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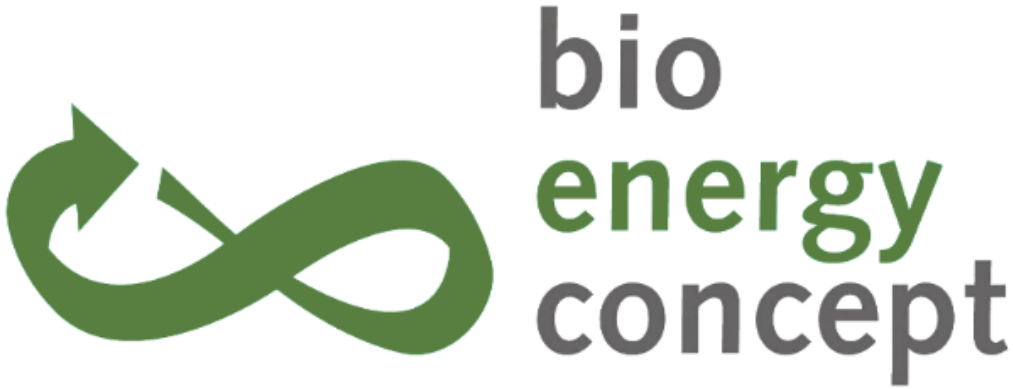


Bioenergy Concept GmbH was founded in ***2007***. Based on many years of experience in project development and construction management of anaerobic digesters, Bioenergy Concept is well equipped to plan, engineer and manage the construction of your project.

Bioenergy Concept is working ***globally with partner companies in the US, South America, India and Ireland***. We are specialized in ***exporting German engineering***, state of the art technology and ***high quality*** components for an extended operational ***lifetime***, ***cost effectiveness*** and ***highest efficiencies***.

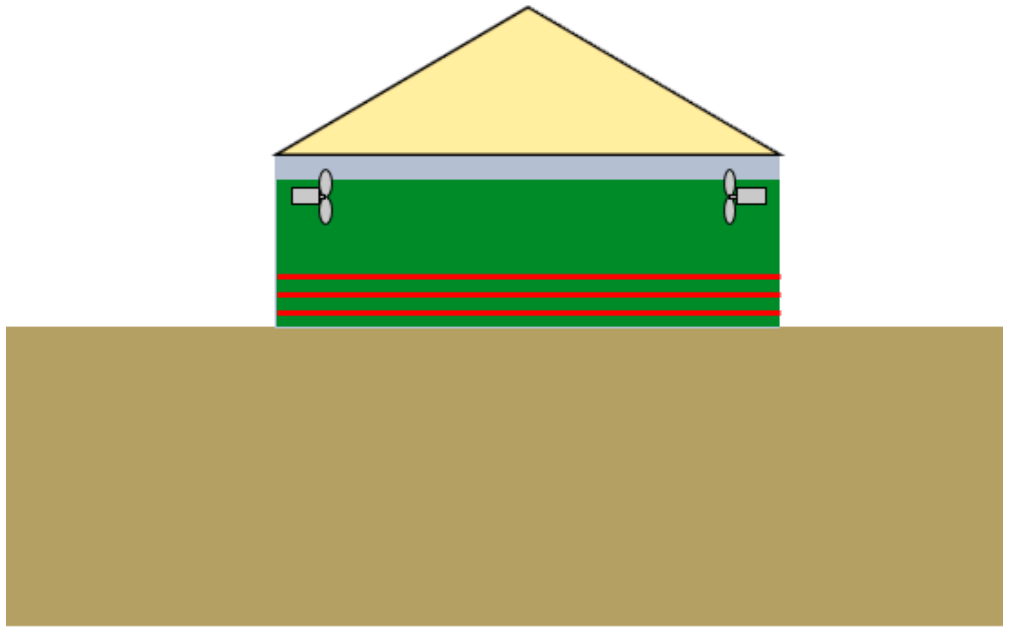
With many years of comprehensive experience in planning and project management of ***AD/Biogas, Biogas upgrading system, Photovoltaic, Woodchip*** and other ***sustainable energy projects***, Bioenergy Concept also develops ***project outlays, feasibility studies*** along with operation management and services even after project completion

Company Profile & Services

- Biochar and bio-oil production
- Project planning, project management, project consulting
- Component suppliers for biogas plants
- Planning of biogas plants
- Feasibility studies
- Optimisation of biogas plants

Section 1
Digester

Design of Conventional Digester



01 Internal Agitator

02 Internal Heat Exchanger

03 Flat Floor Design

Due to the introduction of the substrate (liquid manure, organic residues), inorganic sediments continuously enter the digester and settle on the bottom of the digester.

Disadvantages of Conventional Digester

- **Impurities and sediments frequently clog up**
- **Block the extraction pipes during operation**
- **Plant shut down every 4-5 years**
- **High cost and maintenance**
- **Safety issues higher than expected**

EXAMPLE

Mark Dwan, Plant operator in Kilkenny, Ireland, reports of sediment deposits of 1-2 meters every 4 to 5 years.

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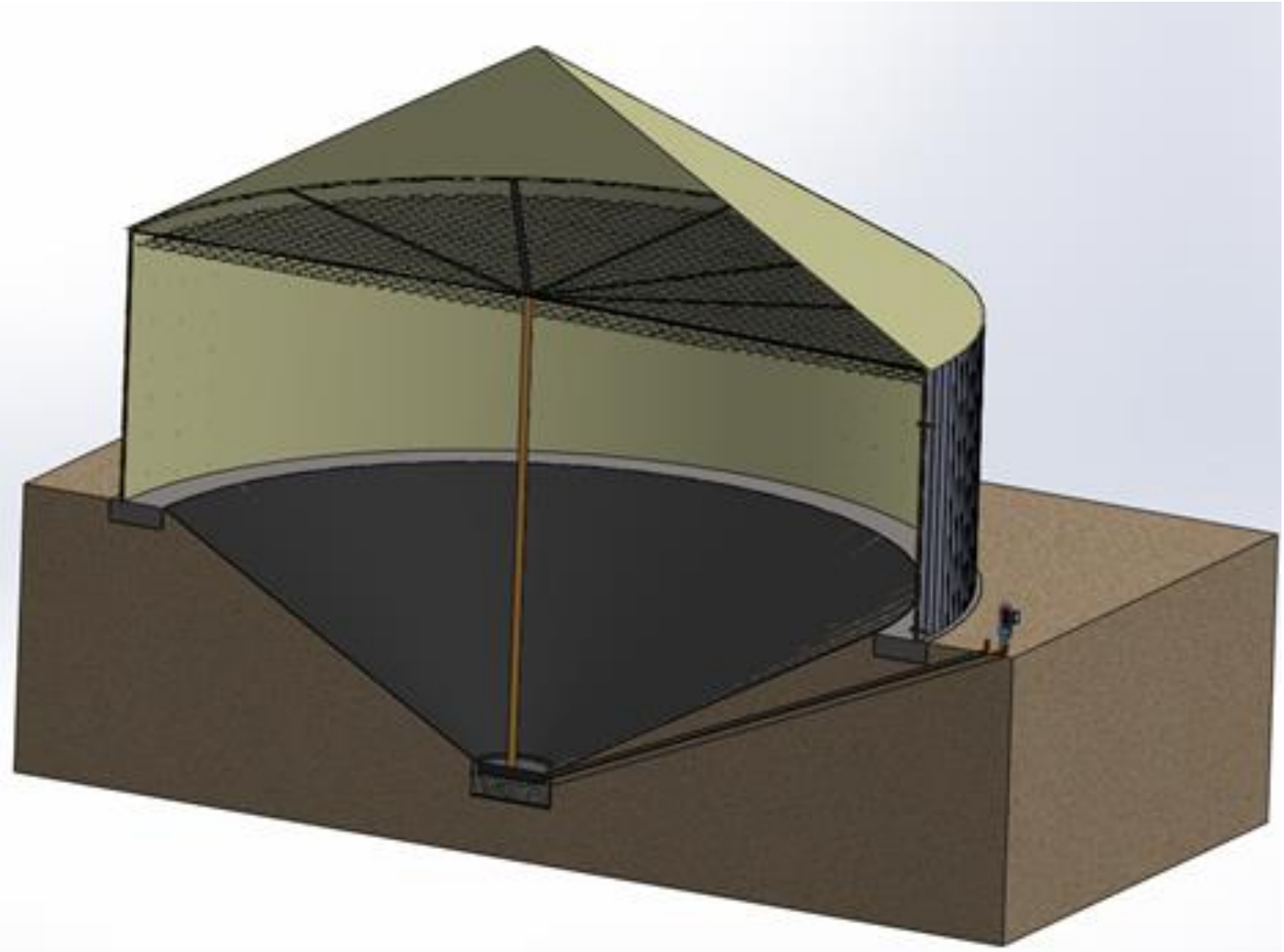

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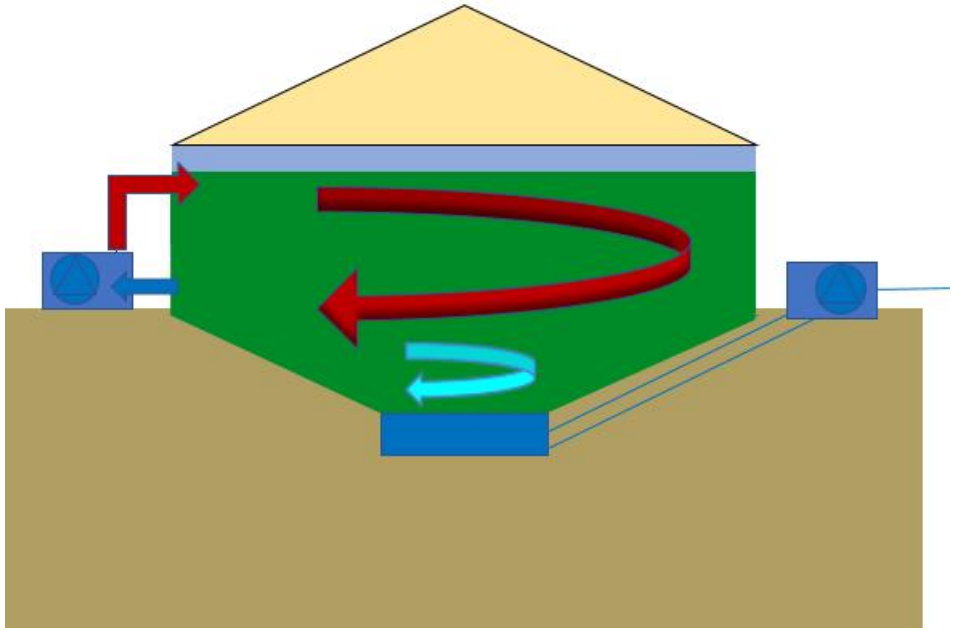
Challenges & Objective

- Solve Sedimentation Problem
- Optimize the energy requirement
- Optimize the construction and investment costs of the project
- Reduce maintenance

Since 2008, Bioenergy Concept has been working on optimizing the digester geometry

Solution: “Vortex Extraction Digester (VED)”

Vortex Extraction Digester (VED)



- The VED system is a simple device
- Patent Technology
- Same construction cost as conventional digester
- No internal or moving components
- Conical construction at the bottom of the tank forming a vortex
- Impurities and sediments are kept in suspension and pumped out of the tank safely and continuously.
- Less agitation requirement compared to a conventional digester
- Reduced energy consumption
- Reduced maintenance and downtime

Section 2
Biogas Upgrading System

Problem with standard PSA method

- Methane capture rate not more than 95%
- Resulting in a significant loss of revenue for the client
- Operating pressure is between 3-6 bar, with high energy consumption

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Solution: Vacuum Pressure Swing Adsorption

- Methane level of >98% in its product gas.
- Methane capture rates of up to 99%, making it a unique technology in biogas upgrading industry.
- Very low power requirement as they are based on the (VPSA) vacuum pressure swing adsorption technology
- Operating pressure 0.7 bar

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Vacuum Pressure Swing Adsorption (VPSA)

Upgrading system	2 stage VPSA
Operating pressure	0.7 bar
Methane capture	99%
Methane purity	96% or higher
H2S	Can handle up to 200 ppm using ACF
Power Consumption	<0.15 kWh/m3 for smaller system

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Section 3
Ablative Fast Pyrolysis

Schematic Diagram of AFP System

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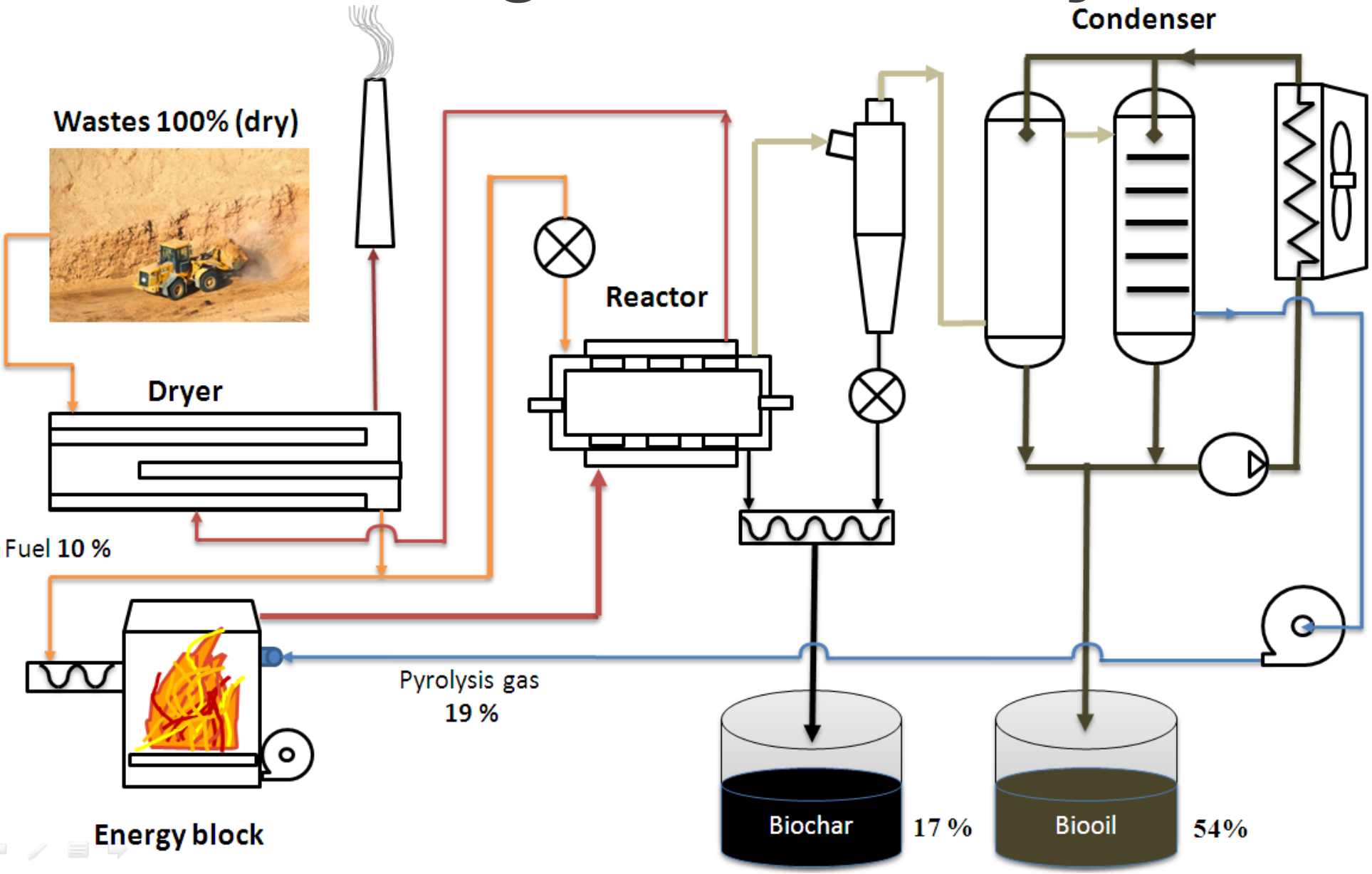


AFP Demonstration & Construction

- Approved by the California Energy Commission.
- The US company Ganrock Corp., Richmond, CA, together with Bioenergy Concept, Lüneburg designed the entire system with a throughput of 500 kg / h
- The plant will be erected on the site of a recycling center near Sacramento.
- Project duration is 3.5 years, commissioning is scheduled for summer 2020. 200.0000 Liter of bio-oil are being produced in the course of the project.
- Project-accompanying R & D work is carried out by the University of Chico, CA, Joint Bioenergy Institute (JBEI), USA, and thermophil international, DE

Feedstocks & Products

Sewage sludge

Seed husks

Wood chips

Plastics

Bamboo

Paddy straw

Some Types of Feedstock

Bio-Oil

Different byproducts

Wood Vinegar

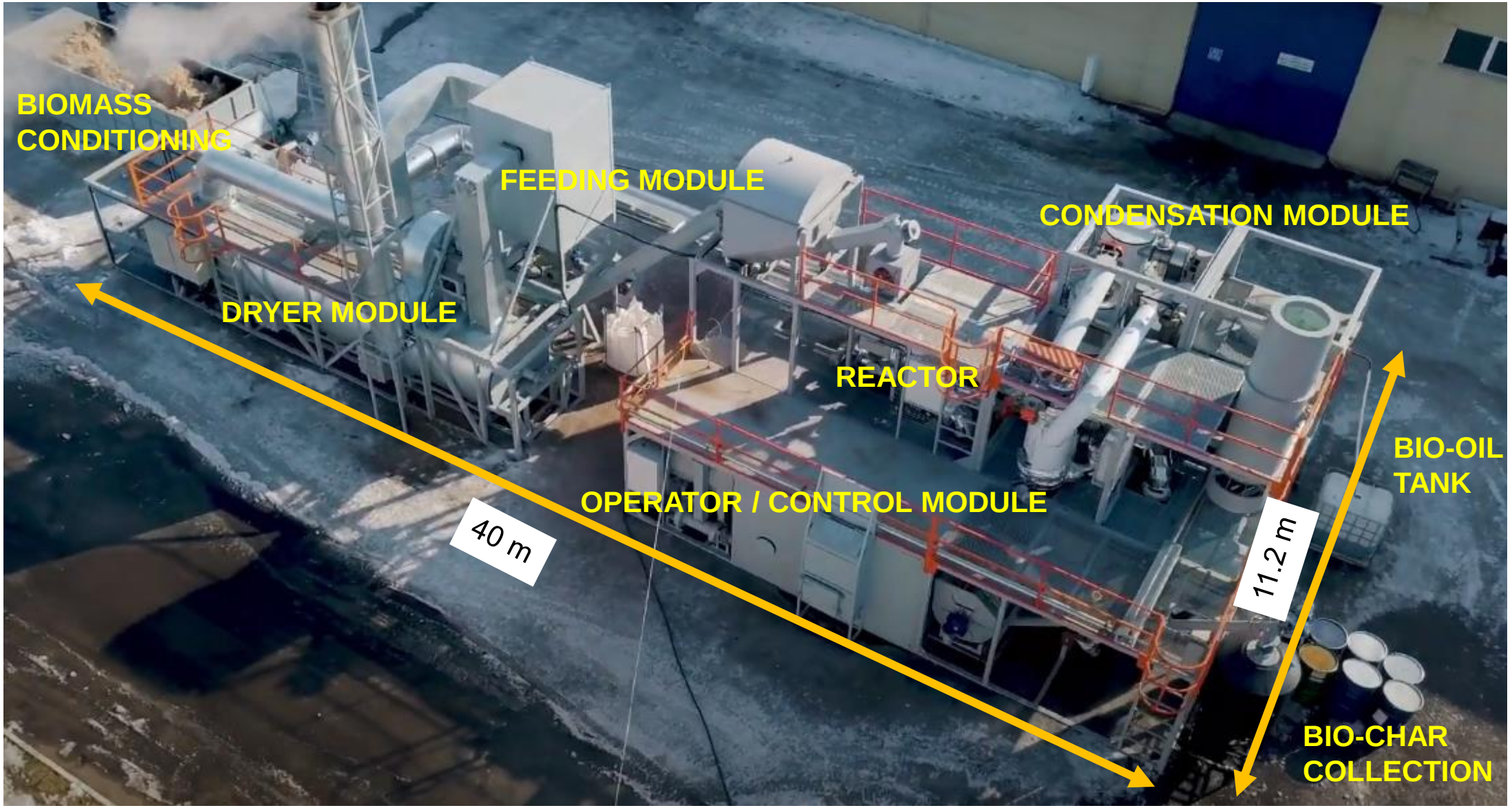
Wood Tar

Bio-Char

Combustion of Bio-Oil: Exhaust Gas Emissions

	Pyrolysis oil	Diesel
ΣROx, %	11.4	11.5
O2, %	5.4	5.5
NOx, ppm	202	105
SO2, ppm	0	0
CO, ppm	7	6
Air Ratio	1.38	1.33
Exhaust gas temp,˚C	149	140
Gross Efficiency	89.9	91.6

Constructed AFP System



Some Reference Projects

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2007

Biogas plant analysis, feasibility study, management & supervision

Bioenergy & Organic Fertilizer Services
Callan, Ireland
5000 t/a Commercial organic waste,
etc.

2008

2010

Fiscalini Farms, Modesto, California
Year commissioned: 2008
Cows: 1500, flush manure

Biogas plant analysis, feasibility study, management & supervision

2012-2015

Biogas plant analysis, feasibility study, management & supervision

Photovoltaikanlage Sonnenergie Nord KG
511 kwp
Lüneburg, Goseburg

2017-2020

Biogas plant, California
Organic residues
2000 m3 digester, BHKW 720kW electric

100 m3/hr upgrading unit to biomethane

Biogas plant analysis, management & supervision

Biogas plant analysis, management & supervision

Testing, Demonstration & Construction of
Ablative Fast Pyrolysis System

Biogas Upgrading Project-
Germany & India

Biogas Plant – California

- 2007 Biogas plant, California
- Dairy cattle liquid manure
- 2* 3500 m3 Fermenter
- CHP, 800 kW electric

Bioenergy & Organic Fertilizer

- 1996/2007
- In Callan, Ireland
- 5000 t/a commercial organic waste, etc

Biogas Plant – California

- 2012 Biogas plant, California organic residues
- 2000 m3 digester with hydrolysis phase
- BHKW 720 kW electric
- 100 m3/h upgrading unit to bio-methane

Photovoltaikanlage

- 2010
- Sonnenenergie Nord KG
- Lüneburg, Goseburg
- 511kWp

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Our Team

Christoph Eusterbrock
Managing Director

Bettina Gehlisch
Assistant Managing Director

Ralf Brügmann
Project Manager

Dheepika Tamilselvam
Project Engineer

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Our Team

Max Wrede
Business & Media Intern

Jonas Eusterbrock
Technical Intern

Orlando Castillo Lopez
Technical Intern

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Our Team

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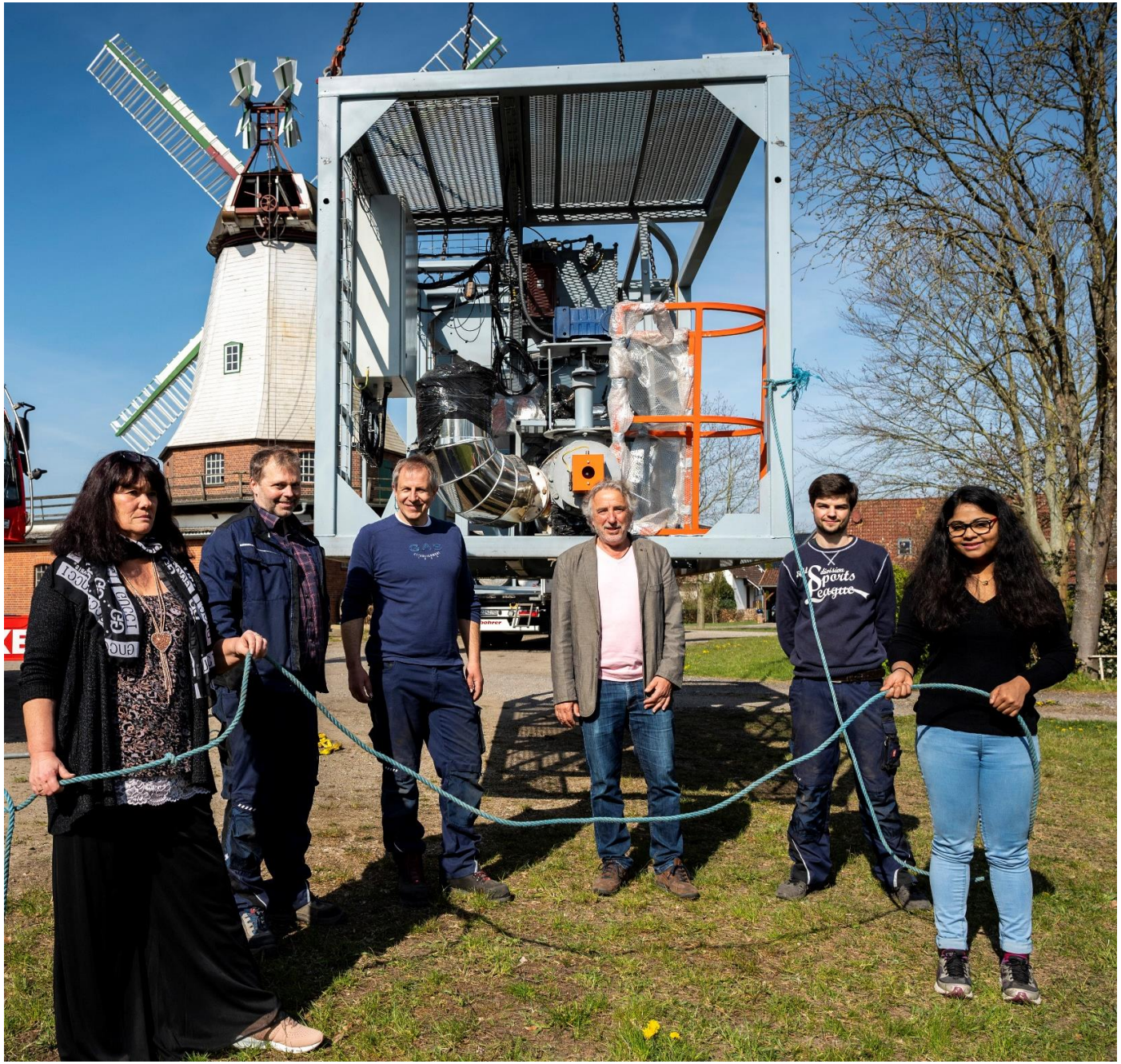
Technical Consultant

Rahul Paliwal
Technical Consultant



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