



# Solar Development: The Engineering Perspective

January, 2022

# Agenda

- The role of the engineering consultant
- Solar in Minnesota
- Project steps
- Siting and feasibility
- Preliminary civil design
- Potential engineering issues



# The role of the engineering consultant

- Determine the technical aspects of the project
  - Geotechnical
  - Structural
  - Electrical (layout, collection, substation, interconnection)
  - **Civil**
    - **Hydrology**
    - **Grading**
    - **Access**
    - **Erosion control**

# The role of the developer

- Bring the project from an idea to a reality
  - Land control
  - Agreements
  - Permit applications
  - Secure financing
  - Equipment procurement
  - Manage engineering needs
  - Find an Engineering, Procurement and Construction contractor
  - Operate the project

# Who do you call first?



The developer has a better understanding of:

- General process
- Permit applications
- Costs
- Agreements

The engineering consultant has a better understanding of:

- Technical aspects
- Consultants typically (not always) assist the developer

# Solar in Minnesota

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Does solar work in Minnesota?

**YES**

**\$**



# Understanding geographical differences:

- Solar Irradiance
  - The amount of solar energy accumulated on an area over time, and it is the principal measurement needed for sizing and estimating the performance of solar systems.
- Solar Irradiance in Minnesota
  - Annual = 5.20 kWh/m<sup>2</sup>/day
    - December = 1.95 kWh/m<sup>2</sup>/day
    - July = 8.46 kWh/m<sup>2</sup>/day

# Understanding geographical differences:

- For Minneapolis, MN
- 1 MW Site
- **1,502,742 kWh**

Month	Solar Radiation ( kWh / m <sup>2</sup> / day )	AC Energy ( kWh )
January	2.54	68,782
February	3.64	90,455
March	5.37	142,640
April	6.53	155,433
May	7.15	170,939
June	7.66	174,405
July	8.46	191,067
August	7.23	168,372
September	5.71	132,497
October	3.64	91,782
November	2.54	64,627
December	1.95	51,743
Annual	5.20	1,502,742

# Understanding geographical differences:

- For Phoenix, AZ
- 1 MW Site
- **2,021,498 kWh**
- **34.5% higher**

Month	Solar Radiation ( kWh / m <sup>2</sup> / day )	AC Energy ( kWh )
January	4.70	112,369
February	5.84	126,289
March	7.69	178,863
April	9.46	210,532
May	10.59	229,650
June	10.99	226,569
July	9.55	204,758
August	8.98	192,951
September	8.17	171,353
October	6.81	152,853
November	4.97	113,691
December	4.17	101,620
Annual	7.66	2,021,498

# Project Steps

## EVALUATION

- **Siting/feasibility**
- Conceptual design
- Environmental critical issues analysis
- Interconnection evaluation

## SITE SELECTION

- Phase I/II environmental permitting
- Geotechnical investigation
- **Preliminary civil design**
- **Hydrology studies**

## DEVELOPMENT

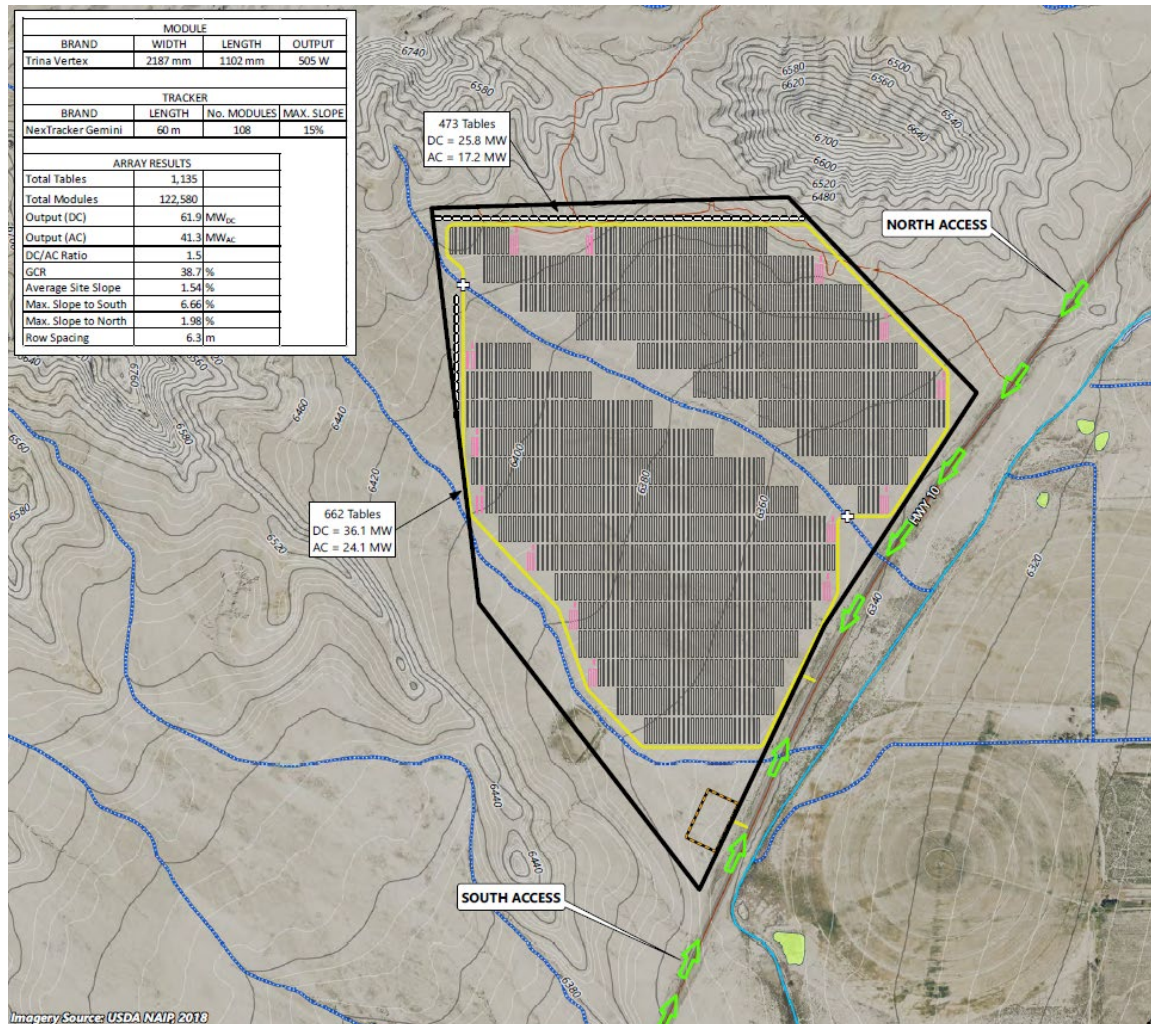
- Civil design
- Electrical design and interconnection
- Structural evaluation
- Pollinator/landscape design

## CONSTRUCTION

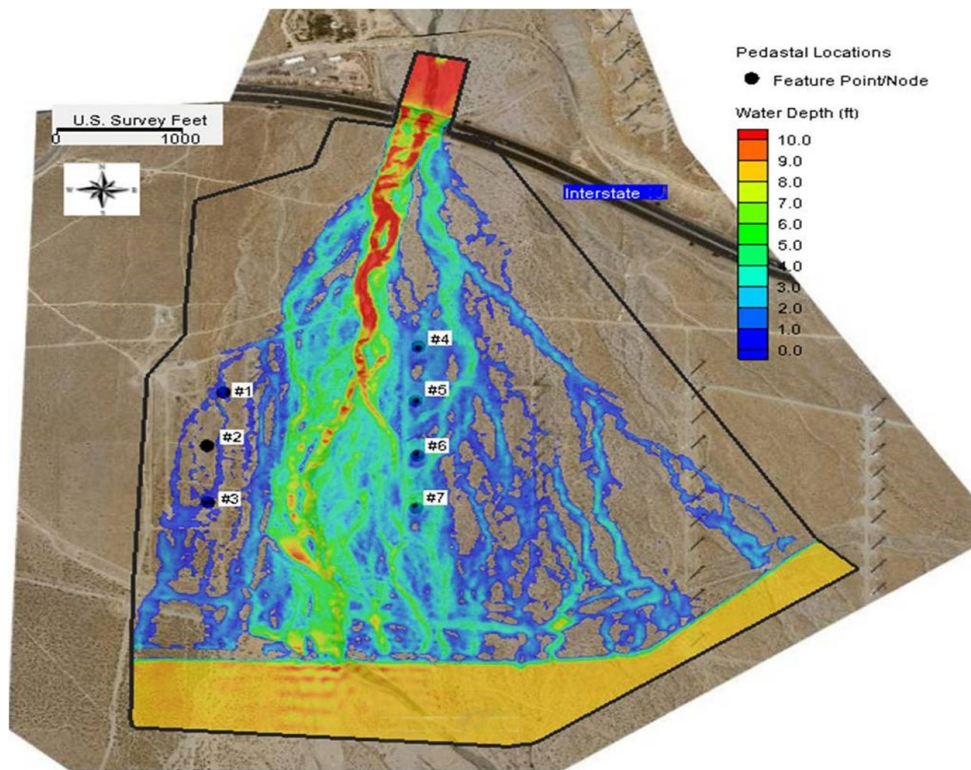
- Construction oversight
- Storm Water Pollution Prevention Plan (SWPPP)
- Spill Prevention Control and Countermeasure (SPCC)

# Siting and feasibility

- Due diligence reviews
- Conceptual civil design
- Capacity analysis
- Site reconnaissance
- Fatal flaws
- Risk assessment
- Next steps and recommendations



# Preliminary Civil design



- Hydraulic and hydrologic modeling
- Preliminary grading
- Access design
- Existing road / bridge evaluations

# Potential engineering issues

- Lean geotechnical investigation
  - Leads to foundation issues
- Lack of hydrology analysis
  - Placing panels in the wrong areas can be costly
- Bad SWPPP design/implementation
  - Projects can be shut-down if not done correctly
- Lack of coordination between disciplines
  - Civil and Electrical require close collaboration

# QUESTIONS?

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# **Going Solar: St. Cloud's Solar Story**

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**Tracy Hodel  
Public Services Director**

**January 26, 2022  
CEAM Annual Meeting**

# AGENDA



City's Energy Story

St. Cloud Solar Portfolio

On-Site Solar Installations

Financials – Case Study

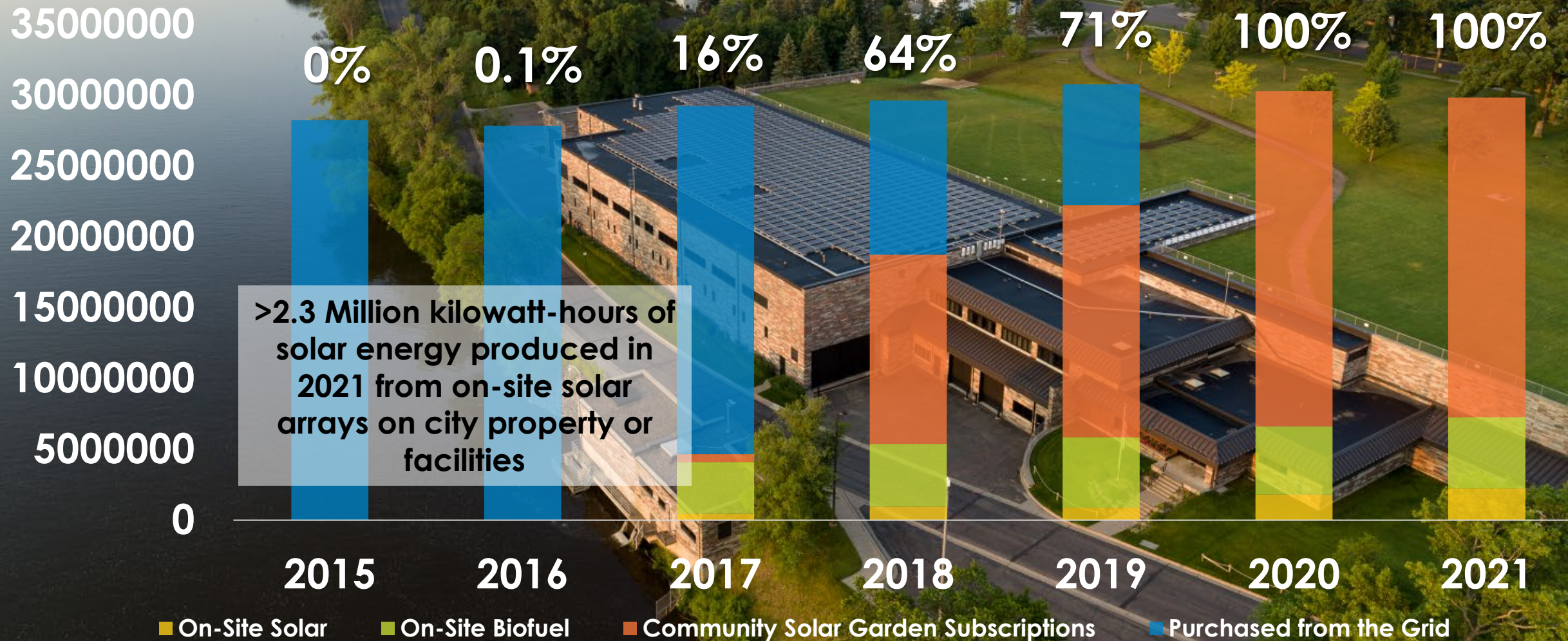
Lessons Learned

# Citywide Energy Story



**>100%  
RENEWABLE**

# Citywide Total Demand & % of Electrical Energy from Renewable Sources



**Community Solar Gardens**

**3<sup>rd</sup> Party Owned Arrays - PPA**

**City Owned Arrays - PPA**

Fire Station No. 2



Nutrient, Energy & Water  
Recovery Facility  
Rooftop



Whitney Senior Center



Whitney Rec Center



Water Rooftop



Nutrient, Energy &  
Water Recovery Facility  
Ground mount



Police Headquarters

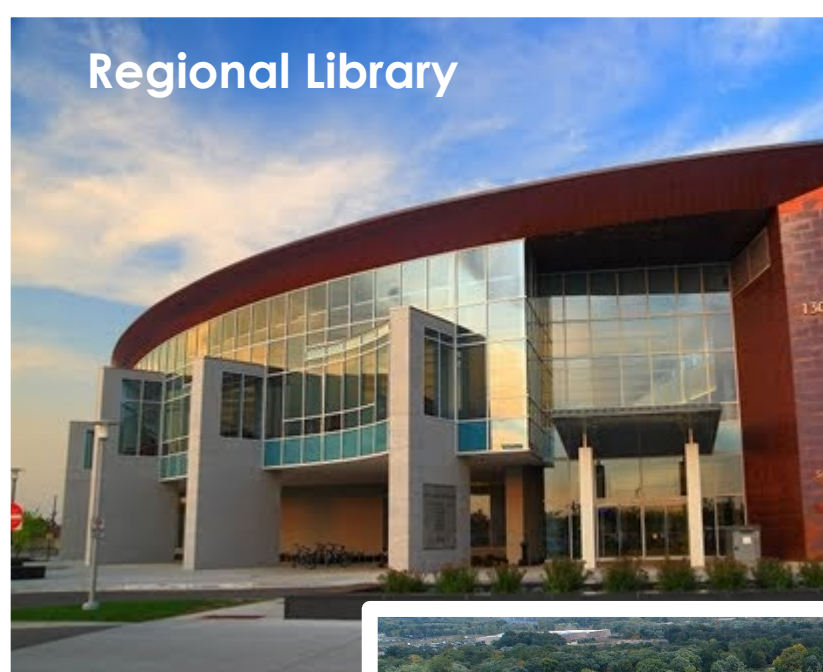


Central Services Building





Fire Station No. 5



Regional Library



Central Services -  
Groundmount



Nutrient, Energy & Water Recovery Facility



Nutrient, Energy & Water Recovery Facility



St Cloud Area Aquatics Center

# Onsite Solar Timeline

**RFP**

**Reviews &  
Interviews**

**City Council  
Meetings**

**Engineering  
Review**

**PPA & Utility  
Interconnection  
Agreements**

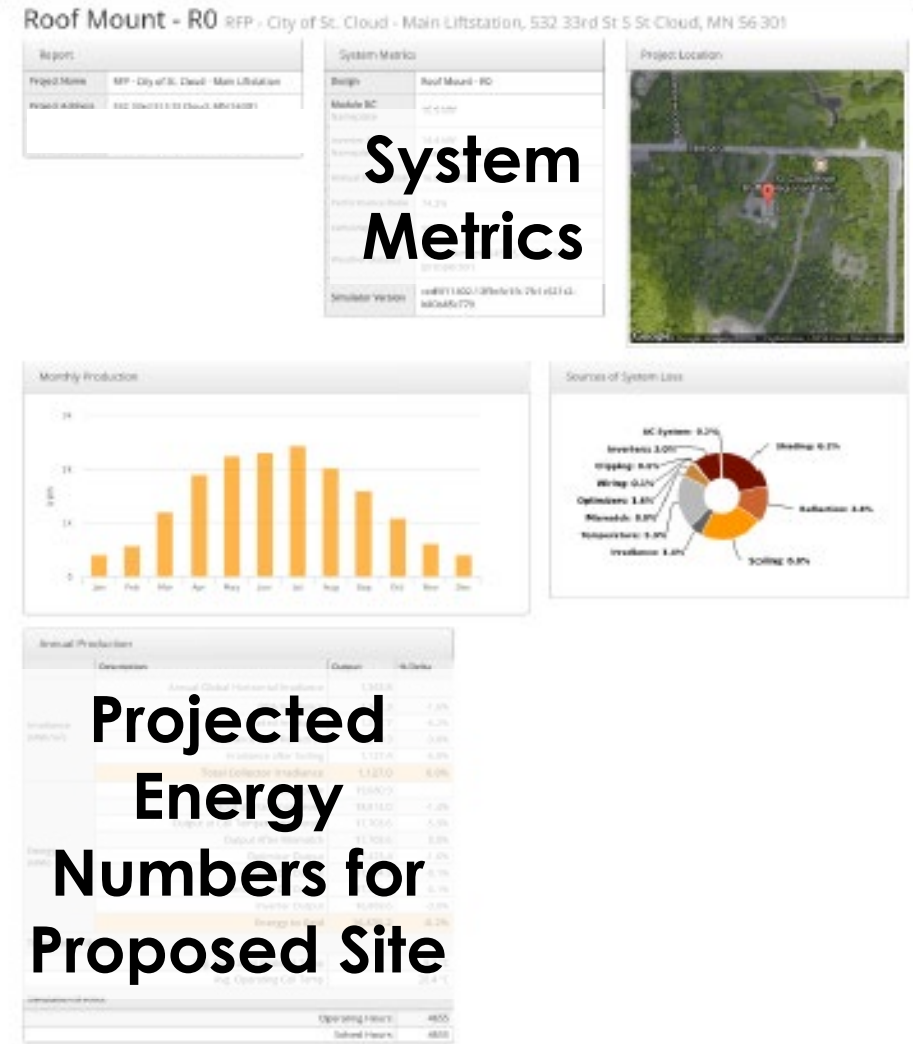
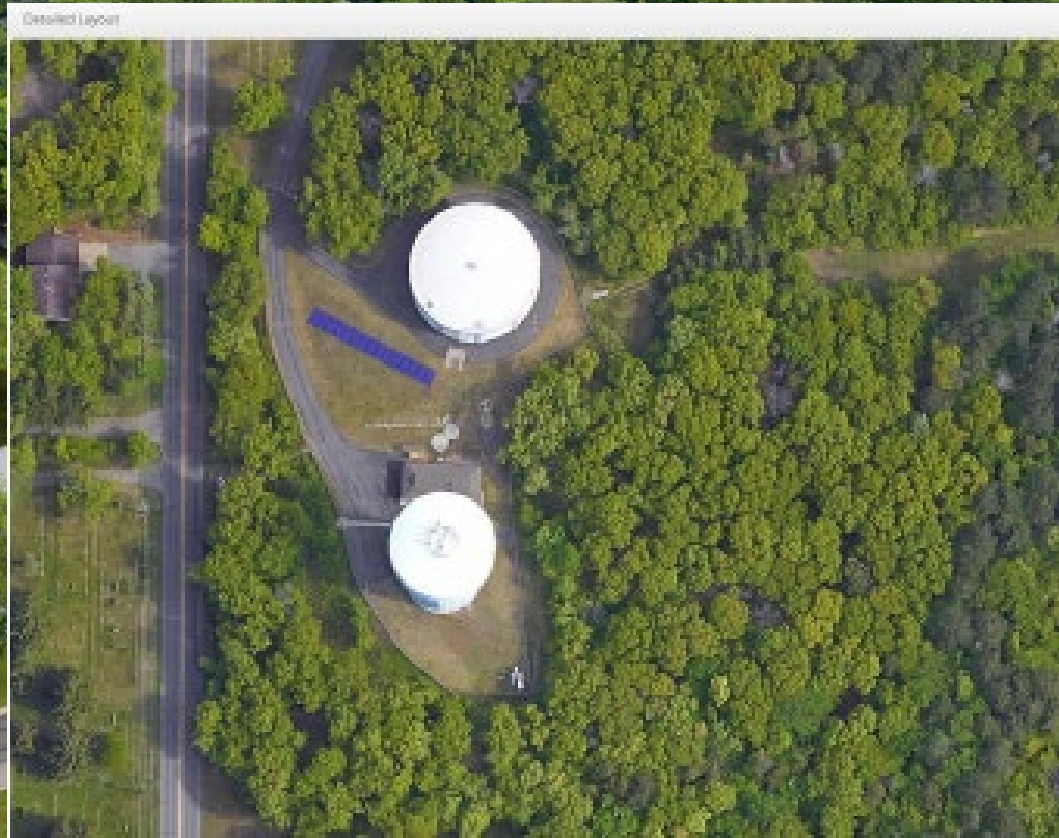
**ONGOING CONVERSATIONS  
& TRANSPARENCY**

**Electrical  
Review**

**Equipment  
Ordering**

**Commissioning**

**Energy  
Management**



# Construction Phase



# Commissioning Phase

Developer

Installer

Investor

Facility  
Manager/Maintenance  
Staff

Utility – Meters & Testing

# Operating Phase



Tracking Production

Monitoring Outages

Consistently Reviewing Financials

Considering System Purchase

## CREDITS

- Made in Minnesota
- PV Credit Rider
- Solar Rewards

## SHORT & LONG-TERM BENEFITS

- Short-term - Onsite solar has overall initial savings due to credits
- Long-term – Ability to purchase at year 6-7; can reduce overall cost of kWh of  $< \$0.03/\text{kWh}$
- Revenue generation opportunity

# Overview of Financials

220 kW @ NEW Recovery Facility

PPA (25 years)

$\$0.13\text{kWh} \times 7,950,000\text{kWh} = \$1,033,500$

City Purchase at Year 7 (2023)

$\$0.13\text{kWh} \times 1,908,000\text{kWh} = \$248,000$

Fair Market Value Purchase = \$390,000

(conservative 65% of construction costs)

$\$248,000 + \$390,000 = \$638,000$

**25-year savings = \$395,500**

\* Flat vs. escalated rate impact

$\$1,033,500 / 7,950,000\text{kWh} =$   
**\$0.13/kWh**

$\$638,000 / 7,950,000\text{kWh} =$   
**\$0.08/kWh**

w/PV credit rider  
 $\$399,000 / 7,950,000\text{kWh} =$   
**\$0.05/kWh**

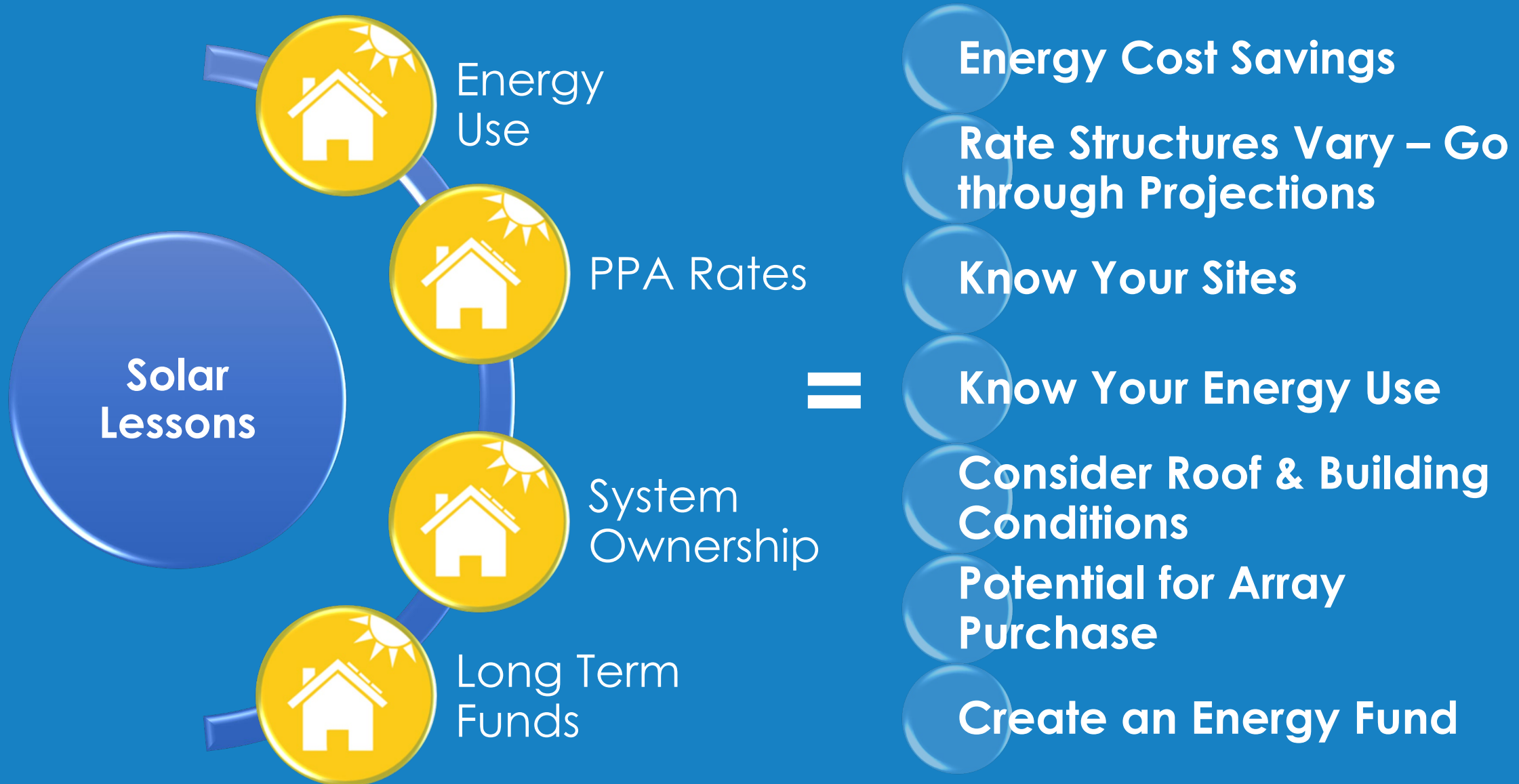
**Xcel seeks 20% electric rate increase over three years**

**Kirsti Marohn**

Brainerd, Minn.

October 26, 2021 4:18 PM

# Lessons Learned: Innovation is a Win-Win





# QUESTIONS & THANK YOU




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**ST.CLOUD**  **GREATER**

**> INNOVATION > IMPROVEMENT > EXCELLENCE**

# Road To A Successful Solar Project

January 26, 2022



# About Cedar Creek Energy



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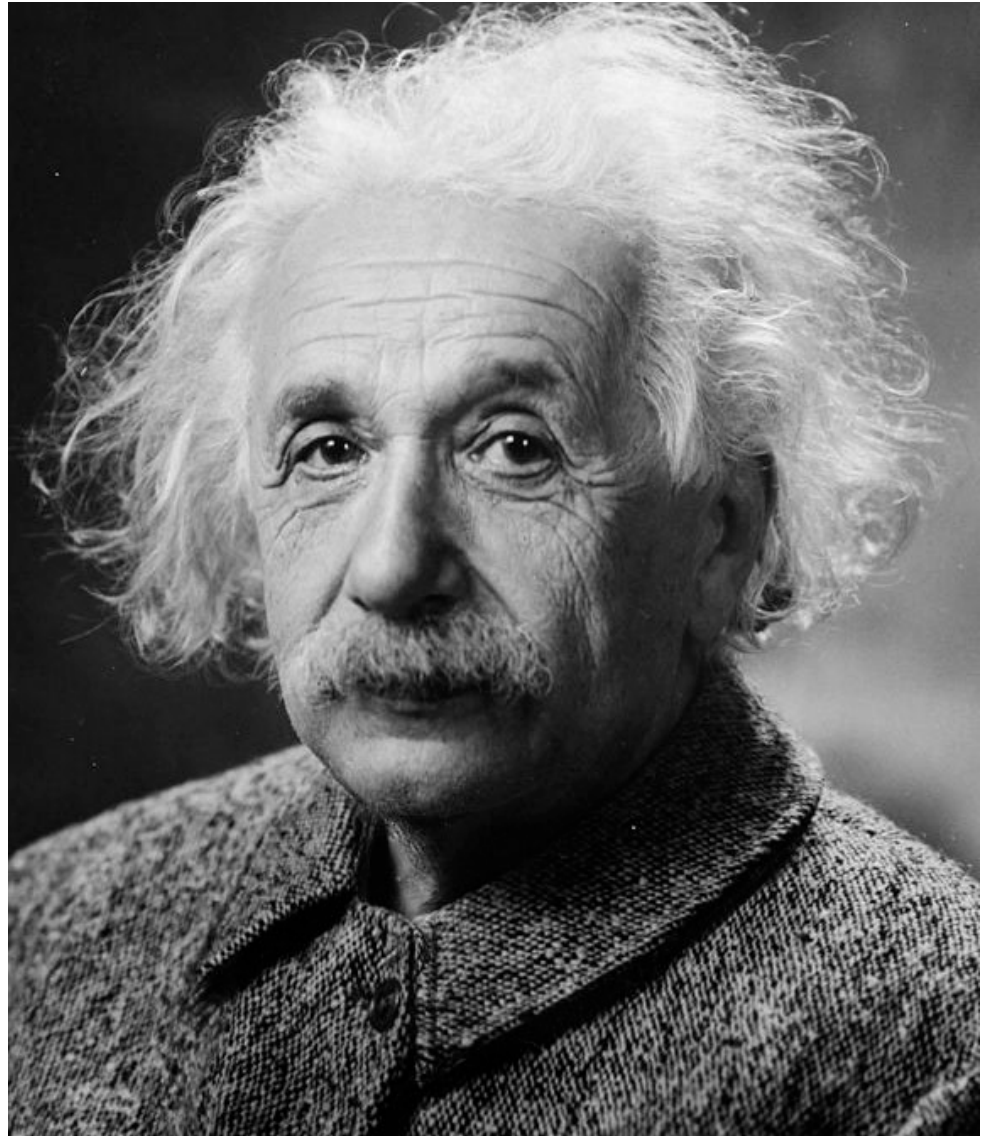
**[Rick@CedarCreekEnergy.com](mailto:Rick@CedarCreekEnergy.com)**

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## Solar Trivia Fact

Albert Einstein  
received Nobel  
prize in Physics for  
his discovery of the  
law of photoelectric  
effect, not  **$E = mc^2$**



# Brooklyn Park Solar Panel Installation



- Largest solar project completed in MN to date (2019)
- Over 2 megawatts installed by the city
- City expected to save \$60,000 after one year
- City will break even over approximately 7 years



# Becker Wastewater Plant



700 kW  
single axis  
tracker system



# City of Eden Prairie

Over a  
megawatt



# Four Keys To A Successful Solar Project



1. Utility company
2. Goal for the project
3. Load profile facility
4. Available roof space or ground space



# Utility Company Providing Power To You Will Be Most Important Factor

- In Minnesota, we have over 230 utility companies
- The rules set by your utility company are going to directly effect the proper design



# Utility Company Providing Power To You Will Be Most Important Factor



- **Xcel Energy**
  - Allows you to install a mega watt and use a virtual bank of the power not consumed live
- **Other utility companies**
  - Net metering law in Minnesota is 40 kW
  - Utility company will purchase all of the power at a whole sale price
  - City would then buy it back at a retail price
- **If you are a city and have your own utility company**
  - The agreement you have with your source of power may be one of the major factors the size of project you install



# Typical Goals For The Project

- Save money by installing solar
- Building a new facility and would like to incorporate solar
- Offset 100% of your consumption with renewable energy





# Goals Intersect With Reality

- Financial standpoint
  - Installing larger system will be most cost effective
- Offsetting facilities with the largest loads:
  - Waste water treatment plant
  - Ice arena
  - Community center
- The correct design solution depends on:
  - Utility company
  - How you use your power
  - Space available



# Goals Intersect With Reality

- How much are you willing to spend today on a solar project?
- Strongly look at an investor initially owning and maintaining the solar via a Purchase Power Agreement (PPA)
- For cities that have their own utility company, building 5 to 10 megawatt systems will drive the cost down



# Why Start A Project In 2022



- Big projects take time
- Federal Tax Credit Scheduled to go down from 26% to 22%
  - For a million dollar project, the tax credit will drop from \$260,000 in 2022 to \$220,000 in 2023
- Inflation
- Knowing what your utility costs will be for the next 25 years
- Avoid RFP's
- Ask questions about how they came to the design solution?
- What are financing options?



# Questions?



[www.cedarcreekenergy.com](http://www.cedarcreekenergy.com)

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