PRIMUS

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Model-based Life Cycle Sustainability Assessment (LCSA) for Plastics and Recycled Content

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HORIZON EUROPE GA No. 101057067

Introducing the PRIMUS project

EU funded,
2022-2025

12 European organisations
Technology Centres
Universities,
Associations
Manufacturing Industry

PRIMUS

Reforming secondary plastics to become the first raw material choice of high added value products

4 demo cases

Contents

- LCSA + System Dynamics
- System Dynamics model for PRIMUS
- Scenarios & Results
- Summary & Conclusions

Life Cycle Sustainability Assessment

- Environmental
- Social
- Economic

- We understand how our system affects the world in e.g. 16 impact categories
- Should we consider other things? E.g. litter
- How does the world affect the sustainability of our system?

System Dynamics

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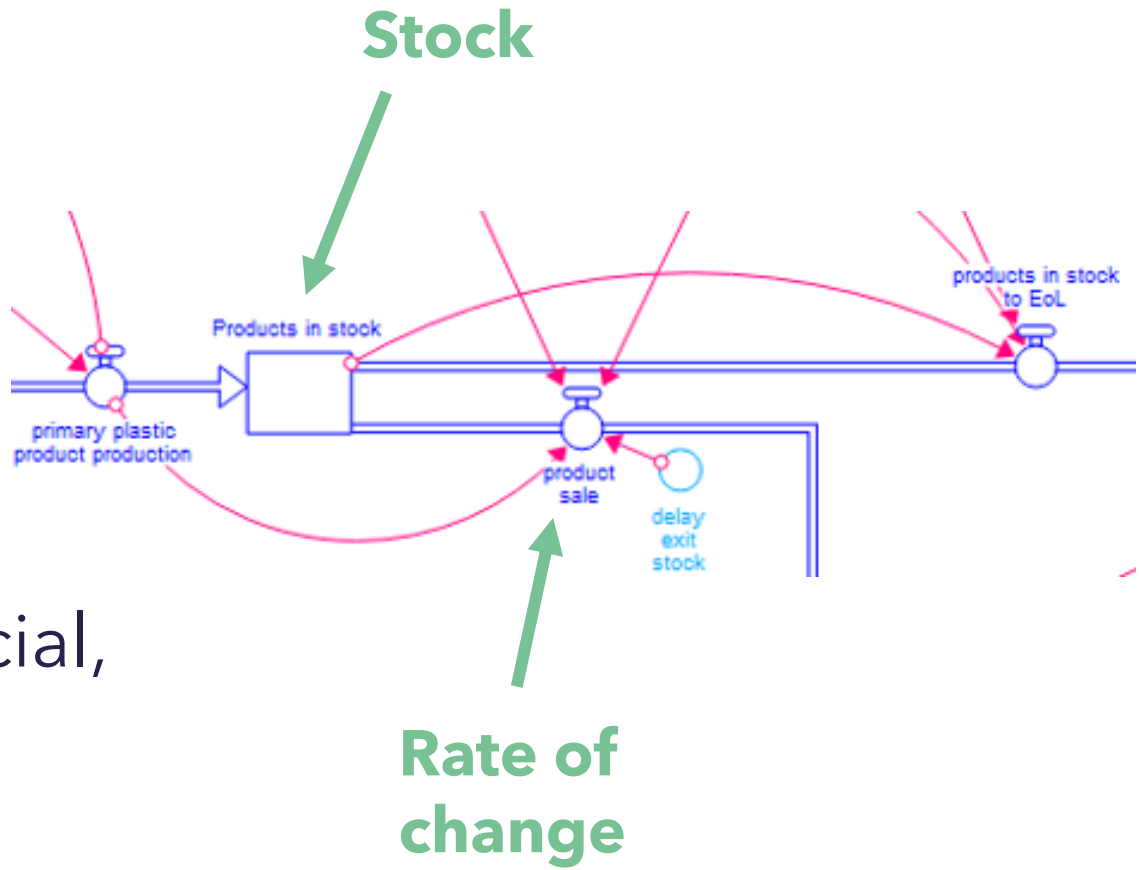
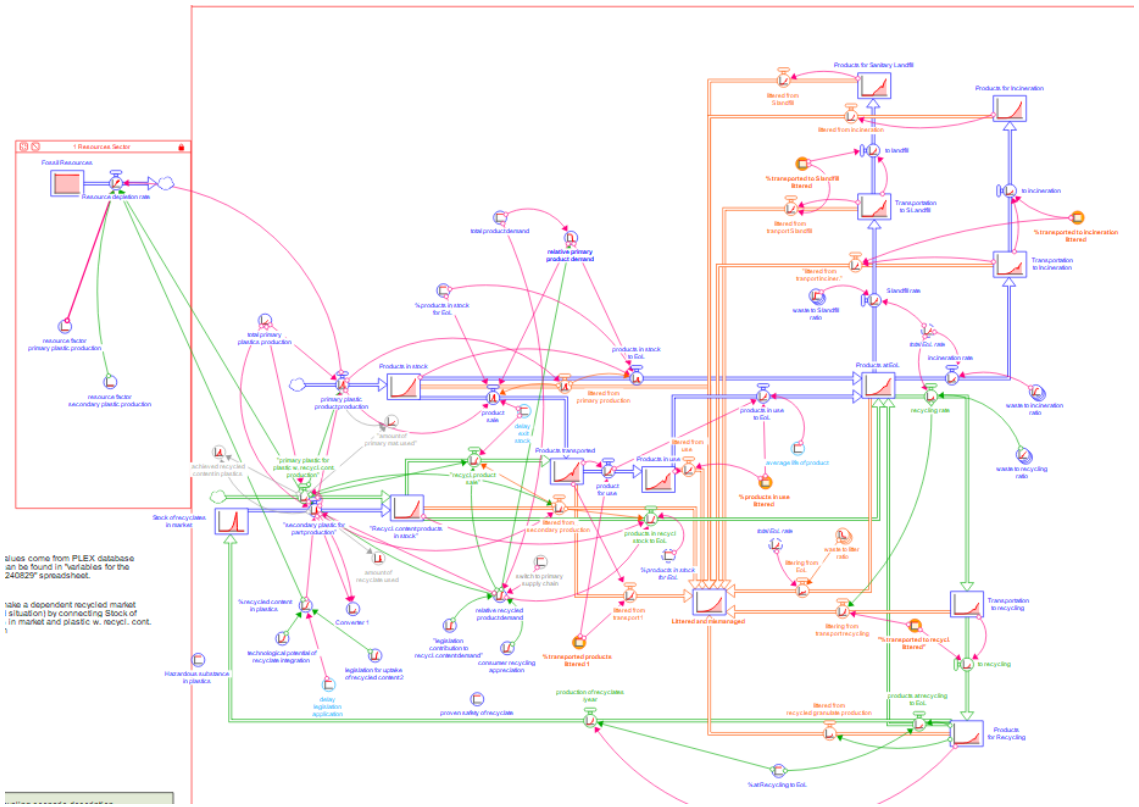
System Dynamics – brief introduction

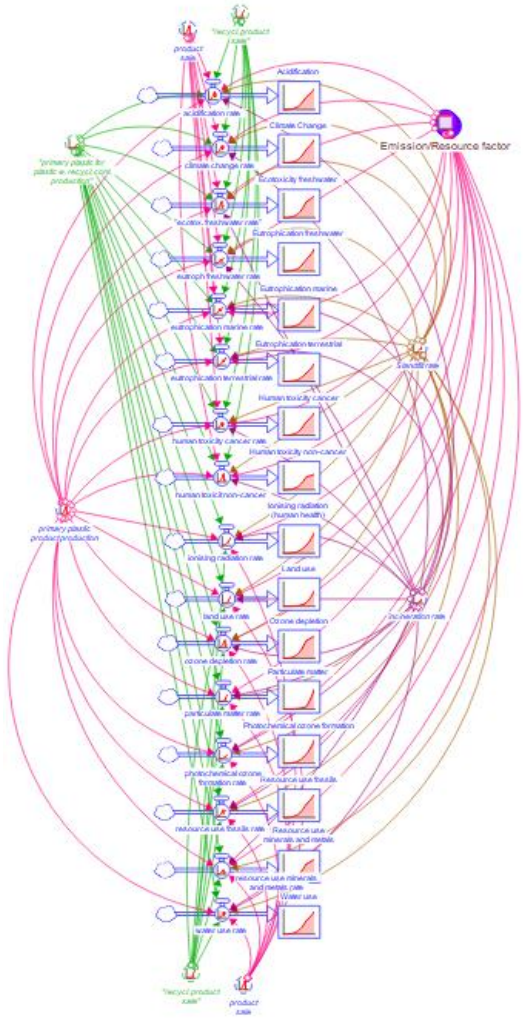
- Computer-aided approach for strategy and policy design.
- The main goal is to help people make **better decisions when confronted with complex, dynamic systems**.
- Dynamic problems: complex social, managerial, economic, or ecological systems.

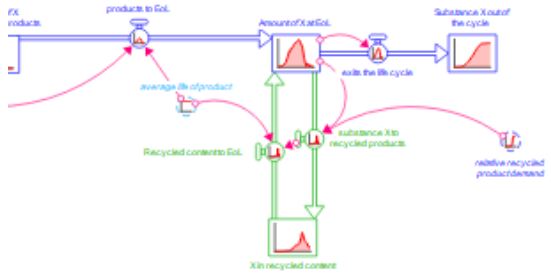


System Dynamics society: https://systemdynamics.org/what-is-system-dynamics/

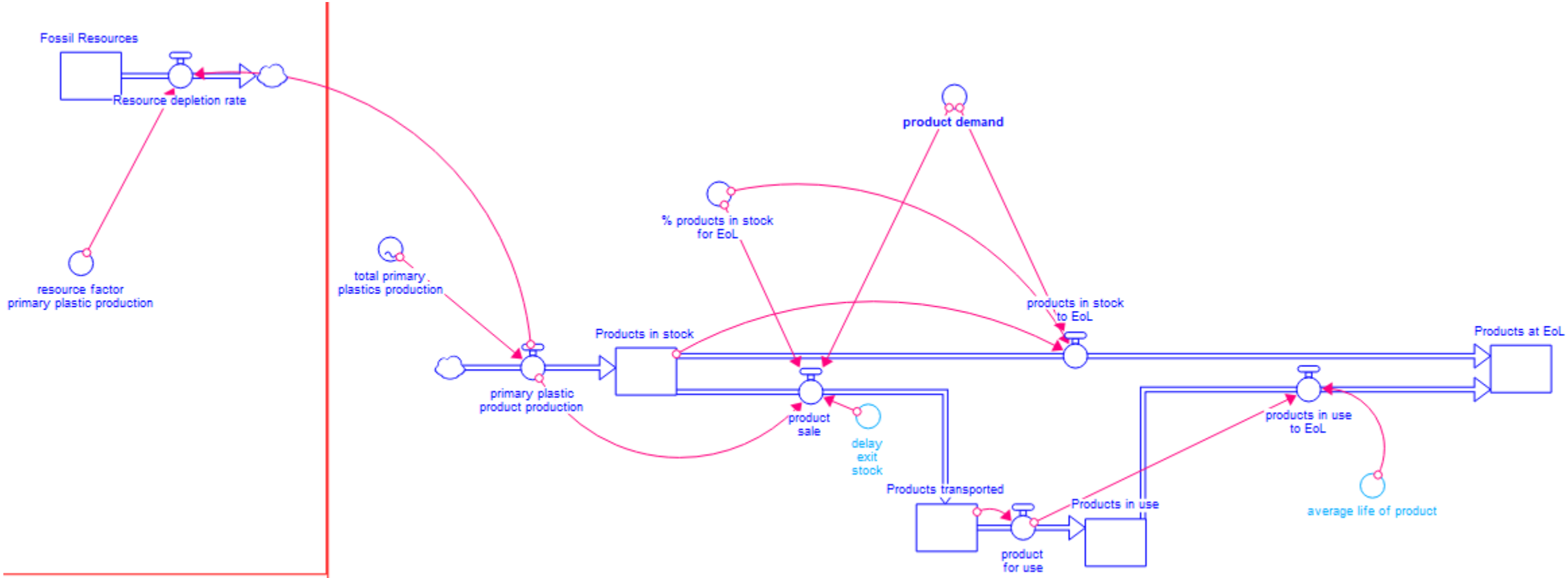
Proposed System Dynamics model for plastic products





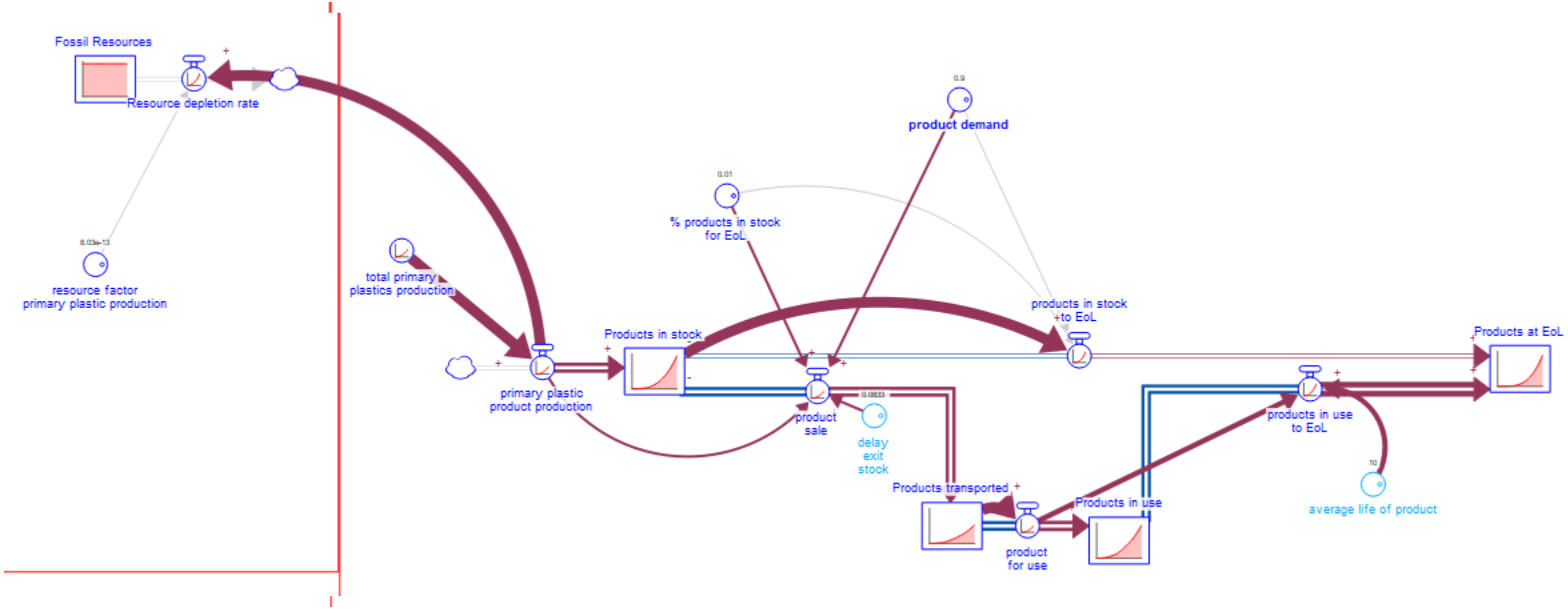


LOOP 1 - Basic plastics life cycle II



We started by constructing a plastics life cycle...

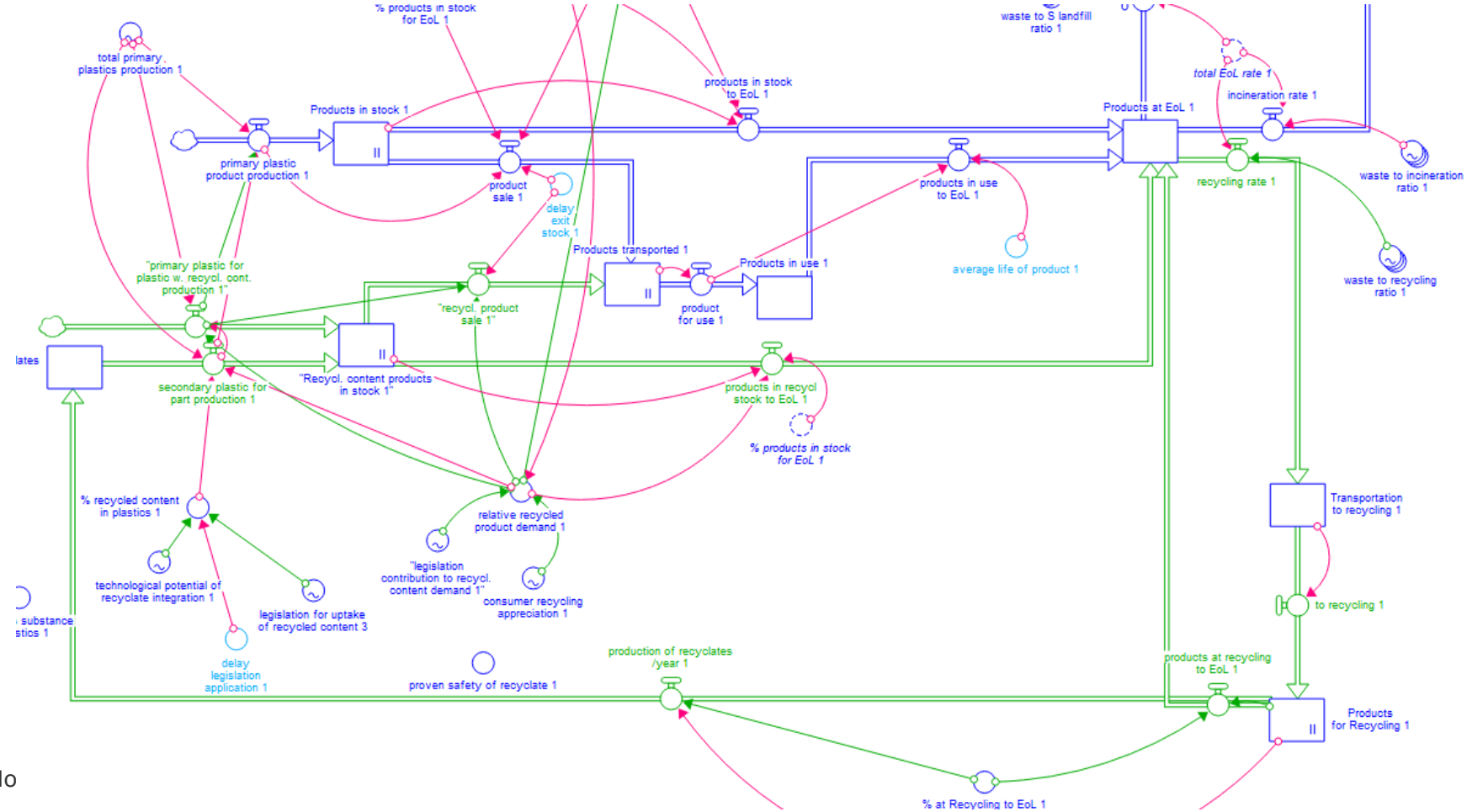
LOOP 1 - Basic plastics life cycle II - calculation



LOOP 2 – recycled content

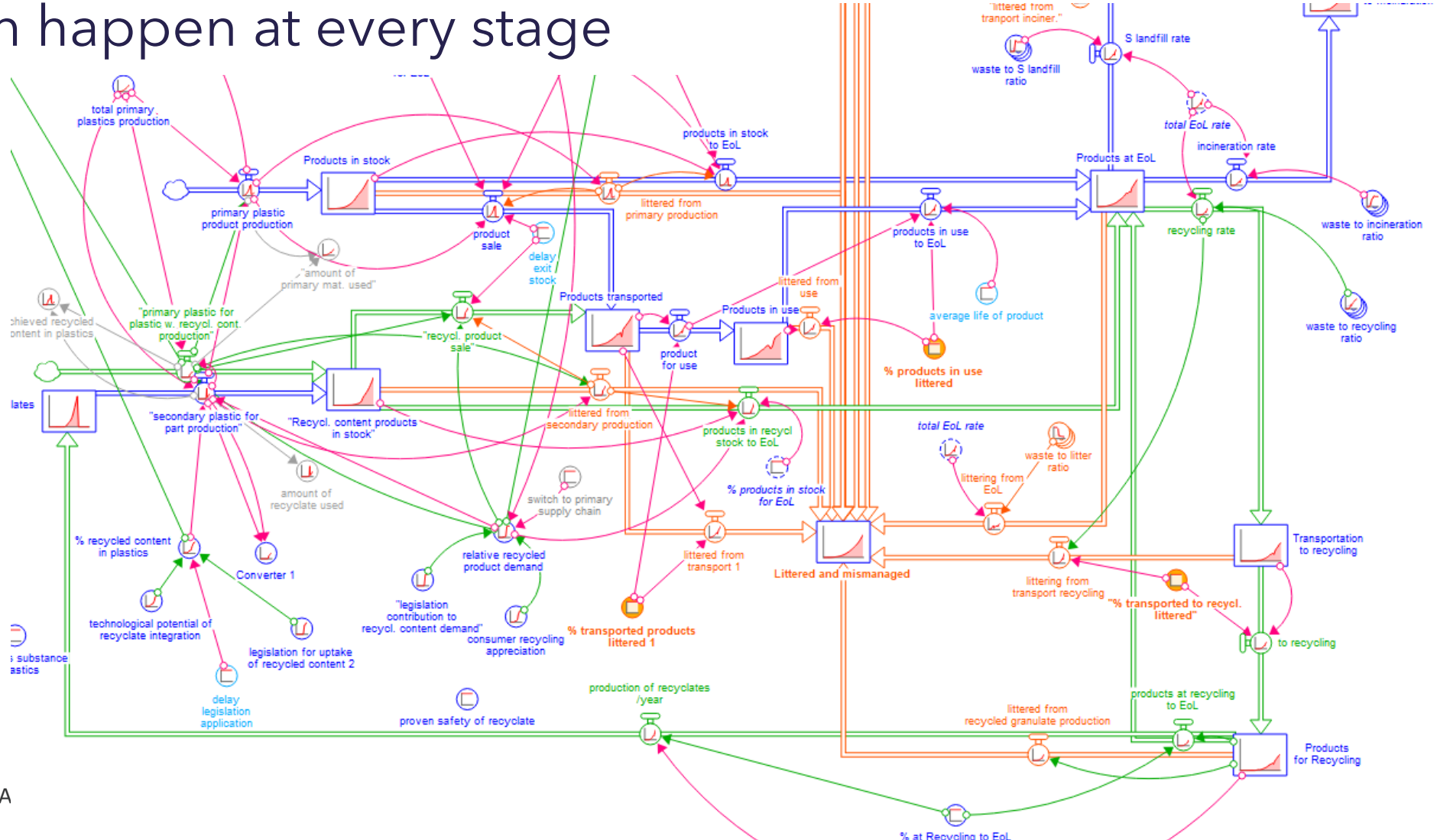
Added a recycling loop (green)

Note EoL

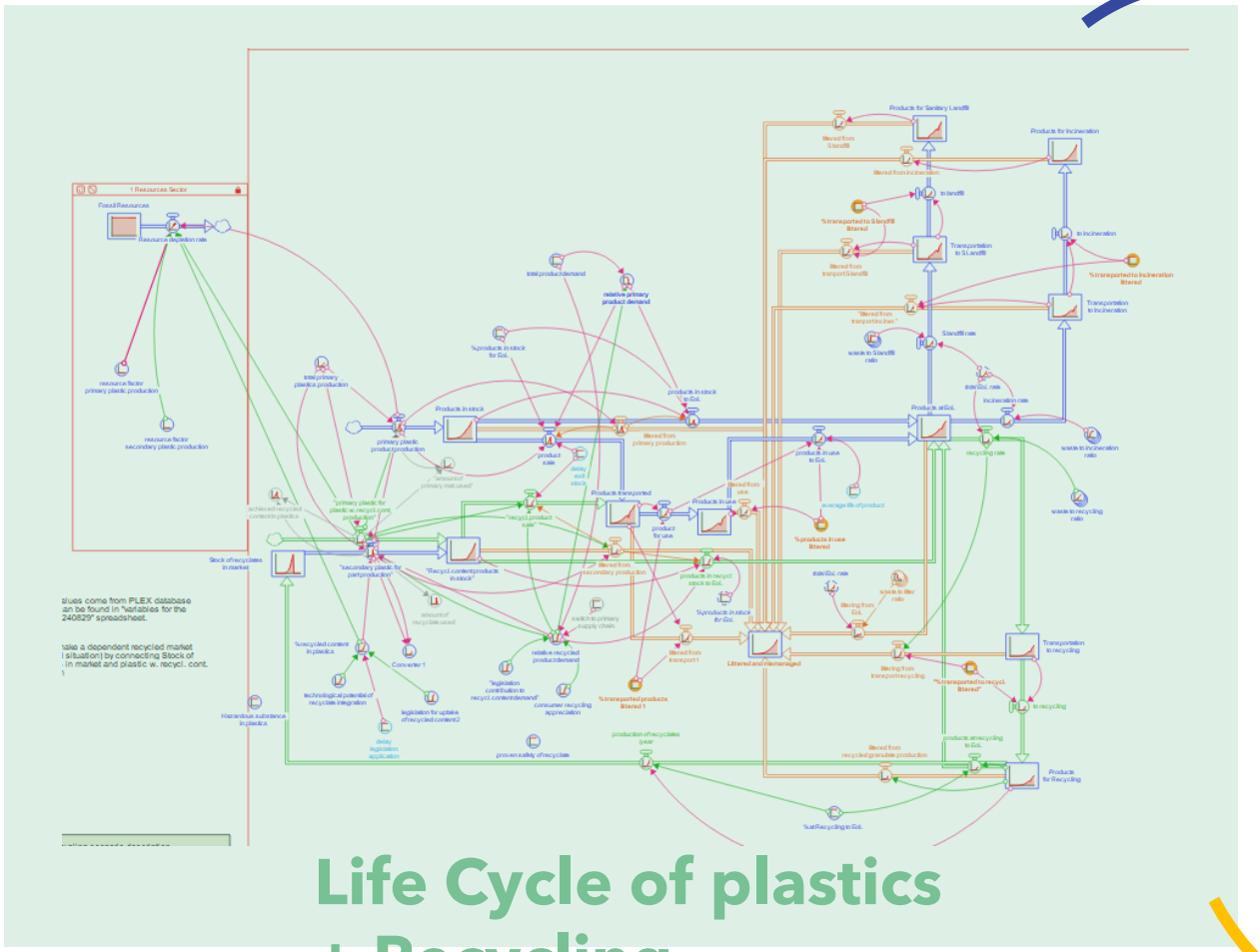


LOOP 3 – litter

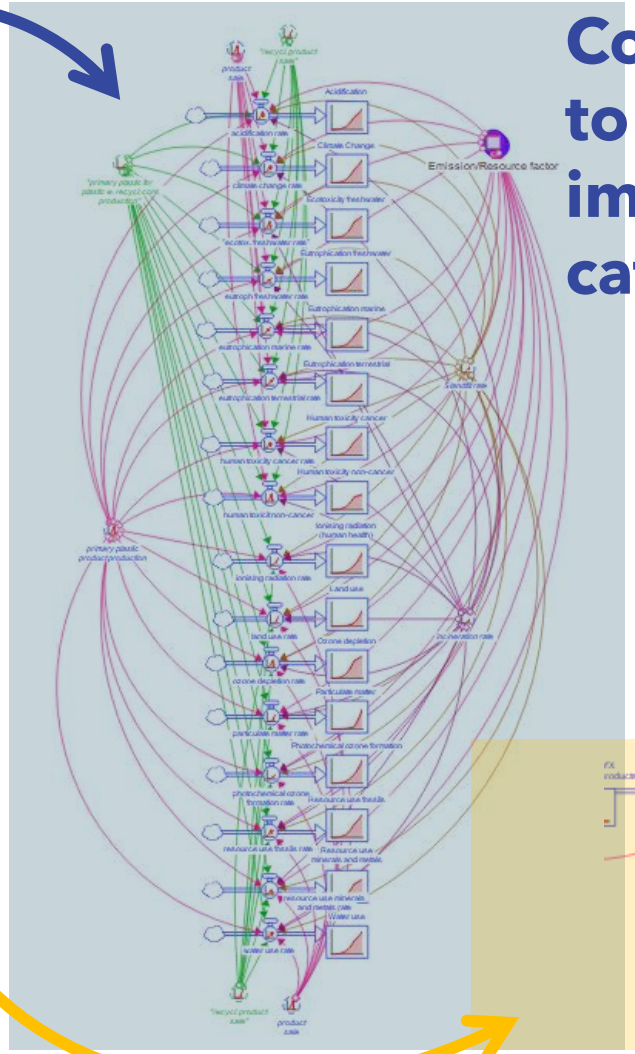
Littering can happen at every stage (orange)



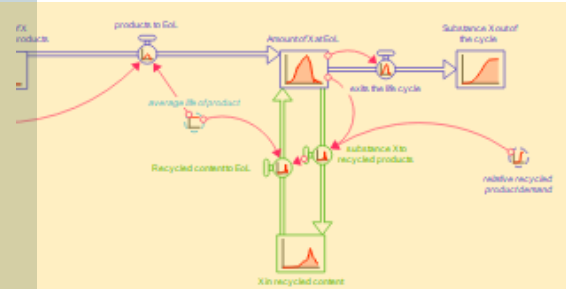
ALL LOOPS – full picture



Life Cycle of plastics
+ Recycling
+ Litter



Connection to LCA impact categories



Unwanted substances

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Software and data

OECD iLibrary

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Home > Statistics > Global Plastics Outlook

Global Plastics Outlook

Our World in Data

ecoinvent

PLEX

Production, use, and fate of all plastics ever made

ROLAND GEYER , JENNA R. JAMBECK, AND KARA LAVENDER LAW Authors Info & Affiliations

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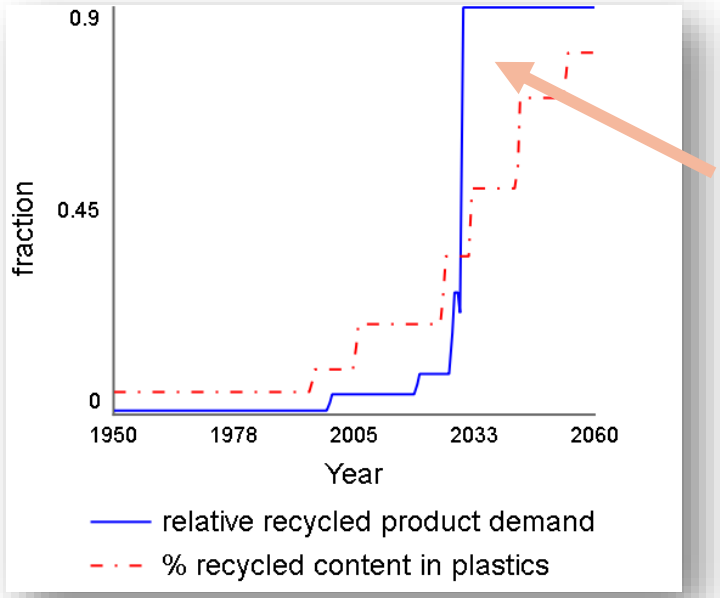
Scenarios & Results

Basic scenario

Defining the Basic scenario

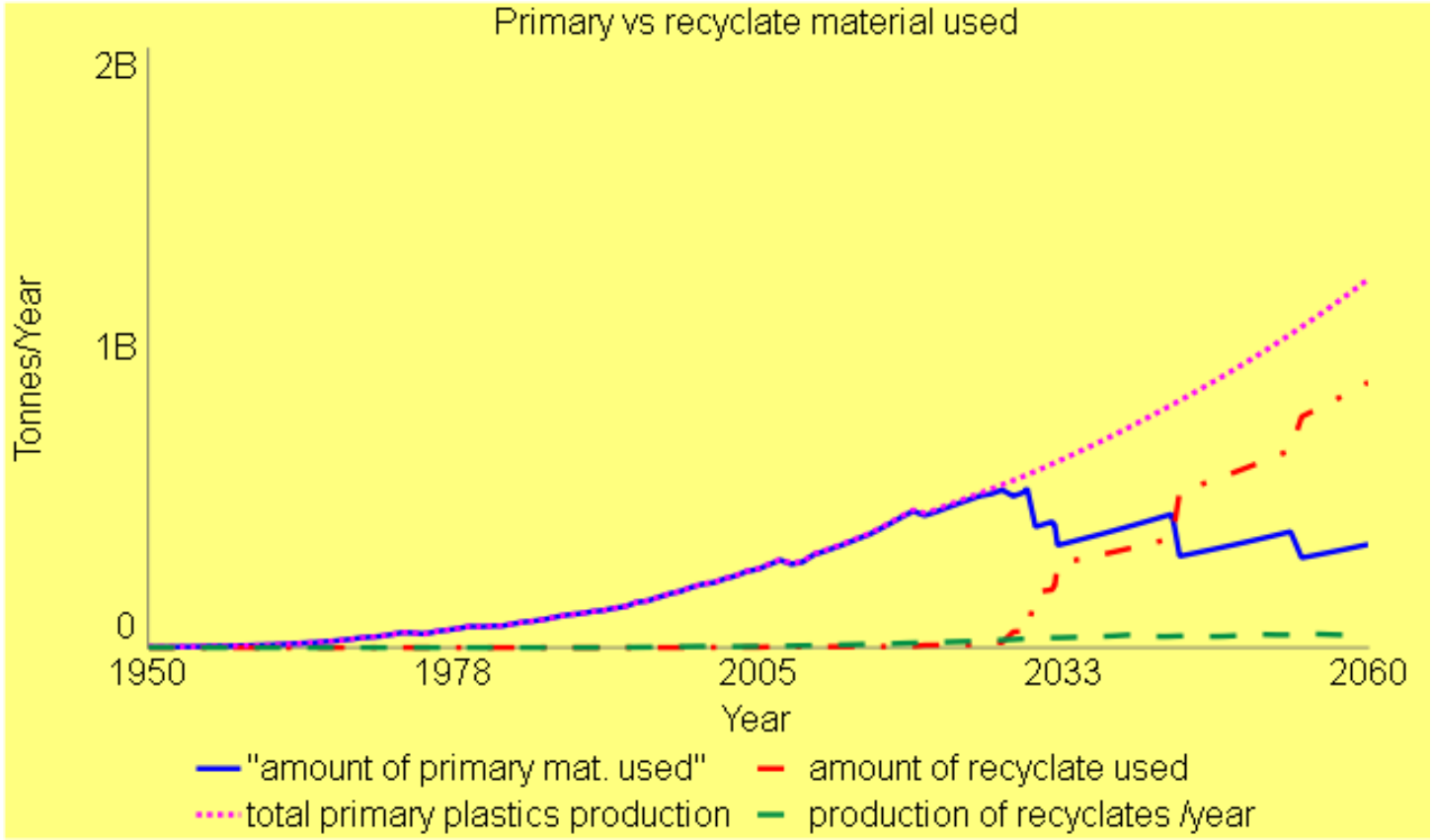
The basic scenario tries to mimic a situation of Circular Economy.



Legislation becomes compulsory in 2030

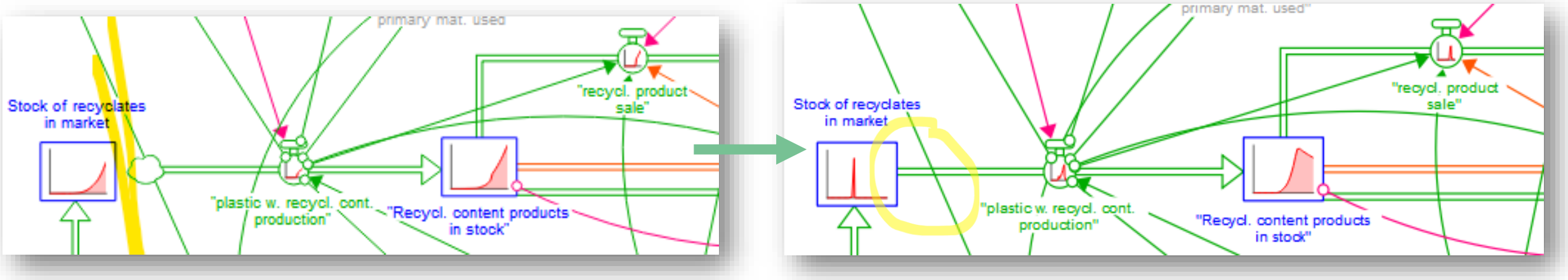
Results of Basic scenario

After 2040 recycled material used overtakes primary material...



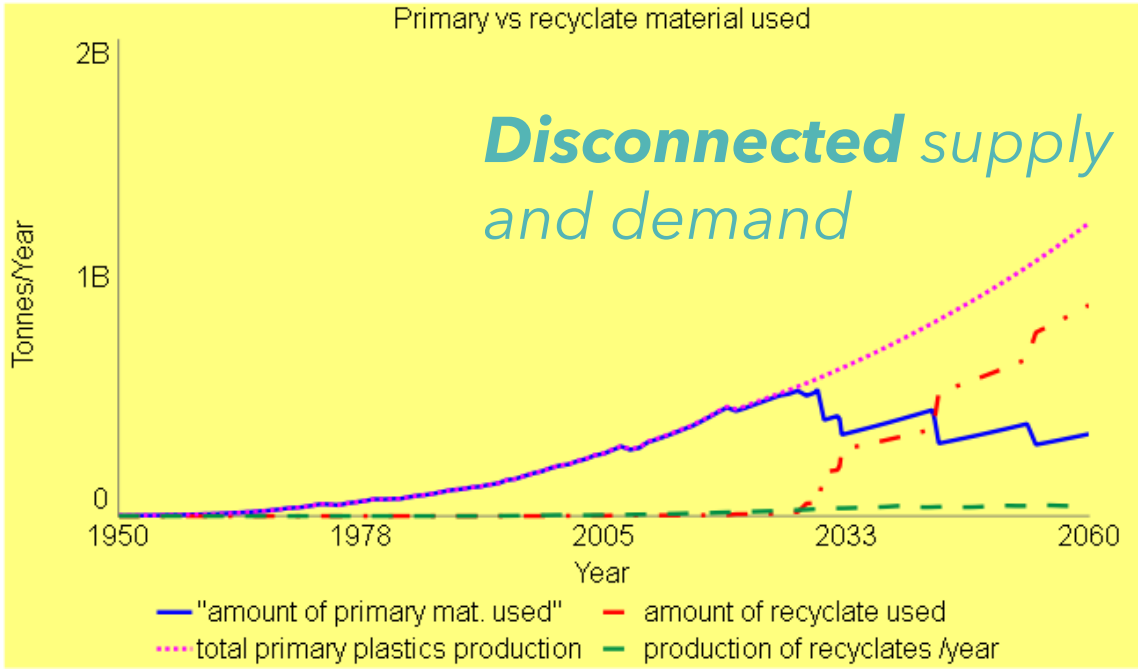
Results of Basic scenario – connecting recyclate consumption and production

If we connect them…

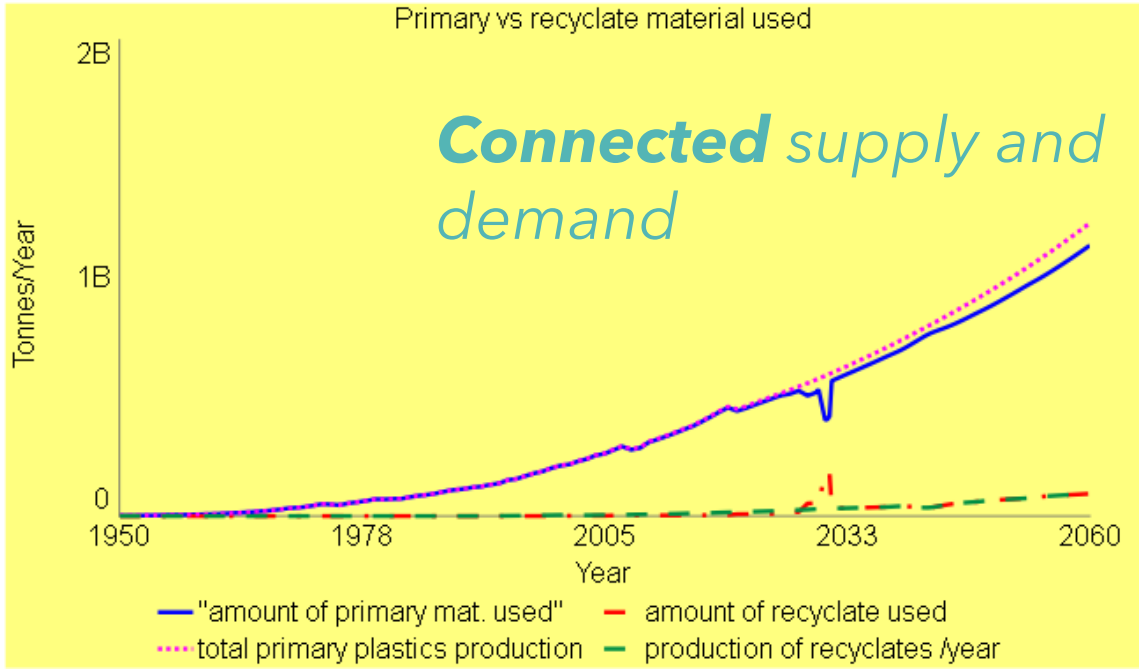


Results of Basic scenario – connecting recyclate consumption and production

There is not enough recycles in the market to meet demand



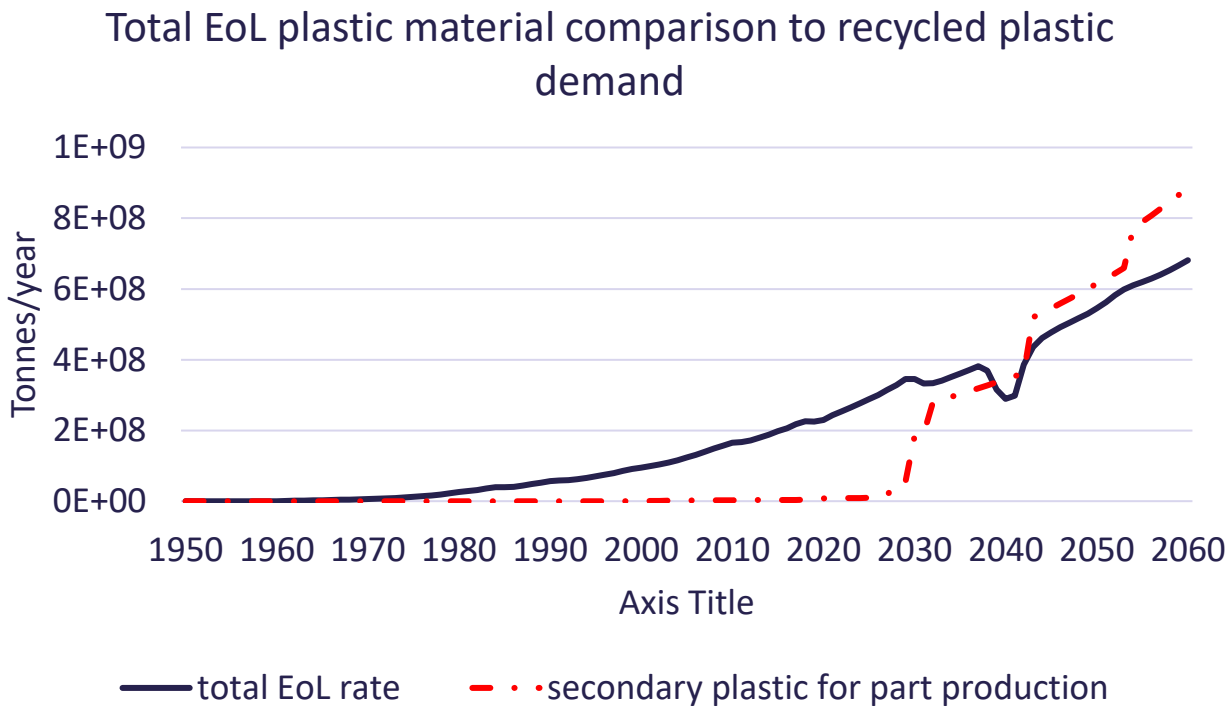
vs



Results of Basic scenario – connecting recyclate consumption and production

What end-of-life scenario could meet such a Circular Economy scenario?

...None

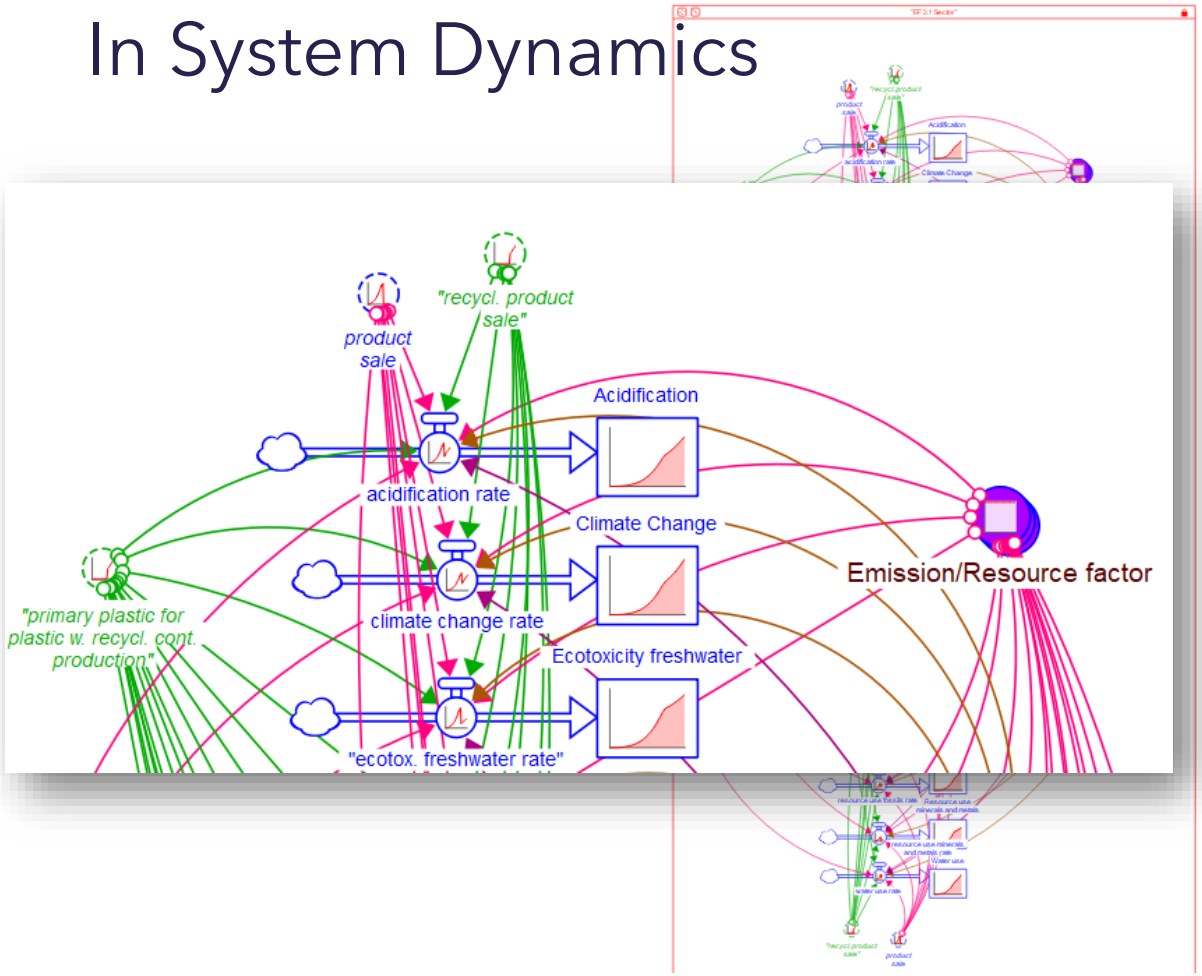


CONCLUSION 1: with a growing demand, even a "Circular Economy" would have to use primary production.

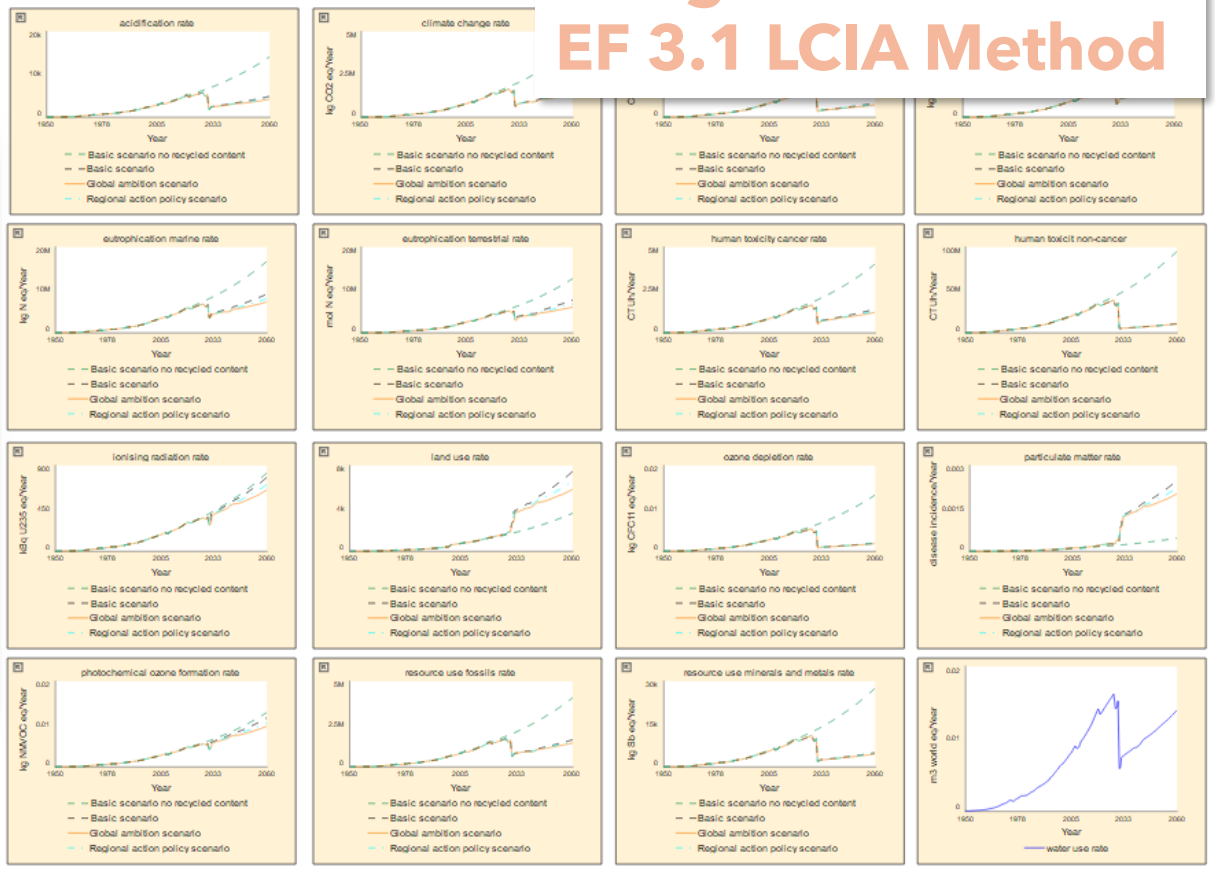
How does this look in LCA?

Results of Basic scenario – LCA in System Dynamics model I

In System Dynamics



16 impact categories
EF 3.1 LCIA Method

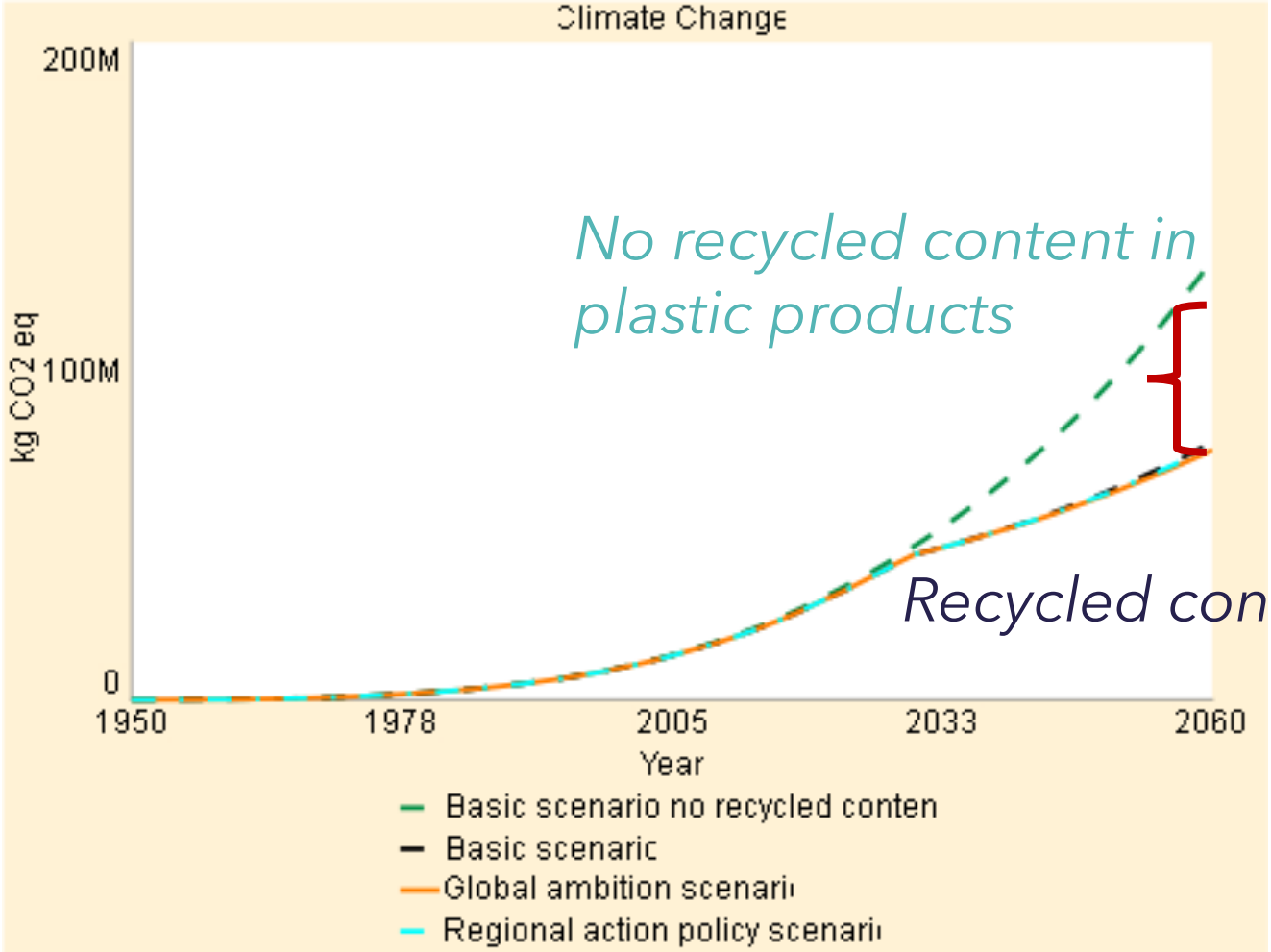


Results of Basic scenario – LCA in System Dynamics model II

Generally we see 2 interesting trends:

Trend #1 – recycling content is better

Majority of impact categories

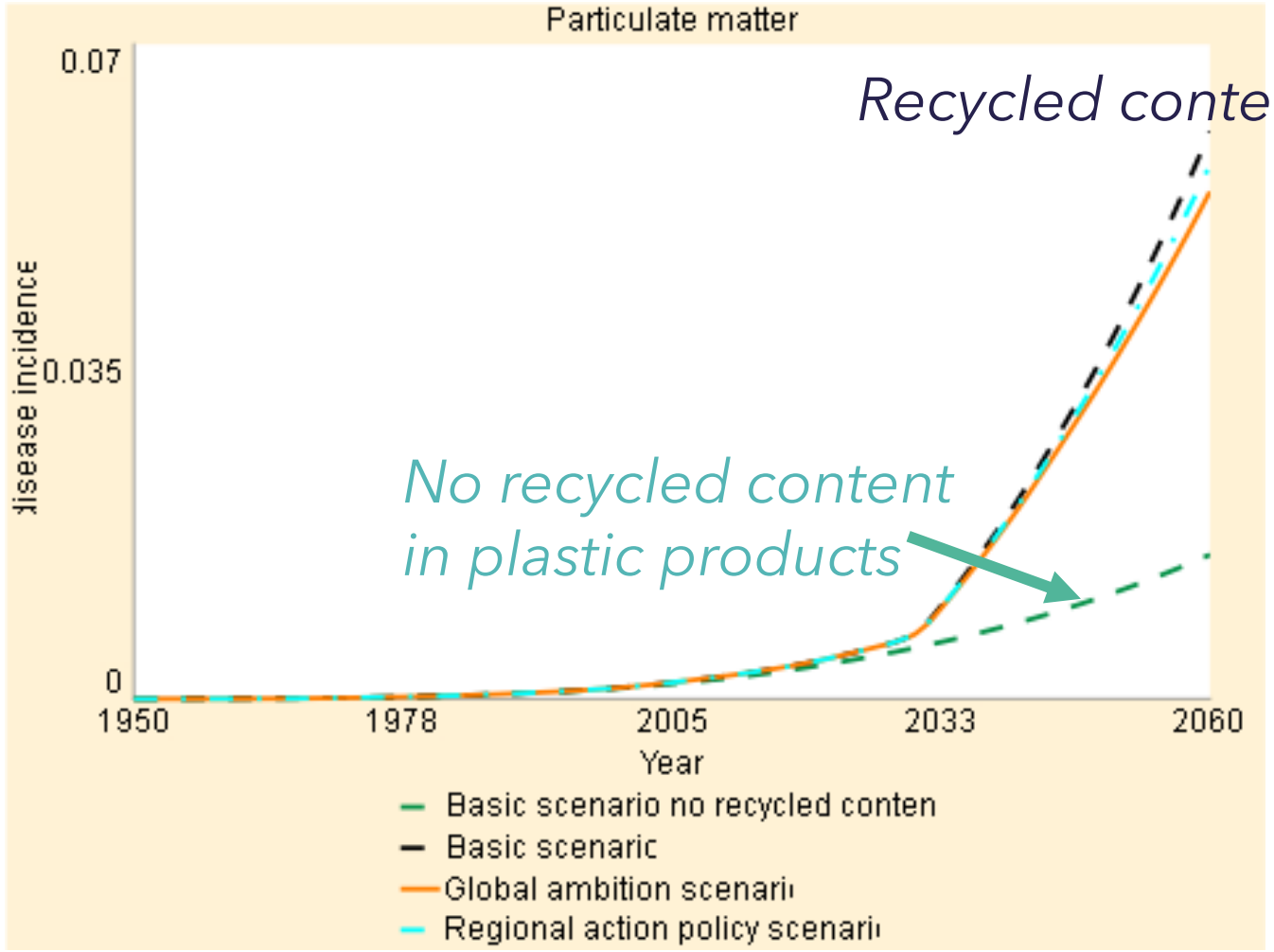


Results of Basic scenario – LCA in System Dynamics model II

Generally we see 2 interesting trends:

Trend #2 – recycling content is worse

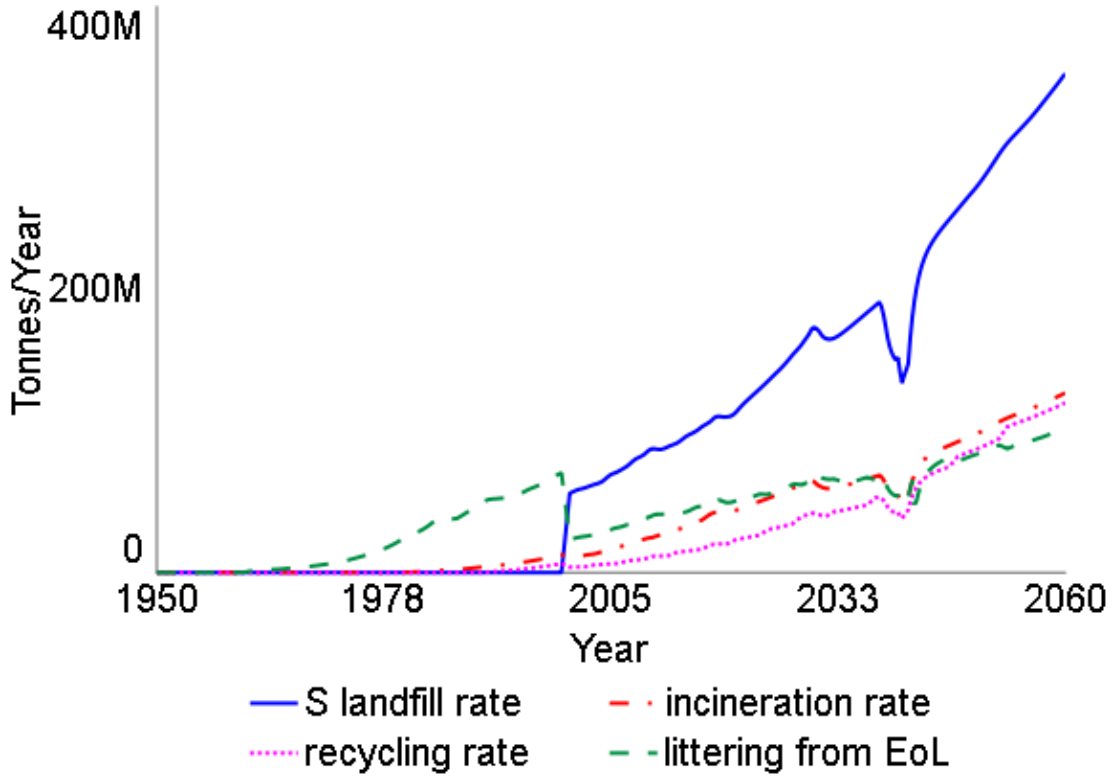
- Particulate matter
- Land use



What about littering?

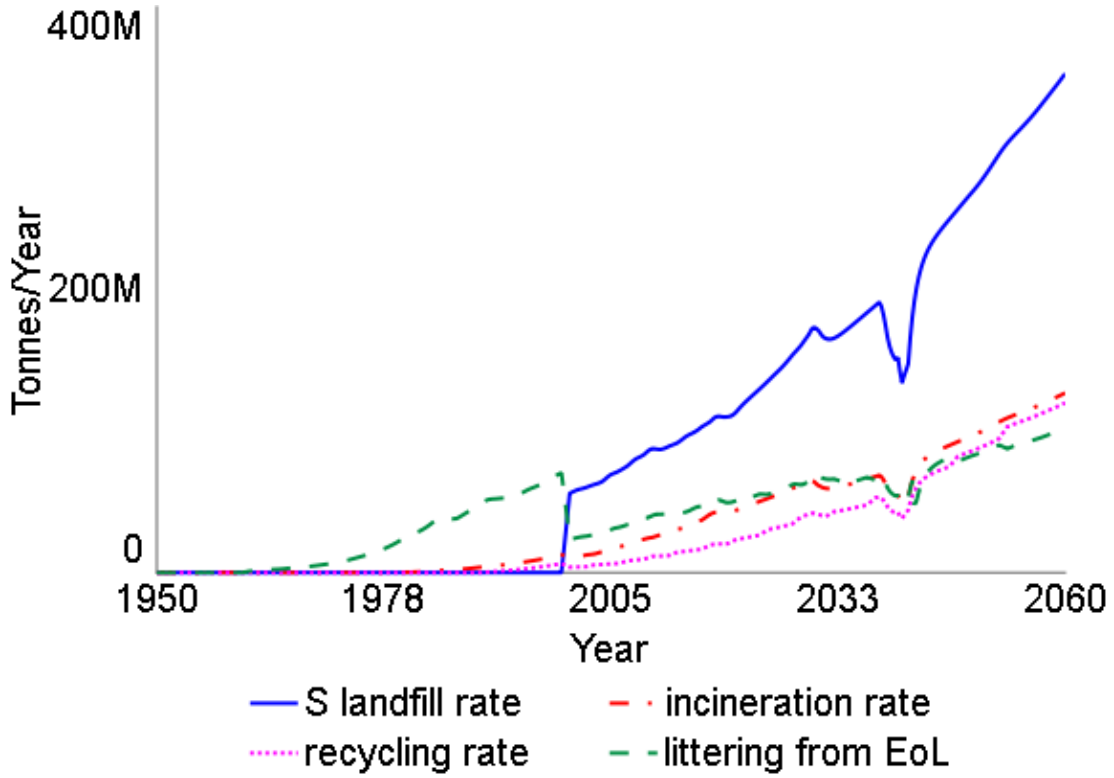
Littering model results

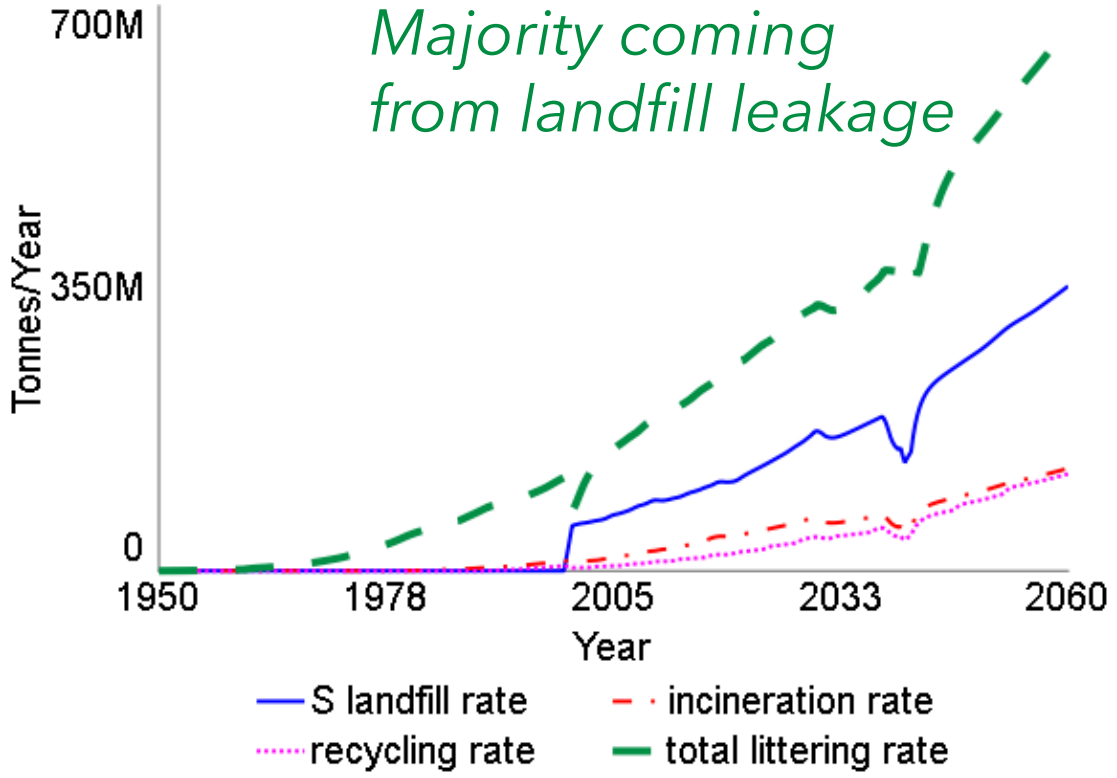
End-of-life rates...



Littering model results

End-of-life rates... vs taking into account all litter

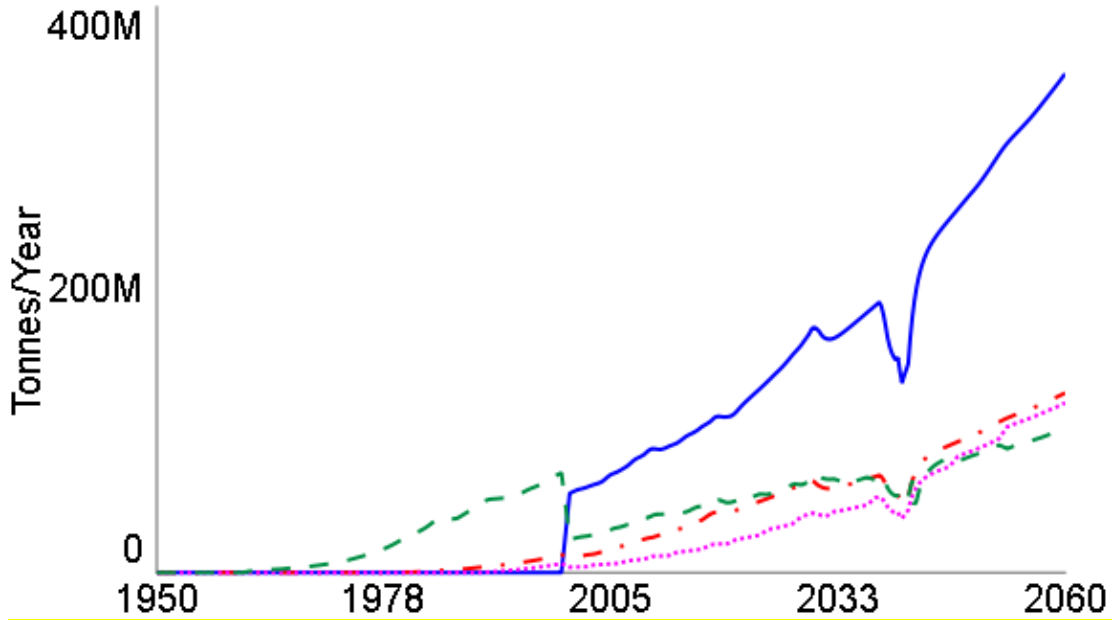


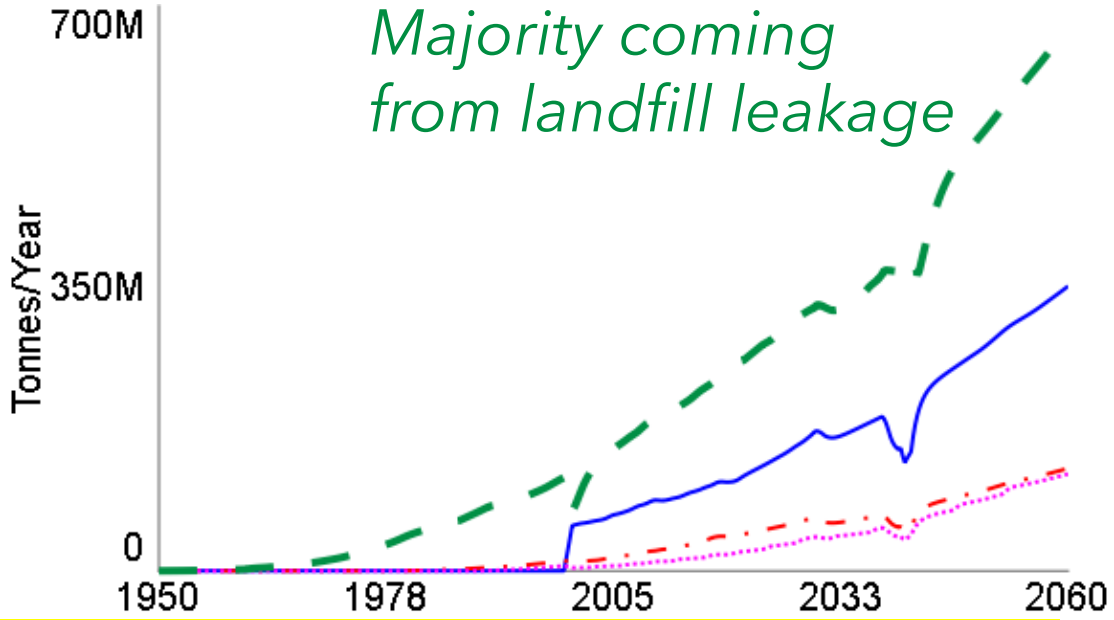


Majority coming from landfill leakage

Littering model results

End-of-life rates... vs taking into account all litter





CONCLUSION 2: Littering, often overseen in assessments, is the most common EoL fate.

Summary

Conclusions according to our model

1. A a growing demand/production of plastics, and not enough recycling rates make a **“Circular Economy” hard to reach.**
2. **LCA impact categories show a slower increase** for the recycled product scenario.
3. **Littering is the most common EoL fate** and is often overseen in assessments.
4. Increasing rate of plastics production comes with an increasing rate of littering.
5. The most effective way to **reduce overall littering of plastics is EoL alternatives to landfill**.
6. **Unwanted substances** in plastic products **will continue to be in the use phase if we recycle** products.

Summary

- LCA perspective is widened with a System Dynamics model.
  - Market perspective
  - Littering
  - Unwanted substances

- Generic SD model for plastics > this can be adapted for specific cases too. E.g. plastic packaging.
- A generic scenario aiming for a Circular Economy was presented.

- Improvements can come with different data inputs.

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WWW.PRIMUS-PROJECT.EU

Thank you!

ANY QUESTIONS?

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