VOC Emission Standards and Turpentine Oil Production (Creating additional profit with amortization well under 2 years)

Decorative Surfaces, Wien
March 6th, 2025

CLASSEN Group

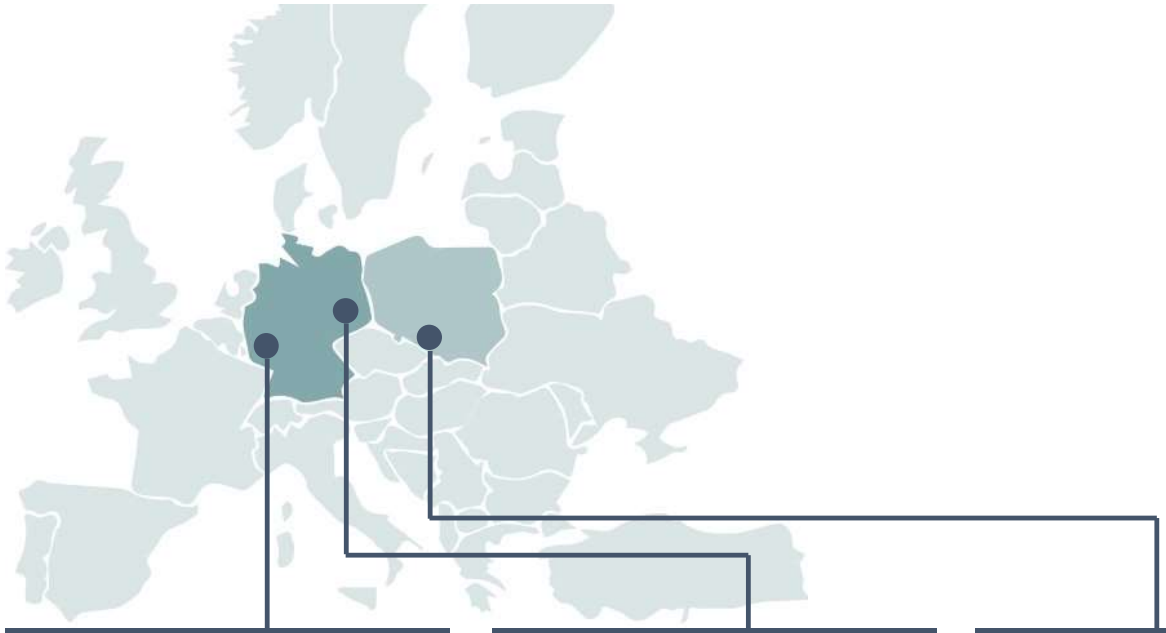
Floors For A Better Tomorrow.

www.classengroup.com

Prof. Dr.-Ing. Bernd Bungert, Moritz Menier,
Fiberboard GmbH, Classen Group
Baruth, Germany

CLASSEN Facts

Locations



Other sales locations:

Latin America	Miami (Florida), USA
North America	Vancouver, Canada
Eastern Europe	Rybnik, Poland
	Kiew, Ukraine
	Gagarin, Russia
Western Europe	Izegem, Belgium
Middle East	Istanbul, Turkey
Far East	Bejing, RP China

CLASSEN Headquarter

Location:	Kaisersesch
Production:	Polymer based flooring
Opening:	1994
Employees:	500
Capacity:	10 Mio. m^2/a
Hall space:	82.000 m^2

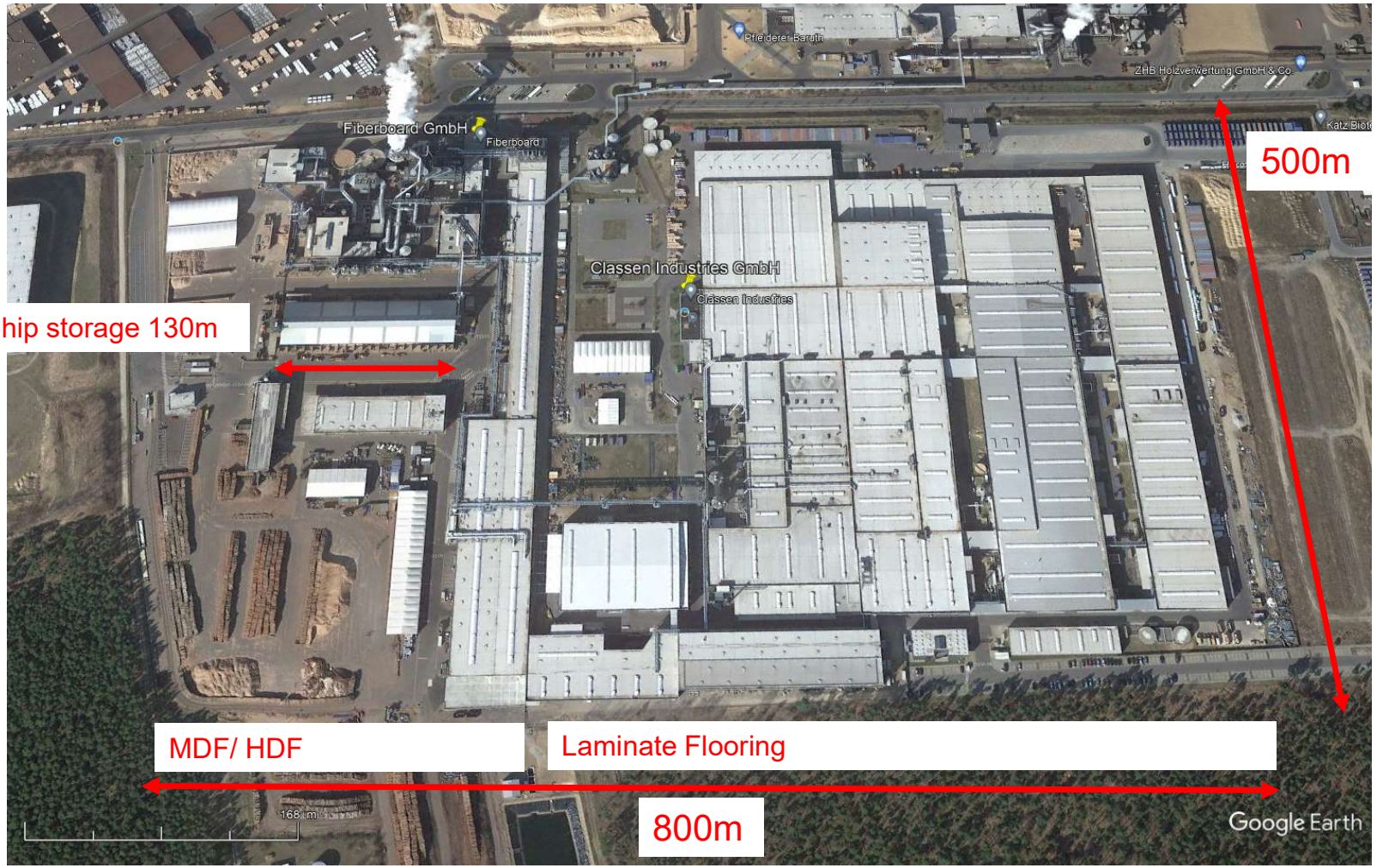
CLASSEN Industries / Fiberboard

Location:	Baruth
Production:	Laminate flooring & HDF-Boards
Opening:	2001 / 2007
Employees:	830
Capacity:	80 Mio. m^2/a
Hall space:	113.000 m^2

CLASSEN-Pol

Location:	Rybnik / Kattowitz
Production:	Interior doors, mouldings & frames
Opening:	1990
Employees:	655
Capacity:	600.000 Stk./a Doors 580.000 Stk./a Frames
Hall space:	20.000 m^2

Baruth: integrated MDF/ HDF production facility



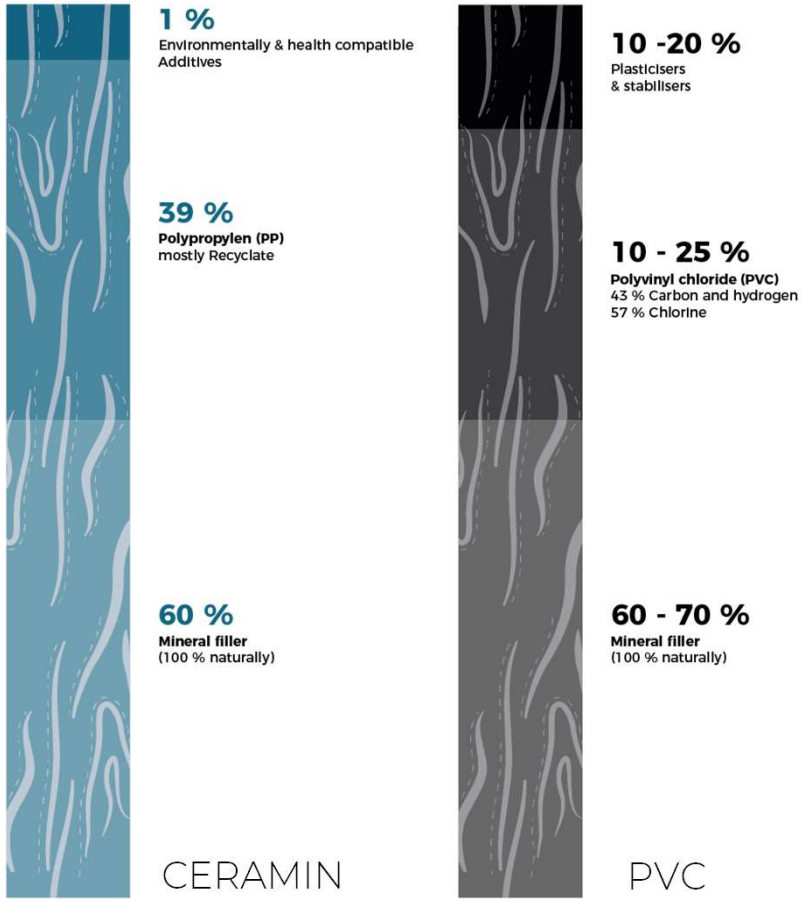
- Fully integrated: from tree to laminate flooring
- **Capacity MDF: 500.000 m³**
- **Capacity Laminate: 80 million m², of which 25 million m² digital printing**
- State-of-the-art logistics concept
- **€ 550 million total investment**

Kaisersesch: Polymer-based flooring

- New core material: mineral filler/polypropylene
- Optimal product design and the associated recyclability
- The healthy alternative for PVC solutions, the easy alternative for ceramic tiles
- Capacity: 10 million m^2 ; current expansion to 20 million m^2
- 225 million € total investment
- Size of the site: 463,000 m^2

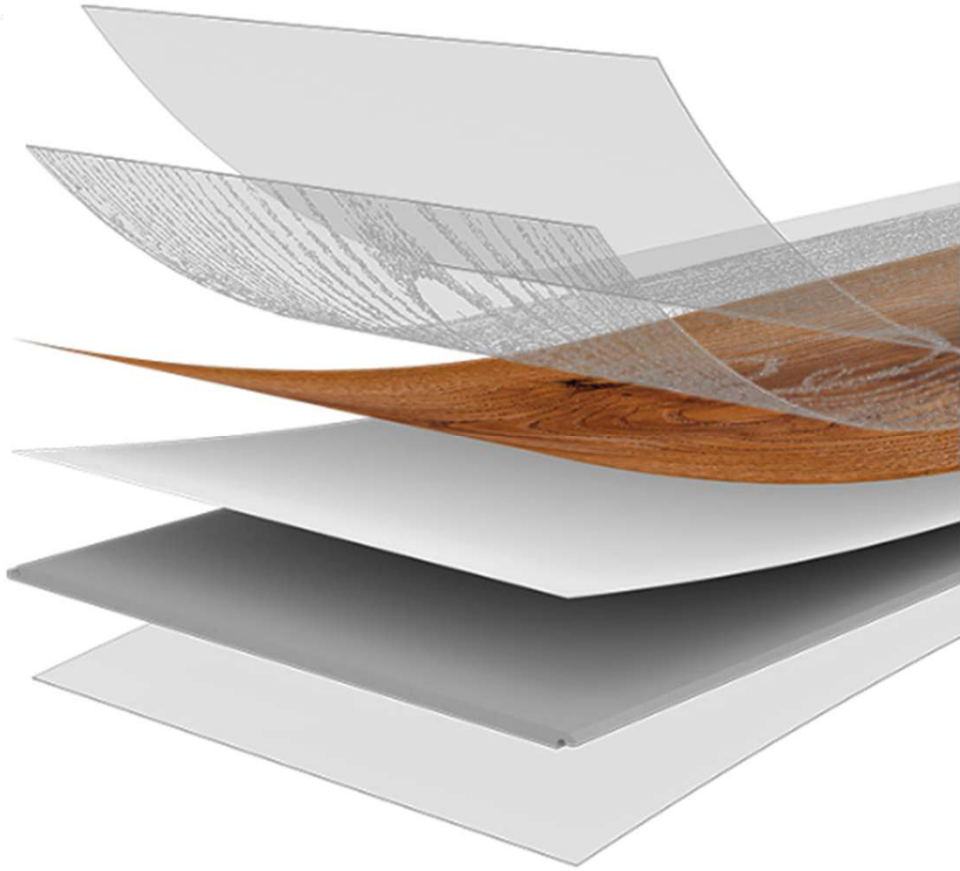
CERAMIN vs. PVC - how the components differ

- CERAMIN is odourless and does not contain any substances that can evaporate and are harmful to health.
  - → One quarter consists of already recycled PP material.
- In the case of PVC, harmful plasticisers and chlorine can be emitted over many years.



Kaisersesch: Polymer-based floor coverings

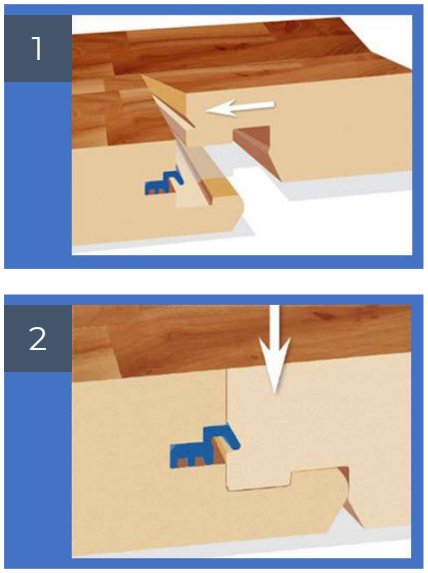
- Growing market for design flooring; predominantly polymer flooring
- Compared to laminate flooring
  - Waterproof
  - Better room sound and impact behavior
  - Lower thickness
- Most manufacturers produce PVC flooring; problem plasticizers, chlorine
- Harmful to health and the environment
- CLASSEN has made a conscious decision not to use PVC and has developed a floor based on polypropylene



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 / m^3 MDF
→ Energy neutral
→ Amortization well under two years

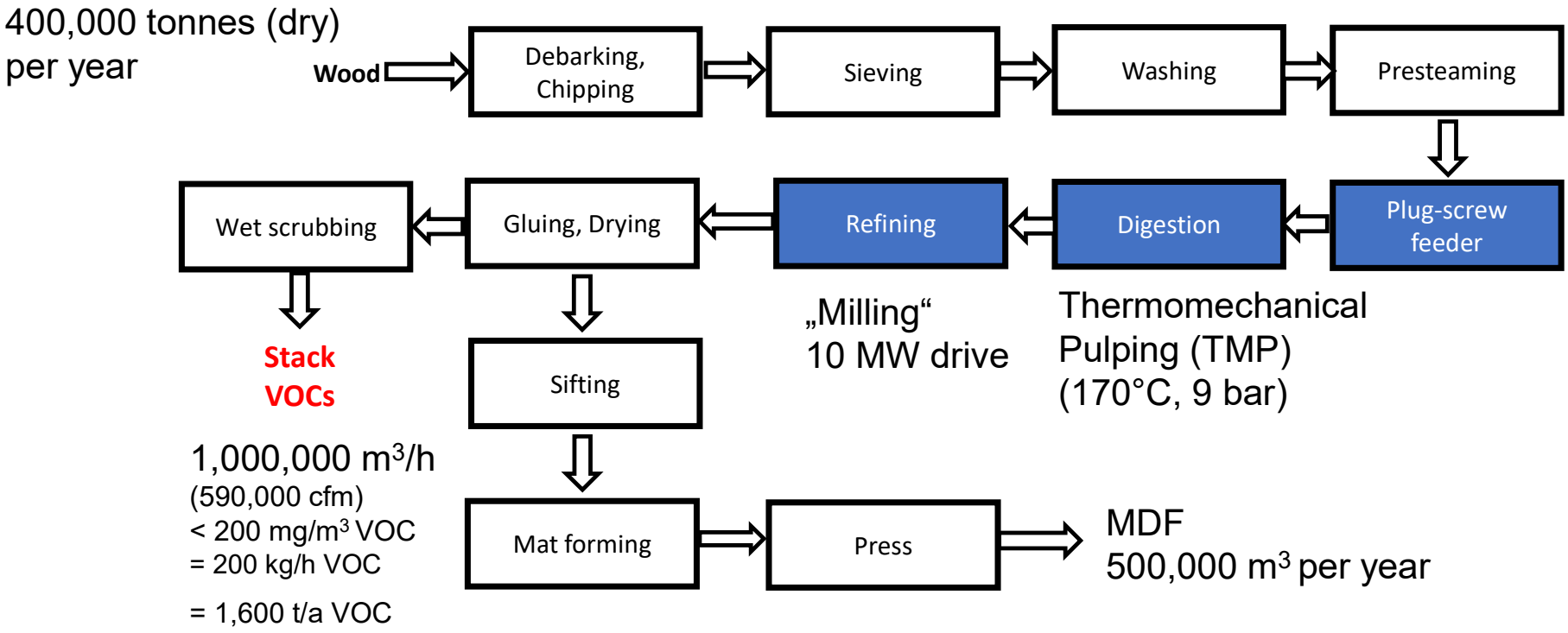
Fiberboard in Baruth/Mark

CLASSEN
Fiberboard GmbH is part of the CLASSEN Group

VOC: Volatile Organic Components

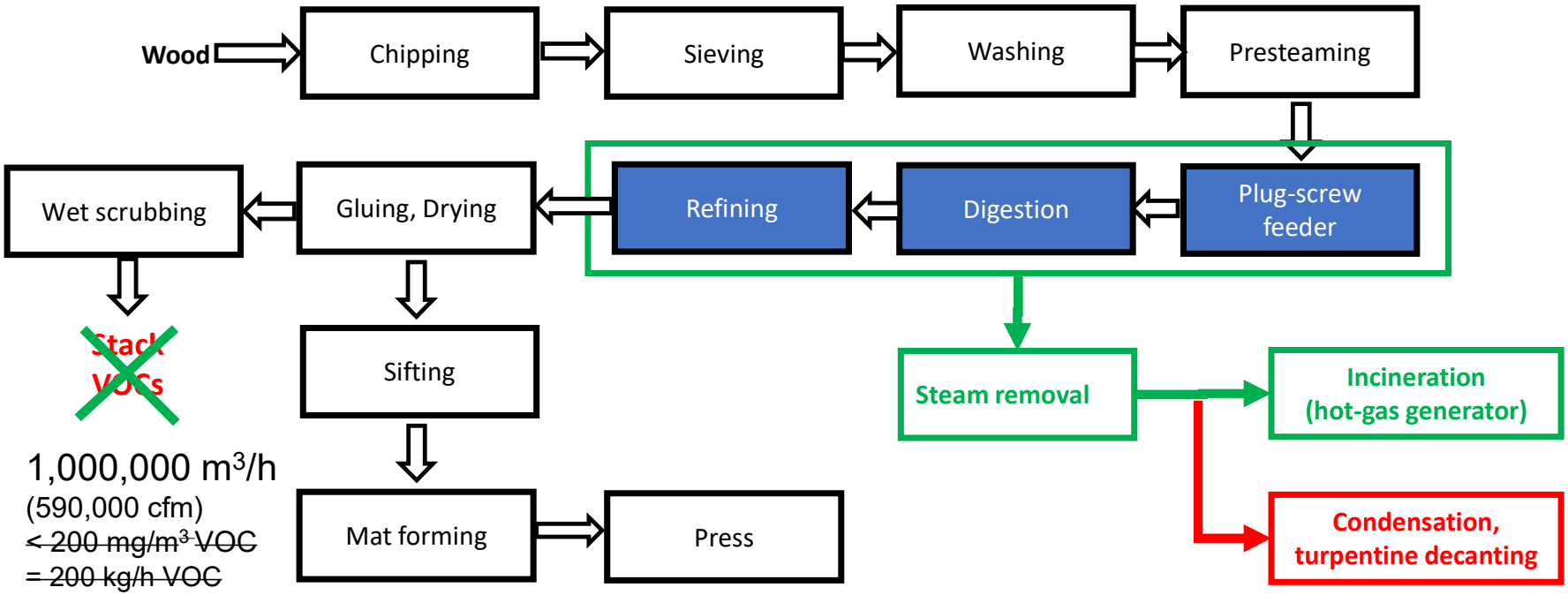
MDF Process

Fiberboard GmbH is part of the CLASSEN Group



MDF-process with VOC reduction with turpentine production

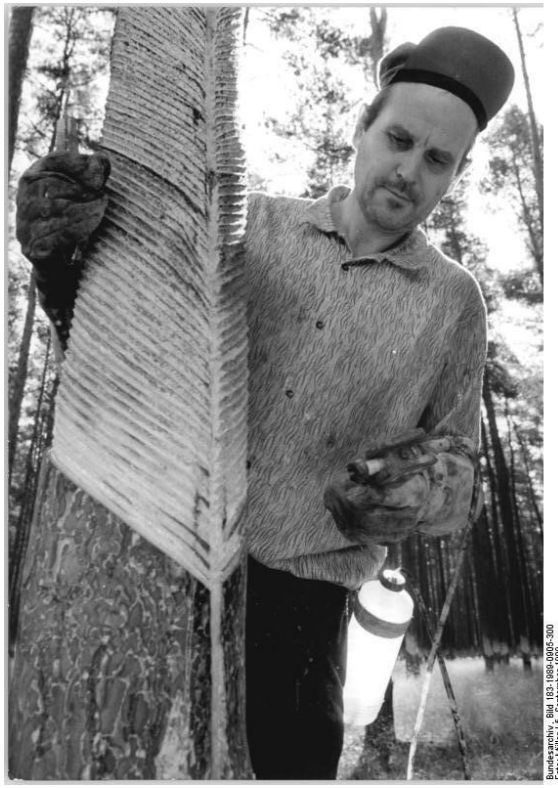
CLASSEN
Fiberboard GmbH is part of the CLASSEN Group



Terpenes – only the smell of resin and forest?

Fiberboard GmbH is part of the CLASSEN Group

- **resin** = sticky liquid from **softwood** like pine, larch and to some extend spruce
- **resin** = resin acids (rosin, **„ amber“**) + **terpenes**
- **terpenes = essential oils**
  (α-Pinen, β-Pinen, Δ-3-Caren, **Limonene**, …)
- Composition and amount depends on pine species
- Mixture of terpenes is called turpentine („genuine turpentine“)
- Smell like freshly cut wood or **perfume?**



Terpenes – only the smell of resin and forest? **No and Yes!**

CLASSEN®
Fiberboard GmbH is part of the CLASSEN Group

No!

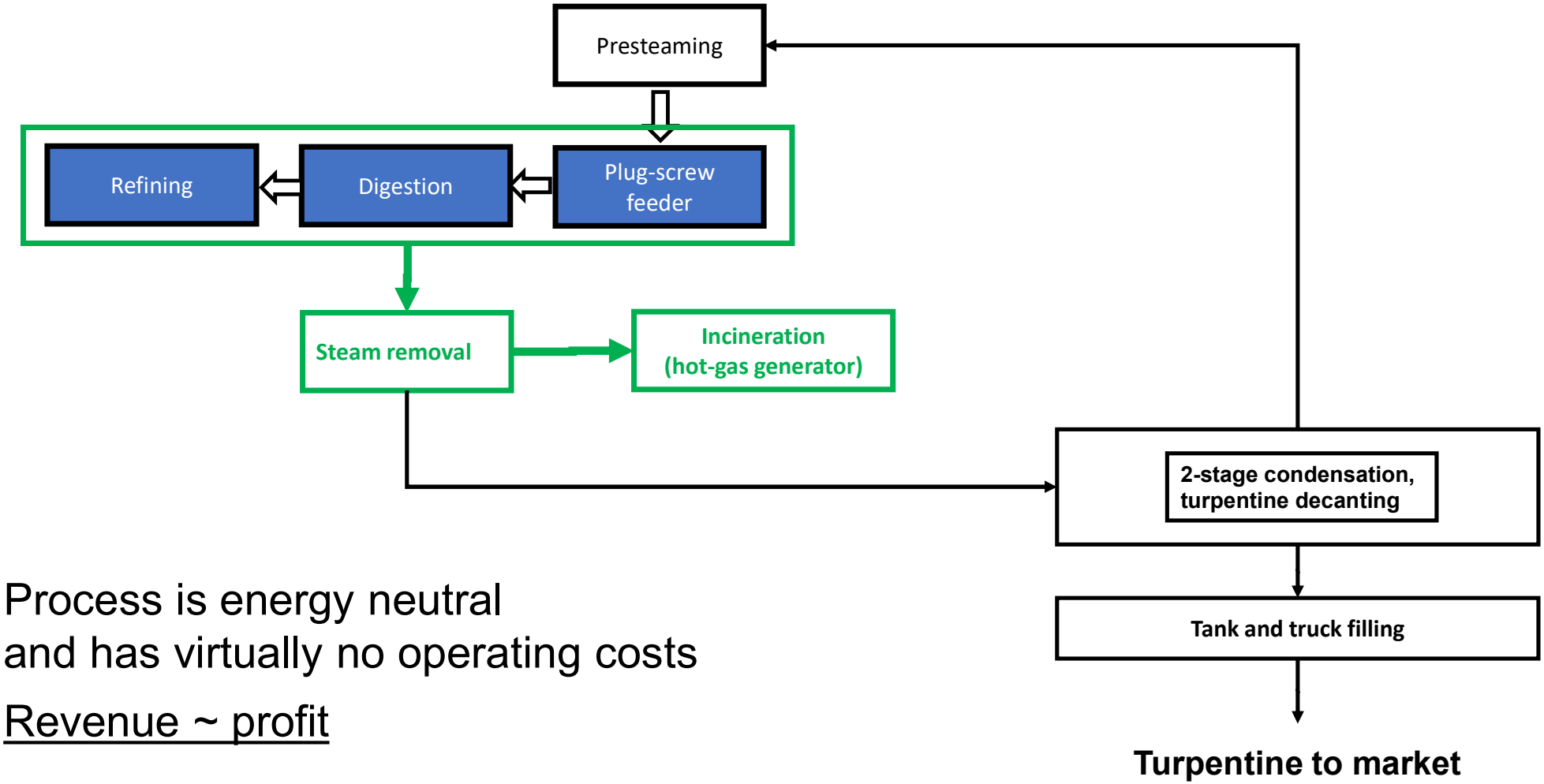
- Terpenes = most important group of **VOC** that form **photooxidants**
- NO_x (car exhaust gases) + VOC + oxygen = photooxidants (ozone)

Yes!

- Terpenes are a valuable and **sought after chemical**
- Market value creates **profit of 3 – 8 € / m^3 MDF**

Turpentine production with 2-stage condensation = energy neutral

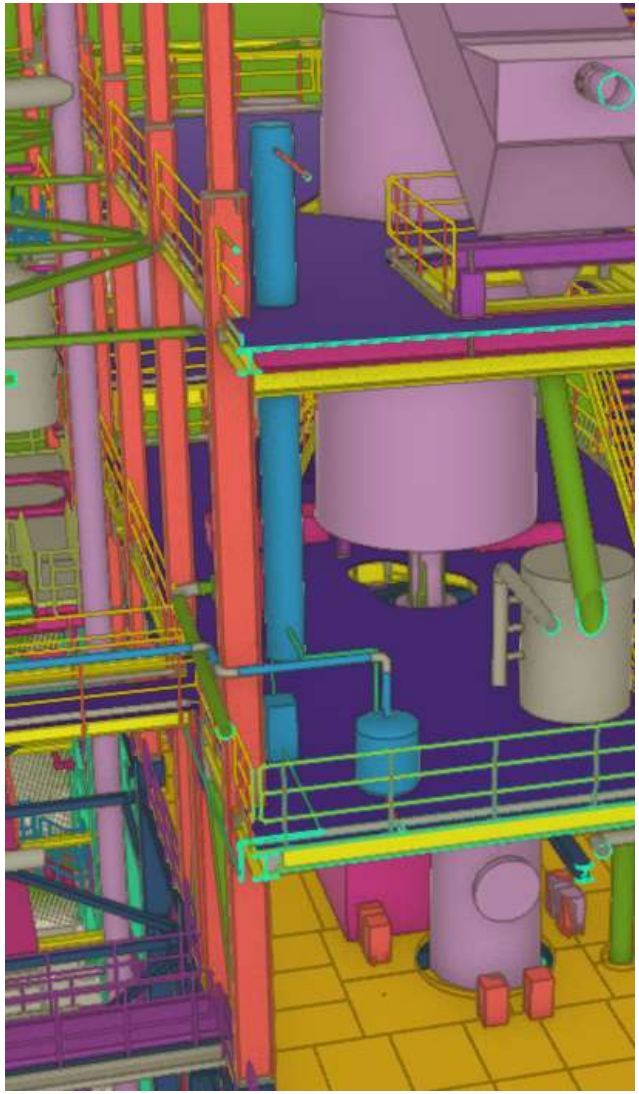
CLASSEN
Fiberboard GmbH is part of the CLASSEN Group

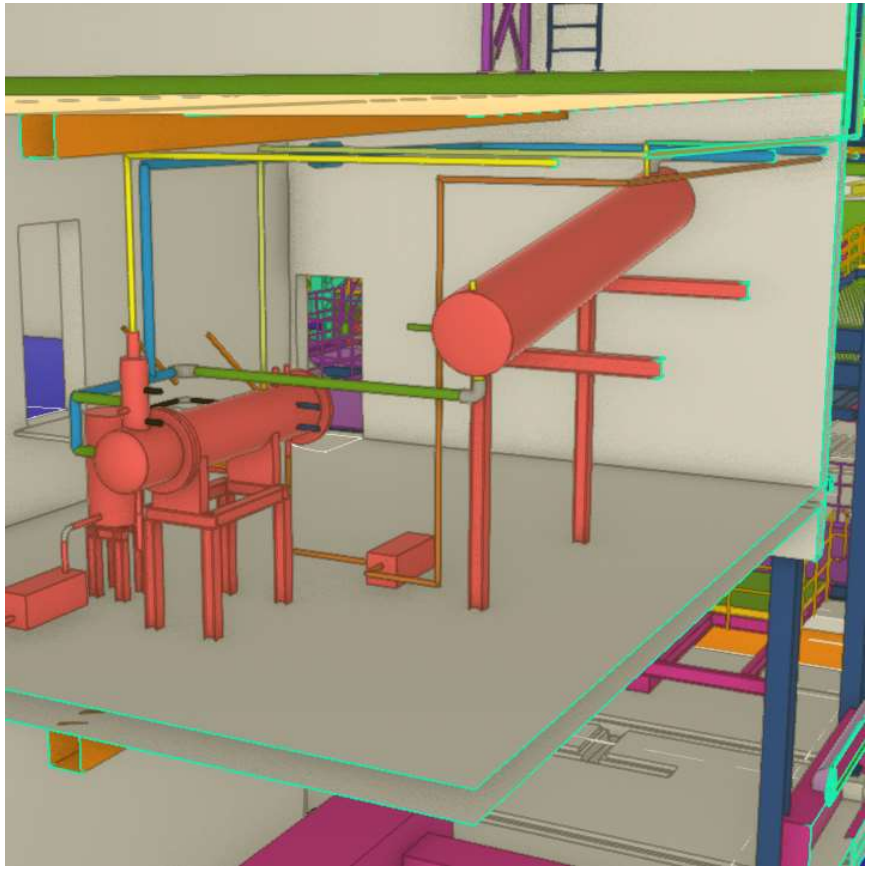


- Process is energy neutral and has virtually no operating costs
- <u>Revenue ~ profit</u>

MDF-Turpentine recovery plant under construction

CLASSEN
Fiberboard GmbH is part of the CLASSEN Group





- Simple plant: two-stage condensation, decanting, storage, tank-truck filling
- No Ex-Zones in your plant!

Benefits

1) Compliance with **EU environmental legislation on VOCs**
   ✓ EU-BAT: 120 mg/m^3 (dry) ~ 100 mg/m^3 (wet, old basis)

2) Reduction of *operating costs* by replacing **Regenerative Thermal Oxidization** (RTO, USA) **Savings of up to € 10 / m^3 MDF**

3) **Additional profit** generation by terpene production (turpentine) **€ 3…8/m^3 MDF**

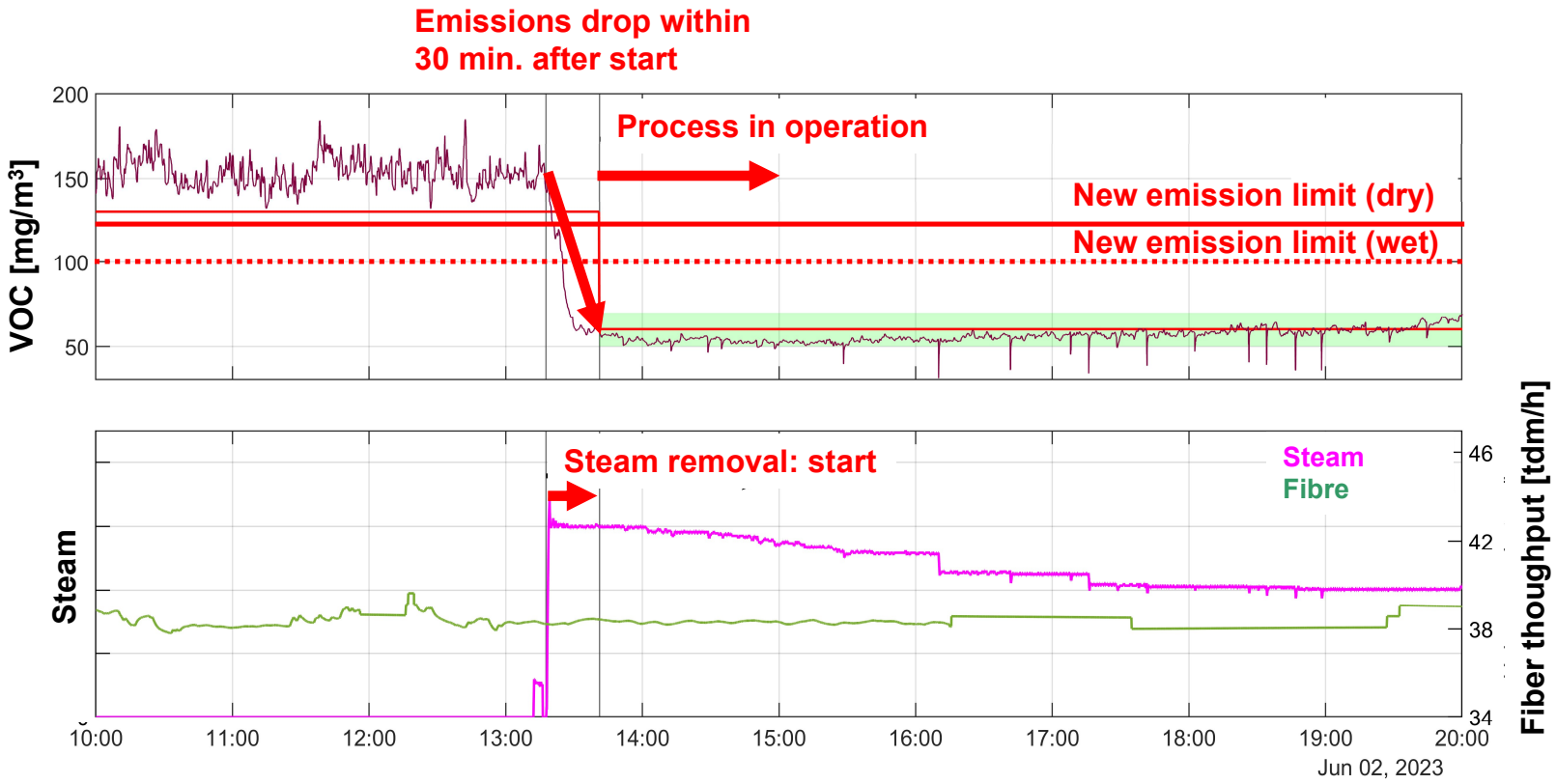
4) **No influence on product performance**

5) **Low investment costs, almost no operating costs**

6) Application for OSB, Particle Board: development under way

7) **Reduction of indoor emissions of boards**

1) Compliance with EU legislation



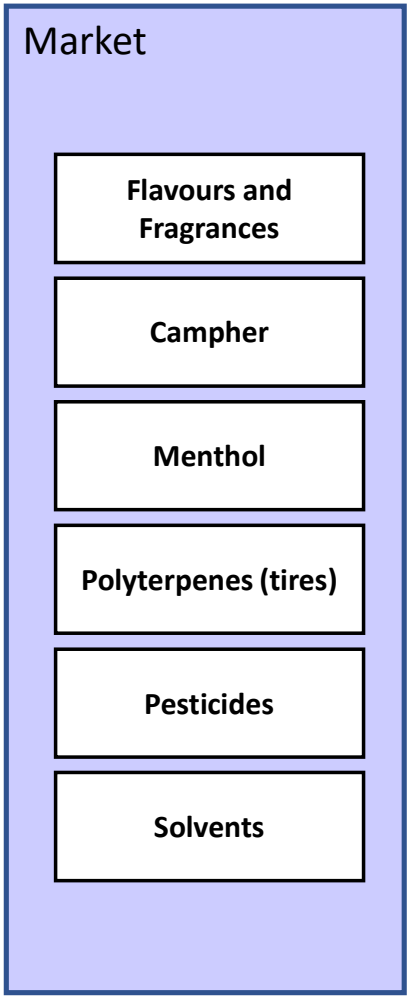
Turpentine production

✓ Reliable attainment of emission limits

✓ Proven in industrial operation

3) Revenue from Turpentine Production

- ✓ Turpentine = essential oil from pines
- ✓ Price depends on composition (α-pinene, β-pinene content)
- ✓ Turpentine is a sought after renewable raw material:
  - Flavour and fragrance industry
  - Chemical industry: tires, adhesives, ink
  - Sustainable Aviation Fuel (SAF)
- ✓ **Turpentine recovery system (MDF-T) in Baruth will come onstream in 2025 to give 1200 tonnes per year of turpentine (= more than one tank truck per week)**
- ✓ **Amortization time well under 2 years**
- ✓ **Profit: € 3…8/m³ MDF**



System installation

CLASSEN®
Fiberboard GmbH is part of the CLASSEN Group

Steam removal

Pipe to hot-gas generator

Combustion-chamber inlet

Business case examples: MDF Turpentine from 6 locations

- For purposes of illustration only
- A price* was calculated from the (α+β pinene) content based on
  - 14 year average price index for Brasilian Gum Turpentine
  - Source: Comexstat, Brazilian foreign trade statistics
  - BT = $ 2300/ ton (€ 2150/ton)
  - Price = (α+β pinene) content * BT
  - Further information: https://prof.bht-berlin.de/fileadmin/labor/mvt/SHK/PCA_Bungert_MDF-T_2023-09-19.pdf
- Busines cases:

1) Baruth Germany	(500,000 m^3/a; Pinus Sylvestris)
2) Brazil	(600,000 m^3/a; Pinus Eliottii)
3) USA	(300,000 m^3/a; Pinus Eliottii)
	(300,000 m^3/a; Pinus Taeda)
4) Australia, New Zealand	(300,000 m^3/a; Pinus Radiata)
5) Portugal, Spain	(300,000 m^3/a; Pinus Pinaster)
6) Turkey	(880,000 m^3/a; Pinus Sylvestris)

* No business information, only meant to assess an order of magnitude

Comparison of 6 busines cases

Nr.	Site	pine	MDF m^3/a	Wood t/a	Turpentine kg/t	Turpentine t/a	(a+b)/ (a+b) e	Turpentine €/t *	Estimated* Revenue [€]	€/m^3 MDF
1	Baruth, Germany	pinus sylvestris	500.000	400.000	3	1.200	0,55	1.183	1.419.000	2,8
2	Brasil	pinus eliottii	600.000	480.000	4,6	2.208	1,00	2.150	4.747.200	7,9
3	USA	pinus eliottii	300.000	240.000	4,6	1.104	1	2.150	2.373.600	7,9
		punis taeda	300.000	240.000	3,2	768	1,02	2.193	1.684.224	5,6
4	Aus, NZ	pinus radiata	300.000	240.000	1,7	408	1,09	2.344	956.148	3,2
5	Spain, Portugal	pinus pinaster	300.000	240.000	4	960	1,02	2.193	2.105.280	7,0
6	Turkey	pinus sylvestris	880.000	704.000	3,5	2.464	0,68	1.462	3.602.368	4,1

* No business information, only meant to assess an order of magnitude

European Green Deal, INCITE

- New technology follows the requirements of the EU Green Deal
- New technology will be listed at INCITE
- The Classen MDF-Turpentine process is a **truly new and sustainable product**

Summary

1) New process reduces emissions dramatically:
   - VOC emissions from dryer
   - Indoor emissions from board (MDF, OSB, Particle Board)

2) Profit generation of € 3 – 8 / m^3 of MDF

3) No influence on product performance

4) Low investment costs, almost no operating costs
   = amortisation well under 2 years

5) Classen will be happy to install the new technology at your plant

Contact

Prof. Dr.-Ing. Bernd Bungert
Bungert@IB-Bungert.de
+49 – 176 5532 6667

Moritz Menier
moritz.menier@classen.de
Mobil US: +01 (336) 425 – 1179
Mobil DE: +49 (160) 712 – 8152

Maciej Górecki
maciej.gorecki@classen.com.pl
+48 602 134 928