

## Normal Baharu Bandar Rendah Karbon Siri 6.0

RIGHT DESIGN & RIGHT SELECTION OF  
CHILLERS FOR CHILLED WATER SYSTEM

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TOTAL GREENHOUSE GAS EMISSIONS DUE TO  
CHILLER OPERATION WHICH ULTIMATELY  
AFFECTING THE CARBON RATINGS

INDIRECT EMISSIONS DUE TO CHILLERS ENERGY USE

+

DIRECT EMISSIONS OF REFRIGERANT

# REDUCING CARBON FOOTPRINT BY SELECTING THE RIGHT CHILLER SPECIFICATIONS

- DUE TO TIME CONSTRAINT WE WILL BE LOOKING AT THREE(3) SMALL AND SIMPLE CHANGES YOU CAN MAKE IN YOUR STATE TO ENSURE A LARGE AND LASTING DIFFERENCE IN REDUCING GREENHOUSE GAS EMISSIONS
  - i. SELECTING THE RIGHT CHILLER FOR THE RIGHT APPLICATION
  - ii. SELECTING THE RIGHT REFRIGERANT
  - iii. AUTOMATE It

## BREAKDOWN OF ENERGY UTILISED IN OFFICE BUILDING

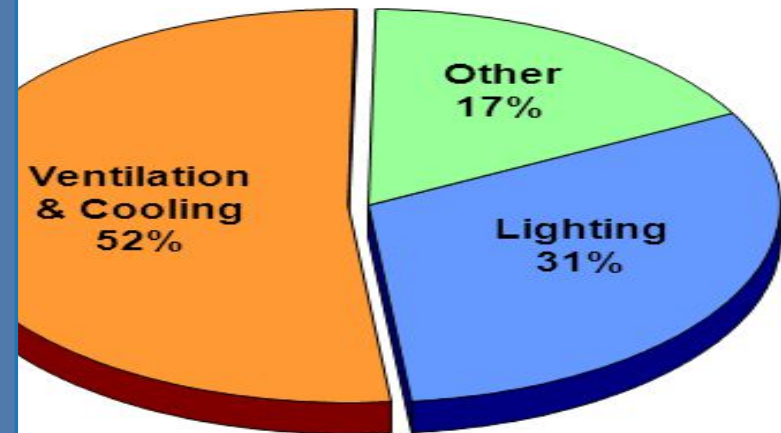
SIEMENS



### Energy Usage in Office Buildings

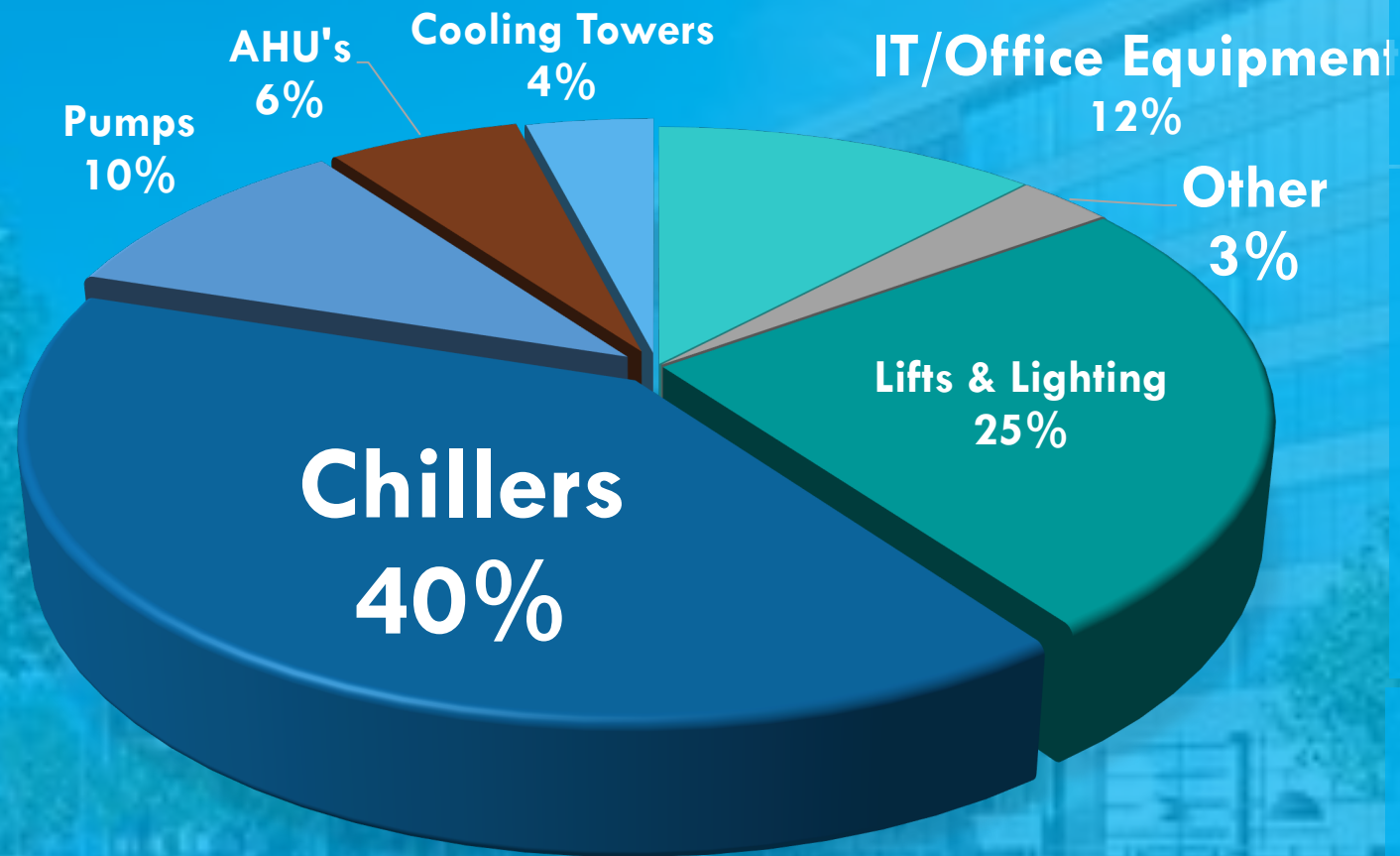
#### PERCENTAGE BREAKDOWN

LIGHTING	31%
OTHERS.	17%
ACMV.	52%



Building Technologies

## TYPICAL COMMERCIAL BUILDING ENERGY USAGE



- HVAC uses  $\approx 52\%$  of a TOTAL buildings power.

- Out of which, Chillers consumed approximately 35-45% of the total buildings power, Chiller being the single largest power consumer

- A right type of Chillers can reduce a buildings power bill by  $\approx 15-20\%$ .

## Energy Optimization for all existing buildings.



### Designers point of view

- 1 Design based on a very HOT DAY
- 2 Building material “U” Value estimated
- 3 High Fresh Air Intake Temperature
- 4 The Building is FULLY OCCUPIED
- 5 Person per sqft is at the highest
- 6 Equipment are ALL TURN ON
- 7 Lights are ALL TURN ON

**MALAYSIAN STANDARD  
GAZETTED IN PARLIMEN**

**ENDORSED BY CONSULTING  
ENGINEERS AND CHILLER  
MANUFACTURERS IN MALAYSIA**

**MS 1525 : 2014**

**Integrated Part Load Value ( IPLV ) , MS 1525**

$$\text{MPLV} = \frac{1}{( 0.01 / A + 0.29 / B + 0.65 / C + 0.05 / D )}$$

# MAESCO

(Pertubuhan Syarikat Syarikat Perkhidmatan Tenaga Malaysia)  
Malaysia Association of Energy Service Companies

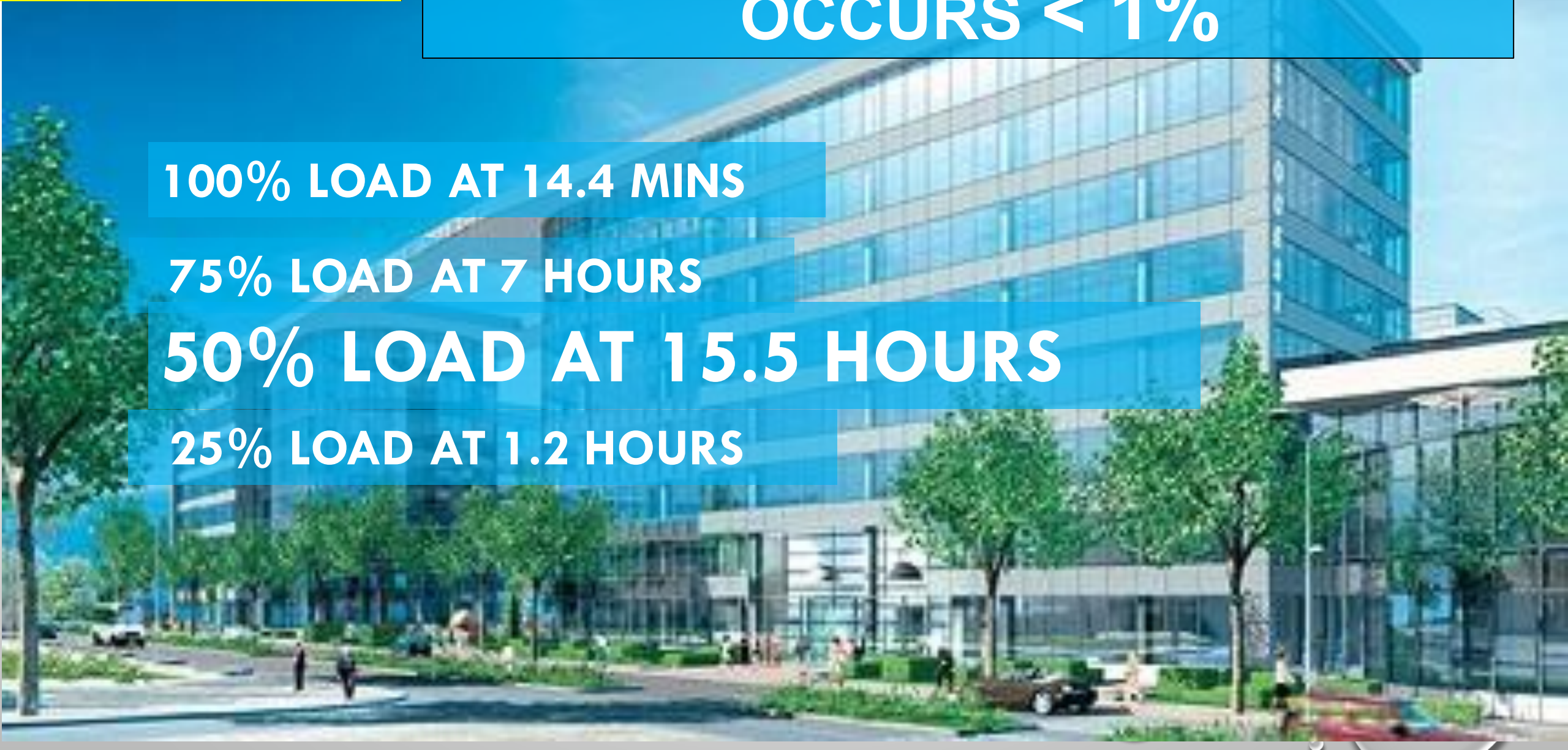
For a building to be at “full-load”  
**OCCURS  $< 1\%$**

**100% LOAD AT 14.4 MINS**

**75% LOAD AT 7 HOURS**

**50% LOAD AT 15.5 HOURS**

**25% LOAD AT 1.2 HOURS**



# CHILLERS IN MALAYSIA



And many more

**PLEASE VERIFY WHICH STANDARDS THEY COMPLY  
TO AND THEIR ELECTRICAL REQUIREMENT**



AHRI 550/590 Standard



EUROPEAN Standard



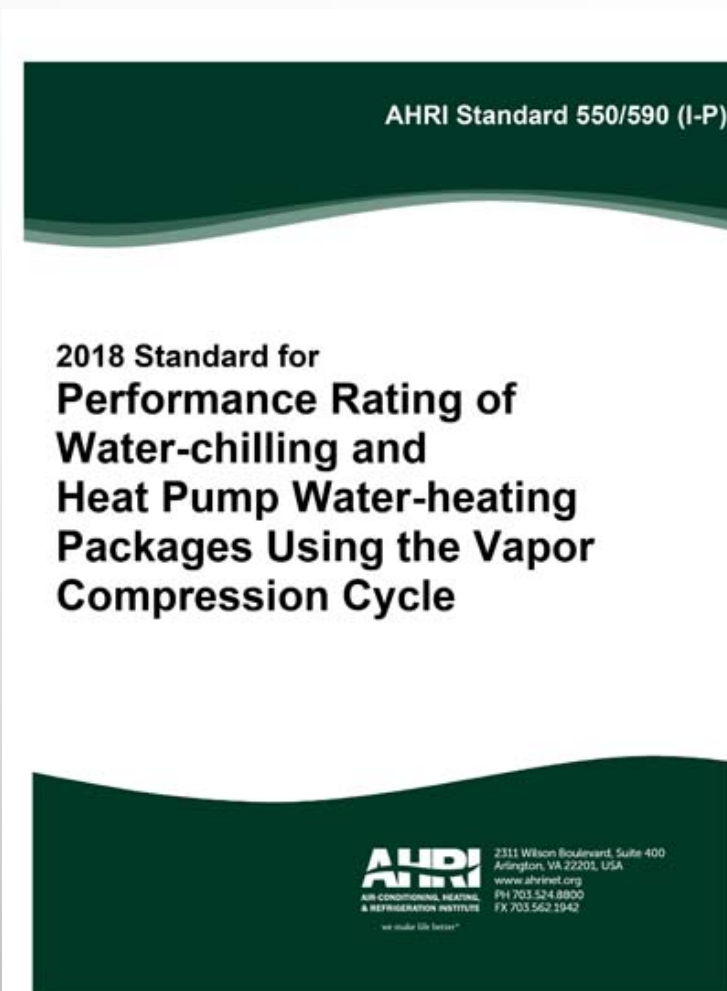
JAPAN INTERNATIONAL Standard



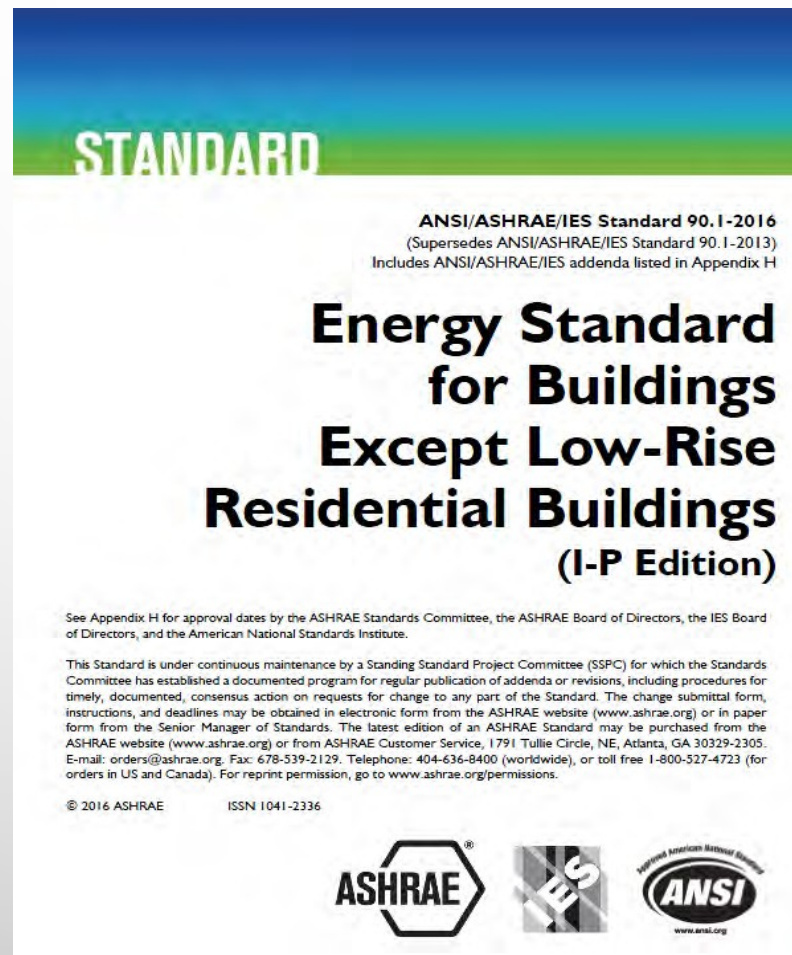
CHINA Guobiao Standard

# Standards Governing the Chiller Plant Efficiencies.

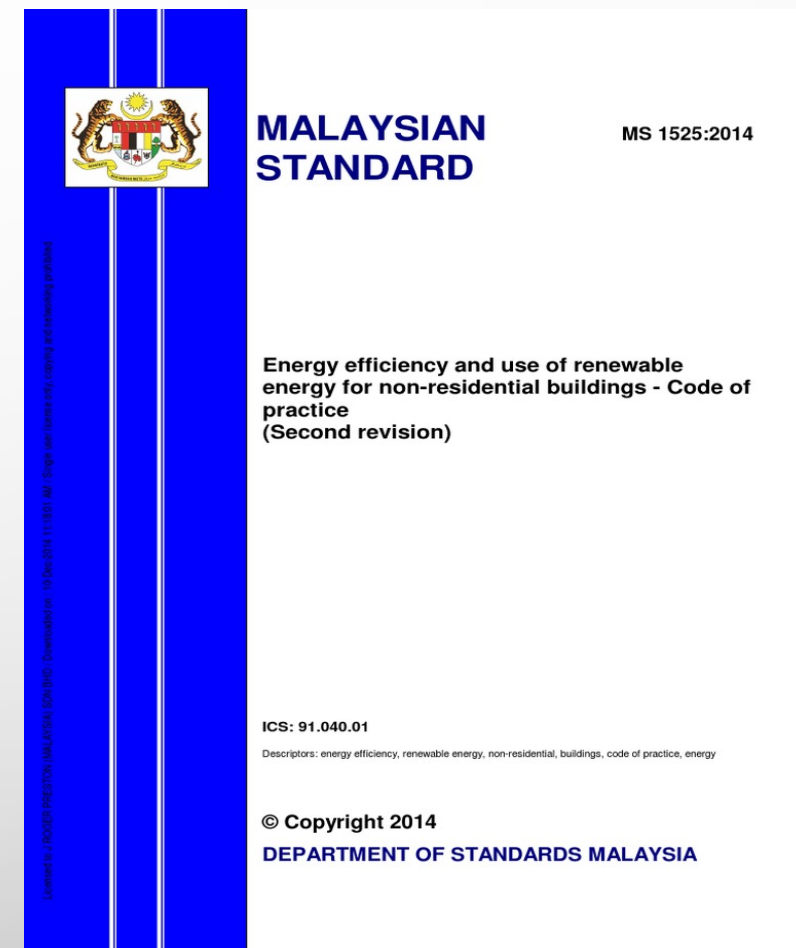
## ASHRAE 550/590



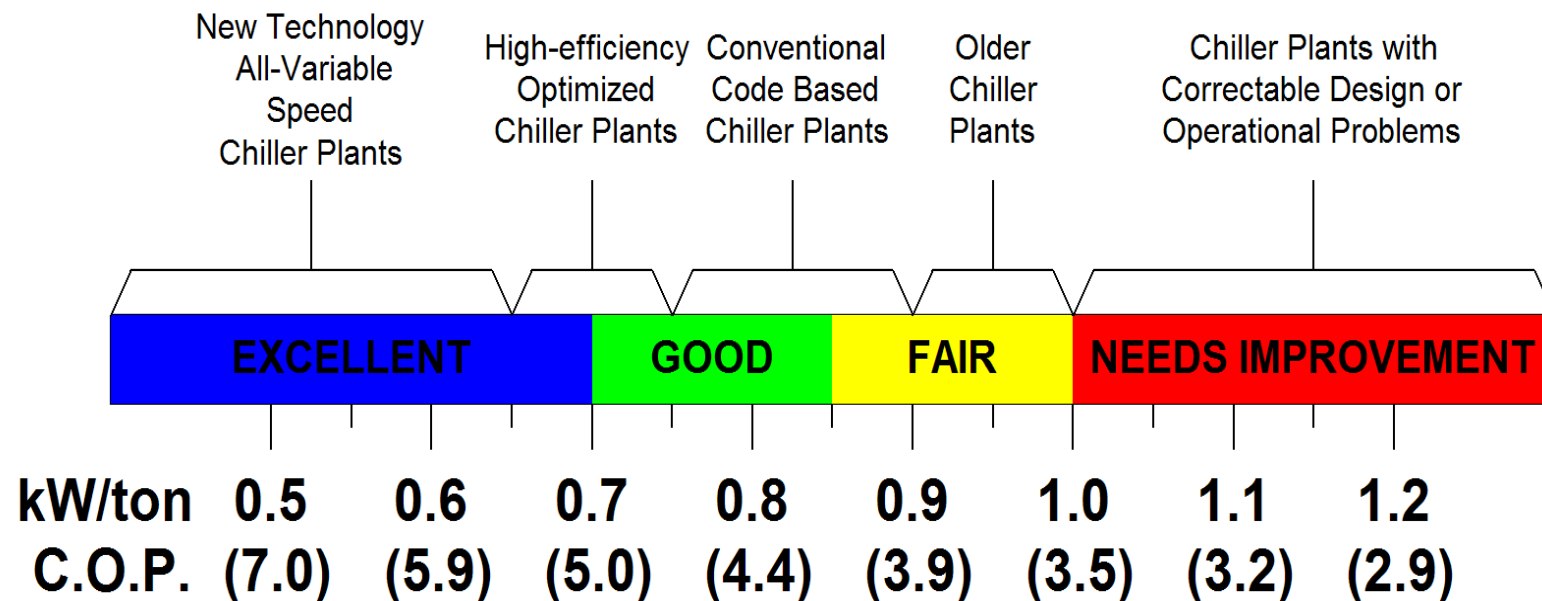
## ASHRAE 90.1



## MS1525:2014



# What constitute a good Chiller Plant kw/RT ?



**AVERAGE ANNUAL CHILLER PLANT EFFICIENCY IN KW/TON (C.O.P.)**  
*(Input energy includes chillers, tower fans, and condenser & chilled water pumping)*

*Based on electrically driven centrifugal chiller plants in comfort conditioning applications with 42F (5.6C) nominal chilled water supply temperature and open cooling towers sized for 85F (29.4C) maximum entering condenser water temperature.*

*Local Climate adjustment for North American climates is +/- 0.05 kW/ton*

1

**Your Industry Need**

2

**Your Operating Hours**

3

**Your Current M&E Infra**

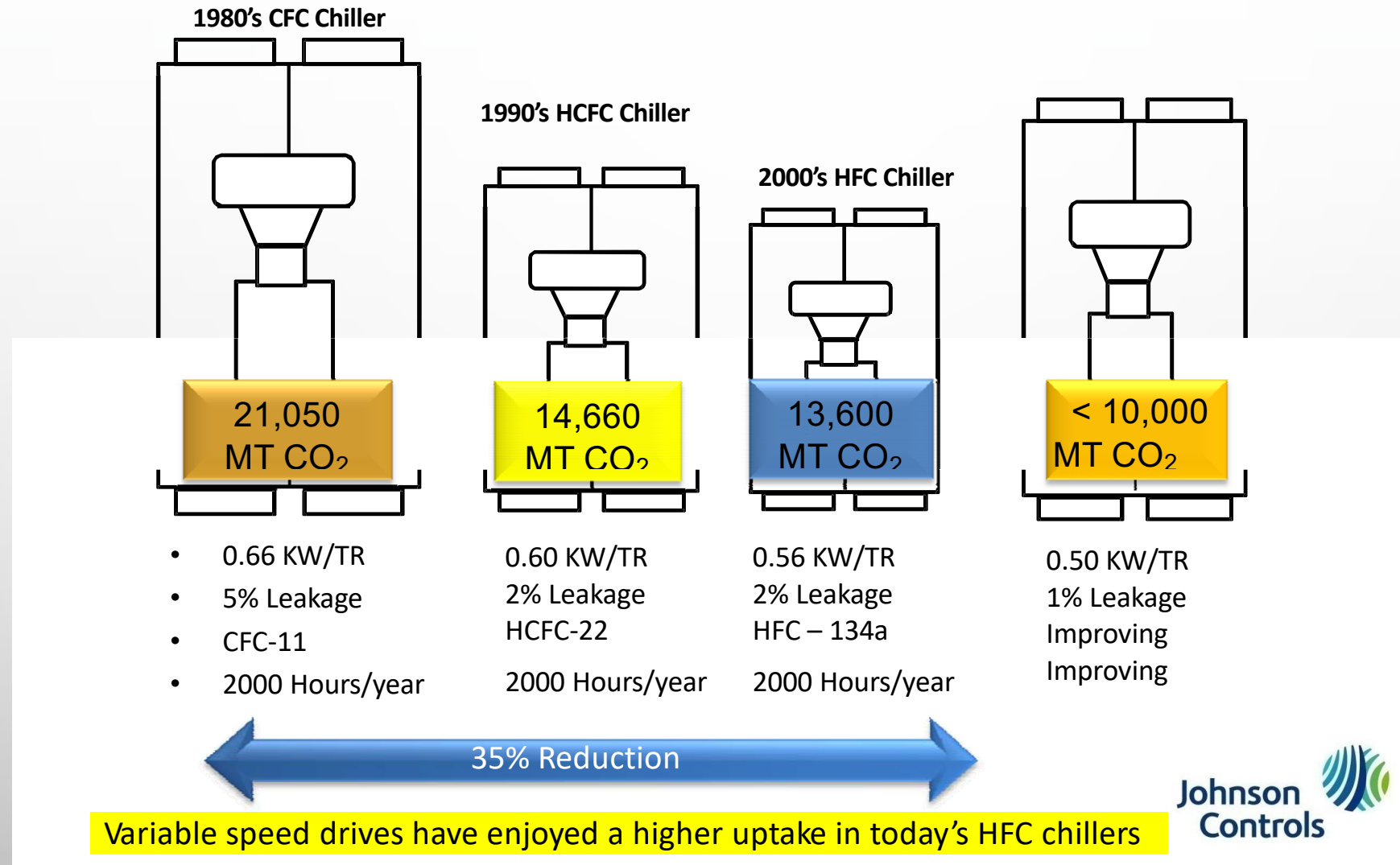
4

**Existing Equipment Limitation**

5

**Budget & Financial Req**

## Chiller Carbon Footprints



**2014 Table 25. Water chilling packages, electrically driven:**

Equipment	Size	<sup>1</sup> COP @100% Load at M'sian test Conditions		<sup>a</sup> MPLV @ MS Std Conditions		<sup>2</sup> COP @100% Load at Std AHRI test Conditions		<sup>b</sup> IPLV@ AHRI Std Conditions	
		Min COP	Max kWe/RT	Min COP	Max kWe/RT	Min COP	Max kWe/RT	Min COP	Max kWe/RT
Air cooled, with condenser	< 105 kWr(30RT)	2.79	1.26	3.20	1.10	2.79	1.26	3.66	0.96
	≥ 105 kWr and < 530 kWr(150RT)	2.79	1.26	3.20	1.10	2.79	1.26	3.66	0.96
	≥ 530 kWr and < 1060 kWr(300RT)	2.79	1.26	3.35	1.05	2.79	1.26	3.74	0.94
	≥ 1060 kWr(300RT)	2.79	1.26	3.35	1.05	2.79	1.26	3.74	0.94
Water cooled, positive Displacement (Reciprocating, Scroll, Rotary Screw)	(< 260 kWr) (< 75RT)	4.34	0.81	4.14	0.85	4.51	0.78	5.58	0.63
	> 260 < 530 kWr(150RT)	4.34	0.81	4.14	0.85	4.51	0.78	5.67	0.62
	≥ 530 kWr and < 1060 kWr(300RT)	4.95	0.71	4.45	0.79	5.17	0.68	6.06	0.58
	≥ 1060 kWr(300RT)	5.41	0.65	4.82	0.73	5.67	0.62	6.51	0.54
Water cooled, Centrifugal	< 1060 kWr(300RT)	5.33	0.66	5.02	0.70	5.58	0.63	5.86	0.60
	≥ 1060 kWr(300 to 600 RT)	5.86	0.60	5.41	0.65	6.06	0.58	6.39	0.55
	> 600 RT	5.96	0.59	5.58	0.63	6.17	0.57	6.51	0.54

# Air Cooled Vs Water Cooled Chiller Performance Chart

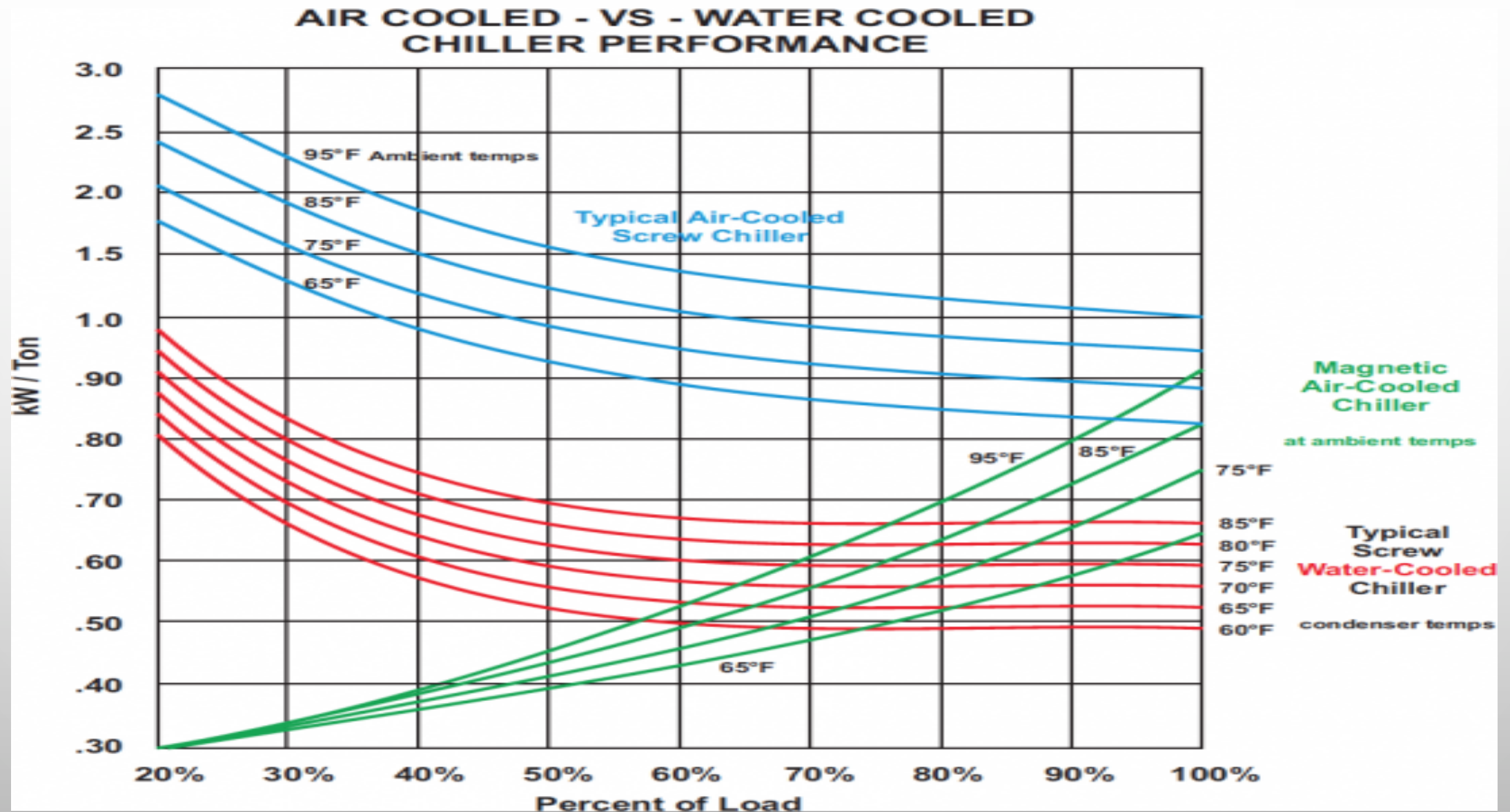
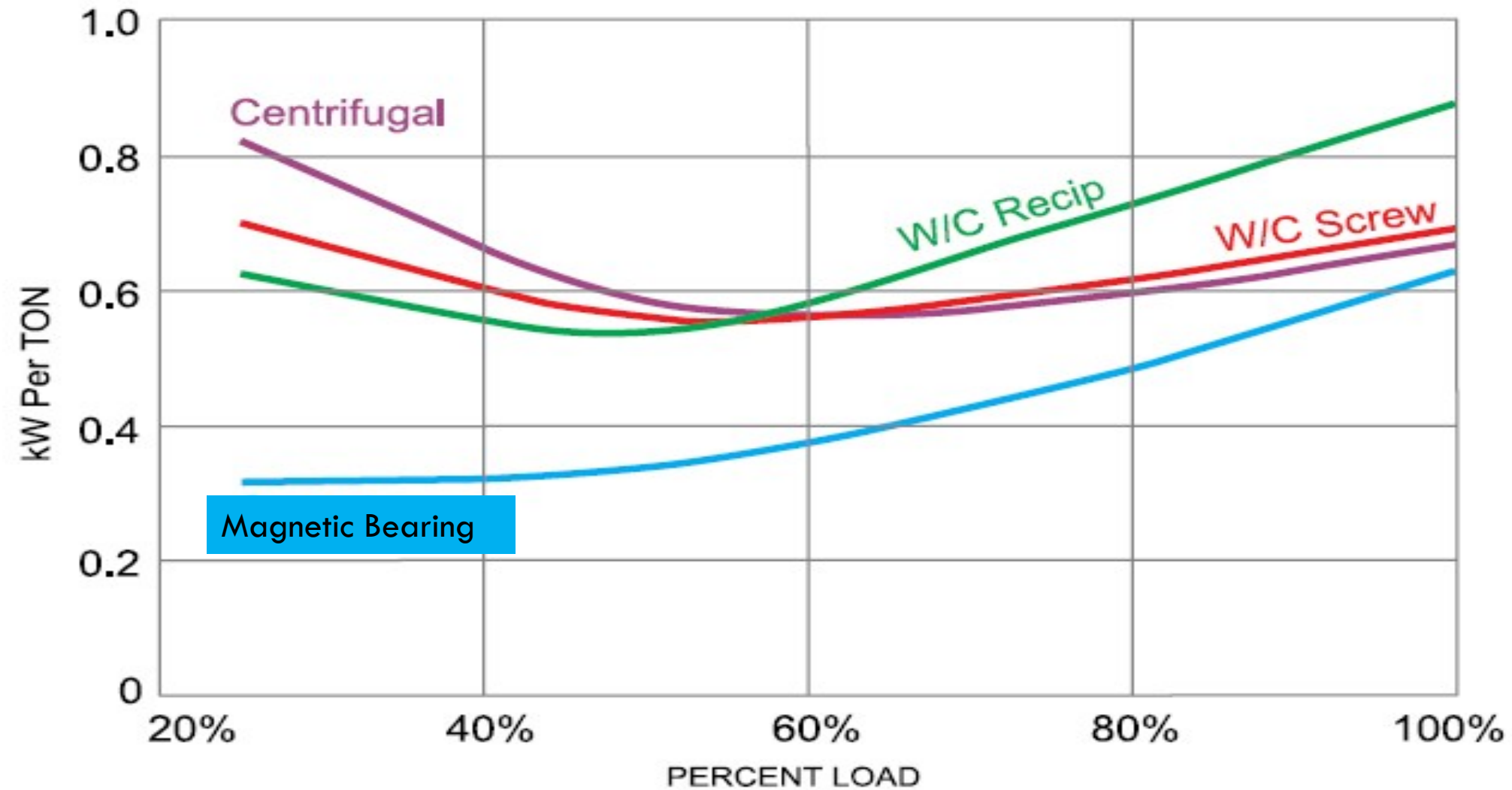
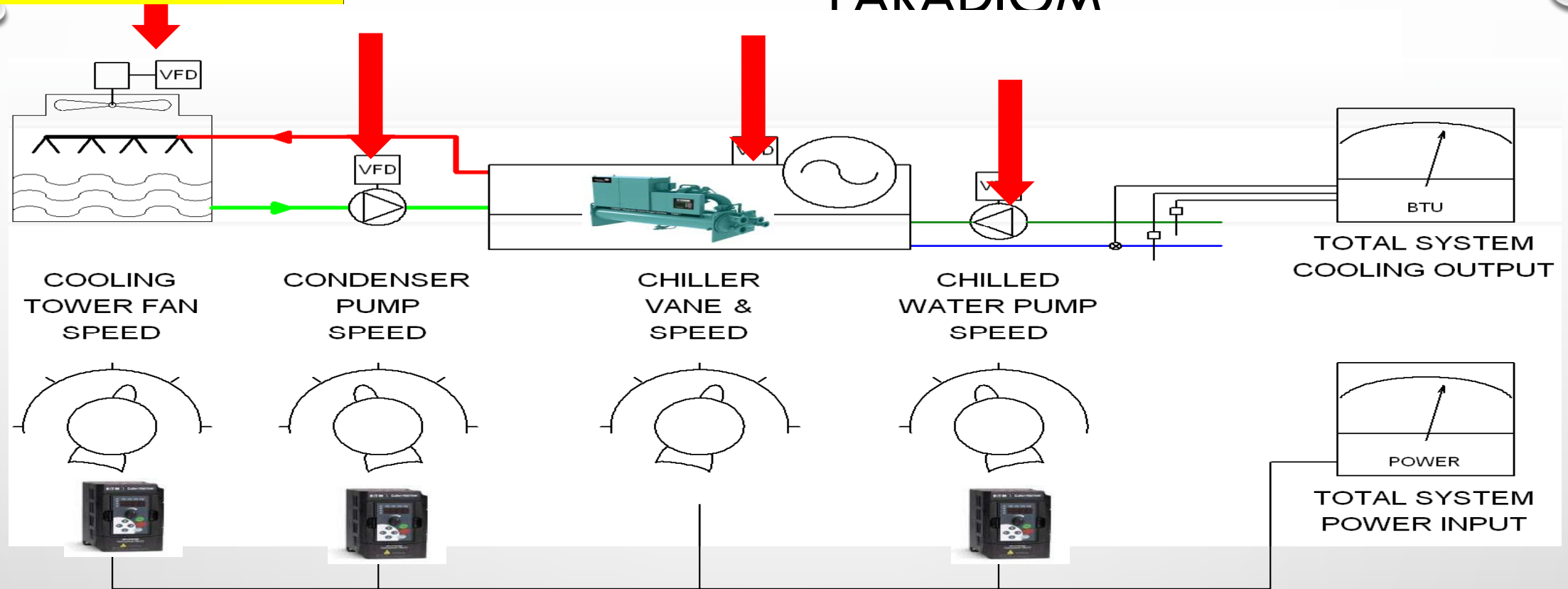


Diagram: Comparison uses generic industry performance data for 250T. water-cooled chillers (data source AHRI) with cooling tower relief









# ALL VARIABLE SPEED PLANT.....THE NEW PARADIGM

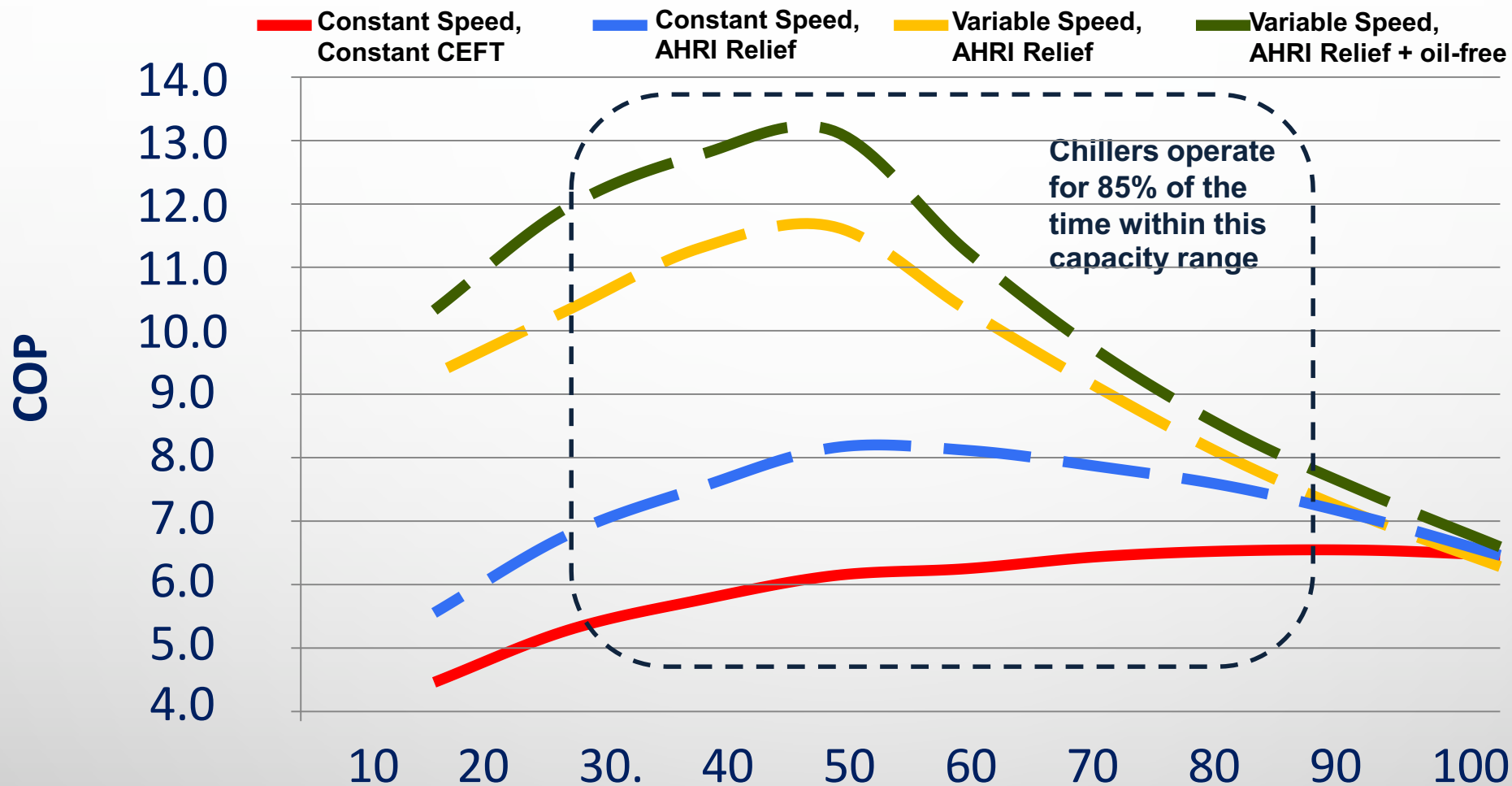


VARIABLE SPEED CUTS ENERGY COSTS AND REDUCED CARBON EMISSIONS BY UP TO 20% COMPARED WITH TRADITIONAL CHILLERS

# The Purpose of Variable Speed Drives

-  Starts & stops the motor
-  Significantly reduces inrush current to less than full load amps
-  Corrects power factor close to unity 
-  Reduces utility electrical demand
-  Regulates compressor speed to provide the most efficient chiller operation, reducing part load energy consumption

WITH OR WITHOUT VSD. VSD technology unlocks efficiency benefit of natural weather conditions



Note: Above is based on water cooled centrifugal compressor technology



# **SELECTING THE RIGHT REFRIGERANT**

## MS2678:2017 Flammable Refrigerant System Code of Practice - OVERVIEW -

Ir CHEN Thiam Leong DL&FASHRAE  
FIEM, FIFireE, PE, CE

## SELECTING THE RIGHT REFRIGERANT

Selecting low global warming potential (GWP) refrigerant chillers for space cooling

GWP is a measure of the warming effect of a gas relative to the warming effect of an equivalent amount of carbon dioxide, usually over a 100-year period.

By switching to low GWP refrigerants, companies can help reduce Sabah's greenhouse gas emissions arising from the refrigeration and air-conditioning sector

## Why Choosing the right refrigerant is important

**Picking a chiller based on refrigerant alone can result in unintended consequences for the owner and the environment**

- Safety code compliance
- Operator training
- Insurance cost
- Reliability
- Legal risk
- Stability



- Efficiency
- Capacity
- Low GWP
- Availability
- Cost of ownership
- Customer preference
- Intellectual property
- Regulatory certainty
- Other industry uses

## CURRENT SITUATION

### MALAYSIA

- CFC (R-11, R-12) PHASED OUT
- HCFC (R-22, R-123) PHASING OUT PROGRAM IN PLACE
- HFC (R-134A, R-32) PHASING DOWN SCHEDULE ON THE WAY
- NATURALS (HC 290) INCREASINGLY CREEPING ON BOARD
- HFC-134A, HFC-410A ARE PREVALENT
- HFC-32 INTRODUCED IN INDONESIA BEGINS TO MAKE ITS MARK
- HFOS(R-1234YF) BEGINNING TO APPEAR

### GLOBAL

- CFCS SUCCESSFULLY PHASED OUT (CIRCA 2000)
- HCFC PHASE OUT PROGRAM IN PROGRESS
- HFC PHASE DOWN COMMENCED
- LOW GWP AND MILDLY FLAMMABLE HFC/HFOS COMING ON STREAM
- HFOS GEARING UP TO REPLACE HIGH GWP HFCS
- NATURAL REFRIGERANTS PROGRESSING AT VARYING PACE

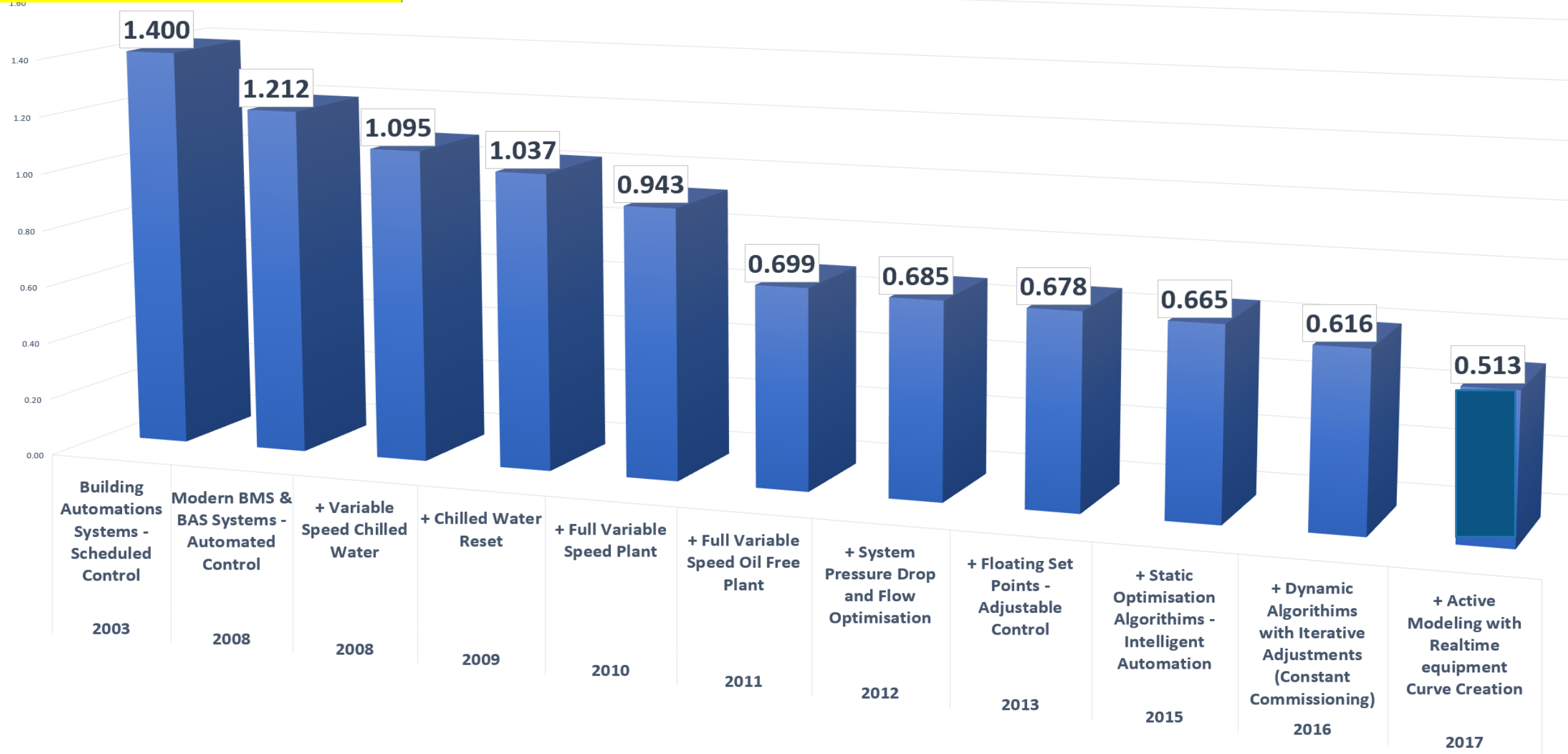
NOT ALLOWED		ALLOWED	
CFC	HCFC	HFC	OTHER
R 11	R 22	<del>R 22</del>	<del>R 170</del>
R 12	R 123	<del>R 32</del>	<del>R 200</del>
R 13	R 124	<del>R 107 A</del>	<del>R 600 A</del>
R 114	R 142B	<del>R 125</del>	<del>R 717</del>
R 500	R 401 A	R 134 A	<del>R 744</del>
R 502	R 401 B	<del>R 143 A</del>	<del>R 1270</del>
R 503	R 402 A	<del>R 152 A</del>	<del>R 718</del>
	R 402 B	<del>R 227 EA</del>	R514A (LOW)
	R 403 A	<del>R 236 A</del>	R513A (MED)
	R 403 B	<del>R 316 A</del>	R1233 ZD (LOW)
	R 408 A	<del>R 404 A</del>	R1234 YF (MED)
	R 409 A	<del>R 407 A</del>	R1234 ZE (MED)
	R 409 B	<del>R 407 B</del>	
		R 407 C	
		R 410 A	
		<del>R 507</del>	
		<del>R 508 A</del>	
		<del>R 508 B</del>	
		<del>ISCEON 55</del>	
		<del>ISCEAON 65</del>	

The image features a light gray gradient background. In the top-left and bottom-right corners, there are several realistic water droplets of varying sizes, rendered with soft shadows and highlights to give them a three-dimensional appearance. The title text is centered in the middle of the frame.

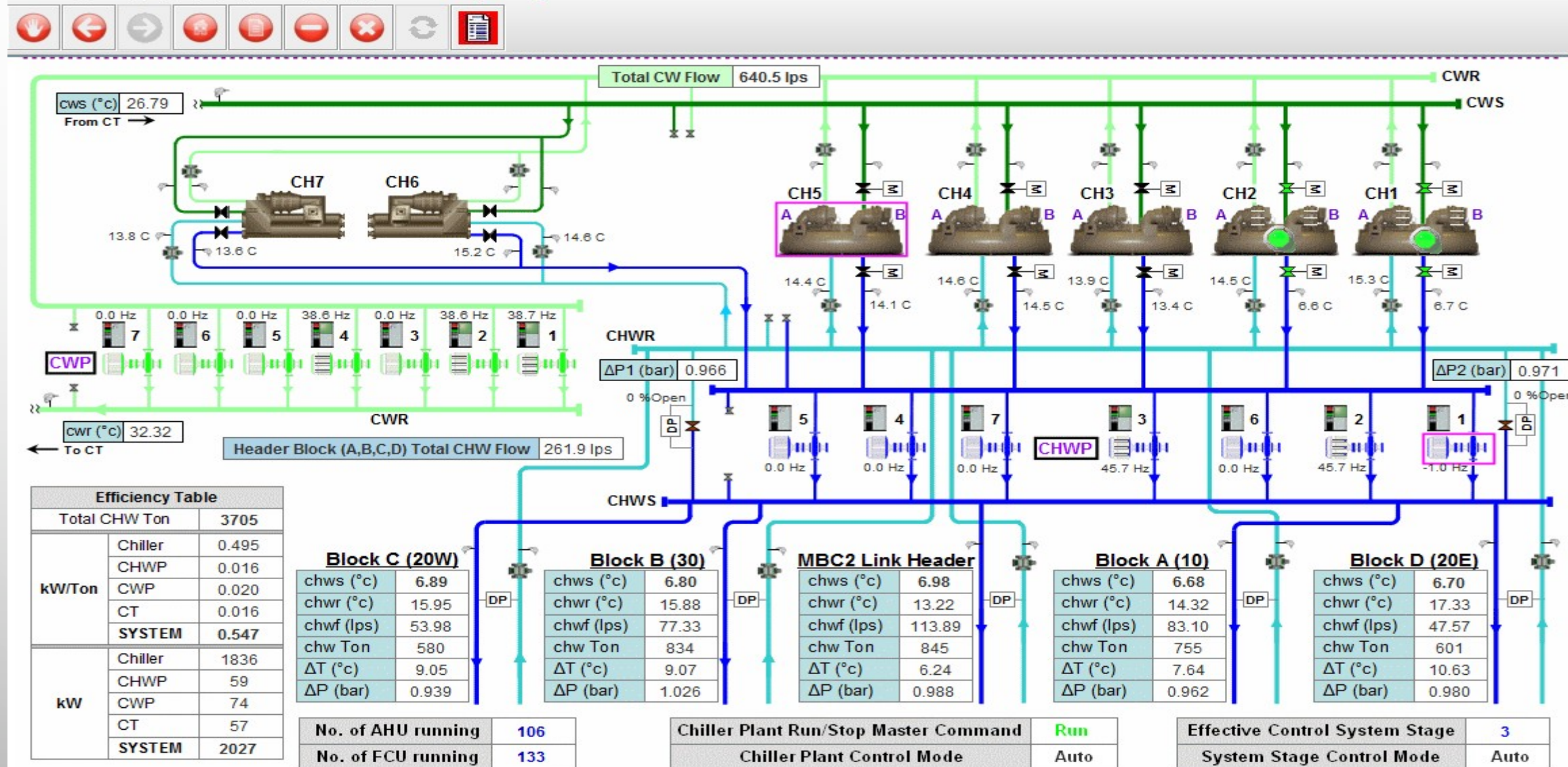
# **CHILLER MANAGEMENT SYSTEM**

IT IS IMPERATIVE YOU INCORPORATE CHILLER MANAGEMENT SYSTEM TO YOUR CENTRAL COOLING PLANT. MAIN BENEFITS INCLUDES

1. MAXIMIZE COMFORT, COMPLIANCE AND PERFORMANCE
2. INCREASED EFFICIENCY
3. INCREASED RELIABILITY
4. REDUCED ENERGY COST
5. REDUCES OPERATING COST
6. IMPROVE SUSTAINABILITY
7. REDUCED DOWNTIME
8. ATTRACTIVE PAYBACK



Renew Drawing Real(nfv) Tools Log Help Tuesday, 30 August 2016 04:12:51 PM SGT



# LIFE CYCLE COST - 20 YEARS LIFE

## Initial Cost

Equipment Cost + Installation + Testing & Commissioning

## Future Cost

Equipment Energy Consumption  
Equipment Maintenance & Consumables

Equipment Availability of Spare parts  
Equipment Technical Backup

Equipment Reliability  
Equipment Downtime

Minimized Carbon Footprint  
Lowered Environment Cost

4.92%

95.08%

# MAESCO

(Pertubuhan Syarikat Syarikat Perkhidmatan Tenaga Malaysia)  
Malaysia Association of Energy Service Companies

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**Thank  
you!**