Methods and tools for environmental sustainability assessment

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Agenda

- Introduction of participants and interests (all)

- Methods and tools

- Demonstration

  - SULCA tool for calculations

  - Network LCA web tool for LCA data collection and results publishing

  - Hands-on group work

- Wrap-up, discussion, ideas for future work

Sustainability assessment at VTT- Products & services

METHODS AND TOOLS FOR SUSTAINABILITY IMPACT ASSESSMENT & COMMUNICATION

LIFE CYCLE ASSESSMENT
(ISO14040-44)

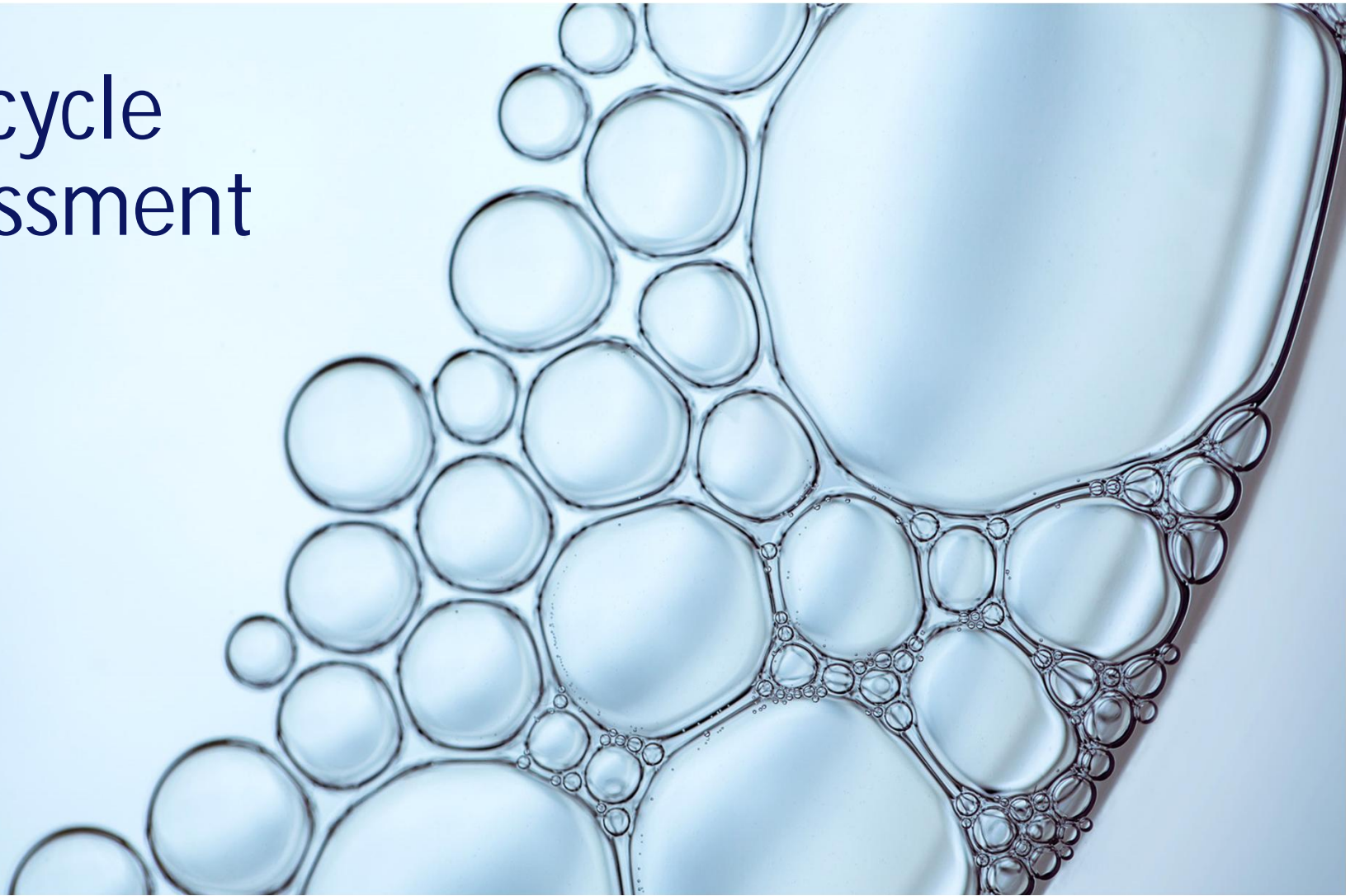CARBON FOOTPRINT
(ISO14067)

WATER FOOTPRINT
(ISO 14046)

HANDPRINT

CRITICAL REWIEWS

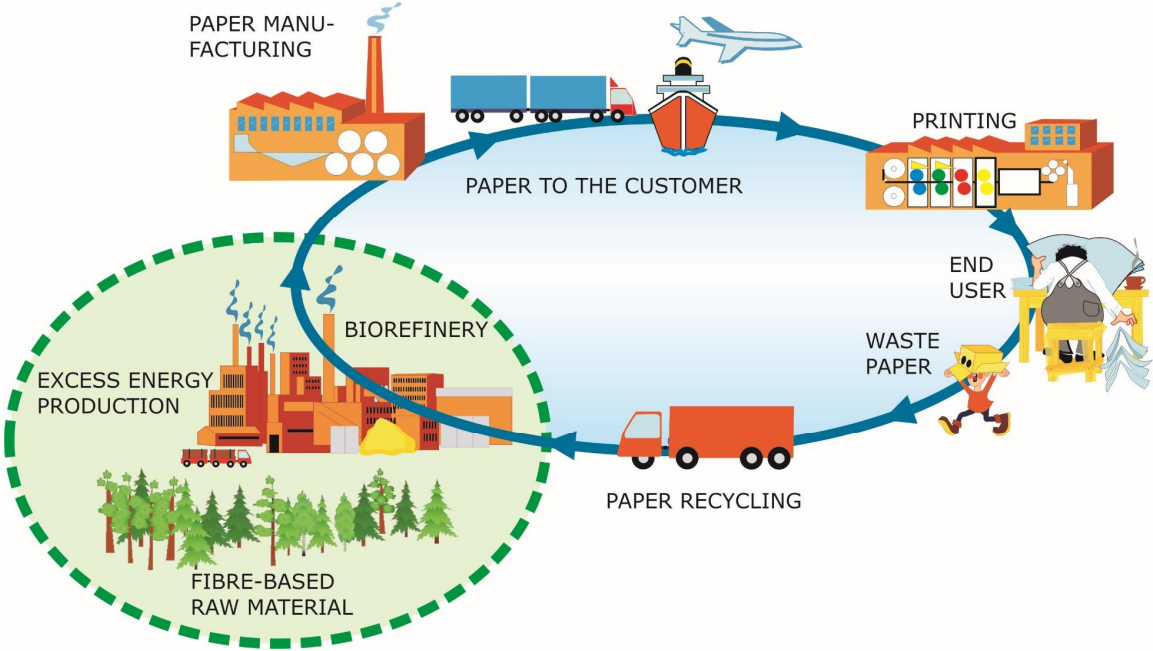ENVIRONMENTAL
PRODUCT
DECLARATION (EPD)
(ISO14025)

SULCA
LCA SOFTWARE

Life cycle assessment

Define problem and life cycle steps | Data collection | Model and calculate impacts | Analyse results and plan actions

Life cycle approach: Quantified environmental impacts and benefits over the life cycle of a product

PAPER MANU-FACTURING

PAPER TO THE CUSTOMER

PRINTING

END USER

WASTE PAPER

BIOREFINERY

EXCESS ENERGY PRODUCTION

PAPER RECYCLING

FIBRE-BASED RAW MATERIAL

| Define problem and life cycle steps | Data collection | Model and calculate impacts | Analyse results and plan actions |

LCA databases

- Databases (ecoinvent, PlasticsEurope etc.) include average data for example on energy and waste treatment

- Aggregated or unit process data

- **Benefits**
  - Readily available data
  - Fills in the data gaps left by specific data
  - Saves resources

- **Challenges**
  - Transparency
  - Data age
  - Compatibility of different databases
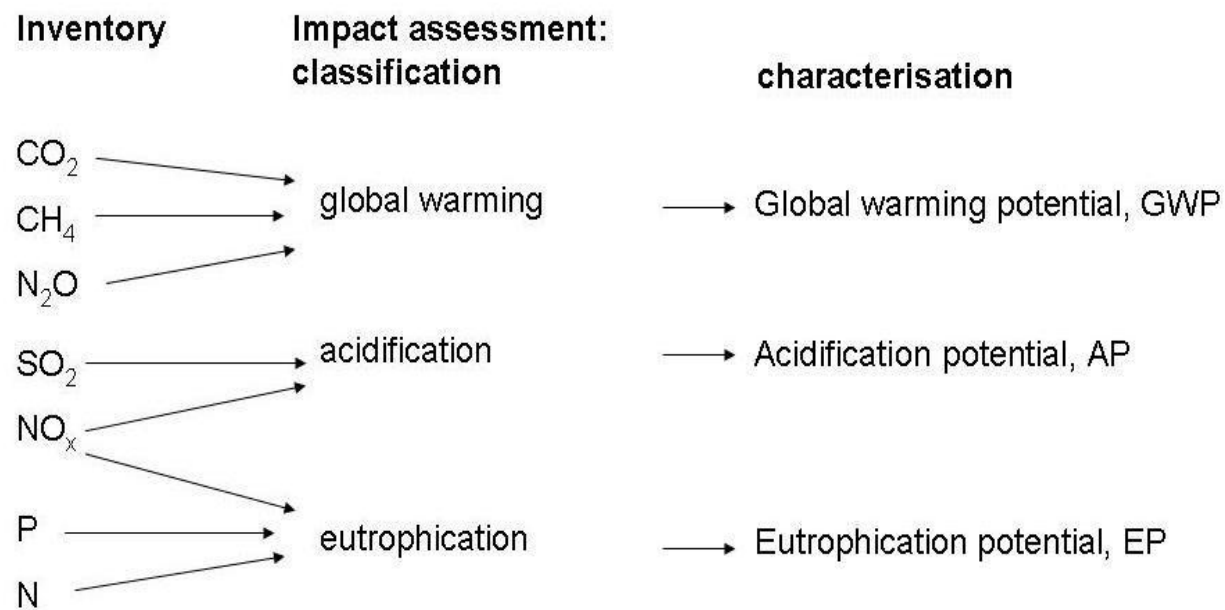 - Average data might not represent the product under assessment

| Define problem and life cycle steps | Data collection | Model and calculate impacts | Analyse results and plan actions |

LCA specific data

- Collected e.g. with inquiries sent to key raw material suppliers
  - Questionnairees can include cover letter, documentation, inputs and outputs
- Inputs and outputs are the materials, emissions, wastes, energy consumption etc. from the real manufacturing processes
- **Benefits**
  - Represents the product under assessment
  - Up-to-date
  - Supplier engagement
- **Challenges**
  - makes data collection more time consuming
  - data quality might vary
  - supplier engagement
  - resource required vs. benefits received
  - data privacy
  - lack of common terminology between various operators
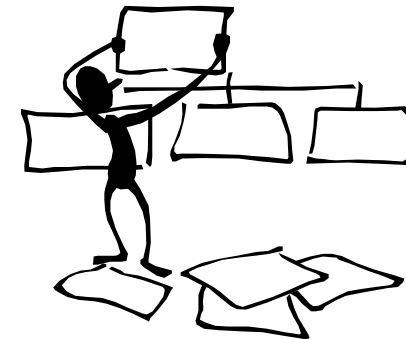
# Calculations of emission inventory and environmental impacts will be carried out with the LCA software tools

Inventory   Impact assessment: classification   characterisation

CO_2
CH_4 → global warming → Global warming potential, GWP
N_2O

SO_2 → acidification → Acidification potential, AP
NO_x

P → eutrophication → Eutrophication potential, EP
N

Internationally agreed for carbon footprint

- Includes **fossil** greenhouse gas emissions (e.g. CO_2 and CH_4). **Biogenic** carbon reported separately but not included in the carbon footprint.

- Can be calculated for products, services or companies.

- Comprises all stages of the life cycle i.e. from cradle to grave or for B-to-B use can represent cradle-to-gate emissions

- Not included is the compensation of emissions (carbon offsetting or carbon storaging).
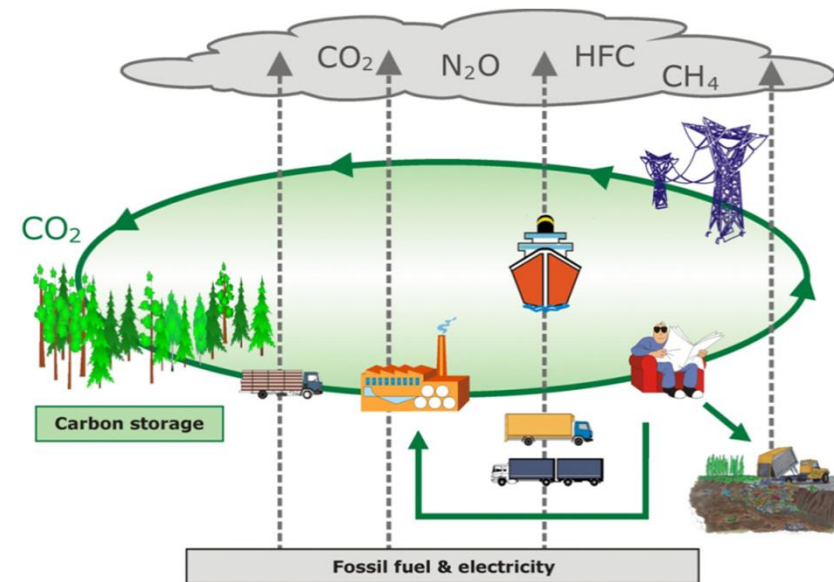
Challenges in communication
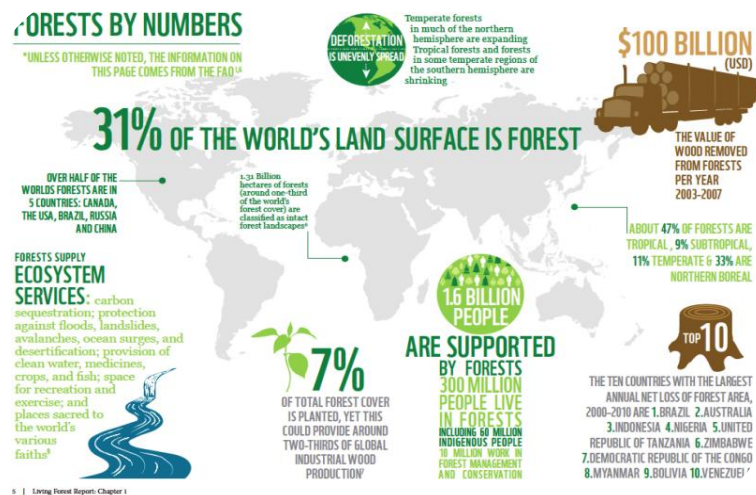
- Results and communication should be science-based

- Easy-to-communicate indicators are needed

- Knowledge causes pain – too many indicators and methodologies available

Handprint is a positive indicator
- shows your environmental benefits

Footprint methods provide high-quality information about environmental burdens of products and processes

Handprint is a new way for companies to assess and communicate the positive effects of their products on sustainable development. It refers to beneficial environmental impacts that organizations can achieve and communicate by providing products or services that reduce footprint of other actors. Handprint is based on assessing the change compared to a defined baseline

Carbon handprint is the reduction of the carbon footprint of another actor. Life cycle assessment and carbon footprint standards are followed in the background (ISO 14040-44, ISO 14067)

Carbon handprint project manager: Saija Vatanen (firstname.lastname@vtt.fi)

Carbon handprint - project
(1.9.2016 - 30.11.2018)
Calculation and communication guideline for a carbon handprint of product

http://www.vtt.fi/handprint

Project partners:

NOKIA KONE PAPTIC

Gasum SITRA NESTE

AM FINLAND 3D metallituostus BIOLAN ao allover

Tekes Metallinjalostajat

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CIRCULAR ECONOMY – recent projects

Our research portfolio related to circular economy covers a large variety of topics from different industrial sectors. Research topics include **indicators for resource efficiency, impacts of recycling** and **re-manufacturing**.

MORE - Real-time Monitoring and Optimization of Resource Efficiency in Integrated Processing Plants
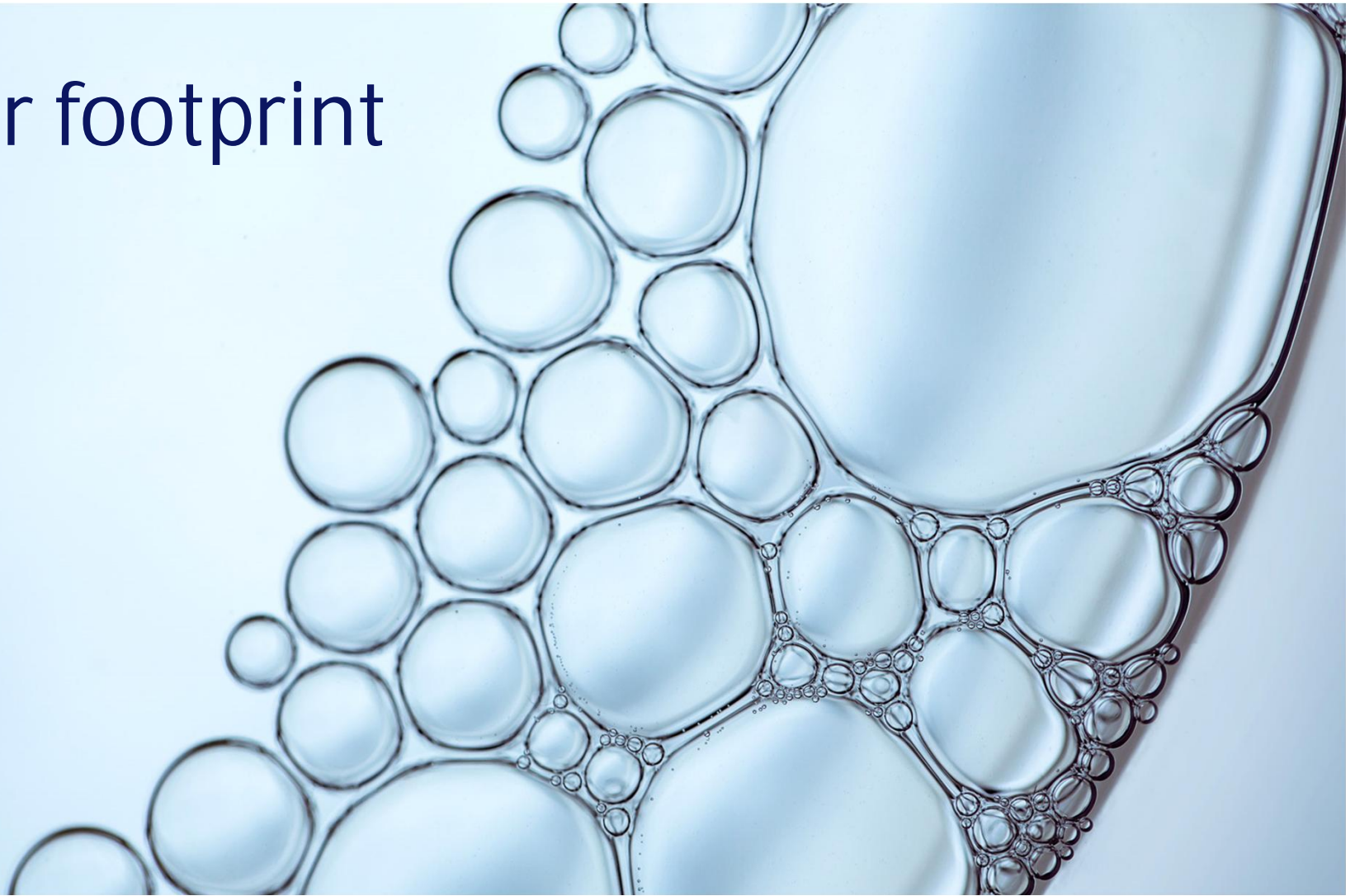EU FP7, 2013 – 2016
http://www.more-nmp.eu/

REFFIBRE - Tools for resource efficient use of recycled fibre materials,
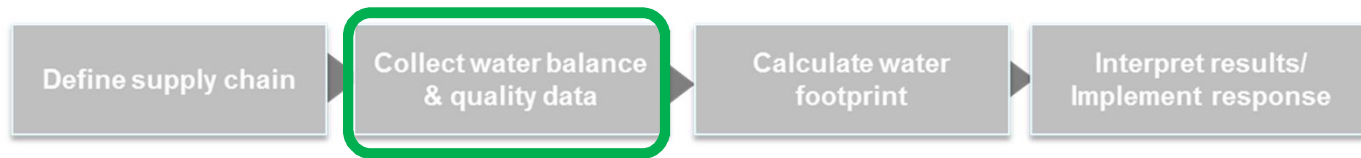EU FP7, 2013 – 2016
http://www.reffibre.eu/

Reman Path Finder – Project develops learning material to European industry about the path to remanufacturing
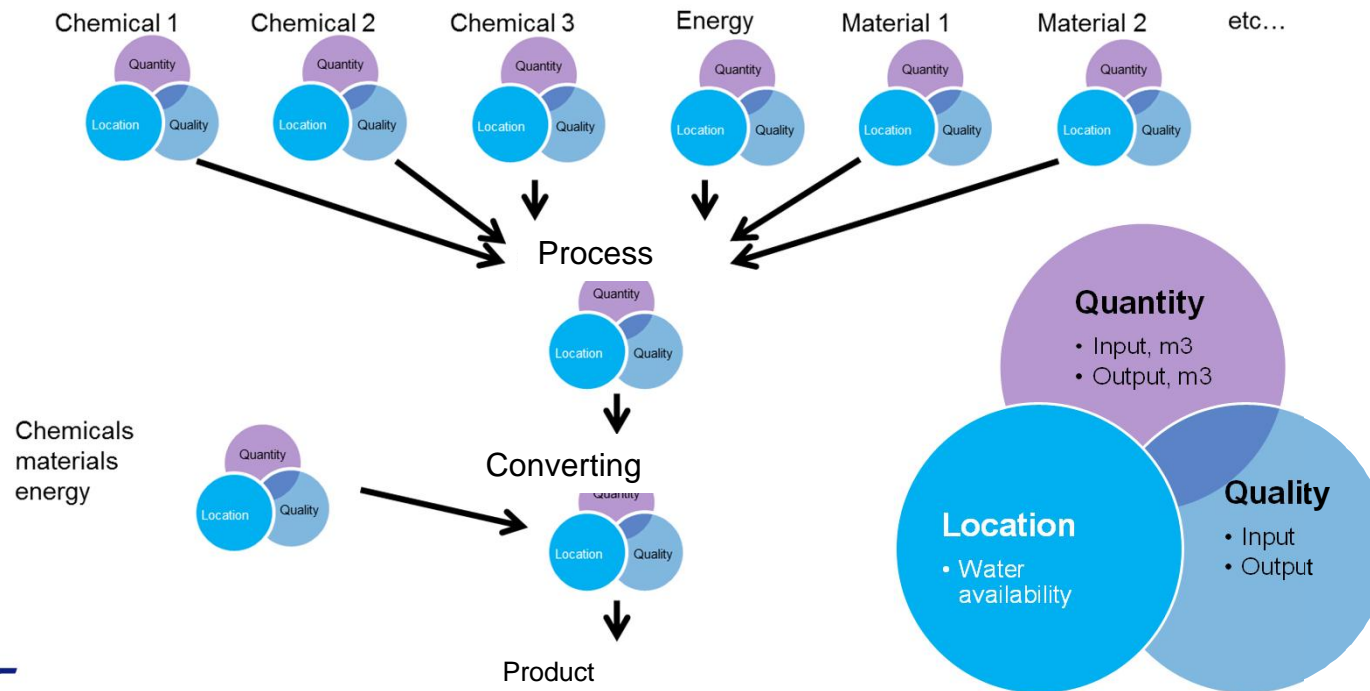EIT Raw material KIC, 2018-2019
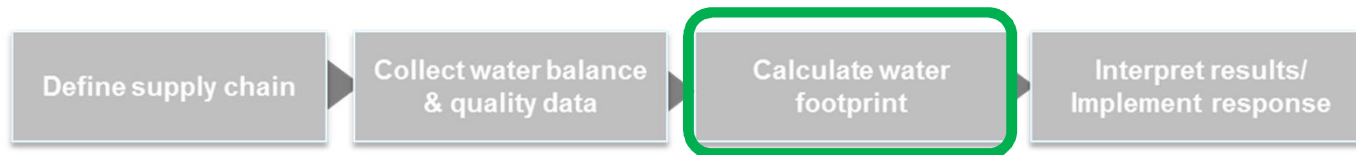
https://www.vtt.fi/sites/remanpathfinder/reman-path-finder
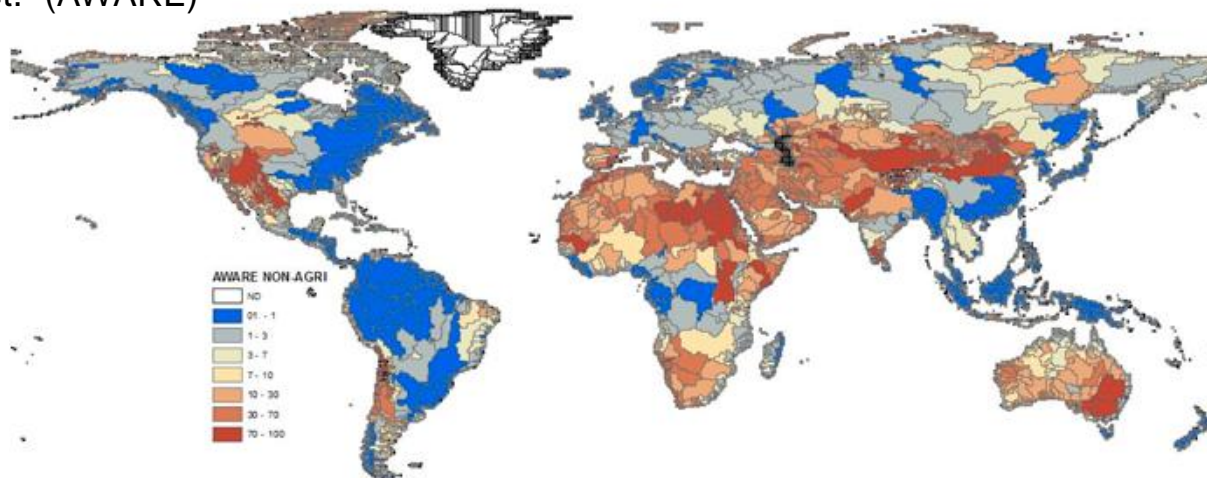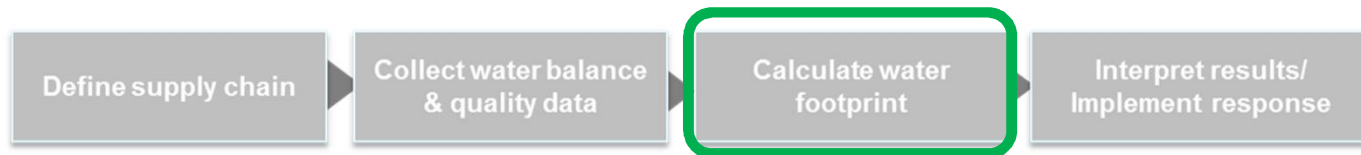
Water footprint

The whole value chain is considered

Local water scarcity indices

- Factors used in calculation

- 0 (no scarcity, blue)
- 100 (extreme scarcity, red)

- "Relative Available WAter REmaining per area in a watershed, after the demand of humans and aquatic ecosystems has been met." (AWARE)

AWARE NON AGRI
- ND
- 01 - 1
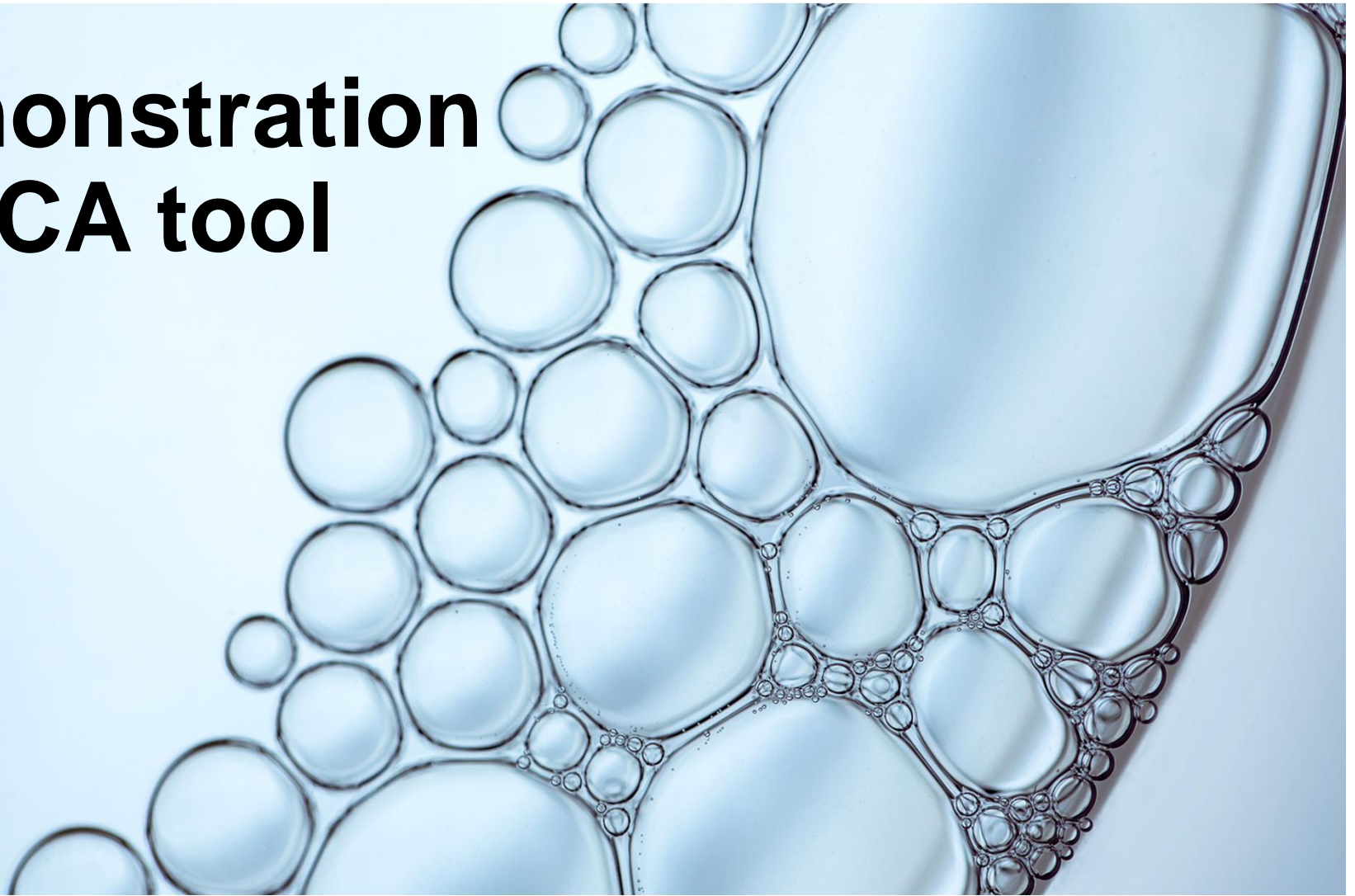- 1 - 3
- 3 - 7
- 7 - 10
- 10 - 30
- 30 - 70
- 70 - 100

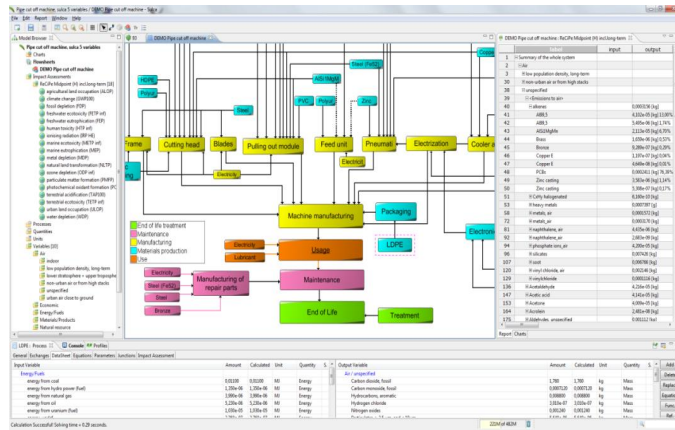**Water inventory (m³)   *   index   =   Water footprint m³ eq.**
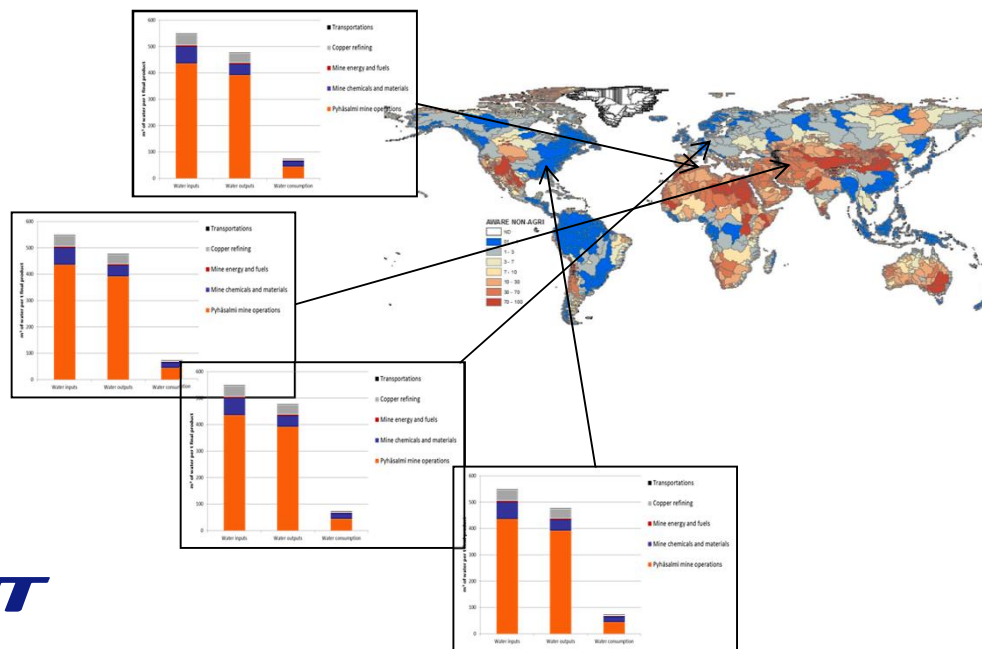
AWARE index:
"Relative Available WAter REmaining per area in a watershed, after the demand of humans
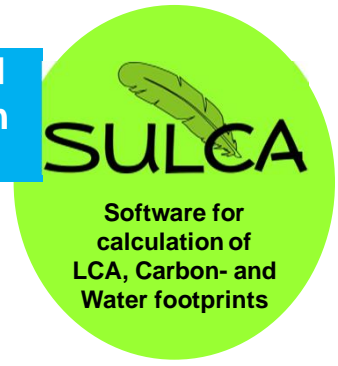and aquatic ecosystems has been met."

Demonstration SULCA tool

LCA software tool SULCA 5.0

- SULCA is an LCA software developed and maintained by VTT. Owned by THTH Association

- Interacts with Life cycle inventory databases (such as ecoinvent) and impact assessment methods.

- VTT conducts LCA calculations and training workshops with SULCA tools.

Life cycle modelling → **Data collection** → **Calculation and impact assessment** → **Analysis and interpretation of results**

SULCA

Software for calculation of LCA, Carbon- and Water footprints

Coffee Mug Model

Goal and scope definition

Create case specific variables
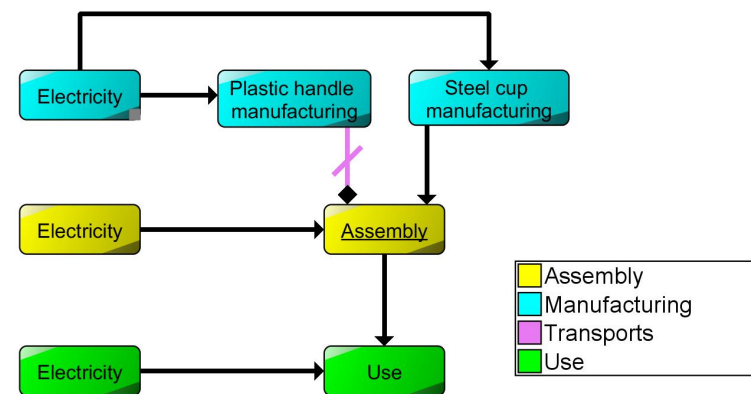
Create case specific processes

- Plastic handles
- Steel cups
- Assembly
- Use

Use generic processes where applicable

- Electricity
- Transports

Calculation *and interpretation* of results
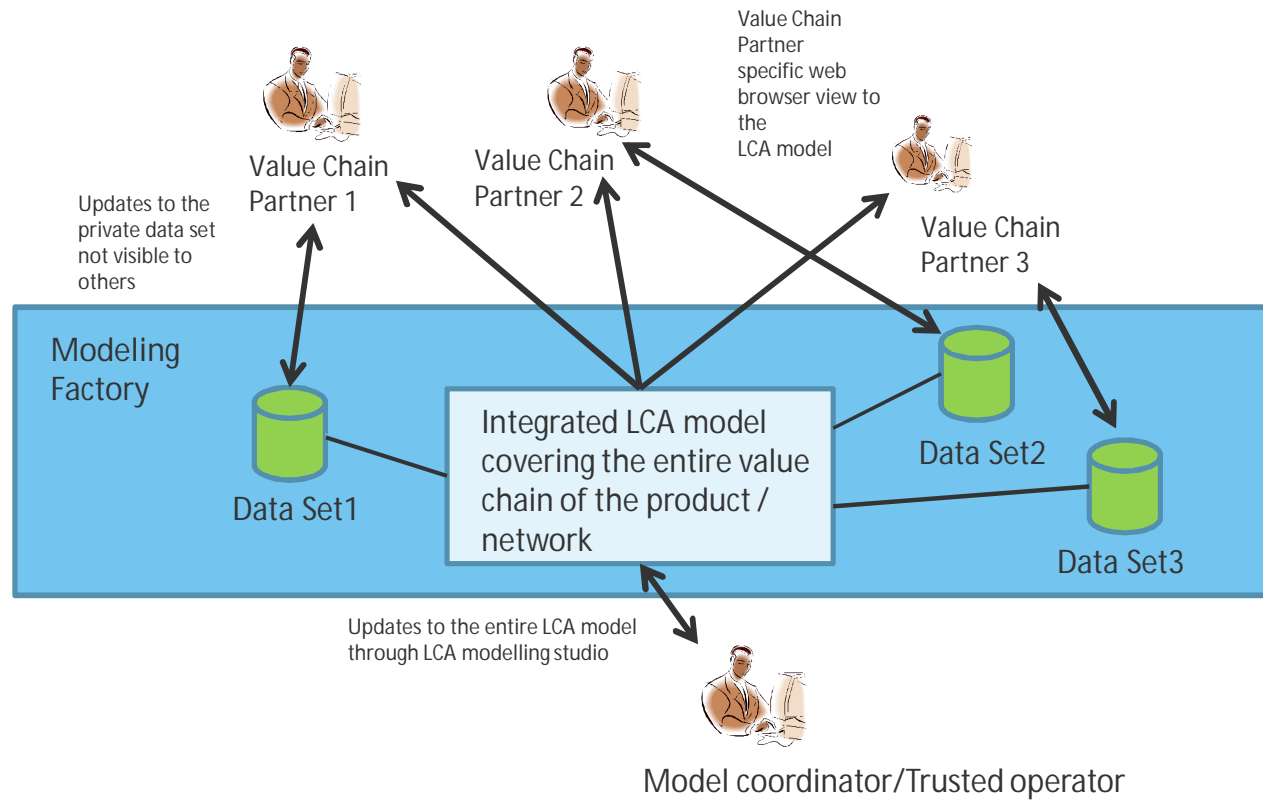
Demonstration→

Network LCA tool - background

- Circular economy requires tools which facilitate collaboration between various value chain partners

- The network LCA tool has been developed in the EIT Raw Materials project Modelling Factory

- The network can be built inside an organization or from various network actors from different organizations

1+1+1=?

1+1+1=?

©Tuoppi

Network LCA Concept

Value Chain Partner specific web browser view to the LCA model

Value Chain Partner 1

Value Chain Partner 2

Value Chain Partner 3

Updates to the private data set not visible to others

Modeling Factory

Data Set1

Integrated LCA model covering the entire value chain of the product / network

Data Set2

Data Set3

Updates to the entire LCA model through LCA modelling studio

Model coordinator/Trusted operator

Network LCA tool- concept

- Network LCA is tool for LCA data collection, data analysis and sharing the LCA results inside the network.

- Operators/value chain partners inside the network feed own process data via web browser without software installations.

- Trusted operator assigns the data and result view rights to appropriate operators

- Network partners can test independently of the trusted operator how the changes to their local data affects their local and the network level results => process design & optimization
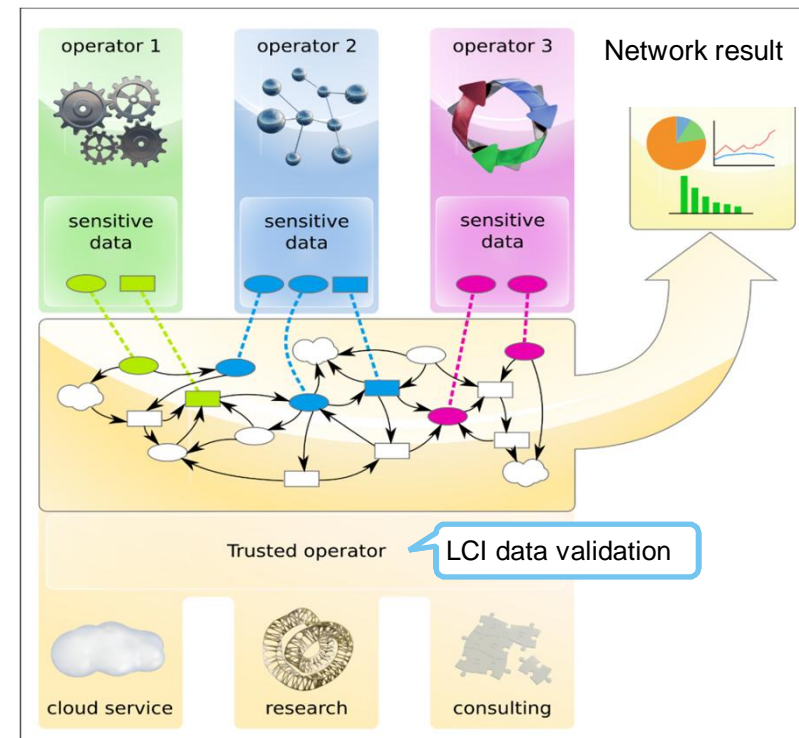
Benefits of Network LCA

✓ Possibility to access to footprint assessment model through web-browser without software installations.

✓ Pre-defined variable and unit lists helps in combatibility in nomenclature

✓ Management of input data collection form versions

✓ Publishing selected parts of LCA results, input data and model to the network members

✓ Running data experiments individually with or without network level footprint assessment (local and network level optimization)

✓ Network LCA service is cloud-based. If required, it can be transferred to intranet service and run solely from customer's own servers.

# Demonstration groupwork: steel coffee mug with plastic handle

- Administrator requests missing data entries from two companies. Administrator sees all operators' data and has access to LCA software.

- Company A: provides data on steel cup and analyses results after Admin grants the rights.

- Company B: provides data on plastic handle and analyses results after Admin grants the rights.

Groupwork

- Network LCA short link to join https://bit.ly/2rYsgbg

- Feed in data based on instructions from tutor

- Inspect global warming potential results

Summary and future work
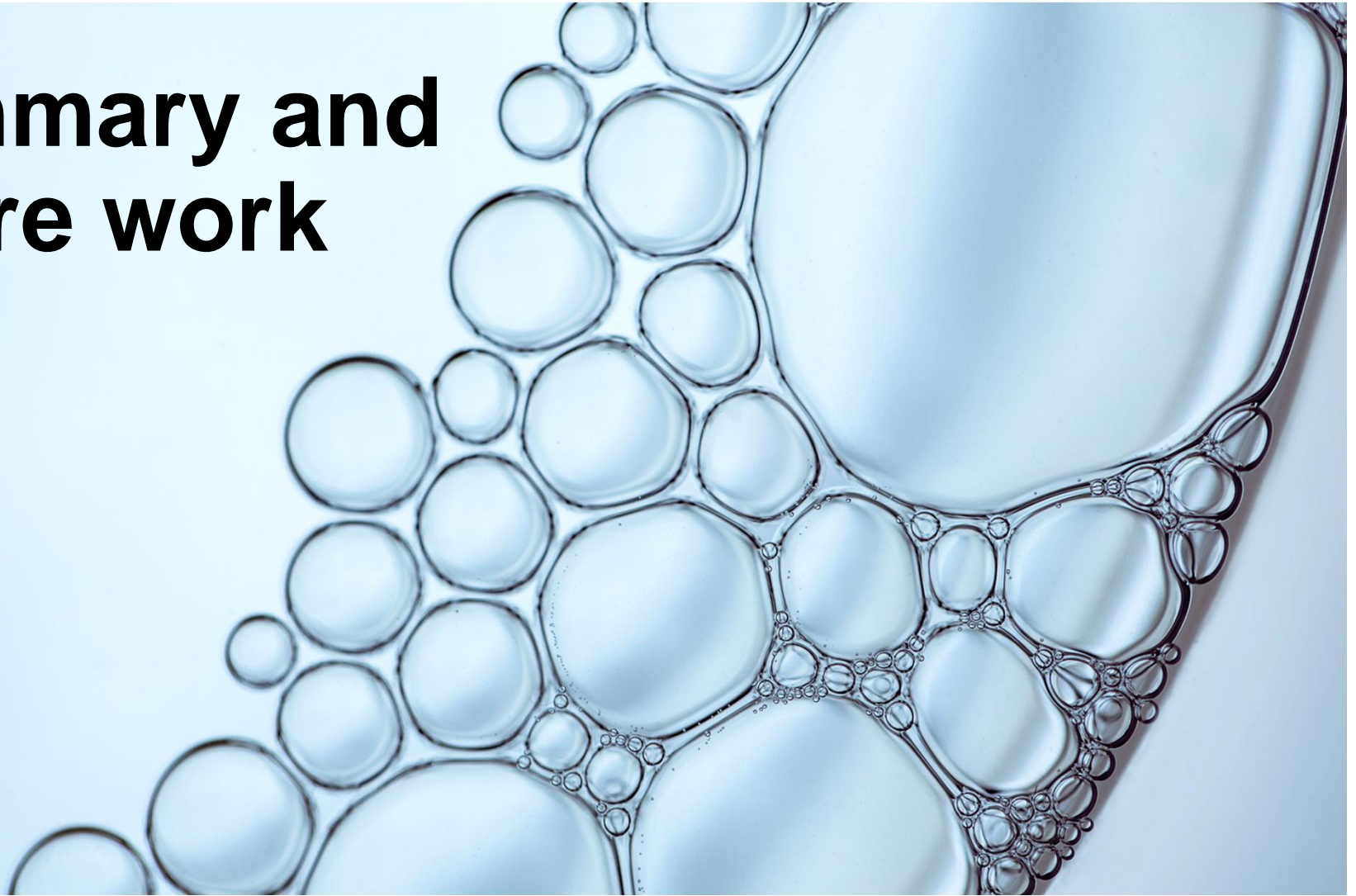
Summary

- Life cycle assessment provides science-based numeric indicators for decision making, comparing different alternatives and communication.

- SULCA tool has been developed by VTT for carbon and water footprint analyses for all kinds of products, energy systems and services.

- Network LCA (work on progress) is s tool which enables footprint data collection, sharing footprint results and local data analyses with web browser.

Future work

- Network LCA consortium continues network LCA tool development.

- The next invited demonstration will be organized on the 25th of June and new demo sessions will follow in fall 2018.

- VTT continues developing Handprint and Water footprint assessment framework with industrial partners.

Thank you!

#VTTpeople