



Smart Industrial Drying & Heating

Microwave, AI, and Sustainable Thermal Solutions by **Kerone Engineering Solutions**



Manufacturing Challenges: The Drying & Heating Crisis

Energy Consumption

Drying accounts for **10–15%** of industrial energy use globally — one of the largest operational cost drivers in manufacturing.

Processing Time

Traditional methods require **24–72 hours** for complete drying, creating costly bottlenecks and limiting throughput capacity.

Uneven Heating

Hot spots and cold zones reduce product quality, consistency, and introduce costly rejects across sensitive product lines.

Operational Costs

High energy bills, frequent equipment maintenance, rising carbon emissions, and tightening sustainability regulations compound pressure.

Traditional vs. Advanced Drying Technologies

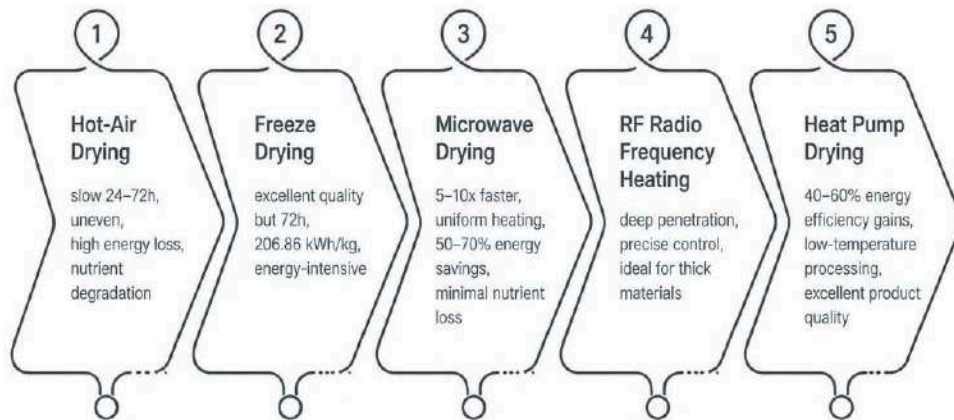
Technology at a Glance

Not all drying methods are equal. While **hot-air drying** remains the industry default, it sacrifices both quality and efficiency.

Microwave drying delivers 5–10x faster processing with 50–70% energy savings and comparable or superior nutritional preservation — making it the leading choice for modern operations.

Heat pump drying has garnered significant attention in the food industry due to its unique energy efficiency, environmental friendliness, and exceptional product quality — offering 40–60% efficiency gains at low operating temperatures.

- ❏ Microwave drying requires shorter drying times and lower energy while matching conventional technologies on nutritional and physicochemical quality.



Kerone's Comprehensive Drying & Heating Solutions

A complete portfolio of **7 thermal processing technologies** engineered for performance, precision, and scalability across industries.



Rotary & Fluid Bed Dryers

Continuous processing for bulk materials, granules, powders, pharmaceuticals, and chemicals.



Conveyor & Vacuum Dryers

High-throughput food and textile lines; low-temperature processing for heat-sensitive premium compounds.



Microwave & RF Systems

Rapid, energy-efficient drying with deep uniform penetration for thick materials and complex geometries.



Heat Pump Drying

Sustainable, low-energy solution optimized for food and agricultural product integrity.

Industry Applications: Across Sectors



Where Kerone Delivers



Food Processing

Fruits, vegetables, grains, spices, dairy powders, specialty ingredients



Pharmaceuticals

APIs, herbal extracts, finished dosages



Chemicals & Agriculture

Pigments, catalysts, seeds, grains, biomass, biofuel residues



Specialty Manufacturing

Textiles, ceramics, minerals, advanced materials, insect protein



Industry 4.0: Smart Drying Systems Powered by AI & IoT



Real-Time Monitoring

IoT sensors continuously track temperature, humidity, moisture, and energy consumption across every drying zone.



Predictive Maintenance

AI algorithms predict equipment failures **5–10 hours in advance**, reducing unplanned downtime by **40–50%** and extending equipment lifespan.



Cloud & Digital Twins

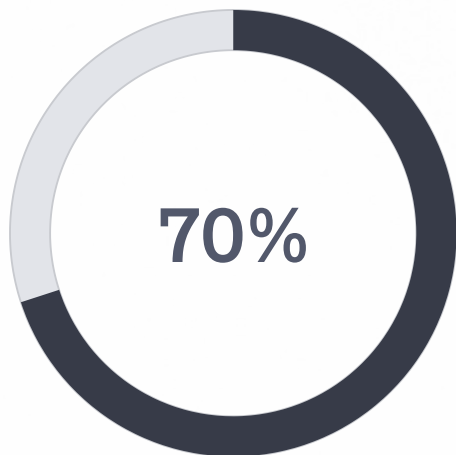
Centralized monitoring across sites and virtual replicas enable simulation and optimization before physical implementation.



Full Automation

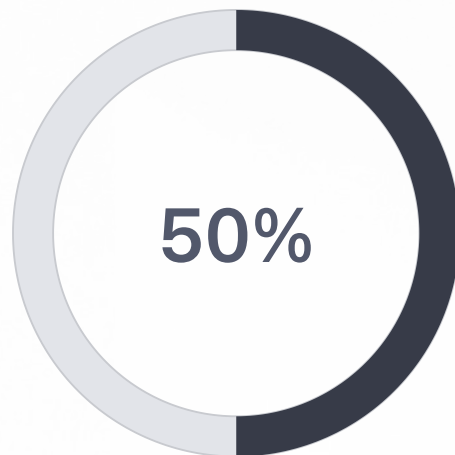
Seamless ERP, MES, and SCADA integration with AI-driven algorithms auto-adjusting parameters for optimal drying curves.

Sustainability: Energy Efficiency & Environmental Impact



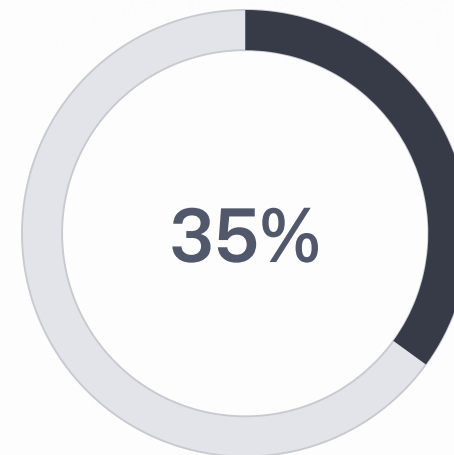
Energy Savings

Advanced insulation, smart power management, and optimized airflow reduce energy consumption by 40–70%.



CO₂ Reduction

Lower energy use translates directly to a 30–50% reduction in CO₂ emissions per unit produced.



ROI Improvement

Reduced energy bills, lower maintenance, and extended equipment lifespan improve return on investment by 25–35%.

A Greener Path to Production

Heat recovery systems capture and recycle waste heat to preheat incoming air or feed materials — turning waste into value.

AI-driven process control eliminates over-drying, ensuring energy is never wasted on product that has already reached target moisture.

Compliance-ready designs align with **ISO 50001**, the EU Energy Efficiency Directive, and corporate net-zero sustainability commitments.

✓ Every Kerone system is engineered to meet tomorrow's environmental standards — today.



Case Study: Black Soldier Fly Larvae Drying

288x

Faster Processing

Drying time reduced from **24 hours** to just **5 minutes** using Kerone's microwave-assisted system with real-time moisture monitoring.

99%

Energy Reduction

1.62 kWh/kg vs. 206.86 kWh/kg for freeze drying — a near-total elimination of energy consumption per kilogram processed.

95%+

Protein Retention

Superior nutritional profile vs. ~85% with conventional methods, with stable water activity (0.60) and extended shelf life.

250%

Throughput Increase

Commercial-scale insect protein production unlocked — enabling the emerging alternative protein industry to scale efficiently.

Performance Comparison: Smart vs. Traditional Drying

Metric	Microwave / RF / Heat Pump	Hot-Air Drying	Freeze Drying
Energy Efficiency	50–70% savings ✓	Baseline — high loss	206.86 kWh/kg ✗
Drying Speed	5–10 minutes ✓	24–72 hours ✗	72 hours ✗
Automation Level	Full AI control ✓	Manual monitoring	Partial automation
Nutrient Retention	95%+ ✓	70–80%	Excellent but costly
CO ₂ Emissions	40–50% reduction ✓	High baseline	Very high ✗
Maintenance Cost	Predictive — 30% lower ✓	Reactive — higher	Complex — highest
Scalability	Modular, cloud-connected ✓	Fixed capacity	Fixed capacity ✗

Kerone's Turnkey Engineering Capabilities



End-to-End Project Delivery

01

R&D & Process Design

Custom process design, feasibility studies, pilot trials, and scale-up optimization for unique applications.

02

Manufacturing & Installation

In-house equipment production with quality certifications, on-site commissioning, calibration, and operator training.

03

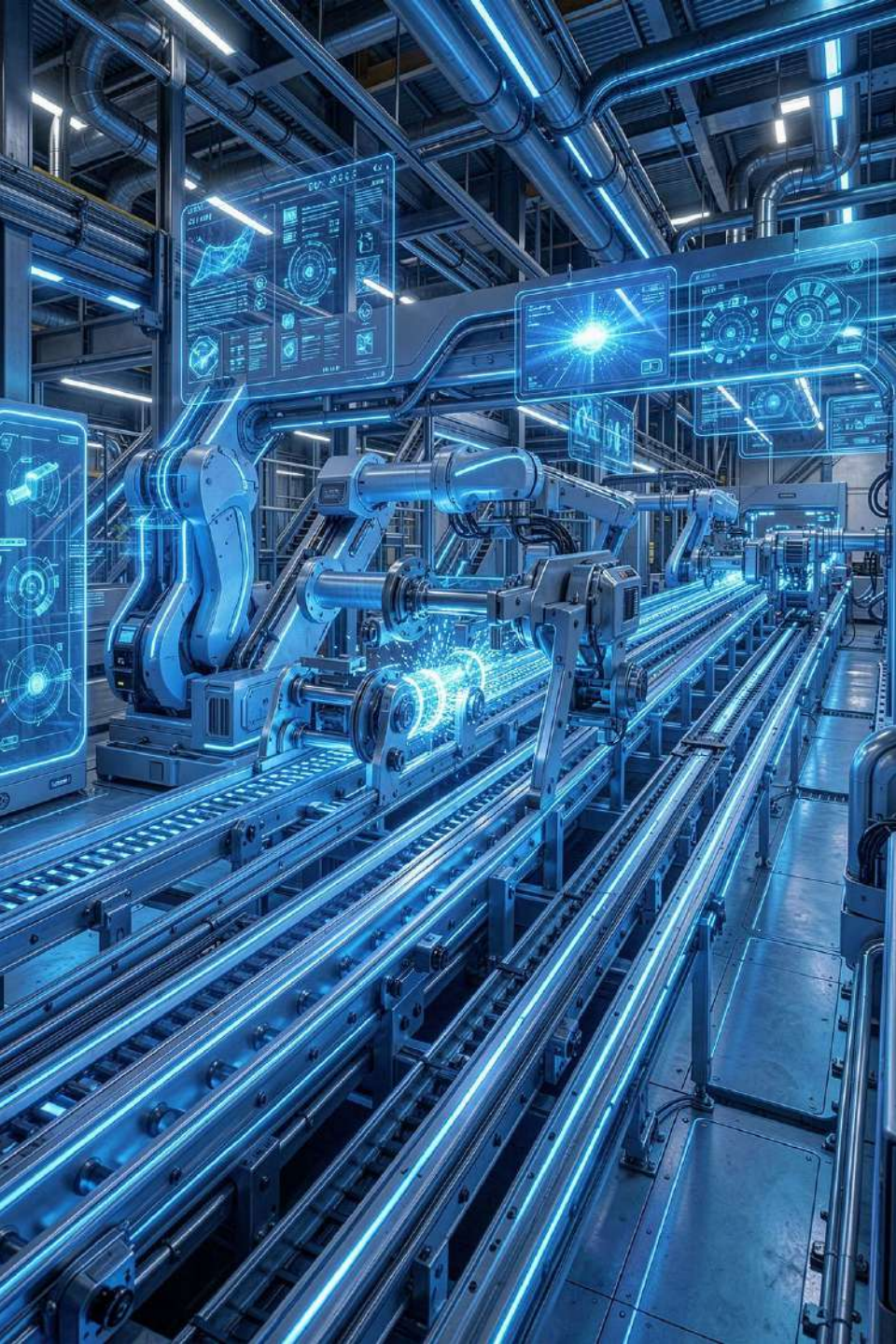
Automation Integration

PLC programming, SCADA systems, and full IoT sensor deployment seamlessly connected to your production ecosystem.

04

After-Sales & SLA Guarantee

24/7 technical support, spare parts availability, and preventive maintenance — with energy, throughput, and quality backed by SLAs.



Future Trends: Smart Factories & Sustainable Manufacturing



AI-Driven Smart Factories

Fully automated, zero-intervention drying operations powered by machine learning that continuously reduces energy use by **10–15% annually**.



Digital Twins & Simulation

Virtual testing of new products and processes before physical implementation — eliminating risk and accelerating innovation cycles.



Circular Economy & Renewables

Heat recovery, waste valorization, solar-assisted, and biomass-powered drying systems targeting **net-zero operations**.



Blockchain Traceability

Immutable, auditable records of drying parameters ensuring food safety compliance and supply chain transparency at every stage.