



*By* David Tilleard

# CAN YOU AFFORD TO OVERLOOK THESE QUESTIONS?

Your guide to the secrets of a successful project

INCLUDES OUR TOP 10 TIPS!

**Byworth**  
BOILERS



# FUEL, EMISSIONS, EFFICIENCY AND TECHNOLOGY ARE ALL IMPORTANT CONSIDERATIONS

AS EACH WILL HAVE A  
SIGNIFICANT IMPACT ON YOUR  
BOILER'S PERFORMANCE & OPEX



## CONSIDERATIONS

If you're currently, or will be in the future, looking to invest in an industrial boiler then incorporate our top 10 tips into your decision-making process to help ensure your project gets off to the right start...

### WHAT IS THE OPERATING EFFICIENCY AND HOW WELL DOES THE NEW SYSTEM FIT MY APPLICATION?

Not many purchasing decisions for your factory have larger or longer-term energy consequences than that of purchasing a new or replacement boiler.

However, purchasing a boiler is frequently undertaken without considering all of the options and alternatives.

If your boiler is maintained correctly, its life span can range over decades. Therefore, significant considerations would be the operating efficiency over the whole load cycle and how well the end product fits your specific application.

**TIP #1**  
Don't concentrate on the upfront cost of the unit, but consider the entire ROI



## EVALUATE THE LIFETIME COSTS

Always base financial decisions on the lifetime running costs of your boiler plant, not purely on purchase price.

For example, a 10 tonne boiler running on gas on even a light load for 20 years would use almost £16million pounds worth of fuel. The boiler would only cost in the region of £150,000, so a few extra thousand pounds invested in a well-designed, more efficient boiler is a very wise move.

### TIP #2

Read our [Energy Efficiency Boiler Advice](http://www.byworth.co.uk/about-us/energy-efficient-boilers) page - [www.byworth.co.uk/about-us/energy-efficient-boilers](http://www.byworth.co.uk/about-us/energy-efficient-boilers)



## WILL YOUR NEW BOILER COMPLY WITH THE MCPD?

In 2018, Directive 2015/2193 "on the limitation of emissions of certain pollutants into the air from medium combustion plants" passed into UK Law. Referred to as The Medium Combustion Plant Directive or MCPD it plugs the gap between the Industrial Emissions Directive 2010/75/EU (the IED) and the "Eco Design" Directive 2009/125/EC. It will apply to all operators of combustion plant rated between 1 MW and 50 MW thermal input. The emission limit values set in the MCPD apply from 20 December 2018 for new plants and 2025 or 2030 for existing plants, depending on their size.

It's important to note that the responsibility for compliance lies with the user of the plant, not the supplier and that compliance can sometimes only be achieved by control of the fuel or by abatement of the flue gases exiting the plant.

[Read our FAQ](#)

### TIP #3

It will be essential to involve potential suppliers early in the project to ensure that the plant does indeed meet the ELV's applicable to you. Some of the issues preventing manufacturers offering off-the-shelf "compliance" with the Directive are:

- New plant will be subject to "aggregation" while existing plant will not.
- Different ELV's may apply in areas of poor air quality
- The plant may be compliant when subject to post-treatment of the flue gas
- The fuel supply can affect certain emissions more than the design of the equipment

## HAVE YOU COMMENCED WITH A DETAILED EVALUATION?

Before committing to a new boiler or replacement one, it is extremely beneficial to do a thorough analysis of your steam or hot water requirements:

- Evaluate your steam pressure and volume requirements remembering lower pressure boiler are slightly more efficient while high pressure is better for distribution efficiency
- Analyse your daily, weekly and annual cycle of boiler loads particularly at low load as boilers that switch on and off frequently are considerably less efficient

### TIP #4

Ensure the steam quality you will be getting will give you the utmost efficiency. Dry, saturated steam will contain no water droplets whereas 99% saturated steam will give you 1% water droplets. The water will transfer no heat and instead acts to reduce the amount of steam the pipe can carry, reducing the overall plant efficiency, a boiler with a lower steam quality will therefore, have to work harder to produce more steam than that of one with a higher steam quality to transfer the same amount of heat.



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## HAVE YOUR REQUIREMENTS CHANGED?

It is not uncommon to find that over time you experience a change in the steam usage trends.

You may have less demand for the end product, therefore, less steam demand.

You may find your existing boiler is too big or too small or operates at the wrong temperature and pressure for your heating process requirements.

The more modern boilers offer very good efficiencies and are available in a wide range of sizes.



### Tip #5

It can often be more valuable to have multiple boiler installations instead of a single larger unit because it would allow redundancy, thus greater plant reliability. Adopting this approach allows operators to maintain peak boiler efficiency when dealing with varying loads.

## HAVE YOU CONSIDERED A WASTE HEAT OR COMPOSITE BOILER?

With certain applications, it makes sense to install a waste heat boiler. Low-temperature applications, for example, could benefit from recovering some of the wasted heat from the exhaust and 'reusing' it elsewhere in the process, thus operating in a far more efficient manner.

Often, we see a small waste heat boiler acting as "duty" with larger boilers acting as "assist" which leaves the large boilers cycling on and off and acting very inefficiently and the waste heat boiler failing on low water because it can't satisfy the demand on its own.



### Tip #6

You will get much better control by investing a bit more money and buying a composite boiler which blends waste and fired boilers into a single unit capable of satisfying the whole site demand.



## WHAT ABOUT ECONOMISERS?



Economisers recover heat from the flue gases after they have left the boiler. fuel usage and emissions, an economiser when heating the boiler feedwater, allows the boiler to more rapidly respond to load changes supporting theories of significant increases in efficiencies. Typically, systems like this pay for themselves within months.

This recovered heat is most frequently used to pre-heat the boiler feedwater and offers fuel savings of between 4 and 10%.

In addition to reducing

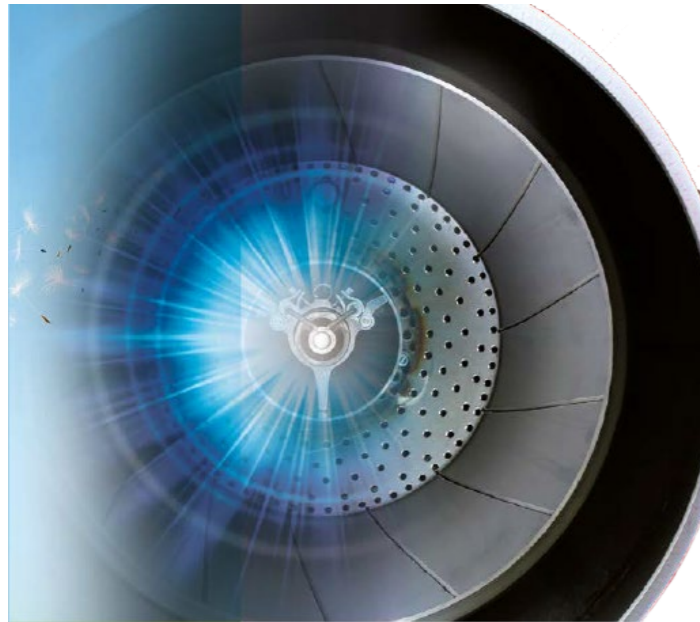
### Tip #7

If you have a large demand for heated process water, then the economiser could be used to supplement the heating of that instead, offering even better savings of up to 15%.

## HAVE YOU CONSIDERED YOUR BURNER SPECIFICATIONS?

Burners vary widely in their specification. Selecting the right burner with the new boiler is critical; especially with applications that require a very low NOx compliance and high turndown ratio to cater for low load conditions.

However, don't waste your money on a high turn-down burner if you don't have a lot of variability in your production steam demand. For example, if your minimum site load is 25% of the maximum, you only need a 4:1 turn down on the burner. Anything higher than this will offer no further



**TIP #8**  
Oxygen trim controls can be useful where you are burning a fuel of varying quality, but the cost is likely to outweigh the benefit for someone burning natural gas or LPG – specifying digital controls should give you a good enough level of repeatability on their own.

Recommended burner and controls manufacturers include:

–weishaupt–

**DUNPHY**

**NU-WAY**  
Enertech Group

**SIEMENS**

**UNIGAS**  
GP BURNERS

**scanview**

Ratiotronic™

**SAACKE**

**JOHN ZINK  
HAMWORTHY**  
COMBUSTION

**RIELLO**

## HOW MANY BOILERS?

When evaluating your boiler options, consider whether backup equipment would benefit your business with regards to:

- Having a "spare" boiler is desirable where the steam is mission critical (such as hospital heating, or where the cost of lost production is high)
- Seasonal changes could mean it is more efficient to have several boilers so you can turn one off during periods of lower demand. For example, in the summer when there is little demand for space heating
- Having several boilers capable of providing only part of the peak demand offers greater turn-down for periods of low demand. This can be more economical than having a full size "spare".

For example, having 3 boilers each capable of supplying half the total steam demand, rather than two boilers that are each capable of the full demand - would likely prove more economical for processes that are sporadic in steam demand.

Tip #9

By having a boiler on standby, you could save thousands in lost production during both planned and unplanned downtime



## PERFORMANCE

Fuel, emissions, efficiency and technology are all important considerations as each will have a significant impact on your boiler's performance and its operating costs.

A general rule of thumb with regards to fuel costs is that they typically account for 10 percent of an organisations total operating expenditure. So it makes sense to place fuel costs as a 'top of the list' consideration.

In general, the preferred fuel is natural gas, propane or light oil.

Natural gas burns the cleanest, subsequently leaving the least residue out of all the fossil fuels. This means that less maintenance is required.

LPG should be preferred over oil where natural gas is not available, due to its price stability and better environmental credentials.

Wood or heavy fuel can be significantly cheaper to run than any other fuel; HFO and wood-fired boilers need careful monitoring and regular cleaning in order to avoid costly downtime caused by losses in efficiency from soot build up.

Dual fuel burners are advantageous when the primary fuel supply is shut down due to maintenance and service or where the supply is inconsistent or it is necessary to start a plant on one fuel before changing to another (as is often the case with biogas for instance).



### Tip #10

**Combustion efficiency** refers to how effective the burner is at burning the fuel completely while...

...**Thermal efficiency** refers to the boiler's ability to transfer heat.

**Fuel to steam efficiency** refers to the actual true boiler efficiency. Fuel to steam efficiency can be calculated by considering the heat balance, i.e. the stack temperature and losses, radiation, excess air level and convection losses. However, when making these calculations, it does not consider variables such as the cycling and purge losses and operating levels, among others. The figures represent a moment in time and not a prolonged period of operation such as a production cycle, or a day of operation.

**Stack losses** refers to the temperature of the combustion gases that leave the boiler and the CO<sub>2</sub> level in those gases (sometimes the O<sub>2</sub> level). Generally speaking, the lower the stack temperature and the higher the CO<sub>2</sub> (lower O<sub>2</sub>), the more effective the heat transfer is and less heat is being lost up the stack.

**Radiation and convection** losses are a function of the surface area of the boiler, the quality of insulation, and the working temperature. They are usually expressed by the boiler maker as a percentage of the maximum firing rate and because they are fairly fixed, it will be a higher percentage at lower firing rates.

Generally speaking, boilers of the same basic design that incorporate a larger amount of heating surface are likely to be more efficient than those with a lower amount of heating surface. Alternative designs can seek to increase the amount of turbulence in the tubes (such as through the use of retarders or Byworth's own XID tubing) to get increased heat transfer from the same amount of heating surface.

The number of passes in a boiler is NOT particularly important to heat transfer. The use of 3 or even 4 passes is about making an efficient use of space (making a shorter fatter boiler rather than a really long skinny one) and NOT specifically about efficiency. It is quite possible to buy reverse flame boilers that are more efficient than some 3-pass boilers.

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## TO CONCLUDE

The performance of the boiler is based on the capability of the boiler, burner and the control systems to match the steam load accurately so that they all work in unison.

The emissions, efficiency, turndown, excess air and capacity all need to be reviewed together when identifying the performance. Whether the burner is able to operate at optimum excess air levels, will in part, affect the efficiency of the boiler.

Burners that are designed insufficiently tend to produce soot or CO at these excess air levels; they can also foul the boiler and considerably reduce efficiency.

Likewise, the control systems on your boiler can enhance efficiency and reduce a company's running costs.

Research your decision thoroughly and don't be afraid to ask the experts any questions that will help broaden your understanding. Ultimately, you want to make the most out of your investment and by understanding these considerations early on in the decision-making process will generate the best return on investment.

**Optimising your boiler plant?**

**Call our experts  
01535 665225**

**Ask  
[sales@byworth.co.uk](mailto:sales@byworth.co.uk)**

