

Practice: 374 - Farmstead Energy Improvement

Scenario: #1 - Lighting - CFL

Scenario Description:

To install dimmable CFLs to replace incandescent lamps on a one-for-one basis. Light fixtures do not have to be replaced. A typical poultry house has 48 fixtures. 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, gasketed or weatherproof housings are required to prevent corrosion and premature failure.

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: \$17.49

Scenario Cost/Unit: \$17.49

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	\$22.96	0.167	\$3.83
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

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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. A typical poultry house has 48 fixtures. 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, gasketed or weatherproof housings are required to prevent corrosion and premature failure.

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: \$22.21

Scenario Cost/Unit: \$22.21

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	\$22.96	0.167	\$3.83
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

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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.

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: \$329.32

Scenario Cost/Unit: \$329.32

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	\$39.38	1	\$39.38
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

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Scenario: #4 - Lighting - Pulse-Start Metal Halide

Scenario Description:

The lighting system consists of a Pulse-Start Metal Halide (PSMH) lamp with a matched ballast or light-emitting diode (LED) equivalent fixtures (as detailed in ASABE S612-compliant energy audit). Associated materials for installation of replacement fixtures are included. Appropriate disposal of existing lamps, ballasts and other materials is required

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: \$40.25

Scenario Cost/Unit: \$40.25

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	\$39.38	1	\$39.38
Materials						
Lighting, Pulse Start Metal Halide	2425	Replacement of lighting with PSMH Light.	Watt	\$0.87	1	\$0.87

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Scenario: #5 - Ventilation - Exhaust

Scenario Description:

Replacement of a conventional exhaust fan with high volume, low speed, efficient exhaust fan. Fans being installed should be models previously tested by BESS Lab or the Air Movement and Control Association and be in top 20 percentile of fans tested. Practice certification will be through receipts and pictures from the applicant. Typical scenario includes the replacement of a 48" fan.

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: \$1,326.18

Scenario Cost/Unit: \$1,326.18

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	\$39.38	3	\$118.14
Materials						
Fan, exhaust, 48" High Efficiency	1187	48 inch high efficiency exhaust fan, controls, wiring, and associated appurtenances. Materials only.	Each	\$1,208.04	1	\$1,208.04

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Scenario: #6 - Ventilation - HAF

Scenario Description:

A system of fans are installed to create a horizontal air circulation pattern; the new system promotes efficient heat and moisture distribution. In a typical 10,000 square foot greenhouse, 10 HAF fans are needed. Fan performance meets Energy Audit efficiency criteria as tested by AMCA or BESS Labs.

Before Situation:

Inefficient air circulation system in a greenhouse.

After Situation:

High-efficiency air circulation system which reduces energy use. 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: 1

Scenario Cost: \$218.66

Scenario Cost/Unit: \$218.66

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	\$39.38	2	\$78.76
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	1	\$139.90

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Scenario: #7 - Plate Cooler

Scenario Description:

The installation of all stainless steel dual pass plate cooler, type 316 stainless steel. Practice installation will be by a factory trained dairy technician and according manufacturer's specifications. Practice certification to be made by a qualified Professional Engineer.
 AgEMP CAP 122

Associated Practices:

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: \$6,389.05

Scenario Cost/Unit: \$6,389.05

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	\$39.38	8	\$315.04
Materials						
Plate Cooler, 750 - 999 gal/hr capacity	1178	Stainless Steel, dual pass plate cooler with 750 - 999 gallon/hour capacity. Includes materials and shipping only.	Each	\$6,074.01	1	\$6,074.01

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Scenario: #8 - Scroll Compressor

Scenario Description:

Install a new scroll compressor, associated controls, wiring, and materials to retrofit an existing refrigeration system. A new condenser is not included in this typical scenario. Typical scenario includes a new 5 horsepower scroll compressor. Associated Practices: AgEMP CAP 122

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: Number of compressors

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$2,642.99

Scenario Cost/Unit: \$2,642.99

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	\$39.38	4	\$157.52
Materials						
Scroll Compressor - 5 HP	1183	Scroll compressor, 5 Horsepower, controls, wiring, and appurtenances. Materials only.	Each	\$2,485.47	1	\$2,485.47

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Scenario: #9 - Variable Speed Drive > 5 HP

Scenario Description:

The typical scenario consists of a variable speed drive (VSD) and appurtances, such as hook-ups, control panels, wiring, control blocks, filters, switches, pads, etc. attached to an electric motor used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production. The motor size, on which the VSD is added, is 10 HP or less.

Associated Practices: AgEMP CAP 122

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: HP of VFD

Scenario Unit: Horsepower

Scenario Typical Size: 50

Scenario Cost: \$11,067.04

Scenario Cost/Unit: \$221.34

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	\$39.38	8	\$315.04
Materials						
Variable Speed Drive, 50 HP	1288	Variable speed drive for 50 Horsepower electric motor. Does not include motor. Materials only.	Horsepower	\$215.04	50	\$10,752.00

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Scenario: #10 - Automatic Controller System

Scenario Description:

The typical scenario consists of an automatic control system installed on an existing manually controlled agricultural system. Typical components may include any of the following: wiring, sensors, data logger, logic controller, communication link, software, switches, and relay.

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: \$1,443.70

Scenario Cost/Unit: \$1,443.70

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	\$39.38	8	\$315.04
Materials						
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
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, 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

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Scenario: #11 - Motor Upgrade > 100 HP

Scenario Description:

The typical scenario consists of replacing an existing electric motor used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production with a new, high efficiency motor. The motor size is larger than 100 horsepower.

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: Number of motors

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$22,139.96

Scenario Cost/Unit: \$22,139.96

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	\$39.38	16	\$630.08
Materials						
Motor, electric, NEMA Premium, 200 HP	1175	Premium NEMA approved electric motor, 200 Horsepower and all required appurtenances. Includes materials and shipping only.	Each	\$21,509.88	1	\$21,509.88

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Scenario: #12 - Motor Upgrade 10 - 100 HP

Scenario Description:

The typical scenario consists of replacing an existing electric motor used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production with a new, high efficiency motor. The motor size is equal to or larger than 10 and less than or equal to 100 horsepower.

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: Number of motors

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$5,970.61

Scenario Cost/Unit: \$5,970.61

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	\$39.38	8	\$315.04
Materials						
Motor, electric, NEMA Premium, 50 HP	1173	Premium NEMA approved electric motor, 50 Horsepower and all required appurtenances. Includes materials and shipping only.	Each	\$5,655.57	1	\$5,655.57

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Scenario: #13 - Motor Upgrade > 1 and < 10 HP

Scenario Description:

The typical scenario consists of replacing an existing electric motor used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production with a new, high efficiency motor. The motor size is larger than 1 and less than 10 horsepower.

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: Number of motors

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$865.55

Scenario Cost/Unit: \$865.55

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	\$39.38	4	\$157.52
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

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Scenario: #14 - Motor Upgrade ≤ 1 HP

Scenario Description:

The typical scenario consists of replacing an existing electric motor used to drive a ventilation fan, irrigation pumps, vacuum pump, or similar equipment involved with agricultural production with a new, high efficiency motor. The motor size is less than or equal to 1 horsepower.

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: Number of motors

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$591.27

Scenario Cost/Unit: \$591.27

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	\$39.38	4	\$157.52
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

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Scenario: #15 - Heating - Radiant Tube

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 evidenced by the energy audit. The typical scenario consists of the replacement of 28 brood heaters with 6 radiant tube heaters.

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. 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: Number of heaters

Scenario Unit: Each

Scenario Typical Size: 6

Scenario Cost: \$8,682.38

Scenario Cost/Unit: \$1,447.06

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	\$39.38	16	\$630.08
Materials						
Heater, radiant tube	1163	Radiant tube heater rated at 125,000 BTU/hour. Materials only.	Each	\$1,342.05	6	\$8,052.30

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Scenario: #16 - 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.

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: 1000 BTU/Hour

Scenario Typical Size: 750

Scenario Cost: \$6,802.58

Scenario Cost/Unit: \$9.07

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	\$39.38	16	\$630.08
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

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Scenario: #17 - 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 ventilation fans are being operated in poultry houses and swine barns. Other systems to transfer heat, as detailed in ASABE S612-compliant energy audit may also be used. Based on a 40' x 500' poultry house.

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 circulated through out the building. 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: Number of inlets

Scenario Unit: Each

Scenario Typical Size: 14

Scenario Cost: \$2,370.74

Scenario Cost/Unit: \$169.34

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	\$39.38	24	\$945.12
Materials						
Inlet, Attic Ceiling	2414	Poultry house attic air inlets. Includes materials only.	Each	\$101.83	14	\$1,425.62

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Scenario: #18 - Building Envelope - Attic Insulation

Scenario Description:

Install a minimum R-7 insulation in addition to 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.

Before Situation:

A poultry 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: \$16,800.00

Scenario Cost/Unit: \$0.84

Cost Details (by category):

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<i>Materials</i>						
Insulation, Fiberglass or cellulose, R-15	1196	Fiberglass or cellulose insulation R-15, includes materials, equipment and labor to install.	Square Foot	\$0.84	20000	\$16,800.00

Practice: 374 - Farmstead Energy Improvement

Scenario: #19 - 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). Based on a 40' x 400' poultry house.

Before Situation:

A poultry 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. 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: \$8,145.00

Scenario Cost/Unit: \$1.81

Cost Details (by category):

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<i>Materials</i>						
Insulation, Panel, R-11 with sheathing	1197	Insulated wall panel typically 3.5" fiberglass batts (R-11), vapor barrier and OSB sheathing, or equal, includes materials, equipment and labor to install.	Square Foot	\$1.81	4500	\$8,145.00

Practice: 374 - Farmstead Energy Improvement

Scenario: #20 - Building Envelope - Sealant

Scenario Description:

A typical scenario is sealing the gaps between walls, gables, ceiling, etc. in a poultry house or greenhouse. Sealing is performed by a professional contractor, not merely use of spray foam from a can. 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.

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. 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: \$4,272.00

Scenario Cost/Unit: \$1.78

Cost Details (by category):

Component Name	ID	Component Description	Unit	Price (\$/unit)	Quantity	Cost
<i>Materials</i>						
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	\$1.78	2400	\$4,272.00

Practice: 374 - Farmstead Energy Improvement

Scenario: #21 - Building Envelope - Greenhouse Screens

Scenario Description:

The mechanical energy screen system consists 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.

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: \$45,880.08

Scenario Cost/Unit: \$1.84

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	\$39.38	16	\$630.08
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: #22 - Greenhouse - Insulate Unglazed Walls

Scenario Description:

A typical scenario is the installation insulation in green house to address energy loss. The insulation can be either of the cellulose 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.

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: \$7,130.08

Scenario Cost/Unit: \$0.29

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	\$39.38	16	\$630.08
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: #23 - Grain Dryer

Scenario Description:

A replacement continuous dryer rated for an appropriate rated bushel/per hour capacity for the operation that 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 evidenced by the energy audit. The typical operation requires a rated capacity of 860 bushels per hour.

Before Situation:

Wet crop is loaded in the top of a horizontal, continuous dryer. Dried crop is augured from the bottom of the dryer. The heated air from the unit's burners passes from the burner plenum through the grain. An on-farm energy audit has identified inefficient manual control of the dryer where the operator controls the plenum temperature and the discharge auger speed to achieve the desired final moisture content. Moisture content is based on measurement of grain leaving the dryer. The plenum temperature setting depends on the moisture content of crop with a typical value of 220 F. The burner cycles on and off, automatically, as necessary to maintain the plenum temperature selected by the operator.

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. 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: \$74,844.64

Scenario Cost/Unit: \$87.03

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	\$39.38	16	\$630.08
Materials						
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
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, 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, 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, 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

Practice: 374 - Farmstead Energy Improvement

Scenario: #24 - Tunnel Door

Scenario Description:

Replace the traditional tunnel inlet curtain with a solid tunnel inlet door to reduce the amount of heat leakage and reduce the amount of energy used to heat and cool the poultry house. Typical tunnel inlet door is 5 feet high and 30 feet long or 150 square feet. Typical poultry house is 40 feet by 500 feet.

Before Situation:

A poultry house with a traditional tunnel inlet curtain is losing heat and is inefficient while using more energy.

After Situation:

Replace the traditional tunnel inlet curtain with a solid tunnel inlet door to reduce the amount of heat leakage and reduce the amount of energy used to heat and cool the poultry house. Typical tunnel inlet door is 5 feet high and 30 feet long or 150 square feet. Typical poultry house is 40 feet by 500 feet. 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: Area of tunnel door

Scenario Unit: Square Foot

Scenario Typical Size: 150

Scenario Cost: \$1,594.68

Scenario Cost/Unit: \$10.63

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	\$22.96	2	\$45.92
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	\$39.38	2	\$78.76
Materials						
Tunnel doors	2413	Tunnel doors are used to replace curtains on tunnel inlets in a poultry house. Includes materials only.	Square Foot	\$9.80	150	\$1,470.00

Practice: 374 - Farmstead Energy Improvement

Scenario: #25 - RO<=200 GPH

Scenario Description:

Reverse osmosis (RO) unit is installed to concentrate the sugar content of sap prior to boiling to decrease boiling time and fuel use. RO units use a combination of electric high pressure pumps and membranes to concentrate the sap. Use for units rated at 200 GPH or less. Complete unit is added to operation with an existing evaporator to process sap before it enters the maple evaporator. Boiling time for concentrated sap is greatly reduced. Typical capacity of the RO unit is 125 GPH. Completion of an Agricultural Energy Management Plan AgEMP or equivalent energy audit identifies the energy savings with planned installation of the RO unit. Units are typically manufactured for maple applications. Associated Practices: AgEMP CAP 122

Before Situation:

1000 tap maple operation with a fuel oil fired evaporator running all sap through the evaporator and no existing RO. Sap is 1-2% sugar. All concentration is through evaporator with excessive boil time, fuel use, and emissions.

After Situation:

Sap is processed through RO before entering the evaporator. Sap is concentrated to 8% or more drastically reducing boil time, fuel consumption and emissions. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Capacity of RO

Scenario Unit: Gallon per Hour

Scenario Typical Size: 125

Scenario Cost: \$3,939.18

Scenario Cost/Unit: \$31.51

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	\$39.38	8	\$315.04
Materials						
Reverse Osmosis unit, variable cost portion	2225	Variable cost portion of a reverse osmosis unit used for maple syrup processing. Materials only.	Gallons per Hour	\$17.20	125	\$2,150.00
Reverse Osmosis unit, fixed cost portion	2224	Fixed cost portion of a reverse osmosis unit used for maple syrup processing. Materials only.	Each	\$1,474.14	1	\$1,474.14

Practice: 374 - Farmstead Energy Improvement

Scenario: #26 - RO>200-600 GPH

Scenario Description:

Reverse osmosis (RO) unit is intalled to concentrate the sugar content of sap prior to boiling to decrease boiling time and fuel use. RO units use a combination of electric high pressure pumps and membranes to concentrate the sap. Use for units rated at greater than 200 GPH and less than or equal to 600 GPH. Complete unit is added to operation with an existing evaporator only to increase existing RO capacity to process sap before it enters the maple evaporator. Boiling time for concentrated sap is greatly reduced. Typical capacity is 600 GPH. Completion of an Agricultural Energy Managment Plan AgEMP or equivalant energy audit indentifies the energy savings with planned installation of the RO unit. Units are typicllay manufactured for maple applications.

Associated Practices: AgEMP CAP 122

Before Situation:

3000 tap maple operation with a fuel oil fired evaporater running all sap through the evaporator and no existing RO. Sap is 1-2% sugar. All concentration is from combustion evaporation with excessive boil time, fuel use, and emissions.

After Situation:

Sap is processed through RO before entering the evaporator. Sap is concentrated to 8% or more drastically reducing boil time, fuel consumption, and emissions. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Capacity of RO

Scenario Unit: Gallon per Hour

Scenario Typical Size: 600

Scenario Cost: \$12,424.22

Scenario Cost/Unit: \$20.71

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	\$39.38	16	\$630.08
Materials						
Reverse Osmosis unit, fixed cost portion	2224	Fixed cost portion of a reverse osmosis unit used for maple syrup processing. Materials only.	Each	\$1,474.14	1	\$1,474.14
Reverse Osmosis unit, variable cost portion	2225	Variable cost portion of a reverse osmosis unit used for maple syrup processing. Materials only.	Gallons per Hour	\$17.20	600	\$10,320.00

Practice: 374 - Farmstead Energy Improvement

Scenario: #27 - RO >600 GPH or add on

Scenario Description:

Reverse osmosis (RO) unit is intalled to concentrate the sugar content of sap prior to boiling to decrease boiling time and fuel use. RO units use a combination of electric high pressure pumps and membranes to concentrate the sap. An add-on unit is added to an existing RO unit to increase existing RO capacity to process sap before it enters the maple evaporato or a large complete RO unit greater than 600 GPH is installed. Typical unit is 1200 GPH. Boiling time for concentrated sap is greatly reduced. Completion of an Agricultural Energy Managment Plan AgEMP or equivelant energy audit indentifies the energy savings with planned installation of the RO unit. Units are typiclly manufactured for maple applications.

Associated Practices:

AgEMP CAP 122

Before Situation:

5000 tap maple operation with a fuel oil fired evaporater running all sap through an existing RO that is under sized causing increased boil time, fuel consumption, and emissions.

After Situation:

Sap is processed through expanded RO before entering the evaporator. Sap is concentrated to 14% or more drastically reducing boil time, fuel consumption, and emissions. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Capacity of RO

Scenario Unit: Gallon per Hour

Scenario Typical Size: 1,200

Scenario Cost: \$20,955.04

Scenario Cost/Unit: \$17.46

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	\$39.38	8	\$315.04
Materials						
Reverse Osmosis unit, variable cost portion	2225	Variable cost portion of a reverse osmosis unit used for maple syrup processing. Materials only.	Gallons per Hour	\$17.20	1200	\$20,640.00

Practice: 374 - Farmstead Energy Improvement

Scenario: #28 - Enhanced preheater, small

Scenario Description:

The unit is installed over the evaporator pan and uses steam from the evaporator pan to pre-heat the sap to as high as 200°F while at the same time injecting air into the sap to promote evaporation. Use for units less than 40 sq ft. Evaporation rates are increased by 65-75%, based on vendor analysis, leading to 40-43% energy savings. Sap is concentrated from Brix 2% to 4% or more before it enters the flue pan. Steam-enhanced systems require at least 9 feet from floor to ceiling. With increased evaporation, it takes less time to boil the sap down, thus saving significant energy (oil & wood fuel) used in the process, as well as labor.

Before Situation:

Existing evaporator uses cold sap at inflow causing long boil times. inefficient fuel use and increased emissions.

After Situation:

Use of a preheater captures waste heat from the evaporator and preheats cold sap and concentrates sap. Boil time, fuel use, and emissions are reduced. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Area of pan

Scenario Unit: Square Foot

Scenario Typical Size: 24

Scenario Cost: \$9,141.55

Scenario Cost/Unit: \$380.90

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	\$39.38	4	\$157.52
Materials						
Sap Pre-Heater, High efficiency, fixed cost	2254	High efficiency sap pre-heater device, fixed cost portion. Materials only.	Each	\$4,102.19	1	\$4,102.19
Sap Pre-Heater, High efficiency, variable cost	2255	High efficiency sap pre-heater device, variable cost portion. Materials only.	Square Foot	\$203.41	24	\$4,881.84

Practice: 374 - Farmstead Energy Improvement

Scenario: #29 - Enhanced preheater, large

Scenario Description:

This unit is installed over the evaporator pan and uses steam from the evaporator pan to pre-heat the sap to as high as 200°F while at the same time injecting air into the sap to promote evaporation. Use for units 40 sq ft and larger. Evaporation rates are increased by 65-75%, based on vendor analysis, leading to 40-43% energy savings. Sap is concentrated from Brix 2% to 4% or more before it enters the flue pan. Steam-enhanced systems require at least 9 feet from floor to ceiling. With increased evaporation, it takes less time to boil the sap down, thus saving significant energy (oil & wood fuel) used in the process, as well as labor.

Before Situation:

Existing evaporator uses cold sap at inflow causing long boil times. inefficient fuel use and increased emissions.

After Situation:

Use of a preheater captures waste heat from the evaporator and preheats cold sap and concentrates sap. Boil time, fuel use, and emissions are reduced. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Area of pan

Scenario Unit: Square Foot

Scenario Typical Size: 40

Scenario Cost: \$8,451.44

Scenario Cost/Unit: \$211.29

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	\$39.38	8	\$315.04
Materials						
Sap Pre-Heater, High efficiency, variable cost	2255	High efficiency sap pre-heater device, variable cost portion. Materials only.	Square Foot	\$203.41	40	\$8,136.40

Practice: 374 - Farmstead Energy Improvement

Scenario: #30 - High Efficiency Pans for < 1000 taps

Scenario Description:

Install high efficiency pans to an existing 2.5 ft. by 8 ft. maple syrup evaporator. High efficiency pans have increased flue surface area and improved flue arrangement to increase boiling rate given the same overall rate of energy inputs. Specific equipment and resulting efficiencies need to be documented in an approved Agricultural Energy Management Plan (AgEMP). Installation needs to according to manufactures's recommendation and schematic. Installation needs to be provided by a Maple Equipment Technician and approved by a qualified Engineer.
 Associated Practices: CAP 122

Before Situation:

Existing maple operation has an existing maple syrup evaporater with documented inefficiencies from an approved AgEMP. Identified efficiency improvement is from pan replacement on an existing arch that is deemed efficient and can be retrofitted with new evaporater pans.

After Situation:

New pans are installed with increased flue surace area and or improved flue agrangements. Boiling rate is increased, boiling time and fuel use are decreased. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Each High Efficiency Pan

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$4,157.63

Scenario Cost/Unit: \$4,157.63

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	\$39.38	8	\$315.04
Materials						
Maple Evaporator Pan (without Arch) < 1,000 Taps	2405	High efficiency evaporator pan for maple syrup production. Does not include the arch. Small operations, less than 1,000 taps.	Each	\$3,842.59	1	\$3,842.59

Practice: 374 - Farmstead Energy Improvement

Scenario: #31 - High Efficiency Pans >=1000 taps

Scenario Description:

Install high efficiency pans to an existing 4 ft. by 16 ft. maple syrup evaporator. High efficiency pans have increased flue surface area and improved flue arrangement to increase boiling rate given the same overall rate of energy inputs. Specific equipment and resulting efficiencies need to be documented in an approved Agricultural Energy Management Plan (AgEMP). Installation needs to according to manufactures's recommendation and schematic. Installation needs to be provided by a Maple Equipment Technician and approved by a qualified Engineer.
 Associated Practices: CAP 122

Before Situation:

Existing maple operation has an existing maple syrup evaporater with documented inefficiencies from an approved AgEMP. Identified efficiency improvement is from pan replacement on an existing arch that is deemed efficient and can be retrofitted with new evaporater pans.

After Situation:

New pans are installed with increased flue surace area and or improved flue agrangements. Boiling rate is increased, boiling time and fuel use are decreased. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Each High Efficiency Pan

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$15,184.18

Scenario Cost/Unit: \$15,184.18

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	\$39.38	8	\$315.04
Materials						
Maple Evaporator Pan (without Arch) ≥ 1,000 Taps	2403	High efficiency evaporator pan for maple syrup production. Does not include the arch. Large operations, greater than or equal to 1,000 taps.	Each	\$14,869.14	1	\$14,869.14

Practice: 374 - Farmstead Energy Improvement

Scenario: #32 - High Efficiency arch < 1000 taps

Scenario Description:

Install high efficiency 2.5 ft by 8 ft. combustion arch to provide combustion for evaporating maple sap. High efficiency arches use air injection, gasification technology, and/or increased insulation properties to increase energy efficiency by increasing boil rate and edits to reduce fuel use. Existing boiling pans are used or if new pans are specified in the AgEMP are installed under the appropriate scenario if available. Specific equipment and resulting efficiencies need to be documented in an approved Agricultural Energy Management Plan (AgEMP). Installation needs to according to manufacturer's recommendation and schematic. Installation needs to be provided by a Maple Equipment Technician and approved by a qualified Engineer.

Associated Practices: CAP 122

Before Situation:

An older inefficient maple evaporator uses excessive amounts of energy to produce a given amount of maple syrup. An approved AgEMP identifies efficiency improvements by replacing the combustion arch with a newer energy efficient combustion arch unit.

After Situation:

A high efficiency arch is installed that will increase boil rate and decrease boil time and energy used. Existing boiling pans are used on the new arch or if replaced are cost shared under an appropriate scenario. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Each Combustion Arch

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$2,015.21

Scenario Cost/Unit: \$2,015.21

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	\$39.38	8	\$315.04
Materials						
Maple Evaporator Combustion Arch without Pan < 1,000 Taps	2406	High efficiency evaporator combustion arch for maple syrup production. Does not include the pan. Small operations, less than 1,000 taps.	Each	\$1,700.17	1	\$1,700.17

Practice: 374 - Farmstead Energy Improvement

Scenario: #33 - High Efficiency arch >= 1000 taps

Scenario Description:

Install high efficiency 4 ft by 16 ft. combustion arch to provide combustion for evaporating maple sap. High efficiency arches use air injection, gasification technology, and/or increased insulation properties to increase energy efficiency by increasing boil rate and edits to reduce fuel use. Existing boiling pans are used or if new pans are specified in the AgEMP are installed under the appropriate scenario if available. Specific equipment and resulting efficiencies need to be documented in an approved Agricultural Energy Management Plan (AgEMP). Installation needs to according to manufacturer's recommendation and schematic. Installation needs to be provided by a Maple Equipment Technician and approved by a qualified Engineer.

Associated Practices: CAP 122

Before Situation:

An older inefficient maple evaporator uses excessive amounts of energy to produce a given amount of maple syrup. An approved AgEMP identifies efficiency improvements by replacing the combustion arch with a newer energy efficient combustion arch unit.

After Situation:

A high efficiency arch is installed that will increase boil rate and decrease boil time and energy used. Existing boiling pans are used on the new arch or if replaced are cost shared under an appropriate scenario. Any improvements are based on a Type 2 energy audit meeting the requirements of ASABE S612.

Scenario Feature Measure: Each Combustion Arch

Scenario Unit: Each

Scenario Typical Size: 1

Scenario Cost: \$15,311.94

Scenario Cost/Unit: \$15,311.94

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	\$39.38	8	\$315.04
Materials						
Maple Evaporator Combustion Arch without Pan ≥ 1,000 Taps	2404	High efficiency evaporator combustion arch for maple syrup production. Does not include the pan. Large operations, greater than or equal to 1,000 taps.	Each	\$14,996.90	1	\$14,996.90