CENTRE FOR CIRCULAR ECONOMY

Towards a low-carbon and resource-efficient circular economy in the Arctic: Case example of industrial circular economy flows in Kemi Arctic region

DIGIPOLIS

Digipolis – Kemi Technology Park

The Circular And Bioeconomy Centre

Arctic Industry and Circular Economy Cluster

Circular Economy – Industrial perspective

Image: European Parliament

THIS IS HOW WE CREATE A

Circular economy

IN FINLAND

1. **Sustainable food system**
2. **Forest-based loops**
3. **Technical loops**
4. **Transport and logistics**
5. **Common action**

Use

The product should be used for as long as possible, it must be serviced and repaired and parts changed when necessary.

Consumer

Consumer demand creates a supply of sustainable products and commodities.

From company to company

Companies will procure and require their subcontractors to provide parts that can be easily repaired – instead of single-use parts.

Retail

Retailers will sell services instead of goods and inform customers about maintenance and repair services, environmental impacts, materials and further use in the final phase of the life cycle.

Distribution

Transport co-ordinated between different sectors, renewable fuels and jointly owned transport equipment will be used in distribution.

Manufacturing industry

Long-term products that can be repaired and maintained will be brought onto the market.
Materials will be separated at the end of the product's life cycle.

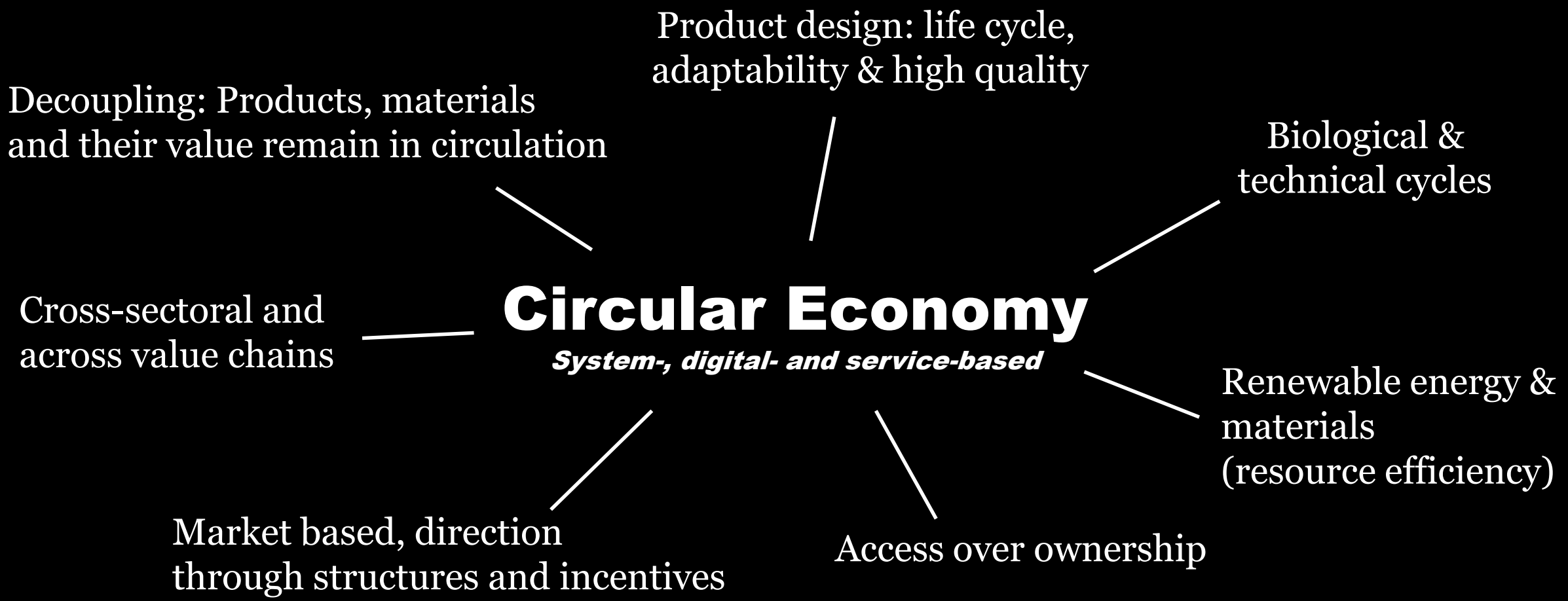
Material processing

Process planning will reduce the energy needed to refine huge amounts of raw materials. The use of side streams will be taken into consideration.

Primary sector (raw materials sector)

The raw materials are capital for the primary sector. Sustainable solutions are based on the wise use of raw materials.

SITRA



Sources: Ellen MacArthur Foundation, Sitra

SITRA


Digipolis -
Kemi Technology Park

Digipolis- Kemi Technology Park: Development company and cluster organisation

- **Digipolis Kemi**, established in 1993
- Owned by the cities of Kemi & Tornio,
- the University of Oulu and municipalities of Simo, Keminmaa and Tervola
- 50 companies, 500 employees in the technology park – network of more than 160
- industrial service businesses in Lapland, more elsewhere
- Development actions and services:
  - Team of 14 persons + service providers
  - Innovative environment especially for industrial service businesses

New openings: **2008-2016 Expertise on Arctic conditions & Industry, novel wood constructions: CLT development platform**

2012- Ecosystem of the Arctic Industry - Innovation Platform

2014- Arctic Industry and Circular Economy Cluster management

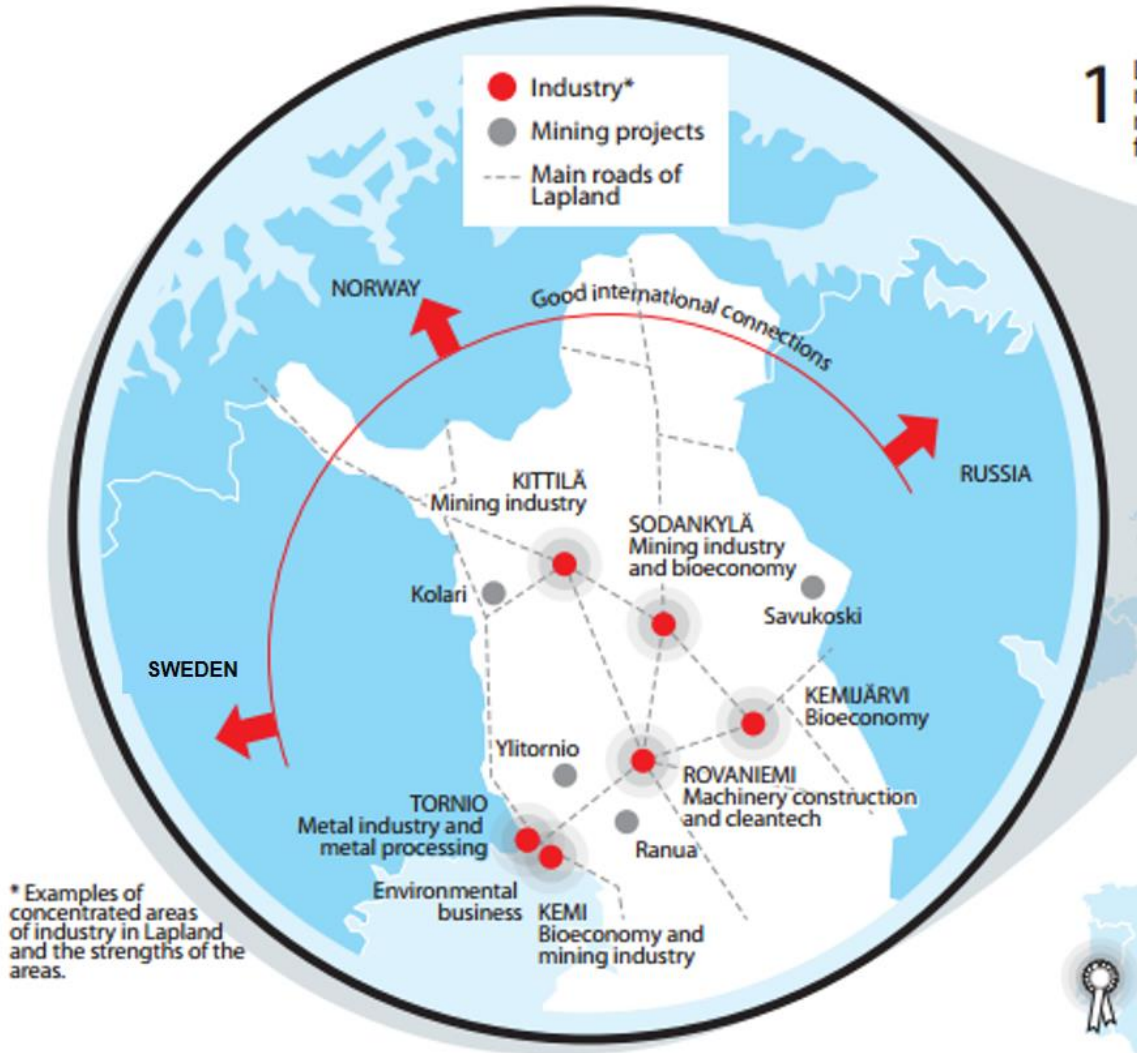
2016- Digipolis chosen as key actor in national circular economy roadmap and implementation of the key project activities

2017- Establishment of Centre for industrial circular economy

- Start-Up, Business Incubation, Business Growth, Invest In services
- 21 ongoing development projects, 584 companies and organisations

DIGIPOLIS KEMI LAPIN AMK Lapland University of Applied Sciences

DIGIPOLIS



* Examples of concentrated areas of industry in Lapland and the strengths of the areas.

1 LAPLAND WAS ELECTED one of the model areas for cluster development in Europe last year, along with five other European top areas.

2 THE ELECTED AREAS have the task of developing a new European cluster model which utilises the existing natural strengths of the participants in the areas extensively.

Lapland's strengths include
A. Stable society
B. Great infrastructure
C. Management of Arctic conditions
D. Diverse natural resources

3 SUSTAINABLE NATURAL RESOURCES processing cluster work is continued in Lapland with the Arctic Business Concept (ABC) project. Especially, the development of the competitiveness, sustainable growth and internationalisation of small and medium-sized companies is supported in this cross-disciplinary cluster.

Modern Cluster of Arctic industry – Sustainable utilisation of the arctic natural resources

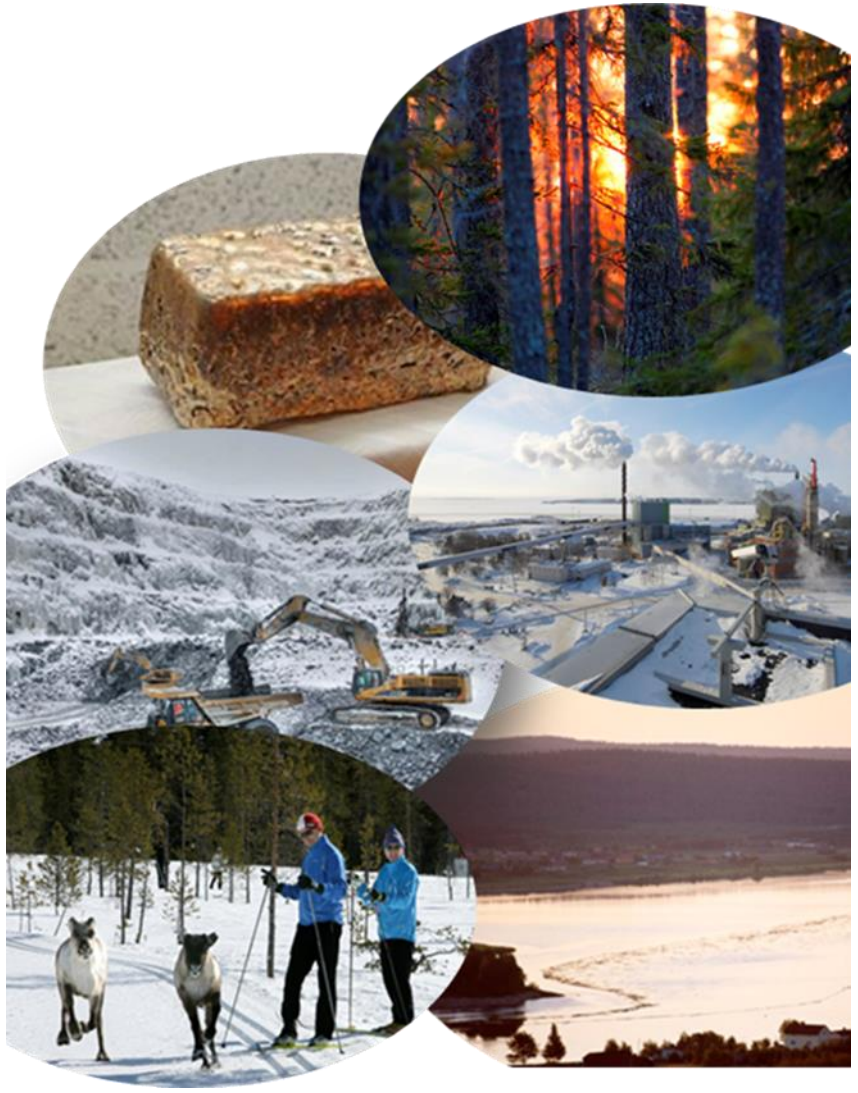
Model region to demonstrate EC new wave cluster policy:

- The region possesses the vast deposits of natural resources and pristine nature
- Lapland has potential to become one of the leading regions in the world in the sustainable exploitation of natural resources
- The region should focus on refining of Arctic natural resources in a socially and ecologically sustainable manner, combined with high value added generation from natural resources in the region
- Focus on to maintain the balance in the sustainable development

DIGIPOLIS

Modern Cluster of Arctic industry – Sustainable utilisation of the arctic natural resources

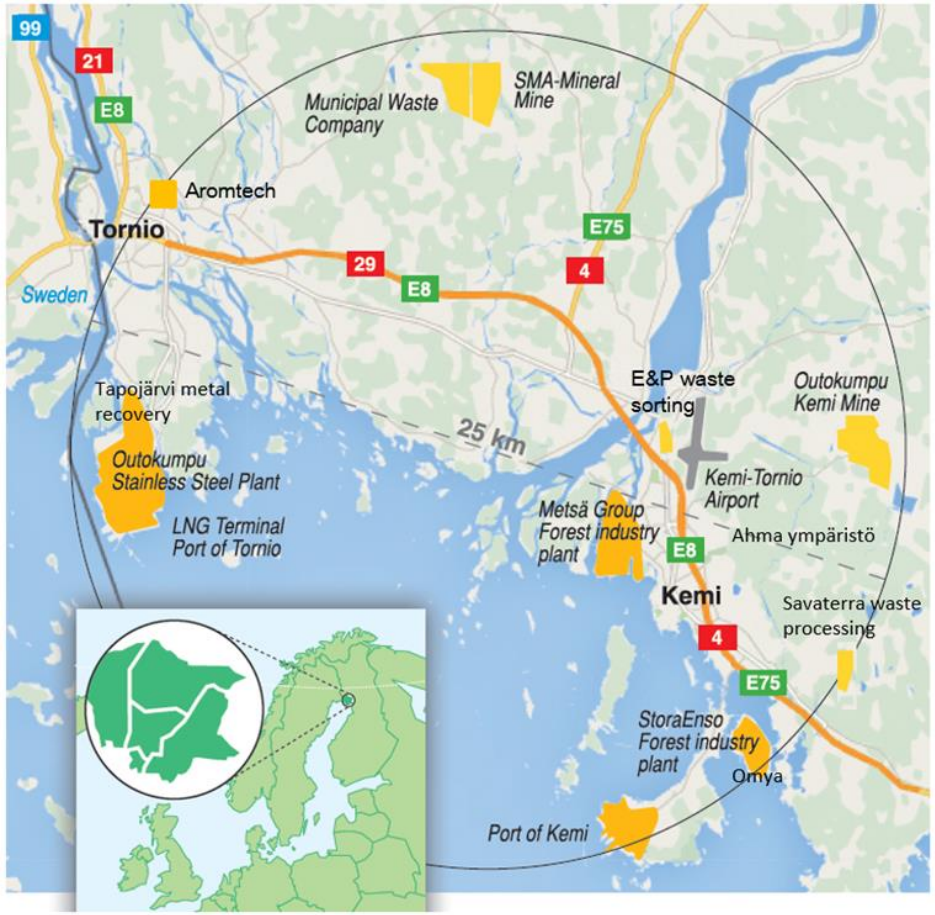
- The strong focus on circular economy and to accumulate the development of the emerging industries.
- Will be a mix of large-, medium-, and small scale industries and other actors, platforms and living lab arrangements with real-life pilot experiments
- The clustering concept will also utilise efficiently the international and global pipelines and will be a tool for the SMEs in Lapland to improve their performance.
- Eco-innovative, resource efficient and competitive solutions with high extent of value addition to increase cross-sectoral activities in Arctic industries



ECOSYSTEM OF ARCTIC INDUSTRY

Kemi-Tornio`s circular economy innovation platform

- Worlds northernmost hub of bio-, mining-, metal industry and services
- 1,7 Mt of by-products and residues (excluding waste rock)
- Responsible for 80% of Lapland's industrial production, with over 5 billion EUR of exports annually (7-8 % of the total export value of Finland)
- Industrial symbiosis estimated at 700 million EUR annually



DIGIPOLIS KEMI LAPIN AMK
Lapland University of Applied Sciences

MAIN INDUSTRY SITES IN KEMI-TORNIO REGION

Metsä Board and Metsä Fibre Kemi mills
- World’s northernmost linerboard production site
- World’s northernmost pulp mill

Outokumpu Chrome Kemi mine
- Europe’s only chromium mine

Outokumpu Tornio stainless steel mill and ferrochrome smelter
- Outokumpu's site in Tornio is the most integrated stainless steel mill in the world
- Europe’s biggest user of recycled steel

Stora Enso Veitsiluoto Mill in Kemi
- World’s 2nd northernmost pulp mill
- World's northernmost paper producer with three paper machines
- Oldest sawmill in production in Northern Finland

Manga LNG liquid natural gas terminal in Tornio 2018

FURTHERING THE CIRCULAR ECONOMY AND BIOECONOMY IN LAPLAND IN 2012–2016

Where did it all begin?

11/2012

The key players of Kemi–Tornio industries and industrial services were interviewed in the side-stream evaluation of needs.

Lapland EU's model region

7/2014

European Commission's selection: Lapland EU's model region in sustainable processing of natural resources

The FISS model

10/2014

FISS workshops, Finland benchmarking, business potential

Recognition for work

21 September 2016

Work carried out by the Kemi–Tornio region & Lapland and Digipolis and partners: Key project of Sitra's Finnish circular economy action plan

Prioritisation of development tasks

4/2013

Priorisation of development tasks with key players of industries and industrial services

Development of operations

2014

Side-stream recognition tool development together with industries across sectoral boundaries. Development of measures furthering the systematic process and taking the matter forward

27 side-stream recognition, total volume:

1.4 million tonnes annually = **Over 100 trucks daily**

Expansion of operations

2015-2016

Entire Lapland's big industries involved in development. Synergies between mines and the processing industry, and entry of new service businesses. Expanding the process to northern Finland, northern Sweden and northern Norway.

2017

Implementation of Sitra's action plan

Industry byproducts utilised

DIGIPOLIS

European Union

Leverage from the EU 2014–2020

LAPIN AMK
Lapland University of Applied Sciences

1 700 000 t of Industrial by-products

Identification

Stream	Quantity t/a
Ferro-Chrome Slag	650000
Steel Slag	400000
Lumpy rock	220000
Sawmill by-products	170000
Calcite + Filter Dust	60000
Burnt Lime/Slaked Lime	30000
Fly Ash	22000
Fiber Clay	20000
Water Purification Precipitate (Steel)	20000
Dolomite- Bricks	20000
Clacite	15000
Biosludge	12000
Ferro-Chrome Underflow	10000
Debarking Waste	9000
Fly Ash	7000
Green Liqour Dregs	6300
Filter Dust (Lime)	5000
Green Liqour Dregs	5000
Bottom Ash	4000
Fly Ash	3000
Knot Reject	2500
Bottom Ash	2400
Burnt Lime	2000
MgO-C Bricks	2000
Bottom Ash	1500

Characterisation

Recognition

Classification

Classification	Examples of utilization
Supporting materials	Agriculture and road construction, concrete aggregate, mining areas
Bases	pH control, liming and soil amendments
Organic matter	Landscaping, combustion
Ashes	Agriculture and road construction, soil amendments, mine filling
Packing materials	Sealing layers of landfill sites
Symbiotic products	Multiple uses

DIGIPOLIS

THE FUTURE OF THE CIRCULAR AND BIOECONOMY IN LAPLAND

DIGIPOLIS

Leverage from the EU 2014–2020

European Union

4,000

The Kemi–Tornio industries currently employ 4,000 people in the region. With future investments in the bio- and circular economy (such as Boreal Bioref, Kaidi), the employment effects in northern Finland are estimated at 2,000 persons.

Industry byproducts utilised

Annually the Kemi–Tornio industries produce

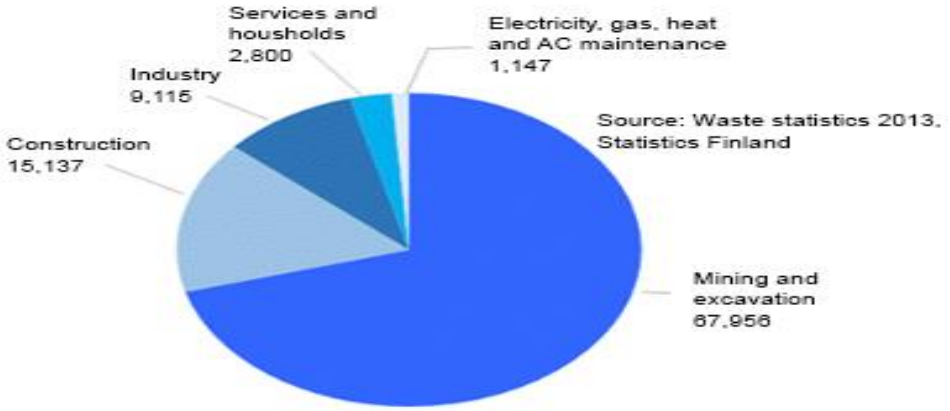
1.7 million tonnes of industrial byproducts

Utilisation categories include neutralisation, circulation of nutrients, excavation, landscaping, soil enrichment, building products, water treatment.

From waste into profitable business

€

Finland has great potential to utilise industrial side streams (94 million t/a), which are currently classified as waste.



96% of waste is non-household generated.

VISION

Lapland world's leading arctic bio- and circular economy region

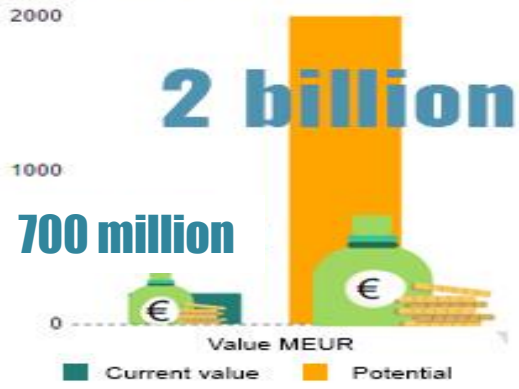
CE-approved recycled materials from industrial side streams:

The annual use of ferrochromium slag in road construction (400,000 tonnes) saves 600,000 tonnes of virgin gravel and rock aggregate and reduces road construction carbon dioxide emissions by 200,000 tonnes.

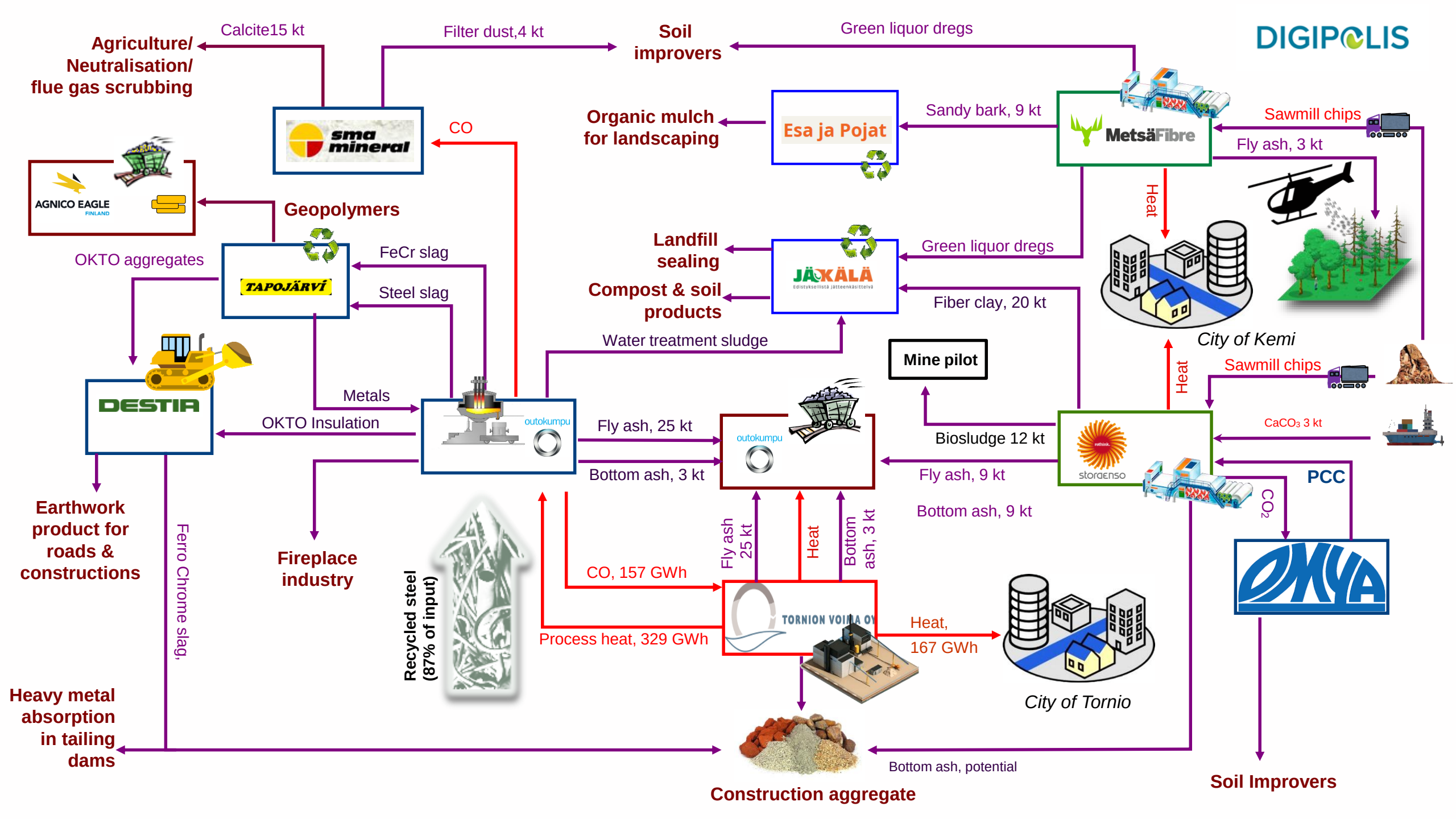
Source: Outokumpu plant in Tornio

Business potential

The current value of Lapland's industrial symbiosis and the potential of the bio- and circular economy

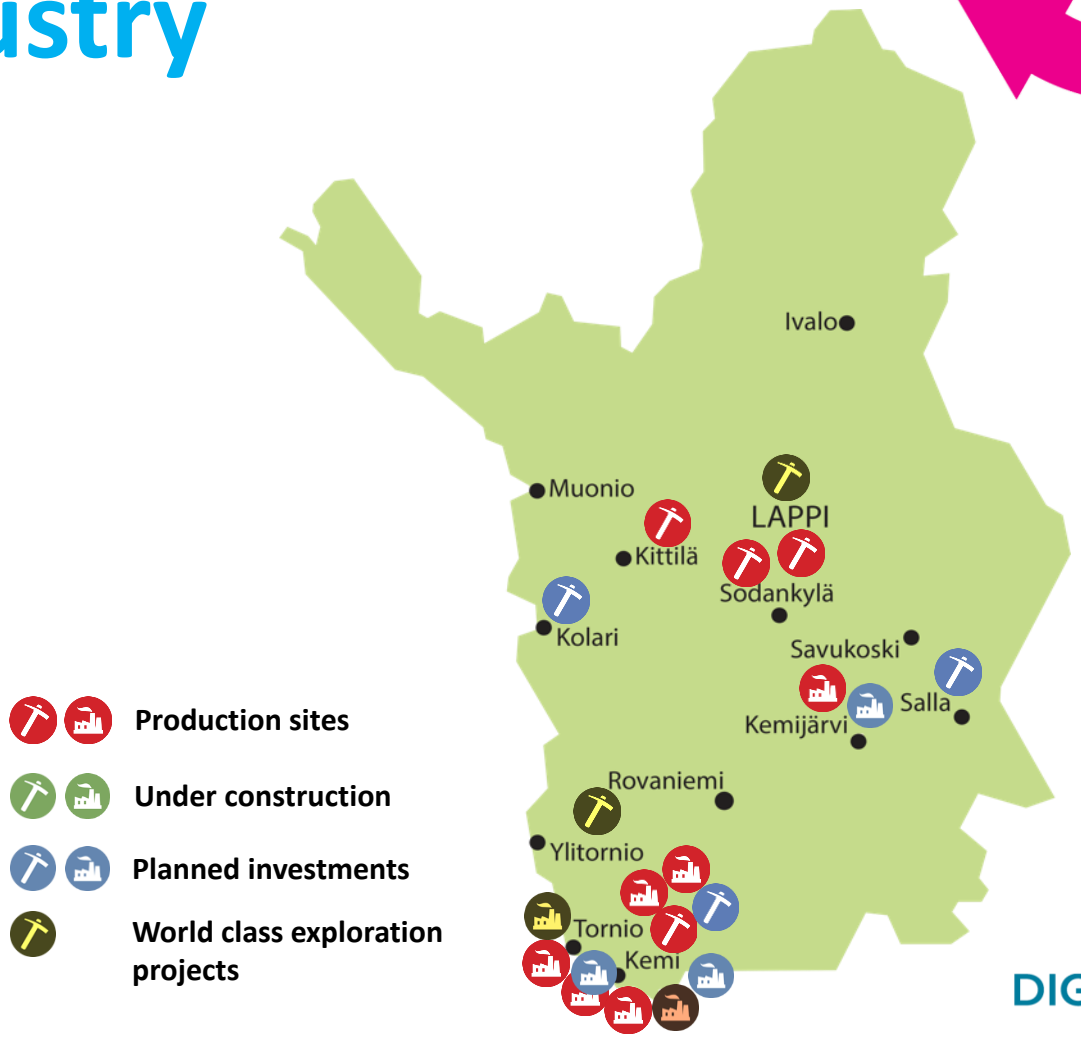


Kemi–Tornio circular economy Ecosystem


DIGIPOLIS
Agriculture/ Neutralisation/ flue gas scrubbing
Calcite15 kt
Filter dust,4 kt
Soil improvers
Green liquor dregs
sma mineral
CO
Organic mulch for landscaping
Esa ja Pojat
Sandy bark, 9 kt
MetsäFibre
Sawmill chips
Fly ash, 3 kt
AGNICO EAGLE FINLAND
Geopolymers
Heat
OKTO aggregates
TAPOJÄRVI
FeCr slag
Steel slag
Landfill sealing
Compost & soil products
JÄKÄLÄ
Green liquor dregs
Fiber clay, 20 kt
Water treatment sludge
City of Kemi
Mine pilot
Heat
Sawmill chips
DESTIA
Metals
OKTO Insulation
outokumpu
Fly ash, 25 kt
Bottom ash, 3 kt
Biosludge 12 kt
Fly ash, 9 kt
Bottom ash, 9 kt
storaenso
CaCO3 3 kt
PCC
CO2
Earthwork product for roads & constructions
Ferro Chrome slag,
Fireplace industry
Recycled steel (87% of input)
CO, 157 GWh
Fly ash 25 kt
Heat
Bottom ash, 3 kt
TORNION VOIMA OY
Process heat, 329 GWh
Heat, 167 GWh
City of Tornio
Heavy metal absorption in tailing dams
Bottom ash, potential
Soil Improvers
Construction aggregate

Utilisation of the arctic natural resources – Lapland's Arctic Industry

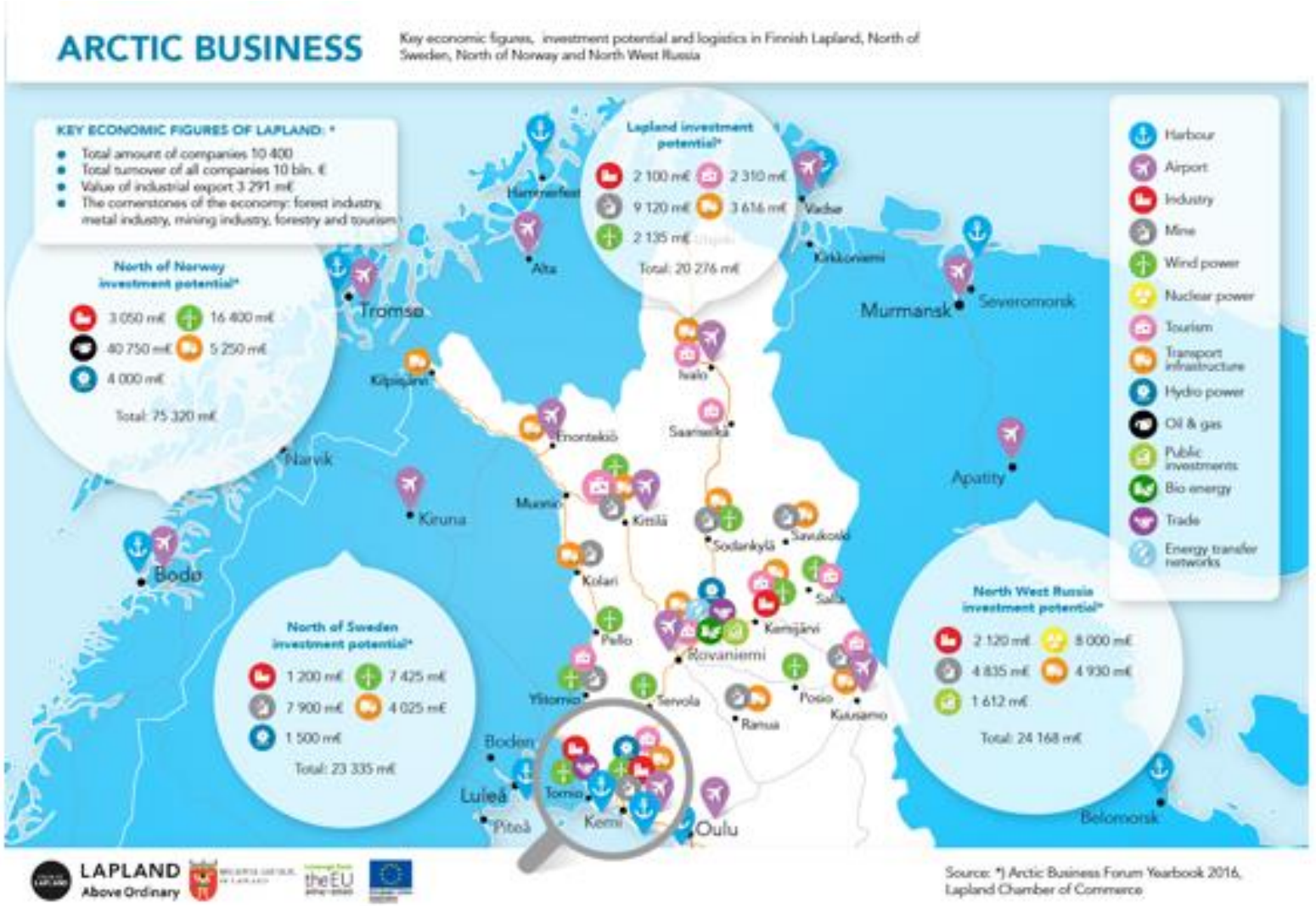
- Arctic Spring, Investment boom in Arctic regions
- Industrial- and mining service companies receive orders worth of hundreds of millions.
- International-industry standards, HSEQ
- Cleantech – growing need of sustainable solutions
- Enhancing Circular Economy
- Internationalization in home market, glocalization
- Internationalization in the surrounding countries
- Own products and services




Arctic Industry & Circular Economy Cluster
Sustainable exploitation of arctic natural resources
ANDRITZ
Valmet
BOLIDEN
metso
AngloAmerican
SPINVERSE
KAIDI
Manga Lng
EIGENOR
Etteplan
REPOLAR
sma mineral
AGNICO EAGLE FINLAND
rethink.
storaenso
Caverion
ASES
Insinööritoimisto ASES Oy
KEMIN SATAMA
Port of Kemi
MetsäFibre
outokumpu
korroosiotyö KORKAL
Kemi Shipping 1894
Hannukainen Mining
NORR HYDRO
akkoy SERVICE
TAPOJÄRVI
KEITELE group
BOREAL BIOREF
BIOJALOSTAMO
SAVATERRA
SAVA GROUP
SANGEN
aromtech
PALSATECH
NTH service
NAPAPIIRIN TEOLLISUUSHUOLTO OY
KEMIJOKI
AHMA
HAVATORGO
Forest of Lapland
STYRUD
eventum
DEKRA
KAIVOSVASTUU
Ympäristöministeriö
Miljöministeriet
Ministry of the Environment
SITRA
Teknologiateollisuus
Motiva
NORDREGIO
Nordic Centre for Spatial Development
SINTEF
IUC NORRBOTTEN AB
GKZ Freiberg
MONTAN UNIVERSITÄT
mining engineering mineral economics
competitividad empresarial
ice
Junta de Castilla y León
European Committee of the Regions
MINISTRY OF INDUSTRY AND TRADE
European Commission
GTK
Luke
LUONNONVARAKESKUS
UNIVERSITY OF LAPLAND
LAPIN YLIOPISTO
LAPIN AMMATTIOPISTO
LAPIN AMK
Lapland University of Applied Sciences
LAPPIA
LUC MATKAILU
DIGIPOLIS
KEMI
TEAM BOTNIA OY
Rovaniemen Kehitys
REGIONAL COUNCIL OF LAPLAND
KEMIJÄRVI
Centre for Economic Development, Transport and the Environment
Agria
Lappi
YLITORNIO
Kittilä
Tervola
LAPLAND CHAMBER OF COMMERCE
LAPLAND
Above Ordinary
European Union
European Regional Development Fund
SILVER
Cluster Management Excellence
DEDICATED TO CLUSTER EXCELLENCE

Arctic Industries: Story of Natural Resources Refining

- Global Markets
- Good Connections
- Arctic Solutions
- Cleantech Solutions
- 5 Bio Refineries
- 32 Sawmills
- 16 Mines
- 5 Metal Refineries
- 2 Aluminium Smelters
- 1 LNG Refinery
- 2 Chemical Plants



DIGIPOLIS

NORDIC COUNCIL OF MINISTERS' SUSTAINABLE NORDIC BIOECONOMY CASE IN CIRCULATE CATEGORY

The Kemi-Tornio region in northern Finland has established an Arctic industry and circular economy cluster to enhance industrial symbiosis and strengthen the development of a holistic bioeconomy in the region. Via extensive analysis of the by-products and residue streams from companies in the region, value-added products are now being produced by combining and rethinking several by-product and residue streams. Examples include silvicultural thinning practices, bioenergy from forest residues with the possibility for future for largescale biofuel production, as well as two plants that enable recovery of metals from slags from the steel and ferrochrome production in the region.

CRITERIA 1
Sustainable use of natural resources

New steel products created in the region contain an average of almost 90% of recycled steel.

CRITERIA 4
Societal benefits

A total of 14 potential industrial symbiosis business cases have been identified in the region; these investments could employ more than 300 people. New large-scale bioeconomy investments and circular value chains could provide up to 500 new jobs in the ecosystem.

CRITERIA 5
Business model innovation

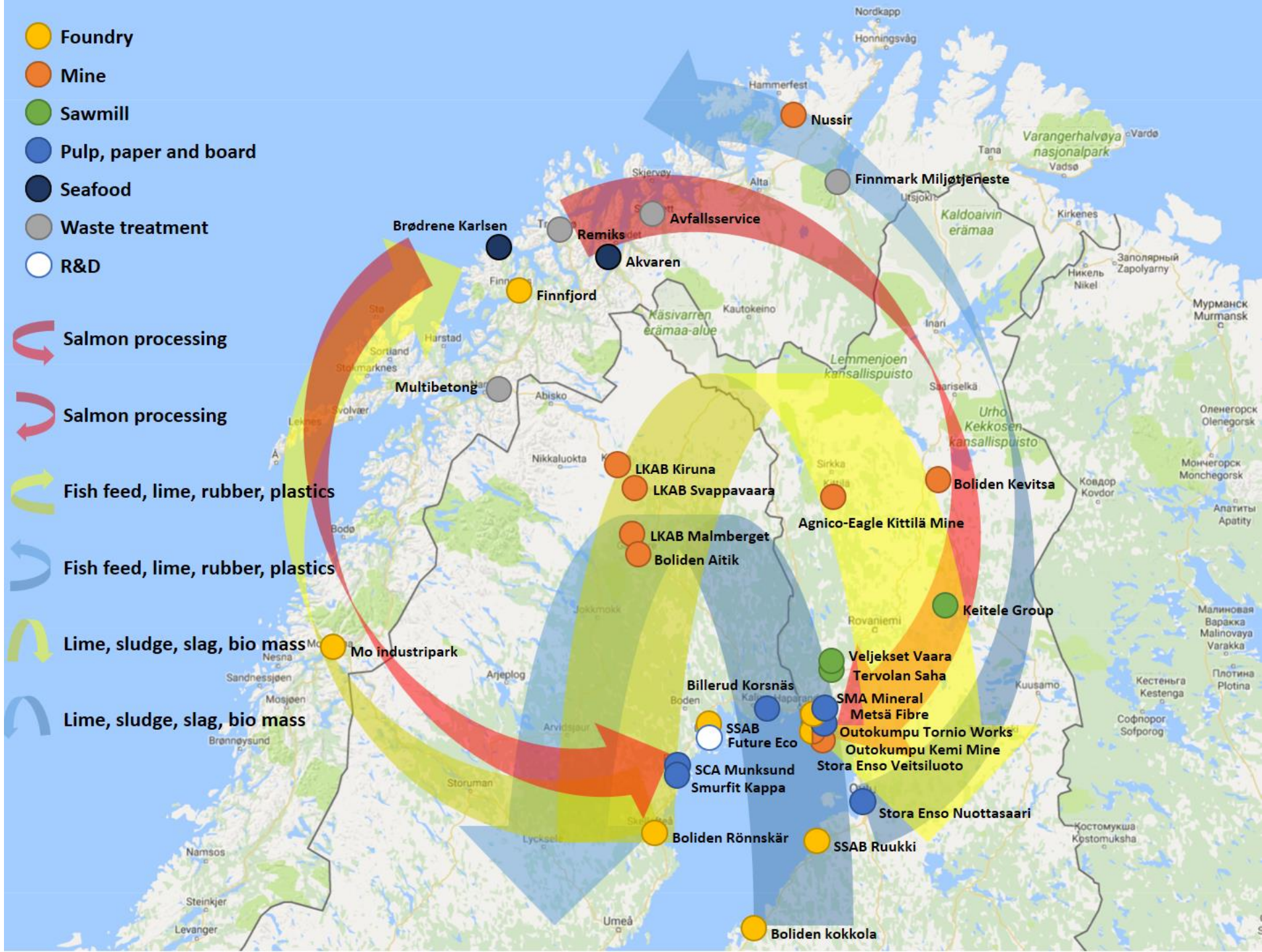
The initiative focuses on creating new value chains and viable business cases based on the 1.7 million tonnes of by-products and residues annually.

DIGIPOLIS

IUC NORRBOTTEN AB
INDUSTRIELLT UTVECKLINGSCENTRUM

SINTEF

FEASIBILITY STUDY 2016



Interreg Nord
Europeiska regionala utvecklingsfonden
EUROPEISKA UNIONEN

Opportunities and plans

Potential utilisation sites in Northern Finland area

- Infrastructure Projects (incl. landfills and recovery sites)
- Mining Projects
- Other industrial projects
- Other projects

Mine projects in Northern Finland

- The cooperation has started with mines that are different stages of the life cycle
- Applications examples: construction, landfills, mine fillings, neutralization etc.

Investment potential and job creation in Kemi-Tornio and Lapland

- 500 000 000 € in 16 different IS investment projects
- 400 new employees
- Kaidi (in Kemi) and Boreal Bioref (in Kemijärvi) biorefineries are CE and IS cases, total Investments 1,68 billion €
- 1300 new employees in potentially circular value chains - ecosystems

Digipolis key actor in Finland's Circular Economy roadmap

THIS IS HOW WE BUILD CIRCULAR ECONOMY IN FINLAND

Technical loops

Competitive advantage from the decreased use of virgin raw materials and long lifecycle of materials and products.

Key projects:

- **The Arctic industries ecosystem and Kemi-Tornio circular economy innovation platform.** ***(Digipolis Oy)***
- Circular economy demo plant for waste electrical and electronic equipment. *(Technology Industries of Finland)*

Plans

- Making pilots, scale-ups and investments to happen, process of cluster funding
- Tighter cooperation and benchmarking through Scandic & European networks
- More resources through strategic alliance with Lapland UAS and growing capacity
- Modern cluster approach and cooperation
- Efficient development/funding tools
- Establishment of Centre for industrial circular economy
- Lapland UAS: CE curricula starts on 2018

Finland becomes a world leader in the circular economy by 2025

Roadmap's ambition:

Increased exports and **growth** for companies from scalable and comprehensive circular economy solutions.

Functional **domestic market**.

Circular economy into the mainstream through **actions** and **concrete pilots.**

Economy, environment & society:

Circular economy as a new cornerstone for the Finnish economy.

Finland as a model country for the challenge of scarcity.

From adapter to pioneer.

Digipolis key actor in Finland's Circular Economy roadmap

THIS IS HOW WE BUILD CIRCULAR ECONOMY IN FINLAND

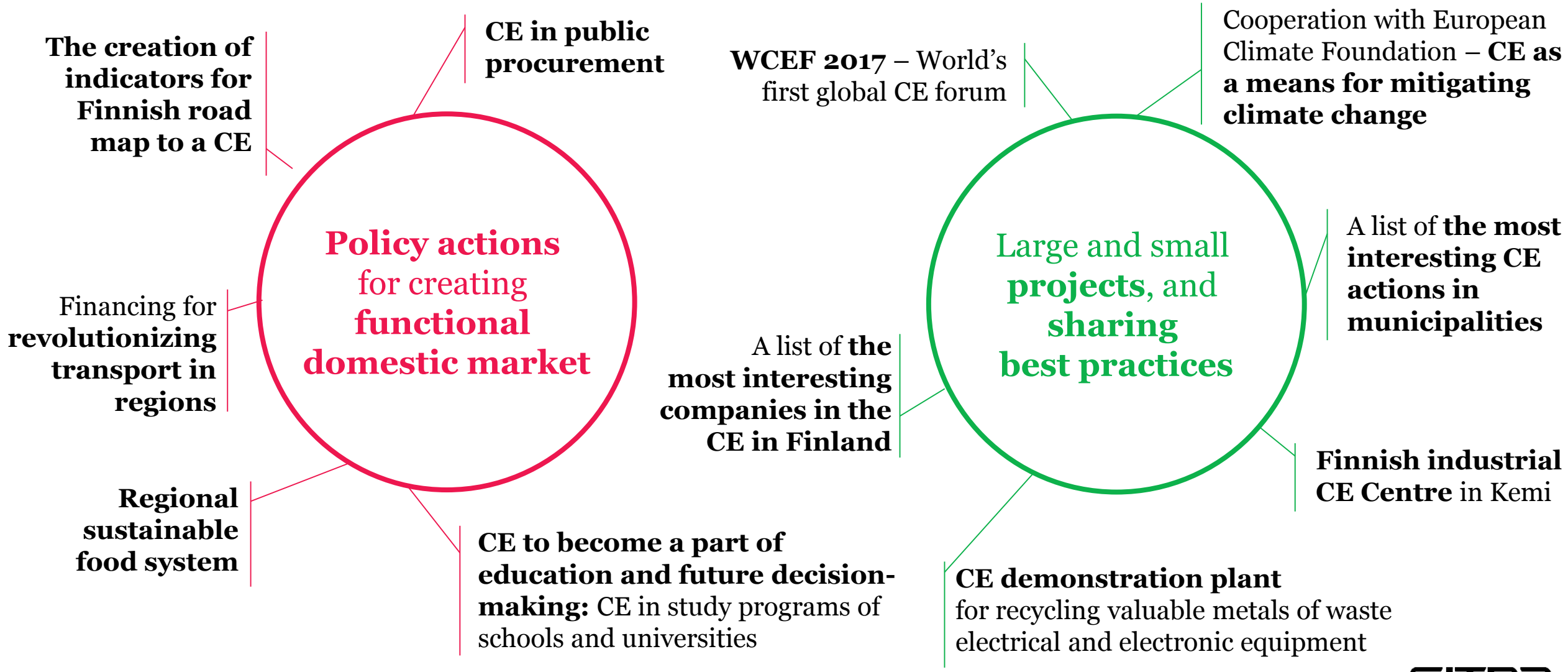
Technical loops

Competitive advantage from the decreased use of virgin raw materials and long lifecycle of materials and products.

Key projects:

- **The Arctic industries ecosystem and Kemi-Tornio circular economy innovation platform.** ***(Digipolis Oy)***
- Circular economy demo plant for waste electrical and electronic equipment. *(Technology Industries of Finland)*

Circular economy can be boosted through long-term systemic changes, quick experiments, scalable solutions, and stimulation of demand



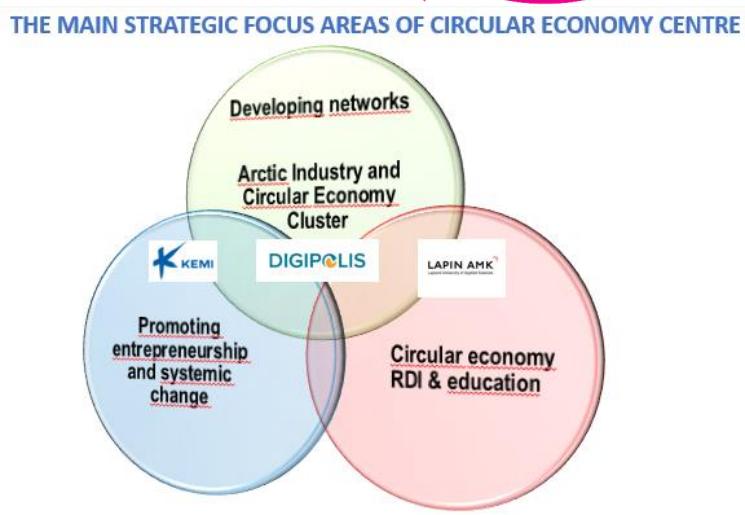
SITRA

Finnish industrial circular economy centre - established in Kemi in 2017

In partnership with the Finnish Innovation Fund Sitra, City of Kemi, Digipolis – Kemi Technology Park and Lapland University of Applied Sciences

First industrial circular economy centre in Finland with national level mandate

Network of industry & university experts and intermediaries



International network including e.g. Nordic and Chinese cooperation partners

National level goals: competence building in industrial circular economy, spreading the operating models of the Kemi industrial circular economy in Finland

Regional/local level goals: new investments and jobs, contribution to sustainable and resource efficient industry modernization, cooperation culture

KEMI

LAPIN AMK
Lapland University of Applied Sciences

DIGIPOLIS

Kemi CE Centre Advisory Board

1. Martti Sassi, Senior Vice President – Head of Operations, Outokumpu Tornio Works
2. Juha Mäkimattila, Mill Director, Stora Enso Veitsiluoto Mill
3. Kari Ala-Kaila, Vice President – Technology , Metsä Fibre
4. Mikko Korteniemi, General Manager, Agnico Eagle Finland Kittilä Mine
5. Jukka Jokela, General Manager/Project Manager, Anglo American - Finland AA Sakatti Mining
6. Jari Hietala, National Division Leader, Eurofins Environment Testing
7. Juha Koskinen, R&D Manager, Tapojärvi Oy/ Hannukainen Mining Oy
8. Tuula Sivonen, Regional Manager, The Federation of Finnish Technology Industries
9. Kimmo Heikka, Managing Director, Kemin Digipolis Oy
10. Heino Vasara, Sector Manager, Centre for Economic Development, Transport and the Environment
11. Eija Virtasalo, Head of Financial Unit, Centre for Economic Development, Transport and the Environment
12. Eira Luokkanen, Head of Unit – Environmental Protection, Centre for Economic Development, Transport and the Environment
13. Jyri Seppälä, Director – Centre for Sustainable Consumption and Production, Finnish Environment Institute (SYKE)
14. Eero Yrjö-Koskinen, Secretary General, Finnish Network for Sustainable Mining and Director, Green Budget Europe
15. Riikka Aaltonen, Senior Adviser – Mineral Policy, Enterprise and Innovation Department, Ministry of Economic Affairs and Employment
16. Kari Herlevi, Project Manager – Circular Economy, Sitra
17. Nani Pajunen, Leading Specialist – Circular Economy, Sitra
18. Olli Dahl, Professor, Aalto University, Clean technologies research group
19. Riitta Rissanen, Managing Director, Lapland University of Applied Sciences
20. Tero Nissinen, Chair, Mayor, City of Kemi

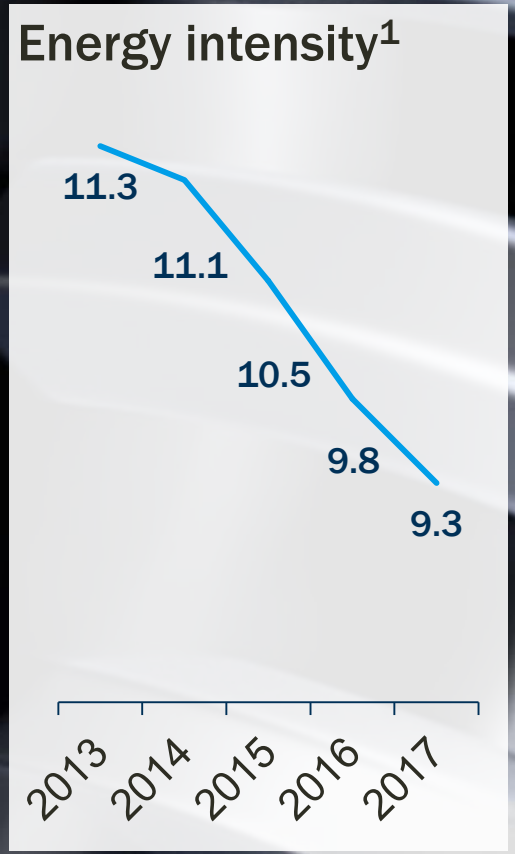
KEMI

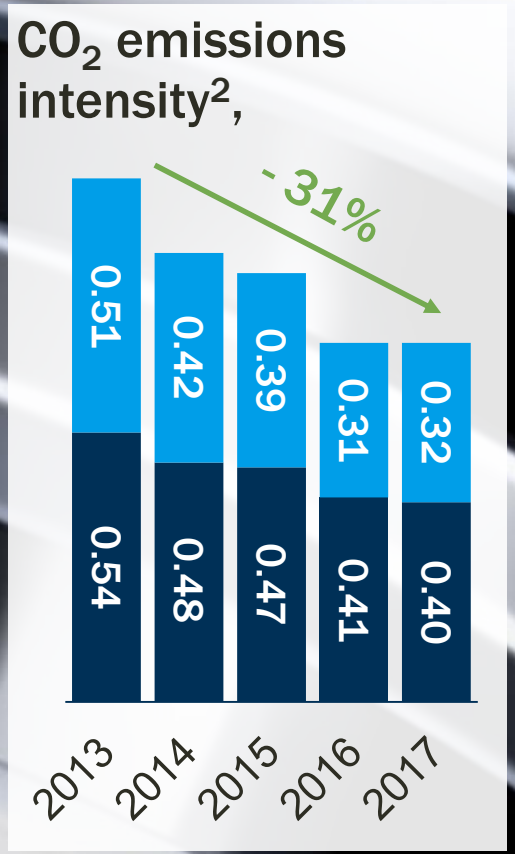
LAPIN AMK
Lapland University of Applied Sciences

DIGIPOLIS

Our business is based on circular economy

We are the world leader in sustainable steel production



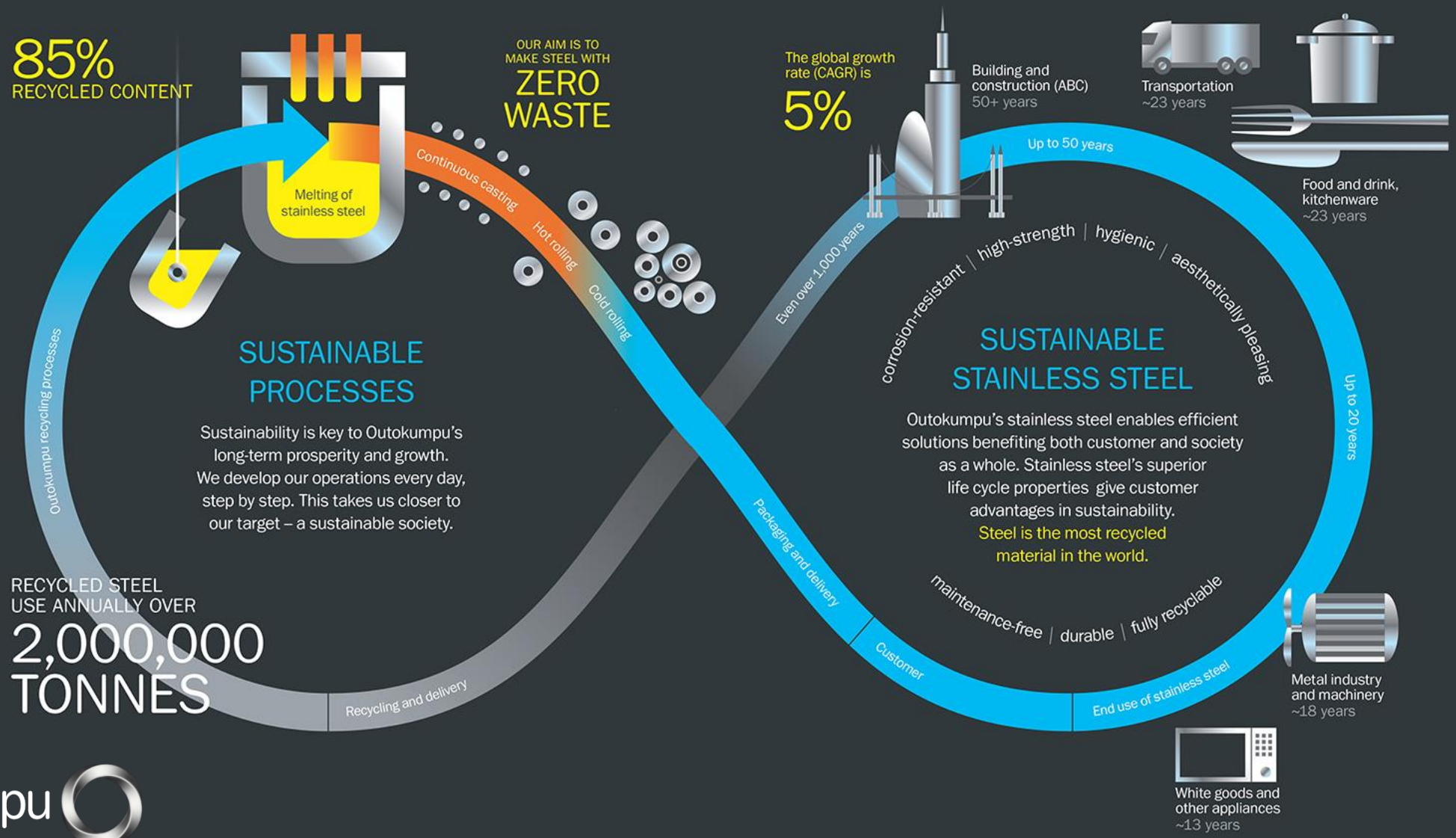


* Q1/18–Q3/18

1. GJ per tonnes crude steel
2. Direct and indirect, tonnes per tonne steel

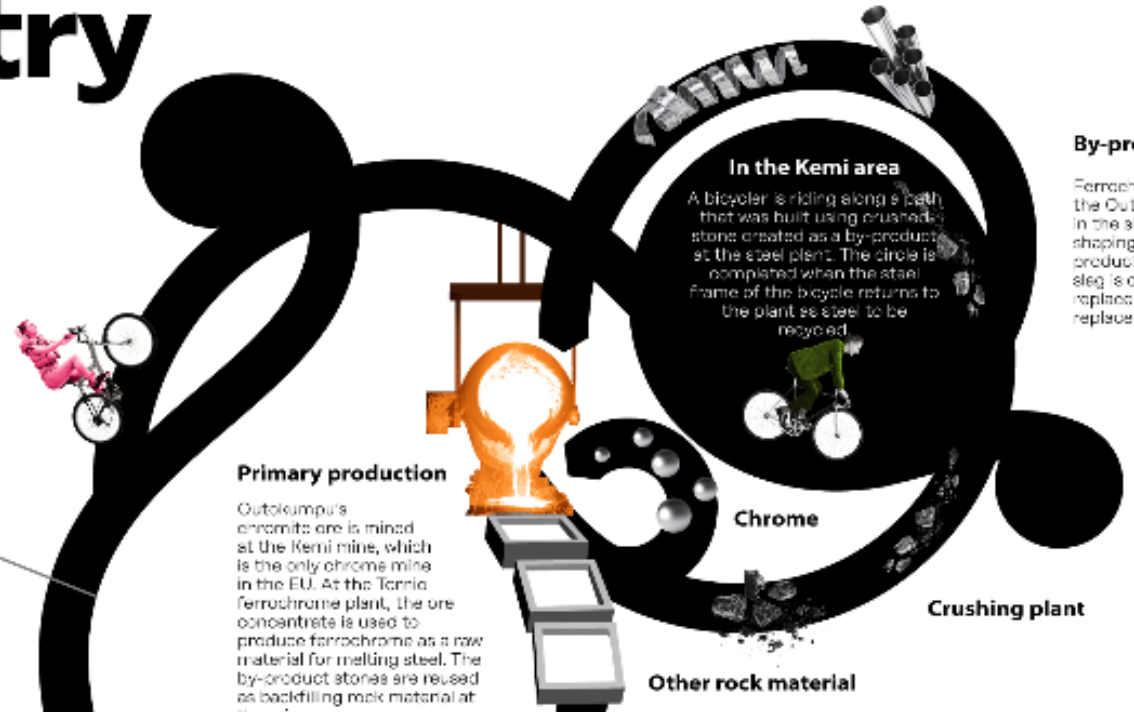
outokumpu

Stainless steel 100% recyclable !



outokumpu

Arctic steel industry



Recycling plant

The share of recycled materials in Outokumpu's steel is nearly 90 per cent. The carefully sorted recycled steel is transported from the raw material warehouse to the steel melter, where it is melted in an electric arc furnace.

By-products from process used

Ferrochrome slag is created as a by-product at the Outokumpu Tornio factory. The chrome left in the slag is returned for melting and also for shaping casting ditches needed in the production process. The stone material in the slag is crushed into earthworks materials to replace crushed rock. Some slag is also used to replace natural gravel.

In the Kemi area

A bicycler is riding along a path that was built using crushed stone created as a by-product at the steel plant. The circle is completed when the steel frame of the bicycle returns to the plant as steel to be recycled.

Use

The product should be used as long as possible; it should be serviced and repaired when necessary. At the end of its life cycle, the parts or materials of the bicycle are recycled for use in another product's life cycle.

Consumer

Each choice on consumption either leads toward a circular economy or maintains the old linear economy. When customers are interested in the materials and the environmental impact from making the product, the manufacturer is pushed toward sustainable business.

Primary production

Outokumpu's chromite ore is mined at the Kemi mine, which is the only chrome mine in the EU. At the Tornio ferrochrome plant, the ore concentrate is used to produce ferrochrome as a raw material for melting steel. The by-product stones are reused as backfilling rock material at the mine.

Chrome

Crushing plant

Other rock material

Material processing

Outokumpu produces stainless steel in Tornio. Its most important alloy is chromium, which gives stainless steel its rust-free properties. Recycled steel is the main raw material of stainless steel.

Manufacturing industry

Selecting the correct grade of stainless steel is crucial in order to ensure that the product's strength, corrosion tolerance, workability, purity and appearance are exactly what is needed in the final product. The frame of the bicycle can also be made of stainless steel. The development and manufacturing phases of the materials determine how the material can be reused at the end of its life cycle. The product design phase effects the products' useful life, serviceability and reparability.

Business to business

Stainless steel is purchased by companies that range from producing building products to bicycles. Companies can affect the entire operating sequence and require all their suppliers provide high-quality and durable materials and long-lasting products which can be repaired.

Retail

In addition to sales, the retailer may offer servicing, repairs and mobility. The seller may offer customers information on the product's environmental impact, materials and how it is to be used at the end of its life cycle.

Distribution

The finished bicycles are delivered to resellers fully assembled.

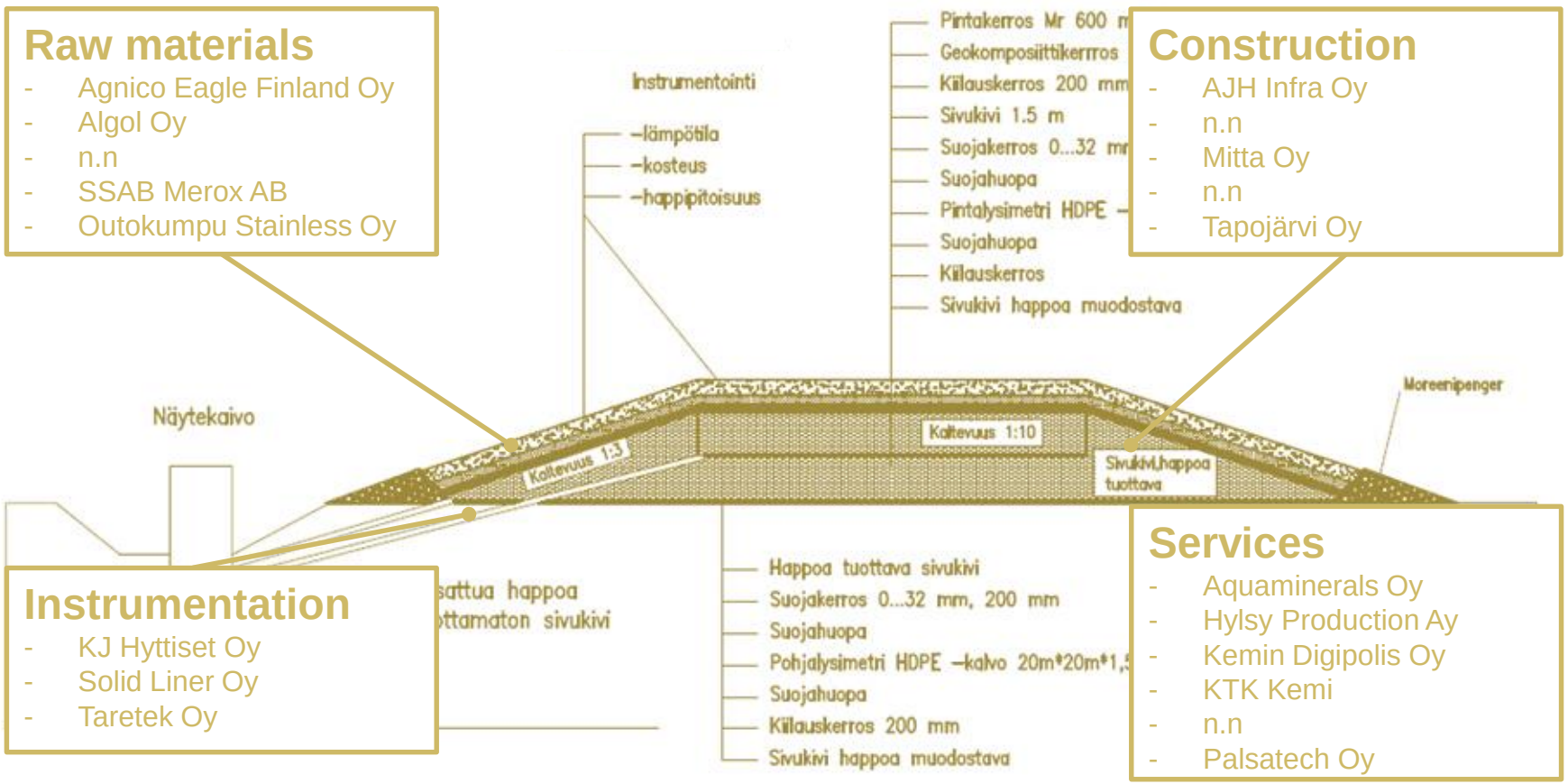
SITRA

https://www.sitra.fi/en/articles/arctic-circular-economy-experts/

Kittilä Mine demo structure 9/2018

Raw materials
- Agnico Eagle Finland Oy
- Algol Oy
- n.n
- SSAB Merox AB
- Outokumpu Stainless Oy

Construction
- AJH Infra Oy
- n.n
- Mitta Oy
- n.n
- Tapojärvi Oy



Instrumentation
- KJ Hyttiset Oy
- Solid Liner Oy
- Taretek Oy

Services
- Aquaminerals Oy
- Hylsy Production Ay
- Kemin Digipolis Oy
- KTK Kemi
- n.n
- Palsatech Oy

TAPOJÄRVI

Tapojärvi expands to Italy

Tapojärvi starts slag handling and metal recovery at Acciai Speciali Terni steel mill that belongs to ThyssenKrupp, a german giant listed company. The contract was signed in Terni, Italy on 4th of December 2018.

According to the contract Tapojarvi Italia s.r.l. will build a slag handling facility and thereafter starts to produce and develop slag-based products for the market. The contract consists of two year period of building the facility and ten years of operating time with additional option for another ten years of operations.

The goal of the contract is to bring Terni to the forefront of managing industrial byproducts.

Tapojärvi is a company specialized in mining services, industrial processes and material handling. The company has two unique metal recovery plants in Finland, where ferrochromium and stainless steel slags are produced into CE-marked byproducts.

Mon 10 Dec 2018 08:07:00 AM EET; http://www.tapojarvi.com/en/news/tapojarvi-expands-to-italy.html

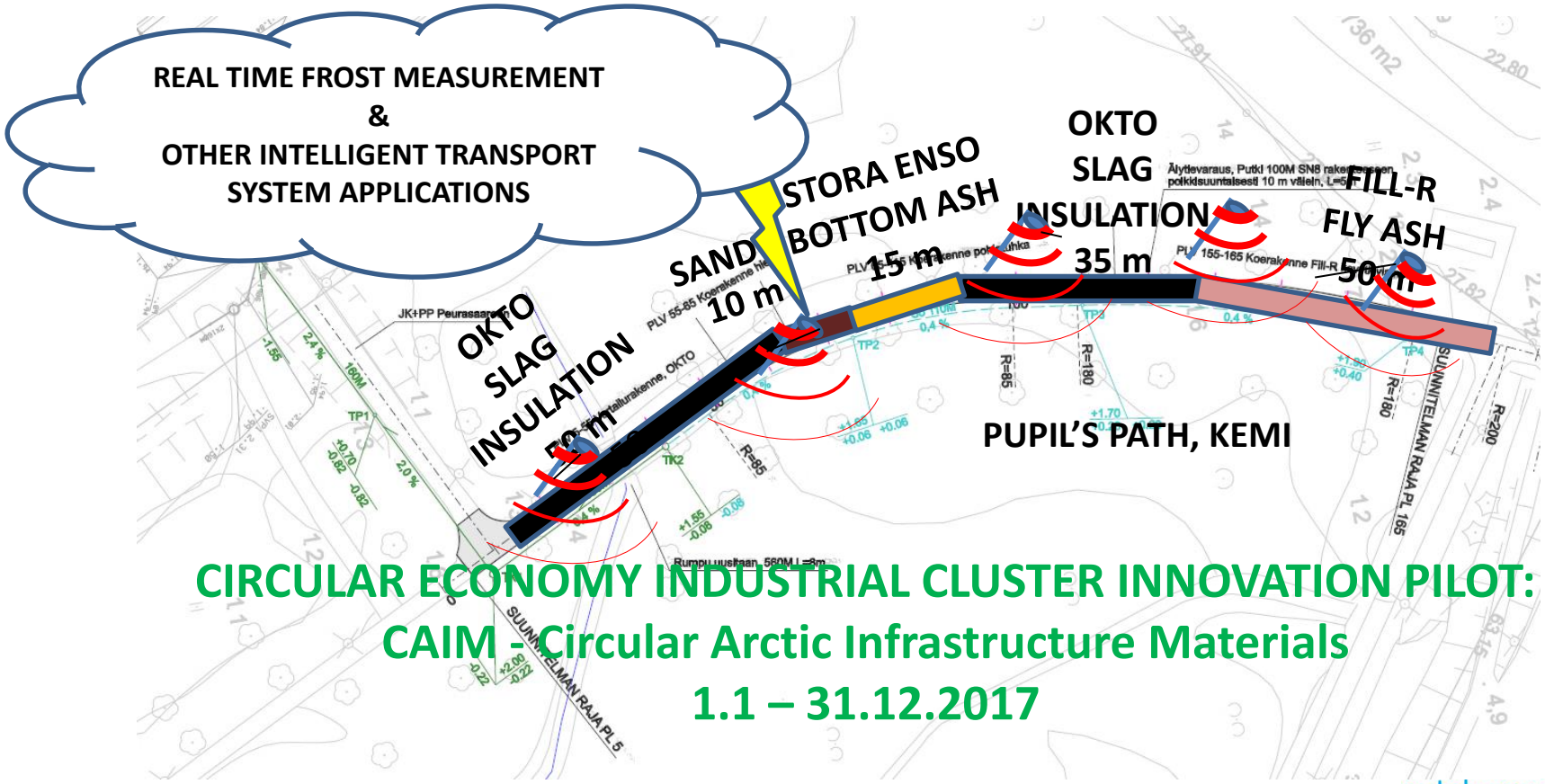
TAPOJÄRVI

DIGIPOLIS

LAPIN AMK
Lapland University of Applied Sciences

REGIONAL COUNCIL OF LAPLAND

EUROPE'S FIRST INTELLIGENT BICYCLE AND WALK PATH USING INDUSTRIAL RESIDUES



CIRCULAR ECONOMY INDUSTRIAL CLUSTER INNOVATION PILOT:
CAIM - Circular Arctic Infrastructure Materials
1.1 – 31.12.2017

KEMI

TOIVANEN

AHMA

ecolan
KASVUN TEKIJÄ

outokumpu

stora enso

The Arctic Industries ecosystem and Kemi-Tornio circular economy – Bringing best learnings forward

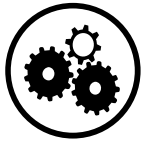
4 years of systematic development has lead to a full-scale industrial symbiosis and circular economy between various industry sectors in Northern Finland.

Now the key is to take the learnings and systematically bring the know-how to other industrial parks and facilities.

How to make it happen?

- Bring together cross-sectoral experts and project managers
- Create operational models on symbiosis
- Invite other clusters to open workshops to make sure the best techniques are put into practice
- Facilitate discussion between private and public entities to tackle administrative bottlenecks

3 **Technical loops**



A cluster optimizing resource and side-stream usage between different industry sectors: metal producers, pulp and paper mills, power plants and chemical industry

1,7 million tonnes of industrial by-products annually

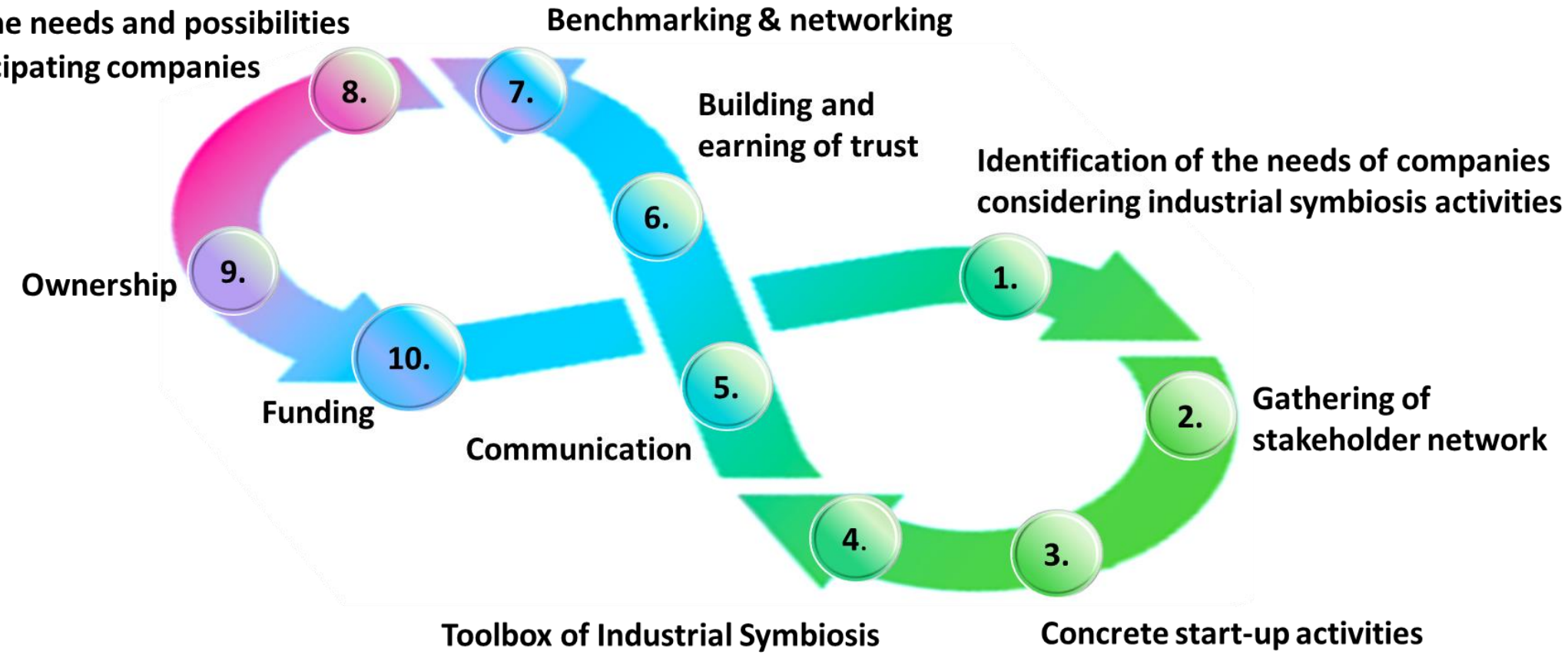
8 % of Finland's exports

Next up! Transform 14 potential cases in the region into circular economy parks

SITRA

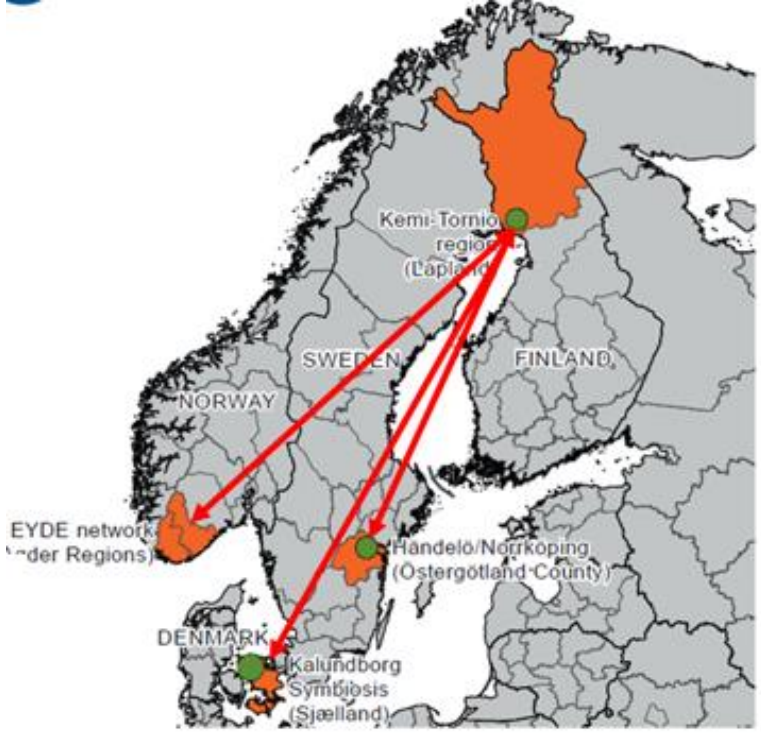
THE DESCRIPTION OF OPERATIONAL MODEL

For Industrial Circular Economy



DIGIPOLIS KEMI LAPIN AMK Lapland University of Applied Sciences

Nordic Industrial Symbiosis Network



- A forum/club to promote joint Nordic initiatives in the field of Industrial Symbiosis
- Creating a Nordic network of Industrial Symbiosis actors
- Core partners at the start-up phase: Kalundborg (DK), Kemi-Tornio (FI), University of Linköping (SE), EYDE Cluster (NO). Nordregio, and Nordic Council of Ministers actively promoting the starting phase
- Introduction at the World Circular Economy Forum, Helsinki in 2017
- Not a closed club; new partners invited to join the network. New partners 2017-2018 include Paper Province, Värmland (SE) and ECO3, Nokia/Tampere (FI)

Nordregio

LAPLAND UNIVERSITY OF APPLIED SCIENCES

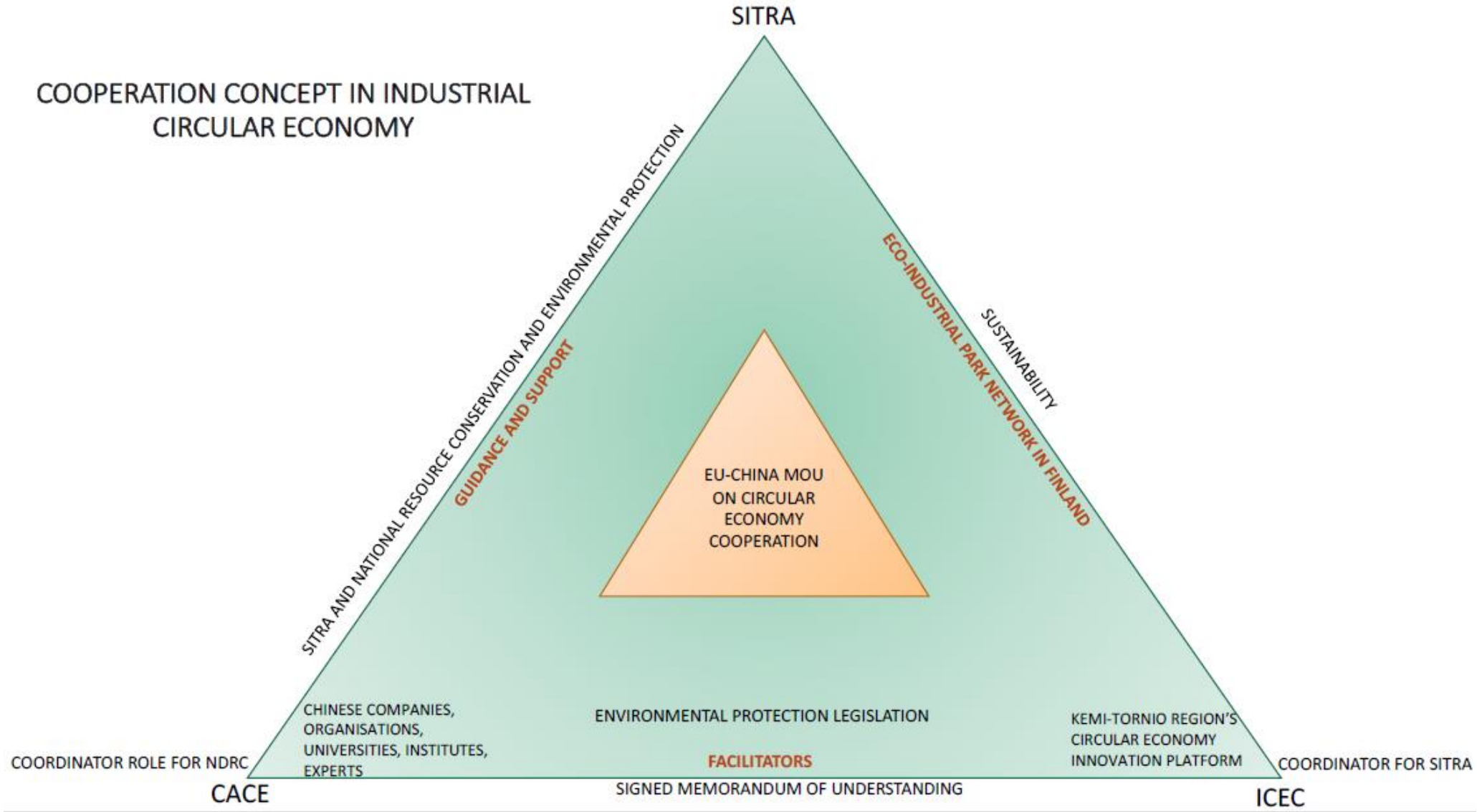
Advancing expertise of circular economy education in Finnish UAS's

- Co-operation of 19 UAS's in Finland
  - Coordinated by Lapland UAS
- 235 credits of circular economy related education
  - 50 % of courses will be provided in English
  - Internationalisation and export of expertise
- Themes
  - Technology, Bio-based materials, General trends, Digitalisation, Effectiveness and regulation, Design, Business, Civil engineering
- Funded by Finland's Ministry of Education and Culture

Ministry of Education and Culture

DIGIPOLIS KEMI LAPIN AMK Lapland University of Applied Sciences

COOPERATION CONCEPT IN INDUSTRIAL CIRCULAR ECONOMY



CENTRE FOR CIRCULAR ECONOMY

China Association of Circular Economy (CACE)

China Association of Circular Economy (CACE), a national cross-region and multi-sector organization, was founded in 2013. As a leading organization in enabling and promoting the circular economy in China, CACE is administrated by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC), and accepts guidance from the National Development and Reform Commission (NDRC).

CACE has nearly 700 members nationwide while the secretariat of CACE has about 50 employees. The members of CACE cover all circular economy areas, including industrial circular economy, agricultural circular economy, waste reuse and recycling, and garbage utilization, etc. CACE was formerly named China Association of Resource Comprehensive Utilization from 1995 to 2013.

DIGIPOLIS KEMI LAPIN AMK Lapland University of Applied Sciences

CENTRE FOR CIRCULAR ECONOMY

OUR STORY

CACE has been attending World Circular Economy Forum both in year 2017 and 2018. City of Kemi and Kemin Digipolis Oy had their first meeting with CACE in June 2017 in Helsinki during the 2017 forum. This meeting has been proved to be a significant start for a fruitful international cooperation between us.

After the June meeting, we realized that we share a lot in common in promotion circular economy both nationally and internationally, ever since, we have been working together to figure out how to make full use of the resources we both have to benefit not only China and Finland, but also other countries and regions.

CACE is under the guidance of China National Development and Reform Commission (NDRC), also directly in contact with the Department of Resources Conservation and Environmental Protection, Centre for Circular Economy in Kemi is under the guidance of Finnish Parliament and Finnish Innovation Fund SITRA, both can play the role of coordinators for promoting international cooperation in circular economy more actively and efficiently.

DIGIPOLIS KEMI LAPIN AMK Lapland University of Applied Sciences

CENTRE FOR CIRCULAR ECONOMY

COOPERATION IN ACTION

In November 2017, a delegation composed of Mayor of Kemi, CEO of Kemin Digipolis Oy, Director of Kemin Digipolis Oy, Principal of Lapland University of Applied Sciences visited CACE, to have a further discussion on the possible cooperation in innovative cleantech, circular economy education and pilot project in China, etc. A Memorandum of Understanding (MOU) among City of Kemi, Kemin Digipolis Oy and CACE was made after this meeting.

CACE is one of the leading players in active promotion of circular economy in China. It has organized delegations of Chinese companies and organizations in the field of circular economy to WCEF both in Helsinki and Yokohama. As an execution part of the MOU, in March 2019, CACE will bring a delegation of 10 Chinese companies to Kemi 150 celebration and The 2nd International Bio- and Circular Economy Forum held in Kemi to enhance the international cooperation between SMEs, universities and organizations in China and Finland.

With our combined forces, we expect that our expertise in development of circular economy on both sides can be utilized more efficiently and generate more sustainable solutions in tackling climate change matters.

DIGIPOLIS KEMI LAPIN AMK Lapland University of Applied Sciences

DONGHUA UNIVERSITY, SHANGHAI

A public research university in Shanghai, China.

Established in 1951, Donghua University is one of the state-key universities directly under the Ministry of Education of China and is a member of China's Project 211 group of national universities. It is a Chinese Ministry of Education Double First Class Discipline University, and is especially well known for its engineering, management, design and materials disciplines.

Lapland University of Applied Sciences and Donghua University signed an Agreement of Cooperation in the beginning of 2018.

A delegation from Donghua University is planning on visiting Lapland University of Applied Sciences in May 2019.

Exchange programmes

- Students
- Staff
- Visiting lecturers
- RDI in resource efficiency

Sustainability Assessment Tool (SAT)

- ✓ Sustainability of the mills means assessment of environmental, economical and social issues with legal aspects using proper metrics. It also covers Regional Economic Dimension (RED)

- ✓ The purpose was to develop a “simple” tool for evaluation the sustainability of process industry

(Images: http://www.goodnewsfinland.com/archive/themes/mining-industry-2/eco-efficiency-in-mining-courtesy-of-finland/, 19.11.2012, http://www.energy-enviro.fi/index.php?PAGE=2906&NODE_ID=2906&ArchiveId=319&ArchiveSelect=200607, 19.11.2012.)

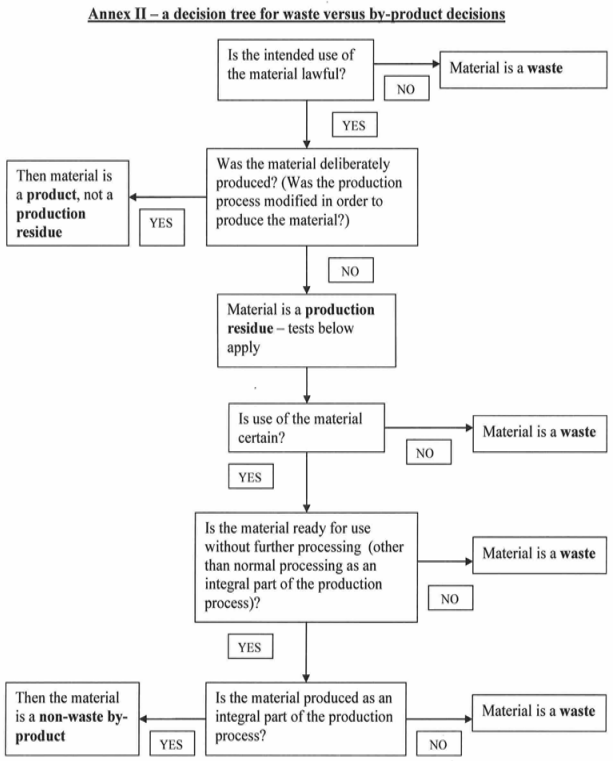
Challenges of industrial circular economy -process

Challenges of industrial circular economy -process was initiated in 6/2018 by the Advisory board of the Circular and Bioeconomy Centre, because the need for a common process was identified by industry and authority stakeholders.

- In the first phase of the process, challenges in developing circular economy were identified across lines of business – as a cross-sectoral approach
- In continuation, the second phase of the process will be launched with the broad-based Status Description -workshop crossing ministry and organisation lines
- A key goal is to develop the operating environment in Finland with the ultimate goal of joint EU-level influence in order to develop the circular economy operating environment

Challenges in by-product business

- Partners: 1. Technology, 2. Business model, 3. Sharing the win-win
- Customers: 1. Competing natural materials, 2. Delivery time
- Authorities: No common understanding or definitions in the EU despite of the same EU regulation and ”EC Decision-tree”
- Examples from the same kind of Outokumpu slag:
  - **UK**: popular ”Green labelled End-of-Waste product” and authorities are recommending to prioritize in public road construction projects
  - **FIN**: by-product and construction material under the EU Constraction Product Directive and REACH regulation
  - **SWE**: always waste, time consuming permits needed for the use => no real commercial possibilities



Summary of Challenges

- **Long-term systematic work: challenge for all utilisation applications is development of the operating culture**
- Promoting the use in smaller projects
    - Data bank for SMEs, at local level
- **Potential users are not aware of the potential of industrial by-products and residues – measuring and communication**
- Producers are not aware of the potential utilisation sites
- **In large projects utilisation of by-products and residues should be taken into account at the design stage**
- The operational model: from the need / from the supply → lab tests → real life pilots → scaling to sustainable solution through eco-innovative business models with process owner
- **Business model – creating and sharing win-win – commercialization – shared responsibilities (productization)**

Establishing common systematic operational culture is needed → Activation and cooperation of authorities, municipalities, industry, industrial services etc.

Case examples

CENTRE FOR CIRCULAR ECONOMY

Summary of Challenges

- **Long-term systematic work: challenge for all utilisation applications is development of the operating culture**
- Promoting the use in smaller projects
  - Data bank for SMEs, at local level
- **Potential users are not aware of the potential of industrial by-products and residues – measuring and communication**
- Producers are not aware of the potential utilisation sites
- **In large projects utilisation of by-products and residues should be taken into account at the design stage**
- The operational model: from the need / from the supply → lab tests → real life pilots → scaling to sustainable solution through eco-innovative business models with process owner
- **Business model – creating and sharing win-win – commercialization – shared responsibilities (productization)**
- **Establishing common systematic operational culture is needed → Activation and cooperation of authorities, municipalities, industry, industrial services etc.**

DIGIPOLIS

CENTRE FOR CIRCULAR ECONOMY

KEMI · TOIVANEN · AHMA · ecovia · outokumpu · storaenso

EUROPE'S FIRST INTELLIGENT BICYCLE AND WALK PATH USING INDUSTRIAL RESIDUES

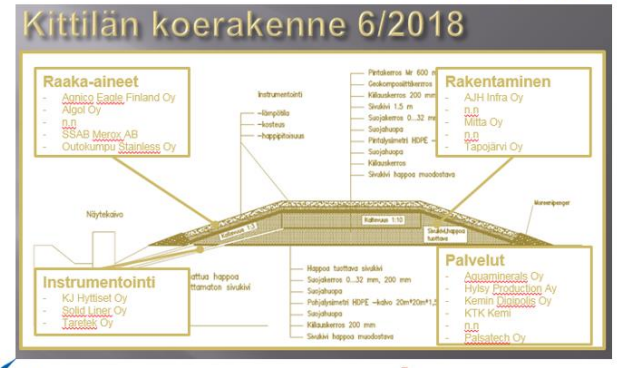
CIRCULAR ECONOMY INDUSTRIAL CLUSTER INNOVATION PILOT:
CAIM - Circular Arctic Infrastructure Materials
1.1 – 31.12.2017

Regional innovations and pilots · REGIONAL COUNCIL OF LAPLAND · LAPIN AMK · DIGIPOLIS

CENTRE FOR CIRCULAR ECONOMY

DIGIPOLIS

CENTRE FOR CIRCULAR ECONOMY



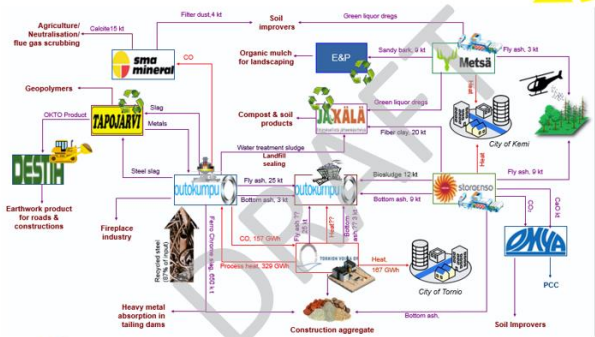
KEMI · LAPIN AMK · DIGIPOLIS

CENTRE FOR CIRCULAR ECONOMY

Biofuelrefinery project in Kemi

LAPIN AMK · LAPPIA · KEMI · KAIDI · KEMIN SATAMA · DIGIPOLIS

CENTRE FOR CIRCULAR ECONOMY



KEMI · LAPIN AMK · DIGIPOLIS

DIGIPOLIS

CENTRE FOR CIRCULAR ECONOMY

Thank You!

Interested in to do co-operation?
Contact: kari.poikela@digipolis.fi

Please visit: www.teollinenkiertotalous.fi/en/home.html

Kari Poikela
Project Director, Centre for Circular Economy
Tietokatu 6
FI-94600 KEMI
mob. +358 50 435 8283
kari.poikela@digipolis.fi

DIGIPOLIS KEMI LAPIN AMK
Lapland University of Applied Sciences