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Sandia National Laboratories/Cordova Electric Cooperative Energy Storage Project

Daniel Borneo, P.E.

Benjamin Schenkman

Sandia National Laboratories

Alaska Rural Energy Conference

April 2016

U.S. DEPARTMENT OF ENERGY NNSA

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SAND Document SAND2016-3241 C

Presentation Outline

- Project team
- Problem statement and project goal
- Community overview
- Generation, Load and other details
- Project description, overall scope, and project goals
- Phase 1 scope, timeline, and budget
- Phase 2 scope, timeline, and budget
- SNL capabilities

Project Team

- US Department of Energy
  - OE Stationary Energy Storage Program
  - Sandia National Laboratories (Sandia)
  - Clean Energy States Alliance (CESA)
- Cordova Electric Cooperative (CEC)
- Alaska Center for Energy and Power (ACEP)

Problem Statement & Project Goal

- Run-of-the-river (no water storage) hydro-diesel islanded microgrid operated by Cordova Electric Cooperative (CEC)

- Periods of *low demand* and *high water availability:*
  - Spills significant amounts of water (non-realized power production)

- Periods of *high demand* and *low water availability:*
  - ***Co-generate with diesel generators***

Approximate cost of generation:
$.0.9/kWh hydro
$0.40/kWh diesel

Project Goal: To provide an in-depth analysis that is detailed enough to develop a business case and technical RFP for an ES for Cordova.

Community Overview

- City of Cordova and Native Village of Eyak
  - 2014 Combined population[i] - 2286
  - Accessible only by sea and air
  - Thriving fishing industry
    - Netting between $45 - $85 million annually

Figure 1: Cordova, AK (red dot). Source: Wikipedia.org.

[i] Alaska Energy Data Gateway, Census Data, retrieved January 2016: https://akenergygateway.alaska.edu/community-data-summary/1421215/

Electrical Generation Detail

- 7.25MW hydropower generation capacity
  - CEC is able to meet demand with hydropower as much as 60% of the time.
- 11.15MW diesel generation capacity

CORDOVA ELECTRIC GENERATING ASSESTS	
Power Creek Hydropower (6MW Total Capacity)	• 2x3MW Turgo Turbine
Humpback Creek Hydropower (1.25MW Total Capacity)	• 2x500kW Francis Turbine • 250kW Turgo Turbine
Orca Diesel Power Plant (11.15MW Total Capacity)	• 2.5MW EMD • 2.4MW Fairbanks-Morse • 2x1.125MW Caterpillar • 4MW EMD

Electrical Load Detail

Bulk of generated electricity is delivered to fish processing industry.
Highest peak demand during summer months. ~ 10 MW
In winter months peak drops below 3MW

- The figure below shows 2014 demand.

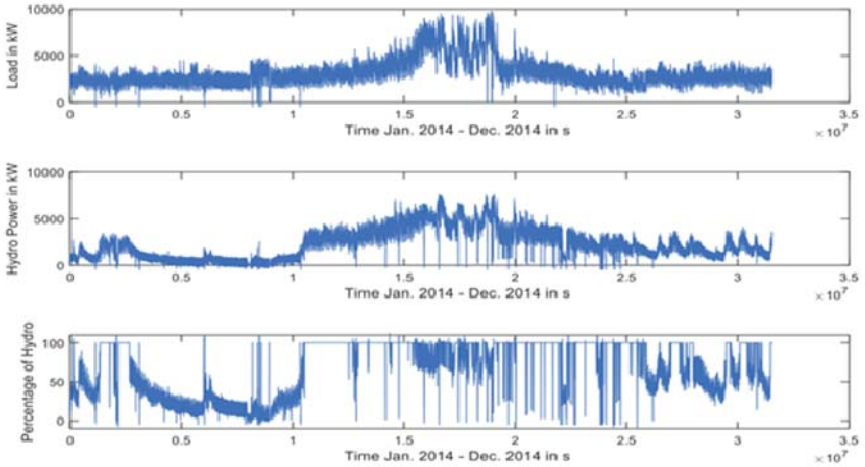
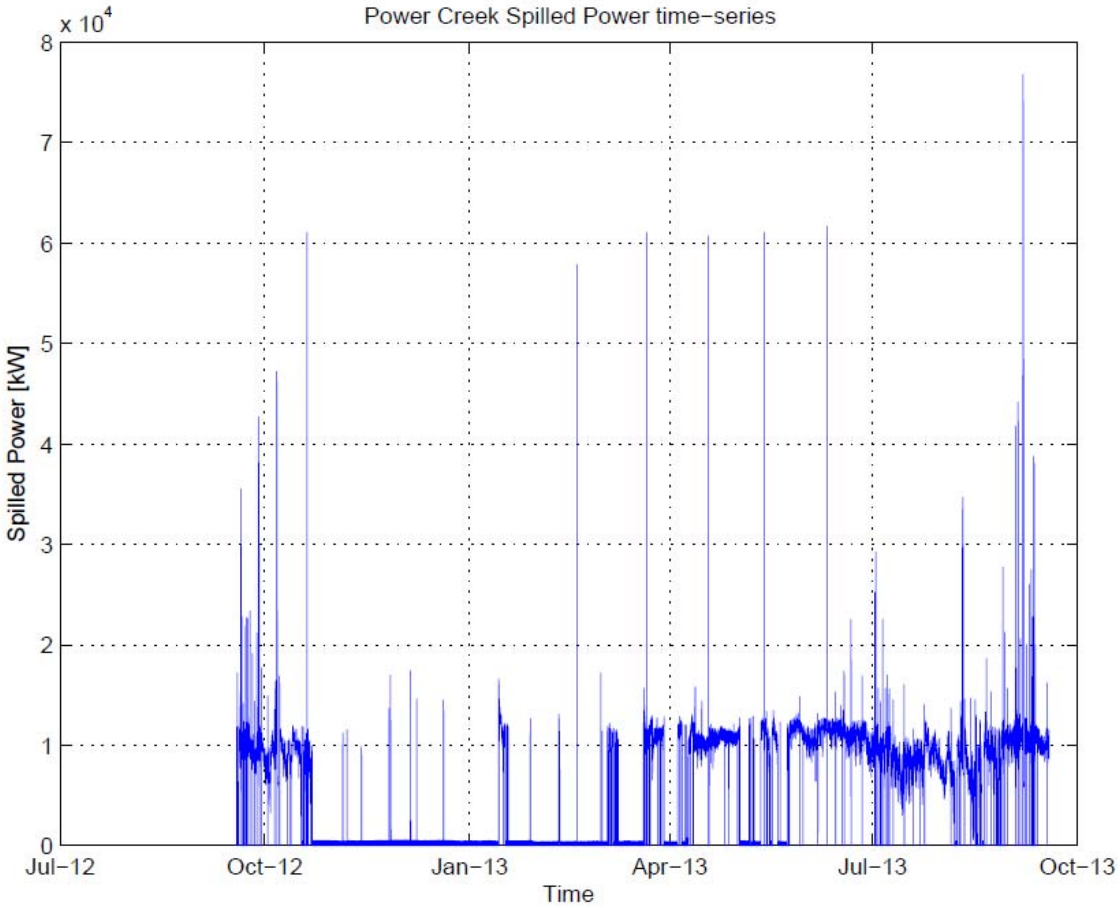


Figure 1: Demand and hydropower generation in Cordova, AK for 2014. Top panel: demand. Middle panel: hydropower output. Bottom panel: hydropower output as fraction of total generation. Intermittent drops to zero in hydropower generation are due to maintenance operations such as clearing debris from the intake structures.

Spilled Water



Mueller-Stoffels, M., Initial Determination: Value of Energy Storage for Cordova Electric Hydro-Diesel System

Potential Opportunity for Energy Storage in Cordova.

- April - September hydropower meets 100% of demand
  - Up to rated capacity of 7.25 MW
  - ***<u>However, periods when there is excess Spill</u>***

- Diesel operates:
  - Summer when load > 7.25MW
  - and occasionally in the winter when Hydro < demand
  - **<u>However, periods when generator is not fully loaded and periods when generator is cycling unnecessarily</u>**

<u>Question – Can ES reduce spill and generator run-time COST Effectively?</u>

Work To Be Performed
Phase 1: May – Sept, 2016

- Perform analysis for the use of an EES system on the CEC grid
  - CEC, DOE/SNL, and ACEP will determine:
    - The availability of excess hydropower
    - Demand of supplemental generation to optimally size an energy storage system
    - Additional services that an ESS may be able to support
    - Based on dynamic modeling identify potential sites for deployment of an ESS.
- Total funding for Phase 1:
  - DOE/SNL - $140K to support analysis - ACEP ($90K) and Sandia ($50K)
  - CEC - $275K (Preliminary completed tasks)
  - ACEP - $15K (Preliminary completed tasks)

Work to Be Performed
Phase 2 – Fiscal Year 2017

- Develop and issue Request for Proposal (RFP)
  - Based on phase 1 analysis CEC may develop and issue an RFP to procure and install an energy storage system
- Install ES storage System
  - Purchase and install an energy storage system at location determined in phase 1.
- Estimated total funding for Phase 2:
  - DOE/SNL - $110K for ES design and installation
  - CEC - $2-2.5M (Energy Storage System procurement and installation)
  - ACEP - $15K (Engineering support)

Work to Be Performed -Ancillary Tasks

- Optimization of the ES applications/services to increase revenue streams and resilience.
- Investigate
  - Delay or avoidance of diesel starts via peak shifting
  - Frequency regulation and spinning reserve
  - Ramping control and optimal loading of diesel generators
  - Reactive power support
- Develop a better understanding of how ES can best be utilized in an isolated microgrid as well as what challenges ES designs face when being installed in harsh environments.

SNL Industry Acceptance Capabilities

Energy Storage System Project Technical Support

- Conduct analysis, perform modeling and provide data on applications, ES sizing and technologies that best solve the client's problem.
- Assist in developing and reviewing a client's request for Information and Proposals (RFI & RFP).
- Assist in the design, procurement specifications, and construction of ESS'.
- Assist in the design of Data Acquisition Systems (DAS).
- Assist in developing the ESS commissioning plan.
- Analyze operational test data and develop system optimization algorithms.

SNL Industry Acceptance Capabilities (Contd.)

ES Testing and Analysis

- Cell and module analysis, up to 48 VDC 2000 A within a controlled environment (chamber)
- Spectral impedance measurement
- Test ESS up to 1.0 MW 480 V 3-phase AC
- On-site (Vendor) acceptance testing support
- Safety evaluations
- Provide third party independent ES system evaluations, analysis, and reports

Industry Outreach

- http://www.cesa.org/webinars/

Mention of our SNL Sponsor – DOE/OE - Grid Energy Storage Program, managed by Dr. Imre Gyuk

Thank You!

- **Dan Borneo - drborne@sandia.gov**
- **Benjamin Schenkman – blschen@sandia.gov**
- **Ray Byrne- rhbyrne@sandia.gov**
- **Mike Baca– mbaca2@sandia.gov**
- **Ana-Marie Beare – amollo@sandia.gov**