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Non – Technical Summary

extension of the Li-ion Battery Factory stage III

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Introduction

LG Chem Wrocław Energy Sp. z o.o. (LGCWA) is part of LG Group, focused on production of lithium ion batteries used in electric cars. Ultimately, it will be the largest plant in Europe producing solutions for powering electric cars. Currently, the company operates two stages of battery production plant in Biskupice Podgórne 15km southwest from Wrocław city in Lower Silesia voivodeship.

From 2017, the company started expansion of plant which includes installation for the production of electrodes and lithium-ion cells. Expansion involves construction of four new production buildings, electrolyte storage tanks, two warehouses and parking area. Additionally, there will be new building constructed for pulverization of cathode that do not meet the quality requirements –this process will ease recycling. The purpose of the plant extension is to increase the production capacity to about 223.5 million cells per year.

LGCWA manufactures its products in compliance with all standards and regulations required by the Polish and international law. The company has implemented environment (ISO14001:2015) and health and safety (OHSAS 18001) management standards. All employees are aware of the company's environmental impact through trainings conducted by specialists. The company regularly checks and assesses the environmental aspects and conducts activities which limit impact on environment.

Place		**Lower Silesia, Wrocław**
Location		**343km South-West from Warsaw, 292.82 ㎢**
Population('17)		**640 000**
Main Industry		**Machinery (automotive), electrical appliances**
FDI	**Automotive / Logistics**	**Volvo(Bus), Wabco(Safety Devices), Amazon**
	Chemicals	**3M, Cargill, US Pharmacia**

Project scope

The subject of the investment is the expansion of the Li-Ion Battery Factory. Stage III of the Battery Factory will be erected in Biskupice Podgórne, on the registration plots no. 2/127, 2/129, 2/144, 2/145 and on the area to be separated from plot No. 2/165, precinct Biskupice Podgórne. The existing stages I and II of the Battery Factory are located on plots no. 2/129, 2/144 and 2/164.

The third stage of the Battery Factory includes an installation for the production of electrodes and lithium-ion cells. The installation will be located on plots No. 2/127 and 2/145 in 4 halls, for which the investor has obtained the environmental decision (decision on environmental conditions of consent for the implementation of the project from 17.01.2019, no. RINiŚ.6220.17.2018-23).

The extension also includes the construction of CCSS (continuous chemical supply system), which will be located next to the PACK II building (former LG Display), the construction of two storage halls and a paved storage area at the PACK II building, as well as a parking lot next to the stage I boiler room. Additionally, a gas boiler room with a combined thermal power exceeding 25 MWt is planned.

The target area of the entire plant development will take approximately 37.6 ha. The new development will occupy an area of approximately 4.5 ha. Stage III will be located in the immediate vicinity of the existing buildings of LGCWA - stages I and II, PACK I and PACK II developments.

The processes taking place in the third stage of the Battery Factory will be analogous to the currently conducted processes in the Fabryka Baterii held in the second stage. The goal of the project is to increase the production capacity of lithium-ion cells to about 223.5 million per year.

In the developed part, all cell production processes will take place - from electrode production to quality tests of the cells made. The processes will be analogous to those carried out in the existing state.

Production technology

The production process will include the following activities:

1. Production of electrodes
   This step consists of weighing and mixing the anode and cathode components. The mixture is then applied to the copper foil in the case of the anode and the aluminum foil in the case of the cathode. Next, the material is dried and goes to the rollers that provide the right density of electrodes.

2. Cell assembly
   In the first stage, the electrodes are cut to the appropriate size through a solid form. Then in the vacuum dryer, the electrodes are completely dehydrated and purified with nitrogen gas. The cleaned electrode rollers are directed to the lamination process, where, as a result of the increased pressure and temperature, cells consisting of electrodes separated by a separator are formed. Cells prepared in this way are folded. Then, aluminum and copper plates are assembled to the electrodes using laser welding technology. The next step is to place previously prepared cells in an aluminum housing, and then to fill with electrolyte. The final process of producing electrodes is the sealing.

3. Forming and loading cells
   At the next stage of production, the cells are stored for the time needed to stabilize the electrolyte. The cells are then charged and unloaded, and then vented in the vacuum chamber. Each battery produced is classified and then packaged for shipment.

4. Cell testing
   Individual cells from the given lot are tested in a separate place - the test building. Tests rely on baking the cells in the furnace, opening the cells, unloading the cells, and also embedding the cells in the NaCl solution.

5. Battery assembling

Each cell is controlled for voltage and continuity of insulation. Then the cells that have passed the tests are directed to the cutting station to obtain the desired size. Subsequently, the cells are assembled to obtain a 12-cell system. Such complex modules are directed to the busbar installation station. After mounting the busbar, the battery is an active product that achieves the assumed voltage and capacity. The modules are then placed in housings. Subsequently, the batteries are filled with a two-component thermally conductive resin. After the resin has been injected, the "aging" stage begins, which is the time in which the resins cure. Next, the module goes to the final test station, where it is loaded and unloaded to check its parameters, among others voltage, internal resistance.

Production capacity

After investment process, production capacity will increase from 60 million to about 223.5 million cells per year. Increased capacity will be associated with increased consumption of raw materials, natural gas and water.

Solutions used for environmental protection

Both in the existing state and in the target state, solutions were designed to protect individual components of the environment, which are shown below:

- the project was designed in accordance with the applicable technical and construction regulations, Polish Standards and the principles of technical knowledge in a manner ensuring safety of use, appropriate hygienic and health conditions and environmental protection, as well as saving energy, fuels and raw materials used,
- the object is heated using low emission fuel - natural gas,
- rainwater and snowmelt collected from potentially contaminated areas before being discharged to the sewage system are cleaned in a separator of oil derivatives,
- in order to maintain proper retention, rainwater and snowmelt water are directed to the storage reservoir before discharge to the sewage system,
- complete separation of sanitary and rainwater sewage systems is ensured, preventing mixing of wastewater,
- paved areas (parking lot) are covered with a tight surface in order to isolate ground and groundwater from potentially secondary contaminated rainwater,
- the waste is stored on the plant site in a selective and safe manner for the water and soil environment,
- car traffic will takes place on designated routes, which will result in minimizing emissions,
- air protection devices were used as absorbers with activated carbon and bag or cassette filters that will minimize emissions into the air,
- distillation of the NMP substance was used for re-use in the process,
- wastewater does not contain substances particularly harmful to the aquatic environment,
- the production process takes place inside buildings, which positively affects the acoustic climate.

The applied solutions protecting water and soil against pollution, as well as proper waste management, will minimize the risk of contamination of water or soil in the area of investment. The use of air protection devices allows compliance with air quality standards around the investment.

Nature protection

The investment area is located outside the borders of protected areas. In the immediate vicinity (up to 10 km) from the area of the planned project there are four protected areas under the Act of April 16, 2004 on Nature Conservation (consolidated text: Journal of Laws 2018, item 142) listed below:

Landscape Park Dolina Bystrzycy located 4,35 km east from project area

Natura 2000 protected areas:
Łęgi nad Bystrzycą PLH020103 located 6,3 km north-west
Przeplatki nad Bystrzycą PLH020055 located 7,3 km south-west

Ecological site Stara piaskownia located 8,3 km north-west

Up to 10 km from the investment area there are no national parks, reserves, protected landscape areas or nature and landscape complexes.

Air emissions

In order to check the impact of the project on the atmospheric air and cumulative impact with other plants in the area under consideration, a computer analysis of the spread of pollutants was carried out.

In the study, in accordance with the reference methodology, the scope of calculations was determined and calculations of pollutants spread in the air were made for the pollutants selected. The conducted analysis showed that the operation of the project will not exceed the air quality standards.

Combine emission to air after expansion is shown in the table below:

	MG / year
Total dust	2,5486
PM 2,5 µm	2,5232
PM 10 µm	2,5486
Sulphur dioxide	13,3012
Nitrogen dioxide	43,7215
Carbon monoxide	9,1806
Copper	0,2136
Nickel	0,0001
Cobalt	8,75E-05
N-Methyl-2-pyrrolidone	39,9221

From the atmosphere protecting point of view after the planned project, including the currently operating installations, a technological installation will be created for the production of lithium-ion batteries with consumption of 322.986 Mg of VOC per year with necessary technological infrastructure and a natural gas fired boilers with a total capacity of approximately 145,2 MWt.

In accordance with the Regulation of the Minister of the Environment of 27 August 2014 on types of installations that may cause significant pollution of individual natural elements or the environment as a whole (Journal of Laws, item 1169), Annex No. 1

• point. 6. 9) installations for surface treatment (coating) of substances, objects or products using organic solvents, with a solvent consumption of more than 150 kg per hour or more than 200 tonnes per year; technological installation will require obtaining an integrated permit.

• point. 1. 1) installations for the combustion of fuels with a nominal power of not less than 50MW

technological and energy installations will require obtaining an integrated permit.

Water usage

The plant does not use its own water intake, it is taken from municipal water supply. Water is used for social and technological purposes.

Total water consumption after plant expansion will be approximately:

- for social and living purposes, approximately 120 000 m3 / year;
- for technological purposes:
    - for boilers approximately 52 000 m^3 annually,
    - for production of electrodes and distillation of NMP approximately 362 000 m^3 annually
    - for cooling systems approximately 925 000 m^3 annually

Water used to supplement losses in the boiler's circulation will be treated using a treatment system equipped with an ion-exchange softener. Water used for technological purposes - for the production of electrodes and distillation of the NMP will be treated using the reverse osmosis process.

The amount of water consumed will be monitored by means of water meters.

Wastewater disposal

The amount of social and living sewage generated after expansion was assumed to be equal to the consumption of water for this purpose, hence the amount is about 67 000 m3 / year.

The pollution indicators characteristic of these wastewater are: BOD5, COD, general suspended solids, total nitrogen, total phosphorus.

Domestic wastewater will be guided to the sewage system along with technological wastewater.

In total, after the expansion of the plant, approximately 120 000 m3 of domestic sewage will be generated.

In connection with the ongoing process, industrial wastewater is generated in the plant. About 30% of the water consumed is wastewater from the water treatment process. The remaining sewage comes from the NMP purification process at the SRP station (Solvent Recovery Plant), from the cooling tower, and from the boilers. Most of the water used for cooling towers, as well as during the drying of the anode evaporates.

The total amount of technological sewage after the expansion of the plant is shown below:

- from boilers approximately 51 300 m3 / year,
- from the production of electrodes and distillation of NMP approximately 151 000 m3 / year,
- from cooling systems approximately 472 000 m3 / year,

The sewage generated is not a source of substances particularly harmful to the aquatic environment.

Rainwater and snowmelt from the sealed surface of the Plant will be captured by gullets and wells of the factory's rainwater drainage system. Rainwater and snowmelt from sealed surfaces will first be retained and then discharged into an external rainwater sewage system. Due to the fact that a part of rainwater is discharged from a hardened surface, on which vehicles generating pollutants in the form of a general suspension and petroleum hydrocarbons can move, rainwater discharged from these surfaces will be pre-treated with a suspension settler and a coalescence separator.

Waste generation

Due to the expansion of the plant by the third stage, the number of waste generated in the production process will increase. It is forecasted that as a result of the investment, the amount of non-hazardous waste generated will be approximately 38 372 Mg / year, while hazardous waste will be 4 828,7 Mg / year. After the expansion of the plant, a total of approximately 69 594,5 Mg / year of non-hazardous waste and around 6 964,95 Mg / year of hazardous waste will be generated.

The amounts presented above were initially estimated on the basis of data available at the current stage of the project. The quantities of generated waste indicate the obligation to change the current permit for waste generation. Before commencing the operation, the investor will obtain relevant permit. The final amounts and types of waste will be given in the application for a change of permit for waste management after the implementation of the detailed balance sheet.

Activities aimed at preventing the generation of waste and reducing the amount of waste and their negative impact on the environment include in particular:

- rational and economical use of raw materials, auxiliary materials, fuels, energy;
- the transfer of waste that can't be avoided is primarily for recovery (preparation for re-use, recycling, other recovery processes) and, as a last resort, for disposal to authorized recipients of waste with a permit to process waste,
- storage of waste in containers appropriate to the quantity, composition, chemical and physical properties of waste, in an environmentally safe manner.
- introduction of organizational, logistic and technological solutions aimed at minimizing the amount of waste generated.
- systematic training in waste management.

All waste generated will be stored selectively in the area to which the investor has a legal title. Hazardous and non-hazardous waste will be stored in a manner adapted to the composition, properties, quantity and type of waste, ensuring environmentally safe collection. The storage of waste generated during the operation of the investment will take place in a manner that is safe for human health and the natural environment. Waste will be transferred only to authorized holders for further development in accordance with the requirements of the Waste Act.

Noise

In order to determine the impact on the environment, calculations of sound propagation in the environment of the analyzed Investment were made. Noise propagation calculations were carried out taking into account the most unfavorable option from the point of view of negative acoustic impact - taking into account the work of all sources at the same time.

Based on the calculations carried out, it is stated that the planned Investment will not cause exceedances of acoustic standards in protected areas occurring in the immediate vicinity of the Plant. There is no need for additional acoustic protection.

Possible social conflicts

LG Chem Wrocław Energy Sp. z o.o. is a Polish company operating on behalf of the Korean LG group, which operates in three sectors in the world: chemical, electronic and telecommunications. LG Chem has companies on the Asian, American and European continent. The Polish branch of the company was established in 2006 in Biskupice Podgórne. LG Chem plans to expand the Battery Factory, which will play an important role in promoting the electric car industry. LG Chem Wrocław Energy obtained environmental decisions for the construction of the 1st and 2nd stage of the Battery plant. The plant contributes to the economic development of the region and creation of jobs.

The implementation of projects that may have an impact on the environment is often accompanied by a lack of social acceptance accompanied by a risk of protests and social conflicts. The effectiveness of conflict resolution is all the greater, the earlier disputes will become the subject of discussion and stakeholder dialogue. It should be noted that the analyzed project is one of the projects that could potentially have a significant impact on the environment, for which the preparation of an environmental impact report is optional and depends on the decision of the authority issuing the decision.

Industrial investments are often associated with the phenomenon known in the literature on social attitudes under the name NIMBY (Not In My Back Yard). People living in the immediate vicinity of the investment are opposed to its creation but would not mind if it were created elsewhere. In the case of the investment, the advantage is the location in the Special Economic Zone "EURO-PARK WISŁOSAN." This area is intended for projects such as the expansion of the Battery Factory. It is located in a considerable distance from the nearest residential buildings. The construction of the installation in this place will not contribute to the change of land development or landscape, which helps to minimize potential objections of local communities from concerns about financial losses resulting from the decrease in the value of real estates located in the vicinity of the planned project, as well as objections arising from concern for impacting the project on the residents of nearby towns.

The analyses show that the emission of pollutants from the installation will not cause excessive nuisances. There were no exceedances of permissible values in the atmospheric air for all considered pollutants. On the basis of the analysis of the course of the isolines of normative levels, it was found that the designed investment will not cause exceeding the acceptable sound level in acoustically protected areas.

As it results from the above information, the project does not pose a threat to residents, and its impact does not exceed permissible values and environmental standards. In the above-mentioned

aspect, it can be stated that no conflicts and social protests related to the impact of investment on people are expected, on the contrary - the undertaking should be perceived as pro-ecological, ultimately aimed at the development of electric transport in Poland.

Greenhouse gases emissions

The planned project involving the expansion of the Battery Factory will not cause direct emissions of greenhouse gases - such emissions will be caused only by transport on the plant premises and by natural gas combustion for heating purposes.

For heating purposes, gas boilers will be used. CO2 emissions from gas combustion are up to 30% lower than in the case of crude oil and up to 60% lower than in the case of coal combustion. The use of natural gas instead of other raw materials, therefore, significantly reduces the amount of greenhouse gases emitted as part of the project.

In connection with the extension of the fuel combustion installation, the plant will be subject to the provisions of the Act of June 12, 2015 on the greenhouse gas emission allowance trading scheme. The company is in the process of obtaining a permit to emit greenhouse gases and will try to obtain free allowances for emission. It is estimated that around 30% of greenhouse gas emissions will be met by free allowances from the reserve envelope.

Conclusions

Taking into account the above, the investment consisting in the expansion of the factory for the production of lithium-ion batteries will not constitute significant threat to people's health and for the environment. In fact, the extension of the factory will create new jobs and improve the situation of the local economy. The development of the battery factory will help to realize the idea of electro mobility on a large scale and the shift away from the use of fossil fuels. The lithium ion battery technology is the most advanced but yet mature and reliable way of energy storage available today. The extension of the factory in Biskupice Podgórne will satisfy the growing demand for these products on the European market.

LG Chem Environmental and Social Management

Corporate principles of sustainability are as follows:

1 We provide environmentally friendly and innovative materials and solutions.

2 We adhere to business ethics as a corporate citizen.

3 We make products and run operations in a sustainable way.

4 We contribute to the growth of communities using our capabilities.

Plant in Biskupice Podgórne has implement OHSAS 18001 and ISO 14001:2015 management systems. Other information can be found at the address
https://www.lgchem.com/global/sustainability/sustainability-introduction/principle

https://www.lgchem.com/pl/sustainability/esh-management/environment-safety-health-business-strategy

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