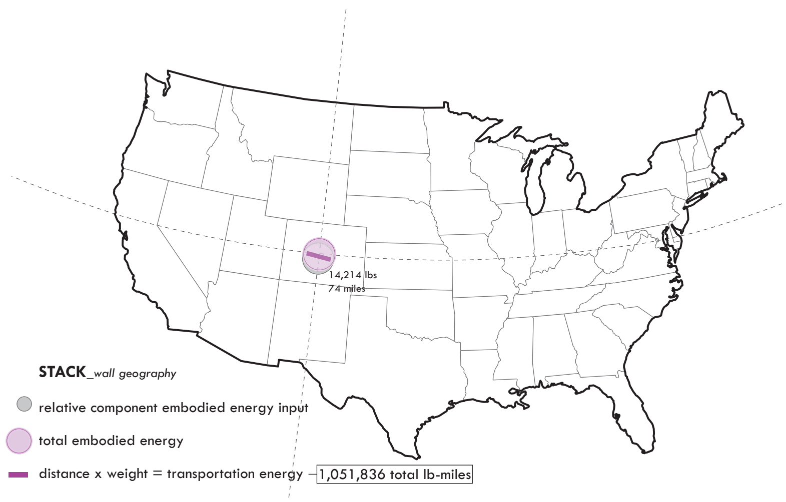
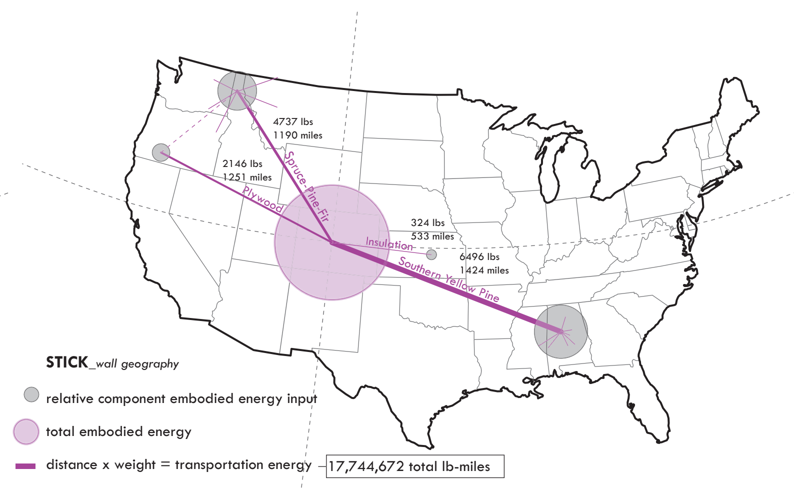
STACKHAUS

KIEL MOE





Among contemporary residential construction techniques, the layered wall assembly remains largely unquestioned—an allegedly efficient system which can be deployed to different architectural ends and effects, but which is itself more or less inviolable. As a challenge to this assumption, Kiel Moe's StackHaus near Granite, Colorado, rethinks the layered wall assembly and proposes in its place a single, monolithic wall, comprised of stacked 6x8 spruce timbers. These timbers act as the structure, enclosure, finish material, and insulation of the building.

The material choice is possible in part because of the modesty of the project—a 360 sq ft multipurpose space, essentially a single room. There is neither plumbing nor HVAC, and the building has no energy input other than the sun and the wind. One of eight buildings constructed by Moe on the rural site, which sits at the base of the Collegiate Peaks and overlooks the Arkansas River, the building functions as a yoga and painting studio, a performance space, and a kind of mini-theater for recitals, plays, and readings.

But the seemingly inefficient use of solid wood construction is also a deliberate response to the site. The spruce is harvested, dried, and milled in the same valley as the project, yielding a surprisingly small transportation footprint. Moe compares this with the thousands of miles from which the materials in a typical "stick" construction assembly—framing, plywood, insulation, etc.—are trucked to the site. The building's straightforward construction also exceeds its apparent simplicity, using lower technology to yield higher performance. Although it has greater mass than a layered construction, its embodied energy is dramatically lower. Moe's design capitalizes on the low thermal conductivity of spruce to regulate temperatures in both summer and winter. Wood is also the only material that sequesters carbon, so this solid wood building ultimately yields a carbon surplus, sequestering twice as much carbon as it took to produce the building itself. And there is even a resultant "gain" in design time as a result of the simplified construction technique.

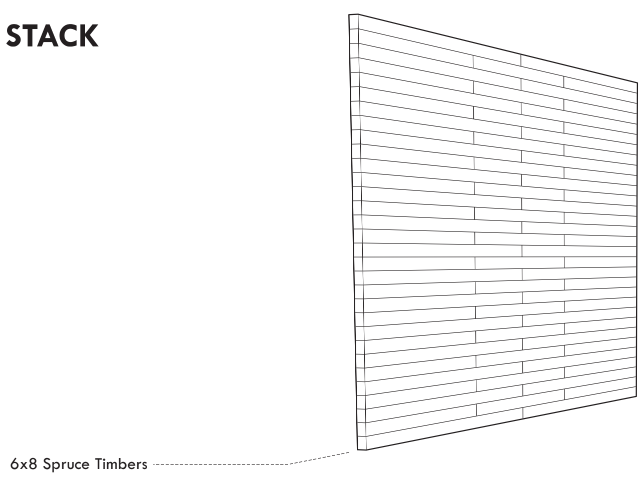
In this modest building Moe proposes a larger ecological argument, tackling what he terms "eco-logistics"—the practices and systems which are outside the domain of the object itself, but which have a meaningful impact on the architecture. In other words, how architecture impacts landscapes, economies, climate, and vice versa. These "extensive" architectural logics are often ignored or elided in the pursuit of design as the ultimate end. For Moe, however, they become primary considerations in the work and are themselves integrated into the design thinking.

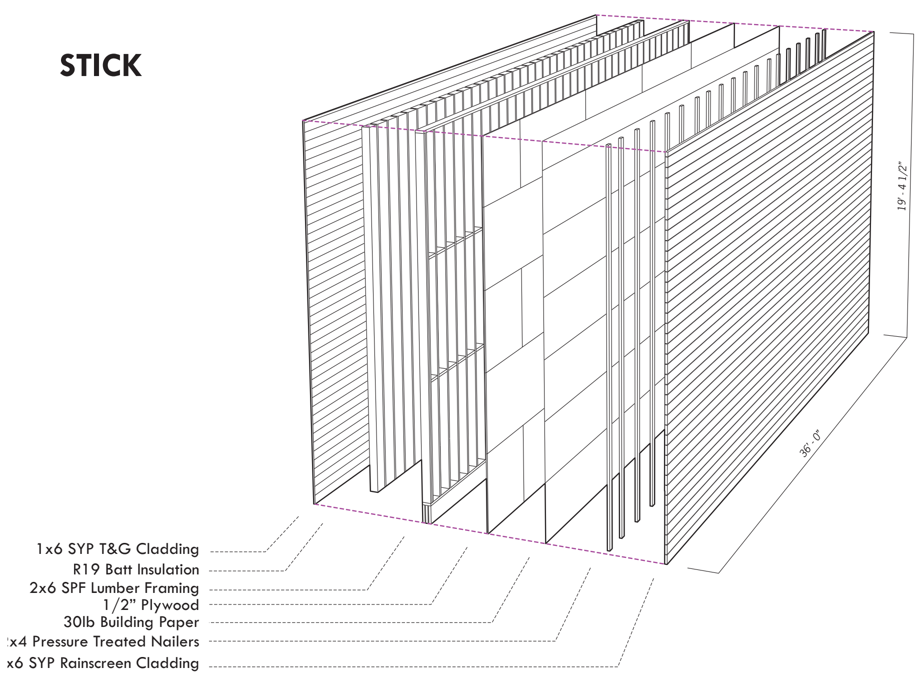
—AMANDA REESER LAWRENCE

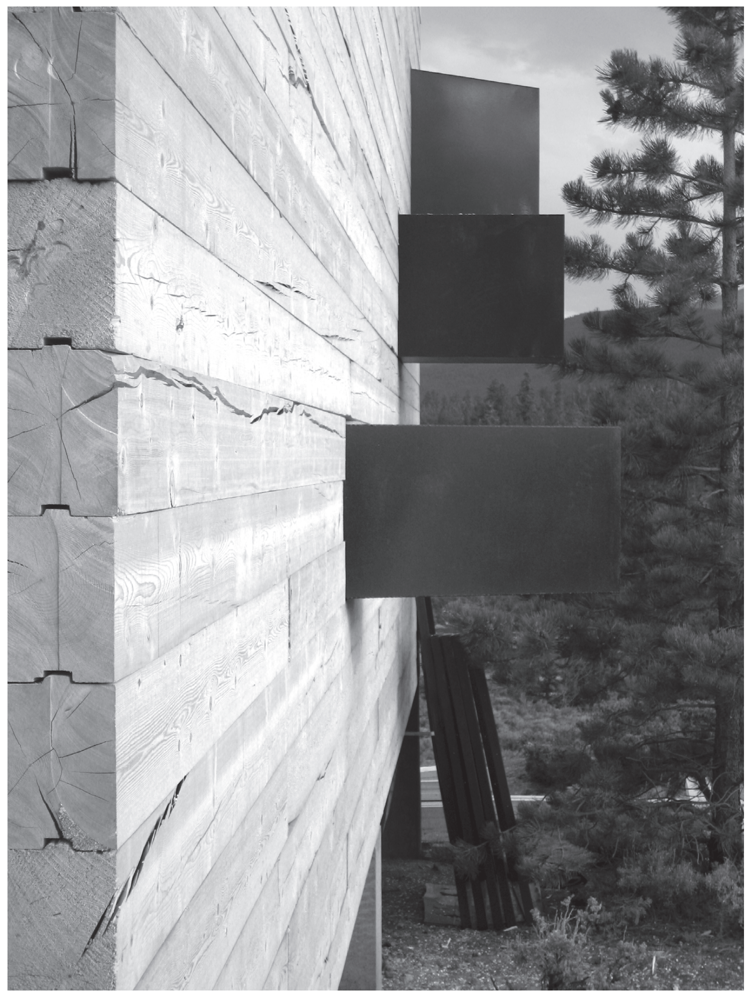
facing page: StackHaus's minimal transportation footprint as compared with that in typical "stick" construction directs more budget and resources into the building itself rather than its "externalities."

right: Two parallel, 19.5 ft tall solid wood beams provide the primary structure, enclosure, finish materials, and thermal strategy for StackHaus.

below: The simplicity of StackHaus's solid wood wall, at left, compared to the layered wall assembly that dominates contemporary residential construction.





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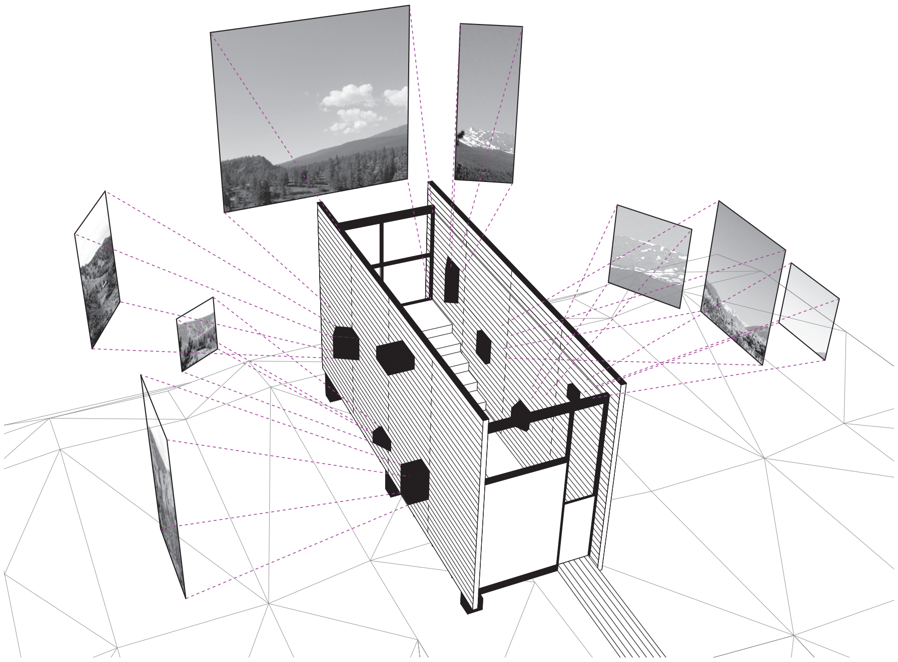
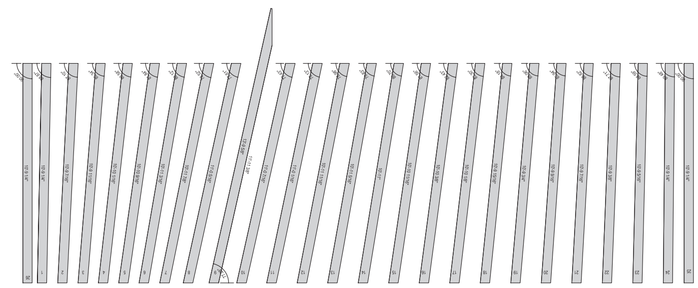
ICC ES ESR 1040
HUD MR 1241
LA RR 24998
CCMC 12472-R
WHITE CITY OREGON

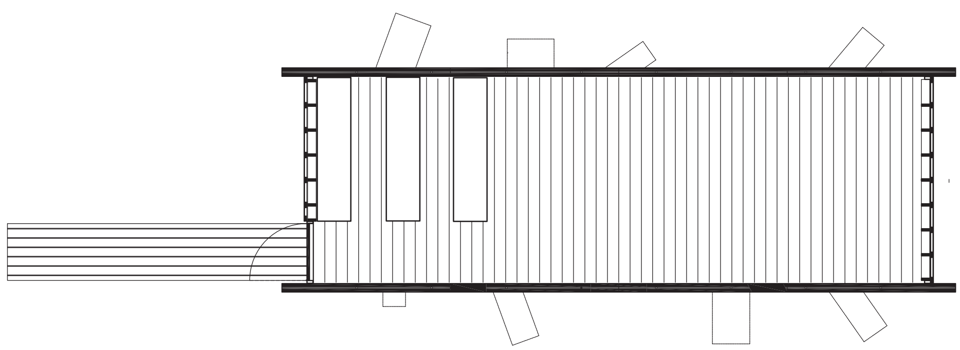


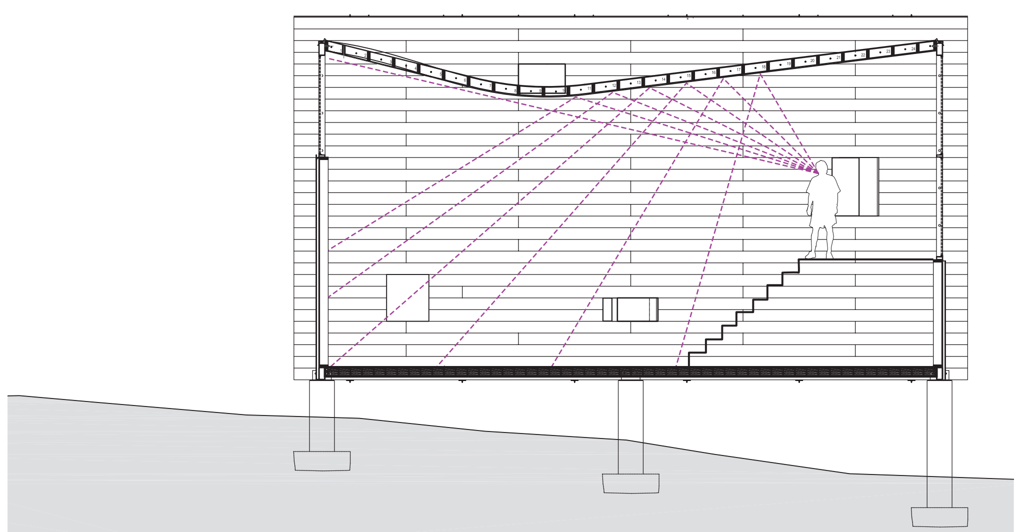
facingpage: 6x8 spruce timbers support the ruled surface roof. Once a timber is installed, it is largely complete. The spruce walls will shrink about 2 in. as they dry. A series of tunable, threaded rods compress the timbers as the material shrinks around slotted connections to the steel moment frames and window boxes.

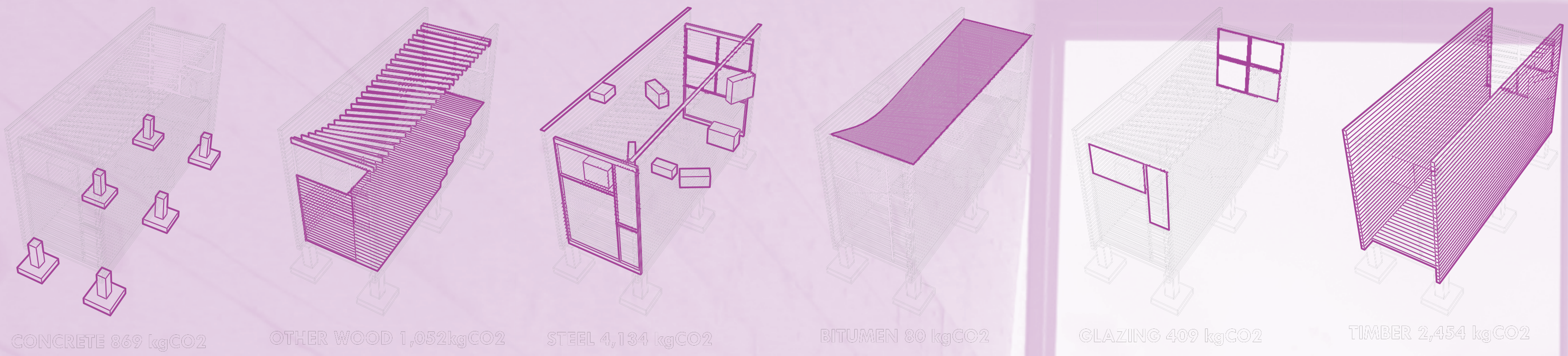
left: A series of steel boxes inserted into the spruce wall provide views and cross ventilation.

below: Roof framing, plan, and section. The asymmetrical belly of the ruled surface roof distributes light and sound in the interior while draining rain and snow from the roof above.









Carbon and Energy Sink

Material[1]		ft³	pounds	meters³	kg	EE (MJ)	EC (kgCO2)
Timber		784.00	18,032.00	22.20	8,179.18	16,358.36	2,453.75
Lumber		99.52	3	2.82	1,278.19	9,458.62	575.19
Plywood		45.06	1,592.36	1.28	722.28	7,484.08	476.49
Steel		47.00	5,148.64	1.33	2,335.39	31,761.24	4,133.63
Concrete		99.00	14,850.00	2.80	6,735.85	6,399.05	868.92
Glazing		7.38	1,062.00	0.21	481.72	7,225.73	409.46
Other materials		6.62	238.92	0.19	157.36	2,346.99	79.68
	totals	1,088.57	43,741.85	30.82	19,889.96	81,034.06	8,997.13
timber %				72.02%	41.12%	20.19%	27.27%

Timber Global Equivalent Carbon Sequestration[2] -792 kgCo2eq./m³ -17582.72 kgCO2 eq.

NET CARBON SEQUESTRATION **-8585.59** kgCO2 eq.

1. Geoff Hammond and Craig Jones. *Inventory of Carbon and Energy (ICE)* . Version 1.6a. 2008
2. Hegger, Manfred, Matthias Fuchs, Thomas Stark, and Martin Zeumer. *Energy Manual: Sustainable Architecture* . Birkhauser, 2008. Table B5.53 p. 161

Project StackHaus / **Location** The Georgia Bar, near Granite, Colorado, 2008 / **Design** Kiel Moe with and for Ron Mason / **Engineer** Chuck Keyes, P.E. of Martin and Martin, Lakewood, CO / **Construction** Kiel Moe with Jacob Mans and Amit Oza

Embodied Energy of Stick and Stack

STICK

	qty	length	linear feet	volume per	feet^3	meters^3	EE (MJ per unit)	Total EE (MJ)
Wall Framing: 2x6 stud	39	18.2	710	0.06	40.66	1.15		
Wall Framing: 2x6 plate	2	36	72	0.06	4.12	0.12		
Wall Framing: blocking	76	0.875	67	0.06	3.81	0.11		
Wall Framing: 2x12 beam	3	36	108	0.11	12.37	0.35		
Wall Framing: total					60.97	1.73	4692	8101
Plywood: 1/2"	23			1.33	30.66	0.87	9440	8195
Batt Insulation: R 19 x 12"	36	18	648		162.00	73.50	150	11025
Interior Finish: 1x6 SYP #1	39	36	1404	0.02	26.80	0.76	4692	3561
Rain Screen: 2x4 nailer	19	19.2	365	0.03	10.45	0.30		
Rain Screen: 2x6 cladding	39	36	1404	0.06	80.44	2.28		
Rain Screen: total						2.57	4692	12075
							Stick Total Embodied Energy	**42958**

STACK

	rows	length	linear feet	volume per	cu feet	cu meter	MJ per unit	MJ
6x8 timber	31	36	1116	0.28	309.03	8.75	848	7421
							Stick Total Embodied Energy	**7421**

Stack: Carbon Sequestration

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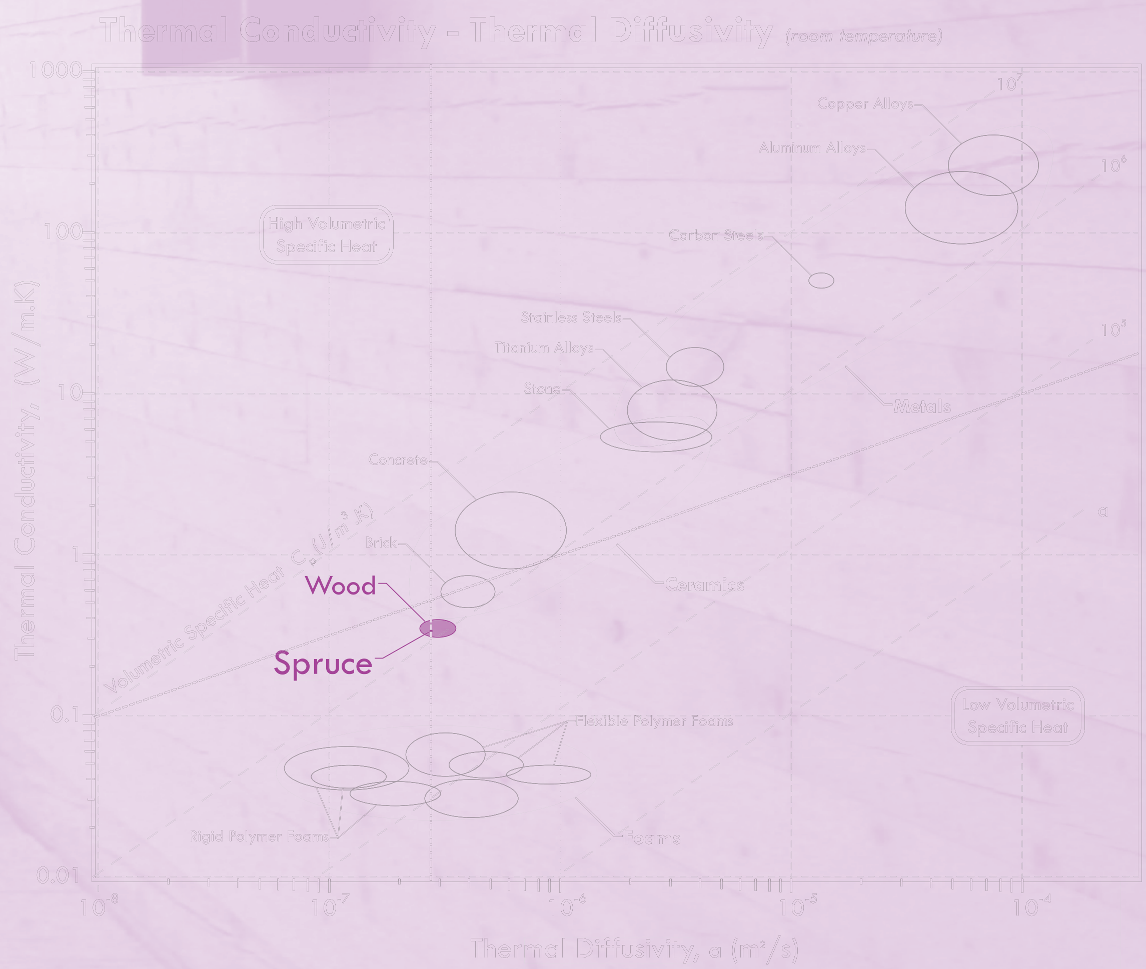

Table 1 (facing page top): The carbon equivalent sequestered by the timber walls and floor is about twice as much as the carbon inherent in all the materials combined, yielding a surplus of sequestered carbon.

Table 2 (above): Embodied energy comparison of a stack wall and a stick wall. The energy inherent in the stick approach is inextricable from the building yet of little value to the architecture or to the larger collective.

Table 3 (right): Thermal diffusivity, which measures the rate at which heat flows through a material, is an often overlooked factor in the thermal performance of more massive approaches to architecture. In the StackHaus the relatively low thermal diffusivity of spruce is why the owner of this building can occupy it in a t-shirt and shorts in -10°F weather with no energy other than the sun.