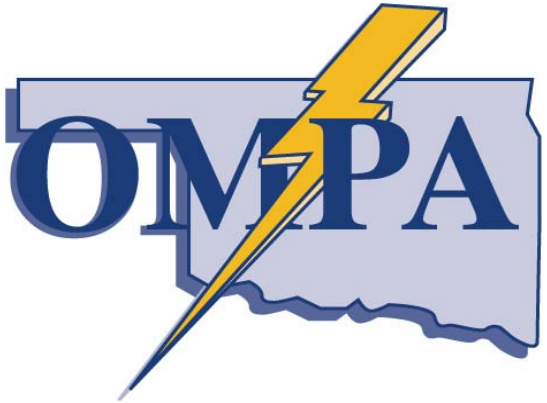
Geothermal Heat Pumps and the OMPA Rebate Program



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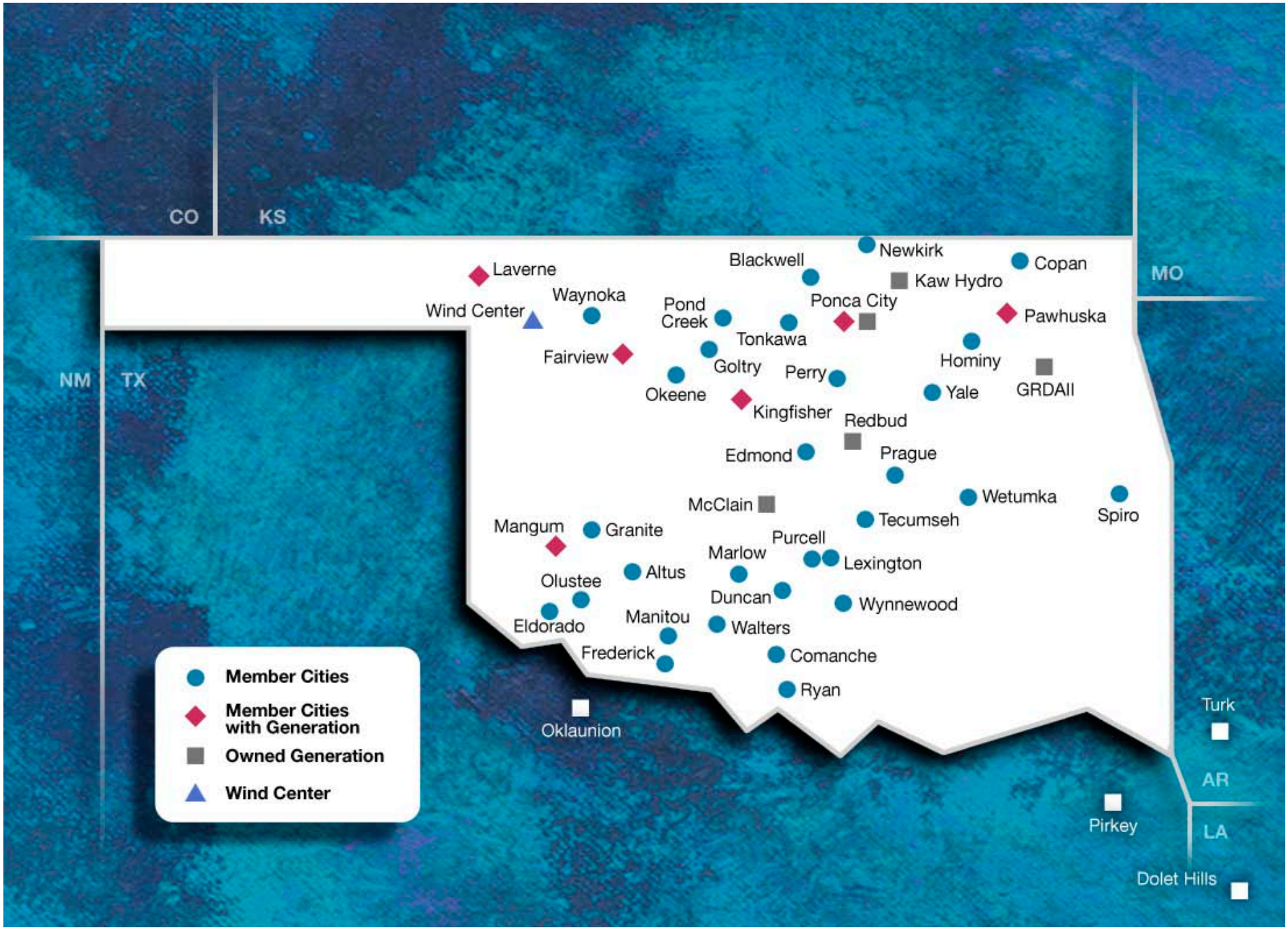
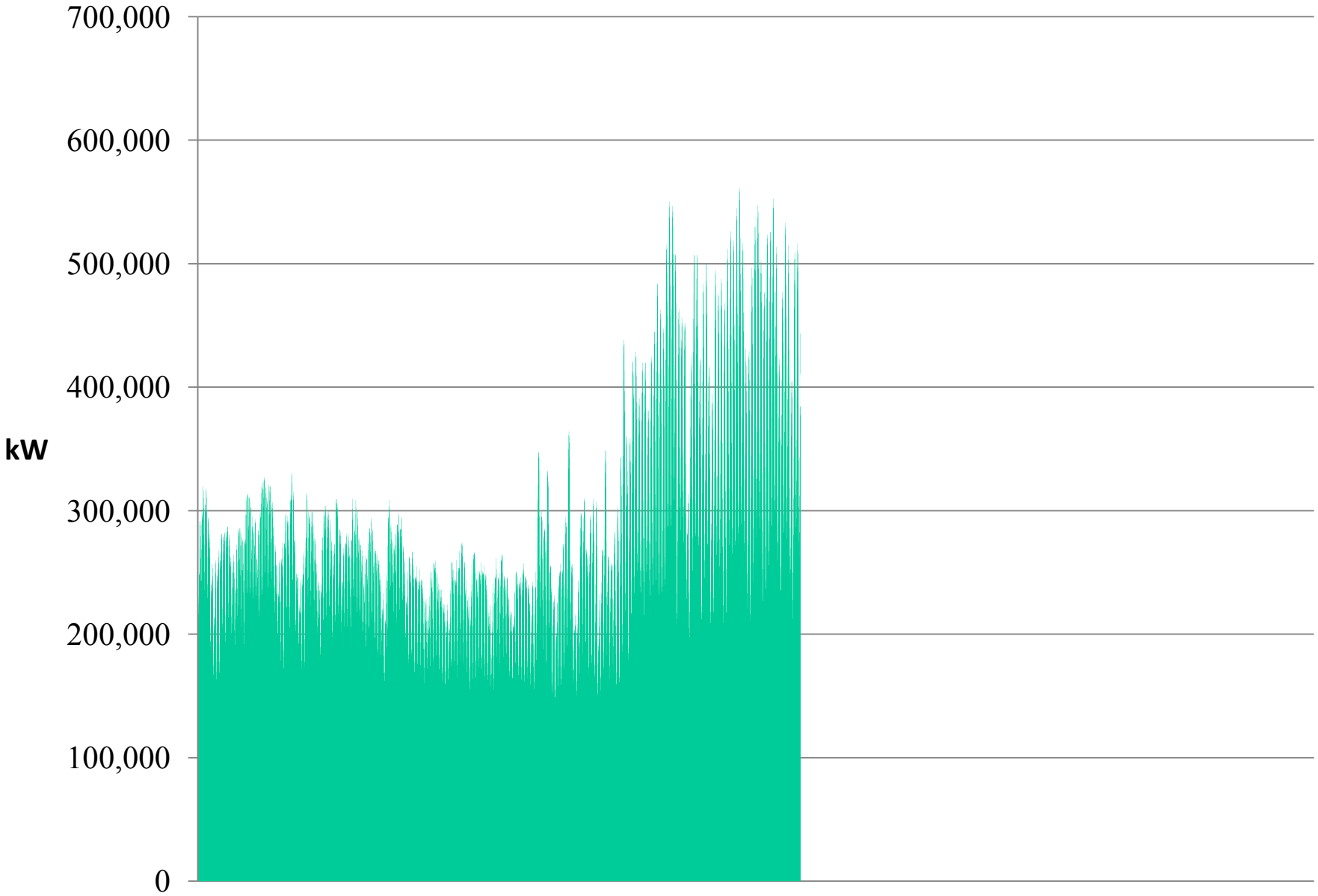
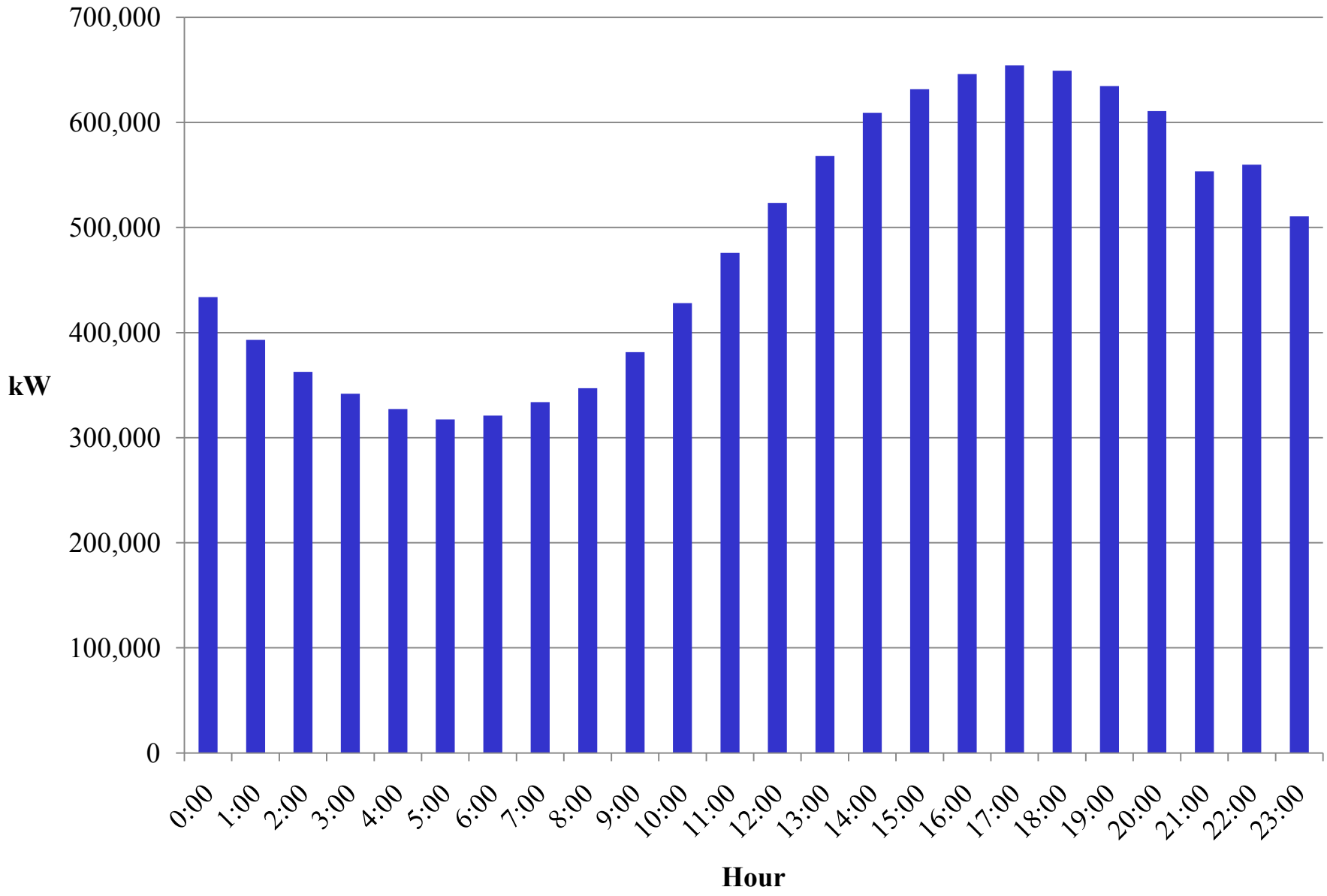
Oklahoma Municipal Power Authority (OMPA)

- Joint Action Agency
  - 36 member towns and cities
- Primary mission
  - Provide reliable low-cost electric power to members
- Other services include
  - Financial, engineering and customer/energy services


CO
KS
NM
TX
MO
AR
LA
Laverne
Waynoka
Wind Center
Fairview
Blackwell
Newkirk
Copan
Kaw Hydro
Ponca City
Pawhuska
Pond Creek
Tonkawa
Goltry
Perry
Okeene
Kingfisher
Hominy
GRDAII
Yale
Redbud
Edmond
Prague
McClain
Wetumka
Spiro
Tecumseh
Mangum
Granite
Purcell
Marlow
Lexington
Altus
Olustee
Duncan
Wynnewood
Eldorado
Manitou
Walters
Frederick
Comanche
Ryan
Oklaunion
Turk
Pirkey
Dolet Hills
Member Cities
Member Cities with Generation
Owned Generation
Wind Center

OMPA Load (2008 Calendar Year)

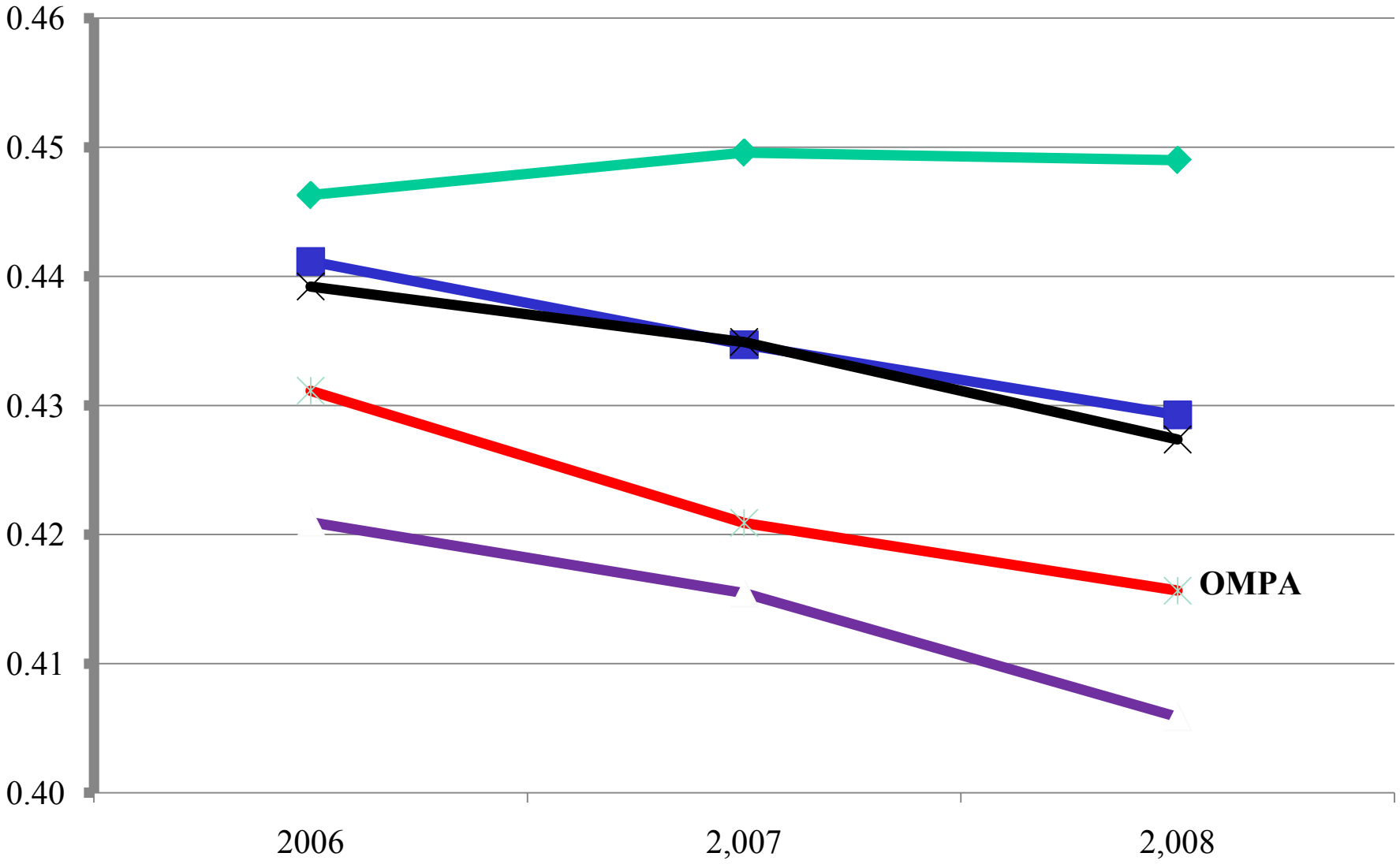



OMPA Load 8/4/2008 (Peak Day)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
kW
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour

Load Factors

Four Largest Cities and OMPA

3-yr Rolling Averages



Rebate Program Objectives

- Reduce summer peaks
  - Delay acquisition of new power resources
- Improve load factor
  - Reduce cost of power for OMPA's member cities
- Higher-efficiency heat pumps help do both
  - Lower summer peaks
  - Add winter electric load

Planning/Justifying the Program

- As a JAA, OMPA must consider
  - OMPA perspective
    - Limit peak kW
    - Improve load factor – add off-peak kWh
  - Member city perspective (Bob has covered this)
    - Promote “best” systems for customers
    - Limit peak kW (lower bills from OMPA)
    - Increase sales/winter sales (lower average cost/kWh)
  - End-use customer perspective
    - First cost
    - Operating costs (kWh)

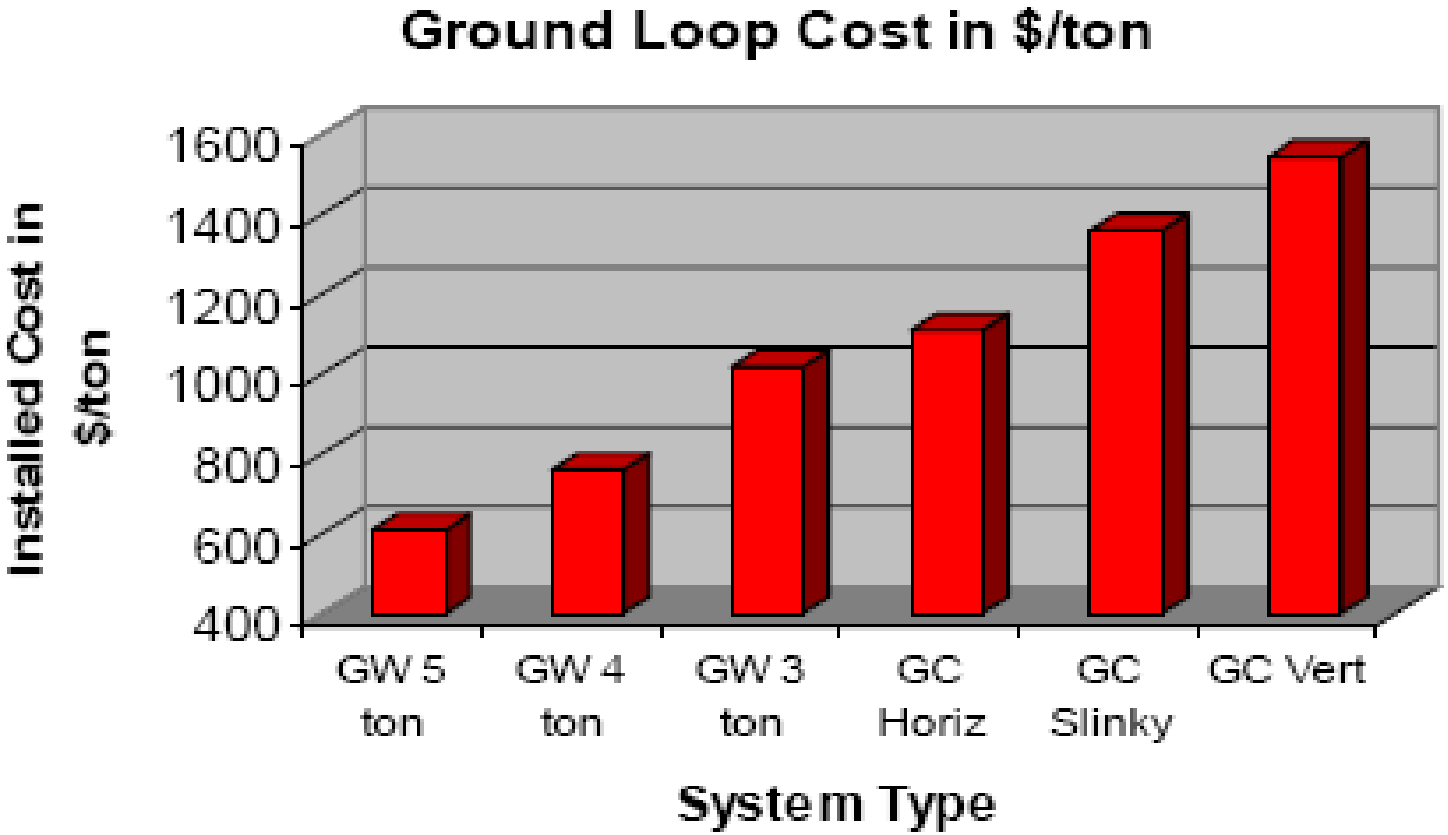
Customer Perspective Advantages/Disadvantages of GHPs

- Advantages
  - **Lowest cost of heating**
  - **Lowest cost of cooling**
  - **Up to 60% DHW energy (with desuperheater)**
  - Factory-matched components
  - No outdoor unit
    - Noise, deterioration, aesthetics
  - Zoning (inside) is easier
  - Better indoor humidity control
  - Lower maintenance
  - Better environmentally

- Disadvantages
  - **High first cost**
  - Lower supply air temperatures when heating, but not as low as ASHPs
  - Existing ductwork may not be adequate (retrofits – older homes)
  - No economizer cooling
  - Separate fresh air requirements

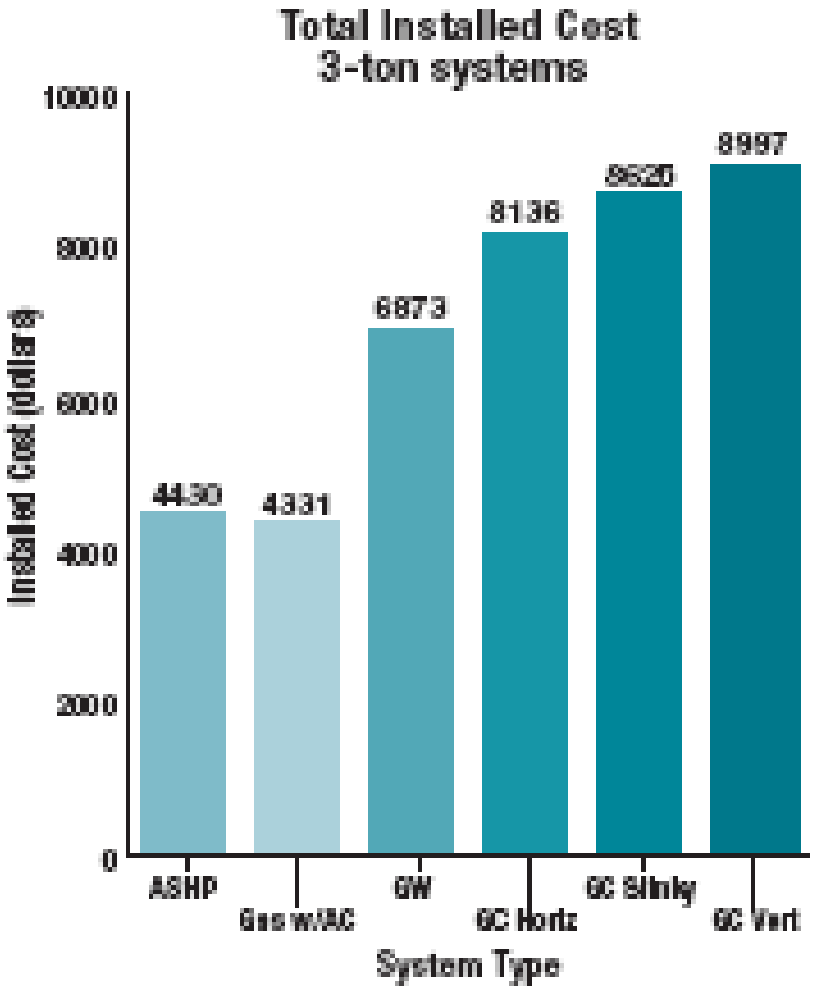
Ground Loop Costs

(Residential)

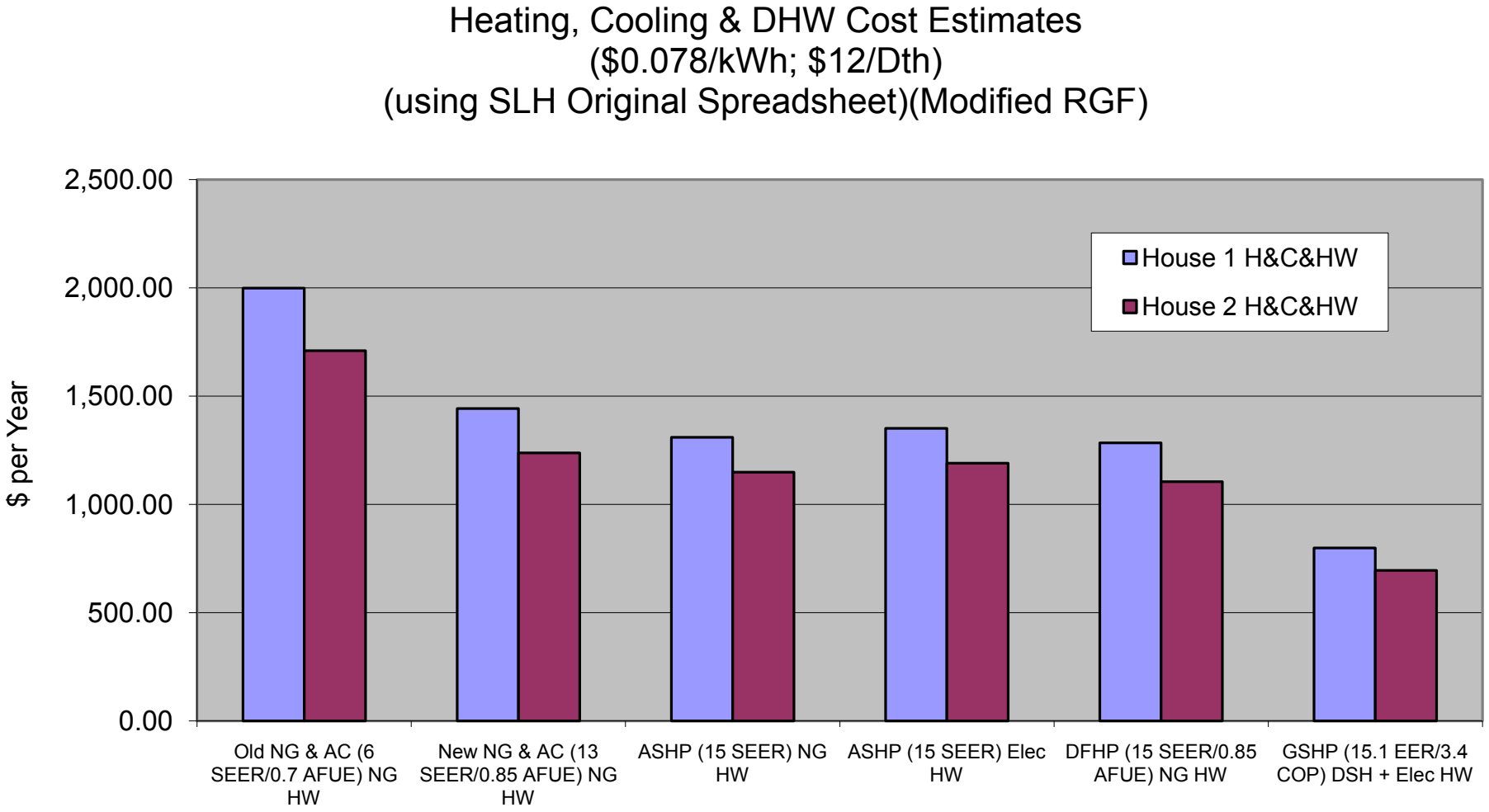


http://www.heatspring.com/downloads/intro/GeothermalSurvivalKit.pdf (Rafferty, 2008)

GHP Installation Costs



Source: An Information Survival Kit for the Prospective Geothermal Heat Pump Owner, Kevin Rafferty, P.E., for HeatSpring Energy, March 2008


Heating, Cooling & DHW Cost Estimates
($0.078/kWh; $12/Dth)
(using SLH Original Spreadsheet)(Modified RGF)
$ per Year
2,500.00
2,000.00
1,500.00
1,000.00
500.00
0.00
House 1 H&C&HW
House 2 H&C&HW
Old NG & AC (6 SEER/0.7 AFUE) NG HW
New NG & AC (13 SEER/0.85 AFUE) NG HW
ASHP (15 SEER) NG HW
ASHP (15 SEER) Elec HW
DFHP (15 SEER/0.85 AFUE) NG HW
GSHP (15.1 EER/3.4 COP) DSH + Elec HW

OMPA Perspective

- Peak avoidance/reduction is the main motivating factor
  - Delay additional generation resources
  - New peaking generation costs $800-$1200/kW
- Relate rebate levels for heat pumps ($/ton) to avoided/delayed generation ($/kW)
- Review existing information, do our own analysis, or hire consultants?

Existing Information

- There's a lot of existing information on demand and energy savings (e.g., ACEEE, CA, TX, NE USA..), but
  - How old is it (standards and efficiencies change)
  - How relevant is it (e.g., climate)
- For example, "Deemed Savings" for the Texas Panhandle Region is 0.54 to 0.64 kW/ton for GHPs with desuperheaters

(Fig. 16 TAC 25.184(d)(1), Public Utility Commission of Texas) (2003)

A Quick Check

- After collecting and reviewing information, we decided to do a quick check for ourselves
- Decided to look at manufacturer's operating data for air conditioners, air-source heat pumps, and geothermal heat pumps

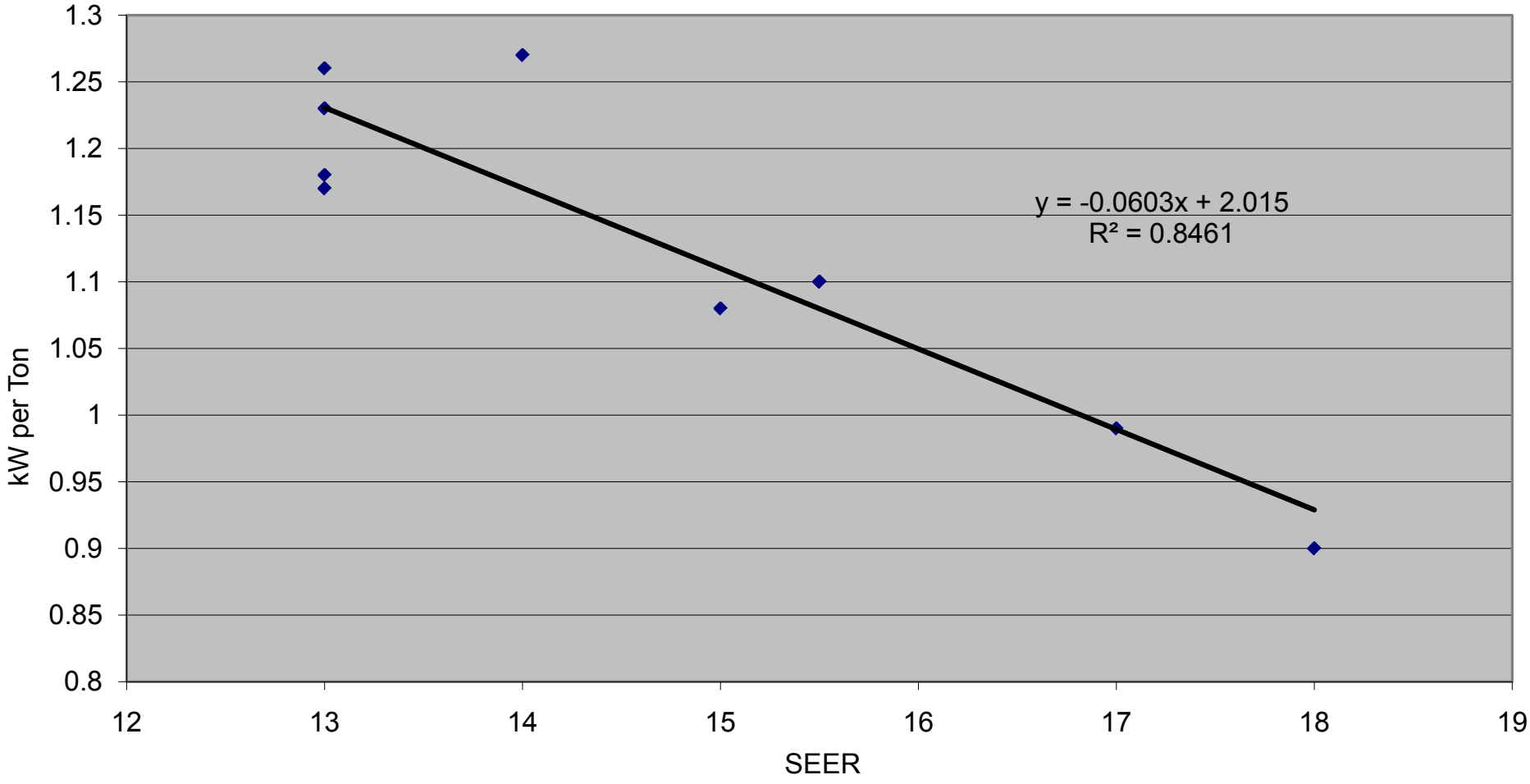
Our Assumptions

- New or retrofit?
  - Assume most systems will be installed instead of systems that would have used basic (13-SEER) air conditioners.
- Under what conditions does OMPA set peaks?
  - ASHRAE's 1% design dry-bulb temperature for Oklahoma locations is 100 to 102 ° F. Manufacturer's data is typically for 10° F increments – closest is typically 105 ° F
- What are the comparable operating conditions for GHPs?
  - Assume Entering Water Temperature (EWT) is 85° F

ACs/ASHPs – kW/ton

at 105° F Outside Air Temperature

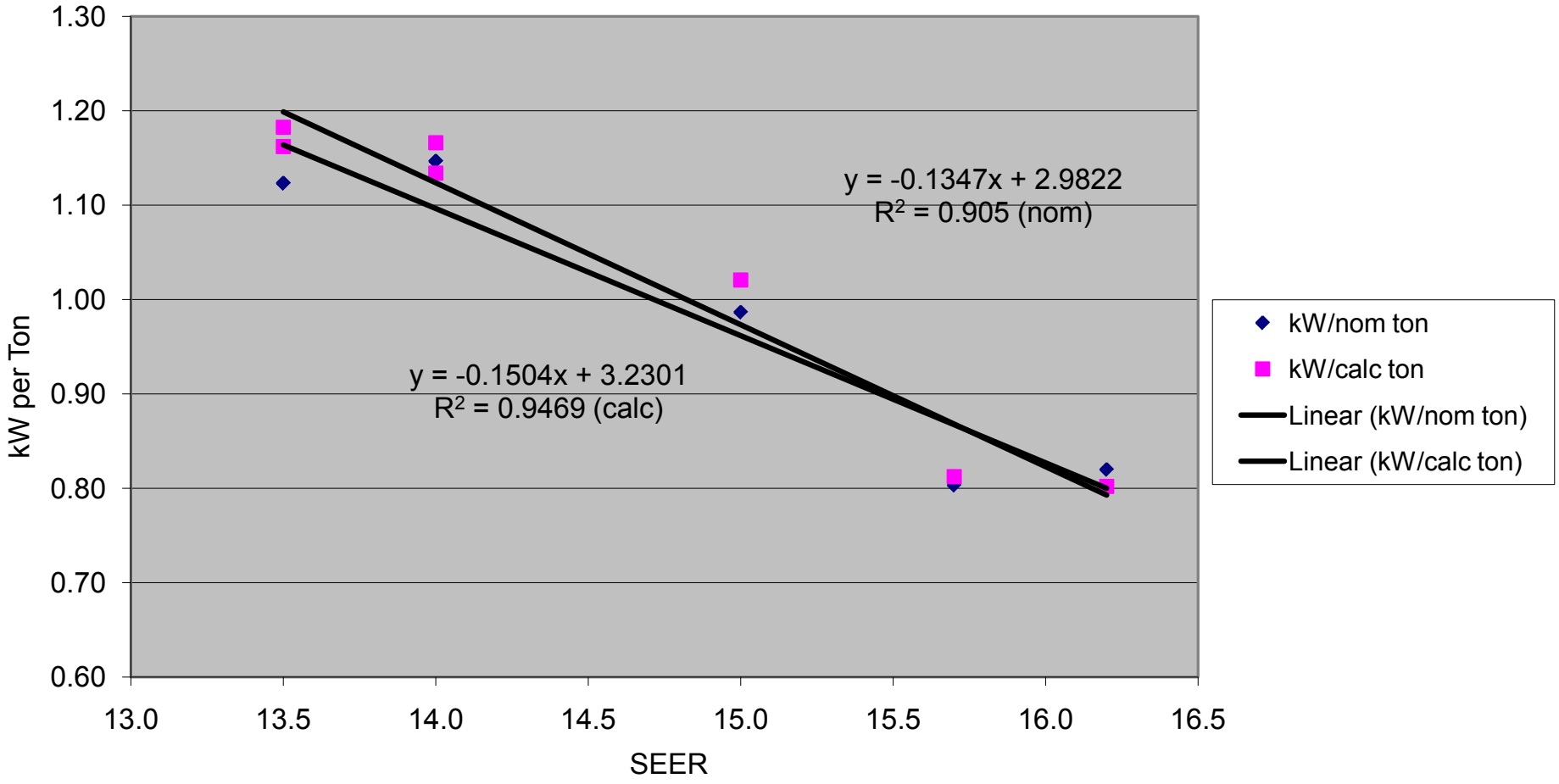
Manufacturer # 1



ACs/ASHPs– kW/ton

at 105° F Outside Air Temperature

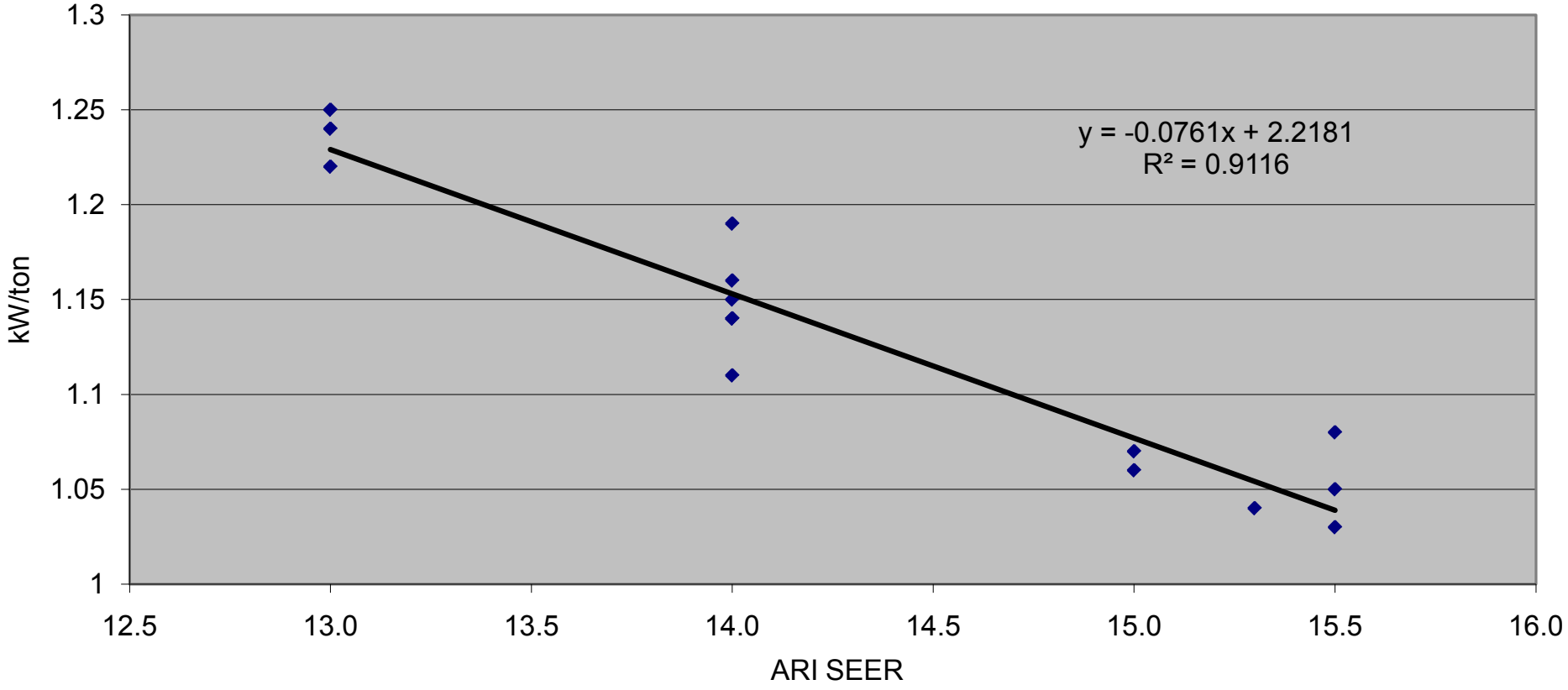
Manufacturer # 2



ACs/ASHPs– kW/ton

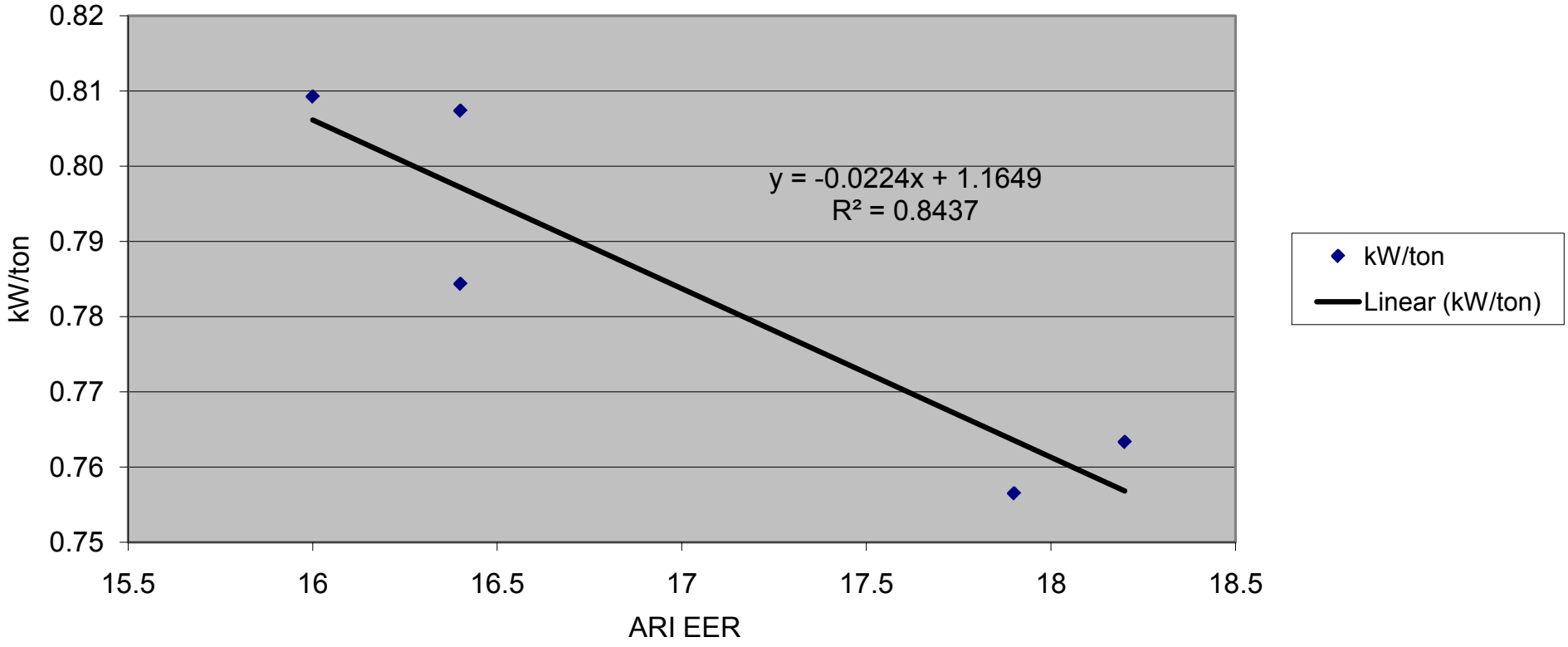
at 105° F Outside Air Temperature

Manufacturer # 3



GHPs – kW/ton

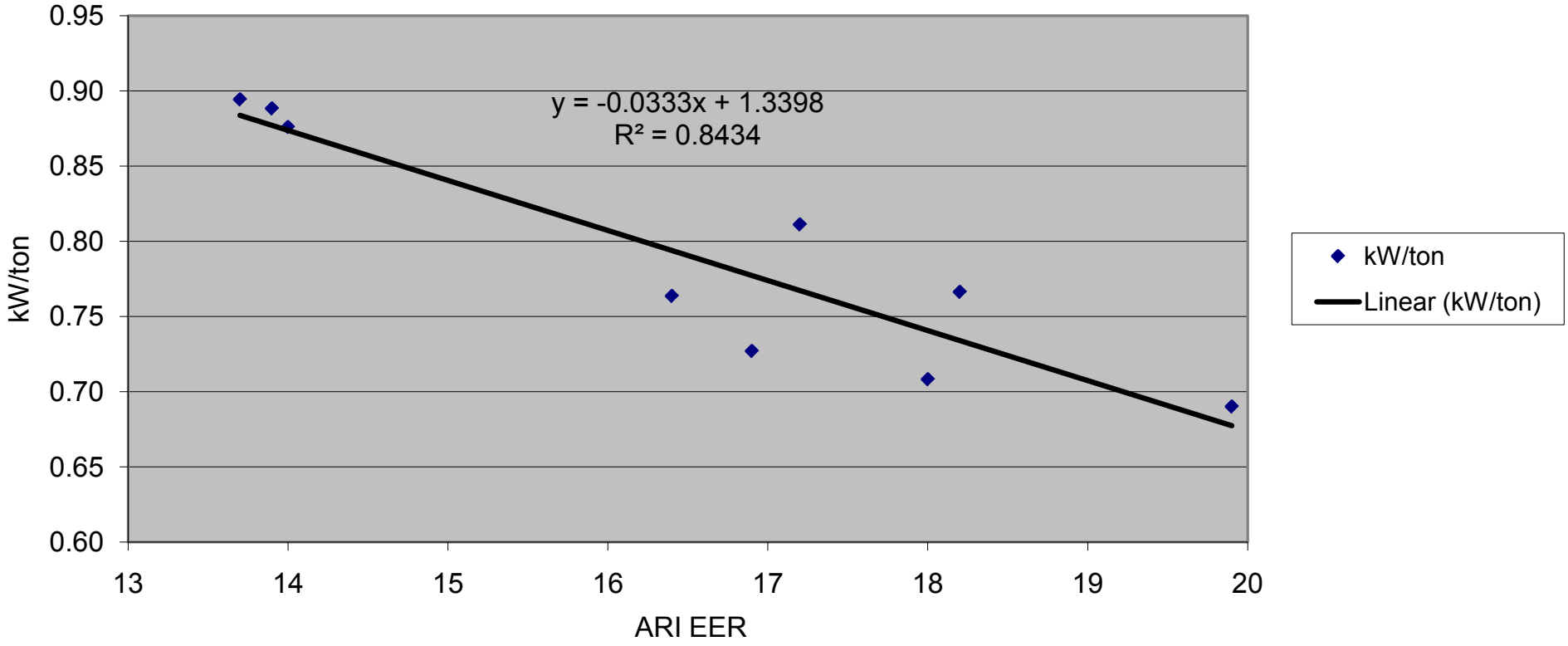
at 85 Entering Water Temperature
Manufacturer # 1



GHPs – kW/ton

at 85 Entering Water Temperature

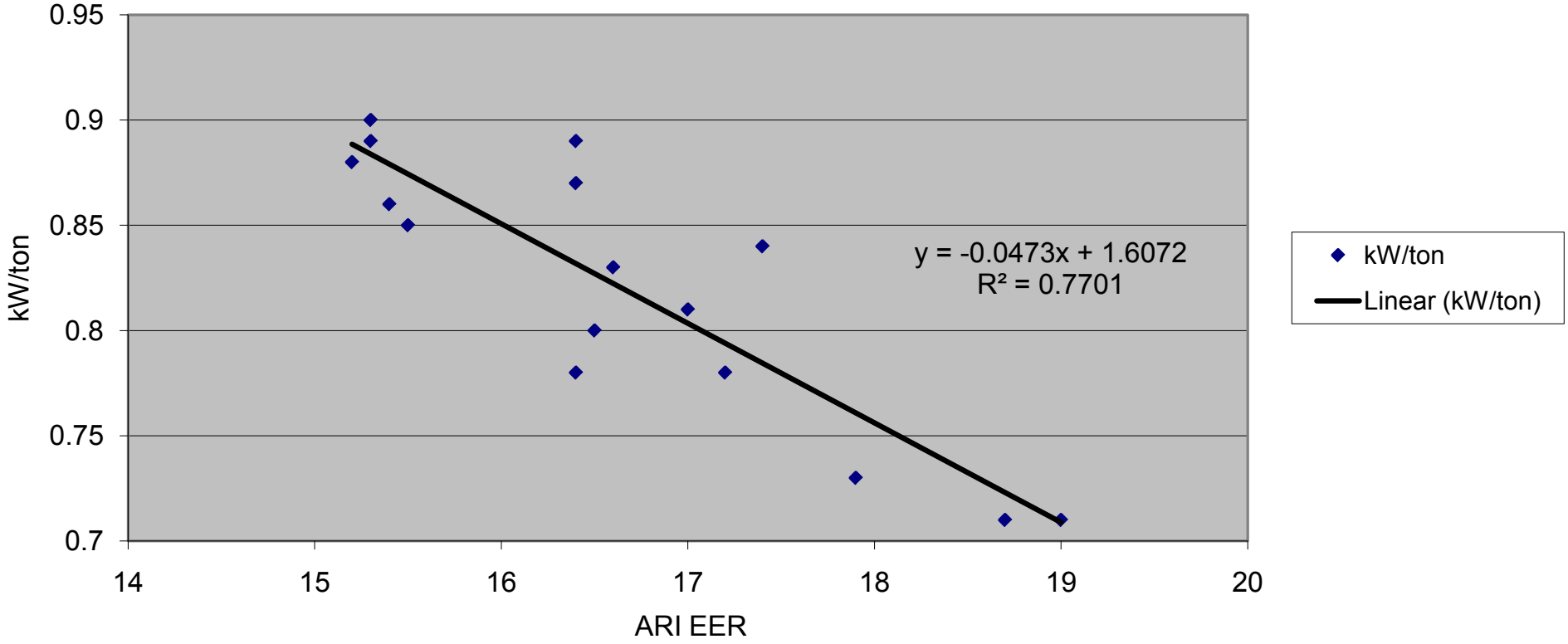
Manufacturer # 2



GHPs – kW/ton

at 85 Entering Water Temperature

Manufacturer # 3



GHP Summary

kW/ton at 85 F Outside Air Temperature

EER	GHP #1	GHP #2	GHP #3	Average	*Difference vs 13 SEER AC
15.1	0.89	0.84	0.83	0.85	0.45
16	0.85	0.81	0.81	0.82	0.48
17	0.80	0.77	0.78	0.78	0.52

*Assumes 13 SEER AC at 105° F outside air temperature is about 1.3 kW/ton
GHP EER of 15.1 is our minimum standard for rebate

Value of GHP to OMPA

- Many GHPs will be above our minimum efficiency standard, so
- Assume
  - GHP value is 0.5 kW/ton
  - New NG generation is $800/ton
- Value of GHPs to OMPA is $400/ton

OMPA's W.I.S.E. Rebate Program

- For GHPs,
  - OMPA's program rebates at $800 per ton, and is a 50/50 shared program with the cities
  - GHP EER must be at least Energy Star plus one (currently 14.1 + 1 = 15.1) and GHP must have a desuperheater installed
  - The program also rebates air conditioners and air-source heat pumps (at lower $ levels) (www.ompa.com/services.htm)

Marketing

- Rebate Program brochure
  - Direct-mail for cities or provide for insert in utility bill mailings
- Area meetings
  - Elected officials/city staff
- Contractor breakfasts/luncheons in member cities
- Low-Interest Loan Program for energy-efficient measures
  - Local bank provides ¼ to1% discount on current market rates

New Tax Incentives

- Stimulus Package
  - Residential Geothermal Heat Pumps
    - Classified as renewable systems, so
    - Federal **tax credit** – 30% of **system** cost, no cap
    - With OMPA rebate, should cover most of the additional costs of GHP versus alternatives
  - **Qualifying** energy efficiency improvements
    - Federal tax credit – 30%, cap of $1,500
- State of Oklahoma
  - **Possible** state tax credits proposed