

Low-carbon household electricity through synergies with bioenergy

**Molly Melhuish melhuish@xtra.co.nz, for
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**Victoria University of Wellington,
National Energy Research Institute**

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Carbon-zero electricity requires renewable energy for peaking and dry year firming

- **Household wood burning can contribute to both**
- **Clean air policies are driving household wood energy out; clean burning appliances are unaffordable to many**
- **Policy responses: NZ needs –**
 - **Better understanding. health impacts of wood burning**
 - **support of clean wood burning commensurate with environmental gains**
 - **Tariffs that reward consumers for low-carbon actions**
 - **Better management of government conflicts of interest between electricity profits and carbon reduction actions**

Dual fuel electricity/ wood systems are in common use now, and efficient

Peak demands: older wood burners often run hot on coldest days when electricity costs are highest

- Households could also offer much more interruptible load – e.g. fridges, E Vehicles could absorb wind intermittency
- Wood can be left to grow in wet hydro years, and burned in dry years providing reserve energy
- Wood is essential backup energy in case of blackout
- Wood should be major rural energy source if uneconomic rural lines closed down, and for carbon zero tourist lodges

Home wood burning is declining

- **Wood burning provided 8 PJ/year consumer energy in 2005**
- **HEEP study showed wood burning provided 45% of household space heating, electricity only 32%.**
- **HEEP sample had 1% of houses with heat pumps; now almost half of new houses have heat pumps,**
- **Whole-house heating uses 3-4 times energy of spot heating**
- **Replacing household wood burning with heat pumps increased kWh demand by 6%, peak demand by 60% (nationwide survey)**

Greenhouse emissions, household space heating

- **H'hold GHG emissions = 11.4% of NZ energy emissions**
- **Marginal emissions are what counts – what actually happens when you switch the heater**
- **MED and MFE analyses of emissions ignore transmission losses, assume marginal generation mostly from gas; I consider it is mostly from coal, and include losses.**
- **I conclude heat pumps have higher greenhouse emissions than gas heaters**

Household space heat source	marginal emissions, kg CO₂/kWh space heat
Electrical resistance heater	0.87
Heat pump, COP 3	0.36
Flued natural gas	0.27
Flued LPG	0.33
Unflued LPG	0.23
Pellets or firelogs	0.018 - 0.034
Firewood transported 100 km, truck	0.010
Firewood transported 25 km, car boot	0.014

Health impacts of wood burning as described in HAPiNZ are controversial

- **Fine particles (PM10) harm health, no question.**
- **Long term health impacts cause around ten times as many early deaths per “dose” of PM10 as short term impacts**
- **90% of CH pollution in winter came from home wood burning in 2001; almost all summer pollution came from vehicles**
- **Summer (vehicle) pollution estimated to cause 4-5 times as many early deaths and illnesses per “dose” as winter (solid fuel) pollution**
- **HAPiNZ says the reason for summer-winter difference should be studied further : I agree!**
- **My hypothesis: wood smoke has large particles – visible like snowflakes - that don't get into lung but are broken into fine particles within measuring device**

Health and air pollution issues

- **Cold houses a confounding factor, winter deaths + illness?**
- **Need to calibrate PM10 readings with measurement technique that cannot break up smoke particles**
- **Need to revisit cost benefit analysis of National Environmental Standard for Air Quality, which assumes zero resource consent cost, no power price increases, and is considered by some to use much too high a value for a “statistical life”**
- **Consider air quality standard based on annual cumulative emissions not number of daily exceedences of 50 microgram/ cubic metre of air**

New home wood burning technology is cleaner, more efficient and convenient

- **Microprocessor combustion control, addition of combustion enhancers, central space/ water heat systems burning low-cost wood chip**
- **Chimney/ flue gases can be scrubbed, recycling heat and removing particles to any chosen level**
- **UK subsidises low-carbon technologies up to £2500 per house; London wants 10% renew'ble E in new subdivisions**
- **NZ beginning to use wood chip as well as pellets; appropriate for central heating and wood gasification for electricity, especially for tourist lodges, rest homes**

Wood fuel availability: the technology defines the resource

- **Highly efficient burners use far less wood than old designs; “firelogs” can be stored to augment wood supply**
- **Pellets, mass-produced, will soon use geothermal drying**
- **Central heating and CHP systems being designed for chips**
- **Firm electricity from wood chip cheaper than wind: CHP from wood gasific. = \$5,000/kWelect., firm wind = \$10,000.**
- **NZ street trees could become “urban forests” – shady streets, sunny houses, native birds, firewood, compost, storm water management. Implement thru transition towns**
- **Biochar can be “harvested” from log fires, to sequester in urban gardens or for clean start of tomorrow’s fire**

Get the picture? A huge choice of low carbon options not being used! Why?

- Perceptions: wood burning on its way out; heat pumps convenient and “efficient” (but N. gas is lower carbon)
- Imperfect competition distorts markets for pellets.
- Regulations focused on appliances not outcomes
- Poor information on existing wood burners, installers
- No electricity tariffs that reward price-responsive demand using wood as dual fuel (or even load shedding, appliance
- Distributed energy needs regulatory & local body support¹¹

Generic causes for these barriers

- **Clean air campaign – which has outlived its usefulness**
- **Clean wood burning like other renewables is high capital cost, unaffordable to many householders**
- **Meagre government RE subsidies and research funding**
- **Gov't will not regulate retailers to deliver genuine benefits**
- **Gov't conflicted: carbon reduction vs fiscal effect of profits**
- **District & regional councils should support transition town movement - but cannot fund peak oil or GHG responses**¹²

Rationale for government intervention

- **Recognise high social cost of restricting wood burning, as wood, at ~7c/kWh, is most affordable space heat**
- **Recognise home wood burning highly effective in reducing emissions, as displaces mostly peak electricity**
- **ETS will create ~ \$1 billion/ yr windfall revenues for Gov't – recycling revenues highly appropriate here**
- **Fund development and deployment of least polluting wood burning in most sensitive airsheds as well as retrofits, transfer \$\$ to local bodies for transition town support**
- **Regulate to ensure cost reflective pricing options**