

Residential Equipment Ground Source Heat Pump (GSHP)

Description: Ground Source Heat Pump < 65 MBTu with EER >= 14 or COP >= 3
 Baseline: Federal Standard Air Source Heat Pump with 11.18 Equivalent EER and 2.26 Equivalent COP *
 Useful Life: 18 Years *

Savings Algorithm *:

$$\text{Cooling kWh} = \left(\frac{1}{\text{EER}(\text{base})} - \frac{1}{\text{EER}(\text{act})} \right) \times \text{CAP} \times \text{CFLH} \times \text{ADJ}(\text{cool})$$

$$\text{Heating kWh} = \text{BACKUP} + \left(\frac{1}{\text{COP}(\text{base})} - \frac{1}{\text{COP}(\text{act})} \right) \times \text{CAP} \times \text{HFLH} \times \text{ADJ}(\text{heat})$$

$$\text{Annual kWh} = \text{Cooling kWh} + \text{Heating kWh}$$

$$\text{Peak kW} = \text{Cooling kWh} \times \frac{1}{8760} \div \text{LF}$$

EER(base): baseline efficiency EER 11.18
 EER(act): cooling efficiency rating of new GSHP (from rebate application ... range = 14.0 to 40.0)
 COP(base): baseline efficiency COP 2.26
 COP(act): heating efficiency rating of new ASHP (from rebate application ... range = 3.0 to 6.0)
 CFLH: 659 equivalent full load hours of cooling (calculated from Assessment)
 HFLH: 669 equivalent full load hours of heating (calculated from Assessment)
 ADJ(cool): 0.8614 adjustment factor to convert from Iowa average CDDs to Sioux City, IA CDDs
 ADJ(heat): 1.0787 adjustment factor to convert from Iowa average HDDs to Sioux City, IA HDDs
 CAP: capacity of cooling system in MBTu (from rebate application ... range = 8.0 to 65.0)
 BACKUP: 5,360.61 kWh savings due to not needing backup heating capability from an ASHP
 LF: 0.0712 load factor (based on Residential Heat – Cooling load shape)

Incremental Cost Algorithm *:

$$\text{Incremental Cost} = (\$0.6262 \times (\text{Annual kWh} - \text{BACKUP})) + \$7,209.68$$

Incentives:

EER 14-17.9: \$1,200
 EER 18-22.9: \$1,800
 EER 23 and above: \$2,400
 COP 3-3.9: \$200 additional to EER rebate
 COP 4-4.9: \$400 additional to EER rebate
 COP 5 and above: \$600 additional to EER rebate
 Incentive Cap: N/A
 Financing: none

Simple Payback:

Payback Pre-Incentive: 20.31 yrs
 Payback Post-Incentive: 4.67 yrs (includes state and federal tax incentives)
 Incentive/Cost Ratio: 77% (includes state and federal tax incentives)

Comments:

* Baseline, useful life, savings, and incremental costs are taken from or calculated from the 2014-2023 Iowa Statewide Assessment of Energy Efficiency Potential.

Residential Equipment Furnace

Description: High Efficiency Furnace < 250 MBTu with AFUE 92% and above
Baseline: Federal Standard Efficiency Furnace < 250 MBTu with 78% AFUE *
Useful Life: 20 Years *

Savings Algorithm *:

$$\text{Annual Therms} = \left(\frac{1}{\text{BASE}} - \frac{1}{\text{AFUE}} \right) \times \text{CAP} \times \text{HF} \times \text{ADJ}$$

$$\text{Peak Therms} = \text{Annual Therms} \times \frac{1}{365} \div \text{LF}$$

BASE: baseline efficiency 0.8000 AFUE
AFUE: efficiency rating of new unit (from application ... range = 0.9500 to 0.9800)
CAP: capacity of new unit in MBTu (from application)
HFLH: 9.165 heating factor (calculated from Assessment)
ADJ: 1.2113 adjustment factor to convert from Iowa average HDDs to Sioux Falls, IA HDDs
LF: 0.2107 load factor (based on Residential – Heating load shape)

Incremental Cost Algorithm *:

$$\text{Incremental Cost} = \$300.00 + (\$297.00 \times (\text{AFUE} - 0.9000) \times \text{CAP})$$

Incentives:

AFUE 0.950 and above: \$600
Incentive Cap: N/A
Financing: none

Simple Payback:

Payback Pre-Incentive: 11.43 yrs
Payback Post-Incentive: 6.76 yrs
Incentive/Cost Ratio: 41%

Comments:

* Baseline, useful life, savings, and incremental costs are taken from or calculated from the 2014-2023 Iowa Statewide Assessment of Energy Efficiency Potential.