



APPLICATION INSTRUCTIONS

Please read the instructions below on how to use the Energy Loan Program application.

Step 1: Read Requirements for Participation.

Step 2: Complete the Application Authorization Form.

Step 3: Complete the Fuel Use Summary form.

Step 4: Complete the Energy Conservation Measure (ECM) worksheet(s) to calculate the savings. If you have an energy study completed, the energy study report may be used in lieu of ECM worksheets.

Step 5: Complete the ECM Summary form.

Step 6: **U.S. Mail Submission:** Print Application Authorization Form, Fuel Usage Summary form, ECM worksheets and ECM summary page. An authorized official must sign the Application Authorization Form and mail the original application and all supporting documents to the address below.

Electronic Submission: An authorized official must sign the Application Authorization Form. Print, scan, and e-mail the scanned Application Authorization Form with the electronic application to the address below.

Please Note: An authorized official is an individual with authority to obligate an eligible entity by signature to a loan agreement and promissory note to repay the loan.

Missouri Department of Economic Development
Division of Energy
Attn: Loan Program Clerk
P.O. Box 1766
301 W. High, Ste. 720
Jefferson City, MO 65102
Email: energy@ded.mo.gov

Please contact us at 1-855-522-2796 or energy@ded.mo.gov for assistance.

ECM WORKSHEETS

The hand-calculation friendly ECM worksheets included with this application are lighting, HVAC - heating, HVAC - cooling, insulation, pipe insulation (gas and electric), and thermostats. For window, dishwasher, and motor upgrade worksheets, please call us at 1-855-522-2796 for further assistance.

Requirements:

By completing and signing this loan application, you have agreed to abide by the Energy Loan Program requirements which may be viewed at: <http://energy.mo.gov/energy/communities/assistance-programs/energy-loan-program/energy-loan-program-application>

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INTRODUCTION

Loan financing may be used for a variety of energy saving investments, from which recipients may benefit from increased comfort in their buildings and reduced energy cost. Loan recipients repay loans with money saved on energy bills. Loans to public K-12 schools, city and county governments are not defined as debt, so loan financing does not count against debt limits or require a public vote or bond issuance. Loan principal and interest, plus any administrative fees, are repaid within a ten year period or less. Individual loan award amounts are based on estimated annual energy savings documented as part of the application process.

The requirements that follow are intended to encourage participation through an application process that requires minimal effort and cost but provides the best estimation of energy savings that are likely to result from the implementation of one or more energy efficiency or renewable energy measures.

The department may request additional information as needed to determine the feasibility of the project, the projected energy savings, and financial risk of the proposed loan application. Applicants must be an acceptable credit risk as determined by the department and capable of repaying the requested loan amount based on a financial risk analysis.

Energy Loan Program statutes may be found under RSMo 640.651 to 640.686. Energy Loan Program Rules are outlined in Title 4 CSR 340-2 dated April 30, 2015. This and other program information may be found at the department's website:

<http://energyloan.mo.gov>

APPLICATION CYCLE

Application cycle(s) information including cycle opening and closing dates, information designating eligible energy using sectors for each application cycle, allocation of total dollars available for loans in each designated energy using sector, and interest rates will be published periodically by the Division of Energy in the *"In-Additions"* section of the Missouri Register and through other public information methods.

An Application Cycle is the period of time each year that the department shall accept applications for financial loan assistance under the provisions of sections 640.651 to 640.686, RSMo. The availability of loan funds is determined for each loan cycle and is announced in the *"In-Additions"* section of the Missouri Register published by the Secretary of State. Application cycles and the availability of loan funds are also made known through other means such as trade shows, association meetings, emails and news articles.

ELIGIBLE ENERGY USING SECTORS FOR FY2016

Public K-12 Schools
City and County Governments including water and wastewater treatment facilities
Public and Private Institutions of Higher Education
Public and Private not-for-profit Hospitals

ELIGIBILITY REQUIREMENTS

The applicant's proposed project must be located within the borders of Missouri.

The applicant must own and operate the building or system proposed for energy saving improvements.

The building, facility or system proposed to receive Energy Conservation Measures (ECMs) must have a useful life and expected operational life greater than the loan repayment period as determined by the Division of Energy.

The applicant must not be in default or have a pending event of a default.

The applicant must have no outstanding or known unresolved actions for violations of applicable federal, state, or local laws, ordinances and rules.

The applicant is not presently debarred, suspended, proposed for debarment, declared ineligible, or otherwise excluded from covered transactions by any federal department or agency.

The applicant must be current on all taxes due and owed to the State of Missouri.

The proposed project must be in compliance with all state and federal environmental laws and permits.

The Department of Elementary and Secondary Education must certify that projects selected for loans are consistent with related state programs for K-12 public education facilities.

The Department of Health and Senior Services must certify that projects selected for loans are consistent with related health requirements for hospital facilities.

The Coordinating Board for Higher Education must certify that projects selected for loans are consistent with related state programs for institutions of higher education facilities.

ELIGIBLE PROJECTS

Loan funds may be used to finance the design, material and equipment acquisition, installation and commissioning of energy efficiency and renewable energy projects to reduce energy consumption and costs in (1) an existing structure; (2) proposed new construction; (3) any applicant-owned group of closely situated structural units that are centrally metered or served by a central utility plant; or (4) an eligible portion of any of these that includes an energy-using system.

For new construction, loans may be used to finance the incremental cost of implementing energy-saving measures that exceed the energy-efficiency standards established by local codes or the latest version of ASHRAE standard 90.1.

APPLICATION PROCESS

Requests for loan financing must be made using the Division of Energy's Energy Loan Program Application Authorization Form, Fuel Use Summary Form, Energy Conservation Measure (ECM) Summary and applicable ECM Worksheets. A Technical Assistance Report (TAR) (see below) may be required for projects that may not be suitable for the ECM Worksheets. A TAR is required for new building construction projects.

The Application Authorization Form must be signed and dated by an authorized official. An authorized official is an individual with authority to obligate an eligible entity by signature to a loan agreement and promissory note to repay the loan. A paper copy of the signed, original Application Authorization Form and required documents may be mailed to the DED/DE address below. An electronic copy of the signed, Application Authorization Form and required documents may be emailed to the address listed below.

The completed Application Authorization Form and required documents, must be received at the following address no later than the loan cycle closing date. Applications received after a designated closing date will not be considered for review or loan award but may be held for consideration during subsequent application cycles.

Missouri Department of Economic Development
Division of Energy
Attn: Loan Program Clerk
P.O. Box 1766
301 W. High, Ste. 720
Jefferson City, MO 65102
Email: energy@ded.mo.gov

TECHNICAL ASSISTANCE REPORT (TAR)

A Technical Assistance Report (TAR) is a specialized engineering report, subject to approval by the department, that identifies and specifies the quantity of energy savings and related energy cost savings that are likely to result from the implementation of one (1) or more energy conservation or renewable energy measures. The TAR need not be prepared by a professional engineer, if the department determines that the adequate performance of the TAR analysis for any project does not require engineering education, training, and experience. At a minimum a TAR shall contain the following items subject to the approval of the Division of Energy:

- Fuel usage summary and analysis of energy costs.
- Detailed description of each ECM.
- Detailed estimate of ECM cost of implementation.
- Detailed analysis of energy savings from each ECM.
- Simple pay back of each ECM.
- Cumulative simple pay back of all ECMs.
- An energy audit must meet the minimum of Level 2 audit per most recent ASHRAE Procedures For Commercial Building Energy Audits.

While a TAR may vary in length and form, the following references may be used as a guide in the preparation of the report:

- Missouri Division of Energy, 2014 Technical Energy Study (TES). Guidelines for Engineering Consultants Performing Energy Audits of Buildings. This guideline is available upon request.
- American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE), 2011. Procedures for Commercial Building Energy Audits, Second Edition.

ECM WORKSHEETS

The ECM Worksheets are a set of worksheets to qualify energy conservation measures for funding approval that have been proven cost-effective over time and, generally, do not require a more comprehensive analysis.

For the Energy Loan Program Application, at minimum, the following items must be submitted: Application Authorization form, Fuel Use Summary, ECM Summary and applicable ECM Worksheets.

Hand calculations or spreadsheets for simple ECMs may be accepted on a case-by-case basis. Modeling is not required when ECM Worksheets are appropriate.

ECM worksheets provide line by line instructions to guide in their completion. The following is a brief description for each worksheet:

- The Motor Upgrade worksheet is used to estimate energy savings for more efficient motor replacement. The worksheet is only applicable to constant load and same size motors. The worksheet is not applicable to pulsating loads, VFDs, random loads, or loads that cycle at rapidly repeating intervals. This worksheet is not included. Call (855) 522-2796 for assistance.
- The Wall or Ceiling Insulation worksheet is used to estimate the savings for an area to be insulated that has a uniform R-value over the entire area and in which the R-value to be added will be applied uniformly over this same area. If the R-value is not the same in all areas of the building or different R-values will be added to separate areas of the building, a worksheet must be used for each of the individual areas.
- The Pipe Insulation worksheets (Natural Gas and Electric) are used to estimate the savings for insulating heating pipes that serve radiators or fan coil units. Furnace rooms, crawlspaces, unheated areas and overheated rooms are typical for effective insulation applications. A Heat Loss Factor Table follows the Pipe Insulation Worksheet for reference. To use the worksheet, the heating and cooling distribution pipe must be in an area of constant temperature. The pipe distribution must be indoors.
- The Programmable Setback Thermostat worksheet is used to estimate the savings as a result of setting the heating thermostat to a lower value during a building's unoccupied hours.
- The Lighting/Motion Sensor worksheet is used to estimate the savings from a reduction in the number of lamps, lamp or ballast wattage, hours of use per year or a change to new efficient fixtures.
- The Windows Replacement/Reduction worksheet is used to estimate the savings from replacing inefficient windows with more efficient models or for the addition of storm windows. The worksheet is also used to estimate the savings from windows reduction. Reduced infiltration and improved U-values are included in the worksheet's computation method. This worksheet is not included. Call (855) 522-2796 for assistance.
- The Heating Plant Replacement worksheet is used to estimate the savings when installing a new more efficient furnace or boiler or when changing the energy sources used for heating. ECMs that reduce the overall heat load, such as insulation or window replacement, should be considered in conjunction with heating plant replacement. Efficiency of an old heating plant is assumed at 65 percent unless field-tested.
- The Cooling Plant Replacement worksheet is used to estimate the savings when installing new more efficient cooling units or when changing the energy sources used for cooling. ECMs that reduce the overall cooling load, such as insulation or window replacement, should be considered in conjunction with cooling plant replacement.
- The Dishwasher - Energy Star[®] worksheet is used to estimate savings when upgrading from a conventional dishwasher model to an **ENERGY STAR[®]** model. The worksheet is applicable for commercial-grade dishwashers with standard commercial rack size only. The worksheet is not applicable to residential units. This worksheet is not included. Call (855) 522-2796 for assistance.
- The Dishwasher - Other worksheet is used to estimate savings when upgrading to dishwashers that are not rated by **ENERGY STAR[®]**. The worksheet is applicable for commercial-grade dishwashers with standard commercial rack size only. The worksheet is not applicable to residential units. This worksheet is not included. Call (855) 522-2796 for assistance.

Vendor/Contractor quotes or other cost estimates can be used as a basis for ECM costs. Vendors/Contractors may assist in the completion of the worksheets. The worksheets are designed to provide conservative estimates of savings using a generalized computation approach.

The Division of Energy may request additional information as needed to determine the proposed project's feasibility and estimated energy savings.

SELECTION CRITERIA

Recipients of loan financing will be determined through a competitive process. Applications will be ranked based on the proposed project's payback score which is determined by dividing the cost to implement a project by the estimated energy cost savings. Projects with the lowest payback score will be funded until all available loan funds are allocated.

PROJECT START DATE

Projects will not be considered that were completed prior to the official loan cycle announcement date. An applicant may submit an application and start a project at any time but SUBMISSION OF AN APPLICATION DOES NOT GUARANTEE LOAN FINANCING. (**Refer to Reimbursement Requirements**)

TERMS OF LOAN

The Division of Energy determines loan interest rates and other fees for each loan cycle – typically from two to four percent. Interest rates for each loan cycle are announced in the “*In Additions*” section of the Missouri register.

Loans (including interest and fees) are repaid within a ten year period or less. Loans will not be made that have a payback period of less than six months.

Loan payments are made on a bi-annual schedule. Invoices for bi-annual payments are issued by DE two months prior to each payment due date. Late payments may be subject to additional charges. Once a loan is fully paid, the “paid” Promissory Note will be returned to the recipient. Loan documents and records must be retained for three years from date of final payment.

REIMBURSEMENT REQUIREMENTS

Once construction is complete, a Final Project Cost Report and Reimbursement Request with supporting documentation (invoices/receipts for goods and services purchased for the project, copies of canceled checks, and itemized accounting) must be submitted within 30 days.

Invoices for work, goods, or services with dates prior to the cycle announcement date will not be reimbursed. The Division will perform a final inspection and complete all close-out documentation prior to reimbursement. Once this process is complete, the reimbursement will be forwarded and a Promissory Note and final amortization will be sent to you. Your first payment will be due to the Division of Energy no more than 150 days from the date of reimbursement.

FOR ASSISTANCE

Division of Energy loan staff is available to answer questions about the application process and technical requirements for submission of a loan application:

Phone: (855) 522-2796

<http://energyloan.mo.gov>



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
APPLICATION AUTHORIZATION FORM

1. SECTOR			
<input type="checkbox"/> School K-12 <input type="checkbox"/> Local Government <input type="checkbox"/> Higher Education <input type="checkbox"/> Other, please specify: _____			
2. HOW DID YOU FIND US? (CHECK ALL THAT APPLY)			
<input type="checkbox"/> Website <input type="checkbox"/> Meeting/Event <input type="checkbox"/> Direct Mail <input type="checkbox"/> Colleague <input type="checkbox"/> Other, please specify: _____			
3. ORGANIZATION NAME			4. Federal Tax ID (EIN) Number:
5. NUMBER OF PEOPLE (students, staff, patients, customers, general public) THAT WOULD BENEFIT FROM THE IMPLEMENTATION OF THIS ENERGY PROJECT		6. MAILING ADDRESS	
7. COUNTY		8. CITY	9. ZIP + 4
10. CONTACT NAME	11. TITLE	12. PHONE NUMBER	13. FAX NUMBER
14. E-MAIL ADDRESS	15. TOTAL PROPOSED PROJECT COST		16. TOTAL LOAN AMOUNT REQUESTED
17. PROJECT TYPE <input type="checkbox"/> Building <input type="checkbox"/> System, specify: _____	18. ESTIMATED START DATE	19. ESTIMATED PROJECT COMPLETION DATE	
20. PROJECT LOCATION (ATTACH LIST OR MAP FOR MULTIPLE LOCATIONS)			21. ESTIMATED ANNUAL ENERGY COST SAVINGS
BUILDING SPECIFIC INFORMATION: FOR MULTIPLE BUILDINGS, USE ADDITIONAL PAGES - INCLUDE INFORMATION FOR ITEMS 22 - 36			
22. TOTAL BUILDING AREA IN SQUARE FEET	23. TOTAL AFFECTED BUILDING AREA IN SQUARE FEET		24. APPROXIMATE NO. OF BUILDING OCCUPANTS
FOR ORIGINAL BUILDING	25. YEAR OF CONSTRUCTION	26. HEATED AREA IN SQUARE FEET	27. COOLED AREA IN SQUARE FEET
FOR ADDITION #1	28. YEAR OF CONSTRUCTION	29. HEATED AREA IN SQUARE FEET	30. COOLED AREA IN SQUARE FEET
FOR ADDITION #2	31. YEAR OF CONSTRUCTION	32. HEATED AREA IN SQUARE FEET	33. COOLED AREA IN SQUARE FEET
FOR ADDITION #3	34. YEAR OF CONSTRUCTION	35. HEATED AREA IN SQUARE FEET	36. COOLED AREA IN SQUARE FEET
37. NAME, TITLE, COMPANY, AND PHONE NUMBER OF ENERGY ANALYST OR OTHERS WHO PREPARED ENERGY SAVINGS CALCULATIONS			
38. BUSINESS TYPE NAMED IN 37 ABOVE			
<input type="checkbox"/> Applicant <input type="checkbox"/> Engineering <input type="checkbox"/> ESCO <input type="checkbox"/> Other, please specify: _____			
APPROPRIATE DISTRICT NUMBERS BASED ON THE APPLICANT'S LOCATION	39. U.S. CONGRESSIONAL DISTRICT	40. MO SENATORIAL DISTRICT	41. MO LEGISLATIVE DISTRICT
<p>The governing board or body has reviewed the ECM Summary and agrees that the building or system information is correct and the project and associated energy conservation measures have been correctly described. Any scanned or photocopied version of the signed original Application Authorization Form shall be considered original, and the governing board or body hereby waives any applicable objection on this basis. The governing board or body authorizes the contact person, named above, to provide any additional information relevant to the review and/or approval of this application.</p> <p>The building, facility or system is owned and operated by the applicant. <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Is the completion of this project contingent on DED/DE Energy Loan Program financing? <input type="checkbox"/> Yes <input type="checkbox"/> No</p>			
By signing this form, you have agreed to and understand the "Requirements" specified on the instruction page.			
PRINT NAME AND TITLE OF AUTHORIZED OFFICIAL	SIGNATURE OF AUTHORIZED OFFICIAL		DATE

AUTHORIZATION FORM INSTRUCTIONS

We recommend that loan applicants contact a Division of Energy loan manager before completing an application. A loan manager can be reached at 1-855-522-2796.

Below are instructions for selected Application Authorization Form fields.

6-9. Enter the information for the organization's administrative office location.

10-14. Enter the contact person's information. The contact person is the individual who can answer the majority of the questions related to this application.

15. Enter the total project cost for all energy conservation measures. This can include reasonable fees for design and commissioning.

17. Select the project type. If selecting "System," give a short description, such as motors or traffic signals.

18-19. Enter the planned start and completion dates of construction activities.

20. Some projects may include several building and/or system locations. Enter the total number of buildings or locations that will be directly affected by the proposed project. If a list or map is needed, enter "see attached."

21. Enter the estimated annual energy cost savings calculated on the Energy Conservation Measure (ECM) Summary.

22. Enter the total area of the building that is served by the utility meters on the Fuel Use Summary.

23. Enter the area of the building that will be affected by energy conservation measures.

37. Enter the contact information for those who provided the technical documentation.

38. Select the business type of the energy analyst identified in 37. If selecting "Other," please describe.

39-41. Enter the appropriate district numbers based on the applicant's location.

An authorized official must sign and date the application. An authorized official is an individual with authority to obligate an eligible entity by signature to a loan agreement and promissory note to repay the loan. Please understand that this is an application only, and it does not obligate your organization to accept a loan, if approved by the Division of Energy.

U.S. Mail Submission: Print Application Authorization Form, Fuel Usage Summary form, ECM worksheets and ECM summary page. Sign the Application Authorization Form and mail the original application and all supporting documents to the address below.

Electronic Submission: Print, sign, and scan the Application Authorization Form. Email the scanned Application Authorization Form with the electronic application to the address below.

Missouri Department of Economic Development
Division of Energy
Attn: Loan Program Clerk
P.O. Box 1766
301 W. High, Ste. 720
Jefferson City, MO 65102
Email: energy@ded.mo.gov

FUEL USE SUMMARY - INSTRUCTION

Please complete an individual fuel usage summary for each meter with proposed energy conservation measures.

Please complete the Fuel Use Summary using data from the most recent 12 months of energy bills. Copies of those energy bills must be submitted with the application.

FUEL USE SUMMARY FOR MULTIPLE METERS

If the project involves more than one meter, please fill out a Fuel Use Summary for each meter.

CONVERSION TABLE

The table below contains conversion information necessary to compute the cost of a million Btu (MMBtu) for each fuel. To use the table, find the relevant fuel type, determine the cost per unit of that fuel and multiply by the appropriate conversion number to obtain the cost per MMBtu.

<u>Fuel Type</u>	<u>Abbreviation</u>	<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
Electricity	E	\$/Kwh	293	\$/MMBtu
Natural Gas	NG	\$/Therm	10	\$/MMBtu
Natural Gas	NG	\$/CCF	10	\$/MMBtu
Propane	LPG	\$/Gallon	10.9	\$/MMBtu
Oil	Oil	\$/Gallon	7.2	\$/MMBtu
Coal	Coal	\$/Ton	0.045	\$/MMBtu
Wood	Wood	\$/Cord	0.045	\$/MMBtu



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
ENERGY CONSERVATION MEASURE (ECM) SUMMARY

Applicant Organization Name						
#	ECM Description	Project Cost (a)	Annual Fuel Savings (b)	Fuel Type	Annual Cost Savings (c)	Simple Pay Back (a) ÷ (c)
1		\$		kWh	\$	
				MMBtu		
2		\$		kWh	\$	
				MMBtu		
3		\$		kWh	\$	
				MMBtu		
4		\$		kWh	\$	
				MMBtu		
5		\$		kWh	\$	
				MMBtu		
6		\$		kWh	\$	
				MMBtu		
7		\$		kWh	\$	
				MMBtu		
8		\$		kWh	\$	
				MMBtu		
9		\$		kWh	\$	
				MMBtu		
10		\$		kWh	\$	
				MMBtu		
Summary		\$		kWh	\$	
				MMBtu		

INSTRUCTIONS

Enter a list of proposed energy conservation measures on this sheet. For further assistance, please contact Energy Loan Program at 1-855-522-2796.



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
LIGHTING/MOTION SENSOR WORKSHEET

Building	Location	Date
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INSTRUCTIONS

To estimate the savings when more efficient lighting is installed, the following information must be known:

The number of existing fixtures being changed.	The number of new fixtures.
The wattage of each existing fixture.	The wattage of each new fixture.
The number of hours of use per year in the past.	The number of hours of use per year in the future.
The cost per kilowatt hour of electricity.	

Please Note:
 If the projects involve several buildings or meters, please submit one worksheet per building or per meter.
 If the project involves several types of fixtures, please submit one worksheet per type.
 Please find example of hours of use under the Additional Instruction section (Page 2).

ATTENTION

*****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.*****

SAVINGS CALCULATIONS

1. Enter the number of existing fixtures being changed Fixtures

2. Enter the wattage of each existing fixture (Input wattages) Watts

3. Enter the hours of use below:

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	# Weeks	Total
Normal Schedule									
Alternate Schedule 1									
Alternate Schedule 2									
								Total	

Hours

4. Multiply (line 1 x line 2) by the total of line 3 kWh/year

5. Enter the number of new fixtures Fixtures

6. Enter the wattage of each new fixture (Input wattages) Watts

7. Enter the new hours of use (reduced hours based on lighting controls if applicable)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	# Weeks	Total
Normal Schedule									
Alternate Schedule 1									
Alternate Schedule 2									
								Total	

Hours

8. Multiply (line 5 x line 6) by the total of line 7 kWh/year

9. Savings: Subtract line 8 from line 4 kWh/year

10. Enter the energy cost (Based on the Fuel Use Summary) \$/kWh

ANNUAL SAVINGS

11. Multiply line 9 by line 10 \$/Year

PROJECT COST

12. Enter the total cost of the project including material, labor and design

SIMPLE PAYBACK

13. Divide line 12 by line 11 Years

DESCRIPTION PAGE**Lighting/Motion Sensor Energy Conservation Measure**

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):

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ADDITIONAL INSTRUCTION

This additional instruction provides an example to fill out the hours of use schedule.

Example: The school has a regular schedule to have the lights on from 7:30 AM - 4:30 PM (9 hours) the entire week for 36 weeks a year while in session. The school has an alternate schedule to have the lights on from 7:30 AM - 4:30 PM (9 hours) on Monday, Wednesday and Friday for 8 weeks a year in summer session. The school has another alternate schedule to have the lights on from 7:30 AM - 12:30 PM (5 hours) from Monday to Friday for 4 weeks a year during breaks. The hours of use can be entered below:

3. Enter the hours of use below:

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	# Weeks	Total
Normal Schedule	9	9	9	9	9	9	9	36	2268
Alternate Schedule 1	9	0	9	0	9	0	0	8	216
Alternate Schedule 2	5	5	5	5	5	0	0	4	100
								Total	2584

Hours

The total calculation is a sum of each schedule multiplied by the number of weeks. Total number of weeks should be totaled for 52 weeks. All schedules are sub-totaled adding hours of use Monday - Sunday. For this example, the "Normal Schedule" total is calculated by $(9 + 9 + 9 + 9 + 9 + 9 + 9 + 9) \times 36 = 2,268$ hours. The "Alternate Schedule 1" is calculated by $(9 + 0 + 9 + 0 + 9 + 0 + 0) \times 8 = 216$ hours. The "Alternate Schedule 2" is calculated by $(5 + 5 + 5 + 5 + 5 + 0 + 0) \times 4 = 100$ hours. The total for all schedules is $2,268 + 216 + 100 = 2,584$ hours.

The school plans to install motion sensors. The motion sensors help reduce the hours of use during the weekend while in session. The lights will only be on for cleaning and maintenance for a total of 1 hour each day during the weekend. To enter item 6 on the worksheet, the "Normal Schedule" is changed from 9 hours to 1 hour on Saturday and Sunday.

6. Enter the new hours of use (reduced hours based on lighting controls)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	# Weeks	Total
Normal Schedule	9	9	9	9	9	1	1	36	1692
Alternate Schedule 1	9	0	9	0	9	0	0	8	216
Alternate Schedule 2	5	5	5	5	5	0	0	4	100
								Total	2008

Hours



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
COOLING PLANT REPLACEMENT WORKSHEET

Building	Location	Date

INSTRUCTIONS

To estimate the savings possible from a cooling plant replacement that is intended to increase the efficiency and/or change energy sources, the following information must be known:
 The annual cooling cost.
 The efficiency of the existing cooling plant [SEER, EER, COP or (1/kw per ton)].
 The efficiency of the proposed cooling plant [SEER, EER, COP or (1/kw per ton)]. (Use same type rating as above.)
 The existing energy cost (\$/million Btu).
 The proposed energy cost (\$/million Btu).

Please Note:

The worksheet is not applicable to estimate the savings for Variable Air Volume (VAV), Constant Air Volume (CAV) or other commercial building systems that perform cooling year round.

Item 5. If the rating is SEER or EER, use the conversion table below (Page 2).

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

SAVINGS CALCULATIONS

1. Total the four energy bills where cooling is included (e.g. June through September) and enter that amount \$
2. Enter the amount of the neutral month (e.g., May) energy bill \$
3. Multiply line 2 by 4.0 \$
4. Subtract line 3 from line 1 - ANNUAL COOLING COST \$
5. Enter the SEER, EER, COP, or (1/kw per ton) for the existing cooling plant
6. Multiply line 4 by line 5 \$
7. Enter the SEER, EER, COP, or (1/kw per ton) for the proposed cooling plant (same type rating as line 5)
8. Divide line 6 by line 7 - PROJECTED ANNUAL COOLING COST \$

AREAS AFFECTED

9. Total area cooled by meter ft²
10. Area affected by the proposed project ft²
11. Divide line 9 by line 10

ANNUAL SAVINGS

12. Subtract line 8 from line 4 and multiply by line 11 - ANNUAL COOLING SAVINGS \$ /Year

PROJECT COST

13. Enter the total cost for the proposed project including material, labor, and design \$

SIMPLE PAYBACK

14. Divide line 13 by line 12 Years

DESCRIPTION PAGE**Cooling Plant Replacement Energy Conservation Measure**

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):

SEER RATING TABLE

If your SEER for cooling equipment is unknown, please use the estimated formula in the table to estimate your SEER rating. Based on a study published by Oak Ridge National Laboratory, the cooling efficiencies in SEER can be estimated by the manufactured date.

Central Air Conditioner or Heat Pump Cooling Efficiency (SEER)	
1970 and earlier	SEER = 6.0
1971 - 1996	SEER = 9.5 + 0.1786 x (year manufactured - 1990)
1997 - 2002	SEER = 10.75 + 0.0750 x (year manufactured - 1997)
2003 - 2007	SEER = 11.2 + 0.3600 x (year manufactured - 2003)
2008 and later	SEER = 13.0

Reference: Oak Ridge National Laboratory, September 7, 2007

COP CONVERSION TABLE

Conversion Formula
COP = SEER x 0.293 = EER / 3.142



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
HEATING PLANT REPLACEMENT WORKSHEET

Building	Location	Date
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INSTRUCTIONS

To estimate the savings possible from a heating plant replacement that is intended to increase the efficiency and/or change energy sources, the following information must be known:
 The annual heating cost.
 The efficiency of the existing heating plant (in percent).
 The efficiency of the proposed heating plant (in percent).
 The existing energy cost (\$/million Btu).
 The proposed energy cost (\$/million Btu).

ATTENTION

*****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.*****

SAVINGS CALCULATIONS

1. Total the seven energy bills where heating is included in (e.g. Oct. through April) and enter that amount		\$ <input style="width:80%;" type="text"/>
2. Enter the amount of the neutral month (i.e., May) energy bill		\$ <input style="width:80%;" type="text"/>
3. Multiply line 2 by 7.0	\$ <input style="width:80%;" type="text"/>	
4. Subtract line 3 from line 1 - ANNUAL HEATING COST	\$ <input style="width:80%;" type="text"/>	
5. Enter the efficiency for the existing heating plant (in percent)		<input style="width:80%;" type="text"/>
6. Multiply line 4 by line 5	\$ <input style="width:80%;" type="text"/>	
7. Enter the efficiency for the proposed heating plant (in percent)		<input style="width:80%;" type="text"/>
8. Divide line 6 by line 7 - PROJECTED ANNUAL HEATING COST	\$ <input style="width:80%;" type="text"/>	
If changing fuel source adjust PROJECTED ANNUAL HEATING COST as follows:		
9. Enter the existing energy cost (\$/million BTU)		\$ <input style="width:80%;" type="text"/>
10. Enter the proposed energy cost (\$/million BTU)		\$ <input style="width:80%;" type="text"/>
11. Divide line 10 by line 9	\$ <input style="width:80%;" type="text"/>	
12. Multiply line 8 by line 11 - AMENDED PROJECTED HEATING COST	\$ <input style="width:80%;" type="text"/>	

AREAS AFFECTED

13. Total area heated by meter		<input style="width:80%;" type="text"/> ft ²
14. Area affected by the proposed project		<input style="width:80%;" type="text"/> ft ²
15. Divide line 14 by line 13	<input style="width:80%;" type="text"/>	

ANNUAL SAVINGS

16. Subtract line 8 (if no change in energy source) or line 12 (if a change in fuel source) from line 4 and multiply by line 15 - ANNUAL HEATING SAVINGS		\$ <input style="width:80%;" type="text"/> /Year
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PROJECT COST

17. Enter the total cost for the proposed project including material, labor, and design		\$ <input style="width:80%;" type="text"/>
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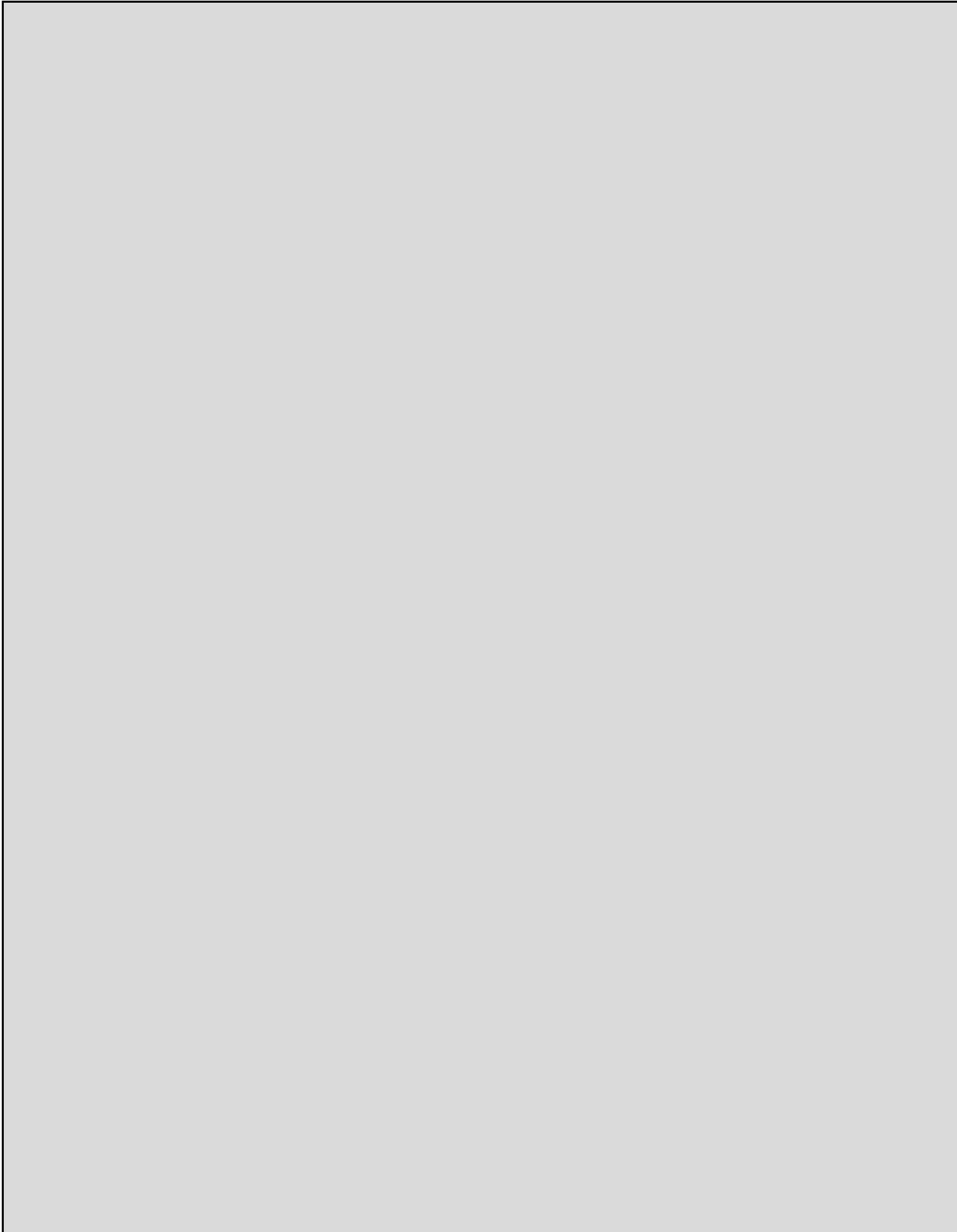
SIMPLE PAYBACK

18. Divide line 17 by line 16		<input style="width:80%;" type="text"/> Years
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DESCRIPTION PAGE

Heating Plant Replacement Energy Conservation Measure

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):





MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
WINDOWS REPLACEMENT/REDUCTION WORKSHEET

Building	Location	Date
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INSTRUCTIONS

To estimate the savings of windows/doors replacement/reduction, the following information must be known:
 The R-Value of the new wall (Window reduction only). U-Value=1/R-Value The energy cost (\$/million Btu).
 Type of the existing and new window (See U-Value table below) The heating/cooling plant efficiency (in percent).
 The total area of the windows being replaced (Square feet). For heating/cooling plant efficiency, see additional instruction section.

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

SAVINGS CALCULATIONS INPUT

<p>Existing Windows</p> <p>1. Enter existing windows area <input style="width: 100px;" type="text"/> sq.ft.</p> <p>2. <input type="text" value="Single Glazing - 1/8 in. glass"/> ▼</p> <p>3. <input type="text" value="Operable - Aluminum with Thermal Break"/> ▼</p> <p>4. <input type="text" value="Select storm window"/> ▼</p> <p>5. <input type="text" value="Tight - Construction supervised by air-sealing specialist"/> ▼</p> <p>6. U-Value of existing windows <input style="background-color: #f8d7da;" type="text" value="Select items above"/></p>	<p>New Windows</p> <p>7. Enter new windows area <input style="width: 100px;" type="text"/> sq.ft.</p> <p>8. <input type="text" value="Select the glass type"/> ▼</p> <p>9. <input type="text" value="Select type of windows"/> ▼</p> <p>10. <input type="text" value="Select storm window"/> ▼</p> <p>11. <input type="text" value="Select leakage level"/> ▼</p> <p>12. U-Value of new windows <input style="background-color: #f8d7da;" type="text" value="Select items above"/></p>
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<p>New Wall (Window Reduction)</p> <p>13. Enter new wall area <input style="width: 100px;" type="text"/> sq.ft.</p> <p>14. Enter R-Value of the new wall frame <input style="width: 100px;" type="text"/></p> <p>15. Enter R-Value of additional insulation <input style="width: 100px;" type="text"/></p> <p>16. <input type="text" value="Select leakage level"/> ▼</p> <p>17. Total U-Value of the new wall</p> <p style="text-align: center;"><input style="background-color: #f8d7da;" type="text" value="Enter items above"/></p>	<p>Building Characteristics</p> <p>18. Enter average building height <input style="width: 100px;" type="text"/> feet</p> <p>19. <input type="text" value="Choose nearest city"/> ▼</p> <p>20. <input type="text" value="Select the type of cooling/heating system"/> ▼</p> <p>21. <input type="text" value="Select the energy consumption type"/> ▼</p>
--	--

ANNUAL SAVINGS

	Energy unit savings	Energy cost savings
22. Savings in Summer		
23. Savings in Winter		

PROJECT COST AND SIMPLE PAYBACK

24 Enter the total cost (Including material, labor and design) <input style="width: 100px;" type="text"/>	Total Annual Savings /Year	Simple Payback years
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ENERGY SAVINGS CALCULATION (DED/DE INTERNAL USE ONLY)

	Existing Windows	New Windows	New Wall
Leakage			
25. Unit Leakage Areas in ² /ft ²	0.01		
26. Average Leakage, in ²	0		
Summer			
27. IDF			
28. Infiltration airflow rate	CFM	CFM	CFM
29. Sensible heat loss through leaks	Btu/h	Btu/h	Btu/h
30. Latent heat loss through leaks	Btu/h	Btu/h	Btu/h
31. Calculate the energy loss total	MMBtu	MMBtu	MMBtu
Winter			
32. IDF			
33. Infiltration airflow rate	CFM	CFM	CFM
34. Sensible heat loss through leaks	Btu/h	Btu/h	Btu/h
35. Calculate the energy loss total	MMBtu	MMBtu	MMBtu

DESCRIPTION PAGE

Windows/Doors Replacement/Reduction Energy Conservation Measure

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):

ADDITIONAL INSTRUCTIONS

Item 21. The efficiency can be from the nameplate data including (but not limited to) AFUE, COP, percentage from btu out/btu in, percentage ratio of efficiency. For example, if the percentage ratio efficiency is 80%, please enter 80. If the COP of the cooling plant efficiency is 2.5, please enter 250%.

If your SEER for cooling equipment is unknown, please use the estimated formula in the table to estimate your SEER rating. Based on a study published by Oak Ridge National Laboratory, the cooling efficiencies in SEER can be estimated by the manufactured date.

Central Air Conditioner or Heat Pump Cooling Efficiency (SEER)	
1970 and earlier	SEER = 6.0
1971 - 1996	SEER = 9.5 + 0.1786 x (year manufactured - 1990)
1997 - 2002	SEER = 10.75 + 0.0750 x (year manufactured - 1997)
2003 - 2007	SEER = 11.2 + 0.3600 x (year manufactured - 2003)
2008 and later	SEER = 13.0

Reference: Oak Ridge National Laboratory, September 7, 2007

COP CONVERSION TABLE

Conversion Formula
$COP = SEER \times 0.293 = EER / 3.142$



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
WALL OR CEILING INSULATION WORKSHEET

Building	Location	Date
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CHECK THE TYPE OF INSULATION PROJECT UNDER CONSIDERATION

Attic
 Crawl Space
 Wall
 Roof
 Other, please specify:

INSTRUCTIONS

To estimate the savings of adding insulation to the ceiling or wall, the following information must be known:

The area of the insulation in square feet.	The heating/cooling plant efficiency (percentage).
The old R-value and the new total R-value.	The heating energy cost (\$/million BTU)/cooling energy cost (\$/kWh).

Please Note:

Multiple Buildings. If the project involves multiple buildings, please submit one worksheet per building.

Item 9. The efficiency can be obtained from the nameplate data including (but not limited to) AFUE, percentage from btu out/btu in or percentage ratio of efficiency. For example, if the percentage ratio efficiency is 80%, please enter 80.

Item 10. For SEER and EER rating, please use the COP conversion (Page 2).

Item 13-14. Degree Days Table provides Heating Degree Days (HDD) and Cooling Degree Days (CDD) depending on location. If the HDD and CDD are known, the numbers may be entered.

ATTENTION

The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.

SAVINGS CALCULATIONS

1. Enter the old R-value	<input style="width:95%;" type="text"/>
2. Enter the R-value of the proposed insulation	<input style="width:95%;" type="text"/>
3. Subtract line 2 from line 1	0
4. Multiply line 1 by line 2	0
5. Divide line 3 by line 4 (U-Value of the insulation improvement)	<input style="width:95%;" type="text"/>
6. Choose the characteristic of insulation installation	Choose Type of Insulation ▼
7. Enter characteristic of insulation installation factor (1 for continuous, 0.75 for non-continuous)	<input style="width:95%;" type="text"/>
8. Enter efficiency of the heating plant	<input style="width:95%;" type="text"/> Percent
9. Enter COP of the cooling plant If the rating is EER or SEER, use the conversion table below (page 2).	<input style="width:95%;" type="text"/>
10. Enter subject area to be insulated (Attic, Crawl Space, Wall, Roof, others)	<input style="width:95%;" type="text"/> ft ²
11. Choose the location nearest the building	Choose nearest city ▼
12. Enter Heating Degree Days (if unknown, Use Degree Days table)	<input style="width:95%;" type="text"/>
13. Enter Cooling Degree Days (if unknown, Use Degree Days table)	<input style="width:95%;" type="text"/>
14. Multiply (0.77 x line 5 x line 7 x line 10 x line 12 x 24) and divide by line 8, then by 1,000,000 (Heating Savings Reduction)	<input style="width:95%;" type="text"/> MMBtu/Year
15. Multiply (line 5 x line 7 x line 10 x line 12 x 24) and divide by line 9, then by 3412 (Cooling Savings Reduction)	<input style="width:95%;" type="text"/> kWh/Year

ENERGY COST

16. Enter energy cost for heating (\$/MMBtu)	\$ <input style="width:95%;" type="text"/> \$/MMBtu
17. Enter energy cost for cooling (\$/kWh)	\$ <input style="width:95%;" type="text"/> \$/kWh
18. Multiply line 14 by line 16 (Heating Cost Savings)	\$ <input style="width:95%;" type="text"/>
19. Multiply line 15 by line 17 (Cooling Cost Savings)	\$ <input style="width:95%;" type="text"/>

ANNUAL SAVINGS

20. Add line 18 and line 19 (Annual Cost Savings)	\$ <input style="width:95%;" type="text"/> \$/Year
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PROJECT COST

21. Enter the total cost of the project including material, labor, and design	\$ <input style="width:95%;" type="text"/>
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SIMPLE PAYBACK

22. Divide line 21 by line 20	<input style="width:95%;" type="text"/> Years
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DESCRIPTION PAGE**Wall or Ceiling Insulation Energy Conservation Measure**

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):

DEGREE DAY TABLE

Please use this "Degree Day Table" to determine "Degree Days" for item 12 and 13 in the Wall or Ceiling Insulation Worksheet.

City	Degree Days (65F)	
	Heating	Cooling
Columbia	5078	1269
Kansas City	5161	1421
St. Louis	4750	1475
St. Joseph	5435	1334
Springfield	4570	1382

SEER RATING TABLE

If your SEER for cooling equipment is unknown, please use the estimated formula in the table to estimate your SEER rating. Based on a study published by Oak Ridge National Laboratory, the cooling efficiencies in SEER can be estimated by the manufactured date.

Central Air Conditioner or Heat Pump Cooling Efficiency (SEER)	
1970 and earlier	SEER = 6.0
1971 - 1996	SEER = 9.5 + 0.1786 x (year manufactured - 1990)
1997 - 2002	SEER = 10.75 + 0.0750 x (year manufactured - 1997)
2003 - 2007	SEER = 11.2 + 0.3600 x (year manufactured - 2003)
2008 and later	SEER = 13.0

Reference: Oak Ridge National Laboratory, September 7, 2007

COP CONVERSION TABLE

Conversion Formula
$COP = SEER \times 0.293 = EER / 3.142$



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURES
DISHWASHER WORKSHEET - ENERGY STAR®

Building	Location	Date

INSTRUCTIONS

This sheet is for a dishwasher upgrade from a conventional model to an **ENERGY STAR®** model. To estimate the savings of dishwasher replacement, the following information must be known:

- | | |
|--|---|
| Type of dishwasher. | Average daily operations (hours). |
| Number of racks washed per day. | Quantity of dishwashers. |
| Operating days per year. | The electricity energy cost (\$/kWh). |
| Building hot water and booster heater fuel type. | The natural gas energy cost (\$/MMBtu). |

Please Note:

If the project involves several dishwashers, please submit one sheet for each characteristic of use (i.e. different number of loads, operating days).

This worksheet is applicable for commercial-grade dishwashers with standard commercial rack size only. This worksheet is not applicable to residential units.

High temperature dishwasher is with a booster. Low temperature dishwasher is without a booster.

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

DISHWASHER HOT WATER SAVINGS CALCULATION

1. Select type of Dishwasher List of dishwasher <input type="text"/>	2. Racks washed per day <input type="text"/>	3. Operating days per year <input type="text"/>
4. Building hot water fuel type <input type="text"/>	5. Booster water heater fuel type <input type="text"/>	6. Average Daily Operation (hours) <input type="text"/>
7. Number of Dishwashers <input type="text"/>	8. Electric rate (\$/kWh) \$ <input type="text"/>	9. Gas rate (\$/MMBtu) \$ <input type="text"/>

ANNUAL SAVINGS

Savings		
Electricity (kWh)	Natural Gas (MMBtu)	Annual Cost Savings
0.00	0.00	\$0.00 /Year

Assumption:

- Water heater efficiency ratings are 98% for electric and 80% for natural gas.
- The inlet water temperature increase for the building water heater is at 70 °F.
- The inlet water temperature increase for the booster water heater is at 40 °F.

Reference: http://www.energystar.gov/certified-products/detail/commercial_dishwashers

PROJECT COST

10. Enter the total cost of the proposed project including material, labor, and design

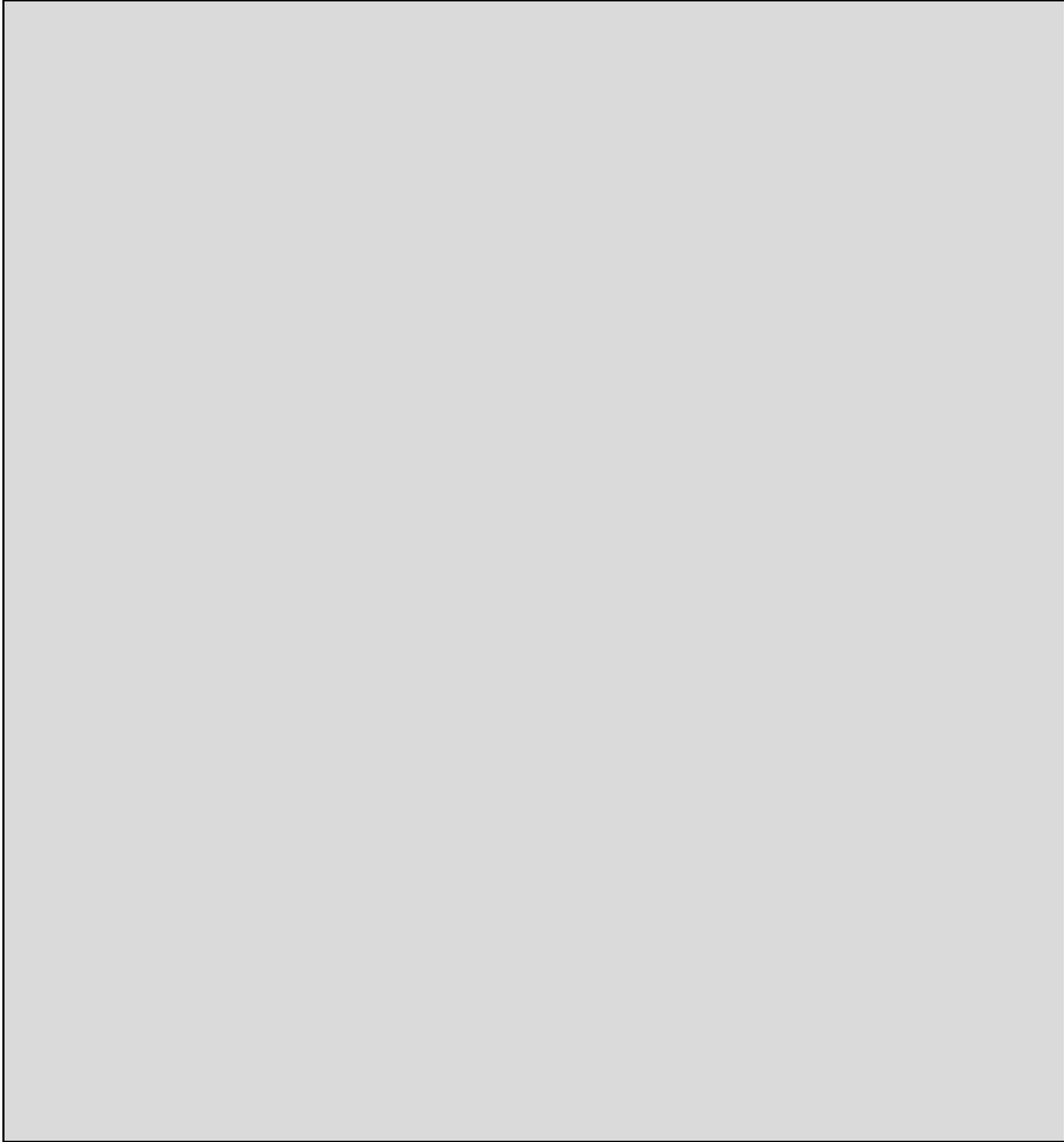
SIMPLE PAYBACK

11. Estimated simple payback period

DESCRIPTION PAGE

Dishwasher - Energy Star Energy® Conservation Measure

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):





MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
PIPE INSULATION WORKSHEET - NATURAL GAS SAVINGS

Building	Location	Date

INSTRUCTIONS

To estimate the savings of adding insulation to the outside of heat distribution pipes, the following information must be known:

The interior pipe diameter.	Bare pipe heat loss factor (use Heat Loss Factor Table).
The total length (feet) of pipe to be insulated.	Thickness of added insulation.
The pipe fluid temperature (°F).	Insulated pipe heat loss factor (use Heat Loss Factor Table).
The pipe room temperature (°F).	Heating plant efficiency (in percent).
The hours of use per day.	The energy cost (\$/MMBtu).

Please Note:
 To use this worksheet, the heating and cooling distribution pipe must be at a constant temperature. The pipe distribution must be indoors.
 If the project involves several buildings, please submit one worksheet per building.
 If more than one pipe condition is used in summer and winter, please submit one worksheet per season.
Item 5. Please enter interior temperature or the thermostat setpoint.
Item 10. The efficiency can be from the boiler nameplate data including (but not limited to) AFUE percentage, percentage from btu out/btu in or percentage ratio of efficiency. For example, if the percentage ratio efficiency is 80%, please enter 80.

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

SAVINGS CALCULATIONS

1. Enter the bare pipe heat loss factor (use Heat Loss Factor Table)	<input type="text"/>	
2. Enter the insulated pipe heat loss factor (use Heat Loss Factor Table)	<input type="text"/>	
3. Subtract line 2 from line 1	<input type="text"/>	
4. Enter the pipe fluid temperature (°F)	<input type="text"/>	°F
5. Enter the pipe room temperature (°F)	<input type="text"/>	°F
6. Subtract line 5 from line 4	<input type="text"/>	°F
7. Enter the total length (feet) of pipe to be insulated	<input type="text"/>	Feet
8. Enter the hours of use per year	<input type="text"/>	Hours
9. Multiply line 3 by line 6 by line 7 by line 8 then divide by 1,000,000	<input type="text"/>	MMBtu
10. Enter the heating plant efficiency (percentage)	<input type="text"/>	Percent
11. Divide line 9 by line 10 and multiply by 100	<input type="text"/>	MMBtu
12. Enter the energy cost (\$/million Btu)	<input type="text"/>	/MMBtu

ANNUAL SAVINGS

13. Multiply line 11 by line 12	<input type="text"/>	\$/Year
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PROJECT COST

14. Enter the total cost to insulate the pipe including material, labor and design	<input type="text"/>	\$
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SIMPLE PAYBACK

15. Divide line 14 by line 13	<input type="text"/>	Years
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DESCRIPTION PAGE**Pipe Insulation Energy Conservation Measure - Natural Gas**

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):

Heat Loss Factor Table

INTERIOR PIPE DIAMETER	BARE PIPE FACTOR	INSULATED PIPE FACTOR						
		INSULATION THICKNESS (INCHES)						
		½	¾	1	1 ¼	1 ½	1 ¾	2
½	0.63	0.163	0.135	0.116	0.105	0.098	0.091	0.086
¾	0.76	0.191	0.155	0.135	0.120	0.110	0.103	0.096
1	0.93	0.211	0.179	0.153	0.136	0.125	0.115	0.108
1 ¼	1.14	0.263	0.210	0.178	0.158	0.143	0.132	0.122
1 ½	1.27	0.287	0.232	0.194	0.172	0.154	0.142	0.132
2	1.53	0.345	0.271	0.229	0.198	0.178	0.163	0.151
2 ¼	1.87	0.425	0.325	0.270	0.237	0.210	0.190	0.175
3	2.15	0.487	0.368	0.309	0.251	0.214	0.211	0.195
4	2.65	0.600	0.447	0.375	0.305	0.279	0.252	0.231
5	3.20	0.663	0.500	0.407	0.346	0.305	0.271	0.245
6	3.70	0.852	0.628	0.536	0.432	0.379	0.341	0.305
8	4.75	1.090	0.828	0.650	0.549	0.486	0.433	0.388
10	5.75	1.341	0.990	0.778	0.678	0.580	0.511	0.457
12	6.75	1.550	1.152	0.920	0.802	0.664	0.604	0.541



MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
PIPE INSULATION WORKSHEET - ELECTRIC SAVINGS

Building	Location	Date

INSTRUCTIONS

To estimate the savings of adding insulation to the outside of heat distribution pipes, the following information must be known:

The interior pipe diameter.	Bare pipe heat loss factor (use Heat Loss Factor Table).
The total length (feet) of pipe to be insulated.	Thickness of added insulation.
The pipe fluid temperature (°F).	Insulated pipe heat loss factor (use Heat Loss Factor Table).
The pipe room temperature (°F).	Heating plant efficiency (in percent).
The hours of use per day.	The energy cost (\$/kWh).

Please Note:
 To use this worksheet, the heating and cooling distribution pipe must be at a constant temperature. The pipe distribution must be indoors.
 If the project involves several buildings, please submit one worksheet per building.
 If more than one pipe condition is used in summer and winter, please submit one worksheet per season.
Item 5. Please enter interior temperature or the thermostat setpoint.
Item 10. If the rating is SEER or EER, use the conversion table below (Page 2).

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

SAVINGS CALCULATIONS

1. Enter the bare pipe heat loss factor (use Heat Loss Factor Table)	<input type="text"/>	
2. Enter the insulated pipe heat loss factor (use Heat Loss Factor Table)	<input type="text"/>	
3. Subtract line 2 from line 1	<input type="text"/>	
4. Enter the pipe fluid temperature (°F)	<input type="text"/>	°F
5. Enter the pipe room temperature (°F)	<input type="text"/>	°F
6. Subtract line 5 from line 4	<input type="text"/>	°F
7. Enter the total length (feet) of pipe to be insulated	<input type="text"/>	Feet
8. Enter the hours of use per year	<input type="text"/>	Hours
9. Multiply line 3 by line 6 by line 7 by line 8 then divide by 3,412	<input type="text"/>	kWh
10. Enter COP of the cooling plant If the rating is SEER or EER, use the conversion table below (Page 2).	<input type="text"/>	
11. Divide line 9 by line 10 and multiply by 100	<input type="text"/>	kWh
12. Enter the energy cost (\$/kWh)	<input type="text"/>	/kWh

ANNUAL SAVINGS

13. Multiply line 11 by line 12	<input type="text"/>	\$/Year
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PROJECT COST

14. Enter the total cost to insulate the pipe including material, labor and design	<input type="text"/>	\$/Year
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SIMPLE PAYBACK

15. Divide line 14 by line 13	<input type="text"/>	Years
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DESCRIPTION PAGE

Pipe Insulation Energy Conservation Measure - Electric

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):

SEER RATING TABLE

If your SEER for cooling equipment is unknown, please use the estimated formula in the table to estimate your SEER rating. Based on a study published by Oak Ridge National Laboratory, the cooling efficiencies in SEER can be estimated by the manufactured date.

Central Air Conditioner or Heat Pump Cooling Efficiency (SEER)	
1970 and earlier	SEER = 6.0
1971 - 1996	SEER = 9.5 + 0.1786 x (year manufactured - 1990)
1997 - 2002	SEER = 10.75 + 0.0750 x (year manufactured - 1997)
2003 - 2007	SEER = 11.2 + 0.3600 x (year manufactured - 2003)
2008 and later	SEER = 13.0

Reference: Oak Ridge National Laboratory, September 7, 2007

COP CONVERSION TABLE

Conversion Formula
COP = SEER x 0.293 = EER / 3.142

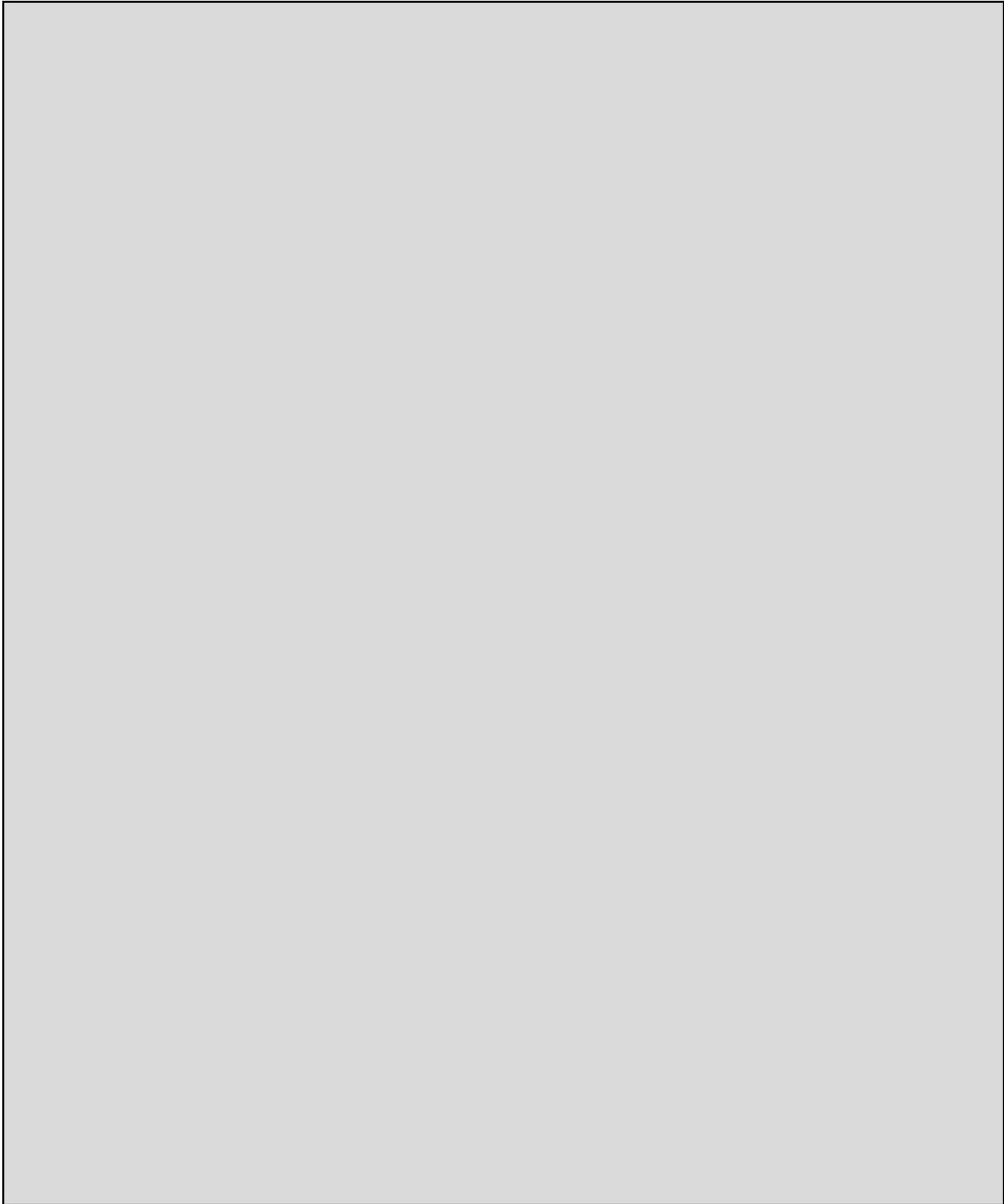
HEAT LOSS FACTOR TABLE

INTERIOR PIPE DIAMETER	BARE PIPE FACTOR	INSULATED PIPE FACTOR						
		INSULATION THICKNESS (INCHES)						
		½	¾	1	1 ¼	1 ½	1 ¾	2
½	0.63	0.163	0.135	0.116	0.105	0.098	0.091	0.086
¾	0.76	0.191	0.155	0.135	0.120	0.110	0.103	0.096
1	0.93	0.211	0.179	0.153	0.136	0.125	0.115	0.108
1 ¼	1.14	0.263	0.210	0.178	0.158	0.143	0.132	0.122
1 ½	1.27	0.287	0.232	0.194	0.172	0.154	0.142	0.132
2	1.53	0.345	0.271	0.229	0.198	0.178	0.163	0.151
2 ¼	1.87	0.425	0.325	0.270	0.237	0.210	0.190	0.175
3	2.15	0.487	0.368	0.309	0.251	0.214	0.211	0.195
4	2.65	0.600	0.447	0.375	0.305	0.279	0.252	0.231
5	3.20	0.663	0.500	0.407	0.346	0.305	0.271	0.245
6	3.70	0.852	0.628	0.536	0.432	0.379	0.341	0.305
8	4.75	1.090	0.828	0.650	0.549	0.486	0.433	0.388
10	5.75	1.341	0.990	0.778	0.678	0.580	0.511	0.457
12	6.75	1.550	1.152	0.920	0.802	0.664	0.604	0.541

DESCRIPTION PAGE

Dishwasher - Other Energy Conservation Measure

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):





MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURES
MOTOR UPGRADE WORKSHEET

Building	Location	Date
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INSTRUCTIONS

To estimate the savings of a motor upgrade, the following information must be known:

Motor horsepower (HP).	Motor load (in percent).
Operating hours of motor (hours).	Monthly demand charge (\$/kW).
Efficiency of existing motor (in percent).	The electricity charge per tailblock (\$/kWh).
Efficiency of new motor (in percent).	

Please Note:

This worksheet is only applicable to constant load and same size motors.
 This worksheet is not applicable to pulsating loads, VFDs, random loads, or loads that cycle at rapidly repeating intervals.

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

MOTOR SAVINGS CALCULATION

1. Motor horsepower (HP)	2. Quantity	3. Motor load (%)	4. Operating hours of motor (hours)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
5. Efficiency of existing motor (%)	6. Efficiency of new motor (%)	7. Monthly demand charge (\$/kW)	8. Electricity charge per tailblock (\$/kWh)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

ANNUAL SAVINGS

Savings		
Electricity Usage Savings (kWh)	Demand Savings (kW)	Annual Cost Savings
0.00	0.00	\$0.00 /Year

PROJECT COST

9. Enter the total cost of the proposed project including material, labor, and design

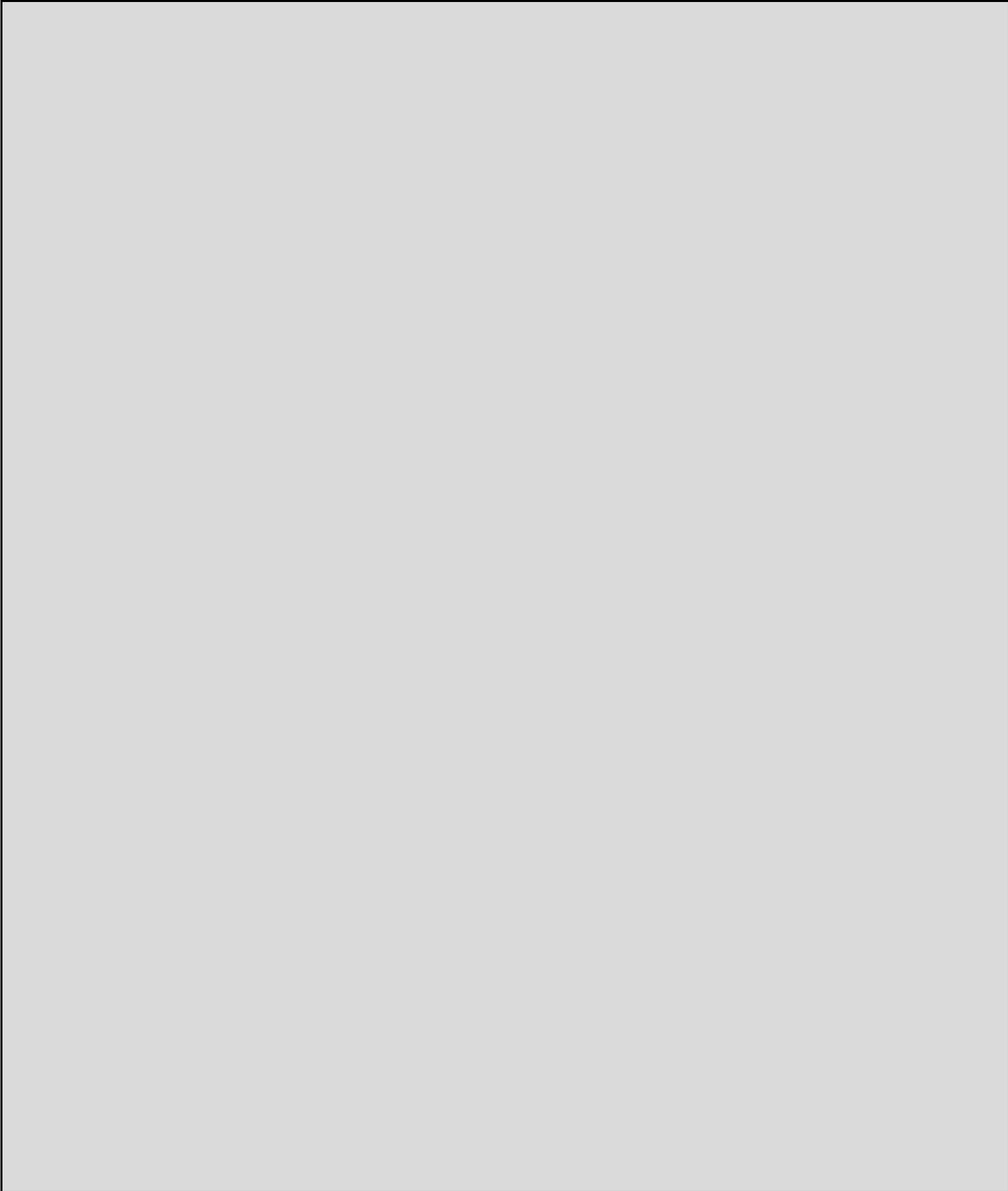
SIMPLE PAYBACK

10. Estimated simple payback period

DESCRIPTION PAGE

Motor Upgrade Energy Conservation Measure

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):





MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
 ENERGY CONSERVATION MEASURE
PROGRAMMABLE SETBACK THERMOSTAT WORKSHEET

Building	Location	Date
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INSTRUCTIONS

To estimate the savings possible from a night setback, the following information must be known:

Total estimated weekday setback hours.	Energy bills.
Total estimated weekend setback hours.	Area of the building.
Average setback temperature difference.	Area of the proposed project.
The annual heating cost.	

Please Note:
 This worksheet is applicable for a setback no greater than an average of 5°F temperature difference.
Item 1. The setback hours should be one or two hours before and after the building schedule. For example, if the building is occupied from 8 AM - 5 PM, weekday setback hours would be from 7 PM - 6 AM. The setback schedule should ensure the space is conditioned and comfortable for the occupants.
Item 3. If the building is unoccupied during the weekends, please enter "24" hrs/day, as the building is vacant.

ATTENTION

****The Division of Energy reserves the right to determine if the worksheet is appropriate for the project and may request additional information. An Energy Conservation Measure (ECM) has the potential of affecting other areas within your facility or system.****

SAVINGS CALCULATIONS

1. Enter the estimated weekday setback hours	<input type="text"/>	hrs/day
2. Multiply line 1 by 5	<input type="text"/>	Hours
3. Enter the estimated weekend setback hours	<input type="text"/>	hrs/day
4. Multiply line 3 by 2	<input type="text"/>	Hours
5. Add line 2 and line 4	<input type="text"/>	Hours
6. Divide 168 hours by line 5	<input type="text"/>	
7. Enter the average setback temperature difference	<input type="text"/>	°F
8. Multiply (line 6 x line 7) by 0.0105	<input type="text"/>	

If the heating energy source is not used for any other purposes and the cost for heating the building is known, then skip lines 9 through 12 and enter the value on line 13. If the energy source supplies heating as well as other needs of the building, go to line 9.

9. Total the seven energy bills in which heating is included (e.g. Oct. through April) and enter that amount	<input type="text"/>	\$
10. Enter the amount of the neutral month (i.e., May) energy bill	<input type="text"/>	\$
11. Multiply line 10 by 7	<input type="text"/>	\$
12. Subtract line 10 from line 9 AND ENTER THIS VALUE ON LINE 13 BELOW	<input type="text"/>	\$
13. ANNUAL HEATING COST	<input type="text"/>	\$

AREAS AFFECTED

14. Total area cooled by meter	<input type="text"/>	ft ²
15. Area affected by the propose project	<input type="text"/>	ft ²
16. Divide line 9 by line 10	<input type="text"/>	

ANNUAL SAVINGS

17. Multiply (line 8 x line 13) by line 16	<input type="text"/>	/Year
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PROJECT COST

18. Enter the total cost for the proposed project including material, labor, and design	<input type="text"/>	\$
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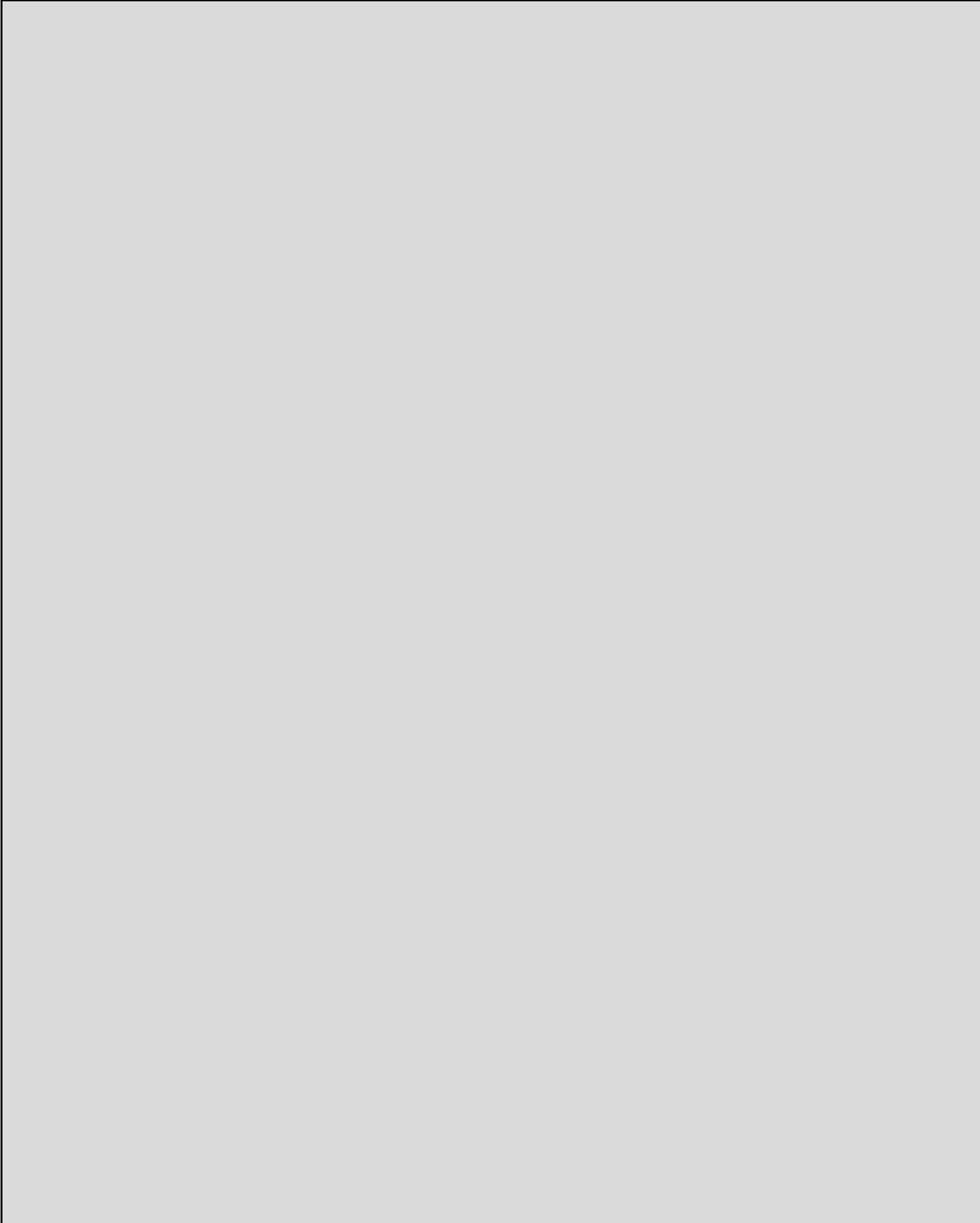
SIMPLE PAYBACK

19. Divide line 18 by line 17	<input type="text"/>	Years
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DESCRIPTION PAGE

Programmable Setback Thermostat Energy Conservation Measure

Describe the existing system and the proposed energy conservation measure (use additional sheets if necessary):





MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT
 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
FUEL USE SUMMARY

Applicant Organization Name	
Specific Building or System Name	
Total Area Cooled in Square Feet	Total Area Heated in Square Feet

SERVICE DATES		Utility providing Fuel			SERVICE DATES		Utility providing Fuel	
FROM	TO	ELECTRICITY			FROM	TO	FUEL Natural Gas/ Fuel Oil / LPG / Other	
MM/DD/YYYY	MM/DD/YYYY	USAGE (kWh)	DEMAND (kW)	COST (\$)	MM/DD/YYYY	MM/DD/YYYY	USAGE CCF	COST (\$)
ANNUAL TOTAL				\$ -				\$ -
AVERAGE UNIT COST		\$/kWh					\$ per CCF	
ACCOUNT NUMBER		\$/MMBtu					\$/MMBtu	
METER NUMBER								

FUEL USE SUMMARY - INSTRUCTION

A individual fuel usage summary shall be completed for each meter with proposed Energy Conservation Measures. The Fuel Usage Summary shall be completed using data from the most recent 12 months of energy bills. Copies of those energy bills must be submitted with the application.

FUEL USE SUMMARY FOR MULTIPLE METERS

If the project involves more than one meter, please fill out a fuel use summary for each meter by clicking a button below.

[Add Fuel Use Summary](#)

CONVERSION TABLE

The table below contains information for the various fuels necessary to compute the cost of a million Btu (MMBtu) for each fuel. To use the table, find the relevant fuel type, determine the cost per unit of that fuel and multiply by the appropriate conversion number to obtain the cost per MMBtu.

<u>Fuel Type</u>	<u>Abbreviation</u>	<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
Electricity	E	\$/Kwh	293	\$/MMBtu
Natural Gas	NG	\$/Therm	10	\$/MMBtu
Natural Gas	NG	\$/CCF	10	\$/MMBtu
Propane	LPG	\$/Gallon	10.9	\$/MMBtu
Oil	Oil	\$/Gallon	7.2	\$/MMBtu
Coal	Coal	\$/Ton	0.045	\$/MMBtu
Wood	Wood	\$/Cord	0.045	\$/MMBtu

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 DIVISION OF ENERGY - ENERGY LOAN PROGRAM
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MM/DD/YYYY	MM/DD/YYYY	USAGE (kWh)	DEMAND (kW)	COST (\$)	MM/DD/YYYY	MM/DD/YYYY	USAGE CCF	COST (\$)
ANNUAL TOTAL				\$ -				\$ -
AVERAGE UNIT COST		\$/kWh					\$ per CCF	
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