

Open Source Tools for Energy Data Analysis

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VEIC

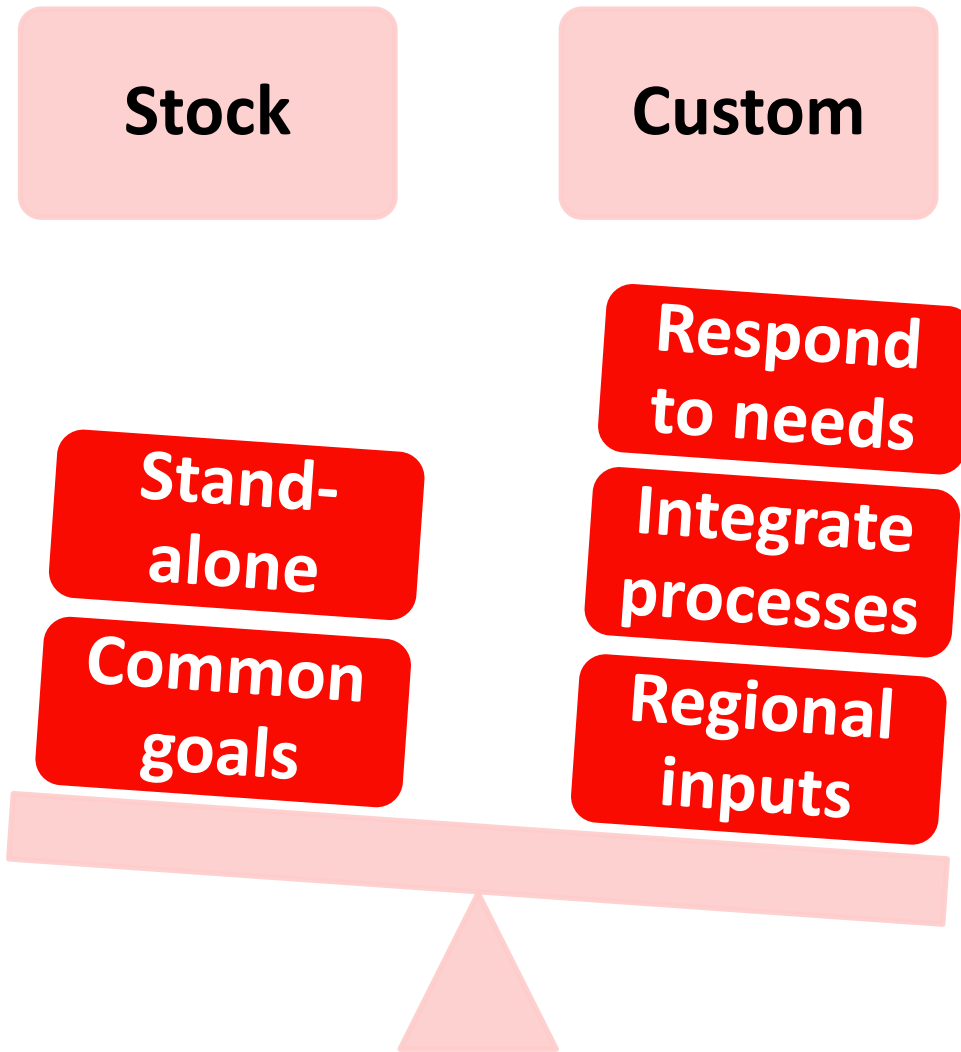


Vermont Energy Investment Corporation

- Mission-driven nonprofit
- Over 25 years reducing economic, environmental costs of energy
- Energy efficiency, renewable energy & transportation
- Consulting & implementation
- 3 energy efficiency utilities



Build or Buy?



What Can't Excel Do?

Boiler Savings Tool v2a.xlsx [Read-Only] - Microsoft Excel

Boiler Savings Tool

INPUT SHEET

Project Name: <<Enter Project Name>>
 Project Number: <<Enter Project Number>>
 Project Manager: <<Enter Project Manager>>
 Date Prepared: <<Enter Today's Date>>

SPACE HEAT AND DEHUMIDIFICATION REHEAT (REQ. WEATHER NORMALIZATION TOOL)

Nearest Weather Station: DC - Dulles

Building & Old Boiler Parameters		
Balance Point	65	deg F
HDD Response Coeff (Fuel Units)	6	Units/HDD
CDD Response Coeff (Fuel Units)	1	Units/CDD
Old System's Ave. Thermal Efficiency	80%	%
Fuel Thermal Content (see table at right)	0.102	MMBtu/Unit
Building's Heating Demand	20.4	MBh/ΔF
Building's Reheat Demand	3.4	MBh/ΔF

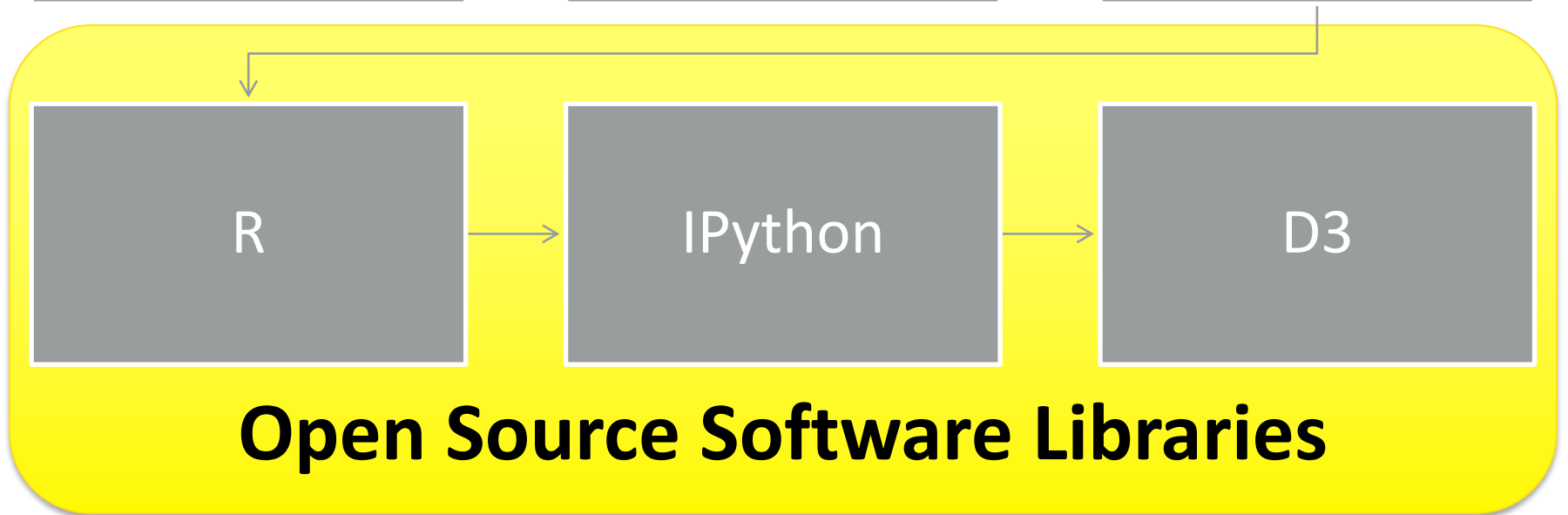
Output MBh Demanded by Building vs. OAT

Fuel Thermal Content Per Unit		
Fuel Type	Unit	MMBtu/Unit
Res. Natural Gas	therm	0.1
Res. Natural Gas	ccf	0.102
Res. Distillate	gallon	0.138
Res. High-Use LPG	gallon	0.0916
Com. Distillate	gallon	0.138
Com. LPG	gallon	0.0916
Com. Natural Gas	therm	0.1
Kerosene	gallon	0.1366
Wood	cord	22

REALITY CHECKS

- MBh is thousand-Btus-per-hour and MMBtu is million-Btus. 1 MMBtu = 1000 MBtu.
- When you convert from MMBtu to MBtu, MULTIPLY by 1000.
- When you convert from MBtu to MMBtu, DIVIDE by 1000.

History of VEIC Analysis Tools



IPython Notebook: Interactive Data Exploration

IP[y]: Notebook

Data Warehouse chart export Last Checkpoint: Jul 02 14:42 (unsaved changes)

File Edit View Insert Cell Kernel Help

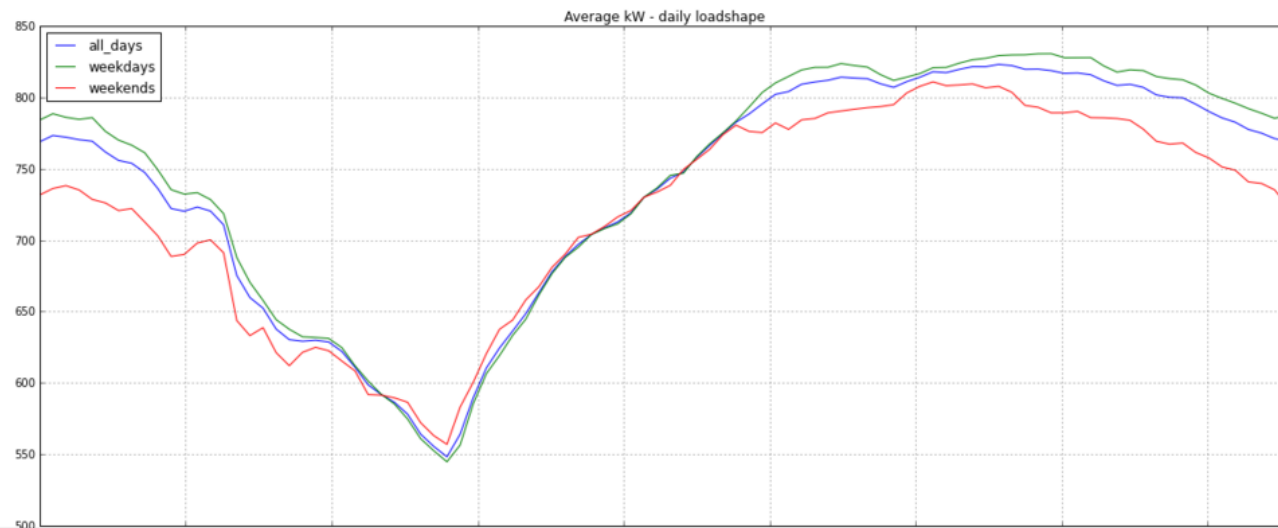
Code Cell Toolbar: None

In [43]: `usage_list.head()`

Out[43]:

		kWh	weekday_val	beginning_datetime	avg_kW
date_value					
2015-02-07	23:45:00	137.97	5	2015-02-07 23:45:00	551.88
2015-02-08	00:00:00	140.85	6	2015-02-08 00:00:00	563.40
	00:15:00	142.56	6	2015-02-08 00:15:00	570.24
	00:30:00	143.01	6	2015-02-08 00:30:00	572.04
	00:45:00	145.44	6	2015-02-08 00:45:00	581.76

In [38]: `loadshapes.plot(figsize=[20,8], title = 'Average kW - daily loadshape')`
`plt.savefig(output_path + 'kw_loadshape_plot.png')`



VISDOM: AMI Feature Extraction

VISDOM Charts select a view: ▼ Save ×

Customer Filters

PGE residential SmartAC (SmartAC) ▼

Filters
select a presi ▼
Save
×

List
Advanced

select a feature: ▼ + filter

CA climate zone ×

Z01 (50)

Z02 (2,906)

Z03 (42,656)

Z04 (17,983)

Z11 (7,099)

Z12 (54,506)

Z13 (40,089)

Z16 (902)

×

Estimated cooling energy ×

zoom
66483.2

Charts

Map
Histogram
Scatter Plot
Cumulative Sum
Sorted Values
Load Shapes

Customer List

<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>3.1% / 3,253 1</p> <p>5.4% / 140.2 kWh</p> </div>	<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>3% / 3,141 2</p> <p>4.7% / 121.7 kWh</p> </div>	<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>2.6% / 2,698 3</p> <p>4.4% / 114.9 kWh</p> </div>
<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>4.2% / 4,392 4</p> <p>3.5% / 91.3 kWh</p> </div>	<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>2.1% / 2,182 5</p> <p>3.4% / 87.5 kWh</p> </div>	<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>3% / 3,128 6</p> <p>2.6% / 67.1 kWh</p> </div>
<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>2.3% / 2,380 7</p> <p>2.6% / 66.2 kWh</p> </div>	<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>3% / 3,155 8</p> <p>2.4% / 62.2 kWh</p> </div>	<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>1.7% / 1,756 9</p> <p>2.2% / 58.0 kWh</p> </div>

Sort by

kwh ▼

Shape count

9

The number of shapes to show

Categories

day peak

6%

6%

double peak (day,eve)

2%

2%

double peak (eve,night)

2%

1%

double peak (morn,eve)

9%

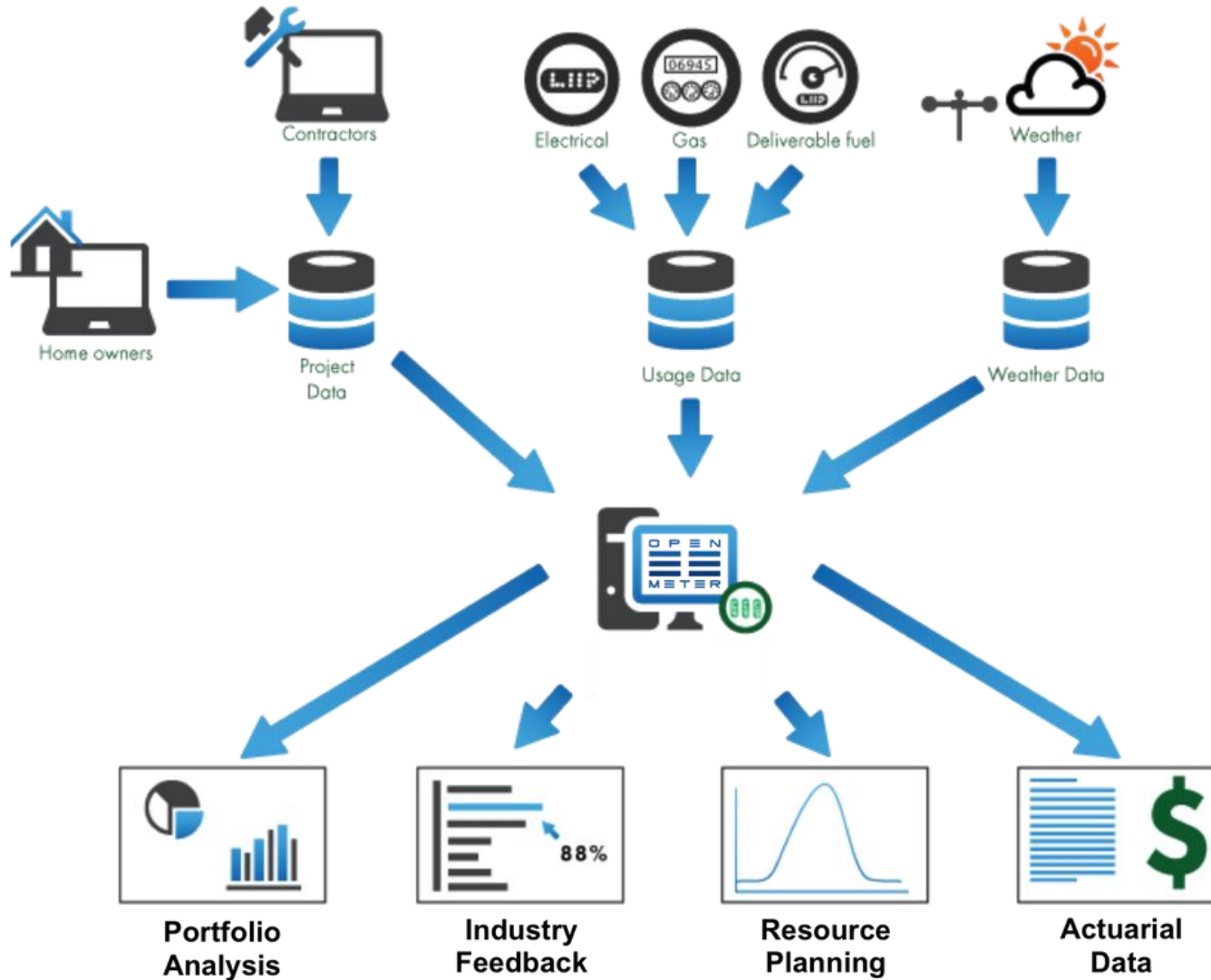
12%

evening peak

73%

67%
■ kWh
■ Members

Open EE Meter: Standardized Savings Calculations



ENERGY STAR Connected Thermostat Spec: Open Source Algorithm for Reporting





Questions?

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