



The State of Montana Mechanical Insulation Energy Appraisal



A State's Look at the Value of Mechanical Insulation





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A State's Look at the Value of
Mechanical Insulation

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Background

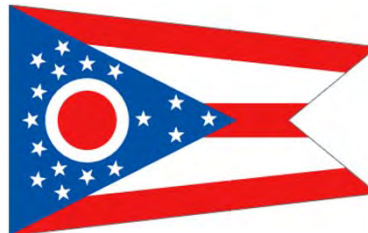
The National Insulation Association and the International Association of Heat & Frost Insulators and Allied Workers created an unprecedented alliance in May 2009 to work together to educate industry on and promote the benefits of mechanical insulation. The alliance ultimately established a public-private partnership with the Department of Energy to launch an aggressive mechanical insulation public education and awareness campaign to combat climate change and improve energy efficiency.



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Background

When the 2009 “Stimulus” package was approved, NIA, the International and our Alliance reached out to the state energy offices to suggest they consider mechanical insulation as a means to create immediate jobs while conserving energy, reducing emissions and receiving a return on their investment.





**Mechanical Insulation
Energy Appraisal
Office Facilities**



**25 Buildings – 56 Mechanical Rooms
3,500 Items were identified**



**Condensate Piping in Original
Governor's Mansion**

Examples



Uninsulated End Cap on Steam Header



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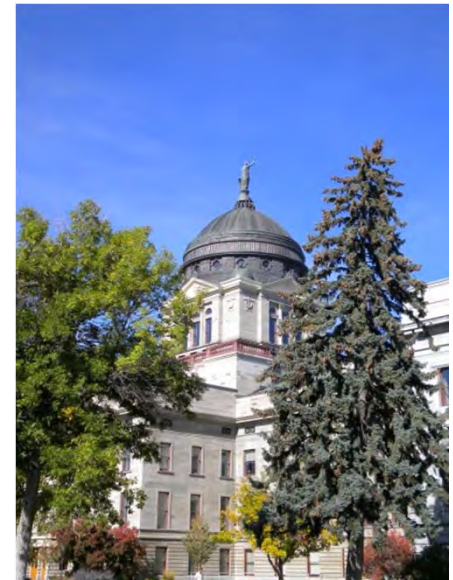
Summary Findings

- Estimated energy savings - 6 Billion BTUs per year
- Overall payback period was 4.1 yrs or 24% annual return
- Projected savings represent roughly 8% of the total natural gas consumption of the facilities analyzed
- Reductions in CO₂ emissions are 300 Metric Tonnes per year
- On a square foot of gross building area basis, the energy savings averaged 4.6 kBtu/sf/yr and energy cost savings were \$0.043/sf

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Approach

- Assemble a Team
- Visit Identified Mechanical Rooms
- Identify Opportunities (Missing Insulation)
- Estimate Costs to Insulate
- Estimate Energy Savings
- Summarize and Report Results





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The Facilities

- **General Services Division**
 - Capitol Building and 4 others served by central steam plant
 - Additional buildings on central campus
- **Montana Law Enforcement Academy**
 - Campus style complex of dorms, classrooms, offices
- **Montana Department of Transportation**
 - Headquarters Complex
- **Montana Department of Military Affairs**



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The Facilities

- 25 facilities – 1.3 Million sq. ft.
- 56 mechanical rooms
 - Mechanical systems within occupied spaces not considered
- Piping and equipment for hot systems
 - Cooling systems not considered
- Not an Energy Audit
 - Envelope/lighting/controls/ventilation/equipment not considered

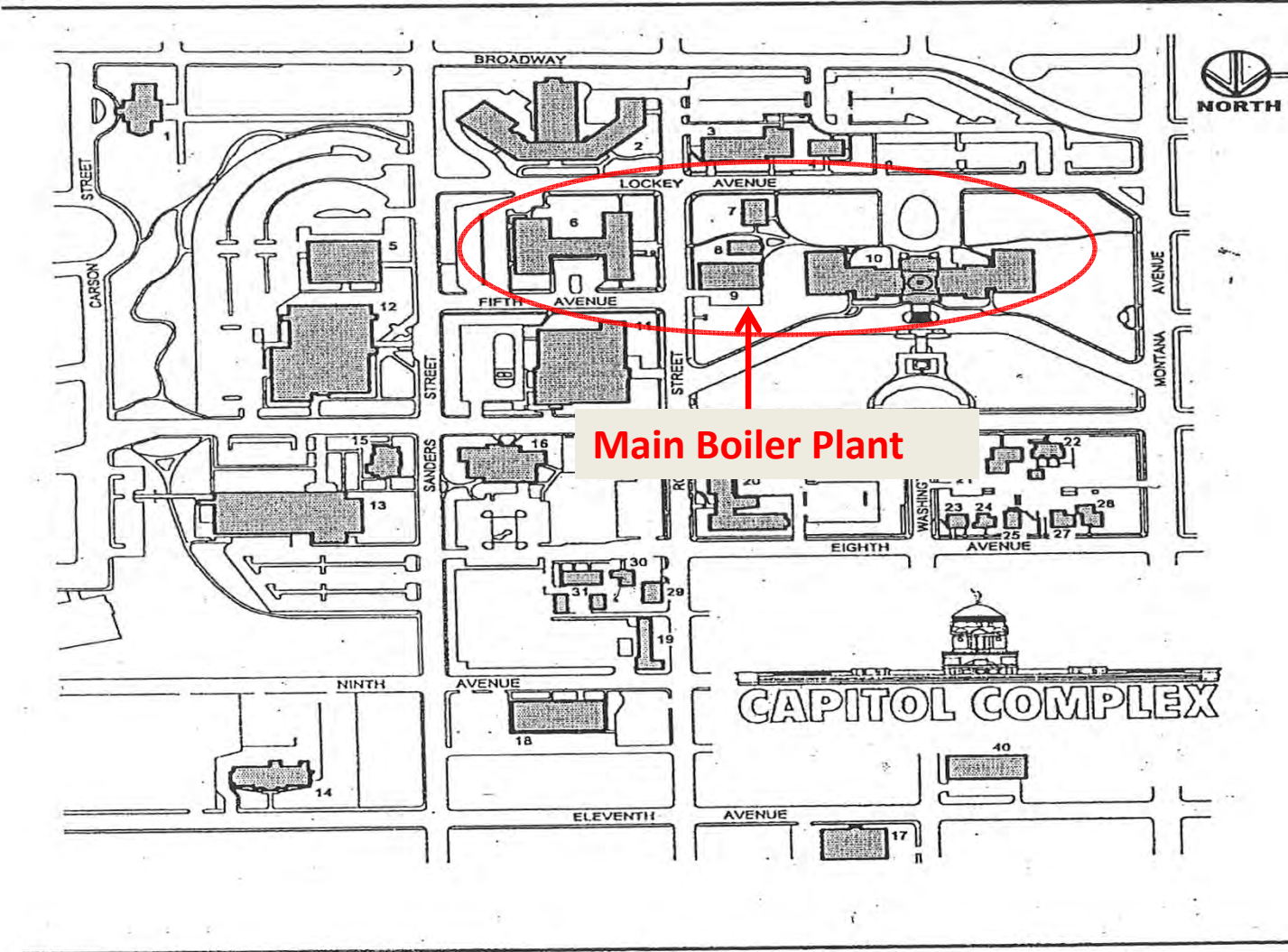


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Key Systems

- Low Pressure Steam Heating
 - 5 psig (230°F)
 - Natural Gas Fired Boilers
- Heating Hot Water
 - 120-180°F, reset to outside air temperature
 - Natural Gas Fired
- Domestic Hot Water
 - 140°F
 - Circulating (typically on timers)

Capitol Square Layout





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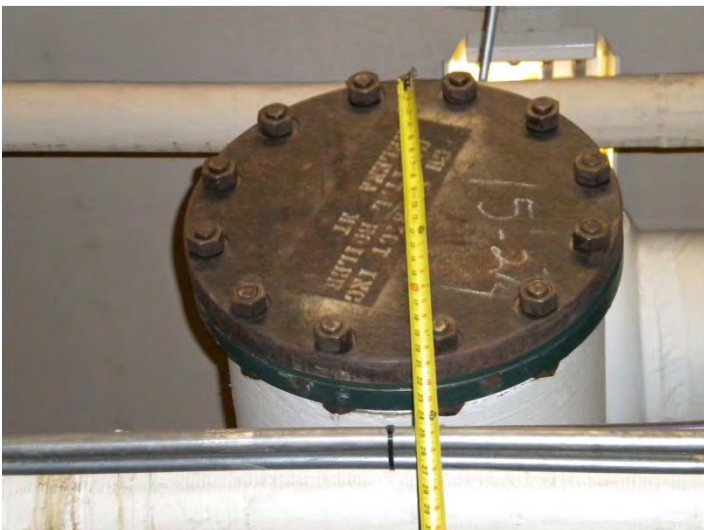
- **Walt Sullivan Building had the Fewest Items**
 - 14 items
 - \$138/yr in energy savings
 - \$600 to insulate
 - 4.3 yr payback





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- **Main Boiler Plant had the Most Items**
 - 400 items
 - \$8,800/yr in energy savings
 - \$35,000 to insulate
 - 4.0 yr payback





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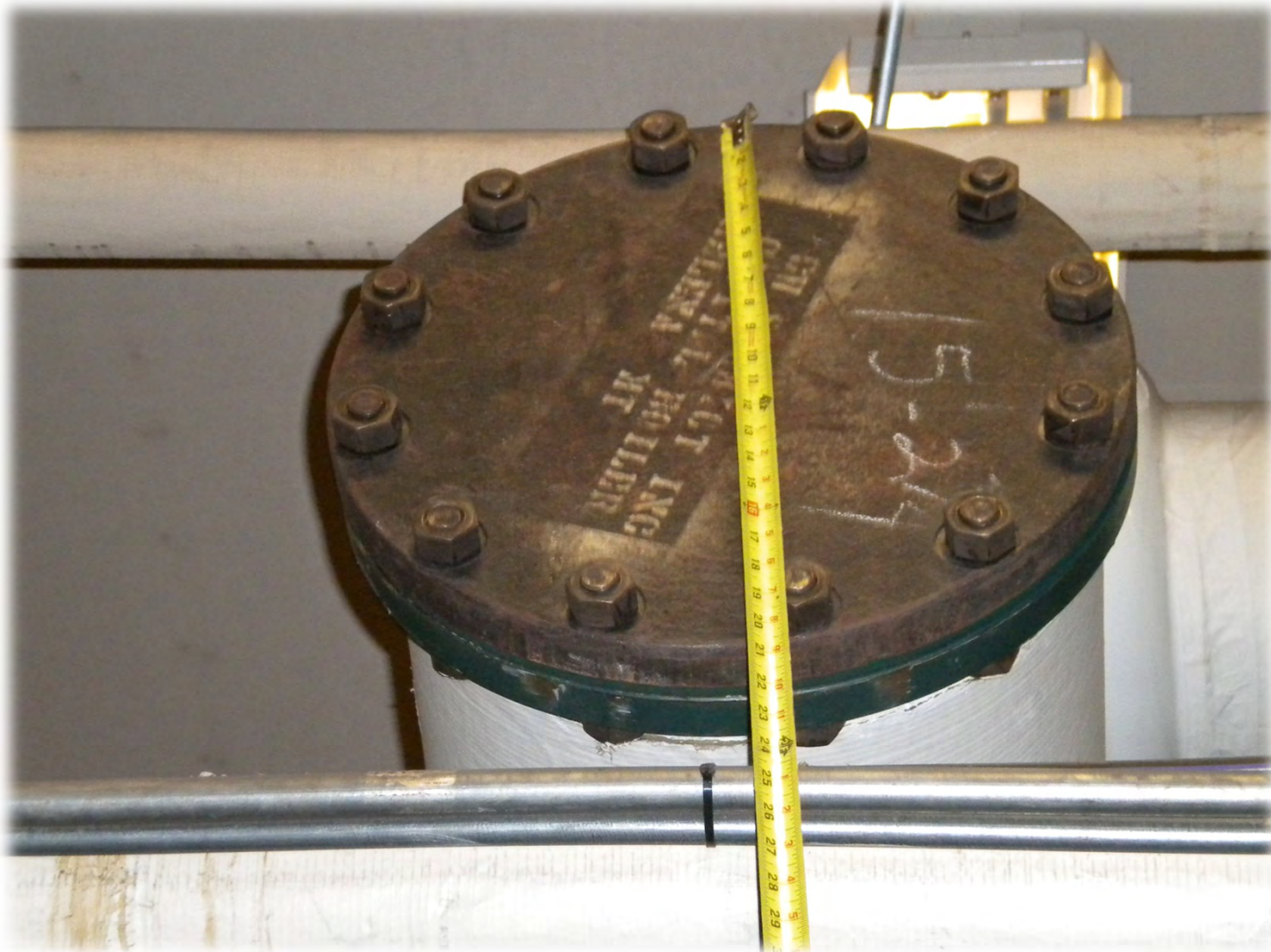
- **Overall Results – 25 Facilities**
 - 3,500 items
 - 6,000 Dekatherms of energy savings
 - 8% of Natural Gas Usage
 - 300 MT/yr of CO₂ reduction
 - \$56,000/yr in energy savings
 - \$201,000 to insulate
 - 4.1 yr payback

Main Boiler Plant



2, 245 hp LP Steam Boilers Design Output = 16.4 Million Btu/h

Main Boiler Plant



Flanged End Cap on 12" NPS Steam Header = Potential Savings \$89/yr

Main Boiler Plant



Flanged Joint on 12" Steam Header = Potential Savings= \$107/yr

Main Boiler Plant and Tunnels



2 LF of 2 1/2" NPS Line – Potential Savings = \$40 /yr

Discussion of Results

- Energy Savings Ranged from **0.3 to 16.4 kBtu/sf/yr**
- Payback Periods ranged from **1.8 to 10.7 yrs**
- Rate of Return ranged from **54% to 7%**
- 82% of the Total Savings with **Paybacks < 5 yrs**

2	7	8	11	13	14	15
Name	Avg Natural Gas Usage, DKT/yr	Energy Savings, DKT/yr	Savings, \$/yr	Estimated Cost, \$	Payback, yrs	Rate of Return, %
Museum	6,440	644	\$5,773	\$10,600	1.8	54%
Corrections	1,377	301	\$2,768	\$5,900	2.1	47%
Old Board of Health	995	63	\$612	\$1,400	2.3	44%
Original Governors Mansion	605	158	\$1,486	\$3,600	2.4	41%
Capital Building	10,122	869	\$7,799	\$29,000	3.7	27%
Law Enforcement Academy Complex	12,222	739	\$7,434	\$27,800	3.7	26%
Metcalf Bldg	1,387	245	\$2,198	\$8,300	3.8	26%
Boiler Plant and Tunnels	NA	977	\$8,768	\$35,000	4.0	25%
Subtotals →		3996	\$36,838	\$121,600	3.3	30%
Walt Sullivan Bldg	3,479	15	\$138	\$600	4.3	23%
Helena OMS	1,361	100	\$902	\$4,000	4.4	22%
Justice Building	2,672	41	\$475	\$2,200	4.6	21%
Old Livestock Bldg	387	130	\$1,265	\$6,000	4.7	21%
DPHHS	3,066	35	\$314	\$1,500	4.8	20%
Aviation Support Facility	4,152	588	\$5,237	\$26,000	5.0	20%
HQ Building	8,440	223	\$2,634	\$13,400	5.1	19%
Scott Hart	4,035	175	\$1,567	\$8,600	5.5	17%
Mitchell Bldg	6,304	116	\$1,037	\$6,000	5.8	16%
Subtotals →		1423	\$13,569	\$68,300	5.0	19%
Fish, Wildlife & Parks HQ	1,037	147	\$1,318	\$8,000	6.1	16%
Executive Residence	536	88	\$780	\$5,200	6.7	14%
5 Last Chance Gulch	1,387	75	\$689	\$4,600	6.7	14%
Historical Preservation	295	60	\$642	\$4,500	7.0	13%
FWP Parks	116	21	\$222	\$1,700	7.7	12%
Subtotals →		391	\$3,651	\$24,000	6.6	14%
Dept of Natural Resources	843	95	\$932	\$7,600	8.2	11%
Helena Job Service	1,423	55	\$488	\$4,600	9.4	9%
Diane Bldg	128	32	\$459	\$4,900	10.7	7%
Subtotals →		182	\$1,879	\$17,100	9.1	9%
Total	72,809	5,992	\$55,937	\$231,000	Wghtd Avg 4.1	Wghtd Avg 24%



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Extrapolation to Other Montana Buildings

- Statewide, Montana has ~ 2,000 Buildings
- Factors for Projections to Similar Facilities
 - Energy Savings ~ 8% of Heating Fuel
 - Energy Savings 4.6 kBtu/sf/yr
 - \$ Savings \$0.043/sf/yr
 - Payback 4.1 years
 - Return 24 %



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Lessons Learned

- Little Things are Important (3,500 items add up!)
- Why is insulation missing?
 - Damaged or removed during maintenance – not replaced
 - Never insulated (extent of insulation)
- Distribution Losses are Important!
 - (especially for district energy systems)



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Montana's Interest in the NIA Proposal

- **Governor Schweitzer's focus on efficiency in government**
- **Emphasis on energy efficiency in state agencies**
- **Green Jobs/Energy Economy**
- **Public-Private Partnership**





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Mechanical Insulation Fits with Current Projects

- **Governor's 20x10 Initiative**
- **DOA's on-going efforts to insulate mechanical systems**
- **DEQ's State Buildings Energy Conservation Program**





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Results from the Energy Appraisal

- **Excellent quality of the energy appraisal**
- **Well documented projects on a building-by-building basis**
- **Good cost data and energy savings estimates**
- **Sufficient detail to move directly into design**



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Additional Results from the Energy Appraisal

- **Small improvements add up**
- **3,500 small items in 25 buildings**
- **Energy Savings:**
 - **6 Billion BTUs per year**
 - **8% of total natural gas use in the buildings**
 - **Payback of 4.1 years at the 2010 gas price of \$8.97/dkt**
 - **Savings of \$55,937**



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Changing Results from the Energy Appraisal

- **Natural Gas Contract Re-Bid for 2011**
- **Costs decreased for 2011-2012**
- **Payback lengthened to 6.5 years**
- **Savings reduced to \$34,933 per year**
- **Still one of the most cost effective projects for the State Buildings Energy Conservation Program**



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Agency Commitment

- **Dept. of Administration – 22 buildings**
- **Dept. of Military Affairs – 1 building**
- **Dept. of Justice – 1 building, campus**
- **Dept. of Transportation – 1 building**



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Financing the Project

- **State Buildings Energy Conservation Program - Self-financed revolving program**
- **Cost estimate of \$160,000**
- **4-year agreement with DOA at 3% interest**
- **Some agencies will use their own money**





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Status of the Project

- Contract completed with an engineering firm to prepare the project for bid using the energy appraisal
- Open competitive solicitation this Spring
- Expect bids in May
- Work to be completed over the summer



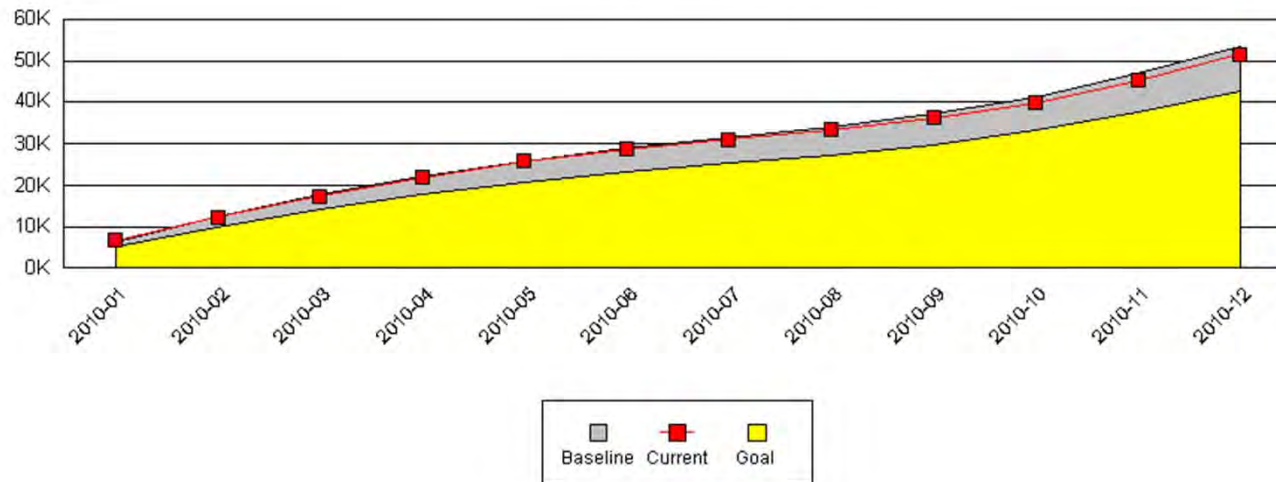


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Review of Savings

- EnergyCap database for all state buildings to review energy use before and after the project

Cumulative Energy Consumption

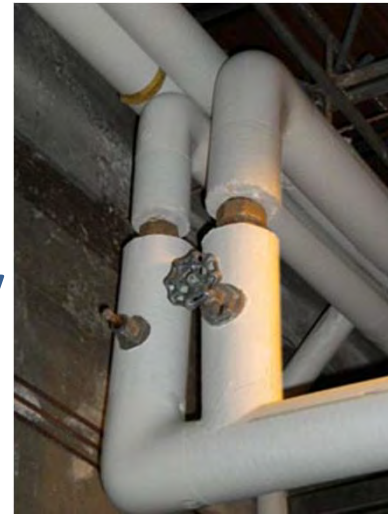




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Lessons Learned

- **Examine mechanical insulation regularly**
- **Repair in a timely manner**
- **Look for opportunities on all projects**
- **Small items add up-large savings from seemingly small items**





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Next Steps

- **Review state buildings for energy savings opportunities based on energy use and size**
- **Include mechanical insulation into current and planned energy projects**
- **Look at potential additional savings at executive branch agencies**
- **Work with universities for savings on eight campuses**



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Navigating State Government Agencies

- **State Architects**
- **General Services Divisions**
- **State Energy Offices**
 - **Variety of names for SEOs**
 - **32 states have Lead-by-Example Programs**
 - **Many have financing programs**





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State Energy Program – DOE Funded

- Every state and territory receives funds annually to reduce energy use in their state
- Many include efforts for state buildings
- Many also have initiatives for schools and local government buildings



Choteau County Courthouse
Photo by Nancy Thornton



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NASEO

- **NASEO – National Association of State Energy Officials**
- **Most states and territories are members of NASEO**
- **Excellent resource for connecting with and working with other states**
- **Affiliate members are welcome to be active members**
- **Annual conference in San Antonio, September 11-14**





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Conclusion

- **Montana had an excellent experience with the Mechanical Insulation Appraisal**
- **Committed to insulating 25 buildings in summer of 2011**
- **Expect to invest \$160,000 and recover that investment in 6 years**
- **Will continue to assess savings opportunities and insulate more buildings in the future**



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Thank You

For
Choosing Montana
and
Providing Excellent Technical Information

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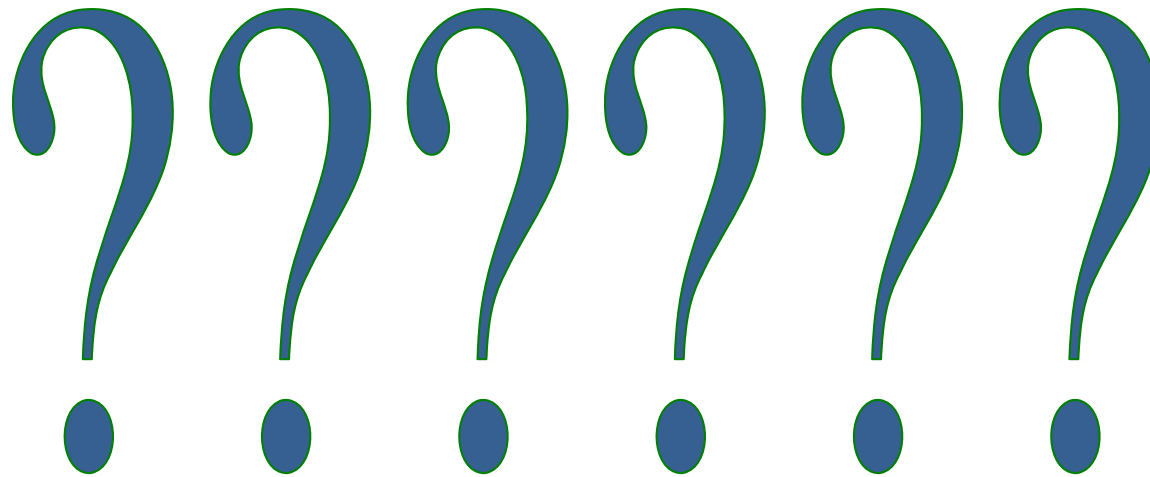
What is next?

- **Mechanical Insulation - Statewide Energy Assessment Program**
Currently in development with the National Association of State Energy Officials (NASEO)
- **Marketing 101 – Telling our story to government and private sector organizations (GSA, Real Estate Roundtable, USGBC, BOMA, etc.)**



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Questions





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This is an exciting time for our industry.

Mechanical insulation is finally receiving

Stay tuned, more to follow

and economic stimulus benefits.



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Thank You

