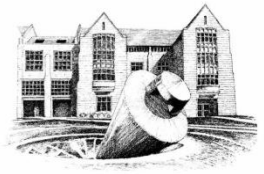
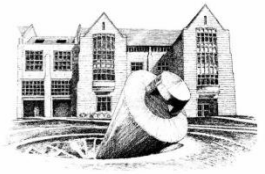


The University of St. Thomas Renewable Energy Facility (USTREF)

HIGHER EDUCATION BLOCK GRANT CONTRACT
WITH THE MINNESOTA STATE COLLEGES AND UNIVERSITIES
RENEWABLE DEVELOPMENT FUND – CYCLE 4
GRANT CONTRACT WITH UNIVERSITY OF ST. THOMAS HE4-2

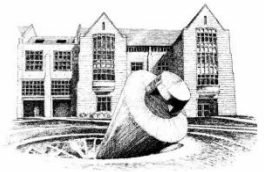
PI: Dr. Greg Mowry

17 Feb 2017



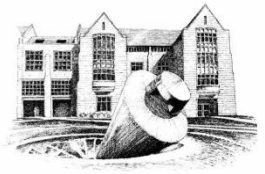
Grateful Acknowledgements

Project funding provided by customers of Xcel Energy through a grant from the Renewable Development Fund.

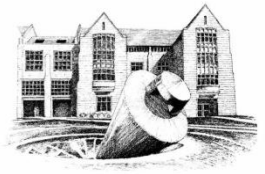


Outline

- Intro and Program Review
- Accomplishments
- Program Benefits
- Budgets and Schedule
- Questions??



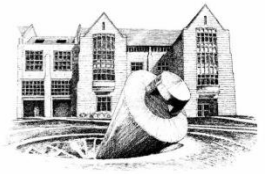
Intro and Program Review



Executive HE4-2 Summary (1)

- Install a multi-purpose microgrid which is now referred to as the, “USTREF”

- The primary objective of this facility will be to promote industry/academic collaboration in the design/build/test and validation of near commercial concepts in the areas of electricity generation and microgrid/subsystem control.



Executive HE4-2 Summary (2)

- Incorporate real scale distributed energy resource and microgrid modeling experience into graduate and undergraduate electrical engineering curriculum;

- Develop an educational portal and curriculum for the K-12 grades showcasing sustainability and alternative energy systems in action.

Solar PV Array
50 kW

Genset (2)
Biofuel
50 kW

Storage Node
25 – 50 kW

Wind Turbine Emulator
25 – 50 kW

3rd Party Test Bays
~ 50 kW; 2 of them

Device Under Test

. . .

Smart Inverter + Switch

Switch

Smart Inverter + Switch

Smart Interface + Switch

Controller + Switch

EMS

480 V 3-Phase 4-Wire Bus

Switch

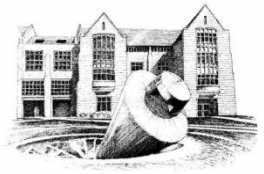
Custom Loads for control studies:
- Dump loads
- IMs
- Arcs, …

XF

Switch

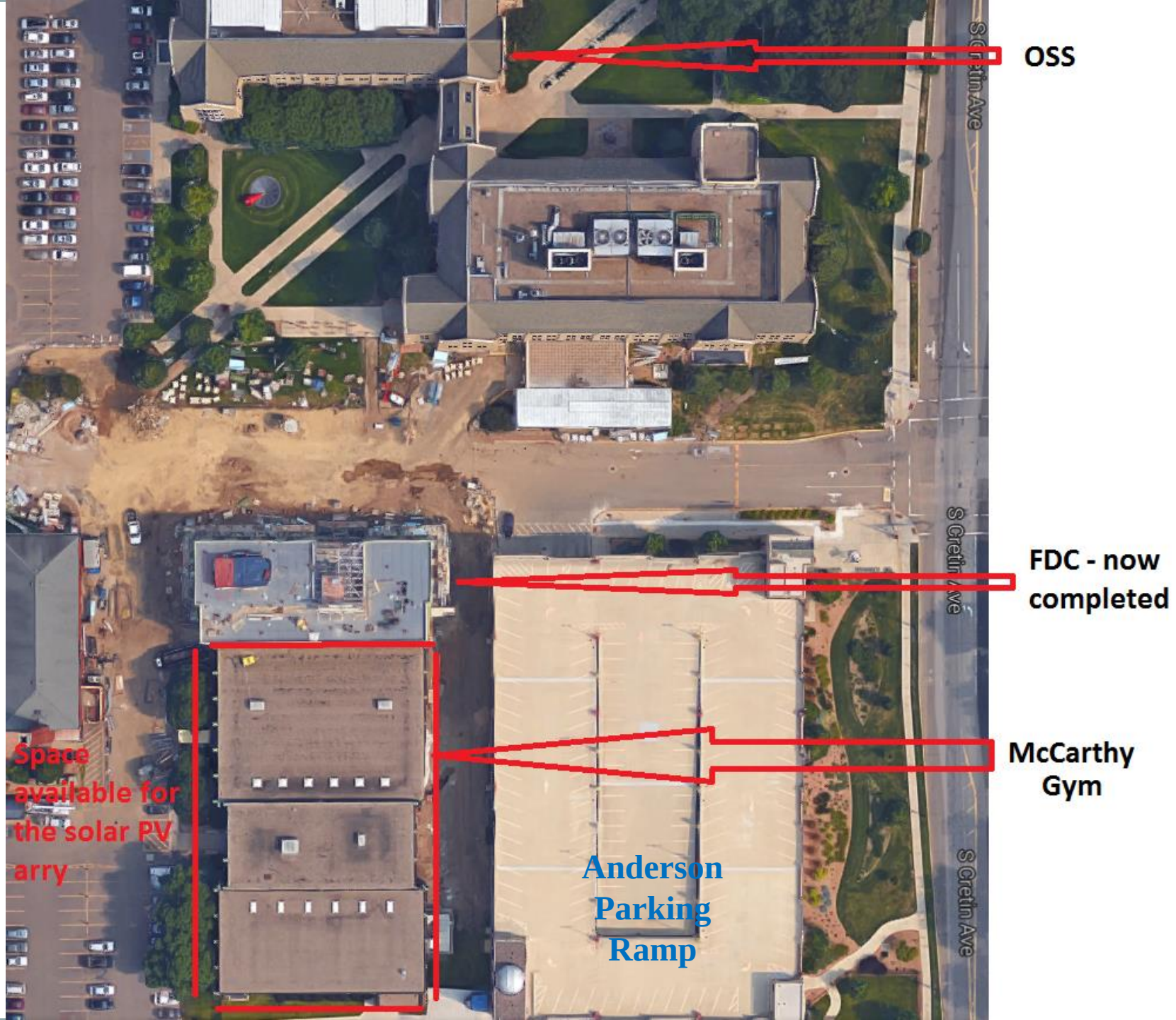
13.8 kV Xcel Energy Campus Feeder

UST Facilities and Design Center



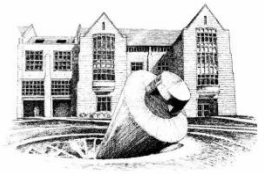
Accomplishments


UST
North
Campus
Summit Avenue
UST
South
Campus
© 2016 Google
Google Earth
1991
Imagery Date: 3/11/2016 44°56'24.89" N 93°12'04.66" W elev 732 ft eye alt 5043 ft


OSS
FDC - now completed
McCarthy Gym
Space available for the solar PV arry
Anderson Parking Ramp
S Cretin Ave

Google Earth view of the UST µGrid location

FDC – the Facilities and Design Center

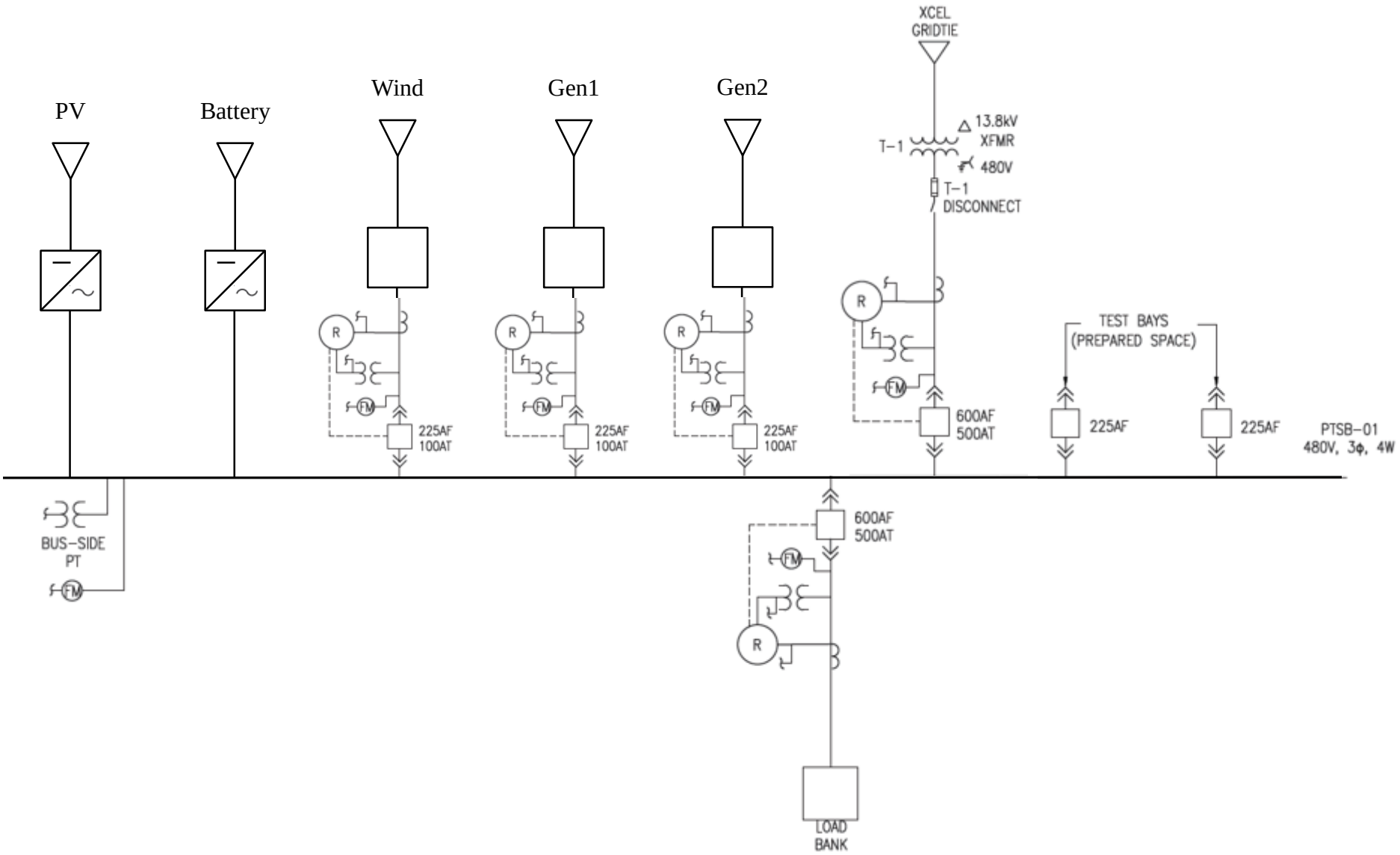


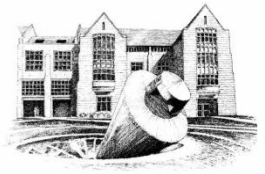
Accomplishments (1)

- Full funding release has occurred

- Nearing the finalization of the one-line diagram that will be used to drive all RFQs, procurements, and asset deployments

Near Final One-Line Diagram of the research Microgrid

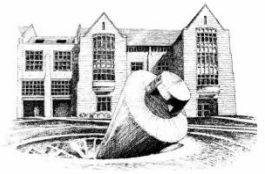




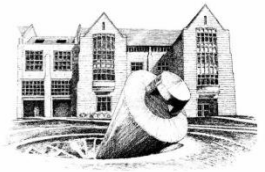
Accomplishments (2)

- Several key vendor/partners:
  - Xcel Energy: grid tie and smart-substation interactions
  - Rhombus Energy Solutions: inverters & distributed EMS
  - Enersys: storage node

- Integration of preliminary R&D into both undergrad and graduate engineering curriculum at UST



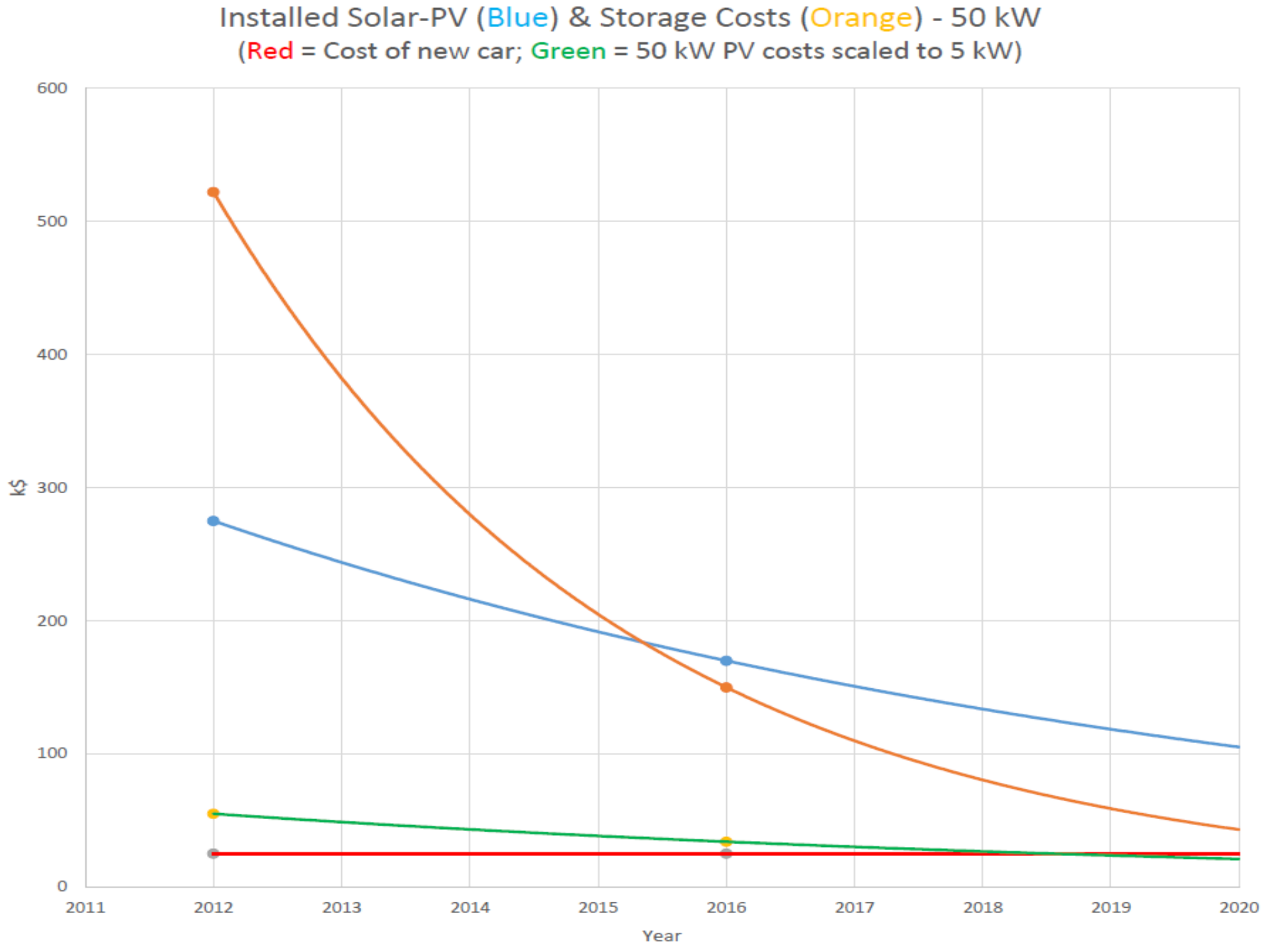
Program Benefits

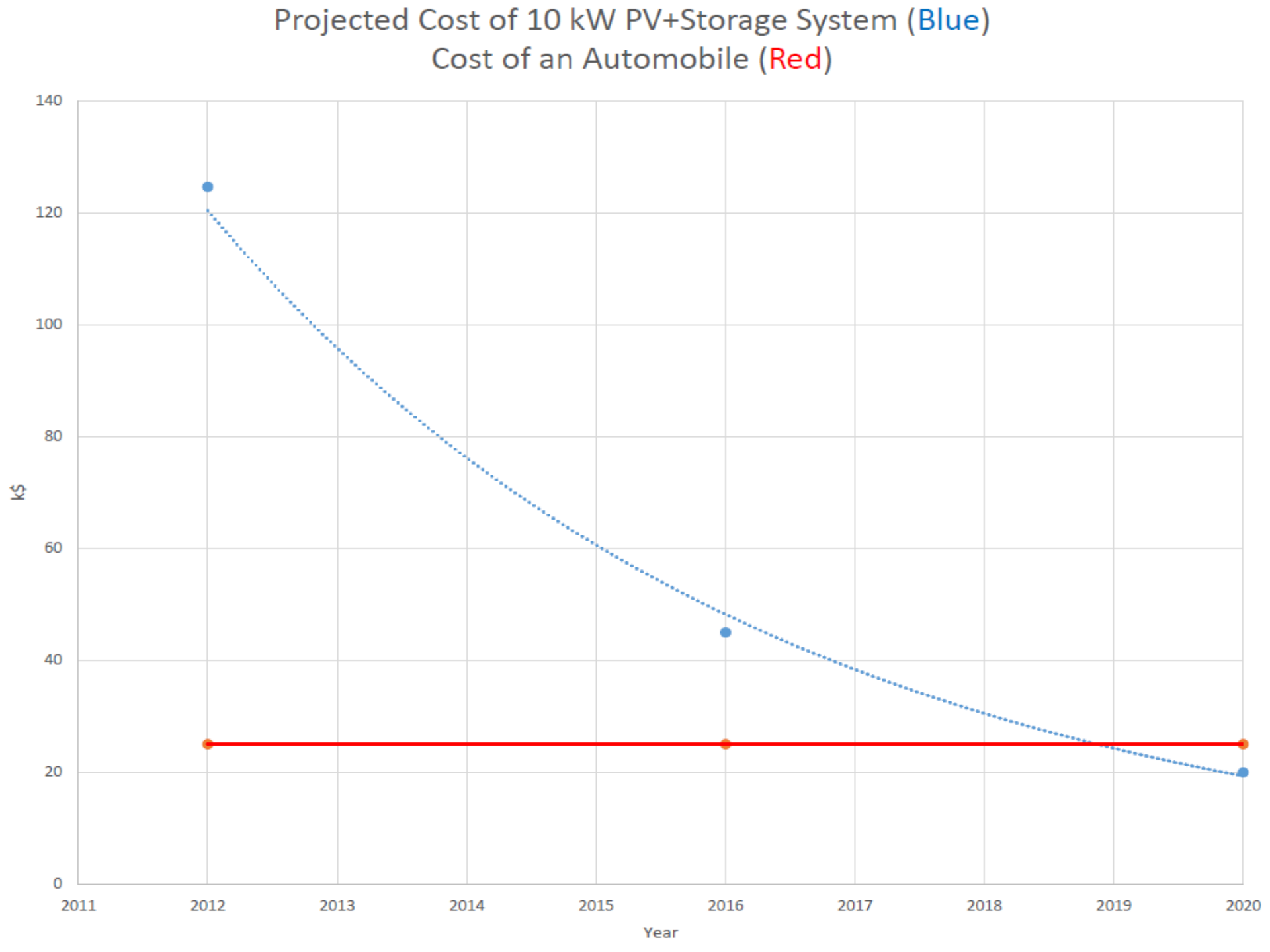


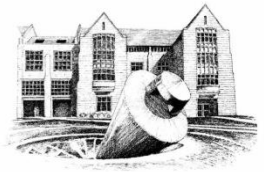
Program Benefits (1)

- Xcel Energy is being recognized as leading-edge and proactive in microgrid technology and deployment

- 4 invited microgrid presentations (completed or pending) with national visibility
  - National Society of Professional Engineers (done)
  - North Central Electrical League (done)
  - Xcel Engineering 2017 Technical Conference (done)
  - 7th Microgrids & Distrib. Gen. for Public & Private Sectors (pending)


Installed Solar-PV (Blue) & Storage Costs (Orange) - 50 kW
(Red = Cost of new car; Green = 50 kW PV costs scaled to 5 kW)
600
500
400
300
200
100
0
k$
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Year

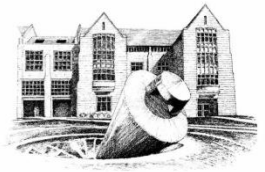

Projected Cost of 10 kW PV+Storage System (Blue)
Cost of an Automobile (Red)
140
120
100
80
60
40
20
0
k$
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Year



Program Benefits (2)

- Significant boon to the University of St Thomas's School of Engineering power program: at both the graduate and undergraduate level

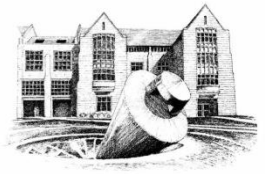
- The first graduate student with thesis/project work related to the USTREF has already graduate; Nathan Webster. He is now at ASU working on his PhD with a power focus



Program Benefits (3)

- Multiple grad and undergraduate research students will starting on the project in Spring 2017 semester as we move into the RFQ phase of the project.

- Significant recognition by 3rd party businesses in & moving into microgrid related markets



Program Benefits (3)

- Opportunities pending for other RDF recipients for Multiple grad and undergraduate research students will starting on the project as we move into the RFQ phase of the project.

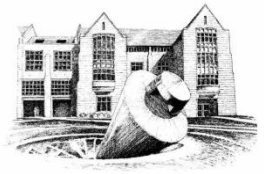
- World-wide recognition of humanitarian microgrid outreach.

Will Steger – Ely, MN

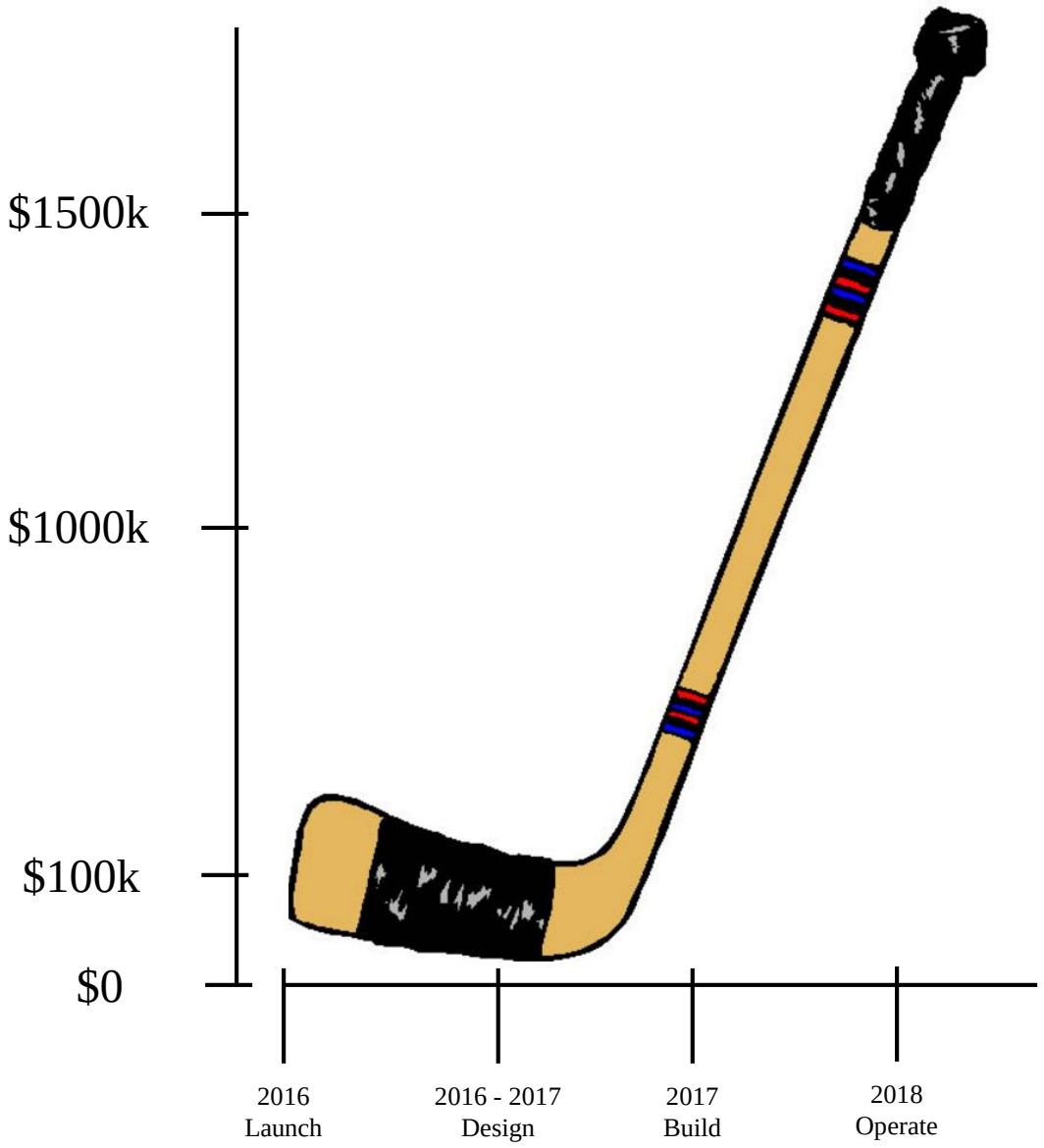

The Steger Wilderness Center is made of glass, native timber and stone, and recycled wood.

Will Steger – Ely, MN

Will Steger – Ely, MN



Budgets and Schedule


$1500k
$1000k
$100k
$0
2016
Launch
2016 - 2017
Design
2017
Build
2018
Operate

Questions??