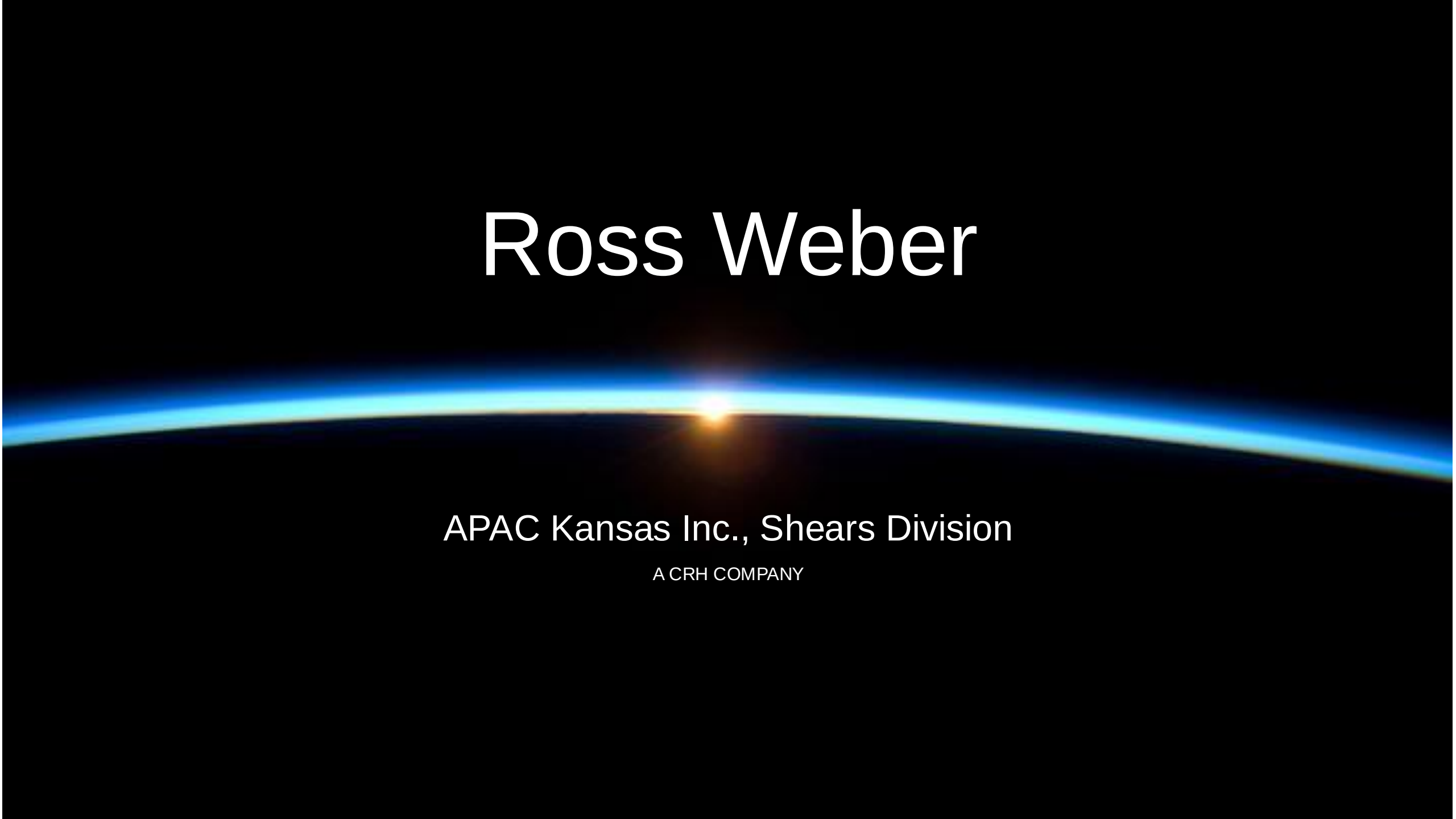

Ross Weber

APAC Kansas Inc., Shears Division

A CRH COMPANY

Old Plants

Not environmentally friendly

Diesel fuel in truck beds and on the ground

No meaningful dust collection system

Hauk 580 Star-Jet

- Does the name fit the burn pattern?
- Was the burn pattern crated to fit the name?

Vulcan Burner

Multi Fuel Burner

Types of fuel

- RFO
- Natural Gas
- Propane
- Liquid Natural Gas
- Biofuel
- Recycled Propane
- Hydrogen
- Natural Hydrogen

RFO Light #5
Recycled Fuel Oil

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- Relatively safe, low explosion probability
- Better EPD (Environmental Product Declaration) rating

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- Sometimes difficult to light

Carbon Dioxide Emissions Coefficients by Fuel

Carbon Dioxide (CO_2) Factors:	Pounds CO_2 Per Unit of Volume or Mass	Kilograms CO_2 Per Unit of Volume or Mass	Pounds CO_2 Per Million Btu	Kilograms CO_2 Per Million Btu
For homes and businesses				
Propane	12.68 gallon	5.75 gallon	138.63	62.88
Diesel and Home Heating Fuel (Distillate Fuel Oil)	22.45 gallon	10.19 gallon	163.45	74.14
Kerosene	21.78 gallon	9.88 gallon	161.35	73.19
Coal (All types)	3,826.88 short ton	1,735.85 short ton	211.63	95.99
Natural Gas	120.85 thousand cubic feet	54.81 thousand cubic feet	116.65	52.91
Finished Motor Gasoline	18.73 gallon	8.49 gallon	155.77	70.66
Motor Gasoline[a]	20.86 gallon	9.46 gallon	167.79	76.11
Residual Heating Fuel (Businesses only)	24.78 gallon	11.24 gallon	165.55	75.09

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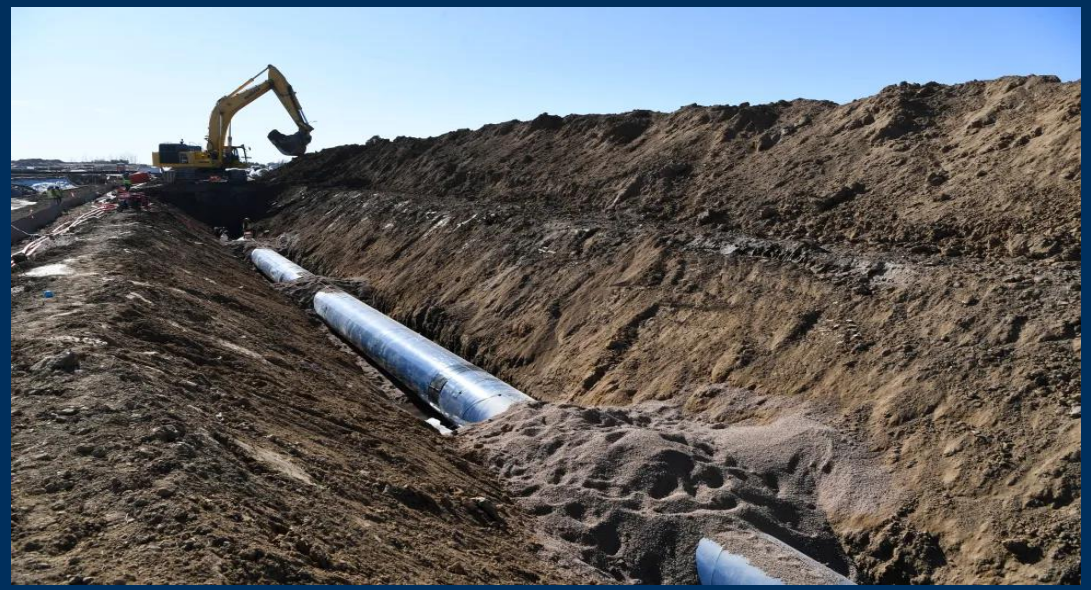
Natural Gas (methane)
Advantages

- Cleanest Burning of industrial fuels
- 30% less CO_2 than RFO
- 16% less CO_2 than propane



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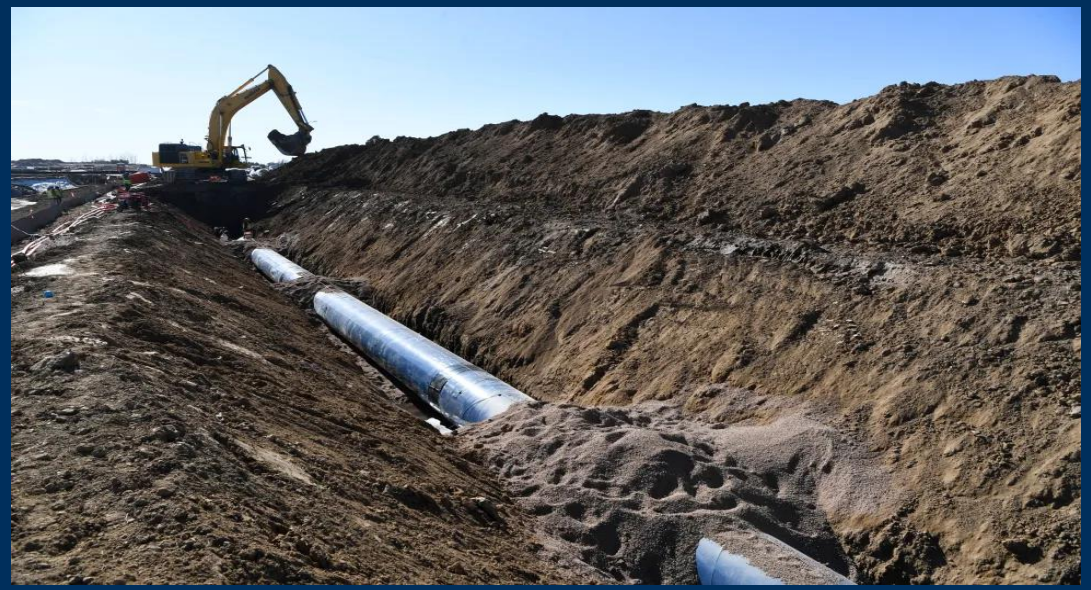

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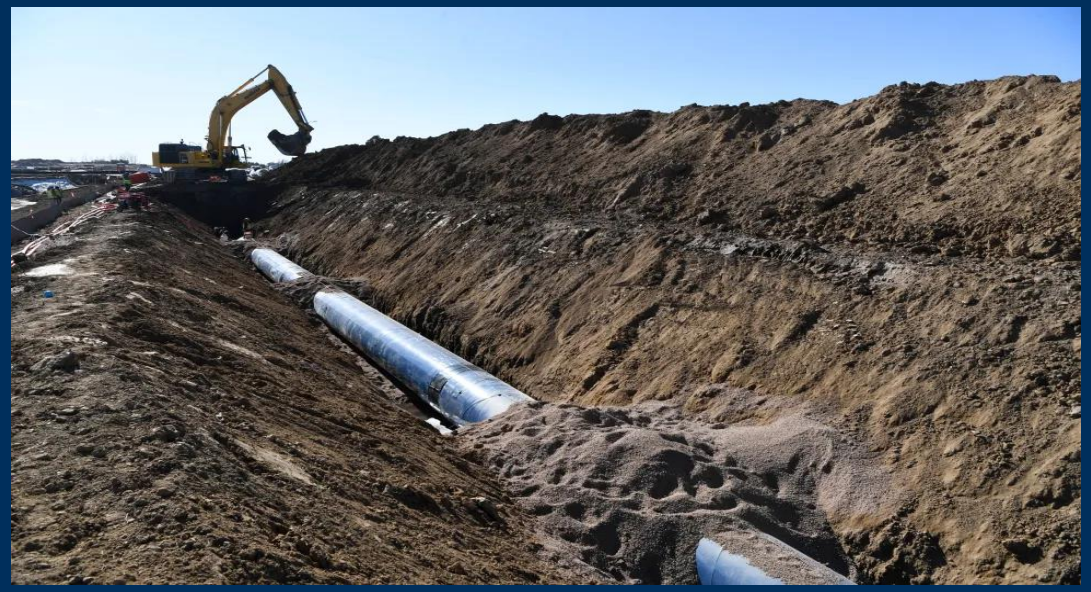

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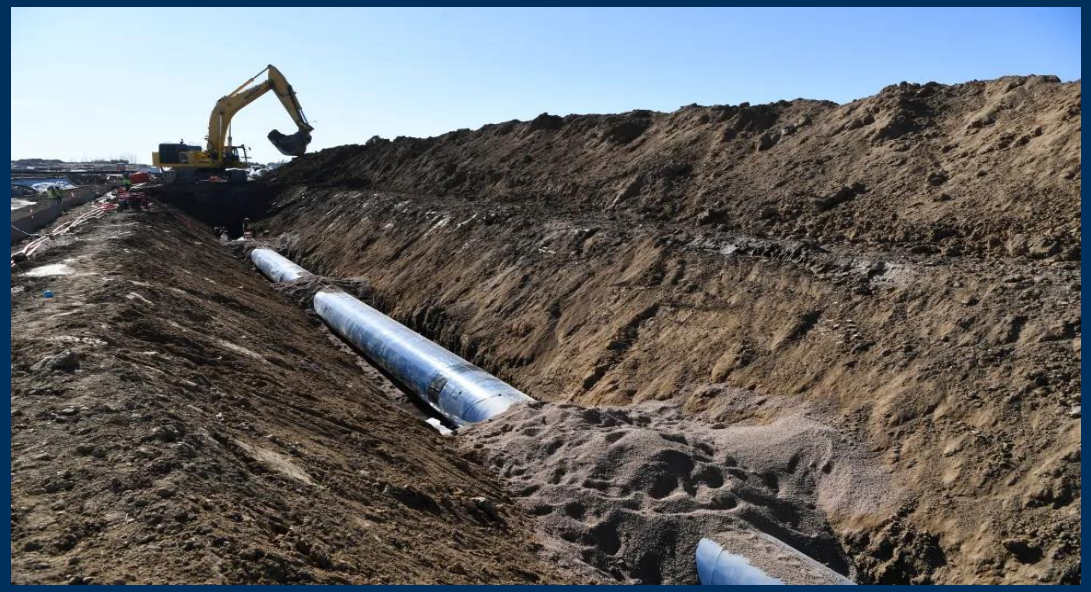

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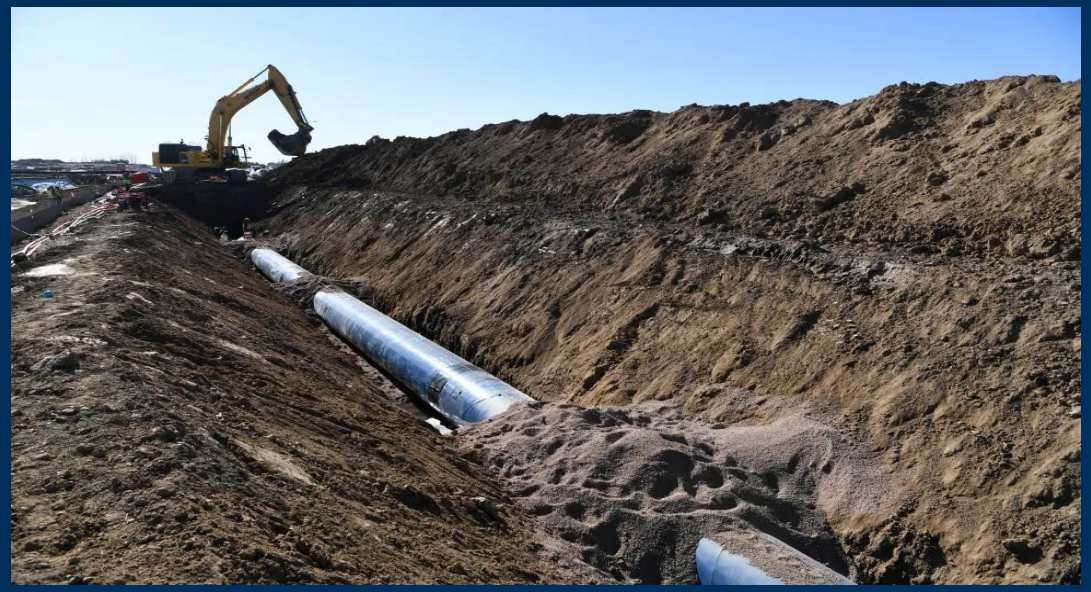

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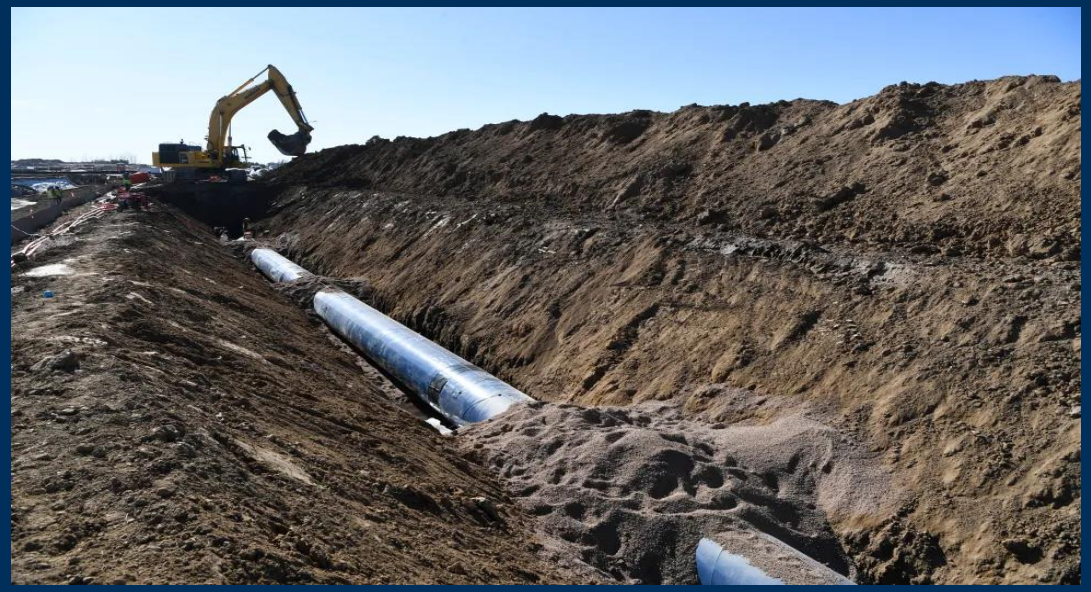
- Easy to light (sometimes too easy)



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Liquid Propane
Advantages

- Competitive price
- Burns clean
  - Easy on burner and baghouse maintenance
- Non-toxic when spilled
- Easy to transport and store
- Deliverable to remote locations and locations without natural gas line
- Consistent supply and quality

Liquid Propane
Advantages

- Indirect leaks to the environment
  - Derived from Natural Gas and Oil production
- Lower density fuel requires larger storage
- Non-renewable
- More volatile than RFO

Natural gas is clean when burned completely

- Incomplete combustion creates black carbon, a very effective short term greenhouse gas.
- Flare gas is a major source of carbon pollution globally due to incomplete combustion


CANADA
U.S.A
Bakken Shale Activity
Minneapolis - Saint Paul
Denver


BAKKEN FORMATION
MINNEAPOLIS - ST PAUL
CHICAGO


[More info]
29 days
SKYTRUTH
Google
2014-08-27


H2

The Colors of Hydrogen

Despite being naturally colorless, hydrogen is differentiated by color codes to denote its production method.

Traditional Hydrogen Production Methods

Gray hydrogen

The most prevalent type. It is sourced from natural gas using a process called steam reforming, but with no emission recapture.

Black hydrogen

Made from anthracite or coal, emitting significant CO_2 and carbon monoxide.

Brown hydrogen

Similar to black, but produced specifically from lignite or brown coal, with considerable emissions.

Innovative Hydrogen Production Methods

Blue hydrogen

Produced from natural gas using a process called steam reforming. Carbon emissions are captured and stored or reused.

Red hydrogen

Produced with thermolysis – a process that combines nuclear heat with water to extract hydrogen

Turquoise hydrogen

Uses methane pyrolysis to produce hydrogen and solid carbon rather than gaseous emissions.

Green hydrogen

Generated using renewable energy sources to electrolyze water, without emitting CO_2.

Purple hydrogen

Produced using electrolysis and thermolysis together (see pink and red hydrogen).

Yellow hydrogen

Produced through solar powered electrolysis, though may sometimes refer to electrolyzed hydrogen from mixed energy sources.

Pink hydrogen

Produced with electrolysis – a process that combines nuclear energy with water to extract hydrogen.

Gold hydrogen

Produced by extracting hydrogen from abandoned oil wells using microbes and enzymatic processes.

White hydrogen

A rare, naturally occurring geological hydrogen that is often associated with natural gas.

FASTECH

Hydrogen has a great image for being clean The production of Hydrogen is not clean

- It is what is known as an energy vector, i.e., it has the capacity to store energy that will later be released, much like a battery in an EV

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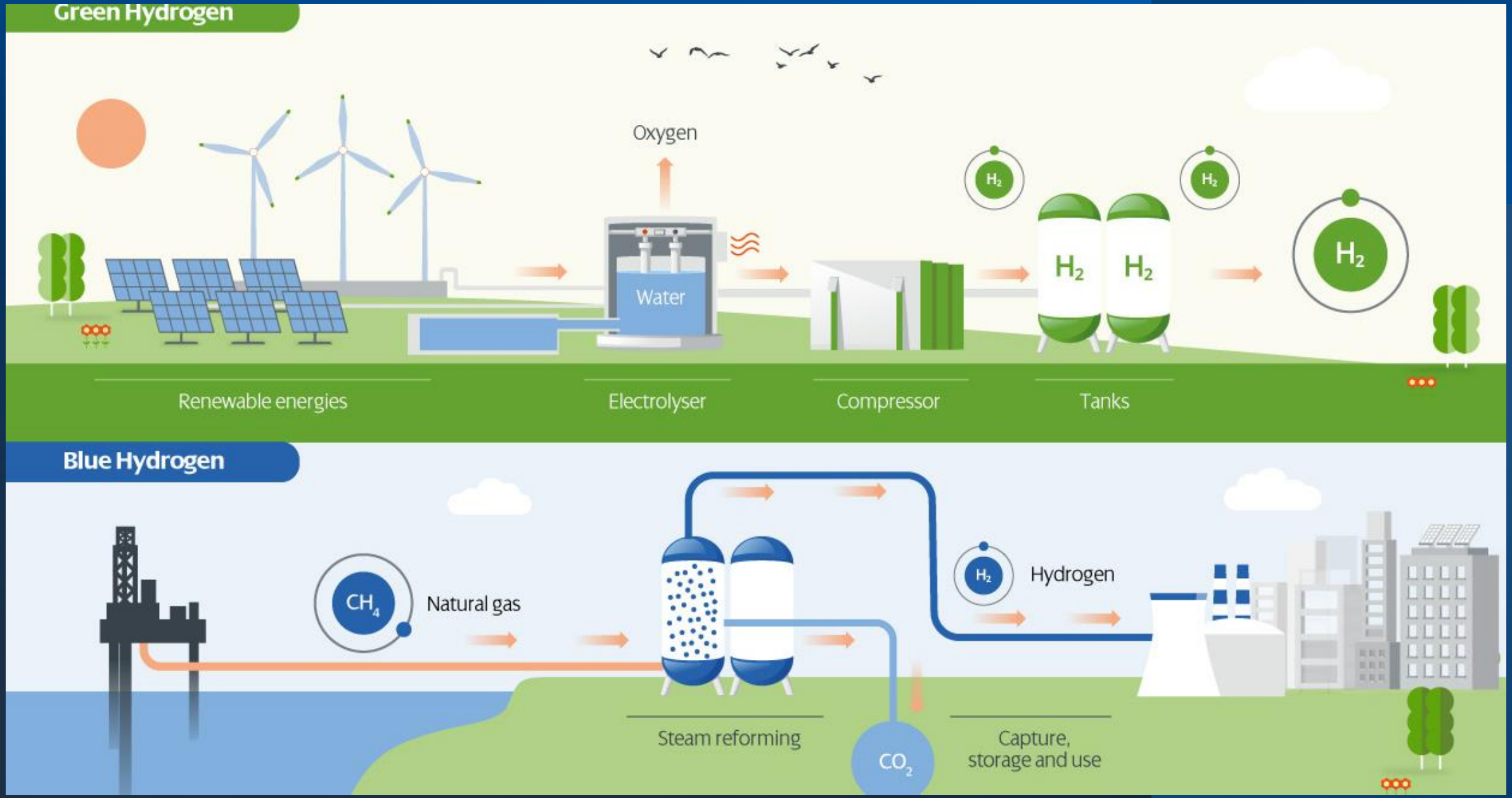
Green Hydrogen
Oxygen
Water
H_2
H_2
H_2
H_2
Renewable energies
Electrolyser
Compressor
Tanks
Blue Hydrogen
CH_4
Natural gas
H_2
Hydrogen
Steam reforming
CO_2
Capture,
storage and use


HYDROGEN

White Hydrogen

Naturally Occurring Hydrogen

White Hydrogen

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- The iron oxidizes to rust by using the oxygen from water leaving pure hydrogen
  - Likely to be fracked to get the production needed to be viable

Natural Hydrogen Energy LLC


12°
8°
4°
0°
0 150 30
0 200 400 km
Tropic of Cancer
ALGERIA
Taoudenni
MAURITANIA
MALI
Timbuktu
Bourem
Goundam
Kabara
Gao
Niafounké
Diré
Ansongo
Ménaka
Douentza
Labbezanga
Nioro du Sahel
Nara
Ambidédi
Médina
Kayes
Diafarabé
Mopti
Bandiagara
Niono
Koro
Sansanding
Djenné
Niamey
Bafoulabé
Kolokani
Ségou
San
BURKINA FASO
Kati
Koulikoro
Satadougou
Bamako
Ouagadougou
Kangaba
Sikasso
Bougouni
Bobo Dioulasso
Kalana
BENIN
GHANA
TOGO
CÔTE D'IVOIRE
© 2012 Encyclopædia Britannica,


0 200 400 km
0 200 400 mi
Western Sahara
ALGERIA
Taoudenni
MAURITANIA
Kidal
Tombouctou
Gao
SENEGAL
Kayes
Mopti
Koulikoro
Niger
NIGER
BAMAKO
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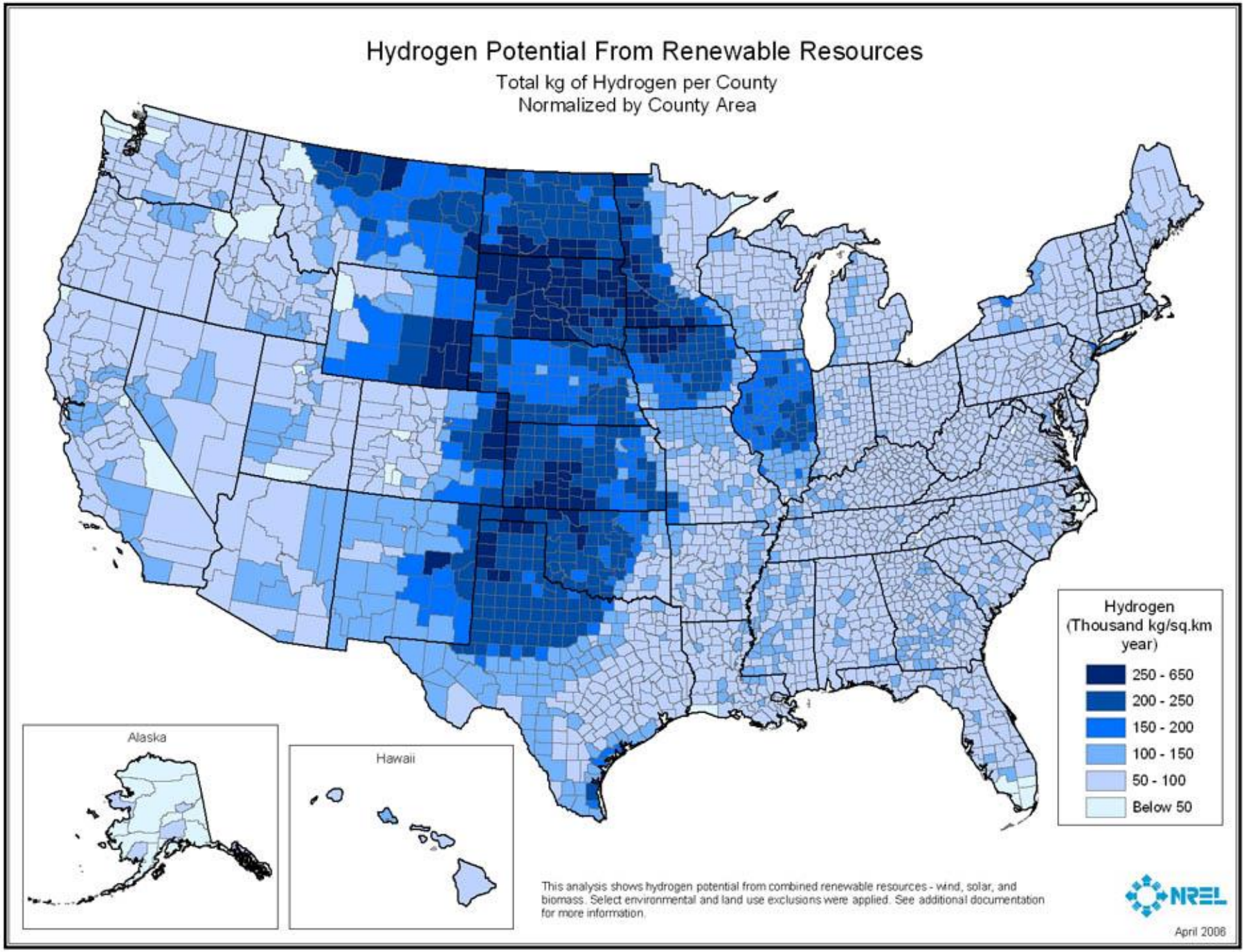
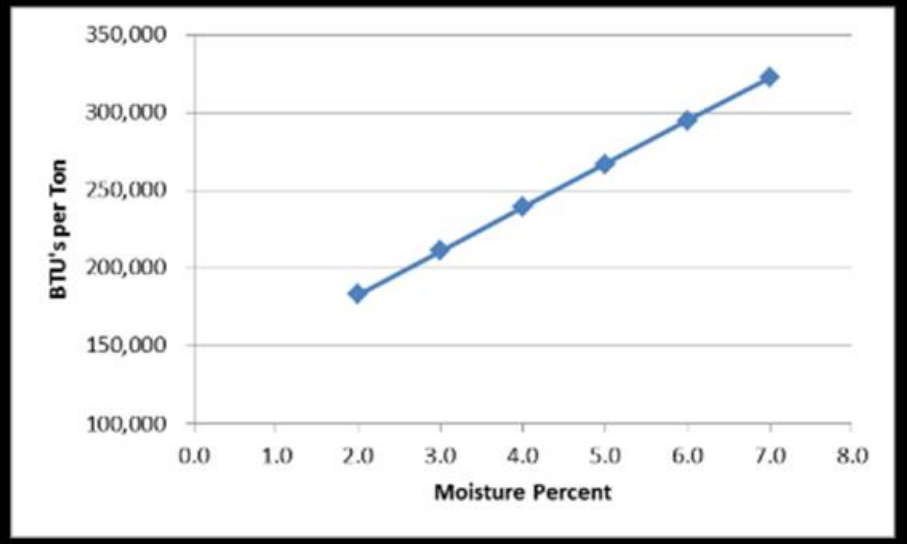
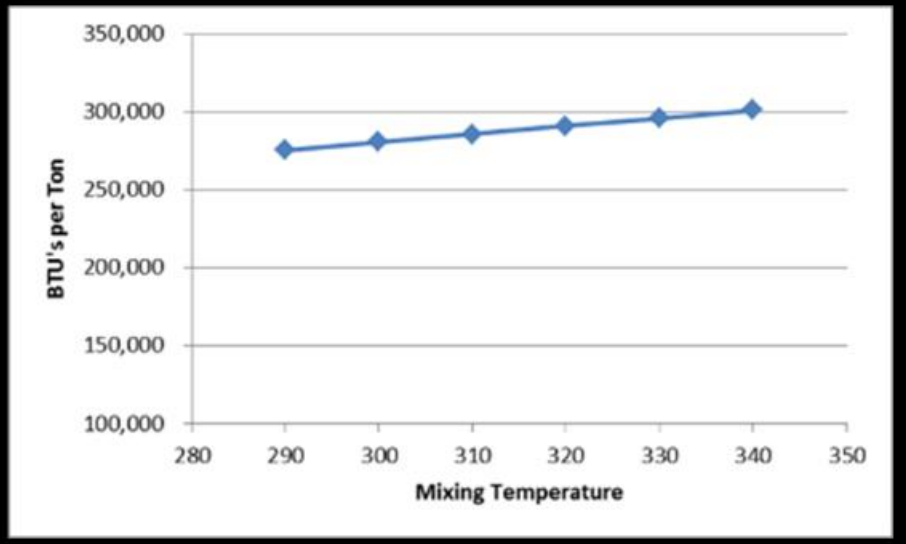

Hydrogen Potential From Renewable Resources
Total kg of Hydrogen per County
Normalized by County Area
Alaska
Hawaii
Hydrogen
(Thousand kg/sq.km
year)
250 - 650
200 - 250
150 - 200
100 - 150
50 - 100
Below 50
This analysis shows hydrogen potential from combined renewable resources - wind, solar, and biomass. Select environmental and land use exclusions were applied. See additional documentation for more information.
NREL
April 2006

Moisture



- *1% change in moisture equals a ~24,000 BTU change per ton of mix*

Temperature



Every 5°F change equals a ~2,200 BTU change per ton of mix

1% moisture reduction = ~55°F temperature reduction

Fuel C02 Fuel Cost Savings

	BTU/ga	ga/ton	BTU/ton	TPD	BTU/day	CO2/day	Tons CO2/day	% CO2 reduction	Fuel /day	% savings fuel
Propane	91,000	2.4	218,400	3,000	655,200,000	90,418	45	-16%	$7,920	
RFO	135,000	1.62	218,700	3,000	656,100,000	108,257	54		$7,290	
Propane	91,000	2.13	193,830	3,000	581,490,000	80,246	40	-11%	$7,029	-11%
RFO	135,000	1.44	194,400	3,000	583,200,000	96,228	48	-11%	$6,480	-11%
Propane	91,000	1.9	172,900	3,000	518,700,000	71,581	36	-21%	$6,270	-21%
RFO	135,000	1.28	172,800	3,000	518,400,000	85,536	43	-21%	$5,760	-21%

Density is the main driver of excessive mix temperature

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Often the contractor raises temp to get KDOT numbers up

Benefits of cooler mix

- ❑Life of surface improves
- ❑Worker comfort
- ❑Easier to roll doesn’t stay in tender zone as long
- ❑Doesn’t promote steam bumps
- ❑Doesn’t reactivate crack seal material as fast

Thank You, Any Questions?