2024

Campus Environmental Audit- Innovative Institute of Law Greater Noida Uttar Pradesh

Innovative Insti
Plot No.-6 Knov
Greater Noid

Navy Blue Energy
NavyBlue Resources Integration and Solutions Pvt Ltd

ABBREVIATION

A-Ampere
AC- Air conditioner
BMS – Building Management System
CFL – Compact Fluorescent Lamp
DG – Diesel Generator
ECO – Energy Conservation Opportunities
EER- Energy Efficiency Ratio
FTL- Fluorescent Tube Light
HT- High Tension
KW – Kilowatt
KVA – Kilo Volt Ampere
LED – Light Emitting Diode
LPD – Lighting Power Density
LT – Low tension
NBC- National Building Code
ODU – Outdoor units
PAC – Precision Air Conditioning
PF – Power factor
TR – Tonne of refrigeration
UoM – Unit of Measurement
UPS – Uninterrupted power supply
V - Voltage

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ACKNOWLEDGEMENT

Energy Audit team of **M/s. Navy Blue Resources Integration & Solutions Pvt Ltd (NBRI)** conducted Campus Environmental Audit of **Innovative Institute of Law, Greater Noida, Uttar Pradesh**, on **28th August 2024**.

We would like to thank Hon. Principal and Management for providing us an opportunity to carry out Campus Environmental Audit at your Facility and would also like to thank all other staff of facility for providing all the support during audit and report preparations.

The purpose of this assessment is to conduct a complete energy performance assessment Mechanical & Electrical Equipment, Water Audit, Renewable Energy Feasibility, Waste Management and Green Audit within the said site to identify whether the existing systems can sufficiently handle the loads required by your operations and seeking improved workplace efficiently.

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INTRODUCTION

Innovative Institute of Law is a non-profit, quality conscious and trend-setting Law Institutes in Delhi NCR with focus on providing equal opportunities for development of human potentials of every segment of society including the differentiated one.

The Innovative Institute of Law has been established through the dedicated and selfless endeavor of educationists and social workers who are deeply concerned with the standards of education and are determined to upgrade the quality, content and direction of education. The Innovative Institute of Law is a venture of its kind where educators and professionals have joined hands to aid and direct the agenda of education. The Innovative Institute of Law is located in the institutional area of Greater Noida and has a magnificent building.

The Innovative Institute of Law strongly supports the anti-smoking and anti ragging campaigns of the Indian Government. The anti ragging Committee of the Pharmacy Institute has implemented all the provisions of anti-ragging in the campus of the Innovative Institute of Law as per the directions of the Supreme Court's Order dated May '2001.

Figure 1 Map Location

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AUDIT STUDY TEAM MEMBERS

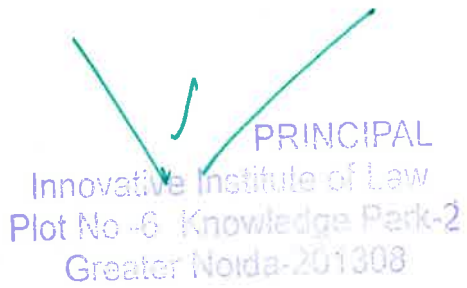
The Audit team comprised of following members from Navy Blue Energy.

Table 1 Audit Team Members

Sr. No	Name of Members	Designation
1	Tushar Harer CEA-30563	Team Leader-Energy Auditor
2	Dr Amol Mande – EA- 26779	Energy Manager
3.	Rajendra Waykar	Energy Engineer

INSTRUMENTS USED FOR MEASUREMENTS AND ANALYSIS-

1. Three Phase Load Manager- With CT, PT
2. Ultrasonic Flowmeter
3. Single phase Instantaneous power Meters
4. Lux Meter
5. Psychrometer



EXECUTIVE SUMMARY

ENERGY AUDIT

Navy Blue Energy Audit team observed some energy conservation opportunity in the premises. Facility can minimize its energy consumption by executing following Energy Conservation measures.

Table 2 Executive Summary

Energy Conservation Measures (ECM)	Estimated Energy Saving	Estimated Monetary Saving	Estimated Investment	Simple Payback Period	Priority
	kWh/Year	Rs/Year	Rs	Month	
Energy conservation Measures by Replacing Old Fans with new Energy Efficient Fans	9110	84830	240000	34	Medium
Energy savings BY Replacing old Tube lights with new efficient LED Lights	934	8701	20000	28	Medium
Energy Conservation Measure by installing rooftop Solar PV Plant	28000	260718	850000	39	Medium
Total	**34044**	**354249**	**1110000**	**37**	

Navy Blue Energy Audit team has thoroughly assessed the complete facility Performance, Team has been observed that there will be around **60%** of Energy Savings Can be Achieved further by implementing the above-mentioned ECM's.

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WATER AUDIT

Table 3 Water Conservation Measures

Water Conservation Measures	Water savings Potential kl/Year
Water conservation potential by using water efficient taps	324
Water saving opportunities with Dual flushing technique in toilet	450
Total	774

Navy Blue Water Audit team has thoroughly assessed the complete facility Performance, Team has been observed that there will be around 21% of Water Savings Can be Achieved further by implementing the above-mentioned WCM's.

WASTE DISPOSAL AUDIT

Presently institute is practicing the waste segregation on site only- good practice.

GREENERY-

Presently the campus has greenery is around the boundary, need to add some more in available areas.

CARBON FOOTPRINT-

Total **429 kg** of CO_2 is getting emitted by the campus per day.

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OBJECTIVE OF AUDIT -

1. The objective of carrying out Green Audit is securing the environment and cut down the threats posed to human health.
2. To make sure that rules and regulations are taken care of
3. To avoid the interruptions in environment that are more difficult to handle and their correction requires high cost.
4. To suggest the best protocols for adding to sustainable development.

SCOPE OF WORK-

Scope of Green Audit shall consider following steps;

ENERGY AUDIT:

It deals with the energy conservation and methods to reduce its consumption and the related pollution. The auditor targets at the energy consuming methods adopted and find whether these methods are using the energy in a conservative way or not.

WATER AUDIT:

Evaluating the facilities of raw water intake and determining the facilities for water treatment. Water
harvesting is one of the best techniques that can be adopted by simply storing the water and using it at the time of scarcity. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water

WASTE DISPOSAL AUDIT:

The waste clearance measures associated to hazardous wastes and recycling are reviewed. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

ENVIRONMENTAL QUALITY AUDIT:

It analyses the air quality, noise level and the programs undertaken by the institute for plantation. The Green Belt should be maintained to reduce the pollution level by decreasing the Carbon dioxide level.

RENEWABLE ENERGY FEASIBILITY

Resources which can be replenished should be used such as rain, sunlight, wind, tides, etc. These resources are more advantageous as they cause least pollution. The importance of these resources is explained by the Audit team.

CARBON ACCOUNTING:

It undertakes the measure of bulk of carbon dioxide equivalents exhaled by the organization through which the carbon accounting is done. It is necessary to know how much the organization is contributing towards the sustainable development. The auditor considers several efforts practiced by the institute to lower the Green House Gases in the atmosphere in order to make the campus more environmentally friendly.

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GOALS OF THE INSTITUTE

In the effort to Enhancing an environmentally literate campus where students can learn the idea of protection of environment and stay healthy. The Institute Management is proactively working on the several facets of "Green Campus" including Plantation of more trees, Water Conservation, Efficient water usage by eliminating leaking water taps, Water Harvesting Pits and interconnecting them to Recharge the Ground Water table. Effective Waste Management which includes Food Waste, Plastic, Paper, Metal Work, Renewable Energy, carbon footprints etc.

1. To create a green campus with focus on above concepts
2. To Harness Solar Power
3. To Conserve Water by eliminating the water leakages, wastage, Rainwater Harvesting
4. To Reduce Waste management through reduction of Food waste generation, Plastic/Paper/Metal waste generation and effective disposal
5. To Reduce the Carbon Footprint
6. Enhancement of Institute profile

Figure 2 Institute Campus

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BILLING ANALYSIS-

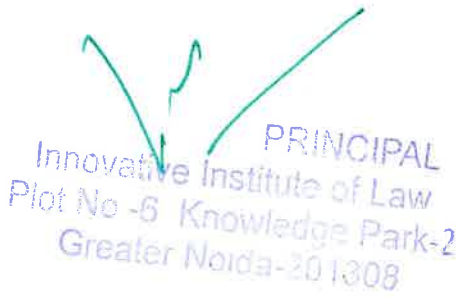
Audit team observed that the Electricity is supplied by state electricity board with **40 kW** of connected load and the average monthly billing is **Rs. 57982/-** . The average KVA demand for the institute is 42 KVA and gross energy rate is **9.31 Rs/kVAh**.

Table 4 Billing Analysis

Consumer Number	**2000024314**
Sanctioned Load	40 KW
Contact Demand	55 KVA

Month	Units (kVAh)	Billed Demand (KVA)	Fixed Charge	Bill Amount (INR)	Energy Charges
Aug-24	16539	55	17689	152993	9.25
Jul-24	19022	54.8	17025	171103	9.00
Jun-24	23862	70.46	22621	225724	9.46
May-24	16090	58.26	18100	152463	9.48
Apr-24	8927	37	11885	90508	10.14
Mar-24	8073	33.33	10011	72526	8.98
Feb-24	10859	34.64	11121	96639	8.90
Jan-24	10379	28.62	9015.3	92890	8.95
Dec-23	7274	33.33	10356	74713	10.27
Nov-23	7626	19.96	6287.4	69624	9.13
Oct-23	10861	41.48	13066.2	100357	9.24
Sep-23	10291	37.8	12135	92028	8.94
TOTAL	**149803**	-	**159312**	**1391568**	-
Average	**12484**	**42**	**13276**	**115964**	**9.31**

(The electricity supply is common for two institutes and the bill used for bill analysis is combined for both the institutes and here we have assumed equal energy usage by the both institutes.)



ENERGY BALANCE

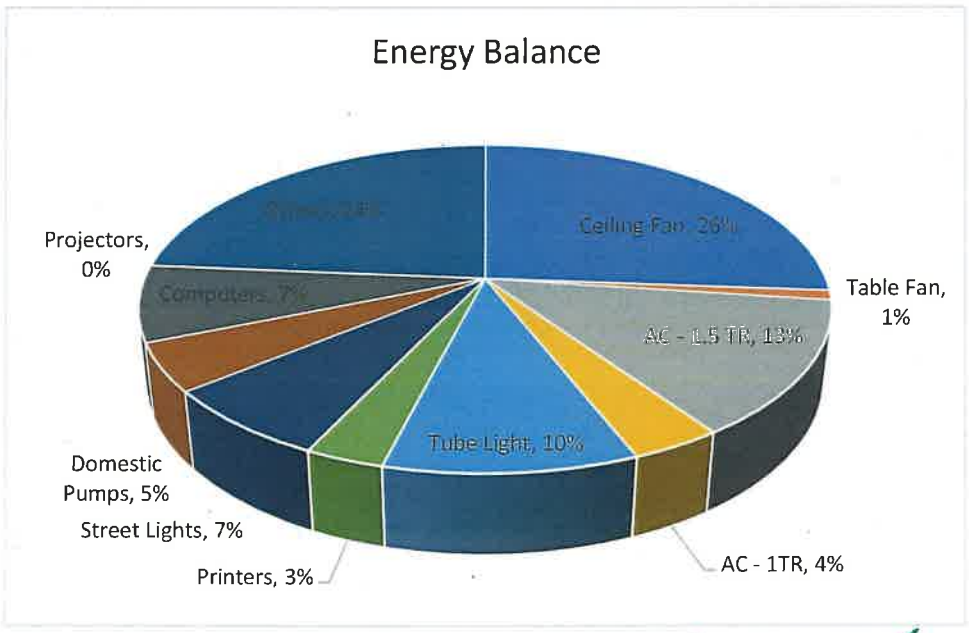
Audit team prepared the energy balance of the facility.

Table 5 Energy Balance

Load Details	QTY	Rated Wattage	Operating Hours	Usage diversity	Energy kWh/Day	Energy %
Ceiling Fan	120	70	8	80%	54	26%
Table Fan	10	30	8	80%	2	1%
AC - 1.5 TR	5	1550	7	50%	27	13%
AC - 1TR	2	1050	7	50%	7	4%
Tube Light	80	40	8	80%	20	10%
Printers	8	250	8	40%	6	3%
Street Lights	15	100	12	80%	14	7%
Domestic Pumps	1	2000	6	80%	10	5%
Computers	40	60	8	80%	15	7%
Projectors	3	50	2	20%	0	0%
Others					49	24%
Total					**205**	100%

The major energy is consumed by fans followed Air Conditioners.

Chart 1 Energy Balance



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ENERGY CONSERVATION MEASURES

ENERGY SAVINGS BY REPLACING EXISTING CEILING FAN BY BLDC FAN

Observation- It is observed that at present facility have conventional Fans which consumes almost double the energy than energy efficient BLDC Fans.

Recommendation- it is recommended to replace the old fans with new energy efficient BLDC Fans, the energy savings potential along with cost benefit analysis mentioned in the table below.

Table 6 Energy Savings Calculations by replacing fan with BLDC Fans

Parameter	UoM	Value
Present Fan Rated Capacity	W	70
Present Fan Energy Consumption	kWh/Year	19622
Total Number of fans	Nos.	120
Proposed Capacity of fans	W	30
Energy savings Potential	kWh/Year	9110
Monetary savings Potential	Rs/Year	84830
Estimated Investment	Rs.	240000
Simple Payback Period	Months	**34**

Site photograph 1 Classroom conventional fan

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ENERGY SAVINGS BY REPLACING OLD TUBE LIGHTS WITH NEW EFFICIENT LED LIGHTS

Presently at facility there are few old FTL Lights installed, which can be replaced with new LED, the potential savings and cost benefit analysis is mentioned in the table below.

Table 7 Energy savings by replacing TFL with LED tube lights

Parameter	UoM	Value
Present FTL Rated Capacity	W	40
Present Fan Energy Consumption	kWh/Year	7475
Total Number of FTL	Nos.	80
Proposed LED Tube light rated capacity	W	28
Energy savings Potential	kWh/Year	934
Monetary savings Potential	Rs/Year	8701
Estimated Investment	Rs.	20000
Simple Payback Period	Months	28

Figure 3 FTL in Campus building

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ENERGY GENERATION OPPORTUNITY BY INSTALLING SOLAR PV PLANT

It is proposing to install a 20 kWp Solar Grid tied rooftop system to get green energy from solar. Here is the cost benefit analysis of the same.

Table 8 Solar PV Feasibility

Parameter	UoM	Value
Present Energy consumption	kWh/Year	57982
Proposed Solar capacity	kWp	20
Energy savings Potential	kWh/Year	28000
Monetary Energy Savings Potential	Rs./Year	260718
Estimated Investment	Rs	850000
Simple Payback Period	Months	39

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WATER AUDIT

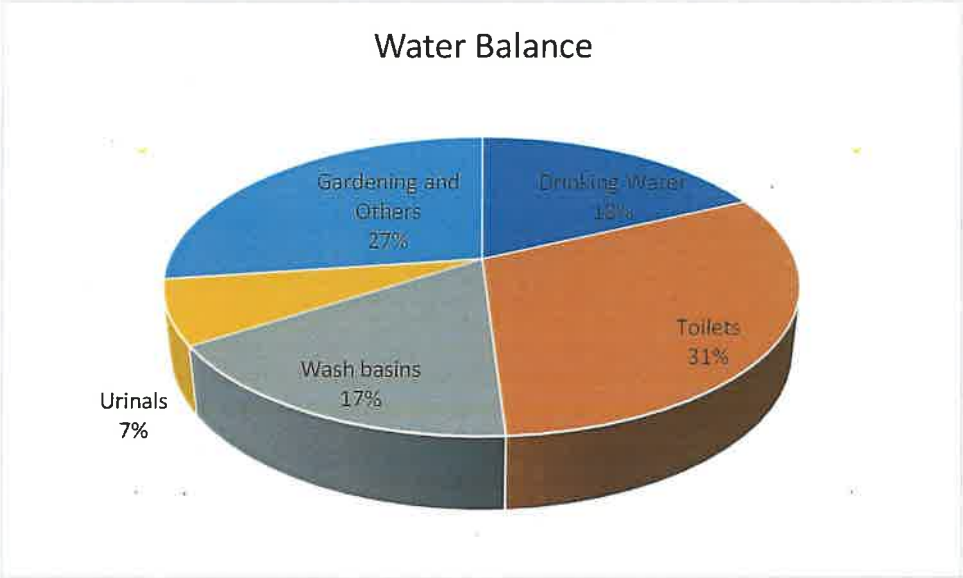
Campus Consuming around 10m^3/day water.

WATER BALANCE

Table 9 Water Balance

Consumption	Liters/Day
Drinking Water	1800
Toilets	3100
Wash basins	1680
Urinals	700
Gardening and Others	2720
Total	**10000**

Chart 2 Water Balance



The major water is used by toilets following by gardening and other uses.

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Site photograph 2 Water Storage Tank in Campus

WATER CONSERVATION OPPORTUNITIES

WATER SAVING OPPORTUNITY BY CONVENTIONAL TAP REPLACEMENT WITH NEW EFFICIENT TAPS

Convectional water taps consume more water than the new water efficient taps, it is recommending replacing conventional taps with new taps.
Here are the savings calculations.

Table 10 Water conservation opportunities by replacing taps.

Parameter	UoM	Value
Present TAP Water Consumption	Liters/Day	1680
Proposed Water consumption	Liters/Day	600
Savings potential	Liters/Day	1080
Savings potential	%	64%

Normal Tap

Water Efficient Tap

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WATER SAVING OPPORTUNITIES WITH DUAL FLUSHING TECHNIQUE IN TOILET

Convectional water Flush consume more water than the new water efficient Flushing system, it is recommending replacing conventional Flush with new Dual flush system.
Here are the savings calculations.

Table 11 Water conservation opportunity by replacing flush with dual flush system.

Parameter	UoM	Value
Present Toilet Water Consumption	Liters/Day	3100
Proposed Toilet consumption	Liters/Day	1600
Savings potential	Liters/Day	1500
Savings potential	%	48%

Site photograph 3 Campus Toilets

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GREENERY SURVEY

Campus having verities of plants since a lot of plants are planted by the administration.

Table 12 List of Plant species in the campus

Sr. No.	List of Plant species in the campus
1	Amala
2	Pipal
3	Neem
4	Jamun
5	Ashoka
6	Bel
7	Banayan
8	Teak
9	Mango
10	Tulsi
11	Aloe Vera
12	Banana
13	Lemon Grass
14	Lemon
15	Sandalwood
16	Gauva

Table 13 Campus Plant Species Pics

	Campus Plants 01

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	Campus plant 2
	Campus plant 3
	Campus plant 4

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	Campus Plant 5
	Campus plant 6
	Campus plant 7

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Waste Management:

1. **Bio Waste** – Mostly Food Waste is generated from the cooked food at the campus in the canteen. It is proposed to install Bio Gas plant in the campus to generate Bio Gas from the food waste, which can be used in the Food Cooking. The Procurement is in process and is installed shortly.

2. **Non-Bio Waste** – Plastic Bottles / Waste Paper / Cardboards/ Batteries etc

Non- biodegradable waste, which cannot be decomposed by biological processes, is called non-biodegradable waste. These are of two types - Recyclable: waste having economic values but destined for disposal can be recovered and reused along with their energy value. e g. Plastic, paper, old cloth etc. Non-recyclable: waste which do not have economic value of recovery. e.g. Carbon paper, thermo coal, tetra packs etc. Disposal of non-biodegradable waste is a major concern, not just plastic, a variety of waste being accumulated. There are a few ways to help non-biodegradable waste management. The impact of non-biodegradable waste on the environment and also focus on its safe disposal for sustainable environment.
Present Status: Dust bins were provided for the waste disposal the same is collected daily once and handed over the Municipal corporation.

3. E Waste Management

Waste Electrical and Electronic Equipment (WEEE) or E-waste is one of the fastest growing waste streams in the world. In developed countries, it equals 1% of total solid waste on an average. In developing countries, it ranges from 0.01% to 1% of the total municipal solid waste generation. In countries like China and India, though annual generation per capita is less than 1 kg, it is growing at an exponential pace.

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CARBON ACCOUNTING / FOOT PRINT

Table 14 Carbon Footprint

Emission Source	Quantity	CO2 Emission Factor	total Emission per Day (kg)
Teaching and Non-teaching	28	700 gram/person/day	19.6
Two Wheelers	25	5 gram/km	3.1
Students	411	700 gram/person/day	210
Four-Wheeler	10	130 gram/km	32.5
Electricity Consumer	205	800 gram/kWh	164
Total kg/Day			**429**

Note: Assume each member travel 25 kms to Institute and 25 kms return to home.

Mode of Transit	CO_2 released (per km driven per person)	CO_2 released during production of vehicle
Car	271 g	313 g
Bus	101 g	---
Bicycle	16 g (This is from the fuel of the rider – food)	16 g

	Pounds CO2	Kilograms CO2	Pounds CO2	Kilograms CO2
Carbon Dioxide (CO_2) Factors:	**Per Unit of Volume or Mass**	**Volume or Mass**	**Million Btu**	**Million Btu**
FOR HOMES AND BUSINESSES				
Propane	12.70/gallon	5.76/gallon	139.05	63.07
Butane	14.80/gallon	6.71/gallon	143.2	64.95
Butane/Propane Mix	13.70/gallon	6.21/gallon	141.12	64.01
Home Heating and Diesel Fuel (Distillate)	22.40/gallon	10.16/gallon	161.3	73.16
Kerosene	21.50/gallon	9.75/gallon	159.4	72.3
Coal (All types)	4,631.50/short ton	2,100.82/short ton	210.2	95.35
Natural Gas	117.10/thousand cubic feet	53.12/thousand cubic feet	117	53.07
Gasoline	19.60/gallon	8.89/gallon	157.2	71.3
Residual Heating Fuel (Businesses only)	26.00/gallon	11.79/gallon	173.7	78.79
OTHER TRANSPORTATION FUELS				
Jet Fuel	21.10/gallon	9.57/gallon	156.3	70.9
Aviation Gas	18.40/gallon	8.35/gallon	152.6	69.2
INDUSTRIAL FUELS AND OTHERS NOT LISTED ABOVE				
Flared natural gas	120.70/thousand cubic feet	54.75/thousand cubic feet	120.6	54.7
Petroleum coke	32.40/gallon	14.70/gallon	225.1	102.1
Other petroleum & miscellaneous	22.09/gallon	10.02/gallon	160.1	72.62
NONFUEL USES				

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Asphalt and Road Oil	26.34/gallon	11.95/gallon	166.7	75.61
Lubricants	23.62/gallon	10.72/gallon	163.6	74.21
Petrochemical Feedstocks	24.74/gallon	11.22/gallon	156.6	71.03
Special Naphthas (solvents)	20.05/gallon	9.10/gallon	160.5	72.8
Waxes	21.11/gallon	9.57/gallon	160.1	72.62
COAL BY TYPE				
Anthracite	5,685.00/short ton	2,578.68/short ton	228.6	103.7
Bituminous	4,931.30/short ton	2,236.80/short ton	205.7	93.3
Subbituminous	3,715.90/short ton	1,685.51/short ton	214.3	97.2
Lignite	2,791.60/short ton	1,266.25/short ton	215.4	97.7
Coke	6,239.68/short ton	2,830.27/short ton	251.6	114.12
OTHER FUELS				
Geothermal (average all generation)	NA	NA	16.99	7.71
Municipal Solid Waste	5,771.00/short ton	2,617.68/short ton	91.9	41.69
Tire-derived fuel	6,160.00/short ton	2,794.13/short ton	189.54	85.97
Waste oil	924.0/barrel	419.12/barrel	210	95.25
Source: U.S. Energy Information Administration estimates. Note: To convert to carbon equivalents multiply by 12/44. Coefficients may vary slightly with estimation method and across time.				
Carbon Dioxide Emissions Coefficients by Fuel				
Detailed factors (discontinued)				

Site photograph 4 Fire Safety Pipeline and Hose

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Site photograph 5 Clean and Cool Drinking Water

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Navy Blue
Symbol of Sustainability

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