Department for
Business, Energy
& Industrial Strategy

John Wainwright & Co. Ltd (Avonmouth Asphalt Plant)

Industrial Heat Recovery Support Programme Case Study

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Context

John Wainwright & Co Ltd is a vertically integrated construction materials business with a quarry, 2 asphalt plants, surfacing and civils engineering operations. It is headquartered near Shepton Mallet, Somerset, at Moons Hill Quarry, with a satellite operation at Avonmouth, Bristol. The company was founded in 1891 and incorporated in 1902.

This case study relates to the asphalt production facility at Avonmouth which was constructed in 2015. The plant includes a 19MW multi-fuel burner capable of burning natural gas and gas oil that dries and heats aggregates as part of the process of manufacturing asphalt products for road construction.

The project objective is to reduce fuel demand by ducting hot air from the site compressor exhaust and recover heat from the plant exhaust with a heat exchanger to preheat the primary air supply to the burner. The combined effect will reduce emissions by about 145 tonnes CO2 emissions per annum. The site configuration is ideal for retrofitting the heat recovery equipment. The plant includes equipment monitoring for operational reasons, and sub-metering has been installed to further enhance energy management, all of which has been important for evaluating this project. The advent of the Department for Business Energy and Industrial Strategy's (BEIS) IHRS programme made this project possible.

Avonmouth Asphalt Plant

How IHRS supported this project

A key factor allowing this project to progress was the grant provided via the IHRS programme, without which the project does not meet the Company internal rate of return. Research undertaken for the Feasibility Study identified two key areas for heat recovery which would help to decarbonise the process and support Environment, Social and Governance benefits. The structure and rigour of the application process ensured client confidence along with learning outcomes likely to be applied elsewhere in the business. Phase 1 was for proof of concept and allowed for increased data acquisition and finessing design criteria for Phase 2.

Benefits and added value

Burners are known to operate more efficiently if the primary air is maintained within a consistent temperature range. Fuel savings can be made if this temperature is elevated within burner design parameters for efficient combustion. However, many asphalt plants are not enclosed in buildings due to cost, therefore key components, such as the burner, are exposed to the elements. For this project, measurements across the air intakes showed that distribution and velocity is very susceptible to crosswinds on the site.

The effect of wind and variable weather is believed to impact on flame geometry and heating efficiency. Directing the compressor exhaust on to the burner air intake has provided the calculated minor improvements, although monitoring through the winter months is required. Measurements show that the compressor exhaust emits 5,000m3/hr (which was higher than expected) at around 45 degrees C reducing slightly once ducted to the burner. Calculations from the initial data acquired indicates at least 50MW per annum is being transferred from the compressor exhaust to the burner. The burner operates at a range that generally requires 15,000 to 20,000m3/hr of air so providing around 25% of the air intake at elevated temperatures will be beneficial.

Phase 2 objective is to ensure all burner input air temperature is elevated to 40-50 degrees C. Phase 2 includes enclosing the burner to eliminate weather effects and to improve the longevity of the equipment.

Lessons learned

The technical concept of diverting the compressor exhaust along with the associated energy benefit calculations was well understood but not applied at asphalt plants. Enlarging the exhaust has improved compressor cooling. Additional flow measurements within the main plant exhaust undertaken during Phase 1 were complicated by the high vapour content, but the reproducibility of the data was improved by ensuring the temperature of the pitot tube could equalise with the exhaust flow before measurements. Beneficially, this led to further evaluation of the quantity of vapour by volume in the exhaust and calculations on the amount of precipitate expected as a result of implementing Phase 2. This provided confidence that the volume of precipitate could be utilised elsewhere in the process limiting the requirement for potable water.

Proceeding to Implementation (Phase 2)

The thorough technical evaluation for the feasibility study underpinned the decision to enter the IHRS programme. Ongoing evaluation during the application process and Phase 1 implementation quantified the large volume of warm air emitted by the compressor and, when combined with main plant exhaust heat recovery, made the opportunity for decarbonising the process through Phase 2 of the IHRS compelling.

Business projections indicate that energy demand is likely to increase along with the unit cost of energy. The data, which was fed into the evaluation models, underscored the imperative of the broader environmental, economic and social benefits of decarbonising the business.

"*This project has shown that challenging industry assumptions, seeking transferrable technologies and exploring technical and engineering research can provide investment opportunities that would otherwise be dismissed. The Government's Industrial Heat Recovery Support (IHRS) programme has made an important contribution to enabling this project at a time when decarbonising industry and optimising energy use is a national and global imperative. Wainwright is proud to be an industry leader and we look forward to implementing Phase 2 resulting in similar energy recovery technology being retrofitted on other plants and being included as standard on new plants."*

Simon Lumkin, Mines & Quarries Consultancy Ltd.

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