European Business Congress Study - 2012

Study "Legal and Regulatory Environment for the Construction and Operation of CNG Filling Stations in European Countries"

BACKGROUND TO THIS PROJECT (2011-2012)

- Sponsor: European Business Congress
- Primary Contractor: National Gas Vehicle Association Russia, assisted by Clean Fuels Consulting
- Project Scope
  - 21 European NGV Country Profiles (West & East Europe) – PowerPoint file
  - Legal & regulatory environment to build fuelling station network – Excel File
  - Strategic approaches to create NGV fuel infrastructure – PowerPoint file
  - NGV Infrastructure Calculation Tool (NICA) – Excel File

PURPOSE OF THE PROJECT

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The European market for natural gas vehicles has been expanding steadily since 1994 when there were 524,000 natural gas vehicles (NGVs) and 1,693 CNG fuelling stations. Today the European market has expanded to 1.5 million NGVs and 4,000 fuelling stations; growth of 286% and 236% respectively.

While NGVs and the fuelling infrastructure are a practical potential business opportunity they compete with the 'politically attractive' technologies such as hydrogen fuel cells and electric battery vehicles. Thus, the time is right for the wider European business community to be made aware of the 'NGV potential.' This is best done by highlighting the excellent opportunities to invest in a sustainable fuel and technology that addresses today's important concerns about energy and the environment through the wider use of NGVs, whether they run on fossil natural gas, liquefied natural gas or renewable biomethane.

The European Business Congress has recognized this need and now is seeking a way to inspire new investments in the CNG fuelling infrastructure across Europe. Once in place, this can lead to a much more widespread development of the European NGV market in individual countries that are linked across Europe along the normal transportation corridors.

ACKNOWLEDGMENTS

The project sponsors wish to thank the following individuals for their dedicated research and analysis in making this project possible

- EBC Project Coordinator: Detlef Wessling, E.On Ruhrgas
- NGVRUS Project Manager: Eugene Pronin, Gazprom
- Clean Fuels Consulting
- Principal Investigator: Dr. Jeffrey M. Seisler
- Research Assistant: Marco Dal Pont
- Project engineer for the Natural Gas Infrastructure Calculation Tool (NICA): Gijs van Schoonhoven (Ingenieurbüro van Schoonhoven)

NGV COUNTRY PROFILES

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NGV Country profiles provide, in a PowerPoint format, a template of information that represents in-depth analyses on a country-by-country basis. The profiles focus on the specific elements that are important to understand the investment environment to develop a CNG fuelling infrastructure. Taken together, these country profiles provide a unique window into individual markets that may be attractive to different commercial interests investing in the NGV infrastructure.

NORWAY
(October 2011)

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COUNTRY PROFILE TEMPLATE

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- NGV Profile
- Motivation
- Energy Profile (oil & gas/imports & exports)
- Vehicles
- Fuelling Infrastructure
- Government Support
- Gas Industry Support
- Conclusions

NGV PROFILE

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- Number of over-the-road NGVs: 376
- NGVs are 0,01% of total vehicle population
- 0,08 NGVs per 1000 population
- CNG fuelling stations: 16
- 13,5 vehicles per fuelling station
- Price differential CNG-Petrol/diesel:
  - CNG equivalent per liter gasoline: 0.81 €/liter
  - Regular Gasoline: 1.67 €/liter

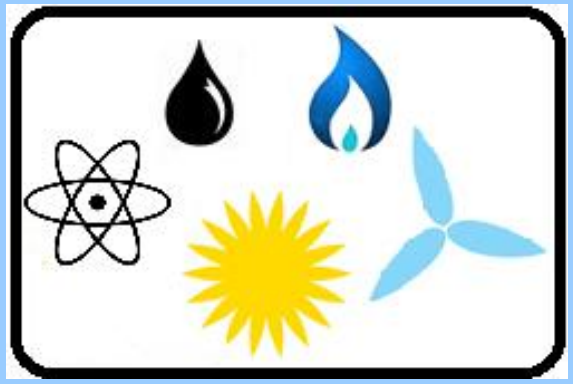
  Natural gas costs 51.5% less then gasoline

Source (August 2010)
The GVR

MOTIVATION

- Natural gas is a safer fuel than gasoline
- Economic advantages
- Environmental considerations

ENERGY PROFILE



ENERGY PROFILE SUMMARY

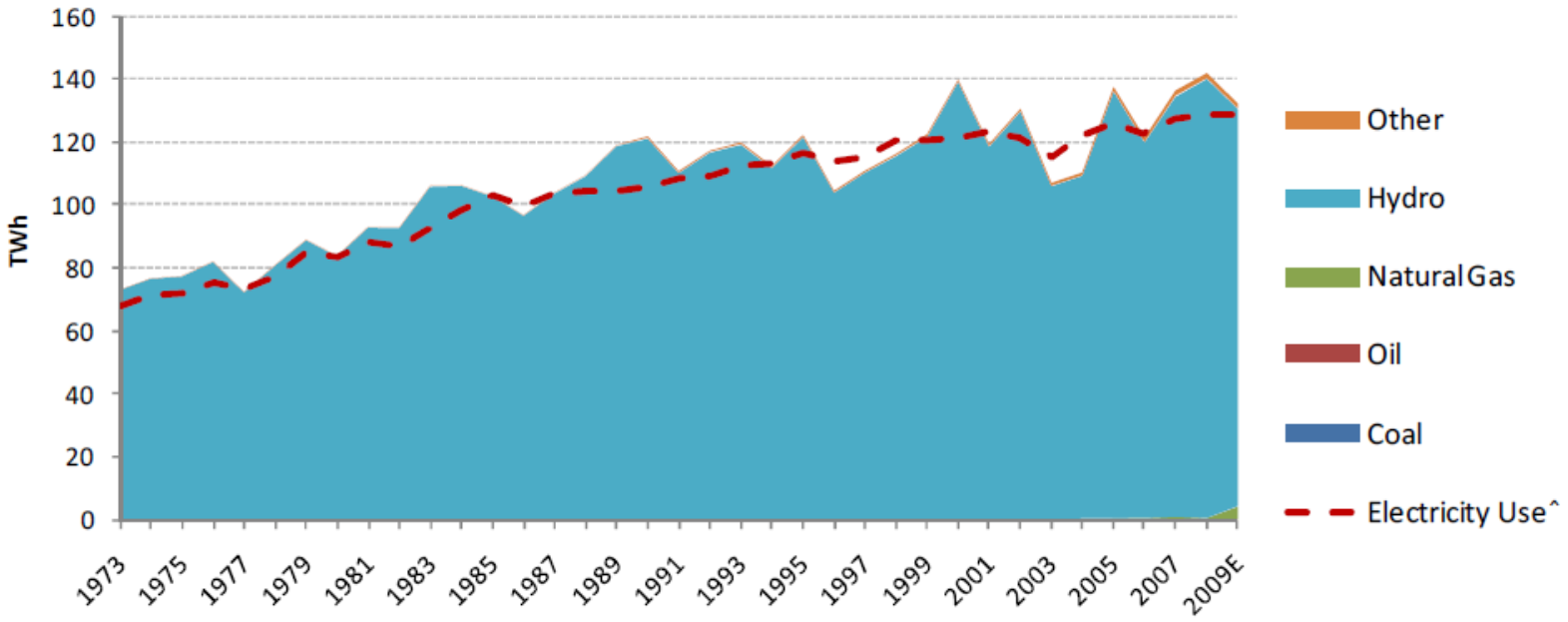
- Highly dependent on the petroleum sector
- Its position as an oil exporter has slipped to ninth-largest as production has begun to decline
- Norway is a significant gas producer (of over 100 bcm in 2010) but is only a marginal consumer
- Norway is the world's second-largest gas exporter

ENERGY PROFILE

- **Oil**
  - production: 2.134 million bbl/day
  - consumption: 221.300 bbl/day
  - imports: 118.200 bbl/day
  - exports: 2.184 million bbl/day
  - reserves: 5.67 billion bbl
- **Natural gas**
  - production: 106.3 billion m^3
  - consumption: 6.6 billion m^3
  - imports: 0 m^3
  - exports: 99.75 billion m^3
  - reserves: 2.039 trillion m^3

Source: CIA World Factbook 2011

Around 96% of electricity comes from hydro-sources. The other 4% is dominated by other renewables like wind and biomass

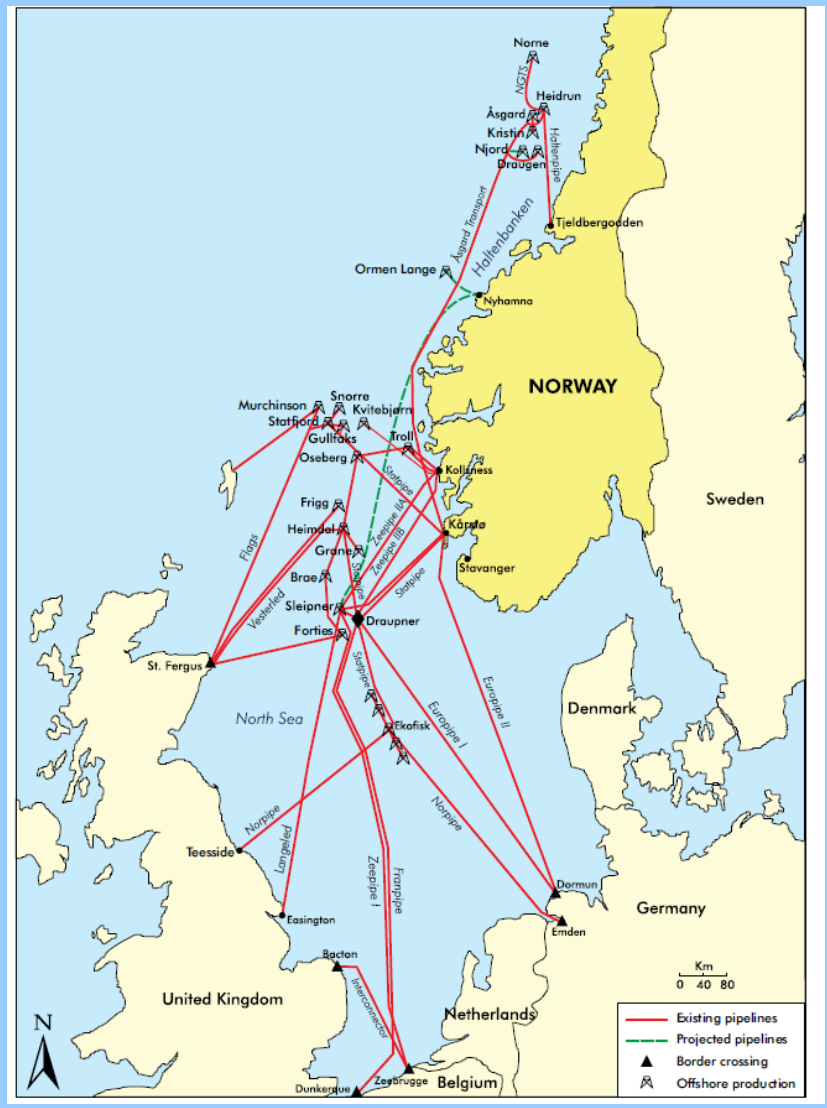


Source: Energy Balances of OECD Countries, IEA

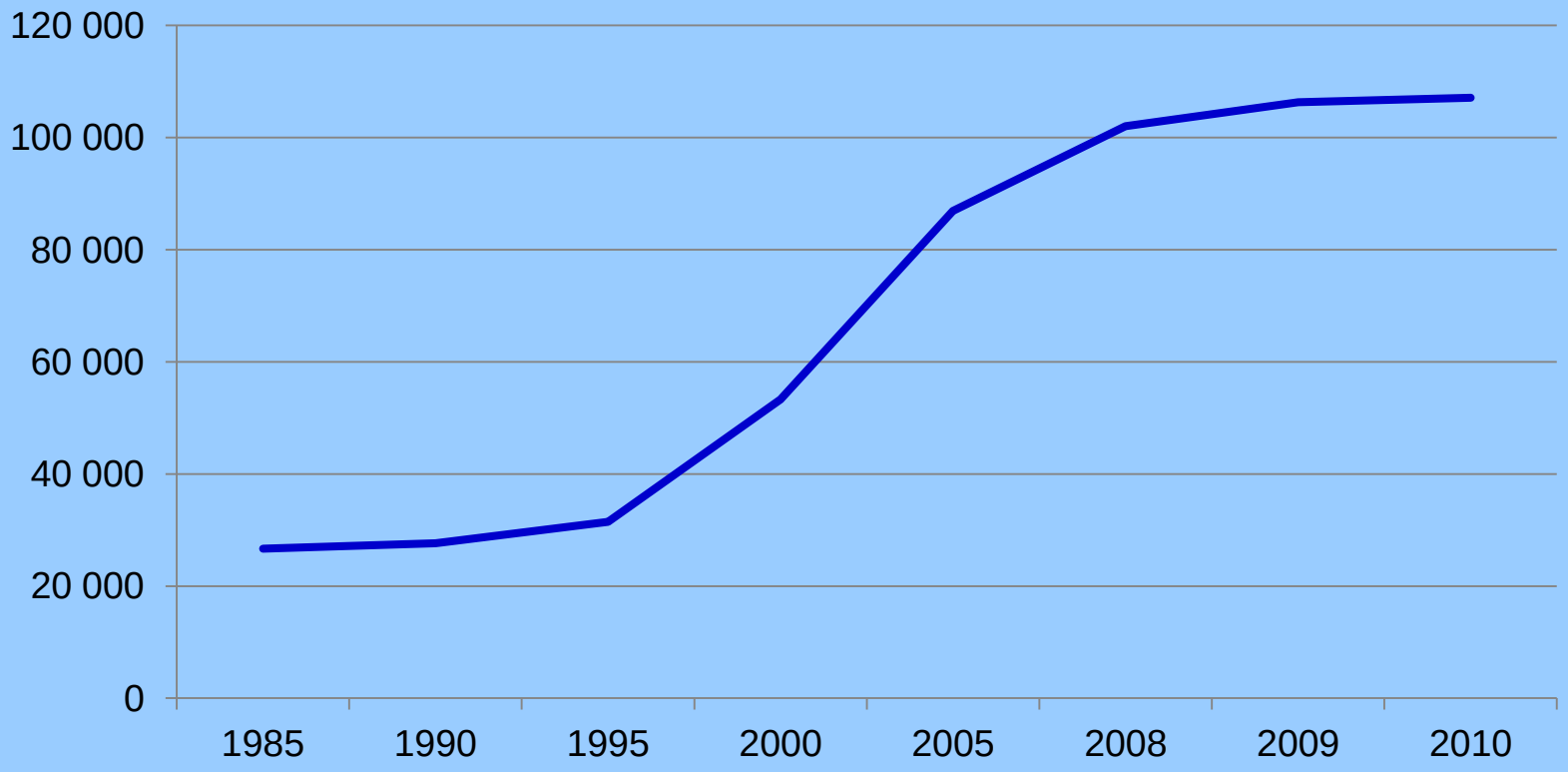
NATURAL GAS PIPELINE MAP

The pipelines built in Norway cover very limited geographical areas due to the mountainous terrain:

- Gasnor has approximately 100 km of pipelines in the south-western part of Norway, in the Haugesund – Karmøy region
- Lyse Gass AS has approximately 450 km of distribution pipelines and distributes natural gas to a very limited geographical area in the south-western part of Norway, in the Stavanger-area



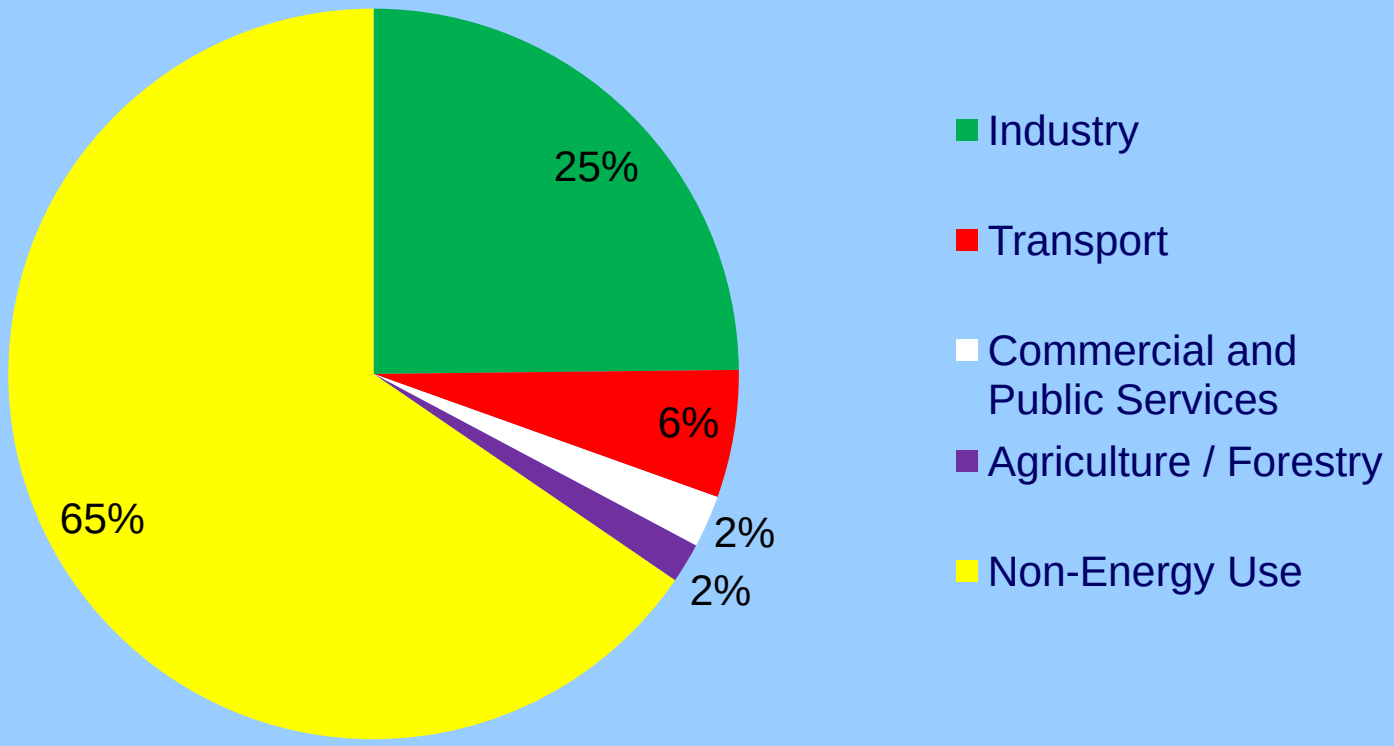
The Norwegian Administration expects natural gas production to range between 105 bcm and 130 bcm over the 2010-2020 period



Source: IEA statistics, 2011

NATURAL GAS

Only 5% of total gas production is used for internal consumption. 65% of this consumption occurs in the energy sector itself, in the upstream oil and gas extraction process



5 LNG production plants, more than 50% of production plants in Nothern Europe

- Melkoya: 4.3 million tonnes of LNG per year
- Tjeldbergodden: 20 tonnes of LNG per year
- Kollsnes: 120 tonnes of LNG per year
- Karmoy: 20 tonnes of LNG per year
- Risavika: 300 tonnes of LNG per year

Source: North European LNG Infrastructure Project: A feasibility study for an LNG filling station infrastructure and test of recommendations. 20 October 2011

LNG is transported from the production plants either by small-scale LNG carriers (ships) or by truck to local storage terminals or bunkering stations

Source: North European LNG Infrastructure Project: A feasibility study for an LNG filling station infrastructure and test of recommendations. 20 October 2011

Small-scale LNG-distribution has become a Norwegian alternative to gas transmission and distribution networks

- Today there are more than 40 small-scale LNG terminals
- No household customers are served from these small-scale LNG-reception terminals
- The LNG distribution system in Norway was developed with industrial customers in mind, but the technology has also made it possible to use LNG as a fuel in marine vessels

ALTERNATE NATURAL GAS SOURCES

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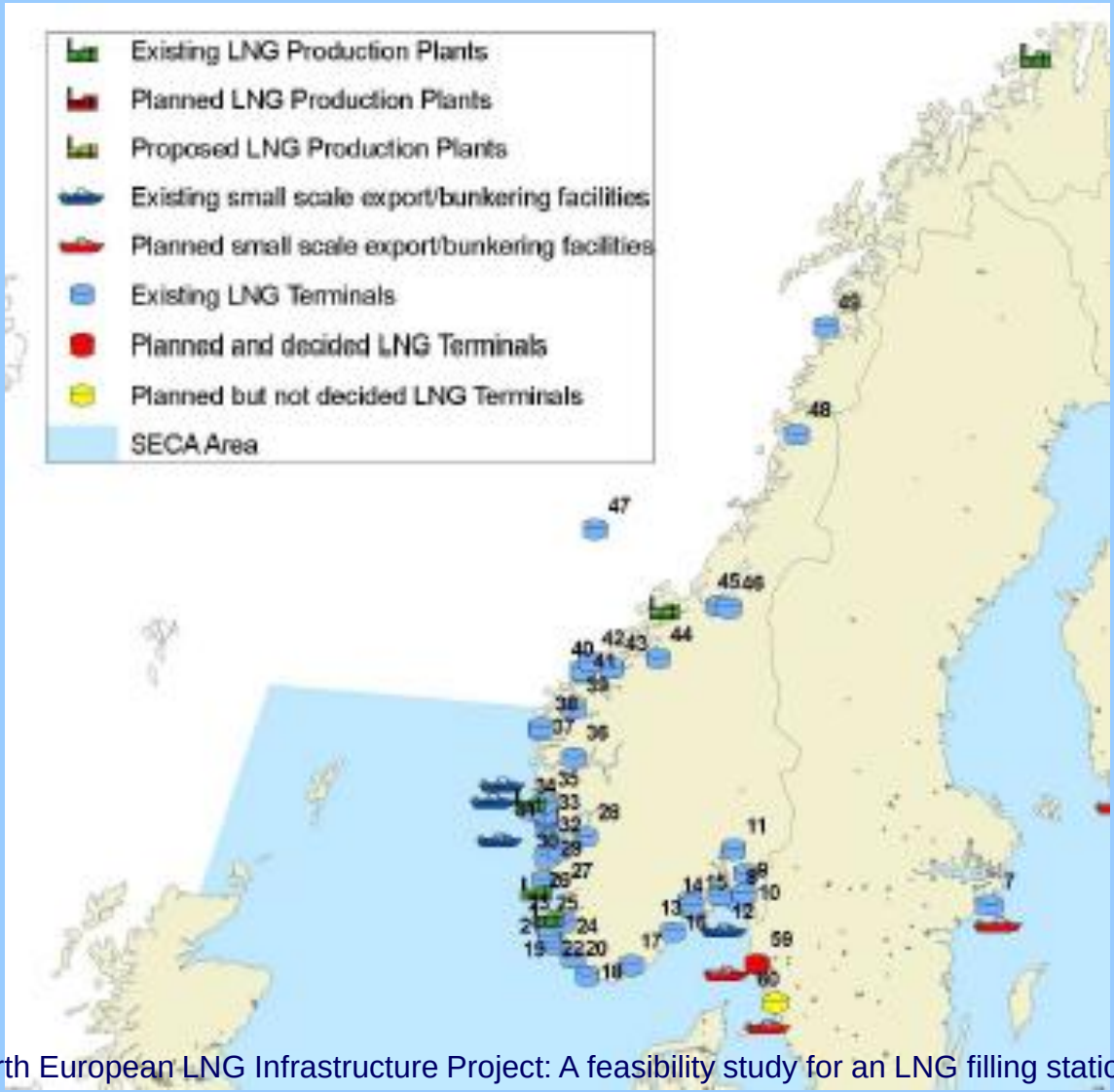
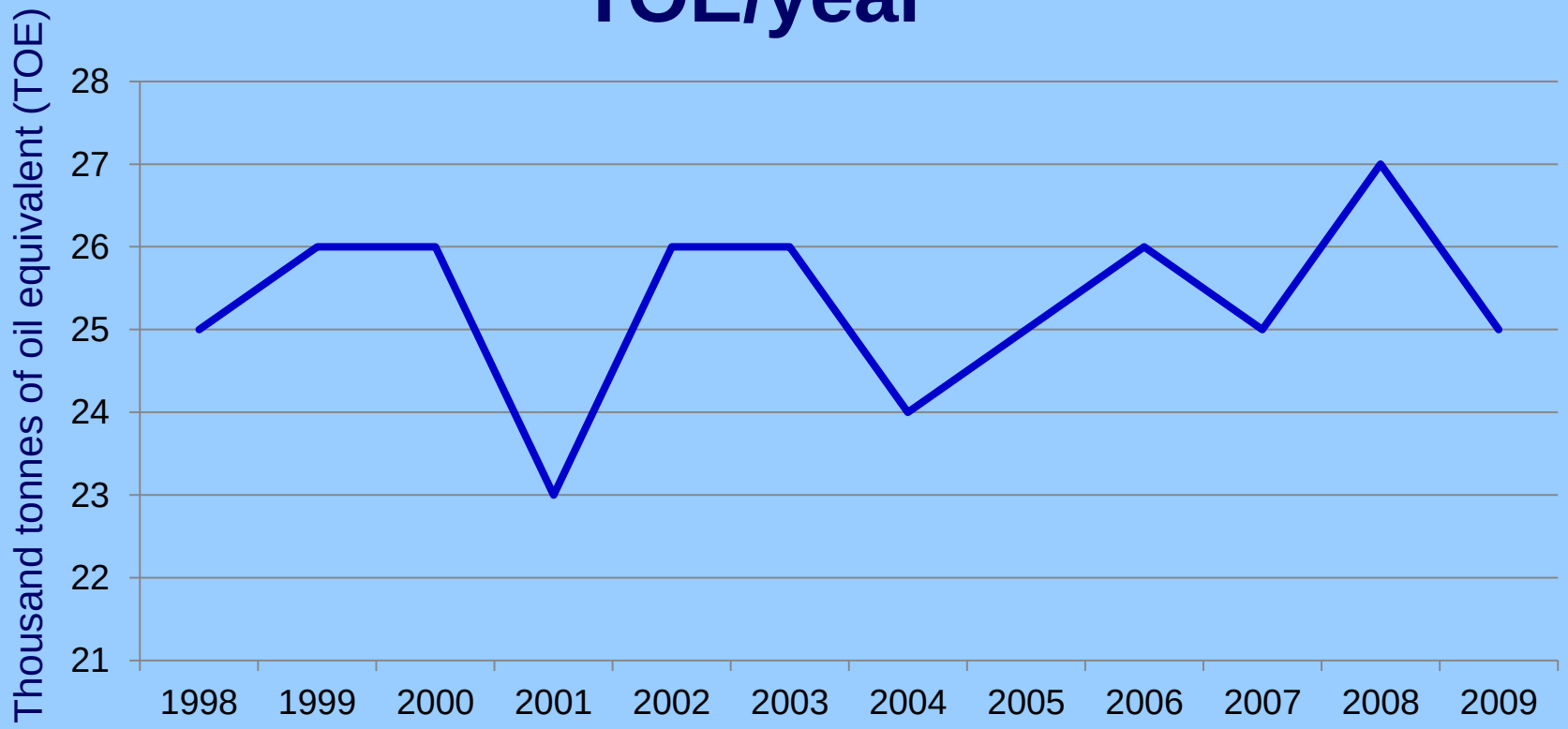


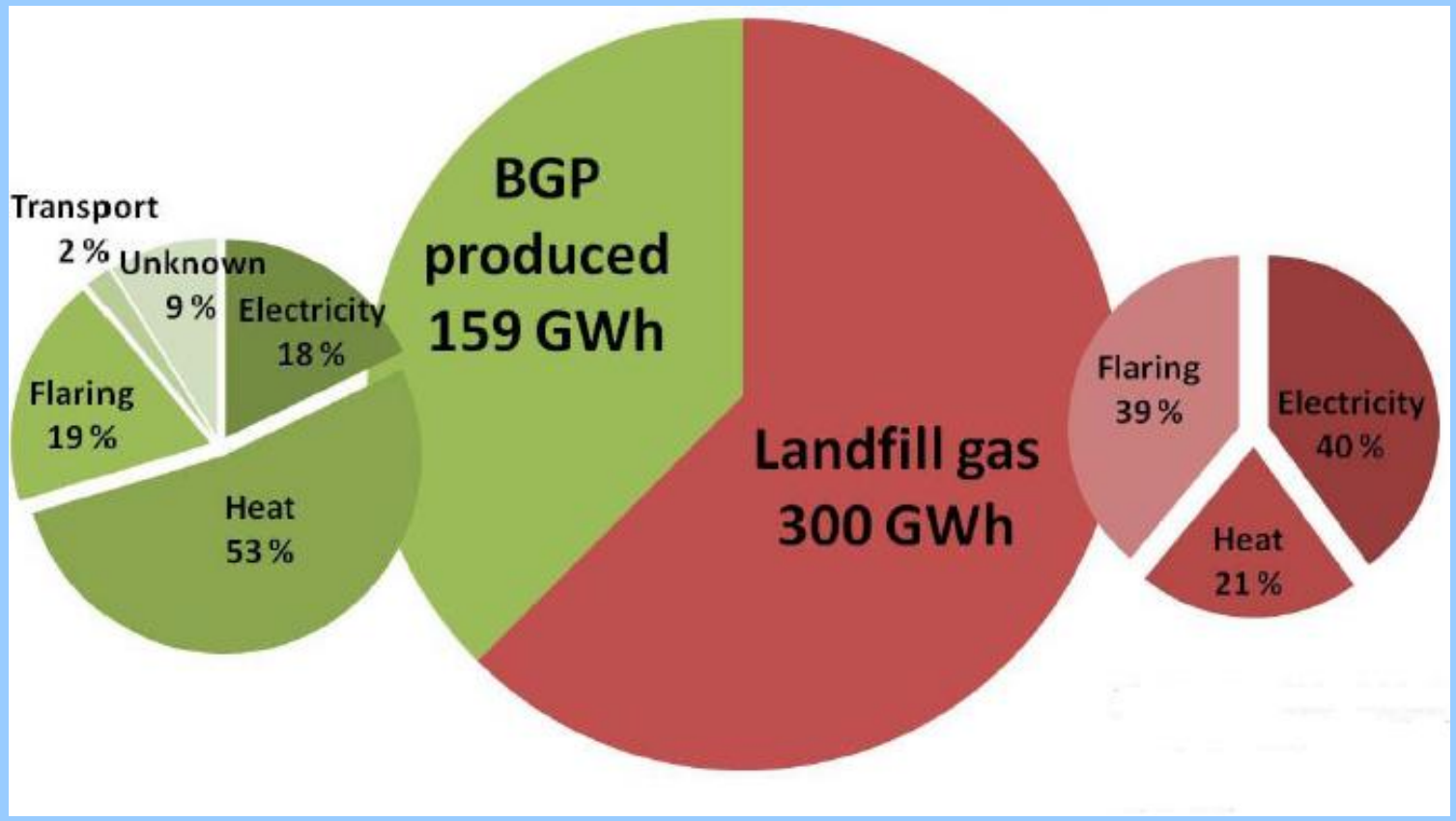
Source: North European LNG Infrastructure Project: A feasibility study for an LNG filling station infrastructure and test of recommendations. 20 October 2011

Biogas production was fairly stable in the last 10 years at around 25 TOE/year



Source: Eurostat

The majority of biogas is produced from landfill gas



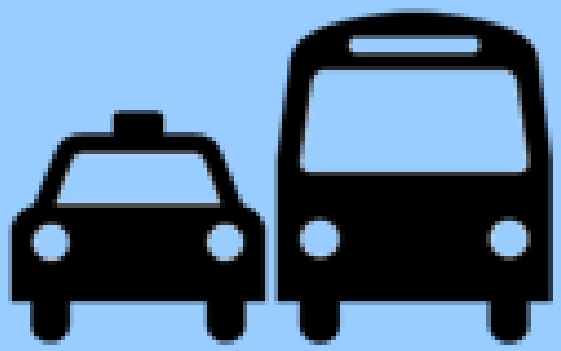
Source: IEA Bioenergy – task 37, Country report Norway, 15 April 2011

ALTERNATE NATURAL GAS SOURCES

- The Norwegian government is targeting to have 30% of livestock manure in combination with 600,000 tons of food waste to be treated in biogas plants by 2020
- **Political goal:** within 2020 Norway should produce 14 TWh from bioenergy

Source: IEA Bioenergy – task 37, Country report Norway, 15 April 2011

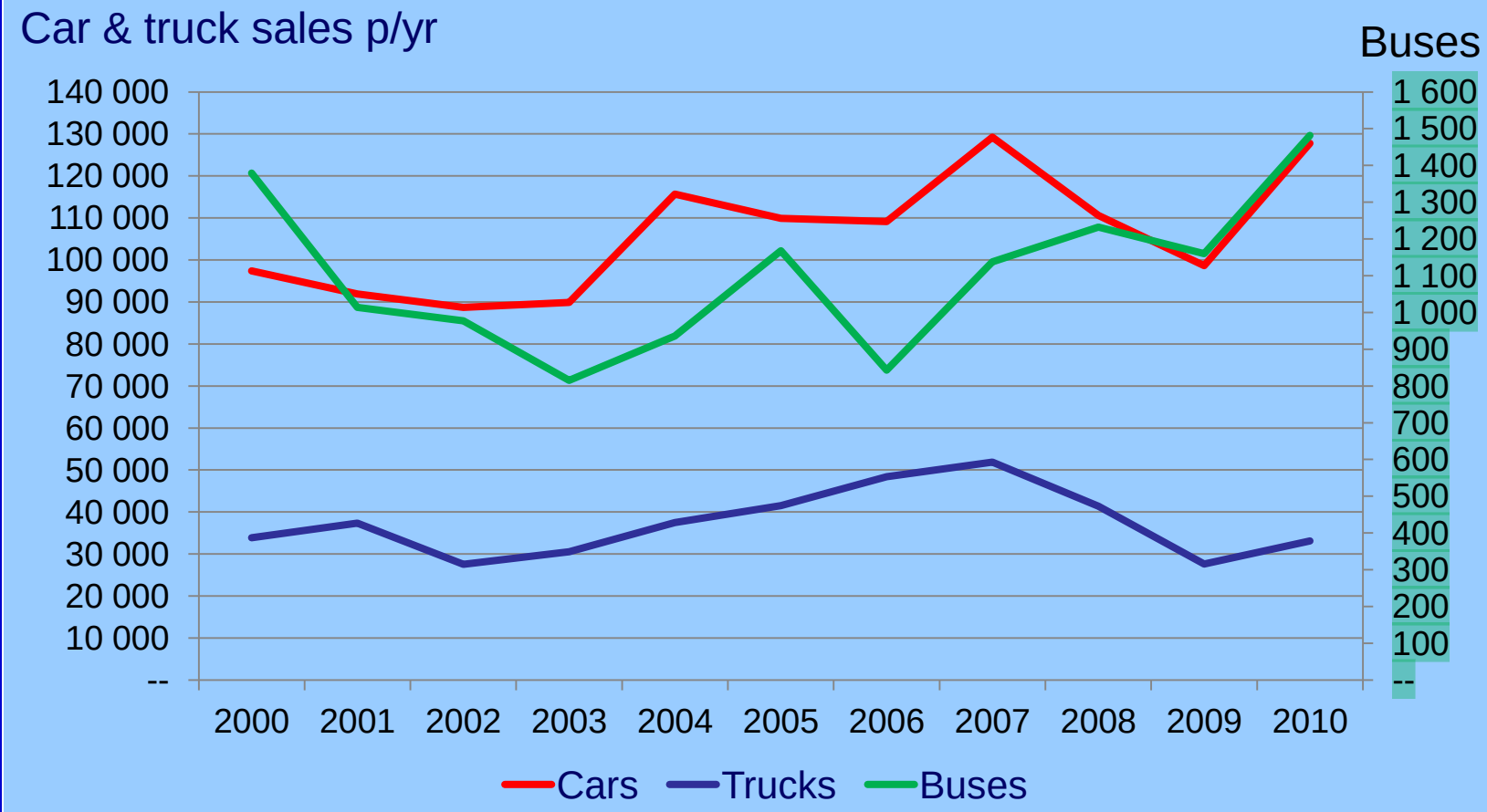
VEHICLE PROFILE



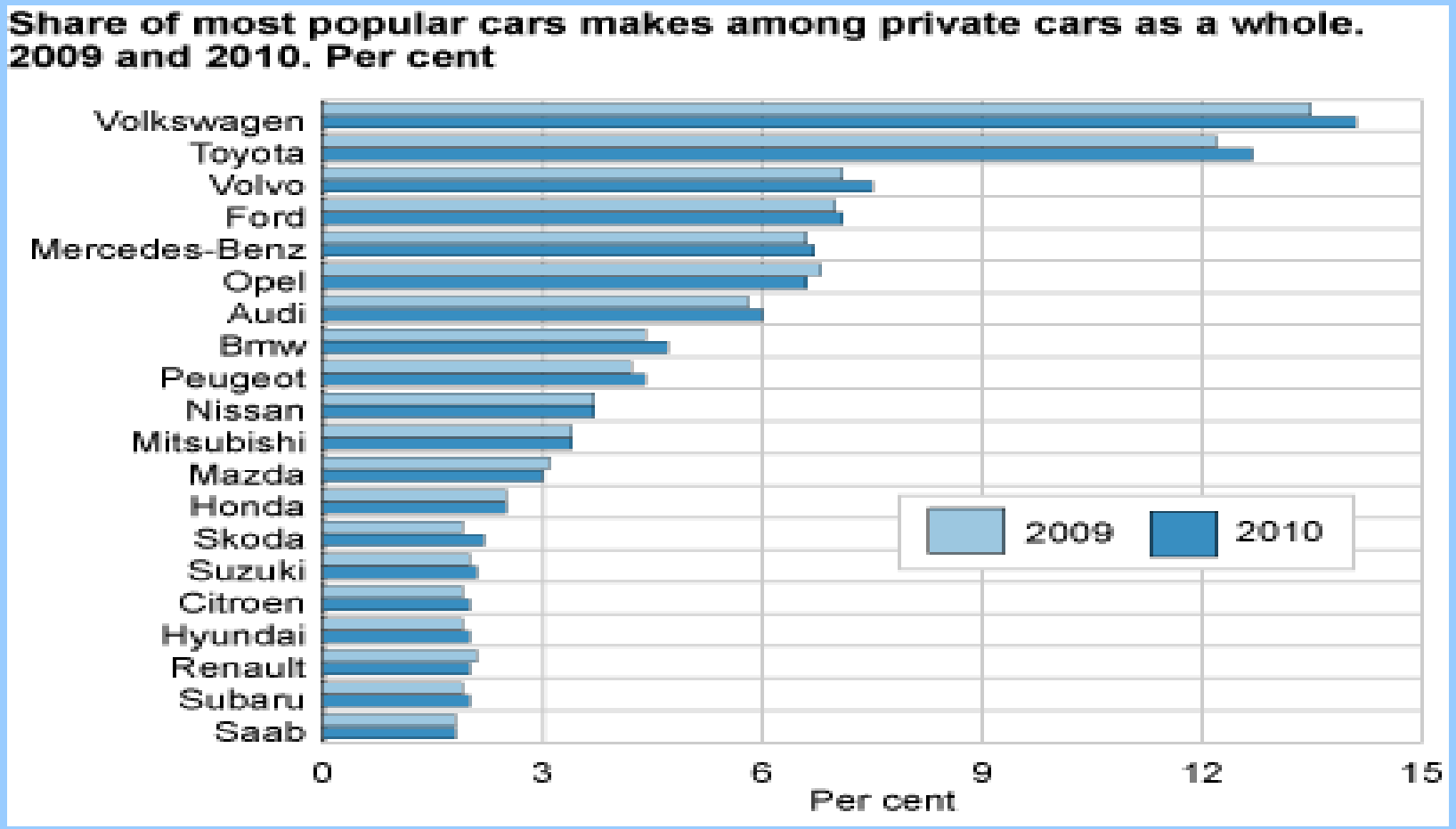
Vehicle Overview

- A total of 2.7 million cars were registered in Norway at the end of 2010
- 2.3 million were private cars and nearly 400.000 were vans
- The stock of private cars has grown by 2.8 per cent in one year, while the stock of vans has grown by 2.5 per cent

Norway has no vehicle production capacity and sales are relatively consistent

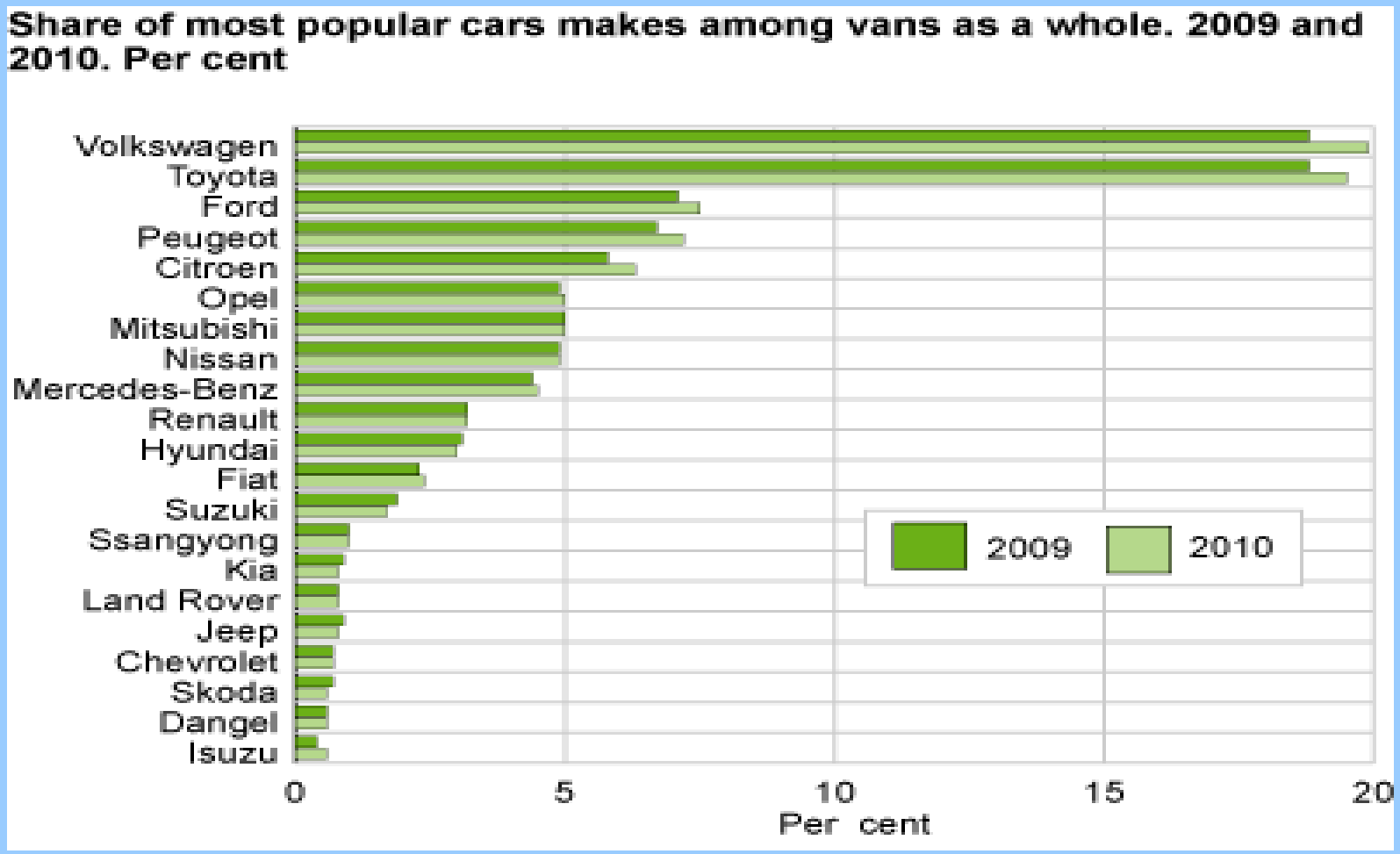


Volkswagen has had the largest market share of private cars in Norway



Source: Statistics Norway 2011

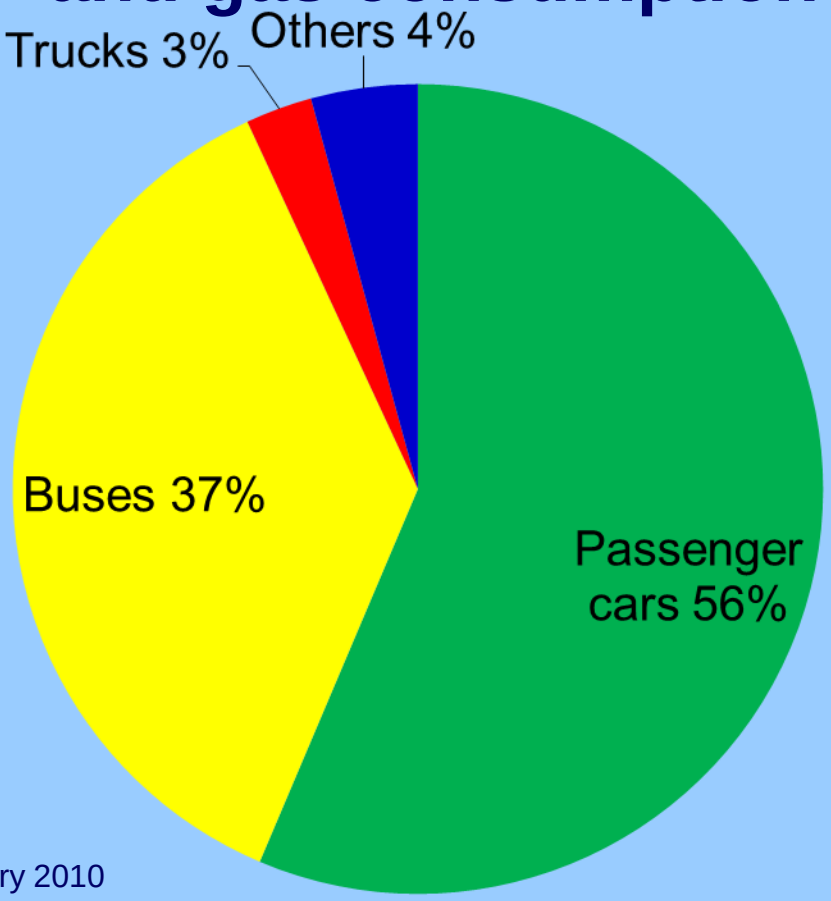
In 2010, Volkswagen surpassed Toyota vans



Source: Statistics Norway 2011

The largest percentage of NGVs are passenger cars but buses are important for high visibility and gas consumption

Total: 376 natural gas road vehicles



Source: The GVR, January 2010

Finance Minister Halvorsen proposed to ban sales of new cars powered by fossil fuels

- Carmakers could only sell new cars from 2015 that run fully or partly on fuels such as electricity, biofuels or hydrogen
- Hybrids using fossil fuels and electricity, for instance, would still be permitted
- Cars already on the road would be unaffected by the new proposed law
- Aims to develop new and more environmentally friendly cars
- The 2015 proposal is not yet adopted by the cabinet because it is opposed, among others, by Labor Prime Minister Jens Stoltenberg

Source: Reuters, Ban gasoline cars from 2015:Norway Finance Minister, April 2009

Renault delivered 13 NG refuse collection trucks

- Operated since September 2009 in Oslo on behalf of Veolia Environmental Services
- 11 Renault Premium Distribution by 24m3 compressors
- 2 Renault Midlum 230 with 12m3 compressors

Source: Renault

Bus operator goal is to provide a 100% fossil free public transport not later than 2020

- Ruter, Norway`s leading provider of public transport services is responsible for the public transport in the Oslo region
- Today, all track vehicles run on green energy and the number of renewable fuelled buses increases steadily
- Ruter, a partner in the Baltic Biogas Bus project, is interested in running buses in Oslo on biogas

Ruter#

Source: Baltic Biogas Bus project

Tide ASA orders 37 Mercedes-Benz Citaro G CNG vehicles

- Tide ASA is one of the largest transport operators in Norway offering both road and water-based public transport services

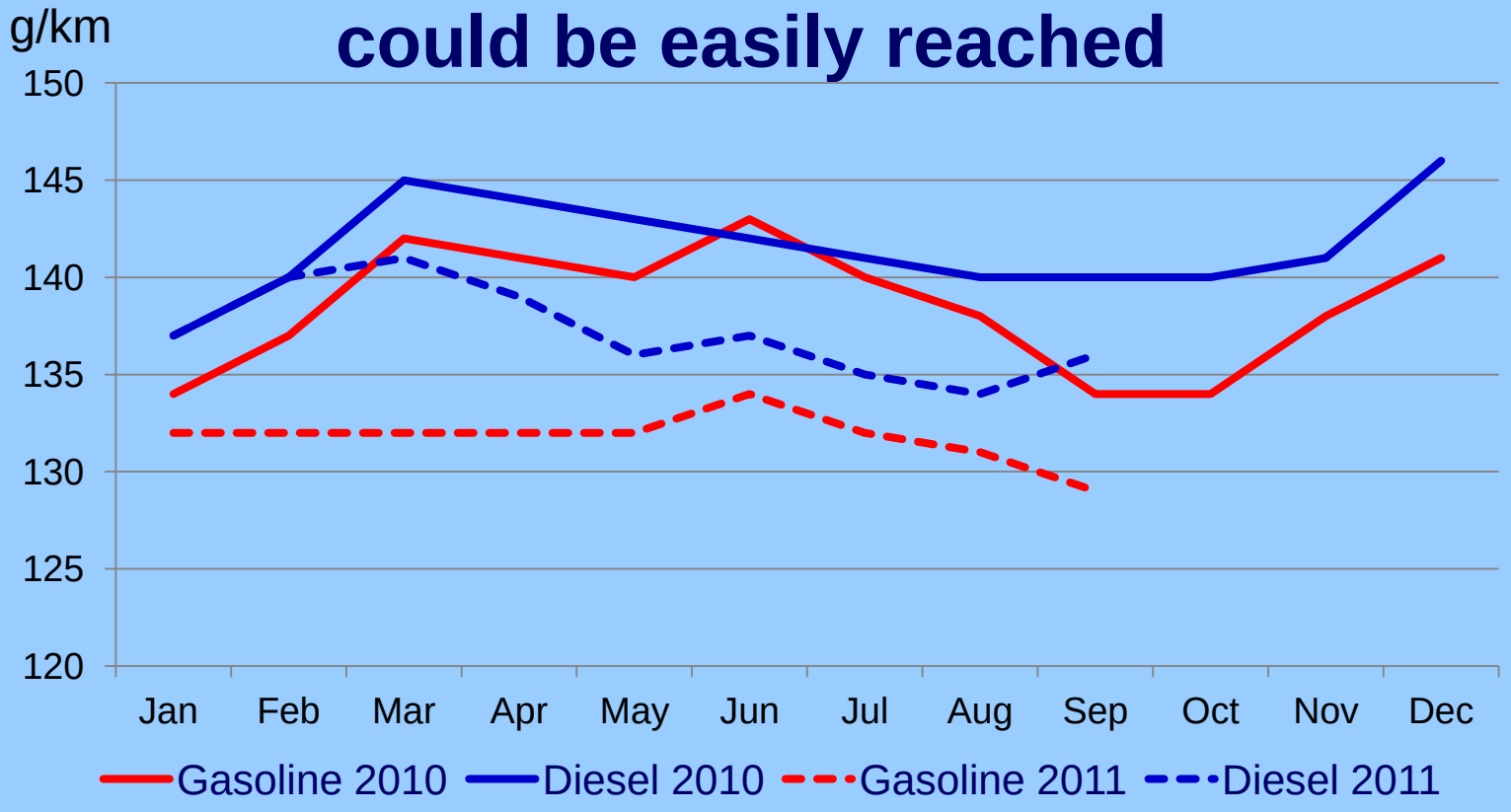
Source: Daimler, 12 March 2011

133 new gas buses in Trondheim

- Gasnor began delivery of 133 new buses in Trondheim in August 2011
- The buses are operated by Tide Buss
- Ultimately the buses will run on locally produced biogas, using fossil natural gas as the back-up

Source: Gasnor

Average CO2 emissions (road vehicles) in August 2011 was 132 g/km, 4.3% lower than in August 2010. The 2012 target of 130 g/km could be easily reached



Source: Information Council for Road Traffic AS

Tromsø will get biogas buses in 2014

- Troms County Council has taken an initiative to ensure that public transport in Tromsø city shall switch to biogas
- Option to buy 30 gas buses in 2014 if it becomes clear that the fuelling infrastructure is in place

Source: Zero Emission Resource Organization, 27 September 2011

Ships are a good opportunity for LNG as motor fuel

- World's first LNG fuelled ferry was built in Norway in 2000
- Numerous Norwegian shipping companies are committing to LNG-fuelled engines on their ships, especially those operating in coastal and fjord trade
- LNG vessels are supported by the government, which provides some incentives for shipowners putting LNG-powered ships into operation

Source: Skipsrevyen, Norway and Poland, 12 June 2011

LNG for ships sets a good example to lead the future NGV develompent

- Gasnor is marketing the ship industry and then will focus on trucks as well
- Moving from ships to expand the truck market in ports provides a synergy that will gain traction at some point in the future
- Good LNG infrastructures already present
- Competitively priced compared to diesel

Source: conversation with a Gasnor stakeholder

Since 2000 20 natural gas vessels are in operation and another 10 are on order

Year	Type of vessel	Vessel name	Owner	Builder	Class	Engine
2000	car/passenger ferry	Glutra	Fjord1		DNV build	MHI
2003	offshore vessel	Viking Energy	Eidesvik	Kleven	DNV	Wârtsilla DF
2003	offshore vessel	Stril Pioner	Simon Møkster	Kleven	DNV	Wârtsilla
2006	car/passenger ferry	Bergensfjord	Fjord1	Aker Yards	DNV	Rolls Royce
2007	car/passenger ferry	Stavangerfjord	Fjord1	Aker Yards	DNV	Rolls Royce
2007	car/passenger ferry	Raunefjord	Fjord1	Aker Yards	DNV	Rolls Royce
2007	car/passenger ferry	Mastrafjord	Fjord1	Aker Yards	DNV	Rolls Royce
2007	car/passenger ferry	Fanafjord	Fjord1	Aker Yards	DNV	Rolls Royce
2008	offshore vessel	Viking Queen	Eidesvik	West Contractor	DNV	Wârtsilla DF
2009	car/passenger ferry	Moldefjord	Fjord1	Gdanska Stoczina	DNV	MHI
2009	car/passenger ferry	Tideprinsen	Tide Sjø	STX France	DNV	MHI gass/Scania
2009	car/passenger ferry	Tidekongen	Tide Sjø	STX France	DNV	MHI
2009	car/passenger ferry	Tidedronningen	Tide Sjø	STX France	DNV	MHI
2009	patrol vessel	Barentshav	REM	Myklebust verft	DNV	MHI
2009	offshore vessel	Viking Lady	Eidesvik	West Contractor	DNV	Wârtsilla DF
2010	car/passenger ferry	Fannefjord	Fjord1	Gdanska Stoczina	DNV	MHI
2010	patrol vessel	Bergen	REM	Myklebust verft	DNV	MHI
2010	car/passenger ferry	Romsdalsfjord	Fjord1	Gdanska Stoczina	DNV	MHI
2010	car/passenger ferry	Korsfjord	Fjord1	Gdanska Stoczina	DNV	
2010	patrol vessel	Sortland	REM	Myklebust verft	DNV	

Norwegian LNG Ships

Passenger & Car Ferry

Supply Ship

Coast Guard

Fjord Ferry

Images by Gasnor 2008, from *LNG as a Ship Fuel*, Creatieve Energie, June 2009

NGV FUELLING INFRASTRUCTURE

Only 16 CNG fuelling stations are operating in Norway

- First station opened by Gasnor in Bergen in 2000
- Stations are owned by Gasnor, Lyse and AGA
- Only one station in Stavanger is a multi-fuel station

Lyse is a supplier of Eco- friendly fuels in the Stavanger area in Norway

- Lyse now operates four filling stations offering two products:
  - Biogas 33: 33% biogas and the rest natural gas
  - Biogas 100: The fuel consists of 100% carbon-neutral biogas with a guarantee of origin. The product is slightly more expensive than Biogass33, but still significantly cheaper than petrol and diesel

Source: Lyse

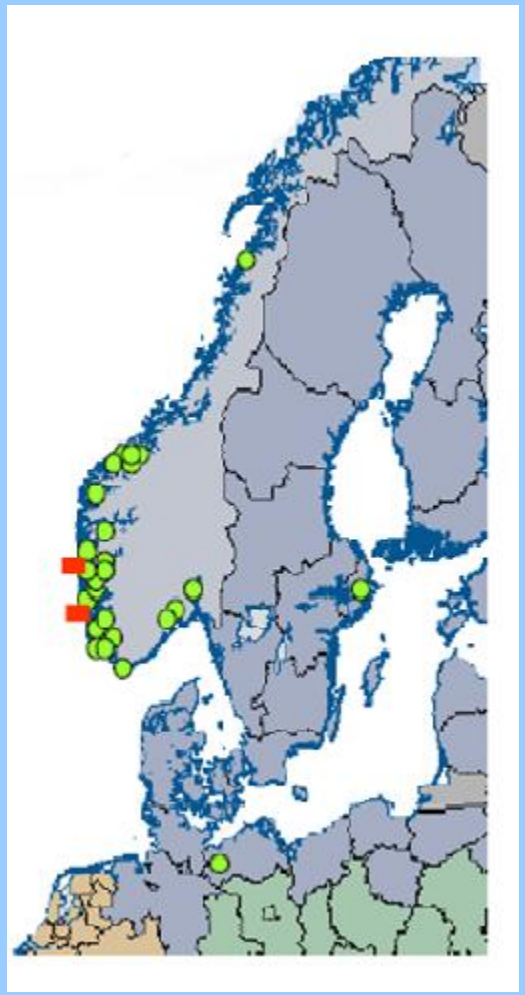
- **Bergen has an L-CNG station for 30 municipal buses, with a 50m3 tank**

Single stage high pressure pump 300 bar, 3Nm3/min (450Nm3/h)

50m3 LNG tank placed on top of a 40 feet container with pumps and vaporizers (located in bus garages)

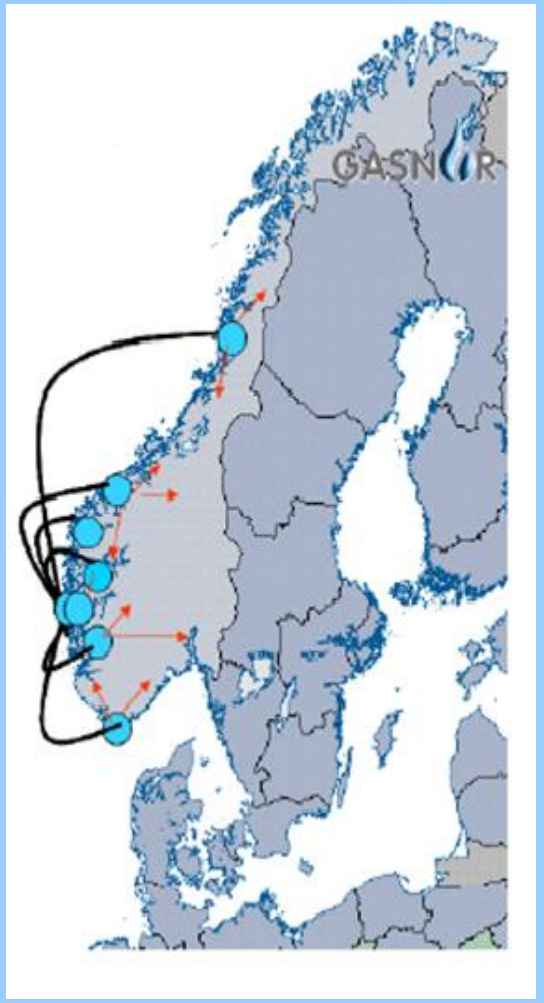
ALTERNATE NATURAL GAS SOURCES

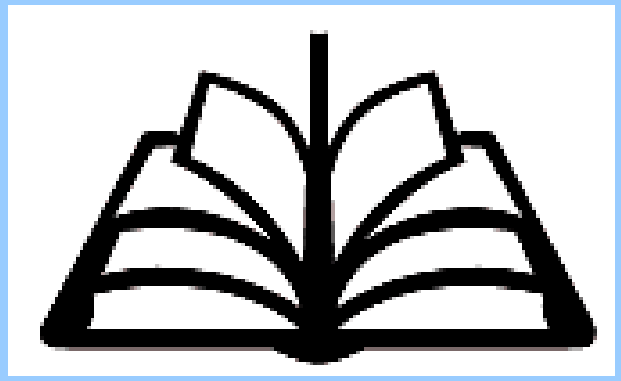
LNG **TRUCK** terminals



LNG fuelling terminals for ship fuelling and bunkering will be growing as the marine market develops

LNG **SHIP** terminals





Only one CNG station is a multi-fuel station. All 16 stations are self service and accept credit cards

- Multi-fuel stations: allowed
- No limits on opening hours
- Self service: allowed
- Payment practices at the pump: cash, credit card and company fuel cards

For CNG and LNG Norway has transposed ISO, European and some US standards

- There are no standards for CNG fuelling stations although the CEN standard PrEN 13638:1999 (CNG Fuel Station) is referenced within other European Norms used in Norway but not specifically transposed as a Norwegian standard. (Presumably they will adopt the new, developing ISO standard for CNG stations)
- There are no existing standards for biogas or biomethane

Norwegian Standards: CNG and related natural gas quality

- ISO 15403: Natural gas for use as a compressed fuel for vehicles (including designation of the fuel quality)
- ISO/TS 16922:2002: Natural gas- guidelines for odorizing gases
- ASTM (American Society for Testing Materials) D6273:38: Standard test methods for natural gas odor intensity
- No current standard for CNG fuel stations

Norwegian Standards: LNG applicable to stations and fuel transfer to vessels

- NS-EN 13645:2001: Design of onshore installations with a storage capacity between 5 tons – 200 tons
- NS-EN 1433-2007: Installation and equipment for LNG- design of onshore installations
- NS-EN 1474:2008: Installation and equipment for LNG design and testing of marine transfer systems

No specified standard for odorization of natural gas

- Odorization required only for pipeline distribution
- Level of concentration and a control are required
- Controls with perdiodical inspections and analytic analysis

Source: Marcogaz

Lack of regulation for LNG is not seen as a problem for Gasnor

- "The regulations are not all in place but it's better to start without them and get experience before making final regulations for bunkering."
- "In the early stages of market development it is better to get temporary exemptions from the regulators, build on experiences, and then proceed to develop of regulations."

Source: conversation with Gasnor stakeholder

GOVERNMENT SUPPORT

6 October 2011, the Government presented its budget proposal for 2012, which included pro-NGV taxation provisions

- Auto diesel tax proposed increased in line with inflation
- The proposed gasoline tax increased slightly less than the expected inflation rate
- CO2 tax increase of 1 cent per liter for gasoline and diesel
- No tax for natural gas and biogas

Tax on CO2 to pay with the first registration of the car

The CO2 “tax” component is calculated on basis of the type of vehicles as well as the emission amount.

- 0-120 g / km = €0
- 120-140 g / km = € 93,90
- 140-180 g / km = € 94,71
- 180-250 g / km = € 220
- Over 250 g/km = € 354

Source: Ministry of Finances: www.statsbudsjettet.no

To stimulate vehicles with low emissions, the government proposed new tariff by 2012

- Government proposes to scale down all amounts given in the CO2 component by2 5 g/km by 1January 2012
- There will only be deductions granted for cars with emissions below 110 g/km, compared to the current limit of 120 g/km
- New deduction amounts to € 97

3 Low Emissions Zones are in preparation

- Norway has not yet established any statutory basis for LEZs, but a new section under the Norwegian Road Traffic Law currently is being prepared for a national scheme
- Norway has an advanced electronic paying and controlling system for charging toll-road projects in 40 locations around the country, and the Norwegian LEZs will be created on the basis of this framework

Source: lowemissionzones.eu

Few governmental incentives exist to develop facilities for biogas production

- No tax on bioenergy/biogas
- Bioenergy programs support several projects:
  - *Innovation Norway:* promotes nationwide industrial development contributing towards innovation and promotion. It supports activity within construction of heat sales, farm heating, greenhouse and biogas
  - *ENOVA:(Norwegian National Energy Agency)* The goal is to make environmentally friendly restructuring of energy consumption and energy generation easier for public and private enterprises to choose simple, energy efficient and environmentally correct solutions
  - Trasnova: aims to reduce CO2 emissions from fossil fuel supporting projects that introduce new transport systems and technology

Source: IEA Bioenergy – task 37, Country report Norway, 15 April 2011

GAS INDUSTRY SUPPORT

Gasnor: the leading natural gas company

- Gasnor owners are major energy companies (Hydro, Statoil, BKK, E.on. Ruhrgas, Haugaland Kraft, Total, and Norske Shell)
- Gasnor distributes natural gas through pipelines (both low and high pressure), as CNG and as LNG
- Gasnor also delivers LNG to other gas distribution companies in Norway and some LNG as fuel for heavy duty trucks and buses in England and Sweden

Gasnor's main focus is on LNG for marine applications

- Focus on the use of LNG and liquefied-to-compressed natural gas(L-CNG)
- Work on biogas to convert it into liquid biogas
- Little interest on commuter cars: only buses and trucks
- Will continue to support existing fuel stations

Gasnor's first LNG supply trucks

Source: conversation with Gasnor stakeholder

Gasnor has a clear vision of the LNG pathway to the future

- "Bunkering for ships is not going to be a big issue to overcome. First we start on the ships and then will focus on trucks as well. Moving from ships to trucks in the port provides a synergy that we will activate at some point in the future but not at first."

Bunkering of Coral Methane by Pioneer Knutsen

Conversation with Gasnor stakeholder; Photo:LNG fuel for ships, A.Skervheijm, Gasnor, 10.2010

NATIONAL LAWS & REGULATIONS

Regulations and bureaucracy generally are transparent and efficient, but regulations can change suddenly

- The overall freedom to start, operate, and close a business is strongly protected under Norway's regulatory environment
- Regulations, standards, and practices often favor Norwegian, Scandinavian, and European Economic Area investors

Source: The Heritage Foundation, 2011 Index of economic freedom

Foreign investment is well accepted

- The government screens new investment and restricts investment in sectors in which it has a monopoly and sectors that are considered politically sensitive, such as fishing and maritime transport
- Residents and non-residents may hold foreign exchange accounts
- There are no restrictions on payments, transfers, or repatriation of profits. With a few exceptions, foreign investors may own land

Source: The Heritage Foundation, 2011 Index of economic freedom

COMMENTS BY STAKEHOLDERS

COMMENTS BY STAKEHOLDERS

"Lack of infrastructure is perhaps the greatest barrier to increased use of natural gas in Norway."

Gasnor

COMMENTS BY STAKEHOLDERS

"The transition to an increased use of LNG as fuel will not only represent considerable business opportunities for the Norwegian maritime industry, it will also provide a new market for Norwegian gas."

Trond Giske,
Norwegian Minister of Trade and Industry

Source: DNV, 24 May 2011

"LNG-fuelled marine transportation is no longer an interesting concept, but an economically positive reality"

Tor E. Svensen,
President of DNV

Source: "LNG-fuelled Shipping Gaining Momentum", NGV Global, September 23, 2010

COMMENTS BY STAKEHOLDERS

- "LNG is a "near perfect" solution for heavy vehicles where you can replace heavy fuel oil and diesel.
- Gas may not be the best solution for cars. Hybrid electrics could be better.
- Diesel, on the other hand, should be 'punished.'"

Conversation with Gasnor stakeholder

What do you see as the challenges and opportunities for natural gas as a transport fuel in Norway?

- "The opportunity is mainly in the shipping sector, particularly for the goods market
- There is not much interest in road vehicles although we would like to see more with garbage trucks and buses. I'm not very optimistic about NGV road traffic; the focus is more on electric vehicles
- Truck owners are hesitant not to be able to take their trucks on gas due to lack of fuel infrastructure."

Consultant to Gasnor

CONCLUSIONS

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- Energy environment
- Gas industry support
- Government support
- NGV market development
- Legal and regulatory framework for CNG station development
- Investment environment

Energy Environment

- Norway will continue to be an important gas supplier into the future and the gas will be mostly exported and used less domestically due to a relatively small distribution network
- Norwegian energy policies promote the use of renewables (especially hydro power)
- Great potential for biogas for the future; also to be transported as liquefied biogas

Gas Industry Support

- Gasnor has a clear focus on the large-scale use of LNG, in the first instance for ships and in future to include trucks serving and servicing ports
- There is no real support for CNG in light duty vehicles although a small CNG station network is likely to stay in place
- LNG stations, L-CNG stations and liquefied bio-gas will be aggressively promoted
- Norway is and will continue to lead the way for LNG in shipping

Government Support

- Government support is more focused on zero emission vehicles (electric and hydrogen cars); a ban on fossil fuel cars is still possible but not likely
- Programs and grants support research on biogas
- General support for renewable fuels should result in wider support for biogas
- Government takes non-restrictive approach to LNG for the transport sector, relying on gas industry expertise

NGV Market Development

- The market for light duty CNG vehicles will be only marginal due to a lack of focus from the gas industry and the limited pipeline network that is restricted (more or less) to the west coast
- CNG buses will continue to see growth
- Buses and heavy trucks on LNG ultimately will expand as the marine LNG market grows
- Norway will continue to be an atypical NGV market due to economics, gas networks, and availability of LNG

Legal and regulatory framework for CNG station development

- Standards used for fuelling station are taken and transposed from Europe and United States, thus satisfying the small market for CNG
- Gasnor will be instrumental in creating standards and regulations as they gain more experience with LNG in the marine and heavy duty bus and truck markets

Investment Environment

- Entrepreneurial activity is well supported by prudent and transparent regulations governing investment and the financial sector
- High level of business freedom has produced a commercial environment that is both innovative and resilient
- Investment in the LNG infrastructure is likely to come from domestic companies that will control the energy market. No external investment is seen needed

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