**Excerpt** *Version*

# Annex 9A

## Understanding the Basics and Supply Potential for Biofuels

September 2021

*Presented by*

SQUARECO

Based in Switzerland, Square Co publishes professional analyses designed to help players active on alternative fuels markets (biodiesel and advanced fuels) to gain a deeper understanding of regulatory frameworks, market trends and industry developments.

Square Co also publishes on a weekly basis a set of independent price assessments for each quality of biodiesel that are very well respected on the global market. As pure analysts we don't take any position on the markets, a specificity that allows us to enjoy a reputation of high reliability and full independence.

Square Co customers include oil companies, biofuel producers, trading companies and governmental bodies located all around the world.

# Conclusion

**Table 16**: Potential of solid feedstocks

| | EFB | Wheat Straw | Barley straw | Corn Stover | Bagasse |
|---|---|---|---|---|---|
| **Feasability** | Low | Medium | Medium | Medium | High |
| **Feedstock collection complexity** | Easy | Very complex | Very complex | Very complex | Easy |
| **Production** | No plant running as of today, neither project announced | Some projects under construction - engineer phase or running | Some projects under construction - engineer phase or running | Some projects under construction - engineer phase or running | Units already running in Brazil |
| **Capex Million EUR** | +/- 250 | +/-250 | +/-250 | +/-250 | +/-250 |
| **Biofuel technology installation** | yes | yes | yes | yes | yes |
| **Annual Capa. prod equivalent** | 50kt | 50kt | 50kt | 50kt | 60kt |
| **Comments** | High capex investment and vertically integrated projects | High capex investment and complexity for securing the feedstocks | High capex investment and complexity for securing the feedstocks | High capex investment and complexity for securing the feedstocks | High capex investment and vertically integrated projects |

**Table 17**: Potential of liquid feedstocks

| | CTO | Tall Oil Pitch | Brown Liquor | EFB Oil | POME Oil | SBE oil | Grape Marc | Wine Lees |
|---|---|---|---|---|---|---|---|---|
| **Feasability** | High | High | High | High | High | Medium | Medium | Medium |
| **Feedstock collection complexity** | Easy | Easy | Easy | Medium | Medium | Medium | Complex | Complex |
| **Production** | HVO plants running in Scandinavia is the proof the technology is working | The feedstock seems able to be processed into Biofuels | Different projects are running in Europe. The technology looks ready | No real investment need on Fame HVO side. Investment to be done on EFB recovery. | No real investment need on Biodiesel-HVO side. Refining or cleaning the product | Complexity for collecting the SBE oil and treated it as a "good enough" palm oil for biodiesel/HVO | Possible but complex. After distillation, another step to a rectification column is | Complex due to low volumes available |

**Table 18**: Summary of the potential supply for each feedstock and associated fuel (KT)

| | Feedstock | Supply (base 2020) | Indicative Biofuel Prod. Yield | Equivalent biofuel | Category of biofuel (most likely) |
|---|---|---|---|---|---|
| **LIQUID** | CTO | 1 901 | 80% | 1 521 | HVO |
| | Tall Oil Pitch | 475 | 80% | - | 0 if all CTO used directly |
| | Brown Liquor | 615 | 70% | 431 | Ethanol |
| | EFB oil | 700 | 95% | 665 | Fame |
| | POME oil | 1 558 | 85% | 1 324 | Fame |
| | SBE oil | 140 | 70% | 98 | Fame |
| | Grape Marc | 8 913 | 45% | 4 011 | Ethanol |
| | Wine lees | 987 | 12% | 118 | Ethanol |
| | **Total liquid** | **13 827** | | **8 049** | |
| **SOLID** | Wheat Straw | 350 343 | 14% | 49 048 | Ethanol |
| | Barley straw | 64 505 | 14% | 9 031 | Ethanol |
| | Corn Stover | 330 003 | 14% | 44 800 | Ethanol |
| | Bagasse | 304 739 | 13% | 58 092 | Ethanol |
| | EFB | 47 100 | 13% | 6 123 | Ethanol |
| | **Total solid** | **1 086 687** | | **147 094** | |

# Summary

# 1. Introduction

## 1.1 Context and objectives of the study

The list of eligible wastes to biofuels incentives at an EU level was first published in the Annex 9 of the ILUC Directive (1513/2015) in September 2015, before being re-printed without any change into the RED2 Directive (2001/2018) in December 2018.

Although the biofuel industry has been dealing with parts A and B of this list for the past six years, the real knowledge of many feedstocks remains limited, not to say missing.
If supply chains and economics of UCO and Tallow C1 are well understood by market players, the picture of most of the 9A feedstocks remains blur. Their classification as “advanced” feedstocks by itself suggests intricacy as only wastes/residues/by-products challenging to transform with existing technologies have been selected.

Square Co teamed up with outsourced experts to examine all the 9A feedstocks potentially suitable for biofuels production (excluding biogas) and determine their level of complexity, maturity and availability. Understanding how and by which industry these wastes were generated constituted the backbone of our work.

This study aims at proposing a clearer vision of the origin of the most promising 9A feedstocks, explaining their basics and estimating their potential supply in the coming decade.
The result of our preliminary work leaded to the selection of 13 feedstocks that hold a potential with technologies already mastered by biofuels companies. All the others are either too confidential, not mature enough or too complex to cover.

This extended research brings an insight into the most promising 9A feedstocks, with a clear explanation of the wastes/residues/by-products streams, challenges associated with their production and a transparent calculation of their potential supply.

Few weeks before the expected publication of an update of the Annex 9, we propose to all biofuel stakeholders to finally gain a clearer vision of the “old” list, with the perspective to serenely apprehend the real potential of each advanced pathway. From 2022, when advanced sub-targets will be enforced in most of the EU markets, navigating the complex business environment of biofuels won’t be achieved without a deeper knowledge of the 9A raw materials.

## 2.2 Classification of 9A feedstocks into 8 sub-categories

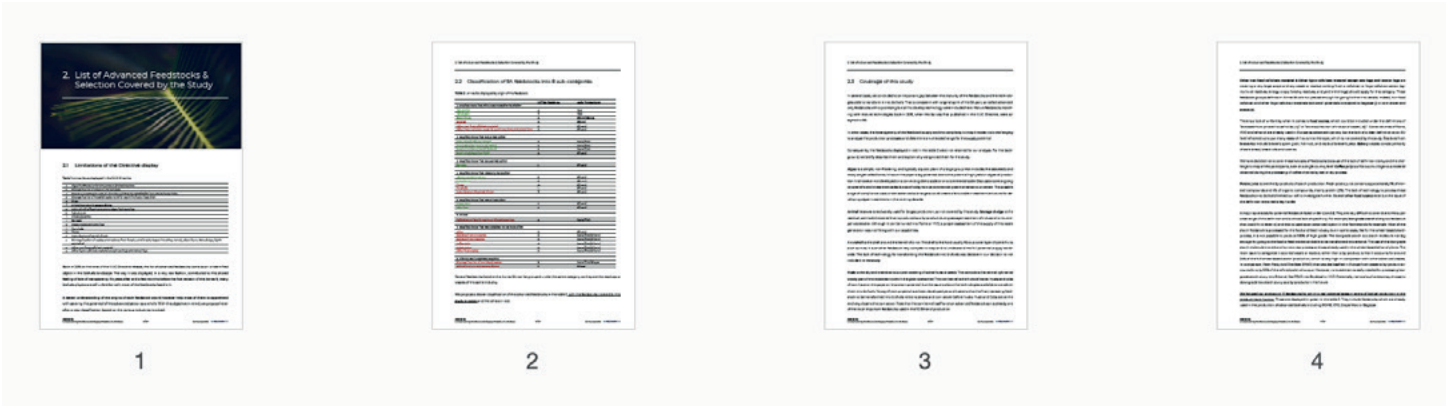
**Table 2**: Annex 9A displayed by origin of the feedstock

| | LETTER UNDER 9A | MAIN TECHNOLOGY |
|---|---|---|
| **1. WASTES FROM THE PULP AND FORESTRY INDUSTRY** | | |
| Tall oil (CTO) | O | HVO |
| Tall oil pitch | H | Fame/HVO |
| Brown liquor | O | Ethanol/Biogas |
| Sawdust | O | Ethanol |
| Other non-food cellulosic material | P | Ethanol |
| Other ligno-cellulosic material except saw logs and veneer logs | Q | Ethanol |
| **2. WASTES FROM THE PALM INDUSTRY** | | |
| Palm Oil Mill Effluent (POME) | G | Fame/HVO |
| Spent Bleaching Earth Oil (SBEO) | G | Fame/HVO |
| Empty Fruit Bunches Oil (EFB oil) | G | Fame/HVO |
| Empty Fruit Bunches (EFB) | G | Ethanol |
| **3. WASTES FROM THE SUGAR INDUSTRY** | | |
| Bagasse | J | Ethanol |
| **4. WASTES FROM THE CEREALS INDUSTRY** | | |
| Wheat and Barley Straw | E | Ethanol |
| Corn Stover | E | Ethanol |
| Husks | M | Ethanol |
| Nutshells | L | Ethanol |
| Cobs cleaned of kernels of corn | N | Ethanol |
| **5. WASTES FROM THE WINE INDUSTRY** | | |
| Grape Marc | K | Ethanol |
| Wine lees | K | Ethanol |
| **6. ALGAE** | | |
| Cultivated on land in ponds or photobioreactors | A | Fame/HVO |
| **7. WASTES FROM THE PROCESSING FOOD INDUSTRY** | | |
| Whey | D | Ethanol |
| Residues from breweries | D | Fame/HVO/Ethanol |
| Residues from bakeries | D | Fame/HVO/Ethanol |
| Coffee Pulp | D | Fame/HVO/Ethanol |
| Potato Juice | D | Fame/HVO/Ethanol |
| Other food wastes | D | Fame/HVO/Ethanol |
| **8. OTHER UNCLASSIFIED WASTES** | | |
| Biomass fraction of municipal wastes | B | Fame/HVO/Biogas |
| Animal manure and sewage sludge | F | Biogas |

Some companies process multiple feedstocks i.e. among those 1.200 ISCC feedstocks certifications, there is 1.014 unique certificates ID hold by 983 unique companies.

The study is delivered with an **Annex in Excel form**, displaying the details (company name, country and statute) of all ISCC valid certificates mentionned in table 20.

# 2. List of Advanced Feedstocks & Selection Covered by the Study



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# 3. Wastes from the Pulp Industry

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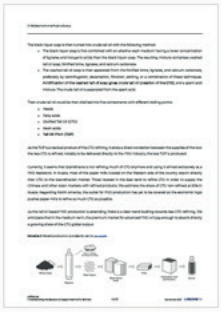
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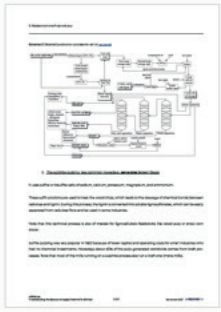
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# 4. Wastes from the Palm Oil Industry

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# 5. Wastes from the Sugar Industry


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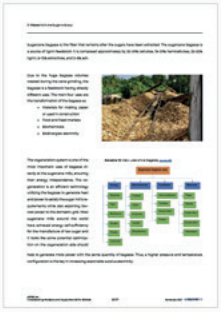
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# 6. Wastes from the Cereal Industry


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# 7. Wastes from the Wine Industry


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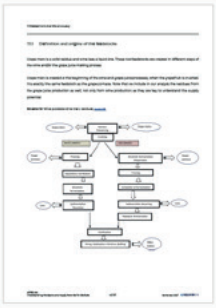
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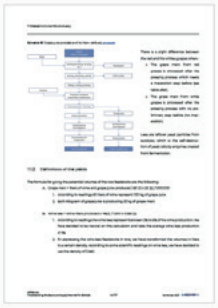
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# 8. Conclusion

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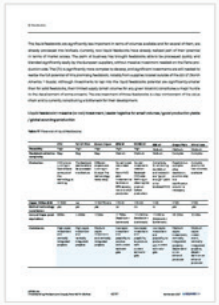
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