

Water & Energy Consulting



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Utility Bill Analysis Tool Overview (AZ Example)

utility bills

Utility Tariffs

Utility Tariffs are categorized by:

- Customer type (residential, small commercial, large commercial, industrial, streetlighting, agricultural, etc.)
- By size (generally by maximum demand – kW but sometimes by energy use kWh)
- By options (bundled rates, time-of-use, peak plans, renewable or green plans)
- By effective date

Tariff Components

- Service/customer/meter charges
- Fees (e.g. franchise fees) and Taxes
- Miscellaneous charges for various programs
- Energy (kWh) charges (generally seasonal)
 - Volumetric
 - Time-of-Use (TOU)
 - Two period
 - Multiple period
 - Volumetric and Time-of-Use
- Demand (kW) charges (maximum 15 minute interval electricity use)
 - TOU – maximum demand during the on peak period, mid peak, off peak, or super off peak period
 - Maximum (noncoincident) – maximum demand any time during the billing period
 - Ratchet – maximum demand during the past year
 - Network Usage – usually max demand during off peak

Energy and demand charges are primary variable costs

Knowing Your Utility Tariff Characteristics Allows You To Do Evaluations




- Evaluate
 - Different tariff selection (bundled, unbundled, TOU)
 - Changes in operations
 - Renewable generation value
 - Adding energy (or water) storage
 - Energy efficiency improvements
 - Changes in system configuration



Design of Bill Analysis Tool

- Tool is an Excel Spreadsheet with multiple tabs (workbooks)
 - Introduction and instructions tab

THE FOLLOWING KEYS APPLY THROUGHOUT THE TEMPLATE:

	Yellow boxes indicate that data to be entered by the user (input)
	Blue boxes indicate that values that were automatically copied from other (input) cells
<i>Text in blue</i>	Blue text consists of instructions for that section of the tool
	Green boxes indicate that values that were automatically calculated or calculated using the input data (results)

- Analysis tab
 - Fill in yellow cells
 - Results show up in Cells D20-H38
 - Total Bills are found in Row 20
- Utility Tariff Tabs
- Financial/Alternative Tab

A Bill Analysis Tool Allows You To Take a Bill And Screen Alternatives

March 20-April 18, 201 Example

Detail of Current Charges

Electric Service

Rate: TOU Plus - AL-TOU-Commercial Climate Zone: Inland
 Billing Period: 3/20/18 - 4/18/18 Total Days: 30
 Meter Number: 06899680 (Next scheduled read date May 21, 2018) Cycle: 14
 Meter Constant: 120.000 Billing Voltage Level: Secondary
 Circuit: 0354 Your circuit is currently not subject to rotating outage. However, this is subject to change without notice.
 Total Usage: 37,660 (Usage based on interval data)

ELECTRIC CHARGES Amount(\$)

Time of Use Customer Charge 139.73
Yellow highlighted values are what you use

WINTER USAGE	On-Peak	Off-Peak	Super Off-Peak	
kWh used	9,545	11,875	16,240	
Rate/kWh	\$.00498	\$.00498	\$.00498	
Charge	\$47.53	+ \$59.14	+ \$80.88	= 187.55

Winter On-Peak Demand 1,363.68
 Winter Non-Coincident Demand 1,742.03

DWR Bond Charge 206.75
 37,660 kWh x \$.00549

Electricity Generation (Details below) 37,660 kWh

WINTER USAGE	On-Peak	Off-Peak	Super Off-Peak	
kWh used	9,545	11,875	16,240	
Rate/kWh	\$.11123	\$.09872	\$.08484	
Charge	\$1,061.69	+ \$1,172.30	+ \$1,377.80	= 3,611.79

Capacity Reservation Demand .00
 0.0 kW x \$4.98

Total Electric Charges \$3,954.03

How To Use Bill Analysis Tool

Subscriber		Account #		Electric Utility Account Number from Bill					
Street address		Acronym		This is whatever name you use to identify this account					
City, State, Zip		Meter Number		Electric Utility Meter Number from Bill					
Contact Person		Street address		Account Address from Bill					
Phone Number		City, State, Zip		Account Address from Bill					
email		Existing Tariff	E-221	Choose from Eligible Tariffs:	E-221				
		Service Voltage	Secondary	Service Voltage from Bill					
Subscription #		Max Demand (kW)		This is the maximum recorded demand for this account.					
Subscriber Type		Bill Month/Year	Jul-18	Bill Date	Number of days in Month	31			
Electric Utility	APS	Season (winter or summer)	summer	Utility Season					
Tool Model	Water system account	Tariff Date	1-Jul-18	Today's Date	8/8/2018	Use Through	1/1/2019	OK to use	
Model Vintage	beta	Bill	\$2,364.17				This is recorded utility bill. While it won't be exactly the same as the model developed bill, it should be reasonably close.		
		Tariff	E-221						
			\$2,364.17	This Column	This Column	This Column	This Column		
		\$ per Month		is for alternative	is for	is for alternatives	is for alternatives		
Season:	Monthly	\$2,279.78		tariffs with the	alternatives	with the	with the	The lowest monthly bill is the best tariff to be on.	
summer	Period	Bill Value	\$ per Month	same TOU	TOU demand	different TOU	different TOU	All these values are for this month's billing statement	
Energy (kWh)	On Peak	9,067	\$25.54	periods		demands	demands	kWh during on-peak period or first XXX kWh	
	Off Peak	12,077	\$1,533.52					kWh during off-peak period or kWh >XXXkWh	
	kWh	21,144							
Demand (kW)	Peak	77.3	\$367.48					Maximum demand (kW) during on-peak period of first XXX KW	
	OffPeak	45.0	\$0.00					Maximum demand (kW) during off-peak period or kW > XXX	
Other Fees	Instrument meter	\$62.62						Self-contained, instrument rated, or primary	
	DSMAC	\$27.29						Demand Side Management Adjustment Charge	
	LFCR	\$59.68						Lost Fixed Cost Recover Charge	
	REAC	\$158.85						Renewable Energy Adjustment Charge	
	PSA1	\$42.48						Power Supply Adjustment Charge	
	EIS	\$2.33						Environmental Improvement Surcharge	
	TCA-1	-\$7.34						Transmission Cost Adjustment Charge (FERC Charges)	
	TEAM	-\$103.86						Tax Expense Adjustor Mechanism	
	AZ Taxes	\$121.44						Note - model does not calculate county or city taxes, nor franchises fees.	
	Reg Assessment	\$5.13						Regulatory Assessment - business customer	

E-32 – Small Business Tariffs

APS		E-32S			
	Service Level	Secondary			
	Max Demand			kW	21-100kW
	Energy Tariff				Time
ENERGY	TOU Period	Summer Acronyms	Price \$/kWh	Winter Acronyms	Price \$/kWh
	first 200kWh	SONP	\$0.1083	first 200kWh	\$0.0913
	>200kWh	SOP	\$0.0654	>200kWh	\$0.0484
	UDC charge	\$0.0000	per kWh		

Utility Tariff E-32S					
DEMAND	TOU Period	Summer Acronyms	Price \$/KW	Winter Acronyms	Price \$/KW
	first 100kW	SONP	\$11.3600	WONP	\$11.3600
	> 100 kW	SMP	\$6.6080	WMP	\$6.6080
	Off-Peak	SOP		WOP	
	Super Off	SSOP		WSOP	
	Maximum or noncoincident generation demand				

OTHER FEES					
	Instrument meter	\$2.0200	per day	Self-contain	
	DSMAC	\$0.3530	per kW	Demand Sid	
	LCR	\$0.7720	per kW	Lost Fixed C	
	REAC	\$0.0075	per kWh	Renewable	
	PSA1	\$0.0020	per kWh	Power Supp	
	EIS	\$0.0001	per kWh	Environmen	
	TCA-1	-\$0.0950	per kW	Transmissio	
	TEAM	-\$0.0049	per kWh	Tax Expense	
	AZ Taxes	5.6000%	%	Note - mod	
	Reg Assessment	0.24%	%	Regulatory	

APS		E-32S					
	Service Level	Secondary					
	Max Demand			kW	21-100kW		
	Energy Tariff				Time of Use Periods		
ENERGY	TOU Period	Summer Acronyms	Price \$/kWh	Winter Acronyms	Price \$/kWh	Summer May-October	Winter November-April
	On-Peak	SONP	\$0.0716	WONP	\$0.0560	3-8pm weekdays	3-8pm weekdays
		SMP	\$0.0000	WMP	\$0.0000	na	na
	Off-Peak	SOP	\$0.0544	WOP	\$0.0412	hours	hours
	UDC charge	\$0.0000	per kWh				

Utility Tariff E-32S						
DEMAND	TOU Period	Summer Acronyms	Price \$/KW	Winter Acronyms	Price \$/KW	
	first 100kW on-peak	SONP	\$19.9770	WONP	\$19.9770	
	> 100 kW on Peak	SMP	\$10.2250	WMP	\$6.6080	
	first 100 kW Off-Peak	SOP	\$7.8790	WOP	\$7.8790	
	>100kW Off-peak	SSOP	\$2.7150	WSOP	\$2.7150	
	Maximum or noncoincident generation demand					

OTHER FEES						
	Instrument meter	\$2.0200	per day	Self-contained, instrument rated, or		
	DSMAC	\$0.3530	per kW	Demand Side Management Adjustm		
	LCR	\$0.7720	per kW	Lost Fixed Cost Recover Charge due		
	REAC	\$0.0075	per kWh	Renewable Energy Adjustment Char		
	PSA1	\$0.0020	per kWh	Power Supply Adjustment Charge cf		
	EIS	\$0.0001	per kWh	Environmental Improvement Surcha		
	TCA-1	-\$0.0950	per kW	Transmission Cost Adjustment Charg		
	TEAM	-\$0.0049	per kWh	Tax Expense Adjustor Mechanism		
	AZ Taxes	5.6000%	%	Note - model does not calculate cou		
	Reg Assessment	0.24%	%	Regulatory Assessment - business c		

Example – Evaluate Alternative Tariffs

		Tariff	E-221	E-221-8T	Tou change	E-32S	E-32Stou
			\$2,364.17			note TOU difference	
			\$ per Month	\$ per Month		\$ per Month	\$ per Month
Season:		Monthly	\$2,279.78	\$2,482.59		\$2,655.24	\$3,561.03
summer	Period	Bill Value	\$ per Month	\$ per Month	Month	\$ per Month	\$ per Month
Energy (kWh)	On Peak	9,067	\$25.54	\$813.04	4,534	\$21.66	\$324.64
	Off Peak	12,077	\$1,533.52	\$580.66	16,611	\$1,368.69	\$902.95
	kWh	21,144			21,144		
Demand (kW)	Peak	77.3	\$367.48	\$511.49	77.3	\$878.13	\$1,544.22
	OffPeak	45.0	\$0.00	\$198.45	45.0	\$0.00	\$354.56
Other Fees	Instrument meter		\$62.62	\$62.62		\$62.62	\$62.62
	DSMAC		\$27.29	\$27.29		\$27.29	\$27.29
	LFCR		\$59.68	\$59.68		\$59.68	\$59.68
	REAC		\$158.85	\$158.85		\$158.85	\$158.85
	PSA1		\$42.48	\$42.48		\$42.48	\$42.48
	EIS		\$2.33	\$2.33		\$2.33	\$2.33
	TCA-1		-\$7.34	-\$7.34		-\$7.34	-\$7.34
	TEAM		-\$103.86	-\$103.86		-\$103.86	-\$103.86
	AZ Taxes		\$121.44	\$131.36		\$140.59	\$188.63
	Reg Assessment		\$5.13	\$5.55		\$4.14	\$3.99

Evaluation of Alternatives

You have to know how the alternative operates (Analysis tab)

- determine what impact on energy (kWh) and demand (KW) alternative has on status quo bill
- Determine new bill values by adding alternative kWh and KW to utility bill

You have to know how much alternative costs (Financial tab)

- Capital (installation cost)
- O&M cost

You have to know alternative useful life (Financial tab)

- Lifetime

You have to know your cost of money (Financial tab)

- Interest rate

Evaluate Alternative

- Run status quo and alternative bill analysis
- Compare bill impact (savings) to cost of alternative to determine if cost effective

Capital Recovery Factor

- Capital Recovery Factor can be used to determine the monthly cost of the project. It can be thought of as the stream of equal payments over a specific time at a given interest rate.
- Given an interest rate “i” and the number of years “n” in the investment period the CRF is:

$$CRF = i(1+i)^n / (((1+i)^n) - 1)$$
- The initial investment times the CRF divided by 12 is monthly cost of the project.
- The monthly cost of the project can be compared to the monthly savings determined by the Bill Analysis Tool to determine if it is cost effective.

	Project Total Cost	\$8,000.00	\$	Total Alternative Cost	
	Monthly Project Cost	\$98.91	\$/month	Monthly Project Cost Equivalent	total cost * (CRF)/12 = \$ per month
	Capital Recover Factor (CRF)	0.1359	annual	Capital Recover Factor (CRF)	$CRF = i(1+i)^n / (((1+i)^n) - 1)$
	Interest Rate (%)	6.0%	%	Interest Rate	Interest rate % input
	Number of Years	10	years	Project Number of Years	life of investment input
	Annual O&M cost	\$100	\$/year	Annual O&M	Annual O&M in \$

Example – Efficiency Improvements

Model Vintage	beta	Bill	\$2,364.17		-\$303.03	\$69.98	-\$233.05	2.15	Measure Simple Payback in Years
				15% efficiency saving		Monthly Cost	Net Monthly		
		Tariff	E-221	E-221-8T	15% efficiency	E-221	E-221-8T	Assuming efficiency improvement cost \$6000 with a 10 year life, \$100/yr O&M. CRF=0.1233	
			\$ per Month	\$ per Month		\$ per Month	\$ per Month		
Season:		Monthly	\$2,279.78	\$2,482.59		\$1,976.75	\$2,243.83	The lowest monthly bill is the best tariff to be on.	
summer	Period	Bill Value	\$ per Month	\$ per Month	Month	\$ per Month	\$ per Month	All these values are for this month's billing statement	
Energy (kWh)	On Peak	9,067	\$25.54	\$813.04	7,707	\$25.54	\$691.08	kWh during on-peak period or first XXX kWh	
	Off Peak	12,077	\$1,533.52	\$580.66	10,265	\$1,300.85	\$580.66	kWh during off-peak period or kWh >XXXkWh	
	kWh	21,144			17,972				
Demand (kW)	Peak	77.3	\$367.48	\$511.49	66	\$312.36	\$434.77	Maximum demand (kW) during on-peak period of first XXX KW	
	OffPeak	45.0	\$0.00	\$198.45	38	\$0.00	\$198.45	Maximum demand (kW) during off-peak period or kW > XXX	
Other Fees	Instrument meter		\$62.62	\$62.62		\$62.62	\$62.62	Self-contained, instrument rated, or primary	
	DSMAC		\$27.29	\$27.29		\$23.19	\$23.19	Demand Side Management Adjustment Charge	
	LFCR		\$59.68	\$59.68		\$50.72	\$50.72	Lost Fixed Cost Recover Charge	
	REAC		\$158.85	\$158.85		\$158.85	\$135.03	Renewable Energy Adjustment Charge	
	PSA1		\$42.48	\$42.48		\$42.48	\$36.11	Power Supply Adjustment Charge	
	EIS		\$2.33	\$2.33		\$2.33	\$1.98	Environmental Improvement Surcharge	
	TCA-1		-\$7.34	-\$7.34		-\$7.34	-\$6.24	Transmission Cost Adjustment Charge (FERC Charges)	
	TEAM		-\$103.86	-\$103.86		-\$103.86	-\$88.28	Tax Expense Adjustor Mechanism	
	AZ Taxes		\$121.44	\$131.36		\$104.59	\$118.73	Note - model does not calculate county or city taxes, nor franchises fees.	
	Reg Assessment		\$5.13	\$5.55		\$4.42	\$5.01	Regulatory Assessment - business customer	

Example – Adding Renewable (Solar)

beta	Bill	\$2,364.17		-\$342.93	\$275.00	-\$67.93	7.36	Measure Simple Payback in Years
				solar savings	Monthly Cost	Net Monthly	<u>Solar Assumptions. 20kW fixed tilt PV installation . Cost is \$2.5/watt installed. 25 year life. CRF=0.064. 3012 kWh production average monthly production.</u>	
	Tariff	<u>E-221</u>	<u>E-221-8T</u>	<u>solar</u>	<u>E-221</u>	<u>E-221-8T</u>		
		\$ per Month	\$ per Month	Generation from PVWatts	\$ per Month	\$ per Month		
	Monthly	\$2,279.78	\$2,482.59		\$1,936.84	\$2,105.58	The lowest monthly bill is the best tariff to be on.	
<u>Period</u>	<u>Bill Value</u>	<u>\$ per Month</u>	<u>\$ per Month</u>	<u>Month</u>	<u>\$ per Month</u>	<u>\$ per Month</u>	All these values are for this month's billing statement	
On Peak	9,067	\$25.54	\$813.04	6,959	\$25.54	\$623.98	kWh during on-peak period or first XXX kWh	
Off Peak	12,077	\$1,533.52	\$580.66	11,173	\$1,312.56	\$580.66	kWh during off-peak period or kWh >XXXkWh	
kWh	21,144			18,132				
Peak	77.3	\$367.48	\$511.49	57	\$272.40	\$379.15	Maximum demand (kW) during on-peak period of first XXX KW	
OffPeak	45.0	\$0.00	\$198.45	45	\$0.00	\$198.45	Maximum demand (kW) during off-peak period or kW > XXX	
Instrument meter		\$62.62	\$62.62		\$62.62	\$62.62	Self-contained, instrument rated, or primary	
DSMAC		\$27.29	\$27.29		\$20.23	\$20.23	Demand Side Management Adjustment Charge	
LFCR		\$59.68	\$59.68		\$44.24	\$44.24	Lost Fixed Cost Recover Charge	
REAC		\$158.85	\$158.85		\$158.85	\$136.23	Renewable Energy Adjustment Charge	
PSA1		\$42.48	\$42.48		\$42.48	\$36.43	Power Supply Adjustment Charge	
EIS		\$2.33	\$2.33		\$2.33	\$1.99	Environmental Improvement Surcharge	
TCA-1		-\$7.34	-\$7.34		-\$7.34	-\$5.44	Transmission Cost Adjustment Charge (FERC Charges)	
TEAM		-\$103.86	-\$103.86		-\$103.86	-\$89.06	Tax Expense Adjustor Mechanism	
AZ Taxes		\$121.44	\$131.36		\$102.48	\$111.41	Note - model does not calculate county or city taxes, nor franchises fees.	
Reg Assessment		\$5.13	\$5.55		\$4.33	\$4.70	Regulatory Assessment - business customer	

Example – Energy Storage

Model Vintage	beta	Bill	\$2,364.17		-\$92.77	\$38.31	-\$54.46	9.18	Measure Simple Payback in Years
					storage savings	Monthly Cost	Net Monthly	Assuming \$200/kW storage cost. 20 KW storage, 100kWh (5 hours per day). Charge in off peak, generate in on-peak. 10% conversion efficiency, 15 year life. CRF=.0899.	
		Tariff	E-221	E-221-8T	storage	E-221	E-221-8T		
			\$ per Month	\$ per Month		\$ per Month	\$ per Month		
Season:		Monthly	\$2,279.78	\$2,482.59		\$2,187.01	\$2,122.47	Switching to E-221-8T payback is about 3 years.	
summer	Period	Bill Value	\$ per Month	\$ per Month	Month	\$ per Month	\$ per Month	All these values are for this month's billing statement	
Energy (kWh)	On Peak	9,067	\$25.54	\$813.04	6,967	\$25.54	\$624.73	generate for 5 hours on-peak	
	Off Peak	12,077	\$1,533.52	\$580.66	14,387	\$1,548.92	\$580.66	recharge during off peak	
	kWh	21,144			21,354				
Demand (kW)	Peak	77.3	\$367.48	\$511.49	57	\$272.40	\$379.15	Maximum demand (kW) during on-peak period of first XXX kW	
	OffPeak	45.0	\$0.00	\$198.45	45	\$0.00	\$198.45	Maximum demand (kW) during off-peak period or kW > XXX	
Other Fees	Instrument meter		\$62.62	\$62.62		\$62.62	\$62.62	Self-contained, instrument rated, or primary	
	DSMAC		\$27.29	\$27.29		\$20.23	\$20.23	Demand Side Management Adjustment Charge	
	LFCR		\$59.68	\$59.68		\$44.24	\$44.24	Lost Fixed Cost Recover Charge	
	REAC		\$158.85	\$158.85		\$158.85	\$160.43	Renewable Energy Adjustment Charge	
	PSA1		\$42.48	\$42.48		\$42.48	\$42.90	Power Supply Adjustment Charge	
	EIS		\$2.33	\$2.33		\$2.33	\$2.35	Environmental Improvement Surcharge	
	TCA-1		-\$7.34	-\$7.34		-\$7.34	-\$5.44	Transmission Cost Adjustment Charge (FERC Charges)	
	TEAM		-\$103.86	-\$103.86		-\$103.86	-\$104.89	Tax Expense Adjustor Mechanism	
	AZ Taxes		\$121.44	\$131.36		\$115.72	\$112.30	Note - model does not calculate county or city taxes, nor franchises fees.	
	Reg Assessment		\$5.13	\$5.55		\$4.88	\$4.74	Regulatory Assessment - business customer	

Cautions and Caveats

- Tariff Specific Applicability – only use tariffs that account is eligible for
 - Type of customer
 - Size of account
- Specific Timeframe –use current effective tariffs
 - Utility tariffs change at least 4 time per year
- Specific Issues - May need to run external spreadsheets to adjust inputs and compare multiple results.
 - Bill encompasses different seasons
 - Bill doesn't have TOU values
 - TOU periods are different between tariffs
 - Comparing status quo with alternative
- Analysis Limitations
 - Does not calculate franchise fees
 - Does not calculate CPP events
 - Special considerations for Renewables Analysis
 - Calculates one month
- Analysis Tool is a Screening Tool
 - Best is choose typical or representative month for initial screen
 - Need to run multiple months and seasons before deciding to change tariffs
 - Can run 12 months of bill analysis to assess alternatives if initial screens look attractive

Conclusions and Recommendations



- The Bill Analysis Tool is a quick screening tool. Be conscious of its limitations.
 - Before making a major decision run several different months and different seasons (at a minimum). For significant capital investments/changes a traditional hourly assessment may be warranted but it is orders of magnitude more work.
 - Hourly electricity usage (demand) values are available from your utility.
- The Tool uses utility billing period values for analysis. You may need to adjust the values for these periods if:
 - the billing periods don't line up
 - when you are evaluating alternatives
- If you have any questions, call.



Contact Info

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