

# Green to Gold with Alternative Fuel Vehicles

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Toronto, Ontario, Canada

Presented by:

Shawn O'Leary, P.E.  
Director of Public Works  
City of Norman, Oklahoma

John H. Bolte, P.E., Principal  
Small Arrow Engineering, LLC  
Joplin, Missouri



# Agenda



- Project/Program Background
- Norman Alternative Fuel Program
- Norman Grant Funding
- Norman CNG Fleet
- Natural Gas Industry Facts
- Norman CNG Fueling Station
- Pros & Cons of Norman Program
- Return on Investment in Norman
- Q & A



# Norman Project/Program Background

- **2008**
  - Gas Prices Spike to \$4/gallon
  - City Fuel Budget Approaches \$1M Overrun
  - City Manager Requests Solutions to Fuel Budget
- **2009**
  - City Council Adopts Alternative Fuel Program
  - Retained Grant Consultant
  - ACOG/Clean Cities Funding
  - ARRA Funding (Stimulus)
- **2010**
  - RFP CNG Station Design/Engineering
  - Bid CNG Station
- **2011**
  - July – December Station Construction
- **2012**
  - January – Soft Opening of CNG Station
  - May – Grand Opening
- **2013/2014**
  - Acquire more CNG Vehicles/Equipment
  - Operate CNG Station



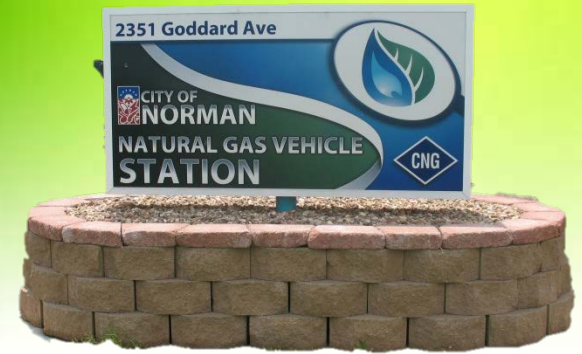
# Norman Alternative Fuel Program

- Adopted by City Council in October 2008
- City Fleet = 867 Vehicles/Equipment
- Recommended AFVs – CNG & Flex Fuel
- Full Cost Savings Realized with CNG Fueling Infrastructure
- AFV Grants Available
- 131 AFVs in first five years
- 572 AFVs (66%) in first five years if biodiesel & E85 used





# Norman Grant Funding



## ● 2009 to Date

### ● Equipment

- 3 Refuse Trucks
- 1 Field Service Truck
- 1 Bucket Truck
- 1 Light Duty Truck
- 1 SUV
- 1 Street Sweeper
- 1 Zero Turn Mower
- \$454,500 Total

## ● 2009 to Date

### ● CNG Infrastructure

- Slow Fill
- Fast Fill
- Grant Funding  
\$1,629,366
- City Match  
\$507,033
- Total Cost  
\$2,136,400



# Norman CNG Fleet



## ● By the End of 2014

- 11 Refuse Trucks
- 43 Pickups
- 5 Sedans
- 1 Bucket Truck
- 2 Street Sweepers
- 2 Mowers
- 6 Generators

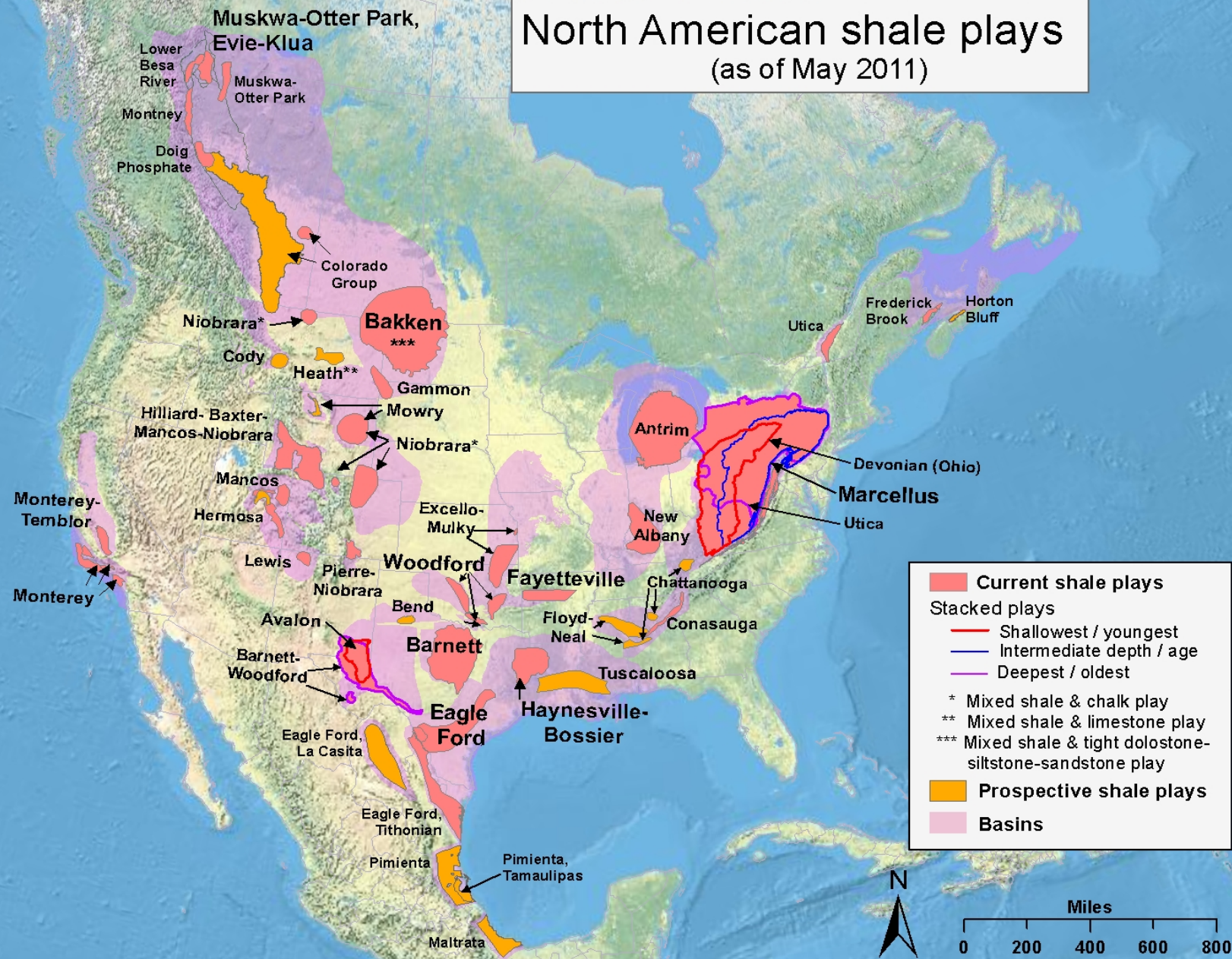
● Maximum Possible Conversions - 300

Total CNG Fleet – 70

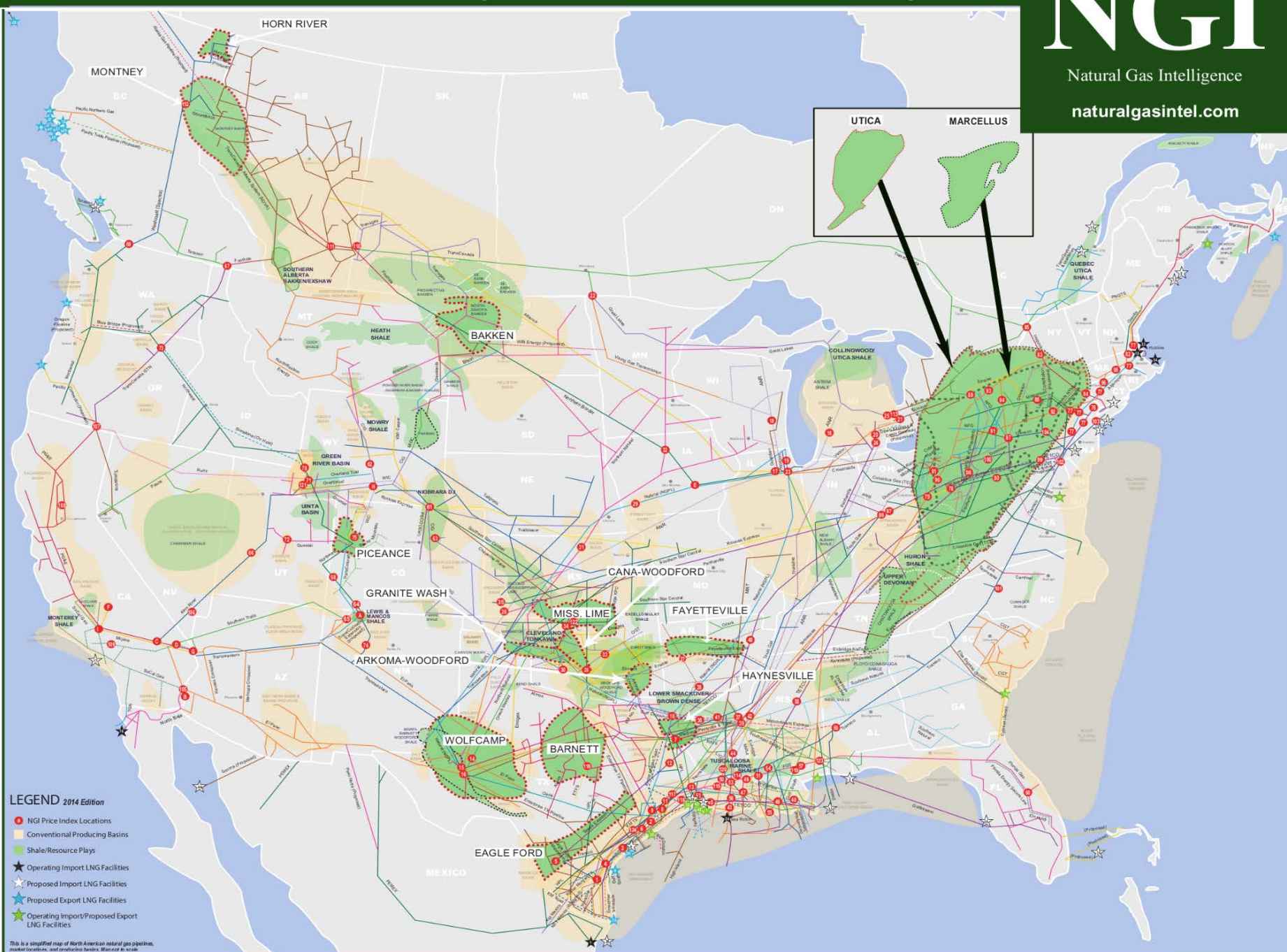




# North American shale plays (as of May 2011)





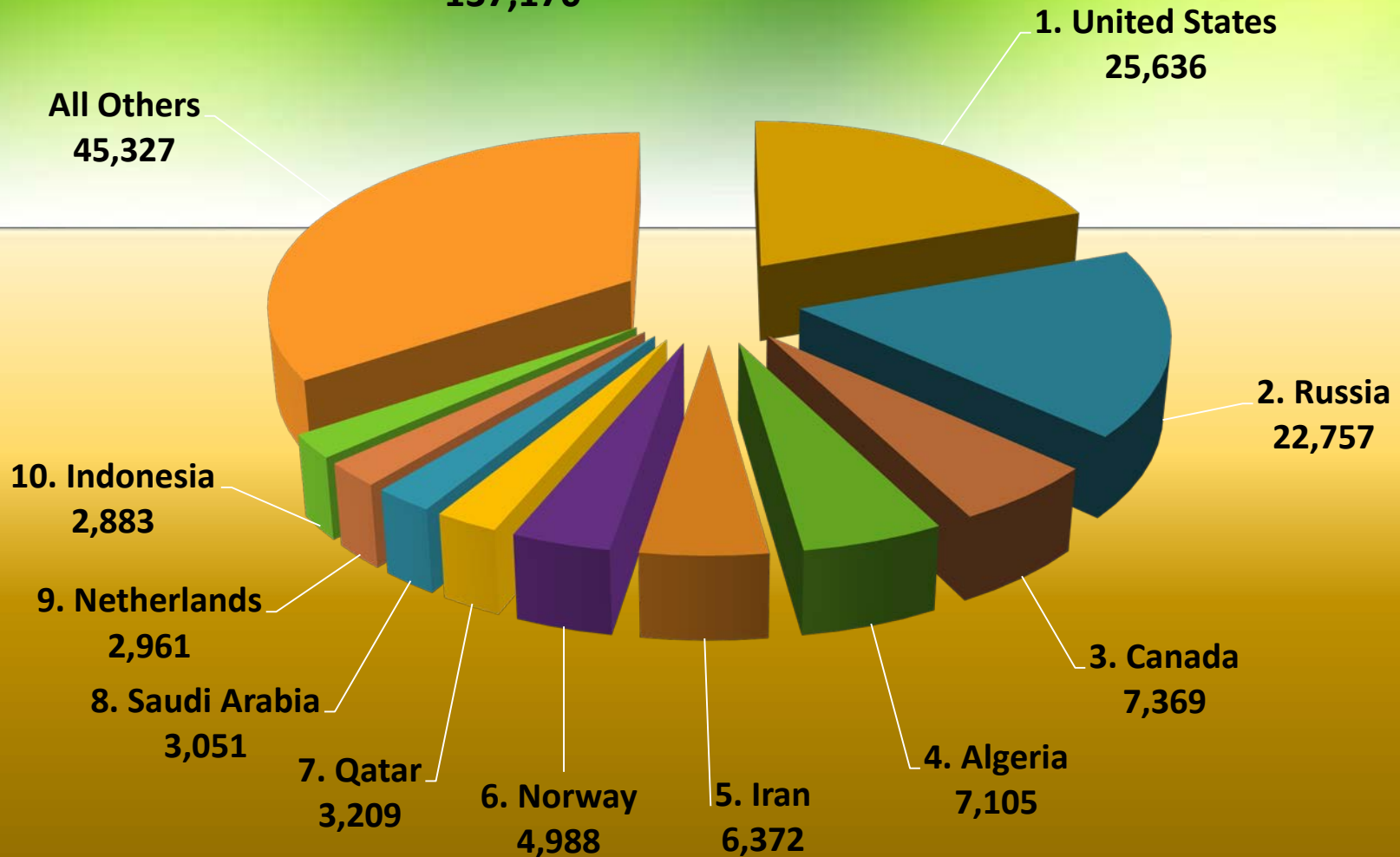




# World Natural Gas Production (BCF)

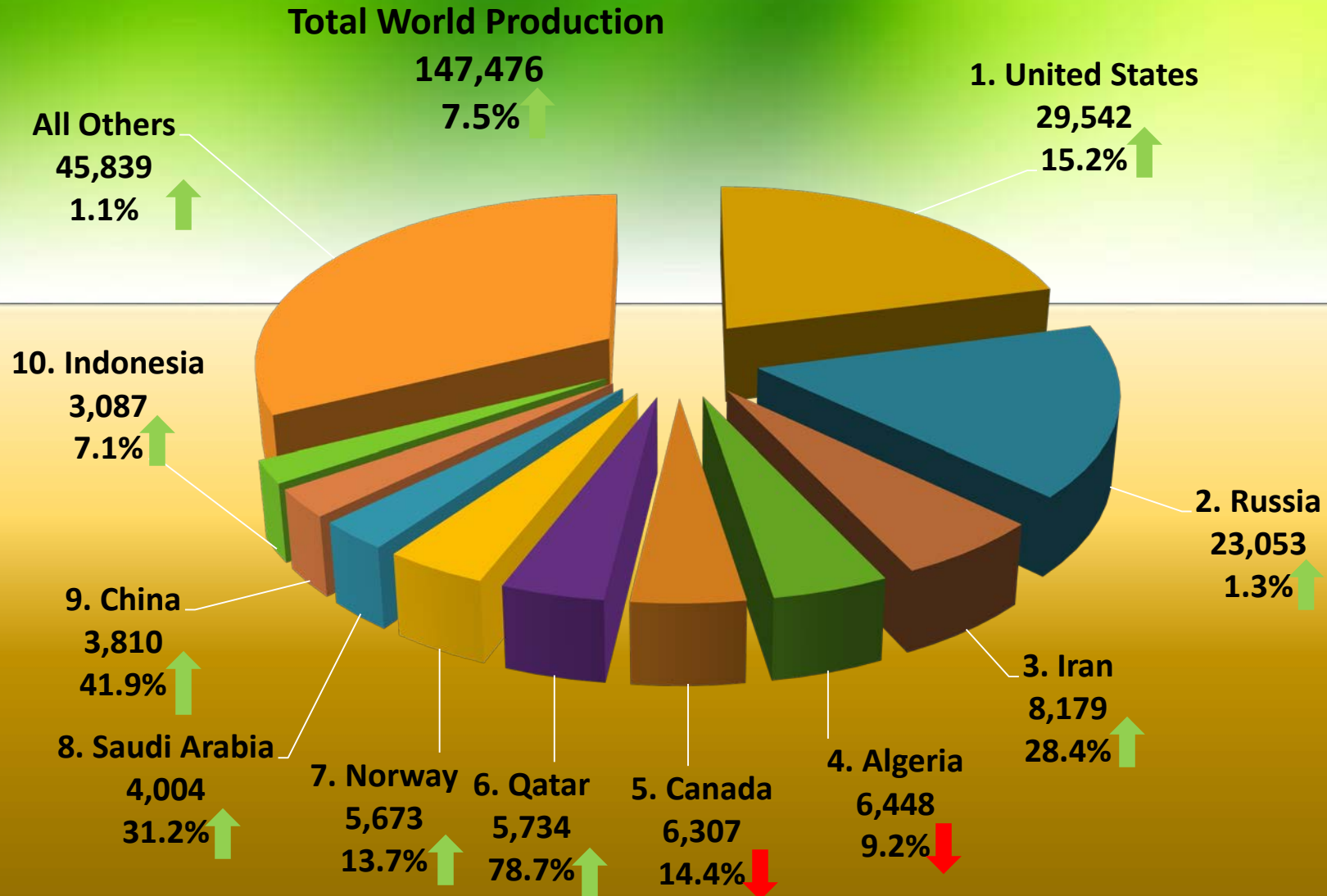
## 2008

**Total World Production**  
**137,170**



# World Natural Gas Production (BCF)

## 2012



# NGV in the World Market

Rank	Country	NG Vehicles	NG Stations	NG Production (BCF)
1	Iran	3,000,000	1,960	8,179
2	Pakistan	2,900,000	3,330	1,543
3	Argentina	2,140,000	1,900	1,557
4	Brazil	1,740,000	1,700	911
5	China	1,580,000	2,785	3,810
6	India	1,125,000	724	1,504
7	Italy	750,000	959	304
8	Ukraine	390,000	324	694

*Source: As of December 2012 - IANGV 2013*  
*[www.ngvglobal.org](http://www.ngvglobal.org)*



# NGV in the World Market

Rank	Country	NG Vehicles	NG Stations	NG Production (BCF)
9	Colombia	380,000	690	1,110
10	Thailand	358,000	470	1,587
>>>				
18	United States	127,735	1,120	29,542
>>>				
29	Canada	12,500	47	6,307
Total	World Wide	16,733,000	21,290	147,476

Source: As of December 2012 - IANGV 2013  
[www.ngvglobal.org](http://www.ngvglobal.org)

# Terms for CNG

## United States

### Volume

- GGE Gasoline Gallon Equivalent  
1GGE = 125 SCF
- DGE Diesel Gallon Equivalent  
1DGE = 140 SCF

### Flow

- SCF Standard Cubic Feet  
1SCF = 1,000 BTU

### Pressure

- PSIG Pounds per Square Inch (Gauge)  
3,600 PSIG @ 70 degrees Fahrenheit

# Terms for CNG

## Canada

### Volume

- GLE Gasoline Liter Equivalent

### Flow

- $\text{NM}^3/\text{H}$  Normal Cubic Meter per Hour
- $\text{SM}^3/\text{H}$  Standard Cubic Meter per Hour

### Pressure

- BAR
  - 200 Bar  $\approx$  3,000 PSI
  - 250 Bar  $\approx$  3,600 PSI



Public Works CNG



Springfield, MO

Laclede Gas CNG



St. Louis, MO

Northville NG



Frankfort, IN

# Where's Waldo

1,150 Mi / 1,850 Km

Joplin, MO to Toronto, ON

\$148.80 Total CNG Cost

≈ 13 cents / mile

≈ 8 cents / km

Blue Water Transit CNG



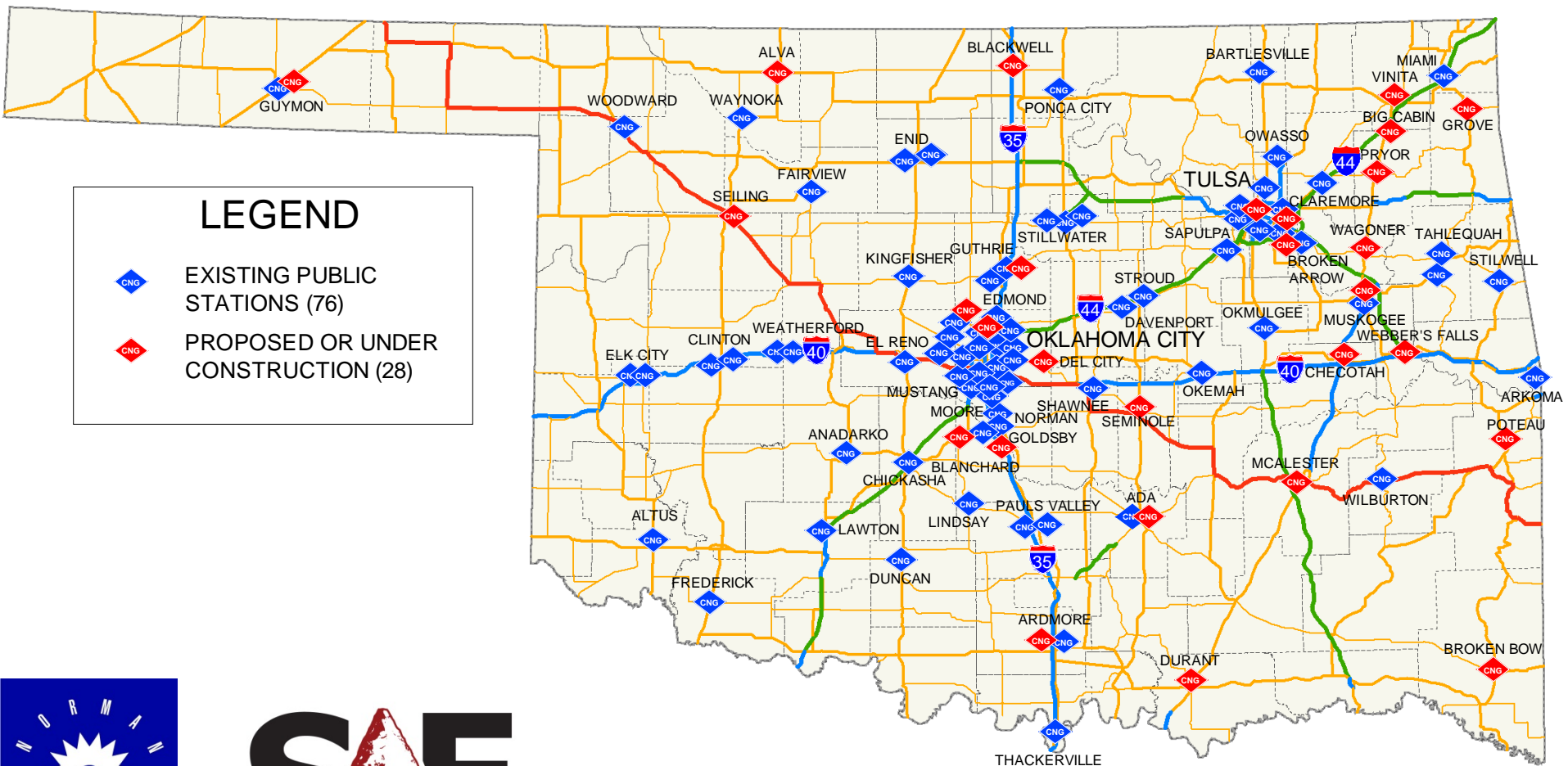
Capac, MI

Queensway Carwash



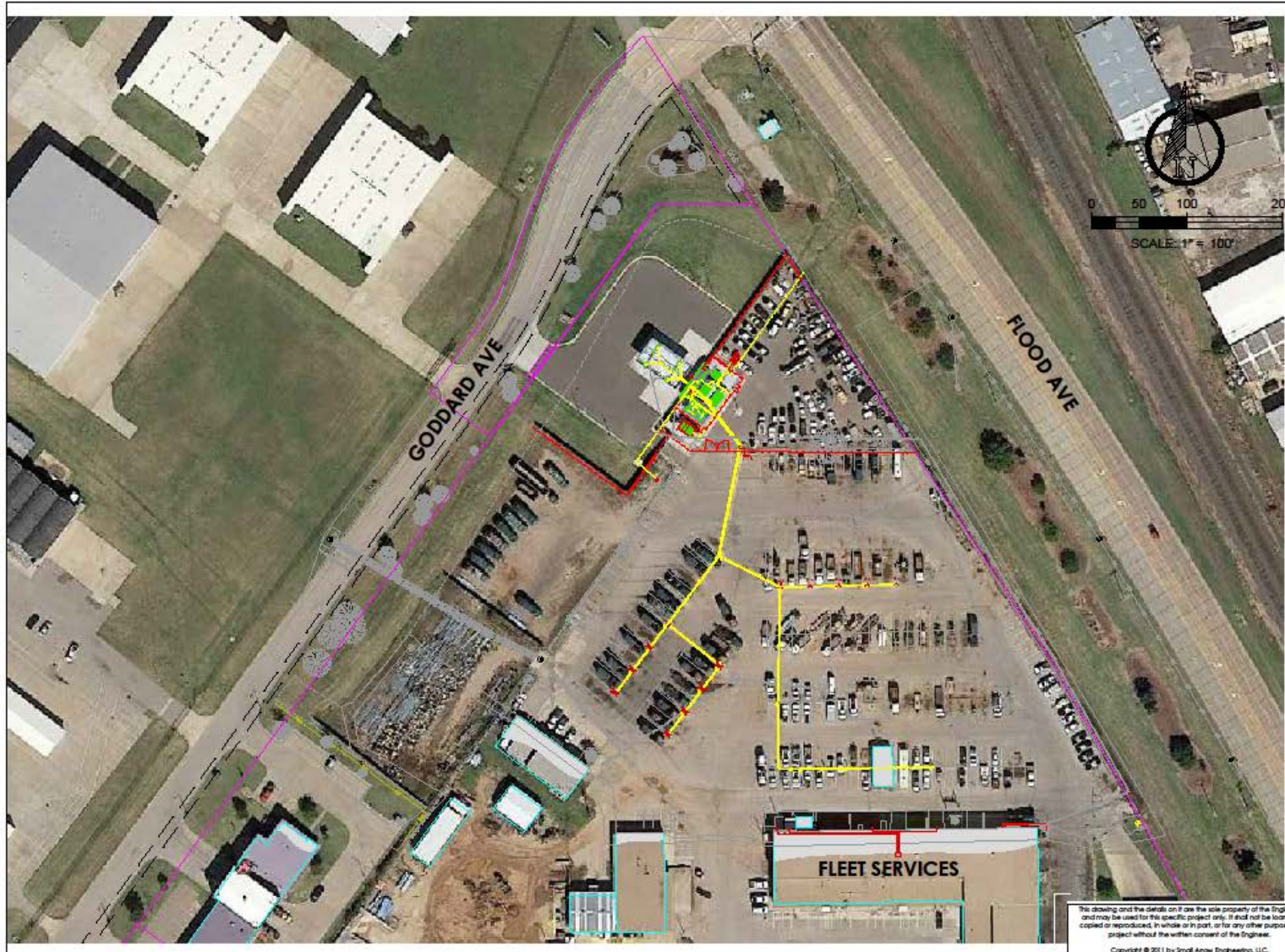
Toronto, ON



## Oklahoma Public Access CNG Stations – July 2014





# Norman CNG Fueling Station



 <b>SMALL ARROW</b> ENGINEERING, LLC	
216 S. MAIN STREET PO BOX 1538 JOPLIN, MISSOURI 64802 TEL: 417.624.2555 FAX: 417.624.2441 EMAIL: jbolte@small-arrow.com	
SMALL ARROW ENGINEERING, LLC. MISSOURI CERTIFICATE OF AUTHORITY: 2015013647 OKLAHOMA CERTIFICATE OF AUTHORITY: 5937	
	
1/10/12 JOHN H. BOLTE - PROFESSIONAL ENGINEER MO LIC: E25511 OK LIC: 18035 KS LIC: 14694 AZ LIC: 37701	
PUBLIC & FLEET CNG STATION CITY OF NORMAN 2351 GODDARD AVENUE NORMAN, CLEVELAND COUNTY, OK OVERALL SITE PLAN	
SURVEY BY: JWB PROJECT #: 11136 DRAWN BY: JWB DATE: 12/20/11 CHECKED BY: JWB SCALE: N/A	
PROJECT: CNG SE EXPANSION SHEET DESC: SITE PLAN SHEET: 2 OF 7	

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# Norman CNG Fueling Station



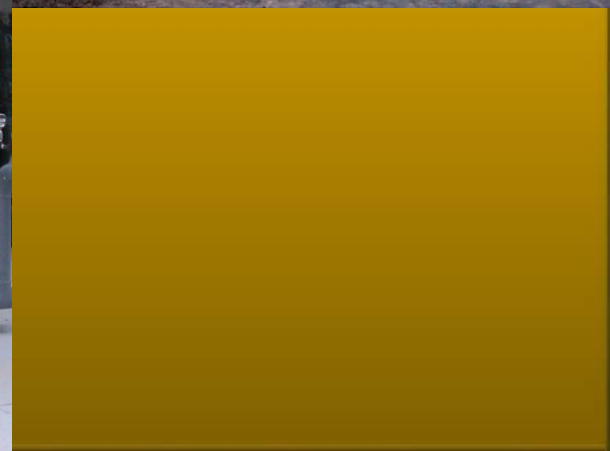
- 4 Fast Fill Dispensers
- 20 Slow Fill Dual Hose Dispensers
- 2 125 HP Compressors
- 1 72 HP NG Drive Backup Compressor
- 1 NG Backup Generator
- 480 gge Available Storage
- Open to the Public 24/7



# CNG Public Fueling Station – Norman, OK

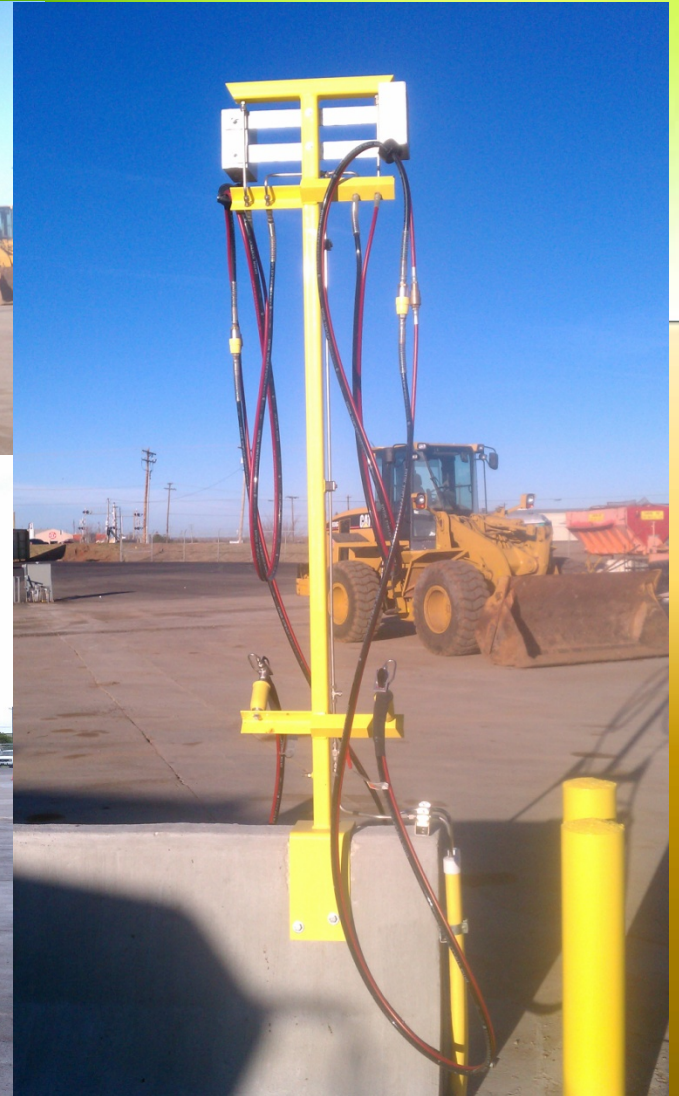








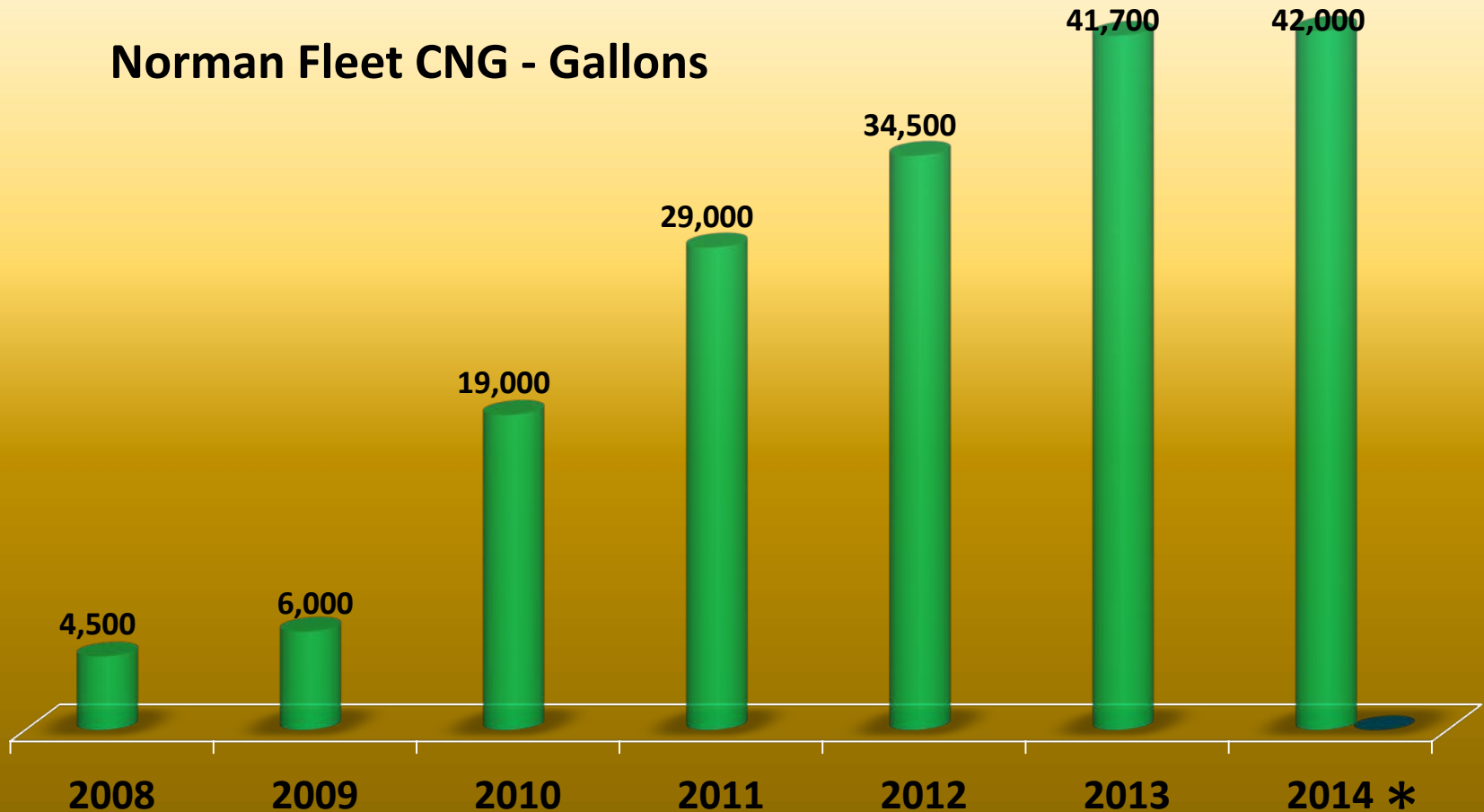
# TYPICAL SLOW FILL FLEET INSTALLATION





# Norman Fleet CNG Fuel Usage History

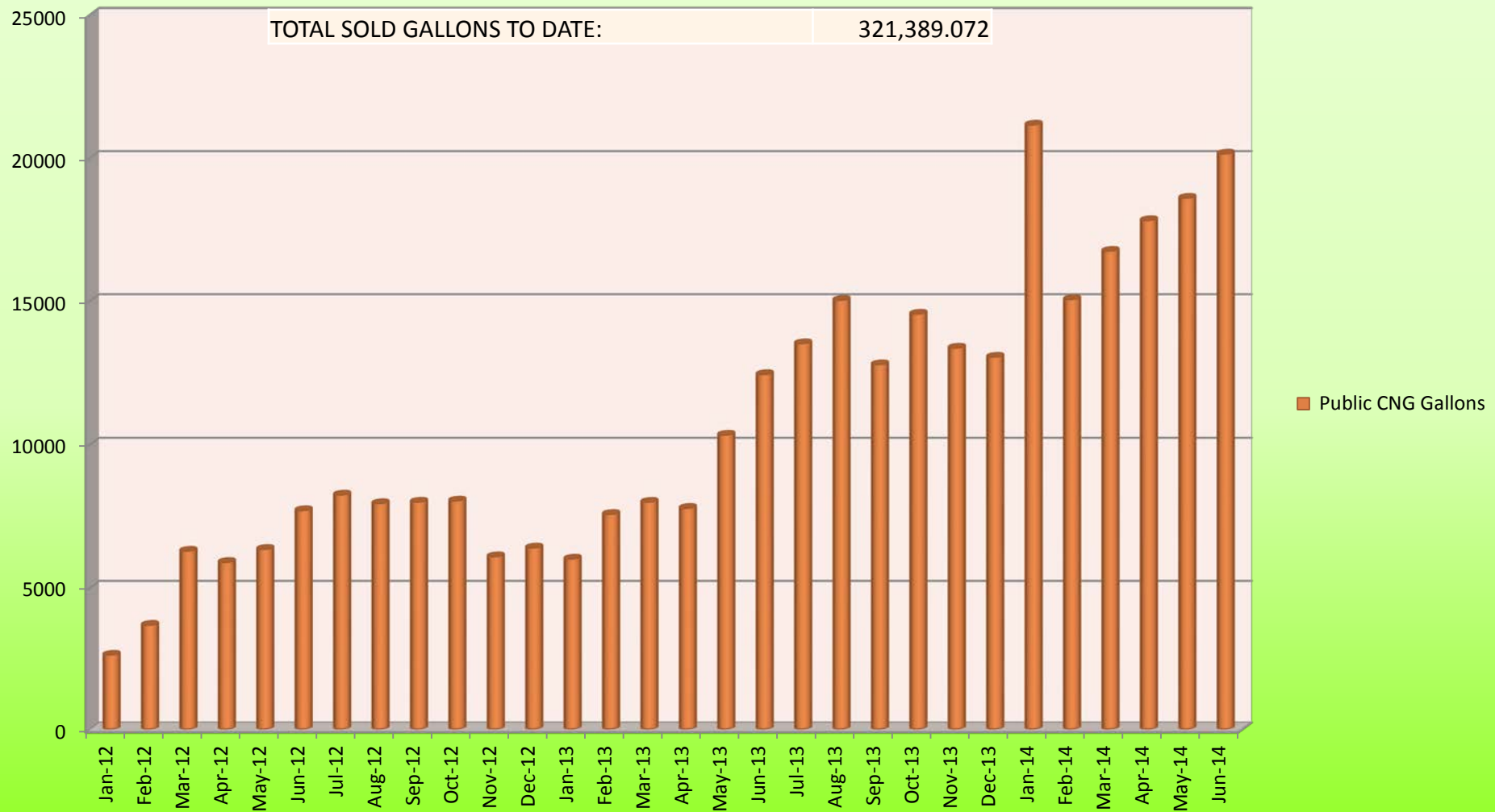
Norman Fleet CNG - Gallons



\* Data from January – June only



# Public Sales - CNG Fuel Usage History





# CNG Fueling Infrastructure

## Current Price Structure

### August 2014

#### Public Sales:

Base Price Per Gallon	\$0.61
Maintenance	\$0.35
Electricity	\$0.14
Gas Transportation	\$0.02
Depreciation and Reserve	\$0.25
Federal Gas Tax	\$0.18
State Gas Tax	\$0.05
<u>Total Pump Price</u>	<u>\$1.60</u>

#### Norman Fleet Sales:

Base Price Per Gallon	\$0.61
Maintenance	n/a
Electricity	\$0.14
Gas Transportation	\$0.02
Depreciation and Reserve	n/a
Federal Gas Tax	n/a
State Gas Tax	n/a
<u>Total Pump Price</u>	<u>\$0.77</u>

# Return on Investment on Vehicles in Norman

- Refuse Truck

- Additional Cost \$45,000
- Recovery 4.3 Years



- Street Sweeper

- Additional Cost \$78,000
- Recovery 6.8 Years



- Pickup Truck

- Additional Cost \$10,500
- Recovery 5.5 Years



- Mower

- Additional Cost \$3,600
- Recovery 2.5 Years



# Return on Investment - CNG Fueling Infrastructure

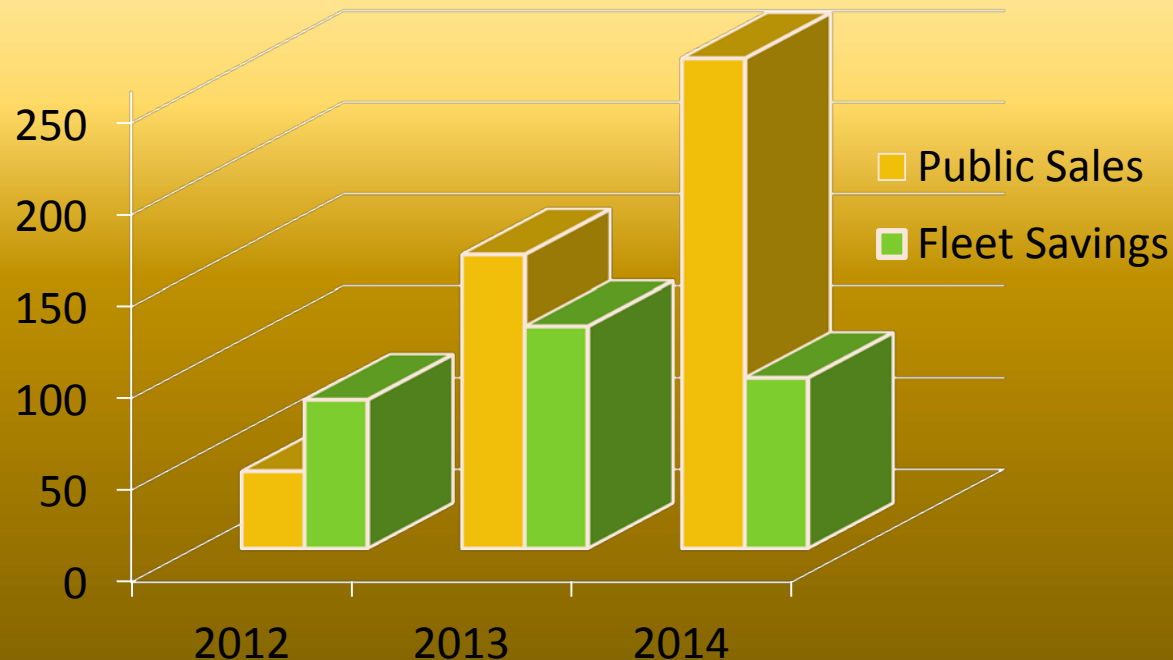
## Revenues to Date for Public Sales

2012	\$ 42,580
2013	160,040
2014 (effective July 31, 2014)	<u>267,050</u>
Sub-Total	\$469,670

## City Fleet Savings to Date

2012	\$ 81,105
2013	121,460
2014 (effective July 31, 2014)	<u>93,745</u>
Sub-Total	\$296,310

**TOTAL = \$765,980**



# Pros & Cons in Norman



## ● Pros

- Cheaper Fuel by more than 50%
- Reduce Air Emissions by 97%
- Noise Reduction by 80% with Refuse Trucks
- Cleaner Fuel
- Domestically Available
- Extend PM Services

## ● Cons

- Limited Fueling Stations
- Shorter Range
- Up Front Cost
- Longer Fueling Time





# Thank You

# *Any Questions?*

Shawn O'Leary, P.E.  
Director of Public Works  
City of Norman, Oklahoma  
[shawn.oleary@normanok.gov](mailto:shawn.oleary@normanok.gov)

John H. Bolte, P.E., Principal  
Small Arrow Engineering, LLC  
Joplin, Missouri  
[jbolte@smallarrow.com](mailto:jbolte@smallarrow.com)

