



iSEE Carbon Offset

Program

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PROJECT OVERVIEW

Institute for Sustainability, Energy, and Environment (iSEE) - “the Institute is purposed to find solutions for the ever-growing **demand for food, water, and energy** while ensuring a **safe, productive, and sustainable environment for all global citizens**”

Clients: Meredith Moore and Stacy Gloss



Illinois Climate Action Plan (iCAP) - the campus’s strategic sustainability plan for achieving **carbon neutrality, or net-zero greenhouse gas emissions**, by 2050 if not sooner

Objective 8.7 - Local Offsets Program: Establish a **local offsets program by FY24**

CARBON OFFSET TECHNOLOGY OVERVIEW

Tree Planting

Trees reduce atmospheric carbon dioxide by removing it from the air through photosynthesis

Geothermal

The heat radiating from the Earth's core used to cool/heat buildings

Solar

The use of energy from the sun that is converted into thermal or electrical energy.



Biodigester

Utilize organic waste, particularly animal and human, to produce fertilizer and biogas

Prairie Restoration

Conversion of cropland into conservation prairie as a carbon sink

Tree Planting On campus

Trees Benefits

18,171 Calculated Trees

Total Yearly Eco Benefits

\$1,521,993.66

Greenhouse Gas Benefits

\$46,804.64

3,114,574.36 lbs CO₂ avoided

3,400,603.95 lbs CO₂ sequestered

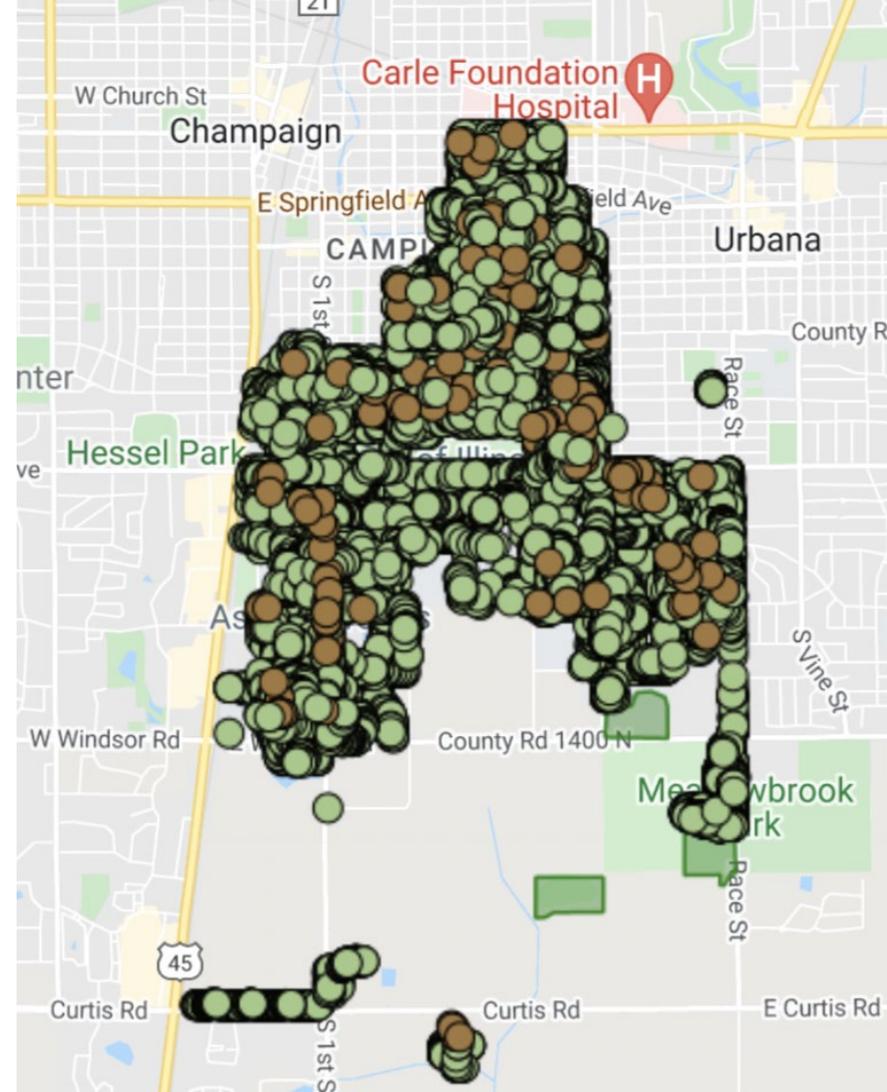
\$500 / tree

Potential Locations:

All over campus, currently looking at the open space at Kirby and Oak St.

Potential Partner:
University F&S

Contacts: Brent Lewis, Ryan Welch



Tree Planting in the CU Community

Champaign

\$200-250 / tree
700+ acres removed
31,399,079.89 lbs of CO₂

Potential Locations:
700+ acres of park ground available

Potential Partner:
Champaign Parks District

Contacts:
Champaign Parks District – Bret Johnson; Urbana Parks District – Derek Liebert



Urbana

\$300/ tree
14,741 trees sequestered
4,184,194.37 lbs of CO₂

Potential Locations:
Vacancies created by recent tree losses or when space is available without impacting sites reserved for athletic activities

Potential Partner:
Urbana Parks District

Prairie Restoration on Campus

\$400/
ton of
CO₂

An acre of prairieland has the potential of offsetting **5 metric tons of CO₂**, and costs roughly **\$2,000** to restore

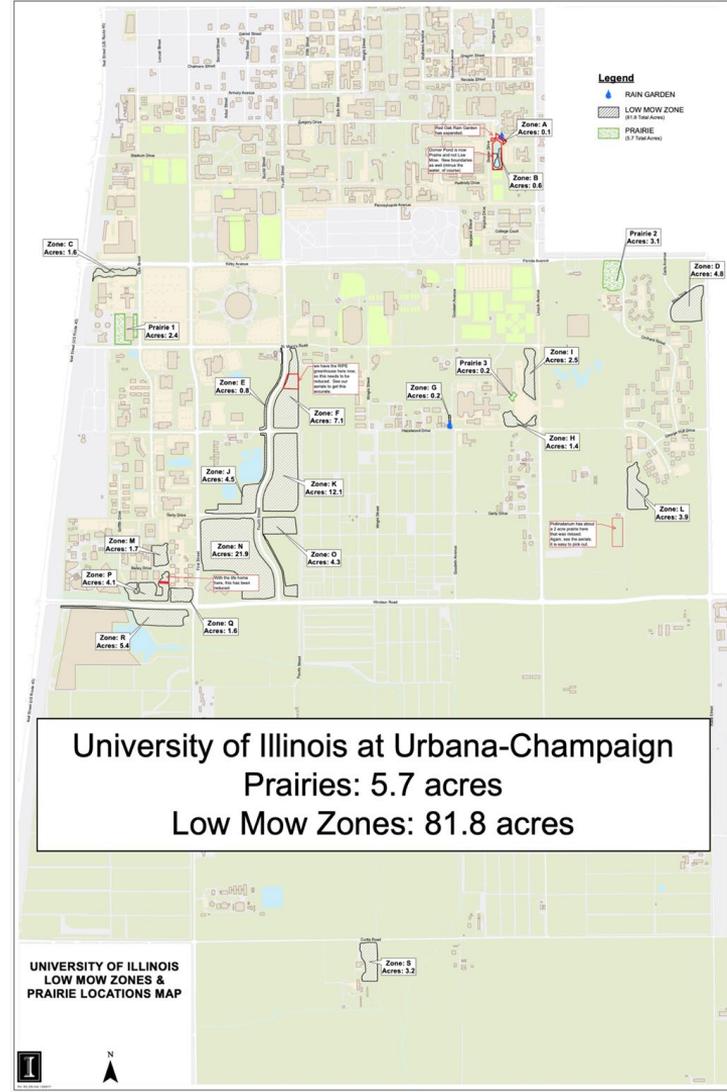
5.7
acres

Current prairieland is maintained by F&S and student groups which rely on **volunteers & grant funding**

81.8
acres

Campus currently maintains **low mow zones** which are prime for prairieland conversion

Contact: Brent Lewis, Capitol Programs, University Landscape Architect



Prairie Restoration in Champaign

565.2
acres

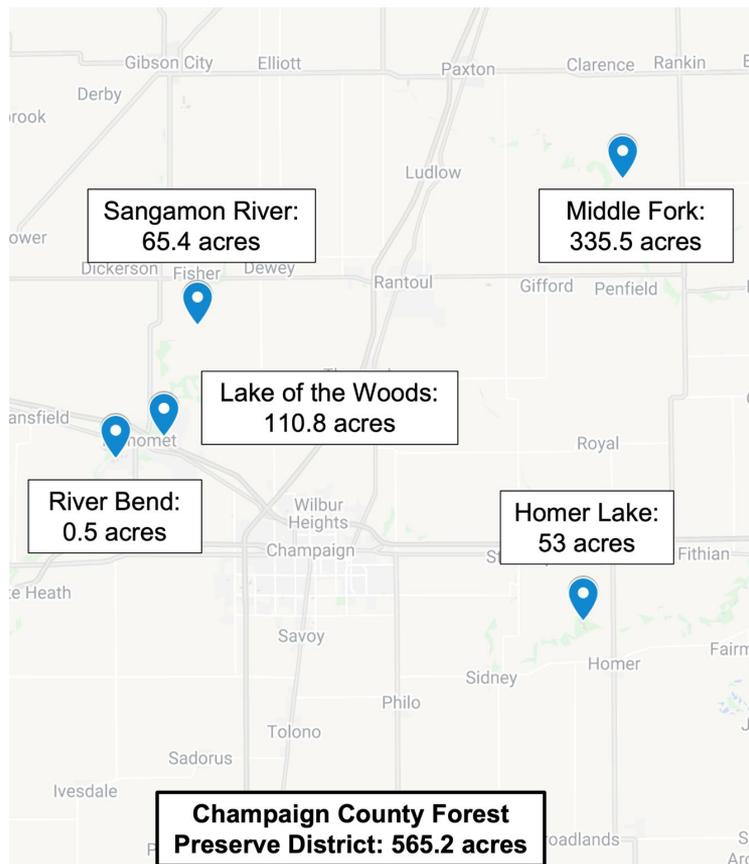
The CCFPD has completed numerous restoration projects across forest preserves

55
acres

The CPD maintains tallgrass lands which require **increased biodiversity and native species presence** to be considered prairieland

Contacts: Peter Godspeed, Director of Natural Resources,
Champaign County Forest Preserve District

Michael Davis, Natural Areas Specialist, Champaign
Parks District



Biodigester on Campus

Potential to use the biodigester to supply **electricity** and **heat** to University facilities

Potential Location:
University of Illinois
Dairy Farm (Moore,
Meredith)



Cost:
\$10,000,000 upfront +
\$25,000/year
maintenance (Duffy,
2017)

Partnerships:
Resource: Sarthak
Presad
Implementation:
SYSTEMA.bio

Solar Energy on Campus

- \$ 3/ 1 watt of solar power
- Solar farm 2.0 produces 20,000 MWH/ year
- Solar panels offset 2,204,634 lbs of Co2

Potential campus locations: South Farms

Potential campus Partners: Ameren, MISO, Customer first renewables and other solar developers, Illinoisolar.org (where other partners would come firm), ESE (Electrical and Computer engineering department), Urbana city (Scott)

The array is located on 54 acres immediately north of Curtis Road between First Street and the railroad tracks.



Contacts: Morgan White (f&s), New Prairie Solar Urbana, Midwest renewable Energy

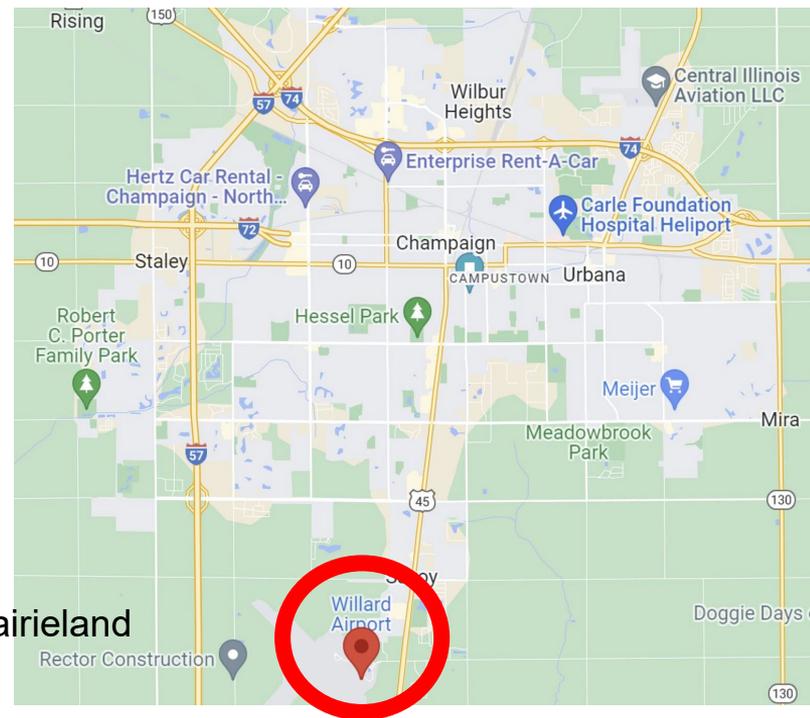
Solar Energy in Champaign-Urbana

- **Willard airport: the amount of potential solar power available for generation has not yet been determined**
- **Cost of solar panels in urbana: \$3 / 1 watt**

Potential campus locations: Willard airport

Potential outside partners:

Ameren, MISO, Customer first renewables and other solar developers, Illinois solar.org, ECE (Electrical and Computer Engineering Department), Urbana city (Scott), F&S, iSEE, Prairieland Energy Inc.



Contacts: Morgan White (F&S), Peter Murphy, Scott Tess



Solar Energy- Project Sunroof

Looking at solar panel installation in the community

Urbana

ESTIMATED SOLAR INSTALLATION POTENTIAL



Overall

Total estimated size and solar electricity production of viable roofs for Urbana, IL

Roofs **66%**
Roofs **6.2K**

Roof space **14.1M**
sq ft
Capacity **199**
MW DC
Electricity **236K**
MWh AC per yr



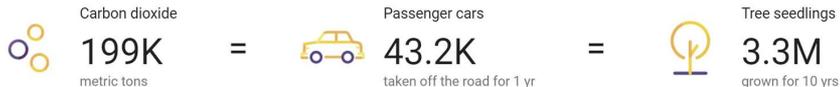
Per roof

Median estimated system size and solar electricity production per viable roof for Urbana, IL

Roof space **810**
sq ft
Capacity **11.5**
kW DC
Electricity **13.3K**
kWh AC per yr

POTENTIAL IMPACT

If all the viable solar installations were implemented, the amount of avoided CO₂ emissions from the electricity sector in Urbana would be:



Champaign

ESTIMATED SOLAR INSTALLATION POTENTIAL



Overall

Total estimated size and solar electricity production of viable roofs for Champaign, IL

Roofs **71%**
Roofs **13.8K**

Roof space **29.4M**
sq ft
Capacity **418**
MW DC
Electricity **498K**
MWh AC per yr



Per roof

Median estimated system size and solar electricity production per viable roof for Champaign, IL

Roof space **740**
sq ft
Capacity **10.5**
kW DC
Electricity **12.3K**
kWh AC per yr

POTENTIAL IMPACT

If all the viable solar installations were implemented, the amount of avoided CO₂ emissions from the electricity sector in Champaign would be:



Geothermal in Champaign Option 1

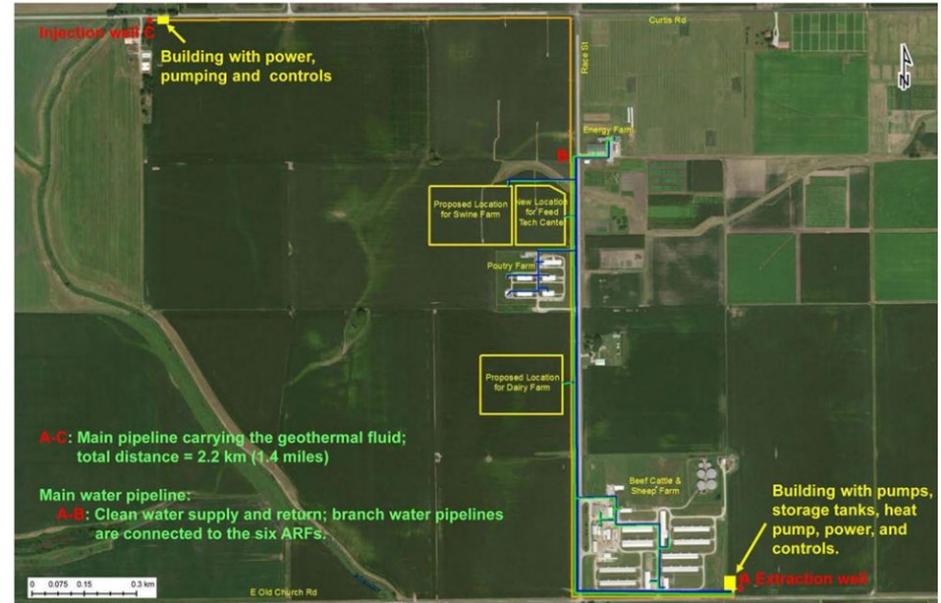
- 3rd-Party Ownership:
 - More affordable bulk purchasing program
- Home site assessment and cost estimations:
 - \$30,000-40,000 per building
- Vertical Loop Geothermal system
- Offsets 66% of CO₂ Emissions per home installment (Vance, 2019)
- Payback period of 15-20 years



(Tess, 2022)

Geothermal on Campus

- Drill 5,745 ft to Mt. Simon Sandstone
 - 111°–115°F
 - Location: Race Street and Curtis Road
 - Potential to implement all buildings
- Capital costs: \$27.5 million
- Annual operating costs: \$272,868
- Lasts: 50-100 years
- NPV: -\$18,914,538
- Partners: Illinois Geothermal Coalition, Illinois State Geological Survey, Prairie Research Institute
- Contact: Andrew Stumpf, Ryan Dougherty
- Funding: USDOE& SSC



(Vance, 2018)

Geothermal on Campus

Carbon Emissions (MTCO ₂ /yr)	
UIUC FY08	575,088.1 (iCAP, 2020)
Air Conditioning, heating, and water heating emissions	345,052.86
Geothermal Offset Potential	227,734.89
Average Sequestration per building	349.82
Remainder needed for NetZero	347,353.21

- Need to implement in **86 buildings** to offset icap goal of 30,000 MTCO₂/yr

Extraction Well

The final well diagram for the extraction well is shown below in Figure C1.1.

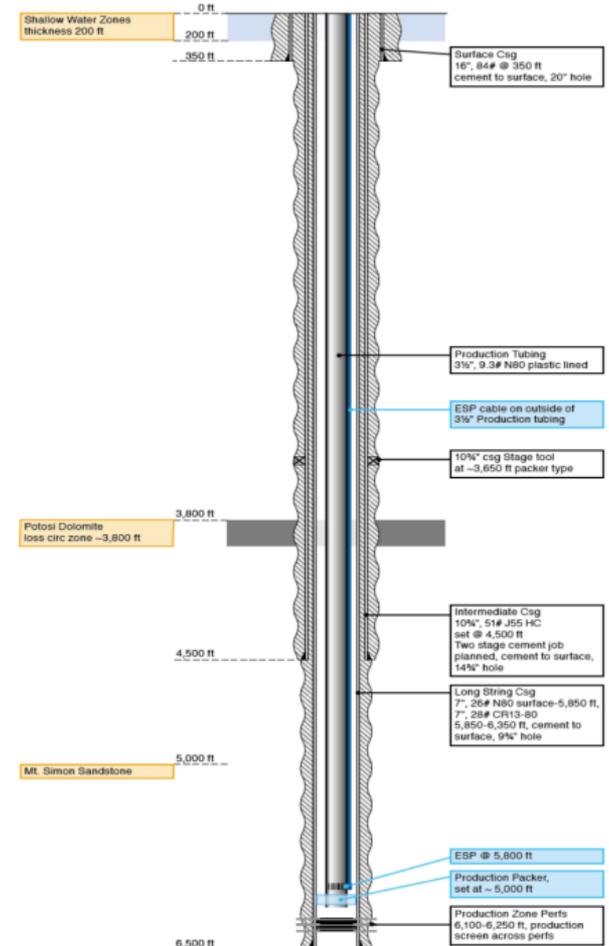


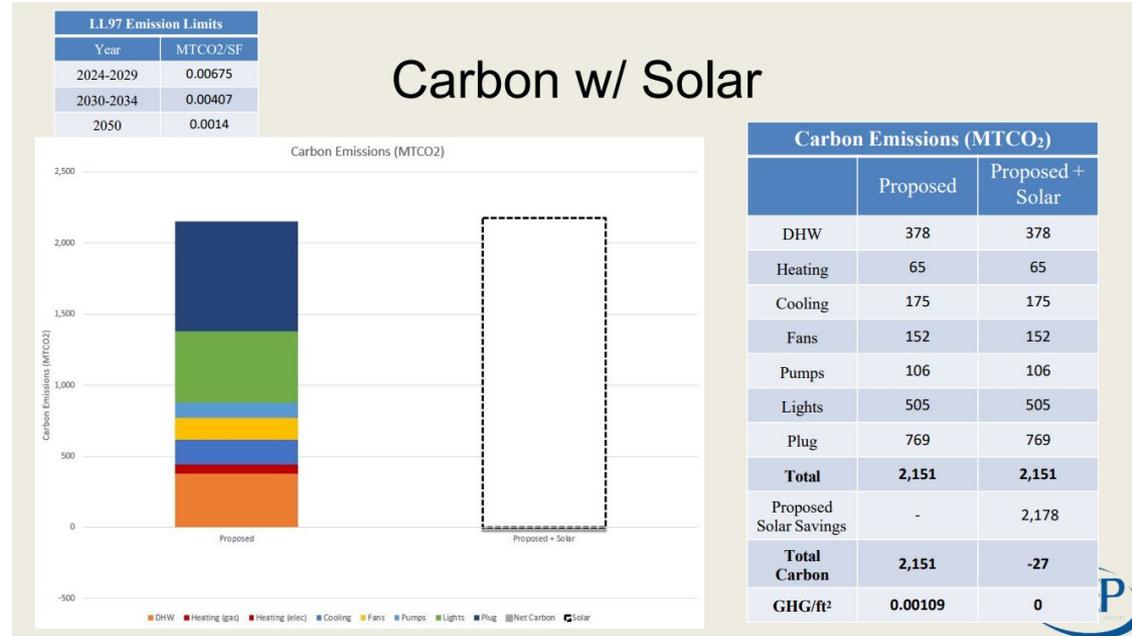
Figure C1.1. Extraction Well Diagram Extraction Well Details

(Vance, 2018)



Net zero W/ Geothermal and Solar (Champaign)

- Solar can generate electricity for heat pumps
 - Eliminates fossil fuel usage
- Expensive solution but can reach net zero
 - Study conducted in EAU Claire, Wisconsin
- Does not include electricity emissions from lights and other appliances



(Urlaub, 2021)



IMPLEMENTATION TIMELINE & RECOMMENDATIONS



Tree Planting

Tree planting is being invested in **now** and requires continuous **maintenance and care**

Prairie restoration is something we can invest in **now** and requires continuous **maintenance and care**

Prairie Restoration

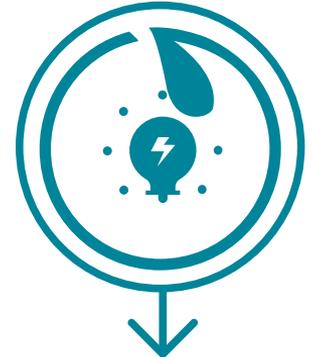


Solar

Solar panel installations could take a **few weeks** depending on the area being covered
Expected: 2023

Geothermal is feasible on campus with **implementation time of 1- 2 years**
Expected: 2025-2030

Geothermal



Biodigester

Biodigesters are a technology that are still developing, and therefore are the **future** (~2050) of carbon offset technologies



Thank you!

Questions?



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