

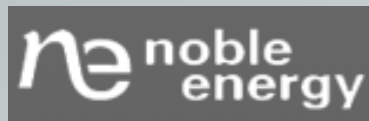
# **The Colorado Plan for Natural Gas Vehicles and Infrastructure**

August 2011

# Making NGV A Reality In Colorado

- Colorado Oil & Gas Association (COGA) NGV committee – May 2011
- Not rocket science but plan involves meaningful dollars and commitment
- Some form of private/public partnership is needed
- Leverages Colorado's abundant natural resource, provides environmental benefits, and adds jobs
- CNGVC is leading the plan implementation

# COGA NGV Committee Members



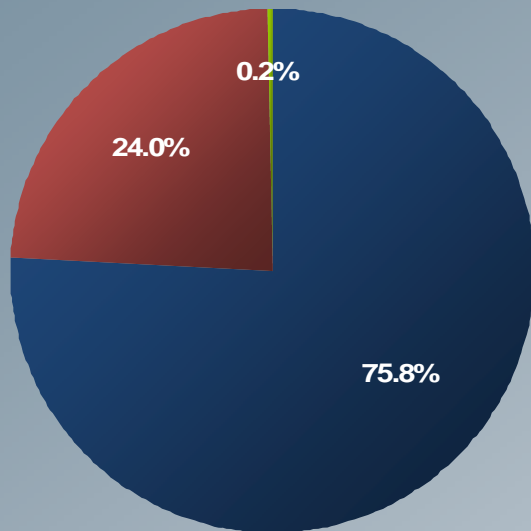
# Why Colorado?

- Leading natural gas producing state
  - Fifth top-producing state in the U.S. (4.1 Bcf/d)
  - Third-largest proven natural gas reserve in the U.S. (23.1 Tcf)
  - Ten of the top-100 Fields by Proved Natural Gas Reserves
- Interstate corridors (I-70, I-25)
- Expanding natural gas infrastructure along corridors



# U.S. & Colorado Transportation Fuel Portfolio

America & Colorado currently rely on one primary fuel for transportation – Petroleum

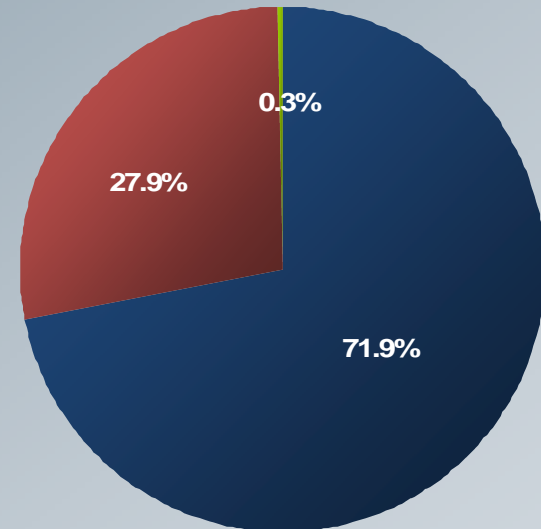


**U.S.**

Gasoline – 140.6 Billion GGE  
Diesel – 44.5 Billion GGE  
Alt. Fuels – .4 Billion GGE

Equivalent to 21.5 Tcf  
or 58.9 Bcfd

■ Gasoline  
■ Diesel  
■ Alternative Fuel



**Colorado**

Gasoline – 2.1 Billion GGE (71.9%)  
Diesel – .8 Billion GGE (27.9%)  
Alt. Fuels – .007 Billion GGE (0.3%)

Equivalent to 340.3 Bcf  
or 0.93 Bcfd

# The NGV Plan

- Requires roughly \$300 Million Investment
  - \$85 Million for fueling infrastructure
  - \$215 million for vehicle incremental costs
- The “Chicken or Egg” dilemma
  - NGV investment
  - Fueling infrastructure investment
- Could generate as much as 246 MMcf/d additional natural gas demand over time (represents 18% increase on overall CO demand)

# CO NGV Build Out – Kickstart the Market

<b>NG Vehicles Required</b>	5,700
<b>NG Fueling Station Build Out</b>	56
<b>Cost to Start Vehicle Growth</b>	<b>\$215 MM*</b>
<b>Cost Start Infrastructure Growth</b>	<b>\$85 MM</b>
<b>Total Cost to Kickstart Growth</b>	<b>\$300 MM</b>
<b>Initial New CO Natural Gas Demand</b>	18 Mmcf/d (6.6 Bcf Annually) 0.43% increase
<b><i>PROGRAM SUCCESS</i></b>	
<b>10% of Fuel Market</b>	100 Mmcf/d (36 Bcf Annually)
<b>25% of Fuel Market</b>	246 Mmcf/d (90 Bcf Annually)

\*Represents incremental cost of conversion.

# Natural Gas Solutions

## Compressed Natural Gas (CNG)

- Source: Pipeline
- Compressed to 3,600 psi
- Primarily for light and medium duty vehicles
- Ideal for return-to base fleets or fleets that require fast-filling
- Time-fill and fast-fill capability / stored in pressurized tanks

## Liquefied Natural Gas (LNG)

- Source: Liquefaction Plant
- Converted to liquid form for ease of storage and transport  
(Cooled to -260 °F and 40 psi)
- Ideal for medium to heavy duty fleets
- Fast-fill / stored in tanks (similar to diesel size)





# Petroleum Fuel By Vehicle Per Year

Vehicle	# Gallons Per Year	Today's Premium*
Freight Truck	12,000	\$60,000
Transit Bus	12,000	\$50,000
Garbage Truck	9,000	\$52,000
Airport Shuttle	5,800 - 7,200	\$30,000
Taxi Cab	5,000	\$10,000
Delivery Truck	4,500 - 5,500	\$30,000
School Bus	2,200 – 2,800	\$36,000
Light Duty Truck	2,000	\$10,000
Consumer Vehicle	1,000	\$7,000

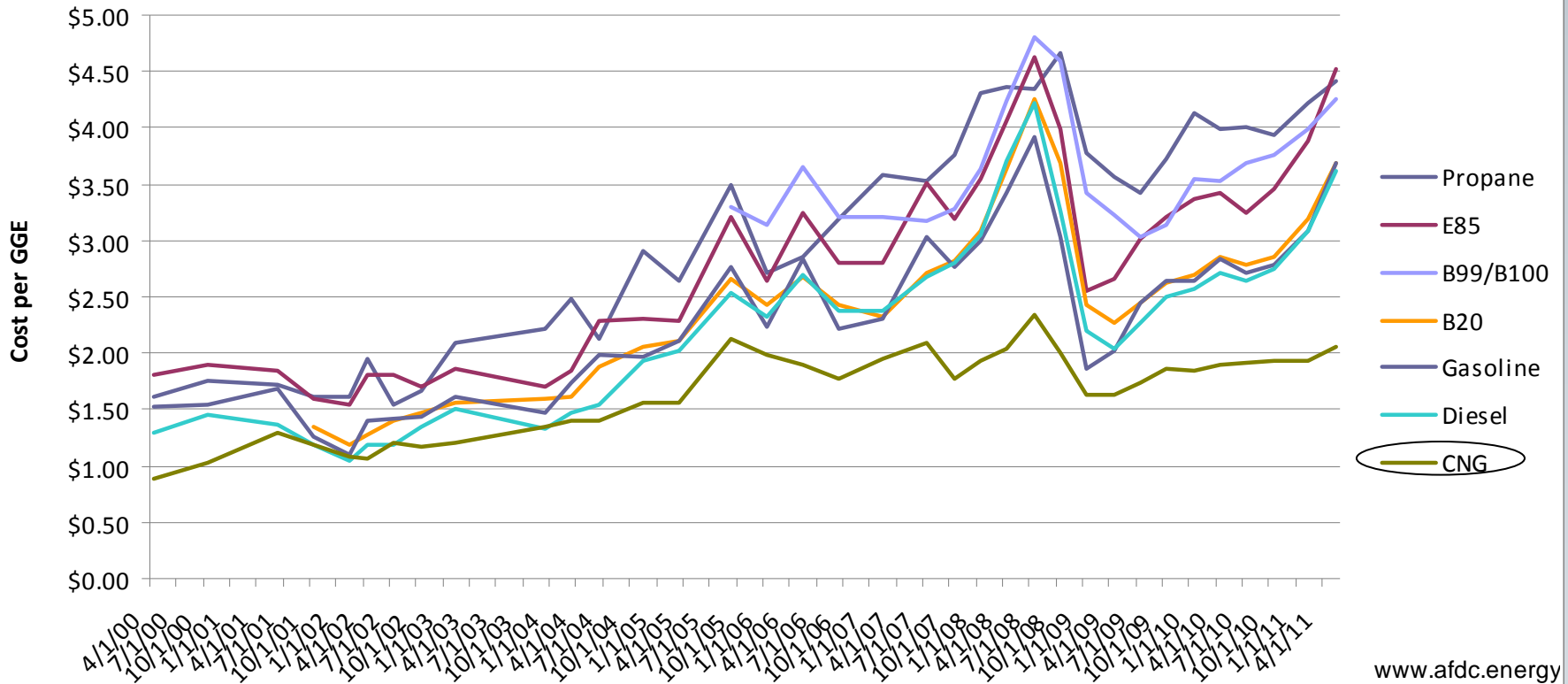


\*Premium is today's price without subsidies or additional volume

# U.S. Average Retail Fuel Prices

## CNG Continues as the Low Cost Fuel

### U.S. Average Retail Fuel Prices



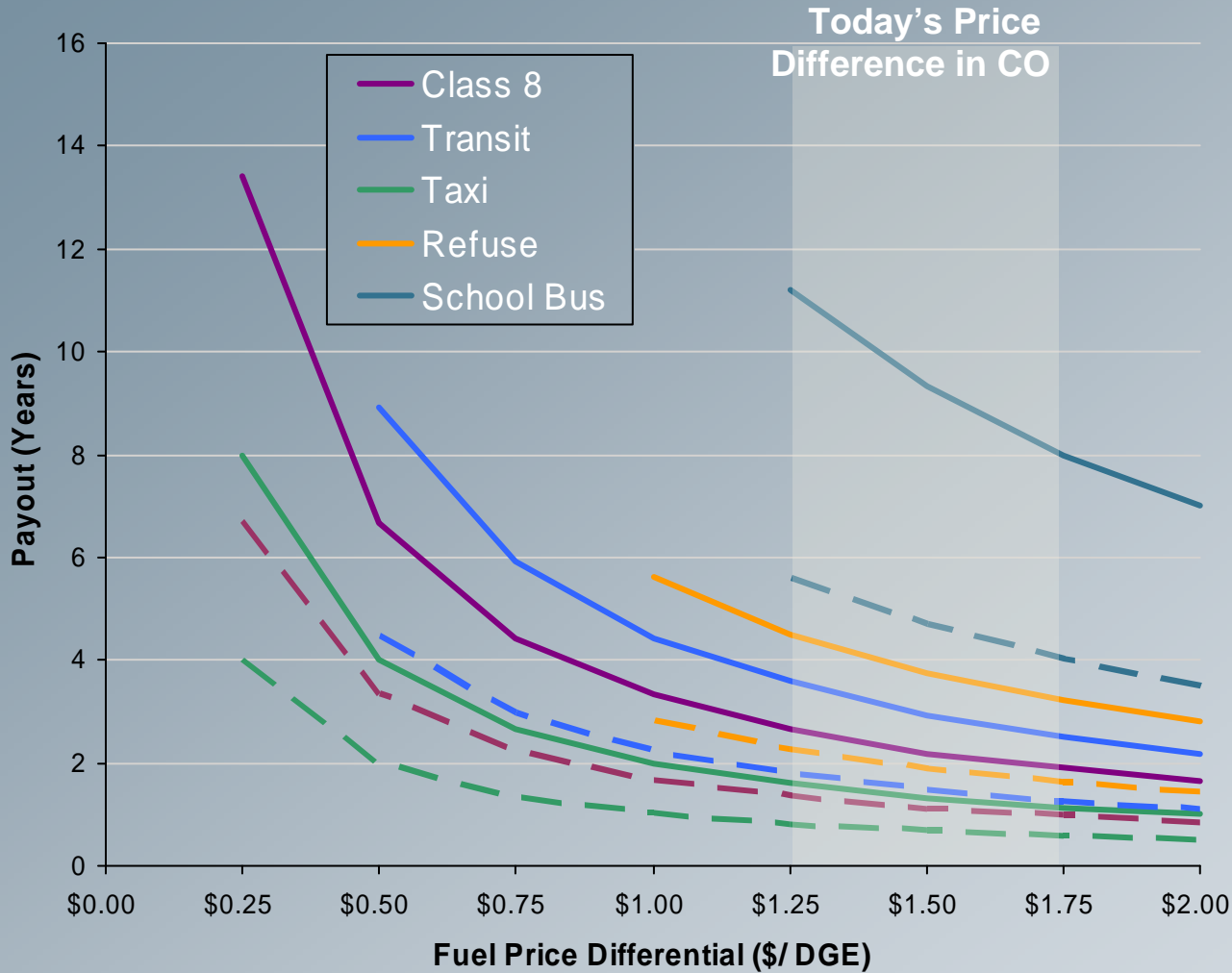
www.afdc.energy.gov/afdc/data/

US national gasoline / diesel average as of April 2011: \$3.69 / \$4.04, CNG priced at \$2.06 gge / dge

B99/B100 are different blends of Bio-diesel

# Natural Gas Vehicles are Viable Now

## Payback Periods Today (no incentives) & Volume \$ Reduction



Dashed lines represent a 50% reduction in NGV premium

### Class 8

Incremental Cost: \$60,000  
5.6 MPG / 100,000 miles/yr  
Lifecycle : 7-10 years

### Transit

Incremental Cost: \$50,000  
3.6 MPG / 40,000 miles/yr  
Lifecycle : 20 years

### Taxi

Incremental Cost: \$10,000  
8 MPG / 40,000 miles/yr  
Lifecycle : 5 years

### Refuse

Incremental Cost: \$45,000  
3.0 MPG / 24,000 miles/yr  
Lifecycle: 8-10 years

### School Bus

Incremental Cost: \$36,000  
7.0 MPG / 18,000 miles/yr  
Lifecycle: 12-18 years

# CO NGV Kickstart Buildout

## Kickstart the Market

	Kickstart Buildout	10% Market Share	25% Market Share
% Colorado Vehicle Market	1.84%	10%	25%
Total CNG Vehicles	5,700	189,500	528,000
Barrels of Oil Displaced (MM Annual)	1.3	7.0	17.3
Natural Gas Demand Bcf / Mmcf/d	6.6 / 18.1	36.5 / 100.1	90.0 / 246.8
<b>Total Economic Impact (\$MM)*</b>	<b>\$93 - 105</b>	<b>\$518 - 570</b>	<b>\$1,045 - 1,450</b>
Total Advanced Clean Fuel Tech Jobs	1,650	32,000	89,000
Program Consumer Cost Savings (\$MM)**	\$81.9	\$441	\$1,071
Cost to Kickstart Vehicle Growth	(\$215)		
Cost to Kickstart Infrastructure Growth	(\$85)		
<b>Total Cost to Kickstart Growth</b>	<b>(\$300)</b>		

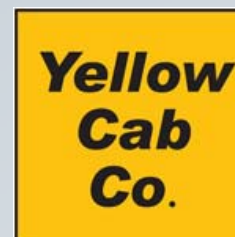
\*\*Estimated Benefits based on 2005 CERI Study and ONRR.gov. Includes Severance Taxes, Property Taxes, Royalties and Revenues from Drilling, Completion, Recompletion and Extraction.

\*\*Gasoline / Diesel prices used: \$3.50, CNG priced at \$2.00 gge / dge

# Who's converting?

## In the U.S. alone, natural gas powers:

- More than 11,000 transit buses
- Nearly 4,000 refuse trucks, with California leading the way
- More than 3,000 school buses
- About 15-17,000 medium duty vehicles, such as airport shuttles and a wide variety of work applications
- More than 30,000 light duty vehicles in federal, state, local government and private fleets



# Leading by Example in Colorado



- 7 Bi-fuel CNG vehicles / 20 Planned converted vehicles 2011
- Co-funding 3 Weld County CNG stations



- 2 Bi-fuel CNG vehicles
- Committed vehicles to Grand Junction and Rifle CNG stations



- 35 Bi-fuel CNG vehicles / 55 Planned converted vehicles 2011
- 2 CNG stations – Ft. Lupton / Parachute
- Co-funding 3 Weld County CNG stations and Grand Junction
- Vehicle commitment to Rifle CNG station
- Utilizing NG rigs



- 11 Bi-fuel CNG vehicles / 10 Planned converted vehicles 2011
- Co-funding 3 Weld County CNG stations
- Utilizing NG rigs



- 33 Bi-fuel CNG vehicles / 20 Planned converted vehicles 2011
- 1 Private CNG station – Trinidad
- Building 1 public station – Trinidad



- 3 Bi-fuel CNG vehicles / 2 Planned converted vehicles 2011
- Committed vehicles to Grand Junction and Rifle CNG stations

# Natural Gas for Transportation

## Market Segmentation



CNG

### CLEAN CITIES

- Municipal government fleets, light duty and medium duty vehicles
- Commercial fleets and personal light and medium duty vehicles
- Airport and port authorities

### CLEAN CORRIDORS

- Heavy duty vehicle freight and goods transportation
- Home base and mid-point fueling patterns
- Transient and varied fueling patterns

### CLEAN GAS OPERATIONS

- Drilling rigs and frac equipment
- Service company light duty vehicle fleets
- Field storage and fuel deployment solutions required

### CLEAN COMMERCIAL

- Extra heavy duty “off-road” vehicles
- Rail, mining, marine, military, and construction services
- Heavy duty engine solutions required

LNG

# Natural Gas Vehicles



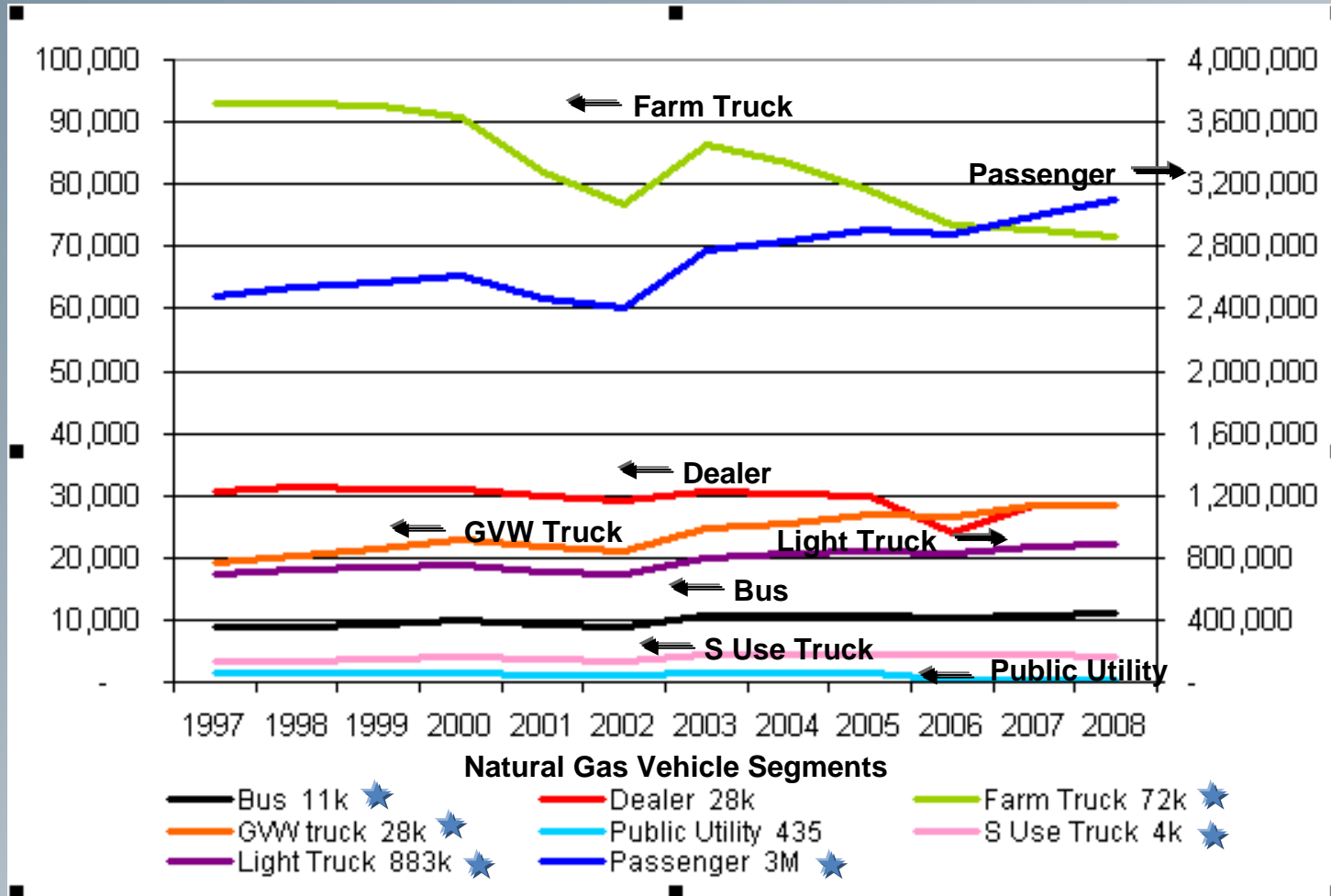


# Colorado Vehicle Registrations

## 6 million vehicles

Bus, Dealer, Farm, Pub. Utility,  
GVW Truck and S. Use

Passenger and Light  
Truck Count



# Colorado Natural Gas Fueling Stations

## 29 Existing CNG Stations

### 13 Public

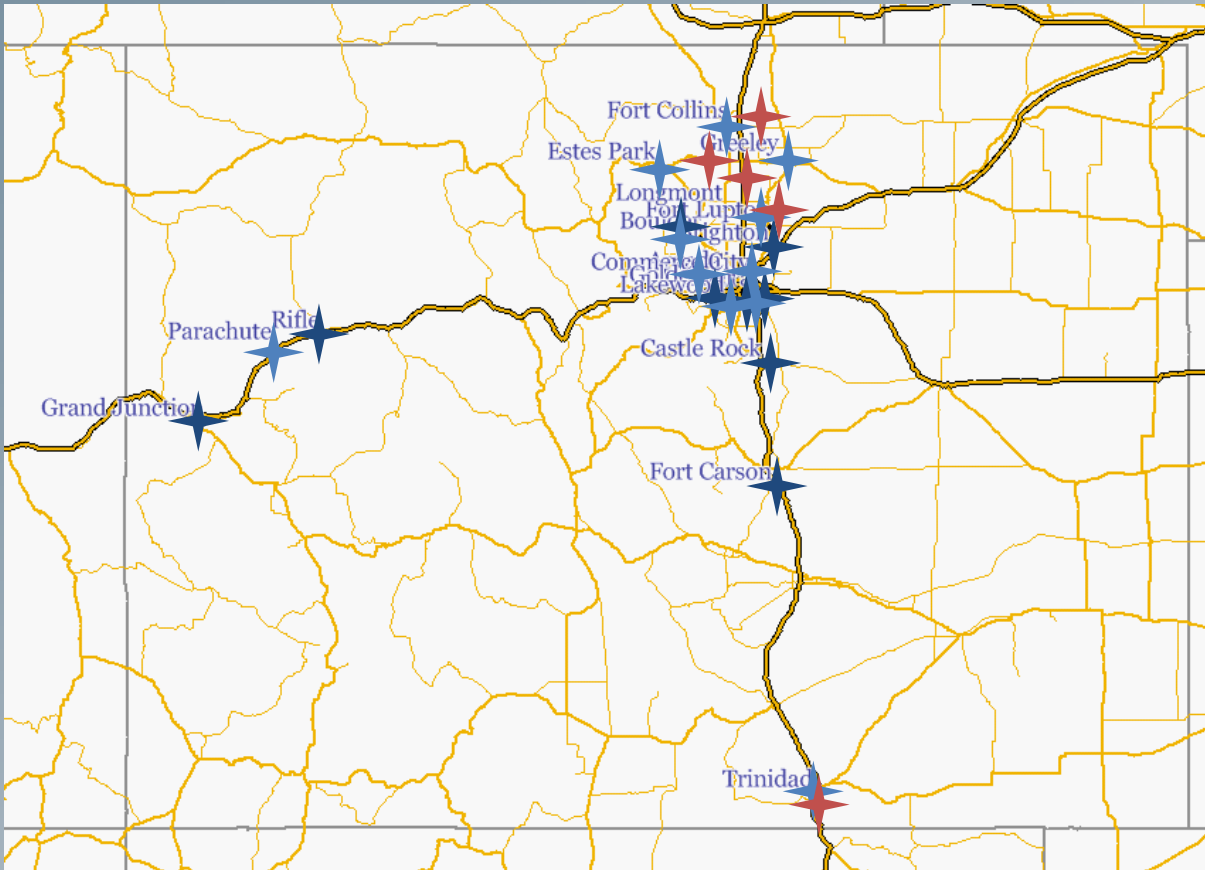
- ★ (Arvada, Aurora, Boulder, Brighton, Castle Rock, Denver (5), Fort Carson, Grand Junction, Rifle)

### 16 Private

- ★ (Boulder (2), Commerce City (2), Denver (4), Estes Park, Fort Collins, Fort Lupton, Golden, Greeley, Lakewood, Parachute, Trinidad)

### 5 Planned CNG Stations

- ★ Weld County (Longmont- 1)
- ★ Trinidad



# Colorado Kickstart Buildout Assumptions

The following assumptions are made to support the infrastructure buildout to Kickstart the market.

1. Create natural gas hubs to support volume required for filling stations
  - Municipalities/counties
  - Natural gas industry fleets
  - Local fleets
2. Connecting hubs to build natural gas highway
  - CNG refueling stations– located every 60 – 100 miles
  - LNG refueling stations – located every 150 – 250 miles
3. Select CNG and LNG sites by doing the following:
  - Prioritized station locations by existing infrastructure, available fleets, etc.
  - Scaled stations in the different locations based on expected load
  - Create network for connectivity throughout state



# CNG Station Type Assumptions

- **Anchor Station** (3k-4k/day or 0.90-1.2M/annual GGE)
  - Redundant Compression = 600 CFM Total
  - Large Storage X 2
  - 4 Dispenser Hoses
  - Resembles ‘Typical’ Gas Station
  - Cost= \$1.5 million
- **Growth Station** (1k-2k/day or 300k-600k/annual GGE)
  - Redundant Compression = 100 - 300 CFM Total
  - Large Storage X 1
  - 2 Dispenser Hoses
  - Cost= \$900,000
- **Satellite Station** (500/day or 150k/annual GGE with time-fill)
  - Redundant Compression = 100 CFM Total
  - Storage X 1
  - 1-2 Dispenser Hoses
  - Cost= \$500,000



Cost estimates are budgetary only and will depend on site specific information, land access not included

# LCNG Station Type Assumptions

- Anchor Station (10k/day or 3.0M/annual GGE)
  - Two 15,000 LNG Gallon Storage Tanks
  - 4 LNG Dispensers- 1 Hose Each
  - 1 CNG Storage 3 Pack
  - 2 CNG Dispenser- 2 Hoses
  - Cost= \$2.7 Million
- Growth Station (5k/day or 1.8M/annual GGE)
  - One 15,000 LNG Gallon Storage Tank
  - 2 LNG Dispensers- 1 Hose Each
  - 1 CNG Storage 3 Pack
  - 1 CNG Dispenser- 2 Hoses
  - Cost= \$1 Million

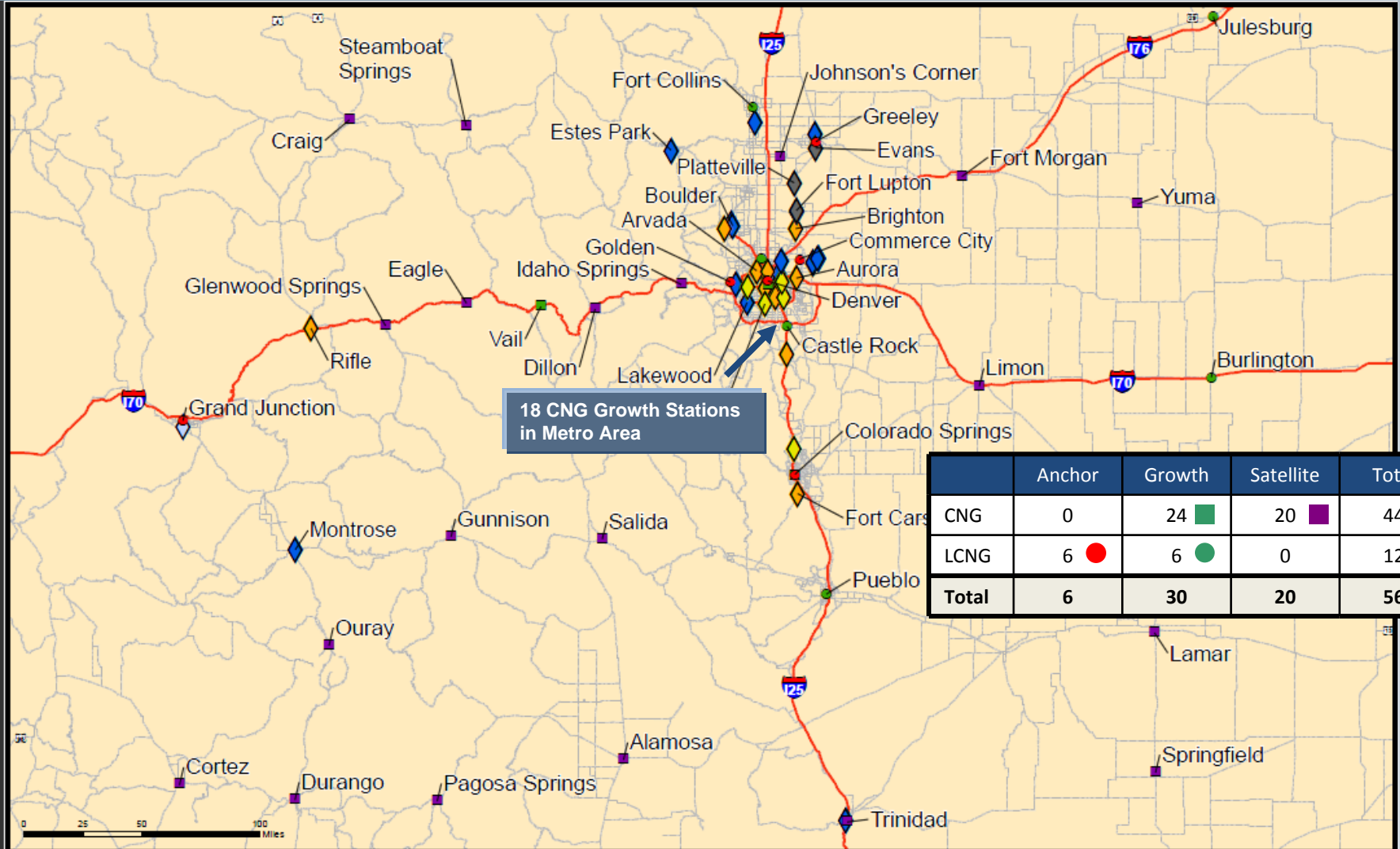


LCNG Station in California

LCNG station dispenses both LNG and CNG. Uses LNG to make CNG

Cost estimates are budgetary only and will depend on site specific information, land access not included

# Proposed Natural Gas Fueling Stations



18 CNG Growth Stations in Metro Area

	Anchor	Growth	Satellite	Total
CNG	0	24	20	44
LCNG	6	6	0	12
<b>Total</b>	<b>6</b>	<b>30</b>	<b>20</b>	<b>56</b>

## Target CNG Stations

- Growth Stations
- Satellite Stations

## Target LCNG Stations

- Anchor Stations
- Growth Stations

## CNG Stations

- ◆ Existing - Private/Public
- ◆ Existing - Public
- ◆ Planned
- ◆ Existing - Private
- ◆ Out of Service

Prepared by: North American Rockies Pipeline Area Coord.  
 Date: 4/2/2011  
 Date: April 28, 2011  
 Contact: Bill Washburn  
 Data Source: ENR, Natural Gas Economy News  
 ENR\_NA\_Rockies\_Coords\_2011\_MetroAreaCNG.sxd by gsp/pt

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# Kickstart Buildout Vehicle & Station Cost

**Total Vehicles: 5,708**

**Total Project Cost = (\$300 MM)**

Vehicle Incremental Cost	Anchor (6)	Growth (30)	Satellite (20)	Total
<b>Vehicles Required</b>	1,692	3,456	560	5,708
Light Duty Premium	180	750	100	1,030
Medium Duty Premium	1,020	780	100	1,900
Heavy Duty Premium	492	1,926	360	2,778
<b>Incremental Cost per Vehicle</b>				
Light Duty Premium	(\$12,000)	(\$12,000)	(\$12,000)	
Medium Duty Premium	(\$32,000)	(\$32,000)	(\$32,000)	
Heavy Duty Premium	(\$50,000)	(\$50,000)	(\$50,000)	
<b>Total Vehicle Incremental Cost (\$MM)</b>	<b>(\$60)</b>	<b>(\$130)</b>	<b>(\$25)</b>	<b>(\$215)</b>

	Anchor (6)	Growth (30)	Satellite (20)	Total
<b>Station Cost (\$MM)</b>	<b>(\$16.2)</b>	<b>(\$27.6)</b>	<b>(\$10.0)</b>	<b>(\$54)</b>
<b>Total Facility Upgrades (20) (\$MM)</b>				<b>(\$6)</b>
<b>Net Station Cost (\$MM)</b>				<b>(\$60)</b>

<b>Management and Contingency Costs</b>				
<b>Training &amp; Project Management 2.5% (\$MM)</b>				<b>(\$7)</b>
<b>Contingency 7% (\$MM)</b>				<b>(\$18)</b>
<b>Total Project Cost</b>				<b>(\$300)</b>

# Colorado Kickstart Modeling Assumptions

- CO Market Kickstart Build out assumes:
  - Complete build out of stations
  - Projected fuel usage is met
  - Cost of stations is consistent with plan
- 10% and 25% Market Penetration assumes:
  - Gasoline/diesel consumption levels do not exceed statewide natural gas station capacity
  - Appropriate investment is provided to stimulate market



# CO Build Out Annual Economic Benefits

<b>Market Share</b>	<b>1.84%</b>	<b>10%</b>	<b>25%</b>
<b>Total CNG Vehicles</b>	5,700	189,500	528,000
<b>Annual Economic Impact to State (Million)*</b>	\$93 - 105	\$518 - 570	\$1,045 – 1,450
<b>Total Adv. Clean Fuel Tech Jobs*</b>	1,650	32,000	89,000
<b>Natural Gas Demand Bcf / MMcfd</b>	6.6 / 18.1	36.5 / 100.0	90.0 / 246.0
<b>Annual Petroleum Displaced (Million barrels)</b>	1.3	7	17
<b>Consumer Cost Savings – NG @ \$2.00 GGE/DGE; Gasoline / Diesel @ 3.50 (Million)</b>	\$81.9	\$441	\$1,071

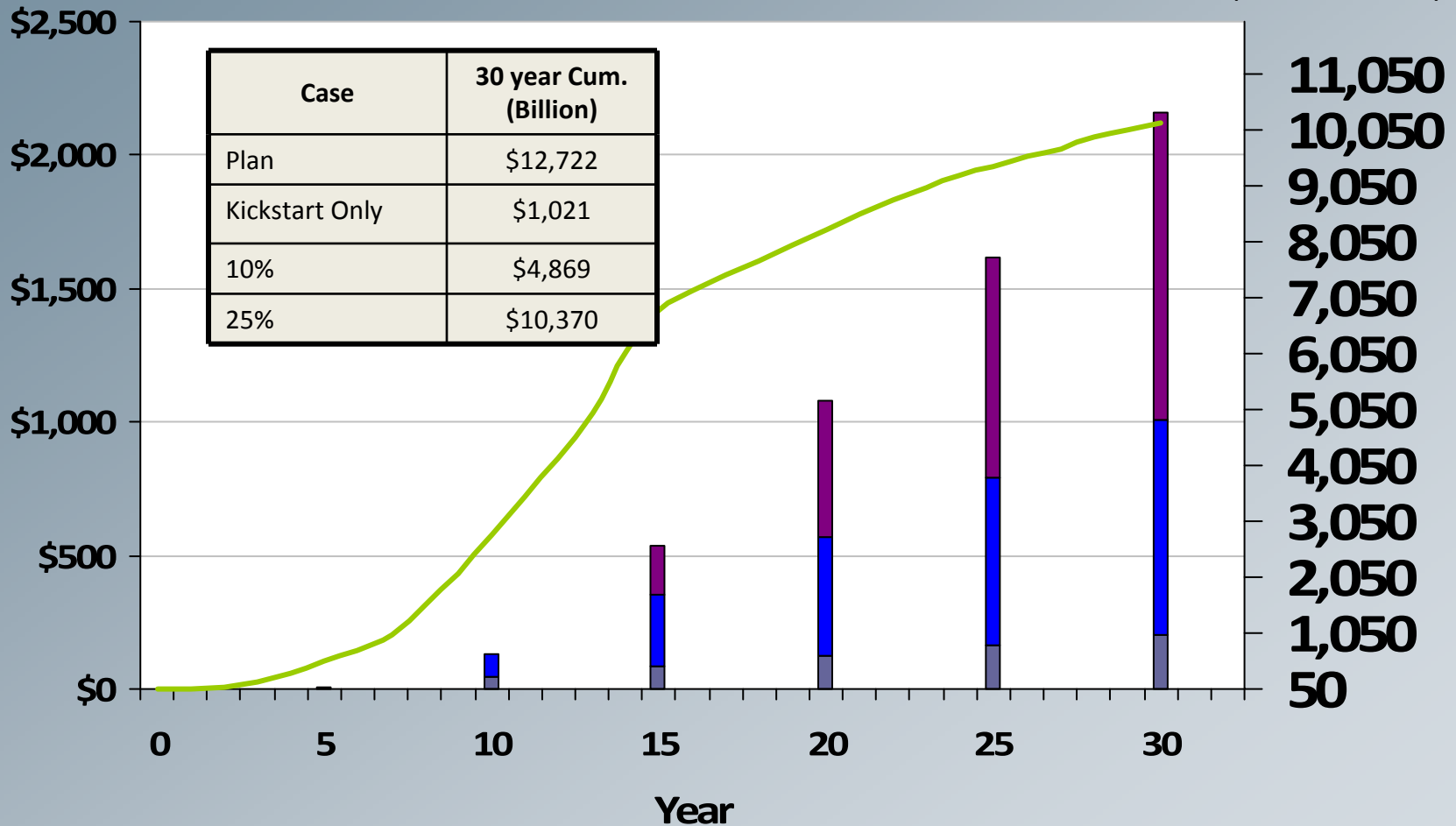
\*Estimated Benefits based on 2005 CERI Study and ONRR.gov. Includes Severance Taxes, Property Taxes, Royalties and Revenues from Drilling, Completion, Recompletion and Extraction.

# Deployment Economic Benefits

30 Year Profiles (Millions)

Annual Impact

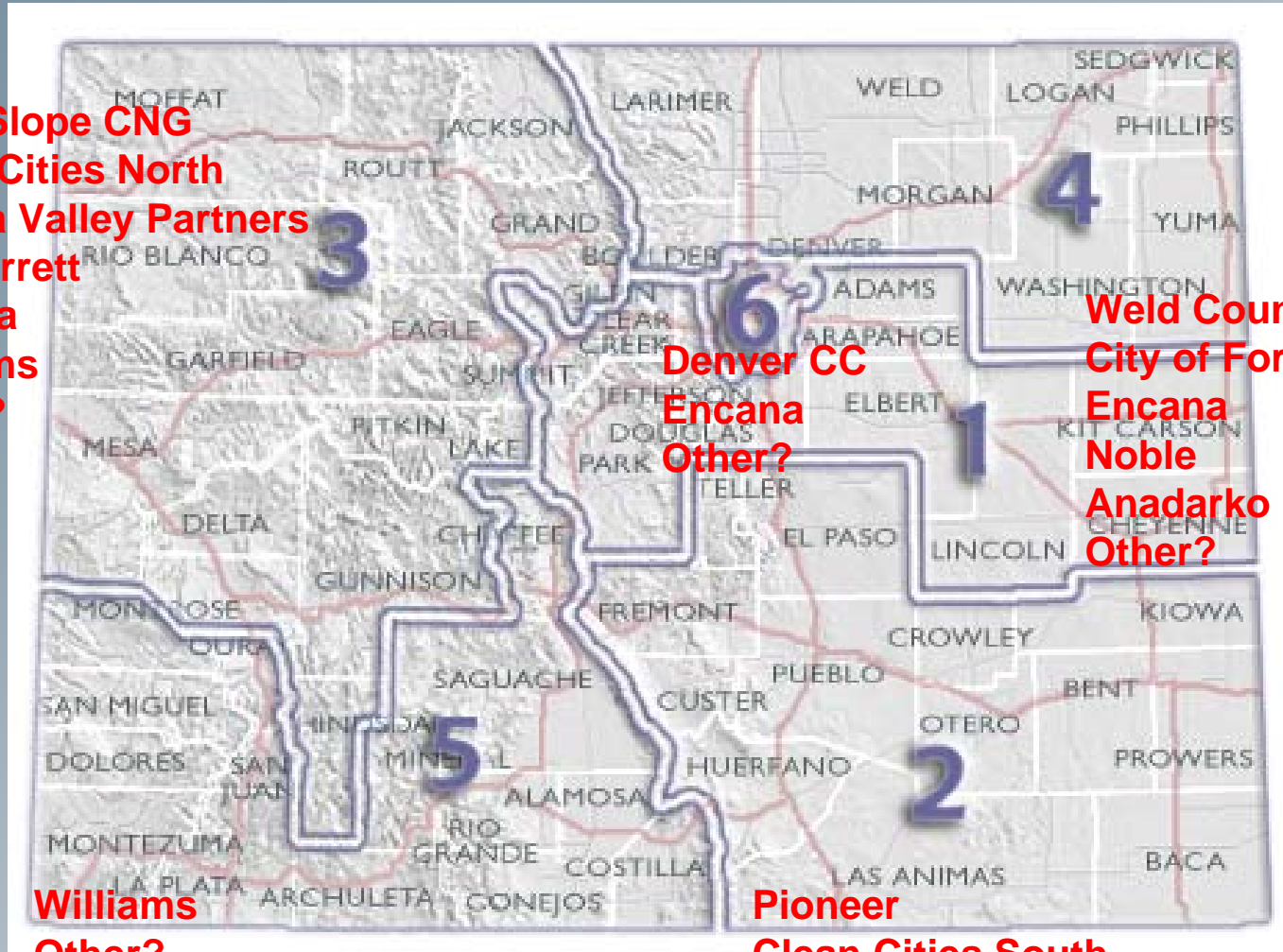
Cumulative Impact  
(thousands)



# Proposed CO CDOT Regions with NGV Leads

Colorado Natural Gas Vehicle Coalition (CNGVC) – Members to lead regions

**West Slope CNG**  
**Clean Cities North**  
**Yampa Valley Partners**  
**Bill Barrett**  
**Encana**  
**Williams**  
**Other?**



# Next Steps For CGNVC

- Project management of the CO NGV Plan to buildout infrastructure and vehicles
  - CNGVC Co-chairs
    - Natalia Swalnick  
Denver Clean Cities Coordinator
    - Alex Schroeder  
Governor's Energy Office
    - Alexine Hazarian  
Encana Natural Gas Inc.
  - Determine Regional Buildout group leaders
  - Enroll members for Coalition and Regional Buildout groups
  - Develop process to follow for Regional Buildout
- Meetings
  - Regional Buildout groups
  - CNGVC group meeting

**Contact Natalia to Join:  
[nswalnick@lungcolorado.org](mailto:nswalnick@lungcolorado.org)**



# Additional Material

# Target LCNG Fuel Stations

	Priority	City	LDC	Electric Utility Service Territories	Station Quantity
<b>Anchor Stations</b>	1	<b>Denver- West (Golden)</b>	Public Service CO	Public Service Co of Colorado	1
	1	<b>Denver- Central</b>	Public Service CO	Public Service Co of Colorado	1
	1	<b>Denver- East (Commerce City)</b>	Public Service CO	Public Service Co of Colorado	1
	1	<b>Colorado Springs</b>	Black Hills Energy	Black Hills Energy	1
	1	<b>Greeley</b>	Public Service CO	Public Service Co of Colorado	1
	1	<b>Grand Junction</b>	Public Service CO	Grand Valley Rural Power Line	1
			<b>TOTAL</b>		
<b>Growth Stations</b>	2	<b>Denver- South</b>	Public Service CO	Public Service Co of Colorado	1
	2	<b>Denver- North</b>	Public Service CO	Public Service Co of Colorado	1
	2	<b>Ft. Collins</b>	Public Service CO	Poudre Valley Rea Inc	1
	3	<b>Burlington</b>	Black Hills Energy	KC Electric Association	1
	3	<b>Pueblo</b>		Black Hills Energy	1
	3	<b>Julesburg</b>	Kinder Morgan	Highline Electric Association	1
			<b>TOTAL</b>		

# Target CNG Growth Fuel Stations

	Priority	City	LDC	Electric Utility Service Terr.	Quantity
Growth Stations	1	Colorado Springs	Black Hills Energy	Black Hills Energy	5
	1	Denver	Public Service CO	Public Service Co of Colorado	18
	1	Vail	Public Service CO	Public Service Co of Colorado	1
		TOTAL			24

# Target CNG Satellite Fuel Stations

	Priority	City	LDC	Electric Utility Service Terr.	Quantity
Satellite Stations	1	Eagle	Public Service CO	Public Service Co of Colorado	1
	1	Glenwood Springs	Public Service CO	Public Service Co of Colorado	1
	1	Idaho Springs	Public Service CO	Public Service Co of Colorado	1
	1	Silverthorne/Dillon	Public Service CO	Public Service Co of Colorado	1
	1	Trinidad		San Isabel Electric Association	1
	2	Alamosa	Public Service CO	Public Service Co of Colorado	1
	2	Durango	Atmos Energy CO KS	La Plata Electric Association	1
	2	Ft. Morgan	Public Service CO	Morgan County Rural Electric	1
	2	Lamar	Kinder Morgan	Southeast Colorado Power	1
	2	Limon		Mountain View Electric	1
	2	Salida	Atmos Energy CO KS	Sangre de Cristo Electric	1
	2	Steamboat Springs	Atmos Energy CO KS	Yampa Valley Electric	1
	2	Yuma	Kinder Morgan	YW Electric Association	1
	3	Cortez	Atmos Energy CO KS	Empire Electric Association	1
	3	Craig	Atmos Energy CO KS	Yampa Valley Electric	1
	3	Gunnison	Atmos Energy CO KS	Gunnison County Electric	1
	3	Johnsons Corner	Public Service CO	Grand Valley Rural Power Line	1
	3	Ouray		San Miguel Power Association	1
	3	Pagosa Springs		La Plata Electric Association	1
	3	Springfield	Atmos Energy CO KS	Southeast Colorado Power	1
		<b>TOTAL</b>			<b>20</b>