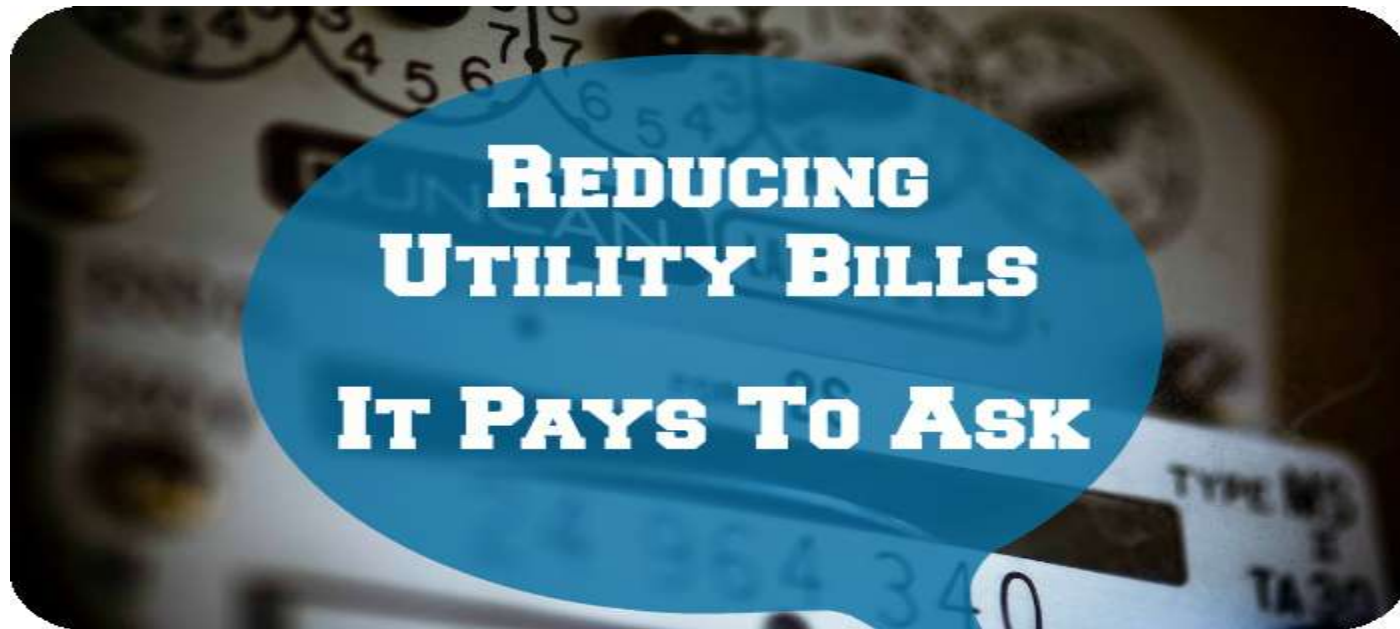


Utility Rate Review and Opportunities



Lon W. House, Ph.D.
Water and Energy Consulting
530.676.8956 or 520.297.2643
lonwhouse@waterandenergyconsulting.com

NRWA Training
June 2015, Reno, NV

Lon W. House, Ph.D.
office: 01.530.676.8956
cell:01.530.409.9702

lonwhouse@waterandenergyconsulting.com
www.waterandenergyconsulting.com

Dr. House has a Bachelors, two Masters, and a Ph.D. in Engineering and Economics from University of California at Davis. He is a Certified Energy Manager (CEM) and a Certified Sustainable Development Professional (CSDP) with the Association of Energy Engineers. He taught engineering in Graduate School at U.C. Davis for a number of years and is the founder and Co-Director of Hydropower for the U.C Davis Energy Institute. He worked for the California Energy Commission for five years as a utility planner, and he was the chief utility planner for the California Public Utilities Commission for five years. In 1990 he went out into the consulting business, starting his own business (Water and Energy Consulting). He has been the Association of California Water Agencies (ACWA) energy consultant since 1992, representing 500 water agencies which are responsible for over 90 percent of the water delivered in California, and is the California Rural Water Association (CRWA) energy specialist, representing over 1,100 rural water and wastewater systems. Dr. House also works for the California Public Utilities Commission as an expert witness on transmission issues and is their water-energy expert, and for the California Energy Commission as a researcher. He is an investment management expert consultant in the water and energy areas for: Gerson Lehrman Group-GLG Scholar Program, eWork Markets, Price Waterhouse-Vantage Marketplace, Roundtable Group, and Standard & Poor's-Society of Industrial Leaders. He has been responsible for training and installation of over 25 small hydroelectric facilities in Southeast Asia. He is a member of the American Water Works Association (AWWA), American Society of Civil Engineers (ASCE), Sigma Xi- the National Research Honor Society, and Association of Energy Engineers (AEE).



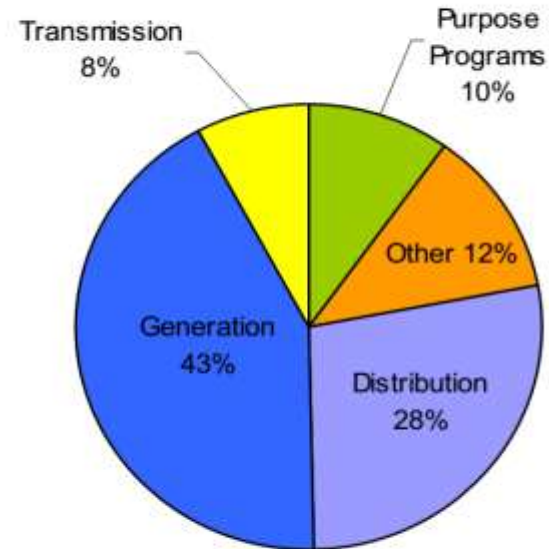
What This Class Will Cover

- How electric utility rates are established
- Time-of-Use
- How to read a tariff sheet
- How to read an electricity bill
- Electric utility bill definitions
- Energy vs. demand change example
- Water system energy conservation measures
- Pump/motor checklist
- Energy assessment tools
- Recommendations

How Electricity Rates Are Set – Total Revenue

Allocation of Generation, Distribution and other Revenue Requirements

- **Generation and Distribution:** Separately allocated using EPMC
- **Transmission:** FERC jurisdictional and allocated by embedded costs
- **Public Purpose Programs:** Allocated mostly by equal cents/kWh
- **Other Costs (i.e. SGIP, CSI):** Allocated by various methods

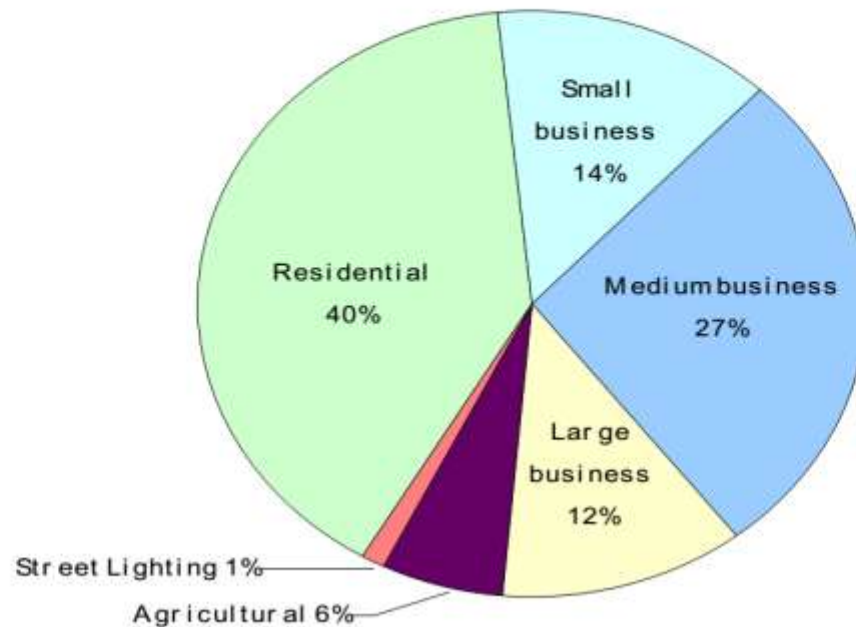


Reflects Revenue Req's. for PG&E in 2011 Annual Electric True-Up filing

**errors due to rounding*

How Electricity Rates Are Set – Assigned To Customer Classes

**Example: Percent of PG&E Total Electric Revenue Requirement
Allocated to Various Customer Classes**



Reflects Costs for PG&E in 2011 Annual Electric True-Up

Some Definitions

Connected Load Charge: A demand charge based on the capacity rating of the pumps connected to the meter.

Customer charge: Customers on certain rate plans are charged a fixed fee for service, regardless of the amount of energy consumed, as well as charges based on usage.

Demand charge: Demand is a measurement of the highest usage of electricity in any single 15 (or sometimes 5) minute period during a monthly billing cycle. Demand is measured in kilowatts (or kW). High demand is usually associated with equipment start-up. By spreading equipment start-ups over a longer period of time, you may be able to lower demand and reduce your demand charges. Peak demand charge = highest 15 minute demand during the peak period, Noncoincident demand charge = highest 15 minute demand any time during the billing period, Ratcheted demand charge = highest 15 minute demand during the last year.

Distribution charge: A charge for the lower-voltage system of power lines, poles, substations and transformers directly connecting PG&E's distribution lines to homes and businesses.

Franchise Fee: This surcharge pays cities and counties for the right to use public streets to provide utility services. PG&E collects the surcharges and passes them to cities and counties. This tax (if any) is charged as a percentage of your energy charges.

Meter Charge: Customers on some time-of-use electric rates are assessed a meter charge to recover the additional equipment costs of providing customers with this type of service.

Meter constant: A factor that converts electric meter read differences to kilowatt hours (kWh).

Multiplier: A factor that converts the gas meter read difference to Therms. The multiplier corrects for differences in elevation, delivery pressure and the heating content of natural gas.

Power Factor. Charge for low power factor (usually < .9)

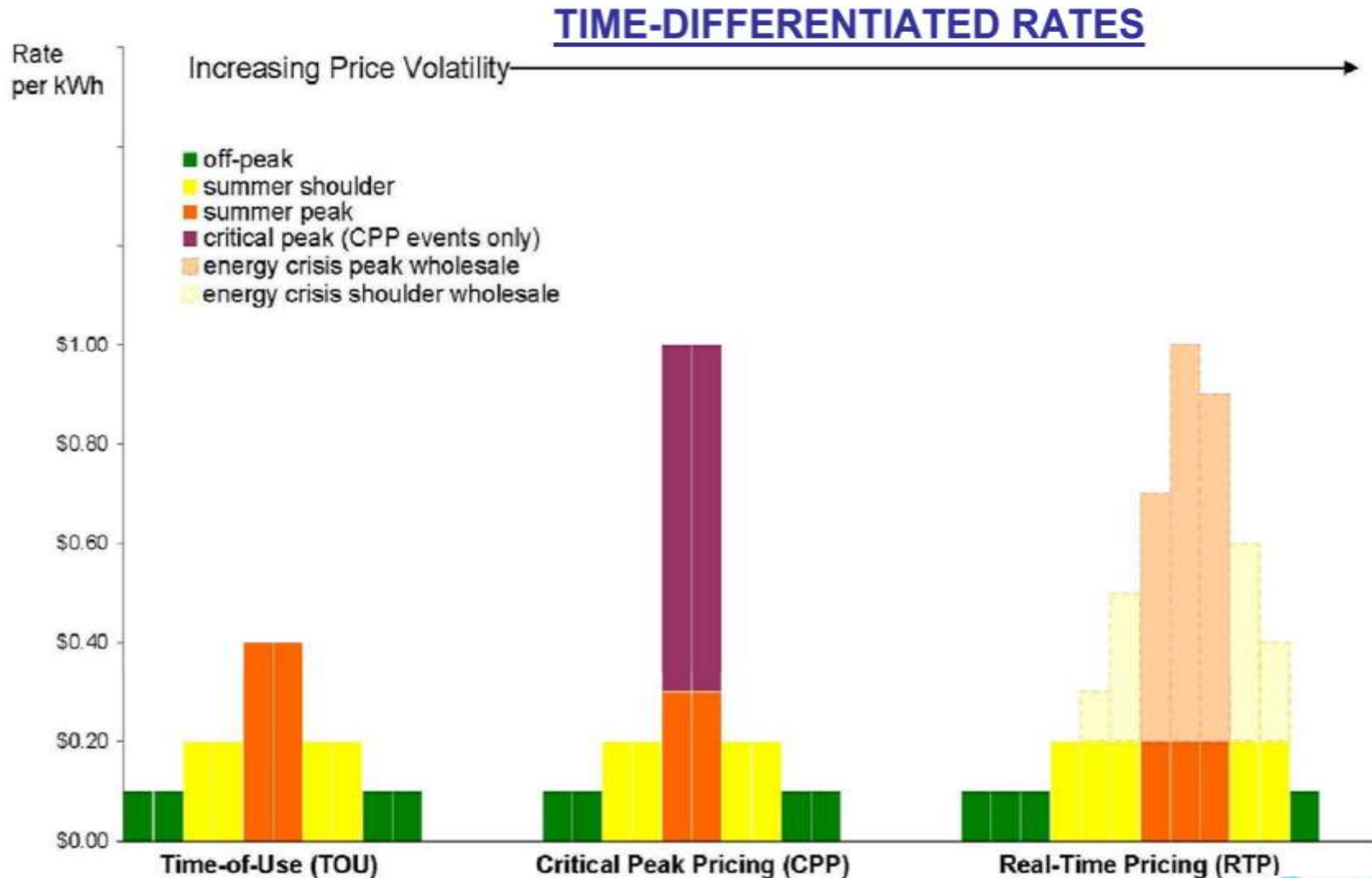
Rotating Outage Block: In the event of a power emergency that causes the California Independent System Operator to determine that rotating outages are necessary, this number indicates the order in which your power will be interrupted.

Serial: The serial code determines when a meter is read for billing.

Time of Use Electric Rate Plans: Instead of a single flat rate for energy use, customers on a time-of-use plan pay higher rates for energy on weekday afternoons and lower rates at other times. Prices also change by season, with higher prices in the summer and lower prices in the winter. This means that when you use energy is just as important as how much you use.

Transmission: The cost of transmitting electricity from power plants, over high-voltage lines and towers, to the distribution system.

Price Varies by Time of Use



PG&E Time Periods

A-1, A-10 and E-19 Time-of-Use Periods

Summer Period A (May-October)

Peak:	12:00 noon to 6:00 pm	Monday through Friday (except holidays)
Partial-Peak:	8:30 am to 12:00 noon	Monday through Friday (except holidays)
	6:00 pm to 9:30 pm	Monday through Friday (except holidays)
Off-Peak:	9:30 pm to 8:30 am	Monday through Friday (except holidays)
	All Day	Saturday, Sunday, and Holidays

Winter Period B (November-April)

Partial-Peak:	8:30 am to 9:30 pm	Monday through Friday (except holidays)
Off-Peak:	9:30 pm to 8:30 am	Monday through Friday (except holidays)
	All Day	Saturday, Sunday, and Holidays

PG&E E-19 Rate Components

TOTAL RATES

	Secondary Voltage	Primary Voltage	Transmission Voltage
<u>Total Customer/Meter Charge Rates</u>			
Customer Charge Mandatory E-19 (\$ per meter per day)	\$19.71253	\$32.85421	\$59.13758
Customer Charge Voluntary E-19:			
Customer Charge with SmartMeter™ (\$ per meter per day)	\$4.59959	\$4.59959	\$4.59959
Customer Charge Rate V (\$ per meter per day)	\$4.77700	\$4.77700	\$4.77700
Customer Charge Rate W (\$ per meter per day)	\$4.63507	\$4.63507	\$4.63507
Customer Charge Rate X (\$ per meter per day)	\$4.77700	\$4.77700	\$4.77700
Optional Meter Data Access Charge (\$ per meter per day)	\$0.98563	\$0.98563	\$0.98563
<u>Total Demand Rates (\$ per kW)</u>			
Maximum Peak Demand Summer	\$16.78	\$16.67	\$15.28
Maximum Part-Peak Demand Summer	\$3.87	\$3.56	\$3.38
Maximum Demand Summer	\$12.24	\$9.72	\$5.95
Maximum Part-Peak Demand Winter	\$0.21	\$0.38	\$0.00
Maximum Demand Winter	\$12.24	\$9.72	\$5.95
<u>Total Energy Rates (\$ per kWh)</u>			
Peak Summer	\$0.15406 (I)	\$0.14164 (I)	\$0.09021 (I)
Part-Peak Summer	\$0.10612 (I)	\$0.10000 (I)	\$0.08604 (I)
Off-Peak Summer	\$0.07472 (I)	\$0.07520 (I)	\$0.07149 (I)
Part-Peak Winter	\$0.09975 (I)	\$0.09531 (I)	\$0.08456 (I)
Off-Peak Winter	\$0.07832 (I)	\$0.07817 (I)	\$0.07303 (I)
Power Factor Adjustment Rate (\$/kWh/%)	\$0.00005	\$0.00005	\$0.00005
<u>PDP Rates</u>			
<u>PDP Charges (\$ per kWh)</u>			
All Usage During PDP Event	\$1.20	\$1.20	\$1.20

PG&E E-19 Peak Day Pricing

PDP Rates

PDP Charges (\$ per kWh)

All Usage During PDP Event	\$1.20	\$1.20	\$1.20
----------------------------	--------	--------	--------

PDP Credits

Demand (\$ per kW)

Peak Summer	(\$6.37)	(\$6.04)	(\$6.29)
-------------	----------	----------	----------

Part-Peak Summer	(\$1.38)	(\$1.17)	(\$1.39)
------------------	----------	----------	----------

Energy (\$ per kWh)

Peak Summer	\$0.00000	\$0.00000	\$0.00000
-------------	-----------	-----------	-----------

Part-Peak Summer	\$0.00000	\$0.00000	\$0.00000
------------------	-----------	-----------	-----------

Total bundled service charges shown on customers' bills are unbundled according to the component rates shown below. PDP charges and credits are all generation and are not included below.

PG&E Electricity Rate Comparison

Rate Schedule	Customer Charge	Season	Time-of-Use Period	Demand Charge (per kW)			Time-of-Use Period	Total Energy Charge (per kWh)		
A-10 TOU (Table B)	\$4.59959 per meter per day	Summer		\$13.36	\$12.61	\$8.94	Peak	\$0.16657	\$0.15422	\$0.12910
			Part-Peak					\$0.15935	\$0.14907	\$0.12439
			Off-Peak					\$0.13739	\$0.12936	\$0.10656
		Winter		\$6.26	\$6.48	\$4.84	Part-Peak	\$0.12195	\$0.11493	\$0.10132
			Off-Peak					\$0.10312	\$0.09951	\$0.08717
E-19 TOU	Meter charge: =\$4.77700/day for E19 V or X; =\$4.63507/day for E19W ^{4/} ; =\$19.71253/day for E19S mandatory; =\$32.85421/day for E19P mandatory; =\$59.13758/day for E19T mandatory	Summer	Max. Peak	\$16.78	\$16.67	\$15.28	Peak	\$0.15406	\$0.14164	\$0.09021
			Part Peak	\$3.87	\$3.56	\$3.38	Part Peak	\$0.10612	\$0.10000	\$0.08604
			Maximum	\$12.24	\$9.72	\$5.95	Off Peak	\$0.07472	\$0.07520	\$0.07149
		Winter	Part Peak	\$0.21	\$0.38	\$0.00	Part Peak	\$0.09975	\$0.09531	\$0.08456
			Maximum	\$12.24	\$9.72	\$5.95	Off Peak	\$0.07832	\$0.07817	\$0.07303



ENERGY STATEMENT

www.pge.com/MyEnergy

1 Account No: 1023456789-0
 Statement Date: 05/09/2013
 Due Date: 05/28/2013

2 Service For:
 Commercial TOU Customer
 1234 Commercial Drive
 Extra Address Line
 Anytown, CA 00000

3 Your Account Summary

Amount Due on Previous Statement	\$465.20
Payment(s) Received Since Last Statement	-465.20
Previous Unpaid Balance	\$0.00
Current Electric Charges	\$580.03

4 Questions about your bill?
 24 hours, 7 days/wk: 1-800-468-4743
 Business Specialist available:
 M-F 7am-7:30pm, Sat 7am-4:30pm
 www.pge.com/MyEnergy

5 Total Amount Due by 05/28/2013 **\$580.03**

Local Office Address
 1918 H ST
 BAKERSFIELD, CA 93301



Please return this portion with your payment. No staples or paper clips. Do not fold. Thank you.

9 99901234567890100000XXXXXX00000000XXXXXX



Account Number: 1023456789-0	Due Date: 05/28/2013	Total Amount Due: \$580.03	Amount Enclosed: \$
---------------------------------	-------------------------	-------------------------------	------------------------

COMMERCIAL TOU CUSTOMER
 1234 COMMERCIAL DRIVE
 ANYTOWN, CA 00000
 EXTRAADDRESS LINE

PG&E
 BOX 997300
 SACRAMENTO, CA 95899-7300



1. Key account data: Account number and due date at the top of every page

Your account number is a 10-digit number. You will receive a separate monthly statement for each active account.

2. Service for: Clearly indicates where your charges were incurred

Some customers receive PG&E service at multiple locations. This section indicates which property incurred the charges in this statement.

3. Your Account Summary: A snapshot of your bill

Although a more detailed breakdown of your charges is available on the following pages, the account summary provides an overview of charges incurred, payments received, and your total amount due.

4. Questions about your bill? Learn how to contact us

If you have any questions, feel free to contact us using the information found on the first page of the statement.

5. Total amount due: Your charges and payment due date, all on one line

Notes about your account and any special programs you participate in. (i.e. Balanced Payment Plan (BPP), CARE).

6. Your enrolled programs: Notes any programs or details that affect your bill total *

Please send payment to this address.

7. Monthly billing history: A chart of your monthly charges over the past year *

The dates used to calculate a bill inclusive of both the "Bill From" and "Bill To" Date.

8. Important messages: Provides timely information from PG&E *

This is the cost of gas and/or electricity that you used during a billing period.

9. Remittance stub: Return this form with your payment to the address indicated

The remittance stub indicates your account number, bill due date, and total amount due. Please return payment to the address shown. For your convenience, we have included a windowed return envelope; please place the remittance stub with the PG&E address showing through the window. The back of the remittance stub includes an area for you to update your account information, as well as an overview of your payment options.



ENERGY STATEMENT

www.pge.com/MyEnergy

Account No: 1023456789-0
Statement Date: 05/09/2013
Due Date: 05/28/2013

10 Important Phone Numbers - 24 hours per day, 7 days per week

Customer Service (All Languages; Relay Calls Accepted) 1-800-743-5000 TDD/TTY (Speech/Hearing Impaired) 1-800-652-4712

Service al Cliente en Español (Spanish) 1-800-660-6789
普通话客户服务热线 (Chinese) 1-800-698-9555

Dịch vụ khách hàng Việt (Vietnamese) 1-800-298-8438
Business Customer Service 1-800-468-4743

Rules and rates

You may be eligible for a lower rate. Find out about optional rates or view a complete list of rules and rates, visit www.pge.com or call 1-800-743-5000.

If you believe there is an error on your bill, please call 1-800-743-5000 to speak with a representative. If you are not satisfied with our response, contact the California Public Utilities Commission (CPUC), Consumer Affairs Branch, 505 Van Ness Avenue, San Francisco, CA 94102, 1-800-848-7570 or 415-703-2032 (TDD/TTY).

To avoid having service turned off while you wait for a CPUC decision, enclose a deposit check (payable to the CPUC) for the disputed amount and a description of the dispute. The CPUC will only accept deposit for matters that relate directly to billing accuracy. If it is not possible for you to pay your deposit, you must advise the CPUC. PG&E can not turn off your service for nonpayment while it is under review by the CPUC. However, you must continue to pay your current charges to keep your service turned on.

If you are not able to pay your bill, call PG&E to discuss how we can help. You may qualify for reduced rates under PG&E's CARE program or other special programs and agencies may be available to assist you. You may qualify for PG&E's Energy Savings Assistance Program which is an energy efficiency program for income-qualified residential customers.

12

Important definitions

Rotating outages/blackouts are subject to change without advance notice due to operation of conditions.

Demand charges: Many non-residential rates include a demand charge. Demand is a measurement of the highest usage of electricity in any single 15-minute (or sometimes five) minute period during a monthly billing cycle. Demand is measured in kilowatts (or kW). High demand is usually associated with equipment start-ups. By spreading equipment start-ups over a longer period of time, you may be able to lower demand and reduce your demand charges.

Time-of-use electric prices are higher on weekday afternoons and lower at other times of the day. The price you pay also changes by season. Prices are higher in the summer and lower in the winter.

DWR bond charge: Recovers the cost of bonds issued by the Department of Water Resources (DWR) to purchase power to serve electric customers during the California energy crisis. DWR bond charges are collected on behalf of DWR and do not belong to PG&E.

DWR power charge: Included in generation charges for energy provided by the Department of Water Resources. Approximately 1% of your energy is provided by DWR and collected by PG&E as DWR's agent. In 2013, DWR will return \$28 million to bundled service customers which offsets other generation charges in this bill.

Power Charge Indifference Adjustment (PCIA): Ensures that customers who purchase electricity (generation) from non-PG&E suppliers pay their share of generation costs acquired to serve them prior to their departure, unless otherwise exempt.

Gas Public Purpose Program (PPP) Surcharge. Used to fund state-mandated gas assistance programs for low-income customers, energy efficiency programs, and public-interest research and development.

Visit: www.pge.com/bill/explanation for more definitions.

Your Electric Charges Breakdown

13

Generation	\$252.49
Transmission	40.09
Distribution	212.85
Public Purpose Programs	42.05
Nuclear Decommissioning	1.51
DWR Bond Charge	14.91
Competition Transition Charges (CTC)	50.11
Energy Cost Recovery Amount	-0.58
Taxes and Other	6.62
Total Electric Charges	\$519.05

"PG&E" refers to Pacific Gas and Electric Company, a subsidiary of PG&E Corporation. © 2013 Pacific Gas and Electric Company. All rights reserved.
Please do not mark in box. For system use only.

14

Update My Information (English Only)

Please allow 1-2 billing cycles for changes to take effect.

Account number: 123456789-0

Change my mailing address to: _____

City _____ State _____ ZIP code _____

Primary Phone # _____ Primary Email _____

15

Ways To Pay

- Online at www.pge.com/waystopay
- PG&E's Mobile Bill Pay
- Automatic Payment Service: Sign up to authorize automatic payments sent from your bank account each month.
- By mail: Send your payment along with this payment stub in the envelope provided.
- By debit card, Visa, MasterCard or Discover: Call 1-877-704-8470 at any time. (Our independent service provider charges a fee for each transaction.)
- At a PG&E payment center or local office: To find a payment center or local office near you, please visit www.pge.com or call 1-800-743-5000. Please bring a copy of your bill with you.

10. Important Phone Numbers: Provides customer service phone numbers

If you prefer not to use our convenient online options, you can call us any time for service requests, general questions and billing information. Customer service is available in a broad array of languages, including Spanish, Cantonese, Mandarin, Vietnamese. For languages not listed above, please call **1-800-743-5000** to be directed to customer service in your language.

11. Rules and Rates: Learn about the rules for disputing charges

If you do have a dispute with PG&E, our regulators have set rules to help protect you. Learn more about those rules [here](#).

12. Important Definitions: Key terms you should know

This section provides key terms used by PG&E and our regulators with definitions that can help you understand your bill. You can find a complete list of these key terms online. [View definitions >>](#)

13. Your Electric Charges Breakdown: Line items on your electric bill

Your electric bill is composed of many parts. You can find a complete list of key terms and their definitions online. [View definitions >>](#)

14. Update My Information: Please let us know if your information changes

In case of an outage, service issue, or other concern, it's important that PG&E has your current contact information. Please let us know if your information changes.

15. Ways to Pay: You have many options to pay your PG&E bill

Paying your energy bill should be hassle free. That's why we offer several, convenient ways for you to pay your PG&E bill, from online and automatic deduction to phone and in person. [Learn more >>](#)



ENERGY STATEMENT

www.pge.com/MyEnergy

Account No: 1023456789-0
Statement Date: 05/09/2013
Due Date: 05/28/2013

16

Details of Electric Charges

04/09/2013 - 05/08/2013 (30 billing days)

Service For: 1234 Commercial Drive

Service Agreement ID: 9087654321

Rate Schedule: A105X Medium General Demand-Metered Service - TOU

17

4/09/2013 - 04/30/2013

18

Customer Charge	22 days	@ \$4.59959	\$101.19
Demand Charge ¹	9.689000 kW	@ \$5.60000	39.79
Energy Charges			
Part Peak	1,445.800000 kWh	@ \$0.11479	165.96
Off Peak	695.091000 kWh	@ \$0.09724	67.59
Energy Commission Tax			0.62
Bakersfield Franchise Surcharge			3.75

19

20

05/01/2013 - 05/08/2013

Customer Charge	8 days	@ \$4.59959	\$36.80
Demand Charge ¹	9.472000 kW	@ \$12.57000	31.75
Energy Charges			
Peak	316.757000 kWh	@ \$0.15821	50.11
Part Peak	263.452000 kWh	@ \$0.16148	42.94
Off Peak	284.558000 kWh	@ \$0.13102	37.28
Energy Commission Tax			0.26
Bakersfield Franchise Surcharge			1.99

Total Electric Charges \$580.03

¹ Demand charges are prorated for the number of days in each rate period.

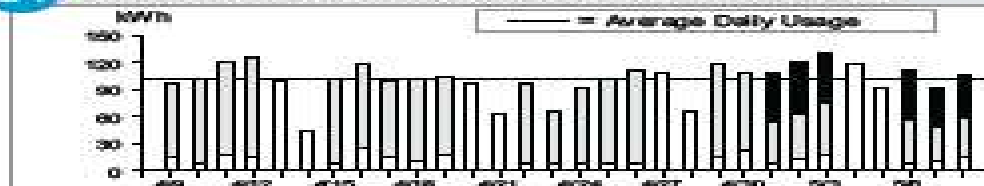
22

Service Information

Meter #	1098765432
Total Usage	3,025.663000 kWh
Serial	N
Rotating Outage Block	1E

23

21 Electric Usage This Period: 3,025.663000 kWh, 30 billing days



Usage	Energy Charges
Peak ¹	\$50.11
Part Peak ²	\$208.90
Off Peak ³	\$104.87

¹Peak: 5/1-10/31 12:00pm-6:00pm, M-F (except Holi days)
²Part Peak: 5/1-10/31 6:30am-12:00pm, 6:00pm-9:30pm, M-F (except Holi days); 11/1-6/30 6:30am-9:30pm, M-F (except Holi days)
³Off Peak: Year Round 9:30pm - 6:30am, M-F (except Holi days)
 Sat-Sun; Holi days



Visit www.pge.com/MyEnergy for a detailed bill comparison.

16. Details of Electric Charges: Includes your rate

This section describes the service period and confirms the address at which electricity was received. Your service agreement ID number is different from your account number. A service agreement documents your particular arrangement with PG&E (including rate plan). This section also includes your rate schedule information, which identifies the type of utility service you receive and how PG&E calculates your bill.

17. Electricity Usage: Notes your electricity usage during a given timeframe

Understanding your electric charges starts with understanding kilowatt hours (kWh). Kilowatt hours are the units used to measure your electric use. You are billed based on how much electricity, in kWh, you use each month.

Energy that is used during “peak” hours is charged at a higher rate than energy that is used during “part peak” and “off peak” hours

18. Taxes and fees: Account information that may affect your total charges

Both state and local governments may place taxes on your energy use.

19. Total electric charges: Total electricity charges, including credits and taxes

The total charges for your electric use, including any credits and applicable taxes.

20. Daily Usage Chart: Shows you when you used the most energy this month *

This daily usage chart visually shows which days you used the most electricity this month, and how much energy you used at peak, part peak and off peak rates. You may use this chart to visually understand when you are using more energy and make decisions about how to spend less on your energy usage.

21. Service Information: Details about your electric meter

Your meter tracks your electricity usage.

22. Additional Messages: Timely information from PG&E *

If relevant, PG&E uses this space to share timely information, ranging from summer safety tips to regulatory updates.

10% Change Example

10% Change in Demand Example			10%	10%		10%	10%	
<u>Electricity Delivery</u>	<u>Cost (\$)</u>	<u>BaseCase use</u>	<u>more kW</u>	<u>less kW</u>	<u>BaseCase use</u>	<u>more kW</u>	<u>less kW</u>	
SummerOn-PeakDemand kw	\$10.04	190.1	209.1	171.1	\$1,908.60	\$2,099.46	\$1,717.74	
SummerNon-CoincidentDemand kw	\$21.84	190.1	209.1	171.1	\$4,151.78	\$4,566.96	\$3,736.61	
Summer Generation Demand kw	\$9.77	190.1	209.1	171.1	\$1,857.28	\$2,043.00	\$1,671.55	
<u>ElectricityGeneration</u>								
SummerOn-Peak kwh	\$0.10664	18,980	18,980	18,980	\$2,024.03	\$2,024.03	\$2,024.03	
SummerSemi-Peak kwh	\$0.09759	17,494	17,494	17,494	\$1,707.24	\$1,707.24	\$1,707.24	
SummerOff-Peak kwh	\$0.07119	22,744	22,744	22,744	\$1,619.15	\$1,619.15	\$1,619.15	
					Total Bill	\$13,268.08	\$14,059.84	\$12,476.31
					Difference	\$791.77		
					Percentage	6.0%		

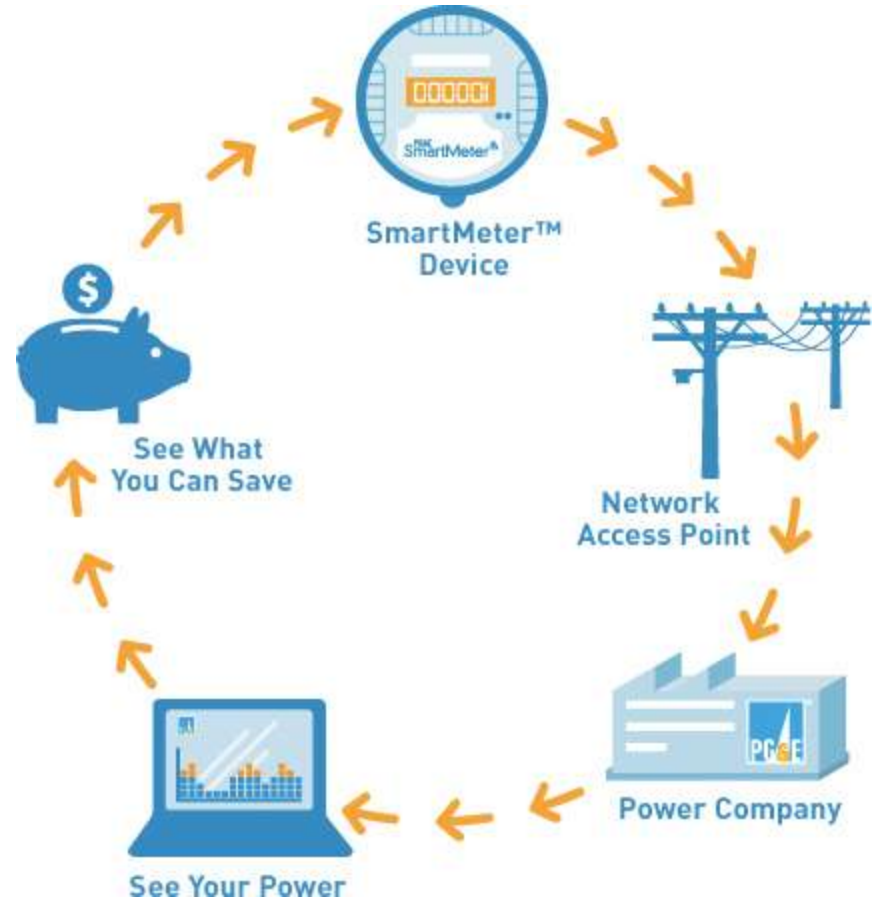
10% Change in Energy Example			10%	\$0.10		10%	10%	
<u>ElectricityDelivery</u>	<u>Cost (\$)</u>	<u>BaseCase use</u>	<u>More kwh</u>	<u>Less kWh</u>	<u>BaseCase use</u>	<u>More kwh</u>	<u>Less kWh</u>	
SummerOn-PeakDemand kw	\$10.04	190.1	190.1	190.1	\$1,908.60	\$1,908.60	\$1,908.60	
SummerNon-CoincidentDemand kw	\$21.84	190.1	190.1	190.1	\$4,151.78	\$4,151.78	\$4,151.78	
Summer Generation Demand kw	\$9.77	190.1	190.1	190.1	\$1,857.28	\$1,857.28	\$1,857.28	
<u>ElectricityGeneration</u>								
SummerOn-Peak kwh	\$0.10664	18,980	20878.0	17082.0	\$2,024.03	\$2,226.43	\$1,821.62	
SummerSemi-Peak kwh	\$0.09759	17,494	19243.4	15744.6	\$1,707.24	\$1,877.96	\$1,536.52	
SummerOff-Peak kwh	\$0.07119	22,744	25018.4	20469.6	\$1,619.15	\$1,781.06	\$1,457.23	
					Total Bill	\$13,268.08	\$13,803.12	\$12,733.04
					Difference	\$535.04		
					Percentage	4.0%		

Getting Your Billing Data

- Paper bills
 - old school but still works
- Annual summary bill
 - provides annual summary of monthly energy billing information
- Smartmeter interval data
 - electricity usage by account every 15 minutes.

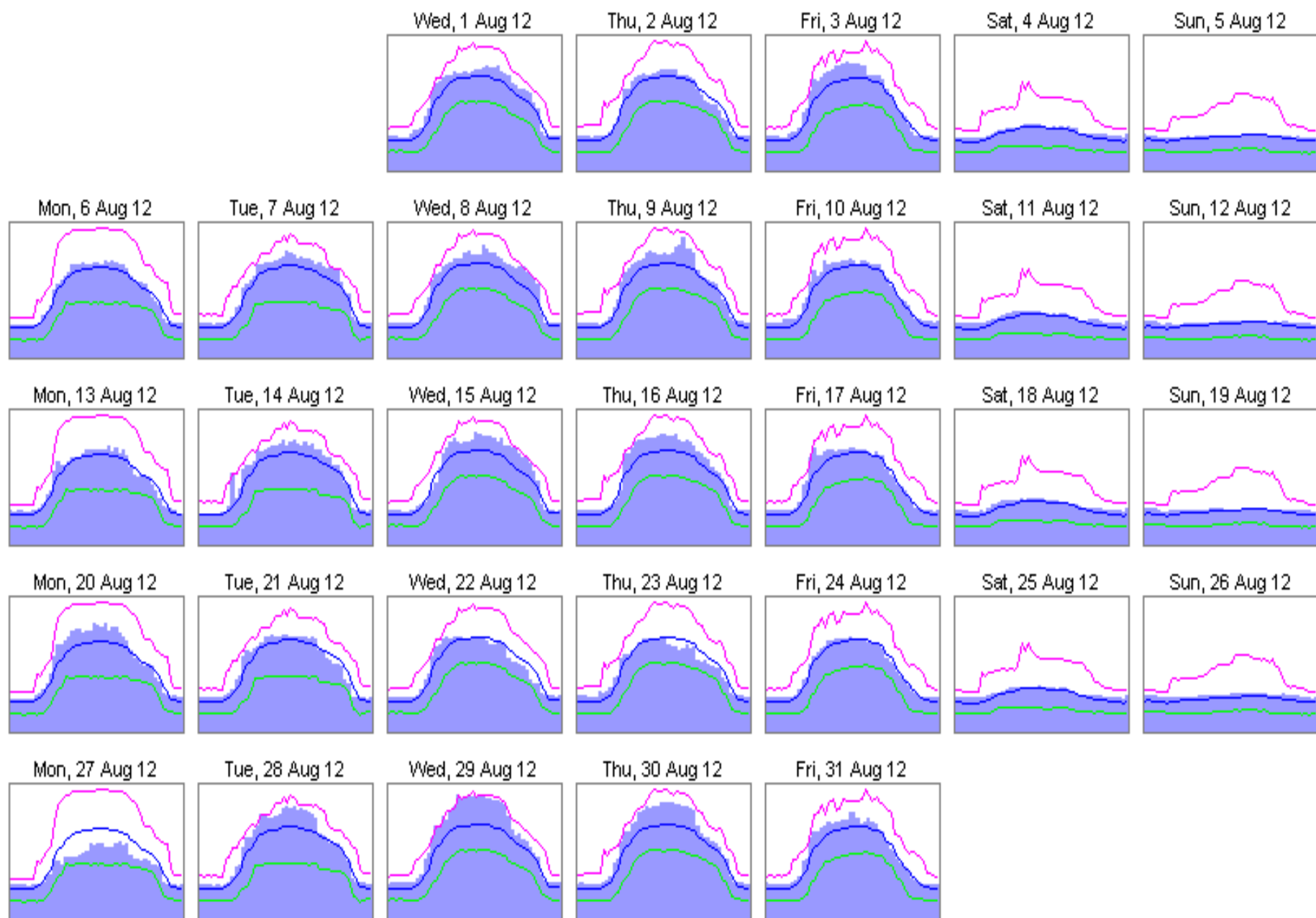
Smartmeter Info

- Online and electronic
- 15 minute interval data
- Detailed history of your energy usage and costs
- Can compare days, weeks, months, years.
- Can provide other valuable information you can use to make informed energy choices.
 - Peak demand
 - Pump startup costs
 - Demand response performance



Half-hourly power

Maximum	1,140.0 kW	on Mon, 18 May 2009 between 12:00 and 12:30
Average	489.2 kW	
Minimum	145.6 kW	on Sun, 24 May 2009 between 03:30 and 04:00



All chart scales run from 0 to 1191.3 kW (average power over half-hour interval). Maximum, average, and minimum profiles are included for each day of the week.

Energy Conservation Measures For Water Systems



Proper equipment sizing (oversized pumps)

- Replace pump/motor with smaller one
- Replace impeller with smaller one
- Install VFD on variable operation pumps
- Add smaller pump for low demands
- Intelligent pumps – automatic regulate flow and pressure

Premium efficiency motors

Install VFDs if applicable

Energy demand management

- Pressure management
- Time of Use operation

Water efficiency efforts

- Water loss control
- Customer water use reduction

Renewable energy

- Solar
- Biogas
- Small hydro (in conduit)

Investigate storage

- Water storage
- Electricity storage

Building efficiency improvements (e.g., lighting and HVAC)

Horsepower	Full Load Motor Efficiency (%)		Annual Savings kWh
	Original Efficiency	Final Efficiency	
10	89.5%	90.5%	605
25	92.4%	93.4%	1,420
50	93.0%	94.0%	2,803
100	94.5%	95.5%	5,431
200	95.0%	96.0%	10,478

Pump/Motor Equipment and Condition Checklist

Minimum Equipment Information to Gather	Additional Equipment Information to Gather	Conditions to Consider
<ul style="list-style-type: none"> ✓ Pump style ✓ Number of pump stages ✓ Pump and motor speed(s) ✓ Pump rated head (nameplate) ✓ Motor rated power and voltage (nameplate) ✓ Full load amps ✓ Rated and actual pump discharge ✓ Operating schedule(s) 	<ul style="list-style-type: none"> ✓ Pump manufacturer's pump curves ✓ Actual pump curve ✓ Power factor ✓ Load profile ✓ Analysis of Variable Frequency Drives (VFDs) if present ✓ Pipe sizes ✓ Water level (source) ✓ Motor current ✓ Pump suction pressure ✓ Discharge pressure 	<ul style="list-style-type: none"> ✓ Maintenance records (frequent replacement of bearings and seals) ✓ Consistently throttled valves ✓ Excessive noise or vibrations ✓ Evidence of wear or cavitation on pump, impellers, or pump bearings ✓ Out-of-alignment conditions ✓ Significant flow rate/pressure variations ✓ Active by-pass piping ✓ Restrictions in pipes or pumps ✓ Restrictive/leaking pump shaft packing ✓ Multiple pump systems where excess capacity is bypassed or excess pressure is provided intermittent

A Tool –

The EPA Energy Use Assessment Tool

- Free of charge, downloadable tool based in Excel that can be used by small and medium water and wastewater systems. The tool can be found at:

http://water.epa.gov/infrastructure/sustain/energy_use.cfm

EPA's self assessment checklists available at:

<http://www.epa.gov/region9/waterinfrastructure/audit.html>

- The tool allows both water and wastewater systems to:
 - conduct a utility bill analysis to determine baseline energy consumption and cost in total,
 - breaks information down to the process-level and equipment-level,
 - identify the most energy-intensive areas of the system and can highlights areas of inefficiency

Data Needs for EPA Energy Use Assessment Tool

All plant utility data (use and cost information) by month (minimum of 12 months) for up to 5 years of analysis

- Collect from utility bills such as electric, natural gas, water/sewer, fuel oil, alternative energy, and other utilities

Non -process information (by building)

- List of lighting fixtures
- HVAC equipment

Drinking water and/or Wastewater treatment plant information

- Monthly treatment/discharge volumes
- Pump and motor nameplate data (horsepower, efficiency rating, full load amp rating)
- Average motor operating amperage
- Process energy demand and energy consumption

VFD Energy

Savings

Determination

You need to know:

- 1. How the existing pump is controlled (Pressure reducing valve (PRV), bypass valve or none)
- 2. Desired pressure setpoint of the system (elevation gain + frictional losses + sprinkler operating pressure)
- 3. Annual operating hours

The last two items, which are typically the most difficult to get, are:

- 4. The approximate percentage of time spent at different flow rates, and
- 5. The pump's performance curve.

Installing a VFD on a pump should only be considered if:

- 1. The discharge pressure pump is controlled by a bypass valve that dumps excess water
- 2. There is significant variation of flow during the time that the pump is operating, and/or
- 3. During low flow operation, the operating pressure of the system with the VFD is significantly lower than the discharge pressure of the pump if it were operating at a fixed speed.

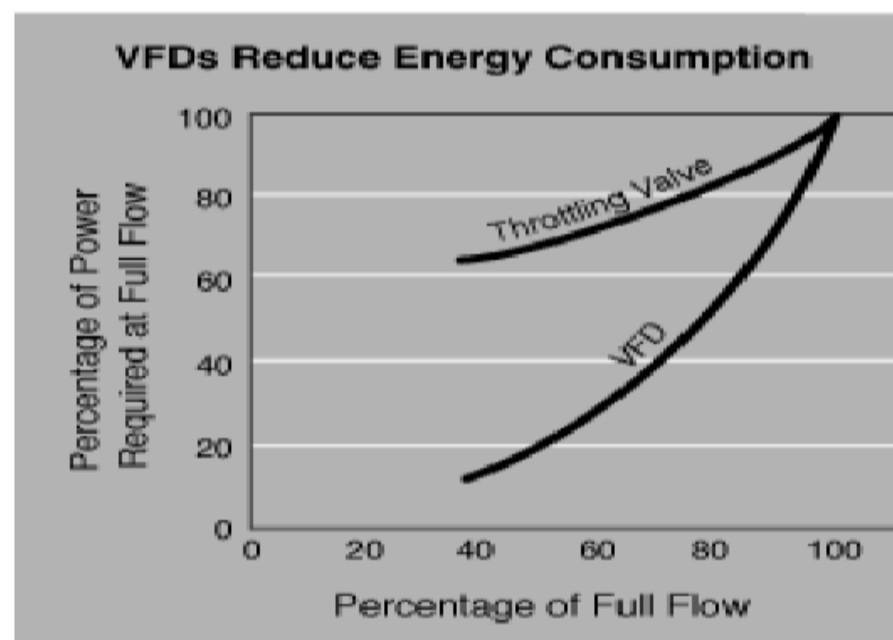


Figure 1. Energy consumption of VFDs and throttling valves.

Recommendations

- Develop an efficiency index for each of your utility accounts: (kWh/MG and kW/MG)
 - For every utility account that you have, by billing period:
 - - record peak demand (kW) and energy (kWh) usage.
 - - record water use by that account (pumped, treated, etc.)
 - Track efficiency index throughout year, and between years – it will alert you to decreases in efficiency and opportunities to save money.

Recommendations (cont.)

- Consider energy operating costs when making management and equipment decisions
- Investigate electric utility opportunities
 - Complimentary bill and tariff analysis
 - Incentives for pump testing, energy audits, leak detection
 - Incentives for efficiency improvements
 - pumps, treatment processes, lighting, HVAC
 - Incentives for renewable energy

I'm not **lazy**

I'm just on my
energy

saving mode