



Innovation is our heritage
EST. 1896

Aviation and Agritech Solutions powered by Tungsram

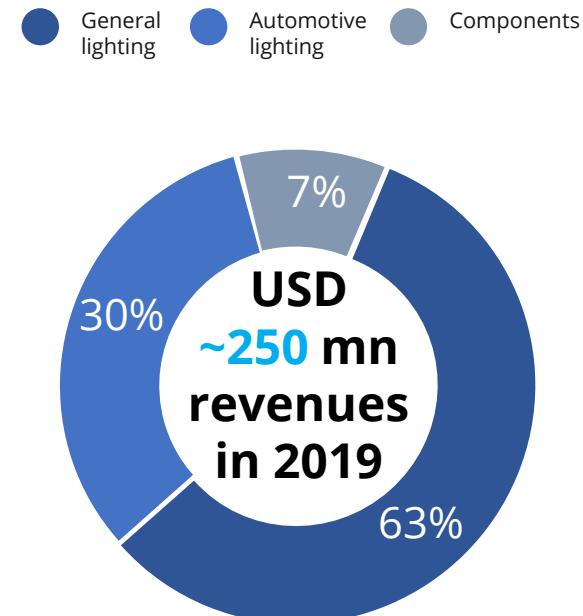


Tungsram has a 120-year long track record and unique assets and capabilities

Over 120 years
of reliable operations

1896

World-class innovation
heritage



3500+ employees in
Hungary and globally



Established sales network in
a **100+** countries:
95+% export

Tungsram Edge
new innovative business

Agritech
indoor farming

**Smart City
Solutions**

**PropTech
Solutions**

**Open Innovation
Center** (InnoHUB)



5 plants for
advanced lighting
technologies and
components



20+ Tungsram
subsidiaries globally.
Offers global access for
Hungarian SMEs



Ceramics, metal,
glass, plastic quality
and tooling
capabilities



Expanding Hungarian
technology center,
SMART everything.
Close network with
Hungarian and global
researchers



Advanced materials in
new industries like
Aviation, Automation,
Batteries, Healthcare &
Power



Unique Company-in-the-box
offering for investors
entering the EU with minimal
up-front investment enabled
by shared Tungsram
infrastructure and resources

Global player in lighting with a focus on innovative technologies

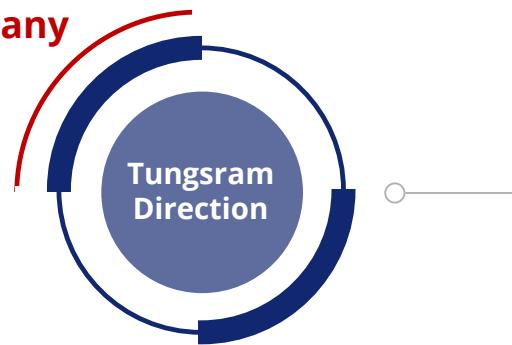
Shifting from a product to service and technology company, leveraging on existing competences

- We have a **40+ technology team** representing our Lighting tech knowledge
- We have **on the field sales force** globally
- We have **world class metal, glass and ceramic production** capability
- We have best in class high quality **TUV accredited Laboratory** to ensure highest product quality
- We produce in Europe with the **highest quality**
- **Strong presence** in the **Automotive OEM** and **Aftermarket** for more than 25 years



World class traditional Lighting company

From Product to a Service and Technology company



- We're selling **W2W Solution** not only boxes
- Our **approach is Ecosystems based** on synergies of our products and services
- Making bold moves into **high growth industries**, built on existing core competencies: Software & Smart solutions, Aviation, Agritech, Components
- **Rapidly reacting on global economical trends** in terms of product and geography
- **Acting as European Flagship** to connect local companies to emerging markets
- Hungary as home country strengthened by **Strategical Agreement with the Hungarian Government** and major industrial and academic institutions

Aviation

– how do we become a winner
in the “post-COVID” world?

Tungsram Aviation plans to subvert the MRO industry

Tungsram has entered into the MRO industry and now is looking for partners to scale it up

- The main focus of the company is **airplane engine maintenance**.
- Currently the extension of maintenance activities and repair work areas **from engine to component** (and different types of engines) is happening, in parallel with the **diversification of the client portfolio**.
- In 2019 the company signed its first **long term service contract with GE Aviation** for engine maintenance, but achieved since the widening of the product and process portfolio. Process types include: cleaning, inspection, different type of repairs Engine types: CFM56, GE90, GE90-100, CF6.

The Business Model



- Business development activities concentrate on:
- Building up **independent relationship with GE overhaul shops** (Wales, Caledonian, Cincinnati) and integration into **GE's global supply chain**, but no limitation to work with other OEMs, like Rolls Royce or P&W.
- Extension to airline owned (Lufthansa) and independent **engine repair shops** (MTU, StandardAero).
- Developing **welding capabilities** to be present at hangar maintenance (ACE) and the widening the welding technologies to fulfill capabilities.
- Reaching out to **parts manufacturers**: in addition to repair work, also take part in the new parts manufacturing, machining, etc.

Existing competences



- Several years **repair experience with GE** Power, Renewables and GE Aviation products.
- **Long term service contract** with GE Aviation.
- The first phase of **investment** has been **completed** (chemical cleaning, FPI, pressure test).
- EASA **certification received** in 2019 and FAA, CAAC in progress (COVID-19 delayed) leveraging **60+ years as automotive OEM supplier**.
- **Certified and skilled staff** (engineering, welders etc.).

Tungsram Aviation puts CEE on the MRO map

The GE contract provides a solid basis for further extension

Market overview and trends



- In 2018, **commercial air transport MRO demand** is estimated to **USD 82.4bn**, with **26% European market share**.
- Purely from engine maintenance, Europe counted for a 43% market share.
- The **global MRO market** is expected to grow by **4.4% p.a. to USD 127.3bn by 2028**.
- The **three largest players** dominate the market with **80% of the total** market share.
- GE and JV GE – CFM International venture engines provide USD 16bn in MRO.
- **Barriers to enter** the air transport MRO market are **high** as players need to obtain all the necessary certifications for even starting a business as a trusted MRO. Currently, **Tungsram received the approval** from EASA Part 145 and was scheduled to receive FAA in May 2020 (COVID-19 delayed). CAAC scheduled for Q4 2021.

Key drivers



- **Number of travelers** will **recover** from extreme COVID-19 low-point over a period of 2-3 years.
- Need for aircraft **engine maintenance is going through extensive consolidation at OEM level**, including strategic reorientation of inhouse scale and scope: **Central Eastern European** region is **the best cost solution** to receive near-shoring volumes.
- **COVID-19 has had no negative impact on Power business**, however it has accelerated the transition to renewable energy which comes with a need for gas-powered electricity generation. Hungary hosts GE Power's largest factory in this sector.

Goal



- To position **Tungsram Aviation as the preferred European service provider**.
- Establish partnerships with other engine manufacturers (P&W, Rolls Royce).
- Systematically **expand product range** to new engine types and parts.

Agritech – how do we feed the hungry planet?

Tungsram Agritech (TA) is a Tungsram spin off

Tungsram expanded its portfolio initially focusing on horticultural lighting, now offering turn-key vertical farms and greenhouse solutions

The Business Model



- Tungsram Agritech initially focused on **horticultural lighting to control the growth, flowering, and maintenance of both indoor and outdoor plants** and managed to become a considerable player in the development of science-based precision farming.
- It optimizes the growth systems with LED lighting and related technologies results in **energy saving compared to Traditional lighting, year-round production, quality improvement, lower operation cost and longer lifetime**, however TA has a full range of HPS, LED or Hybrid solutions.
- TA deploys its **leading product development capabilities** for tailored customer solutions complemented by „**Beyond Lighting**“ technologies: sensors, software, AI etc.
- Target customers are **greenhouse and indoor farm owners or investors, builders and distributors**.
- TA is **unique sales proposition**:
 - **Tailor made** solutions for optimal customer needs / conditions
 - **Competitive** total cost of ownership due to automated and vertically integrated production
 - Reliable after sales support and extended guarantees allow **modern funding models**
 - TA works together with **world leading universities** in agriculture to incorporate innovation real time in the development of its lighting portfolio and the additional technologies.
- **Strong sales pipeline** (currently ~53 million EUR).
- Existing **global sales network** due to the ~125 years of experience on Group level.
- **State of an art local production capacity** specialized for LED fixture manufacturing.
- Proven **component and software solutions** from the long existing Industrial and Outdoor LED Lighting divisions of Tungsram.
- Expandable engineering talent pool, **partnership with biotech and agritech SME's**.
- **Known brand** on the general lighting market.

Existing competences



TA leverages the LED revolution in the Agritech industry

LED in the Agritech industry increases the productivity of farming tremendously

Market overview and trends



- The expansion of **Indoor Farming** - Greenhouses & Vertical Farms - is expected to improve productivity in the agricultural sector and to **drive the demand** for lighting solutions.
- Global **LED** horticultural lighting market standalone (without Hybrid and traditional solutions) is forecasted to become a **USD 7 billion** industry by 2024.
- The global LED horticultural lighting market is growing at a rate of **47% CAGR**.
- Western Europe** is growing significantly year on year (~42% CAGR).
- Lighting solutions **for greenhouses** are the biggest share of the market. LED for **vertical farms** is growing fast although still from a lower absolute value.

Key drivers

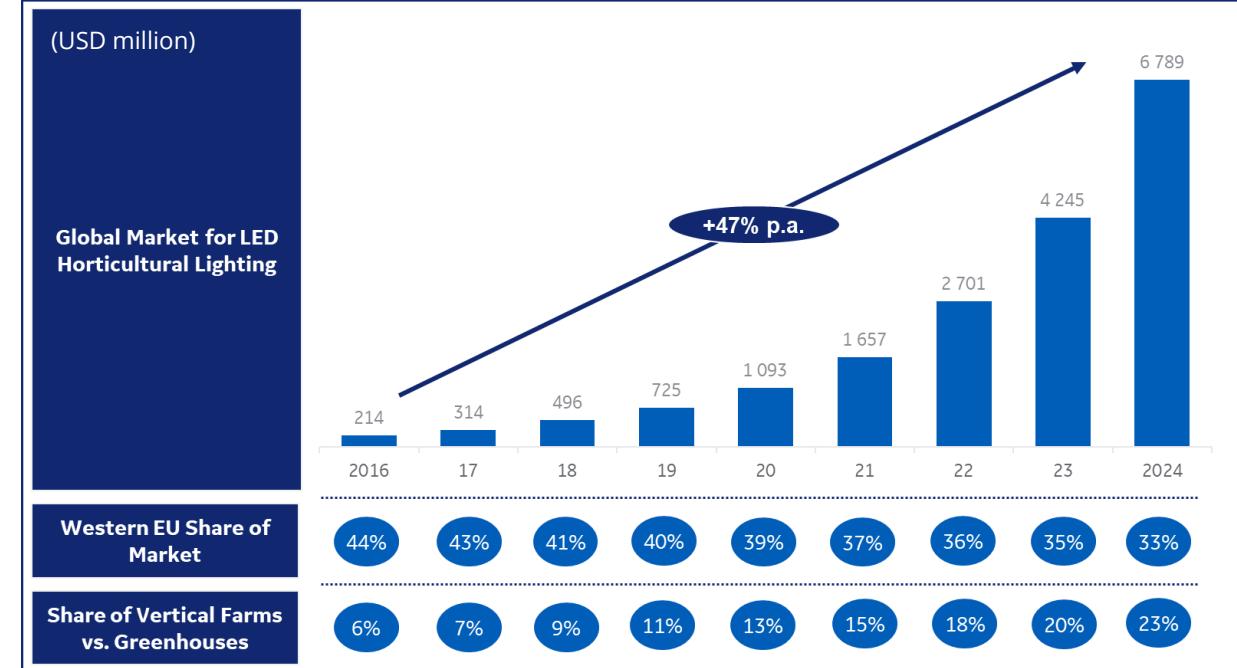


- Primary growth drivers are **the urbanization and increasing needs** of the fast growing population.
- The demand for local, fresh and nutritious vegetables, fruits, herbs all year round.
- Horticultural lighting is also useful in regions where the natural environment and conditions are not supportive enough to the nutritional value of the crops.

Goal



- To become one of the **top 3 lighting solutions provider globally** for agritech businesses in terms of efficiency and quality and capture the vertical farming growth as it turns exponential.
- Achieving just 3% EU and 0,5% Rest of the World market share, results in **USD 100 million revenue by 2025**.
- Service provider approach:** full service provider, starting with the demand survey, followed by design planning and finished with the implementation & potential funding – allowing a **Plant as a Service** business model on long-term.



Source: Strategies Unlimited, Horticulture Lighting Market Analysis and Forecast 2017 + Tungsram estimate

Please contact us:

Joerg Bauer
President & CEO
joerg.bauer@tungsram.com

