MEASURED · REFERENCE INSTALLATION · US, USD

VX-LHR — latent heat recovery, two-pass condensing

Northline Foods, United States: two-pass condensing, four boilers, 8.47 % of the fuel measured

A US food plant with four gas-fired boilers, flue gas leaving near 187 °C, and no way to prove what recovery was worth. We instrumented the plant, ran the baseline, then added recovery in two stages and published the meters.

01 · PLANT PROFILE

Plant profile

CUSTOMER

Northline Foods · United States (demo tenant, plant code withheld)

APPLICATION

Food processing · 4 gas-fired steam boilers · two-stage flue-gas recovery

BOILERS

UB-01 1,500 kW · UB-02 2,500 kW · UB-03 4,000 kW · UB-04 6,000 kW — 14,000 kW installed

RECOVERY EQUIPMENT

VX-SHR (sensible) + VX-LHR (condensing) + VX-MV metering, DXL two-pass condensing family

FLUE GAS PATH

187 °C at the boiler outlet → 110 °C after the dry stage → 45 °C after condensing

HEAT SINK

Boiler feedwater and process make-up water, cold enough to take the flue below its dew point

MEASUREMENT

Fuel, steam, flue in/out, water in/out, condensate — 1-minute samples

DATA

Public dashboard · M&V protocol (IPMVP option B)

02 · BASELINE — BEFORE RECOVERY

Baseline — before recovery

Before recovery the four boilers sent their flue gas to the stack at close to 187 °C. The plant had no way to say what that waste heat was worth, and no way to prove a saving afterwards: the fuel invoice moves for reasons that have nothing to do with a boiler house.

The baseline was therefore a measurement, not an estimate. Fuel input, steam output, flue temperature in and out, water in and out, condensate were sampled once a minute across the normal load profile before any recovery equipment was commissioned.

03 · SOLUTION — WHAT WAS INSTALLED

Solution — what was installed

VX-SHR takes sensible heat from the flue into the feedwater, 187 °C down to about 110 °C. **VX-LHR** is the two-pass condensing stage: the flue is taken below its water dew point so the latent heat of the flue moisture is recovered and the water condenses out on the second pass. **VX-MV** meters the boundary, including the condensate drain.

Two passes rather than one moves more of the flue gas into contact with the condensing surface, which is why the latent share here (4.49 %) is slightly higher than on a single-pass installation of similar size.

Sensible stage — VX-SHR

Flue gas 187 → 110 °C. Heat into feedwater, no condensate. This is the stage a conventional economizer already delivers.

Condensing stage — VX-LHR

Two-pass condensing, flue gas 110 → 45 °C. Latent heat plus the condensed water, metered on the drain.

04 · MEASURED RESULTS

Measured results

Measured on the plant meters across the normal load profile, with both stages running and condensate proven on the drain. One set of readings, expressed in three unit systems.

8.47 %
of the fuel bill saved — measured, both stages

3.98 %
sensible heat — VX-SHR

4.49 %
latent heat and water — VX-LHR

$28,420
annual fuel saving, measured

MEASURED ON THE PLANT METERS · ONE SET OF READINGS, THREE UNIT SYSTEMS

QUANTITY	Recovered duty
UNITED STATES	2,630,078 BTU/h · 2.63 MMBtu/h
VIETNAM	771 kW · 6,166 MWh/yr
OTHER (METRIC)	771 kW · 6,166 MWh/yr

QUANTITY	Flue gas temperature

QUANTITY	Recovered duty
UNITED STATES	2,630,078 BTU/h
VIETNAM	771 kW
OTHER (METRIC)	771 kW

UNITED STATES	369 → 113 °F
VIETNAM	187.2 → 45.0 °C
OTHER (METRIC)	187.2 → 45.0 °C

QUANTITY	Annual fuel (as saved)
UNITED STATES	263,008 therm
VIETNAM	27,747 GJ · 6,166 MWh
OTHER (METRIC)	22,199 GJ

QUANTITY	Annual saving
UNITED STATES	$28,420
VIETNAM	747,446,000 VND
OTHER (METRIC)	€26,146 · £22,452

QUANTITY	CO_2 avoided
UNITED STATES	98.2 short tons
VIETNAM	89.1 tonnes
OTHER (METRIC)	89.1 t

QUANTITY	Recovered duty
UNITED STATES	2,630,078 BTU/h
VIETNAM	771 kW
OTHER (METRIC)	771 kW

05 · SAVINGS AND PAYBACK

Savings and payback

The plant bills in dollars, so the saving is reported in dollars at the plant's own fuel price. The VND and euro columns are conversions at a declared rate (1 USD = 26,300 VND).

3.98 % of the fuel bill comes from the sensible stage alone — that is what a dry economizer of this size would have delivered. The remaining 4.49 % exists only because the flue was taken through condensation, and the condensate meter is the evidence for it.

Payback

This is our own reference installation rather than a customer purchase, so there is no invoiced installed cost to quote and no payback figure on this page. Installed cost for a customer project is quoted per site after the survey — see pricing.

06 · VERIFICATION METHOD

Verification method

Fuel meter and steam meter give the efficiency before and after; flue temperatures and water flow give the recovered duty; condensate mass flow proves the latent stage is running. Everything is sampled once a minute, buffered at the gateway and published, so the percentage can be re-derived by a third party from the raw record rather than taken from a summary table.

The boundary is IPMVP option B: one boundary around the boiler house, all fuel and all steam inside it. The method is published in the M&V protocol.

07 · BEFORE AND AFTER

Before and after

BEFORE	→	AFTER
187 °C		**45 °C**
flue gas straight to the stack		8.47 % less fuel
fuel bill 100 %		$28,420 a year


Condensing fin-tube surface of a Cain two-pass heat-recovery economizer with condensate forming on the fins

The wet condensing surface of the second pass — where the latent share is actually collected.

Photo: Cain Industries

08 · DOWNLOAD, SOURCES AND WHAT THIS DOCUMENT IS

Download, sources and what this document is

Download case study (PDF) | All case studies

What this document is. Our own instrumented reference installation — real meters, real readings, public dashboard. It is not a customer site and no customer name appears on it.

- PULSE — this plant's own meter record and daily statistics, sampled at one minute.
- PULSE — savings and measurement page for the published method.
- Cain Industries — DXL two-pass condensing series, the equipment family used here.

The 55 °C line: flue-gas dew point | M&V protocol | All case studies