

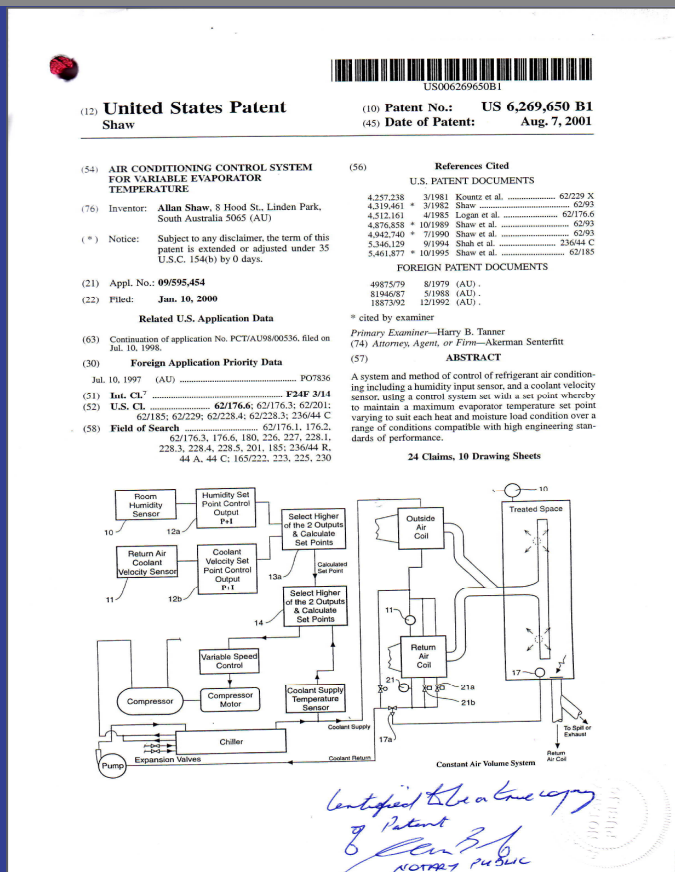


# Agenda



- SMAC = SHAW Method of Air Conditioning
- SMAC: State of the Art Technology for ESCO
- Energy Savings results of SMAC in various climate conditions
- Full Load vs. Part Load
- Existing Air Conditioning Process (Chilled Water System) and its nature of energy consumption
- The outlook of the SMAC process
- SMAC Performances in Full Load Condition
- SMAC Performances in Part Load Condition
- The whole year SAVINGS from various projects around the world
- Expecting paybacks of SMAC
- Q&A

# SMAC = SHAW Method of Air Conditioning



- Invented by Dr. Allan SHAW
- Globally Patented
- SMAC is the new **process** for Air Conditioning which Eliminate the today 100+ Years old technology energy waste
- Work with ANY brand and process conditions

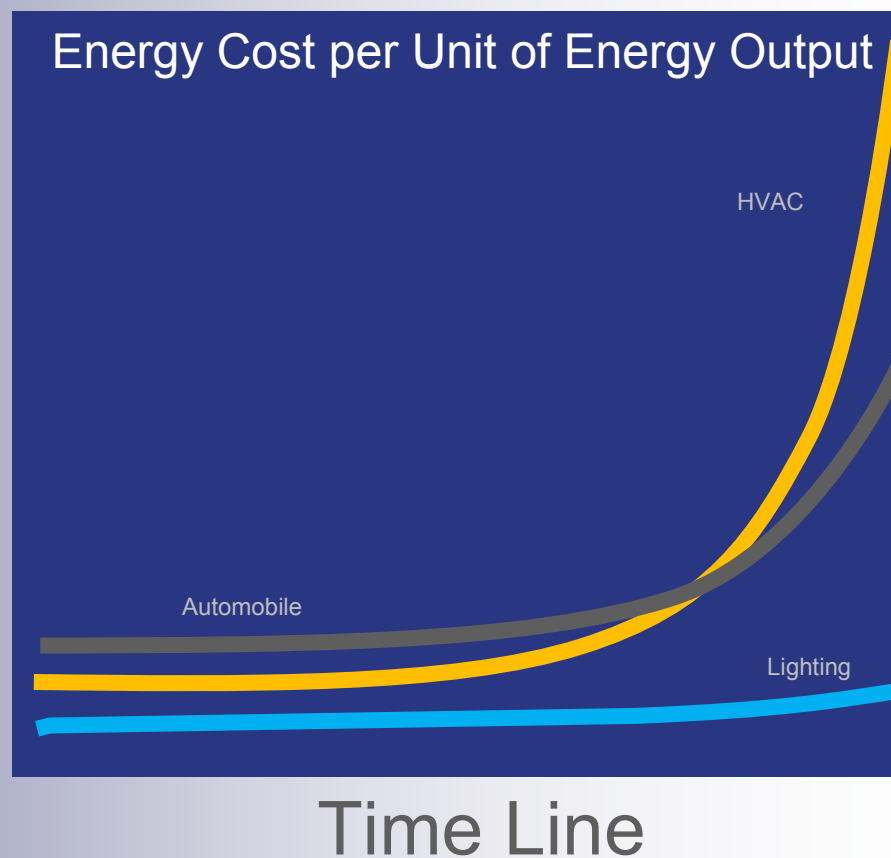
# The Brutal Fact of HVAC process



- HVAC is the Highest Energy consumption segment in Buildings & Air Conditioning Factory in all climate type
  - In Hot & Humid Country > HVAC consume 50-70% of energy bill
  - In Cold & Dry Country > HVAC consume 30-60% of energy bill
  - In precision manufacturing process ( Semiconductor, Data Center, Bio and Petrochem) HVAC consume upto 80% of energy bill
- Today HVAC process technology “Invented 100+ years” by Dr. Carrier and we still using same process with same process efficiency in 99% of installation of the WORLD



- HVAC process is one of the poorest PERFORMANCE in any facility
- FOR ESCO = High Business Potential

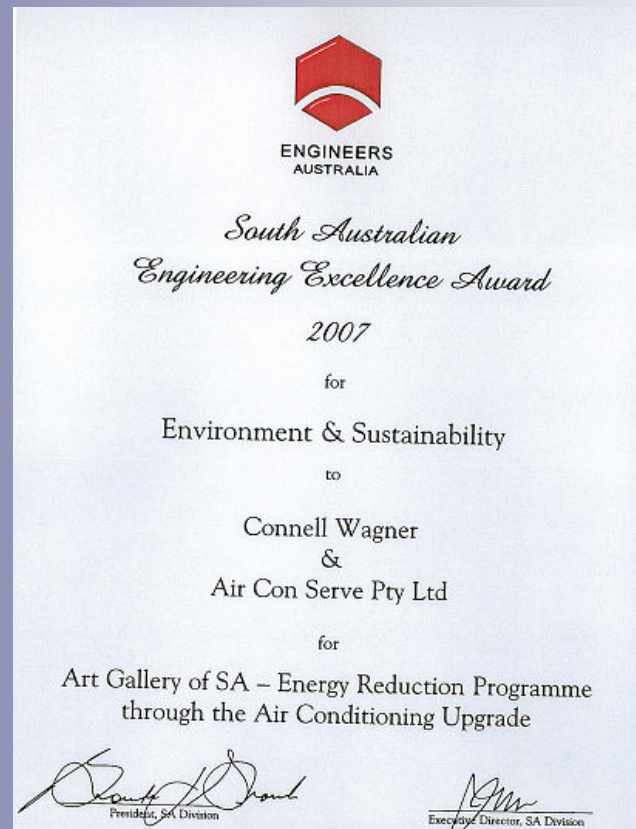


# SMAC: State of the Art Technology for ESCO



- **Success Proof Energy Saving for HVAC**
- **High Saving Potential up to 60% energy saving**
- **Work with existing installation as well as new installation**
- **Straight forward M&V**
- **Highly Effective ECM, Large energy saved and enhance payback**

# Peer Recognition



## Energy Savings results of SMAC in various climate conditions

# Hot & Dry



Project	Energy Savings	Comments
Barmera Hospital	30%	National NECA Award 2002
Art Gallery of SA	50%	National Awards NECA, AIRAH, FMA State Award, Engineers Aust Case Study No 10 <a href="http://www.brite.crcci.info">www.brite.crcci.info</a>
Citi Centre	60%	Finalist CoolWorld Awards – Retrofit of the Year Example No 1 Being the Best <a href="http://www.brite.crcci.info">www.brite.crcci.info</a>



## Hot & Humid



Project	Energy Savings	Comments
Siam Cement HQ Buildings	35%	Improved Air Conditioning Quality through increasing outside air by 800%
Rolly Tasker	63%	Savings from Previous Facility Energy Usage 80kWhr/SQM/Annum Thailand's Optimum Target 120 kWhr/SQM/Annum
Petchaburi Hospital Bangkok Hospital	50%	Installed to operating Theatres (OT) Typical Thailand OT Cooling Load 45 kW SMAC OT 28 kW and provided ideal conditions within theatres

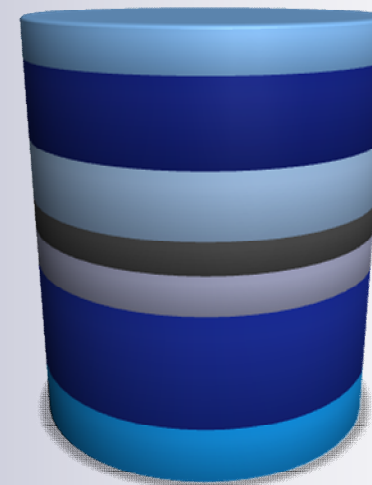


# Full Load vs. Part Load of HVAC system



- Process Design at Full Load **PLUS** safety factor

% Load

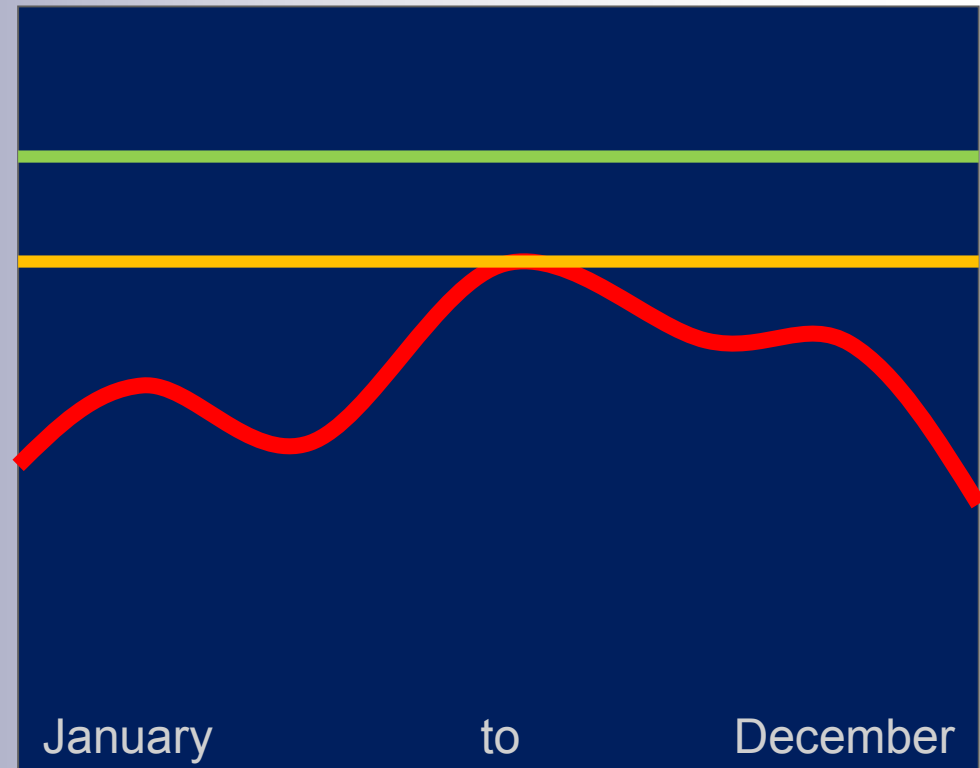


- Safty Factor
- Others
- Equipments
- Lighting
- Human
- Ventilatoin

## Full Load vs. Part Load of HVAC system



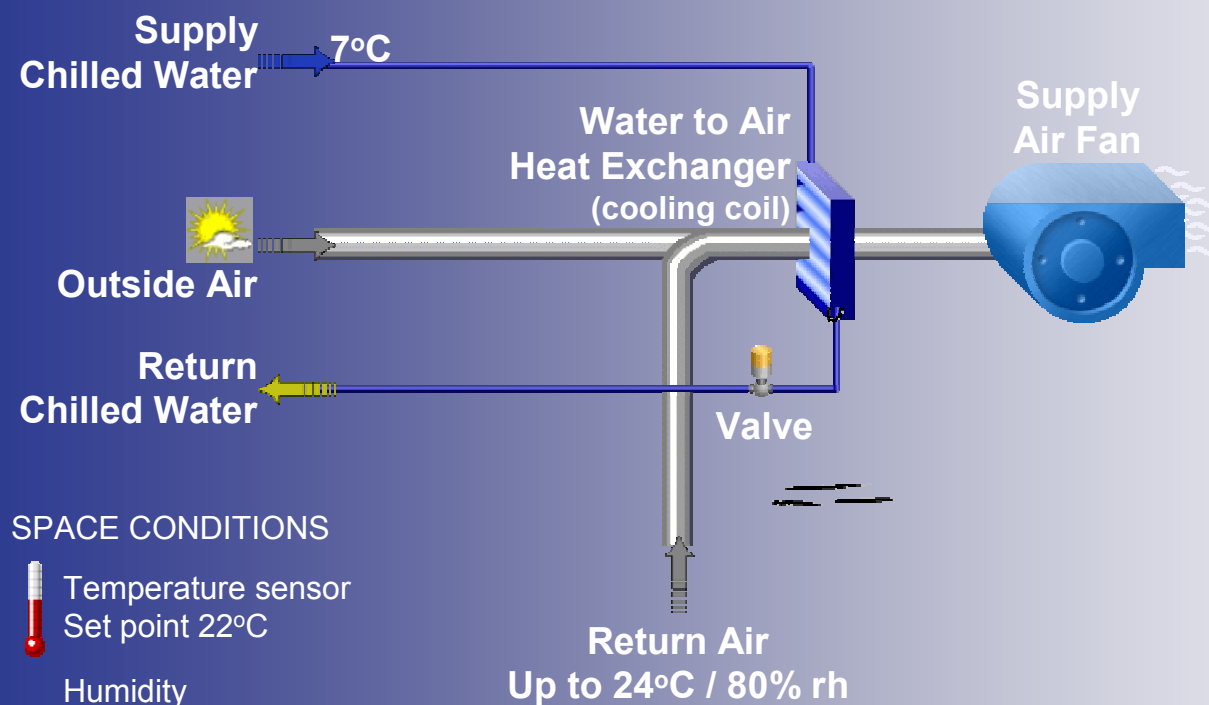
- Process Design at Full Load **PLUS** safety factor
- Process Operate at real load w/o any safety factor = PART-LOAD





# Existing Air Conditioning Process (Chilled Water System) and its nature of energy consumption

# Conventional Air Handling Unit



## SPACE CONDITIONS

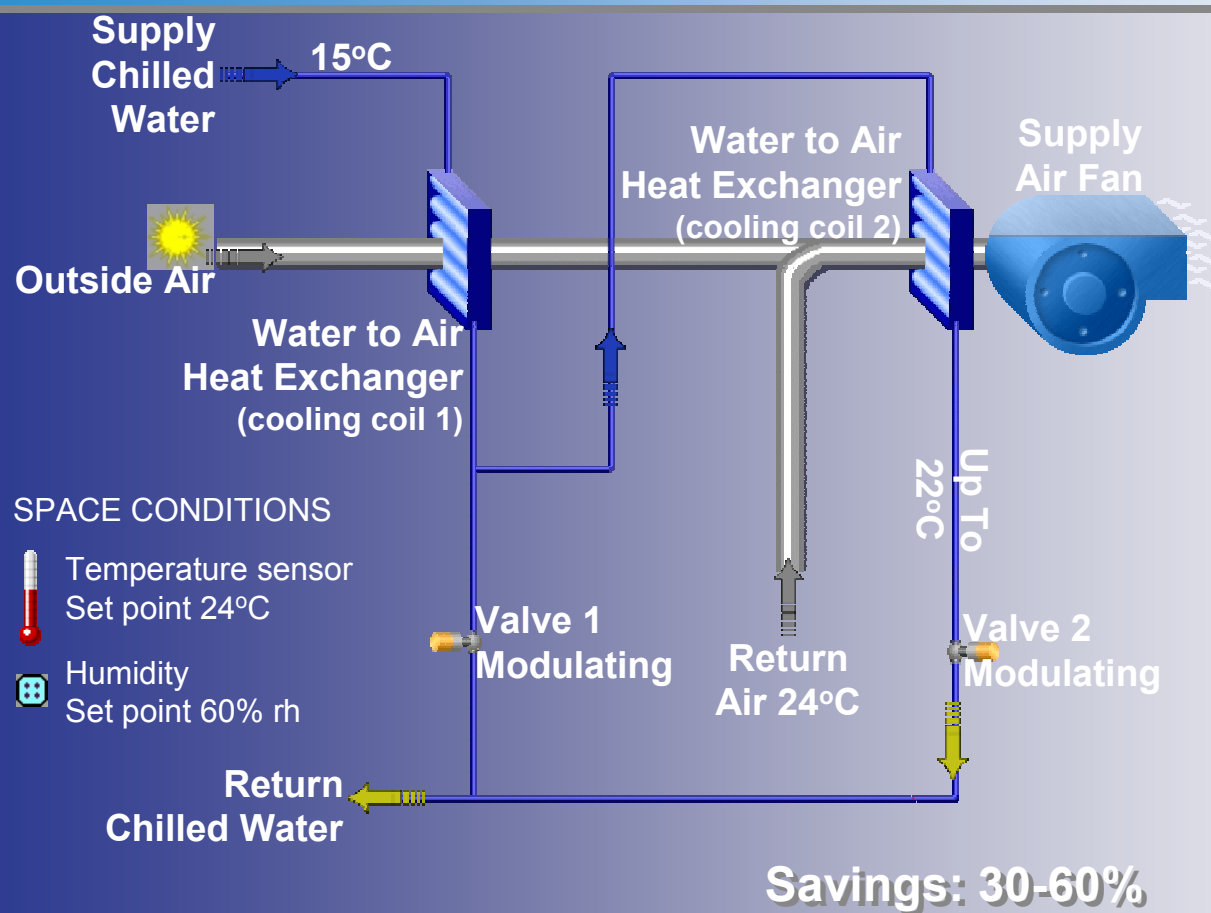
 Temperature sensor  
Set point 22°C

 Humidity  
Up to 80% rh  
Uncontrolled

# Shaw Method of Air Conditioning



# Shaw Method of Air Conditioning

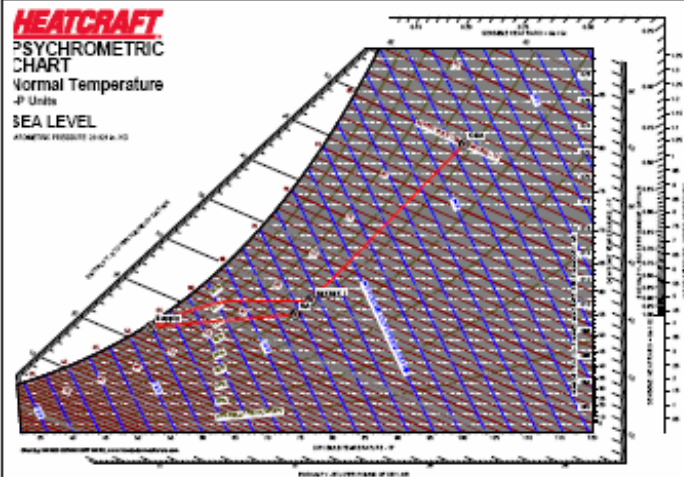


# SMAC Performances in Full Load Condition

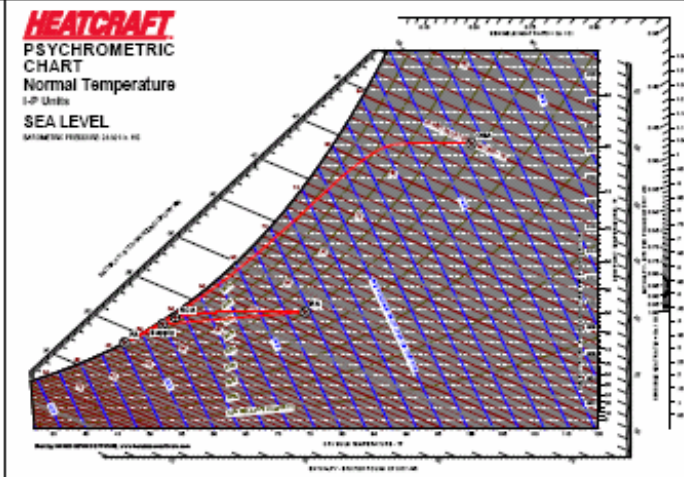


**CASE-1: Maximum Enthalpy Outside Air Condition in Thailand: Temperature 101F Dry Bulb 85F Wet Bulb (Hot Summer Day)**

Conventional Max OSA



Shaw Method® Max OSA



Room Load Total	578,604	Room Load Total	578,604
Room Load Sensible	483,353	Room Load Sensible	483,353
Room Load Latent	95,251	Room Load Latent	95,251
<b>Total Load</b>	<b>741,922</b>	<b>Total Load</b>	<b>699,197</b>
Total Sensible	537,325	Total Sensible	513,353
Total Latent	204,597	Total Latent	185,844

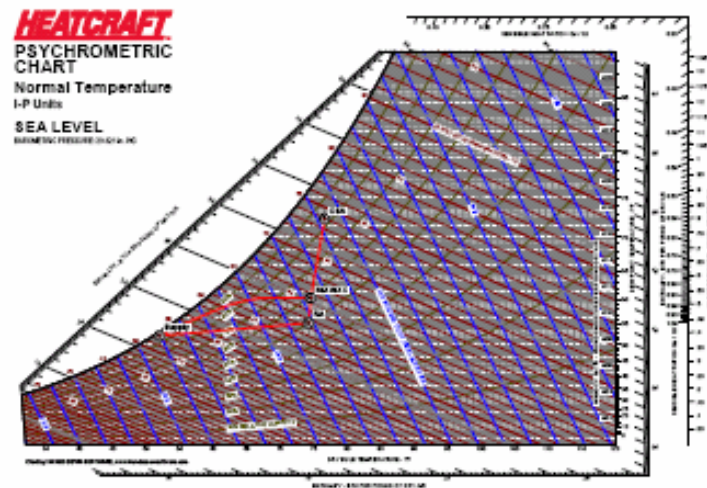
Conventional Use 42,725 btu/hr more (6.1%) than Shaw to be able to cool the space at 100% load at maximum out side air temperature, for 30 Air Handling Unit total energy save is at 1,281,750 btu/hr or 106.8 TR

# SMAC Performances in Part Load Condition



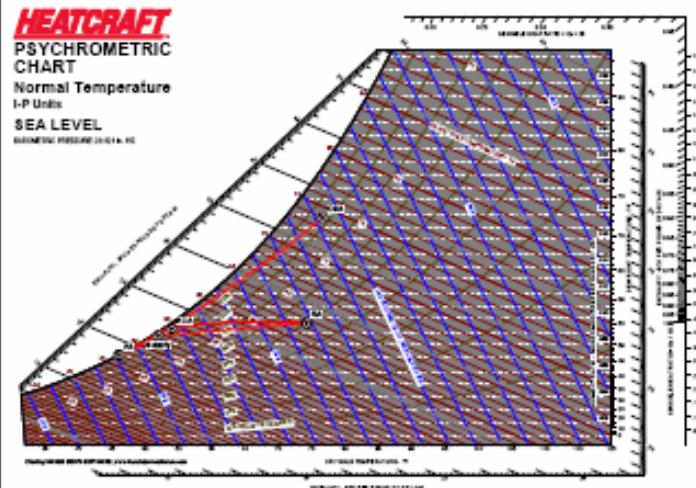
**CASE-2: Minimum Enthalpy Outside Air Condition in Thailand: Temperature 78F Dry Bulb 74F Wet Bulb (Cold Winter Day)**

Conventional Min OSA



Room Load Total	578,604	Room Load Total	578,604
Room Load Sensible	483,353	Room Load Sensible	483,353
Room Load Latent	95,251	Room Load Latent	95,251
<b>Total Load</b>	<b>729,567</b>	<b>Total Load</b>	<b>604,602</b>
Total Sensible	493,462	Total Sensible	513,271
Total Latent	236,105	Total Latent	91,331

Shaw Method® Min OSA



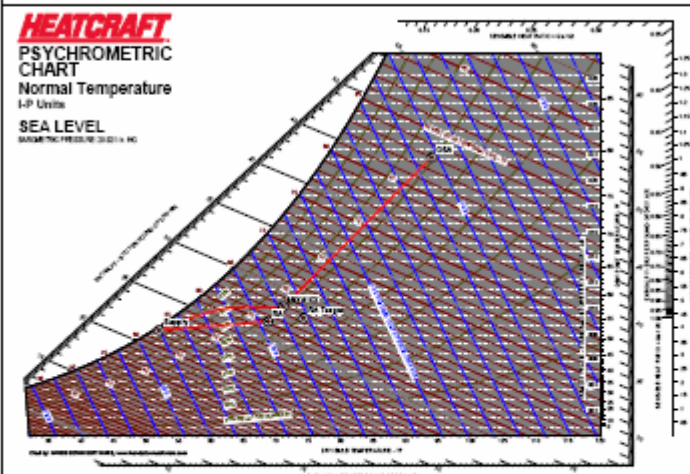
Conventional Use 124,965 btu/hr more (20.67%) than Shaw to be able to cool the space at 100% load at minimum out side air temperature, for 30 Air Handling Unit total energy save is at 3,748,950 btu/hr or 312.4 TR



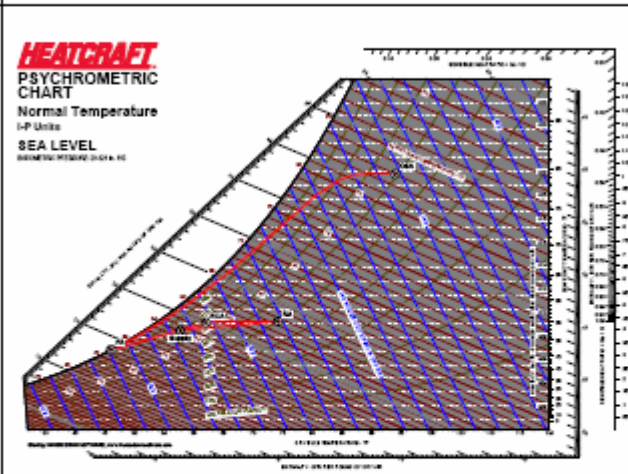
# **CASE-4: Average Enthalpy Outside Air Condition in Thailand: Temperature 95F Dry Bulb 83F Wet Bulb Part Load Condition 75% of room total load**

Conventional Average OSA, 75% Load

**Fail to make 75F50%RH**



Shaw Method® Average OSA, 75% Load



Room Load Total	433,953	Room Load Total	433,953
Room Load Sensible	362,515	Room Load Sensible	362,515
Room Load Latent	71,438	Room Load Latent	71,438
<b>Total Load</b>	<b>597,641</b>	<b>Total Load</b>	<b>501,698</b>
Total Sensible	416,701	Total Sensible	372,225
Total Latent	180,940	Total Latent	129,473

1. In partload (75%) of total design load, the conventional cannot provide "Comfort Zone" the air will be too cold and too humid, the temperature will be around 70F 60% RH. Without achieving target design 75F50%RH, Conventional Use 95,943 btu/hr more (20%) than Shaw to be able to cool the space at 100% load at minimum out side air temperature, for 30 Air Handling Unit total energy save is at 2,878,290 btu/hr or 239.9 TR

## Other Benefits



24° C 60%rh

Provides comfort conditions during cooling season within ASHRAE comfort requirement



## Other Benefits



Typically Reduces Air  
Conditioning Peak  
Electrical Energy by over  
20%

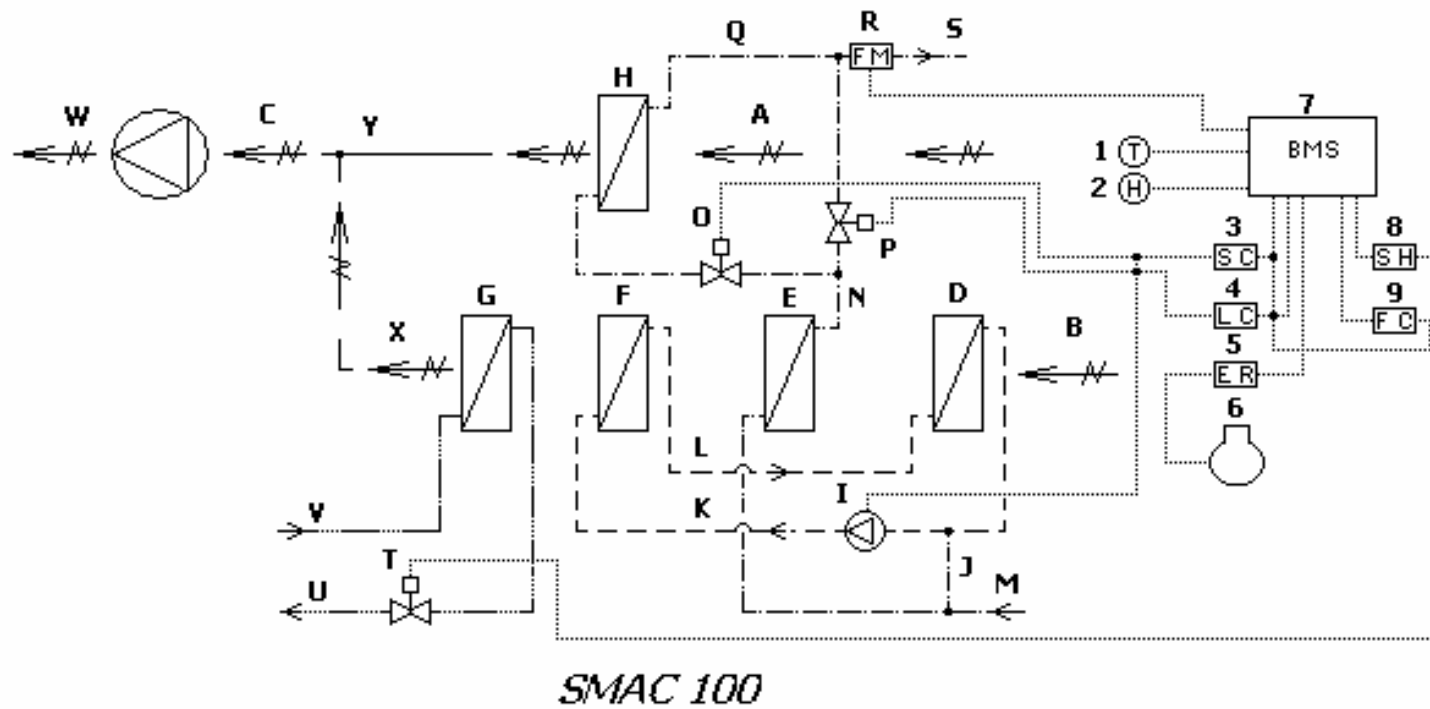
Can reduce electrical grid  
augmentation costs

## Other Benefits

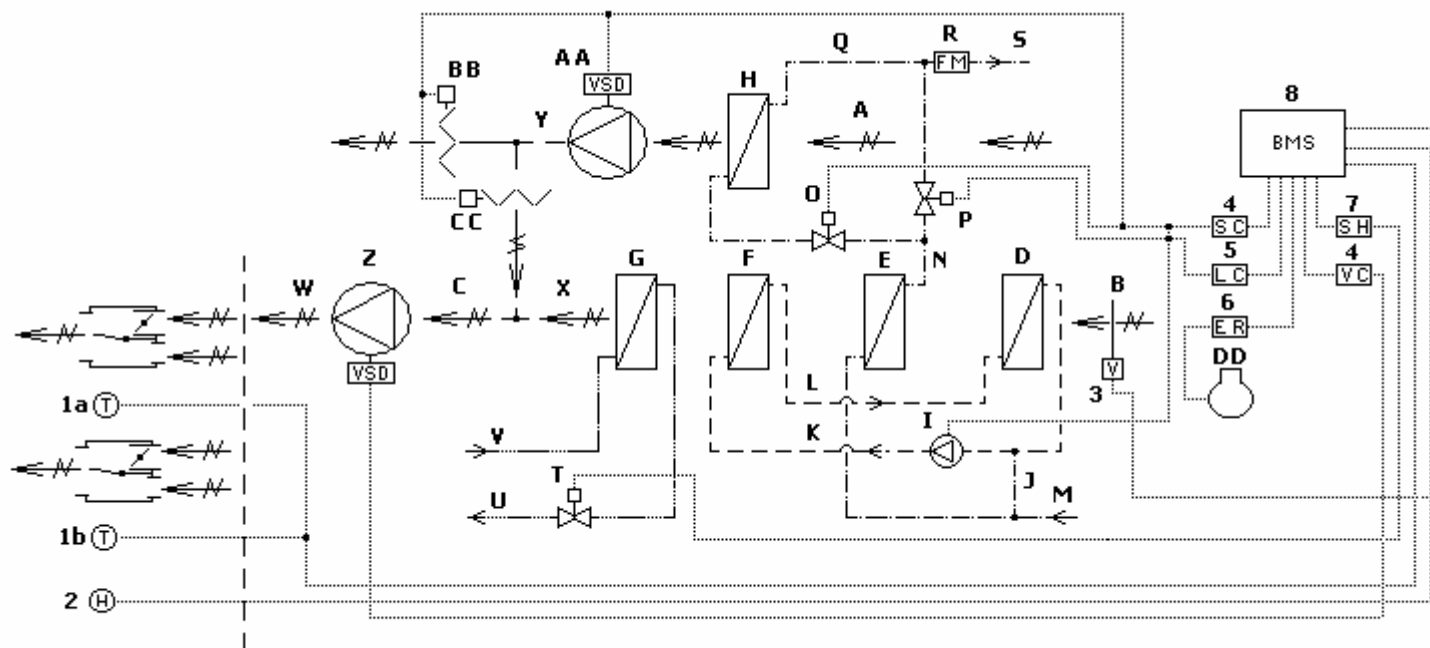


Reduces cooling tower water and chemical usage through reduced cooling demand typical 30 to 40%

# Up to 100% Outdoor Air

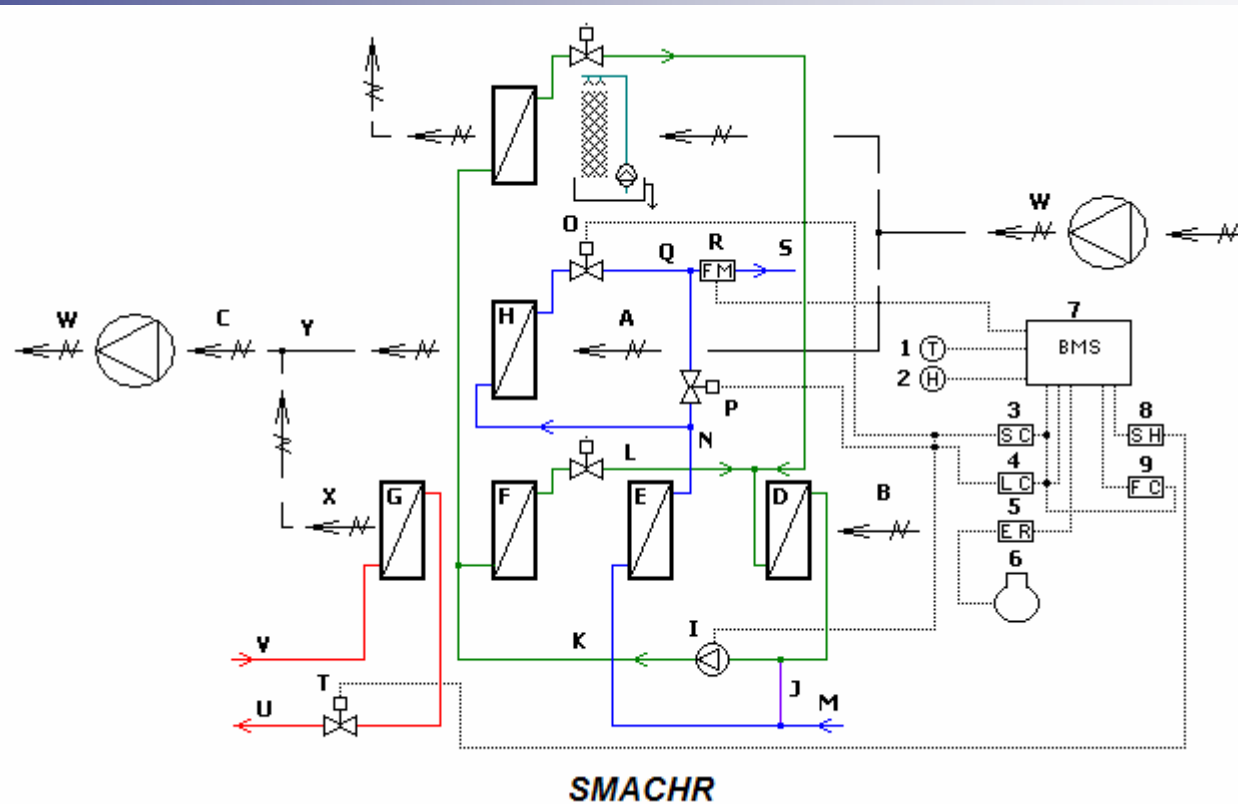


# Variable Volume Systems



SMACVAV

# Heat Reclaim Systems



# Satisfied Customers



This letter serves as a testimony to the performance of the Air Conditioning plant, utilising the SHAW method of control.

The plant has operated throughout a severe wet season, since being installed, and has fulfilled all environmental design criteria without exception, despite having some equipment irregularities that are yet to be finalised.

Since its inception the level of RAPU occupant complaint related to air conditioning has been effectively zero, which is the first time I have experienced this condition in 28 years of Engineering at the hospital

Yours sincerely  
Laurie King

A handwritten signature in black ink, appearing to read 'Laurie King'.

Major Projects Manager  
Engineering Department  
Royal Darwin Hospital  
Ph 89228556

To Whom it May concern

Re Air Conditioning System in RAPU

I am the Clinical Nurse Manager of RAPU and have been an employee of the Royal Darwin Hospital for over 20 years.

Since moving into RAPU in September 2007 we have had no recordable issues with the Air Conditioning system and the Air Conditioning is very effective.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Tracy L Espie'.

Tracy L Espie

# Verified Results

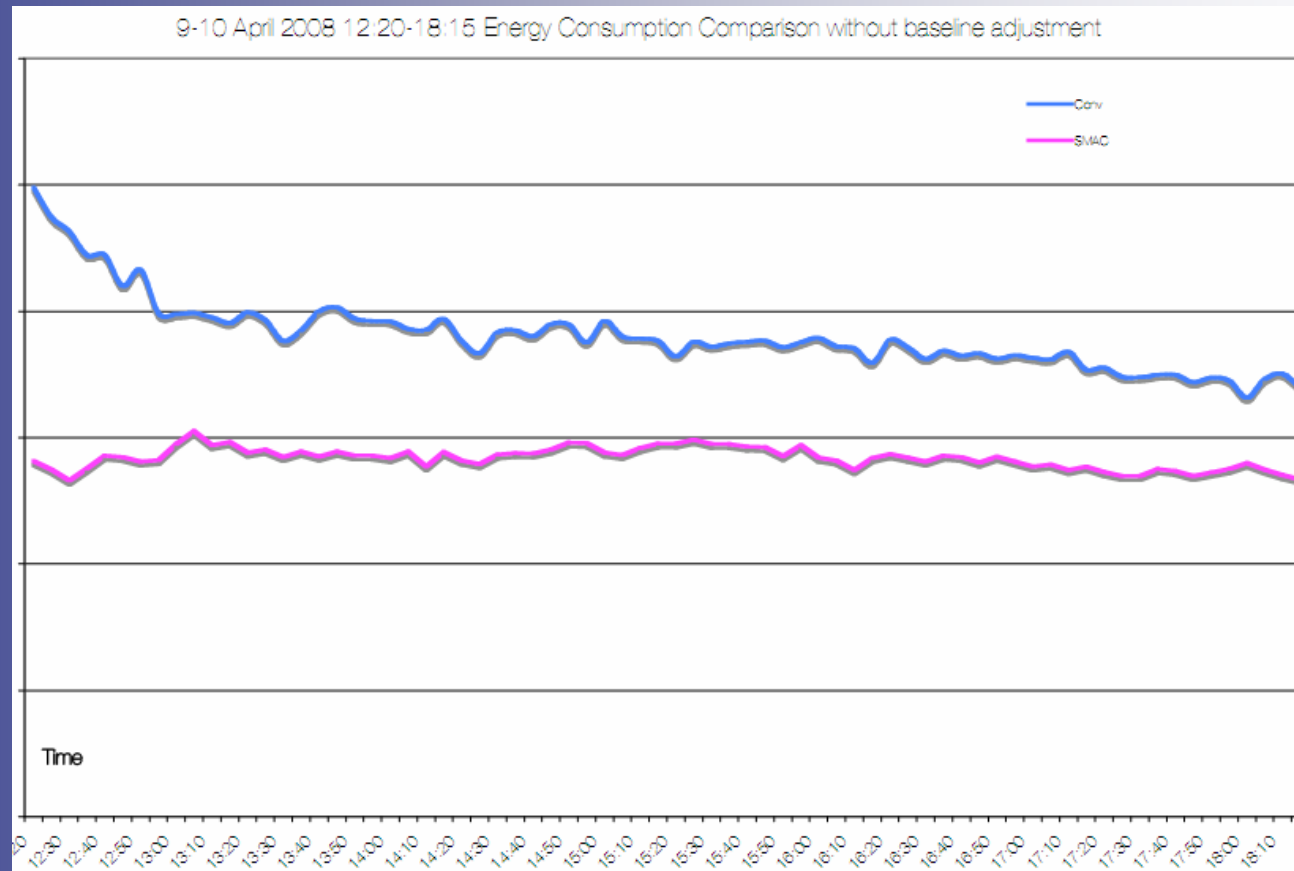


## Results of Energy Saving, Engineering Performances

Results from M&V of HVAC system, SMAC™ use less energy, comparing to Conventional System.

Average Energy Consumption	Conventional	SMAC	Saving	Saving %
<b>Day-on-Day Simple Energy Comparison without BASELINE Adjustment</b>  (Energy Draw from Chiller Plant)  Unit TON	106	86	20	18.87%
<b>Day-on-Day Simple Energy Comparison with BASELINE Adjustment</b>  (Energy Draw from Chiller Plant)  Unit TON	187	116	71	37.97%
<b>Annualized Energy Modeling using AEM4 software to model annual energy consumption using IPMVP type D protocol and modeling method according to USA DOE, without BASELINE Adjustment</b>  (Modeling to Meet whole Plant Capacity and annualized energy consumption) Unit MW.h/Year	5149	4155	994	19.30%
<b>Annualized Energy Modeling using AEM4 software to model annual energy consumption using IPMVP type D protocol and modeling method according to USA DOE, without BASELINE Adjustment</b>  (Modeling to Meet whole Plant Capacity and annualized energy consumption) Unit MW.h/Year	5974	4274	1700	28.46%

# System Comparative





# Economic Returns



## Financial Performance from Implementing SMAC into the system

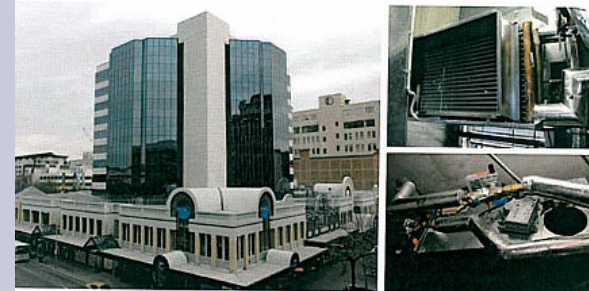
Using AEM4 energy modeling software to expand the Measurement Result TESCO will save 5.3 Million THB per year

System	Conventional	SMAC
Investment (SMAC™ only not include and installation cost)	0	6,500,000.00
First Year Saving, THB	0	5,300,000.00
Payback, Years	0	1.23
Life Cycle Saving over 20 Years, THB	0	99,500,000.00

# Published Designs



## ➤ Example 1: Airconditioning system lifts green rating of 1980s building



### The Project

Refurbishment of the 12-storey headquarters of the South Australian Health Commission, CitiCentre, aimed to lift its audited Australian Buildings Greenhouse Rating (ABGR) from a poor two stars to the desired optimum rating of five stars. The department's offices are located above a busy commercial shopping arcade in the heart of Adelaide's Central Business District and have a facade which consists of large areas of glass with some precast panelling. The initial project to refurbish two floors was completed in 2006 at a cost of \$200,000.

### Project Participants

Tenant: South Australian Department of Health  
Client: DAIS (now DTEI)  
Consultant: System Solutions Engineering  
Contractor: Corporate Air  
Specialist contractor: Air Con Serve Pty Ltd

# Changing Weather



new  
or retrofit

# Greenhouse Gas Emission Reductions



up to

60%

The whole year SAVINGS from various projects  
around the world

# Hot & Dry



Project	Energy Savings	Comments
Barmera Hospital	30%	National NECA Award 2002
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## Expecting paybacks of SMAC



**From 0 Year to average 4 years payback**

# SMAC<sup>®</sup> Benefits Summary



1. Permits higher space temperature set point. Up to ASHRAE peak 26°C/57%rh
2. At all times optimises chiller(s) through higher chilled water temperature
3. Only dehumidifies as necessary
4. Reduces or eliminates reheat for:
  - variable air volume systems
  - close temperature and humidity control applications
  - chilled ceilings
5. Reduces fan energy for:
  - constant volume systems
  - variable air volume systems
6. Reduces cooling tower water and chemical usage
7. Reduces peak electrical demand
8. Fully compliments (applicability):
  - chilled ceiling technologies
  - constant volume
  - underfloor air displacement (UFAD)
  - variable air volume, standard or induction
  - conventional outdoor air economy cycle
  - CO<sub>2</sub> regulation and control
  - Peak electrical load management

## SMAC® Benefits Summary – cont.



9. Universality in application:
  - hot dry
  - hot humid
  - new or retrofit
  - ensure highest comfort provision at all times
10. Ease of design, commissioning and service
11. For new projects, Shaw costs no more than conventional and for retrofits has an under 5 year payback

12. ASHRAE May 2008:

“The use of DOAS for air conditioning applications may become the norm”

SMAC is an enhanced DOAS

# Q&A

