THE COMFORT EQUATION

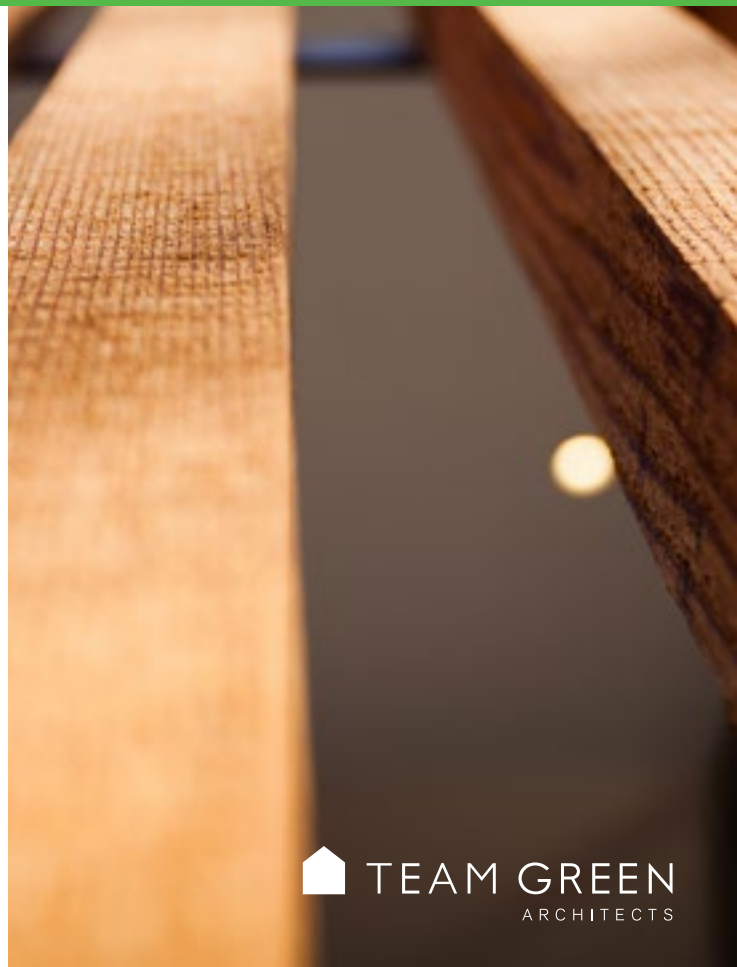
Reduce your heating bill by 90% AND BE 100% more comfortable than your neighbour!

10 Questions you need answered if you're designing a new home...

Homes designed and built to Building Code Minimum standard are often cold and hard to heat in the winter and/or they overheat in the summer. Keeping an ideal temperature balance - healthy and comfortable throughout the entire home – can cost a fortune in energy bills. And the bigger the house, the more it costs. This can lead to a situation of 'fuel poverty', where people can't afford to keep a house warm, healthy and comfortable. As energy costs increase, this already poor situation, will get worse.

If you are planning to build a new home, this can be easily avoided. It is possible to be comfortable throughout your home throughout the year, and to pay significantly less than your neighbour to achieve this.

Remember this is about you, and what is likely to be the biggest investment of your life. Before engaging your new home design team, ask yourself the following 10 questions...



The 10 question checklist for The Comfort Equation

1. What does being **comfortable** mean to me?
2. Does my potential design team fully **understand required comfort levels?**
3. Have I been given an accurate **energy usage model** for my house?
4. Does my design team have a **minimum design standard of energy efficiency?**
5. What is this going to **cost?**
6. If I decide energy efficiency and comfort is important to me, **will this affect the design or my need for large areas of glass to enjoy the views?**
7. By building an “airtight” energy efficient house, will I be encouraging mould through **lack of ventilation?**
8. So if I am being “airtight”, will my building have **adequate fresh air?**
9. If I build to be “airtight” with a ventilation system, **will I be able to open a window?**
10. How will I be doing my bit for the **environment?**

1. What does being **comfortable** mean to me?

Get clear on what comfort means for you, and be realistic about comfort levels throughout the year.

Consider the region you live in. Some climates can be extreme - with freezing temperatures in the winter and too hot in the summer.

Do you know what temperatures you feel comfortable living in? Do you appreciate a home that is neither too damp nor too dry (often through excess blown heat in one spot)? How do you like your home to be heated? Do you like radiant heat, or are you happy just knowing you'll be warm and comfortable and not have to worry about it.

2. Does my potential design team fully **understand required comfort levels?**

Ask your potential design team how they would go about ‘creating basic levels of human comfort within the thermal envelope’. Firstly, do they understand what the basic required levels of human comfort are? And secondly, how they would go about achieving them for you without breaking the bank?

The World Health Organisation (WHO) recommends consistent temperatures between 18 and 24°C and relative humidity levels between 40 and 60%.

Most New Zealand homes, even the newer homes are not achieving these minimum standards.

3. Have I been given an accurate **energy usage model** for my house?

Levels of comfort can be calculated. Building Physics is an accurate science. And it can be applied to your design, and your building envelope to ensure you have the optimum internal climate. Your design team should not only be able to provide you with an accurate energy usage model for you house, they should also understand basic rules around thermal bridging and moisture migration (i.e. moisture in the fabric of your building which can and will turn to mould if not effectively managed.) If your architect is unable to supply this information, there are other companies available who have appropriate knowledge and software to do so.

The relative cost of providing this information is minimal in comparison to the benefits you will gain each year.

In addition, with an active energy model - which is part of the CAD software used to design your house - you can be given accurate information on the options open to you in regards to: levels of insulation, windows selection, shading devices, and many more areas to inform a cost benefit analysis of choosing one product over another, as you go through the design development of your home.

4. Does my design team have a **minimum design standard of energy efficiency?**

(The comfort equation explained) The NZ Building Code is a document that provides the minimum standards of construction, to ensure your building lasts for 50 years, and is a safe environment in which to live (hopefully).

Unfortunately many designers and architects see the NZBC as the standard to be reached for everything to be ok, when it is in fact a minimum standard that you cannot go below without breaking the law.

Professionals working in the industry are aware that more often than not, this relatively low standard is not even being reached in many areas, due to lack of knowledge in the industry.

A design team who are designing to achieve 'Code Minimum' standards will mean that it is only possible for you to have a warm comfortable house if you are prepared to pay extremely high and ever growing energy bills each year. This is because the NZ Building Code for Energy Efficiency (H1) assumes that everywhere in vast areas of New Zealand (i.e. the whole South Island) have the same climate. Clearly this is not the case. For example, the following table illustrates energy modelling of specific heating energy demand in the Wakatipu region to bring a house to 20°C throughout. The NZ Building Code cannot be used as a guide to achieve any form of energy efficiency, comfort or health.

You have the option to make some simple choices at the design stage, which can alter your heat energy bill by up to 90% as indicated in table 1.

Whilst dropping your heating energy bill you are also improving your quality of life, health and comfort. At TGA we have a company minimum standard of energy efficiency. Your homes Specific Heat Energy Demand will not exceed 50kWh/m2/annum whilst allowing for 20°C everywhere throughout the year. As a client your brief and your budget will determine how much you will want to improve on this minimum standard to bring you closer to the Passive House Standard. An energy model is a tangible way to provide you with the information you need to make informed choices. It will also give you a clear understanding of the point of difference between your house and your neighbours, either for your own piece of mind or to provide information for that future buyer.

Note 1: *A study on energy usage by the International Energy Agency indicated that space heating accounts for over 50% of the total energy use of a residential building. In New Zealand the average percentage for space heating of a residential building is 34%. A 2010 paper by BRANZ based on the HEEP (Household Energy End Use Study) indicated that this was due to persistent under heating - living spaces in the South Island were shown to have a mean winter temperature of 14.7°C.*

Note 2. *The Asthma Foundation recommends a minimum of 17 °C. internal temperature and New Zealand has the second highest Asthma rate per capita in the world. Consider what your family's health & medical costs if this is not achieved.*

Table **1.**

Wakatipu Region	**Specific Heat Energy Demand**	**Cost for a 150sqm house per year to heat based on 0.29cents/kW**
Older Housing Stock	Older Housing Stock 200 kWh/m2/annum (or higher)	$8,700 p/a +
NZ Building Code Minimum	150 kWh/m2/annum	$6,525 p/a
Typical NZ house with better insulation	100 kWh/m2/annum	$4,350 p/a
Energy Efficient House (TGA Minimum design)	50 kWh/m2/annum	$2,175 p/a
Passive House Standard	15 kWh/m2/annum	$652.50 p/a

5. What is this going to **cost?**

Or more importantly what will this cost me if I don't? Persistent poor temperature control is having a significant effect on the health of New Zealanders. There are several studies that indicated the extent of this problem.

Until recently the knowledge has not been readily available in New Zealand to provide you with the comfort levels that are needed for a healthy indoor environment without vast expenditure.

This is changing fast. The knowledge, systems and products are now available in New Zealand, as people are gradually demanding more.

Anyone who has lived overseas in Europe or North America will understand the absurdity in the way we live here - where we heat one or two rooms and move as quickly as we can between them. Electric blankets and plug-in column heaters are something that was left in the 70s in most parts of the world. And yet even in Auckland, where it is supposedly a semi tropical climate, this practice is still prevalent. The good news is that we are a young country - we learn fast and we are willing to adapt and change much more quickly than our older more established cousins. Things are changing, more rapidly than you might think. Do you want to be ahead of the game or behind it?

How long you intend to live in your house usually influences how much you spend on the property.

By making informed choices over your energy usage you will be adding calculable and easily definable value to your home. And you will be benefiting hugely by being comfortable and healthy while you live there.

Your annual cost of living will be lower and your health will be better.

Back to the first question of what is this going to cost me? The answer is what is your budget? A well designed home where the architecture is considered alongside energy efficiency will enable you and your architect to make informed choices to suit your budget. Team Green Architects have designed homes that range between $500,000 and $4 million. Anyone can afford to live better, the choice is open to you and with the right information you can decide how far you want to go, and how much you want to save on your energy bill each year. A well designed, airtight, highly insulated home will have very low on-going running costs.

You have the power to make the biggest impact on the money you spend. A decision made early in the process with the right design team, will ensure your house is designed from the start with energy efficiency and comfort at the forefront of the design, adding calculable and easily definable value to your home.

6. If I decide energy efficiency and comfort is important to me, will this **affect the design or my need for large areas of glass to enjoy the views?**

This is a common question and one that is definitely worth asking.

The fastest and most cost effective way to get an energy efficient home is low complexity and smaller or less windows on exposed faces of the home.

If getting as high an energy efficient rating as possible for your budget is what is driving you, then your design team will create a home with these criteria in mind. The majority of people however want some balance. For example, in the Queenstown Lakes region, there is rarely a site that does not have at least one breath-taking view. And more often than not these views are 360 degrees.

Queenstown and Wanaka also have the challenge where often the most breath-taking views are to the South or West – with no ability for passive solar gains from the south or too much low level sun in the summer on the west. Of course people want to be able to enjoy their amazing views, and maintain the indoor – outdoor lifestyle.

By making informed smart choices about the products used in the construction of your home, it is possible to have large windows on any elevation without compromising your energy efficiency.

At TGA we source suppliers and products from within New Zealand and where necessary directly out of Europe so that where required you could have the ultimate in energy efficiency, without compromising on expanses of glass. Due to mass production of better products in other parts of the world, importation and supply of these products is often less costly than a New Zealand alternative – with a greatly increased outcome in comfort levels.

7. By building an “airtight” energy efficient house, will I be encouraging mould through **lack of ventilation?**

There is confusion in New Zealand around the causes of damp and mould, and what should be done to avoid it.

A house that is smart and working with intelligent materials and design solutions does not have this problem.

Building an “airtight” house is also slightly misleading terminology causing confusion over what this actually means. There are several ways to achieve “airtightness”; one material that is used effectively is called a vapour check membrane. This works in conjunction with an equally intelligent external wrap to allow the moisture that is in the building or in building fabric to migrate at the correct rate and in the correct manner throughout the year.

But why is “airtightness” so important?

It should be noted that in a typical modern New Zealand building about 20% of the total energy loss is caused by air leakage.

On average the other envelope heat losses are 25% walls, 30% windows, 10% roof and about 15% through the floor. Once you reach a good standard of insulation the only significant way for you to cut down on your energy bill, and be warm and comfortable, is by building to be “airtight”.

This is why several countries in the EU, plus the USA and Canada all have minimum standards of airtightness that must be achieved to pass Building Code.

In New Zealand we have become accustomed to living in cold drafty houses. This draft is often caused by infiltration through unsolicited cold air (supposedly benefiting our health) that comes in through gaps in the building envelope. Most people are trying to improve this problem solely by means of insulation. But are scared to block up all the holes as they have been lead to believe that just by having cold air moving around they are improving the internal environment, and reducing the likelihood of damp and mould. This does not work – the problem does not go away AND a new one is created.

Mould and damp is a BIG problem in New Zealand houses. Damp and therefore potential mould will form on a surface that is below 13°C if relative humidity levels are above 80%. Thermal bridging, infiltration and cold internal temperatures can all cause cold surface temperatures. This is most commonly seen on aluminium windows with metal edge spacers where condensation forms and the incredible view is obscured through condensation. This dew point is also occurring in the construction and building fabric of most New Zealand homes.

When insulation is not put in effectively or in conjunction with other, better, materials there are still significant dew points throughout the home where condensation and therefore damp and mould will grow.

Infiltration is not only a completely uncontrolled source of cold air, it is air that has passed through potentially harmful materials in the building fabric, and/ or damp and mould which is hidden and commonly occurring in New Zealand construction.

To find out more, refer to the link to the Proclima NZ Study on our Passive House Criteria Page. Or the video clip on this subject of Sian giving a talk at the Home Star conference 2012 in Auckland on our Achievements or YouTube Page .

8. So if I am being “airtight”, will my building have **adequate fresh air?**

TGA recommend a Balanced Heat Exchange Ventilation System in all “airtight” homes.

This system provides a fresh and clean indoor air quality that is completely different to anything you will be used to in New Zealand housing.

It is extremely low velocity 0.2m/s and very low energy to run, and relatively low cost to install (starting at $6,000). It will bring in continuous fresh air to the internal environment and continually expel moist and stale air. These systems are up to 95% efficient, so by insulating well and building airtight you can not only control your ventilation you are retaining the majority of the heat you are creating in your home. This is even the heat created by your general household appliances like the fridge. You will feel completely different in this home with continual fresh and clean air throughout.

9. If I build to be “airtight” with a ventilation system, **will I be able to open a window?**

There is nothing to stop you opening all the windows and doors if you want to.

The Balanced Heat Exchange Ventilation is continually providing clean fresh air, so you no longer feel stuffy or needing to open a window for some fresh air – as you already have it.

It is likely however that you will want to have the doors open to the deck our outside areas in the summer. If you plan to do so all day, then you can turn down your ventilation system or turn it off while the doors are open. But this is entirely up to you.

10. How will I be doing my bit for the **environment?**

The cost of energy (both metaphorically and physically) is high, and continues to rise.

Ensuring you have an energy efficient building envelope will ensure you are tackling one of the biggest effects you will have on the environment.

The lifetime CO2 emissions from operational energy dwarf the embodied energy[1] of construction. For typical standards of building construction, the embodied energy is equivalent to only a few years of operating energy, although there are cases in which the embodied energy can be much higher (Lippke et al., 2004). Thus, over a 50-year time span, reducing the operating energy is normally more important than reducing the embodied energy.

Although the Building Code in New Zealand requires that you are building a house for 50 years, how long do you actually think your house will be standing for?

It is quite likely that it will be long after you are gone. By building better you are changing the legacy of poor construction in New Zealand for future generations. (*A comparative Building Code for Energy Efficiency in the UK requires up to 40% higher thermal resistance (insulation) values than the highest requirements for New Zealand. Standards are increased every four years working towards the long-term goal is to reduce CO2 emissions by 80 per cent by 2050, and means creating buildings with minimal environmental impact.*)

Once you have brought the energy use of your building as low as possible you can more easily go “off grid” if required. Opting for solar panels (PV or solar HW) or other forms of energy generation such as ground loops, wind or water turbines become a much more viable option, as your requirements for energy are so low that the system you require will be much smaller. You will also have more accurate data to enable this system to function efficiently.

[1] *Embodied energy is the total energy required for the extraction, processing, manufacture and delivery of building materials to the building site.*

Next steps

Team Green Architects are leading the way in energy efficient home design in New Zealand. Our team bring years of experience in this area to every project we undertake. We'd be happy to have an initial consultation with you about what's possible on your budget.

Please call us on **+64 (3) 409 0550** or fill out this initial scoping questionnaire that you can find at **www.teamgreen.co.nz/questionnaire**

We look forward to hearing from you.

TEAM GREEN
ARCHITECTS