TOWARDS SMART ZERO CO_2 CITIES ACROSS EUROPE

VITORIA-GASTEIZ ✣ TARTU ✣ SØNDERBORG

Deliverable 5.7: ICT Sonderborg Platform in operation

WP5, Task 5.7

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Abbreviations and Acronyms

Abbreviation/Acronym	Description
SmartEnCity	Towards Smart Zero CO2 Cities across Europe
D	Deliverable
ET	Telia Eesti AS
EU	European Union
EV	Electrical vehicle
FC	Follower City
H2020	Horizon 2020
LHC	Lighthouse City
M	Project month
SONF	Sonderborg Forsyning
v1	Version 1
WP	Work package
TEC	Tecnalia Research & Innovation
ZERO	Project Zero

Table 1: Abbreviations and Acronyms

0 Publishable Summary

Sonderborg's long-term vision is to build a Digital Ecosystem for city data and services by integrating various data inputs and sensor systems together into one city ICT platform, where anyone could build their own Value Adding Services on top of city provided platform.

Sonderborg ICT solution is a Telia smart city service, localized for Sonderborg city needs. This solution was first introduced in Tartu city in 2018 and after its successful introduction, it was deployed in Sonderborg.

The ICT solution consists of multiple separate modules:

1) Telia IoT platform for easy integration of any sensor systems,
2) Data Access Layer (DAL) for Authentication and Consent Management. This layer also introduces an API for Third Party Access to the data,
3) Data Mapping Tool as a technical service for describing and allocating data for end-users,
4) City Portal for end-user access to City and personal data.

Technically the ICT solution consists of multiple services and technologies that are interconnected through APIs. Some of which are only for internal use to ensure the future proofness by modularity, where all the modules could be changed in the system, without changing the whole system itself at once. The rest of the APIs are open to using by partners who have joined the ecosystem and want to utilize one or multiple benefits of the Sonderborg Digital ecosystem.

To utilize the open APIs and grow local competencies, Sonderborg Smart ZEROHACK was introduced as a tool to engage local companies and people. This hackathon was well represented and resulted in three teams using the CIOP's open data as intended. Furthermore, two of the teams were invited to a follow-up meeting to help the local companies in their challenges.

1 Introduction

The aim of Task 5.7 was to deploy the necessary ICT infrastructure needed for data harvesting, data management, monitoring, and evaluation of the Sonderborg ICT System, as well as to implement the specific infrastructure needed for the deployment and operation of the City Information Open Platform (CIOP).

After the Danish ICT partner (Vikinge Gaarden) withdraw their participation in the SmartEnCity project as of 31.08.2018, the WP5 management group in negotiations with EC decided to implement the same CIOP solution that was already implemented in Tartu city within the SmartEnCity project.

Right after the amendment was approved the implementation of the CIOP was started and preparations for the first Sonderborg Smart ZEROHACK started.

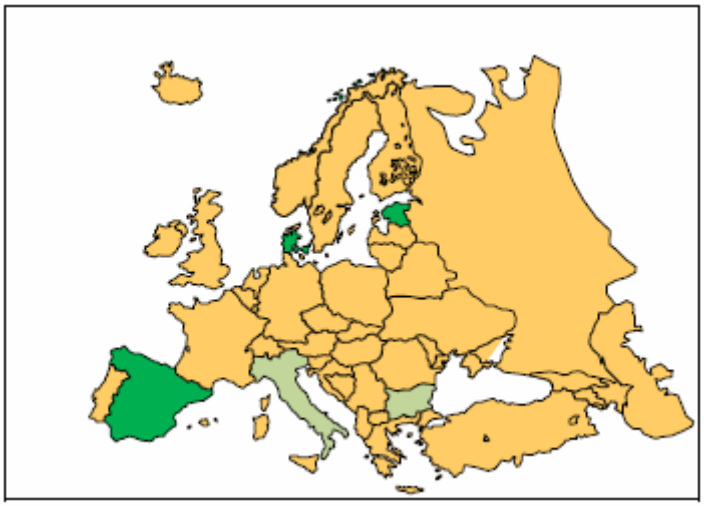

Figure 1: Lighthouse and follower cities in SmartEnCity

1.1 Purpose and target group

The deliverable of task 5.7 is the implementation of Sonderborg CIOP. The purpose of this document is to give a technical overview of how the CIOP is designed and implemented.

The overview includes a description of the different stakeholders, and lessons learned during the implementation of the platform.

The target group of this document includes people with a technical background from municipalities, NGOs, and activist groups interested to replicate similar systems in other European cities.

1.2 Contributions of partners

The following Table 2 depicts the main contributions from participant partners in the development of this deliverable.

Participant short name	Contributions
ET	Writing the technical part, finalizing and submitting the deliverable
ZERO	Writing the hackathon part of the deliverable

Table 2: Contribution of partners

1.3 Relation to other activities in the project

The following Table 3 depicts the main relationship of this deliverable to other activities (or deliverables) developed within the SmartEnCity project and that should be considered along with this document for further understanding of its contents.

Deliverable Number	Contributions
D5.3	Installation of measurement equipment in the housing associations
D5.5	Implementation Of measurement hardware that shows measurements of the solar batteries.
D5.9	Sonderborg Demo intervention summary report
D4.11	Sonderborg CIOP is based on the Tartu CIOP. In Deliverable D4.11 the CIOP is described and detailed.
WP6 deliverables	Sonderborg CIOP is based on the outcomes of ICT Work Packet deliverables

Table 3: Relation to other activities in the project

2 Objectives and expected Impact

The ICT and CIOP implementation is part of the Sonderborg Lighthouse Demonstrator tasks in the SmartEnCity project and is aiming for precise measurements of the project results and better education and awareness of the broader public considering energy consumption and carbon emissions. Furthermore, the CIOP aims at being a smart city platform, that collects and distributes relevant city data and makes these data available for developers and companies that are willing to develop new smart city products and business cases based on these data.

2.1 Objective

The objective is to implement the necessary IT infrastructure in order to collect data from the already established smart city interventions in the housing associations and furthermore to implement a smart city platform that shows the future possibilities of an integrated ICT platform.

2.2 Expected Impact

The Sonderborg CIOP will be the future SmartCity platform of Sonderborg. Already during the project phase, the partnership aimed to make sure that the CIOP platform will continuously be operated, also after the SmartEnCity project. The aim is to collect different sorts of city data and make that data available for different target groups and stakeholders.

The expected impact will be new products, ideas, business cases, and information emerge from this platform and citizens are generally more aware of their energy consumption.

3 Overall Approach

As the Sonderborg CIOP is a clone of the Tartu CIOP the implementation and development of this platform were easier than developing a new platform from scratch. However, several things had to be adjusted in order to fit in the Danish context. These adjustments were both of technical nature but also practical and systemical nature. One of the most obvious adjustments was the translation of the different interfaces to the Danish language. On the more technical and systemic side, one of the most important adjustments was to implement the Danish login method NemID – which is the national standard for authentication and is widely trusted by consumers. As the Danish ICT partner had developed proprietary hardware for data collection, also a new measurement infrastructure had to be installed in houses. Furthermore, some initial city services were implemented in order to show the possible impact/effect of the platform. These are among others showing the individual users' electricity and district heating consumption.
As holding hackathons was part of the second amendment also the Sonderborg Smart ZEROHACK was part of this work package.

Corresponding information platforms in Sonderborg

The concept of the CIOP is very new in Sonderborg. Until now there were made several approaches focusing on giving citizens and other companies access to city-wide information. However, these approaches never were as holistic as the current CIOP's approach. Some examples of city-wide information systems are the park guidance system or information displays at the city entrances, which can show different information and adverts. However, the idea of collecting data city-wide and engaging different companies and stakeholders in using the platform for their purpose and considering that the CIOP is based on an online solution is very different from these earlier approaches.

Figure 2: Infoscreen at city entrance in Sonderborg

4 Task 5.7 / Sonderborg CIOP in operation

The Framework

As the initial task leader VG left the SmartEnCity project in mid-2018 a new solution for the Sonderborg CIOP had to be found. As already described, a collaboration between Telia Eesti and Sonderborg was initialized and the amendment (AMD-691883-41) formalized the collaboration, which enabled the Sonderborg partnership to "re-launch" the work on the CIOP in May 2019.

The implementation of the CIOP was split between ET and ZERO. In this collaboration ET made all the technical tasks and implementations, whereas ZERO was in charge of the local stakeholder management and finding data/data sources that could be added to the platform. The already installed metering equipment had to be changed at the housing associations due to compatibility issues. This task was led by ET and locally supported by ZERO.

The CIOP

The Sonderborg CIOP is a direct outcome of WP6 studies and is built on top of the foundation described in WP6 deliveries, where a state-of-the-art study of available platforms and technologies was performed to find the best data and services integration solution for the city. The Sonderborg CIOP is a direct clone of the Tartu CIOP. Therefore, the technical concept of both platforms is the same

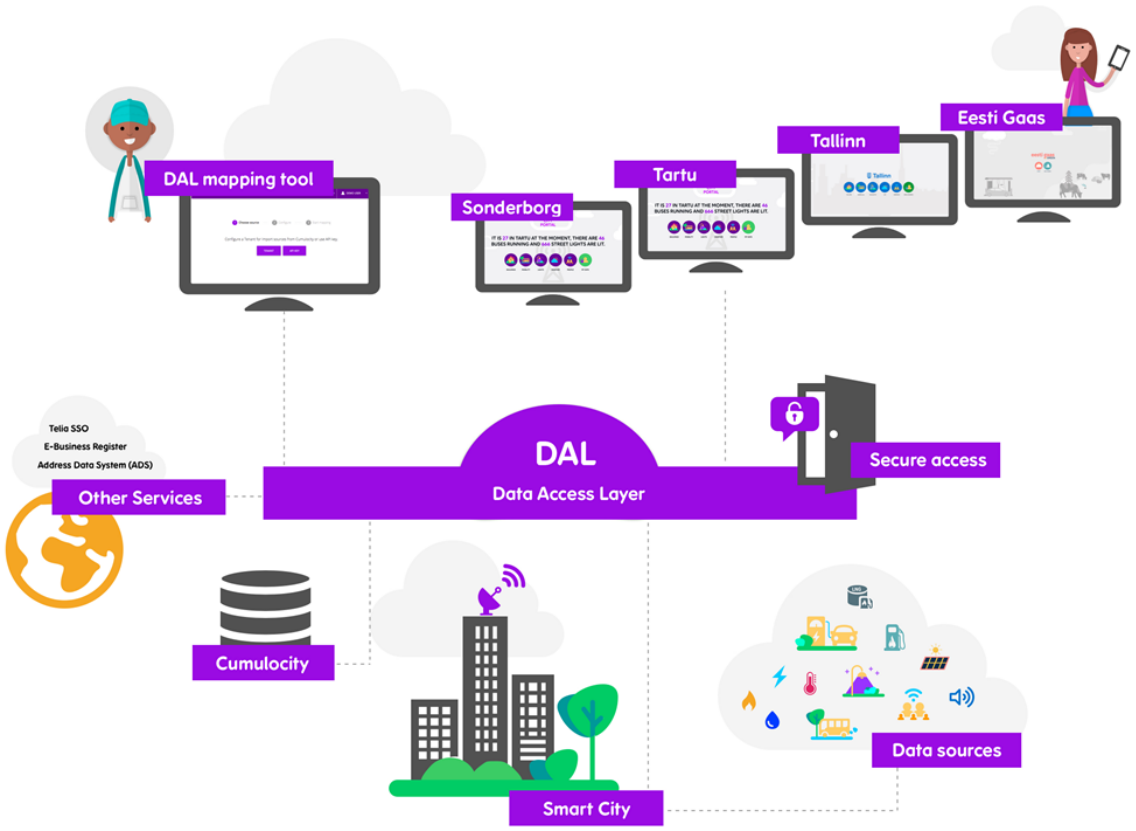

Figure 3 CIOP modules and actors

Cumulocity is the IoT hub to collect the data or backend of the system of the CIOP. Cumulocity is a proprietary IoT software that is developed by the German company "Software AG". Cumulocity handles the different sensor connections and stores the data in the system.

The data sources for the CIOP can be various different sources from the city. In order to get the data, sensors that are able to communicate with the CIOP have to be installed or some other IT system has to provide data over APIs. The easiest way to achieve this is to choose a sensor/device that already is integrated into the cumulocity environment. However, also other data can be integrated even though this needs some effort by the IT support.

On top of Cumulocity and other data inputs, one of the most important parts of the CIOP is **Data Access Layer (DAL)**. This is a secure gatekeeper module between data producers and consumers. All authentications are controlled by DAL, also sharing, a delegation of information, and consent management are handled in this module. These are the components to secure the data and ensure GDPR compliance. In the Danish case, the login method that was chosen is NemID, which is the national standard for online banking and public services.

The Data Access Layer gives the user the possibility to add external data sources. This can either be done through the API (every user gets his/her individual API key token) or through the tenants' user interface of Cumulocity.

The DAL mapping tool gives the possibility to describe and direct, or "map" the data that was already or will be sent to the platform. Describe means that the sender of the data can add some additional information such as the type of the measurement, the address or geographical position of the sensor, device name, etc. Also, it is possible to hand over the sensor to another legal or private person. Through this functionality, it is possible for a company to hire another company to install the sensors. This could typically be an electrician or some other technical educated installer. After installing the sensor, the installer can use the mapping tool to enter some relevant metadata to the sensor and then afterward send it to the data/sensor owner.

The users have to log in with NemID (either private or company NemID).

The dal mapping tool can be accessed on this domain:

https://dal.smartcitysonderborg.dk/en/login/login

The City portal is the user interface of the CIOP and it includes two strictly separate parts - **Open Data** portal and **My Data** portal. Under the Open part of the portal, everyone can see on a map, free of charge, the data that has been published by the city or building owners. Furthermore, different layers of information can be activated and deactivated. Different data sources can be activated and deactivated and the user can choose from different categories of information. For the My Data part of the portal, Danish hard authentication, NemID is used - meaning every Danish citizen can log in conveniently without a separate user account needed. After login, a person can see all the data related to him/her and the data that is shared or delegated to him/her. Also, the city portal gives the possibility to add a dashboard, that displays interesting data for each user. Municipalities, when logged in, can create questionnaires to harvest data in a systematic way.

The city information platform can be accessed on this domain:
https://www.smartcitysonderborg.dk/en/

Technically the CIOP consists of multiple services and technologies that are interconnected through APIs. Some of which are only for internal use to ensure the future proofness by modularity, where all the modules could be changed in the system, without changing the whole system itself at once. The rest of the APIs are open to use by partners who have joined the ecosystem and want to utilize one or multiple benefits of the CIOP.

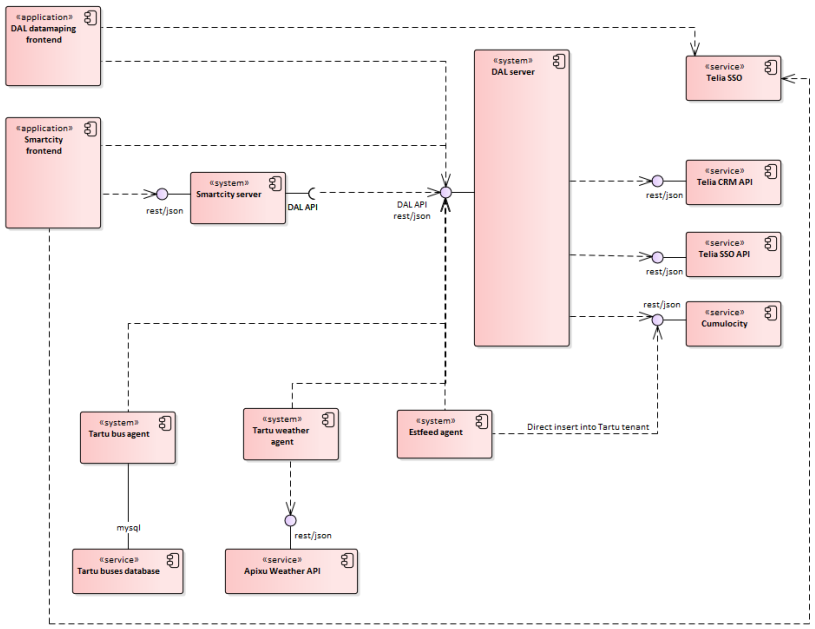

Figure 4 CIOP technical architecture

5 Porting of the platform to Denmark

As the platform initially was developed for the Estonian market, some aspects had to be changed for making the platform work in Sonderborg. The following section will describe the adjustments that had been made.

Translation

The language is of course a very important aspect when talking about user experience and the adoptability of the platform. Therefore, translating the platform was one of the first tasks that had to be accomplished. In order to translate the platform, the Crowdin platform was chosen (https://crowdin.com/).

Through this cloud-based solution, the single buttons and information boxes were translated one by one.

As the Estonian team already from the beginning had worked on an English version of the platform, the Danish version is based on the translation of the English platform to Danish.

His task was accomplished by SONF during June/July 2019.

NemID

Initially, the platform used Estonian login methods (ID-card, Mobile-ID, or Smart-ID). As the Danish citizens obviously don't have any of the Estonian login methods another solution had to be implemented.

NemID is the Danish standard for authentication at bank accounts and public services. As all danish citizens already use this authentication method and it is considered to be very secure the project team choose to implement NemID.

In order to do so, ZERO had to order the NemID solution at nets, as nets require that the company ordering this solution is located in Denmark.

After this, a test environment was set up, which made it possible for the development team to implement NemID on the platform.

Data measurements from the local housing associations

The former IT partner (Vikinge Gaarden) had developed proprietary hardware and protocols for data collection. After projecting the cost and time to port that hardware into new CIOP vs changing the hardware for a more standard one, it turned out to be cheaper and faster to switch out the existing installations with new measurement equipment with the one already compatible with Cumulocity. After the installation of this new hardware the data could be sent directly to the CIOP platform.

6 Additional data to the Danish platform

Besides the data from the housing associations (which is obligatory to collect due to the GA), the CIOP was populated with some initial data and information as the platform through this can show its entire potential.

Furthermore, some initial integrations (services) were added. These integrations enable individual users to see their private energy consumption (electricity and district heating).

Additional data

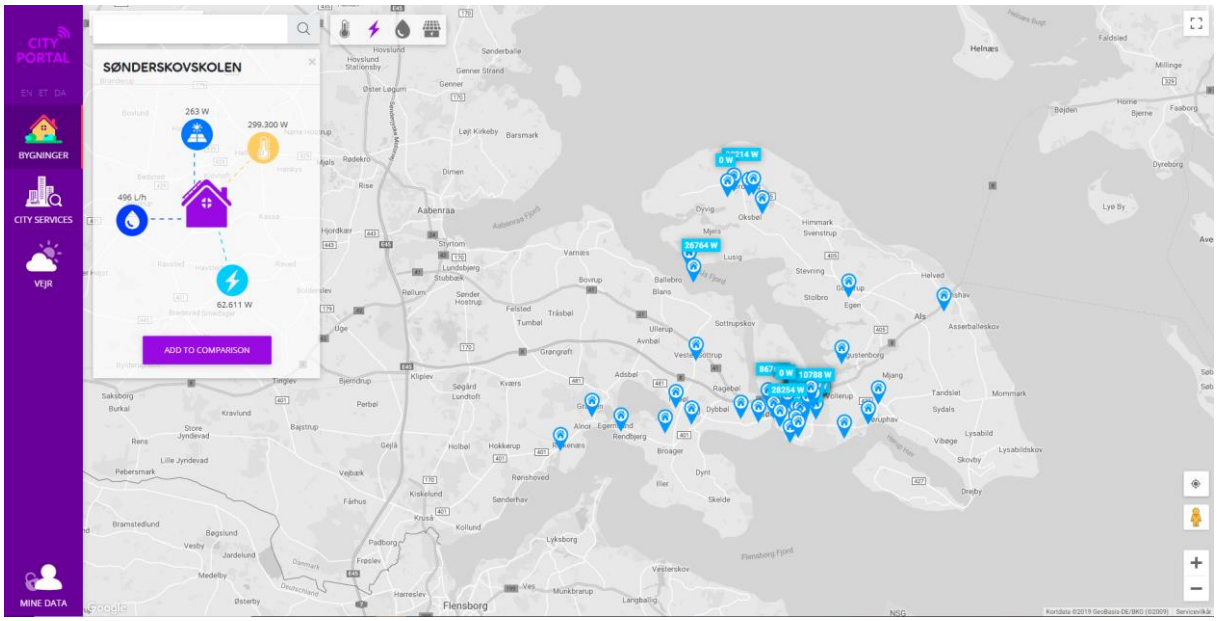

Figure 5 Additional data added to the platform several municipal buildings are added and real-time measurements are shown

Additionally, to the housing associations, several municipal buildings were added to the platform. Schools, elder homes, kinder gardens, and medical centers now show their electricity consumption and partly also water consumption, heat consumption, and PV production. All these buildings can also be compared to each other.

Additional digital services added surplus value to the platform

As an additional service for the citizens, the possibility to see their own electricity and district heating consumption was added. These services rely on external data sources. The data flow is activated by the users when accepting the service. Of course, the individual user has always the possibility to reject the consent at any time in the future, if the user does not wish to see the data anymore.

7 Hackathon – building up local competences

As part of the amendment, local hackathons were decided to be the best way to engage local citizens and companies. As the concept of hackathons was new to ZERO the development of the concept started with some research in Sonderborg and some initial brainstorming on how a hackathon could look like in the local context, taking both the CIOP and additional data into account.

One of the main focuses was to gain more local knowledge on this type of event and to make sure that hackathons would be held more regularly in Sonderborg.

Hackathons as part of the local education

In general, hackathons can be seen as a possibility to learn about new topics and approaches, which is why the concept fits very well into already existing learning environments. Therefore, ZERO approached the local university (southern Danish university [SDU]) to investigate the universities knowledge and experience in having these events.

Figure 6: Student group working at their workstation

The University had some initial experience in holding single hackathons, even though this experience still was limited to one event they had before with a local company.

Additionally, ZERO also approached the local business college which has a lot of different courses from IT/Media, finance, and service over to construction and technology. Here no experiences were made with hackathons before, but the school was open to engaging.

As local knowledge was limited, ZERO decided to hire one of the national experts for hackathons – “Innovation Lab”[1].

Innovation Lab had experiences from organizing several of these events (among others with Siemens Windpower, Mærsk, and Arla foods).

Innovation Lab came up with a convincing concept for the Sonderborg Smart ZERHACK and took over the facilitation of the workshop.

However, it still was important to keep the local university in the project as this was important to keep the concept living in Sonderborg. Also, it was key to keep the university in the project as the participants to engage were students.

[1] Learn more about Innovation Lab here: https://innovationlab.net/

Therefore, ZERO decided to split the organization between these two partners and ran a process with regular project meetings in order to keep each other updated.

Figure 7: Sonderborg Smart ZEROHACK logo

Concept

As ZERO in general aims to act as a project catalyst in order to gain carbon neutrality the city's different companies and stakeholders are very important. Therefore, it soon became obvious that it would not only be ZERO's challenges that had to be hacked, but also challenges from important city stakeholders/companies.

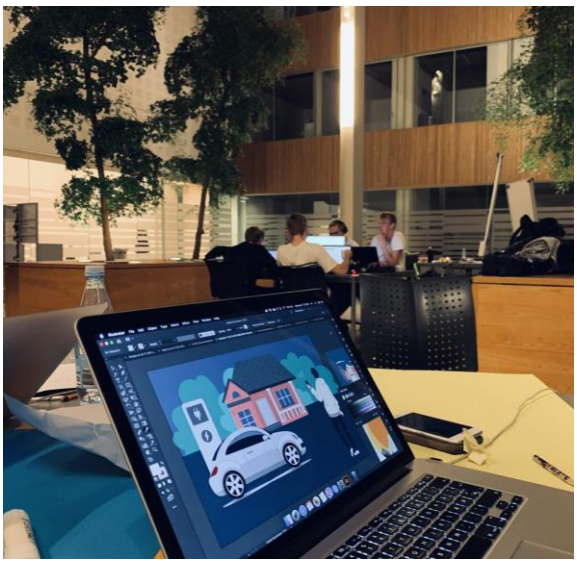

Figure 8: Illustrators working on materials for the presentations

At the same time, the new Sonderborg CIOP had to be a central topic of the hackathon. The data the CIOP potentially would collect and the possibilities to visualize and share data were aspects that were considered when developing the hackathon concept.

As most energy/CO2-related data emerge from the actions of the local utilities and the municipality, some initial phone calls were made to see if a hackathon could catch their attention. After the general concept of hackathons was explained the companies that were asked were happy to participate and bring in their challenges.

Engaging public entities and utilities had the advantage that the solutions that would be

found probably directly would lead to improvements for the citizens in Sonderborg. Also sharing data and challenges probably was a bit easier for these companies, as public services are not directly competing with others.

The public entities that engaged were Sonderborg Varme (local district heating company), Sonderborg Municipality, and Sonderborg Forsyning (local utility company). Furthermore, Evonet (local electricity grid operator) made some data available and the local company "Swipbox" engaged in the event.

Pre-workshop

As the concept of a hackathon was very new to the participating companies the project team decided to have a pre-workshop to clarify the concept at also what would be needed from the companies. Each company ended by defining at least one case/challenge that could be hacked by the participants.

The pre-workshop was held about 1 month in advance of the hackathon, which was important to have enough time to fine-tune the cases and ensure that relevant data could be collected/organized.

The jury of the hackathon

After some discussions, the project team decided to also engage the local companies in the jury of the hackathon. Through this, it was ensured that the participants were motivated and that the results of the hackathon would be directly fed back to the companies that brought up the challenges.

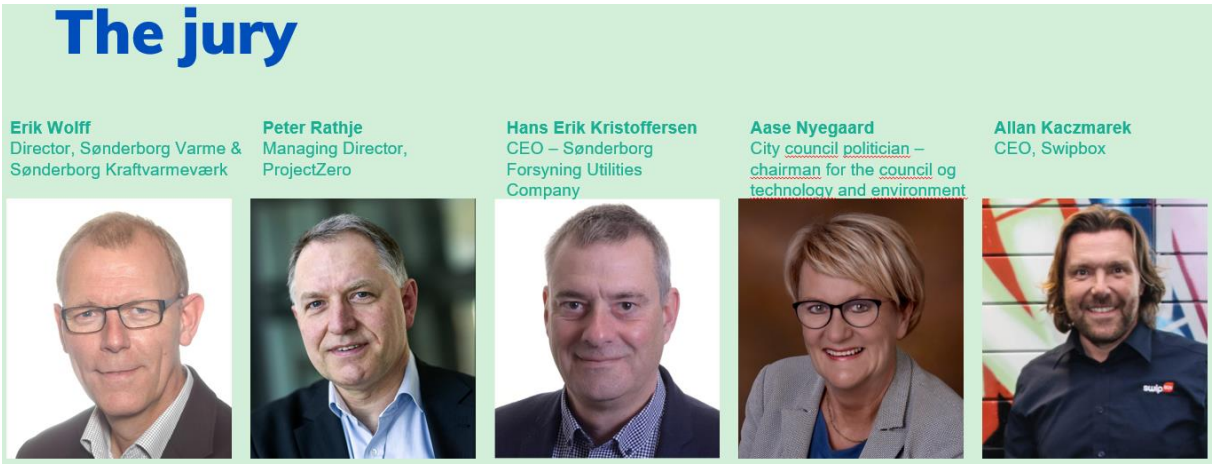

Figure 9: The jury

The teams

All in all 50 students participated in the hackathon.[2] Their background was widely spread both in the case of their nationality but also their profession. As some already signed up as a team the planning team decided to just create groups of the remaining participants, which was accepted by them. In total there were 10 teams and 5 challenges, so each challenge was solved by two teams.

[2] https://emdesk.eu/shared/5dfcae11626bd-43a16368238b868c267b41864dcef97e

The hackathon

The hackathon was held during the first weekend in November starting on Friday at 5 pm and running until Sunday afternoon at 3 pm.

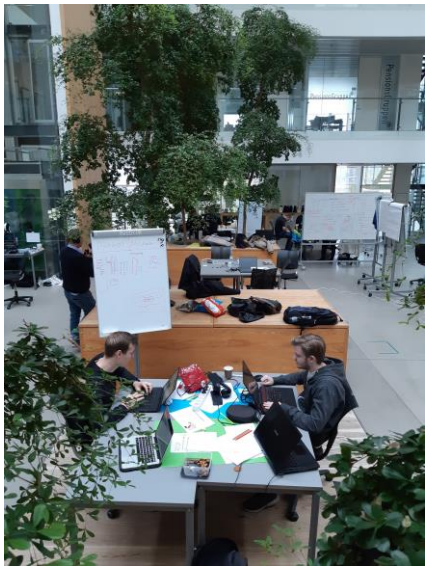

Figure 10: Students programming

The hackathon started with presenting the different challenges, both were presented by representing employees of the company and written in a short and understandable format, so the participants could start working. Some challenges came with data sets, others were in plain text form. The participants were put into groups and got the opportunity to set up a ranked list of which cases they would like they would like to work with. After a short break for dinner, the groups started working.

The venue was held open during the entire workshop and the university organized a team of 25 students, that stayed at the venue in order to make sure all groups had the necessary supplies.

On Saturday the event started with some breakfast and a short motivation exercise and a detailed presentation of the CIOP platform before the groups continued working.

During noon so-called “guru-sessions” were held. During the “guru session” specialists from the companies came in order to help the groups to understand the challenges in detail and help to find possible solutions.

During the afternoon two illustrators came in, which helped with illustrations, logos, designs

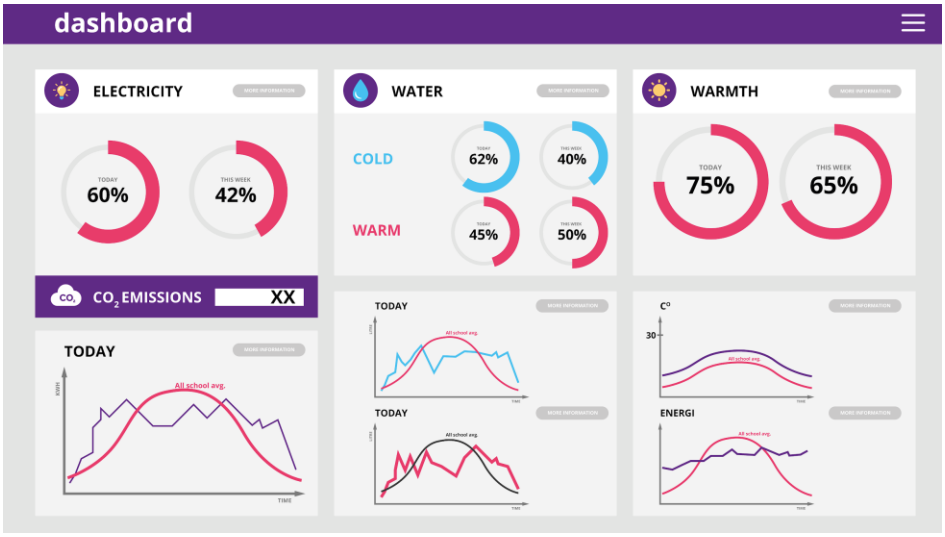

Figure 11: Dashboard idea made up by a student group and created by illustrated

and concepts so the groups were prepared for the presentations the next day.

Also, an inspiring pep talk was held by the facilitators from innovation lab.

Sunday morning was time to finalize the concepts and presentations. The Jury came at noon and the groups started presenting their solutions.

Every group had five minutes for their presentation, afterwards, the jury had two minutes to ask questions.

After the presentations, the jury voted for the winning teams, and finally, the event ended with the prize ceremony where the three best solutions were cored.

Follow up

Two of the winning teams were asked by the companies to present their solution to the company and tell about their findings and thoughts on how to solve their challenge.

8 Conclusions and deviations

The implementation of Sonderborg CIOP was technically rather easy, as the same technology was implemented once before in Tartu. As predicted at the beginning of the CIOP implementation phase, most of the delays and/or kickbacks have been on a human and agreement side – not on technical implementation. Thus, there were no deviations from the planned work.

All in all, the planning and launch of the CIOP have been successful and the system has been collecting data successfully.

9 References to demonstrator

Here are the main links to Sonderborg CIOP:

Sonderborg City Portal: https://www.smartcitysonderborg.dk/da/

Data Access Layer (DAL): https://dal.smartcitysonderborg.dk/da/