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IMPACT ASSESSMENT

Accompanying the document

Communication to the Commission

on communicating outcome of the Impact Assessment related to requirements of Article 3(4) of Directive 2009/28/EC

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This report commits only the Commission's services involved in its preparation and does not prejudge the final form of any decision to be taken by the Commission.

1. INTRODUCTION

Directive 2009/28/EC on the promotion of the use of energy from renewable sources (the "Renewable Energy Directive") established mandatory targets to be achieved by 2020 for a 20% overall share of renewable energy in the EU and a 10% share for renewable energy in the transport sector. For the transport sector each Member State has to ensure that the share of energy from renewable sources in all forms of transport combined in 2020 is at least 10%. All forms of energy from renewable sources can contribute to the target, including biofuels - liquid or gaseous - and electricity produced from renewable sources.

The method for calculation of the contribution of the various forms of energy from renewable sources is included in Article 3(4) of the Renewable Energy Directive and further elements are contained in Article 5.

For biofuels, this calculation involves using the energy contents that are listed in Annex III to the Directive.

For the contribution of electricity from renewable sources, the Directive prescribes that the average share of electricity produced from renewable energy sources has to be taken into account in the calculation. In addition, the Directive requires the Commission to present by December 2011, if appropriate, 'a proposal permitting, subject to certain conditions, the whole amount of the electricity used to power electric vehicles to be counted towards the 10% target'.

For the contribution of hydrogen originating from renewable sources, the Directive does not include any specific rules on how to account this towards the 10% target. The Directive requires the Commission to present by December 2011, if appropriate, 'a proposal for a methodology for calculating the contribution of hydrogen originating from renewable sources for counting towards the 10% target'.

For the contribution of methane originating from renewable sources (biomethane[1]) and supplied via the natural gas grid, the Directive does not include any specific rules for the calculation towards the 10% target. Since this is a matter similar to that of electricity and hydrogen from renewable sources, it would seem appropriate to consider also the accounting of biomethane from the grid.

This report assesses whether it is necessary to add or change accounting rules for certain forms of renewable energy in transport and if so through which measure this would be best achieved. The report comes at this time because as indicated above the Directive requires the Commission by December 2011 to present, if appropriate, proposals with regards to the accounting of electricity and hydrogen from renewable sources towards the 10%. This report responds to these legislative requirements, while taking the opportunity of the requirement of this report also to look in the accounting of biomethane supplied via the grid.

[1] Either 'biogas' upgraded to the quality of natural gas or gas of similar quality produced from biomass by other production methods.

2. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

Organisation and timing

An inter-service working group[2] was established in February 2011. The group met on 4 March, 2 May and 1 July 2011 to discuss the progress of the study referred to in section 2.1. Meetings of the group in its capacity as the Impact Assessment Steering Committee took place on 30 September and 28 October 2011. The present Impact Assessment takes into account the recommendations formulated by the Impact Assessment Board on 9 December 2011[3].

2.1. Consultation and expertise

The Commission carried a public consultation exercise on which further detail can be found in Annex I. One study was commissioned, carried out by the research and consultancy firm *CE Delft*[4], evaluating the importance of electricity, hydrogen and methane from renewable sources for the 2020 EU target of 10% renewable energy in transport, the drivers for their increased share in the general energy mix and different approaches of accounting them towards the 10% target. Further detail on the different approaches of accounting that this study identified can be found in Annex II.

[2] Meetings of this group were chaired by DG Energy. Other Commission Directorates General who were part of this group included the Secretariat-General, DG Agriculture and Rural Development, DG Climate Action, DG Enterprise and Industry, DG Mobility and Transport, DG Research, the Legal Service, Eurostat and the Joint Research Centre.

[3] http://www.cedelft.eu/publicatie/shifting_renewable_energy_in_transport_into_the_next_gear/1257

[4] "Shifting renewable energy in transport into the next gear: Developing a methodology for taking into account all electricity, hydrogen and methane from renewable sources in the 10% transport target".

3. PROBLEM DEFINITION

3.1. What is the issue or problem that may require action?

The Renewable Energy Directive specifies that in each Member State the share of energy from renewable sources in transport in 2020 is at least 10%. The Directive specifies that all types of energy from renewable sources consumed in all forms of transport shall be taken into account in the calculation of the target.

This section will show that the 10% target is to a certain extent an imprecisely defined target since the Directive does not for all potential contributions towards the target contain calculation rules. More specifically it will show that the specific rules for the calculation of the contribution of the various forms of energy from renewable sources (different types of biofuels, renewable electricity, hydrogen from renewable sources, etc.) towards the 10% share for renewable energy in the transport sector address those forms and distribution systems that are expected to make the main contribution towards the target, but do not comprehensively capture new forms and distribution systems of energy from renewable sources that can be used in the transport sector.

In addition, this section will show that for those types of energy from renewable sources that are distributed via a grid in which they are mixed with energy from non-renewable sources, the question arises which accounting rules can treat these types of renewable sources in an equal manner compared to other renewable sources that count toward the target.

The impact and scale of these above regulatory problems seem however minimal. Biomethane supplied through the gas grid is the only form of energy that is expected to be significant by 2020 for which the Directive does not contain accounting rules. Moreover, its contribution to the target is expected to be relatively small and accounting rules are laid down elsewhere. The question of equality of accounting is limited to electricity from renewable sources and biomethane supplied through the gas grid and arises primarily because of the legislative requirement for the Commission to look into this question.

How does energy from renewable sources contribute to energy used in transport?

The transport sector uses at present mostly liquid fuels. Electricity is also used to a certain extent, particularly in trains, metros and trams. Natural gas and LPG are used to a certain extent as fuel for vehicles. These are all energy carriers used to perform the final function of powering a transport vehicle. These energy carriers can often be produced from different energy sources, both fossil and renewable. In many cases, the final energy carriers used to propel transport are produced from a mix of energy sources. This mixing can take place at various stages of production or distribution of the energy carrier, e.g.:

– during the production of the energy carrier, such as for the fuel component 'ETBE'[5] that is chemically produced from two chemical components, one being a refinery product and another ethanol originating from biomass.

5 Ethyl-tertio-butyl-ether

– between the stages of production and distribution, such as the blending of diesel originating from refined petroleum components with biodiesel produced from biomass.

– in the distribution system, such as electricity which is usually supplied via a grid to which many different energy production plants and energy sources supply.

The use of renewable sources for energy in transport takes place largely as a result of specific policy measures put in place to increase the share of energy from renewable sources in transport. It could to a certain extent also be an effect of policy support to increase the share of energy from renewables in general or in other sectors, e.g. in the case of electricity used in transport where the share of renewables in electricity generation depends for a large part on policy measures targeting the electricity sector.[6] In latter case the Renewable Energy Directive prevents that this would be double counted towards the overall target for energy from renewable sources.

3.1.1. How is the contribution of energy from renewable sources towards the 10% target calculated?

The contribution of energy from renewable sources towards the target of the Renewable Energy Directive is based on the gross final consumption of energy. This also applies to the target for energy from renewable sources in transport.[7] The Energy Statistics Regulation[8] specifies what falls under the 'transport'. This includes besides fuels used in road transport also e.g. fuels used in international aviation (when sold in a Member State), electricity use in transport, etc.

The basis of 'gross final consumption of energy' means for energy used in transport that the share of energy from renewable sources is determined on the basis of the energy value of the fuels and other energy carriers used ('tanked') in transport vehicles and in particular what share of that energy value is from renewable sources.

For biofuels, both liquid biofuels as well as gaseous (biomethane), determining the gross final consumption of energy means converting amounts of biofuels commonly expressed in volume or mass into energy units. This is done using the (physically determined) energy content factors laid down in Annex III of the Renewable Energy Directive. The Annex also specifies the renewable energy share of certain fuels that are produced from two chemical components, one being of fossil origin and the other from biomass feedstock. Annex III of the Directive can be updated through comitology procedure to include additional types of biofuels. Further, it is specified in the Renewable Energy Directive that only biofuels compliant with the sustainability criteria set out in the Directive can be taken into account.

For electricity, determining the gross final consumption of energy is straightforward as electricity produced is expressed in energy terms. However, for electricity it is less

[6] At the same time it is also an effect of policy supporting shifts in energy carriers for transport: e.g. electric road transport is also driven by politics addressing air pollution in cities.

[7] As an exception, where it concerns electricity consumed by electric road vehicles, the Directive specifies that the final consumption has to be multiplied by a factor 2.5 in order to compensate for higher energy efficiency of the use of electricity in cars compared to the use of liquid or gaseous fuels in cars.

[8] Regulation (EC) No. 1099/2008

straightforward to determine what the renewable share is. Since electricity is distributed via the electricity grid which has many consumers, including the transport sector, it is also necessary to determine how much of the renewable source of the energy carrier can be attributed to the transport sector. For the contribution of electricity from renewable sources the Renewable Energy Directive specifies that the average share of electricity produced from renewable energy sources (Member States or EU level) has to be taken into account in the calculation.

3.1.2. What potential contribution of energy from renewable sources towards use of energy in transport is not provided for in the specific calculation of the target?

As mentioned above, some energy carriers such as gas and electricity are distributed through grids and used for more purposes than solely the transport sector. In such cases it is necessary to specify how much of the renewable source of the energy carrier that went into the grid can be attributed to the transport sector.

For the contribution of electricity from renewable sources this is determined by using the average share of renewables in electricity generation. However, since there is no way of knowing in a grid which electrons (the energy particles of which electricity exists) were generated from renewable energy sources and thus how many of those ended up being used in the transport sector, this average share is only an approximation of the actual amount of renewable electricity used in transport. There is no single scientific answer to the question of what share of the energy carrier taken out of the grid and used in transport should be counted as renewable. A number of other accounting methods could be used to reflect the renewable energy share. In all these methods there are three aspects that make up the accounting method:

(1) The question of the time factor: a method could look at a longer-term (e.g. a year) volume of electricity and determine the renewable share of that as a whole or apply a time profile monitoring with real time measurements of electricity charging and determination of accompanying renewable share.

(2) The question of how the volume of electricity is determined: whether this is measured at feeding points which would not always have a dedicated meter (e.g. is in the case of households using some of their electricity use to charge electric vehicles) or in the vehicles themselves. Estimates rather than measurements may also be an option where very high accuracy is not required.

(3) The question how the renewable energy share is determined: whether this is based on an average renewable energy share of electricity supplied to the grid or whether it is based on contractual agreements covering such information, such as 'green energy contracts' or 'certificates of origin'.

These methods and their aspects are described in more detail in Annex II.

For biomethane, when it is fed into the gas grid and used in natural gas vehicles, no specifications are provided in the Directive as to regard how much of the renewable source of the energy carrier that went into the grid can be attributed to the transport sector. The types of accounting methods that could apply are the same as for electricity from renewable sources

For hydrogen, the Directive does not contain such rules either and the situation is even more complex since there are many potential ways to produce hydrogen from renewable sources, including:

- from biomethane, e.g. by steam reforming/partial oxidation
- from a mixture of natural gas and biomethane, e.g. by steam reforming/partial oxidation
- on the basis of renewable electricity, by electrolysis
- on the basis of the electricity mix from the grid, by electrolysis
- from biomass directly, e.g. by gasification/partial oxidation or biological processes

In some of these cases, it may be straightforward to determine the renewable share of the hydrogen. This would depend on the distribution system that would be applied. In case this distribution system would be a grid, similar issues as described for methane and electricity would likely arise. The types of accounting methods that could apply are the similar as for electricity from renewable sources as described in more detail in Annex II.

3.1.3. What is the scale of the problem?

Table 1 gives an overview of the different forms of energy from renewable sources and Member States' expectations of their contribution towards the 10% target in 2020. It can be derived that the main contribution toward the 10% target would come from liquid biofuels for which accounting rules are in place. A smaller but still significant contribution would come from electricity from renewable sources, for which accounting rules exist though for which the question is whether these rules treat it in an equal manner as other forms of energy from renewable sources. A much smaller but still significant contribution would come from biomethane distributed via the gas grid, for which accounting rules are not included in the Renewable Energy Directive. Hydrogen from renewable sources is not expected to provide a significant contribution towards the 2020-target. Thus, the scale of the problem seems minimal: it is limited to electricity from renewable sources and biomethane supplied through the gas grid and for the former the Directive already includes rules whereas for the latter the contribution to the target is relatively small.

Table 1: Estimated contributions in final gross energy consumption in the transport sector*

Form of energy	Estimated contribution in transport by 2020 (analysis based on NREAPs[9]) - mtoe	Estimated share in transport by 2020 (analysis based on NREAPs)	Number of Member States expecting a contribution in 2020 (analysis based on NREAPs)
Liquid biofuels	28.9-29.6	9.3-9.5%	27
Electricity from renewable sources (non-road)	2.4	0.8%	25
Electricity from renewable sources (road)	0.7	0.2%	27
Biomethane supplied through the gas grid	up to 0.7	up to 0.2%	up to 14
Hydrogen from renewable sources	0.002	0.001%	1[10]

* Excluding all modifiers for the calculation of the 10% target in Article 3(4) of the Renewable Energy Directive

3.2. What are the underlying drivers of the problem?

The forms and distribution systems of energy, and in particular renewable energy, used in the transport sector are changing. This is in part a result of the targets for renewable energy which drive investment into new renewable energy technologies and in part a result of other policies and developments targeted to render the transport sector more sustainable. As a consequence of these developments the accounting framework in the Renewable Energy Directive may not comprehensively capture new forms and distribution systems of energy from renewable sources that can be used in the transport sector.

In addition, the fact that there is no single scientific answer to the question of what share of an energy carrier taken out of a grid and used in transport should be counted as renewable is a driver for the second problem concerning equality of accounting methods.

9 National Renewable Energy Action Plans, available at: http://ec.europa.eu/energy/renewables/transparency_platform/action_plan_en.htm

10 Romania. In addition, Denmark indicated in its reply to the consultation that it is setting up infrastructure for hydrogen use in transport for which the hydrogen would probably in part come from renewable sources, of which the contribution would however not be significant towards the 10% target.

3.3. Who is affected, in what ways and to what extent?

Member States are affected as they have to comply with the 10% target. They also have to collect the statistics that provide the input for the calculation of their share of renewable energy in transport sector. Developers and marketers of new forms of renewable energy and distribution systems may be affected as absence of specific rules for their forms of renewable energy and distribution systems or the existence of rules that do not treat all forms of renewable energy in an equal manner may constitute a disadvantage for such development. Energy retailers, including small and medium-sized enterprises, may be affected by administrative costs arising from policy options, i.e. cost for generation of data needed for the particular accounting method.

3.4. How are existing policies and legislation affecting the issue?

Existing policies and legislation affect the pace and direction of the development of changes in the transport sector in terms of forms and distribution systems of energy. These include general and specific policies in the area of transport, energy, climate change mitigation, innovation and taxation.

The Energy Statistics Regulation[11] is particular relevant to this issue as the Renewable Energy Directive specifies that the methodology and definitions used in the calculation of the share of energy from renewable sources shall be those of the Energy Statistics Regulation. The Energy Statistics Regulation establishes a common framework for the production, transmission, evaluation and dissemination of comparable energy statistics in the EU. While, as set out above, a number of elements of the methodology for the calculation of the contribution of the various forms of energy from renewable sources towards the 10% share for renewable energy in the transport are set out in the Renewable Energy Directive, a number of other aspects, notably related to data and statistics collection, is covered by the Energy Statistics Regulation. In particular, this is case for the determination of the volume of electricity, methane and hydrogen used in the transport sector, which is the second element of the three aspects involved in the construction of an accounting method for the determination of energy from renewable sources in transport mentioned in section 3.1.2.

3.5. Baseline scenario: how will the issue evolve in absence of intervention?

In the absence of additions or changes to the Renewable Energy Directive on the rules on how certain forms of energy count towards the target, such forms would nevertheless be counted towards the target since the Directive specifies that all forms of energy used in transport count toward the 10% target. This means more specifically for the three energy forms concerned:

- For electricity from renewable sources, the existing accounting rules as described in section 3.1.1 would continue to apply.

- For methane produced from renewable sources and distributed through the gas grid, in the absence of accurate statistical methods for measuring the share of injected biomethane consumption by sector, Eurostat would attribute to each natural gas consuming sector a portion of the biomethane injected to the natural gas network, proportional to each sector's natural gas consumption - as discussed in the

[11] Regulation (EC) No 1099/2008 of the European Parliament and the Council of 22 October 2008 on energy statistics.

'Energy Statistics' Working Party of 8 December 2010[12]. This approach is similar to the approach for electricity from renewable sources.

- For hydrogen produced from renewable sources, Eurostat would find an ad-hoc solution with the Member State concerned. Further, as hydrogen is currently not part of the EU energy statistics system, i.e. no separate statistics are collected on hydrogen according to the Energy statistics Regulation, Eurostat and the Member States would develop statistical methodologies along the lines of the overall energy balance when the contribution of hydrogen to the fuel mix will become significant.

This development is not sensitive to external developments.

The strength of the current framework for the accounting is that Eurostat and the Member States can address within a short time frame any gaps in the methodology that may arise as a result of new forms of renewable energy being used in the transport sector. A weakness of this baseline scenario is the fact that some elements of the accounting framework would not be enshrined in EU law and would therefore have less visibility for those who would want to know what accounting rules apply. A further weakness is that in the baseline scenario there is no possibility to change the accounting rules for electricity from renewable sources if an accounting method would be found that treats this renewable energy form in a more appropriate way compared to other renewable sources than the current method does. However, the contribution towards the target of these forms of renewable energy concerned is limited (cf. Table 1). Thus, a failure to act would have an insignificant impact on the robustness of the system for accounting for renewable energy in transport or on the achievement of the target.

3.6. Should the EU act?

The targets of the Renewable Energy Directive were adopted under the Environment chapter of the Treaty[13], requiring that each Member State ensures that the share of renewable energy in transport in 2020 is at least 10% of the final consumption of energy in transport in that Member State. The accounting rules for this target are the same for all Member States. Any change or addition to those rules should be the same for all Member States.

12 Minutes available at: http://circa.europa.eu/Public/irc/dsis/chpwg/library?l=/minutes_reswp_2010doc/_EN_1.0_&a=d

13 Ex-EC Treaty Article 175(1)

4. POLICY OBJECTIVES

General objectives

The EU's policies on the promotion of the use of energy from renewable sources have been developed in the context of EU energy policy and EU policy aimed at protection of the environment. The development of new and renewable forms of energy is specifically foreseen as an objective in the Treaty and it is clear that this goal is pursued with regard to the need to enhance security of energy supply and that of preserving and improving the environment.

The general objective is to have in place an accounting framework for the 10% target for energy from renewable sources in transport that captures in an equal manner all forms and distribution systems of energy from renewable sources that are potentially used by 2020 in the transport sector.

4.1. Specific and operational objectives

The Renewable Energy Directive and its implementation already contain an accounting framework for the 10% target for energy from renewable sources in transport. The question is whether this existing framework and the accompanying implementation is comprehensive enough to be able to capture in an equal manner all forms and distribution systems of energy from renewable sources that are likely to be of significance by 2020 in the transport sector or whether changes in the accounting for certain forms of renewable energy in transport as well as in the organisational structure of the framework are necessary to facilitate this. The additional question is whether for those types of energy from renewable sources that are distributed via a grid in which they are mixed with energy from non-renewable sources, which accounting rules can treat these types of renewable sources in an equal manner compared to other renewable sources that count toward the target.

Chapter 3 already showed that the problem is minimal: biomethane supplied through the gas grid is the only form of energy that is expected to be significant by 2020 for which the Directive does not contain accounting rules. Moreover, its contribution to the target is relatively small and accounting rules are laid down elsewhere. The question of equality of accounting is limited to electricity from renewable sources and biomethane supplied through the gas grid and arises only because of the legislative requirement for the Commission to look into this question. Even though the problem is not significant the Directive requires the Commission by December 2011 to look into this matter. Therefore, the following specific/operational objectives are established for the accounting framework for the 10% target for energy from renewable sources in transport:

- to treat the accounting for electricity from renewable sources and biomethane distributed via the natural gas grid in an equal manner compared to others forms of energy counting towards the target;

- to contain accounting rules for biomethane distributed via the natural gas grid.

5. POLICY OPTIONS

5.1. Description of the options

This impact assessment looks into both the options for the *content* of the intervention, i.e. the specific method for accounting of electricity from renewable sources and biomethane distributed via the natural gas grid, as well as the options for the *type of intervention*, i.e. the policy instrument to be used for changes or additions to the accounting framework.

Concerning the specific method for accounting, section 3.1.2 identified three elements of such methods. The policy options address the third element, i.e. the determination of the renewable energy share. For the other elements there is either at present technically only one option (time profile monitoring would only be possible in the long term, see Annex II) or the choice for the option does not fall under the scope of this assessment (the determination of the amount of electricity and methane used in transport falls within the scope of the Energy Statistics Regulation, see section 3.4).

Options for the content of the intervention

The analysis in Annex II identifies two main options for the determination of the renewable energy share for the accounting electricity from renewable sources and biomethane distributed via the natural gas grid: in the first case the renewable share would be determined according to the share of renewables in the national production mix of electricity and the share of injected biomethane in the national gas mix in the grid; in the second case the renewable share would be determined according to the information concerning the renewable share in energy contracts between energy retailers and energy consumers.[14] The analysis further identified the possibility of combining those two options with the second applying only where specific metering for the energy use in transport is present.[15] In addition, the study referred to in section 2.1 indicated that changing the specific method of accounting for renewable energy used in transport is unlikely to have a material impact on the demand for renewable energy unless perhaps if the method complied with a number of conditions, among which the requirement that such accounting method would apply only to new renewable energy projects which are not already financially supported by existing Member States' support schemes.[16] This leads to the following four options to be considered:

Option 1 – According to renewables share in the production mix (baseline scenario)

> This option would mean that the renewable share of the amount of electricity used in transport would be determined according to the share of renewables in the yearly average production mix of electricity (Member States or EU level[17]). A similar

[14] Cf. section 10.2 of Annex II

[15] Cf. section 10.4.7 of Annex II

[16] Cf. the conclusions of the chapter "Drivers for the increase in production of electricity, hydrogen and methane from renewable sources" of that study. Those conclusions also mention the condition that the renewable energy concerned is not counted towards meeting the relevant Member State’s overall renewable energy target while it is counted towards the 10% target for renewable energy in transport. This condition does however not seem to fit within the overall approach of the Renewable Energy Directive.

[17] The Directive allows for these two alternatives.

approach would apply for biomethane: the share of injected biomethane in the national gas mix in the grid would determine the share of gas used in transport that counts towards the 10% target for renewable energy in transport. This option reflects the current situation. From the answers to the public consultation it appears that about half of the stakeholders replying would favour this option where it concerns electricity and about one quarter where it concerns biomethane.

Option 2 – According to information in contractual agreements

This option would mean that the amount of electricity and gas used in transport that counts towards the 10% target for renewable energy in transport is determined on the basis of existence of 'green energy contracts' or 'certificates of origin'. Contracts between energy retailers and energy consumers (or the associated bills) or certificates can mention the amount of energy that was generated from renewable sources and sold through this arrangement to a user or seller of electricity or gas in transport and this information would be used to determine the share of electricity and gas from renewables used in transport. The total amount of electricity and gas that is covered by such contracts or certificates would count towards the 10% target for renewable energy in transport. Only contracts that concern production and use of the energy in the same Member State would be covered under this option, because allowing cross-(Member State)border contracts would cause risk in terms of double counting towards transport targets of two Member States and raise other issues on accounting e.g. the same renewable electricity would count towards the overall target of one Member State and towards the renewable energy in transport target of another. From the answers to the public consultation it appears that about one third of the stakeholders replying would favour this option where it concerns electricity and about two thirds where it concerns biomethane.

Option 3 – Combination of options 1 and 2 with option 2 applying on the basis of specific metering

This option would mean that the amount of electricity and gas used in transport that counts towards the 10% target for renewable energy in transport is determined as the sum of two contributions. Firstly, the method as in option 2 would apply for all places where electricity or gas is consumed and metered separately for the use in transport.[18] A second amount would be added to that. That amount would be determined by applying option 1 for all other places where electricity or gas is consumed for transport. In order to prevent double counting, the renewables share in the option 1 part would be corrected for the amount of renewable energy already determined as in option 2 by subtracting that amount from the amount of energy generated from renewables sources before dividing it by the total amount of energy generated. This option is included in particular also because from the answers to the public consultation it appeared that stakeholders were clearly divided on whether option 1 or 2 should apply.

[18] This would at present include all green electricity contracts for railways as well as any other green electricity/methane contract where a specific metering of a feeding point that is used only for transport exist.

Option 4 – Combination of options 1 and 2 with option 2 applying on the basis of additionality

This option would mean that the amount of electricity and gas used in transport that counts towards the 10% target for renewable energy in transport is determined as the sum of two contributions. Firstly, the method as in option 2 would apply but only if the renewable electricity or gas would not receive support from a national support system for renewables and would come from production plants established after a certain date, e.g. 2011. In order to clearly identify the amounts of electricity/gas falling under these conditions, energy retailers would likely need to create a specific type of green energy contract for this option to work. A second amount would be added to that. That amount would be determined by applying the method as in option 1 would apply for all other renewable energy used in transport. This second part of the calculation would be corrected to prevent double counting in the same way as described in option 3. From the answers to the public consultation it appears that only a small number of the stakeholders replying would favour this option. This option is included also because the aspect of additionality is understood to be part of the considerations leading to the requirement for the Commission to present, if appropriate, a proposal with regards to the accounting of electricity from renewable sources towards the 10% target.

5.1.1. Options for the type of intervention

The accounting framework can be laid down by two ways: in the Renewable Energy Directive and by Eurostat and the Member States. Part of the accounting framework could be by laid down by one of these ways with the other part laid down by the other. Other instruments are not available for the aspects of the accounting framework under consideration. Comitology procedure applies only to Annex III which is limited to the aspect of laying down the energy content of transport fuels and cannot specifically address accounting methods for energy forms distributed via grids. Further, the Energy Statistics Regulation is limited to aspects of data and statistics collection. Therefore, for the policy instrument to be used for changes or additions of the accounting framework the following options have been identified:

Option A – Baseline scenario

This option would have the effect of continuing the current situation in which:

– for liquid biofuels, biomethane distributed via segregated systems and electricity from renewable sources the existing accounting rules in the Renewable Energy Directive would continue to apply.

– for methane produced from renewable sources and distributed through the gas grid, Eurostat would attribute to each natural gas consuming sector a portion of the biogas injected to the natural gas network, proportional to each sector's natural gas consumption.

– for hydrogen produced from renewable sources and any other potential forms and distribution system of energy from renewable sources, Eurostat would find an ad-hoc solution with the Member State concerned when the issue becomes relevant.

Option B – No EU action i.e. discontinuing the current framework in the Renewable Energy Directive

This option would have the effect of discontinuing the accounting framework laid down in the Renewable Energy Directive, leaving the accounting framework up to Eurostat and the Member States to define.

Option C – Amendment of the Renewable Energy Directive

This option would amend the accounting framework in the Renewable Energy Directive. This amendment would consist of additional rules concerning the contribution of biomethane supplied through the grid. Depending on the choice for the *content* option, the amendment could also include a change of rules concerning the accounting of the contribution of electricity from renewable sources.

5.2. Discarded options

The following option is discarded:

Option B – No EU action i.e. discontinuing the current framework in the Renewable Energy Directive

While the accounting rules do not have to be contained in the Renewable Energy Directive since Eurostat and the Member States can laid down such rules as necessary, for the main contributions toward the 10%, i.e. liquid biofuels and electricity from renewable sources, they are already laid down in the Directive, which would thus not have to be amended. It is an administrative burden to remove these accounting rules from the Directive in order to include them in other documentation, while there are no benefits from this option since it leaves the accounting system the same. This option would therefore always score lower than either Option A or Option C. Therefore, discontinuing the EU framework of rules is not a desirable option and this will not be further assessed.

5.3. Compatibility of content and intervention type options

The choice for an option for the content of the intervention may affect the availability of choice of options for the type of intervention, as some content options require amendment of the Renewable Energy Directive whereas another can be addressed also in a different way. The combinations indicated with 'X' in Table 2 are the ones possible.

Table 2 Compatible options for content and type of intervention

Type of intervention Content	Option A	Option B	Option C
Option 1	X	discarded	X
Option 2	not possible	not applicable	X
Option 3	not possible	not applicable	X
Option 4	not possible	not applicable	X

The following options will be assessed: 1A (baseline scenario), 1C, 2C, 3C and 4C. Option 2C, 3C and 4C will be further referred to as respectively option 2, 3 and 4 – as indicated in Table 3.

Table 3 Options to be assessed

Option number	**Renewable energy share on the basis of (in brackets type of intervention)**
1A (baseline scenario)	share in production mix (does not amend Directive; rules for electricity as defined in Directive; for biomethane as defined in the minutes of the 'Energy Statistics' Working Party of 8 December 2010[19])
1C	share in production mix (amend Directive to add this for biomethane)
2	information in contractual agreements (amend Directive)
3	combination of 1 and 2 with 2 applying on the basis of specific metering (amend Directive)
4	combination of 1 and 2 with 2 applying on the basis of additionality (amend Directive)

[19] Minutes available at: http://circa.europa.eu/Public/irc/dsis/chpwg/library?l=/minutes_reswp_2010doc/_EN_1.0_&a=d

6. ANALYSIS OF IMPACTS

Objectives and coherence

The objective to contain accounting rules for biomethane distributed via the natural gas grid is achieved in options **1C**, **2**, **3** and **4** by amending the Directive to include such rules. In option **1A** it is achieved by having these rules in the minutes of the Energy Statistics Working Party. In the former case this has easier public access and thus visibility. However, the practical effect of these two ways is the same and thus both are effective in achieving the objective.

The objective of treating the accounting for electricity from renewable sources and biomethane distributed via the natural gas grid in an equal manner compared to others forms of energy counting towards the target is a particular difficult one to analyse, since as indicated in section 3.1.2, there is no single scientific way to address accounting of renewable energy in transport that is distributed through a grid where it is mixed with energy generated from other sources and then used in different sectors. An approach using time profile monitoring with real time measurements of electricity charging and determination of accompanying renewable share as indicated in the first element of the overall method in section 3.1.2 may be the best way to achieve most accurate accounting. In present absence of this possibility the most accurate methodology may be the one of option **1A** and **1C**. A number of stakeholders indicated in the response to the public consultation that approaches such as option **2** may constitute a too beneficial treatment for electricity and methane compared to accounting of other forms of energy in transport towards the 10% renewables in transport target. With a specific renewable energy target in the transport sector but not in other sectors using energy obtained from the grids, in this option existing green energy contracts might simply be redirected from other electricity and gas using consumers towards use in the transport sector. It is questionable whether such accounting rules treat all forms of renewable energy in equal manner. This would also apply to a lesser extent for options **3** and **4**.

Where it concerns coherence with other policies, options **2**, **3** and **4** would not be compatible with current statistics collection in the energy sector which following the Energy Statistics Regulation reflects physical rather than administrative flows. Since these options would mean a fundamental change to accounting and data collection they would also require a transition time before they could be applied.

6.1. Economic, social and environmental impacts

Since the issue under consideration concerns potential changes only to the organisational structure of the framework and only to a *part* of the accounting rules for a target that is already in existence, the potential impacts are limited in number. The following potential impacts are identified:

Economic impacts:

– Cost for private bodies: cost for generation of data needed for the particular accounting method.

– Cost to public administration: cost for collection and processing data needed for the particular accounting method (relevant to the content part of the options), administrative burden related to the process of amendment of the Directive (relevant to the intervention type part of the options).

Social impacts

– Privacy: collection and use of data needed for certain methodologies might cause privacy risks, especially if households are included.

Environmental impacts

– Additional renewable energy generation: certain methodologies might encourage private actors to invest in further generation of renewable energy in addition to the renewable energy already being generated because of the 20% EU target for energy from renewable sources in 2020.

6.2. Economic impact

The economic impact concerns the administrative costs for the public and private sector to generate, collect and process data needed for the particular accounting method. For the baseline, option **1A**, the administrative costs are minimal as the data needed to calculate the average share of renewable energy is available to national bodies processing statistics and often they will already produce such averages. The costs for other options will be those additional to the baseline. Since option **1C** differs from the baseline option 1A only in the *type of intervention*, it has no additional administrative costs except in terms of the process needed to amend the Directive. Most respondents to the public consultation expected there would be additional administrative costs for the other options.

For options **2**, **3** and **4** there are additional costs identified in relation to

– generation/collection of data – likely to fall on business

– aggregation of data from consumers – likely to fall on business

– ensure that the aggregated data is received complete and on time – for public administration

– aggregation of data from different businesses – for public administration

– manipulation of data – for public administration

For option **2** data collection will most likely need to come from billing information from energy companies to consumers of energy in transport, including households that are under a green energy contract and where e.g. electric cars would be charged at home. This means energy companies, both large retailers as well as small and medium-sized enterprises, would need to know which consumers that use the energy supplied, electricity or methane, for transport purposes have renewable energy contracts. They will usually have this information available, but will need to aggregate the data from all consumers. The amount of time involved is not much though remains difficult to estimate; it will be very little for energy retailers that supply green energy only, which are often small and medium-sized enterprises. The total number of energy retailers is given in Annex IV; the precise number of small and medium-sized enterprises in this total is unknown. On the basis of the total number of energy retailers the costs for business is estimated to be in the range of € 0.2 - 1 million[20]. National bodies processing statistics will need to ensure that they receive the aggregated information from energy retailers, which includes reminding energy retailers to submit this data timely and follow up if they do not. They then need to aggregate this information received from the different electricity and gas suppliers. The amount of time involved particularly in ensuring that data are received from energy retailers is difficult to estimate, but depends on the number of energy retailers in a Member State. An estimate of the total EU costs for public administration would be in the range of € 7.500 – 35.000.

For option **3** data collection is similar to option 2. Although the number of customer contracts concerned is lower than for option 2, the work in terms of aggregating data is likely to be similar to that of option 2 and independent on the number of contracts concerned. Therefore the cost for business is likely to be similar to that of option 2. Compared to option 2, in option **3** national bodies processing statistics will not only need to aggregate the information received from the different electricity and gas suppliers, but they will also need to manipulate this and other data as indicated in the description of the option. An estimate of the total EU costs for public administration would be in the range of € 10.000 – 40.000.

For option **4** it is likely that because of the conditions attached to the option, energy companies would create a separate type of energy contract that covers the specific renewable energy plants concerned by this option. This would make then make data collection similar to option 2 and 3. However, they would incur significant additional costs in creating and maintaining a separate type of energy contract. At the same, many energy retailers may opt not to take part in such a new market. The cost for business is therefore particularly difficult to predict; they are estimated at € 0.2 - 2 million. The activities and costs for public administration are expected to be similar as for option 3.

6.3. Social impact

The use of the average share of electricity produced from renewable energy sources or biomethane injected in the gas grid as in option **1A** and **1C** present no risk with regard to privacy as such data is already available.

Since option **2** involves collection of data of specific energy contracts this may cause privacy risks, especially since households are included in this collection of data. The risk involved relates the fact that information about the type of energy contract by households is collected which includes risk for identity theft, surveillance or other misuse of information. However, energy companies currently already posses such information and would provide national statistical bodies only with aggregated information. Therefore, the additional privacy risk compared to option 1 is negligible. Privacy risk could also exist for option **3** although the differentiated approach is likely to exclude most households and therefore the amount of collected privacy sensitive data would be significantly lower than for option 2. Thus, the additional privacy risk for this option is also negligible compared to option 1. Under option **4**, new information related to a new type of renewable energy contract would be collected. However, this new information does not seem more privacy sensitive than an existing renewable energy contract and the amount of contracts covered under this option is likely to

[20] For the all estimates in this section the administrative burden calculator (http://ec.europa.eu/enterprise/policies/smart-regulation/administrative-burdens/database-calculator/index_en.htm) has been used. Details are in Annex V.

be low. Thus, the additional privacy risk for this option is also negligible compared to option 1.

6.4. Environmental impact

The environmental impact in terms of additional renewable energy generation has only the potential to affects the options the options concerning the *content* of the intervention. Therefore, there is no environmental impact for option **1C** which differs from the baseline option 1A only in the *type of intervention.*

Options **2** and **3** are not expected to generate additional renewable energy production. The development is for electricity and methane from renewable sources unlikely to be affected by the exact nature of particular rules for such forms of energy to be counted towards the 10% target as such rules are not expected to be the key driver for the development of such energy forms[21]. Rather, Member States support schemes for renewable energy generation are the main driver for this.

Since option **4** only allows counting on the basis of contractual agreements regarding renewable energy that would not receive support from a national support system for renewables and would come from production plants established after a certain date, e.g. 2011, such renewable energy could be considered additional: it would not have been generated in the absence of this rule. The amount of renewable energy concerned is difficult to estimate. It could well be negligible, also because all Member States have binding targets for the overall share of energy from renewable sources in 2020. If it appears that option 4 would mean some additional renewable energy generation without public support, it is possible that Member States may reduce the support for other renewable energy generation as part of their target would thus be achieved already without public support. In such case the effect of option 4 would not be additional renewable energy generation, but rather a potential small shift of cost for renewable energy generation from the public to the private sector.

[21] Cf. CE Delft report referred to in section 2.1 (an overview of its findings on drivers for renewable energy is provided in Annex III). The answers to the public consultation seemed contradictory on this point: only few respondents indicated that the accounting rules would be a key driver, but nevertheless quite many respondents expected additional renewable energy generation, in particular in the case of biomethane. Although asked, respondents did not explain the reason for the latter expectation in detail. The responses to the public consultation are summarized in Annex I.

7. COMPARISON OF POLICY OPTIONS

Table 4 shows a comparative analysis of the impacts of the analysed options against the baseline scenario, according with the requirements below:

– **Effectiveness**: the analysed options' ability to achieving the policy objectives.

– **Cost-efficiency**: costs to public administration and economic operators.

– **Coherence** with other policies, in particular in the area of statistics collection.

Table 4 Comparison of the analysed options

Options	Effectiveness	Efficiency	Coherence
1A: renewable share in production mix (baseline scenario)	Accounting rules for biomethane supplied via the grid are in place: in minutes of the Energy Statistics Working Party Accounting rules treat all forms of renewable energy in equal manner	No additional administrative cost	Coherent
1C: renewable share in production mix (amend Directive to add this for biomethane)	Accounting rules for biomethane supplied via the grid are in place: in the Directive Accounting rules treat all forms of renewable energy in equal manner	Administrative cost only in terms of the process for amending the Directive	
2: information in contractual agreements	Accounting rules for biomethane supplied via the grid are in place: in the Directive Questionable whether the accounting rules treat all forms of renewable energy in equal manner	Estimate cost for private sector: € 0.2 - 1 million Estimated cost to public authorities: € 7.500 – 30.000	Not compatible with current statistics collection which reflects physical rather than administrative flows
3: combination of 1 and 2 with 2 applying on the basis of specific metering		Estimate cost for private sector: € 0.2 - 1 million Estimated cost to public authorities: € 10.000 – 40.000	
4: combination of 1 and 2 with 2 applying on the		Estimate cost for private	

basis of additionality		sector: € 0.2 - 2 million Estimated cost to public authorities: € 10.000 – 40.000	

From the answers to the public consultation it appeared that stakeholders were divided on whether option 1 or 2 should apply. The comparison of the options shows that where it concerns the *content* of the intervention, i.e. the specific method for accounting, option 1 is the preferred option.

Where it concerns the *type of intervention*, i.e. the policy instrument to be used, option 1A and 1C are only different where it concerns biomethane supplied through the grid, which - as indicated - the Directive did not specifically require the Commission to look into. For renewable electricity, which the Directive explicitly asked the Commission to look into, options 1A and 1C are the same and imply that no further action is needed on this point.

Option 1C of amending the Directive is more administratively burdensome than the baseline scenario, option 1A. The practical effect of both options is the same, because in both cases the accounting method for biomethane supplied via the grid is the same. Option 1C has the benefit for biomethane that the accounting method is included in the Directive, which has easier public access and thus visibility than the minutes of the Energy Statistics Working Party in the case of Option 1A. However, by means of the publication of this Impact Assessment itself it will already become much more widely known what the accounting method for biomethane supplied via the grid is for the 10% target for renewable energy in transport. Further, considering that the contribution towards the 10% target of biomethane supplied though the grid is expected to be relatively small, it would not be proportional to start a process for amending the Directive on this point. Therefore, option 1A is preferred.

8. FUTURE MONITORING AND EVALUATION

Monitoring and evaluation will be done in line with existing requirements for the Commission, in particular Article 23(8) of the Renewable Energy Directive which requires the Commission to present a report by 31 December 2014 addressing inter alia with respect to the 10% target for energy from renewable sources in transport a review of – as specified in indent (b)(iv) inter alia "the methodology chosen to calculate the share of energy from renewable sources consumed in the transport sector". An indicator to be used in this would be the estimated contributions in final gross energy consumption in the transport sector which were also used in this Impact Assessment as present in Table 1. Member States' progress reports submitted according to Article 22(1) would need to be assessed for analysing whether the projections for renewables in transport for 2020 provided in the National Renewable Energy Action Plans remain valid.

Further, Article 9(1) of the Energy Statistics Regulation requires the Commission (Eurostat), in collaboration with the Member States, to make sure that statistics are comparable, transparent, detailed and flexible by inter alia reviewing the methodology used to generate renewable energy statistics in order to make available additional, pertinent, detailed statistics on each renewable energy source, annually and in a cost-effective manner.

List of Annexes

ANNEX I – CONSULTATION

9.1 Introduction and overview of the consultation

From 14/04/2011 to 14/06/2011 the Commission conducted a public consultation to inform its thinking. The consultation is titled *Accounting methods and conditions for the 10% renewable energy in transport target – and on the need for additional types of biofuels being listed in Annex III of the Renewable Energy Directive*[22].

The consultation document poses a series of questions under the following sections:

Section A: Electricity from renewable sources in transport.

This section explores the significance of the 10% target in driving the uptake of electric vehicles, the conditions for counting the whole amount of renewable electricity towards the 10% target, and the costs and benefits associated with preferred options for doing so.

Section B: Hydrogen from renewable sources in transport.

This section explores the techniques for producing hydrogen from renewable sources, and the possible ways of calculating the contribution of hydrogen originating from renewable sources towards the 10% target.

Section C: Biomethane via the natural gas grid in transport.

This section explores the significance of the 10% target in driving the uptake of methane-powered vehicles fuelled by methane from the gas grid, the conditions for counting the whole amount of methane towards the 10% target, and the costs and benefits associated with preferred options for doing so.

Section D: Energy content of biofuels.

This section explores the possible inclusion of types of biofuels not currently listed in Annex III of the Renewable Energy Directive, and the precision of energy content values[23].

22 http://ec.europa.eu/energy/renewables/consultations/20110614_res_target_en.htm

23 The responses to this section have been included in the summary evaluation although this is an element outside the scope of this Impact Assessment.

In total 39[24] responses were received from a range of respondents including:

– national authorities (5 responses);

– companies (16 responses);

– industry associations (16 responses); and

– other organizations including one NGO and one academic institution.

Table 5 provides a list of participants in the public consultation and an overview of the sections of the consultation paper which each participant responded to. Not all respondents provided comments on all of the questions. In many cases the number of responses for individual questions was only around 30 responses. This reduces the significance of a statistical analysis of the responses. Some respondents provided multiple answers to some questions, so the number of responses does not always reflect the number of submissions.

Table 5 Overview of the sections of the consultation paper which each participant responded to

Organization	**Country**	**Section**			
		A	**B**	**C**	**D**
National Authorities					
Danish Energy Agency	Denmark	x	x	x	x
German Ministry for the Environment	Germany	x	x	x	x
Netherlands Ministry of Infrastructure and Environment	Netherlands	x	x	x	x
Sweden Ministry of Enterprise, Energy and Communications	Sweden	x		x	x
United Kingdom Department for Transport	UK	x	x	x	x
Companies					
AGRARplus	Austria	x	x	x	x
APAG (CEFIC - APAG)	Belgium	x		x	x
APPA Biocarburantes	Spain	x	x	x	x
Better Place	Denmark	x			
BioMCN	Netherlands			x	x
CHOREN Industries	Germany		x		x
Diester Industrie	France	x	x	x	x
edp (Energias de Portugal)	Portugal	x			

[24] In total there are 40 responses to the consultation. However, two responses were received from one company. After clarification with the respective company, one response has been deleted.

Organization	Country	Section			
		A	B	C	D
ENI	Italy				x
IFPEN (IFP Energies nouvelles)	France		x		x
INEOS	France	x		x	x
Neste Oil Corporation	Finland				x
Rossi Biofuel	Hungary			x	x
Scania	Belgium	x	x	x	x
Shell	Netherlands	x	x	x	x
TOTAL	France	x	x	x	x
Associations					
Austrian Federal Economic Chamber	Austria	x	x	x	x
Association of the German Biofuel Industry (VDB)	Germany	x	x	x	x
Bundesverband Erneuerbare Energien (BEE)	Germany	x	x	x	x
Central Europe Energy Partners (CEEP)	Belgium	x	x	x	x
Community of EU Railway & Infrastructure Companies (CER)	Belgium	x			
ePURE - European Renewable Ethanol	Belgium	x	x	x	
ESTERIFRANCE (biodiesel producers group)	France	x	x	x	x
EU Biodiesel Board (EBB)	Belgium	x	x	x	x
EU Biofuels Technology Platform (EBTP)	Germany	x		x	x
EU Fuels Oxygenates Asoc. (EFOA)	Belgium				x
EU Hydrogen Association, EHA	Belgium		x		
EU Petroleum Asoc. (EUROPIA)	Belgium	x	x	x	x
Natural & Bio Gas vehicle Asoc. (NGVA)	Spain	x	x	x	
New Energy World Industry Grouping (NEW-IG)	Belgium		x		
SNPAA (Asoc. bioethanol producers, France)	France	x	x	x	
Société Nord Ester	France	x		x	x
Other					
TU Berlin / Mr. Creuzig	Germany	x	x		
Transport & Environment (T&E)	Belgium	x	x	x	x
Total number of responses to each section		30	26	28	30

9.2 Headline results of the consultation

In the period to 2020, none of the respondents sees the 10% target as being a strong driver of electric vehicle developments, and only one of the respondents, the Natural Gas Vehicles Association (NGVA) sees the 10% target as being a strong driver of the development of methane-powered vehicles. More than half of the respondents who provided comment on these questions (questions A1 and C1) see the target as being 'not significant'.

There are a wide range of views on the appropriate conditions for counting the whole amount of electricity used in electric vehicles as being renewable. No clear option emerged as the favoured approach, but it is notable that there was less support for tradable certificates compared with biomethane – roughly a quarter of respondents for electricity compared with nearly half for biomethane.

Around two thirds of respondents do not expect significant hydrogen production from renewable sources by 2020. There are almost no suggestions for calculating the contribution of hydrogen towards the 10% target.

The majority of respondents supported an approach using either tradable certificates or supply contracts which enable accounting for biomethane injected into the grid. However, there are some notable differences of opinion on this issue – for example, Germany is strongly opposed to the use of tradable certificates, whereas other countries such as the United Kingdom, Denmark, Sweden and the Netherlands are supportive of this option.

Several respondents noted risks relating to double counting of biomethane from the grid. Potential double counting could arise if, for example, biomethane is counted for electricity, heat and transport, biomethane is counted in the country of origin and the country of use if there is cross-border trading, or biomethane benefits from multiple support instruments (e.g. feed-in-tariffs, certificates, subsidies, tax exemptions).

9.3 Summary of results from individual sections

Section A: Electricity from renewable sources in transport

Question A1: how do you value the impact of the 10% target for renewable energy in transport by 2020 on the development of electric vehicles?

– *Not significant.*

– *Significant, but other policies/developments will be of more importance.*

– *Important, along with other policies/developments.*

– *A key driver.*

Respondents generally foresee a minor impact of the 10% target for renewable in transport by 2020 on the development of Electric Vehicles (EVs). 17 out of 30 respondents state that the impact will not be significant. The main reason provided is that electricity for EVs will mainly come from non-renewable sources as renewable electricity is envisaged to have only a minimal share of energy used in road vehicles by 2020.

An additional 9 of the 30 respondents indicated that the impact would be significant, but that other policies are of more importance. Suggestions provided by two of the National Authorities and the NGO include National Strategies, National subsidies and CO_2 standards for cars.

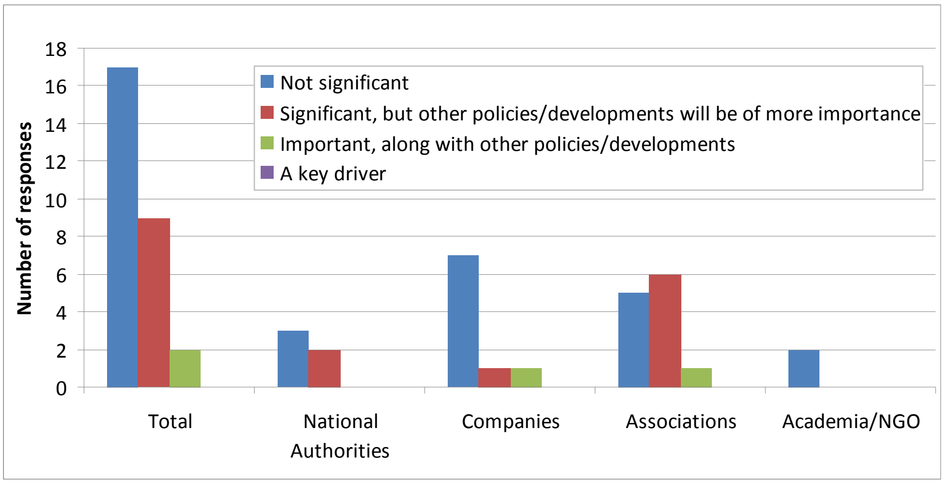

Figure 1 Responses to the impact of the 10% target on the development of electric vehicles

Question A2: under what condition do you think it would be justified to count the whole amount of electricity in electric vehicles as renewable?

– *None.*

– *When the electricity is produced fully from renewable energy and without connection to the electricity grid.*

– *When the electricity comes with a tradable certificate showing that that amount of renewable electricity was generated.*

– *When there is a supply contract showing that that amount of renewable electricity was generated.*

– *When there is evidence on a Member State level that the development of electric vehicles has led to that amount of additional renewable electricity generation.*

– *Other (please specify):*

All of the respondents are opposed to the counting of the whole amount of electricity in EVs as renewable if there is no proof that it is renewable. However, of the 30 responses to this question, there was considerable divergence on the conditions that would justify this:

– around one third of respondents (11) see no conditions as being adequate;

– 8 of respondents state that a certificate system would be adequate;

– 4 state that electricity must be produced fully from renewable energy and without connection to the electricity grid;

– 3 state that there need to be a supply contract showing that that amount of renewable electricity was generated and;

– 3 state that there needs to be evidence that the development of electric vehicles has led to additional renewable electricity generation.

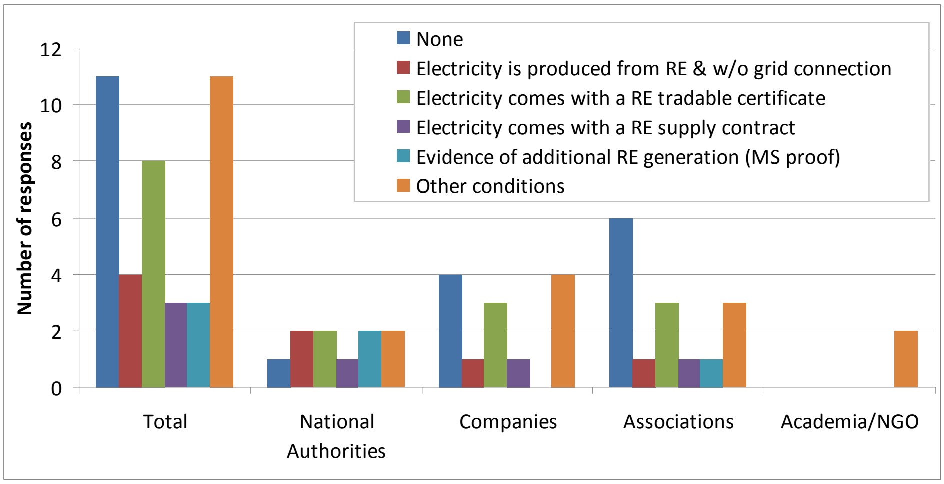

Figure 2 **Responses to the conditions to count the whole amount of electricity in EVs as renewable**

In addition, a number of respondents also suggested other options such as:

– a warranty of the energy supplier that the electricity is 100% renewable (supported by 3 respondents);

– smart charging as a prerequisite which shows how much renewable electricity has been used (supported by 3 respondents);

– a statistical approach based on the electric mix in each Member states during the hours of the most representative charging time, stated by TOTAL;

– if the electricity is delivered by a 100% renewable energy utility, stated by Mr. Creuzig of the Technical University (TU), Berlin.

Question A3: what benefits do you expect the option you selected under (2) will have?

– *Additional renewable electricity generation.*

– *Faster development of electric vehicles.*

– *Other (please specify):*

– *None, it only changes the accounting method.*

There does not appear to be a strong relationship between the choice of conditions under Question A2 and the benefits identified by respondents under Question A3. Regardless of the approach preferred in terms of the conditions for counting renewable electricity, the most common benefit identified by respondents is additional renewable electricity generation (12 of 30 respondents). The second most popular benefit is faster development of EVs (7 of 30 respondents). In addition, a number of other benefits were also mentioned, including 3 respondents which indicated that it would help ensure that the 10% transport target is actually met.

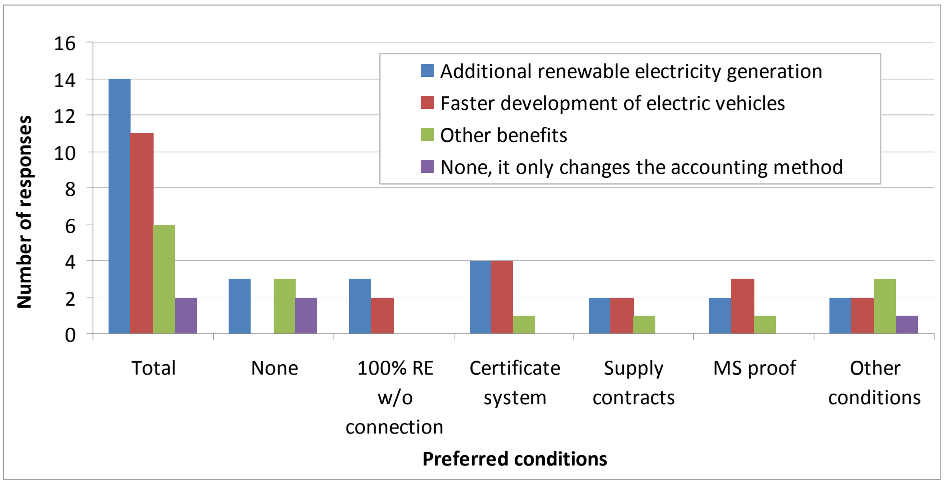

Figure 3 Expected benefits based on the preferred conditions in Question A2

Question A4: what costs in terms of administrative burden do you expect the implementation of the option you selected under (2) will have?

– *Additional statistics collection in all Member States.*

– *Generating additional information on the basis of existing statistics.*

– *Other (please specify):*

– *None.*

The expectations regarding administrative costs of implementing the preferred accounting method are related to the chosen method. Indeed, respondents which see no conditions as being appropriate to justify the counting of the whole amount of electricity as renewable also foresee no additional burden. The respondents which prefer that electricity must be produced fully from renewable energy and without grid connection and those in favor of a certificate-based system believe that additional statistics collection in all Member States will be required.

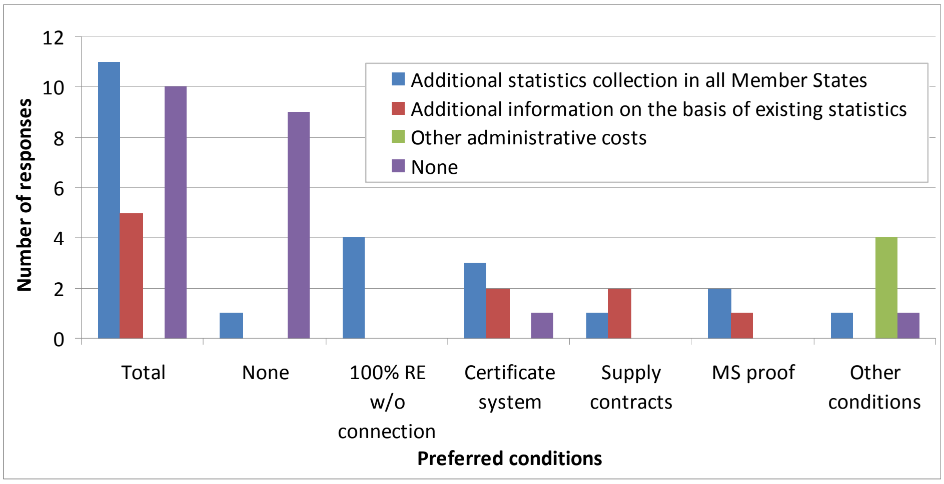

Figure 4 **Expected administrative costs based on the preferred conditions in Question 2**

Section B: Hydrogen from renewable sources in transport

Question B1: Which are in your view the most likely ways to produce hydrogen from renewable sources (partly or fully) by 2020?

– *From biomethane, e.g. by steam reforming/partial oxidation.*

– *From a mixture of natural gas and biomethane, e.g. by steam reforming/partial oxidation.*

– *On the basis of renewable electricity, by electrolysis.*

– *On the basis of the electricity mix from the grid, by electrolysis.*

– *From biomass directly, e.g. by gasification/partial oxidation or biological processes*

– *Other (please specify):*

– *None are likely to be significant by 2020.*

Of the 26 responses to this question, 17 (around two thirds) stated that the production of hydrogen will not be significant by 2020 from any of the techniques listed or using other hydrogen production processes which could have been suggested.

Lack of cost-competitiveness is seen as the main reason, with several respondents (e.g. APPA, Total) mentioning that fossil fuel-based hydrogen production will be the main choice by 2020.

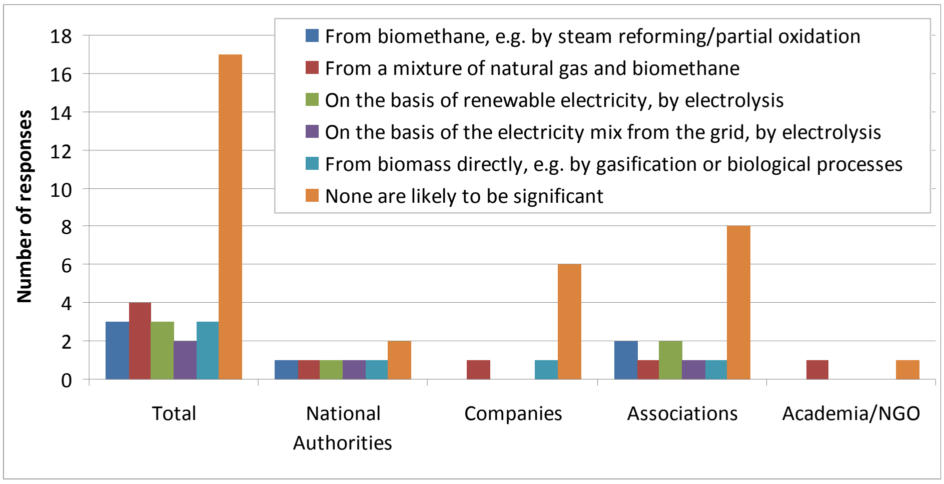

Figure 5 **Views on the most likely ways to produce renewable hydrogen by 2020**

Of those that do see a role for the production of hydrogen from renewable sources, there is no obvious preferred hydrogen production technology. Preferences are rather evenly distributed across the responses, reflecting the fact that infrastructure deployment is at too early a stage to draw robust conclusions regarding which process could emerge as the leading source of hydrogen production in Europe in the future. Indeed, the two submissions from European hydrogen and fuel cell industry associations notably do not single out any of the suggested hydrogen production pathways. Some points worth noting:

– The EU Hydrogen Association is making the case for including 'waste H2' (by-product from industrial processes).

– For cost-reasons, some respondents (3) see natural gas being used at first, possibly successively complemented by biomethane.

– Several respondents mention high shares of renewable electricity in the grid as a driver for hydrogen production, i.e. for large-scale/ long-term energy storage for fluctuating renewable energy sources (in particular, wind power).

Question B2: For each option you selected under (2), if it would be used for transport, how would you suggest to calculate its contribution to the 10% target for renewable energy in transport?

Since hydrogen is expected to play an insignificant role by 2020, most of the respondents do not propose a specific calculation method but state that the development of a calculation method must be in line with the respective production pathways that emerge.

Almost all respondents state that only the share of hydrogen produced from renewable energy (i.e. biomass gasification, biogas reforming or via electrolysis using renewable electricity) should be counted as renewable, excluding quantities derived from fossil fuel use in e.g. mixtures of biomethane and natural gas or when renewable hydrogen is supplied to a grid which is also distributing hydrogen from non-renewable sources.

The respondents are supportive of renewable sources being counted towards the 10% target as long as the Member States provide the respective evidence. This could, for example, be provided by a certificate system (supported by 3 respondents). One industry association (NEW-IG) suggests that until 2020 all of the hydrogen dispensed to vehicles should be counted as renewable as hydrogen use will remain a niche activity by 2020 anyway. Some general descriptions of other possible calculation methods are also provided:

– The calculations should be based on an average vehicle and on the average amount of fossil fuel that is replaced (Netherlands Ministry of Infrastructure and Environment).

– A mass balance system from the source to the final use such as for biofuels could be used, with the same sustainability and accountability conditions should be used (ePURE).

– One respondent (Choren Industry) suggests that the use of hydrogen produced from renewable sources in the mineral oil refining process should also be counted towards the 10% target where it substitutes fossil energy-based hydrogen in this process.

Section C: Biomethane via the natural gas grid in transport

Question C1: how do you value the impact of the 10% target for renewable energy in transport by 2020 on the development of methane vehicles fuelled by methane from the gas grid?

– *Not significant.*

– *Significant, but other policies/developments will be of more importance.*

– *Important, along with other policies/developments.*

– *A key driver.*

Only one of the respondents, namely NGVA, identified the 10% RED target as a ‘key driver’ of the deployment of biomethane vehicles to 2020. Around half of the respondents (15 of 28) state that the impact will be ‘not significant’, with another third of respondents (11 of 28) believing that the target will have an important or significant impact next to other policies.

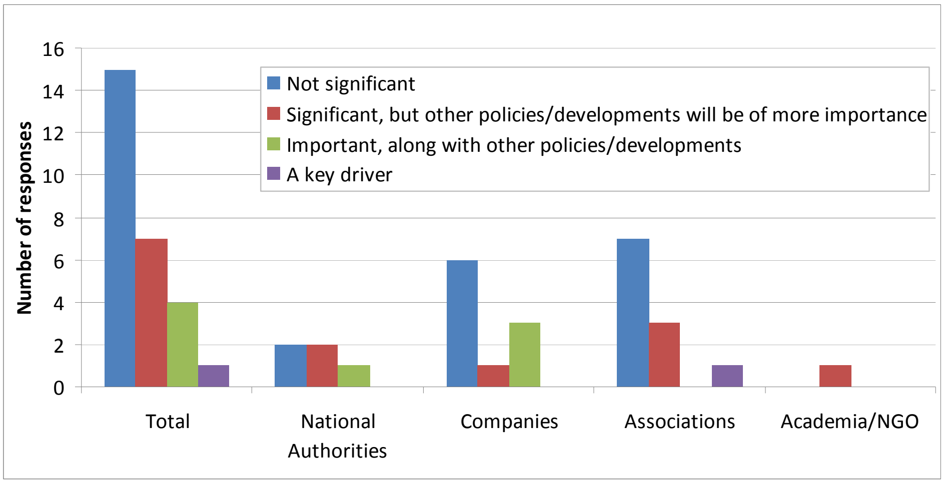

Figure 6 Responses to the impact of the 10% target on the development of methane fuelled vehicles

An important reason provided for the expected low contribution of biomethane in the timeframe to 2020 is the significantly lower barriers to the deployment of liquid biofuels compared with biomethane from the grid[25]. Further, the competition with natural gas, LPG and the greater incentives to generate electricity also limit the use of biomethane as a transport fuel. Policies identified as being more important for the development of methane vehicles relate to the price of methane as a transport fuel, including tax incentives, support mechanisms for infrastructure requirements, or rebates on the purchase price of methane-powered vehicles.

Question C2: under what condition do you think it would be justified to count the whole amount of methane extracted from the gas grid for the use in vehicles as renewable?

– *None, until the time that all methane injected into the gas grid concerned is originating from renewable sources.*

– *When the methane comes with a tradable certificate showing that that amount of biomethane was generated.*

– *When there is a supply contract showing that that amount of biomethane was generated.*

– *When there is evidence on a Member State level that the development of methane vehicles has led to that amount of additional biomethane generation.*

– *Other (please specify):*

There is a split between respondents on the preferred conditions for counting of the whole amount of methane in methane vehicles as renewable:

25 For biomethane, dedicated distribution infrastructure (such as fuelling stations), vehicle drive-trains as well as adjustments of national regulations to allow injection of biogas into the general natural gas grid are required, whereas liquid biofuels can generally 'drop in' to the existing distribution system.

– 7 of the 28 respondents do not want to count all methane as renewable until all methane in the grid is renewable;

– 12 of the 28 respondents support counting the methane as renewable when it comes with a certificate;

– 7 of the 28 are supportive if it comes with a direct supply contract.

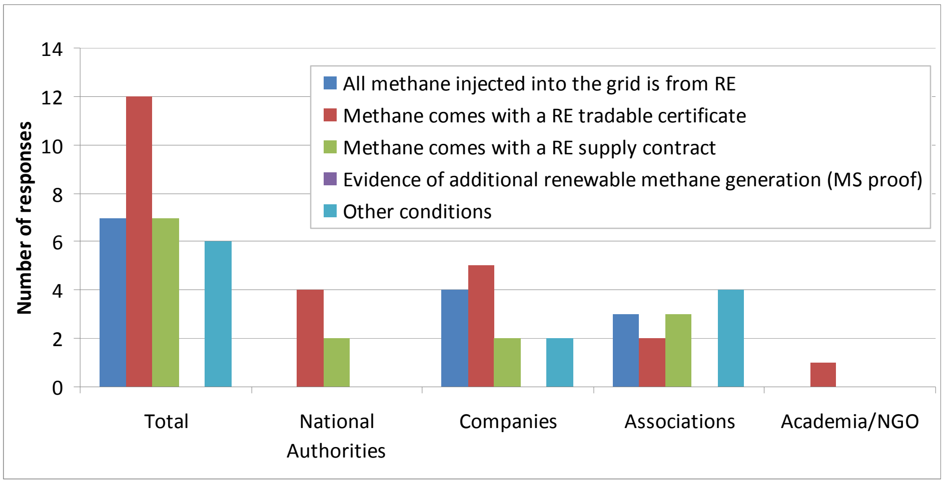

Figure 7 Preferred conditions to count the whole amount of methane as renewable

There is no obvious, preferred set of conditions for counting renewable biomethane, probably reflective of the lack of practical experience to date. Industry responses (companies and industry associations) mainly representing the interests of the liquid biofuels industry prefer that no methane is counted as renewable as long as not all methane in the grid is renewable. However, around half of the company responses are supportive of counting biomethane on the basis of tradable certificates, as were the majority of National Authorities. The United Kingdom, Denmark, Sweden and the Netherlands are supportive of tradable certificates; only Germany is opposed – it supports direct selling to the customer with no double counting due to a separate selling of a green certificate.

Several other respondents also stress that is necessary to ensure that no double counting occurs (Denmark, the Netherlands, APPA Biocarburantes). Several potential fields for double counting are mentioned, for example with regard to biomethane being double counted for electricity, heat and transport; in the country of origin and the country of its use with cross-border trading; or based on different support instruments (feed-in-tariffs, certificates, direct subsidies, tax exemptions).

Question C3: what benefits do you expect the option you selected under (2) will have?

– *Additional biomethane generation.*

– *Faster development of methane vehicles.*

– *Other (please specify):*

– *None, it only changes the accounting method.*

Regardless of the conditions selected in response to Question 2, the most popular benefit identified by the respondents (15 of 27) was that they expect additional biomethane production to result. In many cases, the submissions did not explain in detail why this benefit was expected to result, however, Sweden for example noted that national measures would still be required, and that the 10% target (and accounting method) would not lead to additional biomethane production on its own.

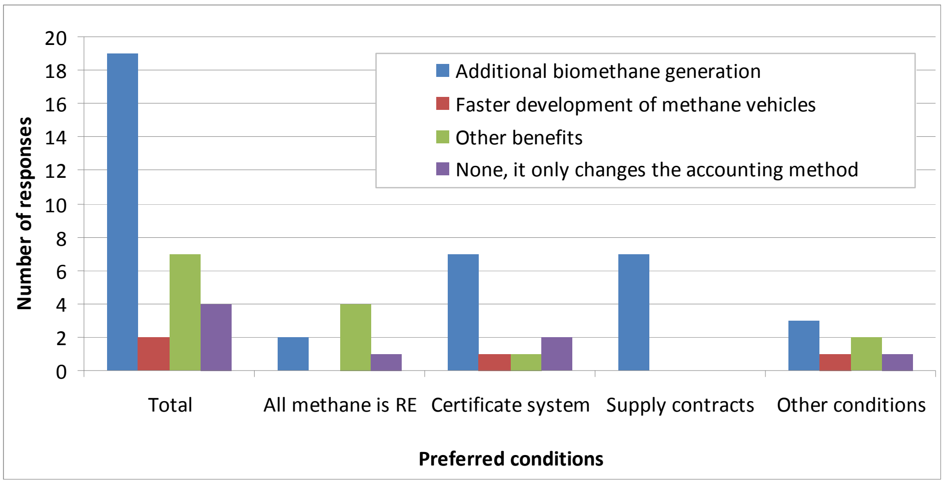

Figure 8 Expected benefits based on the preferred conditions in Question C2

Respondents also suggested a number of other benefits of tradable certificates or direct supply contracts, including the securing of correct and verifiable declarations and accounting and the clear identification of feedstock and processes applied to produce biomethane. The NGVA submission states that it expects significant job deployment in the Member States if any percentage of biomethane being injected into the gas grid is acknowledged.

Question C4: what costs in terms of administrative burden do you expect the implementation of the option you selected under (2) will have:

– *Additional statistics collection in all Member States.*

– *Generating additional information on the basis of existing statistics.*

– *Other (please specify):*

– *None.*

There is no consensus on the expected costs in terms of administrative burden for any of the accounting methods with the exception of the option that all methane injected is renewable, where no costs are expected. In general, industry (companies and industry associations) expects mainly no or low costs in terms of administrative burden, independently from the preferred option. Three out of five of the National authorities stated that there will be additional statistics collection required in all Member States if a certificate system or direct supply contracts are used; the Swedish submission also noted the need for a new administrative system to handle the certification of 'green' contracts.

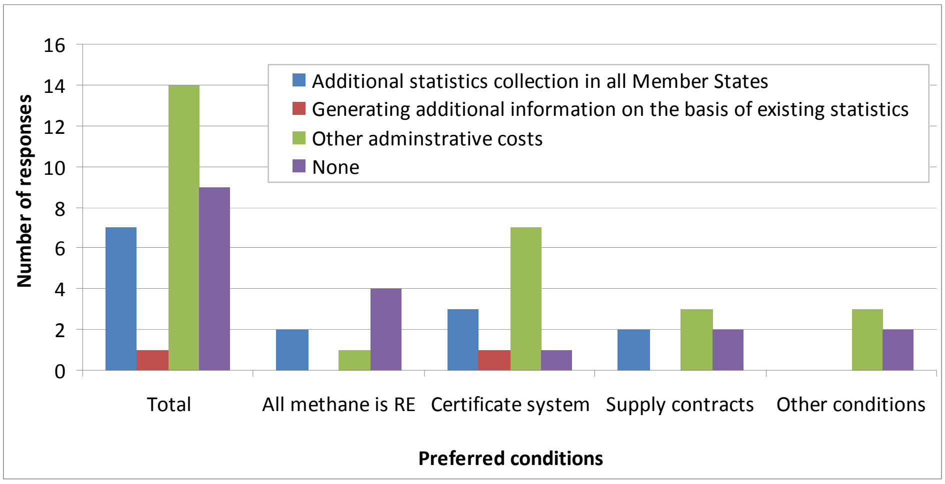

Figure 9 Expected administrative burden based on preferred conditions in Question C2

Section D: Energy content of biofuels.

Question D1: Do you think additional types of biofuels need to be listed in Annex III of the Directive? If yes, which ones and could you provide values?

Around half of the respondents (16 out of 30) would like the Commission to include additional types of biofuels in Annex III of the Directive. Biofuels that should be included are the following (sorted by frequency with most frequently named biofuel listed first):

Table 6 Proposed additional types of biofuels to be listed in Annex III

Type of fuel	Energy content	Mentioned by # respondents
Hydrotreated Vegetable Oil (HVO)		**4**
HVO petrol	44.87 MJ/kg	1
HVO jetfuel	44.30 MJ/kg	2
HVO LPG	46.33 MJ/kg	1
Bio-Ethers		**11**
TAME (Tert-Amyl Methyl Ether)	36.44 MJ/kg, 37.66 MJ/kg	4
TAEE (Tert-Amyl Ethyl Ether)	NV	2
THEME (Tert Heptyl? Methyl Ether)	38 MJ/kg	1
THxME (Tertiary Hexyl Methyl Ether)	NV	1
THEE (Tert Heptyl? Ethyl Ether)	NV	1
THxEE (Tertiary Hexyl Ethyl Ether)	NV	1

Type of fuel	Energy content	Mentioned by # respondents
Diethyl Carbonate	NV	1
Bio-Ester		**2**
FAEE (Fatty Acid Ethyl Esters)	NV	2
Jet fuels		**4**
Fischer-Tropsch jet fuel	NV	2
HVO jet fuels (see HVO)		
jet fuel produced via biomass liquefaction/pyrolysis	NV	1
jet fuel produced via sugar/cellulose direct conversion	NV	1
Renewable Hydrogen	120 MJ/kg, 10.80 MJ/m³	**3**
Biofuels, produced from sugar		**2**
Sugar to Y molecules	NV	1
Direct conversion via sugar/cellulose	NV	1
Bio-Alcohols		**2**
Bio-Propanol	31 MJ/kg	1
Bio-Methanol	NV	1
Woodgas	NV	**1**
Bionaphta	NV	**1**
Used oil	NV	**1**

Several respondents also propose the inclusion of a procedure that allows producers of biofuels to ask at any time for the inclusion of a type of biofuel and value to the Annex III.

Question D2: Do you think more precision in terms of decimals is necessary in the values in the Annex? If yes, could you provide such values?

All five of the responding National Authorities would like to see greater precision, to an accuracy of 1-2 decimal places. Most of the responding companies on the other hand do not see the need for more precision (only three out of the 12 company submissions were in favour). Industry associations were split, however several (3 of 5) would like to have more precision (to 2 decimal places). The Association of the German Biofuel Industry as well as the German Renewable Energy Federation states that it is necessary to clarify the intended purpose of the values listed in Annex III as well as moving to a greater level of accuracy – for example, if the values are to be used for statistical purposes only and not for other purposes such as determining taxation. They insist that Germany was planning to change the values for taxation according to the RED Annex.

With respect to the more precise values for different types of biofuels the respondents mainly referred to specific sources. For example, the Sweden Ministry of Enterprise, Energy and Communications refers to the values used in energy statistics of Sweden, the EU Biofuels Technology Platform and Neste Oil Corporation propose the use of German DIN51900-1:2000 or other standards such as ASTM D 4809-2009. The German Renewable Energy Federation and the Association of the German Biofuel Industry suggest the use of values already applied for taxation (in Germany: Decree of the German Federal Ministry of Finance, 17.06.2007, III A1 – V 8405/07/002). The Austrian Federal Economic Chamber refers to CONCAWE.

For the fuel types that have been proposed by the respondents to be included in Annex III (see Question D1) more precise values can be found in Table 6.

ANNEX II – EXTERNAL EXPERTISE: OVERVIEW OF DIFFERENT ACCOUNTING METHODS FOR ELECTRICITY, METHANE AND HYDROGEN FROM RENEWABLE SOURCES.

This annex presents the findings on different approaches of accounting of the study referred to in section 2.1 of this Impact Assessment.

First, we describe different ***situations*** in which renewable energy (electricity, hydrogen and methane) may be fed into a vehicle. The subject is complex, with many physical possibilities. Therefore, we use these situations as building blocks for building up the analysis, starting with simple situations that are relatively easy to understand, and then moving towards more complex situations. For each situation we will give indications whether or not they will be used in practice.

We then consider possible ***methodologies*** and formulas for incorporating the renewable electricity used in transport in the Renewable Energy Directive (RED) target for transport. After that we will go into the question whether these methodologies are relevant for/could also be applied to hydrogen and methane from renewable sources.

In that part, we will also go into the differences between real time use of the produced renewable energy in a vehicle, or using an energy grid as a kind of storage.

Finally, we analyse the ***conditions*** under which the methodologies can be applied, also regarding the data requirements for monitoring.

10.1 Attributing renewable energy to transport (situations)

A large variety of routes from renewable energy production to the vehicle can be envisaged. In order to structure these, the following schemes of *electricity* production and use in battery-electric vehicles can be sketched to describe prototype situations[26]. The situations are described as general as possible, so that the situations also capture the situations for methane, and most also for hydrogen.

The scope of this study is grid connected renewable energy. However, to deal with the complex matter, we first describe island systems (i.e. not grid connected) to build up the analysis step by step.

Situation 1: direct feeding from an island system renewable source to vehicle

This situation occurs when a vehicle is directly connected to an island system renewable energy source (e.g. a PV-system or a small wind turbine) that is not grid-connected, and there is no other electricity demand from the source nor storage outside the vehicle. All the energy flows into the vehicle when it is charged, real time. The only energy demand is from the vehicle.

[26] Note that these vehicles can be either full electric vehicles, plug in hybrid vehicles or electric vehicles with range extenders.

The amount of renewable energy used by the vehicle can be measured at the source or at/in the vehicle.

Figure 10 **Situation 1:** direct feeding, from an island system renewable source to a vehicle

Situation 2: direct feeding with island system renewable system and storage

When the source from Situation 1 is equipped with a storage facility, some of the energy will be lost in the storage/destorage-cycle, which may be substantial in some cases. The only energy demand is from the vehicle, just as in situation 1.

The amount of renewable energy used by the vehicle can be measured at the feeding point of the vehicle or in the vehicle.

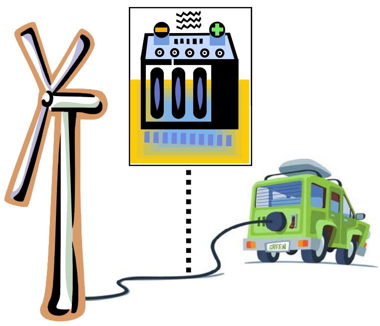

Figure 11 **Situation 2:** direct feeding with island system renewable system and storage

Situation 3: feeding with island system renewable system and various other energy demands.

This might e.g. be the case with an island system household with no grid coupling is operating a renewable energy source, a storage facility and no other fossil powered generator. The difference with situations 1 and 2 is that also other energy demands exist in this situation, beside the vehicle. Therefore, measurement of the renewable energy production is not related to the feeding energy of the vehicle anymore. But all the feeding energy for the vehicle is produced by the renewable energy source.

The amount of renewable energy used by the vehicle can be measured at the feeding point of the vehicle or in the vehicle.

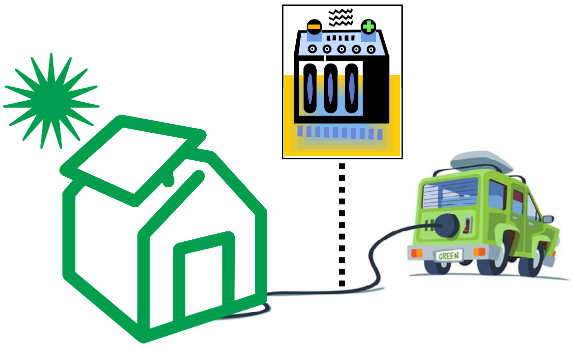

Figure 12 **Situation 3:** direct powering of a vehicle on private property on an island system household, without making use of a public grid, but with other demands also

Situation 4: feeding with island system mixed renewable and non-renewable system and various other energy demands

This might e.g. be the case where a stand alone household with no grid coupling is operating a renewable energy source and other (fossil) energy sources. The difference with situation 3 is the fossil energy source, e.g. a diesel generator. Therefore, measurement of the energy at the feeding point of the vehicle or in the vehicle has no direct relationship anymore with the type of energy production, which in this situation might be the renewable energy source or the fossil energy source. This situation stands as a model for 'real life', where many different types of generators and many different types of demand exist, all coupled to the energy grid.

The amount of renewable energy used by the vehicle can not be measured at one point anymore in this situation. It can be calculated from measurements of the total production per time unit (e.g. one year) of the renewable source and the fossil source (i.e. the production mix), and the energy used by the vehicle in the same period. That way, information on the question whether the vehicle is charged with renewable power or diesel power is lost, since only volume measurements over a period of time are used. To determine whether the vehicle is charged with solar or with diesel power in this situation, real time measurements of the production curves of both generators have to be used and compared to real time measurement at the feeding point of the vehicle or in the vehicle itself.

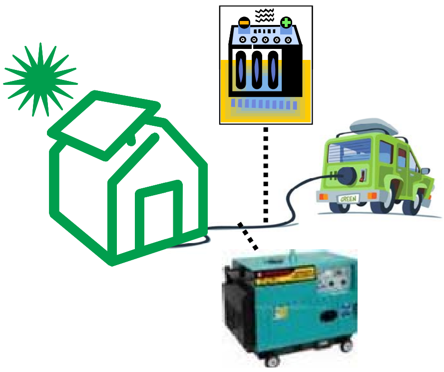

Figure 13 **Situation 4:** feeding with island system mixed renewable and non-renewable system and various other energy demands

Situation 5: grid coupled household with renewable energy system

The grid coupling adds more complexity. In situation 4, the only energy generators were the renewable energy system and the 'fossil' energy generator. Now, the household exchanges energy with the grid, and is coupled to thousands of large and small generators, both renewable and fossil. For methane, this situation describes a private methane filling station 'behind' the gasmeter of the household. The 'production mix' from situation 4 has now become a real statistical production mix.

The amount of renewable energy used by the vehicle can be calculated now from the measurement of the energy used by the vehicle (metering in the vehicle or at its feeding point, since the metering of the household also feeds other demands in the house) and either the (national) energy production mix that is fed into the grid, or the energy production mix that is contracted for the specific feeding point of the vehicle.

Again, in the first case, either the average production mix can be used, or the real lime production mix (see the text box below).

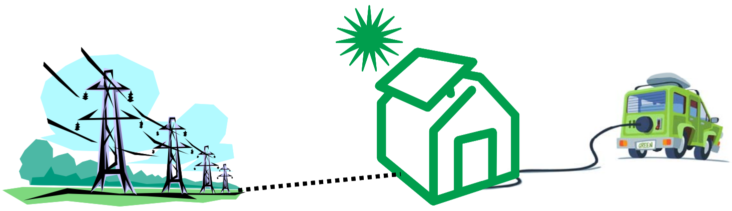

Figure 14 **Situation 5:** grid coupled household with renewable energy system

Are time related measurements relevant?

For methane (and also for hydrogen), the grid is in fact used as a kind of storage facility. The determination of the amount of biomethane in the consumption is determined by the amount of biomethane that is fed into the grid. For electricity however, the factor 'time' enters far more strongly into the analysis.

The time of feeding can be very relevant in some cases, which can be explained with a 'thought experiment'. Imagine a hypothetical situation where electric cars are feeding only at night, and where the only renewable sources of electricity are solar PV-panels, producing only during the day. It is clear in that case that a calculation using yearly sums of electricity use by electric cars and the yearly production mix of electricity would not provide a realistic estimate for determining the amount of renewable electricity actually used in the electric cars. This extreme situation underlines the point that real time measurements can be very relevant. In real life of course, the situation is more complex, since renewable sources such as wind turbines also produce at night time, and since electric cars do not only charge at night. See also the remarks on this subject under 'Conditions'.

Situation 6: grid coupled dedicated feeding point for vehicles

This situation seems one step less complex than situation 5. All energy used at the vehicle charging point is fed into vehicles, and the feeding point may be used by different vehicles - for example, at a public charging station, or CNG filling station, on a highway. The amount of renewable energy can therefore be calculated from the measurement of the energy fed into the vehicles (requiring measurement at the feeding point or in the vehicles), and either the (national) energy production mix that is fed into the grid, or the energy production mix that is contracted for the specific feeding point.

However, taking into account that vehicles can charge at different feeding points, measurement of the energy used at dedicated feeding points can cause problems with either double counting or with data gaps: when at other feeding points the only way to calculate the amount of energy used by the car is measuring in the car[27]. Measuring and counting both at the cars and at feeding points will then cause double counting at these points, whereas data gaps occur when the energy fed in at other points is not measured.

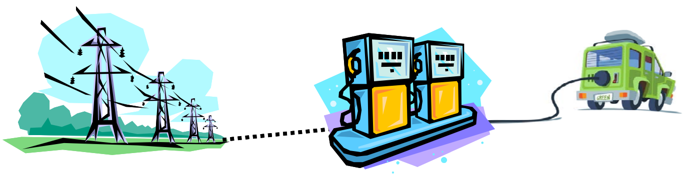

Figure 15 **Situation 6:** grid coupled dedicated feeding point for vehicles

Situation 7: green energy contracts using certificates

This situation resembles Situation 5, but now with a specific 'green energy contract' for the household, that uses green certificates. That may, for example, be green 'certificates or origin' for renewable electricity, or the bioticket that is introduced in the Netherlands. This situation is also relevant for dedicated feeding points for electric or CNG vehicles (see Situation 6).

There is in this situation no direct physical 'link' between the feeding point of the vehicle and the renewable energy source. The link is an administrative one, via certificates that guarantee that the energy that is used by the vehicle (or the household, or company) is produced by renewable sources. These sources can be within the same country, within the EU or outside the EU, depending on the specific contract.

Note that real time measurements are no option in this type of administrative volume contracts.

27 Note that electric cars can in principle be charged ('slow charging') at every possible plug and socket outlet, not especially dedicated for charging of electric vehicles. We assume that not every single grid socket will be metered.

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part 2

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Communication to the Commission

on communicating outcome of the Impact Assessment related to requirements of Article 3(4) of Directive 2009/28/EC

{C(2012) 6287 final}
{SWD(2012) 262 final}

Situation 7a: 'green contracts' from within the country or the EU

In this methodology a certificate system is set up in order to determine the share of renewable electricity (large scale solar-PV, wind on shore, wind off shore, hydro, biomass and possibly CSP) that can be attributed to transport. Such a scheme is comparable with the green contracts that are in place between consumers and electricity suppliers in the Netherlands. In the Netherlands small consumers have the option to enter into a green electricity contract with their electricity supplier. The electricity supplier has to buy green certificates from producers in order to meet its contract obligations with its 'green electricity consumers'. In so far as these contracts are in place, and the consumers concerned make use of EVs, the electricity consumed by these EVs can be considered as coming from renewable sources. Instead of having a contract which covers total electricity of a consumer concerned one could also think of a scheme in which the consumer specifically enters into a green electricity contract for its EV only. However, this only seems possible if separate EV-metering is in place. With respect to railway infrastructure the operator could also enter into such a green electricity contract. Note that these contracts may cover the whole or part of the electricity consumed.

This green certificate system can be applied to renewable electricity generated within the member state, but also for renewable electricity imported from other countries using a similar scheme (see Figure 1 and Figure 2). In order to prevent double counting, regulation has to be put in place which safeguards that green certificates are not issued/sold more than once per MWh of renewable electricity concerned. This to make sure that a growing demand for renewable electricity in the transport sector indeed increases renewable electricity generated within the EU.

Figure 1Situation 7a: indirect powering, within one EU member state and via a contract system

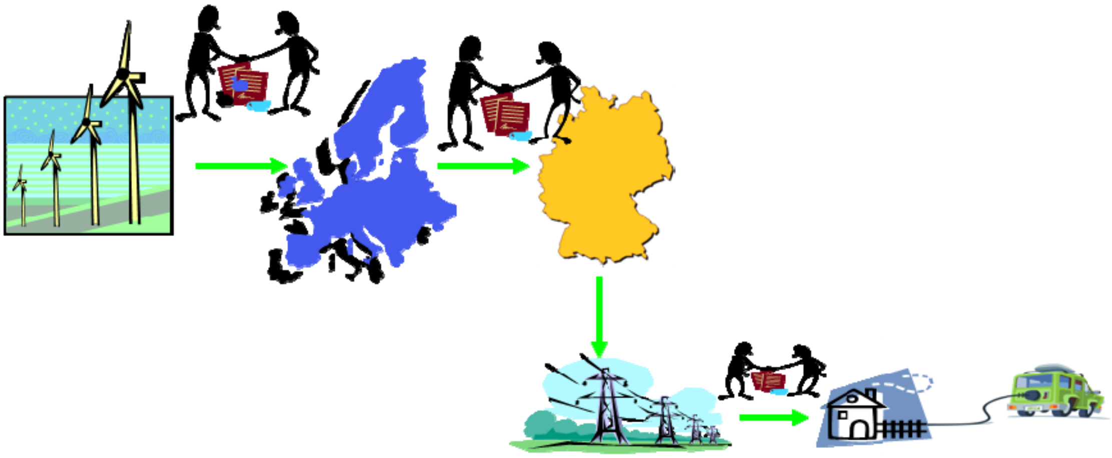

Figure 2Situation 7a: Indirect powering, with renewable energy production in one EU member state and powering the vehicle in another EU member state

Situation 7b: Electricity from outside the EU

Situation 7a could also apply to renewable electricity from outside the EU under the condition that it is possible to take sufficient measures to safeguard that there is no double counting and countries apply the same criteria/methodology (Figure 3). Articles 9 and 10 of the RED have provisions to deal with this.

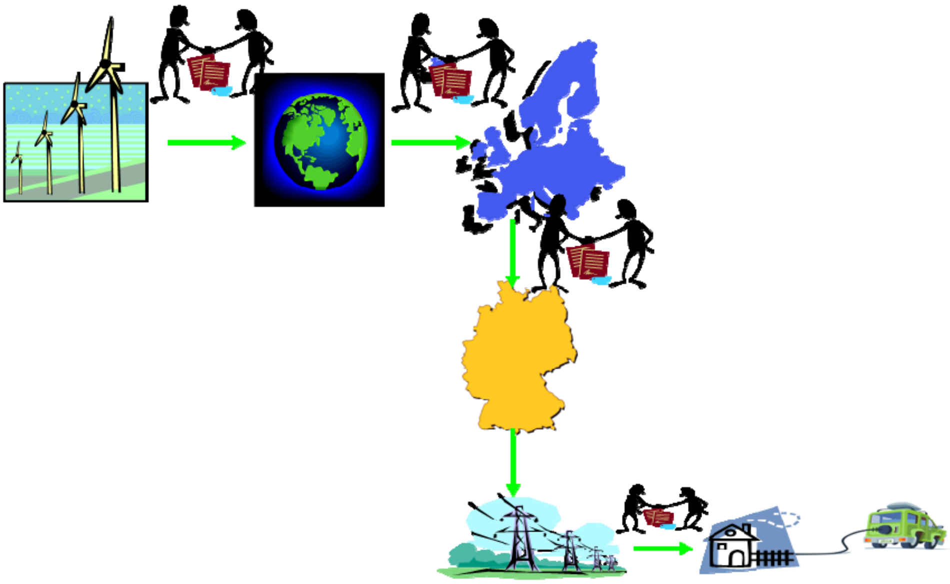

Figure 3Situation 7b: Indirect powering, with production of renewable energy in a country outside the EU (e.g. Norway, 'Desertec' in the Sahara, or even as far as China or the USA)

Since countries concerned fall outside of the EU legislative area, effective supervision (instruments to enforce compliance) is limited.

Situations for Hydrogen

For hydrogen, the situation is slightly different. There are three different technical ways for the production of hydrogen; using electricity, using methane or using biomass. Hydrogen can be produced centrally or onsite at the filling station via electrolysis using electricity, or via reforming of methane (fossil or bio), or via gasification of biomass. The electricity-based routes can be regarded as an extension of the situations described in the case of renewable electricity, with a hydrogen production line as an added 'building block' in the supply chain. The points in the H_2 production process that are relevant for the RED are:

the total amount of energy (i.e. electricity, methane) or biomass that is used in the H_2 production process;

assessment of the part of that energy or biomass that can be counted as renewable.

The third step, that is extra compared to the situations for electricity and methane, is:

measurement of the amount of hydrogen that is used for transport purposes.

This last step is very similar to the 'other (onsite) demands' described for electricity and methane.

If hydrogen is produced centrally, the distribution is done via liquefied hydrogen (LH_2) or compressed gas hydrogen (CGH_2) trailer trucks or H_2 pipelines. Electricity is required for both liquefaction and compression of hydrogen. CGH_2 storage in vessels and transport in H_2 pipelines can be considered 'loss free'. However, similar to batteries' self-discharge, long term storage of liquefied hydrogen may induce losses from hydrogen blow-off (heat intake leads to evaporation of LH2, pressure builds up, CGH2 has to be used in CGH2 applications or vented).

LH_2 storage in cars is practically no longer followed by the automotive industry. LH_2 for the purpose of supplying hydrogen filling stations is an option being followed especially in the early commercialisation stage.

We do not consider the situation of a large scale hydrogen pipeline distribution grid towards feeding points for vehicles here. A distribution logistics via truck already exists, provided by technical gases suppliers such as Air Liquide, Air Products, Linde, etc. From large hydrogen production facilities, the hydrogen is shipped to different customers by truck and sometimes even through (local) pipelines.

Overview of situations

When all building blocks are taken together, we get the overview pictures as given in Figure 4 (electricity), Figure 5 (methane), and Figure 6 (hydrogen). The various measuring points described above are included in the diagrams. The pictures are given from the viewpoint of the renewable energy source.

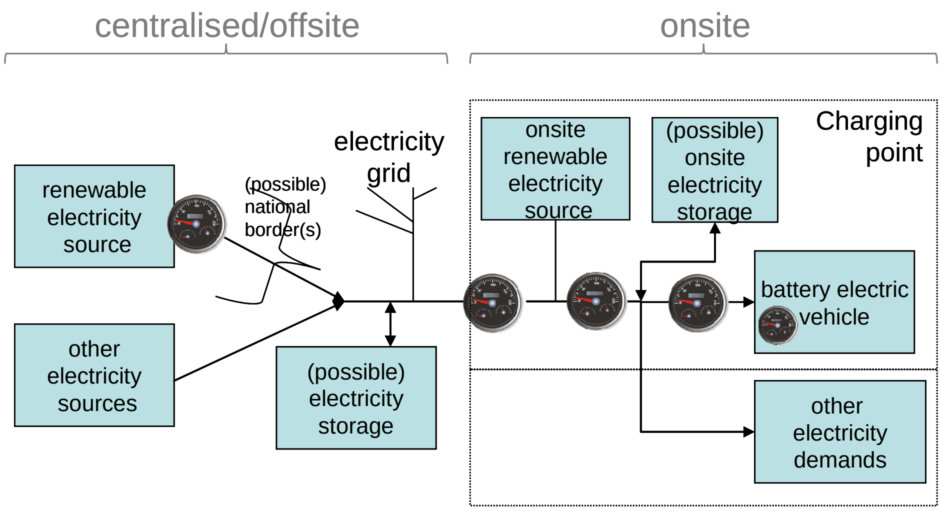

Figure 4Overview of situations for electricity as transport fuel

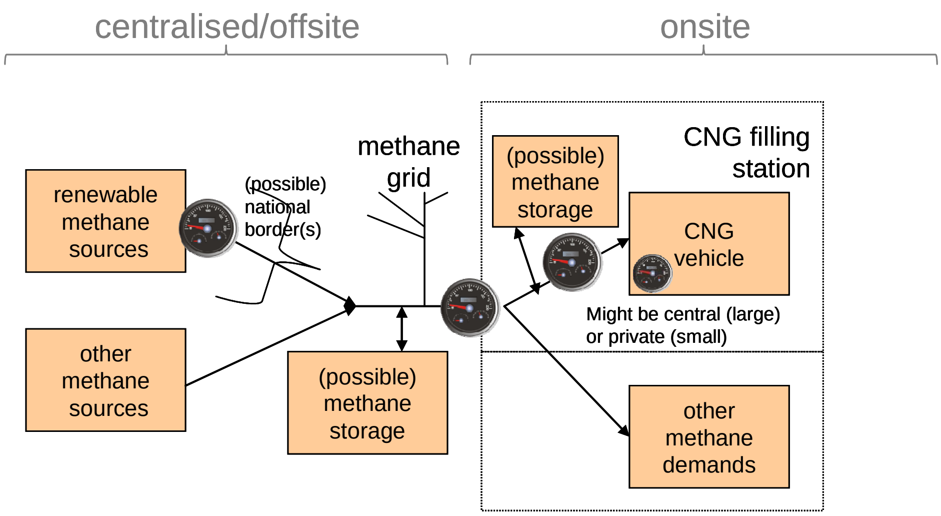

Figure 5Overview of situations for methane as transport fuel

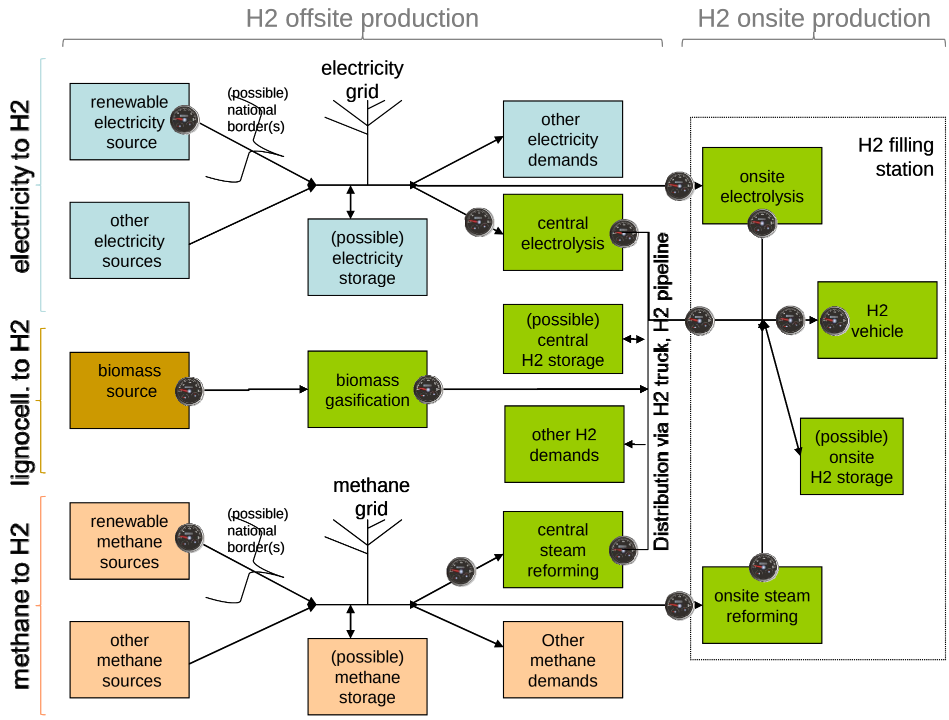

Figure 6Overview of situations for hydrogen as transport fuel

Point of view: from the vehicle

When we change the point of view from the renewable energy source to the vehicle, we can analyse the situation where a vehicle is being fed at different feeding points, each with a different 'situation' as described above. The methodologies should cover both points of view, taken e.g. into account problems with possible overlap and double counting.

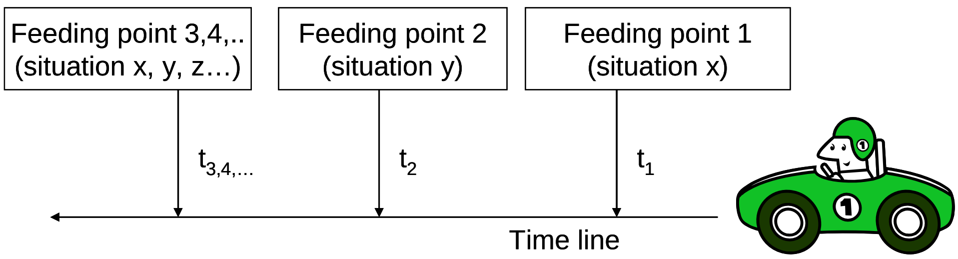

Figure 7Point of view from the vehicle. The picture holds for all considered types of cars (e.g. electric, methane, hydrogen)

Things get even more complicated if vehicle or driver specific fuel supply contracts are considered, take e.g. the case of 'Better Place' and their concept of 'pay-per-use'. Similar to mobile phone contracts, 'roaming' of electricity, methane and hydrogen supply contracts may have to be considered. Whether this type of use will find acceptance with vehicle owners/users or not and whether there will be technical procedures to allow for such contractual models, is highly uncertain to date. Given the complexity and uncertainty of such a case, we recommend to monitor the developments and revise accounting methodologies when and as far as needed at a later point in time, e.g. in the course of another RED review.

Point of view: where to meter or who is the reporting entity?

There are in principle three 'information carriers' involved in the use of transport use. Any of them could be held responsible in the future for monitoring (metering) and reporting the renewable fuel quantities fuelled to any regulatory body/statistics bureau:

1. The dispenser.
2. The vehicle.
3. The client.

Depending on the 'situation' given (see descriptions above), the dispensing entity could also be the fuel customer ('own consumption', e.g. from homemade PV electricity); the fuel customer not necessarily needs to be the vehicle owner; etc.

10.2 Methodologies

Electricity and methane

Having identified all the different situations that might occur in practice, the next step is to define the various methodologies with which the renewable energy used in transport via these routes can be included into the RED transport target. We will first analyse the methods for electricity and methane, and then for hydrogen.

The methodologies for electricity and methane have to consist of two essential steps:

1. Monitoring the total energy input into the vehicle (volume).
2. Assessment of the part of that volume that can be counted as renewable.

From the analysis in the previous paragraph, we conclude that at least for electricity, measurements in the vehicle are a necessary part of every methodology *that wants to cover all situations and with very high accuracy (i.e. using measurements and not estimates)*. The only alternative would be to ensure that measurements are taken at all possible vehicle feeding points, including household power plugs. However, attributed costs and reporting efforts may create quite a severe barrier to the market uptake and use of battery-electric vehicles.

The question now is what methodologies exist to determine the amount of (grid connected) renewable energy that is fed into the vehicle. The methods differ in the accuracy with which the amount of electricity in transport can be assessed. The total amount of energy used by the vehicles is known by adding up the meter readings of all the cars (e.g. on a yearly base). When the attribution of renewable electricity to transport is made dependent on the exact moment in time when EVs are charged (see section **Error! Reference source not found.**), a more complex methodology is needed. In that case more sophisticated metering ('smart metering') and total transparency on all current electricity suppliers is vital in order to be able to know, ex post, exactly when the EVs concerned where charged and what the exact production mix was. Of course, this is only one aspect of smart grids and smart metering.

Step 1 (measurement of the total energy input into the vehicle)

Considering measurements, two main measurement methodologies can be distinguished, where the distinguishing feature is the position of the meter:

1. Measurement of the energy input at the feeding point.
2. Measurement of the energy input in the vehicle.

Using a mix of these two methodologies might be necessary to measure all energy inputs into all vehicles, where problems with double counting have to be solved.

3. Instead of *measuring* the energy input, also estimates (e.g. based on statistics), can be used to get an approximation of the energy input. For example, the average yearly energy consumption of an 'average' vehicle' might be known from statistics, or the average yearly amount of kilometres an 'average vehicle' drives which then has to be multiplied by the average energy consumption per kilometre.

A mix between measurements and estimates might be used for practical reasons, using a different method for different transport systems. For example, the electricity consumption by railway (and tram, metro and trolleybus) can be monitored relative easily at feedings points since they use dedicated feeding points, whereas for road transport, the use of estimates might be preferred as long as no single measurement system is in place that covers all situations.

Step 2 (assessment of the amount of renewable energy)

For Step 2, again two main methodologies can be distinguished:

1. Using the production mix per country (the 'default option' in the RED for electricity).
2. Using the production mix in the specific contract for every specific charging point, which opens e.g. the possibility for counting specific 'green contracts'.

Also for step 2, using a mix of the two main methodologies is possible, where problems with double counting have to be solved.

For the second option in step 2, using the production mix in specific contracts, the difference between renewable energy produced in the member state or in the EU, and outside the EU, is important to address the question of 'additionality'.

Each of the two methods in Step 2 can be subdivided into 'volume monitoring' and a more elaborate 'time profile monitoring'. This is shown in the following table.

Table 1 Volume monitoring versus time profile monitoring

Category	**Volume monitoring**	**Time profile monitoring**
Energy contract (or known 'greenness') of each specific feeding point	√ (including methodologies 1 and 2, and green contracts)	Not possible yet, future option
National production mix	√	Not possible yet, future option

Hydrogen

For hydrogen, as described in the situations, a third step is required. In the first step, the total amount of energy input (electricity, methane, or biomass) into the hydrogen production process is measured. In the second step, the assessment of the amount of renewable energy in that volume is carried out. The third step deals with the measurement of the volume of hydrogen from the production facility that is actually used for transport purposes.

Measuring the total energy, or biomass, input into the hydrogen production process (volume).

3. Assessment of the part of that volume that can be counted as renewable.
4. Measuring the volume of hydrogen that is used for transport.

The first two steps are already described in Table 2. In the case of hydrogen, these two steps do not determine the amount of energy used in the car and the assessment of the amount of renewable energy in that volume, but determine the amount of energy to produce the hydrogen and the renewable part of that amount.

However, the targets in the RED are defined by *final* energy consumption, not by primary energy consumption. Therefore, the input into the hydrogen production process is not relevant for the RED, only the percentage of the input (of electricity, methane or biomass) that can be counted as renewable, and the first step can be omitted in the method. The method for hydrogen consists also of 2 steps:

1. Assessment of the percentage of renewable energy (or biomass) in the input volume of the hydrogen production process

2. Measuring (or estimating) the volume of hydrogen used in transport.

We consider small scale onsite hydrogen production, without separate monitoring of the energy input of the production process, not a realistic option. Therefore, we assume that the total energy input of the hydrogen production processes is always monitored.

10.3 Railways (and tram, metro, trolleybus)

The previous sections were mainly focussed on renewable energy use in vehicles (road transport), but some of them are also relevant for rail transport, and rail transport may be one of the easiest options to contribute to the RED 10% target. The same analysis can be used for tram, metro and trolleybus. Railway transport is easier to cover in statistics than road transport, as there are much less parties involved, and the number of feeding points is much more limited. It seems appropriate for the Commission to set calculation standards in order to ensure that member states apply a uniform calculation method.

When looking at the situations described in section **Error! Reference source not found.**, situation 6 seems the most relevant when looking at rail transport, although also situations 5 or 7 could apply. An Island situation (situations 1, 2, 3 and 4) is not applicable when it comes to rail transport; electricity infrastructure for rail transport is always grid-connected. Note that also 'own power generation' is part of the picture. Diesel trains (and diesel-electric) trains are already covered by the RED.

When looking at situation 6, problems with regard to double counting when a mixed approach is used, using both monitoring at vehicles and at feedings points, is not an issue when it comes to rail transport. In that sense the situation for rail transport is less complicated than it is for road vehicles. The reason is that one does not need to know the electricity consumption of every individual train in order to determine the total electricity consumption in rail transport. Only insight into the overall electricity consumption of the rail transport infrastructure itself and possibly the share of renewable electricity therein is needed.

When looking at metering in general, for rail transport this appears to be less complicated than for electric vehicles, since keeping track of the electricity consumption of each individual train is unnecessary for determining the total electricity consumption involved in rail transport. Besides operating own power generation plants, the rail transport infrastructure operator makes use of (several) grid connections which will already be metered in order for the transmission/distribution system operator to measure the amount of electricity consumed and invoice accordingly. It will therefore be relatively easy to determine the total amount of electricity which can be attributed to rail transport (step 1, as described in section 0) by adding up the meter readings of the different grid connections (energy inputs at the feeding points) related to rail transport[1].

Regarding step 2 of section 0 (assessment of the amount of renewable energy) the same methodologies apply as for electric vehicles. As for electric vehicles, if a more sophisticated methodology is desired, e.g. real time monitoring of the type of electricity actually consumed by rail transport at any given moment, more sophisticated metering (time resolved, which is already becoming the standard for most of the larger electricity consumers) is necessary in order to determine, ex post, what type of electricity (mix) was feeding the rail transport infrastructure, and by that the trains making use of that infrastructure, at specific moments in time.

10.4 Conditions

In this paragraph, the conditions will be described for each method. The main question here is what are the necessary conditions to enable the required monitoring of a) the relevant energy use in transport and b) the share of renewable energy in that energy use. We will also consider situations in which a vehicle charges at different feeding points with different 'situations'.

Conditions for time profile monitoring

If the methodology is to be based on time profile measurements, the following conditions have to be met:

Smart meters at both the feeding point of every vehicle or every vehicle itself, and at every renewable energy source.

Installed procedures ("whom is reporting to who?").

May be an intermediate way is possible, by working with comparison of profiles for charging or feeding, and production.

[1] Taking into account, if and where relevant, the fact that for some feeding points green energy contracts could be in place (situation 7).

This may seem very complex and costly in the current situation, but smart grids (including smart meters) and unique (electric) vehicle IDs, combined with smart tariffs, are expected to be required in the future, if the potential for balancing local electricity production with local demand is to be possible in a two way communication system. Smart grids are the expected future for the electricity grids in the built environment. The real time measurements are an essential part of such an electricity network, which also enable the monitoring of the amount of renewable energy that is used for feeding of electric vehicles. For now, this is not a feasible option. For gas grids, such two way communication on a distribution level is not yet foreseen.

Conditions for volume monitoring

From situations where the energy use is metered at a higher level than the feeding point of a vehicle (e.g. on the level of a 'single user', like a household or an office), one way to monitor the volume of energy fed into the vehicle is by having a meter in the vehicle itself. Another way is to install a dedicated *extra* meter for each charging point, that is then used for monitoring the volume of energy fed into the vehicle. The latter might evolve from future tax legislation, if Member States were to want to put electricity and methane used for transport purposes under a different tax regime than the use of electricity and methane for other purposes.

Another pragmatic way might be to simply neglect in the monitoring all energy that is fed into vehicles where robust monitoring does not exist, i.e. where the charging point does not have a specific meter within a metering and billing regime, or the charging point is also used for other purposes than charging vehicles.

Conditions for metering at feeding points

Feeding points have to be identified ('transport use only') and separately metered. For central feeding points (e.g. dedicated charging points at highways, of CNG-filling stations) this should be no big problem. Once identified, the meter readings have to be collected on a national scale for each Member State. The identification and subsequent data collection will need some kind of legislation and protocols.

For hydrogen production, the energy (or biomass) input into the hydrogen production process is already known for centralised hydrogen production sites. Some legislation and a protocol are needed to be able to use that data for monitoring of the RED.

Conditions for metering in the vehicles

Metering in the vehicle itself solves the problem of monitoring the (renewable) energy use in transport while vehicles can feed at feeding points that are not equipped with separate meters.

The metering in the vehicle is in most cases already present. The question is how to get access to that data for RED monitoring purposes, and with good quality of the monitoring process. For electricity, the future smart grids with smart meters and smart tariff systems will probably solve this problem. If all feeding points are equipped with separate meters, the necessity for metering in the vehicles itself disappears.

Conditions for using the national production mix

The national production mix fed into the grid, for electricity and methane, is already monitored by each Member State.

Conditions for using production mix in individual energy contracts

As described, instead of using the national production mix, a different method is to use the production mix for every energy contract for every feeding point. This way, a direct link and thus a direct driver is established between the electricity, methane or hydrogen used in transport, and the demand for renewable energy. There is not an already existing data process that can be used. This will require large scale data processes and has implications for each energy company; legislation will be needed to get access to the data, and possible privacy risks have to be addressed.

Combining methodologies: green contracts and production mix

It is possible to use a mixed method, using the greenness of the energy contract for specific charging points, and the national production mix for other charging points. However, this requires corrections for possible double counting, since the renewable energy production that is sold in the green energy contract is also counted as part of the national production mix; see the textbox for an example. Since all volumes are known, the correction can be carried out, but might be complex.

10.5 Overview of methods

In conclusion, for electricity and methane the following 6 methods are indentified. Each

Example: data requirement

Consider the relatively simple example of an electric vehicle that charges at only two points:

At home. Situation: grid connected with one meter 'at the front door', several PV-panels on the roof (not separately metered), and the vehicle charges at an ordinary grid socket, not separately metered. No 'green electricity contract'

And at a special EV feeding point, with a dedicated meter at the feeding point, and no other demands, with 'green electricity contract' (100%).

Analysis:

All the electricity that is fed in at point 2 can be counted towards the 10%. Time profile metering is also possible at this point, but that is not yet incorporated into 'green contracts'; we can point that out.

The electricity from the PV-panels is not metered separately, and can not be counted (unless as 'statistically counted' contribution to the national production mix', which is out of the scope of this study).

The feeding point of the car is not separately metered. The way to take the electricity of the car into account is to have a meter in the car itself, or use an extra meter for each specific feeding point (that has to be dedicated). The amount of renewable electricity has to be calculated from the national production mix. Time profile metering (at the car) might be possible in the future.

Note that there might be overlap between the attribution of point 1 and point 2, because the 'green contract' for point 2 might also be counted in the national production mix. Since the volume of electricity fed into cars is known at point 2, the national production mix used for the calculation used at point 1 can be corrected. Another practical solution will be to simply choose (as a country): either use only data from dedicated feeding points combined with data about the 'greenness' of their contract, or only data from meters in cars combined with the national production mix. In the future, with smart grids, mixed solutions can be applied.

method consists of two steps:

Measuring the total energy input into the vehicle.

Assessment of the amount of renewable energy.

The assessments can be by volume or with a time profile. Time profiling is regarded as a future option. In each step, the main methodologies can be mixed, where problems with double counting have to be solved.

Table 2 Overview of methods for electricity and methane

	Step 1 (measurement of energy input into vehicle)			Step 2 (assessment of amount of renewables)	
Method	A: Measurement at feeding point	B: Measurement at the vehicle	C: Using estimates	A: production mix of country	B: production mix in contracts
1	X			X	
2	X				X
3		X		X	
4		X			X
5			X	X	
6			X		X

Current method of data collection by Eurostat

Member States report to Eurostat the amount of renewable electricity used in transport. The amounts of biomethane and hydrogen are still negligibly small, below the reporting limit. By far the largest portion is the electricity used for rail transport, which is already part of the energy statistics of the Member States. This amount is multiplied by the percentage of renewable electricity production (national mix). The same way, the electricity consumption for trams, metro and trolley bus is treated. For road transport, estimates are used based on the number of electric vehicles and the average yearly energy consumption.

From an abstract viewpoint, the methods for hydrogen resemble those for renewable electricity and biomethane. Since the physical process steps are however different, i.e. using electricity or biomethane (or biomass) for the production of hydrogen, we treated the methods for hydrogen separate from those for renewable electricity and biomethane.

Table 3 Overview of methods for hydrogen

	Step 1 (assessment of percentage of renewables in hydrogen production process)		Step 2 (measurement the volume of hydrogen used in transport)		
Method	A: production mix of country (not applicable	B: production mix in contracts	A: Measurement at feeding point	B: Measurement at the vehicle	C: Using estimates

	for biomass)				
1	X		X		
2	X			X	
3	X				X
4		X	X		
5		X		X	
6		X			X

ANNEX III – DRIVERS OF RENEWABLE ENERGY PRODUCTION TO 2020

Table 4 Overview of drivers of renewable energy production to 2020 (source: study refereed to in section Error! Reference source not found.**)**

Drivers	Assessment of current contributions from drivers for renewable energy production across different renewable energy sources (RES)			
	Renewable electricity	**Renewable hydrogen**	**Biomethane (grid)**	**Comments**
		Supply-side drivers		
EU renewable energy policy framework eg. targets for production of renewable energy in RED	HIGH	LOW	MEDIUM	Strongest where there are specific requirements on Member States
EU-level policy instruments eg. EU ETS	MEDIUM	LOW	LOW	Price signal not strong enough on its own at present
Member state incentives for RE development eg. FiTs, portfolio standards, grants etc	HIGH	LOW	MEDIUM	Specific policy measures for renewable hydrogen yet to be developed
Technological/commercial developments eg. capital cost, operating cost, market prices	MEDIUM	MEDIUM	MEDIUM	Depends on technology eg. PV electricity to decrease, CAPEX for on-shore wind nearly mature
		Demand-side drivers		
EU transport policy framework eg. EU FQD; EU 10% transport target; EU strategy on clean/efficient vehicles	LOW	LOW	LOW	Could make transport target additional post 2020
EU transport policy measures eg. vehicle CO_2 performance standards	LOW	LOW	LOW	Current treatment of EVs doesn't distinguish between RE and non-RE
Member state policies and programs on transport sector eg. tax exemptions for purchasing EVs	LOW	LOW	LOW-MEDIUM	Tax exemptions specifically for biomethane CNG in Sweden EV incentives do not require RE generation.
City/regional initiatives eg. City funding for EV charging, parking, separate lane, entry into inner-city	LOW	LOW	LOW	Depends on initiative design, but at present there are few initiatives involving small numbers of vehicles only
Commercial initiatives eg. JVs between utilities, infrastructure companies and car manufacturers	LOW-MEDIUM	LOW-MEDIUM	LOW-MEDIUM	Potential for direct contracts to support additional investment
Technological developments eg. falling costs of EV batteries, increasing battery and fuel cell performance	LOW	LOW	LOW	Battery performance and costs a major issue, but only will have an impact over longer term with mass uptake
Consumer tastes and preferences eg. WTP for renewable electricity in transport	LOW	LOW	LOW	Could be more of a driver in the longer term

ANNEX IV – ENERGY RETAILERS IN THE EU

Table 5 Number of energy retailers in the EU (source: Eurostat, 2008/2009 data)

Member State	Number of gas retailers	Number of electricity retailers	Number of retailers taken into account*
Austria	31	141	141
Belgium	41	34	41
Bulgaria	18	17	18
Cyprus		1	1
Czech Republic	18	281	281
Denmark	13	33	33
Estonia	27	40	40
Finland	25	125	125
France	36	177	177
Germany	820	1000	1000
Greece	4	3	4
Hungary	26	35	35
Ireland	8	9	9
Italy	295	360	360
Latvia	1	4	4
Lithuania	6	9	9
Luxembourg	7	11	11
Malta		1	1
Netherlands	24	32	32
Poland	52	150	150
Portugal	15	6	15
Romania	56	47	56
Slovakia	10	67	67
Slovenia	19	17	19
Spain	28	142	142
Sweden	6	75	75
United Kingdom	17	21	21
EU27 Total	**1603**	**2838**	**2867**

*assuming that most retailers sell both gas and electricity

ANNEX V – ADMINISTRATIVE COSTS ASSUMPTIONS

Table 6 Administrative costs for business – assumed average time spent (range) per year per energy retailer

action	actor	unit	Option 2	Option 3	Option 5
generation, collection and aggregation of data	associate professional/ technician	hours	4-20	4-20	4-40

Table 7 Administrative costs for public bodies - assumed average time spent (range) per year per national statistical body

<table>
<tr><td>action</td><td>actor</td><td>unit</td><td>Option 2</td><td>Option 3</td><td>Option 5</td></tr>
<tr><td rowspan="2">aggregation of data, including ensuring the data is received complete and on time</td><td rowspan="2">associate professional/ technician</td><td>hours*</td><td>8-16</td><td>8-16</td><td>8-16</td></tr>
<tr><td>minutes per energy retailer*</td><td>5-30</td><td>5-30</td><td>5-30</td></tr>
<tr><td>manipulation of data</td><td>professional</td><td>hours</td><td>-</td><td>4-8</td><td>4-8</td></tr>
</table>