

# Weld County Smart Energy

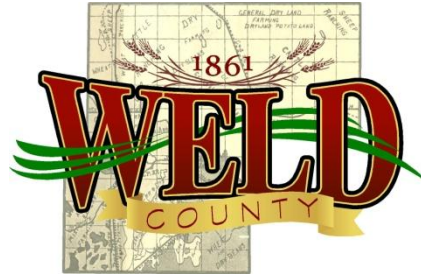
*“Blueprint to Success”*





***Pioneering the capability for  
the utilization of Natural Gas as  
“THE”  
Alternative Transportation Fuel***

# Weld County Natural Gas Coalition

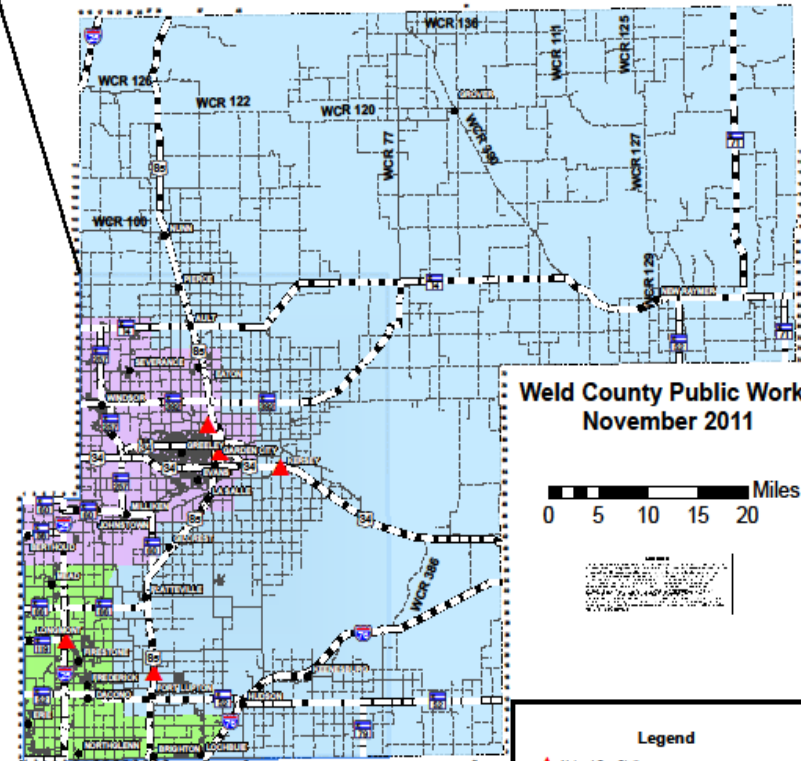
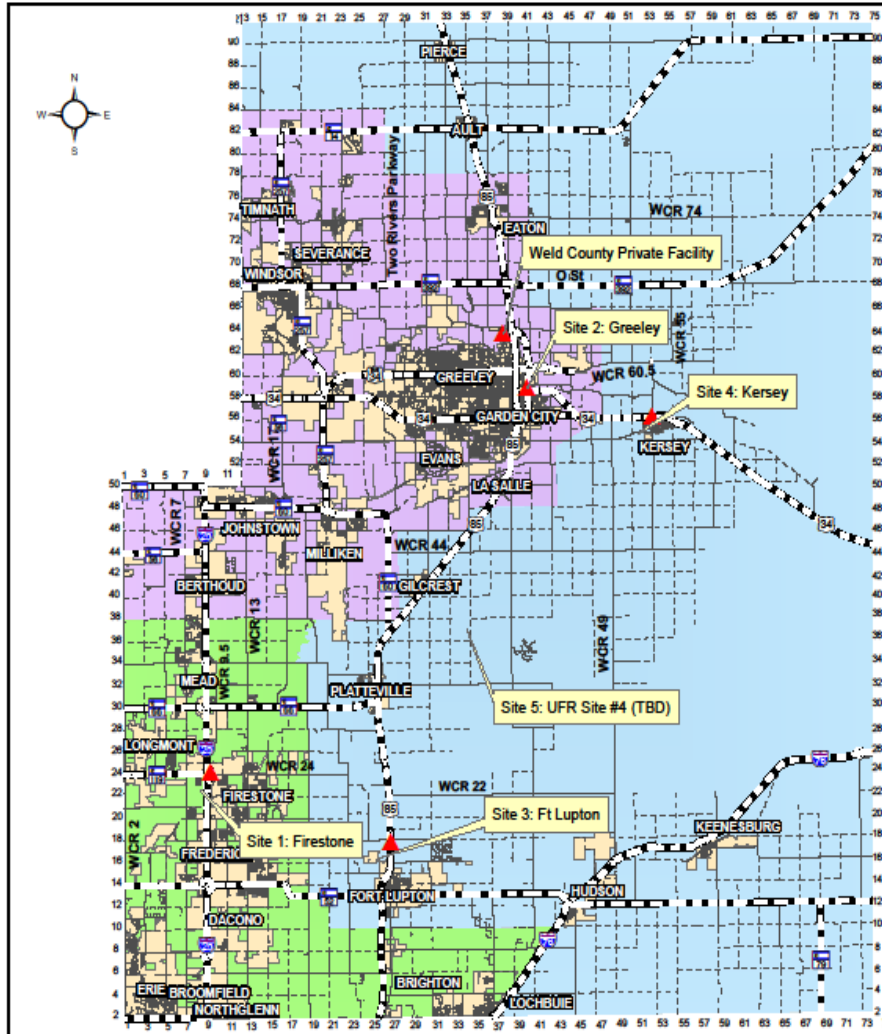


# A Weld County Smart Energy Plan

- **Phase I – Program Launch (COMPLETED)**
  - Develop initial infrastructure (3-5 CNG stations)
  - Pilot programs with stakeholders for vehicle conversions
  - Education and awareness program
- **Phase II – Program Growth (REVISED)**
  - Infrastructure expansion (7-10 CNG stations, 1 LNG station)
  - NGV's increase to 1000 vehicles with pilot expansions and new stakeholders being added
  - NGV and infrastructure certification programs ongoing at colleges
- **Phase III – Program Sustainability**
  - Infrastructure builds out with market demand (15-25 CNG stations and 3 LNG stations)
  - NGV's growth is consumer oriented, count exceeds 10,000 vehicles



# Weld County Natural Gas Fueling Stations Map



## Approved Natural Gas Station Locations

1. Firestone (I-25 & SH 119)
2. Greeley (US 85 Bypass & 16th St.)
3. Ft. Lupton (US 85 & WCR 18)
4. Kersey (US 34 & WCR 53)
5. 4th UFR Site (TBD)

## Legend

- ▲ Natural Gas Station
- Highways
- Local Paved
- Local Gravel
- City Limits
- Upper Front Range Transportation Planning Region
- Denver Regional Council of Governments MPO
- Northern Front Range MPO

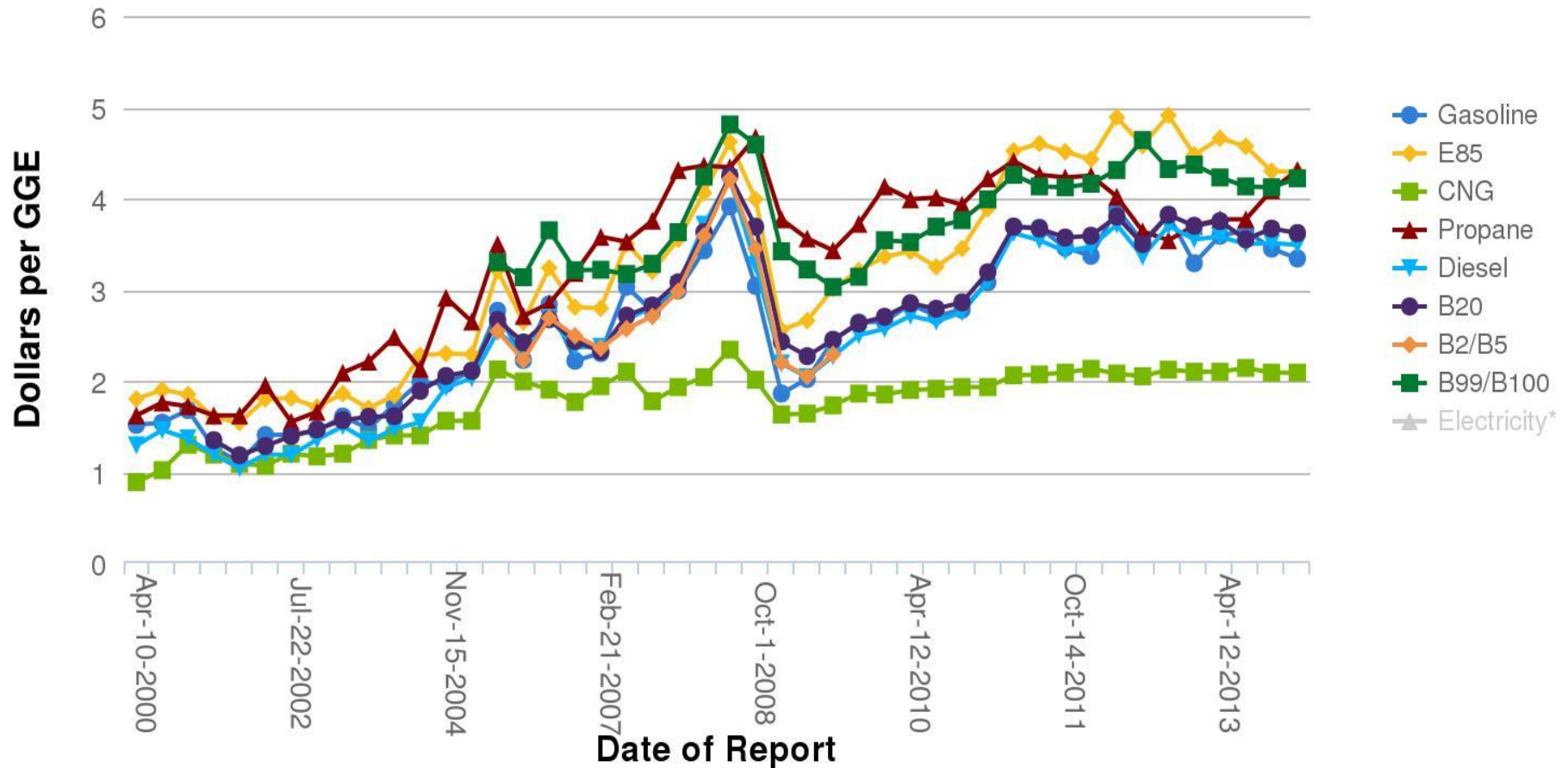
# Weld County NGVs - CMAQ Funds

- \$775,456 – 15 NGVs (NFR MPO)
  - \$276,000 – 4 NGVs (UFR TPR)
  - \$623,264 – 5 CNG School Buses (UFR & Noble)
  - \$483,150 – 12 NGVs (Local Gov't Partnerships)
  - \$353,907 – 8 NGVs (Local Gov't Partnerships)
  - \$1,733,301 – 20 NGVs (Local & PPP)
  - \$1,333,494 – 14 NGVs (NFR-Weld County Fleet)
  - \$560,464 – 11 NGVs (UFR – Local Gov't Partnerships)
  - \$550,000 – Mobile LNG Fueler (PPP)
- 
- Weld County Fleet – 43 NGVs (light, medium, heavy duty)
  - CMAQ Total Funding for vehicles: \$6,788,036



# Natural Gas Fuel Comparison

## Average Retail Fuel Prices in the U.S.



# City of Fort Lupton CNG Fleet







# Compressed Natural Gas (CNG)

## Fueling Station Types

### Time-fill

- CNG is dispensed slowly to fuel tank
- Lower cost station investment (can be 40% lower)
- Best for fleets that return to central lot and sit idle for extended periods

### Fast-fill

- Similar fueling times to normal gas station
- A must for public access
- Good for larger fleets where fueling turn-around time is short
- Can be incorporated with time-fill to enhance payback and public benefit to the community





# Weld County CNG Fuel Site



# Weld County NGVs





# Weld County converting fleet to Natural Gas






# Cost per Mile

- Gasoline – 18 cents per mile
- CNG – 7 cents per mile
- Difference 11 cents per mile
  - \$16,500 vehicle life savings





*Powered by*  **CNG**  
CLEAN WELD COUNTY NATURAL GAS

# Heavy Duty Trucks - LNG







# Firestone CNG Station





# Greeley CNG Station (NFR MPO)



# Kersey Station (UFR TPR)



# Fort Lupton Station (UFR TPR)





# Weld County NGV Event

- <http://www.weldsmartenergy.com/>



# Statewide Natural Gas Program

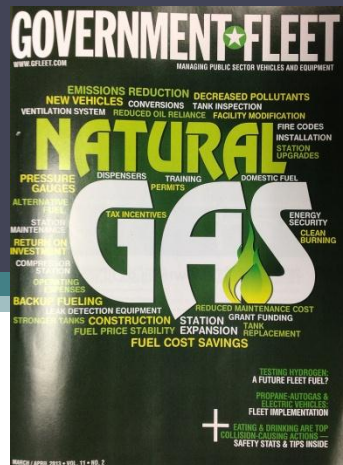






# Weld County Natural Gas Coalition

March/April Issue of Government Fleet Features Weld County's CNG Fleet



www.government-fleet.com



## EXPLORING THE TOTAL COST OF CNG

VEHICLE RETROFITS AND FUELING STATION CONSTRUCTION AREN'T THE ONLY EXPENSES WHEN SWITCHING TO COMPRESSED NATURAL GAS (CNG). HOWEVER, EVEN WHEN CONSIDERING THE TOTAL COST OF CNG, THE PAYBACK PERIOD CAN BE AS SHORT AS THREE YEARS. BY SHELLEY MIKA

**C**onverting vehicles to run on compressed natural gas (CNG) has some clear and immediate benefits. From the beginning, fleets that rely on CNG can expect lower fuel costs, cleaner running engines, lower maintenance costs, and fewer emissions.

For these benefits, however, fleets pay a price. At first, the costs of CNG conversion seem just as clear as the benefits: purchasing new vehicles, converting old ones, and building fueling stations. But as fleets dig into the planning and implementation of a CNG program, other costs emerge. Five industry professionals share their experiences and shed light on the total costs of converting to CNG—and how to avoid budgetary surprises.

**Unexpected Capital Costs**

The true costs of CNG can be broken down into two categories: capital expenses

**AT A GLANCE**

- In addition to vehicle conversions and fueling facility construction, the costs of switching to compressed natural gas (CNG) include:
  - Maintenance facility upgrades
  - Technician training
  - Backup fueling
  - Fueling facility maintenance and repair
  - CNG tank inspection and replacement

and operating expenses. Beyond the purchase or conversion of fleet units and the building of fueling stations, capital expenses include modifications to maintenance facilities, backup fueling stations, and station upgrades.

**Modifications to Maintenance Facilities:** Fleets that service their own vehicles need to make modifications to maintenance facilities—and before CNG vehicles come on board. Specific code requirements exist for facilities that service natural gas vehicles.

"The National Fire Protection Association (NFPA) outlines some requirements for maintenance upgrades, but local building codes might be even more restrictive in regards to maintenance facilities," said Steve Riley, automotive director, City of Coral Gables, Fla. "A lot of the building upgrades would be required right away, before you start working on CNG vehicles—or any vehicle that runs on lighter-than-air fuel."

In order to safely accommodate lighter-than-air fuel, maintenance facility upgrades include pressure gauges, leak-detection equipment, and proper ventilation. Without modifications, the CNG fuel system can be maintained or repaired inside the maintenance facility.

"Costs for the facility upgrades will vary dramatically, depending on the size of the facility, its age, and its current configuration," said Richard Drake, PE, vice president—engineering, TT Environmental, a CNG design and construction services provider.

Modifications to maintenance facilities also require updates to the ventilation system. CNG exhaust systems are considered "high temperature," which are more expensive than older, low-temperature systems. For a basic hose drop system, including the fan, ducting, hose, and installation, fleets can expect to pay approximately \$5,000 per bay (i.e., one exhaust drop for one vehicle).

"These high-temperature systems require stainless steel equipment, with special high-temperature resistant parts and hoses. Therefore, the systems are more expensive than older, low-temperature systems," said Rich Cunningham, national sales manager for Masterduct, a manufacturer of technical hoses for industrial applications. "It is important to have an expert to engineer a proper system for the maintenance facility. This system can be designed for low-cost operation and long-term operation, which improves the return on investment (ROI)."

**Backup Fueling:** Although many fleets have converted to CNG, fueling stations are yet to be widely accessible. That means fleets must have a strategy in place in the event of a power failure or equipment malfunction,

"CNG is not like liquid fuels that can actually be pumped with a hand-operated crank when the power goes out," Drake said. "To avoid downtime, it's important to have a workable contingency plan in place early."

A nearby public fueling station can be used as a backup. "We can fuel our fleet more efficiently by having our own station, but the public stations offer redundancy for us, should our system be unavailable," said Elizabeth Reiford, Weld County, Colo., transportation planner.

**Station Upgrades:** An agency may decide to expand its CNG fleet, but if fueling stations aren't built with future growth in mind, station upgrades will be required to keep up with the fueling requirements of the larger CNG fleet. Those likely include the purchase of CNG compressors, a dryer, additional storage spheres, CNG hookup, electrical hookup, engineering fees, dispenser upgrades, and assorted other minimal costs.

"We had outgrown our old station and

through American Recovery and Reinvestment Act (ARRA) grant funds, were able to upgrade. We already had the existing site, major electrical work, and dispensers in place," said Mark Stevens, fleet manager, City of Asheville, N.C. "Since we had an existing station initially installed in 2005, the overall cost to upgrade our station was approximately \$350,000. The cost to start from scratch and install a station would have [been] approximately \$500,000."

**Compressor Replacement:** Unfortunately, CNG compressors don't last forever, but they should have a predefined lifecycle. As such, it's important to plan ahead for those costs. "When calculating your true operating expenses, you need to consider the long-term capital equipment replacement costs," Riley commented. "Prorate those costs via the straight line depreciation method and put that money away for when you need it. The last thing you need is to have a large portion of your vehicles running on CNG

while trying to fuel the fleet with an old and unreliable compressor station."

**Unexpected Operating Expenses**

In addition to unexpected capital costs are unforeseen operating expenses. In some instances, a CNG fleet has requirements a traditionally fueled fleet doesn't. These include:

**Training:** CNG fueling systems are complex—which means an investment in training for fleet technicians is a must. "It's important to set up the training immediately and have it completed before implementing your CNG equipment purchasing or conversion program," Riley said.

Training won't cost as much as capital expenses, but it's not a small expense. "Proper training is a major cost," Stevens said. "The costs can vary based on in-house training or paying an outside specialist for training."

**Equipment Operation and Maintenance:** When a fleet owner installs the fleet's own fueling infrastructure, it's important



The City of Asheville, N.C., recently upgraded its fueling station to accommodate a larger number of CNG fleet vehicles.



A time-fill station is less expensive to operate than a fast-fill station, but it usually can only be used to fuel vehicles outside regular hours of operation.



# Weld County Natural Gas Coalition

[HOME](#) [UPCOMING EVENTS](#) [AFFORDABLE](#) [CLEAN](#) [AMERICAN](#) [ABUNDANT](#)



## Weld County Natural Gas Coalition

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- Natural Gas Fueling Stations
- Incentives
- Upcoming Events



### NATURAL GAS – THE ALTERNATIVE TRANSPORTATION FUEL ABUNDANT – AFFORDABLE – RELIABLE – CLEAN – DOMESTIC

Welcome to the Smart Energy web site!  
We hope to be a resource about the use of natural gas as an alternative transportation fuel!

#### VIDEO RESOURCES TO HELP WITH YOUR CNG & LNG RESEARCH

Do you have questions about how to fuel a CNG or LNG vehicle? Do you want to learn more about natural gas engines? The Weld County Natural Gas Coalition invites you to visit two sites that provide a wealth of knowledge on the topics of CNG and LNG vehicles.

How to Fuel a Vehicle



Cummins Westport has posted several informative videos on the [Natural Gas Academy](#) section of their web site including "What is Natural Gas?", "Natural Gas Engines" and "How to Fuel a Vehicle", which provides fueling information for both CNG and LNG vehicles.

CAT also offers videos explaining [Dynamic Gas Blending Systems and Kits](#).

When considering CNG or LNG, we understand how important it is to have access to information and resources that will help you make the right decision for your fleet.

#### Complete A Fleet Survey

[Natural Gas Fleet Survey](#)

#### NGV Event Presentations

- [Colorado Energy Office - CNG Case Studies](#)
- [NRGL Presentation](#)
- [IMPOC Automotive Presentation](#)
- [Siemens Natural Gas Presentation](#)
- [American Power Group](#)
- [Marathon Energy Corporation Presentation](#)
- [Zell Energy Presentation](#)
- [Loveland Ready Mix Presentation](#)
- [Noble Energy Presentation](#)
- [Aerodis Petroleum Corp. Presentation](#)
- [Weld County LNG Truck Pictures](#)

#### Calendar

April 2013						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

#### WCNGC Information

[WCNGC Brochure](#)

#### Contact

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<http://www.weldsmartenergy.org>



# Maintenance Facility Modifications



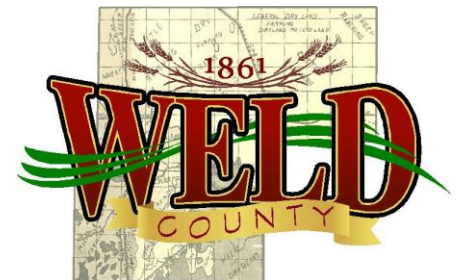
# Facilities

## Maintenance Facilities 3<sup>rd</sup> priority

- Behind Vehicles and Refueling Stations

## Pocket Book

- How much is this going to cost me?
- Depends on facility
- May not be as bad as you think



# Early Modifications

## Fire & Building Official: robust requirements

- No consistency
- Mercy of local authority's wishes
- Cautious due to Propane Vehicle mishaps
  - Faulty pressure relief devices
- Some mandated “ENTIRE” buildings Class I, Division II compliant

## New National Standards/Codes developed

- Allowed for practical approach





# Codes

## **National Fire Protection Association (NFPA) 52 (2010)**

(Vehicular Gaseous Fuel Systems Code)

## **National Fire Protection Association (NFPA) 70 (National Electrical Code)**

## **National Fire Protection Association (NFPA) 30A (2012)**

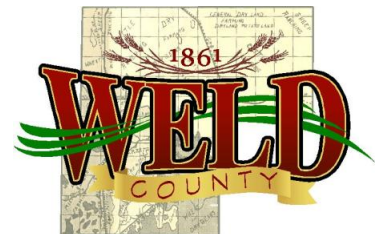
Code for Motor Fuel Dispensing Facilities and Repair Garages

## **International Building Code (IBC 2012)**

## **International Mechanical Code (IMC 2012)**

## **International Fire Code (IFC 2012)**

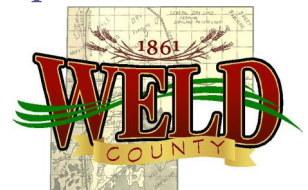
## **NFPA 88A (2007) Standards for Parking Structures**



# Types of Facilities - Minor

## Minor CNG & LNG Repair Facilities

- A minor repair facility is defined as one where work is **NOT** performed on the fuel system and is limited to exchange of parts and other maintenance requiring no open flame or welding
  - By NFPA 30A code definition, minor repair facilities perform services including:
    - Chassis Lubrication
    - Inspections
    - Engine Tune-ups
    - Parts Replacement
    - Fluid Changes
    - Tire Rotation
    - Brake systems
    - Similar Routine Maintenance
- Mitigation efforts **NOT** needed
  - But must comply with minimum Ventilation for Class I and Class II liquid fuel repair garages
- Vehicle Storage Facilities fall into this category



# Types of Facilities - Major

## Major CNG & LNG Repair Facilities

- A major repair facility is one where work is performed on the fuel system, body work and/or repairs requiring open flames or welding
  - Fuel injectors
  - Fuel filters
  - Tanks
  - Fuel Lines
  - Body work
  - Painting
  - Engine Overhauls
  - Note: Some AJH consider spark plug replacement as opening the “sealed” fuel system
- Mitigation efforts **ARE** needed





# CNG Facility Basics

**Hazard** is on ceiling

- Gas Rises and Concentrates

**Classified Space** is 18" down from ceiling

- Items affected:
  - lights, electrical, mechanical, heating, ventilation, roof top unit, conduit penetrations, etc.
- Items in space need to be fully Class I, Division II compliant
  - Or remove these items from the Classified Space
  - Or combination of both
- Heating systems: 750 degree max skin temperature
  - No open flame heaters



# Major Repair Options

## Work on Vehicles outside

### Exhaust fans “continually” operating

- Provides for positive ventilation
- Does not work well during Colorado winter

### Modify Facility:

- “Classified Space” compliant with Class 1, Div. 2
- Control System
  - Monitor for gas leaks (Methane detection)
  - Interlock exhaust fans and fresh air intake
    - Turns ON upon detection of methane
  - Shutdown heating systems
  - Audible & Visual Alarms



# CNG Cost Savings

## Separation

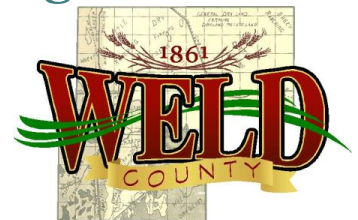
- Some (but not all) facilities can be separated into major or minor repair areas (2-hour fire rating)
- Primary vehicle access from exterior

## Classified Space

- Relocate items (electrical, heat, ventilation, roof top units, lights, etc.)
- May be cheaper than Class 1, Division 2 changes?

## Approval

- Methods must be pre-approved by the Authority Having Jurisdiction (Fire Dept. and/or Building Inspections)
- May have other alternatives





# LNG Facility Basics

## LNG is a cryogenic “liquid”

- As natural thermal change, it will flashover to a gas (CNG)
- Once flashed over, it rises
- Hazard is Floor **AND** Ceiling

## Major Facilities

- Must be compliant with CNG Facility modifications
- Must have a gas detection system

### In addition, must mitigate risks in:

- 18” Classified Space from floor up
- Includes: lights, electrical, mechanical, heating, ventilation, conduit penetrations, floor drains, maintenance pits, etc.
- Floor drains will need a valve to keep liquid from entering sewer system
- Maintenance pits will need monitoring and ventilation



# LNG Cost Savings

## Separation

- Some (but not all) facilities can be separated to provide a major LNG repair area
- Accomplished using fire walls, partitions and other methods

## Classified Space

- Remove items (electrical, heat, ventilation, lights, etc.)
- Tie control wiring to **remove power** to items that remain instead of making them Class 1, Div. 2 compliant
  - Shunt trip circuit breakers

## Manual Valves

- Instead of monitored valves in drain lines, manual valve at floor drains could be used
  - Requires policy & procedures to close prior to brining LNG vehicle indoors
  - Saves removing concrete

## Approval

- Methods must be pre-approved by the Authority Having Jurisdiction (Fire Dept. and/or Building Inspections)
- May have other possibilities



# Components



Relay Controller: \$5,500 Each



# Components



Uninterruptable Power Supply: \$150

# Components



Transmitter: \$700

# Components



Gas Detector: \$1,200 Each



# Components

Each point: \$2,000



# Components

Warning Lights: \$200 Each



0-25 LFL



25-50 LFL



> 50 LFL

# Components



Warning Horns: \$1,300 Each



# QUESTIONS?

**WWW.WELDSMARTENERGY.ORG**

## Contact Information:

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(970) 304-6496 ext. 3748

Toby Taylor  
Buildings & Grounds  
[ttaylor@weldgov.com](mailto:ttaylor@weldgov.com)  
(970) 304-6531

# Natural Gas Fast Facts

- CNG is stored in a gas state at 3,600 psi
- LNG is stored in a liquid state at -260° F
- Vehicle performance using natural gas is the same as gasoline and diesel.

## Annual Fuel Savings when using Natural Gas:

- Class 8 Tractor Trailer: \$30,000
- Garbage Truck: \$20,000
- Transit Bus: \$18,000
- Shuttle: \$12,000
- Taxi: \$8,000

# Natural Gas Vehicle Option Examples

- **Light Duty Vehicles**

- Honda Civic GX
- Chevrolet – Impala, Silverado, Tahoe, Malibu, Tahoe
- Ford – Focus, Fusion, F150, Milan, Transit Connect
- Dodge – Ram

- **Medium Duty Vehicles**

- Chevrolet –W4500, C4500 / 5500, Express, Savana
- Ford – F250, F350, E450, F450, F550, F53 / F59
- Transit Bus – Blue Bird, Thomas Built, El Dorado, Foton America, NABI, New Flyer, Orion, Motor Coach Industries
- Work Trucks – Workhorse, Sterling, International, MaxxForce
- Refuse – American LaFrance, Mack, AutoCar, Crane Carrier, Freightliner, Kenworth, McNeilus, Heil
- Street Sweeper – Elgin, Freightliner, Schwarze

- **Heavy Duty Vehicles**

- Short-Haul – Freightliner, Kenworth, Peterbilt, Volvo Trucks N.A.
- Long-Haul – Kenworth, Peterbilt, Volvo Trucks N.A., International Transtar

- **Heavy Duty Engine Manufacturers**

- Cummins Westport 8.9L ISL G
- Westport 15L



# NGV Performance

- Recent studies indicate natural gas powered vehicle gets about the same fuel economy as a conventional gasoline vehicle on a gasoline gallon equivalent (GGE) basis.
- A GGE is the amount of alternative fuel that contains the same amount of energy as a gallon of gasoline.
- Increased engine life





# NGV Maintenance

- Every 3 years inspections required to ensure all critical NGV components are secure and functioning.
- Some routine maintenance requirements extended due to the cleaner burning nature of natural gas.
- Natural gas is sold in gasoline gallon equivalents (GGEs). A GGE has about the same energy content (121,000 BTUs) as a gallon of gasoline.



# NGV Availability

- Over 120,000 NGVs on U.S. roads today and over 10 million worldwide
- Over 50 different manufacturers produce 150 models of light, medium, and heavy-duty vehicles and engines
- Currently the Honda Civic is the only Dedicated CNG vehicle off the assembly line and available to the general public....in America.
- Many models can be converted:
  - Dedicated – powered solely by natural gas
  - Bi-fuel – capable of running on gasoline or natural gas



# NGV & Safety

- Natural gas is very safe, colorless, non-toxic substance— lighter than air, so if released, it dissipates into the atmosphere.
- Does not leak into groundwater
- High ignition temperature: 1,000° - 1,100° F
  - Gasoline ignition temperature: 495°
  - Diesel ignition temperature: 410°
- Comprehensive fuel tank, vehicle and station design/manufacturing codes and standards.
- Natural gas has a narrow range of flammability (air/combustion ratio - concentrations below 5% and above 15% will not burn).
- Natural Gas fuel tanks are much stronger than Gasoline fuel tanks and are subjected to the following tests:
  - Puncture- <http://www.lincolncomposites.com/media/gunfire1.wmv>
  - Fire- <http://www.lincolncomposites.com/media/bonfire1.wmv>
  - Drop- <http://www.lincolncomposites.com/media/drop1.wmv>