Gas Information Sheet 52

Type B appliance energy efficiency opportunities

Overview

This gas information sheet provides information about Type B gas appliance energy efficiency opportunities for consumers, as well as during specification, installation, and commissioning.

Why is energy efficiency important?

One of Energy Safe Victoria's key objectives is to promote gas installation and gas appliance energy efficiency awareness. The main drivers for improved energy efficiency include:

- reducing operating costs
- lowering environmental impacts (for example, from greenhouse and toxic gas emissions)
- developing marketing opportunities (for example, an improved National Australian Built Environment Rating System (NABERS) rating for commercial buildings has been shown to lead to increased property prices and lease demand).

When specifying, installing, or optimising Type B gas appliances and processes, always consider seeking expert advice to ensure the most energy efficient outcome.

Improving Type B gas appliance energy efficiency for consumers and end users

A higher efficiency Type B gas appliance means less gas input for the same heat output. Methods and techniques for improving Type B appliance efficiency (and associated processes) include:

- reducing process heat losses
- reducing commercial building heat demand
- reducing industrial process heat demand
- regular maintenance
- ongoing monitoring.

Reducing process heat losses

Opportunities to reduce process heat loss include:

- insulation, which involves:
  - hot water pipes (losses from well-maintained pipework are estimated to be approximately 1.5% of a commercial office building system's capacity)
  - steam pipes (uninsulated steam pipes lose a lot of heat, which increases the amount of condensate in the steam and reduces heat transfer efficiency – with an ambient temperature of 15°C, an uninsulated 100 metre run of 50 millimetre pipe carrying steam at 10 bar can condense approximately 180 kg/h of steam through heat loss)
  - spray booths, vats, kilns, and building fabric
- isolating standby lag boilers from water flow by using automatically actuated valves (heat losses from standby boilers are typically 5-10% of the total system heat every hour) – see Example 1
- minimising heating process temperatures (where possible) to reduce radiant losses

- applying time clocks to circulation pumps (for example, domestic hot water (DHW) reticulation in a commercial building) to reduce heat losses from pipes when heat is not required.

Example 1 – installations with multiple boilers (for redundancy)

Project: reduce losses by isolating standby boilers

Average heat load:	500 kilowatt (kW), leaving temperature = 60°C
Natural gas unit cost:	$9/Gigajoule (GJ)
Upgrade scope:	Install automatic isolation valve on standby boiler (5% benefit)
Benefit to operational cost =	$7,100 per year
Capital cost =	$5,000
Simple payback =	1 year
Reduction in greenhouse gas emissions =	440 tonnes CO2-equivalent per year

Reducing commercial building heat demand

Opportunities for reducing heat demand include:

- introducing a dead band between heating and cooling temperature set points for space heating to reduce heating and cooling system conflict (which reduces both heating and cooling energy requirements)
- reducing hot water supply temperature set points (for example, 60°C for DHW)
- introducing temperature resets for the hot water supply (a Heating Hot Water (HHW) loop, for example, with a reset temperature between 50°C-80°C as demand increases)
- introducing ambient temperature lockouts to prevent the heating plant from running when not required
- reducing air infiltration.

Reducing industrial process heat demand

Using lower temperature (liquid) solutions in industrial processes is another way of reducing heat demand. For example, new chemicals may be available for commercial laundries to run their washing cycles at lower temperatures.

Regular maintenance

Regular maintenance is essential for efficient Type B appliance operation. A typical maintenance regime includes the following considerations:

- Tuning the gas burner to achieve an optimum air/fuel mixture can improve heating efficiency by up to 2% (see Example 2). High combustion efficiency is shown through the appliance exhaust gas temperatures and oxygen levels.
- Boiler blow down is essential to maintain the total dissolved solids (TDS) level in the boiler drum, and an optimal TDS level control can save energy, water, and chemical treatment costs.
- Boiler water and fire tube condition. Exhaust gas temperature indicates how efficiently the boiler is using the energy from the combustion of gas. If the exhaust gas temperature rises over time, it may indicate that:

  - there is scale formation on the water side of the heat exchanger surfaces, or
  - the boiler water treatment is not effective, or there is soot build-up in the fire tubes that requires cleaning.
- Regularly checking the steam traps, because it is essential to identify steam losses. Steam in a condensate recovery tank is an indicator of steam trap failure.
- Maintaining hot water valves to prevent unwanted hot water bypass and subsequent overheating and heat loss.

Example 2 – increased efficiency from tuning a gas burner

Project: initiate regular burner tuning

Average heat load:	500 kilowatt (kW), leaving temperature = 60°C
Natural gas unit cost:	$9/GJ
Upgrade scope:	Tuning air/fuel ratio (assumed 2% efficiency benefit)
Benefit to operational cost =	$2,800 per year
Tuning cost =	$2,000
Simple payback =	1 year
Reduction in greenhouse gas emissions =	17 tonnes CO2-equivalent per year

Ongoing monitoring

Installation of gas sub-meters enables energy consumption tracking and system efficiency monitoring (for example, process gas consumption per unit produced).

Improving Type B gas appliance energy efficiency during specification, installation and commissioning

Possible opportunities for licensed gasfitters to influence the efficiency of Type B appliances (through decisions made during specification, installation and commissioning, as well as through ongoing maintenance) include:

- energy efficient product specification
- boiler thermal efficiency
- heat loss reduction
- Type B appliance maintenance
- optimising appliance/process efficiency.

Energy efficient product specification

Careful product selection (where options are available) is the first step to achieving an efficient solution. Energy efficient products to consider include the following:

- A heating plant sized to match heat load and temperature requirements to ensure it can operate in its most efficient band (see Example 3).

- Modulating burners that allow heating production to closely meet process demand. This reduces appliance standby times and associated heat losses, which can be significantly reduced when compared to on/off or (to a lesser extent) multi-stage appliances. The use of electronic commutator (EC)/variable speed burner motors also reduces power consumption when the burner is modulating.
- Fully modulating burners, which more closely track a heat load compared to on/off or partially modulating burners, reduce periods of standby, which can lead to heat losses by up to 4%.
- Economisers to recover heat from flue gases for preheating process air or fluid.
- Catalytic/flameless infra-red ovens, which can reduce fuel demand by up to 80% and paint drying time by up to 50%, and are an alternative to traditional gas-fired spray booths.
- Condensing boilers, which operate at higher efficiencies when cooler supply water is available. The condensing effect only begins as supply water temperatures fall below 50°C, and efficiency improves as the supply water temperature falls.

Boiler thermal efficiency

Typical thermal efficiency for properly maintained boilers is as follows:

- Condensing boilers: up to 98% (when condensing).
- Force draft boilers: 85-90%.
- Induced draft boilers: 80-83%.
- Atmospheric draft boilers: 70%.

Example 3 – increased efficiency from an appropriately sized boiler

Project: boiler plant upgrade

Annual heat requirement:	10,000 GJ
Natural gas unit cost:	$9/GJ
Upgrade scope:	From atmospheric boiler plant (2 x 1000kW boilers at 65% efficiency) to forced draft boiler plant (90% efficiency)
Benefit to operational cost =	
Capital cost =	$250,000
Simple payback =	6.5 years
Reduction in greenhouse gas emissions =	230 tonnes CO2-equivalent per year

Heat loss reduction

Heat loss, which is inherent in heat production and reticulation systems and reduces their operating efficiency, can be reduced a number of ways:

- Insulation, isolating lag boilers on standby, minimising heating process temperatures, and applying time clocks to circulation pumps (see the sections on Consumers and End Users for more information).
- Recovering hot condensate from steam distribution and process equipment and then feeding the condensate to the feedwater tank. This saves energy and chemical treatment costs, and reduces fresh water demand. (A 60°C rise in feedwater temperature can save around 1% of the gas input.)
- Removing leaks in steam traps, joints and valves. Significant steam waste can occur due to leaks. For example, a 3 millimetre diameter hole can discharge as much as 30 kilograms per hour of steam at 1000 kPa. Some leaks are visible and simple to fix, but some are invisible, like leaks through faulty steam traps, and require a visual inspection.
- Installing pressure reducing valves (PRV). As most steam end-users will operate at a lower pressure than the main steam supply pressure, PRVs will reduce pressure. Calibrating the PRV is important, not only to maintain correct operating pressure, but also to improve the dryness of the steam in the process.

Type B appliance maintenance

Regular maintenance is essential for the efficient operation of a Type B appliance. (See the section on regular maintenance for consumers and end users)

Optimising appliance/process efficiency

There are several ways to optimise gas systems through commissioning to increase system efficiency:

- Reducing process temperatures improves system efficiency by reducing heat losses.
- Reducing the temperature of water entering condensing boilers to 50°C by:
  - reducing supply temperatures
  - reducing reticulation system flow rates
  - applying a temperature reset to reduce supply temperatures when heating demand is low (suitable for commercial building heating systems).
- Reducing generated steam pressure to match the site equipment's specifications.
- Optimising boiler/steam generator staging:
  - When the heating demand exceeds the capacity of one boiler, efficiencies can be gained by staging boilers and modulating boilers in parallel.
  - Boilers generally run at higher efficiency at higher capacity, so it is best to stage up late, allowing both boilers to operate at higher firing rates.
- Minimise burner operation cycling:
  - Relatively frequent cycling that causes process temperature set point undershoot and overshoot can lead to heat losses (of up to 4% in boiler – see Example 4).
  - Frequent cycling also increases the combustion chamber's purge cycles and the chamber loses a lot of heat in the process.

Example 4 – reduced operating costs from lower frequency cycling

Project: reduced burner cycling

Average heat load:	500 kW
Natural gas unit cost:	$9/GJ
Upgrade scope:	Optimised burner modulation (assumed 4% efficiency benefit)
Benefit to operational cost =	$5,700/annum
Tuning cost =	$2,000
Simple payback =	1 year

Incentive programs

Incentive programs may provide part or full gas efficiency project funding. Current energy efficiency incentive schemes available in Victoria include the:

- Victorian Energy Upgrades Program (VEU)
- Emissions Reduction Fund (ERF).

Victorian Energy Upgrades Program (VEU)

The VEU, formerly Victorian Energy Efficiency Target (VEET) scheme, is a Victorian Government initiative that promotes and encourages the uptake of energy-efficient technology. It applies to both households and businesses and provides financial incentives to switch to more energy-efficient products and practices.

Emissions Reduction Fund (ERF)

The ERF is a voluntary scheme that aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce emissions.

Who we are

At Energy Safe Victoria we work to keep Victoria energy safe.

We regulate the energy industry and sector to ensure generation, supply and usage uphold safety standards, and engage with the community to raise awareness of energy safety risks.

In everything we do, we strive to deliver on our purpose to keep Victoria energy safe. Always.

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