



# Sheraton Hanoi

## THE GREEN HOTEL

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Hotel 1997 - 2005.*

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# Principle

- The energy is just provided as needed, Just Enough - no waste
- Apply to objective with highest energy saving.
- To apply ES solution with lowest cost and realistic.
- To use saving amount of first project to invest for next projects

# Energy Saving Have done at Sheraton

## Hanoi

1. Primary Chiller Water Pumps
2. Condenser Water Pumps
3. Cooling Tower Fans
4. Kitchen Exhaust Fans
5. AHU Motors
6. Heat Pumps
7. Digital Thermostat with Energy Saving Function
8. Compact, T5 & LED Light –Maximum as possible.
9. Re-used cooling air of exhaust fans to cooling condenser unit.
10. Chiller, Boiler Optimizer operation
11. Good and effectively maintenance for Chiller, Boiler
12. Daily monitoring and control by BAS
13. Applying Water Saving Devices and use water from lake for garden & cleaning
14. Hotel's Associate awareness & participation for Energy Saving.



# Energy saving have done at Hanoi Daewoo Hotel (1998 - 2003)

## 1. Invest by Hotel :

- VSD for cooling water pump( 22KW)-2 unit and fans( 15KW)-2 unit at A/C system at Apartment.
- VSD for AHUs 30KW/set ( 15 unit)
- Water saving device ( Jemflow type) all Hotel

## 2. Invest by investor: by using monthly saving amount to payment to investor (Trane company)

- VSD for Secondary chiller water pumps ( 110KW/ to 15KW-4 unit): 50%-85% saving
- VSD Condenser water pumps ( 45KW/set-2 unit)-35% saving
- VSD for Cooling tower 37KW/ set ( 3 unit): 35%-70% Saving



# Major Equipment for Energy Saving at Sheraton Hanoi Hotel

## A. Installation of VSD:

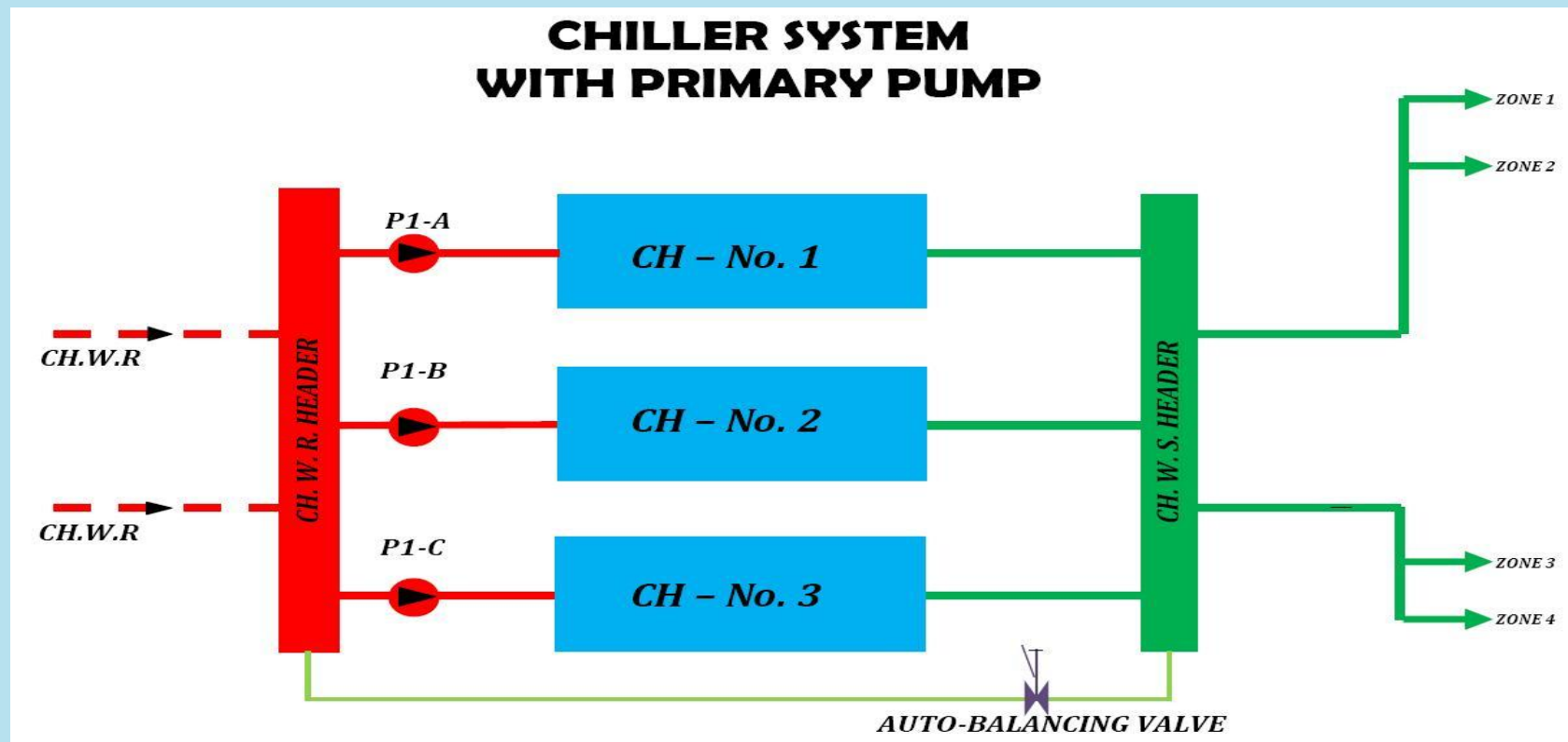
- |                                |       |
|--------------------------------|-------|
| 1. Chiller Water Pumps         | 4 set |
| 2. Condenser Water Pump        | 4 set |
| 3. Cooling Tower Fan           | 2 set |
| 4. Kitchen Exhaust Fan         | 3 set |
| 5. AHU motors                  | 4 set |
| 6. Hot water circulating Pumps | 3 set |

B. Heat Pump 8 set



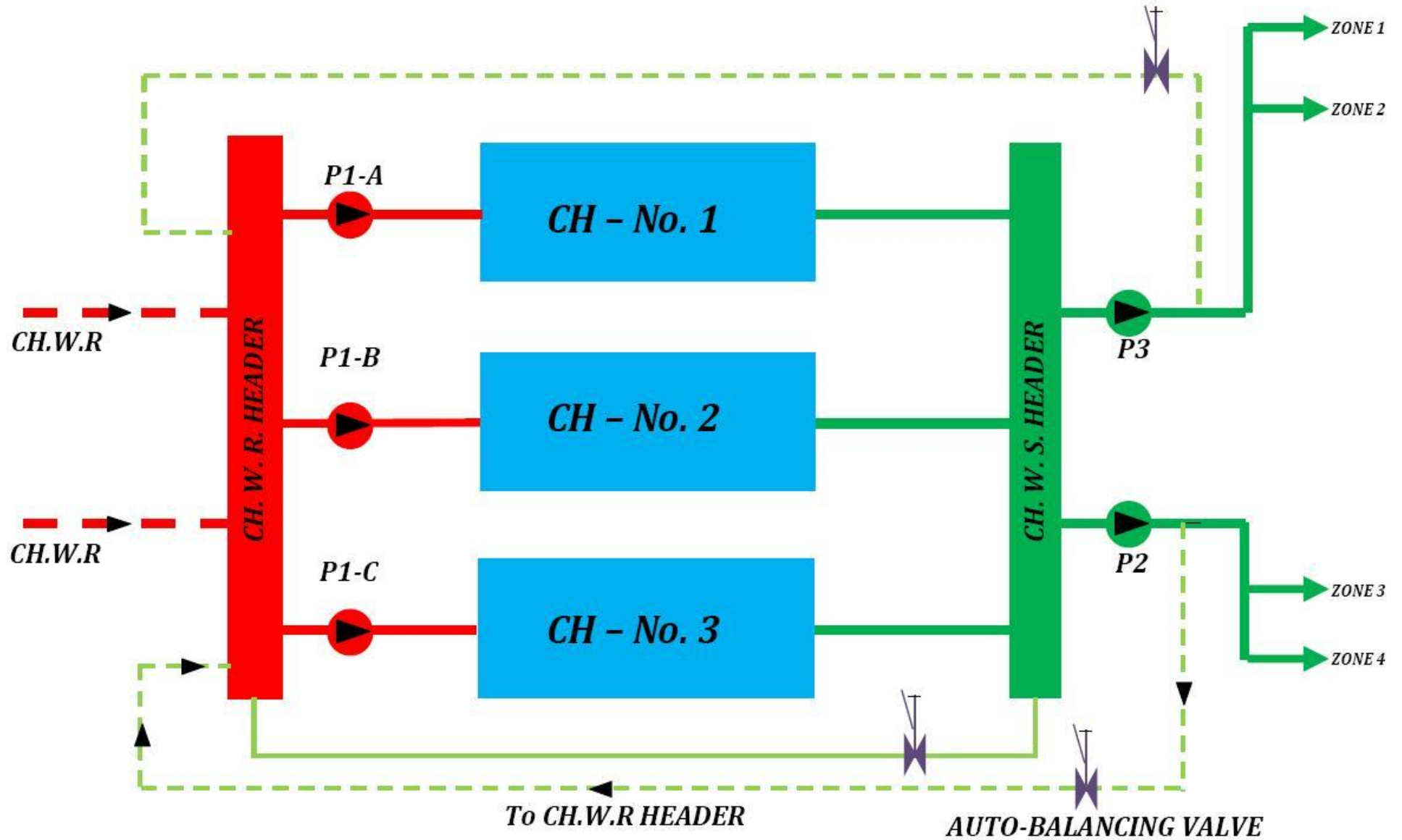
# Chiller System

1. Chiller Design: a chiller is designed with two options:
  - 1.1. Primary Chiller Water System only (option 1) - Sheraton Hanoi Hotel
  - 1.2. Primary and Secondary Chiller Water System (option 2) Hanoi Daewoo Hotel
2. Chiller Diagram
  - 2.1. For option 1



2.2 For option 2

# CHILLER SYSTEM WITH PRIMARY & SECONDARY PUMP



# Successful applying VSD at Hanoi Daewoo Hotel.

## 1. Secondary chiller water pumps:

Principle: Pumps was control by pressure and supply just enough only.

(Existing system, pumps still operated with full load and flow via by pass-lost energy)

## 2. Package VSDs for condenser water pumps and cooling tower fans:

Cooling water temperature will set and pumps and CT fans will auto operation base on setting Temperature and minimum require of Chiller.

## 3. Cooling system for A/C of Apartment-193 unit:

a. VSDs for cooling water pumps: Control by pressure ( Apartment at Daewoo Hotel).

b.VSD for CT fans : Control by temperature.

*Saving Amount 1,700,000KW/Year.*





# Primary Chiller Water Pump

## 1. Sheraton Hanoi Data:

Pump: 4 set – 55kW/set

Flow Rate of Chiller water as designed: 20 - 80 liter/second

## 2. Principle

- Based on technical requirement for the chiller including condenser and cooler water flow, a point is set up to determine the minimum and maximum flow.
- Based on design the flow. The VSD will be installed and control the output of motor to satisfy the big range of flow but the principle must be still ensured that the real minimum flow must be higher than minimum flow of the design
- The optimizer flow (Max Flow) must satisfy the highest and furthest load

## 3. How to apply

Chiller water pumps are installed a VSDs and controlled water flow as chiller loading.

## 4 Result

Before install VSD: 55 kW

After install VSD: 18,5 – 23kW

% Saving: 62,4% -58 %

## 5. Pay back: After 6 month

*Note: Sheraton Hanoi Hotel is the first property in Vietnam to apply VSD for primary chiller water system since 2006*



# Condenser Water Pump

## 1. Sheraton Hanoi Data:

Pump: 4 set – 22kW/set

Flow Rate of Chiller water as designed: 20 - 76 liter/second

## 2. Principle

The flow must satisfy as designed and shall be changing depend on the chiller loading.

## 3. How to operate

- Based on design, the actual min. flow must be higher than min. flow of design
- Based on temperature of condenser water, VSD shall control motor pump up or down to satisfy the change of load.
- Hanoi with 4 seasons, good saving in Winter, Autumn & Spring.

## 4. Result

Before install VSD: 22kW

After install VSD: 14kW

% Saving: 36%.

## 5. Pay back : *After 8 Month*



# Cooling Tower Fans

1. Sheraton Hanoi Data:

Fan: 8pcs – 5kW/pcs – 4 units x 400 ton / unit

Temperature in Hanoi: 14°C – 38°C

2. Principle

The speed of fan is auto-controlled up or down by Temperature Sensor depend on temperature setting of cooling water

3. How to operate and setting:

The temperature of cooling water out is set at 28°C. The first , cooling water pump shall be auto controlled up or down to approach 28°C. In case the pump already run at Max setting speed but cooling water temperature is still up, fans shall be auto speed up to keep water temperature of 28°C .

4. Result

Before install VSD: 5kW/set

After install VSD: 3kW

% Saving: 40%

Very good saving for operation during winter, spring, autumn seasons and keep chiller on optimize operation.

5. Pay back : *After 6 Month.*



# Kitchen Exhaust Fans

## 1. Sheraton Hanoi Data:

Ex – Fan Motor: 2 set x 15kW/set  
Use for Main Kitchen

## 2. Principle

Based on the real use in Kitchen as the Exhaust Fans is not working at full capacity all the times, Exhaust fan shall be controlled by a VSD at High – Mid – Low speeds according to operation hour

## 3. How to set

Pick Hour: – 11kW (11:00am – 1:00pm & 6:00pm – 8:00pm)  
Normal Hour: – 9kW  
Low Hour – 6kW (10:00pm – 6:00am)

## 4. Result

Before install VSD: 15kW  
After install VSD: 9.1kW (average)  
% Saving: 39.3%



# AHUs

1. Sheraton Hanoi Data:

Some AHU installed over-side motor  
Hanoi has 4 seasons

2. Principle

AHU is controlled by VSD so that motor can run from max to min speed when reaching temperature setting but air quality is still good supplying.

3. How to set

Setting temperature at 23°C or 24°C. VSD shall auto control AHU so that temperature of 23°C or 24°C can be maintained and keep air quality by minimum optimize speed

4. Result

% Saving:                    35%



# Heat Pumps

## 1.Principle to Apply:

Apply for all places from where the hot air are produced such as Laundry Room, Boiler Room, Chimney of Boilers.

Hot air source from Laundry is utilized to make hot water and cooling air. Cooling Air shall be returned to Laundry Area with good Environment

## 2.Heat Pump Specification:

Capacity one set: 45kW Heat and Cool air/set

Electric Consumption: 6.7kW/set

## 3.Installation in Sheraton Hanoi: 08 Set was installed .

## 4.Result:

- Saving diesel oil 400 liter/day ( 140,000 Liter/Year)& cooling air for Laundry
- Sheraton Hanoi was STOP USING BOILER for hot water since 2010 and is first Hotel in Vietnam used heat pump to supply hot water for all Hotel

## 5.Pay back : 14 Month

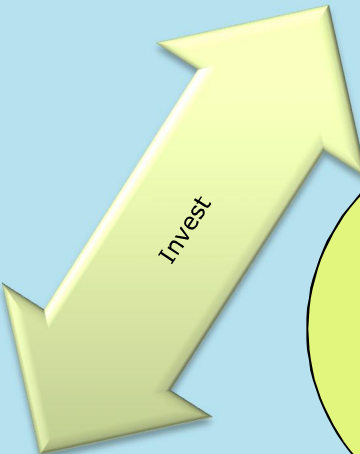


# Water saving

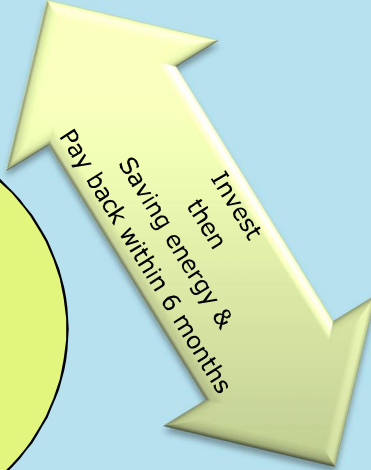
1. Install water saving devices at:
  - All Water taps  
Water reduce from 13liter & 19liter/Minute to 6 liter & 7liter/Minute
  - Showers from 19liter to 10liter/Minute
2. To use water lake from waste water which treatment for Garden and cleaning pavement & road
3. Applying Anti Bio Equipment for Pool:  
Reduce times the back wash filters and Chemical for water treatment.
4. Saving result :30M3 - 50M3/Day.



Beginning 8,700 USD 



Invested from 2005 and completed in 2010



Other VSDs, Heat pumps, LED lighting, T5 lights...



1 set of VSD



# BENEFITS FROM ENERGY SAVING - Sheraton Hanoi Hotel

- Total of electricity energy saving: 75.000 USD/year
- ( Saving by VSD: 550.000 kW/year)
- Diesel oil saving by Heat pumps: 140,000Liter /Year( 100,000. US)
  
- Reducing maintainence and repairing cost: 15.000 USD/year
- Total saving per year: 190.000 USD/year
- Improving equipment operating stability & long life
- CO<sub>2</sub> emission reduce much.

	Unit	2005	2006	2007	2008	2009	2010	2011	2012
CO2 Emission	Ton	3,938	3,787	3,562	3,232	2,874	2,825	2,750	2,728

## Benefit from Energy saving by VSDs – Hanoi Daewoo Hotel.

- Saving Amount 1,700,000KW/Year.



# Reasons for energy saving successfully

1. Optimize investment by using benefit saving amount from first project to invest for next one.( Exp: VSDs for Chillers system: First VSDs cost 8700US at 2005 and next one after 6 month and completed for chiller system at 2006 ). All solutions have done by few year with small amount investment per year- as Budget.
2. Select the projects which simple apply, pay back shortest. (as Compact,T5,water saving devices, VSDs of HVAC system...)
3. Chief engineering should take the initiative to apply Energy saving ( as VSDs chillers, Heat pumps) to reduce cost investment...
4. For projects with big amount(100K) we have success by supplier(Trane+Danfoss) invested and get back monthly-this project have completed after 27 Month-Hanoi Daewoo Hotel ( 2000-2003)-
5. Have strategic of saving energy for long term.
6. Owner & Manager supporting.



# Opportunity of energy saving not applying yet at other properties ? Why?

- The limited technical knowledge: Manager may choose safe solution for his job. (Due to risk will may happen, not sure how much is saved?)
- Investment cost: Too high as Contractors or Consultants bring out the unrealistic cost while Manager has not enough knowledge to analyze to get reasonable cost.
- Owner may not believe or wonder about the life of project and result of energy saving projects.
- Not be required by VN government regulations

# How to apply Energy saving successfully?

1. For long term, the government should issue Energy Regulations including green designs, high efficiency equipments, energy saving apply, energy consumption per M2 or CO2 ton/year.....
2. Energy Audit should be done with reasonable cost. Base on result , the implementation will be done in long term with specified plan
3. A third party should be an investor that supported by WB & others banks, Equipment Suppliers...Monthly saving amount will be pay back for Investors so the properties do not need the investment cost. Finally all participations have their benefits i.e. saving equipments will belong to properties and used for next energy saving period, two rest parties can get back money with interests...
- 4.Chief engineering should take the initiative to apply Energy saving
5. Energy Saving projects must be supported in case technical issues to ensure the equipments are operated smoothly and stably as design.
6. Hotel's Associate awareness & participation for Energy Saving



# Potential project for Energy saving next period

- 1.Re-use released heating from Boiler chimney.
- 2.To use Ozone for Laundry process.
- 3.Re use waste water after treatment for cooling water system and cleaning.
- 4.Add small chiller for winter season
5. LED lighting for whole Hotel
- 6.Solar system for Hot water



# Sheraton Hanoi Awards

- 2009-First Prize of Energy Efficiency Building
- 2010-First Prize of Energy Efficiency Management.
- 2010-Certificated of EMS-ISO 14001
- 2011- Winner of Best Environmental Sustainability Award of Starwood Asian Pacific
- 2012-Green Lotus Level 5 of Vietnam Tourism
- 2013-Travel Life Award (UK)
- 2014-ASEAN Green Hotel Award





THANK YOU!

