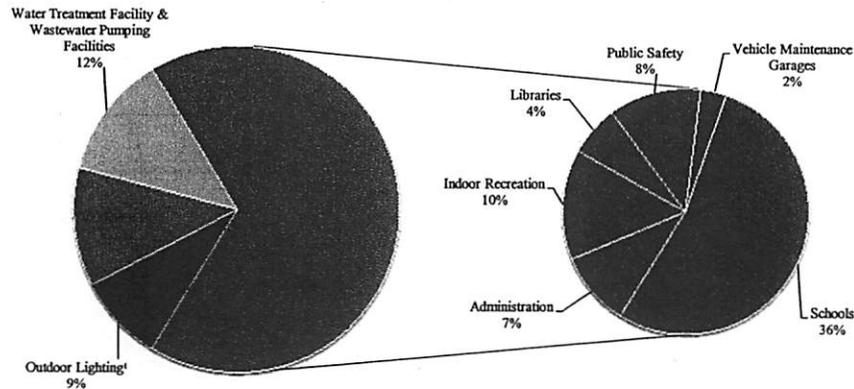
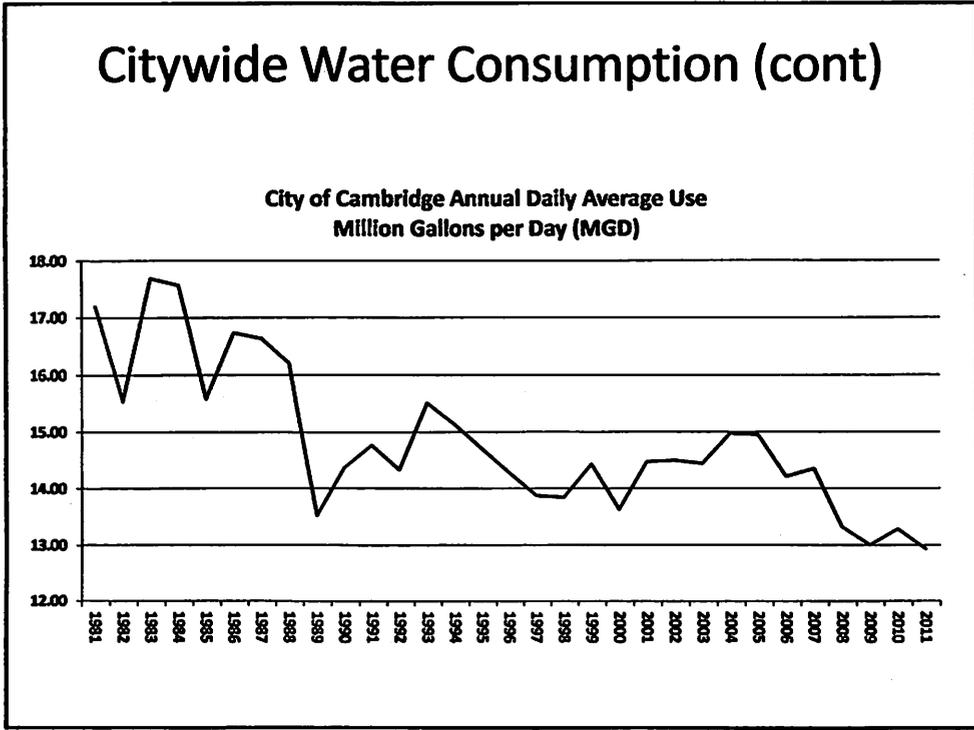
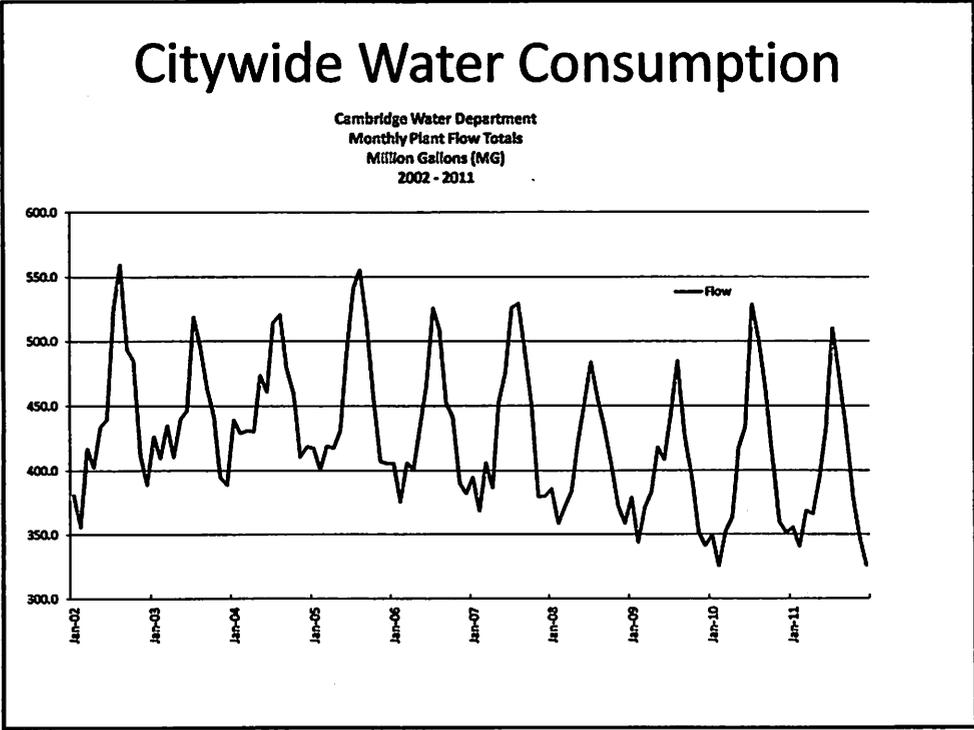


Environmental Committee Meeting on Energy

April 24, 2012

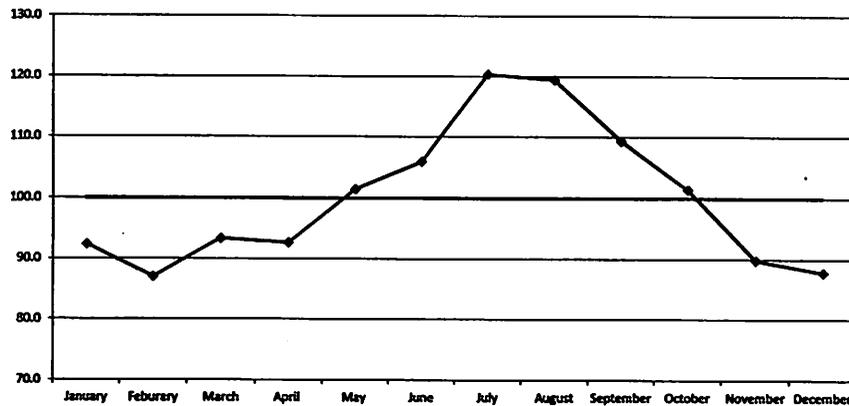
Cambridge Energy Use by Facility Category





Citywide Water Consumption – Seasonal Variation

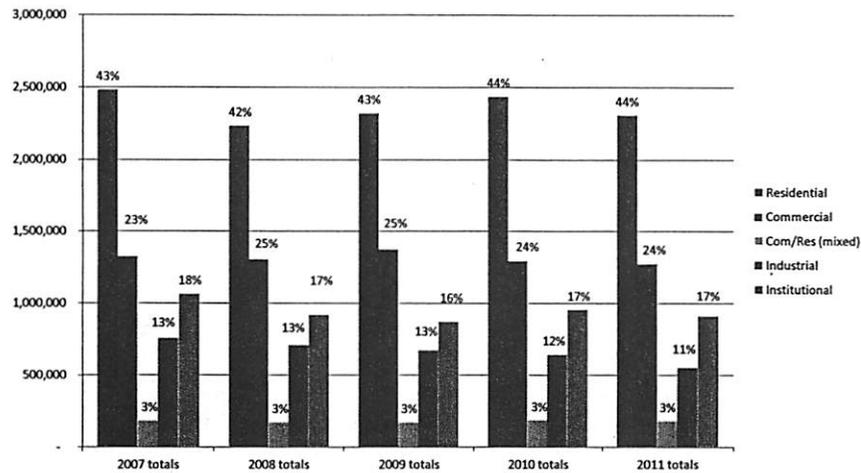
Cambridge Water Department
Monthly Percent of Annual Average Water Use
2002 - 2011



Citywide Water Consumption – User Base Variation

- The categories that we have used in the billing system are as follows: Residential, Commercial, Mixed (commercial/Residential) Industrial and Institutional.
- From 2007 to 2011 the base users have not varied by more than 2 % - see next slide.

Cambridge Water Uses by Category 2007-2011 (units;100CF;750gal)



Citywide Water Consumption – Water Conservation Initiatives

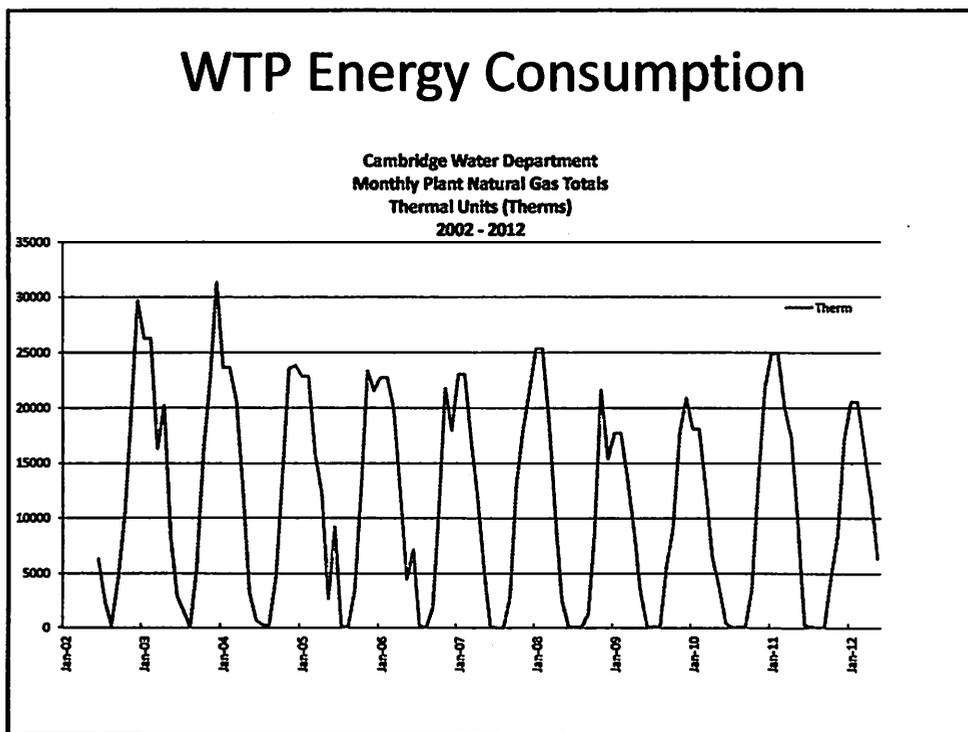
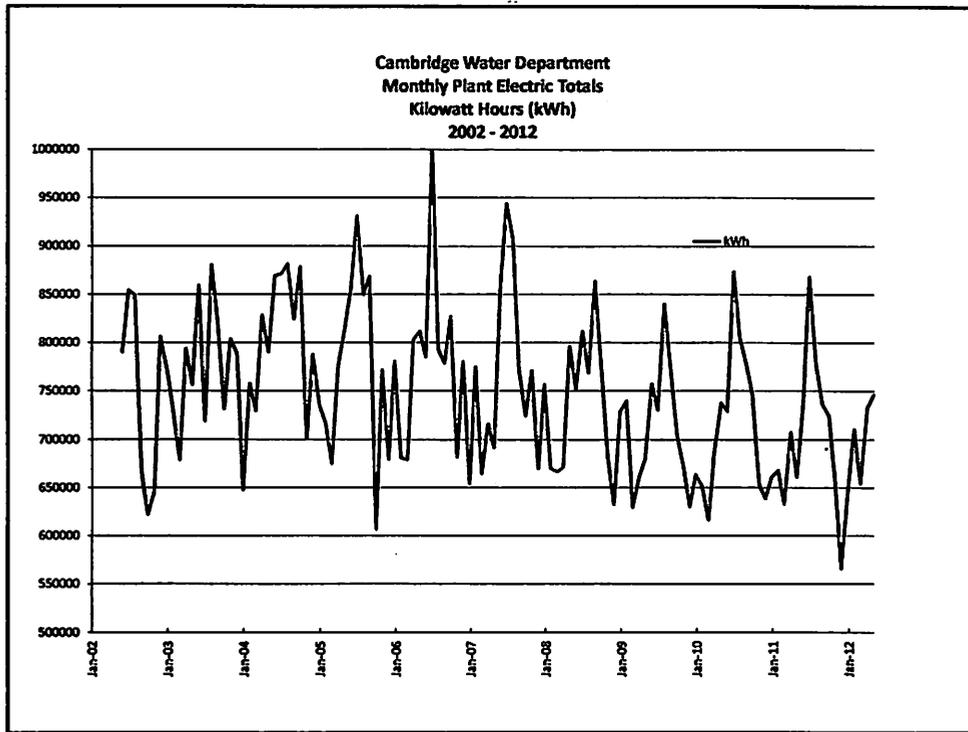
- Enterprise Fund
- Increasing Block Rate Structure
- MWRA Campaign 90's
- Leak Detection Program
- Leak Repair philosophy
- Distribution System Rehabilitation Program
- Distribute MWRA Water Conservation Materials

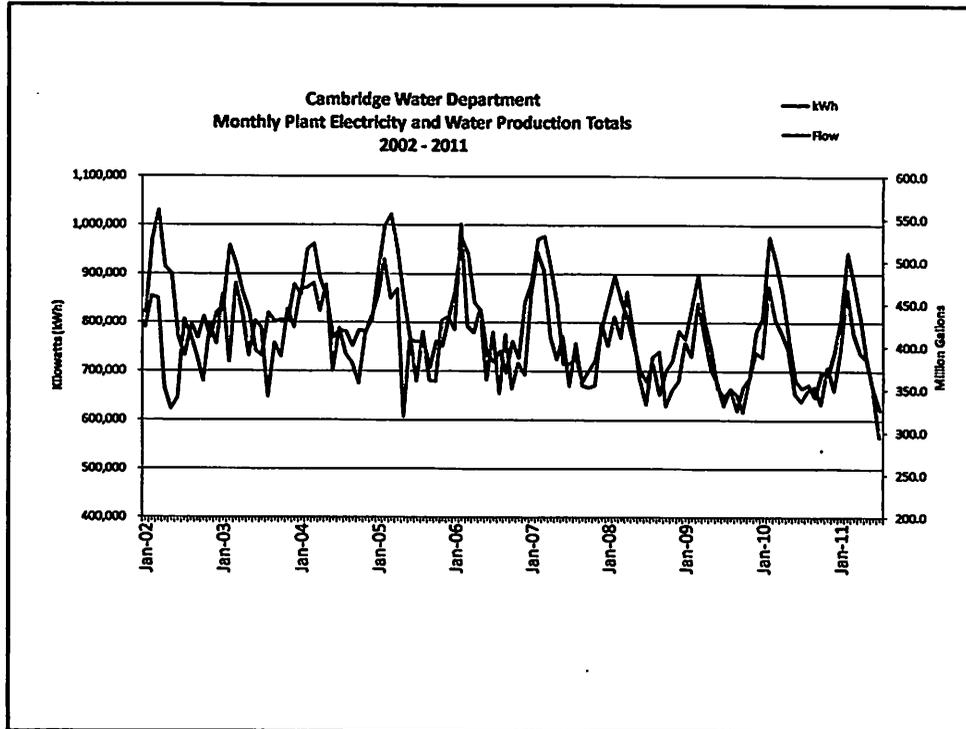
Citywide Water Consumption – Water Conservation Initiatives (cont)

- Web page
- Automatic Meter Reading (AMR) Program
- Water Week, Annual Fresh Pond Day, Plant and Watershed Tours
- Annual Consumer Confidence Report (CCR)
- Cambridge Energy Alliance
- Water Audit

2011 Top 25 Water Users

1	MASS INSTITUTE OF TECHNOLOGY Total	486,765	14	BOSTON PROPERTIES, INC. Total	28,990
2	HARVARD UNIVERSITY Total	475,291	15	CAMBRIDGE HOSPITAL ALLIANCE A/ Total	28,719
3	MIRANT KENDALL Total	291,877	16	HYATT REGENCY CAMBRIDGE Total	27,795
4	CAMBRIDGE HOUSING AUTHORITY Total	207,486	17	BOSTON PROPERTIES LIMITED PART Total	27,134
5	BIOGEN INC Total	94,476	18	205 ALEWIFE LTD PARTNERSHIP Total	26,043
6	SCHOCHET ASSOCIATES & RINDGE A Total	45,758	19	402 RINDGE AVE CORP Total	25,496
7	COLLIERS MEREDITH & GREW Total	45,495	20	EQUITY RESIDENTIAL Total	25,006
8	FOREST CITY MANAGEMENT Total	42,292	21	WHITEHEAD INSTITUTE Total	24,300
9	MOUNT AUBURN HOSPITAL Total	36,607	22	REGATTA RIVERVIEW CONDOMINIUMS Total	24,055
10	ARE TECH SQUARE LLC Total	36,062	23	NOVARTIS Total	22,037
11	WYETH RESEARCH Total	34,993	24	MEMORIAL DRIVE HOUSE LTD PARTN Total	21,970
12	COURT FACILITIES BUREAU Total	34,540	25	CAMBRIDGESIDE GALLERIA Total	21,865
13	CHARLES HOTEL Total	30,360		TOTAL (41% of total usage)	2,165,412





Cambridge Water Department (CWD) - Energy Reduction Program

- Premium Efficiency Motor Program - 2004
- Purchase Hybrid/Fuel Efficient vehicles - 2006
- Demand Response Program – 2007/2011
- PC Monitor Replacement 2007/2008
- HVAC (phase 1) - 2008
- Lighting Upgrades (HIF/Sensors) – 2008
- Green Sense Program - 2008
- Vehicle GPS - 2009
- Hydro Feasibility Study - 2009
- PV Solar Feasibility Study - 2010
- Energy Efficiency and Process Optimization Audit - 2011
- Review and Implement Energy Saving Measures (ESMs) – 2011/12/13

Energy Audit ESM Recommendations

- VFDs on Raw Water Pumps ★
- Finish Water Pump Coatings ★ - as pumps are refurbished
- Energy Efficient Roofs – PV Solar/remaining roof life
- Building Housekeeping ★
- HVAC Systems ★ - Economizer controls and HW VFDs – under review; Fume hood–no savings; Vehicle Storage Building–not practical

Energy Audit Recommendations (cont)

- Lighting ★ - Indoor /outdoor
- Demand Reduction ★
- Demand Response – Options under review
- Process Optimization ★
- Energy Management Program ★ - New Energy Management System under review

CWD – Renewable Energy

- WTP Roof PV Solar ★
- Conduit Hydro-Electric – Regulatory issues

CWD Energy Projects

Project	Total project Cost	Anticipated Completion Date	Energy Savings	Energy Savings In \$
Raw Water Pump Variable Frequency Dr. \$	652,800	7/31/2013	701,200 kWh	\$ 74,800
Process Improvements: No DEP permit or funding required		12/30/2012		
Lower Flyover Pack operating level (Nov 2011)			31,481 kWh	\$ 3,484
Filter Optimization				
Extend filter run time			30,000 kWh	\$ 70,000
SBR Control			6,000 kWh	\$ 10,000
Return to service optimization				
Backwash sequence optimization				
Process Improvements: DEP permit req'd \$	100,000	2/28/2013		
Disinfection System				
Ozone			25,000 kWh	\$ 25,000
Chlorine				
LED Lighting: \$	324,000	12/31/2012		
Replace old interior			60,300 kWh	\$ 6,610
Replace new (Existing HIR) interior			113,240 kWh	\$ 12,610
Outside			24,000 kWh	\$ 2,625
HVAC: \$	173,800	11/30/2012		
Chilled water pumps			31,700 kWh	\$ 3,600
Cooler			15,600 Therms	\$ 23,200
Demand Reduction:		12/31/2012		
High Lift Pump operation modification (started 2007)			167,073 kWh	\$ 18,000
Modified in November 2011 @ 600/yrl				
Modify filter backwash operation (Nov 2011)				\$ 20,200
Modify residual system operation @ 600/yrl (Nov 2011)				\$ 12,000
Renewable Energy: \$	400,000	12/31/2013		
Solar Panels			122,000 kWh	\$ 14,000
Total Costs: \$ 1,600,000				
		Total Energy Savings	1,307,780 kWh	\$ 207,000
			15,000 Therms	
			424 Gallons	
			0.022 MMBTU/h	

CWD Energy Projects Plan

- **Work in conjunction with City/DPW to meet Green Community and other energy goals**
- **Complete Process Optimization Efforts**
- **Continue:**
 - **Green Sense Program**
 - **Tracking energy use**
 - **Review technology, projects and Energy Management System for potential implementation**
 - **Other on-going energy related programs (i.e. premium motors, GPS, etc.)**

CAMBRIDGE WATER TREATMENT PLANT MONTHLY ENERGY AND MAINTENANCE REPORT

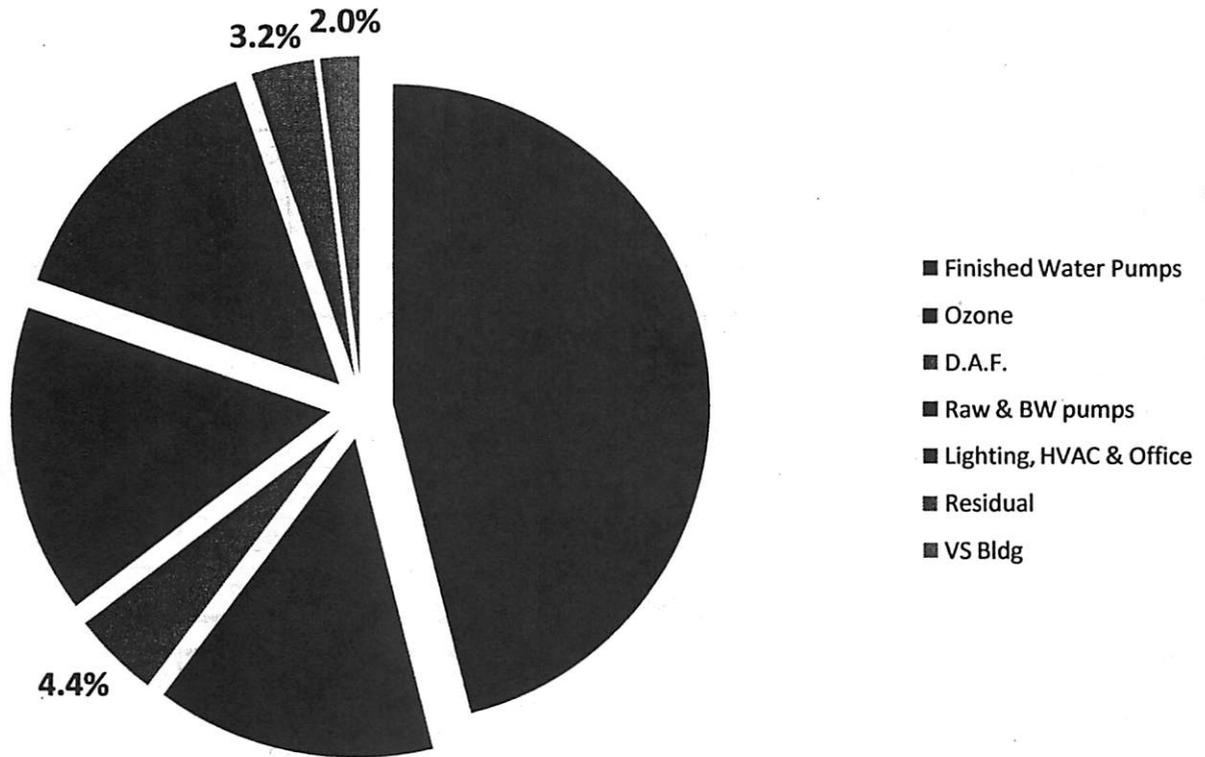


Mar-12

Electrical Energy Consumption for the Month of March-12
Data Generated From In House Electric Power Metering Equipments
Units in kWh

Read dates	Main	Finished Water Pumps	Ozone	D.A.F.	Raw & BW pumps	Lighting, HVAC & Office	Residual	VS Bldg	PF Units	Backup Gen.
2/23/2011 - 3/22/2012	583266	274082	83998	26490	93254	86296	19178	11915	818	0

Cambridge Water Treatment Plant, Energy Balance for the Current Reporting Month



Walter J. Sullivan Water Treatment Plant, Energy Saving Measures, 2007 to 2012

Energy Saving Measure: Reduce flow to 10 MGD and operate on one raw water pump and one finished water pump from Nov. to Feb. 4pm to 9pm weekdays, Nstar's peak demand period during eastern standard time.

Date implemented: Nov. 2011.

Actual energy savings: See charts below.

	Dec. 2010	Dec. 2011	% Change
kWh per day, Nstar readings	21,296	20,211	-5.1%
Nstar demand in KVA, Nstar readings	1,182	978	-17.3%
kWh/MG used by pumping, in house readings	1,154	1,100	-4.7%
Nstar demand cost	\$11,720	\$9,691	-17.3%
TransCanada kWh cost per day	\$1,926	\$1,746	-9.3%
Overall energy cost, Nstar and TransCanada	\$76,285	\$68,332	-10.4%

	Jan. 2011	Jan. 2012	% Change
kWh per day, Nstar readings	21,314	19,578	-8.1%
Nstar demand in KVA, Nstar readings	1,413	1,090	-22.9%
kWh/MG used by pumping, in house readings	1,184	1,122	-5.2%
Nstar demand cost	\$14,223	\$10,692	-24.8%
TransCanada kWh cost per day	\$1,928	\$1,692	-12.2%
Overall energy cost, Nstar and TransCanada	\$83,038	\$78,483	-5.5%

	Feb. 2011	Feb. 2012	% Change
kWh per day, Nstar readings	22,272	20,784	-6.7%
Nstar demand in KVA, Nstar readings	1,317	943	-28.4%
kWh/MG used by pumping, in house readings	1,150	1,117	-2.9%
Nstar demand cost	\$13,250	\$9,117	-31.0%
TransCanada kWh cost per day	\$2,014	\$1,796	-10.1%
Overall energy cost, Nstar and TransCanada	\$83,053	\$74,762	-10.0%

	March 2011	March 2012	% Change
kWh per day, Nstar readings	21,840	20,532	-6.0%
Nstar demand in KVA, Nstar readings	1,141	943	-17.4%
kWh/MG used by pumping, in house readings	1,151	1,129	-1.9%
Nstar demand cost	\$11,402	\$9,117	-20.0%

Energy Saving Measure: Shut off residual and waste wash water system from Nov. to Feb. 4pm to 9pm,

Nstar peak demand period during eastern standard time.

Date implemented: Nov. 2011.

Projected energy savings: Savings of 24 KVA off the Nstar demand charge.

Projected cost savings per year at \$0.11/kWh: At \$10.5/KVA, monthly savings = \$252.

Energy Saving Measure: Lowering Payson Park Reservoir's operating height to 16'-19'.

Date implemented: Nov. 2011.

Energy Saving Measure: Shut down first stage of DAF flocculates.

Date implemented: Nov. 2011, discontinued for cold water operation, resume testing in Spring of 2012.

Energy Saving Measure: Upgrade process area lighting to high efficiency T8 fluorescent light fixtures and install motion and light sensors thru out building.

Date implemented: Dec. 2008.

Projected energy savings: 473706 kWh/year.

Projected cost savings per year at \$0.11/kWh: \$52108 per year.

Energy Saving Measure: Update HVAC computerized system and implemented night time temperature set back and holiday schedules.

Date implemented: Nov. 2008.

Projected energy savings: 39124 kWh/year, natural gas savings undetermined.

Projected cost savings per year at \$0.11/kWh: \$4303 per year.

Energy Saving Measure: During July and Aug., 12pm to 4pm, reduce plant flow and run pond aeration system during off peak hours

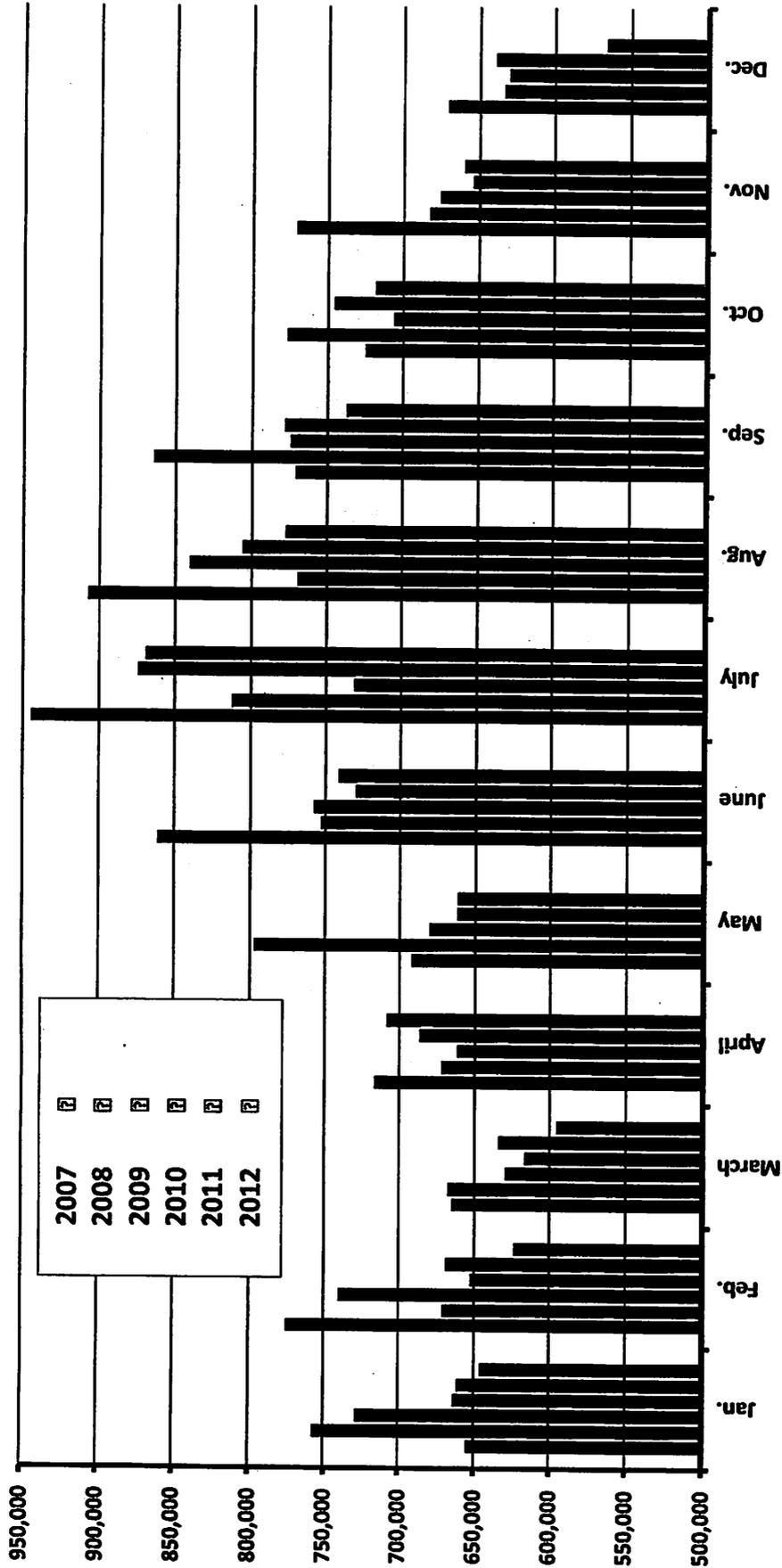
Date implemented: June 2007.

Electrical Power Consumption, units in kWh
Data Generated From In House Electric Power Metering Equipments
(LAST 12 OPERATING MONTHS)

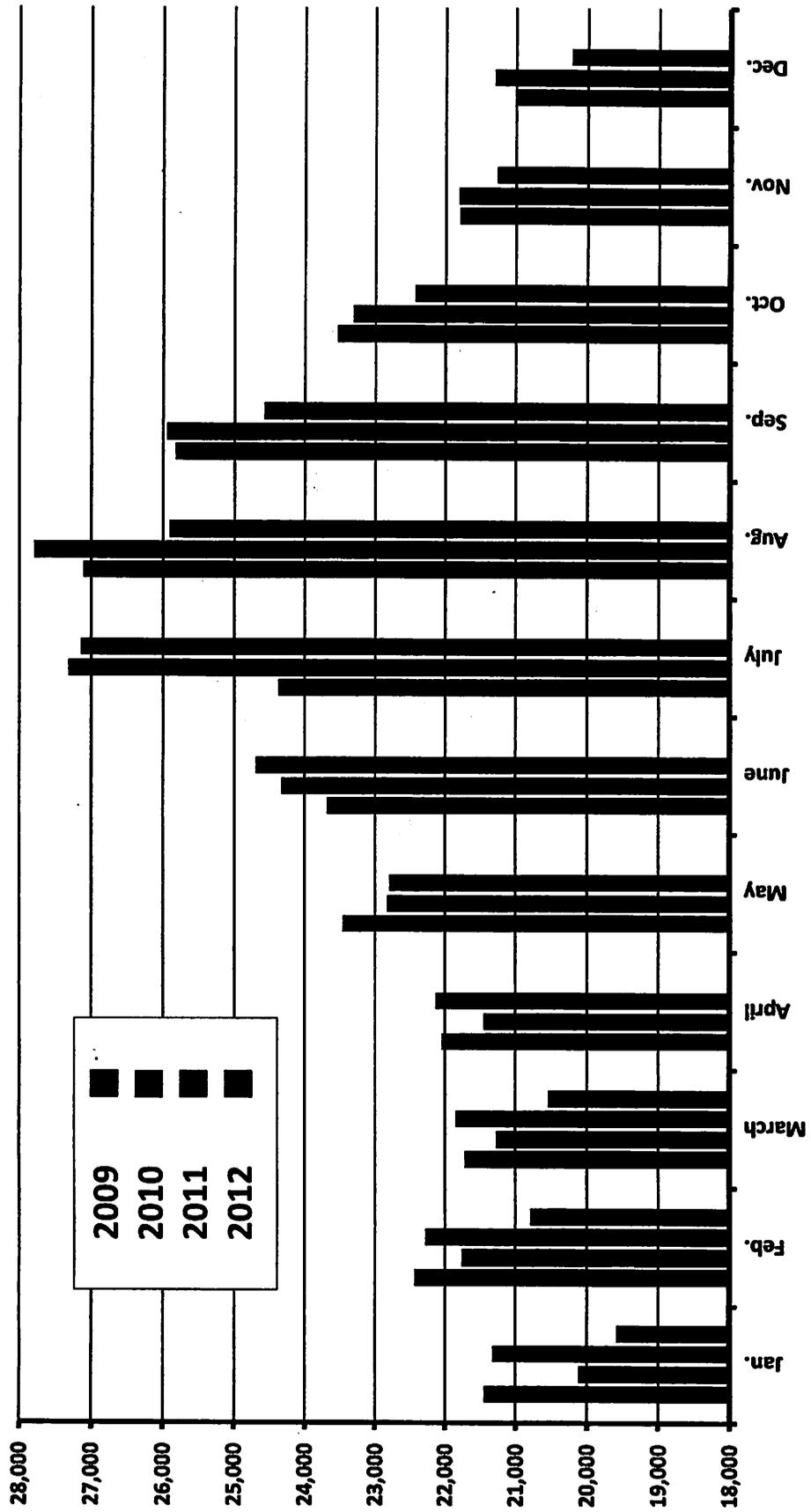
	Main	FW Pump #1	FW Pump #2	FW Pump # 3	FW Pump # 4	Ozone # 1	Ozone # 2	D.A.F.	Raw & BW pumps	Lighting, HVAC & Office	Residual	PF Units	VS Bldg	Backup Gen.
3/1/2011 - 3/31/2011	634702	106229	82808	111068	1497	57247	37276	26286	122222	96641	20117	933	17494	0
4/1/2011 - 5/1/2011	690997	49923	108938	39201	117013	52022	46226	26283	123635	94449	20415	807	15514	0
5/2/2011 - 5/31/2011	691870	1459	53151	158749	108083	50359	55048	25665	120101	93752	19888	757	7933	0
6/1/2011 - 6/29/2011	713341	13364	169957	136932	26818	53766	48779	24737	118172	96656	18616	828	8880	0
6/30/2011 - 8/1/2011	903643	164646	197021	29851	57025	61548	63504	28212	145877	130112	21337	833	11045	0
8/2/2011 - 8/31/2011	861764	168715	62962	1712	145361	50326	52849	25384	122355	105998	18425	786	10136	0
9/1/2011 - 9/29/2011	691464	165372	1404	1395	176570	52440	41543	24711	116222	98791	18091	862	9500	0
9/30/2011 - 10/23/2011	518096	116021	1157	1156	128973	37802	35532	20217	94408	71421	15159	792	6876	0
10/24/2011 - 11/23/2011	652937	7013	180019	111849	7659	54976	46737	25232	108401	92380	19903	1171	10308	0
11/24/2011 - 12/21/2011	547871	49266	33340	108475	62737	47195	37984	23999	85201	82760	18538	816	10455	0
12/22/2011 - 1/22/2012	612357	102990	110953	61261	2221	58858	38708	29144	95731	91129	20780	902	15544	0
1/23/2011 - 2/22/2012	626486	1514	190126	97287	1494	46977	48077	28366	100617	91785	20203	689	13914	0
2/23/2011 - 3/22/2012	583266	1426	182236	89012	1408	45526	38472	26490	93254	86296	19178	818	11915	0

Cambridge Water Treatment Plant Monthly Electric Consumption in kWh

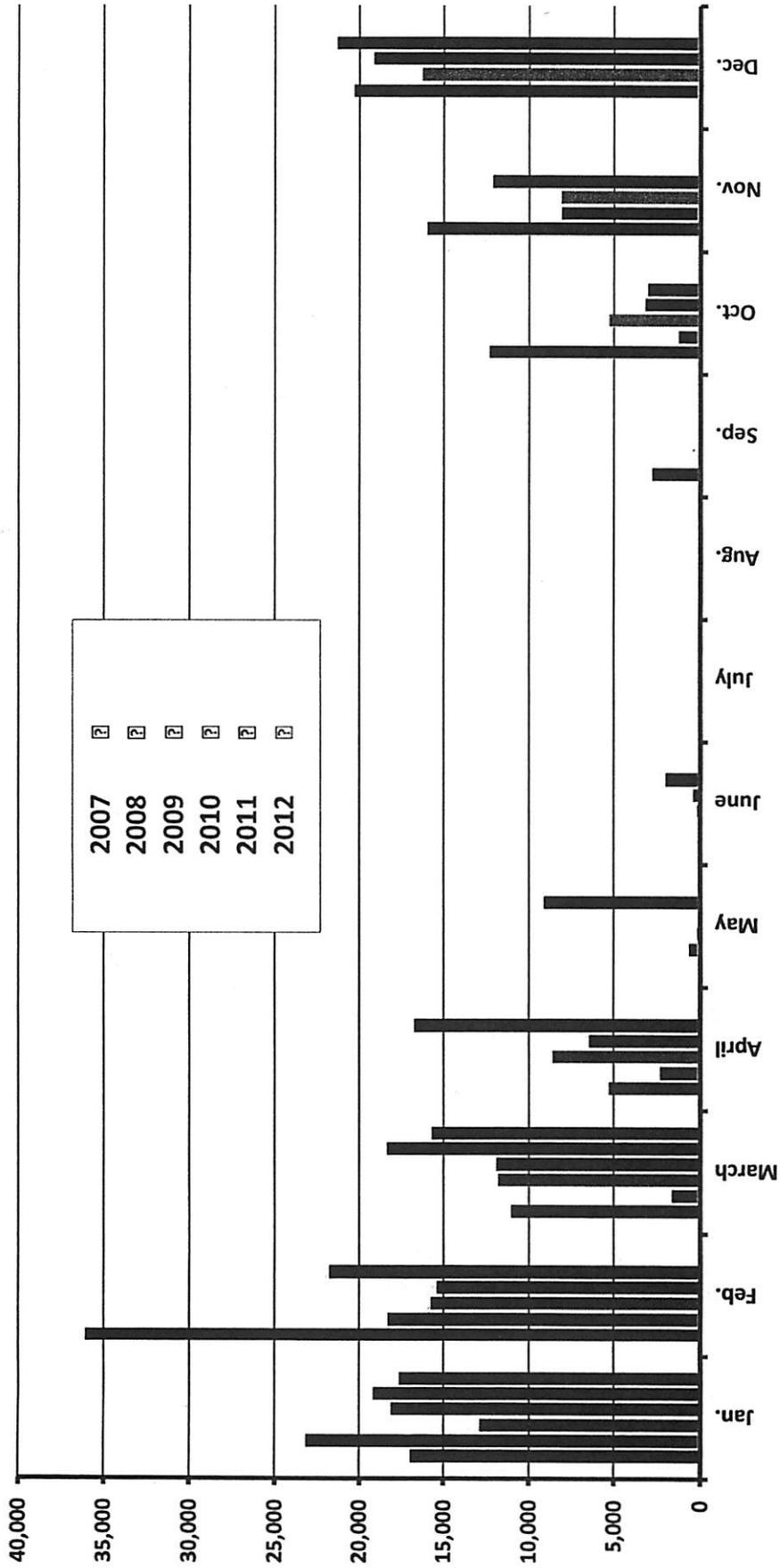
Data Generated From NStar's Monthly Readings



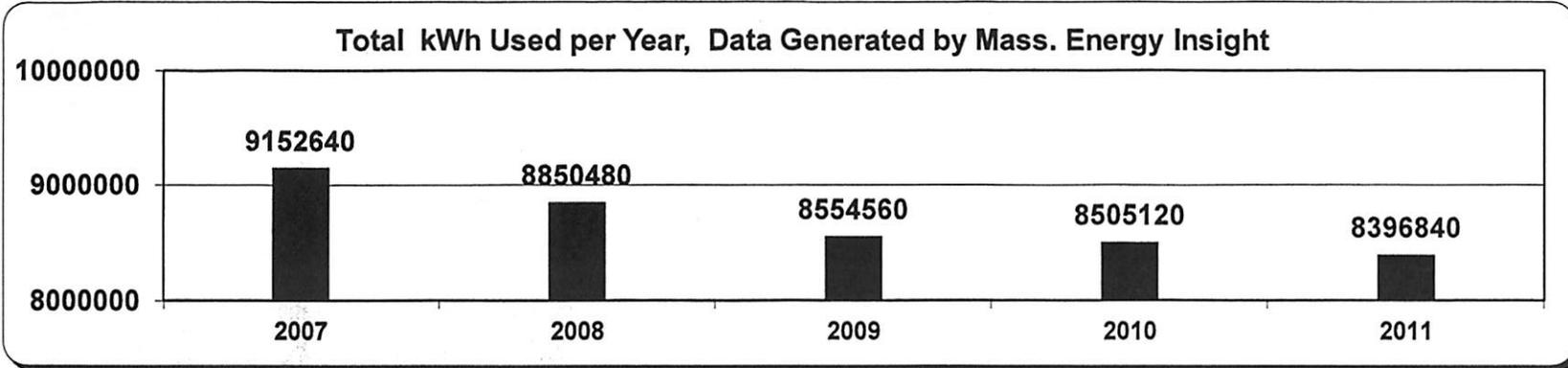
Cambridge Water Treatment Plant Daily Electric Consumption in kWh per Day, Data Generated From NStar's Monthly Readings



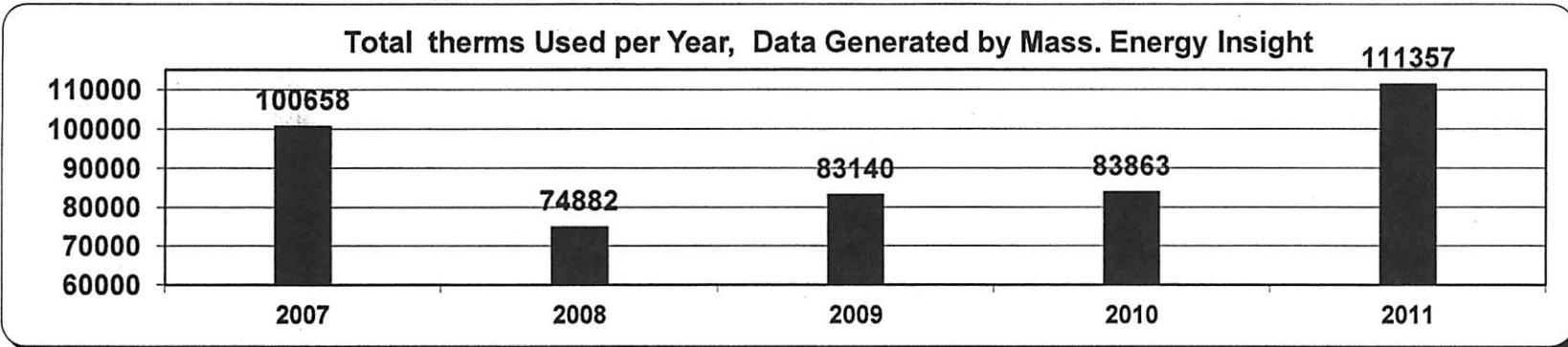
Cambridge Water Treatment Plant Monthly Natural Gas Consumption in therms, Data Generated by Mass. Energy Insight



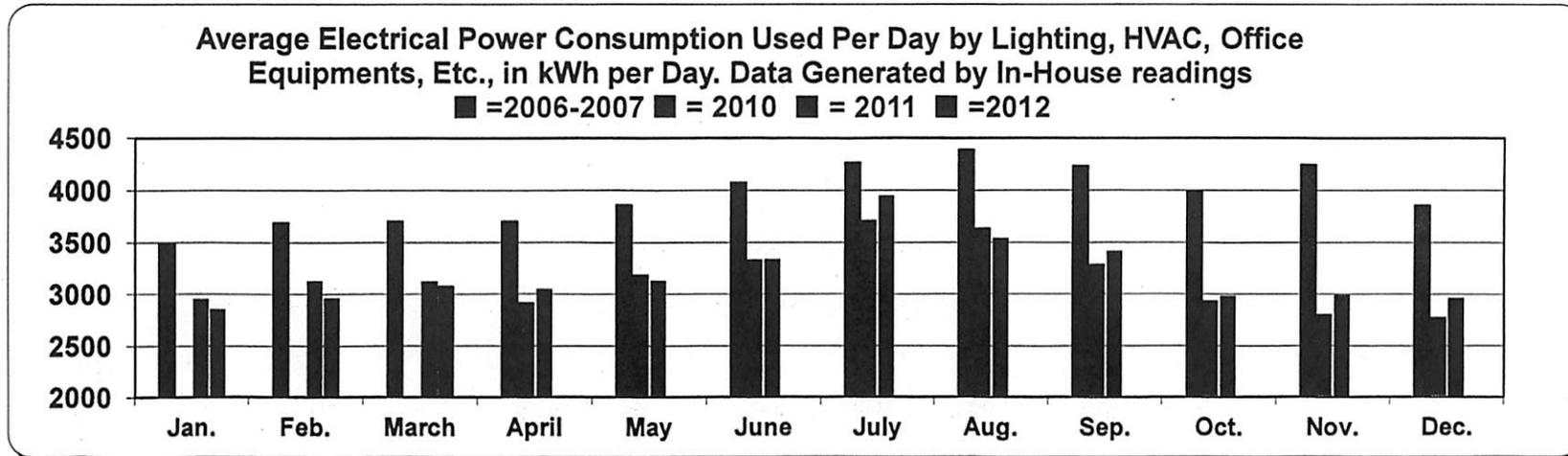
Total Electrical Power Consumption, in kWh per Year, Data Generated by Mass. Energy Insight



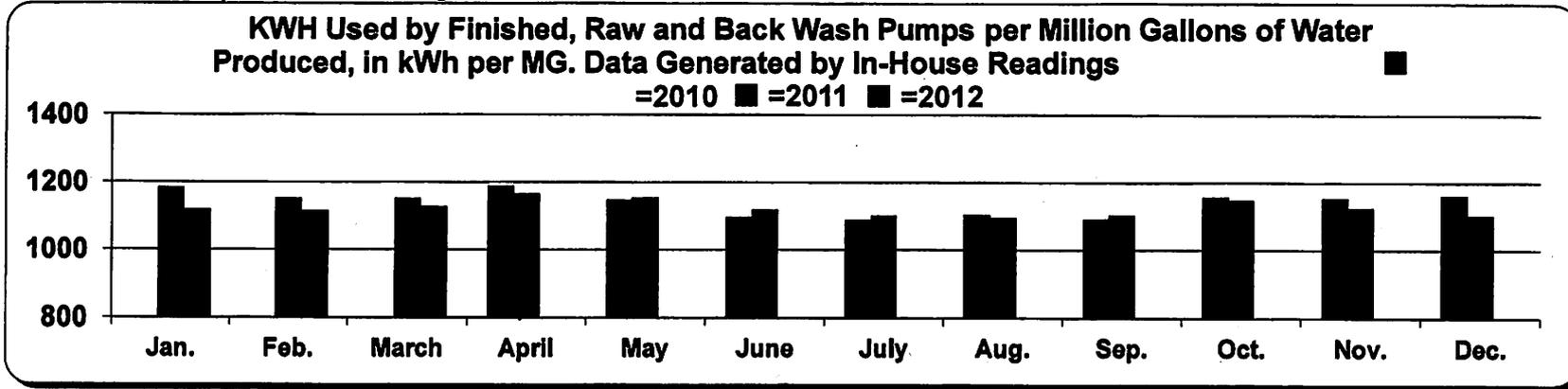
Total Natural Gas Consumption, in therms per Year, Data Generated by Mass. Energy Insight



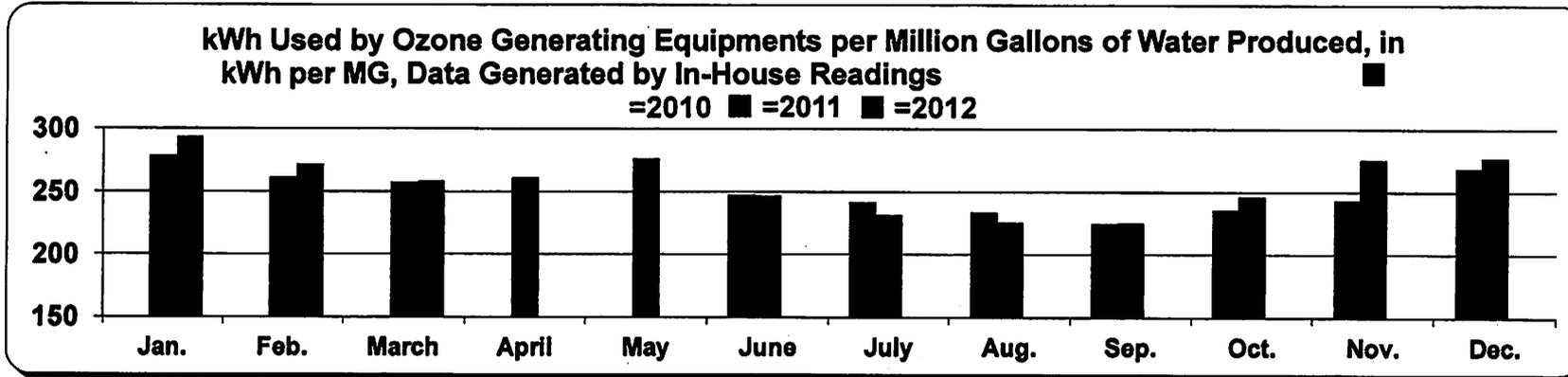
Average Electrical Power Used per Day by Lighting, HVAC, Office Equipments, Etc., in kWh per Day. Data Generated by In-House Readings



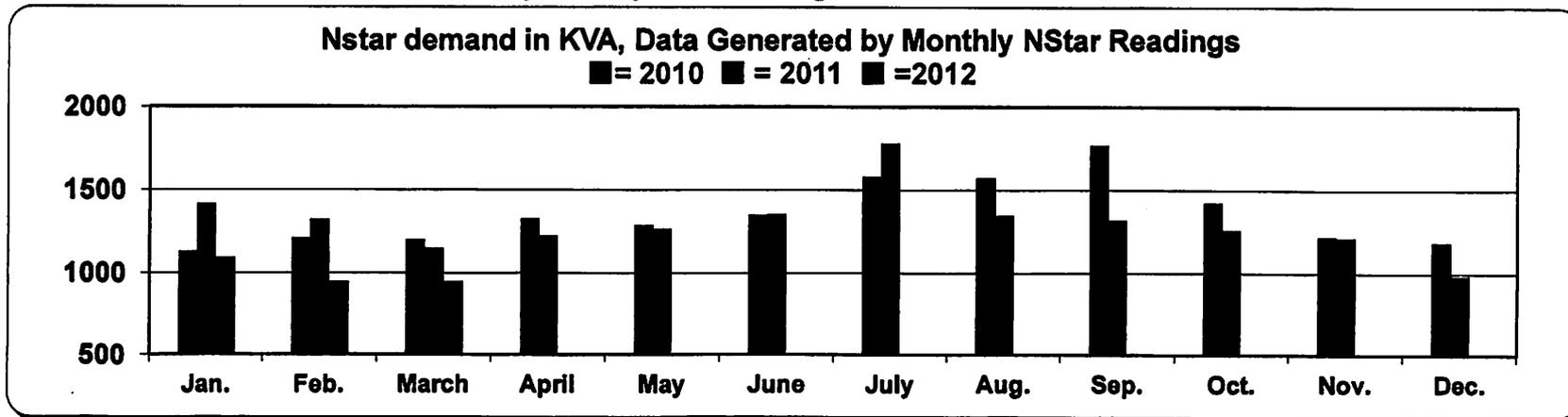
**Electrical Power Used by Finished, Raw and Back Wash Pumps per Million Gallons of Water Produced, in kWh per MG.
Data Generated by In-House Readings**



**Electrical Power Used by Ozone Generating Equipments per Million Gallons of Water Produced, in kWh per MG
Data Generated by In-House Readings**



Nstar demand in KVA, Data Generated by Monthly Nstar readings



Facility	Walter J. Sullivan Water Treatment Plant
Account #	1149 886 0060
Load Zone:	Nema
Rate	LG-TOU (70) G-3
Year:	2012

NSTAR BILL

2012	Meter Read Date	Prior Read Date	Days in Month	Peak Hours	Peak kWhs	Shoulder (Low A) kWhs	Off-Peak (Low B) kWhs	Total kWhs	kWh Cost	Peak kVA	Power Factor	Demand Charges	NGRID Total
Jan	12/22/2011	1/24/2012	33	4pm-9pm M-F	85,946	189,111	371,023	646,080	\$6,982	1090	99.9%	\$10,692	\$17,764
Feb	1/24/2012	2/23/2012	30	4pm-9pm M-F	80,760	191,973	350,787	623,520	\$7,002	943	99.9%	\$9,117	\$16,209
Mar	2/23/2012	3/23/2012	29	9am-6pm M-F	100,514	152,910	342,016	595,440	\$6,687	943	99.8%	\$9,117	\$15,894
Apr			0	9am-6pm M-F				0					\$90
May			0	9am-6pm M-F				0					\$90
Jun			0	9am-6pm M-F				0					\$90
Jul			0	9am-6pm M-F				0					\$90
Aug			0	9am-6pm M-F				0					\$90
Sep			0	9am-6pm M-F				0					\$90
Oct			0	9am-6pm M-F				0					\$90
Nov			0	4pm-9pm M-F				0					\$90
Dec			0	4pm-9pm M-F				0					\$90
Totals			92		267,220	533,994	1,063,826	1,865,040	\$20,671	992	100%	\$28,926	\$50,677

TransCanada Bill

2012	Meter Read Date	Prior Read Date	Days in Month	Approximate Peak Hours	Contract Price	RMR	Congestion	Capacity	Total TransCanada Bill	Supply Cost/kWh
Jan	12/22/2011	1/24/2012	33	12pm-5pm	\$55,821	\$0	\$0	\$4,898	\$60,719	\$0.0940
Feb	1/24/2012	2/23/2012	30	12pm-5pm	\$53,872	\$0	\$0	\$4,681	\$58,553	\$0.0939
Mar	2/23/2012	3/23/2012	29	12pm-5pm					\$0	\$0.0000
Apr			0	12pm-5pm					\$0	#DIV/0!
May			0	12pm-5pm					\$0	#DIV/0!
Jun			0	12pm-5pm					\$0	#DIV/0!
Jul			0	12pm-5pm					\$0	#DIV/0!
Aug			0	12pm-5pm					\$0	#DIV/0!
Sep			0	12pm-5pm					\$0	#DIV/0!
Oct			0	12pm-5pm					\$0	#DIV/0!
Nov			0	12pm-5pm					\$0	#DIV/0!
Dec			28	12pm-5pm					\$0	\$0.0938
Totals			120		\$109,693	\$0	\$0	\$9,579	\$119,272	#DIV/0!

Total TransCanada and Nstar Cost	
Total Cost	Total Cost/kWh
\$78,483	\$0.121
\$74,762	\$0.120
\$15,894	\$0.027
\$90	#DIV/0!
\$169,949	#DIV/0!

Facility	Walter J. Sullivan Water Treatment Plant
Account #	1149 886 0080
Load Zone:	Nema
Rate	LG-TOU (70) G-3
Year:	2011

NSTAR BILL													
2011	Meter Read Date	Prior Read Date	Days in Month	Peak Hours	Peak kWhs	Shoulder (Low A) kWhs	Off-Peak (Low B) kWhs	Total kWhs	kWh Cost	Peak kVA	Power Factor	Demand Charges	NGRID Total
Jan	12/23/2010	1/23/2011	31	4pm-9pm M-F	91,395	187,587	381,738	660,720	\$3,951	1413	98.0%	\$14,223	\$18,729
Feb	1/23/2011	2/22/2011	30	4pm-9pm M-F	103,225	200,090	364,845	668,160	\$4,584	1317	94.0%	\$13,250	\$17,924
Mar	2/22/2011	3/23/2011	29	9am-6pm M-F	126,207	160,645	346,508	633,360	\$4,344	1141	99.0%	\$11,402	\$15,836
Apr	3/23/2011	4/24/2011	32	9am-6pm M-F	185,390	124,102	398,508	708,000	\$4,857	1216	99.8%	\$12,190	\$17,137
May	4/24/2011	5/23/2011	29	9am-6pm M-F	181,272	121,124	358,564	660,980	\$4,534	1259	100.0%	\$11,591	\$16,215
Jun	5/23/2011	6/22/2011	30	9am-6pm M-F	206,965	137,787	395,888	740,640	\$5,081	1348	100.0%	\$13,576	\$18,747
Jul	6/22/2011	7/24/2011	32	9am-6pm M-F	222,852	153,880	491,828	868,560	\$7,795	1778	100.0%	\$18,091	\$25,976
Aug	7/24/2011	8/23/2011	30	9am-6pm M-F	217,450	140,823	418,847	777,120	\$7,522	1339	100.0%	\$13,481	\$21,093
Sep	8/23/2011	9/22/2011	30	9am-6pm M-F	207,031	135,775	393,994	736,800	\$7,132	1314	100.0%	\$13,219	\$20,441
Oct	9/22/2011	10/24/2011	32	9am-6pm M-F	181,799	128,815	408,946	717,560	\$7,013	1252	100.0%	\$12,568	\$19,671
Nov	10/24/2011	11/24/2011	31	4pm-9pm M-F	118,402	178,328	362,310	659,040	\$6,379	1205	100.0%	\$12,074	\$18,543
Dec	11/24/2011	12/22/2011	28	4pm-9pm M-F	73,888	167,968	324,064	565,920	\$5,478	978	99.6%	\$9,691	\$15,259
Totals			364		1,915,876	1,834,924	4,648,040	8,396,840	\$68,670	1,297	99%	\$155,356	\$225,571

TransCanada Bill										
2011	Meter Read Date	Prior Read Date	Days in Month	Approximate Peak Hours	Contract Price	RMR	Congestion	Capacity	Total TransCanada Bill	Total Supply Cost/kWh
Jan	12/23/2010	1/23/2011	31	12pm-5pm	\$59,762	\$0	-\$364	\$4,912	\$64,310	\$0.0973
Feb	1/23/2011	2/22/2011	30	12pm-5pm	\$60,435	\$0	-\$416	\$5,110	\$65,129	\$0.0975
Mar	2/22/2011	3/23/2011	29	12pm-5pm	\$57,287	\$0	-\$168	\$4,714	\$61,833	\$0.0976
Apr	3/23/2011	4/24/2011	32	12pm-5pm	\$64,039	\$0	-\$169	\$5,192	\$69,062	\$0.0975
May	4/24/2011	5/23/2011	29	12pm-5pm	\$59,783	\$65	\$129	\$4,632	\$64,609	\$0.0978
Jun	5/23/2011	6/22/2011	30	12pm-5pm	\$66,991	\$0	-\$430	\$4,139	\$70,700	\$0.0955
Jul	6/22/2011	7/24/2011	32	12pm-5pm	\$78,561	\$0	-\$132	\$4,115	\$82,544	\$0.0950
Aug	7/24/2011	8/23/2011	30	12pm-5pm	\$67,143	\$0	\$0	\$3,996	\$71,139	\$0.0915
Sep	8/23/2011	9/22/2011	30	12pm-5pm	\$63,660	\$2	\$0	\$4,339	\$68,001	\$0.0923
Oct	9/22/2011	10/24/2011	32	12pm-5pm	\$62,601	\$849	\$0	\$4,749	\$68,199	\$0.0950
Nov	10/24/2011	11/24/2011	31	12pm-5pm	\$56,941	\$4	\$0	\$4,681	\$61,626	\$0.0935
Dec	11/24/2011	12/22/2011	28	12pm-5pm	\$48,895	\$0	\$0	\$4,178	\$53,073	\$0.0938
Totals			364		\$748,098	\$920	-\$1,550	\$54,757	\$800,225	\$0.095

Total TransCanada and Nstar Cost	
Total Cost	Total Cost/kWh
\$83,039	\$0.126
\$83,053	\$0.124
\$77,669	\$0.123
\$86,199	\$0.122
\$80,824	\$0.122
\$89,447	\$0.121
\$108,520	\$0.125
\$92,232	\$0.119
\$88,442	\$0.120
\$87,870	\$0.122
\$80,169	\$0.122
\$68,332	\$0.121
\$1,025,796	\$0.122