Practice: 672 - Building Envelope Improvement

Scenario: #1 - 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' agricultural structure. NOTE: NOT USED FOR GREENHOUSES.

Before Situation:

An agricultural facility 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, 374-Farmstead Energy Improvement, and other activities within 672-Building Envelope 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 Wall Insulated

Scenario Unit: Square Foot

Scenario Typical Size: 12,000

Scenario Cost: $24,060.00 **Scenario Cost/Unit:** $2.01

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	$2.13	6000	$12,780.00
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	$1.88	6000	$11,280.00

Practice: 672 - Building Envelope Improvement

Scenario: #2 - 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, 374-Farmstead Energy Improvement, and other activities within 672-Building Envelope 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: $4,440.00 **Scenario Cost/Unit:** $1.85

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	$1.85	2400	$4,440.00

Practice: 672 - Building Envelope Improvement

Scenario: #3 - Slab/floor insulation in cold storage.

Scenario Description:

Thermal insulation installed below floor and/or concrete slab in cold storage spaces to reduce cooling load.

Before Situation:

Operation of cold storage systems (e.g. Walkin coolers) depend on maintaining an inside temperature against a thermal gradient compared to ambient and ground temperatures. Wall insulation (above grade) is generally well addressed via purchase of a modular panel walkin cooler box or via farm-built framed construction. Slab insulation, however, is not always addressed, despite the fact that the ground temperature presents a higher reference temperature (stronger gradient) during most of the typical New England storage season.

After Situation:

Moisture tolerant, below grade, extruded polystyrene insulation @ R4 per inch, referred to as blueboard. 2' x 8' sheets 2" thick. Installing insulation under the slab will improve overall system energy efficiency by providing a thermal break between the cooled space (generally 38 F for coolers and 0 F for freezers) and the ground (average 50 F). It may also support the adoption of concrete slabs in general in cooled spaces which has food safety benefit (condensate management and cleanability).

Scenario Feature Measure: Square feet of conditioned space.

Scenario Unit: Square Foot

Scenario Typical Size: 300

Scenario Cost: $1,458.00 **Scenario Cost/Unit:** $4.86

Cost Details (by category):

Component Name	ID	Component Description	Unit	Price ($/unit)	Quantity	Cost
Materials						
Insulation, Below Grade	2475	Moisture tolerant, below grade insulation to minimum equivalent R-value of 29 ft2-F/BTU.	Square Foot	$4.86	300	$1,458.00

Practice: 672 - Building Envelope Improvement

Scenario: #4 - Greenhouse Bubble Insulation

Scenario Description:

Place aluminium foil faced double bubble insulation on greenhouse sidewalls to bench height (3') and/or cover the endwalls of a greenhouse with insulation from ceiling to floor. NOTE: FOR GREENHOUSES ONLY.

Before Situation:

A greenhouse with standard glazing, plastic or polycarbonate walls has an inefficient building envelope constructed with limited wall insulation. Heating of existing greenhouse is inefficient due to excessive heat loss.

After Situation:

Aluminium foil faced double bubble insulation is placed betwen the inner layer of plastic and the frame of greenhouse sidewalls to bench height (3') and/or covers the endwalls of a greenhouse with insulation from ceiling to floor. A more effective and efficient building envelope created through addition of insulation. The increased insulation reduces seasonal heat loss which reduces the respective need for heating equipment to operate. Associated practices/activities: may include 122-AgEMP - HQ, 374-Farmstead Energy Improvement, and other activities within 672-Building Envelope 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 Wall Insulated

Scenario Unit: Square Foot

Scenario Typical Size: 600

Scenario Cost: $319.96 **Scenario Cost/Unit:** $0.53

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	$39.49	4	$157.96
Materials						
Insulation, Greenhouse, Reflective Bubble	2410	Double bubble reflective insulation with aluminum foil on both sides. Includes materials and shipping only.	Square Foot	$0.27	600	$162.00

Practice: 672 - Building Envelope Improvement

Scenario: #5 - Greenhouse Solid Insulation

Scenario Description:

Cover the endwalls ceiling to floor and/or the foundation (24 inches below ground) of a greenhouse with 1 inch of solid polystyrene or polyurethane insulation. NOTE: FOR GREENHOUSES ONLY.

Before Situation:

A greenhouse with an inefficient building envelope covered with limited end wall or foundation insulation.

After Situation:

Endwalls of greenhouse are covered from ceiling to floor and/or the foundation is covered to 24 inches below ground with 1 inch of solid polystyrene or polyurethane insulation. A more effective and efficient building envelope created through addition of insulation. Associated practices/activities: may include 122-AgEMP - HQ, 374-Farmstead Energy Improvement, and other activities within 672-Building Envelope 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 Insulated

Scenario Unit: Square Foot

Scenario Typical Size: 500

Scenario Cost: $577.96 **Scenario Cost/Unit:** $1.16

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	$39.49	4	$157.96
Materials						
Insulation, Greenhouse, Solid	2411	Solid insulation board with aluminum foil on both sides. 1" X 4' X 8' or 32 sq.ft. Includes materials and shipping only.	Square Foot	$0.84	500	$420.00

Practice: 672 - Building Envelope Improvement

Scenario: #6 - Greenhouse Screens <= 10,000 sq. ft.

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. This scenario includes screens that are <= 10,000 square foot.

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, 374-Farmstead Energy Improvemen, and other activities within 672-Building Envelope 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: 8,000

Scenario Cost: $17,111.84 **Scenario Cost/Unit:** $2.14

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	$39.49	16	$631.84
Materials						
Thermal blanket, ≤ 10,000 square foot	1147	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 less than 10,000 square feet. Materials only.	Square Foot	$2.06	8000	$16,480.00

Practice: 672 - Building Envelope Improvement

Scenario: #7 - Greenhouse Screens > 10,00 sq.ft.

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. This scenario includes screens that are > 10,000 square foot

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, 374-Farmstead Energy Improvement, and other activities within 672-Building Envelope 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: 15,000

Scenario Cost: $28,831.84 **Scenario Cost/Unit:** $1.92

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	$39.49	16	$631.84
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	$1.88	15000	$28,200.00