



FY 2008 ENERGY EFFICIENCY PROGRAM  
EVALUATION

for

City of Biggs Municipal Utility

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**SUMMIT BLUE CONSULTING**

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Submitted to:

Contact name: Marlee Mattos  
Biggsar@biggs-ca.gov

Client Address: Biggs Municipal Utilities  
PO Box 307  
Biggs, CA 95917-0307

Submitted by:

Gary Cullen  
Navigant Consulting, formerly Summit Blue Consulting, LLC  
NW Regional Office, Portland/Vancouver  
1104 Main Street, Suite M110  
Vancouver, WA 98660

*(360) 718-8392*  
*gary.cullen@navigantconsulting.com*

Prepared by: Gary Cullen

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# 1 Introduction

The City of Biggs (Biggs) has a number of energy efficiency programs offered through its utility department. This report describes the results of an Evaluation, Measurement, and Verification (EM&V) study of Biggs' energy efficiency incentive programs.

Two legislative bills (SB1037 and AB2021) were signed into law a year apart. SB1037 requires that the Publicly Owned Utilities (POUs), similar to the Investor Owned Utilities (IOUs), place cost effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the loading order. They must now procure "negawatts" first. Additionally, SB1037 (signed September 29, 2005) requires an annual report that describes the programs, expenditures, expected energy savings, and actual energy savings.

Assembly Bill 2021, signed by the Governor a year later (September 29, 2006), reiterated the loading order and annual report stated in SB1037 as well as expanded on the annual report requirements. The expanded report must include investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB2021 additionally requires a report every three years that highlights cost-effective electrical and natural gas potential savings from energy efficiency and established annual targets for energy efficiency and demand reduction over ten years. The legislative reports require both an on-going assessment of what is occurring within the programs along with a comparison of how much possible savings are left within the POU service territory.

## 1.1 General Utility Background Information

The City of Biggs was founded in 1871 to serve the agricultural commerce in the region. The town has a population of about 1,800 and is located in the Sacramento Valley about 65 miles north of Sacramento. Currently, the utility serves 611 residential customers, 55 commercial customers, and 3 industrial customers. This is a summer peaking utility with a peak demand of about 4 megawatts. Its annual energy usage is just over 16 GWh.

Biggs is located in Climate Zone 11, which is in the central California valley, north of Sacramento. Here the seasons are cool to cold in the winter and hot in the summer. Annual precipitation is about 27" per year with the wettest month being January with about 5". The wettest months are November through March and the summers are generally dry. Table 1 illustrates the heating and cooling degree-days for the nearby weather station at Oroville.

**Table 1: Temperature Reference Points for Biggs**

Base Temperature	65F
Heating Degree Days (HDD)	2,818
Cooling Degree Days (CDD)	1,422

## 1.2 Energy Efficiency Programs Offered

Biggs has developed a portfolio of programs for its residential and non-residential customers to encourage energy conservation and to meet its long-term reduction goals. There are few non-residential accounts in Biggs and the program effort for this customer segment is through custom rebates. Residential programs are primarily appliance and HVAC/Shell oriented. Table 2 summarizes the rebate amounts available to Biggs' residential customers.

**Table 2: Summary of Rebate Amounts for Residential Programs**

Qualified Products	Rating	Rebate
Central Air Conditioning	14 SEER or greater	From \$400 to \$600
Programmable Thermostat		\$35/unit
HVAC Tune-up		\$35/unit
Refrigerator		\$200/unit
Bedroom/Bathroom Occupancy Sensors	Maximum 5 per household	\$10/unit
Radiant Barriers	.95 or greater reflectivity	10¢ per sq. ft
Cool Roof	>.4 reflectivity and >.75 emissivity	10¢ per sq. ft
Attic Insulation	R19 or less to R38	30 ¢ per sq. ft.
Exterior Wall Insulation	R-13+	30¢ per sq. ft
Window Replacement	Energy Star® rated	\$1.00 per sq. ft.
Whole House Fans	1,000 cfm or greater	\$150
Solar-Powered Attic Fan	1 per household	\$40 electric fan, \$5 solar powered fan

Table 3 summarizes the claimed impacts from the City of Biggs FY 2008 energy conservation program efforts. The largest amount of claimed savings was for non-residential lighting. Essentially all of these savings are from one project. Residential lighting has the next largest amount of claimed program savings and this is from a CFL give-away program.

**Table 3: FY 2008 Summary of Program Impacts**

Biggs		Resource Savings Summary							Cost Summary			
Program Sector (Used in CEC Report)	Category	Units Installed	Net Demand Savings (kW)	Net Peak kW Savings	Gross Annual kWh Savings	Net Annual kWh Savings	Net Lifecycle kWh savings	Net Lifecycle GHG Reductions (Tons)	Utility Incentives Cost (\$)	Utility Direct Install Cost (\$)	Utility Mktg, EM&V, and Admin Cost (\$)	Total Utility Cost (\$)
Appliances	Res Clothes Washers											
HVAC	Res Cooling	2			95	76	1,136	1	\$ 177		\$ 14	\$ 191
Appliances	Res Dishwashers											
Consumer Electronic	Res Electronics											
HVAC	Res Heating											
Lighting	Res Lighting	1,000	44	6	39,000	31,200	280,800	150	\$ 2,050		\$ 2,027	\$ 4,077
Pool Pump	Res Pool Pump											
Refrigeration	Res Refrigeration	6	1	1	6,121	6,064	109,159	59	\$ 600		\$ 889	\$ 1,489
HVAC	Res Shell	8	1	1	924	739	14,777	8	\$ 1,664		\$ 135	\$ 1,798
Water Heating	Res Water Heating											
Comprehensive	Res Comprehensive											
Process	Non-Res Cooking											
HVAC	Non-Res Cooling	2	14		16,390	13,112	196,680	109	\$ 3,278		\$ 1,658	\$ 4,936
HVAC	Non-Res Heating											
Lighting	Non-Res Lighting	719	18	11	102,108	81,686	945,834	515	\$ 19,976		\$ 7,560	\$ 27,537
Process	Non-Res Motors											
Process	Non-Res Pumps											
Refrigeration	Non-Res Refrigeration											
HVAC	Non-Res Shell											
Process	Non Res Process											
Comprehensive	Non Res Comprehensive											
Other	Other											
SubTotal		1,737	77	19	164,637	132,877	1,548,387	843	\$ 27,745		\$ 12,282	\$ 40,027

## 1.3 Evaluation Priorities

Evaluation priorities are generally based on a combination of relative size of the savings achieved as well as the degree of uncertainty with *ex ante* estimates of the savings. The cost of different evaluation approaches also is a key element in determining priorities. Normally, these considerations lead to having EM&V efforts directed toward a subset of program offerings. However, the number of participants within the City's energy conservation programs is not large and therefore the EM&V efforts are directed toward all of the program offerings.

## 2 Impact Evaluation

The primary objectives of an impact analysis are to assess gross and net demand and energy savings from a utility's energy conservation programs. An impact evaluation verifies measure installations, identifies key energy assumptions and provides the research necessary to calculate defensible and accurate savings attributable to the program.

None of the measures installed or projects completed in FY 2008 are complex. In all cases, the evaluation consisted of Summit Blue staff coming to the City of Biggs utility offices and personally reviewing all of the program records and documentation.

### 2.1 Residential Programs

Results included in the 2009 submittal to the CEC for the residential sector included:

- Lighting – 1,000 units
- HVAC/Cooling – 2 units
- HVAC/Shell – 8 units
- Refrigeration – 6 units

While visiting the City of Biggs utility offices, Summit Blue staff reviewed all of the supporting records available. For lighting, this was an itemization of CFLs received by a homeowner with the recipient homeowner's signature. For the remaining items, the supporting documentation consisted of receipts or, in the case of refrigerator re-cycling, a statement by the organization confirming pick up of the appliance.

#### 2.1.1 Lighting

To promote CFL lighting, Biggs purchased 1,000 CFLs and distributed them free to any household who would come to their office and pick them up. The maximum per household was three CFLs and upon receipt, they were to sign for them on a log maintained by the utility.

Summit Blue reviewed this log and confirmed that there were signatures. However, signatures were only provided for 837 CFLs. The staff at Biggs believes that all 1,000 were distributed (as there are none left), but that some of them may have been given away during times when they were very busy and they were not able to get the signature. This is likely true, but unfortunately, savings can be claimed only for the 837 CFLs for which there was a signature. Within E3, the proper measure (CFL: Screw-In (16-24W)) was identified for calculating the claimed savings.

#### 2.1.2 HVAC

HVAC measures were split into equipment and building shell measures. The following measures were claimed within the E3 model:

- Attic fan – 1 unit

- Whole house fan with air conditioning – 1 unit
- Ceiling R-0 to R-38 Insulation-Batts – 1 unit
- Window Replacement: Clear Windows (mobile home) – 2 units
- Window Replacement: Clear Windows (single family) – 5 units

Receipts were found and the equipment claimed in E3 verified through review of the receipt for all but the five single family window replacements. City of Biggs staff were asked about these missing receipts and they could not find them either. The claimed savings from these five window replacement units are considered non-verified.

### 2.1.3 Appliances

Six appliance measures were claimed within the E3 model. Each of the receipts for these six measures were found and verified to be the equipment claimed within the E3 model. The six included:

- Refrigerator: bottom mount freezer – 1 unit
- Refrigerator: side mount freezer – 2 units
- Refrigerator recycling – 3 units

### 2.1.4 Summary of Verified Residential Energy Savings

Table 4 identifies the residential energy and peak demand impacts claimed by the City of Biggs in FY 2008. The largest amount of claimed energy savings was from CFL installations. A distant second was from refrigerator recycling

**Table 4: FY 2008 Claimed Residential Program Impacts**

Measure	Claimed				
	Energy Savings/unit (kWh)	Demand Savings/Unit (kW)	Units Claimed	Energy Savings (kWh)	Demand Savings (kW)
Attic Fan	149	0.281	1	149	0.3
CFL: Screw-In (16-24W)	39	0.055	1,000	39,000	55.0
Refrigerator: Bottom Mount Freezer	87	0.015	1	87	0.0
Refrigerator: Side Mount Freezer	98	0.017	2	196	0.0
Ceiling R-0 to R-38 Insulation-Batts	682	0.476	1	682	0.5
Whole House Fan with Air Conditioning	(6)	-0.011	1	-6	0.0
Window Replacement: Clear Windows	88	0.129	2.12	187	0.3
Window Replacement: Clear Windows	11	0.022	5	55	0.1
Refrigerator Recycling	1,946	0.3	3	5,838	0.9
<b>TOTAL</b>				<b>46,188</b>	<b>57.1</b>

Table 5 identifies the verified energy savings as determined through paper verification of receipts maintained by the City of Biggs. Overall, the energy realization rate from residential programs is 86%. The biggest reason for the 86% overall rate is the realization rate for CFLs. The energy realization rate for CFLs is 84%, which is the result of verifying only 837 of the claimed 1,000 CFLs. Better record

keeping in the future will likely improve this realization rate since it is highly possible that all 1,000 CFLs were given away.

**Table 5: FY 2008 Verified Residential Program Impacts**

Measure	Verified					Realization Rate - Energy	Realization Rate Demand
	Energy Savings/unit (kWh)	Demand Savings/Unit (kW)	Units Verified	Energy Savings (kWh)	Demand Savings (kW)		
Attic Fan	149	0.281	1	149	0.3	100%	100%
CFL: Screw-In (16-24W)	39	0.055	837	32,643	46.0	84%	84%
Refrigerator: Bottom Mount Freezer	87	0.015	1	87	0.0	100%	100%
Refrigerator: Side Mount Freezer	98	0.017	2	196	0.0	100%	100%
Ceiling R-0 to R-38 Insulation-Batts	682	0.476	1	682	0.5	100%	100%
Whole House Fan with Air Conditioning	(6)	(0.011)	1	-6	0.0	100%	100%
Window Replacement: Clear Windows	88	0.129	2.12	187	0.3	100%	100%
Window Replacement: Clear Windows	11	0.022	0	0	0.0	0%	0%
Refrigerator Recycling	1,946	0.300	3	5,838	0.9	100%	100%
<b>TOTAL</b>				<b>39,776</b>	<b>48.0</b>	<b>86%</b>	<b>84%</b>

## 2.2 Commercial Programs

Energy savings claimed from installation of commercial sector measures were more than twice the amount claimed for the residential sector. Essentially all of the savings came from five projects implemented in the Biggs school district. Although nearly all of the measures were verified through the review of receipts, it was difficult tying the receipts to the projects and then to the claimed energy savings.

Nearly 70% of the claimed savings come from the dataset of deemed measures within the E3 database. The remaining claimed savings come from engineering calculations. The basis for most of the estimates of energy savings came from an energy audit performed on the school district buildings. However, the calculations for the specific projects often consisted of emails from the engineer identifying calculations as well as handwritten sheets of paper. A review of these calculations found them to be reasonable, however, future EM&V efforts would greatly benefit from better organized project files.

### 2.2.1 Claimed Savings

Table 6 outlines the claimed impacts from the City of Biggs' FY 2008 commercial sector programs. Savings were spread among 13 different measures. Over 85% of the claimed savings is from lighting measures with one-half of the total claimed savings from delamping alone.

**Table 6: FY 2008 Claimed Commercial Program Impacts**

Measure	Claimed				
	Energy Savings/unit (kWh)	Demand Savings/Unit (kW)	Units Claimed	Energy Savings (kWh)	Demand Savings (kW)
Delamp: 4 foot lamp w/ Interact Effects	262	0.052	198	51,876	10.296
Delamp: 8 foot lamp w/ Interact Effects	385	0.077	25	9,625	1.925
T-12 to T-8: 4 foot lamp w/ Interact Effects	41	0.008	403	16,523	3.224
T-12 to T-8: 8 foot lamp w/ Interact Effects	50	0.01	56	2,800	0.56
T5HO4-lamp replaces 400W MH	503	0.166	12	6,036	1.992
Delamp 400W Metal Halide W/Ballast	991	0.4	8	7,928	3.2
100W HPS w/photocell repl 175W MV no cell	1,276	0.075	2	2,552	0.15
100W HPS w/photocell repl 175W MV w/photocell	344	0.075	2	688	0.15
75W incand. 24/7 replaced w/50W HPS w/photocell	386	0.025	5	1,930	0.125
75W incand. w/photocell replaced w/50W HPS w/photocell	205	0.025	3	615	0.075
Delamp 75W incandescent fixture	307	0.075	5	1,535	0.375
2 Carrier 48HJD008 & 1 HJD006 replace vintage units	12,090	8.9	1	12,090	8.9
15 ton Carrier 48HJD017 replaces vintage unit	4,300	8.6	1	4,300	8.6
<b>TOTAL</b>				<b>118,498</b>	<b>39.6</b>

## 2.2.2 Measure Verification

The energy and demand savings claimed per unit were found to be reasonable for all measures. Nearly all measures were verified through the process of finding receipts to support each claim. However, this process could be improved by having the paperwork for each project packaged that includes a project description, identification of each measure claimed with the associated deemed energy savings value clearly identified or the engineering calculations clearly provided, and receipts organized and tagged so that it is easy to identify which receipt goes to which project and measure.

The only measure that could not be fully verified is the delamping count for 4 ft lamps. For this measure, 197 of the claimed 198 could be verified. As shown in Table 7, the overall realization rates for commercial sector measures were essentially 100% for both energy and demand.

**Table 7: FY 2008 Verified Commercial Program Impacts**

Measure	Verified					Realization Rate - Energy	Realization Rate Demand
	Energy Savings/unit	Demand Savings/Unit	Units Verified	Energy Savings (kWh)	Demand Savings (kW)		
Delamp: 4 foot lamp w/ Interact Effects	262	0.052	197	51,614	10.2	99.5%	99.5%
Delamp: 8 foot lamp w/ Interact Effects	385	0.077	25	9,625	1.9	100.0%	100.0%
T-12 to T-8: 4 foot lamp w/ Interact Effects	41	0.008	403	16,523	3.2	100.0%	100.0%
T-12 to T-8: 8 foot lamp w/ Interact Effects	50	0.010	56	2,800	0.6	100.0%	100.0%
T5HO4-lamp replaces 400W MH	503	0.166	12	6,036	2.0	100.0%	100.0%
Delamp 400W Metal Halide W/Ballast	991	0.400	8	7,928	3.2	100.0%	100.0%
100W HPS w/photocell repl 175W MV no cell	1,276	0.075	2	2,552	0.2	100.0%	100.0%
100W HPS w/photocell repl 175W MV w/photocell	344	0.075	2	688	0.2	100.0%	100.0%
75W incand. 24/7 replaced w/50W HPS w/photocell	386	0.025	5	1,930	0.1	100.0%	100.0%
75W incand. w/photocell replaced w/50W HPS w/photocell	205	0.025	3	615	0.1	100.0%	100.0%
Delamp 75W incandescent fixture	307	0.075	5	1,535	0.4	100.0%	100.0%
2 Carrier 48HJD008 & 1 HJD006 replace vintage units	12,090	8.900	1	12,090	8.9	100.0%	100.0%
15 ton Carrier 48HJD017 replaces vintage unit	4,300	8.600	1	4,300	8.6	100.0%	100.0%
<b>TOTAL</b>				<b>118,236</b>	<b>39.5</b>	<b>99.8%</b>	<b>99.9%</b>

## 2.1 Overall Program Realization

Table 8 identifies the sector level and overall realization rate for the measures claimed by the City of Biggs in the FY 2008 program filings. Overall, the energy realization rate was 96% and the demand realization rate was 91%. The primary reason for not having 100% realization was the accounting of only

837 of the claimed 1,000 CFLs distributed to Biggs homeowners. This issue can be easily rectified with tighter control of the distribution process.

The realization rates for commercial measures were particularly good; approaching 100%. However, as noted in the previous section, the records keeping by project needs to be improved. The utility is small enough that simple spreadsheet tracking and maintenance of clear project files is sufficient for good program tracking and good documentation for later EM&V work. A more complex system is not needed.

**Table 8: FY 2008 Claimed and Verified Program Impact Summary**

Sector	Claimed		Verified		Realization Rate - Energy	Realization Rate Demand
	Energy Savings (kWh)	Demand Savings (kW)	Energy Savings (kWh)	Demand Savings (kW)		
Residential	46,188	57.1	39,776	48.0	86.1%	84.1%
Commercial	118,498	39.6	118,236	39.5	99.8%	99.9%
<b>Total</b>	<b>164,686</b>	<b>96.7</b>	<b>158,012</b>	<b>87.5</b>	<b>95.9%</b>	<b>90.6%</b>