SUSTAINABLE AND PASSIVE WAYS TO IMPROVE YOUR COLLECTION ENVIRONMENT

Sustainable Heritage

Christopher Cameron

About me

Christopher worked as a Sustainable Preservation Specialist at the Image Permanence Institute (IPI) for 9 years. During this time, he assisted over 60 institutions with projects ranging from evaluating collections environment and mechanical systems to establish environmental monitoring programs.

Currently working as a Assistant Director of Facilities for a major real estate corporation.

- Certified Project Manager
- Trained in HVAC refrigeration.
- Certified Energy Manager.

CCAMERON@LESSCARBONMORECULTURE.COM

Please hold all questions until the end

Agenda

- Understanding your setpoints and capabilities
- Passive means for improving the environment
- Methods for improving the environment that involve HVAC systems

Why Improve Your Collection Environment

- **A better environment will increase the longevity of the collection and reduce the potential for environmental damage**
- **Improving sustainability will result in reduced carbon footprint and energy consumption**
- **Inform capital investments and strategic planning**

Understanding setpoints and capabilities

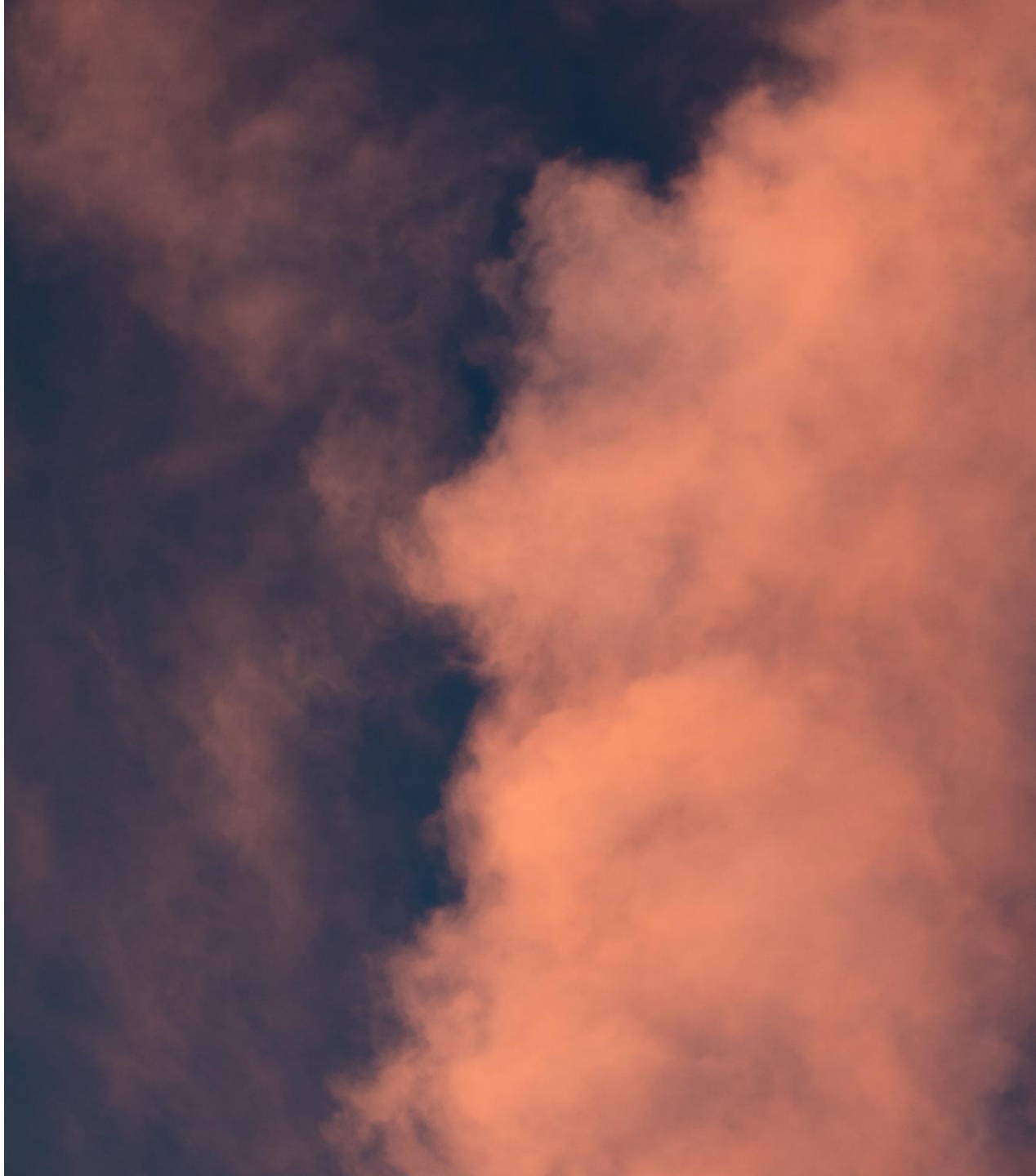
What are you aiming for?

Temperature

- Measured in degrees Fahrenheit (F) or Celsius (C)
- Easy to control or influence
- Will greatly influence the rate of chemical reaction that will determine the rate of decay
- Collection materials will experience temperature changes quickly

Relative Humidity

- A measure of the water vapor content of air
- Will influence the amount of water contained within materials
- Harder to control than temperature
- More energy intensive to raise or lower the relative humidify
- Moisture equilibration takes time for most collection materials



Current Understanding of Collection Needs

70˚F(21˚C) / 50% RH is not desired for the long term storage of all collection materials.

It can be quite costly to achieve and hold this condition

Cooler temperatures slow the degradation of organic materials and increase the quality of the preservation environment

Maintain an RH range appropriate for the collection materials

- Generally between 30-55%
- Avoid extreme lows and highs

Allowing the temperature and RH to fluctuate seasonally may benefit the long term preservation of some materials.

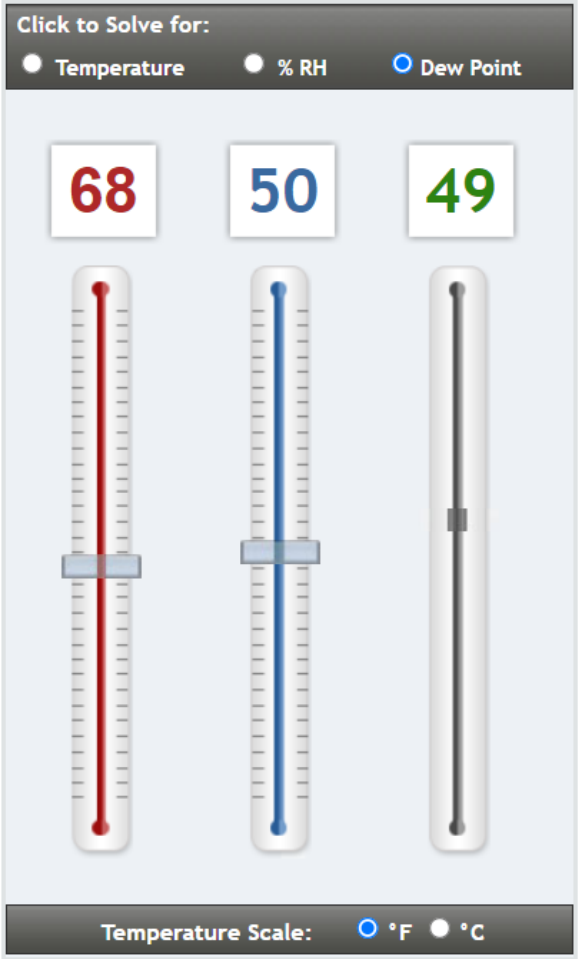
Dew point is Critical

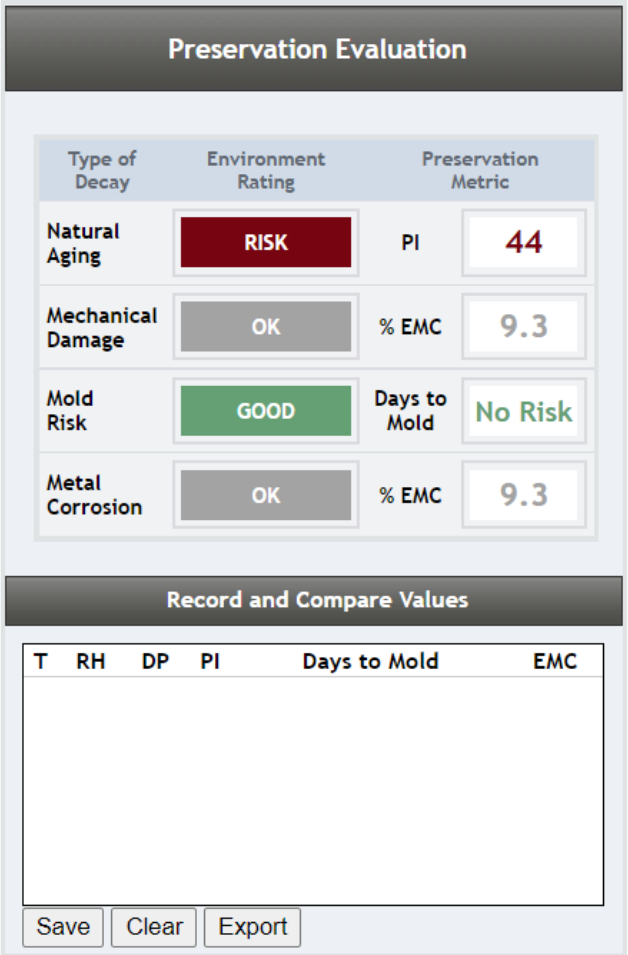
- The temperature at which water vapor in the air becomes saturated and water droplets begin to form
- Dew point can be a better way to understand the moisture content of the air in your space
- Assessing dew point can tell you a lot about your collection space
    - How does the building envelope hold up
    - Does my mechanical system have moisture control
    - Does my building/ storage offer any moisture buffer
        - What does your building look like during a storm
    - Are there similar dew points across spaces
        - Dew point signatures
    - Is there a loss/failure of dew point over time
        - How does a moisture issue affect the space

How to determine your dew point

Use software like dpcalc.org to determine what your dew point may be.

http://www.dpcalc.org/





Sustainable Heritage

Know the history of your building/space

The past history of your building can impact your current capabilities

- Previous design issues
  - Building envelope
  - Air flow
  - Mechanical system
  - Building layout
  - Plumbing issues/design

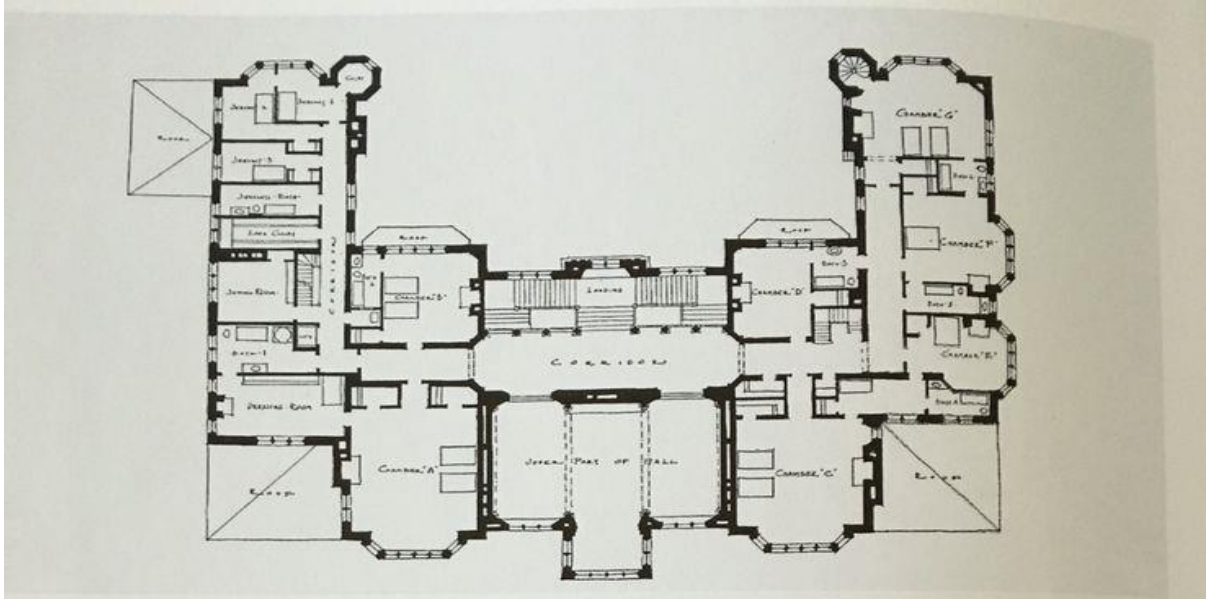
Your Building: Questions for Facilities Staff

- How old is this building?
- Have there been renovations? When? By whom?
- How frequently are inspections and maintenance performed?
- How old is the climate control equipment? What is their life expectancy?
- Where is the equipment located in relation to the collections?
- How often is the roof inspected? By whom?
- What are the biggest issues for the building?
- What are the priorities for equipment repairs or replacement?

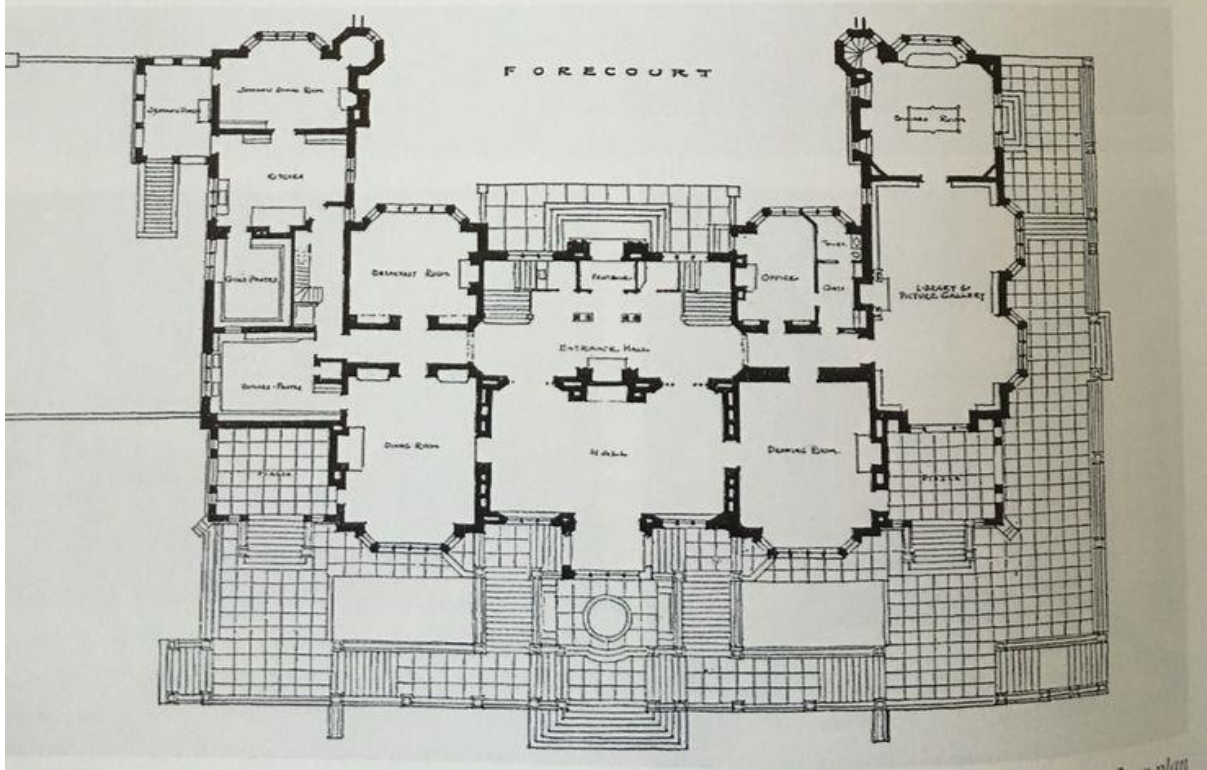
Layout of spaces

The layout of your spaces can influence environmental conditions and sustainability

- Distribution of rooms can impact environmental conditions
- Adding walls to a room may interfere with airflow
- Rooms on the south side may be warmer than rooms on the north side



Second floor plan



If you have a mechanical system

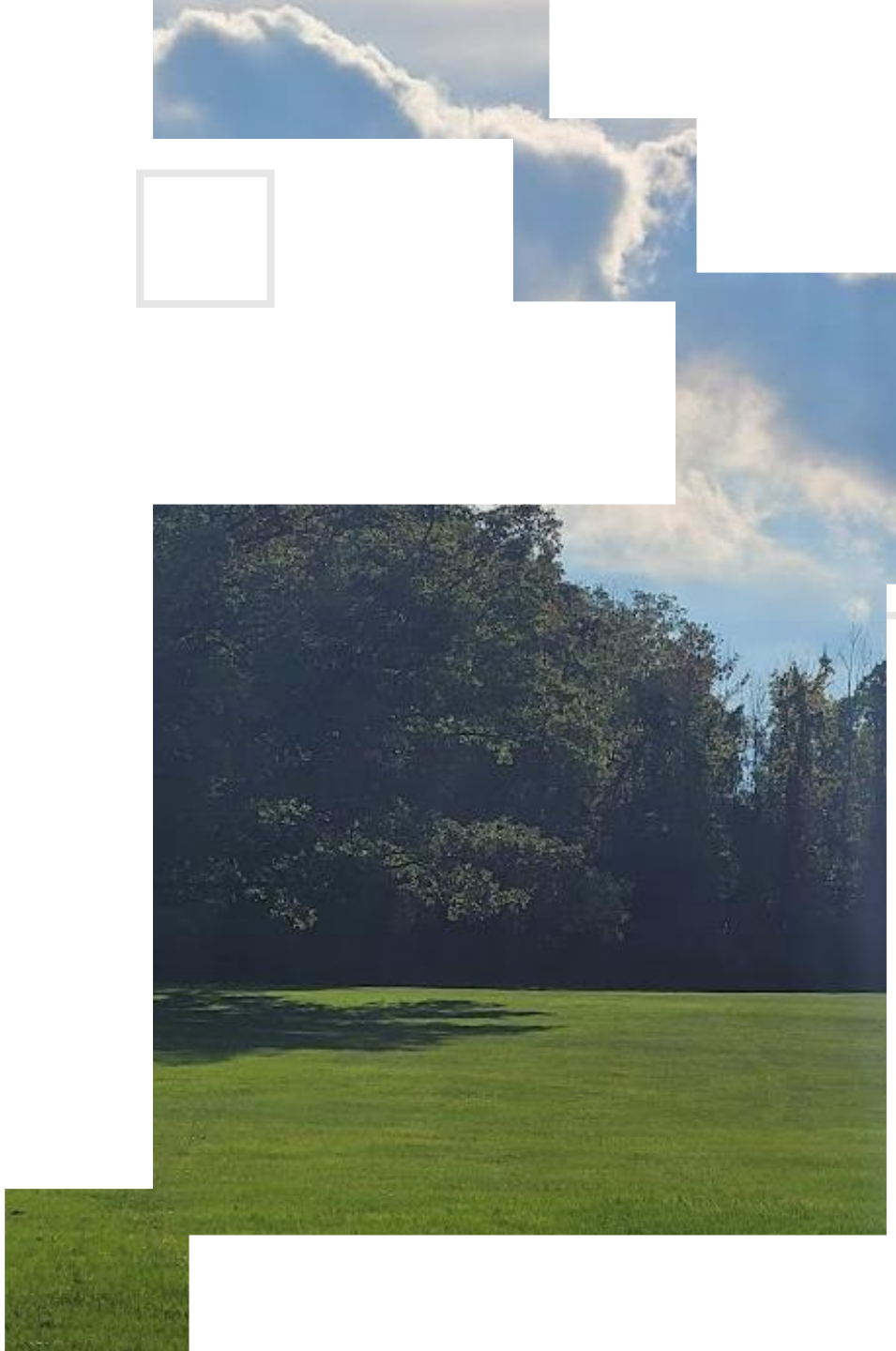
Know what your system is capable of

- Cooling
- Heating
- RH control

- Are you asking for achievable set points

What can you achieve

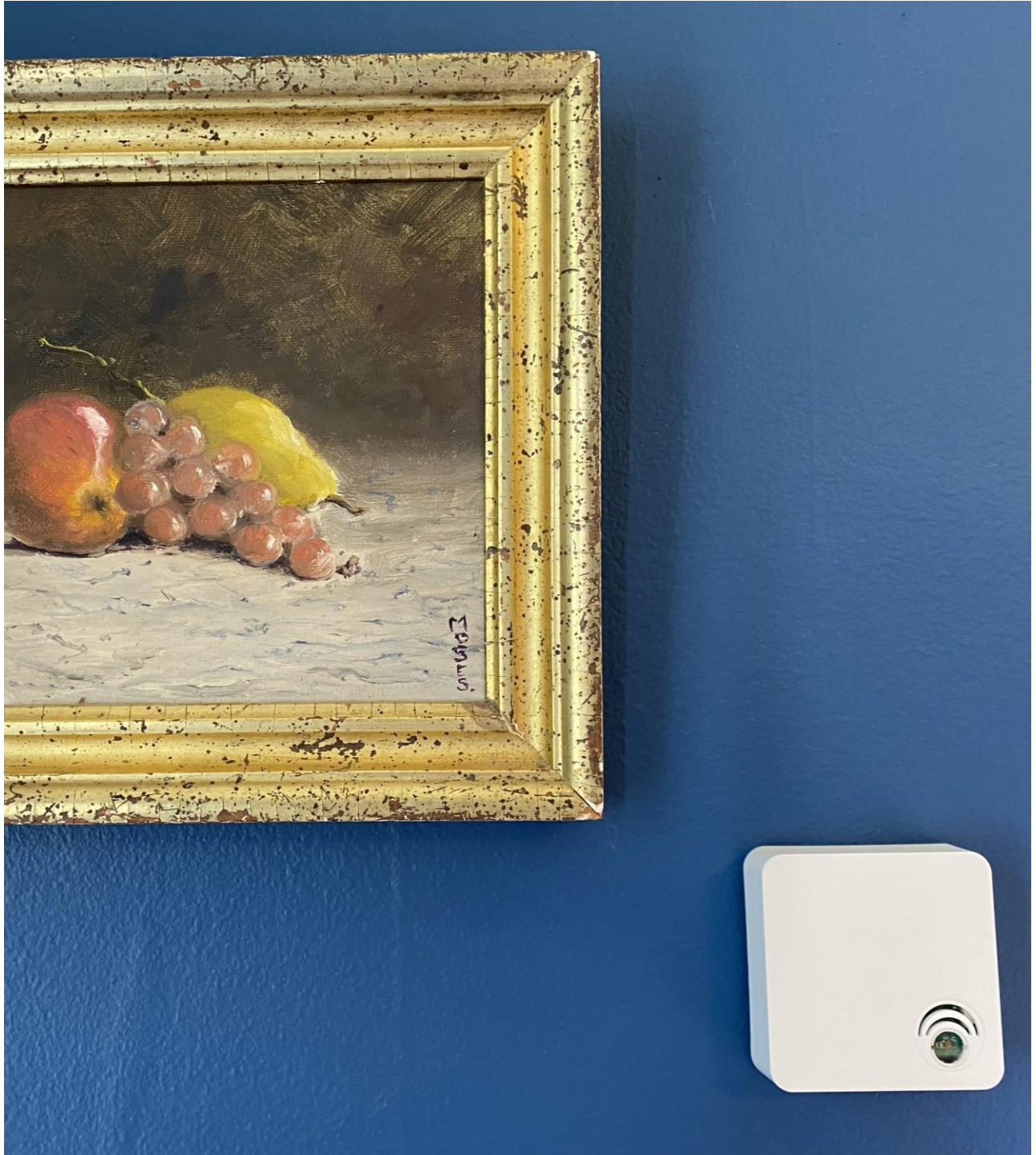
- Look at data for outdoor versus indoor conditions.
  - Compare temp, RH, and DP
  - How do the conditions differ



Occupancy

Occupancy can play a major role in the conditioning of a building.

- You will heat/cool a building to make the occupants happy
- People add heat to a space
- Staff and operation schedules can influence the duration of energy saving policies



Establish a Baseline

- Install data loggers in your spaces to collect data so you can understand what current conditions are
- Routinely check data while implementing changes to ensure the safety of the collection

Separate spaces

- When thinking about environmental conditioning consider that there are three types of spaces in museums
  - Collection storage space
  - Human occupied spaces (office/gallery)
  - No condition (loading dock)
- Each type of space will require different conditioning
- Mixing spaces can use more energy as a system tries to meet different conditions

Passive Methods for Improving Your Environment

Utilize Microclimates

Furniture like cabinets or vitrines can create helpful microclimates

- Provide an excellent buffer for RH
- Less effective for temperature swings
- Added desiccant material will help

Building Envelope

Holes in the building envelope can have a major influence on energy use and ability to control room condition

- Look for holes in the facade
- Be sure all doors seal tightly
- Do not leave doors open for extended periods of time

Building Exterior

- Landscaping
- Brick pointing
- Evaluate your roof
- Door sweeps
- Holes in the envelope
- Gutters/Drainage

Building Interior

- Lights can add heat to a collection space
- Water sources
- Windows (leaky)
- Keep doors to zoned spaces closed
- Vents and HVAC equipment

- Look for signs of trouble
  - Peeling paint
  - Water damage
  - Etc.

Watch for Compounding Issues

Example

- Bad gutters
  - Cause pool of water outside door
  - Water freezes
  - Drain cannot flow
  - Additional water or melting has nowhere to go
    - Flooded office area
    - Damaged exterior
      - Caused gaps in building that allowed pests

Light Reduction

Achieving energy savings by altering the duration, quantity, and the type of lighting used.

Light Reduction

Duration

- Reducing the amount of time light is used in a space
    - Timers or motion sensors
    - Curtains on windows

Exposure

- Reducing the amount of light that is used in a collection space
    - Disconnect every other light
    - Add tint to windows – Remember window tint has a short lifespan

Type

- Swapping out old energy consuming light bulbs for more efficient style bulbs or bulbs that produce less UV
    - Remove T-12 and T-8 bulbs for LEDs

More Solutions

Heating

- Avoid heating the facility if you do not need to
    - If the institution is only open May-Nov, is it necessary to heat the empty buildings to 70˚F (21 ˚C)
    - If there are no visitors/staff in the building
        - Reduce heating to where you feel comfortable
        - Be mindful of water sources if any exist in the building
        - Instead of 70˚F (21 ˚C) will 50˚F (10 ˚C) work

Office Equipment

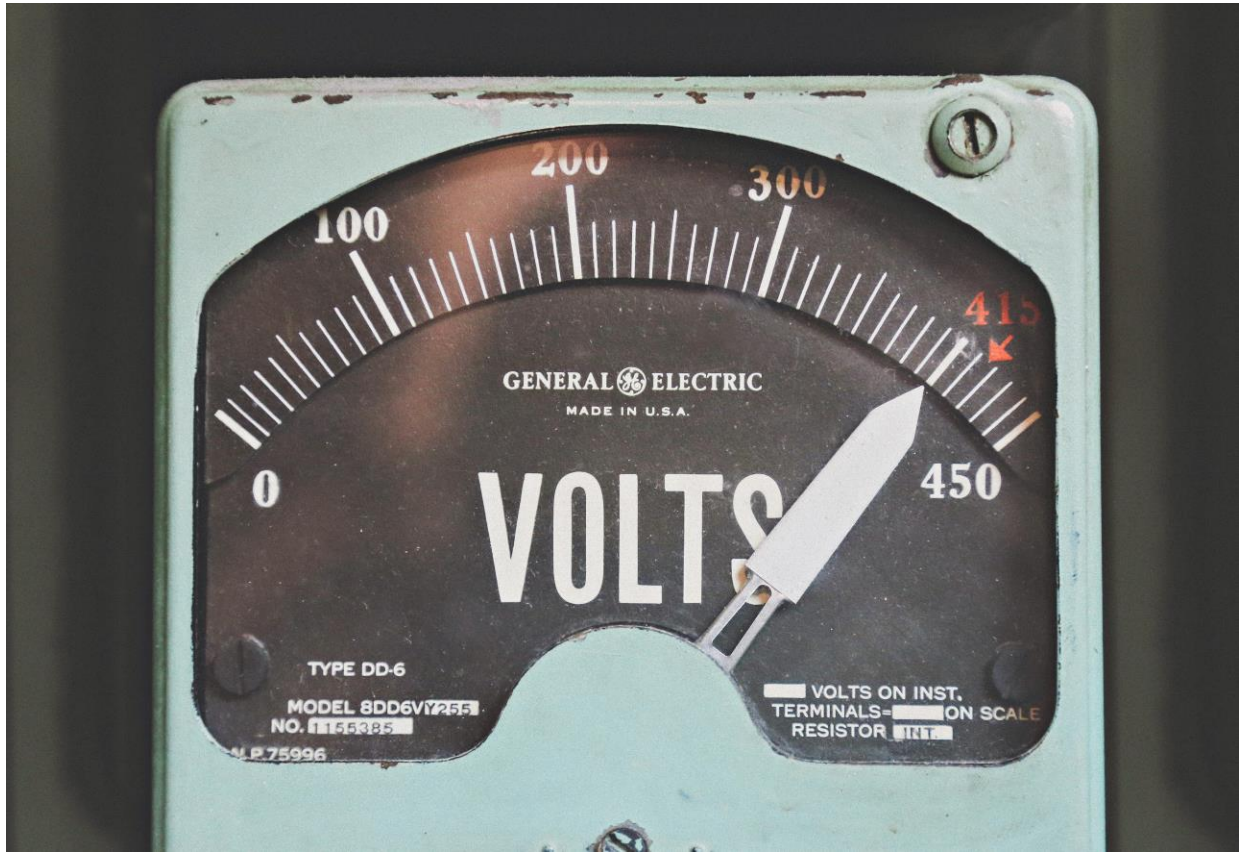
- Equipment can add heat and possibly moisture
    - Turn off any unnecessary equipment when not in use, or move away from collection spaces.

Methods for Improving Your Environment That Involve HVAC Equipment

Shutdowns

The complete shutdown of all components in your HVAC system for a select period of time.

- This includes heating, cooling and humidification components
- Only for a pre determined time



Shutdowns

Pros

- This can yield the significant energy savings over time
- May provide slight improvements in preservation
- In cooler months/locations shutdowns may be for longer periods

Cons

- The risk of the system not returning online
- The facility may not be capable of holding conditions

Set Point Changes

Changing the setpoints of the HVAC system to deliver improvements in preservation as well as in energy reduction

There are two kinds of set point adjustments

- Daily setbacks
- Seasonal set points

Daily Setbacks

Involves establishing separate ‘day’ or operating set points and ‘night’ or after hours set points

Pros

- Depending on type of mechanical system, may save a large amount of energy

Cons

- Potential for complaints from individuals who may be present during the after hours

Daily Setback Examples

Examples

- Gallery Set Points
  - 7am – 5pm 72° - 41% - 47°DP 44 PI
    - 10 hours
  - 5pm – 7am 63° - 56% - 47°DP 54 PI
    - 14 hours

Seasonal Set Points

Establishing seasonal temperature and relative humidity set points in spaces to improve the preservation environment and reduce energy impacts.

Pros

- Saves energy over a season
- Once implemented there is less potential for issues
- Can easily be combined with other energy saving strategies

Seasonal Set Points

- Example
  - Winter
    - 68° - 35% - 40°DP 66 PI
  - Summer
    - 72° - 41% - 47°DP 44 PI
  - Can be combined with daily set point changes for greater savings

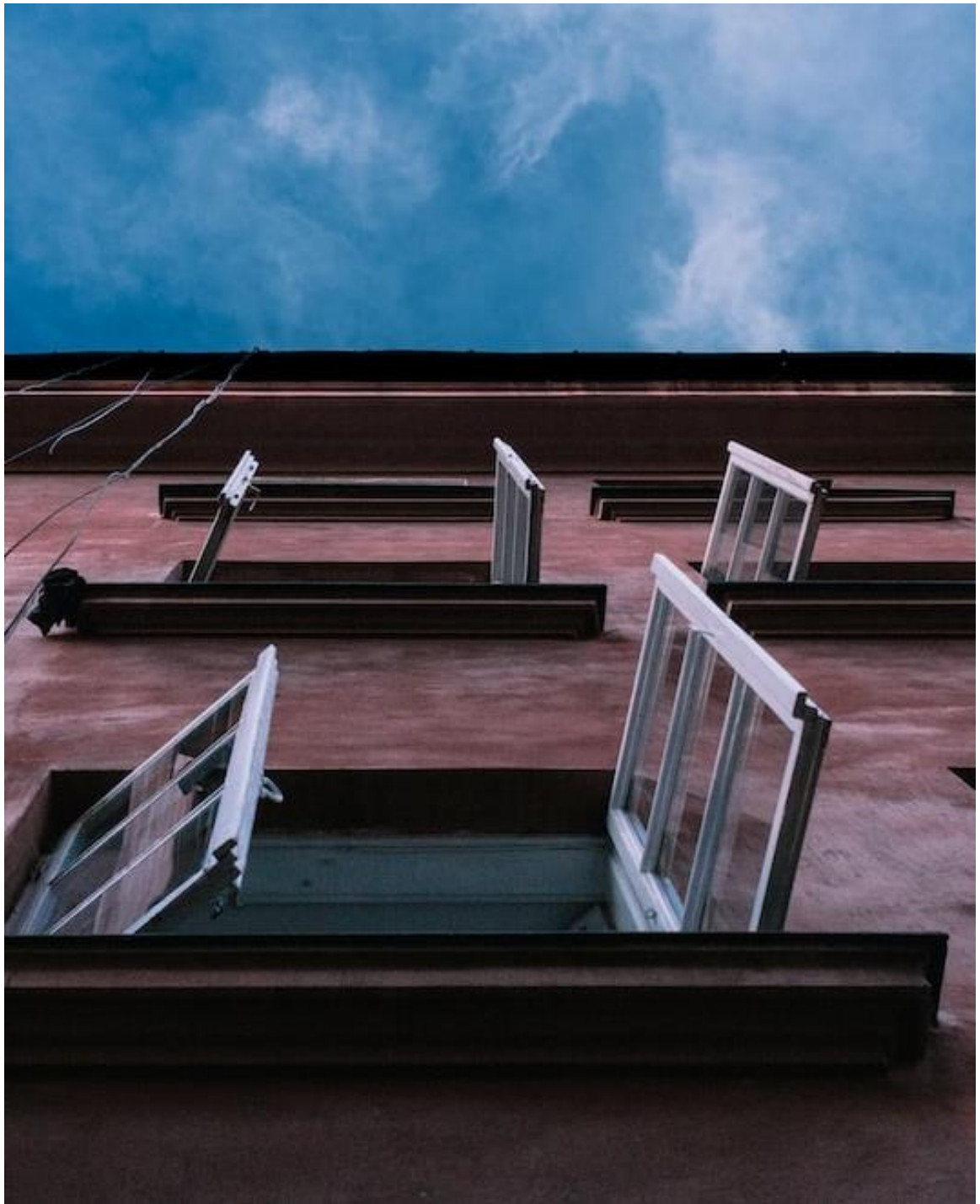
Reduction of Outside air

To reduce the volume of outside air that is used by the air handling unit (AHU).

*This does not involve completely closing off the outside air.

Pros

- Helps a collection space retain its condition better
- Saves energy at the mechanical system

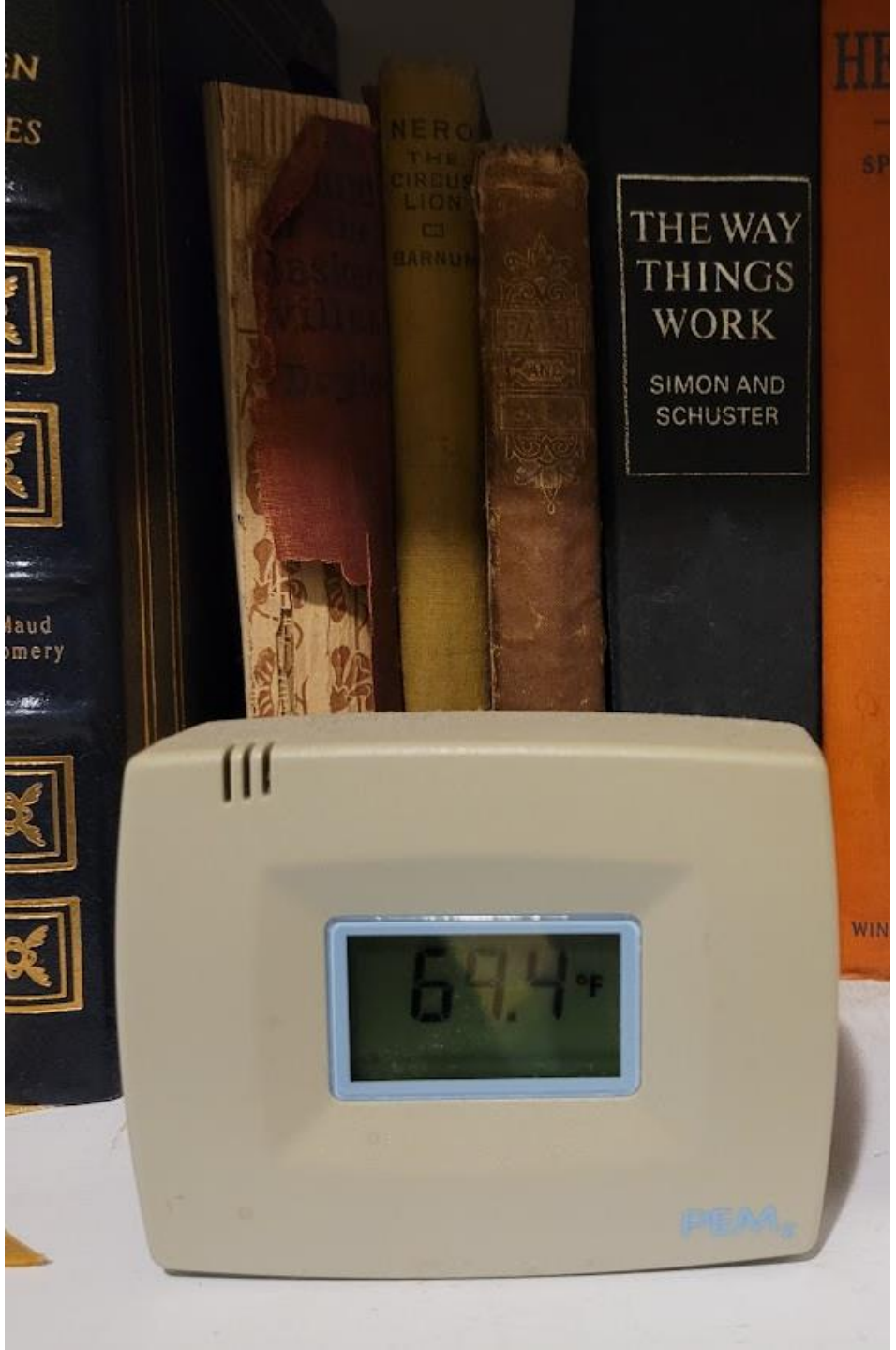


Employ airflow

- Proper air flow is key regardless whether you have an HVAC system or not.
- Try to understand how air was originally intended to move through your facility
- Understand how redesigning spaces can have an affect on your airflow
  - This can include your thermostat placement
- Do not block air sources (windows, supply, or return vents)

Test and evaluate a strategy before permanently implementing it

- Data loggers should be placed in the space to ensure conditions do not deviate significantly
- A two week testing period is recommended



Other mechanical system options

- Rooftop unit retrofit
  - Installing smart motors on older rooftop units is a good way to retrofit these units
  - Smart motors are a way to add a form of BMS control to an older system

- Optimize when your equipment will stop and start
  - Stop any unnecessary equipment at the end of the day
    - Example - hotels turn some elevators off during slow periods
  - Start equipment only when necessary
    - Example - Only run vestibule heaters when the doors are unlocked

Other mechanical systems options

- Utilize better deadbands for your HVAC system
  - A deadband is a temperature range in which neither heating nor cooling system turns on.
  - Some institutions utilize very tight deadbands of 2-3˚.
  - Can you expand this to 5-6˚?

- Be sure all ductwork is sealed
  - Any lost air will need to be made up by the system
  - On return ducts this may allow unconditioned air to enter the system.

Additional Notes

- Regular preventive maintenance is important.
  - Usually the first thing cut
  - Proactive facility management can catch issues early
- Walk-through the spaces regularly
- Analyze data routinely
- Budget for repairs

Grants/Funding

- **NEH Sustaining Cultural Heritage Collections**
- **NEH Preservation Assistance Grants for Smaller Institutions**

- **IMLS Museums for America**
- **IMLS Inspire! Grants for Small Museums**

- **AIC Collections Assessment for Preservation (CAP)**

  Open now February 28 deadline

- **Database of State Incentives for Renewables & Efficiency®**
  - **DSIRE**

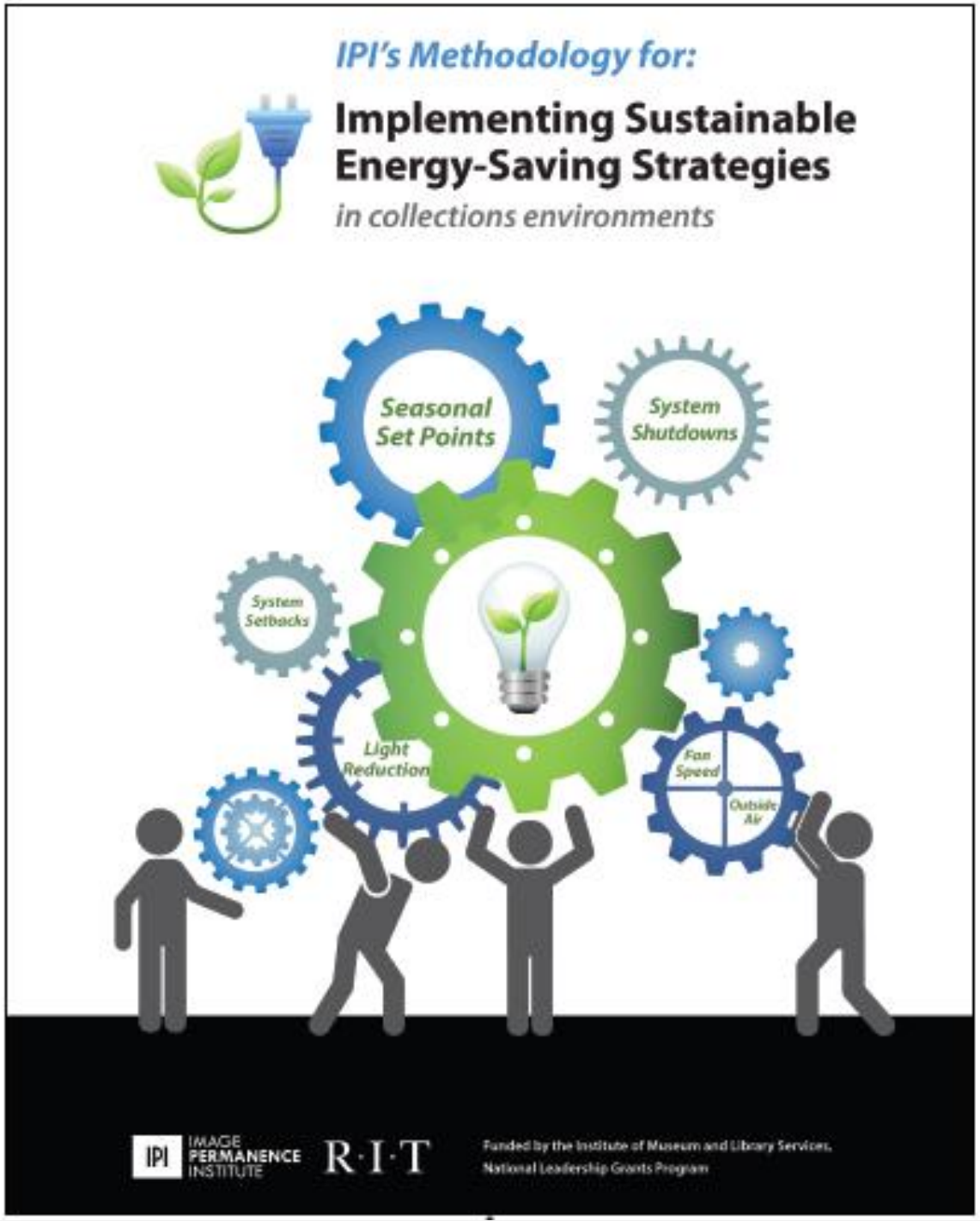
Services We Offer

- Establishing a data monitoring program
- Optimization and analysis of mechanical systems
- Custom environmental assessment
- Mechanical system design representation
- Preservation Commissioning

Sustainable Heritage

Other Resources

- IPI's Environmental Publication Page https://www.imagepermanenceinstitute.org/education/publications.html
  - **IPI's Methodology for Implementing Sustainable Energy-Saving Strategies for Collections Environments**
  - **IPI's Guide to Sustainable Preservation Practices for Managing Storage Environments**
  - **The Role of Dew Point in Sustainable Environmental Management**



Questions

THANK YOU

Christopher Cameron

+1 (585) 317-3522

ccameron@lesscarbonmoreculture.com

LESSCARBONMORECULTURE.COM

Sustainable Heritage