HEAT RECOVERY SYSTEM TO PRODUCE ELECTRICITY IN A CEMENT FACTORY

Project ID: IN/00477/94
Funded under: ENG-THERMIE 1

HEAT RECOVERY SYSTEM TO PRODUCE ELECTRICITY IN A CEMENT FACTORY

From 1994-09-01 to 1996-10-01

Project details

<table>
<thead>
<tr>
<th>Total cost:</th>
<th>EUR 999 443</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU contribution:</td>
<td>EUR 399 777</td>
</tr>
<tr>
<td>Coordinated in:</td>
<td>Italy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic(s):</th>
<th>2.3 - INDUSTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding scheme:</td>
<td>DEM - Demonstration contracts</td>
</tr>
</tbody>
</table>

Objective

To demonstrate the technical and economic viability of the heat recovery from exhaust gases in small - medium size cement factories for electricity production, even if the hot gases are highly dust loaded (i.e. 50 g/Nm³) and have a relatively low temperature (i.e. 305 deg. C).

Hence, the following aims will be pursued:
1. To obtain a reliable heat exchanging device specialized for the dust of cement kilns, which contains adhering argillaceous components.
2. To utilize an Organic Rankine Cycle (ORC) turbogenerator for electric energy production without primary energy consumption.

The pilot heat exchange system was installed and started up during 1995. The Data Acquisition System was put in operation and it started collecting, displaying and storing the data on the heat exchangers. The results after 6 months continuous operation have been encouraging.

So it was decided to study a more compact and efficient pilot exchange (i.e. somewhat more challenging), before setting up the final heat exchanger. A new flat fin pilot exchanger, having a geometrical arrangement and a compressed air cleaning system which would minimise the risk of clogging, is currently under construction.

The electricity produced and the thermal energy recovered without primary energy consumption will imply a fuel saving of about 1200 TOE/year, and consequently an indirect reduction of CO₂ and other polluants to the atmosphere.

The proposed project consists of the design, construction and installation of the following main items:
1. Exhaust heat recovery unit, specialized for the cement kiln application, to be placed upstream from the conditioning tower in order to recover heat from the kiln exhaust. The heat transfer medium will be pressurized hot water, which was preferred to heat transfer oil for safety reasons (fire hazard).
2. Heat recovery unit to be placed on the excess air stream from the fluidized bed combustion air preheater. The fluid through this unit is air, with some load of clinker dust.
3. Organic Rankine Cycle turbogenerator, which generates electricity utilizing the recovered thermal power. The thermal power is fed to the turbogenerator in the form of relatively low temperature (130-140 deg. C) hot water; hence an organic cycle system has been adopted as the best way to efficiently utilize the available heat source. * The control system utilizing a large capacity PLC (hardware and software). A PC is added to perform the supervising, monitoring and Data Acquisition.

Innovative Aspects:
1. New technology in self-cleaning heat exchangers will be adopted, suitable for utilization with highly dust charged hot gases of the adhering type, peculiar of the cement process.
2. Organic Rankine Cycle turbogenerator for electricity production will be adopted in order to better exploit the relatively low temperature heat source.

Expected Results:
1. To produce electricity utilizing the heat recovered from cement kilns exhaust gases (627 kWel annual mean power, 4.5 million kWh/year).
2. To reduce the thermal load of the cooling systems upstream from the filters.
3. To utilize part of the heat recovered for ambient heating inside the plant (0.3 million kWh/year).
4. To improve the operation flexibility of the kiln without increasing the production cost of the cement. In particular the wet season kiln production will be increased.

The estimated annual monetary volume of the energy produced is 582 million of Italian Lire based on an electric energy value of 120.7 Lit/kWh (as per Italian decree CIP 6/92).

Operating and maintenance cost is expected to be about 31 million of Italian Lire/year.

The simple payback time of the investment will be 3.5 years.

Coordinator

Adriasebina Cementi Srl
Corso Venezia 50
20121 Milano
Italy

See on map

Administrative contact: MALFER POMA ANGELO
Tel.: +39-2781571
Fax: +39-276003927

Last updated on 1999-10-21
Retrieved on 2019-07-02

© European Union, 2019