

# EMPOWER WALL

printing advanced energy efficient buildings



**additive  
manufacturing**

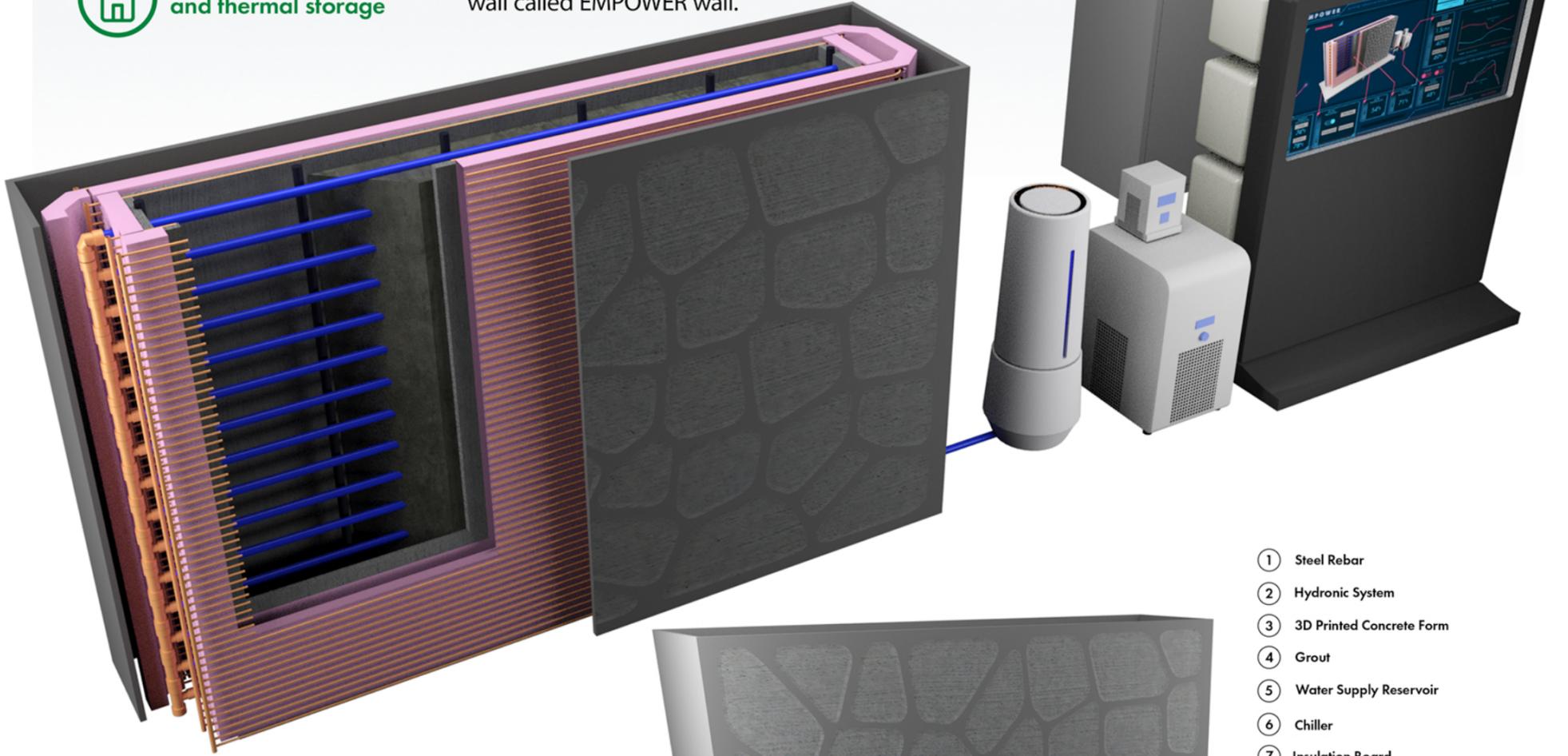


**transactive  
controls**



**active insulation  
and thermal storage**

Oak Ridge National Laboratory in conjunction with the Department of Energy's Federal Energy Management Program, Advanced Manufacturing Office, and the Building Technologies Office is combining advanced manufacturing, building innovations, and power electronics to demonstrate a first of its kind smart wall called EMPOWER wall.



- ① Steel Rebar
- ② Hydronic System
- ③ 3D Printed Concrete Form
- ④ Grout
- ⑤ Water Supply Reservoir
- ⑥ Chiller
- ⑦ Insulation Board
- ⑧ 3D Printed Polymer Scrim
- ⑨ Control System and Smart Inverter
- ⑩ Battery

Designed as an interior wall, EMPOWER wall demonstrates the power of possibilities for the future of resilient, efficient, and secure building technology. EMPOWER wall is 3D printed using an additive manufacturing system, SkyBAAM, that is designed to be deployed within hours to any construction site. Driven by cables and calibrated by laser measurements, SkyBAAM dispenses layers of concrete to form complex three-dimensional objects.

Integrated with a smart inverter, the chiller pumps cold water into the wall's core and cools the concrete. Embedded tubing carries water to and from the chiller, lowering the wall's interior temperature while dynamic insulation controls the wall's surface temperature using the coolness stored in the wall. Model-based predictions control when the insulation is activated, transferring the cool temperature stored in the concrete to the wall's surface through the smart-inverter powered pumps.

The cool surface reduces HVAC use, and the embedded sensors monitor real-time data to continuously optimize and update the control. A battery connected to the smart inverter stores energy from the power grid or from connected distributed energy sources during low demand times and allows this energy to be available during peak demand times. This is designed to lower energy bills, reduce energy consumption, and decrease electricity demand without compromising comfort.

