Impact Assessment Institute

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The Institute for Impact Assessment and Scientific Evaluation of Policy and Legislation

"Impartial Analysis for Policy Making"

Final study on

the IMPACT ASSESSMENT

accompanying the European Commission legislative proposal:

"Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources" SWD (2016) 418

including the IMPACT ASSESSMENT on "Sustainability of Bioenergy"

and on

the coherence between the Impact Assessments and the legislative proposal COM (2016) 767

IAI-RED II-170616f 16th June 2017

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Main Findings

The Proposal for a Directive on the Promotion of the Use of Energy from Renewable Sources (recast) is part of an interdependent package of energy legislation. This IAI study scrutinises the Impact Assessments on renewable energy and bioenergy accompanying that proposal, and their coherence with the proposal in the context of the full legislative package. A number of significant shortcomings in the evidence have been identified, which severely weaken the foundation for this part of the EU's energy policy:

- Absent a positive opinion from the Regulatory Scrutiny Board, adopting the legislative proposal contravenes the written provisions of the Better Regulation Agenda, with insufficient justification provided of the decision to override this requirement.
- Expanding on the conclusion from previous IAI studies, the lack of availability for scrutiny of the models used to calculate macroeconomic parameters, ILUC and effects of alternative fuel policies is very serious, undermining the legitimacy of the results.
- The assessments of policy options for RES-E, RES-H&C and RES-T lack coherent evaluation parameters and do not present consistent comparable analysis.
- If the Reference Scenario is the assumed baseline, evidence indicates that the 27% renewable energy target for 2030 would likely be achieved with already planned legislative measures. This calls into question the value of the directive in the context of the target.
- Conversely, achievement of the Reference and other Scenarios is uncertain, depending on continued on-top investment in renewable energy capacity without the incentive of a sufficiently high ETS allowance price and without equivalent non-renewable capacity being retired to compensate.
- The analysis of the options for meeting the 27% target in 2030 suffers from the fundamental conflict between the "binding" EU target and the lack of binding national targets, undermining the coherence of the package.
- The Impact Assessment presents evidence that biogenic emissions of certain harvested biomass are substantial, but the sustainability criteria in the legislative proposal may not be sufficient to ensure reduced total emissions (supply chain plus biogenic) in the short to medium term.
- The policy to cap food-based biofuels for transport was assumed without supporting analysis and does not differentiate between actual GHG performance of biofuels (including ILUC). Similarly, the Annex IX list of feedstocks not subject to the cap was not supported by evidence nor based on objective criteria.
- Due to the importance attached to ILUC and biogenic emissions, robust, transparent and peer-reviewed methodologies are necessary to calculate accurately their contribution to total GHG emissions and provide stakeholders with confidence in the resulting policy provisions.
- Accounting only for the proportion of each renewable energy source that corresponds to total GHG savings, when calculating the contribution to the total percentage of renewable energy, would more faithfully represent the renewable parameter.

From these findings, the IAI proposes the following considerations in further policy development:

- Fully account for the actual greenhouse gas emissions associated with renewable energy sources, enabling a proportional "renewable" portion of each type to be calculated and applied to policy.
- Target the main priorities of greenhouse gas reduction and energy security more directly, thereby incentivising renewable energy where it is the most effective solution.
- Focus analysis in this domain on removing barriers to market entry for renewable energy.

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Visualisation

The following table provides a visual overview of the results of this report for each element of the evidence presented in the Impact Assessment, using an assessment from 1 to 7 to indicate the level of confidence (1 = highest, 7 = lowest confidence level).

Element	Assessment level & description (1…7)		Notes
Rhetoric	3	Several questions identified on analysis and/or evidence	The introductory text and the language used throughout the report is generally neutral but in a number of cases, the wording indicates preconceptions.
Assumptions	6	Serious concerns identified with analysis and/or evidence	A number of important assumptions are made without supporting evidence, that materially influence the subsequent analysis.
Background data	6	Serious concerns identified with analysis and/or evidence	A number of key pieces of cost data are out of date and transparency is lacking on the inputs to the main model.
Analysis	6	Serious concerns identified with analysis and/or evidence	The models generating results on macroeconomic data, ILUC and employment are not available for scrutiny. Assessment and comparison of impacts lack coherence.
Results	6	Serious concerns identified with analysis and/or evidence	Due to the shortcomings of the assumptions, data and analysis, the results lack robustness and reliability.
Conclusions	6	Serious concerns identified with analysis and/or evidence	There are significant inconsistencies between the Impact Assessment and legislative proposal.

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Key to assessment levels

1	2	3	4	5	6	7
Correct analysis, fully evidenced	Minor questions identified on analysis and/or evidence	Several questions identified on analysis and/or evidence	Concerns identified with analysis and/or evidence	Substantial concerns identified with analysis and/or evidence	Serious concerns identified with analysis and/or evidence	Inadequate analysis / evidence absent

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1. Introduction

The "Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast)" was adopted by the European Commission on 30th November 2016 as part of a package of legislative measures on energy. There is a certain level of interdependency between the legislative proposals in this package. This IAI study scrutinises the two Impact Assessments (on renewable energy and on bioenergy) accompanying the proposal for the renewable energy directive. The study refers to the other pieces of energy legislation and their Impact Assessments where directly relevant. It builds on the previous IAI study scrutinising the Inception Impact Assessment on renewable energy[1]. In particular, this current study identifies shortcomings and inconsistencies in the presented evidence and, where sufficient evidence is available, investigates further to offer alternative approaches.

The Impact Assessment received two negative opinions from the Regulatory Scrutiny Board. In its second opinion, the Board stated "*The lead DG should seek the appropriate political approval should it wish to proceed further with this initiative and launch an interservice consultation prior to presenting the draft legislative proposal to the College.*" The legislative proposal section 3.4 states "*the Commission has considered it opportune to go ahead with a recasting proposal for the Renewable Energy Directive while taking into due account the reservation expressed by the Regulatory Scrutiny Board*."

The Commission's Better Regulation Toolbox[2] section 3.2 states "A positive opinion is required before the inter-service consultation (ISC) on the related proposal can be launched." Proceeding with the proposal therefore contravenes the provisions of the toolbox.

If a decision is made by the Commission to proceed with a piece of legislation that has not received a positive opinion, this should be fully legitimised by the College and should be fully explained in the proposal, in particular detailing why the imperative to proceed overrides the identified shortcomings in the evidence. The explanation does not provide sufficient explanation for the chosen course of action.

A draft version of this scrutiny study was released to interested expert stakeholders for review on 22nd May 2017, with feedback received from three organisations by the 12th June deadline. An overview of the feedback received and any action taken to revise the text of the study is shown in Annex 5. A "tracked changes" version is published on the website to show where changes have been made after the review.

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[1] "Study on the Inception Impact Assessment 'Renewable Energy Package: new Renewable Energy Directive and bioenergy sustainability policy for 2030 – AP 2016/ENER/025' ", Impact Assessment Institute, 30th June 2016.

[2] "Better Regulation Toolbox", European Commission, 19th May 2015. http://ec.europa.eu/smart-regulation/guidelines/docs/br_toolbox_en.pdf

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1.1 Subsidiarity and Proportionality Checks

1.1.1 Subsidiarity check

A section on subsidiarity is included in both the Impact Assessment and the legislative proposal. They each include an adequately detailed explanation of the need for action at EU level to meet its energy policy objectives set by the institutions. They do not however go far enough in acknowledging the point that without binding targets at Member State level, the "binding" EU target for renewable energy has no enforcement mechanism. The proposal, due to the political decision to apply the EU-wide renewable energy target, does not therefore address subsidiarity adequately in the context of the overall objective. A full acknowledgement of this point would have highlighted the inherent conflicts in the legislation and therefore had a fundamental influence on the nature of the assessment, providing transparency for stakeholders on the policy framework.

1.1.2 Proportionality check

Correctly, proportionality is addressed in the legislative proposal rather than in the introduction to the Impact Assessment, as it is dependent on the assessed impacts. The justification for proportionality is adequately detailed and explained.

A question arises due to the shortcomings in the Impact Assessment itself identified by this study, in particular those regarding sustainability of bioenergy and provisions for meeting the 27% renewable energy target in 2030. Those shortcomings put into doubt the conclusions of the Impact Assessment and therefore the conclusion that the policy measures are proportional.

Further, the section on proportionality attempts to rationalise the decision not to apply binding national targets for renewable energy, appearing to imply that solely applying a binding EU target is likely to be more effective. The text explains the consequences of "having solely national measures" would more likely mean falling short of the agreed target, even though such a situation was not an option under consideration.

The proportionality check should focus on whether the proposed measures are proportional for meeting the objective of the policy. In this case it has been used, incoherently, to attempt a justification of the contradictory policy framework defined by the EU institutions.

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1.2 Transparency

The lack of transparency of analytical modelling in EU energy policy remains a serious fundamental challenge to better regulation in this domain. The lack of stakeholder access to the modelling algorithms represents a barrier to understanding and scrutiny by those interested in and affected by energy legislation. This issue was first highlighted by the Impact Assessment Institute study of December 2015[3] scrutinising the Commission's non-legislative Impact Assessments on Climate & Energy Policy & Energy Efficiency. Since then, the modelling data in question, in particular the PRIMES model, has been applied in legislative dossiers such as the Emissions Trading System. For the current energy package, including the proposal on the renewable energy directive, the data has been updated with the same lack of transparency.

It is reiterated that the lack of availability of the underlying data and the inability of stakeholders to scrutinise fully the results generates uncertainty and detracts from the credibility of the analysis underlying the policy making. This is a fundamental flaw in EU energy policy making and calls into serious question the provisions of all the parts of the legislative package on energy.

This was highlighted by the Impact Assessment Institute in a letter to the European Commission[4] and in its study reviewing the Better Regulation agenda[5]. However, progress on making the analytical modelling transparent for stakeholders has not been demonstrated.

[3] "Report on transparency, consistency and feasibility in the Impact Assessments accompanying the European Commission Communications SWD (2014) 15 and SWD (2014) 255", the Impact Assessment Institute, 14th December 2015.

[4] Letter to First Vice President Timmermans, 15th February 2016, Impact Assessment Institute: http://bit.ly/2rgzcgQ

[5] "A year and a half of the Better Regulation Agenda: What happened?", 30th January 2017, Impact Assessment Institute http://www.impactassessmentinstitute.org/br-18-months

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2. Feasibility and consistency check on data and results

2.1 A review of the figures

Fundamentally important to the analysis are the underlying data on renewable energy generation.

The following chart shows the shares of each different element of renewable energy in the total from 2005 to 2014, using EUROSTAT data[6]. The breakdown for heating and cooling in 2012 is performed using data from the European Commission[7]. The shares of the three elements of heating and cooling for 2013 and 2014 are estimated by using the same proportions as reported for 2012.

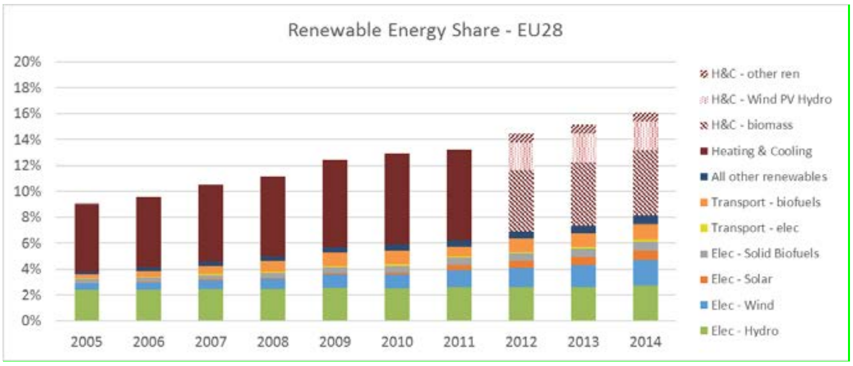

Figure 1: Breakdown of renewable energy share 2005-2014

The percentage and absolute figures are presented in Annex 3.

2.1.1 Meeting the 2020 targets as a baseline

The figures for renewable energy in the EU are fully available for 2014 and by the publication date of this study have also been made available for 2015. The chart below from the European Commission Progress Report on Renewable Energy[8] shows the progress until 2015 of the share of renewable energy in gross final consumption, using a preliminary figure for 2015.

[6] SHARES (Renewables) 2015 Results, EUROSTAT http://ec.europa.eu/eurostat/web/energy/data/shares

[7] "Towards a smart, efficient and sustainable heating and cooling sector", European Commission Factsheet, 16th February 2016 http://europa.eu/rapid/press-release_MEMO-16-311_en.htm

[8] "Renewable Energy Progress Report", European Commission, 1st February 2017, https://ec.europa.eu/commission/sites/beta-political/files/report-renewable-energy_en.pdf

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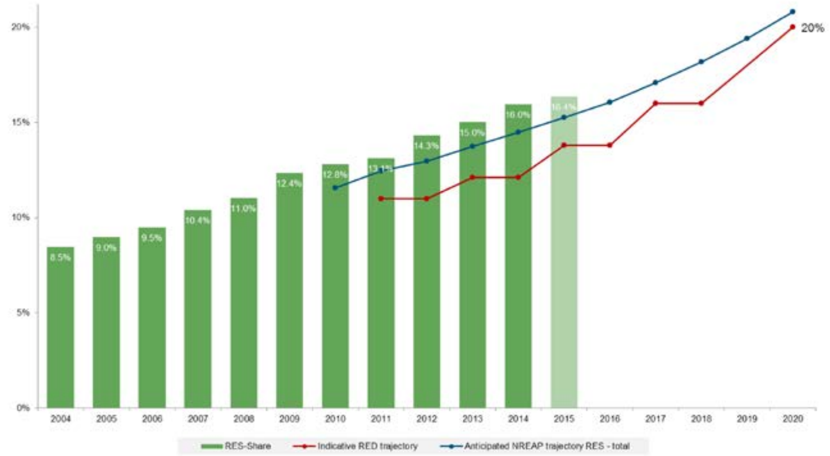

Figure 2: Progress towards 2020 Renewable Energy Target (European Commission)

On page 20 of the Impact Assessment the text states:

> *With an estimated renewable energy share of 17% of gross final energy consumption in 2015, if the effort continues, the EU and an overwhelming majority of Member States are expected to achieve the 2020 targets set in the RES Directive.*

In fact the preliminary figure for 2015 (16.4%, representing a 0.4% increase over 2014) was already available at the time of publication of the IA, and 17% appears to be projection that would assume equal growth in 2015 as in 2014. Subsequently in March 2017, the official share for 2015 was published as 16.66%, representing a 0.53% increase over the revised 2014 figure.

The following table shows the extrapolated share in 2020 and 2030 if a continuation of the linear trend over the last 1, 2, 3, 4 or 5 years is assumed:

Years of linear extrapolation	1 yr (from 2014)	2 yrs (from 2013)	3 yrs (from 2012)	4 yrs (from 2011)	5 yrs (from 2010)
Extrapolated REN share 2020	19.30%	20.39%	20.38%	20.96%	20.42%
Extrapolated REN share 2030	24.58%	27.84%	27.81%	29.57%	27.95%

Table 1: Linear extrapolation of renewable energy share in 2020 and 2030

The results indicate that, with the exception of the most recent figures from 2015, the linear trend would lead to exceeding both the 2020 and 2030 targets. The linear trend is relevant, as it indicates whether maintaining the current trajectory is sufficient or whether acceleration is necessary.

Since the percentage share is influenced by both the numerator (renewable energy consumption) and the denominator (total energy demand), it is informative to isolate these items. The following table looks at two scenarios for the denominator, assuming that gross

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final energy consumption remains at its (low) 2014 level, in which year the 2020 target for energy efficiency was already met[9], and then at its higher 2015 level.

Years of linear extrapolation	1 yr (from 2014)	2 yrs (from 2013)	3 yrs (from 2012)	4 yrs (from 2011)	5 yrs (from 2010)
Extrapolated REN share 2020 if EE target met (2014 denominator)	21.46%	19.97%	20.26%	21.09%	19.90%
Extrapolated REN share 2020 if EE target not met (2015 denominator)	21.00%	19.54%	19.83%	20.64%	19.48%

Table 2: Linear extrapolation of renewable energy share in 2020 with three energy efficiency assumptions

These figures indicate a potential path exists towards meeting the 2020 target, if current growth rates of renewable energy continue and energy efficiency targets are met, with a residual risk of not achieving it. The viability depends on the extent to which the rate of new renewable energy deployment can be maintained and is also strongly dependent on the total energy usage (denominator). The energy usage figure is significantly more volatile than the renewable energy figure and an outlier in 2020 (e.g. an especially cold winter) may lead to missing the target. This undermines the renewable energy share as a valid indicator.

2.1.2 Cost assumptions of renewable energy sources

The Impact Assessment uses assumed figures for the cost of renewable energies in its modelling. In particular, the figures for levellised cost of power generation using non-renewable and renewable energy sources in the tables below are taken from the Reference Scenario 2016 Report[14] were fed into the modelling.

[9] "Assessment of progress towards implementation of the Energy Efficiency Directive", European Commission, 1st February 2017 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0056&from=EN

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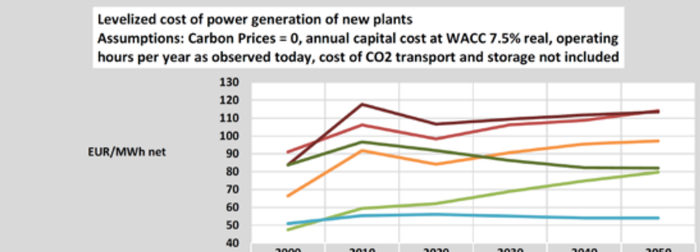
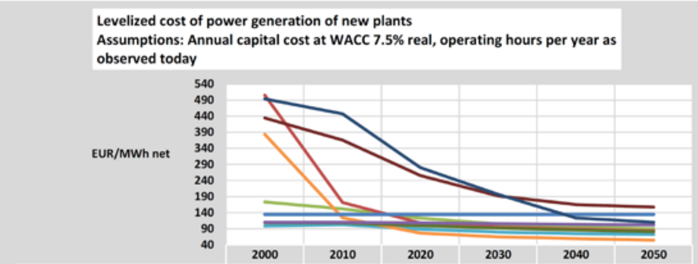
FIGURE 10: INDICATIVE LEVELIZED COSTS FOR NON-RES TECHNOLOGIES



	2000	2010	2020	2030	2040	2050
Pulverized Coal	48	59	62	69	75	80
Supercritical Lignite	51	55	56	55	54	54
Combined Cycle Gas Turbine	66	92	84	91	95	97
Pulverised Coal CCS post combustion	91	106	98	106	109	114
Gas combined cycle CCS pre combustion	84	118	107	109	112	113
Nuclear third generation	84	97	92	86	82	82

Figure 3: Indicative levellised cost of non-renewable energy sources (European Commission)

FIGURE 11: INDICATIVE LEVELIZED COSTS FOR RES TECHNOLOGIES



	2000	2010	2020	2030	2040	2050
Wind Offshore	173	152	123	105	95	90
Wind onshore	99	103	89	80	75	72
Solar PV - South of Europe	383	124	77	65	59	55
Solar PV - North/Central Europe	505	172	108	95	89	84
Solar Thermal	434	365	255	192	165	157
Geothermal	109	108	99	92	86	81
Large Hydro	135	135	135	135	135	135
Small Hydro	110	110	108	106	104	101

Figure 4: Indicative levellised cost of renewable energy sources (European Commission)

The Impact Assessment presents examples of recent (2016) auction prices for wind & solar:

- Wind offshore: €72.7 / MWh (Netherlands) and €60.0 / MWh (Denmark)
- Solar PV: €84.9 / MWh (Germany)

Auction prices are not the same as costs and the cost of grid connection should be taken into account. However, the auction figures for wind (for 2016) above are significantly lower than the projections (for 2030) in the table, indicating the risk of a material overestimate of cost of wind by 2030. A lower cost estimate fed into the modelling could be expected to result in a higher contribution from these sources in 2030 in the scenarios. For solar PV, the auction price (2016, Germany) lies between the cost figures for 2010 and 2020 for Southern Europe but well below those for North/Central Europe. Again a lower cost reflecting actual auction

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prices, fed into the modelling would be expected to result in a higher contribution from this source in 2030.

In order to inform ongoing policy, a recalculation using more up-to-date figures taking into account this more recent information would be necessary. Figures published since the adoption of the proposal indicate potential further drops in auction prices for these renewable energy sources, reiterating the need for updated calculations.

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The figures in the above tables and from the auctions also demonstrate that in 2020 the levellised cost of new renewable power generation remains higher in most cases than non-renewable. In 2030 the cost of renewable energy would in certain cases be competitive with or lower than that of non-renewable, especially if the indicated trend of falling prices continues. However, a consistent comparison assumes that new renewable capacity is competing against new non-renewable capacity, which under a framework of policies to increase renewable energy use is not generally the case. This is discussed further in Section 2.3 below.

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2.1.3 Meeting the 2020 target

The chart on page 20 of the Impact Assessment indicates that 7 out of 28 Member States were more than 30% below their 2020 target in 2015 (including France and UK, with Germany about 20% below, representing in total about 40% of EU population). The data was in turn provided by the 15th annual overview barometer, EurObserv'ER, 2015[10]. This report gives a nuanced forecast of the prospects for 2020 and sets out some of the challenges facing Member States, including the need for continued growth in investment and the low price of oil.

The evidence presented in the Impact Assessment is not sufficient to state with such confidence that an overwhelming majority of Member States are expected to achieve the 2020 targets, nor that the EU is on track to meet the 2020 target of 20% overall.

Further, the Impact Assessment (page 21) acknowledges that the national binding targets effectively end in December 2020. In the original Renewable Energy Directive[11] setting that target, there is no mechanism sufficient to enforce the achievement of the Member States' targets, and therefore of the overall EU target.

The above discussion is material, as the achievement of the 2020 targets is assumed as a "mandatory floor" in the options for meeting the 2030 targets (section 5.5. of the IA). Without a substantive enforcement mechanism, "mandatory" has no consequence in this case. The 2030 strategy is therefore based on assumptions that lack realistic foundation.

[10] "The state of renewable energies in Europe: 15th EurObserv'ER Report", Observ'ER (FR), September 2015 https://www.eurobserv-er.org/15th-annual-overview-barometer/

[11] "Directive 2009/28/EC on the promotion of the use of energy from renewable sources", 23rd April 2009

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The risk of this is explicitly acknowledged in the "Important note" on page 104, in the section on heating and cooling, referred to an assumption of Member States not meeting their 2020 targets and thereby significantly greater effort required between 2020 and 2030.

Therefore, the Impact Assessment should have assessed the impacts of at least one additional scenario that assumes that the 2020 target will not be reached.

Additionally, it would be prudent in further analysis to consider the effects on renewable energy targets of the UK leaving the EU. The UK's renewable energy share in 2030 is projected under the Reference Scenario to be 16.6%. With approximately 11% of EU energy consumption, removal of the UK from the renewables calculation would therefore increase the renewable share for EU27 by approximately 1 percentage point.

2.2 Review of Bioenergy Impact Assessment

Bioenergy makes a substantial contribution to the current and projected future mix of renewable energies in Europe. It is therefore important to understand the implications of biomass sustainability on the renewable energy target.

The Impact Assessment on the renewable energy directive is accompanied by an additional Impact Assessment on sustainability of bioenergy. The relevant elements of this Impact Assessment are taken into account in this IAI study.

The Bioenergy Impact Assessment reviews data from a number of studies. Whilst the projections of these studies for future biomass usage are not identical to each other, their conclusions regarding the sustainability of biomass for energy are mostly consistent.

2.2.1 Discarded options

In the Impact Assessment's selection of policy options, a number of options were discarded, quoting disproportionality of the measures compared to the risks and going against the subsidiarity principle of "leaving primary responsibility to Member States on the choice of instruments to reduce emissions".

The proportionality issue with these options has been addressed in the explanations (section 5.2 and Annex 10), although a full assessment was not performed, thereby not providing a full picture of the impacts and therefore the extent that proportionality is affected. Subsidiarity is not adequately explained in this case, since any criterion set at EU level (e.g. biofuel sustainability criteria) imposes a condition on Member State implementation. The additional options should therefore have been more comprehensively assessed order to determine and compare their input, rather than being discarded in advance.

One of the options is revisited at the end of this review of the Bioenergy Impact Assessment (Section 2.2.5).

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2.2.2 Assessment of Impacts

Key impacts on greenhouse gas emissions are presented in section 6.3.1 of the Impact Assessment. In particular the conclusion states for policy option 2:

> *…it can be concluded that there seems to be almost no benefit of a minimum greenhouse gas performance criterion for supply chain emissions of biomass as long as it is set at the level of 75% or lower.*

This conclusion is reached according to data on current forest feedstocks. However, the effect of a criterion on potential feedstocks with lower performance, that may be introduced in future, has not been considered. In addition, as acknowledged in the description of Option 2 (page 39), a consistent and effective policy would ensure equivalent rules for all types of biomass regardless of their use (biofuels, biogas or heat and power).

Further, when considering biogenic emissions and impact on carbon sinks, the extension of the existing provisions for biofuels restricting the production of feedstocks from certain areas to biomass for heat and power is quoted as having a "significant" impact on the LULUCF sink (table 5, page 48). This is a further substantiation for the introduction of a performance criterion. Table 6 (page 49) however states that the overall effect of this option on biogenic carbon is "positive but uncertain". The conclusion from the Impact Assessment is therefore inconsistent.

Section 6.4.1 on gross added value projects the "deployment" and "income" effects. The deployment effect is quoted as arising from more investment, bringing a larger positive impact in the economy as a whole. This however does not appear to take into account the efficiency of the investment in terms of its contribution to productivity for the whole economy. Further, table 11 shows a positive "net impact in the energy sector" of introducing the sustainability options regarding employment, but again this appears only to address the effect on this sector, not the whole economy. In fact, the discussion on comparing the options (Section 7) explicitly acknowledges this issue, referring to the 'budget effect' (loss of jobs in other parts of the economy, driven by higher consumer spending on energy).

Further, there appears to be a contradiction in the assessment, as page 57 projects a small positive effect on the economy of introducing the bioenergy sustainability options, where by section 7.3 (page 64) states that jobs are lost due to the higher cost of solar and wind technologies.

2.2.3 Biogenic carbon

A primary discussion in the Impact Assessment addresses the issue of biogenic carbon, in particular the timing issues of net emissions, questioning the assumed carbon neutrality of biomass for energy.

In particular, Annex 7, page 103:

> *"The combustion of woody biomass releases, in most cases, more CO2 in the atmosphere, per unit of delivered energy, than the fossil fuels they replace. ...If the forest productivity increases because of the bioenergy production, the continuous*

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substitution of fossil fuels may, in time, recover the additional emissions of bioenergy production."

Further on page 107:

"Certain forest management practices can enhance the carbon sink, but ensuring that the harvest level stays below the growth rate of the forest is not sufficient to ensure climate change mitigations [compared to the unmanaged forest]"

In Section 2.1.2 (page 16), the text states:

"Currently, the majority of the solid biomass used for energy purposes in the EU [industrial & harvest residues, traditional fuel wood] *can be considered to deliver substantial greenhouse gas benefits even when taking into account biogenic emissions."*

Here the alternative treatment of residues etc (e.g. roadside combustion or leaving to decay) is a key parameter in determining the relative emissions due to harvesting.

In Annex 8 these effects are further assessed. The BioImpact[12] study is quoted as concluding that imported wood generates significant additional biogenic emissions in the short (2030) and medium (2050) term, with domestically grown wood also a concern in this respect (domestic crops exhibit faster regrowth).

Annex 9 refers to additional studies. It reaches the conclusion that the CO2 emission reduction efficiency of dedicated stemwood harvest is significantly more carbon intensive than both coal and natural gas in the short term and mostly unfavourable in the medium term. It states that the use of wood from harvest residues, thinning and salvage is approximately neutral in the short term and reduces emissions in the medium and long term.

The conclusions of the quoted studies are not fully consistent but point (page 106) to a generally clear effect of high biogenic emissions in the short to medium term due to energy biomass from sawnwood, stumps and coarse dead wood. Of key importance in assessing the impacts robustly is the selection of the counterfactual: what would have happened in the absence of the farming of the wood? This issue is explicitly acknowledged in the text (e.g. Annex 7).

The short term-and medium-term GHG emissions resulting from, for example, stemwood farming, in comparison to the same forest and all other factors remaining equal (i.e. no forest management measures), would reflect the results presented in Annex 9 as quoted above – i.e. a strongly higher emissions .

If stemwood farming is directly associated with forest management practices and increased investment in forest development, that would not otherwise be employed, that result in increased carbon stocks compensating for the short and medium-term biogenic effects, then

[12] "Carbon impacts of biomass consumed in the EU: quantitative assessment", Forest Research, 2015.

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these can result in an aggregate effect that reduces GHG emissions, including short and medium term.

Annex 7 concludes the following, quoting BioImpact and the Joint research Centre[13]:

> *"…even if with sustainable forest management practices forest removals are lower or equal to the net annual increment of the forest, and carbon stocks are preserved or increasing in time in absolute terms, the total carbon stored in the forest will be in any case lower than the reference scenario of the unmanaged forest and the resulting difference translates into increased net emissions."*

The counterfactual implied is therefore the unrestricted natural growth of the forest. Projecting this notional natural growth in a managed forest is possible, with a certain level of confidence. Forest management practices that increase the carbon stock can be employed to offset the loss of carbon stock from cultivation. However, it could be argued that such measured could be employed in absence of the cultivation in order to increase the carbon stock even further. This demonstrates that there are a number of ways to interpret the counterfactual situation and therefore no single clear method for accounting for carbon stocks.

From the above discussion it is clear that the type of biomass harvesting is critical in determining the total emissions (supply chain plus biogenic) and therefore the extent to which the biomass can be considered carbon neutral in the short, medium and long term. Differentiation is therefore necessary.

These issues are addressed to a certain extent in the legislative proposal on "the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework" (LULUCF), adopted in July 2016. The proposal requires each Member State to ensure no net LULUCF emissions on their territory (taking into account flexibilities), including those from managed forest land.

As proposed, this legislation would not be sufficient to ensure that the use of bioenergy is GHG neutral in the short to medium-term timeframe of concern. For example, in Member States with currently negative LULUCF emissions (e.g. achieved through steady afforestation), it would allow harvesting for bioenergy up to a rate that brings total LULUCF emissions to zero. This could theoretically more than compensate for the LULUCF emissions reductions required in Member States with currently positive emissions.

In addition, the legislation would be applicable as from 2021, whereby the main growth in biomass for renewable energy is projected for the period 2015-2025, thus subject to the LULUCF conditions only for a portion of the growth period.

An effort to address sustainability is also made in the renewable energy legislative proposal Article 26, which defines sustainability criteria for biomass fuels in addition to those for biofuels and bioliquids already regulated in this way, and by applying additional criteria on

[13] "Carbon accounting of forest bioenergy", Joint Research Centre, 2014

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harvesting, forest management and LULUCF. Measuring the extent to which these provisions are sufficient to avoid high risk of biogenic emissions from biomass harvesting and combustion would require much more sophisticated modelling. Without a robust measurement method and a numerical criterion for determining total emissions, it remains possible that certain feedstocks, whilst complying with these criteria, could still result in total net emissions being higher than fossil fuels in the short to medium term.

In addition, equivalent to the argument above, greenhouse gas emission savings criteria are to be put in place only for new installations as from 2021, according to the legislative proposal (Article 26 §7).

2.2.4 Coherence with renewable energy directive proposal

The legislative proposal expands the scope of sustainability and greenhouse gas savings criteria to include biomass for energy, despite the assertion in section 6.3.1.1 of the Impact Assessment that "there seems to be almost no benefit of a minimum greenhouse gas performance criterion". (The robustness of this assertion was put into question in section 2.2.2 above).

The greenhouse gas savings threshold would be applied to facilities starting operation from 2021 onwards. The Impact Assessment states (page 16) that future growing demand for wood biomass could derive from additional harvesting, with the increment occurring by 2025, as confirmed in figure 72 of the EU Reference Scenario Trends to 2050 report[14]. This is consistent with the biomass industry's own findings, as indicated in the above section. It therefore appears that the greenhouse gas savings criterion will at a maximum apply only partially to that growth. The sustainability of that growth is therefore not directly regulated.

Further, the greenhouse gas savings criterion does not take into account biogenic emissions, which constitute a major finding of the Impact Assessment. The results indicate that the long-term effect of increased use of biomass is likely to be substantial reduction in biogenic CO_2 (compared to fossil fuel use). However, the effect in the 2050 timeframe, which is the ultimate focus of EU policy, could for certain feedstocks be emissions greater than those that would be generated by fossil fuels. As indicated in the previous section, this depends on the type of wood and harvesting method.

The Impact Assessment concludes that the scenarios of unconstrained use and of imported wood (scenarios B and C1 in Annex 8) would generate higher GHG emissions than fossil fuels in the short to medium term. However, the provisions of the legislative proposal would not prevent these scenarios. The Impact Assessment further denotes with "caution" the scenarios with domestic crops, domestic wood and "back off" (C2, C3 and D). The

[14] "EU Reference Scenario 2016: Energy, transport and GHG emissions. Trends to 2050", European Commission, 20th July 2016 https://ec.europa.eu/energy/sites/ener/files/documents/20160713%20draft_publication_REF2016_v13.pdf

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assessment indicates that positive approaches to forest management / additional supporting measures for overall positive impacts on GHG emissions would be necessary in any scenario relying on forest bioenergy. Again, the provisions of the legislative proposal would not be sufficient to ensure this positive impact.

Therefore, the projections for the renewable energy proportion for 2020 and 2030 depend partially on growth in combustion of biomass, some of which may generate higher greenhouse gas emissions than fossil fuels in the priority 2050 timeframe. To measure the aggregate effect on GHG emissions, additional transparent and peer-reviewed assessment of the specific biomass harvesting, forest management practices and determination of the counterfactual would be necessary. Only a full accounting of GHG emissions on a case-by-case basis would provide sufficient information to enable an outcome ensuring net GHG emissions reduction.

An additional discrepancy is the requirement in Article 26, paragraph 8 of the proposal for electricity from biomass fuels to be taken into account only if produced in installations applying high efficient cogeneration technology (CHP). The proposal explicitly precludes non-CHP, whereby option 4 in the Bioenergy Impact Assessment only applies an efficiency threshold, concluding that this would exclude non-CHP. Reflecting the Impact Assessment, the application of neutral numerical threshold would provide a proportional incentive for contribution to the desired outcome.

2.2.5 Conclusion on Bioenergy Policy

There are substantial complications with accounting for emissions in bioenergy policy, as acknowledged in the above analysis. In particular the difficulties in determining the counterfactual for farming of biomass for energy use preclude a clear and accountable method to calculate the climate effects.

It is useful therefore to use an extreme simplification of the accounting methodology by separating emissions from forest growth as a thought process for considering the issue:

- Account for emissions at the point of combustion, regardless of source (fossil, renewable or otherwise).
- Account directly for changes in carbon stocks, whether associated with bioenergy or otherwise, by measuring forest growth

Such an accounting is relevant in the case of biomass, due to the disconnect in time between the emission of CO2 from combustion and the absorption of CO2 from the air due to regrowth. A consistent treatment would also allow accounting for afforestation in managed forests, which could therefore be shown to compensate for biogenic emissions of farmed wood.

As mentioned above, the BioImpact study indicates that farming of wood would increase GHG emissions (i.e. reduce carbon stock) compared to unmanaged forests. The suggested method above would however create an accountability of entities responsible for farming for

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the overall climate-relevant effects of their forest management and require methods that at least maintain the overall carbon stock in the short, medium and long term.

This methodology reflects to an extent the discarded option "Introducing biogenic carbon emissions in the methodology on lifecycle emissions from solid biomass" from Section 5.2 of the Impact Assessment.

Whilst such a policy would be expected to increase the administrative burden substantially, it would ensure greenhouse gas savings can be robustly attributed to the biomass in question. It would also provide greater transparency for the industry and other interested stakeholders. Due to the significant contribution of biomass to total consumption of renewable energy and the wide range of potential greenhouse gas effects, there is a valid rationale for considering these efforts. This issue is revisited in the concluding section 4.

2.3 Renewable Energy in the electricity sector

An important fundamental issue is raised in the text of this part of the analysis, on page 80 in the assessment of the environmental impacts of the options, which states:

> *"…since the EU ETS cap sets a binding ceiling on the emissions within the sectors covered by the system, missing the RES target would not impact in absolute terms the EU level GHG emission reductions, which would be achieved in any case."*

Conversely it is also to be taken into account that the falling ETS cap will require either reductions in energy consumption in the covered sectors, switching to lower carbon fuels (e.g. coal to gas) or greater use of renewables. The EU-wide mechanism therefore already exists to stimulate greater use of renewables in electricity, once the allowance market price is sufficient to incentivise renewables above the other mitigation measures. The expected higher annual decrease in the cap from 2021 (at least 2.2% compared to 1.74% assumed in the Reference Scenario 2016) can be expected to encourage deployment closer to meeting the 2030 target.

Further, in the detailed assessment on page 74, the text acknowledges:

> *"This scenario [EUCO27] demonstrates that little support would be needed, and that renewable technologies may be competitive, under the right framework conditions."*

Since in the EUCO27 scenario the 27% renewable energy target for 2030 is achieved, this statement implies that substantial support measures are not required to meet the target. However the analysis leads to a preferred scenario including support for renewables through strengthened market-based design principles. These assertions are inconsistent with each other, if the main objective is to reach the 27% target.

These points put into question the need for explicit measures to support renewables in the electricity sector to meet the 27% target and therefore for the options put forward. This does not exclude the market-based design principles being generally valid in order to facilitate renewable energy as a measure to meet the main objectives of reduced GHG emission and enhanced energy security (further discussed in Section 4).

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2.3.1 Review of the assessment of impacts

In the assessment of the electricity sector, the most substantial impacts are projected to arise in the assessment of the "Framework for cost-effective, and market-oriented and Europeanised support to renewable electricity to promote regulatory certainty" (section 5.1.1). From the language of the description of the options in this section, (page 72) it is clear that option 2 is preferred, before the assessment is articulated. The Impact Assessment should maintain its integrity through adherence to correct procedure, by setting out the options in a balanced manner and providing a factual assessment. The apparent prejudgement of the selection, even if eventually justified by the assessment, is not appropriate for promoting policy based on evidence.

The assessment on page 73 refers to two significant detriments to investment incentives due to variable renewables: low marginal costs lead to lower average prices across the board and increased price volatility.

The text includes a discussion on the interaction with the Emissions Trading System. Page 74 states "The PRIMES model simulates emission reductions in ETS sectors as a response to current and future ETS prices". On page 75 the text further states:

> *It should be noted at the same time that rapid penetration of renewables has a decreasing effect on both the wholesale price as well as on the CO2 price (for a given number of ETS allowances on the market), thereby reducing the ability of the market to act as the driver for investments in both renewables and flexible generation.*

This appears to have introduced a circular argument, implying that higher renewables reduce ETS prices, thereby reducing the incentive for renewables. If renewables really are lower cost than other energy sources, then the lower ETS prices are not a barrier to their further introduction, since the reducing cap will require renewables to continue to reduce emissions in the covered sectors, in particular electricity.

It is however correct that low ETS prices (currently around €5/tonne) do not provide a direct incentive for renewable energy deployment. Since growth in renewable energy is occurring to a great extent due to renewable energy policies in Member States, additional renewable energy capacity is being supplied, without old non-renewable capacity being retired. Therefore the direct comparison of costs of renewable and non-renewable energy does not give a full picture of the framework for investment, since in many cases investment in renewable energy is "on-top" of existing capacity rather than competing with non-renewables.

A change to this incentive can be expected when the ETS cap has reduced to the extent that there is a clear price signal acting on the investment decisions of renewables vs fuel switching vs reducing energy usage.

On page 77 the text states that no modelling assessment of the implementation of the toolkit included in option 2 has been performed, and a qualitative assessment is elaborated. Whilst usually a full assessment of the proposed measures is necessary to provide a comprehensive picture, the lack of an enforcement mechanism at Member State level for the renewable energy target implies that the effects of the measures are highly uncertain.

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For the evaluation of the framework for Europeanised support, therefore the clear preference for option 2, as presented in the table in section 5.1.5., cannot be justified.

There is no explicit section on economic impacts, although these are addressed in the main body of the assessment section.

Social impacts are assessed on page 80, stating the likelihood "that not reaching the 27% target would have negative social impacts in terms of job creations, growth and security of supply.". This relies on the assumption that investment in renewables will automatically increase employment and growth. However, these economic effects can only be positive if the efficiency of economic investments overall is increased. This is explicitly acknowledged later in the Impact Assessment in section 6.4.1, quoting the "budget effect" due to the existence of alternative investment options.

The statement therefore indicates a predisposition in the assessment of investment in renewables rather than the necessary neutral evaluation of the impacts. The fact that the countervailing argument is explicitly acknowledged at a different place in the Impact Assessment (in the reference to the budget effect) indicates a worrying lack of consistency in the analysis.

The social impact of energy prices is not addressed in this section, which leads to a significant information gap for the option comparison.

For the sections on "A more coordinated regional approach to renewables support" and "Reducing the cost of capital for renewable electricity projects" a similar conclusion can be drawn regarding the lack of enforcement mechanism. The assessed impacts of the provisions included in the options may or may not be reasonable, but their efficacy is significantly hindered by the lack of mechanism or incentive to meet the targets at Member State level.

2.3.2 Overall assessment and coherence with legislative proposal

The table showing the overall evaluation of the options includes six criteria. Three of these are designated "overall impact" (social, economic and environmental) and are directly assessed in the text and given a grade accordingly. As indicated above, the social impacts, comprising primarily employment, are not comparable between the scenarios. A full economic cost of the scenarios is not presented nor are the figures compatible between the scenarios.

The other three evaluation criteria are "Key objectives" (effectiveness, efficiency and coherence). These terms are not defined nor are any parameters for their evaluation presented. They therefore appear to have been evaluated subjectively.

In addition, there is no weighting of the parameters, in particular comparing the relative importance of overall impact to key objectives, which would help inform a coherent decision making.

For the evaluation of Europeanised support to promote regulatory certainty, as indicated in the section 2.3 above, the preferred option has not been fully assessed. The assessment also contains inconsistent and inaccurate assumptions and analysis. The strongly positive assessment of option 2 appears therefore to be based on subjective preferences. Whilst the

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merits of the option are apparent, the overall evaluation cannot be considered to be valid, especially in view of the lack of comparability of the parameters.

For "regional approach" and "cost of capital", similar inconsistencies are observed.

The above analysis does not negate the conclusions of this section of the Impact Assessment, but the methodology used and the degree of positive evaluation is not justified by the data and analysis performed.

The options selected for the legislative proposal appear to be generally consistent with the findings of the Impact Assessment.

2.4 Renewable Energy in the heating and cooling sector

In contrast to the electricity sector, the heating and cooling sector is only partly covered by the ETS. Therefore the motivation for measures in the EU-level regulations that enforce action at Member State level is apparent. This is manifested in the options put forward for renewable energy obligations for fuel suppliers.

The reasoning behind introducing option 1, a renewable energy obligation on fossil fuel and fossil fuel based energy suppliers for heating and cooling, is not substantiated. The text (page 101) acknowledges part of the practical concerns with this option, although the concern about fictitious claims by fossil fuel suppliers of their use of renewables is not limited to this case – fraud can be relevant in all cases. The main barrier is the potential inequitable treatment of suppliers with slightly different profiles due to a zero (or other fixed value) threshold for renewable energy share as the criterion for having a renewables obligation on heating and cooling. Option 1 is therefore unnecessary and the main choice is between having an obligation (on all suppliers) or not. Indeed option 1 was quickly discarded in the assessment.

The obligation introduces a level of enforcement on Member States. This is partially equivalent to binding targets on Member States, since it would apply binding requirements on them to impose renewable energy in the sector for which there is no other mechanism at European level.

2.4.1 Review of the assessment of impacts

The economic impacts of the options for "Mainstreaming renewables in the heating & cooling sector" are assessed in a mostly qualitative manner. This section correctly compares the two variants of options 2 for imposing renewables obligations on all fuel suppliers in heating and cooling, in particular noting that variant 1 (gradual obligation) would ensure improvements are required from all suppliers, with likely higher efficiency overall. However, without data about the make-up of those suppliers, the effects cannot be coherently assessed and any conclusion can only be speculative.

Administrative costs are also mentioned but again not assessed, although it is correctly acknowledged that they are likely to be more onerous for smaller companies. No SME test

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was performed in this case, although it is a clear instance where it would have been informative.

A significant omission from this section is a comparison of options 0 and 2, i.e. between the cases with and without an obligation. This is an important element of the analysis, since the efficacy of introduction of the obligation is the most important economic and social question. An obligation would require many suppliers to change their business methods and their own sources of fuel. There is likely to be high variability in the availability of renewable fuels according to geography and level of economic development. Neither variant 1 (1% increase in share per year) not variant 2 (universal 27% obligation) would allow for these variances in conditions.

Further, this would also represent an obligation on consumers, since it cannot be assumed that residential or business users of fuels have the (mostly) heating equipment necessary to apply the alternative fuels that would be on offer. For households in particular this could also represent a significant social impact, whereby in the text no assessment of social impacts has been conducted. Despite this lack of analysis, the social element is evaluated in the final table.

2.4.2 Overall assessment

As in the previous section, the final evaluation table lacks comparability, definition of terms, compatibility and weighting, severely impairing its value in advising policy making in general terms. The specific evaluations also raise questions.

For "Mainstreaming renewables", option 1 is evaluated almost as positively as option 2, despite being discarded early in the discussion of the assessment. It does not appear that the valid objections raised against option 1 were fed into the final evaluation, putting into question the coherence of the analysis. There is no distinction in the evaluation between variants 1 and 2 of option 1, despite these being prominent in the discussion. This appears to be a simple oversight but a material one.

Further to the above the heating and cooling obligation scheme does not differentiate between renewables despite their different greenhouse gas savings performance.

2.5 Renewable Energy in Transport

In this section, a number of policy options for increasing renewable energy in transport are put forward and analysed.

Regarding the assessment of the options, on page 124 the text states the following:

> *"The PRIMES model was used to model impacts of options 0, 2 and 3. Option 1 was not quantitatively modelled as the outcome would depend on the policy choices of the Member States regarding food based biofuels."*

However, options 2 and 3 are presented as being based on option 1. Why the policy choices of Member States are relevant to option 1 and not to options 2 and 3 is therefore not explained. Option 1 was not fully assessed, with the consequence being that this option is

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excluded from a factual and scientific analysis. Even if there are valid reasons for not being able to perform a full analysis on option 1, at least a scenario analysis would have been appropriate in order to assess its potential outcomes. Otherwise option 1 has no value in this Impact Assessment.

In addition the following text is found on page 125:

> *"Due to the significant differences in the assessment tools and underlining assumptions, the results are not directly comparable and therefore the impacts of options 0 to 3 (energy obligation) are presented separate from the assessment of option 4 (GHG reduction obligation)."*

For an Impact Assessment on a key area of policy such as this, it is essential for comparable results to be generated and presented in order to inform selection of policy. In particular the effect on investment, costs and prices should have been compiled for all scenarios with equivalent parameters. This represents a serious shortcoming in the results of the Impact Assessment.

Despite the stated lack of comparability, the overall evaluation for all options 0 to 4 is presented in a single table (page 136/137), implying direct comparability.

In addition to these inconsistencies, it is important to repeat the finding that the bulk of the results (for option 0, 2 and 3) are based on the PRIMES model and therefore lack transparency and credibility for stakeholders[3]. In addition, the ICCT report[15] underlying the evaluation of option 4 is private and not subject to peer review, as explained in Annex 8 of the Impact Assessment.

Further, it is found that all the policy options are explained and set out clearly except 4b, for which details of the four sub-sub-options are only referred to without explanation in table 10 (page 133) on the employment impact. The rationale for the subsequent rejection of this option cannot therefore be properly scrutinised and has not been justified in the Impact Assessment.

2.5.1 Calculation of sustainability of biofuel feedstocks

A list of feedstocks recognised as being valid for the production of advanced biofuels is included in Annex IX of the legislative proposal. It therefore defines which feedstocks are valid for meeting the 3.6% target for advanced biofuels in 2030. This Annex was originally introduced in the ILUC Directive. No evidence nor any objective criterion have been presented to substantiate the feedstocks on this list. There is no link demonstrated between the calculated greenhouse gas emissions of fuels, as detailed in Annexes V and VI, and the

[15] "Service contract for technical assistance facilitating implementation of Art. 7a of the fuel quality directive 98/70/EC", contract no 340201/2015/706549/SER/CLIMA.C.2. with ICCT - International Council on Clean Transportation Europe

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feedstocks included in Annex IX. Such an objective numerical assessment would be necessary in order to provide justification for the entries to be included on such a list.

A particular inconsistency is that of farmed wood as a feedstock, which is not included in the list in Annex IX and thereby is subject to the 3.6% limit by 2030, limiting the potential for this feedstock to contribute in transport. However, farmed wood is potentially a major contributor to the planned growth of renewable energy in electricity. The treatment of farmed wood is therefore not consistent between the different energy sectors, calling into question the approach taken in the Impact Assessment and legislative proposal.

The concept of indirect land use change (ILUC) was formally introduced into EU policy in September 2015 with the "ILUC directive[16]". In March 2016, the report of the GLOBIOM[17] study was published, containing detailed results on ILUC effects of different fuels. The published results of the study contain substantial background information, references and data sources. However, the underlying modelling algorithms are not available for external scrutiny. This is a critical shortcoming in the evidence, denying independent review and validation and excluding wider expert input. Especially as ILUC is a complex concept with many interrelated factors, its calculation would benefit from a broader array of expertise. Further, the study was completed in August 2015, but not published until March 2016, after completion of the public consultation on the Renewable Energy Directive, thereby preventing timely scrutiny and expert feedback from stakeholders.

The Impact Assessment includes a table (see Annex 4) with the greenhouse gas effects of ILUC of various biofuels calculated using different models, assumptions and data. The wide variety of figures indicates a fundamental uncertainty in the calculations and therefore the need for full peer review and expert validation, in order to provide stronger intellectual support for the figures and enhance stakeholder confidence in the evidence.

2.5.2 Objectives and assumptions

The overarching goals of the revised Renewable Energy Directive are clearly set out in section 3 of the Abstract of the Impact Assessment. Prominent among these is a greenhouse gas emissions reduction of at least 40% compared to 1990 levels, including a reduction of 30.2% of emissions in the non-ETS sector (including transport) compared to 2005 levels. Section 6 of the abstract refers to the policy options, which include paths to "phase out food-based biofuels".

[16] "DIRECTIVE (EU) 2015/1513 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources", 9 September 2015.

[17] "The land use change impact of biofuels consumed in the EU", ECOFYS, IIASA, E4TECH Commissioned by the European Commision, 27 August 2015

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The legislative proposal refers to the July 2016 Strategy of Low Emission Mobility, which mentions food-based biofuels and further references the 2014 Climate & Energy Strategy and the ILUC directive. No assessment was provided to support the provisions of that Strategy and there is no formal policy position requiring this phase-out.

The ILUC Directive introduces the concept of distinguishing between land previously destined for food and feed crops that is diverted to biofuel production, thereby creating emissions though indirect land use change (Recital 4). It also states that information on these effects is limited. In particular palm oil associated with drainage of peatland has been demonstrated to be associated with significant depletion of the carbon stock, deforestation and high ILUC emissions. Evidence does not indicate that this is the case for all food and feed based biofuels, nor does it exclude that ILUC emissions can arise from non-food crops.

Recital 27 acknowledges that there are indeed exceptions, with the existence of a distinction between different types of food based biofuels. Certain non-food based biofuels are associated with higher GHG emissions than certain food-based biofuels. The use of the food-based parameter therefore does not align coherently with the underlying objective of the policy to reduce GHG emissions.

The intention to phase out food-based biofuel was used as the assumed basis for further analysis in the Impact Assessment, without explicit evidence presented to support its inclusion.

In the Impact Assessment, some of the text appears to acknowledge this inconsistency:

- The abstract, section 6.3. states that *"…emissions from indirect land use change can be significantly reduced through a gradual phase out of conventional biofuels by 2030, focusing primarily on oil-crop based that are associated with higher ILUC impacts, combined with a higher greenhouse gas emission saving threshold for new biofuel installations."*
- Section 1.3 further states: *"This Impact Assessment addresses only issues related to the climate performance of biofuels, and in particular indirect land use change impacts of conventional food-based biofuels which are not captured by the sustainability criteria."*
- In Section 2.22. under the heading "Transport", the text states: *"This [increasing share of biofuels to 2050) also requires substitution of food-based biofuels by advanced biofuels with low effects on indirect land use change (ILUC) emissions."*
- In Section 2.2.4 under Driver 3 the concept of "low indirect land use change risk biofuels" is introduced, explaining further: *"… ILUC risks of conventional food-based biofuels can be avoided if measures are taken that compensate for the increase in demand for crops."*

The above statements acknowledge the differentiation in ILUC between different fuels and that low ILUC is an important objective. However, the food-based criterion for limiting biofuels is maintained.

In Section 2.2.4 under Driver 3, relevant data on indirect land-use change is set out for a number of biofuels (Annex 4). The range of values is very broad according to all studies

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quoted. If GHG emissions reduction were accepted as an objective parameter, the wide variety of performance justifies a differentiated approach.

Definition of food-based biofuels

Fundamental to this analysis is the definition of "food-based biofuels" in the legislative proposal, Article 2 paragraph (dd):

> *" 'food and feed crops' means starch-rich crops, sugars and oil crops produced on agricultural land as a main crop excluding residues, waste or ligno-cellulosic material;"*

This definition could easily be exploited as it contains implied uncertainties. For example, "agricultural land" and "main crop" are not defined and could be interpreted in different ways. Would a starch-rich crop that is not edible still be defined as "food and feed"? If a non-food main crop (e.g. a cellulosic plant) is grown on agricultural land, this would still generate ILUC and could potentially reduce the carbon stock to the same extent as any food crop, but would not be counted as such.

The lack of objective and consistent parameters for the definitions and policy options creates a suboptimal incentive which is not aligned to the main policy goal and therefore does not support the most effective path to reducing GHG emissions. The preferred policy option in the Impact Assessment would allow 4% food-based biofuels in 2030 (3.8% in the legislative proposal), with a greenhouse gas savings threshold that excludes ILUC. Therefore this option could allow biofuels associated with high total GHG emissions (including ILUC) to be introduced up to the 4% threshold, in contradiction to the intention to reduce fully-accounted GHG emissions from biofuels. The sustainability criteria for feedstocks is intended to filter out those with a risk of high-ILUC emissions, but without specific parameters this cannot be ensured.

To target the objective in the most effective manner, the evaluation should be based on objective numerical criteria.

Advanced biofuels

Further, the preferred policy option depends on growth in the production volumes of advanced renewable fuels to 4% of transport energy (3.6% in the legislative proposal) from the current level of about 0.5%, which is mostly composed of renewable energy in rail and other non-road transport[6]. The 4% figure is derived from the ICCT report, for which the details are not publicly available. Annex 8 of the Impact Assessment provides some additional insight into the figures. It expresses a high degree of uncertainty in the projections for advanced biofuels.

No clear information is provided on the costs of advanced biofuels. A figure of €1.5bn per year for additional investment costs is quoted in Table 8 on page 130 of the Impact Assessment. There are references (on the same page and in the abstract) to decreasing feedstock prices partially offsetting the increased investments. However, without a full transparent assessment of costs, a valid conclusion on the potential for advanced biofuels cannot be reached.

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These factors indicate a significant risk of the alternative fuels technologies and commercialisation not being sufficiently mature to make the expected contribution to GHG reduction by 2030, endangering the achievement of the objectives.

2.5.3 Cut-off point for sustainability of biofuels

Further to the above discussion, the use of a GHG threshold for determining the acceptability of biofuels for contributing to the renewable energy targets can also be put into question. This is addressed in isolation from the issues of ILUC.

The threshold represents a hard cut-off point, which introduces a suboptimal incentive in two ways:

- Biofuels just above and just below the threshold have very similar GHG characteristics, but would be treated very differently in the context of the RED.
- Biofuels significantly exceeding the standard are treated the same as those just exceeding it, thereby creating little incentive for enhanced GHG emissions performance.

This is a typical example of threshold effects. The threshold value by its nature is arbitrary. In this case the effects are material, as the suboptimal incentive risks resulting in less effective climate change mitigation overall.

Further, the default values for biofuels, if above the threshold (i.e. 50% rising to 70% - Article 26§7) do not require actual GHG savings to be determined. This opens the possibility that biofuels are counted whose actual GHG savings are lower than threshold, since the designations in the table of values describe only the feedstock and process generically, which cannot reflect individual harvesting and production conditions. To eliminate any uncertainty and possible unintended consequences, this indicates that the calculation of actual emissions would be necessary for all biofuels, at least at the point that the production volume of such fuels becomes significant.

Reflecting the analysis above, only a numerical accounting for the actual value of GHG savings can enable an incentive to be set that is proportional to the main policy goal. This could be achieved, for example, by only counting the GHG savings percentage of the biofuel as renewable (e.g. 1 litre of biofuel with 80% GHG savings counts as 0.8 litre). When combined with a full accounting for all emissions, including robustly calculated ILUC, this would generate a more accurate picture of the renewable energy being delivered and would create an incentive proportional to the actual desired performance.

2.5.4 Assessment of impacts

The assessment of environmental, i.e. the reduction of greenhouse gases compared to the baseline, and of economic impacts, is based on output from the PRIMES model for scenarios 0, 2 and 3, with the implications for transparency and credibility identified above. There is additional input from GLOBIOM.

Environmental impacts

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If the results for the effect on direct greenhouse gas emissions, as shown in table 6 (page 127), are taken at face value notwithstanding the issues of transparency and credibility of the modelling, some observations can be made:

- The direct and indirect GHG effects are presented separately and in two incompatible formats, making an assessment of the overall GHG savings extremely difficult. The overall GHG savings from the scenarios are not explicitly presented in the text.
- A review of the details results in a maximum saving (option 2C) of about 3%[18] or approximately 27MtCO_2-eq/yr. This is evaluated in the overall table as +++, indicating a large effect but in absolute terms this is small. For example, in the EU Emissions Trading System proposal the cap reduces by 2.2% per year on a baseline of about 2000 MtCO_2eq, approximately 45MtCO_2-eq per year. Since no baseline for the evaluation is quoted, this comparison to a known policy baseline is a valid indicator. The +++ evaluation may therefore create a misleading interpretation compared to evaluation of other parameters.

Economic impacts

In the section on economic impacts, only the capital costs and effect on fuel prices are presented. In table 10, jobs per million Euros of policy cost are presented. However the figures for policy cost itself are not presented.

Social impacts

Employment impacts are presented qualitatively for options 0 to 3 and quantified for option 4 (in the ICCT report, which is not publicly available). Without a quantification of options 0 to 3 based on equivalent parameters nor a scrutinisable calculation for option 4, no valid comparison of the impact is possible.

The quoted employment effects for the scenarios under option 4 are substantial, amounting to 144,000 in the best case and to 60,000 in the case of 4D, which is presented as the preferred option. It is not specified whether these “permanent direct jobs that would be supported by alternative fuel production” only represent the effect in the alternative fuel industry or whether they are the net jobs that would be created, taking into account investment diverted from other purposes.

These are important figures and therefore a clear definition should be presented and proper scrutiny of the details should be enabled. Without these elements, the results cannot be credibly used in decisions on policy making.

There is no assessment of the social impacts of changes in consumer prices.

[18] Table 6 gives -1.5%/1.6% direct emissions effect for options 2C/3 (baseline 970Mt/yr). Table 7 gives 330-90 = 240Mt CO_2-eq indirect emissions effect over 20 years = 12Mt/yr average = -1.2% per year average. The sum of these direct and indirect effects is -2.7%/2.8%.

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Administrative burden & enforcement methodology

The section on Administrative burden in this part of the Impact Assessment includes a discussion of the impacts on Member States and economic actors of applying GHG-based obligation, referring to similar provision in the existing Fuel Quality Directive. The above scrutiny indicates that this option may have greater advantages than those acknowledged in the Impact Assessment and legislative proposal. However, such a policy would require a valid enforcement methodology. In particular, due to the expected increase in the use of electricity for road transport, a method to take account of this as part of an overall obligation to reduce the GHG intensity of transport fuel would be necessary. This is not addressed in the Impact Assessment.

Further, the assessment indicates that administrative burdens can be reduced for producers of advanced biofuels by applying default values for GHG savings. This is correct, but as indicated in Section 2.5.3 above, this risks not accounting accurately for net GHG emissions, especially once the volumes of those types of fuels become significant.

2.5.5 Overall assessment and coherence with legislative proposal

As in the previous sections, the final evaluation table lacks comparability, definition of terms, compatibility and weighting, severely impairing its value in advising policy making in general terms.

Sub-options 4B, C and D are evaluated in the final table (pages 136-137). However it is not clear from the text which scenarios of each of these are evaluated. This is material, since for example figures 23, 25 and 26 and table 10 demonstrate that the effects differ significantly between scenarios.

Options 2C and 4D exhibit identical marks across the six criteria. In the legislative proposal. Option 2 (2C) is selected, stating consistency with current policies for Member States and industry. It also quotes its support for the reduction of food-based biofuels, referring to the July 2016 Strategy of Low Emission Mobility (see comment in Section 2.5.2 above).

It therefore appears that the selection of this option is partly predicated on the objective to reduce food-based biofuels. If however the objective to reduce GHG emissions is given greater prominence, as is consistent with the priorities of EU Climate and Energy policy, there would be a higher probability of the final selection landing on option 4.

A more effective method for accounting for renewable energy for transport would be to use the GHG performance figures for each fuel directly in the calculation of the renewable energy contribution. For example, a biofuel with 100% GHG savings (including ILUC) compared to fossil fuel would count 100% towards the target. A biofuel with only 50% GHG savings would count only 50% towards the renewable energy target. Application of biofuels exhibiting negative GHG savings would therefore reduce the overall renewable energy share. Renewable electricity used in transport (either dedicated or as a proportion of the grid-provided electricity) would count according to the content of its generation.

The above is dependent on a robust methodology to calculate ILUC. This is only possible if a fully transparent and peer reviewed methodology is developed, in which sufficient

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differentiation is applied to various fuel types, feedstocks, global markets and local conditions. This implies a significant administrative burden and more time until full development, but is the only method that ensures accurate accounting for the GHG effects of biofuels.

The above method would proportionally incentivise those biofuels which make a greater contribution to greenhouse gas savings. When the GHG savings are directly calculated in this way, the hard cut-off would not be necessary. The distinction between food-based and non-food-based biofuels would also be removed, as it does not distinguish between actual GHG performances of different fuels.

Acknowledging the significant administrative effort involved in such full accounting and the likely lead time for its introduction, thought could be given to developing a simplified version. Whilst not providing full accuracy, this could generate figures adequate to indicate the magnitude of the actual net greenhouse gas effect of all biofuels and therefore generate greater confidence in the assessment of sustainability of the fuels.

2.6 Achieving the 27% target (Impact Assessment Section 5.5)

There are a number of fundamental shortcomings in the evidence presented, as elaborated in the above sections, that therefore form the overall context for the assessment of the achievement of the overall 27% target renewable energy for 2030.

The macro-economic modelling, as discussed in Section 1.2 above, is not transparent and therefore does not allow scrutiny of the results. Acknowledging this fundamental uncertainty, the following analysis takes into account the modelling results where relevant.

Secondly, there is a fundamental conflict between two of the main political objectives. The European Council[19] endorsed a binding target of 27% renewable energy in gross final energy consumption in 2030, also concluding that binding national targets are not to be applied. The European Parliament has called for 30%[20] implemented through national targets. Binding measures require both an entity with the responsibility to implement them, and an enforcement mechanism. It is possible for these to be present at Member State level but not at EU level. Therefore this element of the policy is developed within an incongruous framework, undermining any and all measures that may be proposed.

Further, throughout this section of the Impact Assessment, the assumption is made that higher deployment of renewable energy results in lower GHG emissions. However, this relationship is not automatic and depends on a complicated combination of the energy

[19] European Council conclusions, 23rd-24th October 2014 http://data.consilium.europa.eu/doc/document/ST-169-2014-INIT/en/pdf

[20] "Towards a European Energy Union" European Parliament resolution, 15th December 2015 http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2015-0444+0+DOC+PDF+V0//EN

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investments and costs of different measures. For example, if lower investment in renewables is compensated by higher investment in energy efficiency, lower GHG emissions may result. In addition, as indicated in the above sections, different types of renewable energy exhibit different performance in reducing GHG emissions, which is not captured by the simple percentage figure.

2.6.1 Baseline

In this section of the Impact Assessment, the assumption is made, according to the 2016 EU Reference Scenario, that all Member States meet their 2020 targets. However, as indicated in Section 2.1.1 above, there remains a chance that the 2020 targets are not met, either individually by Member States or on aggregate by EU28. This should have been factored into the analysis as one possible senario.

On the basis of the assumption of meeting the 2020 targets, the assessment analyses the effect of retaining a mandatory baseline, stating in particular that it creates greater certainty for investors and in terms of environmental outcomes. Whilst greater certainty would indeed be promoted by a truly mandatory baseline, implementation and enforcement would be essential and this is intimately associated with the mechanisms to meet the higher targets for 2030 (and any targets in the interim).

Finally, a mandatory 2020 baseline for Member States has no tangible meaning if the primary targets (post-2020) have no mandatory character (to be addressed in the following sections).

2.6.2 Trajectory

A trajectory has relevance either as an enforcement mechanism or as an indicator. Again, the value of the trajectory is strongly dependent on the method of monitoring and enforcement, discussed in the sections below.

The Impact Assessment states (p 168):

> *The linear approach will result in a more consistent stream of investment across the time period, rather than back loading it to a later point in time.*

This is the case if, as stated on p169 "*renewable energy technologies are mature*". However, technology is continuously improving and a potentially valid alternative scenario is that later production investments (e.g. second half of the 2020's) would be more efficient and effective in reaching the 2030 target if earlier R&D investments are supported. Such a possibility is not taken into account in the Impact Assessment, which therefore reaches its conclusion on the benefits of the linear trajectory without fully considering all options.

If this alternative scenario were indeed economically beneficial, it could potentially also support a more beneficial environmental outcome by generating more efficient renewables deployment and investing in more mature technology with a more favourable environmental performance.

Overall the evidence has not been presented to demonstrate robustly that the linear trajectory would be the most beneficial.

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Again, this is a secondary issue as its consequences depend strongly on enforcement mechanisms.

2.6.3 Ambition gap

The Governance Regulation sets up provisions with the intention to avoid any Ambition Gap.

First of all the setting of an iterative process while writing the Integrated National Energy and Climate Plans (INECPs) would be a valid method to monitor potential ambition gaps from Member States. The Commission will have to review INECPs and Member States would have to resubmit them subsequently if considered as needed. But this review process alone cannot ensure that no ambition gap will appear. Following the Impact Assessment (page 171) specific criteria for MS to use when developing their contributions to the renewables target could have been envisaged, but such a method is not required, except the relevant sections of their INECPs.

Secondly, article 27.1 of the legislative proposal on "Governance of the Energy Union" states

> *"if the Commission concludes that the targets, objectives and contributions of the national plans or their updates are insufficient for the collective achievement of the Energy Union objectives (…) it shall take measures at Union level in order to ensure the collective achievement (…) of the Renewable energy target."*

A few examples of the EU-wide measures are provided in the Impact Assessment (p170, including additional obligations and an EU-level fund). The text then states "*The ambition level of these measures would be automatically increased to fill any resulting gap to the target that can be seen after the national plans have been finalised*". However, no assessment is performed on the impact and feasibility of the measures, for example whether sufficient funding could be put in place to fill the ambition gap. Moreover, as stated in the Impact Assessment (p. 171), a time lag between the ambition gap detection and the negotiation and implementation of corrective measures challenges the effectiveness of this system.

The assessment of economic impact focuses on the impact to the renewable energy sector. A full economic analysis should cover the impact on the entire economy, taking into account investment flows and, as mentioned previously, the "budget effect". The impacts of the potential measures are not assessed, but this would in fact be the most important element of the analysis.

Under the environmental impacts, the text states:

> *"The biggest environmental impact will come from ensuring that the at least 27% renewable energy target is delivered."*

However, higher renewable energy use will not necessarily lead to higher environmental benefits (i.e. GHG reductions), since the GHG performance of different renewable energies is unequal and channelling of investment into other measures could achieve more at the margins.

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In mitigation, the main impacts are subject to the delivery rather than the ambition, so a full scrutiny is deferred to the next section below.

2.6.4 Delivery gap

Except for option 4, introduction of binding targets at Member State level, the measures proposed include no enforcement mechanisms and therefore run a substantial risk of the overall EU renewable energy target for 2030 not being achieved, should the economic conditions be insufficiently beneficial. The review processes are necessary to identify the delivery gap, but the EU wide renewables measures and specific measures to fill the gap are insufficient if not accompanied by an enforcement mechanism.

The statement under Option 3 "The ambition level of these measures would be automatically increased to fill any emerging gap" refers only to an intention rather than a concrete action.

The issue is acknowledged in the introduction to the assessment, stating "A key issue for the design of the legislation is how to provide sufficient incentives for continued delivery of national commitments and also sufficiently ambitious pledges in the first instance." However, no viable solution is presented.

The section on economic impacts correctly identifies energy security and import dependency as key factors for greater renewables implementation. It also states that ineffective gap filling would lead to a lower rate of decarbonisation than is cost effective in meeting the EU's climate and energy objectives. However, if a delivery gap arises, it will likely be due to insufficient investment in renewable energy due to lack of business case, which implies it would be deemed by investors not to be cost effective.

The economic assessment then states that the effect of individual options is difficult to determine at this stage since the measures are not known. However this is precisely the analysis that is required from the Impact Assessment. Further, despite the lack of assessment of the options, a clear evaluation is concluded in the final comparison table (see below).

Again as previously discussed, the environmental impact of renewables deployment is not guaranteed in comparison to other measures for reducing GHG emissions.

The proposal for a Regulation on the Governance of the Energy Union states in article 27.4

> *"If (…) the Commission concludes, based on its assessment (…) in the year 2023, that the linear Union trajectory (…) is not collectively met, Member States shall ensure by the year 2024 that any emerging gap is covered by additional measures, such as:*
>
> - *adjusting sectorial share of energy (…) (H&C, T),*
> - *making a financial contribution to a financing platform set up at Union level (…) and*
> - *other measures."*

This last measure is in coherence with the Impact Assessment. However, there is clear lack of a mechanism to enforce achievement of the target.

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2.6.5 Final assessment

As for the assessment of the individual sectors of energy above, the table showing the overall evaluation of the options (page 177) includes six criteria. Social, economic and environmental impact are directly assessed in the text and given a grade accordingly. Effectiveness, efficiency and coherence are not defined nor are any parameters for their evaluation presented.

Clearly missing from the table are key parameters of viability. None of the criteria are explicitly associated with the likelihood of meeting the 27% target. It is possible that this is covered by the key objective "effectiveness". If this is the case however, the options including national binding targets should be evaluated higher than the other options. In addition, political viability is not assessed in the table (despite being prominently discussed in the text), but this is apparently the most important factor, since the binding national targets are rejected for precisely this reason.

In order to present a true picture of the reasoning behind the assessment, these criteria should have been explicitly and transparently presented as part of the overall evaluation.

As indicated in the above section, differentiated evaluations of economic impact for the various options are presented in the table, despite the statements in the text that it is difficult to distinguish differences between the options.

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3. Needs for meeting the 2030 targets and review of potential contributions

The data on renewable energy shares for the different scenarios is not consistently presented in the Impact Assessment. For example, on pages 67 to 70 the three main scenarios for 2030 are presented with different levels of data regarding the share of each in electricity:

- **Reference scenario 2016**: contribution of wind, PV and hydro presented in terms of proportion of net generation, biomass as share of fuel input in thermal power plants.
- **Baseline (CRA)**: wind, PV, hydro, biomass presented as share of RES-E generation.
- **EUCO27**: only a qualitative overview of the difference to the CRA scenario.

There is no information provided on the shares of each renewable energy type in heating and cooling.

In order to estimate the respective contribution of each renewable energy type in 2030, the figures for 2014 along with the provided figures for the 2030 scenarios have been taken, and a number of assumptions made:

- Share of biomass, hydro/wind/PV (i.e. electricity) and other renewables in heating and cooling are taken from European Commission fact sheet for 2012 and assumed equal for 2013 & 2014 (as indicated above).
- “Other” renewables for electricity and heating & cooling each continue to grow at around 500 Ktoe per year.
- Ratio of hydro/wind/PV in heating and cooling continue to reflect their proportions in electricity.

These assumptions allow a calculation of the contribution of each type of renewable energy to achieving the 2030 target. The following chart demonstrates the figures for the baseline CRA scenario, in which the 27% renewable energy target for 2030 is reached, comparing to the 2014 performance.

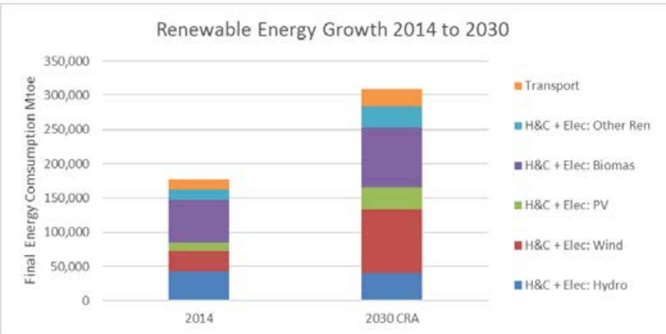

Figure 5: Shares of renewable energy types in 2014 and 2030 (CRA scenario)

Each of the renewable energy types can be assessed in turn to determine the potential for contributing to meeting the target.

<u>Hydro electricity</u>

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The potential for growth in hydro energy is very small, as almost all viable projects have been exploited, as evidenced by its lack of growth between 2004 and 2014. This is aligned with the projection in the Impact Assessment, which also forecasts zero growth for hydro power by 2030.

Wind

The required annual growth rate for wind is calculated as 3,900 Ktoe, in order to meet the above 2030 contribution of 93,000 Ktoe. This is somewhat higher than the growth rate between 2004 and 2014 (2,400 Ktoe/yr) and that from 2011 to 2014 (3,100 Ktoe/yr). An acceleration would therefore be necessary.

The industry's own scenarios (WindEurope[21]) project generation from 67,000 Ktoe (low) to 85,000 Ktoe (high) in 2030. Therefore the required growth is above the industry's own highest projection.

Solar PV

Similarly, for PV the required growth rate is 1,200 Ktoe/yr from 2014 to 2030, reaching 31,500 Ktoe. This is higher than the growth rate between 2004 and 2014 (800 Ktoe/yr), whereby the recent growth rate (2011 to 2014) exceeds this figure (1,450 Ktoe/yr).

The industry itself projects a range of between 10% and 15% of electricity generation by 2030, implying between 30,000 and 45,000 Ktoe.

Biomass

The required annual growth for biomass is 1,600 ktoe/yr from 2014 to 2030, rising from 62,000 to 88,000 ktoe (about a 40% increase). For reference, the growth rate from 2004-2018, according to industry figures[22] (excluding biofuels) is projected to be 2,300 ktoe.

The Commission's modelling (Bioenergy Impact Assessment page 34) also projects an increase in total biomass consumption (between 2015 and 2030), but the increase appears to be only around 30%. All the growth in biomass consumption is projected to occur between 2015 and 2025.

A potential confounding factor is the provision in the legislative proposal to apply sustainability criteria and greenhouse gas emissions savings to biomass fuels for energy generation as from 2021. This may limit the permitted feedstocks and therefore the growth potential of this renewable energy type.

[21] "Wind Energy Scenarios for 2030", WindEurope, August 2015

[22] "Key Figures 2016", AEBIOM, September 2016

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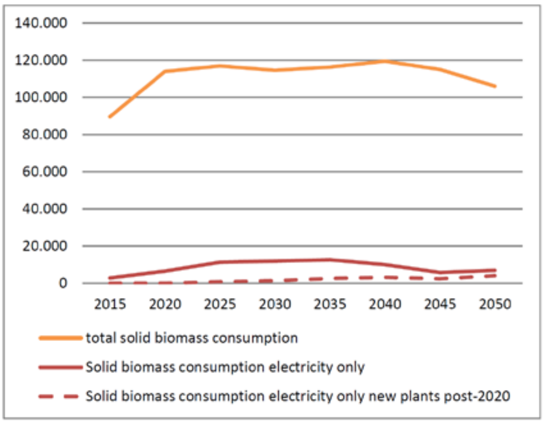

Figure 6: Solid biomass consumption in ktoe (total and electricity only) — Source: Bioenergy Impact Assessment

The industry's projections indicate the potential for increased farming of forest wood out to 2030 in order to meet this additional demand.

The introduction of sustainability criteria and greenhouse gas emissions savings thresholds for biomass may however reduce the potential growth in this sector by excluding certain feedstocks from 2021.

In addition, a notable observation in the Bioenergy Impact Assessment is that the growth in solid biomass in electricity comes mostly from the UK. This will of course have implications for post-2020 EU policy assuming the UK leaves the EU in 2019 as intended.

Other renewable energy types

Other renewables sources include electricity generation from gaseous and liquid biofuels, renewable municipal waste, geothermal, and tide, wave & ocean. An extrapolation of the historical growth (recent or 10 year) would increase the contribution from about 15,000 ktoe in 2014 to about 30,000 ktoe in 2030. Figures from Commission modelling for "geothermal and other renewables" in electricity generation project a 40% increase in this time, which would result in a figure of 21,000 ktoe. Whether a breakthrough in any of these technologies may occur to spur faster growth is uncertain. As a potential baseline that reflects historical growth, the doubling in this category may be considered an informative baseline.

Transport

The total growth in renewable energy for transport required to meet the 2030 scenario is 10,000 Ktoe, to 25,000 Ktoe. The viability of meeting this target depends on the parameters of the limits applied, in particular those considered on "food-based" biofuels.

If a cap on food-based biofuels is applied at 3.8% of transport energy, as in the legislative proposal (Article 7), growth of renewable energy in transport would have to come mainly from advanced biofuels. This is addressed in Article 25, in which a minimum contribution from advanced biofuels is mandated, reaching at least 3.6% (excluding waste fats) in 2030.

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The potential for advanced biofuels is briefly addressed in the Impact Assessment section 2.2.4), comprising a description of the state of play of the main potential fuel types. There is no explicit analysis of the potential for production of advanced biofuels in the volumes that are necessary and the evidence presented is therefore only anecdotal. Evidence has therefore not been presented to demonstrate the potential to meet the 3.6% objective.

The cap on conventional biofuels and the uncertainty in the potential for growth of advanced biofuels and electricity for on-road transport put into question the potential for growth of renewable energy in the transport sector towards the 2030 scenario.

Summary assessment

High and low overall scenarios according to the above figures can be considered:

The figures are presented in tabular form, showing the necessary and historical growth rates of each renewable energy source:

ktoe	Absolute figures		Growth rates	
	Target figure in 2030 CRA/EUCO27	Industry/other projections (range)	Required annual growth Ktoe CRA/EUCO27 (27% EE)	Historic annual growth (10 year / recent)
Hydro	40,000	40,000	0	0
Wind	93,000	67 – 85,000	3,900	2,400/3,100
Solar	31,500	30 – 45,000	1,200	1,200/2,050
Biomass	88,000	80 - 88,000	1,600	2,300/700
Other	30,000	21 - 30,000	1,000	1,000/1,000
Transport	25,000	see text	600	1,100*/700*

Source: EUROSTAT SHARES dataset 2015 for each renewable sector
*Renewable energy in road, rail and other modes plus compliant biofuels

Table 3: Required growth rates of renewable energy types to meet 2030 target for 27% and 30% energy efficiency.

The above figures give rise to high and low scenarios. The chart below shows graphically the two scenarios compared to the target.

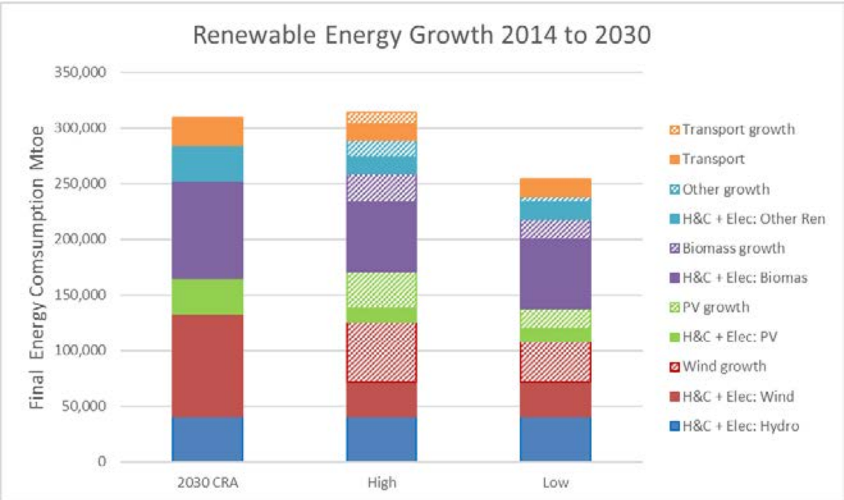

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Figure 7: Renewable energy growth 2014 to 2030 – high and low scenario performance

The chart demonstrates that the 2030 target can be reached (under the 27% energy efficiency scenario) by the optimistic projections for each renewable energy source, but not by the least optimistic projections. In the optimistic scenario, if the growth in wind and solar energy is achieved, reaching the target is dependent also on projected growth in biomass for heating and cooling and in growth in renewable energy in transport.

Other effects

The elimination of priority dispatch for renewable energy sources, as proposed in the European Commission proposal on a regulation on the internal market for electricity[23], is, by its nature, likely to reduce the amount of renewable energy used to generate electricity. Even if sufficient capacity is established at a rate equalling or exceeding the rate of recent years, the absence of priority dispatch for generating installations greater than 500kW reduces the potential for the renewable energy to reach the consumer and therefore to contribute towards the 27% target.

3.1.1 Influence of Energy Efficiency and EU Emissions Trading System

Energy Efficiency

Since the gross final energy consumption differs significantly between scenarios, and this figure is used in the denominator of the calculation of the renewable energy share. It is therefore necessary to take the projected energy savings of each scenario into account.

Gross final energy consumption 2016 Reference Scenario:	1,133,091 Ktoe
Gross final energy consumption CRA scenario 2030 (=EUCO27):	1,086,000 Ktoe
Gross final energy consumption EUCO30 scenario 2030:	1,041,000 Ktoe

In the Reference Scenario, the projected share of renewable energy in 2030 is 24.3%. Adjusting the denominator to reflect the above figures results in the following shares for energy savings of 27% and 30% are calculated:

27% energy savings:	24.3%
30% energy savings:	26.4%

As the European Commission legislative proposal on energy efficiency includes the 30% energy savings target for 2030, it is appropriate to use this figure in calculations. The above figure demonstrates that, in the absence of any confounding effects, 30% energy savings

[23] "Proposal for a Directive on the internal market for electricity (recast) - COM(2016)861", European Commission, 30th November 2016

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would enable the 2030 renewable energy target almost to be reached, with no other measures additional to those in the Reference Scenario.

The extent to which increased energy efficiency would affect (and potentially reduce) the application of renewable energy would require further modelling, so it cannot therefore be assumed that the 30% energy efficiency would automatically increase the share to the 26.4% level. It is however reasonable to conclude that it would make a substantial contribution (see also next section).

The chart is therefore amended to take into account the altered energy efficiency assumption:

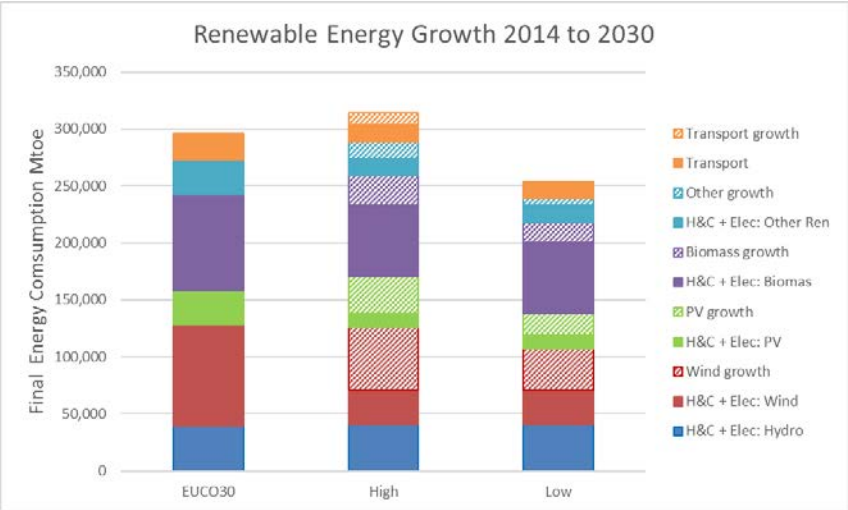

Figure 8: Renewable energy growth 2014 to 2030 – high and low scenario performance with EUCO30 scenario

In this case, the high projections more comfortably exceed the target, with sufficient buffer to allow for growth lower than projected. The low projection is still insufficient to meet the target.

<u>Emissions Trading System</u>

The Emissions Trading System (ETS) was established in order to incentivise the introduction of low-carbon energy sources, including renewable energy. ETS allowances are not required to cover energy produced from renewable sources. Therefore the continuous linear reduction in the cap of allowances can be expected to provide an incentive for renewable energy in these sectors., which are part of both electricity (power sector) and heating & cooling (power and industrial sectors).

The Reference scenario 2016 assumes a linear reduction factor in the cap of allowances of 1.74% between 2021 and 2030. This is an understandable assumption, since it represents the status of the in-force legislation at the time of the publication of the Impact Assessment.

However, it would have been appropriate to create an additional reference scenario using the 2.2% linear reduction factor, which was proposed in the ETS legislative proposal in July

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2015 and already signalled in the Commission's Climate & Energy Communication in January 2014. This would have generated a valuable indicator from the modelling results, by isolating the effect of the change in the cap from 1.74% to 2.2%, since this is the only concrete projected policy action for the timeframe in question.

This detail is not provided in the published results of the model but would have demonstrated the extent to which the ETS itself could have incentivised closing the gap from the 24.3% renewable share projected by the reference scenario and the 27% target. The boundary conditions of this change can be reviewed:

2020 cap of ETS allowances	1,816,452,134
Annual reduction @ 1.74%	38,264,246
Annual reduction @ 2.2%	48,380,081
2030 cap with 1.74% reduction factor	1,433,809,674
2030 cap with 2.2% reduction factor	1,332,651,322

Change in cap due to faster reduction factor = 7.1% lower

In 2030, the Reference scenario projects ETS sectors will generate about 42% of the total GHG emissions. The allowance price is projected to reach €38-42/t for the CRA and EUCO27 scenarios, and €27/t for EUCO30. Some studies have estimated the ETS price necessary to incentivise a switch to renewable energy. For example, CEPS[24] stated:

> *"It is estimated that under current circumstances [2016] … the carbon prices required for the deployment of some types of RE should be in the order of 30€ (before accounting for the additional investments to cope with the intermittency of RE)."*

The €30/t is a little higher than the €27 projected for the EUCO30 scenario in 2030. This level would therefore not be expected to provide a clear price signal across the board for renewable energy under current circumstances, but by 2030 it could potentially incentivise deployment at least for the lowest cost suppliers, in particular in cases where new capacity is needed and is therefore competing against non-renewables.

Further, the CEPS study also refers to energy (intensive) companies using internal shadow prices for carbon, which are significantly higher than the current market price (examples between $30 and $64.5). If the lower ETS cap has the effect of driving such shadow prices higher, the incentive for investment in renewable energy could be expected to increase.

Starting from the Reference Scenario and applying the 30% energy savings figure to the denominator (as discussed above) achieves a 26.4% renewable share in 2030. Even taking into account any secondary effects by which reduced energy demand reduces the deployment of renewable energy, the additional marginal effect of the ETS due to the lower

[24] "2016 State of the EU ETS Report", Centre for European Policy Studies, February 2016 http://www.ceps-ech.eu/sites/default/files/State%20of%20EU%20ETS%20v16_0.pdf

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cap, as discussed above, could potentially drive achievement of the 27% renewable energy share in 2030 with no further measures. Taking into account the potential lower cost indicated by the recent auction prices for wind energy (Section 2.1.2 above) would add to the probability of exceeding the 27% target.

This calls into question the added value of the provisions of the Renewable Energy Directive in meeting the 27% target, when the Reference Scenario is assumed as the baseline.

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4. Conclusions for policy derived from the review of the evidence

The above analysis has demonstrated a number of inconsistencies in EU policy on renewable energy. In particular, these include the conflict between the binding nature of the EU target and the lack of enforceable national targets, the different treatment of biomass for power and biofuels and the insufficient consideration of the existing mechanisms for increased renewables use.

The review of the evidence leads to a number of conclusions that can be useful pointers in designing more effective policy ideas for renewable energy.

4.1 Implications for EU energy and climate data

Renewable energy is counted as emitting zero greenhouse emissions in EU statistical data on energy and climate. Much of the analysis above indicates the complexity of generating accurate greenhouse gas data, in particular related to bioenergy for solid and liquid fuels. As indicated in the section on the Bioenergy Impact Assessment above, actual emissions from combustion of certain types of biomass can be higher than those of fossil fuels in the medium term, with net emissions being very low in the long term as the carbon stock is replenished.

There is therefore a disconnect between the greenhouse gas emission figures and the actual emissions, in terms of the timing of those emissions. Especially in the short term, depending the on the feedstocks used, actual emissions may be materially higher than those reported with the zero emission assumption for renewable energy. A method in the data and modelling to take account of this phenomenon would be beneficial in order to provide a more accurate record.

4.2 Consideration of renewable portion of energy source

Currently each unit of renewable energy consumed is 100% counted towards fulfilment of the renewable energy targets. However, different renewable energy sources exhibit different greenhouse gas emissions performance. For example, biofuels and biomass are explicitly acknowledged to have a greenhouse gas saving of less than 100%. Therefore the strictly renewable portion of these energy sources is the greenhouse gas savings percentage applied. An accurate accounting for renewable energy would therefore use only the proportion represented by the greenhouse gas savings percentage in contributing to the renewable energy share. If so applied, it would preclude the need for a greenhouse gas savings threshold, since even a biofuel with for example, a 20% greenhouse gas saving could make a valid contribution, if economically viable.

Fully consistent treatment would account for all robustly-evidenced sources of greenhouse gas emissions of renewable energies, including indirect land-use change, biogenic emissions, transport, manufacture, maintenance etc., for all renewable energy types and for each individual source.

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Such proportional accounting would introduce a significant additional administrative burden for both governments and the renewable energy industry. Nevertheless, a fully consistent accounting for renewable energy would consider all sources of greenhouse gas emissions and be fully coherent with the evidence.

The consequence of proportional renewable accounting would also likely be the failure to meet the 27% renewable energy target in 2030, since each unit of energy would count according to its greenhouse gas savings performance, i.e. less than 100%. This would either require a lower target to remain feasible, or could, as discussed below, be dealt with by changing the target parameters.

4.3 Coherent alternative indicators for EU climate & energy policy

An underlying theme in these inconsistencies is the lack of full alignment of the objective of this legislation (renewable energy) with the objectives of climate and energy policy. The main underlying objectives of renewable energy use are as follows:

1. Reduction in greenhouse gas emissions
2. Increase in energy security (including import dependency)
3. Long-term availability of energy resources

The use of renewable energy can contribute to each of these objectives, but the relationship is different in each case and also differs between renewable energy types.

Therefore a target for renewable energy is suboptimal in meeting the underlying objectives of climate & energy policy. Indicators and targets, which are directly related to the above objectives, would be more likely to provide a proportional incentive. In this context, the following discussion addresses each objective in turn, considering how more relevant policy indicators can be generated.

4.3.1 Reduction in Greenhouse Gas Emissions

100% of EU GHG emissions are accounted for in two pieces of legislation adopted to regulate them:

Emissions Trading System (ETS): 45% (power & industry sectors)

Effort Sharing Decision (ESD): 55% (residential, transport, small power & industry)

The ETS directly caps the level of emissions in the EU as a whole, thereby providing the indicator and the enforcement mechanism for achieving the GHG reduction objective for that proportion of the emissions (notwithstanding any potential carbon leakage). Compliance measures such as increased use of renewable energy are therefore incentivised through the continuing reduction in the cap of allowances.

The ESD requires Member States to reduce emissions in the relevant sectors to meet their own target. Again, this requires compliance measures to be put in place, which may include the use of renewable energy. Without a hard cap on emissions, the outcome has a lower level of assurance compared to the ETS.

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With these two policies in place, the incentive and mechanism already exists to meet the main policy objective, and renewable energy can be used to achieve it, if it is economically viable compared to other options (such as fuel switching or reduction in energy consumption).

4.3.2 Energy Security

Renewable energy may increase energy security by reducing the need to import energy from potentially unstable countries or regions. In particular this applies to oil and gas. Many (not all) renewable energies (wind, solar, geothermal, ocean, hydro) are by definition local and therefore mostly secure from political instability.

It would therefore be expedient to consider an indicator for geopolitical security of energy and setting policy to enhance that indicator. For example, a parameter that captures the potential for a source of energy to be subject to interruption due to political actions (in the source country or a transit one) could be generated. This parameter would be applied to generate an indicator that represents the security of supply.

A simplified example is the following:

A Member State sources 40% of its energy from the EU (1.0 security factor), 40% from a semi-democratic country (0.75 security factor) and 20% from a country with a high risk of political unrest (0.25 security factor). Its security indicator would therefore be:

$$40\%\times1.0 + 40\%\times0.75 + 20\%\times0.25 = 75\%$$

This indicator therefore provides a guide on the security of a Member State's energy sources, to inform national and EU policy. The indicator could be further developed into a target.

4.3.3 Long-term availability of energy resources

Similar to the above, an indicator can be applied that captures the potential for each source of the EU's energy to be exhausted in the long term. This indicator would apply to all fuels, but would be particularly relevant to fossil fuels due to their exhaustible nature. It could be calculated at EU level according to the annual consumption compared to proven reserves. For example, an exhaustible source whose reserves are 50 times annual consumption would receive a value of 2%. Renewables, whose reserves are theoretically inexhaustible, therefore receive a value of 0. An average can be generated for the EU and individual Member States. Again an overall target could be set in order to incentivise progress.

4.4 Assessment & Conclusion

More analysis would be necessary in order to transform the above indicators into workable parameters. A trading mechanism could be developed (e.g. statistical transfers, tradable certificates). Alternatively, analysis could be performed to apply these parameters within the framework of the existing proposal for renewable energy.

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Using such indicators as parameters would more directly target the policy objectives. The use of renewable energy would be incentivised, where it is the most economically viable of all options for meeting the main policy goals. The goal of renewable energy policy would thereby be focused on ensuring that barrier to deployment of renewables are removed, such that they are enabled when they represent the most cost effective method for reaching the priority policy objectives. This is indeed the objective of many of the policy options assessed for electricity, heating & cooling and transport, but their assessment has been distorted by the need to focus on the target for renewable energy instead of the main priorities of GHG reduction and energy security.

Annex 1: Accompanying statement

This report has been written according to the guiding principles of the Impact Assessment Institute: transparency, objectivity, legitimacy and credibility. It analyses the subject matter from a factual and scientific point of view, without any policy orientation. In respecting these principles it has been compiled following its written Study Procedures [25].

The analysis is open to review and criticism from all parties, including those whose work is scrutinised. Contacts with all relevant parties are recorded to ensure transparency and to guard against "lobbying" of the results.

By its nature the report has a critical characteristic, since it scrutinises the subject document with its main findings entailing the identification of errors, discrepancies and inconsistencies. In performing this work, the intention of the report is to be constructive in assisting with improving Better Regulation practices in the European Union. It should therefore be seen as a cooperative contribution to Europe's policy making process.

This report is also to be considered as a call for additional data. Peer review is an essential step laid down in the procedures of the Impact Assessment Institute and this is manifested in the openness to further review and to identify new data. Even at publication of the final version, the report remains open to newly arising data, information and analysis, which could be taken into account in a future revised version.

The Impact Assessment Institute is a private foundation incorporated in March 2016 under Belgian law, number 0650.623.342. The Institute is inscribed in the EU Transparency Register, number 993290221302-35.

[25] "Procedures for Conduct of Studies", Impact Assessment Institute, December 2015 (http://www.impactassessmentinstitute.org/#!procedures/c1q8c)

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Annex 2: Input from stakeholders

Input contributing to the content of this study was received by direct exchanges with the following organisations:

- European Commission
- Trade associations representing the majority of renewable energy sectors
- A non-governmental organisation
- An EU policy think tank

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Annex 3: Numerical data for renewable energy

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Elec - Hydro	2.4%	2.4%	2.5%	2.4%	2.6%	2.5%	2.6%	2.6%	2.6%	2.7%
Elec - Wind	0.5%	0.6%	0.7%	0.8%	1.0%	1.1%	1.3%	1.5%	1.7%	2.0%
Elec - Solar	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.4%	0.5%	0.6%	0.8%
Elec - Solid Biofuels	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.6%	0.7%
Transport - elec	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Transport - biofuels	0.3%	0.4%	0.7%	0.8%	1.0%	1.1%	0.7%	1.0%	1.0%	1.2%
All other renewables	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%	0.5%	0.6%	0.6%	0.7%
Heating & Cooling	5.3%	5.4%	5.9%	6.2%	6.8%	7.0%	7.0%			
H&C - biomass								4.7%	4.9%	5.0%
H&C - Wind PV Hydro								2.1%	2.2%	2.3%
H&C - other ren								0.6%	0.7%	0.7%
	9.1%	9.6%	10.5%	11.1%	12.5%	12.9%	13.2%	14.4%	15.2%	16.1%

Table 4: Breakdown of renewable energy share 2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Elec - Hydro	29,682	29,552	29,628	29,644	29,743	30,068	30,012	29,879	30,040	29,966
Elec - Wind	5,943	7,082	8,564	10,147	11,725	13,313	15,095	17,089	19,449	21,639
Elec - Solar	126	214	325	641	1,214	2,000	4,065	6,118	7,366	8,410
Elec - Solid Biofuels	3,749	4,147	4,331	4,818	5,222	6,006	6,289	6,833	6,939	7,297
Transport - elec	1,081	1,055	1,072	1,076	1,105	1,175	1,323	1,341	1,485	1,549
Transport - biofuels	3,256	5,497	7,859	10,030	11,796	13,198	8,529	11,603	11,973	13,120
All other renewables	2,767	3,176	3,741	4,104	4,549	5,157	5,663	6,421	6,966	7,403
Heating & Cooling	64,485	66,844	71,378	74,863	77,871	84,360	80,192			
H&C - biomass								54,087	56,099	54,990
H&C - Wind PV Hydro								24,585	25,500	24,995
H&C - other ren								7,375	7,650	7,499
	111,089	117,567	126,899	135,322	143,224	155,279	151,168	165,332	173,468	176,869

Table 5: Absolute renewable energy contributions 2005-2014

Annex 4: Background information on food-based biofuels

The GLOBIOM and other reports present detailed data on the direct and indirect land use change emissions of biofuels. The following table from the Impact Assessment demonstrates significantly different results for different biofuels, indicating that a differentiated approach according to relative GHG performance would be appropriate.

The following table

Table 2: ILUC emissions from GTAP[131], MIRAGE[132], GLOBIOM[133]

	GTAP 2014[1]	MIRAGE 2011[2]	MIRAGE 2013[3]	GLOBIOM 2015[4]
Biofuel	iLUC emissions(gCO2/MJ)			
Corn Ethanol	20	10	12	14
Sugarcane Ethanol	12	13	14	17
Soy Biodiesel	29	56	56	150
Canola=Rapeseed Bi	15	54	55	65
Palm Biodiesel	71	54	55	231

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Annex 5: Overview of feedback received from stakeholder organisations during review of draft study

Organisation	**Nature of feedback**	**IAI response**
An environmental NGO	Recommendations to consider the effects of the UK leaving the EU, reducing costs of solar and wind power and the most recent reports of the European Parliament	Text has been updated to indicate the possible effect of the UK leaving the EU and clarification of the text comparing solar and wind auction prices to the modelling assumptions
An environmental NGO	Recommendation to emphasise the Impact Assessment's analysis of the "unconstrained" and "imported wood" scenarios for bioenergy and to highlight where the legislative proposal is inconsistent with this evidence	Clarifying language added to the relevant section
An association representing a renewable energy sector	A number of detailed arguments and recommendations related to indirect land use change and some recommendations for specific changes	Some additional points and clarifying language added to the relevant sections reflecting available evidence

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