

# SOLAR POWER AT SALEM STATE

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For: GPH 340

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# Introduction

\*Solar power

\*Roofs of Salem State



# Objectives

- Use the roofs of Salem State
- Show how productive the campus can be
- Produce visual proof

# Methods

Solar capabilities of GIS

Database of Massachusetts for GIS data

Layers for:

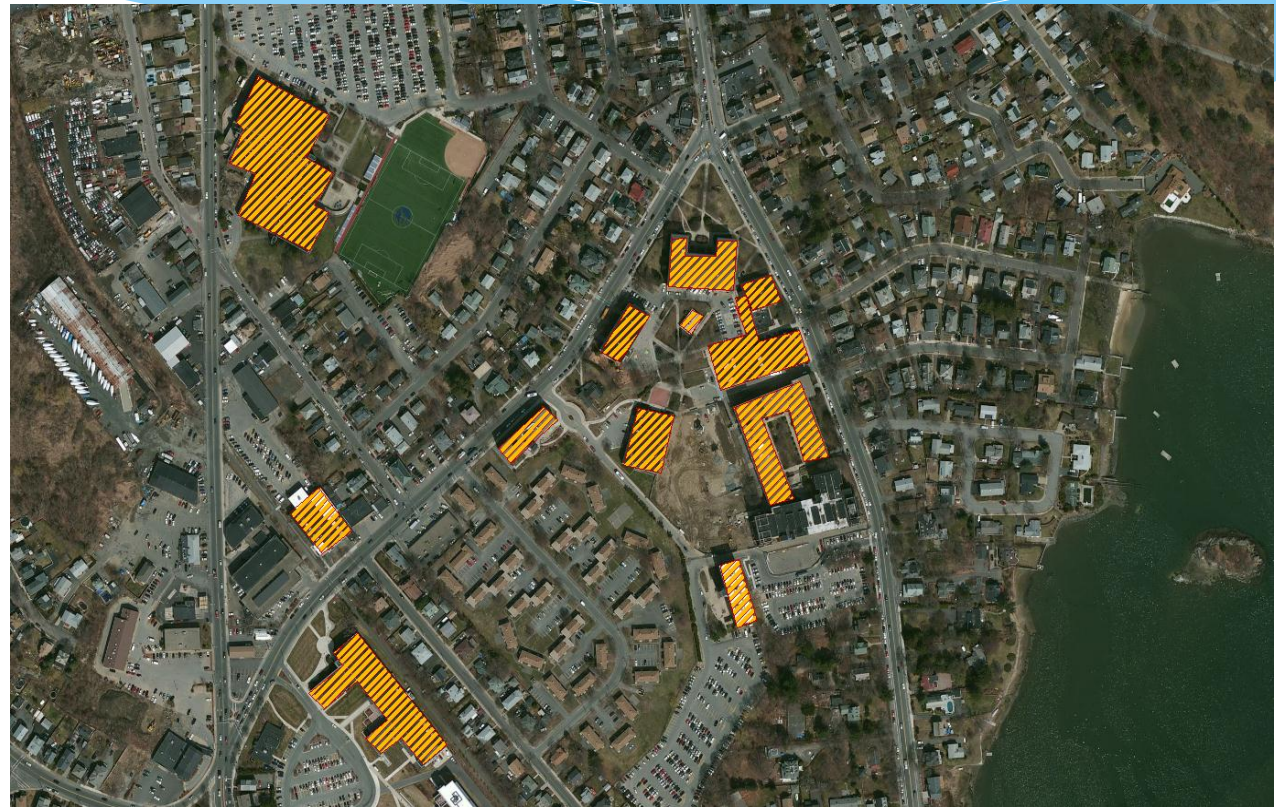
Elevation

Solar energy

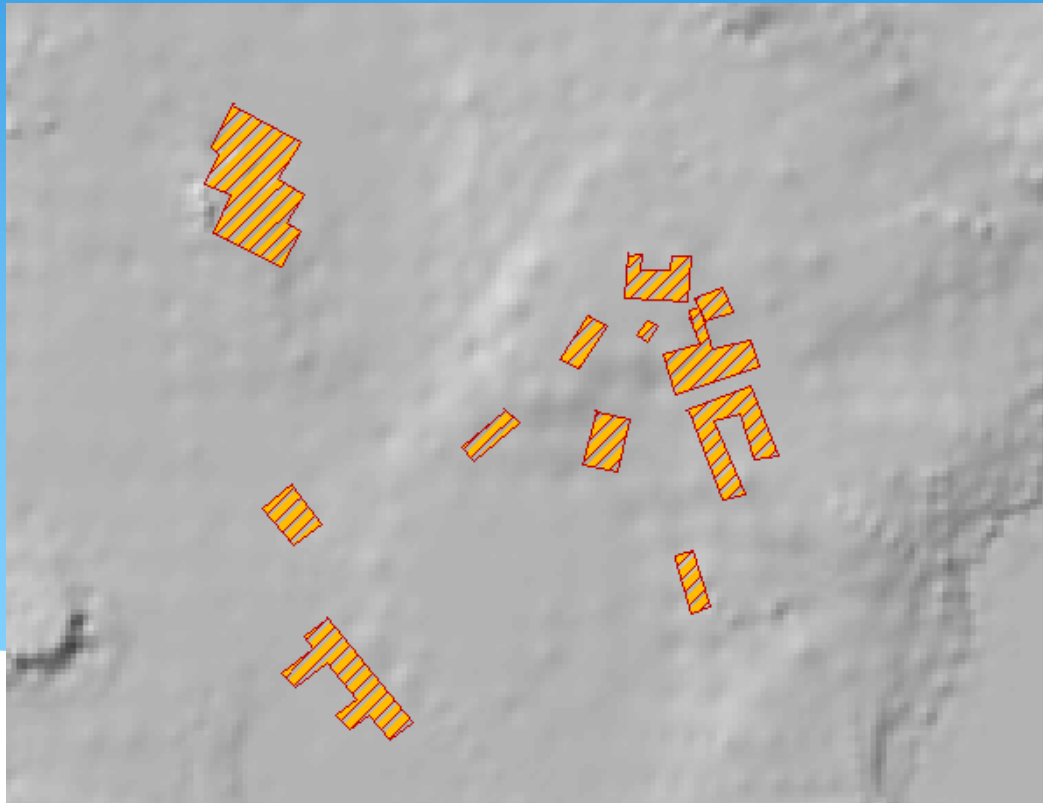
Buildings chosen

# Buildings Selected from Salem State Campus

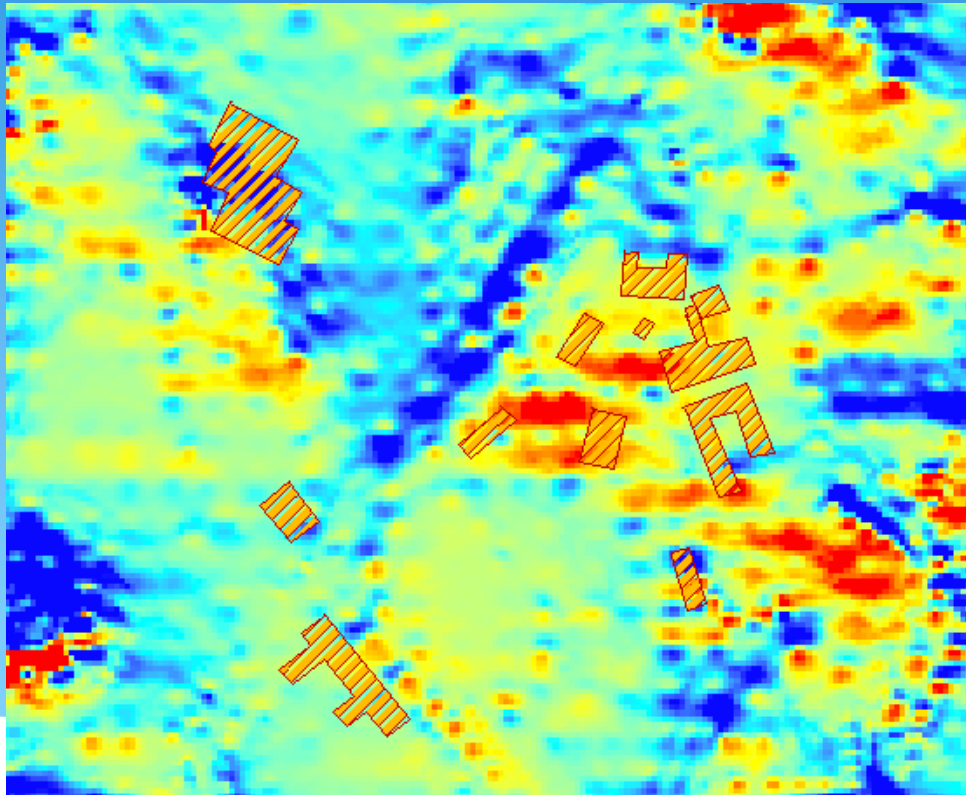
Okeaf  
Central  
Meier  
Cafe  
Sullivan  
Dorm  
Commuter  
Books-warehouse  
Pre-school  
Admission  
Job-services



# Elevation



# Solar Power



# Solar Power hitting each zone

| <u>Name</u>     | <u>Area</u> | <u>Watts/meter^2</u> | <u>Kilowatts/meter^2</u> |
|-----------------|-------------|----------------------|--------------------------|
| Okeaf           | 8,175       | 382,435,168          | 382,435                  |
| Central         | 4,325       | 207,921,856          | 207,922                  |
| Meier           | 3,425       | 165,074,288          | 165,074                  |
| Cafe            | 2,925       | 142,330,080          | 142,330                  |
| Sullivan        | 1,850       | 89,706,208           | 89,706                   |
| Dorm            | 1,825       | 87,951,744           | 87,952                   |
| Commuter        | 1,550       | 76,205,664           | 76,206                   |
| Books-warehouse | 1,425       | 67,915,376           | 67,915                   |
| Pre-school      | 925         | 45,028,000           | 45,028                   |
| Admission       | 600         | 28,985,242           | 28,985                   |
| Job-services    | 225         | 10,922,429           | 10,922                   |

**Total:**

**27,250**

**1,304,475**

# Efficiency of each building based on size

| <u>Name</u>     | <u>Area</u> | <u>Watts/meter<sup>2</sup></u> | <u>Kilowatts/meter<sup>2</sup></u> | <u>Efficiency/Area</u> |
|-----------------|-------------|--------------------------------|------------------------------------|------------------------|
| Commuter        | 1,550       | 76,205,664                     | 76,206                             | 49.2                   |
| Pre-school      | 925         | 45,028,000                     | 45,028                             | 48.7                   |
| Cafe            | 2,925       | 142,330,080                    | 142,330                            | 48.7                   |
| Job-services    | 225         | 10,922,429                     | 10,922                             | 48.5                   |
| Sullivan        | 1,850       | 89,706,208                     | 89,706                             | 48.5                   |
| Admission       | 600         | 28,985,242                     | 28,985                             | 48.3                   |
| Meier           | 3,425       | 165,074,288                    | 165,074                            | 48.2                   |
| Dorm            | 1,825       | 87,951,744                     | 87,952                             | 48.2                   |
| Central         | 4,325       | 207,921,856                    | 207,922                            | 48.1                   |
| Books-warehouse | 1,425       | 67,915,376                     | 67,915                             | 47.7                   |
| Okeaf           | 8,175       | 382,435,168                    | 382,435                            | 46.8                   |

# 15% Efficiency of Solar Panels

| <u>Name</u>     | <u>Area</u> | <u>Watts/meter<sup>2</sup></u> | <u>Kilowatts/meter<sup>2</sup></u> | <u>Kilowatts/M<sup>2</sup> (15%)</u> |
|-----------------|-------------|--------------------------------|------------------------------------|--------------------------------------|
| Okeaf           | 8,175       | 382,435,168                    | 382,435                            | 57,365                               |
| Central         | 4,325       | 207,921,856                    | 207,922                            | 31,188                               |
| Meier           | 3,425       | 165,074,288                    | 165,074                            | 24,761                               |
| Cafe            | 2,925       | 142,330,080                    | 142,330                            | 21,350                               |
| Sullivan        | 1,850       | 89,706,208                     | 89,706                             | 13,456                               |
| Dorm            | 1,825       | 87,951,744                     | 87,952                             | 13,193                               |
| Commuter        | 1,550       | 76,205,664                     | 76,206                             | 11,431                               |
| Books-warehouse | 1,425       | 67,915,376                     | 67,915                             | 10,187                               |
| Pre-school      | 925         | 45,028,000                     | 45,028                             | 6,754                                |
| Admission       | 600         | 28,985,242                     | 28,985                             | 4,348                                |
| Job-services    | 225         | 10,922,429                     | 10,922                             | 1,638                                |

**Total: 195,671**

# Building Roof Limitations

## 25% of roofs occupied

| Name            | Area  | Watts/meter <sup>2</sup> | Kilowatts/meter <sup>2</sup> | Kilowatts/M <sup>2</sup> (15% | Roof Limit(25%) |
|-----------------|-------|--------------------------|------------------------------|-------------------------------|-----------------|
| Okeaf           | 8,175 | 382,435,168              | 382,435                      | 57,365                        | 43,024          |
| Central         | 4,325 | 207,921,856              | 207,922                      | 31,188                        | 23,391          |
| Meier           | 3,425 | 165,074,288              | 165,074                      | 24,761                        | 18,571          |
| Cafe            | 2,925 | 142,330,080              | 142,330                      | 21,350                        | 16,012          |
| Sullivan        | 1,850 | 89,706,208               | 89,706                       | 13,456                        | 10,092          |
| Dorm            | 1,825 | 87,951,744               | 87,952                       | 13,193                        | 9,895           |
| Commuter        | 1,550 | 76,205,664               | 76,206                       | 11,431                        | 8,573           |
| Books-warehouse | 1,425 | 67,915,376               | 67,915                       | 10,187                        | 7,640           |
| Pre-school      | 925   | 45,028,000               | 45,028                       | 6,754                         | 5,066           |
| Admission       | 600   | 28,985,242               | 28,985                       | 4,348                         | 3,261           |
| Job-services    | 225   | 10,922,429               | 10,922                       | 1,638                         | 1,229           |

**Total: 146,754**

# Conclusion and Questions

Commuter building

Okeaf building

146,754 Kw/m<sup>2</sup>

Solar Panels

# Citation

<http://www.esri.com/library/bestpractices/renewable-energy.pdf>

<http://solargis.info/>

<http://blogs.worldwatch.org/revolt/the-role-of-gis-mapping-in-renewable-energy-project-planning/>

<http://solarpower.com/>

<http://www.alternative-energy-news.info/technology/solar-power/>

<http://www.solarpowerinc.net/>