

DEPARTMENT OF GENERAL SERVICES

Commonwealth of Pennsylvania



Energy & Utility Usage Report

Fiscal Year 2016–2017



FACILITIES
ENGINEERING
INSTITUTE



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PENN STATE FACILITIES ENGINEERING INSTITUTE

OUR MISSION

To merit the public trust by meeting customer facility needs through engineering, information management, education, and applied research while exploring new and innovative ways to exceed customer expectations.

OUR VISION

Penn State Facilities Engineering Institute will impart significant value to the services provided to their customers, thereby earning their respect and enhancing Penn State's tradition of excellence.

Director

John Hajduk, MBA

Associate Director

Mark Bodenschatz, PE, CSSP

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EXECUTIVE SUMMARY

The Penn State Facilities Engineering Institute (PSFEI) Energy Team comprised of Energy Team Manager Kurt Homan; Energy Management Consultants Kevin Dean, Scott Harford, Paul Meister, and Devin Pennebaker; and Programmer/Analysts Diane Haldeman and Sophia Mazurczyk, provides the Pennsylvania Department of General Services (DGS) with essential energy services. These services include electricity and natural gas procurement and demand-side energy management. In support of these services, the Energy Team performs database development and management, education, marketplace research and tracking, and assistance with virtually all energy and utility issues. PSFEI Director John Hajduk and Associate Director Mark Bodenschatz oversee all activities of the Institute and are involved in the critical aspects of services to DGS.

PSFEI supports a DGS energy portfolio that covers 7,633 electric and 952 natural gas accounts. During fiscal year 2016–2017, PSFEI supported the Commonwealth of Pennsylvania’s (Commonwealth) web-based energy procurement activities by conducting electricity and natural gas commodity procurement events under the direction of the DGS Bureau of Procurement. Supply contracts were solicited through six electricity bidding events that included 4,886 accounts and resulted in \$3.7 million in projected annual avoided costs versus the utility-issued price to compare. Six natural gas procurement events were held for twenty-eight accounts resulting in projected annual avoided costs of \$4.3 million when compared to natural gas utility sales service tariff rates.

Since 1998, PSFEI’s energy procurement services have saved the Commonwealth \$204 million in energy costs compared to utility tariff costs. The Energy Procurement section of this report presents detailed information about energy procurement activities.

In addition to the avoided energy costs, notable accomplishments during the year included:

- Highlighting the benefits of an enterprise utility bill management system with advanced energy analytics that spans the entire Commonwealth portfolio.
- Securing long-term energy supplier contracts that met or reduced budget projections through strategic energy procurement planning meetings and bid event scheduling.
- Diligently monitoring natural gas markets to time procurement and secure excellent natural gas contract pricing.
- Supporting DGS Guaranteed Energy Savings Act (GESA) program by visiting four Commonwealth facility sites, preparing reports identifying energy-saving project opportunities, providing assistance for three projects with ongoing activities, and attending a GESA update meeting held for the benefit of Commonwealth agencies.

Energy and utility costs for DGS facilities increased by \$708,112 (5%) from the previous fiscal year. Overall energy use reduced by approximately 32,900 million British thermal units (MMBtu) (5%). The abundance of indigenous Marcellus Shale gas and low market pricing provided the Commonwealth with a supply of low-cost energy; however, a marked increase in water consumption and cost escalations built into the Lancaster County Solid Waste Management Authority power purchase agreement

impacted total utility costs for all DGS facilities. Purchased steam energy from NRG Energy Center Harrisburg increased by 5%. The unit cost of steam increased by 3.7%.

PSFEI conducted a comparison of Commonwealth buildings to industry averages using the Commercial Buildings Energy Consumption Survey (revised in December 2012). The average site Energy Use Intensity (EUI) for an office building in the U.S. Northeast region was 93,900 British thermal units per square foot (Btu/sqft). The average Commonwealth building site EUI is 78,590 Btu/sqft, 16% below the national average and 5% less than last year.

The Utility Summary section of this report provides information regarding utility usage and costs. Detailed utility usage and cost information by building is presented in the DGS Energy and Utility Usage section. Both sections have graphical and tabular comparisons of facilities and narrative descriptions.

The Energy Procurement section presents electricity and natural gas procurement activities and market commentaries and analysis. The Summary of Energy Services section provides a summary of the activities and services provided by PSFEI during fiscal year 2016–2017.

The Education section presents an overview of the educational opportunities offered by PSFEI and attendance by DGS personnel.

UTILITY SUMMARY

The Utility Summary section presents utility usage by fuel, provides six-year historical information (unless otherwise stated), compares overall use by building using a site-based Energy Use Intensity (EUI), and benchmarks buildings by their utility cost per square foot.

CONSUMPTION AND COSTS

The Department of General Services (DGS) energy and water cumulative costs totaled over \$15.1 million during fiscal year 2016–2017, an increase of 4.9% from the previous fiscal year. The 2016–2017 winter was 4% milder than the prior year, contributing to a 19% decrease in natural gas energy use. Steam use increased 4.5%.

Thermal energy unit pricing increased during the fiscal year. Natural gas unit costs increased by 14.5% and purchased steam unit costs increased by 3.7%. Electricity use dropped by 5% (6.2 million kilowatt-hours [kWh]) while unit cost increased 4.7% (\$0.34 per kWh), largely the result of transmission cost increases and escalations built into the power purchase agreement (PPA) with the Lancaster County Solid Waste Management Authority (LCSWMA). Water consumption increased by 30% and water cost increased by 28%.

Table 1. Consumption and Costs 2016–2017

Utility	Annual Consumption	Unit Cost	Annual Cost
Electricity	113,866,586 kWh	7.497 ¢/kWh	\$8,536,888
Natural Gas	75,228 mcf	\$7.17 /mcf	\$539,482
Steam	146,833 mlbs	\$24.96 /mlbs	\$3,665,242
Water/Sewer	111,393 mgal	\$21.49 /mgal	\$2,394,229
		Total	\$15,135,841

AVOIDED COSTS

During fiscal year 2016–2017, PSFEI helped DGS and other agencies avoid over \$4.5 million in projected annual electricity and natural gas expenditures as compared to utility-issued, price to compare costs.

Table 2. Avoided Energy Costs 2016–2017

Energy Events	Avoided Costs
Electricity Procurement (Annual Savings)	\$3,685,542
Natural Gas Procurement (Annual Savings)	\$4,304,130
Total	\$7,989,672

DGS SIX-YEAR ENERGY CONSUMPTION AND COSTS

Charts 1 and 2 illustrate energy costs and consumption trends for electricity, steam, and natural gas for DGS facilities over the past six fiscal years. During fiscal year 2016–2017, energy costs increased by \$181,013 or 1.4% from the previous fiscal year. Overall energy use decreased from the previous year by 32,885 million British thermal units (MMBtu) or 5%. The Electricity and Natural Gas Procurement sections provide additional information regarding energy costs and market discussion.

Chart 1. Annual Energy Costs Trend

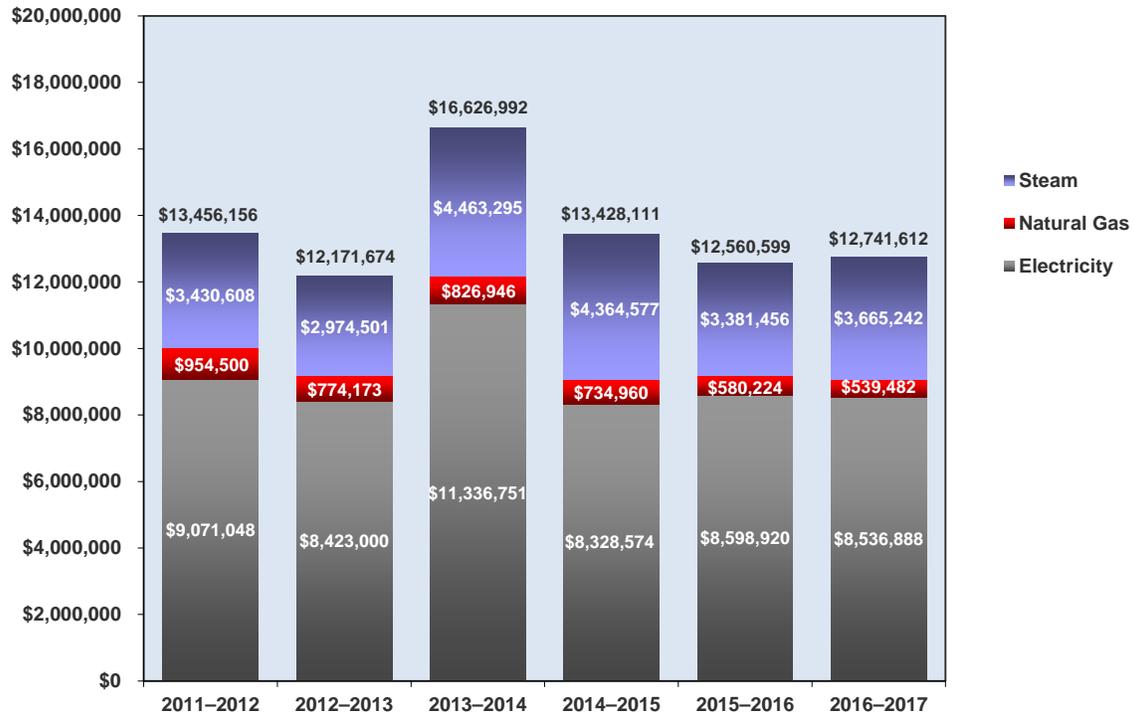


Chart 2. Annual Consumption Trend

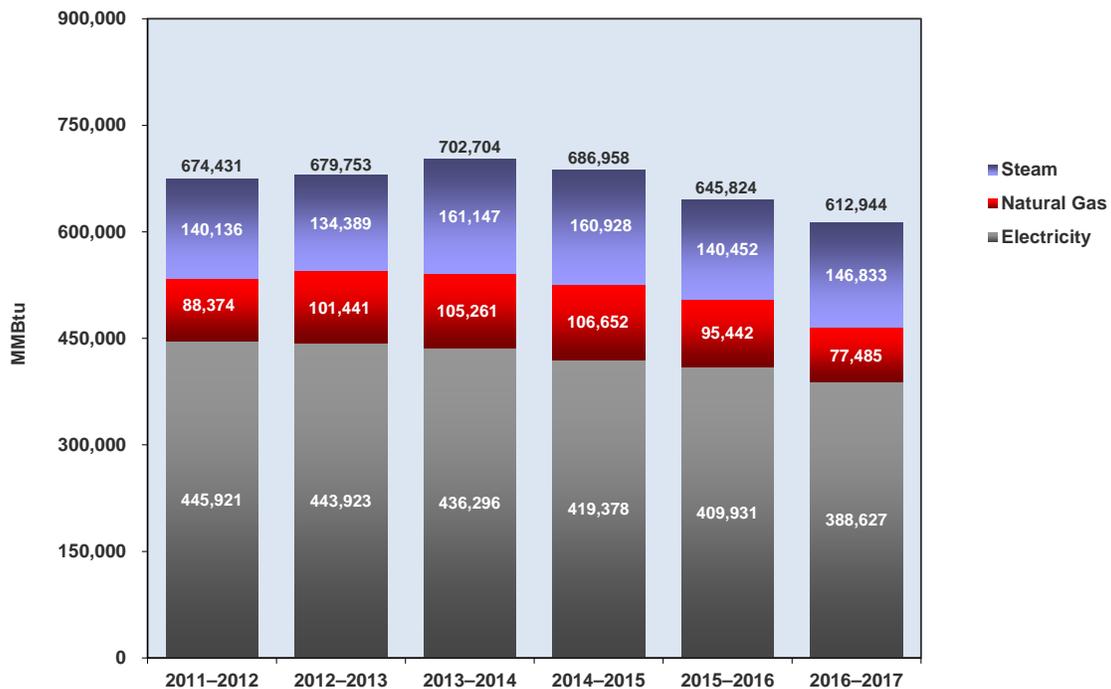


Table 3 provides a detailed agency-level view of energy use and cost information for the past six fiscal years. Total energy use for fiscal year 2016–2017 was 5% lower than the previous fiscal year.

Actual electricity consumption decreased by 6,243,613 kWh (5.2%), which was primarily due to the continued reduction of electricity consumed at the DGS Annex Complex. While the cooling season was 23% warmer than the previous fiscal year, the ongoing conversion to light-emitting diode (LED) lighting contributed to the overall reduction of electricity consumption. Electricity cost decreased \$62,032 (0.7%), notably less than the consumption reduction largely due to the transmission cost increases and price escalations built into the LCSWMA PPA.

Purchased steam costs increased by \$283,786 (8.4%). Steam consumption increased by 6,381 thousand pounds (mlbs) (4.5%); however, the winter was 4% less severe than the previous year. The largest increase occurred at the Main Capitol. The overall steam unit cost increased by \$0.88 per mlb (3.6%).

Natural gas consumption decreased by 19% or 17,434 thousand cubic feet (mcf) and costs decreased \$40,742 (7%). The most significant consumption reductions occurred at the DGS Annex Complex and Rachel Carson State Office Building. The average natural gas unit cost increased to \$7.17 per mcf or 14.5%. For an expanded summary describing the natural gas market, refer to the Natural Gas Market section under Energy Procurement.

Table 3. Annual Energy Consumption and Costs Trend

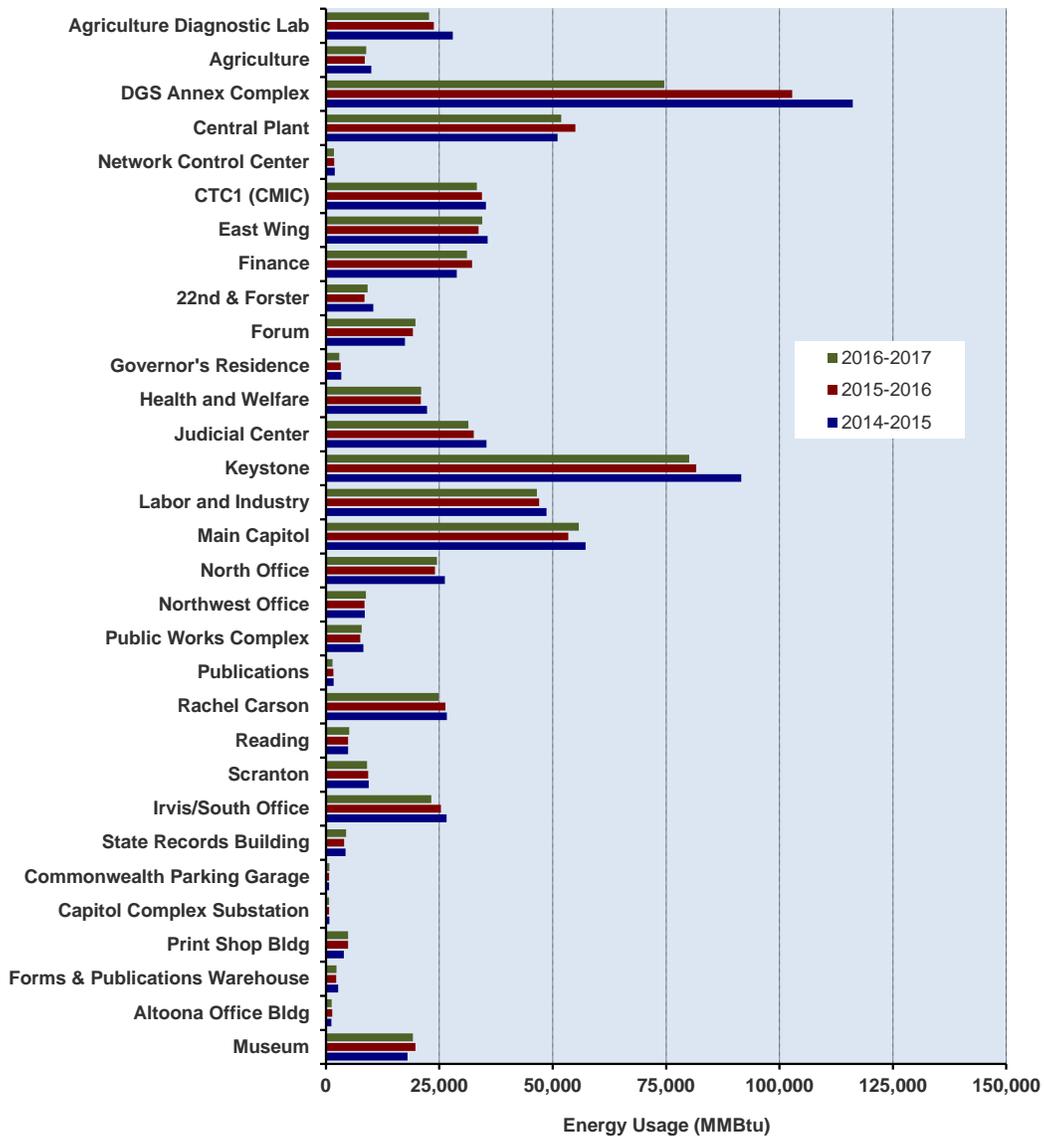
Energy Cost	Units	2011–2012	2012–2013	2013–2014	2014–2015	2015–2016	2016–2017
Electricity	\$	\$9,071,048	\$8,423,000	\$11,336,751	\$8,328,574	\$8,598,920	\$8,536,888
Natural Gas	\$	\$954,500	\$774,173	\$826,946	\$734,960	\$580,224	\$539,482
Steam	\$	\$3,430,608	\$2,974,501	\$4,463,295	\$4,364,577	\$3,381,456	\$3,665,242
Total	\$	\$13,456,156	\$12,171,674	\$16,626,992	\$13,428,111	\$12,560,599	\$12,741,612
Unit Energy Cost/MMBtu							
Electricity	\$/MMBtu	\$20.34	\$18.97	\$25.98	\$19.86	\$20.98	\$21.97
Natural Gas	\$/MMBtu	\$10.80	\$7.63	\$7.86	\$6.89	\$6.08	\$6.96
Steam	\$/MMBtu	\$24.48	\$22.13	\$27.70	\$27.12	\$24.08	\$24.96
Weighted Average	\$/MMBtu	\$19.95	\$17.91	\$23.66	\$19.55	\$19.45	\$20.79
Energy Consumption							
Electricity	MMBtu	445,921	443,923	436,296	419,378	409,931	388,627
Natural Gas	MMBtu	88,374	101,441	105,261	106,652	95,442	77,485
Steam	MMBtu	140,136	134,389	161,147	160,928	140,452	146,833
Total	MMBtu	674,431	679,753	702,704	686,958	645,824	612,944
Unit Fuel Cost							
Electricity	\$/kWh	\$0.0694	\$0.0648	\$0.0887	\$0.0678	\$0.0716	\$0.0750
Natural Gas	\$/mcf	\$11.02	\$7.86	\$8.09	\$7.10	\$6.26	\$7.17
Steam	\$/mlb	\$24.48	\$22.13	\$27.70	\$27.12	\$24.08	\$24.96
Fuel Consumption							
Electricity	kWh	130,653,605	130,068,253	127,833,611	122,876,526	120,108,635	113,866,586
Natural Gas	mcf	86,641	98,486	102,195	103,545	92,662	75,228
Steam	mlbs	140,136	134,389	161,147	160,928	140,452	146,833

Note: Historical data for fiscal years 2012–2013 and 2013–2014 were updated to reflect adding four buildings: Altoona Office Building, Forms & Publications, Print Shop, and Capitol Complex Substation. Electricity totals include Northwest Office Building.

ENERGY USAGE

Chart 3 shows the total usage in MMBtu for each DGS facility for the past three fiscal years. The largest users were the DGS Annex Complex (although its use has declined significantly due to reduced activity) and the Keystone Building. Energy consumption reduced slightly or remained the same from the previous year at most facilities, except for the Main Capitol, which experienced a slight increase. The numeric values of Chart 3 are found in Table 4 on page 5.

Chart 3. Annual Energy Usage Trend



ENERGY USE INTENSITY

Table 4 and Charts 4A and 4B on page 6, show the EUI for each building for the past three fiscal years. The EUI is measured in annual British thermal units per square foot (Btu/sqft) and provides a normalized method to compare building energy use. The EUI is used throughout the energy industry to portray a facility's energy intensity. Chart 4B shows that the Agriculture Diagnostic Lab and CTC1 (CMIC) exhibited the highest energy intensities because of their concentrated end-use equipment and heating, ventilating, and air conditioning (HVAC) loads dictated by building operations. Their energy use is slightly declining over the years displayed.

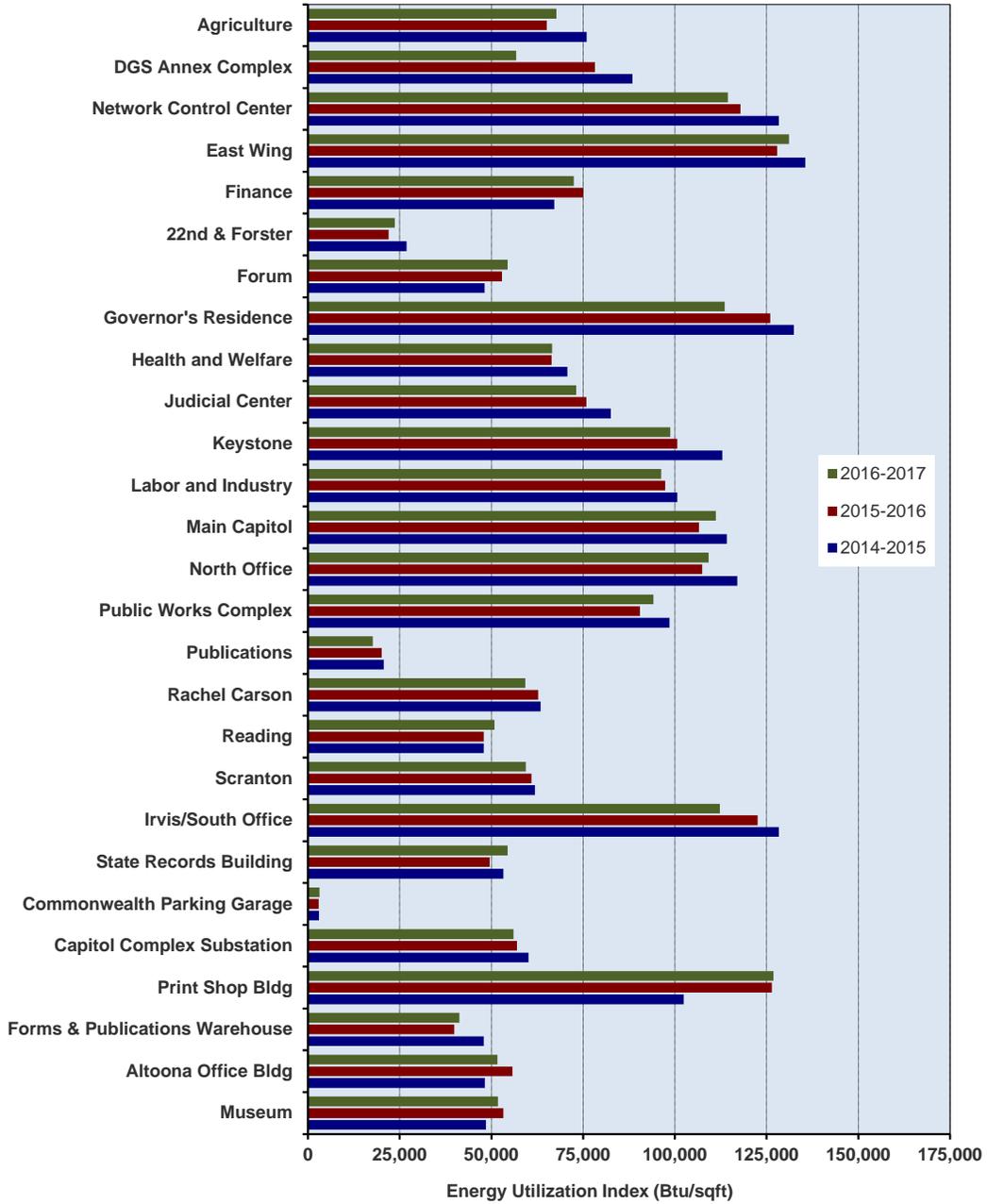
During fiscal year 2016–2017, building EUI remained relatively unchanged. The most significant reductions of energy use occurred at the DGS Annex Complex (24%) and the Governor's Residence (10%).

Table 4. Annual Usage and Energy Intensity Trend

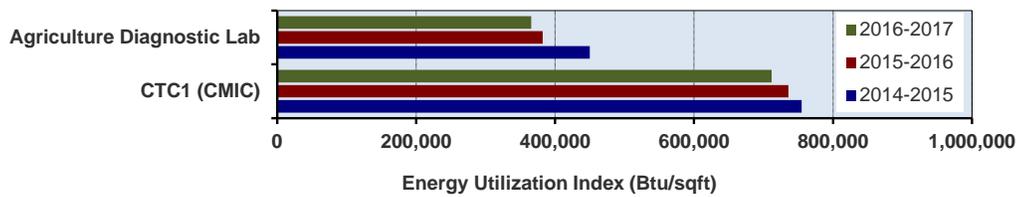
Facility	Total Space (sqft)	2014–2015		2015–2016		2016–2017	
		Btu Usage (MMBtu)	EUI (Btu/sqft)	Btu Usage (MMBtu)	EUI (Btu/sqft)	Btu Usage (MMBtu)	EUI (Btu/sqft)
Publications	81,948	1,692	20,644	1,648	20,112	1,447	17,660
22nd & Forster	388,544	10,449	26,892	8,537	21,972	9,186	23,641
Agriculture	131,391	9,981	75,966	8,553	65,099	8,900	67,738
Agriculture Diagnostic Lab	62,230	27,996	449,877	23,794	382,349	22,742	365,448
CTC1 (CMIC)	46,736	35,273	754,736	34,393	735,895	33,261	711,687
Altoona Office Bldg	24,880	1,199	48,211	1,387	55,751	1,284	51,603
DGS Annex Complex	1,313,571	116,178	88,445	102,784	78,248	74,581	56,777
Fisher Plaza	---	566	---	565	---	552	---
Forms & Publications Warehouse	56,560	2,711	47,928	2,256	39,884	2,332	41,234
Governor's Residence	25,878	3,427	132,422	3,261	126,025	2,939	113,590
Network Control Center	15,400	1,977	128,364	1,815	117,859	1,762	114,446
Print Shop Bldg	38,688	3,962	102,412	4,893	126,462	4,909	126,884
Public Works Complex	83,670	8,247	98,566	7,570	90,470	7,876	94,127
Rachel Carson	420,125	26,641	63,412	26,353	62,726	24,877	59,212
Reading	101,626	4,866	47,878	4,869	47,907	5,166	50,829
Scranton	152,800	9,453	61,862	9,304	60,892	9,079	59,417
State Records Building	81,565	4,346	53,277	4,040	49,536	4,439	54,417
Capitol Complex Buildings¹							
Capitol Complex Substation	12,500	751	60,088	712	56,998	700	56,007
Commonwealth Parking Garage	248,188	735	2,961	732	2,950	778	3,136
East Wing	262,950	35,648	135,568	33,638	127,924	34,483	131,140
Finance	429,521	28,845	67,156	32,213	74,998	31,131	72,478
Forum	362,395	17,434	48,107	19,159	52,868	19,724	54,427
Health and Welfare	315,462	22,307	70,711	20,946	66,398	20,996	66,557
Ivis/South Office	207,138	26,586	128,351	25,389	122,570	23,257	112,279
Judicial Center	429,355	35,426	82,510	32,571	75,861	31,405	73,144
Keystone	811,147	91,597	112,923	81,629	100,634	80,104	98,754
Labor and Industry	483,161	48,648	100,688	47,040	97,358	46,526	96,294
Main Capitol	501,543	57,250	114,148	53,449	106,569	55,746	111,149
Museum	370,442	17,978	48,532	19,734	53,272	19,192	51,808
North Office	223,946	26,205	117,016	24,065	107,458	24,462	109,230
Complex Buildings Total	4,657,748	409,410		391,278		388,504	
Total	7,683,360	678,373		637,299		603,835	
Weighted Average			88,291		82,945		78,590

¹PPL serves the Capitol Complex with one main account. DGS submeters the individual buildings. Central Plant electric energy is distributed to Capitol Complex buildings served by central chilled water on a per square foot basis. The Main Capitol steam metered use and cost is distributed to the Main Capitol, East Wing, North Office, and South Office on a per square foot basis.

Chart 4A. Annual Energy Use Intensity Trend



**Chart 4B. Annual Energy Use Intensity Trend
Agriculture Diagnostic Lab and CTCI (CMIC)**



UTILITY COST PER SQUARE FOOT

Employing a utilities cost per square foot metric provides an additional benchmark to compare buildings of varying sizes and purposes. Components of the total cost include electricity, natural gas, steam, water, and sewer. The utilities cost per square foot values for DGS buildings were generally similar in relation to the EUI except for the cost impact from the increase in water consumed by the East Wing and Main Capitol in fiscal year 2016–2017.

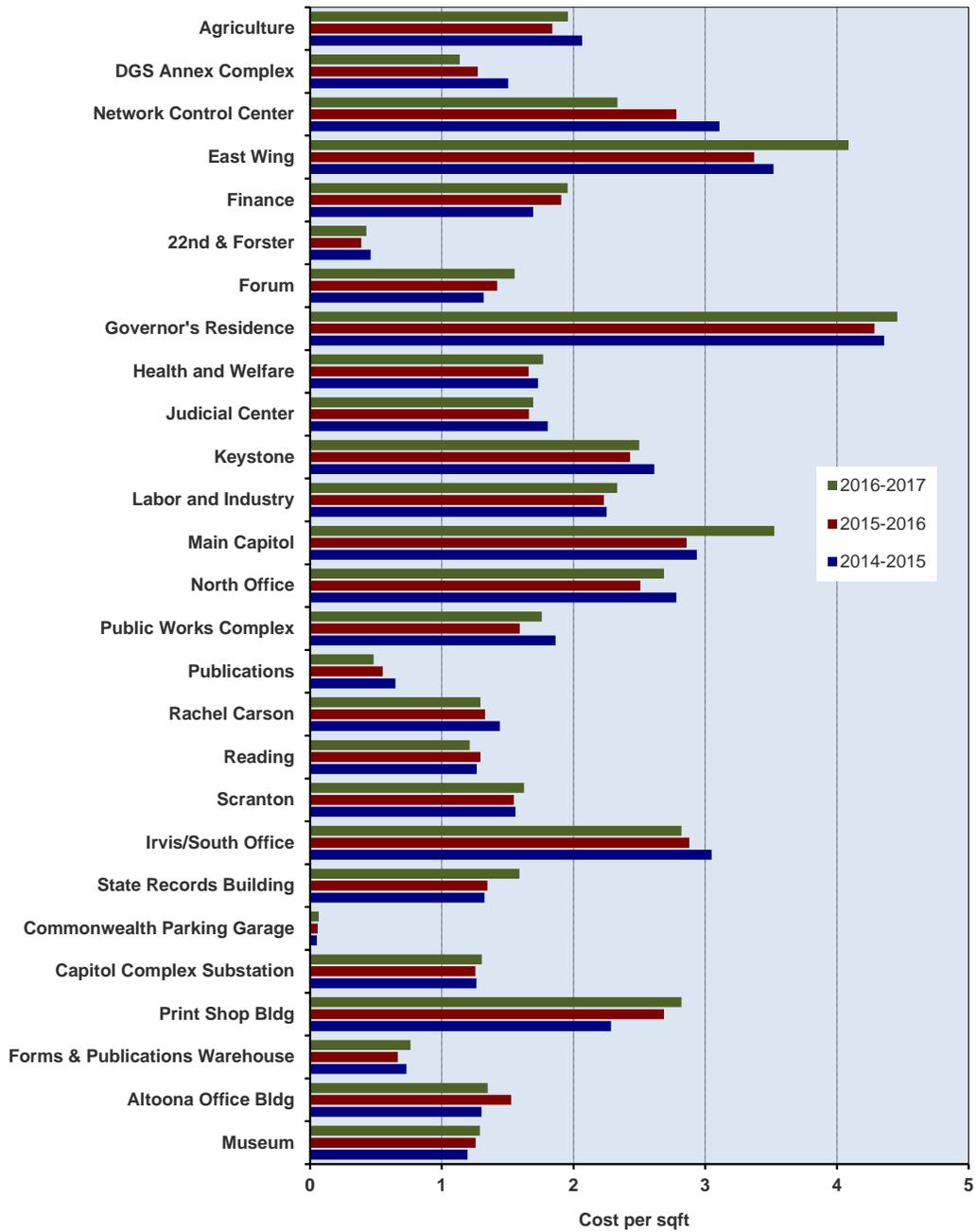
Table 5. Annual Utility Cost per Square Foot Trend

Facility	Total Space (sqft)	2014–2015		2015–2016		2016–2017	
		Cost	\$/sqft	Cost	\$/sqft	Cost	\$/sqft
Publications	81,948	\$53,052	\$0.65	\$45,269	\$0.55	\$39,553	\$0.48
22nd & Forster	388,544	178,724	\$0.46	150,679	\$0.39	165,933	\$0.43
Agriculture	131,391	\$271,392	\$2.07	\$241,655	\$1.84	\$257,111	\$1.96
Agriculture Diagnostic Lab	62,230	\$365,244	\$5.87	\$327,930	\$5.27	\$322,878	\$5.19
CTC1 (CMIC)	46,736	\$734,314	\$15.71	\$689,654	\$14.76	\$725,110	\$15.52
Altoona Office Bldg	24,880	\$32,410	\$1.30	\$37,989	\$1.53	\$33,572	\$1.35
DGS Annex Complex	1,313,571	\$1,977,087	\$1.51	\$1,672,604	\$1.27	\$1,492,825	\$1.14
Fisher Plaza	---	\$35,930	---	\$36,607	---	\$36,080	---
Forms & Publications Warehouse	56,560	\$41,419	\$0.73	\$37,648	\$0.67	\$43,182	\$0.76
Governor's Residence	25,878	\$112,781	\$4.36	\$110,888	\$4.29	\$115,357	\$4.46
Network Control Center	15,400	\$47,847	\$3.11	\$42,824	\$2.78	\$35,925	\$2.33
Print Shop Bldg	38,688	\$88,414	\$2.29	\$103,926	\$2.69	\$109,126	\$2.82
Public Works Complex	83,670	\$155,887	\$1.86	\$133,194	\$1.59	\$147,263	\$1.76
Rachel Carson	420,125	\$605,088	\$1.44	\$558,341	\$1.33	\$543,264	\$1.29
Reading	101,626	\$128,635	\$1.27	\$131,435	\$1.29	\$123,253	\$1.21
Scranton	152,800	\$238,273	\$1.56	\$236,441	\$1.55	\$248,283	\$1.62
State Records Building	81,565	\$108,041	\$1.32	\$109,919	\$1.35	\$129,720	\$1.59
Capitol Complex Buildings¹							
Capitol Complex Substation	12,500	\$15,798	\$1.26	\$15,683	\$1.25	\$16,294	\$1.30
Commonwealth Parking Garage	248,188	\$12,990	\$0.05	\$14,537	\$0.06	\$16,215	\$0.07
East Wing	262,950	\$924,917	\$3.52	\$886,499	\$3.37	\$1,074,887	\$4.09
Finance	429,521	\$727,857	\$1.69	\$818,935	\$1.91	\$840,300	\$1.96
Forum	362,395	\$477,376	\$1.32	\$514,926	\$1.42	\$562,593	\$1.55
Health and Welfare	315,462	\$546,044	\$1.73	\$523,654	\$1.66	\$558,552	\$1.77
Iris/South Office	207,138	\$631,519	\$3.05	\$596,339	\$2.88	\$584,217	\$2.82
Judicial Center	429,355	\$774,372	\$1.80	\$713,109	\$1.66	\$727,244	\$1.69
Keystone	811,147	\$2,120,243	\$2.61	\$1,970,164	\$2.43	\$2,027,867	\$2.50
Labor and Industry	483,161	\$1,088,353	\$2.25	\$1,078,344	\$2.23	\$1,126,073	\$2.33
Main Capitol	501,543	\$1,472,199	\$2.94	\$1,433,846	\$2.86	\$1,767,580	\$3.52
Museum	370,442	\$442,927	\$1.20	\$465,490	\$1.26	\$477,903	\$1.29
North Office	223,946	\$622,982	\$2.78	\$561,674	\$2.51	\$601,531	\$2.69
Complex Buildings Total²	4,657,748	\$9,857,578		\$9,593,200		\$10,381,256	
Total	7,683,360	\$15,032,116		\$14,260,201		\$14,949,692	
Weighted Average			\$1.96		\$1.86		\$1.95

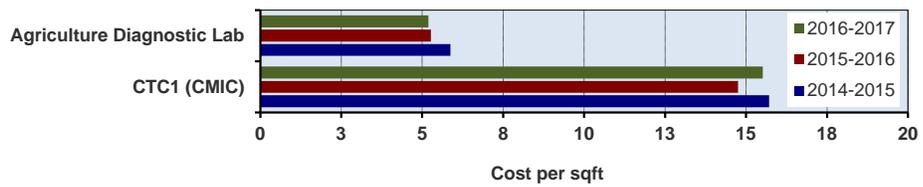
¹PPL serves the Capitol Complex with one main account. DGS submeters the individual buildings. Central Plant electric energy is distributed to the Capitol Complex buildings served by central chilled water on a per square foot basis. The Main Capitol steam metered use and cost is distributed to the Capitol, East Wing, North Office, and South Office on a per square foot basis.

²The Northwest Office Building is excluded from this table because only electricity costs are known. The difference between the total annual costs for fiscal 2016–2017 shown in this table and in Table 1 on page 3 represents the Northwest Office Building's annual electric cost.

Chart 5A. Annual Utility Cost per Square Foot Trend



**Chart 5B. Annual Utility Cost per Square Foot Trend
Agriculture Diagnostic Lab and CTCI (CMIC)**



DGS ENERGY AND UTILITY USAGE

Detailed energy consumption information by building for DGS facilities is presented in this section.

ELECTRICITY USAGE

During fiscal year 2016–2017, DGS facilities consumed 113,866,586 kWh of electricity at a cost of \$8,536,888, averaging a unit cost of \$0.7497 per kWh. This represented a use reduction of 6,243,613 kWh (2%) and a unit cost increase of 5.2% from fiscal year 2015–2016. The unit cost increase was primarily due to the price escalation provisions of the LCSWMA PPA (refer to the Intergovernmental Power Purchase and Sale Agreement section on page 34) and increased transmission charges for the PPL zone.

Table 6. Electricity Usage and Costs 2016–2017

Facility	Account	Utility	Total Space (sqft)	Annual Electricity Consumption					Annual Electricity Costs		
				kWh	kWh/sqft	Peak Demand KW	Peak Demand W/sqft	Average Monthly Load Factor	Cost	\$/kWh	\$/sqft
Publications	1326068018	PPL Utilities	81,948	113,600	1.4	39.0	0.48	0.51	\$9,904	8.719	\$0.12
22nd & Forster	6392068009	PPL Utilities	388,544	1,191,600	3.1	302.0	0.78	0.56	\$95,460	8.011	\$0.25
Agriculture	7499086008	PPL Utilities	131,391	2,556,000	19.5	875.0	6.66	0.44	\$226,953	8.879	\$1.73
Agriculture Diagnostic Lab	4559086014	PPL Utilities	62,230	2,383,800	38.3	550.0	8.84	0.64	\$188,647	7.914	\$3.03
CTC1 (CMC)	5149982011	PPL Utilities	46,736	9,745,500	208.5	1,286.0	27.52	0.89	\$725,110	7.440	\$15.52
Altoona Office Bldg	100009672237	Penelec	24,880	376,176	15.1	140.4	5.64	0.41	\$33,572	8.925	\$1.35
DGS Annex Complex	3690471029	PPL Utilities	---	928	---	2.0	---	0.10	\$370	39.842	---
DGS Annex Complex	7459086015	PPL Utilities	1,313,571	10,319,400	7.9	2,042.0	1.55	0.78	\$832,116	8.064	\$0.63
DGS Annex Complex	9949200005	PPL Utilities	---	220,641	---	---	---	---	\$79,407	35.989	---
Fisher Plaza	0540120009	PPL Utilities	---	161,814	---	---	---	---	\$36,080	22.297	---
Forms & Publications Warehouse	0442069007	PPL Utilities	56,560	211,960	3.7	88.0	1.56	0.33	\$20,379	9.615	\$0.36
Governor's Residence	7819078000	PPL Utilities	25,878	825,800	31.9	---	---	---	\$94,646	11.461	\$3.66
Network Control Center	7479086002	PPL Utilities	15,400	516,400	33.5	117.0	7.60	0.55	\$35,925	6.957	\$2.33
Print Shop Bldg	7791062048	PPL Utilities	38,688	1,321,920	34.2	264.0	6.82	0.64	\$105,495	7.980	\$2.73
Public Works Complex	6372068003	PPL Utilities	83,670	888,000	10.6	283.0	3.38	0.48	\$77,740	8.755	\$0.93
Public Works Complex	8860119006	PPL Utilities	---	1,564	---	---	---	---	\$399	25.506	---
Rachel Carson	6088070004	PPL Utilities	420,125	4,321,800	10.3	1,485.0	3.53	0.44	\$366,995	8.492	\$0.87
Reading	100013480650	MetEd	101,626	1,240,287	12.2	82.9	0.82	2.67	\$97,323	7.847	\$0.96
Scranton	7299129004	PPL Utilities	152,800	2,649,000	17.3	771.0	5.05	0.56	\$221,544	8.363	\$1.45
Scranton	7319129002	PPL Utilities	---	10,456	---	2.0	---	0.60	\$1,118	10.688	---
Scranton	8863773002	PPL Utilities	---	11,305	---	2.0	---	0.60	\$1,242	10.984	---
State Records Center	7235127006	PPL Utilities	81,565	530,100	6.5	156.0	1.91	0.44	\$48,011	9.057	\$0.59
Capitol Complex Buildings¹	4484815085	PPL Utilities									
Capitol Complex Substation	4484815085355	---	12,500	205,124	16.4	---	---	---	\$14,653	7.144	\$1.17
Central Plant	4484815085320	---	3,664,223	15,197,082	4.1	---	---	---	\$1,060,883	6.981	\$0.29
Commonwealth Parking Garage	4484815085352	---	248,188	228,048	0.9	---	---	---	\$16,215	7.110	\$0.07
East Wing	4484815085312	---	262,950	5,311,903	20.2	---	---	---	\$375,294	7.065	\$1.43
Finance	4484815085307	---	429,521	3,492,605	8.1	---	---	---	\$247,176	7.077	\$0.58
Forum	4484815085305	---	362,395	2,281,052	6.3	---	---	---	\$161,216	7.068	\$0.44
Health and Welfare	4484815085308	---	315,462	3,183,486	10.1	---	---	---	\$225,329	7.078	\$0.71
Iris/South Office	4484815085304	---	207,138	3,039,776	14.7	---	---	---	\$214,918	7.070	\$1.04
Judicial Center	4484815085000	---	429,355	5,036,673	11.7	---	---	---	\$356,378	7.076	\$0.83
Keystone	4484815085337	---	811,147	11,951,351	14.7	---	---	---	\$846,261	7.081	\$1.04
Labor and Industry	4484815085309	---	483,161	8,563,525	17.7	---	---	---	\$604,946	7.064	\$1.25
Main Capitol	4484815085301	---	501,543	7,194,077	14.3	---	---	---	\$509,472	7.082	\$1.02
Museum	4484815085311	---	370,442	2,904,130	7.8	---	---	---	\$204,923	7.056	\$0.55
North Office	4484815085303	---	223,946	3,086,343	13.8	---	---	---	\$217,957	7.062	\$0.97
Northwest Office	4484815085101	---	188,819	2,593,360	13.7	---	---	---	\$182,829	7.050	\$0.97
Complex Buildings Total			4,846,567	74,268,535	15.3	15,941	3.29	0.53	\$5,238,451	7.053	\$1.08
Total			7,872,179	113,866,586					\$8,536,888		
Weighted Average					14.5			0.65		7.497	\$1.08

¹PPL serves the Capitol Complex with one main account. DGS submeters the individual buildings.

Note that in Table 6 (page 9) the Reading Office Building’s load factor is 2.67. Load factor is equal to kWh use divided by the product of peak demand times hours of use. A load factor greater than 1 is not possible (the load factor for fiscal year 2015–2016 was 1.21). PSFEI notified DGS regarding this load factor anomaly and recommended that DGS contact the serving utility. Compared to the previous fiscal year, consumption remained similar while demand reduced slightly at most facilities. The DGS Annex Complex peak demand decreased by 25%.

Charts 6 and 7 compare electricity consumption and cost for the previous three fiscal years. Compared to last fiscal year, overall electricity use remained relatively steady, except for a continued significant reduction in use at the DGS Annex Complex.

Chart 6. Annual Electricity Consumption Trend

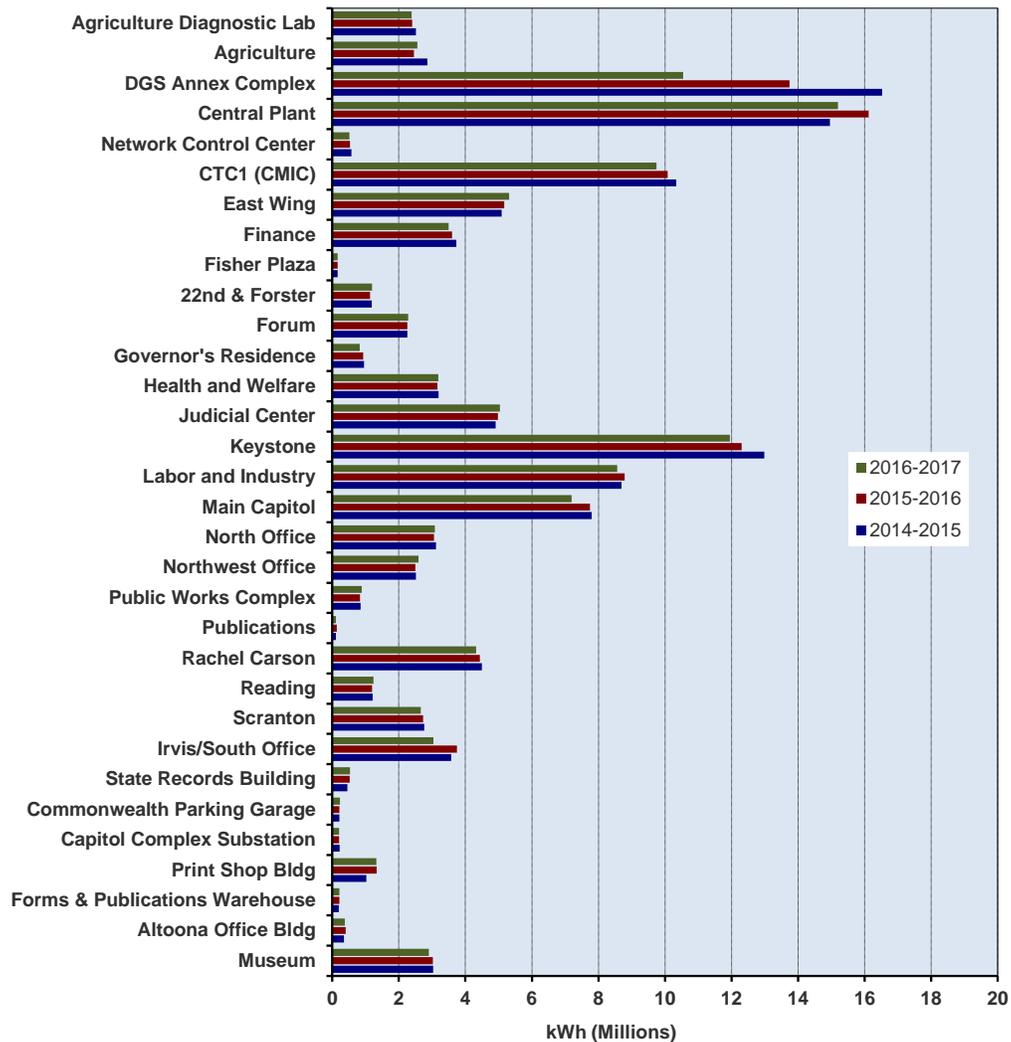
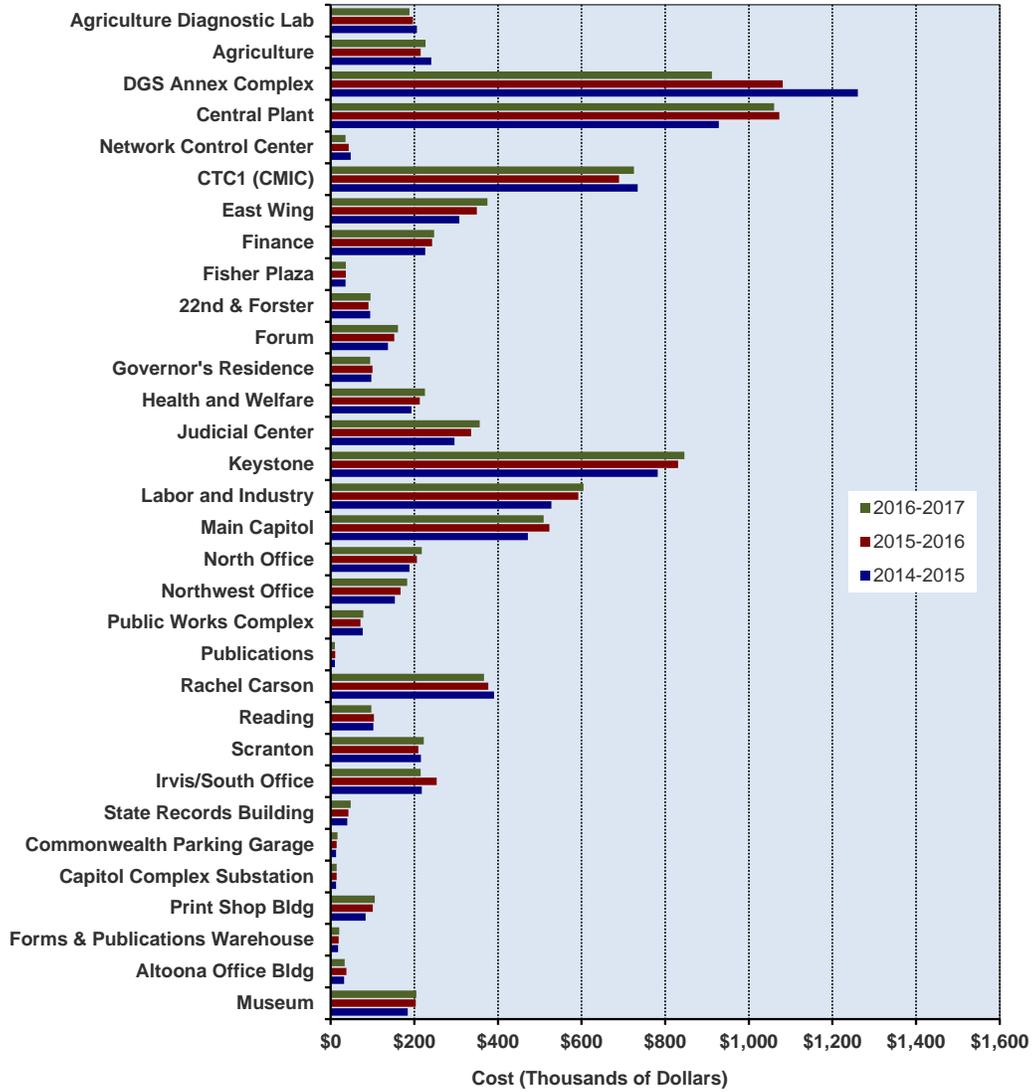


Chart 7. Annual Electricity Costs Trend



NATURAL GAS USAGE

In fiscal year 2016–2017, DGS facilities consumed 75,228 mcf of natural gas, 19% less than fiscal year 2015–2016, due to a slightly milder winter and reduced usage at the DGS Annex Complex. While the DGS Annex Complex consumption continued to decrease from the previous fiscal year, it remained the largest natural gas consumer (49%) of all DGS buildings. Table 7 provides a breakdown of natural gas consumption by facility.

Table 7. Natural Gas Consumption and Costs 2016–2017

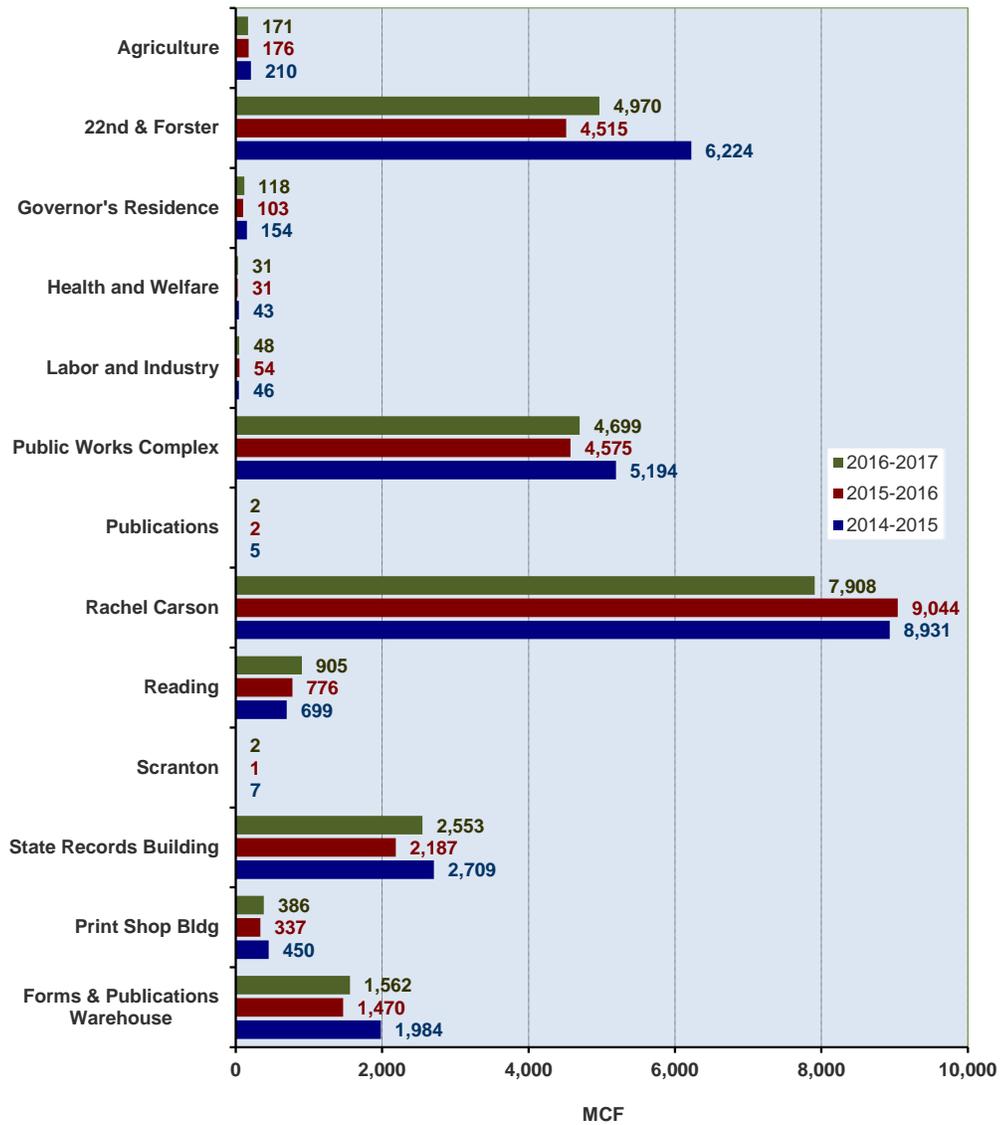
Facility	Account	Utility	mcf	Cost	\$/mcf
Ag Diagnostic Lab	221393572504	UGI Utilities	5,564	\$44,656	\$8.03
	221393575500	UGI Utilities	8,617	\$65,190	\$7.57
Agriculture	221393549217	UGI Utilities	171	\$1,714	\$10.00
DGS Annex Complex	222199731207	UGI Utilities	37,480	\$226,323	\$6.04
22nd & Forster	209192148206	UGI Utilities	2,477	\$22,479	\$9.08
	214460293001	UGI Utilities	2,493	\$22,732	\$9.12
Governor's Residence	202225616200	UGI Utilities	118	\$1,226	\$10.43
Lt. Governor's Residence	211817052705	UGI Utilities	213	\$2,078	\$9.74
Public Works Complex	207364251216	UGI Utilities	4,699	\$42,392	\$9.02
Publications	221393334216	UGI Utilities	2	\$173	\$78.68
Rachel Carson	202228690509	UGI Utilities	7,908	\$60,023	\$7.59
Reading	705001001006	UGI Utilities	905	\$8,168	\$9.02
Scranton	901501601029	UGI PNG	2	\$419	\$199.29
State Records Center	206315701505	UGI Utilities	2,553	\$22,957	\$8.99
Forms & Publications Warehouse	220281009018	UGI Utilities	1,562	\$14,270	\$9.14
Print Shop Bldg	209394162042	UGI Utilities	386	\$3,631	\$9.42
Capitol Complex Buildings					
Health and Welfare	221328187001	UGI Utilities	31	\$451	\$14.54
Labor and Industry	221328192000	UGI Utilities	48	\$601	\$12.53
Complex Buildings Total			79	\$1,052	\$13.32
Total			75,228	\$539,482	
Weighted Average					\$7.17

Charts 8A, 8B, 9A, and 9B (pages 13 and 14) compare the previous three fiscal years of annual natural gas consumption and cost. Note the following observations:

- The 22nd and Forster Office Building consumption increased by 455 mcf or 10%.
- The Rachel Carson State Office Building natural gas consumption decreased by 13%; however, steam use increased by 5%.
- The Reading Office Building consumption increased by 129 mcf or 17%.
- The State Records Building use increased by 366 mcf or 17%.
- The remaining facilities either used the same or slightly less natural gas. The winter of fiscal year 2016–2017 was 4% less severe than the previous winter heating season.

Overall natural gas cost for all facilities declined by \$40,742 or 7% as a result of reduced heating loads, excellent natural gas pricing, and diligent risk management policies.

Chart 8A. Annual Natural Gas Consumption Trend



**Chart 8B. Annual Natural Gas Consumption Trend
Agriculture Diagnostic Lab and DGS Annex Complex**

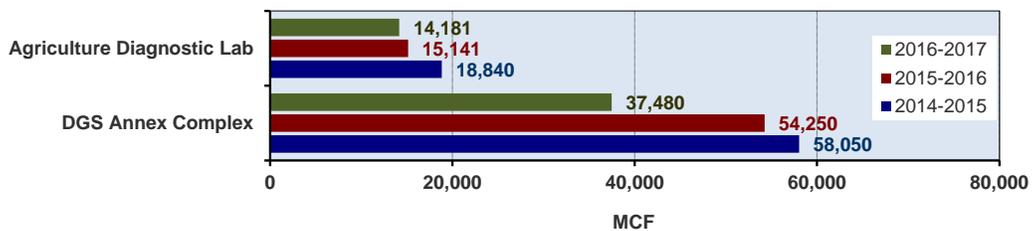
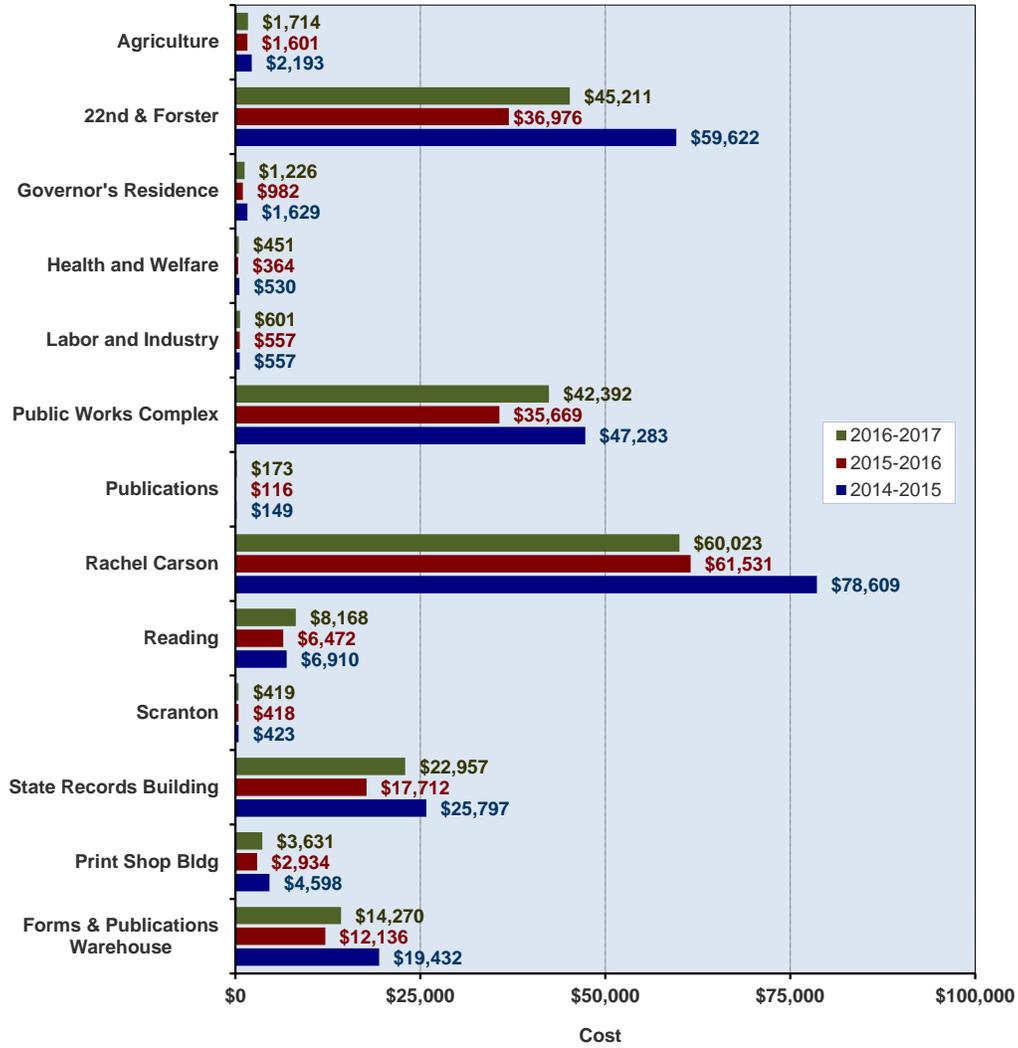
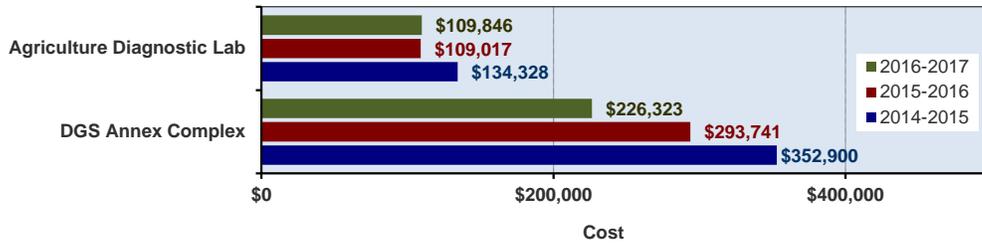


Chart 9A. Annual Natural Gas Costs Trend



**Chart 9B. Annual Natural Gas Costs Trend
Agriculture Diagnostic Lab and DGS Annex Complex**



STEAM USAGE

Table 8 shows detailed steam usage by facility. The Main Capitol remains the largest metered steam load. This account serves the Main Capitol, East Wing, North Office Building, and South Office Building. The Keystone Building is the second largest user of purchased steam. Overall steam use increased by 6,381 mlbs (4.5%) from last fiscal year. Overall costs increased \$283,786 or 8.4%. The unit cost of purchased steam increased 3.7% (from \$24.08 to \$24.96 per mlb).

Table 8. Steam Consumption and Costs 2016–2017

Facility	Account	Utility	mlbs	Cost	\$/mlb
Publications	001024	NRG	1,057	\$25,602	\$24.22
Rachel Carson	001037	NRG	1,981	\$48,341	\$24.40
Capitol Complex Buildings					
Forum	001005FORUM	NRG	11,939	\$300,576	\$25.18
Finance	001484	NRG	13,131	\$330,815	\$25.19
Health and Welfare	001014	NRG	5,633	\$141,848	\$25.18
Judicial Center	001480	NRG	8,137	\$173,566	\$21.33
Keystone	001004	NRG	27,832	\$701,421	\$25.20
Labor and Industry	001007	NRG	10,410	\$262,099	\$25.18
Main Capitol ¹	001002	NRG	57,433	\$1,447,257	\$25.20
Museum	001006	NRG	9,280	\$233,716	\$25.18
Complex Buildings Total			143,794	\$3,591,299	\$24.98
Total			146,833	\$3,665,242	
Weighted Average					\$24.96

¹Includes Main Capitol, East Wing, North Office Building, and South Office Building.

Charts 10 and 11 (pages 16 and 17) show annual steam consumption and cost for each applicable DGS facility for the past three fiscal years. The winter of fiscal year 2016–2017 was 4% less severe than the previous winter heating season. While a majority of facility steam use was similar to the previous year, usage increased at the Main Capitol (23.5%). Unless known operational issues occurred in the Main Capitol, a follow-up investigation is warranted.

Chart 10. Annual Steam Consumption Trend

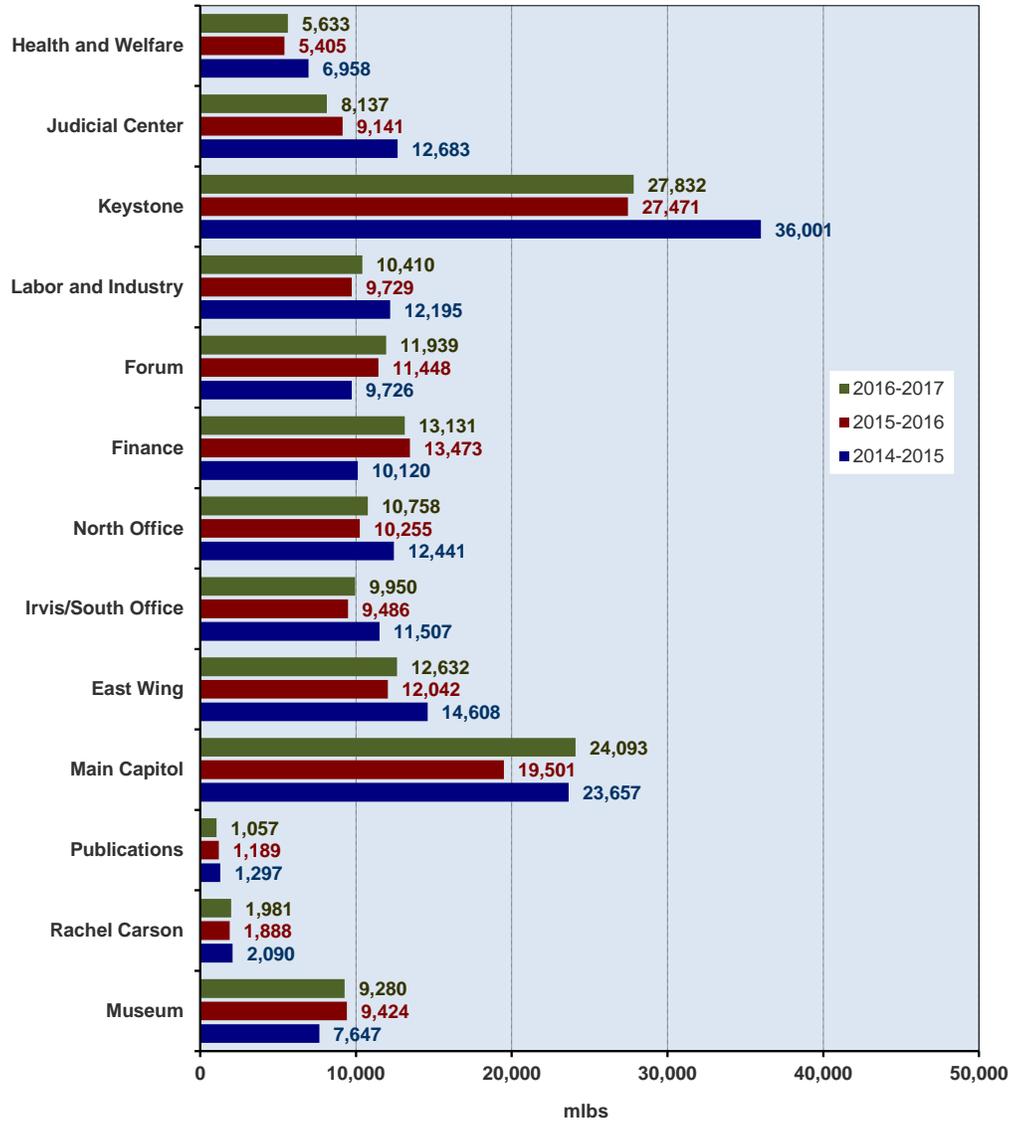
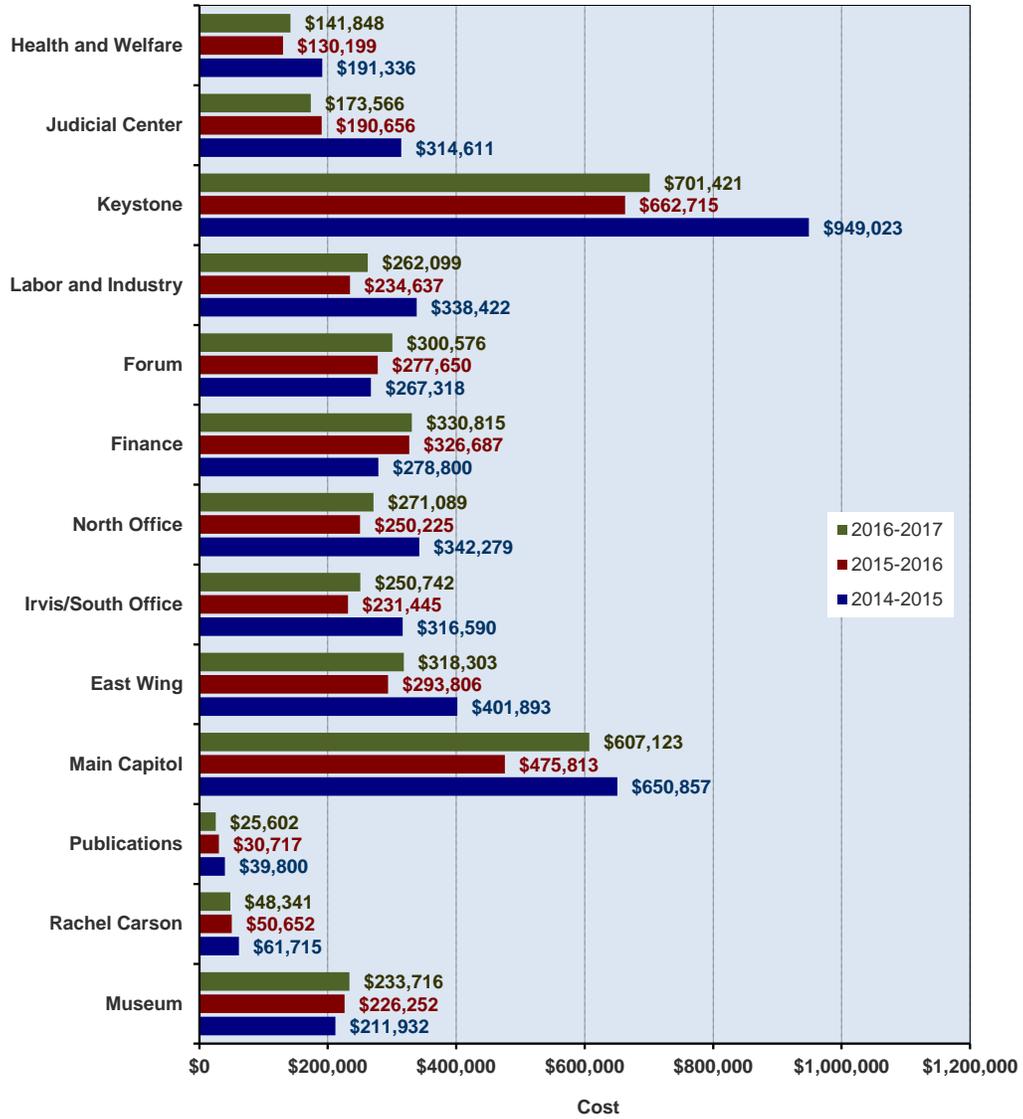


Chart 11. Annual Steam Costs Trend



WATER/SEWER USAGE

Water/sewer usage for DGS facilities during fiscal year 2016–2017 was 111,393 thousand gallons (mgal) at an average cost of \$21.49 per mgal. Compared to the previous fiscal year, consumption increased by 25,752 mgal or 30%. Overall costs were \$2,394,229, representing a \$527,100 (28%) increase from the previous year. Unit costs decreased from \$21.80 to \$21.49 per mgal (1.4%). There were five accounts classified as ready-to-serve with little actual consumption and a high resulting unit cost. These accounts serve fire suppression systems. With the exception of Scranton and the Forms & Publications Warehouse, water/sewer charges were billed together based on metered water use.

Table 9. Water/Sewer Consumption and Costs 2016–2017

Facility	Account	Utility	mgal	Cost	\$/mgal
Publications	0900302100005	Capital Region Water	7	\$3,874	\$553.44
22nd & Forster	6204113200002	Capital Region Water	809	\$25,262	\$31.23
Agriculture	6202602200004	Capital Region Water	1,240	\$28,444	\$22.94
Agriculture Diagnostic Lab	1590031700009	Capital Region Water	421	\$24,386	\$57.92
DGS Annex Complex	1570002200006	Capital Region Water	10,625	\$206,734	\$19.46
DGS Annex Complex	1570202200004	Capital Region Water	12,232	\$147,876	\$12.09
Forms & Publications Warehouse	C0431600	Susquehanna Township Authority	335	\$3,061	\$9.14
Forms & Publications Warehouse	1601105300003	Capital Region Water	335	\$5,471	\$16.33
Governor's Residence	1100103400005	Capital Region Water	1,250	\$19,485	\$15.59
Public Works Complex	0708600200000	Capital Region Water	---	\$18,234	---
Public Works Complex	0709000300002	Capital Region Water	324	\$8,498	\$26.23
Rachel Carson	0900105000006	Capital Region Water	3,570	\$67,904	\$19.02
Reading	1250301	Reading Area Water Authority	793	\$17,763	\$22.40
Scranton	S30891500	Scranton Sewer Authority	1,266	\$4,158	\$3.29
Scranton	2405407533	Pennsylvania-American Water Company	1,266	\$21,046	\$16.63
State Records Building	1590017400003	Capital Region Water	723	\$10,770	\$14.90
State Records Building	6202603300001	Capital Region Water	20	\$47,982	\$2,399.10
Capitol Complex Buildings					
Capitol Complex Substation	1570050900004	Capital Region Water	20	\$1,641	\$82.06
Central Plant	1570002900002	Capital Region Water	19,833	\$336,882	\$16.99
East Wing	1570003800003	Capital Region Water	13,475	\$213,906	\$15.87
East Wing	1570003900001	Capital Region Water	2,400	\$67,078	\$27.95
Finance	0803600200008	Capital Region Water	30	\$48,229	\$1,607.64
Finance	0803610200006	Capital Region Water	3,527	\$50,233	\$14.24
Forum	0803600300006	Capital Region Water	15	\$48,037	\$3,202.46
Forum	0803610300004	Capital Region Water	3,778	\$52,765	\$13.97
Health and Welfare	1570002600008	Capital Region Water	1,610	\$41,723	\$25.92
Health and Welfare	1570002700006	Capital Region Water	725	\$28,863	\$39.81
Iris/South Office	0404200700008	Capital Region Water	1,315	\$39,541	\$30.07
Judicial Center	1600060100000	Capital Region Water	1,045	\$33,517	\$32.07
Keystone	1570003000009	Capital Region Water	---	\$32,358	---
Keystone	1570003100007	Capital Region Water	---	\$18,204	---
Keystone	1570028800004	Capital Region Water	5,830	\$120,201	\$20.62
Labor and Industry	0710202500001	Capital Region Water	1,555	\$40,866	\$26.28
Labor and Industry	1570002400002	Capital Region Water	1,030	\$33,252	\$32.28
Main Capitol	0404200200008	Capital Region Water	18,904	\$276,912	\$14.65
Main Capitol	0803600100000	Capital Region Water	---	\$18,204	---
Main Capitol	1570002300004	Capital Region Water	10	\$47,956	\$4,795.61
Main Capitol	1570002800004	Capital Region Water	15	\$48,030	\$3,202.00
Main Capitol	1570004000008	Capital Region Water	140	\$49,883	\$356.31
Main Capitol	1570004100006	Capital Region Water	---	\$18,220	---
Main Capitol	1570102800000	Capital Region Water	31	\$460	\$14.83
Museum	0404201100009	Capital Region Water	1,849	\$38,741	\$20.95
Museum	1570102300000	Capital Region Water	36	\$523	\$14.48
North Office	0404200600000	Capital Region Water	605	\$27,059	\$44.73
Complex Buildings Total			77,779	\$1,733,283	\$22.28
Total			111,393	\$2,394,229	
Weighted Average					\$21.49

NOTE: No water/sewer reported for Northwest Office Building, Communications Network, or CTC1 (CMIC).

Chart 12 and Chart 13 (page 20) trend water/sewer consumption and cost for the current and prior fiscal years for each facility. While water consumption for some facilities was similar to the previous fiscal year, significant increased use occurred at the Main Capitol (229%), East Wing (150%), and DGS Annex Complex (13.3%). Further investigation is warranted.

Chart 12. Annual Water/Sewer Consumption Trend

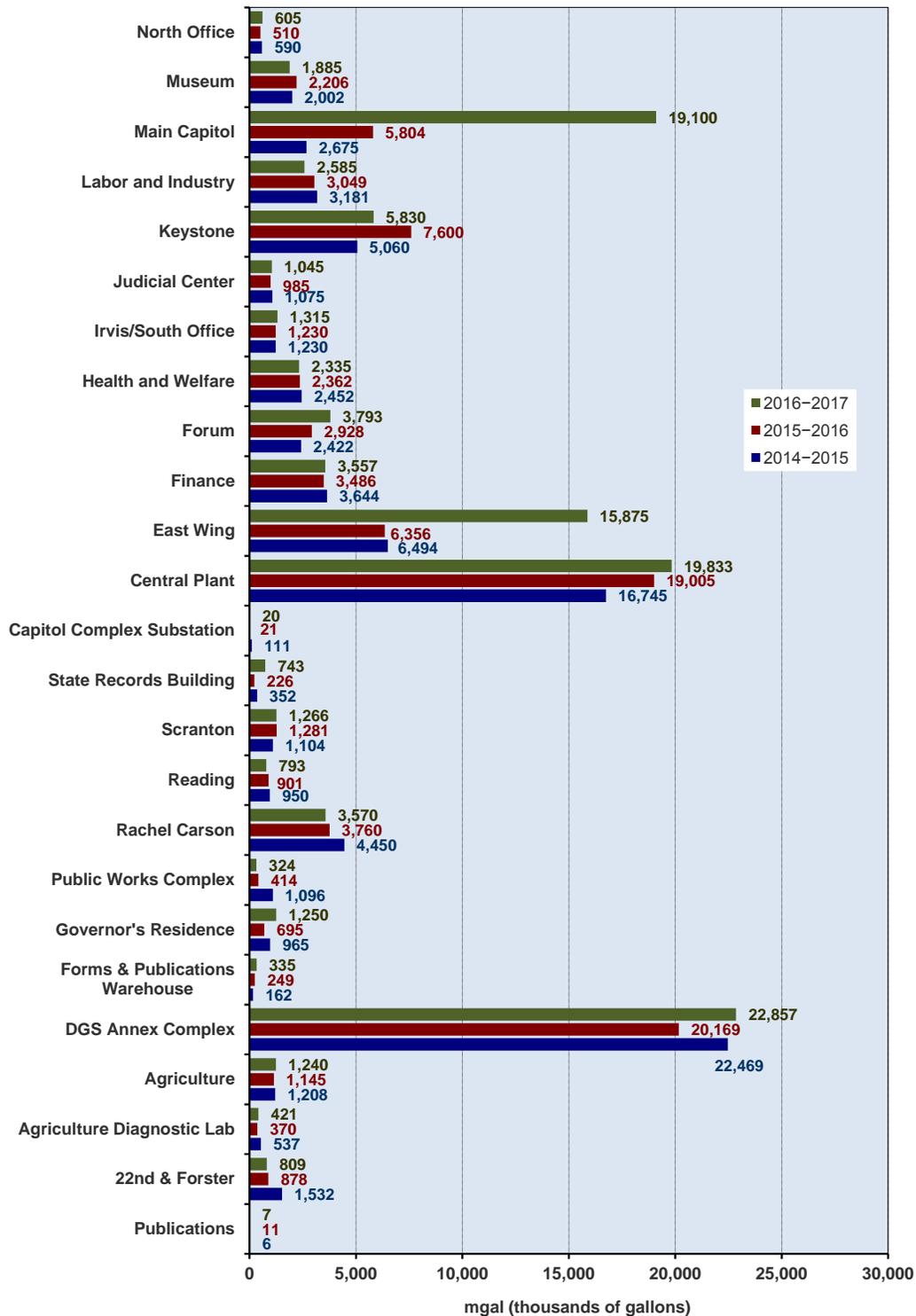


Chart 13. Annual Water/Sewer Costs Trend

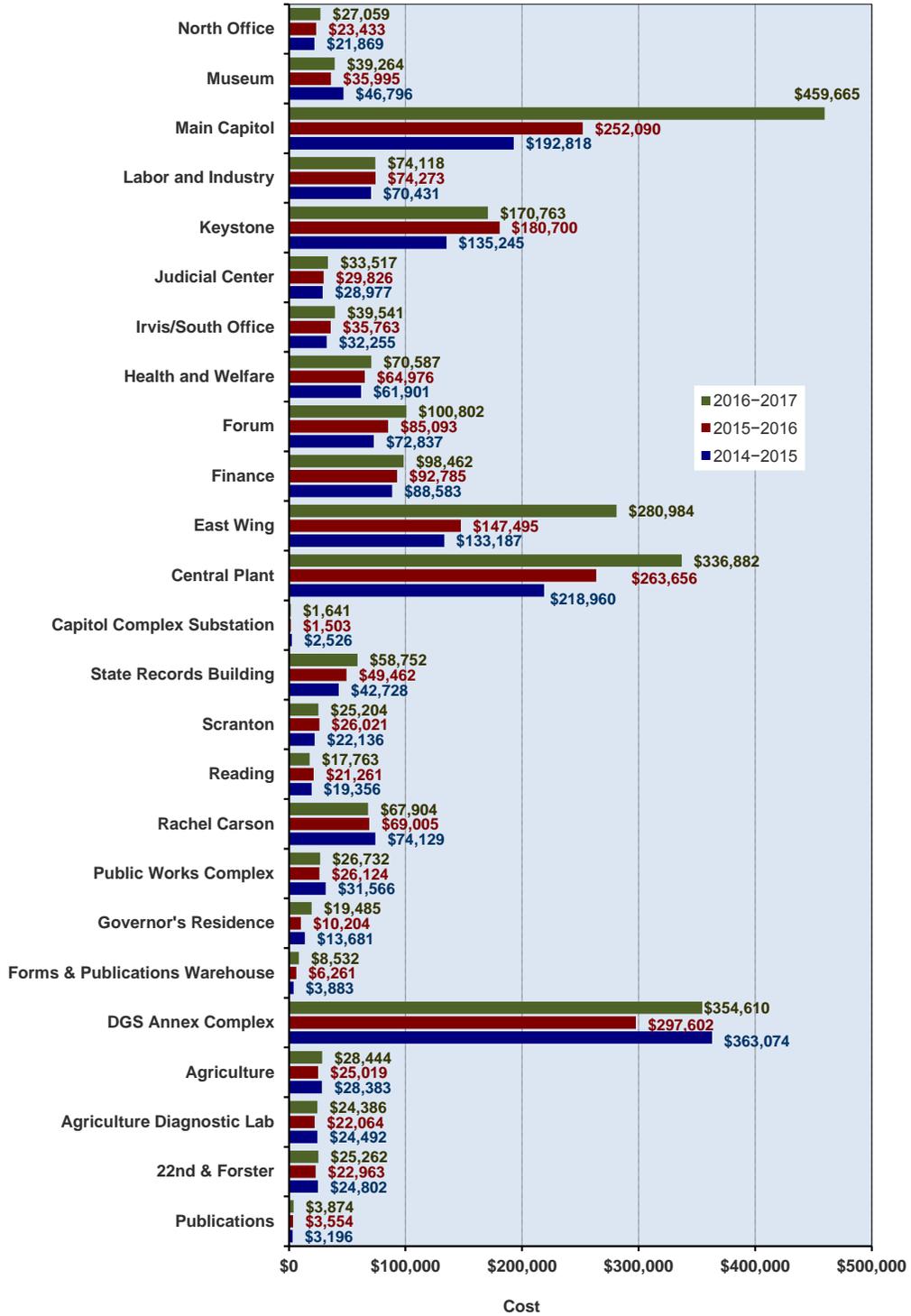


Table 10 shows a history of each facility's water/sewer use. During the 2016–2017 fiscal year, water/sewer unit costs remained relatively constant; however, a significant increase in use occurred at several facilities. The average unit cost of water/sewer decreased slightly (\$21.80 to \$21.49 per mgal), likely resulting from the sizeable increase in metered use.

Table 10. Annual Water/Sewer Consumption and Costs Trend

Facility	2013–2014		2014–2015		2015–2016		2016–2017	
	Cost	mgal	Cost	mgal	Cost	mgal	Cost	mgal
Publications	\$3,132	12	\$3,196	6	\$3,554	11	\$3,874	7
22nd & Forster	\$23,081	1,455	\$24,802	1,532	\$22,963	878	\$25,262	809
Agriculture Diagnostic Lab	\$20,181	497	\$24,492	537	\$22,064	370	\$24,386	421
Agriculture	\$27,221	1,188	\$28,383	1,208	\$25,019	1,145	\$28,444	1,240
DGS Annex Complex	\$280,339	20,989	\$363,074	22,469	\$297,602	20,169	\$354,610	22,857
Forms & Publications Warehouse	\$3,400	62	\$3,883	162	\$6,261	249	\$8,532	335
Governor's Residence	\$12,601	990	\$13,681	965	\$10,204	695	\$19,485	1,250
Public Works Complex	\$21,465	388	\$31,566	1,096	\$26,124	414	\$26,732	324
Rachel Carson	\$64,613	4,515	\$74,129	4,450	\$69,005	3,760	\$67,904	3,570
Reading	\$18,869	837	\$19,356	950	\$21,261	901	\$17,763	793
Scranton	\$21,697	924	\$22,136	1,104	\$26,021	1,281	\$25,204	1,266
State Records Building	\$39,815	568	\$42,728	352	\$49,462	226	\$58,752	743
Capitol Complex Buildings								
Capitol Complex Substation	\$3,506	220	\$2,526	111	\$1,503	21	\$1,641	20
Central Plant	\$173,945	15,175	\$218,960	16,745	\$263,656	19,005	\$336,882	19,833
East Wing	\$124,491	7,575	\$133,187	6,494	\$147,495	6,356	\$280,984	15,875
Finance	\$64,044	1,965	\$88,583	3,644	\$92,785	3,486	\$98,462	3,557
Forum	\$70,309	2,727	\$72,837	2,422	\$85,093	2,928	\$100,802	3,793
Health and Welfare	\$53,325	2,180	\$61,901	2,452	\$64,976	2,362	\$70,587	2,335
Irvis/South Office	\$30,886	1,285	\$32,255	1,230	\$35,763	1,230	\$39,541	1,315
Judicial Center	\$24,906	940	\$28,977	1,075	\$29,826	985	\$33,517	1,045
Keystone	\$121,037	5,040	\$135,245	5,060	\$180,700	7,600	\$170,763	5,830
Labor and Industry	\$61,891	2,940	\$70,431	3,181	\$74,273	3,049	\$74,118	2,585
Main Capitol	\$180,247	2,854	\$192,818	2,675	\$252,090	5,804	\$459,665	19,100
Museum	\$29,640	2,277	\$46,796	2,002	\$35,995	2,206	\$39,264	1,885
North Office	\$19,318	545	\$21,869	590	\$23,433	510	\$27,059	605
Complex Buildings Total	\$957,544	45,722	\$1,106,384	47,681	\$1,287,588	55,542	\$1,733,283	77,779
Total	\$1,493,959	78,147	\$1,757,809	82,512	\$1,867,129	85,641	\$2,394,229	111,393
Percent Change			15.0%	5.3%	5.9%	3.7%	22.0%	23.1%

ENERGY PROCUREMENT

PSFEI is the primary technical adviser to the Commonwealth for the procurement of electricity, natural gas, and coal. The Energy Procurement section provides information about PSFEI's activities and its partnership with the DGS Bureau of Procurement.

KEEPING PACE WITH THE ENERGY MARKETS

PSFEI keeps abreast of energy market trends through extensive relationships and attending meetings and conferences with Commonwealth utilities and nationwide energy suppliers. Similarly, PSFEI monitors regulatory developments by studying the Pennsylvania Public Utility Commission (PUC) rulings and activities. PSFEI also continually monitors the energy markets and policies of the New York Mercantile Exchange (NYMEX), PJM Interconnection, Federal Energy Regulatory Commission (FERC), and other energy organizations.

Trends and developments that affected Commonwealth budgets and energy planning were reported to the DGS Bureau of Procurement at regularly scheduled meetings to establish energy and procurement policies and direction. Combined with supplier contracts, these trends were considered when preparing and submitting utility budget projections to the DGS Bureau of Financial and Management Services.

The DGS Bureau of Procurement and PSFEI used the following energy price risk-management strategies to extend flexibility and ensure maximum cost avoidance in volatile energy markets:

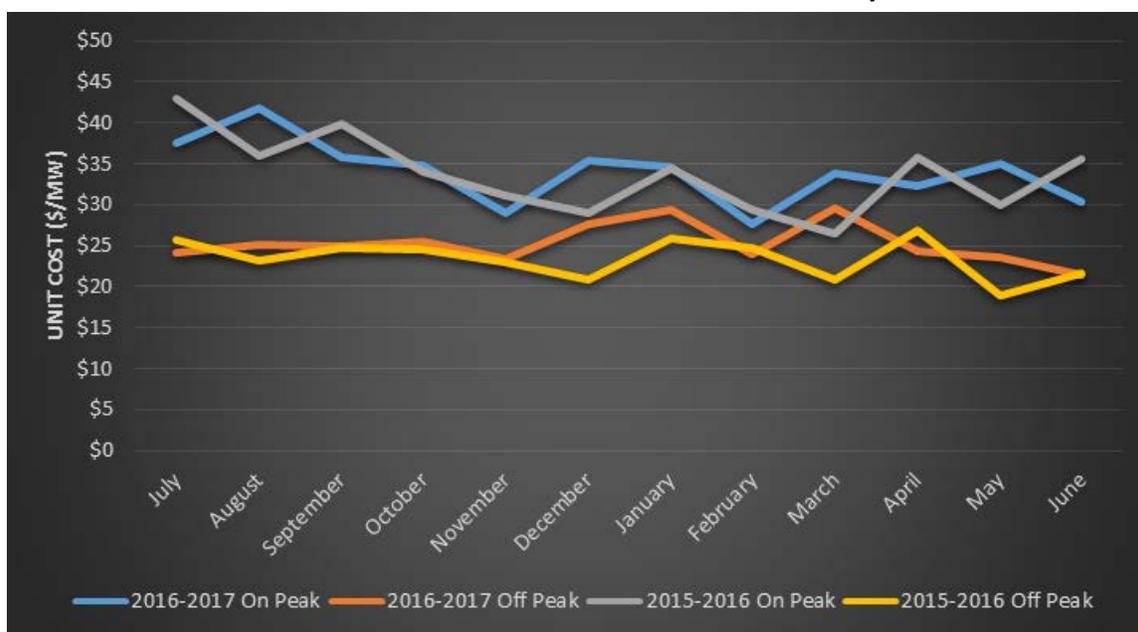
- Applied swing clauses in natural gas and electricity supply contracts to offer price protection and mitigate the risk of market exposure due to variations in expected monthly nominations. The swing clause can protect against market volatility and reduce cost by requiring suppliers to apply the contract price to a specified percentage (typically 10%) above or below the monthly nominations.
- Examined electricity and natural gas bills for rate, energy consumption, demand charges, taxes, and potential tariff savings.
- Remained abreast of energy trends and developments on behalf of Commonwealth facilities. The information and knowledge helps PSFEI advise the Commonwealth to prepare for legislative actions, utility rate increases or decreases, market movements, and emerging procurement methods.
- Held one-day seminars and face-to-face meetings with Commonwealth facilities personnel on Marcellus Shale gas industry developments and utility and environmental issues.
- Selectively used a Block & Index (B&I) electricity commodity procurement product for soliciting large electricity accounts resulting in one account contract using a B&I product.

ELECTRICITY MARKETS

Natural gas and electricity markets continue to exhibit a strong regional correlation. Plentiful natural gas stocks within the footprint of the Commonwealth provide electricity generators with an abundant local energy source.

To gain a more detailed view of electricity market changes, PSFEI analyzed the PJM Western Hub Real Time Locational Marginal Price (LMP) hourly energy market data to compare and contrast fiscal years 2015–2016 and 2016–2017. The average monthly on-peak and off-peak prices are shown in the PJM Western Hub Real-Time LMP by Month graph.

Chart 14. PJM Western Hub Real-Time LMP Prices by Month



The analysis of fiscal year 2016–2017 LMP data shows a return to a summer-peaking pattern, in which the average on-peak monthly LMP price is higher during the summer months than the winter months. This contrasts to the winter-peaking trend experienced in fiscal years 2013–2014 and 2014–2015.

August 2016 represented the highest average on-peak LMP price of \$41.70 per megawatt (MW). This correlates with three of the five coincident peak (5CP) load hours occurring in August. The highest of these 5CP hours, representing the greatest load on the entire PJM footprint, occurred on Thursday, August 11, 2016 at 4:00 p.m. Total PJM system load was 151,945 MW at a real-time energy price of \$144.22 per MW. The third and fifth highest 5CP hours occurred in August as well, with lower loads.

March was the highest average off-peak energy price for fiscal year 2016–2017 at \$29.55 per MW, slightly edging out January at \$29.34 per MW.

While presenting a similar overall pattern, on-peak pricing was approximately 2% higher and off-peak pricing was approximately 9% higher, leading to an around-the-clock average of a 4% increase in LMP pricing for fiscal year 2016–2017 over 2015–2016. Contrasting the increase in average LMP pricing is the observation that fiscal year 2016–2017 experienced a less volatile market in all periods—19% less volatile in the on-peak period, 29% less volatile in the off-peak period, and 20% less volatile overall. Although the average market price was higher in fiscal year 2016–2017, the market was less volatile, lending to a slightly tighter electricity marketplace.

Injecting an additional layer of reliability and stability into the PJM footprint, the Capacity Performance (CP) product, which debuted in fiscal year 2016–2017, ensures that generation is available when needed. For generation assets in this program, penalties for non-performance are much harsher; however, the revenue achieved in the PJM capacity market is also higher providing a financial incentive to comply with the more stringent requirements.

The cost of generation capacity, set by PJM and effective on a June through May cycle, decreased in the western portion of the Commonwealth and remained relatively flat in the eastern portion during 2016–2017, as compared to fiscal year 2015–2016. In general, capacity prices in the eastern portion (served by PECO, PPL, and MetEd) ranged tightly between \$187 and \$190 per MW-day. The western portion (served by Penelec, West Penn Power, Penn Power, and Duquesne Light Company) varied more widely with Penelec exhibiting the highest capacity pricing of \$179 per MW-day while Duquesne Light Company represented the lower end of capacity pricing at \$115 per MW-day. Capacity charges represent approximately 15% of total electric bill charges for larger Commonwealth facilities.

West Penn Power, Penn Power, and Duquesne Light Company experienced significant decreases in capacity pricing compared to fiscal year 2015–2016 with 25%, 56%, and 26% cost decreases, respectively. MetEd and Penelec experienced modest decreases of 2% and 7%, respectively. Capacity prices in PECO and PPL remained nearly identical to the prior fiscal year. Capacity costs should rise on average in 2017–2018 and again in 2018–2019 before declining substantially in 2019–2020.

Transmission rates across the Commonwealth in fiscal year 2016–2017 experienced little change except for the PPL, Penn Power, and Duquesne Light Company territories. PPL and Penn Power experienced increases of 47% and 4%, respectively. Duquesne Light Company experienced a decrease of 7%. All other territories remained constant. These transmission charges account for approximately 15% of the total cost of electricity for larger Commonwealth facilities. Transmission rates are determined based on two primary components, the cost to operate the system and the peak load on the system. In PPL's case, their cost to operate the system increased while the peak load on the system decreased. As a result, customers in the PPL transmission zone experienced a substantial increase in their transmission rate.

Going forward, the First Energy territories of MetEd and Penelec can recalculate transmission costs on a yearly basis as opposed to remaining stagnant due to a recent conversion from standard-rate transmission pricing to formula-rate-based transmission pricing. PECO is in the process of pursuing formula-rate-based transmission pricing; however, it appears PECO's rate will remain relatively flat in the near future.

Two major developments occurred at the regulatory level concerning electric distribution rates. First, the Pennsylvania Public Utility Commission (PUC) approved a base rate increases for MetEd, Penelec,

Penn Power, and West Penn Power. While the PUC approved overall distribution revenue increases of approximately 4% to 7%, the actual impact on customer distribution rates will vary by rate class. The new rates went into effect in January 2017.

The second regulatory development was approval by the PUC of Duquesne Light Company's petition to implement a Distribution System Improvement Charge (DSIC). A DSIC rate is implemented as an additional line-item charge to recover costs incurred to repair, improve, and replace certain eligible distribution company equipment. No DSIC charge for Duquesne Light Company existed in fiscal year 2015–2016. This charge will marginally affect overall distribution costs and is subject to quarterly adjustments.

TAKING ADVANTAGE OF CURRENT ENERGY MARKETS

During fiscal year 2016–2017, PSFEI and the DGS Bureau of Procurement continued to engage a balanced strategy to maximize overall savings potential while providing budget certainty through stable, long-term energy pricing.

Throughout the fiscal year, the electricity futures market continued to exhibit a backwardated¹ pattern, where the market prices for each successive year in the future are progressively lower than the year before it. In order to take advantage of this market condition, 36- and 48-month contract terms were solicited by the Commonwealth in addition to 12- and 24-month terms. In a backwardated market, the lower-priced future years have a positive effect for the consumer by lowering the overall average price.

ELECTRICITY PROCUREMENT

Under the direction of the DGS Bureau of Procurement, PSFEI held six procurement events during fiscal year 2016–2017 and awarded 4,886 Commonwealth, Pennsylvania's State System of Higher Education (PASSHE), and COSTARS members' electricity accounts using the Energy Risk Management Application (ERMA), PSFEI's web-based procurement platform. The net result was approximately \$3.7 million in projected annual avoided costs versus utility-issued price to compare (where available) and previous year contracts. Individual agency cost reductions are in Table 11 on page 27.

The Commonwealth and its energy partners benefited from the contracts awarded during the 2016–2017 fiscal year, as well as the multi-year contracts awarded in fiscal year 2015–2016. Residual avoided costs from these multi-year contracts project to be approximately \$8.7 million.

Fixed-price and B&I bids were solicited for accounts demonstrating billing demands greater than 1,000 kilowatts (KW), where applicable. While only one B&I contract was awarded, the result of this dual product solicitation provided DGS Bureau of Procurement personnel with an opportunity to diversify

¹ When a near-month futures contract is trading at a premium to more distant contracts, that commodity's futures curve is in "backwardation" or the commodity is "backwardated." This occurs when inventories of commodities are tight, so market participants are willing to pay a premium to buy the immediate deliverable commodity. Theoretically, there is no value to carrying costs such as storage, insurance and interest costs since there is a scarcity of the commodities.

their procurement portfolio to achieve maximum avoided cost savings while still adhering to internal risk-management strategies.

The remaining Commonwealth, PASSHE, and COSTARS commercial accounts were aggregated by a major rate class to provide the most attractive load profile for suppliers. This resulted in price realignment across each major rate class. A similar strategy of aggregation was adopted for residential-classed accounts belonging to the Commonwealth, PASSHE, and COSTARS facilities.

Table 11 summarizes electricity procurement avoided costs by agency.

Table 11. Avoided Costs for Electricity Procurement 2016–2017

Agency	Number of Accounts	Cost Reduction (Annual)	Cost Avoidance (Annual)	Cost Avoidance (Total) ¹
COSTARS ²	133	\$1,323,723	\$438,426	\$441,042
Department of Agriculture	3	\$1,725	\$4,557	\$18,229
Department of Conservation & Natural Resources	875	\$150,909	\$253,313	\$980,616
Department of Corrections	106	\$97,242	\$153,200	\$610,142
Department of Environmental Protection	41	\$22,560	\$34,243	\$131,030
Department of Human Services	20	\$91,047	\$128,364	\$395,872
Department of Military & Veterans Affairs	112	\$780,498	\$268,588	\$984,410
Other Agencies ³	165	\$88,182	\$100,139	\$397,223
Pennsylvania Department of Transportation	1,900	\$539,496	\$728,599	\$2,818,430
Pennsylvania Emergency Management Agency	2	\$3,211	\$3,611	\$14,443
Pennsylvania Fish & Boat Commission	44	\$52,027	\$134,255	\$535,514
Pennsylvania Game Commission	82	\$12,820	\$19,031	\$75,980
Pennsylvania Historical and Museum Commission	52	\$27,814	\$32,711	\$129,512
Pennsylvania Liquor Control Board	455	\$352,273	\$354,809	\$1,386,529
Pennsylvania Senate Offices	26	\$5,871	\$4,753	\$19,013
Pennsylvania State Police	540	\$204,122	\$306,489	\$1,208,110
Pennsylvania Turnpike Commission	218	\$310,138	\$536,969	\$2,084,352
Pennsylvania's State System of Higher Education	112	\$141,874	\$183,484	\$717,137
Total	4,886	\$4,205,533	\$3,685,542	\$12,947,586

¹Some contracts awarded were less than or greater than one year.

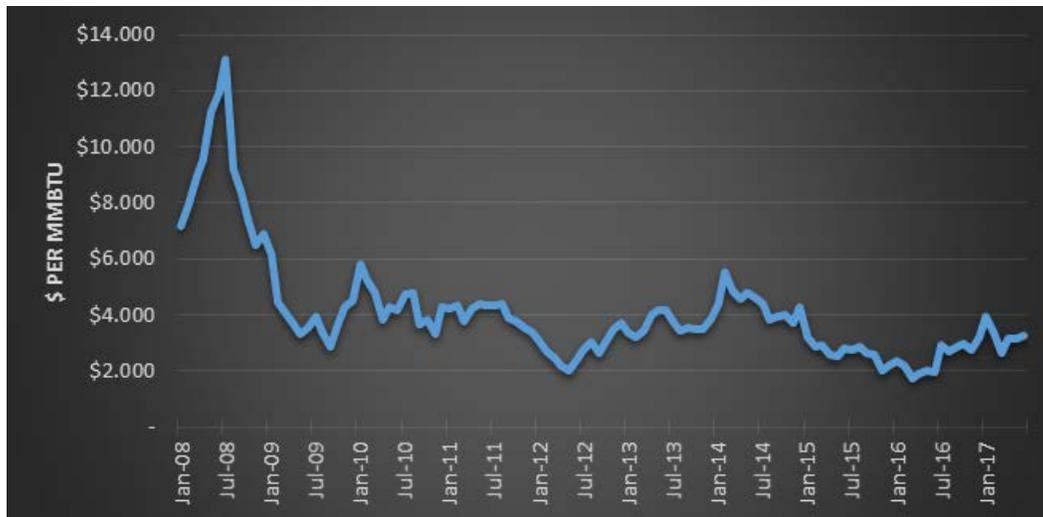
²Includes the Penn State Milton S. Hershey Medical Center.

³Other Agencies include Administration, DGS, EPA, House, Health, and various other small accounts.

NATURAL GAS MARKET

Although natural gas prices have not changed dramatically since fiscal year 2009–2010 as shown in the following graph, prices did increase over the past fiscal year as global demand grew with a corresponding decline in the rate of production growth.

Chart 15. NYMEX Natural Gas Monthly Settlement Price Trend



The average monthly New York Mercantile Exchange (NYMEX) natural gas settlement price rose 35% from \$2.27 per million British thermal units (MMBtu) in fiscal year 2015–2016 to \$3.07 per MMBtu in fiscal year 2016–2017. This increase in price was largely due to market reaction to the decreased volume of gas in domestic storage fields, increased exports of natural gas, and an increase in electric power demand. Price growth is expected to level out as market liquidity increases and supply catches up with demand.

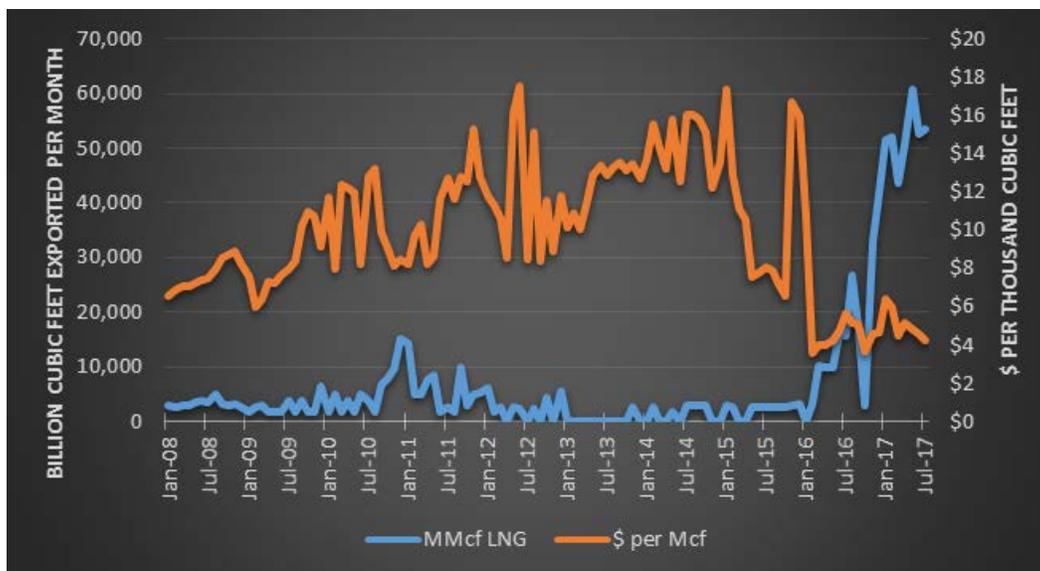
Natural gas storage inventory was 285 billion cubic feet below last fiscal year’s volume of 3.2 trillion cubic feet, with storage levels tracking approximately 15% lower than the previous fiscal year. This contributed to the rise in natural gas prices as market confidence eroded.

Because Marcellus-Utica natural gas production potential exceeds pipeline capacity, the mid-Atlantic region continued to experience discounted gas prices in reaction to weak demand in the local marketplace. Low prices contributed to the growth of natural gas-fired power plant construction in the region. However, new pipeline construction continued to address gas transportation bottlenecks. Increased pipeline capacity will lead to gas price growth as the local mid-Atlantic region market becomes coordinated with higher-priced national and global markets

The United States exported more natural gas than it imported beginning in early 2017. Over the last ten years, the United States exported an average of approximately 3 billion cubic feet of liquefied natural gas (LNG) per month. In 2017, this jumped to an average of 52 billion cubic feet per month. More domestic LNG export terminals are coming on line, are under construction, or are in the permitting

phase. In future years, exports of LNG will grow in importance as a key driver of price. This will remain true despite the tempering of LNG price with increased supply of exporting capacity in a highly global market as shown in the following graph.

Chart 16. U.S. LNG Exports and Price History Trend



The northeast United States experienced an unusually warm winter for the second year in a row. As a result, demand was not a major pricing factor in fiscal year 2016–2017. However, long-term trends in heating degree days (HDD) and cooling degree days (CDD) remain a net contributor to increased demand for natural gas. According to the U.S. Energy Information Administration, over the last twenty years (1998–2017), HDD in the mid-Atlantic region have decreased 0.4% while CDD have increased 7% over the same period. The net effect is a long-term steady increase in natural gas demand and price.

NATURAL GAS PROCUREMENT

Six natural gas commodity procurement events were held during the fiscal year for the Departments of Agriculture (DAG), Corrections (DOC), Human Services (DHS), Military and Veterans Affairs (DMVA), Labor & Industry (L&I), Transportation (PennDOT), the Pennsylvania Historical and Museum Commission (PHMC) and the Commonwealth’s COSTARS partners. PSFEI collected billing data, developed, and confirmed monthly nomination quantities with facility managers, analyzed tariff issues, and conducted competitive bidding events with prequalified suppliers for each of the accounts. Twenty-eight contracts were awarded resulting in a projected annual avoided cost of \$4,304,130 as compared to utility retail tariff rates. Projected avoided costs by agency are shown in Table 12 on page 30.

Both fixed-price and index price (basis price plus variable NYMEX natural gas commodity price) supply contracts were solicited, allowing the DGS Bureau of Procurement to manage price risk and maximize cost-avoidance opportunities.

In addition to the twenty-eight contracts awarded during the 2016–2017 fiscal year, the Commonwealth and its energy partners continued to benefit from forty-five multi-year contracts awarded in fiscal year

2015–2016. Due to the market-driven component of the vast majority of these multi-year contracts, avoided costs varied depending on NYMEX market conditions and the price risk management strategies employed.

PSFEI contributed to the success of the natural gas procurement program by managing and compiling historical usage and cost data for each account. The data was formatted for integration into a Request for Quotation (RFQ) package, along with gas utility tariff and price-to-compare calculations for fiscal year 2016–2017. The RFQ and associated usage data was sent electronically to all pre-qualified natural gas suppliers. Table 12 details the results of the natural gas procurement events. Other accounts in the DGS procurement portfolio that are not identified in Table 12 were shopped in prior years with contracts awarded for multiple years.

Table 12. Avoided Costs for Natural Gas Procurement 2016–2017

Agency	Number of Accounts	Cost Avoidance (Annual)	Cost Avoidance (Total) ¹
COSTARS ²	4	\$3,205,764	\$3,476,535
Department of Agriculture	2	\$22,441	\$44,882
Department of Human Services	4	\$269,828	\$292,951
Department of Military & Veterans Affairs	6	\$31,080	\$82,598
Department of Corrections	9	\$764,107	\$1,025,855
Department of Labor & Industry	1	\$7,255	\$14,511
Pennsylvania Department of Transportation	1	\$2,586	\$5,387
Pennsylvania Historical and Museum Commission	1	\$1,070	\$3,209
Totals	28	\$4,304,130	\$4,945,928

¹Accounts for multi-year contracts.

²Includes the Penn State Milton S. Hershey Medical Center.

RENEWABLE ENERGY CREDITS

RENEWABLE ENERGY CREDIT PROCUREMENT

The Commonwealth continues to offset approximately 30% of its electricity load, through 2018, via the purchase of Green-e certified Renewable Energy Certificates (RECs). The purchased RECs for the Commonwealth’s consumption were derived from wind energy representing 231,735 Megawatt-hours (MWh) of certified, carbon-free generation. This purchase was made possible by the over \$2 million in Commonwealth-wide annual savings through calendar year 2019 achieved in the form of price reductions versus the electricity contracts that expired at the end of 2015. The total annual cost of the REC purchases for the Commonwealth was less than 6% of the annual savings realized from the decreased electricity rates.

The total annual quantity of RECs was distributed to each agency by weighting that agency’s electricity usage in proportion to the Commonwealth’s overall usage. Information by agency is shown in Table 13 on page 31.

Table 13. REC Apportionment by Agency

Agency	CY 2016 Total		CY 2017 Total		CY 2018 Total		Total	
	MWh Credits	Annual Cost	MWh Credits	Annual Cost	MWh Credits	Annual Cost	MWh Credits	Total 3-Year Cost
Department of Agriculture	2,396	\$1,197	2,396	\$1,197	2,396	\$2,072	7,188	\$4,467
Department of Conservation & Natural Resources	6,562	\$3,279	6,562	\$3,279	6,562	\$5,676	19,686	\$12,234
Department of Corrections	74,473	\$37,212	74,473	\$37,212	74,473	\$64,419	223,419	\$138,843
Department of Education	119	\$59	119	\$59	119	\$103	357	\$222
Department of Environmental Protection	2,062	\$1,030	2,062	\$1,030	2,062	\$1,783	6,186	\$3,844
Department of General Services	37,136	\$18,556	37,136	\$18,556	37,136	\$32,122	111,408	\$69,234
Department of Health	685	\$342	685	\$342	685	\$592	2,055	\$1,277
Department of Human Services	20,787	\$10,387	20,787	\$10,387	20,787	\$17,981	62,361	\$38,754
Department of Labor & Industry	1,502	\$751	1,502	\$751	1,502	\$1,300	4,506	\$2,801
Department of Military & Veterans Affairs	29,026	\$14,503	29,026	\$14,503	29,026	\$25,108	87,078	\$54,114
Department of Revenue	1,326	\$663	1,326	\$663	1,326	\$1,147	3,978	\$2,472
Department of Transportation	27,035	\$13,508	27,035	\$13,508	27,035	\$23,385	81,105	\$50,402
PA Emergency Management Agency	765	\$382	765	\$382	766	\$662	2,296	\$1,427
PA Fish & Boat Commission	2,647	\$1,323	2,647	\$1,323	2,647	\$2,289	7,941	\$4,935
PA Game Commission	957	\$478	957	\$478	956	\$827	2,870	\$1,784
PA Historical and Museum Commission	2,264	\$1,131	2,264	\$1,131	2,264	\$1,959	6,792	\$4,221
PA Liquor Control Board	11,979	\$5,986	11,979	\$5,986	11,978	\$10,361	35,936	\$22,332
PA State Police	10,014	\$5,004	10,014	\$5,004	10,014	\$8,662	30,042	\$18,669
Commonwealth Total	231,735	\$115,790	231,735	\$115,790	231,733	\$200,450	695,203	\$432,030

To qualify as a Green-e certified resource, providers must meet criteria set forth by the Center for Resource Solutions in the *Green-e National Standard* document.

The Commonwealth's total annual purchase of 231,735 MWh of Green-e certified RECs places Pennsylvania in the number two position for state governments, behind the state of California, and number 35 overall on the EPA's Green Power Partnership National Top 100 list.

According to the EPA's Greenhouse Gas Equivalencies Calculator, the Commonwealth's purchase led to an annual offset of approximately 160,000 metric tons of carbon dioxide or the electricity use of roughly 22,000 average American homes for one year. The annual carbon sequestered by this purchase is approximately equivalent to 131,000 acres of U.S. forestland, i.e., a parcel of forested land slightly larger than Delaware County.

SUMMARY OF ENERGY SERVICES

GENERAL

With a sharp focus on operational efficiency and cost-control objectives, PSFEI assisted DGS and DGS-supported agencies with the following services:

- Energy information updates
- Energy market trends and regulatory policy updates
- Energy procurement services
- Energy and utility database development and support
- Engineering advisory services
- Research and education
- Review and resolution of utility billing, rates, and service issues

PSFEI conducted meetings with DGS to ensure proper communication and project prioritization. The meetings included topics such as energy-data management, energy procurement, facility systems issues, regulatory issues, and strategic planning.

ENERGY COUNCIL MEETINGS

The Energy Council consists of representatives from all major Commonwealth agencies and promotes communication and education on all energy issues. One meeting was held in fiscal year 2016–2017 (May 18, 2017), an energy summit that focused on utility bill management—the needs, benefits, and an enterprise utility bill management solution.

ENERGY SERVICES

GENERAL

Since 1998, PSFEI has helped Commonwealth facilities avoid nearly \$204 million in energy expenditures via competitive bidding in the electricity and natural gas commodity markets. During fiscal year 2016–2017, procurement avoided contract costs totaled over \$22.4 million.

ENERGY RISK MANAGEMENT APPLICATION

PSFEI continued to improve ERMA, its advanced, multifunction, web-based application that provides online access to detailed procurement and utility billing information allowing facility management personnel to make informed utility and commodity decisions. Development efforts during the fiscal year focused on general bug fixes, system optimization, and enhanced reporting.

ACT 129 SUMMARY REPORT

Act 129 amends the Public Utility Code and includes an Energy Efficiency and Conservation (EE&C) Program that requires each of the seven major Commonwealth electrical distribution companies (EDCs) to adopt plans that reduce energy demand and consumption within their service territory. It includes incentives for energy-efficient equipment upgrades, smart-meter technology, time-of-use rates, real-time pricing plans with conservation components, and alternative energy sources. Since the consumers fund the cost of this program, it is advantageous to participate in the program.

Act 129 Phase III will operate from June 2016 through May 2021 and provide cash rebates for electricity saving initiatives. The program includes an EDC-based demand response program that started in June 2017, which provides a financial benefit to users who can reduce their electric demand during periods of peak grid electric demand. Program specifics are available through each EDC.

The DGS Energy and Resource Management group plays an active role in assisting the Commonwealth with taking advantage of the Act 129 program. PSFEI continues to serve in a supporting role to DGS and any agency who requests program information.

PJM DEMAND RESPONSE PROGRAM SERVICES

PSFEI supported Commonwealth agencies with the PJM Emergency Demand Response program by soliciting Curtailment Service Providers (CSPs) for new and expiring contracts, helping improve communications during scheduled events, and collecting and reporting facility-specific program information. Five facilities intended to participate in the PJM program. Unfortunately, opportunities to participate were missed, resulting in only \$158 in customer payments as shown in Table 14. On a positive note, the Peak Load Contribution (PLC) management initiative during summer 2017 should reflect a reduction in the facilities capacity tags and reduced electricity costs beginning in June 2018.

Table 14. PJM Demand Response Program Results 2016–2017

Facility	CSP	EDC	KW Nomination	KW Reduction ¹	Total Payment ¹
Agriculture	NRG-CS	PPL	73.36	0	\$0
Capitol Complex Buildings	NRG-CS	PPL	765	0	\$0
22nd and Forester Building	NRG-CS	PPL	86.89	11	\$158
Public Works Complex	NRG-CS	PPL	77.15	0	\$0
Rachel Carson	NRG-CS	PPL	75.21	0	\$0
Total Customer Payments					\$158

¹Estimated values provided by the CSP November 2017.

INTERGOVERNMENTAL POWER PURCHASE AND SALE AGREEMENT

In late 2013, a 20-year PPA (Agreement) was executed between the Commonwealth and the Pennsylvania Borough of Columbia (Borough). The Agreement enabled the sale of the Harrisburg Incinerator to the LCSWMA. The incinerator generates steam that is used to generate electricity. The LCSWMA leases the electric generation plant to the Borough. The Borough sells electricity to the

Commonwealth under specific contract terms and pricing that includes annual escalation factors and discounts. The Agreement contains a clawback provision to protect the Commonwealth from making electricity payments in excess of market rates during the Agreement’s final 10 years.

There are nineteen electric accounts assigned to the Agreement—seventeen accounts are DGS-operated facilities, one account is a DOC facility, and one account is a Pennsylvania Emergency Management Agency (PEMA) facility. The Borough provided approximately 81% of the entire electric load for these accounts. The remaining power was purchased from the retail market, either from a competitively procured block of electricity or the Day-Ahead energy market.

Table 15 includes the total electric usage and cost in fiscal year 2016–2017 for the Commonwealth accounts assigned to this contract.

Table 15. Purchased LCSWMA Electricity Summary 2016–2017

Month	Usage (kWh)	Cost (includes gross receipts tax)	Unit Cost (\$/kWh)
July 2016	13,624,619	\$916,639	\$0.0673
August 2016	12,440,331	\$872,833	\$0.0702
September 2016	11,974,807	\$794,000	\$0.0663
October 2016	10,568,388	\$694,197	\$0.0657
November 2016	9,475,323	\$701,337	\$0.0740
December 2016	9,969,292	\$724,959	\$0.0727
January 2017	10,065,233	\$762,328	\$0.0757
February 2017	9,834,907	\$713,084	\$0.0725
March 2017	9,390,909	\$750,790	\$0.0799
April 2017	10,404,467	\$734,727	\$0.0706
May 2017	10,041,128	\$720,942	\$0.0718
June 2017	11,493,806	\$876,275	\$0.0762
Total / Avg.	129,283,210	\$9,262,111	\$0.0716

The unit cost for electricity, excluding utility distribution charges, averaged 7.16 cents per kWh, approximately 27% more than the average price paid for comparable Commonwealth accounts shopped during the same period. The excellent electricity pricing secured during DGS Bureau of Procurement events, coupled with the price escalation provisions of the PPA, likely caused this economic disadvantage for the accounts included in the Agreement.

SUMMARY OF SERVICES BY QUARTER

The summary list of services provided by PSFEI throughout the fiscal year is organized by quarter and separated by type of service.

FIRST QUARTER

PROCUREMENT

Provided DGS and DHS with detailed utility natural gas supply contract information for Selinsgrove Center on August 25, 2016.

Communicated with DGS Bureau of Procurement staff about attending marketing opportunities for the upcoming fall, which will provide PSFEI the opportunity to present the DGS-PSFEI procurement value proposition.

Worked with American PowerNet (APN) to expand the available pool of wholesale suppliers to provide hedging block bids and supply to the DGS portfolio during the winter/summer months and Susquehanna Resource Management Complex (SRMC) plant outages. As of September 30, 2016, Shell Oil and LCSWMA were willing to provide supply without posting collateral. Discussions are underway with a third party.

Researched a discrepancy between a new electric street lighting account and an existing electric account at the DGS Scranton Office. The new account was created in ERMA and will be shopped for supply in January 2017.

Conducted a natural gas procurement event, RFQ DGS 16-03, on September 14, 2016, for 19 Commonwealth accounts, resulting in a combined total of \$911,795 in contract avoided costs.

FACILITIES

Developed and submitted an executive slide deck providing an eight-year energy trend analysis of DGS energy data. Preliminary drafts were submitted to the Deputy Secretary of Property and Asset Management on July 11, 2016.

Continued to work with the DGS Bureau of Real Estate (BRE) to finalize scope and cost to assist BRE with construction and leasing specifications, building surveys, and condition analyses. PSFEI and BRE are currently working to obtain final signatures for contract execution.

Developed a cost estimate to renovate two of the existing coal-fired boilers at Selinsgrove Center to operate on natural gas and back-up fuel oil and submitted the estimate to DGS on July 8, 2016.

Provided follow-up review comments on the Keystone Guaranteed Energy Savings Act (GESA) project to The Efficiency Network (TEN), the Energy Services Company (ESCO), and DGS on July 8, 2016.

Provided utility usage information for the Tom Ridge Environmental Center and Polk Center on July 11, 2016.

Provided follow-up comments regarding the Selinsgrove Center's boilers existing condition related to the ability to retrofit the units to utilize gas/oil burners on July 13, 2016.

Provided utilities data for SCI Muncy to ECG Engineering on July 15, 2016.

Visited the Tom Ridge Environmental Center and Presque Isle State Park on July 19, 2016. Collected utility bill data, developed a report describing the visit, and identified energy savings opportunities for a possible future GESA project. Submitted the site visit report on August 2, 2016.

Visited Polk Center on July 20, 2016. Collected utility bill data, developed a report describing the visit, and identified energy savings opportunities for a possible future GESA project. Submitted the site visit report on August 12, 2016.

Received copies of three technical submission proposals for Thaddeus Stevens College. The proposals were developed by TEN, Reynolds, and ESG. Reviewed the proposals content and submitted comments to DGS on August 10, 2016.

Provided two boiler retrofit project examples that could be reviewed by DHS personnel in early August 2016.

Provided review and comment on August 19, 2016, regarding ECG's response to DGS on August 11, 2016. PSFEI comments specifically addressed the savings opportunity resulting from a boiler retrofit at Selinsgrove Center.

Evaluated a preliminary savings slide deck regarding the SCI Dallas GESA project for DOC on September 16, 2016. Due to many variables, PSFEI recommended making numerous qualification statements regarding the reported savings, which were forwarded to DGS.

Investigated an anomaly spike in consumption recorded on a DGS internal monitoring system during the PJM demand response test event on September 14, 2016, from 12:00 p.m. to 1:00 p.m. PSFEI will compare electric utility interval data to DGS's internally monitored interval data.

Reviewed energy consultant and ESCO qualification criteria and provided recommendations to DGS on August 30, 2016, and September 2, 2016.

Prepared the quarterly utility update report. The dashboard report provided a comparison of utility use and cost for Q4 2016 (Apr–Jun) versus Q4 2015 (Apr–Jun). The following comments were provided:

Electricity

Electricity consumption was 7.4% less in Q4 2016 than in Q4 2015. Costs were 1.2% lower in Q4 2016 than in Q4 2015 as average unit costs were approximately 6% higher.

Heating

Steam consumption was 9.3% higher in Q4 2016 than Q4 2015; steam cost increased by 4%. Natural gas consumption was 7.2% higher yet natural gas costs dropped by 6.7%. It is unclear why thermal energy consumption increased during the non-heating season. Overall heating costs for Q4 2016 were \$20,162 (2.7%) higher compared to Q4 2015.

Water

Water use increased by 12.8% for Q4 2016 compared to Q4 2015. Costs increased by \$48,213 or 9.4%.

MEETINGS

Attended a bi-monthly DGS-and PSFEI meeting in Harrisburg on July 14, 2016. Activities included introducing PSFEI's new programmer/analyst; providing electricity and natural gas market updates; discussing future procurement activities and planning; providing COSTARS electricity initiative updates; reviewing GESA projects and support activities; reviewing the final version of the executive slide deck; and discussing the Energy & Utility Usage Report, Fiscal Year 2015–2016.

Hosted and participated in a DGS and PSFEI bi-monthly meeting at PSFEI in State College on September 19, 2016. Meeting topics included electric and natural gas market updates and procurement schedules, COSTARS activities, DGS *Energy & Utility Usage Report* content discussion, Commonwealth RECs, purchase messaging initiative, GESA initiatives update, and the upcoming DGS-PSFEI contract renewal.

OTHER

Received a request on August 17, 2016, from the DGS Bureau of Financial & Management Services for a 2017–2018 utilities budget.

Submitted the fourth quarter 2015–2016 fiscal year summary of services report to DGS on August 17, 2016.

SECOND QUARTER

PROCUREMENT

Submitted natural gas price-lock recommendations to the DGS Bureau of Procurement on October 21, 2016.

Contacted NRG Harrisburg on October 21, 2016, to discuss the Commonwealth's current natural gas risk-management strategies in an effort to help reduce retail commodity costs. PSFEI learned more about the NRG corporate guidelines placed on the local operating steam producer and shared this knowledge with the DGS Bureau of Procurement.

Continued monitoring PJM developments regarding future demand response program changes.

Conducted market research and planning for the COSTARS electricity procurement expansion. PSFEI took the necessary steps to ensure that PSFEI was operating within the PUC's broker licensing requirements.

Supported DGS and PennDOT with the unexpected drop of several hundred supplier electricity contracts.

Conducted an initial investigation into the reduced electricity purchased through the LCSWMA contract due to a reduction in occupancy at the DGS Annex Complex, which may affect the terms of the PPA. PSFEI will continue to monitor the energy purchases and communicate with DGS.

Conducted two electricity procurement events, RFQs DGS 16-04A on November 2, 2016, for 1,420 accounts, and DGS 16-04B on November 3, 2016, for 3,038 accounts. The two events resulted in a combined total of \$2,728,211 in annual savings versus current contracts and \$12,091,609 in contract avoided costs.

Conducted an electricity procurement event for COSTARS accounts via RFQ DGS 16-06 on December 16, 2016. Through this solicitation, 87 accounts from seven COSTARS partners were awarded at an estimated annual savings versus current contract of \$174,696 and \$254,285 in avoided costs versus the utility price to compare.

FACILITIES

Continued to support DGS and the Department of Military and Veterans Affairs (DMVA) with the Fort Indiantown Gap photovoltaic PPA project, specifically regarding finalizing contract terms and conditions.

Provided support for the potential GESA project at Selinsgrove Center, which included researching historical boiler conversion information at SCI Retreat and Mansfield University and providing the information to DGS via email on October 4, 2016. PSFEI also communicated with UGI about securing an adequate supply of natural gas for Selinsgrove Center.

Attended the GESA program update and overview meeting in Harrisburg on October 17, 2016.

Attended a COSTARS meeting in Allentown with a group of area municipalities on October 18, 2016, and presented an overview of the COSTARS electricity procurement opportunity.

Developed an Act 129 Phase III flyer providing Commonwealth agency contacts as requested by DOC. The initiative included having discussions with each CSP entity. Submitted the information to DOC on October 27, 2016, and copied the DGS Facilities and Assets Management in support of their Act 129 program efforts.

Provided updated cost estimates for boiler conversion at the Selinsgrove Center on November 15, 2016.

Continued supporting DGS on the Thaddeus Stevens College GESA initiative.

Participated in the Department of Conservation and Natural Resources (DCNR) Western Region GESA kickoff meeting at Ohioypyle State Park on December 13, 2016.

Developed and submitted a revised executive slide deck providing an updated eight-year energy trend analysis of DGS energy data. Preliminary drafts were submitted to the Deputy Secretary on December 14, 2016.

Evaluated two Capitol Complex water utility accounts that experienced extended periods of underestimated meter readings, resulting in DGS receiving extremely large bills once actual meter reads occurred. Evaluation and recommendations were submitted to DGS Facilities and Assets Management via email on December 16, 2016.

Assisted the new DGS HVAC Chief in gaining access to ERMA on December 16, 2016.

Obtained information regarding the PUC's jurisdiction over water authorities and provided the information via email to DGS Facilities and Assets Management on December 19, 2016.

Visited SCI Retreat on December 20, 2016, with DGS, DHS, and Selinsgrove Center representatives to review their successful boiler conversion.

Submitted a proposal for Selinsgrove Center's boiler retrofit scope of work to DGS Facilities and Assets Management on December 22, 2016.

Prepared to obtain signatures to finalize the DGS Bureau of Real Estate Lease Specification and Assessment Program agreement.

Familiarized DGS Facilities and Assets Management with the State Transportation Innovation Council's Energy Analytics initiative and facilitated communications with the Pennsylvania Turnpike Commission (PTC).

Continued to support the Commonwealth's participation in the PJM Demand Response Program. Received final program information for 2016 from the CSPs. Six participating Commonwealth agencies reduced a total load of 16 MW resulting in payments of \$593,799.

MEETINGS

Attended the DGS and PSFEI bi-monthly meeting in Harrisburg on November 15, 2016.

OTHER

Submitted the DGS quarterly report for the first quarter of fiscal year 2016–2017 on October 14, 2016.

Developed and published the *Energy & Utility Usage Report for Fiscal Year 2015–2016* via email on December 9, 2016. As requested, mailed four advance hard copies to DGS Property and Assets Management. Nine additional copies were provided at the bi-monthly meeting in January 2017.

PROCUREMENT

Continued monitoring the trend of electricity purchased from the (LCSWMA compared to contractual requirements and provided informational updates to DGS.

Supported DGS in resolving changes to all Pennsylvania Department of Transportation (PennDOT) electricity accounts in FirstEnergy utility territories. The changes, initiated by PennDOT, impacted planned procurement activities. Remedial work involved realigning all utility accounts with the appropriate supplier accounts in ERMA.

Discussed strategic natural gas purchases and market conditions with NRG Harrisburg on February 3, 2017, as previously approved by DGS, and provided a discussion summary via email to DGS.

Developed marketing materials for DGS electricity procurement and GESA program accomplishments and submitted to DGS on February 14, 2017.

Worked with the PSFEI Information Technology (IT) Team to develop a Contract Spend Report for electricity as requested by DGS. The report will be completed early in the 2015–206 fourth quarter.

Developed a marketing brochure and enrollment form for COSTARS electricity procurement with a targeted introductory mailing of 1,000 COSTARS members across the Commonwealth. Mailing will begin in late April 2017.

Worked with COSTARS Invitation to Qualify (ITQ) electricity suppliers to develop broker agreements.

Supported DGS in securing ITQ CSPs for the PJM Emergency Demand Response program. The procurement process of selecting suppliers to serve as CSPs for specific Commonwealth accounts was issued by DGS on March 31, 2017.

Conducted two natural gas RFQ procurement events, DGS 16-07 for three COSTARS accounts on February 21, 2017 and DGS 16-09 for five Commonwealth accounts on March 24, 2017. The two events resulted in a combined total of \$360,162 in avoided costs versus the utilities price to compare and \$569,074 in contract avoided costs versus the utilities price to compare.

Supported the DGS Bureau of Procurement with ongoing, day-to-day account management services for Commonwealth agencies including fuel-price risk management, tariff rate-change issues, and billing and metering discrepancies.

FACILITIES

Continued to support the DCNR GESA initiative by providing ERMA-based electricity account information and assisting DGS with their efforts to obtain other utility account information.

Supported the Selinsgrove GESA initiative by providing utility use and cost data to Selinsgrove Center on January 17, 2017.

Provided initial opinions via email on January 23, 2017, regarding DGS' use of solar powered trash compactors.

Prepared and submitted annual utilities use information on January 24, 2017, for five state prison facilities that were candidates for closure.

Provided fall 2016 annual electricity use and cost information by agency and procurement savings on January 26, 2017.

Updated facility information in ERMA using information received from DCNR on February 1, 2017.

Shared Adverse Interest Act information and requested that DGS provide a determination regarding the go-forward plans for providing EnergyCAP.

Participated in a conference call on February 2, 2017, to discuss water and sewer bill problems, the DGS/PSFEI contract, and EnergyCAP. Provided follow-up information regarding sewer charges from the Borough of Penbrook via email on February 3, 2017.

Provided a digital copy of an electric distribution territory map to DGS on February 20, 2017, as requested, after researching available information through the Penn State library system.

Responded to a request from DGS to investigate Powerstar transformers and their claim of significant energy savings. Provided review comments and an assessment via email on February 21, 2017. Spoke with company representatives at the National Facilities Management & Technology (NFMT) conference in Baltimore, Maryland and confirmed our initial assessment.

Signed statements of confidentiality for the Selinsgrove Center and DCNR GESA projects.

The quarterly utility update report for Q1 2017 (Jul–Sep) versus Q1 2016 (Jul–Sep) was not issued due to inconsistencies discovered in the distribution of individual building electricity use at the Capitol Complex. The dashboard report provides a comparison of utility use and cost for Q2 2017 (Oct–Dec) versus Q2 2016 (Oct–Dec). Following are comments:

Electricity

Electricity consumption was 4% less in Q2 2017 than in Q2 2016. Costs were 6.8% lower in Q2 2017 than in Q2 2016 as average unit costs were approximately 3% lower.

Heating

Steam consumption was 23% higher in Q2 2017 than Q2 2016; steam cost increased by 25%. Natural gas consumption was 4.3% higher, yet natural gas costs dropped by 0.7%. The thermal energy consumption increase was likely due to 28% more heating degree-days during the period. Overall heating costs for Q2 2017 were \$221,456 (20.8%) higher compared to Q2 2016.

Water

Water use increased by 51% for Q2 2017 compared to Q2 2016. Costs increased by \$113,558 or 31%. The increased use and cost are the result of meter reading issues with the City of Harrisburg and large bills received during Q2 2017. Hosted a strategic energy planning meeting with DGS in January 2016 at PSFEI's office in State College. Distributed action items to all attendees in January 2016.

MEETINGS

Hosted a DGS and PSFEI bi-monthly meeting in State College on January 19, 2017, which was attended by representatives from the PTC.

Assisted the PTC and DGS in presenting to the State Transportation Innovation Council on January 31, 2017.

Met with DGS and DCNR representatives in Harrisburg on February 1, 2017, to discuss energy information collection challenges and determine a go-forward solution.

Met with DGS on February 1, 2017, in Harrisburg to discuss energy savings opportunities at the Capitol Complex.

OTHER

Modified energy slide-deck graphics on January 18, 2017, to ensure consistency with other report formats included in the Governor's report.

Prepared and submitted marketing literature portraying energy program success including electricity procurement, REC purchases, energy tracking, and efficiency programs, as requested by DGS.

Submitted the DGS second quarter report for fiscal year 2016–2017 on January 25, 2017.

Met with DGS on February 16, 2017, to discuss an overall plan for utility bill management. Based on DGS legal counsel direction provided on March 2, 2017, PSFEI was requested to develop a proposal for offering EnergyCAP utility bill management as a service through an amendment to the existing interagency agreement. PSFEI is developing costs for this service including EnergyCAP and ERMA integration.

FOURTH QUARTER

PROCUREMENT

Supported the DGS initiative to enable the Commonwealth to receive financial payment from PJM for permanent demand reduction activities including communication with the DGS Bureau of Procurement and Property and Asset Management.

Completed the DGS Bureau of Procurement requested contract spend reports for electricity and natural gas in late April (electricity) and May (natural gas).

Developed COSTARS electricity procurement brochures, letters (co-signed by the DGS Bureau of Procurement and PSFEI), and envelopes. Obtained input from the DGS Bureau of Procurement and selected a targeted list of approximately 1,000 COSTARS members for receipt of program introductory information. Mailings were sent in two stages; follow-up will include direct contact by telephone.

Corrected ERMA bill data errors on April 24, 2017, that resulted from supplier bill format changes to the LCSWMA. Coordinated with DGS Property and Asset Management.

Prepared recommendations to manage the existing electricity purchase contract for SCI Pittsburgh as requested by DOC on June 6, 2017, due to the impending closure plans for the facility.

Secured broker agreements with ITQ suppliers to support the COSTARS electricity procurement program (WGL Energy, Jack Rich dba Anthracite Power & Light, and Talen Energy). In process are agreements with Constellation NewEnergy, Inc.; Direct Energy; Shipley Energy; and UGI Energy Services.

Supported the DGS Bureau of Procurement RFQ DR 16-01 issued on March 31, 2017, selecting suppliers for Commonwealth activities in the PJM Demand Response program. PSFEI communicated with the various agency institutions to assist in establishing the appropriate target reduction levels. DGS awarded contracts on April 12, 2017.

Conducted two electricity RFQ procurement events, DGS 16-10 for 294 Commonwealth accounts on April 26, 2017, and DGS 16-11 for 42 COSTARS accounts on May 22, 2017. The two events resulted in a combined total of \$150,727 in annual avoided costs versus the utilities price to compare, and \$426,767 in total avoided costs versus the utilities price to compare.

Supported the DGS Bureau of Procurement with ongoing, day-to-day account management services for Commonwealth agencies including fuel-price risk management, tariff rate-change issues, and billing and metering discrepancies.

FACILITIES

Commenced providing PLC management service to DGS Property and Asset Management in late April. Determined existing DGS facility load profiles and PLC reduction opportunities and submitted to this information to DGS on May 5, 2017. Discussed opportunities via telephone and email communications, and developed a communication plan and DGS implementation strategy. PSFEI will send email notifications on high-probability PLC event days during summer 2017.

Reviewed projected greenhouse gas reductions submitted by the ECG Group and provided questions regarding the information to DGS on April 26, 2017.

Updated the GESA promotional energy graphics with revised project cost information. A natural gas information graphic will be developed in fall 2017.

Attended a GESA update and planning meeting on May 1, 2017, at DGS in Harrisburg.

Continued supporting the DHS Selinsgrove Center's GESA initiative through communications with UGI Utilities and DGS Property and Asset Management. Submitted review comments regarding the McClure Company proposal to DGS Property and Asset Management on May 1, 2017, supplemented with several follow-up email communications. Provided detailed steam load information to DGS Property and Asset Management on June 1, 2, and 5, 2017.

Provided Illuminating Engineering Society of North America recommended illumination levels information to DGS Property and Asset Management on June 1, 2017.

Initiated communications with the Harristown Development Corporation on June 9, 2017, as requested by DGS to obtain energy use and cost information. DGS Property and Asset Management wants to include their Commonwealth occupied, leased facilities in the *DGS Energy & Utilities Usage Report Fiscal Year 2016–2017*.

Held a pre-project kick-off meeting and walkthrough on June 14, 2017, with DGS facilities electrical and HVAC staff in accordance with the revised scope of services included in new interagency agreement effective July 1, 2017. PSFEI discussed important project elements including schedule, participant responsibilities, and deliverables. Electrical testing is scheduled to begin July 24, 2017, at the Rachael Carson Building.

Began providing facilities engineering and management support to the DGS Bureau of Real Estate (BRE) effective April 1 2017. PSFEI activities included:

- A review of all existing DGS BRE lease templates.
- Three meetings to discuss proposed modifications to existing standard lease templates.
- One day spent shadowing DGS BRE staff to further understand the leasing and space management process.
- Benchmarking of leasing standards.
- Execution of a lease conditions assessment at the Harrisburg Community Corrections Center on July 11, 2017.
- Scheduling of a benchmarking trip (August 9, 2017) to the General Services Administration headquarters in Washington DC with DGS BRE staff.
- Issuance of a report (July 26, 2017) to DGS BRE with recommendations on how to proceed with the leasing templates and a supporting timeline.

Prepared the dashboard report to compare utility use and cost for Q3 2017 (Jan–Mar) versus Q3 2016 (Jan–Mar). Following are dashboard report comments:

Electricity

Electricity consumption was 2.4% less in Q3 2017 than in Q3 2016. Costs were 3.5% higher in Q3 2017 than in Q3 2016 as average unit costs were approximately 6% higher.

Heating

Steam consumption was 1.3% higher in Q3 2017 than Q3 2016; steam cost increased by 6.4%. Natural gas consumption was 26.3% lower and natural gas costs dropped by 16.5%. The thermal energy consumption decrease was likely due to 12% fewer heating degree-days during the period. Overall heating costs for Q3 2017 were \$48,741 (3%) higher compared to Q3 2016.

Water

Water use increased by 16% for Q3 2017 compared to Q3 2016. Costs increased by \$83,243 or 20%. The increased use and cost are the result of past meter reading issues with the City of Harrisburg and Capitol Region Water Authority.

MEETINGS

Attended the DGS and PSFEI bi-monthly meeting in Harrisburg on April 18, 2017.

Hosted the DGS and PSFEI bi-monthly meeting at the PSFEI office in State College on June 14, 2017.

OTHER

Attended a meeting on April 5, 2017, with DGS and DMVA to discuss Commonwealth energy management activities.

Submitted an initial budget and scope letter on April 18, 2017, in response to a March 6, 2017, request from DGS for PSFEI to provide utility bill management services to the Commonwealth.

Continued with development of a Commonwealth utility bill management proposal, working with EnergyCAP and DGS to determine total meter counts, bill capture requirements, and program costs. After several pricing scenarios, meetings, and conference calls, DGS settled on a tiered approach pricing model for Commonwealth agencies.

Hosted a conference call on April 19, 2017, with the DGS Bureau of Procurement and the Commonwealth's Comptroller office to explore methods to obtain copies of all portable document file-(PDF) based utility bills, followed by several additional conference calls.

Submitted the fiscal year 2016–2017 third quarter report containing PSFEI's summary of services on April 26, 2017.

Attended a meeting with DGS, DMVA, and the PTC at the EnergyCAP office on May 3, 2017. The meeting purpose was to familiarize Commonwealth personnel with the EnergyCAP organization and continue discussing Commonwealth utility bill management needs.

Attended and participated in the Commonwealth Energy Summit on May 18, 2017, scheduled as a follow-up to the State Transportation Innovation Council initiative. Presentations focused on Commonwealth utility bill management needs and the benefits realized from having detailed billing information.

Assisted DGS in a follow-up presentation on June 28, 2017, to DCNR regarding the EnergyCAP utility bill management initiative.

SUMMARY OF EDUCATION SERVICES

EDUCATION OPPORTUNITIES

PSFEI developed and conducted technical short courses and special trainings to sharpen job skills for its Commonwealth clients. The short courses were held in the State College area and workshops and seminars were held at convenient locations throughout the state. Thirteen DGS employees enhanced their skills by attending training events in fiscal year 2016–2017.

The following PSFEI short course opportunities were available in fiscal year 2016–2017:

- HVAC Technical Conference, July 27–39, 2016. Topics of instruction focused on basic HVAC thermodynamics, steam trap design and operating principals, heating plant essentials, steam condensate, steam safety, and also included a tour of Penn State's East Campus combined heat and power plant
- Boiler Plant Operations and Maintenance Training, May 2–4, 2017. This course provided instruction on boiler properties of water and steam; boiler processes, controls, operations, safety, pumps and fans, and water treatment; and the impact of environmental regulations. Course attendees were provided with a tour of Penn State's East Campus combined heat and power plant
- Electrical Theory, May 23–25, 2017. Sessions taught during this course included arc flash training, overcurrent relay testing, electrical circuits and transformers, transfer switches, frequency drives, and a review and discussion of Commonwealth projects. Course attendees toured Beaver Stadium's electrical switchgear.
- Effective Facility Management, Year III–Facility Management, June 7–9, 2017. The Effective Facility Management course provides an orderly progression of course topics on a three-year schedule to enhance the knowledge and effectiveness of facility management personnel. This year's session included topics on developing contract strategies and statements of work, leadership and strategy, maintenance strategies, and emergency response.

Five half-day workshops in each of the following categories—boiler, electrical, and HVAC, were offered and hosted at various Commonwealth facilities across the state. Topics vary based on facility staff requests, changes in standards, safety needs, etc. DGS attendance at PSFEI educational training events is detailed in Table 16 on page 50.

Table 16. DGS Attendance at Short Courses and Workshops 2016–2017

Short Courses	DGS Attendance
HVAC Technical Conference	0
Boiler Plant Operations and Maintenance Training	0
Electrical Theory	4
Effective Facility Management	3
Workshops and Special Courses	
Boiler Workshop	0
Electrical Workshop	6
HVAC Workshop	0
Total	13