

ARC 4930 - 30007

Spring 2024

Architecture and Climate

Hybrid Seminar

Zoom and Face to Face

Zoom for online and off-campus programs.

Face to Face or online for UF Gainesville Students

Thursdays | Periods 7–9

Room TBA

Sustainable Architecture: Architecture and Climate

Instructor: Dr. Vandana Baweja, Associate Professor, School of Architecture

Email: vbaweja@ufl.edu Tel:352.294.1465 Office: 242 Architecture

Office hours : TBA

Short Description

The dominance of climate change and the carbon cycle in the development of Sustainable Architecture has signified a major shift in the relationship between climate and architecture. This course examines how anthropogenic climate change became a global architectural concern and how architects have responded to shifting environmental concerns, particularly in Europe. Prior to the ascendancy of climate change and the carbon cycle as metrics of the relationship between buildings and the environment, the architectural environmental paradigms of the 1950s to 1980s were predicated on architecture as mediator between the human body and the outdoor climate. Climate was viewed as a stable environmental actor, which determined architecture. As it became apparent that buildings, as one of the key consumers of fossil fuels, contribute significantly to climate change, the relationship between architecture and climate went through a paradigmatic shift—from one in which climate was a determinant of architectural metrics, to one in which architecture became an active agent in the transformation of global climatic systems.

Detailed Description

The dominance of climate change and the carbon cycle in the development of Sustainable Architecture has signified a major shift in the relationship between climate and architecture. This course examines how anthropogenic climate change became a global architectural concern and how architects have responded to shifting environmental concerns, particularly in Europe. Prior to the ascendancy of climate change and the carbon cycle as metrics of the relationship between buildings and the environment, the architectural environmental paradigms of the 1950s to 1980s were predicated on architecture as mediator between the human body and the outdoor climate. Climate was viewed as a stable environmental actor, which determined architecture. As it became apparent that buildings, as one of the key consumers of fossil fuels, contribute significantly to climate change, the relationship between architecture and climate went through a paradigmatic shift—from one in which climate was a

determinant of architectural metrics, to one in which architecture became an active agent in the transformation of global climatic systems.

Climate change and its metrics—energy consumption and the carbon cycle—have come to dominate contemporary discourses on sustainable architecture and design. Competing and overlapping design paradigms and environmental assessment methods such as—Cradle to Cradle, Bioclimatic Architecture, Biomimicry, Passive and Low Energy Architecture (PLEA), Ecological Design, Net Zero buildings, and Zero-carbon building, Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), LEVELS, and Passivhaus—promise sustainability. These design paradigms are targeted towards sustainable development through a reduction in greenhouse gas emissions and accomplishing efficiencies in the use of energy and materials. The larger goal is to attain an ecological balance between consuming the earth's finite resources and its regenerative capacity. Sustainable development was first defined in the Brundtland Report, titled *Our Common Future*, as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, Gro Harlem and World Commission on Environment and Development. *Our Common Future*. Oxford; New York: Oxford University Press, 1987).

Since the 1990s, as sustainable development emerged as the new paradigm of economic growth based on the carrying capacity of the earth, the term “sustainability” entered the academic discourse and has had an enduring impact on several disciplines in academia. Although the Brundtland Report and the blossoming of the sustainability movement helped to bring awareness to many sectors of society, including architecture and design, the concern for environmental building dates back to postwar period. The growth of the sustainability movement combined with the realization that humans were affecting the climate through the use of fossil fuels (including those used in the built environment) further pushed the architectural world toward sustainable design. Thus, since the late 1980s and early 1990s, sustainable architecture has become an articulated value, and is now regularly associated with the carbon cycle, global ecology, and various facets of sustainability.

Prior to the ascendancy of climate change and the carbon cycle as metrics of the relationship between buildings and the environment, from 1950s to 1980s engineers and architects developed solutions in response to global environmental concerns. Events and phenomena such as—the decolonization and modernization of the tropics, the Cold War, the threat of nuclear holocaust, the Vietnam War, space exploration, the countercultural movement of the 1960s, the civil rights movement, the feminist movement, the OPEC oil embargo 1973–4, rising population, and poverty—transformed public consciousness about the human impact on the environment. In response to environmental problems such as—pollution, energy scarcity, social injustice, poverty, agricultural deficit, ecological catastrophe—that dominated the public consciousness from the 1950s to the 1980s, architects responded with a range of paradigms within different cultural, ideological, and technological contexts. Technocrats and architects and devised resource and energy efficiency, which relied on the

optimization of architecture in response to—climate, fossil fuel consumption, and resource conservation.

The architectural solutions that promised almost closed loops of resources and energy were predicated on architecture as mediator between the human body and climate. Climate was viewed as a stable environmental actor, which determined optimum architecture for a given place. As it became apparent that buildings, as one of the key consumers of fossil fuels, contribute significantly to climate change, the relationship between architecture and climate went through a paradigmatic shift—from one in which climate was a determinant of architectural metrics, to one in which architecture became an active agent in the transformation of global climatic systems.

This course will chart the development of postwar architecture to trace how environmental discourses inform design paradigms; and inversely, how design disciplines have been consequential in the transformation, stewardship, and understanding of the environment. This class covers the intersection of design and environmental histories from the 1950s to now, with an emphasis on Europe.

COURSE PRE-REQUISITES / CO-REQUISITES

None

TEXTBOOK

There is no required textbook. Required readings will be placed on Canvas/E-learning as PDF files.

CLASS REQUIREMENTS FOR STUDENTS

1. Attend class regularly.
2. Each student is expected to present readings as assigned. You are expected to present four readings in the entire semester.
3. Participate in class discussions.
4. Complete a final project or paper.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance will be assessed via roll call and class participation.

Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Excused absences and missed assignments are consistent with UF attendance policy

CLASS PARTICIPATION SCALE

Your participation in class discussions will be evaluated using this scale for points towards your final grade for the semester.

100 = Student **often** contributes thoughtful comments and insights based on class materials and has been a catalyst for other student comments as well as instructor

response; AND listens to the comments and insights of others with respect and attention.

80 = Student **regularly** contributes thoughtful comments and insights based on class materials and **sometimes** results in student as well as instructor response (overall, quality counts more than quantity); AND listens to the comments and insights of others with respect and attention.

60 = Student **sometimes** contributes comments and insights based on class materials, more often at instructor's prompting; generally polite but could be more engaged in class discussions.

40 = Student **seldom** contributes comments and insights of her/his own volition; comments not always relevant to materials or discussion at hand; needs to pay more attention to the contributions of the instructor and peers.

0 = Student **rarely** and reluctantly contributes to class discussions; comments minimal and/or disrespectful; often noticeably disinterested in instructor's and peers' contributions.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>

It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at gatorevals.aa.ufl.edu/public-results/.

Class Demeanor

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and restrict eating to outside of the classroom.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work

submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Counseling and Wellness Center

Contact information for the Counseling and Wellness Center:

<http://www.counseling.ufl.edu/cwc/Default.aspx>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Academic Resources

[E-learning technical support](#), 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.

[Career Resource Center](#), Reitz Union, 392-1601. Career assistance and counseling.

[Library Support](#), Various ways to receive assistance with respect to using the libraries or finding resources.

[Teaching Center](#), Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

[Writing Studio](#), 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

[Student Complaints Campus](#)

[On-Line Students Complaints](#)

Evaluation of Grades

Assignment Group	Weight
Reading Responses	30%
Proposal	10%
Presentations	10%
Final Project	30%
Attendance	20%
Total	100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
90.0–100.0	A	4.00

Percent	Grade	Grade Points
87.0–89.9	A-	3.67
84.0–86.9	B+	3.33
81.0–83.9	B	3.00
78.0–80.9	B-	2.67
75.0–79.9	C+	2.33
72.0–74.9	C	2.00
69.0–71.9	C-	1.67
66.0–68.9	D+	1.33
63.0–65.9	D	1.00
60.0–62.9	D-	0.67
0–59.9	E	0.00

Thursday, January 11th, 2024

Week 1: Introduction

Thursday, January 18th, 2024

Week 2: Geometries of the Sun—Heliodon, Sun Paths, and Orientation.

- Markku Norvasuo, “Designing Properly Lit Homes: The Question of Daylight and Electric Light in the Housing Architecture of Alvar Aalto between 1927 and 1935,” *ICON*, 16 (2010): 179–200.
- Beal, George Malcolm. *Natural Light and the Inside-outside Heliodon*. United States: School of Engineering and Architecture, University of Kansas, 1956.
- Overy, Paul. *Light, Air and Openness: Modern Architecture Between the Wars*. London, Thames and Hudson, 2007.

Thursday, January 25th, 2024

Week 3: Architecture and Climate: Tropical Architecture, UK

- Fry, Maxwell, and Jane Drew. *Tropical Architecture in the Humid Zone*. New York: Reinhold, 1956.
- Huppatz, D J. "Jean Prouvé's Maison Tropicale: the Poetics of the Colonial Object." *Design Issues* 26, no. 4(2010): 32–44
- Immerwahr, Daniel. "The Politics of Architecture and Urbanism in Postcolonial Lagos, 1960–1986." *Journal of African Cultural Studies* 19, no. 2 (2007): 165–186.
- Van der Plaats, Deborah. “Architecture of Sun and Soil: European Architecture in Tropical Australia.” In *Investigating and Writing Architectural History: Subjects, Methodologies and Frontiers*. Papers from the Third EAHN International Meeting, 1119–1130. Turin: Politecnico di Torino, 2014.

DOI: <http://www.eahn2014.polito.it/EAHN2014proceedings.pdf>

Thursday, February 1st, 2024

Week 4: The Club of Rome, 1968: Earth' Carrying Capacity

- Meadows, Donella H. and Club of Rome. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books, 1972.
- Colombo, Umberto. "The Club of Rome and Sustainable Development." *Futures* 33, no. 1 (February 1, 2001): 7–11. [https://doi.org/10.1016/S0016-3287\(00\)00048-3](https://doi.org/10.1016/S0016-3287(00)00048-3).
- Schmelzer, Matthias. "'Born in the Corridors of the OECD': The Forgotten Origins of the Club of Rome, Transnational Networks, and the 1970s in Global History*." *Journal of Global History* 12, no. 1 (March 2017): 26–48. <https://doi.org/10.1017/S1740022816000322>.
- Mihailov, Nikolai, and Lidia Sakelarieva. "Environmental Alarmism: The Club of Rome and Its Critics." *Studia Ecologiae et Bioethicae* 14, no. 4 (December 1, 2016). <https://doi.org/10.21697/seb.2016.14.4.07>.
- Golub, Robert, and Joe Townsend. "Malthus, Multinationals and the Club of Rome." *Social Studies of Science* 7, no. 2 (1977): 201–22.

Thursday, February 8th, 2024

Week 5: Architecture-Climate and Appropriate Technology: The Institut fur Tropenbau [The Institute for Tropical Building (IFT)] Bavaria, Germany.

- Lippsmeier, Georg, Carol Gray Edrich, and Walter Kluska. *Tropenbau: Building in the Tropics*. München: Callwey, 1969.
- Folkers, Antoni S., and Belinda A. C. van Buiten. "The Faculty of Engineering in Dar Es Salaam." In *Modern Architecture in Africa: Practical Encounters with Intricate African Modernity*, edited by Antoni S. Folkers and Belinda A. C. van Buiten, 148–67. Cham: Springer International Publishing, 2019. https://doi.org/10.1007/978-3-030-01075-1_7.
- Day, George, and Simon Croxton. "Appropriate Technology, Participatory Technology Design, and the Environment." *Journal of Design History* 6, no. 3 (January 1, 1993): 179–83. <https://doi.org/10.1093/jdh/6.3.179>.
- Motylińska, Monika. "'A Cross Section of Colonial Technology'? Zooming in and Zooming out on a Photograph of a 1930s German Trade Fair." *ABE Journal. Architecture beyond Europe*, no. 17 (September 2, 2020). <https://doi.org/10.4000/abe.8193>.

Thursday, February 15th, 2024

Week 6: Countercultural Environmentalism and Grahame Caine's Eco-House, London, UK

- Kallipoliti, Lydia. "From Shit to Food: Graham Caine's Eco-House in South London, 1972–1975." *Buildings and Landscapes: Journal of the Vernacular Architecture Forum* 19, no. 1 (Spring 2012): 87–106.
- Roaf, Susan, Manuel Fuentes, and Stephanie Thomas. *Ecohouse: A Design Guide*. Oxford [England]; Boston: Architectural Press, 2001.
- Pursell, Carroll. "Sim Van Der Ryn and The Architecture of The Appropriate Technology Movement." *Australasian Journal of American Studies* 28, no. 2 (2009): 17–30.
- Richard, Sabrina Gabrielle. "Inputs, Outputs, Flows: The Bio-Architecture of Whole Systems Design, the Energy Pavilion, and the Integral Urban House." In *Healing Spaces, Modern Architecture, and the Body*, edited by Sarah Schrank and Didem Ekici. London: Routledge, 2016.

Thursday, February 22nd, 2024

Week 7: Autonomous House, University of Cambridge, UK.

- Hawkes, Dean. "Realising the Autonomous House." *Architect's Journal* 201/2, no. 2 (1995): 37–39.
- Lopez, Fanny. *Dreams of Disconnection: From the Autonomous House to Self-Sufficient Territories*. Manchester: Manchester University Press, 2021.
- "The Alexander Pike Autonomous House, Cambridge." *Architectural Design* 44, no. 11 (1974): 681–89.
- Vale, Brenda, Robert Vale, and Robert James Dennis Vale. *The New Autonomous House: Design and Planning for Sustainability*. New York: Thames & Hudson, 2000.

Thursday, February 29th, 2024

Week 8: OPEC Embargo and Energy Efficient Architecture

- Bahgat, Gawdat. "Geopolitics of Energy: Iran, Turkey, and Europe." *Mediterranean Quarterly* 26, no. 3 (2015): 49–66.
- Borasi, Giovanna, Mirko Zardini, Adam Bobbette, Harriet Russell, and Centre canadien d'architecture. *Sorry, Out of Gas: Architecture's Response to the 1973 Oil Crisis*. Montréal; Montova, Italy: Canadian Centre for Architecture; Corraini Edizioni, 2007.

- Doubilet, Susan. "Energy in Context: International Meeting Center West Berlin." *Progressive Architecture* LXII, no. 4 (1981): 150–52.
- Ray, George F. "Impact of the Oil Crisis on the Energy Situation in Western Europe." In *The Economics of the Oil Crisis*, edited by T. M. Rybczynski, 94–130. Trade Policy Research Centre. London: Palgrave Macmillan UK, 1976.
https://doi.org/10.1007/978-1-349-02810-8_6.
- Rüdiger, Mogens. "The 1973 Oil Crisis and the Designing of a Danish Energy Policy." *Historical Social Research* 39, no. 4 (2014): 94–112.
<https://doi.org/10.12759/hsr.39.2014.4.94-112>.
- Zardini, Mirko. "A Crisis That Made Architecture Real." *Perspecta* 42 (2010): 79–82.

Thursday, March 7th, 2024

Week 9: Sustainable Development and German Forestry

- Ehrenfeld, John R. "Chapter 5. A Radical Notion of Sustainability." In *Sustainability by Design: A Subversive Strategy for Transforming Our Consumer Culture*, 48–57. Yale University Press, 2008.
<https://doi.org/10.12987/9780300142808-010>.
- Hardin, Garrett. "The Tragedy of the Commons." *Science* 162, no. 3859 (December 13, 1968): 1243–48.
- Hölzl, Richard. "Historicizing Sustainability: German Scientific Forestry in the Eighteenth and Nineteenth Centuries." *Science as Culture* 19, no. 4 (December 1, 2010): 431–60. <https://doi.org/10.1080/09505431.2010.519866>.
- Turnbull, Thomas. "Energy, History, and the Humanities: Against a New Determinism." *History and Technology* 37, no. 2 (April 3, 2021): 247–92.
<https://doi.org/10.1080/07341512.2021.1891394>.
- United Nations Conference on Environment and Development. *Agenda 21: The Earth Summit Strategy to Save Our Planet*. Boulder, Colorado: EarthPress, 1993.
- World Commission on Environment Development. *Our Common Future*. Oxford Paperbacks. Oxford; New York: Oxford University Press, 1987.

Thursday, March 14th, 2024

Spring Break

Thursday, March 21st, 2024

Week 10: EU, Global Governance, and Climate Action

- Clémençon, Raymond. “The Two Sides of the Paris Climate Agreement: Dismal Failure or Historic Breakthrough?” *The Journal of Environment & Development* 25, no. 1 (March 2016): 3–24.
<https://doi.org/10.1177%2F1070496516631362>
- Daoudy, Marwa. “Climate Change and the Syrian Revolution.” In *The Origins of the Syrian Conflict: Climate Change and Human Security*, 3–23. Cambridge: Cambridge University Press, 2020. <https://doi.org/10.1017/9781108567053.001>
- Elkerbout, Milan. “The Changing Role of Carbon Pricing in the EU.” *National Institute Economic Review* 251 (2020): R13–R24.
<https://doi.org/10.1017/nie.2020.3>
- Fisher, Liz. “Challenges for the EU Climate Change Regime.” *German Law Journal* 21, no. 1 (2020): 5–9. <https://doi.org/10.1017/glj.2019.87>
- Green, Jessica F. “Climate Change Governance.” In *Global Governance in a World of Change*, edited by Michael N. Barnett, Jon C. W. Pevehouse, and Kal Raustiala, 109–29. Cambridge: Cambridge University Press, 2021.
<https://doi.org/10.1017/9781108915199.004>
- Hare, William, Claire Stockwell, Christian Flachsland, And Sebastian Oberthür. “The Architecture of the Global Climate Regime: A Top-down Perspective.” *Climate Policy* 10, no. 6 (January 1, 2010): 600–614.
- Patt, Anthony. “Energiewende in the German Power Sector.” In *Transforming Energy: Solving Climate Change with Technology Policy*, 225–53. Cambridge: Cambridge University Press, 2015. doi:10.1017/CBO9781139162210.013.
- Rayner, Tim, and Andrew Jordan. “The European Union: The Polycentric Climate Policy Leader?” *WIREs Climate Change* 4, no. 2 (March 1, 2013): 75–90.
- Ugglå, Ylva, and Fredrika Ugglå. “CHANGE: The European Commission’s Climate Campaign as a Technique of Government.” In *Towards a Cultural Politics of Climate Change: Devices, Desires and Dissent*, edited by Harriet Bulkeley, Johannes Stripple, and Matthew Paterson, 24–36. Cambridge: Cambridge University Press, 2016.
<https://doi.org/10.1017/CBO9781316694473.002>.

Thursday, March 28th, 2024

Week11: Environmental Assessment Methods *Passivhaus* [Germany]

- Hopfe, Christina J, and Robert S McLeod. *The Passivhaus Designer’s Manual: A Technical Guide to Low and Zero Energy Buildings*. New York, NY: Routledge, 2015.

- Passer, Alexander, Helmuth Kreiner, and Roman Smutny. "Adaption of DGNB-Methodology to Austria - Lessons Learned from the First Certificates." In *SB11 Helsinki: World Sustainable Building Conference - Helsinki 2011*, 1–6. Helsinki, Finland: Finnish Association of Civil Engineers RIL and VTT Technical Research Centre of Finland, 2011. http://www.irbnet.de/daten/iconda/CIB_DC23231.pdf.
- Wright, Graham S, Katrin Klingenberg, and National Renewable Energy Lab. *Climate-Specific Passive Building Standards*. Golden, CO (United States): USDOE Office of Energy Efficiency and Renewable Energy (EERE), Energy Efficiency Office, Building Technologies Office, 2015.
- Yudelso, Jerry. "CHAPTER 1 The PassivHaus Concept and European Residential Design." In *Green Building Trends: Europe*, 1–14. Washington, D.C: Island Press, 2009.

Thursday, April 4th, 2024

Week12: Zero Carbon Buildings and LEVELS

- Dodd, Nicholas, Mauro Cordella, Marzia Traverso, and Shane Donatello. "Level(s) -A Common EU Framework of Core Sustainability Indicators for Office and Residential Buildings Parts 1 and 2: Introduction to Level(s) and How It Works (Draft Beta v1.0)." European Commission documents. Science for Policy Report. Luxembourg: Publications Office of the European Union, August 1, 2017. <https://doi.org/10.2760/827838>.
- Foxell, Simon. "Carbon Sources and Sinks." In *A Carbon Primer for the Built Environment*. London; New York: Routledge, 2014.
- Foxell, Simon. "Climate and Carbon." In *A Carbon Primer for the Built Environment*. London; New York: Routledge, 2014.
- Lovell, Heather. "The Making of a Zero-Carbon Home." Chapter. In *Towards a Cultural Politics of Climate Change: Devices, Desires and Dissent*, edited by Harriet Bulkeley, Matthew Paterson, and Johannes Stripple, 160–72. Cambridge: Cambridge University Press, 2016. <https://doi.org/10.1017/CBO9781316694473.011>
- Wilby, Robert L. "Why and How Are Carbon Footprints Measured?" Chapter. In *Climate Change in Practice: Topics for Discussion with Group Exercises*, 190–205. Cambridge: Cambridge University Press, 2017. <https://doi.org/10.1017/9781316534588.013>

Thursday, April 11th, 2024

Week13: Net Zero Buildings

Norwegian proposal for a passive house standard (Standard Norge 2010)

Swedish passive house standard (Forum för Energieffektiva Byggnader [Forum for Energy Efficient Buildings] 2009)

Danmarks Lavenergibygning klasse 1
Swiss Minergie-P
French BBC-effinergie

- Cruchten, Gerelle van. *Implementation of the EPBD The Netherlands Status in 2020*. Netherlands Enterprise Agency (RVO), 2020. <https://epbd-ca.eu/wp-content/uploads/2021/12/Implementation-of-the-EPBD-in-The-Netherlands-2020.pdf>.
- Dequaire, Xavier. "Passivhaus as a Low-Energy Building Standard: Contribution to a Typology." *Energy Efficiency* 5, no. 3 (August 1, 2012): 377–91. <https://doi.org/10.1007/s12053-011-9140-8>
- Hu, Ming. "Chapter 1: The Evolution of Net Zero Energy Building." In *Net Zero Energy Building: Predicted and Unintended Consequences*, 2019. ProQuest Ebook Central, <https://ebookcentral.proquest.com/lib/UFL/detail.action?docID=5741718>
- Klingenberg, Katrin, Mike Kernagis, and Mike Knezovich. "Zero Energy and Carbon Buildings Based on Climate-Specific Passive Building Standards for North America." *Journal of Building Physics* 39, no. 6 (2016): 503–21.
- Thomsen, Kirsten Engelund; Wittchen, Kim B.; Sandorff, Søren Mark; Hansen, Allan; Kold, Line; Jørgensen, Kasper Eden; Hoang, To Quyen; Varming, Niels Bruus. "Implementation of the EPBD Denmark: Status in 2020." In *Concerted Action - Energy Performance of Buildings: Country Reports 2020*. Aalborg: Department of the Build Environment, Aalborg University; Danish Energy Agency; Danish Transport; Construction and Housing Authority, 2020. <https://epbd-ca.eu/wp-content/uploads/2021/07/Implementation-of-the-EPBD-in-Denmark---2020.pdf>
- Voss, Karsten, Eike Musall, and J. Roderick O'Donovan. "1 Towards Climate Neutral Buildings." In *Net Zero Energy Buildings International Projects of Carbon Neutrality in Buildings*. München: The Detail Business Information GmbH, 2014. <https://ebookcentral.proquest.com/lib/ufl/detail.action?docID=1383637>

Thursday, April 18th, 2024
Week 14: Final Presentations