

Panel Session #37

Smart Homes and Distributed Generation

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THE UNIVERSITY OF TEXAS AT AUSTIN
TEXAS ADVANCED COMPUTING CENTER

The Age of Big Data – Records

- Fifteen sectors in US have more data stored per company than US Library of Congress (**235 TB per company**)
- As of 2010, **five billion** mobile phones worldwide
- RFID tag sales projected to grow from 12 million in 2011 to **209 billion** in 2021
- Smart meter growth projected from 130 million in 2011 to **340 million** in 2015

The Age of Big Data – Communication

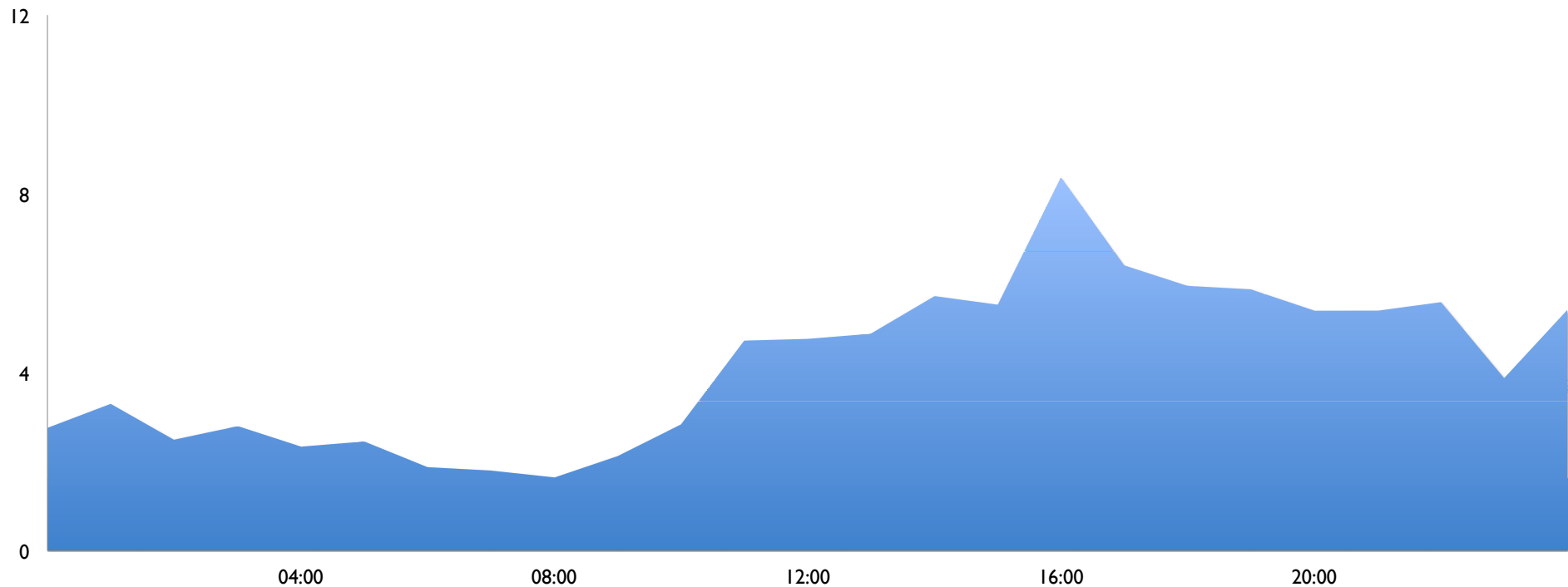
- On Facebook in 2011
 - averages *30 billion* pieces of content shared every month
 - averages *770 billion* page views per month
- On Twitter
 - time to reach first billion tweets: *3 years*, 2 months, 1 day
 - time to reach one billion new tweets in 2011: *7 days*
- Average tweets per day
 - March 2010 50 million
 - February 2011 144 million
 - March 2011 177 million (~ *30M increase* / month)
- On Reddit
 - Feb 2011 – reaches 1 billion page views per month
 - Dec 2011 – reaches *2 billion* page views per month
- Tumblr, Pinterest, Foursquare, ...

Pecan Street Initiative

- Smart grid program in Austin, Texas
 - 200+ homes wired for energy, water and gas consumption at 15 second intervals
 - In 12 months, 3 billion records, 200 GB on disk
 - In 15 months, 5.6 billion records, 862 GB on disk
 - Transition from traditional row-store to column-store
- Project expansion
 - 1000+ homes across Texas (interested in other states too)
 - Finer-grained readings: 15 s -> 5 s -> 1 s
 - More circuits: AC, PV, EV, etc.

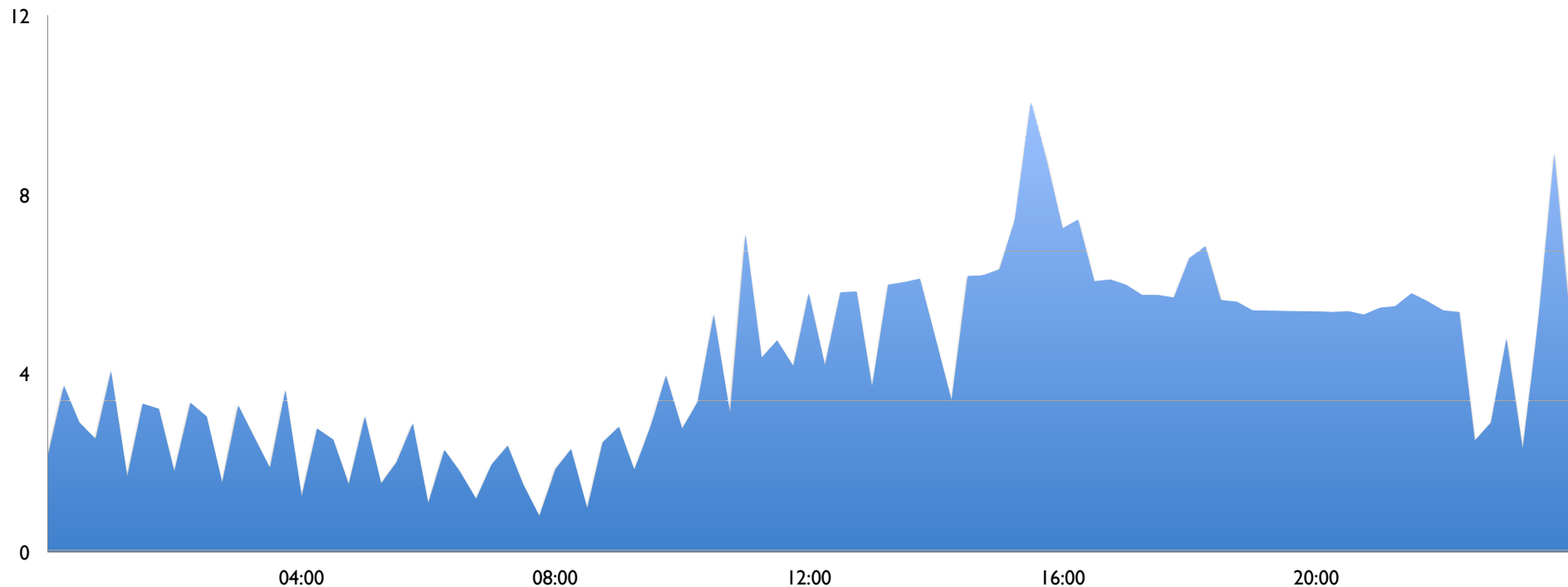
Granularity Matters

August 10, 2011: 1-hour Consumption Data



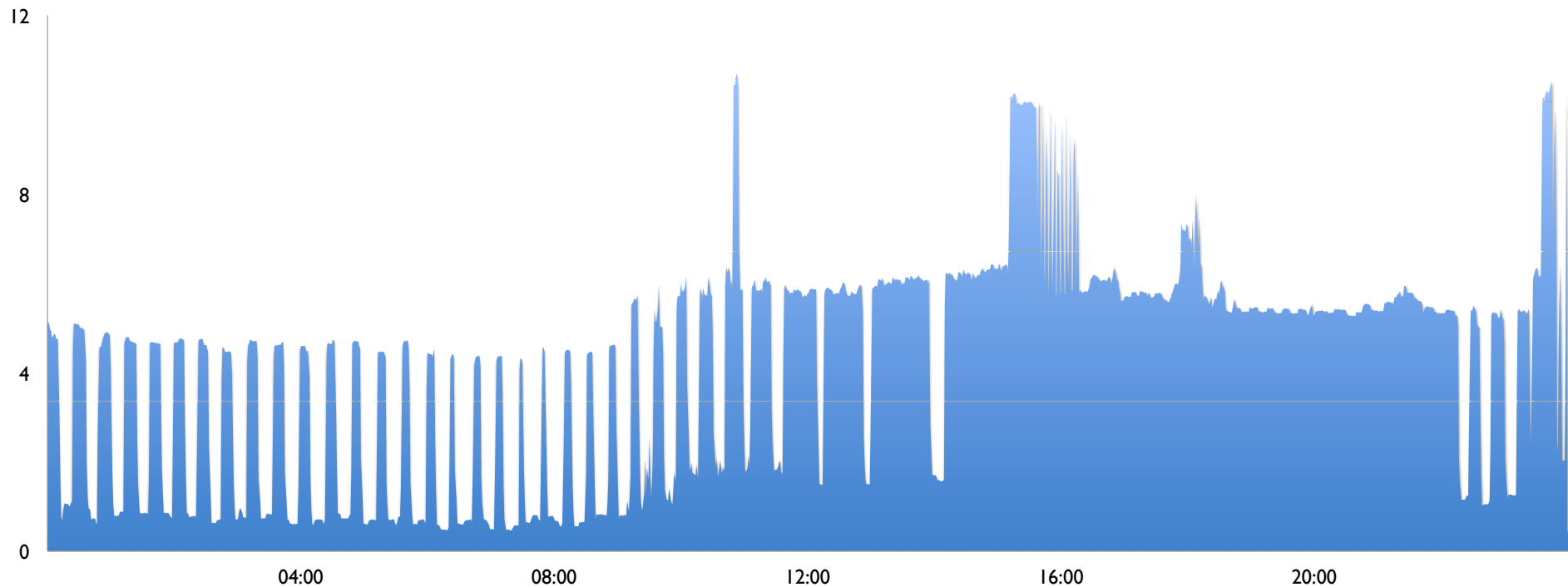
Granularity Matters

August 10, 2011: 15-minute Consumption Data



Granularity Matters

August 10, 2011: 1-minute Consumption Data





Pecan Street Data Portal

House Map - Pecan Street | Dashboard - Pecan Street

https://pecanstreet.tacc.utexas.edu/group/guest/dashboard

Sign Out



Dashboard | Visualization | Data Sets Documentation | Database Documentation | Community

Data Sets Summary

+ DASHBOARD

Usage Data Sets

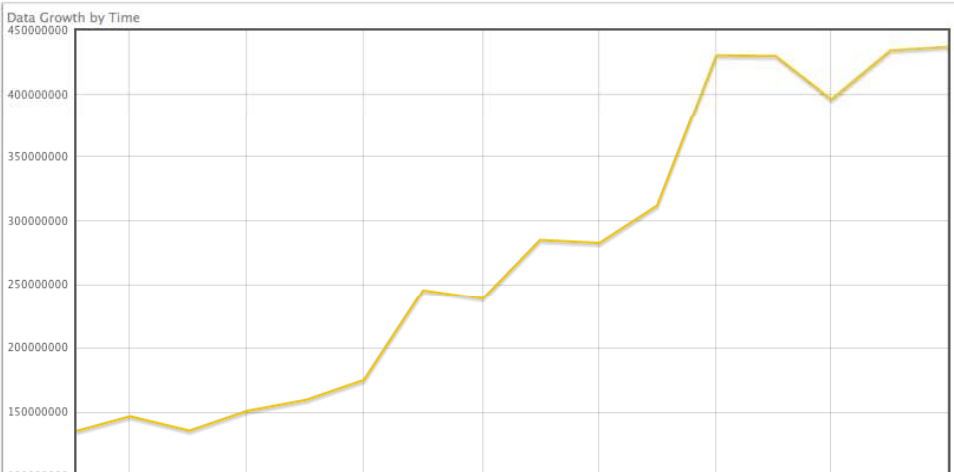
DATA SET	NUMBER OF RECORDS	MIN TIMESTAMP	MAX TIMESTAMP	DISTINCT METERS/CIRCUITS MONITORED
Incenergy Electric	4279351925	02-01-11 12:00 AM	05-30-12 11:59 PM	294
Incenergy Gas	89705440	06-01-11 12:00 AM	02-01-12 11:59 PM	146
Incenergy Water	8764452	06-06-11 12:00 PM	02-01-12 11:59 PM	12
Landis Gyr	563704	05-22-12 08:25 AM	06-05-12 01:10 PM	50
CheckIT	7060073	10-16-11 04:25 PM	03-04-12 11:59 PM	16
eGauge	185807326	06-01-11 11:11 PM	06-13-12 11:59 PM	66

Other Data Sets

DATA SET	NUMBER OF RECORDS	MIN TIMESTAMP	MAX TIMESTAMP	DISTINCT DATA SOURCES
NOAA Weather	28522	01-01-10 12:51 AM	06-01-12 11:51 PM	1
Ercot Generation	36549648	01-01-99 12:00 AM	12-31-11 11:00 PM	163
Ercot SPP Pricing	32991	07-01-11 12:00 AM	06-10-12 11:45 PM	14

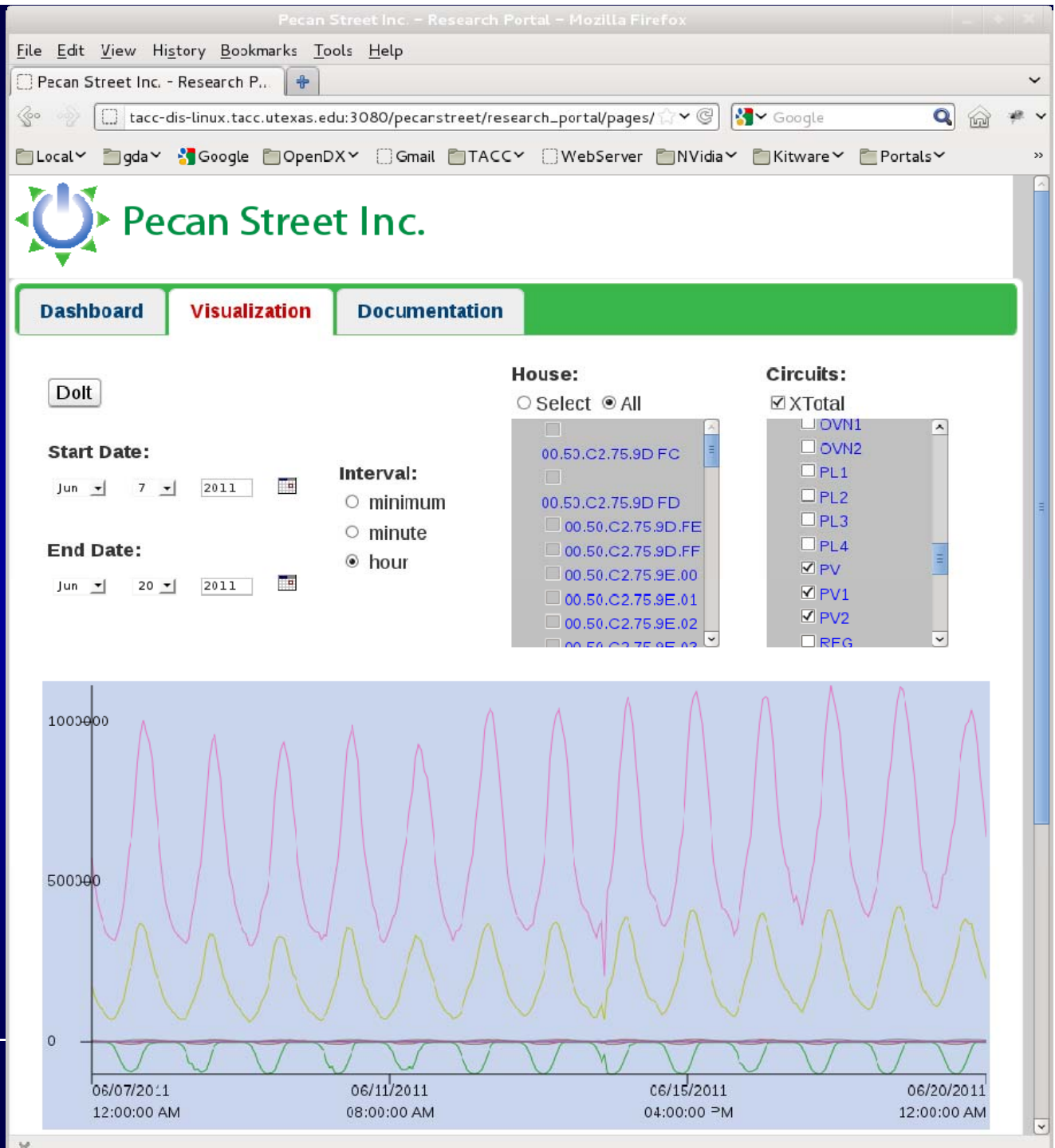
Data Growth

Data Growth by Time

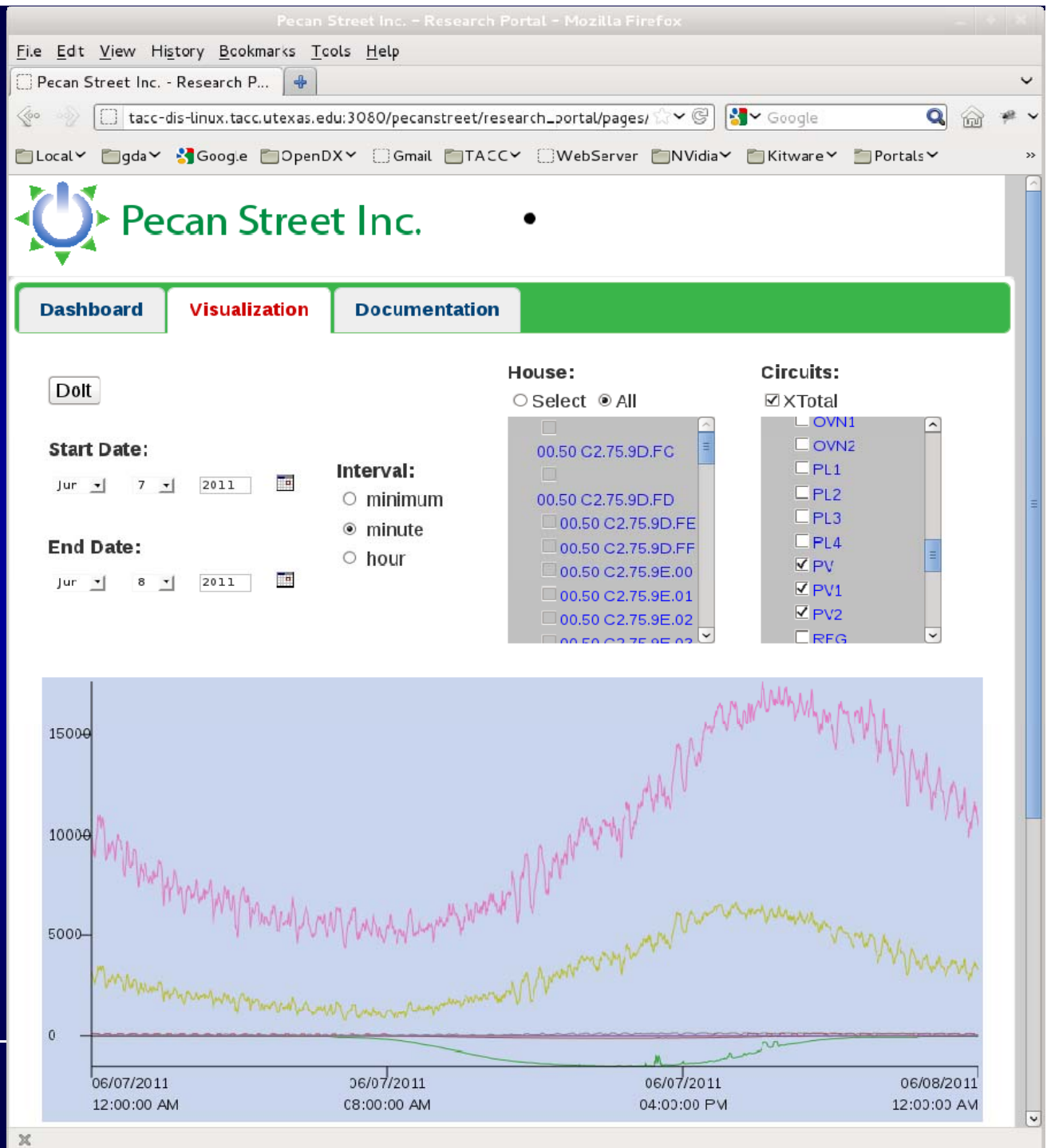


Time	Number of Records
Q1	130,000,000
Q2	145,000,000
Q3	170,000,000
Q4	240,000,000
Q5	280,000,000
Q6	310,000,000
Q7	430,000,000
Q8	420,000,000
Q9	390,000,000
Q10	430,000,000
Q11	435,000,000

Web-Based Visualization



Web-Based Visualization



House Map

House Map - Pecan Street | Dashboard - Pecan Street

https://pecanstreet.tacc.utexas.edu/group/guest/house-map

Sign Out

Pecan Street Inc. **TACC**

Dashboard Visualization Data Sets Documentation Database Documentation Community

Update

Start: 00:00 January 1st, 2012

End: 00:00 January 2st, 2012

Neighborhood Filter:

- Mueller:
- Duke:
- Both

Feature Filter:

- Baseline:
- Has Electric Vehicle:
- Has Photo Voltaic:

Data Sets Filter:

- CheckIT:
- eGauge:
- Landis Gyr:
- Incenergy Electric:
- Incenergy Water:
- Incenergy Gas:

18	35	78	86	94	103	114	370	410	484	545	585	661	739	744
871	898	900	936	964	1050	1101	1114	1185	1192	1314	1334	1463	1464	1589
1642	1714	1718	1790	1796	1800	1801	1852	2018	2062	2129	2149	2158	2171	2233
2337	2345	2461	2575	2638	2645	2653	2743	2814	2818	2829	2859	2945	3009	3039
3192	3256	3313	3342	3432	3456	3482	3544	3577	3724	3739	3778	3824	3831	3834
3936	3967	4031	4141	4154	4228	4251	4336	4421	4447	4590	4671	4726	4767	4998
5077	5193	5218	5275	5292	5323	5371	5403	5433	5545	5746	5785	5810	5839	5874
5972	6088	6246	6394	6423	6493	6636	6673	6794	6827	6830	6836	6910	6990	7024
7057	7113	7161	7361	7454	7488	7504	7531	7536	7589	7680	7683	7731	7769	7866
7982	7989	8031	8047	8084	8236	8268	8317	8399	8560	8597	8600	8719	8741	8767

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Geospatial Visualization

Average home energy usage at 7 am, August 15 2011

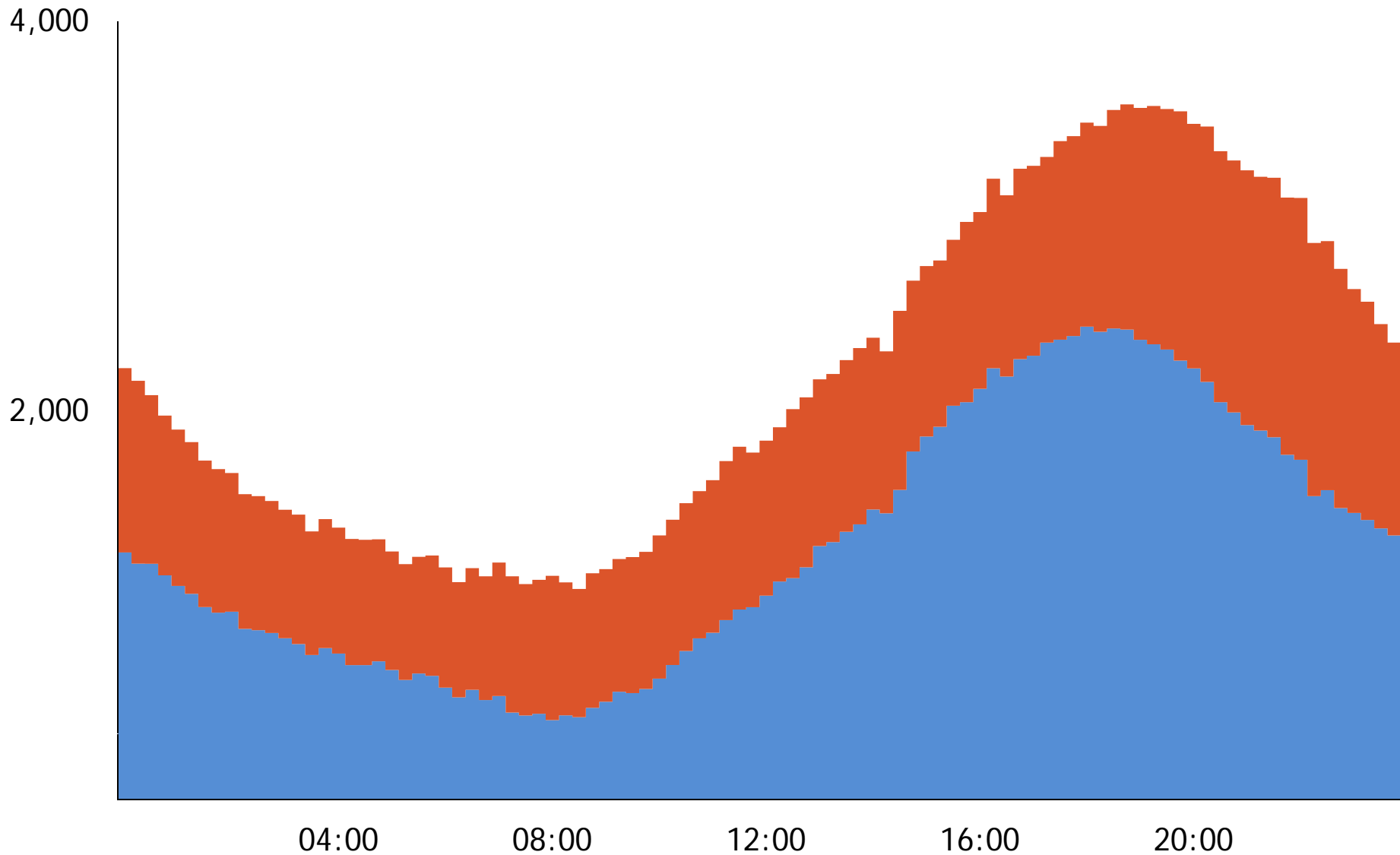


Average home energy usage at 7 pm, August 15 2011

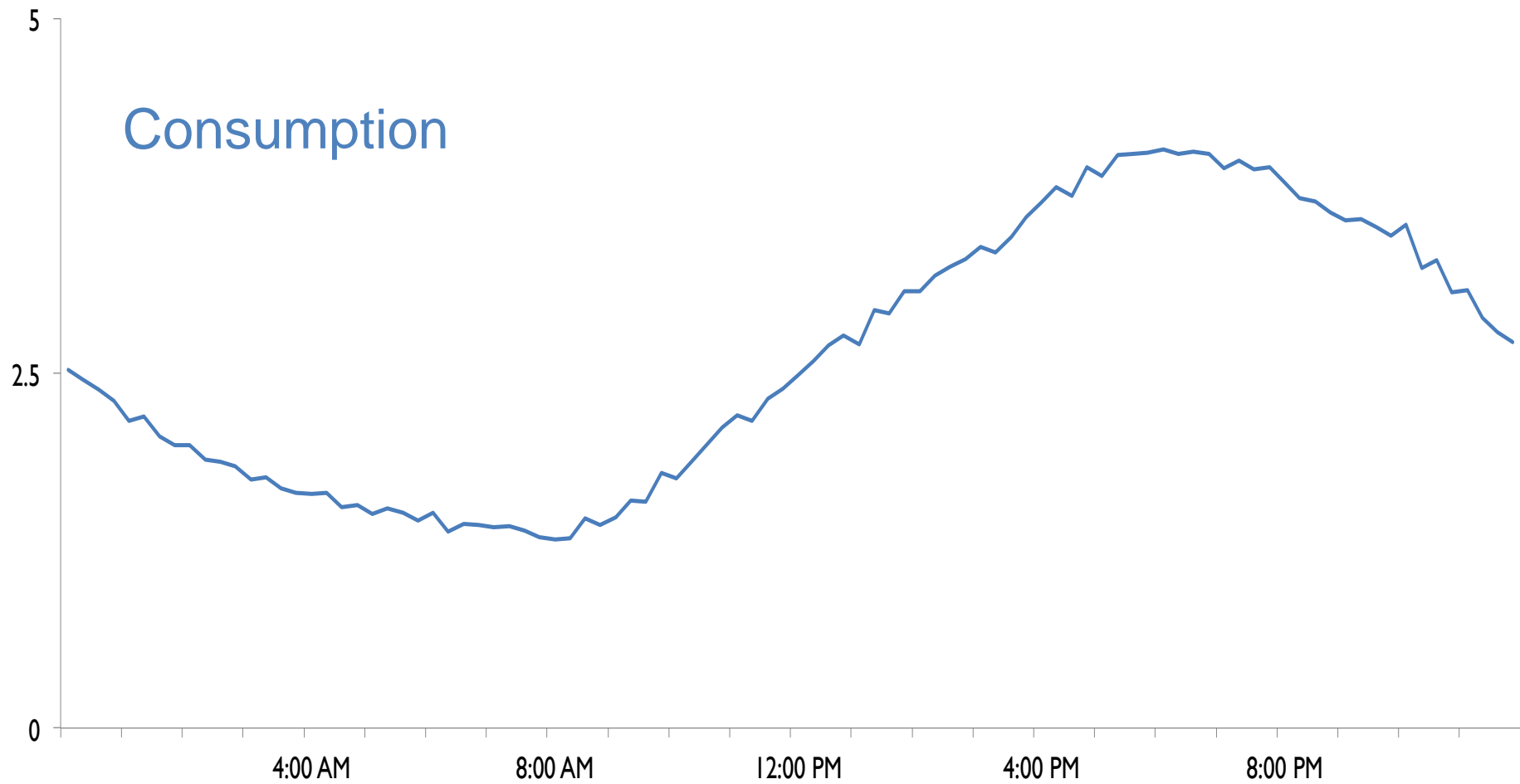
**Mueller neighborhood data grouped by census block
Visualized in Google Earth**

Average Watts

Air Conditioning Inside Mueller

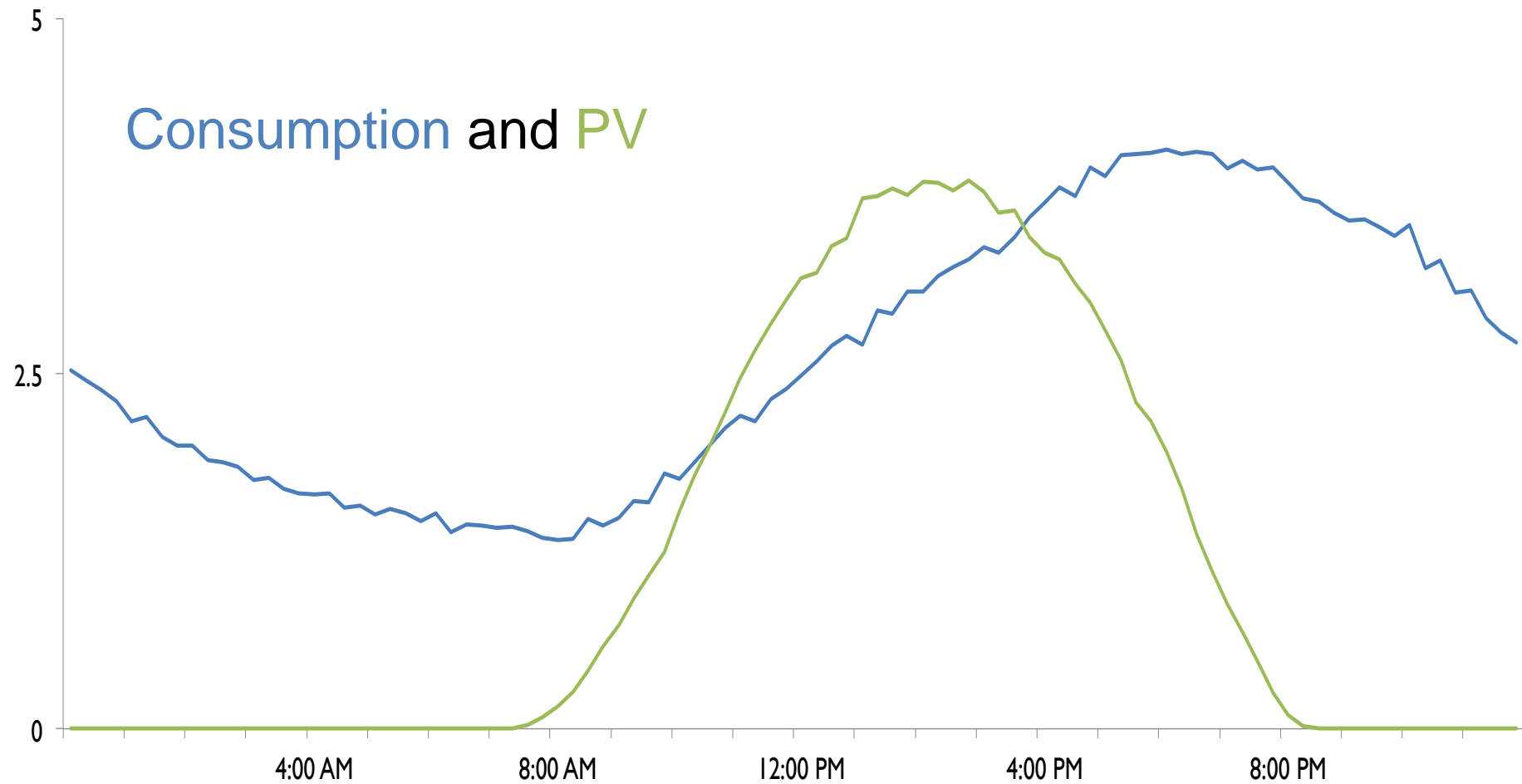


August average Whole-home electricity usage (kW)



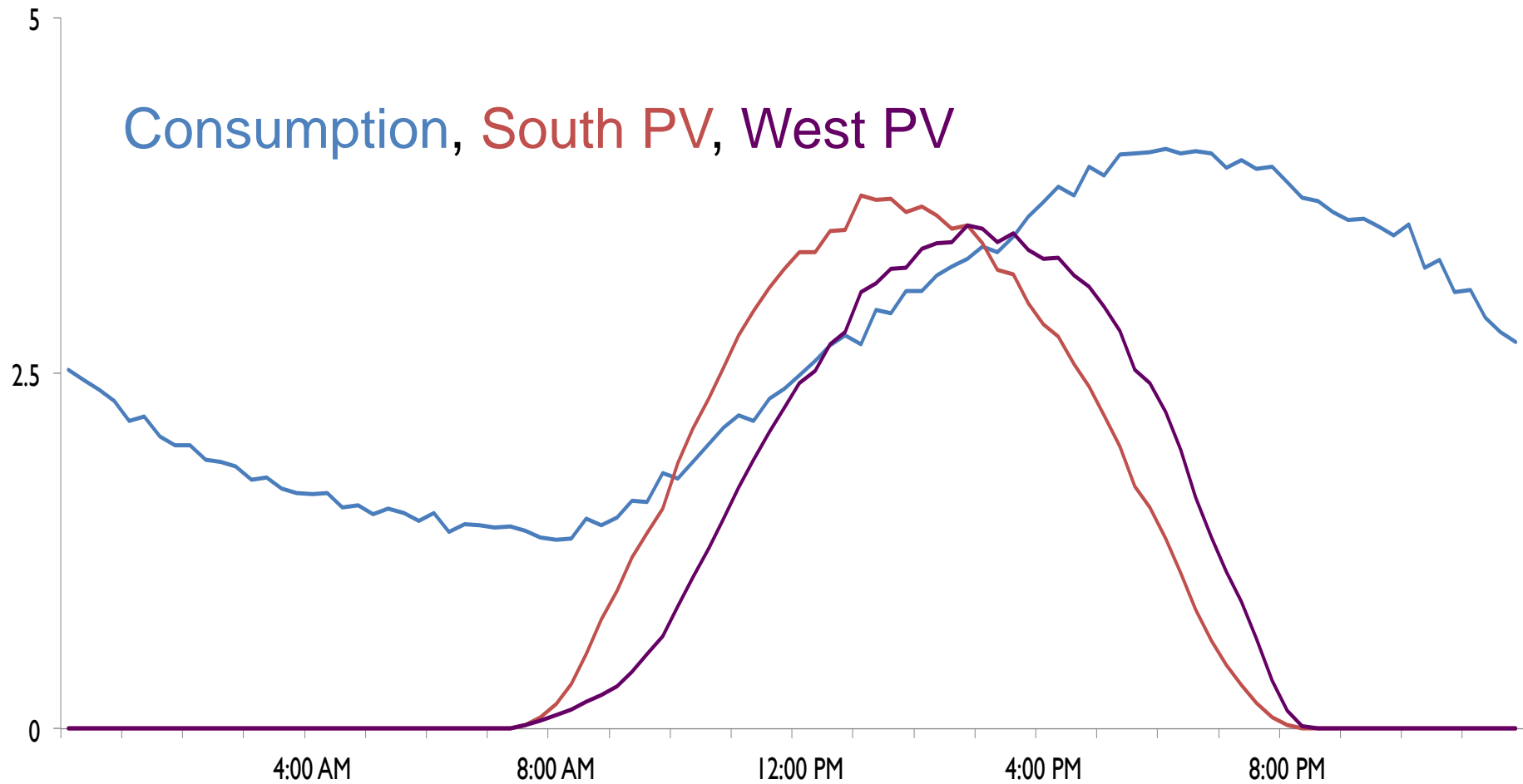
August average

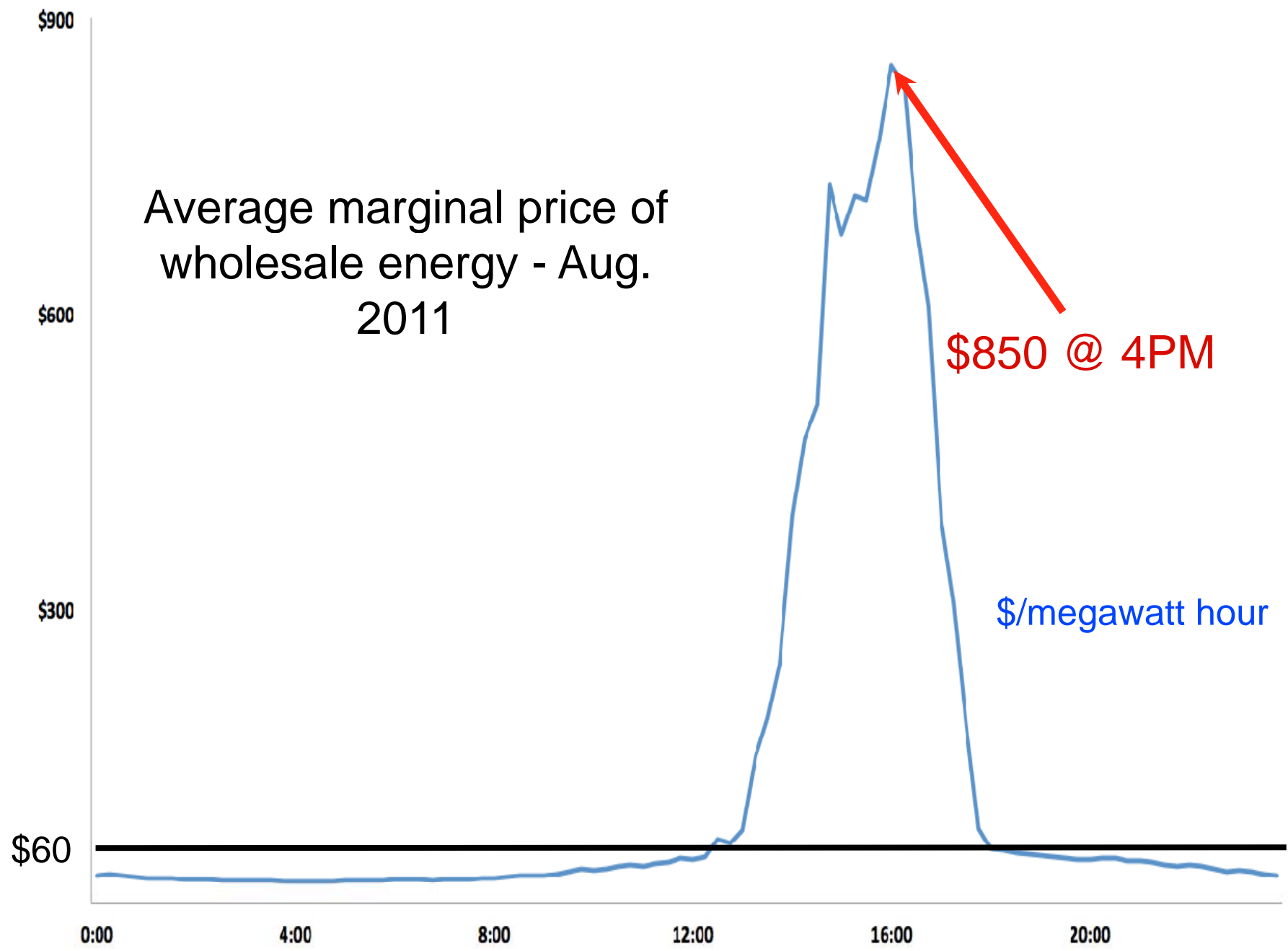
Whole-home electricity usage and generation (kW)



August average

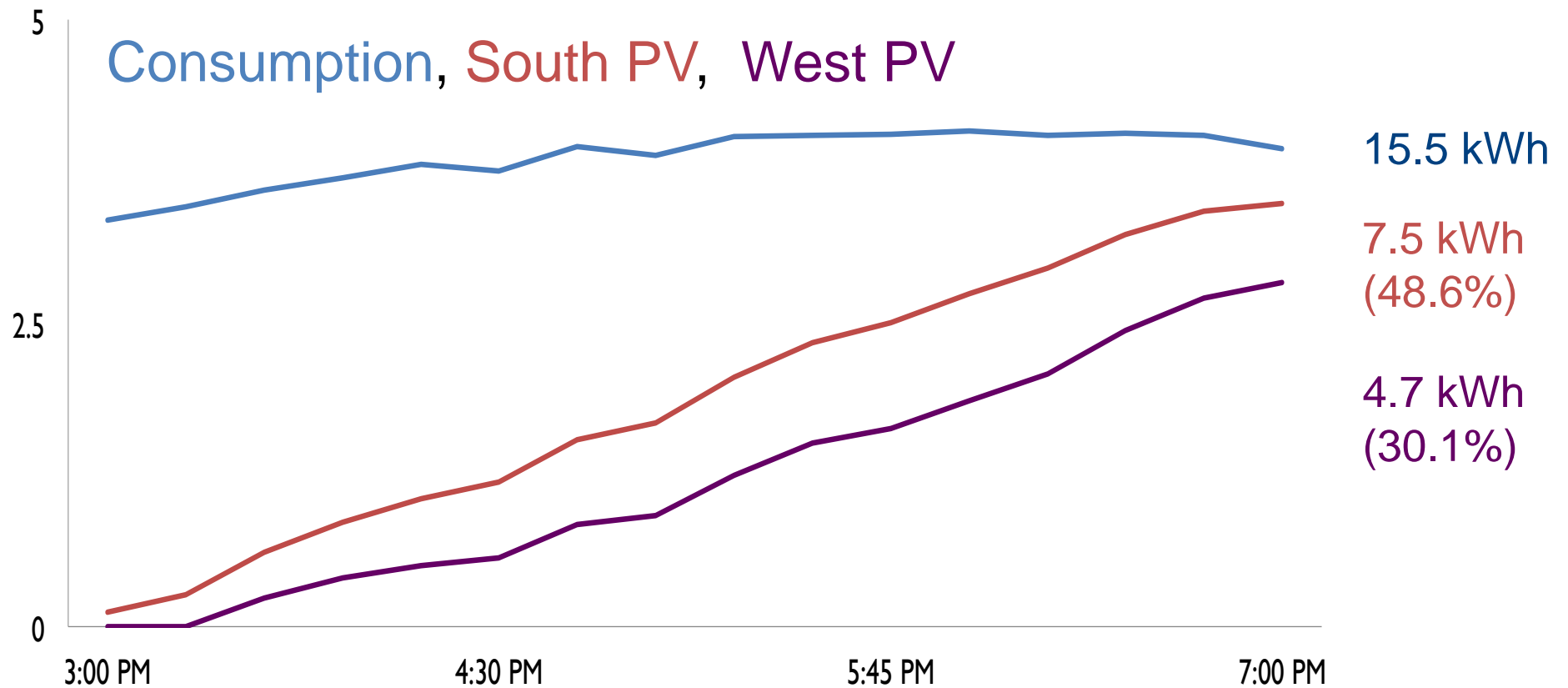
Whole-home usage and modeled generation(kW)





August average

Peak consumption from grid (kW)



Some Research Right Now

- Incentives for differing solar system configurations
 - Pecan St., funded University of Texas researchers
- Feeder-Level Storage and Grid Impacts from EV, PV, storage
 - University of Texas IGERT students, Center for Electromechanics
- Electric, Gas, and Water Disaggregation and Behavior Info
 - funded University of Texas researchers, Pecan St.
- Consumer Behavior and Appliance Use Patterns
 - funded University of Texas researchers, Pecan St.
- Impacts of System Accuracy and Data
 - funded University of Texas researchers, Pecan St.
- AC system sizing, Savings from Energy Efficiency Measures
 - funded University of Texas researchers
- Emissions Reductions
 - Environmental Defense Fund, Pecan St.

Thank you!

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