2022 AIA Fellowship

Candidate Kiel Moe
Organization Kiel Moe, AIA
Location Halifax, Vermont
Chapter AIA Vermont

Category of Nomination
Object 6 > Education

Summary Statement
Kiel Moe illuminates our understanding and practice of energy in architecture as a technical, formal, social, and political enterprise through the singular contributions of his teaching, research, publication, design practice, and building.

Education
2003 Master of Design Studies
Harvard University Graduate School of Design
Advanced Studies Program: Design and the Environment

2002 Master of Architecture
University of Virginia School of Architecture

2001 Bachelor of Architecture
University of Cincinnati School of Architecture and Interior Design

Licensed in:
2018-Present Vermont #134102
2008-2018 Massachusetts: #20725,
2018-Present NCARB # 91046

Employment
Academic:

2021
Cass Gilbert Visiting Professor, University of Minnesota
Lecturer, Southern California Insitute of Architecture

2018-2021
Gerald Sheff Chair of Architecture
Full Professor, McGill University School of Architecture

2011-018
Associate Professor of Architecture & Energy,
Department of Architecture, Graduate School of Design Harvard University
Co-Director, MDes post-professional design research program (2013-2017)

Co-Coordinator, MDes Energy & Environments concentration (2012-2017)
Director, Energy, Environments & Design Research Unit (2012-2017)

2006-2011
Associate Professor of Architecture (awarded tenure 2011)
Northeastern University School of Architecture

2009
Visiting Critic: Berlage Institute, Rotterdam (Master's Class studio with Lars Lerup

2005-2006
Assistant Professor of Architecture, Syracuse University School of Architecture & Syracuse University Center for Excellence in Energy and Environmental Systems

2004-2005
Visiting Assistant Professor
University of Illinois, Chicago School of Architecture

2004 Herbert Greenwald Visiting Critic
University of Illinois, Chicago School of Architecture

Professional:
2008-Present Kiel Moe, Architect, Vermont
1999-2010 Design-build projects with/for Ron Mason, Granite, Colorado
2004-2005 Garofalo Architects: Chicago
2003-2004 WW Architecture: Somerville, MA
2003 Hargreaves Associates: Cambridge, MA
1998-2001 University of Cincinnati Architecture Practicum
1999 The Salk Institute for Biological Studies: La Jolla, CA
1997-1998 Michael McInturf Architect: Cincinnati
1996 John Senhauser Architect: Cincinnati
1994-1995 Anderson Mason Dale PC: Denver

Design & Energy consulting projects
2020 National Renewable Energy Lab project, Anderson Mason Dale Architects, Denver
2010 Integrated Design Consulting for HEWV Architects, Norfolk, VA
2009 Integrated Design Consulting for Anderson Mason Dale Architects, Denver
2007-8 Danny Foster Studio

Kiel Moe illuminates our understanding and practice of energy in architecture as a technical, formal, social, and political enterprise through the singular contributions of his teaching, research, publication, design practice, and building.

Kiel Moe
OBJECT 6: EDUCATION

UNIVERSITY of HAWAI'I® MĀNOA
School of Architecture

September 10, 2021

Mr. Stephen Spurlock, FAIA, Chair
2022 Jury of Fellows
The American Institute of Architects
1735 New York Ave NW
Washington, DC 20006-5292

Dear Mr. Spurlock:

One dividend of age is the chance to work with former students who have long since become your best teachers. Several lucky educators of my generation share such a teacher in Professor Kiel Moe, whom I am now honored to sponsor for Fellowship. By this time, it might be fair to think we've fully mapped the field of energy in architecture, yet Professor Moe defines whole new regions of thought that change the shape of the problem our profession and the world are increasingly desperate to solve. Take for example the title of his book, *Empire, State & Building.* (2017). The punctuation of the title is no mistake. By means of an ampersand in tandem with a full-stop, Professor Moe restores independent value to all three nouns, redefining the context of the question. From there, he proceeds to align the name of America's most famous skyscraper with two seemingly unrelated threefolds, one from philosophy, the other from ecology: first, Foucault's "three great variables"—territory, communication, and speed; second, Odum's three functions of all ecosystems—intake, transformation, and feedback. Understood molecularly, situated anew in the contemporary discourse on carbon, Professor Moe reveals "latent orders of magnitude of energy and agency [that] become apparent to designers otherwise trained to focus on autonomous objects," fully transcending the Vitruvian mold. The telltale feature of truly novel thinking is its capacity to suspend familiarity so that we can see ordinary things in new ways, as though for the first time. All Professor Moe's teaching, writing, and building meet this essential criterion for the advancement of architectural knowledge.

In addition to *Empire, State & Building.*, Professor Moe is the author of six other influential titles: *Unless: The Construction Ecology of the Seagram Building* (Actar, 2020); *Wood Urbanism* (Actar, 2017); *Insulating Modernism: Isolated and Non-isolated Thermodynamics in Architecture* (Birkhäuser, 2014); *Convergence: An Architectural Agenda for Energy* (Routledge, 2013); *Thermally Active Surfaces in Architecture* (Princeton Architectural Press, 2010); and *Integrated Design in Contemporary Architecture* (Princeton Architectural Press, 2008); and the co-author of three more: *What is Energy & How (Else) Might We Think About It?*, with Sanford Kwinter (Actar, 2020); *Building Systems: Design, Technology and Society* (Routledge, 2012) with Ryan Smith; and *The Hierarchy of Energy in Architecture* (Routledge, 2015), with Ravi Srinivasan. As these books suggest, Professor Moe's writings, in concert with his pedagogy and his impressive (growing) body of award-winning built work, rectify pervasive misconceptions about building behavior, advancing an energy-based design ethic rooted in thermodynamic principles.

Professor Moe is the recipient of the Rome Prize, the AIA Young Architect Award, the Fulbright-Aalto University Distinguished Chair, and the Architecture League of New York Prize, among numerous other national and international honors. Major institutions in architecture have acknowledged his work with their highest accolades, including the AIA Upjohn Research Grant, the ACSA New Faculty Teaching Award, two ACSA Faculty Design Awards, and the ACSA annual "best article" award, based on nominations by the editorial board of the peer-reviewed *Journal of Architectural Education*, for an essay on the Salk Institute that single-handedly expands the critical literature on Louis I. Kahn from form to performance, reframing both biological science and the building science that houses it within the jealous optics of art.

Five years ago, our school invited Kiel Moe to present his built work in a solo exhibition, which he entitled "Our Model of Models, My Model of Models." I can think of no model of architectural thinking more suitable to twenty-first century education and practice than his, and no more appropriate acknowledgement of his signal achievements than well-deserved elevation to Fellowship.

Sincerely,

Daniel S. Friedman, PhD, FAIA
ACSA Distinguished Professor (Dean, 2014–2018)
Member, Jury of Fellows, 2005–2007

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1.0 SUMMARY

Kiel Moe illuminates our understanding and practice of energy in architecture as a technical, formal, social, and political enterprise through the singular contributions of his teaching, research, publication, design practice, and constructions.

The impetus of my work as an educator, author, practicing architect and builder has been an expansion of architecture's understanding of energy. It is my duty and delight to help present and future architects grasp the latent beauty and potential of architecture's energetics, and thus the latent ecological, social and political solidarity of design. This expansion of understanding and practice is the basis of my teaching future architects, presently as the Cass Gilbert Visiting Professor at the University of Minnesota, recently as the Gerald Sheff Professor of Architecture at McGill University, and in previous academic appointments as Associate Professor of Architecture and Energy at the Harvard University Graduate School of Design, and Assistant Professor at the Schools of Architecture at Northeastern University and Syracuse University where I was also a Fellow at the Center for Excellence in Energy and Environmental Systems.

My approach to the energetics of architecture emerges from my long engagement with practice and building. Importantly, however, my passion for understanding energetics in a deep and expansive way has led me beyond extant pedagogies and practices of energy in architecture. First, I use ecosystem science and methodologies to move energy questions and methods far beyond the operational fuel bias that has characterized, and woefully limited, architecture's engagement with energy in the past decades. Researching the broader system ecology of building and urbanization allows me to account more completely for all the energy, material, and carbon emissions associated with building. This treatment of architecture's energetics reveals that about 80% of the terrestrial energy associated with a North American construction is bound to the extraction, production, processing, installation, maintenance, demolition and disposal of building material. Only 20% is attached to operational fuels. This radically shifts the role and purview of energy design for architects.

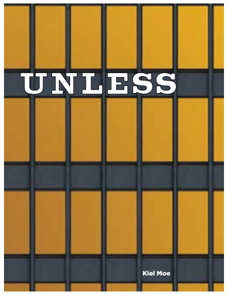
Second, and directly related, by mapping the web of material and flows that support building, the ecosystem method I use also inherently maps the social and political relations that direct and govern those energy-material flows. As such, with this method architects can finally begin to grasp the modes of unequal economic and ecological exchange that are presently inherent to the activity of building but have been externalized by architects.

Visualizing and then radically amending the modes of environmental load displacement, the unequal exchanges, and modes of under-development that are inherent to architecture but, I repeat, outside the purview of traditional practice is absolutely essential to devising more sane ecological and more socially just design practices in architecture. This is a central task of design in this century, one that requires new perspecives, new teaching, and new achievements for architects.

Hereafter, the question of energy is no longer about the efficiency of a building as a performative object, but rather it is about the efficacy of building as world-systems of just ecological, energetic, economic and social exchanges. The energetics of architecture, in my view, is our best pedagogy for learning this key distinction. The ecological, energetic, and material assessment captured by the ecosystem science of building, which in turn leads to a cogent account social, economic, and political account of building together reflects a composite, nexus-based approach that accounts for what all architecture is and does on the thin surface of this planet.

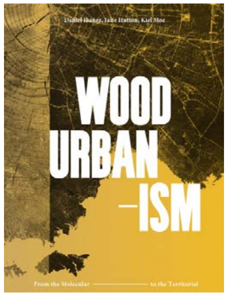
The lessons of this ecological-social approach is the basis of my work as a teacher, researcher, author, and practicing architect. Each of these activities reinforces the other, daily prompting matters of theoretical and practical significance about respective dimensions of my work. For example, my design-build projects demand unique questions about material sourcing and likewise afford approaches to material and energy assemblies not possible in traditional practice. Often, the most routine and basic assumptions of architecture become the site of deep research interrogation in my matrix of architectural activities, leading to novel questions about why build the way we do, why we think about energy the way we do, and the many blindspots therein that merit academic investigation. Accordingly, this focus on the construction ecology of architecture is directly linked to my research as architect, professor and as an author of ten books on architecture. All of this, in turn, becomes manifest in my teaching which brings fresh methods of assessment and fresh methods of design to a new generation of citizen architects equipped to challenge and expand the profession of architecture.

2.0 ACCOMPLISHMENTS



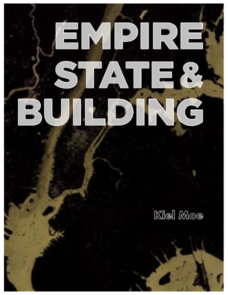
Kiel Moe, ***Unless, The Construction Ecology of the Seagram Building***. Barcelona/New York: Actar, 2020.

A “beautiful” building engendered through the vulgarity of uneven ecological exchanges and chronic processes of socio-economic underdevelopment is no longer a tenable conceit for architecture. These worldy dyanmcis are inherent to building, but abstraced from architecture. As a counterpoint, this book mixes construction ecology, material geography, and world-systems analysis through architecture to help articulate all the terrestrial activities that engender building generally, and more specifically through the example of a most modern of modern architectures: the Seagram Building. This books evokes a broad range of evidence to help explicate the terrestrial activity of this architecture to make design far less abstract and much more literal as a genre of terrestrial activity. Unless architects begin to describe buildings as terrestrial events and artifacts, architects will—to our collective and professional peril—continue to operate outside the key environmental dynamics and key political processes of this century.



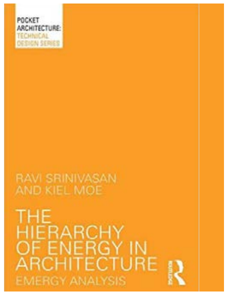
Daniel Ibanez, Jane Hutton, and Kiel Moe, eds., ***Wood Urbanism: From the Molecular to the Territorial***. Barcelona/New York: Actar, 2019.

This book documents recent transscalar design research focused on wood conducted in the Energy, Environments & Design Research lab at Harvard University’s Graduate School of Design. From small-scale thermal properties to large scale forestry, territorial, and carbon cycle issues, wood has latent propensities not well addressed in the current discourse on wood construction. These propensities and implications of wood construction will be presented in this book through a range of design research formats: from testing to in-situ documentation to speculative projects. The aim is to help articulate and illustrate future architectural and ecological potentials of wood.



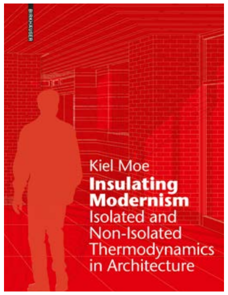
Kiel Moe, ***Empire, State & Building***. Barcelona/New York: Actar (2017).

Empire, State, & Building tracks the building ecology of one building site—that of the Empire State Building—over the last two hundred years of construction. Chapters on the topics of empire, state, and building offer a broader view of building as a central historical process of urbanization. This allows me to make meaningful architectural and ecological comparisons between the construction methods, building typologies, and durations that have occurred on this site: from farm and row houses, to the Waldorf-Astoria Hotel, and finally to the Empire State Building itself.



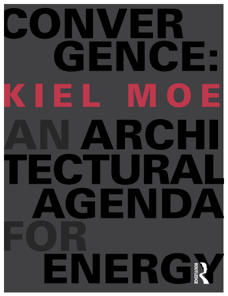
Ravi S. Srinivasan and Kiel Moe, ***The Hierarchy of Energy in Arhcitecture: Emergy Analysis***. London: Routledge (2015).

Co-authored book that provides a clear overview of what energy is and what architects can do with it. Building on the emergy method pioneered by systems ecologist Howard T. Odum, the authors situate the energy practices of architecture within the hierarchies of energy and the thermodynamics of the large, non-equilibrium, non-linear energy systems that drive buildings, cities, the planet and universe.



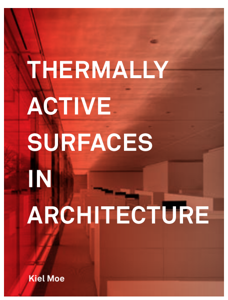
Kiel Moe, ***Insulating Modernism: Isolated and Non-isolated Thermodyanmics in Architecture***. Basel: Birkhauser (2014).

The central thesis in this book is that architects have come to treat buildings as isolated thermodynamic systems even though building and urbanization are constitutively non-isolated energy systems. The conceptual, methodological, political, ecological, and formal implications of this distinction are profound. These implications invert many of our base assumptions about energy. For instance, once understood as a non-isolated system, energy abundance—not fuel scarcity—becomes the central ontological premise of thought and action for energy and architecture. This shifts, radically, the otherwise Calvinist and managerial habits of mind too often associated with energy in architecture. This book focuses on the history of insulation as an alibi to discuss the more fundamental scientific and epistemic roles of isolated and non-isolated systems for architecture.



Kiel Moe, ***Convergence: An Architectural Agenda for Energy***. London: Routledge (2013).

Convergence is based on the thermodynamic premise that architecture should maximize its ecological and architectural power. No matter how paradoxical it might initially seem, architects should maximize energy intake, maximize energy use, and maximize energy feedback and reinforcement. This presumes that the necessary excess of architecture is in fact an architect's greatest asset when it comes to an agenda for energy, not a liability. By drawing on a range of architectural, thermodynamic, and ecological sources as well as illustrated and well-designed case studies, the author shows what architecture stands to gain by simultaneously maximizing the architectural and ecological power of buildings This book reconsiders persistent assumptions about energy, construction, and program to articulate a more ecologically and architecturally ambitious agenda for energy. Convergence offers architects a way to expand their consideration of the total energy flows of a building and its respective environment.



Kiel Moe, ***Thermally Active Surfaces in Architecture.*** New York: Princeton Architectural Press August 2010).

This book is a book on the scientific, material, and design history ofinsulation; but more importantly it is a book on the respective roles of isolated and non-isolated perspectives on energy in architecture. At once technically and culturally explicit, the aim is to peer in to the abyss that separates thermodynamic, architectural, and cultural understandings of energy. By the end of the book, the profound implications of a non-isolated perspective on energy in architecture are articulated through a more thermodynamically accurate, ecological powerful, more culturally relevant, and architectural ambitious perspective on energy in architecture.

Kiel Moe, ***Integrated Design in Contemporary Architecture.*** New York: Princeton Architectural Press (2008).

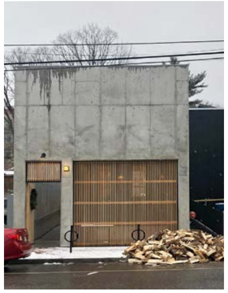
The emerging practice of integrated design provides the strategies to achieve high performance, low energy, and cost-effectiveness, through careful ground-up consideration of how the program, siting, design, materials, systems, and products of a building connect, interact, and affect one another. This approach eschews specialists working in isolation in favor of solutions that are greater than the sum of their parts. *Integrated Design in Contemporary Architecture* takes a comprehensive look at projects that exemplify current approaches to this exciting new field. From museums to residences, from office buildings to universities and yoga centers, this book showcases twenty-eight examples of integrated design that cut across building types, budgets, climates, and locales. Drawings, diagrams, and photographs illustrate how the many disciplines involved in the building process work together to create sustainable spaces that acknowledge architecture's critical role in our shared global community, economy, and ecosystem.

Stack House (Mountain Chapel)
Kiel Moe with and for Ron Mason, FAIA
Granite, Colorado
2008

This design-build project is one of nine projects built at the Georgia Bar, in the high country of Colorado. The proejct uses solid 6x8 Endleman spruce timbers from beetle-kill forests in central Colorado. The project maximizes the use of timber in both quantity and funcitons: the timbers comprise the structure, enclosure, finish materials, and achieves thermally what other architects do with layers of insluation and other products. The role of the thermall diffusivity and effusivity of wood is critical to how the timber structure actaulyl behaves thermally. The maximal use of wood has important carbon implications as well.

Long House
Kiel Moe, AIA
Halifax, Vermont
2015

This project is another solid timber design-build project tied directly to my research on timber architecture, this time Eastern White Pine form local forests and mills. The long house establishes an clear edge to the northern edge of a large forest meadow, thus capturing southern light and heat gains. The stacked timbers walls are reinforced, in this case, by the floor-to-ceiling window frames that tie the structure together and stiffen the walls. The plan typology is a dog-trot, a design that captures and concentrates breezes in the exterior dog-trot deck space. The Long House is complimented by an authentic solid cedar Finnish forest sauna. As a design-source-build project, this building reflects well many aspects of my research, now applied in a built context. This includes the focused research on Finnish sauna architecture while serving as a Fulbright Distinguihsed Chair in Helsinki.



Bath House
Kiel Moe, AIA w/ Decentralized Design Lab
Portland, Maine
2020

This urban bath house/sauna is located in downtown Portland, Maine finished construction in September 2020. Located on a constrained site, with an equally constrianed budget, the architecture organizes a range of thermal experiences around the motive force of an authentic Finnish masonry stove, or *kivaus*. A key part of the matrix of thermal textures experienced in the architecture, the building's wraps around an outdoor courtyard and its warm and cold dipping pools. Together, these spaces and sequences provide a temperature range from zero in the Maine winter to 212°F, the proper temperature for a Finnish sauna. As a social condenser, the locker room-sauna-lounge-outdoor space sequence is organized such that two seperate groups (distinct genders, orientations, identifications) can either remain seperarte or enjoy mixed sauna exoeriences.

Horizon House
Kiel Moe, AIA, adviser for Harvard GSD student project team
Hookido, Japan
2008

First Prize Winner of the
3rd LIXIL International University Architectural Competition

Horizon House was conceived as a process for embracing local and seasonal qualities of place, providing a 360 degree view to the landscape, and reflecting an expanded understanding of ecological boundaries. Sourcing, lifespan, and energy implications of construction materials were incorporated by using salvaged or locally harvested wood products, even in the foundations system, reducing to a minimum embodied carbon impacts. In Horizon House the thermal experience of the inhabitant is linked to the surface of the floor, which provide both radiative heating and cooling using a wood stove in winter and underground pipe and thermal mass storage in summer.

Student Team: Carlos Cerezo Davila, Matthew Conway, Robert Daurio, Ana Garcia Puyol, Mariano Gomez, Natsuma Imai, Takuya Iwamura, and Thomas Sherman

In recognition of his design and research regarding the energetics of architecture, the nominee was awarded a $19.1m CFI grant, the 2017-2019 **Mellon Foundation/Canadian Center for Architecture** Project on Environmental Histories of Architecture, the 2016 **Fulbright Distinguished Chair** in Helsinki, Finland, the 2010 **Rome Prize in Architecture**, and three **Fellowships at the MacDowell Colony** in 2012, 2014 and 2016.

In recognition of his teaching, he was awarded the 2010 **ACSA/AIAS New Faculty Teaching Award** and has been appointed faculty positions at top schools of architecture across the country.

In recognition of his directly-related design practice, he received the 2013 **Boston Design Biennial Award**, the 2011 **Architecture League of New York Prize**, the 2011 **AIA National Young Architect Award**, and numerous design awards for individual projects from the AIA, the American Collegiate Schools of Architecture North American Wood Design Awards, and Boston Society of Architects, among others.

FInally, he is recipient of research funding from the **Canadian Center for Architecture/Mellon Foundation, David Rockefeller Center for Latin American Studies, the Softwood Lumber Board**, the **AIA Upjohn** grant program, the **AIA RFP** grant program, the **Boston Society of Architects Architectural Research Program**, Junior Faculty research grants at the **Harvard Graduate School of Design** and the Northeastern University Provost Faculty Development program.

An abridged list of these and other awards:

2020 Canadian Foundation for Innovation Program
"BARN" Research Facility proposal
Award value: $19,100,000 CAD [fully funded]

2017 Canadian Center for Architecture Project on
Environmental Histories of Architecture

2016 Fulbright Distinguished Chair
Aalto University, Helsinki, Finland

2016 Fellow, MacDowell Colony for the Arts

2015 Arctic Circle Residency: Summer Expedition

2014 Fellow, MacDowell Colony for the Arts

2014 Visiting Artist, American Academy in Rome

2013 Boston Design Biennial winner

2012 Barbara and Andrew Senchak Fellowship,
The MacDowell Colony for the Arts

2011 Architecture League of New York
Young Architect's Prize

2011 AIA National Young Architects Award

2010 American Academy in Rome:
Gorham P. Stevens Rome Prize

2010 Virginia Design Medal

2010 American Collegiate Schools of Architecture
National Design Awards
Mountain Chapel

2009 North American Wood Council Honor Award
Mountain Chapel

2009 AIA Colorado Design Honor Award
Mountain Chapel

2009 AIA Denver Design Merit Award
Mountain Chapel

2009 Metropolis NEXT-GENERATION competition:
Energy use in the 21st Century

2009 American Collegiate Schools of Architecture
National Design Awards
Tubehouse

2007 Boston Society of Architects Design Award
Benning Box project

2006 AIA Committee on the Environment Competition
Honorable Mentio for "Fieldhouse"

2006 American Institute of Architects Denver:
Tubehouse Architect's Choice Award

2005 AIA Western Mountain Design Merit Award:
Tubehouse

2005 AIA Colorado Design Honor Award Tubehouse

2005 AIA Denver Design Merit Award Tubehouse

2004 (with WW Architects) PA Awards:
Progressive Architecture Citation
San Jose State University Art Museum

2003 SOM Foundation: Chicago Institute for Architecture
and Urbanism Competition 1st Prize

2003 (with WW Architects) San Jose State University
Museum of Art and Design Competition 1st Prize

2002 Chicago Athenaeum: American Architecture Award
The River Tower and Studio

2002 AIA Western Mountain Region Design Merit Award
The River Tower and Studio

2002 AIA Colorado Design Honor Award
The River Tower and Studio

2002 North American Wood Council Design Honor Award
The River Tower and Studio

2002 University of Virginia School of Architecture
Design Merit Certificate.

2001 University of Cincinnati School of Architecture
AIA Henry Adams Medal: Highest GPA

2001 University of Cincinnati School of Architecture
Thesis Prize Award: "Best in Show" Design award

2001 University of Cincinnati School of Architecture
Alpha Rho Chi Medal

1999 AIA Colorado Design Honor Award
The River Tower

Invited national and international lectures reflect another important form of recognition and an importnant dimension ofthe nominee's contirbutions to archietcture. *An abridged list*:

2021	Yale University, fall
	Parsons School of Design, Fall
	University of Cincinnati, Fall
	Skyscraper Museum, summer
	Cal Poly San Luis Obispo, Architecture, spring
2020	Washington State University
	University of Idaho School of Architecture
2019	Auburn University Rural Studio
	Architecture League of New York
	AIA Colorado Design + Practice conference
	Wentworth Institute of Technology
	Ryerson School of Architecture, spring
2018	CUNY Spitzer School of Architecture, fall
	Canadian Center for Architecture, fall
	Canadian Center for Architecture, summer
2017	Princeton University
	Torcuato Di Tella University, Buenos Aires
	Columbia University, GSAPP spring
	University of Virginia,
	Virginia Tech University
	Tulane University
	Vienna School of Applied Arts
	Aalto University, Helsinki, Finland
2016	Pontifical Catholic University of Chile
	Yale University
	Illinois Institute of Technology
	University of Hawaii
	Arizona State University
	Harvard University Center for the Environment
	Woodbury School of Architecture
	Princeton University
	The Ohio State University
	ACSA National Conference
2015	University of Tennessee
	University of Idaho
	University of Virginia
	Cal Poly San Luis Obispo
	Louisiana State University
2014	Harvard Graduate School of Design PhD
	Massachusetts Institute of Technology
	Harvard Graduate School of Design DDes
	Louisiana State University
	University of Washington
	Princeton University
	University of Milwaukee
	CUNY
	Yale School of Architecture,
	Harvard Center for the Environment
2013	ACSA National Conference
	University of Michigan
	University of Maryland
	University of Hawaii
	Boston Architectural College
2012	Columbia University GSAAP
	University of Tennessee, Knoxville
	Wentworth Institute of Technology
	Architecture Boston, ABX
	SMARTGEOMETRY, Troy, NY
	Universidade de Coimbra, Portugal, summer
	University of Pennsylvania
	New Jersey Institute of Technology
	Iowa State University
	ACSA National Conference
2011	Harvard University Material Systems
	ACSA National Conference
2010	University of Idaho School of Architecture
	Auburn University School of Architecture
	ACSA National Conference
2009	CIP TALKS, Zagreb, Croatia, fall
	Berlage Institute
	Rhode Island School of Design in Rome
	New England Society of Architectural Historians
	Boston Society of Architects
	Architecture League of New York
	Urban Center Books, New York City
	ACSA National Conference
2008	Northeastern University
	ACSA National Conference
	Massachusetts Institute of Technology
2007	University of Cincinnati
	ACSA National Conference
2007	University of Illinois, Chicago
	ACSA/AIA Cranbrook Teachers Conference
	ACSA National Conference
2006	AIA Integrated Practices Forum, Oak Park, IL.
	ACSA National Conference
2005	University of Cincinnati
2004	University of Illinois, Chicago

The nominee has published **ten books on architecture** and **dozens of contributions to other books, journals, and conference proceedings**. The range of topics span from the ecosystem science basis of architecture, to history of insulation in modern architecture, to a ongoing, mulit-volume material and energetics accounting of archietcture in the last two hundred years through the detailed assesment of a series of iconinc buildings in Manhattan as indicators of how the material, energetic and ecological basis of architecture as evolved.

These publicaitons are important dimension of knowledge sharing that aims to shift percpetions and practices of energy in this century. This century demands, on one hand, a much more scientifically expclict grasp of energy and energetics as well as a more socially and politically coherent grasp of the implications of building as a planetary activity. The importance and breadth of these concerns require book-length treatments, often distilled into more readily-accesible accounts in journals and other publicaiton venues.

Books

- *Unless, The Construction Ecology of the Seagram Building* (in press).Barcelona/New York: Actar (in press, 2020).
- with Sanford Kwinter, *What is Energy & How (Else) Might We Think About It?* Barcelona/New York: Actar (in press, 2020).
- with Daniel Ibanez, Jane Hutton, eds., *Wood Urbanism: From the Molecular to the Territorial.* Barcelona/New York: Actar, 2019.
- *Empire, State & Building*. Barcelona/New York: Actar, 2017.
- with Ravi S. Srinivasan and Kiel Moe, T*he Hierarchy of Energy in Architecture: Emergy Analysi*s. London: Routledge, 2015.
- *Insulating Modernism: Isolated and Non-Isolated Thermodynamics in Architecture*. Basel: Birkhauser 2014.
- *Convergence: Architectural Agenda for Energy*. London: Routledge. 2013.
- with Ryan Smith,eds. *Building Systems: Technology, Design, & Society*. London: Routledge. 2012
- *Thermally Active Surfaces in Architecture*. New York: Princeton Architectural Press. 2010.
- *Integrated Design in Contemporary Architecture*. New York: Princeton Architectural Press. 2008

Contributions To Books

- "Error from the Air", in Beneytez-Duran, Rafael ed., Airscapes, Actar. 2019.
- "Equipment as Environment", Architecture for/of the Environment, Canadian Center for Architecture. 2019.
- "Think like the Forest: Maximizing the Environmental Impact and Energetics of Timber Building", in Markus Hudert, ed., Rethinking Wood, 2019.
- "Broken World Thinking," Pamphlet Architecture 36: "Buoyant Clarity", Christopher Meyer, Danie Hemmendinger, and Shawna Meyer, ed., New York: Princeton Architectural Press, 2017.
- "Not-Zero Energy," Embodied Energy, David Benjamin, ed., Columbia Books on Architecture and the City, 2017.
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Kiel Moe "Stackhouse," PRAXIS 13: Eco-Logics

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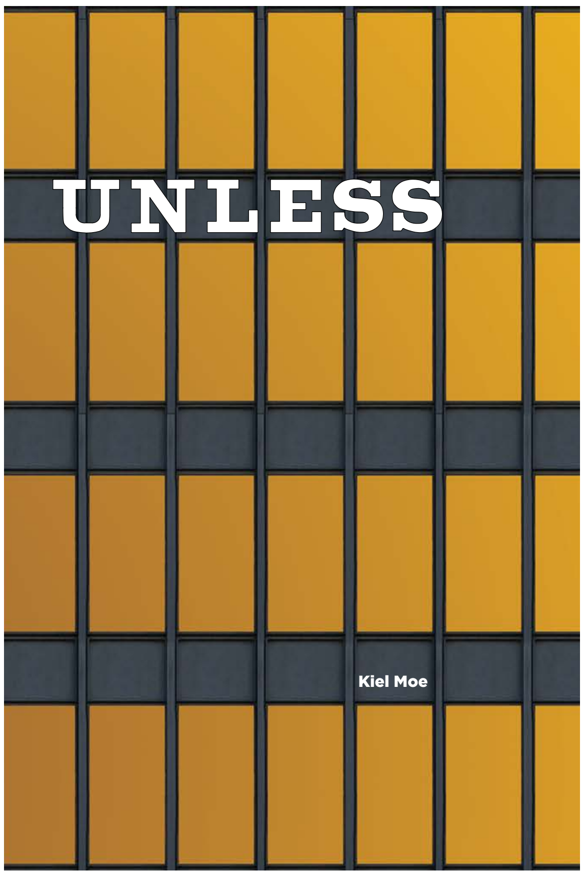
Kiel Moe, ***Unless: The Construction Ecology of the Seagram Building.*** Barcelona/New York: Actar (fall 2020).
[single author book publication]

This book presents a terrestrial description of the Seagram Building. It doing so, it aims to describe how humans and nature interact with the thin crust of the planet through architecture. Architecture reorganizes nature and society in particular ways that today demand overt attention and new methods of description. In particular, the immense material, energy and labor involved in building require a fresh interpretation that better situates the ecological and social potential of design. Given the environmental, social, and political realities that confront us in the storms of this century, we need alternative descriptions of building and architecture as terrestrial activities that help us imagine how to maximize the impact of architecture on its environment in the most positive, generative and architectural ways possible. Architects increasingly need to do so in ways that constantly evince the inherent solidarity and reciprocity of people, places and politics involved in building architecture. The environmental and social conditions of this century suggest a much more recursive description of architecture and its engenderment. I argue that the enhancement of a particular building should be inextricable from the enhancement of its world-system and construction ecology. A “beautiful” building engendered through the vulgarity of uneven exchanges and processes of underdevelopment is no longer a tenable conceit in such a framework.
To this end, the book mixes construction ecology, material geography, and world-systems analysis through architecture to help articulate all the terrestrial activities that engender building generally, and more specifically through the example of a most modern of modern architectures: the Seagram Building. This books evokes a broad range of evidence to help explicate the terrestrial activity of this architecture to make design far less abstract and much more literal as a genre of terrestrial activity. Unless architects begin to describe buildings as terrestrial events and artifacts, architects will—to our collective and professional peril—continue to operate outside the key environmental dynamics and key political processes of this century.



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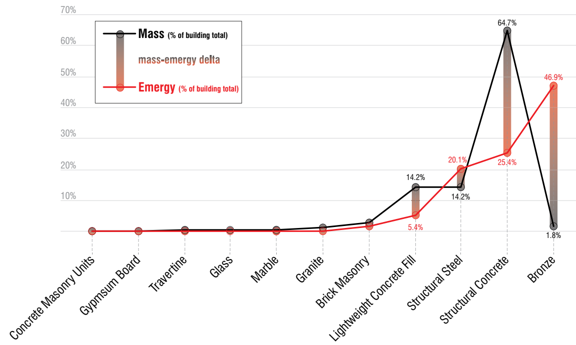
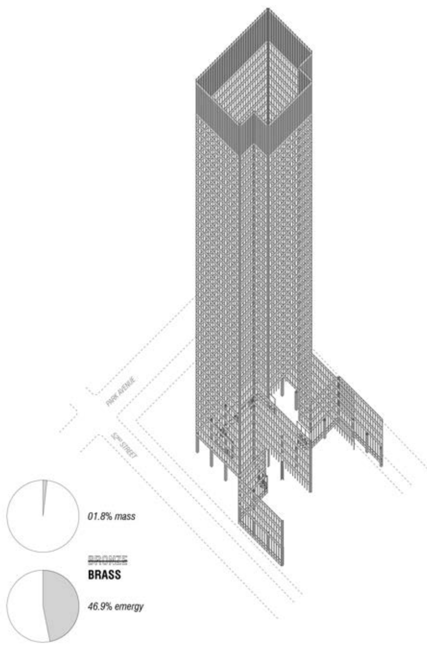
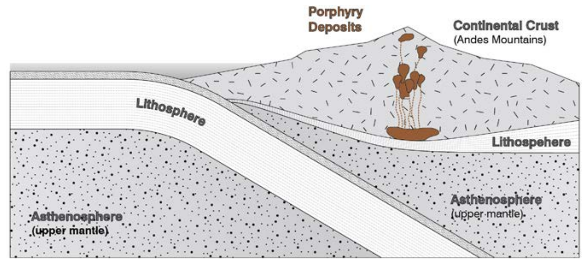
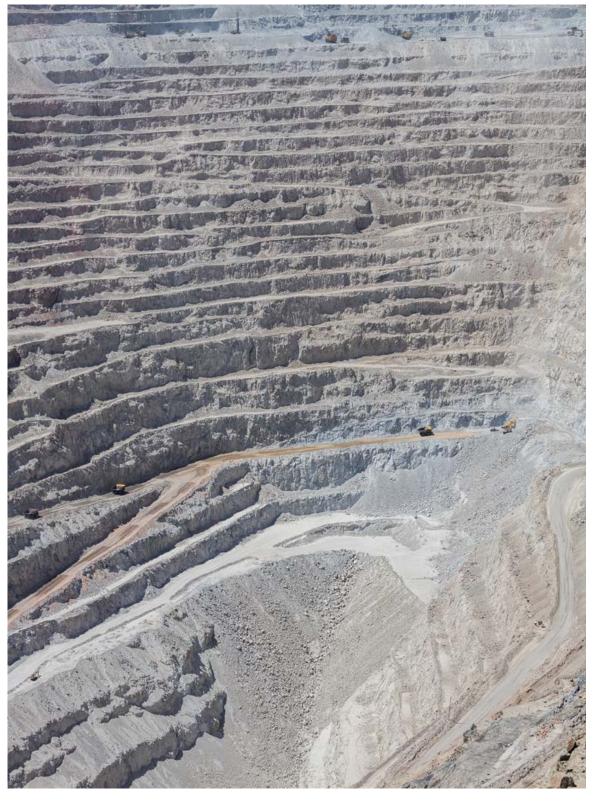


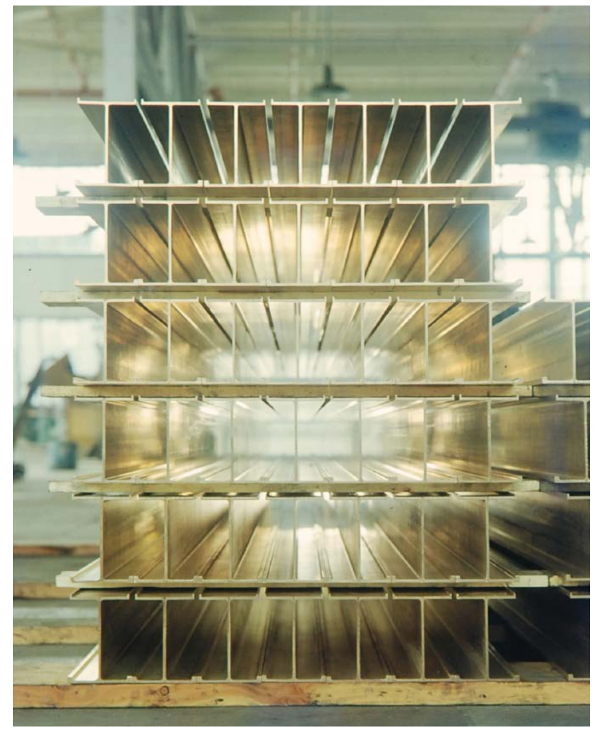


A highly detailed model of every material component in the Seagram Building is the basis of a ecosystem science accounting of the building. In this case, the "bronze" facade (actually brass material) accounts for 49% of the building's construciton energy, but only amounts to 1% of its mass. This striking ratio of energy to mass triggers a deep analysis of its production.



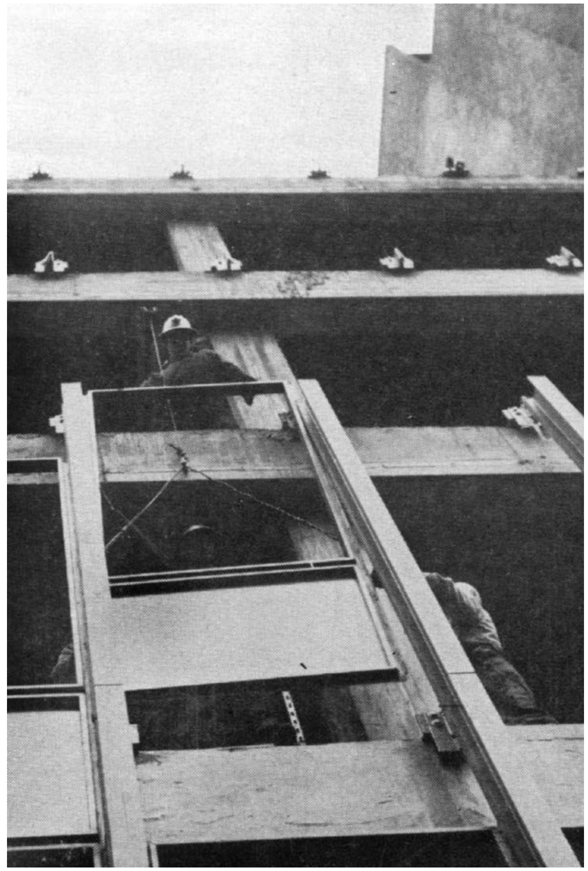


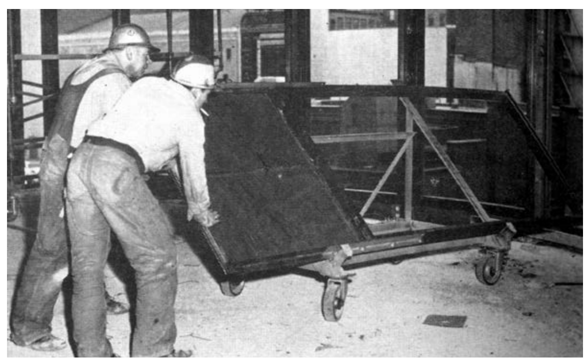
All archietcture is geological before it is anything else. Much of the copper for the brass material of the Seagram Building was mined in the largest hole ever dug by humans, the Chuquicamata mine in Chile. The Argentinian activist famously visited the Chuquicamata mine in the years after the Seagram mining, documenting and protesting the labor and living conditions of miners in this town.



The brass for the Seagram Building "bronze" facade was processed mainly in the west side of Chicago, in Cicero. Immigrant labor hand-tapped each brass extrusion straight, evidence of the highly handcrafted, non-standardized approach to construction.

The brass components from the midwest were assembled and tested at General Bronze in Long Island City, NY. Here the brass was stained to look like bronze, the first of annual oil treatments to maintain the appearance of bronze.





The brass envelope is installed, as per conventional accounts of the building. Although Mies would suggest that "God is in the details", the research for this book suggests that "Gaia is in the details of the details" of the building.

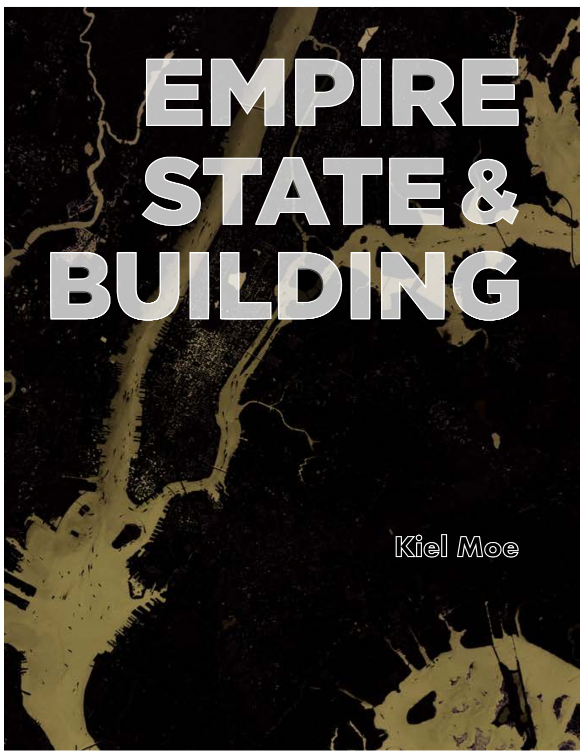
The maintenance of the brass facade, to maintain its bronze appearance, requires an individual to hand rub every square inch of the exterior envelope.

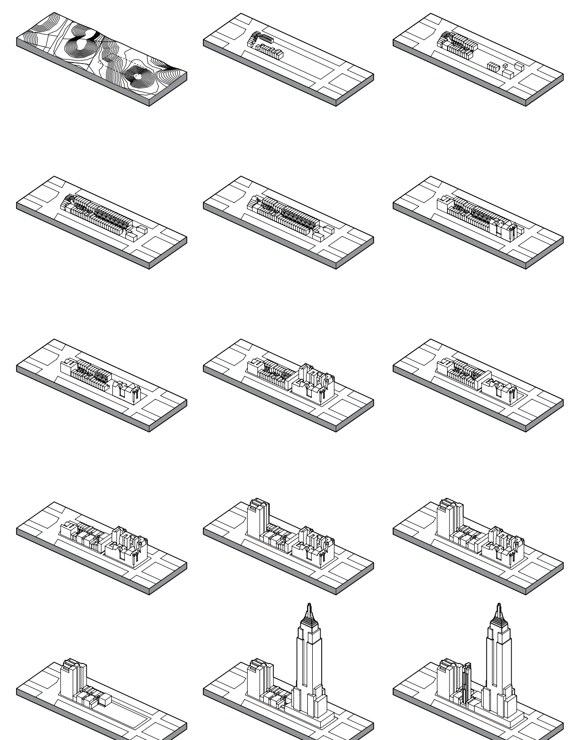
Kiel Moe, ***Empire, State & Building.*** Barcelona/New York: Actar (2017).
[single author book publication]

Whence the accumulation of raw matter and energy of building in New York City?

Through three respective chapters on the topics of empire, state and building, this book considers the material basis of building in terms of the energetics of urbanization. The otherwise externalized material geographies and thermodynamics of building's material basis reveal much about the dynamics and efficacy of how we build; about what does, and what could, support life today. This book plots the material history and geography for one plot of land in Manhattan—the parcel of land under the Empire State Building—over the past two hundred years. Through rich illustrations, it tracks all the building material that has passed through this parcel to better understand building's geographic and ecological dynamics: spatially (in terms of their geographic material footprints and industrial processes) and quantitatively (in terms of embodied energy, embodied carbon, and emergy flow). In successive chapters, the book articulates the empire and states that are inherent to building, but remain unconsidered by architects and urbanists.

The book has three primary chapters. First on the topic of how every building is an empire, an often unwittingly specified geography of material, energy, and labor. The second chapter focuses on the unusually apt term,"State", as both a political description of the geographic empire inherent to building, but also as thermodynamic term that refers to the ecosystemic quantities and qualities of the overall empire of building. This chapter features a comphrensive construction ecology of the Empire State Building site since 1799. After framing the first two chapters as such, the third chapter, "Building", places the extraction, processiing, transportation, production, assembley, disassmebly and refuse of building in a larger context.





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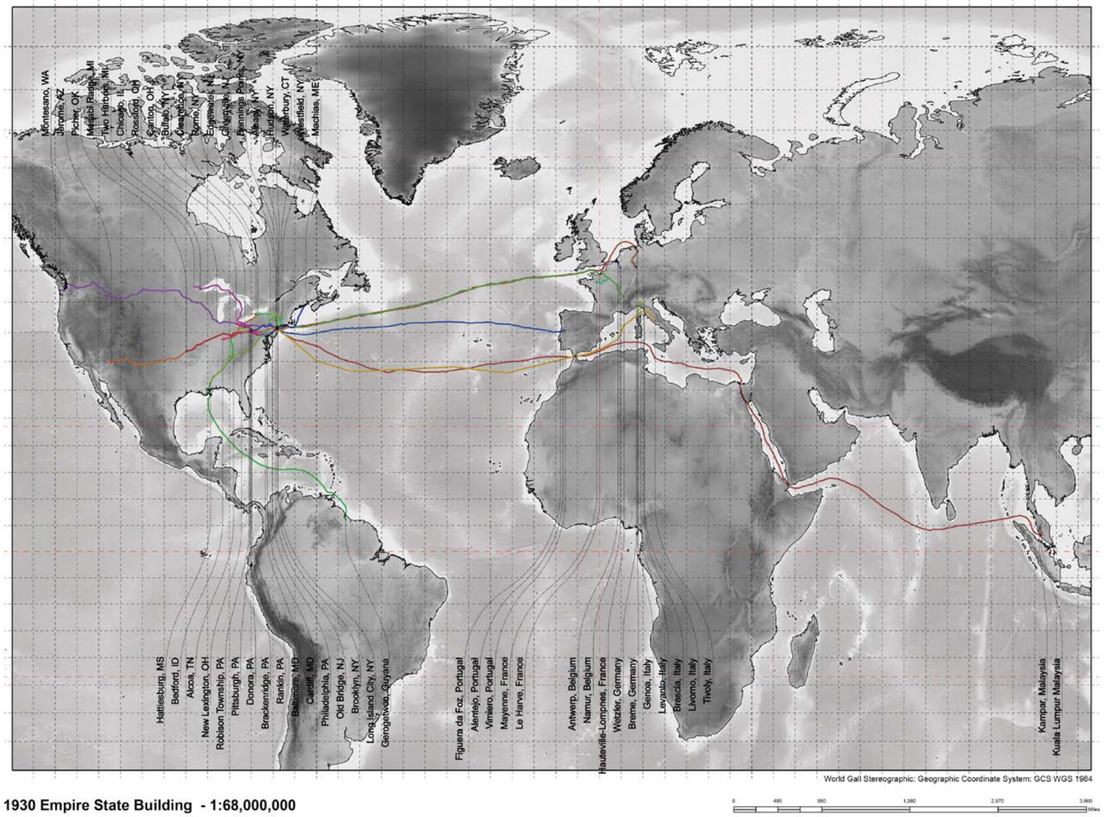
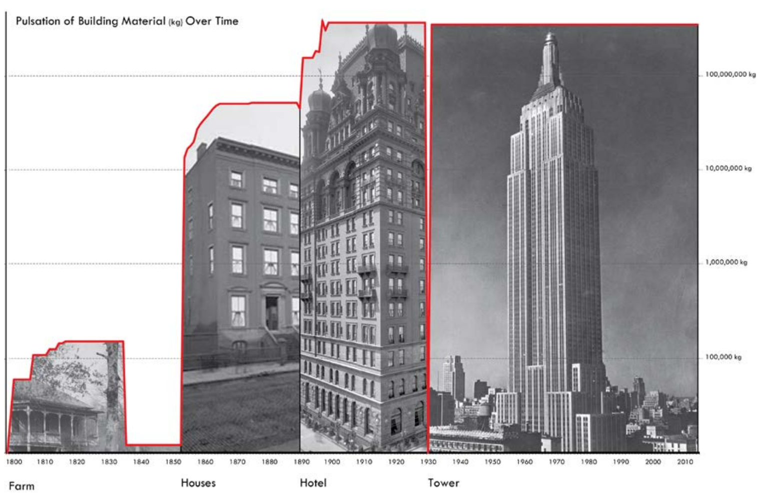


1930 Empire State Building - 1:68,000,000

In this book, the empire, states, and building of single site in Manhattan are mapped, measured, quanitified, molded, and assessed as a construction ecology of three centuries.



Emergy required for buildings	Phase	Material (kg)	Emergy (sej)	Years	Sej/year
Solar energy required (directly and indirectly)	1799-1850 Thomson's House	152,817	2.65957E+17	50	5.31914E+15
to obtain a product; Global cost of production:	1850-1892 Houses	51,887,253	1.2499E+20	42	2.97594E+18
the convergence of space, time and energy	1892-1930 Waldorf Astoria	379,867,823	9.71873E+20	35	2.77678E+19
required for production	1930 Empire State Building	362,054,708	1.66369E+21	85	1.95728E+19

Exergy density of people in buildings	Phase	Number of People	Metabolic Energy	Years	Total Exergy
Energy that can be obtained when a system is	1799-1850 Thomson's House	6	3.82E+09	35	8.02E+19
brought to the thermodynamic equilibrium;	1850-1892 Houses	292	3.82E+09	40	4.46E+21
Distance from equilibrium; level of organization,	1892-1930 Waldorf Astoria	3000	3.82E+09	35	4.01E+22
structure and information	1930 Empire State Building	20000	3.82E+09	85	6.49E+23

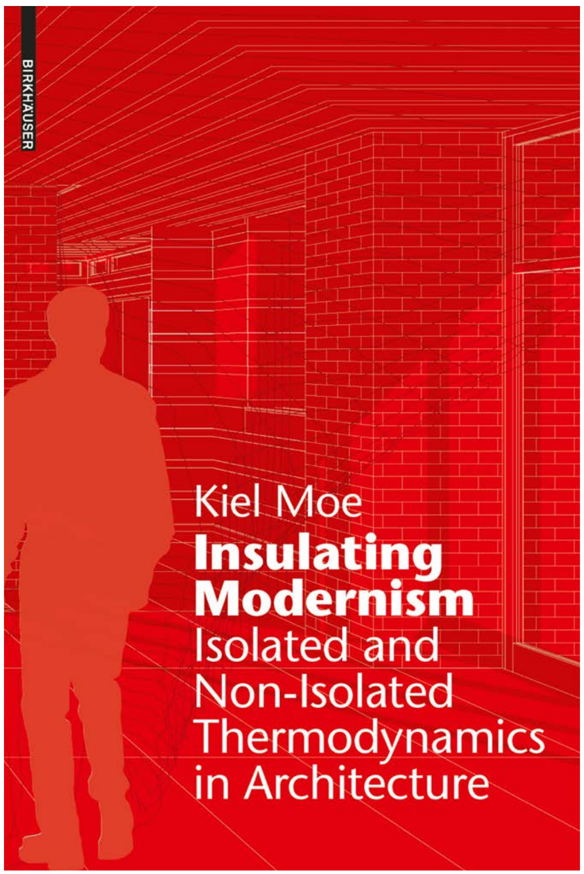
Emergy/Exergy Ratio	Phase	Emergy/Exergy ratio
Cost of production of a unit exergy; the	1799-1850 Thomson's House	0.000066
reciprocal of the efficiency of a system in	1850-1892 Houses	0.000667
converting the energy cost of available inputs in	1892-1930 Waldorf Astoria	0.000692
actual organization	1930 Empire State Building	0.000030

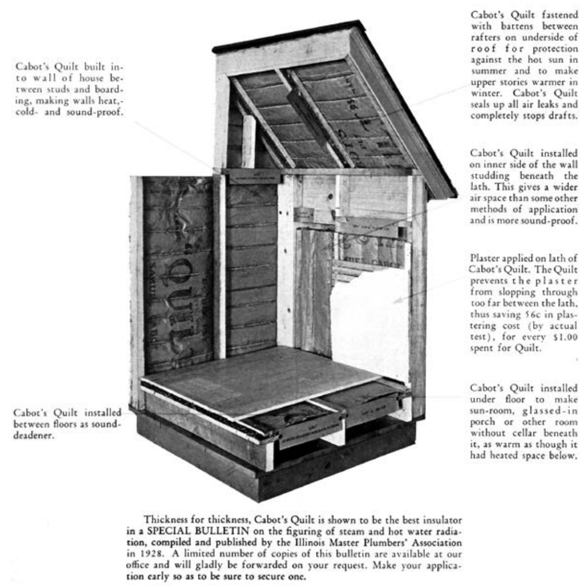
Kiel Moe, ***Insulating Modernism: Isolated and Non-isolated Thermodynamics in Architecture.*** Basel: Birkhauser (2014).
[single author book publication]

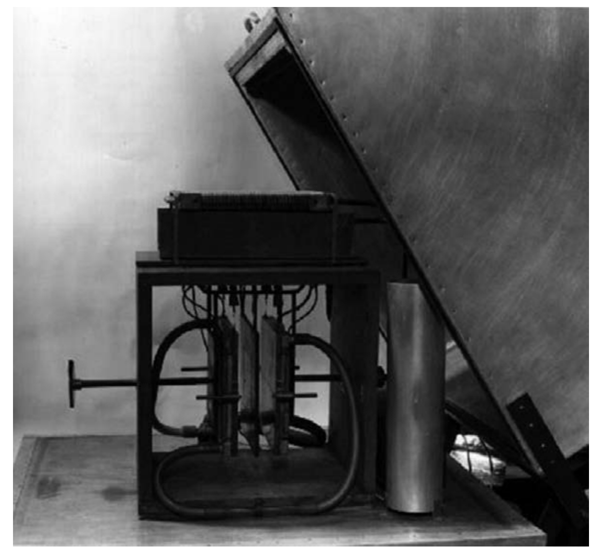
No other concept has disturbed and disfigured our understanding of energy more than the seemingly innocent idea of isolation. Further, no other material practice in architecture has systemically reinforced this errant idea than insulation. In too many cases, architects and engineers treat buildings as increasingly "efficient" isolated systems without any regard for the larger energy hierarchies of a building. This is the exact opposite of how architects should engage energy.

This book is a history of a most common material/energy practice in architecture: heat transfer and insulation. But this history aims for decidedly uncommon futures for architecture: fulfilling the potential of non-isolated thermodynamics in architecture. Much more than walls was insulated in modernity: in the course of modernity, insulation became a highly active physical, conceptual, and historical agent in the determinant habits of twentieth century architectural design and its associated construction practices.

Non-isolated, non-equilibrium thermodynamics drive every building, city, and form of life. Their understanding helps architects grasp centuries-old thermodynamic concepts that position designers to finally capture, channel, intercept, store, accelerate, and modulate the total energetic dissipation of building through design.







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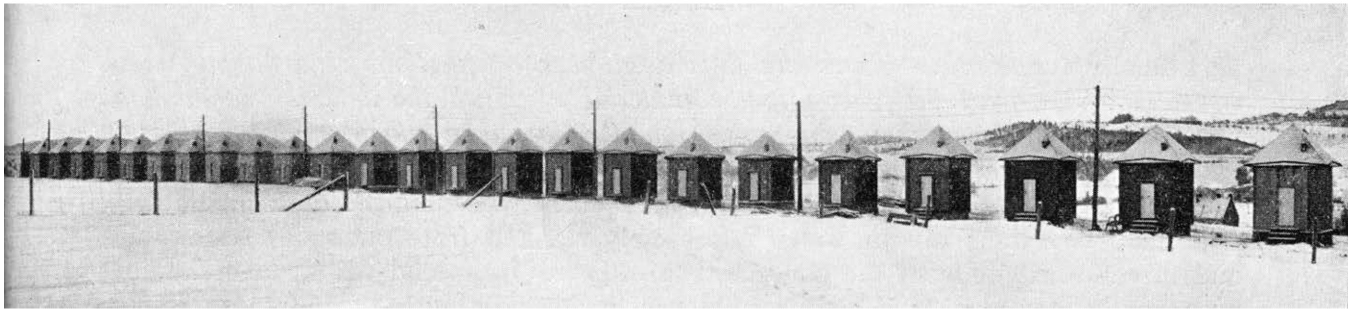
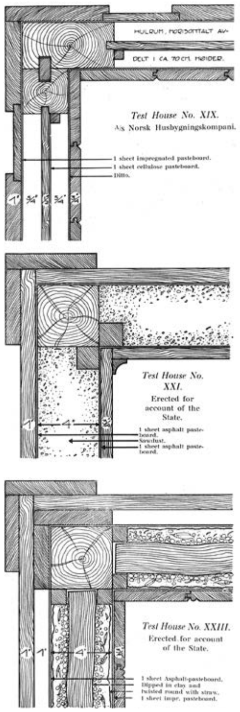
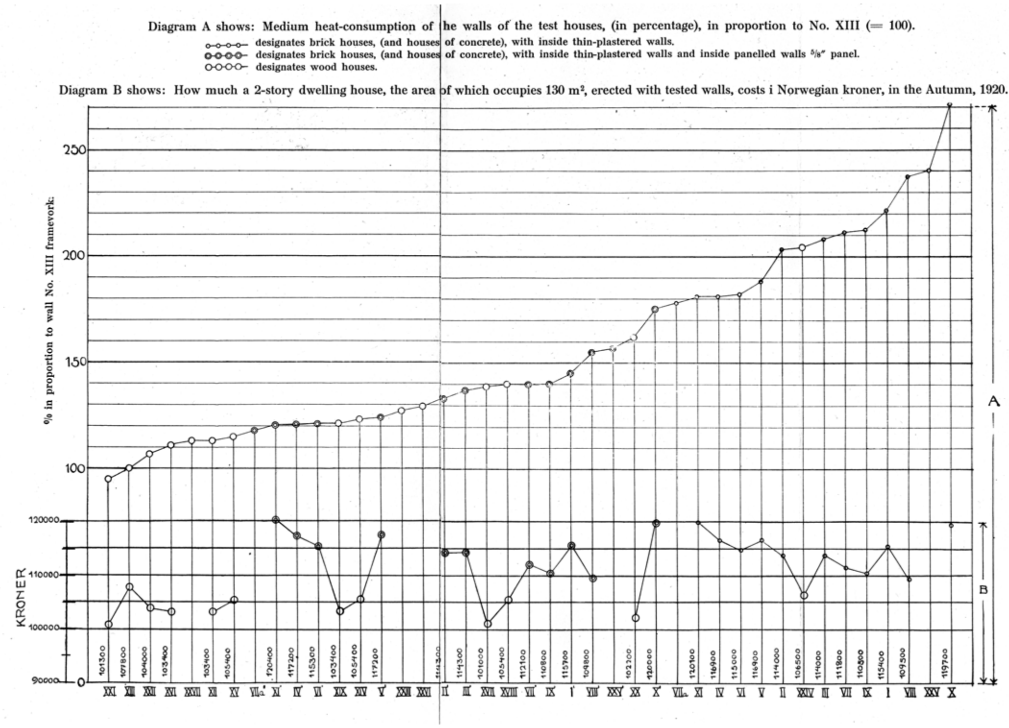
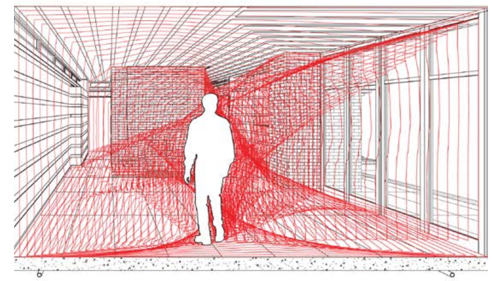
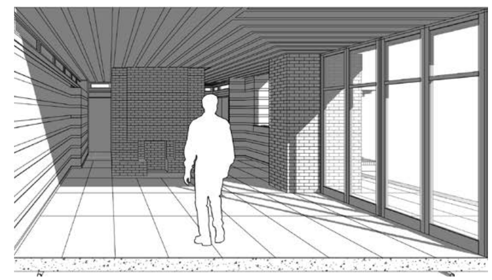
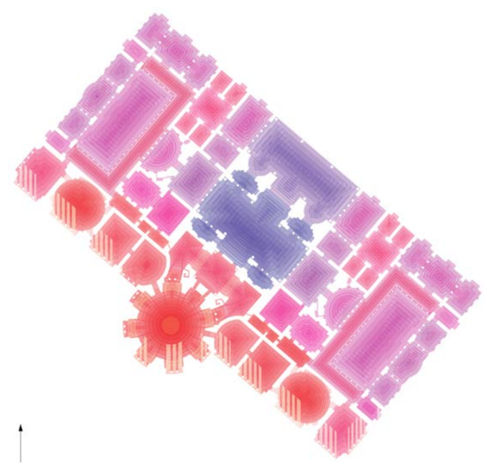












The history of insulation science, practices, materials, and pedagogies are tracked in its North American, and very diffferent European context. The histories help explain why we build the way we do, why we think about energy in the limited way that we do, and what alternatives emerge from, in strict scientific sense, a non-isolated description of architecture and energetic system.

From the sublime energetics of the baths of Caracalla in Rome, to Frank Lloyd Wright's Usonian houseds, to astoundingly coherent and beautiful early-twentieth century studies on energetics in northern Norway, the book collects a range of evidence to describe the reality and potential of a non-isolated descriptuion of architecture's energetics.

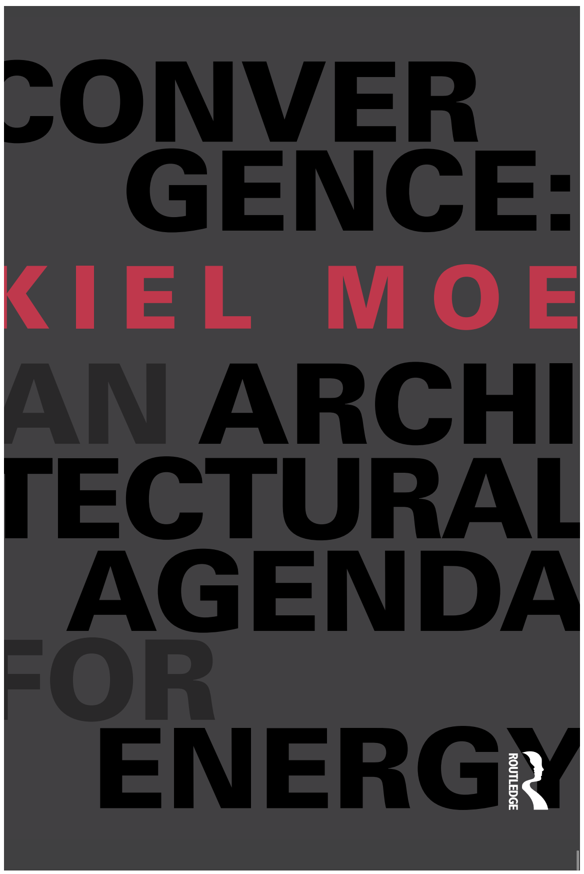
Kiel Moe, ***Convergence: An Architectural Agenda for Energy.*** London: Routledge (2013).
[single author book publication]

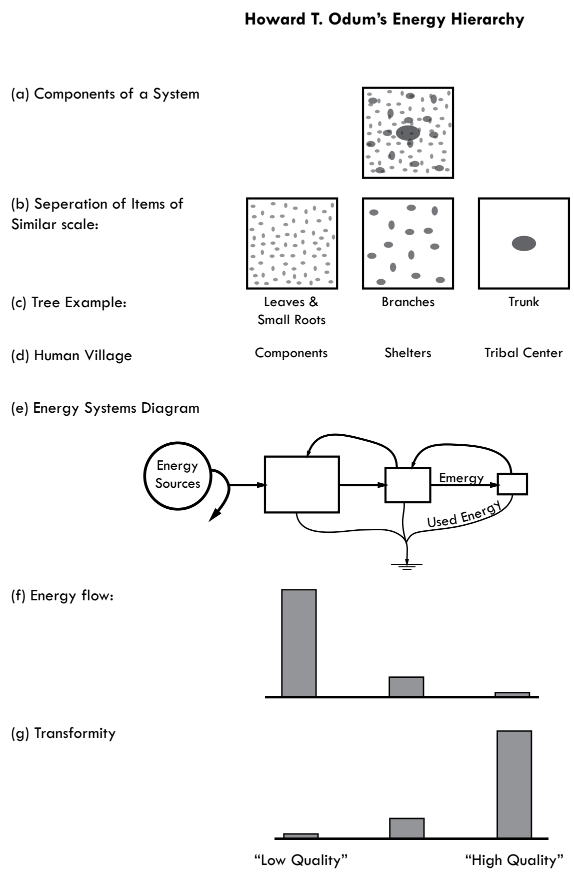
Convergence is based on the thermodynamic premise that architecture should maximize its ecological and architectural power. No matter how paradoxical it might initially seem, architects should maximize energy intake, maximize energy use, and maximize energy feedback and reinforcement. This presumes that the necessary excess of architecture is in fact an architect's greatest asset when it comes to an agenda for energy, not a liability. But how do we start to understand the full range of eco-thermodynamic principles which need to be engaged with in order to achieve this?

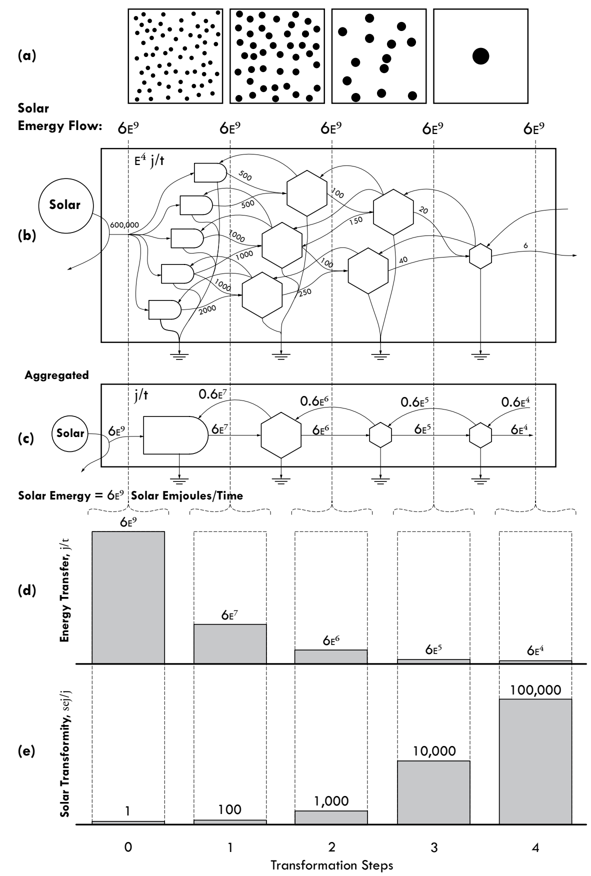
This book explicates three factors: materials, energy systems and ecological amortization. When these three factors converge through design, the resulting buildings begin to perform in complex, if not subtle, ways.

By drawing on a range of architectural, thermodynamic, and ecological sources as well as illustrated and well-designed case studies, the author shows what architecture stands to gain by simultaneously maximizing the architectural and ecological power of buildings This book reconsiders persistent assumptions about energy, construction, and program to articulate a more ecologically and architecturally ambitious agenda for energy. Convergence offers architects a way to expand their consideration of the total energy flows of a building and its respective environment.

When matter is understood as but captured energy, the transformations and convergence of a building's entire energy flow prompts new forms of agency for design and is necessary for an architectural agenda for energy. An architectural agenda for energy suggests that architects would merge the highly additive layers and systems of contemporary construction into a more monolithic and ecologically powerful approach to construction. This convergence of structural, mechanical, and enclosure systems reflects a lower-technology yet higher-performance paradigm that engenders greater knowledge of construction, its metabolism and greater durability.







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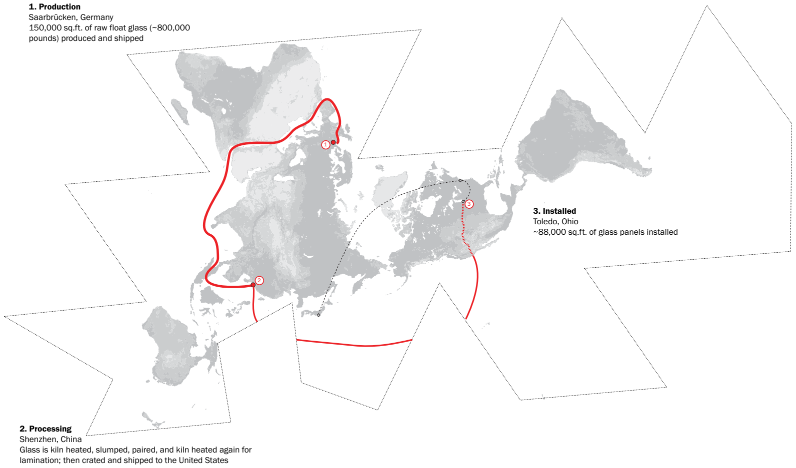
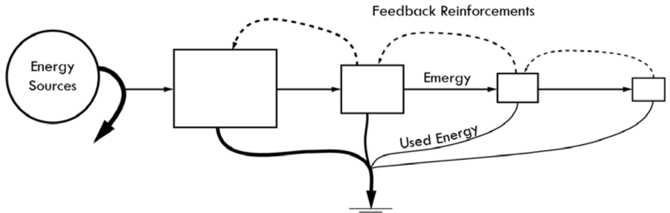
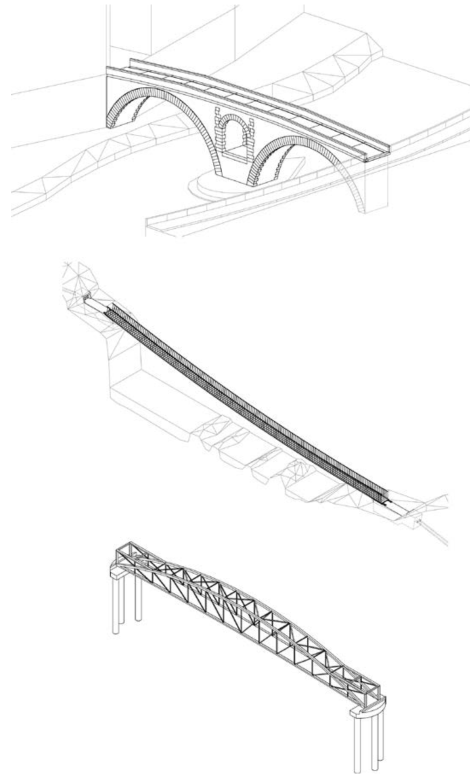
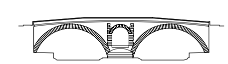




The principles of systems ecology (also known as the thermodyanmcis of large-scale, complex systems such as architecture) are introduced to architects in this book. It tracks how materials and energy converenge, by design, into a building through the large planetary process of building. The energetics of these global processes are critical to architcture's actual ecological efficacy, though these larger energetics have been routienly excluded from practice and research, inexplicably in favor of the operational fuel dyanmics of building as a performative object rather than as planetary process. With a systems ecology accounting, 80% of the energetics of building is the production and assmebly of materials, and only 20% is attached to operational fuel dyanmics. This is good news for architects, who traditionally understand materials better than energy. However, it poses radically different responsibilities for material design.



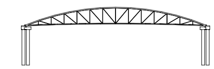


Ponte Fabricius*

	embodied energy (MJ/m³)	material volume (m³)	Total Embodied Energy (MJ)
Travertine	1,890	376	710,205
Pepperino	1,890	1,419	2,682,553
Brick	5,170	129	667,964
Paving stones	1,890	39	72,841
			4,133,563

*For the purposes of this comparison, the Ponte Fabricius calculation uses contemporary embodied energy values for its materials. Because the bridge was built with archaic methods, its actual embodied energy values would be significantly less.

Embodied Energy per generation served:
4,133,563 MJ/ 94 generations=43,974 MJ



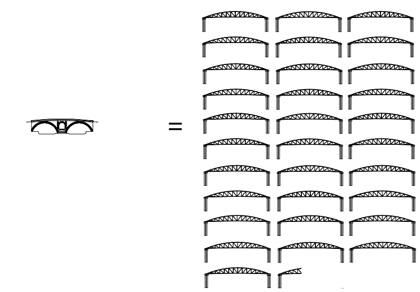
Contemporary Concrete and Steel Bridge

	embodied energy (MJ/m³)	material volume (m³)	Total Embodied Energy (MJ)
Concrete	3,180	57	182,346
Steel	37,210	7	270,487
Glass	41,080	6	228,894
			681,727

Embodied Energy per generation served:
681,727 MJ/ 3 generations=227,242 MJ

1 Ponte Fabricius lasts at least 2075 years, the equivalent of 31+ steel and concrete bridges.

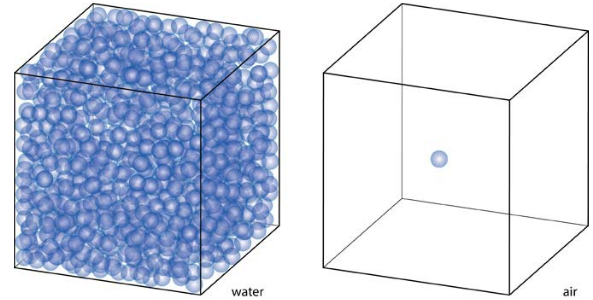
4,133,563 MJ vs **21,358,515 MJ**



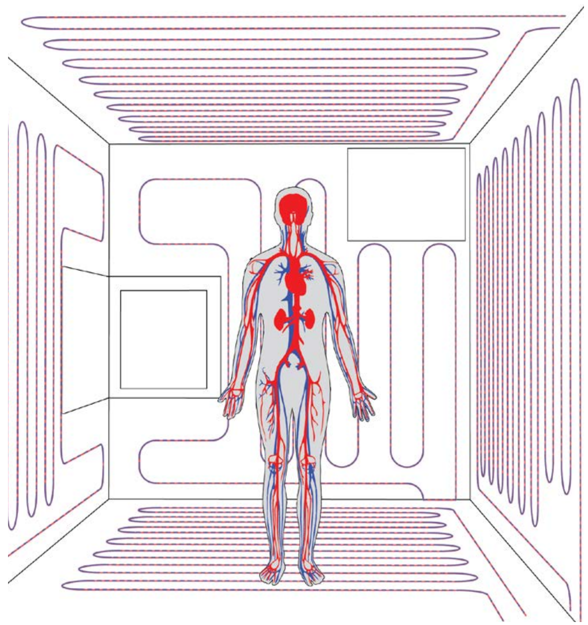
	volume (m³)	density (kg/m³)	weight (kg)	Embodied energy[1] (MJ/kg)	Embodied carbon (kgCO²/kg)	Emergy (sej) x 10^{12}
Suransuns						
V4A Stainless Steel Tension Straps	0.19	8,000	1,535	87,046	9,442	10,700
V4A Stainless Steel Anchors	0.02	8,000	149	8,453	917	1,039
V4A Solid Stainless Steel Guardrail Posts	0.08	8,000	656	37,199	4,035	4,573
V4A Stainless Steel Handrail	0.03	8,000	273	15,473	1,678	1,902
Aluminum AL 99.5 spacers between treads	0.04	2,700	121	18,727	1,107	2,573
Andeer Granite Treads	2.81	2,670	7,489	82,383	4,793	18,274
Concrete Lower Abutment	9.80	2,400	23,511	105,798	17,163	42,554
Concrete Upper Abutment	6.96	2,400	16,707	75,183	12,196	30,240
			total	**430,262**	**51,330**	**101,156**
Ponte Fabricius[2]						
Travertine	375.77	2,050	770,329	970,614	56,234	1,879,602
Pepperino	623.74	1,400	873,236	1,100,277	63,746	2,130,696
Brick	529.20	1,922	1,017,122	3,051,367	233,938	3,743,010
Basalt	38.54	3,011	116,044	146,215	8,471	283,147
Concrete	395.60	2,400	949,440	4,272,480	693,091	1,718,486
			total	**9,540,954**	**1,055,481**	**9,754,941**
Contemporary Steel Bridge						
Concrete	57.34	2,400	137,616	173,396	10,046	249,085
Steel	7.27	7,850	57,062	71,898	4,166	397,720
Glass	5.57	2,600	14,487	43,462	3,332	20,427
			total	**288,755**	**17,544**	**667,232**

Kiel Moe, ***Thermally Active Surfaces in Architecture.***
New York: Princeton Architectural Press (2010).
[single author book publication]

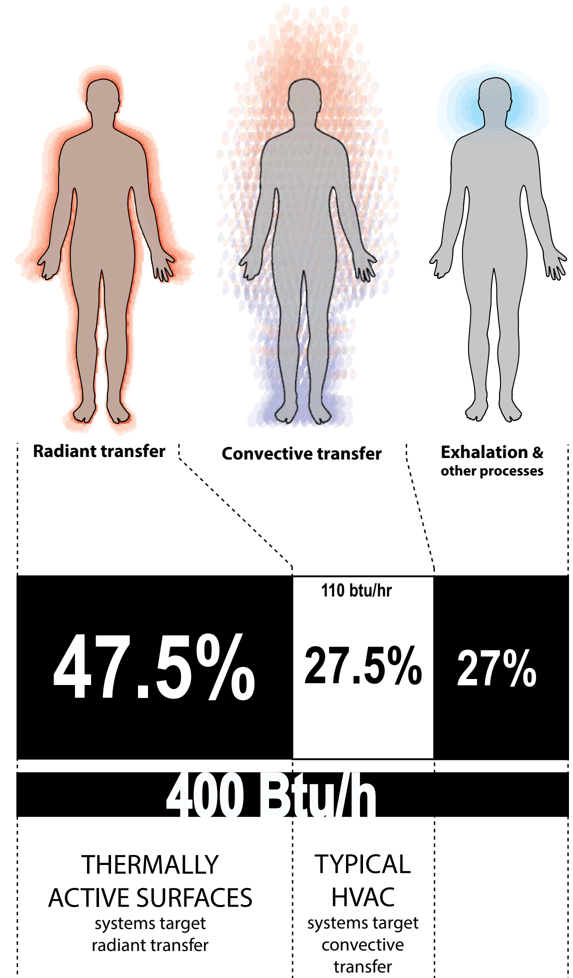
In architecture's ongoing quest for sustainability, it is often the most fundamental practices that require rethinking. For example, why do we heat and cool buildings with air? Thermally Active Surfaces in Architecture, the research argues that water, with its higher density, is far better at capturing and channeling energy. By separating the heating and cooling of a building from its ventilation, the building's structure itself becomes the primary thermal system. Water is moved through tubing embedded in concrete slabs or plaster surfaces. This transformation of energy and building practices triggers a cascading set of possibilities for a building's health, structure, and durability. Thermally Active Surfaces in Architecture details ten contemporary case studies, including projects like Kunsthaus in Austria, by Peter Zumthor; the Zollverein School of Management in Germany, by SANAA; Linked Hybrid in Beijing by Steven Holl; Südwestmetall Regional Headquarters in Germany, by Dominik Dreiner Architekt; and housing for the Kripalu Center for Yoga and Health in Massachusetts, by Peter Rose and Partners.



Energy density is directly related to the density of a material. Water can capture and channel far more energy per unit volume than air. Thermally active surfaces are built around this basic principle.

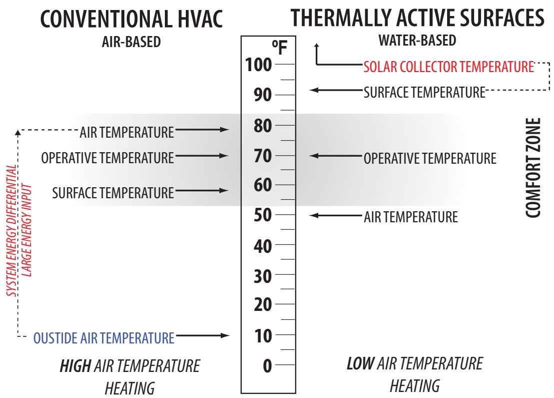


The human body is a thermally active surafce system. Heat energy is mainly transfered in and around a body through the hydronic circulatory system. The heart pumps heat through the blood from the core to the skin, a thermally active surface. Its thermal system is also decoupled form its ventilation system.



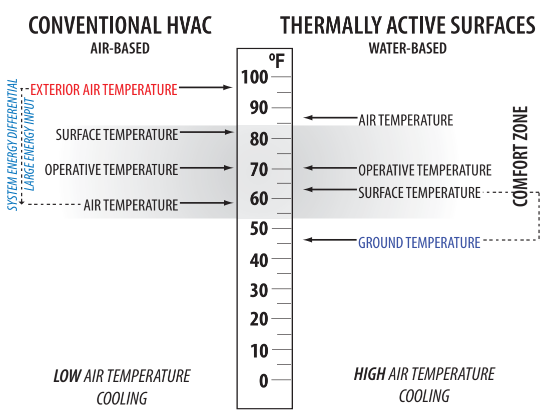
Declaration of Responsibility:
I have personal knowledge of the nominee's responsibility for the exhibit listed above, which included primary responsibility for book authorship. Jennifer Thompson, Editor | Princeton Architectural Press, Hudson, New York

In addition to accessible and richly ilustrated explanation of the principles of thermally active surfaces, the book features ten key case study examples that help archietcts understand the implementation and practice of thermally strategies that match human physiology.



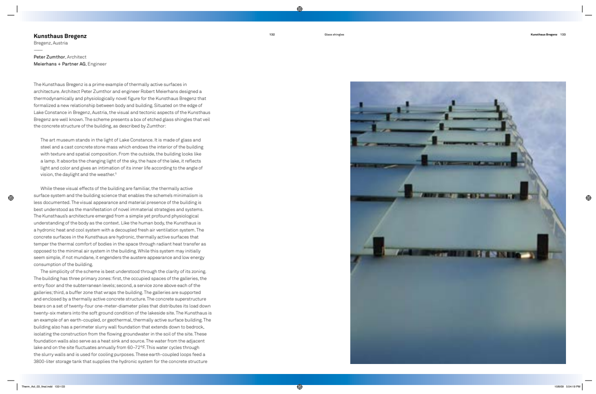
HEATING MODE

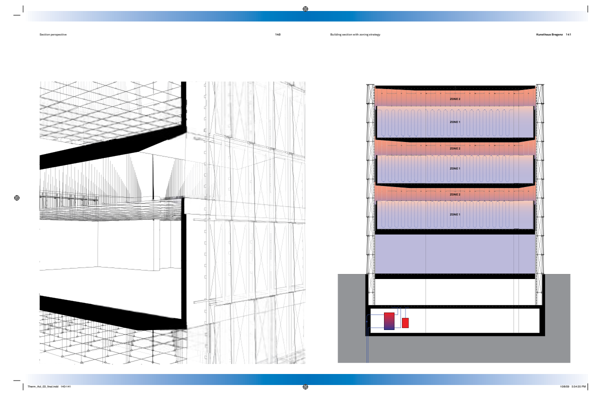
------> = SYSTEM ENERGY INPUT

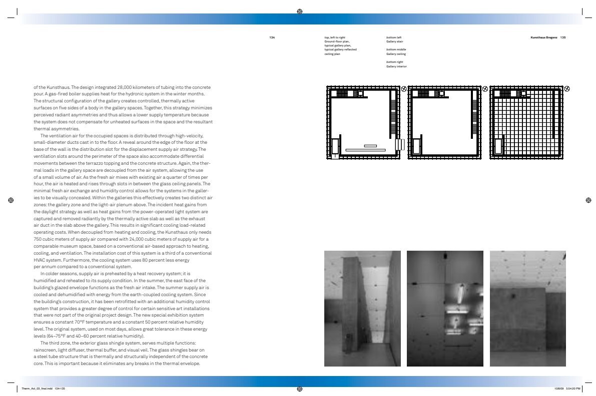


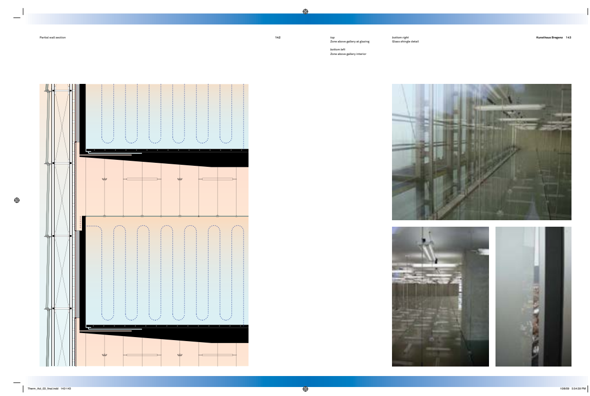
'COOLING' MODE

------> = SYSTEM ENERGY INPUT





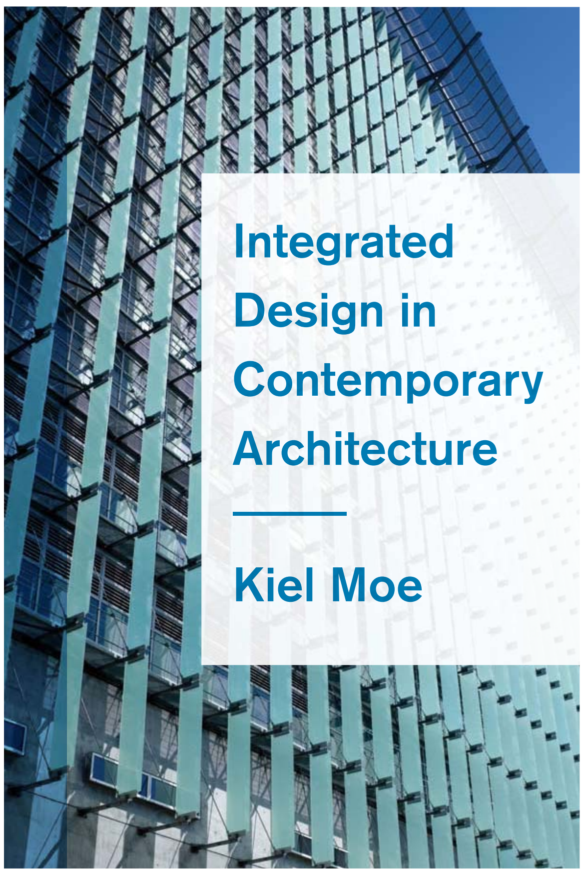


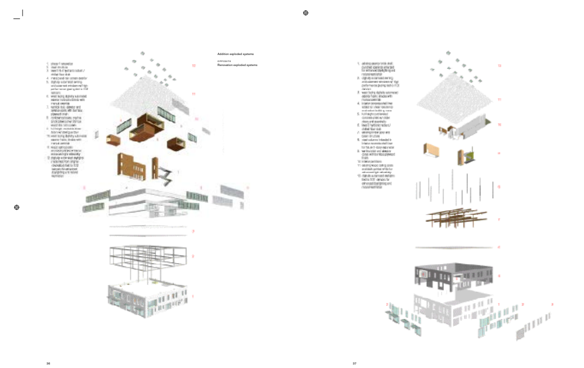


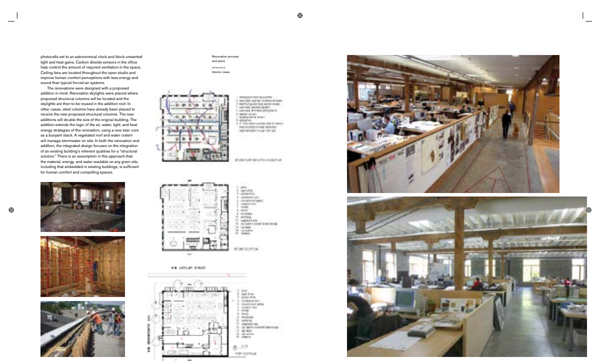
Kiel Moe, ***Integrated Design in Contemporary Architecture.*** New York: Princeton Architectural Press (2008).
[single author book publication]

Sustainability is the pervasive buzzword in any conversation about twenty-first-century building. But just how sustainable must a building be to earn that sought-after designation? How must architects reconsider the entire design process to achieve this important goal? Taking sustainability to the next level, the emerging practice of integrated design provides the strategies to achieve high performance, low energy consumption, and cost-effectiveness through careful ground-up consideration of how the program, siting, design, materials, systems, and products of a building connect, interact, and affect one another. This approach eschews specialists working in isolation in favor of solutions that are greater than the sum of their parts.

Integrated Design in Contemporary Architecture takes a comprehensive look at projects that exemplify current approaches to this exciting new field. From museums to residences, from office buildings to universities and yoga centers, this book showcases twentyeight examples of integrated design that cut across building types, budgets, climates, and locales. Drawings, diagrams, and photographs illustrate how the many disciplines involved in the building process work together to create sustainable spaces that acknowledge architecture's critical role in our shared global community, economy, and ecosystem.







Declaration of Responsibility:
I have personal knowledge of the nominee's responsibility for the exhibit listed above, which included primary responsibility for book authorship. Jennifer Thompson, Editor | Princeton Architectural Press, Hudson, New York


Sidwell Friends School Middle School Renovation and Addition
Washington, D.C.
KieranTimberlake Associates
Gleneagles Community Center
West Vancouver, British Columbia
Patkau Architects, Vancouver, British Columbia
Pittsburgh Glass Center
Pittsburgh, Pennsylvania
Davis Gardner Gannon Pope Architecture, Pittsburgh, Pennsylvania

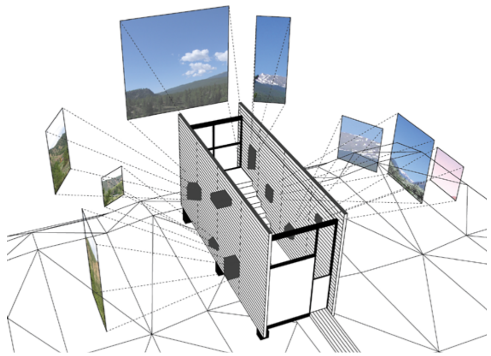
STACK HOUSE

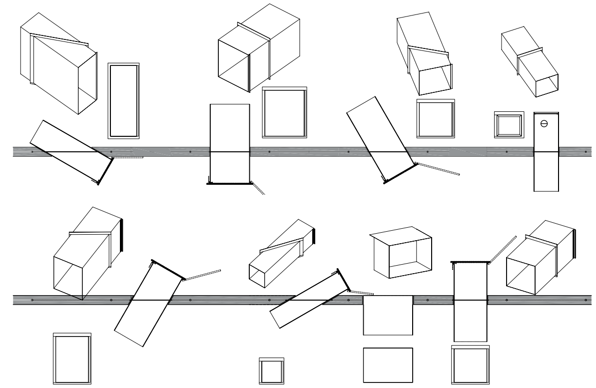
Granite, Colorado

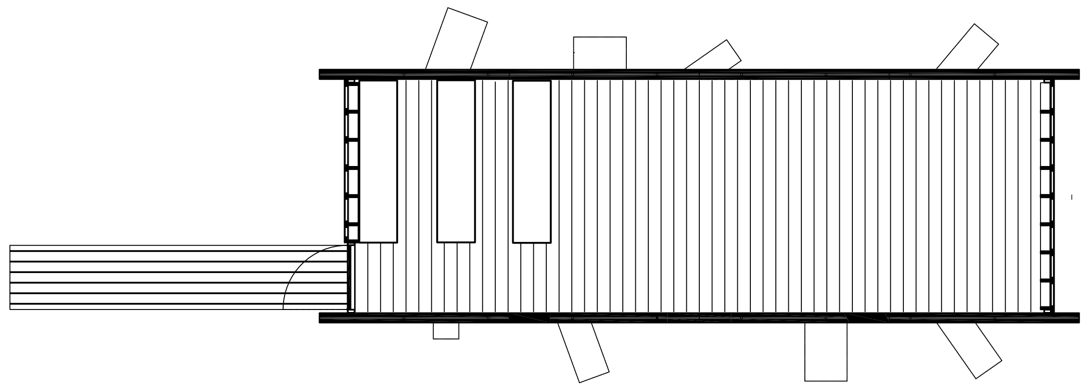
Kiel Moe, AIA, Co-Designer & Builder, 2008

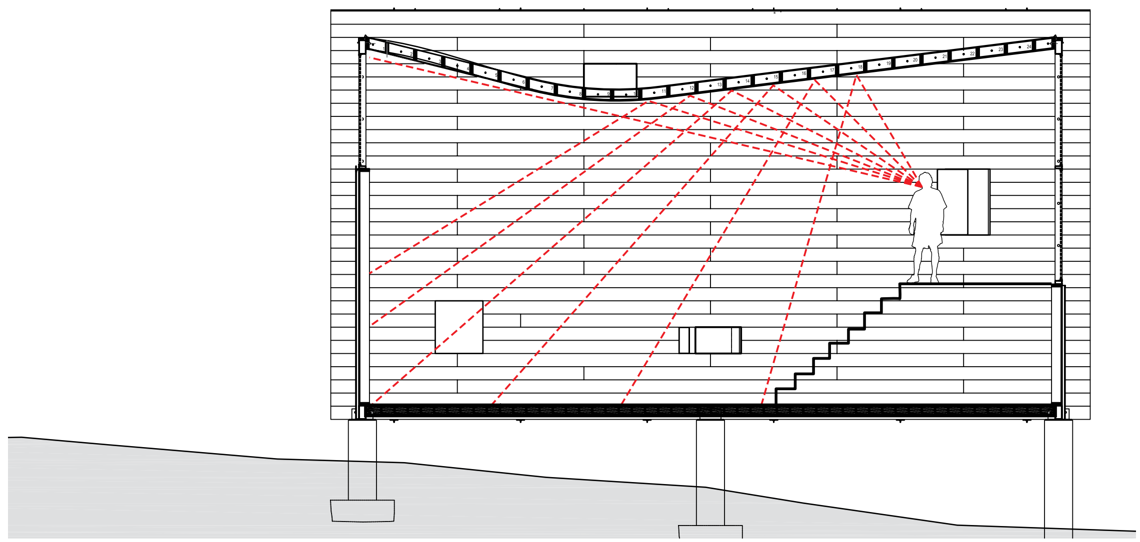
This project is one of nine design and build projects on the same site. This small building is used as a yoga studio, a painting studio, and a performance space for family and friend recitals, plays, and readings. Situated atop a hill surrounded by the Collegiate Peak mountains in central Colorado. Overlooking the Arkansas River Valley, the building captures several significant views of the adjacent landscape.

2009 North American Wood Council Design Honor Award
2009 American Institute of Architects Colorado Design Honor Award
2009 American Institute of Architects Denver Design Merit Award

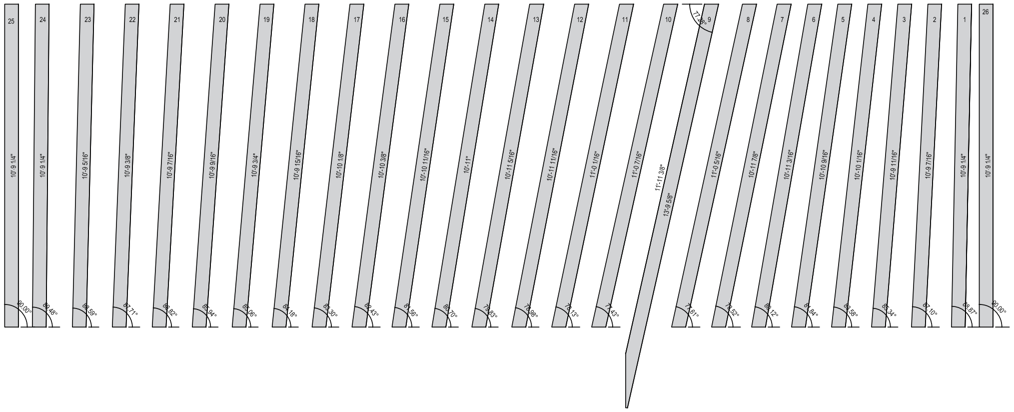


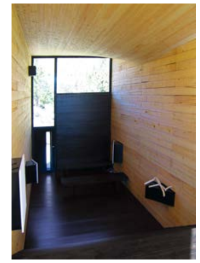


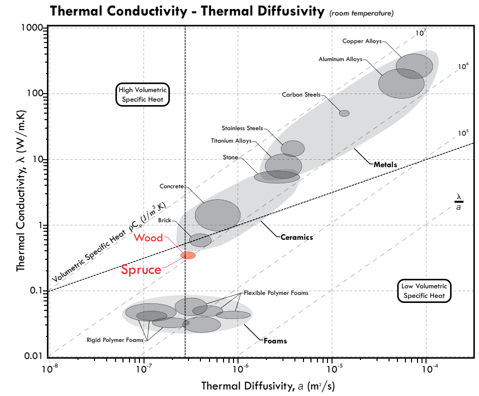


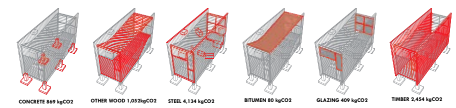


Declaration of Responsibility:
I have personal knowledge of the nominee's responsibility for the exhibit listed above, which included primary responsibility for design and construction. Ron Mason, FAIA, Owner/Client | Anderson, Mason Dale Architects, Denver Colorado









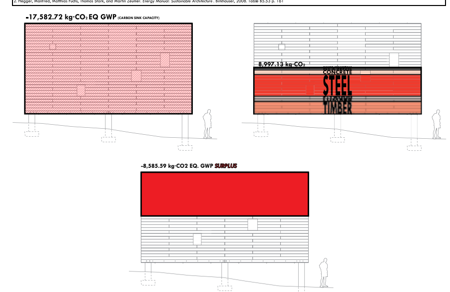
Carbon and Energy Sink

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	2,817.93	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%

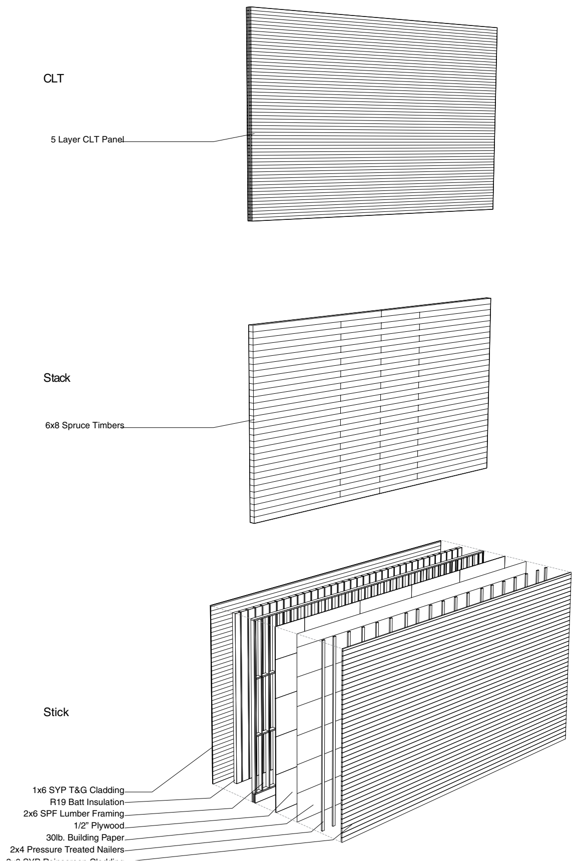
Timber Global Equivalent Carbon Sequestration[2] -792 kgCo2eq./m³ **-17582.72** kgCO2 eq.

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



The construction system utilizes 6x8 spruce timbers for the structure, insulation, finish materials, and enclosure of the walls and floor. The roof is a ruled surface that pitches water and snow to a single scupper on the east wall. This roof also gives the ceiling an asymmetrical belly that casts light and sound about the interior. The unique thermal conductivity and thermal diffusivity of the spruce timbers is used in the summer and the winter to modulate the thermal swings of the climate and seasons; a thermally active surface approach with no energy input other than the sun.



Too often, accounts of the carbon associated with timber building remain focused on the carbon sink potential of primary building material substitution. When designers substitute wood for concrete or steel, ambiguous claims about carbon sequestration often abound in their descriptions of the resulting design (generally by invoking vague, often uncited carbon equivalent values). But by tracking the carbon dynamics of the varied material systems – as opposed to the materials themselves – an account of the total mass of the wood system provides a more complex and specific account of the carbon involved.

Production Energy, Carbon and CO_2e

Construction System	Cumulative Energy Requirements (MJ/m^3) 2,3	Embodied Energy (MJ)	Embodied Carbon (Mg) 4	Equivalent (Mg CO_2e) 5
CLT - Montana	5337	155157	7.18	26.33
CLT - Oregon	5349	155506	7.20	26.38
CLT - British Columbia	5349	155506	7.34	26.91
CLT - Quebec	5375	156262	7.41	27.17
Air-dryed Stacked Timber	573	17567	5.90	21.64
KD Lumber Framed	3189	42713	2.77	10.14

notes:

2. CLT energy requirements were estimated based on Pacific Northwest glulam production and resin energy values, 4,650 and 409 MJ/m3 respectively, (Table 4) from Puettmann, Maureen E. et al. "Cradle-To-Gate Life-Cycle Inventory of US Wood Products Production: CORRIM Phase I and Phase II Products". Wood and Fiber Science 42 CORRIM Special Issue (2010): 23. Harvest and transportation energy requirements were selected based on region Table 6 from Puettmann, Maureen E. et al. (2010).

3. For air-dryed stacked timber, used Pacific Northwest green lumber production values (Table 4) from Puettmann, Maureen E. and James B. Wilson. "Life-Cycle Analysis of Wood Products: Cradle-To-Gate LCI of Residential Wood Building Materials". Wood and Fiber Science 37 CORRIM Special Issue (2005): 23. These production values were combined with the Inland Northweset harvesting and transportation values from Table 6 of Puettmann, Maureen E. et al. 2010.

4. Embodied carbon = mass x fraction of wood content x specific carbon content (see USDA Forest Service. Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States. Newtown Square, PA: USDA Forest Service, 2006.)

5. To calculate CO2e multiply the carbon content by the atomic mass of CO2 (44/12)

Emergy - transformities from *TheHierarchies of Energy in Architecture*

Construction System	Solar Transformities (sej/g) 6	Product Emergy (sej)	Transport Transformities (sej/tonne-km)	Transport Emergy (sej)	Total Emergy (sej)	Percentage of Emergy from Transport	Renewable Emergy
CLT - Montana	2.96E+09	4.30E+16	6.60E+11	1.55E+16	5.85E+16	27%	73%
CLT - Oregon	2.97E+09	4.32E+16	6.60E+11	2.00E+16	6.31E+16	32%	68%
CLT - British Columbia	2.97E+09	4.40E+16	6.60E+11	2.15E+16	6.55E+16	33%	67%
CLT - Quebec	2.98E+09	4.47E+16	6.60E+11	3.64E+16	8.11E+16	45%	55%
Air-dryed Stacked Timber	3.18E+08	3.75E+15	6.60E+11	9.28E+14	4.68E+15	20%	80%
KD Lumber Framed	1.77E+09	9.79E+15	6.60E+11	5.92E+15	1.57E+16	38%	62%

notes:

6. Solar transformities for lumber from Srinivasan, Ravi and Kiel Moe. Hierarchy of Energy In Architecture. London: Routledge, Taylor and Francis, 2015, were modified based on the cumulative energy requirement divided by the cumulative energy requirement of Inland Northwest southwood kiln-dryed lumber, 3189 MJ/m3.

Transport

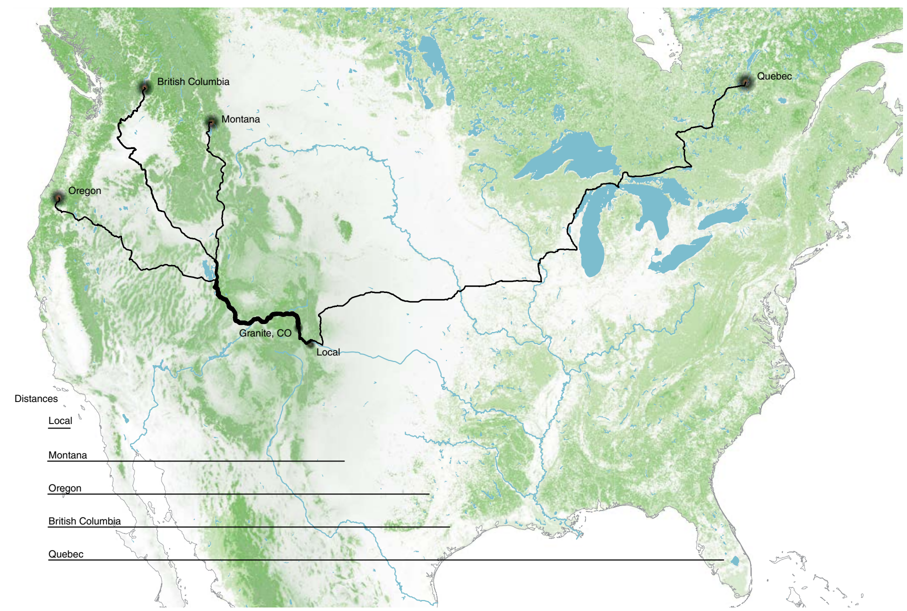
							Method 1			Method 2		Results	
Construction System	Miles	km	MJ/m^{3}km 7	MJ	Percentage of Total Embodied Energy in Transport to Building Site	kgC/m^{3}km 8	Transport (Mg C)	Percentage of Carbon from Transport	Conversion (Mg C02e)	Fossil Fuel CO_2 (MgCO_2e) 9	Net Mg C02e Sequestered (method 2)	Percentage of CO_2e in Freight Transport (Mill to Site using method 2)
CLT - Montana	1007	1621	0.24	11307.4	7%	0.0214	1.008	14%	3.70	4.796	21.53	18%
CLT - Oregon	1294	2082	0.24	14530.0	9%	0.0214	1.296	18%	4.75	6.175	20.21	23%
CLT - British Columbia	1363	2194	0.24	15304.8	10%	0.0214	1.365	19%	5.00	6.634	20.28	25%
CLT - Quebec	2291	3687	0.24	25725.1	16%	0.0214	2.294	31%	8.41	1.2601	15.91	41%
Air-dryed Stacked Timber	74	119	0.24	876.3	5%	0.0214	0.078	1%	0.29	0.287	21.35	1%
KD Lumber Framed	1007	1621	0.24	5209.5	12%	0.0214	0.465	17%	1.70	1.829	8.31	18%

notes:

7. Manufacturing-to-building site basis based on road transportation values from Table 3 of Puettmann, Maureen E. and James B. Wilson. "Life-Cycle Analysis of Wood Products: Cradle-To-Gate LCI of Residential Wood Building Materials". Wood and Fiber Science 37 CORRIM Special Issue (2005): 23. Road transportation is roundtrip with empty back-haul.

8. Carbon emissions factor from Healey, Sean P et al. "Changes in Timber Haul Emissions in the Context of Shifting Forest Management and Infrastructure". Carbon Balance Manage 4.1 (2009): 6.

9. Fossil fuel CO2e based on World Resources Institute (2015). GHG Protocol tool for mobile combustion. Version 2.6.



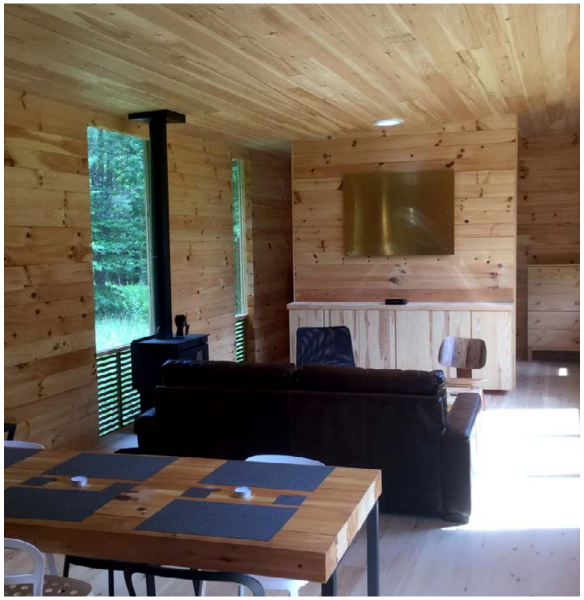
Stackhouse CLT material geographies: sources and routes

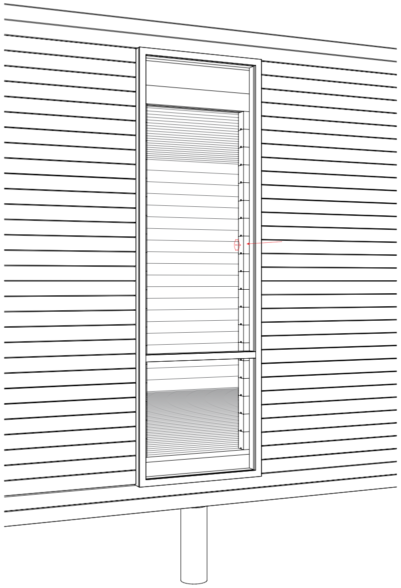
Long House
Halifax, VT

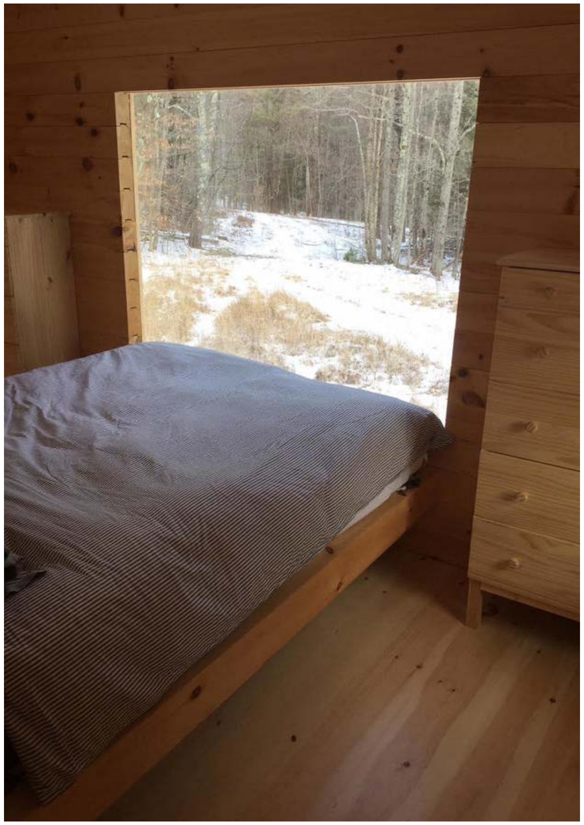
Kiel Moe, AIA, Lead Designer & Builder, 2015

This project is another solid timber building, in this case Eastern White Pine from local forests and mills. The Long House establishes an clear edge to the northern edge of a large forest meadow, thus capturing southern light and heat gains. The stacked timbers walls are reinforced, in this case, by the floor-to-ceiling window frames that tie the structure together and stiffen the walls. The plan typology is a dog-trot, a design that captures and concentrates breezes in the exterior deck space. The Long House is complimented by an authentic solid cedar Finnish forest sauna.

Declaration of Responsibility:
I have personal knowledge of the nominee's responsibility for the exhibit listed above, which included primary responsibility for design and construction. Jacob Mans, AIA. Builder | Miineapolis Minnesota







BATH HOUSE
Portland, Maine

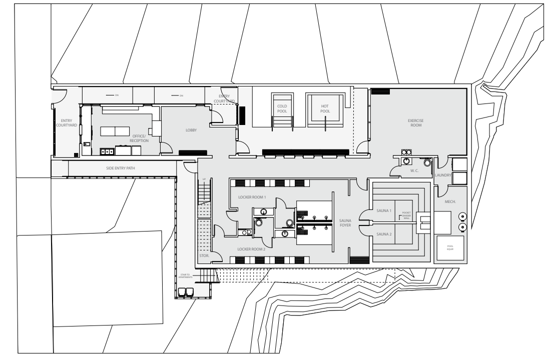
Kiel Moe, AIA, Lead Designer, 2021

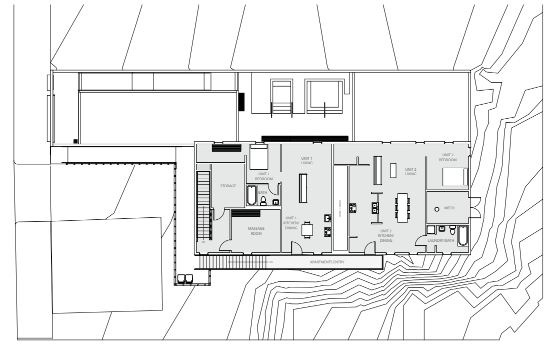
This urban bath explores social, thermal and material issues in architecture. Once a gendered typology with symmetrical sequences for men and women, the spectrum of current gender nomenclatures and orientations demand a typological evolution of the urban bath house to serve a more nuanced and inclusive public. The evolution of this typology requires at once more neutrality about intimate spaces (such as non-gendered locker rooms) while the sauna typology nonetheless retains persistent typological specificity regarding the intricate sequence of changing, showering, sauna, showering, lounging, etc.

In parallel to this social evolution of an architectural typology, the energetics of a bath house are highly suggestive of material and spatial organizations that transcend the additive, thin, and layered logics of typical architectural assemblies. Bath houses benefit from more massive material organizations that engender thermally active surfaces and spatial organizations that enable buoyancy-driven ventilation strategies with the sauna stove as a heat engine for the flow. This typology also affords clear exergy cascades and exergy matching strategies.

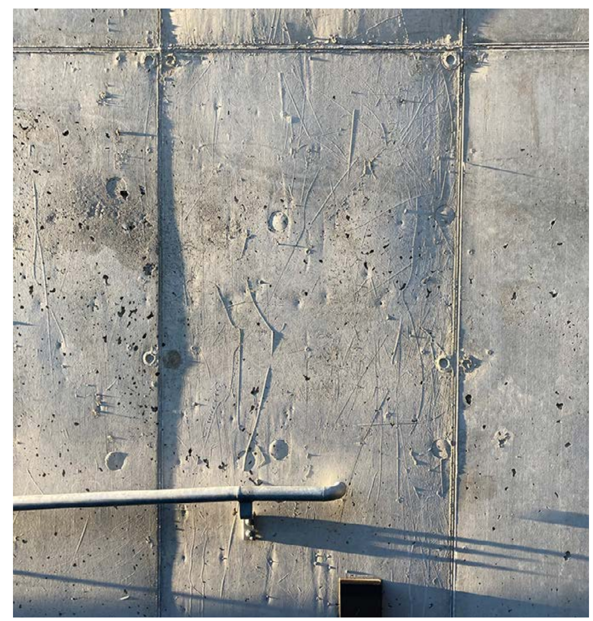
When these issues converge on a urban el-shpaed mid-block site, the resulting architecture is a rich spatial-material-thermal matrix. For the bather, there is a material and thermal matrix from the public street to suana interior to the private mid-block courtyard. This sequence has a range fo thermal and humidity textures than enliven the bather's experience in visual and non-visual ways. In this regard, a contemporary urban bath house challenges a range of architectural assumptions: from ideas about gender, to received habits about space, structure, material, air and fuel.

in-process construction photograph





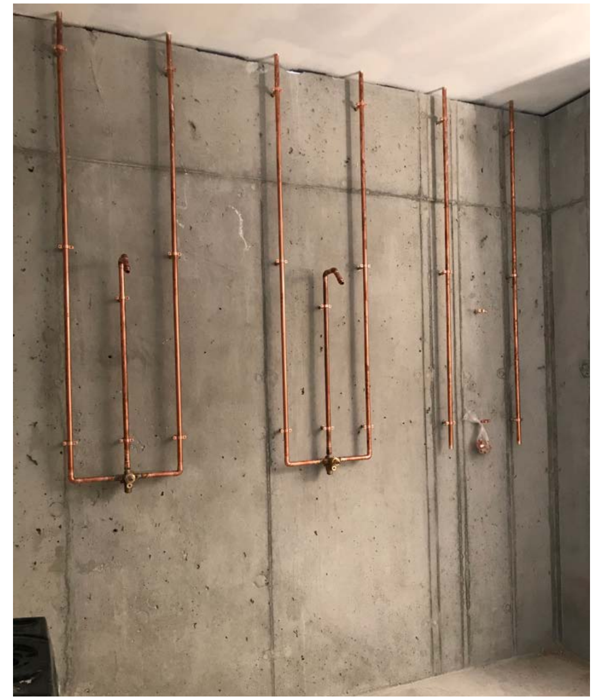
SECOND FLOORPLAN



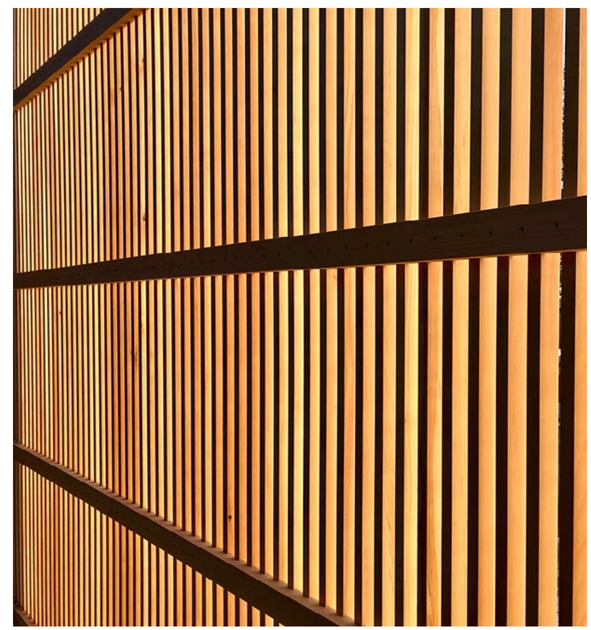
Declaration of Responsibility:
I have personal knowledge of the nominee's responsibility for the exhibit listed above, which included primary responsibility for design. Asher Woodwroth, Owner/Client | Washington Baths, Portland, Maine

in-process construction photograph: custom stove from Finland

in-process construction photograph: sauan showers



in-process construction photograph



HORIZON HOUSE

Hokkaido, Japan

First Prize Winner
3rd LIXIL International University
Architectural Competition

Kiel Moe, Project Co-Advisor, 2013

Horizon House was conceived as a process for embracing local and seasonal qualities of place, providing a 360 degree view to the landscape, and reflecting an expanded understanding of ecological boundaries. Sourcing, lifespan, and energy implications of construction materials were incorporated by using salvaged or locally harvested wood products, even in the foundations system, reducing to a minimum embodied carbon impacts. In Horizon House the thermal experience of the inhabitant is linked to the surface of the floor, which provide both radiative heating and cooling using a wood stove in winter and underground pipe and thermal mass storage in summer.

Student Team:
Carlos Cerezo Davila (MDes '13)
Matthew Conway (MArch I '15)
Robert Daurio (MArch II '13)
Ana Garcia Puyol (MDes '14)
Mariano Gomez Luque (MArch II '13)
Natsuma Imai (MArch I '15)
Takuya Iwamura (MLA '14)
Thomas Sherman (MDes '14)

Declaration of Responsibility: *I have personal knowledge of the nominee's responsibility for the project listed above as project co-advisor.* Mark Mulligan, Co-advisor | Wentworth Institute of Technoloyg, Boston, Massachusetts

3.10 Horizon House *(example student project)*