

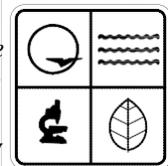
*Application Forms and General Information for the*

# Energy Revolving Fund

*for the Design, Equipment and Installation  
Related to Implementation of an*

Energy Efficiency or Renewable Energy Project

Offered by the  
Missouri Department of Natural Resources'  
Division of Energy



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# **ENERGY REVOLVING FUND**

## **Application Form and General Information**

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# Energy Revolving Fund

## Quick Start Guidelines

- Eligible Participants:** Public K-12 Schools, City and County Governments, Public and Private Higher Education Institutions and Public and Private not-for-profit Hospitals.
- 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.
- 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 the latest version of ASHRAE standard 90.1 (ASHRAE standard 90.1 is updated every three years). The applicant must own and operate the building or system associated with the proposed project.
- Loan Amounts:** Minimum and maximum loan amounts are determined for each loan cycle and depend on the total amount of loan funds available.
- Individual loan award amounts are based on estimated annual energy savings documented in the Energy-Conservation Measures Report submitted as part of the application procedure.
- 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.
- Terms of Loan:** Interest rates are determined for each loan cycle and are set at below market rates typically from two to four percent. Repayment periods may vary but loans usually are repaid in ten years or less. A loan origination fee may be included in the loan amount.
- Application Process:** Request for loan financing must be made using the Missouri Department of Natural Resources' Division of Energy – Energy Revolving [Loan Fund Application](#), [Fuel Use Summary Form](#) and [Energy-Conservation Measure Report](#). The required application and forms may be found on the department's web site: <http://www.dnr.mo.gov/energy/financial/loan.htm>

For less complex projects, worksheets provided in the appendix of the application package may be used to document energy savings for the Energy-Conservation Measures Report.

For more complex projects, a professional energy consultant may be needed to complete the Energy-Conservation Report.

A completed application form and associated documents must be mailed to the following address:

Missouri Department of Natural Resources  
Division of Energy  
Attn: Energy Loan Program Clerk  
P.O. Box 176  
1101 Riverside Dr.  
Jefferson City, MO 65102

**Project Start Date:** Projects will not be considered that were initiated prior to the official loan cycle submission date. An applicant may start a project after receiving confirmation by the Missouri Department of Natural Resources' Division of Energy Loan Program of the date that a complete application has been received. **SUBMISSION OF AN APPLICATION DOES NOT GUARANTEE LOAN FINANCING.**

**For Assistance:** Division of Energy staff members are available to answer questions about the application process or provide technical assistance regarding proposed energy efficiency and renewable energy projects:

Phone: (573) 751-3443 or (800) 361-4827

Web Site: <http://www.dnr.mo.gov/energy/financial/loan.htm>



MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY- ENERGY REVOLVING FUND  
**APPLICATION**

|   |                          |   |   |
|---|--------------------------|---|---|
| 1. SECTOR   |                          |   |   |
| <input type="checkbox"/> School K-12 <input type="checkbox"/> Local Government <input type="checkbox"/> Higher Education <input type="checkbox"/> Other _____   |                          |   |   |
| 2. HOW DID YOU FIND US? (CHECK ALL THAT APPLY)  |                          |   |   |
| <input type="checkbox"/> Web Site <input type="checkbox"/> Meeting/Event <input type="checkbox"/> Direct Mail <input type="checkbox"/> Colleague <input type="checkbox"/> Other _____   |                          |   |   |
| 3. ORGANIZATION NAME  |                          |   |   |
| 4. MAILING ADDRESS  |                          | 5. CITY   | 6. ZIP CODE                               |
|   |                          |   |   |
| 8. CONTACT NAME   | 9. TITLE                 | 10. PHONE NUMBER                                | 11. FAX NUMBER                            |
|   |                          |   |   |
| 12. E-MAIL ADDRESS  |                          | 13. TOTAL PROPOSED PROJECT COST                 | 14. TOTAL LOAN AMOUNT REQUESTED           |
|   |                          |   |   |
| 15. PROJECT TYPE  |                          | 16. ESTIMATED START DATE                        | 17. ESTIMATED PROJECT COMPLETION DATE     |
| <input type="checkbox"/> Building <input type="checkbox"/> System _____   |                          |   |   |
| 18. PROJECT LOCATION (ATTACH LIST OR MAP FOR MULTIPLE LOCATIONS)  |                          |   | 19. ESTIMATED ANNUAL ENERGY COST SAVINGS  |
|   |                          |   |   |
| <b>BUILDING SPECIFIC INFORMATION; FOR MULTIPLE BUILDINGS, USE SEPARATE SHEET OF PAPER</b>   |                          |   |   |
| 20. TOTAL BUILDING AREA IN SQUARE FEET  |                          | 21. TOTAL AFFECTED BUILDING AREA IN SQUARE FEET | 22. APPROXIMATE NO. OF BUILDING OCCUPANTS |
|   |                          |   |   |
| <b>FOR ORIGINAL BUILDING ⑩</b>  | 23. YEAR OF CONSTRUCTION | 24. HEATED AREA IN SQUARE FEET                  | 25. COOLED AREA IN SQUARE FEET            |
|   |                          |   |   |
| <b>FOR ADDITION #1 ⑩</b>  | 26. YEAR OF CONSTRUCTION | 27. HEATED AREA IN SQUARE FEET                  | 28. COOLED AREA IN SQUARE FEET            |
|   |                          |   |   |
| <b>FOR ADDITION #2 ⑩</b>  | 29. YEAR OF CONSTRUCTION | 30. HEATED AREA IN SQUARE FEET                  | 31. COOLED AREA IN SQUARE FEET            |
|   |                          |   |   |
| <b>FOR ADDITION #3 ⑩</b>  | 32. YEAR OF CONSTRUCTION | 33. HEATED AREA IN SQUARE FEET                  | 34. COOLED AREA IN SQUARE FEET            |
|   |                          |   |   |
| 35. NAME, COMPANY AND PHONE NUMBER OF ENERGY ANALYST OR OTHER WHO PREPARED ENERGY-CONSERVATION MEASURES REPORT  |                          |   |   |
|   |                          |   |   |
| 36. BUSINESS TYPE NAMED IN 35 ABOVE   |                          |   |   |
| <input type="checkbox"/> Applicant <input type="checkbox"/> Engineering <input type="checkbox"/> ESCO <input type="checkbox"/> Other _____  |                          |   |   |
| APPROPRIATE DISTRICT NUMBERS<br>BASED ON THE APPLICANT'S LOCATION   |                          | 37. U.S. CONGRESSIONAL DISTRICT                 | 38. MO SENATORIAL DISTRICT                |
|   |                          |   | 39. MO LEGISLATIVE DISTRICT               |
|   |                          |   |   |
| The governing board or body has reviewed the Energy-Conservation Measures Report and agrees that the building or system information is correct and the project and associated energy-conservation measures have been correctly described. 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. |                          |   |   |
| The building, facility or system is owned and operated by the applicant. <input type="checkbox"/> Yes <input type="checkbox"/> No   |                          |   |   |
| PRINT NAME AND TITLE OF AUTHORIZED OFFICIAL   |                          | SIGNATURE OF AUTHORIZED OFFICIAL                | DATE                                      |
|   |                          |   |   |

## APPLICATION INSTRUCTIONS

We strongly recommend that loan applicants contact a Division of Energy loan manager before completing an application. Loan managers can be reached by phone (573) 751-3443 or (800) 361-4827.

*Below are the instructions for selected loan application fields that may require clarification.*

- 3-7. Enter the information for the organization's administrative office location.
- 8-12. Enter the contact person's information. The contact person is the individual who can answer the majority of the questions related to this application.
- 13. Enter the total project cost for all energy-conservation measures. This can include reasonable fees for design and commissioning.
- 15. Select the project type. If selecting "System," give a short description, such as motors or traffic signals.
- 16-17. Enter the planned start and completion dates of construction activities.
- 18. 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 and the number of occupants for each building. If a list or map is needed, enter "see attached."
- 19. Enter the estimated annual energy cost savings calculated in the Energy-Conservation Measures Report.
- 20. Enter the total area of the building that is served by the utility meters in the Fuel Use Summary.
- 21. Enter the area of the building that will be affected by energy-conservation measures.
- 35. Enter the contact information for those who provided the technical documentation.
- 36. Select the business type of the energy analyst identified in 35. If selecting "Other," please describe.
- 37-39. Enter the appropriate district numbers based on the applicant's location.

***Remember to have the authorized official sign and date the application. Understand that this is an application only, and it does not obligate an organization to take a loan, if approved by the Division of Energy.***

Mail the original completed application and associated documents to the address below:

Missouri Department of Natural Resources  
Division of Energy  
Attn: Energy Loan Program Clerk  
P.O. Box 176  
1101 Riverside Drive  
Jefferson City, MO 65102



MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY – ENERGY REVOLVING FUND

**FUEL USE SUMMARY**

APPLICANT ORGANIZATION NAME

SPECIFIC BUILDING OR SYSTEM NAME

TOTAL AREA COOLED IN SQUARE FEET

TOTAL AREA HEATED IN SQUARE FEET

UTILITY PROVIDING FUEL

UTILITY PROVIDING FUEL

UTILITY PROVIDING FUEL

| MONTH     | YEAR | UTILITY PROVIDING FUEL |                |            | UTILITY PROVIDING FUEL       |            | UTILITY PROVIDING FUEL |            |
|-----------|------|------------------------|----------------|------------|------------------------------|------------|------------------------|------------|
|           |      | ELECTRIC               | NATURAL GAS    |            | FUEL OIL/LPG/ OR OTHER _____ |            |                        |            |
|           |      | USAGE<br>(kWh)         | DEMAND<br>(kW) | COST<br>\$ | USAGE<br>(_____)             | COST<br>\$ | USAGE<br>(_____)       | COST<br>\$ |
| JANUARY   |      |                        |                |            |                              |            |                        |            |
| FEBRUARY  |      |                        |                |            |                              |            |                        |            |
| MARCH     |      |                        |                |            |                              |            |                        |            |
| APRIL     |      |                        |                |            |                              |            |                        |            |
| MAY       |      |                        |                |            |                              |            |                        |            |
| JUNE      |      |                        |                |            |                              |            |                        |            |
| JULY      |      |                        |                |            |                              |            |                        |            |
| AUGUST    |      |                        |                |            |                              |            |                        |            |
| SEPTEMBER |      |                        |                |            |                              |            |                        |            |
| OCTOBER   |      |                        |                |            |                              |            |                        |            |
| NOVEMBER  |      |                        |                |            |                              |            |                        |            |
| DECEMBER  |      |                        |                |            |                              |            |                        |            |

ANNUAL TOTAL

AVERAGE UNIT COST

ACCOUNT NUMBERS

## FUEL USE SUMMARY INSTRUCTIONS

*This form should be completed for **each** building or system that has an individual meter.*

Utility bill data is key to identifying energy usage patterns and potential savings, so it is essential that utility bill data is provided. Complete the **Fuel Use Summary** form by entering the fuel usage and cost data from the utility bills of the most recent 12-month period for each building or system proposed to receive loan funds. Record the year relevant to the month as appropriate in the "YEAR" column and identify the name of the utility for each relevant fuel type.

**Electric Bills:** The unit for electricity is kilowatts hours(kWh). Also enter the electric demand (kW) for each month.

**Natural Gas:** Natural gas units are generally expressed in therms or CCF (one hundred cubic feet). Indicate which unit is being expressed.

**Other Fuel:** Units of fuel oil and LPG are generally expressed in gallons. Other units may be tons as in coal, cords and in wood, etc. Indicate which unit is being expressed when applicable.

The "Annual Total" and "Average Unit Cost" rows should be computed and entered in the appropriate spaces provided. Enter all relevant billing account numbers.

## Energy-Conservation Measures Report

Energy cost savings through energy-conservation measures are the foundation for the Energy Revolving Fund. Reduced energy costs resulting from energy-conservation measures provide the money to repay a revolving loan. Therefore, the maximum amount of money loaned for a given project depends primarily on the estimated annual energy cost savings the project is expected to produce. The core of the application is documentation that calculates the anticipated annual energy savings. This document is called the **Energy-Conservation Measures Report**. We must have technical information to substantiate the anticipated energy cost savings of the project.

The **Energy-Conservation Measures Report** must include a basic description of the proposed energy-conservation measure(s), the estimated cost of the energy-conservation measure(s) and sufficient technical documentation to substantiate the annual energy cost savings estimate of each energy-conservation measure.

For straightforward projects, the double-sided worksheets found in the appendix of this packet may be used as sufficient technical documentation to substantiate the annual energy cost savings as well as provide a narrative description of the energy-conservation measure(s). There is a worksheet for each of the following types of projects:

- Wall or Ceiling Insulation
- Pipe Insulation
- Programmable Setback Thermostat
- Lighting Fixture Upgrade/ Motion Sensors
- Window Replacement/Window Reduction
- Heating Plant Replacement
- Cooling Plant Replacement

Projects that are more complex must be handled on a case-by-case basis. Detailed calculations and/or computer modeling may be required. Again, contacting a loan manager for guidance for specific projects is strongly recommended.

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# Appendix A

## Common Energy-Conservation Measures

*This list includes common energy-conservation measures funded by the Energy Revolving Fund. This list does not cover all projects and does not provide details that may be important. Contact an energy loan manager to help maximize a project's potential loan value.*

**Lighting upgrades** are usually very cost effective. The savings generated usually will be sufficient to pay for the lighting energy-conservation measure(s) and may carry over to help pay for another energy-conservation measure that has a longer payback.

**Cooling plant** projects to upgrade existing equipment or new installations in buildings that do not presently have cooling.

**Heating plant** projects often have very good payback due to poor efficiency ratings on older equipment. Replacement of steam boilers with staged hot-water boilers and appropriate controls are often very cost effective.

**Ground and air source heat pumps** often provide energy savings sufficient to pay for a large portion of the system cost for retrofits. For new construction, we can often loan more than the incremental cost for ground source, and the additional loan funds can offset costs of other high-efficiency energy-related components of the new building.

**Window replacement:** Due to the cost of these projects, energy savings generally will support only a portion of the project cost, and paybacks tend to be long, so it is good to combine these projects with others such as lighting upgrades to achieve a reasonable payback period for the overall project. Also, historic preservation issues are sometimes relevant for these kind of projects. We can provide contacts for technical assistance on historic preservation issues through the department's State Historic Preservation Office.

**Window reduction** projects have a much better payback period than window replacement projects. It is important to have a good understanding of how reducing the window area will impact occupants of the building. For areas with no negative impact on the occupants, this can be a very cost-effective energy-conservation measure.

*It is important to understand that the contribution by individual energy-conservation measures to energy cost savings can be complicated by what is known as "interaction." For example, if it is estimated that a window replacement will save 10 percent on heating costs, and a boiler replacement will save 20 percent on heating costs, the actual estimated savings for doing both replacements will be something less than the sum of the two individual estimates, or less than 30 percent. This is interaction. Contact a loan manager for more information about interaction.*

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# Appendix B

## Energy Unit Conversion Table

The table below may be useful for completing the worksheets found in this packet. This table assists with converting various units of energy to million Btu (MMBtu). 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.

| <b><u>Fuel Type</u></b> | <b><u>Abbreviation</u></b> | <b><u>Multiply</u></b> | <b><u>By</u></b> | <b><u>To Obtain</u></b> |
|-------------------------|----------------------------|------------------------|------------------|-------------------------|
| Electricity             | E                          | \$/Kwh                 | 293              | \$/MMBtu                |
| Natural Gas             | NG                         | \$/Therm               | 10.0             | \$/MMBtu                |
| Natural Gas             | NG                         | \$/CCF                 | 10.0             | \$/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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# Appendix C

## Energy-Conservation Measures Worksheets

|   |    |
|---|----|
| Wall or Ceiling Insulation.....             | 15 |
| Pipe Insulation .....                       | 17 |
| Programmable Setback Thermostat .....       | 21 |
| Lighting Fixture Upgrade/Motion Sensor..... | 23 |
| Window Replacement/Window Reduction .....   | 25 |
| Heating Plant Replacement.....              | 27 |
| Cooling Plant Replacement .....             | 29 |

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MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY- ENERGY REVOLVING FUND  
**WALL OR CEILING INSULATION WORKSHEET**

|                |                |            |
|----------------|----------------|------------|
| BUILDING _____ | LOCATION _____ | DATE _____ |
|----------------|----------------|------------|

CHECK THE TYPE OF INSULATION PROJECT UNDER CONSIDERATION

Attic     
  Crawl Space     
  Wall     
  Roof     
  Other \_\_\_\_\_

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

- The area to be insulated in square feet.
- The old R-value.
- The new total R-value.
- The heating plant efficiency (in percent). (Check nameplate or with contractor).
- The heating energy cost (\$/million Btu).

**SAVINGS CALCULATIONS**

|  |       |
|--|-------|
| 1. Enter the old R-value .....                                       | _____ |
| 2. Enter the new total R-value .....                                 | _____ |
| 3. Subtract line 1 from line 2 .....                                 | _____ |
| 4. Multiply line 1 by line 2 .....                                   | _____ |
| 5. Divide line 3 by line 4 .....                                     | _____ |
| 6. Enter the area to be insulated (square feet) .....                | _____ |
| 7. Multiply line 5 by line 6 .....                                   | _____ |
| 8. Enter the heating plant efficiency (percent divided by 100) ..... | _____ |
| 9. Divide line 7 by line 8 .....                                     | _____ |
| 10. Divide line 9 by 10.0 .....                                      | _____ |
| 11. Enter the energy cost (\$/million Btu) .....                     | _____ |

**ANNUAL SAVINGS**

|                                       |               |
|---------------------------------------|---------------|
| 12. Multiply line 10 by line 11 ..... | \$ _____/year |
|---------------------------------------|---------------|

**PROJECT COST**

|  |          |
|--|----------|
| 13. Enter the total cost to insulate the area including material, labor and design ..... | \$ _____ |
|--|----------|

**SIMPLE PAYBACK**

|                                     |             |
|-------------------------------------|-------------|
| 14. Divide line 13 by line 12 ..... | _____ years |
|-------------------------------------|-------------|

**DESCRIPTION PAGE**

**Wall or Ceiling Insulation Energy -Conservation Measure**

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



**PIPE INSULATION WORKSHEET**

|          |          |      |
|----------|----------|------|
| BUILDING | LOCATION | DATE |
|----------|----------|------|

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 (\$/million Btu)                              |

**SAVINGS CALCULATIONS**

1. Enter the bare pipe heat loss factor ..... \_\_\_\_\_
2. Enter the insulated pipe heat loss factor ..... \_\_\_\_\_
3. Subtract line 2 from line 1 ..... \_\_\_\_\_
4. Enter the pipe fluid temperature (°F) ..... \_\_\_\_\_
5. Enter the pipe room temperature (°F) ..... \_\_\_\_\_
6. Subtract line 5 from line 4 ..... \_\_\_\_\_
7. Enter the total length (feet) of pipe to be insulated ..... \_\_\_\_\_
8. Enter the hours of use per year ..... \_\_\_\_\_
9. Multiply line 3 by line 6 by line 7 by line 8 then divide by 1,000,000 ..... \_\_\_\_\_
10. Enter the heating plant efficiency (percent divided by 100) ..... \_\_\_\_\_
11. Divide line 9 by line 10 ..... \_\_\_\_\_
12. Enter the energy cost (\$/million Btu) ..... \_\_\_\_\_

**ANNUAL SAVINGS**

13. Multiply line 11 by line 12 ..... \$ \_\_\_\_\_/year

**PROJECT COST**

14. Enter the total cost to insulate the pipe including material, labor and design ..... \$ \_\_\_\_\_

**SIMPLE PAYBACK**

15. Divide line 14 by line 13 ..... \_\_\_\_\_ years

**DESCRIPTION PAGE**

**Pipe Insulation Energy -Conservation Measure**

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



**HEAT LOSS FACTOR TABLE**

(REFERENCE FOR PIPE INSULATION WORKSHEET)

| INTERIOR<br>PIPE<br>DIAMETER | BARE<br>PIPE<br>FACTOR | INSULATED PIPE FACTOR         |       |       |       |       |       |       |
|------------------------------|------------------------|-------------------------------|-------|-------|-------|-------|-------|-------|
|                              |                        | INSULATION THICKNESS (INCHES) |       |       |       |       |       |       |
|                              |                        | 1/2                           | 3/4   | 1     | 1 1/4 | 1 1/2 | 1 3/4 | 2     |
| 1/2                          | 0.63                   | 0.163                         | 0.135 | 0.116 | 0.105 | 0.098 | 0.091 | 0.086 |
| 3/4                          | 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 1/4                        | 1.14                   | 0.263                         | 0.210 | 0.178 | 0.158 | 0.143 | 0.132 | 0.122 |
| 1 1/2                        | 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 1/4                        | 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 |

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MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY – ENERGY REVOLVING FUND  
**PROGRAMMABLE SETBACK THERMOSTAT WORKSHEET**

|          |          |      |
|----------|----------|------|
| BUILDING | LOCATION | DATE |
|----------|----------|------|

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

- The existing weekly operating hours when occupied.
- existing weekly operating hours when unoccupied.
- The proposed weekly operating hours when occupied.
- The proposed weekly operating hours when unoccupied.
- The annual heating cost.

- The existing weekly operating temperature when occupied. The
- The existing weekly operating temperature when unoccupied.
- The proposed weekly operating temperature when occupied.
- The proposed weekly operating temperature when unoccupied.

**SAVINGS ESTIMATE**

|   |       |
|---|-------|
| 1. Enter the existing weekly operating hours when occupied .....          | _____ |
| 2. Enter the existing weekly operating temperature when occupied .....    | _____ |
| 3. Multiply line 1 by line 2 .....  | _____ |
| 4. Enter the existing weekly operating hours when unoccupied .....        | _____ |
| 5. Enter the existing weekly operating temperature when unoccupied .....  | _____ |
| 6. Multiply line 4 by line 5 .....  | _____ |
| 7. Add line 3 to line 6 .....   | _____ |
| 8. Enter the proposed weekly operating hours when occupied .....          | _____ |
| 9. Enter the proposed weekly operating temperature when occupied .....    | _____ |
| 10. Multiply line 8 by line 9 .....                                       | _____ |
| 11. Enter the proposed weekly operating hours when unoccupied .....       | _____ |
| 12. Enter the proposed weekly operating temperature when unoccupied ..... | _____ |
| 13. Multiply line 11 by line 12 .....                                     | _____ |
| 14. Add line 10 to line 13 .....  | _____ |
| 15. Subtract line 14 from line 7 .....                                    | _____ |
| 16. Multiply 0.0002 by line 15 .....                                      | _____ |

If the heating energy source is not used for any other purposes and the cost for heating the building is known, then skip lines 17 through 20 and enter the value on line 21. If the energy source supplies heating as well as other needs of the building, go to line 17.

|   |          |
|---|----------|
| 17. Total the seven energy bills that heating is included in from October through April and enter that amount ... | \$ _____ |
| 18. Enter the amount of the May energy bill that includes heating .....   | \$ _____ |
| 19. Multiply 7.0 by line 18 .....   | \$ _____ |
| 20. Subtract line 19 from line 17 AND ENTER THIS VALUE ON LINE 21 BELOW.  |          |
| 21. ANNUAL HEATING COST .....   | \$ _____ |

**ANNUAL SAVINGS**

|                                       |               |
|---------------------------------------|---------------|
| 22. Multiply line 16 by line 21 ..... | \$ _____/year |
|---------------------------------------|---------------|

**PROJECT COST**

|  |          |
|--|----------|
| 23. Enter the total cost for the proposed project including material, labor and design ..... | \$ _____ |
|--|----------|

**SIMPLE PAYBACK**

|                                     |             |
|-------------------------------------|-------------|
| 24. Divide line 23 by line 22 ..... | _____ years |
|-------------------------------------|-------------|

**DESCRIPTION PAGE**

**Programmable Setback Thermostate Energy - Conservation Measure**

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



MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY – ENERGY REVOLVING FUND  
**LIGHTING FIXTURE UPGRADE/MOTION SENSOR WORKSHEET**

|          |          |      |
|----------|----------|------|
| BUILDING | LOCATION | DATE |
|----------|----------|------|

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

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

**SAVINGS CALCULATIONS**

1. Enter the number of old fixtures being changed ..... \_\_\_\_\_
2. Enter the wattage of each old fixture ..... \_\_\_\_\_
3. Enter the hours of use per year in the past ..... \_\_\_\_\_
4. Enter the cost per kilowatt hour of electricity ..... \_\_\_\_\_
5. Multiply line 1 by line 2 by line 3 by line 4 and divide by 1000 ..... (Present annual cost of lighting) ..... \$ \_\_\_\_\_/year
6. Enter the number of new fixtures being installed ..... \_\_\_\_\_
7. Enter the wattage of each new fixture ..... \_\_\_\_\_
8. Enter the new hours of use per year in the future ..... \_\_\_\_\_
9. Enter the cost per kilowatt hour of electricity ..... \_\_\_\_\_
10. Multiply line 6 by line 7 by line 8 by line 9 and divide by 1000 ..... (Future annual cost of lighting) ..... \$ \_\_\_\_\_/year

**ANNUAL SAVINGS**

11. Subtract line 10 from line 5 ..... \$ \_\_\_\_\_/year

**PROJECT COST**

12. Enter the total cost to modify the lighting including material, labor and design ..... \$ \_\_\_\_\_

**SIMPLE PAYBACK**

13. Divide line 12 by line 11 ..... \_\_\_\_\_ years

**DESCRIPTION PAGE**

**Lighting Fixture Upgrade/Motion Sensor Energy - Conservation Measure**

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



MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY – ENERGY REVOLVING FUND  
**WINDOW REPLACEMENT/WINDOW REDUCTION WORKSHEET**

|          |          |      |
|----------|----------|------|
| BUILDING | LOCATION | DATE |
|----------|----------|------|

To estimate the savings of replacing existing windows with efficiency upgrades, the following information must be known:

- The R-Value of the new wall (window reduction only). U-Value=1/R-Value
- The U-Value of the existing window (See U-Value table below).
- The U-Value of the replacement window (See U-Value table below).
- The total area of the windows being replaced (square feet).
- The heating energy cost (\$/million Btu).
- The heating plant efficiency (in percent).

**SAVINGS CALCULATIONS**

|   | (a) Old Windows | (b) New Windows | (c) New Wall<br>(window reduction) |
|---|-----------------|-----------------|------------------------------------|
| 1. Enter the U-Values   | _____           | _____           | _____                              |
| 2. Infiltration Factor  | 1.00            | 0.14            | 0.00                               |
| 3. Add line 1 to line 2   | _____           | _____           | _____                              |
| 4. Enter area   | _____           | _____           | _____                              |
| 5. Multiply line 3 by line 4                                      | _____           | _____           | _____                              |
| 6. Multiply line 5 by .100 or [(degree days)*24/10°]              | _____           | _____           | _____                              |
| 7. Enter the heating plant efficiency<br>(percent divided by 100) | _____           | _____           | _____                              |
| 8. Divide line 6 by line 7  | _____           | _____           | _____                              |
| 9. Enter the energy cost (\$/million BTU)                         | _____           | _____           | _____                              |
| 10. Multiply line 8 by line 9                                     | _____           | _____           | _____                              |

**ANNUAL SAVINGS**

11. Subtract line 10b and 10c from line 10a ..... \$ \_\_\_\_\_ year

**PROJECT COST**

12. Enter the total cost of the window replacement including material, labor and design ..... \$ \_\_\_\_\_

**SIMPLE PAYBACK**

13. Divide line 12 by line 11 ..... \_\_\_\_\_ years

**WINDOW U-VALUE TABLE**

| Window System Type   | U-Value* |
|--|----------|
| Single Glass .....   | 1.10     |
| Single Glass with storm window .....                                   | 0.50     |
| Single Glass, low E coating .....                                      | 0.91     |
| Single Glass, low E coating with storm window .....                    | 0.44     |
| Insulating Glass (double glass) .....                                  | 0.55     |
| Insulating Glass (double glass), with storm window .....               | 0.35     |
| Insulating Glass (double glass), low E coating .....                   | 0.38     |
| Insulating Glass (double glass), low E coating with storm window ..... | 0.32     |
| Insulating Glass (triple glass) .....                                  | 0.35     |
| Insulating Glass (triple glass), with storm window .....               | 0.25     |

\*U-Values adapted from the 1985 ASHRAE Fundamentals Handbook.

**DESCRIPTION PAGE**

**Window Replacement/Window Reduction Energy- Conservation Measure**

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



MISSOURI DEPARTMENT OF NATURAL RESOURCES  
 DIVISION OF ENERGY – ENERGY REVOLVING FUND  
**HEATING PLANT REPLACEMENT WORKSHEET**

|          |          |      |
|----------|----------|------|
| BUILDING | LOCATION | DATE |
|----------|----------|------|

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 (cost per million Btu).
- The proposed energy cost (cost per million Btu).

**SAVINGS ESTIMATE**

If the heating energy source is not used for any other purposes and the cost for heating the building is known, then skip lines 1 through 4 and enter that value on line 5. If the energy source supplies heating as well as other needs of the building, proceed with line 1.

1. Total the seven energy bills that heating is included in from October through April and enter that amount . . . \$ \_\_\_\_\_
2. Enter the amount of the May energy bill that heating is included in . . . . . \$ \_\_\_\_\_
3. Multiply 7.0 by line 2 . . . . . \$ \_\_\_\_\_
4. Subtract line 3 from line 1 and enter this value on line 5 below.
5. ANNUAL HEATING COSTS . . . . . \$ \_\_\_\_\_
6. Enter the efficiency of the existing heating plant (percent divided by 100) . . . . . \_\_\_\_\_
7. Multiply line 5 by line 6 . . . . . \$ \_\_\_\_\_
8. Enter the efficiency of the proposed heating plant (percent divided by 100) . . . . . \_\_\_\_\_
9. Divide line 7 by line 8 . . . . . \$ \_\_\_\_\_

If the proposed heating plant will use the same energy source as the existing one, skip lines 10 through 13 and enter the value from line 9 on line 14. If the energy sources for the proposed and existing plants are different, proceed with line 10.

10. Enter the existing energy cost (\$/million Btu) . . . . . \_\_\_\_\_
11. Divide line 9 by line 10 . . . . . \$ \_\_\_\_\_
12. Enter the proposed energy cost (\$/million Btu) . . . . . \_\_\_\_\_
13. Multiply line 11 by line 12 and enter this value on line 14 below.
14. PROJECTED ANNUAL HEATING COSTS . . . . . \$ \_\_\_\_\_

**ANNUAL SAVINGS**

15. Subtract line 14 from line 5 . . . . . \$ \_\_\_\_\_/year

**PROJECT COST**

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

**SIMPLE PAYBACK**

17. Divide line 16 by line 15 . . . . . \_\_\_\_\_ years

**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 NATURAL RESOURCES  
 DIVISION OF ENERGY – ENERGY REVOLVING FUND  
**COOLING PLANT REPLACEMENT WORKSHEET**

|          |          |      |
|----------|----------|------|
| BUILDING | LOCATION | DATE |
|----------|----------|------|

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 rating as above.)
- The existing energy cost (cost per million Btu).
- The proposed energy cost (cost per million Btu).

**SAVINGS ESTIMATE**

If the cooling energy source is not used for any other purposes and the cost for cooling the building is known, then skip lines 1 through 4 and enter that value on line 5. If the energy source supplies cooling as well as other needs of the building, proceed with line 1.

1. Total the four energy bills that cooling is included in from June through September and enter that amount . . . \$ \_\_\_\_\_
2. Enter the amount of the May energy bill that cooling is included in . . . . . \$ \_\_\_\_\_
3. Multiply 4.0 by line 2 . . . . . \$ \_\_\_\_\_
4. Subtract line 3 from line 1 AND ENTER THIS VALUE ON LINE 5 BELOW.
5. ANNUAL COOLING COSTS . . . . . \$ \_\_\_\_\_
6. Enter the SEER, EER, COP or (1/kw per ton) of the existing cooling plant . . . . . \_\_\_\_\_
7. Multiply line 5 by line 6 . . . . . \$ \_\_\_\_\_
8. Enter the SEER, EER, COP or (1/kw per ton) of the proposed cooling plant (Use same rating as line 6.) . . . . . \_\_\_\_\_
9. Divide line 7 by line 8 . . . . . \$ \_\_\_\_\_

If the proposed cooling plant will use the same energy source as the existing one, skip lines 10 through 13 and enter the value from line 9 on line 14. If the energy sources for the proposed and existing plants are different, proceed with line 10.

10. Enter the existing energy cost (\$/million Btu) . . . . . \_\_\_\_\_
11. Divide line 9 by line 10 . . . . . \$ \_\_\_\_\_
12. Enter the proposed energy cost (\$/million Btu) . . . . . \_\_\_\_\_
13. Multiply line 11 by line 12 and ENTER THIS VALUE ON LINE 14 BELOW.
14. PROJECTED ANNUAL COOLING COSTS . . . . . \$ \_\_\_\_\_

**ANNUAL SAVINGS**

15. Subtract line 14 from line 5 . . . . . \$ \_\_\_\_\_/year

**PROJECT COST**

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

**SIMPLE PAYBACK**

17. Divide line 16 by line 15 . . . . . \_\_\_\_\_ years

**DESCRIPTION PAGE**

**Cooling Plant Replacement Energy- Conservation Measure**

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