Tuskegee Healthy House

Affordability, Energy Efficiency and Indoor Air Quality

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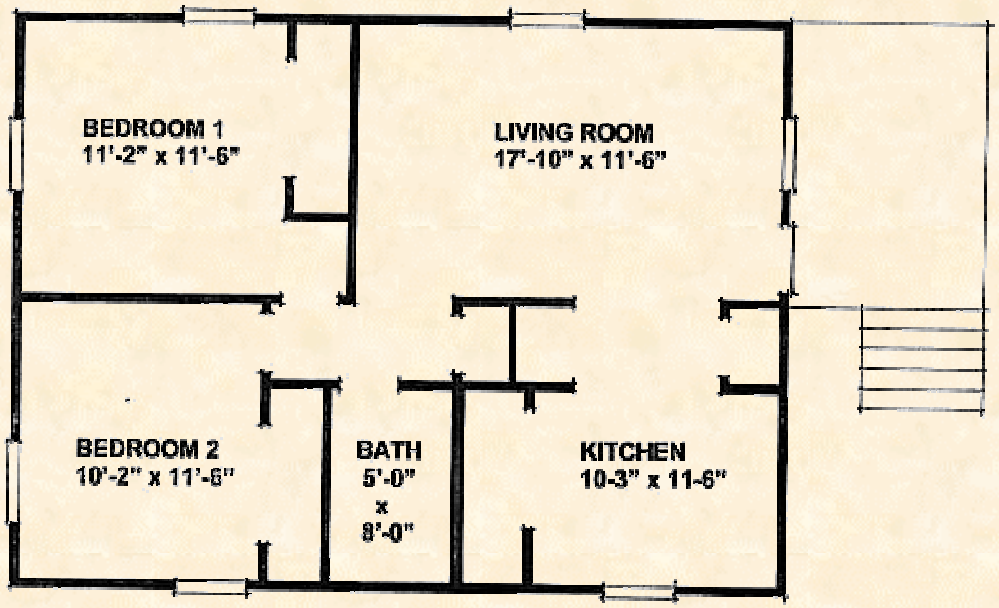
Tuskegee Healthy House

- Designed and built at Tuskegee University in Alabama for very-low income homeowners
- Emphasizing energy efficiency and healthy indoor air quality

Affordability



PROTOTYPE FLOOR PLAN
768 Square Feet

- Target market - low income (gross $12,000/ yr.)
- No more than 30% of gross income spent on conventional 8%, 30 yr. mortgage.
- Homeowner can afford $35,000 or ~ 770 sf home

Energy Efficiency Features

- Well insulated (walls R-19, ceiling R-38)
- Tight construction
- Reflective metal roof
- Unvented crawl space
- Limited and sealed plumbing and electrical penetrations of floor and ceiling
- Heat pump for space heating and cooling

Healthy House Features

- Fresh air enters through air cleaner
  - Turbulent flow precipitation air cleaner (below .3 micron)
- Wood floors and solid wood cabinets
- All electric - no combustion appliances
- No VOC paints and no vinyl wall coverings

Healthy House Experiments

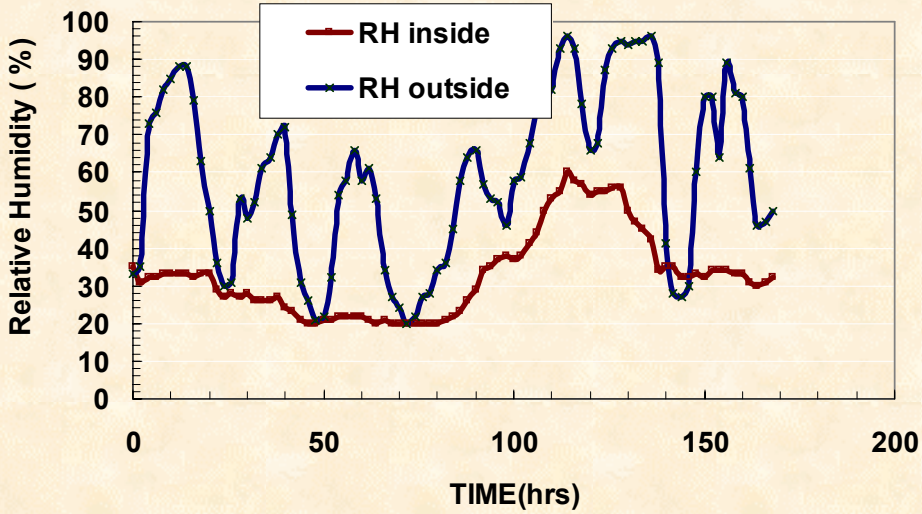
- Instrumented to collect data on IAQ, energy use, and local weather
- Tests of unoccupied house on impact of mechanically induced filtered fresh air on IAQ and energy (heating, cooling, swing seasons)
- Future experiments are planned with the house occupied and furnished.

Heating Season Performance

- Fresh air fan input: 115 cfm

  (double ASHRAE recommendations for 4 occupants)

- Added 107 kWh/wk ($30/mo)

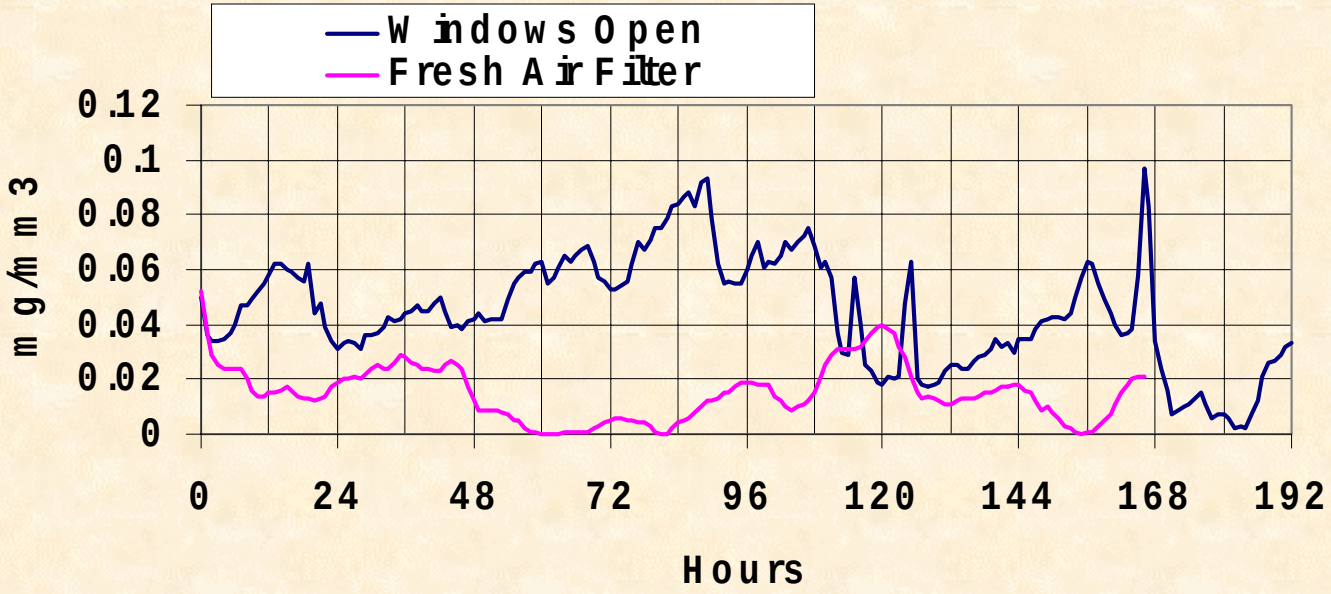


Relative Humidity vs. Time with *Fan On*

RH stayed within 30-50% range when fresh air *fan off*

RH ranged below 30% and above 60% when fresh air *fan on*

Swing Season IAQ Performance: Particulates



Filter in fresh air fan removes particulates > 0.3 microns

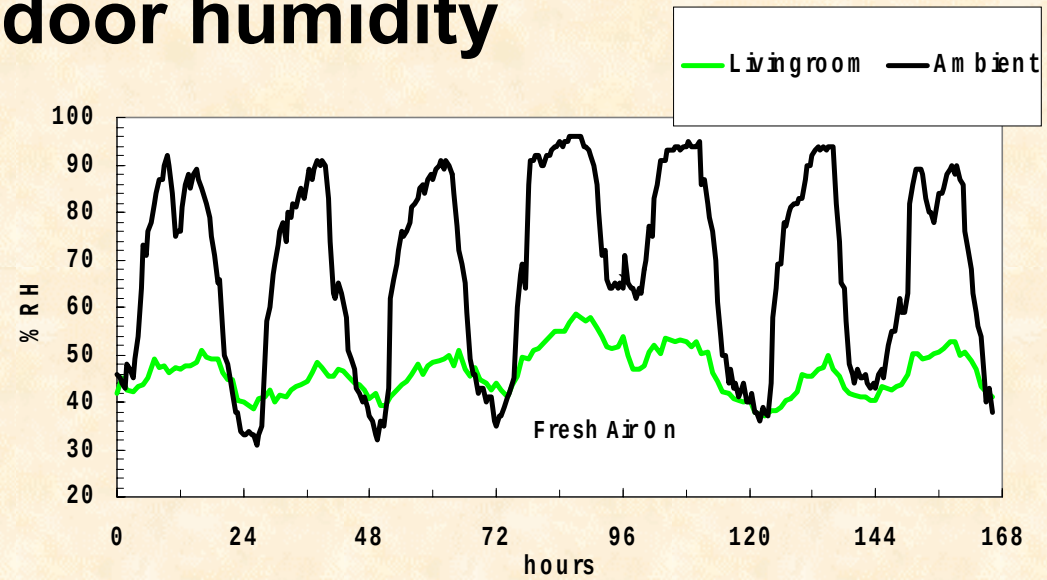
Particulate level with or without filter remained significantly below Canadian recommended level of <40mg/mm^3

Swing Season IAQ Performance for Unoccupied/Unfurnished House :

- All IAQ (CO_2, O_2, CO, VOC) concentrations remained satisfactory with or without use of fresh air fan
- During "crush" (high occupancy) load with fan on, CO_2 increased and O_2 decreased, but not beyond recommended levels—IAQ remained acceptable

Cooling Season Performance

- Operation of both AC and filtered fresh air fan maintained acceptable IAQ.
- Use of fresh air fan increased energy consumption--added 29 kWh/wk ($8/mo)
- Indoor humidity levels increased with elevated outdoor humidity



Potential Future Studies

- Impact of using fresh air fan only part-time or reducing volume
- Impact of furnishings and household products on IAQ
- Impact of occupants on IAQ and energy
- Impact of healthy house on occupants