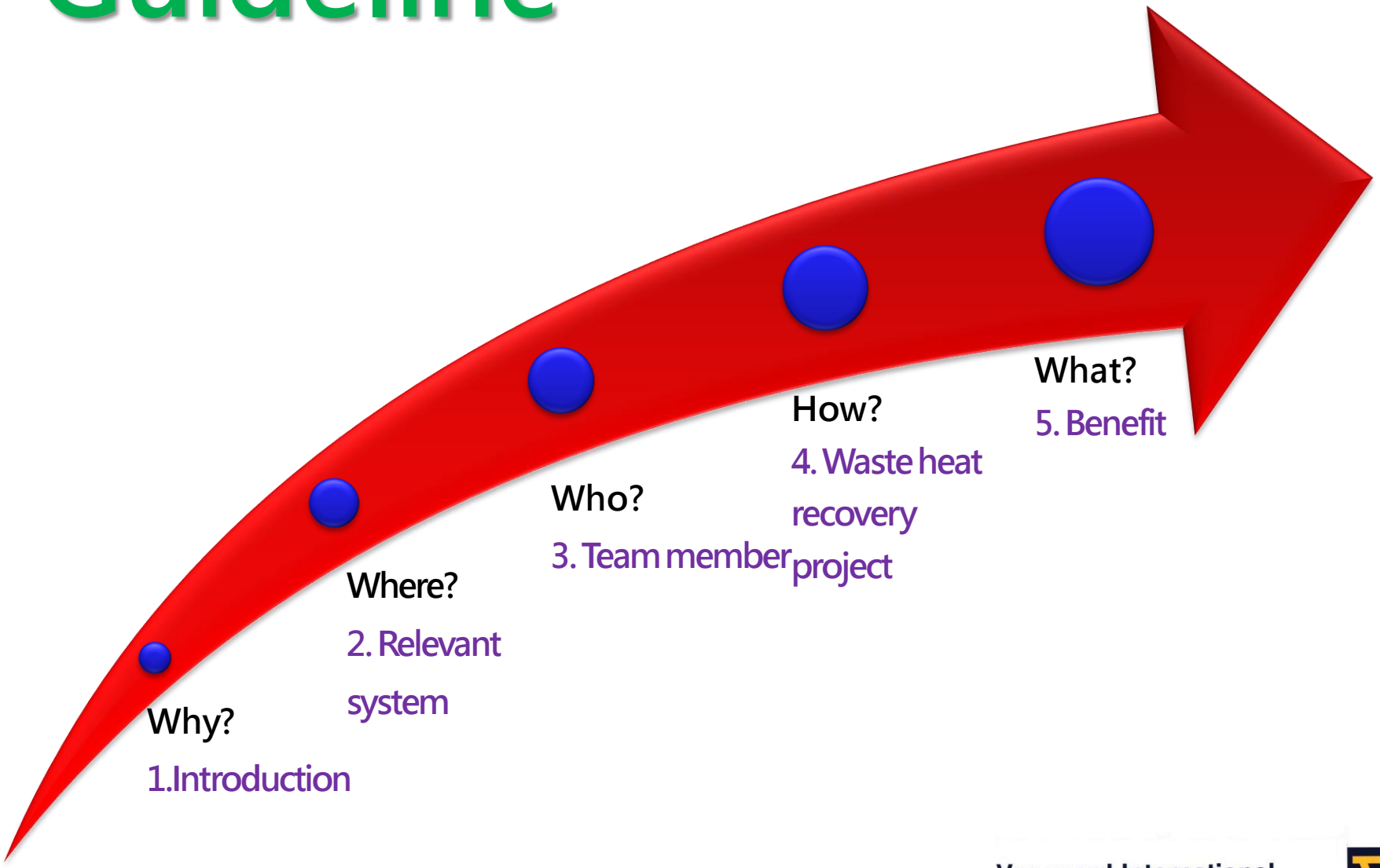
The magic of heat reuse-
Waste Heat recovery project

- VIS FAC Department manager : Alex Wang
- VIS FAC manager : Danny Chen, Jacky Liu, Eric Lai, W.J. Leu , Tiger Wang, S.F. Chen, David Kao
- BenQ ESCO : Jason Lin, Shou C Chen, David Chiu, Anderson Liu, Leo Huang, Dempsey Tseng.

Time: Jun 2018- Sep 2019

Benefit: NT$20,588,212

Guideline

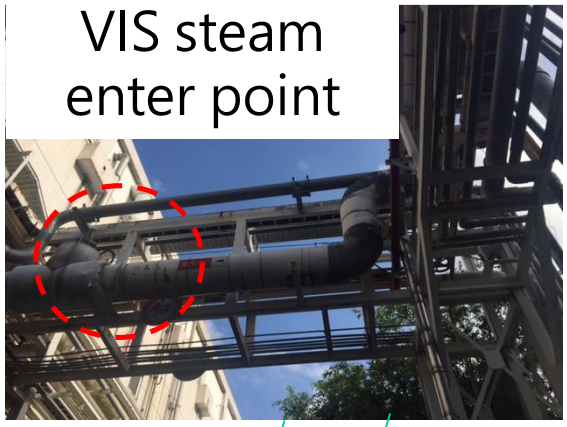


1. Introduction

Hot Ultra Pure Water system(HOT UPW)

Make-Up Air Unit (MAU) system

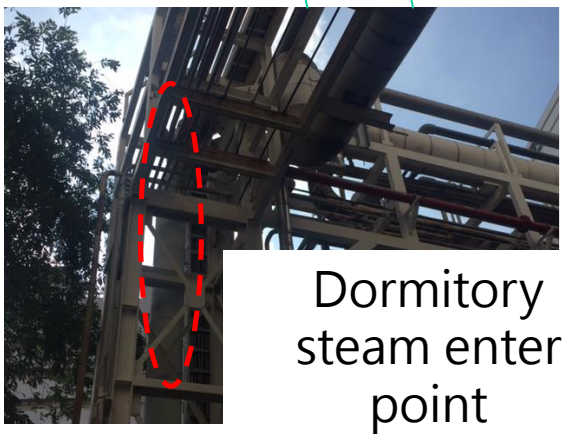
VIS steam enter point



Power Plant of Nanya Plastic Corporation

Steam main pipe

Nanya PCB 5 steam enter point



Dormitory steam enter point

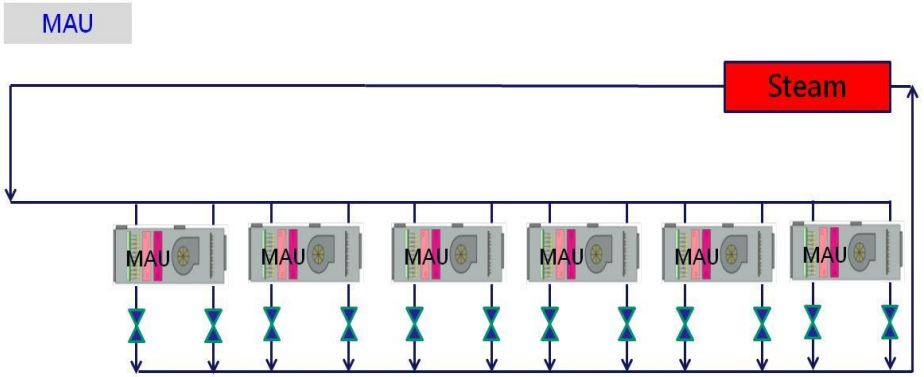
1. Introduction

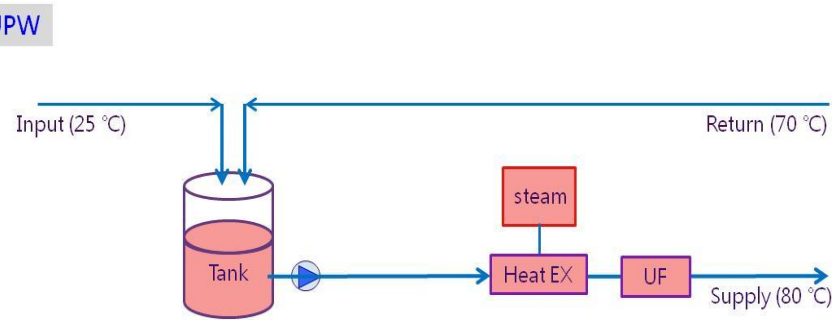
Steam cost: 30,845,320 NTD/year

Increase of steam cost: 44% (2016-2018)

Power Plant of Nanya Plastic Corporation → Steam main pipe →

- Make-Up Air Unit (MAU) system
- Hot Ultra Pure Water system(HOT UPW)

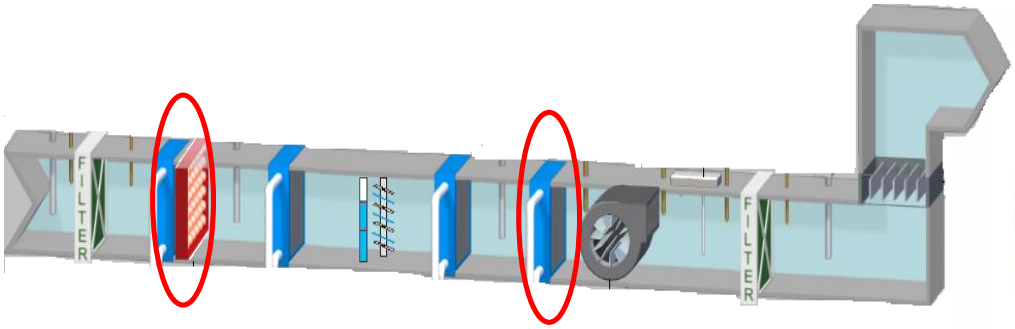




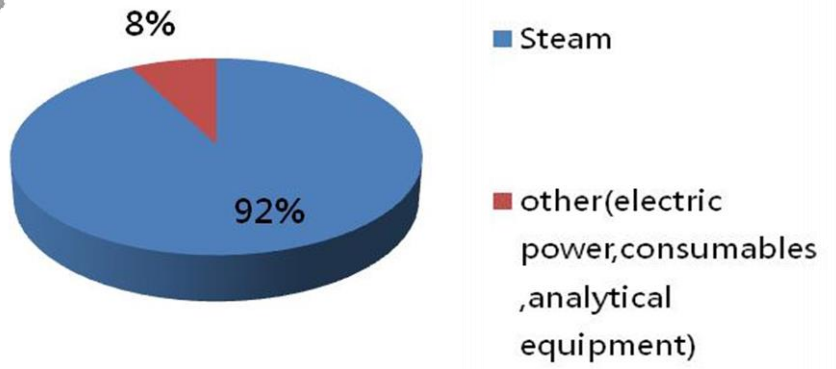
2.Relevant System

- **MAU system**
  1. For **MAU** system, **steam** is important for the temperature & humidity regulation.
  2. Steam usage for MAU : **20,890 ton/year→ $ 20,221,520/year.**

- **HOT UPW system**
  1. For **HOT UPW** water system, **steam price** accounts for most of the running cost.
  2. Steam usage for HOT UPW : **10,974 ton/year→ $ 10,622,832/year.**



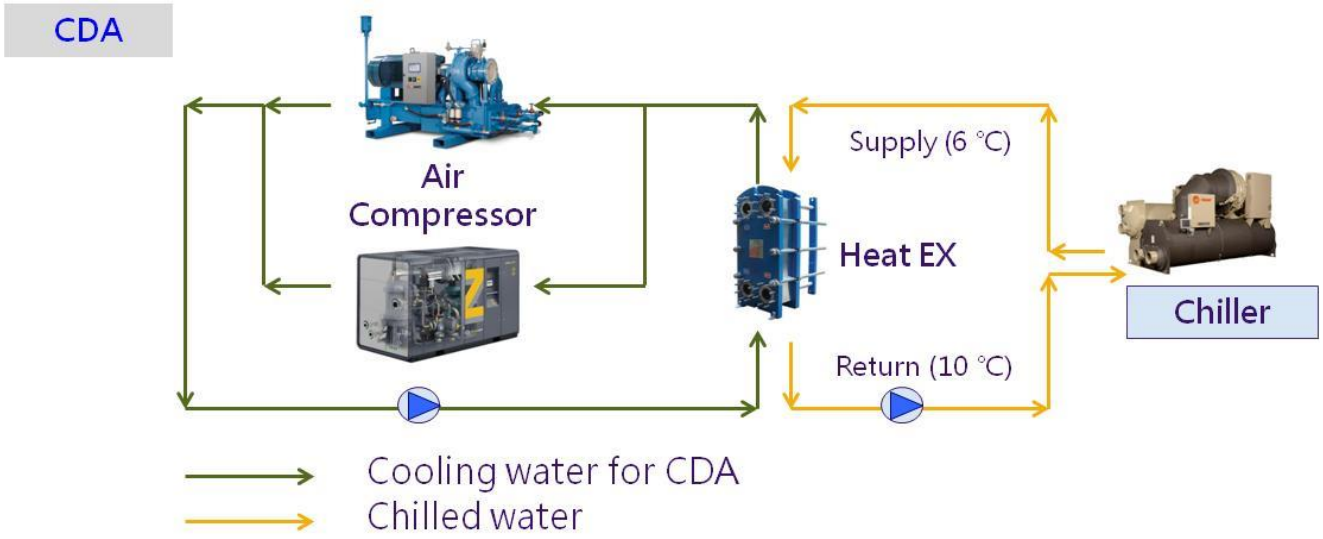
temperature & humidity regulation.



2.Relevant System

- **CDA system**

1. In VIS, there are 6 air compressor(N5900 for UIGC).
2. For **CDA** system, average 125,000 m^3 /day of air producing and 18,000kwh of power consumption per day.

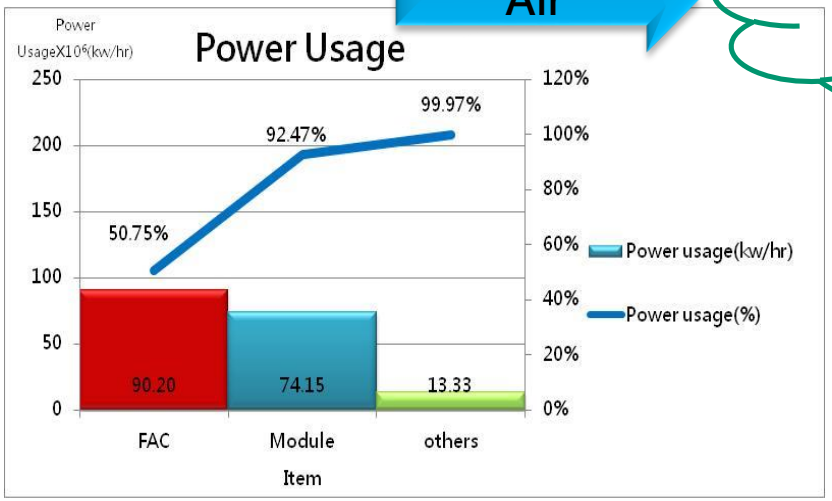


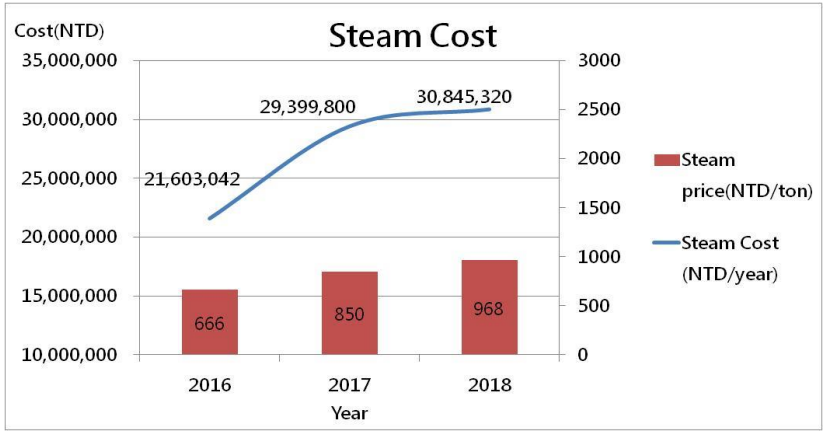
2.Relevant System

Air → CDA(Compress Dry Air) system → CDA

Cooling water

Save money!!!!!





No.	Power	Type
A-101	300HP	Screw
A-102	300HP	Screw
A-103	500HP	Centrifugal
A-104	350HP	Screw
A-105	500HP	Centrifugal
N-5900	2250HP	Centrifugal

3. Team member

Captain FAC →

Alex Wang(VIS)

- Schedule management
- Task assignment

→

Danny Chen (VIS)
Jacky Liu (VIS)
Eric Lai (VIS)
W.J. Leu (VIS)
Jason Lin (BenQ ESCO)

Do it →

BenQ ESCO

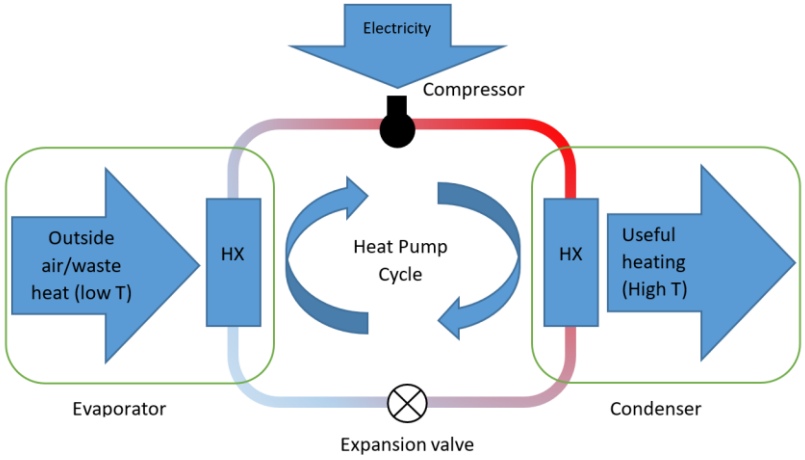
FAC
W.G.C Section

FAC
M.E Section

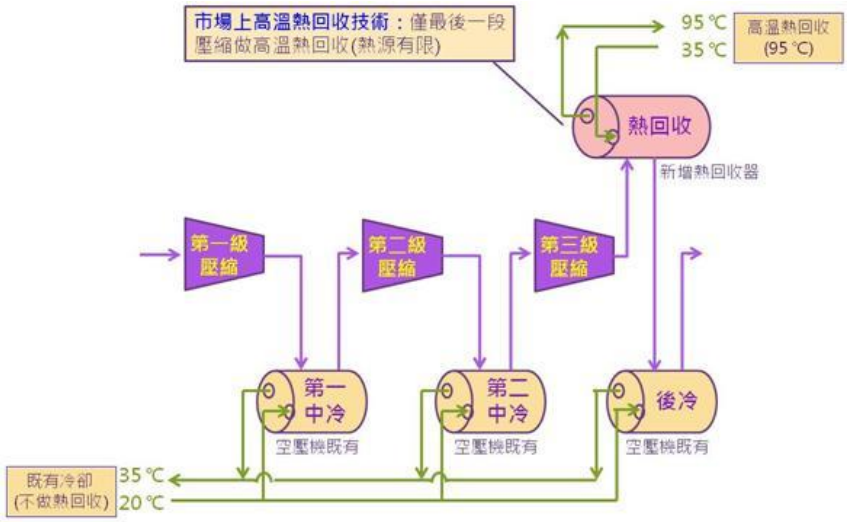
IE

4.Waste Heat Recovery Project

- Heat Pump



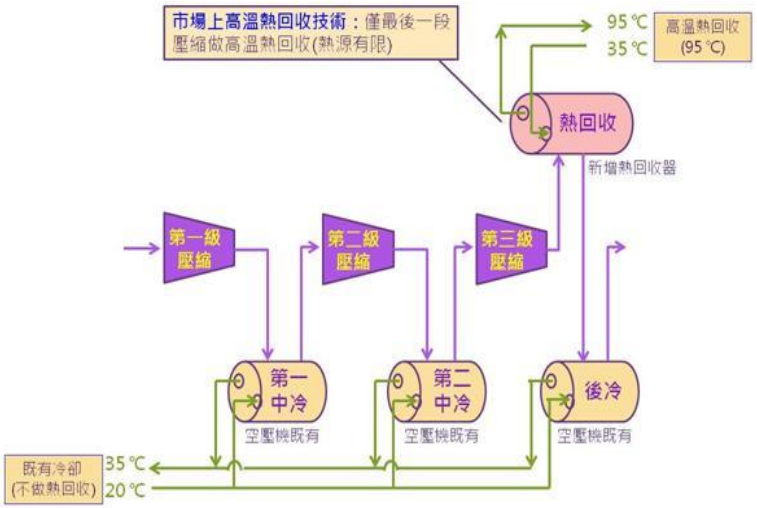
- Waste Heat recovery



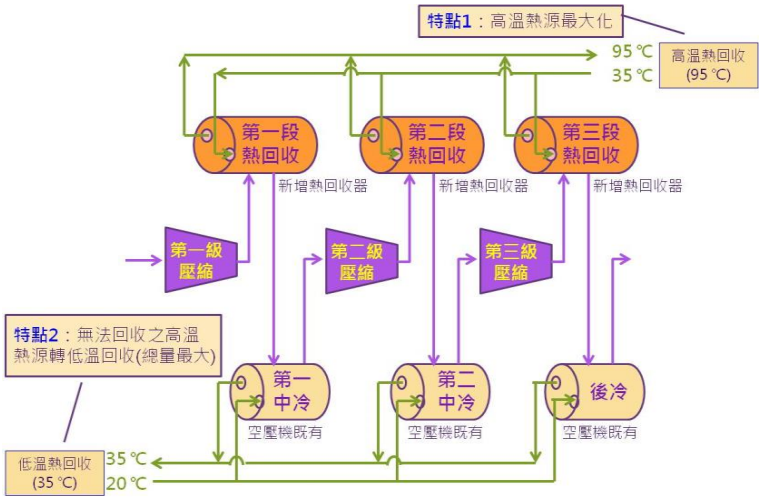
Item	principle	Advantage
Heat pump	Base on second law of thermodynamics, which transfer the energy from low-temperature to high-temperature	Heat & Cold energy generate simultaneously.
Waste Heat recovery	Heat Exchange by changing the loop of cooling water.	No extra power comsumption

4.Waste Heat Recovery Project

- Waste Heat recovery(Normal)

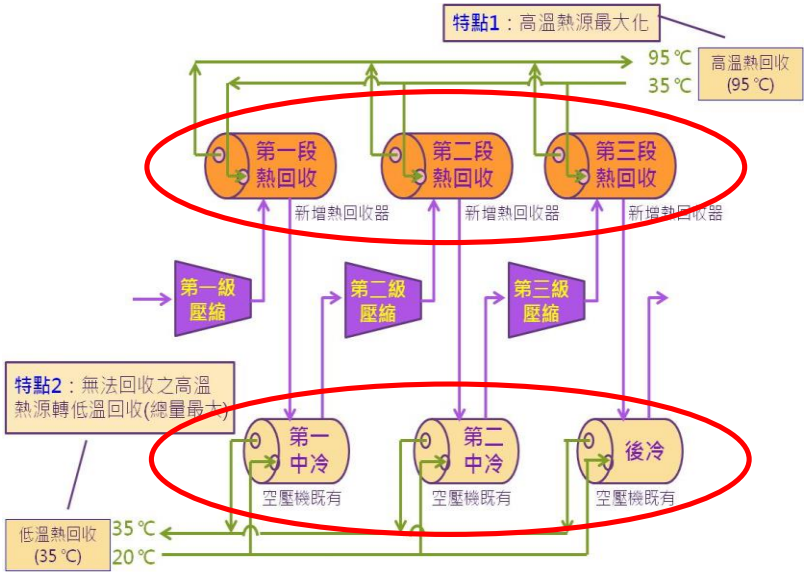


- Waste Heat recovery(**BenQ ESCO**)

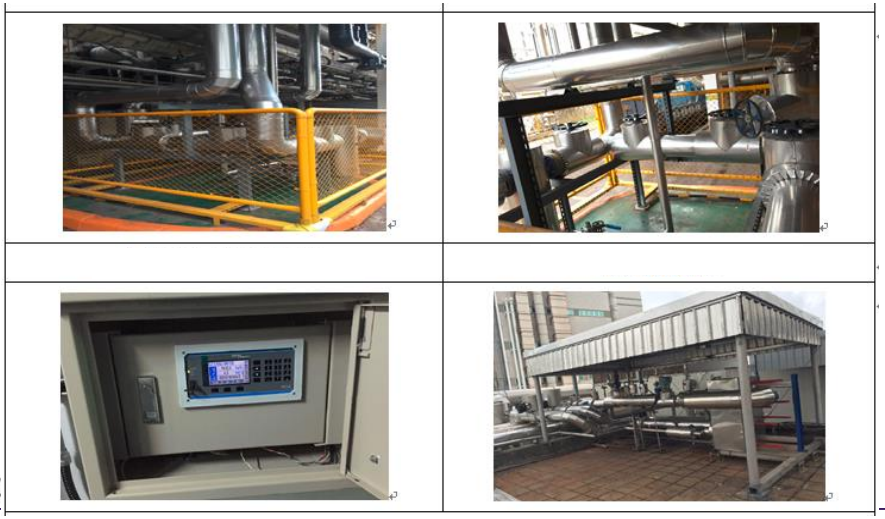


Item	method	Advantage
Waste Heat recovery(normal)	Heat recovery only by the end of output(compress air).	No need for compressor revising.
Waste Heat recovery(**BenQ ESCO**)	Heat recovery from **both cooling water and compress air.**	Maximize the amount of recover ratio.

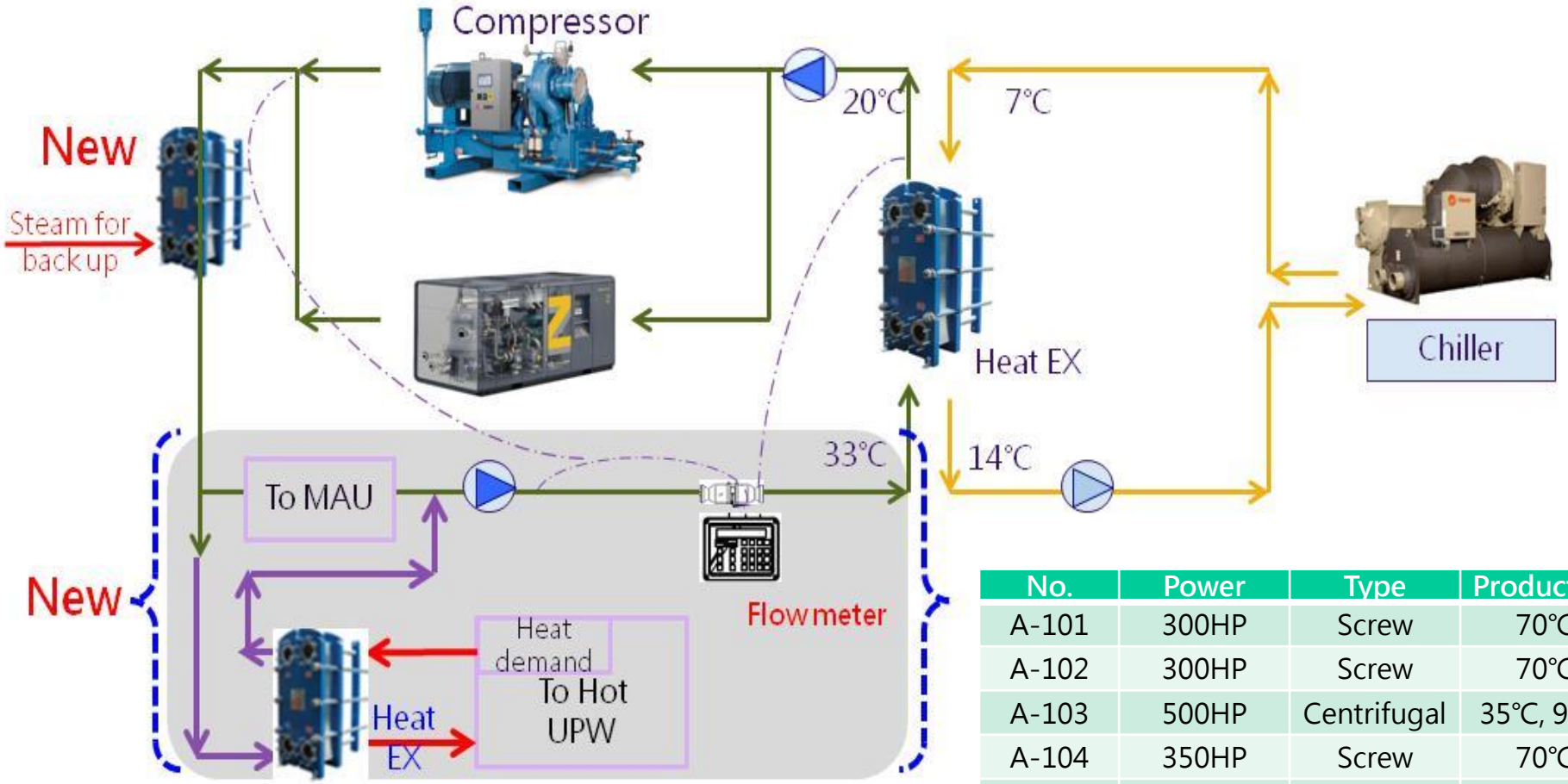
4.Waste Heat Recovery Project



No.	Power	Type	Production
A-101	300HP	Screw	70℃
A-102	300HP	Screw	70℃
A-103	500HP	Centrifugal	35℃, 95℃
A-104	350HP	Screw	70℃
A-105	500HP	Centrifugal	35℃, 95℃
N-5900	2250HP	Centrifugal	35℃



4.Waste Heat Recovery Project



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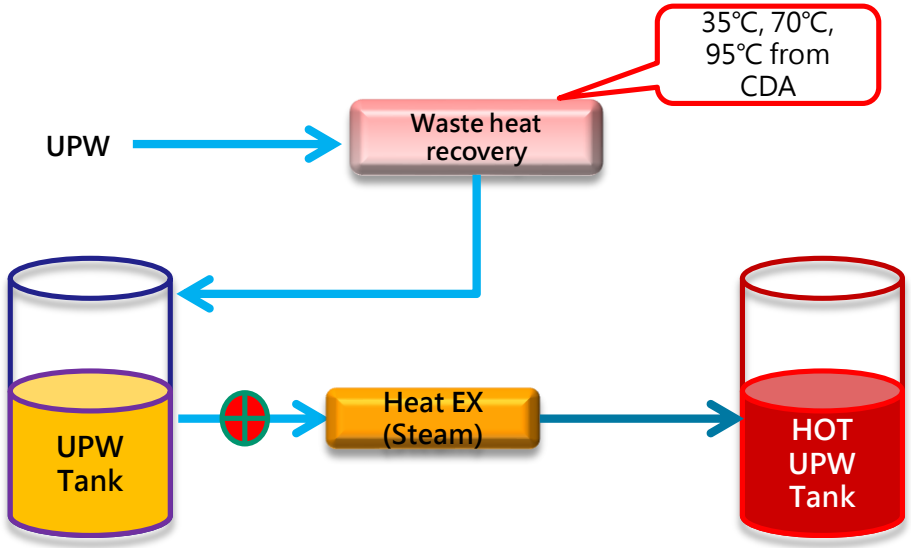
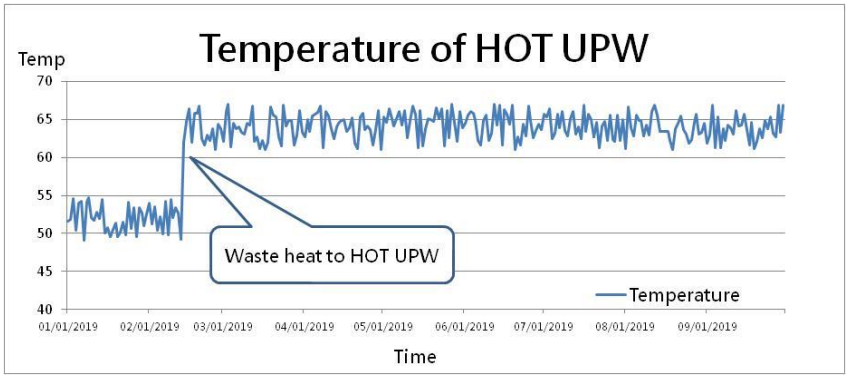
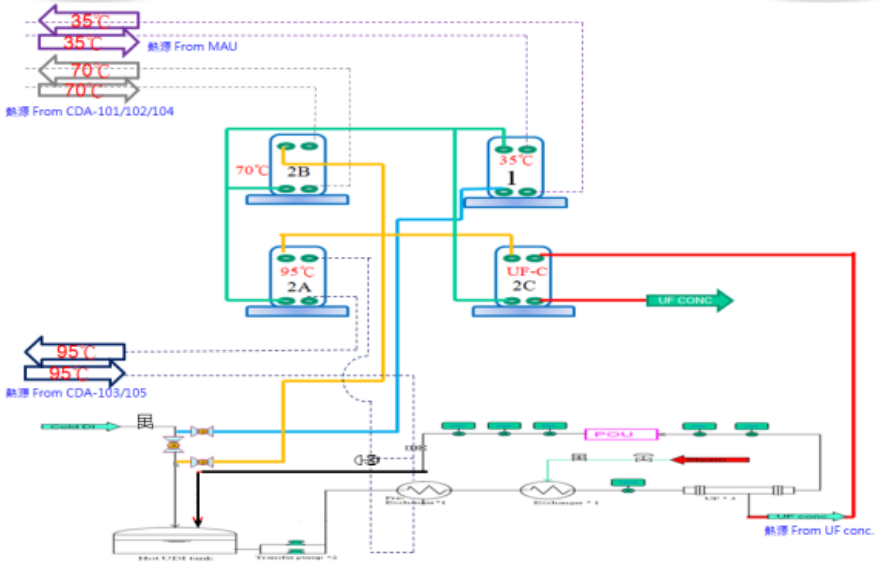
4.Waste Heat Recovery Project

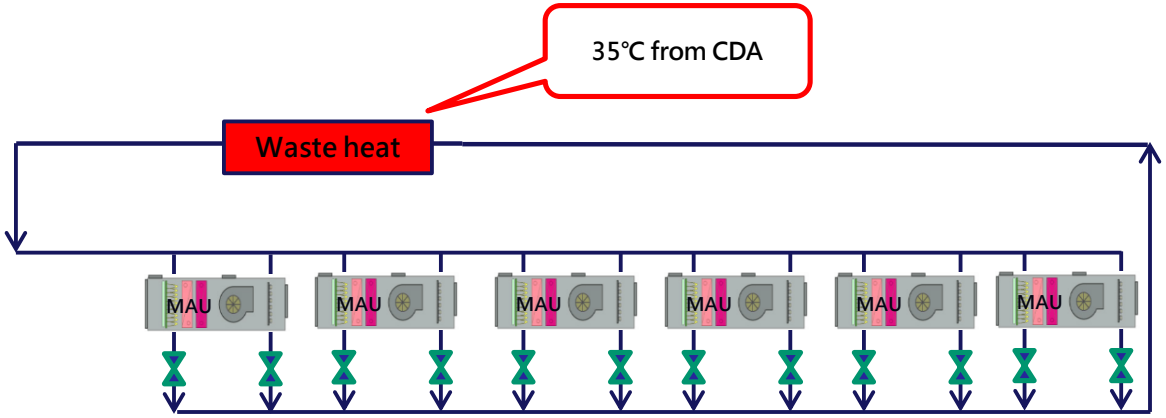


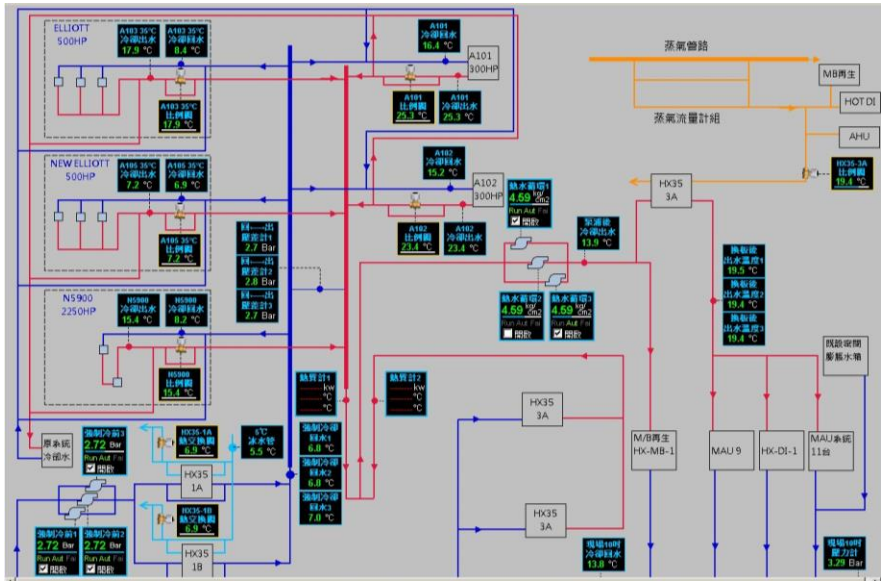


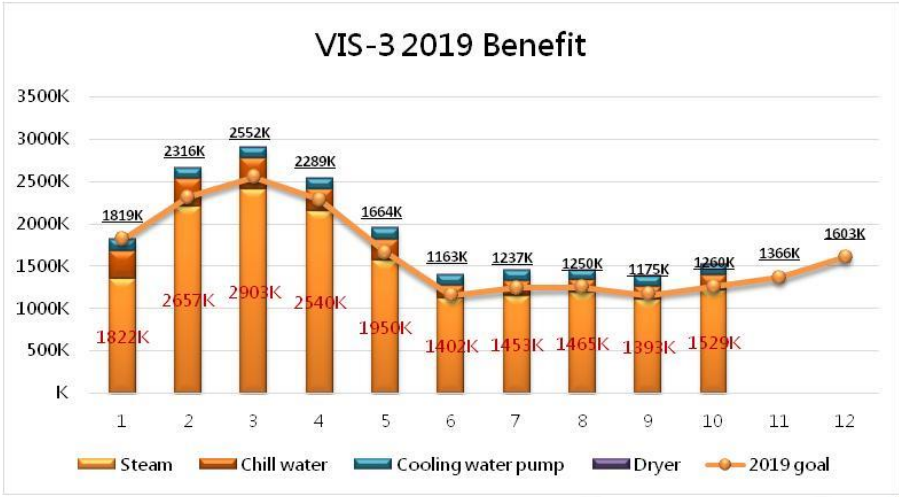


As is Amount of steam for input water 52℃
20CMH*1000kg*(80℃-52℃)/860=1.035ton/hr
To be Amount of steam for input water 64℃
15CMH*1000kg*(80℃-64℃)/860=0.443kg/hr
1.035-0.443=0.591tom/hr
0.591ton/hr*24hr*365day=5179.5ton/year
Benefit = 5,013,723 NTD/year

4.Waste Heat Recovery Project

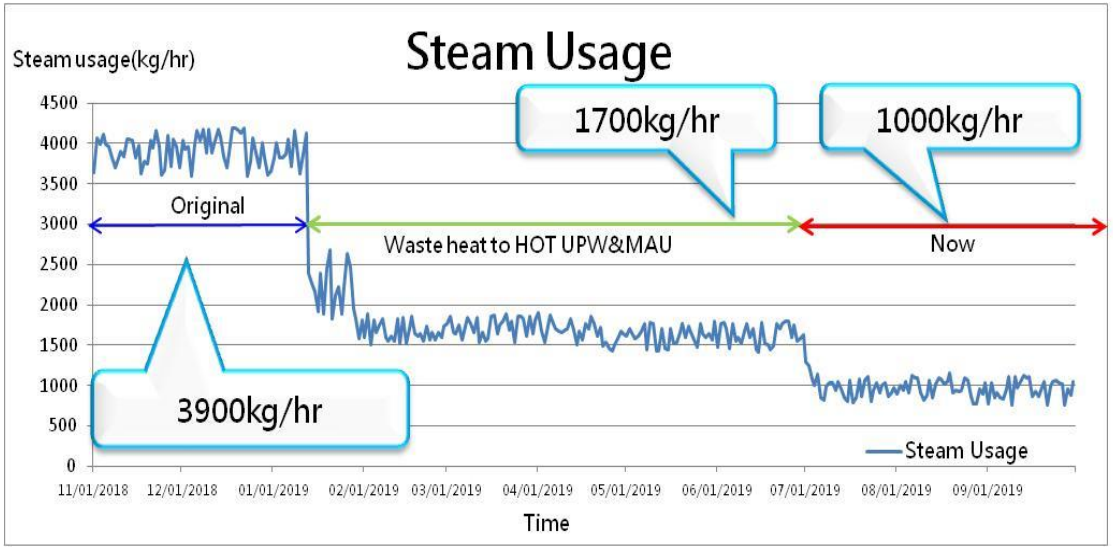




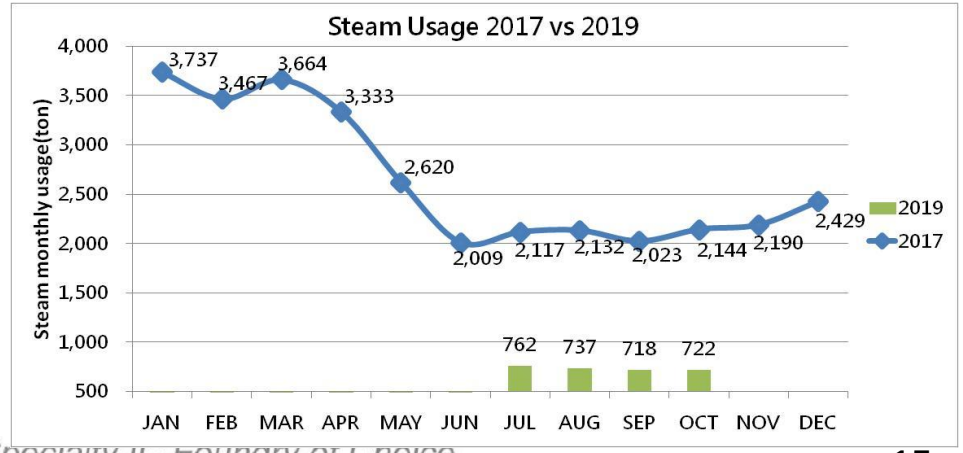


5. Benefit

Steam hourly usage during the process (including MAU and HOT UPW)



65% down



	Jul	Aug	Sep	Oct
2017	2,117	2,132	2,023	2,144
2019	737	731	711	722
Steam saving	65%	66%	65%	66%

5. Benefit

Direct benefit (Steam saving)

Item	Action for steam saving	Steam saving	Benefit(year)
1	35˚C source from CDA system(MAU)	1,988 kg/hr	$10,685,955
2	80˚C source from UF concentration(HOT DI)	591kg/hr	$5,013,723
3	35˚C source from CDA system(HOT DI)		
4	70˚C source from CDA system(HOT DI)		
5	95˚C source from CDA system(HOT DI)		
sum			$15,699,678

Indirect benefit (Power saving)

Item	Power saving(kWh)	Benefit(year)
VIS-3 Chilled water	1,562,711	$3,328,575
VIS-3 Cooling water pump	641,820	$1,367,077
VIS-3 Dryer	90,555	$192,882
sum		$4,888,534

Total benefit:

NT $ 20,588,212