



7/24/2015

WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304

Subject: EnerVest Operating Compression Project Ethel facility

Dear Sir or Madame,

Enervest is placing a Zenith ZPP428 rated at 52HP at this facility. Since this facility does not have a determination I would receive a determination for this unit. If you have any additional questions please feel free to call me at 304-414-8171 or email me at mdearing@enervest.net.

Sincerely,

A handwritten signature in blue ink that reads "Michael Dearing".

Michael Dearing
Air Emissions Supervisor



WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475
www.dep.wv.gov/daq

**PERMIT DETERMINATION FORM
(PDF)**

FOR AGENCY USE ONLY: PLANT I.D. # _____
PDF # _____ PERMIT WRITER: _____

1. NAME OF APPLICANT (AS REGISTERED WITH THE WV SECRETARY OF STATE'S OFFICE):

Enervest Operating

2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE):

Ethel Compressor

3. NORTH AMERICAN INDUSTRY
CLASSIFICATION SYSTEM (NAICS)
CODE:

211111 _ _

4A. MAILING ADDRESS: 300 Capitol St #200, Charleston, WV
25301

4B. PHYSICAL ADDRESS: 37.8942638, -81.91328

5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE MAP AS ATTACHMENT A):

5B. NEAREST ROAD:

Ethel Hollow rd

5C. NEAREST CITY OR TOWN:

Ethel

5D. COUNTY:

Logan

5E. UTM NORTHING (KM):

4194.476

5F. UTM EASTING (KM):

419.7

5G. UTM ZONE:

17S

6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED:

Michael Dearing

6B. TITLE: Supervisor – Air Emissions

6C. TELEPHONE:

304-343-8171

6D. FAX:

6E. E-MAIL:

mdearing@enervest.net

7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY):

7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19
AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED
WITH THIS PROCESS (FOR AN EXISTING FACILITY ONLY):

7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST:

8A. TYPE OF EMISSION SOURCE (CHECK ONE):

NEW SOURCE

ADMINISTRATIVE UPDATE

MODIFICATION

OTHER (PLEASE EXPLAIN IN 11B)

8B. IF ADMINISTRATIVE UPDATE, DOES DAQ HAVE THE
APPLICANT'S CONSENT TO UPDATE THE EXISTING
PERMIT WITH THE INFORMATION CONTAINED HEREIN?

YES

NO

9. IS DEMOLITION OR PHYSICAL RENOVATION AT AN EXISTING FACILITY INVOLVED?

YES

NO

10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE:

08/15/2015

10B. DATE OF ANTICIPATED START-UP:

08/20/2015

11A. PLEASE PROVIDE A DETAILED PROCESS FLOW DIAGRAM SHOWING EACH PROPOSED OR MODIFIED PROCESS EMISSION POINT AS ATTACHMENT B.

11B. PLEASE PROVIDE A DETAILED PROCESS DESCRIPTION AS ATTACHMENT C.

12. PLEASE PROVIDE MATERIAL SAFETY DATA SHEETS (MSDS) FOR ALL MATERIALS PROCESSED, USED OR PRODUCED AS ATTACHMENT D. FOR CHEMICAL PROCESSES, PLEASE PROVIDE A MSDS FOR EACH COMPOUND EMITTED TO AIR.

13A. REGULATED AIR POLLUTANT EMISSIONS:

⇒ FOR A NEW FACILITY, PLEASE PROVIDE PLANT WIDE EMISSIONS BASED ON THE POTENTIAL TO EMIT (PTE) FOR THE FOLLOWING AIR POLLUTANTS INCLUDING ALL PROCESSES.

⇒ FOR AN EXISTING FACILITY, PLEASE PROVIDE THE PROPOSED CHANGE IN EMISSIONS BASED ON THE PTE OF ALL PROCESS CHANGES FOR THE FOLLOWING AIR POLLUTANTS.

PTE FOR A GIVEN POLLUTANT IS TYPICALLY BEFORE AIR POLLUTION CONTROL DEVICES AND IS COLLECTED BASED ON THE MAXIMUM DESIGN CAPACITY OF PROCESS EQUIPMENT.

POLLUTANT	HOURLY PTE (LB/HR)	YEARLY PTE (TON/YR) (HOURLY PTE MULTIPLIED BY 8760 HR/YR) DIVIDED BY 2000 LB/TON
PM	0.00	0.024
PM ₁₀	0.00	0.023
VOCs	0.016	0.072
CO	2.073	9.08
NO _x	1.23	5.39
SO ₂	0.00	0.00
Pb	0.00	0.00
HAPs (AGGREGATE AMOUNT)	0.00	0.024
TAPs (INDIVIDUALLY)*	0.00	0.00
OTHER (INDIVIDUALLY)*	0.00	0.00

* ATTACH ADDITIONAL PAGES AS NEEDED

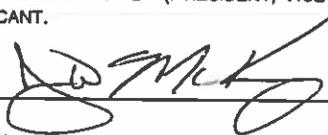
13B. PLEASE PROVIDE ALL SUPPORTING CALCULATIONS AS ATTACHMENT E.

CALCULATE AN HOURLY AND YEARLY PTE OF EACH PROCESS EMISSION POINT (SHOWN IN YOUR DETAILED PROCESS FLOW DIAGRAM) FOR ALL AIR POLLUTANTS LISTED ABOVE INCLUDING INDIVIDUAL HAP'S (LISTED IN SECTION 112[b] OF THE 1990 CAAA), TAP'S (LISTED IN 45CSR27), AND OTHER AIR POLLUTANTS (E.G. POLLUTANTS LISTED IN TABLE 45-13A OF 45CSR13, MINERAL ACIDS PER 45CSR7, ETC.).

14. CERTIFICATION OF DATA

I, James D. McKinney (TYPE NAME) ATTEST THAT ALL THE REPRESENTATIONS CONTAINED IN THIS APPLICATION, OR APPENDED HERETO, ARE TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE BASED ON INFORMATION AND BELIEF AFTER REASONABLE INQUIRY, AND THAT I AM A **RESPONSIBLE OFFICIAL**** (PRESIDENT, VICE PRESIDENT, SECRETARY OR TREASURER, GENERAL PARTNER OR SOLE PROPRIETOR) OF THE APPLICANT.

SIGNATURE OF RESPONSIBLE OFFICIAL: _____



TITLE: Senior Vice President

DATE: 7, 31, 15

** THE DEFINITION OF THE PHRASE 'RESPONSIBLE OFFICIAL' CAN BE FOUND AT 45CSR13, SECTION 2.23.

NOTE: PLEASE CHECK ENCLOSED ATTACHMENTS:

ATTACHMENT A ATTACHMENT B ATTACHMENT C ATTACHMENT D ATTACHMENT E

RECORDS ON ALL CHANGES ARE REQUIRED TO BE KEPT AND MAINTAINED ON-SITE FOR TWO (2) YEARS.

THE PERMIT DETERMINATION FORM WITH THE INSTRUCTIONS CAN BE FOUND ON DAQ'S PERMITTING SECTION WEB SITE:

www.dep.wv.gov/daq

Attachment A

Ethel Compressor Map

Legend

- Feature 2
- Feature 3
- Feature 4

Ethel Compressor

Peach Creek

Continue onto Ethel Hollow

Continue onto Left Fork Dingess Run Rd

Ethel Turn left onto Ethel Hollow

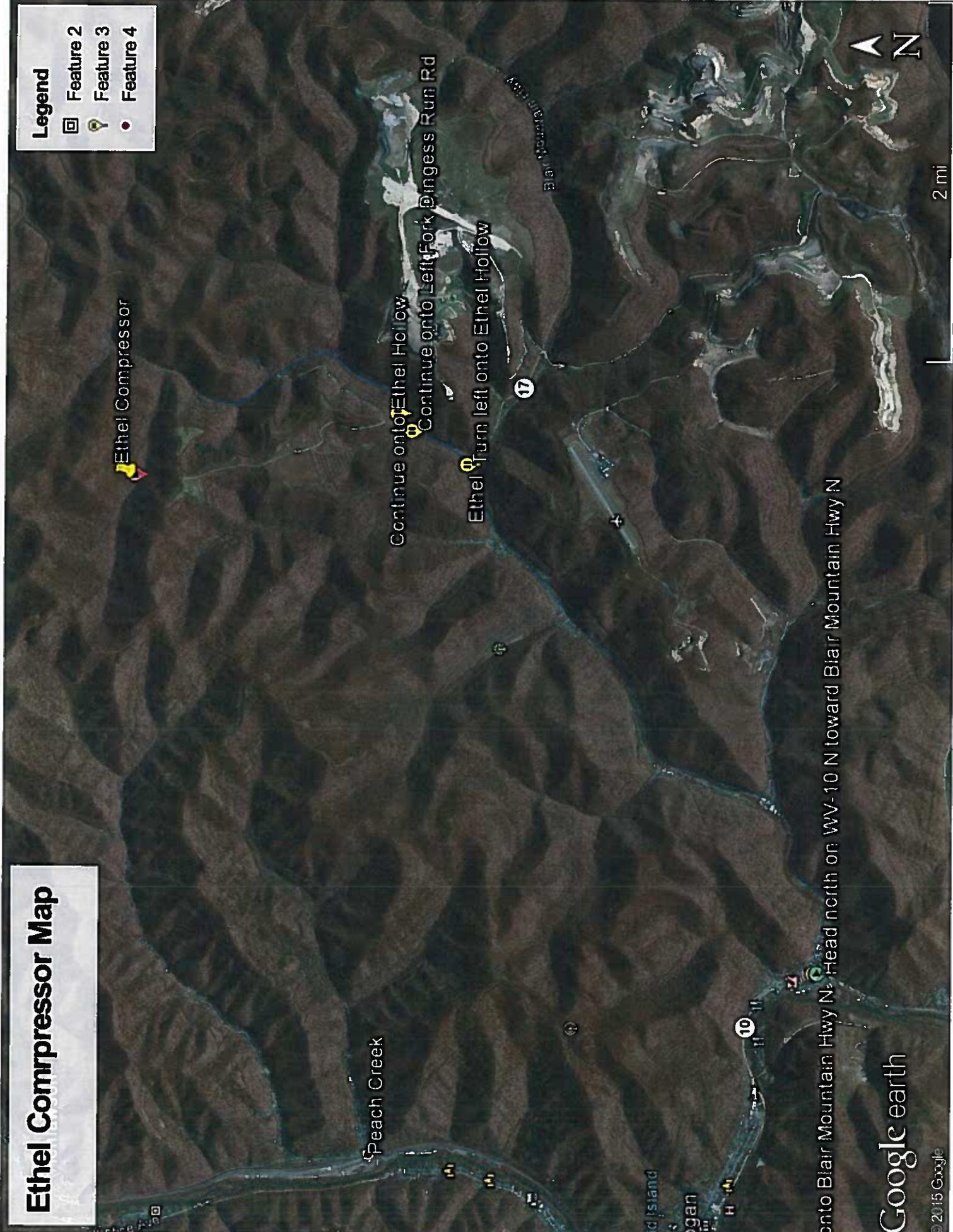
Blair Mountain Hwy

onto Blair Mountain Hwy N. Head north on WV-10 N toward Blair Mountain Hwy N

Google earth

© 2015 Google

2 mi



Ethel (Coming From Ethel, WV):

From Blair Mountain Hwy turn left onto Ethel Hollow Rd .(119/03)
Keep going straight on Ethel Hollow for 3 miles. Make a left onto the 2nd dirt road
Follow that road for 1.5 miles and the compressor will be on the left



A Stollings, WV

B Ethel Hollow, Ethel, WV 25076

Blair Mountain Hwy N and Ethel Hollow

5.8 miles, 11 min

A Stollings, WV

1. Head north on **WV-10 N** toward **Blair Mountain Hwy N**

102 ft

2. Turn right onto **Blair Mountain Hwy N**

3.8 mi

3. Turn left onto **Ethel Hollow**

0.4 mi

4. Continue onto **Left Fork Dingess Run Rd**

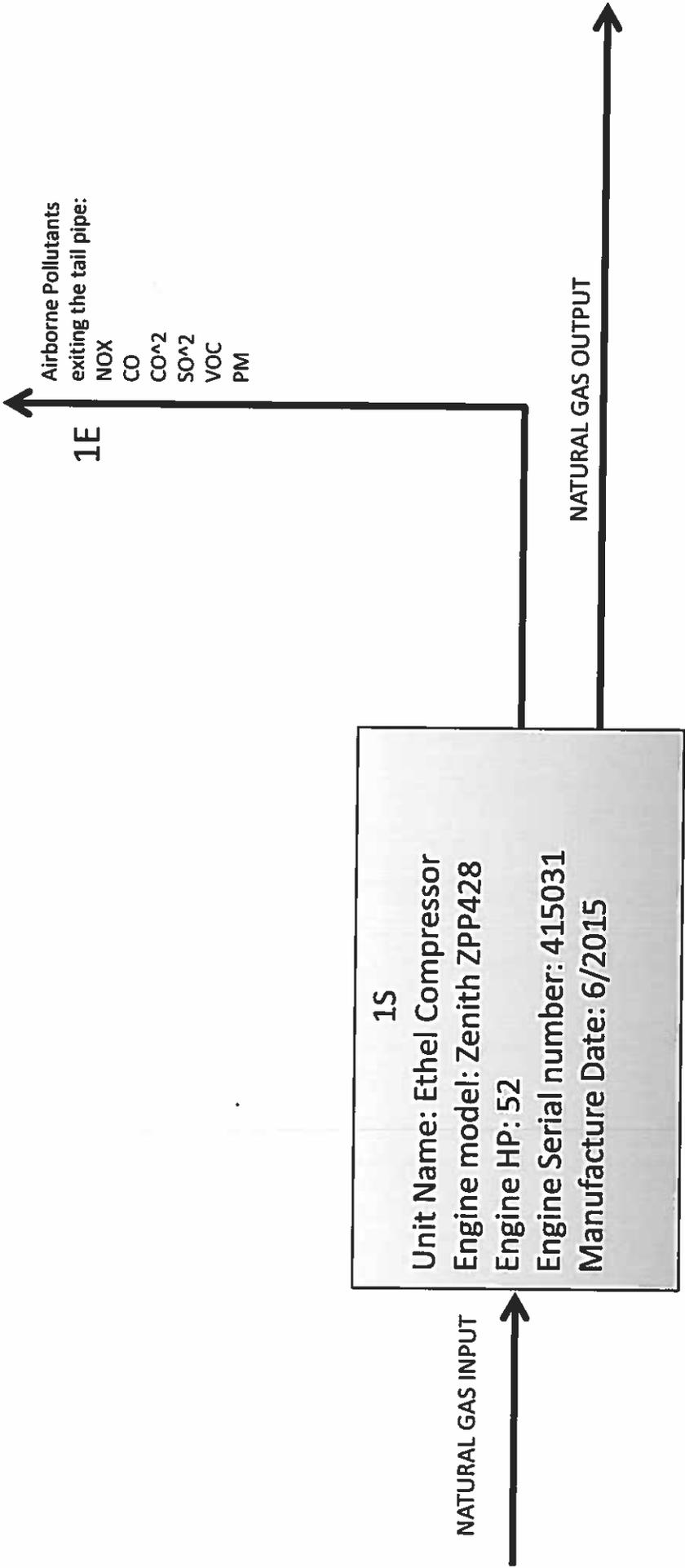
0.1 mi

5. Continue onto **Ethel Hollow**

1.4 mi

B Ethel Hollow

Attachment B



Attachment C

This Engine is used to power a compressor which is then used to compress natural gas to allow Enervest to produce natural gas wells more efficiently.

Attachment D

Section 1: Identification of the substance or mixture and of the supplier

Product Name:	Natural Gas
SDS Number:	724330
Synonyms/Other Means of Identification:	Fuel Gas Residue Gas Processed Gas Natural Gas, Dry Compressed Natural Gas
Intended Use:	Fuel
Manufacturer:	ConocoPhillips 600 N. Dairy Ashford Houston, Texas 77079-1175
Emergency Health and Safety Number:	Chemtrec: 800-424-9300 (24 Hours)
SDS Information:	Phone: 855-244-0762 Email: SDS@conocophillips.com URL: www.conocophillips.com

Section 2: Hazard(s) Identification

GHS Classification

H220 – Flammable gases – Category 1

H280 – Gases under pressure – Compressed gas

Label Elements



DANGER

Extremely flammable gas. (H220)*

Contains gas under pressure. May explode if heated. (H280)*

Gas may reduce oxygen in confined spaces.

Precautionary Statement(s):

Keep away from heat/sparks/open flames/hot surfaces. - No smoking. (P210)*

Leaking gas fire: Do not extinguish, unless leak can be stopped safely. (P377)*

Eliminate all ignition sources if safe to do so. (P381)*

Protect from sunlight. Store in a well ventilated place. (P410+P403)*

* (Applicable GHS hazard code.)

Section 3: Composition / Information on Ingredients

Component	CASRN	Concentration ¹
Natural gas, dried	68410-63-9	100

¹ All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Section 4: First Aid Measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: First aid is not normally required. However, it is good practice to wash any chemical from the skin.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If breathing is difficult, oxygen or artificial respiration should be administered by qualified personnel. If symptoms persist, seek medical attention.

Ingestion (Swallowing): This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Most important symptoms and effects

Acute: Anesthetic effects at high concentrations.

Delayed: None known or anticipated. See Section 11 for information on effects from chronic exposure, if any.

Notes to Physician: Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

Section 5: Fire-Fighting Measures



NFPA 704 Hazard Class

Health: 1 Flammability: 4 Instability: 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

Unusual Fire & Explosion Hazards: Extremely flammable. This material can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. If container is not properly cooled, it can rupture in the heat of a fire. Contents under pressure.

Extinguishing Media: Dry chemical or carbon dioxide is recommended. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. If this cannot be done, allow fire to burn. Move undamaged containers from immediate hazard area if it can be done safely. Stay away from ends of container. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of nitrogen and sulfur may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

Personal Precautions: Extremely flammable. Spillages of liquid product will create a fire hazard and may form an explosive atmosphere. Keep all sources of ignition and hot metal surfaces away from spill/release if safe to do so. The use of explosion-proof electrical equipment is recommended. Beware of accumulation of gas in low areas or contained areas, where explosive concentrations may occur. Prevent from entering drains or any place where accumulation may occur. Ventilate area and allow to evaporate. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Water spray may be useful in minimizing or dispersing vapors. If spill occurs on water notify appropriate authorities and advise shipping of any hazard.

Methods for Containment and Clean-Up: Notify relevant authorities in accordance with all applicable regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

Section 7: Handling and Storage

Precautions for safe handling: Keep away from ignition sources such as heat/sparks/open flame – No smoking. Take precautionary measures against static discharge. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Contents under pressure. Gas can accumulate in confined spaces and limit oxygen available for breathing. Use only with adequate ventilation. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-70 and/or API RP 2003 for specific bonding/grounding requirements. Electrostatic charge may accumulate and create a hazardous condition when handling or processing this material. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Cold burns may occur during filling operations. Containers and delivery lines may become cold enough to present cold burn hazard.

The use of hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of incomplete combustion products (e.g. carbon monoxide, oxides of sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Store only in approved containers. Post area "No Smoking or Open Flame." Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. Avoid exposing any part of a compressed-gas cylinder to temperatures above 125F(51.6C). Gas cylinders should be stored outdoors or in well ventilated storerooms at no lower than ground level and should be quickly removable in an emergency.

Section 8: Exposure Controls / Personal Protection

Component	ACGIH	OSHA	Other
Natural gas, dried	1000 ppm TWA as Aliphatic Hydrocarbons C1-4	---	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye/face protection is not normally required; however, good industrial hygiene practice suggests the use of eye protection that meets or exceeds ANSI Z.87.1 whenever working with chemicals.

Skin/Hand Protection: The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals.

Respiratory Protection: A NIOSH approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode should be used in situations of oxygen deficiency (oxygen content less than 19.5 percent), unknown exposure concentrations, or situations that are immediately dangerous to life or health (IDLH).

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance:	Colorless
Physical Form:	Compressed Gas
Odor:	Slight hydrocarbon
Odor Threshold:	No data
pH:	Not applicable
Vapor Density (air=1):	0.5
Initial Boiling Point/Range:	No data
Melting/Freezing Point:	No data
Solubility in Water:	Slight
Partition Coefficient (n-octanol/water) (Kow):	No data
Percent Volatile:	100%
Flammability (solid, gas):	Extremely Flammable
Evaporation Rate (nBuAc=1):	No data
Flash Point:	-299 °F / -184 °C
Test Method:	(estimate)
Lower Explosive Limits (vol % in air):	2.0
Upper Explosive Limits (vol % in air):	10.0
Auto-ignition Temperature:	999 °F / 537 °C

Section 10: Stability and Reactivity

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Avoid all possible sources of ignition. Heat will increase pressure in the storage tank.

Materials to Avoid (Incompatible Materials): Avoid contact with acids, aluminum chloride, chlorine, chlorine dioxide, halogens and oxidizing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

<u>Acute Toxicity</u>	<u>Hazard</u>	<u>Additional Information</u>	<u>LC50/LD50 Data</u>
Inhalation	Unlikely to be harmful	Asphyxiant. High concentrations in confined spaces may limit oxygen available for breathing. See Signs and Symptoms.	> 20,000 ppm (gas)
Skin Absorption	Skin absorption is not anticipated		Not Applicable
Ingestion (Swallowing)	Ingestion is not anticipated		Not Applicable

Aspiration Hazard: Not applicable

Skin Corrosion/Irritation: Skin exposure is not anticipated.

Serious Eye Damage/Irritation: Not expected to be irritating.

Signs and Symptoms: Light hydrocarbon gases are simple asphyxiants and can cause anesthetic effects at high concentrations. Symptoms of overexposure, which are reversible if exposure is stopped, can include shortness of breath, drowsiness, headaches, confusion, decreased coordination, visual disturbances and vomiting. Continued exposure can lead to hypoxia (inadequate oxygen), rapid breathing, cyanosis (bluish discoloration of the skin), numbness of the extremities, unconsciousness and death.

Skin Sensitization: Skin contact is not anticipated.

Respiratory Sensitization: Not expected to be a respiratory sensitizer.

Specific Target Organ Toxicity (Single Exposure): Not expected to cause organ effects from single exposure.

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: Not expected to cause cancer. This substance is not listed as a carcinogen by IARC, NTP or OSHA.

Germ Cell Mutagenicity: Not expected to cause heritable genetic effects.

Reproductive Toxicity: Not expected to cause reproductive toxicity.

Other Comments: High concentrations may reduce the amount of oxygen available for breathing, especially in confined spaces. Hypoxia (inadequate oxygen) during pregnancy may have adverse effects on the developing fetus.

Section 12: Ecological Information

Toxicity: Petroleum gases will readily evaporate from the surface and would not be expected to have significant adverse effects in the aquatic environment. Classification: No classified hazards.

Persistence and Degradability: The hydrocarbons in this material are expected to be inherently biodegradable. In practice, hydrocarbon gases are not likely to remain in solution long enough for biodegradation to be a significant loss process. Hydrogen sulfide, if present in refinery gas streams, will be rapidly oxidized in water and insoluble sulfides precipitated from water when metallic radicals are present.

Bioaccumulative Potential: Since the log Kow values measured for refinery gas constituents are below 3, they are not regarded as having the potential to bioaccumulate.

Mobility in Soil: Due to the extreme volatility of petroleum gases, air is the only environmental compartment in which they will be found. In air, these hydrocarbons undergo photodegradation by reaction with hydroxyl radicals with half-lives ranging from 3.2 days for n-butane to 7 days for propane.

Other Adverse Effects: None anticipated.

Section 13: Disposal Considerations

This material is a gas and would not typically be managed as a waste.

Section 14: Transport Information

U.S. Department of Transportation (DOT)

Shipping Description: UN1971, Natural gas, compressed, 2.1
Non-Bulk Package Marking: Natural gas, compressed, UN1971
Non-Bulk Package Labeling: Flammable gas
Bulk Package/Placard Marking: Flammable gas / 1971
Packaging - References: 49 CFR 173.306; 173.302; 173.302
(Exceptions; Non-bulk; Bulk)
Hazardous Substance: None
Emergency Response Guide: 115

Note: *Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable*

International Maritime Dangerous Goods (IMDG)

Shipping Description: UN1971, Natural gas, compressed, 2.1
Non-Bulk Package Marking: Natural gas, compressed, UN1971
Labels: Flammable gas
Placards/Marking (Bulk): Flammable gas / 1971
Packaging - Non-Bulk: P200
EMS: F-D, S-U

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #: UN1971
Proper Shipping Name: Natural gas, compressed
Hazard Class/Division: 2.1
Subsidiary risk: None
Packing Group: None
Non-Bulk Package Marking: Natural gas, compressed, UN1971
Labels: Flammable gas , Cargo Aircraft Only
ERG Code: 10L

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	<i>Forbidden</i>	<i>Forbidden</i>	200
Max. Net Qty. Per Package:	<i>Forbidden</i>	<i>Forbidden</i>	150 kg

Section 15: Regulatory Information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: No
Fire Hazard: Yes
Pressure Hazard: Yes
Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

California Proposition 65:

This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Hazard Classification

Canada:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:

- A - Compressed Gas
- B1 - Flammable Gases

National Chemical Inventories

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA
All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: EAR99

Section 16: Other Information

Date of Issue:	02-Apr-2012
Status:	FINAL
Previous Issue Date:	09-Feb-2012
Revised Sections or Basis for Revision:	Identified Hazards (Section 2) Precautionary Statement(s) (Section 2) First Aid (Section 4) Shipping information (Section 14) Regulatory information (Section 15)
SDS Number:	724330

Guide to Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and Implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Attachment E

PURPOSE BUILT INDUSTRIAL ENGINES

Home About Us Engine Models News Contact Us Customer Access Member Login

Model 416 Model 428 Model 644 Model 690

ZPP 428 2.8 Liter DUAL FUEL/GASOLINE & NATURAL GAS

For Industrial Application

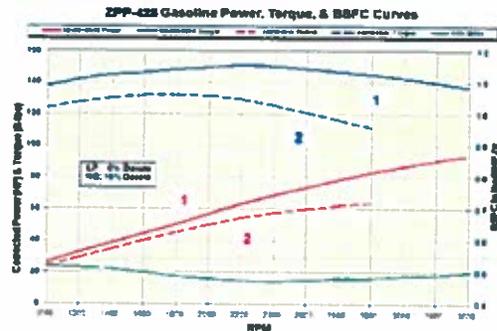


SPECIFICATION DATA:

Intermittent output	94 hp @ 3600 rpm
Continuous output	64 hp @ 3000 rpm
Peak torque	150 ft/lbs @ 2200 rpm
Fuel and type	Gasoline-Multi-port/LPG/NG Mixer Type
Engine configuration	4 Cylinder In-line, OHV
Block Material	Cast Iron
Head Material	Cast Iron
Bore x Stroke (mm)	98.4 X 91.0
Total Piston displacement	2769 cc
Compression ratio	9.5:1
Length x width x height (mm)	772.1 x 563 x 673
Dry weight (excluding shipped loose parts)	155 Kg
Catalyst (2007 emissions compliance)	Remote mounted

Note: HP and Torque figures shown for 2008 LSI - EPA/CARB certified engine with catalyst.

PERFORMANCE CURVES:



Curve 1 - Intermittent Gross Output
 This is the highest output obtainable at standard ambient conditions from a basic engine not-paired with the built-in accessories essential to its operation. These levels may only be maintained for operating periods of short duration.
Applications: Saws, Drills, Aerial Platforms, Scrubbers / Sweepers, Utility vehicles, Construction equipment.

Curve 2 - Continuous Gross Output
 This is the output that can be obtained at standard ambient conditions from a basic engine, operated in a continuous duty mode.
Applications: Generator, Welders, Water pumps, Air compressors, Carpet cleaners, etc.

Actual power levels may vary depending on OEM calibration and application.

ENGINE SPECIFICATIONS:

General-

Cylinders	4
Cylinder Arrangement	Vertical In-line
Bore	3.94 in / 98.43 mm
Stroke	3.64 in / 90.98 mm
Cylinder Displacement	42.24 cu in / 692.3 cc

Total Displacement	169.0 cu in / 2769 cc
Compression Ratio	9.5:1

Physical Data -

Length	30.9 in / 772.1 mm
Width	22.5 in / 563.0 mm
Height	26.9 in / 673.0 mm
Weight	337.0 lb / 153.0 kg
Oil Capacity	4.0 qt / 3.8 L

Fuel System: Gasoline/multiport and/or LPG/NG mixer type -

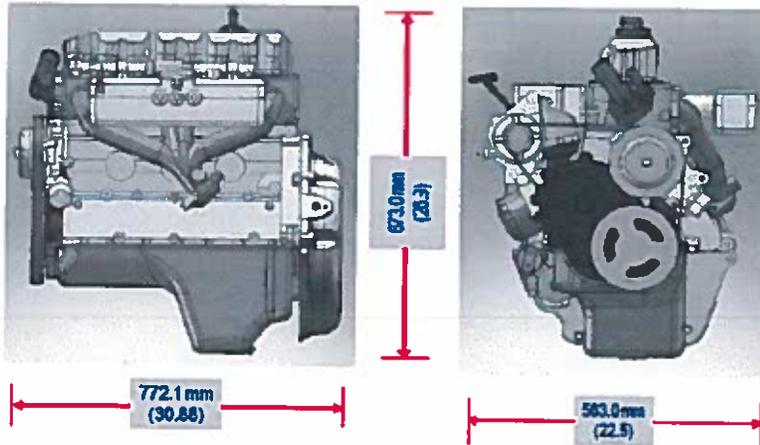
Fuel Pressure LPG / NG	<5 in
Fuel Pressure-gasoline	3 bar
Fuel Requirement	Unleaded Gasoline
Fuel Pump	Electric Type
Electronic Governor	ZEEMS III

Electrical -

Starter Motor	12 V - 1.4Kw
Alternator	12.0 V - 55 A w/ built in regulator
Distributor with coil-Non-certified applications	
Hall effect dist. w/ coil - Certified applications	

Cooling -

Thermostat	180°F / 82°C
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DESIGN AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

Rich Burn Engines 4 Stroke AP 42 Table 3.2-1

Emissions Unit ID:	Ethel	BHP	52	BTU Content of Gas:	1000
Fuel Usage in MMBTU/hr:	0.557	Fuel Consumption BTU/BHP-hr	10714	Date of manufacture:	7/13/2015
Make:	Zenith	Model:	ZPP428	Serial number:	733144
Pollutants		Emission Factor	lbs./hr	Tons Year	G/bhp-hr
NOX ton/yr 90-105% load		2.210000	1.231	5.393	10.740
SOX ton/yr		0.000588	0.000	0.001	0.003
CO Ton/ yr 90-105% Load		3.720000	2.073	9.078	18.078
VOC		0.029600	0.016	0.072	0.144
PM10 (filterable)		0.009500	0.005	0.023	0.046
PM Condensable		0.009910	0.006	0.024	0.048
Formaldehyde(CH2O)		0.020500	0.011	0.050	0.100
Calculations		EF	MMBTU x EF = lbs/hr	(lbs/hr)/2000	(lbs-hr*453.592)/BPH

Fuel Usage Calculator

Rated BHP	BTU/BHP-Hr	MMBTU/ Hr	BTU Content:	Total BTU/Hr	Total BTU Year
52	10714	0.557	1000	557128	4880441280
		$(Bhp \times Btu/Bhp-hr)/1,000,000$		$Bhp \times Btu/Bhp-hr$	$TBtu/Bhp-hr \times 8760$
MMBTU/hr	MCF/HOUR	SCF / HOUR	SCF/YR	MCF/YEAR	MMSCF/YR
0.557128	0.557128	557.128	4880441.28	4880.44128	4.88044128
	SCF-HR/1000	TBtu HR/ Btu Content	SCF-HR*8760	SCF-YR/1000	SCF-YR/1,000,000

BSFC/LBS-HP-HR	HP	Fuel lbs/hr	NG MCF Weight	Fuel MCF/Hr	BTU/Hr	BTU/HP/hr
0.48	52.00	24.96	44.80	0.56	557142.86	10714.29

Prefixes	Mass	Distance	Volume
Metric	1 kg = 2.205 lb	1 cm = 0.4 in	1 L = 0.264 gal = 1000 cm ³ (ml)
pico (p) = 10 ⁻¹²	1 lb = 453.6 g = 16oz	1 m = 3.281 ft = 1.094 yd	1 m ³ = 1000 L = 35.3 ft ³ = 264 gal
nano (n) = 10 ⁻⁹	1 metric tonne = 1,000kg = 2,205lb	1 km = 0.62137 mi = 199 rod	1 gal = 3.785 L = 4 qt = 16 c = 128 oz
micro (μ) = 10 ⁻⁶	1 US short ton = 907kg = 2,000lb	1 mi = 1.609km	1 ft ³ = cf = 28.32 L = 7.482 gal
deca (da) = 10 ¹	1 UK long ton = 1,016kg = 2,239lb	1 smoot = 1.702 m = 5.83 ft	1 bbl = 42 U.S. gal = 159 L = 5.6 ft ³
kilo (k) = 10 ³	Temperature	Area	1 cord = 128 ft ³ = 3.62 m ³
mega (M) = 10 ⁶	°F = 1.8 · °C + 32	1 m ² = 10.765 ft ²	1 ac-ft = 43560 ft ³ = 325,851 gal
giga (G) = 10 ⁹	°K = (°F - 32) · 5/9 + 273.15	1 km ² = 0.386 mi ² = 10 ⁶ m ²	1 km ³ = 0.24 mi ³ = 810,713 acre-ft
tera (T) = 10 ¹²	Time	1 ha = 10 ⁴ m ² = .01 km ² = 2.47 ac	1 bu = 4 pck = 8 gal = 35.2 L = 2,150 in ³
peta (P) = 10 ¹⁵	3,600 sec/hour 730 hour/month	1 mi ² = 2.6 km ² = 640 ac	Flow Rates
exa (E) = 10 ¹⁸	365.25 day/year 8,766 hour/year	1 ac = 4,047 m ² = 43,560 ft ²	1 mbd = 1 Mbbbl/day = 15.34 Ggal/yr
zetta (Z) = 10 ²¹	31,536,000 sec/year	Pressure	= 694.4 bbl/min = 11.57 bbl/sec
Roman	Fuel Economy	1MPa = 10bar = 9.87atm = 145psi	= 485.9 gal/sec
m = 10 ³	1mpg = 0.4251 km/L	1atm = 1.0132 bar = 760 mmHg	1 ft ³ /s = 641 bbl/hr = 449 gal/min (gpm)
mm = 10 ⁶	mpg = 235.2/ L/100 km	= 14.696 psi = 10.33 ton/m ³	1 bbl oil/day ≈ 50 metric ton oil/yr
quad = 10 ¹⁵			1 gpm = 0.063 L/s = 0.00442 ac-ft/day

Energy Unit Conversion

1 J = 1 Nm = 1 kgm²/s² = 0.239 cal = 0.74 ft-lb
 1 Cal = 1 kcal = 1000 cal = 4.187 KJ = 3.968 Btu
 1 KJ = 0.239 Cal = 0.947817 Btu = 0.95 Btu
 1 Btu = 1,055.056 J = 0.252 kcal
 1 kWh = 3.6 MJ = 3,412 Btu; (1MWh = 3.6 GJ = 3,412 mmBtu)
 1 mmBtu = 10⁶ Btu = 1.055 GJ = 1 decatherm
 1 mcf nat. gas (LHV) = 10.27 therm = 1.027 mmBtu = 1.082 GJ
 1 toe = 41.868 GJ = 39.683 mmBtu = 11.63 MWh = 7.33bbl
 1 tce = 29.308 GJ = 27.778 mmBtu = 8.141 MWh
 1 Quad = 10¹⁵ Btu = 1.055 EJ = 293 TWh = 25.2 Mtoe = .974 TCF
 1 EJ = 10⁹ GJ = 10¹⁸ J = .95 Quad
 1 TWyr = 31.5 EJ = 29.86 Quad

Energy Content (Lower Heating Values) (ton = metric tonne)

Crude Oil = 6.119 GJ/bbl = 5.8 mmBtu/bbl = 39.7 mmBtu/ton
 = 145.7 MJ/gal = 38.5 MJ/L = 43.8 MJ/kg (GJ/ton)
 Gasoline = 121.3 MJ/gal (= 32.1 MJ/L = 43.1 MJ/kg = 115 mBtu/gal)
 Diesel = 135.5 MJ/gal (= 35.8 MJ/L = 42.8 MJ/kg = 128 mBtu/gal)
 Biodiesel = 124.8 MJ/gal (= 33.0 MJ/L = 37.5 MJ/kg = 121 mBtu/gal)
 Ethanol = 80.2 MJ/gal (= 21.2 MJ/L = 26.9 MJ/kg = 76 mBtu/gal)
 Methanol = 60.4 MJ/gal (= 15.9 MJ/L = 20.1 MJ/kg = 57 mBtu/gal)
 UN Standard Coal = 30 GJ/ton
 Bituminous = 27-30 GJ/ton (MJ/kg) = 25-28 mmBtu/ton
 Sub-Bitum. = 20-26 GJ/ton (MJ/kg) = 19-24 mmBtu/ton
 Lignite = 10-19 GJ/ton (MJ/kg) = 9-18 mmBtu/ton
 Nat Gas @ STP = 53.2 MJ/kg = 38.2 MJ/m³ = 1027 Btu/ft³
 CNG @ 20 MPa = 50.0 MJ/kg = 9.3 MJ/L = 249.6 mBtu/ft³
 H₂ @ 35MPa (HHV) = 120.0 MJ/kg = 2.7 MJ/L = 72.5 mBtu/ft³
 LPG @ 1.5 MPa = 88.1 MJ/gal = 23.3 MJ/L = 625.5 mBtu/ft³
 Air-Dried Wood(20% Moisture Content) = 15 GJ/ton
 Uranium = 80 GJ/g fissioned = 400 GJ/kg mined (fr'd = .5% mn'd)

Energy of Familiar Phenomena/Society

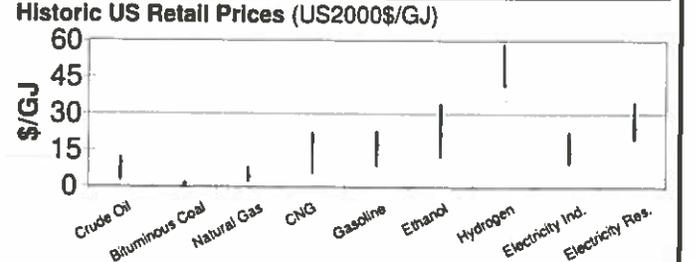
Quart of Boiling Water = 3 MJ 1 wooden match = 1 Btu
 Melt 1 lb Ice = 151 kJ = 143 Btu
 1-GWe Plant running 24 hrs = 260 TJ
 Daily Human Metabolism = 2500 kcal/day = 120 W
 Compact Passenger Car at steady 60 mph:
 Chem. Energy Consumption = 70 kW = 94 hp
 Mech. Energy Production = 15 kW = 20 hp
 '05 US Oil Use = 20.55 Mbpd = 7.506 Gbbl/yr = 238 bbl/sec
 '05 Global Oil Use = 84.37 Mbpd = 31.89 Gbbl/yr = 976.5 bbl/sec
 '05 US Primary Energy Use ≈ 3.35 TW ≈ 105 EJ/yr ≈ 100 quad/yr
 '05 Global ≈ 16 TW = 504 EJ/yr ≈ 480 quad/yr
 Solar Influx at Earth Surface ≈ 100 PW = 3.1 YJ/yr = 200 W/m²

Density

Water = 1 g/cm³ = 1 g/ml = 1 kg/L = 1 metric tonne/m³
 Air at Sea Level = 1.2 kg/m³
 Crude Oil = 0.88 (0.75 - 0.98) kg/L = 7.34 lb/gal = 140 kg/bbl
 Gasoline = 0.745 kg/L = 6.22 lb/gal
 Diesel = 0.837 kg/L = 7.00 lb/gal; Biodiesel = 0.880 kg/L
 Ethanol = 0.789 kg/L = 6.58 lb/gal
 Methanol = 0.792 kg/L = 6.61 lb/gal
 Nat. Gas = 0.717 kg/m³ = 44.8 lb/mcf
 CNG @ 20MPa = 0.185 kg/L = 11.5 lb/ft³ = 5.66 lb/gge
 LPG (propane) = 0.540 kg/L = 33.7 lb/ft³
 Hydrogen = 0.025 kg/L (35MPa); 0.08988 kg/m³ (STP)
 Coal ≈ 1.32 kg/L = 1230 metric ton/ha-m = 1800 sht ton/acre-foot
 API Gravity = (141.5/[Density in g/cm³ at 60 °F]) - 131.5
 Light Crude API > 31.1°; Heavy API < 22.3°; Bitumen API ~ 8°

Power Unit Conversion

1 W = 1 J/s = 3.6 kJ/hour = 31.5 MJ/year
 1 kW = 1.341 hp = 738ft-lb/s
 1 hp = 745.7 W = 0.7068 Btu/s
 1 TW = 10¹² W = 31.5 EJ/year
 1 ton-refrigeration = 12,000 Btu/hr = 200 Btu/min = 3.517 kW



Carbon Dioxide (CO₂) Emission Factors

Note: 44/12 or 3.667 ton CO₂ emissions per ton C emissions

Natural Gas = 121 lb/mcf = 117.1 lb/mmBtu = 50.3 kg/GJ
 Gasoline = 19.56 lb/gal = 156.4 lb/mmBtu = 67.2 kg/GJ
 Diesel = 22.38 lb/gal = 161.4 lb/mmBtu = 69.4 kg/GJ
 Bt. Coal = 4,931 lb/sht ton = 205.3 lb/mmBtu = 88.3 kg/GJ
 Petrol Coke = 32.40 lb/gal = 225.1 lb/mmBtu = 96.8 kg/GJ
 Electric US Av = 1.34 lb/kWh = 0.608 ton/MWh = 168.8 kg/GJ
 Coal-fired Elec = 2.095 lb/kWh = .95 kg/kWh = 260 kg C/MWh

Global Warming Potential (GWP) (τ = 100yr)

CO₂ = 1 CH₄ = 23 N₂O = 296 SF₆ = 22,200
 HFCs = 12 - 12,000 PFCs = 5,700 - 11,900

Rules of Thumb

- 1 Btu = 1,055 J
- 1 kWh = 3.6 MJ = 3,412 Btu
- 1 hp = 746 W
- 1 TW ≈ 30 Quad/yr ≈ 32 EJ/yr
- 23.52 mpg → 10 L/100km → 234 g TtW CO₂/km → 0.832 lb TtW CO₂/mi
- 1 Quad = 10¹⁵ Btu ≈ 1.05 EJ ≈ 25 Mtoe ≈ 300TWh ≈ 0.974 tcf natural gas
- 1 gallon gasoline equivalent (gge) = 121 MJ = 115,000 Btu = 1 kg H₂ = 1.5 gal EtOH
- 1 million barrel oil per day (mbd) = 486 gal/sec = 2.2TJ/yr = 4232 metric ton C/yr
- Nat.Gas: 1 mscf = 0.2832 Nm³ = 1.027 mmBtu = 10.27 therm
- 3.667 (44/12) ton CO₂ per ton C

Sources

This sheet was compiled based on several other useful fact sheets and online resources:

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<http://www.eia.doe.gov/oiaf/1605/qc97rpt/appb.html>
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Historic Price Range Data Sources

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- EIA Petroleum Navigator http://tonto.eia.doe.gov/dnav/pet/pet_pri_top.asp
- EIA Coal News and Markets <http://www.eia.doe.gov/cneaf/coal/page/coalnews/coalmar.html>
- Bloomberg Energy Market Data <http://www.bloomberg.com/energy/>
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