Documentation

Riga Dialogue Platform

Webinars on Monitoring & Evaluation

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Riga Dialogue Platform

Webinars on Smart Cities for Climate Mitigation: Monitoring & Evaluation

Nika Kotoviča, Kristaps Kaugurs

Content

List of Abbreviations

a	Annum
AEP	Annual energy production
CDP	Carbon Disclosure Project
EWS	early warning system
GIS	Geographic information system
GW	Gigawatt
GWh	Gigawatt hour
GWS	German Weather Service
EVs	Electro vehicles
ICT	Information and communication technologies
IoT	Internet of Things
IRR	Internal rate of return
kW	Kilowatt
kWh	Kilowatt hour
LIDAR	Light detection and ranging
m	metre
Min	Minimum
MW	Megawatt
MWh	Megawatt hour
PED	Positive Energy District
PV	Photovoltaic solar panel
PVT	Photovoltaic/thermal solar panel
UDP	Urban Data Platform
WPP	Wind power plant

1 Governance

The first webinar in the series “Smart Cities for Climate Mitigation: Monitoring & Evaluation” focused on governance aspects of smart cities related to monitoring and evaluation.

Benno Keppner, project manager at adelphi, gave the introduction to the webinar with a short overview of the topic of the webinar.

Frank Graage, Steinbeis Nord-Ost, introduced himself as the moderator of the webinar and presented the agenda.

Nika Kotoviča from the **Riga Municipal Agency “Riga Energy Agency”** welcomed all participants and highlighted the relevance of this webinar to previous dialogues held in Tartu, Kaunas and Kiel. Nika Kotoviča emphasized the very ambitious goals towards becoming climate smart cities of all cities in this webinar – Aarhus (Denmark), Riga, Jelgava and Cēsis (Latvia) and Munich (Germany).

1.1 City of Aarhus: Monitoring and evaluation: why is it important?

Henrik D.H. Müller, Chief Climate Officer from the City of Aarhus (Denmark), began his presentation with some general information on the city of Aarhus and introduced the main topic of his presentation – the monitoring activities of the city municipality that foster the green transition and help to reach the targets set. The most important target is to become a climate neutral society by 2030, only 10 years from now.

For the last 12 years the city of Aarhus was working on climate mitigation, focusing on data analysis in order to identify the largest carbon emissions in the city and to find the right measures for cutting carbon emissions at low costs.

Henrik D.H. Müller emphasized that a complex approach is needed to create a new city – a city free from fossil fuels, running on 100% of renewable energy while the whole world today is heavily dependent on fossil fuels. The citizens of Aarhus need new skills and competencies while companies need skilled personal to become climate neutral. The city, the buildings and the infrastructure are not prepared for a future with 100% renewable energy. To accommodate sustainable energy production, storage and distribution, the energy infrastructure needs to be upgraded at estimated costs of up to 100 billion euros. Even the majority of new buildings in the city – not speaking about the older ones – are not equipped for charging electric vehicles. Likewise, the city streets are not equipped with e-vehicle charging stations. To install those, the costs are five times higher than if the buildings, streets and parking lots were equipped with cable trenches when they were built. Such critical infrastructure if not in place can slow down the green transition.

Henrik D.H. Müller explained the need for a comprehensive monitoring of the green transition, as the speed at which the climate mitigation measures are put in place matters, as well as the path of implementing these measures matters. The monitoring system in the city of Aarhus has three levels – the highest level is related to the city’s carbon budget. On the next level the city is monitoring the green transition progress by assessing the change of indicators - hard (e.g., number of EVs in place in 5 years and 10 years from now) and soft indicators (e.g., citizen knowledge on green transition, citizen behaviour). The third level of monitoring is implemented within the framework of the city’s comprehensive climate change mitigation programme that includes over 100 climate mitigation measures and over 300 stakeholders.

Henrik D.H. Müller concluded by highlighting the importance of structured monitoring systems to monitor the status city's climate mitigation projects and initiatives as all the development goals need to be addressed in order to be able to assess the reduction of carbon emissions.

1.2 City of Riga: Urban development data monitoring and evaluation practices

Jurijs Grizāns, Senior Project Manager at the City Development Department of the Riga City Council, presented the monitoring and evaluation system for two main spatial development planning documents of the city of Riga – the sustainable development strategy and the development programme. This system was established in 2010 for the monitoring and supervision of the implementation progress with a focus on the measures (actions), allocated resources and achieved results.

There are four long-term development objectives defined by the Sustainable Development Strategy of Riga until 2030 that are detailed in 19 action directions and 112 sub-tasks. All together 187 indicators have been set. The core tasks of the system are threefold:

- supervision and evaluation of the city development processes;
- circulation of information between all involved municipality structural units;
- reporting on the progress in the implementation of the strategy and development programme.

The following steps of the monitoring and evaluation process were outlined:

- Step 1: Internal data collection and internal assessment (data gathered from 29 municipal structural units, local residents questioned, municipal services evaluated, etc.);
- Step 2: External data collection and external assessment (data collected from external sources on urban economics, social sector, urban environment, non-governmental organisations, governance, etc.);
- Step 3: Reporting (annual progress report, four years' progress report, environment impact assessment report).

Monitoring and evaluation results are shared with city government/politicians, internal and external stakeholders and ad hoc stakeholders during public meetings, seminars, local and international conferences, mass media and social networks.

Further, Jurijs Grizāns shared the city's experience with disclosing environmental data. Riga is participating in the Carbon Disclosure Project (CDP) since 2012. The environmental data for the CDP reporting has been collected from internal and external stakeholders.

Jurijs Grizāns concluded his presentation by sharing Riga's experience on gathering input data for the elaboration of the new Development Programme of Riga for 2021-2027. Over 2,300 residents provided their inputs through online and offline surveys; several workshops and thematic working groups were organized to get inputs from stakeholders, experts and professionals.

1.3 City of Jelgava: Energy Management System of Jelgava City Municipality

Ivo Berkolds, Energy Manager at the Jelgava city (Latvia), presented the energy management system of the city.

Ivo Berkolds raised a question – why smart cities should introduce energy management systems? He pointed out that energy costs form a significant share of municipal budgets while cities have different backgrounds and specific needs that are addressed by different municipal specialists with diverse skills and unequal knowledge. That is why cities need a comprehensive monitoring and evaluation system to manage and control the energy usage in the municipality. The key goal of such a system is to decrease energy consumption and energy costs in the city.

The energy management system in Jelgava city includes 37 municipal buildings (kindergardens, schools, public buildings) and 6600 streetlights. It provides hourly monitoring and monthly monitoring and thus supports such day-to-day operations of municipal specialists as performing data analysis, implementing internal audits and technical inspections as well as elaborating detailed assessments of the municipality's energy consumption. Specific energy performance indicators are used for a detailed analysis of the energy consumption in Jelgava, such as energy consumption per month/per year; heat per m^2; heat per degree days; electricity consumption per m^2; etc. The monitoring and assessment provides justified argumentation for awareness raising of local residents, as well as for capacity building of municipal specialists. However, the bottom line is that it supports decision making for energy efficiency measures that are implemented by the city municipality.

In the end of his presentation Ivo Berkolds introduced an IT solution that was developed for the energy management system of Jelgava – the functionality of the system, vast energy modelling options and tips how such system facilitates the energy management.

1.4 City of Cēsis: Data. Data analysis. Future perspectives in governance framework

Zane Gulbinska, Data Analyst at Cēsis municipality (Latvia) started her presentation with a brief introduction of Cēsis, a small town in northern Latvia that strives for innovativeness and smartness in all areas of its activities.

Zane Gulbinska stated that the most important goal for the municipality is the knowledge management where the data is a fundamental element.

Zane Gulbinska emphasized that data contains high added value providing comprehensive and important information to both, municipality and society. Therefore, the municipality systematically collects public data and provides it for public use. It develops a data governance model that is adept and transparent. This enables free and easy access to public data for anyone. Open data provides options to reuse it, that means it can be used for a new purpose, which was not the original aim, when collecting it. Furthermore, it ca be used by anyone who can benefit from it: citizens, businesses, as well as the municipality can thereby use it in order to improve social, economic or environmental aspects in the city.

Additionally, the municipality is developing its data infrastructure. This is a challenging process, as there is still no common understanding in the public sector of the benefits arising from open data. In response to this challenge, the municipality is developing an open data strategy to a reach mutual understanding of society on three main issues:

- Why do we do it? (e.g., better performance of the municipality, wide economic and social benefits)
- How do we do it? (e.g., data collection, structuring, formatting, publishing in Latvian open data portal)
- What data do we open? (e.g., population statistics, environmental data, spatial data, etc.)

In conclusion, Zane Gulbinska emphasized that opening up the data is a long-term measure. In the long, it is ecpected that the overall performance and capabilities of the municipality and the whole society improve, enabling Cēsis to reach new horizons.

1.5 City of Munich: “Smarter Together” project experience

Felix Hörmann, Urban Planner from the Department of Urban Planning at the City of Munich (Germany) shared his experience from the “Smarter Together” project. He briefly introduced the project that aims to improve citizen’s quality of life in nowadays transforming cities by finding the right balance between ICT, citizen engagement and institutional governance to deliver smart and inclusive solutions.

Felix Hörmann emphasized that sustainable development can only be achieved in integrated, inclusive societies that develop partnerships and foster dialogues among all stakeholders. With this in mind, the “Smarter Together” project has developed a smart Urban Data Platform (UDP) to store, organize and work with data, including web interface, analysis dashboard to access information including access concepts, and transparency dashboard.

In the “Smarter Together” project, the City of Munich was pioneering smart city solutions and implementing demonstration activities in one pilot site – Neuaubing-Westkreuz/Freiham, a housing development area built in the 1960s and 1970s with comparatively poor energy-efficiency standards that reflects well many urban challenges in the city. The pilot aimed at monitoring the results of deployed smart city solutions and upscale them at city level.

The goal was to reduce fossil fuel consumption in Neuaubing-Westkreuz/Freiham and improve residents’ quality of life. The project focused on the following measures:

- Promotion of e-mobility;
- Shift to smart, energy efficient street lighting;
- Refurbishing of housing to reduce energy consumption, aiming towards 100% renewable energy;
- Development of a smart UDP as the technological backbone of all smart city measures and a SmartCity app that creates intelligent links between all services.

Monitoring was limited to the project period, project area and project activities. The main sources of data were key performance indicators (e.g., data on energy refurbishment of buildings), mobility stations / delivery boxes and IoT/Sensor data from the intelligent light posts. Additionally, weather data from the GWS (German Weather Service) was collected and transferred into the UDP.

Felix Hörmann concluded that take-away experiences from the project implementation are the following:

- It was an advantage that the project was implemented in a limited time and space, as the establishment of such monitoring system on a city scale would be an enormous task;

- Transparency in publishing the data in the UDP dashboard was a success, helping to gain the trust of citizens;
- Provision of digital monitoring data requires resources, such as:
  - Elaboration of relevant questions,
  - Technical implementation,
  - Permanent data provision,
  - Legal issues (data privacy, data gate keeper concepts).
- Added value from the pilot implementation – new possibilities for communication, efficiency, increase of the quality of public services, etc.,
- And, finally, the cultural change related to opening of public data was one of the key success of the implemented pilot.

1.6 Discussion

The moderator raised a question: **“When it comes to the monitoring of the smart city development, what is the main driving force behind it?”**

Henrik D.H. Müller, Aarhus: The driving force for Aarhus was a clear political ambition of taking responsibility for global warming and the vision of creating a carbon neutral city by 2030.

Jurijs Grizāns, Riga: In Riga the main driving force was the need for reliable input data for data-based decision-making. There was a need for reliable information to support communication with city residents and different stakeholders.

Ivo Berkolds, Jelgava: For us these were political priorities, as well as there was a need to get information from people and to give information to people.

Zane Gulbinska, Cēsis: Our driving force was a need for data that could serve our politicians to make decisions based on information, not emotions.

Felix Hörmann, Munich: For us the monitoring of the smart city development is a tool to save natural resources, raise quality of life, increase security and inclusion.

The moderator stated that all the cities, who have shared their experience today have high ambitions that lead to large investments in smart city infrastructure. Leading to the follow-up question: **“Did the cities carry out a cost-benefit analysis of the planned measures to reach the set objectives?”**

Felix Hörmann, Munich: Not yet. However, we have thought about it and have elaborated a project proposal for evaluation of smart city development. Regretfully, it was not funded.

Zane Gulbinska, Cēsis: No, not yet.

Ivo Berkolds, Jelgava: Every decision related to energy management system must be based on cost-benefit analysis, e.g., every solution of existing problems shall be evaluated to answer the question – do we have enough energy savings to cover the costs of the planned measures to solve this problem?

Jurijs Grizāns, Riga: Yes, we have performed cost-benefit analysis for a few specific smart city projects, not for the whole city investment programme. That might be our task for the next planning period in our city, within the implementation of the Riga City Development Programme 2021-2027.

Henrik D.H. Müller, Aarhus: Yes, we have established a scheme how to assess the return rate of municipal investments. On the other hand, such municipal initiatives as public education and awareness rising campaigns are very hard to evaluate, as returns are not tangible.

The moderator raised the final question: **“What is the main engagement of stakeholders and citizens in the smart city monitoring process?”**

Jurijs Grizāns, Riga: In our case these are online and offline measures – questionnaires and face to face surveys, thematical meetings with citizens and stakeholders, experts and NGOs.

Felix Hörmann, Munich: I would say interaction with the citizens is increasing well, we interact more with citizens in general, and also to try new ways of online and face-to-face interaction. During the Covid-19 restrictions there is an obvious need to find new ways of citizen participation.

Zane Gulbinska, Cēsis: Our interaction with the citizens is related to learning and capacity building related to opening up the data.

Ivo Berkolds, Jelgava: Different stakeholders are addressed differently. When it comes to citizens, day-to-day communication is needed while with some stakeholders it is enough to address them a couple of times per year.

Henrik D.H. Müller, Aarhus: You cannot do enough communication, and there are no “one size fits all” solutions.

Nika Kotoviča closed the webinar and thanked all participants.

2 Transport

The second webinar in the series "Smart Cities for Climate Mitigation: Monitoring & Evaluation" focused on transportation. Not too long-ago horses and ships were the main mode of transportation. Then, about a century ago the automobile was invented, and urban lives changed. We have rebuilt our cities to accommodate this new form of transportation without ever considering its impact on the environment or ourselves.

Now we stand on the threshold of great change where we must reconsider how we conceive, design, chose, and manage transport in our cities. There are many ways to fail and only few choices lead to success. There is no panacea, which is why it is important to have this opportunity to share ideas and experiences and to learn from each other. There may be similarities in the activities and policies among cities. However, the individual context requires an appropriate choice of application rather than replication. That is why innovative information management and use of potential data sources to gain insights is the first step towards becoming a smart city.

In this webinar, the presentations focused on wide spectrum of tools that can help improve the decisions regarding mobility and transportation. "You can improve only the things you can measure" is the moto and therefore both private and public organisations shared their experiences on building models, collecting, and analysing data, experimenting and applying the results to make our cities smarter and more resilient in transport sector.

2.1 Data analysis and evaluation of results: Application of SUMBA project results

Evelīna Budiloviča, Riga City Development Department's Mobility unit (Latvia), began her presentation with the general introduction of the city's transport system and its simulation models followed by a summary of the results of the SUMBA project – a project that seeks to implement sustainable urban mobility and commuting in Baltic states.

In 2020 Riga updated its multimodal transport planning model, thus replacing its predecessor from 1996. The old model was limited by the geographical boundaries of the city's administrative territory and the number of data sets it operated with. The transportation system must cope with depopulation of the city in favour of metropolitan suburbs. 45% of the inhabitants in the metropolitan area work in Riga and use the car for daily commute. Thus, there was a growing need for the updated model.

In parallel the municipality in cooperation with the Riga planning region and 12 partners from 7 countries were participating in the SUMBA project that aims to develop tools to complement existing tools to better handle commuting challenges across multiple municipalities and different transportation modes.

Among the results, the project created a rich dataset for the updated transportation model that now includes household survey data on travel destinations, chosen transport modes (15 modes in total) for trips in the Riga metropolitan region.

The updated model was tested by running it through "Riga Sustainable Development Strategy 2030" scenarios. The results show that measures included in the planning documentation would increase average speed in the transport system by 10% and shorten the average travel time by 7% if implemented. However, the model and the planned measures are highly car oriented and should expand its means to better public transport inclusion and pedestrian / cyclist prioritisation to fully comply with the goals set by the aforementioned papers.

At the end Evelīna concluded that holistic transport modelling allows to better understand complex systems and to make informed decisions to improve the systems overall performance.

2.2 Opportunities for analysing Riga traffic data

The second speaker, **Jurijs Kondratenko** from **Grupa 93 (Latvia)**, a private sector urban planning consultancy presented the interim findings from their attempts to crunch existing municipal transportation data. He opened by stating that a lot of data is already available to institutions and professionals, but it often is not used.

Jurijs is an economist and environmental scientist, who likes to put a price on phenomena that are difficult to evaluate, such as mobility and the environment. Inspired by a data scientists conference, he dug into the transport system of Riga that burns 1 billion euros per annum on mobility alone. Any improvement to this system would return great savings to the city and the society in general (not even considering the non-financial savings). ´Three existing data sets where used – Riga public transport (RS) ticket validation data, Central Statistic's Bureau's (CSB) Mobility survey, and the big tech company data.

Rigas Satiksme (RS), the municipal public transport company of Riga, has a large dataset that is greatly underappreciated. By analysing data from September 2019 an algorithm was created that can be applicable with updated datasets. The analysed data includes 418'000 trips, 285'000 entry points, 160'000 exit stops, 115'000 whole trips. The model can help to a) better predict travel habits of inhabitants; b) show that connected trips may indicate the need for new transport routes; c) analyse route segments; d) estimate the costs of delays caused by inefficiency; e) justify further development of the public transport in Riga; f) detect free riders; g) optimise solvent & subsidised route segments.

Another data set is the Central Statistic's Bureau's (CSB) Mobility survey of 2017, which yields some insights such as trip count and passenger km's per transport mode, transport mode per trip purpose and trip duration and distance.

The last dataset is from the navigation software company TOMTOM and yields valuable results on people traveling by personal automotive transport. The potential findings include origin – destination trip analytics, real-time traffic analytics, and trip data.

The datasets mentioned clearly demonstrate the unused potential of data that is already available for mobility modelling. Combining these and other sets can reveal further insights into mobility patterns. Calculations indicate that up to 25 % of the mobility costs could be cut by optimizing the overall transport system in Riga.

2.3 Multimodality across the continents

Stener Hansen from **Spare Labs (Norway / Canada)**, presented his company's platform that allows to plan, operate, and analyse complex transportation networks. Unlike most of the competitioners, the platform is a so called "under-the-hood" system that integrates and powers other third-party apps through open API.

The realize module is a complex transportation network planning and simulation tool that is used to better define a good use case based on any data and parameters available to the customer. The resulting use case is then fed into the Spare Launch engine – a fully automated transportation network. Finally, Spare Analyse uses all the data and metrics generated by the system. The system is open and fully controlled by the user thus allowing for unlimited new use scenarios.

To better understand the full potential of the toolset a selection of use cases was presented.

Ruter Age friendly transportation is a door-to-door OnDemand service for people 67 years old or older. The project is a collaboration with the transport company Ruter and the municipality of Oslo. The economic purpose of the project was to stack the cost of on-demand mobility for elderly, who live alone, against the municipal cost of housing them in elderly homes and unneeded sick-beds – all while increasing their quality of life. The data provided new insights - in fact, if an elderly person can stay at his own home for a year or two longer than usually, it justifies the cost of having the on demand system. What started off as a pilot project with approximately 10 vehicles quickly expanded to the whole of city of Oslo with 50 to 70 vehicles running the service.

DART GoLink (Dallas, USA) is one of the world's largest on-demand transport systems. It integrates ride hailing for dispatching overflow trips and guarantees service quality even during demand peaks. The system includes the whole city of Dallas and combines several mobility options. There are two unique functionalities provided by Spare. First, the integration with automatic ride hailing (local taxi service), where taxi service provides peak hour support to on-demand-bus passengers driving them to their destinations. The other functionality that is unique in this project is an end-to-end journey booking and planning tool. The system combines all transport modes (with different operators, apps and services) along the route automatically from on-demand service to fixed line public transport, adding taxi and other services to the mix - all in one system that automatically books the rides and unifies the payment process for the user.

The final example is *first and last mile in Palma de Mallorca (Spain)*. The city had a stronly fluctuating passenger demand that was impossible to satisfy with traditional public transport. The task was to mimic fixed line public transport routes with an on-demand transportation network. The whole system, from the initial contact with the municipality until the working system took 22 hours. It combines the municipal transport fleet with a1 local taxi-service in one fully multimodal toolset for any passenger to use.

2.4 Urban Experiment: Ad-hoc pedestrian street in Riga city centre

Kristaps Kaugurs, from **Riga City Architect's Office (Latvia),** shared his professional observations about a recent urban experiment – an ad-hoc pedestrian street in the city centre of Riga in the midst of the 2020 Covid-19 pandemic.

He began with a retrospection in the brief history of tactical / gorilla urbanism in Riga highlighting some of best-known activities in modern post-1990 history. Although the examples are few, they are bright and well documented. A group of landscape architects (ALPS) back in 2013 made an attempt to join the International Park(ing) day by reclaiming some of the street parking lots for public recreation. A year later a group of architects (Fine Young Urbanists) created 1:1 plywood model of an extended sidewalk and designated cycling lane to show the possibilities. In 2020 four consecutive one day pedestrian-street experiments were organised by the municipality itself, where car traffic was closed for one day on the first Saturday of the month. Although no entertainment was provided in form of street food or activities, people were curious and the experiments became livelier and better organised.

The lessons learned in the previous attempts culminated in a month-long pedestrian street experiment that transformed the street radically adding temporary street furniture, trees and plants, and a rich supply of commercial and cultural activities under the title of Tērbatas[1] summer street. The event was warmly welcomed and received mostly positive feedback.

However, it is necessary for planning professionals to critically look at this particular event and other similar activities and see if, what was dubbed *an experiment,* in fact is one, or maybe it is just an event, regardless how exciting it was. Experimentation in urban planning has a necessary role to field-test the intuitive ideas of professionals, such as low emission zones, traffic moderation, pedestrian zones etc. in order to justify their wider application. Kristaps remarked that any reliable experiment, in its scientific meaning, requires a pre-meditated hypothesis, a well-designed testing environment, considerate data collection, analytics, and evaluation.

While the city of Riga dearly needs new ideas related to public space, it is crucial to follow the scientific method to test, learn, adapt and more importantly, to justify the conclusions. Although some data was collected *post-factum*, some surveys and research were done. It was a last-minute endeavour by enthusiastic public servants and objectively cannot compensate for the lack of preparation and planning. Thus, the conclusion was that professionals are limited in their findings and much of the value of data is lost due to lack of proper method. However, it should be also considered as as a lesson to be better prepared next time when the opportunity presents itself and to do a better job in testing multitude of planning concepts that could be applied in Riga.

2.5 Urban Experiment: Car free avenue in Tartu city

Continuing with the topic of urban experimentation **Tõnis Arjus, Tartu City Architect (Estonia),** presented their experience in creating a car-free avenue in Tartu in the summer of 2020.

Setting the context Tõnis Arjus showed the historic image of the street along the river that once was a busy marketplace. This street was transformed to a transport oriented wide avenue after the war. Such a configuration physically separates the city from its riverside. The city dreams of redeveloping this and other riverfront areas. Some tactical interventions have re-opened people’s interest of the riverside already, therefore it was a logical next step to focus on the possible transformation of the freedom street.

Despite the Covid-19 restrictions that shortly derailed the focus, a kick-of activity called *Car free avenue* was launched – now with additional social distancing 2m X 2m elements were implemented in the design. The month-long event included more than 200+ events, 50+ partnering organisations and more than 150’000 visitors making it a truly free avenue. The street event was made by making it friendly to all age groups, but more importantly, the street became friendly to diverse plant groups in line with #Tartu2024 biodiversity theme in the context of its bid of being the culture capital of the EU in 2024.

Although the opposition quickly dubbed the project absurd avenue fearing change, threat to tourism business and traffic organisation, it turned out that none of these fears became true. The traffic was quickly adapted, and the tourism business received a 20% visitor boost.

[1] editorial note: Tērbata is a historic Latvian name for the city of Tartu, Estonia. The example of Tartus open-street experiment will follow in the next presentation

2.6 Smart E-Mobility: Data Driven Roll-out of charging infrastructure in the Netherlands

In the final presentation **Rick Wolbertus**, from the **university of applied sciences Amsterdam (The Netherlands),** gave an overview on different rollout options for electric car charging infrastructure and the experience of Amsterdam.

Rick Wolbertus opened his talk by introducing the E-Mobility city paradox - a vicious circle, in which cities can tap. The cities want to ban internal combustion engine cars and in doing so, they implement favourable rules, such as free parking for electric vehicles. However, eventually they just replace one type of automobiles parked all over the city with another type of cars that need extra infrastructure for charging.

There are different policies that cities apply to manage their growing e-mobility needs and as their electric vehicle (EV) fleet grows, they need to apply more complex and smart solutions. The e-mobility charging policy pyramid illustrates this process and Rick went on in explaining the differences and challenges each model includes.

Key places model aims to place key charging infrastructure in key places for potential end-users. All cities should start here.

The demand driven model (Dutch approach) places the stations readily available for those who rely on on-street parking facilities. The model provides charging security, incentivises parking and easily integrates with free floating car sharing. However, it is difficult to scale.

Another method is to locate charging infrastructure according to a *pre-determined plan*. This provides the greatest geographic coverage and allows for a scientific approach in choosing the locations. However, such a system often does not meet the demand and creates tough choices regarding the order of implementation – where to start first.

The data driven model starts with monitoring how existing charging stations are used and how the data corresponds on the neighbourhood level and across different times of day. The model is most useful for local operators.

The data driven simulations model allows for application of advanced key performance indicators to determine required system upgrades. You can monitor and adjust the supply in real-time, but more importantly you can base your policy decisions on forecasts and multiple scenario testing, such as future scenarios or vulnerability testing.

In conclusion Rick Wolbertus advised that if you start fresh, it is perfectly ok to start with placing the infrastructure in few key areas. Collection of data from all stations early on helps for future decisions. However, as you scale up, you should be aiming for data and simulation-based rollout as soon as possible.

2.7 Discussion

The need to share experiences

Evelīna Budiloviča praised the opportunities of learning from each other with an example of Riga and Tartu developing similar pedestrian street concepts in parallel and coming to completely different results. She also indicated that Riga has much to learn from Amsterdam when it comes to managing the electric charging stations in urban environment.

How to convince politicians that we need more data?

Jurijs Kondratenko said that cities are still very far from utilising the full potential of data they have already, thus more resources should be invested in creative data analytics. However, it is a challenge to convince politicians and decision makers to invest in this field regardless of the potential returns.

Tõnis Arjus adds that it should be the other way around – decision makers should ask for more data and analysis to help them better communicate their ideas to public. The professionals are trained to come up with intuitive solutions and the data is needed to validate the choices and guide when in doubt. Better data is needed.

However, there is also a potential problem if complex data is not communicated well. We often see that society gets polarised and complex data just increases this phenomenon. If someone is favourable to your idea, they will praise the findings. However, the opposition will always find cracks in the analysis to prove the opposite is true. Thus, a meaningful communication of both data and findings is crucial.

Rick Wolbertus once more underlines that it is a crucial part of our job to make our data simple and understandable for anyone without deep background knowledge. When we are researching something, we come to the point where we seem to know everything about a topic. But then a policy maker needs to decide within a day, for example or a politician needs to explain something to public. So, we need to take care about how we communicate.

How to design an urban experiment for better decisions?

Kristaps Kaugurs stressed the importance of experimentation in urban planning to test the ideas of professionals. However, he also remarked that any experiment, urban or other kind, requires a pre-meditated hypothesis, a well-designed testing environment, considerate data collection, analytics, and evaluation. Many cities, and Riga is among them, don't pay sufficient attention to the design process of intended test thus robbing themselves of the chance to make any conclusions. Quite often what we call an urban experiment is in fact a novel event. Events like Tērbatas street in Riga or Tartu example are nice and they show that people want to take back the public space from cars, but they do not serve the same function as experimentation and do not teach us anything on the methods how to better achieve this goal.

Rick Wolbertus adds that as a person who predominantly works with cars, he recognises that city streets, especially in the central areas, are not made for cars – the streets are made for people. The urban experiments also serve to remind us of this fact from time to time.

3 Infrastructure and Utilities

The third webinar in the series “Smart Cities for Climate Mitigation: Monitoring & Evaluation” focused on infrastructure and utilities.

Benno Keppner, project manager at adelphi, gave the introduction to the webinar giving a short overview of the topic.

Frank Graage, Steinbeis Nord-Ost, introduced himself as the moderator of the webinar and presented the agenda.

Kristaps Kaugurs from the **Riga Energy Agency** welcomed all participants of the webinar and opened up with the moto of the webinars series: “you can change only those things that you can measure”. Kristaps stated that we sometimes think that only the top players can base their decisions on smart city installations. But then, as all of theseminars have proved us, we can make decisions with impact on the whole scale starting from city governance, going through businesses and also on the individual citizen’s level.

Kristaps said that today utilities are in the focus – smart meters and installations that we use on daily basis to improve the quality of our lives. He concluded that often we assume that is our responsibility to take climate friendly decisions and change our behaviour. However, sometimes the challenge is to change the governance decisions.

3.1 Fresh insights gained from a new drinking water quality monitoring technology

Sandis Dejus, Senior Researcher at the Laboratory of Water Technologies and Biotechnology in the Technical University of Riga, began his presentation by stating that tap water is safe in Riga, as well as in our region. Water is tasty and environmentally friendly, and it costs 300 times less than the bottled water.

Further, Sandis Dejus provided insights in the possibilities of researchers in the water sector in terms of smart cities and what actually researchers can monitor in the water supply systems in terms of drinking water quality.

The most important task of water supply systems is to provide safe drinking water, which is a basic human need. Challenges in drinking water supply are related to urbanization, climate change, the extension of water supply networks and intensification of water mining. Under these changing conditions cities need to sustain the amount of water, ensure continuous water supply and the quality of water at reasonable costs.

Sandis Dejus expressed the view that drinking water that meets all the biological, chemical, aesthetic and sanitary requirements is a challenge for water supply companies, as it is difficult to maintain good water quality throughout the distribution network because there are numerous ways how drinking water might be contaminated. Causes of drinking water quality deterioration might be related to system failures such as pipe breaks, corrosion of pipelines, bacterial growth, deteriorated water quality at the water source, failure of the drinking water purification station, etc. Aging of water supply networks led to a re-evaluation of the drinking water supply systems’ reliability and vulnerability to accidental contamination. Contamination of drinking water can cause health, social and economic issues.

Next, Sandis Dejus explained that the monitoring of the water supply system can be done manually or by specific monitoring equipment. The volume is monitored by hydraulic equipment to avoid water leakages while the quality and safety is analysed by sensor systems.

Online water quality monitoring systems significantly reduce health risks related to water quality deterioration due to continuous data collection, automatic contamination detection and fast response to potential contamination. During the last decade, early warning systems (EWS) are being increasingly applied to ensure the safety of drinking water. EWS are driven by conventional sets of drinking water quality sensors, and the collected data is analysed in real time.

Researchers of the Technical University of Riga have developed an innovative technological solution for online real time drinking water quality monitoring. The water sampling, analysis and reporting of results can now be done in just 20 minutes, contrary to conventional laboratory analysis that takes about 18-24 hours to get the result.

Sandis Dejus highlighted the benefits arising from the monitoring process in real scale systems. Advantages are considerable savings of time that lead to better satisfaction of customers and end users and increased loyalty to the drinking water supplier. Drawbacks of the online monitoring are related to the high costs of technologies, unsolved data transfer issues from underground (where the pipes and sensors are located) to online data platforms as well as the need for highly experienced specialists to supervise such monitoring.

3.2 Positive Energy Block in historic urban environment: case study in Riga

Andra Blumberga, Professor at the Institute of Environment and Energy Systems at the Technical University of Riga, began her presentation explaining the definition of the Positive Energy Block (PEB). It is a city quarter that consists of several buildings (new, retrofitted or combination of both). Buildings actively manage their energy consumption and the energy flow between them and the wider energy system. PEB has a positive annual energy balance. It makes optimal use of such elements as advanced materials, local renewable energies, local storage, smart energy grids, energy management (electricity, heating and cooling), user interaction/involvement, etc.

The PEB initiative targets particularly densely built environments promoting shared on-site renewable energy production and storage, using smart grids, ICT, IoT and other highly advanced energy efficiency technologies within the neighbourhoods.

Following this, Andra Blumberga presented the research project that focuses on a transition from a traditional urban block to PEB in the valuable environment of historic city centres, exploring possibilities of waste heat regeneration and on-site renewable energy technologies. In the early stage of this project the criteria were set to select the most appropriate location for the case study – a block in the historical centre of Riga, the UNESCO heritage site. Following the criteria such a block was selected – the Palladium Concert Hall block.

The goal of the research project was to assess different scenarios of how to implement a PEB in a densely populated historical urban environment under specific baseline and urban planning preconditions in Riga, by reducing the impact on climate change and regenerating the urban environment in a way that fully ensures the compatibility of the energy supply and storage technologies with the historical environment.

A system dynamics model was developed for the modelling purposes aimed to identify and assess alternative scenarios based on an hourly energy balance. Three different scenarios were analysed:

- Scenario 1: Energy efficiency and RES first
- Scenario 2: Architectural values first

- Scenario 3: Compromise scenario: balanced energy efficiency, RES and architectural priorities.

Energy consumption data was analysed. The conception for possibilities of on-site renewable energy generation and waste heat recovery from data centres and cooling units in the selected historical urban block was drawn.

The model and analysis showed that it is technically feasible to reduce energy consumption in Scenario 1 by 42% and in Scenario 2 by 30%. However, subsidies are needed for both energy scenarios. It is technically feasible to reach a PEB for heating and electricity production by using seasonal thermal energy storage. Subsidies for heat pumps, heat storage and photovoltaic are needed for the economic feasibility. The results of the study indicates that very ambitious targets for energy efficiency improvement are needed to achieve a PEB – 65 % and 60 % for electricity and heating consumption, respectively. Possible savings of CO_2 emissions are 45–50 kg/m^2 per year.

Andra Blumberga concluded that optimizing energy consumption in cities can have a significant impact on decarbonization strategies approaching a carbon neutral future by 2050.

3.3 Air quality - from measuring instruments to published data: work experience in the City of Riga

Jānis Kleperis, environmental specialist at the Environmental Board of the Housing and Environment Department of the City Council of Riga, presented the work on monitoring and improvement of air quality in Riga.

Jānis Kleperis outlined the key challenges related to air pollution and justified their significance referring to the collected research data by the World Health Organisation. The key impacts of air pollution on human health are: air pollution increases the risk of respiratory diseases and risk of chronic obstructive pulmonary diseases. It also increases the sensitivity to respiratory infections, the risk of developing lung cancer, the risk of cardiovascular system and many other severe health conditions.

Air quality standards are set by the EU Directive on Clean Air and Cabinet Regulation No. 1290 of the Republic of Latvia “Regulations on Air Quality”. The regulation defines the methods for the measurement of air pollutants, ambient air quality assessment and monitoring conditions, including criteria for determining the number of ambient air monitoring stations and conditions of the location for the performance of fixed measurements and sampling, requirements for the assessment of the pollution level, measures to be taken to improve the air quality and conditions for their implementation.

Since 1994, the air quality monitoring in Riga is caried out by using the differential optical absorption spectroscopy method (DOAS). The DOAS system works on the principle that different gaseous pollutants absorb light of different wavelengths that can be measured. For ambient air quality applications, path lengths of several hundred metres are common. There is a relationship between the number of pollutant molecules in the path and the amount of light absorbed. The analyser uses this principle, known as Beer-Lambert's absorption law, to measure pollutant levels. It is possible to identify and determine the concentrations of several different gases in the light path at the same time because every pollutant has its own unique absorption spectrum properties, or fingerprint.

The DOAS air quality monitoring system has three main components: an emitter, a receiver and an analyzer. The emitter sends a beam of light from a powerful xenon lamp over a selected path to the receiver unit. The rest is a math. First, the measurement spectrum is divided by a previously stored “reference”, holding the fixed emission spectrum of the xenon lamp. A further processing is then applied by dividing by a polynomial to remove any remaining and undesired broadband absorption, not originating from the gaseous species of interest. This is possible due to the nature of the molecular absorption, which shows rather sharp “absorption lines”. The result is the differential spectrum.

Jānis Kleperis clarified that there are three air quality monitoring stations currently in Riga. These serve the whole city territory. Data is collected, analysed and presented in the form of an air quality index (AQI). It is also available online to the wider public, thus the city of Riga is fully compliant with the EU Air Quality Framework Directive requirements to ensure that timely information about actual or predicted exceedances of alert thresholds, and any information threshold is provided to the public. Based on the air monitoring data, annual reports on air quality in Riga are elaborated.

3.4 Electric consumption assessment using Smart Meter data and KPI methodology

Anna Mutule from the Faculty of Electrical and Environmental Engineering, Institute of Energetics at the Technical University of Riga, presented her research within the research project “An ICT Platform for Sustainable Energy Ecosystems in Smart Cities (‘‘ITCity’’)”.

To introduce the subject, Anna Mutule stated that people living in cities nowadays progressively take advantage of more communication technologies and multiple opportunities based on the implementation of solutions across various sectors (e.g., transportation, services, infrastructures etc.), thus transforming their environment in a smarter one. These advanced cities are called smart cities. A field with very specific needs is the electric power system that deals with both large entities that govern themselves (grid operators) and the citizens. For both and all actors in between, there is an increased need for information. Steps to provide the data are always taken and several initiatives are ongoing across the world to equip residential users with last generation smart meters. The large number of the developed smart city solutions has created the need for evaluation and comparison.

The presented research case was based on a residential area occupied mainly by university students and after an extensive measurement campaign the results have been studied and analysis methods were proposed. The KPI evaluation method was used to assess the electric energy consumption and the related behavior of students’ dorms. The dorms represent a part of the city through the role of dorm inhabitants and their effects towards energy consumption based on individual user awareness.

To perform the KPI evaluation, two main components were used:

- Real smart meter measurements: continuous weekly consumption samples and yearly consumption,
- Consumption modelling results: consumption survey – assessment of equipment and use habits, Equipment use modelling, user activity modelling.

The data was collected by a smart meter system, providing three-phase electric consumption monitoring of each floor of students’ dorms individually. The yearly energy consumption has been obtained aggregating the smart meter data, while other information is based on statistics.

The inhabitants of student dorms shape the building energy consumption, thereby their individual habits, daily activities and preferences were necessary for a proper consumption assessment. A consumption survey has been carried out to address the individual user consumption in an environment with no smart meter information.

During the modelling stage various models were elaborated and tested. The user behaviour model generated the necessary reference of user daily activity. This information contained data on sleep periods, outdoor and home activity moment. A daylight model was developed to assess the provided weather data regarding local natural lighting. The appliance model was the most important user consumption part, which created the energy consumption individually.

Anna Mutule summarized her presentation by stating that, based on the evaluation of several KPIs and using a model approach, it has been concluded that a large part of the consumption reduction can be made by users, that every dorm has a great potential for reducing its individual total consumption and at the same time for increasing the share of renewable energy and reducing the carbon footprint by photovoltaic panels and the implementation of an energy storage system.

3.5 Managing the Stormwater in Vilnius

Egidijus Steponavičius, Head of Marketing and Communications, at the municipal company “Grinda” in Vilnius (Lithuania) shared the experience on managing the stormwater in Vilnius.

“Grinda” is the municipal enterprise responsible for the supply of a wide range of utility services – construction and maintenance of the city streets, collection and management of surface runoff water, emergency utility services, maintenance of buildings and utility systems in the city and other services.

Similar to other cities in the region, over the last few years the temperature and precipitation extremities in Vilnius are becoming much more intensive. Also, the city is densifying and the share of non-permeable and semi-permeable surfaces, such as roofs, asphalt, and tiles in the city is enlarging. The sewage network was installed in Vilnius already in 1642 and was just a few hundred meters long. Over time, as there was a strong expansion of the network, and in the meantime, resulting from intensive and extensive city development, the existing city's infrastructure became unable to absorb the stormwater volumes during the extreme rainfalls, especially, each year in July and August the city is facing the stormwater-caused floods.

Egidijus Steponavičius admitted that currently the city is mostly fighting with the consequences rather than the causes of the stormwater flooding. To respond to the challenge, the city has defined risky areas and has allocated teams to divert the traffic from these risk areas, as well as to clean debris. In such a situation the city has just two choices:

- Implementation of measures to reduce the amount of stormwater entering the stormwater sewers (e.g., local infiltration units, green infrastructure and nature-based solutions);
- Reconstruction of the existing sewage system so that it meets the needs of both the current and the near future scenarios.

Moreover, the choice must be taken, observing and evaluating such environmental aspects as biodiversity and supporting ecosystem services. A sustainable stormwater management approach should be applied. With this in mind, Vilnius is developing several sustainable stormwater management projects integrating green infrastructure and nature-based solutions.

One of such large-scale projects being implemented in Vilnius – “Management of surface wastewater treatment systems in Vilnius” – includes measures as the reconstruction of the Karoliniškės stormwater treatment plant, reconstruction and building new stormwater collectors with water treatment facilities as units for storage, purification and monitoring of wastewater pollution. The project also includes such activities as the inventory of the Vilnius city stormwater network, digitization and data recording.

Egidijus Steponavičius concluded that these complex measures provide an integrated approach to sustainable stormwater management; they reduce flood risk, enhance biodiversity and recovery of ecosystems.

3.6 Discussion

The moderator posed the speakers the first question: **"Concerning the stormwater management in Vilnius, besides the environmental and safety aspects, is the groundwater also an issue for urging the city to implement sustainable stormwater management?"**

Egidijus Steponavičius replied that in this sense Vilnius is in a very good position, because the geological situation is favourable – there are several layers of groundwater each entering different waterbodies.

The moderator wrapped up the webinar concluding that many important and interesting infrastructure fields were presented and discussed today.

Kristaps Kaugurs closed the webinar, turning back to his remark at the beginning: "we can change only the things that we can measure". Kristaps admitted that we definitely can – we can say that today we found out that even the most rigid systems like utilities and utility systems can become smart and adapt to change. The fluid systems are like people – and their adaptations could be encouraged to happen easier. But it is also something that we learned today – it is not always the case and can be quite challenging. So, us – the people – using the new possibilities and the decision makers, and the governance as part of the decision-making can also be rather stubborn towards changing this trend and bringing a change.

Kristaps thanked everyone who joineed the "Smart Cities for Climate Mitigation: Monitoring & Evaluation" webinars.