Wood Chip for Energy

A Consultant's Perspective

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• Regulatory Background
• Economic Background
• Systems
• Equipment Selection
• What’s Missing??

Regulatory Background

- National Air Quality Standard requires PM_{10}'s to be no more than 50µg/m^3 over 24hrs ***in the airshed***. Allows 1 over-limit event/year.

- The question is "what is the permissible emission rate (as measured in a stack) which will allow this standard to be met"?

- Each Regional Council interprets it in its own way.

Regulatory Background

- ECan undertook a long study and concluded that the reasonable level for ***total*** particulates in a stack was 250mg/m^3. This is the limit generally across the managed airsheds, with 500mg/m3 in unmanaged airsheds.

- ORC is considering limits between 25 and 50mg/m^3

Regulatory Background (Inconsistencies)

- Domestic log burners are allowed 1g/kg of fuel burned (in the same order as 250mg/m^3).
  - Assumes dry wood
  - Assumes that the correct wood types are used
  - Assumes that the burner is clean and well maintained
  - Assumes that it is properly operated.

- Overwhelmingly, in almost every airshed in the country (with very local exceptions), domestic emissions are the primary polluter. (82% in ChCh, 95% Kaiapoi, 92% in Timaru.)

Regulatory Background (Inconsistencies)

- Originally (2002) industrial/commercial use in ChCh was estimated as contributing 9% to the airshed load. Better estimates (2007) have ***halved*** this (and this is still probably high).

- What is the point of applying incredibly tight standards to industrial and commercial emissions, and ignoring the rest? We are needlessly increasing the cost of doing business in NZ.

Regulatory Background (Costs of Regulation)

- Each simple school conversion in Christchurch has cost
  - $3,000 for emissions modelling.
  - $1000 Resource Consent application fee
  - $225 compliance monitoring report (recurring)
  - Additional consultant fees (to me) to provide information and manage the process.

- Yet every application is the same !!!

- Why? It's a no-brainer. When compared to coal:
  - Particulate emissions ¼ (actually, better than this).
  - NOx emissions ¼
  - SOx emissions eliminated.

Economic Background

Fuel	Unit	$/Unit	CV (MJ/unit)	$/GJ	c/kWh	Annual Cost
LPG				$35.23	12.7	$698,301
Diesel	litre	$1.10	38.1	$28.87	10.4	$572,266
Wood Pellets	tonne	$340.00	19	$17.89	6.4	$354,695
Wood Chip (S50, M40)	tonne	$105.00	13.1	$8.02	2.9	$158,872
Wood chip, kiln dried	tonne	$200.00	17	$11.76	4.2	$233,191
Reclaimed Oil	litre	$0.60	38.1	$15.75	5.7	$312,145

Economic Background (Typical School)

- Annual coal burn, 100tonnes (typical of many secondary schools) or 2,100 GJ
- Total fuel cost, $18,000 (at $180/tonne)
- Assuming the same overall system efficiencies, equivalent costs are:
  - $38,000, wood pellets
  - $17,000, wood chip (S50M40)
  - $25,000, wood chip (kiln dried)

Economic Background (Typical School)

- There is no economic driver to cause a small user to change from coal

- Conversion has only happened in the school sector for 4 reasons:
  - Expiry of Resource Consents
  - Equipment failure
  - Availability of EECA subsidies for conversion
  - The Department of Education's lack of concern about running costs, (but unwillingness to fund capital costs).

Systems

- A boiler, no matter what fuel it is burning, is only a part of a system. To concentrate on the boiler only is a serious error.

- Equally important are:
  - The distribution system (adequacy, insulation, extent)
  - Controls.
    - Can the system respond to rapidly changing weather and occupancy?
    - Can it keep the spaces adequately (but not excessively) warm?
    - Can it be easily re-programmed to accommodate changes in occupancy hours, or unforeseen events?
    - Are there adequate controls at the final points of use?

- Maintenance

Systems

- It is my observation that (in the schools sector, and to a considerable extent across the commercial sector) that fuel burn could be cut by 1/3rd by investing the in distribution systems and controls, and maintaining equipment properly

- The effect, ***no matter what fuel is burned*** would be dramatic on both energy efficiency and emissions.

Equipment

- There is a lot of good equipment out there, both home grown and imported.
- Beware of "efficiencies". Some manufacturers quote gross efficiency, some net. A boiler on wood with a gross efficiency of (say) 82% will have a net efficiency of about 89%
- At usages above 1000 t/yr, wood chip generally comes out a clear economic winner, despite the additional plant costs.
- Below 500 tonnes, pellets come out well, as the associated capital costs are usually lower.

Equipment (continued)

- At the less than 500 tonnes end of the market, the competition is not combustion devices or alternative fuels, but ***heat pumps.***

- Consider the advantages.
  - Unit costs of heat delivered of less than 7c/kWh (even at electrical costs of 20c/kWh - Pretty much worst case and with a CoP of only 3)
  - Delivers cooling as well in summer
  - Current water based heat pumps can deliver at 60C + with CoP's of 3.6
  - Large scale users of electricity are buying at a very large discount, as low as 12 to 14c/unit, making for a delivered unit cost of heat of about 3.9c/kWh
  - Capital costs generally considerably lower.

Equipment (continued)

- People like heat pumps.
  - They have them in their own home.
  - They (think) they understand them.
  - They (think) they are environmentally friendly.

What's Missing??

- Low cost boilers at the bottom end of the market. Boiler systems are not there that can beat heat pumps at less than something like 300kW
- A low cost good quality dry wood chip that can be handled with relatively simple equipment. – (It is now available in Christchurch).
- In the case of schools, recognition by the MoE of its responsibilities both for the safety and integrity of school boiler systems, and for long term funding, guidance, and support to schools to choose and operate the right heating systems.
- The recognition by Government at all levels that with wood pellets burned in the correct equipment, we have as near as we will get to a "clean" fuel in NZ

Recap (1)

- Our approaches to the achievement of the National Air Quality Standard are inconsistent

- Applying tight standards to the industrial/commercial sector will have very little impact on overall air quality standards as long as domestic operating practices are ignored. Wood pellets must displace log burners in the home.

- Every implementation has to go through the same Resource Consent procedure which is unnecessary, slow, and costly.

Recap

- There is a serious need for ***accurate*** estimates of emissions from the industrial/commercial sector in many parts of the country.
- Boilers are only one element in a system. We cannot go on ignoring distribution systems, controls, and maintenance.
- The economic case for using wood energy at the smaller end of the market is very hard to make. ***Heat pumps*** are the competition.