Practice: 672 - Building Envelope Improvement

Scenario: #1 - 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 and 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: 20000

Total Scenario Cost: $6,033.74

Scenario Cost/Unit: $0.30

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
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	$22.04	48	$1,058.07
Materials						
Insulation material, cellulose	2272	Cellulose insulation. Unit is a measurement of the in-place volume after being blown. Includes materials only.	Cubic Foot	$0.75	6667	$4,975.67

Practice: 672 - Building Envelope Improvement

Scenario: #2 - 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 and 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: 4500

Total Scenario Cost: $8,154.95

Scenario Cost/Unit: $1.81

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total

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	$1.81	4500	$8,154.95

Practice: 672 - Building Envelope Improvement

Scenario: #3 - Building Envelope, Sidewall Renovation

Scenario Description: Renovate sidewalls from top of footer to eave to remove flexible curtains and construct an insulated permanent wall 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 has plastic or flexible drop-down curtains in one or more walls. The curtains, which provide little thermal resistance, are obsolete due to changes in the ventilation scheme of the house.

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 and 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 Renovated

Scenario Unit: Square Foot

Scenario Typical Size: 4620

Total Scenario Cost: $16,536.72

Scenario Cost/Unit: $3.58

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
Materials						
Corrugated Steel, 28 gage	223	Corrugated or ribbed, galvanized, 28 gauge, includes fasteners, materials only.	Square Foot	$1.39	4620	$6,400.85
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	$1.81	4620	$8,372.42
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	$22.04	80	$1,763.45

Practice: 672 - Building Envelope Improvement

Scenario: #4 - Building Envelope, Sealant, Open Truss

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 and 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: Length of House

Scenario Unit: Foot

Scenario Typical Size: 500

Total Scenario Cost: $4,083.52

Scenario Cost/Unit: $8.17

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total

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	$1.36	3000	$4,083.52

Practice: 672 - Building Envelope Improvement

Scenario: #5 - Building Envelope, Sealant, Drop Ceiling

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 and 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: Length of House

Scenario Unit: Foot

Scenario Typical Size: 500

Total Scenario Cost: $2,041.76

Scenario Cost/Unit: $4.08

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total

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	$1.36	1500	$2,041.76

Practice: 672 - Building Envelope Improvement

Scenario: #6 - 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 and 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: 25000

Total Scenario Cost: $49,696.43

Scenario Cost/Unit: $1.99

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
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	$28.79	16	$460.71
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	$1.97	25000	$49,235.73

Practice: 672 - Building Envelope Improvement

Scenario: #7 - 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 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.

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 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: 25000

Total Scenario Cost: $7,545.41

Scenario Cost/Unit: $0.30

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
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	$28.79	16	$460.71
Materials						
Insulation, Greenhouse, Reflective Bubble	2410	Double bubble reflective insulation with aluminum foil on both sides. Includes materials and shipping only.	Square Foot	$0.28	25000	$7,084.70

Practice: 672 - Building Envelope Improvement

Scenario: #8 - Building Envelope, Insulated Roll-Up Door

Scenario Description: A typical scenario is the replacement of non-insulated rollup doors on poultry houses with insulated rollup doors. The increased insulation reduces seasonal heat loss and heat gain which reduces the respective need for heating and cooling equipment to operate.

Before Situation: Poultry house has non-insulated or inefficiantly insulated rollup doors causing high heat loss or gain.

After Situation: A more effective and efficient energy seal can be created through the addition of, or increased R-value, insulated rollup doors. 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: Each Door

Scenario Unit: Each

Scenario Typical Size: 1

Total Scenario Cost: $1,517.30

Scenario Cost/Unit: $1,517.30

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
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	$22.04	5	$110.22
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 buildings. Materials only.	Square Foot	$8.79	160	$1,407.09

Practice: 672 - Building Envelope Improvement

Scenario: #9 - Building Envelope, Brood Curtain

Scenario Description: Replace an existing uninsulated 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 presumes the curtain is replacing an existing curtain.

Before Situation: The broiler house has an uninsulated mid-house brooding curtain or a brooding curtain which is in poor condition with holes and rips. Either condition allows a significant loss of heat to the off-end during the high-heat period of brooding.

After Situation: A seven-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, 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: Each Brood Curtain

Scenario Unit: Each

Scenario Typical Size: 1

Total Scenario Cost: $940.54

Scenario Cost/Unit: $940.54

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
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	$22.04	10	$220.43
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 fibers and a vapor barrier. Does not include mounting accessories, assumes it is replacing a non-insulated curtain.	Square Foot	$2.06	350	$720.11

Practice: 672 - Building Envelope Improvement

Scenario: #68 - Building Envelope, Tunnel Doors

Scenario Description: A typical scenario is the installation of tunnel doors to replace tunnel curtain openings. Tunnel curtain openings are typically 5 ft. by 60 ft. for a 40 ft. by 500 ft. poultry house; 600 sq. ft. of opening per house.

Before Situation: A 40 ft. by 500 ft. poultry house with an inefficient building envelope having 5 ft. by 60 ft. tunnel curtain openings.

After Situation: A more effective and efficient building envelope can be created through replacement of the tunnel curtain openings with tunnel doors. Associated practices/activities: may include 128-AgEMP, and other activities within 672-Building Envelope Improvement and 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: Sq. Ft. of opening

Scenario Unit: Square Foot

Scenario Typical Size: 600

Total Scenario Cost: $6,906.07

Scenario Cost/Unit: $11.51

Cost Details

Component Name	Id	Description	Unit	Cost	Qty	Total
Materials						
Tunnel doors	2413	Tunnel doors are used to replace curtains on tunnel inlets in a poultry house. Includes materials only.	Square Foot	$10.63	600	$6,377.04
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	$22.04	24	$529.04