

Solving Market Adoption for Emerging Efficiency Technologies

The objective of this challenge is to develop an innovative, holistic solution that will increase the accessibility, purchase, installation, and use of energy efficiency technologies in buildings (residential, commercial, new, or existing). This will lead to reductions in energy use and carbon emissions, and fewer inequalities in obtaining new technologies for identified stakeholder groups.

Background

Energy efficiency in the building industry is not new. The first Energy Policy and Conservation Act was signed into law by President Gerald Ford in 1975,¹ and the U.S. Department of Energy will soon celebrate its 45th birthday. So why don't we see the latest and greatest building technologies everywhere?

For example, LED light bulbs have been on the market for more than a decade at increasingly lower costs, yet only 45% of high-income households and 14% of low-income households report having at least one LED bulb installed.² Similarly, wireless Internet-of-Things sensors and devices are improving how we can interact with and control devices in our homes and our workplaces. Many of these systems require broadband internet, but only 57% of low-income households in the United States have broadband internet.³ In addition, there is an almost 10% disparity in access to broadband internet for rural communities compared with urban and suburban communities.³ An estimated 39% of people living in rural areas lack access to the basic-fixed broadband service⁴ needed for many of these technologies to function.

Heat pump water heaters (HPWH) are another example of a newer technology that can save a substantial portion of energy for domestic hot water building loads—particularly for residential and multifamily dwellings—while simultaneously providing a path toward electrification and grid-wide carbon reduction goals. However, an apartment building with multiple generations of families who may often be home will see an elevated hot water usage profile compared to an apartment building with single-family tenants who are mostly away during the day. HPWHs subjected to higher usage profiles will more often require the use of a backup electric coil, leading to less efficient operation and higher utility costs for a population with less income to spare. Adding to the complexity of the situation, tenants renting an apartment are often responsible for utility bills but do not typically own their water heaters nor have a say in the type of equipment purchased by the landlord or owners. This seemingly energy-efficient technology investment might actually increase the energy burden on certain individuals and communities. Climate considerations should also be taken into account when considering heat pump performance or the current cost difference between switching from natural gas or electricity.

¹ Alliance Commission on National Energy Efficiency Policy. 2013. *The History of Energy Efficiency*. Washington, DC: Alliance to Save Energy.

https://www.ase.org/sites/ase.org/files/resources/Media%20browser/ee_commission_history_report_2-1-13.pdf.

² U.S. Energy Information Administration. 2017. "American households use a variety of lightbulbs as CFL and LED adoption increases." <https://www.eia.gov/todayinenergy/detail.php?id=31112>.

³ Pew Research Center. 2021. "Internet/Broadband Fact Sheet." <https://www.pewresearch.org/internet/fact-sheet/internet-broadband/#who-has-home-broadband?menuItem=89fe9877-d6d0-42c5-bca0-8e6034e300aa>.

⁴ Levin, Blair and Matthey, Carol. 2017. "In infrastructure plan, a big opening for rural broadband." *Brookings Institution: The Avenue*. February 13, 2017.

<https://www.brookings.edu/blog/the-avenue/2017/02/13/in-infrastructure-plan-a-big-opening-for-rural-broadband/>.

The initial cost of a new technology is an important factor for deployment, and innovative solutions to reduce this cost are needed to help increase market adoption and impact. However, this approach may overlook subtleties specific to subsets of the population where reducing cost may not be enough to achieve market adoption potential. For example, there could be perception or lack of awareness barriers,⁵ or barriers specific to certain stakeholder groups that cannot be seen through a cost-only lens. Market transformation does not occur overnight, and sometimes strategic intervention is necessary to accelerate technology adoption—this is your challenge.

The Challenge

This challenge requires students to develop an innovative and holistic deployment solution that will increase market adoption of an emerging technology for building energy conservation and carbon reduction. Teams will first select an emerging technology and a specific stakeholder group with limited adoption of the technology. Teams must then perform market analysis research, identify adoption barriers through stakeholder engagement, and develop a holistic solution (technical, policy, and/or economic) to increase deployment of the technology. The solution must lead to higher market adoption rates and specifically address identified barriers for the chosen stakeholder group. A holistic deployment solution—including technical and non-technical aspects such as policy and economic solutions—is required.

Student submissions should:

- Describe the scope and context of the deployment barriers for a specific technology and associated impacted stakeholder group in the United States, including background research on the emerging technology and market analysis to identify and define adoption barriers.
- Identify affected stakeholders in socioeconomically vulnerable and historically excluded, underserved, and frontline communities (communities at the frontline of pollution and climate change⁶), as well as key stakeholders or partners needed to deploy the idea.
- Develop a holistic solution for the targeted stakeholder group to increase market adoption of the chosen technology at a building-type scale or a community-level scale. The solution may include policy solutions, supply chain and manufacturing processes, economic solutions, or other aspects critical to identified stakeholder barriers, but a technical solution must be proposed.
- Discuss appropriate and expected impacts and benefits of the proposed solution. This should include a cost/benefit analysis and should also consider non-economic costs and benefits, such as occupant health, productivity, well-being, and others.⁷
- Develop a market transformation plan that describes how the team envisions bringing its idea to scale in the market, including sales or distribution channels, outreach mechanisms, stakeholder engagement, and other relevant details; this plan should also describe who the team would

⁵ Cort, K.A. 2013. *Low-E Storm Windows: Market Assessment and Pathways to Market Transformation*. Richland, WA: Pacific Northwest National Laboratory.

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22565.pdf.

⁶ Initiative for Energy Justice. <https://iejusa.org>

⁷ Whole Building Design Guide. 2020. "Consider Non-Quantifiable Benefits." <https://www.wbdg.org/design-objectives/cost-effective/consider-non-monetary-benefits>.

partner with to implement the idea and how the collective team would increase market adoption. Letters of support from potential partners are encouraged.

All solutions must include a cost/benefit analysis. Solutions should consider the following questions:

- If costs are a key barrier for the identified stakeholder group, how will costs be reduced to facilitate adoption by these stakeholders?
- How does the proposed solution change costs, compared with current best practices?
- Are there new business models that could be used to sell the proposed solution?
- What non-economic drivers might enable adoption at scale that in turn drive the costs down?

Cost estimates should focus on those processes, or methods, compared with current practices. Cost estimates need not be exhaustive but should be comprehensive enough to capture the barriers identified and how the solution addresses those cost barriers.

All solutions must include consideration for non-economic costs and benefits, especially those identified as critical through stakeholder outreach and engagement. Solutions should consider the following questions:

- What are the key barriers other than cost for the identified stakeholder group?
- How does the proposed solution address identified non-cost barriers leading to increased adoption of the selected technology?
- What methodologies for quantifying these non-economic costs and benefits would lead to wide adoption rates of the technology?