

PHIUS+ 2018: What's New?

- *More nuance for different building types.*
- *Supports our overall transition to renewable energy.*

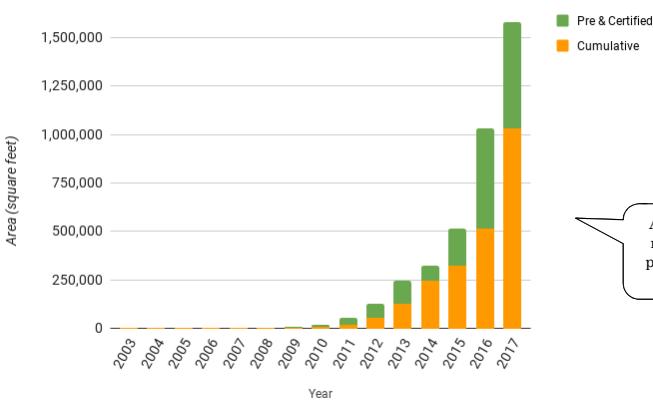
Graham S. Wright



Public Comment Period Open Through April 15

PHIUS+ 2015 quite successful

PHIUS+ Certified & Pre-Certified Square Footage



Year	Pre & Certified (Area)	Cumulative (Area)
2003	0	0
2004	0	0
2005	0	0
2006	0	0
2007	0	0
2008	0	0
2009	0	0
2010	10,000	10,000
2011	20,000	20,000
2012	50,000	50,000
2013	100,000	100,000
2014	150,000	150,000
2015	200,000	200,000
2016	400,000	400,000
2017	500,000	500,000

Actual project numbers – no predictions are included.

Why certify? It shares the knowledge:

- Of how to do this
- That anything is happening

Outline:

- Heating & Cooling
- Getting Quality
- Calculation methods
- More accurate shading
- Revised hot water provisions

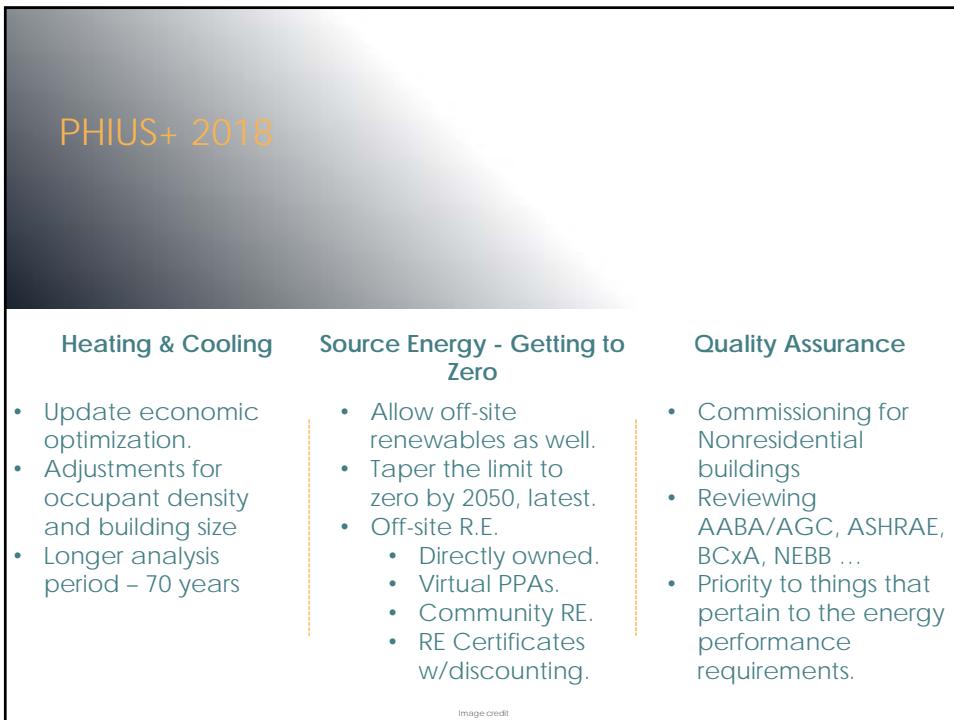
What stays the same?
Still a passive building standard

- Limits on heating & cooling loads,
 - peak and annual.
- Building energy performance standard,
 - with prescriptive quality assurance requirements,
 - pass/fail.

PHIUS+ 2015 Pillars & principles
Details also matter

Heating & Cooling	Source Energy	Quality Assurance
<ul style="list-style-type: none"> • Limits are derived from economic analysis. • Climate-dependent. 	<ul style="list-style-type: none"> • Overall energy use limited on fair-share principles. • Per person for residential, per square foot nonresidential. • Not climate-dependent. • Net of on-site renewables. 	<ul style="list-style-type: none"> • Air-tightness testing • Ventilation commissioning. • DOE checklists for residential bldgs. <ul style="list-style-type: none"> • Energy Star • EPA Indoor airPLUS • Zero Energy Ready

Image credit:



March 23, 2018	Published pilot phase protocol. Public comment period opened.
April 15, 2018	Comment period closes.
Late Apr 2018	Pilot phase protocol finalized. Open for submissions. WUFI Passive only for PHIUS+ 2018 projects.
End Sept 2018	Pilot ends; final protocol published. Dual-cert phase-in continues – accepting both PHIUS+ 2015 and PHIUS+ 2018 projects.
Mid Mar 2019	Phase-in ends. New projects PHIUS+ 2018 only. No new PHIUS+ 2015 projects.

TIME LINE

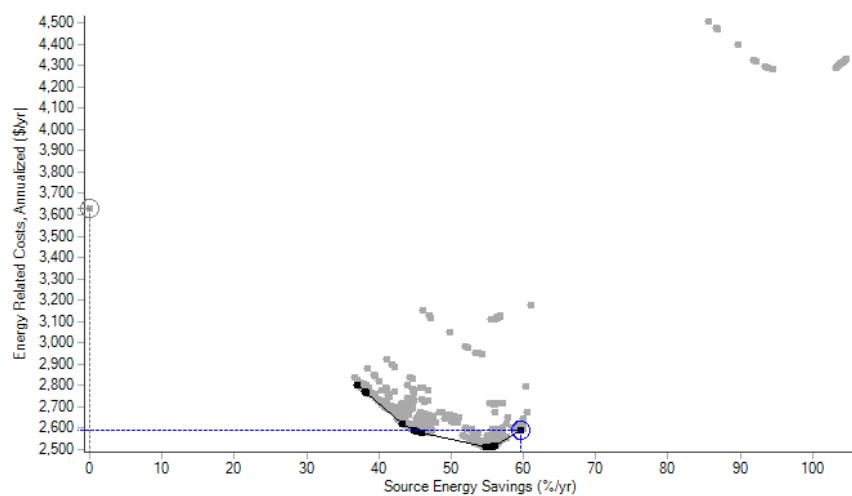
HEATING AND COOLING

As before, using BEopt to do life-cycle cost optimization, to set the limits on heating and cooling loads (peak and annual).

BEopt (by NREL) runs dynamic building energy simulations with different combinations of energy saving options, seeks to:

- Maximize source energy savings, and
- Minimize "annualized energy-related costs", that is, sum of energy bills plus the financed cost of the energy-saving upgrades.

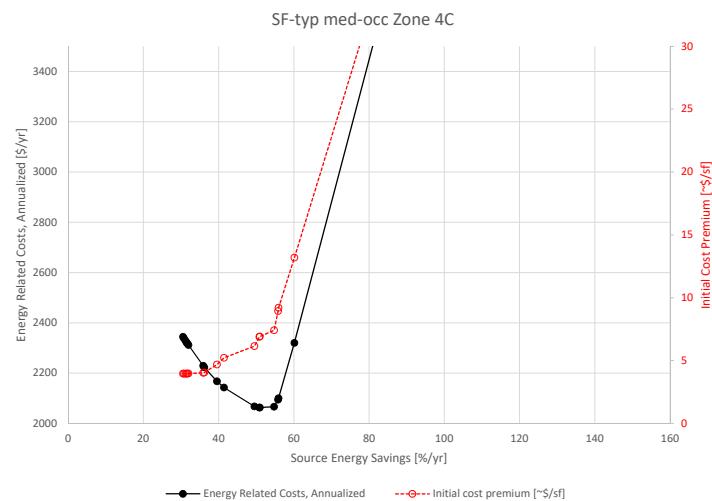
HEATING AND COOLING



HEATING AND COOLING

As before, for a number of study building cases, we:

- Give the optimizer envelope/passive measures, HVAC equipment efficiencies, and solar hot water to try.
- Impose some significant constraints on the optimizer:
 - Window U-values held down to ensure winter comfort even with large glazing areas - also drives toward low peak loads
 - Ducts inside (one of our Zero Energy Ready Home pre-requisites.)
 - Air sealing to 0.06* cfm50/sf envelope (0.08 for tall buildings.)
*or better
- Choose an option package near the minimum cost point.
- Re-model the building in WUFI Passive.
- Note the heating and cooling loads (peak and annual.)
- Do curve-fitting on that data, to set the heating/cooling criteria.



- Turning point in life-cycle cost was often the turning point in initial cost also (but not always).

HEATING AND COOLING

Differences from 2015:

The 2015 development looked at a lot of different climates to come up with targets sensitive to several climate factors.

For the 2018 *pilot phase*, climate sensitivity drops to Zone-by-Zone, but the criteria become sensitive to *occupant density* and *building size*.

More climate sensitivity to be restored with the final protocol in September.

Longer analysis period – 70 year building life.

Still with 2% per year real discount rate and 30-year financing.

HEATING AND COOLING

Differences from 2015:

- Criteria will be sensitive to envelope/floor area ratio and occupant density.
 - Three criteria ranges: small, medium, and large building.

Five study building sizes:

Small house – 25x24 ft two-story, 15% WWR

Typical house – 26x40 ft two-story, 15% WWR

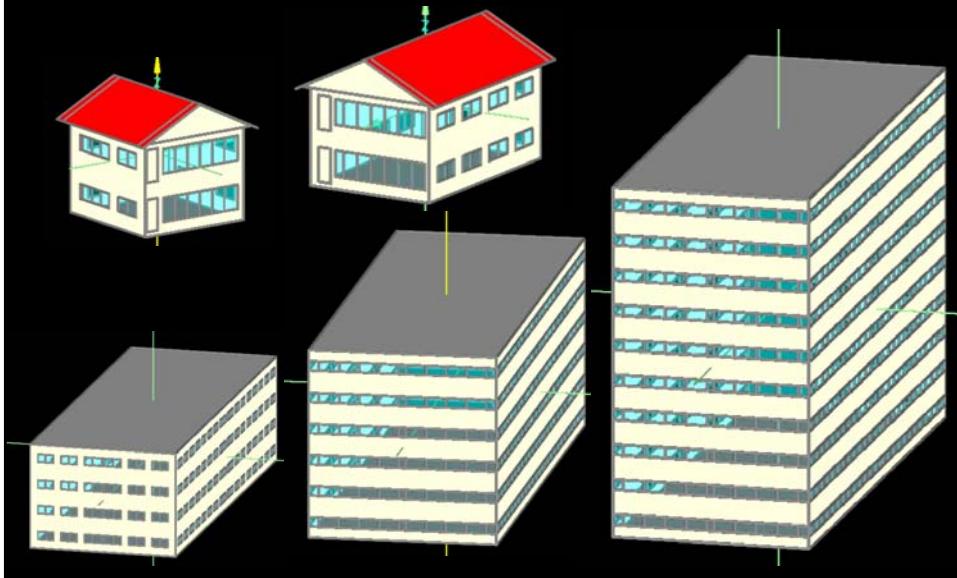
Mid-rise – 56x152 ft four-story (like DOE prototype, 20% WWR)

Nigh-High – ditto but six-story, 30% WWR

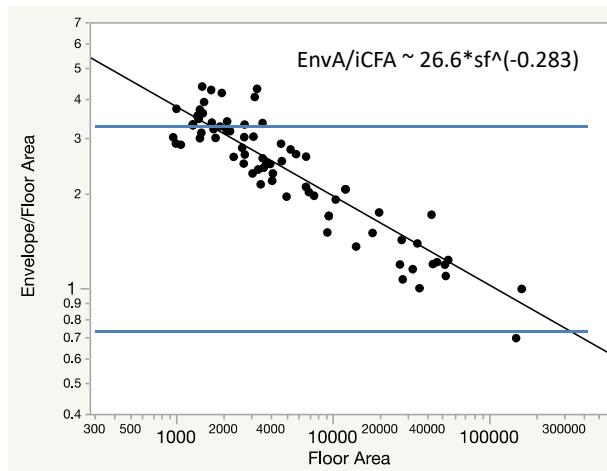
High-rise – ditto but ten-story (like DOE prototype, 30% WWR)

Three study building occupancies: about 235, 370, and 875 sf/person.

5 buildings x 3 occupant densities = 15 scenarios, x 17 climate zones



Envelope-to-floor area ratio vs. Floor area



Pilot phase criteria calculator online

**PHIUS+ 2018 Pilot Phase
Space Conditioning Criteria Calculator**

ASHRAE Climate Zone	4C
Floor Area (ft ²)	5,000
Total Occupancy	11

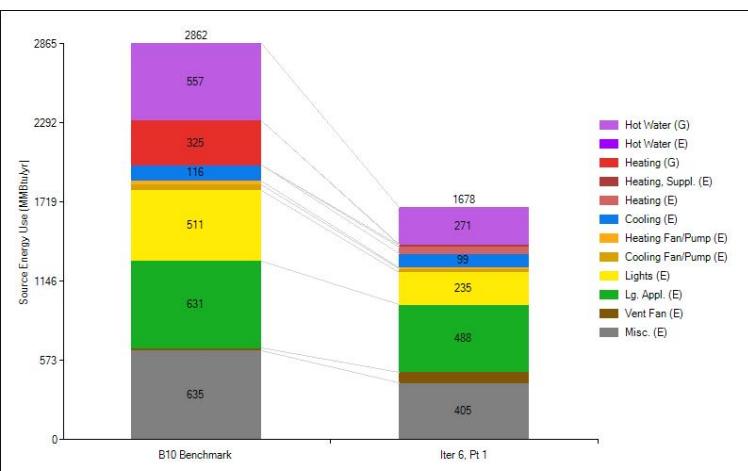
Space Conditioning Criteria

Heating Demand	5.7	kBTU/ft ² /yr
Cooling Demand	3.5	kBTU/ft ² /yr
Heating Load	4.7	BTU/ft ² /hr
Cooling Load	2.7	BTU/ft ² /hr

Typed entry will override sliding scale.

Select your ASHRAE Climate Zone, Floor Area (ft²), and Total Occupancy to estimate your project's space conditioning target criteria. Exact certification criteria can be determined using the project's envelope to floor area ratio and square feet per person calculator found in the 'PHIUS+ 2018 Pilot Phase' document linked at the top of this page. Estimates from this calculator should closely reflect exact targets.

MF-Midrise med-occ Zone 5B



GETTING TO ZERO EMISSION / 100% RENEWABLE ENERGY

FOR THE SAKE OF EVERYTHING, we-humanity must get to *absolute* zero CO2-equivalent emissions (or less).

Let's review: As of 2015, the remaining emission budget is 270 to 470 GtCO₂ according to IPCC ÷ 7 Gpeople -> 39 to 67 tCO₂/person. Average emission budget over 35 years is 1.1 to 1.9 tCO₂. If the glide path is linear, the beginning year emission budget is twice the average -> 2.2 to 3.8 tCO₂/p for all purposes. Allocating 1/3 to the *building sector* gives about 1 tCO₂/p for the beginning year. In an all-electric scenario, a building site energy use of 1400 kWh/person scaled to source energy by a factor of 3 gives 4200 kWh/p source; the same site energy scaled to CO₂ emissions by a factor of 0.68-0.76 kgCO₂/kWh-site-delivered gives 950-1050 kgCO₂/p or again about 1 tCO₂/p. Thus a *year-2015* source energy limit of 4200 kWh/person corresponds to an equal share of the building sector's emission budget. At a typical occupancy of 35 m²/person, this corresponds to 4200/35 = 120 kWh/m². The limit should ratchet down every year thereafter.

GETTING TO ZERO EMISSION / 100% RENEWABLE ENERGY

Year-2015 source energy budget for the building sector was plausibly 4200 kWh/person for residential, 120 kWh/m² [38 kBtu/sf] for nonresidential. (If all-electric but supplied by mostly-nonrenewable-generation.)

Temporarily relieved in PHIUS+2015 to 6200 kWh/year due to calculation protocol increase in residential lighting/plug load usage assumptions.

Use of nonrenewable generation should taper off to zero.

Current PHIUS protocol for building certification recognizes only on-site renewables for reducing source energy use.

Tapering the limit to zero with that framework would force all buildings off-grid.

At some point the building has "done all it can" with conservation and on-site renewables, and responsibility shifts to the energy provider to decarbonize / go-renewable.



GETTING TO ZERO EMISSION / 100% RENEWABLE ENERGY

For PHIUS+2018, change of framework:

Source energy limit tapers to zero by 2050 *at the latest*. Limit for 2018 is **3840 kWh/p** for residential,
110 kWh/m² [34.8 kBtu/sf] nonresidential.

But: the limit is on Net source energy use and all of the following renewables are recognized as offsets:

- All on-site generation (not just the use-coincident fraction)
- Directly owned off-site renewables.
- Community renewable energy
- Virtual Power Purchase Agreements
- Green-E Certified Renewable Energy Certificates, discounted 80%.



GETTING TO ZERO EMISSION / 100% RENEWABLE ENERGY

Additional provisos:

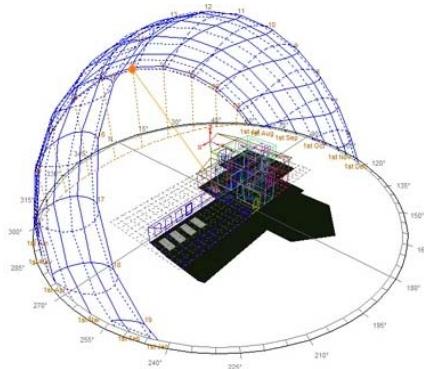
For PPAs, Community RE, and RECs, the building owner must present an actual contract to purchase sufficient RE to meet the (current-year) net source energy target for 20 years.

For onsite renewables or directly-owned off-site, RECs may not be sold off but must be retained/retired.

Where the building owner does not have ownership of the RECs associated with the on-site RE system, owner must obtain and retire equivalent RECs.

QUALITY ASSURANCE AND COMMISSIONING Esp. Nonresidential	<p>Nonresidential protocol is still under discussion, but for the pilot phase it will entail:</p> <ol style="list-style-type: none"> 1. Infiltration testing. 2. Ventilation balancing. 3. Ventilation wattage measurement. 4. Ducted heating/cooling balancing. 5. Verification of envelope, air barrier, thermal bridge mitigation, and shading - built to plans. 6. Verification of lighting, mechanical, and process load systems per plans/energy model. <p>Details TBD by QA Manager and Certification staff on a project-by-project basis.</p>
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CALCULATION PROTOCOL NEW SHADING ALGO



Hourly pre-processor calculates monthly shading factors based on actual building / overhang / reveal geometry.

Site shading may be entered as drawn/visualized objects or by user-defined reduction factors.

CALCULATION PROTOCOL

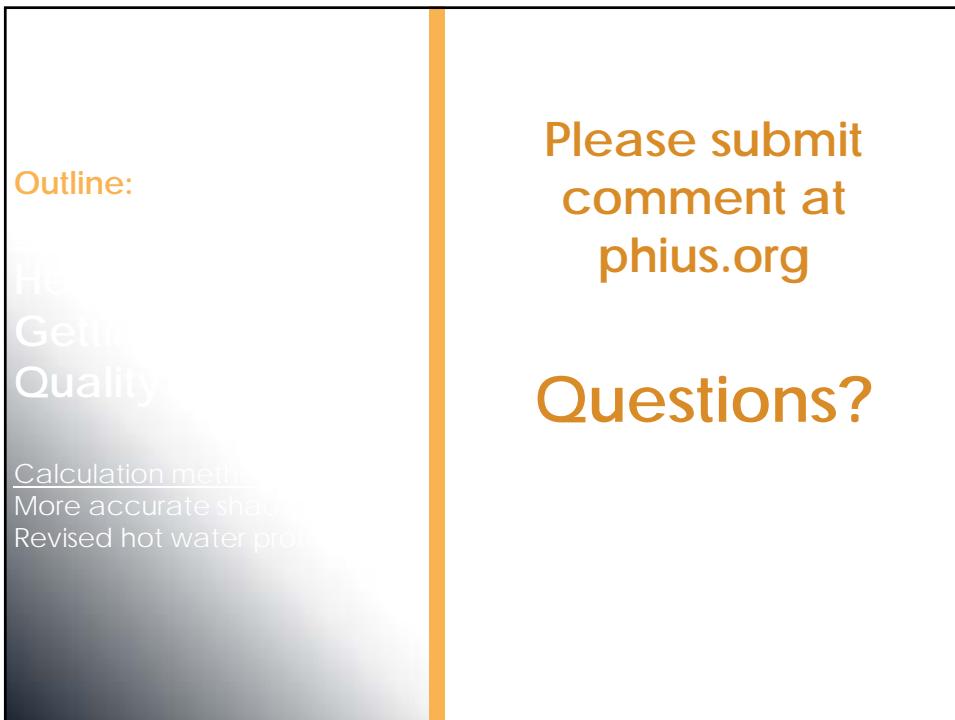
Revised hot water protocol

- Calculation support for meeting EPA Watersense delivery time requirement.
- Revised pipe heat loss calculation scales more realistically to larger buildings.
- Vary cold water inlet temp. monthly per BA/RESNET.
- Alignment with RESNET on low-flow fixture credit, drain water heat recovery, and washer/dryer/dishwasher energy calcs.

CALCULATION PROTOCOL

Source energy use

- Source energy *allowance* associated with cold water (municipal supply pumping & wastewater treatment energy) for buildings that are off-grid for water.
- Source energy multiplier for grid electricity is by *national average* (per Energy Star Portfolio Manager for U.S. & Canada).  U.S. dropped from 3.16 to 3.14 as of Feb 2018 :D
- Offset math for off-site RE works the same way as for on-site – 1 kWh at site offsets 3x at source.





Passive House Institute US

PHNW 2018
conference

Olympia, WA March 29-30, 2018

8.5 CEU

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SELF REPORT AT
PHIUS.ORG/CPHC/SELF-REPORT