Off Grid in 1900
Some generalities and a short discussion of the demolition of unreinforced brick chimneys

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The chosen area of study is the brick chimney which provided heat, hot water and cooking facilities in the timber houses of Auckland 100 years ago. Demolition of these chimneys is common as adaptive reuse of the older houses of Auckland occurs. The number of chimneys present in four representative streets will be counted, using aerial photography from the 1940’s, and compared with the number present in recent aerial photographs. A long quotation, which provides good evidence regarding the importance of open fires for heating in New Zealand is given. Arguments for and against retaining chimneys and utilising wood biomass will be put, and these arguments will be placed in a context of urban resilience and of energy transition.

Keywords: chimneys, energy, demolition, aerial photography, infrastructure, transition, resilience, heritage, housing, off grid, 1900, primary account

Introduction

Early Auckland was a quite densely built up place, and houses were clustered close together. By the end of the 19th century suburbs were established, close to rail and tramway transport links. The infrastructure of these suburbs was hybrid. In most cases the houses were off grid, in today’s terms, and continued to be so until after the First World War. This lack of reliance on infrastructure, which may come under stress, due to economic forces associated with energy transition, or due to natural disasters, may be a lesson from the past that is relevant as we undertake adaptive reuse of our early suburbs and plan new ones. How off grid were the suburbs of Auckland, in 1900?

Water was often collected from roofs for storage in tanks. The high stud found in pre World War One houses in Auckland has been partially attributed to the need to gravity feed water from storage tanks into houses, and the higher roof meant that pumps could be left out of the system. Piped water supply began in the central area in 1854 and in the suburbs by 1877 (Salmond 1986).
Auckland was the last of the large provincial cities in New Zealand to commission an integrated scheme for wastewater disposal. From the 1850’s an ad hoc collection of sewers discharging direct to the harbour had grown up. The Orakei Scheme was opened in 1913 and the main interceptor sewer ran from Avondale to Okahu bay where it discharged screened sewage on the out-going tide off Takapurawha Point.

Water transport was the preferred and most efficient mode of shifting cargo in 1900. Scows and schooners serviced the small volume coastal routes. The scow was a very shallow draft vessel, and most of Auckland province’s rural towns are located at the navigable limit for scows in the headwaters of coastal estuaries. Warkworth, Wellsford, Henderson, Clevedon, and Waiuku are examples (Langdon 2008).

**Energy in Auckland: 1900**

Coal gas was available in Auckland from 1865 on and electric power from 1908 (Bush 1971). Electricity generation began in 1902 for the tramway, using automatically fed coal fired boilers to produce steam to drive the generators.

A commonality between all the technologies of 1900 was efficiency of application, in terms of energy use. Coal and steam had radically changed the technological landscape of the time, but were applied on a case by case basis. For example, the southern ocean sailing route remained in use long after the opening of Suez and the development of relatively efficient steam driven ships, as cargos took long periods to load and less capital intensive ships could more cost effectively spend long periods in port loading bulk cargo. Passengers loaded themselves and by 1900 went through Suez, or west to Canada and then by train across the continent.

The history of energy use is an outgrowth of environmental history. It is often studied in conjunction with economics as there is a direct correlation between economic growth and increased energy usage. Typically, energy is consumed to create heat, light and motive power. It is worth pausing to consider overall trends in energy use, before narrowing the focus to the burning of wood to produce heat.

An often used measure of levels of industrial and technical infrastructure development is that of energy use in gigajoules, on a per capita basis. Per capita energy use in New Zealand has increased several fold since 1900 to a level of 120GJ/capita. This production of ever larger amounts of energy is directly linked to negative environmental effects.

“All anthropogenic energy systems also create environmental impacts, ranging from locally devastating deforestation to globally worrisome changes of the atmospheric composition, above all the emissions of CO2, CH4, SO2, NOx, and volatile organic compounds from fossil fuel combustion that have been responsible for increasing tropospheric temperatures, acid deposition, photochemical smog, and higher ground ozone levels.” (Smil 2010: 2)

In order to address this issue there will be a transition to a lower level of energy use, on a per capita basis. Smil believes that a level of 40 GJ/capita is achievable, and that to achieve it a lowering in lifestyle expectations will be needed.
“Clearly, a strong case can be made for protecting the environment, not only by using natural resources more efficiently, but by simply consuming less energy, amassing fewer possessions and opting for more benign pastimes.” (Smil 1993: 121)

It is not suggested here that New Zealand societies of the future will be a rerun of the society of 1900. The lower level of energy inputs in 1900 may have some relevance in terms of societal resilience and transition to a less energy intense society. In 1900 there were a variety of energy sources in use. New sources included electricity and petroleum. The use of coal and wood, human muscle power, draft animals, windmills and sails persisted. Of these, the focus will now shift to the use of wood in domestic fire places, as a case study.

The use of wood for heat

There is no doubt that wood was an important energy source in Auckland in 1900. Generally, firewood was cut and seasoned, and as a high volume low value cargo, was transported to the city by scow, before being sold.

By 1900 the houses of Auckland had evolved, and a unique local vernacular had developed; the bay villa. These were built of kauri timber, with brick being used for the construction of fireplaces and chimneys. Some houses had as many as three chimneys. Typically, these houses belonged to farmers, or when in town, to those towards the top of the social hierarchy of the day.

Smaller houses had fewer chimneys. Those with single chimneys often had a fireplace in the front parlour back to back with a range oven in the kitchen. Ranges were made in Dunedin by Shacklock from 1873 on (Salmond 1986).

After the First World War fire remained as the primary source of heat for cooking, heating, and hot water for washing and laundry, although it was gradually superseded by electricity as the new technology became more available. In the countryside and the provinces the open hearth remained of key importance in making uninsulated timber houses inhabitable during the winter months.

To illustrate this direct reportage from people who used fire as a primary energy source is available. The transition from solid fuel burning to electricity and later to natural gas occurred gradually. The following is drawn from experience in New Plymouth between the wars.

“On Keeping Warm – Extract from ‘Memoirs’ by Jean Nicholls

When we were first married we lived in a beautiful old 1920s villa. Everybody loved it. We loved it - in the summer. The old wooden homes were built with iron roofs and no regard to windows facing the warmth of the sun. With no insulation, in the winter they were cold, very cold.

Typical of the era our home had lovely high ceilings with pressed steel mouldings; we needed scaffolding to paint them and a stepladder to change a light bulb; we tried to ignore cobwebs and soaring power bills.
Built over sturdy wooden piles; the lovely polished floorboards did their best to keep out the draughts. In the old days they didn't have such things as wall to wall carpets, just rugs and carpet runners. Some enterprising people put sheets of newspaper under the lining, or cheaper 'congoleum', and we had to stuff wads of newspaper into the window joins to stop the old sash frames from rattling in the wind.

**Insulation? Batts? Furry flying mice!** We didn't have those but we did have ants. Scrim was used as a weapon against draughts from the walls. This fine, sacking-like material was tacked to the wallboards and made a base for wallpaper. When the scrim became old or loose it moved about in the draughts, we soon discovered striped wallpaper was not advisable as it made the wavy lines more obvious. Long stuffed material 'sausages' under doors were great draught stoppers too and - great for tripping over.

To keep us warm we had four fireplaces with open grates. If a fire wasn't lit we filled the chimney throat with a piece of hardboard to keep out draughts, soot and the odd bird that wanted to visit. It is amazing what a mess a sooty, terrified bird can make in your living room.

The fires were so cosy in the winter; it was only in the mornings that I cursed having to clean out the ashes, relay the kindling wood and can in the coal. Each summer we chased soot out of the chimneys with a branch from a gorse bush; this saved the expense of hiring a chimney sweep. What a mess that caused. We lay newspaper on the floors and all the furniture had to be covered with sheets. When we first bought the house the chimney hadn't been swept for years. We didn't know that, but we soon found out. The fire brigade was very understanding and the spectacular chimney fire was a great way to meet our neighbours.

I had to clean the grate and surround with black lead, the same stuff I used to polish the coal range and the firedogs. Firedogs? Oh, they were black round knobs with a bar between to hold the poker. All the fireplaces had their own 'furniture' as we called it, the poker, a long-handled brush and shovel, coal bucket, fender and a wire fireguard. In the summer we would put a wooden or brass faced fireguard in the grate to cover up the hole. Some people were very good at making huge decorative paper fans for the grate.

An extra implement we always had was a long-handled toasting fork. In the evenings we loved making toast by the fire, roasting chestnuts and watching imaginary pictures made by the flames.

Everyone had a wood shed, with a big chopping block and an axe to chop wood and make kindling. We tried to avoid using macrocarpa - it would spit showers of sparks. Most people had woollen hearthrugs with the odd scorch mark or two.

By the 1930s there were electric heaters, with one or two open coil bars that would glow red-hot. These replaced the earlier electric elements set in porcelain frets. As they didn't have fans you had to huddle close to them. With their bright reflector backs they were very good at burning legs and furniture too! Quite dangerous I suppose. Some people would put a saucer of water by the electric fire 'to save the air from drying out', and some heaters had a special little water trough in the front. Now we do the opposite and use dehumidifiers! Gas fires with
Porcelain frets were also used and didn’t change much until the modern flame gas fires with their artificial coals and logs replaced them.

There was one room that was always warm - the heart of the home, the kitchen. With the coal range needed for cooking, the firebox was constantly going and constantly had to be fed with coal. At night we banked up the coals and added coke so the fire would last as long as possible. The first job in the morning was to rekindle or relight the stove. Our stove was black though you could get more modern ones in mottled green and cream enamel. The wire rack over the top would always be full of clothes and cloth nappies being aired. When the fire was low the rack also made a warm place for sick kittens and ailing pet budgies as well as warming plates and slippers.

Behind the stove lived a `wet back ', which was a system of water pipes that took hot water to a very small cylinder, it only held about ten gallons. ‘Wet backs' were very popular and convenient though a far cry from the hot water systems of today. Later we managed to get a washing machine on wheels that heated water. We would fill the washing machine, heat it up and trundle it into the tiny bathroom. The only problem being the heat of the water in the rubber drain hose made our bathwater smell of “eau de rubber”!

People who had gas connections often used a ‘caliphont' over their baths. This was a gas-fired cylinder and would heat water reasonably efficiently. They were sometimes called geysers; there were many stories of the hazards and bangs when the early models were lit, so maybe they were well named!

Of course we had hot water bottles to take to bed. The rubber ones were soft and comforting, not like the hard old ceramic affairs though they both had a tendency to leak!

The coal range was great and kept us warm, often too warm during hot summers. We may not have had central heating in those days, but with all the draughts the old houses certainly did have air-conditioning.” (Hitchcock, Nicholls, and Cooke 2008: 44)

**Energy in Auckland: post war fuel transition**

The transition in energy sources used by New Zealand households has been investigated by the Building Research Association of New Zealand. As late as 1971 45% of New Zealand households reported using open fires as their principle heat source. This had reduced to only 10% by 2005, although this statistic is complicated by the fact that many households use several methods to obtain heat within their houses (Camilleri, French, and Isaacs 2007).

**Energy in Auckland: current chimney count**

These figures are borne out by making a count of the number of chimneys present in four representative streets, using aerial photography from the 1940’s compared with the number present in recent aerial photographs.¹ This shows a halving in the number of houses that have chimneys over the period. Both orthographic (plan view) and oblique aerials were used in making the count, in order to achieve the best accuracy, based on the available information.²
Table 1: Houses with chimneys in 2010’s, in Herne Bay, Auckland.

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<th>Houses with 2 brick chimneys</th>
<th>Houses with 3 brick chimneys</th>
<th>Houses with 1 solid fuel heater</th>
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Table 2: Houses with chimneys in 1940’s, in Herne Bay, Auckland

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Arguments for the removal of chimneys

In my work as conservation architect at Auckland Council I have been involved in applications to remove chimneys, where their demolition is controlled through the Resource Management Act, for heritage reasons. Applicants give a variety of reasons for wanting to remove chimneys. These include:- concern that the chimney structure may collapse under loadings generated by very high winds or by earthquakes and concern that the chimneys are unsightly. Another reason is that the open fire is no longer in use, and the house owners wish to free up the space currently occupied by the chimney. This space is often used to accommodate an ensuite bathroom.

Further reasons to demolish chimneys are inefficiency and a fear of health effects associated with wood smoke. Such smoke contains fine particles and tarry substances which are regarded as hazardous. An official Auckland Council brochure contains the surprising claim that open fires make houses colder, and is associated with website information that claims that air pollution, which is comprised of 72% wood smoke from domestic sources causes 300 premature deaths in Auckland each year.

“An inefficiently run wood burner or domestic fire produces even more of this hazardous smoke as well as a tarry residue which has a bad effect on health. They do not heat your home properly – in fact open fires will actually draw heat from your home and create draughts. They are also very inefficient. The most energy efficient and clean home heating method is a heat pump as it does not create smoke or produce harmful fine particles” (Enjoy the heat not the smoke 2012).

Arguments for the retaining of chimneys in place

There are heritage reasons to conserve chimneys. Historic heritage is regarded as important in Auckland’s increasingly multicultural society. It provides continuity, and shared experience, in a city that has been rapidly transformed over the past 30 years, and is still undergoing transformation. At the least, old buildings serve as landmarks in the cityscape, by which a population can maintain orientation.

As well, old buildings contribute to the local distinctiveness of a place, particularly if they are of a type that is not common elsewhere in the world. This is true of the traditional timber houses of Auckland. Few cultures in the world built in timber, and built so many houses of similar type in such a short time period. These houses constitute an important and unique heritage asset in terms of tourism. The houses probably hold this value to a greater extent than the old masonry public and town centre buildings of the city, which are more similar to buildings common in overseas cities.

An examination of the literature regarding the conservation of New Zealand houses shows that all commentators are in agreement regarding the importance of chimneys and the degree to which they were an important and prominent element in the design of our traditional timber houses.

“During the Victorian period visually prominent chimneys were often elaborately treated, with polychrome and moulded brickwork as well as decorative chimneypots. Victorian chimneys in
particular should be carefully conserved and repaired as they form a vital part of the houses character.” (Arden and Bowman 2004: 136)

“Chimneys were another dominant feature highly visible from the street. They were also decorated. Some were very elaborate with extravagant tops of patterned and polychrome bricks and bands and often with tall elegant chimney pots.” (Stewart 1992: 41)

“Above the roof, the chimney was a challenge to the bricklayers art, and even modest houses sported chimneys with extravagant tops corbelled out, and out, and back again, often with specially shaped bricks.” (Salmond 1986: 125)

A further reason to keep chimneys in place is related to possible uncertainty and discontinuity of energy supply, as society enters a time of transition in the sources of materials used to produce energy. It is conceivable that electricity, which is the highest quality and most flexible energy source in application, will increase in price in an attempt to reserve its use for more high value applications than space heating. It is also possible that supply discontinuities will occur, due to natural or human generated disaster. Wood is widely available in our environment, and burning it in the same way as is described above, in the oral history from New Plymouth is likely to decrease the discomfort of such events. The ability to keep warm in such events, if they were to occur in winter would reduce health risks and make communities generally more resilient.

In conclusion

As noted in the introduction, all forms of energy generation have environmental impacts. Fossil fuel combustion produces CO2, CH4, SO2, NOx, and volatile organic compounds that are responsible for increasing tropospheric temperatures, acid deposition, photochemical smog, and higher ground ozone levels. Wood is not a fossil fuel, as it is not the product of fossilisation and biodegradation of organic matter. The decomposition of fallen timber left in the bush and not burnt does generate slightly less atmospheric CO2 than that which would result from burning a similar quantity of wood, because by the time the bark of a dead tree has rotted, the log has already been occupied by other plants and micro-organisms which continue to sequester the CO2 by integrating the hydrocarbons of the wood into their own life cycle.

The net increase in atmospheric carbon that results from burning timber is less than that which results from burning fossil fuels, as the tree the wood came from would have eventually rotted and produced atmospheric CO2 if not burnt, and an equivalent quantity of CO2 is likely to be reabsorbed by the tree that replaces the one lost, in a temperate climate. For burning fossil fuels the same calculation is not applicable, as material formally sequestered, and not part of the carbon cycle, creates an additional load of CO2 in the atmosphere.

When considering the use of open fires it may be necessary to balance the negative health effects of particulate emissions against the negative effects of climate change induced by increased atmospheric CO2 levels if the burning of wood is substituted by the use of electricity produced by burning fossil fuels in locations far from dense populations and that use stacks with scrubbers that remove the particulates. In New Zealand hydroelectric power accounts for 57% of the total electricity generation in New Zealand, with the rest being produced using mainly coal and gas.
Having households retain the ability to use open fires does keep options open, as the future of energy pricing and energy use is uncertain. Households that retain and maintain chimneys are considered more resilient in terms of coping with grid failures and changes in energy pricing than those that don’t.

There are good heritage and building conservation reasons for leaving chimneys in place, where they are present as part of the original fabric of traditional New Zealand houses.

Taking these three arguments together I conclude that public policy that encourages the loss of chimneys may not provide a net long term public benefit.

It seems likely that other off the grid technologies of 100 years ago may be open to similar analysis, in terms of urban resilience. Use of available land for food growing, encouragement of the planting of useful trees rather than the merely ornamental, minimisation of waste production, onsite disposal of waste, and the harvesting of rainwater; all have the potential to increase resilience.

In many of these cases there may be problematic health effects associated with the adoption of such techniques in individual cases, but these effects may be offset by larger scale benefits at the level of populations.


References


