# Circular economy and climate change mitigation


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# How are the CE and low-carbon targets linked with each other?

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# CE and low-carbon targets

- Substantial amounts of greenhouse gas (GHG) emissions are generated in the raw-material extraction, production processes as well as at the end-of-life phase of products
- Tightening national and international emissions reduction targets require CE solutions
- European Commission launched its CE package in 2015 including an action plan for the CE and legislative proposals (European Commission, 2015)
- Finland has its own road map to a CE which highlights the opportunity to become a pioneer in carbon-neutral circular economy and low-emission solutions (Sitra, 2016)



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# Despite the ambitious missions and great targets, the actual economic and environmental impacts of different CE actions are still not known very well



Photo source: SYKEkuvat

# What do we already know? What are the main knowledge gaps?



Photo source: Wilma Hurskainen, SYKEkuvat

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# CE and emissions reductions – What do we already know?

- The climate change mitigation discussion and policies often aim at the decarbonization of the energy system
- However, many studies exist assessing the emissions reductions resulting from different types of “non-energy” CE activities

→ **Due to complex interactions and lack of detailed data the assessment of the emissions reduction potential of CE is difficult**



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Photo source: SYKEkuvat

# CE and emissions reductions – What do we already know?

- The generalizability of CE studies is challenging
  - Target countries and areas are different
  - The determination of CE varies between studies
  - Considered CE actions differ
  - Different modeling methods have been used
    - Life-cycle assessments, environmentally extended input-output models, computable general equilibrium models etc.
  - The underlying assumptions differ (e.g. substitution between sectors)
- **It is hard to predict what happens in the future**



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# What is the potential of CE solutions in climate change mitigation?

Photo source:SYKEkuvat



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# Potential of CE solutions in climate change mitigation

- **The potential of the "non-energy" CE actions is modest, yet valuable on the GHG abatement (Material Economics, 2018; Trinomics, 2018; Geerken et al., 2019; Seppälä et al., 2016)**
  - The emissions mitigation potential of CE actions is estimated to vary between 2% and 20%



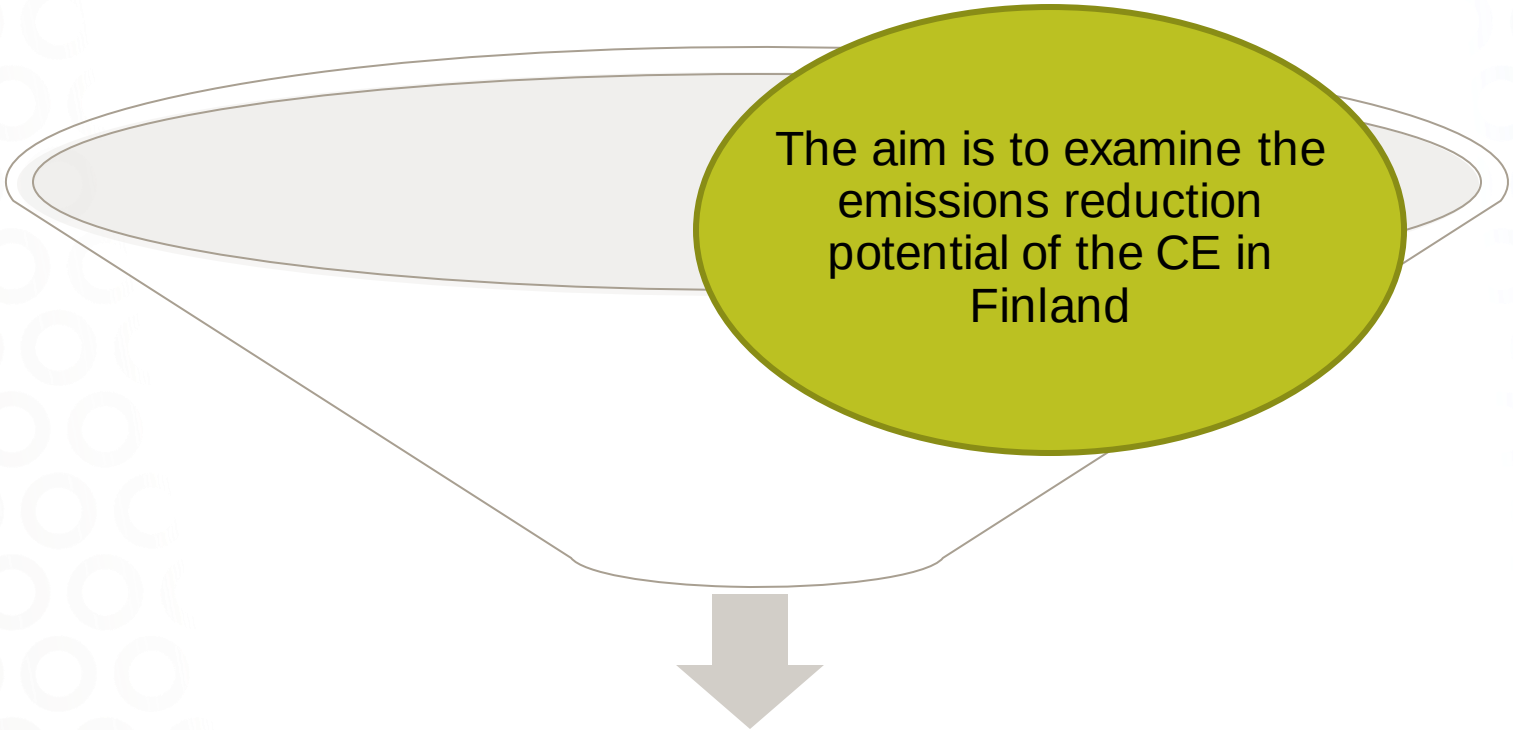
Photo source: SYKEkuvat

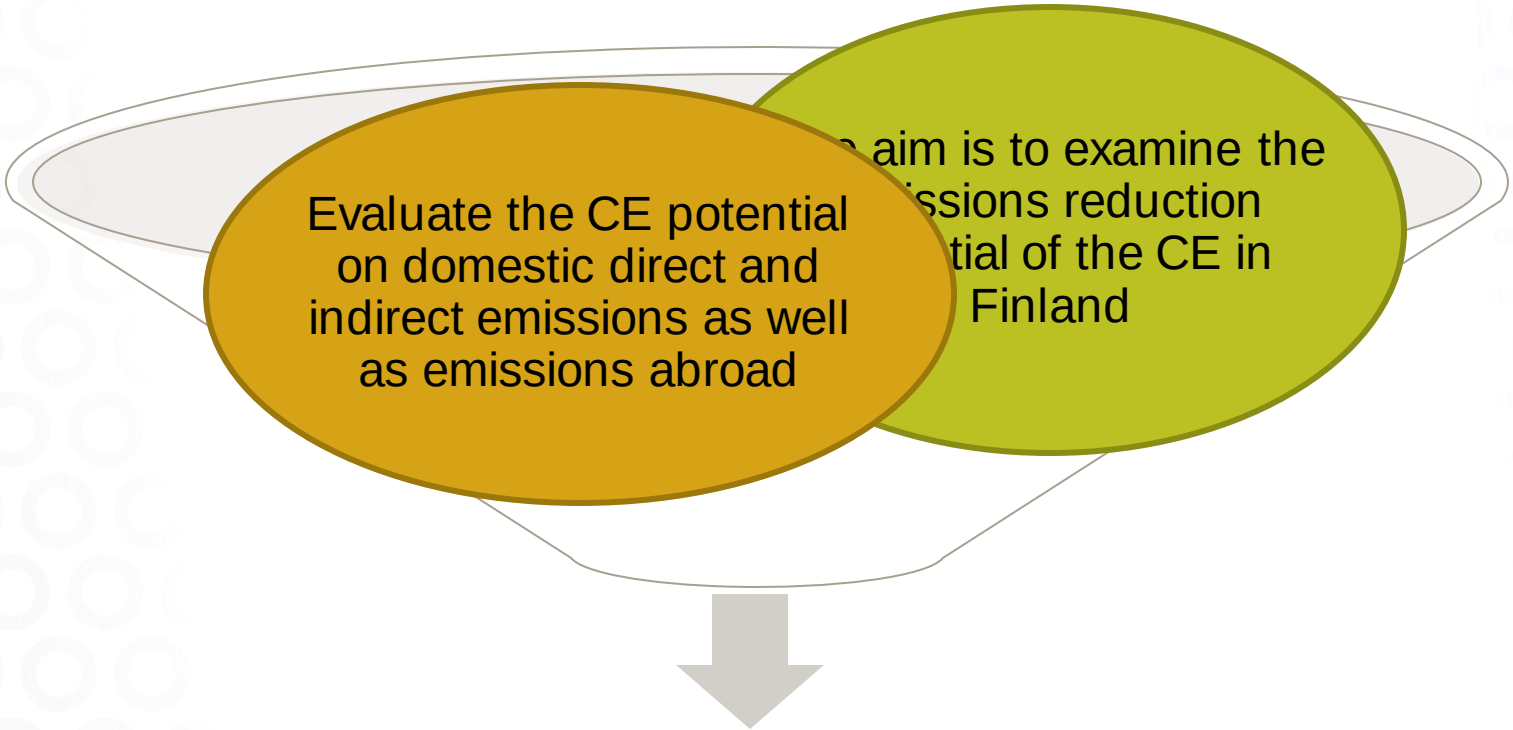
# Assessment of emissions reduction potential of CE in Finland

by Riina Antikainen, Enni Ruokamo, Jyri Seppälä, Susanna Sironen and Hannu Savolainen



Photo source: Enni Ruokamo


The aim is to examine the emissions reduction potential of the CE in Finland


Evaluate the CE potential on domestic direct and indirect emissions as well as emissions abroad
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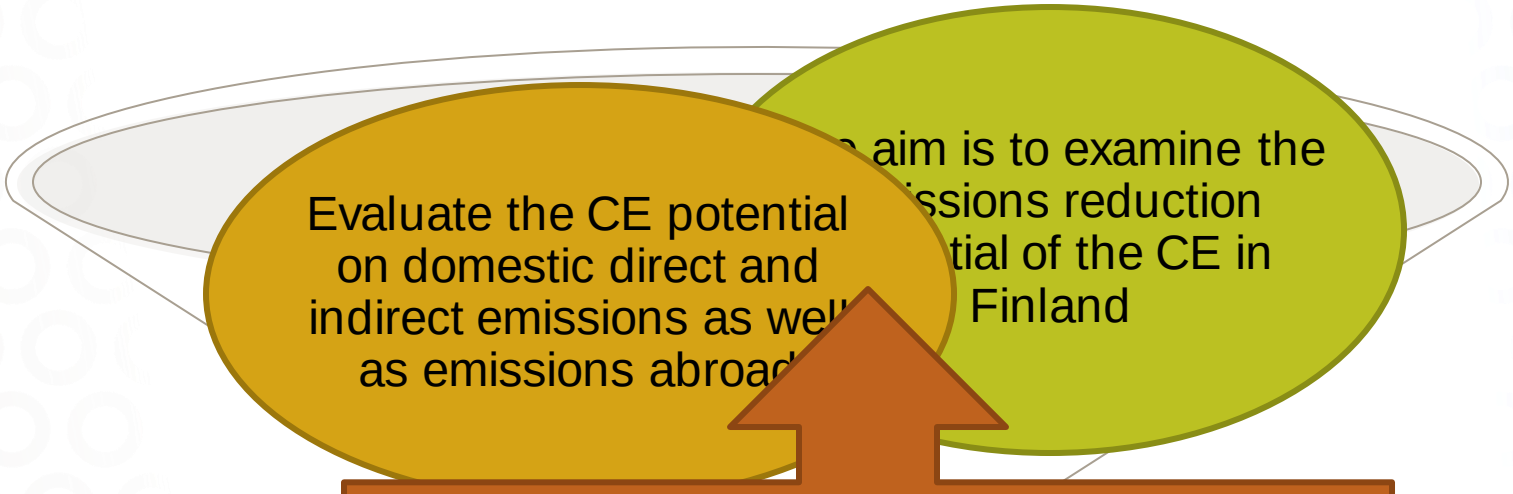


An environmentally extended input-output model ENVIMAT is used to assess the emissions reductions potentials and life-cycle environmental impacts caused by different industries (Savolainen et al., 2019)



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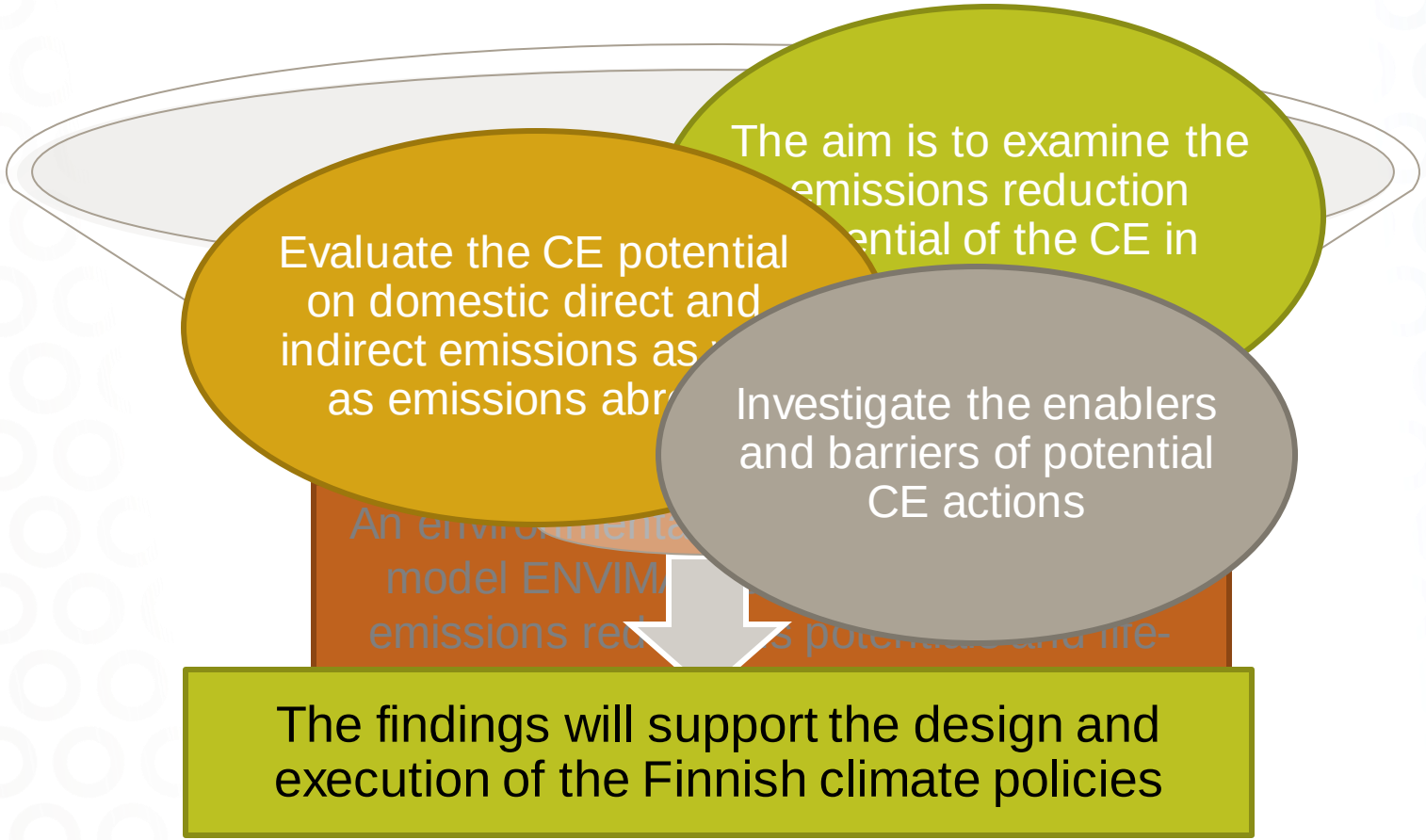
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Investigate the enablers
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The findings will support the design and
execution of the Finnish climate policies



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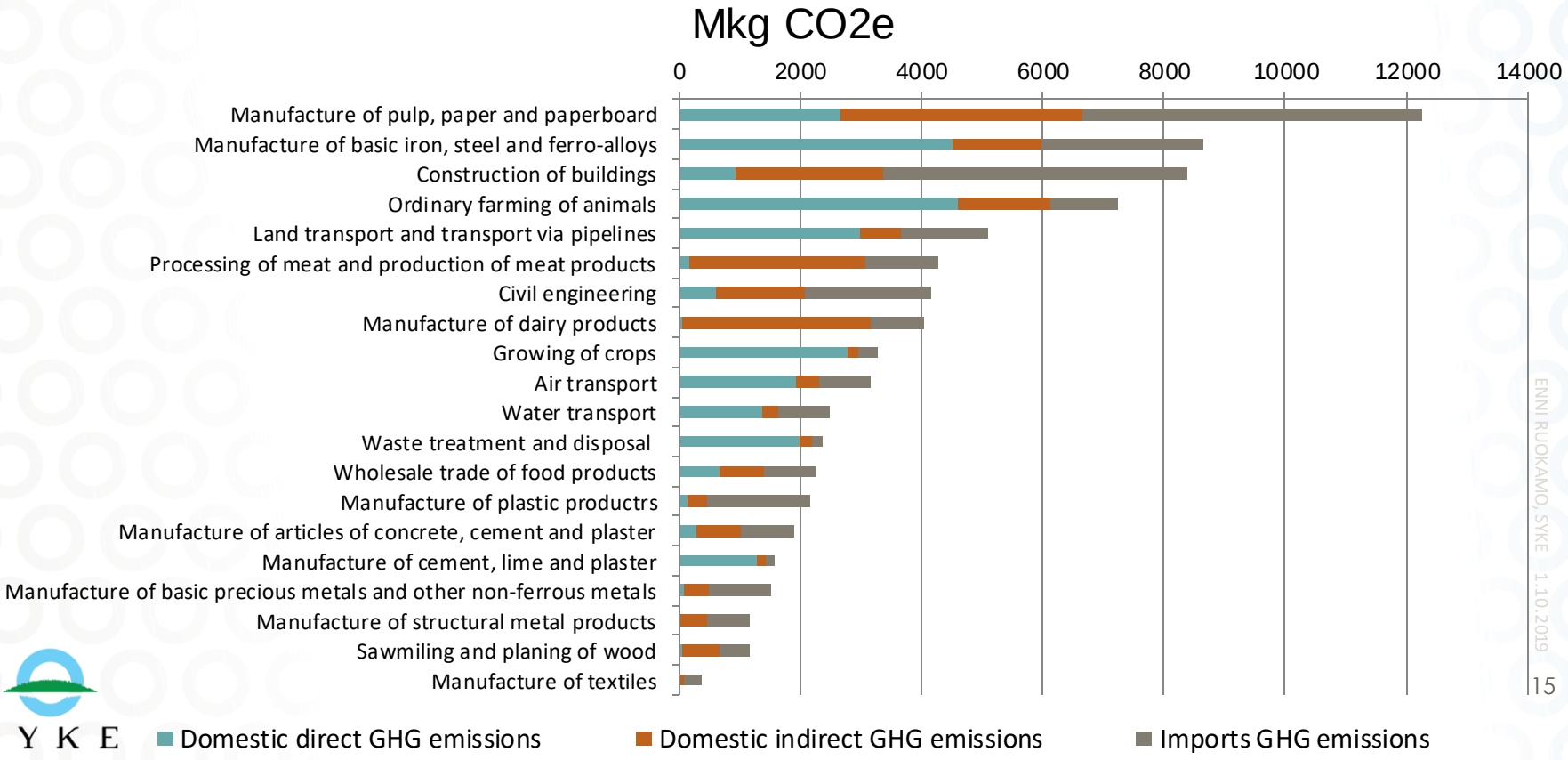
# Life-cycle GHG emissions of selected Finnish industries

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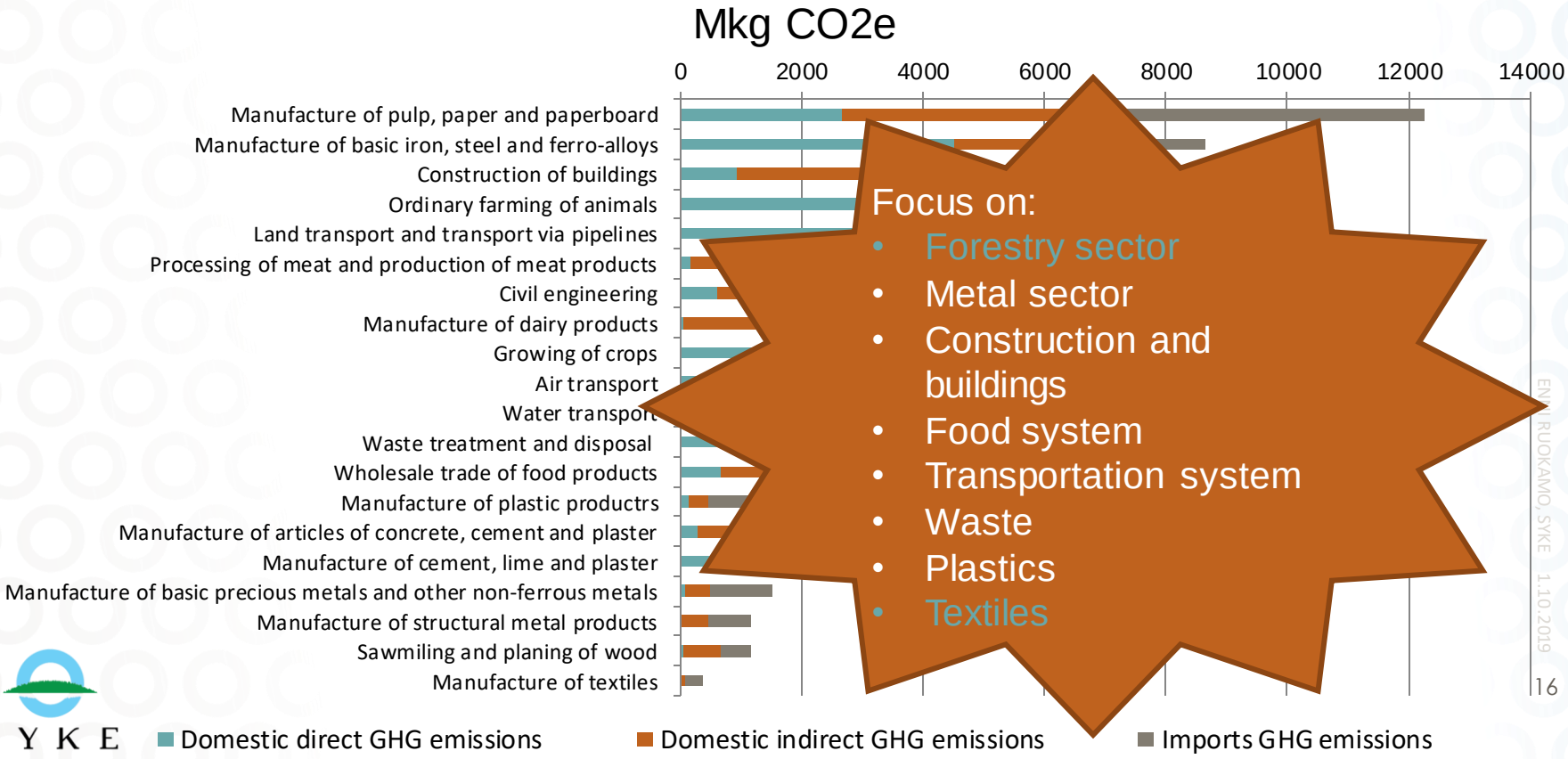
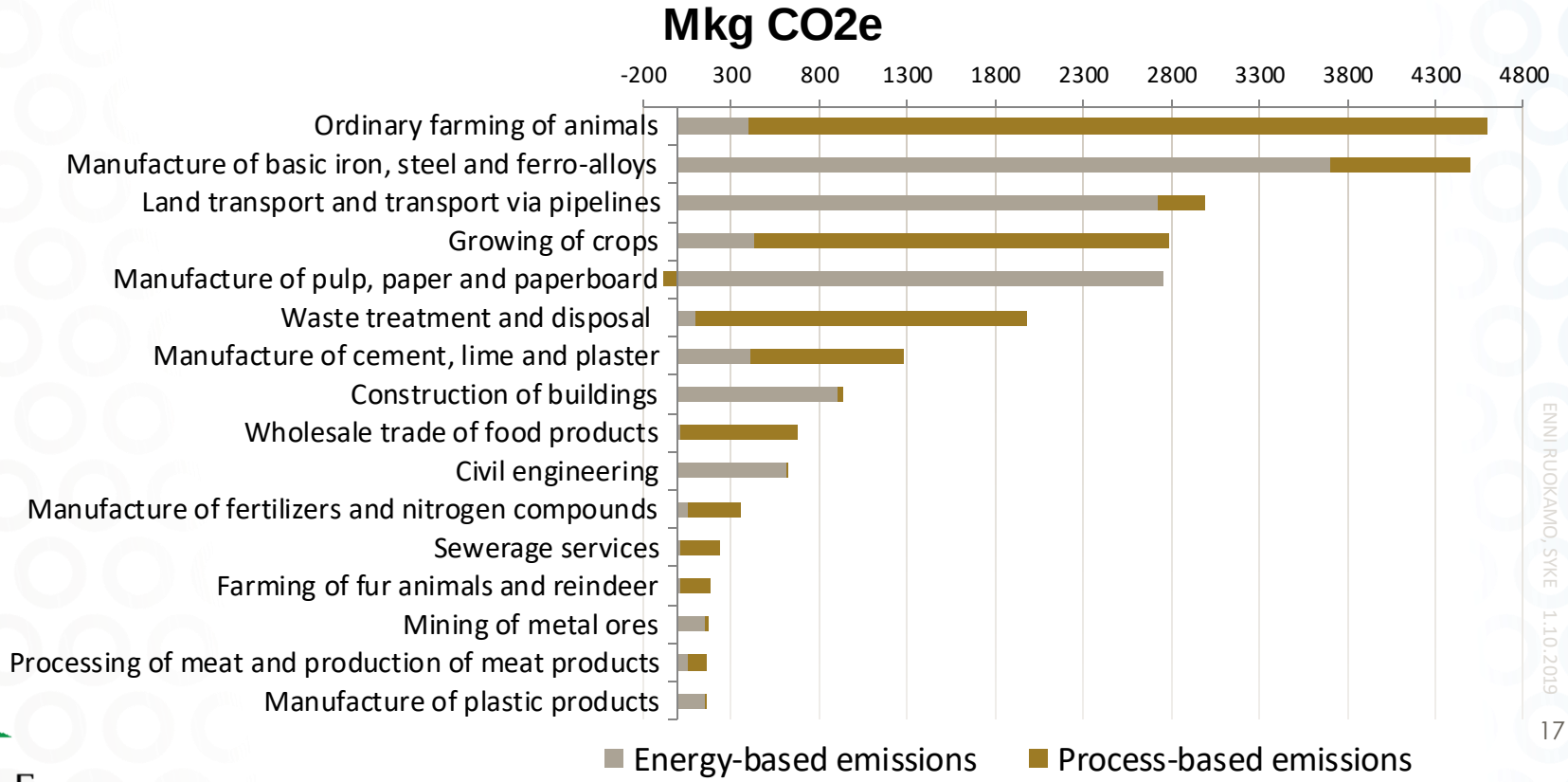
# Life-cycle GHG emissions of selected Finnish industries



# Direct GHG emissions of selected key industries



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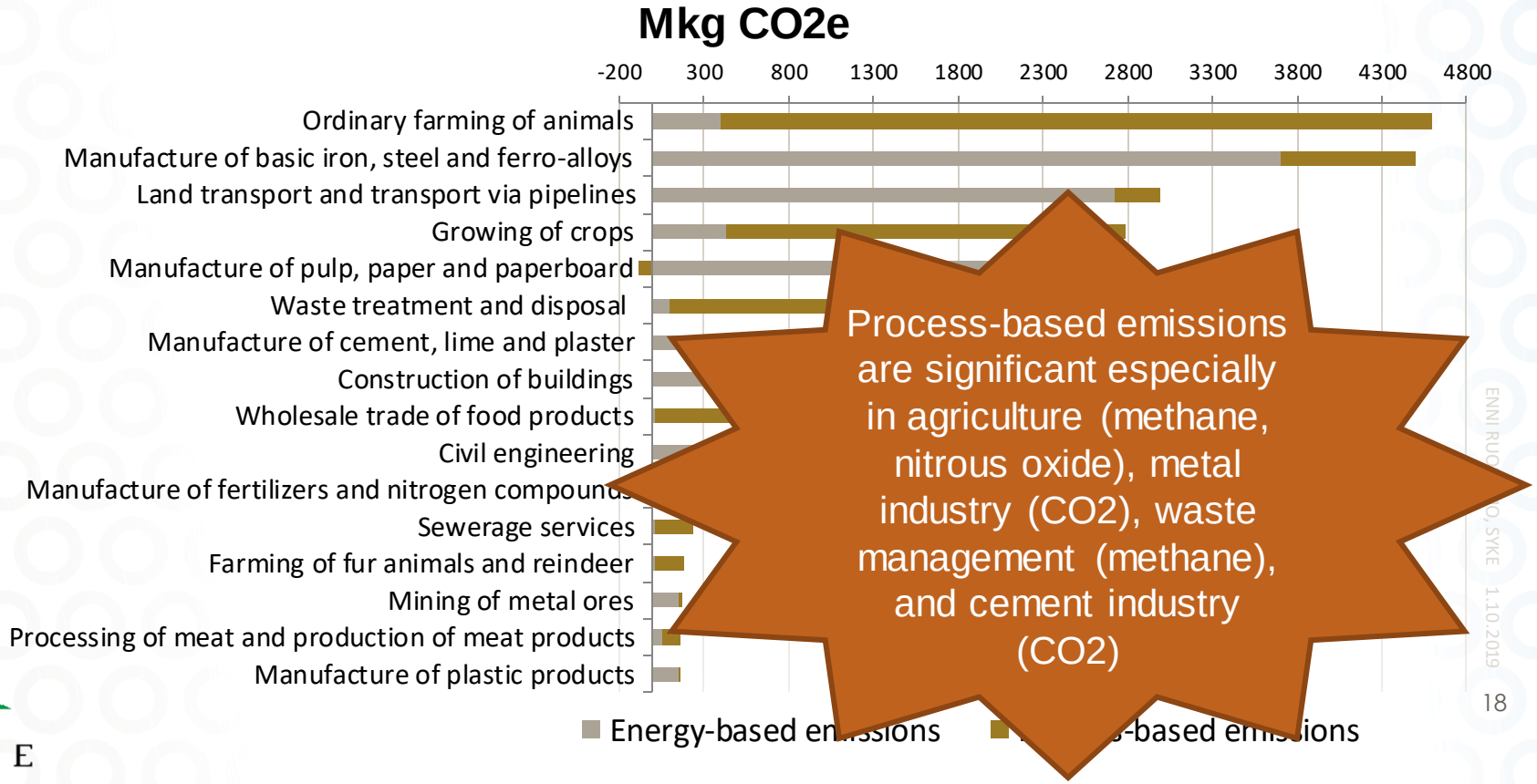
# Direct GHG emissions of selected key industries



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# How to reduce process-based emissions?

**Ruotsissa testataan ratkaisua, joka mullistaisi yhteiskunnan ja romauttaisi päästöt – ja idea voi tulla käyttöön ensimmäisenä Suomessa**

Yksi ainoa terästehdas aiheuttaa seitsemän prosenttia Suomen koko hiilijalanjäljestä. Tämä voi kuitenkin muuttua.

Ilmastonmuutos 8.9.2019 klo 11.03 | päivitetty 8.9.2019 klo 18.30


Source: YLE news

**Jätteiden hyödyntäminen on ekoteko ja viimein se kiinnostaa myös yrityksiä – siksi tutkijat kehittävät uusia materiaaleja jätteestä**

Tutkijat kehittävät jätteistä muun muassa ekomateriaaleja. Yksi esimerkki on lasivillasta kehitetty maailman lujin betoni.

Kiertotalous 31.1.2019 klo 06.00


Tutkijat lupaavat, että uudenlaisen geopolymeeribetonin valmistamisessa syntyy vain viidennes siitä hiilidioksidista, jota sementin valmistamisessa vapautuu ilmakehään.



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# Conclusion



Photo source: SYKEkuvat

# Key findings and recommendations

- Even though the emissions reduction potential related to energy is substantial, **“non-energy” CE actions are still valuable and powerful**
- It is challenging to assess the exact amount of reduced emissions for each CE action → **It is important to concentrate on the relative potential of different CE actions**
- Predicting **the future includes many uncertainties**

Photo source: SYKE/Inet



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# Key findings and recommendations

- CE actions targeting **process-based emissions** could provide significant emissions reductions
  - Examples: new technologies to manufacture cement/concrete and steel
- **Demand side measures** are very important as well
  - Mitigate also energy-based emissions
- Extraction of natural resources has impacts on **biodiversity** and **ecosystem services**

Photo source: SYKE/Inet

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# THANK YOU FOR YOUR ATTENTION!

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