

Analysis Subcommittee Review of USDA/DOE “Foundational” Documents

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- Quality of Assumptions
- Quality of Data
- Appropriateness of Analysis Methods
- Are Conclusions Supported by the Analysis
- Quality of Peer Review



1. [ARS] Crop and soil productivity response to corn residue removal: A literature review, by *Wilhelm, et al.*

Reviewers: John Hickman (Lead); Eric Larson, Ed White

Summary: Very well done review. This article qualifies as a foundational document into providing important background information as to the maximum permissible corn stover removal rates that ensure sustained soil productivity.



2. [ARS] A matter of balance: Conservation and renewable energy, by *Johnson, et al.*

Reviewers: John Hickman (Lead); Charles Kinoshita

Summary: Overall, this article does not qualify as a foundational document or analysis. Rather it is more of an editorial, based on limited data, that we need to be more cautious in guidelines to remove crop residue until better data is available. The paper also proposes an alternative approach to determine crop residue removal guidelines. The concepts proposed by the authors deserve serious consideration and debate in developing residue removal guidelines, but must be supported by more science based research.

Recommendations, at a minimum, must recognize that crop residue conversion to biofuels provide tangible environmental benefits, albeit how to balance such benefits aside soil sustainability will be difficult.

3. [ARS] Enhanced Biotransformation of Furfural and Hydroxymethylfurfural by Newly Developed Ethanologenic Yeast Strains, by Liu *et al.*

Reviewers: Ralph Cavalieri (Lead); Ed White

Summary: Reports research dealing with development of strains of ethanol-producing yeasts that were more tolerant of inhibitory fermentation products, furfural and hydroxymethylfurfural (HMF). The adapted strains were able to convert 100% of HMF into FDM, a less inhibitory metabolite, while retaining ethanol productivity. The methods used are appropriate and the conclusions are supported by the data collected. The article is published in a blind peer-reviewed journal, so it meets the scientific standards of peer-reviewed scholarship.



4. [ARS] Bacteria engineered for fuel ethanol production: Current status, by Dien, *et al.*

Reviewers: Charles Kinoshita (Lead); Ed White

Summary: The document is a review paper, not an analysis, therefore there were no key assumptions or appropriate analysis methods used. The review paper is very thorough within its narrow focus area and the data quality is extensive. The conclusions are reported very succinctly. The publication presumably was peer reviewed by a confidential panel of experts.

5. [OCE] The 2001 net energy balance of corn ethanol, by Shapouri and McAloon

Reviewers: John Hickman (Lead); Eric Larson; Ed White

Summary: Key assumptions were appropriate. The authors should report more details as to the procedures to allocate energy to ethanol and co-products and compare their results to that utilized in other studies. Some of the data quality was poor. The authors also do very little to conclude that methodology to determine energy use and allocate total energy between ethanol and co-products is indeed an improvement over previous studies. This appears to be an internal document without peer review. The author's have other more detailed reports which would appear to be better classified as a "foundational" document as compared to this report.

Reviewers: Eric Larson (Lead), Ed White, Doug Hawkins

Summary: Assumptions behind the analysis are described clearly and, in most cases, they are well justified. The detailed methodology is well described conceptually. Two sensitivity studies were carried out, which provides helpful insights. However, it would have been appropriate to include at least one additional sensitivity study focusing on alternative methods for allocating by-product credits. Very detailed input data are provided. The conclusions are generally well-supported by the analysis. It is unclear what independent review was undertaken of this document.

7. [FS] Engineering yeasts for xylose metabolism, by Jeffries

Reviewers: Ralph Cavalieri (Lead), Ed White

Summary: This is a review article published in a peer-reviewed journal. As such it does not lend itself to our normal assessment. It is a relatively thorough review of the state of published knowledge as of the date of its writing, sometime in 2005. It is especially useful in its conclusion that careful adherence to anaerobic conditions during adaptive evolution of yeast strains is necessary for success and that *P. stipitis* along with new strains derived from nature are important areas of continuing research and development. While an important document, it is unclear why this is considered to be a “foundational document” to the USDA as it plans its biomass program.



8. [OBP] Bob Reynolds' Ethanol Infrastructure Report

Reviewers: Doug Hawkins (Lead), Ralph Cavalieri, John McKenna

Summary: Overall, the report provides one scenario for large scale ethanol production and does a very good job of analyzing the infrastructure that might be required to distribute and store this much fuel. There are aspects of the report which feel “incomplete” – such as the analysis of potential ethanol production from dedicated cellulosic energy crops. The assumptions that there will be demand for fuel ethanol in the years and at the levels of production contemplated in this study are reasonable assumptions to make. Although , they reference their own earlier work for some assumptions. It would be more appropriate to reference an independent prediction – say from DOE or DOT on this matter.

8. [OBP] Bob Reynolds' Ethanol Infrastructure Report (con't)

Summary (con't): One of the curious methods employed in this work is the estimation of costs required for ethanol infrastructure followed by the subtraction of costs that would have been required for gasoline infrastructure projects (based on increased gasoline demand). The approach can best be described as “how much ethanol can come from corn if nothing else matters” coupled with “if one produced 40 BGY of ethanol from corn, what would it cost to move, store, blend and distribute it”. One of the curious methods employed in this work is the estimation of costs required for ethanol infrastructure followed by the subtraction of costs that would have been required for gasoline infrastructure projects (based on increased gasoline demand). In the production area, the data quality is “OK”. Reasonable ethanol production values are used and referenced, potential increases in productivity are similar to those used in other reports. There are areas where data is lacking – cost to build a cellulosic ethanol plant, for example. There is also a need to have a better idea of where long-term steel prices will go – given the large impact of steel cost on the overall cost of plants and infrastructure.