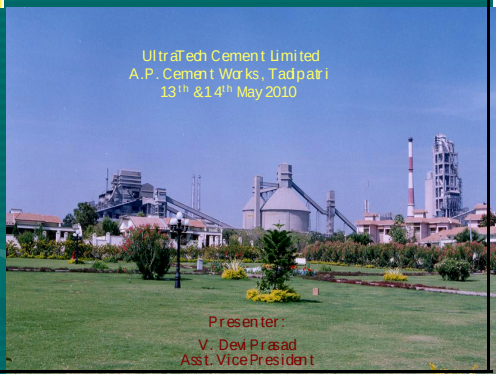
4 MW Waste Heat Recovery Power Plant



UltraTech Cement Limited
A.P. Cement Works, Tadipatri
13th &14th May 2010

Presenter:
V. Devi Prasad
Asst. Vice President

APCW Power

Total Plant Power Demand : 104 MVA (Ph-1+II : 39+65 MVA)

Power Sources:

- 2 x 25 MW Thermal Power plant (CFBC Boilers)
- 50 MVA EB Power
- 4 MW Waste Heat Recovery Power plant
- 2 x 12 MW DG Power plant (stand by)

Other Options:

- Thermal,
- Gas,
- Wind,
- Solar,
- Waste Heat recovery.

- Steam turbine
- Organic Rankine Cycle

4.0 Waste Heat Recovery Power Plant

Organic Rankine Cycle Turbine:

- Technical Benefits
  - High vapor turbine efficiency at low speed
  - Condensing near atmospheric pressure
  - Smaller size air cooled condensers
  - Moisture free turbine expansion.
- No Water Consumption (No WTP)
- Non IBR (No Steam)
- No Extra Manpower (1 per shift)
- Attracts CDM Benefits (Environment)

Suppliers:

Energy Converter : ORMAT Systems Limited, Israel.
WHOH : Transparent Energy Systems, Pune

Cement Plant - Overview

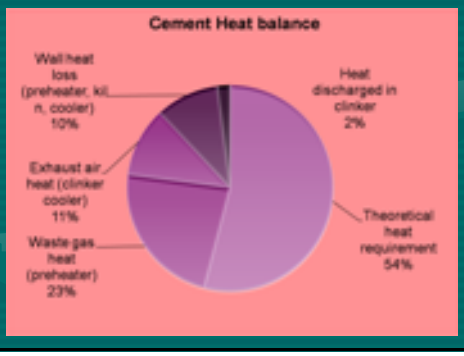
Phase I - Kiln:

Design : FLS
Capacity : 8000 TPD
Dimensions (dia) : 75 x 4. 75 Dia,
Pre-heater : 6 Stage

Phase I - Cooler

Design : FLS, COOLAX,
Cooler Fans : 16,
Cooler area : 141 Sq. Met,
Cooler Vent fan: 585 kW.

Typical Heat Balance in Cement Mfg



WHRU - Input Parameters

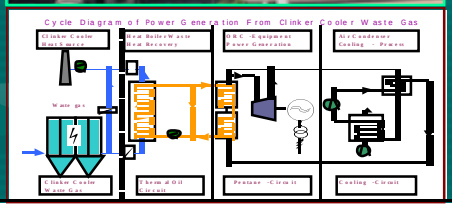
Basis of Design :

Gas Design Mass Flow rate : 485 Tons / Hr

Design Gas (In / out)Temp. : 320 / 150 °C
Max. Dust loading : 90 mg / Nm3
Ave. Dust particle size : 45 Microns
Air pressure after ESP : -30 mm WC

Design Conditions
Ambient Temp. : 35 Deg C. (Ave. Temp : 32 Deg C)
Altitude : 350 Met AMSL

Overall View



WHRU – Output Parameters

Design Power Output Parameters:

Gross Out put : 4000 kW

Net out put (OEC) : 3335 kW

Aux. Power Cons. : 665 kW

Pentane Pumps : 2X180 =360 kW

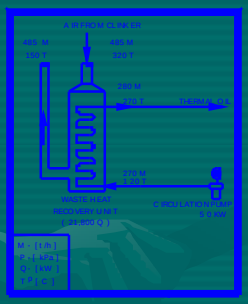
ACC Fans : 12 X18.5 = 222 kW

Seal oil Lube system : 2X3.7 = 7.4 kW

WHOH Pumps : 2X37 =74 kW

Air Compressor : 1X12 kW : 12 kW

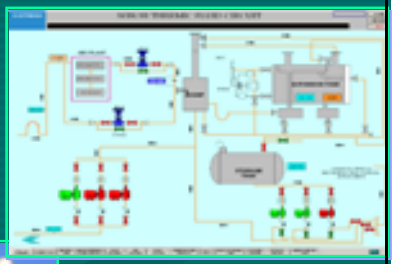
WHOH – Output Parameters



Waste Heat Oil Heater
Out put parameters

Flow rate : 247 TPH
Temperature, inlet : 120°C
Temperature, outlet : 270°C
Quantity :125 Tons
Design Pressure : 7.5 Bar
Dry Weight : 500 Tons
Aux. Power Cons. : 65 kW

Waste Heat Oil Heater



- Good thermal stability
- High heat transfer coefficient
- Low viscosity
- Non-toxic, safe & easy to handle
- Non-corrosive

OEC Details

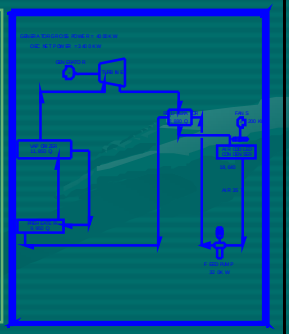
ORMAT Energy Converter

Turbine :
Three stage-Impulse type
Speed: 1500rpm

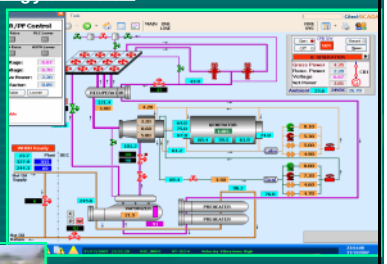
Generator:
6.6MVA, 50Hz, 1500rpm

Motive Fluid:
Pentane – 23 Tons
Flow : 172 T/h
Before Turbine:
Temp: 204 Deg C
Pressure: 23.8 Bar

Condenser: Air Cooled



ORMAT Energy Converter

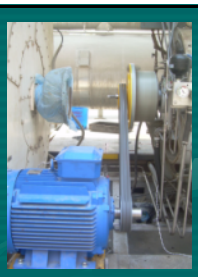


Operation Performance

Description	Unit	07 - 08	08 - 09	09 - 10
GrossGeneration	Lac kW h	224	228	165
Net Export Power	Lac kW h	191	195	140
Aux. Consumption	%	15.1	14.6	15.0
Ave. Gross Output	MW	3.0	3.2	3.0
Availability factor	%	90.7	99.9	93.3
Run Hours	Hrs	7,482	7,037	5,556

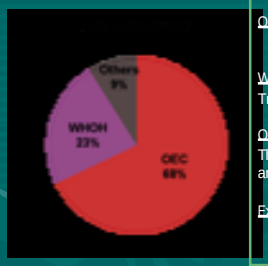
Maximum Power recorded : 4.35 MW

Maintenance



- Turbine Clocked 21,000 Hrs
- Turbine seal failed.
- Major Overhaul done in Mar.'10
- All internals found OK.

Project



OEC (supply) : ORMAT

WHOH (Supply & Erection): Transparent

Others: Ducting, Piping, Civil, Thermic Electricals, OEC Erection and Plant Commissioning.

Execution Period: 18 Months
Start: Sept. 2005
Commissioned : March 2007

CDM Project

Project No – 0872
Registration date 19th oct`07
Expected reduction in emission by 20,851 Tons of CO_2

Year	CO_2 Reduction (Tons of CO2)
2007-08 (VERs)	7,477
2007-08 (CERs)	7,636
2008-09 (CERs)	15,079 (Under issuance)
2009-10 (CERs)	10,823 (Under verification)
2010-16 (CERs)	1,05,000 (Expected)

Project Challenges....

- Ø In house Engineering
- Ø WHOH - Vendor identification in India
- Ø Pressure drop across WHOH with in the fan capacity.
- Ø Execution by in house contracts
- Ø Interfacing between OEC & WHOH
- Ø Clarity on input data.
- Ø Hook up during Plant shutdown

O&M Teething problems. ...

- Ø Longer synchronization time

  (Breaker closing angle increased from 5° to 10°)
- Ø Turbine injection Valve (Flow serve to Fisher)
- Ø Vaporizer Level controller (Location)
- Ø WHOH – HMI to Scada (Improvement)
- Ø ACC Fan Motors (Frequent bearing failures for ACC fan motors)
- Ø Thermic fluid circulation pumps (Upgraded from 30 to 37 kW)

Our verdict....

- Ø First of its kind in India & 2nd in world for this application.
- Ø One person /shift operation.
- Ø Commissioned in March`07. Completed 21,000 Hrs.
- Ø Meets 4 % of Phase 1 Power requirement
- Ø Zero water consumption
- Ø Emphasis on minimizing the thermal pollution.
- Ø High Availability
- Ø No fuel requirement – Negative Power Generation cost

Happy to answer your questions.....