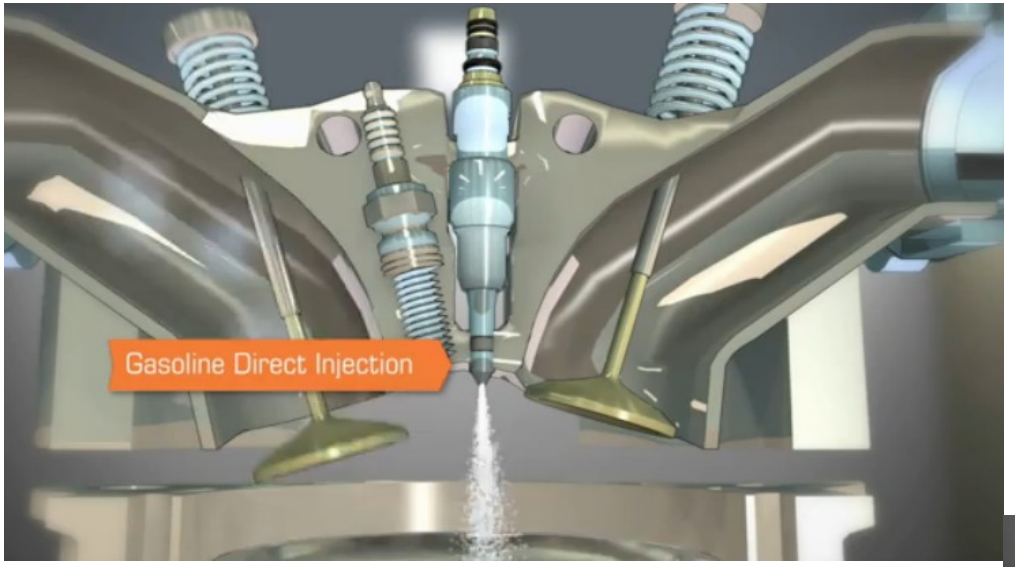
A Comparison Study on Natural Gas Engine and Gasoline Engine

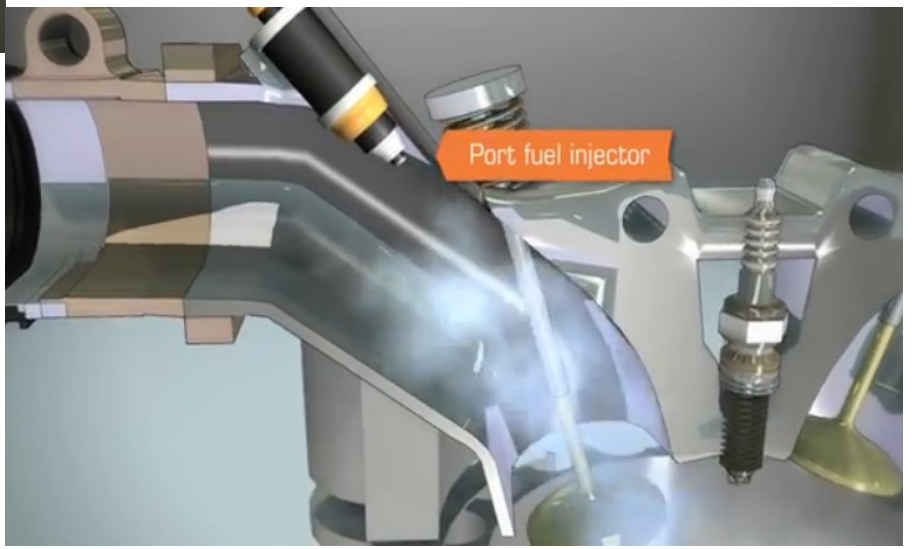
Muyun Cai

Introduction to internal combustion engines

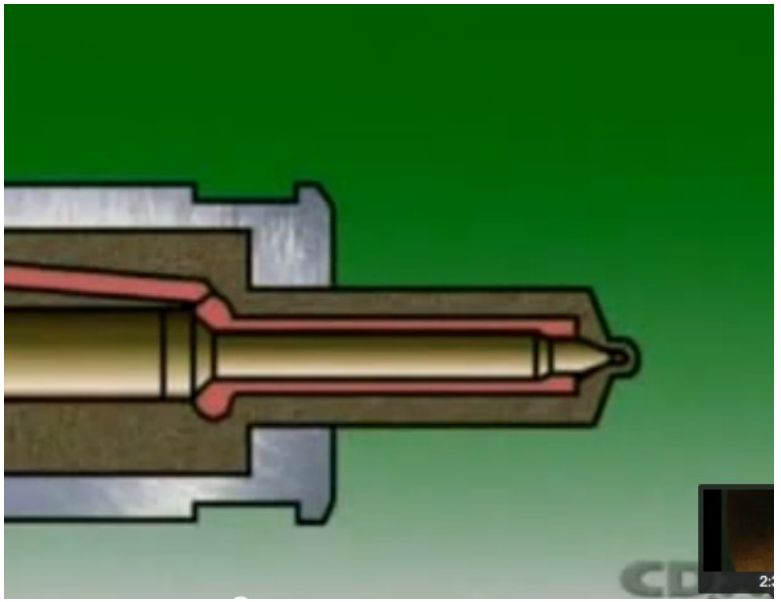
- http://www.youtube.com/watch?v=V-z-R8Mv_HM

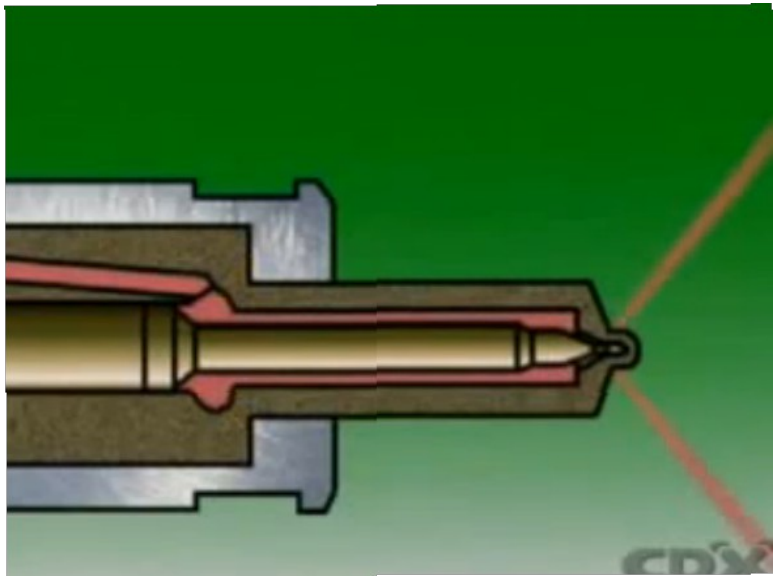
Provide gas mixture

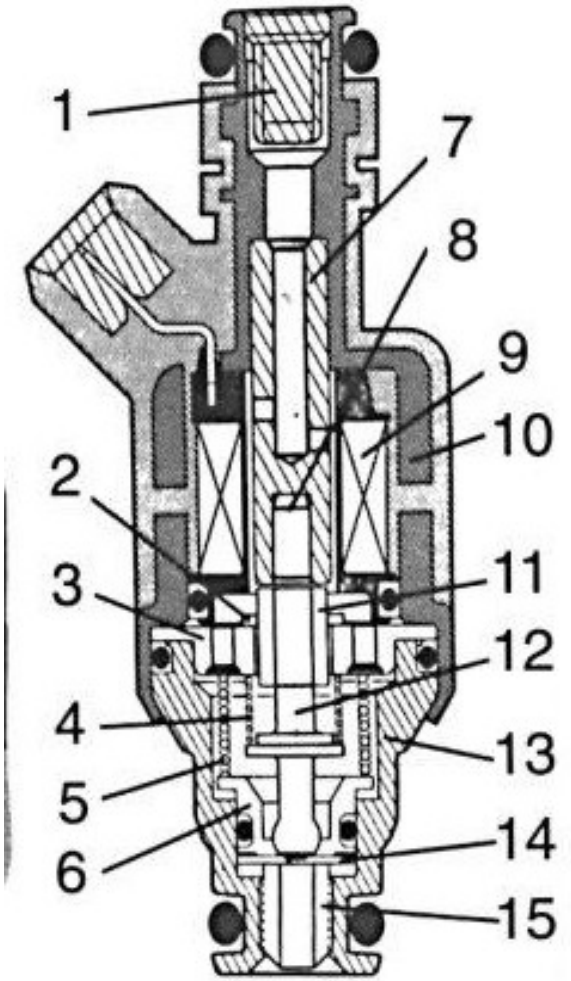




Provide gas mixture







1 - Filter
2 - Guide ring
3 - Spacer
4 - Core spring
5 - Seat spring
6 - Seat
7 - Pole piece
8 - Stop
9 - Solenoid coil
10 - Solenoid body
11 - Core ring
12 - Core
13 - Spray tip housing
14 - Director
15 - Spray tip

ROCHESTER

Intake Air

- Moderately excessive air increases the efficiency: insufficient – fuel not burned 100%; too much – heat loss to excessive air.
- Percentage of excessive air:

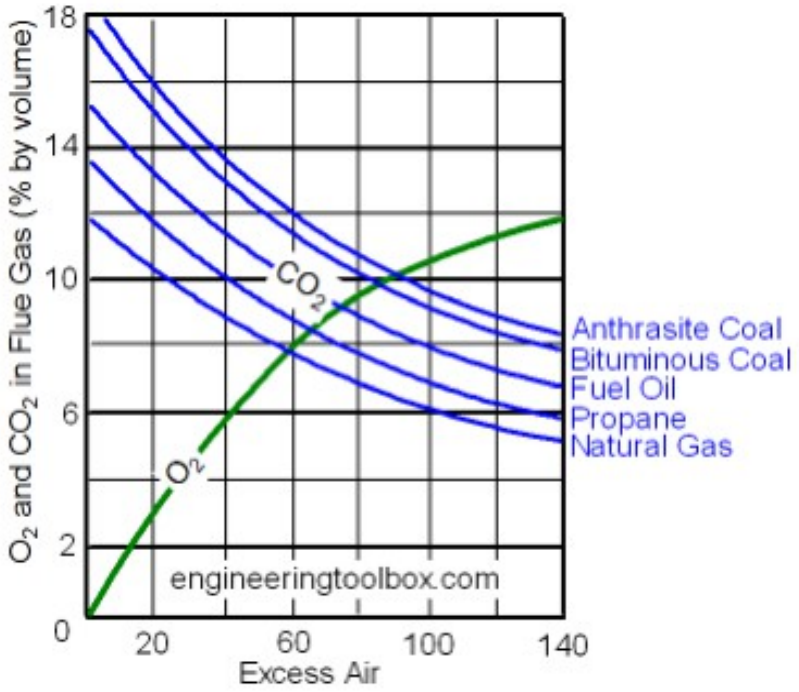
  5 - 10% for natural gas

  5 - 20% for fuel oil

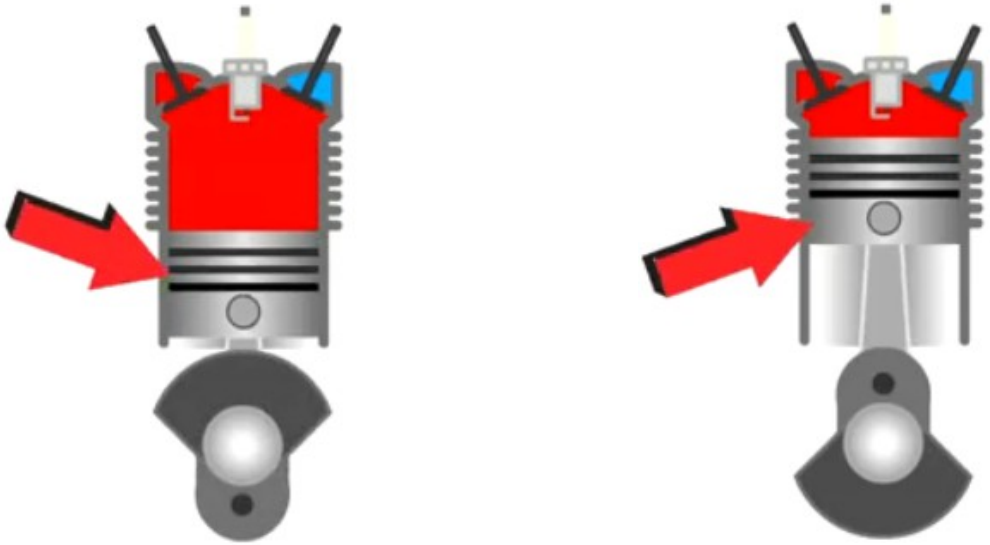
  15 - 60% for coal

Intake Air

Combustion Efficiency (%)						
Excess %		Net Stack Temperature[1] (^oF)				
Air	Oxygen	200	300	400	500	600
9.5	2.0	85.4	83.1	80.8	78.4	76.0
15	3.0	85.2	82.8	80.4	77.9	75.4
28.1	5.0	84.7	82.1	79.5	76.7	74.0
44.9	7.0	84.1	81.2	78.2	75.2	72.1
81.6	10.0	82.8	79.3	75.6	71.9	68.2



Compression ratio



Compression ratio

$$\eta_{th} \equiv \frac{\text{output}}{\text{input}}.$$

- Honda civic specs

	LX	Natural Gas
Engine Type	In-Line 4-Cylinder	In-Line 4-Cylinder
Engine Block/Cylinder Head	Aluminum-Alloy	Aluminum-Alloy
Displacement (cc)	1798	1798
Horsepower @ rpm (SAE net)	140 @ 6500	110 @ 6500
Torque (lb-ft @ rpm, SAE net)	128 @ 4300	106 @ 4300
Redline (rpm)	6700	6700
Bore and Stroke (mm)	81 x 87.3	81 x 87.3
Compression Ratio	10.6:1	12.7 : 1
Valve Train	16-Valve SOHC i-VTEC®	16-Valve SOHC i-VTEC®

Ways to implement CNG engine

- DIY conversion kits; Conversion service
- Companies:

  Energy and Water Solutions;

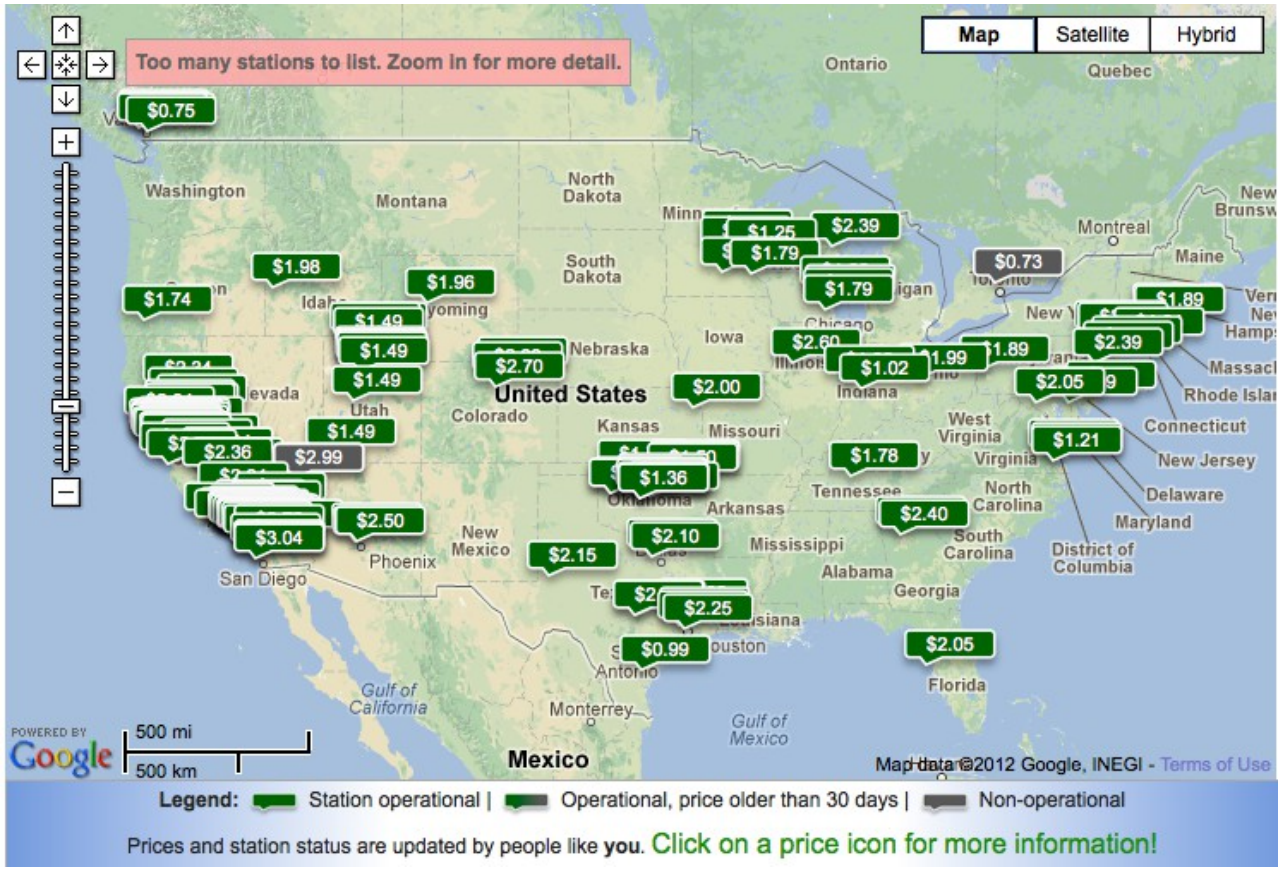
  Red Gas;

  Omnitek;

  CNG United;

  Altech-eco corporation...

Limitation


Map
Satellite
Hybrid
Too many stations to list. Zoom in for more detail.
$0.75
$1.98
$1.96
$1.74
$1.49
$1.49
$1.49
$1.49
$2.36
$2.99
$3.04
$2.50
$2.70
$2.00
$2.39
$1.25
$1.79
$1.79
$0.73
$2.60
$1.02
$1.99
$1.89
$2.39
$2.05
$1.89
$1.21
$1.78
$1.36
$2.40
$2.10
$2.15
$2.25
$0.99
$2.05
United States
Mexico
Canada
Ontario
Quebec
Montreal
Washington
Montana
North Dakota
South Dakota
Nebraska
Colorado
Kansas
Missouri
Iowa
Chicago
Indiana
West Virginia
Virginia
Tennessee
Arkansas
Mississippi
Alabama
Georgia
North Carolina
South Carolina
Florida
Maine
New Jersey
Delaware
Maryland
District of Columbia
Connecticut
Rhode Island
Massachusetts
Phoenix
San Diego
New Mexico
Monterrey
Gulf of California
Gulf of Mexico
Utah
Nevada
500 mi
500 km
Map data ©2012 Google, INEGI - Terms of Use
Legend: Station operational | Operational, price older than 30 days | Non-operational
Prices and station status are updated by people like you. Click on a price icon for more information!


Cedar Rapids
Rockford
$2.46
Naperville
Davenport
Joliet
$2.59
$2.60
Illinois
Springfield
$1.98
St. Louis
$1.26
$2.49

Limitation

Type	range (mile)
Honda Civic	422.4
Honda Civic Natural gas	225-250

- Chicago-Champaign: 140 miles
- Chicago-St. Louis: 300 miles

References

[1] Fochtman et al. United States Patent US6431474

[2] Quantum Fuel System Technologies Worldwide Inc. *Alternative Fuel Injectors.*

[3] http://www.youtube.com/watch?v=wRIKJ6Av5zo

[4] BAF technologies, *Alternative Fuel Systems – CNG 101*

[5] http://www.omnitekcorp.com/altfuel.htm

[6] Ma, Fanhua et al. *Effect of compression ratio and spark timing on the power performance and combustion characteristics of an HCNG engine*

[7] http://www.cngnow.com/stations/Pages/information.aspx

[8] http://www.engineeringtoolbox.com/

[9] http://automobiles.honda.com/civic-sedan/specifications.aspx

[10] J-J Zheng, et al. *engineEffect of the compression ratio on the performance and combustion of a natural-gas direct-injection*