

Equity, Energy and the Built Environment: Current Practices and Future Transitions

SUMA 5805 // Summer 2022 // Tues/Thurs, 2:10-4:00 PM // VIRTUAL

Content

As the energy paradigm slowly shifts from fossil fuels to alternatives, issues of cost and equity on both the supply and demand side become increasingly urgent. Populations impacted on both sides of energy production and consumption can share the benefits of empowerment, including potentials for greater energy independence; and the dangers of disempowerment, from the implications of fracking to the unjust distribution of systems cost. Within these considerations, the built environment is an important object of study. The built environment accounts for approximately 40% of energy consumption worldwide, including heating, cooling, lighting and electrical power; it affects all of humanity across cultural and political boundaries.

Buildings represent a middle ground between the enormity of infrastructure and the intimacy of human behavior. They are at the intersection of energy practices and social equity, where economic, health, environmental and cultural factors are most open to examination, with unexpected results. For example, recent studies in the US show an unexpected correlation between building insulation, usually of interest only to the landlord who pays for heat; and the likelihood of tenant disconnection notices for energy bills, usually associated only with consumer-billed electrical energy. Another example, derived from international sustainable development practice, has correlated ambient interior daytime temperature in homes and schools to productivity, education and other human development indicators.

This course is not only concerned with the benefits of adequate and equitable energy provision, but also with the implications of energy justice in its current forms and as we transition to sustainable energy sources. It also considers the role of the legacy physical environment, urban and non-urban, in creating opportunities for passive environmental controls that can contribute to other quality of life and community improvement goals. The equitable distribution of access to non-carbon energy and the appropriate placement of new energy infrastructure are also factors at play.

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Structure

The idea of “energy justice” will be explored in this context, drawing upon comparative policy approaches from different US state and international contexts. Concepts will be made tangible in case studies drawn from New York City, from your own experiences, and from a research project that will result initially in a class resource of concepts and approaches, then in a study of how some of these may be applied to the situations you record in your own environment. The resulting compendium of research will consider the intersection of equity and energy in the built environment by topic and by scale, from the individual to the infrastructural. It will give you a great basis for your individual work for reference in areas as varied as physiognomy, materials, cultural practice and construction technology. The study of how to apply these ideas will draw on the observations and interviews that will emerge from personal journaling, another of the primary assignments the course will require. You will receive separate assignment sheets for these assignments.

This course will be structured using a variety of opportunities to understand, through the lens of inclusion and equity, the intersection between technical building energy systems and the factors that influence how buildings are experienced. Specific to this course is its integrative scope, which will consider the financial, policy, physical and human factors that exist under current and prospective future energy systems. Students will gain technical knowledge and methodological skills to assess buildings and the systems that make them livable based on micro- and macro-level factors.

Learning Objectives

By the end of this course, students will be able to:

- Define the temporal, spatial, demographic and socio-economic dimension of energy equity
- Identify systems interconnection of architecture, policy, technology and human factors in assessing energy equity
- Identify both physical and intangible aspects affecting energy equity, especially at the building scale
- Define governance strategies and pitfalls to address energy equity
- Propose specific frameworks that characterize energy equity risks, the actors involved and pathways towards sustainability
- Apply quantitative and qualitative methods to assess energy facets in daily life
- Synthesize and present complex systems to explore threats to equity during sustainable energy transitions
- Engage stakeholders and consider their perspectives when solving problems

Readings and Websites

All reading material, composed of peer-reviewed articles, news articles and technical reports will be made available through coursework and will be discussed during lessons. Below are a few supplemental sources that may also be of interest:

- Alisdair McGregor, Cole Roberts and Fiona Cousins, *Two Degrees. The Built Environment and Our Changing Climate* (Routledge, 2013) reviews different climate types and appropriate strategies by referencing excellent case studies
- James Marston Fitch, *American Building: The Environmental Forces that Shape It* (Various editions) a classic of early building/environment interface studies
- <https://www.ibp.fraunhofer.de/en/expertise/energy-efficiency-and-indoor-climate.html> See this webpage for state-of-the-art research and tracking of energy efficiency and thermal comfort and health
- <https://www.homeinnovation.com/> Organization focused on market research and uptake of energy efficiency and new energy options for residential construction

Writing Center

The Writing Center provides writing support to undergraduate and graduate students. In one-on-one consultations and workshops, consultants offer feedback and strategies to help you improve at every stage of your writing, from brainstorming to final drafts. <https://www.college.columbia.edu/core/uwp/writing-center>

Columbia University Library

Books are underused and underrated, but you have access to Columbia's extensive library system. Check out the online catalogue. Avery is the world's largest architectural library, visit it before you graduate. <https://clio.columbia.edu/>

SPS Academic Resources

The Office of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching. <http://sps.columbia.edu/student-life-and-alumni-relations/academic-resources>.

Columbia University Information Technology (CUIT) Computer Use Policy

Columbia University requires that all individuals accessing University electronic information resources to abide by the standards of acceptable usage indicated within this policy. The University is not responsible for information or materials residing on non-University systems or available over publicly accessible networks even if accessed via the University's network. Such materials do not necessarily reflect the attitudes, opinions, or values of the University, its trustees, faculty, staff, or students. Columbia University's network and computing technology provides information, data, and communication services. Responsible use of electronic information resources is necessary to create and maintain an open community of responsible users based on mutual respect and cooperation, commitment to the integrity of resources and data, and compliance with all University policies and federal, state, and local statutes.

There are three individual assignments and one multipart collaborative research-based project required in this course. Submission requirements and due dates are also listed below. All submissions must be uploaded to Courseworks before the start of class on the day due.

The three individual assignments will challenge students to reflect upon the history of energy equity in the built environment through readings and to document their own experience of thermal comfort, physiologically and spatially, and its effect on their daily lives. The individual assignments are:

1. Weekly readings and preparation for active discussion on the readings during class time (an average of 35-50 pages of readings for each class);
2. You will select the readings for one class session and lead an approximately twenty-minute class discussion, including preparing questions for discussion. Please sign up on the document circulated by the TA, beginning on July 8th's class; and
3. Entries in an "energy journal," maintained over first portion of the course, noting personal thermal comfort in the built environment including interior and exterior situations, as outlined in weekly prompts or "quests."

The long-form assignment has two parts, one group and one individual. The group assignment is to produce a lexicon for class reference on a series of active and passive ways in which thermal comfort, especially cooling in cities (also the subject of your journaling) can be enhanced. To assist students, progressive assignments will be due throughout the semester (see separate assignment sheet). The team members will be assigned by the professors and, if needed, regrouped to ensure equitable distribution of student effort and learning. The second portion of the assignment will be an individual research paper. See additional detail below and on assignment sheets:

1. Group Research Project (group; 1,500 words plus diagrams and illustrations)
 - a. Each group or pair will select from a list of potential research topics;
 - b. During the first three weeks of class, the group will work together first to compile a literature review (format will be given) of no fewer than five peer reviewed articles or books;
 - c. The lexicon entry will be uploaded to a site (i.e. Miro) that all students have access to and should reference. We will review these entries during class;
2. Energy system futures (individual; 3-4,000 words plus illustrations)
 - a. The groups will then break apart and each student will work individually for the final three weeks of class on considering how the findings in the group research work might be applied to the conditions established in their quests;

- b. Each student will describe the energy system detailed in their journal, then select a scale for further analysis and research, culminating in a set of well-founded suggestions for improving thermal conditions while also decreasing the need for energy inputs that balance accommodations for vulnerable populations and advance equity justice;
- c. The individual research will be submitted in the form of a final paper uploaded to canvas.

Evaluation and Grading

The final grade will be calculated as described below, based upon a standard A-F scale:

Assignment	% of Grade
In class participation, attendance and preparation for reading discussions in class	15
Leadership of student discussion on one class session’s readings	15
Energy Journal/fulfilment of five energy quests	25
Energy technologies and human impacts research lexicon (group)	20
Energy technologies and human impacts application/essay (individual; 3-4,000 word paper)	20

Participation and Attendance

We expect you to come to class on time and thoroughly prepared. We will keep track of attendance and look forward to an interesting, lively and confidential discussion. If you need to miss a class for any reason, you must notify us and/or the TA the absence with us in advance. Absence not communicated at least 24 hours before class will constitute an unexcused absence except in the case of documented personal or health emergencies. Unexcused absences will result in the forfeiture of credit in the class participation portion of the grade. Multiply unexcused absences can result in a failing grade.

A Hyflex course means that you are permitted to participate either online or on Columbia campus, subject to room capacity limits. You must follow all Columbia University Covid protocols to attend in person, including vaccination, masking and reporting requirements. A hyflex course is not, however, an asynchronous online course; you must attend during class time. Absence required for professional or personal reasons must be cleared with the professors and the TA in advance. Failure to do so at least 24 hours before class time will result in an unexcused absence.

Late Work

There will be no credit granted to any written assignment that is not submitted on the due date noted in the course syllabus. In the case of documented personal or medical emergency, contact the professors as quickly as possible.

Citation and Submission

All written assignments must follow one of the recommended citation format (see this [link](#)), cite sources, and be submitted to the course website or as specified.

Copyright Policies

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be “used for any purpose other than private study, scholarship, or research.” If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of “fair use,” that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times. SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School’s policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Plagiarism will be recognized and will result in forfeiture of all credit for the written assignment in which plagiarized text has been used.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <http://health.columbia.edu/services/ods/support>.

Part I: Energy, Empathy and Equity

(1) Week 1 July 5: Introduction to Concepts, Course Content and Each Other

- **Lecture (DH/LW):** Energy forms and their Socio-economic and Cultural Context – Thermal and Electrical Energy, Thermal Comfort, Urban Microclimates and Energy Justice;
- Energy literacy ice breaker
- **Reading:**
 - Sandra Lenzholzer, *Weather in the City: How Design Shapes the Urban Climate* (naioio publishers: Rotterdam, 2015) Chapter 1 and 2, pp. 18-51 (33 pp.);
 - Peter Silver et al, *Introduction to Architectural Technology* p. 72-75 (3 pp);
 - Horta, A., Wilhite, H., Schmidt, L., & Bartiaux, F. (2014). Socio-technical and cultural approaches to energy consumption: An introduction. *Nature and Culture*, 9(2), 115-121. (6 pp)
 - Baker, S. H. (2019). Anti-resilience: A roadmap for transformational justice within the energy system. *Harv. CR-CLL Rev.*, 54, 1.
 - Reames, T. G. (2016). Targeting energy justice: Exploring spatial, racial/ethnic and socioeconomic disparities in urban residential heating energy efficiency. *Energy Policy*, 97, 549-558. (11 pp);
- **Supplemental Readings:**
 - Jenkins, K. E., Stephens, J. C., Reames, T. G., & Hernández, D. (2020). Towards impactful energy justice research: transforming the power of academic engagement. *Energy Research & Social Science*, 67, 101510.
- **Assignment:** Introduction to energy journaling/quest 1: methods of recording and assessment quantitative and qualitative; Introduction to course website

(2) Week 1 July 7: Historic Building Types and their Energy/Wellbeing Scenarios

- **Lecture (LW):** A History of domestic architecture and energy in a New York City context
- **Reading:**

- Richard Plunz, A History of Housing in New York City, Preface (10 pages); the Plunz book is available in digital form through your Clio accounts if you would like to view floor plans from the 1890s onwards;
- Michael Osman, Modernism's Visible Hand (Chapter 1 excerpt, 31-44) (13 pp);
- Daniel Barber, 'Climate Sensitive Architecture as a Blueprint' RCC Perspectives , No. 2, Energizing the Spaces of Everyday Life: Learning from the Past for a Sustainable Future (2019), pp. 77-86 (9 pp)
- **Due:** Quest 1 (via canvas website)
- **Assignment:** Group Research Project introduced and groups formed; Quest 2

(3) Week 2 July 12: Powerless: The Human Side of Household Energy

- **Lecture (DH):** Introduction to key concepts and framing/measurement of energy insecurity and energy burden
- **Readings:**
 - Hernández, D. (2016). Understanding 'energy insecurity' and why it matters to health. *Social Science & Medicine*, 167, 1-10 (10 pp);
 - Hernández, D., & Laird, J. (2021). Surviving a Shut-Off: US Households at Greatest Risk of Utility Disconnections and How They Cope. *American Behavioral Scientist*, 00027642211013401.
 - Drehobl, A., Ross, L., and Ayala, R. 2020. How High are Household Energy Burdens? Washington, DC: American Council for an Energy-Efficient Economy.
- **Supplemental Readings:**
 - Jessel, S. G., & Hernández, D. (2019). Energy, Poverty, and Health in a Changing Climate: A Conceptual Review of an Emerging Literature. *Frontiers in Public Health*, 7, 357;
 - Hernández, D., & Siegel, E. (2019). Energy insecurity and its ill health effects: A community perspective on the energy-health nexus in New York City. *Energy Research & Social Science*, 47, 78-83.
 - Lewis, J., Hernández, D., & Geronimus, A. T. (2019). Energy efficiency as energy justice: addressing racial inequities through investments in people and places. *Energy Efficiency*, 1-14 (14 pp)
- **Due:** Quest 2
- **Assignment:** Quest 3

Part II: Metrics, Methods, Urban Heat and Cooling

(4) Week 2 July 14: Housing in the US – Finance, Regulation, Equity

- **Lecture (DH):** Housing Interventions for Health and Energy Justice- RAD, Clean Heat, AC Distribution
- **Guest Lecture:** Susanne Schindler
- **Reading:**
 - Heat, housing and the horrific Bronx Fire, Diana Hernandez, New York Daily News

- The Paradox at the Heart of the Fires, Susanne Schindler, Urban Omnibus
- **Supplemental Reading:**
 - The Landscape of Housing: Twin Parks Northwest 40 years on
<https://urbanomnibus.net/2013/11/the-landscape-of-housing-twin-parks-northwest-40-years-on/> (Links to an external site.)
 - A Few Days in the Bronx: From Co-op City to Twin Parks
<https://urbanomnibus.net/2012/07/a-few-days-in-the-bronx-from-co-op-city-to-twin-parks/> (Links to an external site.)
 - The Chain of Failures that Left 17 Dead in a Bronx Apartment Fire, <https://www.nytimes.com/interactive/2022/07/08/nyregion/bronx-fire-nyc.html?referringSource=articleShare> (Links to an external site.) [access NY times via your Columbia account. Instructions for doing so can be found here: <https://guides.library.columbia.edu/nytimes>]Links to an external site.
- **Due:** Quest 3
- **Assignment:** Ongoing work on Group Research Project; Quest 4

(5) Week 3 July 19: Methods of energy analysis and alternatives to conventional building systems

- **Lecture (LW):** Some basics for measuring thermal energy performance in buildings
- **Readings:**
 - Kohta Ueno, 'How to Look at a House Like a Building Scientist (Part 2: Heat), December 4, 2019. Building Science Corporation website
<https://www.buildingscience.com/documents/published-articles/pa-1902-how-look-house-building-scientist-part-2-heat;>
 - Sandra Lenzholzer, Weather in the City: How Design Shapes the Urban Climate (naioio publishers: Rotterdam, 2015) Chapters 5 and 6 (32 pp);
- **Supplemental Reading:**
 - Philippe Rahm, 'Meteorological Architecture' in: Architectural Design, 5/2009, v. 79, issue 3, p. 30-41 (12 pp)
- **Due:** Quest 4; Literature review for research project, introductory paragraph and outline for Group Research Project
- **Assignment:** Ongoing work on Group Research Project; Quest 5

(6) Week 3 July 21: Heat and the City: Heat, Health and Policy Reform

- **Lecture (DH):** Urban Heat Island, Heat Waves, Health Impacts of Excess Heat and Unequal Access to Cooling
- **Guest Lecturer:** Lonnie Portis, WE ACT for Environmental Justice-
<https://www.weact.org/campaigns/heat-health-equity/>
- **Guest Lecturer:** Vjollca Berisha, Maricopa County Department of Public Health and Katie Lane, NYC Department of Health and Mental Hygiene
- **Readings:**

- White-Newsome, J., O'Neill, M. S., Gronlund, C., Sunbury, T. M., Brines, S. J., Parker, E., ... & Rivera, Z. (2009). Climate change, heat waves, and environmental justice: Advancing knowledge and action. *Environmental Justice*, 2(4), 197-205.
- Ormandy, D., & Ezratty, V. (2016). Thermal discomfort and health: protecting the susceptible from excess cold and excess heat in housing. *Advances in Building Energy Research*, 10(1), 84-98.
- Cong, S., Nock, D., Qiu, Y. L., & Xing, B. (2022). Unveiling hidden energy poverty using the energy equity gap. *Nature communications*, 13(1), 1-12.
- **Supplemental Readings:**
 - <https://www.nytimes.com/2019/05/24/health/climate-change-elderly.html>
 - <https://www.wnyc.org/story/life-new-york-public-housing-no-air-conditioning/>
 - <https://www.npr.org/2019/09/03/754044732/as-rising-heat-bakes-u-s-cities-the-poor-often-feel-it-most>
 - <https://www.nytimes.com/2021/06/01/well/mind/summer-seasonal-affective-disorder.html>

Due: Quest 5

- **Assignment:** Complete Group Research Project

(7) Week 4 July 26 Student Presentations: Lexicon entries and findings presented in class; submissions and group discussion of journaling efforts to date; group discussion of how to think about impacting spaces observed in journaling based upon topics researched for lexicon

- **Due:** Lexicon entries posted and reviewed
- **Assignment:** Begin individual research work

(8) Week 4 July 28: Guest Lecture Prof. Forest Meggers

- **Lecture:** Innovations in cooling technologies
- **Readings:** (subject to change)
 - Meggers, F. & Aviv, Rysanek, Chen and Teitelbaum (2021). 'A Better Way to Cool Ourselves'. *Scientific American*, May 26 2021.
<https://www.scientificamerican.com/article/a-better-way-to-cool-ourselves/>
 - Teitelbaum, E. et al., (2020) 'Membrane-assisted radiant cooling for expanding thermal comfort zones globally without air conditioning'. *Proceedings of the National Academy of Sciences USA* 117 (35). <https://www.pnas.org/content/117/35/21162>
 - Aviv, D., et al., (2021) 'A fresh (air) look at ventilation for COVID-19: Estimating the global energy savings potential of coupling natural ventilation with novel radiant cooling strategies'. *Applied Energy*, 292.
<https://www.sciencedirect.com/science/article/pii/S0306261921003421>
 - Andlinger Center for Energy and the Environment blog April 15, 2021
<https://acee.princeton.edu/acee-news/building-technology-opens-the-door-to-increased-ventilation-lower-energy-costs-globally/>

- Schlossberg, T. (2020) 'Cooling Off without Air Conditioning'. The Washington Post, Sept 10 2020 <https://www.washingtonpost.com/climate-solutions/2020/09/10/radiant-cooling-climate-air-conditioning/?arc404=true>
- **Due:** Thesis proposal and outline for individual research project
- **Assignment:** Annotated bibliography

Part III: Lighting and Appliances

(9) Week 5 August 2: Lighting, Perception and Human health

- **Lecture (LW):** Principles of architectural lighting
- **Guest lecturer:** Micaela Martinez, Emory University; Lighting sources and transitions, circadian rhythms and health benefits of daylighting
- **Readings:**
 - Marilyne Andersen, 'Unweaving the Human Response in Daylight Design' (Building and Environment 91 (2015)) (13 pp);
 - Dominoni, D. M., & Nelson, R. J. (2018). Artificial light at night as an environmental pollutant: An integrative approach across taxa, biological functions, and scientific disciplines. *Journal of Experimental Zoology. Part A, Ecological and integrative physiology*, 329(8-9), 387;
 - James, P., Bertrand, K. A., Hart, J. E., Schernhammer, E. S., Tamimi, R. M., & Laden, F. (2017). Outdoor light at night and breast cancer incidence in the Nurses' Health Study II. *Environmental Health Perspectives*, 125(8), 087010.
- **Additional Readings:**
 - Reames, T. G., Reiner, M. A., & Stacey, M. B. (2018). An incandescent truth: Disparities in energy-efficient lighting availability and prices in an urban US county. *Applied energy*, 218, 95-103 (12 pp);
 - <https://www.nytimes.com/2018/12/28/nyregion/how-deepak-chopra-wellness-expert-spends-his-sundays.html>
- **Assignment:** Ongoing work on research project

(10) Week 5 August 4: Appliances, household equipment and clean cooking globally and domestically

- **Lecture (LW):** Cultural history of appliances
- **Guest Lecture:** Misbath Daouda, Mailman School of Public Health
- **Reading:**
 - Sigfried Giedion, *Mechanization Takes Command*, pp. 612-27 (15 pages);
 - A review of household air pollution and health: [https://www.jacionline.org/article/S0091-6749\(19\)30582-2/fulltext](https://www.jacionline.org/article/S0091-6749(19)30582-2/fulltext)
 - A review of LPG use and gender dynamics: <https://doi.org/10.1080/00220388.2019.1657571> (Links to an external site.)
 - On gas stoves and methane emissions: <https://www.nytimes.com/2022/01/27/climate/gas-stoves-methane-emissions.html> (Links to an external site.)
 - NYT article on gas stoves and VOCs: <https://www.nytimes.com/2022/06/28/climate/natural-gas-home-toxic-chemicals.html>

- **Supplemental reading:**
 - Austin Troy, *The Very Hungry City* Chapter 1 pp.13-31 (18 pages);
- **Due:** Annotated bibliography for individual research project
- **Assignment:** Ongoing work on research project

Part IV: Policies and Programs to Achieve a Just Energy Future

(11) Week 6 Aug 9: Just Transition and Resilience

- **Lecture (DH):**
- **Guest lecturers:** Aditi Bansal, Columbia Global Energy Policy/Mailman School of Public Health and Sahara James, Kinetic Communities
- **Readings:**
 - Harrahill, K., & Douglas, O. (2019). Framework development for 'just transition' in coal producing jurisdictions. *Energy Policy* 134. doi.org/10.1016/j.enpol.2019.110990;
 - Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition." *Energy Policy* 108. doi.org/10.1016/j.enpol.2017.06.014
 - <https://assets.ctfassets.net/ntcn17ss1ow9/21c9L5c5UiKKKJWtmPnqS1/7013a521c1c2783b1595b239629f885d/ACEEE-summer-study-2018-NY.pdf>
- **Assignment:** Ongoing work on research project

(12) Week 6 August 11: Energy Policies to Address Equity and Measure Impact

- **Lecture (DH):**
- **Panel 1:** Measuring Impact toward Energy Justice
- **Guest Lecturers:** Carlos Martin, Urban Institute &
- **Panel 2:** Policy Innovations toward energy justice in the US
- **Guest Lecturer:** Jamal Lewis Green & Healthy Homes Initiative; Lauren Ross, Department of Housing and Urban Development (formerly at American Council for an Energy Efficient Economy (ACEEE))
- **Readings:**
 - <https://www.urban.org/research/publication/state-equity-measurement>
 - <https://grist.org/fix/clean-energy-programs-poor-equity-maps/>
 - https://www.aceee.org/files/proceedings/2016/data/papers/2_542.pdf
 - https://www.energy.ca.gov/sites/default/files/2019-12/energy_equity_indicators_ada.pdf
- **Assignment:** Ongoing work on research project

Due by August 12: Final individual journals and final research project