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Planning a pellet plant (example for wood pellets)

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BEA - About us

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BEA offers technical services for production and thermal utilization of solid biofuels, especially pellets.

Engineering and consultancy

- Process Development (e.g. Torrefaction)
- Engineering incl. permissions for pellet plants
- Business plans and Feasibility studies

Production and supply of lab equipment

- For pellet plants
- For fuel laboratories

Fuel analysis and Quality control

- Accredited laboratory for solid fuel analysis
- Contract with 130+ pellet production plants for EN*plus*®/DIN*plus* inspection worldwide
- Experts with > 20 years experience

PPA professional pellet analyzer

Gutmann, largest pellet store in Austria

Next Fuel / Andritz Torrefaction technology

Mechanical durability tester for pellets

> 400 Tumblers sold since 2009
(status 4/2023)

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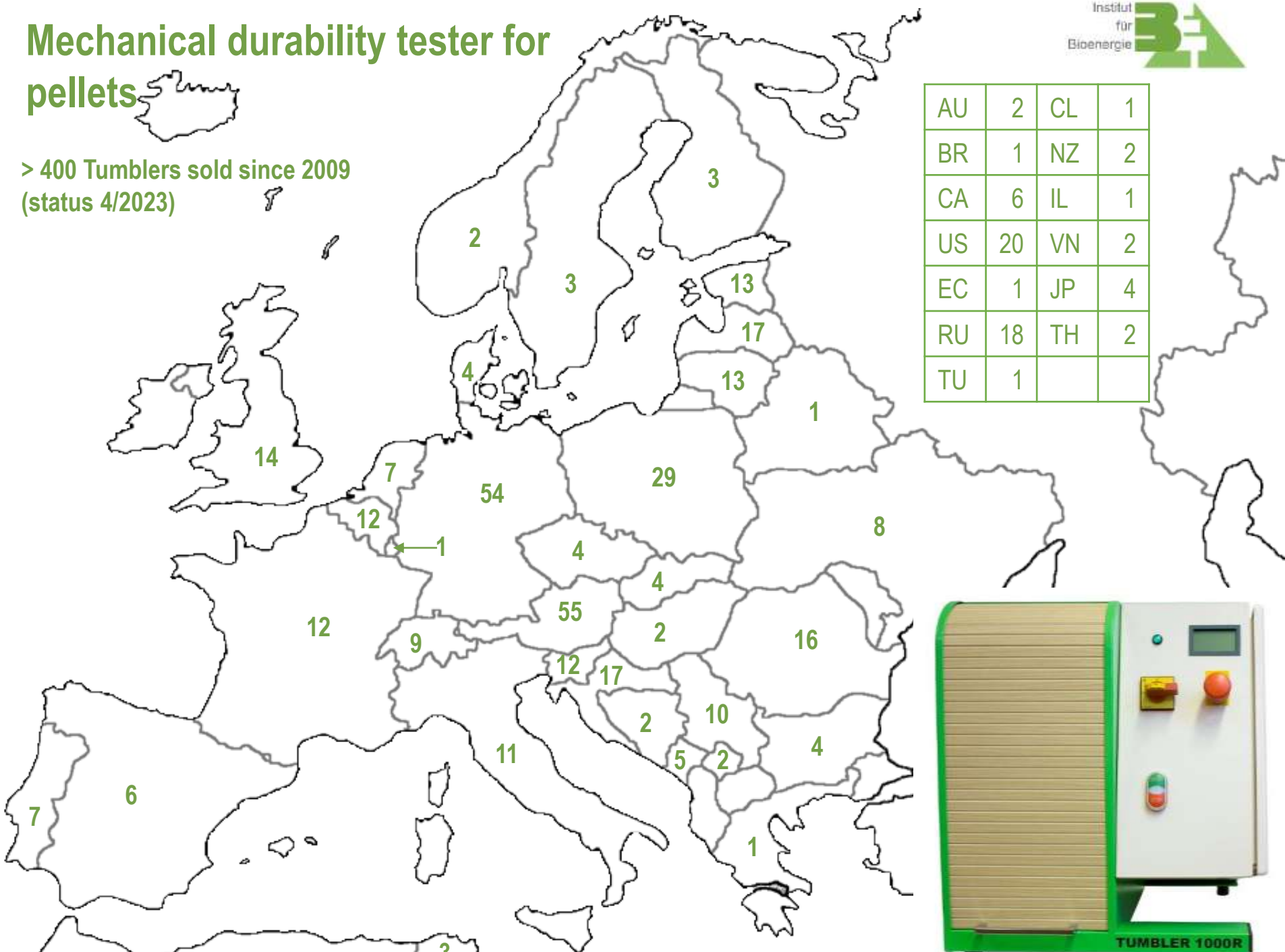
AU	2	CL	1
BR	1	NZ	2
CA	6	IL	1
US	20	VN	2
EC	1	JP	4
RU	18	TH	2
TU	1		



Example pellet plant I

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Good ideas

- Raw material with high potential and low competition (low quality hardwood)
- Innovative drying and production concept reducing drying energy
- New machine technology

Mistakes made

- No professional engineering
- High downtime
- Wrong product placement

Source: BEA

Example pellet plant II & III

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Source: BEA

Good ideas

- High quantity production using economy of scale
- Placed in port for easy export / in the sales area

Mistakes

- Raw material sourcing and logistics not planned properly

Source: www.phoenix.com

The business Idea

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The first idea for a pellet plant:

- Evaluate raw material availability:
  - Quantity
  - Quality
  - Availability next 10 years
  - Availability during the year
- Define the product and quality requirements

⇒ Engage a consultant / engineer for:

- Plant concept
- Business model
- Tenders

Raw materials for wood pellets

logs

forest wood residues → A1, A2, B
round wood → A1, A2

saw-mill byproducts

saw dust → A1 (without bark)
wood chip → A2 (with bark)
off-cuts → A2 (with bark)

wood from agriculture

short rotation plants → A2, B
landscape conservation → A2, B

recycling wood

recycling wood (A1), chemical untreated → B*

* Prohibited by law in some countries e.g. Italy and France

pellet use

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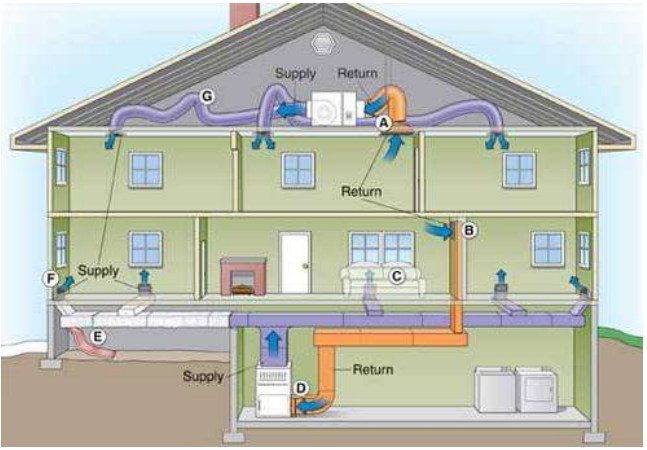
Power generation

~ 50% of current use

Animal bedding &
oil patch absorbent &
Smoking stove

High price, low quantity



Cooking

Future market

Africa/Asia?

Heat & hot water
Residential/commercial/
institutional

~ 50% of current use

Source: Wood Pellet Association of Canada

Source: Mimimoto

Current markets for wood pellets (and quality topics)

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Bagged, 15kg

A1 / A2

Stoves

⇒ Heating a room

Low fines, length, ash content

~ 2 - 20 to

A1

Central heating

⇒ Heating of house and warm water

Fines, durability, ash, ash melting

Bulk

~ 20 - 1000 to

A1 / A2

Heating plants / industry

⇒ Hot water, grids

Fines, durability, ash melting

I1 - I3

>1000 to

Power plants / CHP

⇒ Power, heat

Chlorine, nitrogen, heavy metals, particle size distribution in pellet

Step I planning a pellet plant

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The investor must provide

- Desired plant capacity
- Product requirements and raw materials available
- Product storage size and intended trade form
- Site to build plant and frame conditions: especially available infrastructure like power, water, etc.

Consultant should

- Check legal requirements
- Calculate mass & energy balance
- Create block chart (main technologies)
- Evaluate different technologies for specific project
- Create a process flow diagram (PFD)

Mass & energy balance

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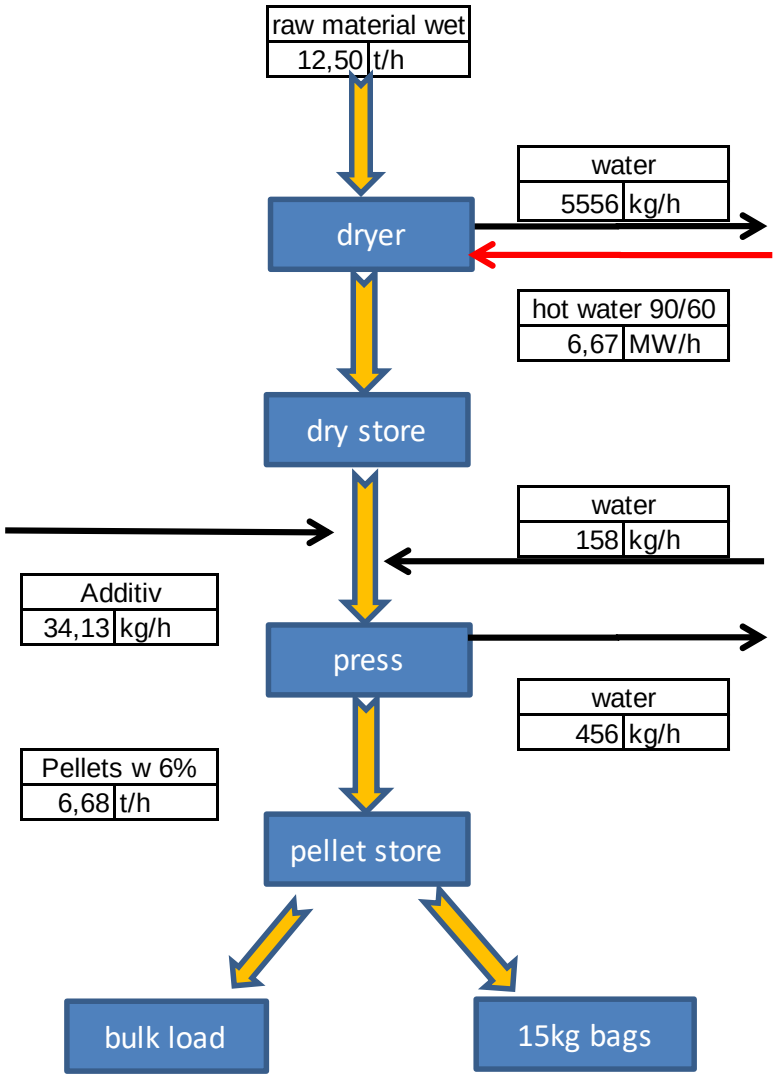
Parameter

Projet	WBA - webinar
capacity	48 106 t/a
operating hours	7 200 h/a

process step	Input	Output	water input	water output	water balance
	t/h	t/h	%	%	kg/h
wood chips wet	4,17		50,0		
saw dust, wet	8,33		50,0		
wet grinding	4,17	4,17	50,0	50,0	0
dryer	12,50	6,94	50,0	10,0	5556
shavings	0,00			0,0	
dry storage	6,94	6,94	10,0	10,0	0
hammermill	6,94	6,94	10	10	0
condtioner	6,94	7,10	10	12	-158
additive	0,03	7,14			
pellet press	7,14	6,83	12	8	310
cooler	6,83	6,68	8	6	145
storage	6,68				



Block diagram, example

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Chips, sawdust

CHP heat

Shavings

Sieving, wet grinding

Dryer

Dry storage

Dry grinding

Pellet plant

Pellet storage

Bulk loading

Packaging

dryer

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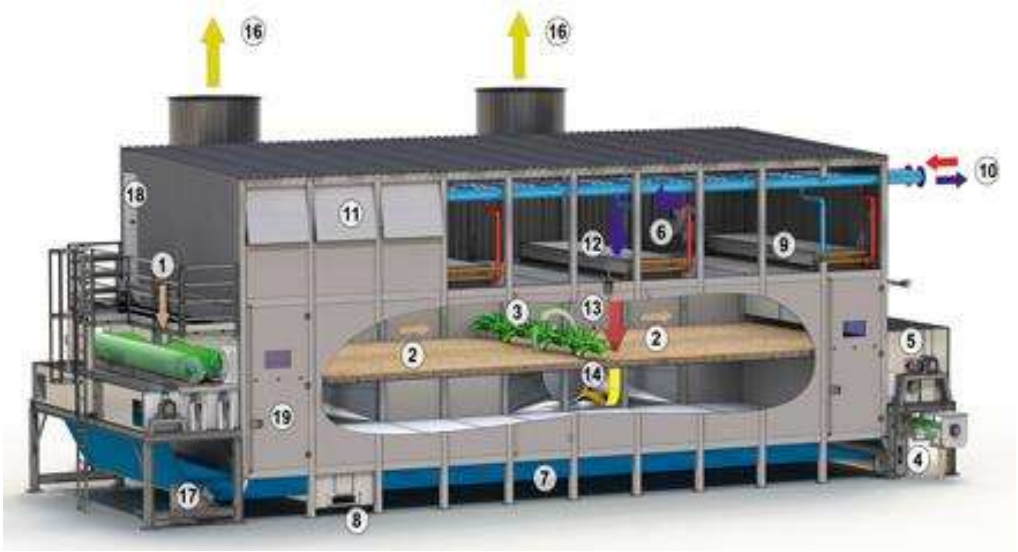
System decision

- Belt dryer: requires hot water (=> boiler), more expensive but safe operations and low emissions
- Drum dryer: fired with biomass, cheap in investment and operation



Source: Stela, Swiss Combi

Source: BEA, plant Georgia Biomass

Pellet press

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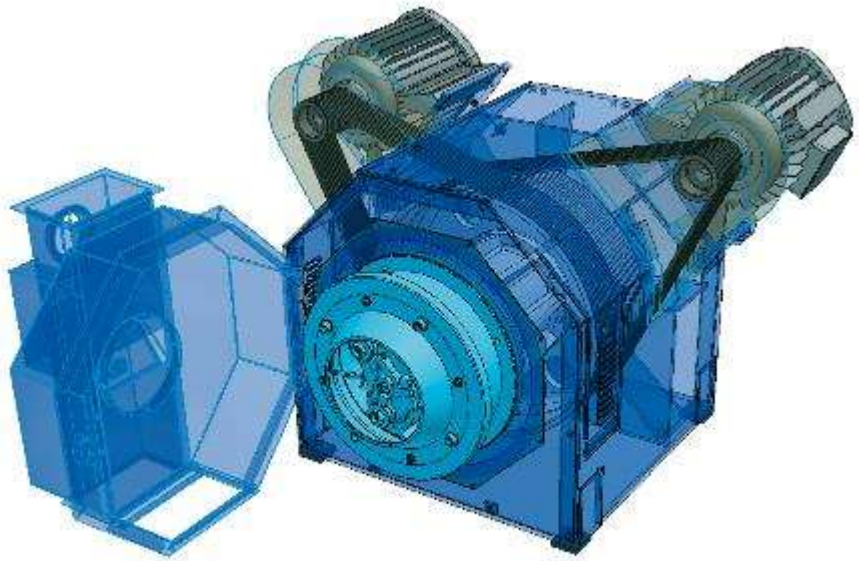
System decision

- One big press or several small lines?
- Flat die press
- Ring die press



Source: Salmatec

Source: Kahl

Selection of size and machine

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Not all technology offered on the market is suitable for every purpose!

- Woody biomass is difficult to pelletize, needs strong machines
- Argro-residues eventually difficult to handle and convey

Example - Not suitable for wood pellets:

Small machines

Source: www.biofuelmachines.com/how-to-make-your-own-wood-pellets.html

Mobile systems

Source: www.hsbiopellet.com/product/Pellet-Press/Movable-Pellet-Plant.html

Pellet storage

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System decision

- Silo storage
- Flat storage
- Only bagging, no storage

Source: www.liquidplanner.com/

Source: BEA

Process flow diagram (PFD)

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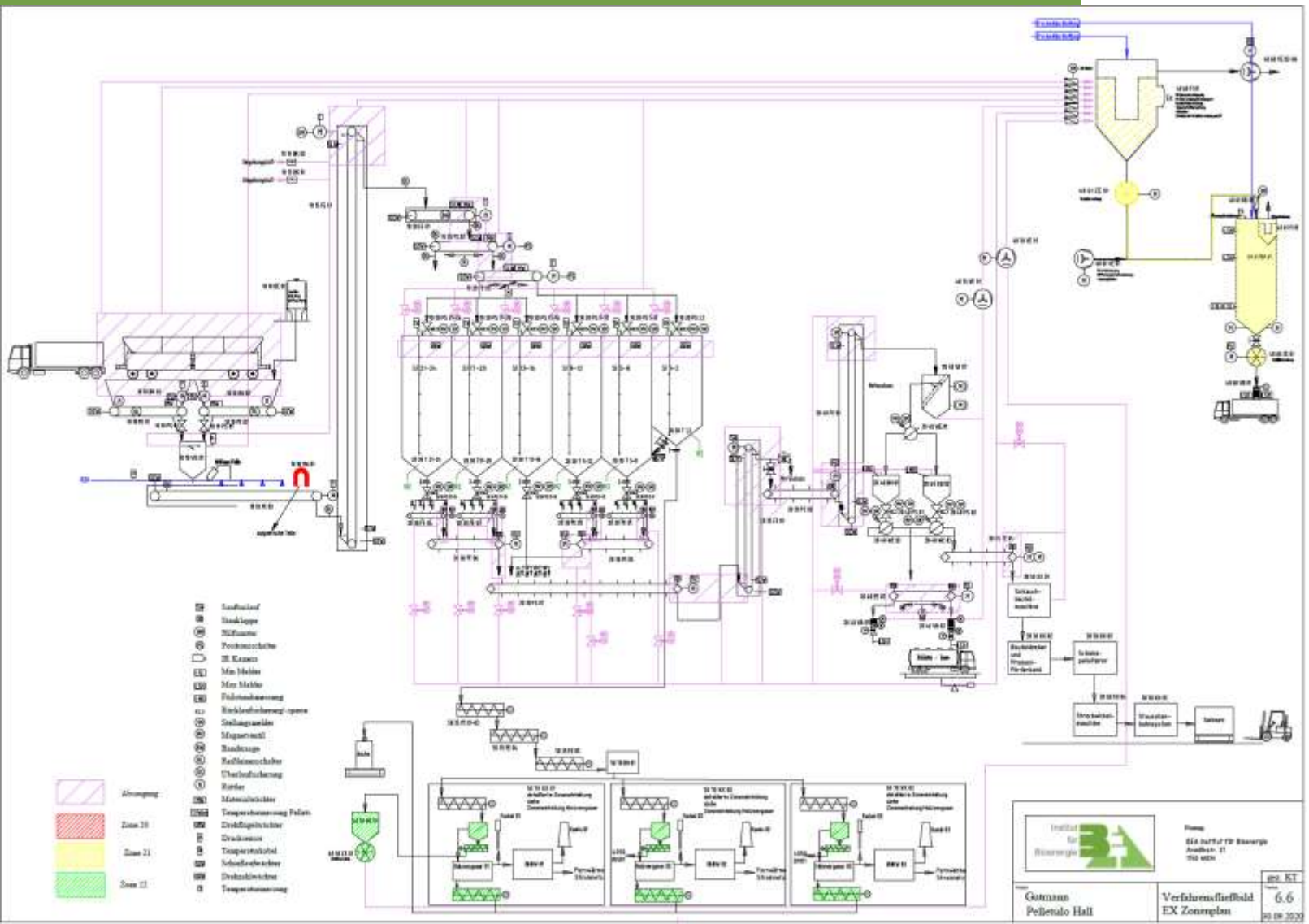

Example !!

Step II planning a pellet plant

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The investor must provide

- Expected costs for raw material
- Expected price for product
- Costs for power, water, etc.
- Financial conditions (e.g. interest rates, capital costs)

Consultant should provide a project feasibility (bankable project)

- Create a plant layout
- Estimate investment costs
  - Invest for technical equipment incl. Installation and comissioning
  - Invest for site, construction incl. Infrastructure (usually in close cooperation with investor and needs local partner!!)
- Estimate operating costs
- Provide a business plan

Layout and visualization

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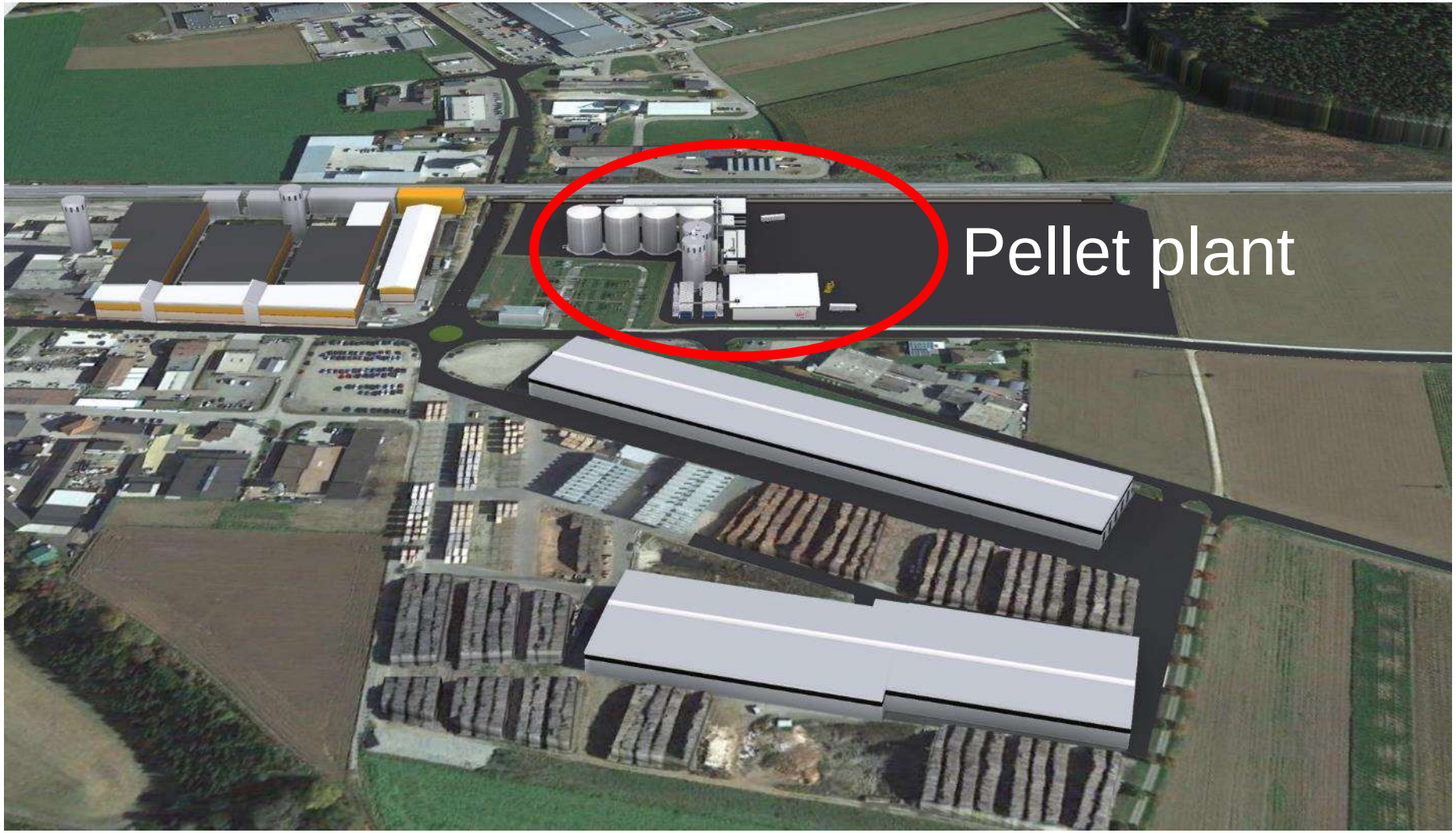

Source: Teccon engineering, study of a pellet for wood processing industry, 150.000 t

Layout and visualization

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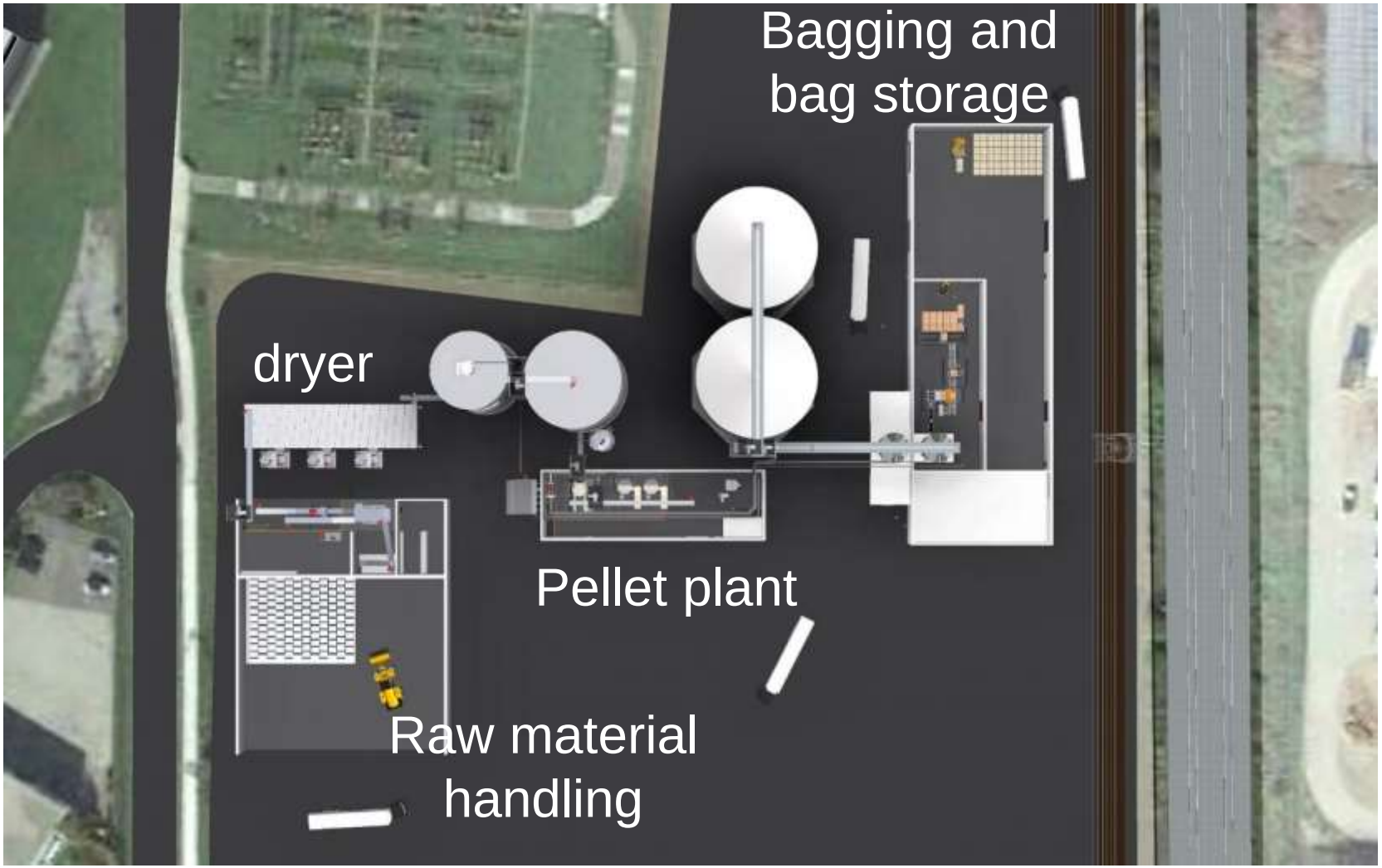
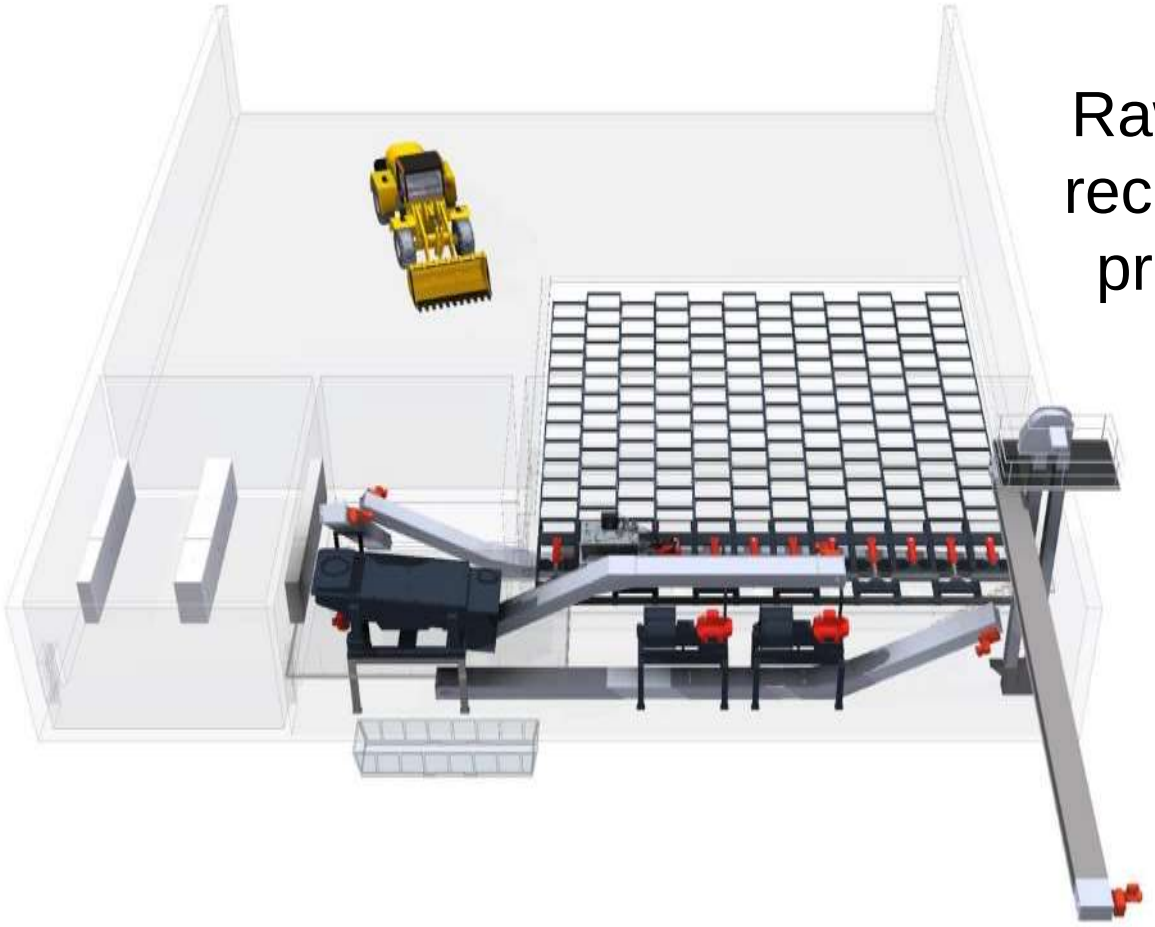


Source: Teccon engineering, study of a pellet for wood processing industry, 150.000 t

Layout and visualization



Raw material reception and preparation

Source: Teccon engineering, study of a pellet for wood processing industry, 150.000 t

Layout and visualization

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Source: Teccon engineering, study of a pellet for wood processing industry, 150.000 t

Layout and visualization

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Source: Teccon engineering, study of a pellet for wood processing industry, 150.000 t

Investment, calculation

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Total investment cost for a 50.000 t wood pellet plant, project „WBA webinar“

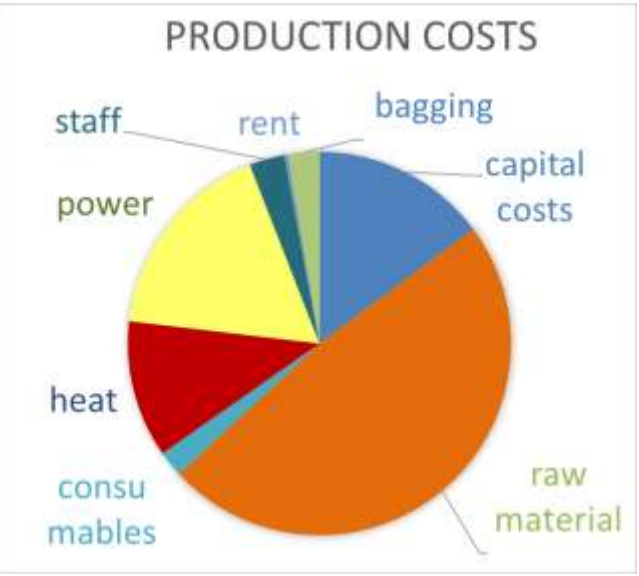
Invest	
construction	3 500 000 €
wet material conveying	2 200 000 €
dryer and dry silo	2 000 000 €
pelleting, truck loading	2 150 000 €
pellet storage, conveying	1 950 000 €
cabelling, control system, installation, comissioning	1 450 000 €
planning and permit	500 000 €
unexpected	500 000 €
total	**14 250 000 €**

Operating costs

Total annual operating cost for a 50.000 t wood pellet plant, project „WBA webinar“

operating costs	
spare parts	149 605 €
consumables (water, oil, additive)	125 284 €
heat for dryer	2 160 000 €
power	320 413 €
staff	370 000 €
rent	40 000 €
total	**3 165 303 €**

Summary



Ready to order and implement!

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Business Model pellet plant
Projekt WBA webinar

Input

sawdust wet	30 000 t (db)/a
costs sawdust wet	140,00 €/t (db)
wood chips	15 000 t (db)/a
cost wood chips	120,00 €/t (db)

Output

Output 1: bulk	60%
Output 2: 15kg bags	40%
Price bulk (EXW)	290,00 € / t
price 15kg bags (EXW)	308,00 € / t

Project-Parameter

operating hours pellet line	7 200 h/a
total production	**48 106** t/a

Business Model

total investment	**14,3 Mio €**
capital costs	**38,36** € / t
raw material	**124,72** € / t
operating costs	**95,47** € / t
consumables	5,71 € / t
heat	29,93 € / t
power	44,50 € / t
staff	7,69 € / t
rent	0,83 € / t
bagging (calc. on total!)	6,80 € / t
production costs	**258,56** € / t
sales price	**297,20** € / t
earning	**38,64** € / t
total sales	**1 858 940 €/a**

financial parameters

equity	20,0%
cost of equity	15,0%
cost of debt	2,5%
capital costs	5,00%
tax rate	25,00%

financial indicators

Free Cash Flow	**3,7 Mio €**
EBIT (average)	**2,3 Mio €**
net earnings	**1,5 Mio €**
net present value	**17,3 Mio €**
amortization period	**4,16 years**
Internal Rate of Return	**25%**

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Interested in a feasibility ?

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