

Lahti: The first carbon rationing experiment applied to local journeys

Lahti, Finland

Introduction



The City of Lahti in Finland was the first to experiment with a carbon **trading scheme among its inhabitants to reduce transport-related emissions**. The inhabitants who volunteered to take part in the experiment were assigned a carbon allowance that decreased proportionally to the carbon emitted from their journeys. To implement the scheme, the city teamed up with researchers and companies to develop a **mobile app that enabled users to manage their carbon allowance, by measuring and deducting the emissions linked to each of their daily trips** - a "Personal Carbon Trading" (PCT) scheme. The app was used on a regular basis by **350 citizens between the end of**

May and December 2020 and it rewarded those who did not exceed their **weekly carbon allowance by offering them, for instance, vouchers for local businesses or transport tickets**. This experiment is part of an action plan financed by the European Urban Innovative Action fund, called CitiCap, the goal of which is to develop alternative practices to driving cars. Lahti won **the European Green Capital 2021 award**, in recognition of the innovative actions implemented over the past three years in this medium-sized city, guided by a strong political drive towards decarbonisation. The project exemplifies the paradigm shift called for by local officials, who argue that greater ecological resilience can be achieved by slowing down - as shown in one of CitiCAP's promotional videos which ends with a slogan that is still unimaginable in France: "Lahti. Slow, dark, enduring."¹

Methodology:

The description and analysis of this experiment is based on data and documents in English made available on the Urban Innovative Action website and on interviews carried out with the **project's manager, Anna Huttunen**, and one of the researchers involved in the project design and evaluation team, **Ville Uusitalo**.

¹ Source: Lahden kaupunki, "Final Conference: CitiCAP - Citizens' cap and trade co-created," March 24, 2021
<https://www.youtube.com/watch?v=lyMgpkxRYy4>

Lahti, a medium-sized city and a pioneer in urban ecology

Geography and demography

- Area: 517.63 km² (*more than 2x the size of Marseille*)
- Number of inhabitants: 120 112 (*6th largest city in the country, comparable to Perpignan*)
- Population density: only 1027 inhabitants / km², with 75% of the inhabitants living within 5 km of the city center

Economy

- Rapid urbanisation in the 1970s, increase in the unemployment rate (x5) between 1990 and 1995 with regional deindustrialisation
- Capital of and an important railway junction of one of the most dynamic regional economic hubs in the country, historically at the heart of a trade route between Helsinki and Saint Petersburg
- Tourist destination: around Lake Vésijärvi and during its annual ski competition, Lahti Ski Games
- Research centers: Department of Environmental Ecology of the University of Helsinki, LUT University (Lappeenranta-Lahti University of Technology), LAB University of Applied Sciences

Governance

- Municipal Council : Social Democratic Party of Finland (SDP, centre-left) closely followed by the National Coalition Party (Kok, centre-right)
- Administrative Council ("City Board"): 11 members, led by Sirkku Hilden (SDP)
- Temporary mayor appointed by the municipal council in 2018: Pekka Timonen

Environmental policies - Objective: carbon neutral by 2025

- Nature conservation and promotion: restoration of Lake Vésijärvi, having become one of the most polluted in the country by the end of the 1980s
- Air quality: implementation of a specific plan in 1997
- Energy transition: fuel recycling from the end of the 1990s, end of coal use and installation of the Kymijärvi III bioenergy plant in 2019
- Circular economy: Päijät-Häme regional plan, unprecedented in the country
- Decarbonising the activities of the symphony orchestra and the hockey team
- First self-service ski-sharing programme

The origins and principles of voluntary rationing in Lahti: cheaper than tramways or a metro and fairer than a carbon tax

- **Travel rationing, a specific policy for reducing carbon emissions**

Carbon rationing is, much like the carbon tax, a **policy that monetises carbon emissions**. But it is different in that it limits potential carbon emissions by setting a **cap on overall emissions and allocating a maximum quantity of carbon that can be emitted by each individual**. This cap and trade policy has been implemented at the level of the European Union, with the establishment of the largest global carbon market and the allocation of "carbon quotas" that, since 2005, have limited the permitted emissions of nearly 10,000 plants across various industries (electricity, manufacturing and aviation).

The Personal Carbon Trading experiment in Lahti applied this principle on a local level. By rationing the carbon emissions of Lahti's inhabitants, the goal was essentially to encourage them to reduce their individual car journeys. This strategy of rationing residents' travel-based emissions proved to be an alternative to the carbon tax on fuels, which increases the price of fuel without guaranteeing an overall reduction in emissions.²

- **The origin of Lahti's travel rationing experiment**

The travel rationing experiment in Lahti is part of a long history of active environmental policies (see box). In 2016, in response to a call for projects from the European Urban Innovative Actions fund, Lahti was looking to test new measures and asked various local actors to think about innovative ways to encourage citizens to change their individual mobility practices, in order to reduce their emissions. In its call for projects between December 2016 and April 2017, the UIA targeted innovative urban projects dedicated to mobility, which had a participatory aspect and could be reproduced in other European cities. According to LUT University researcher Ville Uusitalo, at the time the city was struggling with the limitations (in particular financial) of a policy based solely on developing public transport services: "A tram would cost too much for a medium-sized city like ours."³ It was therefore the researchers at LUT University who proposed to test rationing with an instrument called Personal Carbon Trading (PCT)⁴, which consisted of giving a maximum amount of carbon to each inhabitant for their travels, allocated as an individual emissions credit that they can manage like a specific allowance.

- **The principles used to allocate a carbon allowance to the inhabitants of Lahti**

The city of Lahti decided that participation in the travel rationing experiment would be:

- **voluntary**: it would not be compulsory and people would be able to quit the app at any time
- **incentivised**: successful management of the allowance would be rewarded but there would be no punishment for those who failed to do this.⁵
- **fair**: considered fair without being egalitarian (see below)
- **participatory**: defined by the inhabitants

The city therefore hoped that the terms for allocating the individual carbon allowance would be discussed by the citizens, trusting them to decide upon a method that was both fair and acceptable - a considerable challenge when setting up such a system, but necessary to make it acceptable. For this, interviews were conducted with 60 citizens.

The citizens chose to allow certain participants to be allocated a larger carbon allowance (without exceeding + 30%), based on three criteria:

1. The number of **children**

² Kuokkanen, A., Sihvonen M., Uusitalo, V., Huttunen, A., Ronkainen, T., Kahiluoto, H. "A proposal for a novel urban mobility policy: Personal Carbon Trade experiment in Lahti city," Utilities Policy, vol. 62, February 2020.

³ Interview with Ville Uusitalo, May 24, 2021

⁴ Interview with Anna Huttunen, PCT project manager, May 25, 2021

⁵ Interview with Anna Huttunen, PCT project manager, May 25, 2021

2. Exceptional **personal circumstances** (such as a serious health problem)
3. The **distance** between their home and the city centre, their workplace or main services

However, they decided that each participant should still make the same effort and therefore reduce their emissions by **the same proportion** (-25%) between the start and the end of the experiment.

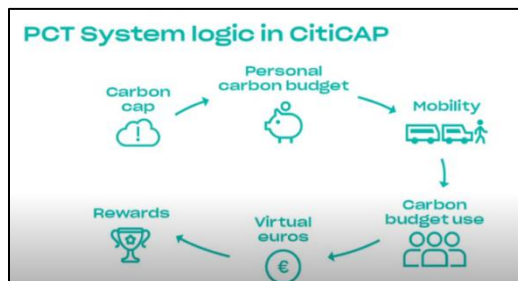
These criteria were then put to the vote of **304 respondents**, thereby being legitimised and accepted.

Note that two other alternatives that were discussed were not adopted:

1. **Equal carbon credit allocation:** all participants would have had the same carbon allowance, regardless of their personal situation.
2. **A different emissions reduction target based on the participant’s situation:** participants would have had a personalised emissions reduction target. For example: households living far from the centre would have had to reduce their carbon consumption by 15%, while those living closer would have had a higher reduction target.⁶

The absolute limit not to be exceeded was determined by the city based on the residents’ average emissions and the adopted reduction targets. At the very start of the experiment, the average individual weekly carbon allowance aimed to reduce the average travel-related emissions of Lahti by 20%: i.e. 17 kg CO₂ per week (up to 22 kg for those who were granted a larger budget). The participants’ carbon allowance was then gradually reduced over time, reaching a 25% emissions reduction target by the end of the experiment.

The carbon savings were converted into euros by establishing a **carbon price**. This price fluctuated according to the supply and demand for carbon credits, but it was also raised as part of a campaign aimed at incentivising participants to reduce their emissions even more. These virtual euros rewarded those who managed not to exceed their allowances, and enabled them to buy, for example, bus tickets or bicycle repair services.⁷ Those who exceeded their allowance had to “buy” additional credits with their virtual euros.



How the PCT works. Source: Lahden kaupunki, “Final Conference: CitiCAP – Citizens’ cap and trade co-created,” March 24, 2021

⁶ Lahden kaupunki, “[Final Conference: CitiCAP – Citizens’ cap and trade co-created](#),” March 24 2021

⁷ Ibid.

Voluntary rationing as part of a larger urban transformation project

Lahti's voluntary rationing experiment is part of a larger project, CitiCap, that aims to reduce the city's carbon emissions linked to local travel:

1. A **Sustainable Urban Mobility Plan (SUMP)** that completes the city's Master Plan and that, for the first time, reflects Lahti's commitments in terms of transitioning towards more sustainable mobilities. This enshrines 13 measures for the development of active modes by 2030⁸ and will now serve as a reference document.
2. **Developing bicycle infrastructure:** this involves building a 2.5 km long motorway reserved for bicycles, at a cost of nearly 2 million euros.
3. **Developing the mobile app** to manage individual carbon allowances, at a cost of around 1 million euros.

In all, the **budget** for implementing the three components of the CitiCap project amounted to **4.7 million euros**, of which nearly 80% was financed by European funds from the UIA (**3.7 million euros**).

A coalition of public and private actors

- The **City of Lahti** directed the project, being in charge of the its organisation and communication.
- The city relied on **two universities** (LUT and LAB) to conduct research on the model and its effectiveness, and to take part in developing the app and assessing its performance.
- **Three companies (Goodsign, Moprism and Future Dialog)** were responsible for designing the system:
 - **Moprism**, a company that specialises in data collection related to mobility, provided the technology for tracking journeys and identifying what modes were used.
 - **Goodsign**, that designs data processing software, received all the data collected by the app to calculate emissions and monetisations.
 - **Future Dialog** was in charge of creating the app itself and designing the user interface.
- **LADEC**, an organisation responsible for developing local businesses, served as an intermediary with businesses, inviting them to provide products and services as rewards on the app's "market." LADEC's team also played a role in citizen outreach and communication.⁹

Few human resources were mobilised internally to coordinate this large consortium: the project's manager Anna Huttunen worked alone on behalf of the city (often with an intern, and the support of the communication and IT department) and five researchers were working at LUT for the project.¹⁰

⁸ Some key measures of the plan are: consolidate and improve the network of cycle paths (61km in total) made up of bicycle parking areas and facilities along the roads, establish a winter maintenance policy for cycle paths and footpaths, implement Mobility Plans for schools and a Mobility Plan for city staff, set up a "Bike Point" in the city to repair bicycles and serve as a starting point for activities, establish a policy (regarding traffic, accessibility, service improvement) to encourage greater use of public transport, develop a passenger information system, achieve the target of 41% of buses running on alternative fuels by 2025, develop the collection of traffic and mobility data, set up a "bicycle system" designed to complement public transport, ease traffic in the city centre and design the public space for pedestrians, cyclists and public transport

⁹ "CitiCAP: Citizen's cap-and-trade co-created", Urban Initiative Actions <https://uia-initiative.eu/fr/uia-cities/lahti>

¹⁰ Interview with Anna Huttunen, May 25, 2021

The calendar

Once the UIA funding was granted in 2017, the **first phase** (early 2018) focused on **modelling the quantification of emissions** from people’s travels and **developing the mobile app** that participants would use. The app’s initial version was operational after a year, at the beginning of 2019.

The **second phase** consisted of collecting basic data from 150 citizens and quantifying the emissions related to their mobility in order to set the cap (from **autumn 2018 to spring 2019**).

Then came the third phase: the **test phase** (from spring 2019 to spring 2020) during which the employees of the town hall first, and then a group of 600 people, were able to **use the app**. Feedback on user-experience was gathered from analysing 49 questionnaires.

Finally, **the experiment** itself took place in the second half of 2020. Its results, as well as a new round of questionnaires, were analysed in early 2021 by the team of researchers.¹¹



¹¹ Lahden kaupunki, [“Final Conference: CitiCAP – Citizens’ cap and trade co-created,”](#) March 24, 2021

The carbon impact of an unprecedented but limited experiment

- **The impacts of rationing on the residents' carbon emissions**

Based on the analysis of the questionnaires completed before and after the experiment (131 and 47 responses respectively), the researchers confirmed that **the selected method, which consisted of distributing individual carbon allowances, was considered to be fair by the participants**. 20% of them were granted a larger allowance to compensate for living over 10 kilometres away from their work, the centre or essential services. Only 3% of participants were affected by health problems that required longer and more frequent trips. A third of all participants had to resort to requesting additional rations, mainly households with children.¹²

Given this context, **the main findings** regarding the users' practices are the following:

1. **App users reduced their car use more** than the control group and more than what city traffic data showed over the same period.¹³ Indeed, during the three months of reliable data in the fall of 2020, the app users decreased their emissions by 30% (from 18kg CO₂ to 12 kg CO₂ per week and per user on average) while the control group decreased theirs by about 20% (from 17 kg CO₂ to 14 kg CO₂). However, because of Covid-19 and the catch-up effect during the summer holidays, it is difficult for the researchers to draw conclusions on the period as a whole and on whether the initial goal of a 25% reduction over the planned 6 months of the experiment was achieved.
2. The researchers found that **fluctuations in the price of CO₂ had no effect on the evolution of user mobility**.¹⁴

But the experiment also changed how users perceive their travels:

3. **36%** of users claimed that **their mobility was more sustainable** during the project, while **57%** did not see any difference and **7%** did not know how to respond.

The users' main motivations for taking part were to **learn more about their own mobility (67%)**, to make the effort to improve their behaviour (**56%**) and to earn rewards (**44%**). Understanding the policy's goal was also important: 79% of users claimed that they now understood how rationing works and why it is useful after taking part in the experiment.¹⁵

- **An imperfect experiment disrupted by the pandemic**

According to the survey, the participants had relatively diverse profiles, but the group as a whole was not representative of Lahti's population. In relation to the city's general population, the participants:

- were slightly more **educated**
- had a higher **income**
- were **younger**
- were less likely to own or have access to a car¹⁶

With more than 2,500 registrations, the number of participants initially went well beyond the 1,300 expected by the organisers. This is a testament to the interest and curiosity in the experiment among Lahti's residents. However, the number of regular users throughout the experiment was much lower, between **150 and 350**.¹⁷

Covid obviously destabilised the project, insofar as users *de facto* travelled less during this period. The researchers were, however, able to limit its impacts by focusing on the results for the period right after the fall of 2020, a period during which the pandemic was more under control in Lahti.

¹² "CitiCAP PCT pilot and main results: motivating citizens to reduce their mobility emissions through Personal Carbon Trading", lahti.fi, March 2021. <https://www.lahti.fi/en/files/citicap-pct-pilot-and-main-results/>

¹³ Interview with Ville Uusitalo, May 24, 2021

¹⁴ "CitiCAP PCT pilot and main results: motivating citizens to reduce their mobility emissions through Personal Carbon Trading", lahti.fi, March 2021. <https://www.lahti.fi/en/files/citicap-pct-pilot-and-main-results/>

¹⁵ Ibid.

¹⁶ Lahden kaupunki, "Final Conference: CitiCAP - Citizens' cap and trade co-created," March 24, 2021 <https://www.youtube.com/watch?v=lyMqpkxRYy4>

¹⁷ Information gathered from an interview with Ville Uusitalo, May 24, 2021

The conditions for the success of Lahti's experiment, according to the project team

According to the feedback from the project team, several conditions render the success of such an experiment more likely:

1. Having a favourable territory: the size and urban configuration

- **A city where people can manage without a car:** with 75% of its inhabitants living within 5 kilometres of its centre, Lahti is a city that people can get around by bike or on foot, at least when the weather is not too cold.
- **A city that is too small to justify heavy transport infrastructure:** being too small to justify investing in new heavy infrastructure, the city turned out to be an ideal testing ground for the relevance and efficiency of trying to change residents' behaviours.
- **But a city big enough to serve as an example:** Lahti is however big enough to assemble the necessary human resources to pilot such a project and to become a model for other cities around the world.¹⁸

2. Benefitting from a political consensus around the project and deploying sustained communication

Anna Huttunen puts the success of the voluntary rationing experiment down mainly to the consensus reached around the project. It was not met with any political opposition that could have slowed down its conception or implementation, in particular because of its (substantial) funding by the UIA, and also thanks to a shared belief that the city as a whole would benefit from its effects in the long run. The project's manager also emphasised that developing the app and all the content surrounding it only represented one part of the total budget, which was mainly devoted to cycling infrastructure. At the city council, the project was widely acclaimed. Anna Huttunen also insisted on the importance of communication. By highlighting the app's features designed to test travel rationing based on citizen participation, volunteering and rewards, the communication strategy paid off and contributed to the positive reception among the general public. The strategy was then backed up with the aforementioned questionnaires sent to residents, with discussion groups to collectively define the allocation methods of the carbon allowance, and then, throughout the whole experiment, with campaigns and social events in well-frequented and popular places such as libraries or certain public spaces, to increase the number of users, interact with citizens or teach them how to use the app.¹⁹

3. Establish participatory governance and integrate public and private actors

Still according to Anna Huttunen, including citizens from the onset when designing the credit distribution method, but also having regular interactions with them (questionnaires, participatory events, interviews, etc.), guaranteed the project's acceptability, especially since the experiment involved no obligations or sanctions. From her point of view, incentivising a change in behaviour at the local level can work, provided that the policy is conceived in a democratic way, as was the case in Lahti.

The project was also able to benefit from a coalition of local actors - both public (researchers) and private (companies) - and from their scientific expertise in the social sciences and new technologies, which was necessary to develop a fully-functioning app quickly.

4. Mastering new digital technologies for a thoroughly modern experiment

Without its main instrument - the digital app for managing one's individual carbon allowance - the experiment could not have taken place. Without it, participant mobility could not have been detected or automatically quantified. The prerequisite was collecting "open source" data relating to the carbon emissions of each mode - including infrastructure construction and vehicle production (for example, for electric cars). Ready for use in early 2019, the first version of the app was made available to users in September. It then continuously evolved, based on user feedback, improving the detection quality of different modes and enriching mobility data. These are all essential elements for assessing the rationing policy.²⁰

¹⁸ Interview with Anna Huttunen, May 25, 2021

¹⁹ Ibid.

²⁰ Interview with Ville Uusitalo, researcher at the University of Lahti, May 24, 2021

Lessons to be drawn from Lahti's experiment for conducting a voluntary rationing policy

1. On the design methods of the digital rationing app

The city of Lahti chose to pilot the design and development of the voluntary rationing app itself, and created it from scratch. This choice involved important project time and significantly mobilised the city staff, often working under tight schedules, whether due to the considerable number of stakeholders, technological requirements or the necessary iterations between design and use.²¹ It was also subject to circumstantial setbacks, such as a cyberattack against the city's data system in the summer of 2019. Considering all this, the project team wonders whether in the future, companies might be interested in developing this type of "product," thus relieving cities from having to do so.

2. About the group of volunteers and how they used the digital rationing app

The **app** was used on a regular basis by a maximum of **350 users**. The project team considers that, for an experiment, and for a medium-sized city like Lahti, this is a good result. The volunteers were mainly recruited from among the younger age groups, with the app perhaps not being so accessible to older generations. The team also felt that some inhabitants were reluctant to entrust their personal data to the app, despite the commitment to guarantee compliance with European directives on the matter.²²

Many people who registered at the beginning of the experiment stopped using the app midway through,²³ growing tired of its repeated errors in detecting travel modes, of its excessive energy consumption on smartphones, and of an interface that was not user-friendly. Some participants also did not play along, with some even cheating (21% admitted to sometimes leaving their phones at home or turning off their GPS to earn more rewards).²⁴

In the end, while the project's manager is aware that such an experiment can only have relative significance insofar as it was voluntary and did not impact the user's personal funds, she does suggest two avenues for improvement:

- create a more user-friendly and fun interface, with daily "challenges" to encourage users to stay engaged with the app without getting bored or wanting to cheat²⁵
- use more "low tech" tools, such as giving people an individual carbon credit card that would be debited each time they purchase fuel. However, the carbon card would have the disadvantage of only tracking and limiting travel by internal combustion engine car (and not those made by bus or electric car, for example) but it would have the advantage of being less intrusive.²⁶

²¹ Interviews with Ville Uusitalo and Anna Huttunen, on May 24 and 25, 2021, respectively

²² Interview with Anna Huttunen, May 25, 2021

²³ Ibid

²⁴ "CitiCAP PCT pilot and main results: motivating citizens to reduce their mobility emissions through Personal Carbon Trading", lahti.fi, March 2021. <https://www.lahti.fi/en/files/citicap-pct-pilot-and-main-results/>

²⁵ Interviews with Ville Uusitalo and Anna Huttunen, on May 24 and 25, 2021, respectively

²⁶ Interview with Anna Huttunen, May 25, 2021

What next?

Since the experiment ended in December 2020, Ville Uusitalo and Anna Huttunen have been keeping the project going in different ways, for example by designing an interface intended to **educate and encourage citizens to change their lifestyles**, to **reproduce the experiment in other “follower cities”**²⁷ and to **adapt the concept to other organisations such as businesses**. The city of Lahti and the LUT researchers are also developing an **app within the framework of the EU’s Horizon Europe programme, integrating sectors other than mobility** (housing, food and other consumer sectors).²⁸

Key figures of the voluntary rationing experiment in Lahti

Preparation and design: 3 years

Duration of the experiment: 6 months including 3 months of usable data for analysis

Budget: € 1M

Participants: 2,500 registered, including 600 during the test phase, but only 150 to 350 regular users per week during the experiment

Answers to questionnaires: 131 for the initial questionnaire, 47 for the final questionnaire

Average weekly carbon consumption by the inhabitants of Lahti city: 21 kg

Individual carbon allowance: between 17 and 22 kg per week at the start of the experiment, defined according to individual criteria (number of children, place of residence, etc.)

Emissions reduction target: initially -25% between the start and the end of the experiment, disrupted by the Covid-19 pandemic

Carbon price used: € 0.10 / kgCO₂, increased to € 0.50 then to € 0.75 / kg CO₂ during certain weeks

Rewards delivered: 175

Total monetary value of rewards delivered: 2,400 euros

²⁷ Interview with Anna Huttunen, May 25, 2021

²⁸ Interview with Anna Huttunen, May 25, 2021

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