Biofuels and RED II: At What Cost?

Context

Key European Commission documents refer to substantial cost savings when transitioning from conventional to advanced biofuels. This cost saving claim is actively implied but never explained, nor are solid references provided. It is just presented as a fact in important decision-supporting documents such as the impact assessment behind the RED II. Astoundingly, this suggestion of cost savings has been uncritically accepted by most policymakers, so much so that not one of the political groupings in Parliament has included this as an issue in their extensive complaints about the Commission's RED II proposal.

No one in the Commission or the Parliament seems to care whether the goals of RED II could be achieved more cost-effectively than the proposal set out by the Commission. This lack of concern for taxpayers and consumers is striking—and at least for the political groupings who have a measure of accountability to voters, is playing with fire.

Tracing the origin of the Commission's cost saving claim to its source raises lots of red flags. Price projections for advanced biofuels appear to derive from a single report that is not peer-reviewed and is by researchers who are commercially conflicted. Indeed, the data behind this report was obsolete even when it was written, and every predictions has proven wrong.

Policy-making based on obscure references

RED II proposes an increasing role for advanced biofuels at the expense of conventional biofuels. The impact assessment behind RED II[1] proposing to transition from conventional biofuels to advanced biofuels opines that the transition will be inexpensive:

> *„one important element to be considered is the feasibility of converting a part of the current production capacity to produce advanced biofuels. Significant synergies for bioethanol sites exist through co-location of the new separate second generation plant adjacent to the first generation facility and through retrofitting by altering an existing first generation production line for producing advanced alongside conventional biofuels. In this way, existing jobs are preserved and new jobs are created while generating 40% CAPEX savings which represents roughly a 20% total cost reduction."*

No source is given for this claim in the RED II or its various background documents.

The impact assessment also argues that "*Major cost savings of advanced facilities compared to conventional facilities are related to lower fuel costs compared to conventional biofuels and to a credit for valuable co-products from advanced processes*".

The impact assessment pays little attention to the issue of total costs of advanced biofuels and fails to acknowledge the prevailing low price of conventional biofuels and conventional biofuel feedstocks, the prevailing high process costs for advanced biofuel feedstocks, the robust markets for (valuable) co-products of conventional biofuels, and the virtually non-existent markets for (not-so valuable) co-products of advanced biofuels.

[1] Impact Assessment of RED II (2016). http://eur-lex.europa.eu/resource.html?uri=cellar:1bdc63bd-b7e9-11e6-9e3c-01aa75ed71a1.0001.02/DOC_2&format=PDF

It does not provide a clear answer on how much the projected advanced biofuels production capacity investments will cost, or the production costs of such new investments. Remarkably, there is no meaningful discussion about how much more advanced biofuels will cost than conventional ones, but rather just an unsupportable conclusion that they will actually cost less.

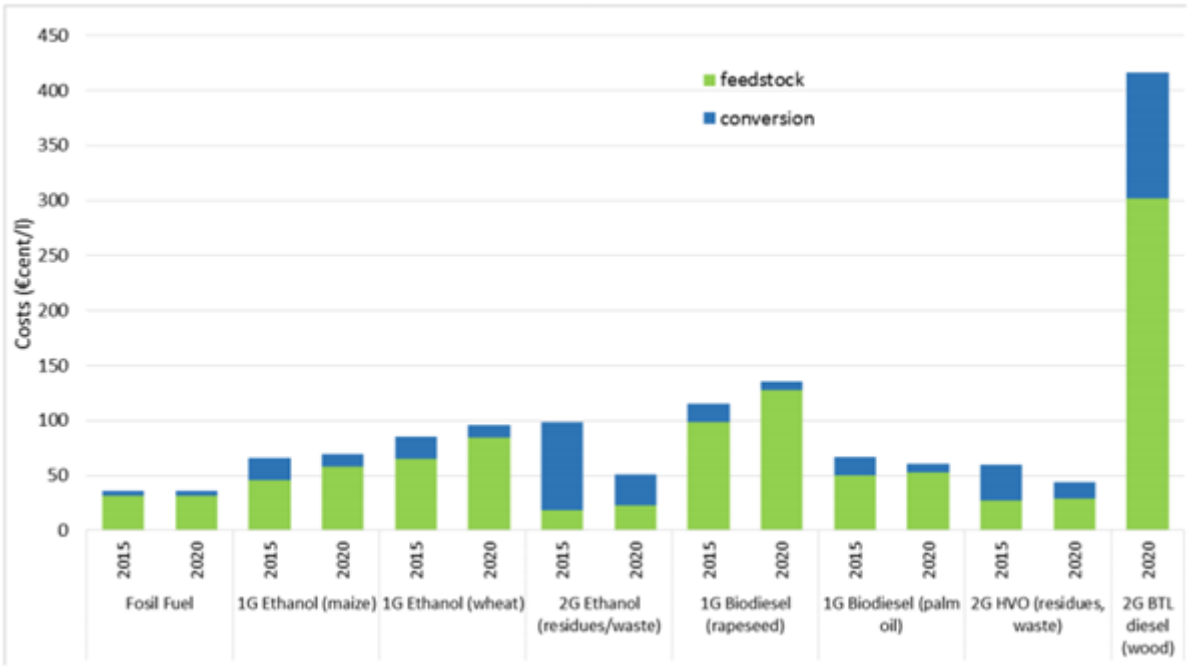
Origin of data and assumptions

In the absence of specific references in RED II documents to cost assumptions, it is important to uncover what has informed the cost thinking behind these documents. It takes a bit of research to identify possible sources.

The *40% CAPEX saving* when co-locating advanced biofuel plants seems to come from IEA-RETD (2015)[2]. We cannot find any other reference for the specific figure of 40% cost saving. IEA-RETD (2015), co-authored by Uwe Fritsche, reports on their survey's finding "that retrofitting and colocation could generate savings of 40% CAPEX, which represents roughly a 20% total cost reduction".

Examining the robustness of the paper, it presents a chart (below) showing advanced biofuels to be substantially cheaper than conventional biofuels not just by 2030, but already by 2020. Production costs of cellulosic ethanol in 2020 are projected to be 25% less than corn ethanol and half the price of conventional wheat ethanol. That is an astonishing projection both from a technical standpoint and from a policy standpoint.

Production costs for selected biofuel pathways as projected by background paper



Source: IEA-RETD (2015). Table adapted from Festel et al. (2014).

[2] IEA-RETD (2015), Towards advanced Biofuels - options for integrating conventional and advanced biofuel production sites http://iea-retd.org/wp-content/uploads/2016/08/20160202-IEA-RETD-RES-T-BIOPLANT-1.pdf.

From a technical standpoint, the wave of cellulosic ethanol plant closures in the past two years in Europe and the Americas *despite a large price premium in every market for cellulosic ethanol*, is remarkably at odds with this research finding. Indeed the chart above suggests that wheat and corn ethanol plants would be closing now for price reasons but not cellulosic plants. Yet, there are more wheat and corn ethanol plants in Europe and the Americas today than in 2015, while more than half of all cellulosic plants are now closed.

To delve down a little deeper, the actual sale prices of wheat and corn ethanol in the Americas and Brazil since 2015 have never been as high as the production costs listed in this chart above. Conventional ethanol plants have not, as suggested, operated at tremendous losses for three years running but are profitable. Cellulosic ethanol plants, on the other hand, backed by some of the world's largest chemical companies (such as Beta Renewables and DuPont among others) would not be closing if their total cost of production was *half* the sales revenue for their product.

If the defining difference, as the chart above argues, between conventional biofuels and advanced biofuels is that advanced biofuels are cheap to produce (albeit not as cheap as oil), then from a policy perspective there would be no need for a separate mandate for advanced biofuels.

The source of data in IEA-RETD (2015) for this upside down view of biofuels is Festel et al. (2014)[3], which projects biofuel production costs in scenarios broken down by the price of oil. Production costs is defined in this work as the sum of raw material prices and conversion costs, and crude oil prices of €50, €100, €150 and €200 per barrel were applied in the scenarios.

As already described above, the overall projections of Festel et al. have turned out to be wide of the mark. These overall projections are in turn based on ill-conceived thinking on basically every element making up these projections:

- Conversion costs for lignocellulosic materials were projected to drop from 805 €/m3 in 2015 to 280 €/m3 in 2020. It is clear now that costs have not decreased much and that this is the reason for plant closings. Accordingly, total costs of lignocellulosic ethanol will not drop to the projected 512 €/m3 by 2020 from 988 €/m3 in 2015. A drop of this much is just remarkable. Festel provides no explanation for how a price drop of this magnitude could happen in just a few years.
- The prices of raw materials in the projection also contradict reality. Raw material prices in 2015 were far lower than what the authors projected. For instance corn lingers below 130 €/t at the turn of 2018, while it was predicted to be in the range of 184-271 €/t in 2015, and 232-319 €/t in 2020. Corn prices in the past five years never reached even the lower boundary of the projection for 2015-2020.
- The market price of conventional ethanol (that is the feedstock cost and the conversion cost set out in the chart above *plus* profit) averaged 550 €/m3 in 2015 in Europe. In contrast, Festel claims that the production cost alone is between 663 and 881 €/m3 for corn ethanol, and 856 and 1169 €/m3 for wheat ethanol in 2015. The real price of ethanol in 2017 averaged 547 €/m3 in Europe. The costs in 2020

[3] Festel et al., 2014: Modelling production cost scenarios for biofuels and fossil fuels in Europe. Journal of Cleaner Production 66:242–253

for corn ethanol are projected by Festel to be between 695 and 913 €/m3, while for wheat ethanol between 961 and 1273 €/m3. The futures in Europe for ethanol in 2020 are around 470 €/m3 today.

Some academics are out of touch; Festel's paper is out of this world. Yet, he seems to be the Commission's favoured source of information about biofuel prices. This is especially remarkable given that another part of the Commission, DG Agri, includes annual, respected and far more accurate price indications for biofuels, which are discussed in the next section. These DG Agri estimates were ignored (or dismissed) by the Commission's RED II architects from DG Energy.

Price projections in European Commission proposal

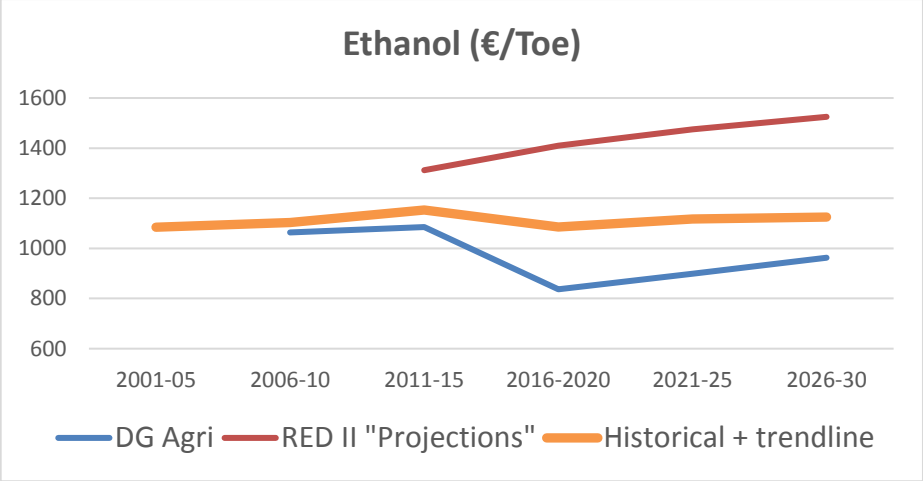
How far these price follies extend into the Commission decision making process is unclear. It does not actually appear that Festel is the only relevant data point. That would be good news if the second source was more reliable. It is not.

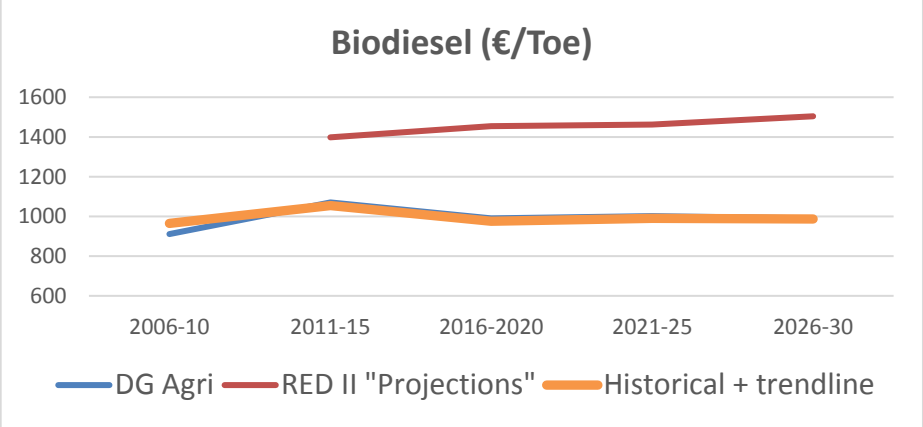
The impact assessment behind RED II is explicitly stated to be based in Primes modelling. "*PRIMES is an energy model used for modelling all policy elements of the RES Directive included in this Impact Assessment*"[4]. The PRIMES biomass supply model is private and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens. Since the Primes model is commissioned by DG Energy and used for grounding RED II, its validity is of key importance. Note that it does not differentiate between advanced and conventional biofuels. It does, however, differentiate between ethanol and biodiesel.

DG Agri in its annual Medium Term Outlook presents forecasts for a range of commodities that closely match historic figures and trends derived as linear regression from historic data. Here, it should be noted that, while the Commission does get data wrong, this Medium Term Outlook is not only respected, but it is globally respected and has an established track record both of accuracy and transparent explanation. It cannot be overstated the degree to which the Medium Term Outlook embodies excellence in modelling and reverence for accurate data. In this respect, the fact that the Medium Term Outlook tracks and models ethanol and biodiesel prices is quite salient.

There is a large discrepancy between values of the Primes model, on the one hand, and either historic prices (and their derived trends) or the Medium Term Outlook. The charts below depict the divergence between figures applied by DG Energy for the preparation of RED II, historic data, and the Medium Term Outlook. The conclusion is unavoidable; the Primes model is also entirely wrong.

[4] http://eur-lex.europa.eu/resource.html?uri=cellar:1bdc63bd-b7e9-11e6-9e3c-01aa75ed71a1.0001.02/DOC_2&format=PDF





Conclusion

The European Commission's policymaking on biofuels is rooted in the premise that advanced biofuels will soon become (or already are) cheap and also that existing ethanol plants will simply convert into successful cellulosic ethanol plants. Reality is different. Advanced biofuels are not cheap, when they exist at all. Conventional biofuels are not expensive. Likewise, the idea that ethanol plants can or would convert to cellulosic plants is the mere pipe dream of an academic supported by the IEA and the Commission (instead of by the private sector) without any scientific grounding.

By Uwe Fritsche's logic, electric vehicles will in the future be provided not by Tesla, but by Lada and the existing fleet of Volkswagen diesels, because there would be huge capex savings in using the bodies of discarded old cars rather than starting from scratch. Every reason why that won't happen applies to why Dr. Fritsche is wrong about cellulosic ethanol conversions. Indeed, tellingly, Fritsche's only industrial sounding board in his study was Abengoa, which shortly after informing Dr. Fritsche's vision went bankrupt after spending nearly $1 billion on a failed cellulosic ethanol plant. Abengoa was Spain's largest ever bankruptcy, and a vocal proponent of Commission biofuel zaniness. The one thing that the Commission, Abengoa, Festel and Fritsche share is a supernatural ability to disregard reality.

It is clear that the RED II proposal, whereby conventional biofuels are to be replaced by cheap advanced biofuels between 2020 and 2030, is unhinged. The fact that the EC got it so wrong on advanced biofuel costs argues for the need to reassess, fundamentally, the policy proposals.

A revised RED II biofuel policy proposal will need to be based on the fact that advanced biofuels are not cheap, will not become so between 2020 and 2030, and their scale is limited over the next 10 years. Reliance on advanced biofuels to replace oil in meaningful quantities in the short term is unjustified. Policy proposals will need to reflect reality and therefore will need to scale down on the ambition for advanced biofuels, without scaling down on the ambition to provide a reason for these technologies to improve.

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