## TOWARDS CARBON-NEUTRAL CIRCULAR ECONOMIES AT THE REGIONAL LEVEL

The City of Turku aims to become carbon neutral by 2029 and climate positive with negative net emissions thereafter. This ambitious goal is supported by deep decarbonization measures, carbon sinks and a strong commitment to circular economy practices at the regional level. Drawing from experiences and best practices in Turku, this document explores:

- > How the circular economy supports climate action and the key role of cities and regions
- > 3 pathways to cut GHG emissions through circular economy measures at the regional level
- > Regional collaboration as a cross-cutting enabler of carbon-neutral circular economies



## Indirect emissions: The blind spot of current mitigation efforts

To date, most of the policy discussions and investments around climate action have focused on decarbonizing production systems and increasing energy efficiency. These efforts are crucial to meet the goals of the Paris Agreement but do not sufficiently address emissions deeply embedded in the materials and products flowing within the economy. It is estimated that about 50 percent of total greenhouse gas emissions are caused by resource extraction and processing (International Resource Panel, 2019).

From extraction to manufacturing, transport, distribution and disposal, materials and products produce substantial emissions all along their lifecycle. These emissions are called indirect emissions, as they are a consequence of the activities of a specific entity, but are not owned or managed by this entity. Indirect emissions arise across different geographical boundaries and actors, which makes them particularly difficult to calculate and manage.

## How the circular economy can help

Currently only nine percent of the materials flowing through the global economy are revalorized (Circle Economy, 2019). This means that all the energy and resources that went into producing the other 91 percent are wasted after a single use.

By prioritizing regenerative resources, preserving what is already made, using waste as a resource or generating new business models (e.g. as-a-service models, sharing platforms), the circular economy allows operationalizing action on emissions across direct and indirect sources and helps achieve carbon neutrality targets. A recent study by Sitra concluded that improving the use of key materials that already exist in the economy can take the EU industries of steel, plastics, aluminium and cement halfway towards net-zero emissions (Sitra, 2018).

## Cities have a crucial role to play in addressing indirect emissions

Home to over 50 percent of the global population and economic and industrial hotspots, cities are responsible for 70 percent of greenhouse gas emissions (UNFCCC, 2017) and 75 percent of natural resource consumption worldwide (UNEP, 2017). From impacting supply chains through **public procurement to integrating sustainable resource management and planning into their policies**, cities play a crucial role in implementing circular economy measures that mitigate embedded emissions.

Experiences from the City of Turku demonstrate how circular economy measures can help operationalize systemic climate action.

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## **REGIONAL CIRCULAR ECONOMY TOOLS FOR CARBON NEUTRALITY**

The circular economy offers an **implementation-oriented framework to mitigate climate change** through the three main pathways below. When implemented in combination, these pathways have the potential to cut carbon emissions in a systemic way. At the same time, they also yield **multiple co-benefits**, such as job creation and increased economic competitiveness.

Pathway 2 -

New clean

sources of

energy

#### Pathway 1 -Closing resource loops across value chains

Re-circulating materials, building efficiency in the design of products and infrastructures or generating business models that build on pooling or cascading resources represent different means through which the circular economy reduces new production needs as well as related energy demand and carbon emissions (Sitra, 2018).

Best practice example from Turku: As the principal owner of the non-profit company Turku Science Park Ltd, the city of Turku has been supporting a number of private sector circular economy initiatives in the region. An example is the Smart Chemistry Park (SCP), located in the neighboring municipality of Raisio. The SCP is an industrial symbiosis project which offers an on-site platform for 14 companies working in the chemicals industry to identify synergies. Companies share the cost of the common facilities and have access to expertise on chemical safety and patent engineering.



Climate mitigation and adaptation require energy systems powered by low carbon sources that are resilient enough to face supply shocks. Energy recovery from organic waste and wastewater is a cost-efficient way to generate energy through under-utilized waste resources.

Best practice example from Turku: The Kakolanmäki Waste Water Treatment Plant collects and treats the wastewater coming from Turku and thirteen neighbouring municipalities. Two heat pumps utilize wastewater heat to produce district heating and cooling for 15,000 households. Sludge from the plant is used for biogas production, serving local electricity, heating and transport needs through a carbon-neutral source. These wastewater activities produce ten times more energy than they consume.



## Pathway 3 -Protecting carbon sinks

Powered by regenerative resources and aimed at protecting the long-term ability of ecosystems to provide key services, the circular economy is an effective tool to protect natural carbon sinks such as oceans, forests and soils. For instance, allowing nutrients to be cycled back into soil through composting practices ensures that soil retains as much of the carbon trapped in the ground as possible.

Best practice example from Turku: Prior to the installation of the Kakolanmäki Waste Water Treatment Plant, waste water was collected separately by fourteen municipalities in the region and nutrients capture for recovery wasn't maximized. As a result, the Turku marine area was characterized by substantial phosphorous, nitrogen and suspended solid loads. Centralizing all municipal wastewater treatment plants in one location at Kakolanmäki has resulted in fewer load point centres. Furthermore, nutrient recovery practices have led to an 83 percent decrease in phosphorous load in the Turku marine area, which has had a positive effect on water quality in the Baltic Sea.

## LEADING CLIMATE ACTION AT THE LOCAL LEVEL

In order to become carbon neutral, the Turku area strives to reduce greenhouse gases by 80 percent compared to the 1990 level by 2029. From 2029 onwards, Turku aims to become a climate positive area with negative net emissions (meaning that compensation will be greater than emissions).

Turku's Climate Plan 2029 is articulated around five mitigation measures (outlined below), which link directly to the circular measures outlined in the previous page.











#### Carbon neutral energy system

The heat, cold, steam and electricity used in the Turku area will be produced in a carbon neutral manner at the latest in 2029. Smart solutions and energy efficiency will be leveraged in the development of energy systems in the Turku region.

#### Low carbon mobility

The city is promoting active mobility and developing public transport and cycling infrastructure. The city is also investing in electric mobility, in mobility as a service solutions and in low emission logistics.

#### Sustainable urban structure

The City of Turku is steering an urban structure conducive to sustainability through zoning, land use, traffic planning and related development projects. Sustainable construction is developed and promoted.

#### City's climate responsibility

Turku City Group's subsidiaries are obliged to focus on the lifecycle climate and environmental impacts of their investments. Subsidiaries also participate in the implementation of an assessment model in collaboration with the City of Turku.

#### Strengthening carbon sinks

The City of Turku increases the carbon absorption capacity of vegetation and soil through various measures: increasing the number of green areas, maintaining forests, fields and the amount of vegetation in various areas of the city.

## Circular Turku: Collaborating for resource wise climate action at the regional level

The City of Turku and its surrounding region host a vibrant ecosystem of circular economy actors and front-runner initiatives that contribute to local climate action and sustainable resource management. The city is eager to work together with these actors to create a roadmap towards resource wisdom and carbon neutrality. Supported by the Finnish innovation fund Sitra, the Circular Turku project aims to design replicable tools for local governments to operationalize the circular economy in an inclusive and collaborative manner. These learnings will be shared through ICLEI's global Green Circular Cities Coalition, which connects cities, experts, businesses, and other relevant stakeholders to foster urban circular economy transitions.



## Regional collaboration as a cross-cutting circularity enabler

- Increased agency: Implementing circular economy measures implies linking sectors that are usually siloed. These areas may be under the jurisdiction of different departments, municipalities or levels of governments. Regional collaboration increases the ability of individual municipalities to bring sectors together on circular economy initiatives.
- Reaching a critical mass: Regions offer an appropriate scale to effectively manage material use in carbon intensive categories (construction materials, chemicals, textiles, etc...). Taking a circular regional approach can minimize material use in a cost-effective manner.
- **Pooling resources:** Circular infrastructures such as the Kakolanmäki Waste Water Treatment Plant lead to long-term costs savings but are often linked to a higher upfront investment than traditional projects. Collaboration among different municipalities allows cities and districts to pool resources to finance upfront costs.
- Networking for innovation: Circular projects often need to think outside the boundaries of linear systems and innovate. The convergence of a diverse set of actors, such as universities, businesses and community initiatives, within regions offer opportunities for circular innovation and synergy between different actors (e.g. for the purpose of industrial symbiosis).

## Conclusion

Opportunities for more circular use of materials deserve a central place in climate policy at the local level. Circular economy opportunities should be incorporated alongside renewable energy supply, emission reduction in transport and heat, and energy efficiency. The circular economy is one of the main priorities of Turku and Southwest Finland, with initiatives already implemented that successfully cut carbon emissions. These initiatives demonstrate the pivotal role regional collaboration plays in designing carbon-neutral circular economies.

## References

Circle Economy (2019) The circularity gap report 2019. <u>https://www.circulari-ty-gap.world/</u>

International Resource Panel (2019) Global Resources Outlook: Natural resources for the future we want. <u>https://www.resourcepanel.org/reports/global-resources-outlook</u>

Sitra (2018) The Circular Economy a Powerful Force for Climate Mitigation Transformative innovation for prosperous and low-carbon industry. <u>https://</u> media.sitra.fi/2018/06/12132041/the-circular-economy-a-powerful-force-for-climate-mitigation.pdf

UNEP, 2017. Resilience and Resource Efficiency in Cities. <u>https://wedocs.unep.org/</u> <u>bitstream/handle/20.500.11822/20629/</u> <u>Resilience\_resource\_efficiency\_cities.</u> <u>pdf?sequence=1&isAllowed=y</u>

UNFCCC, 2017. Urban environment related mitigation benefits and co-benefits of policies, practices and actions for enhancing mitigation ambition and options for supporting their implementation. <u>https://unfccc.int/resource/climateaction2020/media/1308/Urban\_Environment\_17.pdf</u>

## **Partners overview**



#### **City of Turku**

Located in Southwest Finland, Turku is Finland's oldest city and a global frontrunner for climate action.

•I.C.L.E.I Local Governments for Sustainability

### ICLEI – Local Governments for Sustainability

is a global network of more than 1,750 local and regional governments committed to sustainable urban development.

# SITRA

#### Sitra

is the Finnish innovation Fund focused on improving the well-being of Finnish residents towards a fair and sustainable future.

