ENDEMIC
— process engineering —

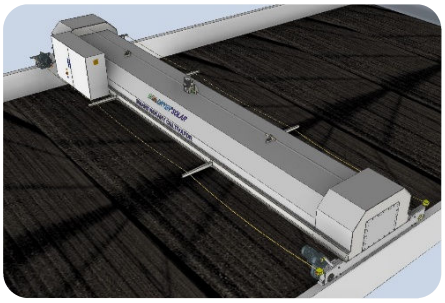
BiMaDRYER® SOLAR

NATURAL BIOMASS DRYING FACILITIES

AND

RATIONAL AND ECONOMIC INTEGRATED SOLUTION ALTERNATIVES

GENERAL TECHNICAL SPECIFICATIONS



ISO 9001:2015 ISO 14001:2015

ISO 45001:2018

BiMaDRYER ®SOLAR- BIOMASS NATURAL DRYING FACILITY

BiMaDRYER ®SOLAR is a natural drying facility utilizing solar energy, specifically designed within a solar greenhouse, for drying dewatered sludge from domestic and industrial wastewater treatment plants, as well as other various biomasses, achieving up to 90% drying levels.

A solar greenhouse is constructed on a steel structure built on a reinforced concrete base, utilizing carbon fiber panels.

The drying fans, exhaust fans/covers, and specially designed dewatered sludge/wet biomass mixing, spreading, and pushing machine are equipped for high drying efficiency and odorless operation.

The sizing of the solar greenhouse and optimization of evaporation/drying are carried out based on the climatic characteristics of the region where the solar greenhouse will be installed, sunlight position, solar energy efficiency, as well as the quantities of the raw materials to be dried and their dry matter concentrations, in accordance with the required evaporation capacity for drying needs.

BiMaDRYER ®SOLAR greenhouse structures are designed in single or multiple units according to capacity requirements.

External temperature, humidity, and wind, as well as internal temperature and humidity within the greenhouse, are continuously monitored with specially selected equipment and devices. Equipped with internal circulation and exhaust fans, as well as spreading/mixing/pushing machines (SRC), they are set according to ideal solar drying conditions and perform their expected functions automatically and/or manually during operation.

Wet sludge or biomass is systematically transferred to the solar greenhouse via a conveyor equipped with automatic discharge gates.

The **Smart Rotary Cultivator (SRC)** systematically and repeatedly spreads and mixes wet sludge or biomass along the length of the greenhouse at selected spreading thicknesses. Both dry and wet biomass are mixed. This process eliminates potential odor problems in the greenhouse. The drying effect is enhanced by circulation fans, while exhaust fans expel internal air exceeding the set humidity limit out of the greenhouse.

When the biomass, spread and mixed at regular thicknesses in the greenhouse, reaches the selected thickness and the anticipated drying level, different programmable operational methods are applied in single or multiple greenhouse systems. Through the operation of the SRC, dry biomass is discharged and removed from the system, initiating the transfer of new wet sludge/biomass into the greenhouse. In multiple greenhouse structures, wet sludge/biomass is periodically and automatically transferred to other greenhouse sections. The discharge of dry sludge from the greenhouse is carried out either through a discharge conveyor or by loading onto suitable vehicles.

All of these operations can be performed manually or automatically; for these processes, the ENDRY-XW software has been developed.

Endemic holds ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, ISO 10002:2018, and CE certificates as part of its additional steps to provide the best customer support and deliver high-quality products. BiMaDRYER ® SOLAR is supplied in compliance with TS EN 13031.1:2020-02 B15, TS 498, and Eurocode 8 solar greenhouse standards and regulations, as well as the EC Machinery Directive.

BiMaDRYER® SOLAR APPLICATION AREAS

*The design and construction of the **Niksar Wastewater Treatment Plant** IPA-II project, under Environment, Urbanization and Climate Change Ministry, EU and Foreign Relations General Directorate, has been completed by the Contractor firm **ÇEVTAŞ** in accordance with FIDIC (Yellow Book) standards. The facility is operated with 2 hall Solar Sludge Drying Unit with a capacity of **15 tons/day** dewatered sludge.*

BiMaDRYER®*SOLAR* drying systems are used for drying the following dewatered sludge and wet biomass:

Urban and industrial sources:

- Dewatered sludge from urban wastewater treatment plants
- Industrial sludge
- Waste and RDF

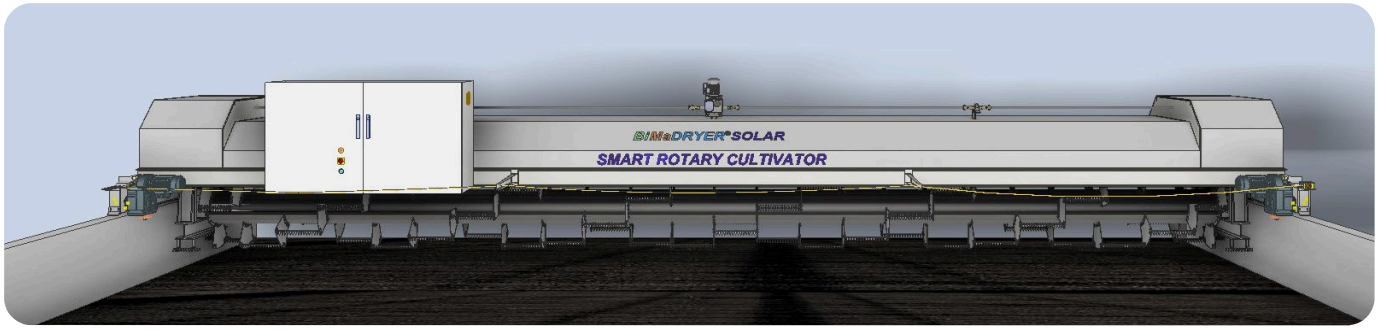
Agricultural sources:

- Animal waste
- Plant waste
- Straw, husks
- Corn stalks and cobs
- Fruit and fruit waste

Forest sources:

- Wood, bark, leaves, and branches

SMART ROTARY CULTIVATOR- SRC Rotary Mixing Machine



The SMART ROTARY CULTIVATOR (SRC) is the most important machine of the BiMaDRYER® SOLAR Drying Facility. The SRC is equipped with superior functional features.

SRC ELECTRO-MECHANICAL SYSTEM FEATURES

- Forward and backward, fast and slow automatic, frequency-controlled, linear bridge movement system along the hall
- Rotary spreading, mixing, and pushing drum equipped with rakes and cutters, with adjustable speed
- Level-controlled rotary drum with automatic height adjustment
- Start/stop switch devices for periodic stopping/starting operations
- Emergency machine stop system for operator safety
- Motor & gearbox brake systems
- Control and command panel

SRC OPERATING FEATURES

- To maximize evaporation efficiency, the layer of wet sludge/biomass is kept at the top of each layer spread during each cycle.
- Aeration of the wet layer is ensured.
- Mixing of the dry layer with the wet layer is done to prevent odor.
- During drying, in systems with continuous input and output of wet/dry biomass, the dry biomass can be continuously transported to the exit section or exit conveyor along the length of the hall.
- There is no wasted space in the drying hall.
- Biomass clumps are evenly distributed in the drying area.
- Dry biomass can be easily transported to the collection point.
- Approach to the SRC is restricted for operator safety. In such cases, the SRC automatically stops.
- Continuous presence of an operator is not required during normal operation. This ensures high standards of occupational safety.
- Personnel requirement is half an hour.
- It is produced to heavy-duty standards.
- The SRC is a convenient, simple, and aesthetic machine.
- It is an energy-efficient drying operation.
- Fully integrated into the BiMaDRYER® SOLAR Drying System.
- It operates under manual or automatic operation principles within the system's software and automation, subject to the operator's command.

SMART, CREATIVE and ECONOMICAL INTEGRATED SLUDGE / BIOMASS DRYING SOLUTIONS

The biggest disadvantage of energy-efficient BiMaDRYER® SOLAR Drying Facilities is their large space requirements. The solution to this is energy-efficient Hi-Tech integrations.

The following can be considered as alternative, smart, creative, and economical solutions instead of conventional thermal drying systems:

1. Integration of solar energy and heat pump with renewable energy for drying.
2. Integration of solar energy, heat pump, and waste cogeneration heat with renewable energy for drying.
3. Integration of solar energy, heat pump, and microwave drying.
4. Integration of microwave and heat pump with belt drying.
5. Heat pump-assisted belt drying systems.

The drying integrations mentioned above can be supported by renewable energy sources such as PV panels, wind turbines, waste heat from BiMaGAS (Biomass Gasification Power Plant), etc.

"Innovative" drying methods to replace conventional thermal drying systems should be evaluated separately for each project's requirements, considering material/energy/economic balances and sustainable operation balance, and the most suitable choice should be made. You can also inquire about Microwave with Heat Pump Drying Integration from our company.

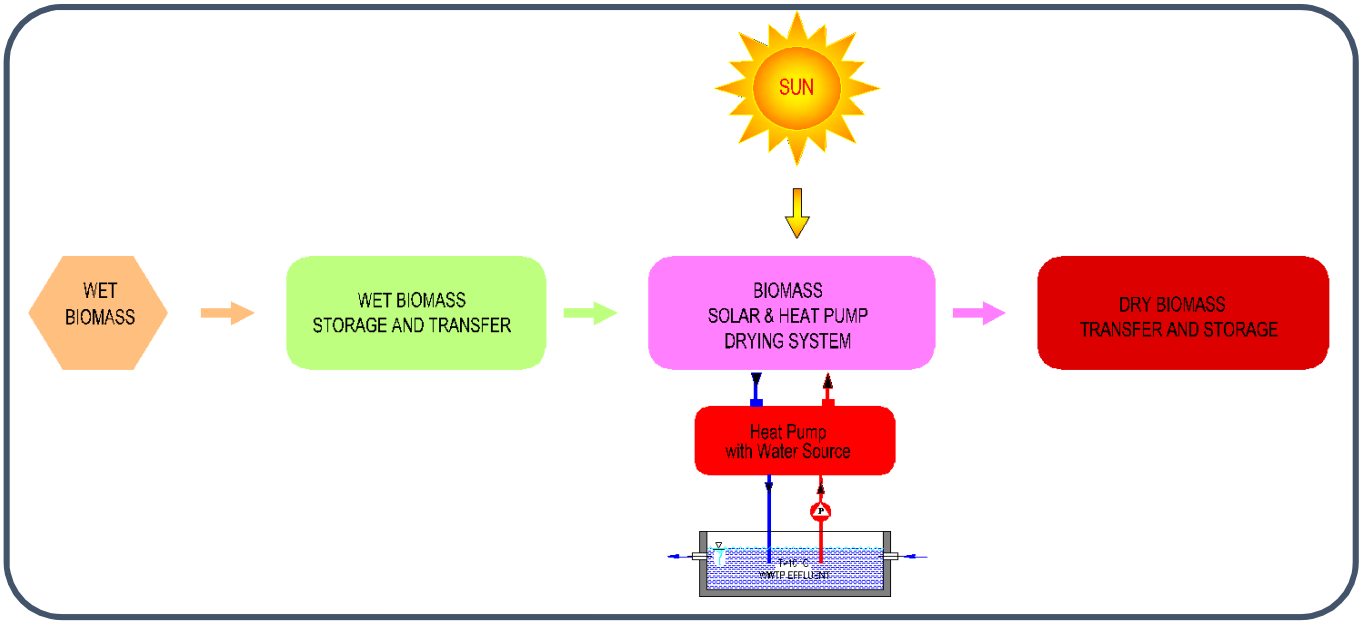
The focus will be on BiMaDRYER®SOLAR&HT - Solar Energy and Heat Pump Integrated Drying Facilities.

The emphasis is particularly on the drying of dewatered sludge from wastewater treatment plants.

Solar drying is resolved with much smaller space requirements through Heat Pump integration.

This solution offers economic and significant advantages in terms of both Investment Cost (CAPEX) and Operating Cost (OPEX), and it comes with easy and simple operation features.

BiMaDRYER® SOLAR&HT SLUDGE/BIOMASS DRYING SCHEME



Block Diagram of Sludge / Biomass Drying Facility with Solar and Heat Pump Integration

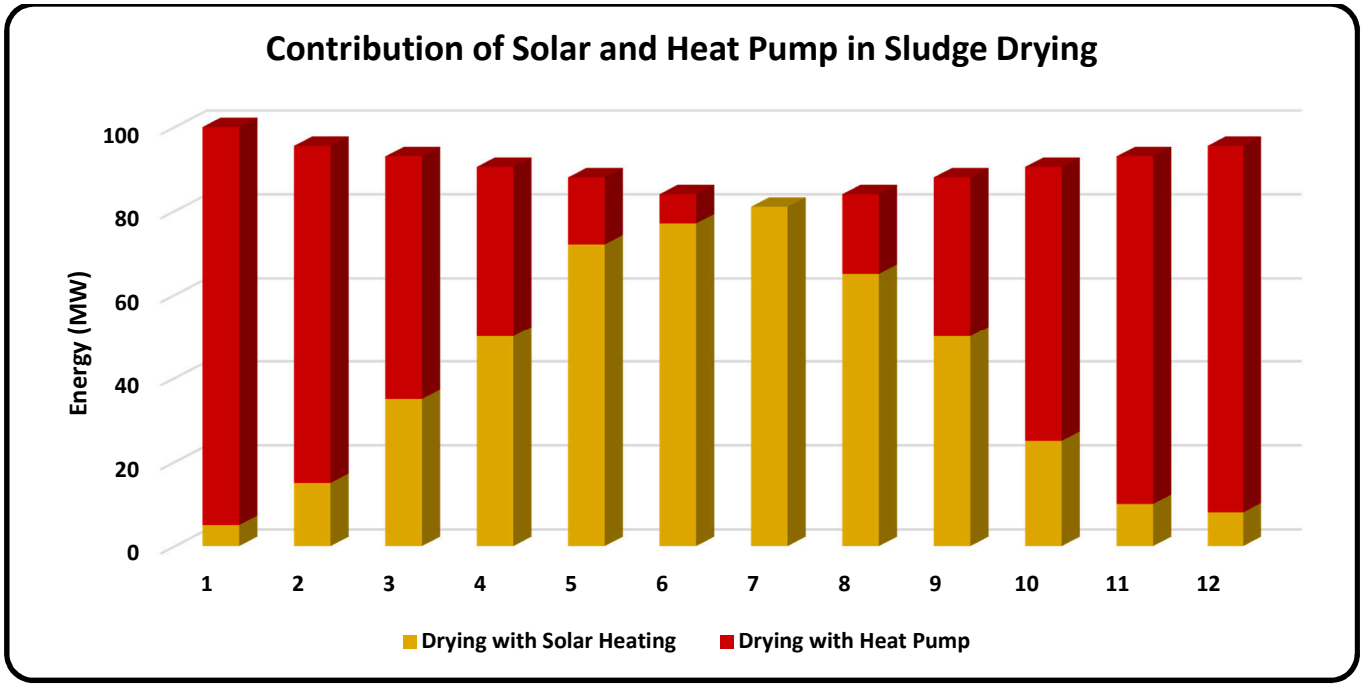
In BiMaDRYER® SOLAR drying facilities, in addition to solar energy, **HEAT PUMP** has been integrated into the system. Heat pump automation has been added, and all other operating features are the same as solar drying.

In this alternative, a water-source heat pump is integrated into the system. The WWTP outlet water temperatures are 10°C and well above. This WWTP discharge serves as the energy source for the water-source heat pump. Heat pumps are renewable energy machines that produce 4 kW of thermal energy with an average of 1 kW-hour of electrical energy. The main components are the evaporator, condenser, compressor, and expansion valve. The heat pump uses environmentally friendly fluids such as R410A, NH3, or similar.

The unit heat from the water source is amplified approximately four times and sent to the solar greenhouse, where it heats the wet sludge with this secondary heat. The drying system is now ready to operate with the integration of solar energy and the heat pump.

Based on the evaporation needs for drying, optimizations are made for the renewable energy obtained from the greenhouse area and the heat pump. This allows for the calculation of the most economical CAPEX and OPEX, design of the system, selection of E&M equipment, and implementation of control and automation. The system will be made available for the operator's use.

If there are digester/cogen units in the AAT, including the heat from these sources in the integration calculations would be a correct approach.



In the above graph, under general conditions, the shares of total drying energy composed of solar energy and heat pump energy are shown by month. Energy-economic optimization should be done according to each region and drying demands.

In solar greenhouse structures, drying periods for sludge can range from 3 to 20 days depending on the solar exposure regimes in summer and winter. This can lead to significant space requirements or difficulties in achieving drying efficiencies during winter regimes. The best solution to eliminate these negative conditions would be heat pump integration, achieved through careful calculation and design optimization.

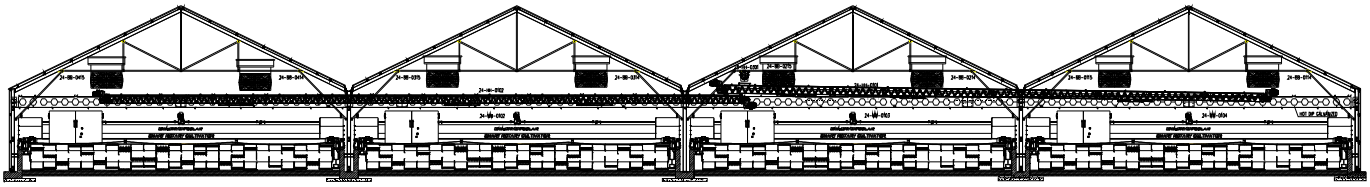
In cases where greenhouse area is insufficient, additional solutions such as pre-drying to the required levels using Microwave Drying can also be integrated into engineering calculations as a rational alternative.

SRC- SMART ROTARY CULTIVATOR TECHNICAL SPECIFICATIONS

ENDMIC manufactures SRC Machines in various sizes depending on solar greenhouse designs. The technical specifications of the SCR-12 Smart Rotary Cultivator are below.

SMART ROTARY CULTIVATOR/ SRC-12	
Model	SRC-12
Machine features	Mixing / aeration / granulation / transport / stacking
Steel construction material	St 52 / hot dip galvanized
Rake and cutter material	AISI316L
Linear bearing material	Special stainless steel
SRC-12 main dimensions WxLxH	3.200x12.280x1.900 (mm)
Rack gear height	Drum in parking position:2,297 mm / $drum_{max.}$ depth:2073 mm
Control panel WxLxH	45x2000x1200 (mm)
Sludge spreading width	12.000 mm
Sludge spreading height	500 mm
No. of bridge travel motor	2 pieces
Travel motor power	2,2 kW
Travel motor type	DR473.00/Yılmaz Redüktör
Drive type	Adjustable with frequency controller
Motor operating mode	Synchronous
No. of drum rotation motor	2 pieces
Rotation motor power	5,5 kW
Rotation motor type	KR473.00/Yılmaz Redüktör
Drive type	Adjustable with frequency controller
Motor operating mode	Synchronous
No. of drum/rake lifting motor	1 piece
Lifting motor power	1,1 kW
Lifting motor type	LOCK EWA 14
Drive type	Adjustable with ultrasonic level control
Vertical adjustable height	500 mm
Total installed power	16,5 kW
Local Control panel	1 piece / for each machine
Main control panel	1 piece / for total drying halls
Operator panel	1 piece for each SRC machine / on main control panel
Inter-panel communication type	Wireless
System software code	ENDRY-12.4
Operating mode	Manual/automatic
Stop swiches	2x2 pieces
Safety switches	2 pieces
Ultrasonic level control device	1 piece
Cable carrying system	Roller/linear

BANDIRMA WWTP (IPA-II PROJECT) - SOLAR DRYING 4 HOLES/SECTION



SRC- SMART ROTARY CULTIVATOR - CERTIFICATES

CERTIFICATE

ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SAN. VE TİC. A.Ş.

ISO 9001:2015

GCR CERT

CERTIFICATE

ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SAN. VE TİC. A.Ş.

ISO 45001:2018

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DECLERATION OF CONFORMITY – CE

WE HERE DECLARE MANUFACTURER / EU REPRESENTATIVE:

ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SANAYİ VE TİCARET ANONİM ŞİRKETİ

Dudullu OSB Mah.DES-110 Sk. No:42 Ümraniye – İSTANBUL / TÜRKİYE

That following described product in our delivered version complies with the appropriate basic safety and health requirements of the Directive 2006/42/EC (Machinery Directive) based on its design and type, as brought in circulation by us. In case alteration of the product, not agreed upon by us, this declaration will lose its validity.

Description of the Product	: SMART ROTARY CULTIVATOR
Product Commercial Brand	: ENDEMIC
Product Type	: Rotary Mixing Machine
Standards	: EN ISO 12100:2010, EN ISO 60204-1
Applicable EC Directives	: 2006/42/EC (Machinery Directive)

MANUFACTURER AUTHORIZED SIGNATURE

Name / Function	: BURAK ATOM OKUMUŞ / General Manager
Location / Date	: TÜRKİYE / 01.07.2024
Signature	:

CERTIFICATE

ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SAN. VE TİC. A.Ş.

ISO 10002:2018

QA-AC-7218/24

QA TECHNIC – UYGUNLUK ONAYI

ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SAN. VE TİC. A.Ş.

DUDULLU OSB Mah. DES-110 Sk. D.20 BLOK NO:42 ÜMRANİYE İSTANBUL/ TÜRKİYE

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CERTIFICATE OF ORIGIN AND QUALITY

For equipment and accessories issued by manufacturing company.

PRODUCT NAME	: SMART ROTARY CULTIVATOR
MODEL & S/N	: SRC-12
TYPE	: Rotary Mixing Machine
SUPPLIER NAME	: ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SANAYİ VE TİCARET ANONİM ŞİRKETİ
SUPPLIER ADRESS	: Dudullu OSB Mah.DES-110 Sk. No:42 Ümraniye İSTANBUL / TÜRKİYE
MATERIAL	: Drum & Frame: ST37, Rake material: AISI316L, Drive head & bridge construction: ST-37 Material primer+epoxy top coat painted welded steel construction
COUNTRY OF ORIGIN	: TÜRKİYE

THEREFORE, WE CONFIRM THAT THE PRODUCT AND ACCESSORIES LISTED ABOVE HAVE BEEN PRODUCED IN THE BEST CONDITIONS. ALL MATERIALS ARE THE BEST QUALITY, AND THE MANUFACTURING PROCESS WAS MONITORED ALL THE STAGES.

MANUFACTURER AUTHORIZED SIGNATURE

Name / Function	: BURAK ATOM OKUMUŞ / General Manager
Location / Date	: TÜRKİYE / 01.07.2024
Signature	:

CERTIFICATE

ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SAN. VE TİC. A.Ş.

ISO 14001:2015

TÜRKİYE ODALAR VE BORSALAR BİRLİĞİ

KAPASİTE RAPORU

İSTANBUL TİCARET ODASI

Geçerlilik Süresi Sonu 18.04.2025

endemic CE

WARRANTY CERTIFICATE

MANUFACTURER

NAME	: ENDEMİC FİTO FARMA BİYOTEKNOLOJİ SANAYİ VE TİCARET ANONİM ŞİRKETİ
ADRESS	: Dudullu OSB Mah.DES-110 Sk. No:42 Ümraniye İSTANBUL / TÜRKİYE
PHONE	: 0216 415 10 14 - 0216 489 12 58 - 59
PRODUCT NAME	: SMART ROTARY CULTIVATOR
MODEL & S/N	: SRC-12
WARRANTY PERIOD	: 24 Months

WARRANTY CONDITIONS

- This equipment are under the manufacturer's warranty for the period mentioned above against design and production defects.
- This warranty does not apply to damage caused by accidents, negligence or misuse.

MANUFACTURER AUTHORIZED SIGNATURE

Name / Function	: BURAK ATOM OKUMUŞ / General Manager
Location / Date	: TÜRKİYE / 01.07.2024
Signature	: