

# Stocks, flows and sinks of plastic polymers within products in Norway from 2000 to 2050

## Assessment of future waste management practices and recycling targets



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### Background

- Previous estimates indicate that in Norway ~0,3 million tonnes (Mt) of plastic products were put on the market<sup>1</sup> annually, while 3.1 Mt of plastic products are in-use<sup>2</sup>.
- An overview of current and future plastic stock and flows is essential to set reliable targets for plastic recycling<sup>3</sup>, and devise effective strategies to reduce plastic waste generation.

### Methods

- Material flow analysis was used to estimate the flow of plastic in Norway from 2000 to 2050 based on the model by Kawecki et al<sup>4</sup>.
- Seven polymers were included: polypropylene (PP), low-density polyethylene (LDPE), high-density polyethylene (HDPE), polyvinyl chloride (PVC), polyurethane (PUR), polystyrene (PS), and polyethylene terephthalate (PET).
- A business-as-usual (BAU) scenario was assumed using GDP projections<sup>5</sup> to forecast future input of plastic polymers with constant transfer coefficients of various flows from 2020 forward.

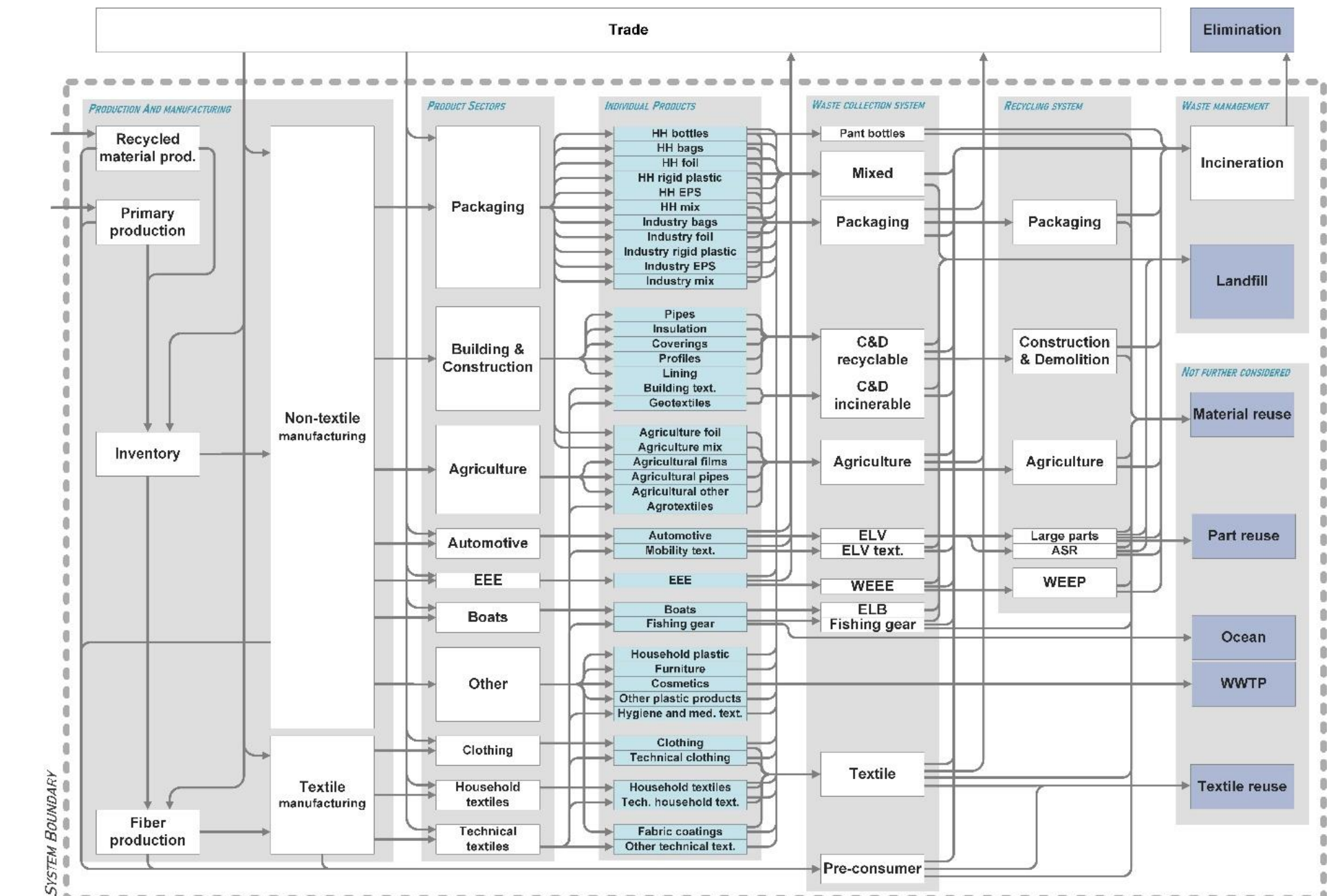


Figure 1: Conceptual structure and application of polymers in various product sectors in Norway (adopted from Kawecki et al. (2018)). Stocks are shown in light blue, sinks in dark blue.

### Results

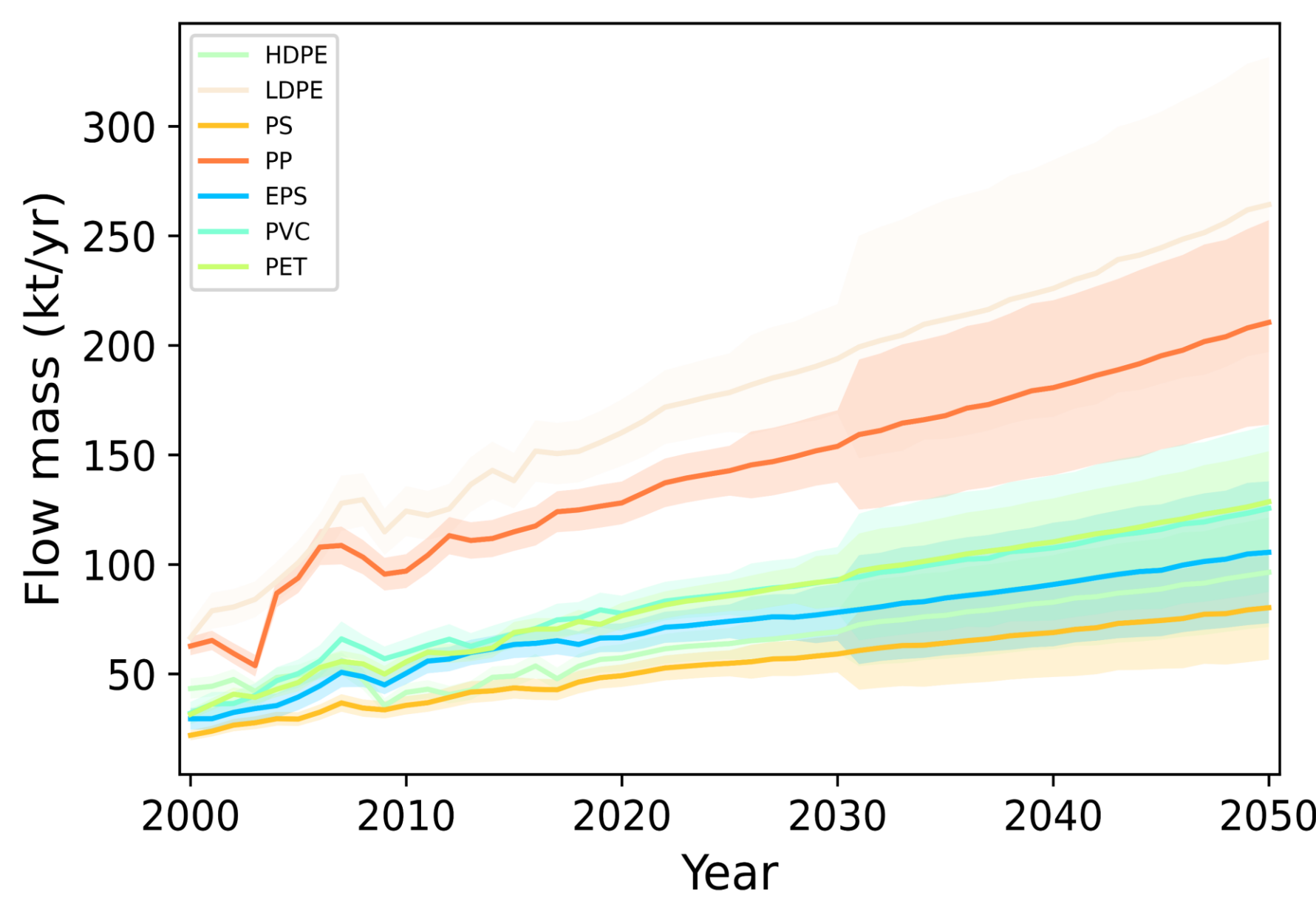


Figure 2: Plastic polymers put on the market (POM) in kt/year (with estimated standard deviation) in Norway from 2000 to 2050.

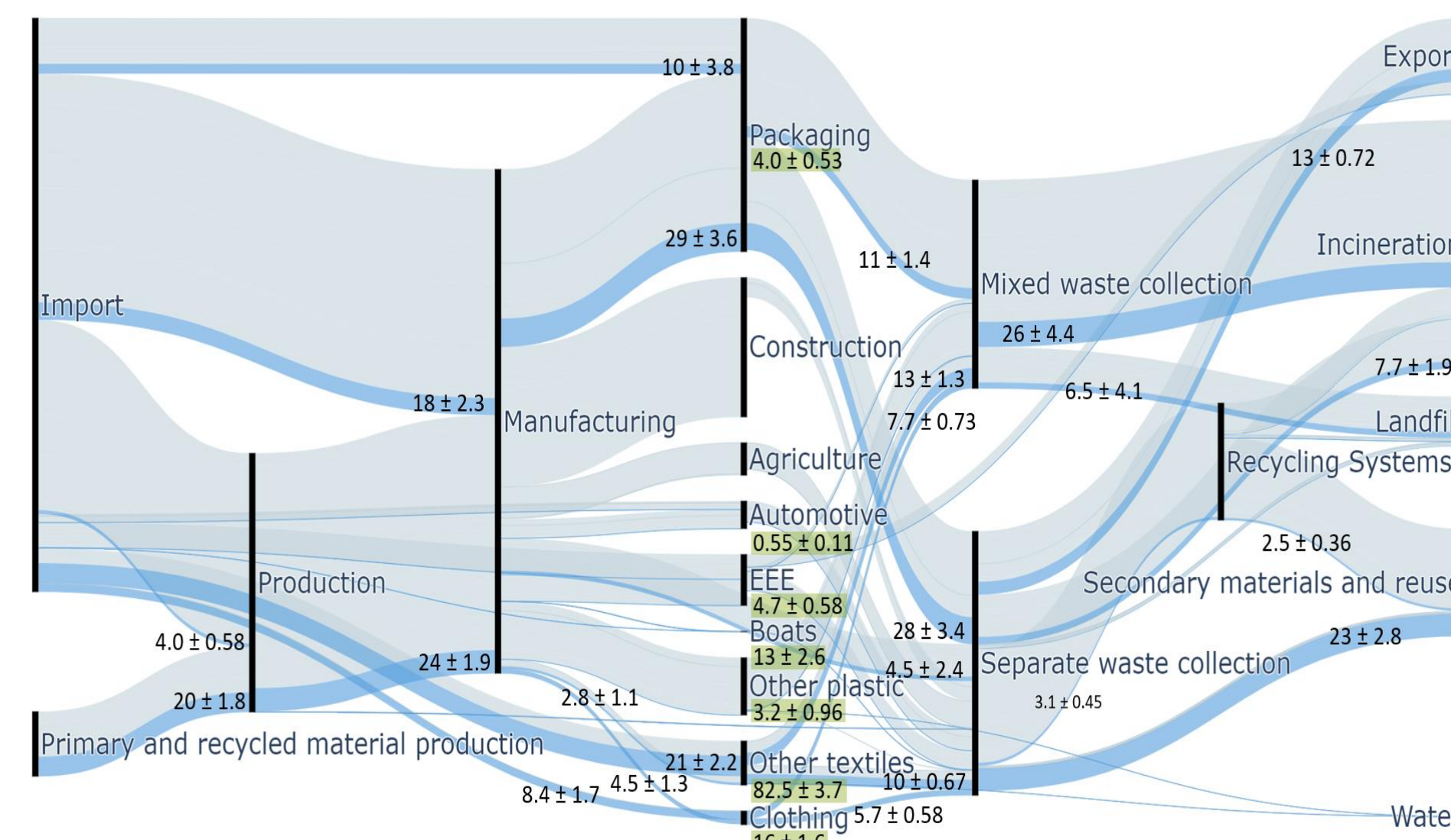


Figure 3: Material flow analysis of plastic in Norway in 2020 from production to waste. Sum of six polymers (HDPE, LDPE, PS, PP, EPS and PVC) flows is in grey, and flows of PET is shown in blue. The quantities of PET flows >1 kt are indicated. Stocks of PET are highlighted in green.

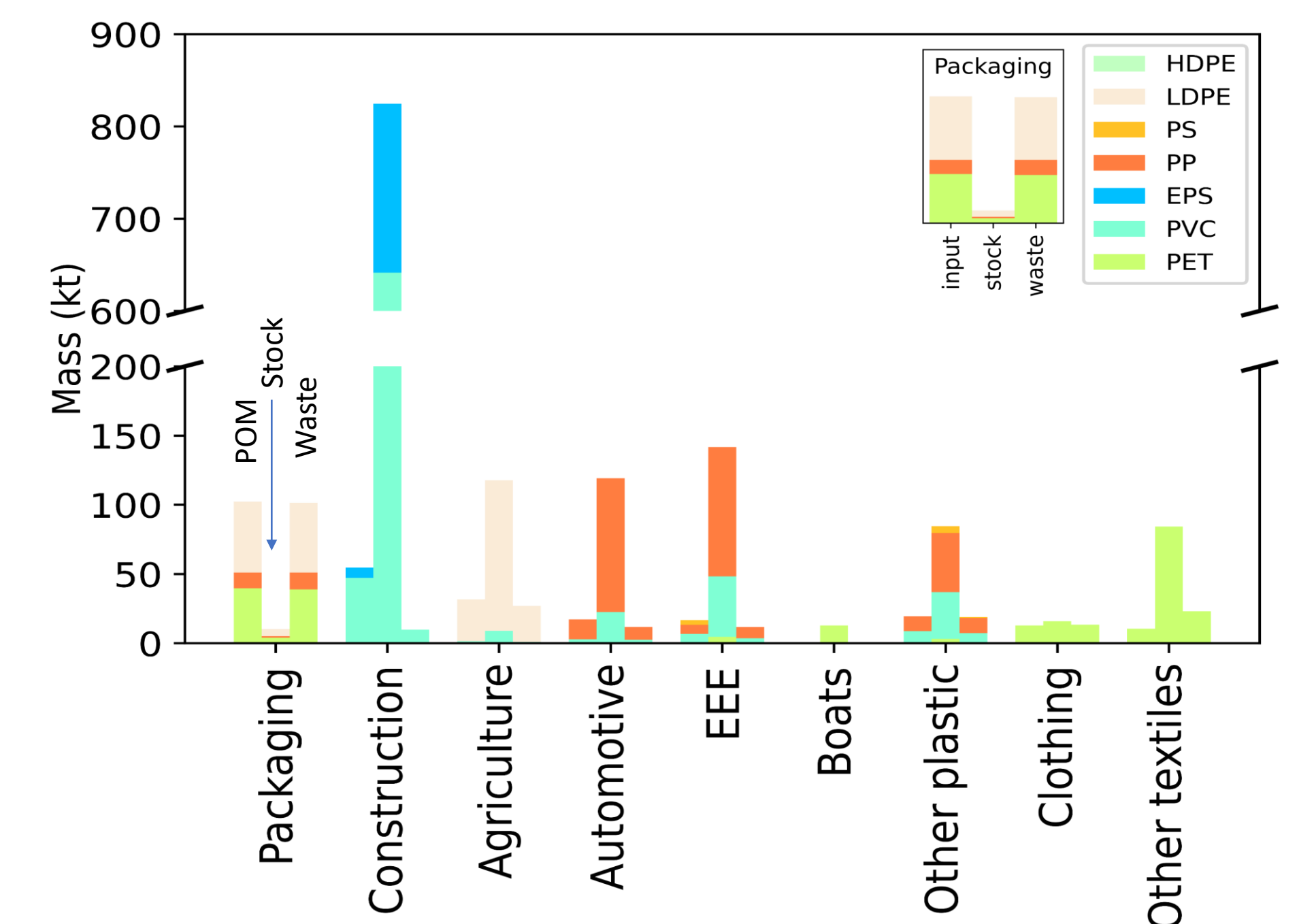


Figure 4: Quantity of plastic polymers (HDPE, LDPE, PS, PP, EPS, PVC and PET); POM (first bar), in stock (second bar) and in waste (third bar) for Norwegian product sectors in 2020

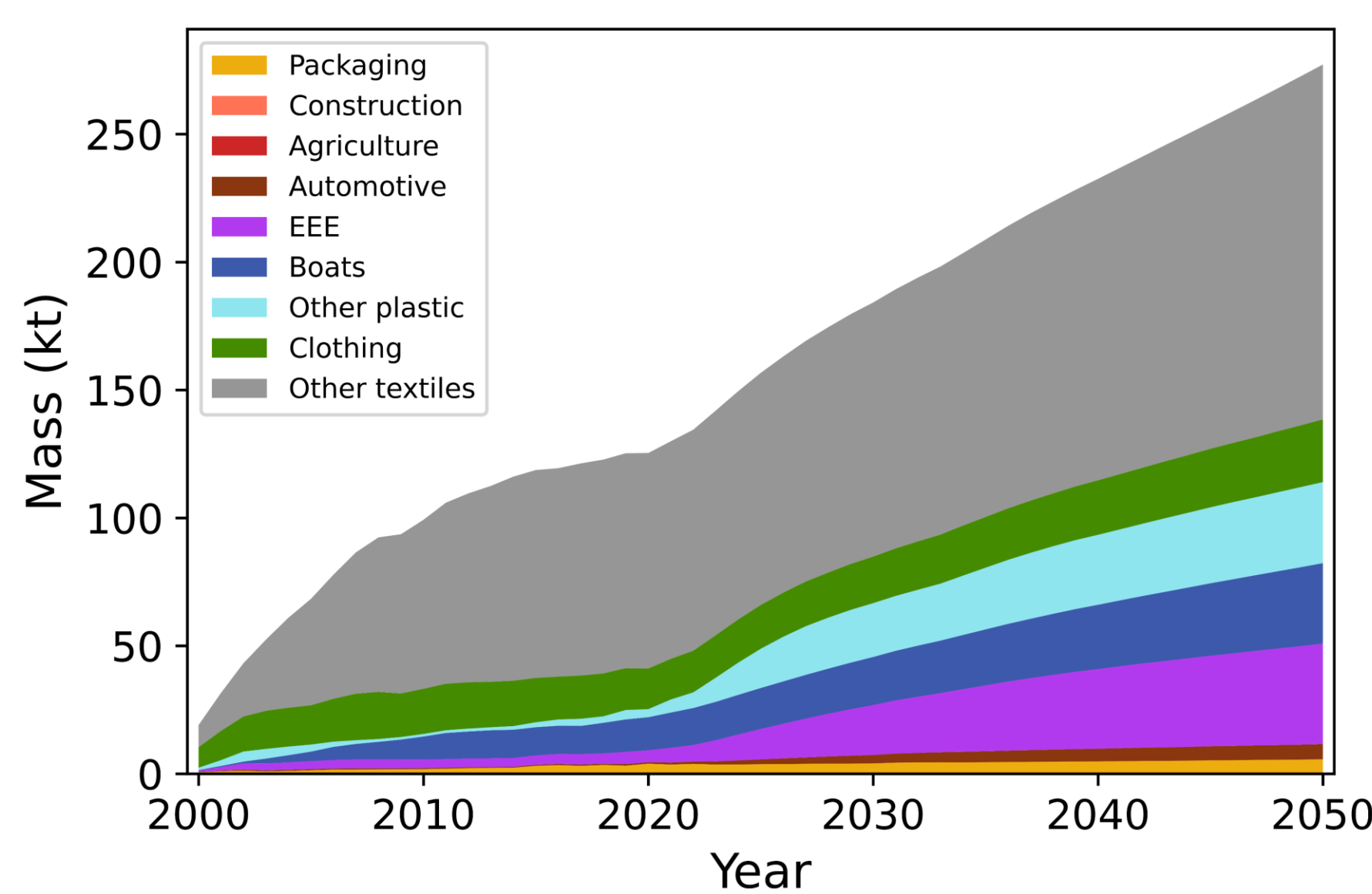


Figure 5: Mass (in kt) of PET in in-use stocks in Norway from 2000 to 2050

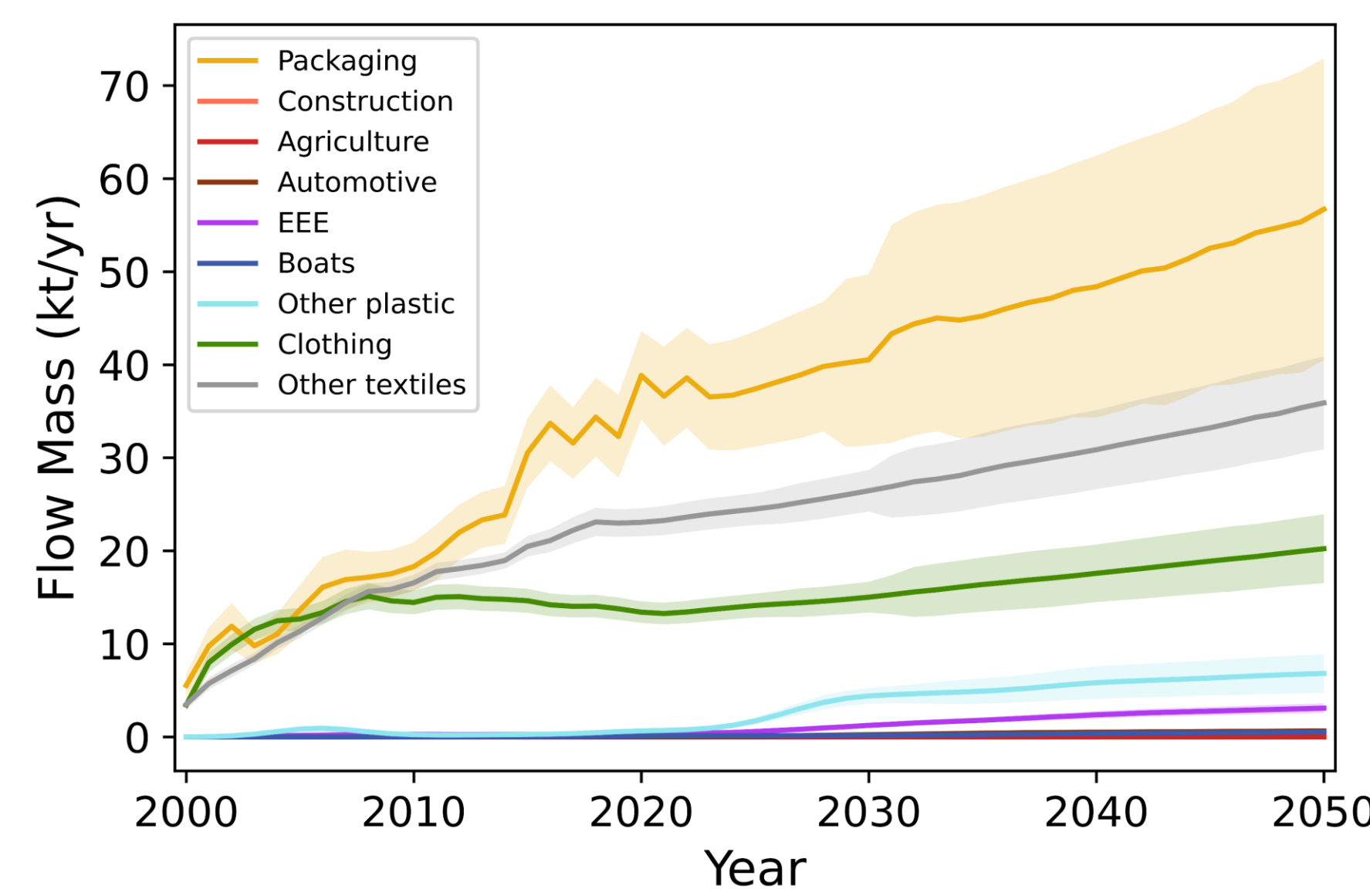


Figure 6: Flow (in kt/year) of PET from different sectors to waste in Norway between 2000 and 2050 including standard deviation

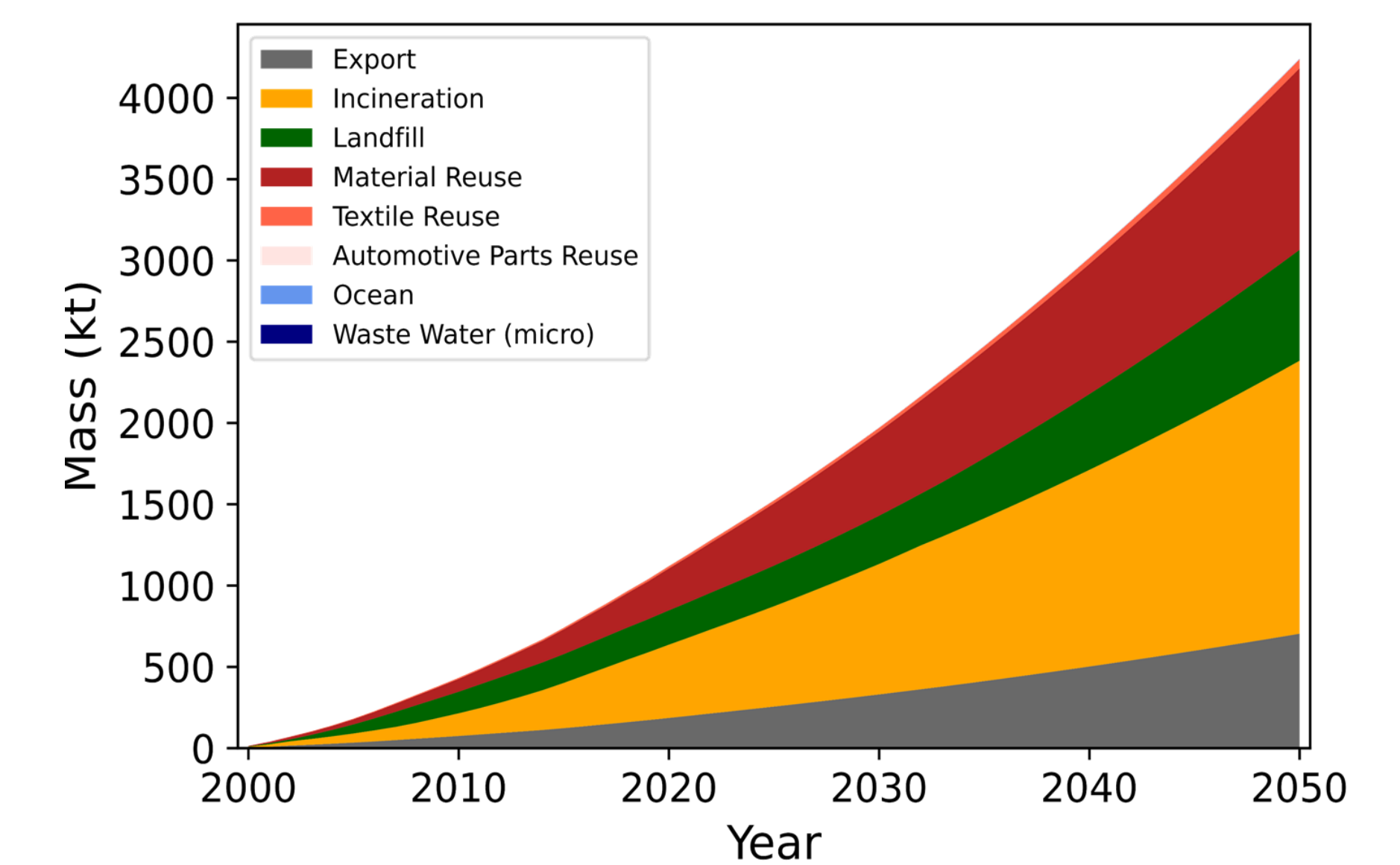


Figure 7: Mass (in kt) of PET accumulated in sinks in Norway between 2000 and 2050

### Conclusions

- In 2020, 615 ± 22.9 kt of plastic was put on the market. This number is expected to increase to 1010 ± 105 kt in 2050 under BAU.
- Effective waste management strategies should address the large flows of short-lived plastic products (e.g., packaging), as well as up coming plastic waste flows from current large stocks of plastic products (e.g., construction and EEE).
- The majority of PET in stock is stored in clothing and textiles in the form of polyester, with smaller amounts in EEE, boats or other plastics. The stock of PET is expected to double by 2050 from 125 ± 5.1 kt to 277 ± 22 kt.
- Packaging, clothing and textile waste make up the largest share of PET flowing to waste.
- In 2020, 90% of PET bottles was separately collected. This value is much lower for packaging of the other products resulting in ~30% of all packaging being collected from the waste stream.

### References

- <sup>1</sup>Deloitte (2020) Available at: [https://www.wwf.no/assets/attachments/Report\\_Deloitte\\_AS\\_WWF.pdf](https://www.wwf.no/assets/attachments/Report_Deloitte_AS_WWF.pdf)
- <sup>2</sup>HMF, Handelens Miljøfond (2020). Materialstrømmen til plast i Norge – hva vet vi ?
- <sup>3</sup>Klima- og miljødepartementet (2021). Noregs plaststrategi. Available at: <https://www.regjeringen.no/no/dokumenter/noregs-plaststrategi/id2867004/>
- <sup>4</sup>Kawecki, D., et al., (2021). Polymer-specific dynamic probabilistic material flow analysis of seven polymers in Europe from 1950 to 2016. Resources, Conservation and Recycling, <https://doi.org/10.1016/j.resconrec.2021.105733>
- <sup>5</sup>OECD (2022), available at: <https://data.oecd.org/gdp/real-gdp-forecast.htm>

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