SLOVENSKI STANDARD
SIST-TP CEN/TR 16514:2013

01-september-2013

Goriva za motorna vozila - Neosvinčeni motorni bencin, ki vsebuje več kot 3,7 % (m/m) kisika - Smernice, preskusne metode in zahteve za bencin E10+

Automotive fuels - Unleaded petrol containing more than 3,7 % (m/m) oxygen - Roadmap, test methods, and requirements for E10+ petrol

Kraftstoffe für Kraftfahrzeuge - Unverbleiter Ottokraftstoff mit höheren Gehalten an Oxygenaten als 3,7 % (m/m) - Roadmap, Prüfverfahren und Anforderungen für E10+ Ottokraftstoff

Carburants pour automobiles - Essence sans plomb contenant plus de 3,7 % (m/m) d'oxygène - Feuille de route, méthodes d'essai et exigences pour les essences E10+

Ta slovenski standard je istoveten z: **CEN/TR 16514:2013**

ICS:

75.160.20 Tekoča goriva Liquid fuels

SIST-TP CEN/TR 16514:2013 **en**

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 16514

June 2013

ICS 75.160.20

English Version

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This Technical Report was approved by CEN on 16 March 2013. It has been drawn up by the Technical Committee CEN/TC 19.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. CEN/TR 16514:2013: E

Contents

Page

Foreword 4

1 Scope 5

2 Normative references 5

3 Summary 5

4 Context 7

5 CEN/TC 19/WG 38 7

6 External drivers 7
6.1 Introduction 7
6.2 Renewable Energy Directive (RED, 2009/28/EC) 8
6.3 Fuel Quality Directive (FQD, 2009/30/EC) 8
6.4 Vehicle CO_2 (Regulations 443/2009 and 510/2011) 8
6.5 Today's situation 8
6.6 Factors to be considered 10
6.7 Final remarks on external drivers 11

7 Engine and vehicle concepts and techniques 12
7.1 Summary points 12
7.2 Current and future constraints for an E10+ petrol 13
7.2.1 Existing Euro 6 and CO_2 legislative roadmap 13
7.2.2 Recommendations for new vehicle concepts 13
7.2.3 Engine calibration potential 14
7.2.4 Potential for new pollutants in legislation 14
7.2.5 Impact on vehicle and fuel system components 14
7.2.6 Higher consumption 15
7.3 Opportunities for an E10+ petrol 15
7.3.1 Helping reduce pollutant emissions and CO_2 15
7.3.2 Current cars 16
7.4 High oxygenate fuel combustibility determination (RON/MON) for an E10+ petrol 16
7.4.1 RON-MON relationship 16
7.4.2 RON-MON impact with higher oxygenates 19
7.4.3 RON-MON needs for higher oxygenate-containing fuels 20
7.5 Driveability (volatility descriptors) for an E10+ petrol 20
7.5.1 General 20
7.5.2 Vapour pressure 20
7.5.3 Distillation 21
7.5.4 Other parameters/tests 21
7.6 Oxygenate compounds for an E10+ petrol 23
7.7 Other factors 23
7.8 Possible studies 23

8 Refinery, blender and logistics 24
8.1 Scope of current and future constraints and opportunities 24
8.2 Refining related matters 24
8.2.1 Ethanol 24
8.2.2 Ethers (ETBE and MTBE) 27
8.3 Blending ethanol and ethers 28
8.3.1 General 28
8.3.2 Refinery blending of ethanol 29

8.3.3 Terminal blending of ethanol 29
8.4 Distribution and service station issues 29
8.4.1 Climatic conditions, seasonal grade management/changeover processes 29
8.4.2 Water handling 29
8.4.3 Housekeeping - Water management, tank draining, disposal of water drains and microbiological growth 31
8.4.4 Materials compatibility 31
8.4.5 Vapour recovery systems 38
8.5 Logistics 38
8.5.1 Transport of ethanol and oxygenate blends 38
8.5.2 Co-mingling of different grades in terminals, service stations and vehicles 39
8.5.3 Management of off-grade product 39
8.5.4 Number of Mogas grades 39
8.6 Safety and fire fighting measures 39
8.6.1 Safe handling 39
8.6.2 Surface spills and leaks 39
8.6.3 Fire protection and fire-fighting agents for fires involving ethanol/petrol blends 39
8.6.4 Storage 40
8.6.5 Sources of ignition 40
8.7 Regulatory requirements 40

9 Test methods 41
9.1 Introduction 41
9.2 Current petrol fuel requirements 41
9.2.1 General 41
9.2.2 Sulfur 41
9.2.3 Manganese 42
9.2.4 Lead 42
9.2.5 RON/MON 43
9.2.6 Density 43
9.2.7 Oxidation stability 43
9.2.8 Gum 43
9.2.9 Copper strip corrosion 44
9.2.10 Hydrocarbons (olefins and aromatics) 44
9.2.11 Oxygen and oxygenates 44
9.2.12 Benzene 45
9.2.13 Vapour pressure 45
9.2.14 Distillation 46
9.2.15 Sampling 46
9.3 Potential new petrol fuel requirements 46
9.3.1 Sulfate 46
9.3.2 Chlorides 46
9.3.3 Iron 46
9.3.4 Ash forming components 47
9.3.5 Silver strip corrosion 47
9.3.6 High boiling components 47
9.4 Summary 47

10 Conclusions 49

11 Acknowledgement 50

Annex A (informative) **Abbreviations** 51

Bibliography 54

Foreword

This document (CEN/TR 16514:2013) has been prepared by Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin”, the secretariat of which is held by NEN.

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1 Scope

This Technical Report presents an overview and time plan for test methods and requirements that could be expected for future unleaded petrol and petrol blends in Europe. This means unleaded petrol with an ethanol/oxygenates level higher than allowed in the Fuels Quality Directive, Annex I [4], which is petrol containing up to 3,7 % (*m/m*) of oxygen, more familiarly known as E10.

Specific issues that may apply for certain levels or types of oxygenates are highlighted where appropriate in the appropriate sections of this report. This report does not take into account all issues related to vehicles that are specially designed to run on a much wider range of oxygenate contents above E10+, for example up to E85.

The report covers fuels and vehicle concepts for both E10+-capable (without engine efficiency gains) and E10+-optimised (with engine efficiency gains).

NOTE 1 Following the large possible combinations and levels of oxygenates, the work focuses on unleaded petrol with a nominal ethanol content between 10 % (*V/V*) and 25 % (*V/V*). Once the ethanol is higher than approximately 20 % to 25 % (depending on the vehicle) more engine and vehicle measures would likely be needed.

NOTE 2 For the purposes of this document, the terms "% (*m/m*)" and "% (*V/V*)" are used to represent the mass fraction, μ, and the volume fraction, φ, respectively.

NOTE 3 Although EN 228 speaks about and defines "unleaded petrol", the wording "petrol" is used throughout this document for the sake of readability.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 228, *Automotive fuels — Unleaded petrol — Requirements and test methods*

EN 14214, *Liquid petroleum products — Fatty acid methyl esters (FAME) for use in diesel engines and heating applications — Requirements and test methods*

EN 15376, *Automotive fuels — Ethanol as a blending component for petrol — Requirements and test methods*

3 Summary

This report provides an overview and time plan for test methods and requirements to be expected for future unleaded petrol containing oxygenate levels higher than currently allowed in the Fuels Quality Directive (FQD).[2],[3],[4] Before an E10+ petrol specification is developed in response to a legislative initiative, the following factors should be considered:

a) need for more research to define preferred and achievable specifications for an E10+ petrol blend;

b) need for adequate time to implement vehicle and fuel options, after an E10+ standard has been defined;

c) market introduction scenarios of the fuel supply and automotive industry, which general follow the steps:

   1) introduction of capable cars,

   2) build infrastructure for the availability of the fuels, and

3) introduce optimised vehicles

d) need for EC funding to begin the necessary laboratory and vehicle testing.

E10+ petrol may be introduced for future new engine designs if benefits in regulated emissions, Tank-to-Wheels CO_2 and Well-to-Wheels CO_2 emission performance are demonstrated. These new designs could take advantage of the properties of an E10+ petrol to achieve these benefits, based on a higher oxygen content and a higher Octane Number (RON and MON). Because increasingly stringent vehicle regulations limit the regulated pollutants that a motor vehicle may emit, a future E10+ petrol standard may also require new limits for inorganic chlorides, phosphorus, sulfates and ash content, for example, in order to enable the performance and durability of both the engine and aftertreatment system. To ensure this performance, the impact of oxygen content higher than 3,7 % (*m/m*) in petrol on regulated pollutants, CO_2, vehicle driveability and pre-ignition and knock behaviour shall be studied in depth before an E10+ specification can be drafted.

The manufacture, distribution and sale of petrol containing higher oxygenate levels pose certain constraints and opportunities which shall also be considered. When ethanol is used as the primary oxygenate, for example, it can introduce some specific challenges that shall be carefully addressed, e.g.:

- effect of ethanol on vapour pressure, octane rating, distillation and related properties;
- tendency of ethanol to increase the dissolved water content of petrol;
- compatibility of materials in contact with both the liquid and vapour phases.

To facilitate any eventual marketing of E10+ petrol, new regulatory requirements should be agreed by the co-legislators in the European Parliament and the Council (on the basis of a Commission proposal) in consultation with industry stakeholders.

Finally, each specified or limiting fuel property shall be measurable by one or more test methods which have been verified to produce statistically relevant results at the expected levels of the property under investigation. In order to limit the scope regarding combinations and levels of oxygenates the focus for the test methods (Clause 9) is merely on petrol with a nominal ethanol content between 10 % (*V/V*) and 25 % (*V/V*). This focus is chosen as once the ethanol is higher than approximately 20 % to 25 % (depending on the vehicle) more engine and vehicle measures would likely be needed. This report discusses the likely applicability of current test methods for E10+ petrol and provides an estimate of the time and effort that would be required to verify applicability.

Assuming that the FQD is amended with the legal parameters of an E10+ petrol, a nominal specification for E10+ petrol, based on sound technical data, will take several years to develop and evaluate. Following this work, about five some additional years would be required to develop and commercialise E10+ capable vehicles, followed by up to five years to commercialise E10+ optimised vehicles and refuelling infrastructure. The path to successful implementation of an E10+ petrol grade will therefore be complicated, requiring considerable research on vehicles and test methods and coordination amongst all industry stakeholders.

EC funding may also be needed at an early stage to complement on-going stakeholder research and answer many of the technical questions that are related to E10+ petrol specifications and test methods.

This report considers issues related to E10+ petrol in the following four areas:

1) external drivers; policies and market drivers and constraints,

2) engine and vehicle; constraints related to component compatibility, emission and fuel consumption (challenges and opportunities), plus consumer reliability, and the possibilities to overcome those,

3) refinery, blending and logistics; constraints related to crude feedstock, process control, blending capacity and fuel station capability, plus inherent safety, and anticipating those,

4) test methods; applicability of existing techniques and needs to verify such.

Used abbreviations are presented in Annex A.

4 Context

The European Union is promoting renewable energy use in Europe and could encourage the extension of automotive petrol blended with higher fractions of renewably-sourced ethyl alcohol (referred to in this document as ethanol) and/or other oxygenates. Additionally, the EU has put in place stringent tailpipe pollutant emission limits and CO_2 targets for new vehicles sold in the EU market. It is uncertain at this point how these targets will influence the development of the European fuels market beyond 2020. Because vehicle performance and higher oxygenate levels shall be carefully assessed, harmonised fuel specifications are essential to ensure acceptable vehicle performance and durability in the market. The development of new fuels and vehicles is however a long and intensive process.

At the CEN/TC 19 meeting in May 2011, a priority was placed on “E10+” petrol in order to be prepared for future market and legislative decisions. It was agreed that a detailed assessment of biofuels and blends in Europe over the coming decade was needed that should be prepared through a multi-stakeholder approach. To develop this longer-term vision, CEN/TC 19 agreed to work together as Industry and Stakeholder partners to complete this assessment and outline the possible constraints and advantages of a future E10+ petrol.

Therefore CEN has combined efforts to draft this overview and time plan for test methods and requirements to be expected in the future. This work has been done with the participation of the convenors of test method working groups and vehicle and fuel experts from ACEA, CONCAWE, UPEI and e-PURE.

5 CEN/TC 19/WG 38

CEN/TC 19 requested WG 38 (New Fuels Coordination and Planning) to develop a CEN/TR that describes a European standardisation roadmap for future ‘E10+’ unleaded petrol. The scope of work was to draft an overview and time plan for test methods and requirements to be expected in the future. The experts that have contributed to this CEN/TR are known to the CEN/TC 19 Secretariat.

The working group has met on the following occasions so far:

— 21 December 2011, Amsterdam, 1st meeting;

— 3 April 2012, Delft, 2nd meeting;

— 22 August 2012, 3rd meeting (web-conference);

— 17 September 2012, 4th meeting (web-conference);

— 14 March 2013, 5th meeting.

6 External drivers

6.1 Introduction

In its 2009 legislation, the European Union adopted new policies to reduce Greenhouse Gas (GHG) emissions, improve energy security, and support agricultural development. Road transport was especially targeted by these policies because it is a major consumer of liquid fuels and contributes a significant percentage to total European GHG emissions. More importantly, road transport demand and associated GHG emissions have grown over the past decades and there are fewer alternatives in transport to reduce this growth compared to other energy-consuming sectors. The societal challenges associated with increasing access to personal and goods transport while steadily reducing GHG emissions and improving energy security are widely recognised. For this reason, the 2009 European climate and renewable energy legislation had several key elements as presented below.

6.2 Renewable Energy Directive (RED, 2009/28/EC)

The RED [5] mandated that at least 10 % of transport fuels on an energy basis shall be derived from sustainably produced, renewable sources by 2020. This can include the use of bio-blending components in fuels for road and non-road applications, the use of renewable electricity for vehicle recharging, biogas from waste materials, and other approaches.

Common products are those products derived from specific feedstocks, such as ethanol from sugar fermentation, ethers produced from renewable ethanol or methanol, and fatty acid methyl esters (FAME) and hydrocarbons produced from vegetable oils and animal fats. Pilot and commercial developments are progressing on new production pathways for many bio-blending components. These new developments may produce the same product but from a different feedstock or process (for instance, lignocellulosic ethanol). However, only the fairly common products are likely to be available in sufficient quantities to meet the 2020 mandate for transport fuels

6.3 Fuel Quality Directive (FQD, 2009/30/EC)

The FQD [4] requires that fuel suppliers reduce life-cycle GHG intensity associated with transport fuels by at least 6 % by 2020, versus a 2010 baseline. Historically, European refineries have improved their energy efficiency by about 0,5 %/year over the past 20 years at the same time that fuel demand has increased and product specifications have tightened. Energy efficiency improvements in the fuel manufacturing process can contribute to the FQD target but most of the mandated GHG reduction over this decade is expected to come from blending bio-components into fuels.

To achieve the FQD and RED mandates, these bio-components shall meet minimum GHG reduction thresholds that will change over the decade. They also shall be certified and audited as having been derived from sustainable sources and a number of EC-recognised certification schemes are now in place.

In addition, the FQD legislates the introduction into the market of ‘E10’ petrols, having up to 3,7 % (*m/m*) oxygen content and corresponding to 10 % (*V/V*) ethanol or appropriate volumes of ethers (MTBE or ETBE), higher alcohols, or other oxygenates (except methanol). Today’s E5 petrol, having a maximum of 2,7 % (*m/m*) oxygen and meeting EN 228 specifications, shall also be marketed for several years in order to ensure the performance of older petrol vehicles that are not fully compatible with higher oxygenate blends.

6.4 Vehicle CO_2 (Regulations 443/2009 and 510/2011)

Although new passenger vehicles and light-commercial vehicles shall meet stringent pollutant emissions requirements [6], they should also meet new fuel consumption limits on a fleet-average basis by manufacturer in order to increasingly reduce GHG emissions from the vehicle fleet.

For passenger cars, these new limits (Regulation 443/2009 [7]) are effective in 2015 and require that each manufacturer’s new vehicles achieve 130 g CO_2/km, on a fleet-average basis, through engine and vehicle performance improvements. The procedures for achieving the already defined target of 95g CO_2/km from 2020 are now being discussed. Similar targets (Regulation 510/2011 [8]) are now in place for light-commercial vehicles and are also being considered for commercial vehicles. A recent Commission proposal indicates that even lower CO_2 targets beyond 2020 will be developed by the EC by end-2014.

6.5 Today's situation

Today’s EN 228 specification allows blending of up to 3,7 % (*m/m*) oxygen in petrol (E10), either from ethanol, higher alcohols, or ether oxygenates. EN 228 also specifies a second petrol containing up to 2,7 % (*m/m*) oxygen (including E5) which is intended for older vehicles that are not compatible with higher oxygenate blends. The EN 590 diesel fuel specification [20] allows up to 7 % (*V/V*) FAME in diesel fuel (B7). Ethanol used for petrol blending shall comply with EN 15376 and FAME used for diesel fuel blending shall comply with EN 14214.

For diesel fuel, hydrocarbon-only blendstocks produced from natural vegetable or animal oils or from biomass are allowed and are generally less restricted in blending volume, subject to the requirements of EN 590, because they are very similar in composition to fossil fuels. Other work is also in progress to provide new opportunities and markets for biogas manufactured from waste and residues, dimethyl ether (DME) manufactured from pulp and paper products, renewable electricity, and other products that will help to achieve the legislated mandates.

In Europe today, more diesel fuel is sold than petrol even though there are currently more petrol cars than diesel cars in the total on-road fleet. This is because the number of new diesel cars purchased has increased over the past decade due to consumer preference and lower excise duty rates on diesel fuels in many countries. Freight transport in Europe is also dominated by on-road trucking which consumes considerable diesel fuel. The result is that there is currently a higher demand for diesel fuel and a lower demand for petrol than European refineries can easily produce. Refinery process technologies can only be adjusted within certain operational limits on the available crude oil supply.

Because of the existing imbalance in EU diesel/petrol production, Europe currently exports excess petrol production to North America and other regions and imports diesel fuel and jet/kerosene from Russia, the Middle East, and elsewhere. This import/export situation raises questions for the future regarding Europe's energy security and the sustainability of global trade for refined fuel products. New requirements for lower sulphur marine fuels as well as new environmental legislation are putting additional pressure on refineries. Although refineries are investing in new process units for increasing distillate fuel production, this imbalance in fuel demand is expected to continue for more than 10 years.

These factors mean that there is a clear market need for diesel blending components that meet the FQD and RED requirements and are fully compatible with diesel vehicles. This is proving to be a greater challenge than anticipated and the current blending limit for FAME in diesel fuel is limited while CEN/TC 19 work on the basis of an EC Mandate is in progress to increase the allowed level to 10 % (*V/V*) FAME (B10). Although some vehicles in captive fleets or niche markets can use diesel fuel containing higher FAME levels, such as B20-B30 or even B100, many vehicles are not compatible with FAME levels higher than B7. Similar to what is occurring for the introduction of E10 petrol, the market introduction of B10 diesel fuel would require vehicle compatibility lists and pump labelling to guide consumer purchasing and the continued marketing of a B7 grade for those vehicles that are not compatible with B10. In addition, the GHG reduction potential of many FAME products do not appear to be as good as for many petrol blending components.

Considerable work is in progress to accelerate the production of advanced renewable products for diesel fuel blending, such as the hydrotreated vegetable (and animal waste) oils (HVO) and biomass-to-liquid (BTL) products mentioned earlier. However, the pace of development of these product developments is slower than expected, with the possible exception of HVO, and they are not expected to make a big impact on renewable fuel supply in this decade.

Given these near-term problems on the diesel side, there is interest in considering more oxygenate blending above E10 in European petrol. However, because petrol represents a smaller fraction of the total European fuel demand, increasing oxygenate blending in petrol will also reduce the demand for petrol from crude oil and make the European diesel/petrol imbalance worse. In addition, increasing renewable blending components in petrol could reduce Tank-to-Wheels GHG emissions for petrol vehicles while increasing the Well-to-Tank GHG emissions at the same time from the combined petrol and diesel fuel supply. Thus, all factors shall be carefully considered which is the subject of this report.

Starting from the 2000 model year, most European vehicles are compatible with petrol containing up to 3,7 % (*m/m*) oxygen from ethanol or other allowed oxygenates. National specifications for E10 petrols are now in place in France, Germany, Finland, and Spain, while other countries are awaiting the outcome of

CEN/TC 19 discussions on a revised EN 228 specification. Specially adapted vehicles that can be fuelled with up to 85 % (*V/V*) ethanol (E85) are also available in some countries.

Since not all existing vehicles are E10 compatible (about 10 % of the petrol vehicles in Germany, for example), a ‘protection grade’ petrol (E5) has been mandated by the FQD to be marketed in parallel with E10 petrol. Recent market experience with the introduction of E10 petrol in Germany has shown that customer acceptance of the higher ethanol blend has not been strong and the corresponding sales of E10 petrol has been below expectation. The market share of E10 grade in the total gasoline sales more than one year after the introduction of the grade were about 15 % in Germany, 30 % in France and 60 % in Finland. This experience indicates that a future introduction of an E10+ petrol will require a coordinated introduction of compatible vehicles, fuel grades, and consumer awareness information in order to be successful. Key factors for success may be for instance a progressive launch of new fuel on a voluntary basis, an appropriately informed consumer and a broad availability of communication about vehicle compatibility.

Importantly, ethanol, produced from sugar or starch or manufactured from lignocellulosic biomass, exhibits some of the highest GHG reductions amongst the renewable products that are either readily available or in commercial development. ETBE, when manufactured from bio-ethanol, also has a 47 % renewable contribution and a GHG reduction that depends on the ethanol used. These products shall be independently certified as meeting minimum sustainability and GHG reduction requirements in order to qualify their use in fuels against the RED and FQD obligations. In the future, the GHG emissions performance of different fuel blends could well be valued on a Well-to-Wheels, rather than on a Tank-to-Wheels, basis.

Thus, there may be societal benefits to petrol fuels containing oxygenate levels higher than 3,7 % (*m/m*) oxygen if there is also consumer acceptance to further increase the renewable content of road fuels beyond the E5/E10, E85, and B7/B10 grades that are already envisioned for the EU-27. Rather, issues related to vehicle compatibility (both forward and backwards), fuel refining, blending, and logistics, test methods for E10+ specifications and implementation issues are discussed in detail. It is expected that the results of additional research and stakeholder discussion will be needed to define nominal specifications for this E10+ petrol at a later stage.

6.6 Factors to be considered

Regardless of the specification that is ultimately decided for E10+ petrol, there are several factors that should be considered:

6.6.1 Need for more research to define adequate E10+ specifications:

Currently, there are various ideas being explored through preliminary studies by different stakeholders in order to identify potential requirement for possible future E10+ specifications.

Based on these preliminary ideas, considerably more research will be needed by all industry stakeholders on possible E10+ formulations in order to validate potential performance and WTW GHG reduction benefits while minimising performance disadvantages, system inefficiencies, and added costs. This research will be directed towards narrowing the possible formulation options and establishing a nominal specification for a future E10+. Key parameters could include maximum and minimum oxygenate levels, minimum research and motor octane, and volatility requirements and definitions. It is also quite likely that new test procedures for vehicle cold and hot weather performance may be needed that take into account modern engine and vehicle control systems. The following specific areas have already been defined that will need more research:

a) Research (RON) and Motor (MON) Octane Numbers and Octane Sensitivity. This could include a new RUFIT (Rational Use of Fuels in Private Transport) study, as was conducted in the 1970s, to assess possible changes in engine design, RON/MON levels, crude oil utilisation, fuel manufacturing costs, and GHG reductions on a Well-to-Wheels basis.

b) Impact of E10+ volatility on:

   1) Lambda deviations and exhaust emissions under cold engine starting conditions;

2) Cold engine starting and drivability performance;

3) Hot weather starting, vapour lock, and drivability performance;

4) Evaporative emissions;

c) Materials compatibility with elastomers and gaskets in vehicles and in the fuel supply and distribution system;

d) Materials compatibility issues with metallic alloys and fuel system components;

e) Valve seat recession, cylinder liner wear, and cam lobe wear with higher ethanol fuels;

f) Lube oil dilution by fuel and faster than expected loss in lube quality;

g) Fuel system deposit control on intake valves and in the combustion chamber;

h) Fuel and lube system additives specially adapted to higher ethanol levels;

i) After-treatment systems that are fully compatible with higher ethanol/petrol blends;

j) Sensor technologies for engines and after-treatment systems;

k) Vehicle durability testing.

6.6.2 Need for adequate time to implement vehicle and fuel options:

From previous experience with the revision of EN 228 to include E10 petrol, a transition to E10+ shall allow sufficient lead time for implementation. To put this in perspective, even a relatively limited laboratory and vehicle study aimed at defining the specifications for E10+ will take several years to organise and execute with the cooperation of all stakeholders. After this, a CEN standard would need to be developed requiring at least an additional three years. Vehicle industry experts also estimate that about five years would be required to develop E10+ compatible vehicles once a nominal specification for E10+ petrol has been defined. This time does not seem unreasonable given the simultaneous requirements for vehicles to meet lower CO_2 and Euro 6+ emissions limits, long-term vehicle durability requirements, and in-use compliance performance.

As E10+ compatible vehicles are introduced into the on-road fleet, the market introduction of E10+ petrol would need to be coordinated in order to encourage the penetration of E10+ compatible vehicles. Since there will be older vehicles in the fleet that are not E10+ compatible, a ‘protection grade’ fuel will be needed for some time (E5 or E10 depending on when an E10+ grade is introduced). This means that there is little expectation that an E10+ grade can be implemented quickly enough, compared to other fuels such as E85, to significantly impact the 2020 RED and FQD targets.

6.7 Final remarks on external drivers

The path to a successful commercialisation of an E10+ petrol grade will be complicated, requiring considerable research on vehicles and test methods and coordination amongst all industry stakeholders. The vehicle industry’s current view is that there will not be backwards compatibility of a future E10+ grade with the existing on-road fleet so that some type of ‘protection grade’ will be needed in the future. This point will need to be considered as one aspect of E10+ implementation.

While this report begins to describe a future state for an E10+ petrol, it is also very important to point out that the much nearer-term target and priority is a successful and pan-European implementation of E10 petrol and B7 diesel grades, including pump labelling and the ready availability of consumer awareness information. Getting this implementation right will ensure that Europe is on the right trajectory to future GHG reduction in road transport with consumers who are fully informed and engaged.

7 Engine and vehicle concepts and techniques

7.1 Summary points

1) The roadmap for the completion of the 95 g CO_2/km target for that applies from 2020 onwards, possible CO_2 targets beyond 2020 and the completion of the Euro 6 emission requirements, including the introduction of new test cycles, imposes a limitation as to when an E10+ petrol could be introduced in terms of the new vehicle development timetables and the complete compatibility of new vehicles to use an E10+ petrol.

2) An E10+ petrol will be for future new vehicle technologies only. Backwards compatibility with current vehicles and vehicles introduced in the coming years cannot be ensured, although it is the car manufacturers' responsibility to communicate on backwards compatibility for their own cars.

3) E10+ petrol with higher oxygen content could offer opportunities to introduce new engine/vehicle designs that can take advantage of the characteristics of an E10+ petrol in terms of reduced tailpipe CO_2 and certain regulated emissions, depending on the higher minimum oxygenates content and the accordingly increased Research Octane Number and Motor Octane Number. Both parameters need to be increased in a completely new E10+ petrol standard in order to gain a Tank-to-Wheels CO_2 benefit.

4) The impact of a highly oxygenated fuel on currently and potentially future regulated pollutants, CO_2 and vehicle driveability needs to be studied in depth.

5) Engine calibration potential needs to be taken into account. If an E10+ petrol could have a narrow min/max ethanol or oxygenate range around the specified maximum, there could be advantages for engine efficiency and to help optimise the design and calibration of future engines. E10+ reference fuels should reflect what can be expected in the marketplace.

6) Today MON is a parameter also for describing low and high-speed pre-ignition. RON – measured with an appropriately modified CFR engine for higher oxygenated fuel – correlates well with knock behaviour even at modern downsized turbo charged direct injection engines, at least for pure hydrocarbons or low ethanol blended petrol (<10 % (*V/V*) ethanol), but even for higher ethanol blends (>10 % (*V/V*)) as long as only moderately retarded combustion is applied (Centre of Combustion – CA50 needs to be approximately 12 ° below the CA ATDC [12]). The phenomena of pre-ignition and knock behaviour in high boost-level engines operating at even higher BMEP levels may require a completely new approach and modifications to existing test methods or new test method developments.

7) The sensitivity between RON-MON for high ethanol/oxygenate blended petrol needs assessment taking these issues into consideration.

8) A suitable RON/MON test method with sufficiently proven accuracy range needs to be addressed for petrol containing more than 4,0 % (*m/m*) oxygen (e.g. E101+). DIN 51756-7 [13] – describing modifications of the CFR engine – is a good basis for the development of a new standard.

9) Access to leaded Primary Reference Fuels (PFR) or the definition of (new) PRFs for RON/MON testing (in accordance to EN ISO 5163 [9] /EN ISO 5164 [10]) for RON > 100 need to be addressed.

10) The driveability indicators e.g. vapour pressure and distillation, will need to be controlled seasonally as in EN 228 and in such a way that vehicle driveability effects are limited. For this it might be necessary to identify new descriptors and their appropriate ranges to guarantee the proper functioning of future engines.

11) New limits will need to be established for the blending components and the final E10+ petrol blend. EN 15376 could be possibly be revised to take into account the effect of trace contaminants (sulphate, chlorides,...) on vehicle components and exhaust after treatment systems.

12) The vehicle and engine technology that would be needed to meet possible future emission and CO_2 targets that EU legislators might establish beyond 2020 are presently not known. Matching the specifications of an E10+ petrol with future (unknown) vehicle and engine technology will require substantial research.

7.2 Current and future constraints for an E10+ petrol

7.2.1 Existing Euro 6 and CO_2 legislative roadmap

Euro 6 still has many open issues and the roadmap is complicated and unclear.

New measures scheduled to be introduced into legislation to apply in the 2020 timeframe or later include:

— new test cycle and procedures for CO_2 and emissions (WLTP);

— new tests (real driving emission tests);

— tighter OBD and cold start emission limits (covering also diesel NOx);

— more extensive evaporative emission test;

— presently, Euro 6(a) applies from 2014/2015 and Euro 6(b) applies from 2017/2108.

The introduction of an E10+ petrol will eventually be reflected in the test reference fuel (since test reference fuel is supposed to reflect market average). However, should an E10+ test reference fuel be mandated before it is widely introduced into the market or later? The test fuel needs to be known well in advance for efficient engine design and calibration but a test reference fuel could not be defined until there is a clear view of the parameters and methods needed to fully describe an E10+ market fuel in a completely new standard.

The introduction of an E10+ petrol would require amendment to the Fuel Quality Directive, completion of a robust and fit-for-purpose CEN standard and then suitable lead-time for industry (auto and oil) to develop and deliver the fuel and the vehicles to the market.

The already on-going discussions of all the above new legislative requirements for Euro 6, etc. should only be based on an E10 (or B7) reference fuel at this time. Introduction of a new reference fuel reflecting a future E10+ petrol would need rather more time, i.e. at a compatible date reasonably beyond Euro 6(b) from 2017/2018 and from when the specifications of any E10+ market petrol is defined.

7.2.2 Recommendations for new vehicle concepts

An E10+ petrol can only be considered looking forwards. Backwards compatibility with the older vehicle fleet (including at that time the E10 compatible vehicle fleet) cannot be considered.

The introduction of future engine concepts that can meet the demands of EU legislation and new market fuel developments needs lead-time according to a defined legislative timetable, a period of regulatory stability to allow recuperation of investments and a common and harmonised roadmap for the introduction of new fuels across the EU without market fragmentation.

To help meet future passenger car / light-commercial vehicle CO_2 legislation, i.e. the 95 g CO_2/km target applicable from 2020 onwards and the development of any legislative target set beyond that date, it is important to investigate:

— opportunities for increasing the engine compression ratio and any limitations imposed in terms of engine on downsizing when using new high-octane fuels (boosted octane by increased ethanol content or other preferred oxygenate, when minimum ethanol content in accordance with increased RON/MON is specified);