RECP Best Practice Catalogue

Heat recovery from Arabic bread tunnel ovens

Developed within the framework of MED TEST II

July 2018

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

The SwitchMed Programme is funded by the European Union

Best Practice - Heat recovery from Arabic bread tunnel ovens

SECTOR:	**Food & Beverage**
SUBSECTOR:	Bakery and farinaceous products
PRODUCTS	Bread
CATEGORY	Technology upgrade/Eco-innovation
APPLICABILITY	Utilities

COMPANY NAME	NOT DISCLOSED
COMPANY SIZE	SME

Best Practice - Heat recovery from Arabic bread tunnel ovens

Description of the problem (Base scenario):

In high volume Arabic bread production, the fermented dough passes on a conveyor belt through a fuel fired tunnel oven where the dough is exposed to an overhead open flame, it turns into a loaf of bread in a lapse of time not exceeding 7 seconds. The case under consideration is for an assembly of newly installed 3 diesel fired tunnel ovens with a burner rating of 260 KW each.

Typically more than 60% of the energy input to an Arabic bread tunnel oven is wasted as heat in the chimney stack. The temperature of the combustion gases from the oven at the inlet to the chimney has been measured at 600°C.

The ovens diesel consumption is estimated at nearly 600,000 liters of diesel fuel per year based on readings taken between March and June 2018 (see below table). This represents nearly 20% of the final energy consumption in the plant.

The Arabic bread ovens operate from 6 PM till 6 AM, therefore outside the working hours of the rest of the plant. See figure 1 below for details.

Month	Total diesel consumption (lt)
March	44,700
April	56,500
May	43,000
June	48,400

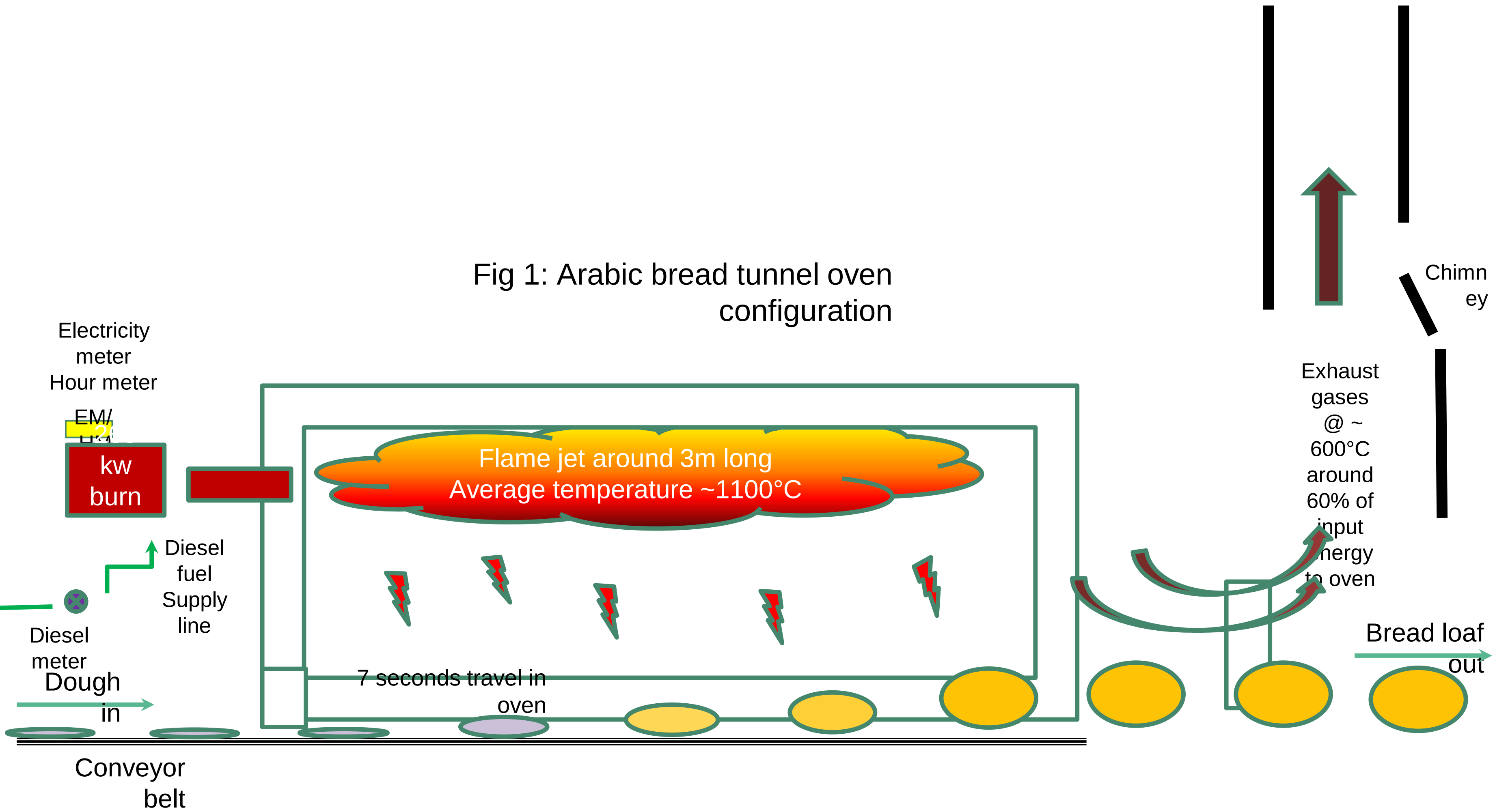

Fig 1: Arabic bread tunnel oven configuration

Best Practice - Heat recovery from Arabic bread tunnel ovens

Description of the solution	Part of this high quallity wasted energy could be recovered to produce steam to be used in the plant for operating a 250 KW absorption chiller. The air conditioning is kept operating during night time in some parts of the plant therefore a coincidence factor of unity is possible with respect to air conditioning. This will displace electricity needed to operate the vapor compression type AC machines. The proposal calls to install a 75 KW Heat Recovery Steam Generator (HRSG) at the exhaust of each oven, the three HRSGs are linked together by a steam header. Each can produce around 90 kg/hr of saturated steam at 9 bars (180°C). Basically the generated steam from the HRSGs working at full load will cover 100% of steam requirements for air conditioning noting that the AC night load for the plant wil be smaller than 250 KW. The Arabic bread ovens operate at least 12 hours per day all year long. One other advantage is that the water and electricity requirements for the cooling tower of the absorption chiller will be minimal considering that free night cooling may be possible during the mild season. Figure 2 below is a schematic of the proposed installation.

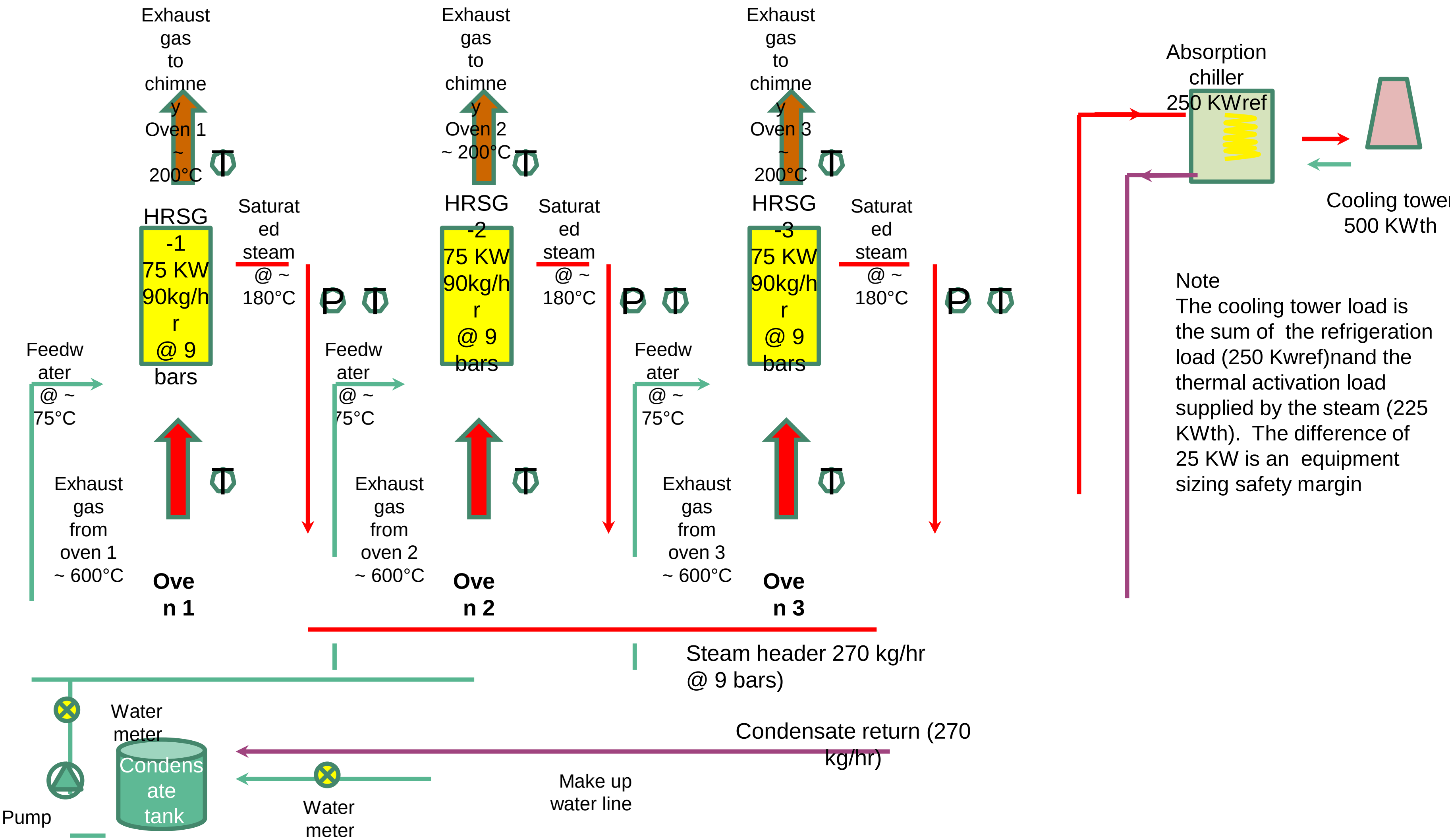

Figure 2: Arabic bread tunnel ovens heat recovery system configuration

Best Practice - Heat recovery from Arabic bread tunnel ovens

Economic Benefits	Proposal electricity savings air conditioning: 300 Mwhre (100% coverage) Price electricity: 80 EUR/Mwhre (Combined utility/in-house generation cost at base case) Proposal cost saving electricity for air conditioning: 300*80 = 24,000 EUR/year Proposal water consumption in cooling tower: 500 m^3/year Proposal electricity consumption to run equipment included in proposal: 3 Mwhre/year Market price of water: 2.5 EUR/m^3 Proposal cost of water for cooling tower: 500*2.5 = 1,250 EUR/year Proposal cost of electricity: 3*80 = 240 EUR/year Expected savings resulting from intervention: 24,000 - 1,250 - 240 = 22,500 EUR/year Maintenance costs of HRSGs and absorption chiller offset by vapor compression equipment. The savings represent around 1.5% of the overall final energy use in the plant.
Environmental Benefits	Specific CO_2 emissions of electricity grid: 1000 kgCO_2/MWhre Avoided CO_2 emissions: (300 - 3)*1000 = 297,000 kgCO_2/year (<1% of plant CO_2 emissions)
Environmental Negative impacts	Water consumption for cooling towers; 500 m^3/year (0.6% of overall plant water consumption)
Other benefits	Not applicable
Health and safety impact	Not applicable

Best Practice - Heat recovery from Arabic bread tunnel ovens

Capital investments & financial indicators	Cost of intervention: 85,000 EUR Return on investment (simple payback): 3.7 years
Suppliers	
Other aspects	- The cost of intervention shown above includes the cost of the information system to implement a Performance Monitoring and Verification Plan for that intervention. - Accurate actual consumption figures were obtained thanks to the information system installed by the company at the start of the project at the request of the MED TEST II team. Diesel fuel consumption were monitored on a daily basis. - Above calculations are based on production period between September 2016 and August 2017.
Implementation	Measure is being studied, expected implementation in 2019.