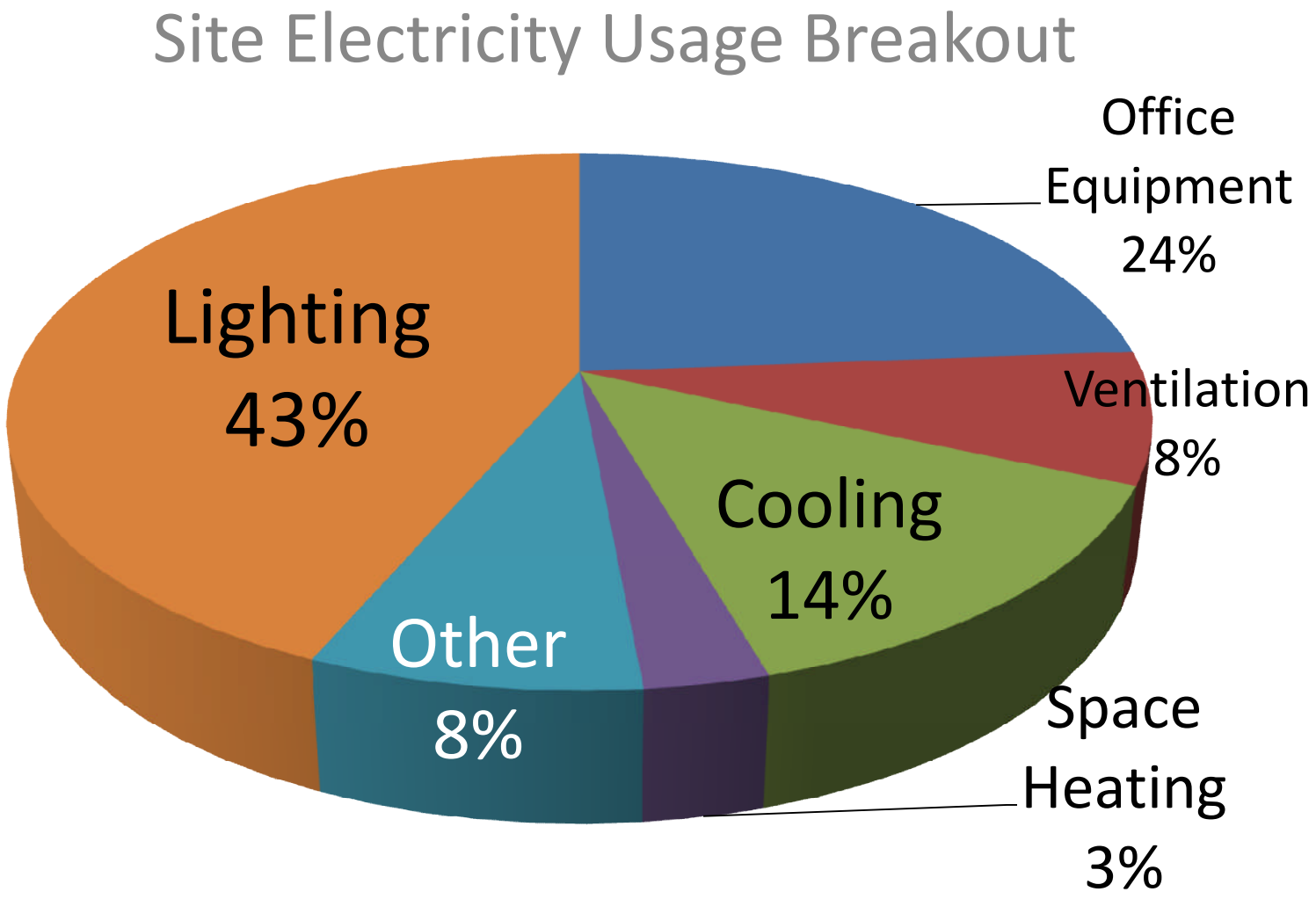
# GREEN GOV

## *“Clean Energy Projects”*

**Mark Ewing**
**Director**
**Energy Division**
**Facilities Management and Services Program**
**Public Buildings Service**

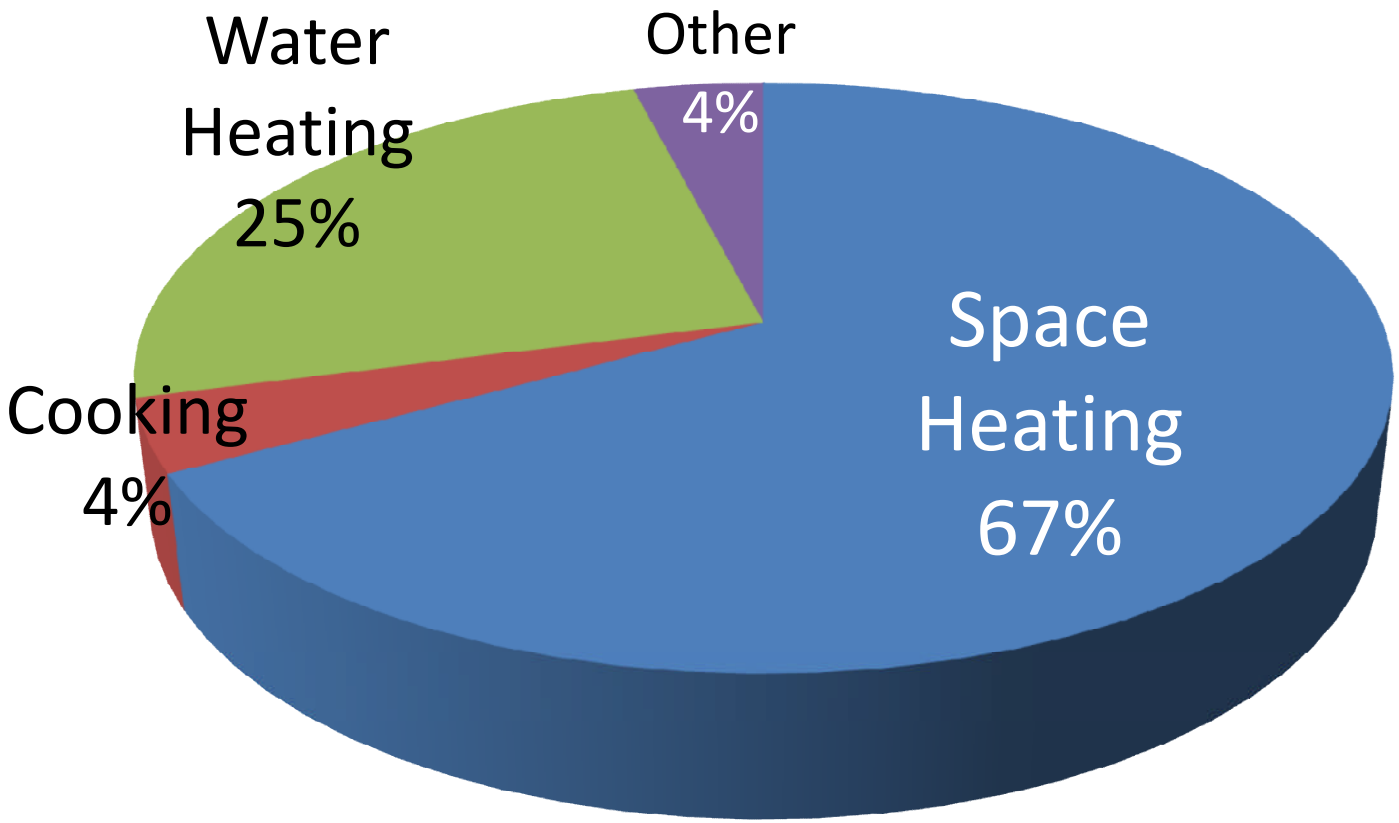
# An Ideal World-What Does It look Like?

# Understanding Energy Usage of Govt. Buildings



# Understanding Energy Usage of Govt. Buildings

## Site Natural Gas Usage Breakout



# Required Annual Usage

- Case Study – 250,000 sq. ft. Facility

  - Electricity Consumption 13.4 kWh/sq.ft
    - Required Annual Electricity = **3,350 MWh**

  - Natural Gas Consumption 32.8 cubic ft/sq.ft

    **33,456 BTU/sq.ft**
    - Required Annual Natural Gas = **8,364 MMBtu**
      **≈ 2,450MWh**

**Challenge #1:**

- ***11,940*** monocrystalline panels similar to panels used at DFC would be needed to provide enough power for electric consumption alone.

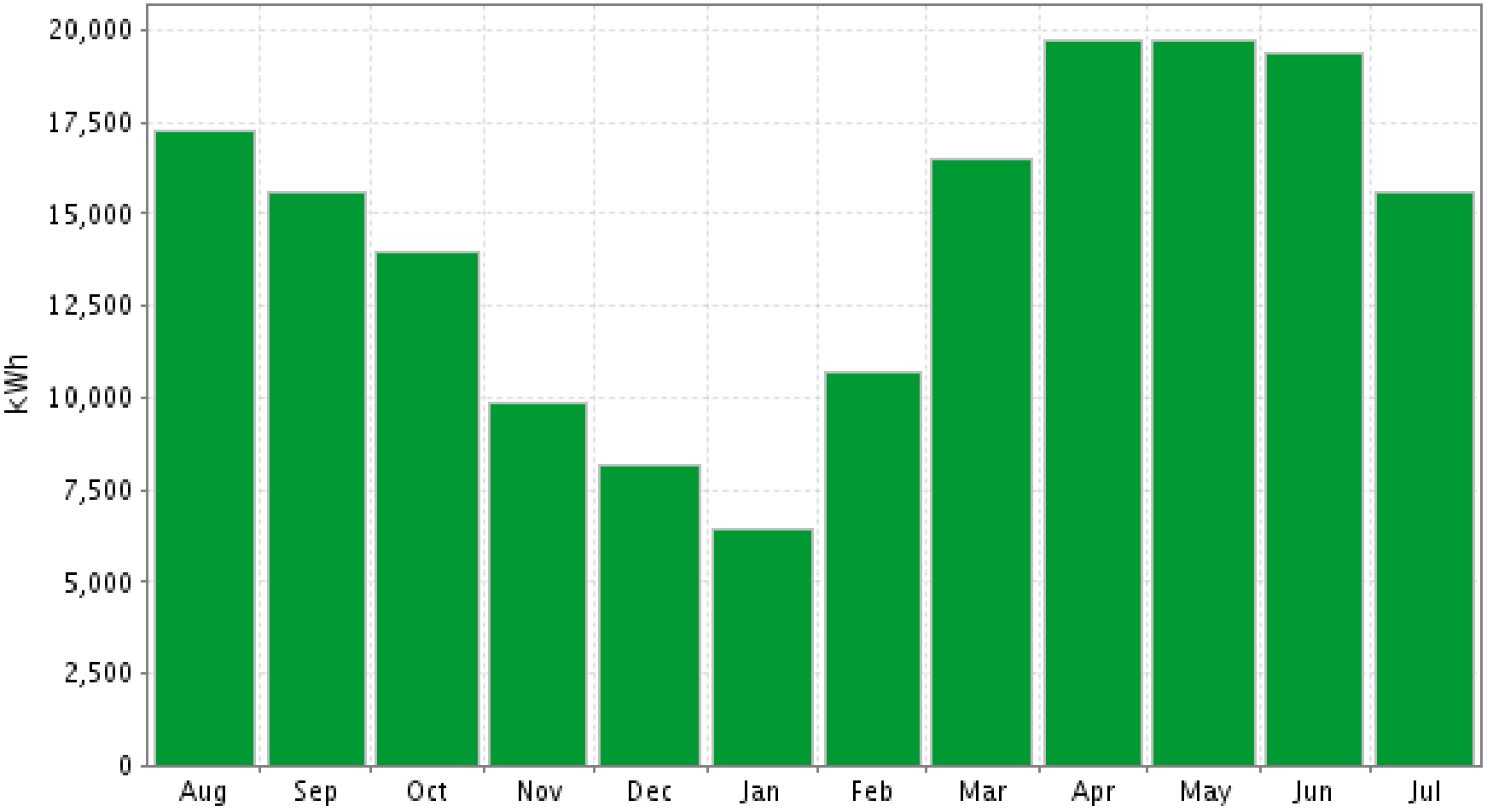
**Challenge #2:** *We still need to heat the building!*

- In general a Geothermal field uses 1-8 acres per megawatt(MW), therefore 1/2-4 acres would be needed for this size building
- Direct Use Geothermal $18.26/sq.ft ≈$4,565,000.

  (Very Expensive - Remember, this building is only 250,00 sq.ft)
- Direct Use Geothermal would increase electric usage therefore, even more panels would be needed.

# Challenge #3: PV Output Reliability

(Varies with regions)



# Possible Solution

- Therefore, it would be necessary to use a combination of technologies in order to provide adequate heating/cooling at all times while meeting other building usage needs.

# What Strategies Can Get Us There?

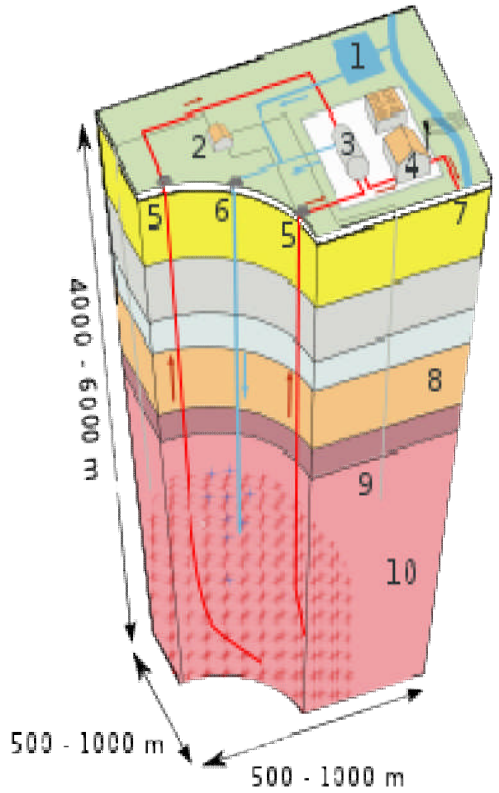
- **Geothermal**
- **Evacuated tube collectors**
- **Photovoltaic panels**
- **Concentrated Solar power**
- **Excess heat is diverted to an absorption chiller to provide site cooling**
- **Site wide power distribution**
- **Excess power returned to the national grid**

# Enhanced Geothermal Systems-EGS

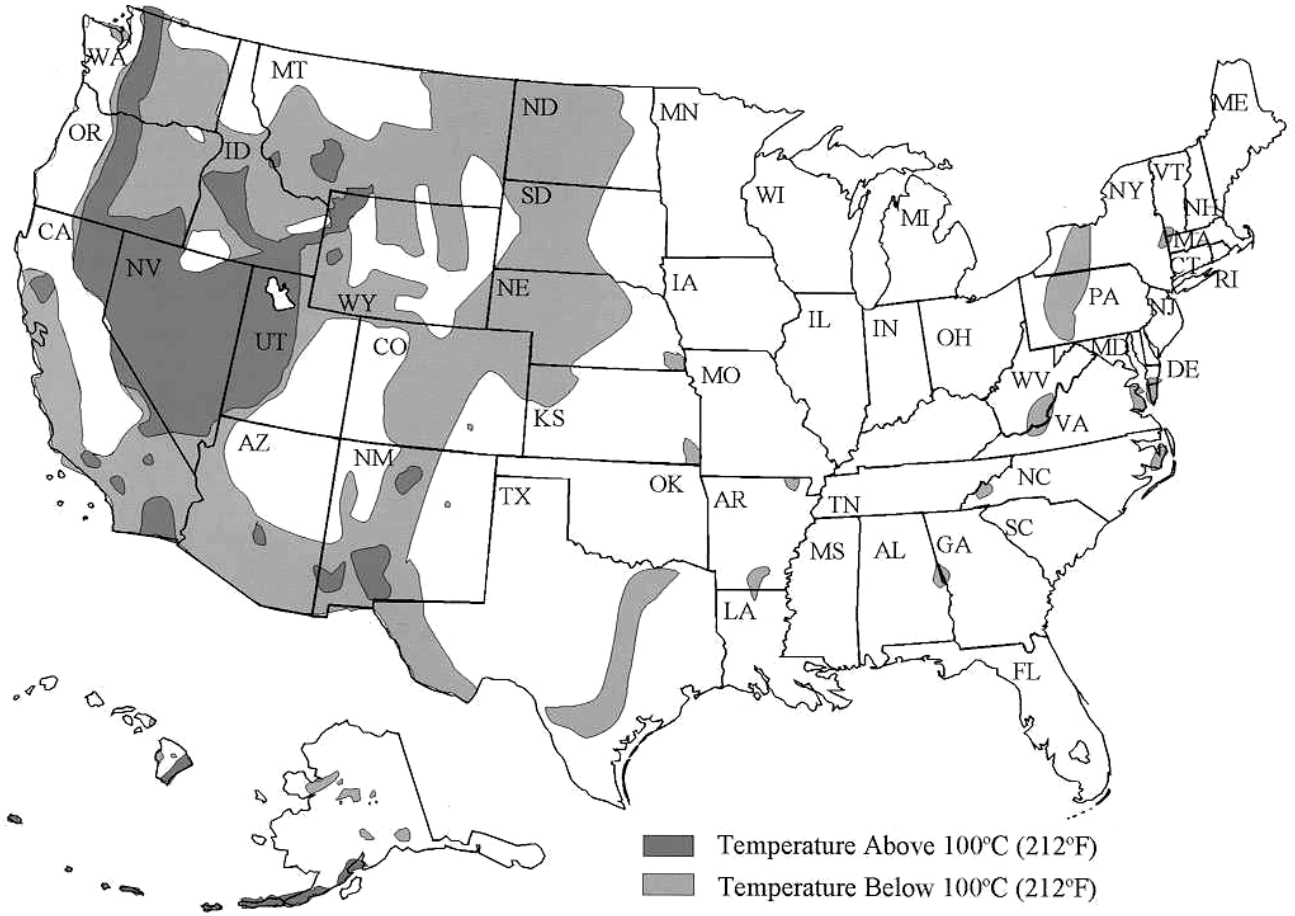
- Power produced 24 hours a day like a fossil plant

- Enhanced Geothermal plants under Construction will generate between 5,000–10,000 MW of power

- Ideally, an Enhanced Geothermal Systems plant could be installed an replace our dependency on our steam generation for the heating of Federal Facilities.



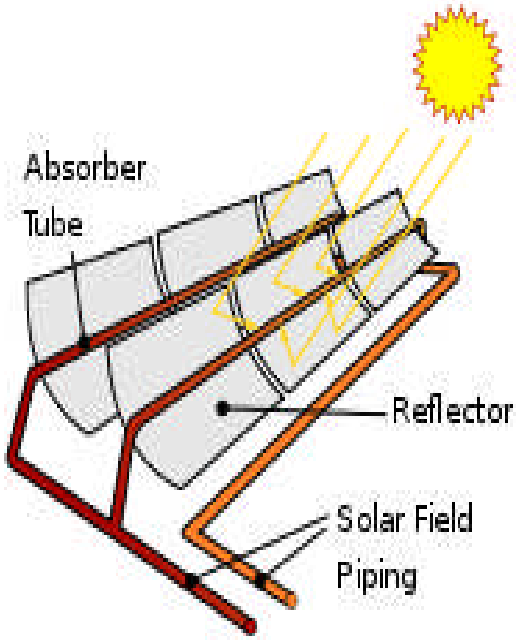
# Regions Where Enhanced Geothermal Works Best



# Concentrated Solar Power- CSP

- CSP can be used to produce heat and electricity

- CSP plants can produce electricity day and night by storing heat generated



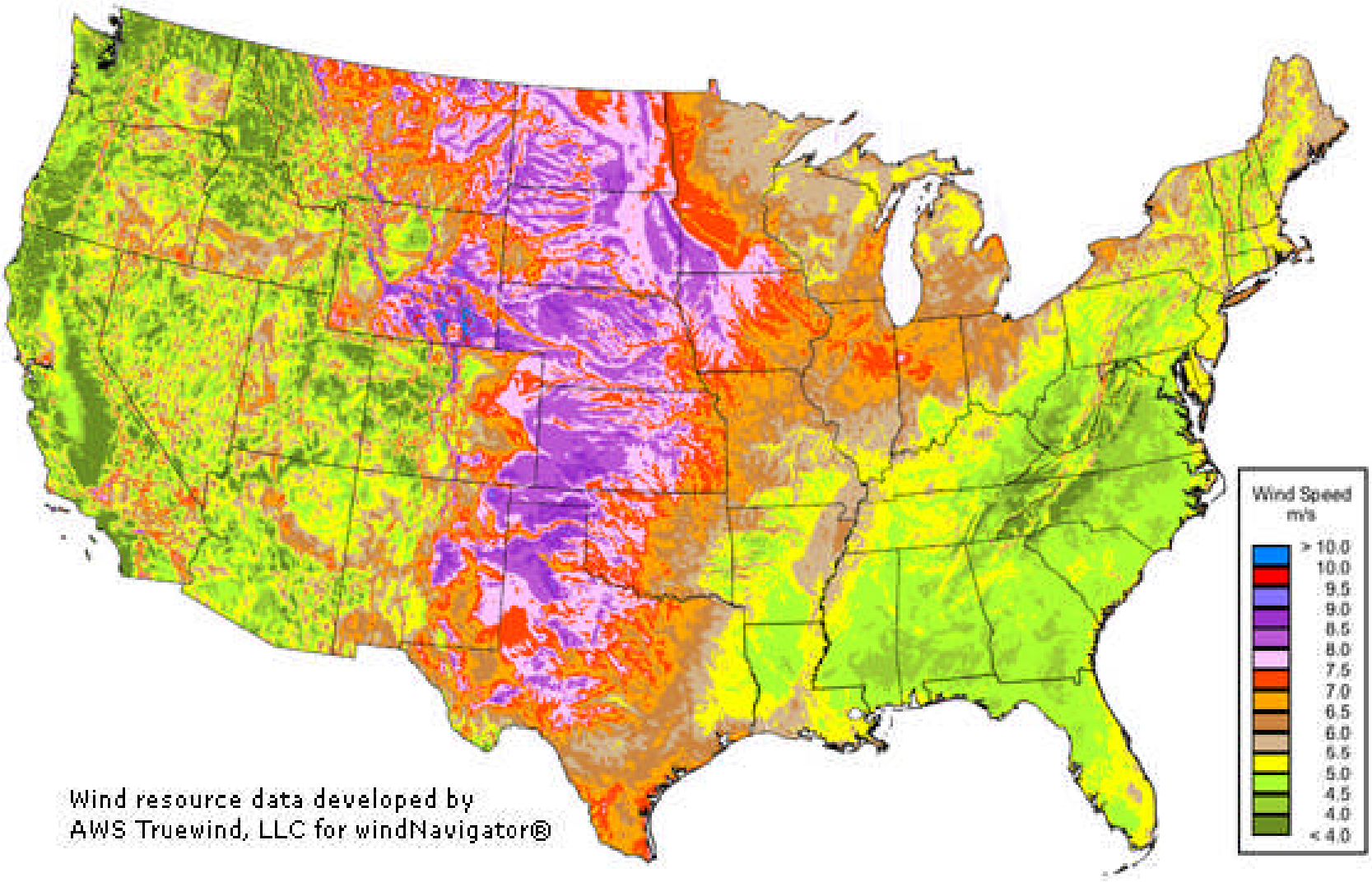

- **Nevada Solar One** is a concentrated solar power plant with a capacity of 64 MW and maximum capacity of 75 MW.
- Electricity production is estimated to be 134 million kWh/year.

# Jackman, ME – Wind Turbine

45°37'38″N 70°12'39″W

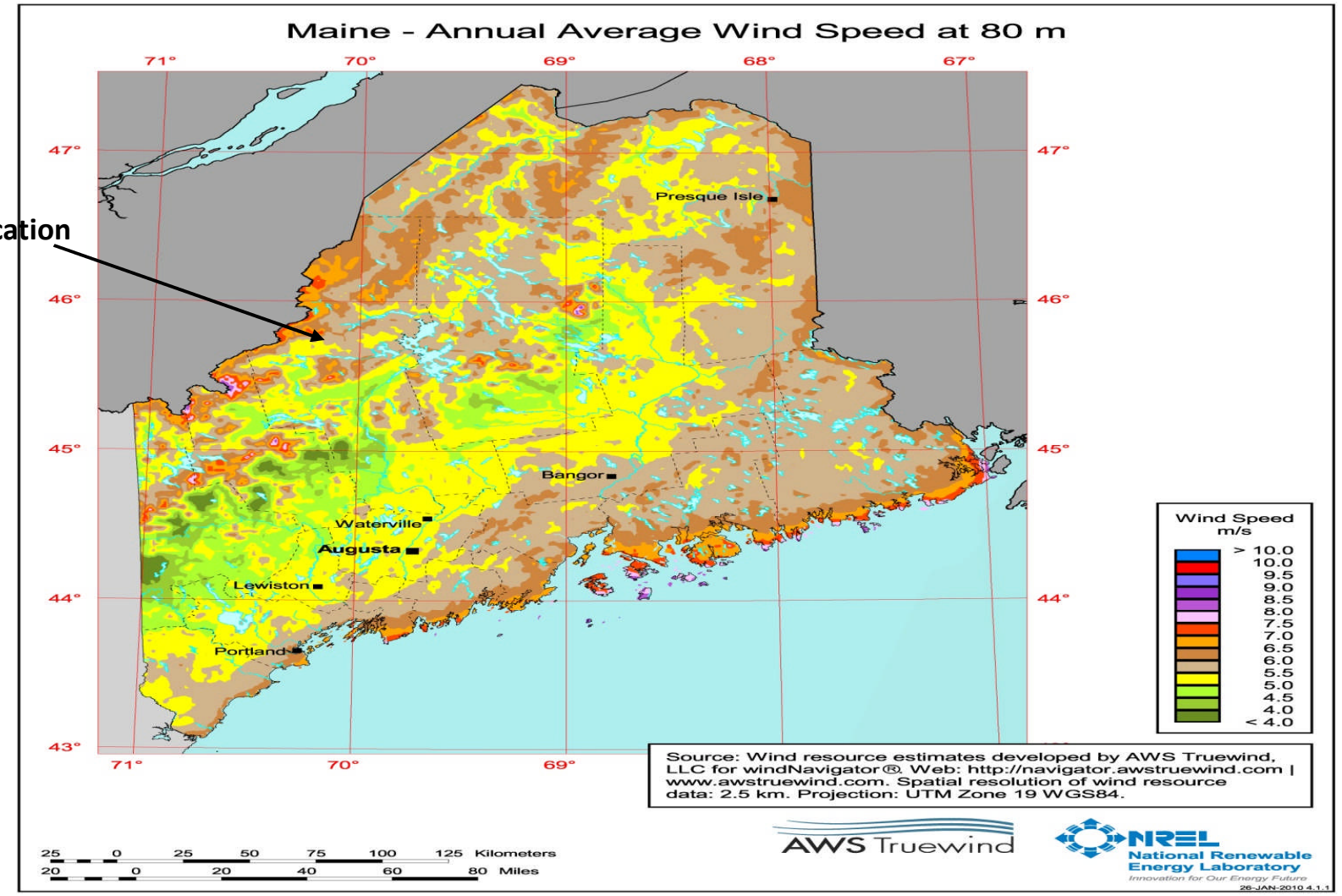
- 100 kW turbines that each are estimated to produce 220,000 kWh annually for a total of estimated 440,000 annual
- Turbines will provide approx. ***50%*** of LPOE's needs hence reducing required #2 oil.
- Cost $1,817,193.80
- 204,590kwh/Year/Turbine saved
- For our 250,000 sq.ft building case study, this would account for 12.2% of electric consumption.

# National Wind Map



# Jackman, ME – Wind Map

**Dual Wind Turbine Location**

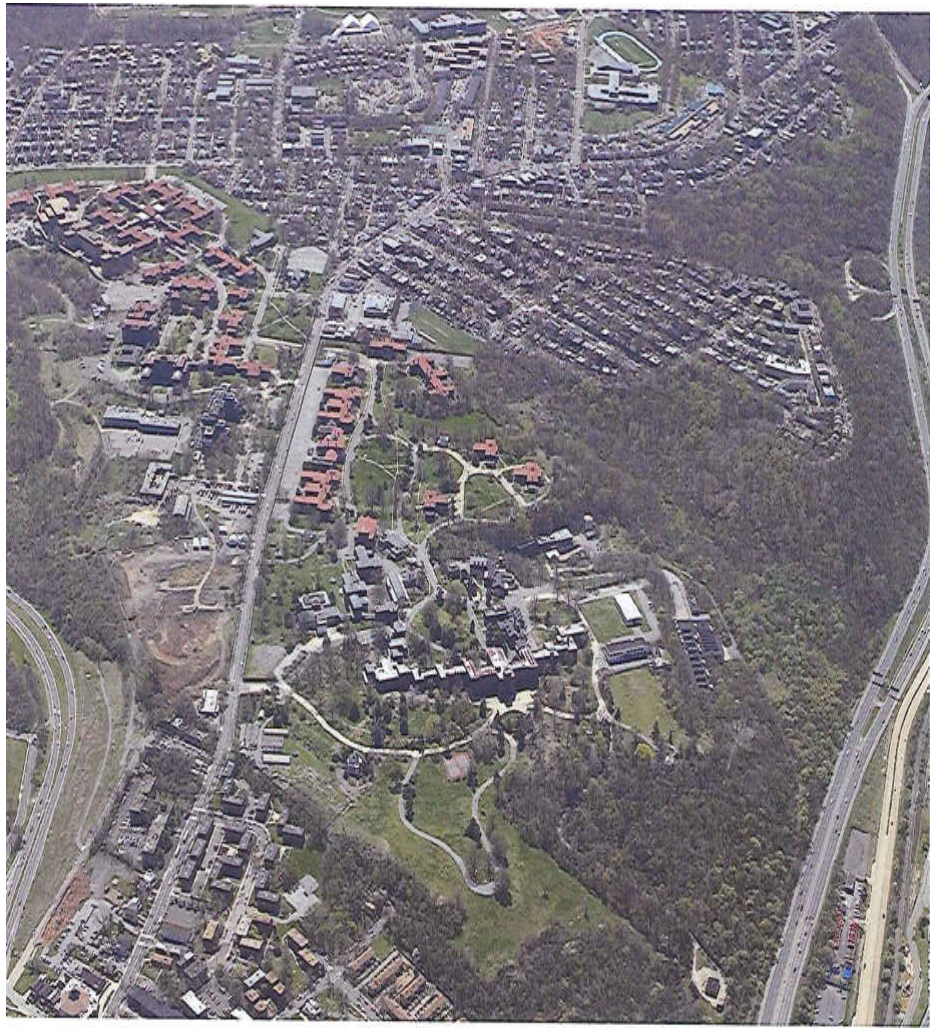



TRANSNAT
01/01/2007

# ST. ELIZABETH'S "GREEN" INITIATIVES

# BACKGROUND OF CAMPUS

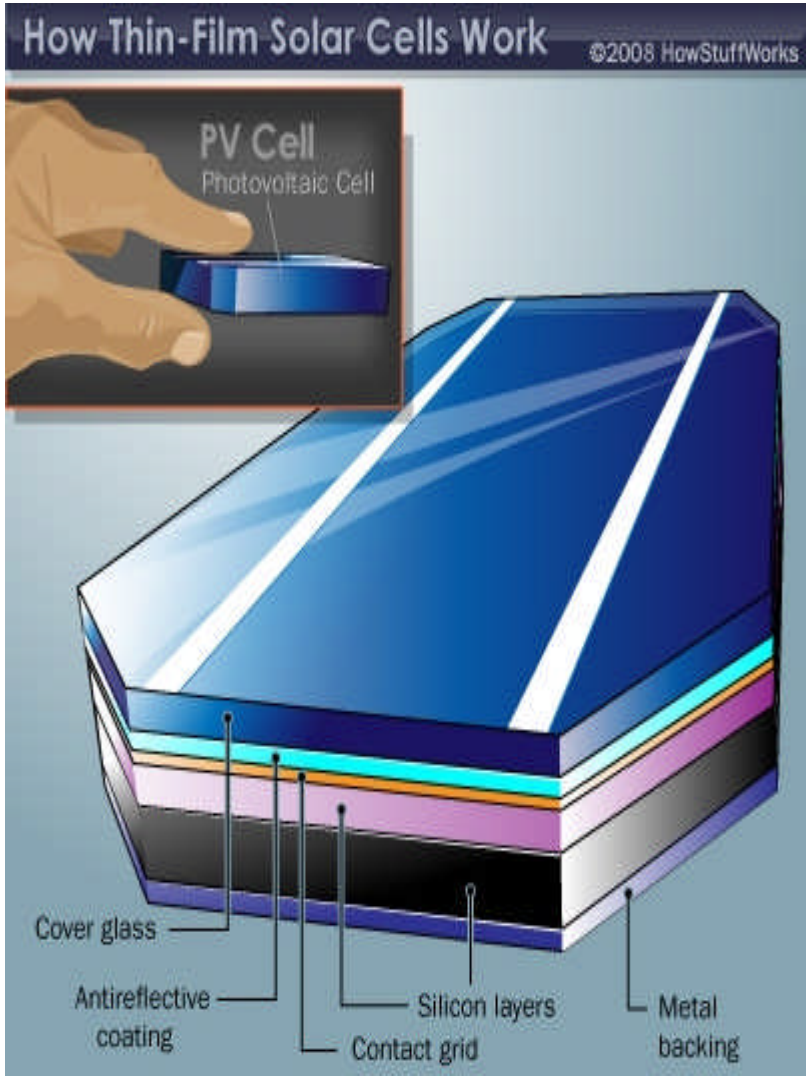
- National Historic Landmark
- Campus Size: 176 Acres
- Total Building Size: 4.5 Million SF
- Time: 6 years



# PLUMBING SOLAR COLLECTORS AND PHOTOVOLTAICS

**1B Adaptive Reuse Project Features:**

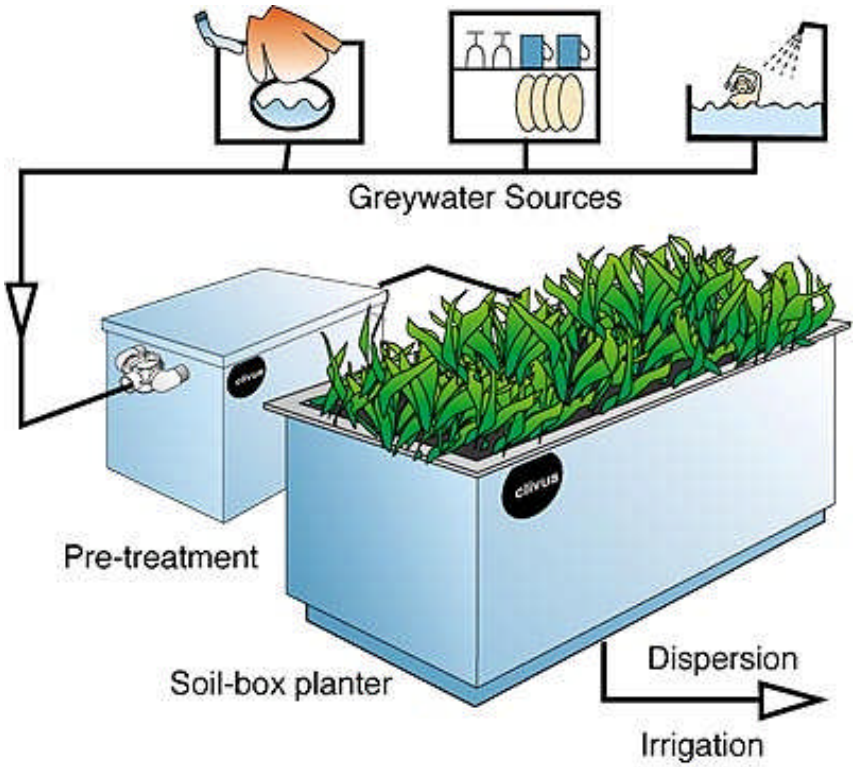
- Plumbing Solar Collectors:
  - Bldgs 33&34
    - 30,000 BTU/day
    - 11,000 BTU/day per Cat. “D” Mild Cloudy Output
  - Bldg 49
    - 30,000 BTU/day
    - 11,000 BTU/day per Cat. “D” Mild Cloudy Output
- Electric PV Systems:
  - Bldg 31 = 6.250 kW
  - Bldg 33/34 = 10 kW
  - Bldg 49 = 75 kW
  - VIP and Staff Screening Bldg at Gate 1 = 20.8 kW



# WATER REUSE

**US Coast Guard Building Features:**

- Landscaped courtyards to capture and reuse surface water runoff as greywater
  - i.e. when it rains, water is collected and used as toilet water

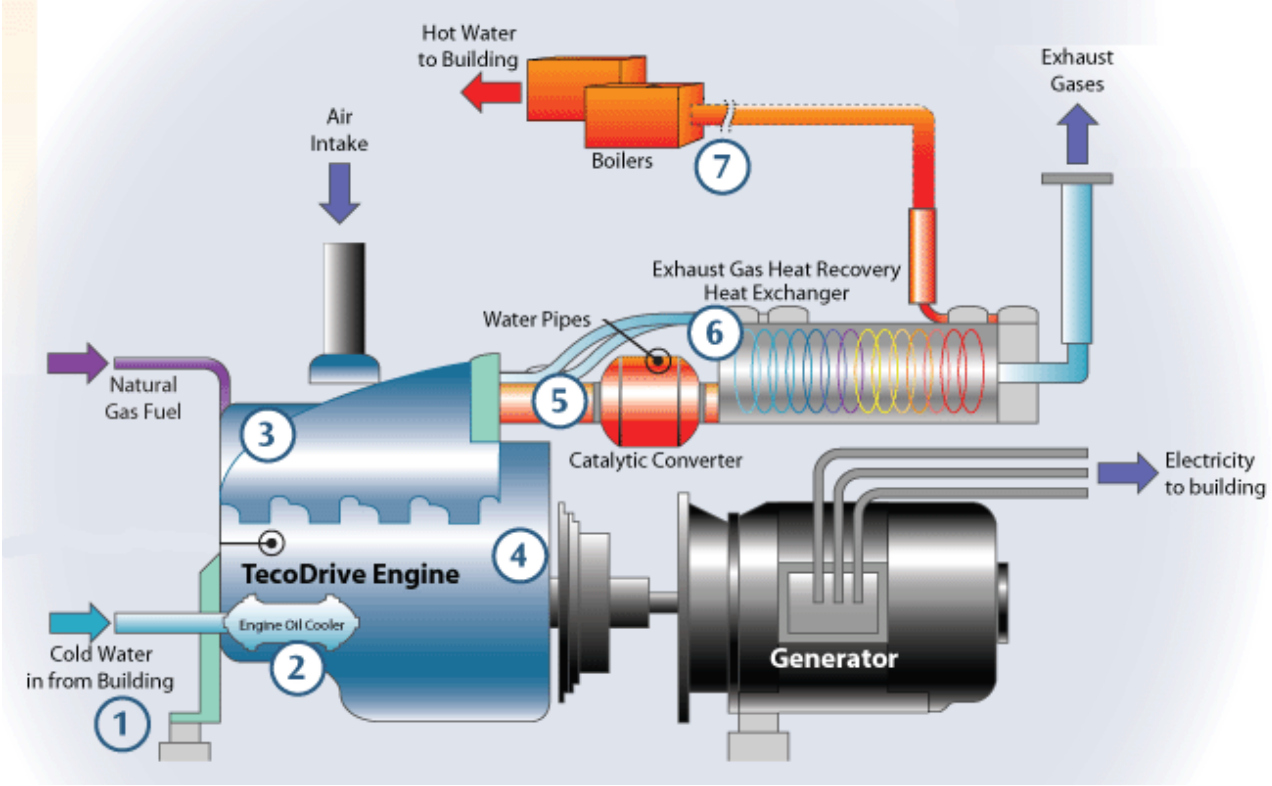


# AUTOMATED LIGHTING

**US Coast Guard Building Features:**

- Automated lighting to lower electrical uses
  - i.e. lights turn on automatically when you enter a room

# COGENERATION




**Entire Campus Features:**

- No wasted electricity due to transmission
- Carbon footprint reduction
- Estimated Output: 25 MW

# TURBINE

# GENERATOR

# The Reality

- 100% reduction of our carbon footprint, can this be done?
  - It appears that it is possible, however, success at this venture would require changes to our infrastructure.
  - We are looking at individual buildings, but a complete reduction would require looking at things from a macro perspective. Construction of GSA facility/campus based power plants working in tandem with existing infrastructure making the target more feasible.
  - PV should also be used on individual buildings as supplemental energy, but because of its reliability and efficiency, it cannot be our sole source of power.