

# District Cooling Workshop

Wednesday 18/6/2014

## Towards Cooperative District Cooling Society

# KM-DC Workshop Towards Cooperative DC Society

18<sup>th</sup> June 2014

**Qatar District Cooling Company  
(Qatar Cool)**

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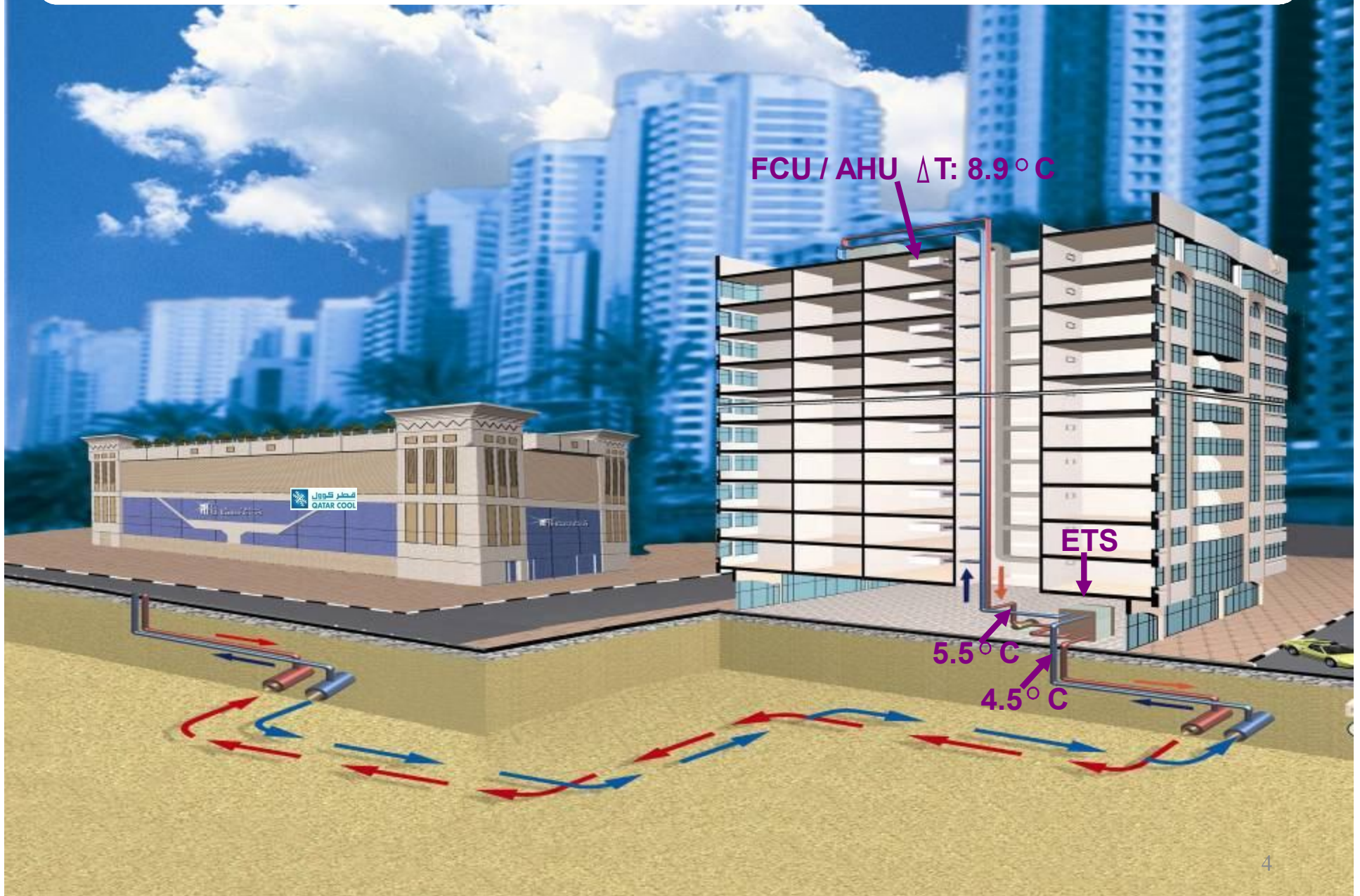
# OUTLINE

- **DC in Qatar**
- **Qatar Cool – Current & Expansion**
  - Demand Increase from Current Plants
  - New Plant-3 @ WB
  - Expansion Study @ TPQ Plant
- **Current DC Challenges**
- **Opportunities for Cooperation amongst DC Providers**



# District Cooling - Qatar

# How District Cooling Works



## DC Brief

- DC has been implemented world-wide since the turn of the 20th century & in the GCC region as early as the 1960's.
- > 550 DE systems in the US, > 40% DE market share in EU.
- Qatar-TR: ~ 800K with > 15 DC systems. In 2017: 1.5M?

## DC & QNV 2030

QNV-2030, 4th Pillar: Environmental Development:  
“management of the environment such that there is harmony between economic growth, social development and environmental protection.” ..... DC:

- Is a sustainable cooling alternative.
- Eliminates noise pollution.
- Reuses local resources (TSE).
- Reduces environmental emissions including air pollution, GHG, and ozone-destroying refrigerants.
- Reduces annual CO<sub>2</sub> emissions by about 1.25 ton for each for each 1 TR @ DC Plants.
- **Reduces legionella risks.**

## What Does DC Offer??

- Reduces the required connected electricity by  $> 50\%$ .
- Reduces  $> 40\%$  of electricity consumption.
- Saves customers around 25% of the LCC of the AC system.
- Offers lower costs (CAPEX & OPEX): equipment, construction, operations, utilities, profit opportunity.



## What Does DC Offer??

- DC saves building space that can be used for more valuable purposes.
- DC enables a greater degree of flexibility, as building needs can go up or down without the need to change the central plant's capacity.
- ***DC consumes 20-25m<sup>3</sup>/yr for each 1 TR @ DC Plants!!***

# District Cooling: Where in Qatar





# Qatar Cool: Current

2003-2005



2009

2006



2008

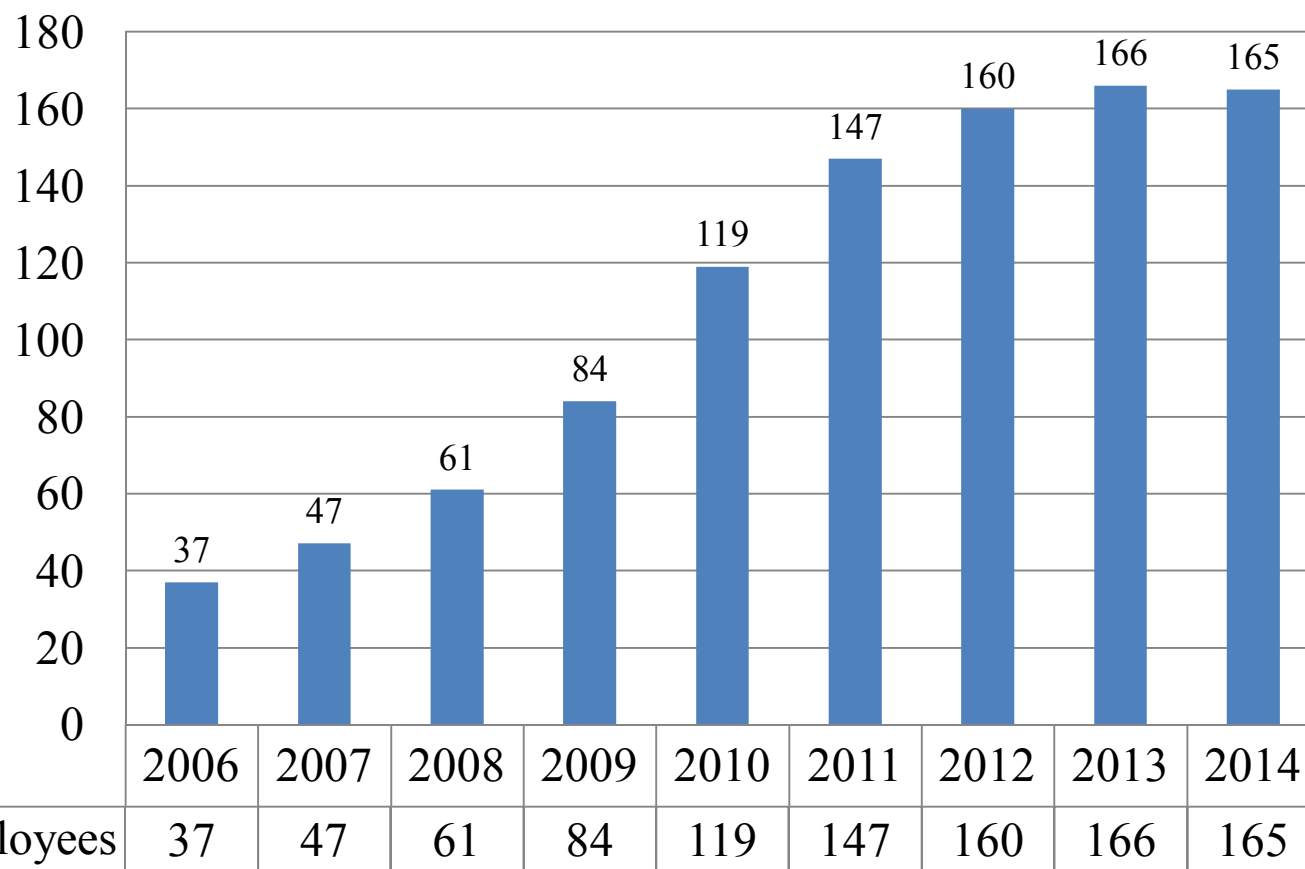
2007

2011



2014

# Qatar Cool's Employee Growth







# Qatar Cool's Network in West Bay Area

## POTENTIAL TOWERS

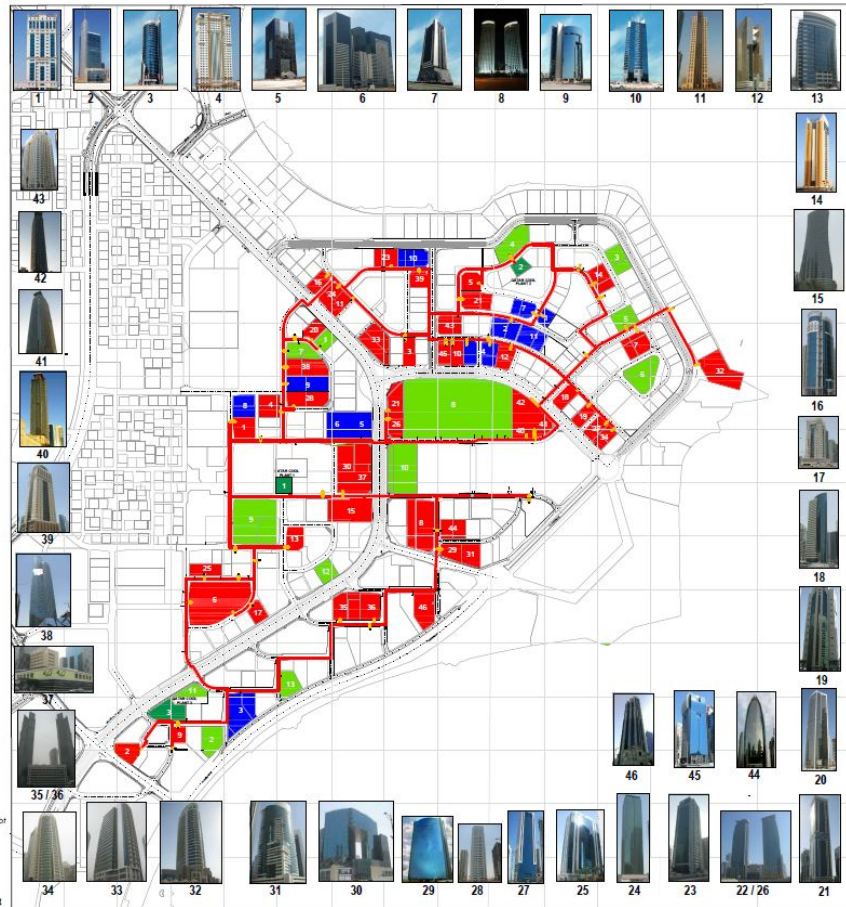
1. Al Baker Tower
2. New Al Mansa Tower
3. Shk. Abdul Rahman Tower
4. JW Marriott Tower
5. Al Tamayn Tower
6. Al Darwish Tower
7. Rahman (Sahara) Tower
8. City Center Mall
9. Asia Tower
10. Q-Rad - West Bay Central
11. Q-Rad - West Bay South
12. IBQ Tower
13. QMTC Tower



PLANT 1



PLANT 2



## OPERATIONAL TOWERS:

1. Al Zahara Tower
2. Commercial Bank
3. Qatar Insurance Co.
4. Al Rabban Tower
5. M Tower
6. Erdan Towers (4)
7. Sara Tower
8. Alfordan Towers
9. Al Jazi Tower
10. Dolphin Tower
11. Amwaj Tower
12. Al Dosa Tower
13. Al Wosail Tower
14. Al Seel (Older) Tower
15. Qatar Navigation
16. Alami Tower
17. Qasar Tower
18. Soweid Al Misnad Tower
19. Ashri Tower
20. Golden Tower
21. Kempinski Hotel & Suites
22. Marriot Renaissance
23. Beach Tower
24. Luffan Tower
25. Umm Bab Tower
26. Marriot Courtyard
27. Al Jazeera Tower
28. Arava Tower
29. Thamer Tower
30. The Gate
31. Ramee Tower
32. Hilton Tower
33. Al Margab Tower
34. Yohan Tower
35. Palm Tower A
36. Palm Tower B
37. Salam Plaza
38. Sibsonite Tower
39. Dukhan Tower
40. Rotana Tower
41. Marweb Tower
42. Shangri-La Tower
43. Jude Tower
44. Wood Tower
45. Lotaf Tower
46. Al Jasmiah Tower

## CONTRACTED TOWERS:

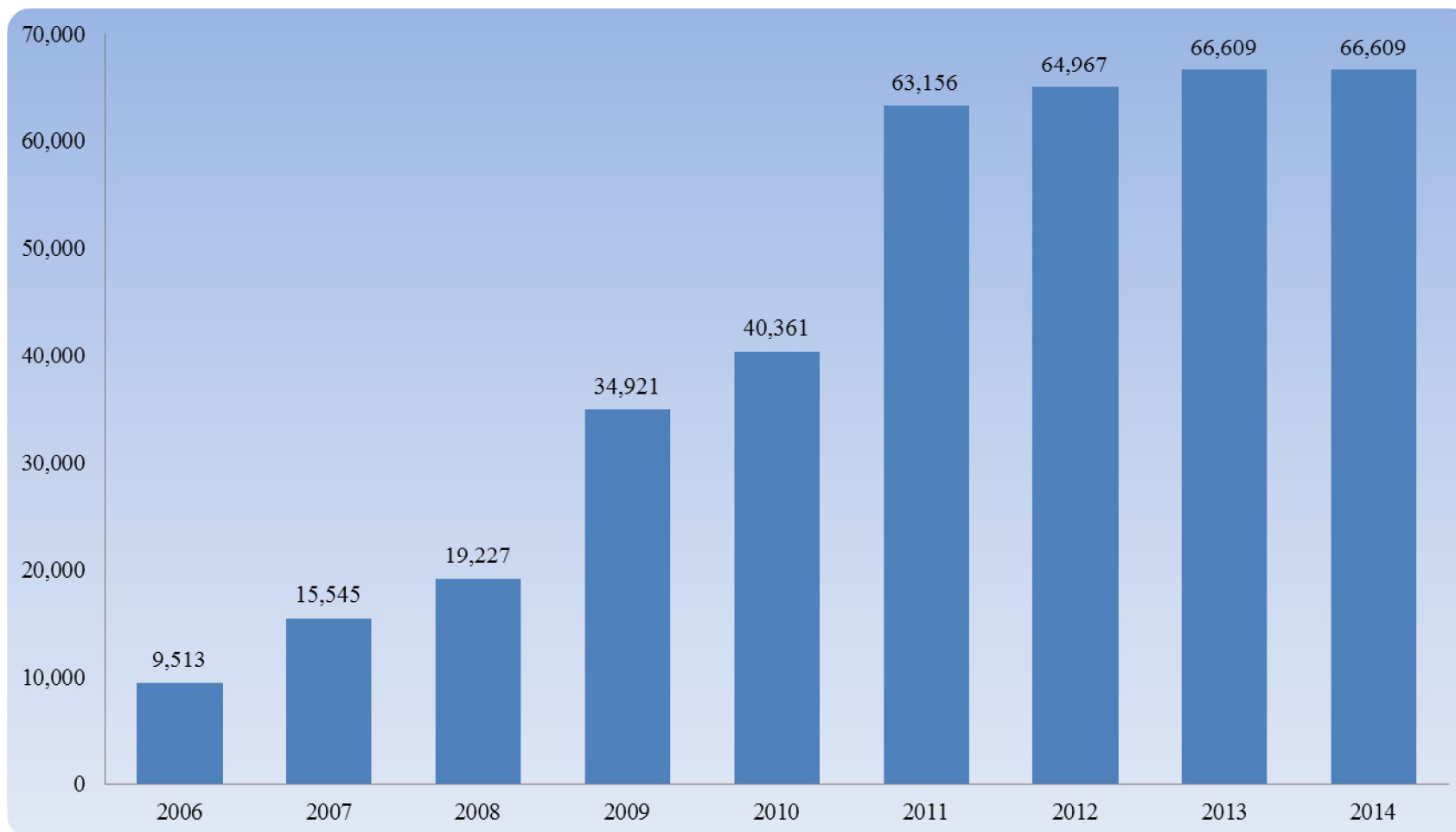
1. A'ayan Tower
2. Al Majeed Tower
3. Dubai Tower
4. Al Baker Towers
5. Commercial Twin Towers - Hotel
6. Commercial Twin Towers - Office
7. Sin Samikh Tower
8. Rabban Suites
9. Noor Tower
10. Haha Hotel
11. Waldorf Astoria Hotel

## LEGEND:

- OPERATIONAL TOWERS
- CONTRACTED TOWERS
- POTENTIAL TOWERS

17-Apr-2014  
jbt-4

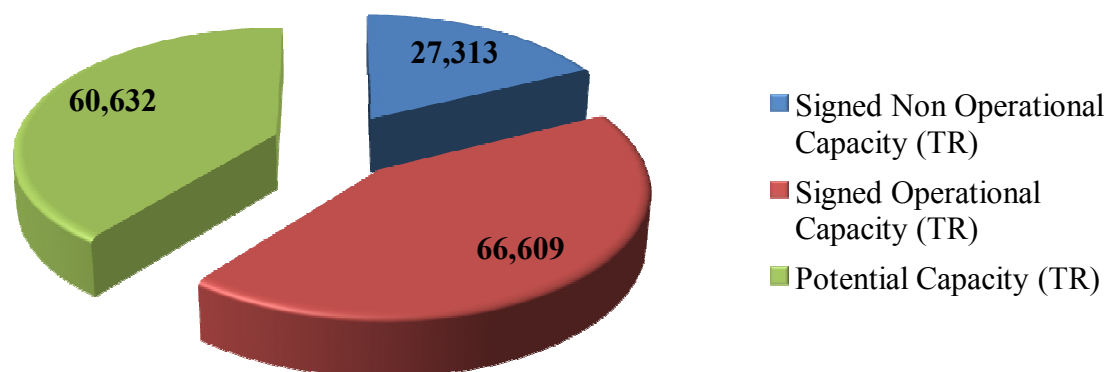
## Connected Load – West Bay





# Qatar Cool's Operation

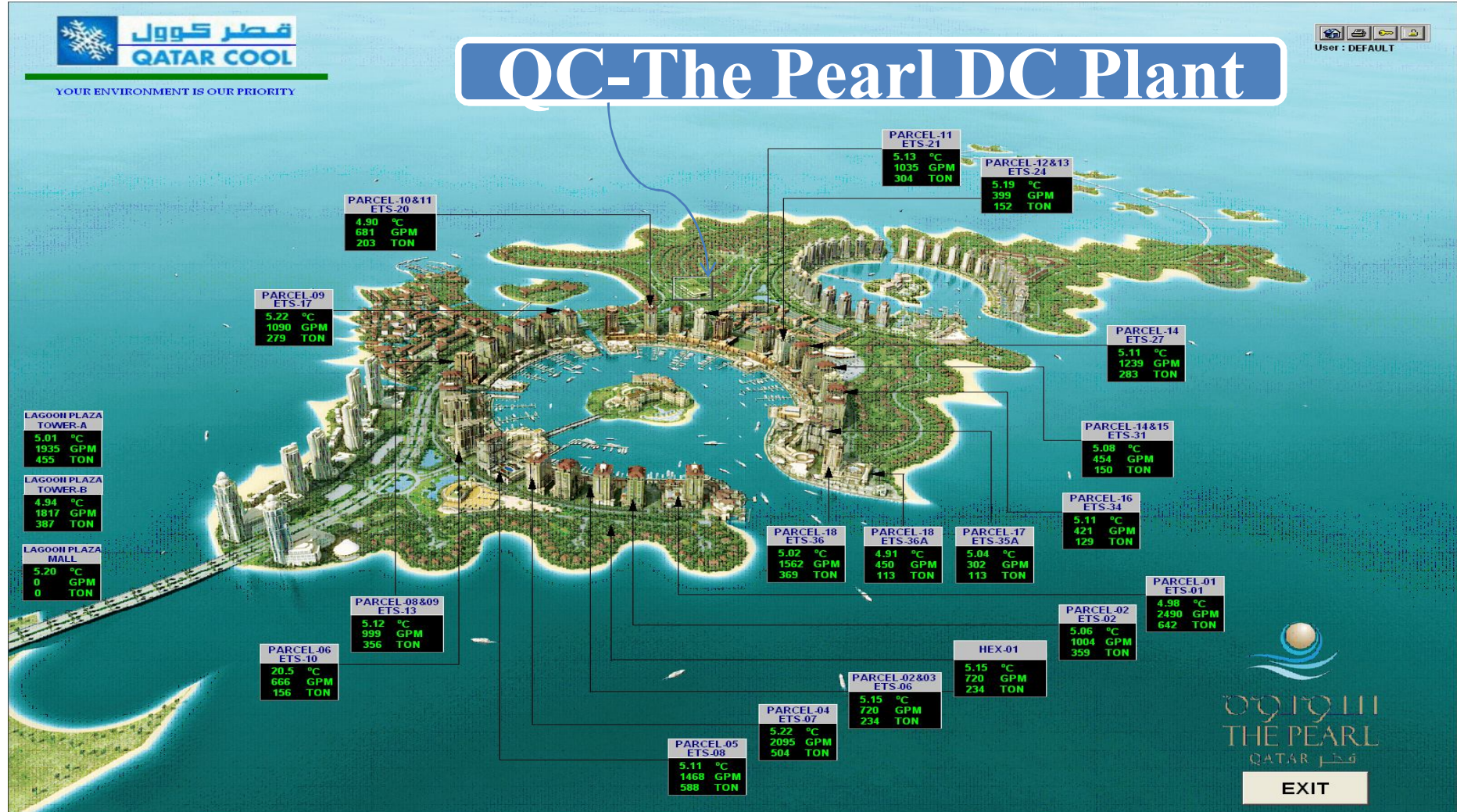
## WEST BAY, DOHA



No.	Category	Capacity (TR)	% of Total Load
1	Residential	28,186	31
2	Offices	40,539	46
3	Hotels	25,197	23
<b>Total</b>		<b>93,922 TR</b>	<b>100 %</b>

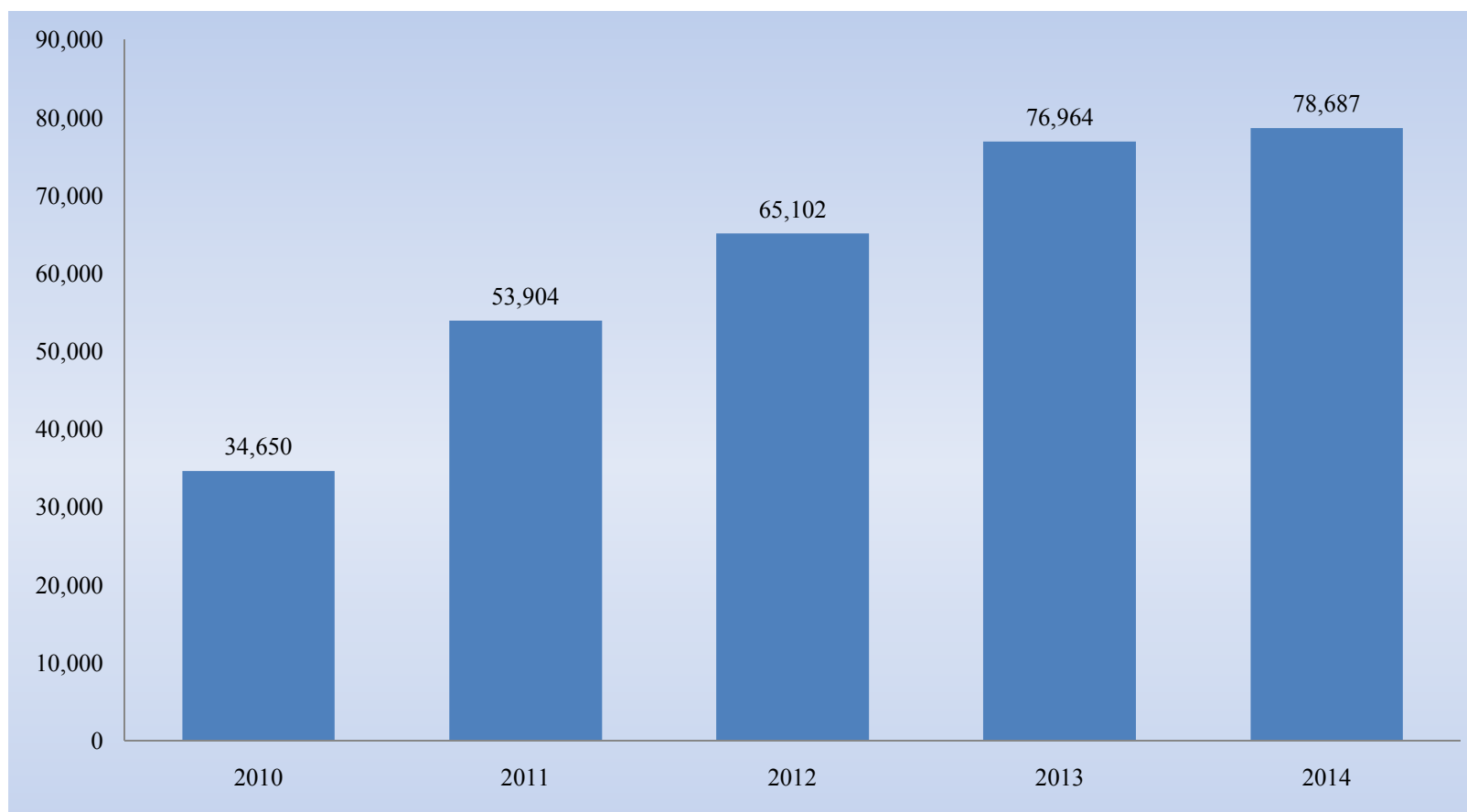


# QC-The Pearl DC Plant



EXIT

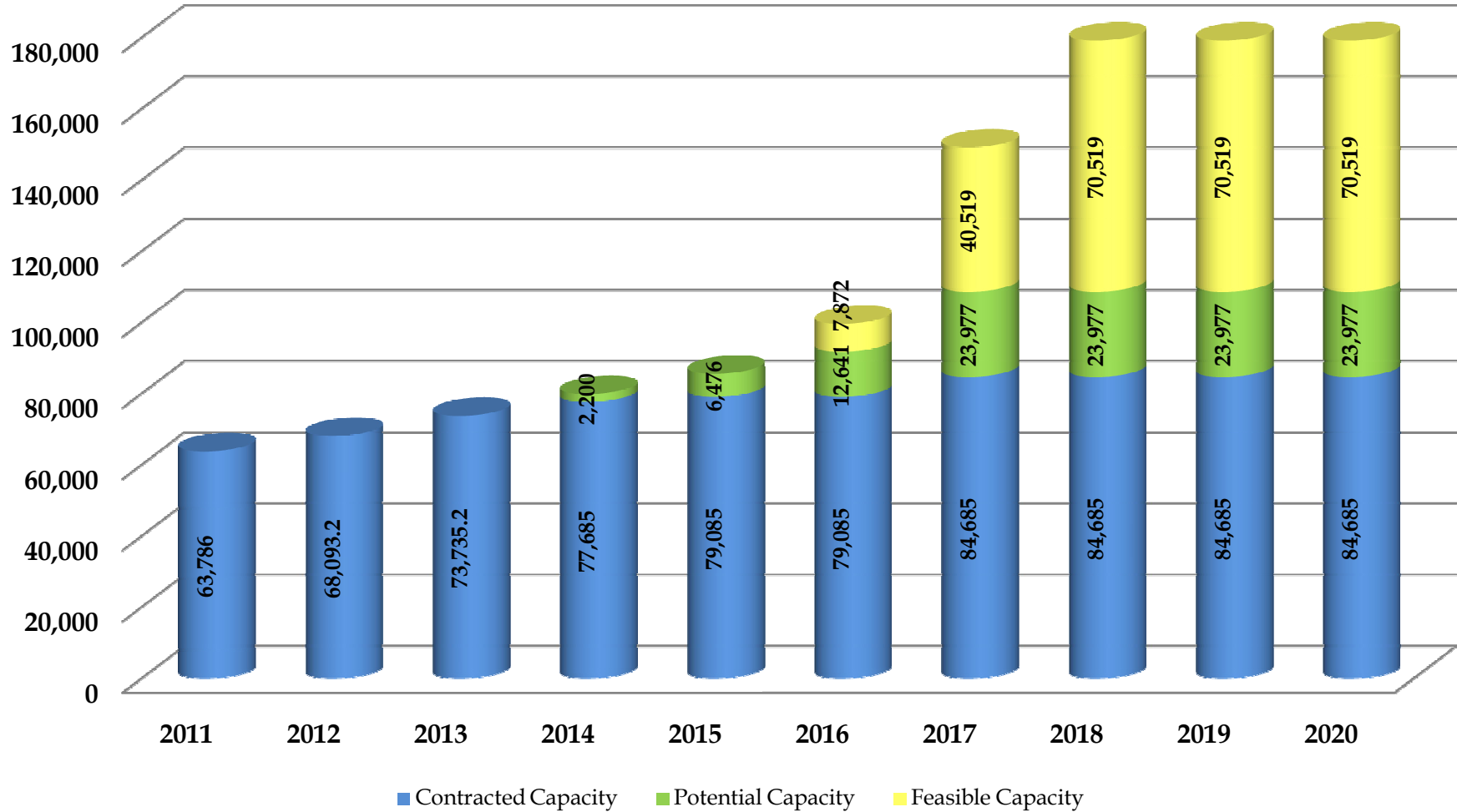
## Connected Load – The Pearl Qatar





# Qatar Cool - Expansion

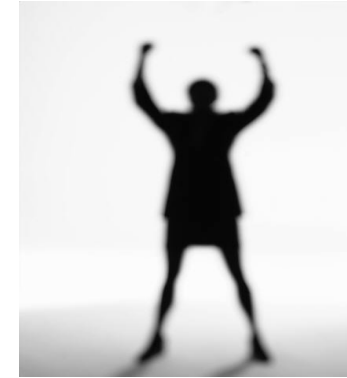
# WEST BAY AREA CAPACITY UPDATE



## The Pearl-Qatar DC Plant Expansion

- Current load 130K TR: reserved 100%.
- Growing Demand by around 20K TR:
  - Within the Pearl-Qatar
  - Outside the Pearl-Qatar

## AWARDS



### IDEA-2008

“DE SPACE BEYOND NORTH AMERICA CATEGORY”-WORLD WIDE:

**BRONZE AWARD:** NUMBER OF BUILDINGS COMMITTED TO DE.

**SILVER AWARD:** TOTAL BUILDING AREA COMMITTED TO DE.

### IDEA-2009

“DE SPACE BEYOND NORTH AMERICA CATEGORY”-WORLD WIDE:

**GOLD AWARD:** NUMBER OF BUILDINGS COMMITTED TO DE.

**SILVER AWARD:** TOTAL BUILDING AREA COMMITTED TO DE.

### IDEA-2010

“DE SPACE BEYOND NORTH AMERICA CATEGORY”-WORLD WIDE:

**BRONZE AWARD:** TOTAL BUILDING AREA COMMITTED TO DE.

### ACEC-2011

THE AMERICAN COUNCIL OF ENGINEERING COMPANIES “ENGINEERING EXCELLENCE AWARD (EEA) COMPETITION – THE “ACADEMY AWARDS OF THE ENGINEERING INDUSTRY”.

### IDEA-2012

“SYSTEM OF THE YEAR AWARD”:

**OPERATIONAL EXCELLENCE, ENVIRONMENTAL STEWARDSHIP, ENERGY EFFICIENCY, & CUSTOMER COMMITMENT”**

## 2013

### IDEA

**BRONZE AWARD:** NUMBER OF BUILDINGS COMMITTED TO DE BEYOND NORTH AMERICA.

**SILVER AWARD:** TOTAL BUILDING AREA COMMITTED TO DE BEYOND NORTH AMERICA.

**AWARD OF EXCELLENCE:** FOR MUNICIPAL SCHEME SERVING MORE THAN 10,000 CITIZENS AT 3RD GLOBAL DISTRICT ENERGY CLIMATE AWARDS.

**CERTIFICATE OF RECOGNITION:** FOR INNOVATIVE PRACTICES.

**CLIMATE CONTROL: THE BEST DISTRICT COOLING PROVIDER:** AT CLIMATE CONTROL MIDDLE EAST.

## 2014

**TARSHEED-KAHRAMAA: INDUSTRIAL BUILDING CONSERVATION AWARD.**

**IDEA:** “SYSTEM OF THE YEAR AWARD”: **OPERATIONAL EXCELLENCE, ENVIRONMENTAL STEWARDSHIP, ENERGY EFFICIENCY, & CUSTOMER COMMITMENT”**



# Current DC Challenges



## CURRENT DC CHALLENGES

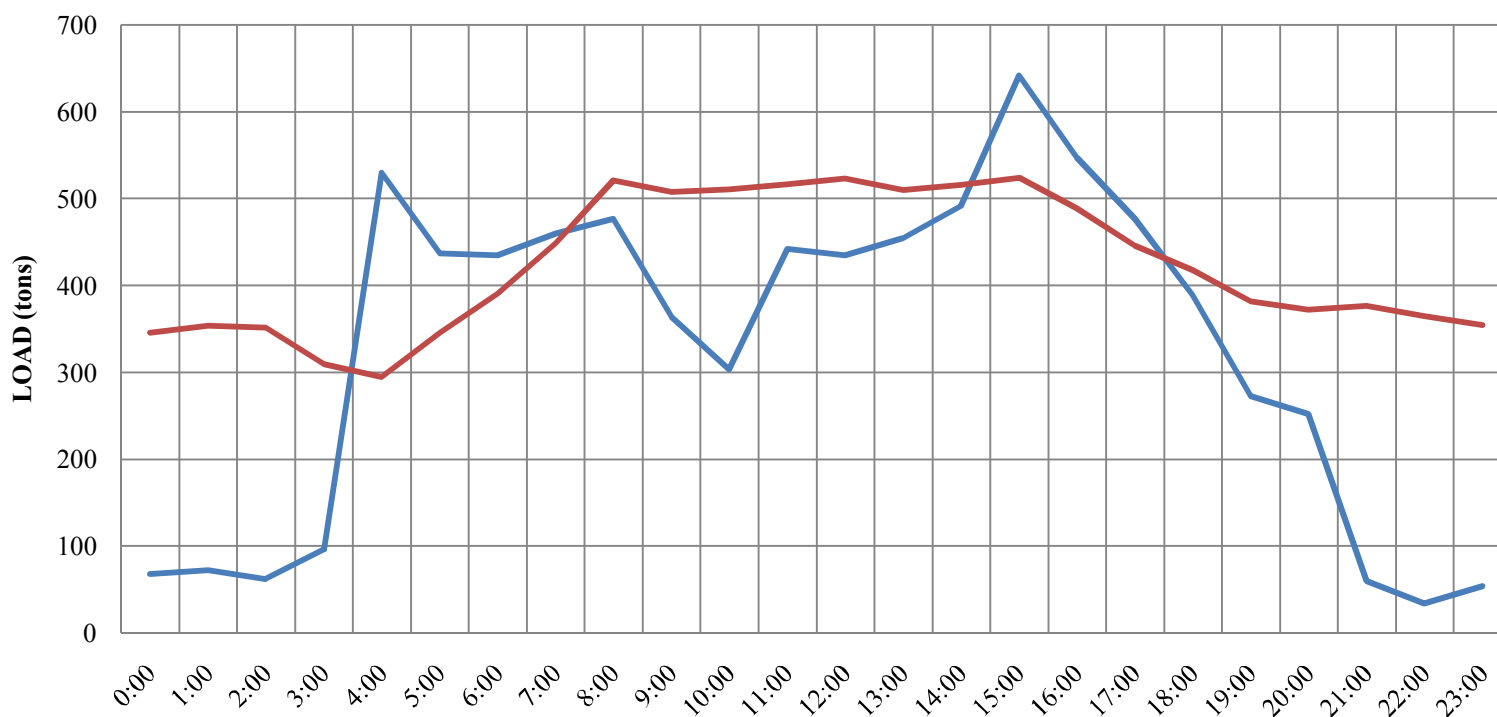
- Water Resource Management: Authorities' Approvals.
- Power Availability.
- Land Availability.
- Space for TSE Polishing Units (RO) in Existing Plants.
- New Piping Distribution Networks.
- Utility Charges (Residential/Commercial/Industrial).
- Performance of Customers' Buildings.

## Effects of Low $\Delta T$ on Energy Efficiencies

SUPPLY TEMP °C	RETURN TEMP °C	$\Delta T$ °C	FLOW US gpm/ton	INCREASE IN PUMPING POWER KW
5.5	14.4	8.9	1.50	1
5.5	13.4	7.9	1.68	1.40
5.5	12.4	6.9	1.93	2.13
5.5	11.4	5.9	2.26	3.42
5.5	10.4	4.9	2.72	5.96
5.5	9.4	3.9	3.42	11.85
5.5	8.4	2.9	4.60	28.84
5.5	7.4	1.9	7.026	102.76

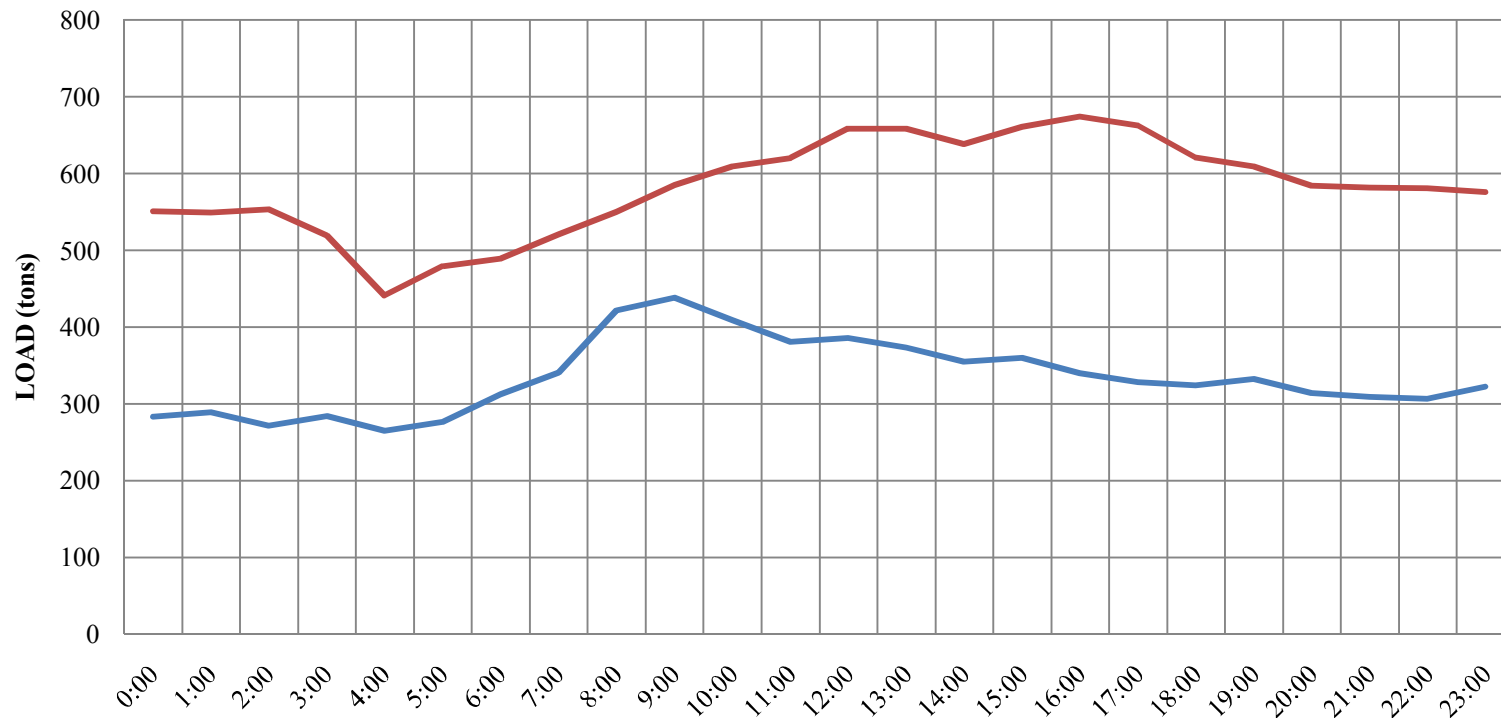
# Good: Building Cooling Load Profile

HOURLY LOAD PROFILE - HIGH  $\Delta T$  TOWERS (7 Aug 2011)



# BAD: Building Cooling Load Profile

HOURLY LOAD PROFILE - LOW  $\Delta T$  TOWERS (7 Aug 2011)







# Opportunities for Cooperation among DC Providers

## Opportunities for Cooperation among DC Providers

- Share of Knowledge & Experience.
- Interface of Piping Network for Back-up & Peak Loads.
- Utilization of DC Plants for Temp Cooling.
- Collective Collaboration with Authorities on Regulations, Standards, & Best Practices.

# Connected Power Saving-Qatar

## Mega-Watt

System Configuration	Qatar Current (800K TR)	Qatar ~ 2017 (1.5M TR)
Decentralized	1,768	3,315
District Cooling	800	1,500
<b>Estimated Saving</b>	<b>968</b>	<b>1,815</b>

### Basis of Calculations & Assumptions:

- DC @ 1KW/TR.
- Decentralized @ 1.7 KW/TR.
- DC is 30% less than decentralized (diversity).



# Power Consumption & CO<sub>2</sub> Emission Saving Qatar Mega-Watt-Hr/Yr

System Configuration	Qatar Current (800K TR)	Qatar ~ 2017 (1.5M TR)
Decentralized	2,380,000	4,462,500
District Cooling	1,400,000	2,625,000
<b>Power Saving</b>	<b>980,000</b>	<b>1,837,500</b>
<b>CO2 Emission Saving (Tons/yr)</b>	<b>500,000</b>	<b>937,500</b>

Basis of Calculations & Assumptions:

- DC @ 1 KW/TR & **50% Utilization** of total DC Capacity.
- Decentralized @ 1.7 KW/TR.

# Anticipated Cooling Water Requirements Qatar

Million m<sup>3</sup>/yr

System Configuration	Qatar Current (800K TR)	Qatar ~ 2017 (1.5M TR)
Decentralized	13.3	33
District Cooling	10.7	26
<b>Estimated Saving</b>	<b>2.6</b>	<b>7</b>

## Basis of Calculations & Assumptions:

- DC Companies' utilize Efficient Water Management Processes.
- **50% Utilization** of total DC Capacity.
- Study/Survey of Decentralized Systems Water Performance is underway. Expected to consume 25% over DC.

## Makeup Water & Discharge Quantities @ Different Water Sources

Million m<sup>3</sup>/yr

Water Source	Qatar Current (800K TR)	Qatar ~ 2017 (1.5M TR)
Potable	10	19
TSE-Direct	15	28
TSE-Polished	18	35

@ **50% Utilization** of total DC Capacity.