RECP Best Practice Catalogue

Replace boiler for tunnel dryers

Developed within the framework of MED TEST II

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

The SwitchMed Programme is funded by the European Union

Best Practice - Replace boiler for tunnel dryers

SECTOR:	**Food & Beverage**
SUBSECTOR:	Processing and preserving of fruit and vegetables
PRODUCTS	Semi-finished dry pellets (potato, corn, wheat)
CATEGORY	Technology upgrade/Eco-innovation
APPLICABILITY	Utilities

COMPANY NAME	NOT DISCLOSED
COMPANY SIZE	SME

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Description of the problem (Base scenario):

This plant uses 5 drying lines to remove moisture from products with a maximum combined capacity of 1.3 MW. The source of heat is provided by an aging 3MW heavy fuel fired hot water boiler. Previously a 1.5 MW boiler was operated, however it is now out of service.

The number of production lines operating varies greatly, but seldom do the 5 lines operate together. Thus in some periods only two drying lines may be running with a combined capacity of 240 KW (Some lines have different capacities). It was obvious that the boiler does not match the profile for hot water demand by the drying lines, sometimes the boiler load factor dropped to less than 15% with the corresponding decrease in operating efficiency. Furthermore, the boiler is quite old with a nominal rating somewhat oversized with respect to the demand. Its operating efficiency did not exceed 75% at full demand with minimums as low as 50% because of frequent starts and stopa due to reduced load and probably also because of water leaks into the firetubes. The latter issue is a major concern because it results in production stoppage.

The breakdowns are due to corrosion in the boiler internals, the cause is probably the formation of sulphuric acid in cold spots when boiler cools down. The boiler uses heavy fuel with high sulphur content (> 3%).

Boiler consumption for the period May 2016 – April 2017 was measured at 336 Tonnes of heavy fuel, this represents some 43% of final energy demand for this plant for this period.

Boiler performance was closely monitored during this period using an energy meter at boiler output. Daily readings were recorded.

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Description of the solution	The proposal is to replace the 3 MW heavy fuel fired boiler with two diesel fired 800 KW boilers and one diesel fired 600 KW boiler. The reasons for this choice are as follows: - The current plant hot water load is 1.3 MW, thus any two boilers can easily cover full load - The scheme provides operating flexibility, the smaller boiler willl be used when only two lines are operating - There is no sudden surge in hot water demand, the load is constant and can be scheduled ahead of time to determine which boilers will be operating - There is spare capacity at full load in case one boiler breaks down. This will avoid production stoppage - The boilers capacity could meet any plant expansion Note; There was a plan to propose a biomass boiler for the smaller rating (600 KW) but the economic feasibility was marginal because the proposal is switching from heavy fuel, a relatively inexpensive fuel.

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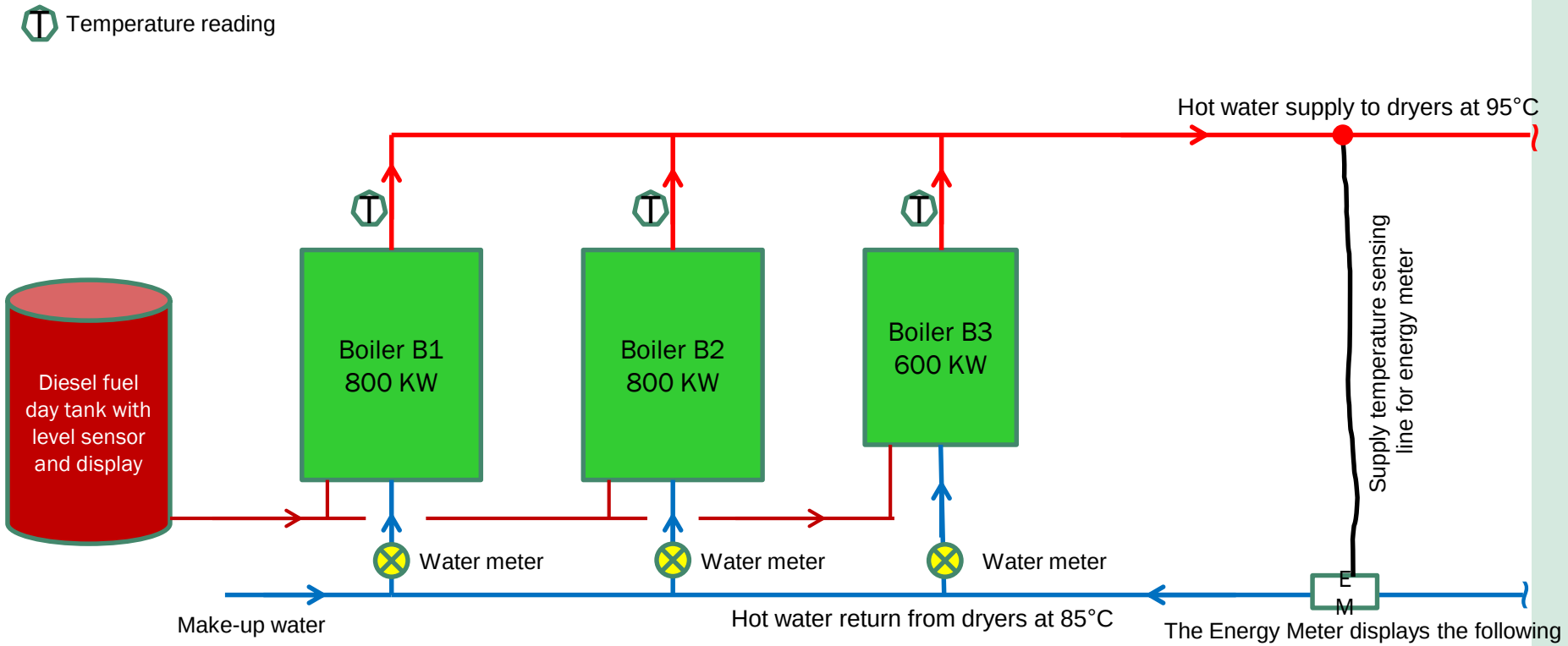
Proposed configuration for boilers



The Energy Meter displays the following

- Delivered energy by the boilers
- Supply and return temperatures
- Quantity of water circulated

TEST Training kit

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Economic Benefits	Measured Heavy Fuel (HF) consumed to produce hot water: 336 Tonnes/year Estimated Diesel consumption after replacing boiler: 250 Tonnes/year (~ 25% decrease) Actual production stoppage due to boiler breakdown: 6 days/year (Based on three breakdowns per year, each breakdown requires on average 2 days to repair) Market price of heavy fuel : 350 EUR/Tonne Market price of Diesel : 600 EUR/Tonne (Note: there is no price adjustment for calorific values) Lost net revenues per day of breakdown: 6,000 EUR/day (Based on company turnover) Actual heavy fuel cost to produce hot water: 336*350 = 117,000 EUR/year Estimated diesel fuel cost to produce hot water (new boilers): 250*600 = 150,000 EUR/year Estimated avoided loss in net revenues (reduced breakdowns): 7*6,000 = 42,000 EUR/year Expected total savings: (117,000 – 150,000) + 42,000 = 9,000 EUR/year (7.5%) The financial savings are quite low while the energy savings are much higher, this is because the proposal switches from a lower cost polluting fuel to a higher cost less polluting fuel. They will have a significant impact on specific energy use of the different products manufactured.
Environmental Benefits	Expected fuel savings: 86 Tonnes/year (12% of overall plant energy use) Specific CO_2 emissions of diesel: 3200 $kgCO_2$/Tonne (it is assumed that HF has same values) Avoided CO_2 emissions: 86*3200 = 275,000 $kgCO_2$/year (11% of overall plant CO_2 emissions)
Other benefits	Not applicable
Health and safety impact	Diesel fuel is a much cleaner fuel to handle than HF, it has lower health risks.

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Capital investments & financial indicators	Cost of intervention: 80,000 EUR Return on investment (simple payback): 8 years
Suppliers	Not disclosed
Other aspects	- This project should not only be considered from a return on investment perspective because there is a qualitative switch from a dirty less expensive fuel to a less polluting more expensive fuel. A proposal was submitted to the client to replace the existing generators and rely 100% on in-house electricity supply with heat recovery. This scheme will reduce overall boiler capacity requirement to only 900 KW making the overall proposal very attractive especially that the heat recovery installation is existing on site but is not operational. - 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. The following was monitored on a daily basis: 1) Heavy fuel consumption of boiler, 2) Delivered energy from boiler, 3) Water quantity processed through boiler. Above calculations are based on the readings between May 2016 and April 2017.
Implementation	Measure is being considered for implementation 2019 – 2020.