Reduce Polystyrene

Used in the scenario "Ban Polystyrene Packaging" on the first tab, this intervention reduces material and operates by simply subtracting consumption in packaging and sending that delta "onwards" to waste and trade.

1 Introduction

This intervention is mechanistic and does not use significant external literature support. Even still, it makes a number of important and often user configurable assumptions.

1.1 Assumptions

- There is a known percent of polystyrene used in packaging ($\%_{packaging-PS}$).
- The reduction is linear from 2024 to configurable end date (default of 2050).
- The change in consumption to the change in waste generation is subject to lifecycle distribution delays.
- The lifecycle duration for polystyrene is the same as the larger packaging consumption sector.

1.2 External knowledge

This intervention does not use external literature to provide constants or other numbers beyond what is in the model itself though it uses some polymer-level data available from the underlying business as usual model.

2 Primary impact

This intervention assumes an input percent reduction in polystyrene consumption and has access to the percent of packaging that uses that polymer (~3.4% by default) by mass. The change to packaging becomes the following:

$C_{packaging} = C_{packaging} - \Delta_{PS}$ $C_{packaging} = C_{packaging} - (C_{packaging} * \%_{packaging-PS} * \%_{PS-reduction})$

Note that Δ_{PS} requires propagation across waste and imports.

3 Secondary impact

The reduction in polystrene Δ_{PS} is distributed proportionally across waste within the region:

$W_{fate} = W_{fate} - \frac{W_{fate}}{W_{total}} * \Delta_{PS}$

This change in waste is subject to lifecycle distribution delays. Note that imports also change as a result of reduced consumption:

$T_{import} = T_{import} - \frac{T_{import}}{C_{total}} * \Delta_{PS}$

Here C is all input plastics (consumption) including domestic production and imports.

4 Tertiary effects

As imports have changed, exports from other countries will reduce as well:

$T_{region-export} = T_{region-export} - \frac{T_{region-export}}{T_{total-export}} * \Delta_{import}$

Note that Δ_{import} comes from the region in which the intervention was introduced.

5 Discussion

This technical note now turns to interactions and future work.

5.1 Interactions

This intervention may interact with others in multiple ways but the primary mechanisms are consumption and waste. First, this lever's reductions are visible in production and consumption-dependent interventions like minimum recycled content. For example, a cap on virgin production can use this lever as "credit" towards its goal before further reducing plastic generation to meet its target. Second, this impacts waste like the amount of recyclable material available for interventions such as minimum recycled content. To that end, the reduction in available recycled material is visible for waste-dependent interventions including caps on different waste streams.

In practice, this intervention places a constraint on production of plastics alongside the constraints considered by other interventions and the "strictest" constraint is the one that is ultimately reported. The same holds true for waste generation impact such that another intervention may "supersede" this lever if the materials being reduced by this intervention do not allow that other lever to achieve its goals.

5.2 Future work

- The labeling of this intervention is being adjusted to refer to polystyrene not expanded polystyrene.
- Right now, all interventions assume the global average of 3.4% by mass for packaging is polystyrene but this may be adjusted to be region-specific.