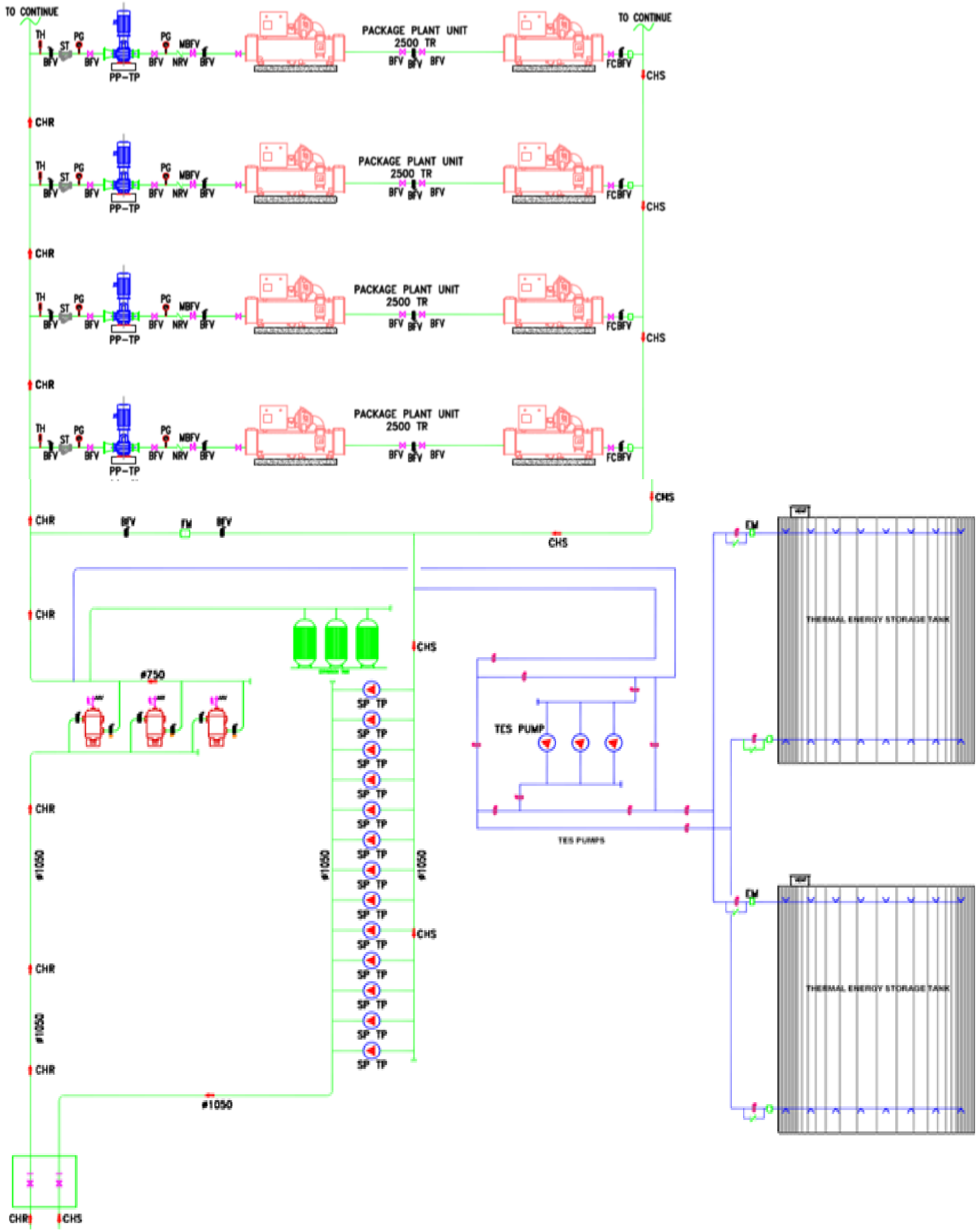


BUSINESS BAY TES SCHEMATIC

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

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.

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



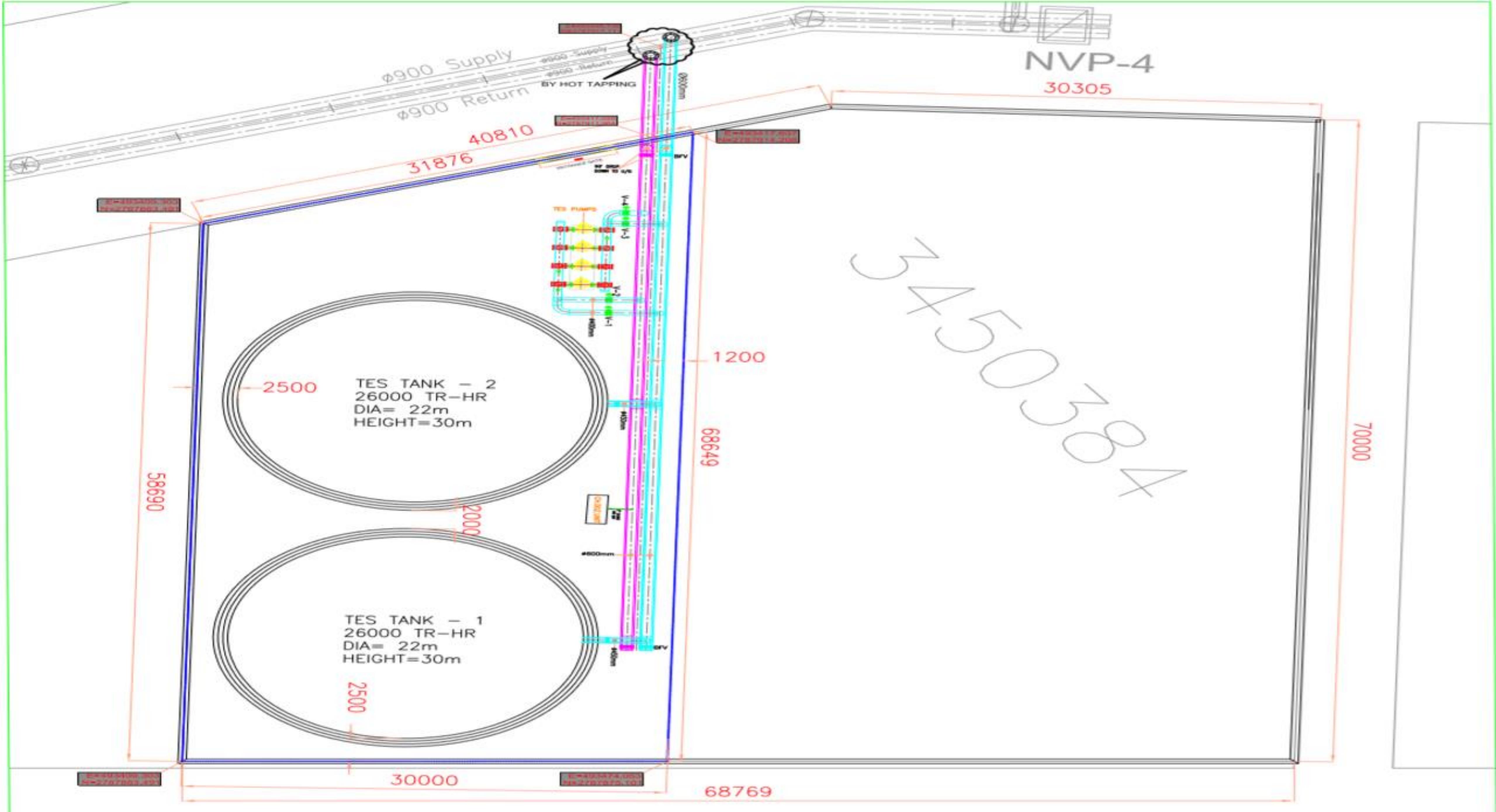
JBR- DCP TES SCHEMATIC

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
30305
40810
31876
TES PUMPS
BFV
1200
2500
TES TANK – 2
26000 TR–HR
DIA= 22m
HEIGHT=30m
68649
70000
58690
2000
3450384
TES TANK – 1
26000 TR–HR
DIA= 22m
HEIGHT=30m
2500
30000
68769

BB-06 DCP TES

Q&A