

Saving Olivet Money *With* Creation Care

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Scholar Week

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“God allows us the low points of life in order to teach us lesson that we could learn in no other way.” – C.S. Lewis

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Pro-Life or Pro-Choice

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- 1 Very big ways of saving money at Olivet *with* creation care.

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- ① Very big ways of saving money at Olivet *with* creation care.
- ② Small ways of saving money at Olivet *with* creation care.
- ③ Low hanging fruit: Creation care that has a very small cost, yet a big impact.

1. Solar Panels

Google Project Sunroof:

- Type in address
- How many solar panels are best?
- Where to place them?
- How many hours of sunlight per year?

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Burke Administration Building:

Comparison with residential homes.

1. Solar Car Ports



Figure : Michigan State University solar carport project completed on December 20, 2017.

1. Solar Carports: Proposal

What if we also did solar carports here at ONU?

Google Project Sunroof can be used to

- count the number of viable parking spots on campus
- estimate the number of hours of sunlight per year

1. Solar Carports: Sanity Check

Solar panels in Illinois? Maybe in Texas... by they can't make sense here.

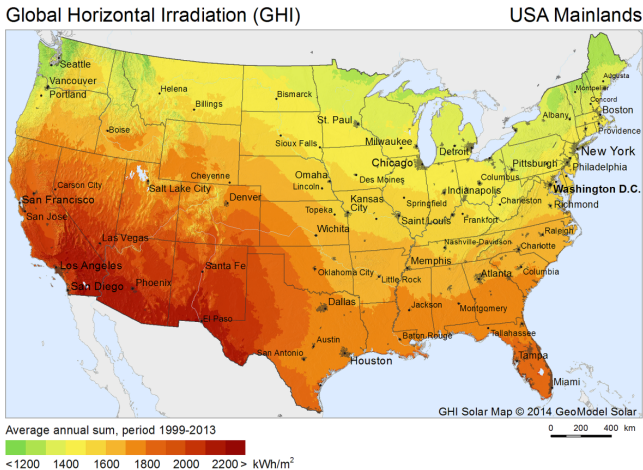


Figure : From Wikipedia.

1. Solar Carports: Calculation

Location	Number of Parking Spots
Burke parking lot	205
Admissions and Shine parking lot	87
Chapel parking lot	598
Weber and Warming House parking lots	370
Baseball Diamond parking lot	315
Miller parking lot	22
LaVasseur Square parking lot	111
Total on main campus	1,688

Parking spots are 9 ft \times 18 ft, totaling to about 273,456 ft².

1. Solar Carports: Calculation

Canadian Solar panels:

- Measure about 17.62 ft^2 , so we would need about 15,519 solar panels.
- Can generate 0.325 kW each.
- Cost about \$310.00 each.

Solar array would be able to output

$$(15,519)(0.325\text{kW}) = 5043.7\text{kW}.$$

1. Solar Carports: Calculation

Not optimal south angle: Output = $5043.7\text{kW} - 10\% = 4539.33\text{kW}$



Figure : Michigan State University solar carport project completed on December 20, 2017.

1. Solar Carports: Calculation

Solar array can generate approximately

$$\underbrace{(0.8)}_{*} (1400 \text{ hrs sunlight/yr})(4539.3\text{kW}) = 5,084,016\text{kWh/yr.}$$

* Solar array in Ireland had 20% loss from “array capture losses, system losses, cell 385 temperature losses, soiling and degradation”

1. Solar Carports: Calculation

Cost of solar panels

$$= (0.75)(15,519 \text{ solar panels})(\$310.00) = \$3,608,167$$

Cost of carports

$$= (0.75)(1688 \text{ pk. spt.})(\$1300 \text{ carport/pk. spt.}) = \$1,645,800$$

Connect to grid (including inverters)

$$= (5,084,016 \text{ kWh/yr}) \left(\frac{\$2.5 \text{ million}}{15,000,000 \text{ kWh/yr}} \right) = \$847,336$$

Cost of setting up carports = \$847,336

Total cost = \$6,948,639

1. Solar Carports: Calculation

Break even analysis?

Solar carport array generates = 5,084,016kWh/yr.

We could save = \$508,402/yr (assuming that we pay \$0.10/kWh)

$$\text{Break even time} = \frac{\$6,948,639}{\$508,402} = 13.7 \text{ years.}$$

After break even point, we would be *saving* \$508,402/yr.

1. Solar Panels on Roofs: Proposal

What if instead, or in addition to, we installed solar panels on the roofs of campus buildings here at ONU?

Google Project Sunroof can be used to

- count the annual hours of sunlight for each building
- estimate the size (in square feet) of the solar panels for each roof

1. Solar Panels on Roofs: Proposal



Figure : From Energy Sage

Differences from solar carports:

- ① Facing south at optimal fixed angle on roof (no 10% loss)
- ② Lower mounting and labor costs vs. carports
- ③ No possible aesthetic concerns

1. Solar Panels on Roofs: Calculation

Cost of solar panels

$$= (0.75)(22,408 \text{ solar panels})(\$310.00) = \$5,041,800$$

$$\text{Cost of mounting} = (22,408 \text{ panels})(\$100/\text{panel}) = \$2,240,800$$

Connect to grid (including inverters)

$$= (8,195,852 \text{ kWh/yr}) \left(\frac{\$2.5 \text{ million}}{15,000,000 \text{ kWh/yr}} \right) = \$1,365,975$$

$$\text{Cost of setting up mounting} = \frac{1}{3} \cdot \$1,365,975 = \$455,325$$

$$\text{Total cost} = \$9,103,900$$

1. Solar Panels on Roofs: Calculation

Break even analysis?

Solar roof array generates = 8,195,852kWh/yr.

We could save = \$819,585/yr (assuming that we pay \$0.10/kWh)

$$\text{Break even time} = \frac{\$9,103,900}{\$819,585} = 11.1 \text{ years.}$$

After break even point, we would be *saving* \$819,585/yr.

1. Solar Panels: Carport vs. Rooftop

	Carport	Rooftop	Combined
Upfront Cost	\$6,948,639	\$9,103,900	\$16,052,539
Break Even	13.7 yrs	11.1 yrs	≈ 12 yrs
Savings after B.E.	\$508,402/yr	\$819,585/yr	\$1,327,987/yr

1. Solar Panels: Carport vs. Rooftop

Wait. . . Inverters are warrantied for 12 yrs, with extendable warranties for 20 or 25 yrs. Replacement cost?

	Carport	Rooftop	Combined
Upfront Cost	\$6,948,639	\$9,103,900	\$16,052,539
Break Even	13.7 yrs	11.1 yrs	≈ 12 yrs
Savings after B.E.	\$397,958/yr	\$705,809/yr	\$1,103,767/yr

Sanity Check: Break even in El Paso will be between 7 and 9 years instead, because of 50% more sunlight per year.

Loss in efficiency from panels? 2% first year and 0.5% each subsequent year.

2. Lighting: Saving money in smaller ways

Signs aren't often as effective as we would like.



Figure : Signs for English and Modern Languages Made by Sara Curtis

2. Lighting: Proposal

What if we installed automatic motion sensor switches in the classrooms, conference rooms, etc.?

How much money could we save per year?

2. Lighting: Burke 001 Calculation

- Fall/Spring: Approx. 49 hrs/wk when building is open and no classes in the room.
- Summer: Approx 49 hrs/wk when building is open and no classes in the room.
- $45 \times$ Phillips T8 fluorescents that draw $32 \text{ W} = 0.032\text{kW}$ each.

We would use approximately:

$$(45 \text{ bulbs})(0.032 \text{ kW/bulb})(49 \text{ hrs/wk})\underbrace{(40 \text{ wks/sem})}_{15+15+10} = 2822.4 \text{ kWh/cal yr}$$

- Cost for Lighting
= $(\$0.10/\text{kWh})(2822.4 \text{ kWh/cal yr}) = \$282.24/\text{cal yr}$
- Cost of **auto on/off switch** \approx \$100
- Cost of 45 LED replacement bulbs = \$450

2. Lighting: Burke Basement Conf. Room Calculation

- Fall/Spring: Approx. 35 hrs/wk when lights are on and room is not being used.
- $18 \times$ Phillips T8 fluorescents that draw $32 \text{ W} = 0.032 \text{ kW}$ each.

We would use approximately:

$$(18 \text{ bulbs})(0.032 \text{ kW/bulb})(35 \text{ hrs/wk})\underbrace{(30 \text{ wks/sem})}_{15+15} = 604.8 \text{ kWh/ac yr.}$$

- Cost for Lighting
 $= (\$0.10/\text{kWh})(604.8 \text{ kWh/ac yr}) = \$72.58/\text{ac yr}$
- Cost of **auto on/off switch** $\approx \$100$
- Cost of 18 LED replacement bulbs $= \$180$

2. Lighting: My Burke Office Calculation

- Fall/Spring: Approx. 17 hrs/wk when I have class, meetings, etc.
- $9 \times$ Phillips T8 fluorescents that draw $32\text{ W} = 0.032\text{ kW}$ each.

We would use approximately:

$$(9 \text{ bulbs})(0.032 \text{ kW/bulb})(17 \text{ hrs/wk})(15 \text{ wks/sem})(2+4/15 \text{ sem/ FA, SS, US}) \\ = 165 \text{ kWh/ac yr.}$$

- Cost for Lighting
 $= (\$0.10/\text{kWh})(165 \text{ kWh/ac yr}) = \$19.83/\text{ac yr}$
- Cost of 9 LED replacement bulbs = \$90

2. Lighting: Proposal

- 1 Install automatic motion sensor switches, or timer switches in classrooms, conference rooms, etc. Break Even within approximately 1 year.
- 2 Take the savings from the switch over approximately 2 years and replace all fluorescents with LEDs that cuts lighting cost, when in use, by 45%.

2. Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Etc.



Figure : Williams Hall

2. Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Etc.



Figure : Wisner Hall

2. Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Etc.



Figure : TVs in Reed Hall on 24/7

2. Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Etc.

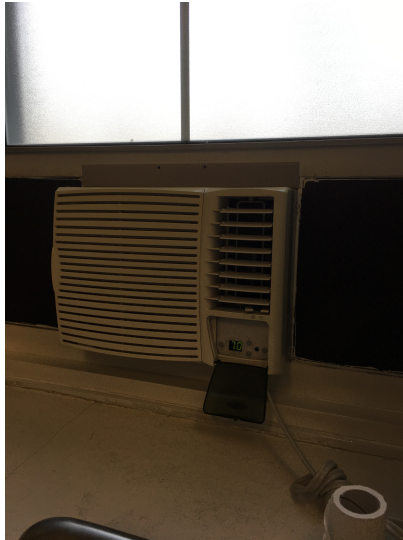


Figure : Air Conditioner Often on in Winter and Over Weekends/Breaks.



2. Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Etc.



Figure : TV in Burke on 24/7

2. Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Etc.



Figure : TV in Burke on 24/7

2. Lighting, Air Cond, Etc. Proposal

- 1 Install automatic motion sensor switches, or timer switches on all other Lighting, Air Conditioners, TVs, Lab Equipment, Exercise Equipment, Projectors etc.
- 2 For equipment that shouldn't be turned off and on this way, or if it isn't feasible, have Public Safety shut it down when closing building.

2. Office Computers

Proposal: Office Computers

- Screen: turn off after 5 minutes of inactivity.
- Computer: go to sleep after 30 minutes of inactivity.
- Cost: Less than 2 minutes of your time.
- Can we also do this for lab computers?

2. Office Computers: Screen/Computer Sleep

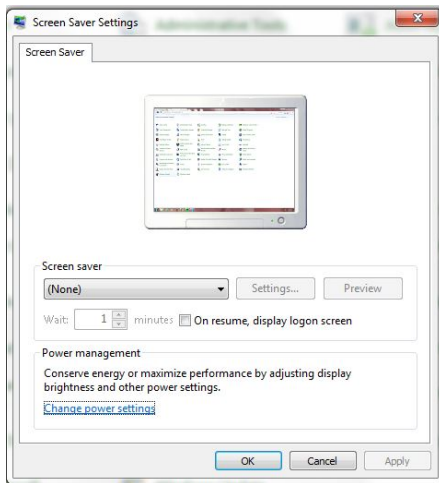


Figure : Type “Screen Saver” into Windows search and select “Turn Screen Saver Off/On” to bring this up. From here select “Change power settings”.

2. Office Computers: Screen/Computer Sleep

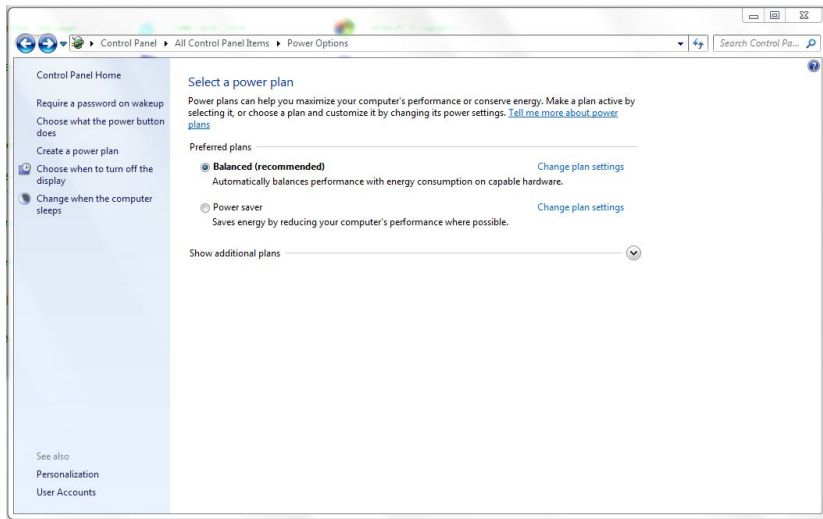


Figure : Select “Choose when to turn off the display” on the left side.

2. Office Computers: Screen/Computer Sleep

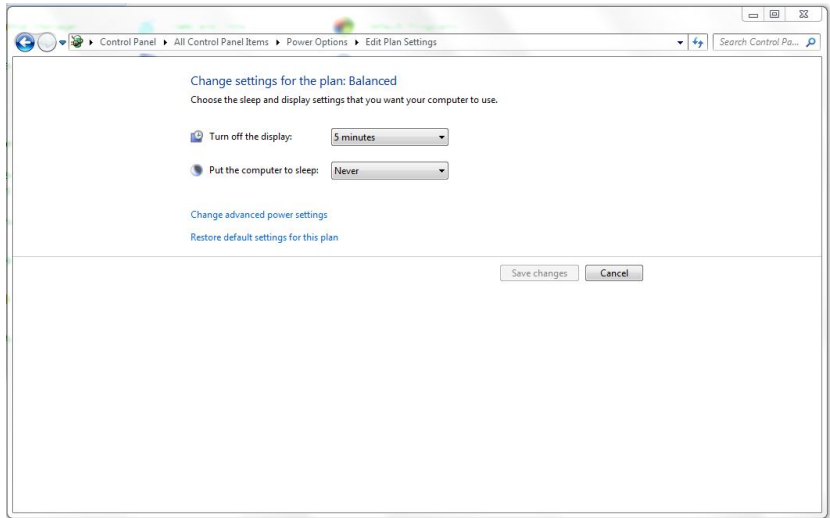


Figure : Change *display* to “5 minutes” and *computer* to “30 minutes”

3. Other Ideas?

“Christians are supposed not merely to endure change, nor even to profit by it, but to cause it.” – Harry Emerson Fosdick

3. Other Ideas? Recycling



Figure : Effectiveness of Signs (Spring 2015)

3. Other Ideas? Recycling



Figure : Effectiveness of Signs Above Recycle Bin (Spring 2018)

3. Other Ideas? Recycling Proposal

- Take some of the money we saved on cutting down in other wasteful areas to help improve our recycling.
- Recycle bins in every classroom, conference room, etc.
- Recycle bins on each floor.
- Better yet . . . next to each garbage can a clearly labeled recycle bin.

3. Other Ideas? Recycling Proposal



Figure : University of Tennessee

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“Christians are supposed not merely to endure change, nor even to profit by it, but to cause it.” – Harry Emerson Fosdick

- Think up your own ideas to *cause* changes, **big** or , with Creation Care.
- Critique and/or improve these ideas presented here.
- Help put them into action.