OET
MANUFACTURING

Industrial R2R Production
of Next-Gen OPVs

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OET
Energy Technologies

Industrial R2R Production
of Next-Gen OPVs

NanoManufacturing
The Future of Clean Energy

INTERNATIONAL
Nanotech Hub
THESSALONIKI

NHT

Nanotech Hub Thessaloniki
International Excellence in Nanotechnology

OET is the major pillar of Nanotech Hub Thessaloniki (NHT),
a pioneering ecosystem that brings together cutting-edge research,
advanced manufacturing, and high-tech entrepreneurship in
nanotechnology, advanced materials, organic electronics, and
regenerative medicine. Situated in Thessaloniki, Greece, NHT integrates
leading companies, research institutes, and industrial organizations,
fostering a unique environment where scientific discovery is transformed
into real-world applications.
By uniting industry and academia, NHT accelerates the
development of disruptive green industry, green energy technologies,
A.I. driven manufacturing, advanced materials, sustainable innovation
as well as healthcare and regenerative medicine, positioning Thessaloniki
as a European hub for nanotechnology and deep-tech excellence.

Terminology

BIOPV: Building Integrated Organic Photovoltaic
EV: Electric Vehicle
IoT: Internet of Things
IPV: Integrated Photovoltaics
Agrivoltaics: OPVs in Agriculture
LTFN: Nanotechnology Lab LTFN
M2M: Mashine-to-Mashine
R2R: Roll-to-Roll

OET is at the forefront of EU's transition into a global leader in clean energy, nanotechnology, and green industrial innovation. Through its pioneering work in OPVs and printed energy technologies, OET strengthens EU's position in the international renewable energy sector, while promoting energy independence, high-tech exports, and sustainable agriculture.

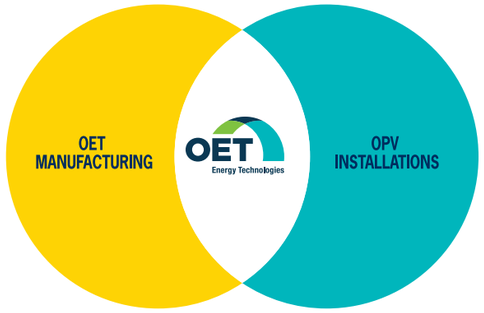
OET's Impact on the EU

Transforming the EU through Innovation, Sustainability, and Technology Leadership

By integrating innovation with large-scale industrial applications, OET contributes to the country's economic transformation—generating new investments, increasing GDP, and expanding the EU's technological footprint worldwide. As a result, the EU is becoming a major exporter of scientific knowledge and green technologies, while also reducing reliance on imported energy through locally produced OPVs. With tailored solutions for agriculture, smart cities, and off-grid communities, OET is driving a clean energy future—for everyone, everywhere.

Introduction

Creating tomorrow's sustainability, today



Welcome to OET,
where innovation harmonizes with sustainability.

With over 35 years of experience in thin-film technologies and organic printing electronics, OET is at the forefront of reshaping the energy landscape. We are dedicated to driving the transition to a climate-neutral economy through the development and deployment of cutting-edge Organic Photovoltaic (OPV) technologies.

At OET, we operate with two dynamic pillars:
OET Manufacturing and OPV Installations.

OET Manufacturing operates the world's first fully automated Roll-to-Roll (R2R) production line for Integrated Photovoltaics (IPVs), bringing nanotechnology, advanced materials, and AI-driven manufacturing to scale.

OPV Installations delivers tailored, real-world solutions by integrating OPVs into various industries, helping shape a sustainable, energy-autonomous future.

HISTORY

Founded in 2012 by **Prof. Stergios Logothetidis**, OET's legacy traces back to the Nanotechnology Lab LTFN at Aristotle University of Thessaloniki, established in the late 1980s.
Guided by a vision to unlock the potential of nanotechnologies and organic electronics, OET has evolved into a world leader, coordinating noumerous European and National R&D projects, collaborating with 200+ institutes, universities, and high-tech companies, and creating a robust ecosystem across:
- Advanced materials
- Thin films
- Organic printing electronics
- Bioelectronics
- Nanometrologies

Awarded twice with the prestigious Seal of Excellence from the European Innovation Council, OET exemplifies innovation and excellence in the pursuit of a greener tomorrow.

2012
Normal modules

2013
Inverted #1 and Portable Charger

2014
Inverted #2 Laser Scribing

2015
- **Establishment of the Unique R2R Pilot to Production Line for OPVs**
- **In-Line Optical & Laser Technologie**

2020
- Power output of OPV panels x 2
- Increase of our production yield to 90%
- Integration of OPV panels in Buildings & Bus stops

2021 2022
- Implementation of different instalation methodologies
- Energy Autonomus Greenhouses
- Solar Parking & EV Charging Station
- Fully Automated R2R Line for OPVs

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- BIOPVs: Integ of OPVs in in

TOURISM - LEISURE

OPV Installations offer flexible, lightweight, and semi-transparent OPV solutions tailored for the hospitality, recreation, and outdoor leisure industry. By embedding energy autonomy into functional outdoor elements, OPVs technologies enhance visitor experience, improve energy efficiency, and contribute to the sustainability goals of hotels, resorts, beach facilities, and tourism destinations.
OPVs Applications include:

- Solar Beach Umbrellas
- Solar Sunbeds
- Solar Pergolas

URBAN INFRASTRUCTURE SMART GREEN CITIES

OET develops flexible, semi-transparent OPV-based systems for urban infrastructure, offering functional and aesthetic energy solutions that provide solar autonomy, reduce operational costs, and improve urban resilience. These OPVs Applications include:

- Solar-powered Bus Stops
- Metro & Tram Stations
- Pavilions and OPV Covered Parking Areas

MOBILITY INTEGRATION

OPV Installations develop advanced solutions designed for integration into the mobility and transportation sector, enabling clean energy generation on vehicles without compromising design, weight, or functionality. OPVs applications include:

- Solar car roofs
- Solar for Tracks and Light Commercial Vehicles
- OPVs for Boats and Yachts

WEARABLES & CONSUMER ELECTRONICS

OPVs Wearables Applications can be embedded into:
- Textiles clothing
- Jackets
- Wrist-mounted accessories,
- Portable and personal devices
- Bags
- Backpacks

and other fashion accessories as wenabling continuous power supply to smart devices, health trackers, and wearables.

DEFENSE

Defense Applications include OPV-integrated uniforms and tactical gear, mobile field shelters and tents, energy-supported military vehicles, and drones equipped with OPV surfaces for extended flight time and real-time surveillance.

OPV
INSTALLATIONS

OPV INSTALLATIONS specializes in the real-world deployment of OPV technologies across diverse sectors.

OPV Installations design and deliver flexible, aesthetically adaptable, and energy-efficient solar solutions tailored to real-world environments. Beyond application design, we develop an international network of technology and application partners, who promote and implement innovative OPV Intallations in their regions.

AGRIVOLTAICS

Agrivoltaics: OET applies advanced semi-transparent OPVs to both greenhouse structures and open-field cultivation systems, enabling the triple—use of agricultural land for food production, clean energy generation, and efficient resource use.

Triple Land Use Model
OET's agrivoltaic systems are designed to maximize land productivity by simultaneously enabling:

1. Increase of agricultural production (e.g. crops, vegetables, fruit trees)
2. Photovoltaic energy generation, and
3. Climate optimization (cooling, shading), and water and energy conservation.

BIOPVS

BIOPVs: Transparent solar panels for commercial and residential buildings. BIOPvs applications include retrofit installation for existing buildings, where OPVs are applied to all surfaces, even in custom shapes, or as solar windows, balconies, canopies, and atriums for a seamless solution having a double role as a building element and energy provider.

TIMELINE

8
6
4

2016
OPV Panels on Automotive

2017
BIOPV Panels

2018
Efficiency World Record OPV Panels

2019
Apollo Series OPVs

…tion
…as station
…gration
…otel atrium
…gration
…dustry facilities
2023

Product development of OPV Installations in Agrivoltaics, Urban Infrastrucure, Wearables and Defence OPV Applications Technologies
2024

Establishment of the world's first R2R Automated Manufacturing Line for IPVs
2025

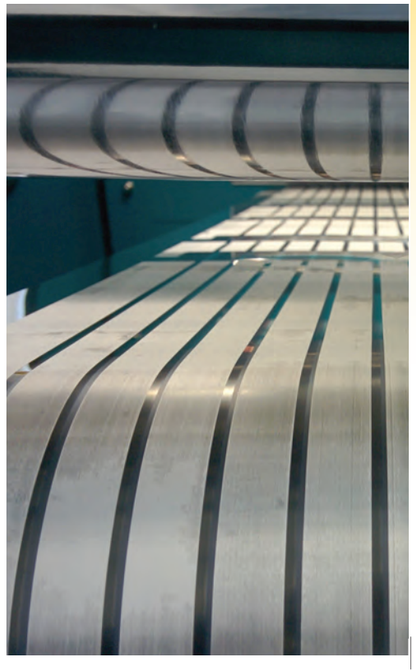
The Team

Our success story is a testament to the dedication of a dynamic team of experts who are the driving force behind our innovation, coordinate projects, and foster excellence in research.

Fueled by a shared vision for a sustainable future, our team continues to lead the way in green industry and green energy solutions.

Comprised of industry experts in the fields of nanotechnology, physics, chemistry, materials engineering, electronics, engineering, agriculture, medicine, and beyond, each member contributes invaluable expertise to our mission of innovation and sustainability.

Technologies Portfolio



OPVs exhibit stable energy production and demonstrate high efficiency in low-light conditions, such as cloudy weather and indoor lighting. Additionally, OPVs can generate energy from diffused light and are not dependent on orientation.
They can begin harvesting energy from early morning until late afternoon, ensuring an extended operational period throughout the day. Furthermore, they are less susceptible to performance degradation due to heat.

4. Sustainability & Environmental Impact

Conventional PVs generate a high carbon footprint and use toxic materials (lead, cadmium, fluorinated gases), making recycling difficult.

OPVs are 99% recyclable, non-toxic, and environmentally friendly, aligning with EU circular economy principles.
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5. Cost & Economic Viability

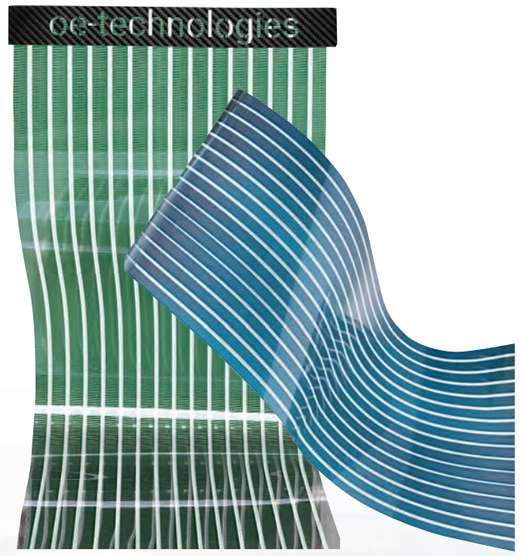
Silicon PVs require high installation costs, long payback periods, and extensive maintenance.

OPVs are cheaper to produce and install, have a faster return on investment, and are ideal for integrated solar applications (agriculture, urban energy, mobility solutions).

6. Versatility & Integration

PVs are limited to rooftops and ground-mounted solar farms, unsuitable for transparent, mobile, or curved structures.

OPVs can be embedded in windows, facades, solar curtains, vehicles, bus stations, parking spaces, and smart textiles, making energy harvesting seamless while maintaining high aesthetic appeal.



Conclusion: the Future is OPV

Conventional PVs are outdated built for large-scale farms, but unsuitable for modern urban environments and next-gen mobility solutions.
OPVs unlock new possibilities by enabling solar power on every surface, turning buildings, agriculture, transportation and everyday objects into energy sources.
Their sustainability, cost-efficiency, and adaptability make OPVs the future of solar energy, leading the transition to a decarbonized, decentralized, and intelligent energy ecosystem.

The Key Advantages of OPVs Over Conventional PVs

As the world moves towards sustainable and decentralized energy solutions, Organic Photovoltaics redefine solar technology by offering flexibility, adaptability and sustainability, overcoming the limitations of conventional silicon-based photovoltaics. These are the main differences between conventional PVs and Organic PVs in the following categories:

1. Material & Manufacturing Process

Conventional PVs rely on silicon wafers or thin-film materials, requiring high-energy fabrication and expensive infrastructure.

OPVs use organic semiconductors, produced via low-temperature roll-to-roll (R2R) printing, enabling cost-effective, scalable, and low-energy production.

2. Flexibility & Weight

Traditional PVs are rigid, heavy, and breakable, limiting integration into unconventional surfaces.

OPVs are ultra-lightweight (<0,5kg/m2), flexible (bending radius <20cm), and rollable, allowing installation on buildings, glass surfaces, vehicles, wearables, and off-grid applications.

3. Energy Efficiency & Performance

Silicon PVs offer high initial efficiency but degrade over time and lose performance in shaded, high-temperature, and low-light conditions.

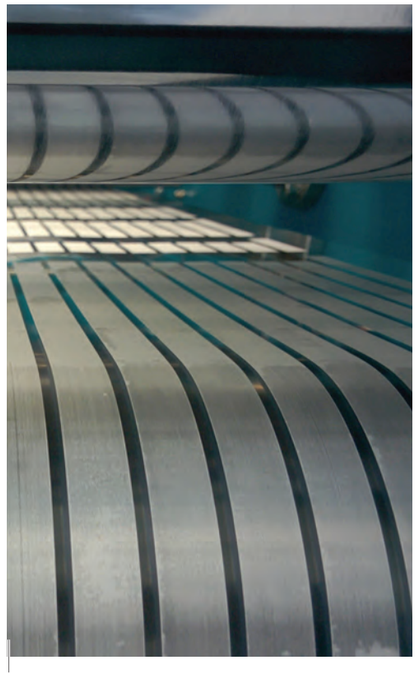
Core Activities

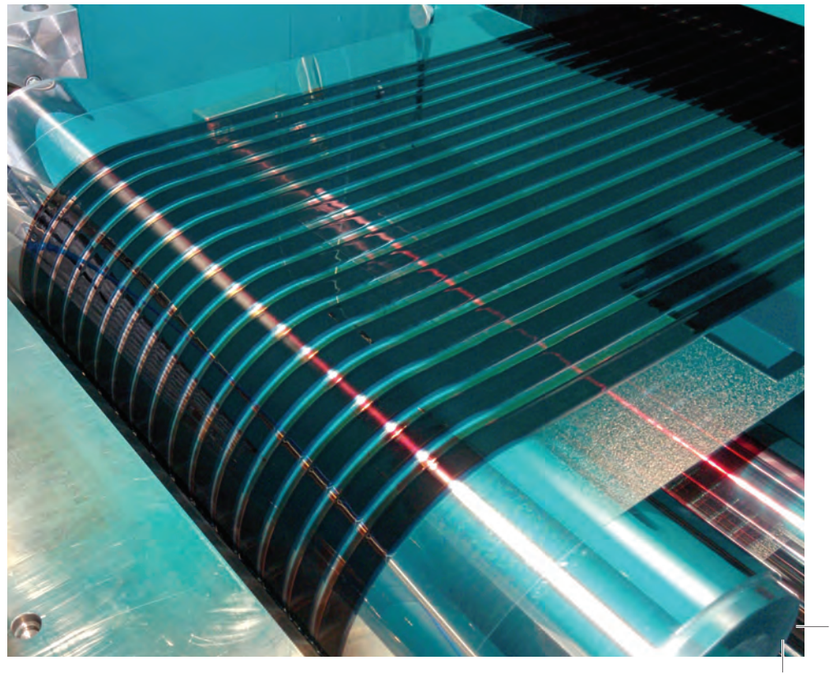
- Designing, developing, manufacturing Organic Photovoltaic Products through Roll-to-Roll (R2R) manufacturing processes
- Nano/micro-precision in-line ultra pulsed laser patterning
- Real time precision (nano)metrology and quality control tools to ensure the GPVs efficacy during production
- Automated coating stations and vision systems
- Digital monitoring and real-time closed-loop feedback control during production.

Technology Transfer

Intellectual Property: Holding patents, secret know-how and recognized intellectual property for cutting-edge technology.

Installations: Versatility in OPV applications, including BIOPVs, Agrivoltaics, Automotive, Urban Infrastructures, Consumer Electronics, Wearables, IoT, Defense etc.





Introducing the Factory of Smart Manufacturing

Our objective is to revolutionize traditional manufacturing and industrial practices by integrating cutting-edge technologies such as automations, nanotechnology, in-line ultra-pulsed laser and precision (nano) metrology and control tools.

Through the utilization of large-scale machine-to-machine communication (M2M) and IoT, we aim to enhance automation, industry 4.0 concepts, AI, streamline communication, and enable self-monitoring capabilities in R2B printed OPVs.

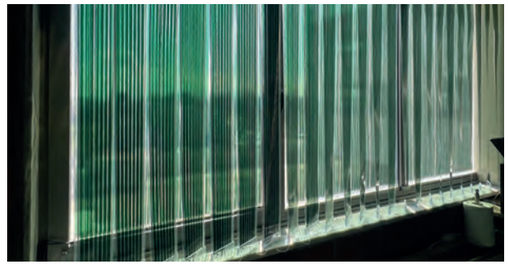
This empowers our smart machines to analyze and diagnose issues autonomously, eliminating the need for human intervention and ensuring seamless operations. OET is dedicated to achieving Near Zero Defects, maximizing yield, minimizing material waste, and ensuring high reliability and processability while reducing production costs.

Aesthetic & Customization Features

- **Aesthetic Color Options:** Available in different colors, allowing integration into architectural designs.
- **Customizable Shapes & Designs:** Can be produced in various geometries to match design and functional requirements.
- **Printed Graphics & Patterns:** Ability to incorporate branding or design elements directly on the OPV panels.
- **Seamless Integration with Building Facades:** Can be embedded into windows, skylights, glass walls, and decorative elements.
- **Dynamic Transparency Control:** Adjustable transparency for applications in greenhouses, BIPVs, and smart windows.

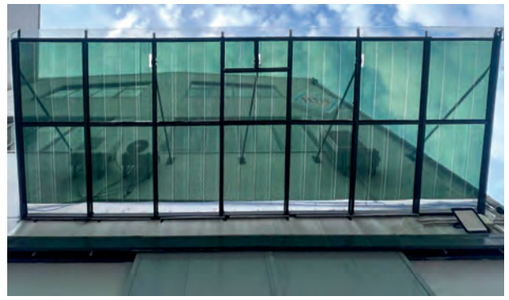
Economic & Energy Benefits

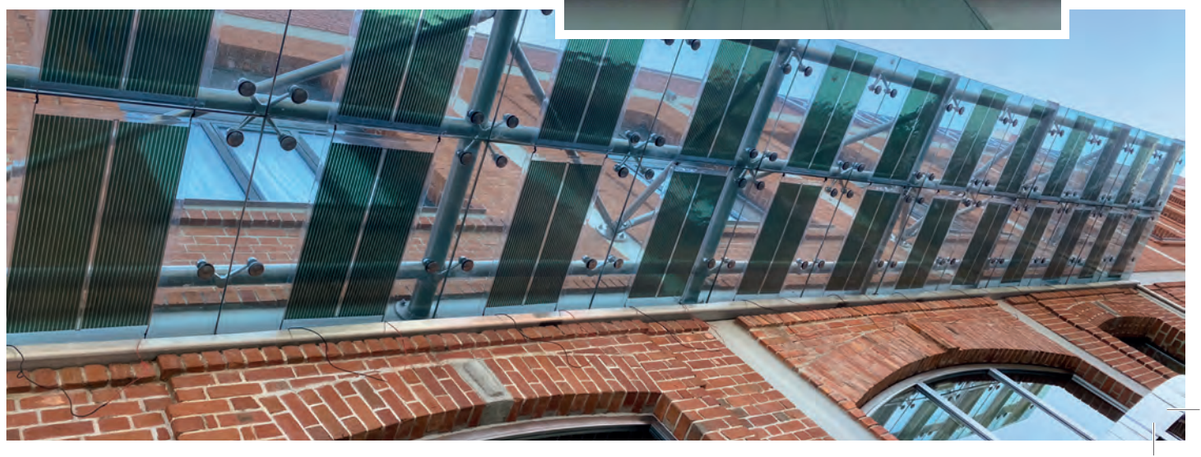
- **Cost-Effective Manufacturing & Installation:** Due to R2R printing and lightweight properties, reducing overall costs.
- **Short Payback Period:** Faster ROI due to high adaptability and integration possibilities.
- **Short Energy Payback Period:** shorter energy payback period compared to conventional PVs, due to their low-temperature manufacturing processes and lightweight, flexible materials.
- **Energy Independence & Autonomy:** Enables off-grid applications and decentralized power generation.
- **Compatible with Smart Grids & Storage Solutions:** Supports energy storage and grid-balancing technologies.



Installation & Application Versatility

- **Lightweight Construction:** Ideal for rooftops, glass structures, and applications where weight is a concern.
- **Retrofit Capability:** Easily installed on existing infrastructure without the need for extensive modifications.
- **Customizable Formats:** Can be adapted for rigid, flexible, or rollable solutions.





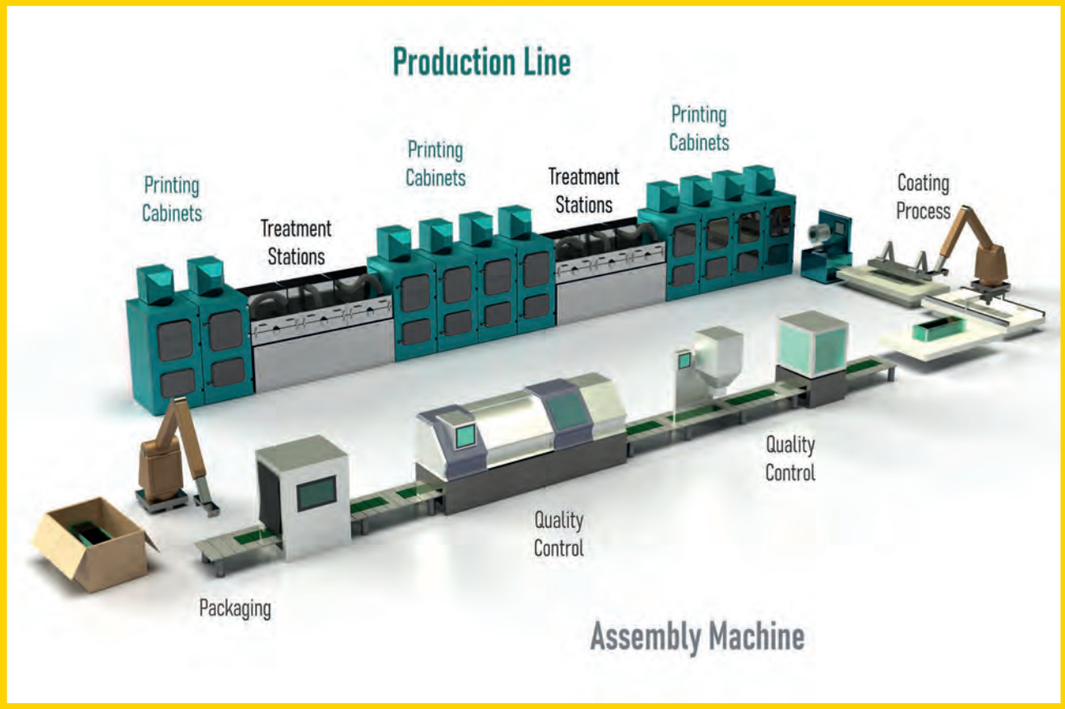
CORE TECHNOLOGICAL CHARACTERISTICS OF OPVs

- **3rd Generation Photovoltaic Technology:** OPVs belong to the latest generation of solar cells, leveraging organic materials for energy conversion.
- **R2R Printing Production:** Enables mass production at a lower cost, ensuring scalability and rapid deployment.
- **Ultra-Thin & Lightweight:** As thin as a few microns, significantly reducing structural load requirements.
- **Flexible & Bendable:** Can be curved and shaped to fit various surfaces, ideal for architectural and mobile applications.
- **Semi-Transparent & Tunable Light Transmission:** Can be adjusted for different levels of transparency to balance energy generation and aesthetics.
- **Efficient in Low-Light Conditions:** Performs well under diffused light, cloudy weather, and even artificial lighting conditions.
- **Temperature Stability:** Less affected by high temperatures compared to silicon-based PVs.
- **Non-Toxic & Environmentally Friendly:** Free from hazardous materials such as lead or cadmium.

- **Recyclable Materials:** Up to 99% recyclable, supporting circular economy principles.
- **Low Carbon Footprint:** Energy-efficient manufacturing with minimal CO2 emissions.

World's 1st R2R Automated Manufacturing Line for IPVs

New production line, 21.2M€ investment from EU **Annual capacity >1.000.000 m²**



OET Turn-Key Solution

OET, with the dedicated team of experts in the field of OPV technologies and organic printing electronics and applications, is poised to offer a turnkey solution in OPV manufacturing on an industrial scale.

From our new facilities in Thessaloniki, where we've relocated since 2022 to accommodate our growth, we have initiated the construction of the world's first industrial-scale Automated Manufacturing Line for Integrated PVs (IPVs), funded by the EU.

At OET, innovation meets sustainability as we drive the future of green industry and energy solutions.

State of the Art Manufacturing at OET

OET's manufacturing facilities are equipped with cutting-edge technologies that ensure the highest level of quality, efficiency, and scalability in production. Our state-of-the-art facilities include:

Automated Manufacturing Line for IPVs: Our world-first R2R production line for Integrated Photovoltaics (IPVs) allows us to manufacture flexible, semi-transparent OPVs at an industrial scale, enabling mass production with precision and speed.

R2R Slot-Die Coater: This advanced coating technology ensures uniform material deposition on substrates, optimizing material usage and providing superior quality control.

R2R Inkjet Printing: This system enables high precision patterning of organic materials, offering flexibility in design and accurate deposition for OPV functionality.

R2R Gravure Printing Line: A high-throughput printing solution that produces OPVs efficiently, maintaining consistency across large-scale production runs.

Digital Cutter SE&RS System: Optimizes cutting precision, minimizing waste and ensuring that each OPV module meets exact specifications.

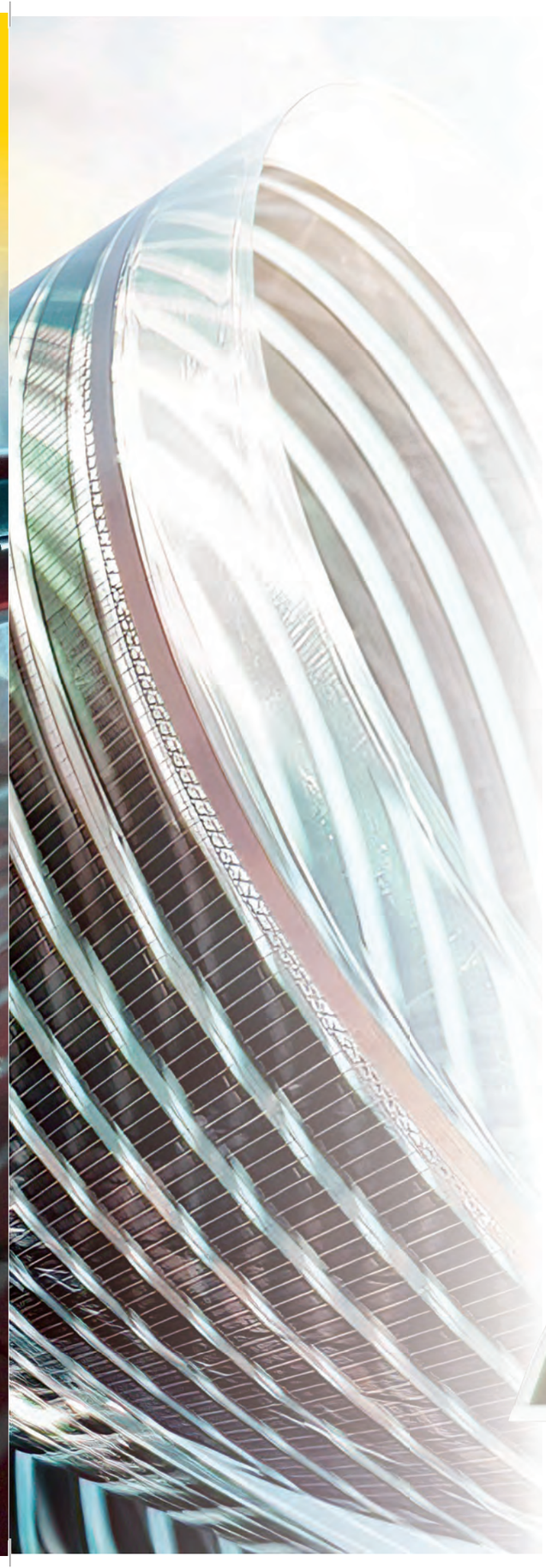
Quality Control Tools for PVs: Advanced tools for in-line monitoring the quality and performance of PVs throughout the production process, ensuring consistent quality and reliability.

Chemical Labs: Chemical laboratories enable the development and testing of materials such as organic semiconductors and polymers, ensuring the best materials are used in the manufacturing process.

Aging Chambers: These chambers assess the long-term durability and performance stability of our OPVs, simulating harsh environmental conditions.

Solar Simulators: These tools replicate real-world sunlight conditions, ensuring our OPVs perform optimally in all environmental scenarios.

Stability Testers: Each OPV module undergoes rigorous testing for stability to ensure reliable performance over time.



Product Futura

Characteristics and Benefits

High Transparency: Offering transparency of over 50% for optimal indoor and low-light applications, and higher transparency with optical engineering.

High visual uniformity: Making the OET Futura OPV the best solution for window applications and glass facades to solar car domes.

Freedom of Design: Providing design flexibility and visual uniformity for diverse applications.

APPLIED TECHNOLOGY MODELS

Product Apollo

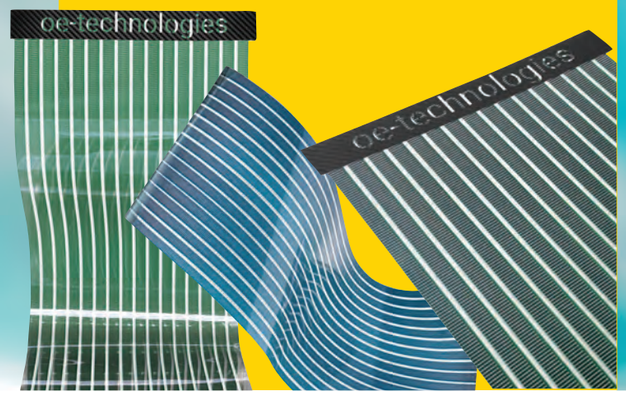
Characteristics and Benefits

Flexibility: Flexible and reliable for ease of use and adaptability.

Lightweight: Weighing approximately 0.5 kg/ mL for convenient on-the-go use.

Transparency: Providing transparency of over 30% for aesthetic appeal.

Aesthetic Design: Merging functionality with various colors for a stylish appearance.



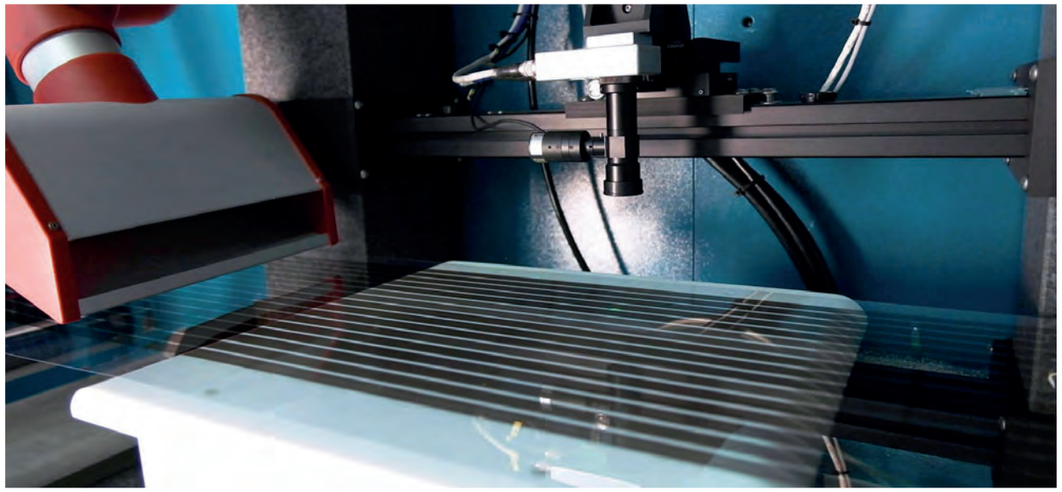
High-End R2R NanoManufacturing

As the global demand for photovoltaic modules continues to rise, Europe must revitalize its photovoltaic industry and develop an efficient, cost-effective, and environmentally friendly R2R OPV industry.

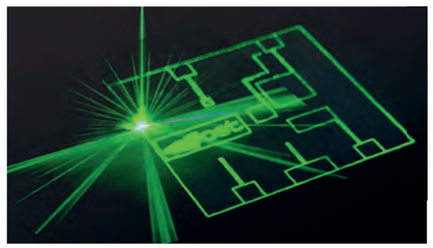
Automation and optimization are the keys to overcoming production challenges. At OET, we lead the way in scalable OPV manufacturing, ensuring high throughput and low environmental impact.

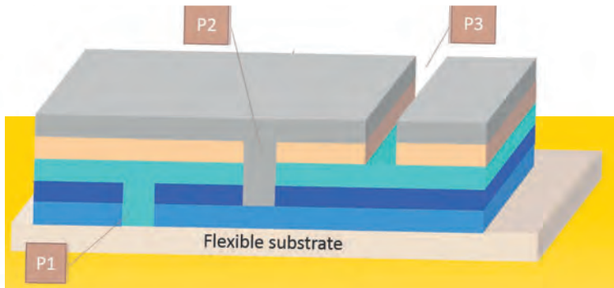
In-Line Technologies Integration

OET distinguishes itself with advanced R2R manufacturing capabilities, integrating cutting-edge process monitoring and optimization technologies directly into the production workflow. This integration enables real-time performance tracking and adjustment, maximizing production efficiency and OPV quality.

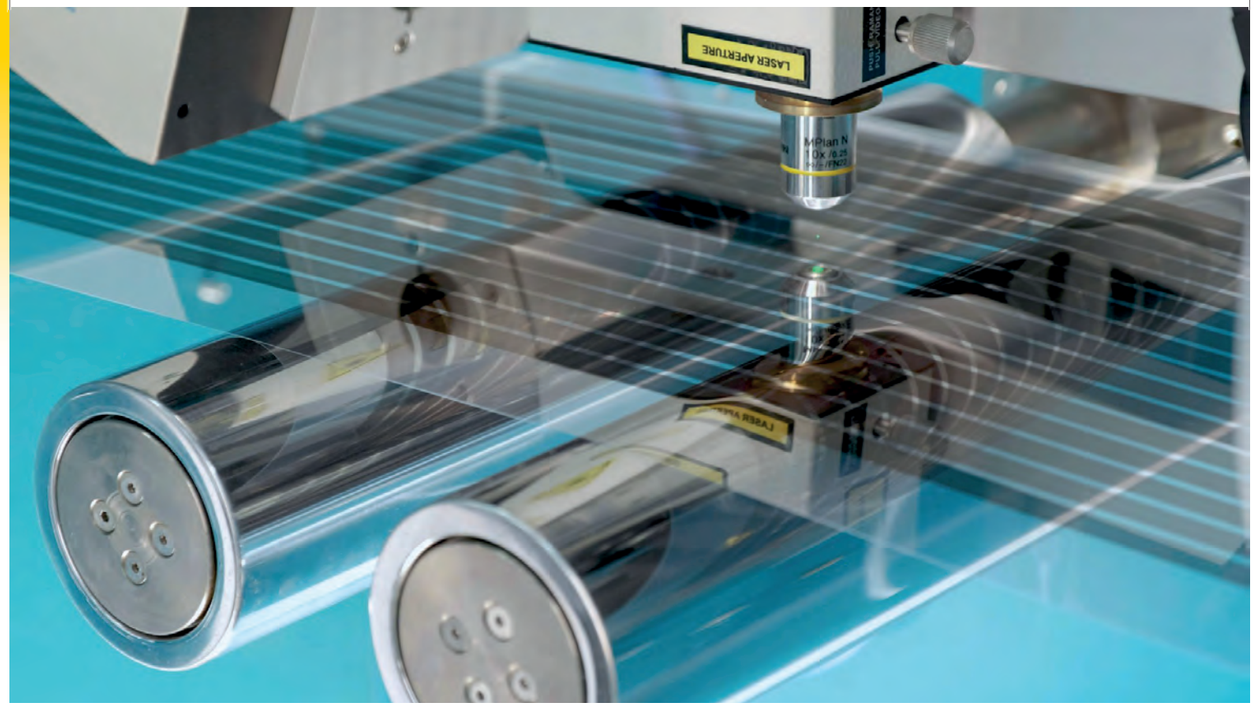


Our expertise in in-line monitoring and laser technologies allows for continuous optimization during production, ensuring that each nano-layer is accurately deposited for maximum device energy efficiency.





In-line laser processing implemented in OET's 3rd Gen OPVs



Quality Control Techniques for Maximum Production Yield

To ensure **maximum yield** and **superior** OPV performance, OET employs advanced quality control techniques, including:

In-line Pulse Laser Patterning & Scribing: Precision structuring of the OPV layers, ensuring optimal light absorption and energy conversion efficiency.

In-line Spectroscopy & Electrical Monitoring Systems: Real-time monitoring of material properties such as optical and electrical characteristics, ensuring that every OPV meets our rigorous performance standards.

Automated Testing: Each OPV module undergoes comprehensive performance testing to verify its efficiency, stability, and durability.

By incorporating these innovations into our R2R printing production process, OET ensures consistent, high-quality output, setting us apart as a technological leader in the OPV industry.