Statewide Energy Auditing for Energy Master Plan

State of South Dakota
January 13, 2010

Outline

- Introductions
- Approach & Timeline
- Current Energy Situation
- Investigation & Findings
- Recommendations

Project Team

Project Role	Project Role	Certified Energy Manager	LEED Accredited	Professional Engineer (PE)	Project Management	Energy Efficiency Studies	Retro-commissioning	Energy Financial Analysis	Energy Modeling	Building Systems M&V	Renewable Energy Studies	Energy Efficiency Reviews	Sustainable Design
Larry Jensen	Principal-in-Charge		X	X	X	X	X	X				X	X
Peter Dahl	Sustainability Specialist		X		X			X				X	X
Jim Miller	Mechanical Engineer	X		X		X	X	X	X		X	X	X
Tom Schubbe	Senior Engineer Associate					X		X	X		X		
Doug Lucht	Senior Mechanical Engineer			X		X	X	X	X			X	X
Paul Johnson	Senior Mechanical Engineer	X	X	X		X		X	X	X	X	X	X
Matt McReynolds	Mechanical Engineer			X		X	X	X	X	X	X	X	X
Matt Wolf	Mechanical Engineer		X	X		X	X	X	X		X	X	X
Rob Bortscheller	Mechanical Engineer					X		X	X			X	X
Todd Lagus	Mechanical Staff Engineer					X	X	X	X	X		X	X
Mike Temme	Mechanical Staff Engineer					X		X	X			X	X
Tim Kempf	Mechanical Staff Engineer 3					X		X	X			X	

Energy Project Experience

Project	Energy Assessment and Review	Retro-commissioning	Systems Measurement and Verification	Energy Modeling	Energy Financial Analysis	Renewable / Alternative Energy	Project Management / Owner's Representative	Equipment and Systems Operations Training	Energy Efficiency Reviews	Environmental Engineering	Sustainable Engineering Design
Biomass Feasibility Study		X			X	X				X	
Biomass Feasibility Study		X			X	X				X	
Biomass Fuel Feasibility Study		X			X	X					
Commissioning/Energy Modeling	X			X	X				X		
Commissioning/Energy Modeling	X		X	X	X				X		
Energy Analysis Engineering Assistance Study	X	X			X						
Energy and Greenhouse Management Master Plan	X	X			X					X	
Energy and Sustainability Planning	X									X	X
Energy Assessment/Energy Modeling	X	X		X	X						
Energy Assessments/Energy Modeling	X	X		X	X						
Energy Audit & Engineering Services	X	X			X			X		X	
Energy Audits	X	X	X	X	X						
Energy Consulting Services	X	X			X						
Energy Infrastructure Project	X	X			X		X			X	
Energy Modeling and Retro-Commissioning	X	X	X	X	X						
Investment Grade Energy Audit	X	X			X						
LEED Commissioning/Energy Modeling	X		X	X	X						
Natural Gas Production From Biomass		X			X	X					
Solar Energy Project						X	X				
Utility and Energy Assessment	X	X			X						
Wind Energy Feasibility Studies and Design		X			X	X					

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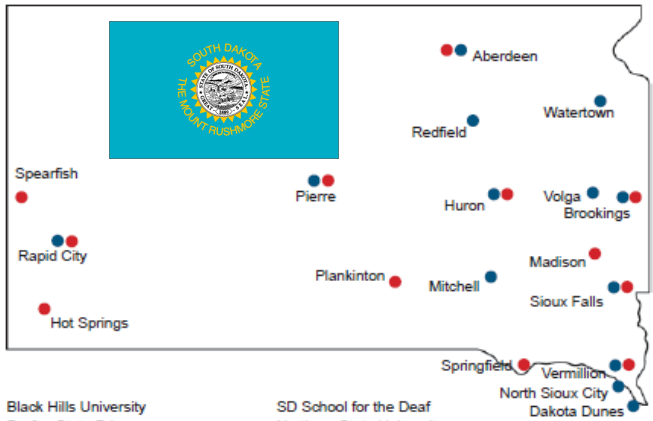
Familiarity with Project Locale



Black Hills University
Durfee State Prison
Developmental Center
STAR Academy
Human Services Center
University of South Dakota
Capitol Complex
State Training School
SD School of Mines and Technology
SD School of Visually Handicapped
SD School for the Deaf
Northern State University
Dakota State University
Minimum Security Facility
State Veteran's Home
Women's Prison
South Dakota National Guard
SD State Penitentiary
SD State University

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Scope

1. Analyze and quantify energy use and cost
2. Perform site investigations to identify high-impact energy efficiency measures
3. Quantify economics and energy savings

4 months to audit 14,267,082 SF

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Timeline

Start August 5, 2009

Site Investigations: 7 weeks

Delivered December 1, 2009

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Approach & Process

- Facility targeting:
  - Defined facility types & analyzed energy use data
  - Identified key facilities with high potential for energy efficiency
  - Prioritized facilities based on energy intensity

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Approach & Process

- Site investigation:
  - Collected building systems & operations data
  - Interviewed operations staff
  - Identified measures during facility assessment
    - Multi-building campuses included campus-wide and facility-specific measures

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Approach & Process

- Technical Analysis for each measure:
  - Estimated probable implementation cost
  - Summarized operations effects
  - Developed a preliminary estimate of potential energy savings and energy cost avoidance
- Evaluated renewable energy generation potential and performance
- Recommended additional energy management practices for consideration

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Approach & Process

- Reporting:
  - Evaluated measures based on investment costs per unit of energy saved, and simple payback
  - Assigned relative priority based on metrics
  - Summarized potential for energy savings relative to current consumption

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Current Energy Situation

- Historically, energy in South Dakota was relatively inexpensive, but that has changed.
  - Consumption increasing
  - Exceeding WAPA allocations
  - Rates increasing
- Tracking energy consumption
  - Statewide database, *EnergyCAP*

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Current Energy Situation

- Past energy projects:
  - Lighting upgrades
  - Updating HVAC controls
  - Add'l insulation on steam lines
  - Boilers replacements and upgrades
  - Roof replacements and upgrades
  - Installing VFDs for motor controls
  - Heat recovery
  - Steam efficiency
  - Window replacement included in renovations

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1st State building to receive LEED® Certification

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Current Energy Situation

- Building Construction
  - 2008: LEED Silver certification required
    - Underway: 9 renovations, 12 new construction
  - OSE enforces ASHRAE 90.1-2007 as the energy standard for State buildings
- State Procurement
  - Energy Star appliances and equipment
- Renewable Energy Generation
  - Capitol Lake Plaza
    - Geothermal, Photovoltaic & Wind
  - Star Academy Biomass Boiler

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Current Energy Situation

Energy Use in MMBTUs	
Agency	**2008**
Bureau of Administration (BOA)	101,637
Board of Regents (BOR)	1,255,598
Department of Human Services (DHS)	240,984
Department of Agriculture (DOA)	12,257
Department of Corrections (DOC)	245,293
Department of Transportation (DOT)	83,491
Game, Fish and Parks (GFP)	25,118
Leased Facilities (LSA)	67,670
Military and Veterans Administration (MVA)	133,874
TOTAL	**2,165,922**

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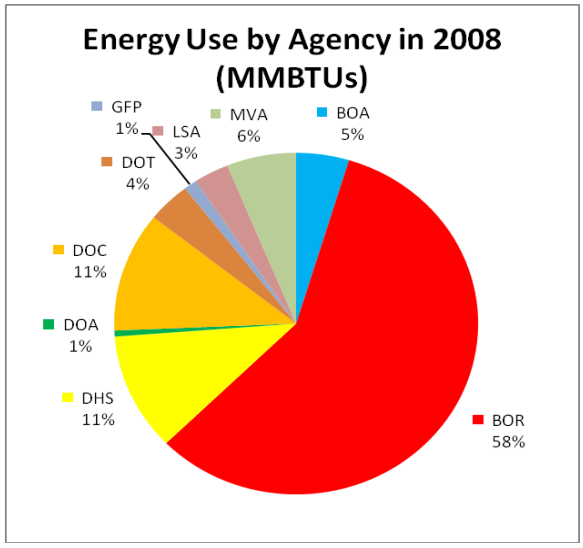
Current Energy Situation



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Current Energy Situation

Energy Expenditures	
Agency	**2008**
Bureau of Administration (BOA)	$981,911
Board of Regents (BOR)	$11,332,390
Department of Human Services (DHS)	$2,188,040
Department of Agriculture (DOA)	$141,374
Department of Corrections (DOC)	$2,547,677
Department of Transportation (DOT)	$1,268,552
Game, Fish and Parks (GFP)	$550,029
Leased Facilities (LSA)	$754,729
Military and Veterans Administration (MVA)	$702,210
TOTAL	**$20,076,376**

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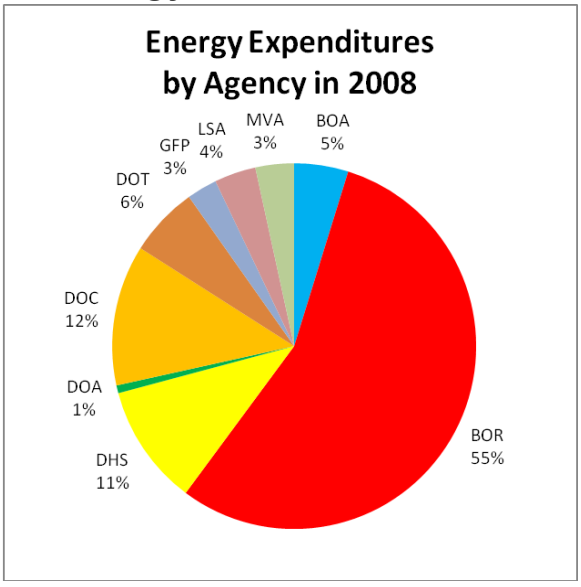
Current Energy Situation



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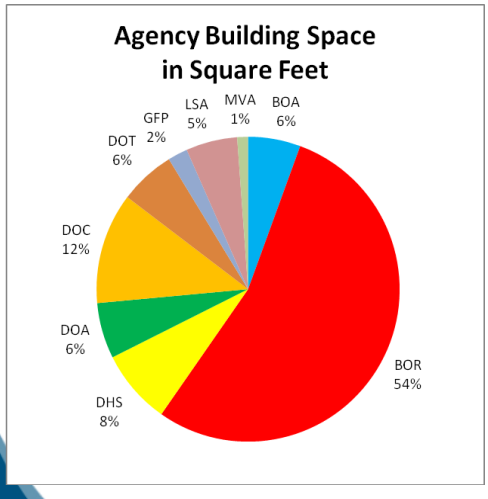
Current Energy Situation



Agency	EUI (kBTU/SF)
BOA	128
BOR	164
DHS	215
DOA	14
DOC	147
DOT	99
GFP	84
LSA	87
MVA	409

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Investigation & Findings

- Investigated 9.5 million SF of buildings
- 1168 Energy Conservation Measures at 252 buildings
  - 569 lighting measures
  - 229 controls measures
  - 164 heating measures
  - 87 retrocommissioning measures
  - 119 other measures

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Investigation & Findings

% Energy Use Reduction	Reduction in MMBTUs	Implementation Cost	Annual Savings
5%	108,296	$1,445,575	$956,832
10%	216,592	$7,390,503	$1,996,594
15%	324,888	$32,738,588	$3,569,855
20%	433,184	$58,147,238*	$5,232,726*

* NOTE: values extrapolated to buildings outside of the investigation, based on findings of buildings within the investigation

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Viability of Renewables

- Best of the Renewables:
  - Wind Turbines:
    - Large scale: 20 years
    - Small scale: 37 years
  - Photovoltaics: 129 years

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Recommendations

- Provide an Energy Manager for Agencies
- Advanced metering & monitoring
  - Estimated costs to install:
    - $5-10K per building
    - $250K for a large campus
  - Save an additional 5-20% of utility budget
- Develop LEED Implementation Guide

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Recommendations

- Continued & expanded use of a Statewide Energy Database
- Use Energy Star Portfolio Manager to rate energy efficiency of buildings
- Apply LEED to existing building operations
- Include energy management considerations when leasing space

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Discussion