

Project Title: Sodium Sulfur Battery Energy Storage		
Contract Number: RD3-12	Milestone Number: 2	Report Date: May 20, 2009
Reporting Period: January 2008 – December 2008		
Milestone Description: Milestone 2 – Engineering and Design		
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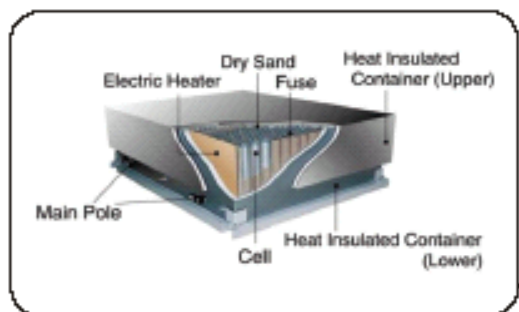
MILESTONE SUMMARY REPORT

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

Executive Summary:

We've purchased the battery from NGK Insulators Ltd., a Japanese firm involved in the manufacture and sale of power-related equipment. Versions of this technology are already being used in Japan and in a few U.S. applications, but this is the first domestic application of the battery as a direct wind energy storage device.

The battery is made up of twenty 50-kilowatt modules, each containing 320 battery cells. The battery is roughly the size of two semi trailers and weighs approximately 80 tons. The battery is able to store about 7.2 megawatt-hours of electricity, with a charge/discharge capacity of one megawatt. When the wind blows, the batteries are charged. When the wind calms down, the batteries supplement the power flow. Fully charged, the battery could power 500 homes for over 7 hours.



Above: a cross section of the battery components

Right: a schematic of a single battery cell



We've contracted with S&C Electric, a Chicago-based company that provides equipment and services for electric power systems, to design and build the PCS and to provide turnkey installation services for the DESS.

GridPoint Inc., a leading innovator in smart grid technology, is providing the communications and control system for system integration, remote control and data access. This system will allow the battery system to be the first of its kind to act like a power plant, including selling power into the MISO market and responding to Automatic Generation Control signals.

The second milestone was completed in July 2008, with the final engineering drawings provided by S&C electric. All additional equipment was ordered, including transformers and back-up generator. In December 2008, an Xcel Energy Information Systems Architect completed the design work for the communications architecture, which will allow remote control of the battery.

Technical Progress:

- ❑ Final engineering and design for the DESS installation was completed and included foundation design, ground grid design, cable and conduit schedule, metering design and bus and layout schedule.
- ❑ W2B Connectivity design (the communication architecture) was completed, including metering and sending an Automatic Generation Control (AGC) signal through Xcel Energy's EMS system to the battery via Gridpoint. This allows remote monitoring and control of the battery.

Additional Milestones:

- ❑ Milestone 3 addresses actual construction and installation activities
- ❑ Milestone 4 addresses development of the research plan for analysis of project results

Project Status:

- ❑ Milestone 2 is 100% complete

Attachments:

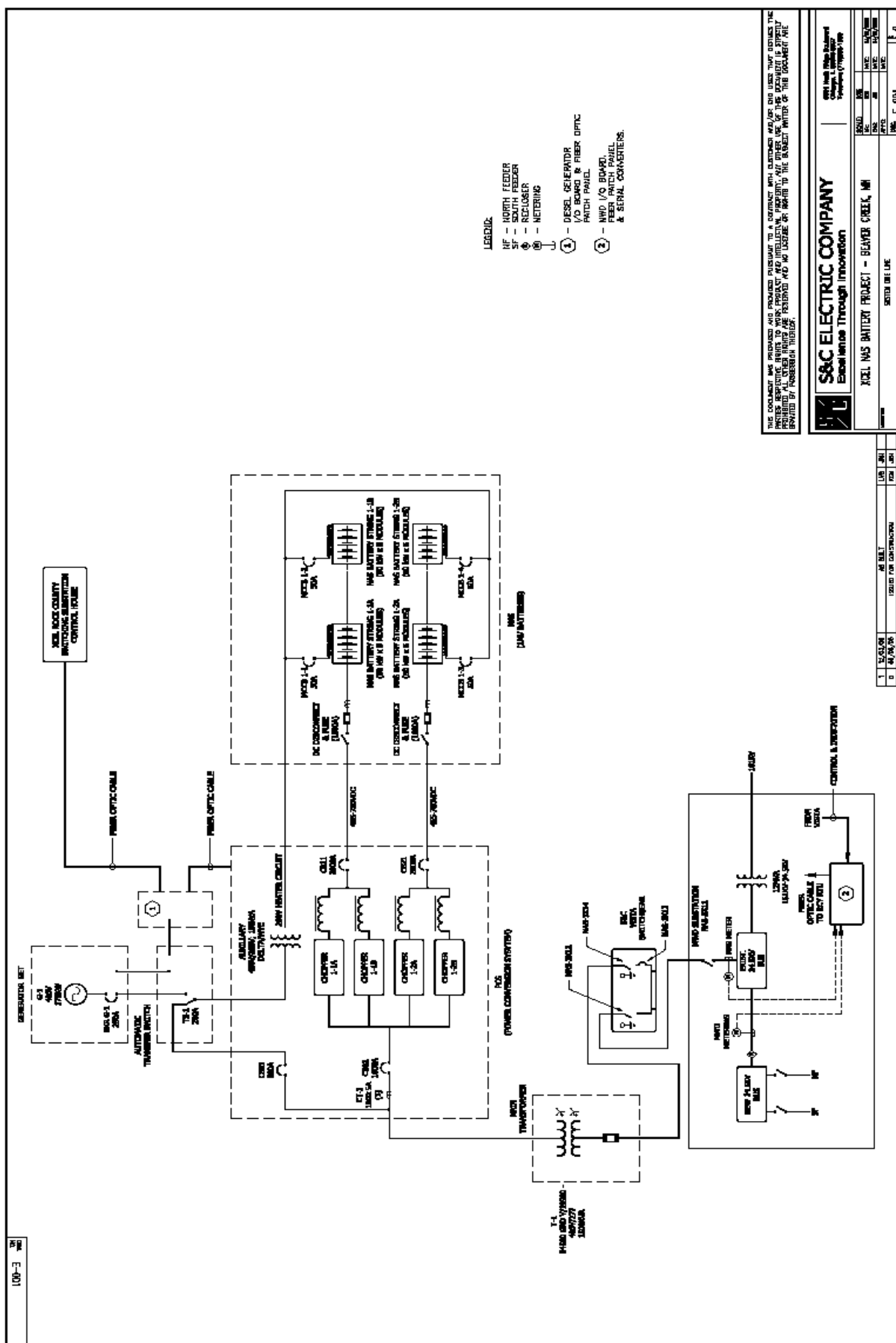
1. Xcel Energy Battery System One-Line Drawing
2. Minwind Substation One-Line Drawing
3. Information Architecture Drawing

Note: These are the main drawings only. We have about 100 pages worth of additional drawings.

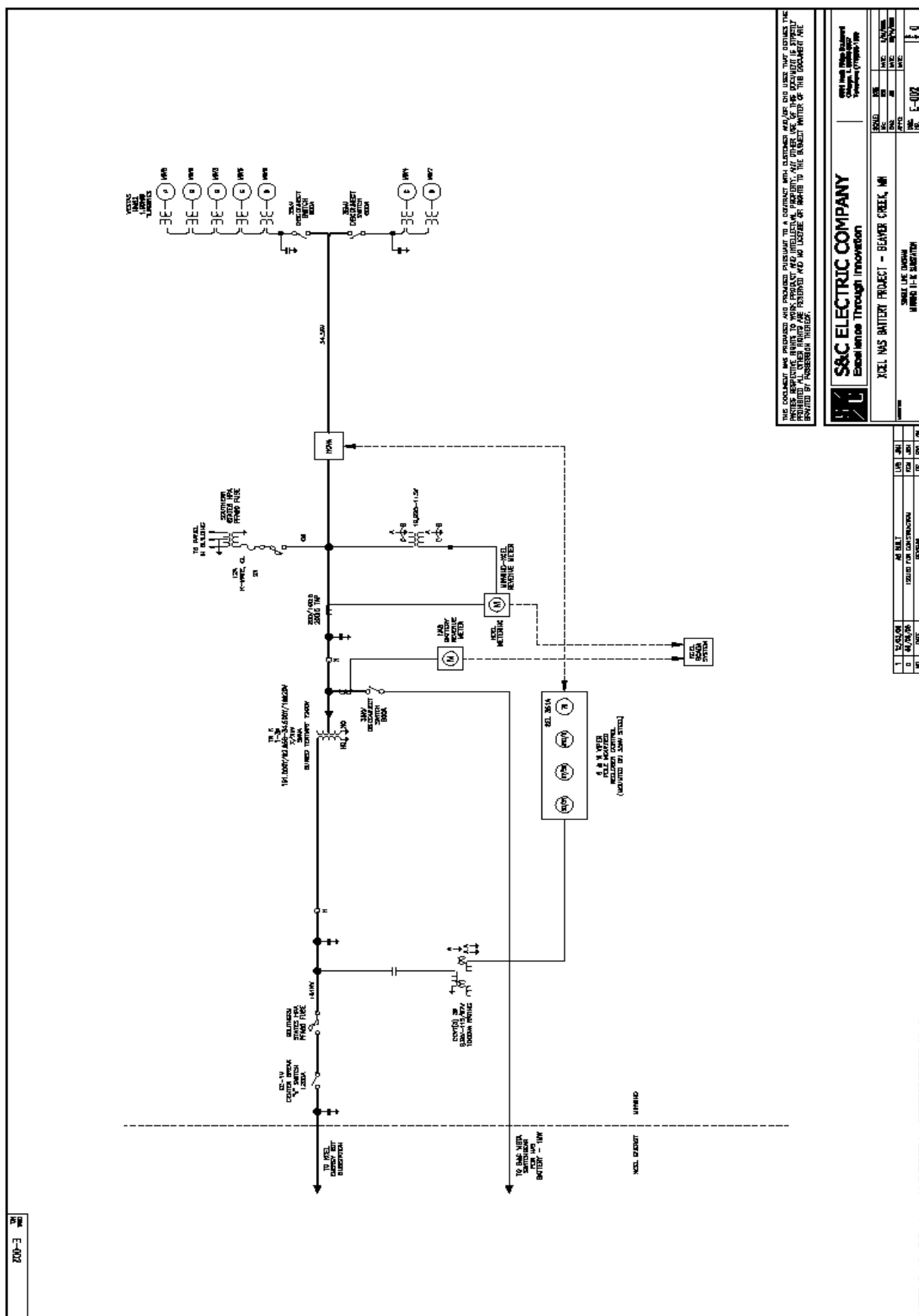
LEGAL NOTICE

THIS REPORT WAS PREPARED AS A RESULT OF WORK SPONSORED BY PROJECT FUNDING PROVIDED BY CUSTOMERS OF XCEL ENERGY THROUGH A GRANT FROM THE 100% RATEPAYER FINANCED RENEWABLE DEVELOPMENT FUND ADMINISTERED THROUGH THE NORTHERN STATES POWER COMPANY, A MINNESOTA CORPORATION.

Attachment 1: Xcel Energy Battery System One-Line Drawing



Attachment 2: Minwind Substation One-Line Drawing



Attachment 3: Information Architecture Drawing

