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Executive Summary

Preliminary Report about the potential to heat recover from
industrial effluents for electric valorization by
ORC (Organic Rankine Cycle)
at National level.

Maggio 2010

Progetto LIFE08 ENVIT 000422

Policy and governance actions to reduce CO2 emissions by energy
valorization of process effluents in
Energy Intensive Industries. Acronym: H-REII

www.hreii.eu

Partners:



The ambitious targets set in the EU climate and energy package “20-20-20” (A reduction in EU greenhouse gas emissions of at least 20% below 1990 levels , 20% of EU energy consumption to come from renewable resources and A 20% reduction in primary energy use) have activated a series of actions in member states aimed to obtaining the expected results. Among the energy efficiency actions **an important role can certainly be covered by the highly energy-intensive industries**, which can, **in the face of limited and well defined interventions, obtain important results.**

The Italian Action Plan for Energy Efficiency, prepared in 2007 by the Ministry of Economic Development, **mentioned among the possible actions the recover waste in highly energy-intensive companies without quantifying the potential savings achievable**, because of the difficulty of standardizing applications and technology to use. The sector of recovery from process’ effluent is characterized by a multiplicity of possible applications with different system and technique solutions, aimed to recovery in thermal use, to produce electricity or both.

In 2008 was launched in Brescia **the first national pilot project (H-REII: Heat Recovery in Energy Intensive Industries)**. The project aims **to map the potential to recover waste in highly energy-intensive companies** (cement, glass industries, steel, aluminum and nonferrous, heat treatments, chemical industry, refineries, oil & gas, agribusiness, textile, paper) **using the ORC (Organic Rankine Cycle) technology with power generation sizes between 0.5 MWe1 and 5 MWe1.**

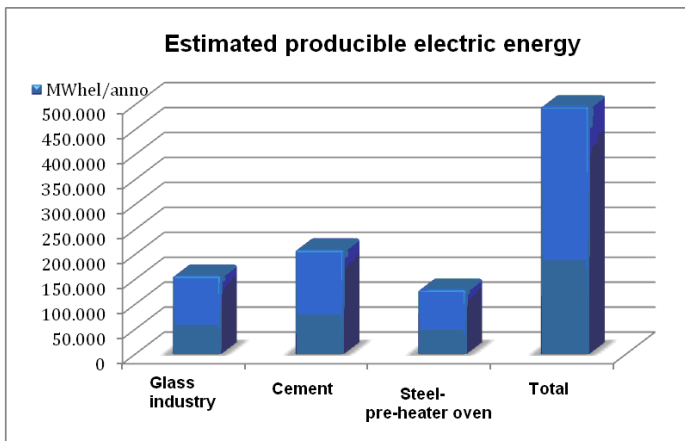
The project partners are: AIB - Industrial Association of Brescia, CSMT – Multi-sectoral and Technological Service Center, FIRE – Italian Federation for rational energy use, Province of Brescia, University of Brescia - Department of Mechanical Engineering and Turboden S.r.l..

Thanks to the availability of **about 110 energy audits carried out in Italy and Europe**, and **an analysis of allocations quotes by National Allocation Plans (ETS)**, at the outset, it was estimated **the potential for energy recovery in 3 of the 10 areas of**

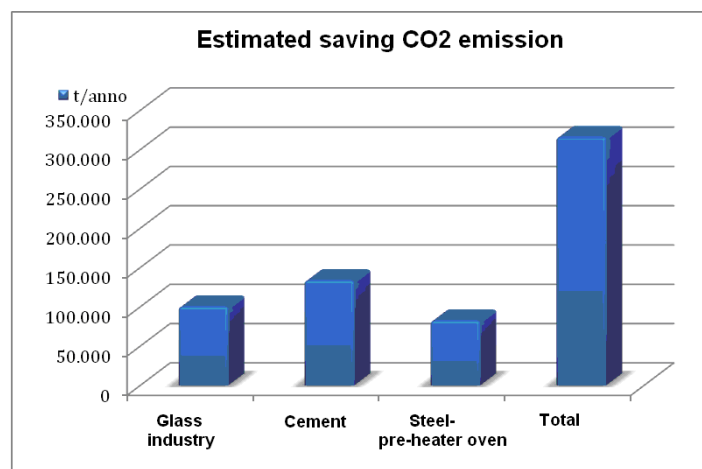
investigation. The other seven sectors will be analyzed in detail in 2010, within the H-REII project, co-funded by LIFE +.

The prudential estimate, on Italian cement, glass and steel industries – only the pre-heater oven, highlights a potential saving of 500 GWhel/year of electricity (about 93,000 tep/year), **7% of the total estimated energy savings for the Italian industry for 2010**, and prevents the emission of over 316,000 tons of CO₂/year.

Really, considering the entire steel industry (steel production plants, coke oven, sintering plants) the potential would be much higher.



Estimate of the producible electric Energy in the 3 sectors analyzed. (n.b. in the steel estimation it wasn't considered the steel production plants, coke oven and sintering plants because the analysis is limited to heat recovery from rolling mill downstream of electric arc furnace.)



Estimate of the prevented CO₂ emission.

This report highlights the potential for recovery in the 3 areas already investigated, describes the existing worldwide Best Available Techniques (BAT) and estimates the required investments. The general considerations emerged are:

- Applications for recovery of effluent with ORC technology **are technically achievable**;
- **The potential of proliferation of these distributed generation systems of small size are very high** and replicable in Europe and worldwide;
- **Italy is currently the European leader in the ORC technology** with enormous potential for consolidation of the sector;
- **The pay-back time are often considered too long by the investors** (6-8 years on average in the absence of incentives are well above of **4-5 years expected**);
- The **current incentives** (Energy Efficiency Certificates) for these applications **are not standardized** and do not contribute effectively to enable investments because of their **low economic value**.

The preliminary results of the report highlight that, in order to stimulate the effluents' recovery actions in highly energy-consuming processes, **must be defined**:

- **A feed-in tariff mechanism or a multiplier of Energy Efficiency Certificates for each kWhel of electricity generated by recovery** which can give to the incentives a value of about **40,0 €/MWhel**;
- **A fixed duration of the incentive period** (10 years).

In order to quantify the necessary resources, and a possible review of the annual/biennial objectives, it may be appropriate to set a maximum limit of equipment installed (for example, 200MWhel to be installed by 2020).

The following table shows the values of cost and benefit measured in this paper, with the following considerations:

- The estimated saving is **almost 500 GWhel/year to 2020**;
- The differential in cost is calculated between € 0.04/kWhel (the target value) and the current value of the incentive system of TEE, approximately € 0.0167 / kWhel (The data was obtained considering TEE Type III , approximately equal to 90 €);

- The CO₂ savings are quantified in terms of less CO₂ emission permits to buy on the market (at value of 15 €/ton CO₂ - source GME October 2009);
- The lower cost of electricity generation from renewable sources to attain the objectives of the climate-energy package, estimated at € 18.7/MWhel following the ERSE methodology;
- Sales and VAT are related to the realization of the plants and include maintenance costs.

INCENTIVE COSTS

Increase in annual incentive cost	11,58 M€/year
Total annual costs for incentive	19,88 M€/year

DIRECT BENEFITS

The less CO ₂ emission permits to buy per year	4,74 M€/year
The lower cost of electricity generation from renewable sources	9,29 M€/year

INDUCED BENEFITS

Increase in installers' turnover by 2020	250 M€
Extra VAT return	49 M€
Turnover for O&M	6 M€/year
VAT return for O&M	1 M€/year
Estimated employment created	About 300

Against the **total costs of about 20 M€ per year**, it is possible to quantify **benefits for more than 64 M € per year**, counting only the applications for the Italian territory, contributing to the **consolidation of Italian leadership in this sector**, **creating employment** and **helping to pursuit the energy efficiency goals**.