



Building Science Laboratory & Training Facility at FSEC

The uniqueness of this facility is the ability to vary the building airtightness, air leakage, and thermal boundary parameters in a controlled fashion and evaluate their interactions with both conventional and advanced HVAC systems.



Construction for first building completed at the Florida Solar Energy Center November 1999

Mission:

This unique facility will be used to advance understanding of building science and proper application of HVAC equipment through research and training.

Research:

The design of this building is based upon the most recent developments in building science and has the flexibility to address a wide range of issues. These issues include:

- Moisture control
- Indoor air quality
- Duct leakage
- Building airtightness
- Ventilation rates
- Building air boundaries
- Uncontrolled air flow variations
- Interaction of uncontrolled air flows with building envelope and HVAC design variations
- Pressure imbalances
- Duct system design
- HVAC design/control

Training:

This facility is ideally suited to hands-on building science and HVAC systems training. In addition to housing the training, it serves as a "live" training model. Trainees will see in real time the pressure and air flow response of the building as air flow rates, barriers to flow, and pathways to flow are changed at the turn of a switch. Training topics well suited to this facility:

- Building science fundamentals
- Energy and IAQ diagnostic methods and tools
- Energy rating programs
- Ventilation system design and controls
- HVAC system design fundamentals

Features:

AC systems. Two independent AC duct work systems of different capacity, and the ability to install split systems, roof-top package units, advanced dehumidification systems, and various control/operation designs.

Air distribution system. Controllable duct leakage, variable return air configurations (permitting evaluation of ducted versus plenum design), and duct insulation effectiveness.

Ceiling. The ability to vary ceiling space ventilation, the location of the insulation (roof versus ceiling), and the airtightness of the ceiling.

Building envelope. The ability to vary building envelope leakiness by means of operable vents along the perimeter of the building, above the ceiling, and in the occupied space.

Removeable wall section. This feature allows evaluation of various exterior wall assemblies.

Ventilation. The ability to change building ventilation rates and pressure differentials by varying outdoor air, exhaust air, and make-up air systems.

Building type. This facility allows simulation of various building types, including office, retail, restaurant, assembly, etc.

Data acquisition. Recording temperatures, humidity, air flow, and pressure in soil, slab, walls, occupied space, ceiling space, and roof, plus power sub-metering, AC condensate, and heat flux.

Training. Hands-on training is enhanced by a large classroom with learning stations and instrumentation to display temperature, humidity, or pressure responses.



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Issues:

Uncontrolled airflow, including duct leakage, restricted return air, and unbalanced exhaust air -- has been identified in recent years as one of the dominant contributors to IAQ, energy use, comfort, ventilation, and building degradation problems in buildings. *Research need: to understand the interactions and consequences of uncontrolled air flow with various building configurations and HVAC systems.*

HVAC systems are designed to deal with temperature, relative humidity, and ventilation, but are generally controlled by temperature alone. In most buildings, the ventilation need is variable while the system provides constant ventilation. As a consequence, the air handler runs continuously often producing poor dehumidification. *Research need: to evaluate HVAC design/control that simultaneously controls relative humidity and ventilation.*

Poor indoor air quality often results from ventilation problems, pressure imbalances, or poor AC performance. Understanding uncontrolled air flows and pressure differentials is key to achieving high-performance buildings -- including reduced allergy-related illnesses and workplace absenteeism. *Research need: to explore contaminant transport and generation, and how to create more productive indoor environments while minimizing toxins and allergens.*

Technology transfer of building science knowledge and diagnostic skills is key to prevention and correction of building problems. *Training need: to transfer knowledge and skills to building practitioners.*



This facility will play a central role in a new research and training initiative at the Florida Solar Energy Center called the Building Science Center, which is dedicated to advancing building science knowledge and transferring it to building practitioners.