# SSA 3

## Compare three ethanol mixtures

**Mats van der Heijden**

February 22, 2021

## Goal

- In the last meeting something was said about three different kinds of ethanol mixtures. The goal of this SSA is to figure out what the differences are and which ethanol the best choice is for our project.

## Conclusion

- The conclusion was quiet easily drawn. The small discussion about the different kinds of ethanol does have no impact on our project.
- Because this was not a very large SSA, I also wrote a piece for the report. The only thing that has still to be determined is whether the piece of text should be in the report. This can be a small discussion in the meeting.

## Problems

- I didn't encounter any problems

## Time Division

- 1 hour on investigation different kinds of ethanol
- 1 hour on helping Joey with his SSA
- 2 hours on report piece
- 1 hour on this file

Overleaf Link

# Start SSA

In the last meeting Joey mentioned a remark about the SSA from Alexandra. Her SSA was about the fuel mixture between gasoline and ethanol. However, in the project supporting lecture was an item about diverse types of ethanol. Due to this some extra investigation was needed and I was assigned to examine this aspect.
First things first, the slide Joey was talking about, was a diagram with information about the greenhouse effect reduction. On this chart were almost a dozen kinds of ethanol visible.
The options are:

- Wheat straw ethanol
- waste wood ethanol
- farmed wood ethanol
- sugar cane ethanol
- wheat ethanol (straw as process fuel in CHP plant)
- sugar beet ethanol
- corn ethanol, community produced
- wheat ethanol (natural gas as process fuel in CHP plant)
- wheat ethanol (natural gas as process fuel in conventional boiler
- Wheat ethanol (process fuel not specified)
- Wheat ethanol (lignite as process fuel in CHP plant)

These diverse sorts of ethanol, are all produced in a different way. However, these are all producing types that all give the same end result; ethanol. Therefore there are no differences in the diverse kinds of ethanol. This results into the fact that it doesn't matter how our fuel is made, because the ethanol values will be the same.

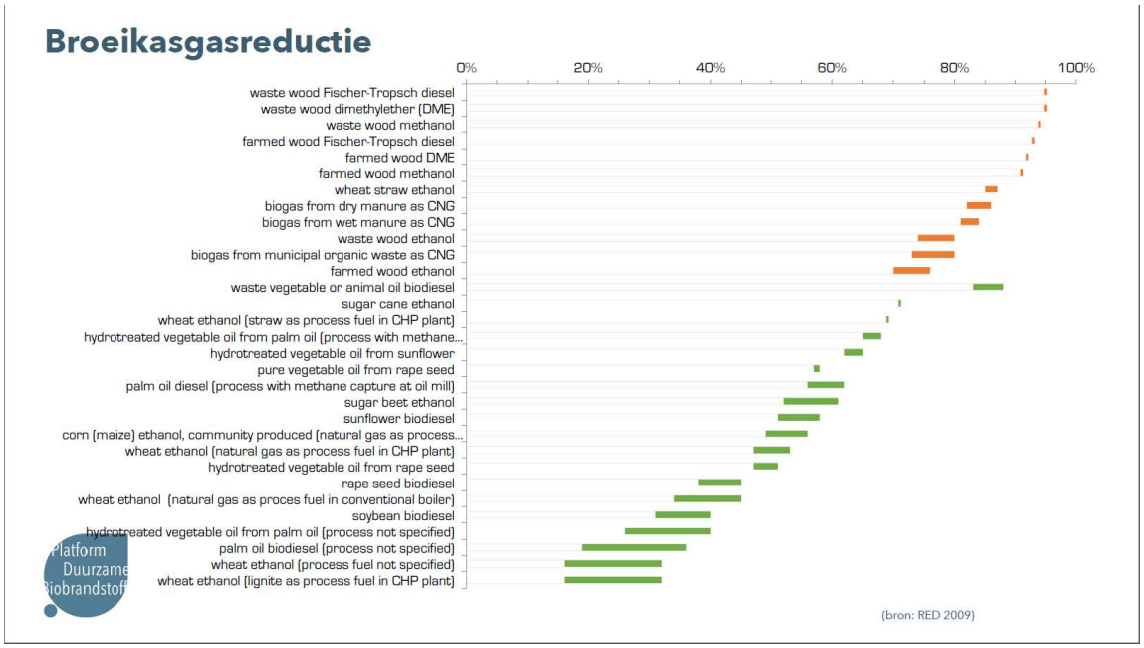


Figure 1: Chart of Greenhouse Effect Reduction

## Report work

The second part of my SSA was the part where I put the gathered information into the report. However it turns out afterwards that there is only 1 type of ethanol. This given feature gave me another brain wave to put that into the report.
The part I've written is about the makings of ethanol and the environmentally best way to do that.

## Ethanol

When making a fuel mixture out of gasoline and ethanol, the main concept is reducing the impact on the environment. To do this best, there should be some research done about the manufacturing of ethanol. It turns out to be possible on a lot of different ways. All these different ways also have another impact on the environment. Because the whole project is about influencing the environmentally damage, it should be of great importance to investigate the diverse ways too.

The main ingredient for ethanol is biomass[**?**]. Biomass can be all kinds of plants and trees. The main source nowadays is wood waste, but also plant waste can be used. In the last few the production of ethanol has become so large that farmers have been growing special crops with the purpose to make biomass.
It is a very long and difficult way to make ethanol out of biomass. In total there are six essential steps to make bio ethanol, these are the following[1]:

1. Milling, firstly the fundamental bio crop that has been chosen has to be milled. In this process the usable starch is separated from the other waste. It has to be taken into account that every crop needs another way of milling.
2. Liquefaction, water is added to the starch to make a soggy mixture. Afterwards it is heated to 100 degrees (boiling temperature) to break the starch into smaller pieces.
3. Saccharification, special types of enzymes are being added. This ensures the starch turns into usable glucose.
4. Fermentation, yeast is added to the glucose, a chemical reaction between the two gives ethanol as a result.
5. distillation, the resulting mush is still containing only 15% ethanol. Because ethanol has a relatively low boiling temperature of 78 degrees, it can be distilled so only the ethanol is left.
6. Denaturation, the last step is not necessary. This step takes care for the safety of the product. During this process another fluid is added to to the pure ethanol, so it becomes unusable for consumption. In this case not really relevant, because the added fluid is gasoline.

Because some of these steps take a lot of energy, such as the liquefaction, it is even more important to pick a right choice of making biomass in the first place. Therefor it is recommended to use fully bio waste. When already waste is used, the efficiency will go up immensely. This because there is no need of growing extra crops and use a lot of additional energy, just to make new fuel. When special crops need to be grown for ethanol, the best options are starch-rich crops such as corn or wheat.

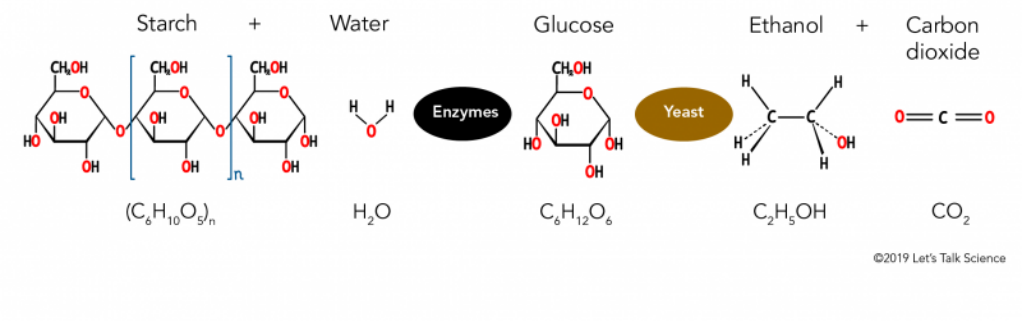


Figure 2:

# References

[1] https://letstalkscience.ca/educational-resources/backgrounders/how-ethanol-made

[2] https://www.eia.gov/energyexplained/biomass/