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Lessons learned from South Pacific Passive House certifications
How not to kill a Passive House project
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Hard-Fought Lessons Learned
PASSIVE HOUSE
CERTIFIER
Passive House Institute accredited
SIMPLE BUT NOT EASY
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Airtightness is not an accident. A bit of a rush job on documenting a simple project meant that we were on site before some of the details were finalised. The result was an airtightness 'layer' that was alternately installed on the inside face and the outer face of the wall… i.e. no connection. The ineffective 'fix' was frenetic taping of both inside and outside faces to effectively have two airtight layers. It also meant we had to do some really tricky key-hole surgery to get to some areas. The lesson? Don't let the architect or builder assure you "it's taken care of", make sure you wrest control of the Passivhaus aspects as much as possible. [Airtightness test is complete…results as expected!]

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EVERYONE starts with a fireplace in their house.
That's everyone. No exceptions (to date). "But it still gets quite cold in my area". This is Passivhaus, people! There are buildings with no heaters in the Alps and in the Antarctic, so there's no need for that fireplace in our climate where it very occasionally dips below zero.

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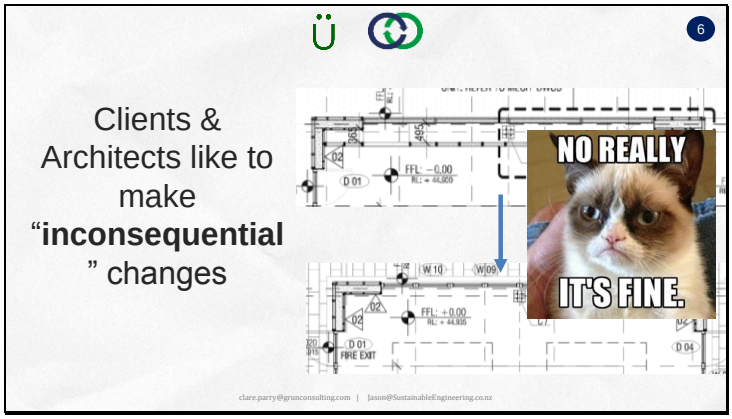

Clients and architects change things lots without telling you. NEVER ASSUME!
Make sure they understand that changing a whole west-facing wall to 80% glazed is going to impact the Passivhaus compliance! The nasty shock of suddenly noticing things like this on the updated construction drawings involves a whole lot of panicked PHPP calculations late at night.

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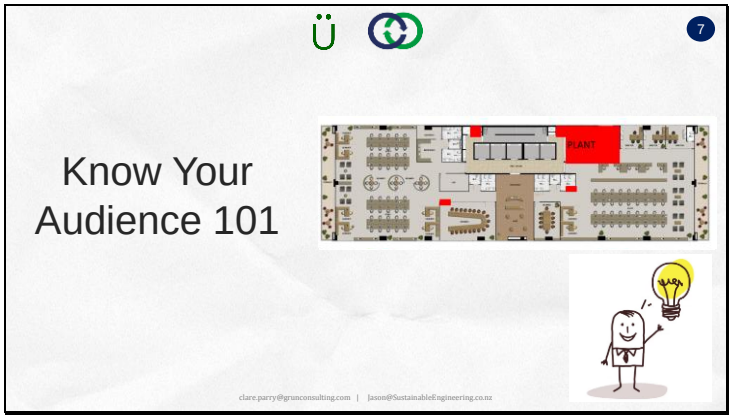

Bring the whole team along for the ride. It makes life easier.
Architects really hate mechanical services. The pleasure of telling them that the air-conditioner can be omitted dissipates super quickly when you add that the ventilation system is going in instead. Adding that there'll be no outdoor condenser and ducts will be ultra-low profile sometimes soften the blow. Didn't someone say comfort and IEQ?
Clients don't love the story about low energy bills as much as they love the one about jumping out of bed on winter mornings.

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Minimum compliance is pretty bad; even above minimum compliance can result in perverse outcomes.

Just because something gets a certain number of stars does not mean that it is good. That's the legal minimum, not an aspiration. A recent client decided not to pursue EnerPHit but chased 7 Star NatHERS (Home Star). Many 'partially efficient' outcomes, such as one wall insulated but not the adjacent wall, and HRV without airtightness. One can only do so much!

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Story on certified PH that was too warm. Refer to several others.

We design PH buildings to minimize heat losses, if you put too much window area in and in-sufficient shading, you will cook your clients. In my opinion, even 5% over heating is a cause for a close look . During the summer season and the spring and fall season, yes you in theory can vent that heat out but are your clients going to be happy with having to leave windows open on sunny days and close them on cloudy days? If you've got a normal set of DINK (Dual Income No Kids) that's going to be gone at work during the day, they're going to come home every sunny afternoon in the spring in fall & their building is going to be overheated. They've got a building that's uncomfortable still. It's not too cold anymore. Now it's too hot.

Remember, the overheating prediction in PHPP, as you all know, is for the whole building. Assuming that things uniformly mixed. If you've got a lounge with glass on three sides in without shading and, the building is at 2% over heating, you probably are at 0% at the rest of the building and at 20% in that one room. Direct solar gain through windows can overpower the simple ventilation system we have. You need to be really careful about this.
Totally agree – if it’s over 5% then I fix it, that’s too much!

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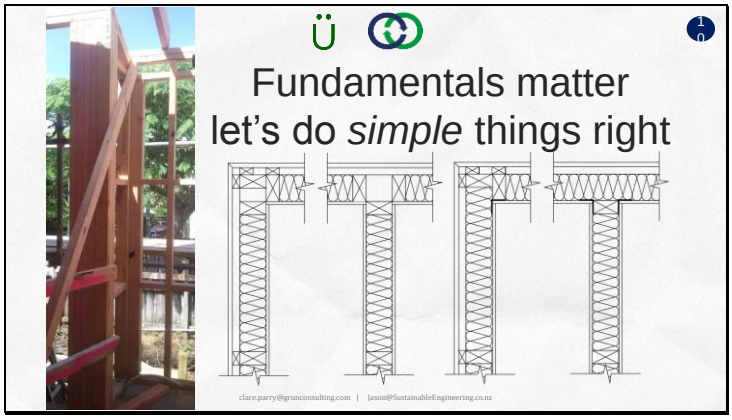

This is a photo of a certified passive house stud wall. It's not one of my buildings. You'll notice quite a few studs in that corner. Is this a sub-optimal solution?

We're leaving energy savings on the table by not even trying to optimize details in many cases. I realize our climates are easier than Germany in general. Two stud corners, or a California corner are both acceptable in New Zealand, especially if you're going to apply plywood or OSB sheathing to the building frame. There's no need for these extra studs, they don't do any structural work. If you go to a two stud corner with GIB clips, it's just as strong in shear as a regular standard corner. Overdesign is not the point of Passive House.

Another example fewer windows with bigger frames. Instead of having a single window with two operable panes and one fixed pane, just go with one single tilt-turn over that whole opening. The window would be less expensive, less frame area and, your insulation value is much better.

Two more examples: ventilation duct fresh/exhaust air lengths and window details. It can make sense to locate MVHR units centrally but because you have heat losses in the fresh/exhaust ducts if they're more than a meter or two long you lose efficiency. It makes more sense to keep those ducts short or over-insulate. The installation detail and resulting thermal bridge values for windows ... I realize that window insulation details are tricky in New Zealand because the weather tightness issues. That's always a concern. We're already in the alternative solution space with council so let's do it right. If you design an efficient detail with a PSI of 0.02 or less, you've just designed your client into a much less expensive window frame and with the same performance as a more expensive frame by just getting your details right.

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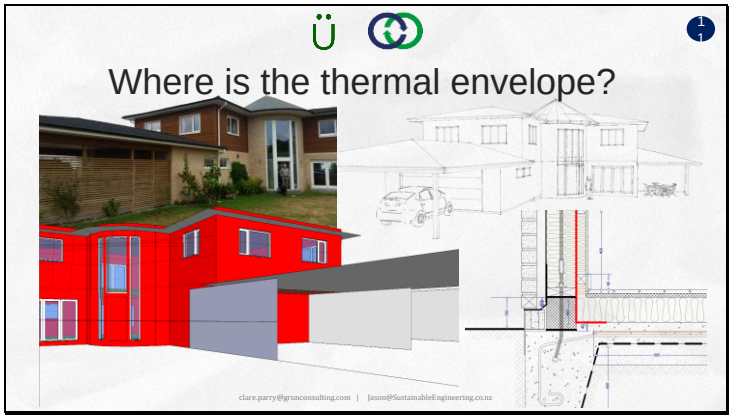

Often at the edge of the slab the insulation pokes in or out a bit. The thermal envelope in PHPP doesn’t jog in and out like that. The thermal envelope runs straight vertically down from the outside edge of the wall insulation layer down to the underside of the floor insulation layer. If you confuse this your areas and maybe your thermal bridge calculations need to be redone. It's really important. It's easy to get wrong.
Also, when you're doing areas, spot check. In other words, the whole roof and floor should be about the same for a single level building. The same thing with the east/west and north/south wall areas. Don’t forget the entire floor or the roof – it has happen. Several times, I've seen people double count the exterior door area. They'll enter the exterior door area on the Areas tab and then forget to subtract it from their external wall area. That's conservative and fine but it is an error that I often see.

I actually recommend that instead of putting in the front door on the Area tab, you go ahead and put them in as windows. You can do that just by setting the g-value = 0 and set the Ug value of the glazing/frame to the U value of the door. The nice thing about that is that it considers the thermal bridges at the edge as well. For one door, it's fine to leave it in that sheet.

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We all remember the childhood story about the three bears. I believe it's teaching the moral of sufficiency – enough to meet but not exceed the need.
Thermal bridging calculations for Passive House should be like that. Sufficient to assess the additional thermal leakage but not excessive. The whole point of using exterior dimensions is so that we can skip thermal bridge calculations for many junctions. What I tend to see submitted is either no thermal bridge calculations or a huge number. You want to do as few thermal bridges as possible while still showing you have met the standard.
In general for a slab house in New Zealand. If you calculate or reference the PSI-value for the slab edge, any concave corners and, a window sill that's pretty much the absolute minimum. The window sill is typically a larger PSI-value than the head or jamb so it may make sense to do those as well. Once you start calculating the external corners or the roof-to-wall detail, which are all likely slightly negative you start stepping into needing to calculate MANY junctions – likely would only makes sense for a system of building approach.

Another 'just right' case is Ventilation. It's important to fill out the ventilation tab correctly as it can have a high impact on overall performance. Even in mild climates like Wellington over/under sizing ventilation can cause issues with certification. Get the ventilation correct in PHPP.

Now that it is designed right in needs to be commissioned just right. That is at the *typical* flow rate. Typical is 77% of your design maximum value. That's the flow rate you must commission at. Commissioning and operating the building at maximum design air flow rate can add 2 kWh/m^{2}a to a buildings SSHD.

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So I was taught a Russian proverb, "doveryai no proveryai" (trust, but verify) by a German building scientist via Ronald Regan – the world is a weird place.

Windows are rocket science. You should not trust anyone when they tell you that their window is fine for your building. You shouldn't trust any of the numbers, you shouldn't trust they're going to put the windows in your box, you shouldn't trust that you're going to get the glass you thought you were going to get. You shouldn't trust that the spacers between the pieces of glass are going to be actually the spacers that you thought you purchased. Unfortunately, this is the area where I've had the most lessons learned. There have been cases where people have purchased windows and got the wrong glass. The window supplier thought it would be fine to put in a different coating. "No, I don't tell anybody we just put it in." There have been cases where different kinds of windows were installed than expected. The windows in bathrooms have solid aluminium frames instead of those nice timber ones that you paid for. Someone thought they were getting nice warm edge spacers made out of plastic with a thin layer of stainless or something. Instead, what they got was solid aluminium. With windows, trust but verify. Frames have been specified with one U-value and provided the wrong paperwork to show it was compliant. The correct number was higher by 15%.

All of these situations were avoidable. You need to make sure that you verify the numbers. It's fine to love your window supplier. But verify. "Yes, I need a report. I need an ISO10077-2 U-frame value not an ISO10077-1, which is completely freaking useless, ISO10077-2. I need the glazing done per EN673 and EN410 – to two decimal places not one! Once you've done it once for your supplier, you're done. You don't have to worry during certification. Do it right once.

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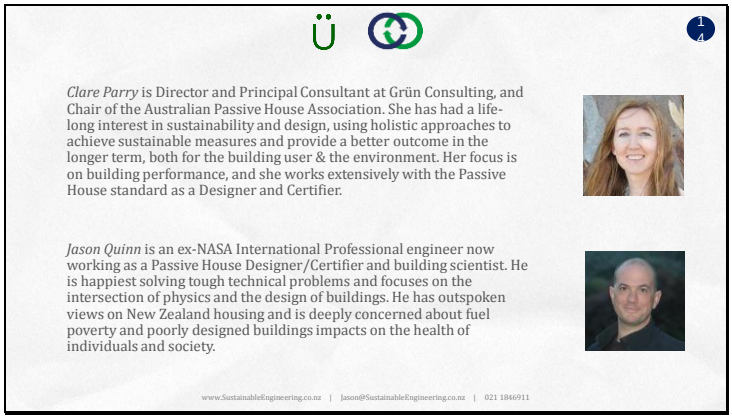

These collected lessons learned are of the most common issues that have been encountered in the design/build & commissioning of many Passive House projects in the South Pacific. These issues are varied and have ranged from design issues such as an inadequate understanding of where the thermal envelope lies, to build issues such as installed hardware differing from that originally specified, to incorrect commissioning. What they all shared in common is they could or did prevent certification i.e. ‘killing’ the project. Although the certification process found most of these during the pre-construction review some issues were not found until post-construction, requiring costly remediation or failure to meet the stringent Passive House Institute Certification criteria.