

Introduction Meeting Low Temperature Drying Cement Industry

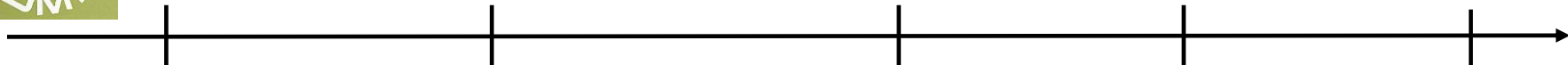


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- Company overview/portfolio & markets
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- Cement Industry: References
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SWISS COMBI – family company in 3rd Generation



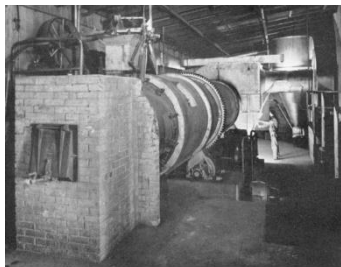
1960

1980

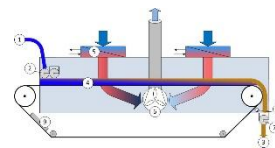
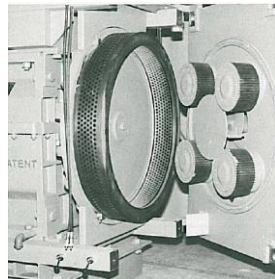
1983

1990

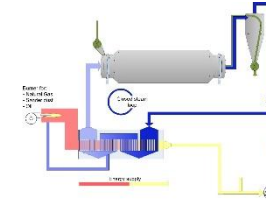
2019



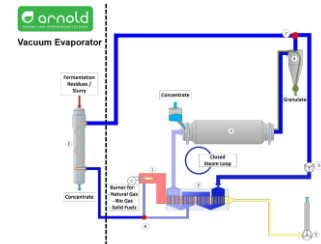
Grastrocknungsanlage mit einer stündlichen Leistung von 2000 kg Frischgras. Es werden auch viele andere Produkte getrocknet.



KUVU/BD



ecoDry

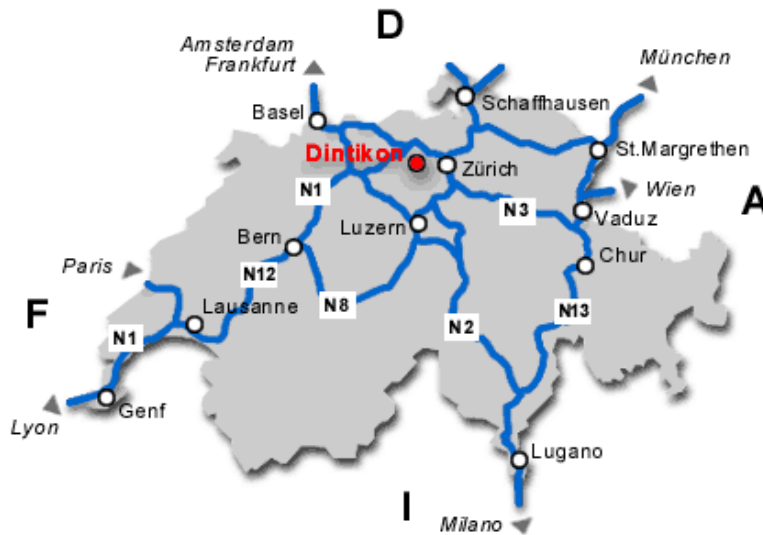


eFF
(ecoFertilizer
Factory)

Product Quality

Product Quality + Energy + Emissions

SWISS COMBI - Location



- Brand
 - **SWISS COMBI** (W. Kunz dryTec AG)
- Key Figures
 - Turnover: appr. TEUR 15'000
 - Headcount: appr. 30
- Key competence
 - Drying technology for biomass @atmosphric pressure**
- Business Model:
 - EPC: Engineered Solutions:
 - Energy savings
 - Emission reduction
 - Technology provider → licences/partner
 - Service/After Sales

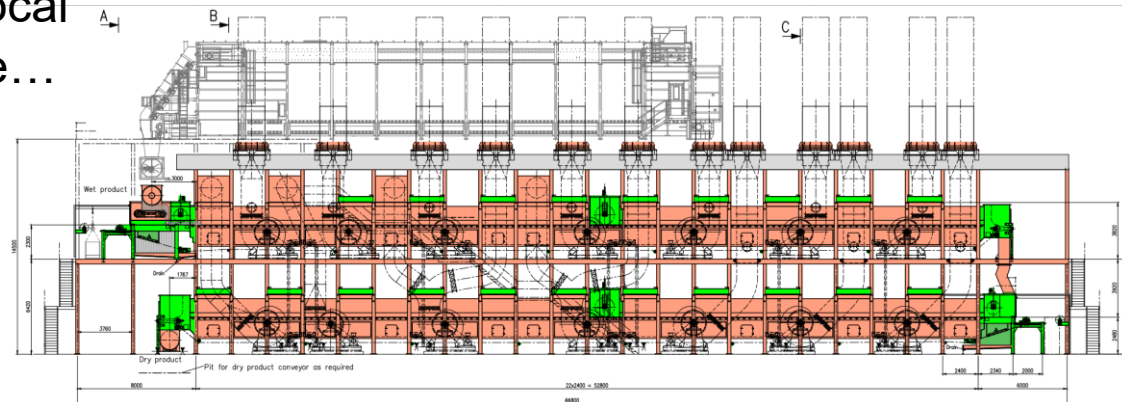
SWISS COMBI

Your partner for Drying Solutions – Delivery Models

- Complete delivery from Swiss Combi (delivery of complete dryer package to Enduser site)
- Partner Model= delivery of key Components + Engineering acc. SOR (Split of Responsibilities)

Typical SOR: delivery of Inlet /Outlet Modules and Engineering to China:

-> optimize import duties/tax, local currency/FOREX, Delivery time...



SWISS COMBI

Customers & Partners by Industries... (extract)

ALCOBIOFUEL
power of nature

ADM

TATE & LYLE

GEA

Lantmännen

Bioethanol&Starch

ĐURO ĐAKOVIĆ

drax

binderholz
tiptop timber

HS TIMBER GROUP

Wood Pellets

BÜTNER

PRÚDESA

DEDERT

Valmet
FORWARD

Exclusive partners

KRONOSPAN

ZRK
MDF & PARTICLEBOARD

Panel Boards

azpo

Energy

CRH

Cement

OKI PULP & PAPER
pulp and paper products

Bracell

Metsä

Renova

Pulp & Paper

SÜDZUCKER

Tereos

AGRANA

THAI ROONG RUANG SUGAR GROUP

Lin

MITR PHOL

Sugar Beets

Sugar Cane Mills

SWISS COMBI Portfolio

Drying and Energy Recovery Solutions



Installed Plants

500+

Countries

56

Industries

15

Years of experience

60+

SWISS COMBI Test Capabilities & Demonstration Plants Overview



**Static Test Dryer
(product samples
5 kg batch)**

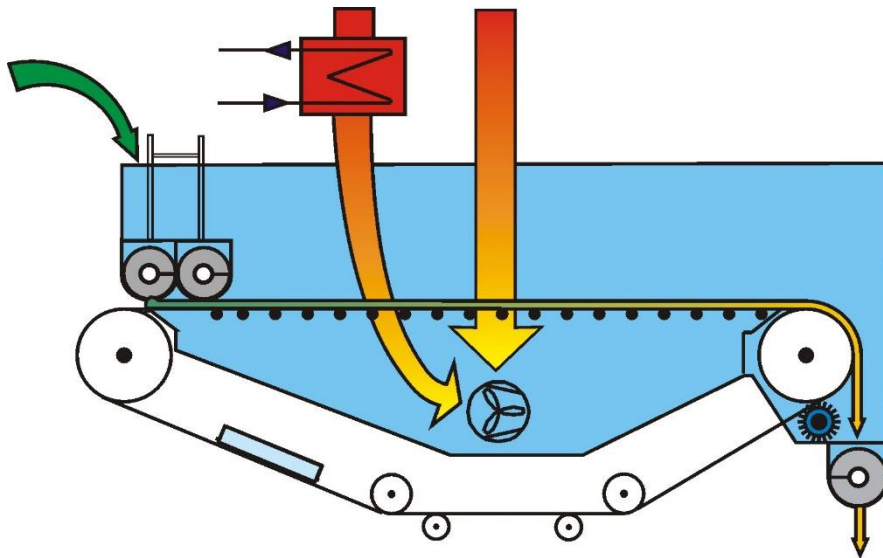


ecoDry – Evap ca. 100 kg/h test plant



Belt Dryer continuous test plant – 2 m²

Technology low temperature Belt dryer



**Belt dryer and KUVO System
(low temperature drying)**



SWISS COMBI Technology: Belt Dryer

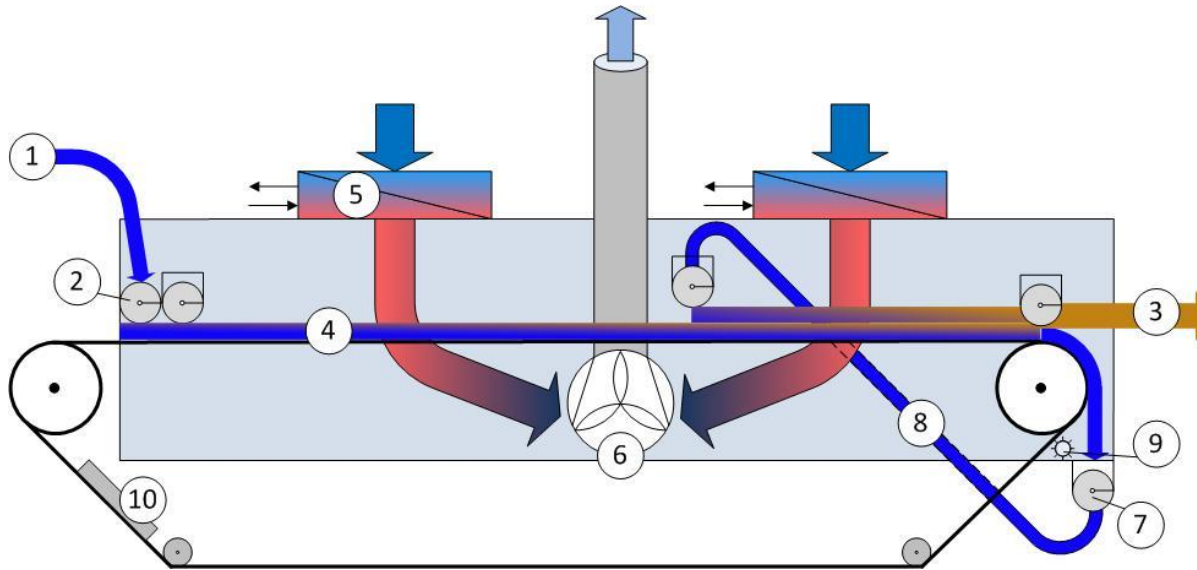


*Belt Dryer in Ruyères, CH , 6.7 t/h – 130 m²
drying of Sawmill (Wood pellets)*

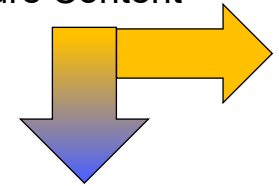


*Belt Dryer in Tulln AT, - 45 t/h – 870 m²
drying of Sugar Beet Pulp*

Belt Dryer with double product layer system

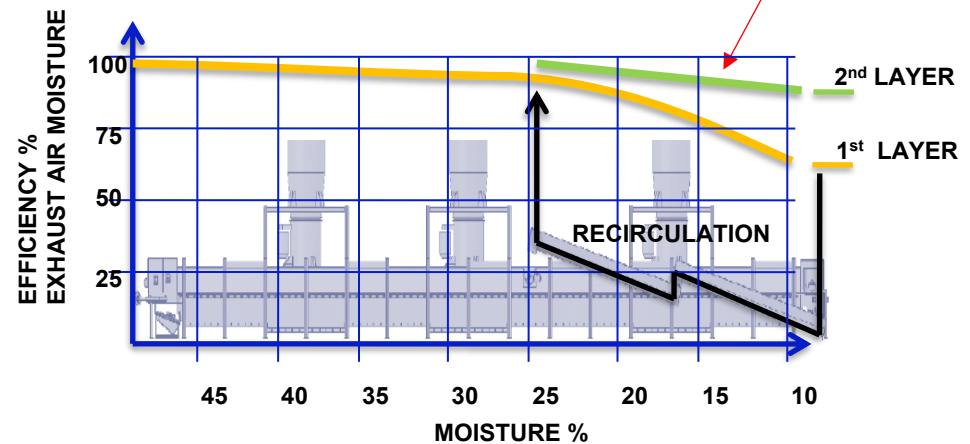


Upper Part is mixed and achieves homogenous Moisture Content

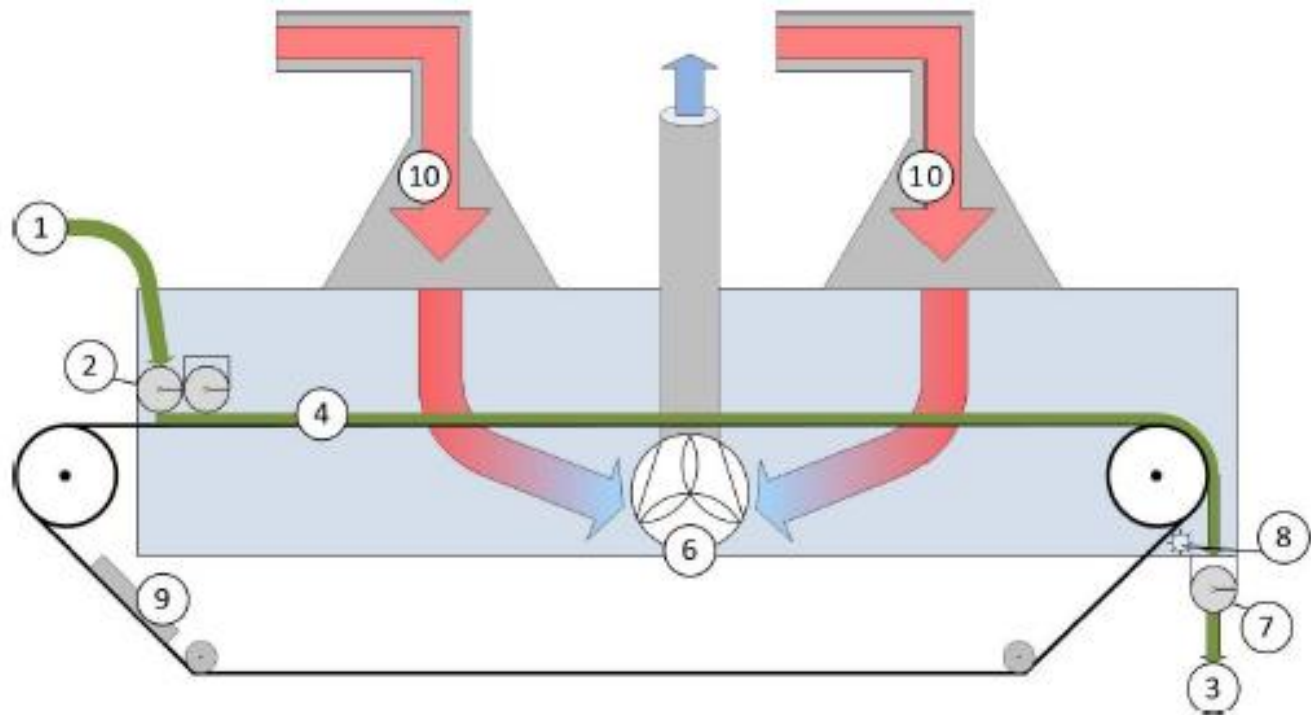


Upper Part is discharged
Lower Part is recycled

1. Wet biomass
2. Feeding screws
3. Dry biomass
4. Product layer
5. Heat exchangers
6. Exhaust fan
7. Discharge screw
8. Recycling screw
9. Belt cleaning system (dry, brush)
10. Belt cleaning system (wet)



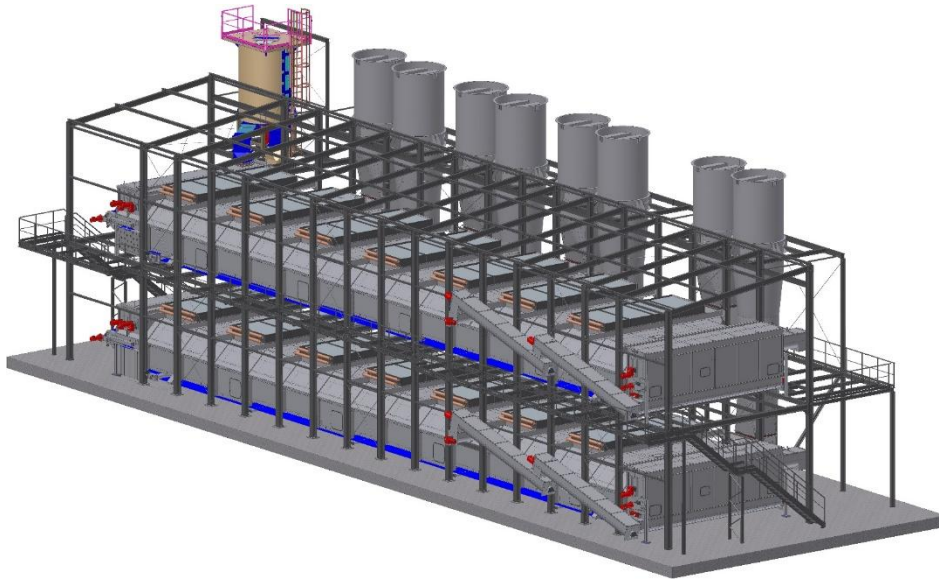
Belt Drying system – KUVVO with single product system heated with Flue Gas/Hot air



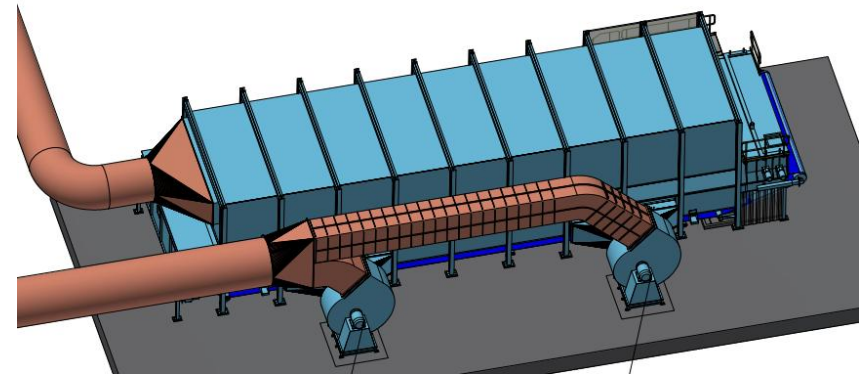
1. Wet biomass
2. Feeding screws
3. Dry biomass
4. Product layer

6. Exhaust fan
7. Discharge screw
8. Belt cleaning system (dry, brush)
9. Belt cleaning system (wet)
10. Hot air feed (KUVVO)

SWISS COMBI Low Temperature Belt Dryer Concepts



2-Storey Belt Dryer
heated with hot water



KUVO Belt Dryer 130 m²
heated with hot air or flue gases

SWISS COMBI Belt Dryer Reference List Overall by Projects

SWISS COMBI Band Trockner - Belt Dryer - REFLIST - 20240821

Belt Dryer / KUVO: References
Bandtrockner / KUVO: Referenzen
Sécheur à bande / KUVO: liste de références



AUFTRAGS- JAHR	KUNDE (ENDKUNDE)	Ort im Innkreis	Anzahl Anlagen	TYP*	PRODUKT**	LAND
Year of PO	Customer (Enduser)	SITE Town	dryer units	Type*	Feedstock/Product	Country
2023	MHL - MALINAU HIAU LESTARI	Malinau Regency	1	0 / 207	Microchips / Hackspäne	Indonesia
2023	Chaulnes	Chaulnes	1	0 / 214	Sawdust/Sägespäne	France
2023	Schweizer Zucker AG	Frauenfeld	2	7.2 / 306	Sugar beet pulp/Rübenschnitzel	Switzerland
2023	Yantai G Health New Material Technology co. Ltd	Yantai	2	7.2 / 358	LSB flakes/sawdust (partly)	China
2023	Hunan Luü Wood Co.,Ltd.	Yongzhou	4	7.2 / 374	OSB-Flakes	China
2023	Mtr Phol - Mtr Phuviang Sugar Factory - MPV2	Khon Kaen Province	1	0 / 157	Bagasse	Thailand
2022	Scenie Archimbaud	Labouheyre	1	7.2 / 358	Sawdust/Sägespäne	France
2022	Thai Roong Ruang Industry Co., Ltd.	Phetchaboon	1	0 / 157	Bagasse	Thailand
2022	Mounlapamok / Prodesa (license)	Mounlapamok	1	0 / 288	Sawdust/Sägespäne	Laos
2022	ZRK Group	Mardan	2	7.2 / 408	PB: Wood Flakes + Bagasse	Pakistan
2022	Hunan Luü Wood Co.,Ltd.	Yongzhou	4	7.2 / 374	OSB-Flakes	China
2022	Groupe Francois	Virton	1	SC-BT-7.2-150m2-D	Sawdust/Sägespäne	Belgium
2022	Renova Group	Torres Novas	1	0 / 46	Paper sludge (white) / Papierschlamm (weiss)	Portugal
2022	Kronospan	Sanem	4	7.2 / 358	PB: Confidential/Vertraulich	Luxembourg
2022	Mtr Phol - MKS2	Kalasin 2	1	0 / 157	Bagasse	Thailand
2022	Mtr Phol - MPL2	Phu Luang 2	1	0 / 157	Bagasse	Thailand
2021	Luzéal	Recy	1	7.2 / 342	Alfalfa/Alfalfa	France
2021	Kronospan	Auverre	2	0 / 171	PB: Confidential/Vertraulich	France
2021	Mtr Phol - MPK3	Phu Khiev	1	0 / 157	Bagasse	Thailand
2021	Mtr Phol - Mtr Phol Phu Luang Sugar- MPL1	Phu Luang	1	0 / 157	Bagasse	Thailand
2021	Mtr Phol - Mtr Phuviang Sugar Factory - MPV1	Khon Kaen Province	1	0 / 157	Bagasse	Thailand
2020	Tschopp Holzwerke AG	Buttsholz	1	0 / 256	Sawdust/Sägespäne	Switzerland
2020	Metsä Fibre / Valmet (license)	Kemi	1	7.2 / 424	bark P45 (Mix of pine, spruce and birch)	Finland
2020	Duro Dakovic	Gospic	1	0 / 200	Forest Residues/Waldabfälle	Croatia
2020	Mtr Phol	Kalasin	1	0 / 157	Bagasse	Thailand
2020	Mtr Phol - MPK2	Phu Khiev	1	0 / 157	Bagasse	Thailand
2020	Mtr Phol	Dan Chang District	1	0 / 157	Bagasse	Thailand
2020	Akistama / Prodesa (Lizenz)	Vitebsk	1	0 / 240	Sawdust/Sägespäne	Belarus
2020	Pinnacle / Prodesa (Lizenz)	High Level	1	7.2 / 325	Sawdust/Sägespäne	Canada
2020	Agro recycling AP	Fredericia	1	0 / 60	Confidential/Vertraulich	Denmark
2019	Balcas Ltd.	Enniskillen	1	0 / 60	Sawdust/Sägespäne	United Kingdom
2019	Rayonier AM / Prodesa (Lizenz)	Tartas	1	7.2 / 424	Forest Residues/Waldabfälle	France
2019	Bracell / Valmet (Lizenz)	Lençóis Paulista	2	7.2 / 274	Bark (Eucalyptus) / Rinde	Brazil
2019	Funan Bio Energy Co. Ltd.	Fusui	1	0 / 130	Bagasse	China
2019	Agro Energie Rigi	Küssnacht	1	0 / 125	Sawdust/Sägespäne	Switzerland

- >200 belt dryers
- 23 KUVO belt dryers + 1 KUVO demo plant
- >160 Belt dryer projects realized

SWISS COMBI Belt Dryer

Reference List Overall by Feedstocks

(municipal) SRF - Alternative Fuel (AF) / hausmüll-SRF Alternatives Brennsto	1
Alfalfa&beet pulp/Alfalfa&Rübenschnitzel	1
alfalfa&Gras/Alfalfa&Gras	1
Alfalfa/Alfalfa	1
Bagasse	13
Bagasse (fresh + Hydrolyses)	1
Bark (Eucalyptus) / Rinde	2
bark P45 (Mix of pine,spruce and birch)	1
Bark/Rinde	4
Confidential/Vertraulich	2
Forest Residues/Waldabfälle	4
Gras&alfalfa/Gras&Alfalfa	12
Gras&Corn&Straw/Gras&Mais&Stroh	1
Gras&Corn&Wood Chips/Gras&Mais&Hackschnitzel	1
LSB flakes/sawdust (partly)	2
Microchips / Hackspäne	1
OSB-Flakes	9
Paper sludge (white) / Papierschlamm (weiss)	1
PB: Confidential/Vertraulich	6
PB: Wood Flakes + Bagasse	2
Pomace/Trester	1
Sawdust&bark/Sägespäne&Rinde	10
Sawdust&Gras/Sägespäne&Gras	2
Sawdust&Gras/Sawdust&Sägespäne	1
Sawdust/Sägespäne	84
Sugar beet pulps/Rübenschnitzel	24
Wood Chips & Shavings & Gras/Hackschnitzel&Späne&Gras	1
Wood Chips&Forest Residues/Hackschnitzel&Waldabfälle	2
Wood Chips/Hackschnitzel	9
Wood Chips/Holzspäne	1
Wood flakes/Holzspäne	1
Wood shavings/Hobelspäne	5



Wood Flakes



RDF/SRF



Wood Chips



Gras/Alfalfa



Bark

SWISS COMBI Belt dryer

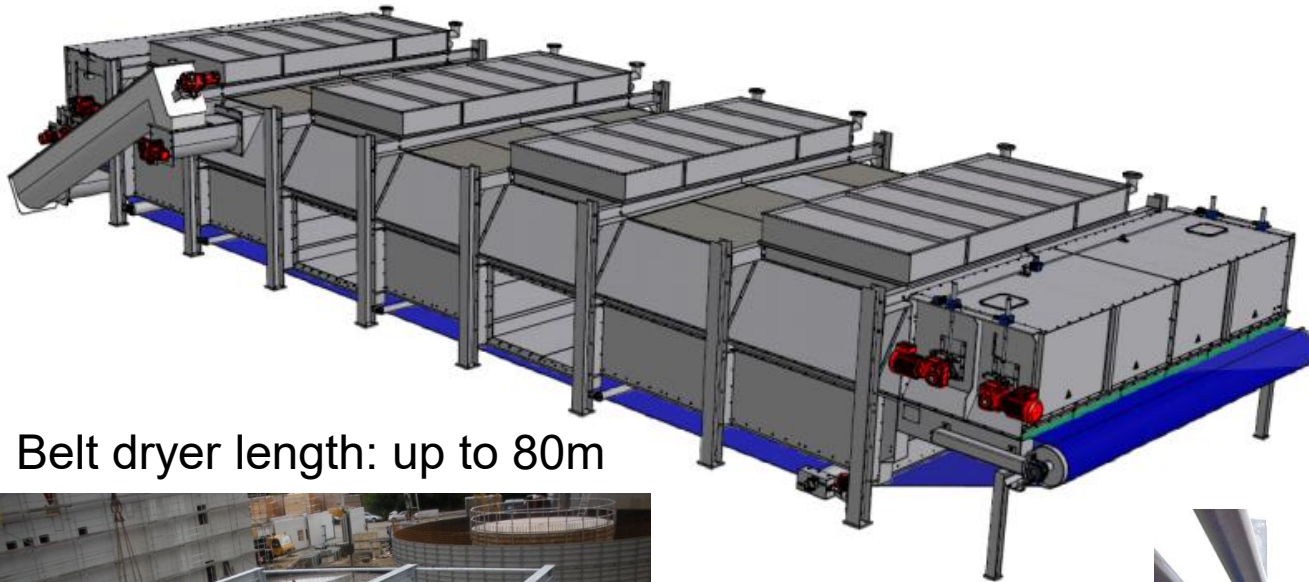
Reference visit - Proposition

Tour	Feedstock	Site	Industry	Comments
Haltikon/Buttisholz	Sawdust (Softwood)	CH, Haltikon (KUVO with hot air recovered from Flue gas economizer) and Buttisholz, CH	Production of wood pellets (EN Plus Quality)	2 sites in 1 day possible, very nice place!
Domat Ems	Forest Residues/Wood Chips (Softwood)	Domat Ems, CH	Utility CHP: Production of electricity and industrial heat	
Torres Novas	Paper sludge (from paper recycling)	Torres Novas, Portugal	Production of hygienic paper	this dryer is actually quite small

More details about References: →see factsheets

SWISS COMBI Belt Dryer

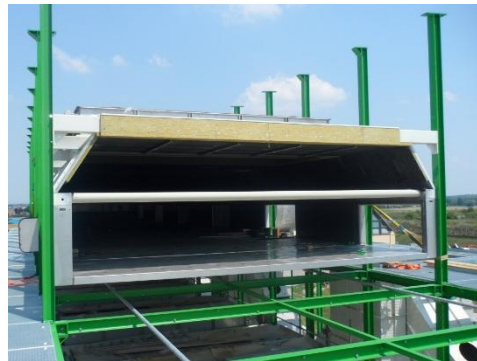
Modular construction



Belt dryer length: up to 80m

Standard Belt Widths:

- 2 m (compact)
- 3.7 m (compact)
- 6 m (industrial)
- 7.2 m (industrial)

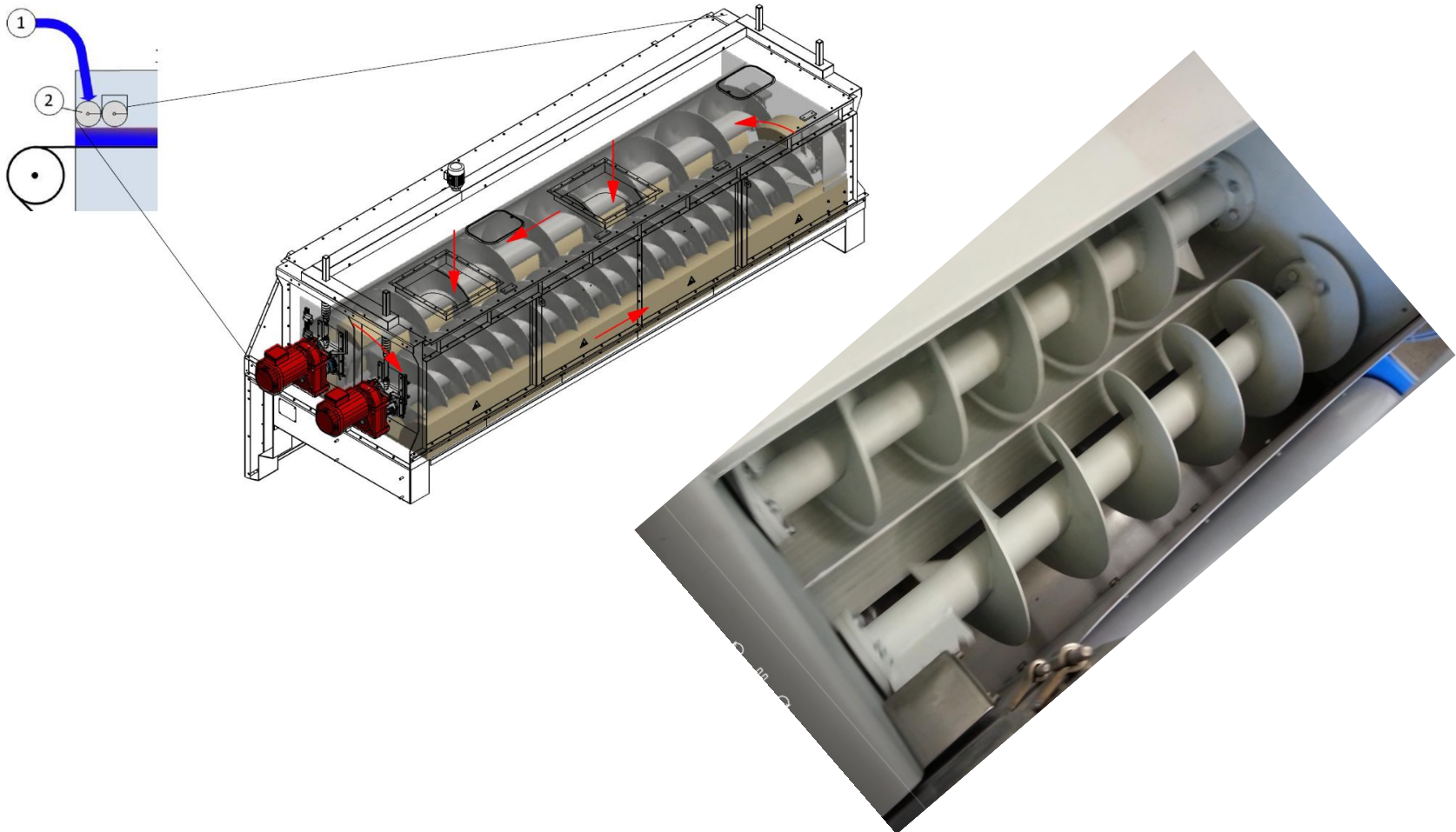


Utilization of low temperature heat Design with spare capacity!

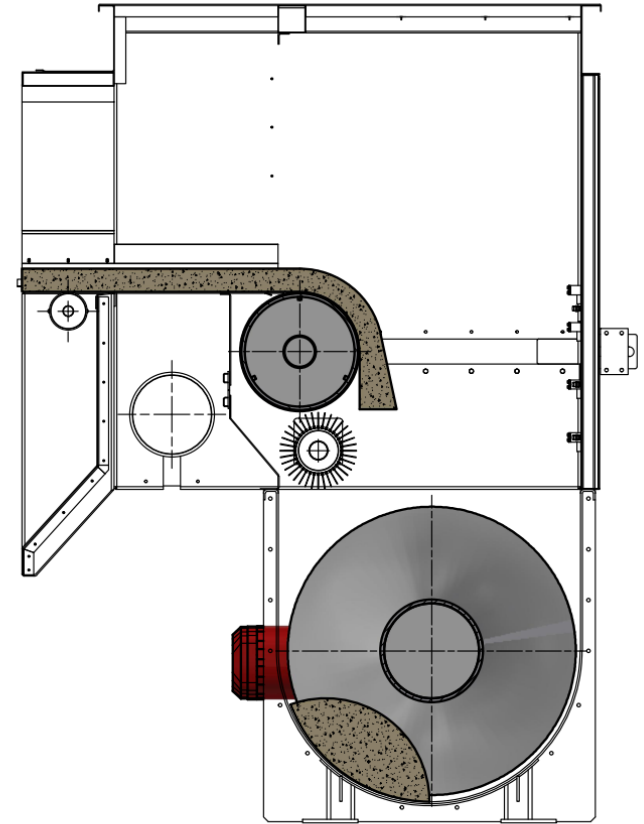
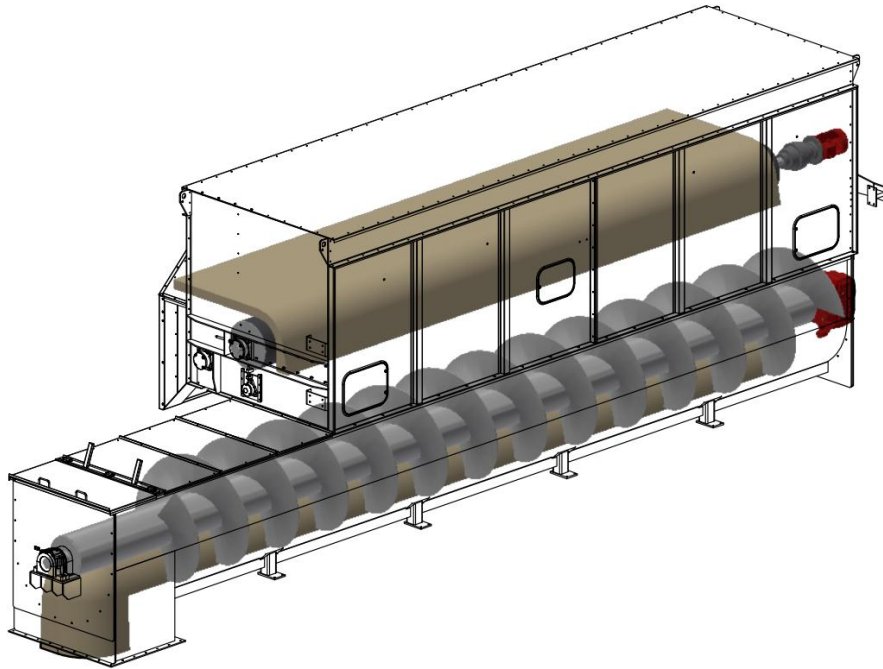


- **Hot water**
 - $\leq 120^{\circ}\text{C}$
 - One, two or three stage heating (e.g. 1st stage from flue gas condenser)
 - Glycol for freeze protection
- **Low pressure steam**
 - 1.2 – 2 bar abs
 - Condensate subcooler
- **Hot air or flue gas**
 - Air or flue gas $< 120^{\circ}\text{C}$

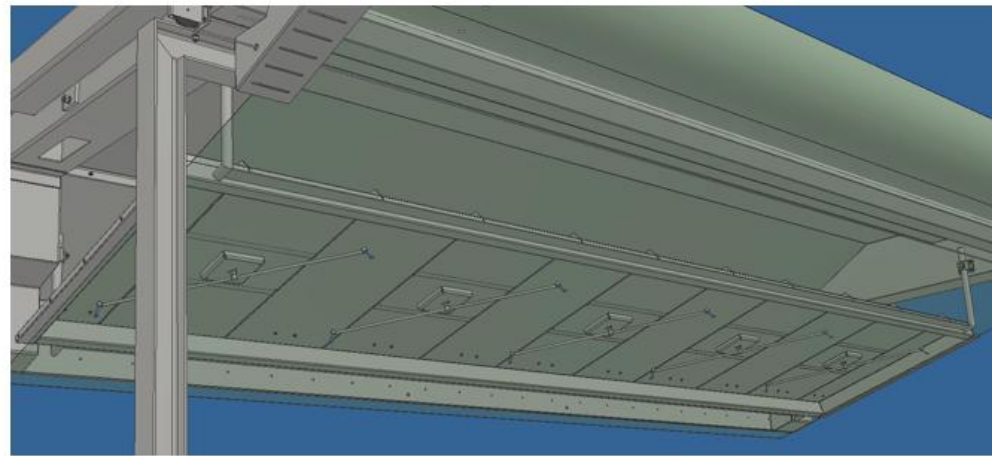
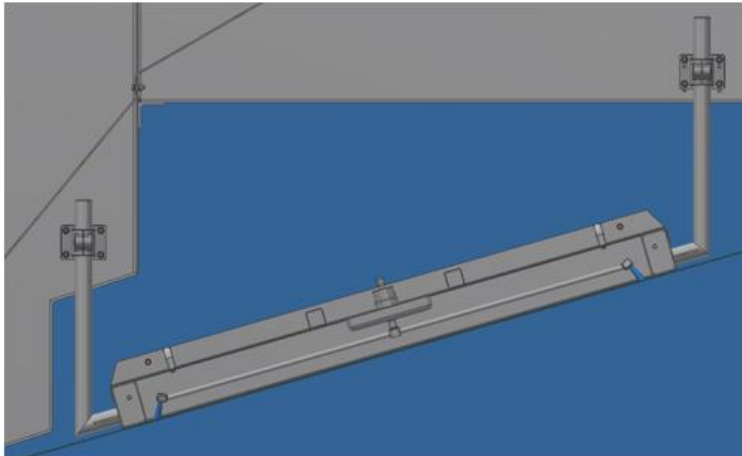
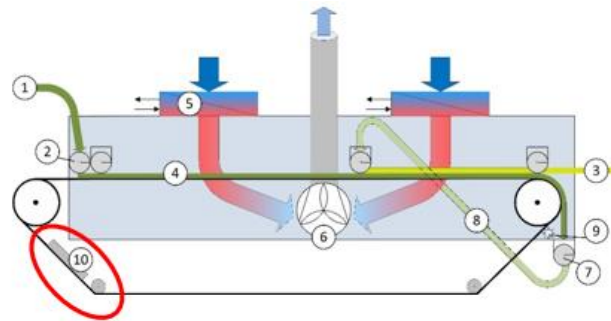
Swiss Combi Belt Dryer Feeding system



Swiss Combi Belt Dryer Discharge Screw



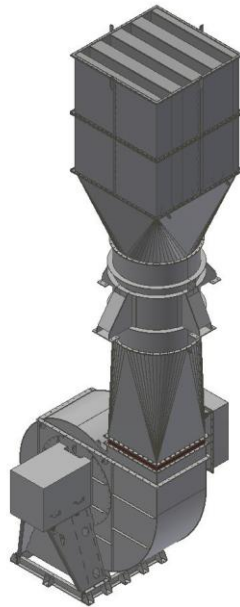
Swiss Combi Belt Dryer Wet Cleaning System with high performance



Swiss Combi Belt Dryer

Noise reduction / „silent“ Solutions

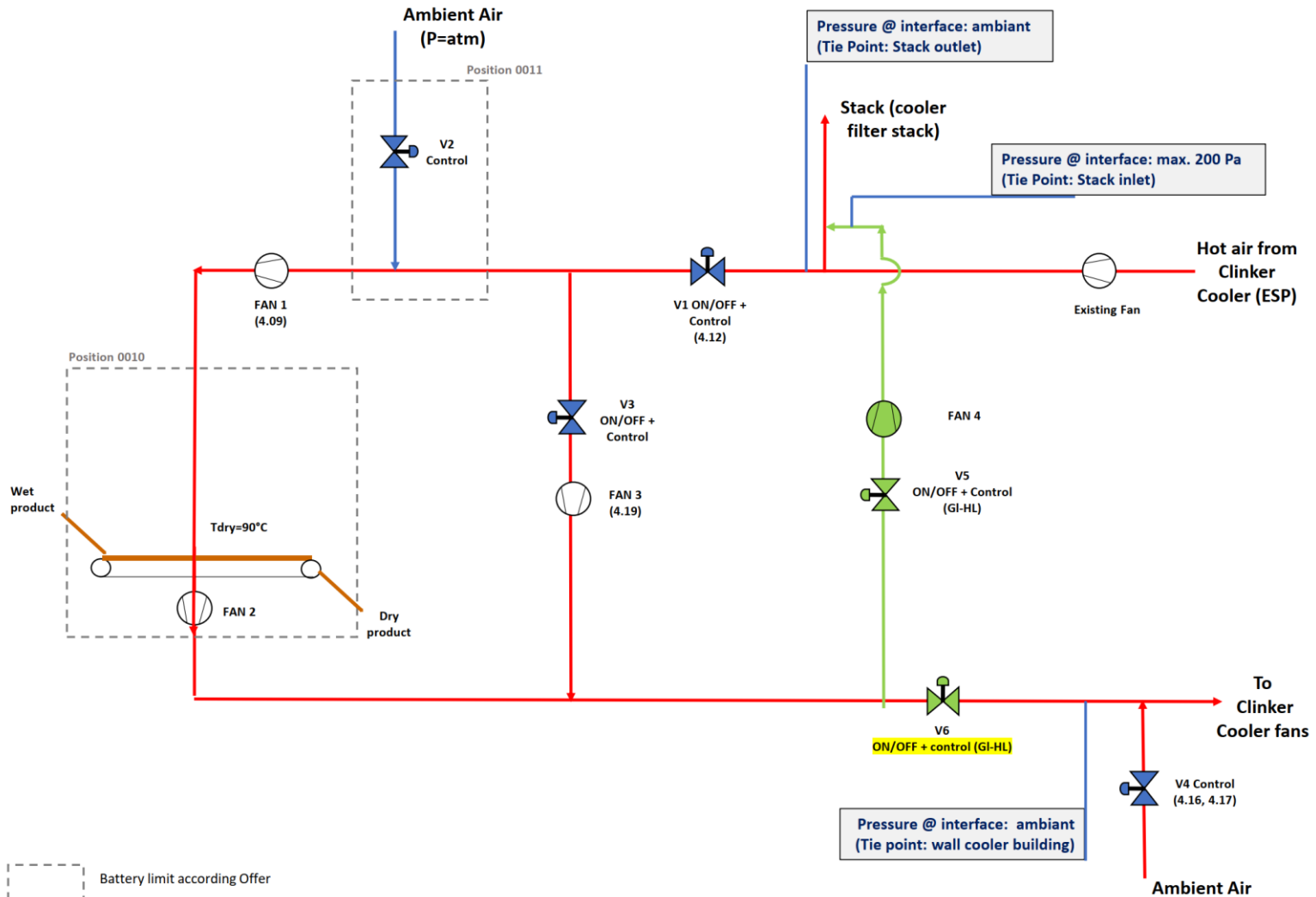
- When the dryer is installed close to residential areas noise must be reduced
- Swiss Combi does this by:
 - Enclosing the dryer
 - Isolating acoustically the discharge line.



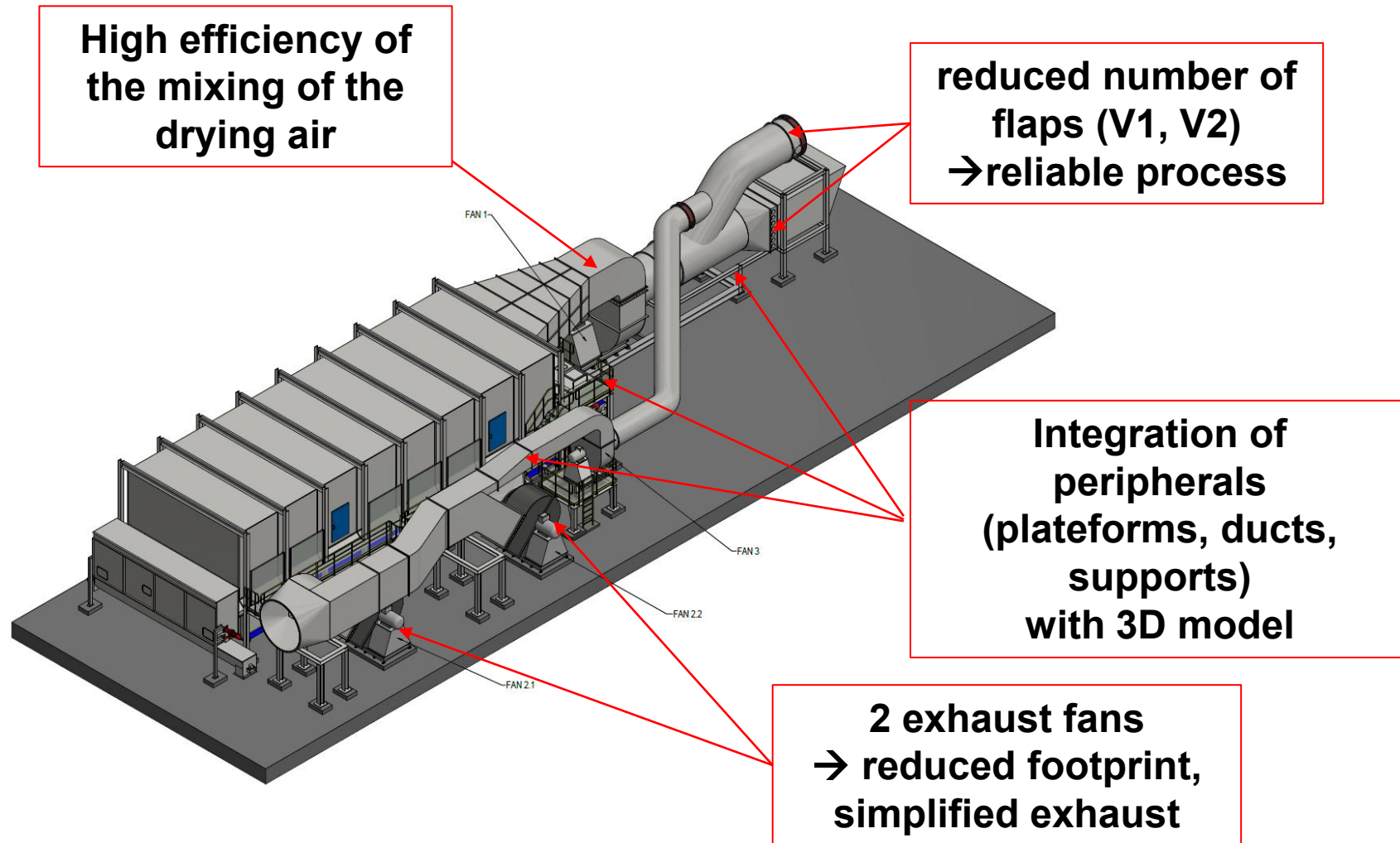
Ozarow Reference Reference Factsheet

Plant Capacity*:	Wet RDF (Moisture Content = 35 % _{wet base})	19.6 t/h
	Dry RDF (Moisture Content = 15 % _{wet base})	15.0 t/h
	Water evaporation	4.6 t/h
Footprint (LxW):	appr. 26.4 m x 11.7 m (dryer excluding peripherals)	
Drying Surface:	129 m ²	
Heat Sources*:	Hot Air from clinker cooler	83'000 Nm ³ @ T= 220 °C
Elec. power installed:	approx. 212 kWel	
Year of Order:	2023 Q4 (start up in 2025)	
Special features:	<ul style="list-style-type: none"> - Drying temperature of 90°C after mixing of ambient air - High efficiency mixing of ambient and hot air - Minimized number of flaps - Operation of the dryer in different modes: exhaust to clinker cooler fan, exhaust to stack and hybrid - Design of the dryer and peripheral equipment (mixing, bypass) by Swiss Combi - Discharge screw compliant ATEX22 inside - Benefits: cement mill can accept high moisture RDF from municipality, decarbonized fuel 	
*: max values		

Ozarow Reference Reference HMB (Heat & Mass Balance)



Ozarow Reference Reference Layout (3D)



Ozarow Reference Reference Review Impressions



Your future projects

Design Basics & Requirements

3 Product/Raw Material to be dried						
3.1	Product	Sawdust				
3.2	Particle size	TBD	mm x mm x mm		(light + with a thick.)	
3.3	Bulk density	Approx 450	kg/m ³	wet or dry	wet	
3.4	Wet Product	MEI	LC1 (winter)	LC2 (average)	LC3 (summer)	LC4
		Mass flow				
		Moisture content				
		Temperature				
3.5	Operating hours					
	Crop season:		hours per day			
			days per year			
	Off season (if applies):		hours per day			
			days per year			
3.6	Dry Product moisture content	DBY	LC1 (winter)	LC2 (average)	LC3 (summer)	LC4
		Mass flow		15		
		required moisture content		"12-15"		
4 Heat Sources						
4.1	Hot water	forward temperature	100	°C		remark
		return temperature	80	°C		[2]
		Max. available heat	TBD	kWh		
		Mass flow	TBD	kg/h		
		Heating media water-glycol	0%			for cold areas: glycol concentration (i.a. 30%) recommended
4.2	Steam	Temperature	-	°C		
		Pressure	-	bar abs		pressure at interface to the dryer
		Mass flow	-	kg/h		
4.3	Fluegas	Temperature	approx 450	°C		
		Dew Point Temperature	-	°C		alternatively: concentration of water in the gas
		Mass flow	-	kg/h		
		Volume flow	-	m ³ /h		
		Pressure @ interface	-	bar		
		Composition (chemical)	-			[2], [3]
		Dust concentration	-	mg/m ³		[4]
4.4	Comments	[1]	In the case several heat sources are available, please specify which heat source shall be consumed as a priority			
		[2]	for non commercial heating media risk of corrosion and choice of materials might require the chemical analysis			
		[3]	please specify the flue gas composition: CO ₂ , H ₂ O, SO ₂ , O ₂ , CO, H ₂ , NO _x , NO ₂ , VOC, COS, H ₂ S, ...			
		[4]	Please specify if the flue gas treated upstream the dryer (bag filter, electrofilter, scrubber, ...)			
5 Ambient Conditions						
5.1	Site adress for the installation	Kinnared				
5.2	Meters above sea level					
5.3	Installation				Indoor or Outdoor	
5.4	Ambient air temp. & humidity		LC1 (winter)	LC2 (average)	LC3 (summer)	LC4
		Ambient Temperature	TBD	TBD		
		Relative humidity	TBD	TBD		

KUVO possible with hot air or Flue gas
(Specification acc. Questionnaire required)

Swiss Combi Clean & Efficient Drying Solutions!

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