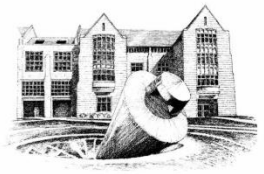
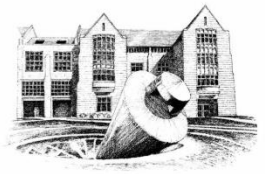


The University of St. Thomas Renewable Energy Facility (USTREF)

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

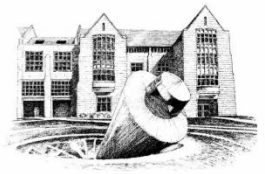
PI: Dr. Greg Mowry

12 Dec 2017



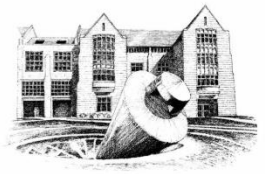
Grateful Acknowledgements

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

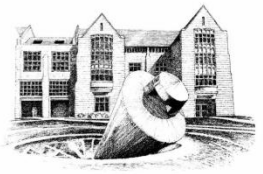


Outline

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



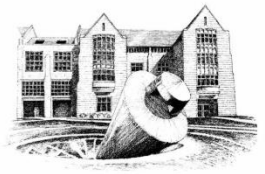
Intro and Program Review



Executive HE4-2 Summary (1)

- Install a multi-purpose **RESEARCH** microgrid which is now referred to as the, "USTREF" [the **U**niversity of **S**t **T**homas **R**enewable **E**nergy **F**acility]

- 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

Smart Inverter
+
Switch

Genset (2)
Biofuel
50 kW

Switch

Storage Node
25 – 50 kW

Smart Inverter
+
Switch

Wind Turbine
Emulator
25 – 50 kW

Smart Interface
+
Switch

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

Device Under Test

Controller
+
Switch

. . .

EMS

480 V 3-Phase 4-Wire Bus

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

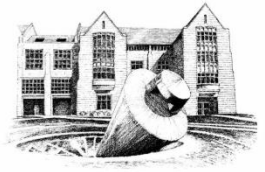
Switch

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

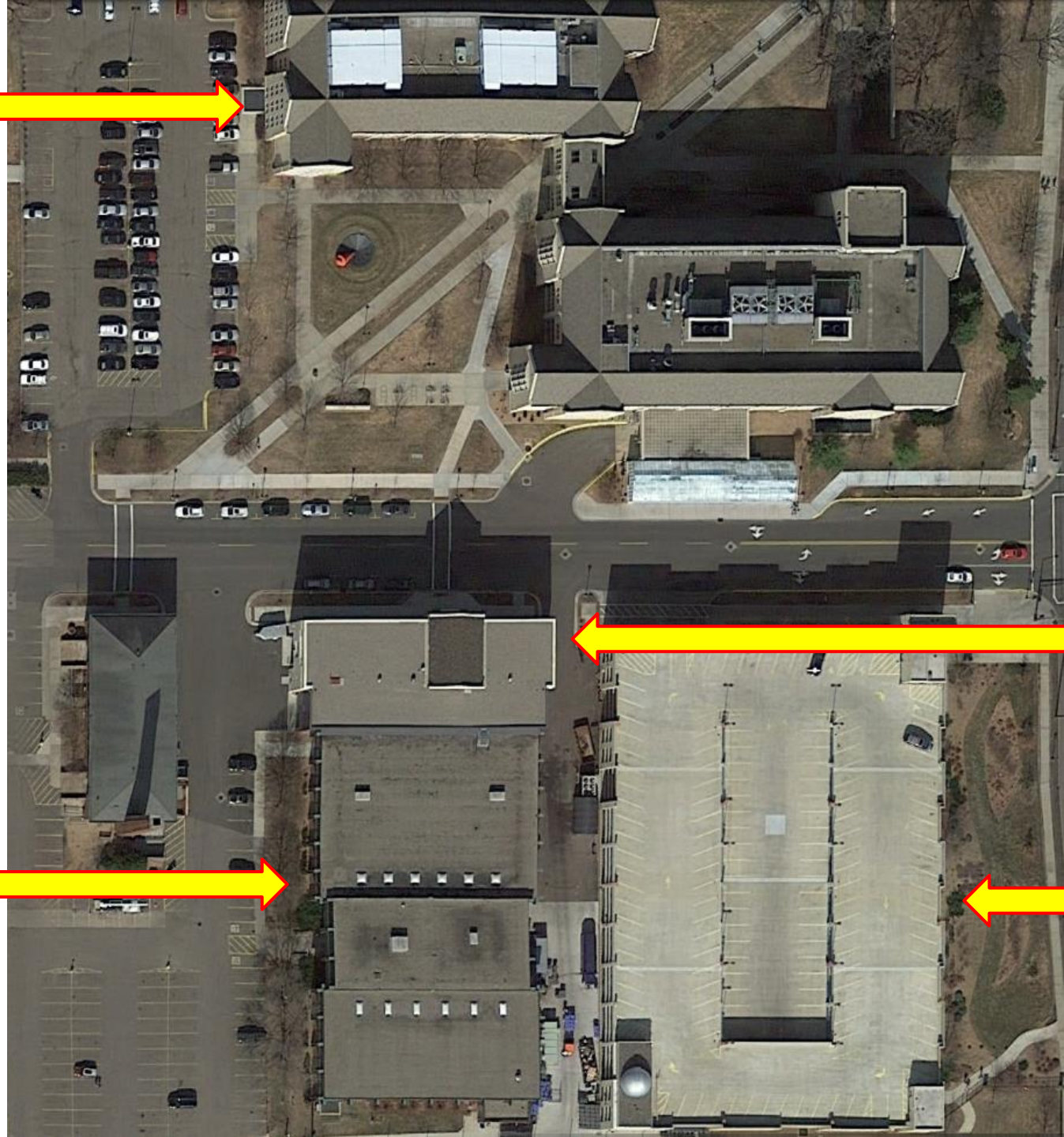
OSS

My office

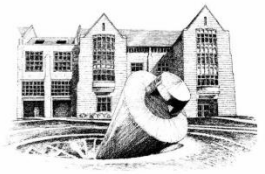
Google Earth view of the UST µGrid location

McCarthy Gym

PV array & roof space
For 3rd party test



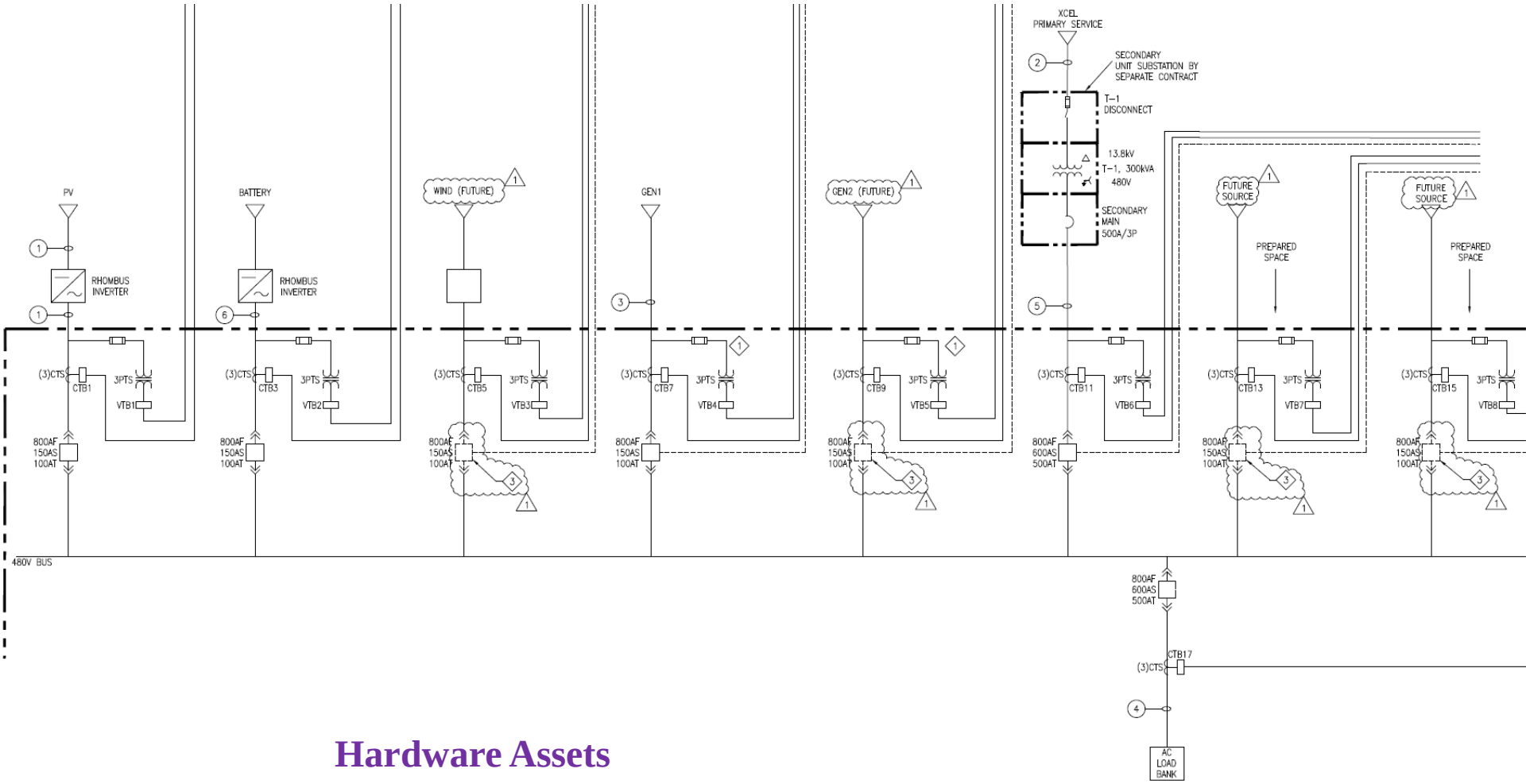
FDC – the Facilities and Design Center; Office View



Accomplishments (1)

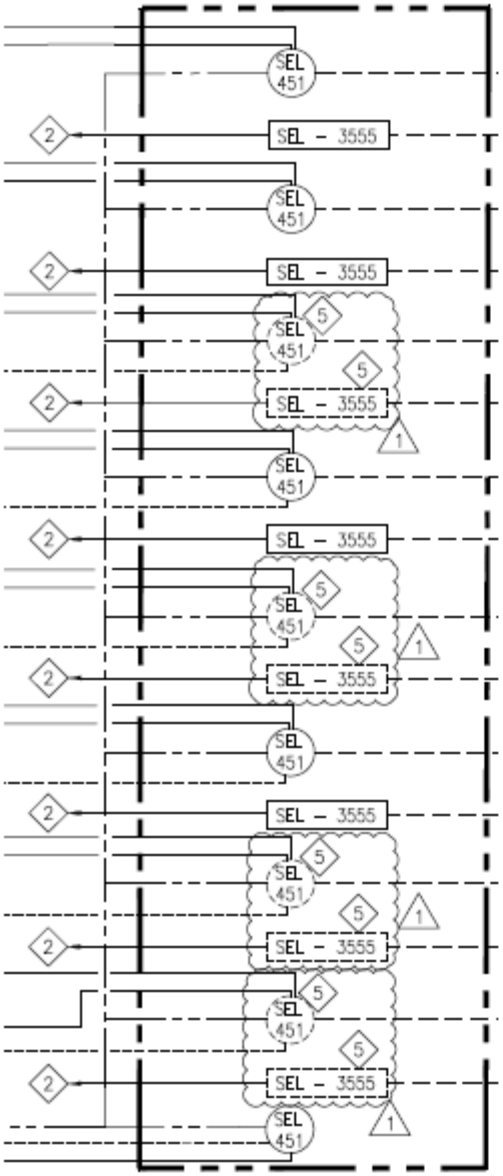
- The one-line diagram that drives all RFPs and RFQs, procurements, and asset deployments was finalized

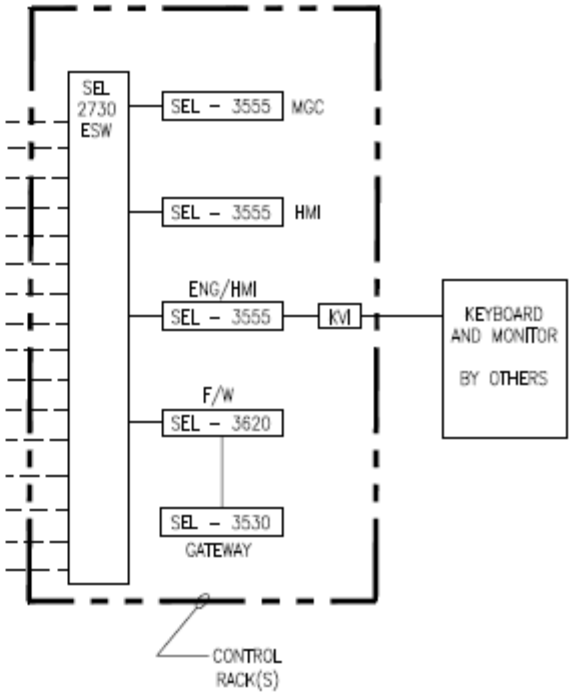
One-Line Diagram of the Research Microgrid



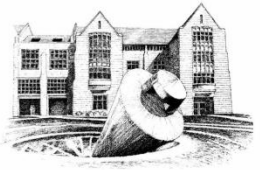
Hardware Assets

One-Line Diagram of the Research Microgrid





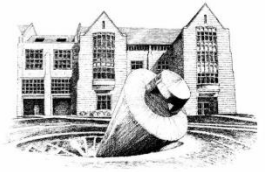
Metrology and Controls



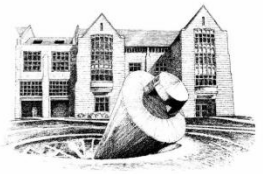
Accomplishments (2)

- Key Partner Arrangements:
  - Xcel Energy: Smart grid development & security – in process
  - Rhombus Energy Solutions: Advanced inverters – done
  - Enersys: storage node – in process
  - Amzur/UST/Xcel distributed intelligence EMS & smart-grid controls – done

- Integration of preliminary R&D into engineering curriculum
  - Microgrid teaching module developed and in use – done
  - Distribution and microgrid course under development for 2018-2019 academic year – in development



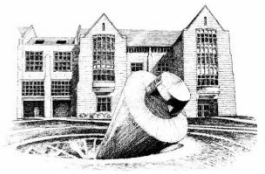
Program Benefits



Program Benefits (1)

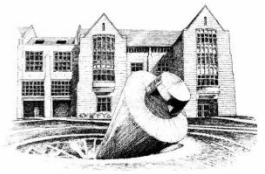
- Xcel Energy is being recognized as leading-edge and proactive in microgrid technology and deployment

- 5 invited microgrid presentations: national visibility
  - National Society of Professional Engineers – national conference
  - UST Smart Climate Event – open to UST alumni & public
  - MIPSYCON presentation
  - 7th Microgrids & Distribution/Generation for Public & Private Sectors
  - MnSEIA – Midwest Gateway to Solar



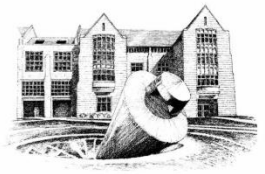
Program Benefits (2)

- Significant boon to the University of St Thomas's School of Engineering power program: at both the graduate and undergraduate level
  - Currently ~ 65 grad students in the MSEE power program
  - Growth of power program into distribution systems and electric vehicles for the 2018-2019 academic year
  - Potential for a new engineering building with major power center



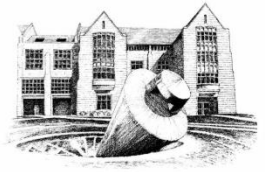
Program Benefits (3)

- Development of several key partnerships & 3rd party vendors with leading-edge companies in microgrids and smart-grid research
  - Rhombus energy Systems
  - Enersys
  - Amzur Technology – and possibly Duke energy
  - Schweitzer Engineering Laboratories
  - Oak Ridge national Laboratory (ORNL)

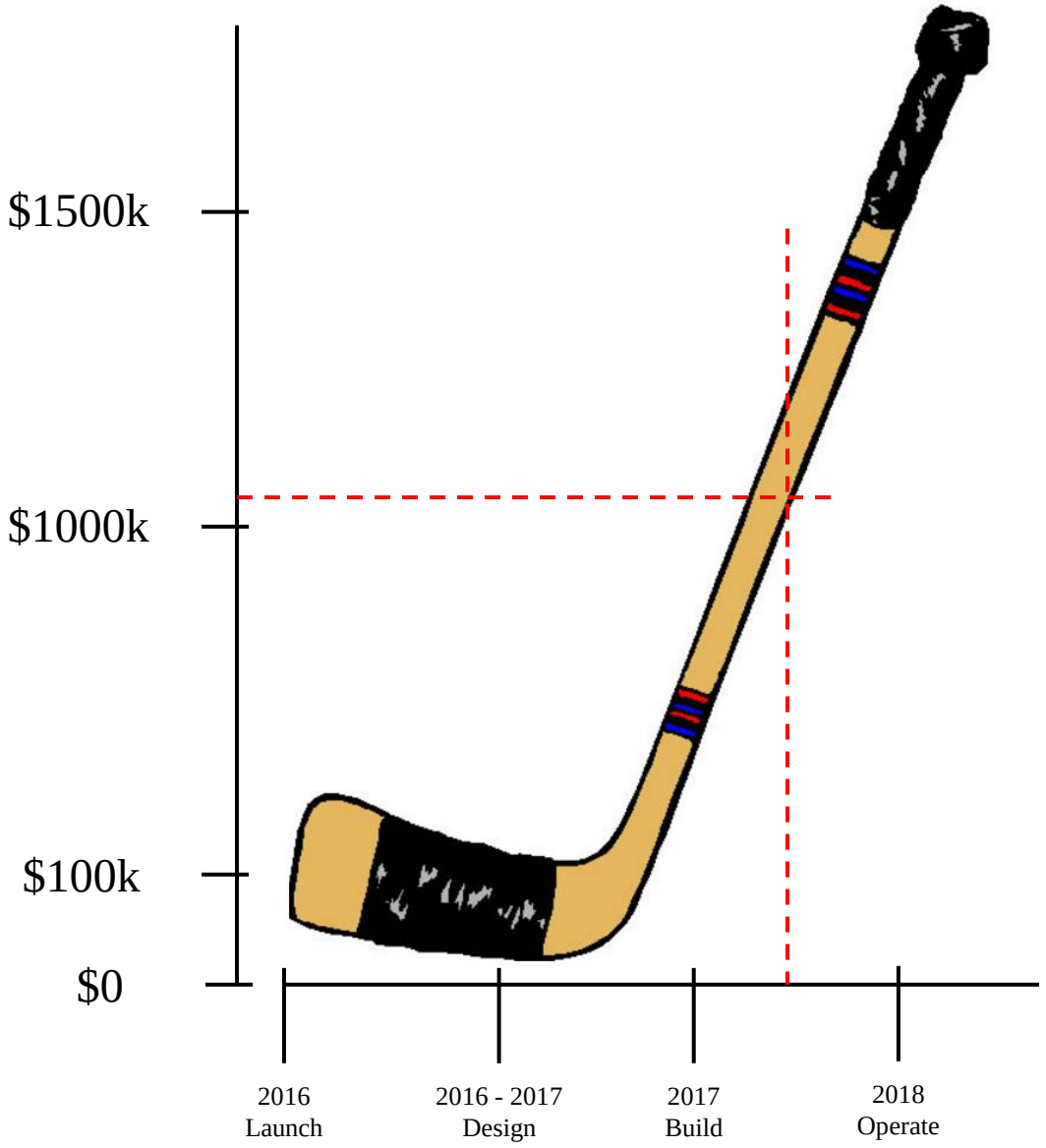


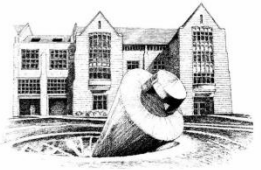
Program Benefits (4)

- The Amzur Technologies, UST Power Program, Xcel Energy partnership: Smart-Grid & Microgrids
  - ✓ DERs, distributed intelligence, and modern smart-grid standard – the USTREF EMS is the test platform
    - IEEE 1547.x
    - IEEE 2030.5/SEP2
    - Open FMB
    - ASHRAE201/FSGIM



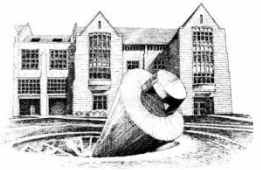
Budgets and Schedule


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



Capital Expenditures

- Switchgear – States Manufacturing – MN Company; $500k
- Gensets – Cummins – MN Company; ~ $50k
- EMS – Amzur Technology – USA Smart-grid Company; $100k
- Storage – Enersys – USA Company; $140k
- PV array – RFP/RFQ IP; ~ $175k
- Construction – MN Companies – RFP/RFQ IP; ~ $250k



Schedule

✓Full funding release August 2016 – Completed

✓Civil engineering planning completed in Q3 2017 – Completed

✓Switchgear to be delivered in December 2017 – Completed circa 12 December 2017

✓ RFQs & asset ordering: Q4 2017 – In process

✓ Grid-connection application to Xcel Energy Q4 2017 – In process

✓ Island mode connection and commissioning Q2 – Q3 2018

✓ Grid tie to Xcel Energy Lindstrom feeder in Q4 2018

Questions??