## Practice: 374 - Farmstead Energy Improvement

## Scenario: #1 - Lighting - CFL

### Scenario Description:

Installation of dimmable CFLs to replace incandescent lamps on a one-for-one basis. Light fixtures do not have to be replaced. CFL requirements: minimum 8 Watt, 4100 Kelvin, dimmable, grow-out bulb; industrial grade; suitably protected from dirt accumulation. In high humidity environments or areas subject to wash down, gasketted or weatherproof housings are required to prevent corrosion and premature failure. Payment includes lightbulbs and labor to install.

### Before Situation:

An inefficient lighting system such as one using incandescent lamps has been identified by an on-farm energy audit.

### After Situation:

More efficient lighting is provided by Compact Fluorescent Lamps (CFLs) in order to reduce energy use as evidenced by the energy audit. Associated practices/activities: 122-AgEMP - HQ, 670-Lighting System Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each lamp replaced

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $17.41 **Scenario Cost/Unit:** $17.41

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $22.43 | 0.167 | $3.75 |
| ***Materials*** | | | | | | |
| Lighting, bulb, CFL, 8 watt | 1166 | 8 watt compact fluorescent lamp (CFL), typically 4100 Kelvin, dimmable, grow-out bulb, industrial grade, suitably protected from dirt accumulation. Materials only. | Each | $13.66 | 1 | $13.66 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #2 - Lighting - LED

### Scenario Description:

To install dimmable LEDs to replace incandescent lamps on a one-for-one basis. Light fixtures do not have to be replaced. LED requirements: minimum 6 Watt, 3700 Kelvin, dimmable, grow-out bulb; industrial grade; suitably protected from dirt accumulation. In high humidity environments or areas subject to wash down, gasketted or weatherproof housings are required to prevent corrosion and premature failure. Payment includes lightbulb and labor to install.

### Before Situation:

An inefficient lighting system such as one using incandescent lamps has been identified by an on-farm energy audit.

### After Situation:

More efficient lighting is provided by Light-Emitting Diode (LED) lamps in order to reduce energy use as evidenced by the energy audit.Associated practices/activities: 122-AgEMP - HQ, 670-Lighting System Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each lamp replaced

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $22.13 **Scenario Cost/Unit:** $22.13

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $22.43 | 0.167 | $3.75 |
| ***Materials*** | | | | | | |
| Lighting, bulb, LED, 6 watt | 1167 | 6 watt light emitting diode (LED), typically 3700 Kelvin, dimmable, grow-out bulb; industrial grade; suitably protected from dirt accumulation. Materials only. | Each | $18.38 | 1 | $18.38 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #3 - Lighting - Linear Fluorescent

### Scenario Description:

The lighting system consists of a four-foot, three-lamp fixture with a single electronic ballast. The high-efficiency lighting system uses high-efficiency T8 or T5 fluorescent lamps. Associated materials for installation of replacement fixtures are included. Appropriate disposal of existing lamps, ballasts and other materials is required. Payment includes lamps, ballast, fixtures and labor to install.

### Before Situation:

Inefficient lighting (such as incandescent or T12 fluorescent tubes driven by magnetic ballasts) as evidenced by an on-farm energy audit.

### After Situation:

High-efficiency lighting system which reduces energy use. The new lighting equipment will provide suitable light levels and reduce overall power requirements (kW) compared to the existing lighting system as evidenced by the energy audit. Associated practices/activities: may include 122-AgEMP - HQ, 670-Lighting System Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each fixture replaced

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $324.33 **Scenario Cost/Unit:** $324.33

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 1 | $34.39 |
| ***Materials*** | | | | | | |
| Lighting, fixture, Fluorescent, 75 watt | 1168 | 75 watt fluorescent lamp fixture with T5 or T8 lamps and ballast. Materials only. | Each | $289.94 | 1 | $289.94 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #4 - Lighting - Outdoor/High Bay

### Scenario Description:

The lighting system consists of a outdoor/high bay light such as, but not limited to, pulse-start metal halide (PSMH) lamp with a matched ballast. Associated materials for installation of replacement fixtures are included. Appropriate disposal of existing lamps, ballasts and other materials is required. Payment includes lamp and labor to install.

### Before Situation:

Inefficient high-bay or exterior lighting (such as mercury vapor, T12 fluorescent, or similar) as evidenced by an on-farm energy audit.

### After Situation:

High-efficiency lighting system which reduces energy use. The new lighting equipment will provide suitable light levels and reduce overall power requirements (kW) compared to the existing lighting system as evidenced by the energy audit. Associated practices/activities: may include 122-AgEMP - HQ, 670-Lighting System Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each fixture replaced

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $255.42 **Scenario Cost/Unit:** $255.42

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 3 | $103.17 |
| ***Materials*** | | | | | | |
| Lighting, Pulse Start Metal Halide | 2425 | Replacement of lighting with PSMH Light. | Watt | $0.87 | 175 | $152.25 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #5 - Ventilation - Exhaust

### Scenario Description:

Replacement of an exhaust fan with a more efficient exhaust fan. Payment includes fan, controls, wiring, associated appurtanences and labor to install.

### Before Situation:

Inefficient ventilation in an agricultural building.

### After Situation:

High-efficiency ventilation system which reduces energy use. The new ventilation equipment will provide suitable air quality and reduce overall power requirements (kW) compared to the existing ventilation system as evidenced in an energy audit. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $1,267.64 **Scenario Cost/Unit:** $1,267.64

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 3 | $103.17 |
| ***Materials*** | | | | | | |
| Fan, exhaust, 36" High Efficiency | 1185 | 36 inch high efficiency exhaust fan, controls, wiring, and associated appurtenances. Materials only. | Each | $1,040.66 | 0.25 | $260.17 |
| Fan, exhaust, 54" High Efficiency | 1188 | 54 inch high efficiency exhaust fan, controls, wiring, and associated appurtenances. Materials only. | Each | $975.92 | 0.25 | $243.98 |
| Fan, exhaust, 42" High Efficiency | 1186 | 42 inch high efficiency exhaust fan, controls, wiring, and associated appurtenances. Materials only. | Each | $1,433.24 | 0.25 | $358.31 |
| Fan, exhaust, 48" High Efficiency | 1187 | 48 inch high efficiency exhaust fan, controls, wiring, and associated appurtenances. Materials only. | Each | $1,208.04 | 0.25 | $302.01 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #6 - Ventilation - Horizontal Air Flow/Stir Fan

### Scenario Description:

A system of fans are installed where none exist to create a horizontal air circulation pattern, and remove air stratification. The new system promotes efficient heat and moisture distribution. Payment includes fan controls, wiring, associated appurtanences and labor to install.

### Before Situation:

Inefficent air circulation system in a greenhouse or livestock house

### After Situation:

High-efficiency air circulation system which reduces energy use. In a typical 10,000 square foot greenhouse, 10 HAF fans are needed. The new equipment will provide suitable air quality and reduce overall power requirements (kW) compared to the existing system as evidenced in an energy audit. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each

**Scenario Unit:** Each

**Scenario Typical Size:** 4

**Scenario Cost:** $834.72 **Scenario Cost/Unit:** $208.68

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Fan, HAF, 1/10 to 1/15 HP | 1189 | High efficiency Horizontal Air Flow (HAF) fan, controls, wiring, and associated appurtenances. Materials only. | Each | $139.90 | 4 | $559.60 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #7 - Ventilation - Cool Cell, Evaporative Cooling System

### Scenario Description:

A cool cell evaporative cooling system is installed in a livestock barn to reduce total ventilation requirements in hot weather. Scenario is applicable where there is an existing, inefficient cooling system/ventilation system in place that will be replaced by the cool cell. Payment includes all materials and labor to install the evaporative cooling system.

### Before Situation:

Inefficent ventilation temperature control in a poultry or livestock house

### After Situation:

A cool cell evaporative cooling system reduces energy use by allowing lower ventilation rates that will result in net energy savings. The new equipment will provide suitable air quality and reduce overall power requirements (kW) compared to the existing system as evidenced in an energy audit. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Square Foot

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 520

**Scenario Cost:** $13,951.04 **Scenario Cost/Unit:** $26.83

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 96 | $3,301.44 |
| ***Materials*** | | | | | | |
| Evaporative Cooling System, Large | 2400 | Energy efficient cooling systems installed in ventilated livestock confinement or greenhouses for temperature control. Complete system with cooling pads, aluminum distribution and end panels, 1/3 HP submersible sump pump and plumbing kit. Greater than 9 | Square Foot | $20.48 | 520 | $10,649.60 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #8 - Refrigeration - Plate Cooler

### Scenario Description:

The installation of all stainless steel dual pass plate cooler, type 316 stainless steel. Pament includes plate cooler and labor to install.

### Before Situation:

Inefficient milk cooling (minimal pre-cooling of milk before entering the bulk tank).

### After Situation:

High-efficiency milk cooling system which reduces energy use. The new milk cooling equipment will pre-cool the milk and reduce overall power requirements (kW) compared to the existing milk cooling system (where most of the cooling was accomplished in the bulk tank) as evidenced in an energy audit. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $4,659.33 **Scenario Cost/Unit:** $4,659.33

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Plate Cooler, ≤ 499 gal/hr capacity | 1176 | Stainless Steel, dual pass plate cooler with < 499 gallon/hour capacity. Includes materials and shipping only. | Each | $4,384.21 | 1 | $4,384.21 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #9 - Refrigeration - Scroll Compressor

### Scenario Description:

Install a new comparably sized scroll compressor, associated controls, wiring, and materials to retrofit an existing refrigeration system. A new condenser is not included in this typical scenario. Payment includes compressor, controls, wiring, appurtanences and labor to install.

### Before Situation:

Inefficient reciprocating compressor as a key component of the refrigeration system used to cool milk. The compressor is a critical part of a milk cooling system, affecting milk quality, system reliability, and system efficiency.

### After Situation:

A more efficient scroll compressor, which will reduce energy use, is evidenced by the energy audit. A comparably sized scroll compressor provides refrigeration capacity at a higher efficiency than a reciprocating compressor. Newer scroll compressor systems typically reduce electricity use by 15 to 25 percent compared to reciprocating compressors. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 5

**Scenario Cost:** $2,623.03 **Scenario Cost/Unit:** $524.61

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 4 | $137.56 |
| ***Materials*** | | | | | | |
| Scroll Compressor - 5 HP | 1183 | Scroll compressor, 5 Horsepower, controls, wiring, and appurtenances. Materials only. | Each | $2,485.47 | 1 | $2,485.47 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #10 - Refrigeration - Compressor Heat Recovery System

### Scenario Description:

Install a new comparibly sized compressor heat recovery unit. The unit includes insulated storage tanks with heat exchangers added to a refrigeration system. The system utilizes the heat extracted from the fluid (e.g. milk) that passes through the hot gas refrigerant line from the refrigeration system's compressors, to pre-heat water to approximately 110°F before it enters a conventional water heater. Energy savings comes from the reduced heating required in a water heater. Low ambient controls and/or condenser variable speed drives are part of the installation. The actual number of heat recovery units and their location will depend on the operating hours of the compressor and the configuration of the existing system. Payment includes all materials and appurtanences and labor to install.

### Before Situation:

Inefficient use of heat extracted from the milk during the cooling process

### After Situation:

A more efficient compressor heat recovery system is installed, which will reduce energy use, is evidenced by the energy audit. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $3,492.43 **Scenario Cost/Unit:** $3,492.43

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Compressor heat recovery (CHR) unit, High Efficiency | 1899 | Compressor heat recovery (CHR) units (insulated storage tanks with heat exchangers) added to a refrigeration system, use the heat extracted from a warm fluid (e.g., milk) that passes through the hot gas refrigerant line from the refrigeration system's compressors, to pre-heat water to approximately 110°F before it enters a conventional water heater. Energy savings comes from the reduced heating required in a water heater. Low ambient controls and/or condenser variable speed drives are part of the installation. The actual number of heat recovery units and their location will depend on the operating hours of the compressor and the configuration of the existing system. | Each | $3,217.31 | 1 | $3,217.31 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #11 - Controller - Variable Speed Drive for ≤1 HP Motor

### Scenario Description:

Installation of a variable speed drive (VSD) for a ≤1 horsepower electric motor typically used in small dairy operations. Payment includes appurtances, such as hook-ups, control panels, wiring, control blocks, filters, switches, pads, etc. and labor to install. Payment does not include the cost of the motor.

### Before Situation:

The system is inefficient when a motor operates at constant speed to satisfy a load which varies as to flow rate and/or pressure requirements.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a VSD to control electric motors. After the VSD is applied, the motor speed can be adjusted to reduce power requirements and better match varied flow or pressure requirements. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 1

**Scenario Cost:** $3,911.33 **Scenario Cost/Unit:** $3,911.33

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Variable Speed Drive, 1 HP | 2347 | Variable speed drive for 1 Horsepower electric motor. Does not include motor. Materials only. | Horsepower | $3,636.21 | 1 | $3,636.21 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #12 - Controller - Variable Speed Drive for >1 to <10 HP Motor

### Scenario Description:

Installation of a variable speed drive (VSD) for a >1 to <10 horsepower electric motor. Payment includes appurtances, such as hook-ups, control panels, wiring, control blocks, filters, switches, pads, etc. and labor to install. Payment does not include the cost of the motor.

### Before Situation:

The system is inefficient when a motor operates at constant speed to satisfy a load which varies as to flow rate and/or pressure requirements.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a VSD to control electric motors. After the VSD is applied, the motor speed can be adjusted to reduce power requirements and better match varied flow or pressure requirements. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 5

**Scenario Cost:** $5,188.92 **Scenario Cost/Unit:** $1,037.78

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Variable Speed Drive, 5 HP | 2348 | Variable speed drive for 5 Horsepower electric motor. Does not include motor. Materials only. | Horsepower | $982.76 | 5 | $4,913.80 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #13 - Controller - Variable Speed Drive for 10 to <50 HP Motor

### Scenario Description:

Installation of a variable speed drive (VSD) for a >10 to <50 horsepower electric motor typically used in small dairy operations. Payment includes appurtances, such as hook-ups, control panels, wiring, control blocks, filters, switches, pads, etc. and labor to install. Payment does not include the cost of the motor.

### Before Situation:

The system is inefficient when a motor operates at constant speed to satisfy a load which varies as to flow rate and/or pressure requirements.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a VSD to control electric motors. After the VSD is applied, the motor speed can be adjusted to reduce power requirements and better match varied flow or pressure requirements. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 10

**Scenario Cost:** $6,761.32 **Scenario Cost/Unit:** $676.13

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Variable Speed Drive, 10 HP | 1287 | Variable speed drive for 10 Horsepower electric motor. Does not include motor. Materials only. | Horsepower | $648.62 | 10 | $6,486.20 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #14 - Controller - Variable Speed Drive for ≥ 50 HP Motor

### Scenario Description:

Installation of a variable speed drive (VSD) for a ≥ 50 horsepower electric motor used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production. Payment includes appurtances, such as hook-ups, control panels, wiring, control blocks, filters, switches, pads, etc. and labor to install.

### Before Situation:

The system is inefficient when a motor operates at constant speed to satisfy a load which varies as to flow rate and/or pressure requirements.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a VSD to control electric motors. After the VSD is applied, the motor speed can be adjusted to reduce power requirements and better match varied flow or pressure requirements. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 100

**Scenario Cost:** $11,847.12 **Scenario Cost/Unit:** $118.47

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Variable Speed Drive, 100 HP | 1289 | Variable speed drive for 100 Horsepower electric motor. Does not include motor. Materials only. | Horsepower | $115.72 | 100 | $11,572.00 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #15 - Controller - Single Function Automatic Controller System

### Scenario Description:

The typical scenario consists of a single function automatic control system installed on an existing manually controlled agricultural system such as, but not limited to, irrigation systems or agricultural building control systems. Typical components may include any of the following: wiring, sensors, data logger, logic controller, communication link, software, switches, and relay. Payment includes materials and appurtanences and labor to install.

### Before Situation:

A manually controlled system is existing in an agricultural facility that causes the inefficient use of energy, as evidenced by an on-farm energy audit.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of an automatic controller that helps regulates the energy consumption of the existing system. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each system

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $1,403.78 **Scenario Cost/Unit:** $1,403.78

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Switches and Controls, programmable controller | 1193 | Programmable logic controller (with or without wireless telecommunications) commonly used to control pumps and irrigation systems | Each | $147.28 | 1 | $147.28 |
| Switches and Controls, temp sensors | 1192 | Temperature and soil moisture sensors installed as part of an electronic monitoring (with or without wireless telecommunications) commonly used to control pumps and irrigation systems | Each | $582.25 | 1 | $582.25 |
| Switches and Controls, Wi-Fi system and software | 1194 | Software with built-in cellular or Wi-Fi communication commonly used to control pumps and irrigation systems | Each | $399.13 | 1 | $399.13 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #16 - Controller - Multiple Function Automatic Controller System

### Scenario Description:

The typical scenario consists of a multiple function automatic control system installed on an existing manually controlled agricultural system such as, but not limited to, agricultural building control systems. Typical components may include any of the following: wiring, sensors, data logger, logic controller, communication link, software, switches, and relay. Payment includes materials and appurtanences and labor to install.

### Before Situation:

A manually controlled system is existing in an agricultural facility that causes the inefficient use of energy, as evidenced by an on-farm energy audit.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of an automatic controller that helps regulates the energy consumption of the existing system. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each system

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $4,372.22 **Scenario Cost/Unit:** $4,372.22

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 38 | $1,306.82 |
| ***Materials*** | | | | | | |
| Switches and Controls, temp sensors | 1192 | Temperature and soil moisture sensors installed as part of an electronic monitoring (with or without wireless telecommunications) commonly used to control pumps and irrigation systems | Each | $582.25 | 4 | $2,329.00 |
| Switches and Controls, programmable controller | 1193 | Programmable logic controller (with or without wireless telecommunications) commonly used to control pumps and irrigation systems | Each | $147.28 | 5 | $736.40 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #17 - Motor - ≤ 1 HP Electric Motor Upgrade

### Scenario Description:

Replacement of an existing electric motor with a upgraded electric motor typically used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production. The upgraded electric motor will be the same size as the existing less efficient motor it is replacing. This scenario is for motors ≤1 horsepower. Payment includes motor, appurtanences and labor to install.

### Before Situation:

The system is inefficient with a standard efficiency motor.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a NEMA premium efficiency motor. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 1

**Scenario Cost:** $571.31 **Scenario Cost/Unit:** $571.31

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 4 | $137.56 |
| ***Materials*** | | | | | | |
| Motor, electric, NEMA Premium, 1 HP | 1169 | Premium NEMA approved electric motor, 1 Horsepower and all required appurtenances. Includes materials and shipping only. | Each | $433.75 | 1 | $433.75 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #18 - Motor - > 1 to <10 HP Electric Motor Upgrade

### Scenario Description:

Replacement of an existing electric motor with a upgraded electric motor typically used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production. The upgraded electric motor will be the same size as the existing less efficient motor it is replacing. This scenario is for motors ranging from >1 horsepower to <10 horsepower. Payment includes motor, appurtanences and labor to install.

### Before Situation:

The system is inefficient with a standard efficiency motor.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a NEMA premium efficiency motor. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 5

**Scenario Cost:** $845.59 **Scenario Cost/Unit:** $169.12

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 4 | $137.56 |
| ***Materials*** | | | | | | |
| Motor, electric, NEMA Premium, 5 HP | 1171 | Premium NEMA approved electric motor, 5 Horsepower and all required appurtenances. Includes materials and shipping only. | Each | $708.03 | 1 | $708.03 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #19 - Motor - 10 - <50 HP Electric Motor Upgrade

### Scenario Description:

Replacement of an existing electric motor with a upgraded electric motor typically used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production. The upgraded electric motor will be the same size as the existing less efficient motor it is replacing. This scenario is for motors ranging from 10 horsepower to <50 horsepower. Payment includes motor, appurtanences and labor to install.

### Before Situation:

The system is inefficient with a standard efficiency motor.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a NEMA premium efficiency motor. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 10

**Scenario Cost:** $1,393.51 **Scenario Cost/Unit:** $139.35

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Motor, electric, NEMA Premium, 10 HP | 1172 | Premium NEMA approved electric motor, 10 Horsepower and all required appurtenances. Includes materials and shipping only. | Each | $1,118.39 | 1 | $1,118.39 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #20 - Motor - ≥ 50 HP Electric Motor Upgrade

### Scenario Description:

Replacement of an existing electric motor with a upgraded electric motor typically used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production. The upgraded electric motor will be the same size as the existing less efficient motor it is replacing. This scenario is for motors of 50 horsepower or greater. Payment includes motor, appurtanences and labor to install.

### Before Situation:

The system is inefficient with a standard efficiency motor.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a NEMA premium efficiency motor. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 100

**Scenario Cost:** $7,615.09 **Scenario Cost/Unit:** $76.15

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 16 | $550.24 |
| ***Materials*** | | | | | | |
| Motor, electric, NEMA Premium, 100 HP | 1174 | Premium NEMA approved electric motor, 100 Horsepower and all required appurtenances. Includes materials and shipping only. | Each | $7,064.85 | 1 | $7,064.85 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #21 - Motor - Variable Speed Electric (Split Phase)

### Scenario Description:

Installation of a multi speed electric motor typically used to drive a ventilation fan in a livestock production house. Payment includes motor and labor to install. Control panel is not included. Refer to associated control panel scenarios as needed.

### Before Situation:

The system is inefficient when a motor operates at constant speed to satisfy a load which varies as to flow rate and/or pressure requirements.

### After Situation:

An on-farm energy audit has determined that energy use can be reduced through use of a multi speed electric motor. After the motor is installed, the motor speed can be adjusted to reduce power requirements and better match varied flow or pressure requirements. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Horsepower

**Scenario Unit:** Horsepower

**Scenario Typical Size:** 1

**Scenario Cost:** $225.28 **Scenario Cost/Unit:** $225.28

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 3 | $103.17 |
| ***Materials*** | | | | | | |
| Motor, electric, Multi Speed, 10 HP | 1154 | Multi speed electric motor, 10 Horsepower maximum output and all required appurtenances. Materials only. | Horsepower | $122.11 | 1 | $122.11 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #22 - Heating - Radiant Systems

### Scenario Description:

Replace "pancake" Brood Heaters in a poultry house with Radiant Tube Heaters, or similar. Replacement will require the materials and labor to remove existing heating system, re-plumb gas lines, cables and wench system to retrofit new radiant tube heaters, and miscellaneous items to complete the installation. Alternate acceptable radiant heating systems can include radiant brooders and quad radiant systems as indicated in the energy audit. Payment includes materials and labor to install the new system.

### Before Situation:

Inefficient heat distribution equipment, such as conventional "pancake" brood heaters. The Pancake brooder, mounted at a low installation height, primarily warms the air. They provide a one-to-two foot perimeter at desired temperatures around each brooder. A large number of brooders are required to cover a significant percent of floor space. As the warmed air naturally rises it loses effectiveness for poultry on the ground.

### After Situation:

Energy use is reduced through installation of a more efficient heater. Radiant tube heaters primarily warm objects within a direct line of sight (similar to the sun or an open fire). Air temperature is of relatively little importance for a radiant heating systems to be effective. As a result, radiant sytems are typically installed 5' or more above the floor level. This height extends the distribution of the radiant heat over a larger area than is possible with pancake style heaters. A roughly 16' diameter radiant heat zone heats over twice that of a convential pancake brooder. The typical scenario consists of the replacement of 28 brood heaters with 6 radiant tube heaters. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each

**Scenario Unit:** Each

**Scenario Typical Size:** 1

**Scenario Cost:** $1,410.83 **Scenario Cost/Unit:** $1,410.83

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 2 | $68.78 |
| ***Materials*** | | | | | | |
| Heater, radiant tube | 1163 | Radiant tube heater rated at 125,000 BTU/hour. Materials only. | Each | $1,342.05 | 1 | $1,342.05 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #23 - Heating - Building

### Scenario Description:

Replace existing low efficiency heaters with new high efficiency heaters. High-efficiency heating systems include any heating unit with efficiency rating of 80%+ for fuel oil and 90%+ for natural gas and propane. Applications may be air heating/building environment and hydronic (boiler) heating for agricultural operations, including under bench, or root zone heating. An alternative to heater replacement might be the addition of climate control system and electronic temperature controls with +/- 1 degree F differential, to reduce the annual run time. Payment includes heater and labor to install.

### Before Situation:

Buildings heated with low efficiency heaters or heaters without proper electronic climate controls

### After Situation:

Higher efficiency heaters reduce energy consumption, energy costs, and GHG emissions. These replacement systems can be fueled by natural gas, propane, or fuel oil. Associated practices/activities: 122-AgEMP - HQ and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Rated Heat Output

**Scenario Unit:** 1,000 BTU/Hour

**Scenario Typical Size:** 750

**Scenario Cost:** $6,722.74 **Scenario Cost/Unit:** $8.96

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 16 | $550.24 |
| ***Materials*** | | | | | | |
| Heater, high efficiency | 1165 | Natural gas, propane, or fuel oil unit heater or boiler and venting materials. Includes materials and shipping only. | 1,000 BTU/Hour | $8.23 | 750 | $6,172.50 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #24 - Heating - Attic Heat Recovery Vents

### Scenario Description:

Install actuated inlets or automatic latching gravity inlets that draw warmer, drier air from the attic to assist with moisture and heat control when ventiliation fans are being operated in poultry houses and swine barns. In certain situlations it may be necessary to also upgrade the ventilation system in addition to the vent upgrades. Other systems to transfer heat, as detailed in ASABE S612-compliant energy audit may also be used. Payment includes materials and labor to install.

### Before Situation:

Heated buildings with attic spaces but no means to transfer heat between the heated space, attic, and ambient (outside) air when relative conditions allow for reduced energy use.

### After Situation:

Attic vents or inlets allow dry warm air from the attic to cirulated through out the building in a 40' x 500' poultry house. By using pre-warmed air from the attic less energy is needed for heating 122-AgEMP - HQ and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Each inlet

**Scenario Unit:** Each

**Scenario Typical Size:** 14

**Scenario Cost:** $2,250.98 **Scenario Cost/Unit:** $160.78

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 24 | $825.36 |
| ***Materials*** | | | | | | |
| Inlet, Attic Ceiling | 2414 | Poultry house attic air inlets. Includes materials only. | Each | $101.83 | 14 | $1,425.62 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #25 - Building Envelope - Attic Insulation

### Scenario Description:

Install a minimum R-7 insulation in an existing attic or ceiling to reduce heat transfer. Increased insulation reduces seasonal heat loss and heat gain which reduces the respective need for heating and cooling equipment to operate. Payment includes materials, equipment and labor to install.

### Before Situation:

An agriculture house with an inefficient building envelope with limited attic insulation.

### After Situation:

A more effective and efficient building envelope can be created through addition of, or increased, attic insulation. Associated practices/activities: 122-AgEMP - HQ, 672-Building Envelope Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Area of Attic Insulated

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 20,000

**Scenario Cost:** $15,000.00 **Scenario Cost/Unit:** $0.75

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Materials*** | | | | | | |
| Insulation, Fiberglass or cellulose, R-15 | 1196 | Fiberglass or cellulose insulation R-15, includes materials, equipment and labor to install. | Square Foot | $0.75 | 20000 | $15,000.00 |

**Practice: 374 - Farmstead Energy Improvement**

**Scenario: #26 - Building Envelope - Wall Insulation**

**Scenario Description:**

Enclose both sidewalls and endwalls from ceiling to floor in one of two manners: 1) metal exterior, 3.5" fiberglass batts (R-11), vapor barrier, & interior plywood or OSB sheathing, or 2) closed-cell polyurethane foam application (minimum 1" thickness (R-7) of 2.5 lbs/cu.ft. or higher density, (3.0 or higher density preferred) with a form of physical protective barrier on lower 2' (may be 6 lbs/cu.ft. or higher density 1/8" thick foam, or treated lumber). Payment includes materials, equipment and labor to install.

**Before Situation:**

An agriculture house with an inefficient building envelope with limited wall insulation.

**After Situation:**

A more effective and efficient building envelope can be created through addition of, or increased, insulation in a 40' x 400' poultry house. Associated practices/activities: may include 122-AgEMP - HQ, 672-Building Envelope Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Area of Wall Insulated

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 4,500

**Scenario Cost:** $8,280.00 **Scenario Cost/Unit:** $1.84

**Cost Details (by category):**

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Materials*** | | | | | | |
| Insulation, polyurethane, R-7, with sheathing skirt | 1198 | Closed-cell polyurethane foam insulation (minimum 1" thickness (R-7) with a protective sheeting barrier on lower 2 feet of wall height. Includes materials, equipment and labor to install. | Square Foot | $1.84 | 4500 | $8,280.00 |

**Practice: 374 - Farmstead Energy Improvement**

**Scenario: #27 - Building Envelope - Sealant**

**Scenario Description:**

Seal the gaps between walls, gables, ceiling, etc. in a poultry house or greenhouse. Payment includes materials, equipment and labor performed by a professional contractor.

**Before Situation:**

An agricultural facility with an inefficient building envelope with gaps between walls, ceiling, etc. for a total of 2400 linear feet.

**After Situation:**

A more effective and efficient building envelope can be created through interior sealing of the exterior walls at the footer plate, eaves, ridge cap, and gable ends. The sealant reduces seasonal heat loss and heat gain due to infiltration which reduces the respective need for heating and cooling equipment to operate. The unit basis of payment in this scenario is each house based on 60' x 500' poultry house with an assumed need of sealant to seal 2400 linear feet of gap. Associated practices/activities: may include 122-AgEMP - HQ, 672-Building Envelope Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Perimeter of heated structure

**Scenario Unit:** Foot

**Scenario Typical Size:** 2,400

**Scenario Cost:** $3,816.00 **Scenario Cost/Unit:** $1.59

**Cost Details (by category):**

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Materials*** | | | | | | |
| Sealant | 1150 | Greenhouse and building gap sealant. Performed by a professional contractor spraying the areas with an approved sealant for poultry production facilities. Includes materials, equipment and labor to install. | Foot | $1.59 | 2400 | $3,816.00 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #28 - Building Envelope - Greenhouse Screens

### Scenario Description:

Installation of a mechanical energy screen system associated with a greenhouse consisting of a drive motor, support cables, controls, and shade material, which may be woven, knitted, or non-woven strips of aluminum fiber, polyethylene, nylon or other synthetic material. The screen provides a means to better control solar heat gain and heat transfer during night or cold weather conditions to reduce energy use. Screens and similar devices may also be used to divide internal areas and allow for differentiated heating, ventilation, or cooling system operation to reduce energy use. Payment includes materials and labor to install.

### Before Situation:

Heating and cooling of an existing greenhouse, or similar structure with conditioned spaces, is inefficient due to poorly regulated heat transfer. A need to regulate an entire space for uniform conditions when some portions have differing, intermittent requirements can also reduce efficiency.

### After Situation:

The greenhouse is fitted with a mechanically controlled energy screen installed truss-to-truss or gutter-to-gutter, with side screens as necessary, reducing heat loss in the greenhouse. Associated practices/activities: may include 122-AgEMP - HQ, 672-Building Envelope Improvement, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Area of Screen

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 25,000

**Scenario Cost:** $45,800.24 **Scenario Cost/Unit:** $1.83

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 16 | $550.24 |
| ***Materials*** | | | | | | |
| Thermal blanket 10,001 - 50,000 square foot | 1148 | Thermal blanket greenhouse screens: mechanical energy screen system consists of a drive motor, support cables, controls, and shade material, which may be woven, knitted, or non-woven. Size Range is 10,001 to 50,000 square feet. Materials only. | Square Foot | $1.81 | 25000 | $45,250.00 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #29 - Building Envelope - Greenhouse Unglazed Wall Insulation

### Scenario Description:

Installation of insulation in greenhouse to address energy loss. The insulation can be either of the cellouse or bubble type (or equivalent). The increased insulation reduces seasonal heat loss and heat gain which reduces the respective need for heating and cooling equipment to operate. Payment includes materials and labor to install.

### Before Situation:

Green house with standard glazing, plastic or polycarbonate walls and no insulation. Heating and cooling of an existing greenhouse is inefficient due to excessive heat loss.

### After Situation:

The greenhouse is fitted with insulation installed truss-to-truss or gutter-to-gutter and/or non glazed endwalls and/or sidewalls, reducing heat loss and gain in the greenhouse. Associated practices/activities: may include 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Square Feet of insulation

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 25,000

**Scenario Cost:** $7,050.24 **Scenario Cost/Unit:** $0.28

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 16 | $550.24 |
| ***Materials*** | | | | | | |
| Insulation, Greenhouse, Reflective Bubble | 2410 | Double bubble reflective insulation with aluminum foil on both sides. Includes materials and shipping only. | Square Foot | $0.26 | 25000 | $6,500.00 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #30 - Building Envelope - Insulated Door Upgrade

### Scenario Description:

Replace an existing door with an insulated door, such as but not limited to a steel roll up door in a poultry building. Increased insulation reduces seasonal heat loss and heat gain which reduces the respective need for heating and cooling equipment to operate. Payment includes materials and labor to install.

### Before Situation:

Agriculture building's existing door is inefficient

### After Situation:

A 20 guage 12' x 12' rolling service insulated steel door is installed as a replacement for an existing less efficient door on a poultry building. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Square foot

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 144

**Scenario Cost:** $1,499.12 **Scenario Cost/Unit:** $10.41

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 8 | $275.12 |
| ***Materials*** | | | | | | |
| Door, Insulated, Roll-up | 2392 | Rolling service insulated steel door, 20 gauge. Includes hardware required to install. Used to replace non insulated door in poultry buildings. Materials only. | Square Foot | $8.50 | 144 | $1,224.00 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #31 - Building Envelope - Insulated Curtain Upgrade

### Scenario Description:

Replacement of an existing non-insulated curtain with a seven layer insulated curtain with an R- value of 3 for a livestock building. The curtain's two outer layers are vinyl and polyethylene and the five inner layers are composed of insulating materials with air trapping fibers and a vapor barrier. Payment includes curtain and labor to install. Payment does not includes mounting accessories because the scenario assumes the curtain is replacing a non-insulated curtain.

### Before Situation:

Existing livestock curtain is inefficient.

### After Situation:

A 7 layer insulated curtain is installed as a replacement for an existing less efficient curtain on a livestock building. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Square Foot

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 1,080

**Scenario Cost:** $2,602.24 **Scenario Cost/Unit:** $2.41

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 16 | $550.24 |
| ***Materials*** | | | | | | |
| Curtain , 7-Layer, R3 Insulated | 2427 | Seven layer insulated curtain with an R-value of 3 for a livestock building. Typical curtain size is 4' x 270'. The curtain's two outer layers are vinyl and polyethylene and the five inner layers are composed of insulating materials with air trapping fi | Square Foot | $1.90 | 1080 | $2,052.00 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #32 - Building Envelope - Curtain Wall Conversion

### Scenario Description:

Converting part or all of a curtain wall to solid insulated wall by installation of an insulated metal cover in a livestock building. Payment includes materials and labor for the installation of a weather proof exterior such as, but not limited to, corrugated steel, and insulation such as, but not limited to polyurethane R-7. Payment does not include upgrade to ventilation.

### Before Situation:

Existing livestock curtain is inefficient.

### After Situation:

An insualted metal wall is installed as a replacement for an existing less efficient curtain on a livestock building. Conversion is for an building that requires 3040 sq ft of wall to replace the curtains. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Square Foot

**Scenario Unit:** Square Foot

**Scenario Typical Size:** 3,040

**Scenario Cost:** $10,948.10 **Scenario Cost/Unit:** $3.60

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| General Labor | 231 | Labor performed using basic tools such as power tool, shovels, and other tools that do not require extensive training. Ex. pipe layer, herder, concrete placement, materials spreader, flagger, etc. | Hour | $22.43 | 30 | $672.90 |
| ***Materials*** | | | | | | |
| Insulation, polyurethane, R-7, with sheathing skirt | 1198 | Closed-cell polyurethane foam insulation (minimum 1" thickness (R-7) with a protective sheeting barrier on lower 2 feet of wall height. Includes materials, equipment and labor to install. | Square Foot | $1.84 | 3040 | $5,593.60 |
| Corrugated Steel, 28 gage | 223 | Corrugated or ribbed, galvanized, 28 gauge, includes fasteners, materials only. | sq ft | $1.54 | 3040 | $4,681.60 |

## Practice: 374 - Farmstead Energy Improvement

## Scenario: #33 - Grain Dryer

### Scenario Description:

A more efficient replacement continuous dryer rated for the present dryer bushel/per hour capacity to treat existing energy concerns. The operation includes a microcomputer-based control system that adjusts the amount of time the crop remains in the dryer in order to achieve a consistent and accurate moisture content in the dried product. Alternate types of replacement dryers which reduce energy use are acceptable as defined by the energy audit. The upgraded grain dryer will be the same size as the existing less efficient grain dryer it is replacing. Payment includes materials and labor needed for the installation.

### Before Situation:

Current grain dryer identified in the Agricultural Energy Management Plan is inefficient.

### After Situation:

Energy use is reduced through installation of a more efficient continuous dryer that uses a microcomputer-based controller to reduce overdrying and total time of operation. The typical operation requires a rated capacity of 860 bushels per hour. Associated practices/activities may include: 122-AgEMP - HQ, and other activities within 374-Farmstead Energy Improvement. The resource concern is inefficient use of energy in the farm operation which increases dependence on non-renewable energy sources and can be addressed through improved energy efficiency. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

**Scenario Feature Measure:** Rated capacity of the dryer

**Scenario Unit:** Bushel per Hour

**Scenario Typical Size:** 860

**Scenario Cost:** $74,764.80 **Scenario Cost/Unit:** $86.94

### Cost Details (by category):

| Component Name | ID | Component Description | Unit | Price ($/unit) | Quantity | Cost |
|---|---|---|---|---|---|---|
| ***Labor*** | | | | | | |
| Skilled Labor | 230 | Labor requiring a high level skill set: Includes carpenters, welders, electricians, conservation professionals involved with data collection, monitoring, and or record keeping, etc. | Hour | $34.39 | 16 | $550.24 |
| ***Materials*** | | | | | | |
| Grain dryer, Centrifugal, 20' | 1160 | Grain dryer, 20 foot Centrifugal with rated capacity of 785 bushels/hour. Materials only. | Bushels per Hour | $84.01 | 172 | $14,449.72 |
| Grain dryer, Axial, 16' | 1159 | Grain dryer, 16 foot Axial with rated capacity of 600 bushels/hour. Materials only. | Bushels per Hour | $78.54 | 172 | $13,508.88 |
| Grain dryer, Centrifugal, 24' | 1161 | Grain dryer, 24 foot Centrifugal with rated capacity of 860 bushels/hr. Materials only. | Bushels per Hour | $89.97 | 172 | $15,474.84 |
| Grain dryer, Axial 28' | 1162 | Grain dryer, 28 foot Axial with rated capacity of 990 bushels/hr. Materials only. | Bushels per Hour | $87.99 | 172 | $15,134.28 |
| Grain dryer, Axial, 12' | 1158 | Grain dryer, 12 foot Axial with rated capacity of 460 bushels/hour. Materials only. | Bushels per Hour | $90.97 | 172 | $15,646.84 |