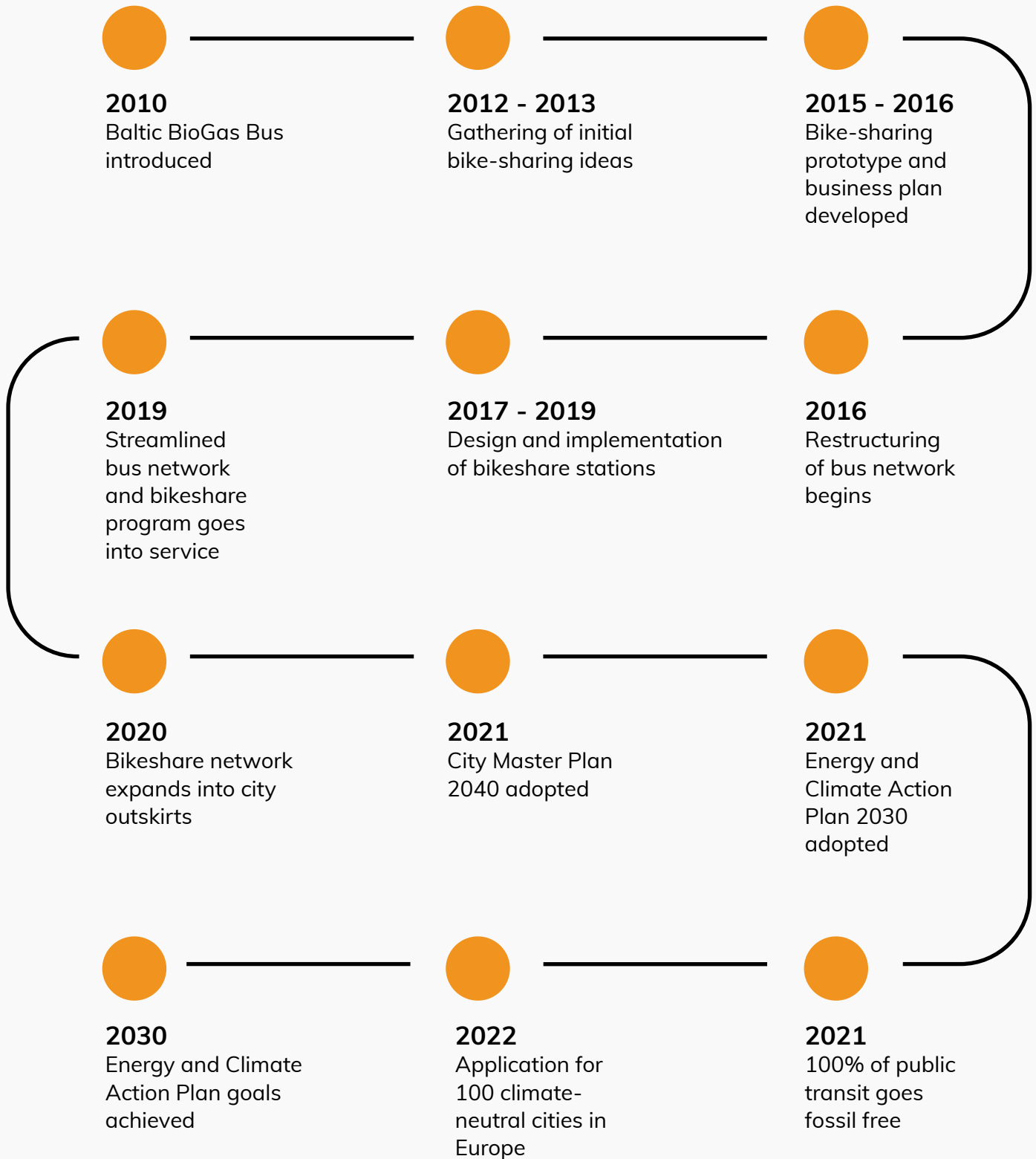


Tartu's Approach to Climate Goals Through Sustainable Mobility Planning



Timeline of major milestones:



1. Tartu's plans shaping the sustainable future

Tartu's Soviet-era housing with more recent interventions such as open spaces and shared streets for walking and cycling. Source: City of Tartu.



With just over 95,000 residents, the university town of Tartu is the second largest city in Estonia. First settled in the 5th century AD, Tartu has survived numerous empires that have shaped its development. Due in part to its location between the Baltic Sea and the border of Russia, historical events like aerial bombings during World War II and Soviet Era reconstruction had led to developments that needed a 21st century update through more strategic urban planning.

Taking a systemic approach to enabling green mobility, the city has created two evidence-based plans for future development over the last several years. These plans were derived from cooperation cooperations with the local university — the largest employer in the city — and planners worked with extensive mobile data, conducted interviews with residents, explored expert analyses and gathered information on

traffic density to determine the most sustainable way forward. Intended to complement the ultimate goal of reducing carbon emissions and providing more renewable energy options, the new Master Plan and the Climate and Energy Action Plan 2030 were both adopted in 2021.

Tartu's recent development integrates with older architecture and street design for all sustainable modes. Source: Maanus Kullamaa.



Climate and Energy Action Plan 2030

The City of Tartu drew up an official [Climate and Energy Action Plan](#) to solidify action items in the areas of government, energy management, power consumption, housing and building management, and the production of thermal and renewable energies. The plan works towards a 40% reduction in carbon emissions by 2030 (as compared to 2010) and climate neutrality by no later than 2050. These steps, taken in order to mitigate the impact of climate change, see not only enhanced production of renewable energies locally but also a shift away from the use of non-renewable energies in the municipal sector, including public transportation.

Complementing the Urban Master Plan, the Energy Plan goes further in instituting public service measures aimed at increasing pedestrian and bicycle traffic while reducing private transport and the number of cars in the city. The underlying principle for designing mobility prioritizes walking, cycling (including e-mobility), and public transport over private transport. As such, the plan calls for the construction of a uniform main network of cycling tracks, mobility centers in the outskirts to connect main destinations in the city with fast public transport connections, and the expansion of public transport services of the city to nearby settlements.

Tartu City Master Plan 2040

Tartu has created an urban master plan focused on making public transport options more appealing, implementing 100% carbon neutral public transport options and upgrading neighborhoods to shorten travel distances within the city to 15 minutes. Markedly different from the planning that took place in the late 90s and early 2000s, the current plan prioritizes the city center in a way that aligns growth with Tartu's historic roots. By shifting away from the urban sprawl dynamic of the 90s, which saw new university buildings constructed on the city's outskirts, Tartu now focuses on "mobility centers" that reduce reliance on personal automobiles and favor active and public transit. Featuring a number of pedestrian-oriented street redesigns, it abandons a long-planned inner ring road around the city and introduces a revamped bus network and bike-sharing scheme intended to reduce noise and air pollution while enhancing residents' quality of life and relieving traffic density issues.

2. Clean transport: biogas buses and e-bikes

Tartu's new biogas buses make trips more convenient and comfortable through more direct routes and low floor design. Source: City of Tartu.



Key facts of Tartu's clean transport:



500 e-bikes and 250 pedal bikes in the bicycle fleet



2.4 million trips and 6.6 million km in total trip distance since inception of bikeshare in July 2019



25 bus lines streamlined to 13 routes with easier access, 64 biogas buses deployed



Bus passenger numbers increased by 10% after network redesign (pre-pandemic)



100% fossil fuel-free public transport since 2021

Cycling and biogas buses — a winning combination for city resilience

Planners took a two-pronged approach to getting residents to make more active mobility choices, getting them out of their cars and using environmentally friendly means of transport. One area of focus was on the enhancement of infrastructure to make bicycle usage a more appealing endeavor. Taking concrete steps to that end, the city implemented a bikeshare scheme featuring electric bikes with well-located stations determined by already existent mobility patterns. They likewise improved infrastructure to incorporate cycle and pedestrian paths throughout the city.

Making public transport a more viable fossil fuel-free option for travel than passenger vehicles was the second area of consideration for planners. Thanks to the Baltic BioGas Bus project plan first introduced in 2010 and the [financial support](#) from the European Union, the city was able to switch its fleet of buses entirely to low floor buses run on locally produced biogas, making Tartu one of the first fully carbon-neutral public transport systems in Europe. After introducing 64 buses in July of 2019, when the new lines also went into effect, ridership increased by 10.3% — around 100,000 passengers. By January 2021, public transport in the city became entirely carbon neutral as a result of these biogas buses.

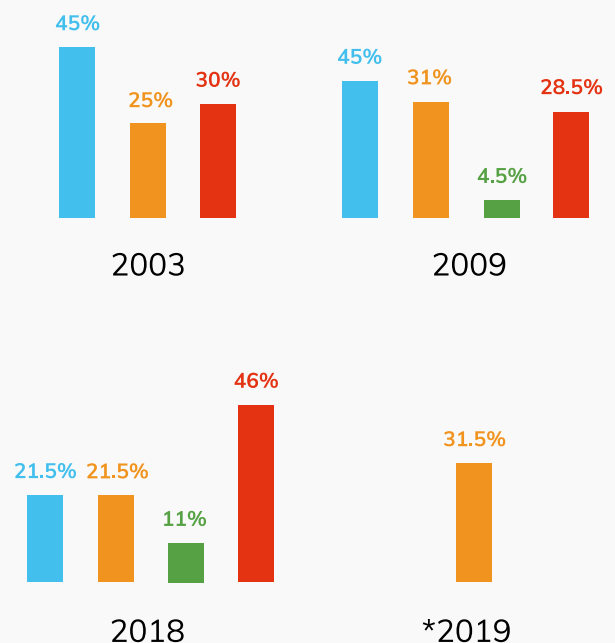
Tartu residents admire new biogas buses. Source: City of Tartu.







Redesigning bus network to attract more users

Redesigning the bus network was a strategic move to help the Tartu bus system become more efficient and reach more users amid challenging issues of growing car usage. The mobility surveys undertaken by the City of Tartu saw a switch in modal split from 2003 to 2018 for all transport options. In the 15-year period, trips done on foot have been steadily decreasing while the use of cars has increased. The use of bicycles has increased slowly, while bus usage has fluctuated dramatically — ranging from 25% in 2003 to 31% in 2009 and down to 21.5% in 2018. A shift in living standards that allowed for private motor vehicle usage and suburban sprawl may account for some of the shifts towards more car trips, with the financial crisis of 2008 and pandemic of 2020 throwing the connection between economic issues and the affordability of individualized transport choices into sharper relief.

Tartu modal split data. Source: City of Tartu.



-  Walking
-  Public Transport
-  Cycling and other forms of micromobility
-  Car
- * No data for other modes

To help stabilize the numbers of those using public transport — and facilitate more people stepping out of their cars — Tartu implemented a fully redesigned bus network in 2019. A reconsideration of the complete bus network shifted city routes, shortening travel times between common points of interest and reducing headways. By improving these existing bus lines, the city was also able to eliminate long waits at transfer points and added ease of access, with some lines requiring no additional walking as part of first and last mile connectivity. The new system saw a 10% year-on-year increase in passengers, a gain which remained consistent until early 2020, when pandemic-related closures shifted common travel patterns. Although social distancing measures implemented in March 2020 led to a significant decrease in numbers of trips taken and the number of travelers using public transport has yet to return to the pre-pandemic levels, the redesign, combined with the bike-sharing scheme and focus on planning human-centered streets, has helped to maintain the progress already achieved.

The bus network redesign relied on accessibility indicators which guide Tartu's land use and mobility planning. To that end, planners have mapped access (when walking, cycling or using public transport) to schools, kindergartens, grocery stores, jobs and various services for each property in the city. This provided a great and fairly detailed overview of the situation in every part of the city, which allowed for targeted interventions to improve access in various areas of Tartu. Understanding how and why people use public transport was key to rethinking the service that the bus network provided to the community. In 2016, the city began gathering information from more than 27 datasets; planners utilized unique evidence taken from anonymized mobile phone movements to get a real-time overview of how people made their way throughout the city. They likewise worked with people with disabilities as well as students from the local universities and schoolchildren to get a better feel for their needs. Reviewing land use maps added insights into population density and space.

This data-driven planning, combined with regulatory measures such as the Public Transport Act, led to the creation of an entirely new network of bus routes that were put in service in July 2019. While the redesign expanded the reach of the bus network, it simultaneously streamlined services,

reducing the route from 25 lines to just 13. Though this restructuring resulted in fewer total routes, the new routes were simplified, more direct and better connected. Doing away with routes in favor of pendulum routes, transport planners also incorporated an entirely new route that passes through all of the most important points of interest requested by city residents. Added frequency of service eliminates excess wait times and better connectivity options enhance accessibility for passengers.

Increasing access and bus ridership through technology

Already a highly evolved country technologically speaking, Estonia incorporated advancements in mobile technology to make the bus network easier to use. An [online route planner](#), combined with multi-platform electronic ticketing and [contactless ID-card validation](#) created a simplified payment system that can be used on the go.

Increasing access through bikeshare

Due to the high share of motorization in Estonia, Tartu initially began exploring the idea of a public bike-sharing system in 2012 as a means of finding a feasible alternative to cars. By encouraging bike use, the city hoped to decrease environmental problems such as noise and air pollution as well as traffic density and parking issues.

To make the switchover to bicycles a success, the city drew up a business plan in 2016 that looked at potential daily users as well as land use and traffic paths. Here, accessibility also played a prioritized role. Data compiled through mobile positioning as well as interviews conducted with residents and students gave planners a good insight into the best locations for bike stations around the city.

A call for proposals led to the development of prototypes for the bicycles on offer, a contract which eventually went to Canadian bike manufacturer, Bewegen. The publicly run bike network features hybrid systems that use both easy-to-create virtual stations as well as physical docks. GPS technology and secondary locks enable dockless bikeshare while the area of use is geo-fenced to prevent theft and long-distance travel.

By the time implementation of the scheme was complete in 2019, there were 69 stations with a total of 500 electric bikes and 250 regular pedal bicycles strategically placed around the city. Bike stations were initially prioritized to include the Soviet-era housing district of Annelinn, whose residents hold lower incomes than the city-wide mean. Going forward, new bikeshare stations have been located based on the 15-minute city concept, further increasing access.

Additionally, an inexpensive payment plan and flexible memberships contributed to the success of the program, which saw more riders than

anticipated in the first year: 29,000 users in total. Riders pay just 30 Euros for an annual membership, which comes with an unlimited number of 60-minute-long rides. Connected to the public transport payment system, joint ticketing allows for transfers from one mode to another; the bikeshare comes at no additional cost to those with select bus tickets, including the right to ride free on a 90-day bus pass.

The city counted over 830,000 rides in the first 11 months of the program and an 11% increase in the mode share for cycling. Within a year of its inception, despite the pandemic's arrival in spring of 2020, bikeshare mileage increased by 38%. Bewegen estimates that Tartu's system has among the highest per capita utilization rates in the world. By 2021, the network was further extended, with 90 stations in operation, including more located in the suburban areas of Ihaste, Märja, Rahinge and Kvissentali to incentivize car-free trips to the city center. Tartu estimates that cycling and use of other forms of micromobility will surpass 20% by 2030.

Tartu's bikeshare. Source: City of Tartu.



3. Reshaping city streets and spaces

Redesign of streets in Tartu aims to bolster both the environmental and social resilience. Source: Maanus Kullamaa.



Reconstruction of pedestrian and cycling infrastructure

Tartu represents a specific urban environment due to its post-Soviet socio-cultural context. Following independence from the Soviet Union in 1990, the state had to rebuild its transportation systems, institutions and capabilities from scratch; the result is an ongoing, adaptable approach to urban planning that places quality of life, equity, and non-motorized mobility at the forefront.

Although the City of Tartu already started compiling the city's Urban Master Plan as well as the Energy and Climate Action Plan several years ago, they had begun instituting green planning principles earlier, following on the Convention of Mayors in 2014 and as part of the Lighthouse Project [SmartEnCity](#) in 2016. With funding from the European Union, Tartu became one of three SmartEnCity demonstrator cities, a model of a smart and resource-efficient urban environment that focuses on improved energy efficiency and increased usage of renewable energy. One of the initial measures undertaken through the program was the redevelopment of an apartment

block area to not only upgrade the buildings to meet green building standards but which also saw planners converting parking spaces into pedestrianized play areas to enhance the quality of life for residents. This human-centered planning also later included the incorporation of bikeshare stations in the residential area so as to enhance first and last mile connectivity, something replicated in areas around the city later.

A key objective in Tartu's SmartEnCity approach was the active engagement of the citizenry in creating a high quality living environment and shifting patterns of behavior toward making more environmentally aware choices. While energy-saving methods of building remodels were undertaken and renewable energy made more abundant, residents were also included in the plans to make bicycling a more attractive means of transportation. SmartEnCity serves as one example of several plans that have been developed; these work in tandem to serve the city's main target of developing a sustainable, healthy, and secure city environment. In terms of mobility, for example, Tartu is concentrating on the enhancement of public transport and

cycling, a goal which is complemented in the urban built environment through construction projects that renovate housing blocks and shift toward a 15-minute city development plan. Undertaken with the community in mind, these housing developments around the city receive enhanced public squares and play areas. With the addition of bikeshare stations at these housing developments, the city has granted an accessible means of transport to residents and in doing so, shortened the amount of travel many undergo on a daily basis. The city's master plan foresees this short distance city approach to urban planning to carry on at least through 2030.

Planners likewise reconsidered the layout of the city, reshaping streets to add bicycle infrastructure and footpaths. A master plan that had long called for the building of an inner ring road has been scrapped, replaced by a 3km long linear park. One of the main traffic nodes, Riia Street, underwent construction and a green connection was made between two university campuses; the result is a thoroughfare that better meets the needs of cyclists and pedestrians. A new cycling route on Vanemuise Street was opened to connect the old town with numerous culture venues while a construction project on Ülikooli Street reshaped the pedestrian space at the university campus in the city center. Tartu's university plays a central role not only in the city's development but also in the decision-making surrounding green mobility options.

Tartu's urban fabric features residential clusters with safe cycling infrastructure. Source: Maanus Kullamaa.



While collaborating with the university allows for greater understanding of how the projects are working, getting students on board with the planning ensures that they make use of the new, more sustainable options made available.

Tunnel created along Riia Street under a railway bridge provides a main connection between the city center and the hospital and university campus. Prior to construction, the connector for non-motorized modes was a treacherous and narrow path (see the before and after images). Source left: TiiAR via Wikimedia Commons; right: Mana Kaasik.



Programming of streets

The pandemic and related social distancing measures in 2020 and 2021 likewise provided fertile grounds for experimenting with enhanced mobility alternatives and led to insights into what planning measures residents might most benefit from in future. Taking advantage of the warm weather in summer to encourage outdoor gatherings and highlight the possibilities that open car-free spaces can bring for public enjoyment, the city implemented a weeks-long Car-Free Avenue. The plan featured dance programs, childcare, sports, a street market, and other events; it proved highly popular and is anticipated to become an annual tradition. A similar approach to encouraging outdoor activities took place during the pandemic winter. Tartu established new pilot programs that offered car-free activities in city parks, creating an ice sculpture area in a central park and adding cross-country ski tracks in four large peripheral parks that proved well-utilized.

This sort of experimentation will continue as the city prepares for its role as one of three designated European Capitals of Culture in 2024 and will likely lead to further new ideas for creating a more livable city with lower pollution, less noise, and less traffic. Taking the theme of “Arts of Survival” for its cultural showcase, the program, still in development, intends to focus on ways to strengthen communities, promote an environmentally friendly culture and include ecological messaging and actions for surviving as a small city in the 21st century — an indication of Tartu’s commitment to sustainable urban planning. This synergizes with one of the goals of the Climate and Energy Action Plan 2030, which is to expand residents’ awareness of the impact of climate change and prepare them for future possibilities brought on by a changing world.

Tartu’s Car-Freedom Avenue offered installations and activities for youth and adults throughout 2020 and 2021, and it was replicated in various parts of the city. Source left: Evelin Lumi; right: Mana Kaasik.



4. Lessons learned



Public discussion on the draft of Tartu's Master Plan in September 2020. Source: Mana Kaasik.

The City of Tartu serves as a model of sustainable mobility integration due to the local government's willingness to engage with both the community and European organizations to find workable solutions to long-term problems. While incorporating feedback from the community to ensure their needs were met, the city reconsidered and readjusted initiatives that had long been in the works, securing future buy-in from local residents.

Participative Budgeting: Locals Decide

One of the unique aspects of the mobility planning was Tartu's use of participative budgeting principles to determine planning investments. First approved in 2013, the policy annually sets aside 1% of the city budget for projects suggested by residents that would provide solutions to practical problems.

In 2014, that investment went towards upgrading city sidewalks to eliminate curbs that may have hindered those with trolleys, baby buggies, or wheelchairs from crossing with ease and adding

tactical aids for those with vision issues, an investment in pedestrian safety. Mobility issues were again addressed in 2019 with an initiative designed to take cyclist safety near a school into account. The project saw a pedestrian and cyclist-friendly redesign of Kroonuaia Street and the Kroonuaia Bridge the following year.

While the city receives numerous suggestions each year for how best to invest this budget, Tartu provides a powerful example of how an engaged citizenry can be incorporated into mobility planning in a positive manner. Active community involvement ensures that changes made to the master plan will be well-received and long utilized.

Active Community Engagement

This sort of engagement could likewise be seen in the city's ultimate decision to do away with plans for constructing an inner ring road that had been in the works since the 1990s. In lieu of the road, a 3 km linear park for pedestrians and cyclists will be built that will afford more green space and areas for co-mingling among community members.

The concept of open public space was tested throughout the city when COVID-19 pandemic measures limited travel. In the summer of 2020, car traffic on the main arterial road was closed for nearly a month to provide outdoor gathering space for residents. Recreation and cultural activities on offer ensured the car-free avenue became a meeting point for townspeople. The events sparked a public discussion throughout Estonia about climate change, excessive car ownership, and different methods to tackle the issues faced when trying to build a sustainable future.

During the extremely snowy winter of 2020/21, high-quality spaces were likewise created to provide safe recreation opportunities outdoors, including a snow park for families, an ice rink in front of the town hall, and cross-country skiing tracks laid in urban parks. These temporary solutions provided planning officials with insight as to how popular such initiatives would be among townspeople before more fixed solutions were constructed.

The courage to be experimental paid off in Tartu; this offers insight into the possibilities created by innovative thinking that targets locals.

Data determinants

Data is and remains key to understanding mobility in Tartu. Known as the "City of Good Thoughts" locally, as the intellectual capital of Estonia, Tartu is home to a number of high-tech companies and start-ups. It's uniquely poised to adopt technology in its administrative processes and, having already implemented many smart solutions, was in a position that allowed for data to be gathered and incorporated in planning.

Working from more than 27 datasets, including anonymized mobile tracking to trace how people moved throughout the city, the city gained insight into how best to improve mobility. The gathered data informed the revamped bus routes to shorten commuting times, helped determine the locations of bikeshare stations and can be used in future to determine how well-received specific initiatives are. Using smart sensors and the smart bike tools to build an advanced data infrastructure, the city can likewise make decisions regarding traffic patterns and street renovations that benefit future mobility plans.

Data not only assisted planners in developing the new Master Plan and Climate and Energy Action Plan, it continues to provide insights to the community as the documents live digitally thanks to Estonia's technological revolution that has done away with paperwork. Providing much of the data gathered via open source offers the community easily-accessed insight into the forward motion of city officials in their planning processes and implementation and a singular, multi-layered map which offers advanced capabilities for reviewing the document.

At the end of 2021, [the application of real-time calculation](#) of the modal distribution of city modes was completed as a joint work of the city and the University of Tartu. This resource is unique as it uses various data from sensors and information systems and calculates the modal distribution with hourly accuracy based on special algorithms. The application is very important for monitoring various city measures.

6. Conclusion

Public Hearing on the
Climate and Energy
Action Plan. Source:
Mana Kaasik.



Although the City of Tartu continues making adjustments and advancements to its urban master plan, it can serve as a model medium-sized city with its sustainable mobility initiatives and emphasis on energy efficiency and renewable energy usage. Reconfiguring streets to emphasize pedestrian and bike travel ensures ease of access for non-vehicular modes of transportation. Cost-effective public transportation options, including a bike-sharing scheme that reaches most areas of the city, eliminates economic barriers to accessing affordable mobility. While there are further steps to be undertaken in the building sector to turn Tartu into a walkable, 15-minute city with mixed use neighborhoods, ongoing experimental efforts with car-free zones and outdoor activity areas have provided insight into future reception of such concepts. By incorporating local residents in the decision-making process, officials are ensuring that the changes to urban planning measures are not only well-received but that the expanded mobility options are taken up by locals.



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