RUGGEDISED
Designing smart, resilient cities for all

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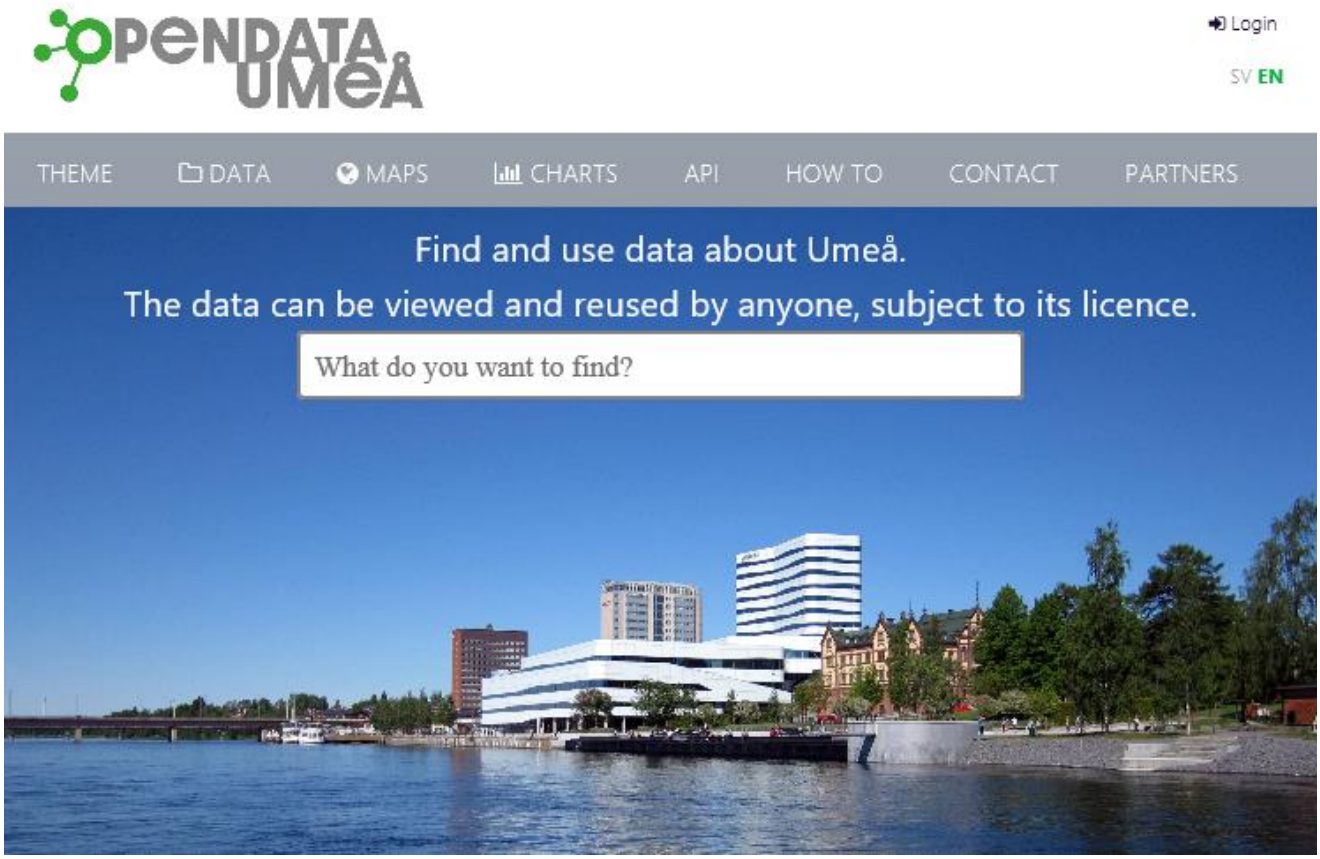
# Executive summary

The city of Umeå has created a smart city open-data decision support platform(opendata.umea.se) that was released to the public in October 2019. We can already see that it has a strategic value for the city, including the Data sets, as an enabler for creativity and will be providing digital and data-driven innovation, multi stakeholder collaboration and value co-creation within Umeå. On the platform the city administration has for instance published data that earlier was collected and sent to those who requested it, and now the ones interested of the data can collect it themselves from the portal and the city administration can use the time for other duties. With the platform citizens are invited to take part of collected data, i.e. view it and use it, and to give feedback to it. The platform will clearly challenge the old ways of working when digital innovation efforts confront existing slow decision-making processes.
The city of Umeå decided to make a procurement process for their decision support platform. A vital part for that was to identify the requirements for that platform. The requirements would have been the same had we decided to build it ourselves. For the procurement process a list with requirements was listed, some were stated as Must-have and others as “Good-to-have”. There were also a considerable amount of requirements regarding the hosting of the platform. Since a procurement process within the public sector is very regulated it was important that no rules were bent or broken. Although every effort was made regarding clear requirements, and clarity with how the procurement process worked, an appeal was made after the outcome was made public. Because of that the project lost momentum, and even though the appeal was withdrawn at the end, the release of the platform was delayed.




Since we did not develop the platform the big technical obstacle that arose was the high demand on security regarding all our data bases. That meant that letting the platform, hosted by our supplier, collect data sets using an API was not accepted. The solution was to export files to an ftp site that the platform harvested from. APIs can however be used with sources that allow this.

The real challenge was not a technical issue but rather regarding data ownership, and that is where the big challenge ahead also lies. The problem with ownership regarding data sets suggest that a strong leadership is needed to clarify where that role is.

It is evident that the platform can be used to build a bridge, between policy makers and citizens, in terms of using technology for the achievement of specific policy goals, while satisfying the information demand. However, to build that bridge we need concrete actions to use data to develop new ways of working and to manage the data value cycle accordingly.

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# 1. Introduction

RUGGEDISED is a smart city project funded under the European Union's Horizon 2020 research and innovation program. It brings together three lighthouse cities: Rotterdam, Glasgow and Umeå and three follower cities: Brno, Gdansk and Parma to test, implement and accelerate the smart city model across Europe.

Working in partnership with businesses and research centres these six cities will demonstrate how to combine ICT, e-mobility and energy solutions to design smart, resilient cities for all. This means improving the quality of life of citizens, reducing the environmental impact of activities and creating a stimulating environment for sustainable economic development.

Umeå is a centre of education, technical and medical research in Sweden, with two universities. It counts 123,.000 inhabitants with two-thirds of the population born outside the municipality, and around one tenth from outside of Sweden. Umeå citizens are among Sweden's most educated and are known to be very environmental engaged. Smart city thinking is at the core of the City of Umeå's overall vision of continued social, economic and environmentally sustainable growth. RUGGEDISED will facilitate a unified 'smart district', which is underpinned by planned regeneration and new developments, existing smart city capabilities and committed public and private sector investments.

In RUGGEDISED, Umeå will focus on an Innovation District that is situated immediately to the east of Umeå city centre, the University city area, which includes a mix of residential, academic and research facilities from two universities, a regional hospital, and community, recreational and commercial buildings. The neighbourhood is characterised by its young, student-influenced, population with 40,000 daily visitors. As such, the neighbourhood is one of the least car-dependent neighbourhoods in Umeå. The area will triple its inhabitants during the time of the project. Amongst the smart solutions implemented, the RUGGEDISED project will look at peak load variation management, shared use of energy and a smart, open-data city decision support platform. This document describes one of Umeå's nine solutions – U8 open-data city decision support platform.

# 2. Smart city open-data decision support platform

## 2.1 Open data

In this report Umeå's smart solution, U8, is described. The delivery is a smart city open-data decision support platform (opendata.umea.se). But what does that cover? That question was one of the challenges that needed to be answered. The answer would be the embryo to a requirement specification used in the procurement process that took place. One of the things that was identified, also indicated by the name, was that the foundation for the platform would be an open data platform. Umeå already had an open data platform called Open North, hence the natural step would have been to use that one as the foundation for the decision support platform. However, as will be shown in coming chapters, there were also demands on visualization and user friendliness. The existing portal had no clear owner and the first impression did not flirt with the user and make it curios to investigate more data.

With that as input a list with requirements was made. A list that could be used for building our own decision support platform, or as input for a procurement process.

## 2.2 Features

Apart from open data to be the foundation, another requirement was high demands regarding visualization of published data. With that, not only easily understandable tables were meant, but it also included diagrams and maps.
To truly be a decision support platform there must also be the possibility to combine different data sets, and for instance to build your own map with different layers of data.
A requirement that is easily forgotten is the user friendliness, a "tool" must be easy to use and to understand. The tool should not be an obstacle, but rather an enabler.
Apart from all the requirements regarding functionality there were also a list with "non-functional" requirement regarding for instance support, maintenance etc. When a list with requirements was identified, each requirement was tagged "must-have" or "good-to-have".

In the end the requirements where the ones listed in table below.

**Table 1: Requirements on the platform**

| No | Requirement | Importance |
|---|---|---|
| 1 | The supplier is responsible for maintenance and the operation of the platform. That includes responsibility for incident management. | Must |
| 2 | The provider shall ensure access to the platform 24 h/day 7 days a week. Exemption for shorter planned maintenance, as well as "force majeure" | Must |
| 3 | Updates to the platform shall be included. It includes the supplier perpetuating and further developing the platform in step with the outside world so that it maintains its ability to be available and secure over time | Must |
| 4 | The agreement shall conclude that the supplier provides Technical Support, this shall be specified in an annex. | Must |
| 5 | For its staff, the supplier will regularly carry out training for increased awareness of information security. | Must |
| 6 | The supplier must have carried out a risk assessment for the system and implemented measures for identified deficiencies. | Must |
| 7 | The provider shall have procedures to ensure that only competent staff have physical access to the data hall | Must |

| | | |
|---|---|---|
| 8 | The supplier shall have functions, processes and procedures to monitor and make performance forecasts | Must |
| 9 | The supplier shall have a protection against malware for the parts included in the delivery. | Must |
| 10 | The supplier shall have procedures and functions for backup and restoration of information according to agreed availability requirements with the Client. Backups shall be protected in the same way as the original information and are stored separately | Must |
| 11 | The supplier shall inform the customer without delay about technical vulnerabilities in the components delivered. Detected vulnerabilities should be addressed immediately | Must |
| 12 | The supplier shall have information security guidelines within its development processes. | Must |
| 13 | The supplier's liability shall include subcontractors. The client shall be informed on request about which subcontractors are used. | Must |
| 14 | The supplier shall have procedures for reporting, escalation and handling of security events and security incidents. | Must |
| 15 | The supplier, together with the designated role of the Client, will cooperate in dealing with vulnerabilities, security events or security incidents. | Must |
| 16 | The supplier shall work continuously and in consultation with the Client to ensure that the delivery at all times complies with the current laws and regulations placed on the Client's business. | Must |
| 17 | Users who sign in to the platform should be able to easily upload new datasets. | Must |
| 18 | Who can log on to the platform is controlled by the customer (Umeå Municipality) | Must |
| 19 | **Only** logged-in users should be able to upload/change the dataset on the platform | Must |
| 20 | The platform should support connecting metadata to the datasets | Must |
| 21 | There should be the possibility to schedule harvesting of the dataset automatically through the platform at certain intervals. There must be possibility to set these intervals from several times/days up to 1 time/year. These data sets will then be visible on the platform should the logged in user select that, this means that it will remain invisible to visitors if specified. | Must |
| 22 | For each dataset, it should be possible to choose whether a dataset will grow when new data is added or if the existing data is to be replaced (rewritten). | Must |
| 23 | Various visualizations (table, graphs, map with position if available in the dataset and general information about the dataset) should be automatically created on the platform by logged in users. These visualizations should then be immediately visible to all visitors to the platform if logged in users choose to publish these. This functionality must be validated by the supplier through testing by the customer. | Must |
| 24 | Visitors should be able to choose to download (export) datasets found on the platform in standardized format. | Must |
| 25 | On the platform, an API will automatically be created for a data set. | Must |

| | | |
|---|---|---|
| 26 | Visitors should be able to easily combine different datasets on the platform, for example, using Maps. | Must |
| 27 | The platform should be able to create an RDF file that can be harvested without problems by oppnadata.se | Must |
| 28 | There must be no restrictions on the number of API calls that can be made to the platform. | Must |
| 29 | There must not be restrictions on the number of datasets allowed to be on the platform | Must |
| 30 | It's an **advantage** if the platform supports real-time data. | Good to have |

## 2.3 Procurement

Since Umeå had a slow start with the project it became clear that time and resources were lacking in order to build our own platform, hence a procurement process was started. Since the goal was to ensure a platform that would be used even after the project was ended it was eminently clear that a procurement process was needed, one that secured the possibility to extend a contract with a vendor if we wanted.
A survey of what was available on the market showed that no vendor had exactly what we wanted, but some was close.
When the process was started and made public, the interest was higher than expected. Questions were raised by vendors that we did not know about and it was clear that the market is bigger than we knew. In the end there were tenders from five different vendors.

Intressenter (5)

| Organisation |
|---|
| OpenDataSoft |
| Metasolutions AB |
| Norconsult Astando Aktiebolag |
| Sensative AB |
| T-Kartor Geospatial AB |

**Figure 1: The vendors that made a tender.**

When the last day for tenders had passed an intensive period off testing started.
Four of the five vendors were contacted, and a test site requested, in order for us to verify each requirement. One of the vendors had offered a price so much higher than the others that we hoped for finding a complete product among the others. According to the procurement they could have up to five days to offer a test site. Some of the vendors immediately gave us access to a test site, while others tried to stall and wanted to demo their product instead.

When the evaluation started, it became clear that some of the bidders had not expected a fast process. They did not yet have what they offered. Precious time was wasted on endless discussions during the process. Some demanded that they would be allowed to demo the product instead of us testing it.
Others were monitoring our testing and adapted their product to our testcases (which resulted in failed tests since they “broke” their code with a patch they made).

When finally, a winner was announced, much later than we originally planned for, there still was a vendor who choose to appeal that result. Thus, we were once again caught in discussions with little progress, and

as a result the plan with a public platform before the summer holidays could not be met. In the end that vendor withdraw their appeal and we could finally sign a contract.

What we learned from the procurement process however, was that no matter how clear we thought our requirements were – they could have been even more clarified. We could have been even more clear with the fact that we would test and verify each functional requirement ourselves (a demo from them would not suffice). We could have stated the definition for “open data”. Would we do it again the approach would be a little different and we would for instance add a requirement stating that the product in the tender should contain all the requested functionality when the tender is made.

## 2.4 Data governance

The big challenge was, and is, not a technical issue. In order for the platform to truly become a decision support platform, there need to be relevant data sets on it. And therein lies the challenge. Once the platform was in place it became evident that a clear framework for data governance is missing within the municipality. Some stake holders were reluctant to publish data. They did not feel confident about owning the data in the first place and did not see why publishing open data should be prioritized at all. There were also an insecurity regarding whether the data could be published when thinking about the quality. Most, if not all, questions would not have been an issue with a clear data governance framework in place (that however is not a part of this project). Those who already had citizens requesting the data, welcomed the opportunity to publish it on the platform. They could see that time would be saved and that they could focus on other things.
Apart from reluctance to publish data, there are also cases where the data is actually “out of reach”. The data is stored with a third party, who has realised its worth and hence will not give it up. This is a problem we already knew existed in some places within the municipality, and to handle that it is nowadays mandatory to add a requirement regarding API and access to the data in all procurement processes regarding systems.

### 2.4.1 Meta data

Each data set requires meta data, to ensure that everyone using/viewing it understands exactly what it is. We have set up rules saying that each data set must be accompanied with a clear description regarding the data set. Another rule we have, is that each data set must have an email address, to the information owner, specified in the descriptive text. That is both a service to the public, if they have questions about the data set, and an incentive to the department publishing the data to ensure that the description of the data set is good. Because if it’s not, there will be questions.


**Figure 2: The information text for the data set "Geographical areas"**

There must also be a description for each variable in the data set stating what it means and preferably which values it can have. The latter is of course only feasible if the possible values are few.
If there for instance is a unit “L” it must be stated what “L” stands for. There must be no room for different interpretations, otherwise someone might use the data thinking that “L” means “Little” and another thinks that it stands for “Large”.


**Figure 3: Part of the variable description for the data set**

The importance of good meta data will also lower the risk of users combining data sets that should not be combined/compared.

We offer the portal as bilingual, Swedish and English, but it is only the descriptions for the data set and the variables that can be toggled with. The actual data will of course not change. This means that if for instance the word “björk” is in the data it **will not** change to “birch” when selecting English.

### 2.4.2 Data privacy

One of the things the stakeholders are obliged to do before publishing a data set is what we call a security classification. The classification is a way to ensure that the stakeholder does not publish data, as open data in violation of the General Data Protection Regulation.

### 2.4.3 Database security

A major challenge for the data sets that were to be uploaded, was the high security requirements that surround all databases in the municipality. Since we decided to outsource the hosting of the portal it meant that if we wanted to upload our own data using an API, we needed to open up that API for “outsiders”. A route that was not going to be accepted by the security responsible within the municipality. The solution was to use files that were exported to an ftp area. The portal then harvested the files from that area. For

the real-time data, e.g. sensor data, that data will be pushed to the portal directly using the portals push api.

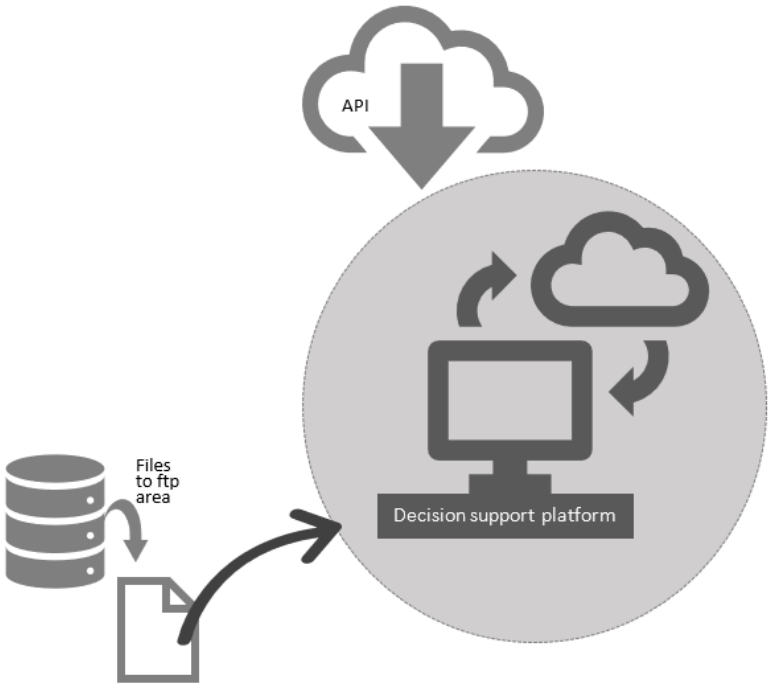


**Figure 4: Data set import to the portal**

The API approach is however used for the data sets that the portal harvest from other open data sites, e.g. open data from Naturvårdsverket (the Swedish environmental protection agency). Should we in the future prefer to use only the API approach, there is the option to create a database outside of the firewall and store the exported data there.

## 2.5 Visualisations

One of the requirements we had on our platform, was regarding visualisations for the data sets. With our platform we can offer different kinds of visualisations, all depending on the data. Our high demands on visualisations are partly due to the added value for the end user, it is much easier to understand the data if there are visualisations connected to it. But while working with the platform we also realised that it is much easier to persuade stakeholders that “yes their data will bring value to the citizens”, when the platform presents it with the visualisation.
When creating a new dataset some visualisations will be offered automatically, depending on the data. There is also the possibility to add a “Custom view” where the publisher can create their own visualisation. Among the published data set this was done for the data sets containing energy consumptions. Since there was nothing in the data set showing the position for the geographical area, this information was added as a custom view with a map showing the area. That map is created from another data set “Geographical areas”.

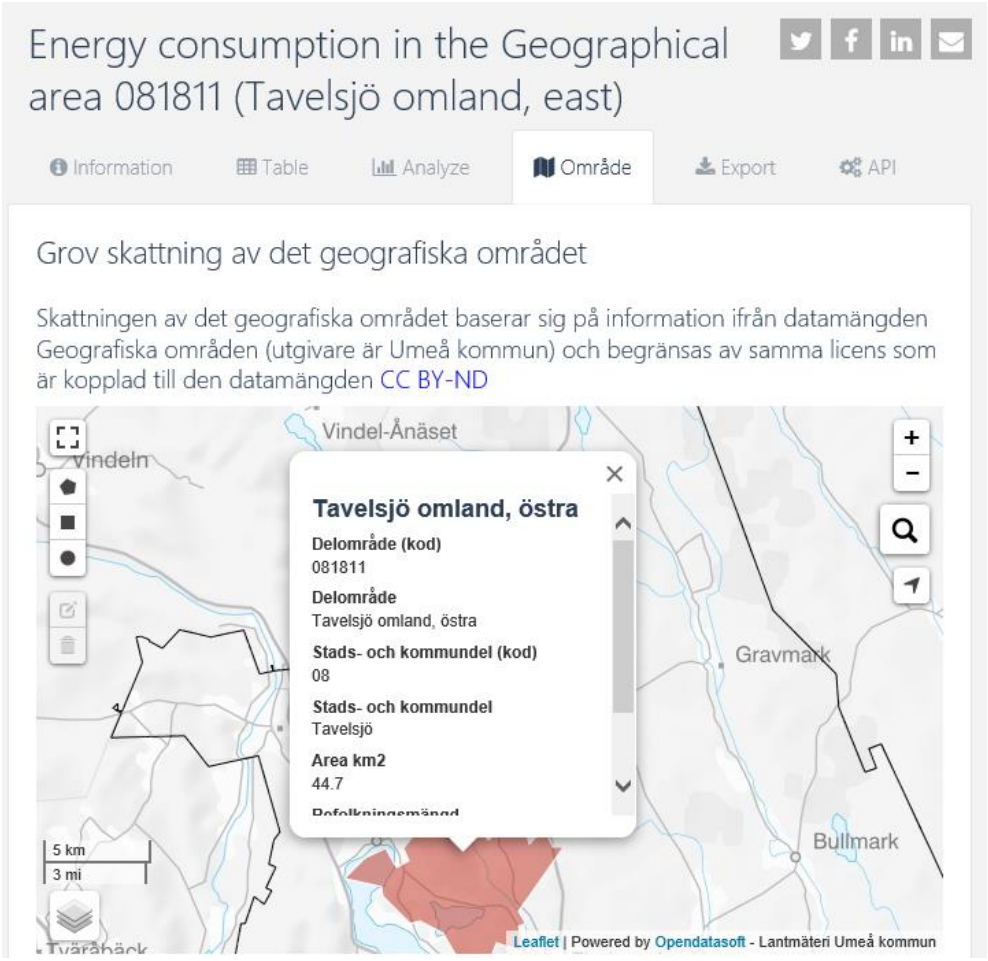


Figure 5: Example of custom view for a data set

Depending on the data, these are the kind of visualisations that will be offered if the corresponding data is found; tables that lists the data, analysis, maps, calendar, images.

## 2.6 Combining data set

The true potential with the platform, and what makes it a decision support platform, is the possibility to combine data sets on it (without downloading the data). A user can always select to export the data from the portal and make their own analysis, but on the platform exist the possibility to combine maps and charts, right there, without exporting the data. To make combinations on a map is fairly easy to understand how to do, and also to understand the resulting map. But when combining charts with different kind of data it demands that the user understands the data that they combine. Then again, this should not be a problem if the quality of the meta data is good enough.
Every one that uses the platform can combine data sets and save the map/chart that they have created. There is also the possibility to share your combination with others, would you like to.

# 3. What have we gained?

With our smart city open-data decision support platform, we aim to provide a way to understand the impact of smart city interventions through real-time visualization as well as static data. We have also provided a way to quickly combine different data set to examine results. This way, we expect to enhance the possibility of quickly gaining access to data for making well-founded decisions for the council as well as for citizens. By combining different city data regarding for example environment, real time or not, we will find the means to make a real impact on quality of life. The open-data decision support platform could also be a way to ensure that we all base our decision on the same data when engaging in strategical planning.

With this platform it has been clear that within the city we have a problem where digital innovation efforts confront slow decision-making processes. The city will need to change old ways of working and enable space for digital innovation, experimentation and collaboration. Also, the legal framework and the business model of organisations siloed thinking is one of the obstacles that must be dealt with.

However, the platform can be used not only to anticipate the citizens' needs, but also to deliver better services, improve policy implementation and the municipality can also evaluate their own performance. For instance, if a campaign to save energy has been focused on a specific part of the city, it will now be easy to evaluate whether it gave the desired effect by investigation the data set that shows the energy consumption in that area.

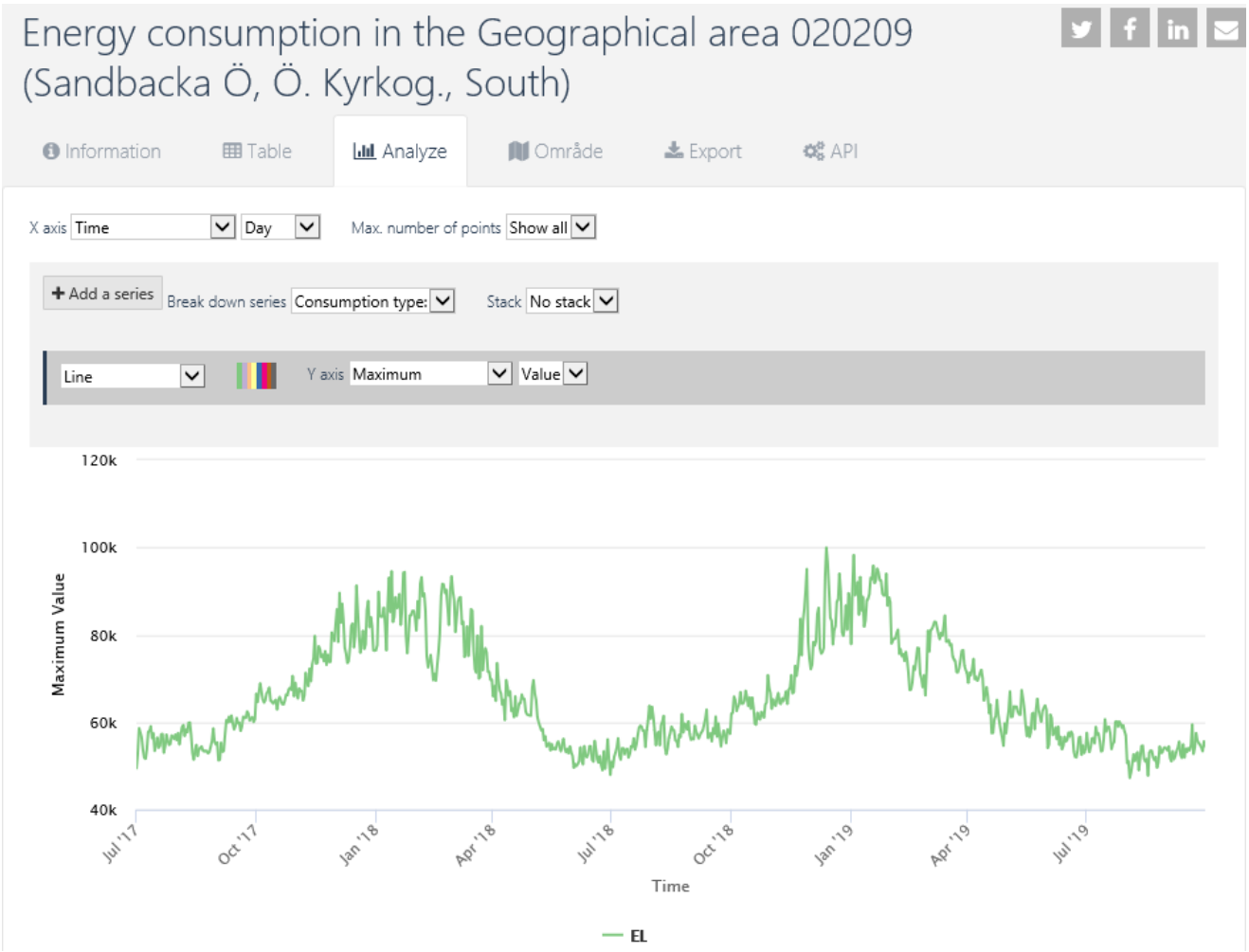


Figure 6: Graph showing the Energy consumption in an area

One of the data sets that are found on the platform is results from radon measurements in houses, this is a data set that was prioritized to be one of the first ones to be published. The request to be prioritized was formulated as *"we get several requests each week for this information and have to spend time finding the requested information and send it"*. Now, since the data set is published as open data, they can use that time working on other things.

Apart from the data set with radon measurements, there is another data set regarding radon that can be found on the platform and that is Radon risk areas, areas where there are abnormally high levels of radon gas in the soil and rocks. By combining these two it can easily be detected whether the measurements have been mostly made in the areas with high risk regarding to radon gas in the ground.

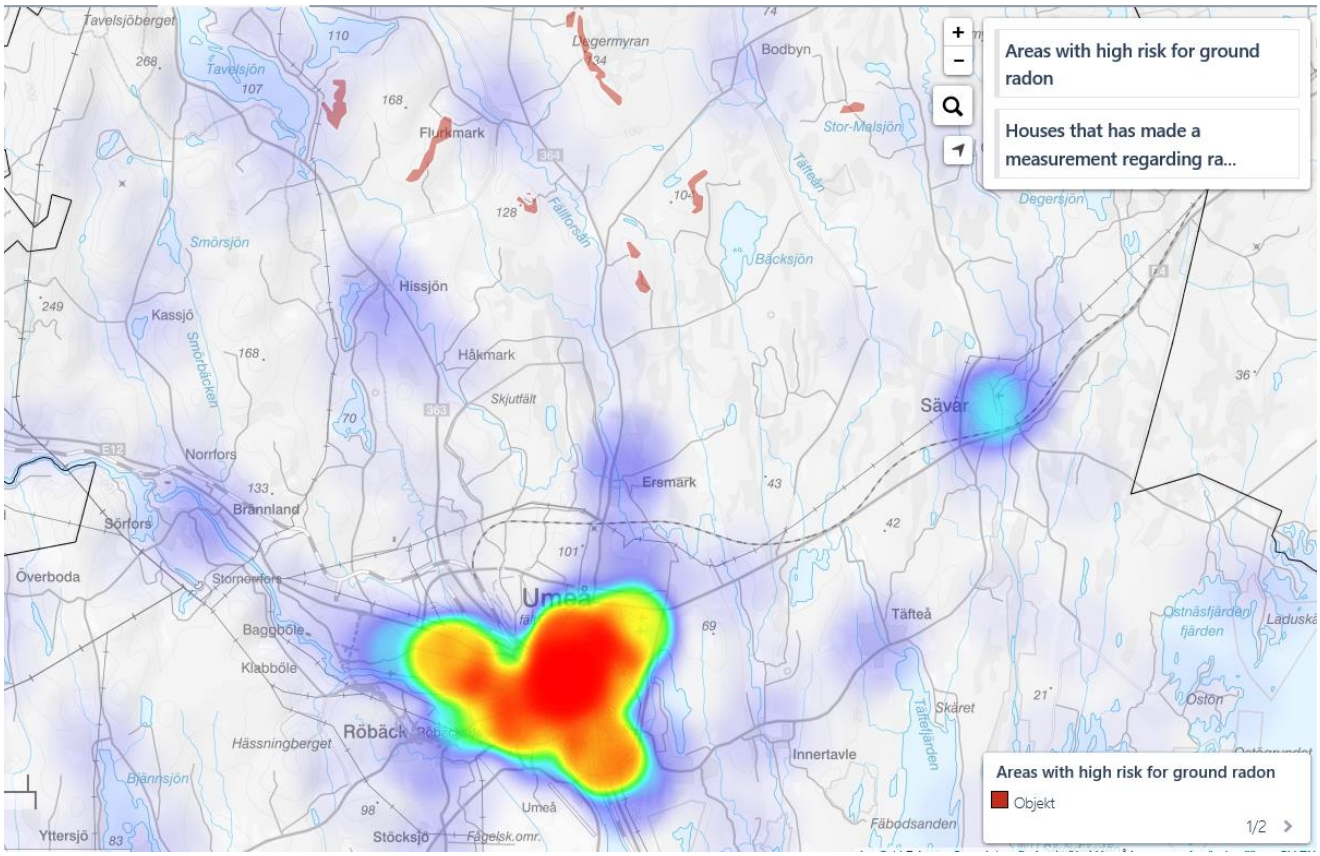


**Figure 7: Map showing if radon measurements were mostly made in houses located in area with high risk regarding ground radon**

With this as input the municipality could, if they wanted to, decide to focus a campaign for radon measurements in the areas where there are high levels of ground radon.

The platform can be used to monitor the entire lifecycle of the Municipality, from evaluation of what has already happened to delivering todays values and planning for the future.

All the public data on the platform has a license attached to it. The data is free to use as long as the user follows the regulations stated in the license. Thus, Umeå now has valuable data to feed the community and to support innovative solutions created by different entrepreneurs. To help that happening the platform must be known to everyone, it should be the natural source to search in when data is needed both for the citizens and the public sector. In order to promote the platform, and to make it a well-known source of data, the university has been contacted. The platform is now used as a data source for the students at the department of computer science. Through this we hope that in a couple of years they feel familiar with it and thus will engage in keeping it alive and use it when stating facts in community discussions. Another department at the university that will be using the platform is the department for mathematical statistics.

As a rapid digital transformation changes all aspects of daily life, citizens in Umeå will without doubt expect their local government to provide better services and policies that deliver on the promises of the digital age. With the advances in technology and strategic use of data via the decision support platform, the politicians in Umeå can create conditions for improving the quality of public services, increasing the effectiveness of public spending and safeguarding ethical and privacy considerations. The mission ahead of us will be to ensure that the platform is used with all the potential that it offers when using data to deliver outcomes. That will also be a way to preserve, maybe even increase, public trust.

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