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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN  
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL  
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**Clean Power for Transport: A European alternative fuels strategy**

{SWD(2013) 4 final}

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**1. INTRODUCTION**

**Europe is heavily dependent on imported oil for its mobility and transport:** in 2010, oil counted for 94% of energy consumed in transport, with 55% the largest consumer, 84% of it imported, with a bill of up to €1 billion a day in 2011, leading to a significant deficit in the EU trade balance of around 2.5% of GDP. Our supply of oil, and thus our mobility, depend to a large degree on politically unstable regions raising security of supply concerns. Price hikes driven by speculation on the impact of oil supply disruptions have cost the European economy an additional €50 billion per year over the last four years.

The effect of the oil dependency on the European economy is too large to neglect – the Union must act to end it. A strategy for the transport sector to gradually **replace oil with alternative fuels and build up the necessary infrastructure could bring savings on the oil import bill** of €4.2 billion per year in 2020, increasing to €9.3 billion per year in 2030, and another €1 billion per year from dampening of price hikes.

**Support to the market development of alternative fuels and investment in their infrastructure in Europe will boost growth and a wide range of jobs in the EU.** Research convened by the European Climate Foundation finds that 'greening' cars could generate about 700,000 additional jobs by 2025. Vigorous action of the Union as a first-mover on innovative alternative fuel solutions (for instance on batteries and powertrains) will also create new market opportunities for European industry and bolster Europe's competitiveness on the emerging global market.

Whilst further efficiency improvements spurred by EU regulations on vehicle emissions of CO<sub>2</sub> will continue to represent the lowest hanging fruits in the short to medium term, **low-CO<sub>2</sub> alternatives to oil are also indispensable for a gradual decarbonisation of transport**, a key objective of the Europe 2020 strategy for smart, sustainable and inclusive growth<sup>1</sup>, towards the target of a 60% reduction of CO<sub>2</sub> emissions from transport by 2050 set out in the "Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System" (2011 White Paper on Transport)<sup>2</sup>. Such fuels are often also beneficial in helping urban areas to meet Union air quality obligations.

Powered two-wheelers, using different alternative fuels, could also contribute to these objectives.

At present, the market development of alternative fuels is still held back by technological and commercial short-comings, lack of consumer acceptance and missing adequate infrastructure. The current high cost of innovative alternative fuel applications is largely a consequence of these shortcomings. 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.**

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<sup>1</sup> COM (2010) 2020

<sup>2</sup> COM (2011) 144

For these reasons, this Communication sets out a comprehensive alternative fuels strategy and the road to its implementation covering all modes of transport. It aims at establishing a long-term policy framework to guide technological development and investments in the deployment of these fuels and give confidence to consumers.

An accompanying legislative proposal<sup>3</sup> provides a general direction for the development of alternative fuels in the Single European Transport Area. Member States would have the flexibility to develop policy frameworks for the market development of alternative fuels in their national context. The proposal also sets binding targets for the necessary infrastructure build-up, including common technical specifications. For electric recharging points, the proposal provides a single connector solution ensuring interoperability across the EU and certainty for the market.

The strategy proposed in this Communication builds on substantial work with industry, public authorities and civil society - in the European Expert Group on Future Transport Fuels<sup>4,5</sup>, the Joint Expert Group Transport & Environment<sup>6</sup>, CARS 21<sup>7</sup>, public consultation<sup>8</sup>, and studies<sup>9</sup>.

For a long time the Union has invested in research and development into alternative fuels. The Commission's proposal for energy taxation based on CO<sub>2</sub> emissions and energy content<sup>10</sup> supports alternative fuels. EU legislation limiting the CO<sub>2</sub> emissions from cars and vans<sup>11</sup> has stimulated industry to develop low-CO<sub>2</sub> alternative fuel technologies. However, previous European initiatives supporting alternative fuels<sup>12</sup>, including market quota<sup>13</sup> and favourable taxation<sup>14</sup>, have been followed up in uneven and disjointed ways.

Some Member States have adopted ambitious targets on the deployment of alternative fuels and taken initiatives on infrastructure<sup>15</sup> with some progress seen. In other Member States, discussions on initiatives have only started recently and progress is slow. But there is a common trend throughout the European Union to use the potential of alternative fuels in transport. Different technological choices in different parts of Europe, however, have led to a

<sup>3</sup> COM (2013) 18

<sup>4</sup> Report of the European Expert Group on Future Transport Fuels, 25 January 2011  
<http://ec.europa.eu/transport/urban/cts/doc/2011-01-25-future-transport-fuels-report.pdf>

<sup>5</sup> Report of the European Expert Group on Future Transport Fuels, 20 December 2011,  
[http://ec.europa.eu/transport/urban/cts/future-transport-fuels\\_en.htm](http://ec.europa.eu/transport/urban/cts/future-transport-fuels_en.htm)

<sup>6</sup> Report of the Joint Expert Group Transport & Environment, 22 May 2011:  
[http://ec.europa.eu/transport/urban/cts/doc/jeg\\_cts\\_report\\_201105.pdf](http://ec.europa.eu/transport/urban/cts/doc/jeg_cts_report_201105.pdf)

<sup>7</sup> CARS 21 High Level Group Final Report, 6 June 2012:  
[http://ec.europa.eu/enterprise/sectors/automotive/files/cars-21-final-report-2012\\_en.pdf](http://ec.europa.eu/enterprise/sectors/automotive/files/cars-21-final-report-2012_en.pdf)

<sup>8</sup> Public Consultation on alternative fuels, 11 August – 20 October 2011:  
[http://ec.europa.eu/transport/urban/consultations/2011-10-06-cts\\_en.htm](http://ec.europa.eu/transport/urban/consultations/2011-10-06-cts_en.htm)

<sup>9</sup> <http://ec.europa.eu/transport/urban/studies/doc/2011-11-clean-transport-systems.pdf>

<sup>10</sup> COM(2011)169

<sup>11</sup> Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO<sub>2</sub> emissions from light-duty vehicles, OJ L 140, 5.6.2009, p. 1 and Regulation (EU) No 510/2011 of the European Parliament and of the Council of 11 May 2011 setting emission performance standards for new light commercial vehicles as part of the Union's integrated approach to reduce CO<sub>2</sub> emissions from light-duty vehicles, OJ L 145, 31.5.2011, p. 1.

<sup>12</sup> Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions on alternative fuels for road transportation and on a set of measures to promote the use of biofuels, COM (2001) 547

<sup>13</sup> Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, OJ L 23, 17.5.2003, p. 42.

<sup>14</sup> Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, OJ L 283, 31.10.2003, p. 51.

<sup>15</sup> Impact Assessment SWD(2013) 5 and related Summary SWD(2013) 6

fragmentation of the internal market, creating technology border lines inhibiting the mobility of alternatively fuelled vehicles across Europe. Market penetration is hampered by the lack of infrastructure and common technical specifications, and requires additional specific policy measures.

Europe-wide coordination is needed to ensure proper functioning of the internal market and large-scale deployment of alternative fuels. A stable policy framework with binding targets for infrastructure build-up is essential to attract private investment into alternative fuel and infrastructure roll-out, without burdening public budgets. Public intervention creating a clear regulatory framework should ensure consumer trust in the early stages of market take-up and complement the significant efforts already being made by Member States and industry.

## 2. A COMPREHENSIVE MIX OF ALTERNATIVE FUELS

A consistent long-term strategy on alternative fuels has to meet the energy needs of all transport modes and be consistent with the EU 2020 strategy, including decarbonisation. However, the alternatives available and their cost differ between modes. The benefits of alternative fuels are initially larger in urban areas where pollutant emissions are of great concern and in freight transport where alternatives have reached a sufficient level of maturity. For certain modes of transport, in particular long-distance road freight and aviation, limited alternatives are available. **There is no single fuel solution** for the future of mobility and all main alternative fuel options must be pursued, with a focus on the needs of each transport mode.

**A strategic approach for the Union to meet the long-term needs of all transport modes must therefore build on a comprehensive mix of alternative fuels.** All options need to be included in the strategy without giving preference to any particular fuel, thereby keeping technology neutrality. EU-wide availability and common technical specifications should be provided for all alternative fuels presented in table 1.

Fuel	Mode Range	Road-passenger			Road-freight			Air	Rail	Water		
		short	medium	long	short	medium	long			inland	short-sea	maritime
LPG												
Natural Gas	LNG											
	CNG											
Electricity												
Biofuels (liquid)												
Hydrogen												

Table 1: Coverage of transport modes and travel range by the main alternative fuels

Security of energy supply to transport is warranted by the wide diversification of sources for the different alternative fuels, in particular through the use of the universal energy carriers of electricity and hydrogen, and the close link to renewable energy sources.

### 2.1. LPG (*Liquefied Petroleum Gas*)

LPG (Liquefied Petroleum Gas) is a by-product of the hydrocarbon fuel chain. Its use in transport increases resource efficiency. Currently, it derives from crude oil and natural gas; and in the future possibly also from biomass. Currently, gas (natural gas as well as LPG) is

being flared of in huge quantity <sup>16</sup> (140 billion cubic meter in 2011). LPG is widely used in Europe, accounting for 3% of motor fuels and powering 9 million cars. LPG infrastructure is well established, with some 28,000 dispensing sites in the EU but with a very uneven distribution across the Member States. Its advantage consisting in producing low pollutant emissions, however, has been diminishing as the EURO standards have progressed to lower general emission limits. There remains, however, a clear advantage in particulate emissions. LPG might still expand its market share but will likely remain a niche market.

## **2.2. Natural gas including biomethane**

**Natural gas** can be supplied from large fossil fuel reserves<sup>17</sup>, from biomass and waste as biomethane, where production should come from sustainable sources, and in future also from "methanisation" of hydrogen generated from renewable electricity<sup>18</sup>. All can be injected into the natural gas grid for supply from a single network. Natural gas offers a long-term perspective in terms of security of supply to transport and a large potential to contribute to the diversification of transport fuels. It also offers significant environmental benefits, in particular when it is blended with biomethane and provided that fugitive emissions are minimised. Natural gas also presents an advantage in lower emissions.

### ***LNG (Liquefied Natural Gas)***

Natural gas in liquefied form (LNG) with high energy density offers a cost-efficient alternative to diesel for waterborne activities (transport, offshore services, and fisheries), trucks and rail, with lower pollutant and CO<sub>2</sub> emissions and higher energy efficiency. LNG is particularly suited for long-distance road freight transport for which alternatives to diesel are extremely limited. Trucks might be able to meet the more stringent pollutant emission limits of future EURO VI standards cost-efficiently.

LNG is also an attractive fuel option for vessels in particular to meet the new limits for sulphur content in marine fuels decreasing from 1 % to 0.1 % from 1 January 2015 in Sulphur Emission Control Areas (SECAs) in the Baltic Sea, North Sea and English Channel as set by the International Maritime Organisation (IMO)<sup>19</sup>. These obligations will be relevant for about half of the 10,000 ships currently engaged in intra-EU shipping. LNG is an attractive economic alternative also for shipping outside SECAs, where sulphur limits will decrease from 3.5% to 0.5% from 1 January 2020, and globally.

Lack of fuelling infrastructure and common technical specifications on refuelling equipment and safety regulations for bunkering hamper market uptake<sup>20</sup>. LNG in shipping, on the other hand, could be economically viable, with current EU prices considerably lower than for heavy fuel oil and low sulphur marine gasoil, and prospects of increasing spreads in future.

LNG development into a global commodity can improve security of energy supply in general by boosting the use of natural gas as fuel for transport. LNG use in transport can also increase the value of gas otherwise flared.

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<sup>16</sup> World bank <http://www.worldbank.org/en/news/2012/07/03/world-bank-sees-warning-sign-gas-flaring-increase>

<sup>17</sup> IEA, World Energy Outlook 2011; natural gas: <http://www.iea.org/aboutus/faqs/gas/>

<sup>18</sup> <http://www.research-in-germany.de/46100/2010-05-06-storing-green-electricity-as-natural-gas,sourcePageId=8240.html>

<sup>19</sup> Directive 2012/33/EU of the European parliament and of the Council of 21 November 2012 amending Council Directive 1999/32/EC

<sup>20</sup> North European LNG infrastructure project; final report May 2012

### ***CNG (Compressed Natural Gas):***

**Natural gas vehicle technology is mature for the broad market**, with close to 1 million vehicles on the road in Europe and around 3,000 filling stations. Additional refuelling stations could easily be supplied from the existing dense natural gas distribution network in Europe, provided the quality of gas is sufficient for CNG vehicles.

CNG vehicles have low pollutant emissions and have therefore rapidly gained ground in urban fleets of buses, utility trucks and taxis. Optimised gas-only vehicles can have higher energy efficiency.

An economically viable market development could be expected by private initiatives as CNG vehicles are competitive with conventional vehicles in price and performance, and natural gas is cheaper than petrol and diesel. But public intervention is necessary to avoid fragmented EU level markets and to enable EU-wide mobility for CNG vehicles.

### ***GTL (Gas-To-Liquid)***

Natural gas can also be transformed to a liquid fuel by first decomposing it to a "synthesis gas", consisting of hydrogen and carbon monoxide, and then by refining to a synthetic fuel with the same technical characteristics as conventional fuels, fully compatible with existing combustion engines and fuel infrastructure. Synthetic fuels can also be produced from waste feedstock. They improve the security of supply and reduce pollutant emissions of present vehicles. Moreover they promote advanced engine technologies of higher energy efficiency. High cost, however, presently limits market take-up.

## **2.3 Electricity**

Electric vehicles (EVs), using a highly efficient electric motor for propulsion, can be supplied by electricity from the grid, coming increasingly from low-CO<sub>2</sub> energy sources. Flexible recharging of vehicle batteries, at times of little demand or ample supply, supports the integration of renewable energy into the power system. EVs emit no pollutants and no noise and are therefore particularly suited for urban areas. Hybrid configurations, combining internal combustion engines and electric motors, can save oil and reduce CO<sub>2</sub> emissions by improving the overall energy efficiency of propulsion (up to 20%) but are, without external recharging possibilities, not an alternative fuel technology.

**The technology of electric vehicles is maturing**, and the deployment of EVs is picking up. Member States aim to have 8-9 million EVs on the road by 2020. The main issues are high cost, low energy density and heavy weight of batteries. These limit the driving range of vehicles considerably. Normal recharging takes several hours. Fast, possibly inductive recharging or battery swapping can alleviate the problem. Improvements in battery technology are essential for the market take-up of EVs. Electric two-wheelers share all the assets of EVs and can support their broad market penetration.

Lack of recharging points, with a common plug, is a major obstacle to market uptake. They would need to be located at home, at the workplace and also in public spaces. At present, the majority of Member States do not have sufficient number of publicly accessible recharging points, and have not announced policies to develop an adequate network of recharging facilities.

EVs can also be used for electricity storage and grid stabilisation and, in order to allow for a flexible electricity pricing system based on demand/supply, a controlled interaction with the electricity network will be needed.

Electricity can supply clean power also to waterborne transport. Shore-side electricity use by ships berthed at ports has been recommended where air quality or noise limits are exceeded<sup>21</sup>.

## 2.4. Biofuels (liquid)

**Biofuels are currently the most important type of alternative fuels, accounting for 4.4%<sup>22</sup> in EU transport.** They can contribute to a substantial reduction in overall CO<sub>2</sub> emissions, if they are produced sustainably and do not cause indirect land use change. They could provide clean power to all modes of transport. However, supply constraints and sustainability considerations may limit their use.

Biofuels can be produced from a wide range of feedstock through technologies in constant evolution and used directly or blended with conventional fossil fuels. They include bioethanol, biomethanol and higher bioalcohols, biodiesel (fatty-acid methyl ester, FAME), pure vegetable oils, hydrotreated vegetable oils, dimethyl ether (DME), and organic compounds.

First generation biofuels are based on food crops and animal fats. They mainly include biodiesel and bioethanol. In order to mitigate against possible impacts of some biofuels, the Commission has proposed<sup>23</sup> to limit the amount of first generation biofuels that can be counted towards the Renewable Energy Directive<sup>24</sup> targets to 5%, and increased the incentives for advanced biofuels such as those made from ligno-cellulosic biomass, residues, waste, and other non-food biomass, including algae and microorganisms. Post 2020, the Commission is of the opinion that only the latter biofuels should receive public support.

Liquid biofuels commercially available today are mainly "first generation" biofuels. Blends with conventional fossil fuels are compatible with the existing fuel infrastructure, and most vehicles and vessels are compatible with the blends currently available (E10 - petrol with up to 10% bioethanol and diesel with up to 7% FAME biodiesel content). Higher blends may require minor adaptations of power trains, and corresponding fuel standards need to be developed. High-level petrol-ethanol blend containing 85% ethanol (E85) is used in only few Member States in flexible fuel vehicles (FFVs) that can also use lower blends.

Consumer acceptance of biofuels has been hampered by the lack of coordinated action across Member States when introducing new fuel blends, the lack of common technical specifications, and the lack of information on the compatibility of new fuels with vehicles.

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<sup>21</sup> Commission Recommendation of 8 May 2006 on the promotion of shore side electricity for use by ships at berth in Community ports (2006/339/EC)

<sup>22</sup> Source: [http://ec.europa.eu/energy/publications/doc/2012\\_energy\\_figures.pdf](http://ec.europa.eu/energy/publications/doc/2012_energy_figures.pdf) (data relating to 2010)

<sup>23</sup> COM (2012) 595 - [Proposal for a directive of the European Parliament and of the council amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources](#)

<sup>24</sup> Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ L 140, 5.6.2009, p. 16.

Some biofuels such as hydro-treated vegetable oils can be blended at any ratio with conventional fuels and are fully compatible with existing refuelling infrastructure and road vehicles, vessels, locomotives, and planes for up to 50% blends.

For aviation, advanced biofuels are the only low-CO<sub>2</sub> option for substituting kerosene. The compatibility of bio-kerosene with today's planes has been proven. Cost, however, has to become competitive. The 'Flightpath 2050'<sup>25</sup> initiative aims at 75% reduction in CO<sub>2</sub> emissions and 90% reduction in nitrogen oxide (NO<sub>x</sub>) emissions.

## **2.5. Hydrogen**

Hydrogen is a universal energy carrier and can be produced from all primary energy sources. It can serve as transport fuel and as storage medium for energy from solar and wind power. Its use therefore has the potential to improve the security of energy supply and reduces CO<sub>2</sub> emissions. Hydrogen is most efficiently deployed in a fuel cell which is twice as efficient as a combustion engine. It may also be used as feedstock to produce liquid fuels of various kinds that can be blended in or substitute normal petrol and diesel fuels.

The technology for hydrogen fuel cell vehicles is maturing, and is being demonstrated in passenger cars, city buses<sup>26</sup>, light vans and inland ship applications. They have performance, range and refuelling times comparable to gasoline and diesel vehicles. Presently about 500 vehicles are in operation, and around 120 hydrogen refuelling stations in place. Industry has announced a roll-out of vehicles, including hydrogen powered two-wheelers, for the next years, and several Member States plan for hydrogen refuelling networks. European type approval regulation includes hydrogen vehicles.

The main issues are high cost of fuel cells and the absence of a refuelling infrastructure network. Industry studies indicate that costs can be reduced to the levels of conventional petrol and diesel vehicles by 2025<sup>27</sup>.

Ships and vessels can use clean power supply by hydrogen-supplied fuel cells. Small boats have run on hydrogen while larger vessels would mainly use auxiliary power supplied by hydrogen fuel cells when they are at berth. Fuel cells operated with hydrogen could replace diesel engines in trains.

## **3 PRIORITY FIELDS FOR FURTHER EU ACTION**

Priorities for further action need to be set according to the stage of technological maturity and market development as well as future perspective of the different fuels, focussing on infrastructure, technical specifications, consumer information, co-ordination of public expenditures to reduce costs and improve impacts, and R&D.

### **3.1 Addressing alternative fuels infrastructure**

The proposal for a "Directive on the deployment of alternative fuels infrastructure"<sup>28</sup> is a major step to solve the "chicken and egg" problem where alternative fuel infrastructure is not

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<sup>25</sup> Flightpath 2050, Europe's Vision for Aviation. Report of the High Level Group on Aviation Research. Luxembourg: Publications Office of the European Union, 2011.

<sup>26</sup> <http://www.global-hydrogen-bus-platform.com/>

<sup>27</sup> "A portfolio of power-trains for Europe: a fact-based analysis. The Role of Battery Electric Vehicles, Plug-in Hybrids and Fuel Cell Electric Vehicles", McKinsey & Company, 2010

<sup>28</sup> COM(2013) 18



built as there is an insufficient number of vehicles and vessels, the manufacturing industry does not produce them at competitive prices as there is insufficient consumer demand, and consumers in consequence do not purchase them. This proposal provides for sufficient infrastructure coverage to ensure economies of scale on the supply side and network effects on the demand side. It focuses on the fuels where failures of market coordination are particularly relevant, that is electricity, hydrogen and natural gas (LNG and CNG). Without such an action all other efforts to promote alternative fuels risk remaining ineffective.

The Commission has initiated work towards a comprehensive strategy on LNG for shipping, involving in particular the European Maritime Safety Agency (EMSA) and representatives from industry. This topic is addressed in an accompanying Staff Working Document<sup>29</sup>.

The investment in the build-up of alternative fuels infrastructure (estimated at €10 billion) will pay back with the market take-up. Direct public funding for infrastructure build-up is not needed if Member States use the wide range of policy tools at their disposal, such as building permissions, concessions, procurement regulations, access and charging regulations and non-financial incentives. European Union funds, on the other hand, are available for the market development of alternative fuels and the build-up of their infrastructure.

Moreover, a market-take up for gaseous alternative fuels will also create an incentive to reduce hydrocarbons' venting and flaring which would in turn create supply savings as well as climate and environmental benefits.<sup>30</sup>

### **3.2 Developing common technical specifications**

Most urgent is the implementation of common technical specifications in the Union for the interface between EVs and recharging points. The lack of an agreement on a "common plug" is now considered one of the heaviest impediments to the broader market uptake of EVs in Europe<sup>31</sup>.

Common technical and safety specifications are also needed for hydrogen, CNG and LNG refuelling points and for the injection of biomethane into the natural gas grid. For biofuels, high blend standards should be formulated.

The proposed infrastructure Directive addresses the key issues of standards and requires the implementation of common technical specifications for alternative fuel infrastructures.

### **3.3 Addressing consumer acceptance**

Privileged access rights, including charging, e.g. in urban access restriction zones, are effective non-financial incentives to use alternative fuel vehicles. Addressing this subject is considered for the urban mobility actions announced in the 2011 Transport White Paper.

Information campaigns and large-scale demonstration projects should improve acceptance of new technology concepts and inform citizens. Horizon 2020 will support these activities.

Harmonisation of consumer information on fuel quality and vehicle compatibility and on the availability of recharging/refuelling points, as well as on environmental, financial and safety

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<sup>29</sup> SEC (2013) 4

<sup>30</sup> It is estimated by the World Bank that the annual volume of natural gas being flared and vented worldwide each year is about 110 billion cubic meters (about 3 % of all gas marketed in the world), enough to provide natural gas for the annual consumption of Germany and Italy, <http://www.climate.org/publications/Climate%20Alerts/sept2012/flaring-venting-emissions.html>

<sup>31</sup> COM (2012) 636 Final

aspects is important to create consumer acceptance, in particular for biofuels and synthetic fuels. This is addressed in the accompanying legislative proposal.

Guidelines on financial incentives for consumers to purchase clean and efficient vehicles are indispensable in order to coordinate the demand-side measures adopted in Member States. This subject is addressed in a forthcoming Commission Staff Working Document "Guidance on financial incentives for clean and energy efficient vehicles"<sup>32</sup>.

### **3.4 Addressing the technological development**

R&D funding within Horizon 2020 should prioritise research, demonstration or market-oriented projects for alternative fuels on all transport modes according to the different stages of their technological and economic development.

Specific technology roadmaps for alternative fuels will be developed in the frame of the Strategic Transport Technology Plan<sup>33</sup>. Where several options exist for the same application, fuel prioritisation should be guided by a well-to-wheels analysis, such as developed in studies coordinated by the Joint Research Centre (JRC) of the European Commission<sup>34</sup>.

Public-private partnerships should be further developed based on the experience gained with European Technology Platforms and Joint Technology Initiatives (JTIs). The European Green Cars initiative, the Fuel Cells and Hydrogen Joint Undertaking, Clean Sky, and SESAR have driven development in their respective areas and a new Joint Technology Initiative on the bioeconomy is under preparation.

New partnerships should support technology development and accelerate market introduction, such as the Smart Cities & Communities initiative<sup>35</sup>. The Commission will facilitate information exchange and coordinated regional action across the EU with the European Electromobility Observatory.

Research and development of advanced biofuels, the only alternative fuel option for aviation, need further investment. The European Industrial Bioenergy Initiative launched in November 2010 in the framework of the Strategic Energy Technology Plan (SET-Plan)<sup>36</sup>, aims at large scale commercial availability of advanced bioenergy, including resource-efficient biomethane production, by 2020. Dedicated financing instruments and market incentives will support the construction of production plants for aviation and other advanced biofuels, with the aim to attain the target of two million tonnes of sustainable biofuels by 2020 for civil aviation in the Union, as set out by the European Advanced Biofuels Flightpath launched by the Commission in 2011<sup>37</sup>, together with major airlines, aircraft manufacturers and biofuel producers.

New research facilities for Electric Vehicle / Smart Grid Interoperability in the Joint Research Centre (JRC) will support EVs and smart grids. The facilities will include full vehicle, component, including battery, and smart grid testing capabilities in support of international standardisation activities. The JRC will promote the development of harmonised testing methodologies and global standards for EVs, their power grid interoperability and their recharging technologies through an international partnership with the US Department of Energy (Argonne National Laboratories).

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<sup>32</sup> SEC(2013) xxx

<sup>33</sup> COM(2012) 501 final of 13/09/2012

<sup>34</sup> [http://iet.jrc.ec.europa.eu/about-jec/sites/iet.jrc.ec.europa.eu/about-jec/files/documents/wtw3\\_wtw\\_report\\_eurformat.pdf](http://iet.jrc.ec.europa.eu/about-jec/sites/iet.jrc.ec.europa.eu/about-jec/files/documents/wtw3_wtw_report_eurformat.pdf)

<sup>35</sup> COM (2012) 4701

<sup>36</sup> [http://ec.europa.eu/energy/technology/set\\_plan/set\\_plan\\_en.htm](http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm)

<sup>37</sup> [http://ec.europa.eu/energy/renewables/biofuels/flight\\_path\\_en.htm](http://ec.europa.eu/energy/renewables/biofuels/flight_path_en.htm)

Batteries and fuel cells are key technologies and a comprehensive R&D strategy needs to be launched to regain knowledge in Europe. Electrochemistry, as a core scientific knowledge, therefore needs to be promoted in R&D and professional education. Manufacturing, including hydrogen production from renewables and on-board storage should be given support to regain and strengthen European competitiveness in this field.

Union funded projects address LNG infrastructure and deployment needs: for shipping the North European LNG Infrastructure Project, the Clean North Sea Shipping (CNSS) project, the marine engine project HELIOS, and for heavy duty vehicles the LNG Blue Corridor project. Further research is needed on dedicated engines and after-treatment for CNG and LNG powertrains and light-weight fuel tanks.

#### **4. CONCLUSIONS**

The market development of alternative fuels should break the dependence on oil and contribute to improving the security of Europe's energy supply, support economic growth, strengthen the competitiveness of European industry, and reduce greenhouse gas emissions from transport.

The increasing demand for energy for transport and the need to break transport's dependency on oil can only be met by the comprehensive mix of alternative transport fuels presented in this Communication. The growing interest for natural gas – for maritime and inland-waterways, for long distance road haulage applications, and light duty vehicles - as well as electricity for short distance road transport - indicates that it would be possible, in the short to medium term, to both increase the European supply of energy for transport as well as reduce dependency on imported oil. At the same time, accelerating the development of advanced biofuels – which have potential for all transport modes, but are the only option for aviation - and the progressive build-up of electricity and hydrogen supply networks to provide area wide coverage for road transport are essential for rapid market development. In parallel, research and development of critical components for electric propulsion such as batteries, should deliver significantly improved range, performance, durability and reduced costs for a competitive market offer.

This Communication and the accompanying legislative proposal catalyse the transformation of Europe's energy supply for transport. With the requirements to establish national policy frameworks for alternative fuels and the build-up of infrastructure with common technical specifications, the EU will complete the policy measures on the development of alternative fuels, from research to market penetration, by ensuring availability of the fuels in the market.

No public spending is required for the build-up of alternative transport fuel infrastructure if the Member States use the wide range of measures available to mobilise private investment cost-efficiently. Union support will be available from TEN-T funds, Cohesion and Structural Funds together with the European Investment Bank lending.

A broad basis among industry, policy and civil society should be maintained for the future development of alternative transport fuels, using the existing European expert groups with participation from industry, civil society, and the Member States.<sup>38</sup>

The Commission will continue to support the Member States, review progress and propose any necessary changes and adjustments taking into account technological and market developments.

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<sup>38</sup> Inter alia the European Expert Groups on Future Transport Fuels and the Joint Expert Group Transport & Environment.