

## Case-studies in Gävle, Sweden



The second case-study was held in Gävle, Sweden, 2019.

One of the main objectives in project Crea-RE "Creating aligned studies in Resource Efficiency" is to implement joint innovative cooperation between companies and higher VET to ensure better matching work opportunities of sustainable business. As a part of different activities in the theme of resource efficiency and circular economy, a case-study has been organized (after Riga case-study) in Gävle, Sweden.



Figure 1. Project kickoff meeting at the University of Gävle.

Students from Finland, Sweden, Latvia and Russia participated in an international intensive study-week in Gävle during March 2019 (figure 1 above illustrates project kick-off and presentation of case-study instruction at the University of Gävle). Four different cases-studies were organized in close corporation with Gästrike Ekogas AB, Uppsala Vatten and Avfall and Vattenfall in Uppsala. Students from those counties carried out their studies in groups to investigate possibilities for enhancing circular economy and recourse efficiency in different industries. Some general tasks concerning case companies can be listed as:

- What are main drivers for implementing circular economy principles in the company?
- What are main obstacles for implementing circular economy principles in the company?
- Compare acquired knowledge with students' ideal circularity model developed before the study trip.
- Learning about real situation in the company, what had not students anticipated in the ideal circularity model?
- Recognize one particular problem, which students (or researchers in the university) can help the company to solve regarding circularity. What is the proposal for the company?

Before study trip, students learned basic information about the assigned case companies. Students developed their own ideal circularity model for the particular industry. They used creative thinking – if anything were possible. During study trip, students had acquired understanding about peculiarities of the particular company – main business activities, scale of operations, value chain of the final product, main material flows on the site. What circular economy principles (or business models) are applied in the company operations? Students had also considered the use of circularity principles in materials sourcing, design, manufacturing, distribution and sales, consumption and use, collection and disposal, recycling and recovery, use of renewable energy.

#### *Human Lean Center, “Pedal car factory”*

As part of the team-building activities and also to give the students an understanding of the streams and use of resources. And then be able to apply it to the case company in their project with and see how they can optimize their flows and also identify whether a company has waste that another company can see as a resource, the students visited Human Lean Center at the University of Gävle and there is a production line where ordinary pedal cars are used as objects and assembled together (see figure 2). Human Lean Center conducts experience-based education for both students and companies at the University of Gävle.



Figure 2. Students in the pedal car factory working with the pedal car.

Results from abovementioned case companies were summarized and presented during April 2019. Some highlights from students' work as well as their reflections are given below.

#### *Uppsala Vatten och Avfall AB (Wastewater)*

Uppsala Vatten och Avfall AB is a municipal company with about 200 employees. Since the company provides different services ranging from drinking water, wastewater treatment, household waste

collection, biogas production to waste recycling, this group focused on the business area of wastewater treatment. After a guided tour at the site of wastewater treatment facility at the company (see figure 3), the project group decided to aim the project for creating more value with the ideas from circular economy through the wastewater management system. More specially, the group aimed at minimizing the waste and gain ideas of the most environmentally friendly waste water management system possible. As a matter of fact, the company has already practices circular economy. For instance, they use the sludge as a fertilizer and they provide biogas as an energy carrier to provide the heat for the system. This is actually due to the fact that wastewater is rich the phosphorus and after biological treatment the phosphorus together with other organic substances ends up in the sewage sludge. The sludge consisting nutrients can therefore be used as a fertilizer while the organic matters can be broken down through for instance anaerobic digestion to produce biogas.



Figure 3. Guided tour at wastewater treatment plant Kungsängsverket at Uppsala Vatten och Avfall AB.

Since the wastewater consists high amount of phosphorus, the project group proposed that the phosphorus in the wastewater could be refined as black phosphorus (black phosphorus is an allotropy of phosphorus and it has interesting properties that can be used in electronics) for creating more value for Uppsala Vatten AB. However, it was also identified that to transform the phosphorus in the wastewater that is basically in different form to black phosphorus requires deeper understanding of the technology as well as a careful investigation of the cost-benefits.

*The reflection from the students* suggests that they are satisfied with the study visit since such opportunity for seeing and participating in real life case study helps to understand problem more, it allows to rich previously gained knowledge about resource efficiency.

#### *Uppsala Vatten och Avfall AB (Drinking Water)*

Greywater recycling system can be a good alternative to save large amounts of water. Even if it's expensive to install in every household and sometimes hard to get society involved in such massive water cycle renovation, the system is already proved to be effective; the water storage is a variable in volume, system installation could be EU funded and it could save up to 15326189 m<sup>2</sup> of water in Uppsala daily according to the calculation.

Since the objective of this project group was to learn about Uppsala Vatten AB (drinking water) and how it could become even more circular and sustainable for the future, and based on the fact that

the company itself did not have any specific issues to solve, it made this case study challenging but also very innovative.

#### *Gästrike Ekogas AB*

The purpose of the study visit was to let the students meet and visit real companies to see their processes and how they work with resource efficiency and circular economy (see figure 4). The students are then working in groups, one from each country, to map the energy and material flows to identify where there is potential for improvement. One of the companies that we visit was Ekogas, a biogas plant in Forsbacka, Gävle. Ekogas is a company who produce biogas from e.g. food waste, fat sludge and garden waste. The technique is a thermophilic plug flow digester and is used for dry digestion. The outcome is biogas (methane and carbon dioxide), and a biodigestate, a concentrated nutrients that farmers can spread on their fields. Ekogas is a relatively young company that has a working technology which is a good example of the circular economy.

The project group identified three problems: plastic in the food waste, metal in the food waste and low use of biogas in private cars. The conclusions and proposals are that Ekogas don't have the right group of costumers yet and suggest that Ekogas need to take a notice of the four Ps with their marketing; product, price, promotion and place to attract more customers. Another conclusion is that Ekogas need to inform the citizens about how to sort their waste and the importance of not putting plastic and metal in the food waste.



Figure 4. Guided tour at Ekogas plant in Forsbacka.

*The reflection from the students* about the study visit was very positive. Several of them were pleasantly surprised at how good the companies are working on these issues such as resource efficiency. However, most of them suggest more time for introduction about the companies and the aim of the project and study visit before we went there.

#### *Vattenfall AB*

Vattenfall AB, which is owned by the Swedish state, employs approximately 20 000 workers and has facilities spread across Nordic countries and around the central Europe. The study visit is performed at Vattenfall's waste incineration plant in Uppsala, where the facility produces district heating and energy by using waste as its main resource. The project aimed to give insight into what problems arise when burning waste at Vattenfall incineration plant and tried also to identify ways for improving circular economy and reducing material waste. As byproduct of incinerations, both



gypsum and bottom ashes, have been suggested to be reused as constructions material such as drywall and concrete and road pavement respectively.

*The students reflected that the study visit was a learning experience on circular economy and on incineration facilities.*

### **Some words from student about the case-study**

“It was great to have the opportunity to participate in the project, this project teaches the basics of a cycle economy, the introduction of which at the enterprises in the world and in our country is becoming increasingly relevant. The big positive thing is that the project includes not only lectures and theoretical material, but also practice like visits various enterprises, where you can see how it works, and moreover participate in the development of activities related to the cycle economy. Thus it turns out competently / interesting / involving a built-in system of training students. I liked the selection of enterprises for student projects that are socially significant. It was interesting and relevant for me to lean alternative sources of energy and how it is organized in enterprises.”



Figure 5. Students participated the second case-study in Gävle, Sweden, 2019.