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Welcome to IDEA's CO₂ Emissions Calculation Tool for District Heating and Cooling Systems.

IDEA has developed this tool with a goal of collecting data on the carbon dioxide footprint of the US District Energy (DE) industry and to publicize the benefits of DE in mitigating carbon dioxide emissions.

The data will be used to assess the impact of various carbon dioxide emissions legislation schemes and will be very important for developing our policy advocacy arguments related to greenhouse gas emissions.

1. Please click on the "**Carbon Calculator**" tab and enter data for your system there.
2. Please use **TABLE 2** in the "**Tables for Worksheet**" tab to select your eGRID value.
3. Please save the completed worksheet and send a copy to Len Phillips at len.idea@districtenergy.org.

CONFIDENTIALITY

All information will be treated confidentially and aggregated for industry analysis.

Thank you in advance for your cooperation and support.

DISTRICT ENERGY SYSTEM - CO₂ Emissions Calculations Tool

Year: 2007

Period: January 1 to December 31, 2007

INSTRUCTIONS:

- Data entry cells are colored yellow. Please Type in data or select from a drop down menu box (when indicated).
- White, grey and black cells are for information and calculation only.
- Please provide a value in the "lbs CO₂/MMBtu" column, if the default provided does not apply to you.
- Based on the eGRID region you selected, you will find ratios for electricity used (lbs CO₂ / MMBtu) in **TABLE 2** of the "Tables for Worksheet" sheet.
- Please use units specified in table. If necessary, use **TABLE 1A** in the "Tables for Worksheet" sheet to convert from your units to required units.
- Please provide any notes in the box at the bottom of this sheet.

System information:	Type of system (select): College / University	Name of system: Western Illinois University (WIU)		
	Name of contact: Charles G. Darnell	Phone No: (309) 298 1834	Email address: cg-darnell@wiu.edu	
System location:	City, State: Macomb, Illinois, 61455		eGRID subregion (select): SRMW (Middle Mississippi)	
	Degree days (base 65°F):	Heating degree days: 6314	Cooling degree days:	3249

FUELS AND ENERGY INPUTS	Quantity used	Units	MMBtu/Unit	MMBtu	Mix	lbs CO ₂ /MMBtu	CO ₂ Emissions (lbs)
DIRECT EMISSIONS (fuel sources)							
Coal	14,367	Tons (long)	21.40	307,463	30.7%	204.03	62,731,720
Natural Gas	479,348	MMBtu	1	479,348	47.9%	116.38	55,786,520
No. 2 Oil		Gallons (std US)	0.115	0	0.0%	159.66	0
No. 6 Oil	2,231	Gallons (std US)	0.124	277	0.0%	171.98	47,571
Biomass		MMBtu	1	0	0.0%	204.88	0
Landfill Gas		MMBtu	1	0	0.0%	115.12	0
Biogas		MMBtu	1	0	0.0%	115.11	0
Other solid or liquid fuel	10,617	MMBtu	0.0916	973	0.1%	138.30	134,504
Other renewable (PV, wind ...)		MMBtu	1	0	0.0%	0.00	0
Sub-totals for direct emissions				788,060			118,700,315
INDIRECT EMISSIONS (purchased energies)							
Plant electricity (fan, motor ...)	62,533	MWh	3.412	213,362	21.3%	436.78	93,193,137
Heat pumps - electric		MWh	3.412	0	0.0%		0
Electric driven chiller & tower		MWh	3.412	0	0.0%		0
Municipal solid waste		MMBtu	1	0	0.0%	199.85	0
Waste wood		MMBtu	1	0	0.0%	195.00	0
Waste tires		MMBtu	1	0	0.0%	189.54	0
Geothermal		MMBtu	1	0	0.0%	0.34	0
Industrial heat		MMBtu	1	0	0.0%		0
Purchased steam		Mlbs	1.150	0	0.0%	205.30	0
Sub-totals for indirect emissions				213,362			93,193,137
Total fuel and energy inputs				1,001,422			211,893,452

31,366 Tons CO₂

USEFUL / OUTPUT ENERGY	Quantity delivered ^(a)	Units	MMBtu/Unit	MMBtu	Mix	lbs CO ₂ / MMBtu	CO ₂ Emissions (lbs)
Electricity		MWh	3.412	0	#DIV/0!	NA	NA
Steam		Mlbs	1.150	0	#DIV/0!	NA	NA
Hot water		Mlbs	1.150	0	#DIV/0!	NA	NA
Chilled water		Ton-hr	0.012	0	#DIV/0!	NA	NA
Total useful / output energy (not used in carbon dioxide footprint calculation)				0			

(a) Metered sales to customers

CARBON DIOXIDE FOOTPRINT OF DHC FOR ALL SOURCES OF FUEL AND ENERGY	
TOTAL CO₂ EMISSIONS (Tonnes):	96,113
AVERAGE CO₂ CONTENT (lbs/MMBtu):	212

NOTES

Electrical total is for entire campus. WIU does not sub meter Heating Plant and buildings. Cooling Degree Days based on 50 F.

Types:

Utility (public)
Utility (private)
College / University
Research campus
Healthcare
Airport
Military basis
Other

eGRID subregions:

AKGD (South/Central Alaska)
AKMS (Most of Alaska)
AZNM (Southwest US)
CAMX (Southwest Coast)
ERCT (Most of TX)
FRCC (Most of FL)
HIMS (HI excluding Oahu)
HIOA (Oahu Island)
MROE (Eastern WI)
MROW (Upper Midwest)
NEWE (New England)
NWPP (Northwest US)
NYCW (NYC)
NYLI (Long Island, NY)
NYUP (Upstate NY)
RFCE (Mid-Atlantic)
RFCM (Most of MI)
RFCW (Ohio Valley)
RMPA (CO-Eastern WY)
SPNO (KS-Western MO)
SPSO (TX Panhandle-OK)
SRMV (Lower Mississippi)
SRMW (Middle Mississippi)
SRSO (Southeast US/Gulf Coast)
SRTV (TN Valley)
SRVC

DISTRICT ENERGY SYSTEM - CO₂ Emissions Calculations Tool

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The following tables will help you select the correct quantity & CO₂/MMBtu units

TABLE 1A - CONVERT YOUR QUANTITY UNIT TO THE UNIT REQUIRED

Calculation way: ←	Your quantity unit: →	1 Mlb	1 MBBL	1 Therm (US)	1 Gallon (US)	1 MCF	1 Ton (long)	1 m ³
Fuel & energy purchases	Required quantity unit: ↓	=	=	=	=	=	=	=
Coal	Ton (long)	0.00045	NA	NA	NA	NA	1	NA
Natural Gas	MMBtu	NA	NA	0.09998	NA	0.82	NA	0.02896
No. 2 Oil ⁽¹⁾	Gallon (standard US)	140.29181	42,000	NA	1	NA	NA	NA
No. 6 Oil ⁽¹⁾	Gallon (standard US)	121.20478	42,000	NA	1	NA	NA	NA
Biomass	MMBtu	NA	NA	NA	NA	NA	13.6	NA
Purchased steam	Mlb (000 lbs) ⁽²⁾	1	NA	83.73210	NA	NA	NA	NA

Source: <http://www.onlineconversion.com> + <http://www.fpl.fs.fed.us/documnts/techline/fuel-value-calculator.pdf>

(1): conversions from Mlb of No. 2 oil and No. 6 oil into gallons are respectively based on an average density of 7.128 lb/gallon and of 8.2505 lb/gallon

(2): conversion from therms of purchased steam into pounds is based on an average pressure of 150 and a temperature of 358.23°F and a content of 1194 Btu/lb

TABLE 1B - SCALING UNITS

Name of unit	Billion	Million	Thousand	Unit
Barrels (BBL)	Billion BBL	MMBBL	MBBL	BBL
British Thermal Units (Btu)	Billion Btu	MBtu or MMBtu	KBtu	Btu
Cubic feet (CF)	Billion CF	MMCF	MCF	CF
Pounds (lb)	Billion lb	MMlb	Mlb or Klb	lb

TABLE 2 - CARBON DIOXIDE EMISSION FACTORS - Indirect emissions due to electricity use in plant

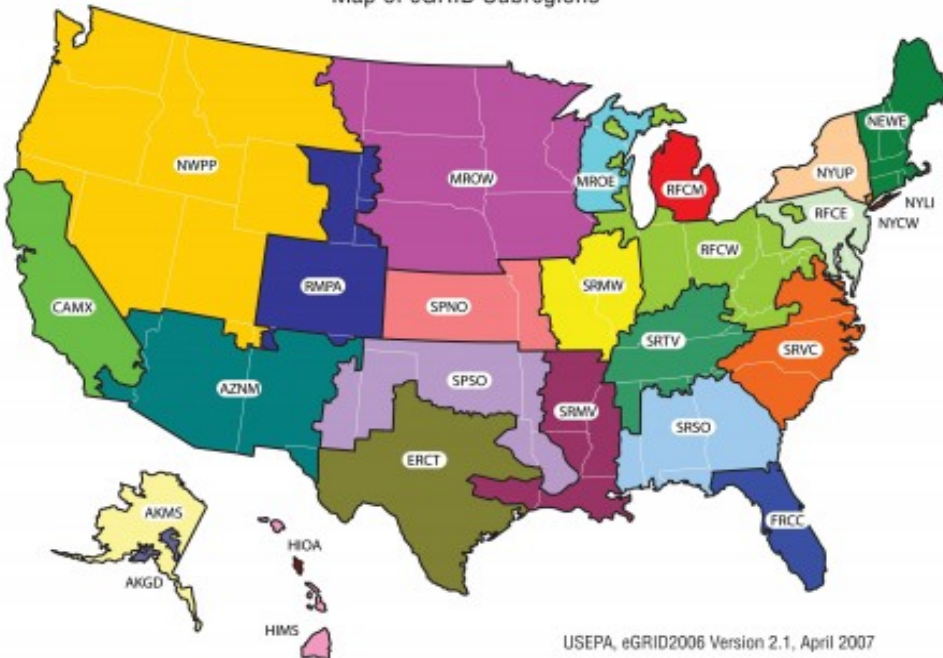
Please use this table to provide lbs CO₂/MMBtu information in the worksheet for: Plant electricity (fans, motors ...), Heat pump - electric, and Electric driven chillers and towers.

eGRID subregion	(lbs CO ₂ /MMBtu)	eGRID subregion	(lbs CO ₂ /MMBtu)
AKGD (South/Central Alaska)	368.45	NYLI (Long Island, NY)	240.22
AKMS (Most of Alaska)	140.70	NYUP (Upstate NY)	321.07
AZNM (Southwest US)	367.52	RFCE (Mid-Atlantic)	481.05
CAMX (Southwest Coast)	257.52	RFCM (Most of MI)	456.13
ERCT (Most of TX)	416.33	RFCW (Ohio Valley)	596.64
FRCC (Most of FL)	389.10	RMPA (CO-Eastern WY)	577.77
HIMS (HI excluding Oahu)	426.76	SPNO (KS-Western MO)	516.14
HIOA (Oahu Island)	506.46	SPSO (TX Panhandle-OK)	332.77
MROE (Eastern WI)	544.74	SRMV (Lower Mississippi)	540.52
MROW (Upper Midwest)	531.58	SRMW (Middle Mississippi)	436.78
NEWE (New England)	266.37	SRSO (Southeast US/Gulf Coast)	438.11
NWPP (Northwest US)	269.95	SRTV (TN Valley)	335.97
NYCW (NYC)	270.28	SRVC	413.87

Source: EPA - Climate leaders program - Year 2004 Indirect emissions from purchased/sales of electricity and steam, June 2004

eGRID subregion map is also seen on: <http://www.wri.org/map/map-egrid-subregions>

Map of eGRID Subregions



USEPA, eGRID2006 Version 2.1, April 2007

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The following tables provide additional useful references

TABLE FOR MMBTU/REQUIRED UNIT CONVERSION USED IN WORKSHEET

Fuel / Energy	Calculation way: →	MMBtu
Coal	1 Ton (long) =	26
Natural Gas	1 MCF =	0.820
Fuel oil No. 2	1 gallon (standard US) =	0.115
Fuel oil No. 6	1 gallon (standard US) =	0.124
Wood pellets	1 Ton (long) =	13.600
Electricity	MWh	3.412
Steam	Mlbs (000 lbs)	1.150
Chilled water	Ton-hour	0.012

Source: <http://www.fpl.fs.fed.us/documnts/techline/fuel-value-calculator.pdf> for the 5 first values

TABLE FOR CARBON DIOXIDE EMISSION FACTORS - Direct and indirect emissions due to fuels and energies inputs

Fuel type	(lbs CO ₂ /MMBtu)
Coal (anthracite) *	226.19
Coal (bituminous) *	204.03
Coal (lignite) **	215.53
Coke *	222.93
Diesel *	159.66
District chilled water - electric driven chillers * ⁽¹⁾	153.80
District chilled water - absorption chillers using natural gas *	160.04
District chilled water - engine driven chillers using natural gas *	106.76
District heat *	174.10
Fuel oil No. 1 *	159.66
Fuel oil No. 2 *	159.66
Fuel oil No. 4 *	159.66
Fuel oil Nos. 5&6 *	171.98
Geothermal **	0.34
Kerosene *	157.81
Landfill gas **	115.12
Liquid propane *	138.74
Municipal solid waste ***	199.85
Natural gas *	116.38
Other biomass gas **	115.11
Other gases **	141.54
Other renewable energies (PV, wind ...) ***	0.00
Propane *	138.30
Purchased steam ****	205.30
Waste tires ***	189.54
Waste wood ***	195.00
Wood *	204.88

* Source: Carbon dioxide Inventory and tracking in portfolio Manager (emission factors revised Sept. 2007) EPA - Climate leaders program; Indirect emissions from purchased/sales of electricity and steam, June 2008

** Source: National Renewable Energy Laboratory - Power Technologies data book (chapter 12: conversion factors)
http://www.nrel.gov/analysis/power_databook/docs/pdf/db_chapter12_6.pdf

*** Source: Energy Information Administration - Official Energy Statistics from the U.S. Government - Emission coefficients
<http://www.eia.doe.gov/otaf/1605/coefficients.html>

**** Source: Energy Information Administration - Appendix B, Form EIA-1605 Instructions 2001
<http://www.businessroundtable.org/pdf/climateRESOLVE/1605bData.xls>

(1): eGRID subregion rate in lbs CO₂/kbtu divided by 0.64611

TABLES FOR WEIGHT-MASS, VOLUME AND ENERGY UNITS CONVERSION

Weight / Mass	Calculation way: →	kg	lb	t (metric)	long t	short t
kilogram	1 kg =	1	2.205	0.001	0.001	0.001
pound	1 lb =	0.454	1	0.0005	0.0004	0.001
ton (metric = tonne)	1 t (metric) =	1,000	2,204.623	1	0.984	1.102
ton (long)	1 long t =	1,016.047	2,240	1.016	1	1.120
ton (short)	1 short t =	907.185	2,000	0.907	0.893	1

Volume	Calculation way: →	Bbl	CF	m ³	gallon	Imp. Gal.	L
Barrel (petroleum)	1 Bbl =	1	5.615	0.159	42.000	34.972	158.987
Cubic foot	1 CF =	0.178	1	0.028	7.481	6.229	28.317
Cubic meter	1 m ³ =	8.522	35.315	1	264.172	219.969	1,000
Gallon	1 gallon =	0.024	0.134	0.004	1	0.833	3.785
Imperial gallon	1 Imp. Gal. =	0.029	0.161	0.005	1.201	1	4.546
Liter	1 L =	0.006	0.035	0.001	0.264	0.220	1

Energy	Calculation way: →	Btu	J	therm	Wh
British Energy Unit	1 Btu =	1	1,055.056	0.00001	0.293
Joule	1 J =	0.001	1	0.00000001	0.0003
Therm (US)	1 therm =	99,976.124	105,480,400	1	29,300.111
Watt-hour	1 Wh =	3.412	3,600	0.00003	1