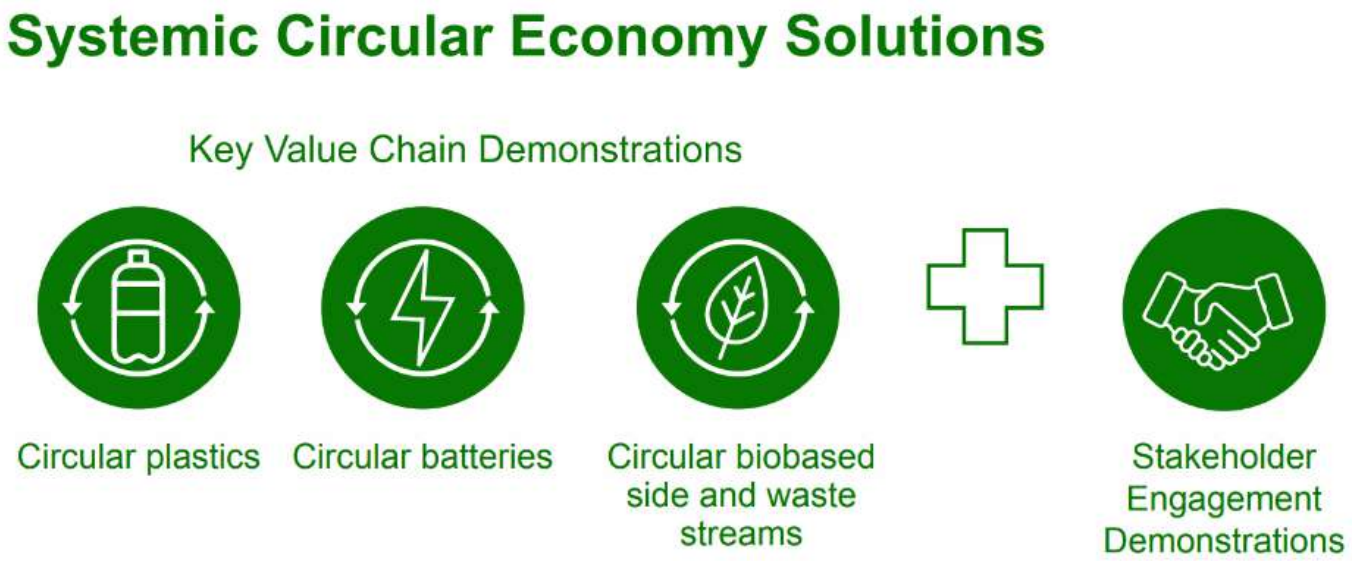
TREASoURcE

Applying system dynamics sustainability assessments (SDSA) to assess circular economy solutions in cities and regions

Alexander Koch, GreenDelta

Funded by the European Union

Motivation



- The TREASoURcE project is demonstrating and replicating circular economy solutions for 3 key value chains (plastics, batteries, biomass) in selected regions and municipalities
- A context-based sustainability assessment approach is needed
- This will allow localized decision-making for sustainable solutions

Funded by the European Union

Sustainability Assessment Framework

TREASoURcE

Goal

Describes the reason for carrying out the study

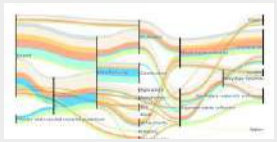
Scope

- Types of materials and products
- Value chain system boundaries
- Regional boundaries
- Timeframe
- Indicator types and metrics
- Data requirements
- Model structure
- Scenarios / Strategies

Data collection

Primary and secondary data collection

Data collection with (dynamic) MFA

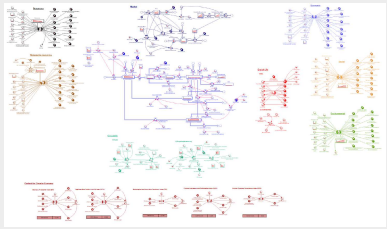


Data generation with (prospective) LCSA

openLCA

Results calculation

System dynamics



Validation

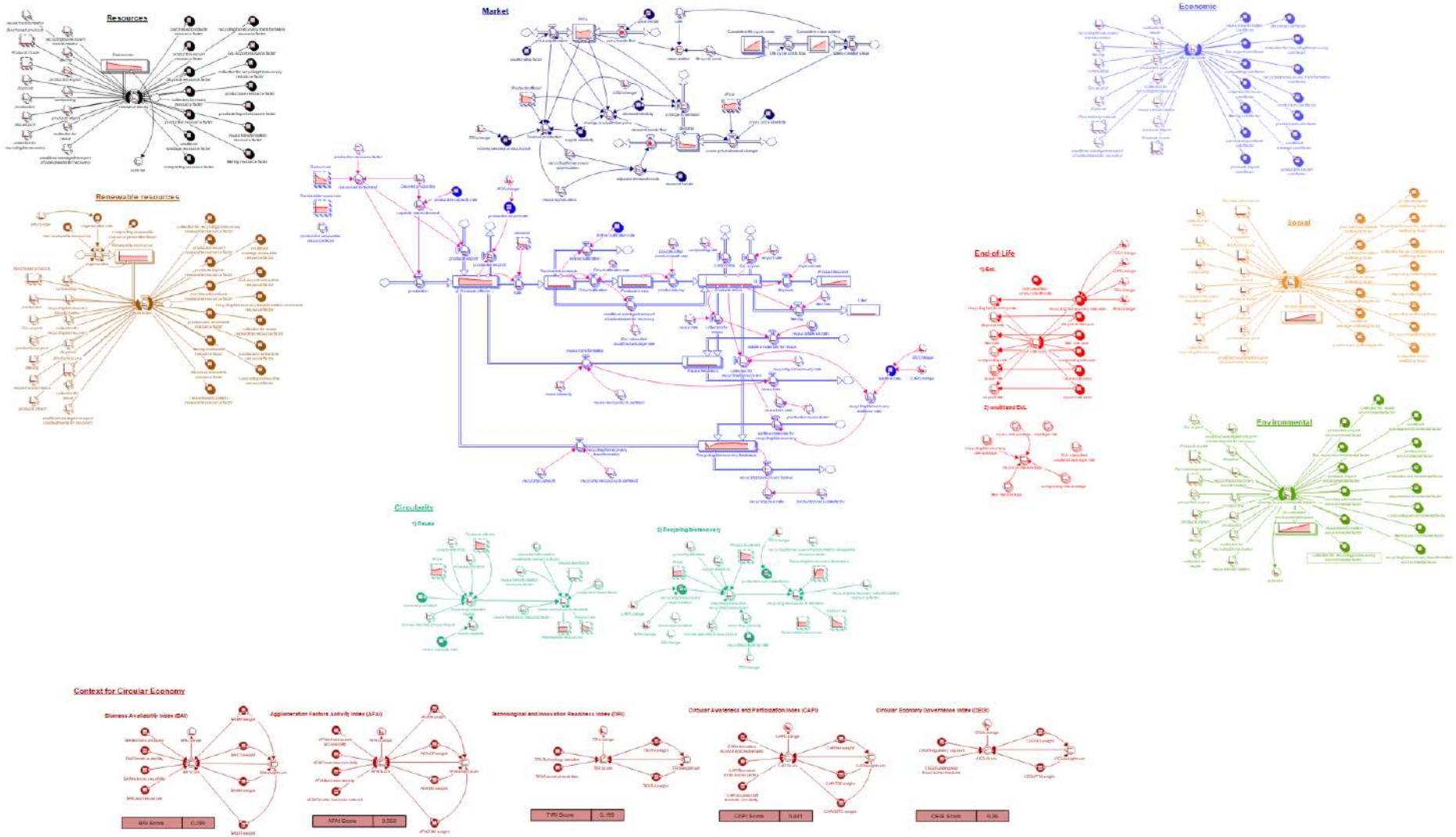
Classification

Interpretation

- Key observations
- Results analysis
- Sensitivity analysis
- Trade-offs
- Strategy recommendations

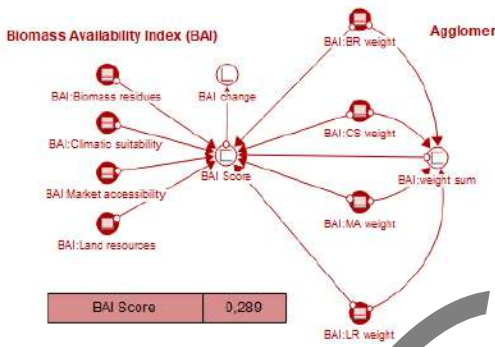
Funded by the European Union

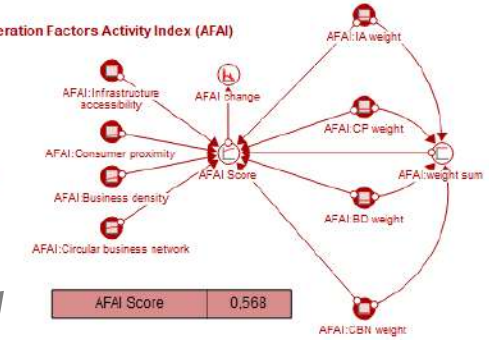
System Dynamics

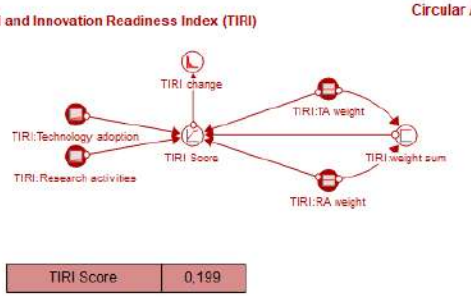


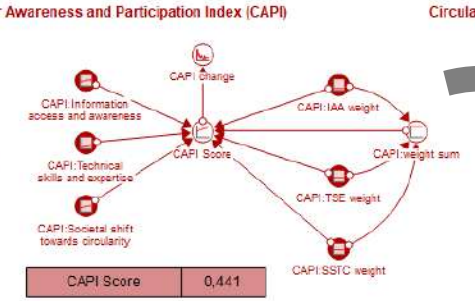
Funded by
the European Union

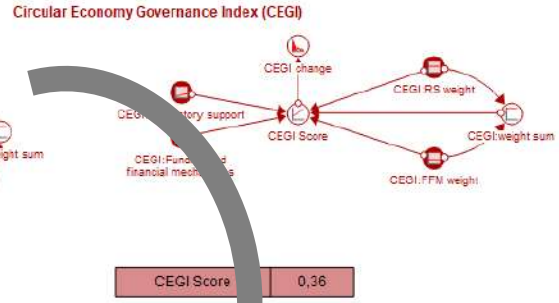
Context Indicators & Metrics

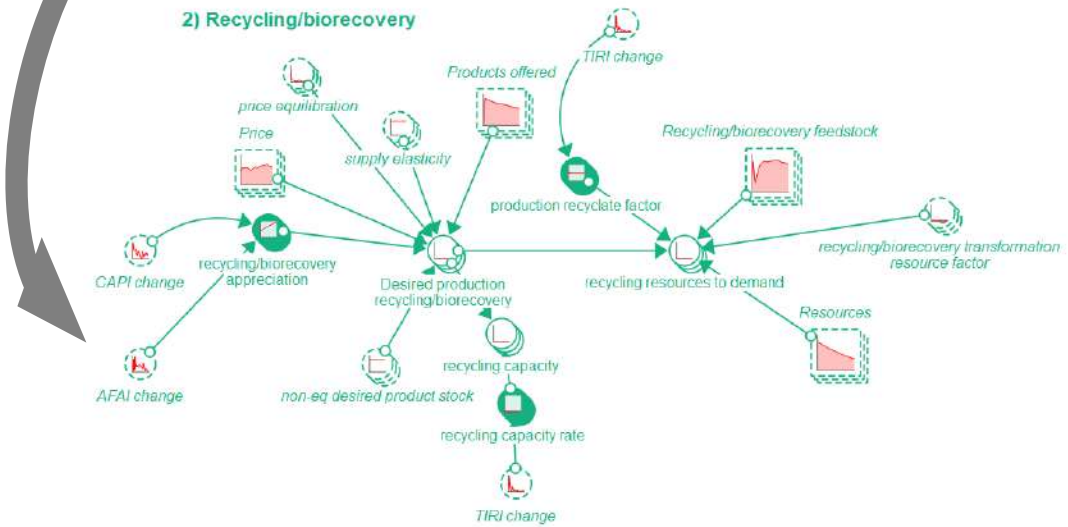


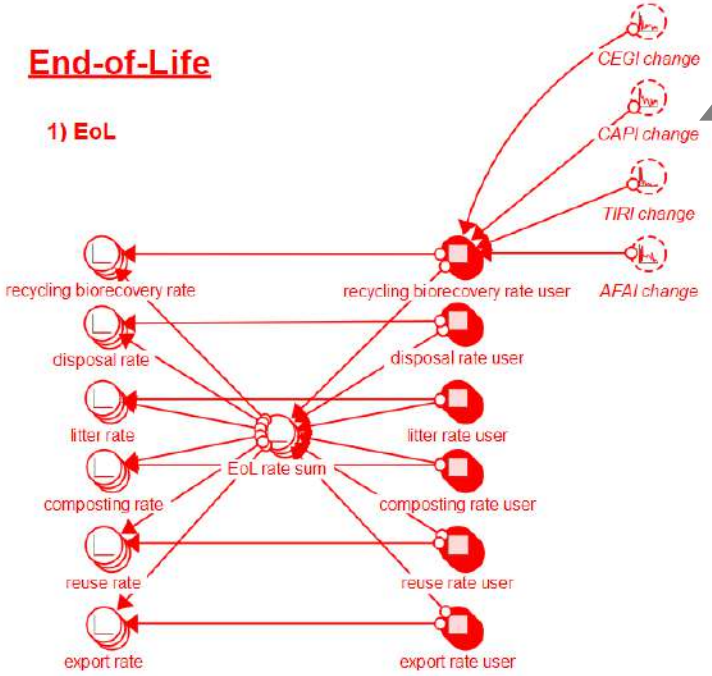








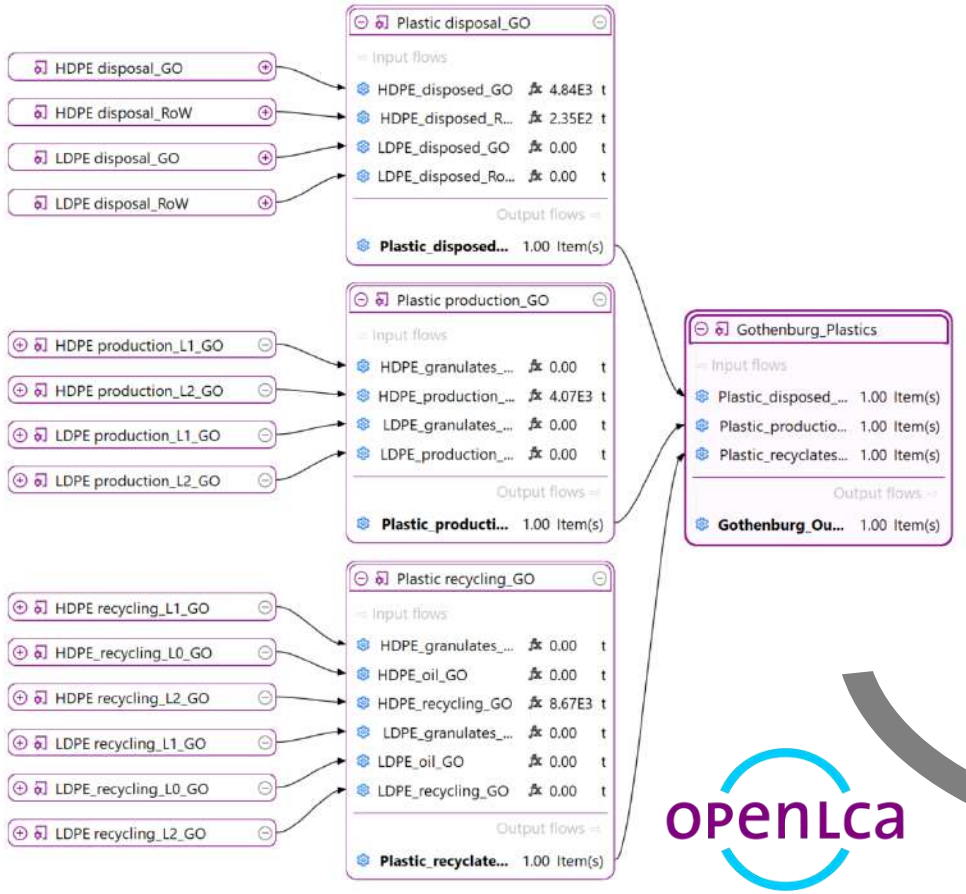


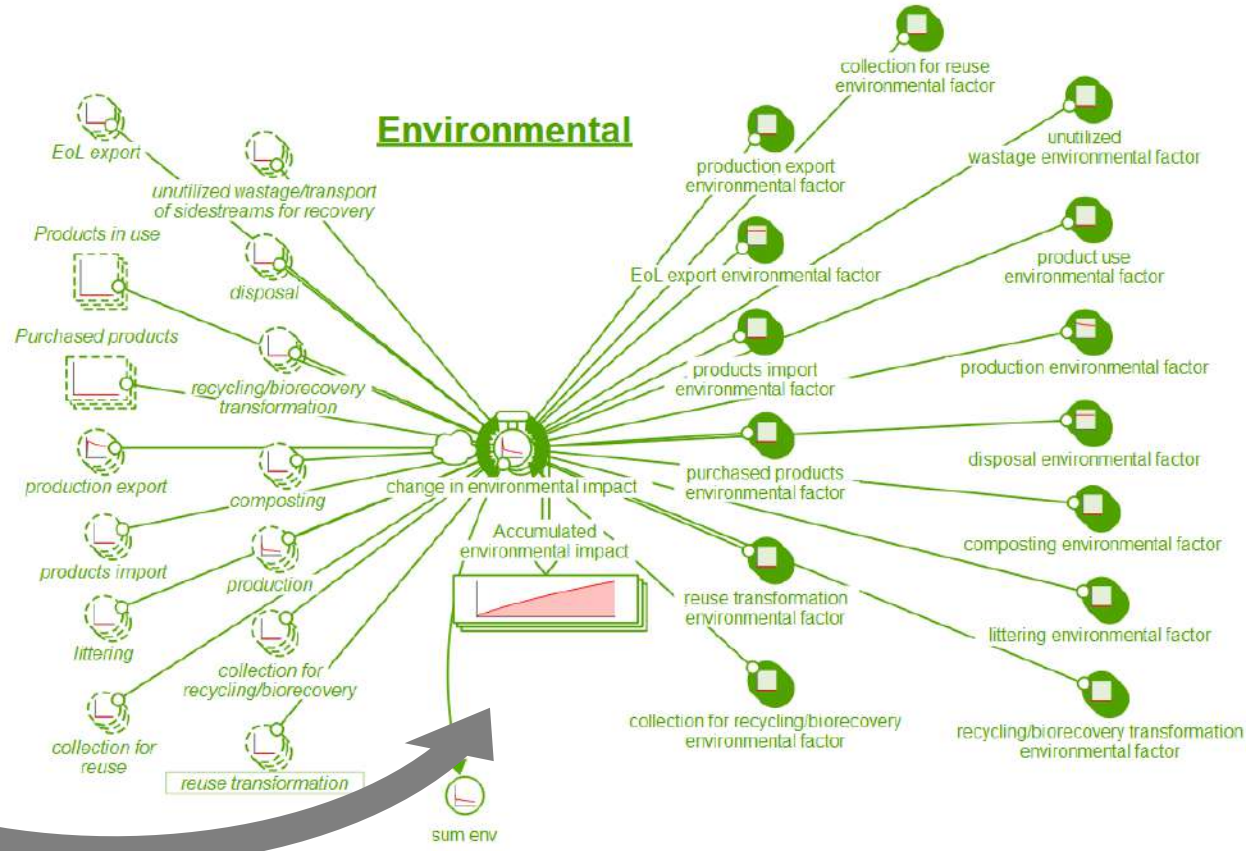


Funded by the European Union

Mainly derived from Tapia et al. (2021): Towards a territorial definition of a circular economy: exploring the role of territorial factors in closed-loop systems, European Planning Studies

Prospective LCA

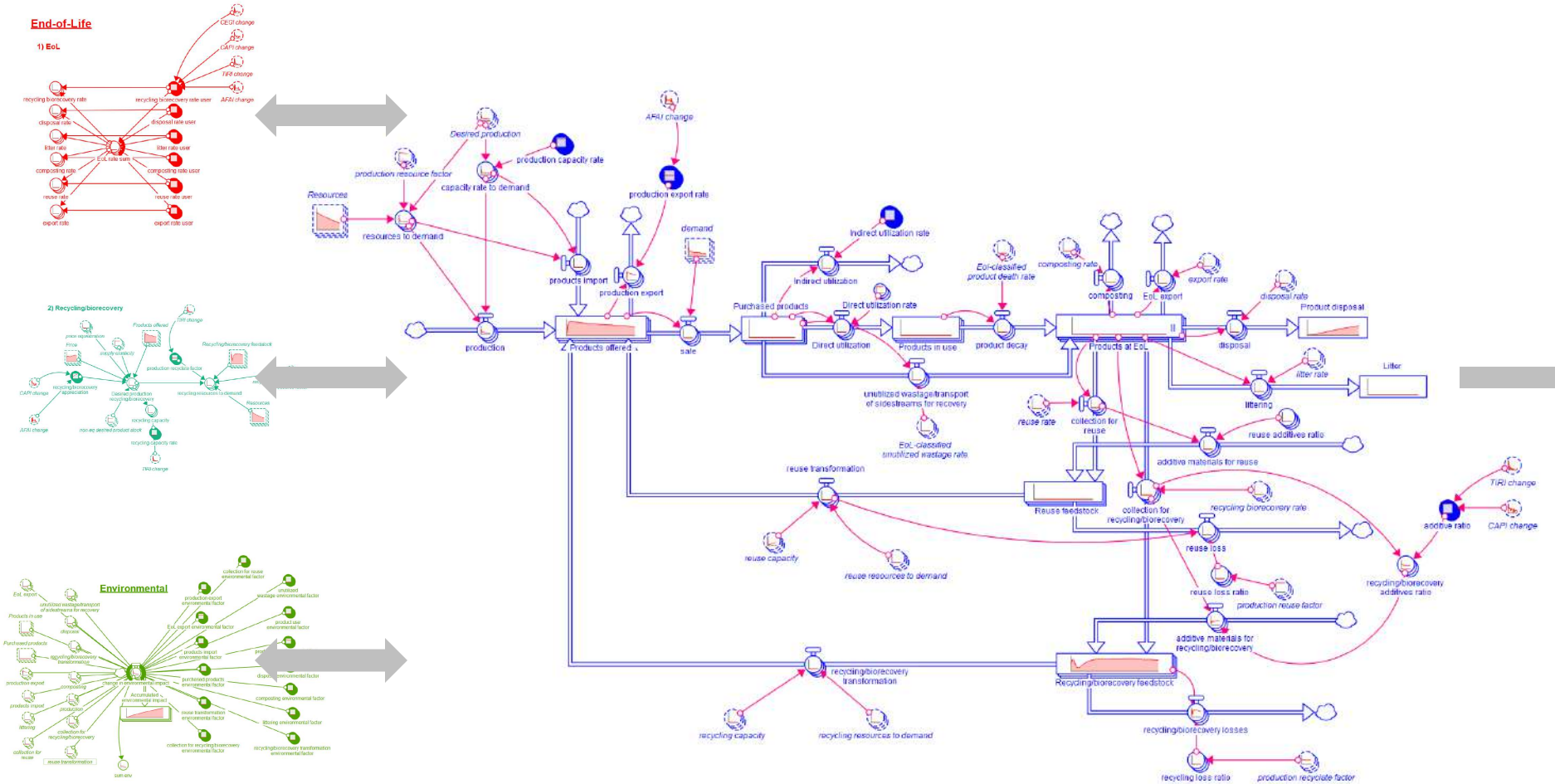


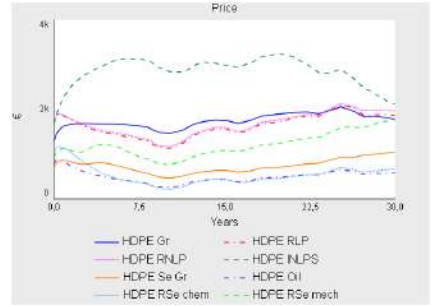


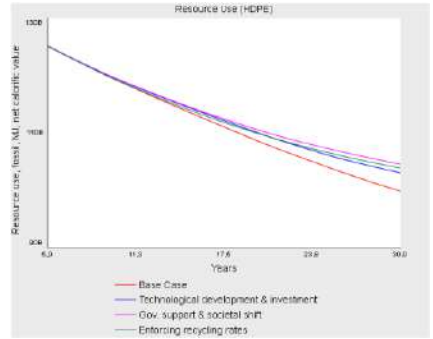
Funded by the European Union

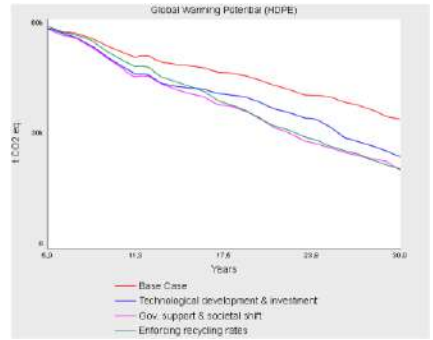
SDSA – System Dynamics Sustainability Assessments

TREASoURcE



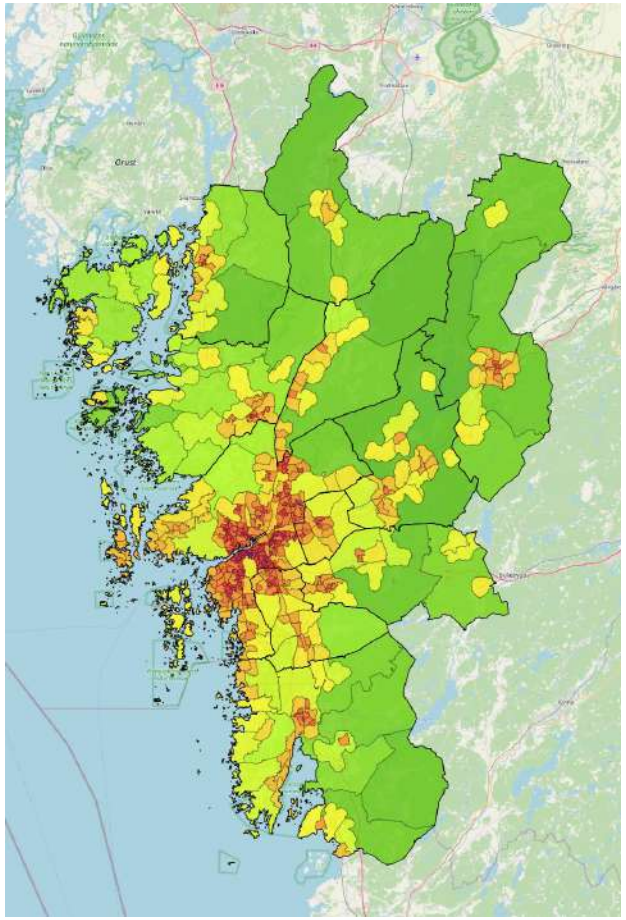






Funded by the European Union

Case Study – Plastic Recycling in Gothenburg



Goal

- Project partners plan to demonstrate chemical recycling in Gothenburg, Sweden
- Is this suitable from a sustainability perspective?

Scope

- Looking mainly at 4 polymers (HDPE, LDPE, PET, PP) used for packaging
- Data allocation approaches defined where data was missing

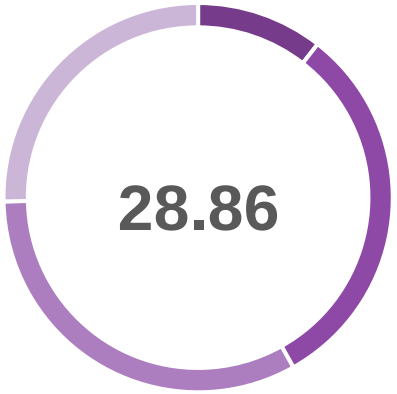
Funded by the European Union

https://www.citypopulation.de/en/sweden/metrogoteborg/

Results – Context Indicator Scores

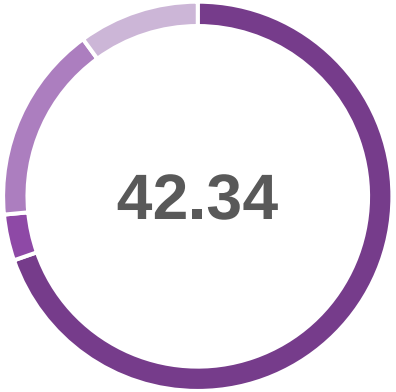
TREASoURcE

Biomass Availability Index



- Land resources
- Climatic suitability
- Biomass residues
- Market accessibility

Agglomeration Index

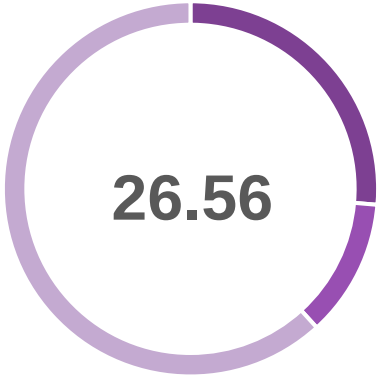


- Infrastructure accessiblity
- Consumer proximity
- Business density
- Circular business network

Technology Index

- Technology adoption
- Research activities

Circular Participation Index



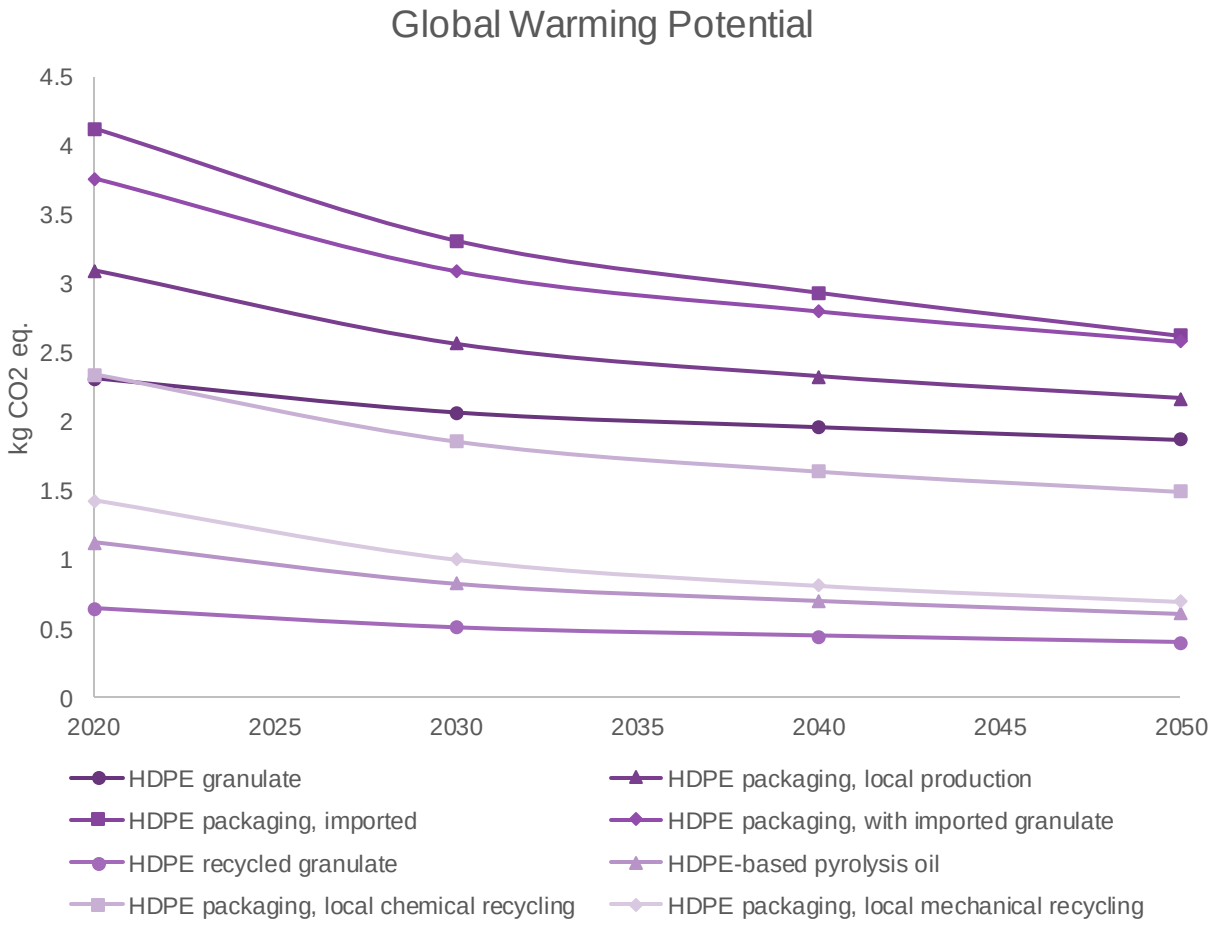
- Information access and awareness
- Technical skills and expertise
- Societal shift towards circularity

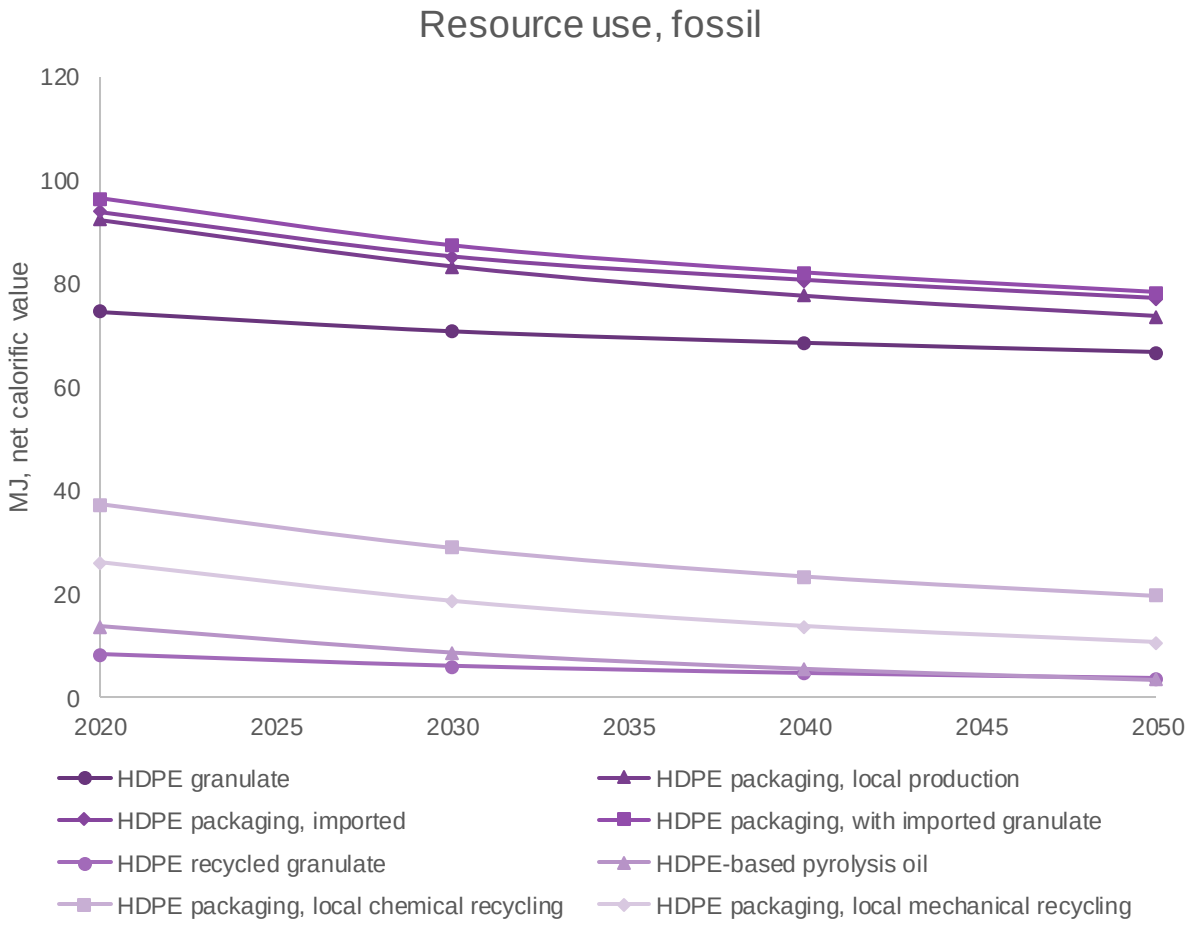
Governance Index

- Regulatory support
- Funding and financial mechanisms

Funded by the European Union

Results – Prospective LCA

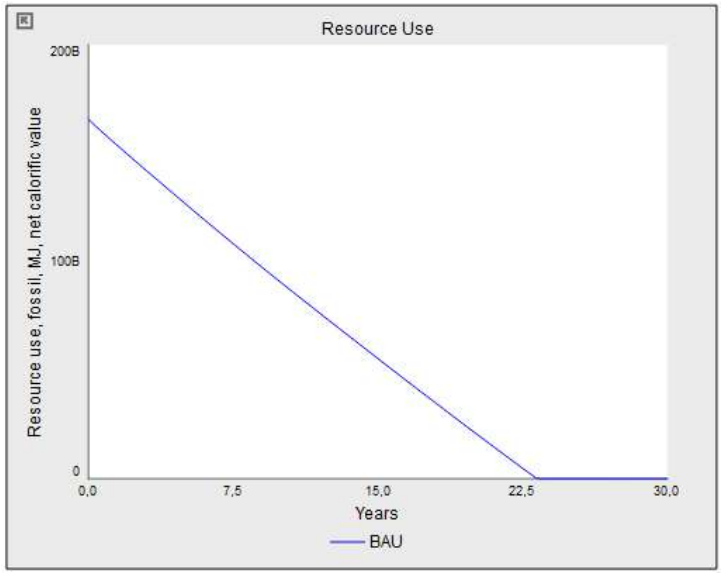


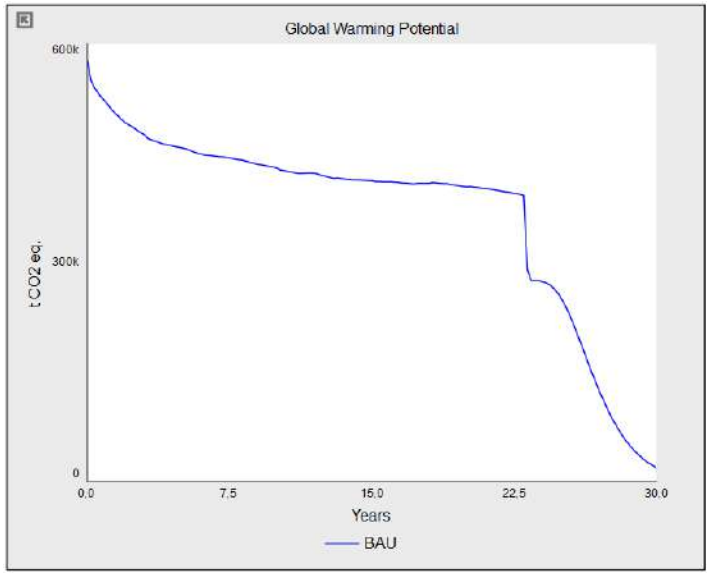


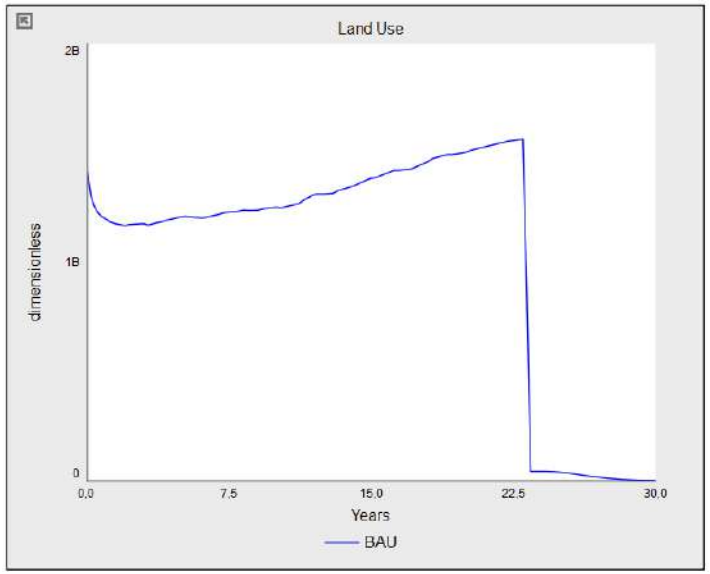
Funded by
the European Union

Results – Impact

Business as usual



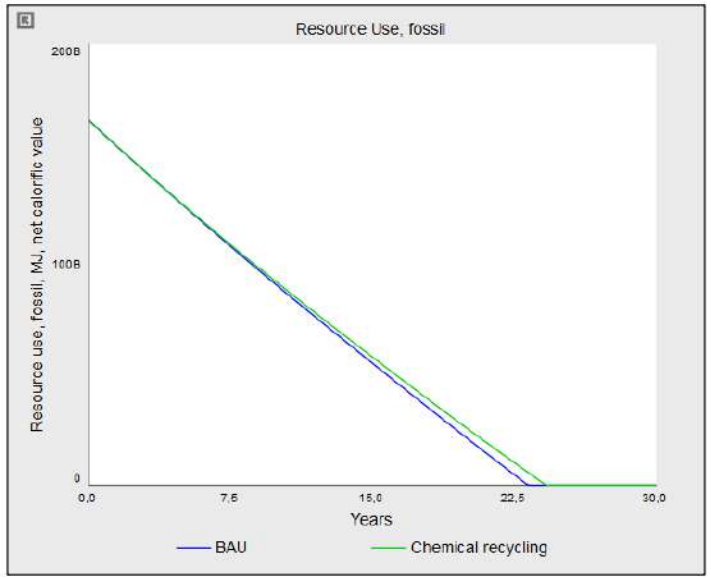


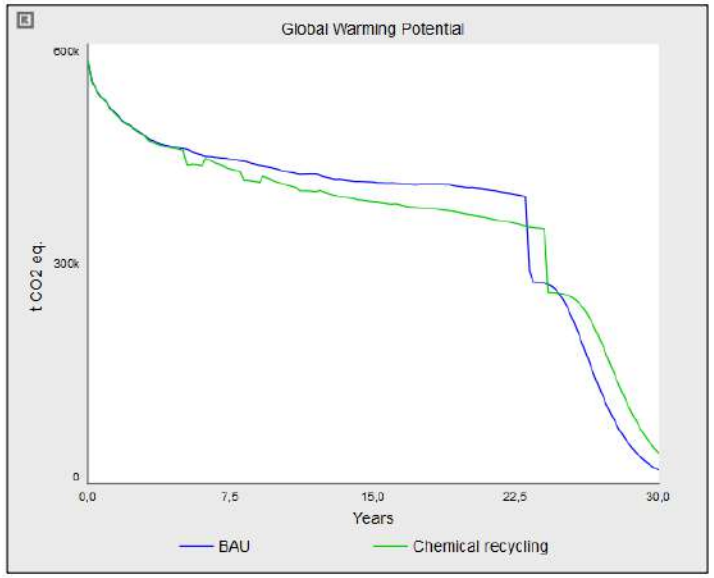


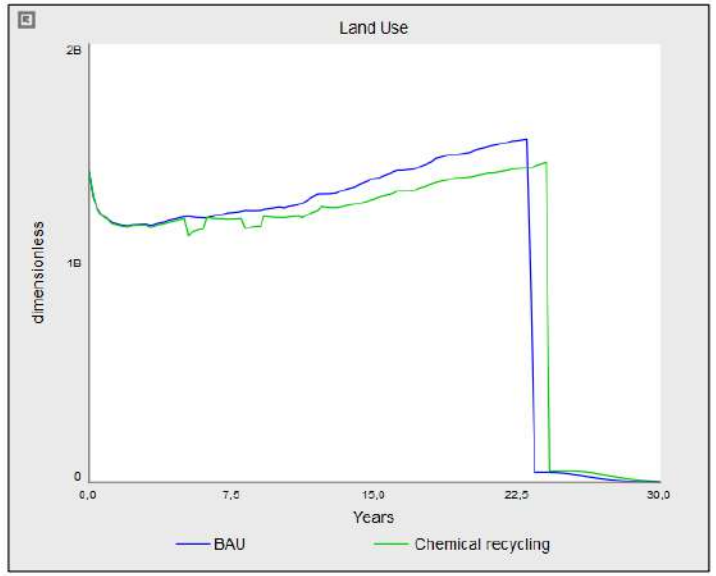
Funded by
the European Union

Results – Impact

Increasing chemical recycling capacity







Funded by
the European Union

Outlook

- Use SDSA to find the optimal mix of strategies for a specific city or region
- Context-suitable strategies accelerate the transition to a circular economy
- Several challenges...
  - Data heavy models
  - Simplification of real life decisions and causal relationships
- ...but development is ongoing
  - Better SD-translation of existing causal relationships
  - Reduce model complexity by creating sub-models that focus on the decision to be made
  - Validation approach in the making

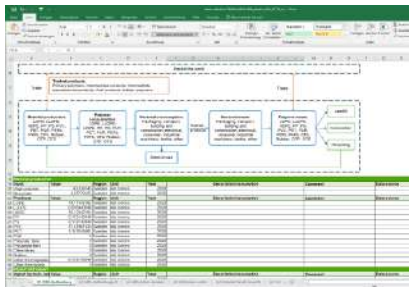
Funded by the European Union

Vision for an SDSA Tool in TREASoURcE

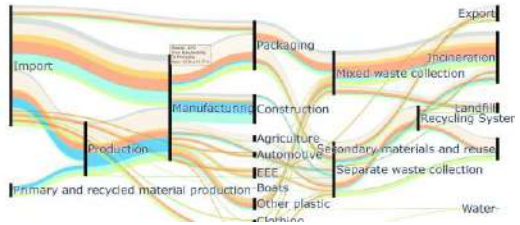
TREASoURcE

User interface for data input

Excel import



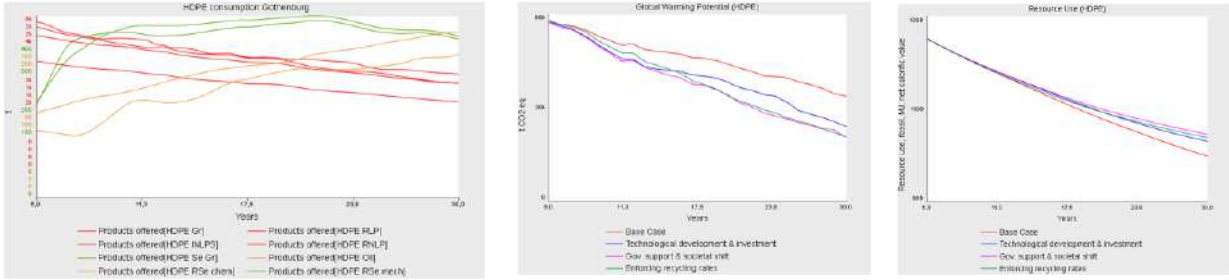
Sankey export



LCA & SD background models

openLca

Calculation of impacts over time for different strategies



Funded by
the European Union

TREASoURcE

Thank you!

Alexander Koch, GreenDelta

koch@greendelta.com

Funded by
the European Union