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Study and Design of a Tariff For Dynamic Reactive Power

DECC

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Background and Overview

PG&E is actively working to develop a tariff for the supply of local dynamic reactive power that will not only incent the right behavior to enhance system reliability but will also provide a payment mechanism valued in between the cost of supply and the value to the local distribution company and/or the CAISO.

- In California as well as other regions, the System Operator is responsible for the integrity and reliability of the grid. – without the range of options available to an integrated utility like PG&E pre-deregulation.
- All loads connected to the ISO-controlled grid must maintain a power factor within the narrow band of 0.97 lag and 0.99 lead – for which they are not compensated. PG&E's tariff requires unity power factor and provides financial incentive if $PF > 0.85$ and imposes a penalty if $PF < 0.85$
- All generators connected to the ISO-controlled grid must maintain a power factor within the narrow band of 0.90 lag (absorbing VARs) and 0.95 lead (producing VARs). Generators receive no compensation for operating within prescribed band.
- PG&E's standby tariff prior to the CPUC-approved General Rate Case (GRC) phase 2 standby tariff revisions effective 1/1/08, the generator in its obligation to provide all of its reactive needs, as mandated in PG&E's standby tariff, may at times adversely impact system reliability.
- There may be periods, especially in the winter when generator output is generally maximized due to the increased air mass flow rate while system loads are seasonally lower due to reduced AC loads – thus potentially increasing system voltage. In this scenario, producing VARs may in fact adversely affect system reliability.

Background and Overview continued

The CAISO must manage the VAR-constrained areas through the issuance of Reliability-Must-Run (RMR) generation cost-based contracts, market based dispatches and through Out Of Stack (OOS) redispatch orders. PG&E may also use static sources or issue voltage orders to correct problems.

- Cost of RMR contract is assessed to the Participating Transmission Owner (PTO) in whose service territory the generator resides. The cost is recovered through reliability service rates by all customers based on class contribution to system peak.
- The CAISO may through market based dispatch, instruct generators to produce VARS or absorb VARS. If by complying with CAISO market dispatch orders, the generator experiences a reduction in real power output, the generator is settled for their opportunity cost. Cost as above are charged to the local PTO and spread across all customers.
- The CAISO may at times redispatch energy referred to as Out Of Stack (OOS) redispatch energy for the benefit of producing more VARs. In such cases, the generator is compensated for the minimum load energy and additional compensation.

PG&E is working towards developing a tariff for the supply of local dynamic reactive power

To develop a just and reasonable reactive tariff, a determination must be accomplished to determine PG&E's historical and current cost of supplying VAR regulation as well as the cost and value to customers of reactive power.

- **PG&E must:**
 - Inventory all of PG&E's own static and dynamic sources employed in VAR regulation to determine the present cost of supplying reactive power.
 - Determine what does it cost a generator to provide VAR support; considering fuel, loss opportunity if providing VARs results in a reduction of real power output.
 - Determine what is the cost of a load entity to install or redesign facilities to improve power factor or to install active front-end devices which would supply VARs.

PG&E's REACTIVE TARIFF TREATMENT OF LOADS


- **Power factor adjustments apply only to demand-metered accounts with a minimum demand of 500 kW. The monthly bill will be adjusted based on the power factor of 85 %.**
 - If the average power factor is greater than 85 %, the total monthly bill, excluding any taxes and the energy procurement surcharge, will be **REDUCED** by 0.06 percent of each percentage point above 85%
 - If the average power factor is less than 85 %, the total monthly bill, excluding any taxes and the energy procurement surcharge, will be **INCREASED** by 0.06 percent of each percentage point below 85%

PG&E'S REACTIVE TARIFF TREATMENT OF GENERATION

Prior to 1/1/08 when the revised standby tariff with new language on reactive demand treatment becomes effective, PG&E's standby tariffs were in some circumstances detrimental to system reliability.

- PG&E's tariff required that ALL customers design and operate their generating facilities (both small and large generators) at a unity power factor.
- For large transmission-connected synchronous generator on Automatic Voltage Regulation (AVR), PG&E has granted waivers on a case-by-case basis.
- PG&E assesses a reactive demand charge if the customer places a reactive demand in excess of 0.1 kVAR per kW of reservation capacity or generator capacity depending on if the customer is under a net sale agreement.
- Permanent ratchet provision which can only be reversed after the customer demonstrates to PG&E's satisfaction that adequate corrective action has been taken.
- The reactive demand charge jumps from \$0.15/kVAR to \$0.35/kVAR effective 1/1/08. The \$0.15/kVAR charge has remained unchanged for over 30 years even though all other rate components have, for the most part, increased with inflation.

Sample large generator actual bill showing 21% reactive charge contribution to monthly bill

		PACIFIC GAS AND ELECTRIC COMPANY ELECTRIC DETAIL OF BILL July 26, 2007 to August 26, 2007		FULL SERVICE Account ID: Service ID:
				PAGE 1
BILLING SUMMARY:				
	Reservation Charges - Standby			\$1,448.40
	Service Charges			\$1,048.77
	Energy Charges			\$18,932.75
→	Reactive Power Charge		→	\$5,616.00
	TOTAL OF OAS:			<u>\$27,045.92</u>
	Transmission	\$3,495.80		
	Distribution	\$7,031.97		
	Public Purpose Programs	\$1,616.01		
	Nuclear Decommissioning	\$67.23		
	DWR Bond Charge	\$1,167.80		
	On-Going CTC	\$17.42		
	Energy Cost Recovery Amount	\$839.13		
	Generation	\$12,810.56		
	Energy Commission Tax			\$54.78
	TOTAL BILLED AMOUNT:			<u>\$27,100.70</u>
QUESTIONS REGARDING THIS BILL CAN BE DIRECTED TO: PHIL FURNISS (831) 479-5892				
) Copies (08/28/07) Biller: CJZ1		IPBS#:		

Sample Generation information



PACIFIC GAS AND ELECTRIC COMPANY
ELECTRIC DETAIL OF BILL
July 26, 2007 to August 26, 2007

FULL SERVICE
Account ID:
Service ID:

RATE APPLICATION

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RESERVATION INFORMATION:

RATE SCHEDULE	GENERATOR LOCATION	GENERATOR CAPACITY
STOUTP	1515 ALVISO-MILPTAS RD S.J.	195000

RESERVATION RATCHETED DEMAND:

RATE SCHEDULE	RATCHETED RESERVATION CAP.	RATCHETED MONTH	RATCHETED MAX DEMAND DATE	RATCHETED MAX DEMAND TIME
STOUTP	2,400	Jul 2007	07/16/07	19:45

RESERVATION CHARGE:

BILLING FACTOR = 1.000

RATE SCHEDULE	SEASON	RATE EFFECTIVE DATE	DAYS IN RATE PERIOD	RES. DEMAND (KW)	RATE PER KW	BILLED AMOUNT	TOTAL RATE	TOTAL CHARGE	COMP TYPE
STOUTP	Summer	03/01/07	31	2,040	.36	\$734.40			TRANS
STOUTP	Summer	03/01/07	31	2,040	.18	\$367.20			DIST
STOUTP	Summer	03/01/07	31	2,040		\$346.80	.71	\$1,448.40	GEN
TOTAL						\$1,448.40			

Reservation Demand = Ratched Reservation Capacity x Standby Multiplier
Charge = Res. Demand x Rate x Billing Factor x (Days in Rate Period / Days in Billing Period)
GEN = Residual of total charge less other component types.

SERVICE CHARGE:

RATE SCHEDULE	CHARGE TYPE	SEASON	RATE EFFECTIVE DATE	DAYS IN RATE PERIOD	RATE	BILLED AMOUNT	COMPONENT TYPE	TOTAL RATE	TOTAL CHARGE
STOUTP	Customer Charge	Summer	03/01/07	31	33.83129	\$1,048.77	DIST	33.83129	\$1,048.77
TOTAL						\$1,048.77			

Monthly Charge = Monthly Rate x Monthly Billing Factor x (Days in Rate Period / Days in Billing Period)
Daily Charge = Daily Rate x Days in Rate Period
GEN = Residual of total charge less other component types.



Pacific Gas and Electric Company®

Sample generator on AVR showing that power factor will vary depending on system conditions



PACIFIC GAS AND ELECTRIC COMPANY
ELECTRIC DETAIL OF BILL
July 26, 2007 to August 26, 2007

FULL SERVICE
Account ID:
Service ID:

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USAGE HISTORY

TOU Energy History:

RATE SCHEDULE	BILLING PERIOD	BILLING MONTH	BILLING FACTOR	SUMMER ENERGY ON PEAK (kWh)	SUMMER ENERGY PART PEAK (kWh)	SUMMER ENERGY OFF PEAK (kWh)	WINTER ENERGY PART PEAK (kWh)	WINTER ENERGY OFF PEAK (kWh)	ENERGY TOTAL (kWh)
STOUTP	08/26/07	AUG 2007	1.000	22,920	51,480	174,600			249,000
STOUTP	07/26/07	JUL 2007	1.000	25,200	53,040	169,320			247,560
STOUTP	06/26/07	JUN 2007	1.000	38,280	58,200	168,720			265,200
STOUTP	05/28/07	MAY 2007	1.000	30,960	43,320	147,000	12,360	21,600	255,240
STOUTP	04/26/07	APR 2007	1.000				95,280	153,600	248,880
STOUTP	03/27/07	MAR 2007	1.000				54,960	98,280	153,240
STOUTP	02/26/07	FEB 2007	1.000				93,720	183,120	276,840
STOUTP	01/25/07	JAN 2007	1.000				110,760	200,400	311,160
STOUTP	12/26/06	DEC 2006	1.000				106,080	187,200	293,280
STOUTP	11/27/06	NOV 2006	1.000	9,480	11,040	37,880	80,040	152,280	290,720
STOUTP	10/25/06	OCT 2006	1.000	48,480	58,080	171,240			277,800
STOUTP	09/26/06	SEP 2006	1.000	32,400	54,000	175,320			261,720
STOUTP	08/27/06	AUG 2006	1.000	45,720	60,960	186,480			293,160
STOUTP	07/27/06	JUL 2006	1.000	17,160	43,560	174,360			235,080
STOUTP	06/27/06	JUN 2006	1.000	36,120	59,400	152,880			248,400

TOU Demand History:

RATE SCHEDULE	BILLING PERIOD	BILLING MONTH	BILLING FACTOR	SUMMER MAX DEMAND ON PEAK (kW)	SUMMER MAX DEMAND PART PEAK (kW)	SUMMER MAX DEMAND OFF PEAK (kW)	WINTER MAX DEMAND PART PEAK (kW)	WINTER MAX DEMAND OFF PEAK (kW)	MAX DEMAND (kW)	POWER FACTOR %
STOUTP	08/26/07	AUG 2007	1.000	1,440	1,920	1,440	1,920	1,920	1,920	21%
STOUTP	07/26/07	JUL 2007	1.000	1,440	2,400	960	960	1,440	2,400	41%
STOUTP	06/26/07	JUN 2007	1.000	1,440	1,440	1,440			1,440	67%
STOUTP	05/28/07	MAY 2007	1.000	960	1,440	1,440	1,440	480	1,440	55%
STOUTP	04/26/07	APR 2007	1.000				960	960	960	99%
STOUTP	03/27/07	MAR 2007	1.000				960	1,440	1,440	100%
STOUTP	02/26/07	FEB 2007	1.000				960	960	960	100%
STOUTP	01/25/07	JAN 2007	1.000				1,440	1,920	1,920	84%
STOUTP	12/26/06	DEC 2006	1.000				1,440	960	1,440	92%
STOUTP	11/27/06	NOV 2006	1.000	960	960	960	1,920	960	1,920	100%
STOUTP	10/25/06	OCT 2006	1.000	960	1,440	1,440			1,440	83%
STOUTP	09/26/06	SEP 2006	1.000	960	1,440	960			1,440	33%
STOUTP	08/27/06	AUG 2006	1.000	1,440	1,920	1,440			1,920	77%
STOUTP	07/27/06	JUL 2006	1.000	1,440	1,920	2,400			2,400	7%
STOUTP	06/27/06	JUN 2006	1.000	1,440	1,920	1,440			1,920	28%



PG&E'S REACTIVE TARIFF TREATMENT OF GENERATION

Through collaboration with customer groups, the ORNL and PG&E, the CPUC approved revised standby tariff to be effective 1/1/08 which is better aligned with the CAISO's tariff and enhances system reliability.

- Those customers operating synchronous generators who are otherwise obligated to comply with PG&E switching center voltage orders are exempt from the Reactive Demand Charge, provided that customer is in compliance with all valid PG&E switching center voltage orders.
- Non compliance penalties imposed if On any second or further event of noncompliance within 12 months of the prior noncompliance occurrence, a penalty will be billed to the account, equal to the lesser of the number of months since the last noncompliance penalty and the number 12, multiplied by the highest created Reactive Demand in the most recent noncompliance period, multiplied by the current Reactive Demand Charge rate.

CUSTOMER INPUT ON DEVELOPING A JUST AND REASONABLE REACTIVE TARIFF

PG&E recognizes that customer input is vital not only for acceptance of any new tariff but it is also necessary for a well thought-out product.

•PG&E in collaboration with ORNL and also with consultation of the CAISO is working with 5 selected customers representing different market segments:

- Mall
- Merchant generator
- University
- Manufacturing facility
- Grocery store

CONCLUSION

<i>Customer Type</i>	<i>Prior to 1/1/08</i>	<i>Post 1/1/08</i>	<i>Ideal Tariff</i>
<i>Loads</i>	85% PF reference – credit issued/penalty imposed in the form of monthly bill increase or reduction equal to 0.06 % of the bill for each percentage point above or below 85%	85% PF reference – credit issued/penalty imposed	PG&E pays for reactive power if supplied in accordance with tariff language
<i>Inductive generators</i>	Must be set at unity power factor. Penalty of \$0.15 per kVAR applies if kVAR surpasses 10% threshold	Must be set at unity power factor. Penalty of \$0.35 per kVAR applies if kVAR surpasses 10% threshold	Must be set at unity power factor. Penalty will apply for poor PF
<i>Transmission-connected synchronous generators on AVR</i>	Must be set on voltage schedule but reactive charges assessed if more than 0.1 kVAR per kW imposed on PG&E system – charges may be waived on a case-by-case basis	Must be set on voltage schedule and comply with certain guidelines – reactive charges waived. Non compliance penalty in tariff. No compensation	Tariff designed to compensate generators for providing dynamic reactive power regulation
<i>Other synchronous units</i>	Must be set at unity power factor. Penalty of \$0.15 per kVAR applies if kVAR surpasses 10% threshold	Must be set at unity power factor. Penalty of \$0.35 per kVAR applies if kVAR surpasses 10% threshold	May elect to provide VAR regulation like the generators on AVR and compensated in accordance with the tariff.

