



中国建材

中材节能股份有限公司
Sinoma Energy Conservation Ltd.

The 4th Generation of Waste Heat Recovery Technology In Cement Industry

Speaker: MR. QU HE

Lower Carbon Better Future



About Sinoma EC

Sinoma Energy Conservation Ltd

- An A-shares main board listed company
- Specialized in energy conservation and environmental protection industry under CNBM

Established in
2007

Main Business
**Clean Energy
Engineering and Equipment
Energy Saving Building Material**

Our Vision
**Becoming a benchmark of green
energy and environmental protection
integrated service provider.**

Leading the industry in WHR, new building materials, sand and gravel aggregate production line and special boiler manufacturing.

400+

WHR Plants
Rank 1st in Global
Building Material Industrial

200+

Silicate Board
Production lines
Rank 1st in Domestic
Market

150+

Sand & Aggregates
Production Lines
Rank 1st in Domestic
Market

50k t/y

Waste Incineration
Boiler
Rank 1st in Domestic
Market

26b kWh

Annual Power
Generation

20m t

Annual CO₂
Emission Reduction



中材节能股份有限公司
Sinoma Energy Conservation Ltd.

High-tech Enterprise with
industry-leading core technology
R&D capabilities.

500+

Scientific and
technological
R&D personnel

18

National
Standards

400+

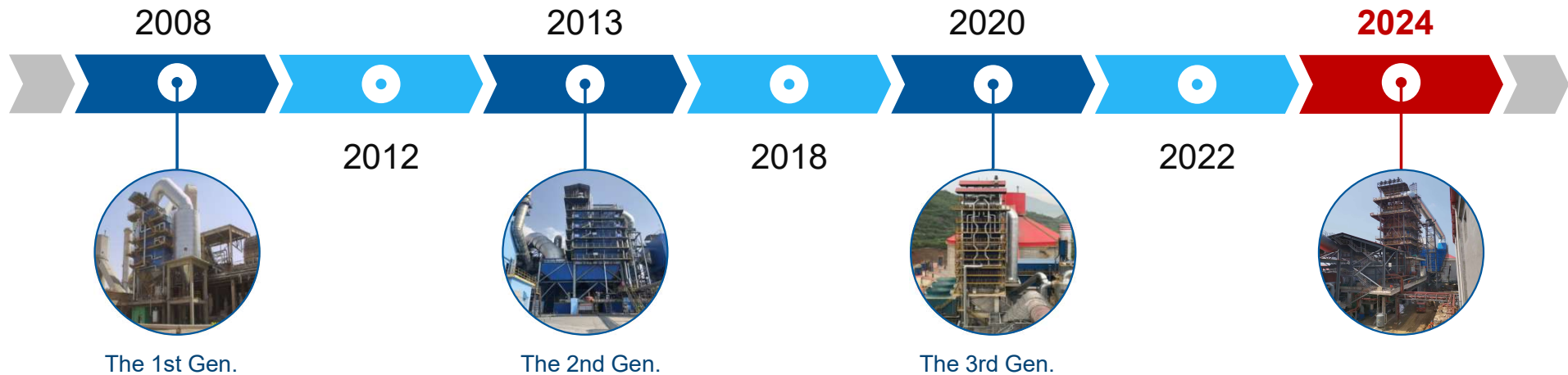
Valid Patents

12

Industrial
Standards

Design Standard Editor
of national cement waste
heat power generation

WHR Tech. History



- 5 stage PHT
- 3rd Gen. Grate Cooler
- Standard coal consumption > 115
- Single Pressure
- Power generation 36kWh/t.cl
- SP boiler as main actor
- AQC boiler and chamber separately
- Modified turbines

- 5 stage PHT
- 3rd/4th Gen. Grate Cooler
- Standard coal consumption > 105kg/t.cl
- Double pressure system
- Power generation 33kWh/t.cl
- AQC and SP half and half
- Boiler and chamber arranged together
- Customized Turbines

- 6 stage PHT
- 4th Genof middle roller grate cooler
- Standard coal consumption 93kg/t.cl
- Compound double pressure
- Power generation ≥28kWh/t.cl
- AQC boiler as main actor
- Boiler and cooler arranged in one
- Upgraded the turbine steam flow and improved the automation

The 4th Generation



Overview of the 4th Gen. WHR Tech.

Single Reheat the Rankine Cycle

The SRC adopts single reheat cycle
Main Steam Pressure 1.6~2.0MPa(a)
Reheated Steam Pressure 0.4~0.6MPa(a)
3% increase in cycle efficiency



Cooler Exhaust Gas Closed Loop System

The residual air discharge to the chimney at 90-100°C is returned to the grate cooler
The power generation increases 6~7kWh/t.cl



Lower-resistance and High-efficiency HRSG Boiler

Adopts finned tubes
Enhance heat transfer
Reduce boiler heat exchanger surface
30% reduction in resistance
20% reduction in boiler weight



Updated System

Digital Empowerment

APS

Upgraded the operated valves to electric valves
One-key start and stop and fully automatic operation of single system and whole system



APC

Adopt expert-level optimized control sys.
Reduce manual operation
Realize optimal operation
Achieve unattended operation



Digital O&M

Visualization of production data
Timeliness of production control
Remote device O&M
Intelligent data analysis



Main Technical Data

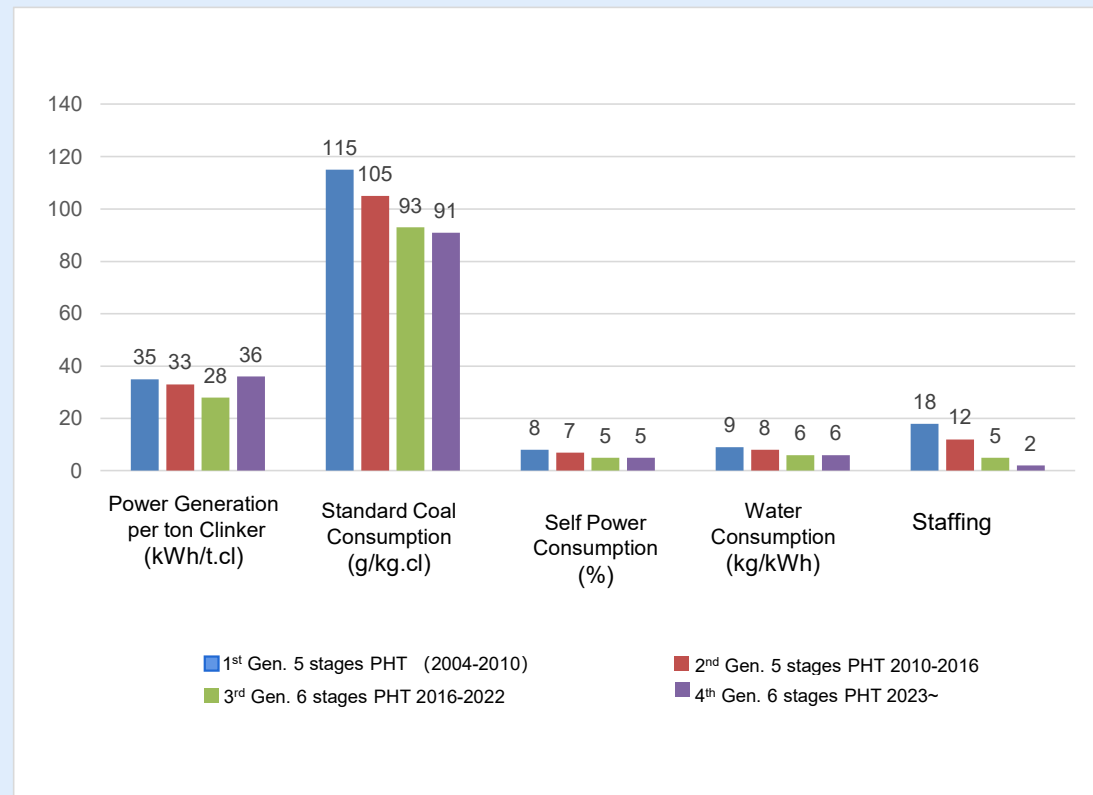
Tech. & Economic Indicators

Power Generation for 6 stages PHT	36 kWh/t.cl
Power Generation for 5 stages PHT	42kWh/t.cl
Labor Quota	2 person
Automation and Intelligence	One Key Startup- stop Unattended Operation
Payback Period	~4 Years

Comparison with 3th Gen. Tech

Ton Clinker Power Generation	+8kWh/t.cl
Labor Quota	-50%
Investment	+20%
Payback Period	-0.5 Year

Comparison of 1st to 4th WHR Tech



Process of 4th Gen. WHR Tech

Process

01 Heat Source Side

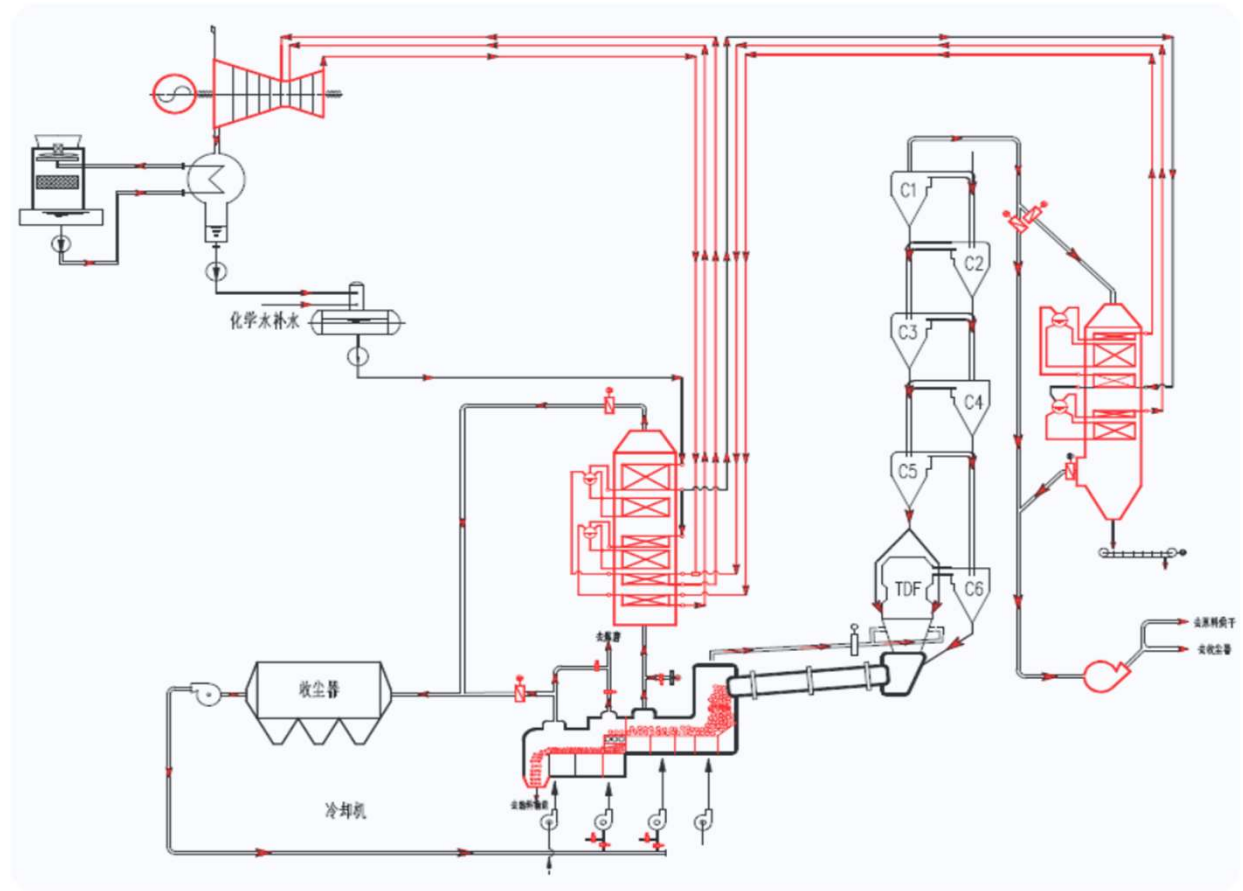
The flue gas system adopts 100% recirculating air from cooler
The heat absorbed by the boiler increases 25~30kCal/kg.cl

02 Heat Using Side

Single reheated SRC circulating
Circulating thermal efficiency increased from 20% to 23%

03 Application Scope

New WHR Plant (Preferable to be built at the same time as the cement line)
WHR Retrofitting (Some technologies are available)



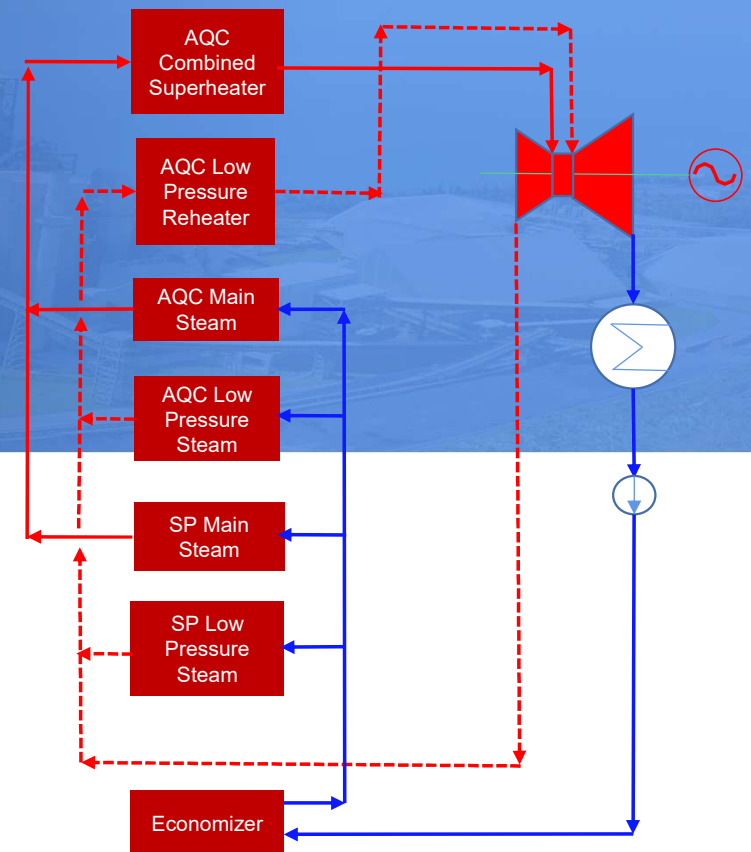
Process of 4th Gen. WHR Tech

The circulating thermal efficiency increases from 20% to 23% with the same heat source

Power generation increases 3~4kWh/t.cl

The low-pressure steam after expansion in the high-pressure section of the steam turbine is mixed with the steam generated in the low-pressure section of the boiler, and then re-introduced to the boiler reheater for heating up. After the superheat is increased, feed it into the low-pressure cylinder of the steam turbine for expansion, which greatly improves the in-cycle efficiency of the steam turbine.

The most favorable reheat pressure is between 0.2~0.3Pa.
Suitable for new WHR project.



Cooler Exhaust Gas Closed Loop System

System Advantages

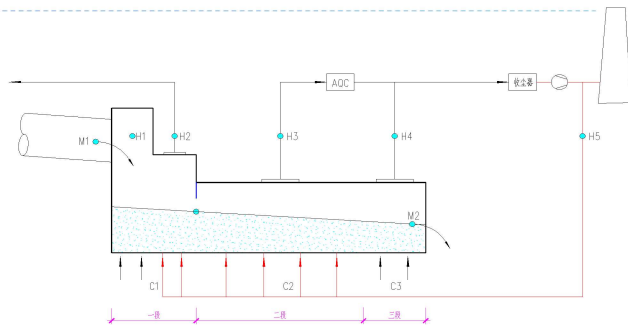
“Zero Emission” at Cooler Side

Clinker temperature out the cooler remains the same (ambient temperature +65°C)

No extra heat consumption of the production line

Increased generated power capacity
7~8kWh/t.cl

Increased power consumption 1kWh/t.cl
Increased net capacity **6-7kWh/t.cl**



Measures

Accurate AQC boiler selection, adapt to various working conditions, ensure that the exhaust gas temperature is stable

The unique return air position ensures the strength and cooling effect of the clinker, and does not affect the heat of the secondary and tertiary air

Increase the cooling fan capacity of the grate cooler

Replace or modify the grate cooler to increase the grate bed area

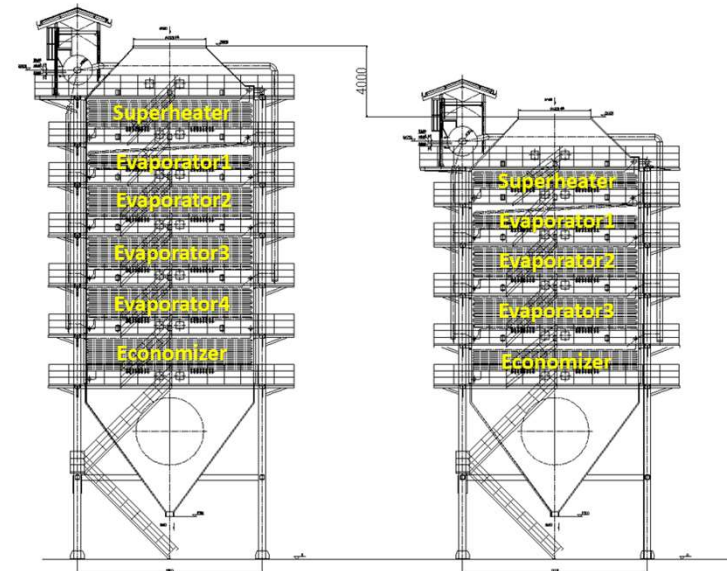
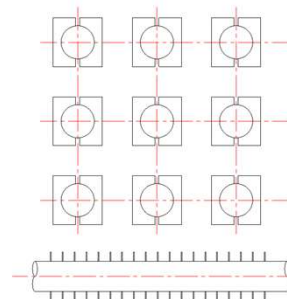
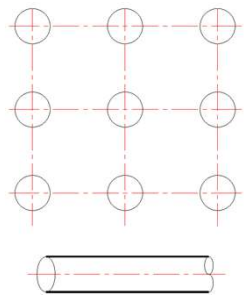
The refined operating system makes the AQC boiler perfectly integrated into the kiln head exhaust gas treatment system

The cooler exhaust gas closed loop system is suitable for the new line, and the line PHT revamping from 5 stages to 6 stages and cooler upgrading!

Lower-resistance and High-efficiency SP Boiler

1. The flue gas resistance of the system is reduced by 25~30%,
The power consumption of ID fans is reduced by 0.2kWh/t.cl
2. The boiler weight is reduced by 20% and the equipment cost is reduced

3. The height of the boiler is reduced, and the amount and difficulty of erection work are reduced.
The process layout is smoother
4. The boiler can be constructed with a modular tube box. Reduce the difficulty of on-site construction and save the construction period



New Integrated Model of WHR+SCR

Split Arrangement TRADITION

- Large Footprint
- High Investment
- High Resistance
- High Power Consumption



INNOVATE

Integrated Arrangement

- Small Footprint
- ~10% Reduction in Investment
- The system resistance is reduced by 600Pa
- Saving power consumption 0.6kWh/t.cl



VS



Digital Empowerment

Highly Intelligent Control



APC

Expert-level optimized control sys.
Reduce manual operation
Realize optimal operation



DEH

Upgrade the turbine DEH system
Automatic unit startup and shutdown,
steam rolling, speed up, warming up,
synchronization, load adjustment



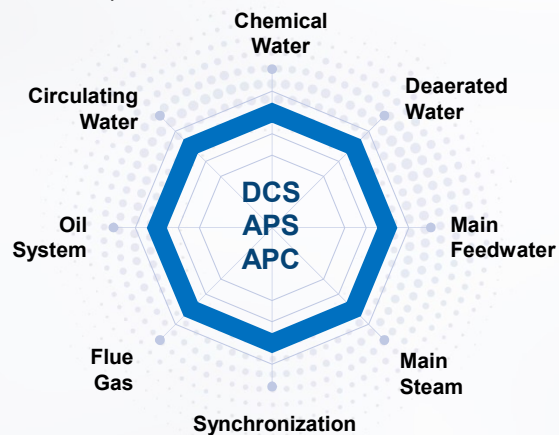
APS

Electric Valves and Remote
Instruments
One-key Start and Stop in Cold
and Hot State
Fully Automatic Operation



Digital O&M

Visualization of production data
Timeliness of production control
Remote device O&M
Intelligent data analysis



Application Scenarios

❑ WHR New Project

Installed Capacity of WHR

(Based on 6000t/d production line)

- ❑ 1 set 10/12MW Reheated STG. (for 6/5 stages PHT)
- ❑ 1 set Reheated AQC Boiler
- ❑ 1 set Low Resistance and high efficiency SP boiler

Upgrade Result

- ❑ Power Generation per ton Clinker
36kWh/t.cl(6 stages PHT)
42kWh/t.cl(5 stages PHT)
- ❑ One click start-stop, unattended operation, intelligent operation, and digital management
- ❑ **Payback period ~ 4 years**

❑ WHR Upgrade

Suitable for the Gen. 1st or 2nd

Upgraded Items:

- ❑ Replace a new AQC Boiler
- ❑ Expand or replace the grate cooler
- ❑ Expansion of circulating cooling water system
- ❑ Increase closed full circulation air
- ❑ The STG., SP boiler maintain the existing ones
- ❑ Increase a steam turbine driving ID fan at the grate cooler

Upgrade Result:

The power generation **increases by 6kWh/t.cl,**
or the power **consumption of the clinker line decreases by 6kWh/t.cl**
The investment payback period of about **4.5 years.**



Other Energy Utilization in Cement Plant

In addition to WHR, Sinoma Energy Conservation Ltd. has mature technology and successful experience in solar energy, biomass energy, geothermal energy, radiant heat recovery, and energy storage systems, which can provide comprehensive energy solutions for cement plants.



Energy Utilization and Carbon Reduction



WHR



Solar



Wind



Biomass



Geothermal



Radiant
Heat



CCUS



Energy
Storage



绿色低碳 共创未来

LOWER
CARBON

BETTER
FUTURE



中国建材

中材节能股份有限公司
Sinoma Energy Conservation Ltd.



Web: <http://www.sinoma-ec.cn>

Tel: +86-(0)22-27788159

Email: linnan@sinoma-ec.cn

Add. Sinoma EC Plaza, Intercross of
Tianning Road & Gaofeng Road,
Beichen District, Tianjin, PR China.