



DUBAI HILLS
ESTATE

Where luxury resides

OVERVIEW OF THE SOLUTION FOR

Dubai Hills District Cooling Plant

Enhanced performance and reduced CAPEX

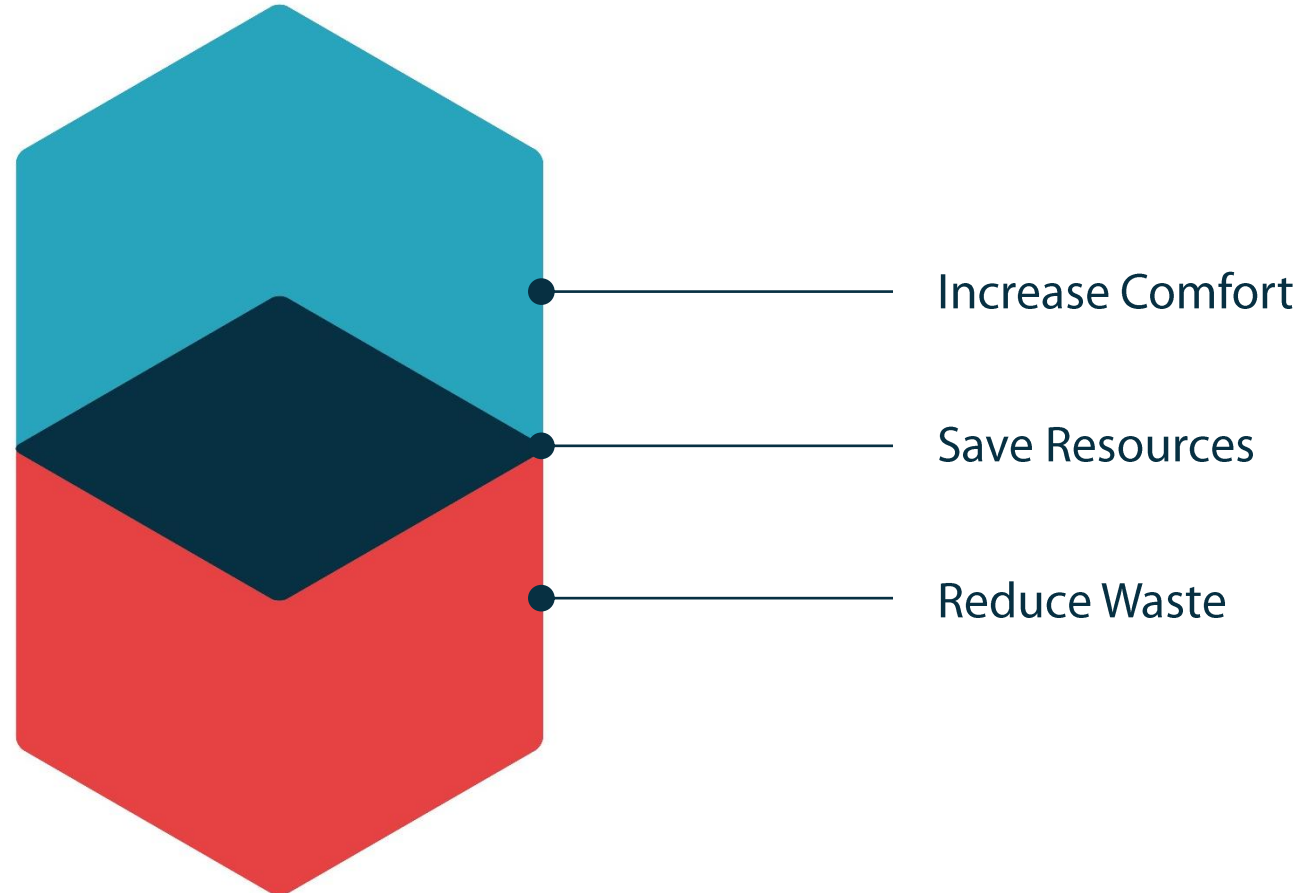
Date: 9th September 2016

Revision 00

**Optimised Energy Service with
full benefits & savings
to the client**

Our Philosophy

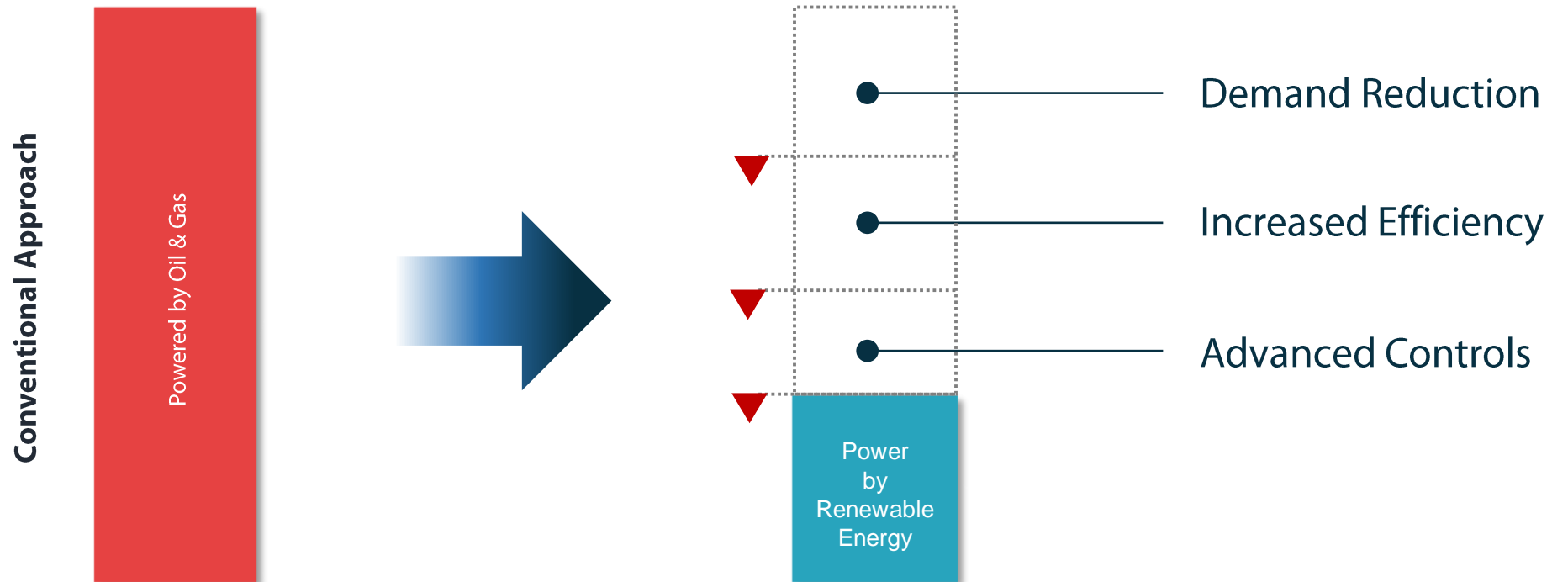
Follow nature's design of **symbiosis**.



By following nature's design of symbiosis, the waste of one system is the feed of another. Which fully integrates the principles of sustainability and is bolstered by politics, culture, environment and economics .

Our Approach

Achieves the lowest viable carbon footprint and future emissions possible, with a robust and profitable business model to further **enhance sustainability**.



Every effort to improve adds up to substantial enhancement and sustainability of the present, which requires commitment and discipline to ensure the correct environmental impacts are met for the economic benefit. The only change is an economic change !

LETS

Understand

To know where we are going we need to know what we are up against, as the solution is in the problem.

The Project

Mixed use development of apartments, retail & commercial, however villas and townhouses are not connected to the district cooling system.



MAPLE 2

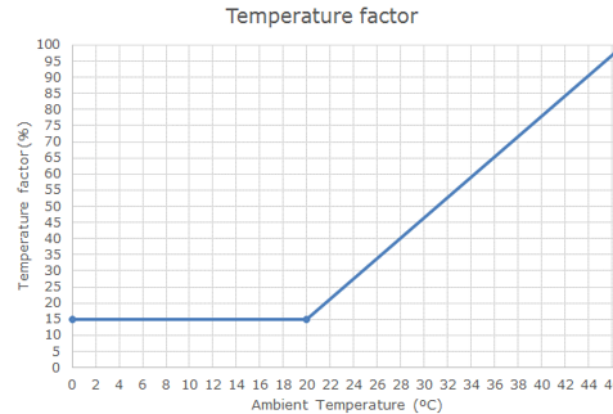
Plant Location



The Load Build Up & Assumptions

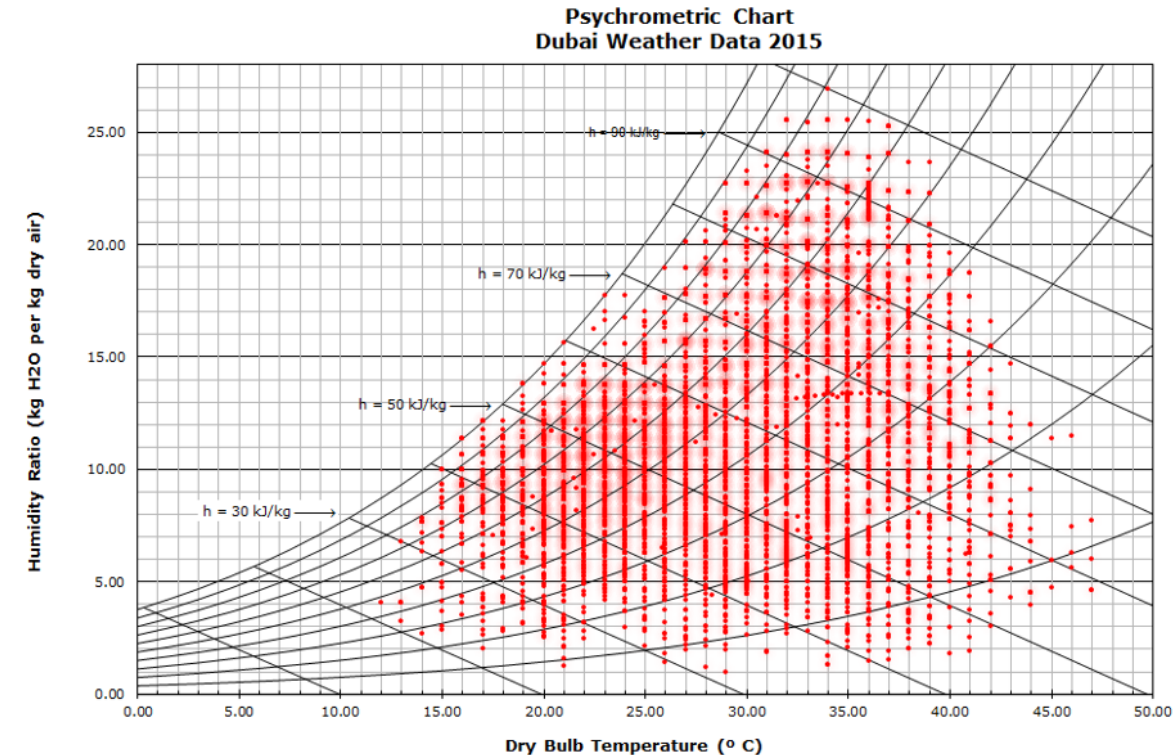
Peak cooling demand expected **48,000TR**, serviced by 40,000TR electric chillers and 54,000TRh TES tank with discharge capacity of 8,000TR.

Building Occupancy Factors for Cooling			
Time	Retail	Residential	Commercial
0:00	0%	60%	10%
1:00	0%	60%	0%
2:00	0%	60%	0%
3:00	0%	60%	0%
4:00	0%	60%	0%
5:00	20%	100%	10%
6:00	50%	100%	35%
7:00	60%	100%	60%
8:00	65%	100%	100%
9:00	75%	50%	100%
10:00	80%	25%	100%
11:00	80%	25%	100%
12:00	80%	25%	100%
13:00	90%	40%	50%
14:00	95%	60%	100%
15:00	100%	85%	100%
16:00	100%	100%	100%
17:00	100%	100%	100%
18:00	95%	100%	100%
19:00	90%	100%	90%
20:00	85%	90%	80%
21:00	70%	80%	60%
22:00	50%	70%	50%
23:00	20%	60%	25%



COOLING DEMAND FACTORS (simplified)

- These factors multiply the peak cooling demand to calculate the hourly demand:
- Time factor, depending on the time and the building type
- Temperature factor, depending on the ambient temperature, extracted from actual weather data

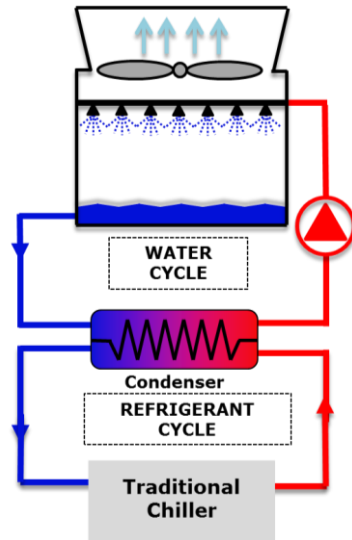


Assumed Load Split

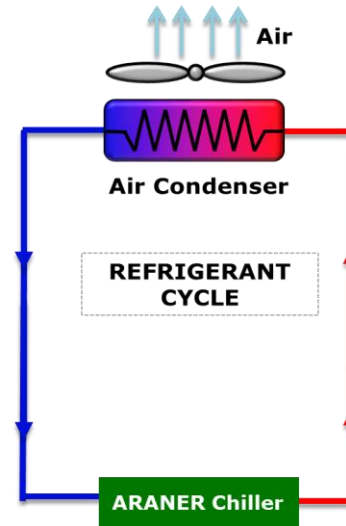
	Retail	Residential	Commercial
Load	9,600	24,000	14,400

Comparison of Options

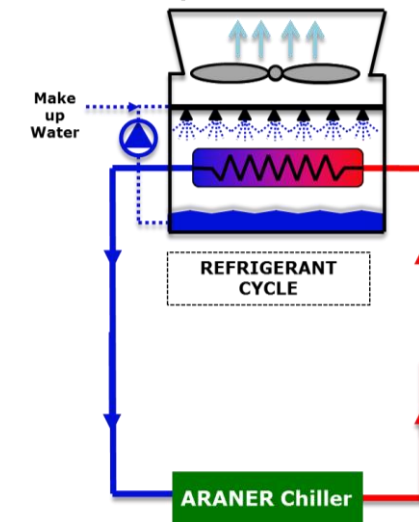
We have developed unique solutions and alternatives to assist Emaar **achieve sustainability.**



Base Tender



Air-Cooled



Evaporative Condenser

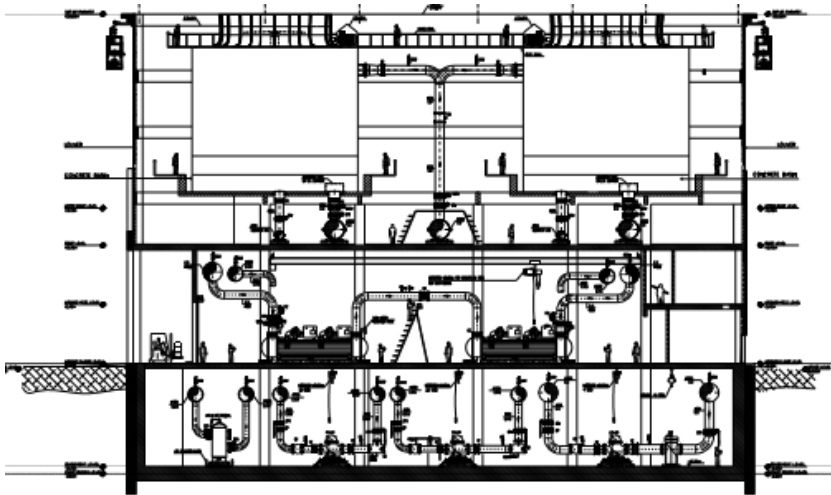


Strengthening Emaar's brand by exceeding the expectations of the customer by reducing costs, saving the environment, improving the experience within the development and enhancing its lifestyle.

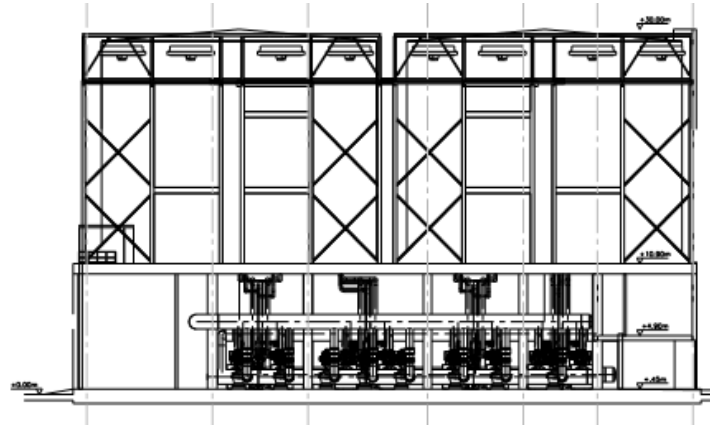
Want to know more?

Comparison of Options

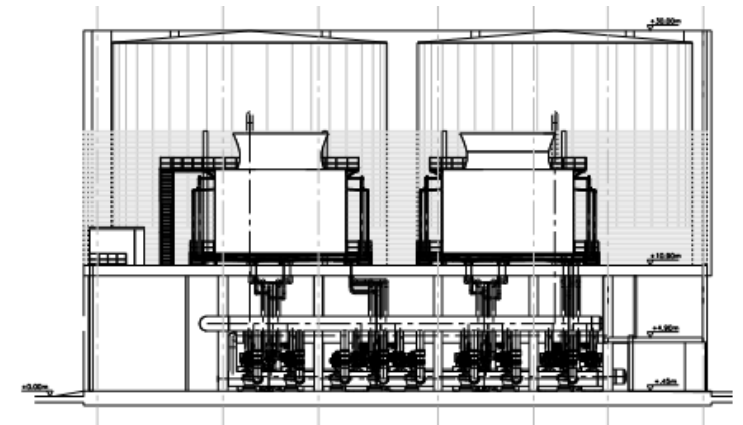
Typical Cross Section



Base Tender



Air-Cooled



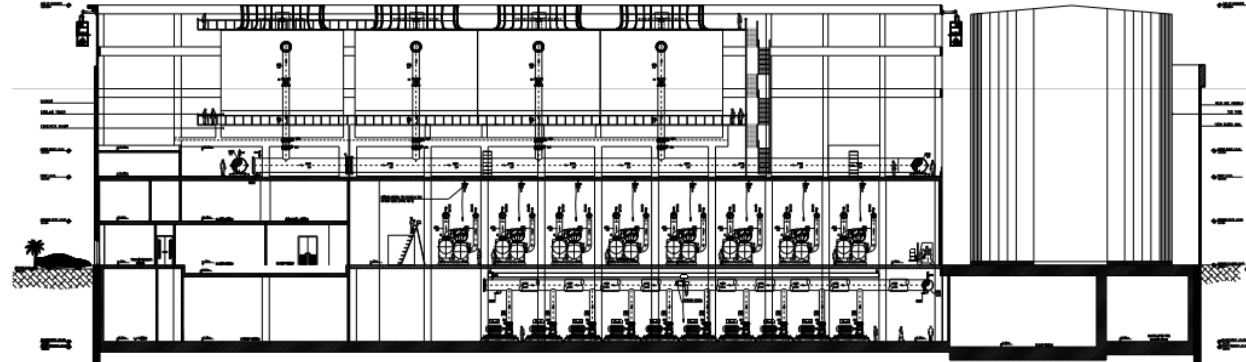
Evaporative Condenser



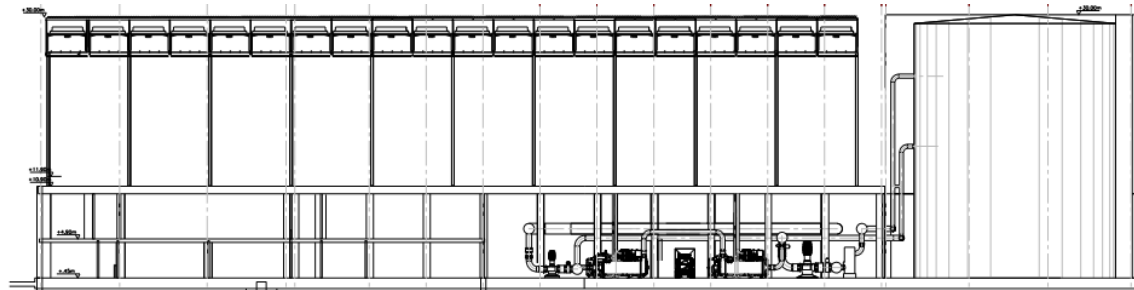
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Comparison of Options

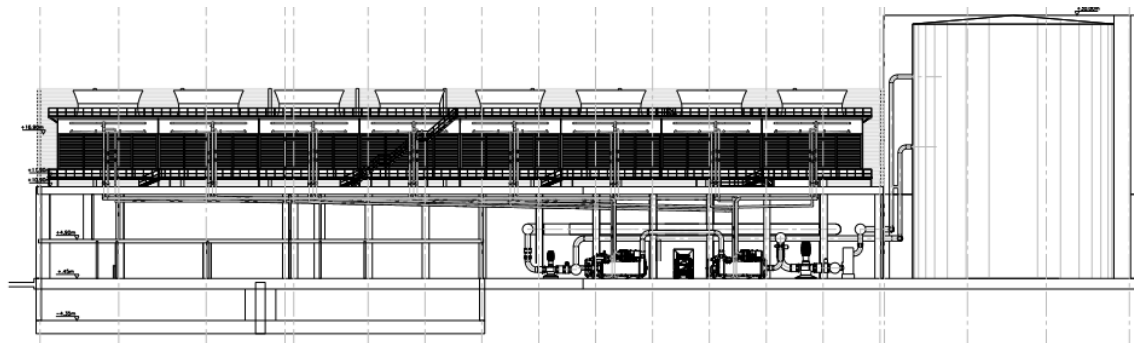
Typical Long Section



Base Tender



Air-Cooled



Evaporative Condenser



Eliminate the need for a basement or dramatically reduce it.

Air-Cooled Option



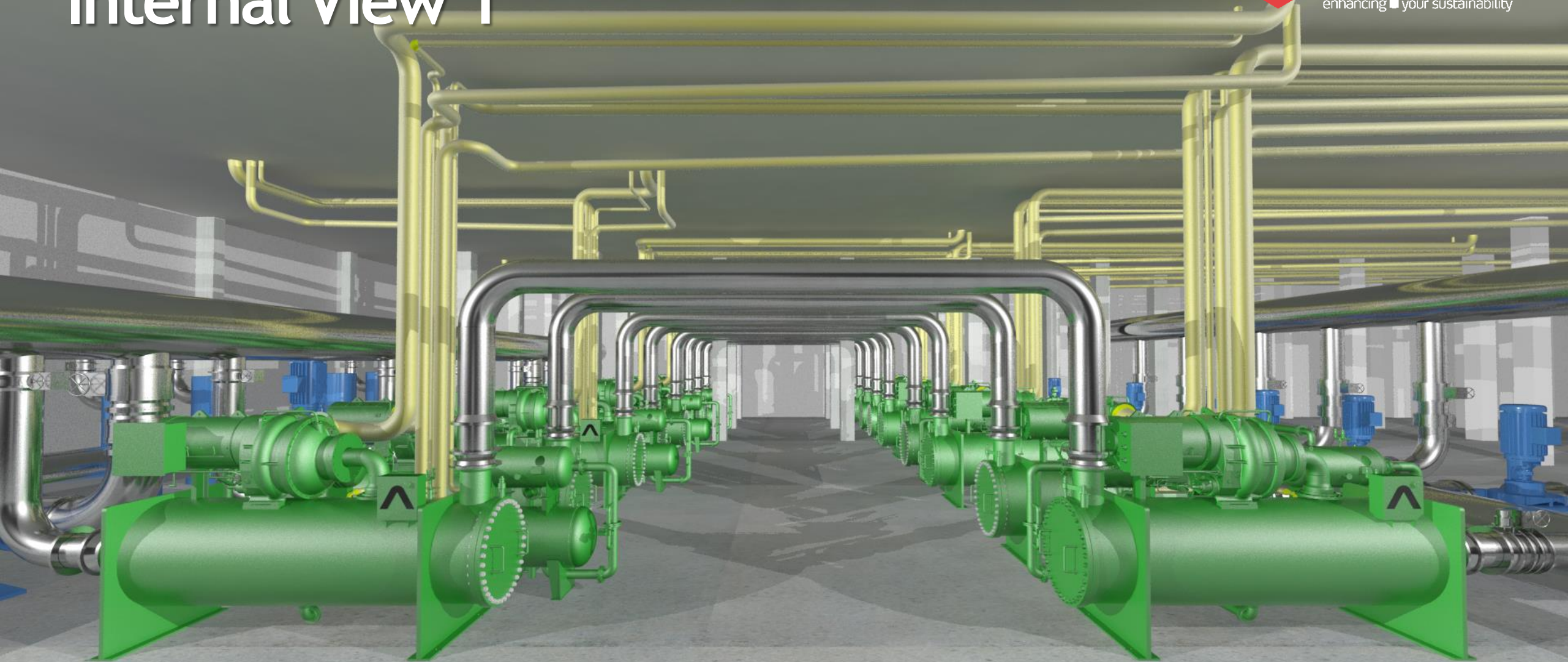
Same foot print as
Base Tender!

Evaporative Condenser Option

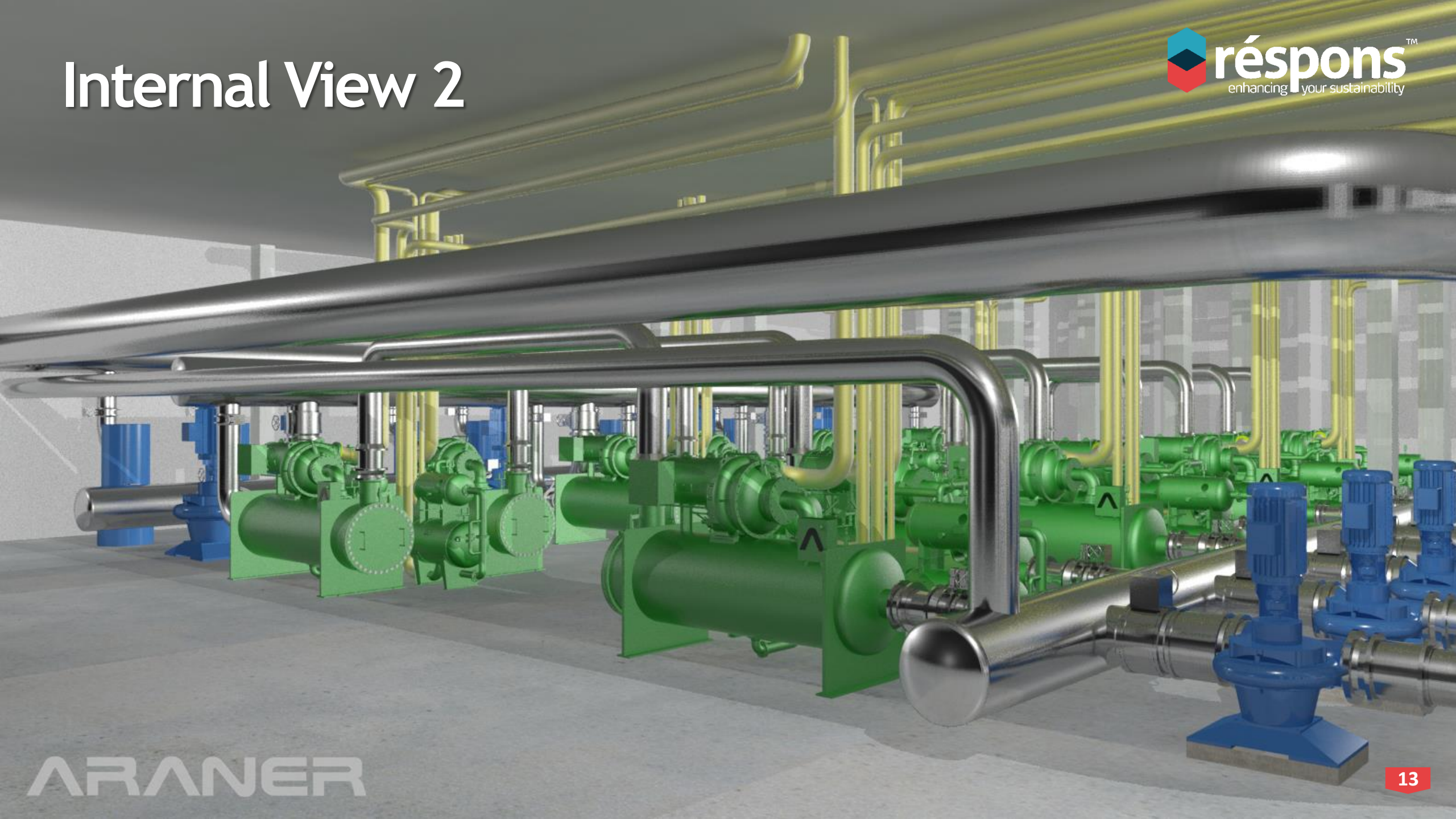


Option to reduce
façade height by
8.1m

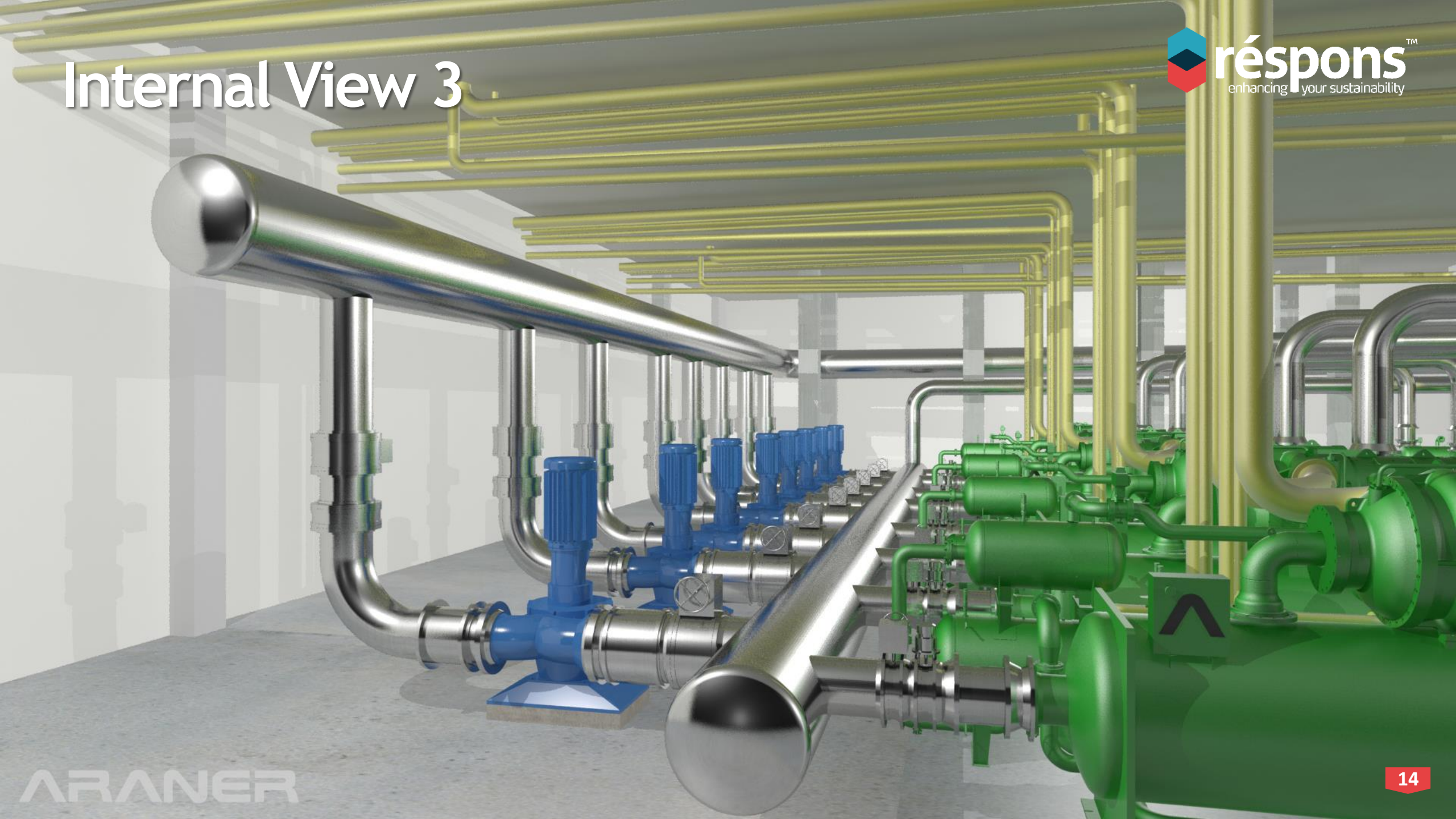
Internal View 1



Internal View 2



Internal View 3



Calculation Results

Based on peak design conditions of:

Dry Bulb Temperature 46°C

Wet Bulb Temperature 31.5°C

	Base Tender	Air-Cooled Alternative	Evaporative Alternative
Peak efficiency with TES (kW/TR)	0.803	1.137	0.719
Process Design efficiency (kW/TR)	0.949	1.350	0.848
Yearly Average efficiency (kW/TR)	0.761	0.922	0.657
Energy Consumption (kWh)	93,595,281	113,870,068	80,807,665
Water Consumption (m ³)	1,580,756	0	1,577,501

14% better

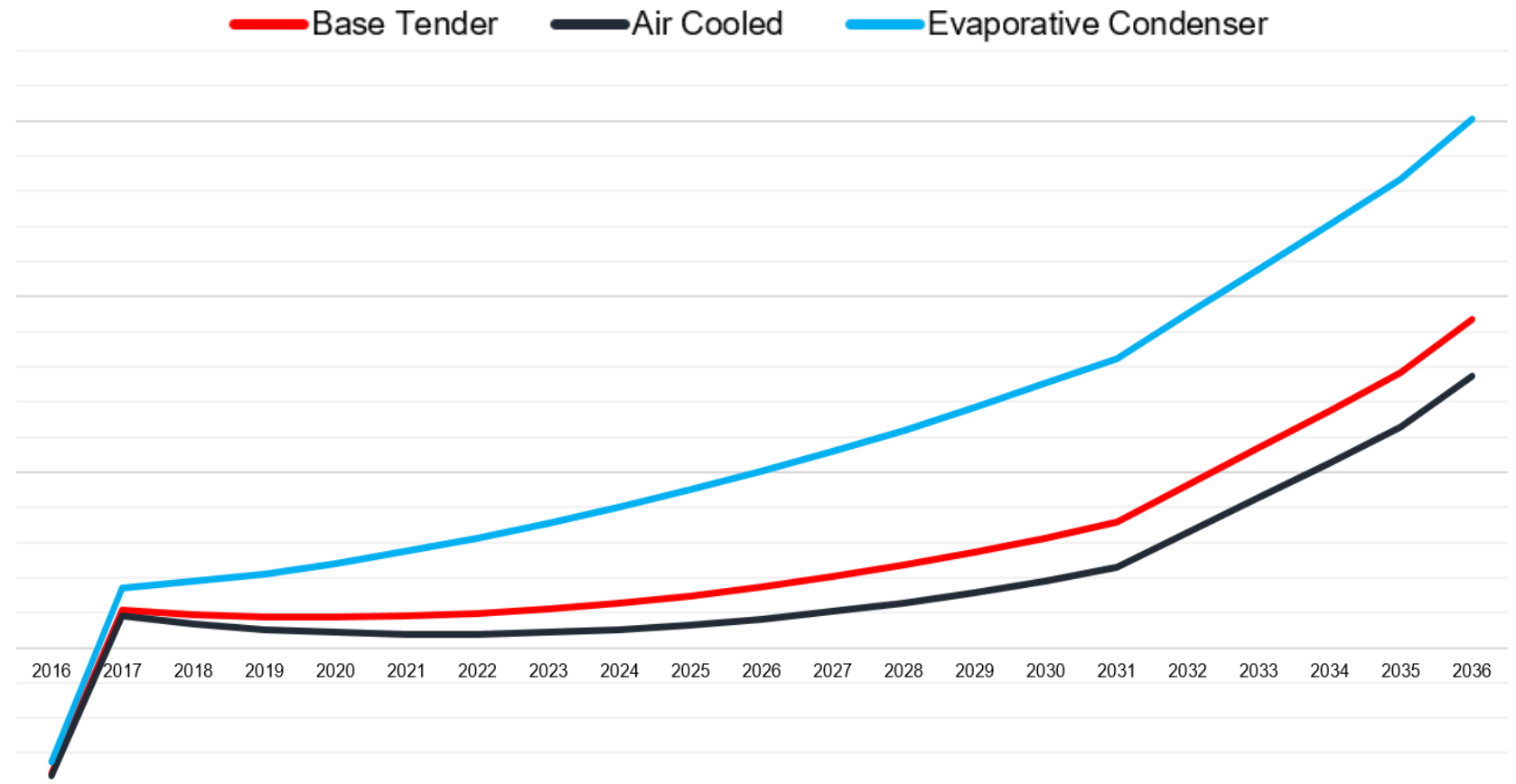
Economic Performance of Options

In search of **maximum returns.**

Parameter	Rate
Connection Fee* (Once off)	AED 2,500 per TR
Capacity Charge (Annually or split Monthly)	AED 750 per TR
Energy Rate (Monthly)	AED 0.568 per TRh
EFLH (Equivalent Full Load Operating Hours)	2,500 hours

* Based on Total Connected Load

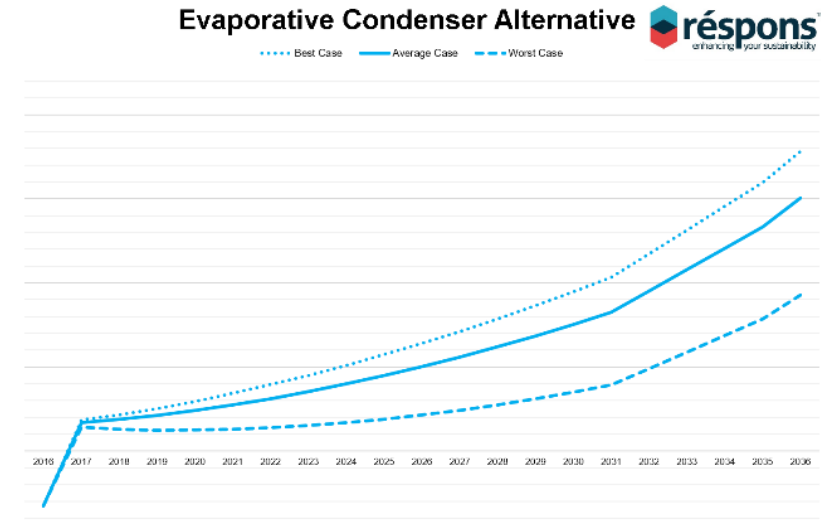
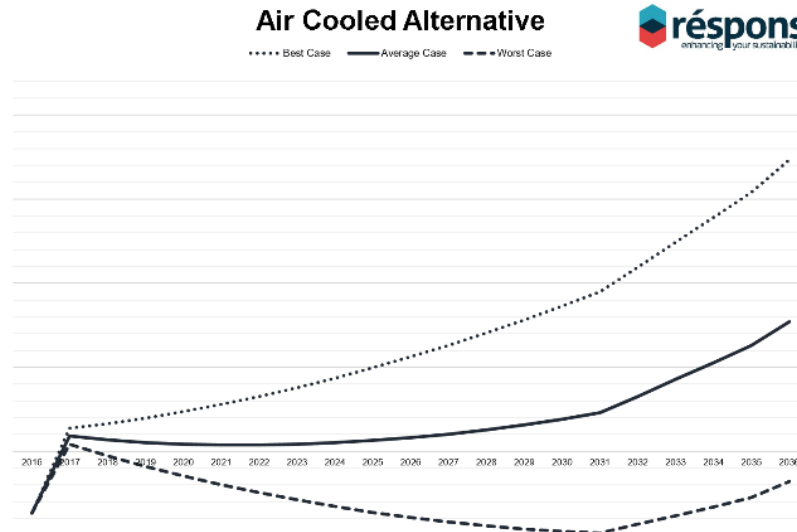
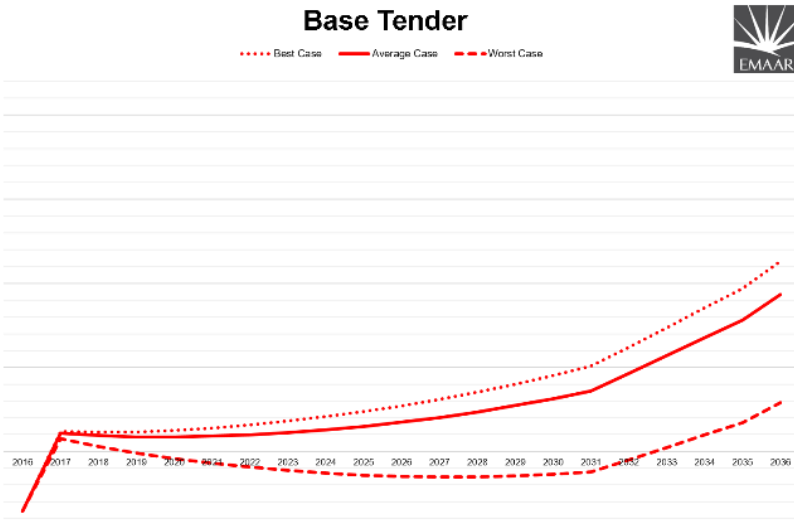
Electricity Rate	44.5 fils / kWh
TSE Water Rate	9.04 AED / m ³



The evaporative condenser option provides the most profit in all situations and also proves to be the most stable and robust with regards to maintaining a positive cash flow at all times. This is *assuming 100% uptake of plant capacity and full utilization*, further analysis is required.

Risk & Sensitivity

In search of **robustness & least risk.**



Cash flow concerns for Base & Air-Cooled options

LEGEND:

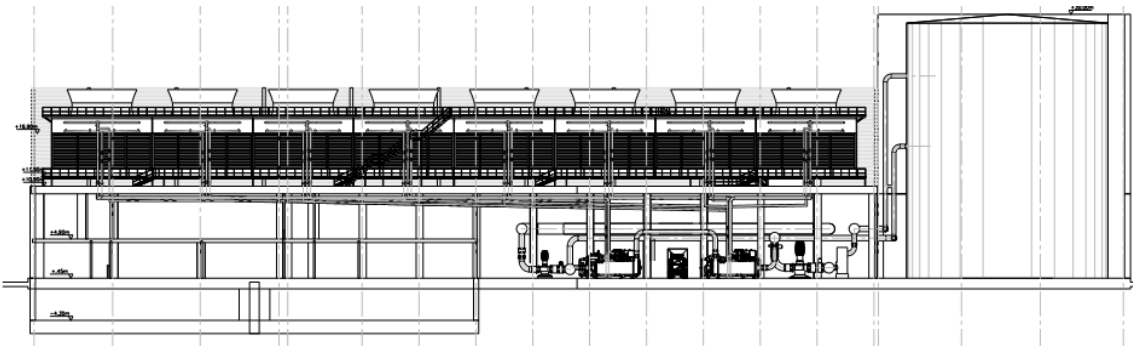
- **Best Case** uses Annual Average Efficiency including the TES tanks.
- **Average Case** uses Peak Design Efficiency including the TES tanks .
- - - **Worst Case** uses Peak Design Efficiency only

The **evaporative condenser** option proves to be the most stable and robust with regards to maintaining a positive cash flow in all situations. This is assume 100% uptake of plant capacity and full utilization, further analysis is required.

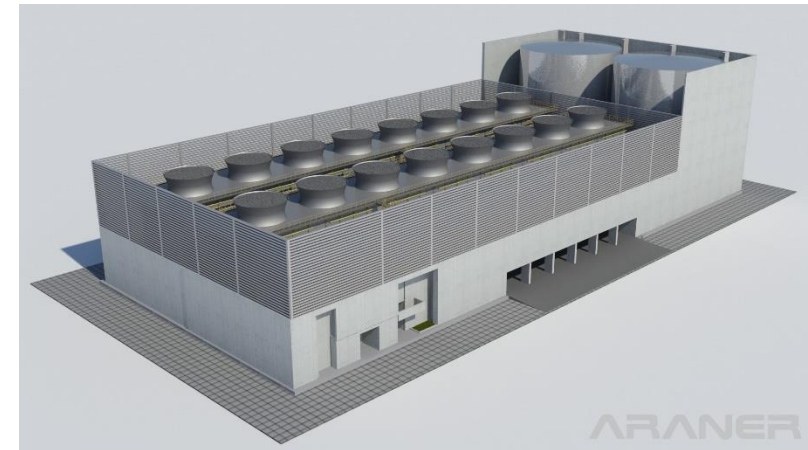
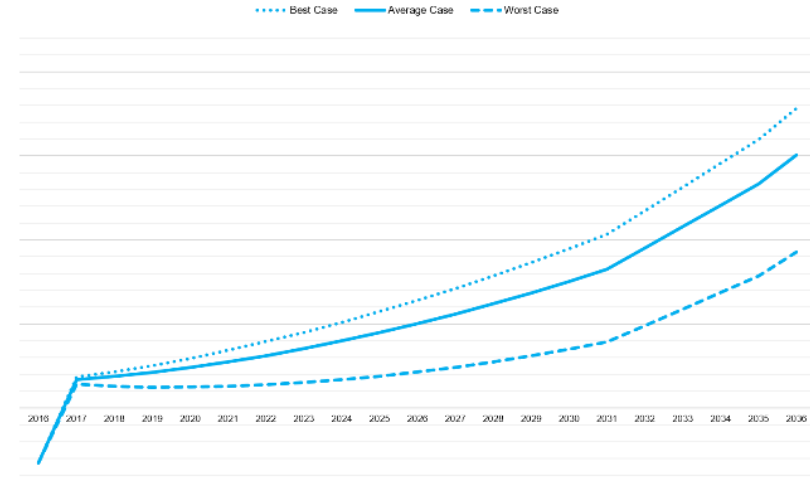
Conclusion

The evaporative condenser solution provides **enhanced performance and reduced CAPEX**

1. Best Efficiency & Lowest Capital Cost
2. Most Robust Performance
3. Reduced Basement
4. Overall Building Height can be reduced by 8.1m
5. Opportunity to convert to hybrid to get benefits of air-cooled option in winter and reduce water consumption by 40%



Evaporative Condenser Alternative



Strengthening Emaar's brand by exceeding the expectations of the customer by reducing costs, saving the environment, improving the experience within the development and **enhancing sustainability**.

THANK YOU

for your time

The vision belongs to all of us, let's
achieve the goals.