

Autogas in Europe, The Sustainable Alternative

An LPG Industry Roadmap

2013 Edition





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FOREWORD FROM THE PRESIDENT



Since the publication of the first edition of this Autogas Roadmap in 2008, the Autogas sector has seen some impressive growth and a cursory look at the number of Autogas cars in use across Europe tell us a simple story: The European driver likes Autogas.

A few examples – in the years 2007-2011 the number of Autogas cars in Germany rose from 200,000 to 455,000, in Italy from 1 million to 1,787,000, and looking outside of the EU to Turkey, now the world's leading Autogas market, 4 out of every 10 private cars runs on Autogas. As demonstrated in this publication, the benefits of in both environmental and economic terms of using Autogas are significant – the uptake we have seen across the continent is already saving millions of tonnes of CO₂, clearing the air in our often unexpectedly polluted urban areas, and offering millions of Euros of reductions in external costs.

There is often talk in Brussels and in national capitals of the need and the difficulty to break the duopoly of conventional fuels, petrol and diesel, in road transport – as the figures above show, the evidence from our sector is that not only is this possible but that it is happening right now. However, both the Autogas sector and policy-makers must acknowledge that there is much further work to be done if Autogas is to fulfil its potential of accounting for 10% of the passenger car fuel mix by 2020.

The European Autogas sector is committed to continued investment in its product, its network, and its people in order to maximise the opportunity of spreading Autogas to as many of Europe's citizens as possible. Although Autogas is by far Europe's leading alternative fuel, with more than 40.000 filling stations across the continent, there are still areas where development of this network is in its early stages. If we take the example of Spain: In 2007, there were only 32 dispensing points in the entire country. However, after significant investment from the local Autogas industry working in partnership with other stakeholders, this number has risen to more than 470 in just 5 years, and by 2014 will reach around 750. This is just one example- there have been similar investments made in a number of countries across Europe, which until recently had few Autogas cars and stations - Greece, Serbia and Ukraine all fall into this category.

Such commitments and investments made by the Autogas sector require public policy that offers both the right signals to stakeholders, and the immediate incentives for consumers. The policy-makers "toolbox" in section 5 of this publication details a number of measures which European, national and local policy-makers can make use to further stimulate uptake of Autogas. While there is no doubt that appropriate excise duty, not just for Autogas but for all alternative fuels, should be a cornerstone of alternative fuels strategy, there are many other incentives which can be applied to facilitate the move away from more polluting and high carbon conventional fuels.

This combination of the right public policies along with commitments and investments on the part of the Autogas sector can continue to transform the potential of Autogas into reality. To this end, AEGPL and its members look forward to strengthening cooperation with stakeholders across Europe.

The AEGPL wishes to thank the many industry representatives and external experts whose consistent and high-quality input contributed greatly to the development of this document and the ideas that underpin it.

Ramón de Luis Serrano
President of the AEGPL

A handwritten signature in black ink, appearing to read 'R. Serrano', written over a blue background.



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EXECUTIVE SUMMARY

The European Autogas industry is looking to the future. Autogas, the commonly used term to describe Liquefied Petroleum Gas¹ (LPG) used as an automotive fuel, is poised to play a larger role in the European road transport fuel mix, particularly as regards use in passenger cars.

Autogas, already Europe's most widely used alternative fuel, offers a series of specific advantages. Its particular characteristics, both as a fuel and an industry, make it ideally suited to the contemporary energy and environmental paradigm, in which Europe faces the challenge of balancing the diverse imperatives of security, sustainability and competitiveness.

As an environmentally friendly and economical fuel, Autogas can help keep Europe's citizens moving while minimizing the impact of transport on human health and the natural environment. This combination of attributes makes it an obvious alternative as part of a diverse and sustainable energy mix.

Autogas already powers over 10 million vehicles across Europe*, representing close to 4% of the overall European passenger car fleet and playing a substantial role in numerous countries. However, due to its heterogeneous emergence and development, the European market remains fragmented and characterized by a high degree of un-exploited potential. Successful development in a number of national markets, both in Europe and around the globe, demonstrates that given the necessary commitment on the part of the sector and public policy-makers, Autogas can emerge as a key element of the energy portfolio, yielding considerable environmental and socio-economic benefits.



Independent analysis based on TREMOVE, a modelling tool used by the European Commission to underpin policy development in the transport domain, demonstrates that the growth of the Autogas market from the 2008 share of 2% to a 10% share of the European passenger car fuel market by 2020 would generate substantial benefits. Notable advantages would include 350 million tonnes of avoided CO₂ emissions, - equivalent to the combined total Greenhouse Gas output of Belgium, Sweden, Bulgaria and Lithuania in 2005 - and over €20 billion worth of savings on external costs associated with damage to human health and the natural environment.

Transforming this considerable potential into reality can only be achieved through an immediate and concerted commitment on the part of the Autogas industry and policy-makers at European, national and local level. This process can be rapidly launched since it would not require massive investment in infrastructure or R&D. The technology exists today!

As a green alternative with substantial scope for technological evolution and a source of high-skill jobs across the EU, Autogas can also play a role in immediately reinvigorating Europe's automotive industry, thereby contributing to the broader objectives outlined by the European Commission in the CARS 2020 Action Plan it proposed in November 2012.

The European Union, as the established global leader in the pursuit of a more sustainable energy model, can and should play a leading role in ensuring that Autogas' potential contribution to meeting Europe's energy and environmental objectives is optimized.

¹ LPG is a generic term covering butane, propane and mixtures thereof.

* For the purpose of this document, 'Europe' is defined as the EU28 + Norway, Turkey and Switzerland



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PART 1. AUTOGAS IN A NUTSHELL

■ What is Autogas and where does it come from?

Autogas is the term used to describe LPG (Liquefied Petroleum Gas) used as an automotive fuel. LPG is a blanket denomination covering propane (C_3H_8) and butane (C_4H_{10}), two naturally occurring gases which are easily converted to liquid form through the application of moderate pressure.

LPG is primarily derived during the extraction of natural gas, and is also produced in refineries. It is a highly versatile energy source with hundreds of applications in the home, in industry, agriculture, and - of course - as an automotive fuel². Often underexploited in the past due to unsustainable practices such as flaring and venting, it is increasingly being recognized as a unique and valuable energy resource.

Visit the AEGPL website to learn more.

■ What advantages does Autogas have to offer?

Both as a product and an industry, Autogas is ideally placed to play a role in helping Europe meet its energy and environmental challenges:

- Reducing pollution: One diesel vehicle emits the same quantities of NO_x as over 20 LPG vehicles, and PM (particulate matter) emissions from LPG-fuelled vehicles on an urban cycle are below reliably measurable levels³;
- Mitigating climate change: Well-To-Wheel analysis demonstrates that an Autogas-fuelled vehicle generates 14% and 10% fewer CO₂ emissions than its petrol and diesel-run equivalents respectively;

Autogas also emits almost no black carbon, a pollutant which is also the second biggest contributor to climate change

2 Globally, Autogas currently accounts for 9% of total LPG consumption.

3 Findings of the 2003 European Emissions Testing Programme: <http://www.aegpl.eu/media/81357/eetp%20english%20version%20official%20report%2018%2002%202004.pdf>.

- **Enhancing security of supply:** With its diverse origins, flexible supply chain and increasing production levels, LPG is an alternative energy Europe can rely on. According to the BP statistical review, LPG from NG fields alone could last at least 60 years at the current reserve to production ratio;
- **Reducing fuel costs for citizens:** By virtue of its strong supply prospects, LPG is cheaper than conventional fuels. Furthermore, as a result of its environmental advantages, it benefits from a favourable tax framework, making it by far the most affordable transport fuel option for citizens;
- **Stimulating competitiveness and employment in Europe:** Composed largely of SMEs, the Autogas industry employs thousands of citizens from all across Europe in high-skill jobs. Moreover, European companies are able to export their technology abroad, thereby contributing to Europe's goal of moving toward a knowledge-based economy.

Powering 10 million vehicles across Europe and accounting for almost 4% of the passenger car fleet road transport fuel mix, Autogas is already the leading alternative fuel in the EU. Through a joint effort on the part of industry and public authorities, there is potential for rapid and considerable growth, particularly in the passenger car sector.

Autogas could account for a 10% share of Europe's passenger car fuel mix by 2020.

This would yield considerable benefits for governments, individual citizens and society in general.





PART 2. ADVANTAGES OF AUTOGAS FOR END-USERS AND SOCIETY AS A WHOLE

2.1 Cleaner fuel for a greener Europe: Autogas as the eco-friendly option

Of the many advantages of Autogas, the most significant may be its contribution to improving air quality, particularly in urban areas, where air pollution poses a serious threat to human health and diminishes quality of life for all citizens. Autogas is the most effective option for converting the existing pool of petrol-fuelled cars into more environmentally friendly vehicles.

In a context of increased public awareness of the importance of environmentally responsible energy use, there is a tendency for all energy sectors to position themselves as “clean”. Indeed, the term is so frequently invoked that its meaning is often obscured. Autogas’ status as an eco-friendly fuel is based not on rhetoric but rather on a solid platform of tangible and scientifically-proven advantages.

■ So what does “clean fuel” mean?

In recent years, various independent studies have confirmed Autogas’ green credentials.

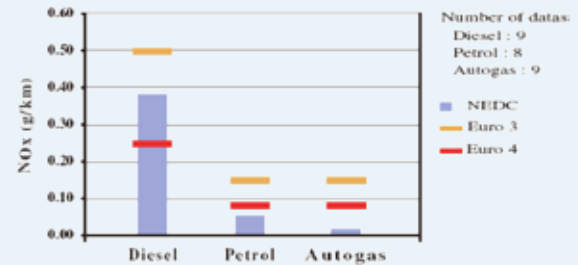


Figure 1: Overview of results of EUROPEAN EMISSIONS TESTING PROGRAMME (EETP)⁴

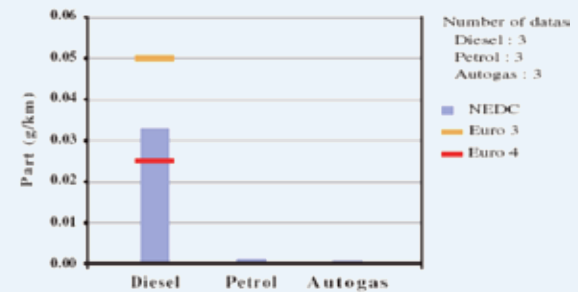
Key findings of the EETP study

- Autogas-fuelled cars generates 96% less NOx than diesel and 68% less than petrol
- Autogas vehicles on an urban cycle are below reliably measurable level

NOx emissions



PM emissions



NEDC: New European Driving Cycle

⁴ Findings of the 2003 European Emissions Testing Programme <http://www.aegpl.eu/media/81357/eetp%20english%20version%20official%20report%2018%2002%202004.pdf>

Figure 2: Overview of results of the Auto-Oil II Programme ⁵

Auto-Oil II Programme

The report highlights no less than 16 specific advantages of Autogas, including:

- Relatively high octane number provides room for increases in the compression ratio and fuel efficiency of dedicated engines;
- Autogas has lower particulate emissions and lower noise levels relative to diesel, making it more attractive in urban areas;
- Its low emissions have low greenhouse gas effect and low NOx precursors;
- It contains negligible toxic components;
- It has very low sulphur levels giving rise to insignificant sulphur dioxide emissions;
- Autogas offers a series of comparative advantages as regards non-regulated pollutants:
 - PAH (polycyclic aromatic hydrocarbons) and aldehyde (formaldehyde, acetaldehyde, acrolein) emissions are much lower than diesel-fuelled vehicles;
 - Benzene, Toluene, Xylene (BTX) emissions are lower than petrol-fuelled vehicles;
 - Summer smog formation potential is lower than that of petrol.

■ Why clean fuel matters

A broad scientific consensus is emerging as to the serious impacts of pollutants, including combustion-related fine particulate matter (PM), on human health. The most recent scientific findings point to the adverse health effects of some PM components, black carbon particles in particular are linked with cardiovascular health effects and premature mortality .⁶

“Evidence shows that air pollution at current levels in European cities is responsible for a significant burden of deaths, hospital admissions and exacerbation of symptoms, especially for cardiorespiratory disease. Exposure to air pollutants is largely beyond individuals’ control and requires action by public authorities at the national, regional and even international levels”

The World Health Organisation (WHO) ⁷

Figure 3: Urban population in the EU exposed to air pollutant concentrations above the WHO reference levels (2008-2010)⁸

Pollutant	Exposure estimate (%)
PM _{2,5}	90-95
PM ₁₀	80-81
O ₃	>97
NO ₂	6-12
SO ₂	58-61
CO	0-2
Pb	<1

Diesel Exhaust Fumes and Cancer

As well as the well-documented negative effects that engine pollution has on cardio-vascular health, the WHO confirmed in 2012, after years of research, that there is a clear link between diesel engine fumes and lung cancer. Diesel exhaust fumes are now classified as **carcinogenic to humans (Group 1)**. Dr. Christopher Portier, Chairman of the WHO working group stated “The scientific evidence was compelling and the Working Group’s conclusion was unanimous: diesel engine exhaust causes lung cancer. Given the additional health impacts from diesel particulates, exposure to this mixture of chemicals should be reduced worldwide”

More information can be found from the International Agency for Research on Cancer, an extension of the World Health Organization. www.iarc.fr

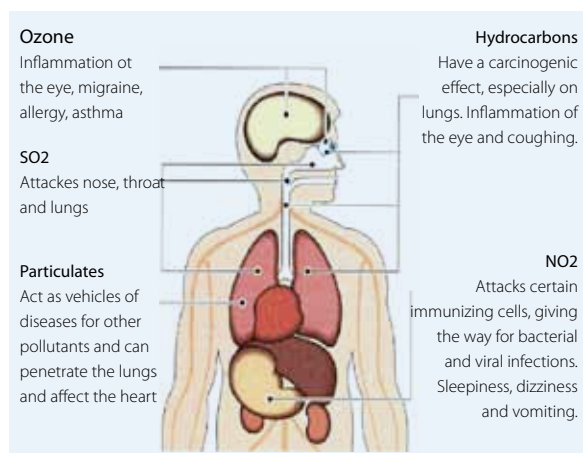
⁵ Auto-Oil II Programme: <http://ec.europa.eu/environment/archives/autooil/index.htm>.

⁶ WHO ‘Review of evidence of health aspects of air pollution – REVIHAAP’ First results, published in January 2013

⁷ WHO, <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality>

⁸ European Environment Agency Air Quality in Europe 2012 report

Figure 4: Health impacts of pollutants



In addition to affecting human health, certain air pollutants also have damaging environmental impacts. Nitrogen in particular, which is a natural fertilizer, causes biodiversity loss by favoring the growth of nitrogen-hungry plants over others, a phenomenon called eutrophication. In 2025 62% (420000 km²) of Natura 2000 protected area will still be under threat⁹. Additional nitrogen release also results in acidification.

■ **Potential solutions:**
Which ones, when, and at what cost?

It is encouraging to observe the steps taken by the EU to address concerns over emissions from conventionally-fuelled vehicles and their impact on public health and the environment.

“A considerable reduction in NOx emissions from diesel vehicles is necessary to improve air quality and comply with limit values for air pollution.”¹⁰
European Commission

While such an improvement can be achieved, it requires the installation of particulate filters and de-NOx after-treatment

2.2 Autogas as a weapon against climate change

Just as Europe needs to address the issue of air quality in its cities, it must also confront the more global challenge of climate change. As an increasingly clear scientific consensus emerges, notably thanks to the work of the International Panel on Climate Change (IPCC), a series of points have become clear:

- Climate change is linked to human activity;

devices which increase the cost of the vehicle and decrease its fuel efficiency. Improving the emissions profile of a vehicle is considerably easier and more cost-effective when it is running on an inherently clean fuel such as Autogas.

■ **Autogas:**
the immediately available clean alternative

As outlined above, Autogas, by virtue of its simple molecular structure, is an inherently clean alternative. While the development of legislation designed to reduce the impact of conventionally fuelled vehicles on human health and the environment is commendable, it will inevitably take time before its impact can be observed.

Black Carbon and Climate Change

In January 2013, a landmark study by the *Journal Geophysical Research – Atmospheres* published findings that black carbon, commonly known as soot, accounts for more than twice the climate impact than previously thought, second only to carbon-dioxide. Furthermore, it noted that reduction of such emissions, which are caused by diesel engines, wood and coal burning, would have the added benefit of *immediately* slowing down warming and improving public health.

Co-lead author Tami Bond from the University of Illinois at Urbana-Champaign stated “Policy makers, like the Climate and Clean Air Coalition, are talking about ways to slow global warming by reducing black carbon emissions. This study shows that this is a viable option for some black carbon sources and since black carbon is short-lived, the impacts would be noticed immediately”

- While individual efforts are valuable, the scope of the problem is such that concerted action driven by public policy is essential;

9 Source: findings of the International Institute for Applied System Analysis (IIASA) presented to the 5th TSAP stakeholder expert group in Brussels on 3 April 2013
10 Recital 6 of Regulation (EC) No 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information.
11 European Environment Agency <http://www.eea.europa.eu/highlights/most-carmakers-must-further-improve>

- These measures must be rapidly conceived and implemented if they are to be of optimal effectiveness.

Road transport is responsible for approximately 17,5% of Community Greenhouse Gas emissions¹¹. It is therefore a sector for which climate change mitigations measures must be implemented.

■ So what is the way forward for the road transport sector in Europe?

Too often, debates surrounding this question are polarized between two untenable alternatives; unsustainable dependence on conventional fuels and the immediate phasing-in of new technologies, whose effectiveness, availability, and cost have not yet been clearly established.

The time has come to abandon this technological fatalism and consider other alternatives. Combining the certainty and immediate availability of a conventional fuel with meaningful advantages in terms of CO₂ reduction, **Autogas can serve as a third way, bridging the gap with the transport fuel mix of the future** and facilitating the transition toward a low-carbon energy model.

“Autogas is the only fuel that can act as a bridge between our existing oil habits and a cleaner, less oil intensive future. To begin with, it contains more hydrogen and less carbon, so it is both better for the planet and also more easily refined into hydrogen (for fuel cells). LPG would also allow us to continue to use some of our existing refining and distribution assets.”

Paul Middleton, The End of Oil, 2007

■ Autogas for a cooler planet

Key facts about Autogas and CO₂ emissions¹²:

- Tank-To-Wheel (tailpipe) emissions: 12% lower than a petrol-fuelled car;
- Well-To-Wheel emissions: 14% lower than a petrol-fuelled car, 10% lower than diesel;

- Well-To-Tank emissions: 37% and 44% lower than for petrol and diesel respectively, are the lowest of any fossil energy.

Furthermore, Autogas, (propane/butane) is not considered by the International Panel on Climate Change (IPPC)¹³ as a greenhouse gas.

Recognizing these advantages, the European Parliament has **“called on the Commission to consider the role and potential of gaseous alternative fuels, such as liquefied petroleum gas [Autogas] and natural gas, which can contribute to the immediate reduction of CO₂ emissions and to the diversification of the energy supply”**.¹⁴

In addition to this, in 2013 the European Commission published its ‘Clean Power for Transport’ package, which aims at reducing carbon emissions from transport through the uptake of alternative fuels including Autogas.

“If we don’t take action very soon, we could unleash runaway global warming that will be beyond our control and it will lead to social, economic and environmental devastation worldwide...There’s still time to take action, but not much.”¹⁵

Tony Juniper, Friends of the Earth

Based on conservative estimates, the 10 million vehicles already running on Autogas in Europe represent an annual savings of at least 3.5 million tonnes of CO₂¹⁶. In light of its dual advantages of CO₂ reduction¹⁷ and immediate availability, there is a compelling case for a greater role for Autogas in the EU road transport mix.

Autogas makes an immediate and meaningful contribution to the EU’s efforts to reduce CO₂ emissions from vehicles and to the broader goals of reducing total EU CO₂ emissions by 20% by 2020 and meeting national targets on climate change mitigation within the framework of the post-Kyoto regulatory framework. The technology is ready now. The benefits will be felt for generations.

¹² JEC Well-to-Wheels study Version 3, year 2008, assessment of a wide range of automotive fuels and powertrains relevant to Europe in 2010 and beyond: <http://ies.jrc.ec.europa.eu/WTW>

¹³ IPCC website: <http://www.ipcc.ch/>.

¹⁴ European Parliament resolution of 24 October 2007 on the Community Strategy to reduce CO₂ emissions from passenger cars and light-commercial vehicles.

¹⁵ In response to a 2005 finding that a vast expanse of western Siberia is undergoing an unprecedented thaw that could dramatically increase the rate of global warming.

¹⁶ Calculation assumes emissions of 201 g/km for an average car in traffic in 2007 (source EEA), calculation made with a CO₂ offset of 12% per car, with a mileage of 16.000 km/annum.

¹⁷ On the basis of the agreement reached in December 2008 by the European Council and Parliament on a regulation setting emission performance standards for new passenger cars, in the case of bi-fuelled vehicles (petrol/gas), Member States shall use only the figure measured for gas.

2.3 Autogas as part of a more secure European energy mix

In developing an energy policy equipped to meet the daunting challenges of today and tomorrow, the European Union has wisely placed security of supply at the heart of its strategy. Fundamental to this strategy is the recognition of the need to promote a diverse energy mix, wherein a wide range of sources, with equally diverse origins, combine to meet Europe's needs. This diversification policy is being vigorously pursued in certain sectors, notably electricity generation in which renewable energy looks set to play an increasingly significant role in the EU energy portfolio.

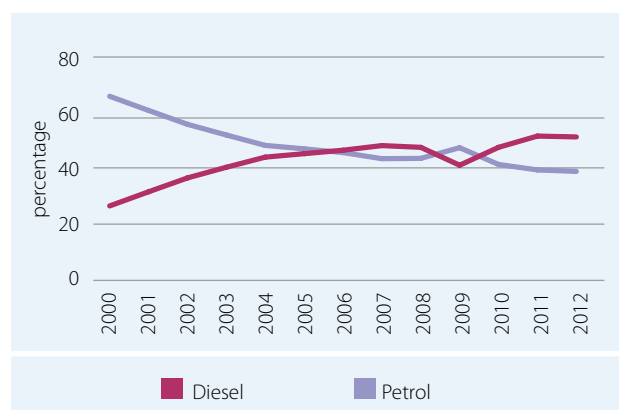
Conversely, the EU's road transport fuel mix remains heavily dependent on two conventional options, petrol and diesel. This is of particular concern in the context of the ongoing dieselisation of the road transport fuel mix, not only in Europe but in other major markets around the globe.

This phenomenon, which continues to have a detrimental impact on air quality and human health, is also a concern in the context of Europe's energy supply security.

Overreliance on any one fuel constitutes a strategic weakness. This problem is exacerbated by the fact that the global

diesel supply does not always grow at a rate commensurate with demand, making it subject to frequent and volatile increases in price.

Figure 5: Registration of new passenger cars in the EU (2000-2012)



Source: EEA, Monitoring CO₂ emissions from new passenger cars in the EU, Summary of data for 2012

By sheer virtue of its immediate availability as an alternative fuel option, Autogas contributes to the diversification of the European fuel portfolio. Even more importantly, the particular attributes of the product and the industry make it perfectly suited to enhancing Europe's energy security.



■ Strong supply prospects

As outlined above, Autogas is in fact LPG used as a vehicle fuel. Characterized by a highly fluid trading system, the contemporary LPG market is truly globalized. Indeed, LPG scores nearly twice as high as both petrol and diesel on the OECD's Trade Openness Index¹⁸. In this context, the global surplus of LPG constitutes an opportunity to re-balance the European road fuel mix, particularly in the context of concerns over increasing EU dependency on diesel imports.

Figure 7: Global LPG Base Surplus, million tonnes



Source: IHS Energy Insight

With an annual forecasted global LPG surplus ranging from 15-17 million tonnes through 2017, there is every reason to believe that Autogas can further solidify its position as Europe's leading alternative fuel in the coming years. These robust prospects are underpinned by substantial reserves of LPG's source materials, natural gas and oil. The International Energy Agency's 2011 World Technology Outlook notes that even in a scenario without a policy framework aimed at curbing demand for oil:

"The global natural gas resource base is vast and widely dispersed geographically. Conventional recoverable resources are equivalent to more than 120 years of current global consumption, while total recoverable resources could sustain today's production for over 250 years"

IEA, World energy Outlook 2011.

There are therefore no concerns as to the availability of LPG for the foreseeable future.

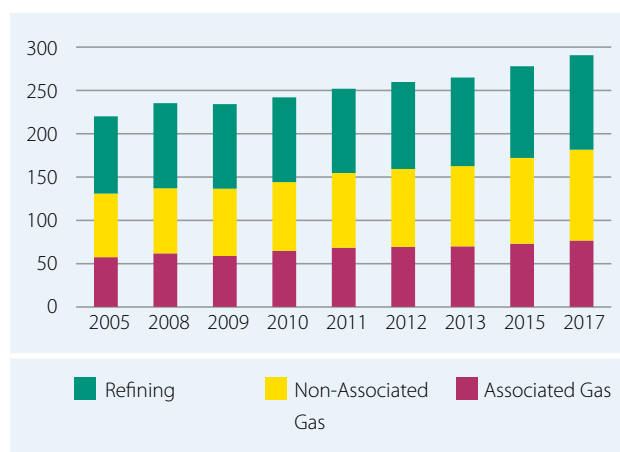
■ Diverse origins

Currently, there are three distinct sources of LPG:

1. Processing during gas extraction (aka non-associated gas—including LNG)
2. Processing during oil extraction (aka associated gas)
3. As a naturally occurring product during the refining of crude oil

At present, 60% of global LPG production comes from sources 1 and 2, with production from natural gas fields constituting an increasingly significant share.

Figure 8: Global supply of LPG by source, in millions of tonnes



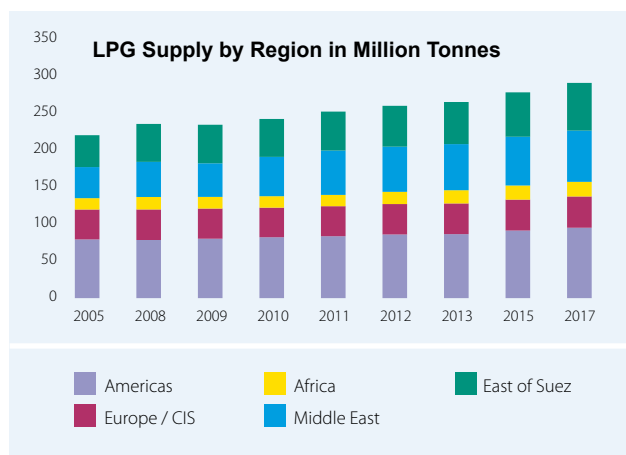
Source: IHS Energy Insight

Furthermore, production of bio-LPG has started and considerable potential for future development has been identified. The European Commission's CARS 21 final report of 2012 recognizes that the injection of sustainably produced bio-propane could further reduce CO₂ emissions from Autogas.

The diversity of LPG's supply base is reflected not only in its various physical origins, but also in the geographical diversity of its production.

18 NERA Economic Consulting Report, <http://www.europia.be/content/default.asp?PageID=412&DocID=13597>.

Figure 9: Evolution of LPG production by region up to 2020



Source: IHS Energy Insight

Flexible supply chain with multiple entries into Europe

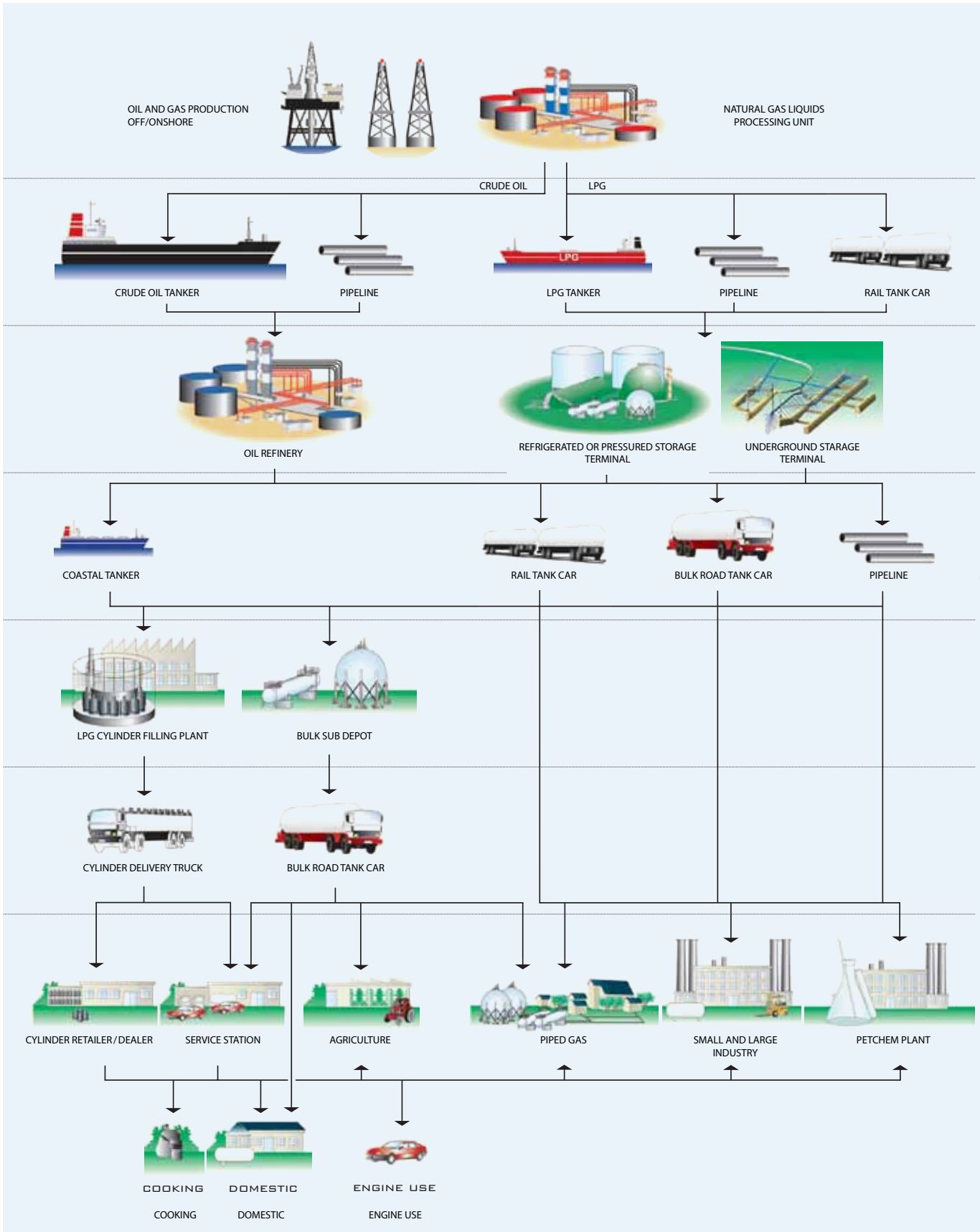
In a climate of increasing uncertainty and concern over access to global energy resources, LPG's highly flexible supply chain is a significant advantage. Vulnerability to supply disruption is greatly reduced thanks to the numerous routes and means (ship, rail or road) by which LPG can be transported. LPG is particularly conducive to shipping as it requires considerably less pressure than natural gas to convert it into liquid form.

With increasing supply levels, numerous physical origins and geographically diverse supply sources, LPG can be counted on to help Europe meet its road transport demand. This is particularly significant in the context of ongoing uncertainty over Europe's energy security, so dramatically underscored by the recent gas supply crisis.

The outlook for LPG supply is sufficiently robust to accommodate a rapid and sustainable increase in the use of Autogas in Europe. Indeed, a jump in European consumption of Autogas from 8.5 million tonnes in 2011 to 20.1 million tonnes in 2020 is a realistic objective. Due to the projected global surplus, this could be achieved without provoking substantial supply tensions or price increases. At a time when European citizens and policy-makers are badly in need of alternative transport solutions, the emergence of Autogas is an exciting and timely development. Diversification is security and security is strength.



Figure 10: Overview of the LPG production and distribution chain



Source: World LP Gas Association

STEP 1 Production

The production of "field grade LPG" is the result of the treatment of NGLs. This treatment is necessary to produce:

- a) Oils that are suitable for transport to refineries and
- b) Natural gases that correspond with commercial specifications.

STEP 2 Transportation

While crude oil is transported from the production sites to refineries by tankers or pipelines, LPG is transported to storage terminals by large LP Gas carriers, pipelines or train.

STEP 3 Refining and storage

Butane and propane can also result from the oil refining processes. LPG storage terminals store products that are imported in large quantities.

STEP 4 Transportation

The LPG is then delivered by train, road, coastal tanker or pipeline to cylinder filling plants and intermediate-size storage areas.

STEP 5 Bottling and storage

Cylinders are filled with butane and propane at bottling plants. LPG is generally stored in pressurised tanks (vessels or spheres) in intermediary storage centres.

STEP 6 Distribution

LPG can be transported virtually anywhere, either in cylinders or bulk. Trucks transport butane and propane cylinders from the bottling plant to retailers, as well as to private and professional customers. Meanwhile, small bulk trucks distribute LPG from the storage centres to various consumers.

STEP 7 End users

LPG is easily available to end users through cylinder sales points such as commercial stores or service stations close to their locations. Customers requiring larger volumes can purchase LPG in bulk.

Equipment manufactures

Companies around the world provide filling, storage, controlling and safety equipment as well as services to the LPG industry and end users.



tank manufacturing



cylinder manufacturing



engine use LPG equipment



LPG appliances and equipment

2.4 Autogas as an economic alternative

In the context of concerns over the rising price of many essential products, including food, European citizens are particularly sensitive to the volatility of conventional transport fuel prices observed during recent years.

In addition to the broad social benefits stemming from its low level of pollutant and CO₂ emissions, Autogas offers the additional advantage of being more affordable than any other commercially available transport fuel.

■ The low price of Autogas is the result of two distinct factors:

- **A surplus of availability and strong long-term supply prospects**

As outlined in the previous section, due to an absence of supply tensions, Autogas is a highly affordable fuel, cheap-

er than both petrol and diesel, independent of taxation or costs associated with transport to market. The Autogas market is sufficiently long to support a rapid and substantial growth in demand up to 2020.

- **The application of favourable tax rates due to its environmental advantages**

The framework for excise rates on energy products in the EU is established by Directive EC/2003/96. The integration of the external cost reductions - notably in terms of public health care - associated with the use of Autogas is reflected in the comparatively low excise rates applied to it. The minimum levels of taxation applicable to motor fuels in the EU are the following:





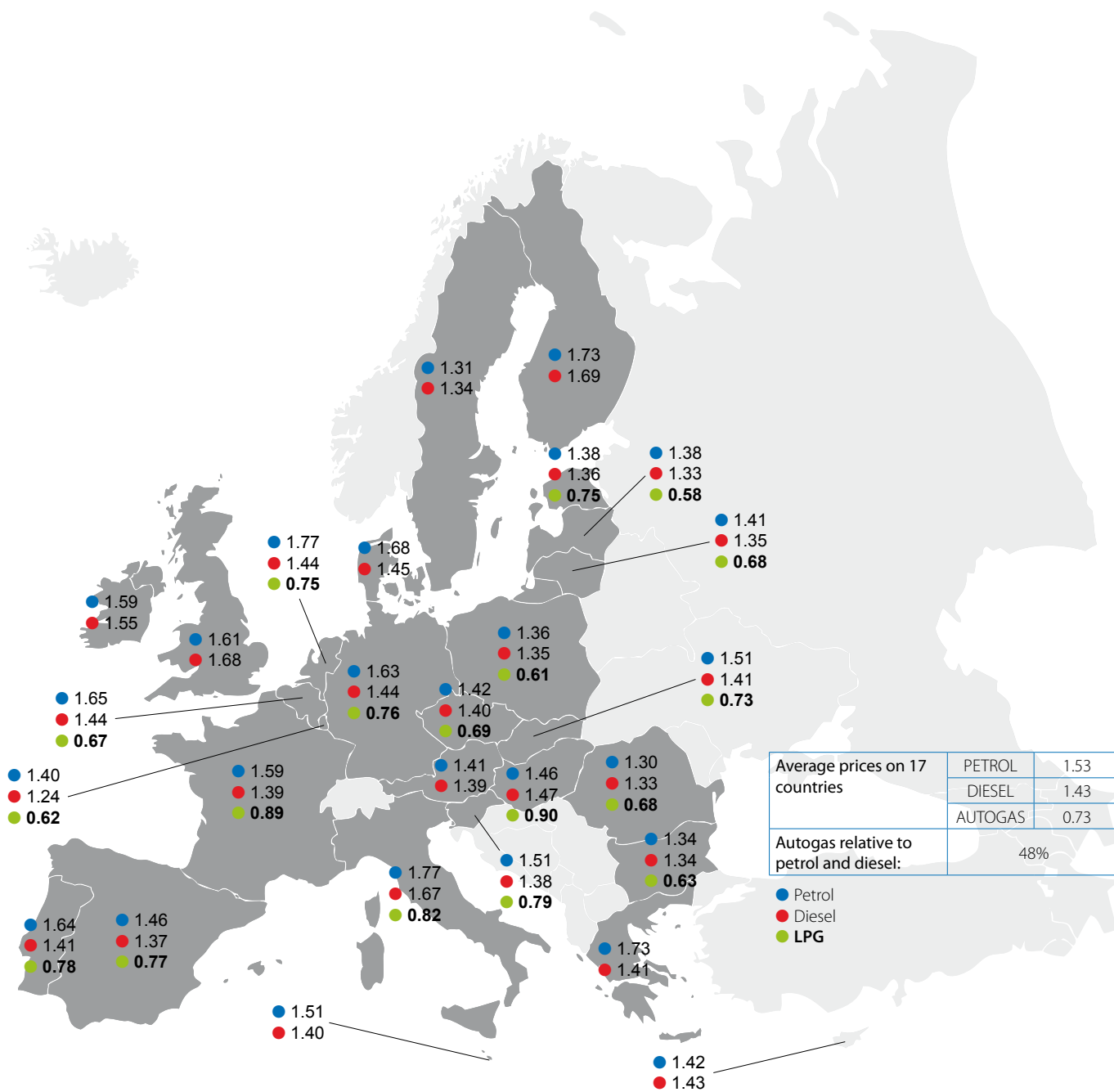
Figure 12: Overview of minimum excise duties on automotive fuels as foreseen in 2003/96/EC

	Current minimum excise duty rates	As of 1/01/2010	As of 1/01/2012 ¹⁹	As of 1/01/2014 ¹⁹
Unleaded petrol €/1000l	359	359	359	380
Diesel €/1000l	302	330	359	380
LPG €/Tonne	125	125	125	125

The Directive foresees exemptions allowing Member States to apply an excise duty of zero for both LPG and Natural Gas. Such favourable tax conditions simultaneously illustrate and reinforce LPG’s status as a green and affordable alternative fuel. As European citizens and policy-makers seek an appropriate balance between environmental and economic imperatives, Autogas is an increasingly appealing solution.

¹⁹ European Commission, COM (2007) 52.

Figure 13: An overview of average pump prices in €/l (VAT & excise duty included) in a selection of European countries in April 2013



Source: Oil bulletin, DG MOVE, European Commission

2.5 Autogas as a part of Europe's socio-economic fabric

By virtue of the particular characteristics of the industry and the product itself, Autogas makes a unique contribution to Europe's competitiveness and its social and economic development.



The European Autogas sector is:

- Significant, generating employment across Europe, including high-quality, skilled jobs for engineers and mechanics;
- Dynamic and primarily composed of SMEs operating in a genuinely liberalized market;
- Innovative, with gas feeding system designers constantly pursuing R&D developments aimed at enhancing the performance of vehicles running on Autogas. The technological leadership of European companies in this domain has allowed them to successfully export their know-how and capture a substantial share of overseas markets;
- Competitive, since for the reasons outlined above, Autogas is significantly less expensive than other commercially available fuels such as petrol and diesel;
- Responsible, as demonstrated by the participation of numerous Autogas operators in programmes aimed at preserving the natural environment and offsetting CO₂ emissions²⁰;
- Safe, since the safety record of Autogas is equal to – if not better than – that of conventional fuels, particularly since the implementation of active safety measures by the Autogas industry.

²⁰ Relevant examples include initiatives by the German LPG Association (<http://www.autogastanken.de>) and the Italian Gaseous Fuel Feeding Systems Association (<http://www.ecogas.it>).



PART 3. AUTOGAS IN EUROPE AND THE WORLD

3.1 Autogas in Europe: a wealth of untapped potential

Though it is Europe's leading alternative fuel with an extensive infrastructure network already in place, Autogas remains only a bit-player in the current mix. Powering over 10 million vehicles across Europe, Autogas currently accounts for 4% of the European passenger car fleet.

This current market is characterized by a high degree of heterogeneity, with rapid and substantial growth observed in certain countries and very limited presence in others.

This uneven distribution suggests that there is considerable scope for increasing the presence of Autogas in many European national markets. Over the past few years, success stories can already be observed in a number of countries:

- Italy:** In the past few years, in response to concerns over urban air quality, the Italian authorities have implemented measures to promote the use of gaseous fuels. As a result, 344,000 Autogas-fuelled vehicles arrived on the market in 2007 alone, with 279,000 more in 2008;
- Poland:** Autogas accounts for nearly 15% of the passenger car fuel mix, making it an essential component of the national fuel portfolio;
- Germany:** Thanks to a long-term commitment to supporting gaseous fuels on the part of the Federal government, the number of Autogas powered vehicles in the passenger car fleet increased by over 50% between 2008 and 2011, with sustained growth expected over the coming decade;
- Turkey:** Autogas accounts for 40% of the fuel mix of privately-owned cars.

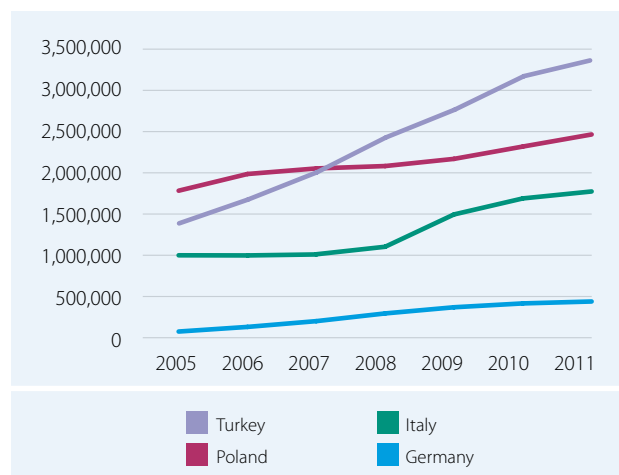
In those national markets in which Autogas is well-established, public policy makers - in cooperation with the Autogas industry - have played an important role in stimulating and maintaining the momentum needed to drive the sector. This growth is the consequence of a virtuous cycle wherein decision-makers guide citizens down a beneficial policy pathway by stimulating the growth of the market. This yields socio-economic benefits which reinforce the validity of the original policy.

An optimal exploitation of this type of cycle requires a stable and long-term strategy, notably characterized by the implementation of a taxation and incentive framework favouring the development of clean alternatives such as Autogas. Such measures are an effective means of overcoming reluctance on the part of drivers to make the initial investment associated with a switch away from conventional fuels.

Despite the potential exhibited in a selection of countries, the European Autogas market remains fragmented. Given its numerous advantages, particularly in terms of air quality, climate change, and energy security, Autogas can and should play a greater role in the energy mix across Europe. Indeed a Contact Group on alternative fuels, established by the European Commission, has highlighted the considerable potential for an increase in the current market share of Autogas.²¹

Autogas is perfectly compatible with contemporary energy and environmental challenges. As a unified single marketplace with an unmatched inclination towards progressive policy-making, the European Union is well-placed to exploit its advantages on an unprecedented scale.

Figure 14: Evolution of the number of Autogas vehicles in 4 European countries



Source: WLPGA Statistical Review of Global LPG

²¹ Report, 'Market Development of Alternative fuels', 2003, DG Energy & Transport, European Commission.

3.2 Autogas in the world

The development of the Autogas market is by no means confined to Europe. In countries around the globe, citizens and decision-makers have already embraced the movement. In 2011, Autogas was used to power more than 21 million vehicles globally, cementing its position as the world’s most widely used alternative fuel. This represents an increase of more than 60% since 2007. Its growing popularity is driven by the combination of its inherent environmental advantages and the establishment of an increasingly favourable regulatory framework in a diverse array of countries. Recognizing the potential of Autogas to contribute to meeting a wide range of environmental, social and economic challenges, decision-makers have moved to promote its growth:

- Providing citizens with information about nature and benefits of Autogas;
- Fiscal incentives (excise duty reflecting advantages of the fuel);
- Granting exemptions from congestion charges in urban areas;
- Granting exemptions from vehicle registration and road tax;
- Providing grants or low-interest loans for conversion to gaseous fuel system;
- Cooperation with car-makers in pursuit of technological development.

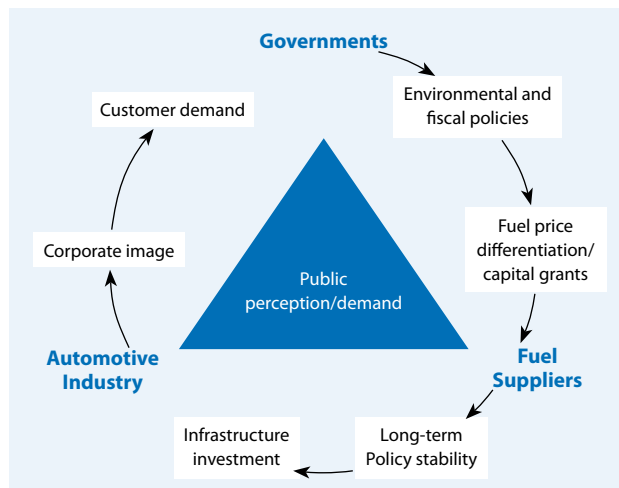
The beneficial impact of these steps is readily apparent. If Autogas already accounts for a significant and growing share of the overall road transport fuel mix in a series of countries, it is in no small measure thanks to the active support of national and local authorities all over the planet.

Figure 15: A statistical overview of the role of Autogas in 10 leading countries around the world in 2011

Country	Number of Vehicles	Number of dispensing sites
Turkey	3,335,000	9,419
Poland	2,477,000	5,700
South Korea	2,455,112	1,910
Italy	1,787,000	2,955
India	1,714,440	1,090
Russian Federation	1,400,000	4,500
Ukraine	1,300,000	2,422
Thailand	843,450	900
Serbia	550,000	500
Australia	513,562	3,703

Source: WLPGA

Figure 17: Growing the Autogas Market: A Virtuous Cycle



Public Authorities can play an essential role as a catalyst in this process, providing incentives to encourage citizens to take up alternative fuels such as Autogas. They can also contribute through the establishment of a clear and long-term regulatory framework that gives fuel suppliers and the automotive industry²² the stability they need in order to invest in this technology with confidence.

An optimal exploitation of this phenomenon can only be achieved if it is pursued on a European scale. As noted in the 2013 European Commission Communication on the deployment of alternative fuels, **“Initiatives to support alternative transport fuels exist at both EU and national level but a coherent and stable overarching strategy with an investment friendly regulatory framework needs to be put in place.”**²³

Through a concerted effort by policy-makers and the European Autogas industry, the shift from a fragmented collection of national markets to a cohesive and dynamic European sector can be achieved.

22 This includes not only car manufacturers but also vehicle dealers as well as producers and installers of Autogas conversion kits.
 23 European Commission Communication Com(2013)17 on the Clean power for transport – A European alternative fuels strategy’

PART 4. AUTOGAS IN EUROPE TOMORROW: A PART OF THE SOLUTION

4.1 Demonstrated benefits for citizens and society as a whole

One of the most consistent and accurate messages to emerge from recent debates on the future of the European energy model is the need for a diverse portfolio. Successfully managing the simultaneous pursuit of sustainability, competitiveness and security will require the application of a broad mix of technologies and energy sources, including Autogas.

Autogas technology has consistently evolved with a view to remaining compatible with the most advanced available powertrains. The Autogas sector is committed to continuing this evolution as new and innovative technologies including direct injection engines and electric hybrids emerge.

European, national and local policy-makers looking to address the twin objectives of protecting human health and the environment should exploit the immediately available benefits of Autogas to the greatest extent possible. Industry projections suggest that given the appropriate regulatory framework, Autogas could meet as much as 10% of Europe's road transport fuel mix by the year 2020. This evolution would make an ideal complement to other long-term policy tracks aimed at establishing an energy mix for Europe that is at once sustainable, secure and competitive.

In its final report published in June 2012, the CARS 21 high level group noted that Autogas could be considered by Member States to play a more important role improving sustainability of transport. The report also notes that Autogas is currently the most wide-spread alternative fuel and that there is infrastructure already established in several Member States²⁴.



rue de la loi, Brussels

²⁴ CARS 21 High level group, Final report on the Competitiveness and Sustainable Growth of the Automotive Industry in the European Union (June 2012)

In an effort to better understand and quantify the potential benefits that would stem from a greater penetration of Autogas, AEGPL commissioned a study by the research group Transport & Mobility Leuven (TML). **Having already carried out numerous studies on transport and energy on behalf of the European Commission, TML is particularly well-placed to analyse the potential impact of the emergence of Autogas as a more significant player in Europe’s road transport fuel mix.**

In the framework of its collaboration with the European Commission, TML developed TREMOVE, an econometric modelling tool used to predict emissions from the transport sector on the basis of policy scenarios.

TREMOVE is an econometric model designed to facilitate policy assessment by studying the impact of transport and environment policies on emissions from the transport sector. The model uses assumptions regarding the transport demand, modal shifts, vehicle stock renewal and scrappage decisions as well as the emissions of air pollutants and the welfare level, for policies as road pricing, public transport pricing, emission standards, subsidies for cleaner cars etc. TREMOVE has been used by the European Commission’s DG Environment as the basis for the development of policy in key domains including CO₂ emissions and air quality.

To evaluate the potential impact of an increased role for Autogas, the TM Leuven team developed a specific model using relevant modules of TREMOVE:

- **Vehicle stock:** Anticipated evolution of the total car fleet;
- **Emission and fuel consumption:** Anticipated fuel consumption and pollutant emissions based on average emission factors and fuel efficiency;
- **Overall Social Welfare:** Anticipated savings in terms of costs to consumers and society in the form of reduced external impacts resulting from emissions; namely, damage to the environment, impact on public health, and exacerbation of climate change.

The results of the TREMOVE simulation are highly encouraging. In addition to the advantages linked to the diversification of the fuel mix and a reduced dependence on imported diesel, the model demonstrates that a higher penetration of Autogas in Europe has the potential to significantly reduce tank-to-wheel emissions of CO₂ and a series of key pollutants. A shift from a base-case scenario to a situation in which Autogas accounts for 10% of the overall road transport mix by 2020 would therefore yield considerable benefits.

As outlined above, Autogas-fuelled vehicles outperform conventional alternatives in terms of numerous key emissions and pollutants. With their detrimental effects on the health of human beings as well and the natural environment, these emissions generate “external” costs in the form of climate change, air pollution, hospitalisations, premature deaths and other negative consequences.

The TREMOVE model demonstrates the potential of Autogas to reduce cumulative overall tailpipe emissions until 2020 - 314 million tonnes of avoided CO₂ emissions and 11,000 tonnes of avoided Particulate Matter emissions - along with the associated damages and subsequent costs. Moreover, TM Leuven’s analysis projects a further savings of 35 million tonnes of CO₂ once well-to-tank emissions are taken into account.

Figure 18: Reduction of cumulative tank-to-wheel emissions during the period of 2007 to 2020 in comparison to the baseline scenario and associated savings

Pollutants emissions	Tonnes of emissions saved	Savings for Society (in millions of Euros) ²⁶	Impacts ²⁵
CO	952,719	€5	Premature mortality Heart/lung cancer Respiratory infections Allergies Dizziness Headaches
HC	111,688	€254	
NOx	337,363	€3,910	
PM	11,109	€834	
CO ₂	314,806,613	€13,813	Climate Change

These avoided emissions would represent a **total savings of over € 20.3 billion in externalized costs**, benefiting not only individual citizens but European society in general.

²⁵ The World Health Organization (WHO) has extensively documented the health impacts key pollutant emissions on human health: <http://www.who.int/mediacentre/factsheets/fs313/en/index.html>.
²⁶ External cost assumptions based on CAFÉ (Clean Air for Europe) Data From DG Environment of the European Commission: <http://ec.europa.eu/environment/archives/cafe/general/keydocs.htm>.

Figure 19: Projected penetration rate in the Autogas vision scenario

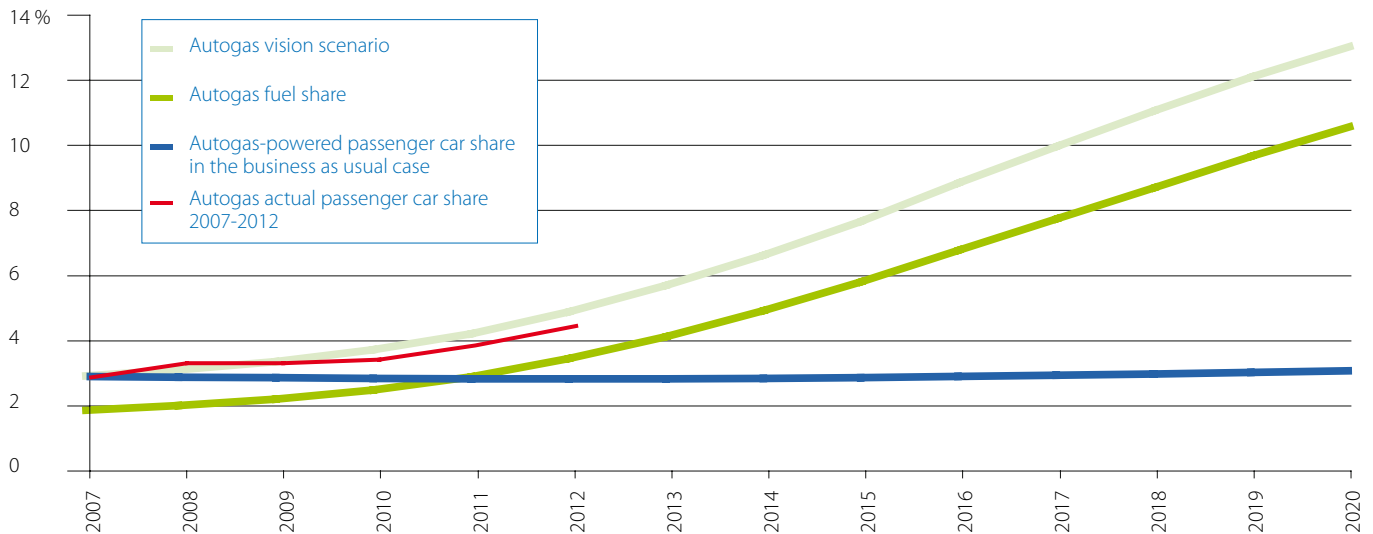
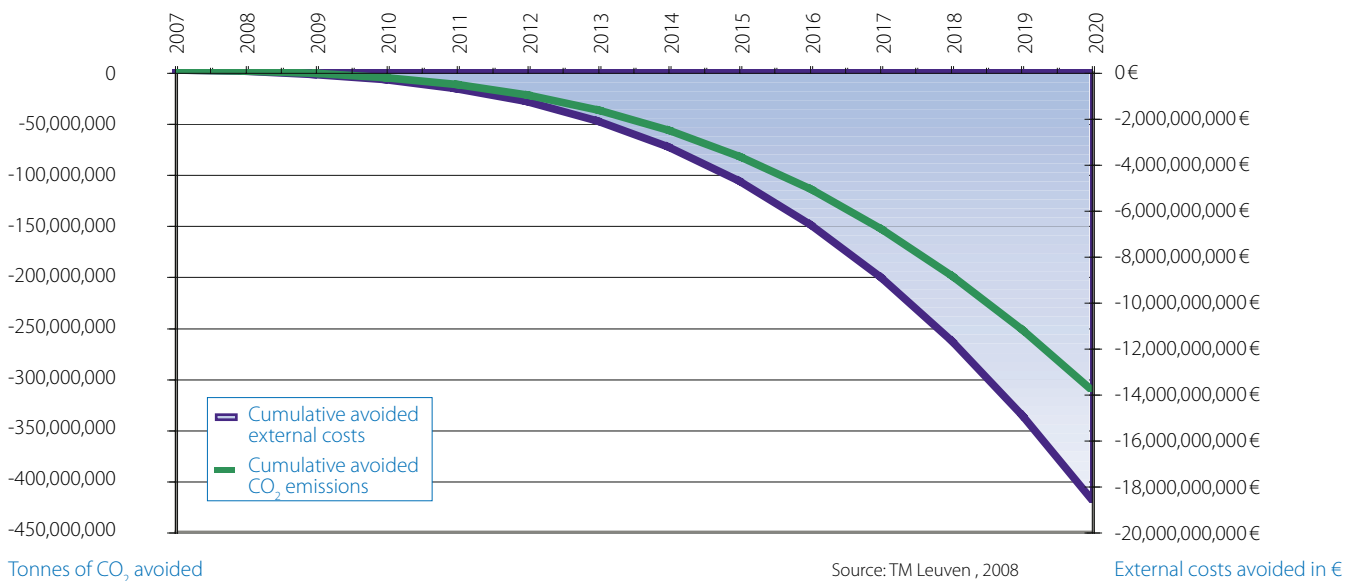


Figure 20: Projected saving stemming from wider use of Autogas in the road transport mix



Based on the commitments from the Autogas sector and from decision-makers described in part 5, the Autogas vision scenario foresees an increased number of bi-fuelled vehicles offered by car manufacturers/importers, while the independent retrofit market will remain an important element of the sector. In this scenario, a significant number of drivers opt for Autogas vehicles over their diesel powered counterparts.

This scenario is based on the assumption that the existing infrastructure, more than 37,500 refueling sites in 2011, helps stimulate demand for retrofitted vehicles, and the high compatibility of Autogas with conventional fuelling infrastructure allows for the rapid growth needed to keep pace with increasing demand, with only modest investment being required.

TM Leuven's analysis is based on a growth curve whereby Autogas-fuelled vehicles would account for 12.96% of passenger cars and Autogas would represent 10.5% of the overall European fuel share by 2020. As a result of this anticipated growth, the Tremove model foresees a reduction of CO₂ emissions of 349 million tonnes and avoided external costs of €20.3 billion.

These overall societal advantages are complemented and reinforced by the economic benefits enjoyed by end-users making the switch to Autogas. The scenario outlined above foresees a cumulative total of € 41.2 billion in savings on fuel costs between 2007 and 2020. Given the ongoing anxiety among citizens as regards the cost of conventional fuels and the general economic climate, this constitutes a point of particular interest.

Increased uptake of Autogas would imply a reduction in excise revenue in some Member States. However, the Tremove model demonstrates that this is compensated for by the combination of saved external costs and saved fuel costs. This equation effectively means that European citizens will be able to enjoy the benefits that a greater role for Autogas would entail at little or no overall cost to society. This is a compelling win-win opportunity that policy-makers simply cannot afford to ignore.

To summarize, the Tremove simulation identifies a series of positive impacts that would stem from the establishment of a 10% share for Autogas in Europe's road transport fuel mix by 2020. These benefits correspond closely to Europe's most pressing energy, environmental, and economic challenges:

TM Leuven key findings

- €20.3 billion saved in external costs thanks to reduced emissions;
- 349 million fewer tonnes of CO₂ in Europe by 2020;
- €41.2 billion in savings for individual end-users;
- An improvement of at least € 7.3 billion in Europe's balance of payments;
- A European fuel mix that is diversified and - by extension - more secure, as well as softened diesel prices.



Hydrogen refilling station in Berlin which uses LPG as its feedstock. The facility was created within the framework of the European Commission's 6th framework programme on research.

In addition to its advantages as a fuel in and of itself, Autogas could be used to support the emergence of hydrogen as a transport energy solution. With its portability and high hydrogen content, Autogas could serve as a feedstock for:

- Onboard reforming units in vehicles, required due to the absence of infrastructure for direct hydrogen refuelling;
- Onsite reforming units in filling stations.

4.2. Autogas in the city: a particular added-value

While the persistent problem of accumulated pollution in cities is certainly the result of numerous factors, the European Environmental Agency has identified the increased use of diesel in urban areas as a probable cause²⁷. In any case, the socio-economic consequences of this problem are dramatic.

"Emissions of air pollutants derive from almost all economic and societal activities. In Europe, emissions of many air pollutants have decreased. Much progress has been made in tackling air pollutants such as sulphur dioxide (SO₂), carbon monoxide (CO) and benzene (C₆H₆) while other pollutants still present a serious threat to the health of Europeans and their environment. Indeed air pollutant concentrations are still too high and harm our health and the ecosystems we depend on. A significant proportion of Europe's population lives in areas, especially cities, where exceedances of air quality standards occur. Particulate matter (PM) and ozone (O₃) pollution are particularly associated with serious health risks."

(The European Environment Agency, 2012)

Associated health impacts translate into a significant burden, not only for those directly afflicted, but for governments, tax-paying citizens and society at large. The World Health Organization (WHO) notes that young children and the elderly are particularly vulnerable.

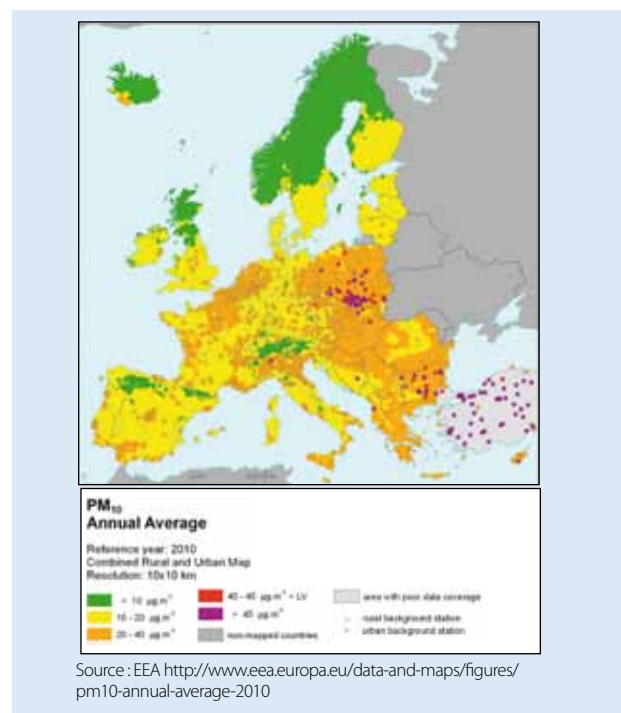


It is estimated that a reduction in the level of Particulate Matter alone - in line with WHO guidelines²⁸ - would yield the following benefits in Europe:

- €58–161 billion saved through the reduction of premature deaths;
- €29 billion saved on the cost of hospital admissions and morbidity.

More generally, such an improvement would enhance the quality of life for all citizens, particularly those living and working in cities across Europe. **In the EU between 2008 and 2010 about 21% of the urban population was exposed to PM10 level above the EU limit value, while up to 81% of the same population was exposed to PM10 concentrations exceeding the stricter WHO limit value²⁹. According to the Aphekom project co-funded by the European Commission, air pollution in Europe leads to a reduction in life expectancy of around 8.6 months per person.³⁰**

Figure 21: Annual average PM10 concentration in Europe in 2010



27 http://reports.eea.europa.eu/eea_report_2007_1/en/eea_report_1_2007.pdf.

28 To WHO guideline limits (established in 1999): PM2.5: 10µg/m³ annual mean, 25µg/m³ 24-hour mean; PM10: 20µg/m³ annual mean, 50µg/m³ 24-hour mean.

29 EEA Air quality in Europe 2012 report

30 EEA Every breath we take 2013

Figure 22: Passenger cars not complying with Euro 5 or 6 standards circulating in Europe



While the social and economic stakes are so high, Europe should use every weapon in its arsenal to tackle the problem. The stricter emissions standards established under the EU’s Euro 5 and 6 Regulations are a step in the right direction. Yet the phasing out of older vehicles that do not comply with these more appropriate requirements will be a slow and lengthy process, with high pollutant emitting vehicles continuing to circulate well beyond 2020.

The lag-time associated with the phasing out of high-polluting diesel-powered vehicles is of particular concern in Europe’s cities, where the concentration of pollutants is highest and poses the most significant threat to human health.

As many as 75 million passenger cars still not conforming to Euro 5-6 standards will be on the road in 2020.

The need to rapidly introduce cleaner fuels into the energy mix is reinforced by the International Energy Agency’s projection that even in a scenario where an aggressive policy framework allowing a 50% reduction of global CO₂ emissions by 2050, low-carbon pure electric vehicles are not expected to arrive on the market before 2025³¹.

As an immediately available alternative fuel with significant advantages in terms of Particulate Matter and NOx, Autogas can help get European cities greener, faster:

- Existing vehicles can be retrofitted to run on Autogas, dramatically reducing their pollutant emissions;
- Thanks to enhanced quantity and quality (through greater collaboration with vehicle manufacturers) of factory-installed systems, Autogas vehicles will continue to compare favourably to their conventionally-fuelled counterparts.

Many cities across Europe have already recognized this potential and adopted policies encouraging citizens to opt for Autogas. In its dual role as legislator and disseminator of best-practices, the European Union has the opportunity to help ensure that these benefits are exploited for the benefit of millions of European citizens and European society in general.

31 As projected in the ‘Blue’ scenario, presented in the International Energy Agency’s Energy Technology Perspectives 2008.

PART 5. FROM POTENTIAL TO REALITY: THE WAY FORWARD

The potential evolution described above reflects the ambitious spirit of the Autogas sector. The target share and the associated strategy are based on an objective analysis of growth prospects through 2020 and represent a realistic vision of the future.

The 10% share projected using the TREMOVE model is ambitious yet entirely realistic. It reflects a development strategy based on two mutually reinforcing pillars: technological evolution and continuous development of infrastructure.

While the independent retrofit market will remain an important element of the sector, the Autogas vision scenario foresees a steady evolution towards engines more suitable for Autogas and a continuing evolution of Autogas technology itself. The arrival on the market of the world's first Autogas/electric hybrid vehicles and the first steps towards the development of bio-Autogas represent a concrete demonstration of this potential.

With over 37,500 filling stations already in place across Europe, Autogas has far and away the most widely established filling network of any alternative fuel. The existing infrastructure helps stimulate demand for retrofitted vehicles, and the high compatibility of Autogas with conventional fuelling infrastructure allows for the rapid growth needed to keep pace with increasing demand, with only modest investment being required.



This development potential should give car manufacturers the confidence and security to invest in Autogas, facilitating the evolution from independent retrofitting, to manufacturer retrofitting and beyond.

As already demonstrated in some national markets, the potential is real, and the benefits for European society are clear. Yet this ambition can only be transformed into reality through a genuine commitment on the part of the Autogas industry and associated stakeholders, combined with an appropriate evolution of the regulatory framework at local, national and European level.



5.1 Commitments from the autogas sector

Commensurate with the requests for support from policy-makers, the European Autogas industry is prepared to make a considerable commitment of human and financial resources in order to realise these ambitions:

- Reach out to citizens to inform them of the potential of Autogas to keeping Europeans moving while protecting the natural environment. Research suggests that a key obstacle to the development of alternative fuels is a lack of awareness among citizens. The Autogas industry is committed to addressing this through a renewed dedication to communicating with the public. In a number of European countries the Autogas industry has already undertaken mass media publicity campaigns to highlight both the ecological and economic benefits of Autogas to the end consumer;
- Pursue a deeper and enduring coordination with car manufacturers, ideally under the auspices of an EU-level technology platform, with a view to developing engines more conducive to the use of Autogas;
- Continue to ensure that European Autogas supply remains commensurate with demand;
- Continue to develop a European filling station network in accordance with anticipated needs. Although the coverage of filling stations is sufficient in most countries, in areas where the network is less dense (e.g. Spain), the Autogas industry has made significant further investment over the past 5 years;
- Promote and facilitate the training and certification of Autogas kit installers. There are currently a number of national schemes which aim to guarantee the quality of retrofit of Autogas vehicles.

5.2 Policy initiatives to stimulate the emergence of Autogas as part of a rationalized fuel portfolio

Policy-makers, seeing the merits of alternative gaseous fuels often pose the question, “what can we do to help?” Experience has shown that progressive public policy can be a highly effective catalyst for the development of alternative fuels, launching the virtuous cycle described on page 26.

At all levels of government - international, European, national, and local - there are concrete opportunities for decision-makers to influence and shape the behaviour and decisions of actors within their constituency. With its well-established role as a leader in the move towards a more secure, sustainable and competitive energy model, the European Union is particularly well-placed to play such a role and to serve as a model in this respect.

The establishment of a wider role for alternative fuels within the EU’s fuel mix is entirely in keeping with this mission. As demonstrated by the TM Leuven study, a scenario in which Autogas accounts for a 10% share of passenger car fuel by 2020 would yield significant benefits for Europe, its constituent Member States, and its citizens. The European Union could play a vital role in ensuring that this potential is realised. This could be achieved by establishing a target of a 10% share for Autogas in the EU passenger car fuel mix, consisting of appropriate targets at the Member State level based on national circumstances, and calling on Member States to take appropriate measures to this effect. Measures taken at European level would offer the combined advantages of ensuring concerted action throughout the EU



while facilitating cross-fertilization as regards best practices in the pursuit of a common objective.

Governments at all levels wishing to promote a wider role for alternative fuels such as Autogas have a wide range of potential measures at their disposal. A compelling and immediate example is the recognition of the capacity of Autogas to contribute to the EU objective of reducing CO₂ emissions from light-duty vehicles. The agreement reached by the European Council and Parliament in December 2008 provides that the **anticipated CO₂ emissions of bi-fuel (Autogas/petrol) vehicles are to be based solely on the gaseous profile**. Not only does this approach offer the benefit of encouraging car manufacturers to invest in alternative gaseous fuel technology (R&D and demonstration), it helps ensure that the proposed legislation reflects - as accurately and completely as possible - the genuine contribution that gaseous fuel technology makes to reducing the carbon footprint of the European vehicle fleet.

The European Commission's 2013 proposal for a **Directive stimulating the development of alternative fuels COM (2013) 18** is also a step in the right direction, not just for promoting Autogas, but all alternative fuels. However, as of publication of this Roadmap, the Directive could be significantly strengthened through the adoption of an approach which requires Member States to formulate concrete national action plans for the uptake of alternative fuels, rather than focusing on infrastructure. Put simply, although the right political signals would be sent by the adoption of this Directive, a one size fits all approach for the European transport mix would be over-prescriptive, and most likely to result in wasted resources.

■ Stimulating the Emergence of Autogas within the fuel mix

Measures aimed at guiding consumers toward environmentally friendly products are widely promoted in EU legislation and are already successfully employed by Member States. There are a wide range of policies through which public authorities can enhance citizens' awareness of Autogas. Similarly, there are numerous practically applicable mechanisms through which public policy can encourage the switch to an alternative fuel such as Autogas by addressing the barrier posed by the need for up front investment³², a key obstacle for many citizens.



Renault/Dacia

³² A typical conversion from petrol to Autogas currently costs between €1,000-3,000, depending on the country.



A policy-maker's toolbox:

- **Continued application of low or zero excise duty on Autogas** a provision already foreseen in the EU's energy taxation Directive 2003/96/EC. Any limited reduction in excise revenue is compensated in the form of a reduction of external costs stemming from the low impact of Autogas on the environment and public health compared to conventional fuels. Moreover, overall excise intake can be easily rebalanced with a fractional increase in the duty applied to conventional fuels, which would continue to represent the bulk of the overall fuel mix.
 - **Direct subsidies to cover the cost of equipping a vehicle with an Autogas system, whether at the moment of purchase or as a retrofit.** Such incentives are already in place in some EU states and in numerous countries around the world and have proved highly effective. Another approach is to grant an equivalent reduction on income tax for citizens switching to Autogas.
 - As part of its 2008 package on Climate Change Policy, the European Commission announced its intention to allow for enhanced flexibility on **the use of state-aid as support for measures favouring environmental protection or tackling climate change.** The provision of state-aid to regions or cities wishing to encourage
- the use of Autogas-fuelled vehicles, particularly in urban areas, would be entirely compatible with the spirit of this policy. Moreover, it would allow newer Member States, many of which are still in the early stage of developing their renewable energy capacity, to take immediate action aimed at establishing a cleaner energy mix. In order to give an initial boost to the emergence of a dynamic Autogas market, some Member States could offer tax exemptions to operators actively investing in the development of associated infrastructure, notably to reach a suitable density of Autogas filling stations.
- Increasingly, cities across Europe are taking exemplary action in the promotion of low-polluting vehicles. **These measures include exemption from congestion charges for low emission vehicles, free parking for alternative fuel vehicles, and access restriction to town centres during peak pollution periods for high polluting vehicles.** Autogas is consistently included in the category of desirable fuels, particularly in urban areas. This approach, already in place in major centres as well as many mid-sized cities, should be propagated by other municipal authorities and encouraged by their national and European counterparts.
 - Member States and local authorities can set a positive example for citizens by actively **promoting the switch to alternative-fuel vehicles through progressive public procurement policy.** The European Union is actively working to develop a legal framework to underpin this socially beneficial practice.
 - In the context of scrapping schemes aimed at simultaneously kick-starting and "greening" the European automotive industry, **Member States could encourage the substitution of older conventional vehicles by alternative-fuel-powered replacements.**
 - Conversely, in some EU Member States, **discriminatory measures against Autogas persist,** for example, in the form of **prohibited access to certain underground parking structures.** In addition, many national governments impose an excessive requirement as regards mandatory distance between Autogas filling stations and residential buildings. Such bans and disproportionate



requirements, based on out-dated or non-existent scientific rationale, constitute an administrative obstacle to the pursuit of an environmentally friendly transport policy, often impeding the development of Autogas in those areas in which it could make its most significant contribution. Local and national authorities should initiate a comprehensive and transparent review of this counterproductive and irrational approach. The European Autogas industry, established as the global leader as regards the safe distribution and use of its product, would welcome the opportunity to contribute to this process.

- **Stronger collaboration between public authorities and industry** in pursuit of an optimal technical evolution, as regards both the Autogas technology itself and the conditions of its use.
- The emergence of hybrids such as the Repsol/ Castrosua electric/Autogas bus provides a powerful demonstration of the **scope for the continued development of Autogas technology**. In its role as a coordinator of pan-European R&D initiatives, **the European Union is ideally**

placed to ensure that this vast potential is effectively exploited by both car-makers and citizens in Europe. The European Commission should encourage the creation of an alternative fuel technology platform, bringing together distributors, car-manufacturers, equipment-makers, researchers, and policy-makers with a view to enhancing the performance of gaseous fuelled engines and vehicles as a whole.

- An immediate means of optimizing the performance of Autogas vehicles across Europe would be the **uniform application of a homogenous type-approval standard across the EU territory for retrofitted gas feeding systems**. In UNECE Regulation 115, the EU already has a ready-made standard at its disposal. Currently, the Regulation is applied with varying degrees of consistency in different Member States, leading to a fragmented European market. By integrating Regulation 115 into the Community acquis, the European Union could ensure that the performance and quality of Autogas systems across Europe is both harmonized and optimized.

Figure 23: Non-exhaustive Overview of measures through which policy-makers can promote the use of Autogas and – by extension – a cleaner, more secure road transport fuel mix for Europe

Actor	Domain	Action
EU Policy-Makers	Recognition of advantages and potential of gaseous fuels, including Autogas	<ul style="list-style-type: none"> Continued recognition of the status of Autogas as a clean, lower-carbon alternative; Highlight benefits of gaseous fuels, both as a fuel and as a vehicle technology; Explicit inclusion of Autogas as an option in any alternative fuel legislation; Establish an EU target of a 10% share for alternative gaseous fuels.
	Taxation/Fiscal Incentives	<ul style="list-style-type: none"> Ensure that the advantages of Autogas continue to be reflected in EU excise legislation; Base vehicle registration and circulation tax rates on well-to-wheel environmental performance; Establish a reduced VAT rate for Autogas vehicles/conversions based on environmental advantages; Allow for recovery of VAT on labour costs related to conversion to Autogas; Permit Member State-contributions to Autogas fleet development under state-aid rules.
	Technical/R&D	<ul style="list-style-type: none"> Integrate UNECE Regulation 115 into EU legislation; Support and coordinate R&D efforts aiming to optimize gaseous fuel technology in Europe.
National/Local Policy-Makers	Recognition of advantages and potential of gaseous fuels, including Autogas	<ul style="list-style-type: none"> Inform citizens of the potential of gaseous fuels to rapidly improve urban air quality; Evaluate growth potential of Autogas within the national fuel mix; Encouraging use of gaseous alternative fuels through “green” public procurement.
	Taxation/Fiscal Incentives	<ul style="list-style-type: none"> Apply excise duties reflecting environmental advantages of Autogas; Offer incentives to citizens purchasing Autogas vehicles/retrofit kits ; Base vehicle registration taxes on well-to-wheel analysis of pollutant and CO₂ emissions; Grant incentives such as reduction of parking fees and congestion charges to Autogas drivers; Grant tax benefits to Autogas operators investing in infrastructure development.
	Technical/R&D	<ul style="list-style-type: none"> Ensure that national type-approval legislation is consistent with UNECE Regulation 115; Facilitate placement of Autogas filling stations in urban areas by ensuring that safety provisions are in line with objective risk analysis.



CONCLUSIONS

Never before have the qualities of Autogas been so closely aligned with the needs of European citizens and policy-makers. In order to meet the diverse challenges associated with pursuing sustainability, security and competitiveness, Europe will need to rely on a wide range of energy solutions and make intelligent use of resources by employing each available energy where it is most effective. Autogas, automatically produced during production of natural gas and oil, is a readily available resource that can and should be used to help Europe meet its energy needs. In this context, it is essential to move the passenger car fuel sector beyond the conventional dichotomy of diesel or petrol, towards a more diverse and flexible system.

Autogas, already Europe's leading alternative fuel, is prepared to enhance its contribution. The Autogas vision presented in this document foresees a future in which Autogas meets 10% of Europe's road transport needs by 2020. This will yield positive and significant social and economic benefits for European society that are worth recalling:

- €20.3 billion in external costs saved thanks to reduced emissions;
- European CO₂ emissions reduced by 350 million tonnes;
- €41.2 billion in savings for individual end-users;
- An improvement of at least € 7.3 billion in Europe's balance of payments;
- A fuel mix that is more diverse, secure and more affordable, notably due to anticipated softening of diesel prices;
- A greener and more competitive European automotive industry.

The European Autogas industry is more committed than ever to working together with policy-makers and citizens to ensure that the considerable potential of Autogas to contribute to Europe's social, economic and environmental objectives is exploited to the greatest possible extent.

This Roadmap is a call for immediate action by all relevant stakeholders committed to securing a more sustainable competitive future for Europe and its citizens. The immediate availability of Autogas as a part of the solution to the EU's energy and environmental challenges is simply too good an opportunity to miss.

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