

**CENTRE FOR CIRCULAR ECONOMY**

# **Kemi-Tornio industrial circular economy centre and network cooperation of Finnish ecoindustry parks with Sitra**

**DIGIPOLIS**

**Digipolis – Kemi Technology Park**

**CE Centre Kari Poikela**

**Circular Economy Forum**

**Kemi 24.5.2018**

## THE FUTURE OF THE CIRCULAR AND BIOECONOMY IN LAPLAND

Industry byproducts utilised



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.

Annually the Kemi-Tornio industries produce

1.7 million

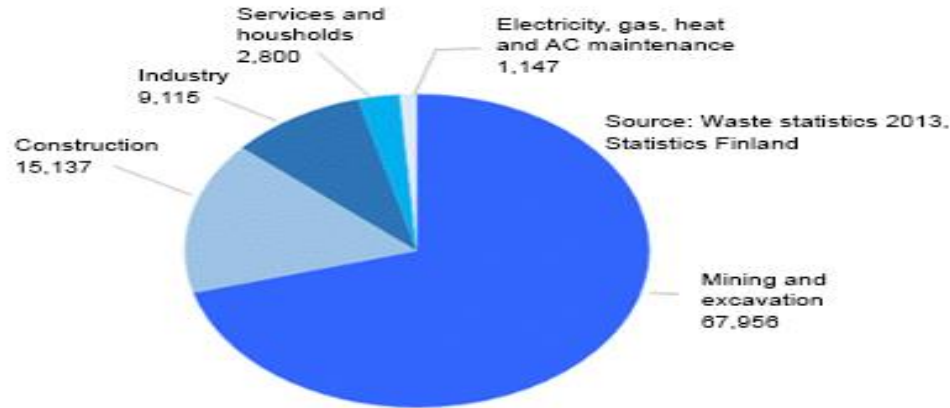
tonnes of industrial byproducts

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

### Business potential

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

2000

2 billion

1000

700 million



### 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

### Kemi-Tornio circular economy Ecosystem



# ECOSYSTEM OF ARCTIC INDUSTRY

Kemi-Tornio's circular economy innovation platform

- World's 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



## 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 biggest chromium mine

outokumpu



### 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 2<sup>nd</sup> 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

## Industry byproducts utilised

### 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

### 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

### Prioritisation of development tasks



**4/2013**

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

### 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

# 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



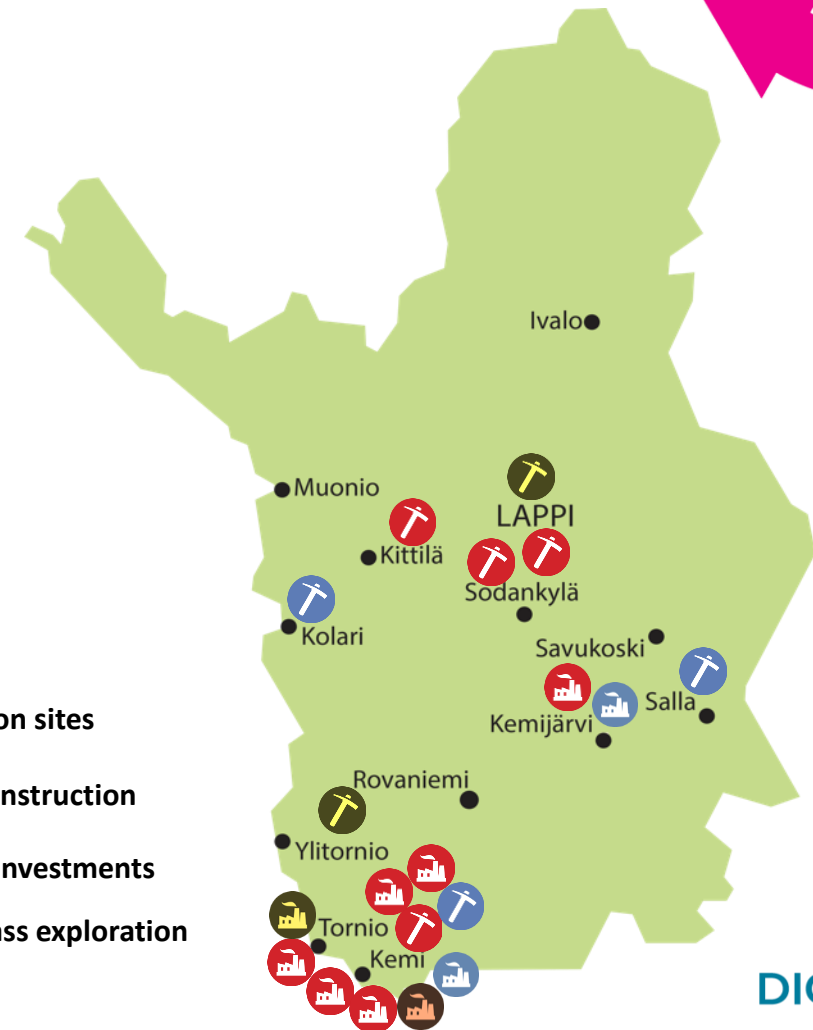
## Classification

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

# 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

-   Production sites
-   Under construction
-   Planned investments
-  World class exploration projects

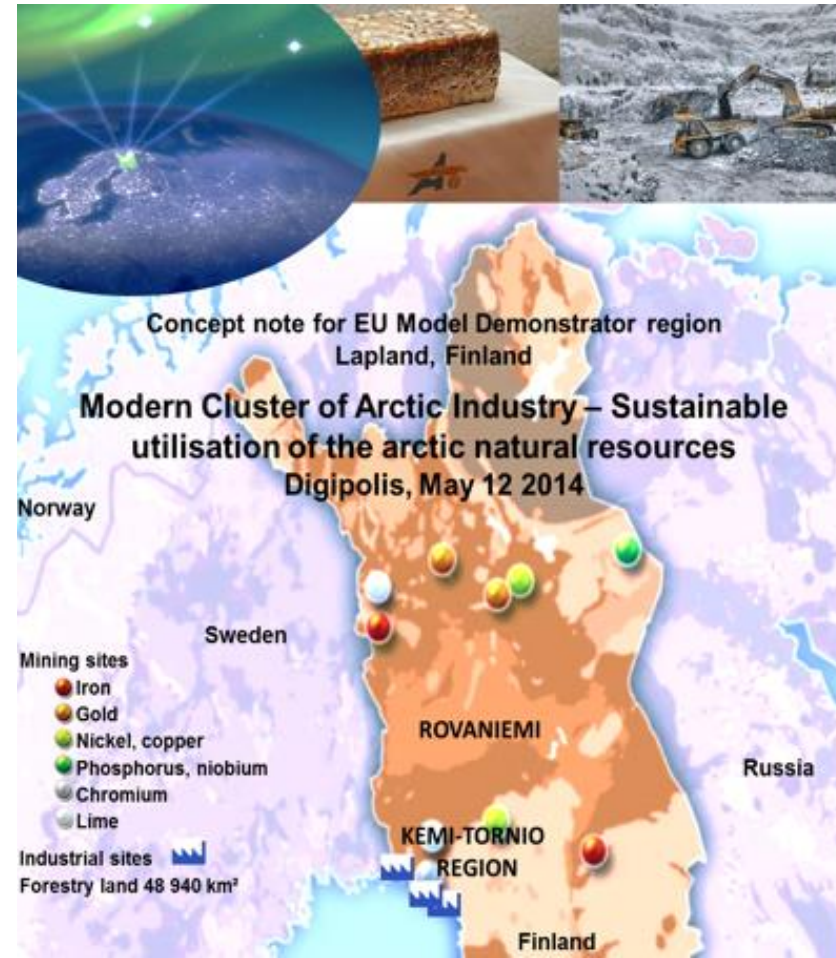


## ARCTIC BUSINESS CONCEPT ABC

### 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



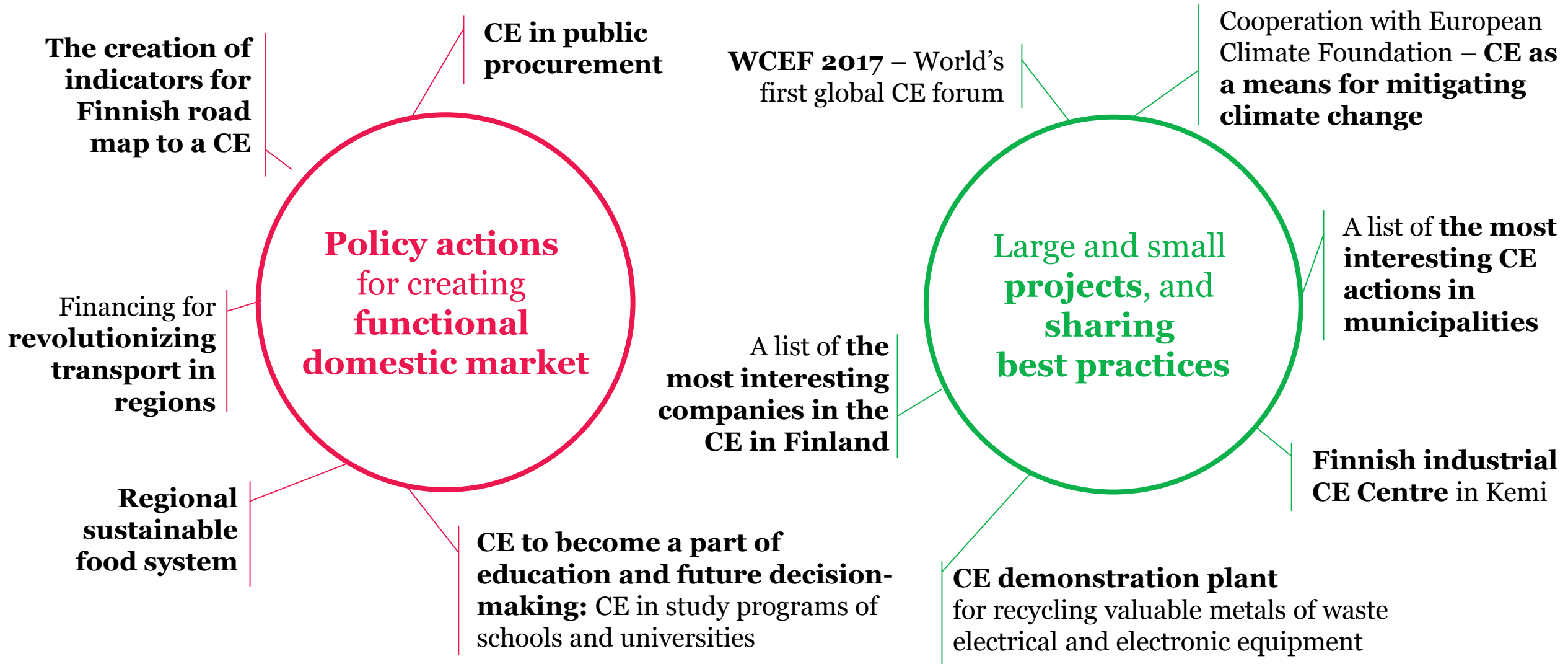


**Arctic Industry & Circular Economy Cluster**

**Sustainable exploitation of arctic natural resources**

**SILVER Cluster Management Excellence**  
DEDICATED TO CLUSTER EXCELLENCE

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



## 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

## 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

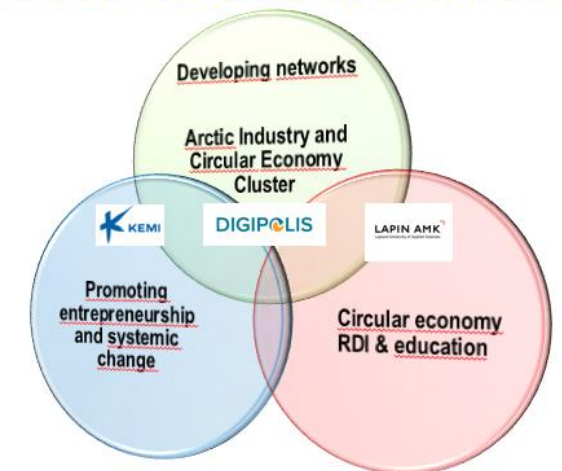
Network of industry & university experts and intermediaries

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

THE MAIN STRATEGIC FOCUS AREAS OF CIRCULAR ECONOMY CENTRE



## OPERATIONAL MODEL FOR REGIONAL/LOCAL INDUSTRIAL CIRCULAR ECONOMY PLATFORMS

Description of the operational model for local/regional industrial circular economy platforms, largely based on the experiences of the Kemi-Tornio in 2012-2017

Eight major pillars - to be regionally/locally adapted taking into account the local industrial background and features



Area	Activities
Industrial	Metals, Chemicals, Paper, Textiles, Food, etc.
Service	Logistics, Maintenance, Repair, etc.
Energy	Renewable energy, Waste-to-energy, etc.
Waste	Recycling, Waste management, etc.
Water	Water treatment, Reuse, etc.
Land	Land reclamation, etc.
Other	Research, Education, etc.

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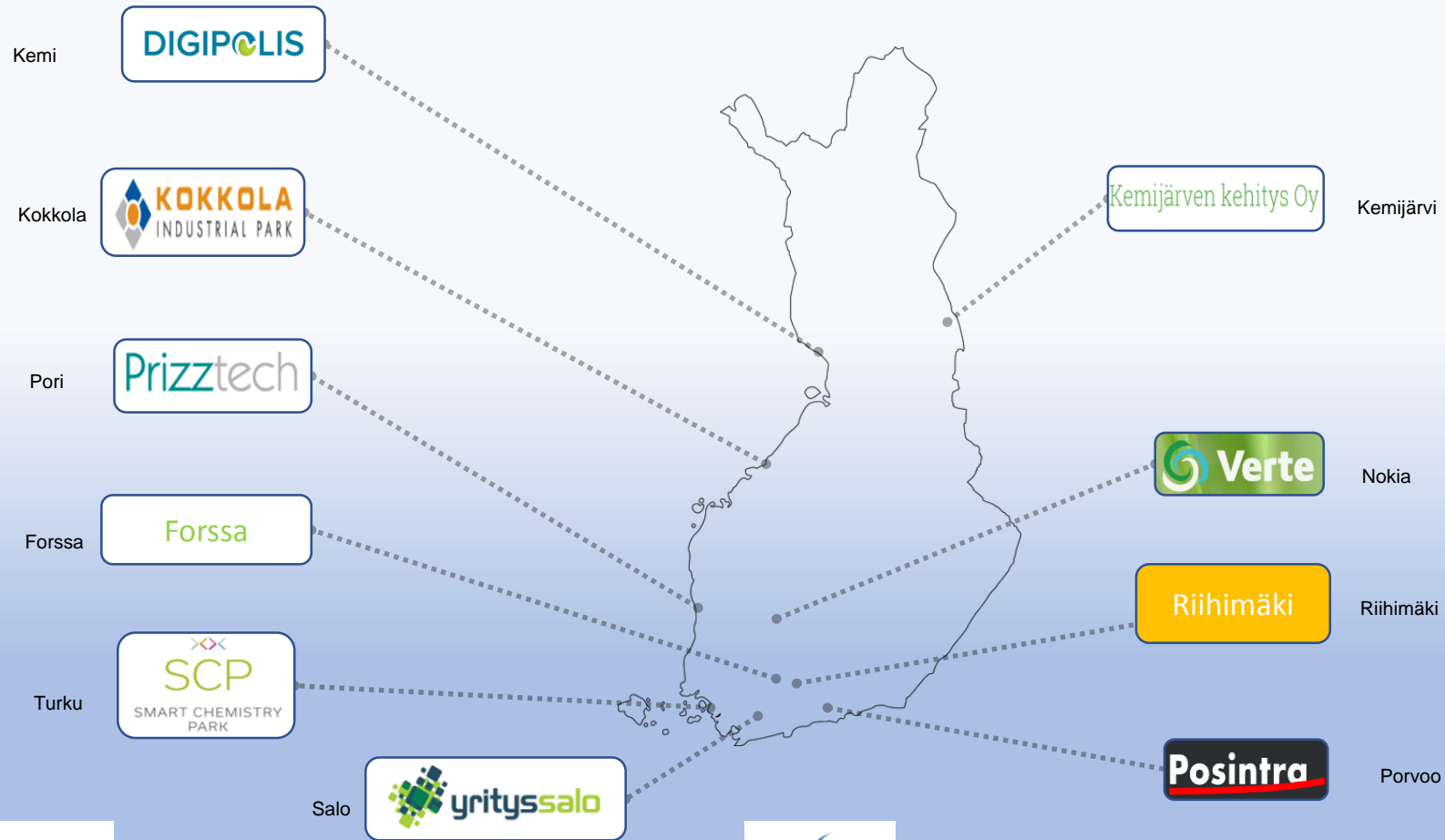
**2017**  
Implementation of Sitra's action plan

DIGIPOLIS theEU theEU LAPIN AMK

## DESCRIPTION OF OPERATIONAL MODEL: EIGHT PILLARS

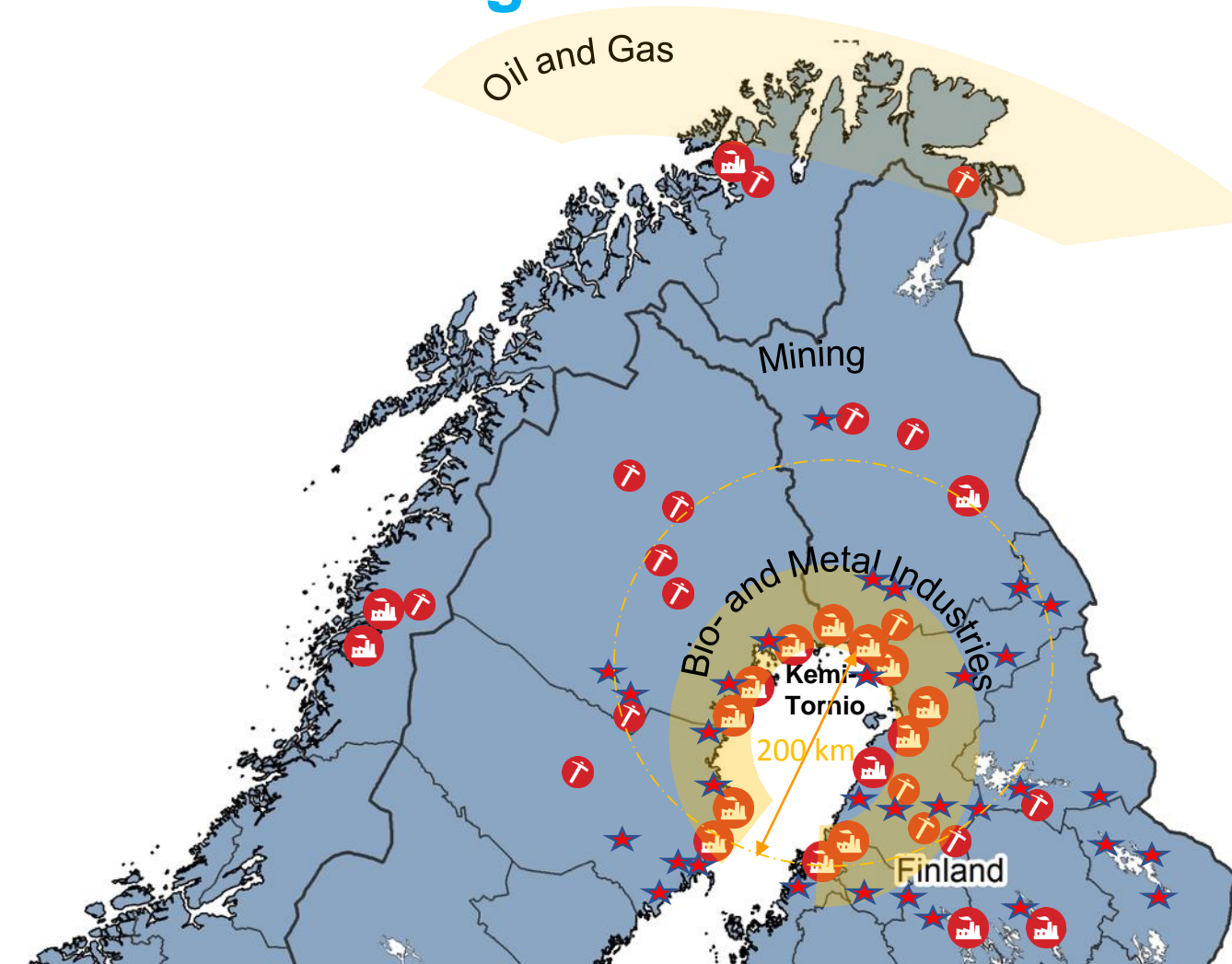
- 1 Identification of the needs of companies considering industrial symbiosis activities
- 2 Gathering of stakeholder network: companies, R&D organizations, public authorities
- 3 Concrete start-up activities: industrial pilots & public-private initiatives
- 4 Toolbox of Industrial Symbiosis: information on possibilities (know-what), instructions on practical utilization (know-how), information sources (know-who)
- 5 Communication on the possibilities, first success stories and events of industrial circular economy
- 6 Trust building, including e.g. practices and instructions regarding dissemination of industrial symbiosis information
- 7 Benchmarking & networking : regionally, nationally, and internationally
- 8 Priority in the needs and possibilities of the participating companies

## Network of eco-industry parks in Finland



## Nordic Industries Story of Natural Resources Refining

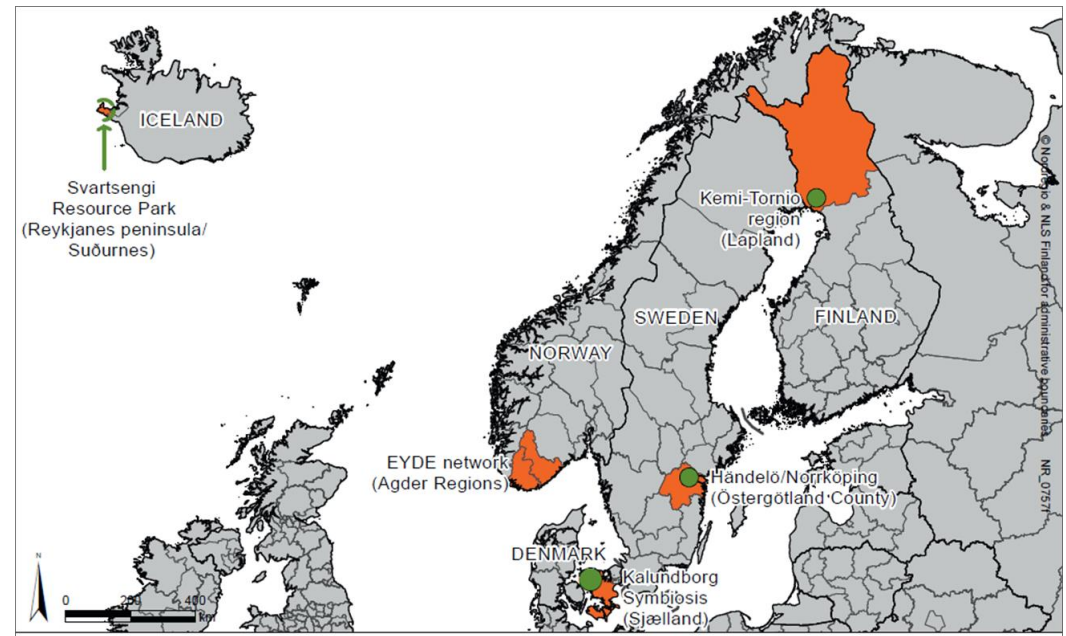
- Global Markets
- Good Connections
- Arctic Solutions
- Cleantech Solutions
- 5 Bio Refineries
- 32 Sawmills
- 16 Mines
- 5 Metal Refineries
- 2 Aluminium Smelters
- 1 LNG Refinery
- 2 Chemical Plants





# 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)



## Case examples

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### 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.

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KEMI TOIVANEN AHMA ecovin outolumpu storanso  
 EUROPE'S FIRST INTELLIGENT BICYCLE AND WALK PATH USING INDUSTRIAL RESIDUES



Regional innovations and pilots  
 REGIONAL COUNCIL OF LAPLAND

LAPIN AMK

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### Biofuelrefinery project in Kemi



LAPIN AMK

LAPPIA

KEMI

KAIDI

KEMIN KUTAMA

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# 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](http://www.energy-enviro.fi/index.php?PAGE=2906&NODE_ID=2906&ArchiveId=319&ArchiveSelect=200607), 19.11.2012.)

# Thank You!

Interested in to do co-operation?  
Contact: [kari.poikela@digipolis.fi](mailto:kari.poikela@digipolis.fi)

Please visit: [www.teollinenkiertotalous.fi](http://www.teollinenkiertotalous.fi)

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