

經濟部工業局

鋼鐵產業-低碳綠色製程座談會

宜諾工程公司1/11/2017

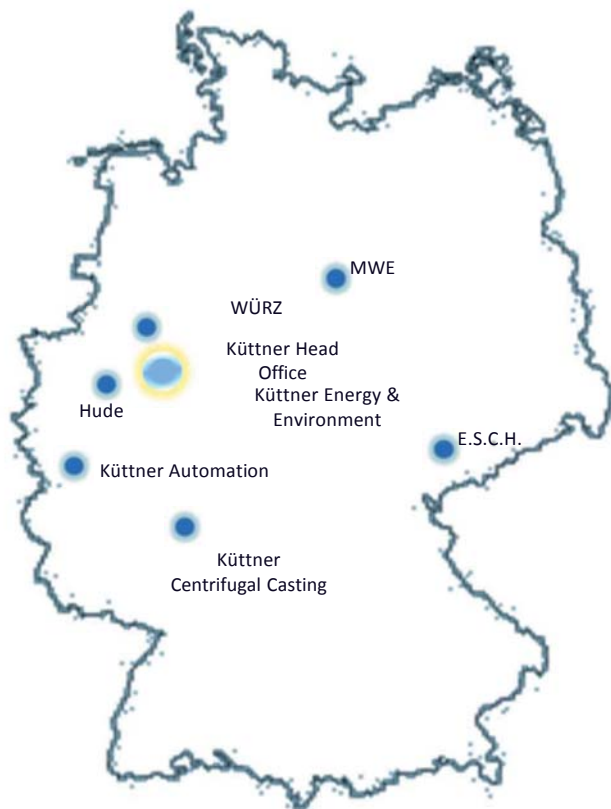


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公司簡介 Company Overview

The Küttner Group in Germany

KÜTTNER



Küttner GmbH & Co. KG, Essen

Headquarter

Küttner Ironmaking and Energy GmbH, Essen

Küttner Automation GmbH, Trier

Associated Companies

- Hude GmbH, Erkelenz Kokereitechnik
- MWE GmbH, Magdeburg Walzwerktechnik
- E.S.C.H. GmbH, Unterwellenborn Pneumatische Fördertechnik
- WÜRZ GmbH, Willich Rekuperative Wärmetechnik
- Küttner Centrifugal Casting GmbH, Karlstadt



ELITE

LOCAL BRANCH OFFICES

KÜTTNER



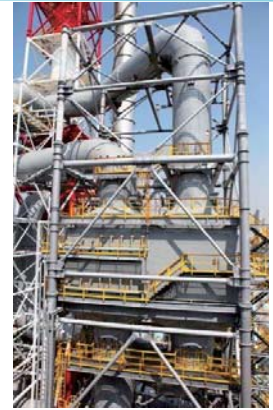
BRANCH OFFICES

- Kuttner France
- Kuttner Spain
- Kuttner S.A., Belgium
- Kuttner do Brazil
- Somani Kuttner India (P) Ltd. Kolkata
- Kuttner North America
- Kuttner Asia Co. Ltd.
- Kuttner South Africa, (pty) Ltd.
- Kuttner Ukraine GmbH, Donetsk UKR

ELITE

➤ Design and Supply of High Efficient Heat Recovery Systems for

- the Steel and Non-Ferrous Industry
- the Cement Industry
- the Glas Industry
- the Chemical Industry
- Power Plants, Compressor Stations, etc.



- Identification of Heat Recovery Potentials
- Customized Heat Recovery Solutions
- Supply of Components, Plant Sections and Turn-Key Plants
- Basic and Detail Engineering
- Erection, Supervision of Erection and Commissioning



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Küttner Heat Recovery Technology **KÜTTNER**

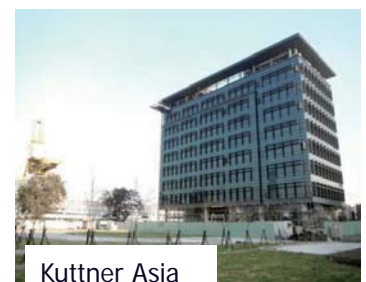
- Support from preliminary engineering to final commissioning
- Customized design for a maximum benefit
- Additional support from our local subsidiaries
- Possibility of partial deliveries from local suppliers
- Access to production facilities



Kelvion Poland



Küttner Asia



Küttner Asia



集團組織 Elite Group



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專業服務 Professional Services



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廢熱回收專家 HRS Expert

恆怡集團近年來致力於工業廢熱回收系統工程，引入高技術門檻及高附加價值之關鍵元件——熱管於國內生產製作。

Elite Group has dedicated into industry HRS in recent years, lead manufacturing for the key element of HRS, HEAT PIPES, into Taiwan market.

廢熱回收使工廠需要燃燒的燃料減少，降低燃料成本的同時也達到製程減廢，以及減少碳排放之目的。

Heat recovery helps plants to lower the usage of fuel; whereas the waste and carbon reduction happened at the same time.

恆怡廢熱回收系統特色 Characteristics of Elite's HRS

1.
德國工藝
German
Technology

2.
台灣製造
Made in Taiwan

3.
全球在地化
Glocalization

廢熱變黃金
Waste into Gold



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構造及塗覆專利 Structure & Coating Patents



台灣專利
Taiwan

大陸專利
China

印尼/越南專利
Indonesia / Vietnam



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品質認證 Quality Accreditation



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競爭優勢 Competitive Advantages

✓ 客製化製造：

根據訂單，現場勘驗製作

Tailor-made design:

According to different order, the tailored design is made after site inspection.

✓ 專利：

保障熱管優勢 (詳見下頁)

Patent:

See as next page.

✓ 品質保證：

ISO 9001 / ISO 14001/ ASME / PED

Quality Assurance (ISO9001, SO14001, ASME and PED)



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競爭優勢 Competitive Advantages

✓ 市場獨占性及獨特性：

目前世界上歐盟美日均無類似產品產製，本公司投資興建之熱管製造廠為100%德國原生設計並由德國100%技術移轉於台灣。

- Unique market position

There is no similar products production system in EU, United States and Japan. ELITE's investment in the construction of the factory for the heat pipe is 100% Germany original design by the German technology and 100% transfer in Taiwan.

✓ 技術領先：

德國母公司 Küttner 全力技術上奧援，並有原廠技師駐點，以符合100%德國 (DIN) 品質。

- Advanced leading technology skill

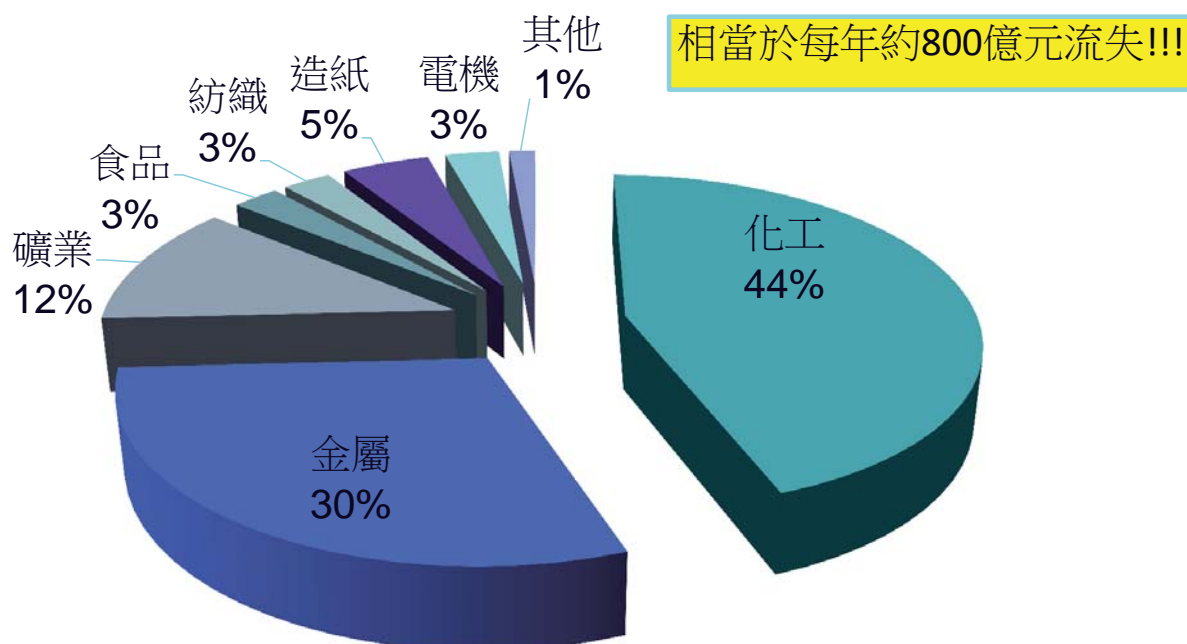
100% technical support by Küttner, Germany and stationed with Germany original technicians to comply with 100% Germany DIN quality.



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為何要節能減廢？ Why waste heat recovery?

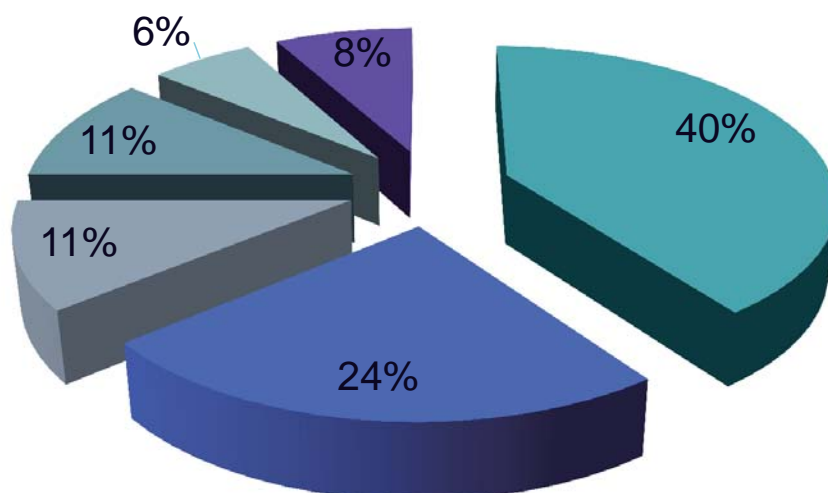
101年工業大戶總餘熱量推估 (合計3,900,350公秉油當量)



為何要節能減廢? Why waste heat recovery?

200度以下餘熱佔總餘熱量64%

■ <150 ■ 151~200 ■ 201~250 ■ 251~300 ■ 301~400 ■ >400



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資料: 能源資訊網



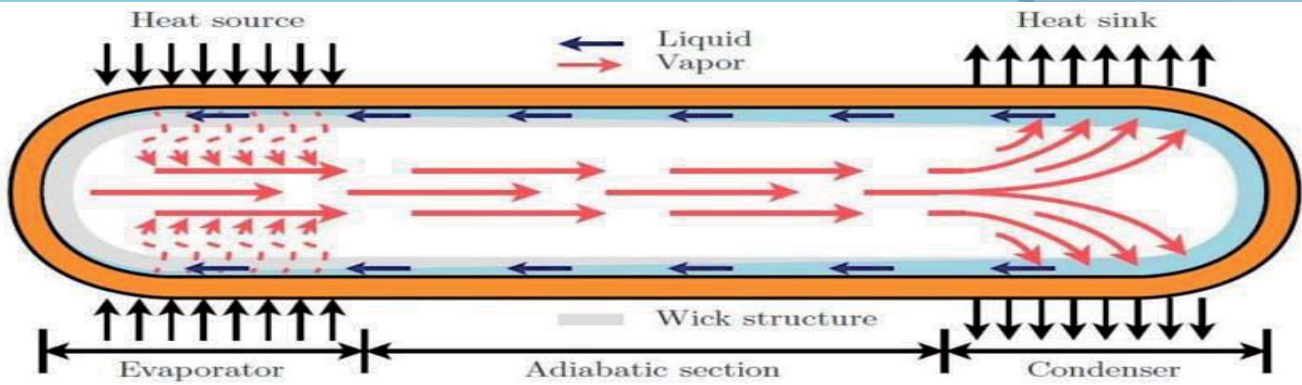
2 節能減廢-熱管技術應用

Ecostat Heat Pipe Technology /Application

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熱管工作原理 Heat Pipe Principle



熱管工作原理說明

熱管兩側封閉，管內抽真空，熱媒(如:純水)在管內進行相變循環，說明如下:

1. 在熱管蒸發端:純水吸熱汽化後產生水蒸氣，蒸氣分壓逐漸上升。
 2. 在熱管絕熱段:水蒸氣在真空環境快速流向低壓的冷凝端。
 3. 在熱管冷凝端:水蒸氣散熱冷凝後產生冷凝水附著於內管壁。
 4. 在熱管內管壁:利用毛細組織或重力產生虹吸作用，冷凝水流回蒸發端。
- 熱管內熱媒週而復始地反覆循環傳熱，遂達成外部冷熱兩氣流熱交換之目的。
 - 純水汽化潛熱(Latent heat) 2,260,000J/kg為顯熱4,200J/kg. k高約538倍。
 - 水蒸氣由高壓流向低壓在真空狀態下，理論上接近音速。



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熱管型式 Type of Heat Pipe

PTFE熱管

PTFE Heat Pipe



鰭片式熱管

Finned Heat Pipe



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熱管使用條件 Conditions of Application

依照製程條件分別有以下兩種不同的熱管應用

The application of heat pipes are basically sorted into below two different categories based on the process conditions

PTFE熱管 PTFE Heat Pipe

- 適用於酸性或腐蝕性煙氣
Apply to flue gas which containing acidic or corrosive substances
- 可耐熱至**260° C**
Temperature resistance up to 260° C
- PTFE可以保護熱管防止侵蝕及延長使用壽命
PTFE can protected heat pipes from erosion and extend operational life

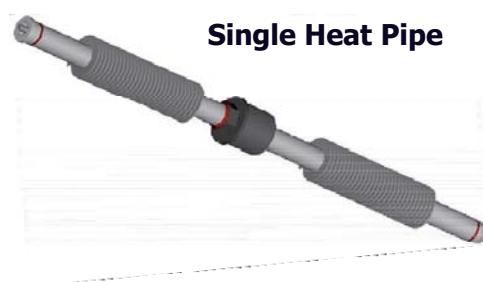
鰭片式熱管 Finned Heat Pipe

- 適用於較清淨的煙氣
Suitable for relevant clean flue gas
- 可耐熱至**350° C**
Temperature resistance up to 350° C
- 鰭片可增加熱交換面積也可藉由鰭片間距調整壓損
Fins can increase the heat transfer area, pressure drop can also be adjusted via fin spacing

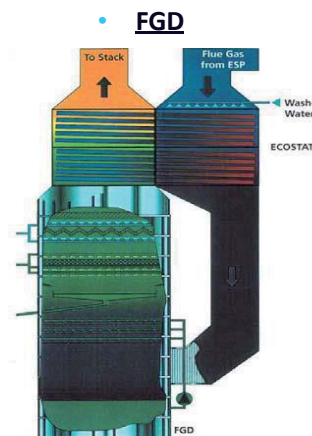
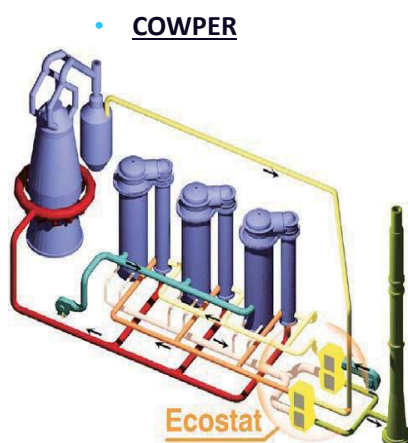
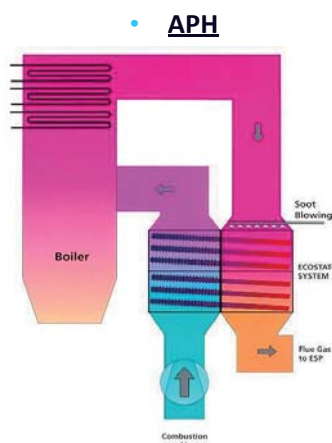


ECOSTAT Heat Pipe - Applications

- Air Pre-Heating (APH) for Boilers
- Air and Gas Preheating in Steel Industry (COWPER)
- Around Flue Gas Desulfurization (FGD)



Single Heat Pipe



ECOSTAT System - Attributes & Advantages

Attribute

- Simple plant geometry, compact design
- Arrangement horizontal or vertical
- Large number of independent pipes
- Minor pressure drop
- Gas-tight, no leakage
- No moving parts
- No control and safety elements necessary

Advantage

- Ease of erection and inspection
- Flexible for installation
- High reliability and availability
- Low fan power consumption
- No risk of mixing of gas streams
- No additional energy necessary
- Simple configuration



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熱交換器種類 Types of Heat Exchanger

各式熱交換器一覽表

Heat Exchangers Comparison Chart

型式 Type	廢熱來源 Heat Source	回收能源媒體 Cold Medium	特徵 Performance	檢討要點 Disadvantages
管式 Shell and tube	氣體或液體 Gas or liquid	氣體或水 Gas or water	U (熱傳係數) = 23.3W/m ² K U (heat transfer coefficient) =23.3W/m ² K	塵埃、腐蝕 Dust, corrosion
玻璃披覆鋼管 Glass coated steel pipe	腐蝕性氣體 Erosive gas	氣體或水 Gas or water	用於 SOX Use in SOX	加工問題、耐久性 machining, endurance
細溝管 Rill pipe	氣體 Gas	氣體 Gas	傳熱較佳 better heat transfer	細溝管 rill pipe
蓄熱迴轉式 Rotary	氣體 Gas	氣體 Gas	最高操作溫度 450°C, U=29.1W/m ² K highest operation temperature: 450°C, U=29.1W/m ² K	漏氣2%、需迴轉動力 2% leakage, rotary power needed
板式 Plate	氣體 Gas	氣體 Gas	安置容易, 最高操作溫度 850°C, U=23.3W/m ² K easy installation, highest operation temperature: 850°C, U=23.3W/m ² K	塵埃 Dust
熱管式 Heat pipe	氣體或液體 Gas or liquid	氣體或液體 Gas or liquid	密封性良好, 中低溫操作, U=58.2 W/m ² K no leakage, mid to low working temperature, U=58.2W/m ² K	塵埃、腐蝕 Dust, corrosion
復熱式 Recuperator	燃燒後排氣 Burned Gas	預熱燃燒用空氣 Preheated combustion air		

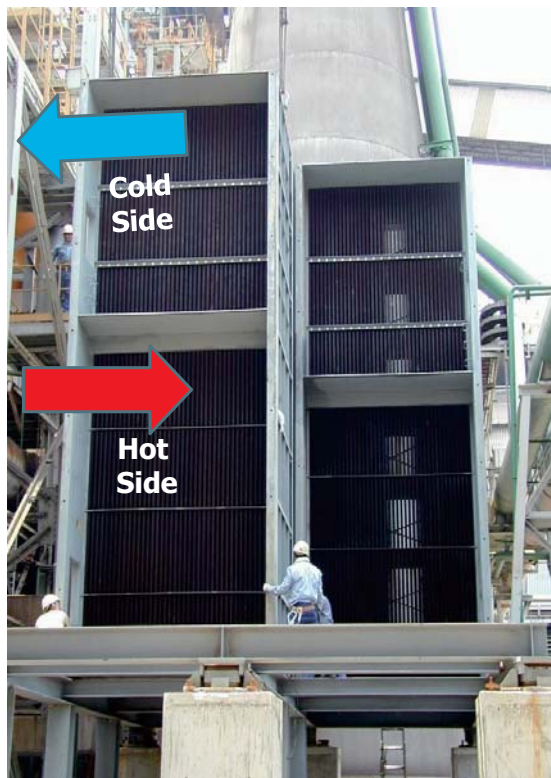
[資料來源] [Sources]

■ 廢熱節能管理手冊 Page 24



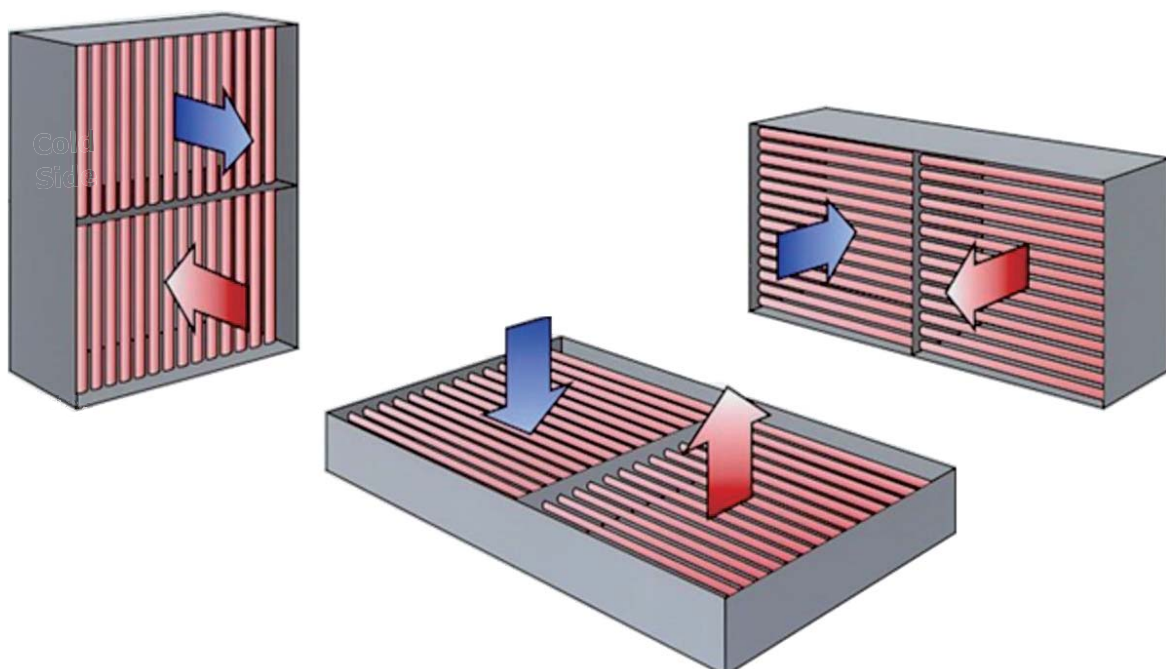
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熱管式氣氣熱交換器 ECOSTAT GGH



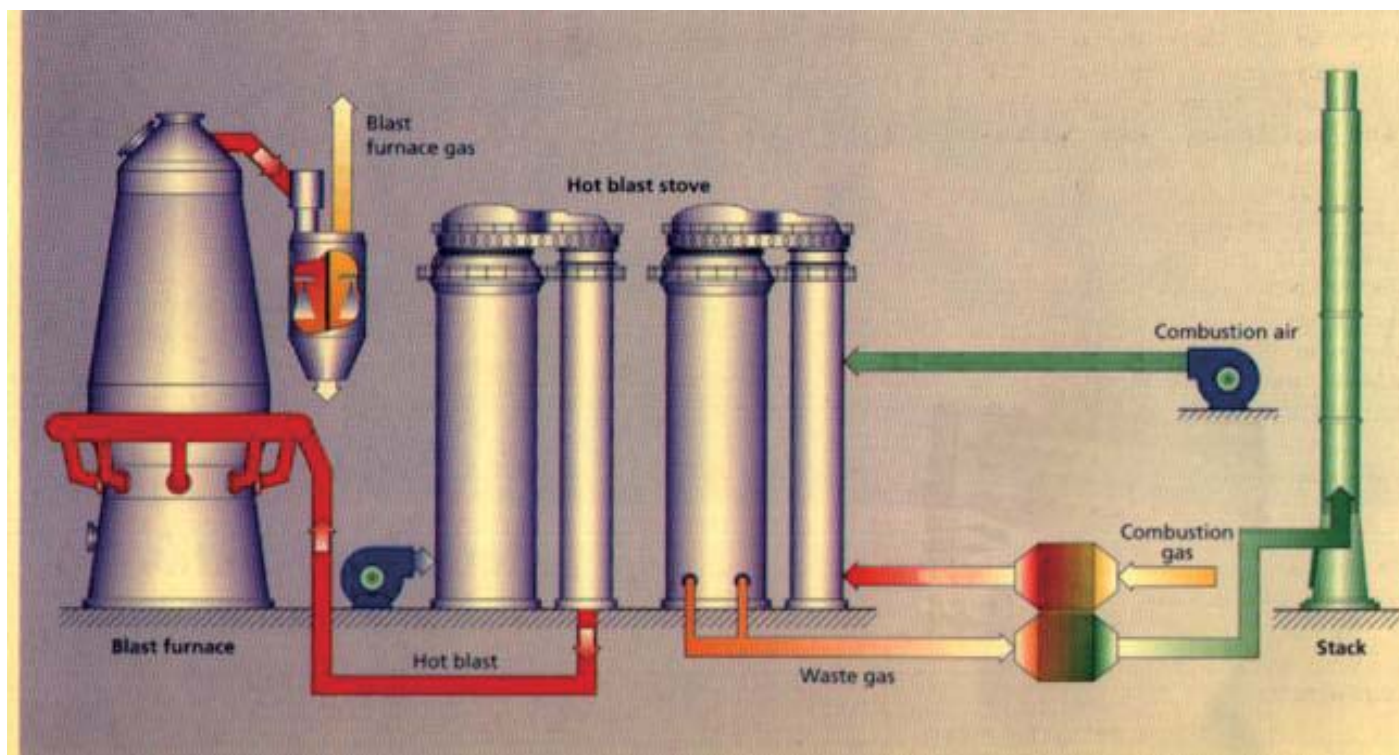
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熱管箱安裝方式 Bundle Arrangement



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節能改善案例 2_ Ecostat in Hot Stoves Taiwan 2001



熱風爐熱管式燃氣預熱器應用
Heat Pipe BFG Preheater – Ecostat



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節能改善案例 2_ Ecostat BFG Preheater Stoves 2001



熱風爐熱管式燃氣預熱器應用
Heat Pipe BFG Preheater – Ecostat



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BFG

廢氣流量: 186,353 Nm³/h
 285°C => 125°C, 4.0 mbar
 燃氣流量: 163,132 Nm³/h
 25°C => 215°C, 5.3 mbar

廢氣

回收熱能
 Energy saving:
 12,320 kW

中鋼二號高爐熱管式應用範例
 CSC BF2 Heat Pipe BFG Preheater – Ecostat



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回收熱能
 Energy saving:
 35.040 kW_{th}

Combustion gas and combustion air heating

Waste gas	122.000 Nm ³ /h; 380 / 160°C
Combustion air:	142.250 Nm ³ /h; 20 / 283 °C;
Capacity:	12.800 kW
Waste gas :	212.545Nm ³ /h; 380 / 160
Combustion gas:	209.410 Nm ³ /h ; 40 / 283 °C;
Capacity:	22.240 kW

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中鋼四號高爐熱管式應用範例
 CSC BF4 Heat Pipe Preheater - Ecostat



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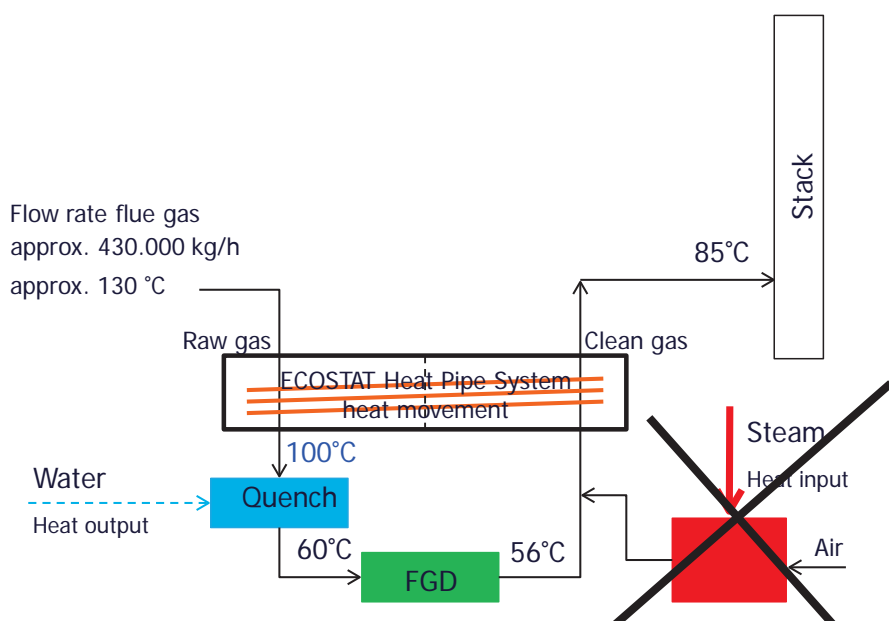
中龍一號及二號熱風爐熱管式應用範例
DSC BF1 & BF2 Heat Pipe Preheater - Ecostat



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FGD - Situation with Heat Pipe

The Ecostat Heat Pipe System equipped with PTFE coated heat pipes reduces the water consumption at the quench and stops completely the steam consumption.



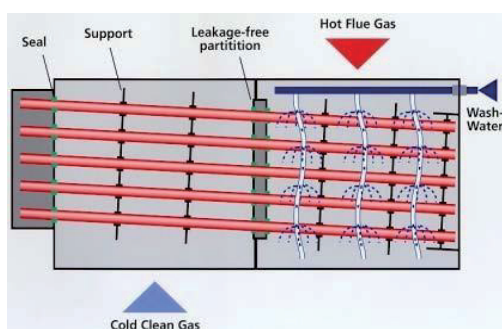
Advantages

- Saving of fossil fuel (no steam)
- Saving of quench water
- Saving of waste water at FGD
- Saving of Power for Pumps



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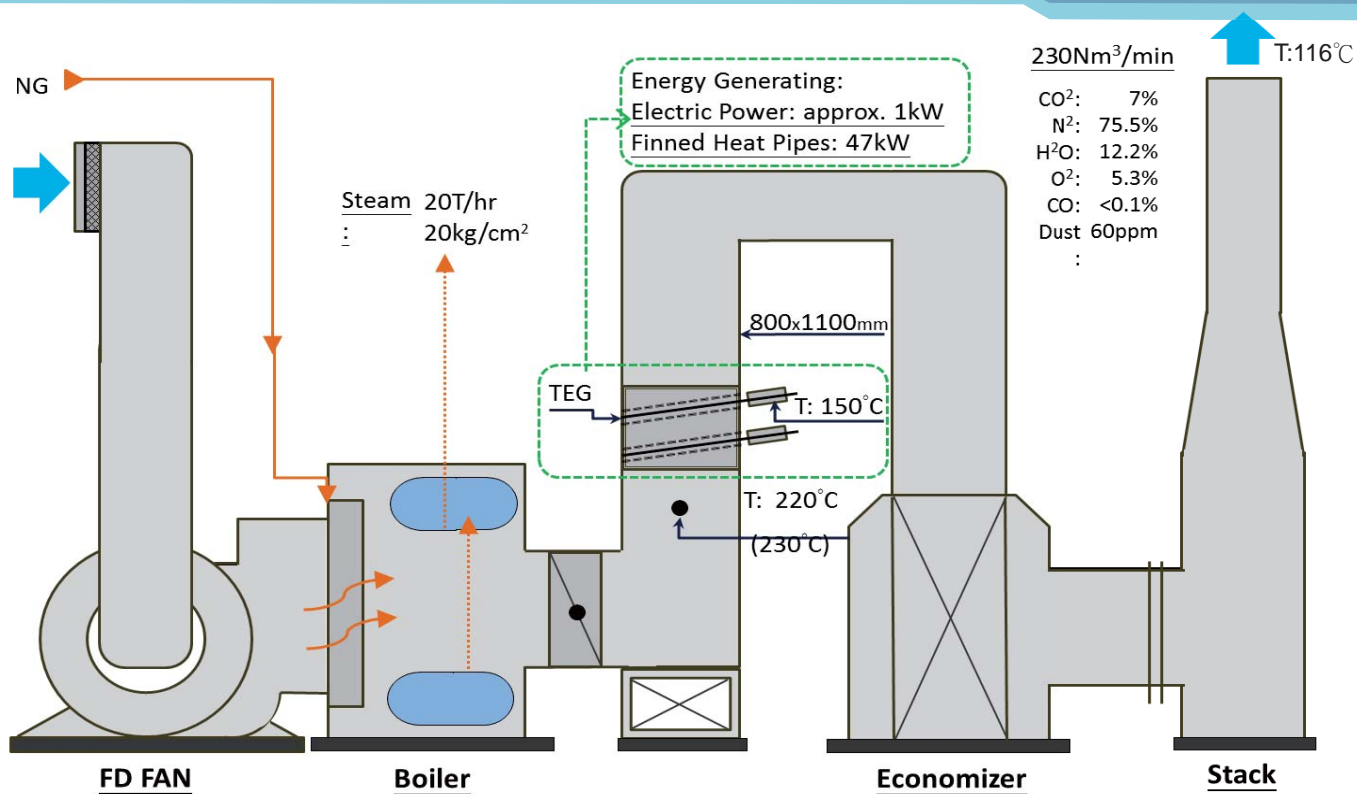
300噸鍋爐熱管應用 Ecostat at 300 tons Boiler Plant



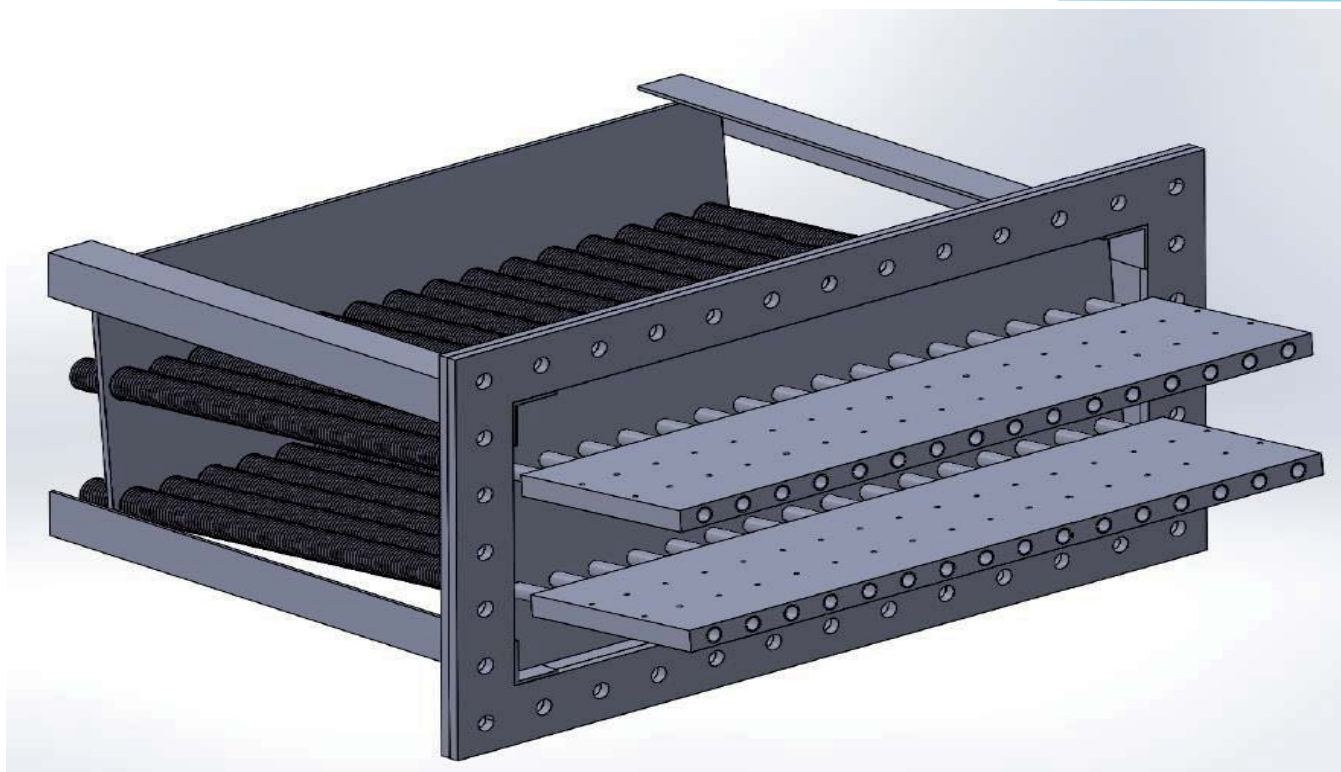
31

ITRI-TEG Project Process Flow Sketch

工研院鍋爐煙氣kW熱電案



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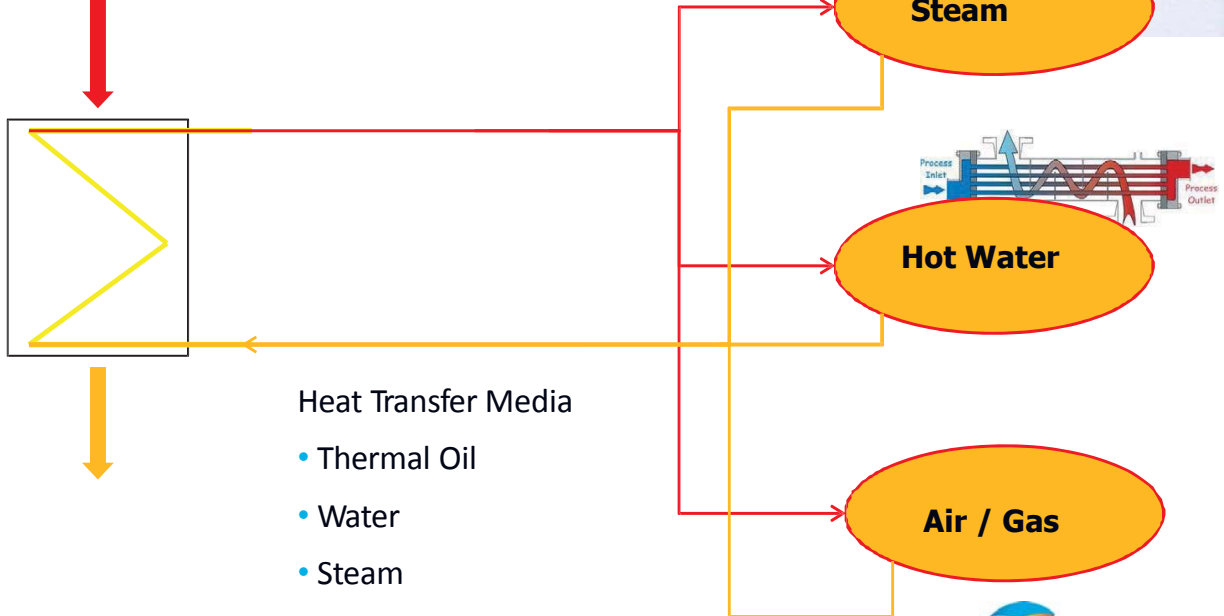
3 節能減廢-熱媒油系統應用 Ecoflow Thermal Oil System / Application



ECOFLOW - Principle

This heat transfer system is using the energy for hot waste gases

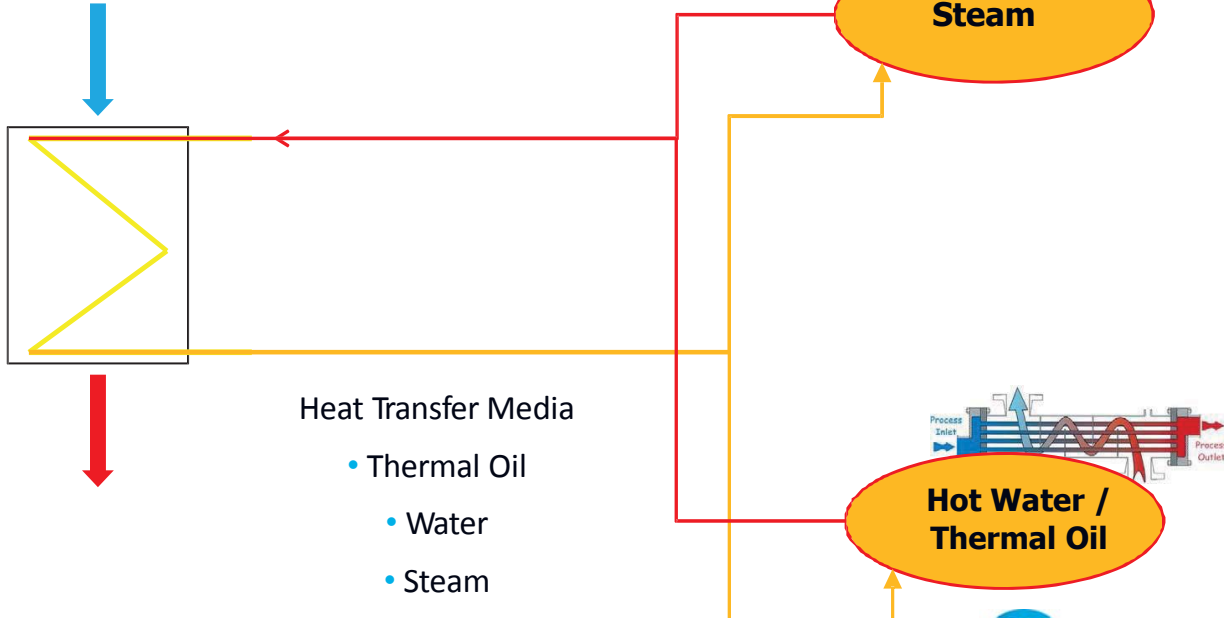
Hot Waste Gas



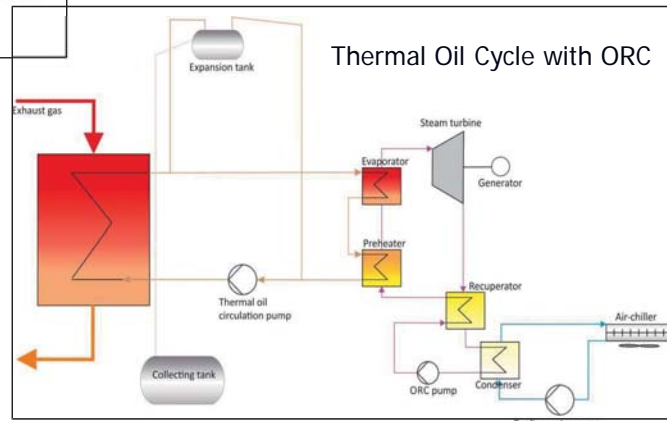
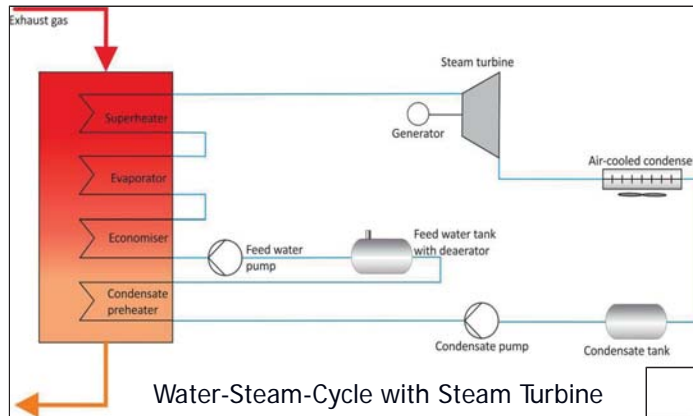
ECOFLOW - Principle

This heat transfer system is using the different energies to heat cold waste gases

Cold Waste Gas



Ecoflow Systems – Power Generation



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Ecoflow System – Attributes

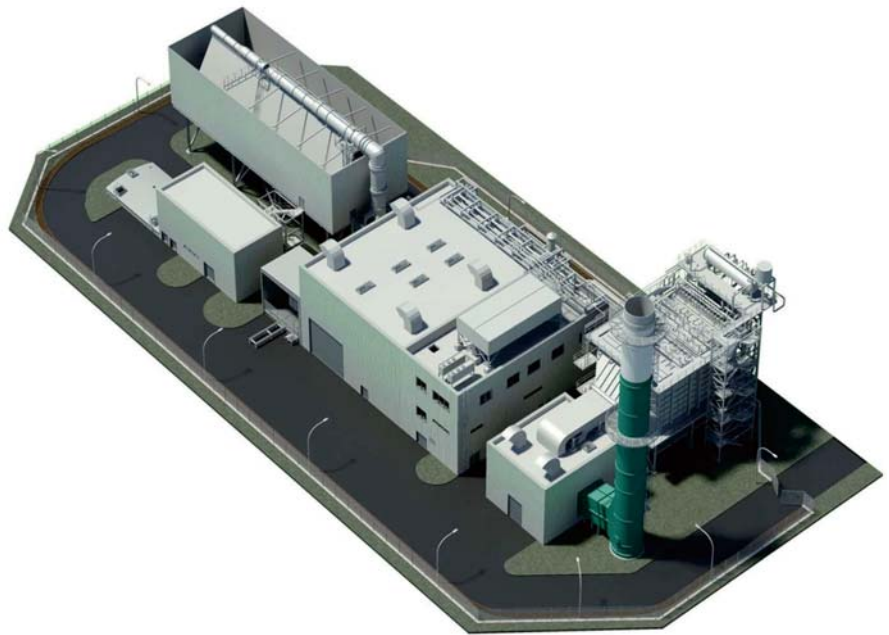
- Simple heat exchange technology
- Heat duties from 100 to 50.000 kW
- Heat transfer fluid: preferred water or thermal oil
- Surmountable large distances between heat source and consumer
- High operational flexibility for any consumer
- Adaptable to the requirements of the consumer
- Opportunity for CHP with steam turbine or ORC
- High control ability



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Heat Recovery at a Gas Compressor Station

- Küttner acts as General Contractor and supplies Turn-Key Plant
- Scope of Supply:
 - Waste heat boiler
 - Fan
 - Stack
 - Water treatment plant
 - Turbine & generator
 - Pumps
 - Air condenser
 - Piping
 - Process control system



Hot Stove Plant - Ecoflow Application

Preheating of combustion air and gas (low calorific gas) by using hot waste gas from the stoves

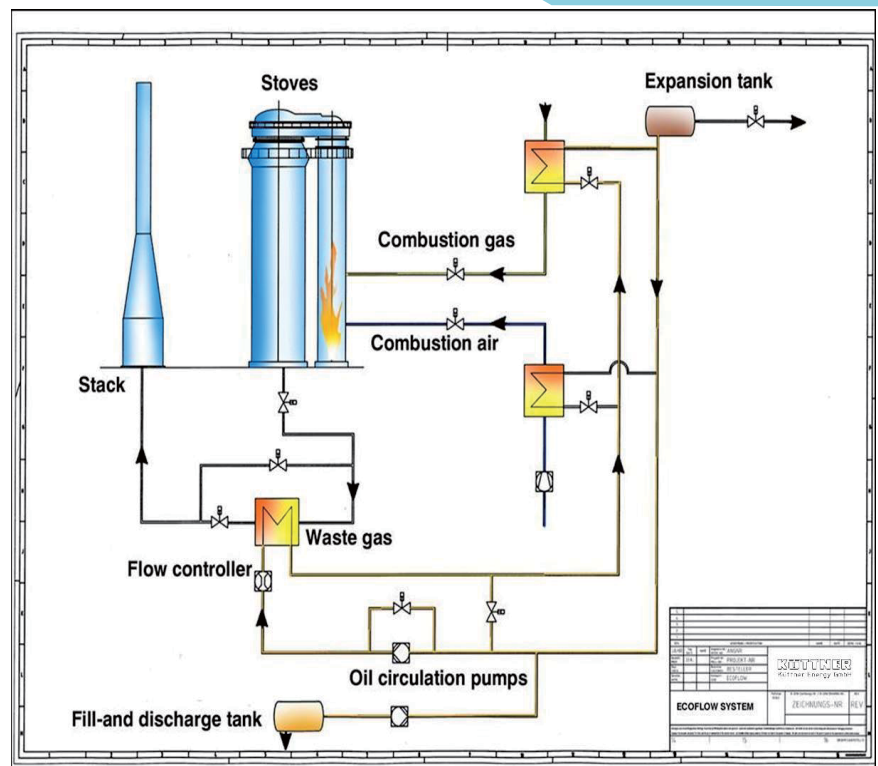


Reduction /

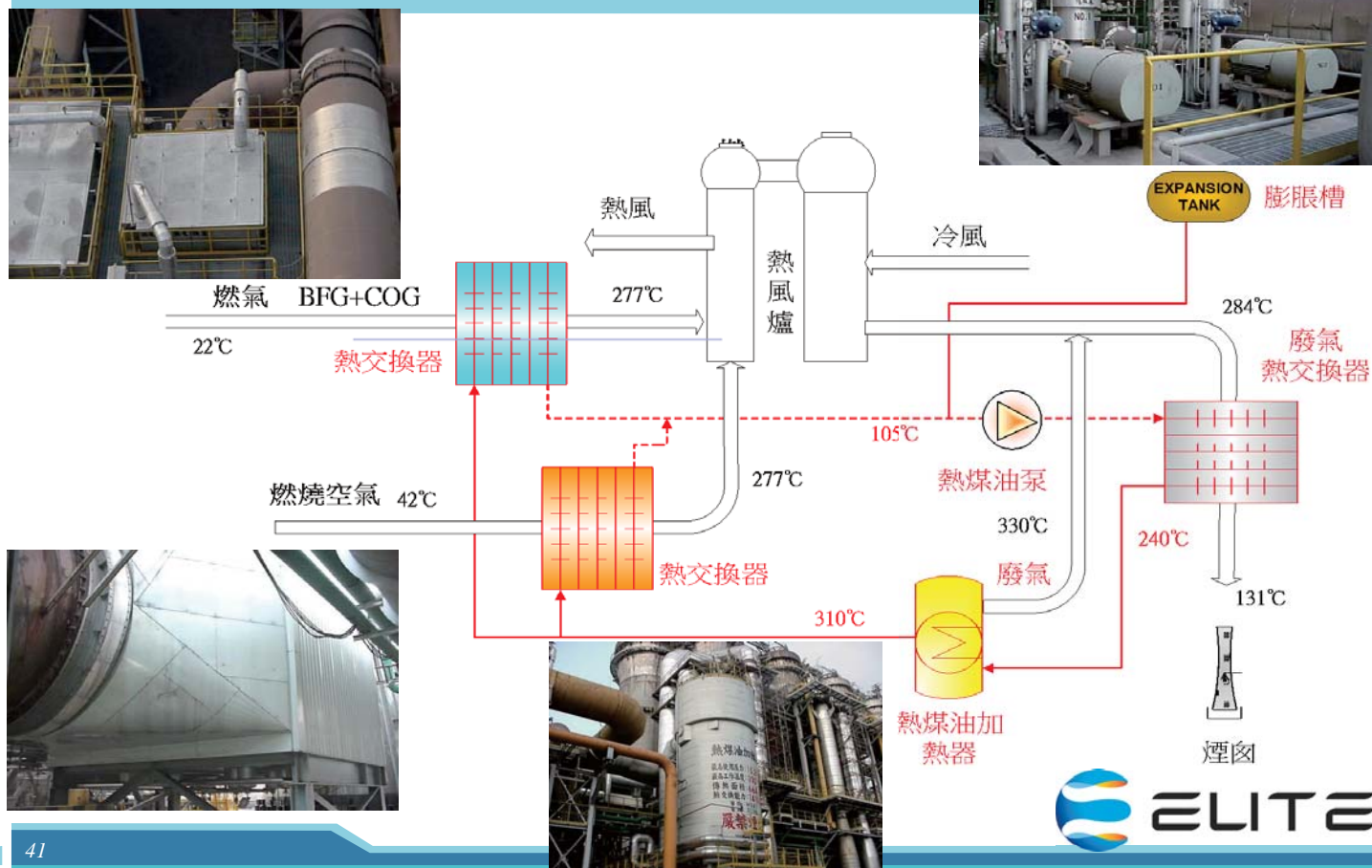


Elimination of Rich Gas

Reduction of Energy Costs



ECOFLOW - Thermal Oil Application – CSC BF3



ECOFLOW - Thermal Oil Application – CSC BF3



Combustion air and gas preheating

Waste gas:	122.000 Nm3/h;	275 / 135°C
Combustion air:	142.200 Nm3/h;	42 / 280°C;
Combustion gas:	220.040 Nm3/h;	22 / 280°C;

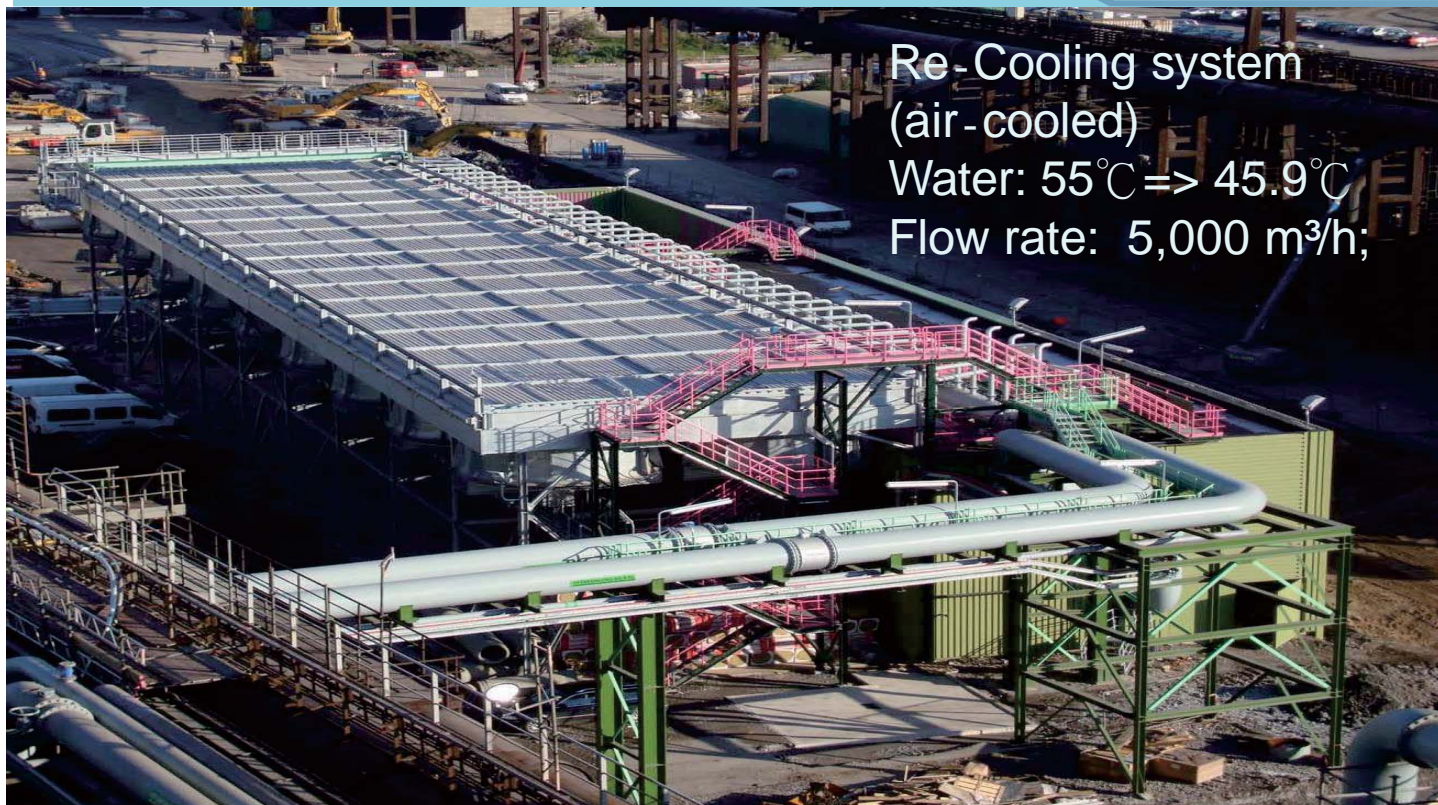
23.320 kW -> 1. step (exhaust gas)
12.550 kW -> 2. step (Thermal oil boiler fired by BF-gas)



Scope of Supply:

- Heat Recovery System
- BF-Gas fired Thermal Oil Boiler
- Thermal Oil Circuit

Re-Cooling System at BF 8, ThyssenKrupp Duisburg



Re-Cooling system
(air-cooled)
Water: $55^{\circ}\text{C} \Rightarrow 45.9^{\circ}\text{C}$
Flow rate: $5,000 \text{ m}^3/\text{h}$;



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Ecoflow 燒結廠應用例(義大利 Taranto, Italy)



waste heat recovery from sinter cooler 4 & 5
at Taranto, Italy to generate process steam

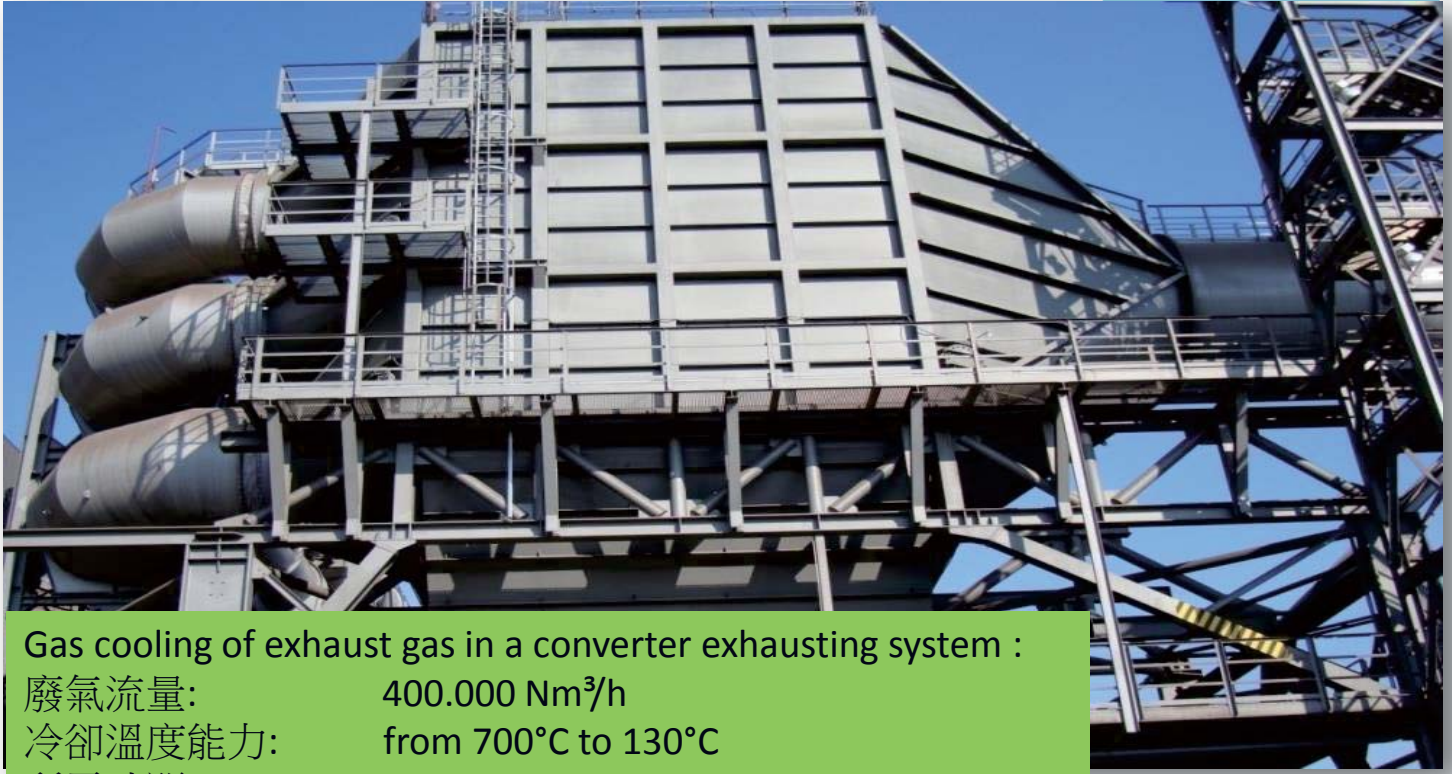


Waste gas flow rate: $2 \times 320.000 \text{ Nm}^3/\text{h}$; 320°C
Steam generation: $2 \times 23 \text{ t/h}$ 23 bar(a); 280°C
Capacity: $2 \times 16860 \text{ kW}$



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Heat accumulator at Arcelor Mittall, Eisenhüttenstadt



Gas cooling of exhaust gas in a converter exhausting system :

廢氣流量: 400.000 Nm³/h
冷卻溫度能力: from 700°C to 130°C
所需時間: 150 sec.



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應用實績
Application References



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References - Excerpt

Industry	Project	Performance kW
Steelworks	Jindal, India, HRS at BF2, Ecostat auxiliary Burner fired by BF Gas	16.700
	CSC Taiwan, HRS at BF4, Ecostat auxiliary Burner fired by BF Gas	35.200
	TATA Steel, India, HRS at BF2, Ecostat	32.000
	EKO Stahl, Germany, HRS at BF 5A, Ecoflow , auxiliary Burner fired by BF Gas	26.700
	VAI UK, HRS at BF3, Ecostat	20.400
	CSC Taiwan, HRS at BF 2, Gas Preheating Ecostat	12.300
	Voest Austria, HRS at BF A, Ecostat	11.230
	CSC Taiwan, HRS at BF 3, Ecoflow auxiliary Burner fired by BF Gas	37.300
	TKS AG Germany, Extension Thermal Oil at BF 9, 4th Cowper, Ecoflow	
	TKS AG Germany, Cole Pre Heating BF1 (+ Extension)	
	VAI UK for Dragon Steel Taiwan, HRS at BF1, Ecostat	22.000
	TKS AG Germany, Air-Cooling System BF 8, Plant Hamborn	45.900
	SMS Basco Air-Cooling System , Kazakhstan	7.550



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國內廢熱回收實績 Local HRS References

KUTTNER

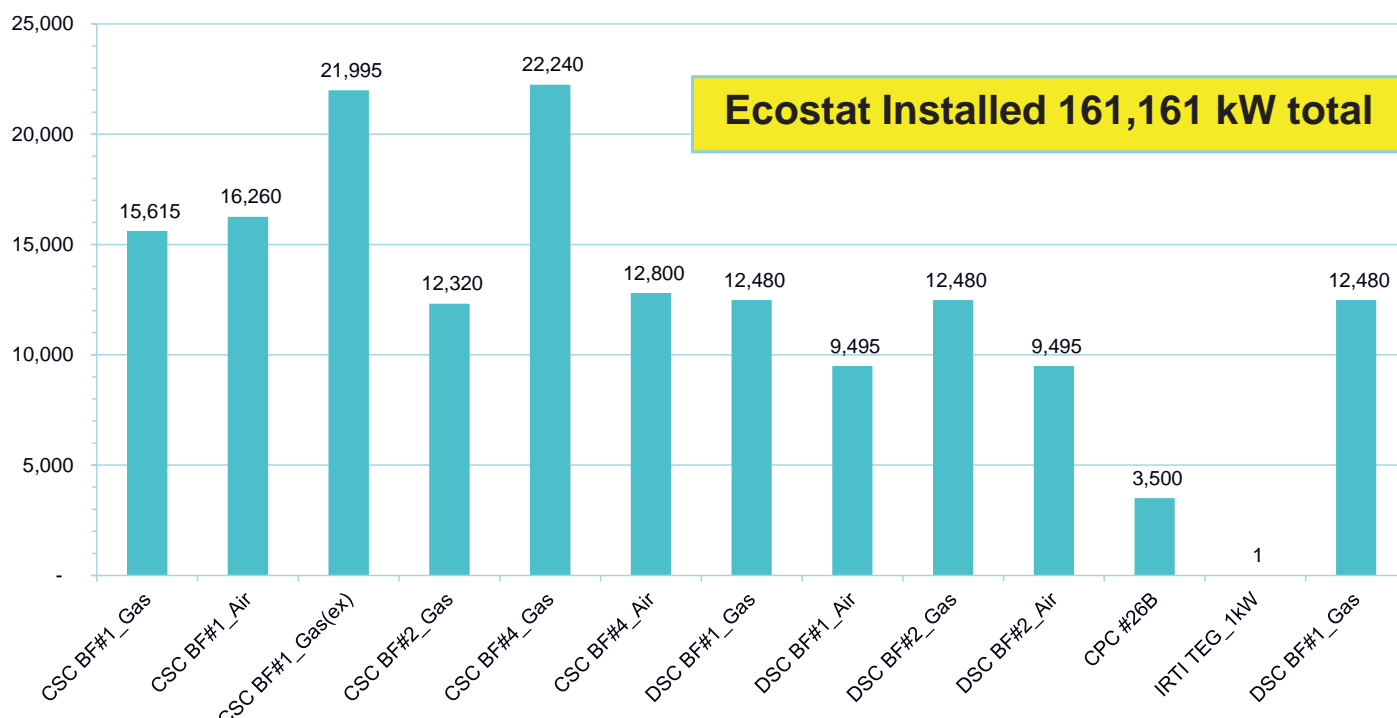
專案 Project	完工年份 Completed Year
中鋼一號高爐熱管式廢熱回收系統 CSC BF1 Heat Pipe Type Waste Heat Recovery System (Ecostat)	2001
中鋼一號高爐增設 Air Preheater 熱管式加熱系統 CSC BF1 Additional Air Preheater Heat Pipe Type Waste Heat Recovery System (Ecostat)	2010
中鋼三號高爐熱煤油廢熱回收系統 CSC BF3 Thermal Oil Type Waste Heat Recovery System (Ecoflow)	2003
中鋼二號高爐熱管式廢熱回收系統 CSC BF2 Heat Pipe Type Waste Heat Recovery System (Ecostat)	2005
中鋼四號高爐熱管式廢熱回收系統 CSC BF4 Heat Pipe Type Waste Heat Recovery System (Ecostat)	2006
中龍一號高爐熱管式廢熱回收系統 DSC BF1 Heat Pipe Type Waste Heat Recovery System (Ecostat)	2009
中龍二號高爐熱管式廢熱回收系統 DSC BF2 Heat Pipe Type Waste Heat Recovery System (Ecostat)	2012
中油林園廠#26鍋爐熱管式廢熱回收系統 CPC Linyuan Plant No.26 Boiler Heat Pipe Type Waste Heat Recovery System	2013
中鋼三號高爐熱煤油廢熱回收系統更新 & 中龍一號高爐熱管式廢熱回收系統更新 CSC BF3 Thermal Oil Type BFG preheaters Renewal & DSC BF1 Heat Pipe Type BFG preheaters Renewal	2017



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國內熱管熱回收實績 Ecostat Installed, Taiwan

Kuettner Asia Performance (kW) ~2017



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Thank You

