

GEOHERMAL HVAC AS A METHOD TO INCREASE LOAD FACTOR

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Edmond Electric reviewed our customers and faced the facts

- Our load is predominantly residential (57%)
- EE has little industrial load (2%)
- Our largest customers are public entities – a medium size university (15,000+), the city of Edmond, and the public schools
- The university is already doing load shifting and peak shaving utilizing ice storage, has a light summer load until late August, has limited ability to shift more load
- Public schools already setback the start of school two weeks in order to save on air conditioning
- Need to improve L.F. on residential use
- EE's electric load peaks in August
- EE's load is cooling dominant
- Heating in our area is predominantly natural gas
- Large scale TOU on residential is not yet feasible on our system
- Approximately 45-55% of residential load in our area is HVAC
- Water heating is approximately 19% of residential load
- 3911 HDD and 1728 CDD

General ways to improve our load factor

1. Increase winter load
2. lower peak demand
3. shift load to nighttime

Oak Ridge National Laboratory did a report
titled

Geothermal (Ground-Source) Heat Pumps:
Market Status, Barriers to Adoption, and Actions to
Overcome Barriers

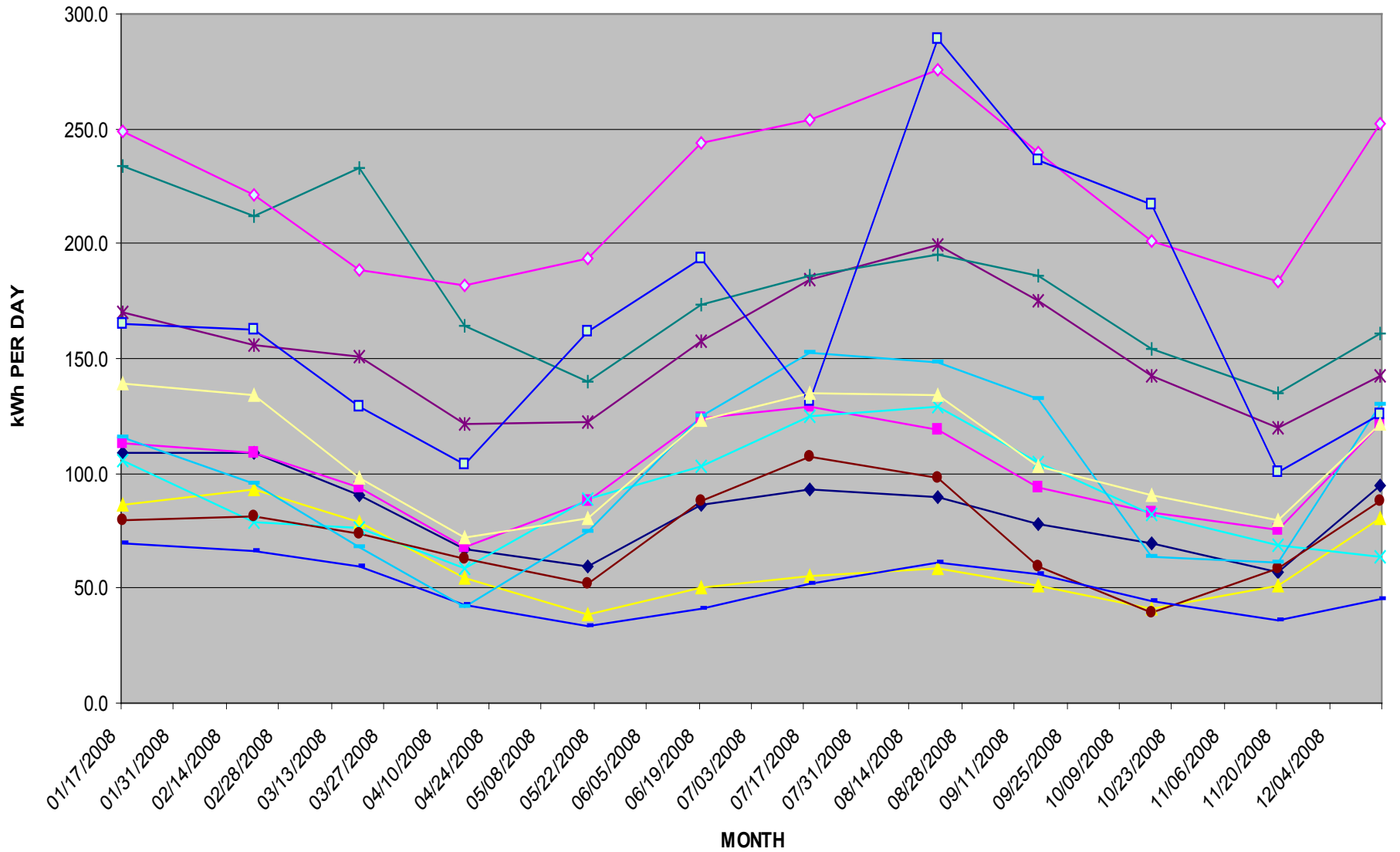
December 2008

In this report they state about the first large geothermal HVAC retrofit project

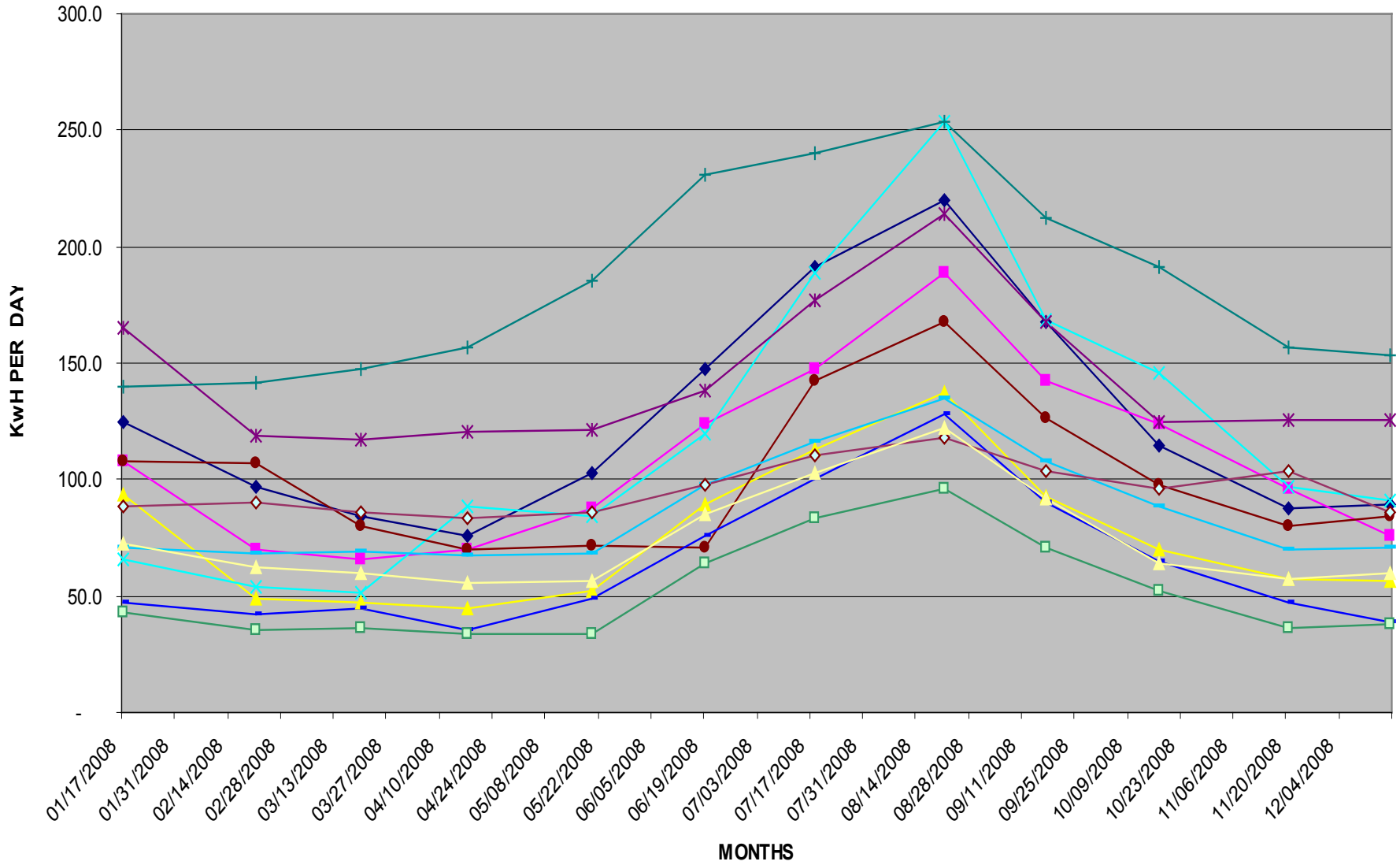
“A rigorous evaluation of a 4000-home GHP retrofit at Fort Polk, Louisiana, provided the evidence that tipped the scales toward agency confidence in the technology. The overall electricity consumption of Fort Polk’s city of 12,000 people was reduced by 26 million kWh per year (33 percent), summer peak electric demand was reduced by 7.5 MW (43 percent), and the annual electric load factor increased from 0.52 to 0.62. “

ORNL/TM-2008/232

ENERGY USE GEOTHERMAL HVAC HOMES 2



ENERGY USE SPLIT-SYSTEM HVAC HOMES 2



	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	ENERGY USE OF GEOTHERMAL HVAC HOMES IN EDMOND													
23/2009														
	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day		
Jan-08	108.7	113.0	86.6	105.3	169.7	79.5	233.9	69.4	115.5	248.6	165.4	139.4		
Feb-08	109.1	108.6	92.6	79.0	156.0	81.3	212.4	65.9	95.2	221.2	162.9	133.9		
Mar-08	90.5	94.3	78.9	76.0	150.8	73.8	233.0	59.2	68.0	188.6	129.4	98.3		
Apr-08	67.3	67.8	54.3	58.9	121.2	62.7	164.2	42.8	41.9	181.4	104.3	72.0		
May-08	59.5	87.7	38.6	89.0	122.7	51.8	140.3	33.4	74.6	193.5	161.6	80.9		
Jun-08	86.7	124.3	50.3	103.3	157.7	88.3	173.7	41.0	124.8	243.4	193.7	122.9		
Jul-08	93.2	129.2	55.4	125.1	184.5	107.1	186.0	52.3	152.7	253.8	131.5	135.2		
Aug-08	89.8	119.4	58.9	128.8	199.8	98.3	195.6	61.5	148.4	275.9	288.7	134.2		
Sep-08	77.9	93.9	51.1	104.9	174.8	59.8	186.4	55.9	132.4	239.3	236.5	103.1		
Oct-08	69.7	82.8	41.1	82.5	142.6	39.3	153.9	44.0	63.7	201.3	217.4	90.8		
Nov-08	57.2	75.3	51.5	69.1	120.0	58.6	134.8	35.6	61.3	183.1	100.2	79.7		
Dec-08	94.7	121.3	80.4	63.4	142.8	87.8	160.8	44.8	129.9	251.9	125.6	121.8	average	
ave kWh	83.7	101.4	61.6	90.4	153.6	74.0	181.3	50.5	100.7	223.5	168.1	109.3		
peak	77%	79%	67%	70%	77%	69%	78%	73%	66%	81%	58%	81%	73%	

DATE	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	kWh/day	Average
3/23/2009	ENERGY USE OF SPLIT-SYSTEM HVAC HOMES IN EDMOND													
1/17/08	124.7	108.1	93.8	65.9	165.1	107.9	140.0	47.2	70.7	88.1	43.2	72.5		
2/21/08	96.9	69.6	48.8	54.4	118.8	106.8	141.6	41.8	68.4	89.8	35.8	62.2		
3/20/08	84.1	66.0	47.6	51.3	117.0	80.0	147.4	45.1	69.4	85.7	36.0	59.5		
4/17/08	75.5	70.1	44.6	88.5	120.9	69.8	157.2	35.1	67.6	83.5	33.3	55.9		
5/20/08	102.5	88.0	52.2	84.1	121.1	71.4	185.6	48.7	68.5	85.8	34.0	56.1		
6/19/08	147.5	123.9	89.2	119.7	138.6	70.7	230.8	75.4	97.7	98.1	63.6	85.1		
7/18/08	191.0	147.2	113.3	189.0	177.3	142.2	239.8	100.3	116.1	110.7	83.4	102.6		
8/21/08	220.0	188.8	137.7	253.4	214.1	168.0	253.3	127.7	134.4	117.8	96.1	122.0		
9/17/08	167.6	142.7	93.0	168.4	167.9	126.1	212.3	90.0	107.6	104.0	70.5	91.9		
10/17/08	114.3	123.5	69.8	145.6	124.4	98.0	191.3	64.6	88.7	96.4	52.1	64.3		
11/20/08	87.5	96.4	57.3	96.7	125.7	79.7	156.9	47.4	70.1	103.9	36.2	57.3		
12/17/08	89.0	75.6	56.7	90.9	125.3	83.9	153.6	39.1	70.7	85.6	37.8	60.0		
average kWh	125.1	108.3	75.3	117.3	143.0	100.4	184.1	63.5	85.8	95.8	51.8	74.1		
Ave/peak	57%	57%	55%	46%	67%	60%	73%	50%	64%	81%	54%	61%		60%

Value of GSHP to City

(proposed for discussion)

- Avoided Peak
 - \$50/kW.yr
 - 0.5 kW/ton
 - Value = \$25/ton.yr
- Extra Load
 - Heating - \$15.40/ton.yr
 - DHW - \$9.50/ton.yr
- Total = \$50/ton.yr
- This value repeats year after year – once the system is in, the customer will not change systems
- 10-year value - \$500/ton
- 20-year value - \$1,000/ton

Value of Extra Load to City

(proposed for discussion)

- Heating - assume
 - 4 BTU/HDD-sq ft
 - 3500 HDD
 - COP = 4
 - 1 ton per 600 sq ft
 - City profit = 2.5c/kWh
- Value = \$15.40/ton.yr
- Hot Water – assume
 - 64 gallons per day
 - 65% from GSHP
 - So 35% extra load
- Value = \$38/yr
 - Assume 4 ton unit avg
- Value = \$9.50/ton.yr

Geothermal HVAC cost after Fed Tax Credits and EE's rebate

- 3 Ton geothermal unit, no duct - \$10,000
 - Federal Tax Credit 30% - \$ 3,000
 - Edmond Electric Rebate - \$ 2,400
- » **NET** **\$ 4,600**