Natural gas station networks

Factors supporting and hindering their development

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Agenda

- Natural gas as a fuel
- Development of networks in the world
- Influencing factors on density of network
- Obstacles to network evolvement
- Solutions to overcome this problem
- Reasons for success in Argentina and Italy
Natural gas reserves in trillion m$^3$

Drillable reserves of natural gas: 140 trillion m$^3$

$1m^3 = 11.5$ kWh
Natural gas as a fuel -
Natural gas

- Beginning as a fuel for vehicles at the beginning of the last century
- 85% methane, 10% N2 and CO2, rest higher hydrocarbons
- two types of NG: L and H (99% methane)
- more than 2 million vehicles today
Natural gas as a fuel - Natural gas supply

- Genuine energy alternative (methane)
- Liquefied form (-162°C/-259°F) or as compressed gas
- Caloric value equal to that of Diesel
- Mainly used as compressed gas
Natural gas refueling stations
- elements for a system of stations

- National gas pipeline supply network
- local filling stations comprising storage, gas compression and refueling pipes
- high pressure gas storage tanks suitable for attachment to vehicles and capable of withstanding crash impact forces
Natural gas as a fuel -
Natural gas vehicles

• Conventional engines can be converted to run on natural gas
• level of efficiency 36-37%
• 1kg NG (H) = 1,5l gas (cost reduction ~50% for Germany)
Comparison Argentina - Italy - USA

<table>
<thead>
<tr>
<th>Country</th>
<th>Vehicles converted</th>
<th>Refuelling stations</th>
<th>Last update</th>
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Top 10 Countries NGVs

Importance of Argentina
Role of small countries
High concentration of NGVs
Low importance in the US
Well developed industry nations improve their position - Importance of degree of development
Influencing factors on density

- We conclude from our observations so far that the density of the network of natural gas stations is influenced by two factors:
  - By the amount of NGVs
  - By the general degree of development of infrastructure in a country
Main Obstacle to the Creation of Natural Gas Station Networks

No NGVs without fuelling stations - no fuelling stations without NGVs
How to break this cycle

• Public policy
  – Financial support for buying NGVs
  – Tax reduction on natural gas
  – Taxing more the classic fuels
  – Financing compressor stations
  – Allowing only "green" cars in the cities
  – Requiring a percentage of "green" vehicles
How to break this cycle 2

• Focusing on large fleets:
  – Transport companies
  – Postal services
  – Urban goods distribution firms
  – Taxis
  – Communal business services
Argentina

- NGVs since the 80ies

- Reasons for success:
  - Abundant resources of natural gas
  - Obstacles to energy export
  - Strong support by the Argentinean government
    - Tax reduction
    - Special programs
Top 10 Countries NGVs

- Argentina: 36%
- Italy: 18%
- Brazil: 14%
- Pakistan: 10%
- US: 5%
- India: 4%
- China: 2%
- Venezuela: 2%
- Egypt: 5%
- Russia: 5%

Number of fuelling stations Argentina

- Number of fuelling stations in Argentina

Years: 1984 to 2000
Number: 0 to 900
Italy

- NGVs since the 20ies
- Reasons for success
  - Strong support by the Italian government
  - Early use of natural gas as a fuel
  - Less strict rules concerning changes of cars
  - Many different types of NGVs offered
  - Reduction of damages inflicted by urban traffic pollution to the artistic and archaeological urban patrimony (Ravenna, Pavie, Padoue,...).
Conclusion

We strongly recommend that other countries follow the example of Argentina and Italy!