



Circular Economy in the Biorefinery Pischelsdorf

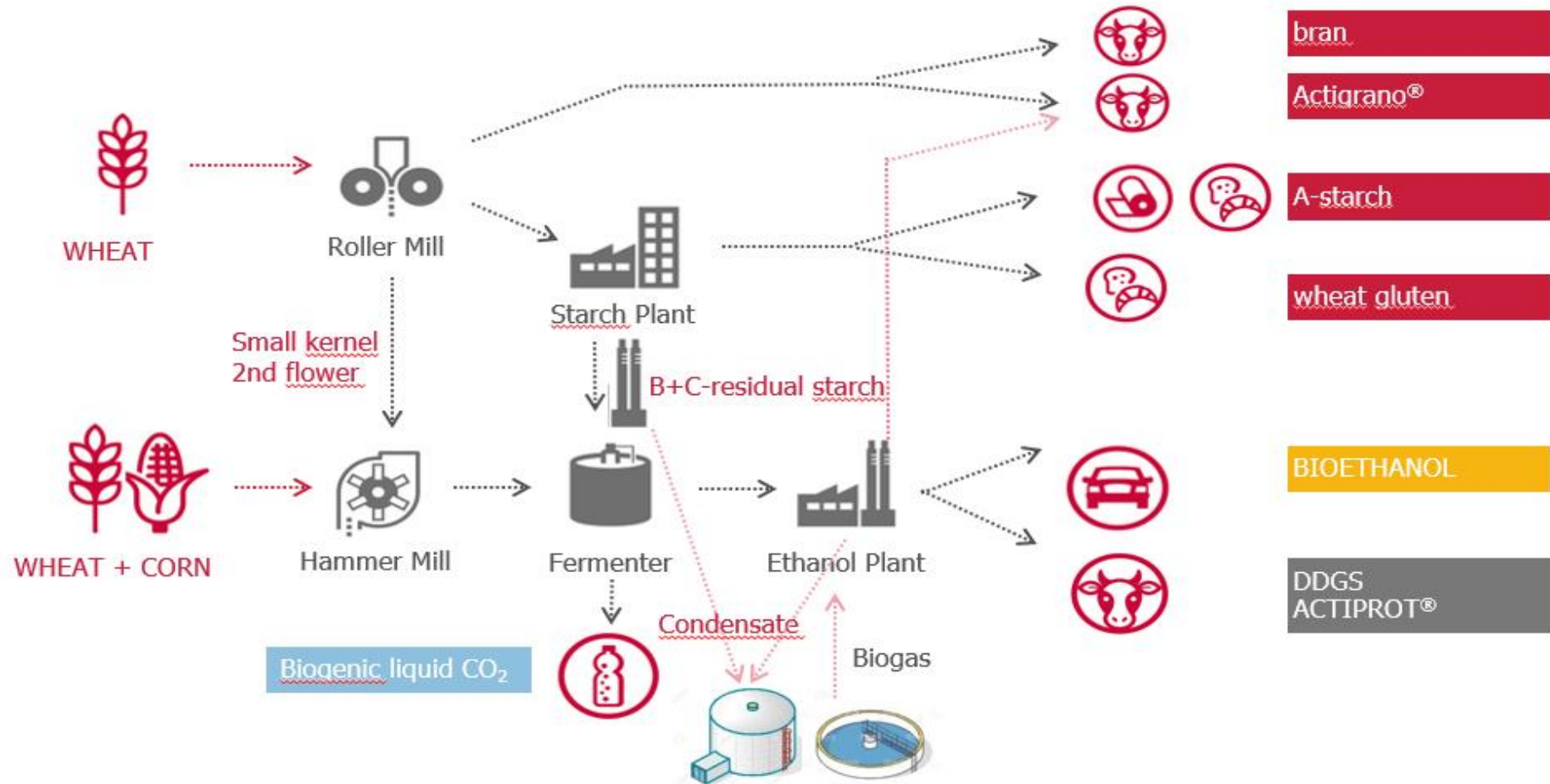


AGENDA

- 1 Process diagram, -integration
- 2 Products
- 3 Energy integration
- 4 Process automation
- 5 Fermentation optimisation
- 6 Challenge: climate friendly logistics

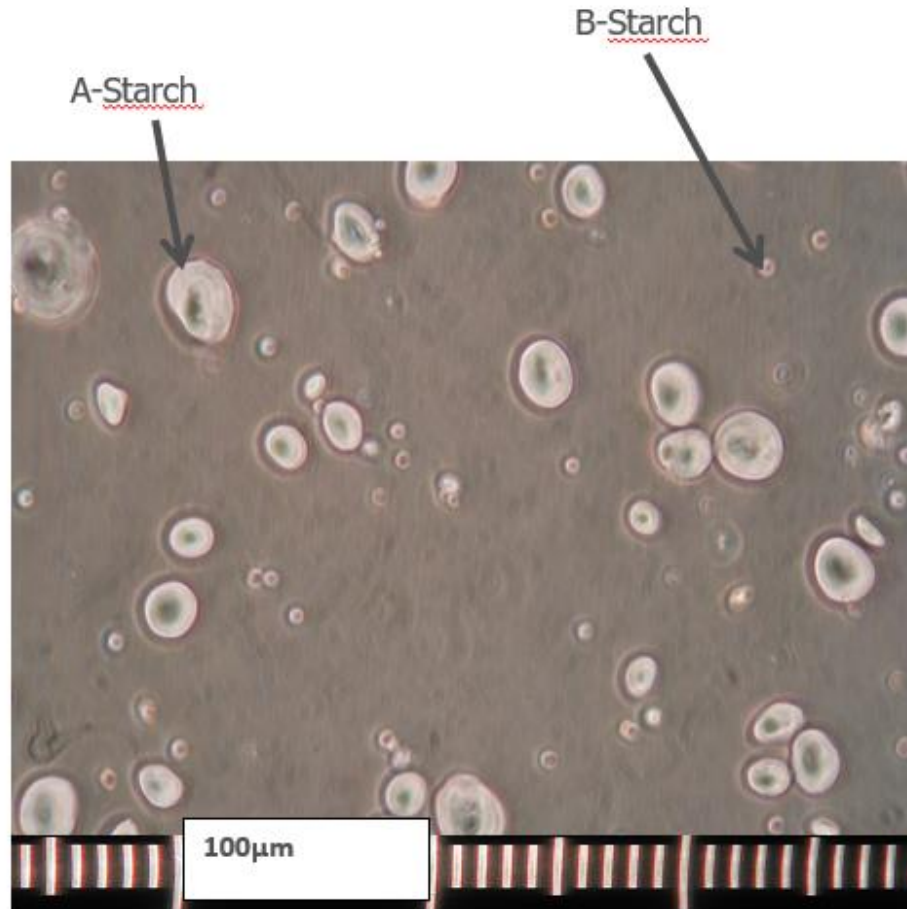


HIGH BIOPROCESSINTEGRATION = HIGH EFFICIENCY





WHY IT IS USEFUL TO COMBINE WHEAT STARCH AND ETHANOL



about 50 % of the starch particles in wheat flour are coarse-grained



OUR FINISHED PRODUCTS



Gluten
55.000 t/a



A-Starch
250.000 t/a



CO₂
80.000 t/a



Air Liquide

FOOD

FEED

PAPER
CORRUGATED

ActiProt®
150.000 t/a



GMO-free

ActiGrano®
110.000 t/a



FEED



Bran
30.000 t/a



BioAgenasol®
10.000 t/a



FERTILIZER

EtOH
260.000 m³/a



GREEN
ENERGY



CONCENTRATED PROTEIN FACTORY PISCHELSDORF

Wheat: 945.000 t
12,2% protein

Corn: 245.000 t
7,8% protein

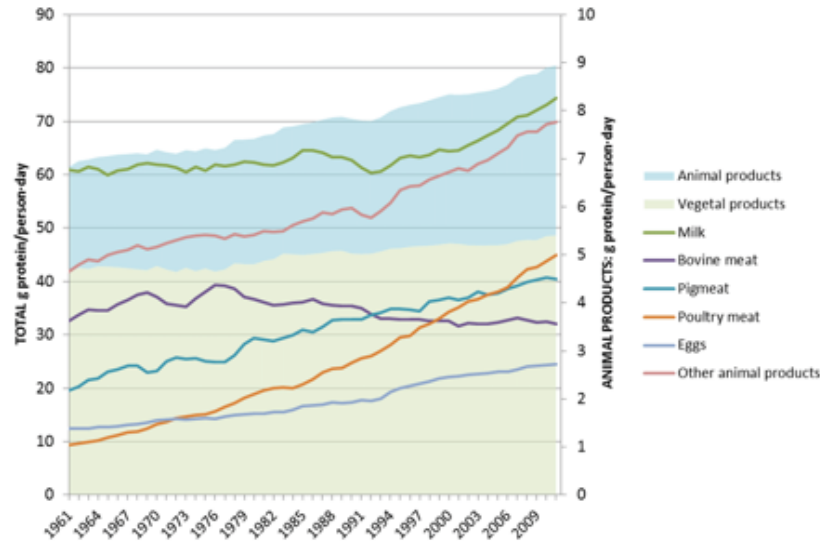
Total raw material: 1,2 Mio. t
Total dry protein: 115.000 t



Wheat-protein, -gluten	>80% <u>protein</u>	<u>Bakery products</u> <u>Fish farming</u> <u>Petfood</u>	(53.000 t / 44.000 t TS <u>protein</u>)
Protein feed ACTIPROT®	>28% <u>protein</u>	Feed beef	(145.000t / 42.000t TS <u>protein</u>)
Wheat gluten feed	>20% <u>protein</u>	Feed <u>ruminant</u>	(109.000t / 21.800t TS <u>protein</u>)
Wheat bran	>15% <u>protein</u>	Feed beef	(35.000 t / 4.800 t TS <u>protein</u>)



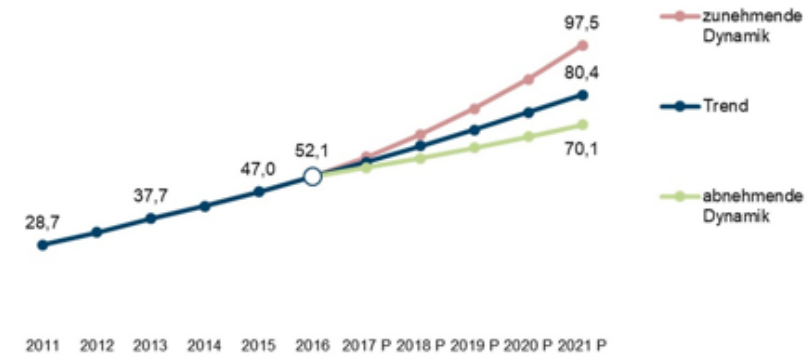
PRODUCTION DRIVERS



World average daily protein consumption per capita by protein type and by animalsource product. (FAOSTAT, 2015)

demand increase for concentrated protein (eating habits)

Onlineumsatz in Mrd. Euro
Prognose 2017 bis 2021 in 3 Varianten



Angaben zu Endverbraucherpreisen, inklusive Umsatzsteuer
Lesebeispiel: Bei zunehmender Dynamik steigt der Onlineumsatz in Deutschland bis 2021 auf einen Wert von 97,5 Milliarden Euro.
Quelle: IFH KÖLN, Angaben 2011-2016 auf Basis HDE Online-Monitor 2017; die Nettoangaben im HDE Online-Monitor 2017 wurden vom IFH Köln auf Bruttowerte umgerechnet. Prognose (P)

Increase of online trade => more cardboard boxes needed => increase of starch production



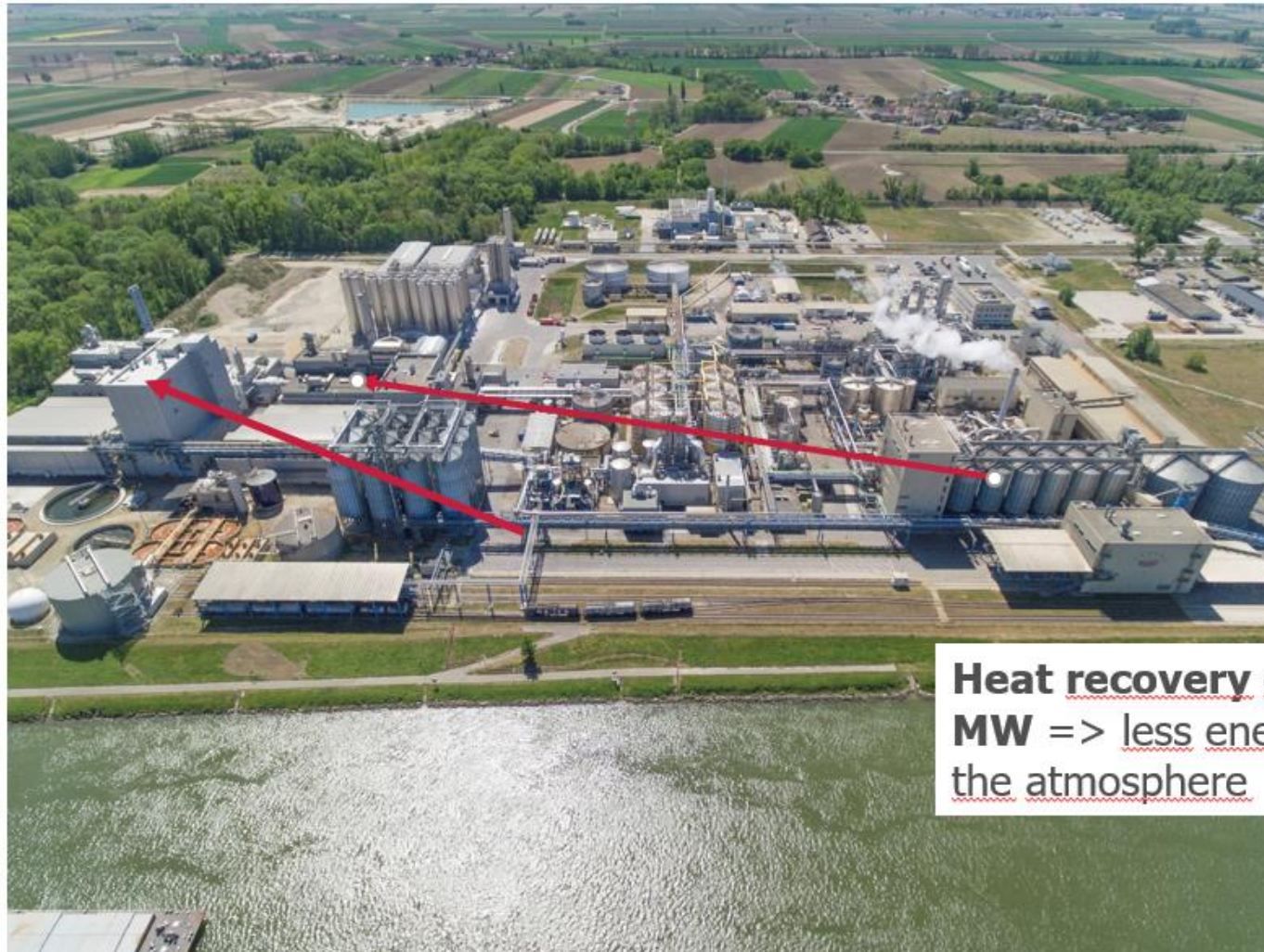
SUSTAINABLE, CLIMATE-FRIENDLY STEAM SUPPLY



The main steam supply is provided by a steam line from the nearby waste incineration plant => **this results in a high overall efficiency of the industrial compound, even during summer**

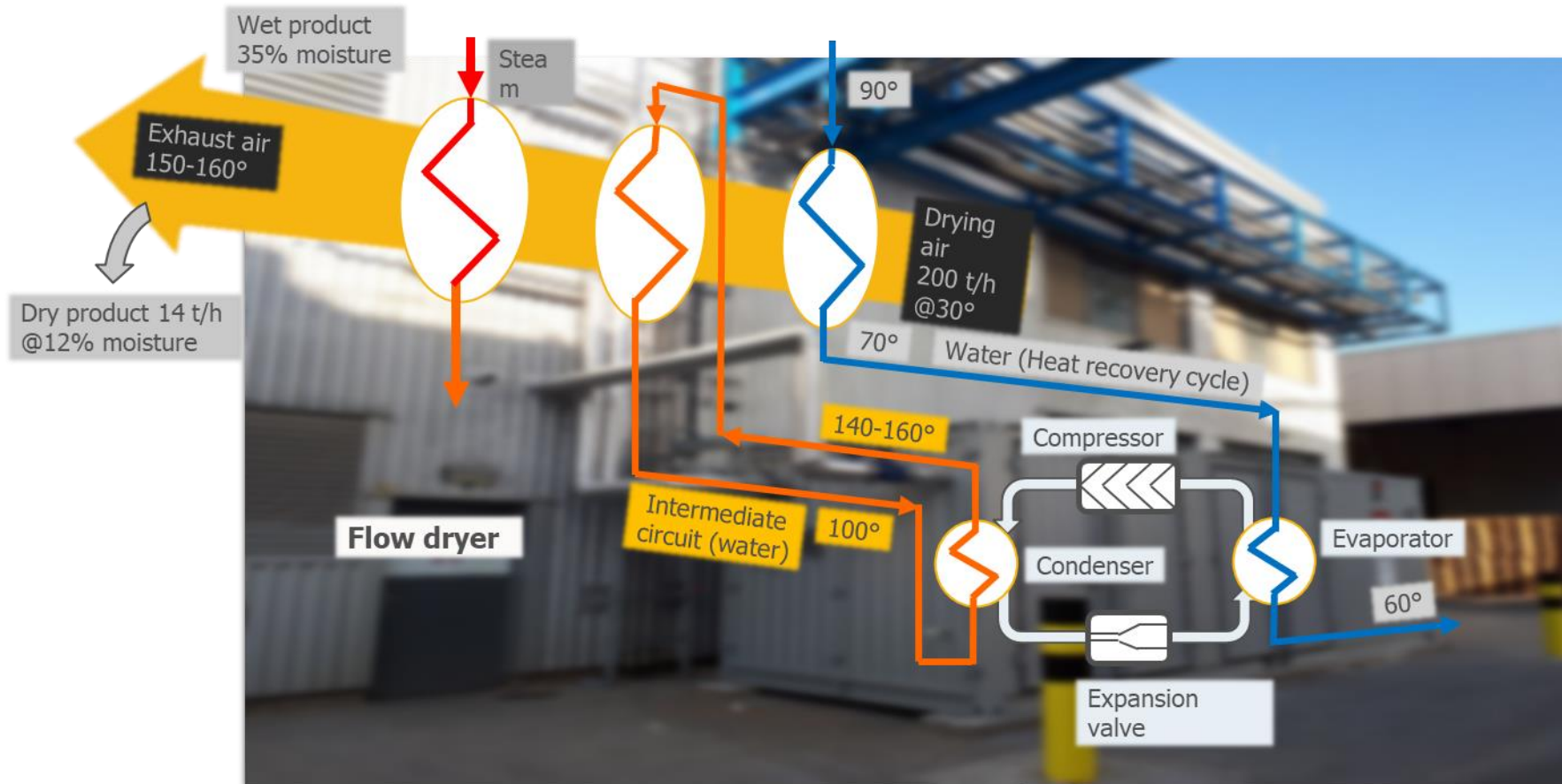


HIGH ENERGY INTEGRATION WITHIN THE PLANT

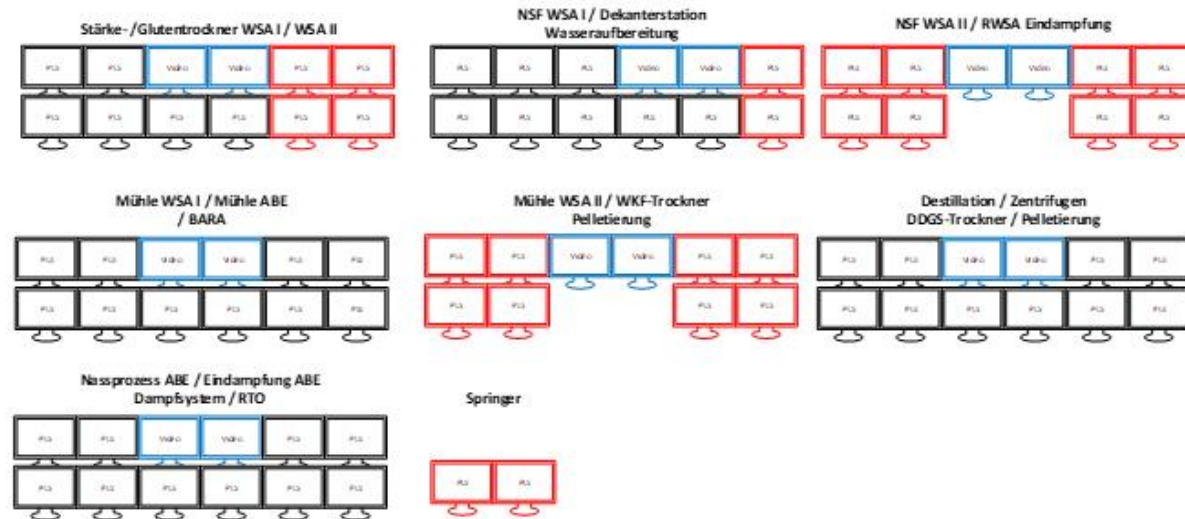


Heat recovery of approx. 10 MW => less energy is lost into the atmosphere

CLIMATE NEUTRALITY: HIGH TEMPERATURE HEAT PUMP DEMONSTRATOR



PROCESS AUTOMATION - DIGITALISATION



- Central control room in the middle of the plant
- Seven operators are running the process units 24/7



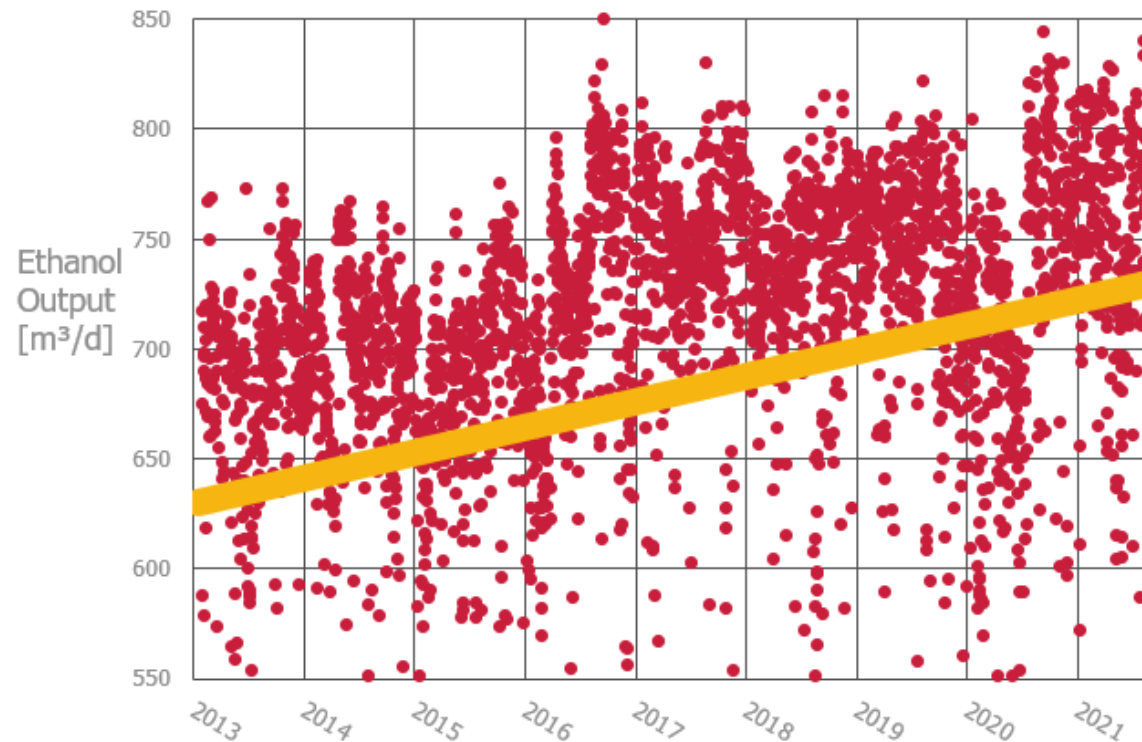


PROCESS OPTIMISATION – FERMENTATION YIELD

ethanol yield per fermentation volume[L/m³]

2013: 37,5L/m³ to 2021: 43,4L/m³

= **15% increase**



Operational excellence achieved by:

- **Fermentor working space increase** foam reduction with defoaming agents, enzymes, mechanical foam destruction, process control e.g. slurry transfer process control
- **Sanitization without chem. disinfectant** optimization of dead space in piping, process water recycling, CIP process
- **temperature profile** cooling optimisation

CHALLENGE: CLIMATE FRIENDLY LOGISTICS



Train:
20% (overall)



Barge:
40% (raw material)
40% (ruminant feed)



Truck:
50% (overall)



Tractor:
8% (raw material)

