# Energy reductions through simple boiler maintenance and tuning – Case Study

**In a recent pilot run by EECA, 8 organisations collectively achieved total fuel savings of more than $200,000 p.a. for a total investment of $10,000. Boiler sizes ranged from 150 kW up to 15 MW. The average tune-up cost was $1,250 with prices for the work ranged from $690 - $2,500. With the exception of one boiler that achieved no savings at all, the remainder achieved paybacks ranging from less than 1 week to just over 7 months.**

The message from all this is clear. All boiler owning organisations should ensure there is an appropriate maintenance and boiler tuning regime in place and that boiler tuning is occurring in accordance with that regime.

Rob Bishop of Energy Solutions commented on his experience with combustion boilers in New Zealand: "Only 10-20% are well-maintained and efficient; maybe 40% (including very large ones) are grossly inefficient, poorly controlled, or even dangerous. For boiler tune-ups "payback" is typically two months.

How much excess air is required depends on the specific boiler – it can range from 0.5% to 20+% for gas boilers. For energy efficiency, the lower the excess air the better. The way to find out how much is required is to measure the flue gas and keep reducing the excess air until the carbon monoxide rises to about 50 ppm, and stop there or back off a little.

The optimum tuning interval can be found by measuring and reporting the efficiency BEFORE as well as after the tune-up (for at least the first two tune-ups). This is to help determine how quickly the boiler goes out of tune.

Here's what I wrote in Appendix E of the "Bloggsville Motor Inn" sample energy audit report (which is on the ESL and EMANZ websites) in 1996:

Combustion appliances operate like automobile carburettors and their air-fuel mixture balance shifts over time. Thus boilers, like carburettors, need tune-ups to maintain their efficiency. The optimal time period between tune-ups depends on specific circumstances, but no less than annually (at the start of the heating season) is recommended.

A specialised combustion efficiency meter is required to do this properly. A mechanical services contractor should be able to test combustion efficiency and tune the boiler for about $100.

The optimal frequency of boiler maintenance is determined by:

- measuring and recording the efficiency before tuning,
- tuning the boilers to maximum efficiency, while measuring and recording that efficiency,
- re-measuring and recording the efficiency several weeks later,
- re-tuning the boilers to maximum efficiency, while measuring and recording that efficiency.

The decline in efficiency is used to determine the next tune-up date, and the results from this are used to further optimise the tune-up interval.

The attached graph shows the results of an example, where the efficiency of the boiler used for space heating and water heating (3,000 kWh/d in winter, 1,000 kWh/d in summer) is assumed to drop linearly over time, at a rate between 0.3%/month and 2%/month ( a reasonable range, based on past experience). For the heat load at Bloggsville Motor Inn (600,000 kWh/y of gas), a 2%/month efficiency drop, and $100 tune-ups, the monthly cost of both boiler inefficiency and tune-ups is summed for the whole year and shown on the graph.

The lowest annual cost, based on these conditions, is for 3 tune ups per year: one at the start of winter (April) one mid-winter (July), and another near the end of winter (October).
That's what I'd mean by "optimised" tuning."

Perhaps other people will have some better ideas. For example, the costs are probably more than $100/tune-up now, but energy costs are also higher than the 3¢/kWh used in the example.