Presentation to
Dover School Committee
by
Chickering Energy Committee

Paul Wood (Chairman), Dana White, Larry Fisch,
Sara Molyneaux, Kimberly Cone

Goals of the Committee

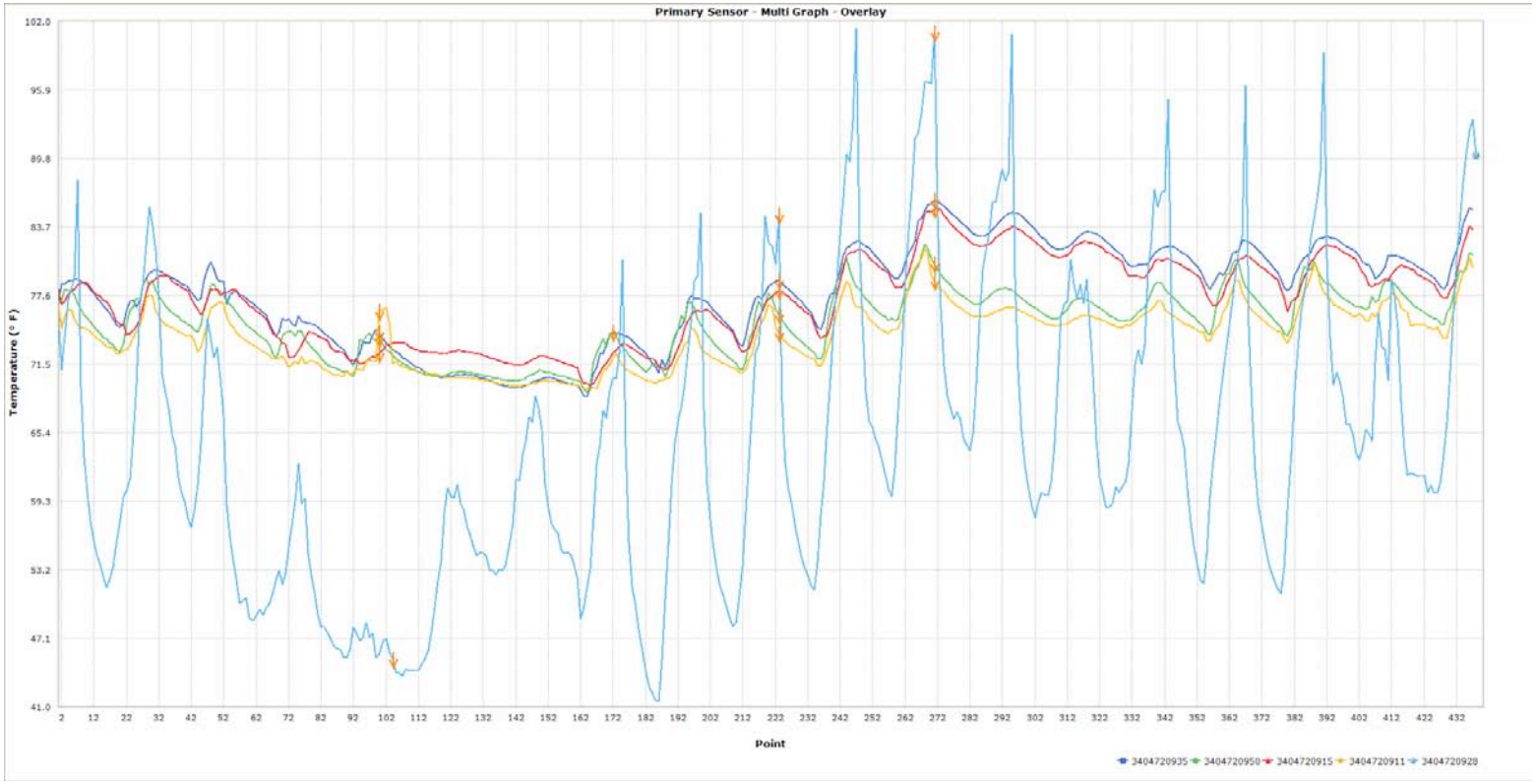
- Test hypothesis that building overheats in warmer weather
  (Subjectively observed by teachers and students, especially in West and South facing rooms -- 2nd/4th grade rooms)
  - Investigate building design
  - Collect objective data
- If an overheating problem is determined:
  - Recommend cost-effective, efficient cooling solutions
  - Determine whether window films are a helpful solution
    (Teachers and students dislike the aesthetics of current films)

Building design observations

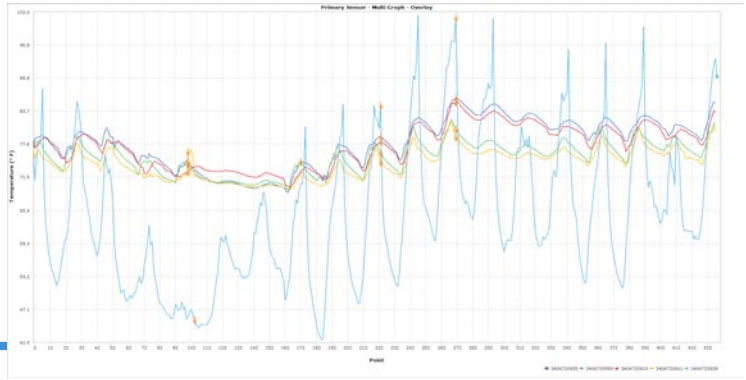
- Designed for 3 seasons (fall,winter, spring)
  - Minimal window operation
  - No ducts for potential A/C
  - Air exchange only - no cooling capacity
- Energy efficient
  - Shut down air handler after hours to save electricity
  - Unidirectional ceiling fans bring warm air down (winter only benefit)
  - Well-designed overhangs on East, South and West wings
  - Window films applied to 2nd and 4th grade wings to reduce solar heat gain (infrared heat)

Data collection

- Program and place 10 state-of-the-art monitors
  - 6 classrooms, 2 hallways, outside, Medfield classroom
- Record hourly temperatures 24-hours/day for 3 weeks (5/14–6/21)



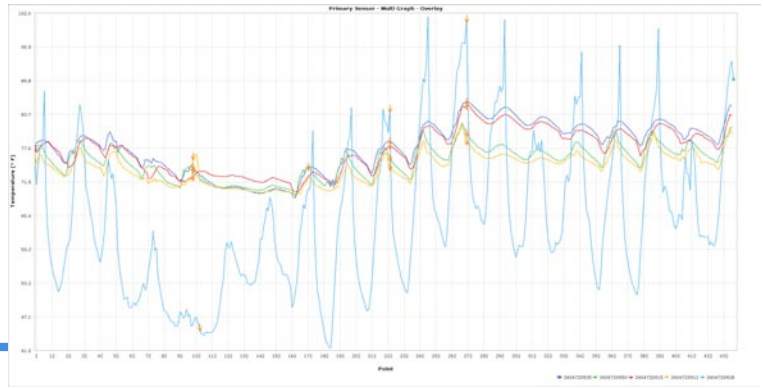
Data analysis



- Building temperatures fluctuate only 5-8 degrees in 24 hours
  - 68.6 is lowest recorded room temp since May 14
  - Starting temperatures mostly in mid to upper 70's
- Differentials
  - 2 degrees between SW/NE sides
  - Additional 2-3 degrees between first/second floors
  - Same 2 degrees between 4th/5th grade and 2nd/1st grade wings

  Only significant as temperature reaches above 78 degrees.
- Starting temp is crucial… **building is not cooling down at night**
  - Before noon, outside is almost always cooler than inside.
    This is when windows can be opened for fresh air.

Why doesn't the building cool?



- Hot air from previous day cannot escape. No way to exhaust warm building.
- Positive pressure in building does not allow outside air in.
- Small size of window openings does not allow any cross breeze.
- Ceiling fans are too high and unidirectional.
- No part of system is designed to cool.

Do window films help?

- Effective technology
- Compromise of tint vs. solar blocking
- Must have direct sun to have effect

Direct sun line on 6/1/07

10:30am

1:50pm

12:30pm

2:50pm

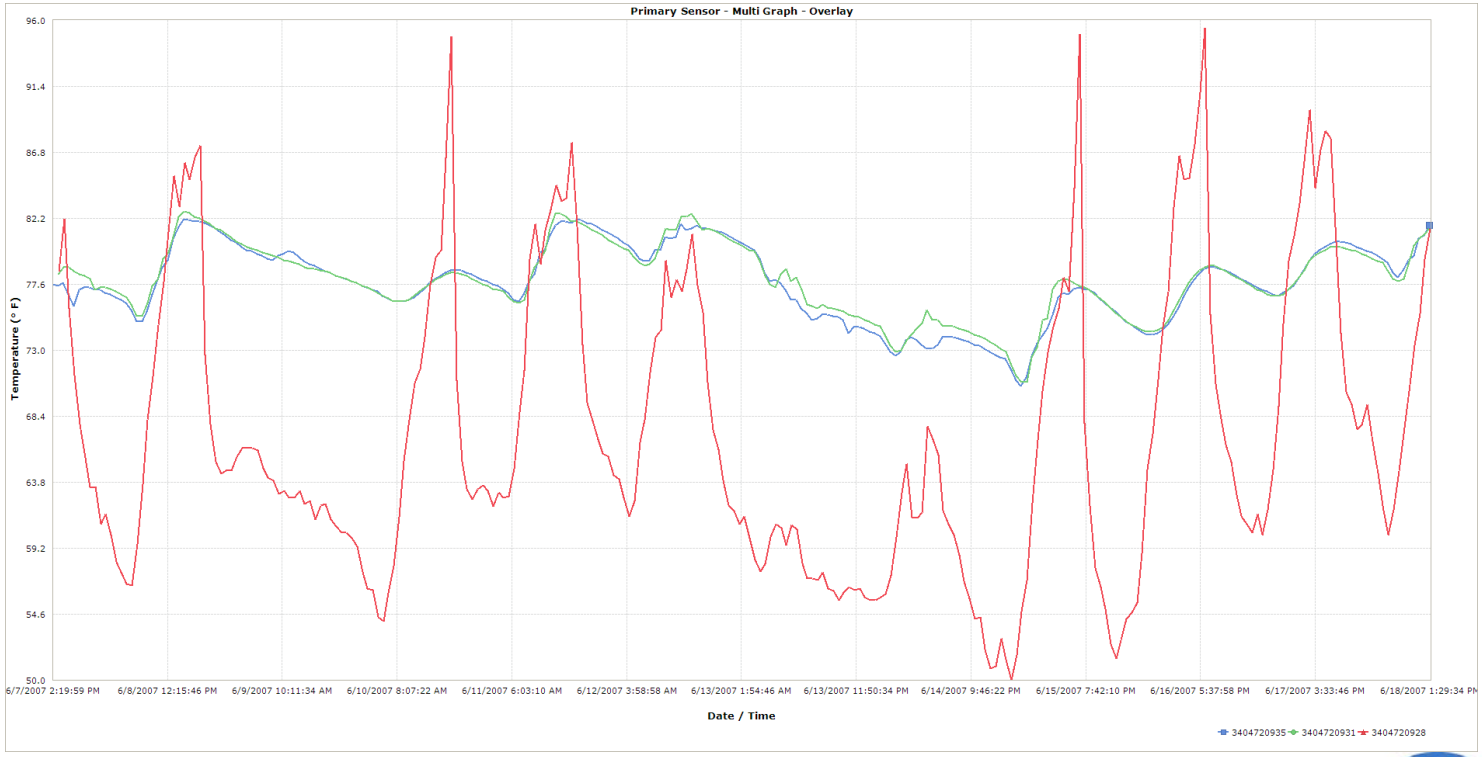
Window films: analysis/conclusions

- Second Floor
  - Room darkening but no direct sun comes to windows.
  - Films unnecessary since overhang blocks direct sunlight.

- First floor
  - Early morning sun hits lower part of window only.
  - Films have very limited use.

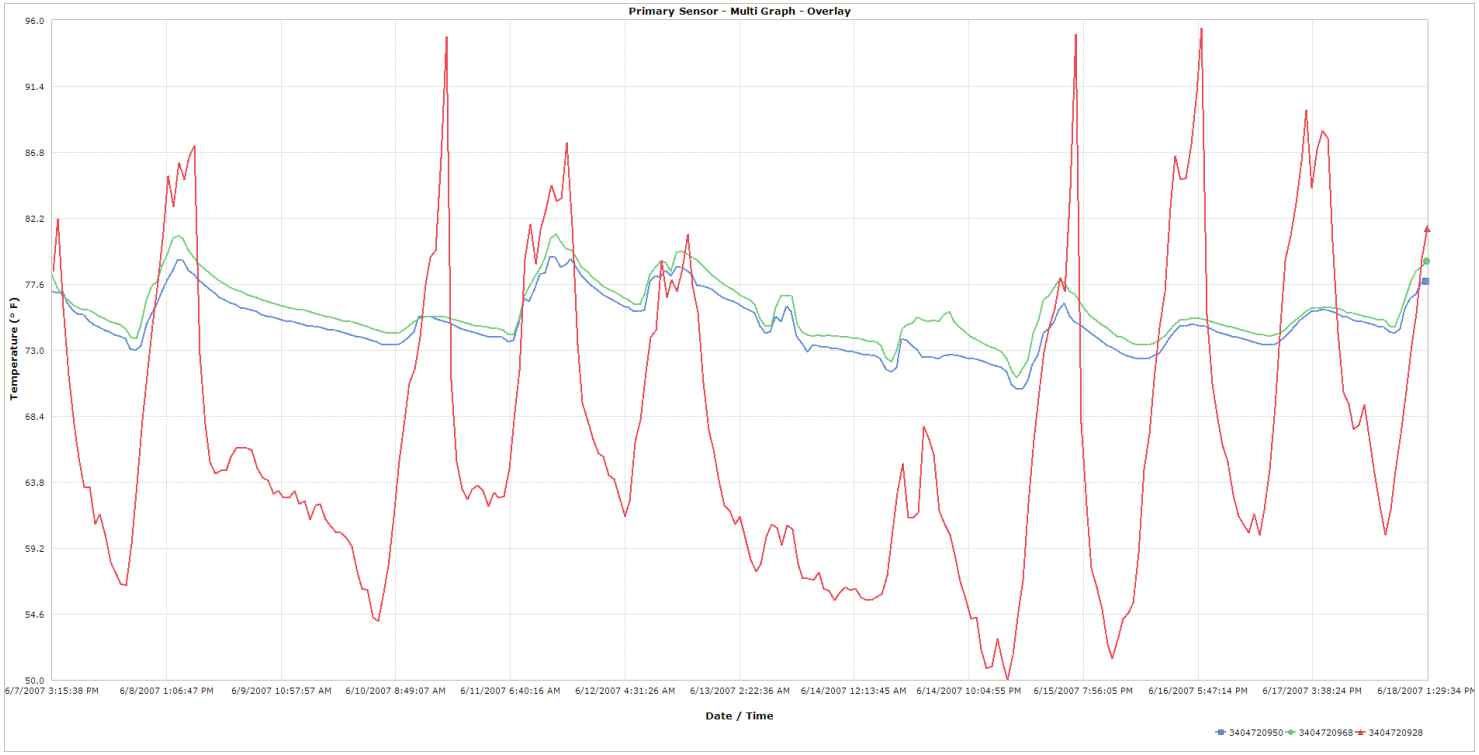
10-day data: no film vs. film (4th grade)

No difference between no-film (Wadness) and film (Macht)



10-day data: no film vs. film (2nd grade)

24-hour constant 1-degree difference between no-film (Brannelly) and film (Ulrich)



Recommendations

- Find a way to exhaust air from the building and bring in outside air when the temperature is warmer inside.
- Increase air circulation in the room
  - Consider installing ceiling fans at 9-10 feet high
  - Change *some* windows to enable more air flow
- Obtain bids from HVAC/Engineering Firm to exhaust hot air from building
- Consider A/C -- last option from a financial perspective
- Remove films from all classrooms