

MDF-Turpentine: Project Status and Worldwide Rollout

PCA 2025 International Conference, San Diego

September 23rd, 2025

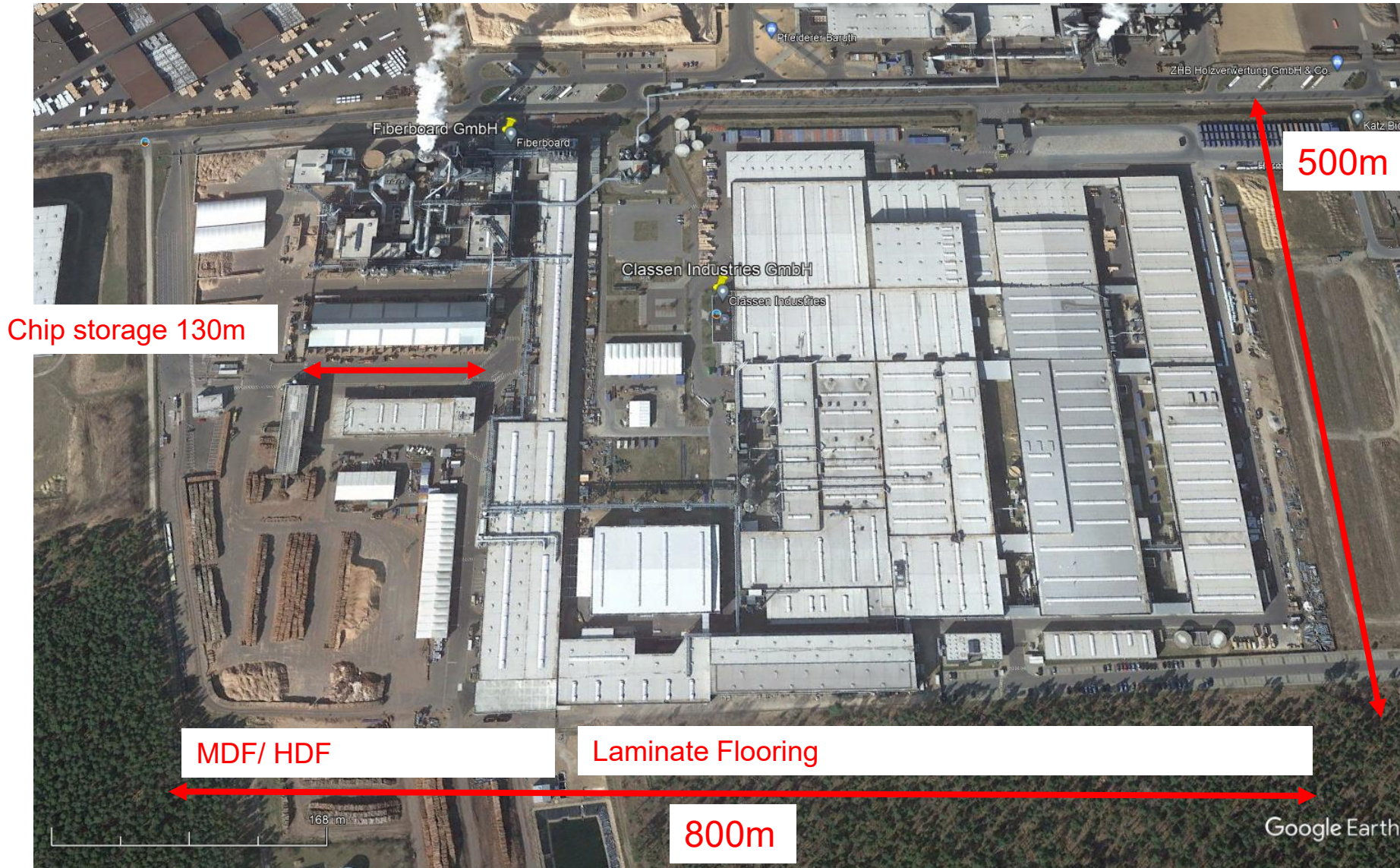
CLASSEN Group

Floors For A Better Tomorrow.

www.classengroup.com

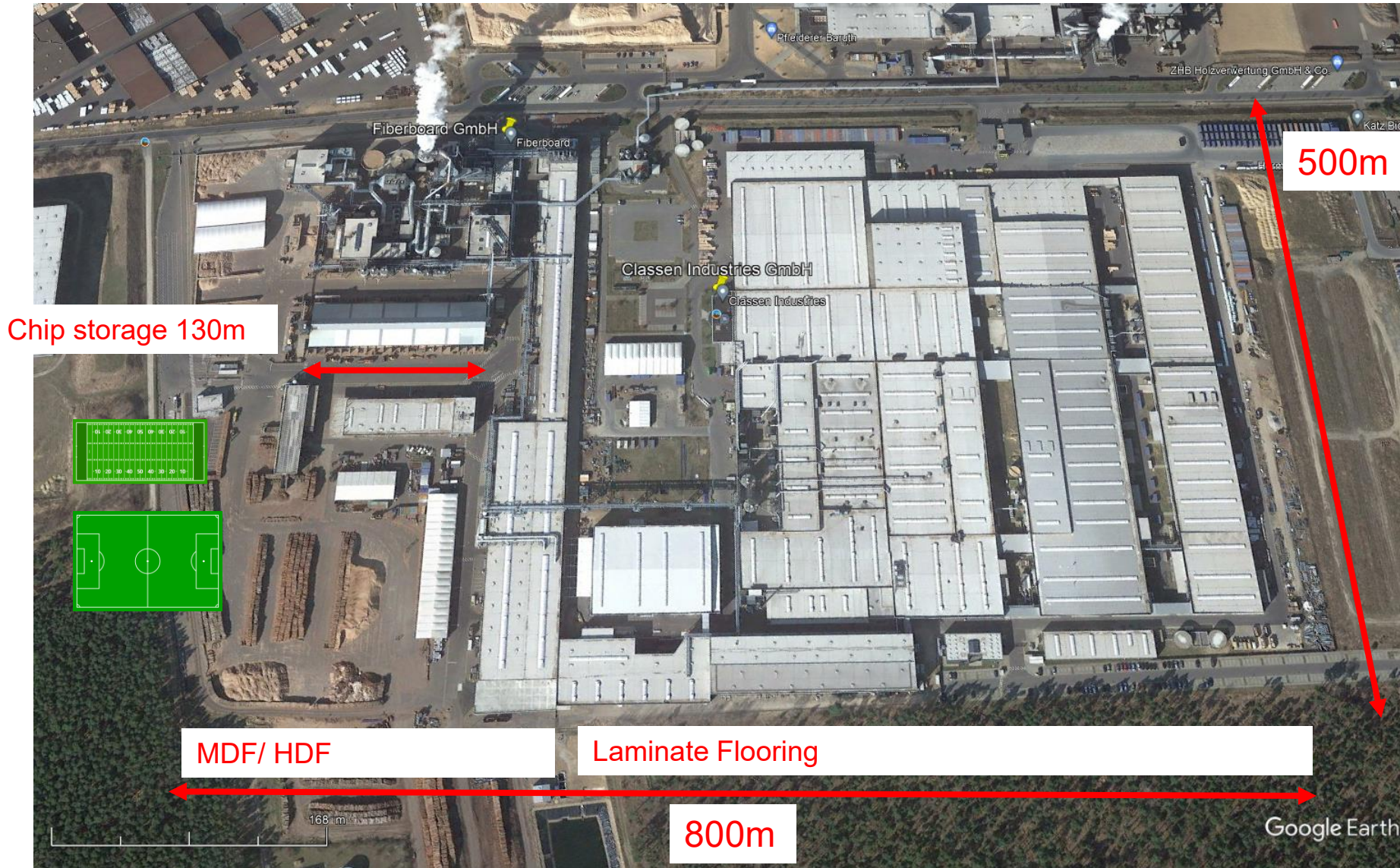
Prof. Dr.-Ing. Bernd Bungert, Prof. Dr.-Ing. Thomas Heine
Dr. Holger Heinrich, Christian Dümichen,
Carsten Buhlmann, Maciej Gorecki
Fiberboard GmbH, Classen Group
Baruth, Germany
Berlin University of Applied Science and Technology

Baruth: integrated MDF/ HDF production facility



- Fully integrated: from tree to laminate flooring
- **Capacity MDF: 500. 000 m³**
- **Capacity wood 400 000 t**
- **Capacity Laminate: 80 million m², of which 25 million m² digital printing**
- State-of-the-art logistics concept
- **€ 550 million total investment**

Baruth: integrated MDF/ HDF production facility

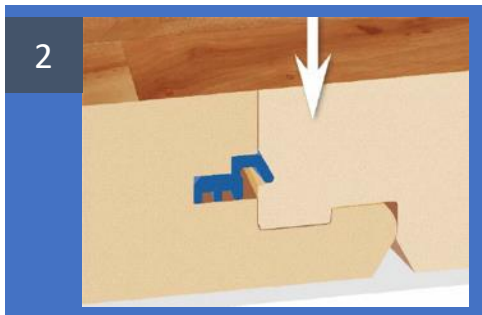


- Fully integrated: from tree to laminate flooring
- **Capacity MDF: 500. 000 m³**
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- **Capacity Laminate: 80 million m², of which 25 million m² digital printing**
- State-of-the-art logistics concept
- **€ 550 million total investment**

Numerous innovations and patents

megaloc

CLASSEN megaloc as a worldwide patented quick laying system with high safety comfort



LLT

CLASSEN's patented Liquid Laminate Technology

The HDF core board is bonded with untreated decor paper and backing. The impregnation takes place in a continuous processing process by **liquid** application. Finally, the structure is created under heat and high pressure.

Advantages:

- Energy-saving production Highly transparent surfaces
- Realistic decor designs
- Individually developed gloss levels
- Optimum look and feel of the laminate surface
- Logistical advantages

Industrial digital printing

Conventional:

Analogue printed papers are purchased from external service providers and glued (laminated) to the board

- High minimum purchase
- Little flexibility
- High storage costs

Digital printing

- Exclusive designs with smaller batch sizes
- Own decor development (design centre)
- High-quality surfaces with synchronous pores become even more precise
- **Baruth prints 25 % digital**
- **Kaisersesch prints 100 % digitally**

...

New technology: essential oil from pine trees (wood oil/ turpentine)

...

MDF-Turpentine

Conventional:

Essential oils are released to the atmosphere with dryer off gases

New:

Production and sale of essential oil

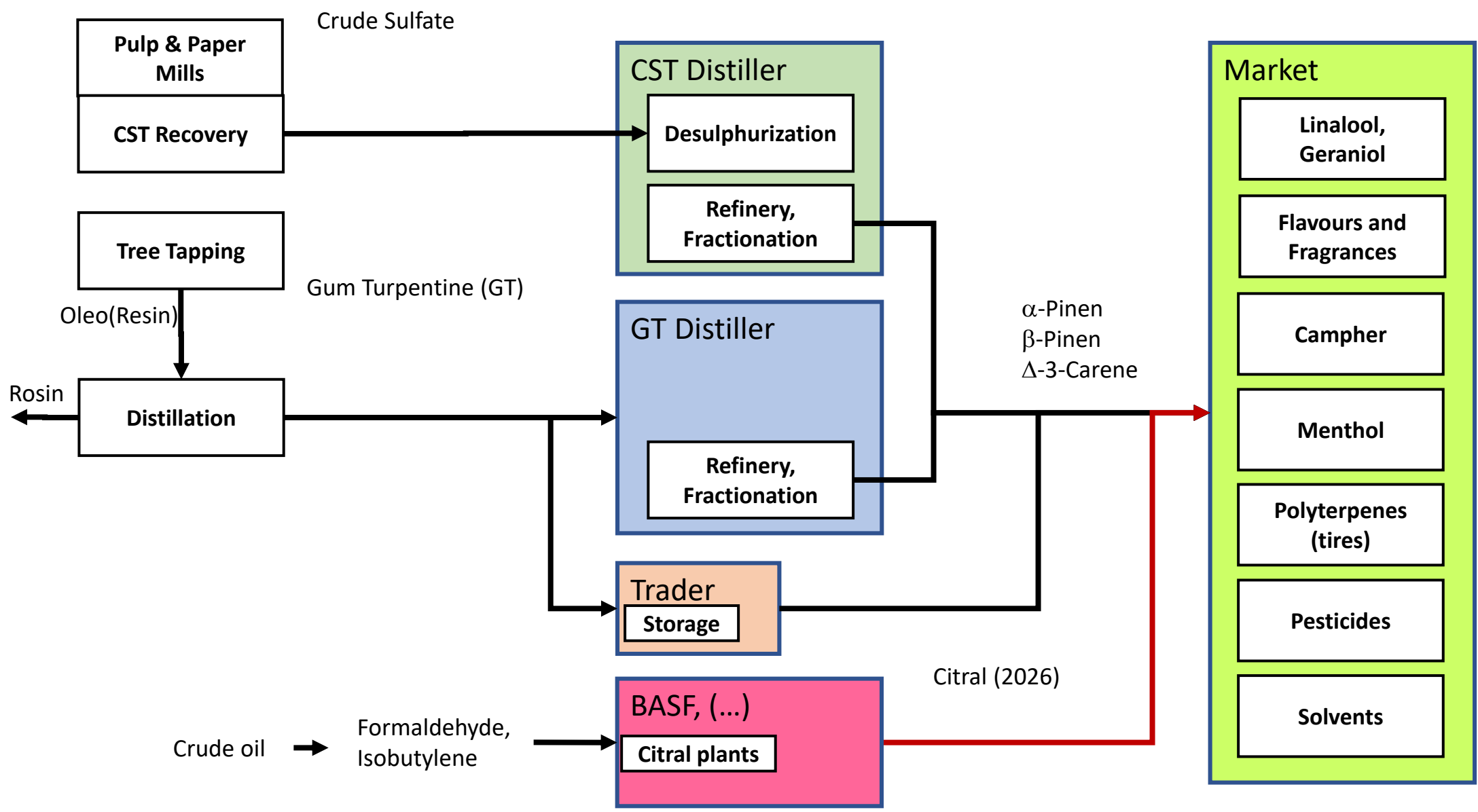
- 1200 t/year = one tank truck per week
- Additional profit generation of € 3 ... € 8 / m³ MDF
- Energy neutral
- Amortization well under two years

New route to turpentine

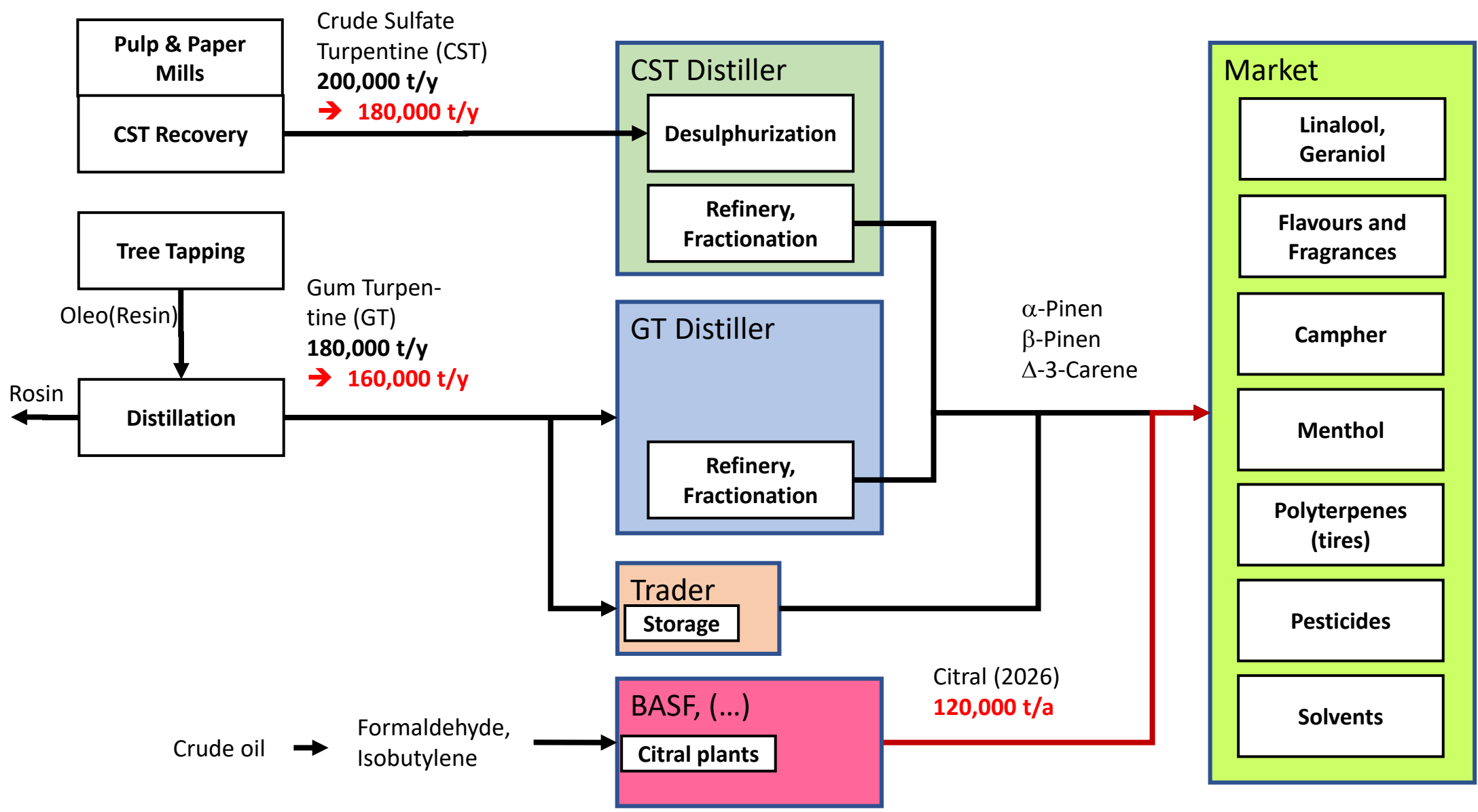
First presented at PCA meeting in Dublin in 2023 ([link and more info on last slide](#))

- Tree tapping
 - Extraction from pine stumps
 - Kraft process at pulp mills
 - Medium Density Fiberboard production (MDF)
 - Quality (almost) like gum turpentine
 - No sulfur
 - Continuous production (no seasonal dependence)
 - Worldwide potential: 120,000 t/year
- Gum Turpentine (GT)
Wood Turpentine
Crude Sulfate Turpentine (CST)
- MDF-Turpentine (MDF-T)

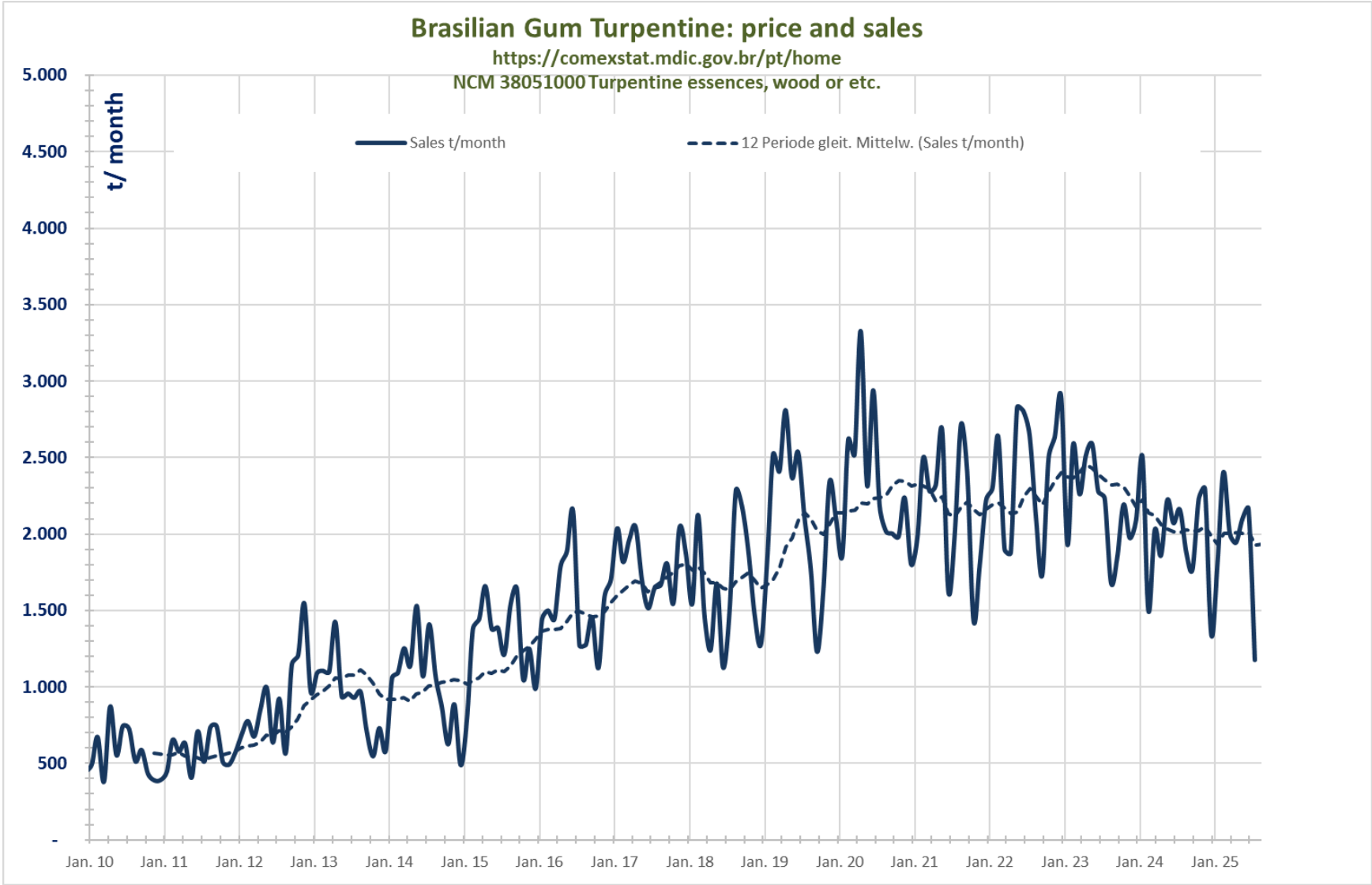
Production and Market route for CST, GT, MDF-T, Citral



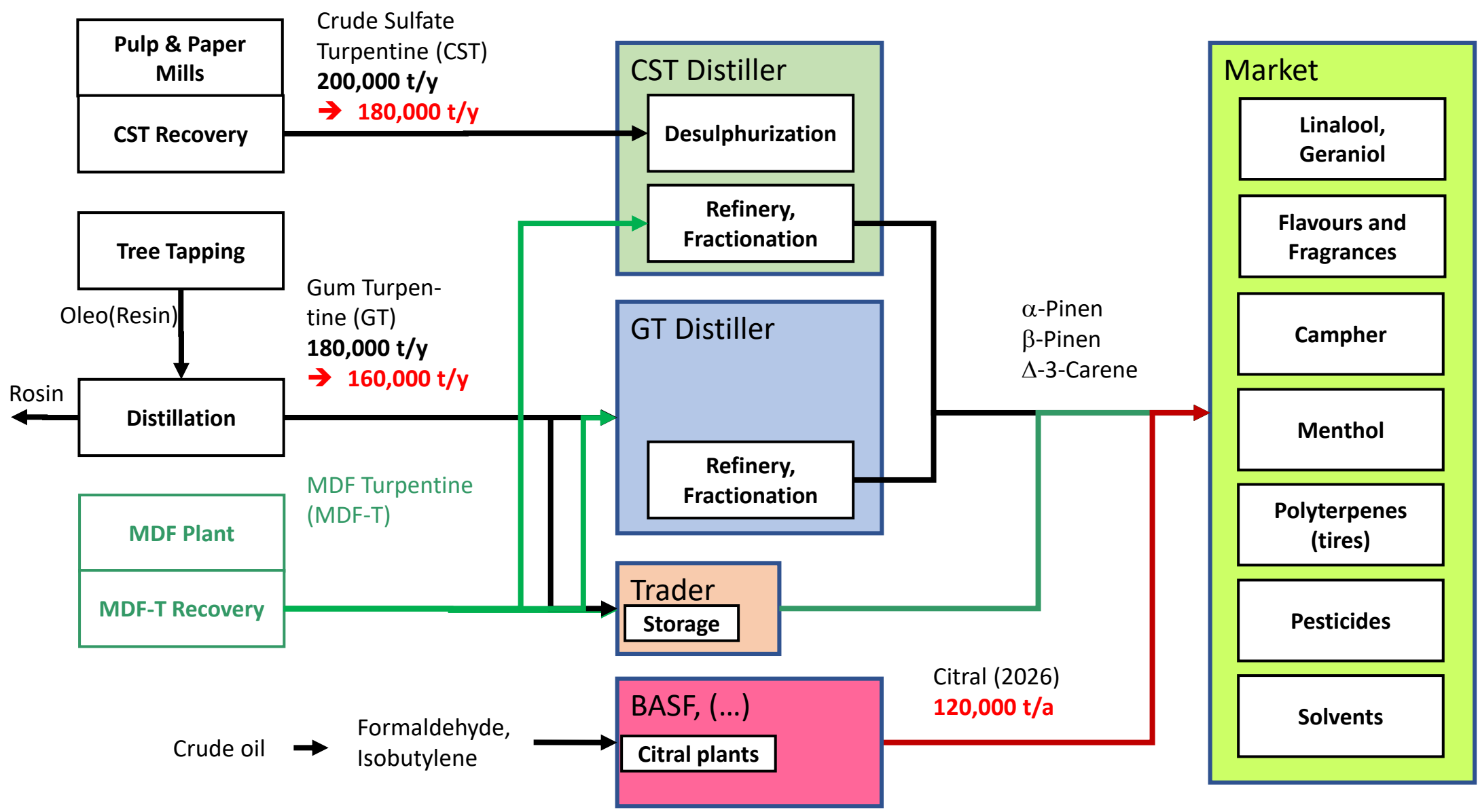
Production and Market route for CST, GT, MDF-T, Citral



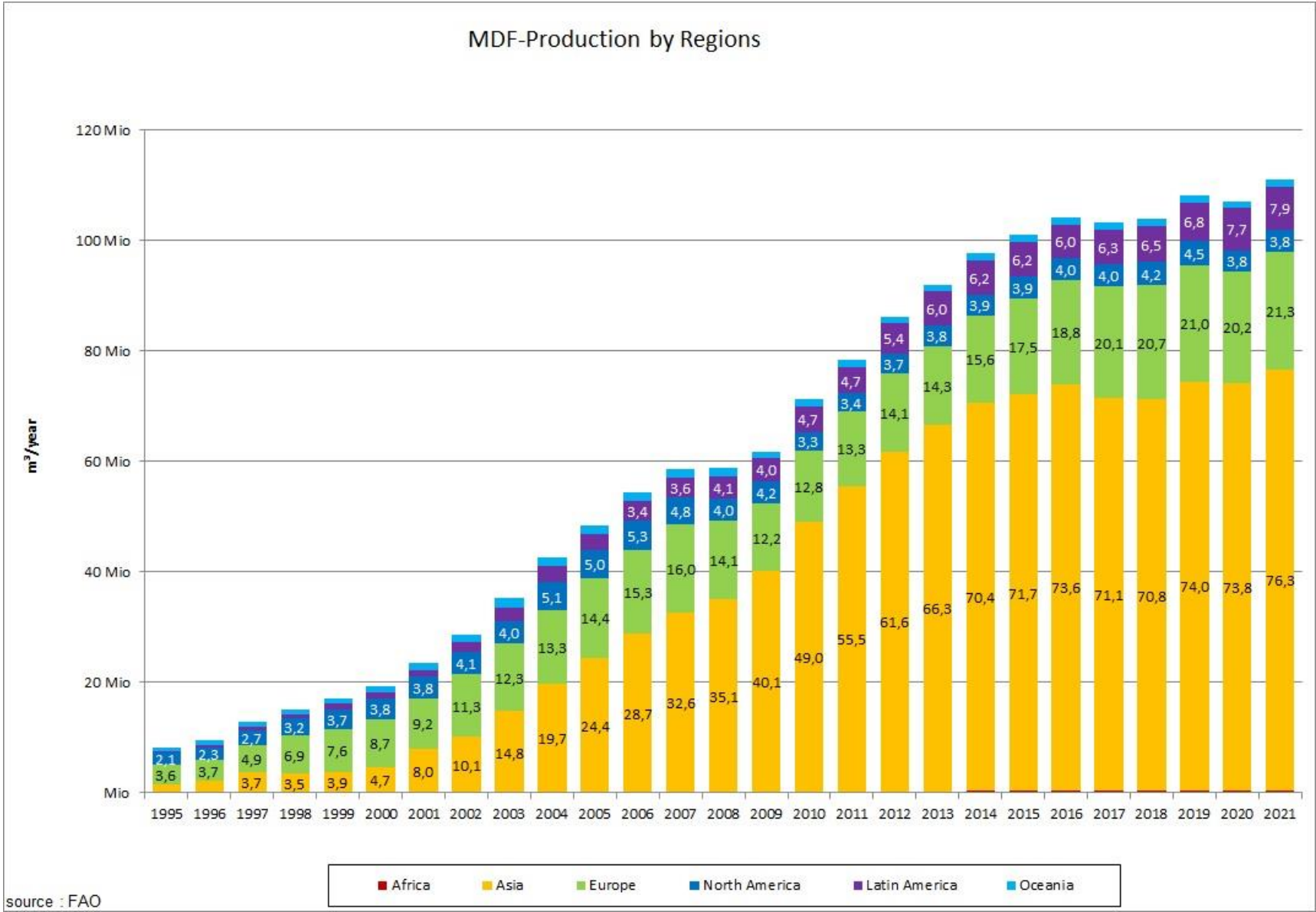
Production and Market route for CST, GT, MDF-T, Citral



Production and Market route for CST, GT, MDF-T, Citral



MDF-Production and (soft-)wood usage



110 million cubic meters
= 80 million tonnes of wood
(dry matter)

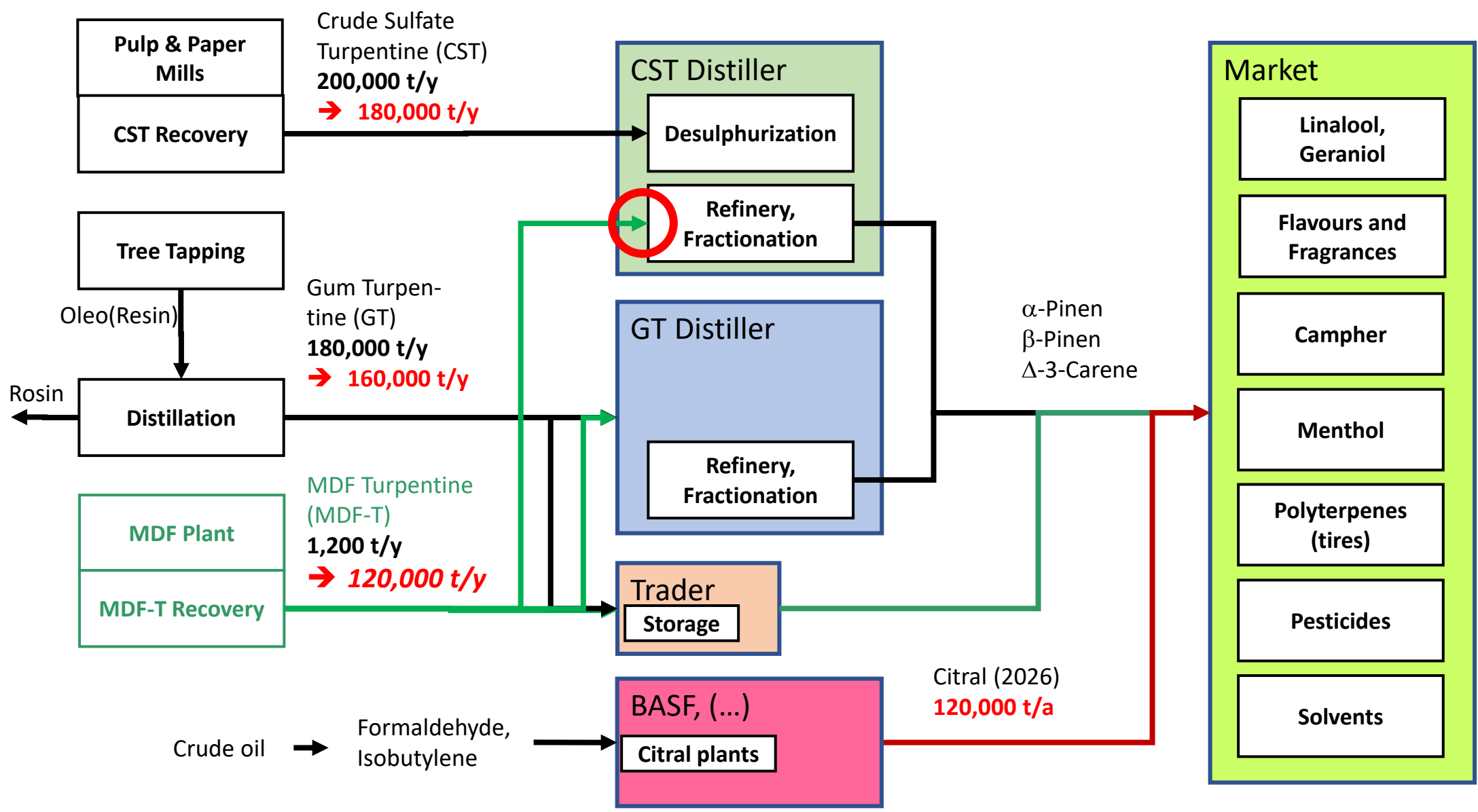
3 500 million (=3.5 billion) scf
(standard cubic feet)

Softwood: 50%

Turpentine content:
Average 3 kg/t

Total potential: 120 000 tonnes
MDF-turpentine
per year

Production and Market route for CST, GT, MDF-T, Citral (2026)



Wood-Based Panel Production in Brandenburg, Germany



Dryer, Sifter and Mat Forming



Wood-Chip Storage

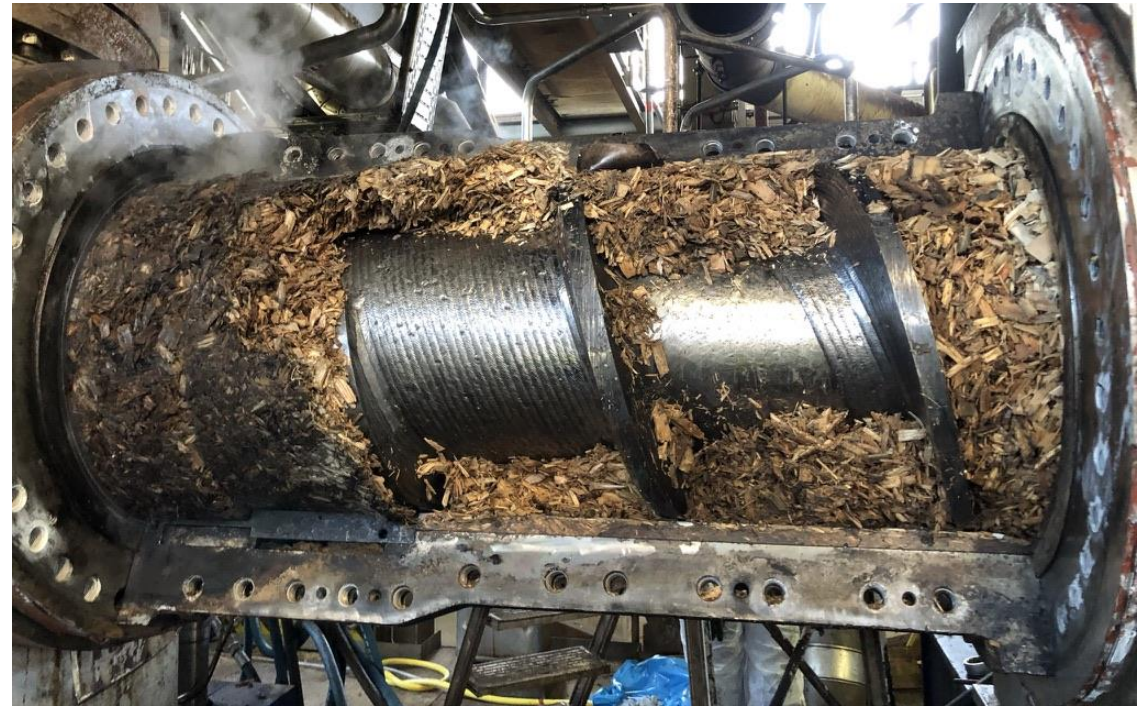


Wood-Chip Storage, 70 000 m³ (6 day production)

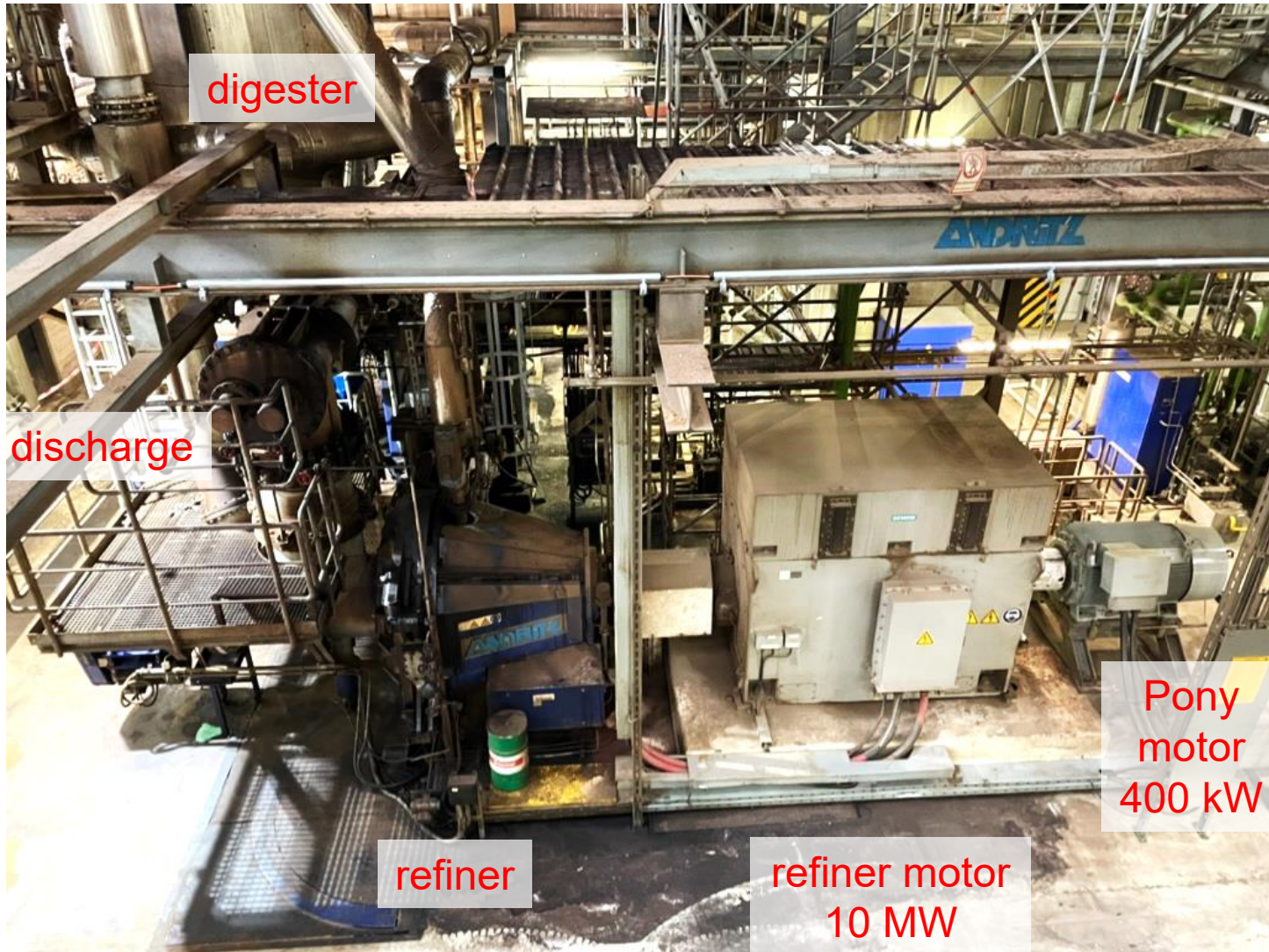
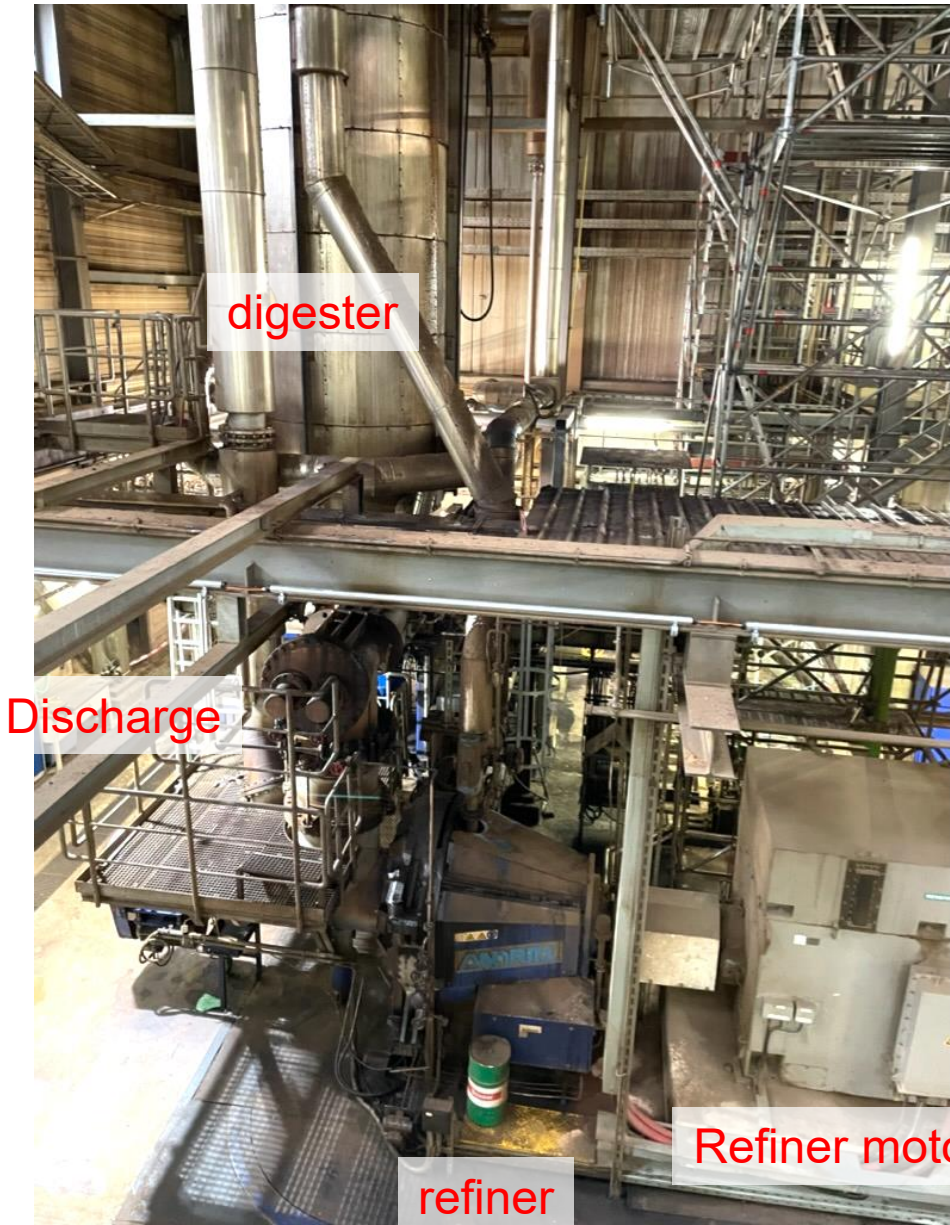


Plug-Screw Feeder from presteamer to digester (cooker)

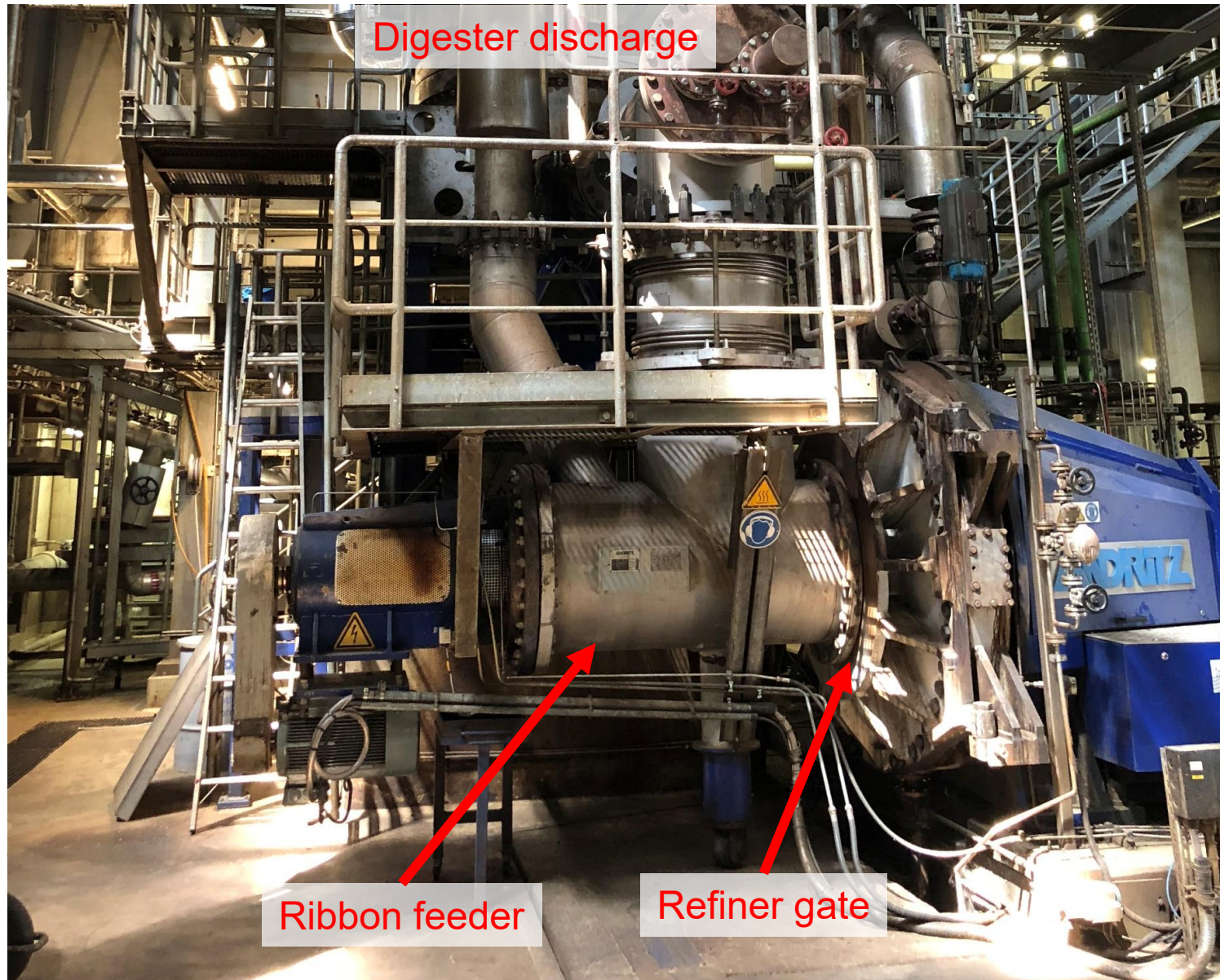
(sealing the feed of 52 t/h (dry = 100 t/h wet) from 1 bar to 10 bar! And dewatering at the same time ...)



Digester and Refiner



Refiner feed



Refiner (rotor-stator mill)



Mat forming

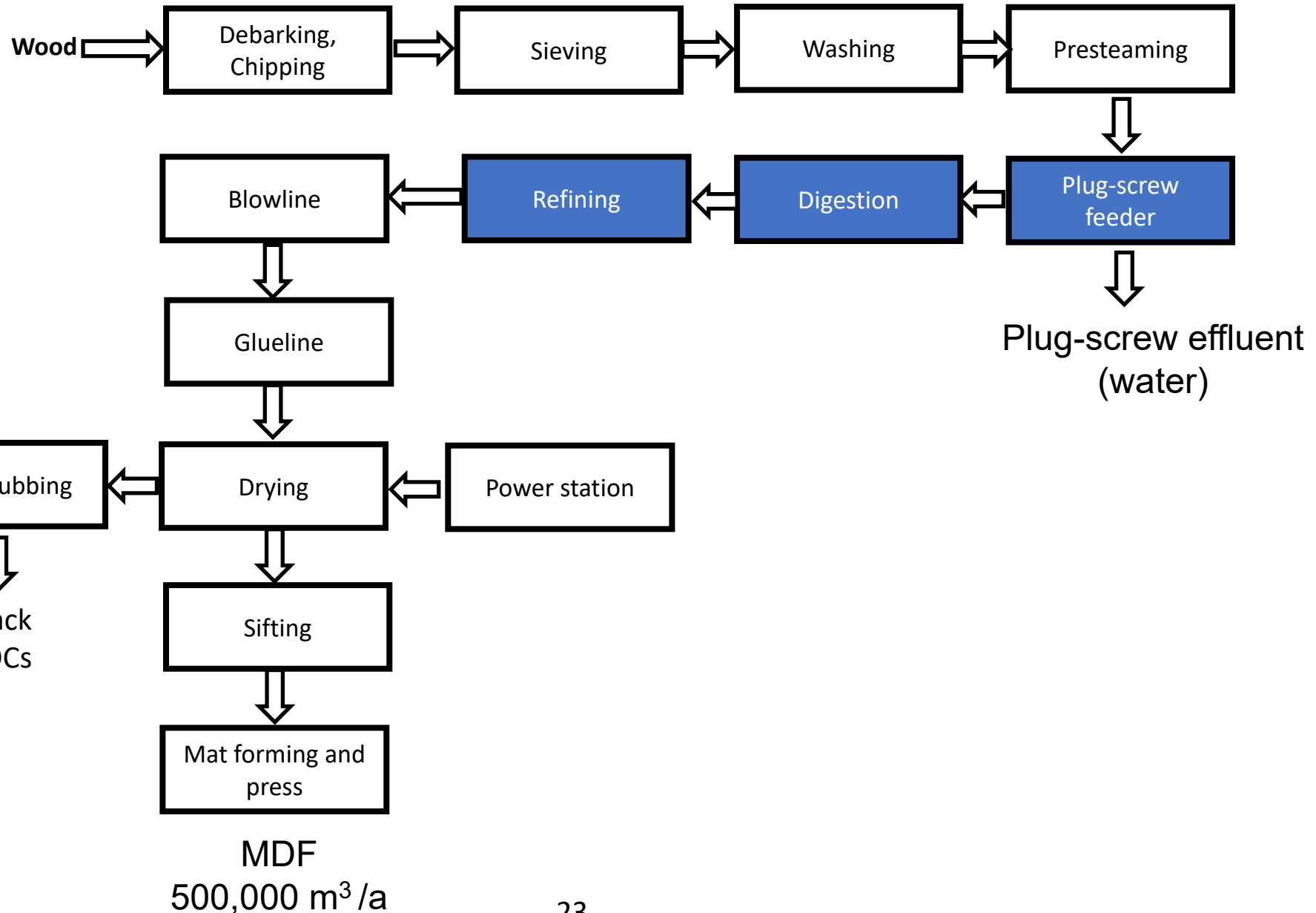


MDF after press



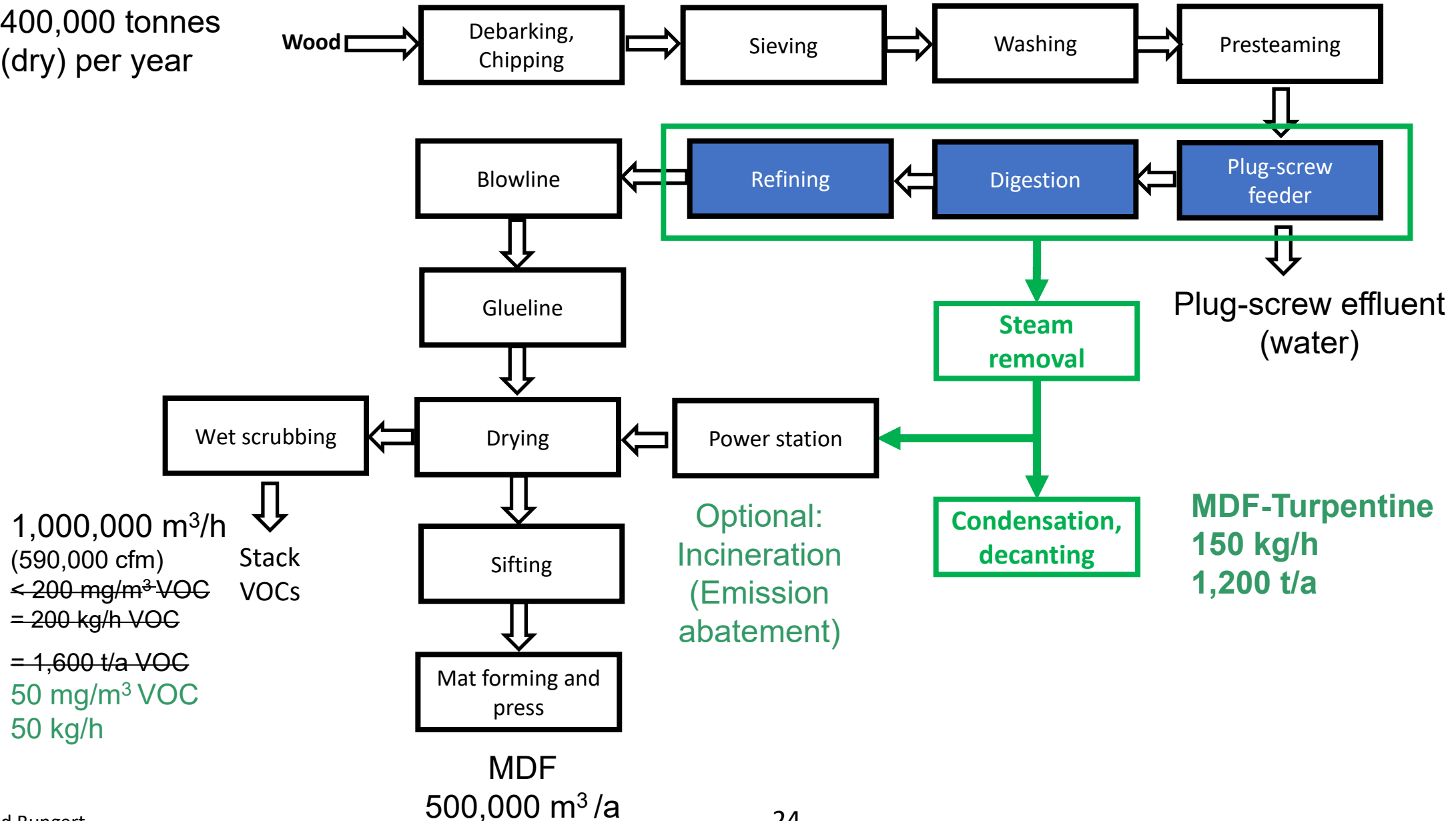
MDF Process, MDF-Turpentine production

400,000 tonnes
(dry) per year



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400,000 tonnes
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MDF-T Pilot Production



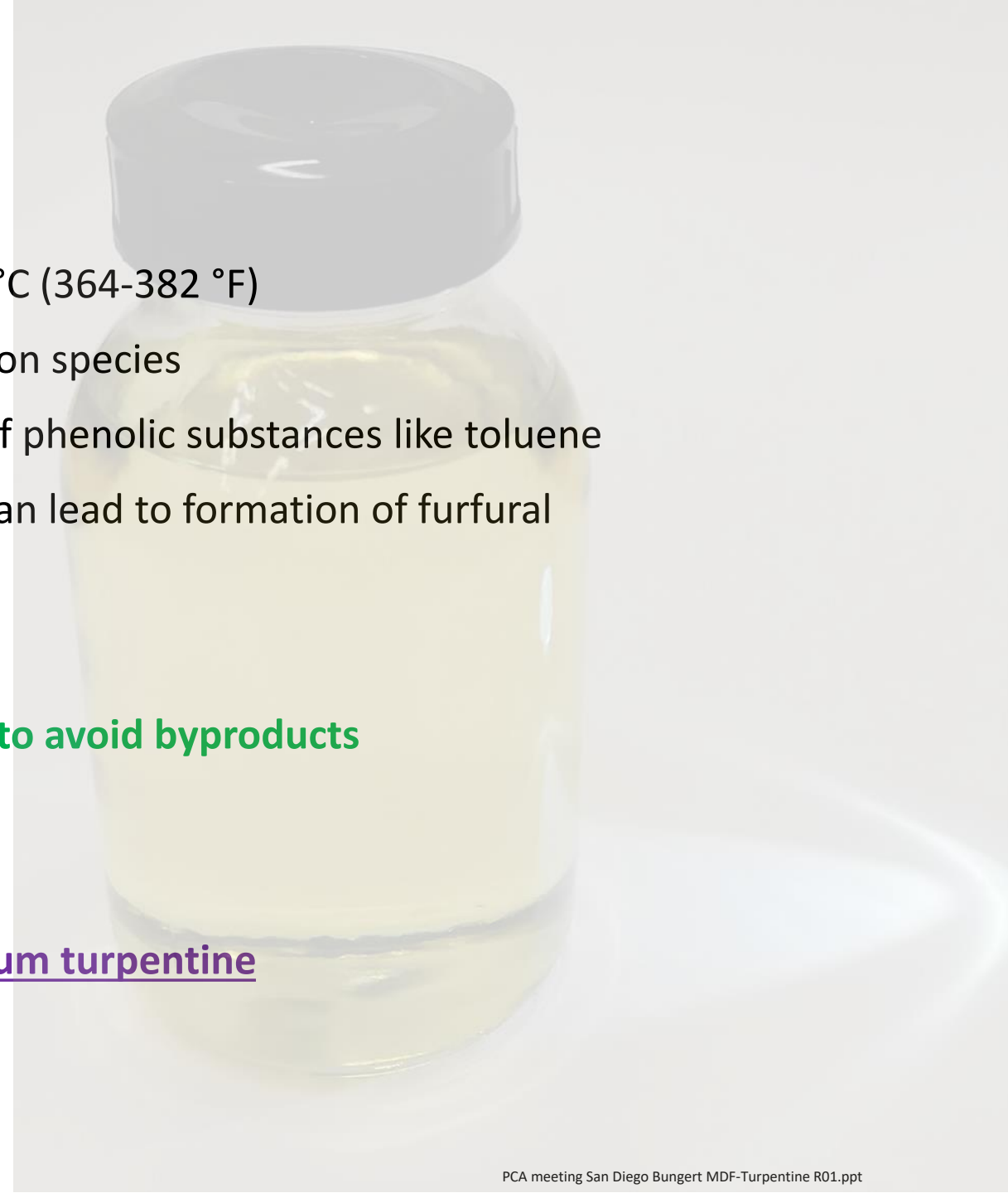
MDF-T Pilot Production: Process Stability, Market Samples

- Pilot production: 5 kg/h ... 40 kg/h (40...360 t/year, up to ¼ of production capacity)
- In operation since 2021
- Continuous operation since 2023
- Thorough investigation of
 - Process parameters of main MDF production
 - Process parameters of MDF-T process
 - Yield
 - Raw material composition (70-100% pine, 0-20% spruce, 0-20% hardwood)
 - Raw material moisture
 - Raw material origin
 - Hardwood types (beech, poplar, oak, ash, ...)
 - Seasonal effects
 - Byproducts from decomposition of digestion process
 - (...)
- **Profound understanding of process and process stability accomplished**



MDF-T: Quality and possible byproducts

- Digestion takes place for 3-5 minutes @ 170-180°C (364-382 °F)
- Composition of α -pinene and β -pinene depends on species
- Decomposition of lignine can lead to formation of phenolic substances like toluene
- Decomposition of hemicelluloses and pentoses can lead to formation of furfural
- Sulfur is not present at all
- **The Classen MDF-T process has been optimized to avoid byproducts**
- **Technology can be applied worldwide**
- **The quality of MDF-Turpentine is (almost) like gum turpentine**



MDF- Quality

Product specification: **MDF-Turpentine**



DESCRIPTION

Turpentine produced by MDF-Turpentine process based on steam processing of wood chips obtained principally from scots pine (Waldkiefer, *Pinus Sylvestris*) obtained from the MDF plant of Fiberboard GmbH in Baruth/ Mark, Germany.

SPECIFICATION

Appearance : Clear

Colour : Almost colourless, slightly yellow

Alpha Pinene content (%) :	47 (standard value);	40 (min)
Beta Pinene Content [%]:	5 (standard value);	2 (min)
Delta 3 Carene Content [%]:	30 (standard value);	37 (max)
Limonene content [%]:	4 (standard value)	

Sulfur content [ppm]:	3-3.3 (standard value);	3.5 (max)
Water content [%]:	0 (standard value);	0.1 (max)

TYPICAL PROPERTIES

Acid Number (mgKOH/gr) :	1-2 (typical value)
Relative Density [g/ml] :	0.865 (typical value)
Flash point [°C]:	39-41
Kinematic viscosity [mm ² /s]	1,18 (typical value)
Vapor pressure at 20°C [mbar]:	21 (typical value)

PACKAGING

Bulk Isotank or Intermediate Bulk Container

Appearance :

Clear

Colour :

Almost colourless, slightly yellow

Alpha Pinene content (%) :	47 (standard value);	40 (min)
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MDF-safety data sheet, REACH (please find link at end of presentation)



Seite: 1/12

Sicherheitsdatenblatt
gemäß Verordnung (EG) Nr. 1907/2006, Artikel 31

Druckdatum: 30.10.2024 Versionsnummer 1 überarbeitet am: 30.10.2024



ABSCHNITT 1: Bezeichnung des Stoffs beziehungsweise des Gemischs und des Unternehmens

- 1.1 Produktidentifikator
- Handelsname: **MDF-Terpentin, MDF Turpentine**
- EG-Nummer: 932-349-8
- Registrierungsnummer 01-2119553060-53-X
- UFI: Entfällt. Anhang VII der CLP-Verordnung nicht anwendbar.



Safety data sheet
according to Regulation (EC) No 1907/2006, Article 31

Page 1/12

Printing date 30.10.2024 Version number 1 Revision: 30.10.2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

- 1.1 Product identifier
- Trade name: **MDF Turpentine**
- EC number: 932-349-8
- Registration number 01-2119553060-53-X
- UFI: Not applicable. Annex VII of the CLP Regulation does not apply.



Fiche de données de sécurité
selon règlement (CE) N° 1907/2006, Article 31

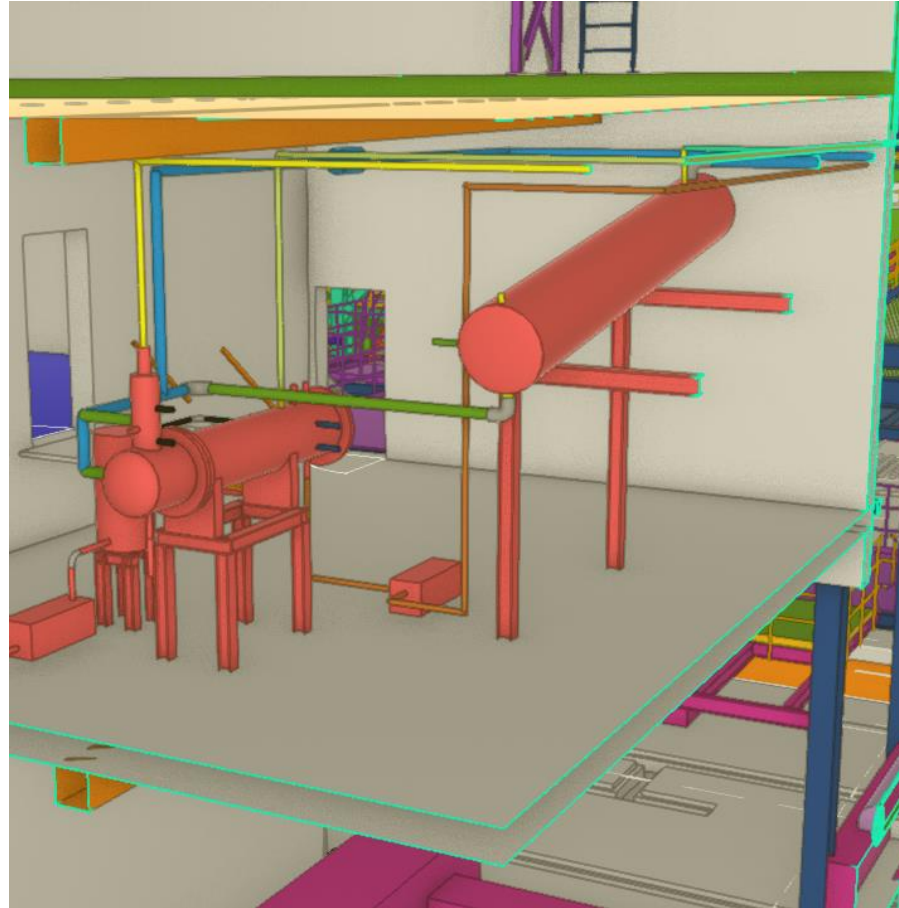
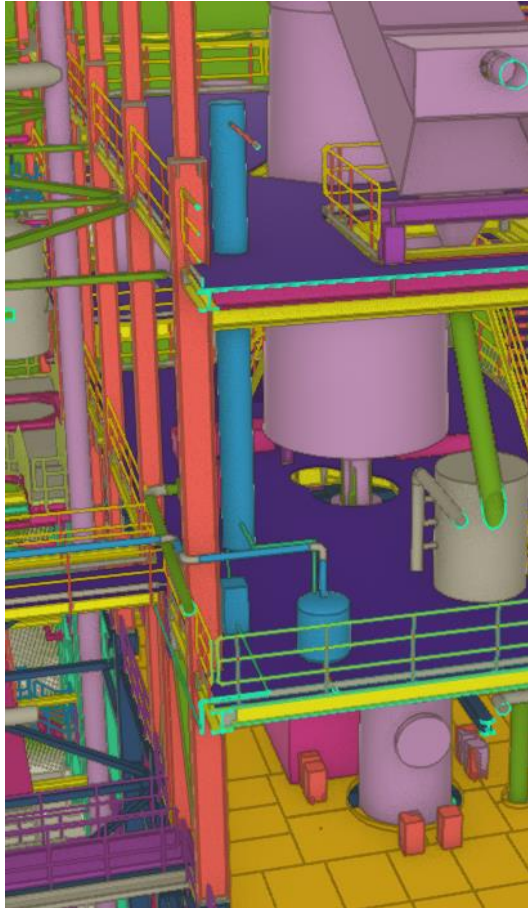
Page : 1/12

Date d'impression : 30.10.2024 Numéro de version 1 Révision: 30.10.2024

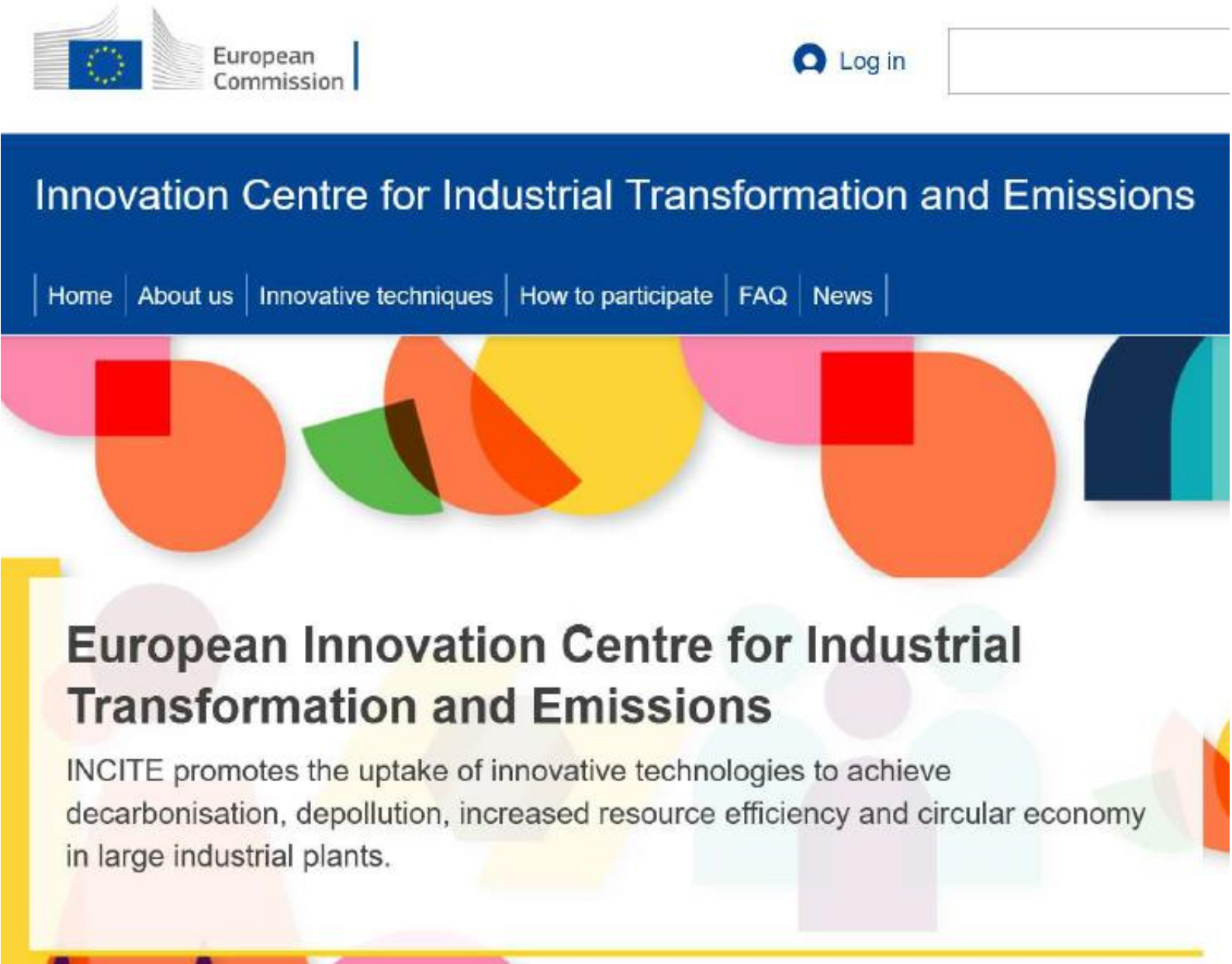
RUBRIQUE 1: Identification de la substance/du mélange et de la société/de l'entreprise

- 1.1 Identificateur de produit
- Nom du produit : **Térébenthine MDF**
- Numéro CE : 932-349-8
- Numéro d'enregistrement : 01-2119553060-53-X
- UFI: Pas applicable. Annexe VII du règlement CLP non applicable.

MDF-Turpentine recovery plant under construction (procurement started)



- Simple plant:
 - two-stage condensation, decanting, storage, tank-truck filling
 - Turpentine decanting at far below flash point (41°C, 95°F)
 - Residence time decanting under 5 minutes
- No Ex-Zones in your plant!
- Production readiness: Q4.2026



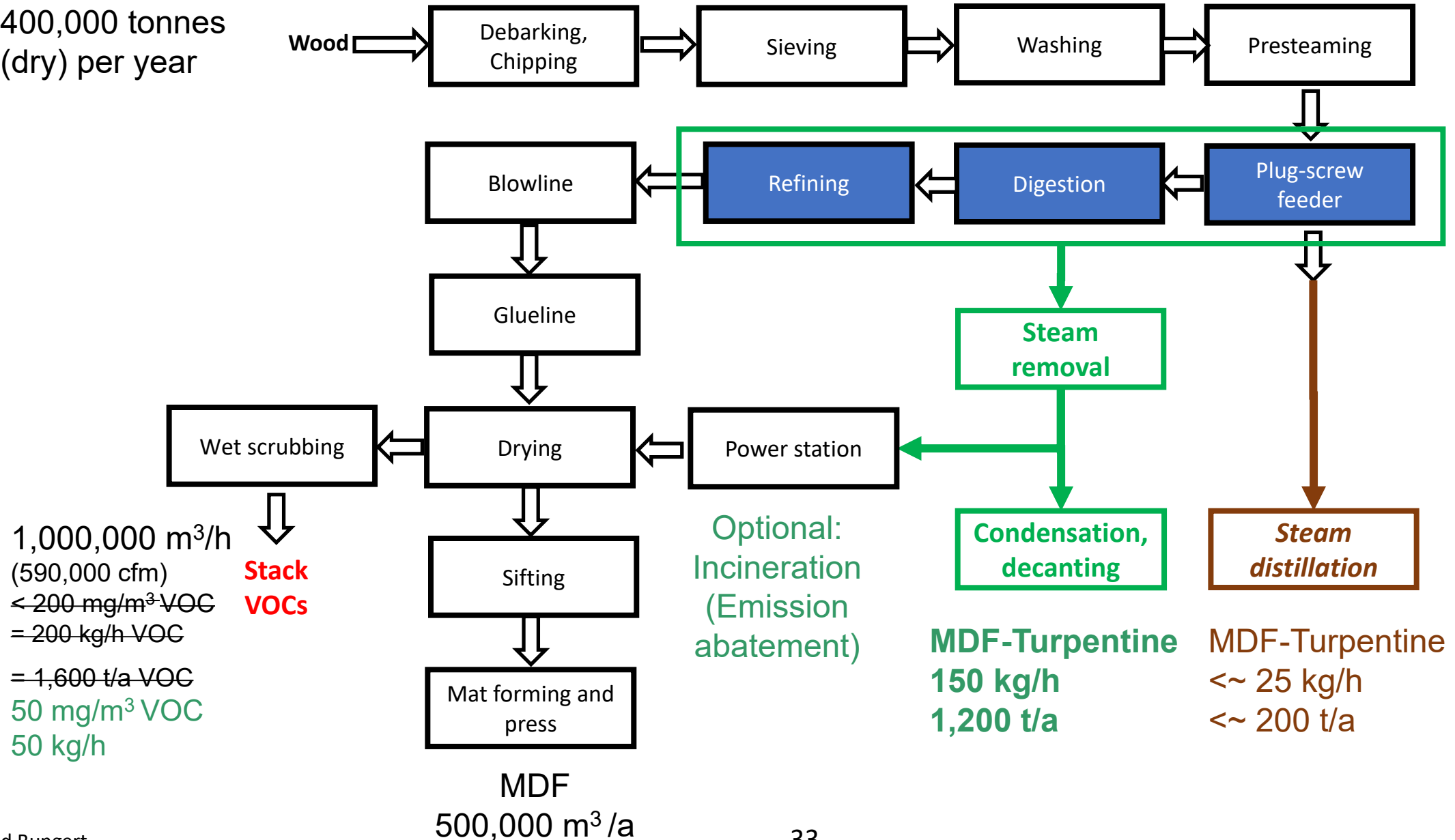
Project status: INCITE, EU legislations, US Title V air pollutant threshold

- INCITE will list MDF-T soon as emerging technique
- Technology will thus automatically become state of the art
- Producing turpentine means reducing VOCs!
- MDF-T makes the use of natural gas for VOC abatement in the US obsolete! Extreme cost reduction. Carbon footprint (scope 1 & 2) reduced by 50%!
- European laws are getting stricter and stricter!
- There will be a lot of pressure on European and American MDF-producers

Additional benefit for European and American MDF producers

MDF Process, **MDF-Turpentine production**, *process alternatives*

400,000 tonnes
(dry) per year



IP Position: IPR 1 (2020), IPR 2 (2021)

- Granted
- One objection defeated before European patent court
- No other objections, deadline for objection passed

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
02. September 2021 (02.09.2021)



(10) Internationale Veröffentlichungsnummer
WO 2021/170779 A1

(51) Internationale Patentklassifikation:
D21B 1/12 (2006.01) *B27N 3/04* (2006.01)
B27N 1/00 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2021/054788

(22) Internationales Anmeldedatum:
26. Februar 2021 (26.02.2021)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
20160148.1 28. Februar 2020 (28.02.2020) EP

(71) Anmelder: **FIBERBOARD GMBH** [DE/DE]; An der Birkenpfuhlheide 4, 15837 Baruth (DE).

(72) Erfinder: **HENNIG, Andre**; c/o Fiberboard GmbH, An der Birkenpfuhlheide 4, 15837 Baruth (DE). **DÜMICHEN, Christian**; c/o Fiberboard GmbH, An der Birkenpfuhlheide 4, 15837 Baruth (DE). **SCHWENDY, Martin**; c/o Fiberboard GmbH, An der Birkenpfuhlheide 4, 15837 Baruth (DE). **Bungert, Bernd**; 14169 Berlin (DE). **HEINE, Thomas**; 13599 Berlin (DE).

(74) Anwalt: **MICHALSKI HÜTTERMANN & PARTNER PATENTANWÄLTE MBB**; Speditionstrasse 21, 40221 Düsseldorf (DE).

(81) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH,

(54) Title: METHOD AND PROCESSING SYSTEM FOR REDUCING VOLATILE ORGANIC COMPOUNDS FROM WOOD CHIPS

(54) Bezeichnung: VERFAHREN UND VERARBEITUNGSSYSTEM ZUM REDUZIEREN VON FLÜCHTIGEN ORGANISCHEN VERBINDUNGEN AUS HACKSCHNITZELN

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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(43) Internationales Veröffentlichungsdatum
26. Januar 2023 (26.01.2023)



(10) Internationale Veröffentlichungsnummer
WO 2023/001978 A1

(51) Internationale Patentklassifikation:
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B27N 1/02 (2006.01) *B27N 3/18* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2022/070535

(22) Internationales Anmeldedatum:
21. Juli 2022 (21.07.2022)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

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21187502.6 23. Juli 2021 (23.07.2021) EP

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BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, RU, TJ, TM), europäisches (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Veröffentlicht:
— mit internationalem Recherchenbericht (Artikel 21 Absatz 3)

(54) Title: PROCESS FOR MANUFACTURING FIBER BOARDS WITH REDUCED VOC EMISSIONS
(54) Bezeichnung: VERFAHREN ZUM HERSTELLEN VON FASERPLATTEN UNTER VERRINGERTEM VOC-AUSSTOß

itine R01.ppt

Bernd Bungert

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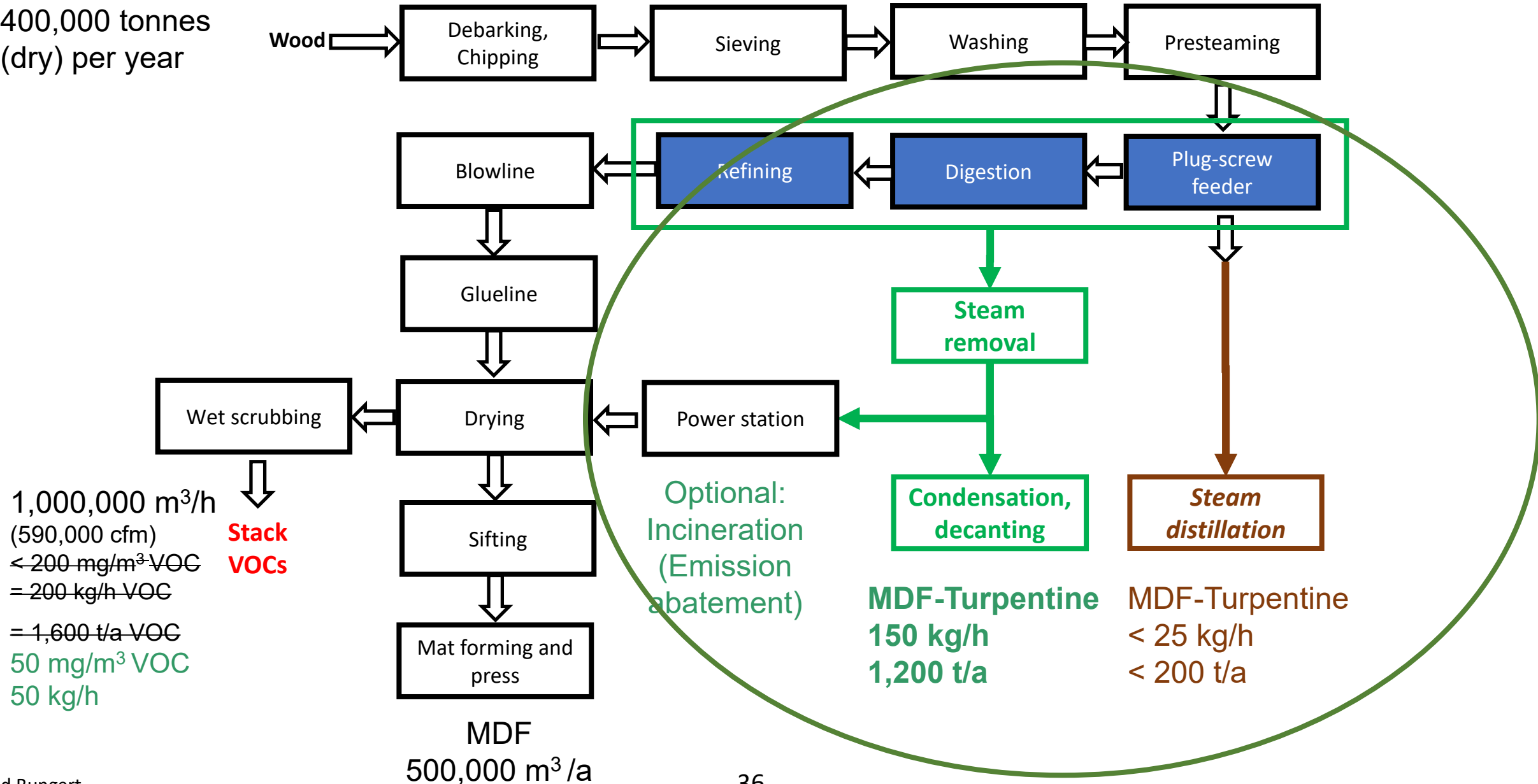
IP Position: patent family

IPR 3-8

- Process
- Purification of MDF-T
- Process Control
- Process alternatives
- Side effects including purification of CST
- Application for
 - Oriented Strand Board (OSB)
 - Particle Board (PB)

MDF Process, **MDF-Turpentine production**, *process alternatives*

400,000 tonnes
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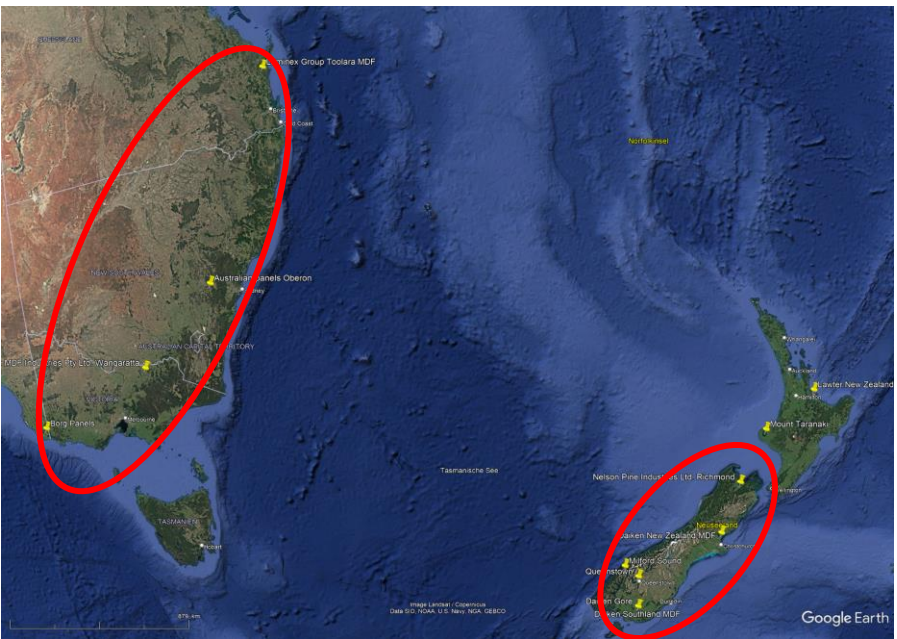
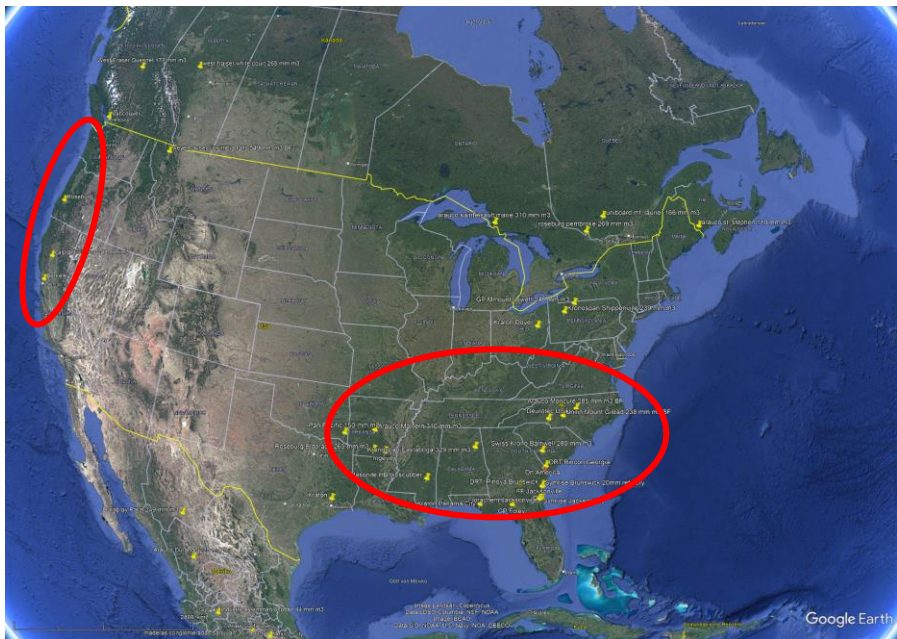
Process alternatives and IP status

- Process alternatives covered quantitatively by IP Position
- Includes Steam Distillation from plug-screw effluent („Liquid Method“)
- Classen has marketed „megalog“ click system for laminate flooring and other technologies (LLT, DP, AP, etc.) worldwide achieving double digit mm profit per year
- Classen IP network is worldwide active
- IPR 1 has been challenged by a major European equipment supplier and contractor. Case was clearly won at EPO/ European Patent Court
- IPR 1, 2 have been granted without objection within shortest time, no other objections, deadline for objection passed
- **Strong IP position**

Process alternatives and IP status

- Any Turpentine from Europe will appear on REACH
- Any new Turpentine source will be known in the community
- Classen is ready and experienced to actively maintain their IP position
- Classen is prepared to immediately sue any breach and any violation of their IPP
- **Classen gives its licensees maximum security in terms of**
 - **Technology**
 - **Reliability**
 - **Competitiveness**

MDF-T producers, key markets, focus customers



Projects under development

- Classen develops lighthouse projects together with focus customers
- Rollout with partners to begin in 2026
- Current lighthouse projects:
 - North America 1 (Pinus Palustris)
 - North America 2 (Pinus Taeda)
 - North America 3 (Pinus Taeda, MDF-T instead of RTO (thermal oxidization))
 - South America (Pinus Taeda & Eliottii)
 - Europe Southwest (Pinus Pinaster)
 - Europe Middle and North (Pinus Sylvestris)
 - Türkiye 1 (Pinus Brutia)
 - Türkiye 2 (Pinus Brutia & Pinus Sylvestris)
 - Türkiye 3 (Pinus Nigra & others)
 - Australia and New Zealand (Pinus Radiata)
- Typical production: 500 – 1 200 t/a
- Composition ...

Turpentine composition for pine species

- 1) Data base (to be published soon, >200 entries)
- 2) Steam Distillation in lab at BHT by clevenger stills
 - All customers
 - Anybody else
 - Gives Yield
 - Composition by GC
- 3) Please send us your sample ... (see slide 46 for that)

Turpentine composition for pine species

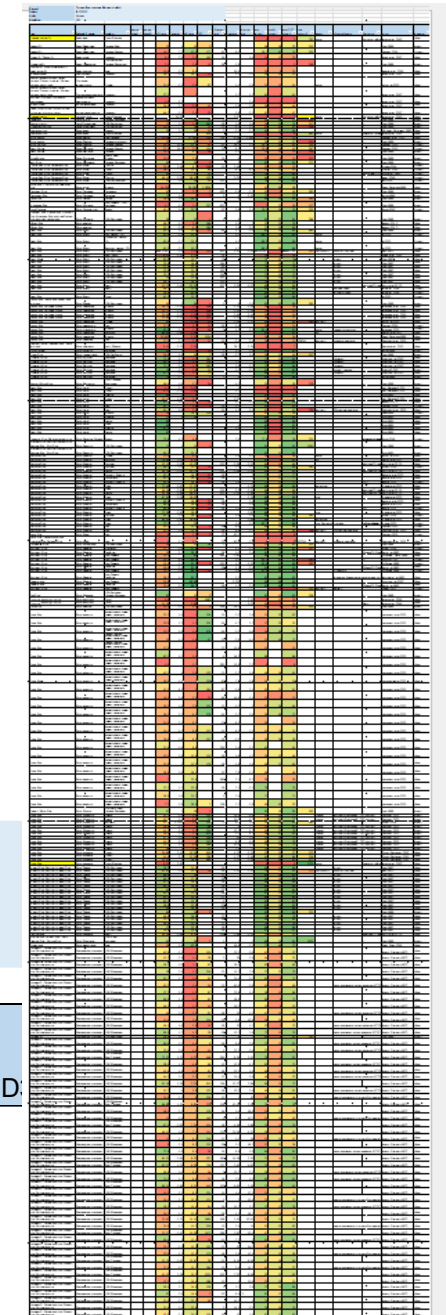
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 - All customers
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 - Gives Yield
 - Composition by GC
- 3) Please send us your sample ... (see slide 46 for that)

Projekt:	Turpentine composition and yield											
Datum:	31.08.2025											
Autor:	Bungert											
Revision:	R14											
Tree	Botanical name	Region	source wood	source branch	a-Pinene	Campher	b-Pinene	D3C	b Phellan-drene	Limonene	Terpino-lene	

Turpentine composition for pine species

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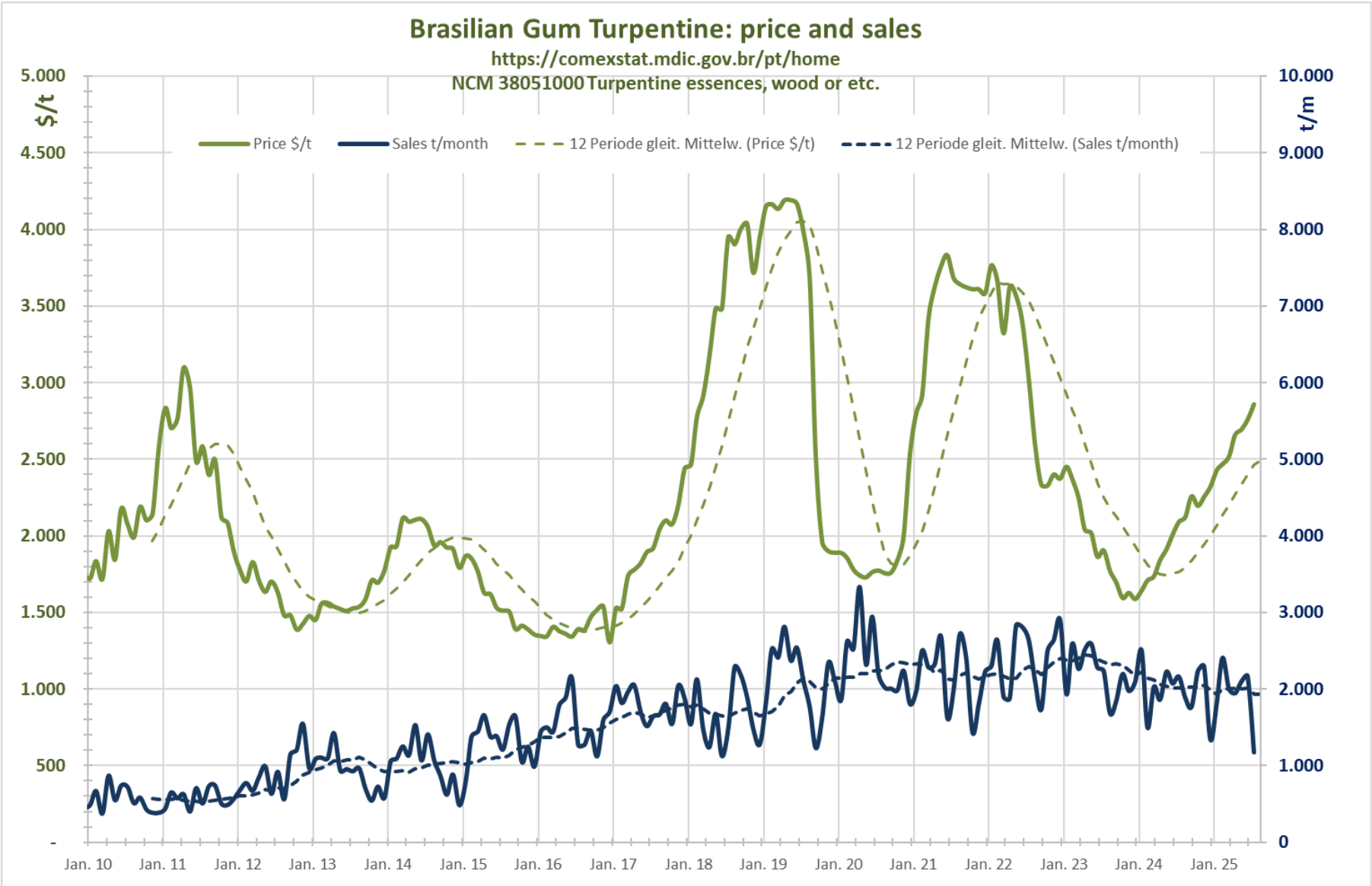
Projekt:		Turpentine composition and yield																									
Datum:		31.08.2025																									
Autor:		Bungert																									
Revision:		R14																									
Tree		Botanical name		Region		source wood		source branch		a-Pinene		Campher		b-Pinene		D:		rpino- ie									



Market development

- Project sales and development
 - Current: Lighthouse/ Focus Customers by Classen
 - From 2026:
 - Contractor/ EQP supplier
 - T-Fractionator
 - Technology Distributor
- Licenses
 - Direct from Classen
 - Over Contractor/ EQP supplier
 - T-Fractionator
- Technology transfer:
 - By Classen
 - By Contractor
- Erection and /or financing
 - Licensee or Contractor or T-Fractionator/ Buyer
- MDF-T Sales
 - Direct by licensee (MDF producer)
 - „Auction“
 - Broker/ Trader

Market development: pricing, BGT index



Source: <https://comexstat.mdic.gov.br/pt/home>

Market development: value of MDF-T

- BGT price: (<https://comexstat.mdic.gov.br/>, NCM code 38051000) = public information
- Quality factor (α and β -pinene content related to that of *pinus eliottii* (90%),
e.g. *pinus sylvestris*: 50% alpha and beta and thus $50/90=0.56$)
- Δ -3-Carene content for users who make use of it
- Heating value of the rest
- Logistics and transport costs
- Assessment of MDF-T relative to BGT and CST
- Hardly any data on CST, therefore possible adjustment (if taken at all) by a factor x times the price for BGT
- X being close to one

Summary

- Turpentine market is in need of a new source
- MDF-T gives a great new potential
- First plant to come onstream in 2026
- Technology is safe, reliable, proven and stable
- IP position gives licensees maximum security
- Market development strategy is picking up and rollout under way
- **MDF-T is ready to enter the market**

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Further information

Presentations:

PCA meeting Dublin 2023

https://prof.bht-berlin.de/fileadmin/labor/mvt/SHK/PCA_Bungert_MDF-T_2023-09-19.pdf

European Panel Federation Brussels 2024

https://prof.bht-berlin.de/fileadmin/labor/mvt/SHK/EPF_IED_working_group_Brussels_R01.pdf

Surfaces Eurasia Istanbul 2024

https://prof.bht-berlin.de/fileadmin/labor/mvt/SHK/Surfaces_Eurasia_2024-11-27_28_R01.pdf

Data sheets:

Product data sheet

https://prof.bht-berlin.de/fileadmin/labor/mvt/MDF-Terpentin/Classen_MDF-Turpentine_PDS_R04.pdf

Material Safety Data Sheet (German)

https://prof.bht-berlin.de/fileadmin/labor/mvt/MDF-Terpentin/sd17514_-_MDF-Terpentin_DE_DE_.pdf

Material Safety Data Sheet (Englisch)

https://prof.bht-berlin.de/fileadmin/labor/mvt/MDF-Terpentin/sd17514_-_MDF_Turpentine_EU_EN_.pdf

Material Safety Data Sheet (French)

https://prof.bht-berlin.de/fileadmin/labor/mvt/MDF-Terpentin/sd17514_-_Terebenthine_MDF_FR_FR_.pdf