Hi, Welcome. Introduce self, introductions around.
Tad Everhart Introduction, Certified Passive House Consultant, author of PH NW, PH NY booklets
NWEBG – 3 state regional alliance of Architects, Builders Contractors – homeowners into Ecological Building
Est. 1993 our Members are pioneers and veterans of green building
Our Missions is to transform the built environment for long-term sustainability through education
To empower our members to create that transformative change through their progressive work
We pursue our mission by providing open source educational tools

The Code Innovations Database is one of those tools, a good example

NWEBG has Several active chapters -
➤ **Portland Chapter**, being revived by collaborating with other groups – joint events
Before- Thank our Champions – Albert Rooks Small Planet Supply

[www.EcoBuilding.org/about](http://www.EcoBuilding.org/about)
Passive House, Net-Zero, and other Green Building Innovators are a virtual R&D Department for tomorrow’s building industry, pushing envelope with advanced designs, materials and technology, making it easier to build green.

You are the Innovators - creating breakthroughs so today it’s possible to live w/no energy bill, work in buildings that are comfortable and healthy.

Yet innovators often face an uphill climb, fraught regulatory hurdles from codes and standards that lag behind the pace of innovation, essentially make high-performance innovations illegal. Many of our best ideas not recognized in the building codes, prevent broad adoption. Many are the norm in Europe, yet illegal here.

Not to be deterred, you push through, blaze a new trail, making it easier for others to follow your footsteps.

Code innovators jump hoops, pay for testing through accredited labs, invest their own time, money, blood sweat and tears. Diligently prove and document effectiveness, life/health safety and environmental performance. Pioneering new compliance paths, Adoption of new codes and standards, bringing systems into mainstream to make high-performance - norm rather than exception.

Code Innovators, I salute you. Your work is important and I am working just as hard to recognize and empower your important work.
It's not enough to just champion a design or technology, and get a permit. What happens next is equally important.

Will your innovation be a “one-off”, leaving others who might follow to fend for themselves, to relearn the lessons, reinvent the wheel?

Each successful code innovation is a source rich info, a potential precedent that can support replication and be adopted broadly.

Sadly, like apples fall in autumn, info often left on the ground to rot.

If you’ve won a permit, you can’t let that information rot on the ground. This is a shame, people + world waiting for that info.

YOUR job, not just innovate, but then to share and make accessible Document and share your innovation
Passive House Champions and other innovators are the true heroes of sustainability

American business model programmed us for competition, to protect proprietary info
EcoBuilders reject that model, curious propensity to share intellectual property, expose “trade secrets”

It’s not just to win at business, you want to accelerate Passive House design to create a sustainable future.
   E.g. Hammer and Hand Best Practices Manual  

Is this just because you’re bleeding heart do gooders who are trying to save the world?

‘Transformative Business model “Co-opetition.”’ EcoBuilders have discovered more success sharing information, forming partnerships, than following the traditional cut-throat business model.
The CIDB a new web-based resource that exists
to help building officials, builders and other stakeholders to share information about successfully permitted green and high performance building innovations.

Info and resources to help people navigate a successful path to compliance get permit faster, more efficiently, at less cost.

If a project doesn’t conform with the existing code...still takes more time and cost, right? Would you generally agree? Any comments? [Pause, Response.]

The Purpose: Making it Easier to Build Green!
Filled with case studies of innovations that don’t fit prescriptive path

Detail permitting process, requirements, alt. compliance
Testing, modeling, engineers’ stamp etc.
Supporting docs

Examples – For Passive House, one of the first code innovation case studies was on H/ERVs. Even in high-performance homes which are not Passive Houses, the H/ERV is a proven energy-saver. Undersized heating systems in passive house and other super efficient buildings require special code approval

North Passive house case study can be used as a precedent, convince code official to approve something similar

May be the first time your local building code official has been introduced to other official’s permitting buildings with “undersized” space heating systems.
a resource to connect designers, builders and owners as well as regulators with critical information at just the right time.

Launched 2014 by NW EcoBuilding Guild, in partnership with Thurston County, WA.

2016-18 Expansion plan
• Publish hundreds more case studies
• Profile innovative policies, codes and standards
• Education & Advocacy
• Focus strategy – Energy Water and Wood
• Partner with orgs – presentations, research, advocacy
• Goal put this info in the hands of every code official

www.CodeInnovations.org
There are many definitions of sustainability, certifications, levels where innovation occurs. We’re not creating a new rating system! Whether PH, NZ, N+ Living Building Challenge, We want to document and share your breakthroughs Not just deep green projects Incremental improvements sometimes face code barriers.

e.g Martha Rose / Ben Walsh simple yet significant innovation “Ply on foam sheathing” – standard stick built wall, 1-2” of rigid foam between framing and plywood shear wall creates a thermal break, reduces infiltration, add insulative value. Reduce energy load 27% from a code minimum. Something any framing crew can adapt to, yet Washington County would not approve without testing. Ben partnered with NEEA and OSU testing lab, seismic testing – Surprise! 4x better than code minimum in earthquake. Now ample documentation to approve anywhere. With documentation in place, can imagine this becoming a code requirement?

So now I ask you? What regulatory barriers have you overcome?
There are several compliance paths available for innovators who’s projects don’t fit the normal prescriptive path to approval. Each innovation is unique, and each jurisdiction / code official may have a slightly different approach. Good to understand all the options.

Let’s walk through them.
Alternative Means and Methods:
Nearly all building codes contain a provision to allow for approval of alternatives.

Here’s the language from Section 104.11 of the 2012 International Building Codes

“The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code ... where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and is at least the equivalent of that prescribed.
Alternative Means and Methods:
The most common alternative path. Works at state and local levels where codes are adopted and enforced.
Evidence based – i.e. Still requires Product testing, documentation, justification. But provides a compliance path for innovations not yet recognized in codes and standards
Usually site-specific, i.e. the approval only applies to the specific project. However, such an approval can be cited as a precedent to win approval in other jurisdictions
Broad-based easy to apply to a lot of different circumstances,
However, once a project is approved, its’ not easy to find the information after the fact.
The language and application of Alternative Means and Methods has evolved over time. For example, this new language added to the 2015 IBC:

“Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved”

Provides accountability to the applicant seeking approval; Also protects the Code Official from criticism later if someone doesn’t like the decision, paper trail to defend the action.
Rigorous testing by accredited facility/lab, using recognized testing procedures is required for most new products/technology. Can be very costly, presents a barrier to entry for many innovators. Have to have deep pockets can get a new innovation to market. Can find support for testing by partnering with universities, government grants – programs to commercialize new products.

ASTM, ISO & UL set protocols for recognized testing methods. Once test data to show it meets accepted standards for health and safety, ICC Evaluation Services is often the next step on the way to code adoption – Testing, field trials, and other evidence reviewed by an expert panel, peer review process, publish. Evaluation Report can be used by any jurisdiction to approve AMM innovation.

UL Listing is usually even more expensive, long time, field testing. Once listed, innovation can be approved anywhere.

In Europe, instead of UL listing, use CE “European Conformance” to list approved products/technology. But USA only recognizes UL is recognized.

E.g. Sanden CO2 Heat Pump Water Heater – environmentally superior, best efficiency, approved by CE in Europe for years, still not UL listed due to high cost. So can only be approved by AMM. See 3 case studies for details.
Formal Interpretations

- National and state levels
- Clarify a grey area within the code
- Used for fitting new technologies within the existing code

Code Interpretations – used to clarify grey areas within the code, used to fit new technologies with the existing codes. Usually done at state level, but sometimes national, by ICC.
In Oregon, they have a State Adopted building code, which locales are required to enforce, without amendments.

To allow for changes to the code to accommodate incoming or alternate standards they have a unique process: Statewide Alternative Methods.

E.g. Air Admittance Valves, adopted in 2007, updated in 2014. We’ll come back to this later in the presentation, but without this SAM stack vent roof penetrations would be required on all homes in Oregon, making it very difficult to approve a Passive House design that eliminates such penetrations without a variance. Unfortunately due to lobbying from the plumbing industry this SAM doesn’t go far enough and a variance was required anyway on Tad’s house.
If you choose that path, you must follow the entire code.

Oregon’s Reach Code was an early example, unfortunately it’s not widely known and almost never gets used. Massachusetts “Stretch Code” emphasizes energy performance, as opposed to prescriptive requirements, is designed to result in cost-effective construction that is at least 20% more energy efficient than that built to the "base" energy code.
Innovations follow these alternative paths until formally recognized in the Code with prescriptive or performance based standard. Can take a very long time. And not every innovation is destined for prescriptive adoption, e.g. inherently site-specific application Strawbale construction, 20 yrs working for IRC “Appendix J” in 2013.

Model codes are updated every three years by ICC, upcoming hearings After adopted, another couple of years for adoption by State and Local Add several more years to overcome jurisdictional inertia, resistance to change, lack of time / resources / and code official training. Minimum 6-7 year process. More often a decade or more. Costs of testing, field trials, evaluation, education and approval + time, daunting to small entrepreneurial innovators to bring their “big idea” to market. Many try and fail for each innovation that succeeds.

Model codes created through democratic but political processes. interplay between commercial interest, special interest, inertia and public interest = Additional barriers to small companies with alternates to “known” well-established products and their industry lobbyists. Stick with it long enough, overcome the odds, adoption into formal code has the greatest potential for widespread adoption.
Here’s a Passive House related code adoption proposal, from the Safer Insulation Institute

The proposed change would not:
– require changes in current building practice
– preclude the use of foam insulation with added flame retardants

The proposed change would:
– maintain fire safety
– enable production and use of plastic insulation foams without added flame retardants
– increase product selection for builders and designers

For more information or to get involved, please contact SaferInsulation@gmail.com.

- See more at: http://saferinsulation.org/code-change-proposals/#sthash.eVZkXAuP.dpuf
Portland ATAC Story:

Created in 2008 by City ordinance---inspired by Green Building pioneer Mike O’Brien -- then-City Green Building advisor
Low cost ($150) with easy written appeal form.
You get to sit around a table with the committee members working together for a solution they can recommend.
Open Q & A. Non-adversarial process, but rather collective inquiry.
Committee members are peers (architects, engineers, builders in private practice).

Only one city building official participates in ATAC in “ex-officio” basis to inform other members. City building official does not vote.
Prompt written decisions (recommendations). Not binding on building code appeals hearing officer, but persuasive.

King County’s version of Portland’s ATAC is called CCAB IAC  (Innovation Advisory Committee)

In Portland, some innovations through the ATAC and some simply through successful code appeals.
Portland ATAC Story
09-007 - Lime Plaster Industrial Hemp Wall Construction
09-005 - Light Straw Clay (LSC)
09-006 - Earthen Masonry (COB) Rumford Style Fireplace

Many of the innovations are unrelated to Passive House. Primarily green building (materials).
Portland ATAC Story

However, many technologies necessary or very helpful for Passive House have been recommended by ATAC (and approved in the subsequent building code appeal based on ATAC’s recommendation).

And many more are possible.

These are only a few.
Many Zehnder HRVs have been installed with approval by building officials even without UL listing which is otherwise required for equipment.

Currently, only one Zehnder HRV (CA 550) is UL listed.

Small Planet Supply works with Zehnder America to obtain field UL listing of CA 350.

ATAC recommendation was in 2009, and it was based on European Conformance (CE), certification by other independent institutes, meeting ISO standards, a large number of successful installations in Europe, and the owner’s (Zehnder) taking legal responsibility for the safety (which is part of CE).

Approval was quick after a 30-minute hearing and submission of testing information.

ATAC had a few questions, but it recognized its superior performance and necessity to achieve the Passive House Standard.
One building/project can have multiple code innovations.

One of the most important was written permission to substitute continuous, lower-velocity/volume whole-house ventilation for intermittent, higher-velocity/volume (code-required) kitchen ventilation.

Multiple Passive Houses were completed, but the written permission removed any uncertainty or risk.

Dylan Lamar demonstrated greater air changes with continuous whole-house ventilation.
Not just written decision approving alternative kitchen ventilation, but also

1) Non-rated eves for shading windows within 3 feet of property line (code allowed only 24” overhang, but 48” overhang needed to prevent destroying sensitive energy balance). Allowed with exterior side wall fire suppression sprinkers in the vicinity.

2) Combustible deck material with 3 feet of property line allows where environmentally superior deck material. Again, with side wall sprinkling.

3) Storage building attached to duplex building allowed for bikes based on site plan, firewall separation, ventilation, and environmentally superior development and site plan

Yet all of these successful appeals are hidden on the City’s website requiring you about them and to know how to search for them.

They are buried. And even if you know of them first, and know how to find the City’s building code appeal database, you may not find them. You need to know the right search terms.

For example, you might know that Green Hammer was the builder, but if you entered that name under appellant name, you would not get the results.
Abstract
Seattle’s residential building code requires domestic hot water heating system be tested and listed by a testing agency approved by the State of Washington. In the 1990s, Japanese engineers developed heat pump domestic hot water heaters using CO2, an abundant, natural refrigerant. These systems are known as “Eco-Cute” which means environmentally-friendly hot water because using CO2 avoids conventional synthetic refrigerants which have high global warming potential (GWP). Although Sanden’s Eco-Cute is not yet tested by an approved agency, the City of Seattle’s Innovation Advisory Committee (ITAC) recommends Hammer & Hand be permitted to install the CO2 system as an alternate material because of its superior performance and environmental attributes if it meets four conditions.

Permitting Process
Hammer & Hand is constructing a Passive House and it wants to use the environmentally superior Sanden CO2 refrigerant heat pump water heater system to provide both domestic hot water (DHW) and space heating in the house. The intent of Seattle’s Residential Code is to ensure that materials and equipment such as water heaters are evaluated and certified to meet accepted standards by third-party organizations approved by the the City. Even though the City requires third-party testing to the UL standard, and Sanden has not yet completed that testing, the SRC recognizes that alternative technologies with equivalent or greater attributes (performance, safety, durability, etc) can be approved by the building officials.

Hammer & Hand corresponded with Maureen Traxler, City staff supporting the IAC, who assisted in facilitating the proposal. The written application and subsequent oral presentation to the Committee included information establishing Sanden’s Eco-Cute’s superior performance and environmental attributes. Much of the information was presented earlier to the City of Portland Alternative Technology Advisory Committee which recommended approval of the Sanden system. In addition, we gave a power point presentation and presented the results of Washington State University’s 2013 laboratory testing of the Sanden system.

There were twelve (12) members of the ITAC present plus five (5) DPD officials in the audience. The meeting included numerous questions, lots of interest and legitimate concerns, and encompassed a 1-hour discussion.

The ITAC Chair had prepared a 26-page report listing relevant codes and standards which helped guide the discussion. The ITAC also discussed freeze protection during an extended power outage. The ITAC voted unanimously to recommend the Sanden system on the condition Hammer & Hand supplies the following information:

- Record of application and timeline for UL Approval Until UL approval is confirmed, approval by a 3rd party testing agency approved by the State of Washington Confirmation of Lead-Free manufacturing and materials per code
- ITAC’s recommendation is also conditioned on case-by-case review and approval in the permitting process for each specific building installation.

Provides both DWH and space heating in Dan Welch’s [bundle] design studio’s Birch House (Living Building Challenge home).

Installed by Hammer & Hand in Madrona as well as by Cascade Built in Park Passive in Seattle.

Now installed in Emerson House by Birdsmouth Construction in Portland for both DHW and space heating. And same in Olympia by Albert Rooks of Small Planet Supply.

One system does the work of two----tunneling through the cost barrier---with environmentally-superior refrigerant (GWP of 1 instead of over 1,000).

Virtuous progression.

Cascading!
Just as UL-listing can be a time and cost barrier delaying or preventing innovation, there are other barriers to environmentally-superior technology.

Conventional plumbing requires atmospheric venting of waste pipes. Ambient air is pulled down waste pipes with water draining from plumbing fixtures. Sewer gases building up outside of building can vent to outdoors instead of building up in waste water piping.

2 problems for Passive House: 1) lots of holes in roof assembly air barrier and 2) increased area of thermal envelope that must be insulated.

In addition to many other problems: 1) danger to plumbers on roofs, 2) toxic substances in manufacture of piping—much of which is unnecessary, 3) durability of roof jacks, 4) greater chance of roof leaks, 5) more labor and materials increases construction costs.
Solutions: Air-admittance valves (AAV) are one-way valves allowing make-up air from inside the house but no sewer gases into the house.

Plus: Two-way valves with activated-charcoal filters at clean out to relieve any positive pressure of sewer gases from waste system outside building.

Eliminate all of the green piping in the diagram.

Codes often 1) not allow AAV, 2) restrict to when atmospheric venting impossible (island kitchens), 3) restrict numbers, 4) unscientific limits of number of plumbing fixtures on each AAV, 5) mandate at least one through-roof vent.

City of Portland ATAC ignored “non-technical factors” at work in State Code process and allowed per manufacturers’ specifications.
Not just innovative designs or equipment, but materials.
Yet it is unknown, and some else will need to hire a fire protection engineer again unless we post this on the CIDB. Addition of ThermaCork to an assembly does not impair the fire resistance of the assembly which would otherwise be deemed to be a 1-hour wall.

1) Initially, building official said that addition of ThermaCork within the UL-fire rated assembly means it is no longer a 1-hour UL-fire rated assembly. You cannot build it as planned.

2) Birdsmouth’s fire protection engineer states Harmathy’s Rule 2 of fire endurance: Fire resistance does not decrease with additional layers. The resistance of the layers can be added.

3) Birdsmouth’s fire protection engineer concludes ThermaCork would likely contribute some fire resistance but assigns it zero to be conservative, and provides analysis of fire resistance of the entire wall including the ThermaCork adding the accepted resistance of most of the other layers (except not including the ThermaCork or the aluminum panels on the exterior)

4) This is consistent with the general Harmathy’s Rule.

5) Based on the general rule and his conclusion about ThermaCork, building official finds the UL-fire rated assembly with the addition of 3” of ThermaCork is still a 1-hour fire resistant wall (from both sides) and meets building code requirements for the wall of the buildings (required to meet the 1-hour rule because of the ADU below the main dwelling unit makes it two units for building code analysis).

That is an achievement: addition of eco-friendly insulation does not impair the fire resistance of the other materials in the assembly or the assembly as a whole.
The absence of a negative is still a positive achievement.
Appealed 2008 Oregon Residential Specialty Code restrictions on unventilated roofs to avoid foam by

1) Air barrier in plywood structural sheathing prevents air from transporting moisture to sheathing
2) Over-insulation prevents any moisture on bottom of sheathing from condensing
3) Vapor-permeable weather resistant barrier over nonstructural (plywood) sheathing covering dense-packed “overframing” allows drying to outside
4) Ventilation channel above nonstructural (plywood) and under metal roofing facilitates drying to outside
5) borate-treated cellulose (mold prevention and moisture distribution, buffering, and release)
6) Continuous ventilation with heat recovery controls interior moisture

Dylan Lamar provided WUFI moisture analysis of alternatives assemblies with this summary:

“Research in Portland, OR has shown that stopping air leaks within the structure is more important than vapor retarders in preventing moisture damage in mild marine climates (b). The subject residence is being built to the Passive House standard (c) with requires an Airtight building shell (≤ 0.6 ACH @ 50 pascal pressure, measured by blower-door test). The cellulose material contributes to a safe assembly. The borates in cellulose insulation provide superior control against mold. Cellulose acts to distribute moisture throughout the cavity, preventing the buildup of moisture in one area and helping to dry the moisture more quickly. Cellulose manufacturers do not recommend the installation of a vapor barrier (d). “
Owl Haven, Ken Dickey’s home on Bainbridge Island. Spoke at 2014 PHNW Conference – his presentation on the website. He utilized several innovations documented in the Database
Zehnder Comfo-Air “most efficient HRV”
Undersized Heating System
Exterior Cork Insulation

After receiving a favorable code interpretation from the building official, inspector actually flagged the systems. Dickey used case studies from the Database to help show the inspector and code official and reinforce his case, and then was approved.
We’re not just talking about individual code innovations. As mentioned previously, new products and technology being approved through Alternative compliance often results in adoption of new codes language and innovative policy solutions, and evolution of the building code structure and process itself.

Let’s take a look at some Policy Innovations related to Passive House
NK Architects recently welcomed a delegation from Brussels, Belgium including architects, trade officials and their Secretary of State, to share the remarkable story of their mandatory "passive house" building code standards adopted in 2015. It began in 2007, when they launched an “EcoBuilding Cluster” and gained significant incentives for “exemplary buildings” – very low energy, economical and beautiful. Since then there have been 5 MILLION square feet of super-efficient commercial buildings constructed, showing industry skeptics that these buildings were easier and less expensive to build and operate, and transforming the market in the process!
California’s recent revisions to Title 24 put in place ambitious performance goals: all residential buildings must be Zero Net Energy (ZNE) by 2020, and all commercial buildings must follow suit by 2030.

On November 2nd, King County rolled out a bold exciting update to their Strategic Climate Action Plan.

*develop, adopt, and implement bold residential and commercial energy codes, reducing energy consumption in new buildings to net zero by 2030. By 2030, 100 percent of new developments achieve Built Green Emerald Star, LEED Platinum or Living Building Challenge standards. Why is there no mention of Passive House?*
Not just for specific designs, but policy changes facilitating widespread Passive House construction

“Relaxation of Regulations”: Relaxation is rationally based on Passive House design:

“Achieving a low-energy, high-efficiency home through high quality thermal envelope design and better insulation will result in thicker walls and ceilings, thus impacting floor area.”

Excludes a portion of the floor area (based on thicker, superinsulated assemblies)

City of Vancouver green rezoning policy (2010, revised 2014)

Rezoning for large commercial and multi-unit residential projects must meet Passive House, LEED Gold (including 22% reduction in energy cost over code), or Living Building certification. This policy impacts 60% of square footage developed in the City of Vancouver (an estimated 2.6 million square feet of new development each year).

City of Vancouver thick wall exclusion (2010, revised 2015)

This policy allows all building types to exclude the area used for insulation that exceeds minimum code requirements in floor space ratio calculation. Maximum limit on exclusion was explicitly based on the amount of insulation deemed required to achieve PH. Relaxation to other regulations used to control bulk and massing in single family developments (height, yard, setbacks, etc.) is also being considered (see below).

City of Vancouver setback allowance (in development)

This would allow some relaxation in height, front and backyard setbacks (greater building depth) for one- and two-family dwellings to recoup indoor useable area lost because of thicker walls for PH certified buildings.

Relax side setbacks to extent exterior shading devices needed.

Relax height limits for rooftop equipment.

Requires CPHC/D using PHPP.

Relaxations summarized in short, clear, and helpful Guidelines document which provides explanation and cites to specific code sections.
Hope we’ve convinced you
If we are truly committed to a climate-friendly future
No time to lose – for dramatic reductions in CO2

Move beyond the game of “telephone” method of sharing information – lacks velocity and loss of quality / accuracy
Even conferences and tours – limit to how many we reach, preaching to the choir
Think of Database as on-ramp to the information Superhighway – reach everyone anywhere any time.

But only works if we can fill with great content
So please Document your Innovations on the Code Innovations Database!

Only takes 30 seconds to fill out the form basics and submit your project idea. You can fill out more of the form if you want, but it’s not required. If you were directly involved in the project and have your files handy, filling it out completely should only take 5 or 10 minutes.

Then – as resources allow - we’ll work with you to do a complete write up on your project and your unique path to compliance!

It costs us about $2,500 to publish each case study, so we’re more likely to put yours in if you can recruit a couple of companies or people to help “underwrite” (i.e. sponsor) the case study.

Check our website or talk to Chris if you want to know more about this process!
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