Data-driven Insights from the Nation’s Deepest Ever Research on Customer Energy Use
University-based research and commercialization — 501(c)(3)

16 full-time employees
Pecan Street Inc.

- Research
  - Pecan Street Research Institute

- Commercialization
  - Pike Powers Lab
    - and
    - Center for Commercialization
Milestones

Nation’s deepest data on customer electric and gas use

89.5 million unique electricity use and voltage reads per day

World’s first independent research meter network

Nation’s highest residential concentration of electric vehicles
Residential Impacts

Correlations and findings

Unique use cases
Residential impacts
Off-peak vs. On-peak load
by customer class

5:15 pm
March 9, 2011
31,262 MW

August 3, 2011
68,416 MW

Source: ERCOT
Average marginal price of wholesale energy - Aug. 2011

$/megawatt hour

$850 @ 4PM

$/megawatt hour
July 31, 2012  Daily electric use: smart meter

Source: Pecan Street Research Institute
Demand management tools

Green building
Behavior response
Appliance efficiency
Feedback systems
Four Categories of Electricity Use

Always On
Thermal
Electric-gas substitute
Intentional

Source: Pecan Street Research Institute
Four Categories of Electricity Use  *Always On*

Source: Pecan Street Research Institute
Four Categories of Electricity Use

Always On
Thermal
Electric-gas substitute
Intentional

Source: Pecan Street Research Institute
Four Categories of Electricity Use  

**Thermal**

Source: Pecan Street Research Institute
Four Categories of Electricity Use

- Always On
- Thermal
- Electric-gas substitute
- Intentional

Source: Pecan Street Research Institute

Electricity use by gas appliances
Four Categories of Electricity Use

Electric - gas substitutes

Electricity use by electric appliances

Source: Pecan Street Research Institute
Electricity used for a load of laundry –
gas and electric dryers

- Electric dryer: 38¢
- Gas dryer: 6¢

Source: Pecan Street Research Institute
Four Categories of Electricity Use

Always On
Thermal
Electric-gas substitute
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Source: Pecan Street Research Institute
Four Categories of Electricity Use

Intentional

Source: Pecan Street Research Institute
Correlations and findings
Seasonal variation by individual load
watts per square foot

Air conditioner compressor
Clothes Dryer
Dishwasher
Microwave
Refrigerator
Washing Machine

Source: Pecan Street Research Institute
Correlations and findings

Thermal consumption is largest use category: cooling alone ~ 50 percent of total annual electricity use

Green built homes used 45 percent less electricity for cooling (per square foot) than non-green built homes

Old homes with retrofits used 25.4 percent less electricity than non-green built homes

Gas appliances provide significant net energy reductions and operational cost savings

*Thermal consumption correlated with higher ambient temps:*
Warmer climate will increase demand for thermal category
Unique use cases
July 31, 2012  Whole home

Source: Pecan Street Research Institute
<table>
<thead>
<tr>
<th>Time</th>
<th>Watts</th>
</tr>
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<tbody>
<tr>
<td>0:00</td>
<td>1,750</td>
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<tr>
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<td>5,250</td>
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<tr>
<td>16:00</td>
<td>7,000</td>
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</tbody>
</table>

*Source: Pecan Street Research Institute*
Summer day • Whole home + pool pump

Source: Pecan Street Research Institute
July 31, 2012  HVAC compressor • 8 homes • 1-minute interval

Peak 3.83 kW   Total Consumption 32.93 kWh

Peak 1.75 kW   Total Consumption 20.80 kWh

Peak 3.91 kW   Total Consumption 35.78 kWh

Peak 3.47 kW   Total Consumption 27.02 kWh

Peak 2.61 kW   Total Consumption 22.22 kWh

Peak 2.83 kW   Total Consumption 34.21 kWh

Peak 3.18 kW   Total Consumption 32.39 kWh

Peak 2.72 kW   Total Consumption 20.34 kWh

Source: Pecan Street Research Institute
Average marginal price of wholesale energy - Aug. 2011

$850 @ 4PM

$/megawatt hour
August 2011 average

Solar PV generation and whole-home electricity usage (kW)

Consumption, South PV, West PV

Source: Pecan Street Research Institute
4 Transformers

“Normal” Transformer

“Loaded” Transformer

Transformer Monitoring
Power Comparison

Source: Pecan Street Research Institute
Power Comparison

Source: Pecan Street Research Institute
505 homes in Austin
300 + homes in Houston, Dallas-Ft Worth
~ 65 homes with electric, gas, water
69 homes with EV’s + Level 2
210 homes in one neighborhood
with rooftop solar PV
225 + homes > 10 years old

Public school(s)
High resolution transformer monitoring
Multi-family (60-120 units) – Spring 2013
Small commercial
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