

## **Payback Model (Residential)**

Currently there is a 30% federal tax credit available for all residential installations with no cap.

Every home will have a different projected payback depending on its location, building construction, etc.

Here we will explore a typical payback for a new construction 2,700 S.F. home vs. a few different conventional setups in the New England climate:

- 2,700 S.F. new construction home built to code
- Peak Losses: 45,000 Btuh (3.75 Tons)
- Peak Gains: 31,500 Btuh (2.62 Tons)

Approx. Total cost for Geothermal System -	\$45,000 (Before Incentives)
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	\$31,500 (After Incentives)
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Approx. Total cost for Conventional Oil Boiler w/ Baseboard & Conventional A/C System -	\$20,000
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<b>Initial cost difference between systems -</b>	<b>\$11,500</b>
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## Financial Details When Paying Cash for the System

Below find a 20-year cash flow projection for this model home for a geothermal system vs. a conventional oil and setup when paying cash for both systems (please note that the utility savings will vary based upon weather data, user's thermostat setpoints, projected fuel rates, etc.):

Financial Details When Paying Cash for the System					
Year	System Cost		Marginal Capital Cost Difference	Energy Savings	Cumulative Cash Flow
	Conventional	Geothermal			
1	\$20,000	\$31,500	\$11,500	\$3,123	\$8,377
2	-	-	-	\$3,299	\$5,078
3	-	-	-	\$3,485	\$1,592
4	-	-	-	\$3,681	\$2,089
5	-	-	-	\$3,887	\$5,976
6	-	-	-	\$4,104	\$10,081
7	-	-	-	\$4,333	\$14,414
8	-	-	-	\$4,574	\$18,988
9	-	-	-	\$4,828	\$23,816
10	-	-	-	\$5,095	\$28,911
11	-	-	-	\$5,376	\$34,287
12	-	-	-	\$5,672	\$39,959
13	-	-	-	\$5,984	\$45,943
14	-	-	-	\$6,312	\$52,255
15	-	-	-	\$6,657	\$58,912
16	-	-	-	\$7,021	\$65,933
17	-	-	-	\$7,404	\$73,336
18	-	-	-	\$7,806	\$81,142
19	-	-	-	\$8,230	\$89,373
20	-	-	-	\$8,676	\$98,049
<b>Totals</b>	<b>\$20,000</b>	<b>\$31,500</b>	<b>\$11,500</b>	<b>\$109,549</b>	<b>\$98,049</b>
<b>Model Assumptions</b>					
Electricity Cost			\$0.16/kWh	Increases 3% every year	
Heating Oil Cost			\$3.50/gallon	Increases 5% every year	
Geothermal Unit Efficiency (Seasonal Average)			3.9 COP		
Conventional Furnace/Boiler Efficiency			92% Efficient		

The projected payback shows that the system would create a positive cash flow between years 3 and 4, and this does not include the lower expected maintenance costs and longer equipment lifespan of the geothermal system over the conventional setup. Also it should be noted that once the life of the equipment is reached, the ground loop system would not need replacing, as that is a cost which is only incurred once upon initial construction.

## Financial Details When Including Geothermal System in Home Mortgage (@ 5.5% Interest)

Below you can find a cash flow projection should the costs of the system be worked into the home's 30-year fixed rate mortgage as most new construction projects would be:

Financial Details When Including Geothermal System in Home Mortgage @ 5.5% Interest					
Year	Loan Payment		Marginal Cost Difference	Energy Savings	Cumulative Cash Flow
	Conventional	Geothermal			
1	\$1,363	\$2,146	\$783	\$3,123	\$2,340
2	\$1,363	\$2,146	\$783	\$3,299	\$4,855
3	\$1,363	\$2,146	\$783	\$3,485	\$7,557
4	\$1,363	\$2,146	\$783	\$3,681	\$10,455
5	\$1,363	\$2,146	\$783	\$3,887	\$13,559
6	\$1,363	\$2,146	\$783	\$4,104	\$16,880
7	\$1,363	\$2,146	\$783	\$4,333	\$20,429
8	\$1,363	\$2,146	\$783	\$4,574	\$24,220
9	\$1,363	\$2,146	\$783	\$4,828	\$28,264
10	\$1,363	\$2,146	\$783	\$5,095	\$32,576
11	\$1,363	\$2,146	\$783	\$5,376	\$37,952
12	\$1,363	\$2,146	\$783	\$5,672	\$43,624
13	\$1,363	\$2,146	\$783	\$5,984	\$49,608
14	\$1,363	\$2,146	\$783	\$6,312	\$55,920
15	\$1,363	\$2,146	\$783	\$6,657	\$62,577
16	\$1,363	\$2,146	\$783	\$7,021	\$69,598
17	\$1,363	\$2,146	\$783	\$7,404	\$77,001
18	\$1,363	\$2,146	\$783	\$7,806	\$84,024
19	\$1,363	\$2,146	\$783	\$8,230	\$91,471
20	\$1,363	\$2,146	\$783	\$8,676	\$99,363
21	\$1,363	\$2,146	\$783	\$9,145	\$107,725
22	\$1,363	\$2,146	\$783	\$9,639	\$116,581
23	\$1,363	\$2,146	\$783	\$10,159	\$125,957
24	\$1,363	\$2,146	\$783	\$10,706	\$135,879
25	\$1,363	\$2,146	\$783	\$11,281	\$146,377
26	\$1,363	\$2,146	\$783	\$11,887	\$157,480
27	\$1,363	\$2,146	\$783	\$12,523	\$170,004
28	\$1,363	\$2,146	\$783	\$13,193	\$183,197
29	\$1,363	\$2,146	\$783	\$13,898	\$197,095
30	\$1,363	\$2,146	\$783	\$14,639	\$211,734
<b>Totals</b>	<b>\$40,882</b>	<b>\$64,386</b>	<b>\$23,504</b>	<b>\$226,620</b>	<b>\$211,734</b>
<b>Model Assumptions</b>					
Electricity Cost			\$0.16/kWh	Increases 3% every year	
Heating Oil Cost			\$3.50/gallon	Increases 5% every year	
Geothermal Unit Efficiency (Seasonal Average)			3.9 COP		
Conventional Furnace/Boiler Efficiency			92% Efficient		

Here it demonstrates that the increased yearly mortgage payments from installing a geothermal system would be less than the projected annual utility savings, which creates a positive cash flow for the system on year one. Again this does not account for the lower anticipated maintenance costs and longer projected lifespan of the geothermal equipment which only helps even more.

## Financial Details When Paying Cash for the System

Next a natural gas and conventional A/C system will be explored, with the same initial equipment costs as the oil system however lower operational costs than the oil system. Below you is a 20 year projection for if the system if it were paid for in cash:

<b>Financial Details When Paying Cash for the System</b>					
Year	System Cost		Marginal Capital Cost Difference	Energy Savings	Cumulative Cash Flow
	Conventional	Geothermal			
1	\$20,000	\$31,500	\$11,500	\$1,312	\$10,188
2	-	-	-	\$1,398	\$8,789
3	-	-	-	\$1,489	\$7,300
4	-	-	-	\$1,585	\$5,715
5	-	-	-	\$1,687	\$4,029
6	-	-	-	\$1,794	\$2,235
7	-	-	-	\$1,907	\$328
8	-	-	-	\$2,026	\$1,698
9	-	-	-	\$2,153	\$3,851
10	-	-	-	\$2,286	\$6,137
11	-	-	-	\$2,427	\$8,564
12	-	-	-	\$2,575	\$11,139
13	-	-	-	\$2,732	\$13,872
14	-	-	-	\$2,898	\$16,769
15	-	-	-	\$3,072	\$19,842
16	-	-	-	\$3,257	\$23,099
17	-	-	-	\$3,451	\$26,550
18	-	-	-	\$3,656	\$30,206
19	-	-	-	\$3,873	\$34,079
20	-	-	-	\$4,101	\$38,179
<b>Totals</b>	<b>\$20,000</b>	<b>\$31,500</b>	<b>\$11,500</b>	<b>\$49,679</b>	<b>\$38,179</b>
<b><u>Model Assumptions</u></b>					
Electricity Cost			\$0.16/kWh	Increases 3% every year	
Natural Gas Cost			\$1.43/therm	Increases 5% every year	
Geothermal Unit Efficiency (Seasonal Average)			3.9 COP		
Conventional Furnace/Boiler Efficiency			92% Efficient		

Here it can be seen that even with the lower operational costs of a high efficiency natural gas and A/C system that there will be a positive cash flow between years 7 and 8.

## Financial Details When Including Geothermal System in Home Mortgage (@ 5.5% Interest)

If this same natural gas & A/C install were to be worked into the mortgage of the home, again with a 30-year fixed rate mortgage at 5.5%, a positive cash flow will be found from year one:

Financial Details When Including Geothermal System in Home Mortgage @ 5.5% Interest					
Year	Loan Payment		Marginal Cost Difference	Energy Savings	Cumulative Cash Flow
	Conventional	Geothermal			
1	\$1,363	\$2,146	\$783	\$1,312	\$529
2	\$1,363	\$2,146	\$783	\$1,398	\$1,144
3	\$1,363	\$2,146	\$783	\$1,489	\$1,849
4	\$1,363	\$2,146	\$783	\$1,585	\$2,651
5	\$1,363	\$2,146	\$783	\$1,687	\$3,554
6	\$1,363	\$2,146	\$783	\$1,794	\$4,564
7	\$1,363	\$2,146	\$783	\$1,907	\$5,688
8	\$1,363	\$2,146	\$783	\$2,026	\$6,931
9	\$1,363	\$2,146	\$783	\$2,153	\$8,300
10	\$1,363	\$2,146	\$783	\$2,286	\$9,802
11	\$1,363	\$2,146	\$783	\$2,427	\$12,229
12	\$1,363	\$2,146	\$783	\$2,575	\$14,804
13	\$1,363	\$2,146	\$783	\$2,732	\$17,537
14	\$1,363	\$2,146	\$783	\$2,898	\$20,434
15	\$1,363	\$2,146	\$783	\$3,072	\$23,507
16	\$1,363	\$2,146	\$783	\$3,257	\$26,764
17	\$1,363	\$2,146	\$783	\$3,451	\$30,215
18	\$1,363	\$2,146	\$783	\$3,656	\$33,888
19	\$1,363	\$2,146	\$783	\$3,873	\$36,177
20	\$1,363	\$2,146	\$783	\$4,101	\$39,494
21	\$1,363	\$2,146	\$783	\$4,341	\$43,052
22	\$1,363	\$2,146	\$783	\$4,595	\$46,864
23	\$1,363	\$2,146	\$783	\$4,863	\$50,943
24	\$1,363	\$2,146	\$783	\$5,145	\$55,304
25	\$1,363	\$2,146	\$783	\$5,442	\$59,963
26	\$1,363	\$2,146	\$783	\$5,755	\$64,934
27	\$1,363	\$2,146	\$783	\$6,085	\$71,020
28	\$1,363	\$2,146	\$783	\$6,433	\$77,453
29	\$1,363	\$2,146	\$783	\$6,800	\$84,253
30	\$1,363	\$2,146	\$783	\$7,187	\$91,440
<b>Totals</b>	<b>\$40,882</b>	<b>\$64,386</b>	<b>\$23,504</b>	<b>\$106,326</b>	<b>\$91,440</b>
<b>Model Assumptions</b>					
Electricity Cost			\$0.16/kWh	Increases 3% every year	
Natural Gas Cost			\$1.43/therm	Increases 5% every year	
Geothermal Unit Efficiency (Seasonal Average)			3.9 COP		
Conventional Furnace/Boiler Efficiency			92% Efficient		