
Securing Our Energy Future Through Innovation In Building Technology

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NIST
National Institute of
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NIST Mission

To promote U.S.
innovation and industrial
competitiveness by
advancing

measurement science,
standards, and
technology

in ways that enhance
economic security and
improve our quality of life



NIST infrastructure paves the way to innovation

Tests, Measurements, Models and Standards are the “roads and bridges” to our technology future



- Groundbreaking research tools that enable work in new fields — quantum information, nanotechnology, hydrogen fuel cells, molecular bioscience
- Better measurement methods to ensure reliability quality, trust
- Performance measures for accurate technology comparisons
- Standards to assure fairness in trade

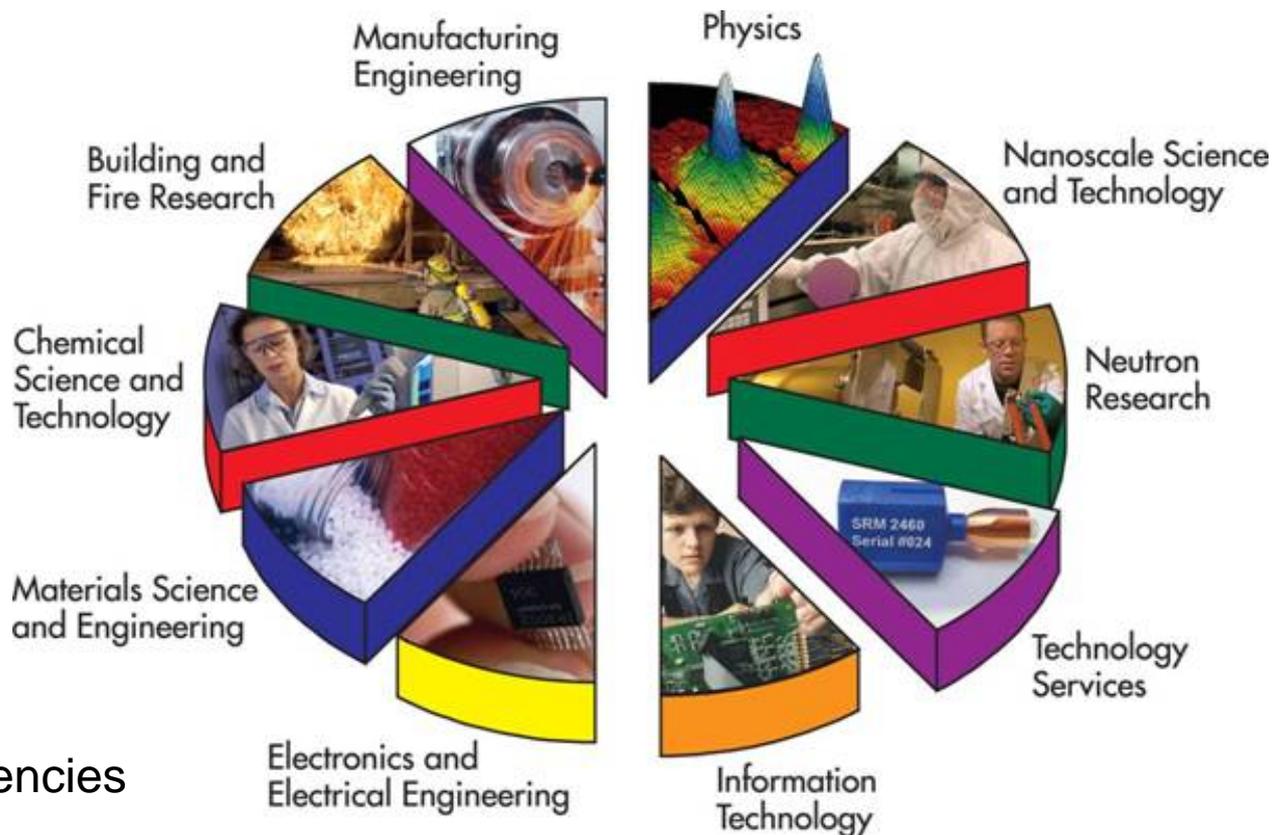
The NIST Laboratories

NIST's work enables

- Science
- Technology innovation
- Trade
- Public benefit

NIST works with

- Industry
- Academia
- Other government agencies
- Measurement laboratories
- Standards organizations



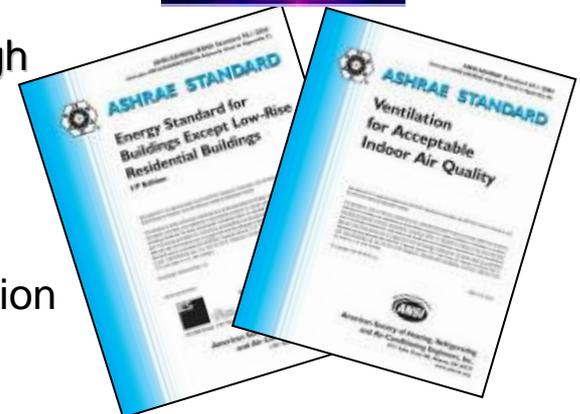
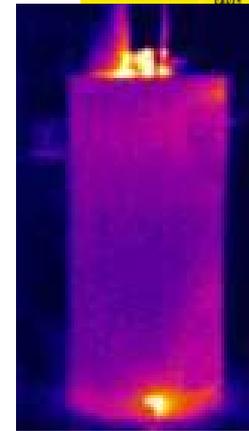
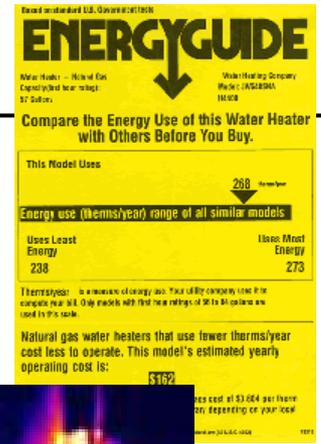
Supporting New Industry: White-Light LEDs

- NIST research supports emerging industry for white-light LEDs
- State-of-the-art facility will help researchers create optimal illumination properties



NIST Contributions to Energy Efficiency

- **Building Automation and Control** – enabling energy savings, reduced operating costs, and improved occupant comfort and safety via BACnet standard for integration of building automation and control systems adopted by ISO, CEN, and over 30 countries
- **Energy Efficiency of Appliances** – enabling energy savings, reduced operating costs, and consumer awareness via standard DOE testing and rating procedures for HVAC, water heaters, and appliances
- **Indoor Air Quality** – enabling indoor air quality by providing minimum threshold standards for ventilation while ensuring efficient use of energy resources in buildings nationwide
- **Renewable Energy** – enabling use of solar equipment through test method and rating procedure development that forms the basis of industry (Solar Rating and Certification Corporation) certification programs
- **Sustainability Assessment** – enabling science-based selection of cost-effective, environmentally preferable building products through incorporation in major U.S. “green building” rating systems



Construction and Building Industry Partners



- Board of Advisors
- Breakthrough Strategy Committee
- Benchmarking and Metrics Committee
- Cost of Inadequate Interoperability Study
- Workshops and Conferences
- Research Teams



(Conceived by CII and NIST in 1999)

- Capital Projects Technology Roadmap
- Cost of Inadequate Interoperability Study
- Automating Equipment Information Exchange
- Intelligent and Automated Construction Job Site
- Building Information Modeling
- Workshops and Conferences



- Building and Fire Codes and Standards
- Technical Guidelines
- Measurement Techniques
- Performance Prediction Tools
- Committees, Councils, and Boards
- Workshops and Conferences
- Collaborative Research
- Publications
- Working Groups



Strategic Priorities: Building and Fire Research



Measurement Science for:

- Net Zero Energy, High-Performance Buildings
- Breakthrough Improvements in Construction Productivity
- Predicting Life Cycle Performance of Infrastructure Materials
- Innovative Fire Protection
- Disaster-Resilient Structures and Communities

Measurement Science for Building Energy Technologies

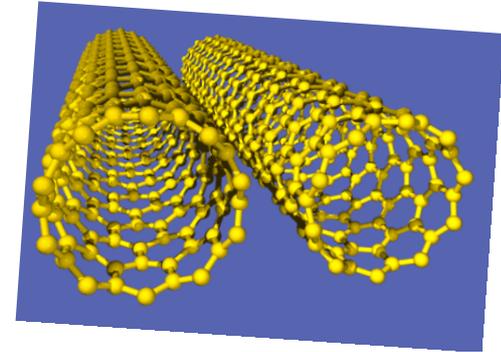
- **Building Performance Measurements** – thermal integrity, ventilation rates, indoor contaminants, life-cycle performance of HVAC equipment
- **Intelligent Control Systems** – real-time controls for minimizing energy use, utility/building interactions to lower CO₂ emissions
- **Emerging Energy Technologies** – renewables (photovoltaic, fuel cells), high-performance HVAC (nanofluids, thermoelectric cooling), solid state lighting (LEDs), high-performance building materials
- **Carbon Footprint Metrics & Tools** – life-cycle cost studies integrated with economic and environmental assessments, sustainability metrics for building products, sub-systems, and systems



NIST fuel cell testing facility

Measurement Science for Predicting Life-Cycle Performance of New Infrastructure Materials

Multi-scale predictive models of nanocomposites: degradation, flammability, nanoparticle release



Chemical, physical & mechanical measurements that are predictive of changes in key properties over the life cycle

Measurement and prediction of in-service and post-service nanoparticle release rates



Structural



Fire retardants



Photovoltaics



Repair

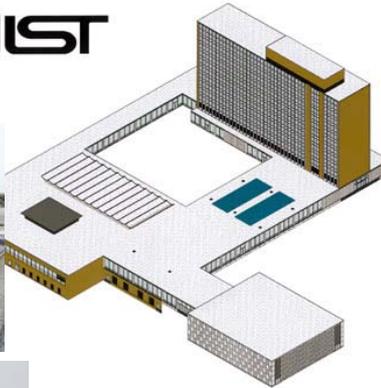


Weather resistant

“Greening” of NIST

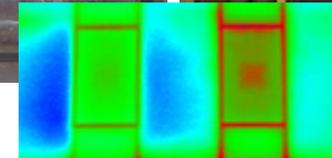
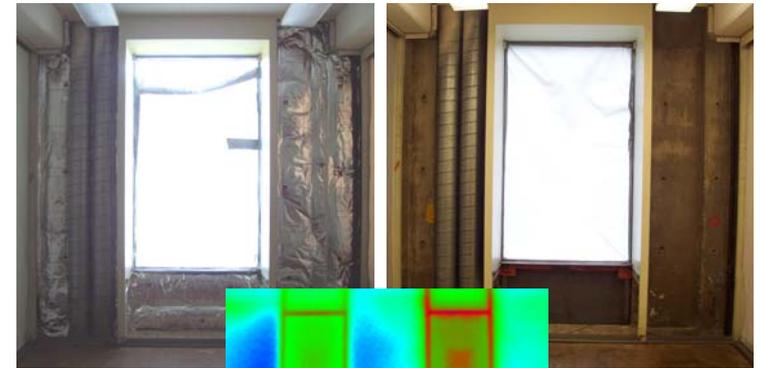
Alternative Energy

NIST



- Solar Parking Lot Lights
- Bldg 101 Photovoltaic System
- Boulder Wind Power Purchase

Energy Efficiency

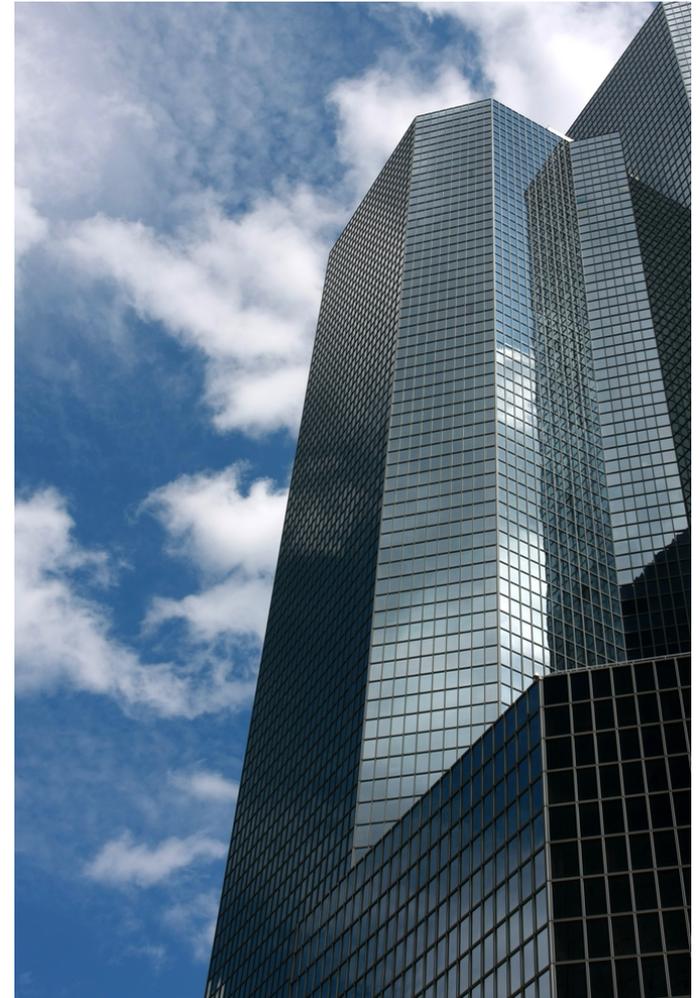


- Building 226 Office Renovations
- Vending Misers
- Energy Star Electronics

In Short: Measurements Lead to Better Decisions

Target Capabilities Enabled By NIST Energy & Sustainability Research

- Quantify energy performance of components/systems as installed
- Optimize control system performance while responding to performance degradations
- Assess performance of emerging building energy technologies
- Evaluate and predict sustainability performance over building service lives



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