



ENDemic
— process engineering —



BiMaDRYER[®] SOLAR

*Solar-Thermal Rotary Cultivator
Natural Biomass Drying Facilities*

GENERAL SPECIFICATIONS

BiMaDRYER® SOLAR – Natural Biomass Drying Facility



SMART, INNOVATIVE,
COST-EFFECTIVE



BiMaDRYER® SOLAR is a natural drying system utilizing solar energy. It is specifically designed to operate within a greenhouse structure for drying dewatered sludge from municipal and industrial wastewater treatment plants, as well as various types of biomass, achieving drying levels of up to 90% dry solids.

The solar greenhouse is constructed using a reinforced concrete foundation, combined with a steel structure and carbon fiber panels.

To ensure high drying efficiency and odour-free operation, the system is equipped with drying fans, exhaust fans/vents, and specially designed wet sludge / wet biomass mixing, spreading, and conveying machines.

The sizing of the greenhouse and the optimization of evaporation and drying performance are carried out based on:

- Local climatic conditions
- Solar radiation and sunshine duration
- Energy efficiency targets
- Quantity and dry solids content of the material to be dried

All parameters are calculated according to the required evaporation capacity.

BiMaDRYER® SOLAR greenhouse structures can be designed as single or multiple units, depending on capacity requirements.

Temperature, humidity, and wind conditions inside and outside the greenhouse are continuously monitored using dedicated instrumentation. Internal circulation fans, exhaust systems, and spreading/mixing/conveying machines (**Smart Rotary Cultivator**) are automatically and/or manually controlled to maintain optimal solar drying conditions.

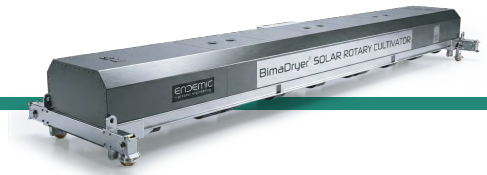
Dewatered sludge or biomass is transported into the greenhouse via conveyor systems equipped with automatic discharge mechanisms.

The **Smart Rotary Cultivator (SRC)** ensures continuous spreading and mixing of wet sludge or biomass at controlled layer thicknesses, delivering uniform drying performance. Mixing of dry and wet material prevents odour formation, while drying efficiency is enhanced through optimized air circulation and exhaust of moisture-laden air.

Once target thickness and dry solids levels are reached, programmable modes enable simultaneous discharge of dried biomass and intake of new wet sludge, ensuring continuous operation. In multi-greenhouse systems, material is automatically transferred between sections, and dried output is removed via conveyors or loaded directly into transport vehicles.

All operations are managed manually or automatically via Endemic's proprietary ENDRY-XW software. BiMaDRYER® SOLAR and SRC units are designed, manufactured, and supplied in accordance with CE requirements (Machinery Directive 2006/42/EC) and relevant European standards, including EN 13031-1, Eurocode (EN 1990–1998), EN 1090, EN 60204-1, EN ISO 12100, EN ISO 13849-1, together with applicable EU environmental, sludge management, and energy efficiency directives.





APPLICATION AREAS

Bandırma Wastewater Treatment Plant – IPA II Project

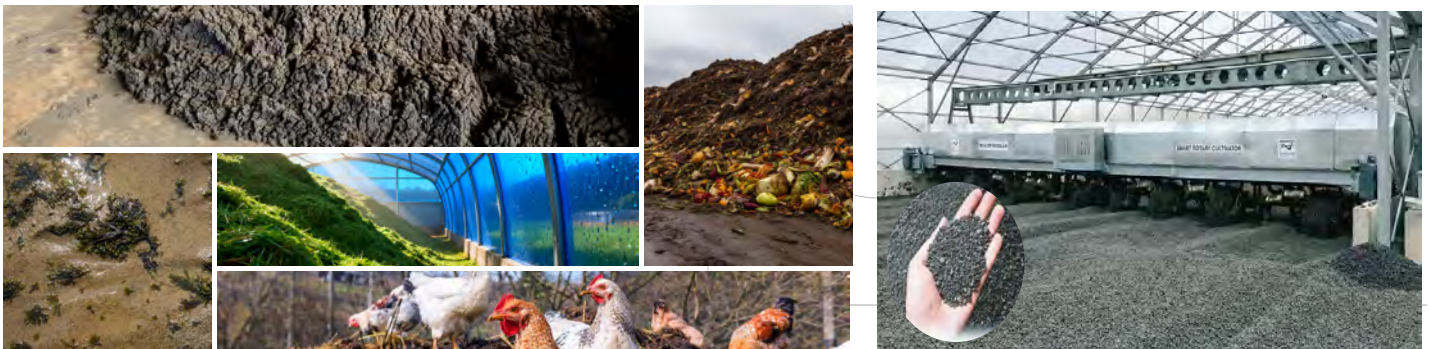
Completed by ÇEVTAŞ under the Ministry of Environment, Urbanization and Climate Change, Directorate General for EU and Foreign Relations, in accordance with FIDIC (Yellow Book) standards.

The facility operates with a Solar Sludge Drying System consisting of **4 greenhouse units**, with a total capacity of **30 tons/day** of dewatered sludge.



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

Category	Applications / Materials
Municipal & Industrial	Municipal sludge; Industrial sludge; RDF & waste; Food processing sludge; Pulp & paper sludge; Textile sludge; Chemical & petrochemical sludge
Agricultural	Animal manure; Plant residues; Straw & husks; Corn stalks & cobs; Fruit & vegetable waste; Olive pomace; Sugar beet pulp
Forestry	Wood residues; Bark; Leaves; Branches; Sawdust; Wood chips
Organic / Biomass	Digestate; Compost feedstock; Green waste; Algae; Aquaculture sludge





The state-of-the-art **Smart Rotary Cultivator (SRC)** is the key machine of the **BiMaDRYER® SOLAR Drying Facility** and is equipped with advanced functional capabilities.

SRC Electro-Mechanical System Features

- Forward–reverse, variable speed, automatic, frequency-controlled linear bridge movement system along the greenhouse
- Rotary spreading–mixing–conveying drum equipped with adjustable speed, rakes, and cutting elements
- Automatically height-adjustable, level-controlled rotary drum
- Start/stop switches for periodic operation
- Emergency stop system for operator safety
- Motor and gearbox braking systems
- Control and command panel



SRC WORKING PRINCIPLE

- Forward–reverse, variable speed, automatic, frequency-controlled linear bridge movement system along the greenhouse
- Rotary spreading, mixing, and conveying drum operating at adjustable speed and equipped with rakes and cutting elements
- Automatically height-adjustable, level-controlled rotary drum
- Start/stop switching mechanisms for periodic operation
- Emergency stop system for operator safety
- Motor and gearbox braking systems
- Control and command panel
- **Easy maintenance with individually replaceable cultivator blades**



BiMaDRYER® SOLAR

In energy-efficient BiMaDRYER® SOLAR drying systems, for projects with limited drying area, the required footprint is minimized through advanced, energy-efficient technology integrations.

Alternative and integrated solutions:

- Solar energy + heat pump integration
- Solar energy + heat pump + waste cogeneration heat
- Solar energy + heat pump + microwave drying
- Microwave + heat pump + belt drying
- Heat pump-assisted belt drying systems



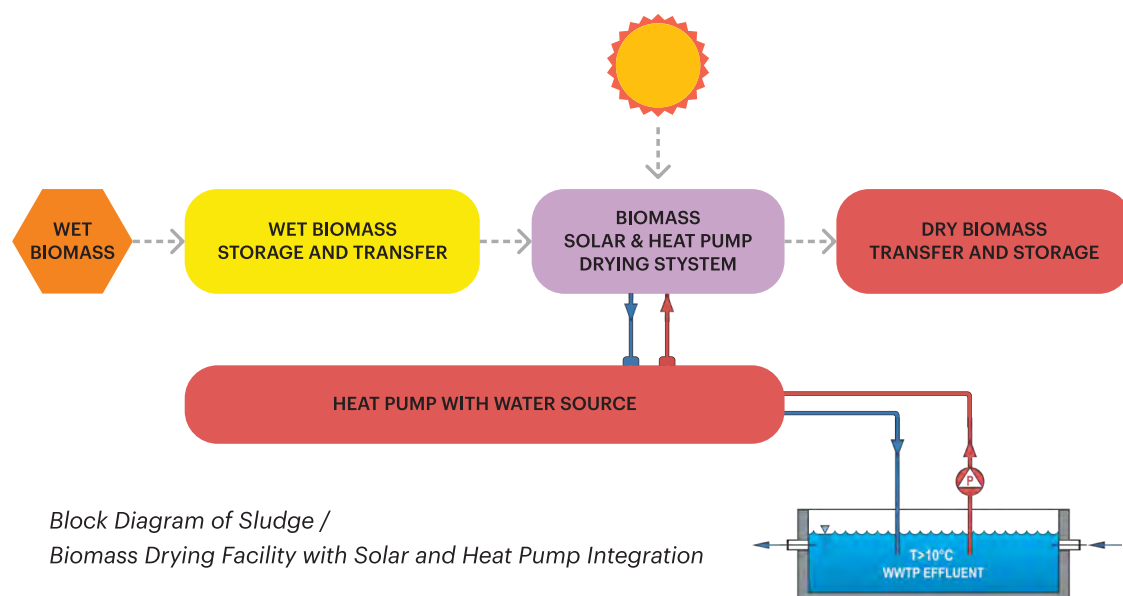
The above-mentioned drying integrations can be supported by renewable energy sources such as PV panels, wind turbines, and waste heat from BiMaGAS (Biomass Gasification Power Plants).

Innovative drying methods that can replace conventional thermal drying systems should be evaluated individually for each project, considering material, energy, and economic balances, as well as long-term sustainable operation criteria, in order to determine the most suitable solution.

Information on heat pump-integrated microwave drying systems can also be provided upon request.

The primary focus will be on BiMaDRYER® SOLAR & HT – Solar and Heat Pump Integrated Drying Systems, with particular emphasis on the drying of dewatered sludge from wastewater treatment plants as the main application area.

Through heat pump integration, solar drying systems can be implemented with significantly reduced area requirements, offering substantial advantages in terms of both Capital Expenditure (CAPEX) and Operating Expenditure (OPEX), while standing out with their simple and reliable operation.



BiMaDRYER® SOLAR & HT – Integrated Solar + Heat Pump Drying

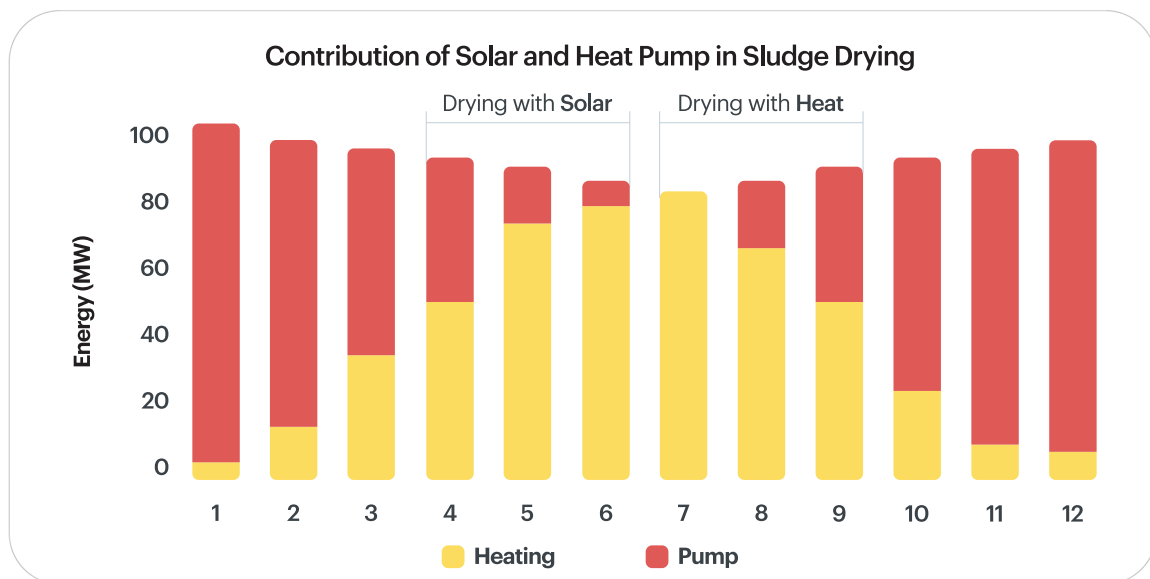
In BiMaDRYER® drying systems, a heat pump can be integrated alongside solar energy to significantly enhance drying performance while maintaining the simplicity of solar-based operation. The system includes dedicated heat pump automation, fully synchronized with the overall process control.

A water-source heat pump utilizes WWTP effluent (typically $\geq 10^{\circ}\text{C}$) as a stable and renewable energy source. With an average consumption of 1 kWh electrical energy, the system generates approximately 4 kW of thermal energy, delivering highly efficient heat recovery through components such as the evaporator, condenser, compressor, and expansion valve, using environmentally friendly refrigerants (R410A, NH_3 , or equivalent).

The recovered thermal energy is transferred into the greenhouse, supporting sludge heating and accelerating evaporation. This solar + heat pump integration enables reliable, year-round drying performance with significantly reduced area requirements.

System design is optimized based on evaporation demand, climate conditions, and energy balance, ensuring the most economical CAPEX and OPEX. All electromechanical equipment, control systems, and automation are engineered to deliver a fully integrated and ready-to-operate solution.

Where available, waste heat from digesters or cogeneration units can be incorporated into the system, further improving overall energy efficiency and project economics.



The graph illustrates the monthly distribution of total drying energy, highlighting the contributions of solar energy and heat pump integration. System design and energy-economic optimization must be carried out for each project based on local climate conditions and drying requirements.

In solar greenhouse systems, drying times typically range from 3 to 20 days depending on seasonal solar radiation, which may increase area requirements and limit performance in winter conditions. These limitations can be effectively overcome through heat pump integration, optimized through careful engineering and design.

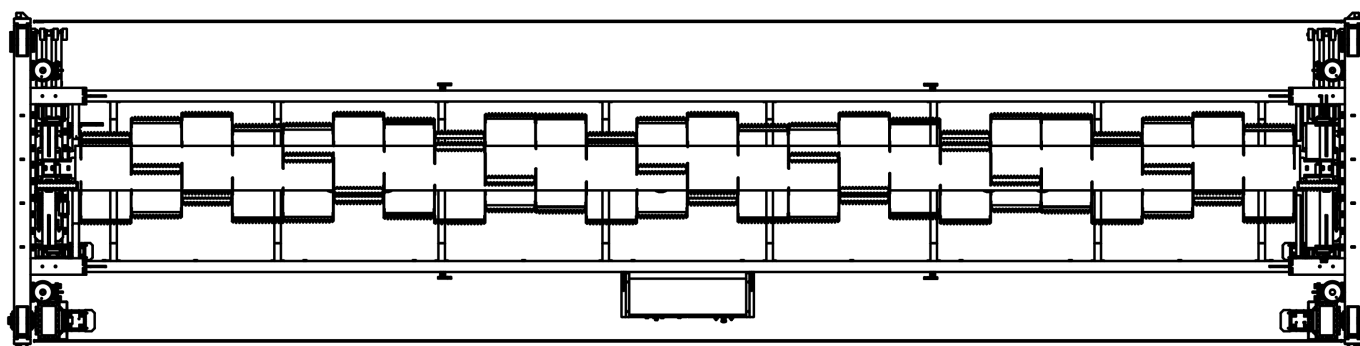
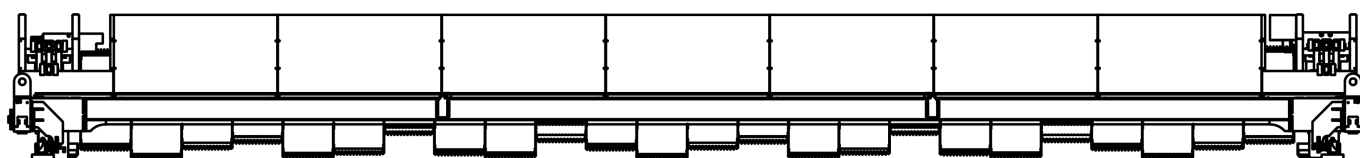
Where greenhouse area is constrained, microwave pre-drying solutions can be incorporated as a practical and efficient alternative to achieve the required performance.



TECHNICAL SPECIFICATIONS OF SRC-12

ENDEMIC manufactures SRC machines in various sizes and capacities, depending on the solar greenhouse design. The technical specifications of the SRC-12 Smart Rotary Cultivator are presented below.

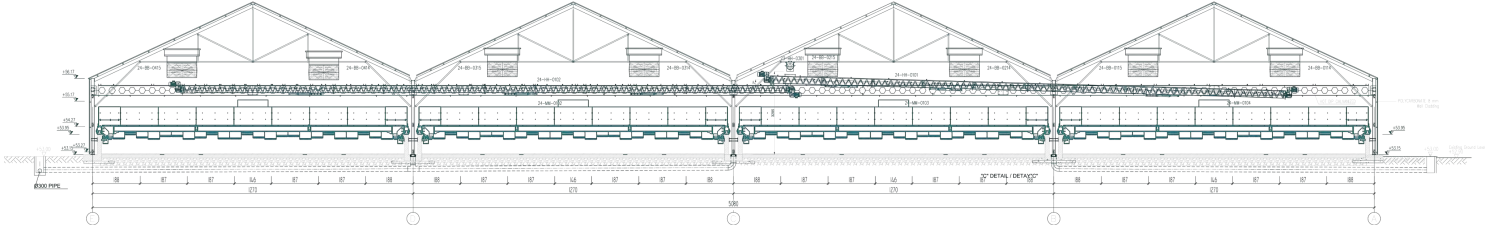
Model SRC-12		Model SRC-12	
Parameter	Specification	Parameter	Specification
Machine Functions	Mixing / Aeration / Conditioning / Conveying / Spreading	Motor Type	Synchronous
Structure Material	St 52 steel, epoxy coated	Drum Lifting Motors	2 units
Rakes & Cutting Parts	AISI 304 / AISI 316 stainless steel	Lifting Motor Power	0.55 kW
Linear Rail Material	Special stainless steel	Control Type	Adjustable via ultrasonic level control
Dimensions (L × W × H)	3,200 × 12,800 × 1,900 mm	Vertical Adjustment Range	500 mm
Control Panel Dimensions (W × L × H)	350 × 1,200 × 500 mm	Total Installed Power	16.5 kW
Sludge Bed Width	12,000 mm	Local Control Panel	1 unit per machine
Spreading Height	500 mm	Main Control Panel	1 unit per sludge drying hall
Bridge Drive Motors	2 units	Operator Panel	Mounted on SRC unit
Bridge Drive Power	2.2 kW	Panel Communication	Wireless
Drive Type	Speed controlled (frequency inverter)	Control Software	ENDRY-XW
Motor Type	Synchronous	Operation Mode	Manual / Automatic
Drum Rotation Motors	2 units	Stop Switches	2 × 2 units
Drum Drive Power	5.5 kW	Emergency Stop	2 units
Drive Type	Speed controlled (frequency inverter)	Ultrasonic Level Sensor	1 unit
		Cable Handling System	Pulley / Linear system



SRC-12

BiMaDRYER® SOLAR

*Solar-Thermal Rotary Cultivator
Natural Biomass Drying Facilities*



ENDeMiC
— process engineering —



**Regenerate
Planet Earth**



endemic
Endemic Fito Farma Biyoteknoloji
Sanayi ve Ticaret A.Ş.

📍 Dudullu OSB, Esenkent Mah. 110. Sokak, D20 Blok,
No:42, 34776 Ümraniye - İstanbul, Türkiye

🌐 www.endemicprocess.com

☎ +90 532 286 42 36

☎ +90 216 489 94 56

✉ info@endemicprocess.com



ENDeMiC
— process engineering —