

The background features a complex pattern of yellow hexagons and black lines. Some hexagons are solid yellow, while others are outlined. The black lines form a network of interconnected paths, resembling a circuit board or a molecular structure. The overall aesthetic is modern and technical.

WROCLAW

**ELECTRONIC
INDUSTRY
CENTRE**

2025

ARAW: COOPERATION IS EMBEDDED IN WROCLAW'S DNA

Wroclaw has been successful in attracting big investments for years now, stimulating the development of not only the region but also of the whole new branches of economy, with the example of the growth of battery industry in Poland as a result of the LG Energy Solutions investment. What is the reason for such effective actions?

Mateusz Jarzombek: The need for direct support of investors in Wroclaw was noticed 20 years ago when LG corporation found the city interesting for its business. Since that moment, we have been working with companies from different industries and cultures, but for all investors one matter seems the most important: the availability of employees. It is directly connected to the openness of universities to cooperate with businesses.

We also see the significance of big investments such as LG. We can even talk about the "LG effect", visible in places where 20 years ago we only had an empty piece of land and now you can see a production hub, not only with LG production halls, but also of the suppliers of this Korean corporation and other key investors, such as Amazon. What is more, we notice that big investments are especially resistant to current economic conditions; LG reacted immediately to the loss of interest in the electric vehicles battery market, changing its production profile to the energy storage systems. Thanks to that, LG could keep its qualified staff and their valuable supply chain which they had been building for years.

In 2023, Intel announced the plan to build a back-end facility in Wroclaw. Is the Intel effect still noticeable in this situation?

Mateusz Jarzombek: Cooperation with Intel, which Wroclaw Agglomeration Development Agency (ARAW) was a part of from the very beginning, started around 2 years before publicly announcing the decision to choose Wroclaw as the location for their back-end plant. The procedural aspect of this project was not much different than what we are dealing with on an everyday basis. But the difference was in the potential of this investment and the great potential of the semiconductors sector. The scale and importance of this investment required work in several subgroups, focusing on such topics as education, infrastructure, housing, etc. We currently have a good understanding of what is actually needed for the semiconductor companies and this knowledge resulting from many months of preparations will always stay with us. This great volume of completed work and the wealth of experience are a valuable component of the Intel effect.

Aneta Herbuś: The effect of Intel can also be noticed in education. Intel strongly appreciates the openness of the educational units of Wroclaw University of Science and Technology, which immediately started cooperation with the company, adjusting the curriculum to the needs of the company. Centrum Placówek Kształcenia Zawodowego (en. The Centre of Vocational Education Institutions) reacted in a similar way. Cooperation with Intel resulted in commissioning a dedicated laboratory. Interestingly, despite the discontinuation of Intel's investment in Wroclaw, this cooperation still continues. We have excellent academic staff that is open to cooperation and we are well-prepared to accept even the biggest investments.

Interview
Aneta Herbuś
Head of Investment Support Department
Mateusz Jarzombek
Director of the Business Support Centre

ARAW: COOPERATION IS EMBEDDED IN WROCLAW'S DNA

Mateusz Jarzombek: I think we also need to mention the plot in Miekinia, which is still under preparation for housing a big investment. It is a unique asset on the European scale: it is a vast, serviced, and well-communicated plot that is well-adapted for a big investment project divided into several stages. The plot is perfectly prepared for the needs of the semiconductor industry.

What is the reason for Wrocław to be chosen as the location for such investments more than other big cities?

Mateusz Jarzombek: A unique investment climate is rooted in the history of Wrocław. After the war, the whole population of the city changed, and the Wrocław community was created anew. People who came here from different parts of the country, representing different cultures and mentality, had to cooperate at that time. Openness for co-creating reality, not only the economic, but also the social one remains in the city's DNA. It is currently also visible in business, and it is not only our opinion; we often house guests who are in Poland for the first time and openness is the first thing they notice. There are of course also more tangible aspects, such as the presence of a strong academic environment.

Wrocław is proud to offer one of the best start-up ecosystems, being one of the most important electronics design and production centres in the country. Why was such a flourishing start-up environment created exactly here?

Aneta Herbuś: Wrocław has in fact outrun Warsaw for two years in a row in the Start-up website ranking. Similarly, in the opinion-forming list of DealRoom, we were included among technological stars; the first in Poland, the second place in Europe and the eight one in the world. Again, the success of the start-up ecosystem is deeply rooted in openness, knowledge exchange, and cooperation. We are sure that the success of such companies in the semi-conductor industry as XTPL and Nanores will inspire other teams. It is a very active ecosystem, which can unite generations: many people who have already done their exit, are still strongly engaged in the growth of the ecosystem, providing mentoring support for other companies. They do it inspired by passion and the will to return what they received 10 years ago.

Interview
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Mateusz Jarzombek
Director of the Business Support Centre



Wrocław Agglomeration
Development Agency



Invest in
Wrocław



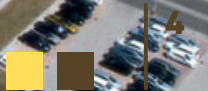
SUCCESS OF LG INVESTMENT

LG Energy Solution Wrocław is the biggest plant producing electrical vehicle batteries in Europe. Biskupice Podgorne by Wrocław is a location of **a 100 ha** modern technological park which has been gradually expanded since 2016 and employs several thousand people. Only the LG Energy Solutions plant employed over **6200** in 2024, including 2000 in administrative positions. The LG plant in Biskupice Podgorne is one of the biggest investments in Poland after 1989; the capital expenditure up to 2022 amounted to **USD 5 billion**.

Annual production of EV batteries by Wrocław amounts to **700 thousand**, and the company aims at producing one million of electronic vehicle batteries a year. Current production capacity is 86 GWh and the company turnover in 2023 amounted to over PLN 39 billion. In November 2024 the company decided to start producing battery energy storage units.

LG Energy Solutions is a global leader, providing batteries for all market segments: from consumer products in IT and electrotools systems, through advanced automotive industry, **supplying 13 from among 20 world biggest automotive brands**, to energy storage systems.

The investment of the LG corporation is an example of a successful cooperation of business and science. The cooperation between LG Energy Solution Wrocław and the Wrocław University of Science and Technology started several years ago, and it culminated in the opening of the **Electromobility Laboratory** in November 2023, for which the company spent over PLN 600 thousand. Also, the company has signed cooperation agreements with the University of Economics and the WSB Merito University.



WROCLAW: EXAMPLES OF FOREIGN INVESTMENTS IN THE ELECTRONIC INDUSTRY

PRUFTECHNIK/FLUKE



One of the fastest growing B&R centres in Wroclaw is PRUFTECHNIK-Technology; at the end of 2024 the company employed **94 people**, 26 more than a year earlier. Since 2019 PRUTECHNIK has been a part of the **Fortive** corporation, which develops Fluke products, among others. As a result, the operations of the Wroclaw unit focuses on designing hardware and producing software for the development of measurement systems of both brands: **PRÜFTECHNIK** and **FLUKE**.

USI Asteelflash



This company first operated in Poland as a branch of Chung Hong Electronic, but in **2020** all shares were taken over by **Universal Global Electronics**, today's owner of this company. In Europe, USI corporation is mostly known from the acquisition of the second biggest EMS producer in Europe, a French company called **Asteelflash** (2020). Currently, the company is one of leading production plants in Europe which provide electronic manufacturing services (**EMS**). The company employs **150 people**, and it finished 2023 with turnover of **PLN 187 billion**. In 2024, USI opened a new production plant in Biskupice Podgorne and announced the construction of one more plant.

Jabil Poland



In November **2022**, an American company **Jabil** opened its **project centre** in Wroclaw, after being present in Poland since 2008 in a big production plant in Kwidzyn. The Wroclaw branch of this company designs electronic supply, mechanics, printed circuits, supports industrialization, and manages projects. The team has ca. **30 members**.

ZF CV Systems Poland



Wroclaw production plants of **ZF** corporation are one of the biggest electronic companies in Lower Silesia; currently the company employs over **2800 people**, with a turnover of **PLN 2.8 billion**. The company manufactures advanced brake systems for utility vehicles, control systems and clutch and transmission control systems, as well as pneumatic suspension systems for passenger cars. The research and development team works on the development, construction, and testing of key components for utility vehicles, such as buses, vehicles heavier than 6 t, tractors and trailers. The R&D team develops, among others, brake system elements, pneumatic suspension system elements, and the components of clutch and transmission systems.

Diehl Controls Poland



Diehl Controls has been gradually developing its operations in Poland since **1999**. The first plant created in **Namyslow** manufactures electronics. In **2006** a **research and development centre was opened in Wroclaw**. Currently, the company employs almost **1100 people** in both locations. Diehl Controls in Wroclaw develops and manufactures electronics for home appliances, including control systems and user interfaces. The company designs and implements new and improves existing electronic projects, carries out EMC compliance tests and equipment production cost analysis. Products by Diehl Controls Polska are used in the final products of such home appliance producers as BSH, Electrolux, Gorenje, or Whirlpool. Sales revenues from all ready products and goods amounted to **PLN 590 million** in 2024.

SEMICONDUCTOR WROCLAW

QNA TECHNOLOGY

QNA Technology focuses on developing technologies and procedures for the production of **semiconductor nanomaterials (so-called quantum dots)**, not including heavy metals and used in the production of displays. A quantum dot is a semiconductor nanocrystal with dimensions measured in nanometers, with a structure consisting of an inorganic semiconductor core (responsible for generating and absorbing light), a coating protecting the core from external factors, and an outside organic coating.

SEMIQUA

SemiQa is a pioneer in **ANNET** (analogous neuron network) technology used in innovative AI applications, offering a 50 times higher speed and 5 times lower energy usage. This technology will ensure a 100 times lower delay level for real time applications. The company is a part of the prestigious **NVIDIA Inception** program.

NANORES LAB

NanoresLAB is a **nanotechnological laboratory** supporting its clients from **semiconductor** industry with the usage of such tools as SEM (Scanning Electron Microscopy), FIB (Focused Ion Beam), TEM (Transmission Electron Microscopy), EDS (Energy Dispersive Spectroscopy), CT (Computerized Tomography) or femtosecond laser. This research provides detailed information on physical and chemical properties of semiconductor structures.

SYSTERION

Systerion develops innovative **nanopositioning** and **nanoalignment** equipment designed for ultra-high precision tasks in the most demanding industrial environments. Nanoalignment systems are optimized for industries that demand extreme precision, including the production of **semiconductors**, optical systems, and advanced manufacturing.

XTPL

XTPL developed an innovative printing head and dedicated nanoink enabling ultra-high precision dispensing and obtaining nanostructures for applications in the semiconductor sector, as well as in the construction of displays, biosensors, or ultra advanced PCBs. This solution allows to obtain micrometric (1-100 μm) structures, required by most companies on the semiconductor market. The XTPL method allows you to add material in order to achieve desired patterns in a one-stage process with submicron precision and simplicity. It solves several basic problems of photolithography, a currently standard market subtractive technology in the production of semiconductors.

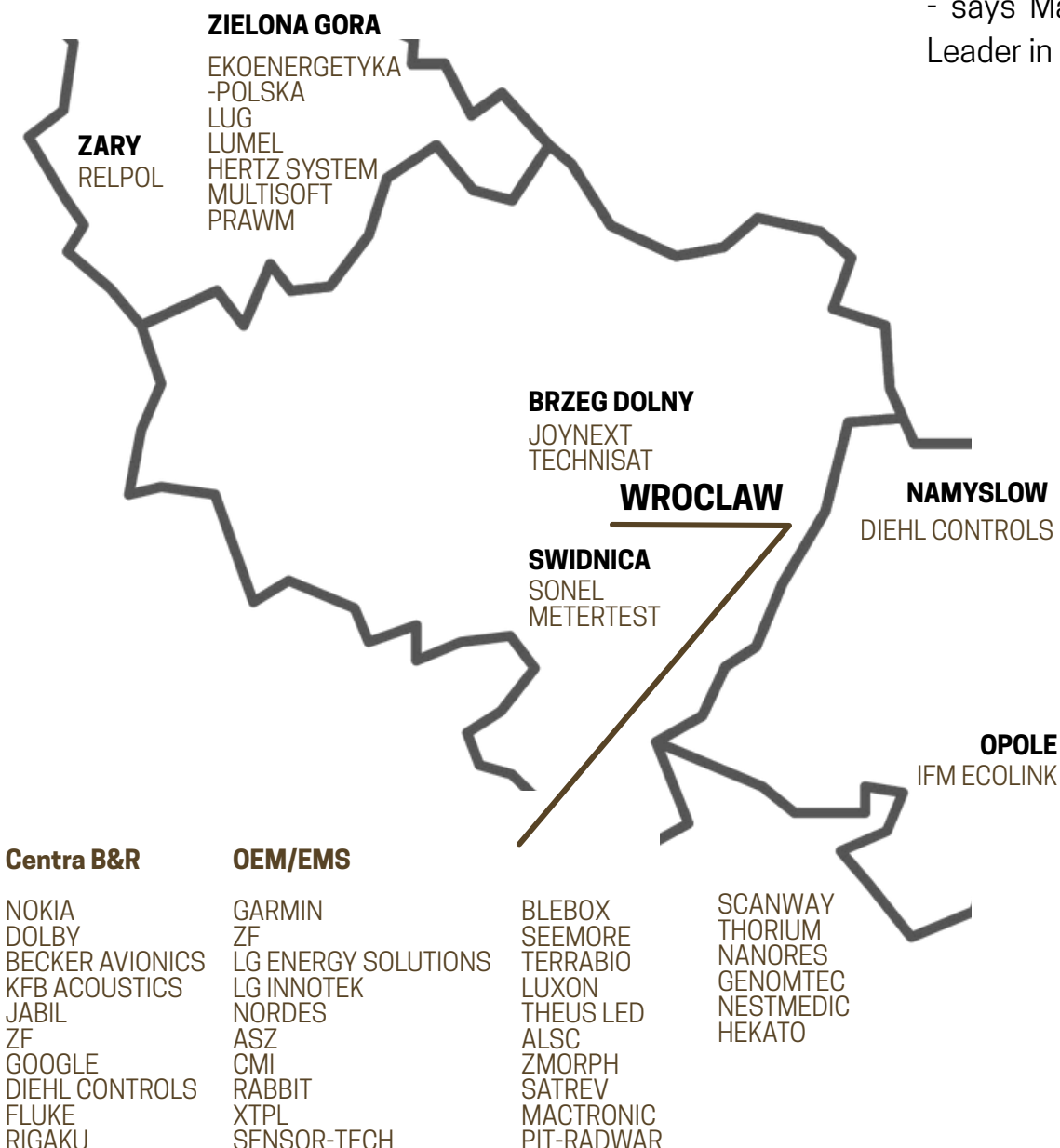


LOWER SILESIA: A COMPLETE ECOSYSTEM OF THE ELECTRONIC INDUSTRY

The ecosystem of the electronic industry in Lower Silesia is really extensive. It includes not only numerous foreign investors who have their R&B centres here, but also a long list of leading Polish companies from OEM and EMS sectors. Especially strong representation can be found in the medical electronic, astronautic, and aviation industry, measurements, and IoT.

-Today, the semiconductor industry in Europe is developing between Germany, the Czech Republic and Poland, where production plants and competence centres are located and operating. Poland, as the third partner in this set-up, contributes with new resources, both in infrastructure and human resources, strengthening the regional value chain. Transborder cooperation will be a key factor in the creation of European technological autonomy, especially in the area of advanced semiconductors, which are a basis for advanced computers, phones, and server infrastructure. For Poland, it is not only the chance for our participation in the strategic ecosystem, it's a real possibility to build our own industry sector based on local competencies, international cooperation, and growing interest of investors.

- says Max Dropiński, CEE Leader in SEMI.org.



THE TRIANGLE CONCEPT: WROCLAW / THE CZECH REPUBLIC / SAXONY

Silicon Saxony

Silicon Saxony is the biggest in Europe and the 5th biggest microelectronics cluster in the world. The cluster includes three cities, with the main centre located in **Dresden** and many interesting companies located also in **Leipzig** and **Chemnitz**. According to information provided in Saxony Trade & Invest Corporation, there are 3650 companies operating in Saxony, employing over **81,000 employees** (with ca. 39,000 employees focusing on the software development, operating mostly on the B2B-basis). The cluster is represented by a **complete supply chain for semiconductors**, from silicon wafers to integrated circuits and electronic systems. Apart from companies, the centre is supported by universities and a German research centre **Fraunhofer**.

Silicon Saxony mostly brings together several plants conducting **semiconductor production processes**. They have originated from AMD, for years an American company **GlobalFoundries** has been developing in Dresden their biggest and cutting-edge production plant in Europe, operating in 22nm, 28nm, 40nm, and 55nm technology. The plant employs **ca. 3200 people**. Also **XFab**, one of GlobalFoundries's competitors, has a 350 nm technology production plant in Dresden. **Bosch** opened their semiconductor production plant in Dresden in June 2021. The investment of ca. **EUR 1 billion** is the biggest single investment in over 130 years of Bosch's history, and the plant will eventually employ **700 people**. In 2019, also **Renesas** opened its research and production centre in the area.

Apart from the presence of many leading companies, the future of the cluster also attracts interest; in the next few years, there are plans to invest over **EUR 23 billion** in Silicon Saxony. A key investment is a joint project of **TSCM, Bosch, NXP, and Infineon** (ESMC project) investing into a giant production plan of the latest-generation integrated circuits worth over **EUR 10 billion**. The plant should be ready in 2027 and employ 2000 people. **Infineon** is building a cutting-edge semiconductor production plant called Smart Power Fab in Dresden, investing over **EUR 5 billion** in this project. The plant will produce analogue chips and power system components, and its commissioning is planned in 2026. The investment should be co-financed with EUR 1 billion from the EU Chips Act program.



Illustration source:
SAXONY! Germany with That Certain Something,
Saxony Trade & Invest Corporation,

THE TRIANGLE CONCEPT: WROCLAW / THE CZECH REPUBLIC / SAXONY

The semiconductor industry in the Czech Republic

As informed by CzechInvest, the organization responsible for attracting investments and the country's economic growth, there are **80 companies** in the Czech Republic whose operations are engaged in the semiconductor supply chain. In total, those companies employ **11,000 people**. The success of the Czech Republic on the semiconductor market is based on the presence of several world producers and functioning of three production plants.

The key investor in the Czech Republic is **onsemi** (previously called **ON Semiconductors** and Motorola). Americans produce in Rožnov, manufacturing both semiconductor wafers and ready-made integrated circuits. The company continues the traditions of TESLA, established in Rožnov in 1949. Apart from the production plant, the company also has two design companies: **ON Design Czech** (Brno) and **SCG Czech Design Centre** (Rožnov) design integrated circuits and develop software for processing big datasets and production automation. A Japanese company **Hitachi** produces Diodes for applications in the automotive industry, conventional and switching thyristors, transistors and diodes dedicated for power supply systems (for power converters in rail vehicles, wind power plants, energy transmission systems, and in the industry). The company continues the tradition of ČKD Polovodiče, acquired by ABB, and transferred to Hitachi Energy as a part of later restructuring. The Czech Republic is also the location of a back-end production plant of an originally Czech company called **Argotech**. The plant specializes in installation, development, and engineering services in the area of optical fibers, semiconductor photonics, microelectronics, and micromechanics.

Also other world leaders of the semiconductor industry have their design units in the Czech Republic: a Japanese company **Renesas**, a pan-European **ST Microelectronics**, and a Dutch company **NXP**. Also a Swiss company ASICentrum has their design unit there, as well as a Czech company Codasip, created and grounded in the experience of staff of Brno University of Technology, specializing in RISC-V architecture.

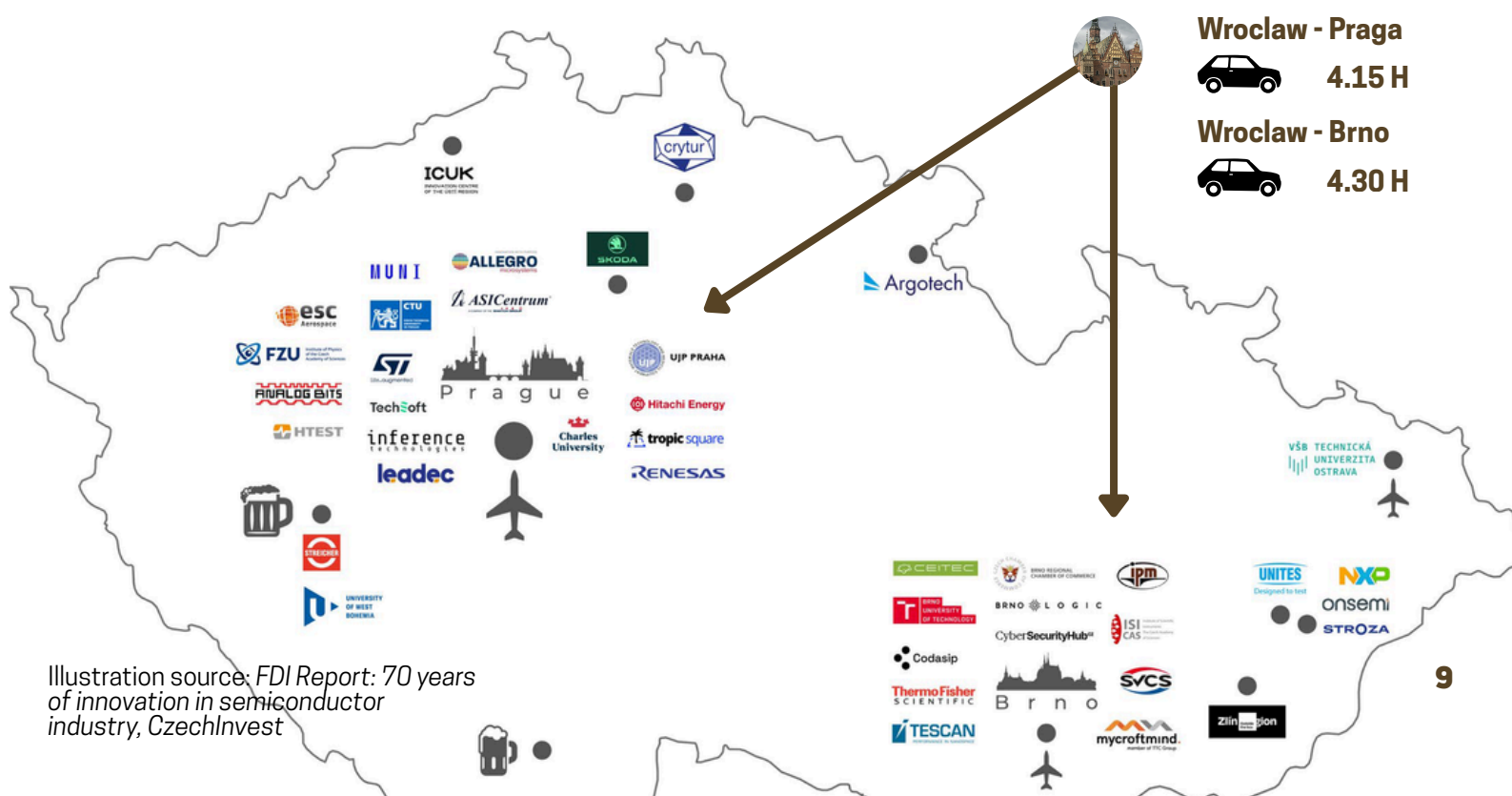


Illustration source: FDI Report: 70 years of innovation in semiconductor industry, CzechInvest

LSSE HAS THE BEST LAND IN EUROPE

What attracts investors from innovative industries to the Legnica Special Economic Zone (LSSE)?

One of the most important assets is the location of the area managed by LSSE, placed close to the German and Czech border, with access to the main communication routes. LSSE S.A. ensures access to well-communicated, equipped with necessary infrastructure undeveloped investment areas, including big complexes of dense areas of over 300 ha, which is unique on the country level and allows to position projects of a strategic meaning for the country economy.

Every investor first asks about human resources, and the whole region of Lower Silesia has an extensive academic and research base, such as Wroclaw University of Science and Technology, the University of Wroclaw, Wroclaw University of Environmental and Life Sciences, all of which can educate a qualified engineering and research staff. Another strong argument is also the presence of many foreign investors who give examples to more companies wanting to invest here. Lower Silesia has become a location for research and development centres of companies such as Nokia, 3M, LG, Google, IBM, Capgemini, Dolby, and many more. As a result, this region has become an IT hub, including many centres of services and research outsourcing.

Is the geographical proximity of business partners still important in the context of the Saxony-Czech Republic-Lower Silesia triangle?

Despite increasing globalization, digitization, and informatization, geographical proximity is still crucial in the supply chain, due to such factors as shortened supply time and lower logistic costs. Geographical proximity also allows for more effective planning of the production and logistic process. Quality supervision, supplier control, and bigger possibilities to quickly react to all unpredicted changes in demand, failures, or other market disturbances. When it comes to the geopolitical situation, logistic proximity also mitigates the risks, such as pandemics, military conflicts, or disturbances in the sea transport, allowing to build a more resistant and sustainable supply chain. In the context of the Saxony-Czech Republic-Lower Silesia triangle concept, the concentration of plants from a given industry supports cooperation, specialization, and innovation. Location of a production plant nearby key elements of the supply chain, such as suppliers, clients, and infrastructure, increases company's competitiveness, lowers costs, allows for more flexibility, and mitigates operational risk.

In the end, Intel gave up on the plan to build its back-end plant in Miekinia. What will now happen with the land plot that was perfectly adapted for the needs of the semiconductor industry?

Real properties initially offered to Intel, after the formal end of this cooperation, will be offered to other entrepreneurs interested in this area. Despite Americans' resignation to build a semiconductor integration plant, infrastructure investments continue, which additionally increase the attractiveness of the investment offer of the said land. In our opinion, the area of the Industrial Park in Sroda Slaska and Miekinia is unrivalled in the country when it comes to its location for global players in semiconductor or automotive industry, and it is surely one of few such well-prepared land plots in the whole European Union.

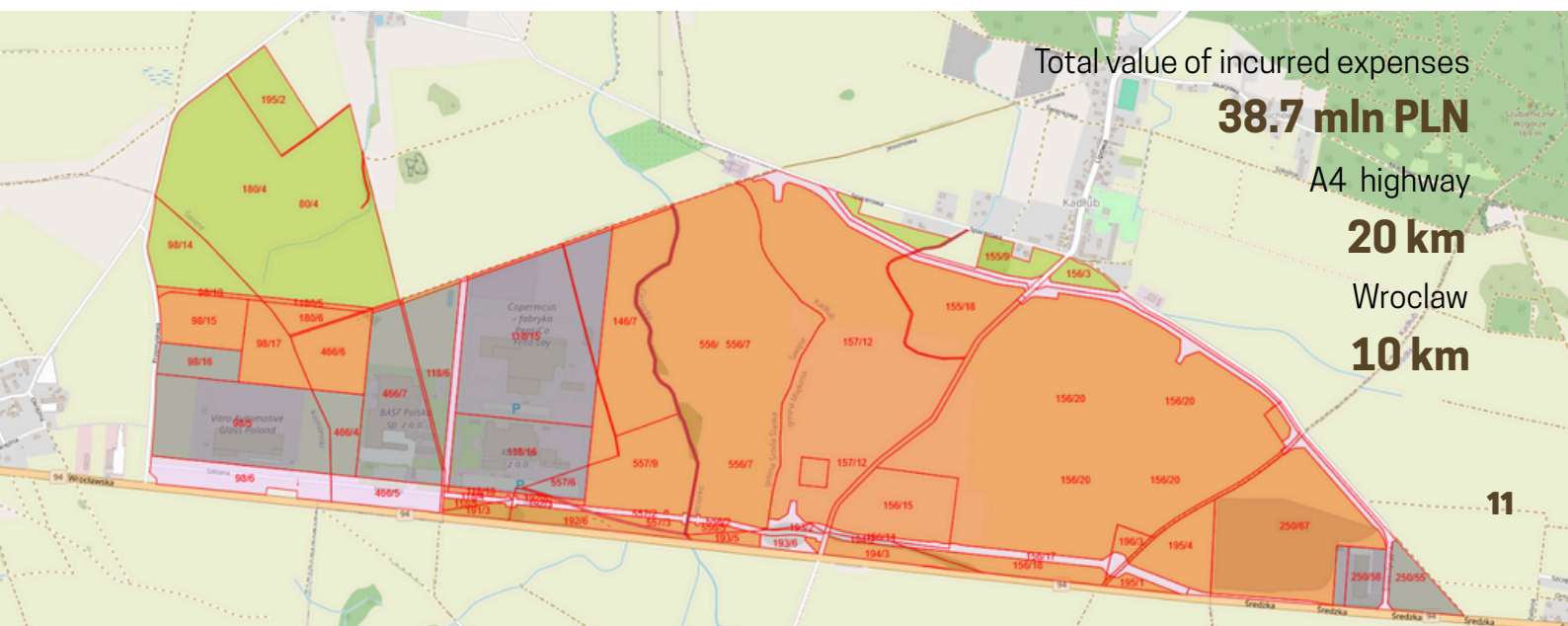
Interview

Kajetan Bator

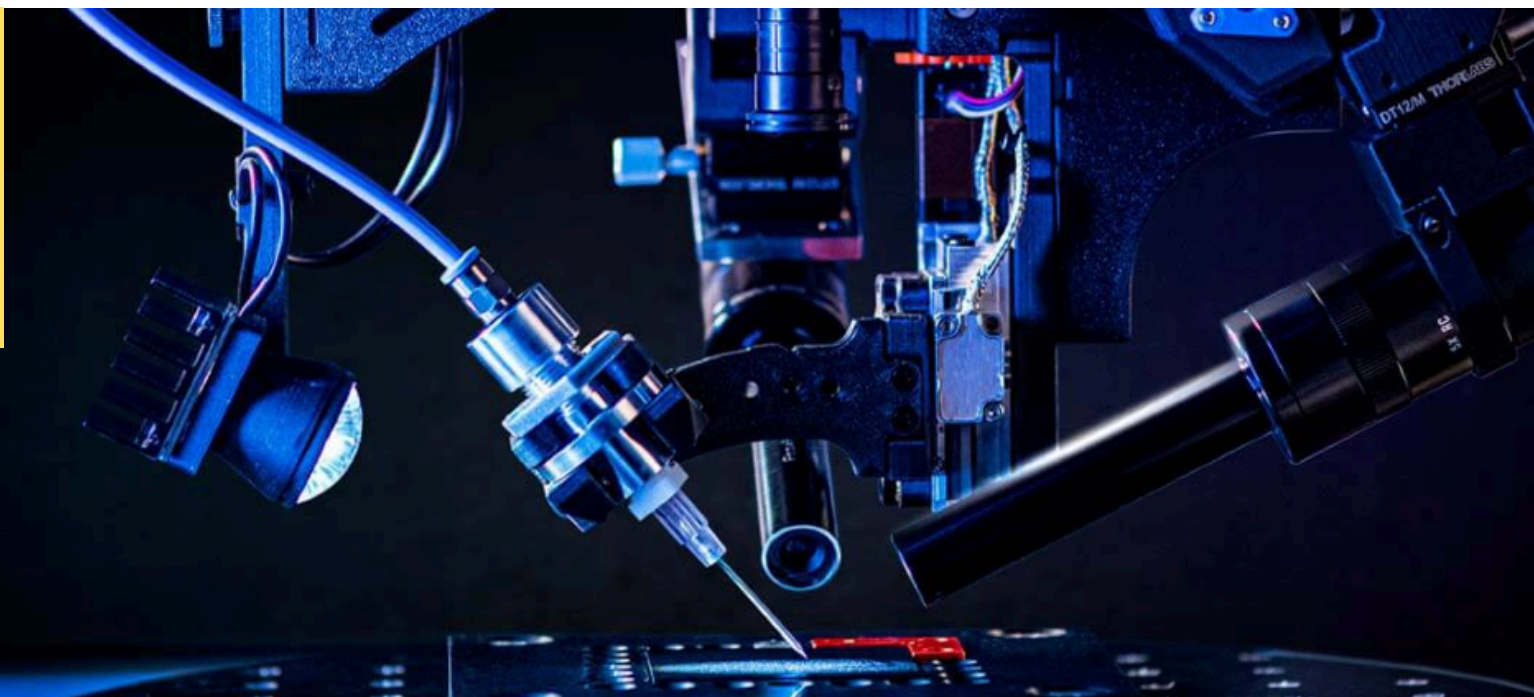
The CEO of
LSSE SA

MIEKINIA SUBZONE: SRODA SLASKA; LAND ADJUSTED FOR THE NEEDS OF SEMICONDUCTORS

- The area of the Industrial Park is within the borders of Legnica Special Economic Zone (Legnicka Specjalna Strefa Ekonomiczna), subzone of **Sroda Slaska and Miekinia (503 ha)**. The area of the Park is equipped with full technical infrastructure intended for supporting future investors.
- The Park is located directly by **national road no. 94**, which serves the subzone via three access roads. Design and construction work are currently underway, creating a communication structure with municipal roads of a joint length of approximately 8.6 km.
- **The main power source** is located by the northern border of the subzone, providing electrical power for entrepreneurs (currently with **a reserve capacity of approximately 10 MW**). The LSSE has project documentation for the construction of a new main power supply, which could provide additional energy of up to 50 MW. In the case of high power demand for electrical energy of up to 400 MW, Spółka Polskie Sieci Elektroenergetyczne S.A. plans to build a big 400/111 kV substation on the plot of ca. 12-13 hectares till 2030.
- Along the southern border of the subzone, there is a g225 **gas pipeline** of medium pressure, providing gas for recipients in the area of the Park. Currently, the reserve amounts to ca. **1000 m³/h**.
- The area is served by a Water Treatment Plant located directly on the northern border of the Park in Kadlub and a Water Treatment Plant in Sroda Slaska. The existing **water supply network** (w200-280) can supply water in the amount of up to **3,000 m³/day** for sanitary and industrial purposes. Construction of a new Water Treatment Plant in the Miekinia Commune is currently underway, providing an additional water capacity of approximately 5,000 m³/day. This will allow for a total water supply of approximately 8,000 m³/day to the Industrial Park. Completion and commissioning of the project are planned for the second quarter of 2026.
- The Subzone area is served by two sewage treatment plants, located in Sroda Slaska and in Wroclaw (Janowek Wastewater Treatment Plant), through the **sanitary sewer network** (ks180-200). The Miekinia Commune has begun construction of its own sewage treatment plant with a capacity of 6,500 m³ per day, along with the expansion of the sanitary sewer network, with a total length of approximately 30 km. Completion and commissioning of the project are planned for the third quarter of 2027.
- **Precipitation water** can be discharged into a newly constructed, sealed retention reservoir with a capacity of 30,000 m and a depth of 2.7 m. Additionally, the LSSE, together with the Miekinia Commune, is implementing the construction of an external precipitation water drainage system. The system will consist of three additional absorption and evaporation reservoirs with a total capacity of 43,000 m³ (completion of the project: the third quarter of 2026).
- The LSSE has levelled the area of **approximately 50 ha**.



XTPL: FROM LABORATORY TO INDUSTRY



Today XTPL seems to be on the border between two worlds: laboratory innovation and industrial implementations. How could we characterise today's stage of a company's development?

-We are still at the stage of implementing our technology on the market. It's an early stage of commercialization, despite the fact that we have already sold our products to over 20 countries on 3 different continents. At this moment, the most important task for us is to gain the first clients for industrial implementations, building out reliability this way and gaining market acceptance for our solutions. [...] Adopting new technologies depends not only on our determination, but also on how quickly clients will be able to implement them. It still requires some patience. We perceive our operations both in a short-time (analysing quarterly results) and in a long-term perspective. I think we have successfully completed the incubation stage of our technology and of its first productization, which resulted in, among others, the start of industrial implementation in January this year for our final client in China, one of the biggest producers of advanced displays in the world.

In 2025, the sales of Delta Printing System is planned to correspond to ca. 70% of the company's revenue, while R&D projects and industrial implementations will constitute the remaining 30%. However, the dynamic growth of the company in the following years is supposed to be caused by industrial applications.

- We have already delivered over 40 Delta Printing System machines, which are used in research and development works. Even though they are still not devices for industrial applications, they were delivered to prestigious clients in Europe, the United States, and Asia. This means we've gained our first market foothold. Since the beginning of this year, we've been carrying out our first-ever industrial implementation. While this doesn't translate into spectacular sales growth yet, it's crucial for our credibility. It's a step up in our league, allowing us to develop our technology for industrial applications. These initial implementations are intended to be a springboard for subsequent projects and further growth.

Interview
**Filip
Granek**
The CEO XTPL
SA



XTPL: FROM LABORATORY TO INDUSTRY

The company has opened its office in Boston, which also functions as a laboratory, where potential clients can test XTPL devices and technology on the site. Which markets will become crucial for XTPL in the next few years?

-From our perspective, two markets are the most crucial and promising. On the one hand, it is the United States, where we see big potential for highly advanced technological solutions but on a smaller production scale. I am talking about the High Mix Low Volume segment, including microelectronics, semiconductors, and the dualuse area, which means civil and military, also defensive applications. On the other hand, in Asia we observe a definitely bigger interest in solutions for large scale production. We will not deliver the whole device to this market, rather focusing on components, mainly printing heads (UPD modules), which are used in bigger production systems, especially in the display sector and in advanced microinstallation of semiconductors. [...] Europe is a very interesting market for research and development. We can see big interest both in academic circles and among newer technological companies, which are exceptionally innovative and can create groundbreaking solutions. The situation is less optimistic when it comes to big industrial players. In my opinion, this is one of the challenges in Europe that we can perfectly incubate new technologies, but we often lack a bigger scale to translate those innovations into a bigger industrial production and measurable benefits.

XTPL operates in the area of nanotechnology, which gets more and more out-of-laboratory applications. It is one of the most difficult and exciting areas of the high-tech market.

-We're observing that nanotechnology is getting an increasing presence in industrial applications. It is no longer just an interesting innovation confined to research and development laboratories, but is beginning to find a real place in large-scale industry. Of course, many breakthrough solutions continue to emerge at the research level, but not all technologies ultimately make it into the products we use every day. The key challenge remains the "lab-to-fab" process. It is a long, complex journey. Many technologies, though very promising in the research phase, ultimately fail to find widespread application. It could be said that there exists a "graveyard" of technologies that, despite high hopes, have failed to make it into industry. [...] We need to make it straight that even though there is a lot of activity in the laboratories, a successful commercialization of those technologies is a really difficult process, not only in Poland, but in the whole world. [1].

Interview
Filip Granek
The CEO XTPL
SA

EDUCATION FOR SEMICONDUCTORS

Secondary education

On 11th June 2025, the Centre of Vocational Education Institutions (Centrum Placówek Kształcenia Zawodowego) in Wrocław opened a new, one of the most advanced Digital Laboratory of Prototyping and Creating Mechatronic Systems in Poland. It can be used by students during their mechatronics, mechanical engineering, automatics, electronics, and technical IT classes. Students can use, among others, 3D printers (FDM and SLA), CO₂ lasers, oscilloscopes, laboratory power supplies, soldering stations, and microcontroller work sets. Grant supporting the development of vocational education in the area of producing advanced semiconductors was financed by Intel.

-In cooperation with ARAW and CPKZ, we have commissioned a specialized mechatronics laboratory in Wrocław suited for the needs of the semiconductor industry, supporting the education of technicians and production line operations already at the secondary education level. At the same time, in cooperation with Wrocław University of Science and Technology, we have provided a license on a practical course prepared by me and covering the whole production cycle of integrated circuits, from design to testing and packing. The course was created with the help of the highest-class experts with hands-on experience in the microelectronics industry, designed to meet real industry needs.

Thanks to these initiatives, Poland gains new qualified, both technical and engineering workers who can support new investments in the semiconductor sector. It is a material advantage for investors and local companies, which do not have to start from scratch, but instead can build on existing educational and competence-related potential, says Max Dropiński, CEE Leader in SEMI.org

Higher education

A key unit in Wrocław University of Science and Technology is the Faculty of Electronics, Photonics, and Microsystems, educating in such specializations as electronics, photonics, mechatronic microsystems, or automatics. In 2024, **341** first-level engineering studies students and **114** second-level studies (master's degree) students graduated from electronics specializations in the faculty. In 2025, the numbers were **282** and **113**, respectively. Approximately one-third of graduates completed courses related to semiconductor technologies at an equivalent level of proficiency.

The following departments operate in the Faculty of Electronics, Photonics, and Microsystems:

- Department of Acoustics, Multimedia and Signal Processing
- Department of Cybernetics and Acoustics
- Department of Electronic and Photonic Metrology
- Department of Microelectronics and Nanotechnology
- Department of Microsystems
- Department of Nanometrology
- Department of Field Theory, Electronic Circuits and Optoelectronics

The remaining faculties of Wrocław University of Science and Technology supporting the development of semiconductor industry:

- Faculty of Information and Communication Technology
- Faculty of Electrical Engineering
- Faculty of Fundamental Problems of Technology

IN THE END WE NEED A PRODUCT

In January 2024, soon after announcing Intel's decision to build a backend plant nearby Wroclaw, Wroclaw University of Science and Technology signed a contract including, among others, an agreement to jointly carry out research and development project, as well as create and adapt the curriculum to adjust it to company's specific needs. What will happen to this program in the current situation?

The curriculum whose flagship partner was Intel means for the university that we want to direct our cooperation to the semiconductor industry. No investment of the American company in Lower Silesia does not cancel this program, quite contrarily, we continue to stay in touch when it comes to teaching and rely on materials provided by Intel. Certainly, the final stages of semiconductor production are and will continue to be part of our curriculum. Semiconductor manufacturing technologies are not limited to just one company, and the concept of semiconductors is much broader than just processors.

Which elements related to the process of semiconductor production are included in the curriculum taught by Wroclaw University of Science and Technology? Does the university have suitable conditions for teaching more staff to support the semiconductor industry?

Our faculty includes three departments which are the most related to concepts of producing semiconductor tools. The Department of Nanometrology prepares instruments with which we can see the results of the production process and understand in detail the intricacies of the nanoworld. The Department of Microelectronics and Nanotechnology, based on owned devices, creates semiconductor structures. Finally, the Department of Microsystems deals, among others, with packaging, diagnostics, and reliability study.

In the end, Intel withdrew its investment, but as I mentioned, the collaboration with the company continues, and dedicated courses related to device manufacturing and packaging are included in various degree programs. These courses cover virtually the entire semiconductor production cycle: design, modelling, manufacturing, packaging, and testing. Furthermore, these topics have been a part of our curriculum for many years. With this direction in teaching, the curriculum is fully prepared for collaboration with semiconductor companies, and it is just a matter of potential focus on collaboration with a specific company, customization, or emphasis on certain elements.

On the one hand, semiconductor manufacturing is a challenging specialization, but on the other, the semiconductor industry is relatively underrepresented in Poland. First, young people need to learn the basics of physics and chemistry, and for most, these courses are difficult. The immediate question is: where will we find work after these university programs? The presence of a major investor like Intel would make a significant difference, giving our students a vision for their future careers. Other companies, such as Taiwanese ones, offer internships in semiconductor manufacturing, but the prospect of working abroad does not appeal to students, who would prefer to work locally.

Interview

**Rafał
Walczak**

Dean of the
Faculty of
Electronics,
Photonics, and
Electrosystems at
Wroclaw
University of
Science and
Technology

IN THE END WE NEED A **PRODUCT**

What experience in cooperation with the semiconductor industry does Wrocław University of Science and Technology have?

Semiconductors are not only about processors but also about elements called microsystems, combining movable micromechanics and electronics based on silicon, with the best example of sensors. They are the foundation for the development of drones or the automotive industry. Quite naturally, as a teaching institution, we will not be competing with leading manufacturers, but we look for their niche applications, such as our constructions dedicated for detecting a specific type of biological material, used in space industry or quantum sensors.

We work on their development both at the basic and materials research stage – as handled by, for example, the Faculty of Fundamental Problems of Technology - and we have laboratories where we can fabricate semiconductor devices and microsystems, from substrate to a finished component. While this is not mass production, our laboratory on ul. Długa in Wrocław has a production line that can be used to test prototypes and advance the project to TRL4 or TRL6 levels.

Wrocław is a leading centre of electronics with numerous companies designing and manufacturing electronics. Is it an important argument in the process of attracting investors from the semiconductor industry?

Absolutely yes, the technical culture has existed in Lower Silesia for years. It mostly results from the fact that people working at Wrocław University of Science and Technology have always been oriented into cooperating with the industry. The mindset of these people has always been focused on developing a working product, which is not always obvious. Often, projects developed by scientists ended up with just an article or another promotion. At Wrocław University of Science and Technology, this approach resulted in products, and this element still exists. Nanores and XTPL were created by graduates of our program who grew up in this culture and who also have a deep understanding of what is happening down there, at the level of the nanoworld.

Compared, for example, to mounting BGA, mounting a chiplet is much more complicated and sophisticated. The installation of PCAB means mounting in two dimensions, and advanced packaging introduces the third one; dies are put in a stack. We still need to address all aspects of electrical contacts and consider that the entire structure operates under the influence of temperature and electromagnetic field changes. Semiconductor devices must operate reliably for years, and the varying thermal expansion of all the materials used in them is a significant challenge. I remember the discussion that began when Intel expressed its interest, regarding whether we would be just another assembly plant. Nothing could be further from the truth: packaging is a very complex and sophisticated process; it would be a strategic skill for Poland.

Interview

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CASE STUDY: BATTERY PRODUCTION IN POLAND - A NEW SECTOR IN SEVERAL YEARS

Battery production is an unquestionable example showing that within merely several years, a completely new innovative industry sector can emerge in Poland.

In October 2016, a Korean company **LG Energy Solution** started the construction of its electric vehicle battery production plant in **Kobierzyce** nearby Wroclaw, the production began one year later. Since that time, plants producing lithium-ion battery chemicals, separators, copper foils, mechanical components for batteries, as well as plants for their recycling have been established in Poland: in just a few years, we have created a complete supply chain. **After merely several years of development, a completely new sector was created and Poland became the biggest car battery exporter in the European Union and the second one in the world.**

When LG was looking for a location in Europe, the decision was quite easy: the production hub in Kobierzyce has been persistently developed since the mid-2000s. The first stage of LG Energy Solution's expansion amounts to PLN 1.3 billion and includes the creation of 700 jobs. The plant was persistently developed in 2017 and 2019. On 19th January 2021, it was decided that the fourth stage of Kobierzyce production plant construction would be supported. As a result of its completion, the total investment will exceed **EUR 3.1 billion**, and employment will ultimately reach up to **10,000 people**. In July 2023, the Wroclaw factory reached 7,000 employees, with production capacity reaching 86 GWh, against the planned target of 100 GWh. Batteries produced in Wroclaw are used in electric vehicles manufactured by Audi, BMW, Fiat, Ford, Porsche, and Volkswagen.

LG Energy Solution's investment was the beginning of the whole series of investment projects and the construction of a complete supply chain in Poland. In the first wave of investments, right after the announcement of LG's investment, numerous Asian companies decided to pick Poland as one of their locations, most frequently being the suppliers of the Korean corporation. Several of those projects constitute large-scale investments.

SK Innovation first decided to invest in separator production plants in Dabrowa Gornicza at the end of 2018, and then again at the end of 2020. However, the most thrilling news came from early 2021 when the company announced plans to build plants 3 and 4, making Dabrowa Gornicza location of the world's largest separator factory, and the Korean company's investment will reach around PLN 7 billion. The first plant opened in 2021, with the rest scheduled for completion in 2024. SK IE Technology's total separator production capacity will increase from the current 860 million m² meters to 2.73 billion m² by 2024.

Umicore has been present in Poland since 2016, when it opened its catalyst production in Ruda Slaska. In 2022, with the cost of EUR 660 million, the company built its second plant in Radzikowice, specializing in manufacturing advanced cathode materials for lithium-ion batteries. At the beginning of 2024, Umicore started the construction of its third plant as a joint investment with **PowerCo** owned by VW. Till the end of 2023, Umicore and PowerCo plan to invest ca. **EUR 1.7 billion** and create **1,000 jobs**. This investment started at the beginning of 2023 is carried out within the operations of a new joint-venture called **IONWAY**.

CASE STUDY: **BATTERY PRODUCTION IN POLAND** - A NEW SECTOR IN SEVERAL YEARS

One of the most important investments in Poland is the production plant of battery energy storage systems in Gdansk, in which the production started in August 2023. Currently, the plant belongs to an American company **Lyten**, and it specializes in the production of systems based on lithium-sulphur batteries.

In recent years, battery systems production plants such as **Wamtechnik** in Piaseczno and **Johnson Matthey** in Gliwice have been expanded. The wave of investment continues today: in early 2024, one of the longest-operating battery pack manufacturers in Poland, the German **BMZ**, decided to expand its Gliwice plant at a cost of PLN 103 million. In April 2024, the Polish company **Green Cell** opened a battery production plant for electric bicycles in Cracow. One of the most dynamically developing Polish companies is **Impact Clean Power Technology**, which started its operations in its cutting-edge plant called **GigafactoryX** in 2024.

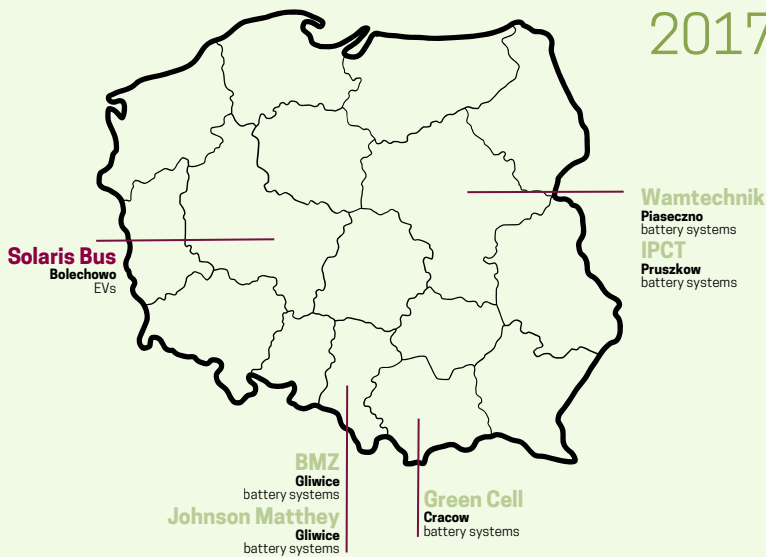
In a bigger perspective, the development of the battery production industry has also contributed to investments in the broadly defined electromobility sector.

Jawor nearby Wroclaw was first the location for building a battery and electric engine production plant of **Mercedes-Benz**, and in 2022, it was announced as the location of a EUR 1 billion construction plan for an electric van plant that would employ 2,500 people. **The VW plant** in Poznan also changes its production profile, introducing more and more electric models. Since 2023, electric scooters have also been produced in Wroclaw by **eSchwalbe**. Electric bus manufacturers are flourishing in Poland, including Polish **ARP e-Vehicles**. **Eaton** produces electronic systems for EVs in Tczew, as does **ZF** in Czestochowa and Wroclaw. The high-voltage cable production sector for EVs is also thriving: companies which have invested in this sector in Poland include, among others, **Aptiv, Phoenix Contact e-Mobility, Kyungshin, and LS Cable**. Adam Drzew, an associate of Elon Musk, announced in October 2023 a PLN 30 million investment in an EV harness production plant in Zelichow.

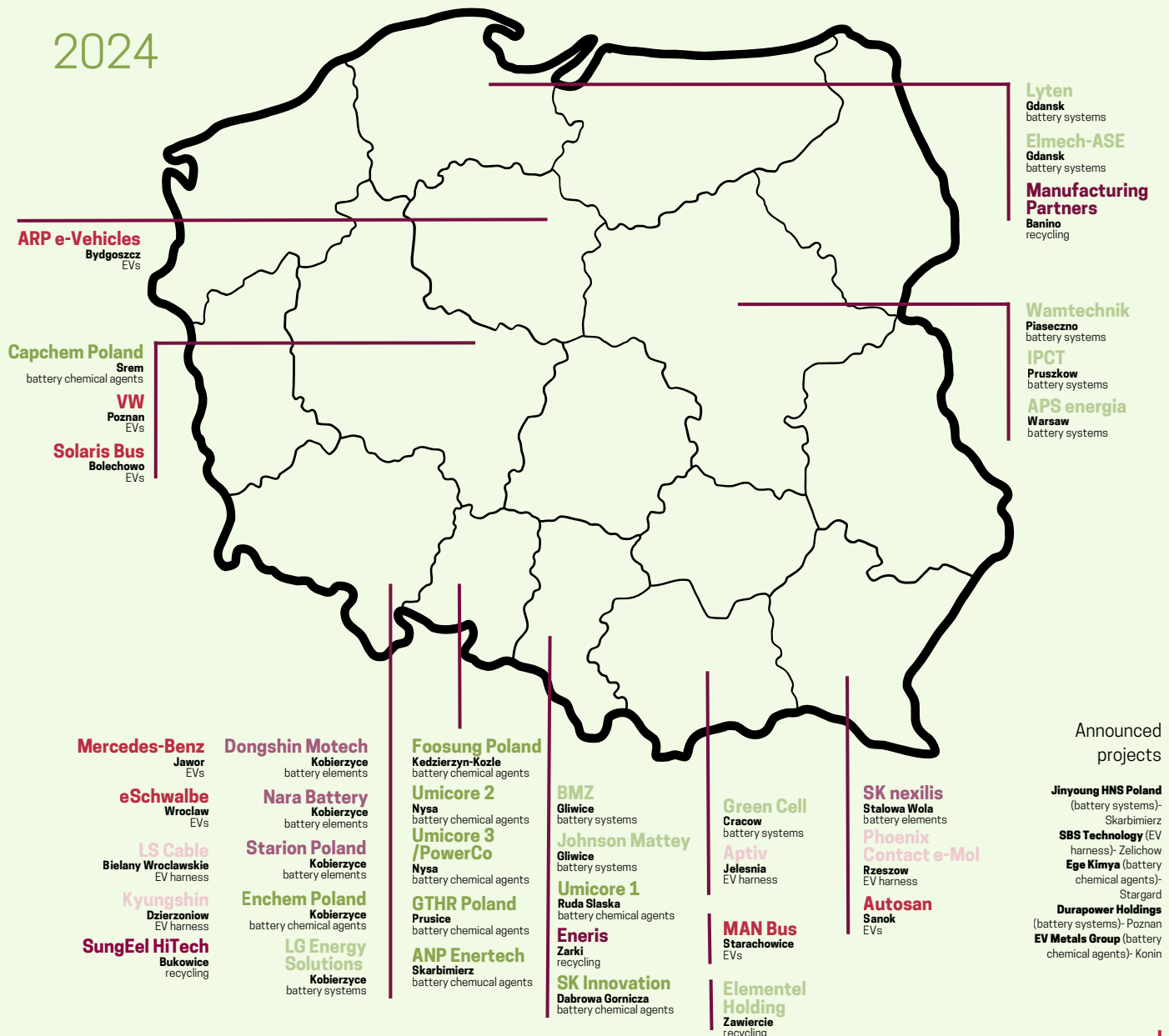
CASE STUDY: BATTERY PRODUCTION IN POLAND - A NEW SECTOR IN SEVERAL YEARS

Before LG's decision to build an enormous battery factory in Poland, the country's battery production industry had only been represented by several companies. Since 2017, we have created a complete supply chain for Li-Ion batteries and developed other sectors, such as EV and high-voltage cable production.

2017



2024





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