

Doral Arrowwood– Natural Gas Consumption Measurements

The three engines at Doral Arrowwood are served by a common gas meter on a dedicated natural gas account. No pulse output is available from the billing meter. Natural gas consumption for the CHP system was measured using the utility billing data collected from Con Edison’s Transportation Customer Information System (TCIS). This reading provides the total gas use in CF between the two billing periods, typically 30 days apart.

Using the interval monitored data, the total measured gross energy in the same period is calculated, and the normalized fuel consumption per gross kWh of generation is computed (CF/kWh). This normalized fuel consumption rate is then applied to each interval of generation data to compute the fuel consumption for each record. Using a CF/kWh value rather than an actual heat rate (BTU/kWh) reduces the confusion when evaluating performance at either HHV or LHV. The result of the calculation is CF/interval, to which the appropriate heating value can be applied.

Table 1 displays the natural gas data, gross electrical generation, and resulting normalized fuel consumption rate for each billing period.

Table 1. Doral Arrowwood Natural Gas Utility Billing Data and Coincident Generation

		[1]	[2]	[3]	[4]	[5]	[6] = [2]+[3]+[4]	[7] = [1]/[6]	[8] = [6]*3.413 / [1] * 1.03 * .9
Start Date	End Date	Gas Consumption (CF)	Generator #1 Gross Generation (WG1) (kWh)	Generator #2 Gross Generation (WG2) (kWh)	Generator #3 Gross Generation (WG3) (kWh)	Parasitic Consumption (WPAR) (kWh)	Gross Generation (kWh)	Normalized Fuel Consumption (CF/kWh)	Gross Electrical FCE (% LHV)
12/4/2012	1/3/2013	2,296,000	54,810	54,255	54,255	3,350	163,321	14.06	26.2%
1/3/2013	2/4/2013	2,440,000	56,902	64,196	64,196	3,715	185,293	13.17	28.0%
2/4/2013	3/6/2013	2,246,000	59,708	45,853	45,853	3,611	151,414	14.83	24.8%
3/6/2013	4/4/2013	1,902,000	36,896	50,935	50,935	2,470	138,766	13.71	26.9%
4/4/2013	5/3/2013	1,078,000	29,121	29,961	29,961	1,963	89,043	12.11	30.4%
5/3/2013	6/4/2013	867,000	13,109	11,466	11,466	775	36,042	24.06	15.3%
6/4/2013	7/3/2013	832,000	-	-	-	-	-	n/a	n/a
7/3/2013	8/2/2013	797,000	1,329	1,650	1,650	296	4,629	172.18	2.1%
8/2/2013	9/3/2013	1,035,000	30,612	23,418	23,418	5,541	77,449	13.36	27.6%
9/3/2013	10/2/2013	1,069,000	27,831	32,759	32,759	6,088	93,348	11.45	32.2%
10/2/2013	10/31/2013	1,155,000	26,481	33,125	33,125	6,150	92,731	12.46	29.6%
Totals		13,221,000	322,361	334,502	334,502	32,888	991,365	13.34	27.6%

Note: Red indicates incomplete monthly readings from data loss

The normalized fuel consumption and electrical FCE displayed a significant amount of variation between billing periods. Data was not collected between May 13, 2013 and July 31, 2013 due to change in configuration of the site supplied data logger, highlighted in red. Since the onset of monitoring, the cumulative electrical FCE for the CHP system has been 27.6% LHV, or 13.34 CF/kWh, if the months with partial data collection are excluded. This normalized fuel consumption ratio has been applied to all data.