jump into STEM
COLLEGIATE BUILDING SCIENCE COMPETITION

Professor Team Webinar #2

May 24, 2024

Yeonjin Bae, ORNL
Kim Trenbath, NREL

U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY
BUILDING TECHNOLOGIES OFFICE
OAK RIDGE National Laboratory
NREL NATIONAL RENEWABLE ENERGY LABORATORY
Pacific Northwest NATIONAL LABORATORY

Agenda

- JUMP into STEM Competition
- 2024-2025 Professor Team
- Share Your Experience
- 2024-2025 Potential Challenge Topic
- Q&A

Management Team

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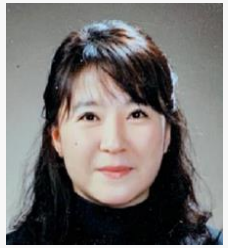
COLLEGIATE BUILDING SCIENCE COMPETITION

U.S. Department of Energy (DOE) Building Technologies Office (BTO)

Nicholas Ryan

Oak Ridge National Laboratory Grid Interactive Controls, Integrated Building Performance



Dr. Yeonjin Bae

Bill Eckman

Dr. Mini Malhotra

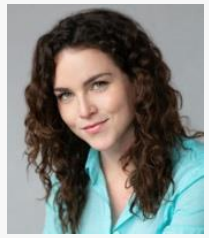
Dr. Yeobeom Yoon

Jason Schmidt

National Renewable Energy Laboratory Building Technologies and Science Center

Dr. Kim Trenbath

Allison Georgeson



Dr. Kerry Rippy

Alyssa Bersine

Willy Heredia

Pacific Northwest National Laboratory Building Simulation & Design, Building Systems

Dr. Sarah Newman

Carmen Cejudo

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JUMP into STEM Overview

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COLLEGIATE BUILDING SCIENCE COMPETITION

- BTO-sponsored building science collegiate competition
- Student teams respond to one of three challenges
- Promotes ideation and diversity
- Awards include mentoring and paid internships
- 2024-2025 is seventh year of student competition

For more info:
www.jumpintostem.org

Vision

jump into STEM
COLLEGIATE BUILDING SCIENCE COMPETITION

- Inspire the next generation of building scientists, focusing on creative ideation and diversity in the building science field
- Provide a gateway for college undergraduate and graduate students to experience the research and career possibilities of studying building science
- Attract students from diverse majors and diverse backgrounds

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JUMP into STEM Competition

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Tentative Student Competitions for Building Technology Innovation

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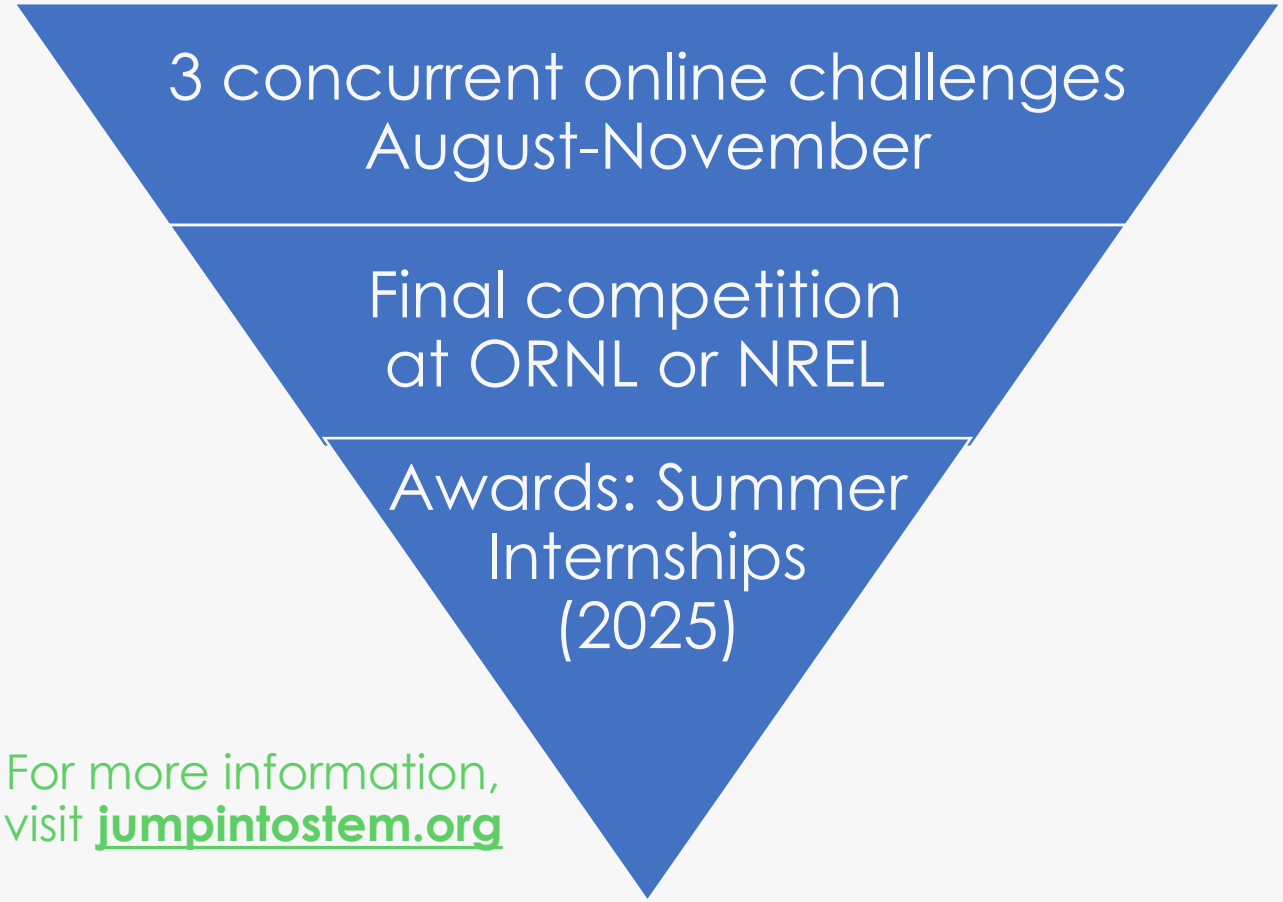

For more information, visit **jumpintostem.org**

How it works:

- Fall semester: three building science challenges for innovation
- Supported with technical overview slide deck for each challenge
- Webinars
  - Professor team webinars
  - Student webinars
- Finalists compete in Final Competition at ORNL or NREL for paid summer internships at ORNL, NREL or PNNL

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COLLEGIATE BUILDING SCIENCE COMPETITION

2024-2025 Professor Team

2024-2025 Professor Team

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COLLEGIATE BUILDING SCIENCE COMPETITION

Join the JUMP into STEM Professor Team!

Your Role and Activities:

- The Professor Team connects DOE's goals within the Challenges to university students.
- Engage with JUMP into STEM team to provide feedback on potential challenges and updates during the competition
- Incorporate at least one (1) challenge into an appropriate Fall 2024 course as part of the student's grade
- Support students on research and submissions
- Promote JUMP into STEM to other university stakeholders.

JUMP into STEM participants Jarrett Thomas and Jai Huntley, and Hampton University Professor Laura Battaglia

For more info:
https://jumpintostem.org/professors/

2024-2025 Professor Team (cont.)

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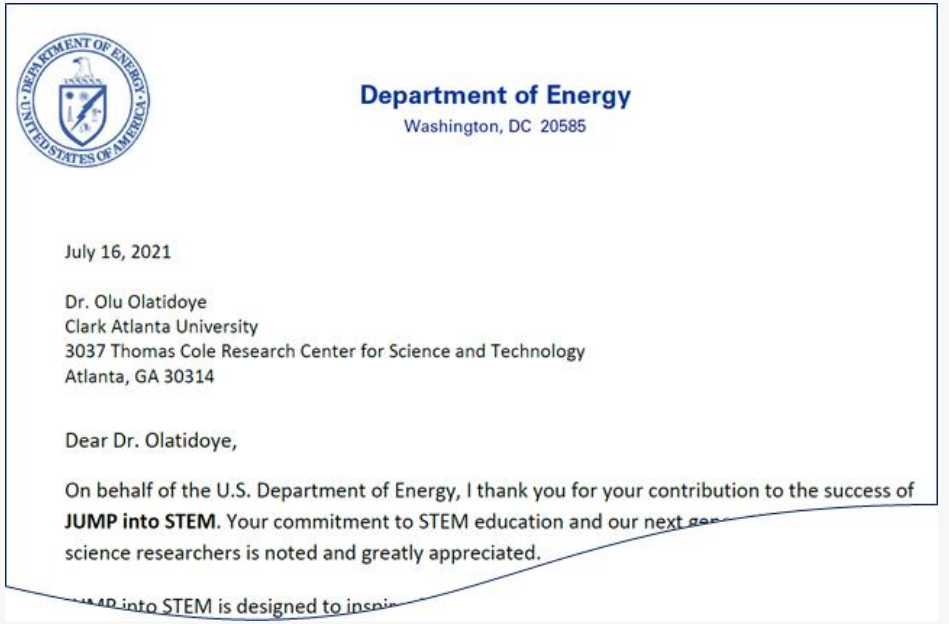
COLLEGIATE BUILDING SCIENCE COMPETITION

- **Benefits to participating:**
  - Meet service-related metrics for your university by contributing to the development of a nationwide student competition.
  - Letter of Recognition
    - Recognizes participation
    - Official letter from U.S. Department of Energy's Building Technologies Office (BTO)
  - Incorporate at least one (1) challenge into an appropriate Fall course as part of the student's grade **that leads to students' submissions**



Department of Energy
Washington, DC 20585

July 16, 2021

Dr. Olu Olatidoye
Clark Atlanta University
3037 Thomas Cole Research Center for Science and Technology
Atlanta, GA 30314

Dear Dr. Olatidoye,

On behalf of the U.S. Department of Energy, I thank you for your contribution to the success of **JUMP into STEM**. Your commitment to STEM education and our next ge
science researchers is noted and greatly appreciated.

MP into STEM is designed to inspi

2023–2024 Professor Team

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★ New to the Team in 2023
★ HBCU/MSI/HSI

Dr. Davide Ziviani
Purdue University
Mechanical Engineering

Dr. Zoltan Nagy★★
The University of Texas at Austin
Architectural and Environmental Engineering

Liane A Hancock★
University of Louisiana at Lafayette
Architectural and Environmental Engineering

Dr. Karl Heine
Embry-Riddle Aeronautical University
Mechanical Engineering

Dr. Liang Zhang ★★
University of Arizona
Civil Engineering and Engineering Mechanics

Dr. Mohammad Heidarinejad★
Illinois Institute of Technology
Architectural Engineering

Dr. Allison Mahvi★
University of Wisconsin, Madison
Mechanical Engineering

Dr. Rania Labib★
Prairie View A&M University
Architecture

Dr. Shahin Shafiee★★
Prairie View A&M university
Mechanical Engineering

Dr. Yao Yu
North Dakota State University
Construction Management and Engineering

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Dr. Somayeh Asadi★
Pennsylvania State University
Architectural Engineering

Dr. Moe Alahmad
University of Nebraska-Lincoln
Electrical Engineering

Dr. Bilal Alhawamdeh★
Western Michigan University
College of Engineering and Applied Sciences

Dr. Hessam Taherian ★
Pennsylvania State University
School of Science, Engineering, and Technology

Dr. Nelson Fumo
University of Texas at Tyler
Mechanical Engineering

Dr. Heather E. Dillon
University of Washington
Mechanical Engineering

Dr. Mehdi Mortazavi★
Worcester Polytechnic Institute
Mechanical & Materials Engineering

Dr. Aysegul Demir★
University of Wyoming
Civil & Architectural Engineering

Dr. Manish Dixit★
Texas A&M University
Construction Science

Dr. Suresh Dhaniyala★
Clarkson University
Mechanical and Aerospace Engineering

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★ New to the Team in 2023
★ HBCU/MSI/HSI

Dr. Thomas D. Tran
Indiana Tech
Mechanical Engineering

Dr. Hassan Qandil ★★
University of North Texas
Mechanical Engineering

Dr. Endong Wang ★
SUNY College of Environmental Science and Forestry
Sustainable Construction

Dr. Behnam Shadravan ★
Florida A&M University
Architecture and Engineering Technology

Dr. Dalya Ismael ★
Old Dominion University
Engineering Technology

Dr. Sesha Srinivasan ★
Florida Polytechnic University
Engineering Physics

Dr. Patrick Tebbe
Minnesota State University
Mechanical Engineering

Kathryn Jackson ★★
Northern Oklahoma College
Renewable Energy

Dr. Manohar Chamana ★★
Texas Tech University
Wind Energy Program

Dr. Nancy Landreville
University of Maryland Global Campus
Applied Mgmt and Decision Science

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★ HBCU/MSI/HSI

Dr. Mookesh Dhanasar ★★
North Carolina A&T State University
Mechanical Engineering

Dr. Seyed A. Niknam ★
Western New England University
Industrial Engineering

Dr. Jessica April Ward ★
Prairie View A&M University
Architecture

Dr. Paulette Vincent-Ruz ★★
New Mexico State University
Chemistry and Biochemistry

Dr. Joseph Carpenter ★
The University of Alabama
Mechanical Engineering

Dr. Ahmed Ouf ★
Alabama A&M University
Community and Regional Planning

Lynn Albers
Hofstra University
Mechanical Engineering

Dr. Mariantonieta Gutierrez Soto
Pennsylvania State University
Architectural Studies

Dr. Shuang Cui
University of Texas - Dallas
Mechanical Engineering

Lynn Abdouni ★
University of Georgia
Mechanical Engineering

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★ New to the Team in 2023
★ HBCU/MSI/HSI

Dr. Zheng O'Neill
Texas A&M University
Mechanical Engineering

Dr. Olu Olatidoye ★
Clark Atlanta University
Sponsored Program Administration

Dr. Lori Troxel
Vanderbilt University
Civil/Environmental Engineering

Dr. Raymond Tesiero ★
North Carolina A&T State University
Civil, Architectural &
Environmental Engineering

Share Your Experience

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COLLEGIATE BUILDING SCIENCE COMPETITION

1. Introduction of Topics
2. Course Integration
3. Student Engagement
4. Experience and Feedback
5. Advice for Colleagues
6. Challenges and Highlights
7. Additional Insights

JUMP into STEM Videos

- Check out latest videos of JUMP into STEM!

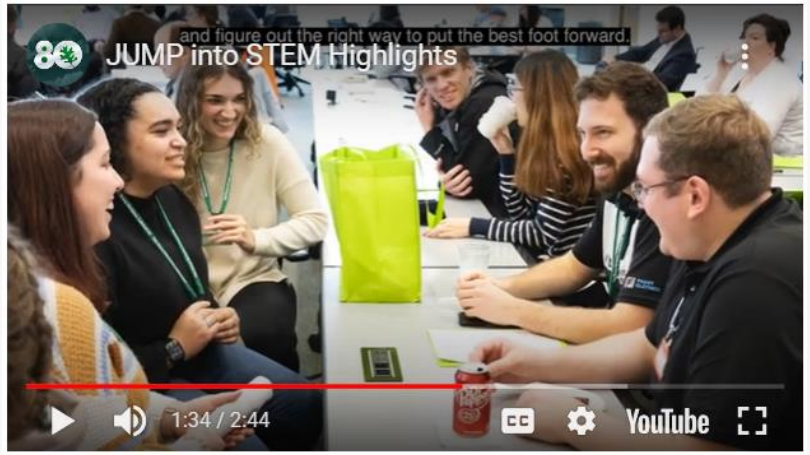
Join the JUMP into STEM Professor Team

https://jumpintostem.org/professors/

2022-2023 JUMP into STEM Final Competition Highlights

https://www.jumpintostem.org/final-event/

2023-2024 JUMP into STEM Final Competition Highlights



https://www.jumpintostem.org/final-event/

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JUMP into STEM Challenge Topics

2023–2024 Challenge Topics

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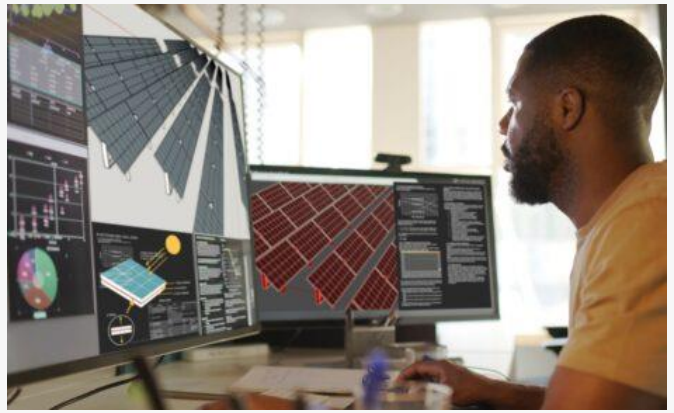
Keepin' it Cool (or Hot)

That's a Wrap!



You and Me, Carbon Free!

Challenges

- **Background**
- **Technical Overview**
- **The Challenge**
- Requirements
- Evaluation Criteria

That's a Wrap!

08/01/2023

The objective of this challenge is to improve the **building envelope performance** of new or existing residential buildings by reducing energy consumption in a cost-effective and accessible way.

Background

In the heat of summer, does your air conditioner seem to run all the time? In winter, do cold drafts in your house make it impossible to get comfortable? Your house may be energy inefficient due to the performance of the building envelope. The **building envelope**—consisting of the walls, roof, foundation, and windows—separates the interior living conditions from the exterior weather and is the single largest contributor to primary energy use in residential buildings.[1] Nearly 60% of total residential building energy is used to provide occupant comfort by heating, cooling, and ventilating the living space.[2] The performance of the building envelope disproportionally affects communities that lack the resources to improve the quality of the building envelope through remediation techniques.[3]

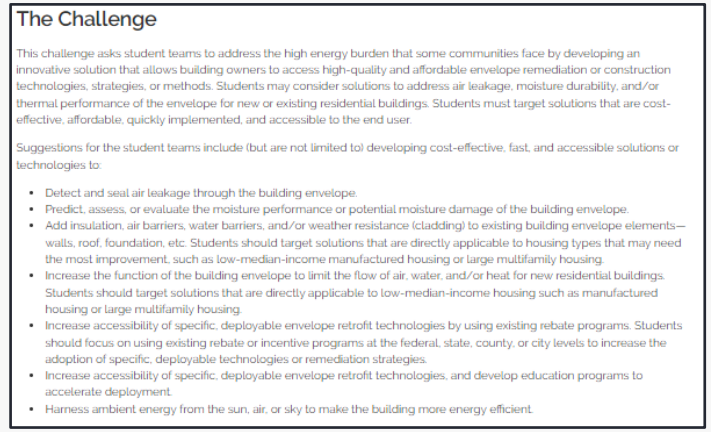
Source: GettyImages

One of the primary functions of the building envelope is to control the flow of matter and energy—specifically, the flow of moisture, air, and heat between the interior and exterior.[4] Failure to control this flow can cause reductions in energy efficiency, durability issues, decrease in occupant comfort, and reduced indoor air quality, which can lead to mold and cause significant health issues.[5] The flow of moisture (both liquid water and vapor) is typically controlled using water-resistive barriers, ventilation air gaps, and drainage planes. The flow of air is typically controlled using air-resistive barriers and air sealing techniques. The flow of heat is controlled using insulation and solar reflectance. While new building construction can easily benefit from novel technologies and methods, many of these control methods can be difficult, cost-inhibitive, or sometimes even impossible to implement into existing buildings.[6]

More than 50% of existing residential buildings in the United States were built before 1980 when energy conservation codes were first introduced,[7] and they lack modern efficient technologies that effectively control the flow of matter and energy. However, less than 2% of U.S. buildings are **remediated** each year[8] to improve the energy efficiency, primarily because the cost to retrofit commonly exceeds several thousand dollars[9] and often falls entirely on the building owner. In some cases, the building owner may have a high **energy burden** and may not have the resources to improve the quality of the building envelope to lower energy consumption. Energy burden is the percentage of a household's gross annual income spent on energy costs (including electricity, natural gas, and other home-heating fuels).[10] A person is considered energy burdened if they spend 6% or more of their annual income on energy costs.[11] Lower income households are disproportionally impacted by energy burden—households that make $15,000 or less per year spent on average 21% of their income on utilities and may forgo other life necessities in order to address issues with the envelope.[12] To increase energy efficiency and address energy burden, innovative solutions must be developed that provide access to energy-efficient, cost-effective, and accessible building envelopes.

Example of the *background*

Examples of the *Technical Overview*



The Challenge

This challenge asks student teams to address the high energy burden that some communities face by developing an innovative solution that allows building owners to access high-quality and affordable envelope remediation or construction technologies, strategies, or methods. Students may consider solutions to address air leakage, moisture durability, and/or thermal performance of the envelope for new or existing residential buildings. Students must target solutions that are cost-effective, affordable, quickly implemented, and accessible to the end user.

Suggestions for the student teams include (but are not limited to) developing cost-effective, fast, and accessible solutions or technologies to:

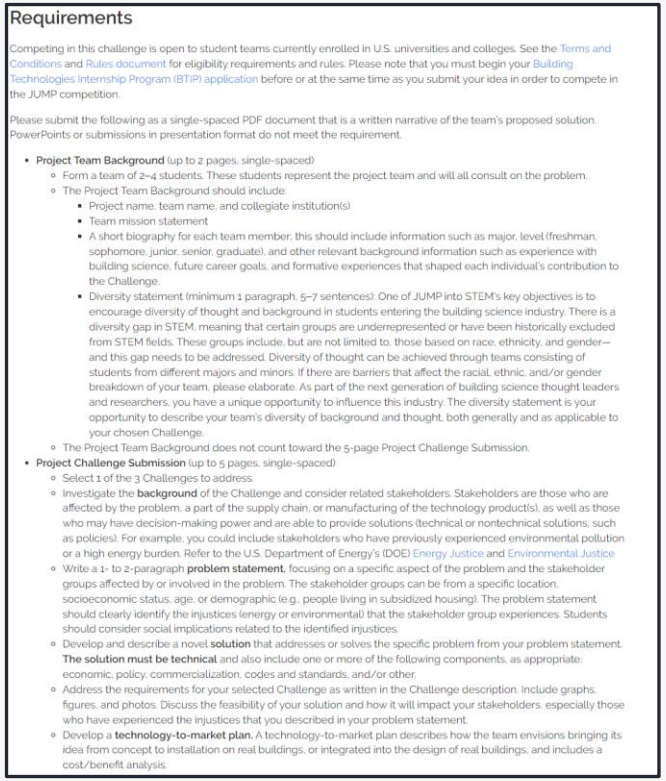
- Detect and seal air leakage through the building envelope.
- Predict, assess, or evaluate the moisture performance or potential moisture damage of the building envelope.
- Add insulation, air barriers, water barriers, and/or weather resistance (cladding) to existing building envelope elements—walls, roof, foundation, etc. Students should target solutions that are directly applicable to housing types that may need the most improvement, such as low-median-income manufactured housing or large multifamily housing.
- Increase the function of the building envelope to limit the flow of air, water, and/or heat for new residential buildings. Students should target solutions that are directly applicable to low-median-income housing such as manufactured housing or large multifamily housing.
- Increase accessibility of specific, deployable envelope retrofit technologies by using existing rebate programs. Students should focus on using existing rebate or incentive programs at the federal, state, county, or city levels to increase the adoption of specific, deployable technologies or remediation strategies.
- Increase accessibility of specific, deployable envelope retrofit technologies, and develop education programs to accelerate deployment.
- Harness ambient energy from the sun, air, or sky to make the building more energy efficient.

Example of the *challenge*

https://www.jumpintostem.org/challenge/thats-a-wrap/

Challenges

- Background
- Technical Overview
- The Challenge
- **Requirements**
- **Evaluation Criteria**



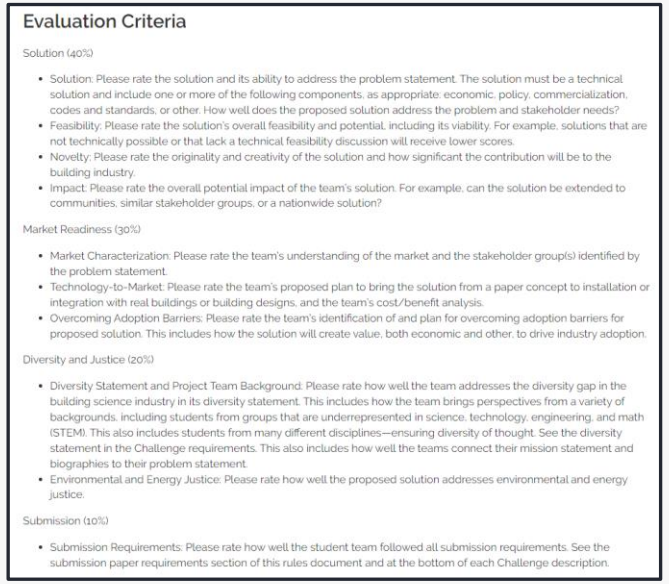
Requirements

Competing in this challenge is open to student teams currently enrolled in U.S. universities and colleges. See the Terms and Conditions and Rules document for eligibility requirements and rules. Please note that you must begin your Building Technologies Internship Program (BTIP) application before or at the same time as you submit your idea in order to compete in the JUMP competition.

Please submit the following as a single-spaced PDF document that is a written narrative of the team's proposed solution. PowerPoints or submissions in presentation format do not meet the requirement.

- **Project Team Background** (up to 2 pages, single-spaced)
  - Form a team of 2–4 students. These students represent the project team and will all consult on the problem.
  - The Project Team Background should include:
    - Project name, team name, and collegiate institution(s)
    - Team mission statement
    - A short biography for each team member; this should include information such as major, level (freshman, sophomore, junior, senior, graduate), and other relevant background information such as experience with building science, future career goals, and formative experiences that shaped each individual's contribution to the Challenge.
    - Diversity statement (minimum 1 paragraph, 5–7 sentences): One of JUMP into STEM's key objectives is to encourage diversity of thought and background in students entering the building science industry. There is a diversity gap in STEM, meaning that certain groups are underrepresented or have been historically excluded from STEM fields. These groups include, but are not limited to, those based on race, ethnicity, and gender—and this gap needs to be addressed. Diversity of thought can be achieved through teams consisting of students from different majors and minors. If there are barriers that affect the racial, ethnic, and/or gender breakdown of your team, please elaborate. As part of the next generation of building science thought leaders and researchers, you have a unique opportunity to influence this industry. The diversity statement is your opportunity to describe your team's diversity of background and thought, both generally and as applicable to your chosen Challenge.
  - The Project Team Background does not count toward the 5-page Project Challenge Submission.
- **Project Challenge Submission** (up to 5 pages, single-spaced)
  - Select 1 of the 3 Challenges to address.
  - Investigate the **background** of the Challenge and consider related stakeholders. Stakeholders are those who are affected by the problem, a part of the supply chain, or manufacturing of the technology product(s), as well as those who may have decision-making power and are able to provide solutions (technical or nontechnical solutions, such as policies). For example, you could include stakeholders who have previously experienced environmental pollution or a high energy burden. Refer to the U.S. Department of Energy's (DOE) Energy Justice and Environmental Justice
  - Write a 1- to 2-paragraph **problem statement**, focusing on a specific aspect of the problem and the stakeholder groups affected by or involved in the problem. The stakeholder groups can be from a specific location, socioeconomic status, age, or demographic (e.g., people living in subsidized housing). The problem statement should clearly identify the injustices (energy or environmental) that the stakeholder group experiences. Students should consider social implications related to the identified injustices.
  - Develop and describe a novel **solution** that addresses or solves the specific problem from your problem statement. **The solution must be technical** and also include one or more of the following components, as appropriate: economic, policy, commercialization, codes and standards, and/or other.
  - Address the requirements for your selected Challenge as written in the Challenge description. Include graphs, figures, and photos. Discuss the feasibility of your solution and how it will impact your stakeholders, especially those who have experienced the injustices that you described in your problem statement.
  - Develop a **technology-to-market plan.** A technology-to-market plan describes how the team envisions bringing its idea from concept to installation on real buildings, or integrated into the design of real buildings, and includes a cost/benefit analysis.

Examples of the *Requirements*



Evaluation Criteria

Solution (40%)

- Solution: Please rate the solution and its ability to address the problem statement. The solution must be a technical solution and include one or more of the following components, as appropriate: economic, policy, commercialization, codes and standards, or other. How well does the proposed solution address the problem and stakeholder needs?
- Feasibility: Please rate the solution's overall feasibility and potential, including its viability. For example, solutions that are not technically possible or that lack a technical feasibility discussion will receive lower scores.
- Novelty: Please rate the originality and creativity of the solution and how significant the contribution will be to the building industry.
- Impact: Please rate the overall potential impact of the team's solution. For example, can the solution be extended to communities, similar stakeholder groups, or a nationwide solution?

Market Readiness (30%)

- Market Characterization: Please rate the team's understanding of the market and the stakeholder group(s) identified by the problem statement.
- Technology-to-Market: Please rate the team's proposed plan to bring the solution from a paper concept to installation or integration with real buildings or building designs, and the team's cost/benefit analysis.
- Overcoming Adoption Barriers: Please rate the team's identification of and plan for overcoming adoption barriers for proposed solution. This includes how the solution will create value, both economic and other, to drive industry adoption.

Diversity and Justice (20%)

- Diversity Statement and Project Team Background: Please rate how well the team addresses the diversity gap in the building science industry in its diversity statement. This includes how the team brings perspectives from a variety of backgrounds, including students from groups that are underrepresented in science, technology, engineering, and math (STEM). This also includes students from many different disciplines—ensuring diversity of thought. See the diversity statement in the Challenge requirements. This also includes how well the teams connect their mission statement and biographies to their problem statement.
- Environmental and Energy Justice: Please rate how well the proposed solution addresses environmental and energy justice.

Submission (10%)

- Submission Requirements: Please rate how well the student team followed all submission requirements. See the submission paper requirements section of this rules document and at the bottom of each Challenge description.

Examples of the *Evaluation Criteria*

https://www.jumpintostem.org/challenge/thats-a-wrap/

Idea Submission

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COLLEGIATE BUILDING SCIENCE COMPETITION

Forming teams

- Teams of 2 – 4 students
  - Undergraduate or graduate
  - Multiple majors and/or minors

Diversity of thought and background

- This will be evaluated based on the diversity statement that is required as part of the submission
  - Underrepresented groups in STEM (including, but not limited to race, ethnicity, gender)
  - How the team contributes to diversity in building science

(Tentative) Idea Submission

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Project Team Background

- 2-page max (Single-spaced)
- Project name, team name, and collegiate institution(s)
- Team's mission statement
- Short bio for each team member
- Diversity statement
  - minimum 1 paragraph, 5–7 sentences

Plagiarism will not be tolerated. The quality of writing will be considered, so review by peers is strongly encouraged.

Project Challenge Submission

- 5-page max (Single-spaced)
- **Background**
  - Investigate the background of the Challenge and consider related stakeholders
- **Problem statement:**
  - Focus on a specific aspect of the problem
  - Identify stakeholder(s)
- **Solution**
  - Technical solution + one or more of the following components
    - Economic, policy, commercialization, codes and standards, and/or other
- **Technology-to-market plan**
  - Cost/benefit and market adoption barrier analysis
- **Market adoption barrier analysis**
  - Identify at least one key market adoption barrier for implementation

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The 2024-2025 DRAFT Challenge Topics

2024–2025 Potential Challenge Topics

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1. Creating a Paradigm Shift in Building Science

The current processes for designing, constructing, and powering U.S. buildings in both the residential and commercial sectors are based on unlimited natural resources and cheap energy. These processes do not yet factor climate change impacts. Increasing sustainability and decarbonization of building lifetime, including construction, operation, and decommissioning may require disruption in the buildings industry. Examples of disruption include advanced building construction that take advantage of offsite fabrication and robotics or efficient transformation to building-level direct current distribution. This disruption could start a paradigm shift in building science. Students should identify areas in the industry ready for disruption, propose innovative solutions, and describe how the market could be transformed.

2. Driving Affordability

Decarbonizing U.S. buildings will require innovative solutions that are technical and holistic. Historically, advanced technologies have early adopters that drive uptake, and this sometimes occurs before the technology is scaled. There is a need for solutions that will quickly become affordable and reduce carbon emissions from commercial and residential buildings in the U.S. Students should create technical and holistic solutions that will decarbonize buildings through pathways such as energy efficiency, advanced controls, advanced appliances, demand flexibility, and more. A key part of the solution is considering affordability for stakeholders including building owners, the government, and low- to moderate-income communities.

3. Solidifying Buildings as a Desirable Industry

The U.S. Department of Energy has established building decarbonization goals in 2035 and 2050 and accomplishing them will require more skilled, trained workers in the buildings sector. High paying and interesting jobs will attract these workers. A healthy buildings industry includes jobs at a variety of education levels with growth in the field. Skill areas could be technology, construction, policy, education, or other. There's currently a shortage of skilled professionals needed to deploy energy efficient and decarbonized technologies (i.e., contractors). Students should develop a solution to grow the buildings industry through increased technology and create ways to train and increase the buildings workforce.

4. Enabling Equitable Occupant Comfort

Buildings primarily serve as shelter, so ensuring occupant comfort and indoor air quality are absolutely critical for modern buildings. Mitigating climate change requires all aspects of building operations to decarbonize. To reach all stakeholders, including those who are from low- to moderate-incomes or historically underserved communities, the clean energy transition must be affordable. Students should develop technical and holistic solutions that address this need.

2024–2025 Potential Challenge Topics

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5. Automating Building Construction

The field of building technology has grown significantly over the past 30 years with tech companies possessing high market shares. Technology, including software, machine learning, artificial intelligence, and automation, is integrated into all industries. The uptake in the building industry has not been as quick as others. Solutions are needed including construction affordability (including retrofit), building construction automation, and adaptable models and controls. Students should develop a solution to decrease the time and cost of building construction thought advanced building construction technologies and strategies.

6. Solidifying Resiliency

All building infrastructures have risks such as being impacted by extreme weather and cyberattacks. Resilient solutions are needed to maintain spaces for people to live, work, and play. Resilience prevents loss from theft and disaster, both which come with a hefty price tag. Students should develop solutions to address resiliency that will benefit communities, people, and industries that are susceptible to disasters and attacks.

7. Building Comfort in Extreme Climates

Residents of very hot, very cold, and very humid climates consume high amounts of energy to heat, cool, and dehumidify their buildings. With the goal of decarbonization, there is a push to developing highly efficient cold climate heat pumps that eliminate the need to burn fuel at the site to heat a building. In addition, decoupling dehumidification from the sensible load could further add to efficiencies. Students should develop technologies for decarbonization while maintaining or improving occupant comfort in extreme climates.

8. Reducing Peak Demand

Part of the decarbonization strategy includes reducing peak demand through thermal energy storage, controls, and demand flexibility. Students should develop building-related solutions for reducing peak demand on the electrical grid, and not how the electrical distribution infrastructure would be affected.

9. Greening Building Materials

Decarbonization calls for the development and use of thoughtful low-embodied carbon materials that can be repurposed or recycled at the end of its life cycle. Sustainable building materials can be used in construction and technologies such as thermal energy storage or the building envelope. The industrial sector is interested in ways to reduce their scope. Students should develop solutions that enable sustainable building materials, including green concrete and life cycle assessments.

2024–2025 Potential Challenge Topics

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10. Mitigating the Market Problem

Heat pump water heater technology has been commercially available for decades. There are also utility incentive programs, but uptake is very low. There is a need to understand the market for this technology and to develop solutions to increase uptake. Students should work to develop ideas for increasing market penetration of heat pump water heaters.

11. Reducing refrigerant emissions

The US Environmental Protection Agency (EPA) reports that refrigerant leaks from air conditioning systems contribute approximately 5% to the nation's greenhouse gas (GHG) emissions. Specifically, U.S. supermarkets release up to 25% of their refrigerant gases into the atmosphere Existing refrigerants have high global warming potential. There is a need to better understand refrigerant leakage and to develop a mitigating solution. One idea is to research the leakage rates. Another idea is to develop technologies that use low global warming potential refrigerants. Another area of interest is the tradeoff calculation by heat pump efficiency compared to refrigerant switching, including costs calculations.

12. Addressing Deferred Maintenance: Strategies for Emission Reduction and Building Performance Improvement

Many buildings face a backlog of maintenance tasks due to budget constraints, lack of prioritization, or insufficient planning. This can lead to increased operational costs, reduced energy efficiency, and heightened safety risks. In particular, HVAC systems, plumbing, and structural components often suffer from deferred maintenance, resulting in decreased performance and increased emissions. There is a need for proactive maintenance strategies, incorporating predictive analytics and modern technologies to prioritize and address critical maintenance needs effectively. Students should develop ideas on how deferred maintenance can be systematically addressed to reduce emissions and improve building performance. Students can also develop ideas on how to automate the decision-making process or assess methods to prioritize tasks within given real-world constraints.

13. Treating the Indoor Air

Indoor air quality (IAQ) correlates with human health. There is a need to decrease poor indoor air quality conditions. Could IAQ be combined with a climate solution? An example includes scrubbing the air quality pollutants while concurrently scrubbing CO2. Students should create ways to reduce carbon emissions and improve IAQ that is affordable for a variety of stakeholders.

Feedback on challenge topics

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- Do these topics (at least one topic) cover your class?
- Which challenge topics can you provide in your class or to your students' group?

1. **Creating a Paradigm Shift in Building Science**
2. **Driving Affordability**
3. **Solidifying Buildings as a Desirable Industry**
4. **Enabling Equitable Occupant Comfort**
5. **Automating Building Construction**
6. **Solidifying Resiliency**
7. **Building Comfort in Extreme Climates**
8. **Reducing Peak Demand**
9. **Greening Building Materials**
10. **Mitigating the Market Problem**
11. **Reducing refrigerant emissions**
12. **Addressing Deferred Maintenance: Strategies for Emission Reduction and Building Performance Improvement**
13. **Treating the Indoor Air**

Feedback on challenge topics (cont.)

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- Any suggestions for your students?

- Any feedback on challenge topics?

Next Meeting

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Professor Team Webinar #3 for all professor team members

- Will be scheduled in late June or early July

Professor Team Webinar #3

- Selected challenge topics
- Program updates
- DRAFT submission requirements and evaluation criteria

Final Reminder

- Interested in joining the Professor Team?
- Please email me to confirm your interest
  - Yeonjin Bae (baey@ornl.gov)
  - Fall courses that could include a JUMP into STEM challenge
- Professor Team Webinar
  - Recording and slide deck will be uploaded on the JUMP into STEM webpage
  - www.jumpintostem.org/professors

Thank you!

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Questions?

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Q&A