TRONDHEIM KOMMUNE
Tråanten tjïelte

NetZeroCities Pilot Cities Programme Cohort 2:
Cities as a Test Bed for Climate Neutrality: Implementing CCS in Waste-to-Energy for a Net-Zero City (CCWaSte4NetZero)

Waste-to-Energy CCS in Climate-Neutral Trondheim

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This report summarises the following work packages in the CCWaSte4NetZero project:

WP3: Citizen engagement and stakeholder involvement (partly)
WP4: The Climate Plan and Climate City Contract
WP6: Strategies to overcome key barriers to climate transition in transport and zero emission construction sites

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May 2026

Trondheim is one of the 112 Mission Cities in the EU Mission for 100 climate-neutral and smart cities by 2030. This report summarises the Pilot Cities Programme (PCP) project activities connected to waste-to-energy carbon capture and storage, one of the most important measures for Trondheim's climate neutrality.

NetZeroCities and Pilot Cities Programme

In April 2022, the European Commission announced the 112 cities selected to participate in the EU Mission for 100 climate-neutral and smart cities by 2030, also known as the **Cities Mission**. The Mission is launched as part of the Horizon Europe programme.

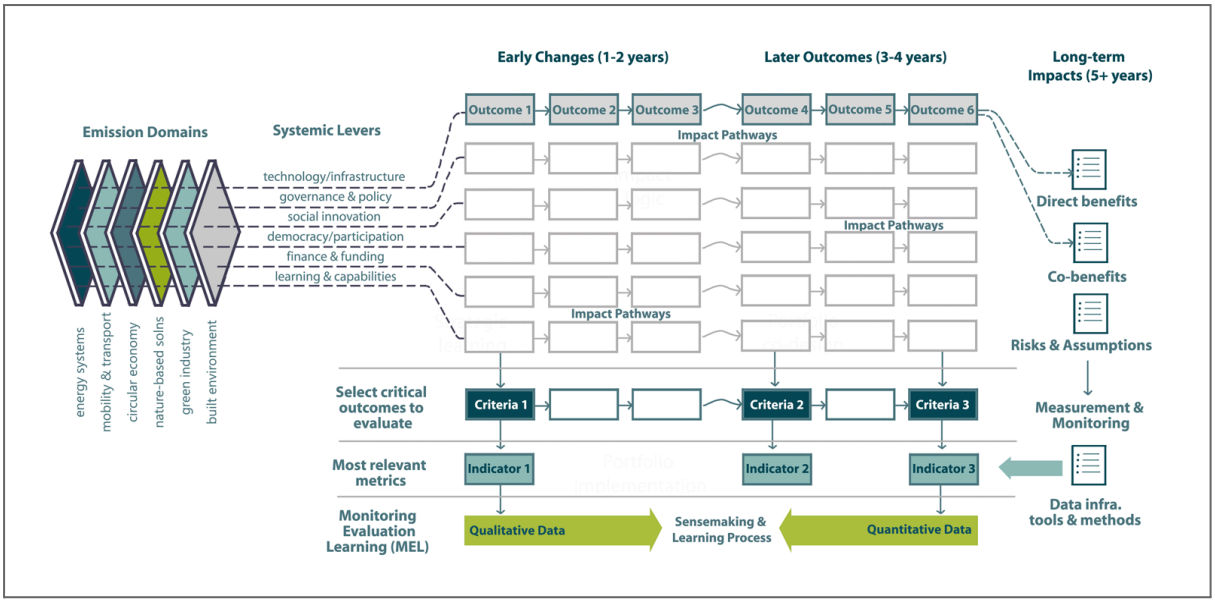
NetZeroCities is the operating platform for the EU Cities Mission (https://netzerocities.eu/). It works as a service-oriented platform and has been designed to help cities overcome the current structural, institutional and cultural barriers they face in order to achieve climate neutrality by 2030. It aims to help European cities by providing them with the support and solutions they need to achieve climate neutrality in a socially inclusive way.

NetZeroCities has taken responsibility to develop and facilitate the following tools and programmes for the climate transition in the 112 Mission Cities and more:

- **Climate City Contract:** The Climate City Contract is used as a roadmap to guide city actions and investments, to continuously evaluate their strengths and gaps and to explore innovative solutions to reach climate objectives while leaving no one behind. The Climate City Contract is both a process and a living document with three interlinked components: Commitments, Action Plan and Investment Plan.
- **Capacity building programmes:** Pilot Cities Programme (PCP), Twinning Learning Program (TLP) and Enabling City Transformation (ECT). Among those, the **Pilot Cities Programme** supports European cities to test and implement innovative approaches to rapid decarbonisation, working across thematic areas and functional silos in support of systemic transformation.

The NetZeroCities impact framework, illustrated in the figure below, outlines the overall process of a Mission City's transformation and its interconnected actions directed towards intended outcomes and impacts. The starting points for this impact framework are the key *emission domains* critical for climate-neutrality. Next in the planning of actions, the *systemic levers* in six different categories overcome the key barriers and challenges within each of the emission domains. The levers amplify and enable *early and later-stage outcomes* and *long-term impacts*, including direct impacts (like sectoral emission reduction), as well as a wide range of co-benefits and risks.

This impact framework is the backbone for "monitoring, evaluation and learning" of the Climate City Contract and the Pilot Cities Programme.



CCWaSte4NetZero - short project intro

Programme Type	NetZeroCities Pilot Cities Programme, Cohort 2 (2023)
Project title	Cities as a Test Bed for Climate Neutrality: Implementing CCS in Waste-to-Energy for a Net Zero City
Project Acronym	CCWaSte4NetZero
Project period	01 May 2024 - 30 April 2026
Project Partners	Trondheim Municipality (lead), Lunera Energi (Statkraft Varme until 01.12.2025), SINTEF Energi, SINTEF Digital

The goal of this pilot project is to solve key barriers to implementing CCS from the WtE-plant. While the project has waste handling, district heating and circular economy as its core domains, the interventions and learning points are also to increase our systemic knowledge and capabilities to overcome other key barriers for climate neutrality.

Project aims:

1. **Develop knowledge, raise awareness and ensure societal and political acceptance** for implementing WtE-CCS as part of the city's ambition of becoming climate neutral
2. Develop **a viable business-model** for implementing WtE-CCS, including financial incentives for biogenic carbon emissions
3. Develop **a roadmap on systemic inclusion of CCS and carbon removals** in cities climate action plans in Europe, including principles for a fair business model
4. Develop the systemic knowledge and capabilities of the city to also **overcome other key barriers** for climate neutrality by 2030

A successful pilot project will to a large extent contribute to the plant owner's readiness to take an investment decision for building a CCS-plant. If implemented, the annual CO_2-emissions in the city will be reduced by approx. 220k tons, of which 90-110k tons are fossil emissions and 110-130k tons biogenic.

The project partnership is based on the **triple helix model**. The close collaboration and interaction between government, industry and research institutions shall bridge the gap between policy, market and research needs for WtE-CCS. The work packages structure the respective roles:

WP 1: Management - Management of the consortium (Trondheim Municipality)
WP 2: Identify barriers and drivers - Understanding the key barriers and drivers in the pilot project (SINTEF Energi)
WP 3 Citizens Engagement and Stakeholder Involvement - Pilot activities towards citizens and key stakeholders (SINTEF Digital)
WP 4: The Climate Plan and Climate City Contract - Aligning the pilot activities with the new climate strategy of the city (Trondheim Municipality)
WP 5: Enabling Sustainable Business Model - Develop a sustainable business model for WtE-CCS (Statkraft Varme/Lunera Energi)
WP 6: Strategies to overcome key barriers to climate transition in transport and zero emission construction sites - Develop a plan on how the learnings can be adopted to other key emission domains in the city (Trondheim Municipality)

Why is waste-to-energy carbon capture and storage (WtE-CCS) important for climate-neutral Trondheim?

The climate inventory from the Norwegian Environment Agency shows that the direct greenhouse gas (GHG) emissions in Trondheim have been reduced by 28% from 2009 to 2024. The politically adopted goal is to reduce emissions by 80% by 2030. This cannot be achieved without carbon capture and storage at the waste-to-energy facility at Heimdal Varmesentral at Tiller. The facility itself accounts for approximately one quarter of total GHG emissions in Trondheim. Three-quarters of emissions in Trondheim come from three sources: transportation (35%), the construction sector (15%) and district heating (25%).

Trondheim's climate management

Here is a summary of Trondheim's climate management, with a list of important local policy instruments or mechanisms for the realization of WtE-CCS at Tiller.

Municipal Energy and Climate Plan
Trondheim has been active in climate governance for over two decades. The first municipal climate and energy plan was adopted in 2001, in light of the Kyoto Protocol in 1997. The plan was then revised in 2010, 2017 and 2024.

In April 2024, Trondheim's fourth version of the Municipal Energy and Climate Plan, Klimaløftene, was adopted by the City Council. The name Klimaløftene can be seen as an extension of Trondheimsløftet, the Municipal Master Plan. It can be translated as our climate pledges for the future. This new policy instrument serves as the strategic foundation for Trondheim's engagement in the EU Cities Mission. The four climate pledges are:

1. Trondheim is Climate-Neutral. Together we create a zero-emission society.
2. Trondheim is Energy-Smart. Together we make the best use of our renewable energy resources.
3. Trondheim is Circular. Together we take care of the resources and create a circular city.
4. Trondheim is Climate-Resilient. Together we create a sustainable society.

"Carbon sequestration for climate neutrality" is one of nine focus areas. "*To become a climate-neutral city, we must cut our direct emissions by at least 80 percent and offset the rest by 2030. In Trondheim, potential capture and storage of CO_2 at the residual waste incineration plant could offset our remaining emissions in time. In addition, we must preserve and enhance our natural carbon stocks in natural and agricultural areas.*"

Climate budgeting

Trondheim Municipality has since 2018, one year after the initiative taker Oslo, included a cross-sectoral climate budget as part of its yearly municipal budget plan. The municipal climate budget provides a useful framework for iterative updates, gathering input from across the organisation, integration of new climate actions, and reporting. The primacy of the budget as a governance tool also gives climate action necessary cross-sectoral buy-in.

In Climate Budget 2026, these two measures are related to the WtE-facility:

K11 Phasing out fossil oil and gas from district heating supply

Waste heat from waste incineration (final treatment of residual waste) constitutes the main supply of energy in the district heating system in Trondheim (approximately 70 percent). There is a particular need for other energy sources in the winter months during periods of high load and for emergency purposes. Fossil energy is still used for this purpose, but Statkraft Varme is working to switch to alternative energy sources, such as bio-oil.

R10 Pilot project on implementing carbon capture at Tiller

Collaboration between Trondheim Municipality, SINTEF and Statkraft Varme, with funding from the EU Cities Mission. The purpose is to help secure a positive investment decision for the facility owner through better understanding of the citizens' attitudes, political room for manoeuvre and possible business models.

Climate City Contract

As one of the 112 cities in the EU's Cities Mission (Climate-Neutral and Smart Cities), Trondheim delivered the first version of Climate City Contract (CCC) in autumn 2024 and was awarded with the Mission Label in May 2025. The CCC details how Trondheim Municipality plans to mobilise various stakeholders in the city and beyond to reach climate-neutrality by 2030.

The Climate City Contract contains three parts: Commitments, Action Plan and Investment Plan. The Commitments were signed by the mayor and the commissioner for Environment, Business Development and Transportation with a statement of support from a selection of key partners. The Action Plan and Investment Plan have a common structure. It describes the current status, specifies paths towards climate neutrality in detail and presents enabling interventions such as regulatory and societal innovation. The documents are comprehensive and contribute to strengthening anchorage and sharing ownership. The CCC is both a mobilization tool and a management tool for Trondheim's climate transition.

With the CCC approved and Mission Label awarded, Trondheim is entitled to support from Climate City Capital Hub. The Capital Hub provides technical assistance, financial advisory and structuring expertise that helps cities shape climate action plans into bankable propositions.

CDP A List: four years in a row

CDP, earlier known as Carbon Disclosure Project, runs the world's only independent environmental disclosure system for companies, capital markets, cities, states and regions to manage their environmental impacts. The CDP-ICLEI track is adopted by NetZeroCities in connection with the Climate City Contract. Trondheim has been reporting to CDP for years. Since 2022 and for four years in a row, Trondheim's climate governance has been recognised by the CDP Cities A List.

738 cities were scored in 2025, with 120 cities receiving an A. CDP A List demonstrates what climate leadership looks like in practice. The cities disclose their climate risks, needs and opportunities; attract investment for priority projects; and showcase replicable, high-impact solutions.

Parliamentary governance model and the Leangen Declaration

June 2024 was a historic moment in Trondheim's political landscape: The municipality turned into the parliamentary governance model after 187 years of chairmanship model. The municipal operation is being restructured, and it takes time for the organisation to adjust to new routines.

After the local election in 2023, the new city government was formed in Trondheim. The Leangen Declaration is the foundation for the new political coalition in position. Even though one of the three founding parties withdrew from the coalition in January 2026, the Declaration still applies. The City Government shall "*contribute to binding investment decisions for carbon capture from point emissions*".

The WtE-CCS value chain

WtE-CCS is addressed as one of the most important climate issues in Trondheim's Climate City Contract: "*Waste-to-energy in Trondheim is a vital part of treating waste produced in the whole of central Norway, dramatically reducing the need for landfill. It also covers approx. 30% of Trondheim's heating needs. In dialogue with the municipality, the plant owner is actively assessing the feasibility of carbon capture at the plant. An assessment has been made about the value chain for carbon*

capture and storage (CCS) in Mid-Norway. CCS would also capture the biogenic emissions from waste incineration, enabling Trondheim to become carbon neutral already with current targets."

Incineration of residual waste

Norway implemented a national ban on landfilling biodegradable and combustible waste in 2009. The waste-to-energy facility in Trondheim, Heimdal Varmesentral, was established and run by Statkraft Varme long before that. It has been in operation for more than 40 years for both effective handling of residual waste and district heating. In December 2025, Lunera Energi took over as the facility owner.

The existing facility serves a substantial region when it comes to waste incineration, managing between 210,000 and 225,000 tons of residual waste annually, from nearly 70 municipalities from Gudbrandsdalen in the south to Saltfjellet in the north. While the exact numbers fluctuate slightly from year to year, the general distribution of the in-coming waste stream is 50% household/municipal waste and 50% from business and/or industry.

Roughly 50% to 60% of the energy produced at Heimdal Varmesentral actually comes from biogenic sources (wood scraps, paper/cardboard fibers that cannot be recycled, and other organic traces). The percentage of biogenic content may vary in the future due to various municipal measures. Trondheim Municipality began rolling out its food waste collection system in spring 2023. In addition, the SESAM post-sorting plant, currently in the detailed engineering and procurement phase, is designed to significantly increase material recovery by extracting various plastic fractions (PE, PP, PET) before the remaining waste is sent to incineration.

District heating in urban energy system

The district heating system in Trondheim is a crucial energy infrastructure, distributing approximately 650 GWh of waste heat through a 250-kilometer network. This system covers one-third of the energy needed for heating in the city. Historically, the utilisation of this energy recovery has successfully phased out numerous local oil and gas boilers. District heating is to-date the "backbone" of a sustainable urban energy system in Trondheim. It acts as a giant thermal battery that contributes to both system flexibility and resource efficiency.

In Norway, where electricity is the primary energy carrier, using electricity to heat space and water during cold winter days can crash the power grid. District heating takes that massive "thermal load" off the electricity grid, freeing up power for things that must have it, like electric vehicles and industry. The district heating network in Trondheim has contributed to 2 billion NOK in savings on electricity grid investments, according to Statkraft Varme/Lunera Energi.

In Norway, municipalities can mandate that new buildings or major renovations within a concession area must connect to the district heating network. For Trondheim, this obligatory connection is a vital policy tool that ensures financial viability for the facility. However, developers can sometimes apply for exemptions if they can prove their alternative (like a local geothermal heat pump) is more environmentally friendly or if the cost of connecting is unreasonably high.

Carbon capture

The WtE-facility is an important urban infrastructure for incineration of residual waste and district heating. At the same time, it accounts for approx. 25 % of Trondheim's direct GHG emissions. Decarbonizing this single emission source is a highly efficient way to scale climate action across an entire population.

Statkraft Varme/Lunera Energi has developed a realistic and mature carbon capture project. Here is a timeline summarizing the efforts made:

- 2020: Statkraft Varme began assessing the feasibility of carbon capture from the WtE-plant at Tiller.
- 2022: A decision was made to move forward with the further development of the Carbon Capture and Storage (CCS) concept.
- 2024: The concept study was concluded: Further work is to focus on increasing both technical and commercial robustness.
- 2025: The ownership of the WtE-plant was shifted from Statkraft to Lunera Energi.
- 2026: Decision on FEED studies pending. New round in Q4 2026.

The new facility owner Lunera Energi took over in December 2025 and decided in February 2026 to put comprehensive technical studies (FEED studies) on hold. Technically, the project is ready for FEED studies covering the entire value chain, but existing commercial conditions do not provide sufficient robustness in the business model. A new decision will be made in Q4 2026 on whether, and if so to what extent, the project should be continued. The original plan was to get CCS in operation in 2030. If it is decided in Q4 2026 to go further, the WtE-CCS plant will not be in operation until 2032.

The detailed regulation of the carbon capture plant site (Østre Rosten 82, 84, 86, 88 og 90) was initiated in 2023 and sent for public hearing in January 2025. The County Governor in Trøndelag had objections on four points. Three points have been resolved. The last one is still to be clarified.

Established in 2020, the KAN-network is a strategic industry collaboration between Norway's largest waste-to-energy plants who aim for CCUS (carbon capture, utilisation and storage) as their climate cure. The individual incineration plants realized they faced the same massive challenges: high costs, complex technology, and a lack of transport/storage infrastructure for CO2, which led them to join forces. The founding members were Statkraft Varme in Trondheim, BIR in Bergen, Forus in Stavanger, Returkraft in Kristiansand, and Hafslund Celsio in Oslo. The network now has 9 members in total. In 2026, the digital handbook "CCS for Waste Incineration" was published. The KAN-network shows that WtE-CCS plant at Tiller is backed by shared technical knowledge and a unified voice toward the Norwegian government for funding and regulation. The WtE-sector shall not be left behind by the national "Longship" CCS project.

Transportation and permanent storage

For transport and storage, CCUS Mid-Norway is a crucial project-based cluster. Statkraft played a leading role in this cluster cooperation. The other industrial partners are Equinor Tjeldbergodden,

Franzefoss Minerals, Wacker Chemicals and Elkem Thamshavn. Phase 1 (2021-2023) was led by SINTEF, and Statkraft took over project leadership in phase 2 (2023-2025). Key results from phase 2, launched in February 2025 during this PCP project, covered concept selection for permanent storage sites and local port infrastructure, cost optimisation and policy recommendations.

To conclude:
The studies and assessments so far prove that WtE-CCS in Trondheim is technically feasible. The remaining challenge is the commercial gap. More details are addressed in the WP5 report made by Statkraft Varme/Lunera Energi.

WtE-CCS shall not be a hinder for circular economy

Some argue against WtE-CCS and point out that the costly investment may hinder the development of a circular economy. This shall not be the case in Trondheim. Both the municipality and the WtE-facility owner are aware of the priorities. Circular economy is about reducing our consumption of resources and ensuring that as much waste as possible can be recycled and used in new production. But, there is still residual waste that can't be recycled. In Norway, the residual waste is incinerated for energy recovery. In this case, CCS is our best option for cutting GHG emissions from the waste-to-energy process.

One of the three societal development goals in Trondheimsløftet, the Municipal Master Plan, is "*Trondheim shall assume responsibility for a greener and more circular city*". In addition to the Municipal Energy and Climate Plan mentioned, there is a comprehensive mix of policy instruments for better resource management, which covers areas such as waste, nature, food, agriculture, buildings and construction, public procurement, sustainable value creation and the municipal library service. Among the existing programmes and activities, we shortly describe the following:

<u>Municipal waste management</u>
The Municipal Waste Plan was adopted by the City Council in 2019, and the revision is currently in the initial phase. The Waste Plan lays the foundation for overall and long-term waste management and covers the municipal responsibility for household waste, waste from municipal operations and waste from public spaces.

In 2025, Trondheim Municipality delivered approx. 22,500 tons of residual waste for incineration. Lunera Energi is a private company. It is not possible to ensure that residual waste from households in Trondheim will be delivered to this facility. The choice of facility is decided through a public procurement procedure.

In Trondheim, we have differentiated waste fees. The amount of waste fee depends on the quantity, ie. the size of the subscriber's container for residual waste. The practice is designed with an intent to stimulate increased source separation, and thus increased recycling. The fees charged to residents must cover the actual, necessary costs of managing household waste—nothing more, nothing less. It is to be debated politically and societally whether CCS counts as "necessary".

From Waste to Resources - Trondheim's ECT-pilot

"From Waste to Resource" (2023-2030) is Trondheim Municipality's project portfolio for circular economy and waste reduction. It consists of various projects and is financed by the municipal business fund and external financing. The portfolio functions as a catalyst and door-opener for collaboration among researchers, business and various municipal units. It covers categories such as plastics, textiles, construction masses and food waste, with the main goal to create more green jobs and circular services.

"From Waste to Resource" is the Trondheim pilot for portfolio management in the ECT project "Empowered Governance". Enabling City Transformation (ECT) is one of three capacity building programmes run by NetZeroCities. We seek project synergies and plan joint sessions.

Action Plan for Circular Economy - kick-off

The importance of circular economy is rising on the political agenda of the EU. The geopolitical situation results in an escalating fight for resources. In April 2026, Trondheim Municipality kicked off its work to draft the Action Plan for Circular Economy, a tool to deal with overlapping societal crises and challenges. The plan shall build upon existing practices and state-of-the-art knowledge, with efforts and participation from various municipal units.

The triple helix partnership

The project consortium consists of 4 partners: Trondheim Municipality (public authority), Statkraft Varme/Lunera Energi (plant owner), SINTEF Energi and SINTEF Digital (research institutions). The two SINTEF-organisations are separate jurisdictional units but belong to the same "SINTEF-family".

The waste-to-energy facility in Trondheim is fully private. It was owned and operated by Statkraft Varme AS. During the project period, the business unit was announced for sale. In December 2025, the new owner Lunera Energi AS took over. This private ownership is quite unique among similar WtE-facilities.

As previously described in "The WtE-CCS value chain", Statkraft Varme/Lunera Energi has taken an active role in CCS. In addition, SINTEF is also highly CCS-competent. For several decades, SINTEF has collaborated closely with industry on a broad range of technologies to develop solutions for carbon capture, storage and utilization. They bring insights and expertise from several international and national projects such as ACCESS, CaptureX, CCUS Mid-Norway and CircWtE. Every other year, SINTEF organizes TCCS - the leading scientific conference on carbon capture, transport and storage in Trondheim. The 13th round was held in June 2025.

In June 2023, a collaboration agreement on WtE-CCS was signed between Trondheim Municipality and Statkraft Varme. This PCP project is an extension of the collaborative work. In December 2019, the top executives from Trondheim Municipality and SINTEF also signed a collaboration agreement, where "climate, environment and circular economy" is one of the strategic focus areas identified. These agreements formed a good foundation for project partnership, and the PCP project enabled and strengthened the triple helix partnership for WtE-CCS in Trondheim.

Citizen engagement and stakeholder involvement

"Just Transition and Public Health" is one of nine focus areas in the Municipal Energy and Climate Plan. "*We will promote equity and solidarity in the fight against climate change. We will conduct inclusive and fair processes and design energy and climate measures that avoid increasing social inequalities and preferably enhance social sustainability.*"

In choosing methods for citizen engagement and stakeholder involvement, we assume that there is no question too complex. It is important to involve citizens early, ensure their integrity and be open to the input and advice they provide. There can be a thin line between manipulation and real democratic impact, and crossing that line can have consequences for the municipality's credibility and reputation.

Annual climate survey

Since 2017, we have conducted annual climate surveys with 1000 respondents amongst citizens in Trondheim. Overall, the survey shows that our goal to make the city climate neutral has good support amongst the citizens - with an impressive 87 % stating it is "very important" or "important" in 2017. The support has declined to 71 % in 2025, of which 28 % states the climate goal is "very important". This trend is also observed in both national and international surveys. When it comes to CCS, 55% of the respondents support the idea of WtE-CCS in Trondheim. 35% are positive to increasing waste fees to help finance it.

Citizens' assembly on carbon capture and storage (CCS)

In June 2025, Trondheim Municipality organised a citizens' assembly asking advice on how to implement WtE-CCS in a way that is sustainable and fair for all. The assembly followed the OECD-principles and was financed as activity in this PCP project.

The assembly's 15 recommendations provided valuable insights on the citizen's concerns, and were formally presented to the City Council shortly after. The new management of the WtE-plant has invited representatives from the assembly to present and discuss the recommendations as part of their final investment decision.

The citizens' assembly paid a lot of attention to co-benefits and just transition issues in their recommendations with statements like "do no significant harm", and "the decision-making processes must be transparent" and "it's paramount to ensure that CCS does not result in extra burdens for low-income families". Furthermore, they were concerned that CCS could be a "sleeping pillow" for other climate mitigation measures, and stressed the importance of circular economy and nature's capacity as carbon sinks.

In addition to citizen engagement, Trondheim Municipality has also been active in strengthening multi-level governance and networking among city peers, in order to improve the framework conditions for WtE-CCS.

Dialogues with other levels of government

In September 2025, the PCP project team made a presentation entitled “CCS in climate-neutral Trondheim” for the Committee for Preparedness, Climate and Nature in the Trøndelag County Council. Later that day, the council members visited Heimdal Varmesentral for a site visit.

In October 2025, the Commissioner for Environment, Business Development and Transportation from Trondheim Municipality sent a written response to the public hearing of the National Budget 2026, emphasizing the need for a better regulatory framework for carbon capture and storage (CCS) at waste incineration plants.

In February 2026, the Norwegian Environment Agency launched their annual report “Climate Measures 2026” and pointed out CCS as a vital action for the Norwegian climate targets. The local politicians in Trondheim have received visits from their colleagues in the Norwegian Parliament or Ministries to the WtE-facilities from time to time.

Dialogues and collaborations with other cities

The KAN-network is an industry collaboration for WtE-facilities in different cities. The four biggest cities in Norway, Oslo, Bergen, Trondheim and Stavanger have also established a climate forum for information exchange and collaboration. So far, Oslo is the only Norwegian city that has reached Final Investment Decision (FID) for WtE-CCS. The Oslo CCS at Klemetsrud, run by Hafslund Celsio, is part of the national Long Ship project. It is planned for operation in Q3 2029.

Stavanger is another Norwegian city active in CCS. Stavanger and Trondheim are partners in the earlier-mentioned ECT project “Empowered Governance”, in which Stavanger’s pilot is CO2 management. In addition to WtE-CCS, their industrial partners also aim for commercial potential within transport and storage offshore.

Trondheim and Stavanger jointly took a study trip to Öresundskraft in Helsingborg, Sweden in November 2025. We learned about their project Innozhero financed by the European Innovation Fund. The highlighted issues were policy context, value chain, business model and citizen communication.

NetZeroCities peer-to-peer CCUS sessions

NetZeroCities is the platform that facilitates capacity building and information exchange between the 112 Mission Cities. The peer-to-peer sessions on CCUS were initiated in spring 2025. Most of the participating cities are from the Nordic region. Trondheim has participated actively. This PCP project has been featured twice in the program, in February and April 2026.

Systemic levers for WtE-CCS

Among the six systemic levers in the NetZeroCities impact framework, we select the following to elaborate for WtE-CCS in Trondheim.

Governance & policy

Over time, carbon capture and storage/utilisation (CCS/CCUS) has steadily risen on the political agenda and is now recognized as a necessary measure for achieving cities' climate targets. Multi-level governance is essential for the success of CCS/CCUS projects. SINTEF Energi has led the effort to analyse the impact of policies across EU, national, and local levels (WP2).

This PCP project has provided Trondheim Municipality and the involved partners with a deeper understanding of how governance and policy act as systemic levers for WtE-CCS. This insight indicates how to effectively influence and participate in future policy development.

A lot of key legislation and framework currently is under development at both EU and national level. The possible inclusion of WtE-plants in the EU ETS-system is still to be decided (most likely by mid-2026). The revision of the EU ETS-system is crucial for stable framework conditions for investment. In Norway, if the national parliament decides to implement a reverse tax scheme for capture and storage of biogenic CO2-emissions from 2027, that would contribute to removing remaining barriers for the further implementation of WtE-CCS in Trondheim.

Finance & funding

Lunera Energi, the WtE-plant owner in Trondheim, has calculated the CAPEX and OPEX of CCS, including the entire process from capture to transport and permanent storage (WP5). Currently, the projected revenues are not enough to cover these costs, and a long-term, self-sustaining business model is still being developed. Although the municipality does not own a stake in the plant, we have participated actively in exploring solutions for a viable business model. We also make continuous efforts to persuade national authorities to establish financial schemes that enable Lunera Energi and other WtE-plants in Norway to make the final investment decision.

This PCP project has given us valuable insights about what is needed to make WtE-CCS possible. Finance and funding is identified as the bottleneck. We are currently in dialogue with the Climate City Capital Hub to explore how to make WtE-CCS more "bankable". Can the municipality contribute to improving the project's financial profile one way or another, such as by lowering investment risks and facilitating access to lower-interest capital for the plant owner? In addition to WtE-CCS, we also seek assistance from the Capital Hub for the investment of shore power solutions for cruise ships.

Traditionally, municipalities only work with financing their own projects. However, as estimated by NetZeroCities, 80–90 % of the investments required for a city to reach climate neutrality come from other stakeholders than the municipalities themselves, such as private businesses and national authorities. We need more knowledge and competence on how the city can contribute to making critical climate projects, which we do not own, financially sustainable. The experience gained here will be used to further operationalise the Investment Plan in our Climate City Contract.

Democracy/participation

Trondheim has ambitious climate goals to reduce our GHG emissions by 80% and become climate neutral. The major emission domains, including transportation, buildings and construction and

the waste-to-energy facility, are closely connected to the citizens' everyday life. We need to involve and engage the citizens in decision making for lasting behavioural changes.

The municipalities have a particular responsibility to facilitate the democratic processes which the climate transition should build upon. The citizens shall be invited to envision and co-create the climate-neutral future. We need to strengthen our capacity in various participatory methods. This round of citizens' assembly was a highly valuable learning process. Through the PCP project, we had the possibility to work together with the leading researchers and practitioners in this field, such as Arild Ohren (DemSoc and NTNU) and SoCentral. With the insights and knowledge gained, we shall actively look into how we can further adopt participatory methods in our municipal routines. We shall also disseminate our experiences in relevant arenas. Among others, the research project Democratic Innovations and Responsive Politicians (DEMRE) has followed our work with interest.

Learning & capabilities

NetZeroCities published a story about Trondheim's PCP project in July 2025. Somewhat repetitive, but here is how our work has been highlighted regarding "what carbon capture is teaching Trondheim about climate transformation":

(1) **Learning to think like a business.** *The lack of ownership has placed the city in a role of orchestration and matchmaking. To do this job effectively, Trondheim Municipality is embedding itself in the decision-making logic of the plant owner and trying to understand what a viable business case for CCS would look like.*
Workshops they organised with Statkraft and SINTEF, a leading Norwegian research institute, revealed how business decisions heavily depend on factors like operational costs, timelines and emerging carbon markets. By bringing this experience into the municipality, Trondheim is positioning itself to work more efficiently with companies and increase the number of such partnerships in future.

(2) **Listening to citizens.** *Trondheim municipality hosted a citizens' assembly and invited a randomly selected group of residents to take part in a series of four workshops focused on one key question: How can the CCS project be implemented in a way that is socially just and publicly understandable? All four workshops took place in June, with citizens presenting their recommendations to the city government. This was not the first citizens' assembly, but this time Trondheim Municipality aims for institutionalisation of this method. The results will lead to more spaces for community engagement in municipal decision-making across the whole organisation.*

The employees of Trondheim Municipality and the politicians are important stakeholders in understanding the importance of CCS for Trondheim's climate transition. We are in the process of developing digital training modules addressing climate change, circular economy and industrial and natural carbon dioxide removal (CDR) with employees and politicians as target groups (WP3).

SINTEF Digital has put together a roadmap for building public and societal acceptance for WtE-CCS in Trondheim, Norway. It is designed for both policymakers and academic readers, integrating

local, national, and European policy frameworks alongside structured short-term (to 2030) and long-term (to 2050) actions (WP3).

Key learnings for other emission domains

Approx. three-quarters of Trondheim's direct GHG emissions come from three sectors: energy supply (WtE-facility), road traffic (transportation) and mobile combustion (construction sites). These sectors will remain prioritized towards 2030. WP6 of the PCP project examines how the learnings can be made relevant for other emission domains.

Citizens' assemblies for other emission domains?

Citizens' assemblies can be an important supplementary element in the democratic process. Ordinary citizens are invited to discuss a matter of political significance, after which their recommendations can form part of the political decision-making basis. It must be addressed that citizens' assembly is a resource-intensive instrument. Good implementation requires considerable effort from the organizers and the participating citizens, before, during, and after the event. If the results are to make an impact on decision-making, political anchoring and follow-up are required.

Carbon capture and storage is a complex climate measure that will affect the local community in various ways. However, measures for the transport sector may seem more intrusive. Taking the introduction of zero-emission zones for vehicles as an example, while we expect a positive effect on GHG emissions, it also prevents fossil fuel vehicles from accessing these zones. This could potentially arouse frustration and resistance among the citizens. Other examples of intrusive transport measures are a reduced number of parking spaces and/or increased parking fees.

Here is our evaluation about citizens' assemblies as a participatory method:

- It can be useful for medium-scale interventions in the transport sector, including parking policy, expansion of bus lanes, and redesign of city streets, but less suitable for large infrastructure projects, such as regional highways, due to limited local authority or the complexity of the project.
- It is a less relevant method for measures such as implementing zero-emission construction sites. This is because the measure is less visible and affects citizens to a lesser extent, and because the recommendations may have limited influence on national regulation and enforcement.

Key learning points for other emission domains

Trondheim Municipality has ambitious climate goals to become climate neutral. The Municipal Energy and Climate Plan sets the strategic guidelines towards 2030, while the Climate Budget shows the measures in detail. Several of the measures in the Climate Budget can be described as powerful, and those may be perceived as intrusive, both towards citizens and the business sector. Examples of this include the introduction of zero-emission zones for all types of road traffic, zero-emission construction sites, zero emissions for ferries, fast ferries, passenger boats, prohibition of fossil fuel use in non-quota obligated industry, etc. To implement these measures, various preconditions identified in this project must be met:

- The measures must be anchored in **strategic and overarching goals**. They must be recognized as real emission sources and systemically integrated into climate governance tools.
- **Regulatory and economic frameworks** must be in place. For example, legal authority must be granted for the introduction of regulations for implementing zero-emission zones for transport and zero-emission construction and civil engineering sites, and support schemes must be established to reduce investment risk. The schemes must be predictable and long-term.
- The introduction of powerful and intrusive measures will require **cooperation and knowledge development** among authorities, the business sector, research and development, and citizens, to foster understanding and shared commitment.
- Finally, it is critical to ensure **public trust and political/regulatory support.** This is to secure the measures the necessary legitimacy and anchoring required for success criteria to be achieved.

Activities in other emission domains - integration with CCC

Trondheim does not have plans to revise the Climate City Contract as a whole, if not required by NetZeroCities or EU Cities Mission. The Investment Plan may be revised or supplemented, depending on our on-going exchange and collaboration with Capital Hub. Our Climate City Contract is an operating tool for reaching the overarching goals in the Municipal Energy and Climate Plan. The implementation of the climate measures are planned and revised annually in the Municipal Climate Budget. The learning points summarized above will be taken into consideration for the improvement of the existing routines.

Moving forward

Trondheim Municipality and the project partnership shall continue to make efforts for the realization of WtE-CCS in Trondheim. Here is a summary of our key action list:

- Dialogue and collaboration with Lunera Energi and Capital Hub: Consider engaging Capital Hub for strategic advice on how to de-risk the WtE-CCS-project to improve its bankability.
- Advocating for national supporting schemes - Enova and more.
- Update and influence: EU ETS and market for biogenic quotes.
- Dialogue and collaboration with other cities:
    - Join forces with Stavanger (Trondheim's ECT partner) and a few other important Norwegian cities to advocate for enabling regulatory framework at national level.
    - Networks like Nordic Carbon Removal Association and City CDR Initiative
- Evaluating Trondheim's take on the newly launched JRC Guidance on negative emissions for cities

Appendix 1: CCWaSte4NetZero deliveries

Trondheim's climate management

WP4/ACT29: As one of the 112 chosen Mission Cities, Trondheim will deliver a Climate City Contract with 3 main elements: Commitments, Climate Action Plan and a Climate Investment Plan
WP4/ACT31: Integrating pilot activities with the climate budget to be proposed for the fiscal year 2025

WtE-CCS and circular economy

WP4/ACT28: Integrate state-of-the-art knowledge on circular economy and material and resource flows, in order to secure a holistic approach and systems thinking regarding WtE-CCS

Citizen engagement and stakeholder involvement

WP3/Del 11 (ACT 17/18/20/21/23/24): Summary of learning from stakeholder dialogue meetings, city twinning activities, co-creation workshops and meeting with Citizens Assembly
WP4/ACT32: Evaluate co-benefits and just transition issues

Systemic levers for WtE-CCS

WP4/ACT30: One of the key barriers to be addressed in the climate plan and climate city contract, is CCS for the waste incineration plant. Citizens engagement and stakeholder involvement (WP3) and a sustainable business model (WP5) are key inputs in this regard.
WP4/ACT33: Update version 2.0 of climate Investment plan for the city

Key learnings for other emission domains

WP6/ACT45: Evaluate to what degree a "citizens assembly" could be a useful tool for the two specific emission domains (transport, zero construction sites)
WP6/ACT44: Assessing the strategies outlined in the climate and energy plan, compared to learning points from the pilot activities described in WP 2-5
WP6/ACT46: Implementation of plan/activities towards these other specific emission domains, if decided, would be integrated in a revised version of the Climate City Contract

Appendix 2: Municipal climate policy documents

Municipal Energy and Climate Plan (Klimaløftene - kommunedelplan for energi og klima)

Municipal Climate Budget 2026 (page 12-27 in the Municipal Budget Plan 2026)

Trondheim's Climate City Contract

The Leangen Declaration (Leangenerklæringen 2024-2027)

Appendix 3: Timeline of key project-relevant activities

Apr 2022	Trondheim selected as one of 112 Mission Cities
Jun 2023	Trondheim Municipality and Statkraft Varme AS signed collaboration agreement
Apr 2024	Municipal Energy and Climate Plan adopted by the City Council
May 2024	**PCP CCWaSte4NetZero project start**
Jun 2024	Trondheim into the parliamentary governance model
Oct 2024	Trondheim's first Climate City Contract delivered
May 2025	Mission Label awarded
Jun 2025	The 13th Trondheim CCS Conference (TCCS)
Jun 2025	Citizens' assembly on carbon capture
Oct 2025	1st roundtable with Capital Hub
Dec 2025	Ownership transferred - Statkraft Varme AS became Lunera Energi AS
Feb 2026	Lunera Energi decided to put FEED decision on hold
Apr 2026	**PCP CCWaSte4NetZero project end**
May 2026	2nd roundtable with Capital Hub (Nordic Edge Expo)