U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY & RENEWABLE ENERGY

Advanced Building Construction

The U.S. Department of Energy's (DOE's) *Building Technologies Office* (BTO) is carrying out R&D and market transformation efforts to integrate energy efficiency solutions into an evolving U.S. construction industry to deliver affordable, appealing, high-performance, low-carbon new buildings and retrofits at scale.

Zero energy retrofits can be completed quickly and without disruption to occupants by incorporating most of the improvements into the façade of the building. *Photo credit Energiesprong.*

Transforming Construction

While other industries (e.g., automotive, biotech, aeronautics) have capitalized on digitization and process improvements, little has changed in U.S. construction practices, with construction sector labor productivity remaining largely stagnant since the end of World War II. Plagued by insufficiently skilled labor, as well as market fragmentation and an underinvestment in innovation, this subpar productivity translates into higher costs, extended construction times, and inconsistent performance.[1]

At the same time, the majority of existing buildings—homes and commercial buildings alike—use energy inefficiently, and many were not built to meet modern-day challenges and needs, from wildfires, floods, and electricity disruptions to increased demand for sustainable construction and smart home systems. About half of the nation's 125 million existing buildings were built before 1980, prior to modern building codes. Only a tiny percentage have undergone deep energy retrofits because doing so typically requires highly individualized, costly, complex, and disruptive upgrades.

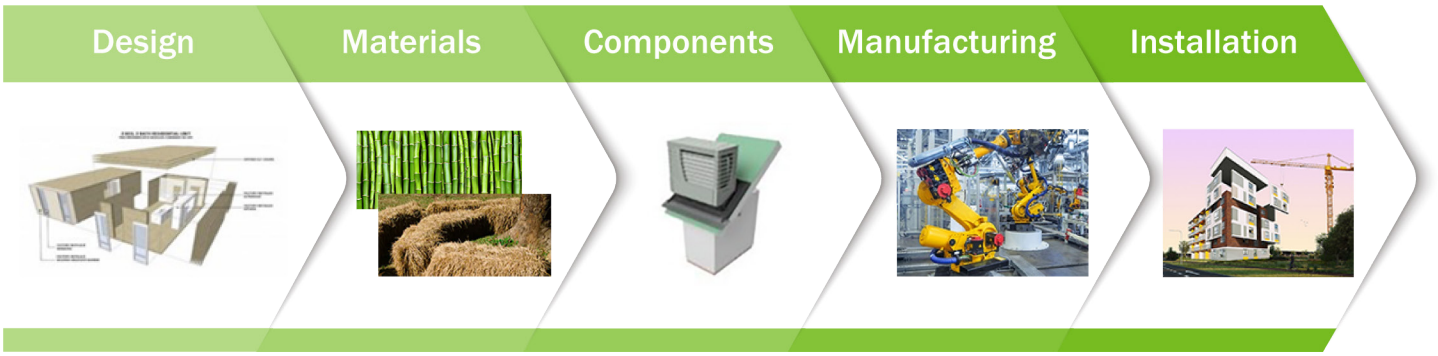
To address these building sector challenges, a new approach to building construction and renovation is imperative.

Advanced Building Construction: Modern Methods & Low-Carbon Solutions

As modular construction and pre-fabrication become more widely used in many parts of the world, and the need for affordable housing continues to grow, the time is ripe for reinventing the U.S. construction industry. Advanced Building Construction, or ABC, aims to seize this opportunity and ensure that the U.S. leads not only in construction productivity—with underserved communities actively participating in a reimagined construction workforce—but in the development and delivery of low-carbon, appealing building solutions that are accessible to all.

ABC marries advanced technologies and methods—such as offsite construction, design for manufacturing and assembly, packaged mechanical systems, robotics, and 3D printing—with low-carbon materials and high-efficiency systems. But ABC is about more than just cutting costs and carbon—ABC focuses on appealing to the customer with new products and offerings that provide more value (e.g., aesthetics, convenience, improved living and working conditions, resilience).

Innovation Across the Supply Chain + Streamlined Delivery



Credits: Tocci (Design), Factory Zero (Components), Energiesprong (Installation)

ABC capitalizes on opportunities all along the supply chain and applies new business models to address market fragmentation and deliver appealing, easy-to-install solutions for both new construction and renovation.

DOE's ABC Initiative

The ABC Initiative uses a multi-pronged approach to address research, development, and market challenges with the goal of integrating highly efficient and low-carbon innovations into the construction industry's broader modernization efforts. Through competitively awarded R&D projects and cutting-edge building technologies research at DOE's national laboratories, the establishment of an ABC Collaborative with key industry partnerships, workforce training, and other strategic activities, the ABC Initiative works to not only drive development of new technologies and approaches but also ensure that these solutions are widely used in the market.

With an eye toward the customer, and a goal of a carbon-neutral U.S. building stock by 2050, DOE is partnering with private, public, and non-profit leaders to develop high-value products and approaches that can deliver new buildings and retrofits with the following key attributes:

- √ **Highly energy-efficient** with **low carbon** footprints
- √ **Affordable** to developers and consumers
- √ **Faster** renovation and construction, with **less disruption** to building occupants
- √ **Added value,** such as better indoor air quality, improved comfort, and reduced maintenance

3D-printed molds designed to incorporate innovative shapes and materials enable integration of energy-efficient design strategies for improved envelope performance. *Photo credit Autodesk.*

DOE's Strategies for Enabling ABC	
Technical R&D	Investing in R&D projects, from advanced materials, modular construction and 3D-printing to robotics, digitization, and simplified installation methods
Analysis & Tools	Conducting analytical studies and modeling to refine and optimize ABC investments and identify opportunities to cut costs
Technology Scaling	Linking researchers, manufacturers, and investors to elevate the most promising ABC innovations and drive development of streamlined, appealing solutions
Market Scaling	Expanding the market for ABC solutions by tackling barriers, marrying consumer interests with supplier innovations, and aggregating public & private sector demand

While both new construction and renovation can benefit from streamlined, modernized approaches, customer-oriented deep energy retrofit solutions are likely to require even greater ingenuity. Ultimately, building owners need options that address the specific characteristics of the existing building but can still be manufactured at scale to ensure affordability. Novel methods that are pre-packaged, easy-to-install, and deliver energy savings along with other values such as attractive facades and improved resilience are essential to driving demand.

ABC Collaborative: Bridging Supply & Demand

The ABC Collaborative is bringing together an array of building industry stakeholders to accelerate the development, demonstration, standardization, and mainstream adoption of innovative, high-performance construction technologies and processes that enable the widespread delivery of ABC solutions. By coordinating with building owners and developers (demand-side); manufacturers, suppliers, installers, and extended workforce (supply-side); R&D organizations; and market enablers (e.g., workforce training organizations, financiers, insurers, code officials, government agencies, accreditors, utilities), the ABC Collaborative will create a pathway to market transformation and scaling of cost-effective advanced building construction.

ABC Collaborative

- √ **Driving transformation** of the construction sector by harnessing building owners' collective buying power
- √ **Reducing industry fragmentation** with new business models for more efficient market transactions
- √ **Attracting investment** to spur technology R&D and commercialization
- √ **Communicating broader customer interests** to technology developers and suppliers

Get Involved!

Interested in learning more about the ABC Initiative? Email us at *abc@ee.doe.gov* or visit us at *buildings.energy.gov/abc*. For information on the ABC Collaborative, visit *advancedbuildingconstruction.org*. ■

References

[1] McKinsey Global Institute. 2017. *Reinventing Construction: A Route to Higher Productivity. McKinsey & Company.*

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For more information, visit: *buildings.energy.gov/abc*

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