### SOLUTIONS





MAY 2022:

# YEARS MONTHS

UNTIL GLOBAL CO, BUDGET IS USED UP

UN WARNS Earth "firmly on track toward an unliveable world".

IPCC REPORT "Now or never" if world is to stave off climate disaster.

> GLOBAL WARMING **IPCC:** Mankind is running out of time.

#### PYREG'S CARBON DIOXIDE REMOVAL TECHNOLOGY NECESSARY TO ACHIEVE OUR CLIMATE GOALS





### **68 GWh** RENEWABLE **ENERGY**

8,000 households



#### 7 million trees

up to now

per year





#### PYREG SOLUTIONS MULTI-MATERIAL CAPABILITY

#### CARBONACEOUS RESIDUES



#### BIOMASS



GREEN WASTE WOOD CHIPS NUT SHELLS FOOD WASTE FRUIT PEELS & CORES



MIXED

RUBBER VARIOUS PLASTICS COMPOSITE PACKAGING



AGRICULTURAL FERTILIZER

#### SEWAGE SLUDGE BIOSOLIDS MANURE STABLE BEDDING

INDUSTRY



INDUSTRIAL SLUDGES ORGANICALLY POLLUTED RESIDUES PRODUCTION RESIDUES



#### PYREG SOLUTIONS WORLDWIDE

#### IN DETAIL

#### SEWAGE SLUDGE RECYCLING

SILICON VALLEY



During the carbonization process, the contained nutrients of the dried sewage sludge are conserved. The sewage sludge is sanitized on site and is SUSTAINABLE PLANTING OF **URBAN TREES** SWEDEN



Biochar obtained by carbonization, becomes works autothermalan important component ly. Beyond that the of planting substrate, in which water and nutrients are stored, specially adapted to the completely recycled into needs of urban trees. As neighboring processes a marketable (approved a consequence, the life Europe-wide) phosphate expectancy of the trees network), or can be con- tion of CO, emissions. is extended and the risk verted into electricity. to lose new plantings is

reduced.

**GREEN ENERGY** PRODUCTION, LOCAL HEATING NETWORK SWITZERLAND



The PYREG system system generates an energy surplus of up to 600 kW,, which is used either directly for (drying, local heating

RECYCLE RESIDUAL MATERIALS AND IMPROVE CO, BALANCE

GERMANY / USA



The PYREG system enables upcycling of different residuals into clean biochar. Through closed-loop material cycles, the sustainable and climate-friendly car- oceans. bonization-technology contributes to the reduc-

ipal waste from rivers and canals can be car-

**CLEANING OF** 

INDIA

MARINE LITTER

Mixed green and munic- The biomass-obtained biochar, together with compost, is processed bonized on site and thus to a high-quality plant be sustainably disposed soil, which improves the geneous biochar can, of before they reach the growth of plants in a sustainable and 100 % natural way.

PRODUCTION

OF SOIL

AUSTRIA

DISPOSAL OF INDUSTRIAL SLUDGE

CHINA



Industrial waste materials can be carbonized without prior sorting. The resulting homoe.g. be used as a filler in further integrated processes.





## **CUSTOMERS &** PARTNERS

Sonnererde has built the first biochar production plant in Europe in 2012! The plant operates 24 hours a day and produces about 1,000 kg of high-quality biochar per day. This biochar pioneer feeds the energy, released during the carbonization process, into its heat network - for heating and drying the feed material.

#### REFERENCES SOIL PRODUCTION



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In 2011, we opted for PYREG technology because only it could meet the strict limits of the Waste Incineration Ordinance. As we now know, this was absolutely the right decision.



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Gentle carbonization of the residual materials is the basis of our valuable potting soil. We have chosen PYREG because their many years of scientific support and practical experience give us great security regarding our sustainable product quality.



GERALD DUNST MANAGING DIRECTOR

AARON SASSMANNSHAUSEN MANAGING DIRECTOR

In close cooperation with the University of Halle-Wittenberg, Bionero GmbH has developed a Terra Preta made of unused biological materials. This plant soil, produced from vegetable charcoal and compost, improves the growth of plants in a sustainable and 100 % natural way.

www.bionero.de

🙎 bionero®







#### REFERENCES **BIOCHAR PRODUCTION & CARBON DIOXIDE REMOVAL**



As the leading marketer of EBC certified biochar, we invest heavily in applied research and in the certifiability of carbon sinks. In order to be able to guarantee our quality promise on a long-term basis, we have been successfully cooperating with PYREG from the very beginning. We currently have three PYREG plants in operation and will expand our capacity with two new systems at a new location in north Germany.

#### NOVO CARBO

CASPAR VON ZIEGNER MANAGING DIRECTOR

NovoCarbo is a leading international producer and marketer of biochar, with focus on industrial and agricultural sectors. Biochar is an important element for its customers to achieve their CO, targets. Taking this into account, NovoCarbo is production, up to 150 KW of heat are generated per plant. Fetzer uses this heat pursuing a CO<sub>2</sub> certificate for its biochar, in 2020.

Moola is the name of the biochar, produced by Fetzer Rohstoffe & Recycling GmbH, which is made from regional biomass (wood chips, grain husks). During to heat the water system of a PET recycling plant. The remaining energy is used to heat the administration rooms.

Our customers actively contribute to climate protection, as carbon remains contained in the soil for hundreds of years (carbon sink). Over the course of time we have put three PYREG plants into operation – what better proof can there be that we stand by our ecologically and economically sensible decision?



CHRISTOPH ZIMMERMANN MANAGING DIRECTOR

www.novocarbo.com

www.du-gut-pflanzenkohle.de

#### REFERENCE SEWAGE SLUDGE RECYCLING



The treatment of biosolids from sewage sludge to biochar with high nutritional value is not only cost efficient, but also a sustainable solution to locally transform organic streams into renewable energy and biochar. Once used as a phosphate fertilizer in the ground, it helps to improve the environmental footprint by sequestering CO<sub>2</sub> for centuries. By reducing the waste volume by 90 %, the PYREG technology offers a great cost saving.

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DARIO PRESEZZI MANAGING DIRECTOR

The vision of Bioforcetech is simple: instead of trucking "waste" away, we offer the technology that can autonomously transform organics into value. In the US alone, over 100 M tons of organic waste per year are sent to landfill, incinerated or land applied, creating environmental and health problems.





#### REFERENCES DISPOSAL OF INDUSTRIAL SLUDGE, RESIDUALS



Our goal is to provide our customers with a complete, efficient and cost-effective solution which continually creates an add value. By integrating PYREG technology at the respective sites and making additional use of the bioenergy generated, we have achieved this in a sustainable manner.



Critical, difficult to dispose of and cost-intensive industrial waste is not only a problem in the Asian region. PYREG plants enable our customers to recycle them in a sustainable way - directly at their site. In addition to enormous cost savings, the use of this technology also improves the waste balance, which makes it possible to expand the site.



PENG JIANG MANAGING DIRECTOR



WEIRONG CHEN MANAGING DIRECTOR

Henotec GmbH, founded in 2012 in Munich, helps European environmental technology companies enter the Chinese market. Henotec Qingdao specializes in solutions for the recycling of bio-waste, henotec Shanghai in solutions for the task is to offer solutions for a sustainable emission control and waste treatment. recycling of hazardous waste.

Meiho is an environmental service provider for automation and environmental technology in the field of industrial production- and painting-lines. The primary

Our cooperation partner Professor Dr. Bruno Glaser, a German soil biogeochemist and lecturer at the University of Halle [Saale], with a research focus on Terra Preta and biochar, is considered a luminary in the field of biochar.

www.henotech.com

www.shmeiho.com





"This exciting and highly topical subject focuses, among other things, on the fact that the biochar introduced into the soil not only serves as a long-term CO<sub>2</sub> sink, but also makes the soil more fertile and less susceptible to the negative consequences of intensive use and climate change," says Bruno Glaser.

"I have been working successfully with PYREG for more than 10 years, as their technology enables the use of this natural problem solver."



PROF. DR. HABIL. RER. NAT. BRUNO GLASER SOIL BIOGEOCHEMISTS AND UNIVERSITY LECTURER AT THE UNIVERSITY OF HALLE (SAALE)

www.landw.uni-halle.de/prof/bodenbiogeochemie





**REFERENCE** CARBON DIOXIDE REMOVAL & RENEWABLE ENERGY



Maine is the place to deploy, state of the art carbonization technology and the time is now! Our vision is to co-locate biochar production at large sources of biomass feedstock (byproducts form Maine's vast working forests), thereby driving a true circular economy, through the application of innovative NetZero technology.

Using a proven process, we will use these forestry byproducts to produce an end product that nourishes soils, cleans water and removes carbon dioxide from the atmosphere, while simultaneously generating renewable energy.

To make this vision a reality, we have chosen PYREG as our strategic partner. We are thrilled to be walking this path together and doing good – not only for the region, but also for the world.



FRED HORTON CEO STANDARD BIOCARBON

Standard Biocarbon has a mission to lead the creation of a modern North American biochar industry as part of a global climate solution. The company will manufacture high quality European standard biochar with Pyreg machines from forest waste which have traditionally been used for paper or power generation, both in decline. Our goal is to create a new growth industry, leveraging the infrastructure of the forest products industry in our region to serve growing demand for better soil, cleaner water and less CO, in the air.

www.standardbiocarbon.com

### PYREG

## SELECTED REFERENCES

### **REFERENCES BIOMASS** P1500, P500

		SITE	SYSTEM	COMMISSIONING	
1	Sonnenerde Gerald Dunst Kulturerden GmbH	Riedlingsdorf <b>AUT</b>	P500	2011	Green waste Grain husks
2	Verora GmbH	Edlibach <b>SUI</b>	P500	2012	Woodchips Green waste
3	Fetzer Rohstoffe und Recycling GmbH	Eislingen <b>GER</b>	P500 P500 P500	2013 2018 2018	Woodchips Forestry and agricultural residues
4	NovoCarbo GmbH	Dörth <b>GER</b>	P500 P500	2014/18 2018	Woodchips Screenings
5	Finzelberg GmbH & Co.KG	Andernach <b>GER</b>	P500	2015	Production residues
6	Abfallwirtschaft und Stadtreinigung Freiburg (ASF) GmbH	Freiburg <b>GER</b>	P500	2016	Woodchips Various biomass
7	Abfallwirtschaftsgesellschaft des Neckar-Odenwald-Kreises (AWN) mbH	Buchen <b>GER</b>	P500	2016	Woodchips Various biomass
8	AH Meyer (Roess Nature Group)	Tianjin <b>CHN</b>	P500	2016	Straw Coconut fiber
9	Greenpoch s.a.	Wagnelée <b>BEL</b>	P500	2016	Woodchips Green waste



10	Stockholm Vatten	Stockholm <b>SWE</b>	P500	2016	Woodchips Green waste
11	Skanefro AB	Hammenhög <b>SWE</b>	P1500	2018	Agricultural residues (Pallets) Various biomass
12	Bionereo GmbH	Thurnau <b>GER</b>	P500	2018	Woodchips Green waste Various biomass
13	AS Rohstoffe GmbH	Lohsa GER	P500	2020	Woodchips Forestry and agricultural residues
14	Jordpro AS	Trondheim <b>NOR</b>	P500	2020	Woodchips Green waste
15	Industrielle Werke Basel (iwb)	Basel SUI	PX1500	2021	Woodchips Green waste
16	Standard Biocarbon	Maine USA	2 x PX1500	2022	Woodchips Waste Wood
17	thyssenkrupp rothe erde Germany GmbH	Lippstadt <b>GER</b>	PX1500	2022	Woodchips Screenings
18	NovoCarbo	Grevesmühlen GER	2 x PX1500	2022	Woodchips Green waste



#### **REFERENCES SEWAGE SLUDGE** P500

		SITE	SYSTEM	COMMISSIONING	
19	Zweckverband Abwasserbeseitigung Linz-Unkel	Unkel <b>GER</b>	P500	2015	Dried sewage sludge
20	Entsorgungsverband Saar (EVS)	Homburg <b>GER</b>	P500	2016	Dried sewage sludge
21	Bioforcetech Corporation	Redwood, California <b>USA</b>	P500	2017	Dried sewage sludge
22	Skanefro AB	Hammenhög <b>SWE</b>	P500	2019	Dried sewage sludge
23	Trutnov	Trutnov <b>CZE</b>	P500	2020	Dried sewage sludge
24	Lorsbach	Lorsbach <b>GER</b>	PX750	2021	Dried sewage sludge
25	Umweltbetrieb (USK)	Kleve <b>Germany</b>	PX750	2022	Dried sewage sludge
26	Bioforcetech Corporation	Ephrata, Pennsylvania <b>USA</b>	PX500	2022	Dried sewage sludge
27	Bioforcetech Corporation	California <b>USA</b>	PX500	2022	Dried sewage sludge

A500

OUT PHOSPHORUS FERTILIZER

#### **REFERENCES INDUSTRIAL RESIDUALS / DISPOSAL**



#### **REFERENCES RESEARCH SYSTEMS BIOMASS**

00		SITE	SYSTEM	COMMISSIONING	
30	Eigenbetrieb Umwelttechnik Baden-Baden	Baden-Baden <b>GER</b>	A500	2019	Various regional biomass
31	NovoCarbo GmbH	Dörth <b>GER</b>	A500	2019	Various regional biomass

#### **REFERENCES PYREKA**

LABORATORY SCALE UNIT OF PYREG SYSTEM

		SITE	SYSTEM	COMISSIONING
32	Agroscope, Bundesamt für Landwirtschaft (BLW)	Zürich <b>SUI</b>	PYREKA	2014
33	Austrian Institute of Technology (AIT)	Tulln <b>AUT</b>	PYREKA	2016
34	Zürcher Hochschule für Angewandte Wissenschaften (ZHAW)	Zürich <b>SUI</b>	PYREKA	2017
35	FH Burgenland	Pinkafeld <b>AUT</b>	PYREKA	2020
36	Universität Kassel	Kassel <b>GER</b>	PYREKA	2020

GERMAN 🔅 🔅 🔅 ENGINEERING

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