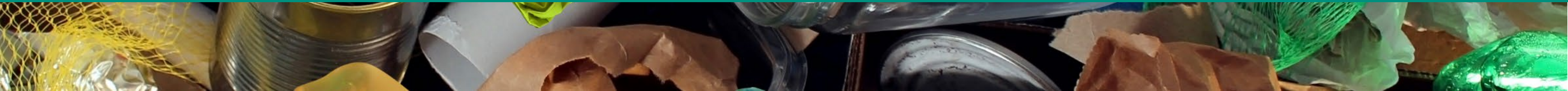
Oregon Recycling Modernization Act Technical Workgroup on Materials Lists

Meeting #4

July 19, 2022

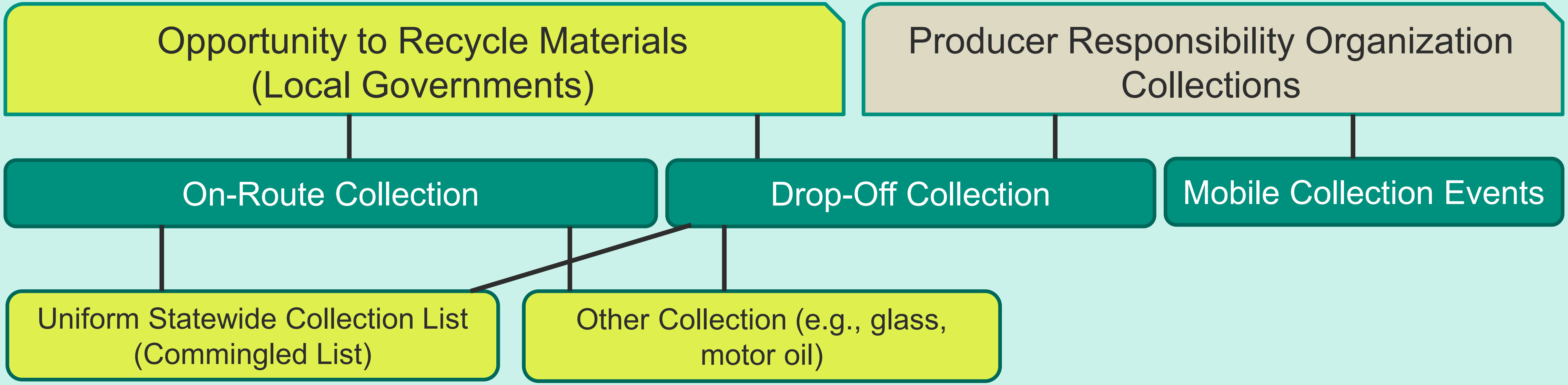


Follow-Up: Material Lists

Key Questions:

1. Which materials should regulated local governments (subject to Oregon's Opportunity to Recycle Act) collect for recycling?
2. Of those, which should be collected on-route? At depots? Which should be included in the state's Uniform Statewide Collection List?
3. Which materials should PROs collect for recycling (at depots, mobile collection events)?
4. For those, what convenience standards, collection targets and performance standards should be required?
5. Are there additional requirements that should be mandated?

Initial Rulemaking (2022 – 2023)



Other Processes

PRO Program Plans

- Could add materials to Uniform Statewide Collection List (subject to DEQ Plan approval)
- Could add other recycling to meet plastic recycling goal(s)

Other Private Recycling

Subsequent EQC Rulemakings

Follow-Up: On-ramps and off-ramps

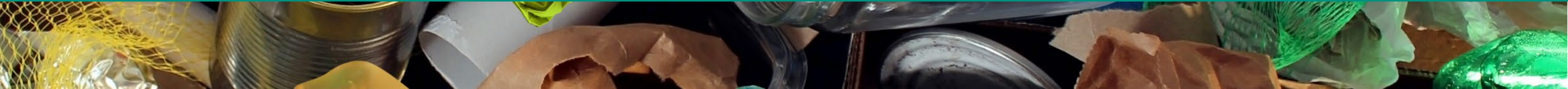
DEQ's preliminary thinking

1. Follow statutory requirements (e.g., ORS 459A.914)
2. Criteria in ORS 459A.914(3) are "considerations" . . . not all are "pass/fail"
3. Lists will likely evolve over time
4. Provide for a robust public process that is informed by evidence
5. Local governments and other partners will need time to adjust to changes
6. Removing materials from an acceptance list is more difficult than adding materials
7. For some materials, depots could be a stepping stone to eventual commingled collection . . . or not

Responsible End Markets

David Allaway and Nicole Portley
Oregon DEQ Materials Management Program

Technical Workgroup on Materials Lists
July 19, 2022



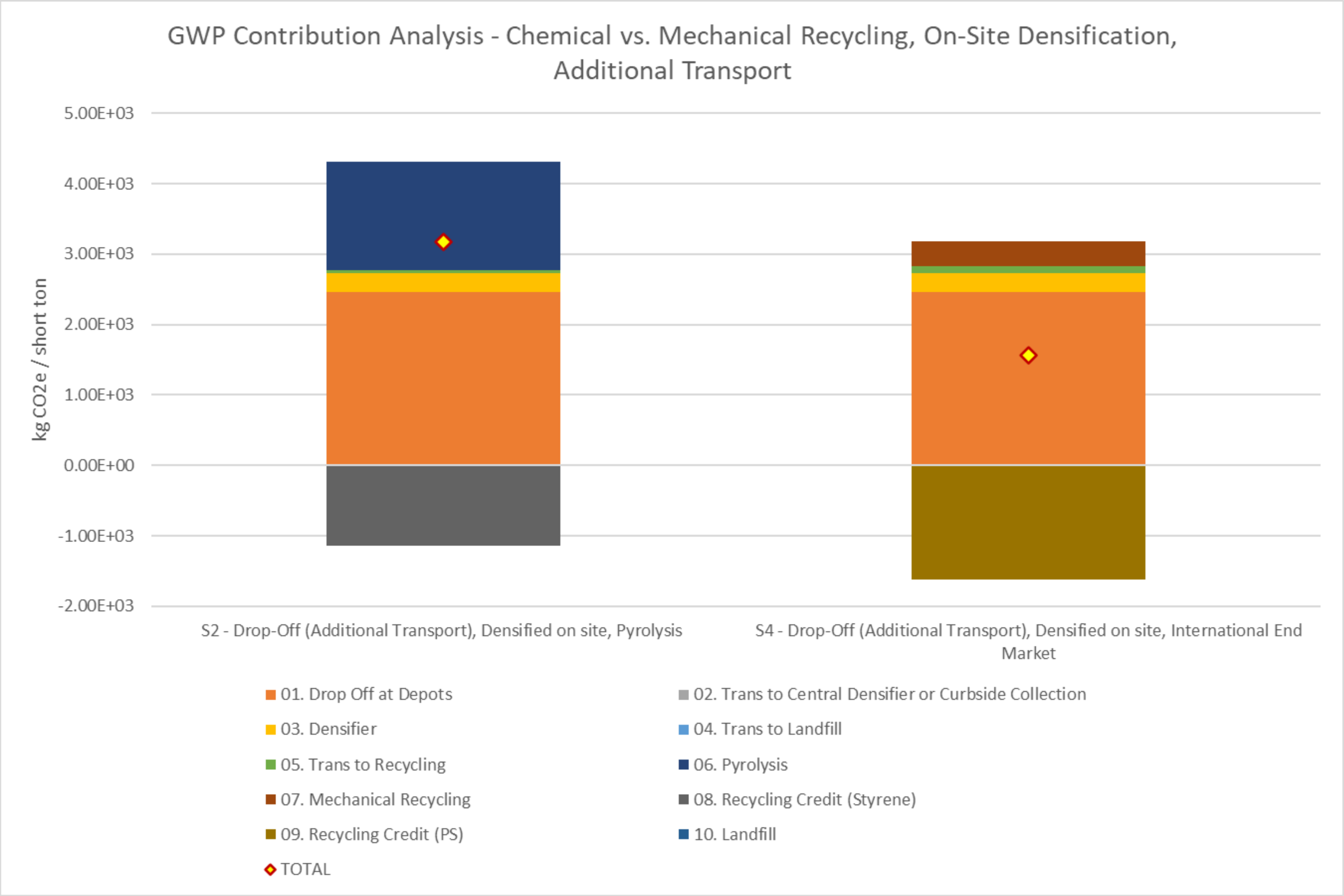
Today’s discussion

1. Background and context
2. Rule concept: Definition of “end market”
3. Rule concept: Standards for “responsible” end markets
4. Rule concept: Reporting, auditing and enforcement
5. Rule concept: Definition of “practicable”

Responsible end markets . . . or not

Photos: Megan Ponder

Not all end markets are the same



Oregon's "waste management" hierarchy

Pre-RMA
"Solid waste management"

- Reduce amount of waste generated, then
- Reuse materials, then
- Recycle material, then
- . . . and etc.

Post-RMA
"Materials management"

Minimize the net negative impacts of materials across their full life cycle . . .

Reduce the amount of materials used . . .

If information on impacts is unavailable or highly uncertain, then:

- Reduce amount of waste generated, then
- Reuse materials, then
- Recycle materials, with preference given to pathways that result in the greatest reduction of negative impacts on well-being and environmental health. Where impacts are not known, preference is given to:
  - Displacement of more impactful materials, and
  - Processes that best preserve value and molecular structure

“Responsible end markets”

Per statute:

“a materials market in which the recycling or recovery of materials or the disposal of contaminants is conducted in a way that benefits the environment and minimizes risks to public health and worker health and safety.”

Commingled processor and PRO obligations

	Commingled Processors
Scope of materials	All materials accepted (covered products and others)
Responsible end markets	• Market materials to responsible end markets • Report all disposition
Follow the policy hierarchy	No obligation

Commingled processor and PRO obligations

	Commingled Processors	Producer Responsibility Organizations
Scope of materials	All materials accepted (covered products and others)	Covered products: 1. Collected for recycling at PRO depots 2. Included on the uniform statewide collection list and collected under the opportunity to recycle 3. Identified as a “specifically identified material” 4. Recycled in an effort to achieve statewide plastic recycling goal
Responsible end markets	• Market materials to responsible end markets • Report all disposition	• “To the extent practicable, ensure that covered products will be . . . delivered to responsible end markets. • Report all disposition

DEQ

Commingled processor and PRO obligations

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Responsible end markets	• Market materials to responsible end markets • Report all disposition	• "To the extent practicable, ensure that covered products will be . . . delivered to responsible end markets. • Report all disposition
Follow the policy hierarchy	No obligation	"To the extent practicable, ensure that covered products will be . . . managed according to the hierarchy of materials management options under ORS 459.015(2)"

DEQ

Today's discussion

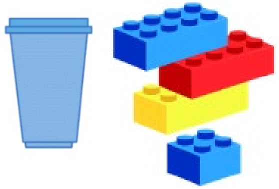
1. Background and context (David)
2. Rule concept: Definition of "end market" (Nicole)
3. Rule concept: Standards for "responsible" end markets (Nicole)
4. Rule concept: Reporting, auditing and enforcement (Nicole)
5. Rule concept: Definition of "practicable" (David)

Defining "end market" by material

- Glass: user of the recyclate to make a new product e.g. bottle or fiberglass manufacturer, pozzolan producer, etc

- Metal: producer of the recyclate, e.g. of ingots, sheet, coil etc. by smelting

- Paper: facilities that re-pulp recycled material into pulp for paper manufacturers or into paper or paperboard.



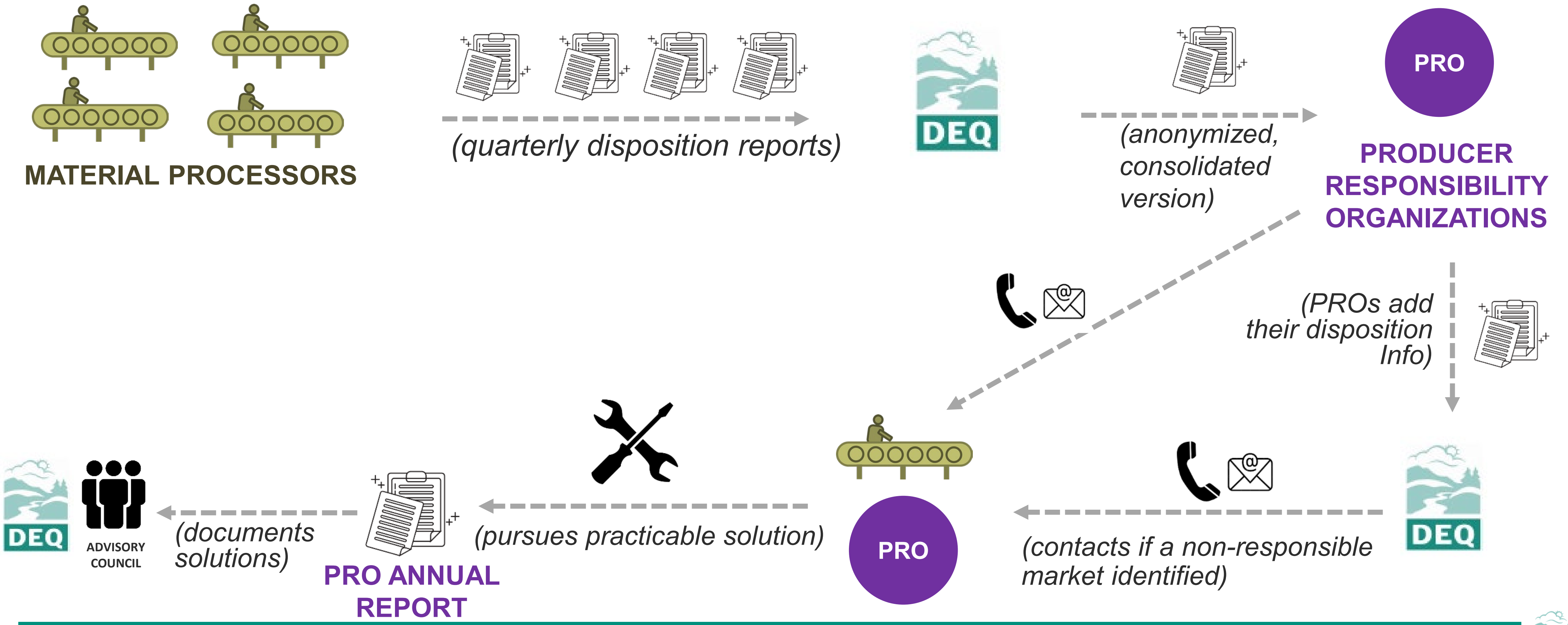
- Plastic for food and beverage packaging and children's toys: user of the recyclate to make a new product

- Plastic for all other applications: last handler (typically a reclaimer) of the recyclate (typically flakes or pellets) before sold to the producer of a new product.

Standard for "responsible"

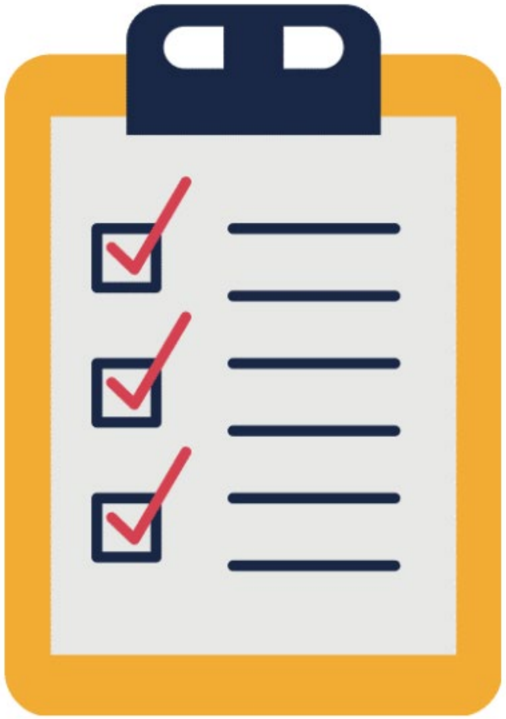
- Compliant
- Transparent
- Environmentally-sound
- Achieves adequate yields

How will reporting work?: process in statute



Rule concepts: reporting and auditing

1. Required annual auditing by PROs and inclusion in annual reports
2. Required audit components:
    a. Random bale tracking
    b. Rationale for “end market” identification
    c. List of relevant laws and treaties;
    d. Documentation that supply chain entities meet the “responsible” standard
    e. Documentation of any non-compliance with standards,
    f. Documentation of the auditor’s qualifications; and
    g. Certification and signature from the auditor



PRO obligations are “to the extent practicable”

ORS 459A.896(2):

“A producer responsibility organization, shall, *to the extent practicable*, ensure that covered products collected in this state for the purpose of recovery and described in ORS 459A.869(7) will be:

(a) Delivered to responsible end markets;

(b) Managed according to the hierarchy of materials management options under ORS 459.015(2); and

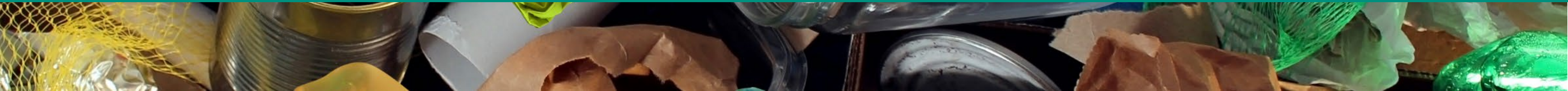
(c) Managed in an environmentally protective way through to final disposition.”

Proposed definition of "practicable"

1. Provide examples:
    i. Provide financial support to help a market change operations
    ii. Provide financial support to redirect materials to a different end market
    iii. Re-direct disposition (for materials under PRO's direct control)
    iv. Offer to buy or take ownership of materials (to bring them into direct control)
    v. Develop new markets
2. "Impracticable" requires technical barriers that cannot be overcome or transactional costs that aren't justified (given resulting societal benefits)
3. For all claims involving responsible end markets not being practicable, require critical review by DEQ . . . and initiate review of material acceptance lists if agreed

Short Break

The meeting will resume within five minutes



Evaluation Matrix Changes

- Aerosol cans
- Paper “cans” with steel ends
- Hardcover books
- Time permitting: Large-format HDPE and PP packaging (e.g., buckets, pails, trays, crates, etc.)

Comparative Life Cycle Assessment of Expanded Polystyrene Dispositions (Updated)

Materials Management

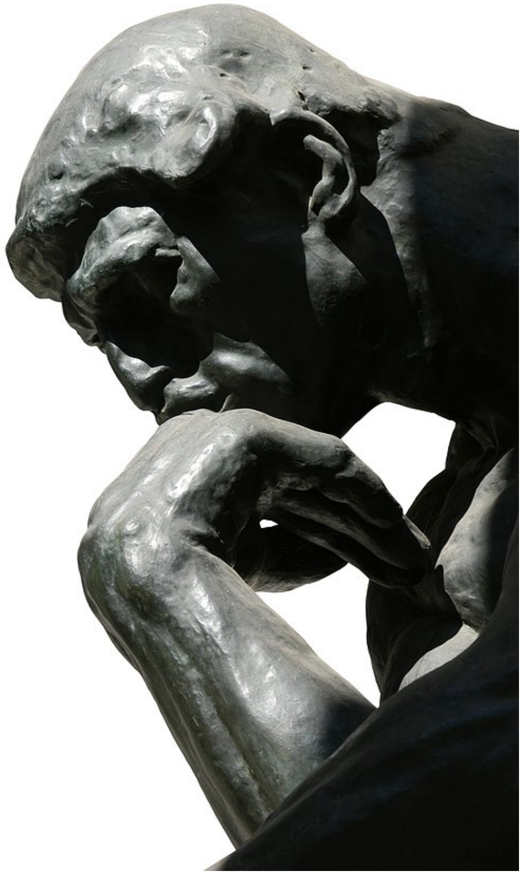
July 19, 2022
Material Lists Technical Workgroup Meeting #4

Agenda

- Goal and Scope
- Results
- Interpretation and Limitations
- Potential Next Steps

Project Goals/Objectives

- Using Comparative Life Cycle Assessment
  - Quantify the environmental impacts of different end of life management scenarios for Expanded Polystyrene (EPS) to identify trade-offs and key variables.



Scope – Functional (Declared) Unit

- **Function:** Disposition of EPS through different end of life pathways

- **Magnitude/unit:** 1 us ton (short ton)

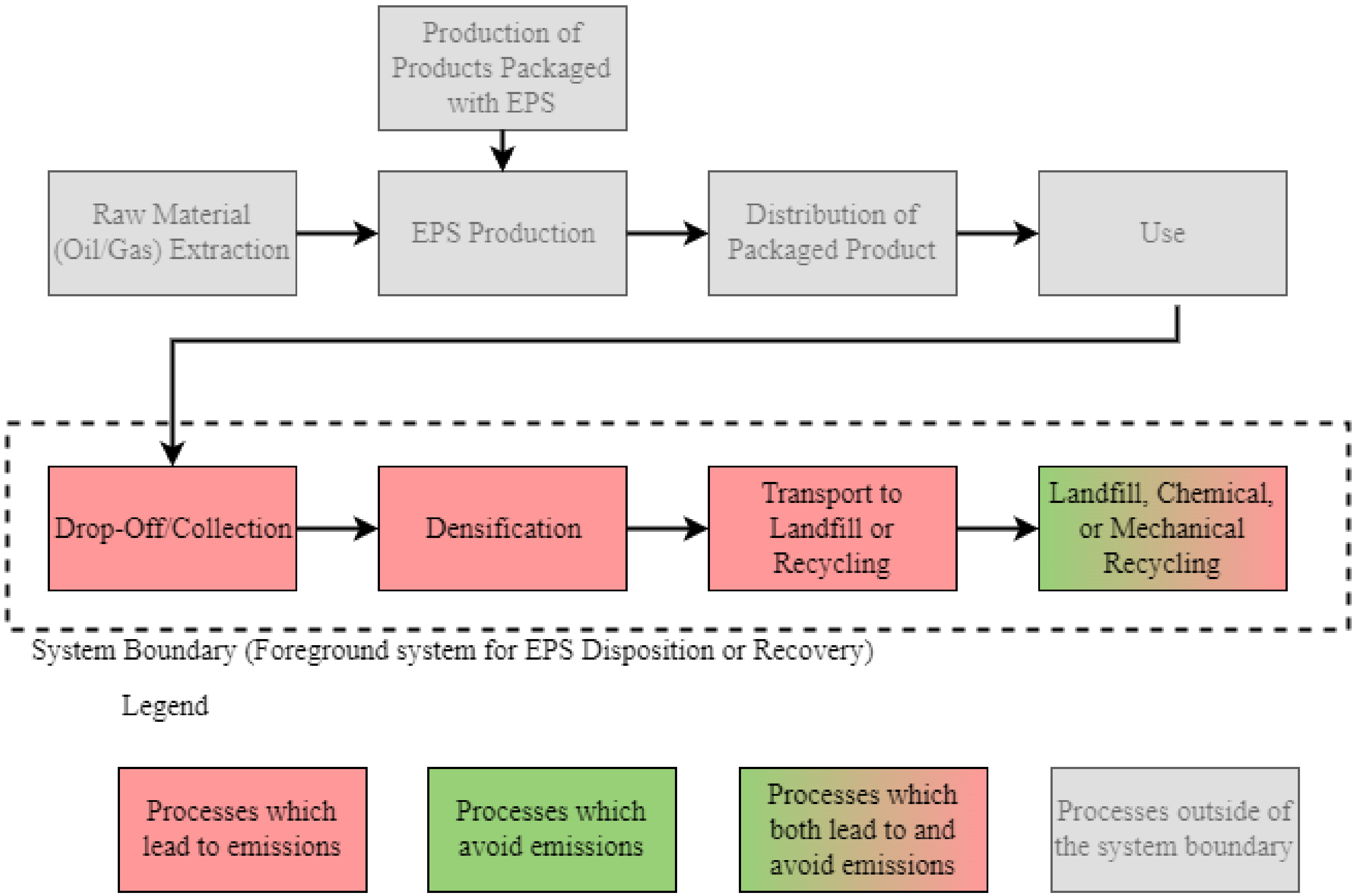
Scope – Key Variables Evaluated

- Collection - Marginal vs Additional Drop-Off vs On Route
- Densification – Onsite vs Offsite vs Undensified
  - Transport – Densified vs Undensified
- End of Life Dispositions - Chemical Recycling (Oregon) vs Mechanical Recycling (Asia) vs Mechanical Recycling (Domestic, California) vs. Distant Landfilling vs Local Landfilling

Scenarios Evaluated

Scenario Number	Collection	Densification	Disposition
S1	Drop-Off (Marginal)	On-site	Pyrolysis (in-state)
S2	Drop-Off (Additional)	On-site	Pyrolysis (in-state)
S3	Drop-Off (Marginal)	On-site	Mechanical Recycling (Asia)
S4	Drop-Off (Additional)	On-site	Mechanical Recycling (Asia)
S5	Drop-Off (Marginal)	Off-Site	Pyrolysis (in-state)
S6	Drop-Off (Additional)	Off-Site	Pyrolysis (in-state)
S7	Drop-Off (Marginal)	Off-Site	Mechanical Recycling (Asia)
S8	Drop-Off (Additional)	Off-Site	Mechanical Recycling (Asia)
S9	Drop-Off (Marginal)	None/Undensified	Pyrolysis (in-state)
S10	Drop-Off (Additional)	None/Undensified	Pyrolysis (in-state)
S11	Drop-Off (Marginal)	None/Undensified	Distant Landfill
S12	Drop-Off (Additional)	None/Undensified	Distant Landfill
S13	On Route to Transfer Station	None/Undensified	Distant Landfill
S14	Drop-Off (Marginal)	None/Undensified	Nearby Landfill
S15	Drop-Off (Additional)	None/Undensified	Nearby Landfill
S16	On Route Direct to Landfill	None/Undensified	Nearby Landfill
S17	Drop-Off (Marginal)	On-site	Mechanical Recycling (California)
S18	Drop-Off (Additional)	On-site	Mechanical Recycling (California)
S19	Drop-Off (Marginal)	Off-Site	Mechanical Recycling (California)
S20	Drop-Off (Additional)	Off-Site	Mechanical Recycling (California)

Scope – System Boundary



Scope – System Boundary

- **Temporal Coverage** – 2016-2022
- **Geographical Coverage** – Oregon
- **Technological Coverage** – This study is intended to represent materials management options for expanded polystyrene the foreground system covers technology and processes related to transportation of EPS to central locations or collection depots, mechanical densification, transport to end markets, chemical recycling, mechanical recycling, or landfilling. The background system includes electricity, thermal energy, and energy carriers (e.g. fuels).

Scope – Data Sources

- Primary Data Sources
  - Mechanical Densification – from Tillamook County
  - Pyrolysis – from Agilyx/Regenyx Air Contaminant Discharge Permit - 2020 Annual Report
- Secondary Data Sources
  - Truck Emissions – diesel combustion from USLCI (US DOE)
  - Truck Fuel Efficiency – US EPA Smartway
  - Passenger Vehicle Emissions – GaBi Database
  - Ship Emissions – GaBi Database
  - Mechanical Recycling – GaBi Database
  - Landfilling – GaBi Database
  - Fuels (Diesel or Gasoline) – GaBi Database
  - Production Emissions for Displaced Materials (Styrene and Polystyrene) – GaBi Database

Scope – Selected Impact Categories and Indicators

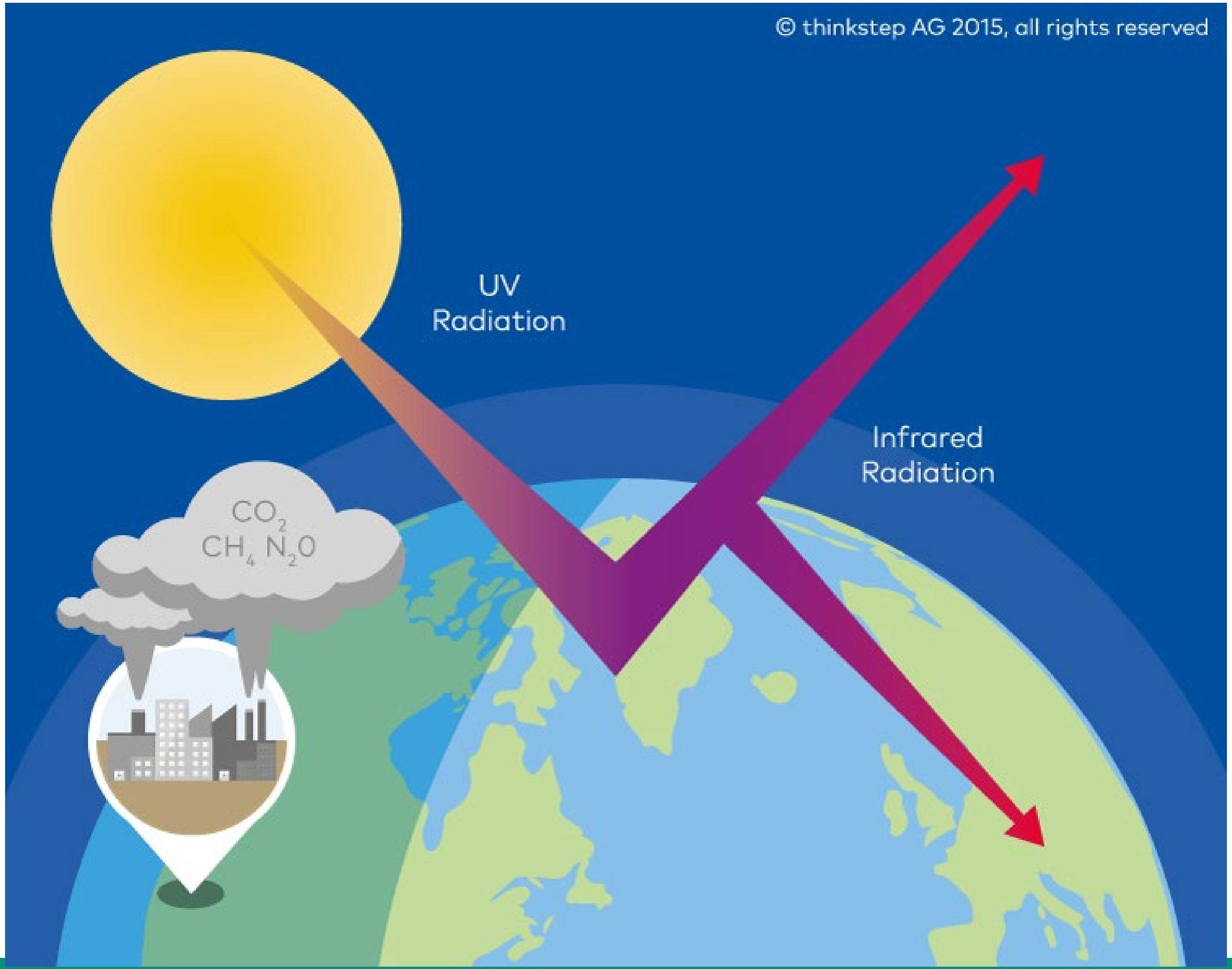
TRACI 2.1 LCIA Categories

- Acidification Potential (AP)
- Eutrophication Potential (EP)
- Ecotoxicity (ETP)
- Global Warming Potential (GWP100)
- Particulate Matter (PM2.5) Potential
- Human Toxicity Potential (HTP) – Cancer
- Human Toxicity Potential (HTP) – NonCancer
- Ozone Depletion Potential (ODP)
- Smog Formation Potential (SFP)

Environmental Indicators

- Fossil Resource use
- Water Consumption
- Primary Energy Demand

Global Warming Potential



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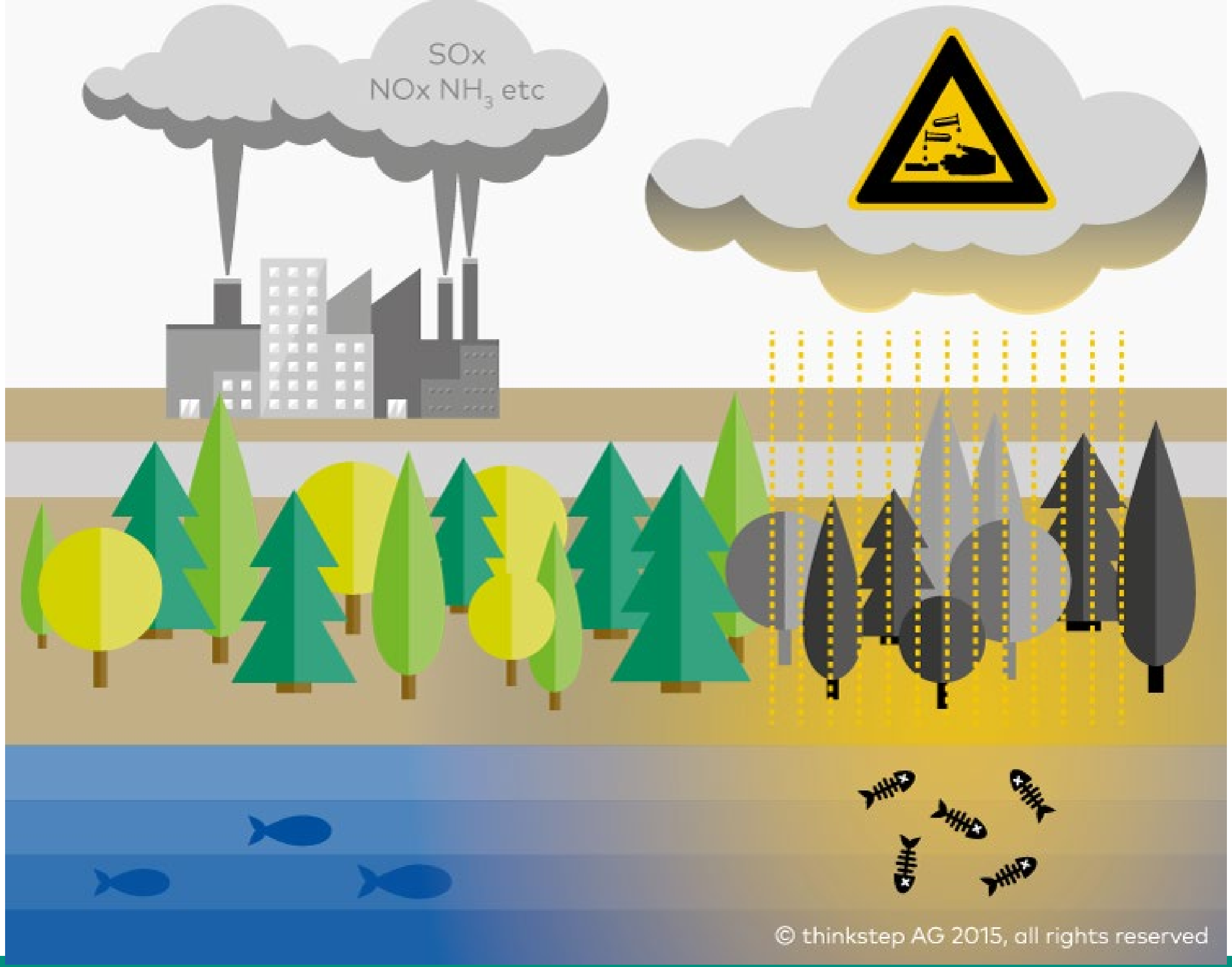
Acidification Potential



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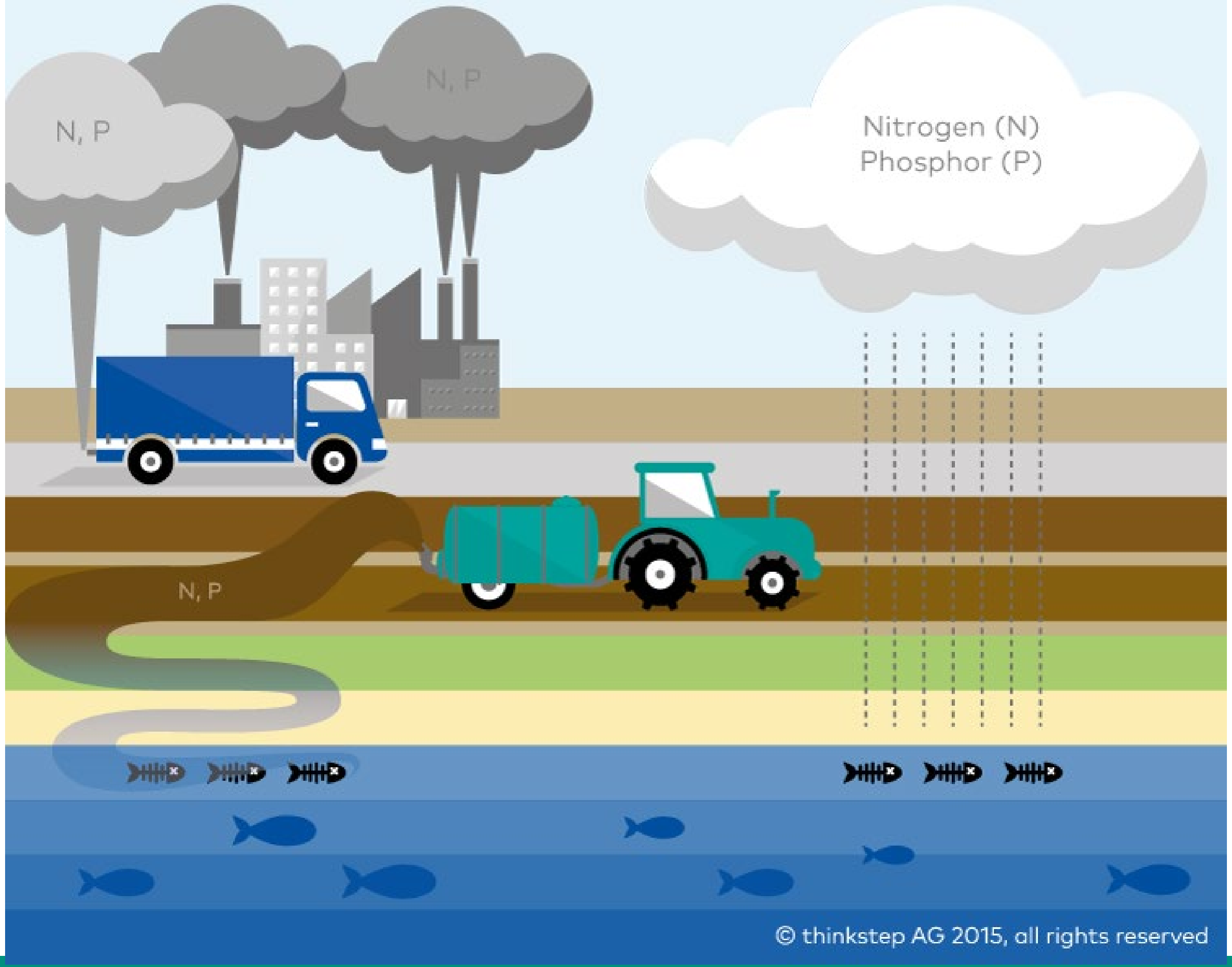
Eutrophication Potential



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Smog Formation Potential

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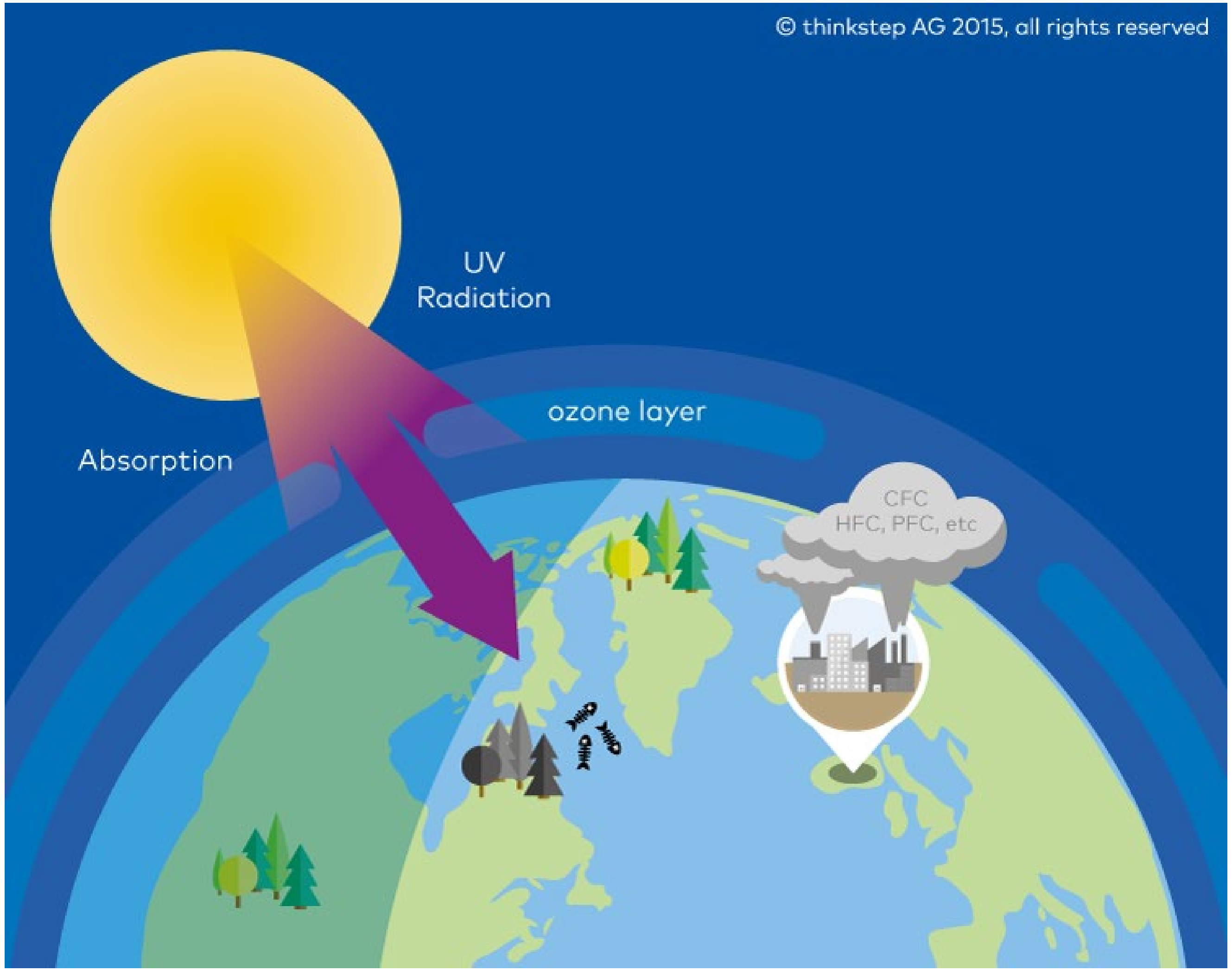
Ozone Depletion Potential



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Primary Energy Demand

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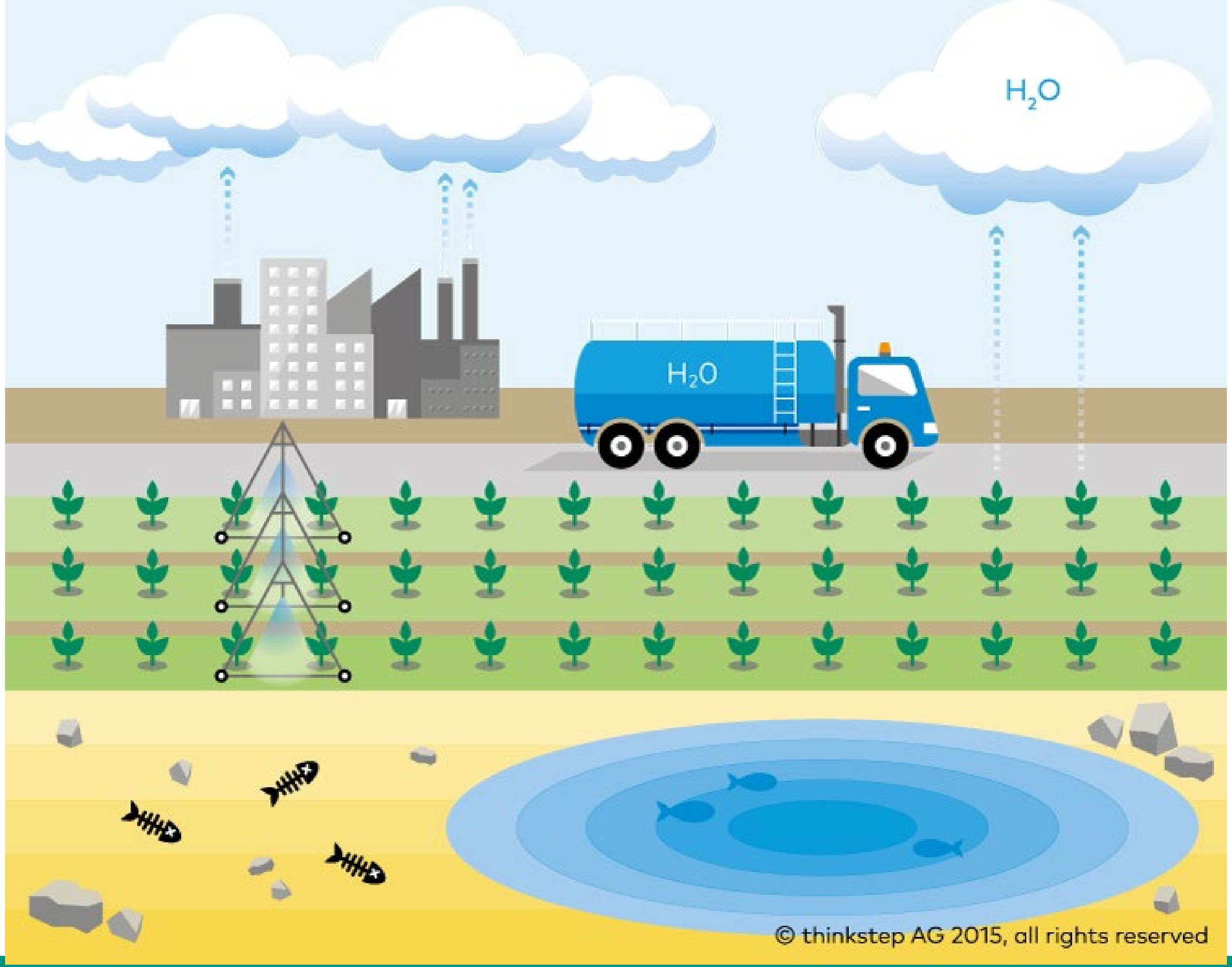
Freshwater Consumption



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Preliminary Results

Life Cycle Impact Assessment (LCIA) and Indicators

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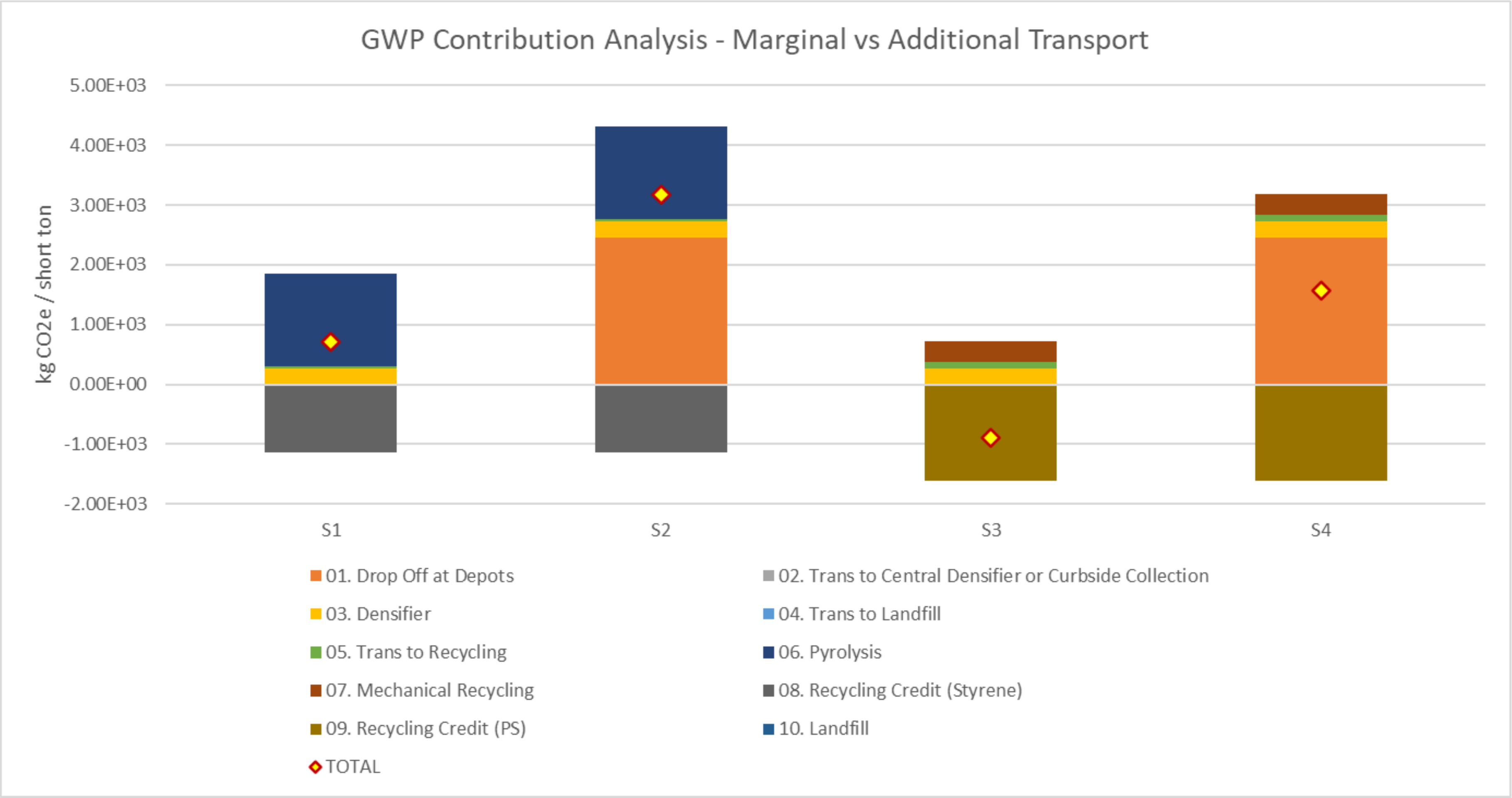
LCIA Results – Global Warming Potential (GWP)



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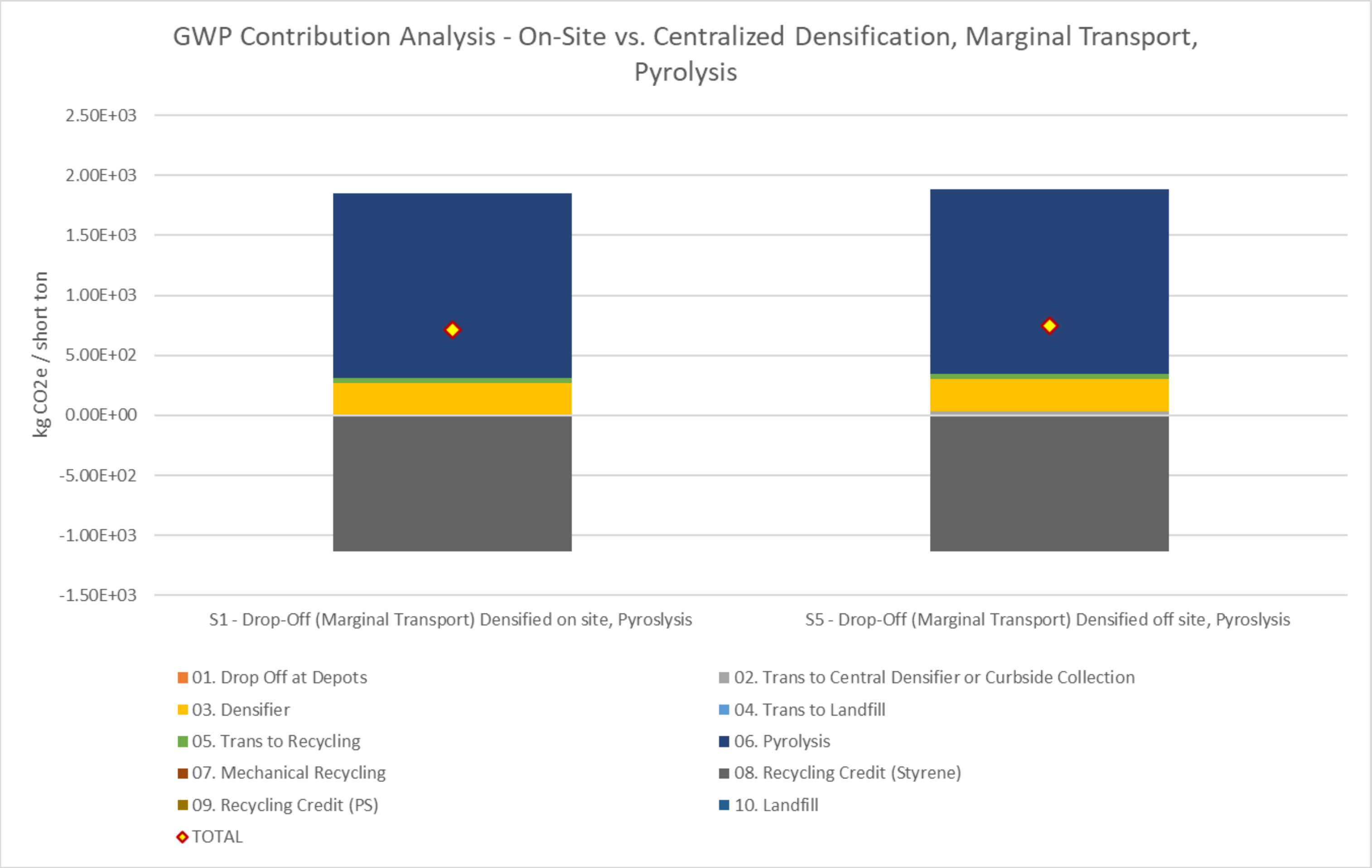

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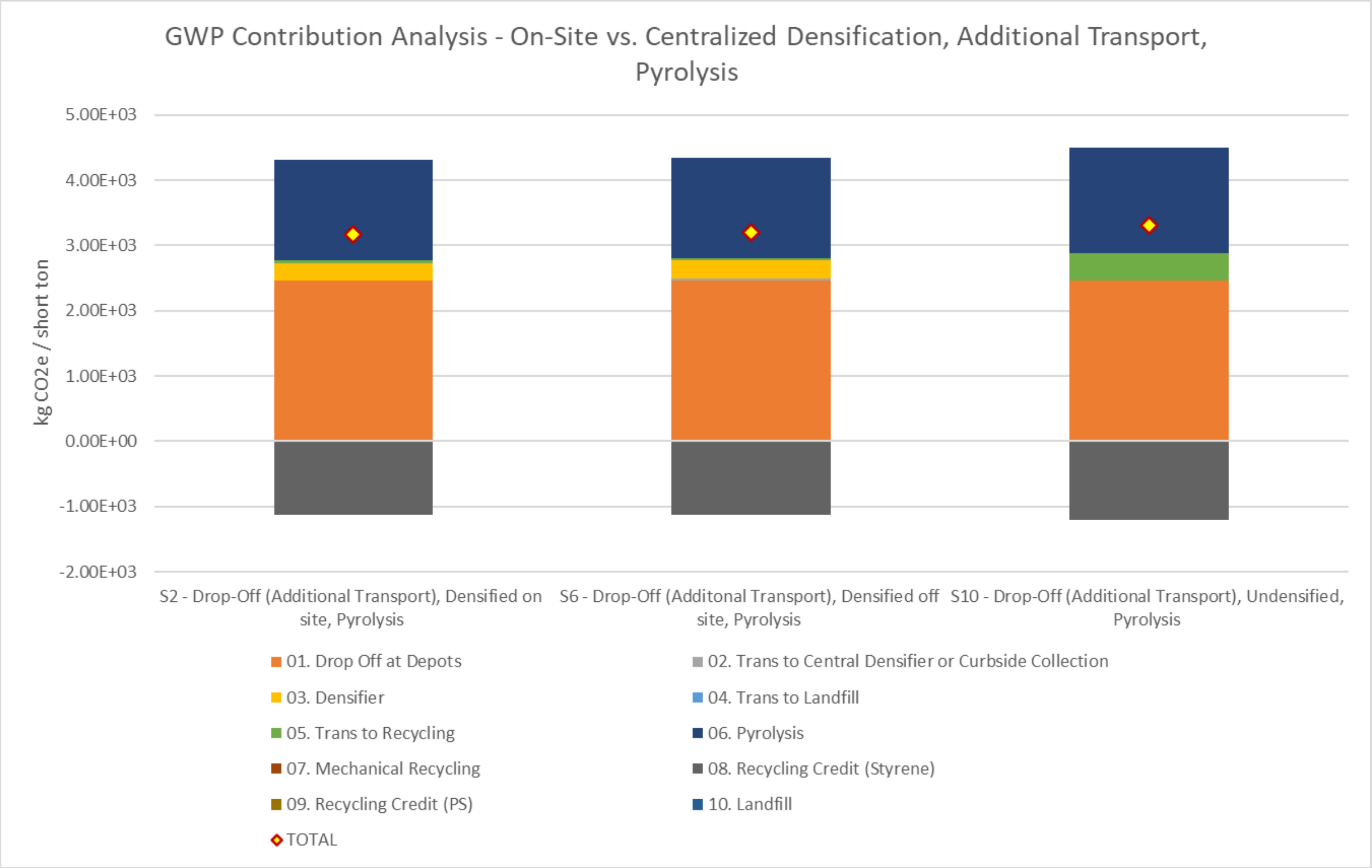

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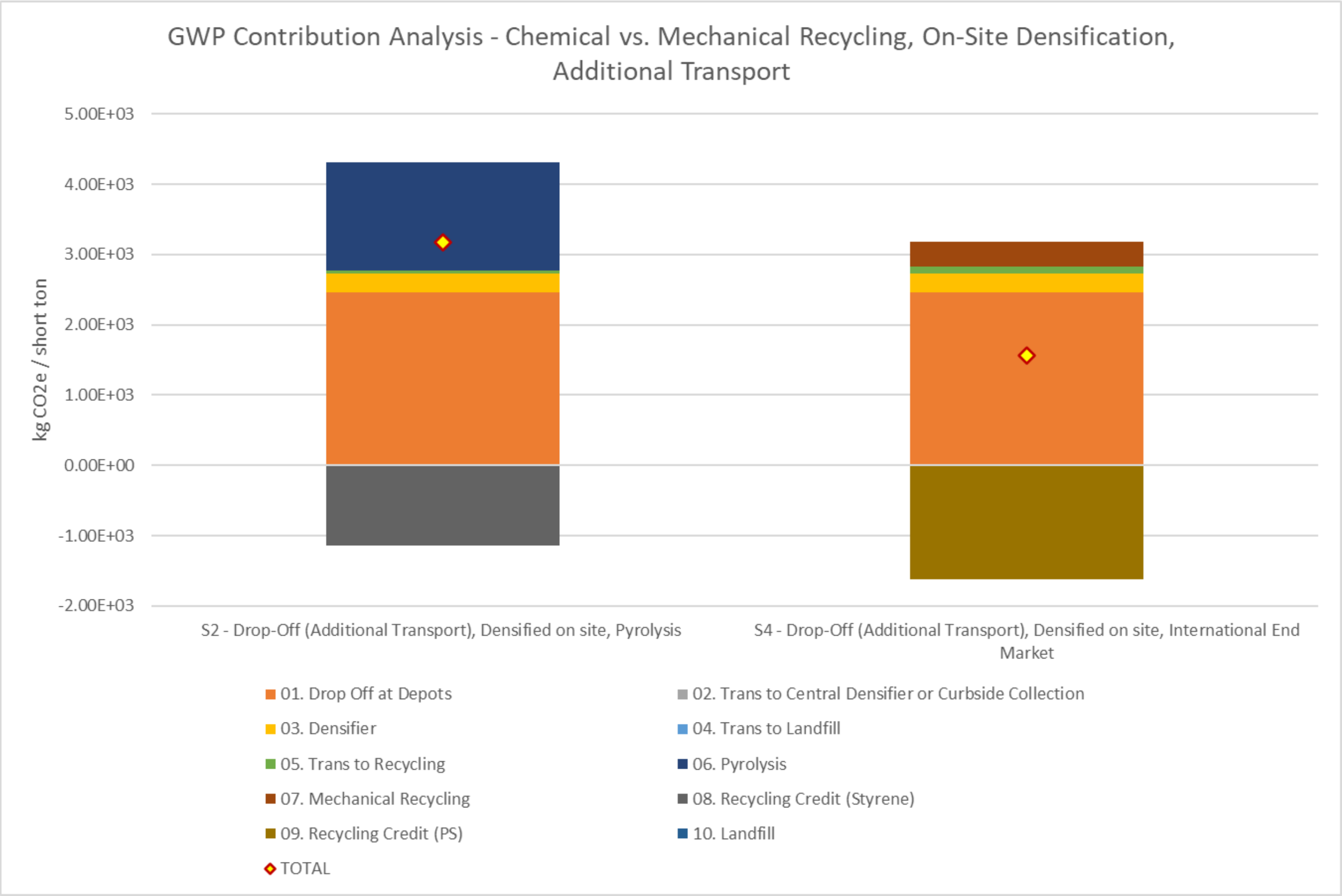

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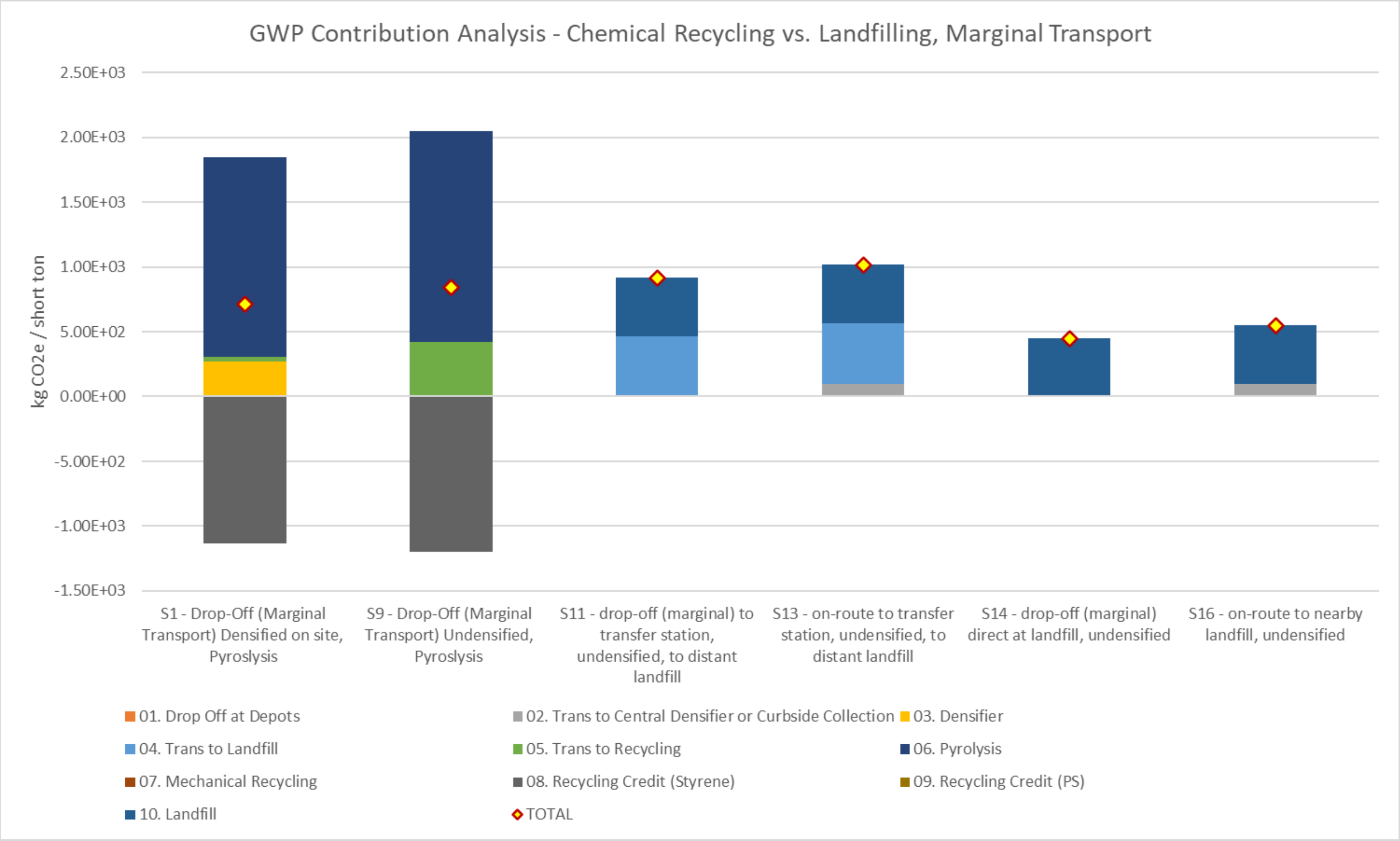

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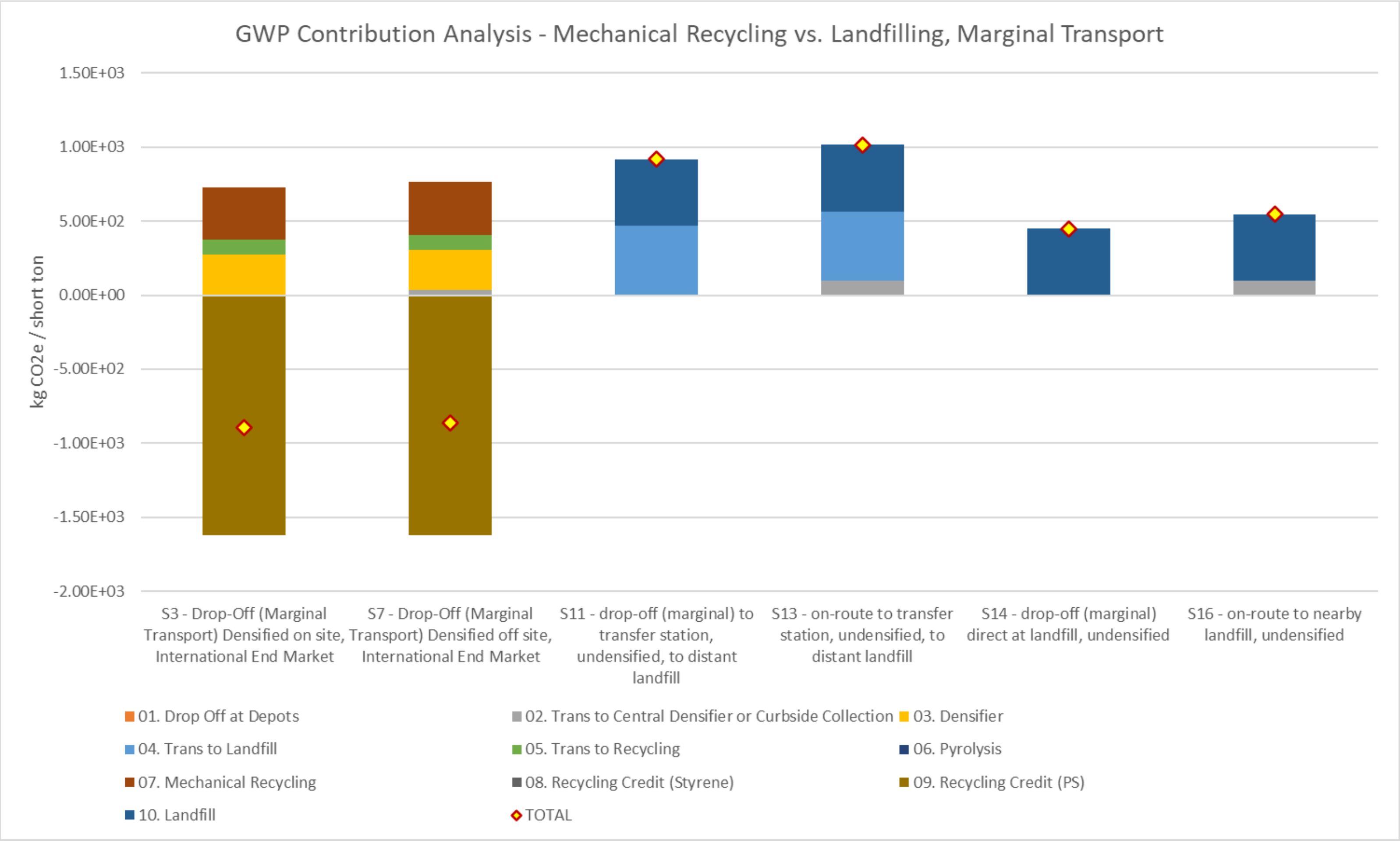

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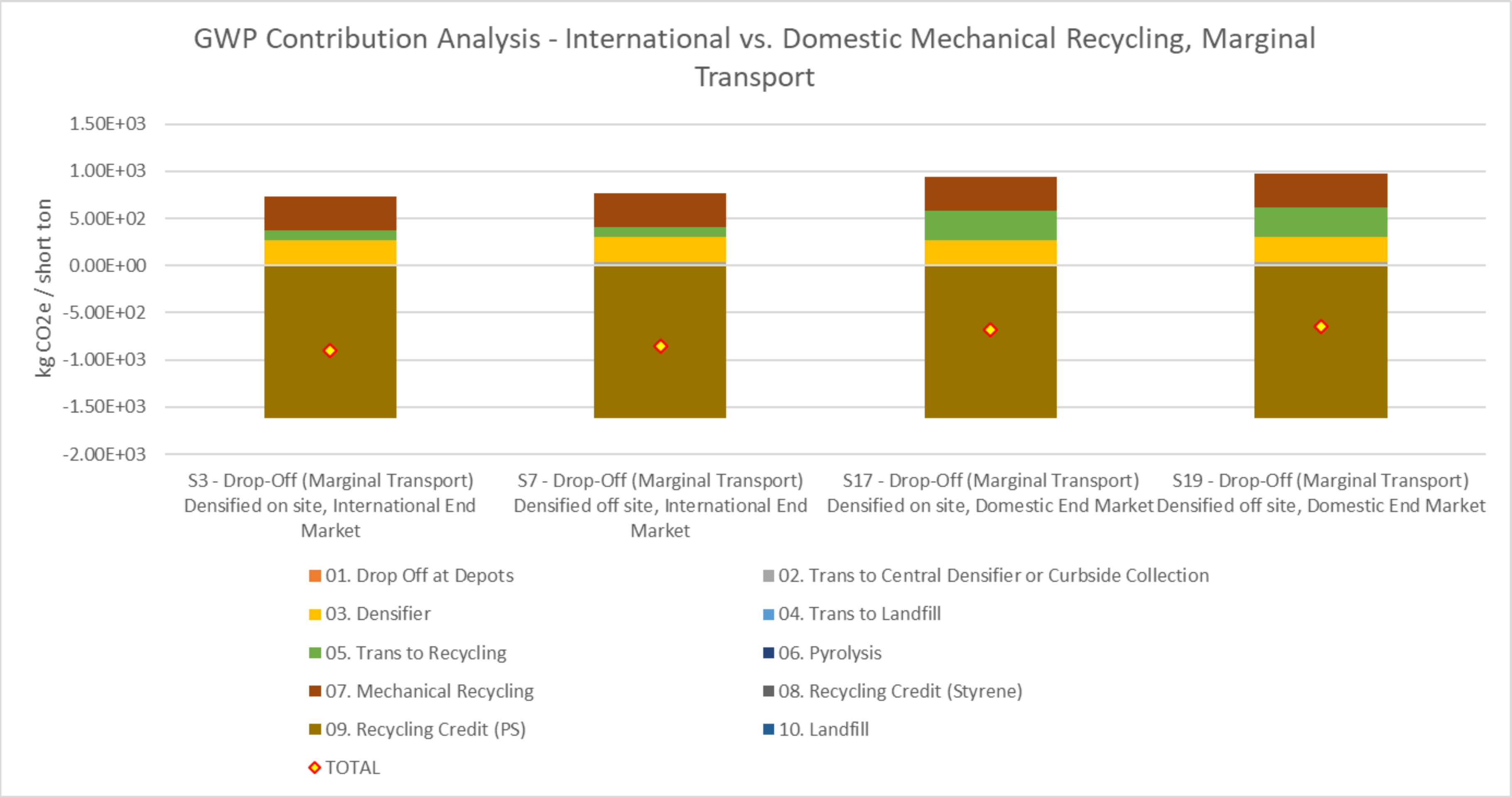

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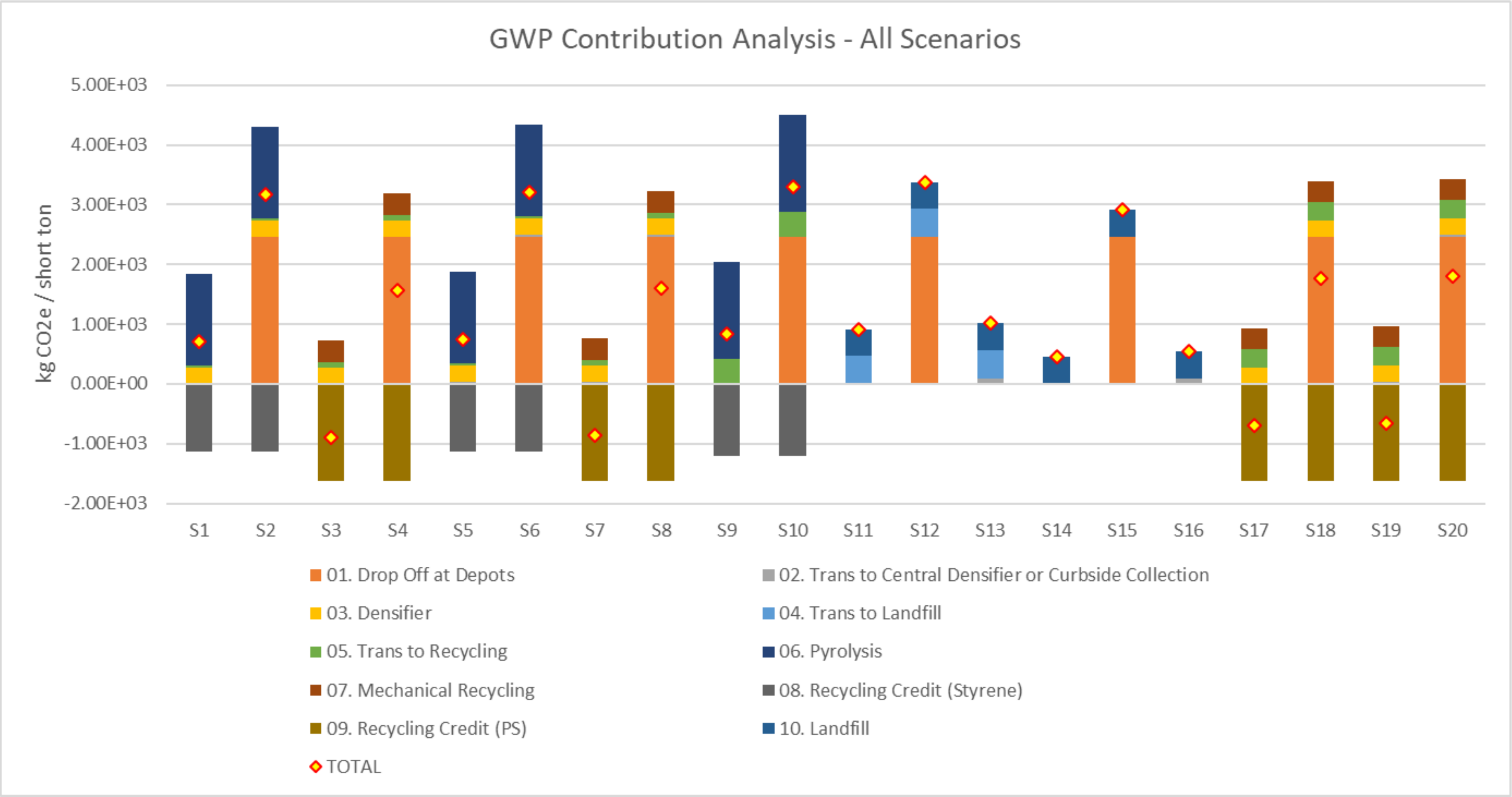
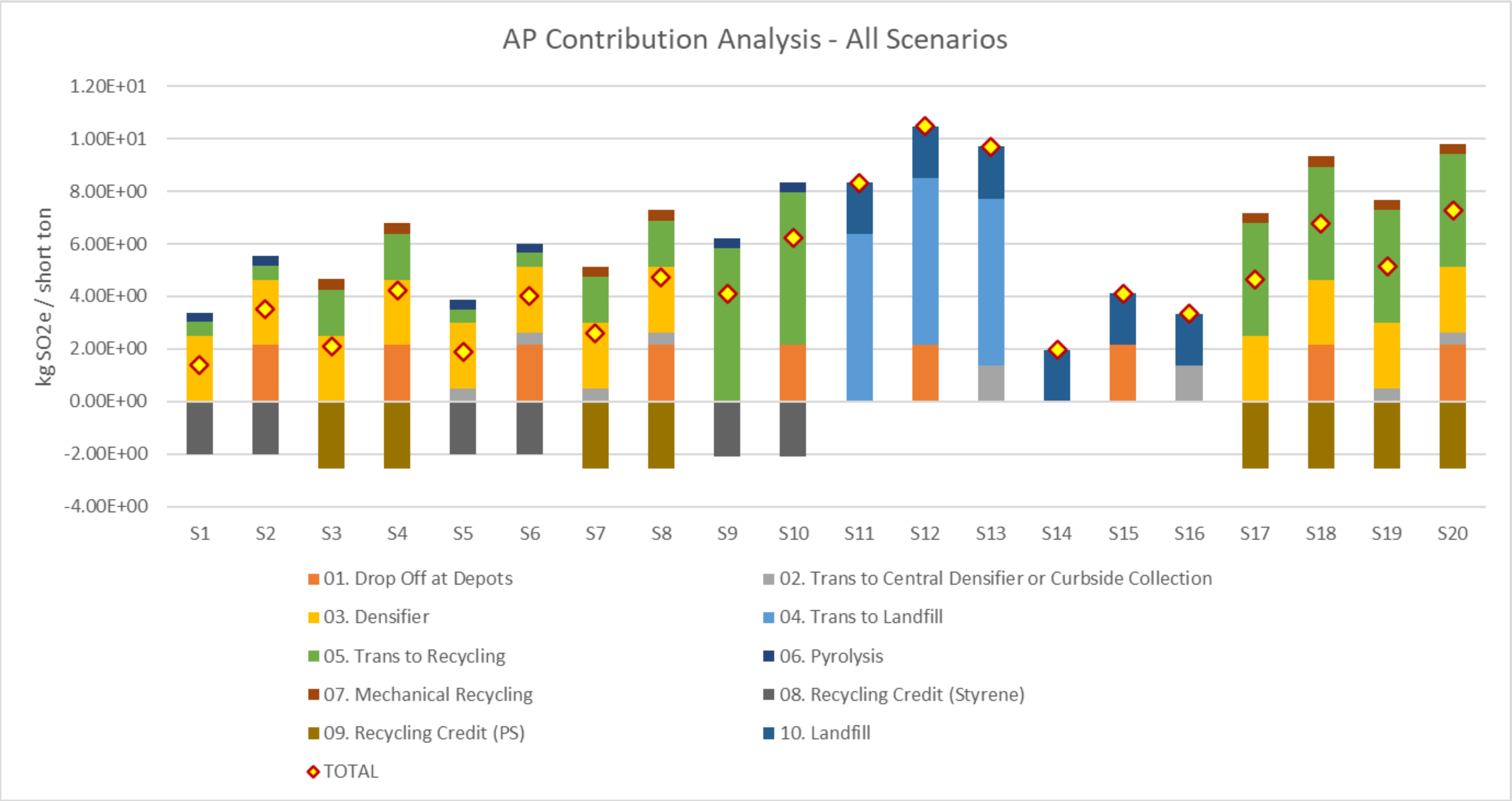
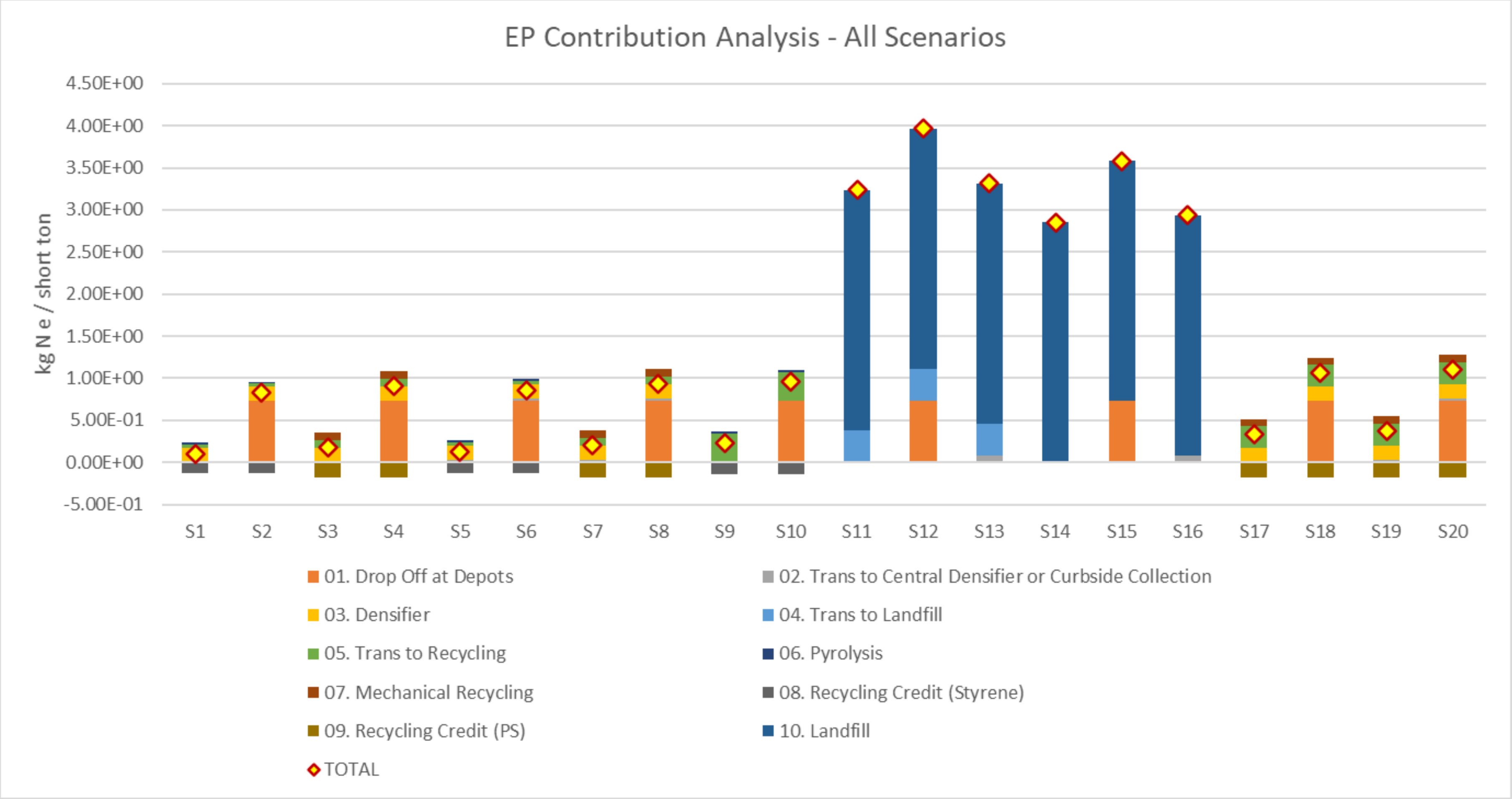


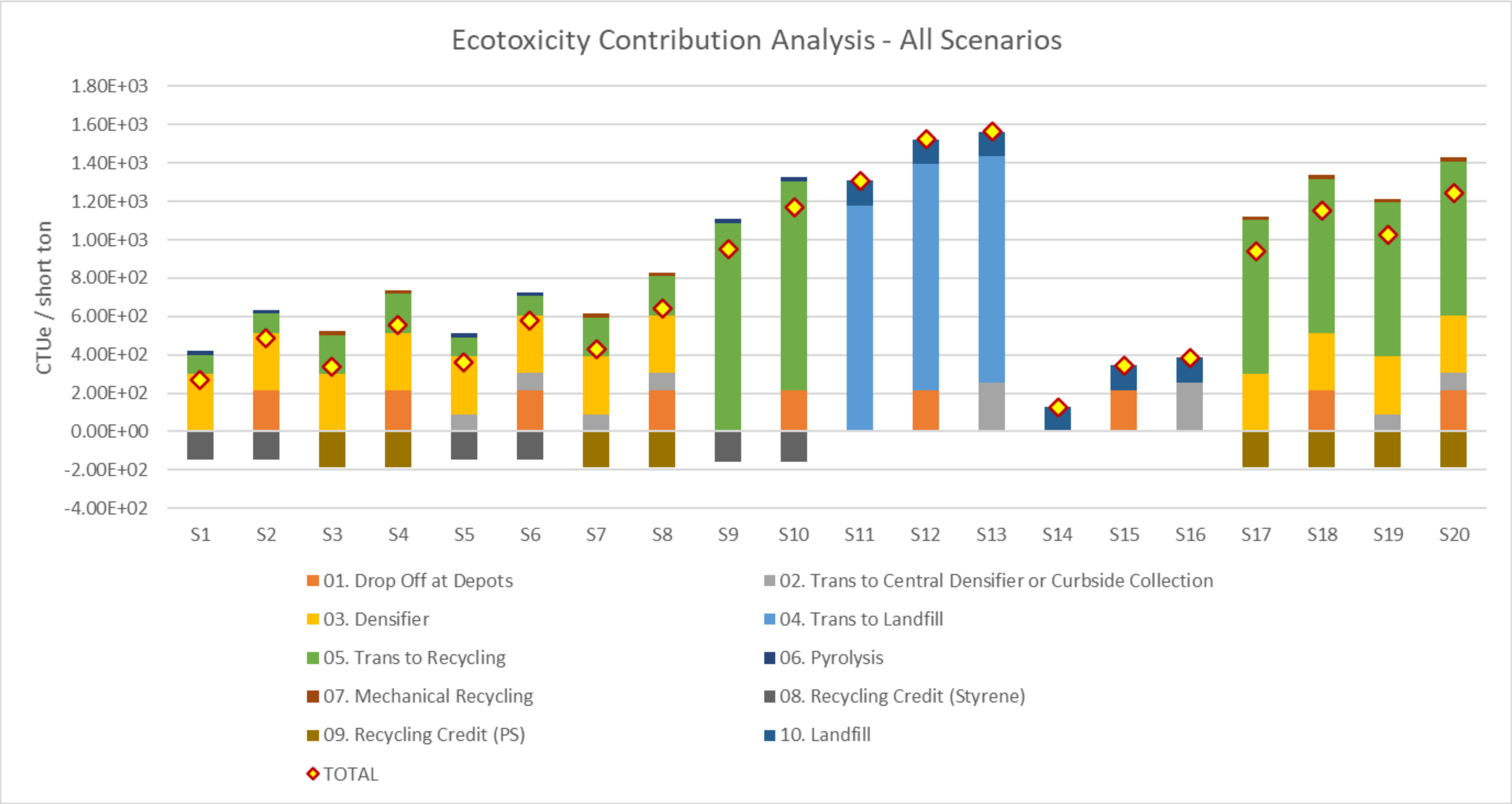
LCIA Results – Acidification Potential (AP)



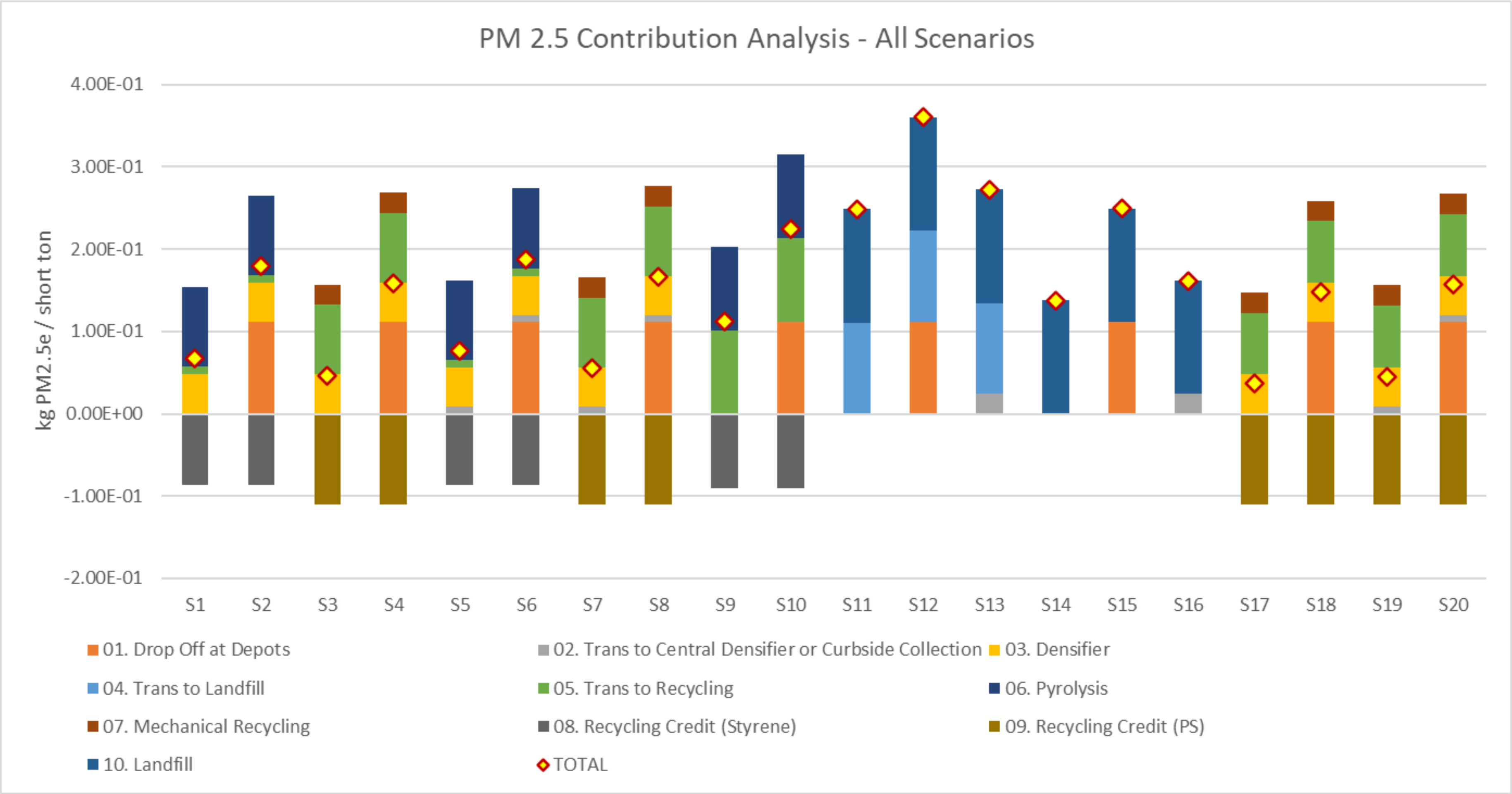
LCIA Results – Eutrophication Potential (EP)



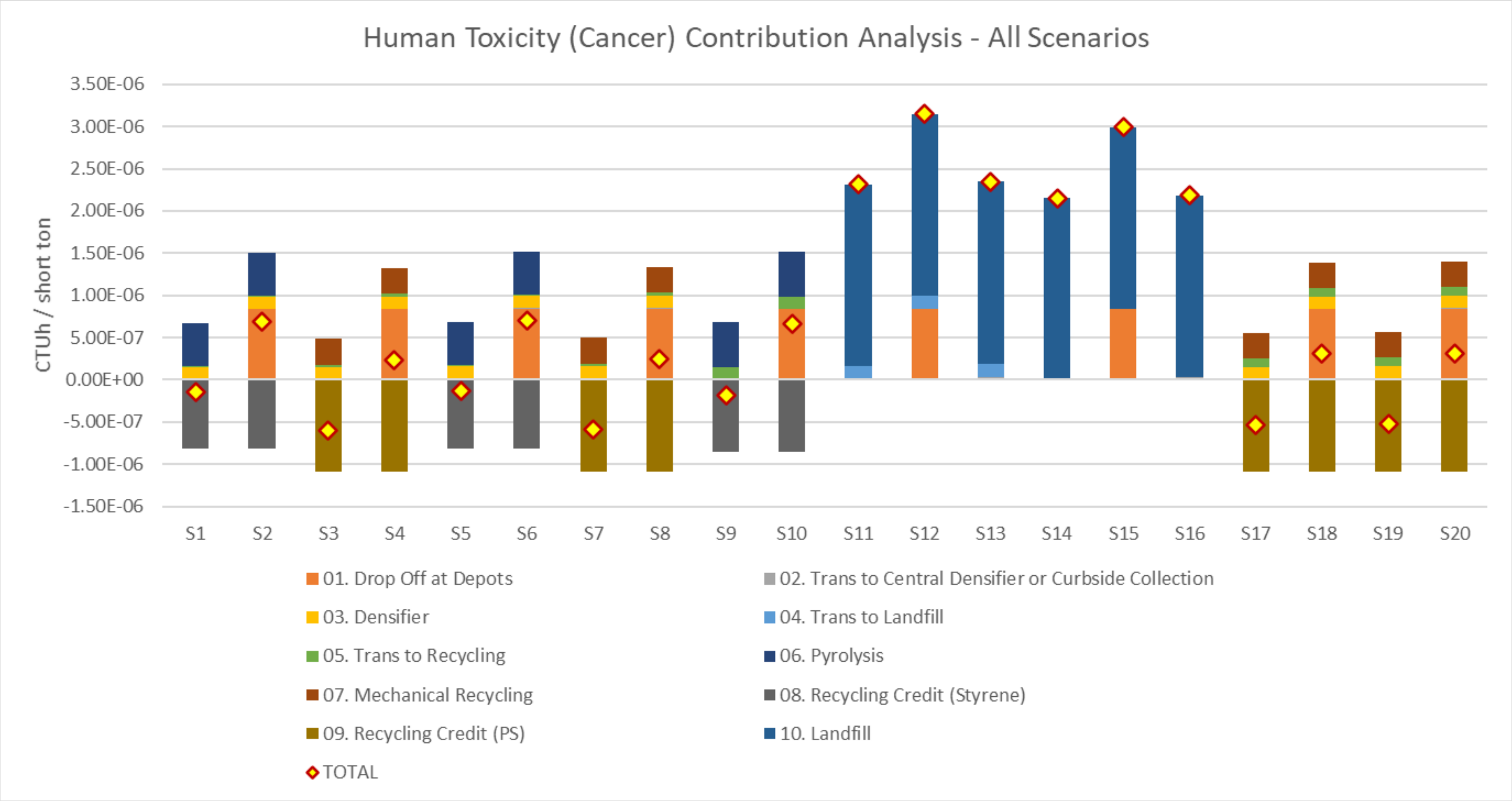
LCIA Results – Ecotoxicity Potential (ETP)



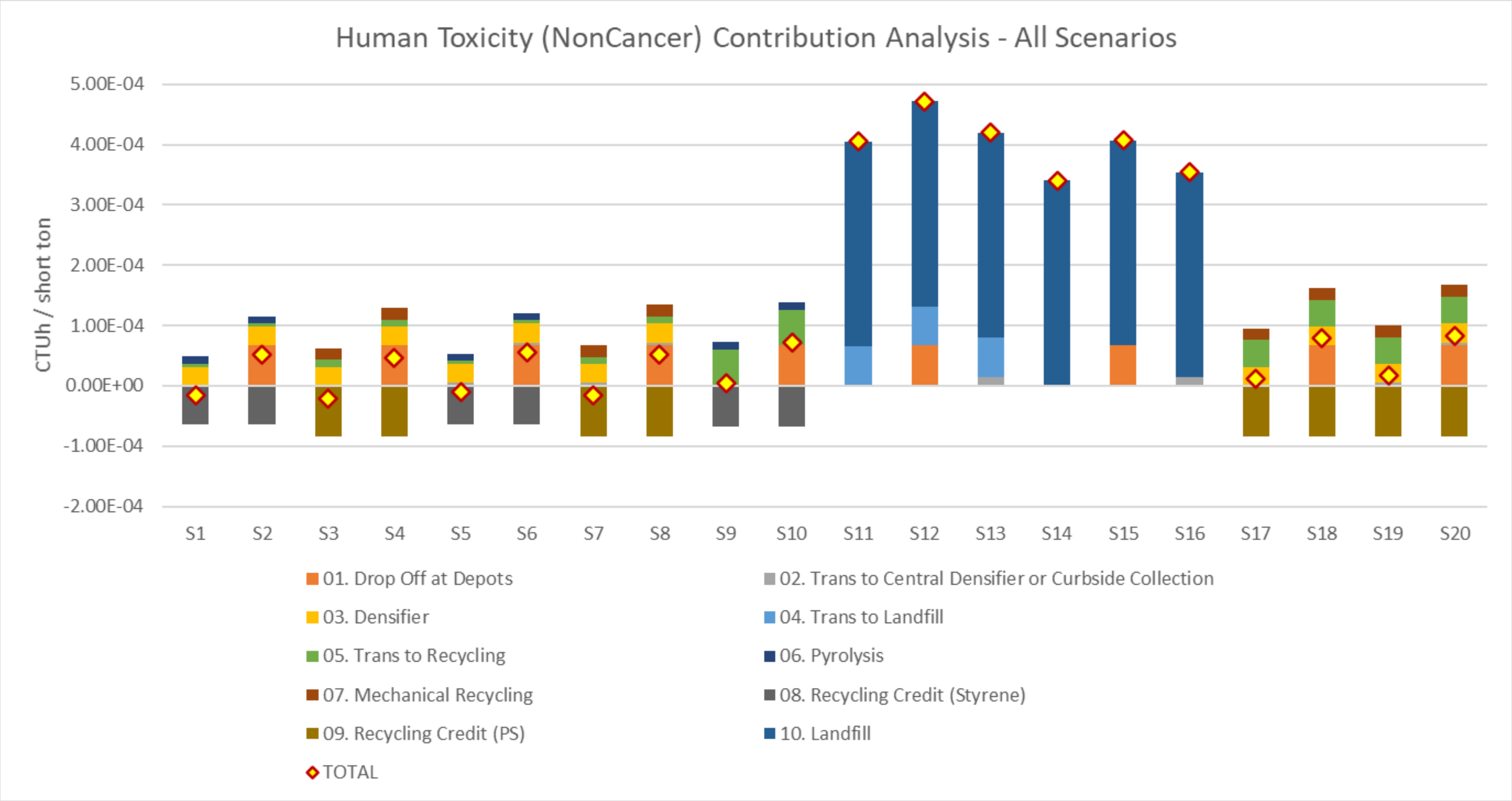
LCIA Results – Particulate Matter (PM 2.5)



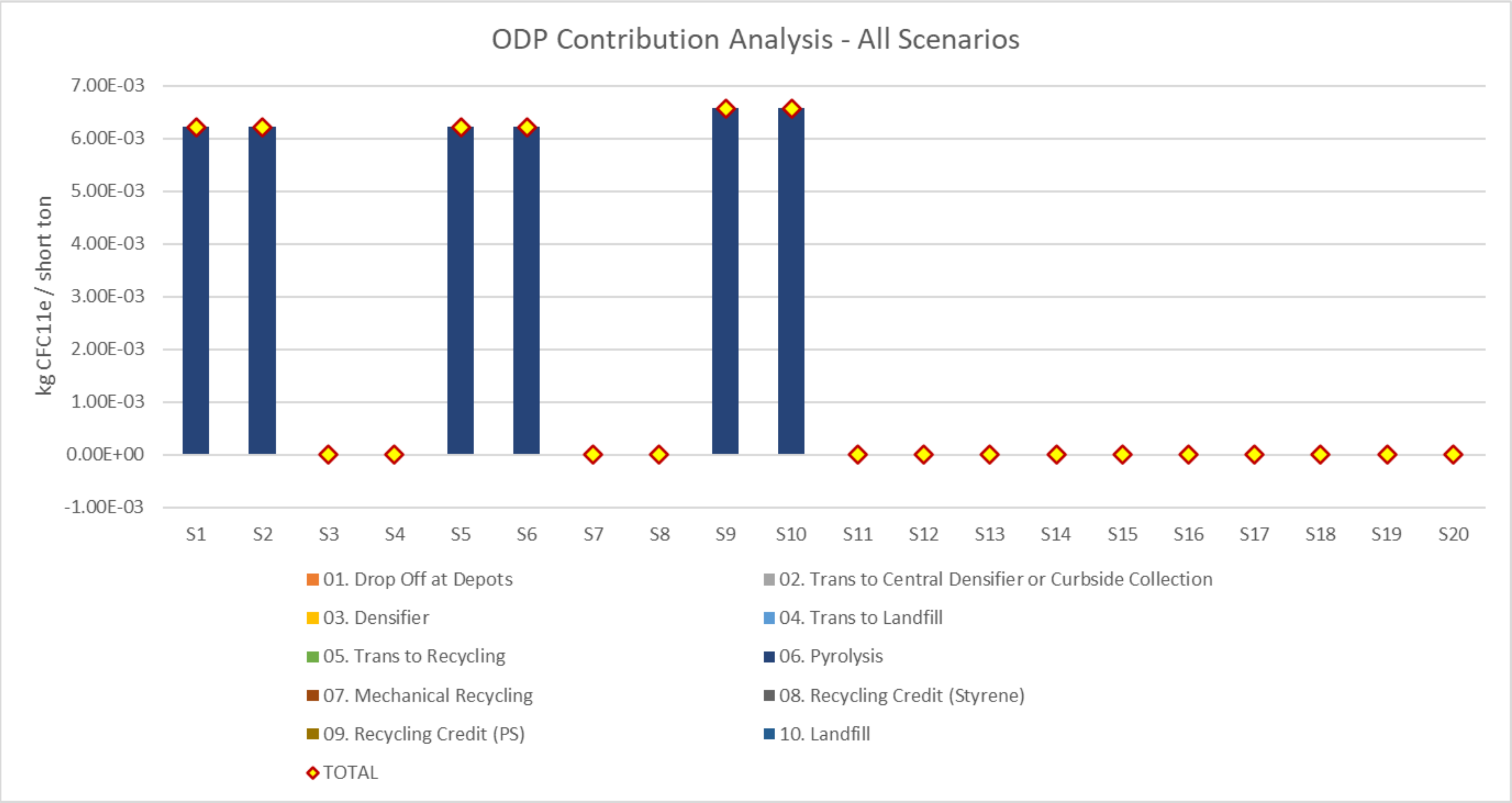
LCIA Results – Human Toxicity Potential (Cancer)



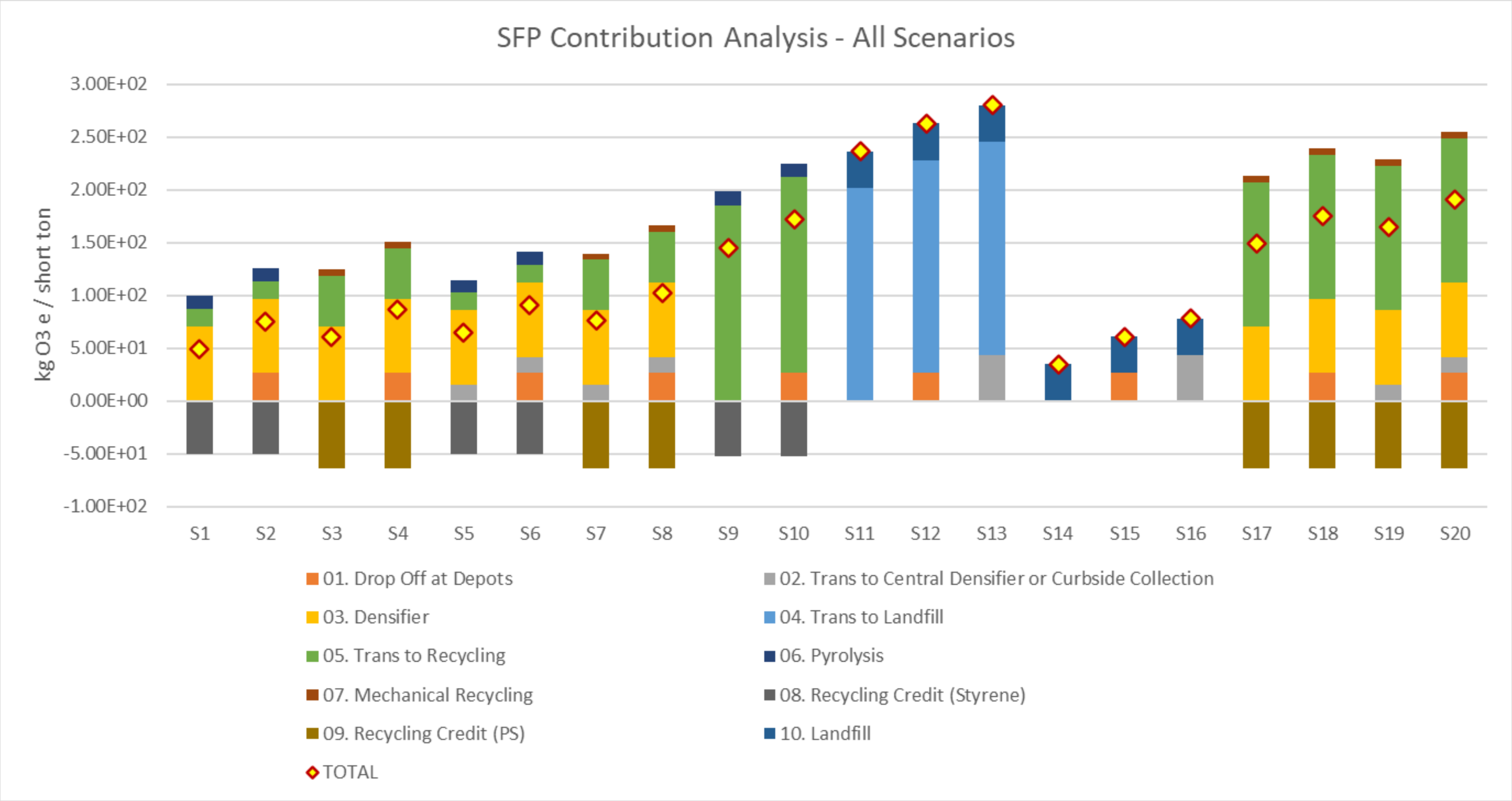
LCIA Results - Human Toxicity Potential (NonCancer)



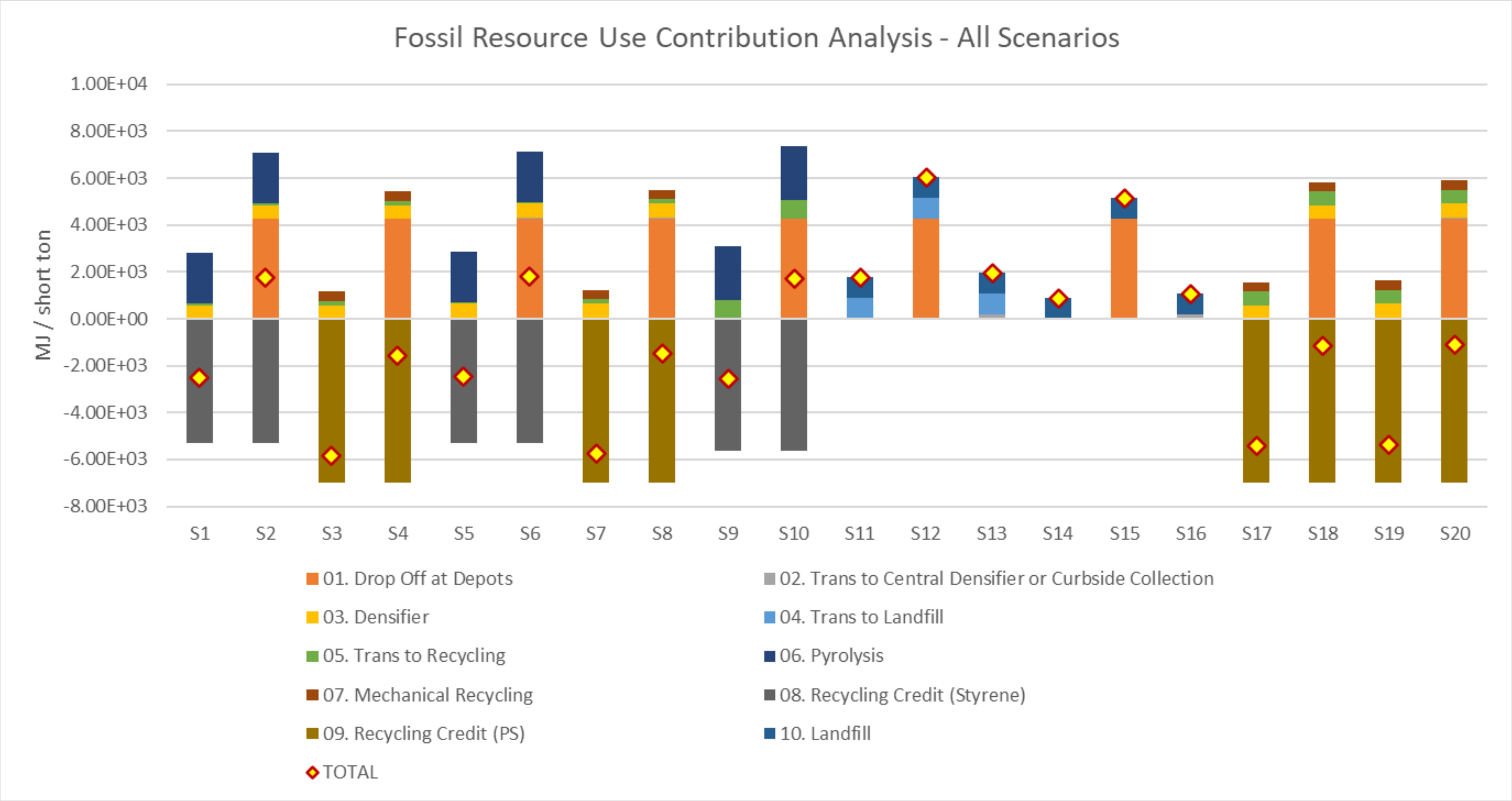
LCIA Results – Ozone Depletion Potential (ODP)



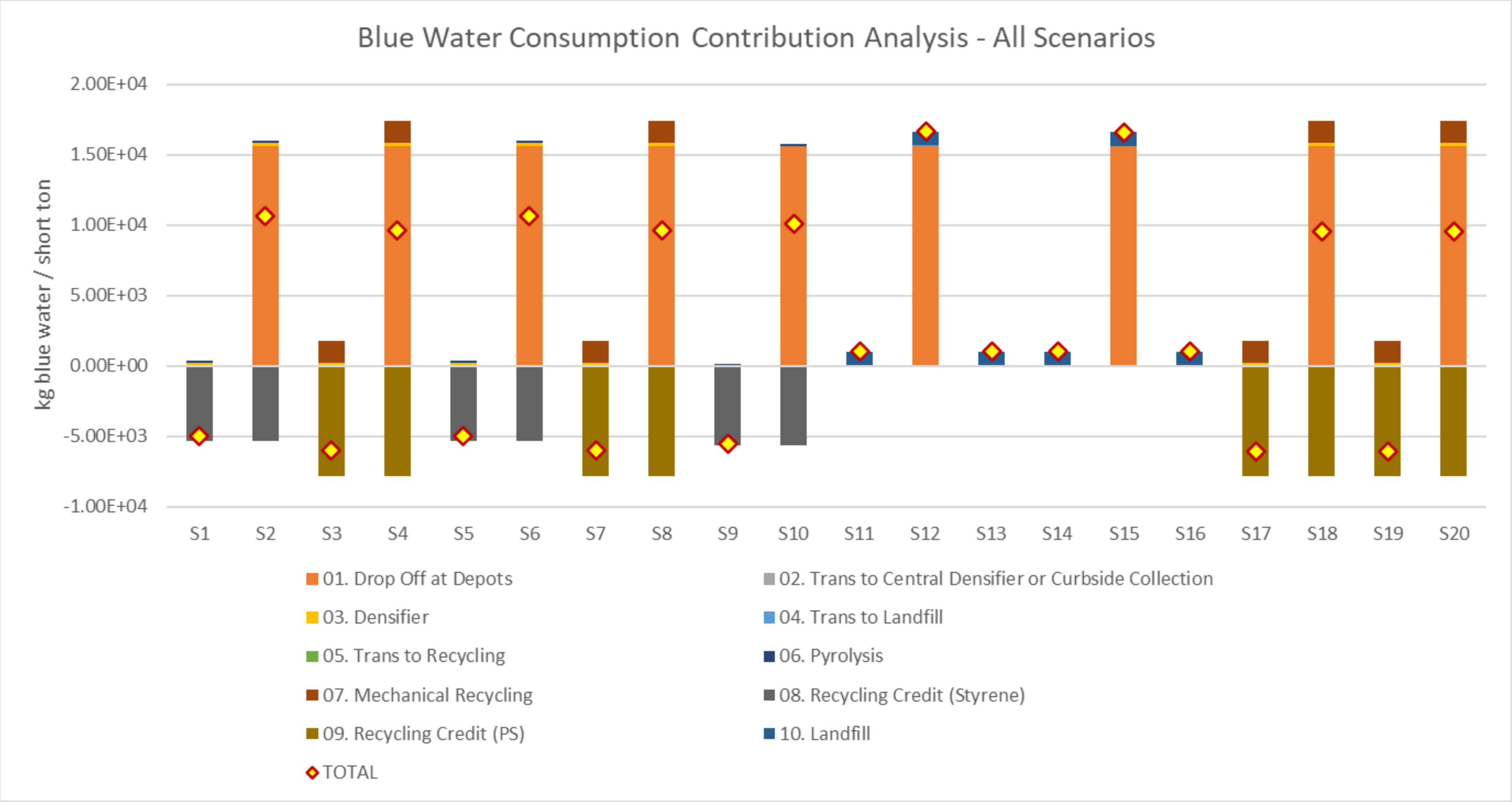
LCIA Results – Smog Formation Potential (SFP)



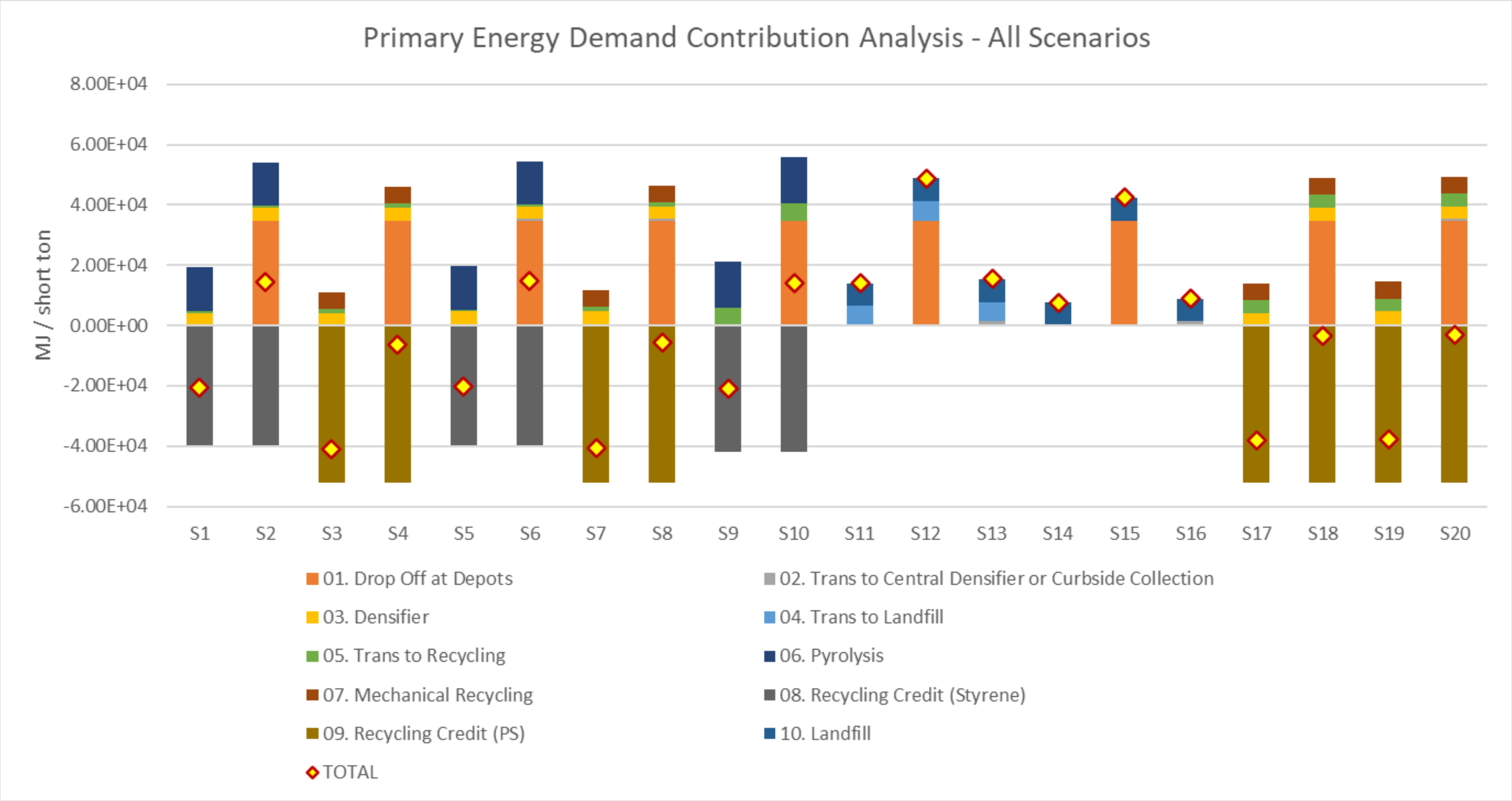
Indicator Results – Fossil Resource Use



Indicator Results – Bluewater Consumption

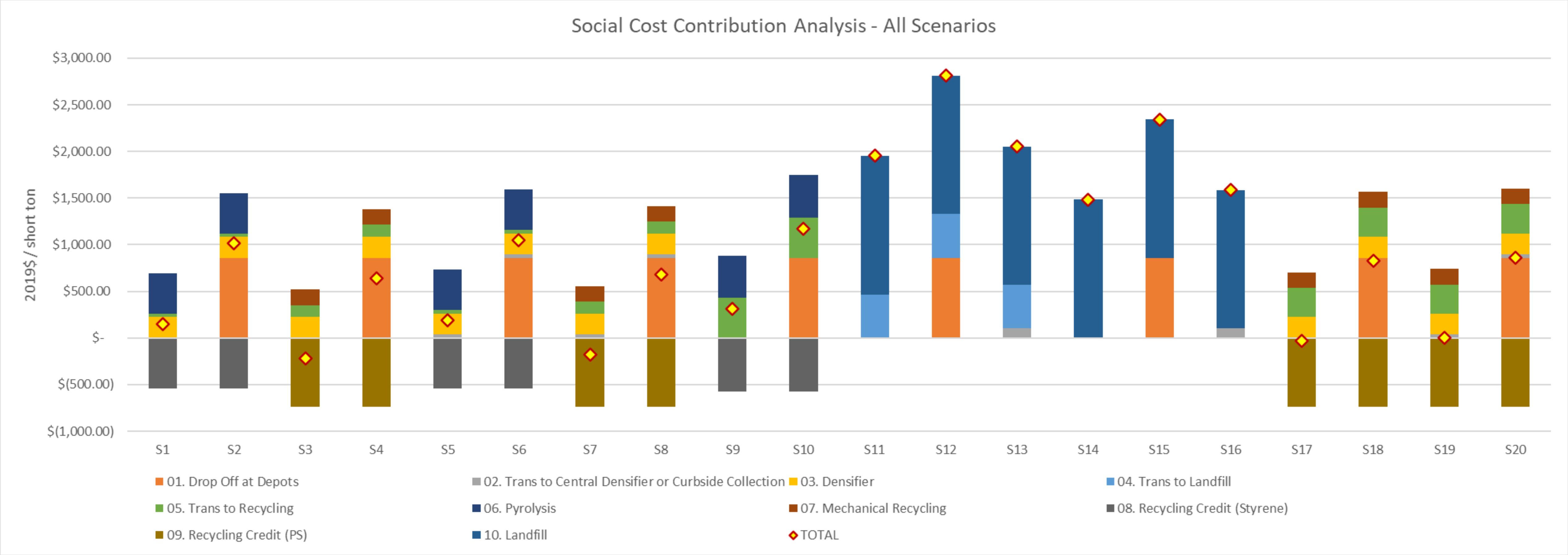


Indicator Results – Primary Energy Demand (PED)

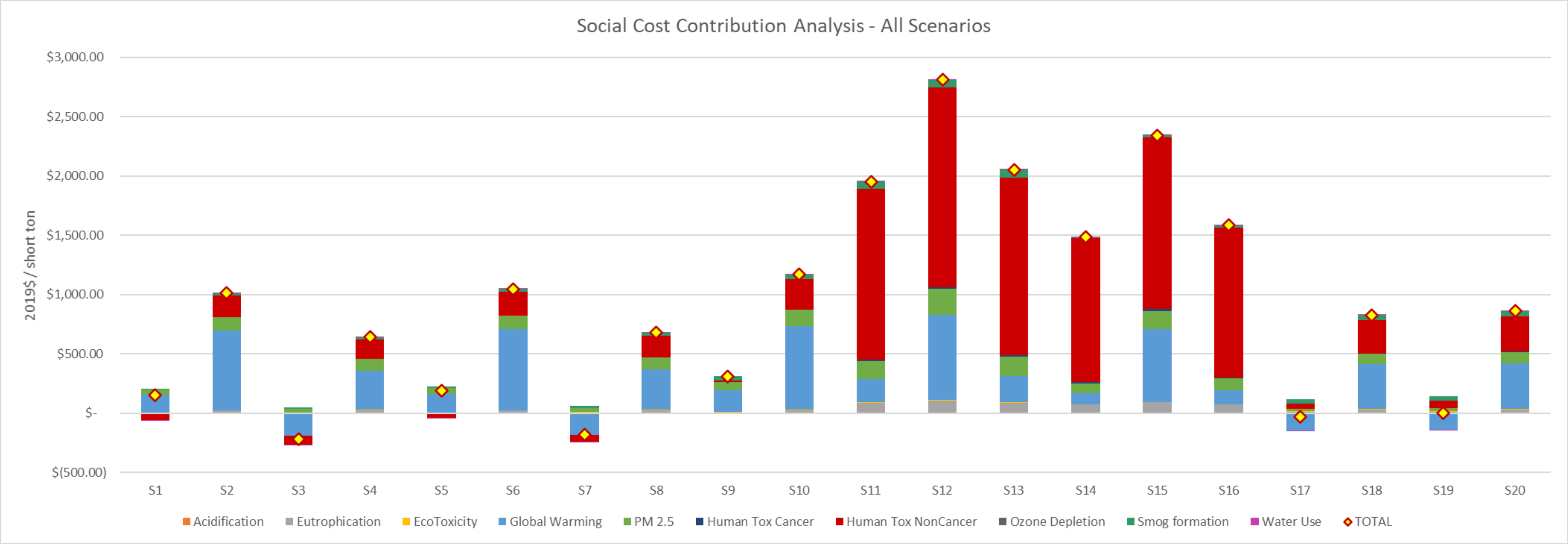


Damage Costs

Damage Costs by Life Cycle Stage



Damage Costs by Impact Category



Interpretation

Key Findings

- **Convenience of drop-off sites matters -** idea of marginal vs additional transport was the single biggest variable influencing results.
- **Densification is justified** when transport distances are large
- **Densification** can be on-site or off-site
- **Disposition results are mixed**
  - The best disposition varies by impact category
  - Also depends on whether your landfill is nearby or distant
- **Domestic end markets** do not necessarily lead to environmental outcomes.

Assumptions and Limitations

Assumptions

- Average distance traveled for drop-off (additional) is 4 miles (so 8 miles round trip) all of these emissions are allocated to EPS recovery and so do count towards the impacts of this system.
- Average distance traveled for drop-off (marginal) is 4 miles (so 8 miles round trip) however the emissions are allocated to the primary purpose for the trip (e.g. grocery store) and so do not count towards the impacts of this system.
- Densification of EPS is based on mechanical densifier technology only (however thermo-mechanical densifiers are also used in practice)
- Transport for drop-off is by passenger vehicle
- Transport to landfill is by truck
- Transport to chemical recycling is by truck
- Transport to mechanical recycling is a combination of transport by truck and ocean ship
- Have scaled-up the impacts of landfilling by a factor of approximately 5. This reflects an assumption that landfill operations for an undensified material (e.g. EPS) will increase because of the volume of this material compared to municipal solid waste generically (based on the ratio of the density of EPS compared to the average density of MSW).
- Model assumes 1:1 substitution for primary material production as a recycling credit. In other words, for each unit of EPS recovered (after losses are accounted for) an equivalent unit of primary production is avoided (e.g. Styrene or Polystyrene).

Assumptions and Limitations (cont.)

Limitations

- No information on co-products (char, syngas, wax, etc.) of pyrolysis are included, so all emissions associated with pyrolysis are allocated exclusively to styrene monomer produced. Depending on the amount and quality of co-products, when included, a reduction in the process emissions for pyrolysis is expected (though it is predicted to be small if allocation is based on the economic value of these co-products)
- No direct human health exposures are accounted for by processors of this material (e.g. those handling EPS at the recycling facility)
- The effects of mismanagement of these materials (e.g. litter) are not accounted for in the model or impact results.
- Domestic and international recycling processes are modeled using the same underlying data. As such, no regional variations in recycling technology, environmental laws, or energy systems are accounted for. It's possible that these differences, should they exist, could affect the recycling process emissions profile.

Feedback and/or Questions

Thank You!

Peter Canepa (peter.canepa@state.or.us)

Comparative Life Cycle Assessment of Glass Collection and Recycling

Materials Management

July 19, 2022

Material Lists Technical Workgroup Meeting #4

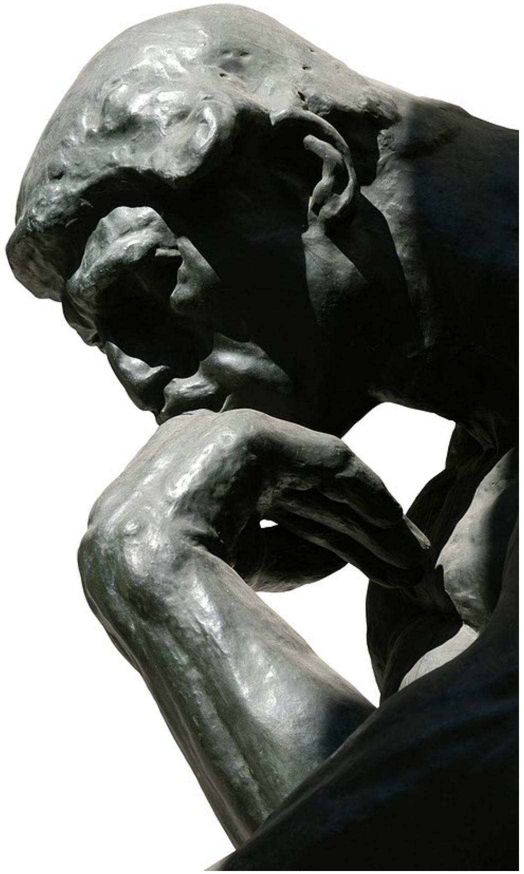
Agenda

- Goal and Scope
- Results
- Interpretation and Limitations

Goal and Scope

Project Goals/Objectives

- Using Comparative Life Cycle Assessment
  - Quantify the environmental impacts of different end of life management scenarios and end markets for container glass to identify trade-offs and key variables.



Scope – Functional (Declared) Unit

- **Function:** Disposition of container glass through different mechanical recycling pathways

- **Magnitude/unit:** 1 us ton (short ton)

Scope – Key Variables Evaluated

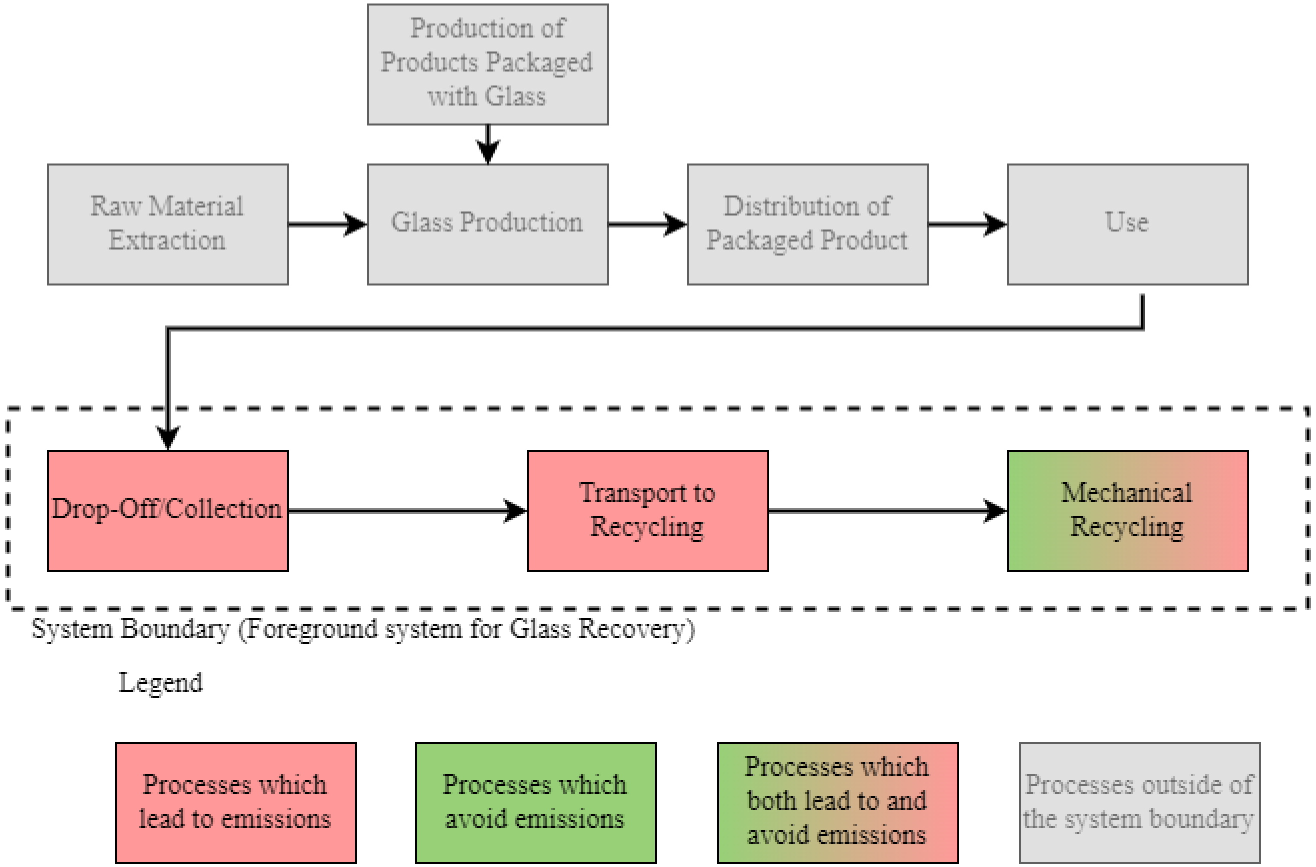
- Collection
  - Marginal vs Additional Drop-Off vs On Route Collection
  - Distinguish between Metro and Rest of State for all scenarios
  - Distinguish between lower and higher site density for drop-off scenarios
  - Distinguish between glass only and dual-compartment (glass + comingled) trucks for on-route scenarios
- End Markets for Mechanical Recycling
  - Local Bottle Plant (Owens Brockway, Longview, WA)
  - Distant Bottle Plant (Owens Brockway, Tracy, CA)
  - Fiberglass (Owens Corning, Santa Clara, CA)
  - Ground Glass Pozzolan (Hypothetical Plant in Vancouver, WA)

Glass Scenarios Evaluated

Scenario	Collection*	Drop-Off Site Density	Region	Source Type	Disposition	End Markets
S1	On Route (Combined)	n/a	Metro	Residential	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S2	On Route (Combined)	n/a	Rest of State	Residential	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S3	On Route (Dedicated)	n/a	Metro	Residential	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S4	On Route (Dedicated)	n/a	Rest of State	Residential	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S5	On Route (Dedicated)	n/a	Metro	Commercial	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S6	On Route (Dedicated)	n/a	Rest of State	Commercial	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S7	Drop-Off (Additional)	Low	Metro	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S8	Drop-Off (Marginal)	Low	Metro	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S9	Drop-Off (Additional)	Low	Rest of State	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S10	Drop-Off (Marginal)	Low	Rest of State	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S11	Drop-Off (Additional)	High	Metro	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S12	Drop-Off (Marginal)	High	Metro	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S13	Drop-Off (Additional)	High	Rest of State	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
S14	Drop-Off (Marginal)	High	Rest of State	Unspecified	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan

*On-route (combined) = a single truck with two compartments, that picks-up both comingled recyclables and glass at the same time. On-Route (dedicated) = a glass only truck, no comingled recyclables. Drop-Off (Additional) = user behavior where an additional, dedicated trip, is taken to drop-off recyclables. Drop-Off (Marginal) = user behavior where recyclables are dropped-off as part of another trip (e.g. on the way to the grocery store).

Scope – System Boundary



Scope – System Boundary

- **Temporal Coverage** – 2016-2022
- **Geographical Coverage** – Oregon
- **Technological Coverage** – This study is intended to represent materials management options for container glass, the foreground system covers technology and processes related to transportation of glass to central locations or collection depots, transport to end markets, and mechanical recycling. Credits are based on substitution for three different materials – container glass, fiberglass, or ground glass pozzolan. The background system includes electricity, thermal energy, and energy carriers (e.g. fuels).

DEQ

Scope – Data Sources

- Primary Data Sources
  - On-Route Collection – Multiple Haulers provided Transportation Distances for on-route collection
- Secondary Data Sources
  - Truck Emissions – diesel combustion from USLCI (US DOE)
  - Truck Fuel Efficiency – US EPA Smartway
  - Passenger Vehicle Emissions – GaBi Database
  - Mechanical Recycling – GaBi Database
  - Fuels (Diesel or Gasoline) – GaBi Database
  - Production Emissions for Displaced Materials (Primary glass production, fiberglass, and Portland Cement) – GaBi Database

Scope – Selected Impact Categories and Indicators

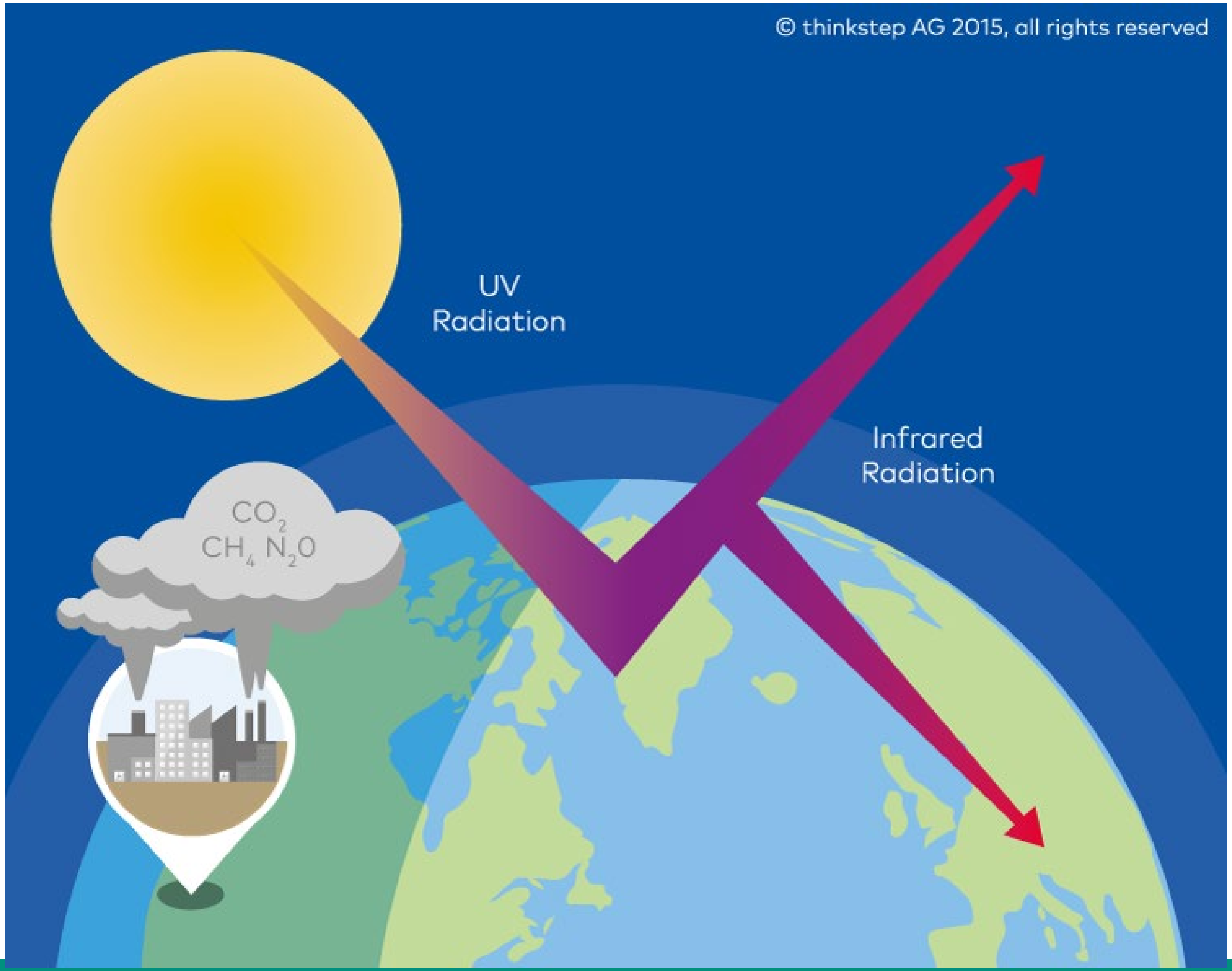
TRACI 2.1 LCIA Categories

- Acidification Potential (AP)
- Eutrophication Potential (EP)
- Ecotoxicity (ETP)
- Global Warming Potential (GWP100)
- Particulate Matter (PM2.5) Potential
- Human Toxicity Potential (HTP) – Cancer
- Human Toxicity Potential (HTP) – NonCancer
- Ozone Depletion Potential (ODP)
- Smog Formation Potential (SFP)

Environmental Indicators

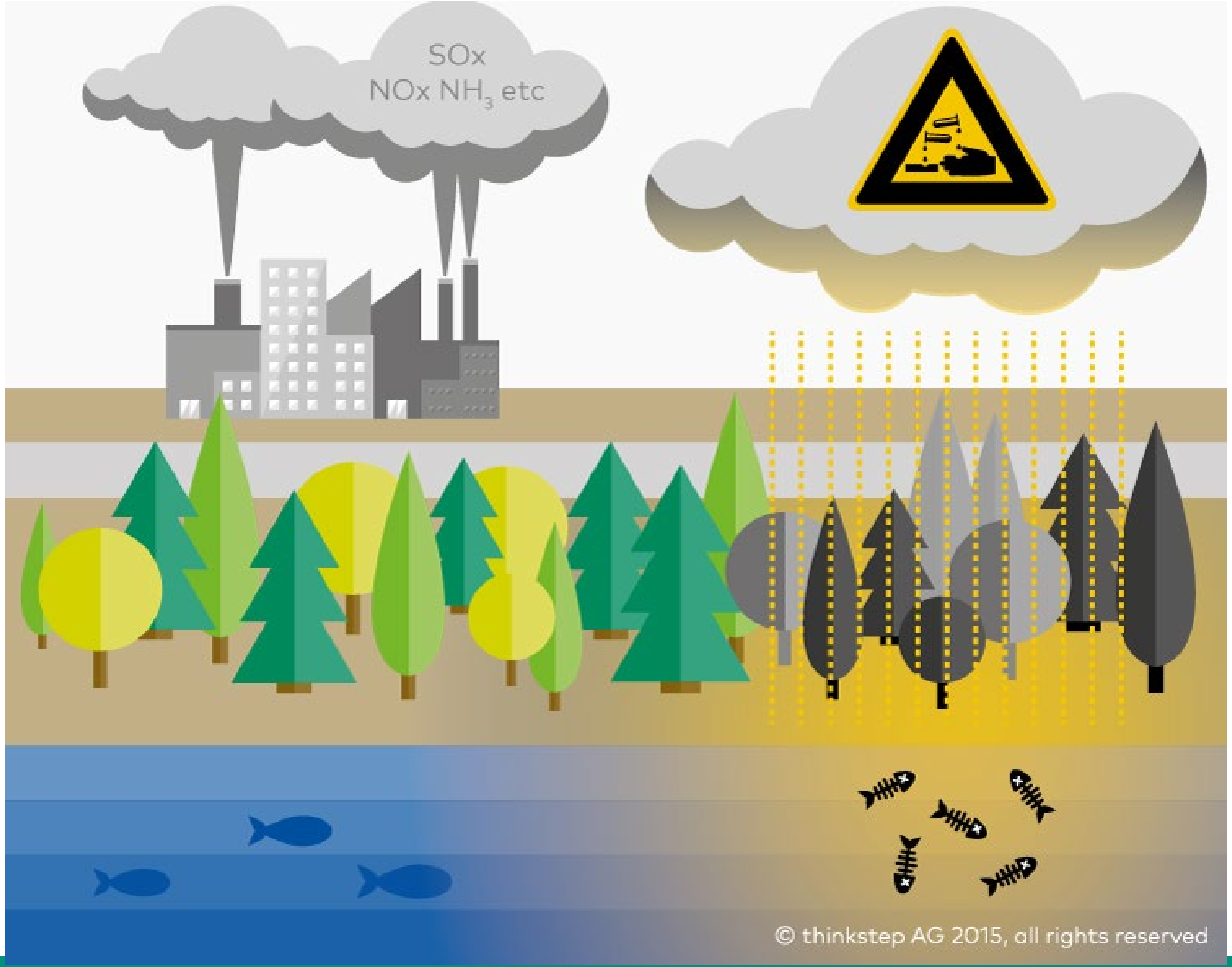
- Fossil Resource use
- Water Consumption
- Primary Energy Demand

Global Warming Potential



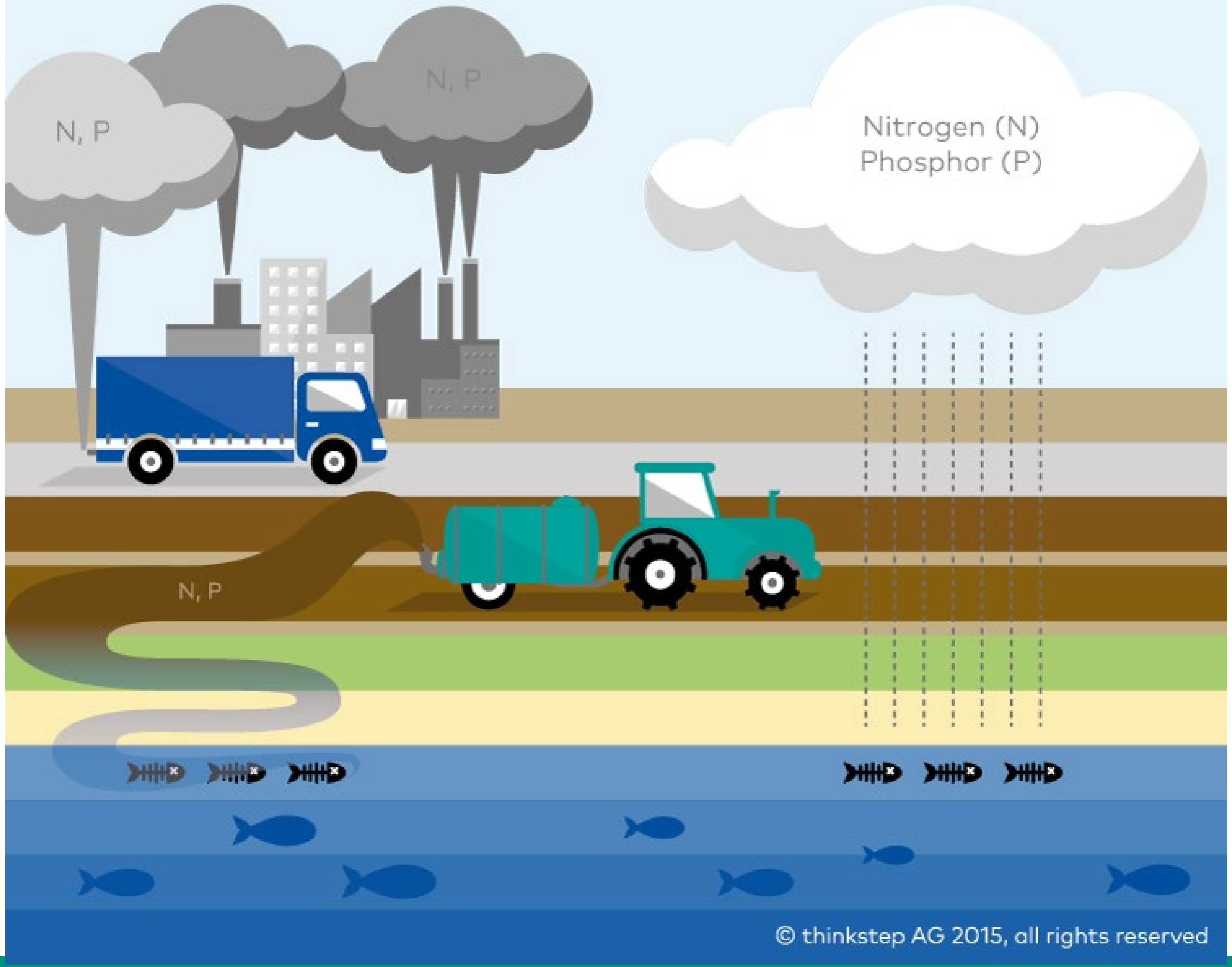
Source: thinkstep, used with permission

Acidification Potential



Source: thinkstep, used with permission

Eutrophication Potential

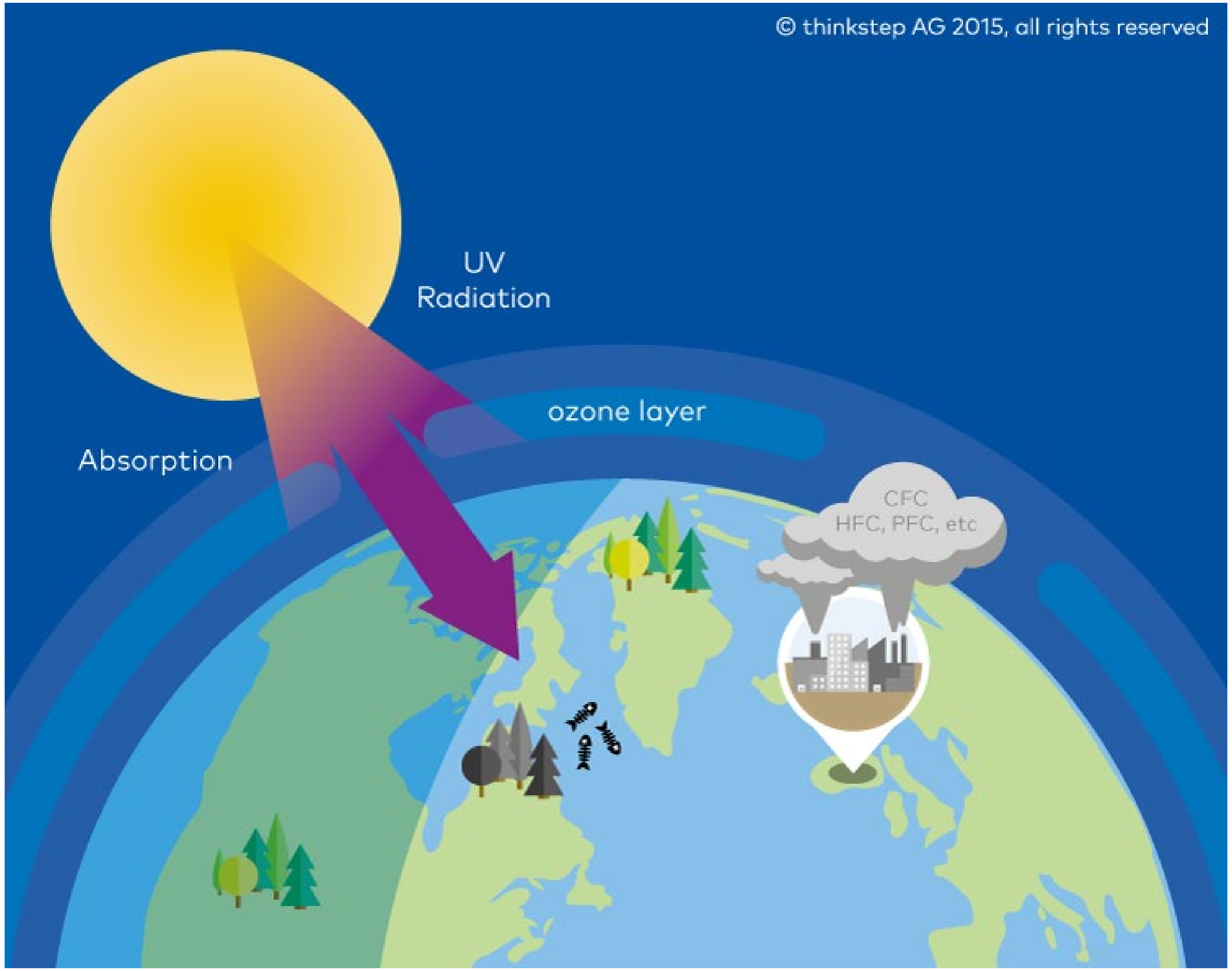


Source: thinkstep, used with permission

Smog Formation Potential

Source: thinkstep, used with permission

Ozone Depletion Potential

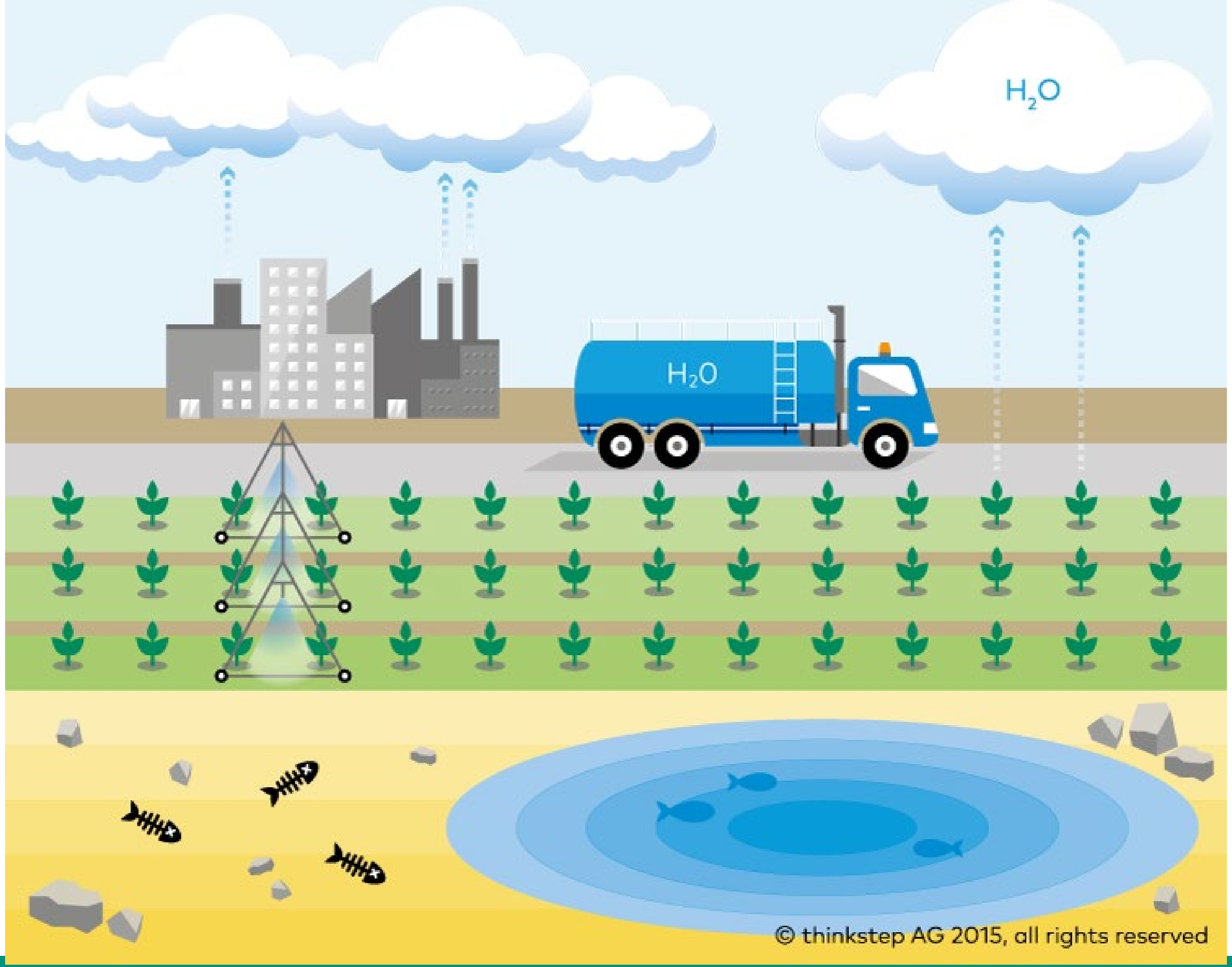


Source: thinkstep, used with permission

Primary Energy Demand

Source: thinkstep, used with permission

Freshwater Consumption



Source: thinkstep, used with permission

Preliminary Results

Life Cycle Impact Assessment (LCIA) and Indicators

Glass Scenarios Evaluated

Scenario	Collection*	Drop-Off Site Density	Region	Source Type	Disposition	End Markets
S1	On Route (Combined)	n/a	Metro	Residential	Mechanical Recycling	Glass to Glass, Glass to Fiberglass, Glass to Pozzolan
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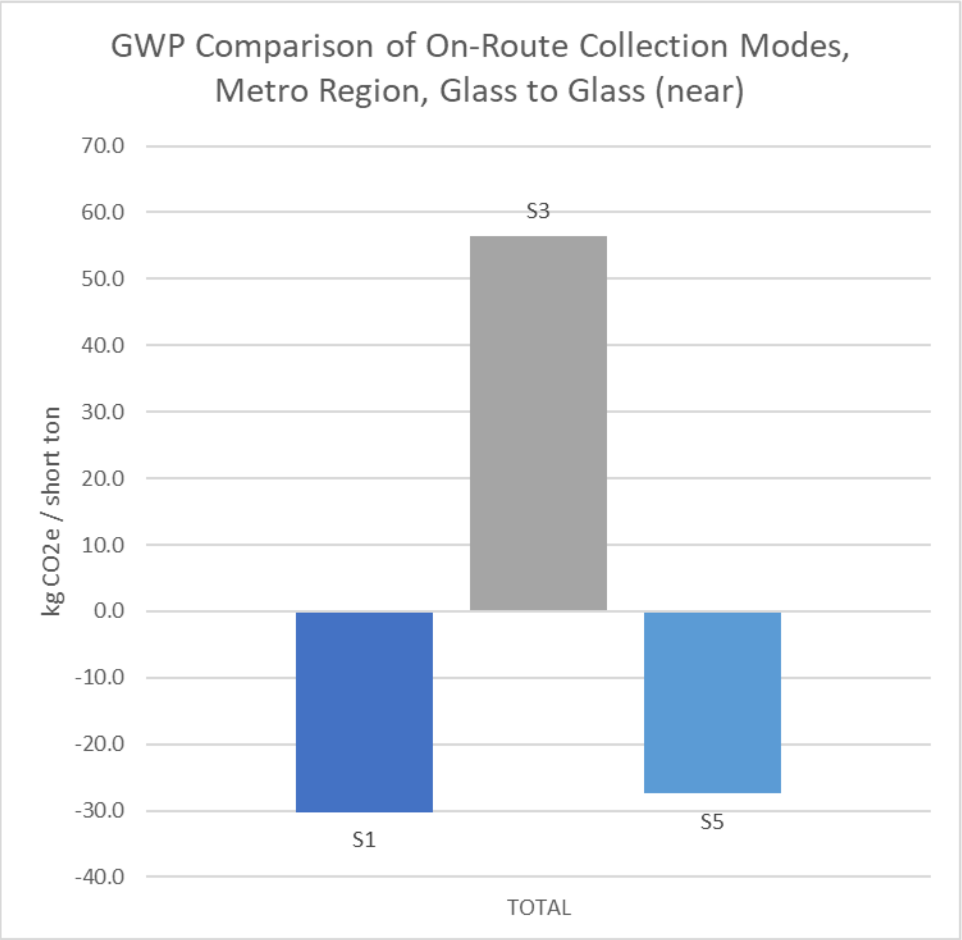
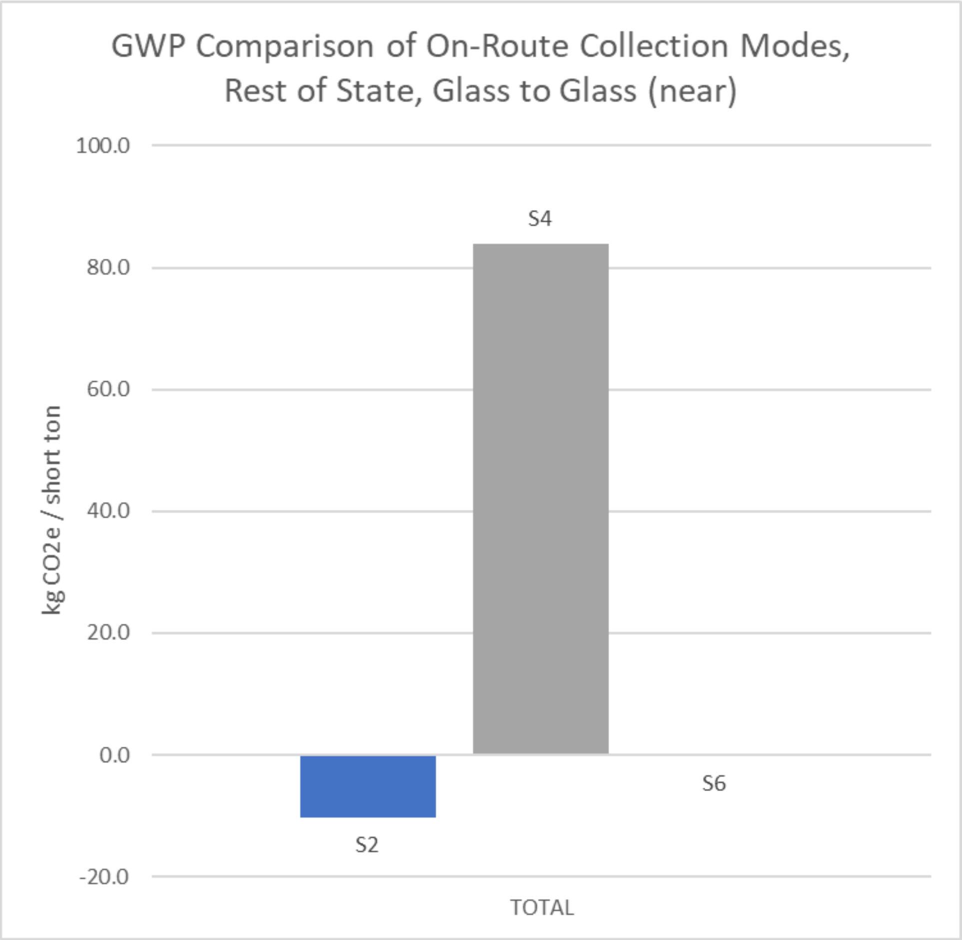
“Glass to Glass (Near)” Results

Owens Brockway

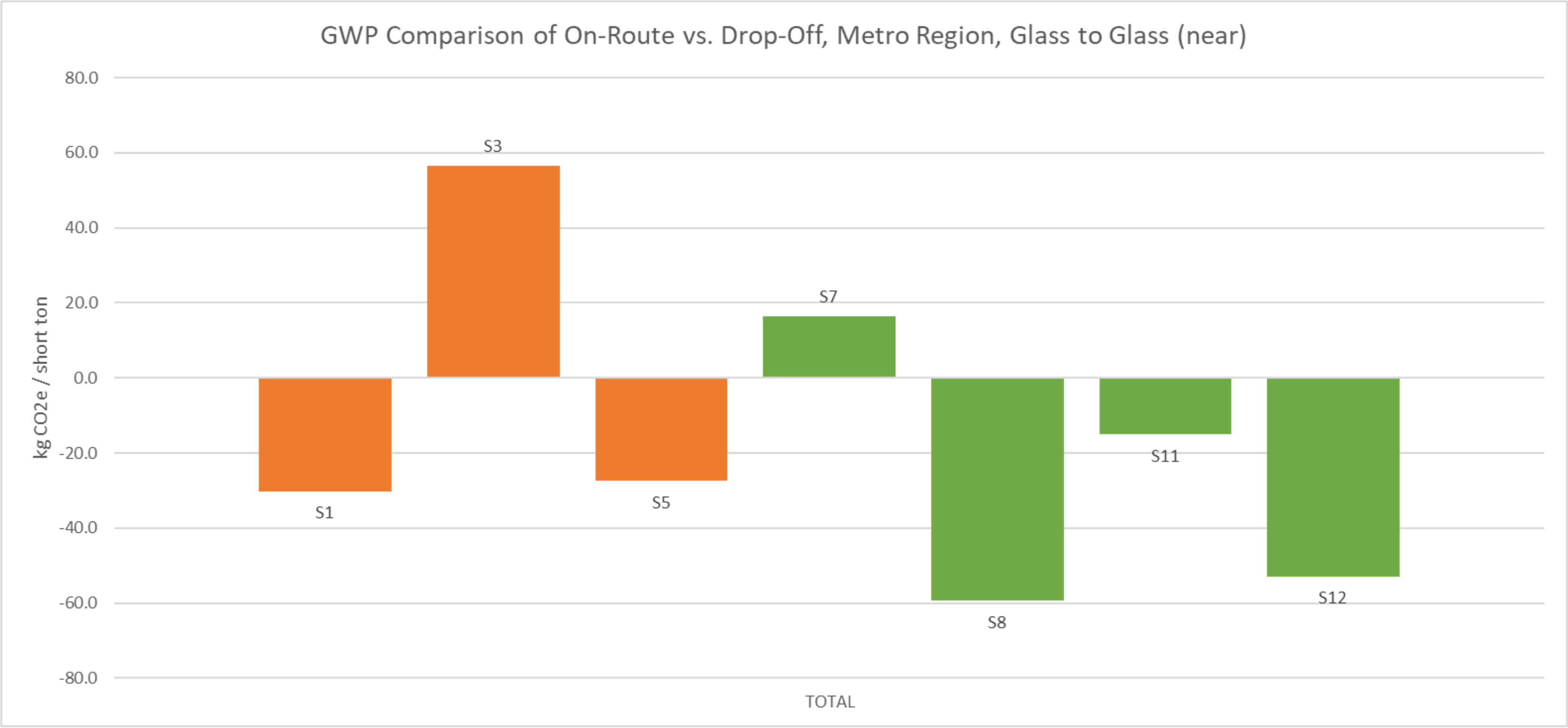
Longview, WA

LCIA Results – Global Warming Potential (GWP)

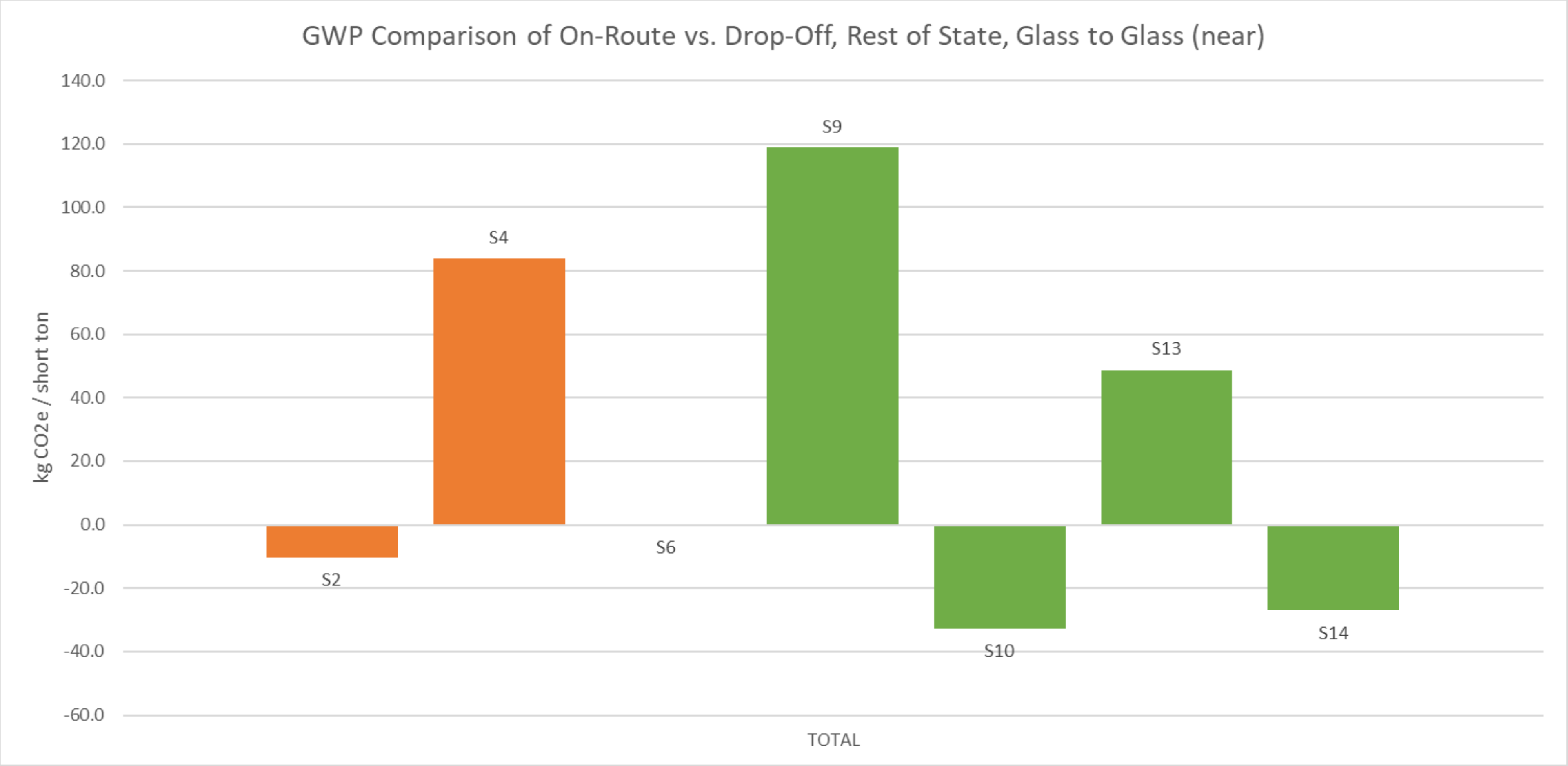




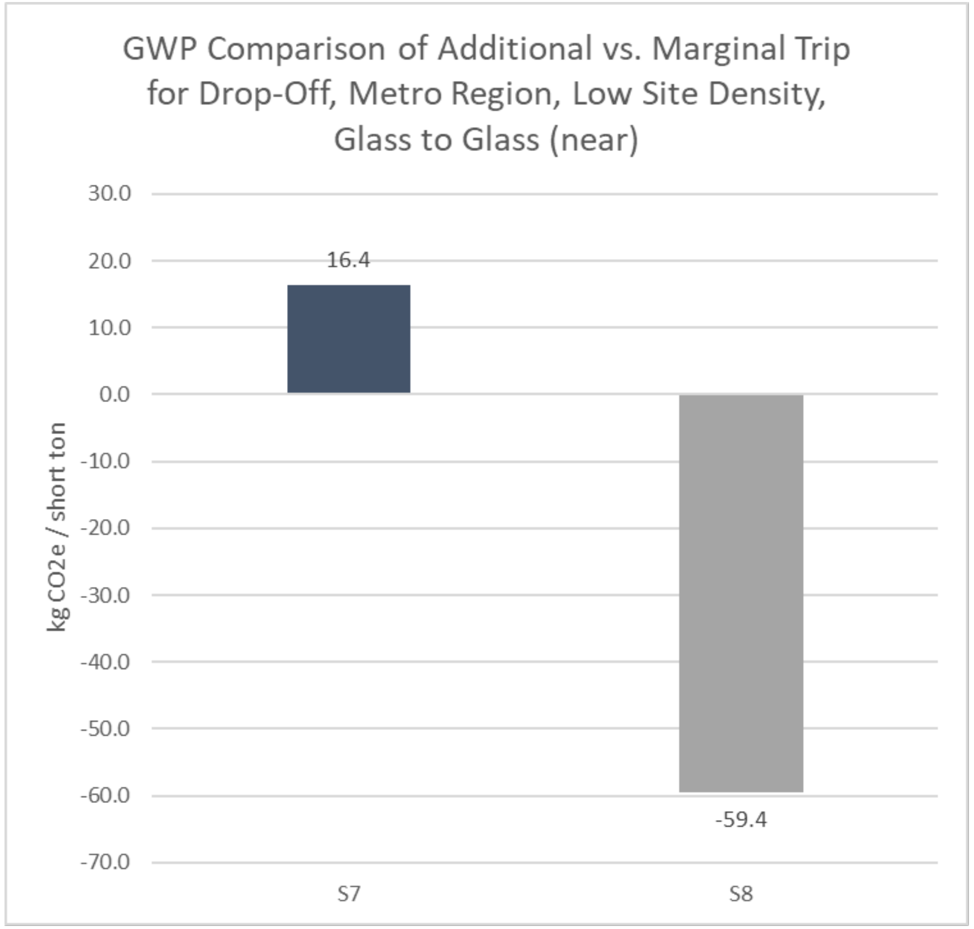
LCIA Results – Global Warming Potential (GWP)

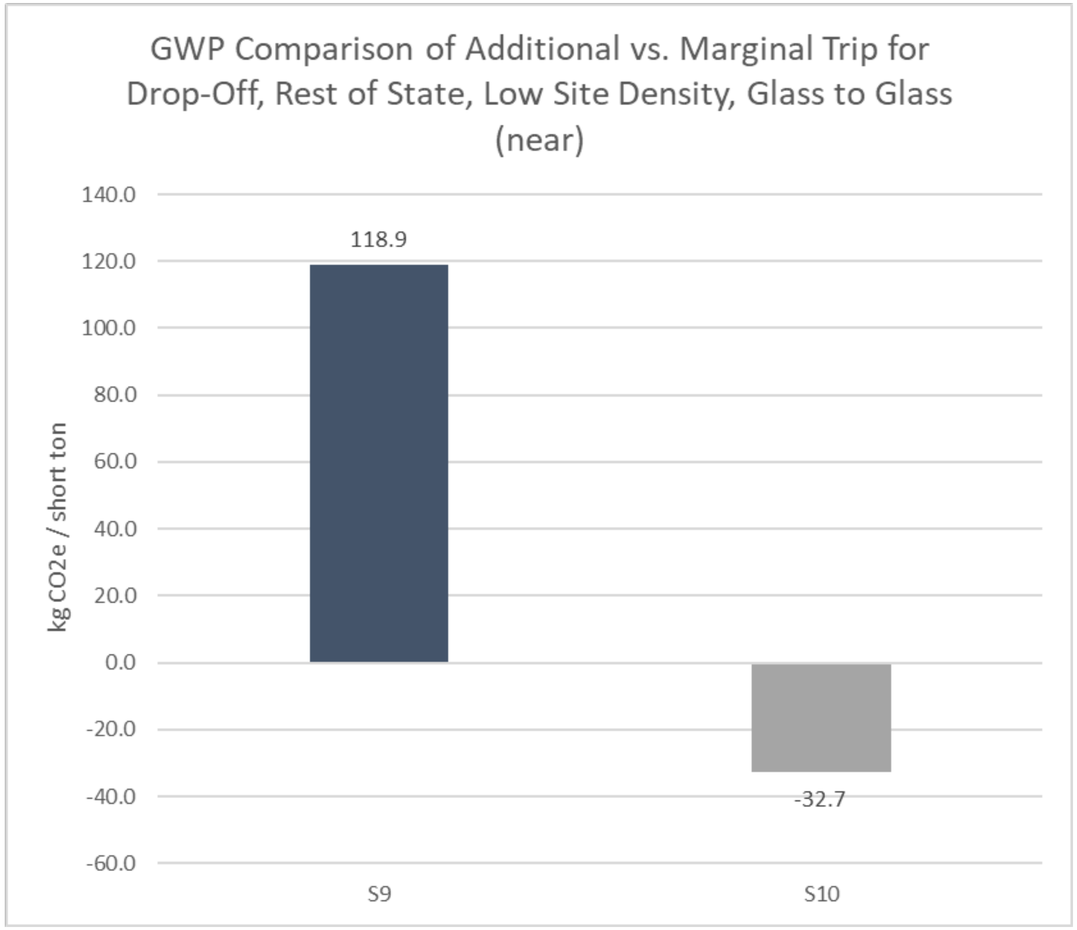


LCIA Results – Global Warming Potential (GWP)

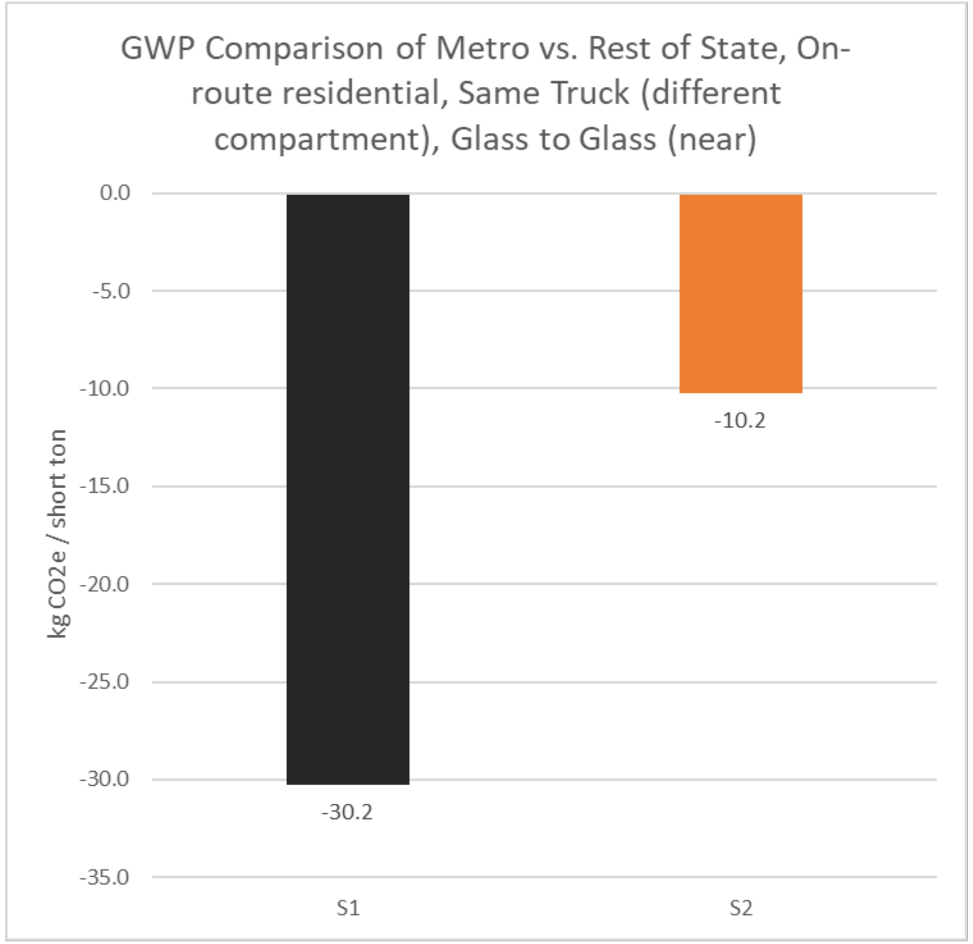


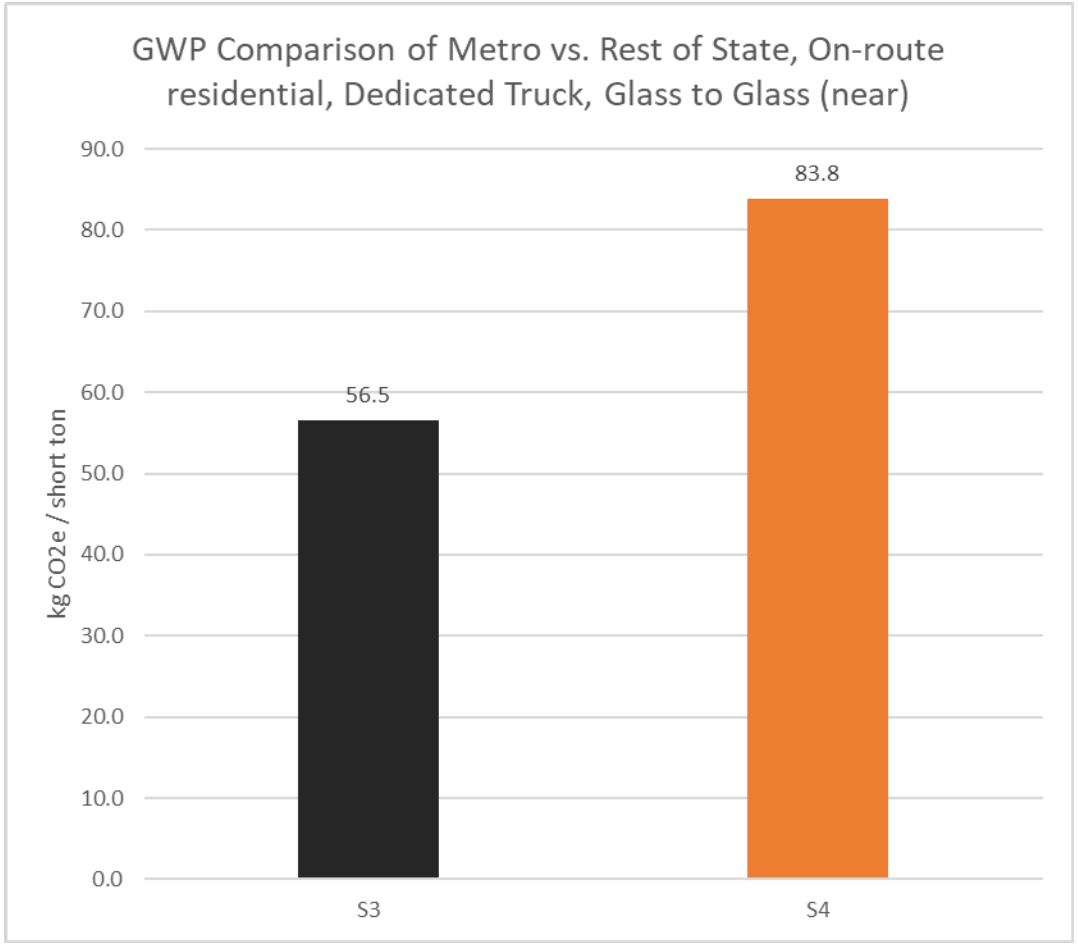
LCIA Results – Global Warming Potential (GWP)



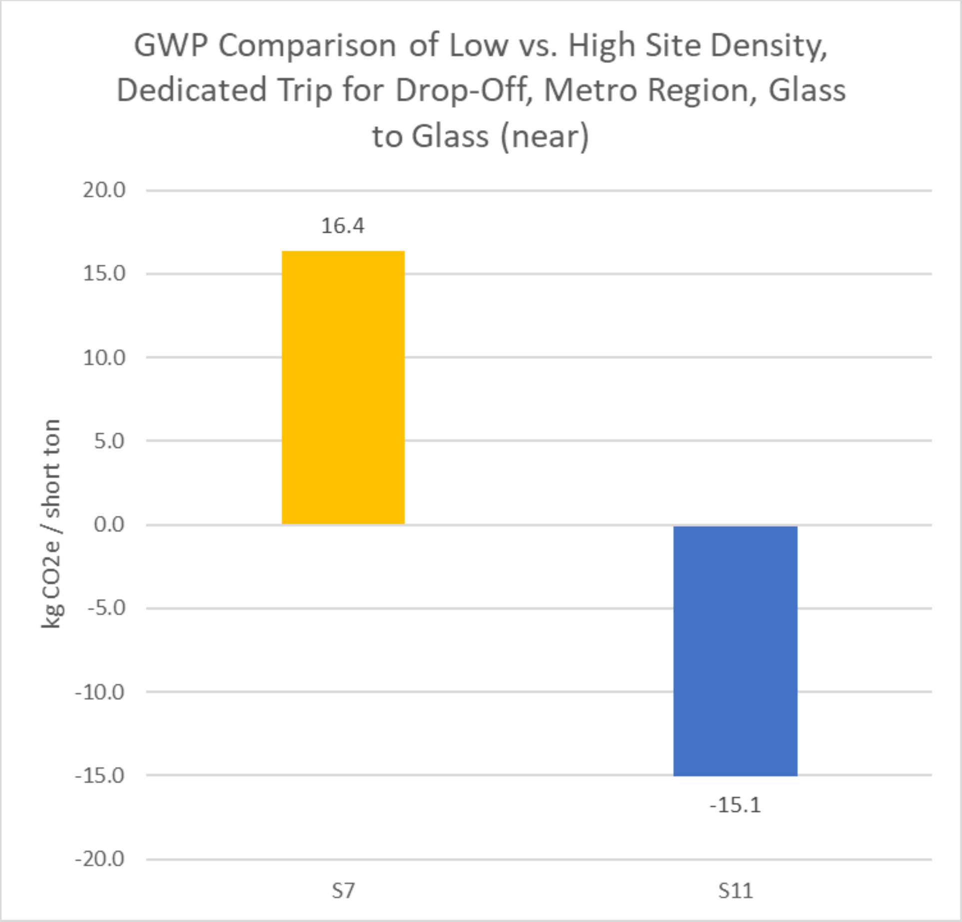


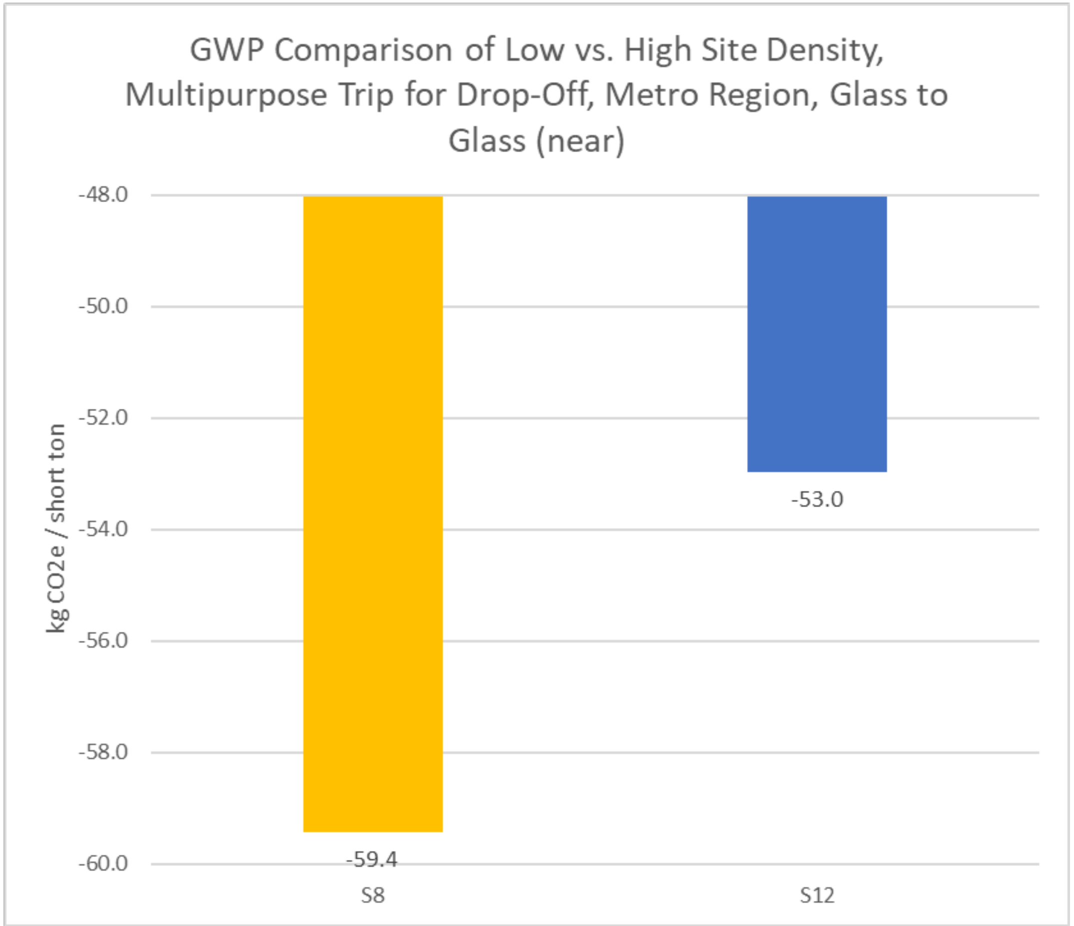
LCIA Results – Global Warming Potential (GWP)



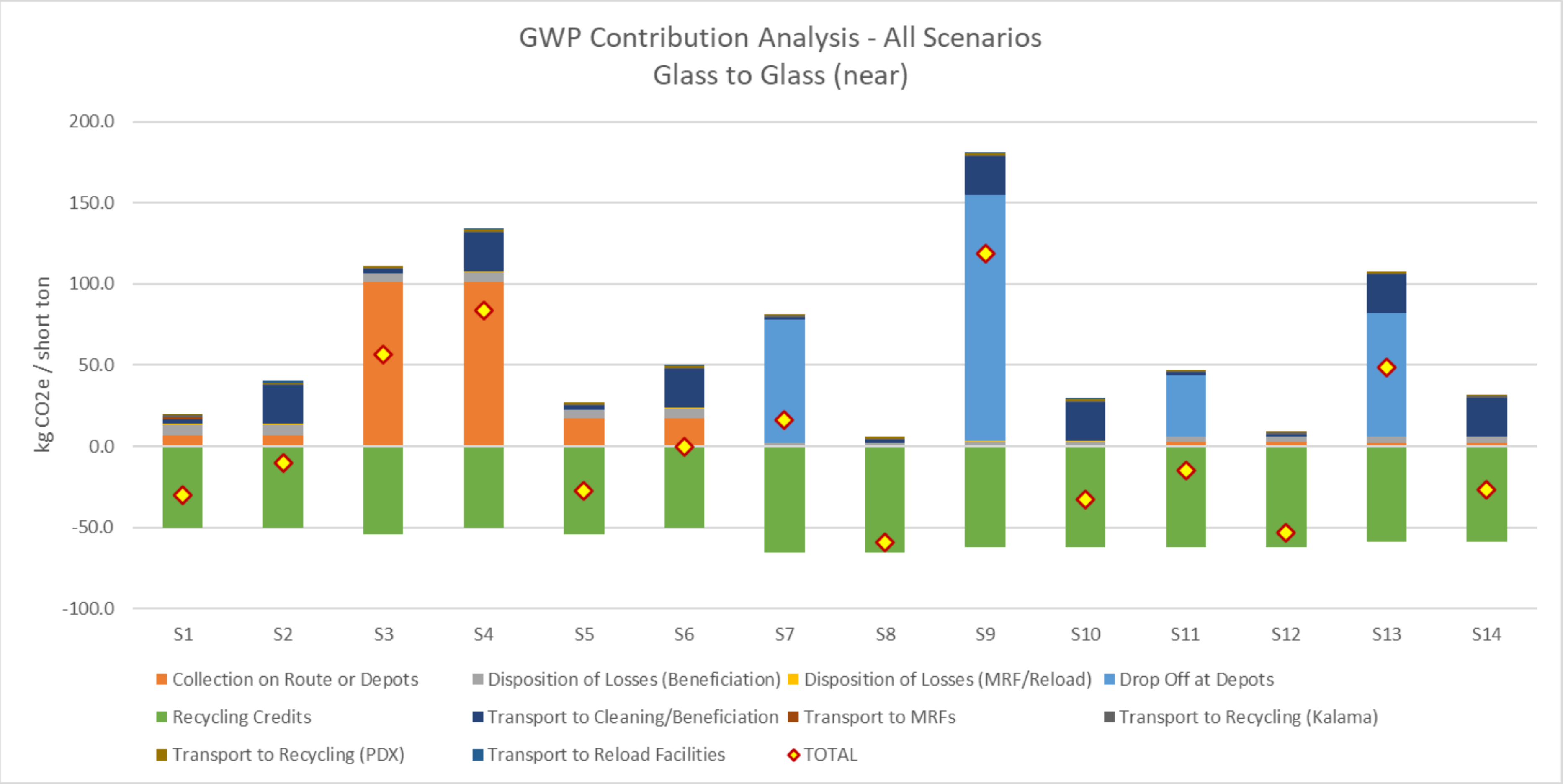


LCIA Results – Global Warming Potential (GWP)

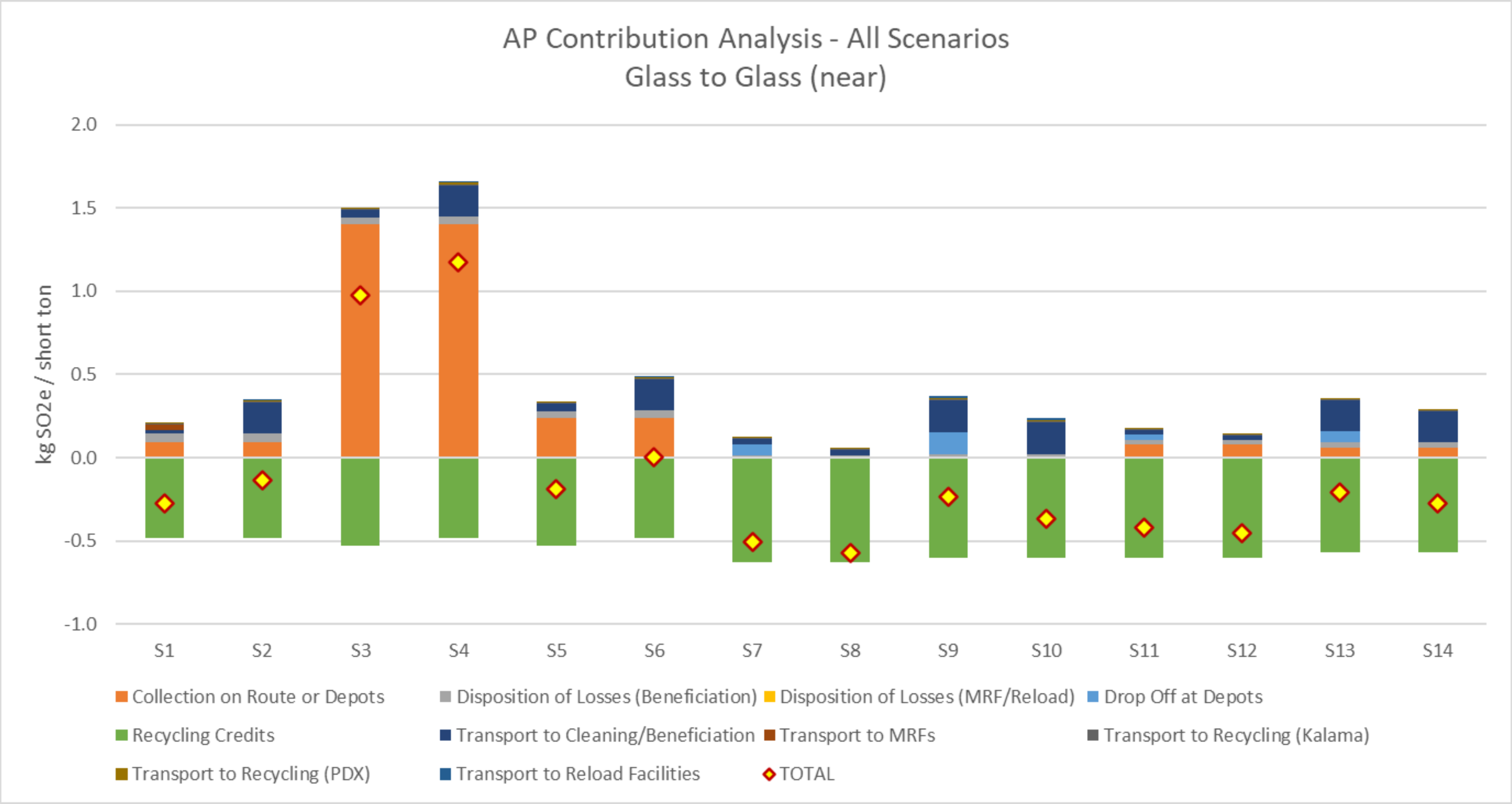




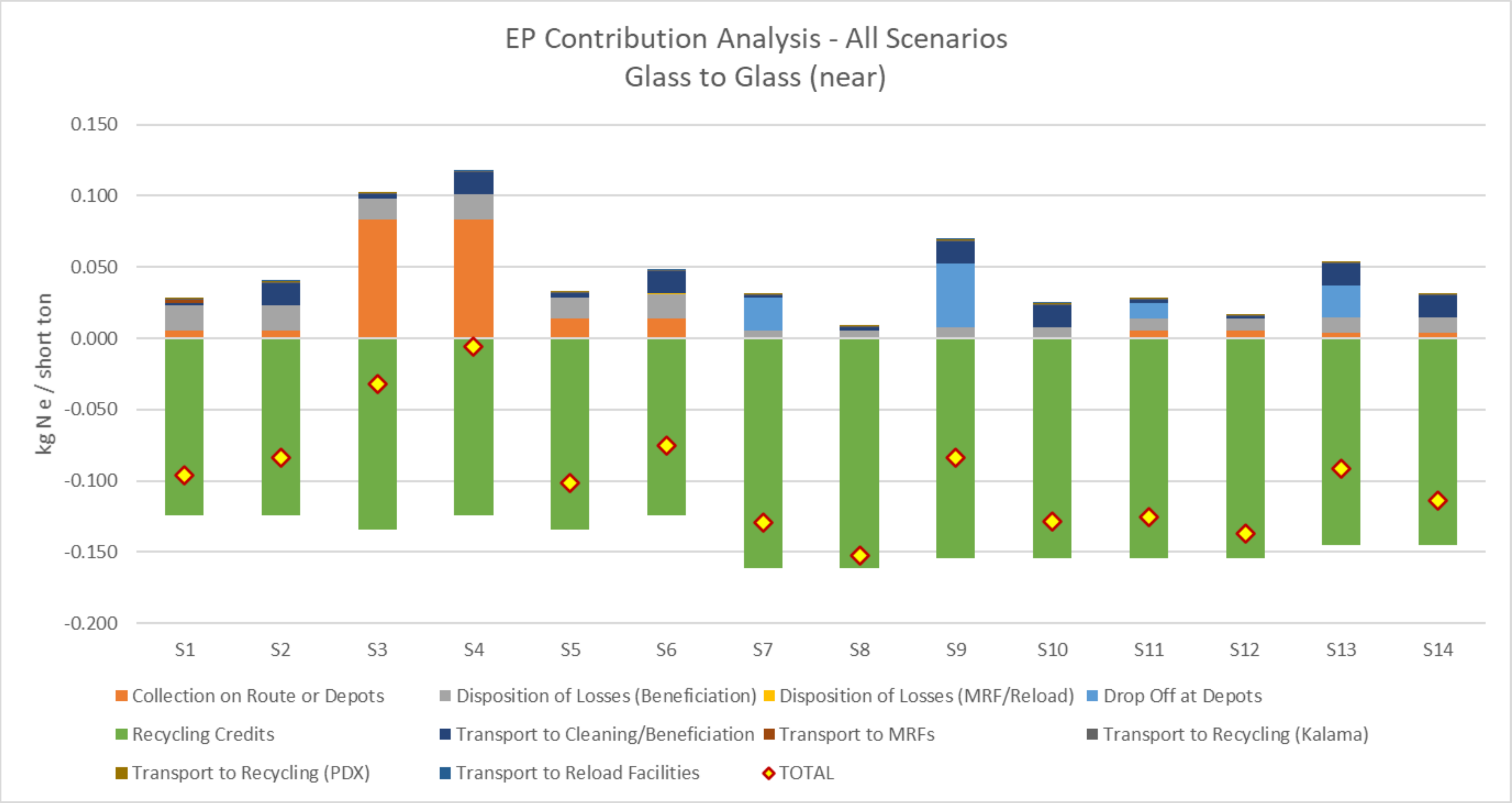
LCIA Results – Global Warming Potential (GWP)



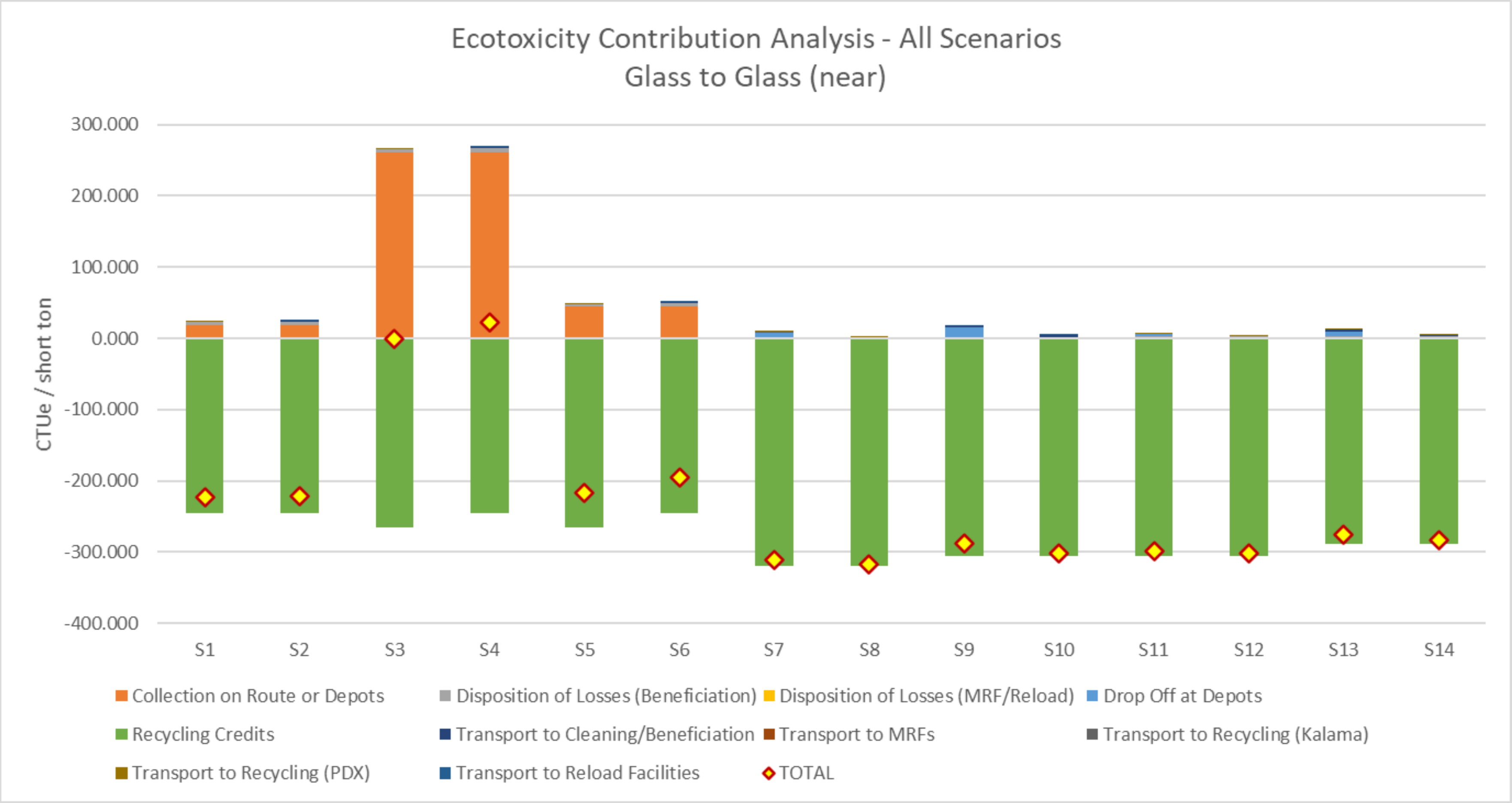
LCIA Results – Acidification Potential (AP)



LCIA Results – Eutrophication Potential (EP)

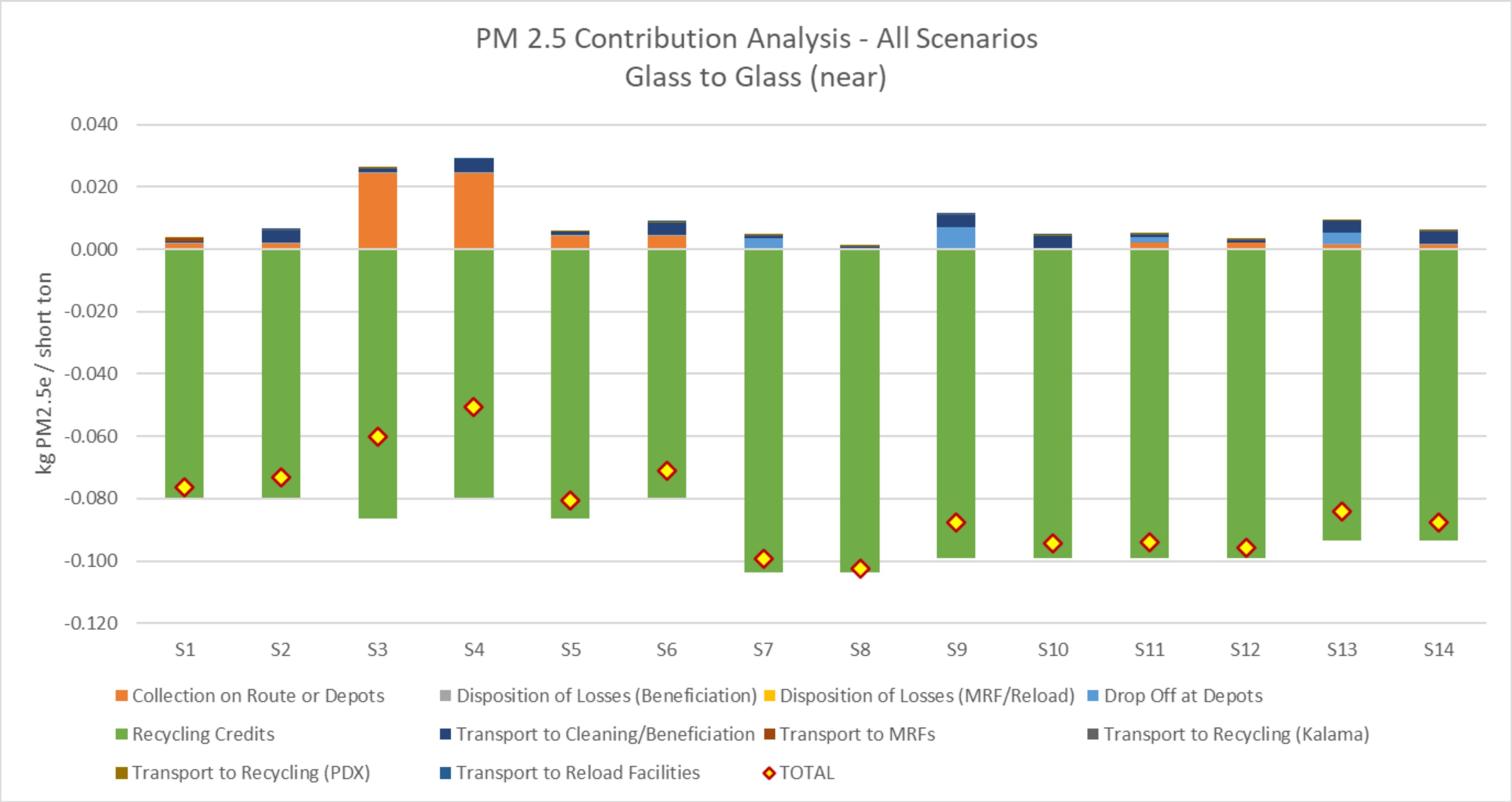


LCIA Results – Ecotoxicity Potential (ETP)



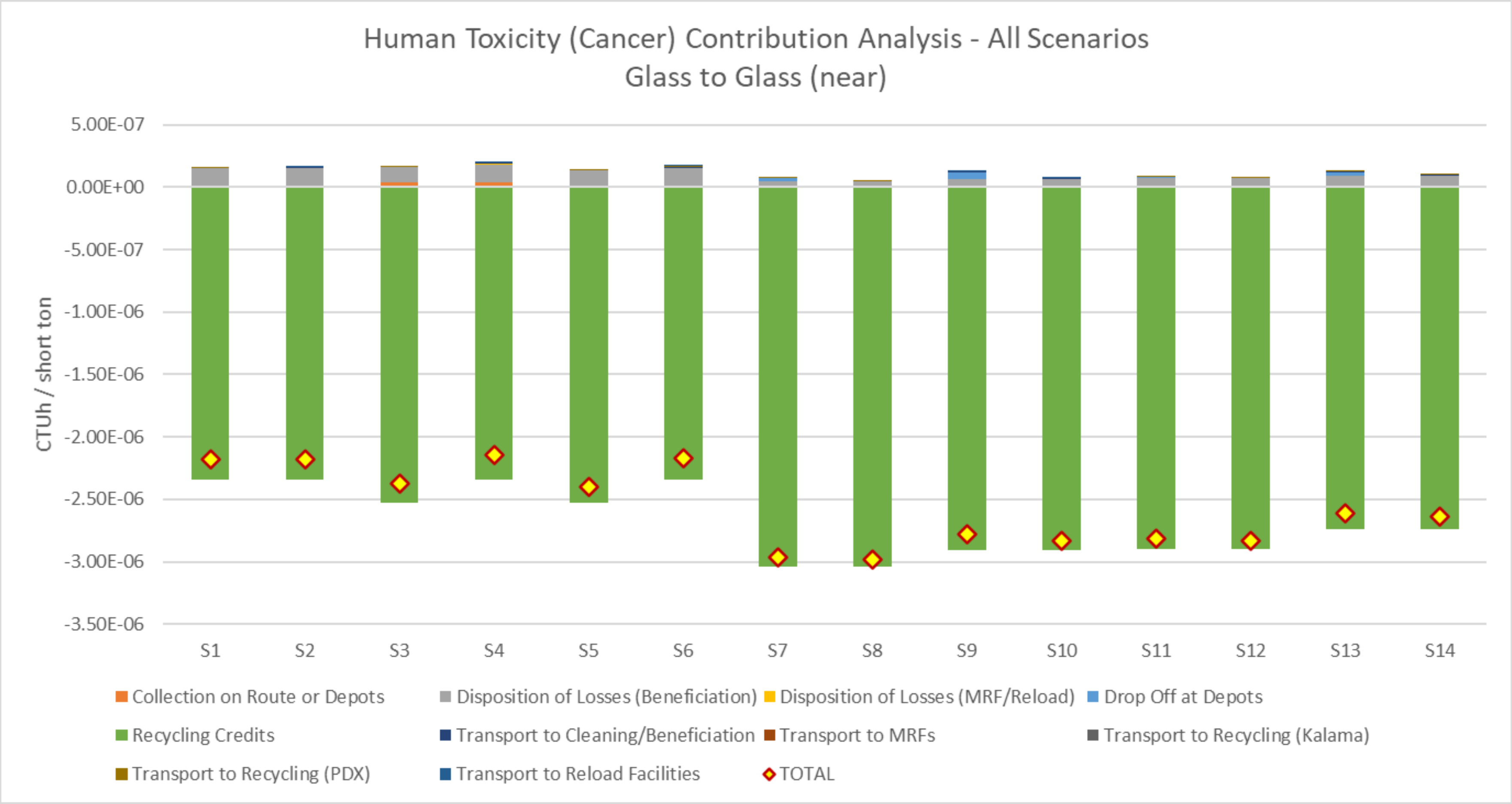
DEQ

LCIA Results – Particulate Matter (PM 2.5)

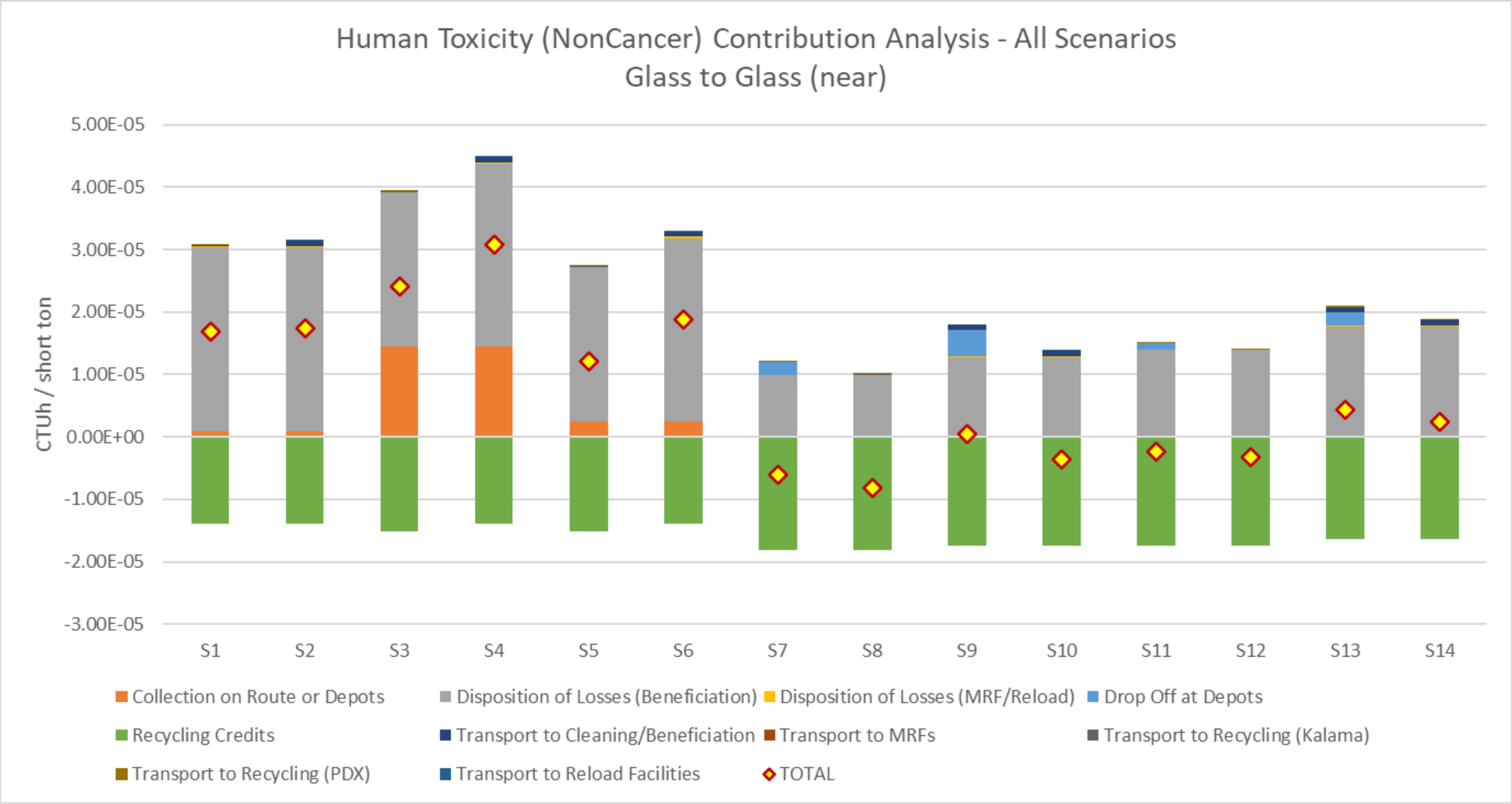


DEQ

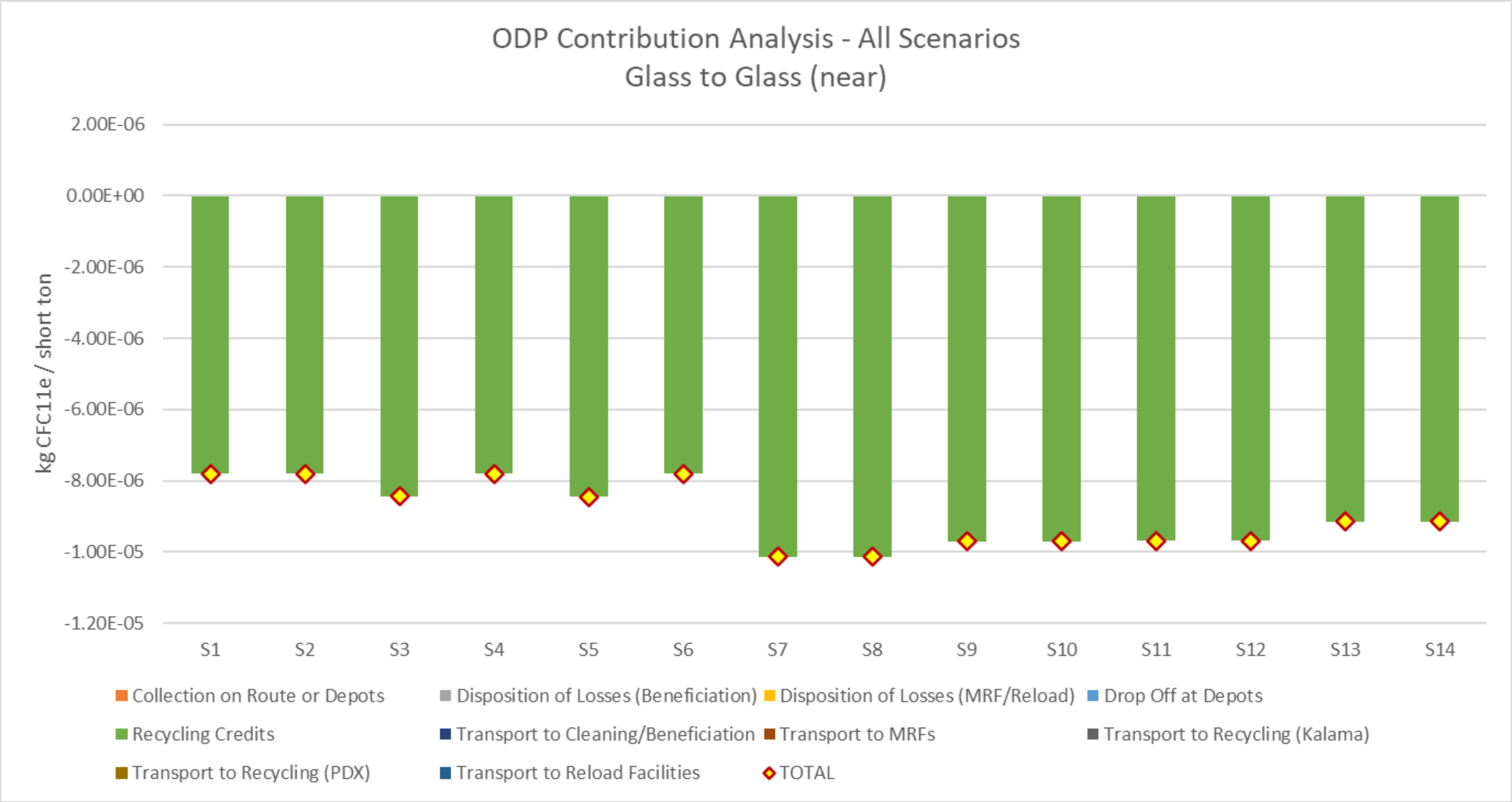
LCIA Results – Human Toxicity Potential (Cancer)



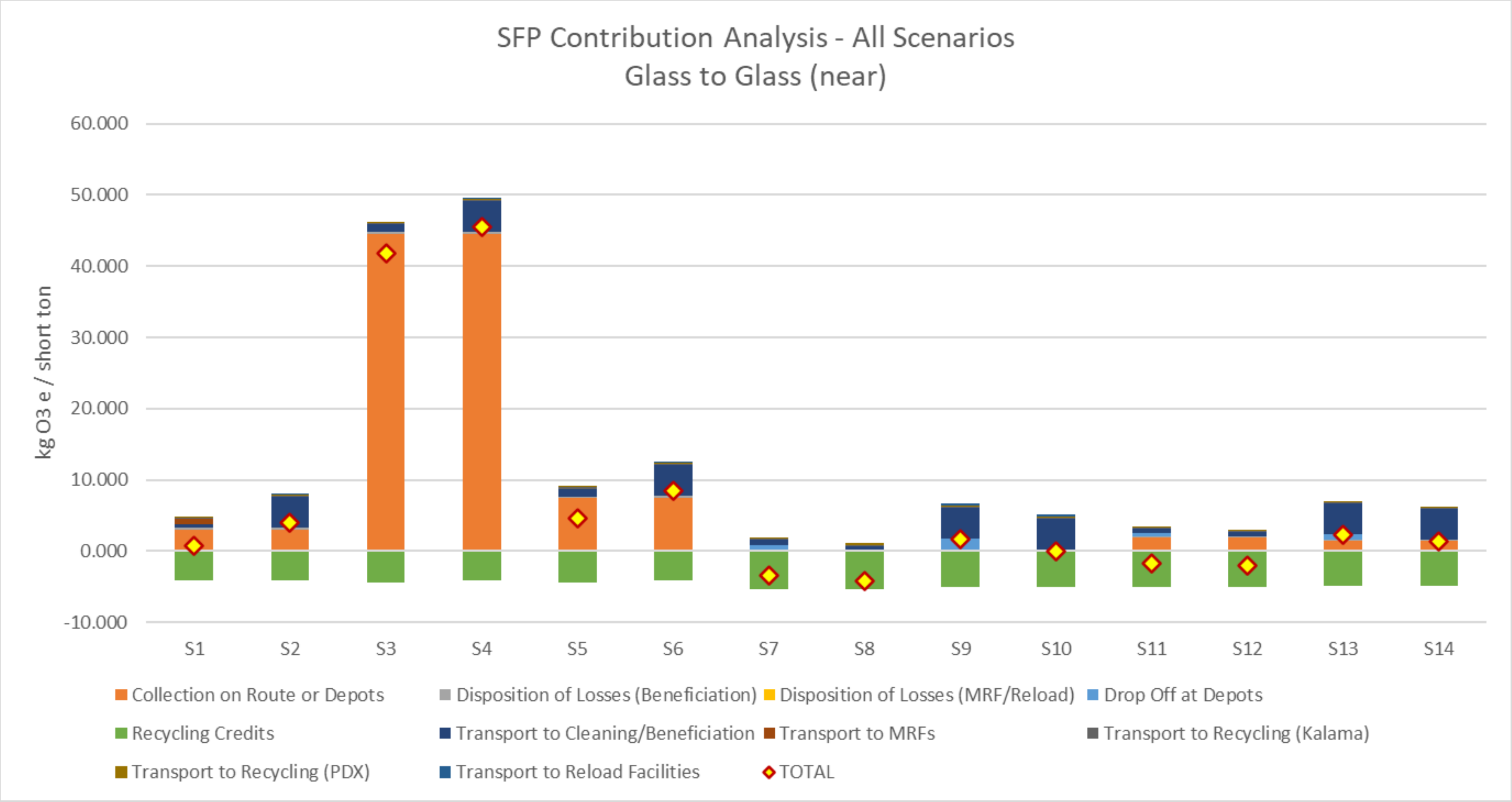
LCIA Results - Human Toxicity Potential (NonCancer)



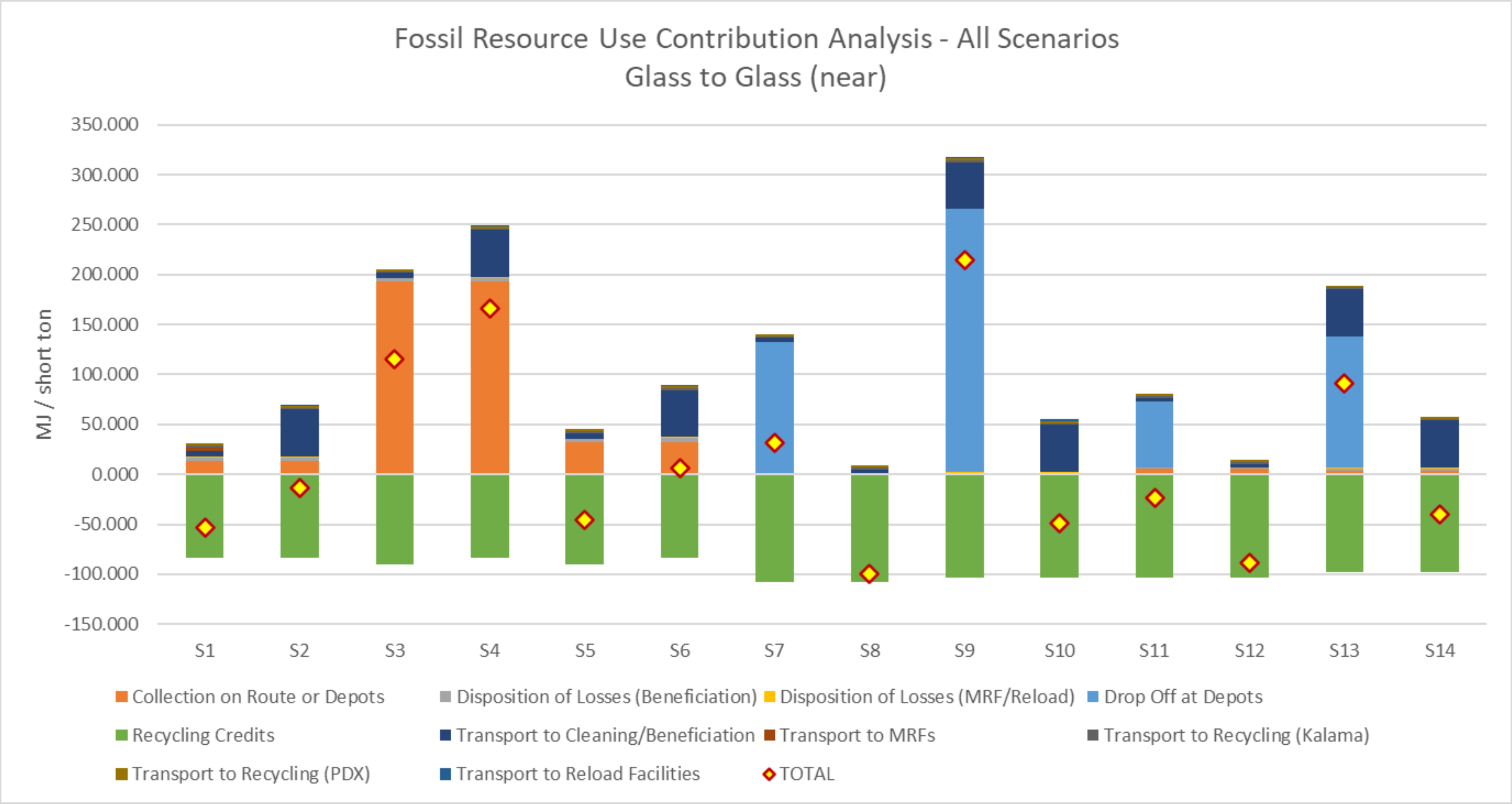
LCIA Results – Ozone Depletion Potential (ODP)



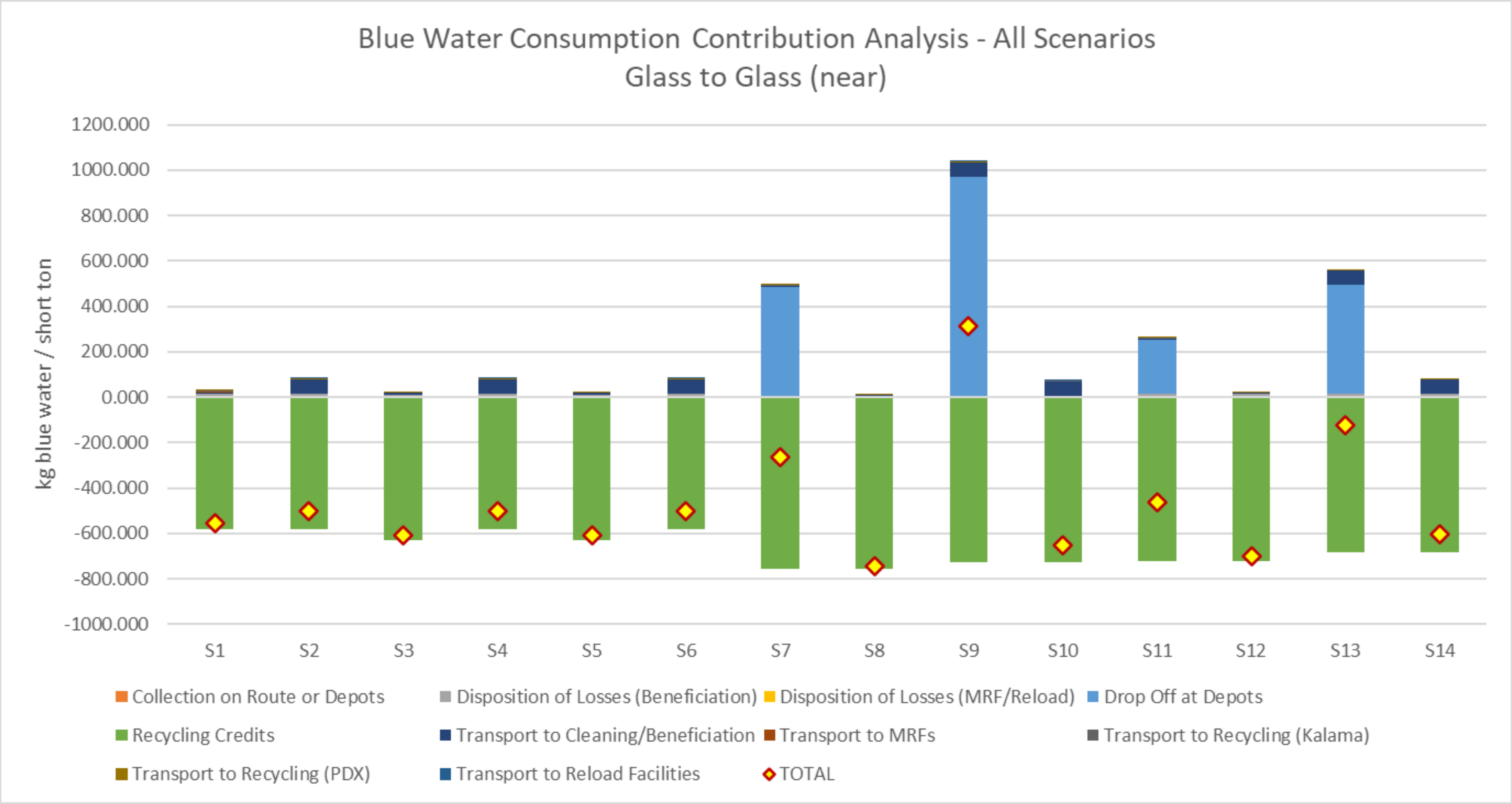
LCIA Results – Smog Formation Potential (SFP)



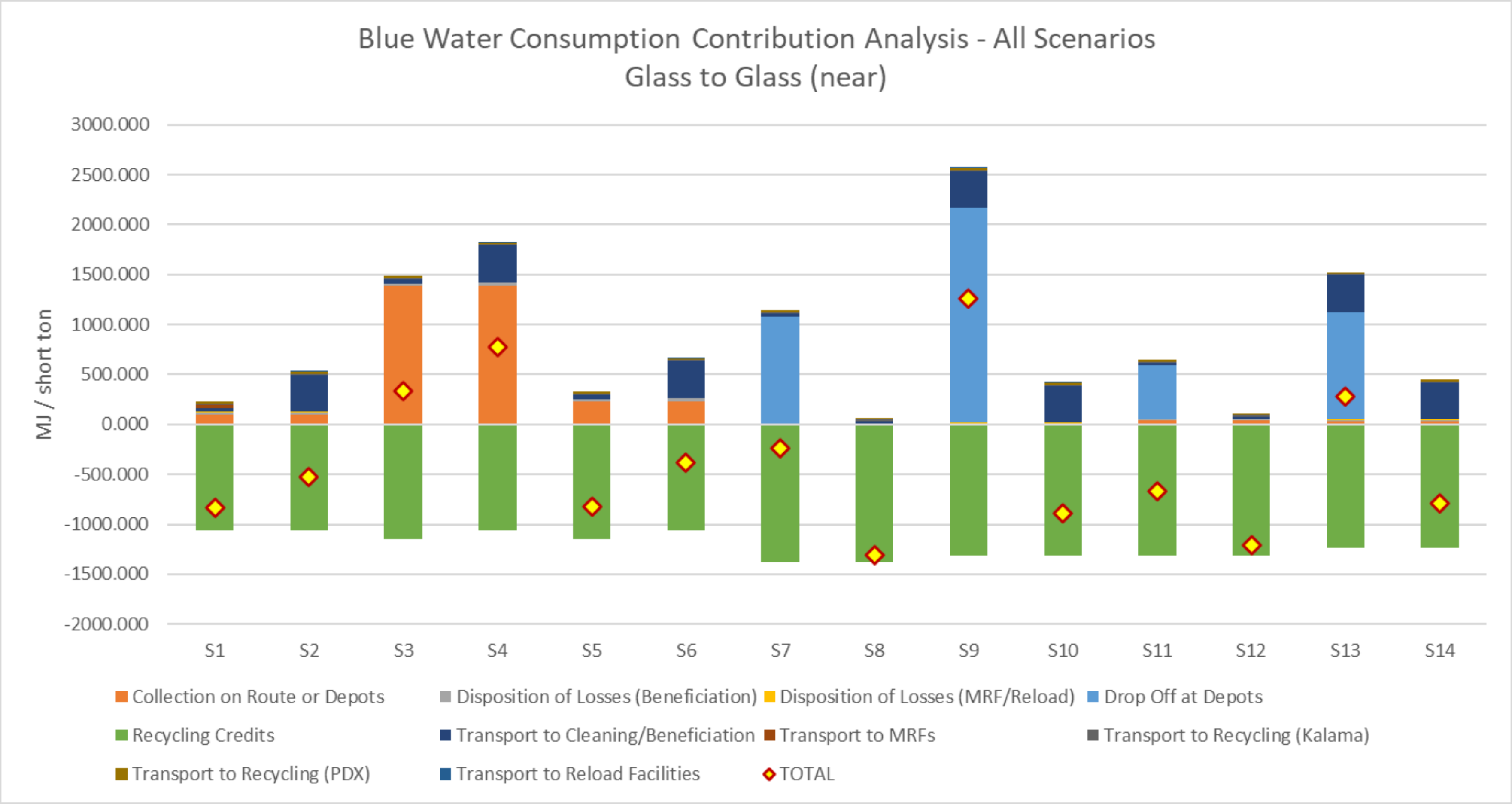
Indicator Results – Fossil Resource Use



Indicator Results – Bluewater Consumption



Indicator Results – Primary Energy Demand (PED)

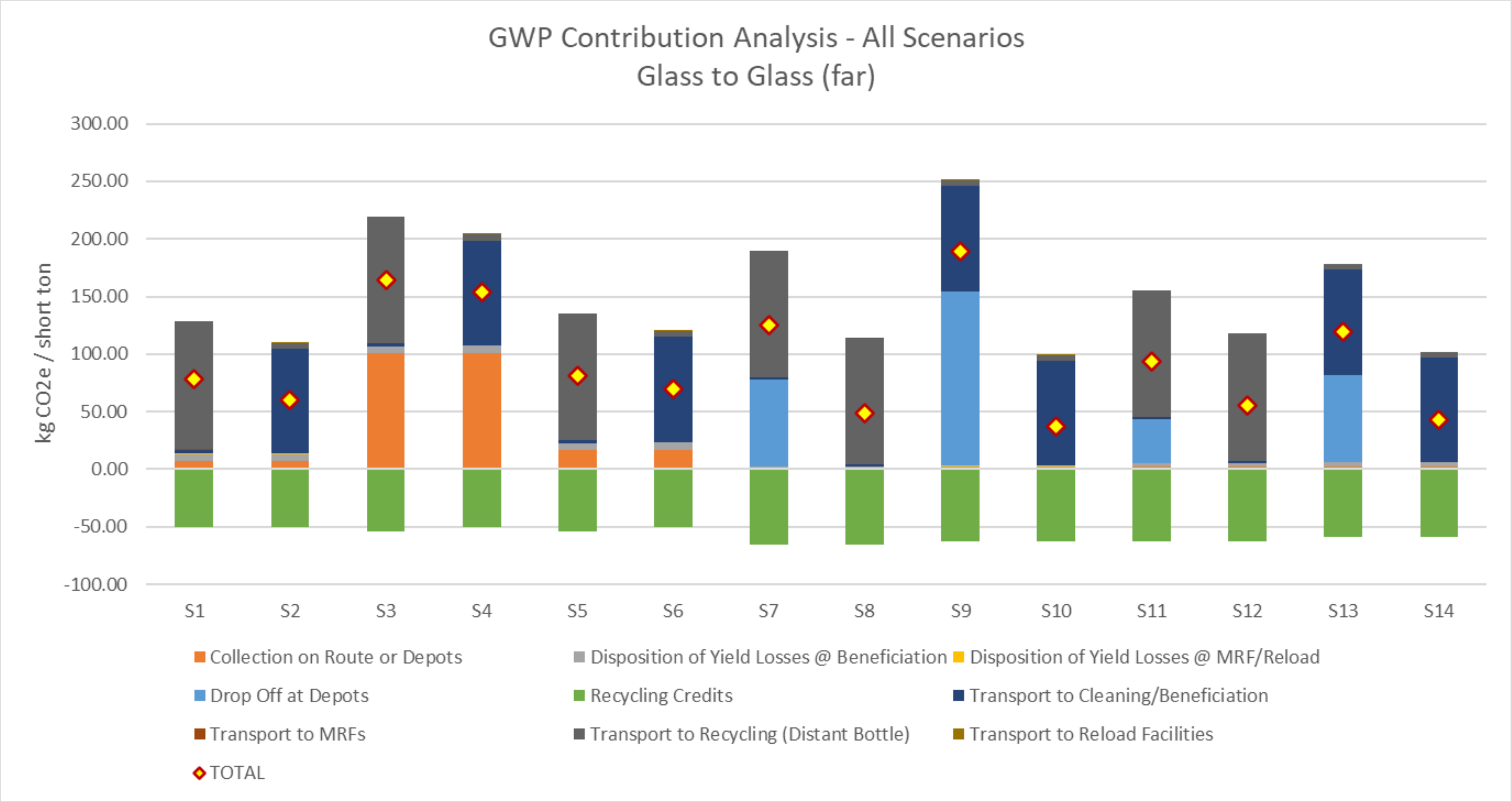


“Glass to Glass (Far)” Results

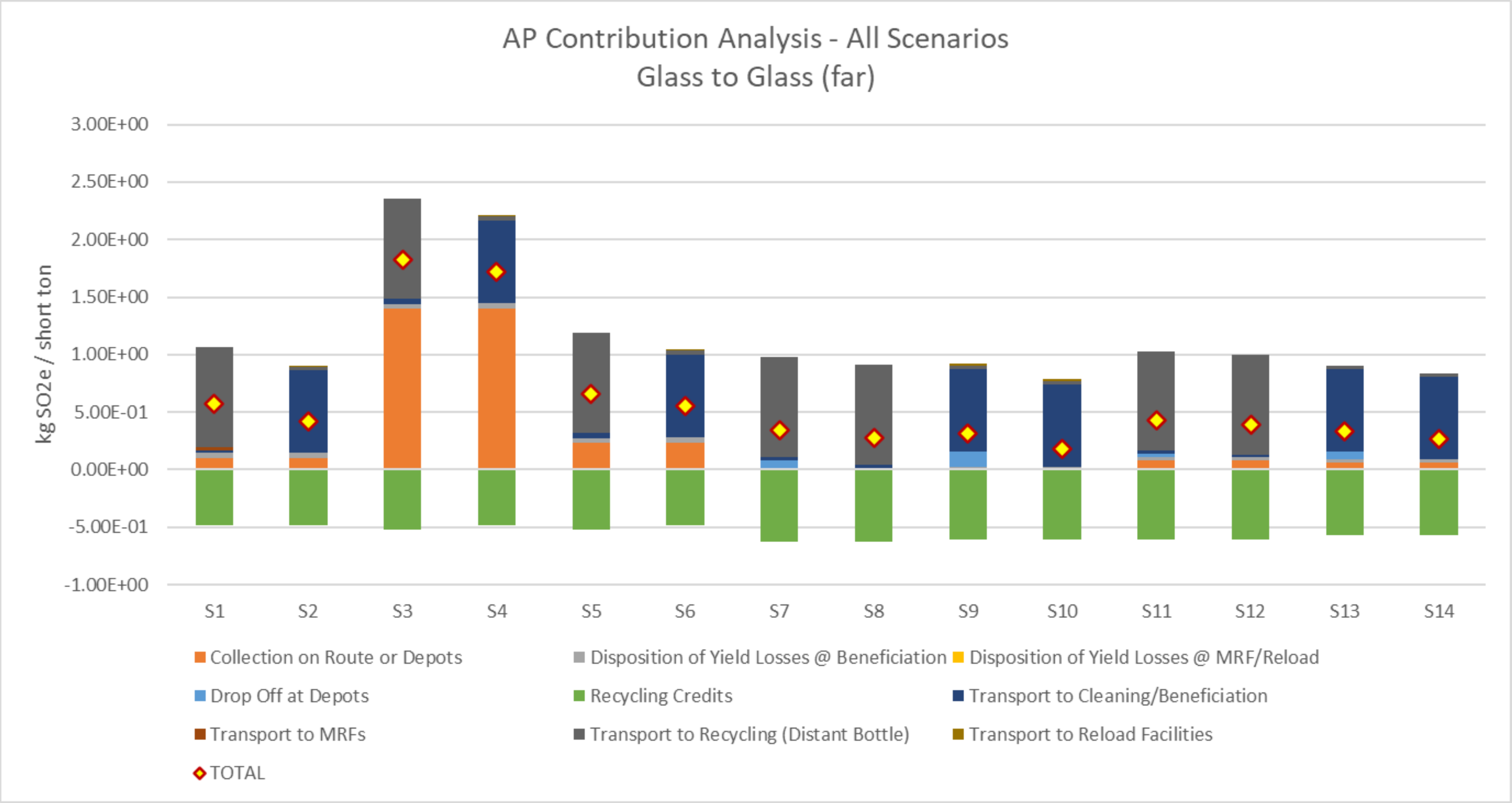
Owens Brockway

Tracy, CA

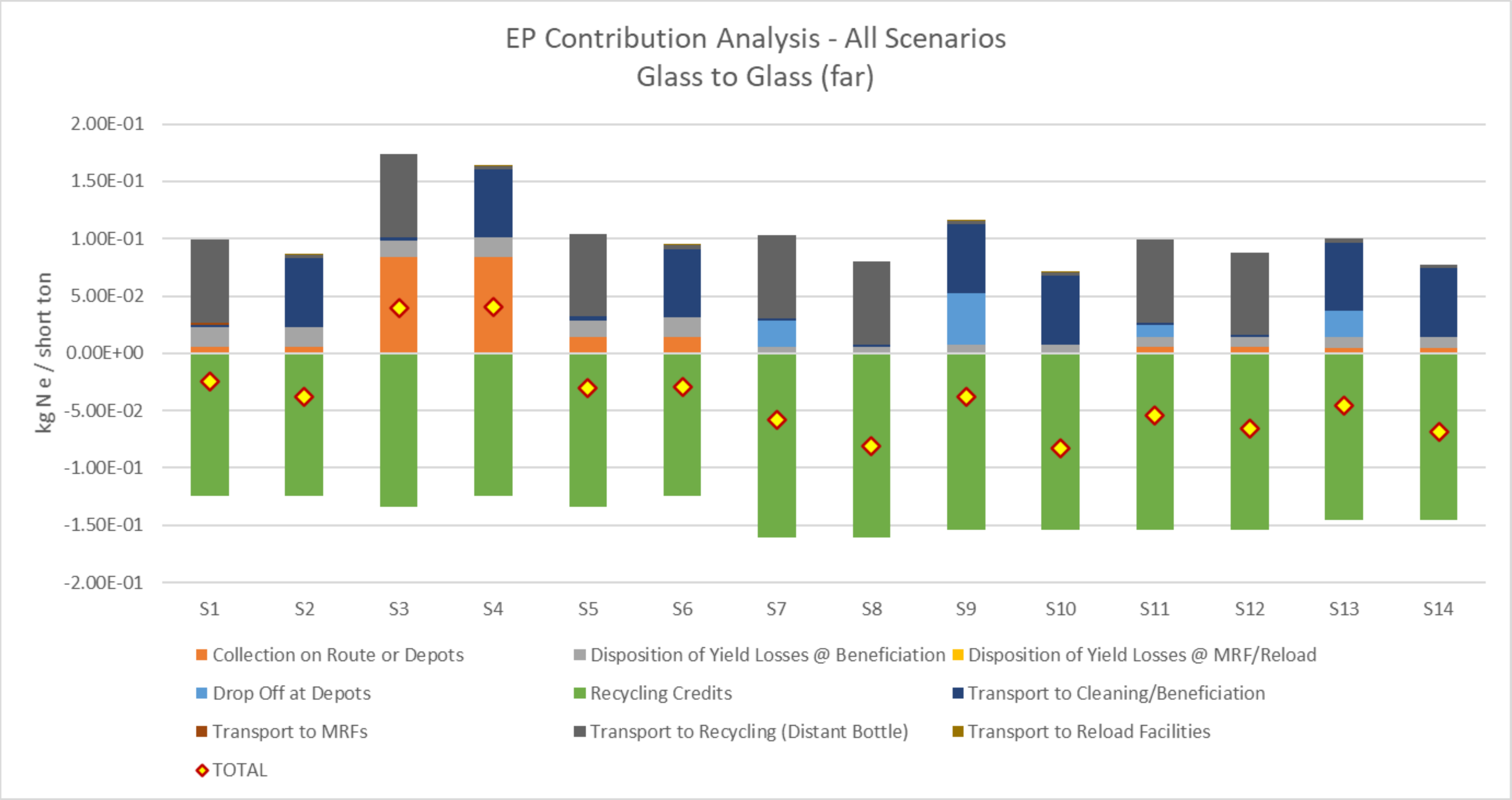
LCIA Results – Global Warming Potential (GWP)



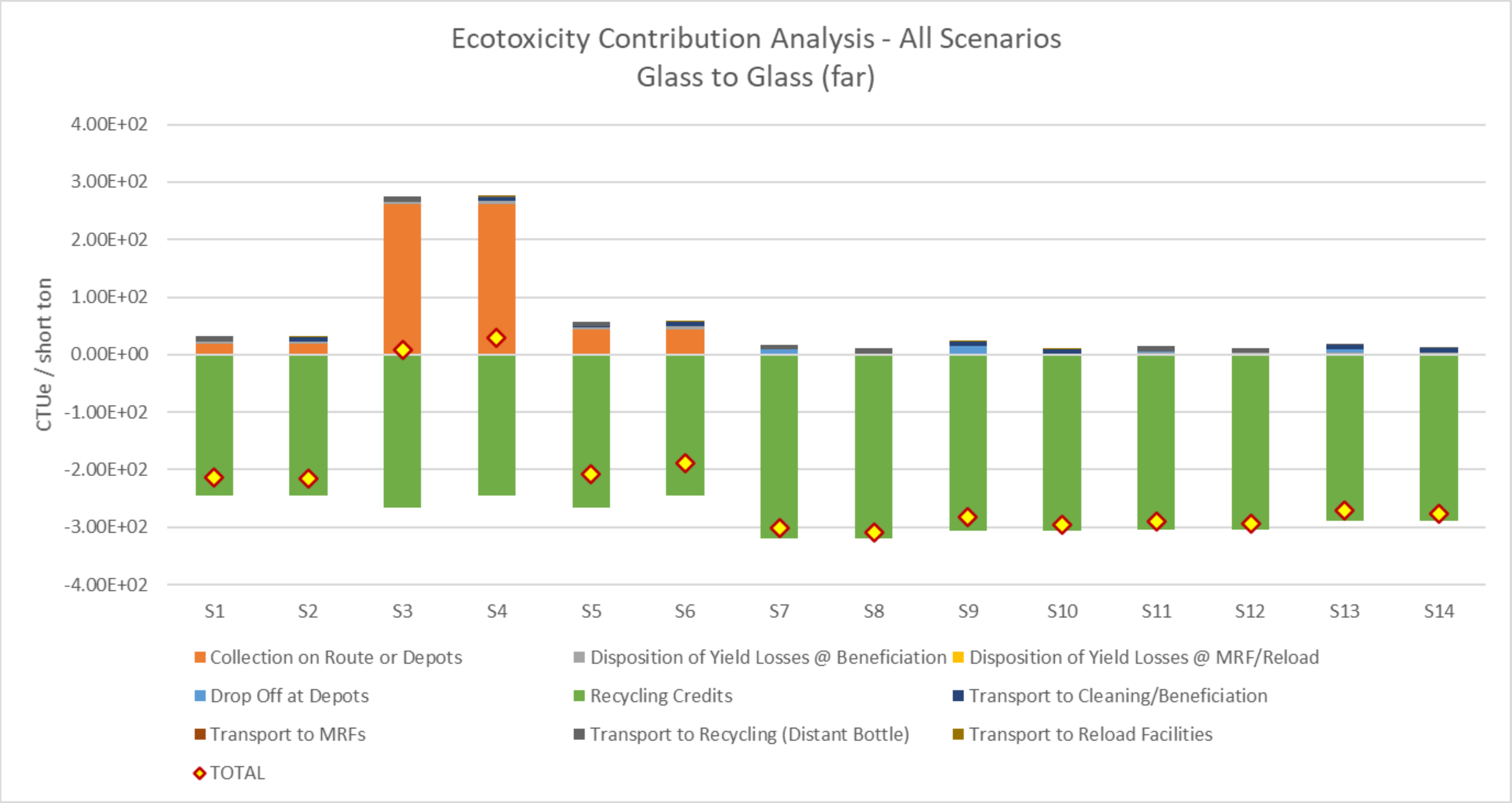
LCIA Results – Acidification Potential (AP)



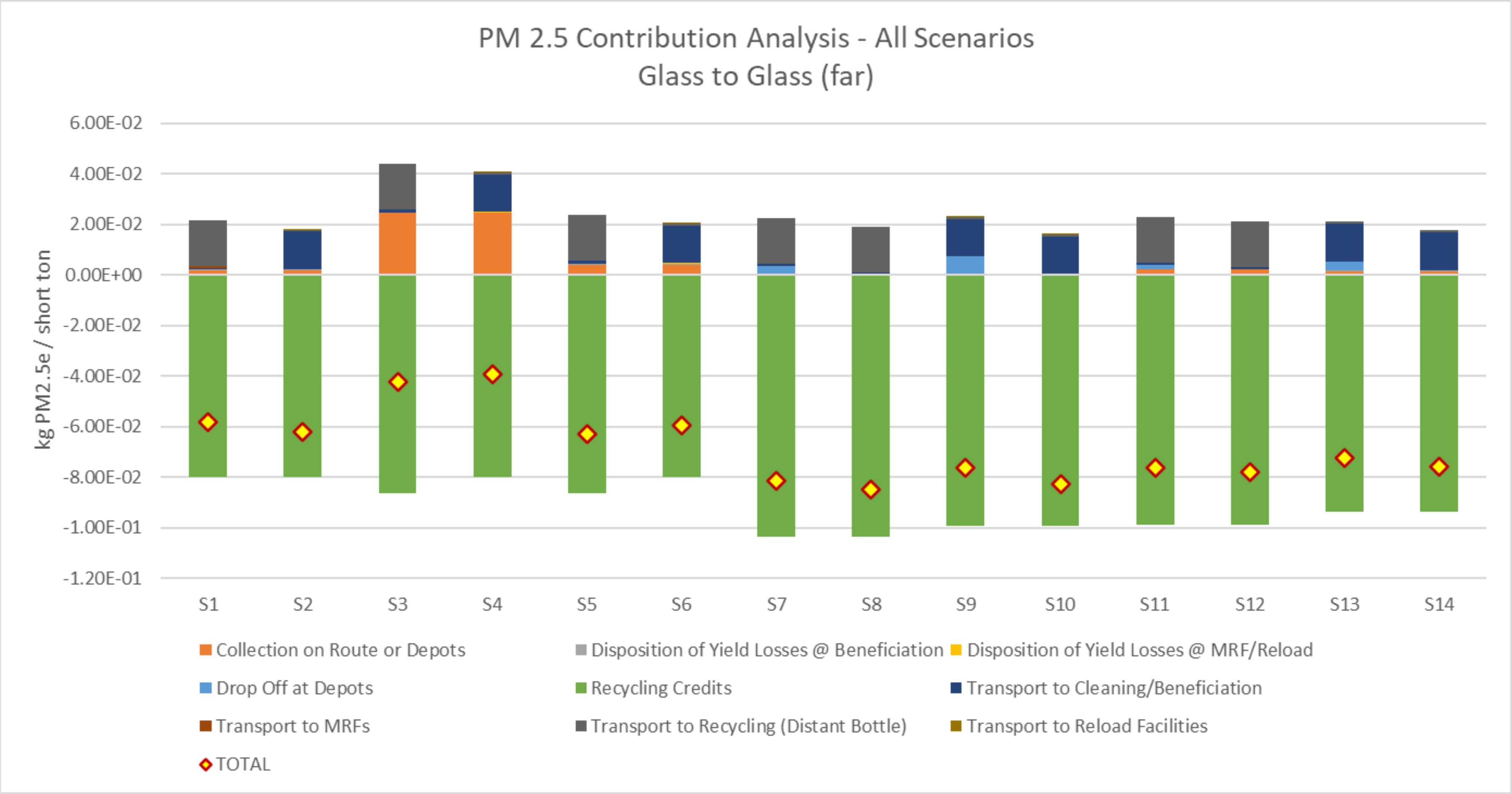
LCIA Results – Eutrophication Potential (EP)



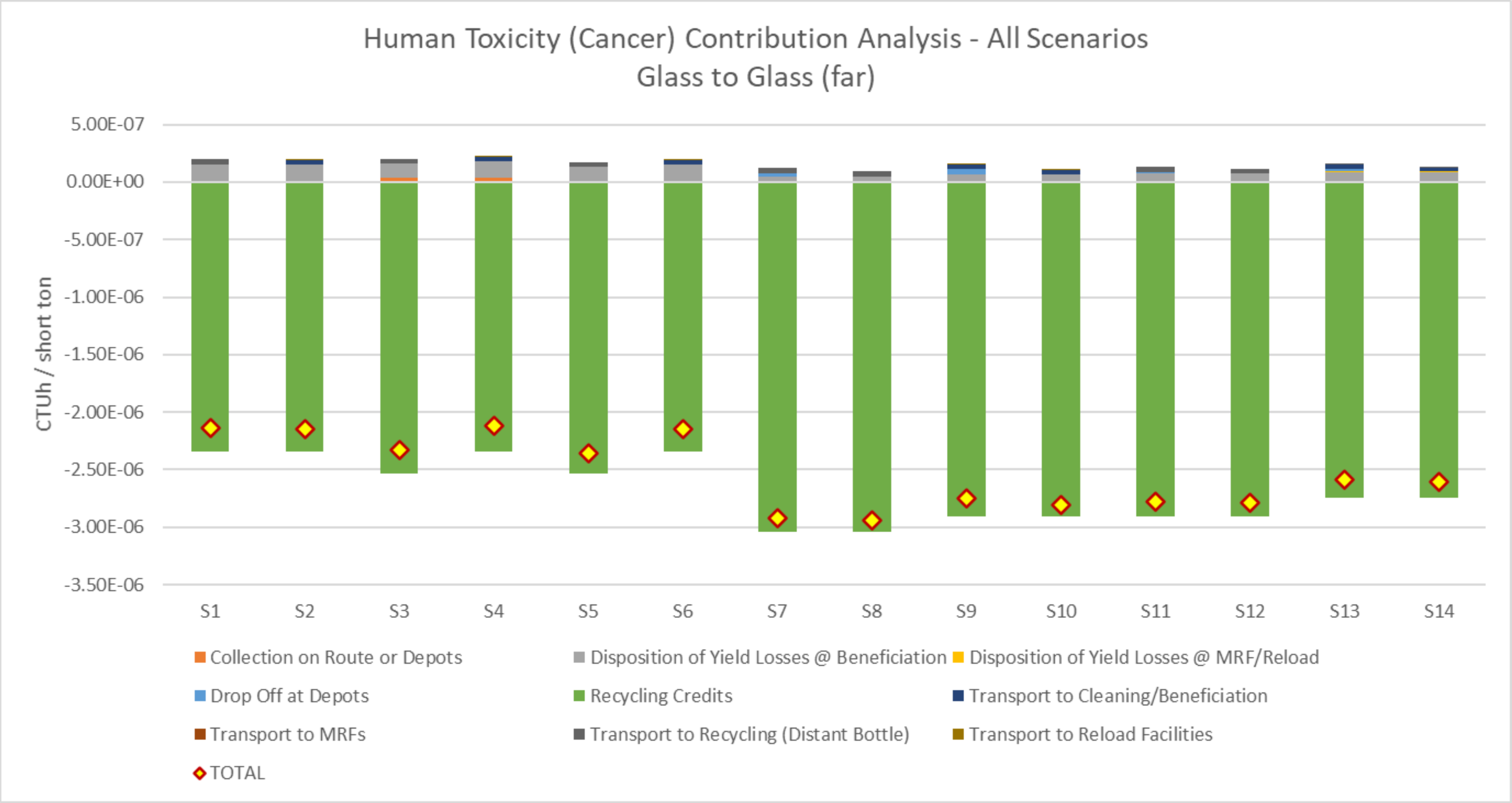
LCIA Results – Ecotoxicity Potential (ETP)



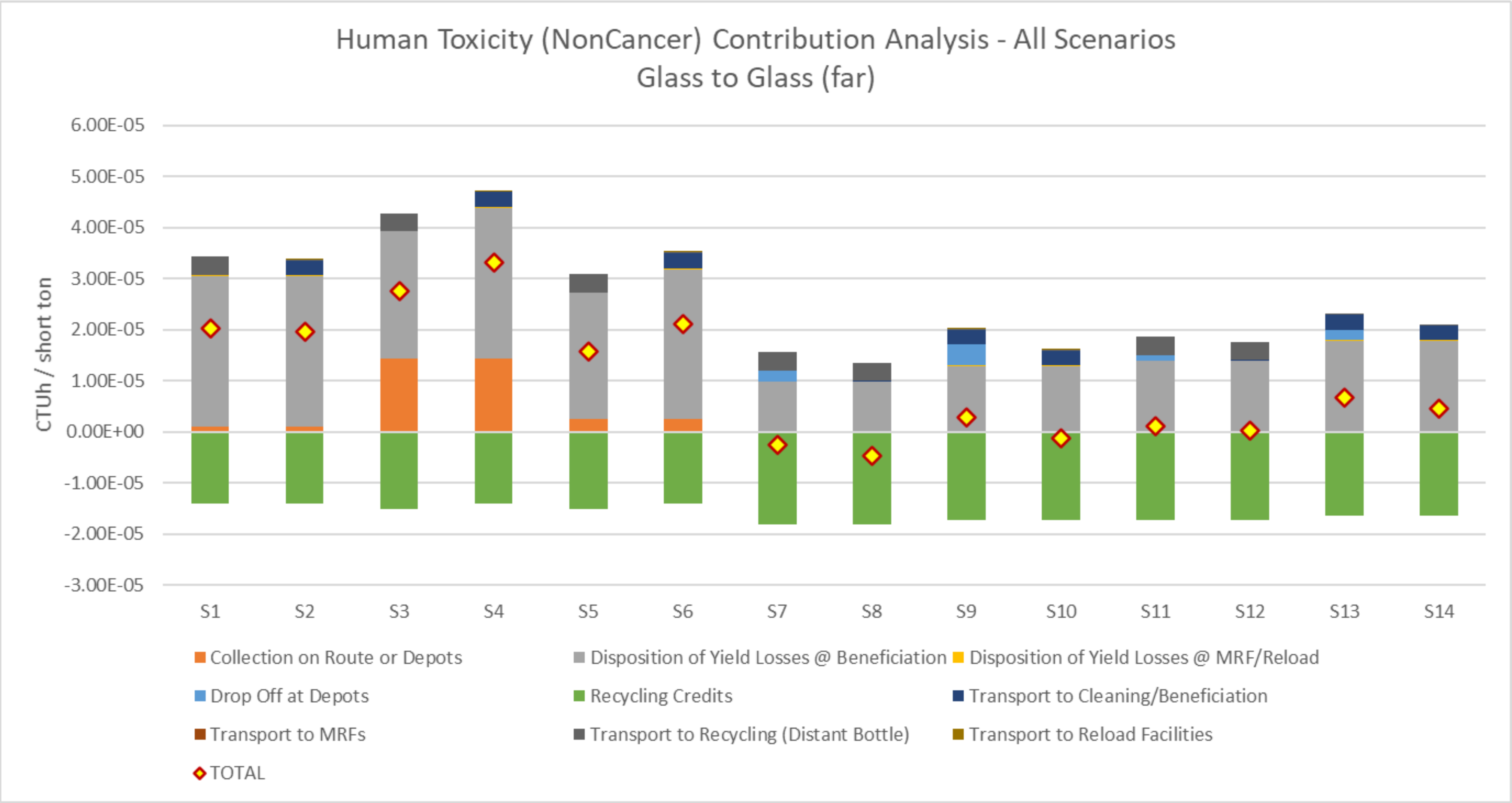
LCIA Results – Particulate Matter (PM 2.5)



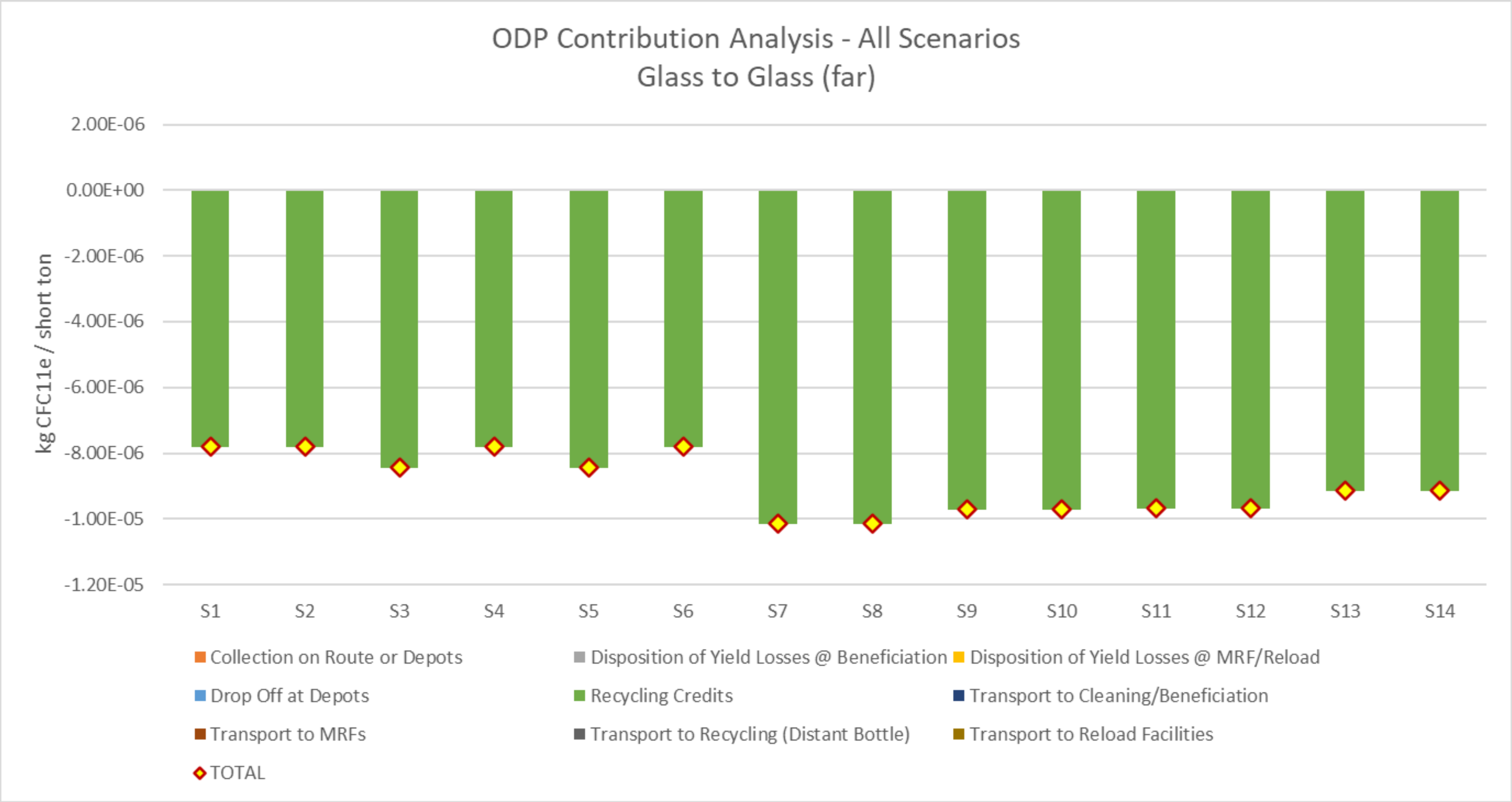
LCIA Results – Human Toxicity Potential (Cancer)



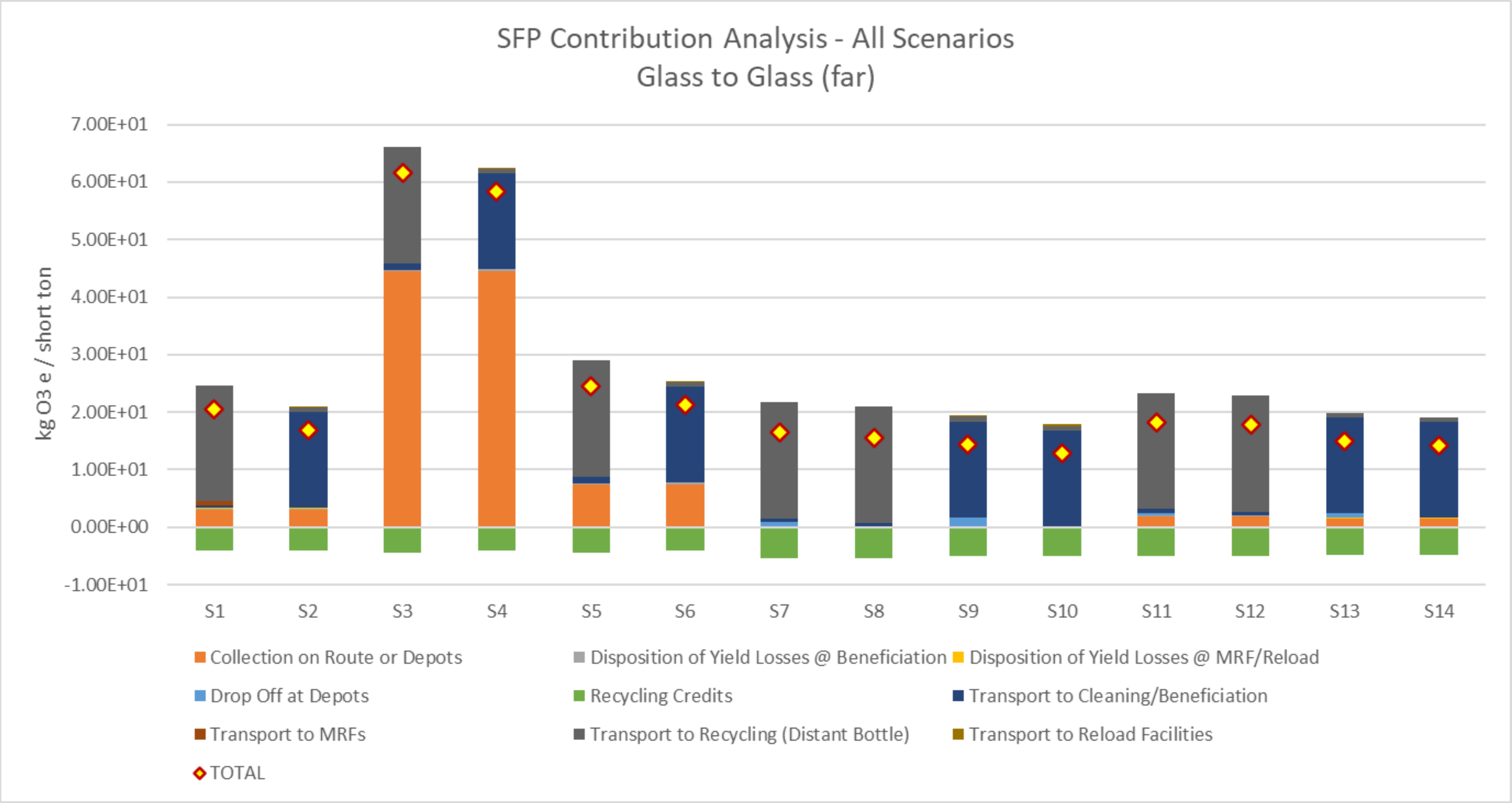
LCIA Results - Human Toxicity Potential (NonCancer)



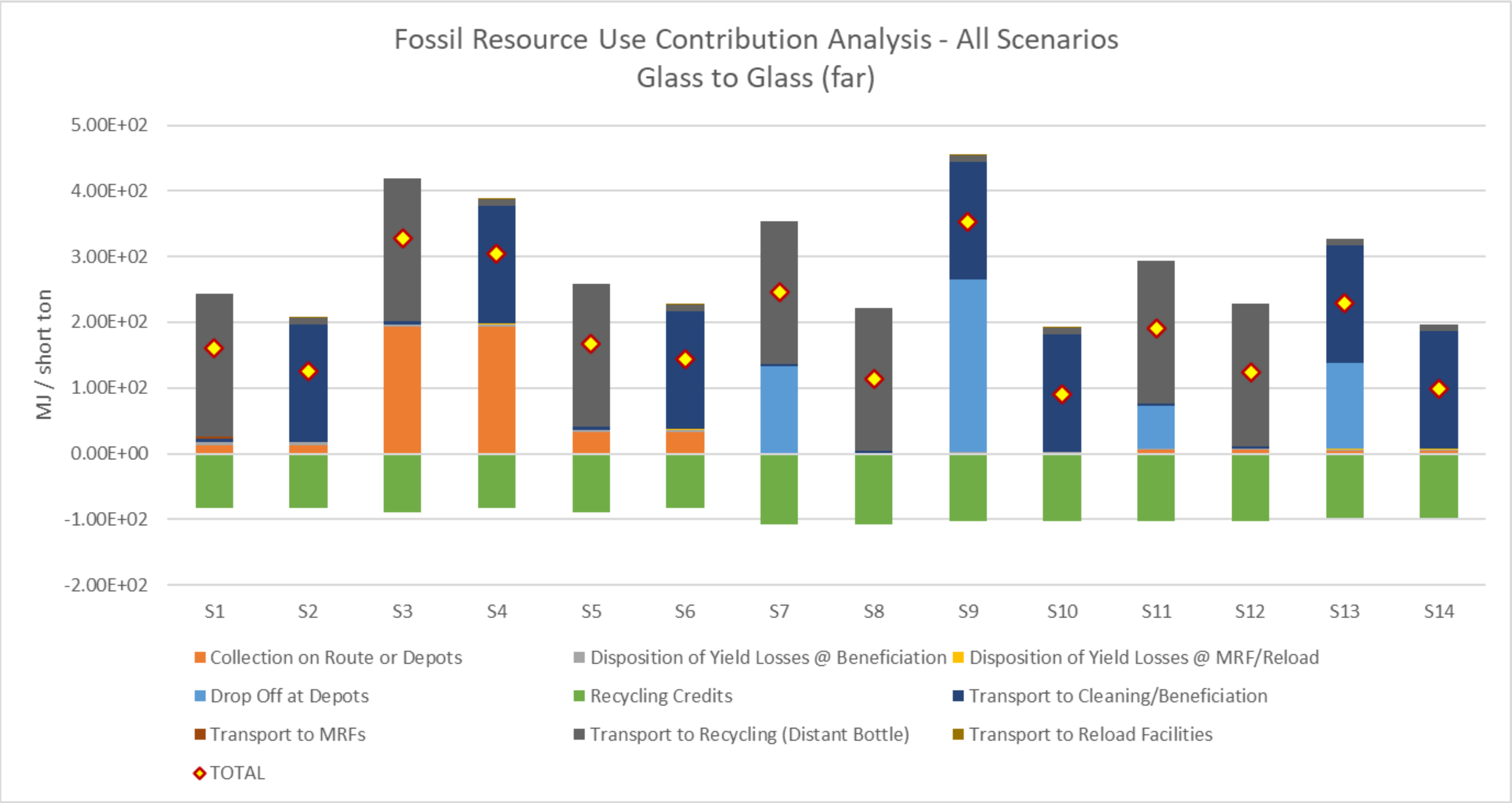
LCIA Results – Ozone Depletion Potential (ODP)



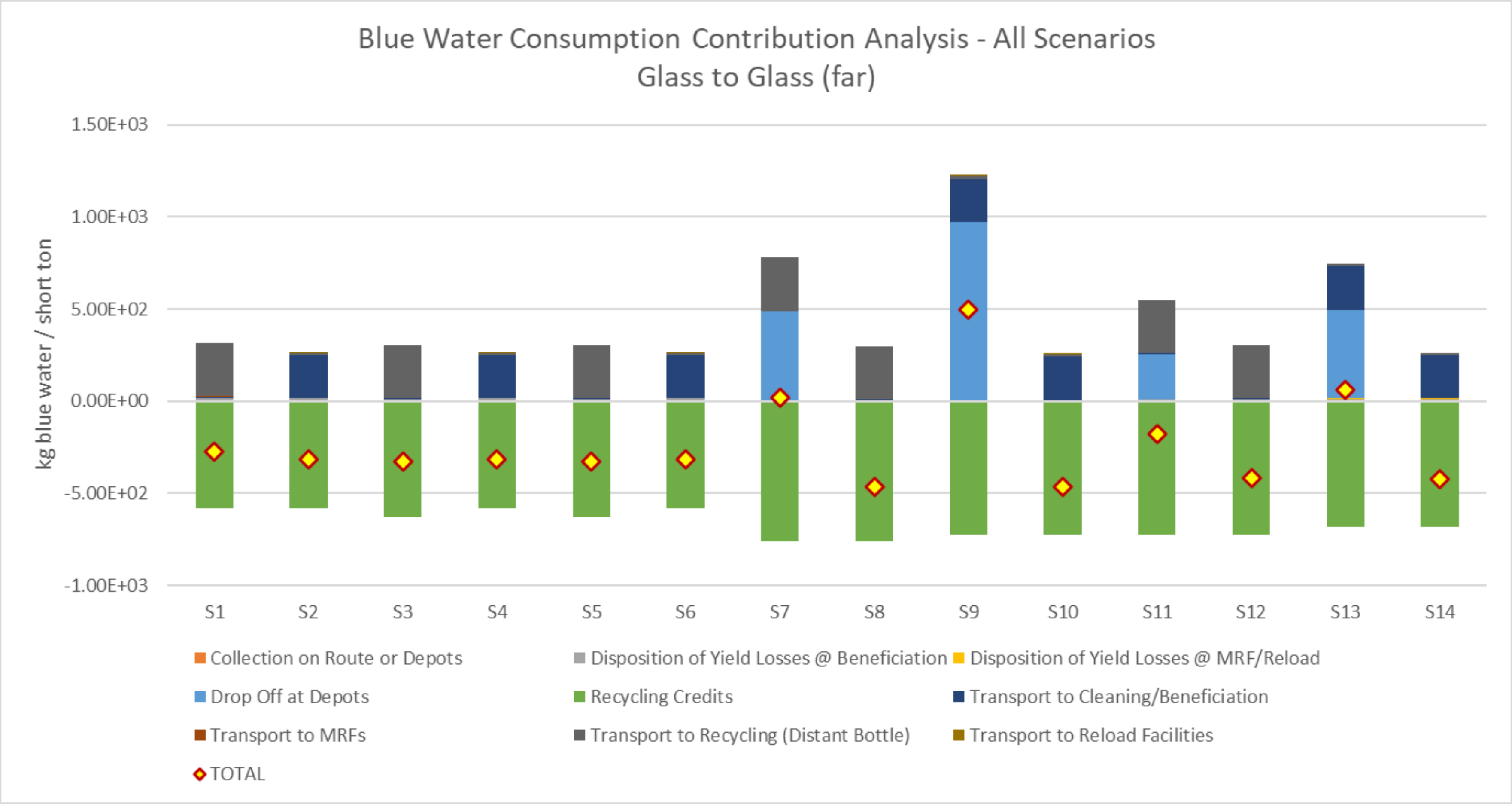
LCIA Results – Smog Formation Potential (SFP)



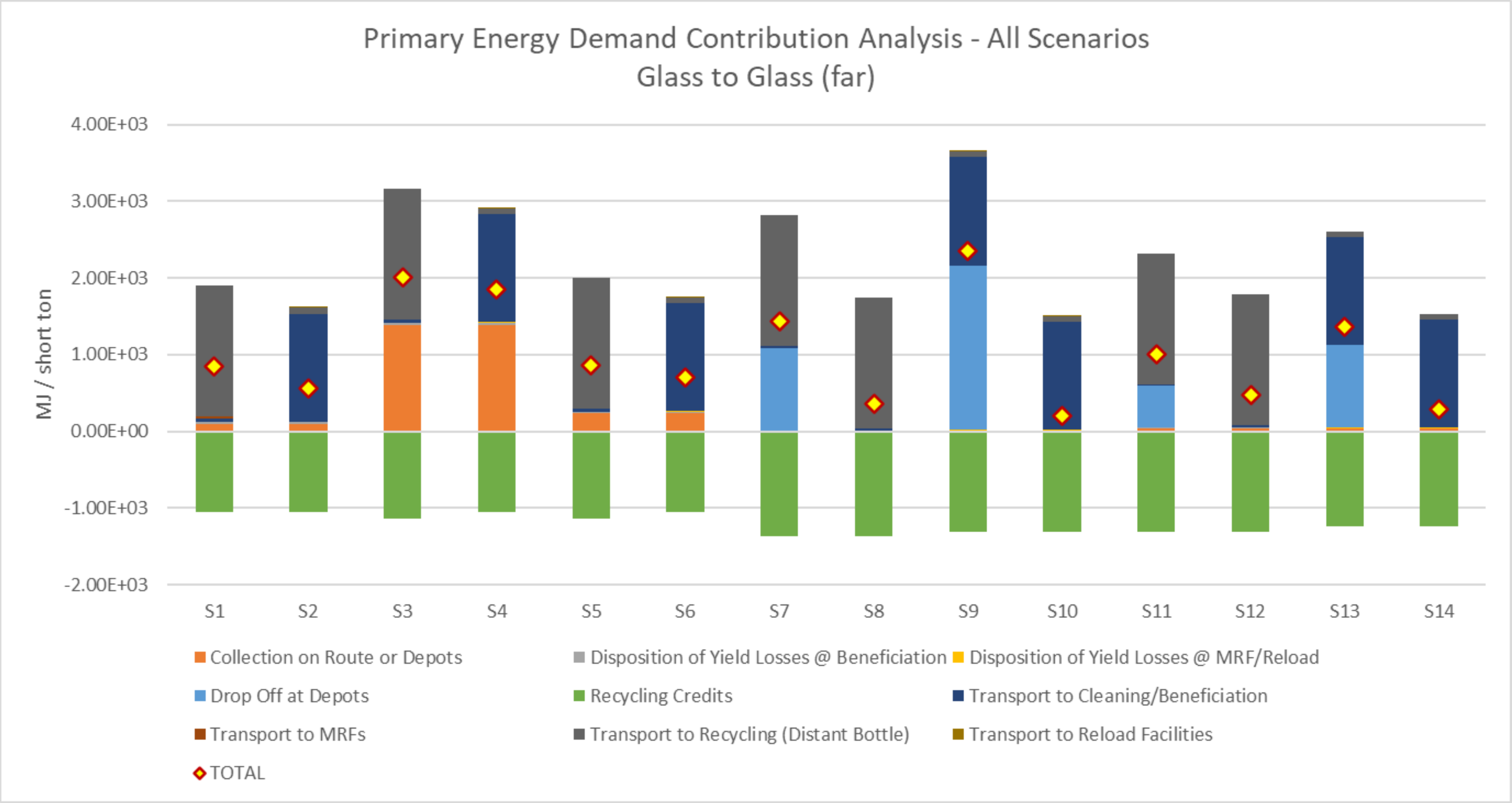
Indicator Results – Fossil Resource Use



Indicator Results – Bluewater Consumption



Indicator Results – Primary Energy Demand (PED)

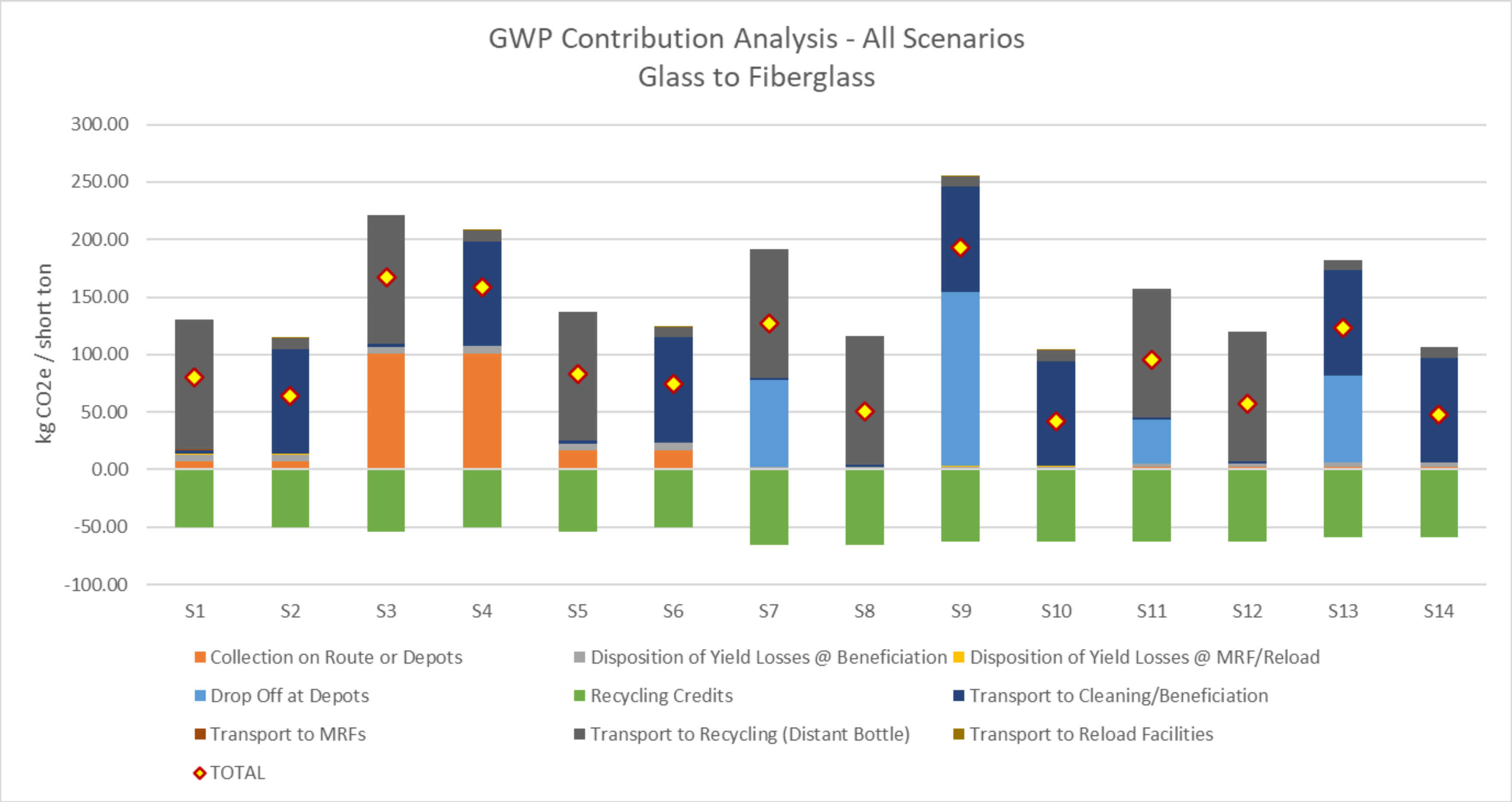


“Glass to Fiberglass” Results

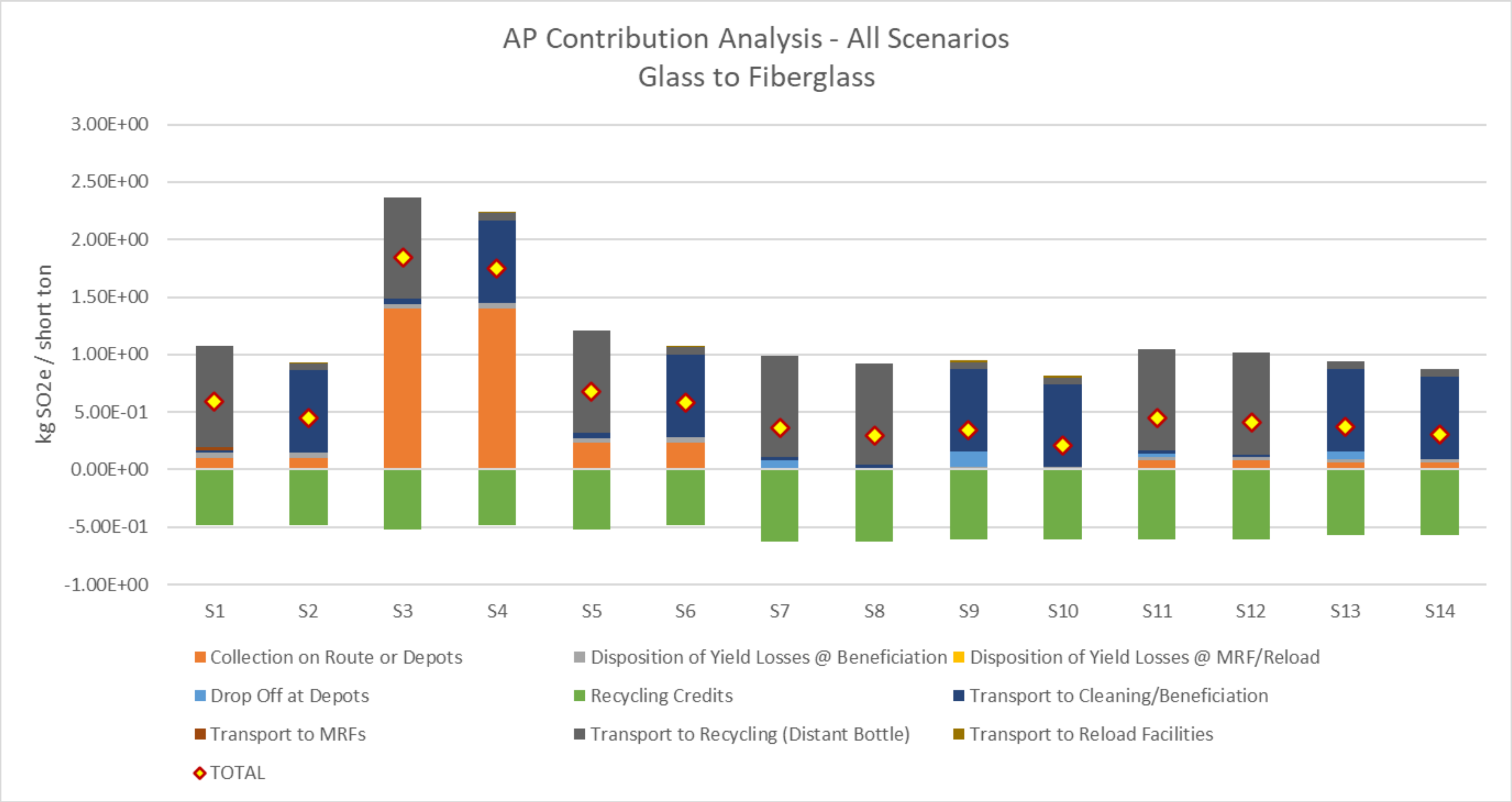
Owens Corning

Santa Clara, CA

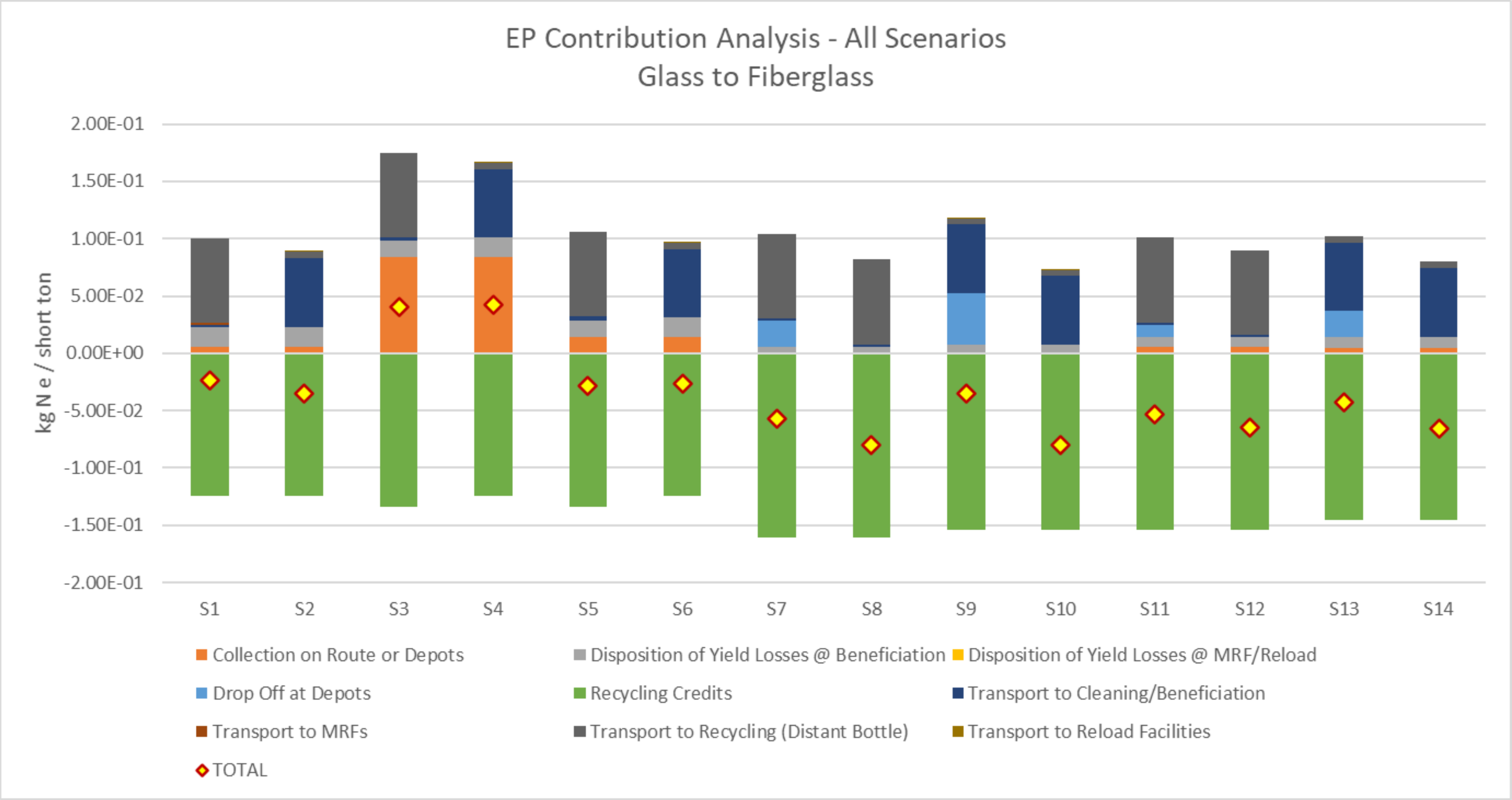
LCIA Results – Global Warming Potential (GWP)



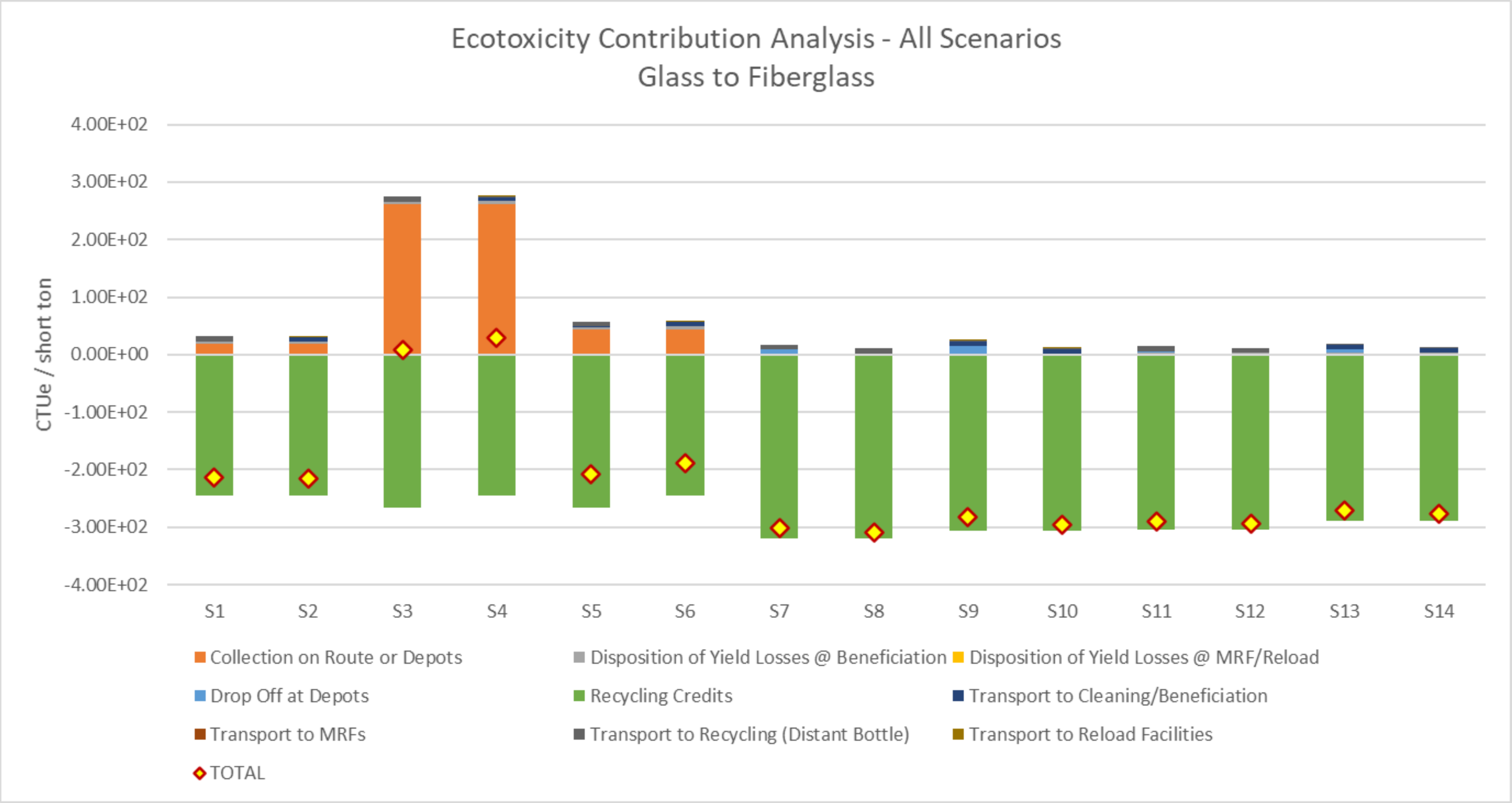
LCIA Results – Acidification Potential (AP)



LCIA Results – Eutrophication Potential (EP)

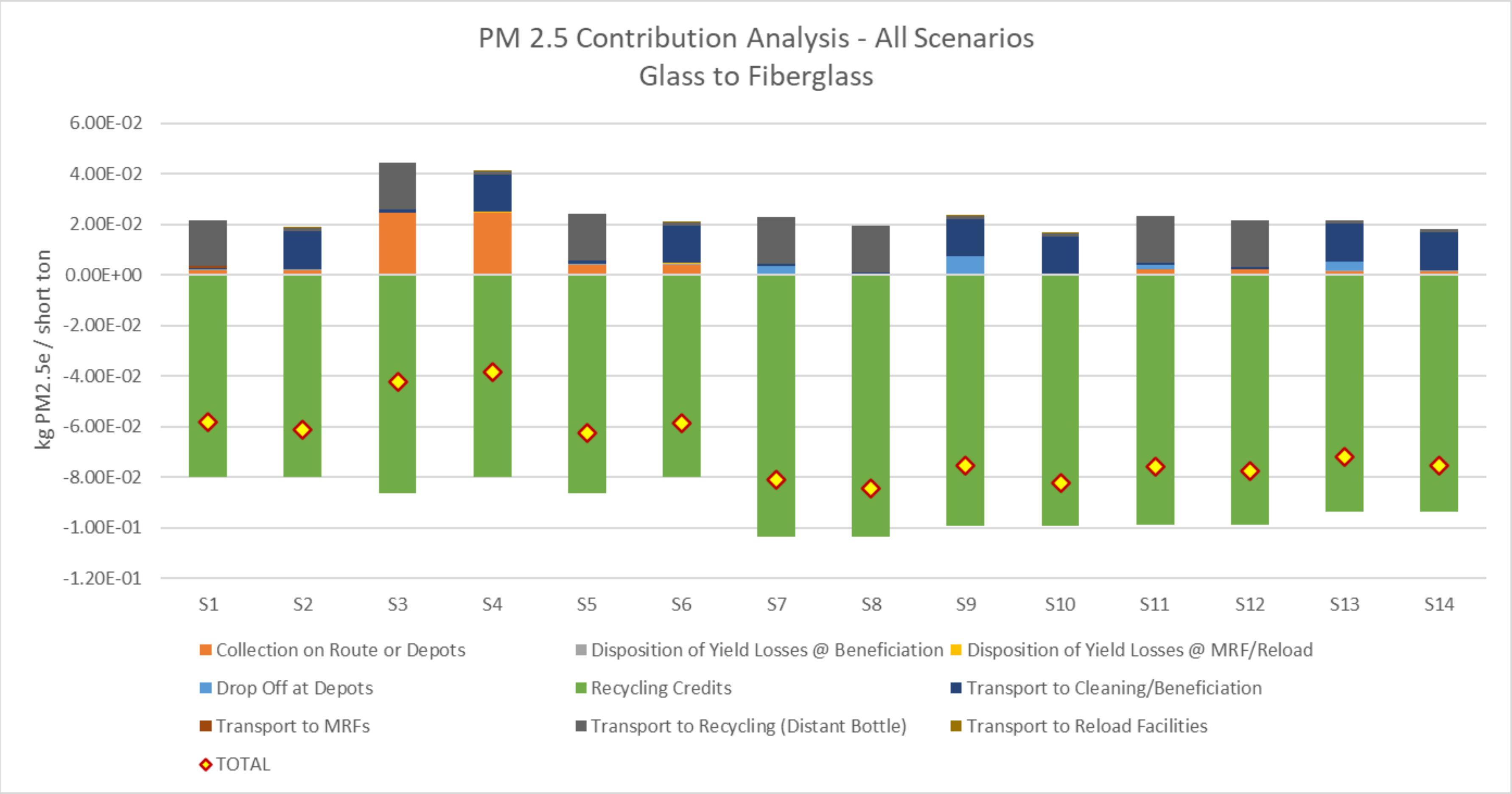


LCIA Results – Ecotoxicity Potential (ETP)

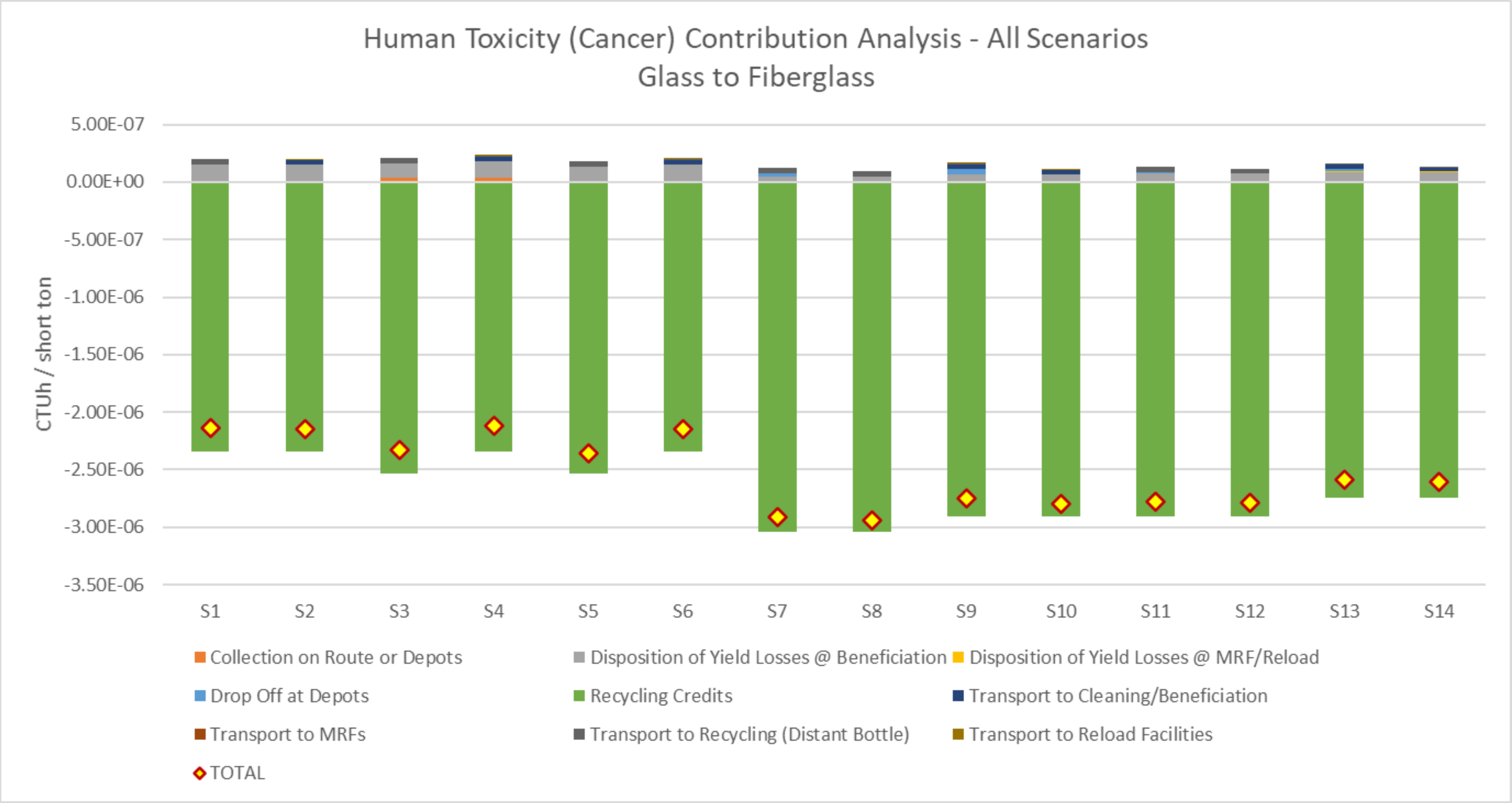


DEQ

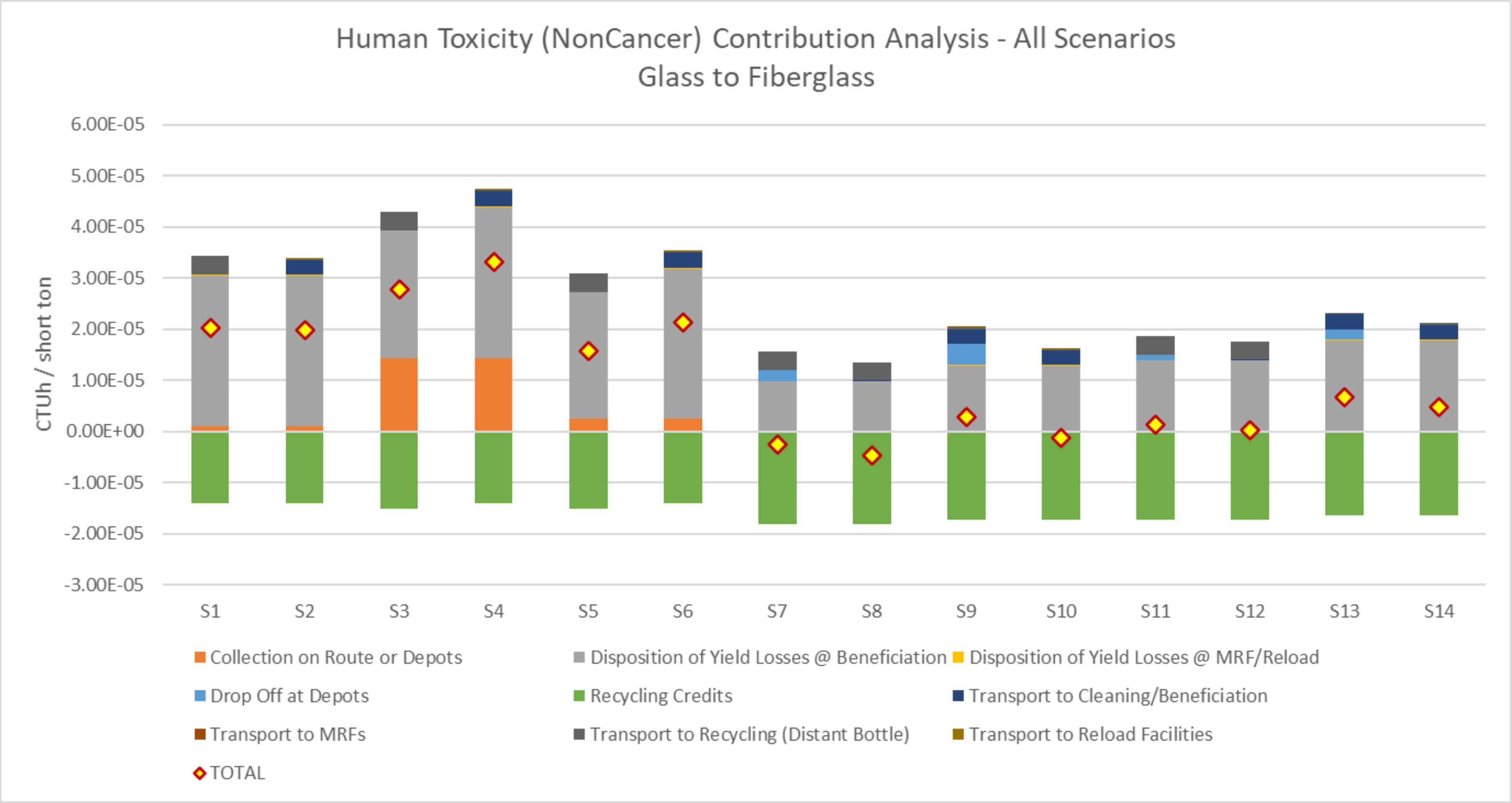
LCIA Results – Particulate Matter (PM 2.5)



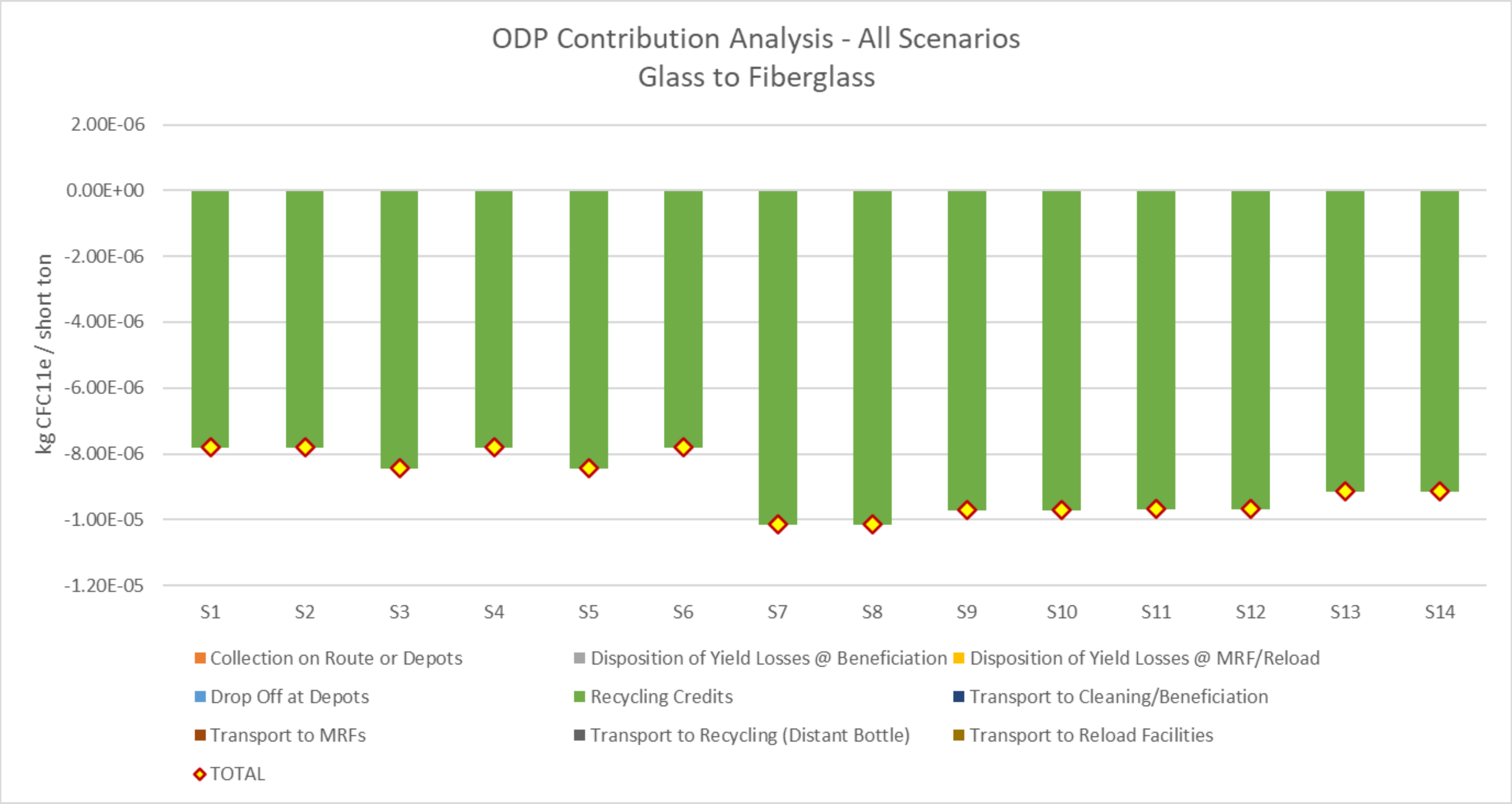
LCIA Results – Human Toxicity Potential (Cancer)



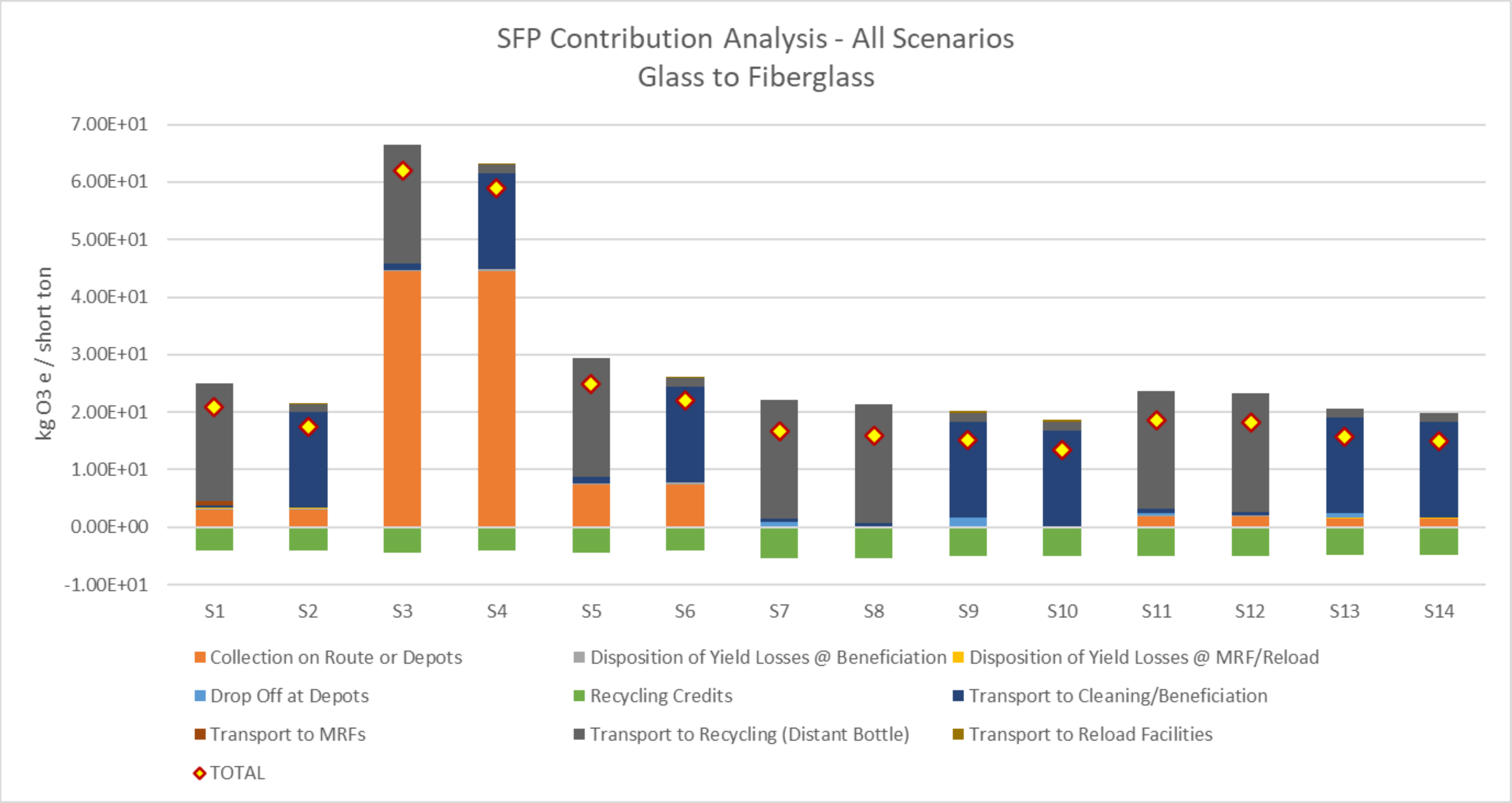
LCIA Results - Human Toxicity Potential (NonCancer)



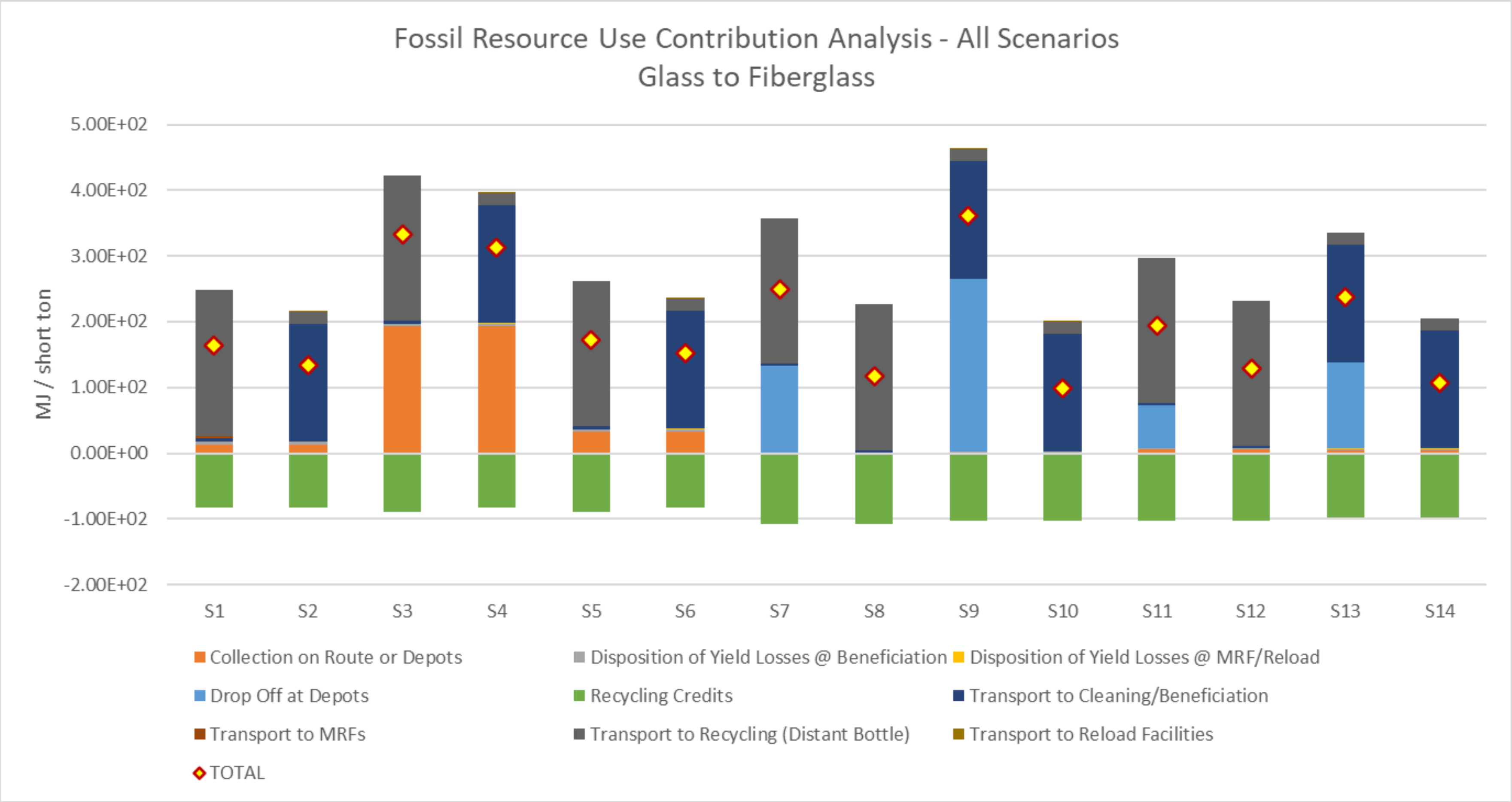
LCIA Results – Ozone Depletion Potential (ODP)



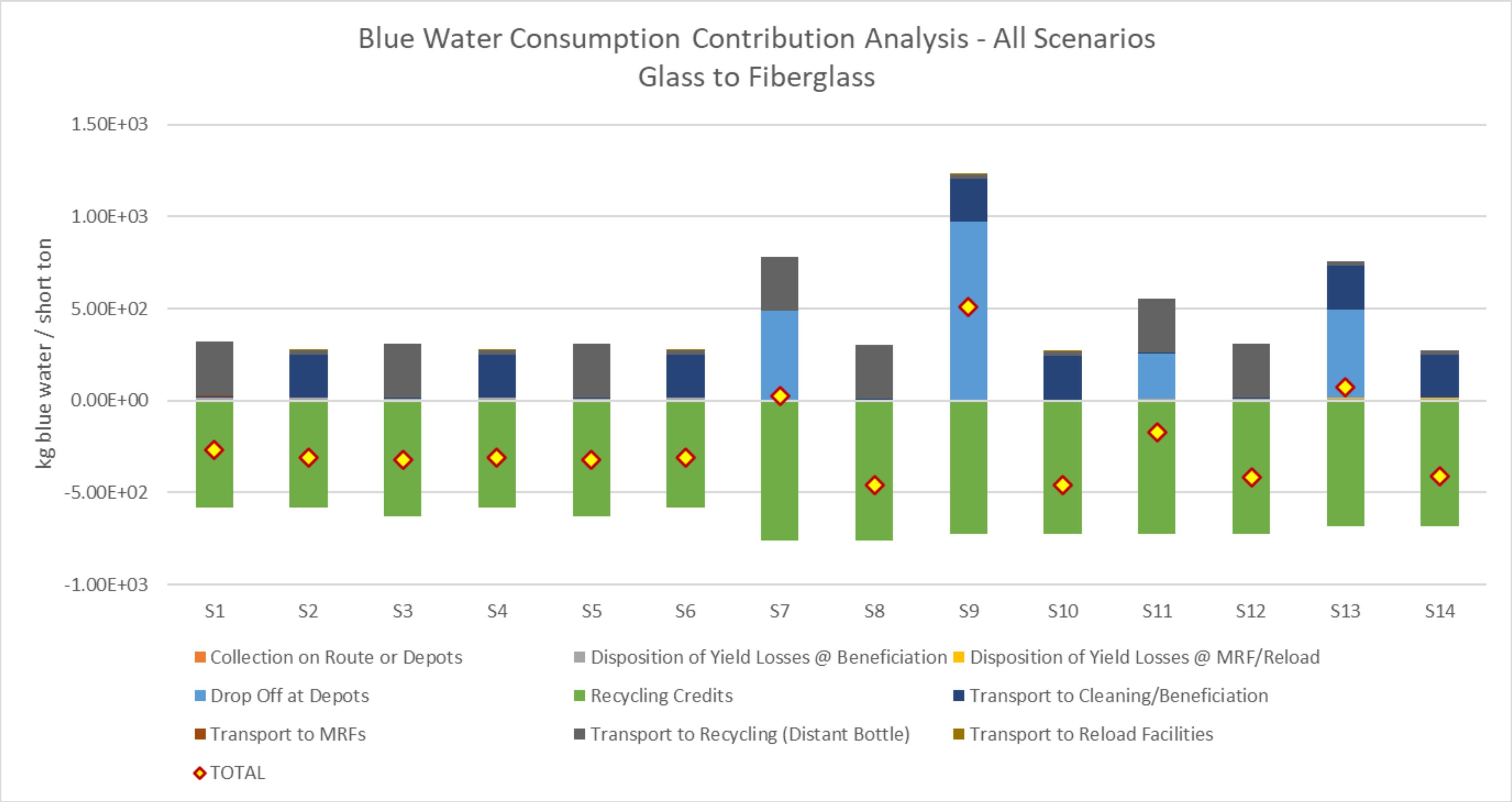
LCIA Results – Smog Formation Potential (SFP)



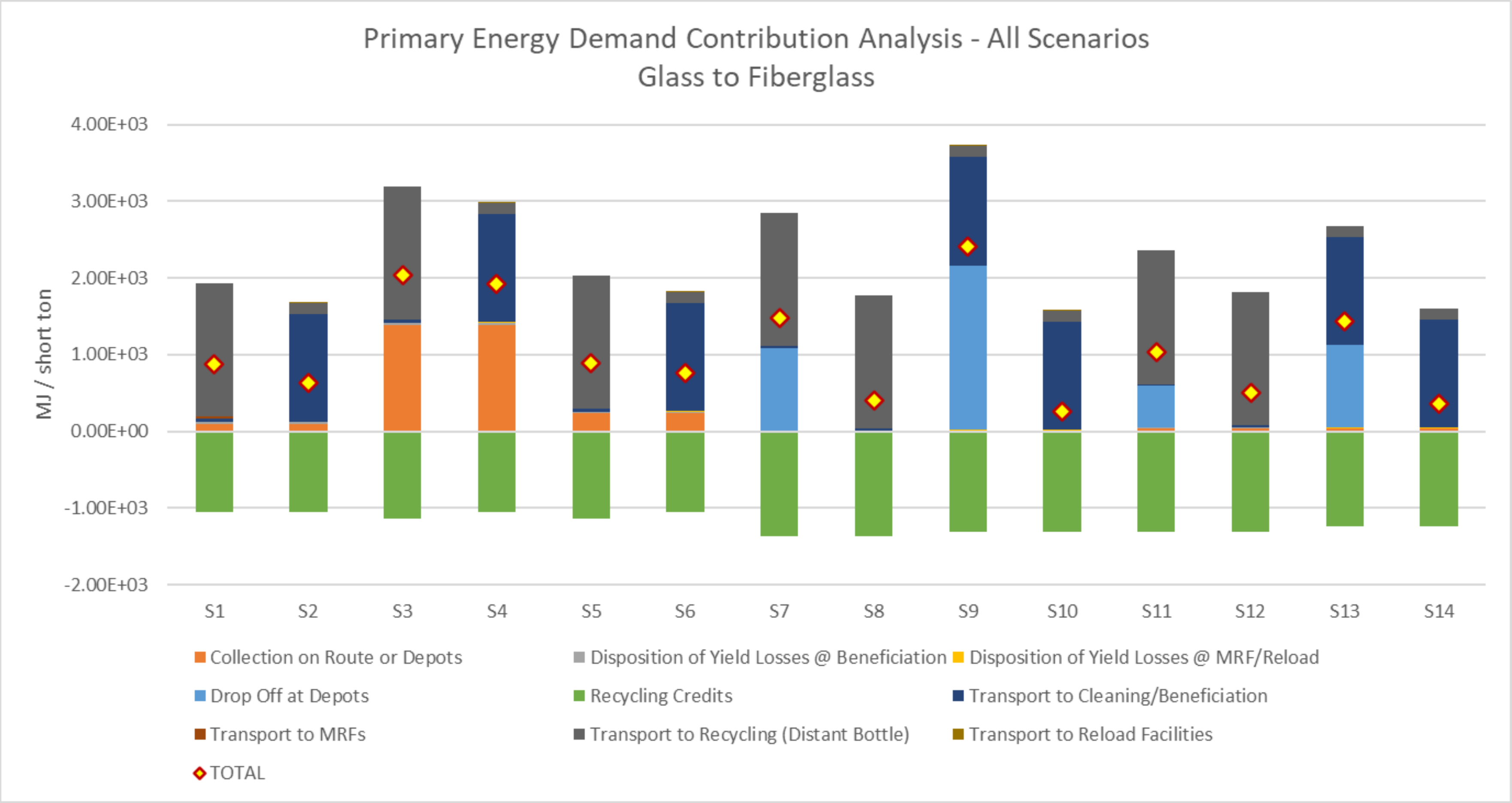
Indicator Results – Fossil Resource Use



Indicator Results – Bluewater Consumption



Indicator Results – Primary Energy Demand (PED)

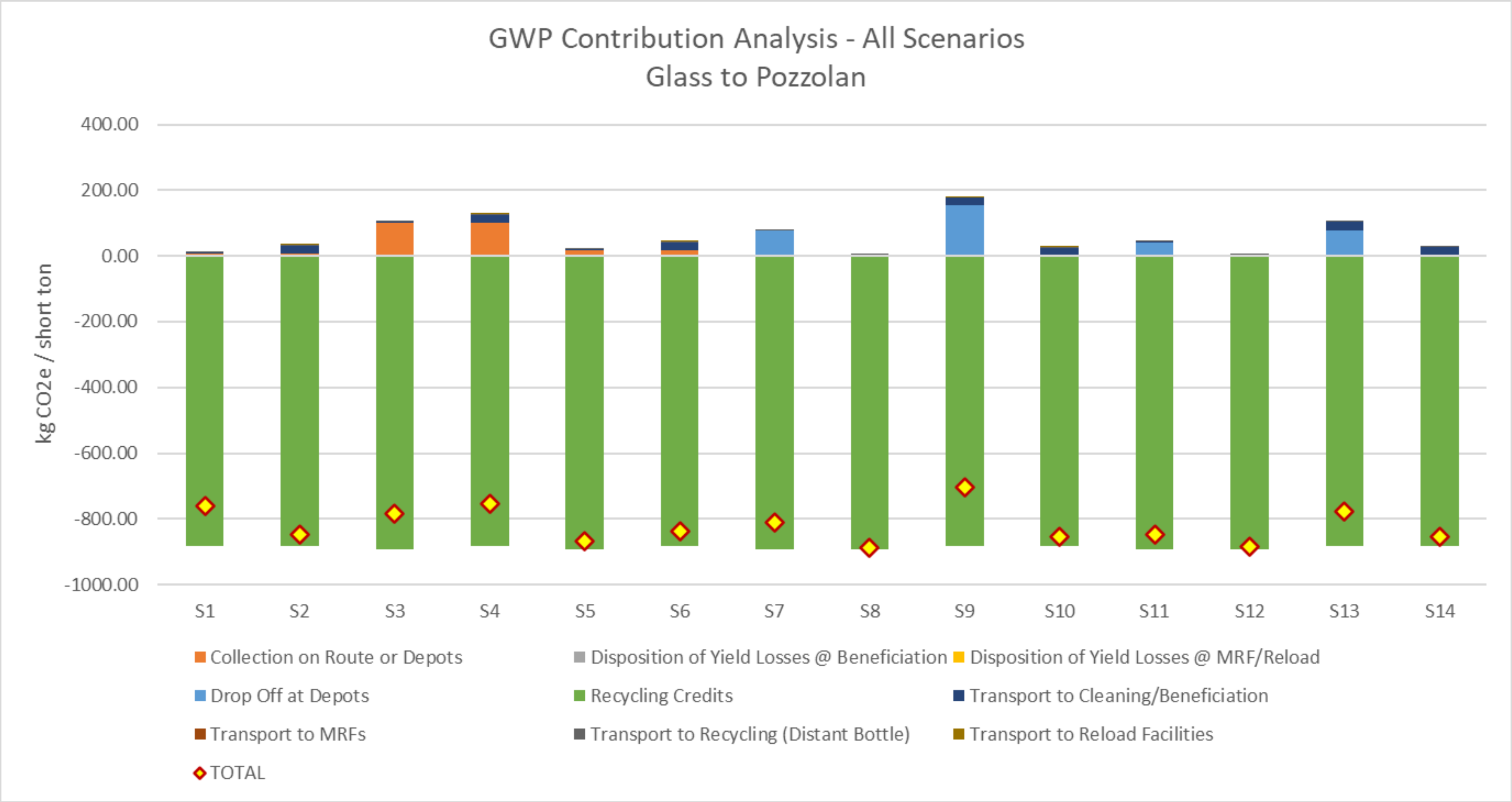


“Glass to Pozzolan” Results

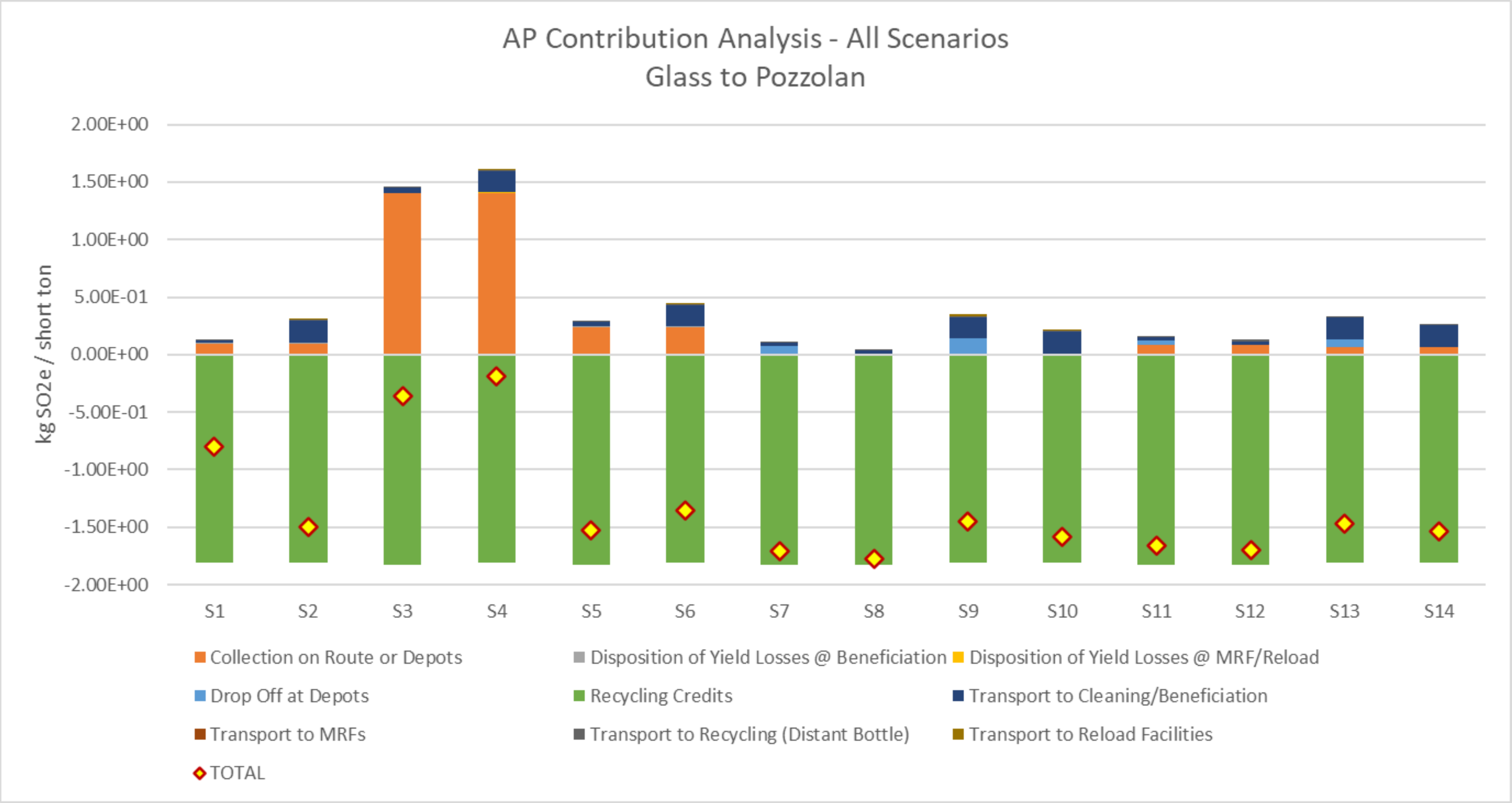
Hypothetical Plant

Vancouver, WA

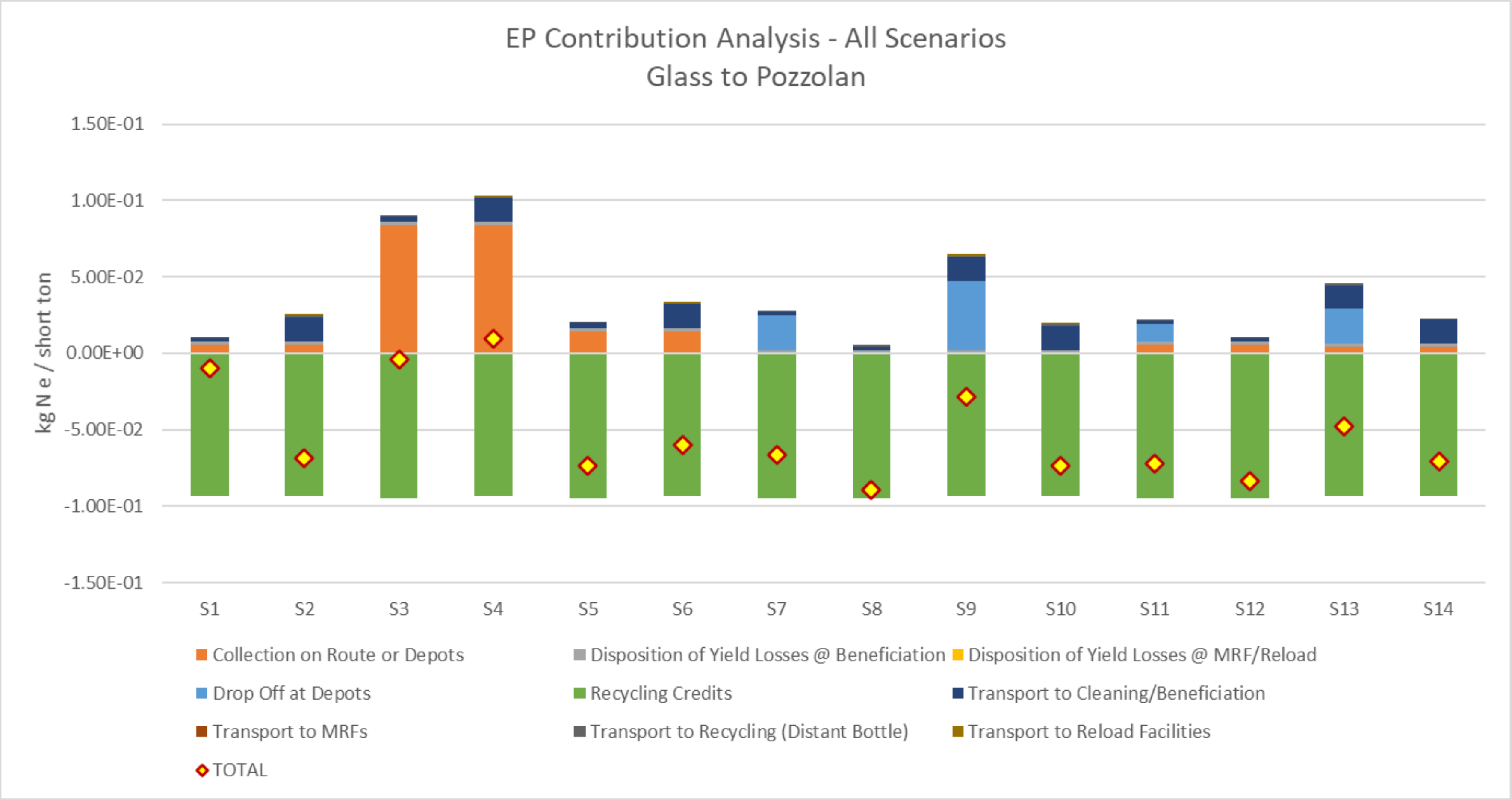
LCIA Results – Global Warming Potential (GWP)



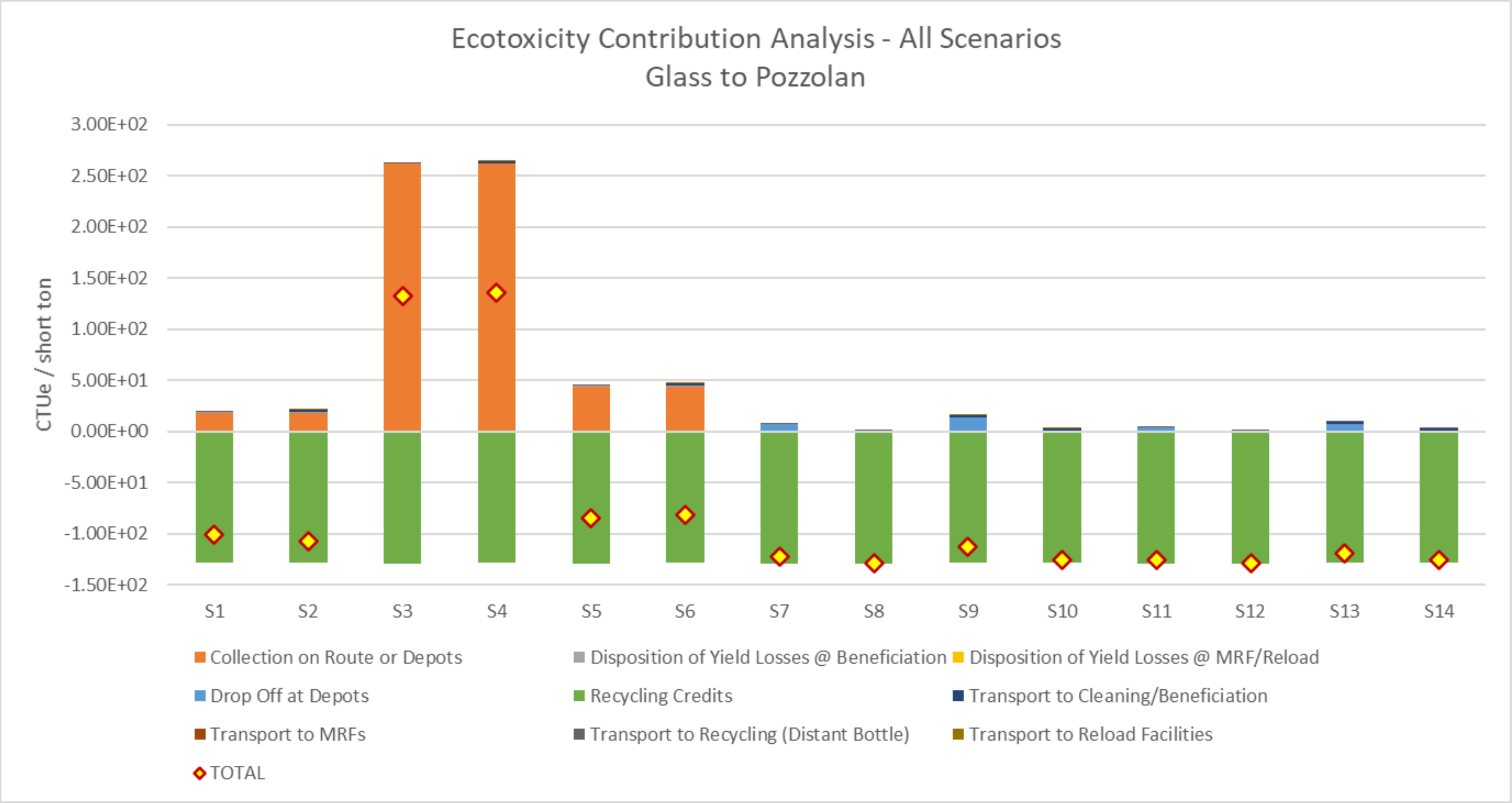
LCIA Results – Acidification Potential (AP)



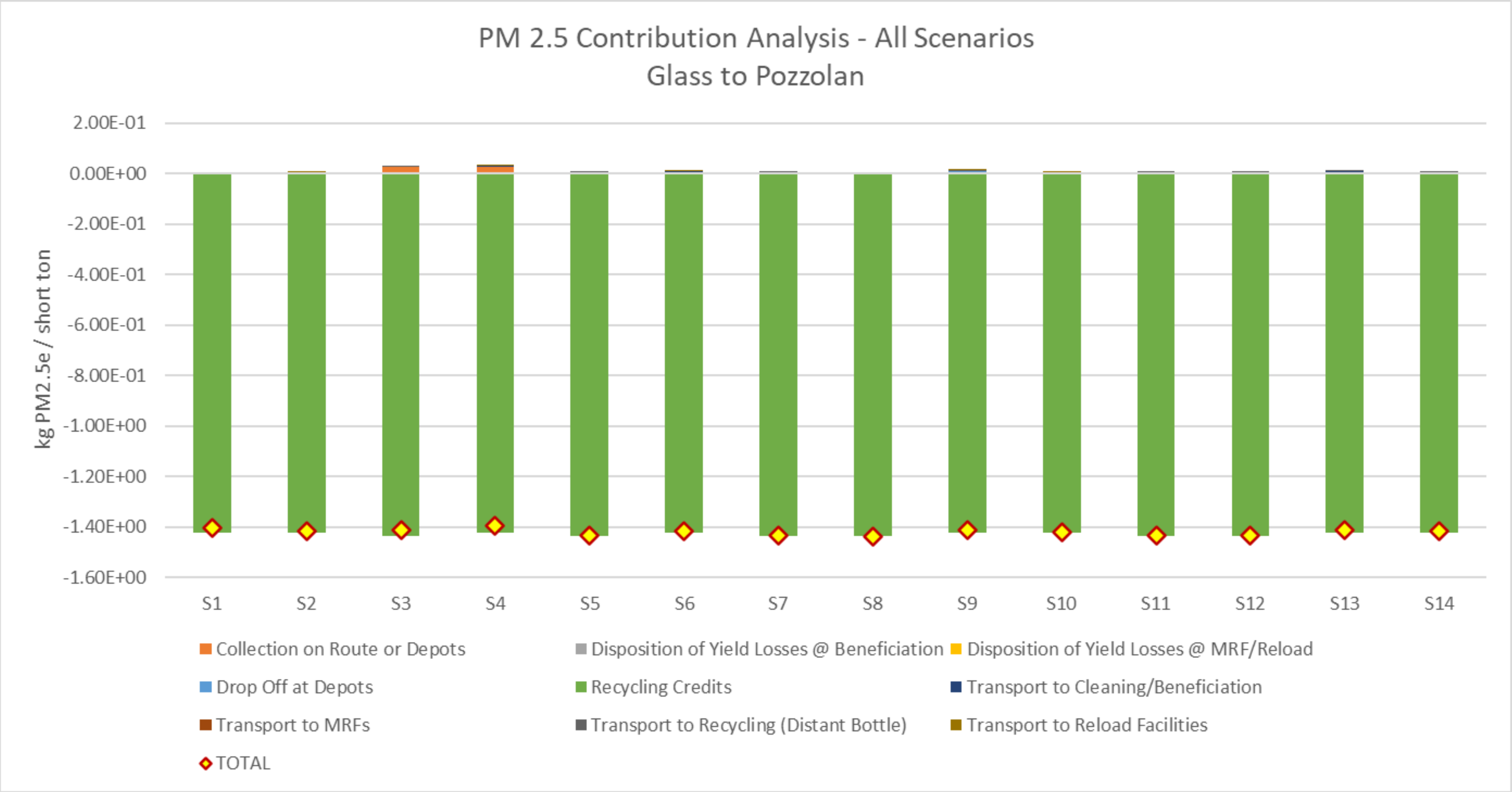
LCIA Results – Eutrophication Potential (EP)



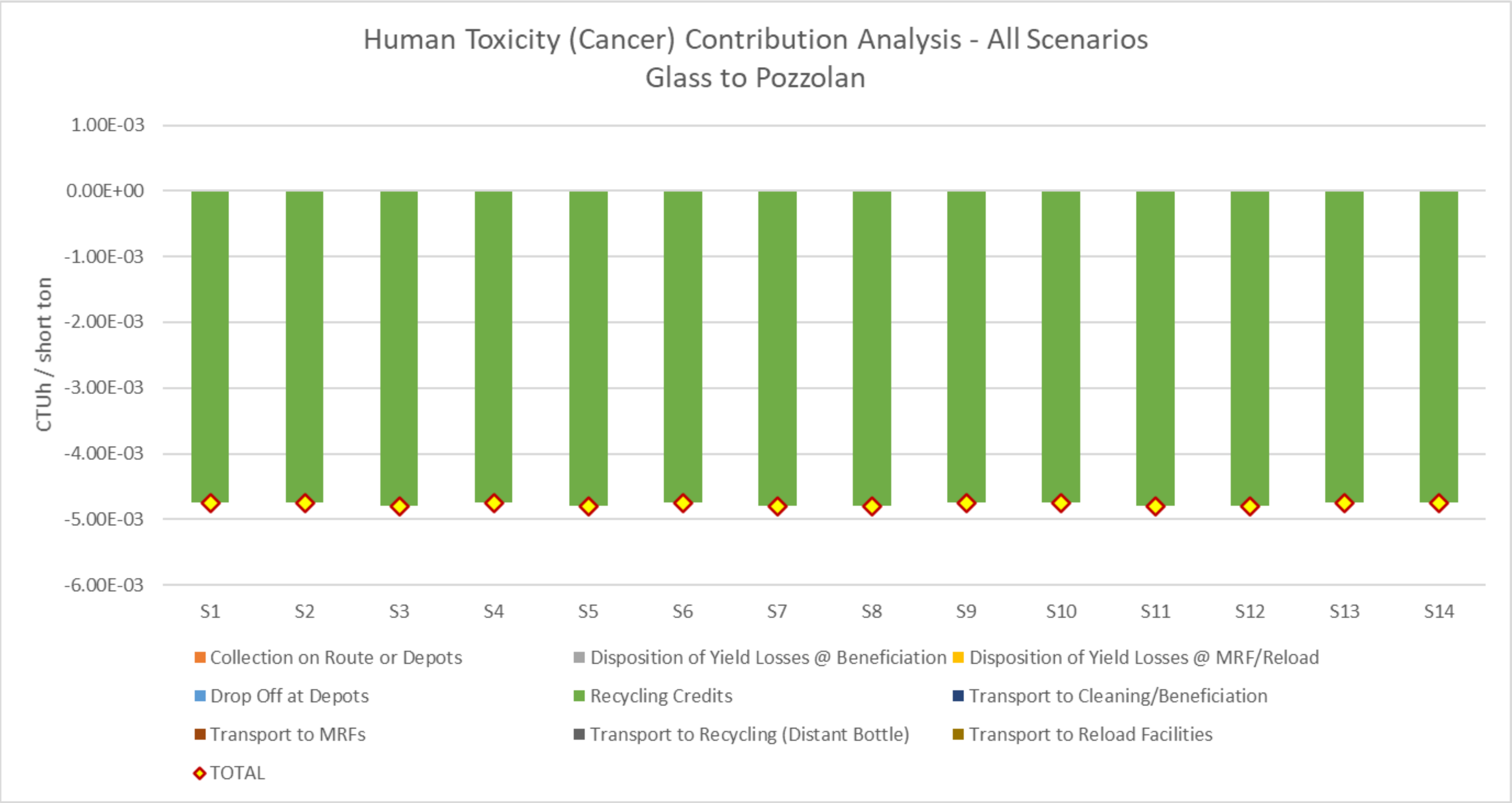
LCIA Results – Ecotoxicity Potential (ETP)



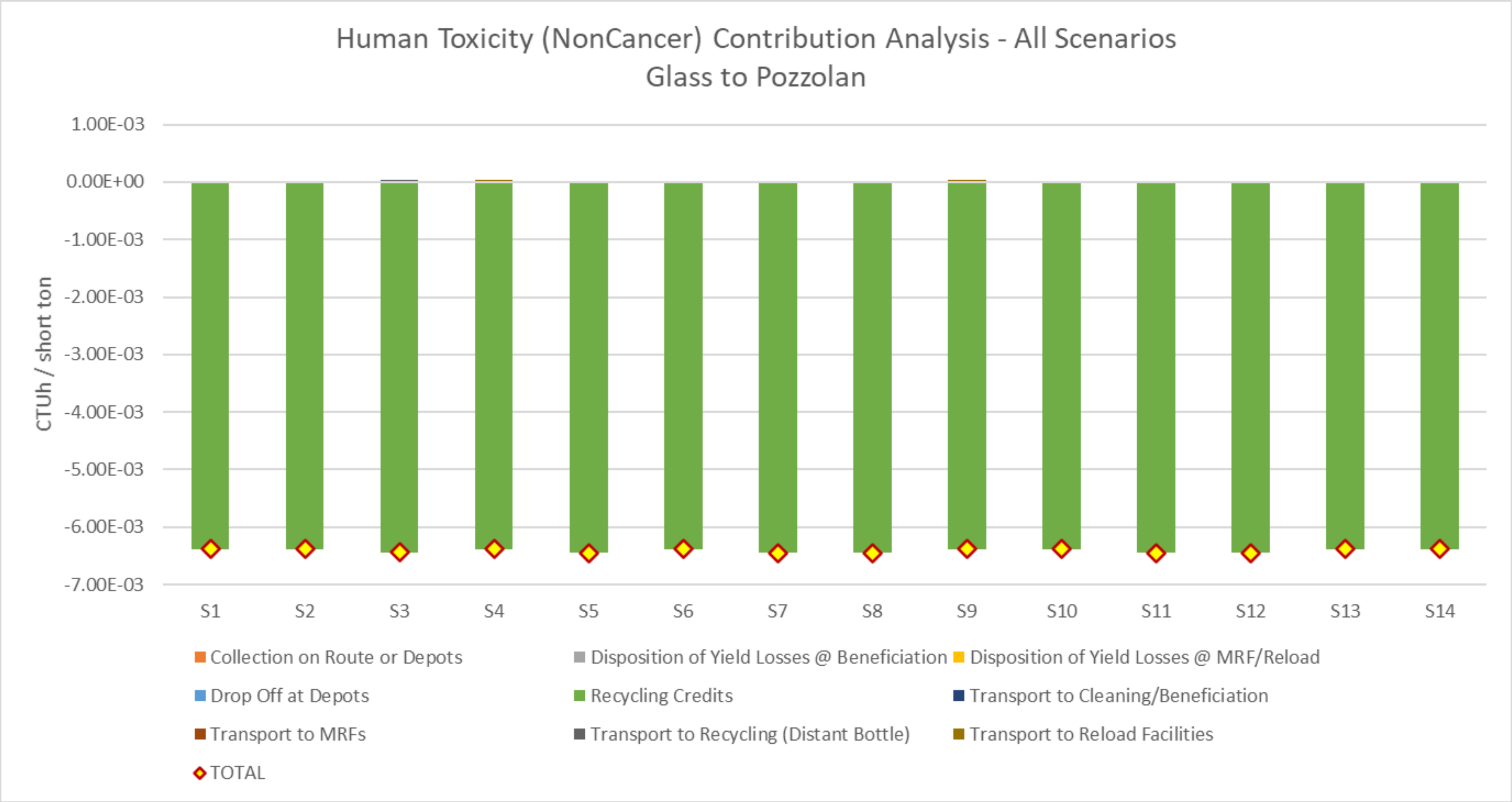
LCIA Results – Particulate Matter (PM 2.5)



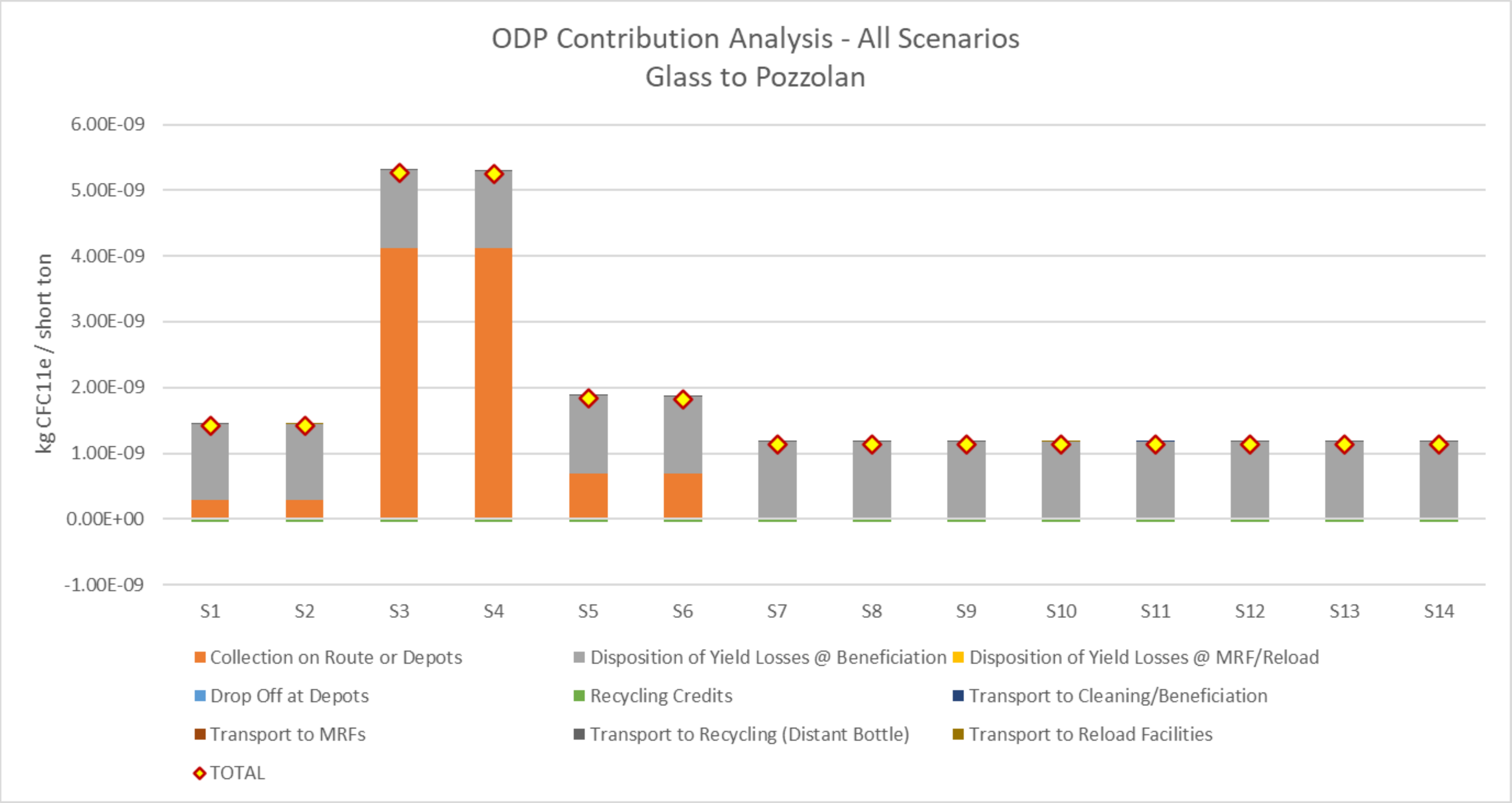
LCIA Results – Human Toxicity Potential (Cancer)



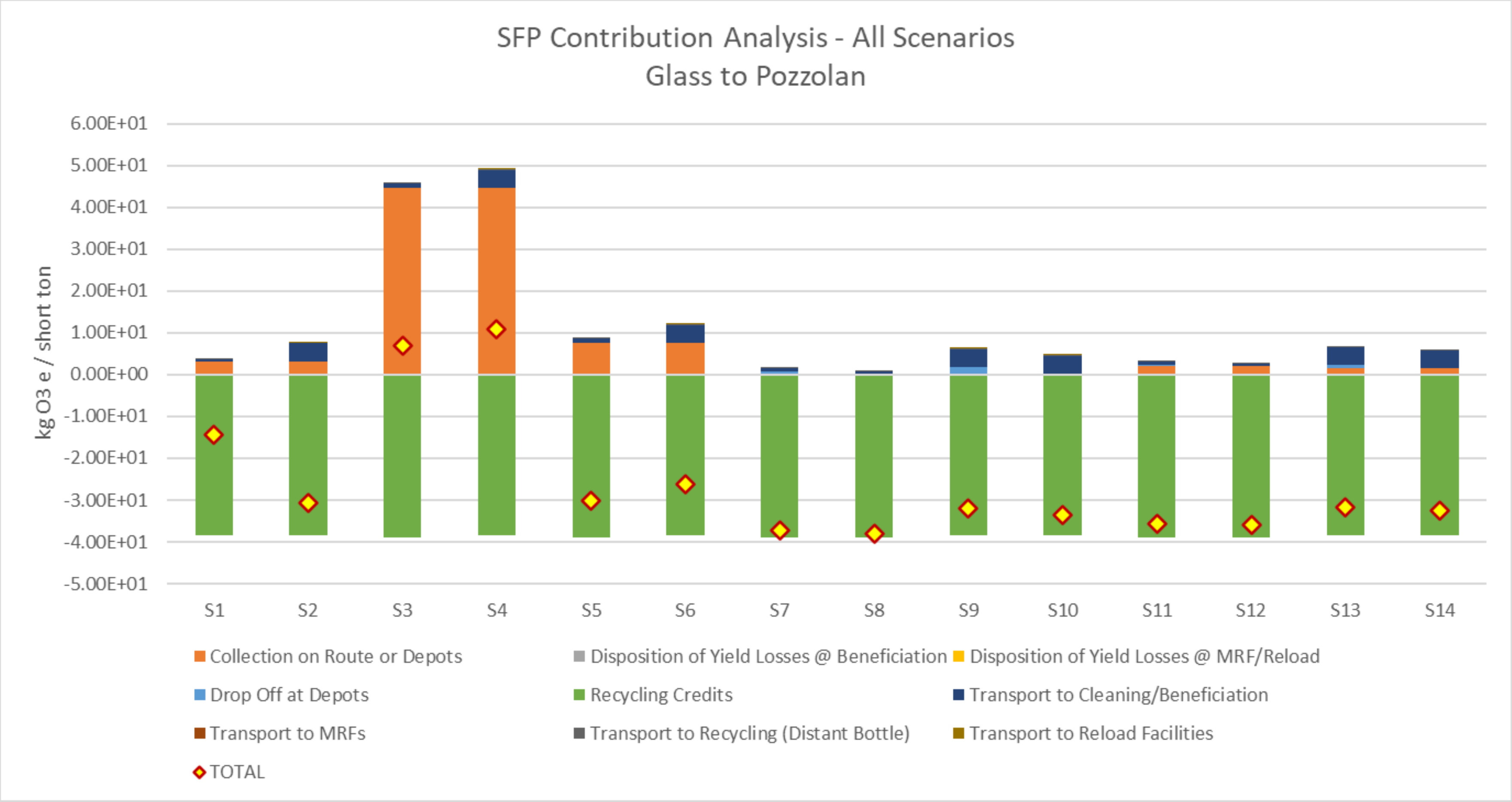
LCIA Results - Human Toxicity Potential (NonCancer)



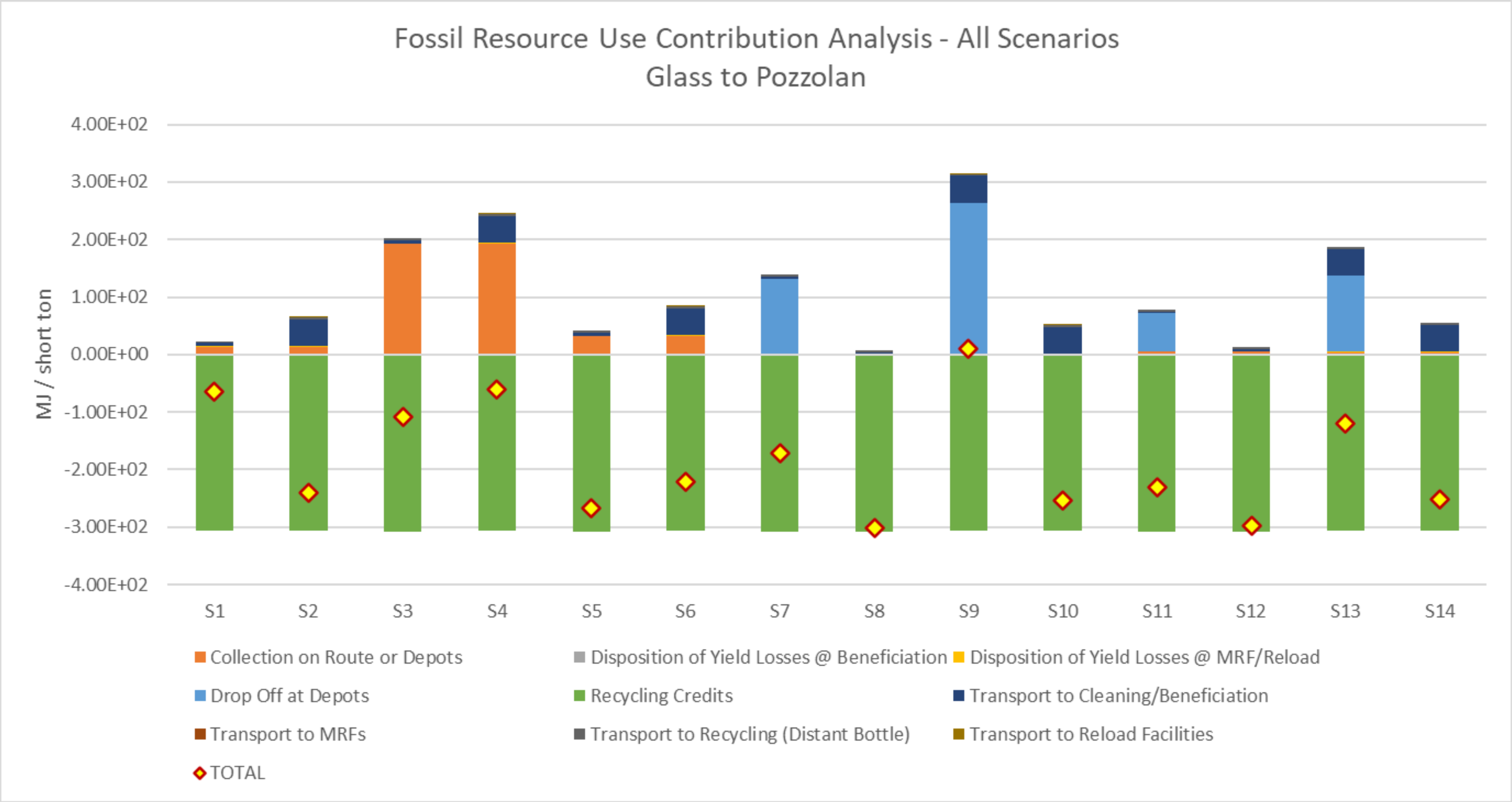
LCIA Results – Ozone Depletion Potential (ODP)



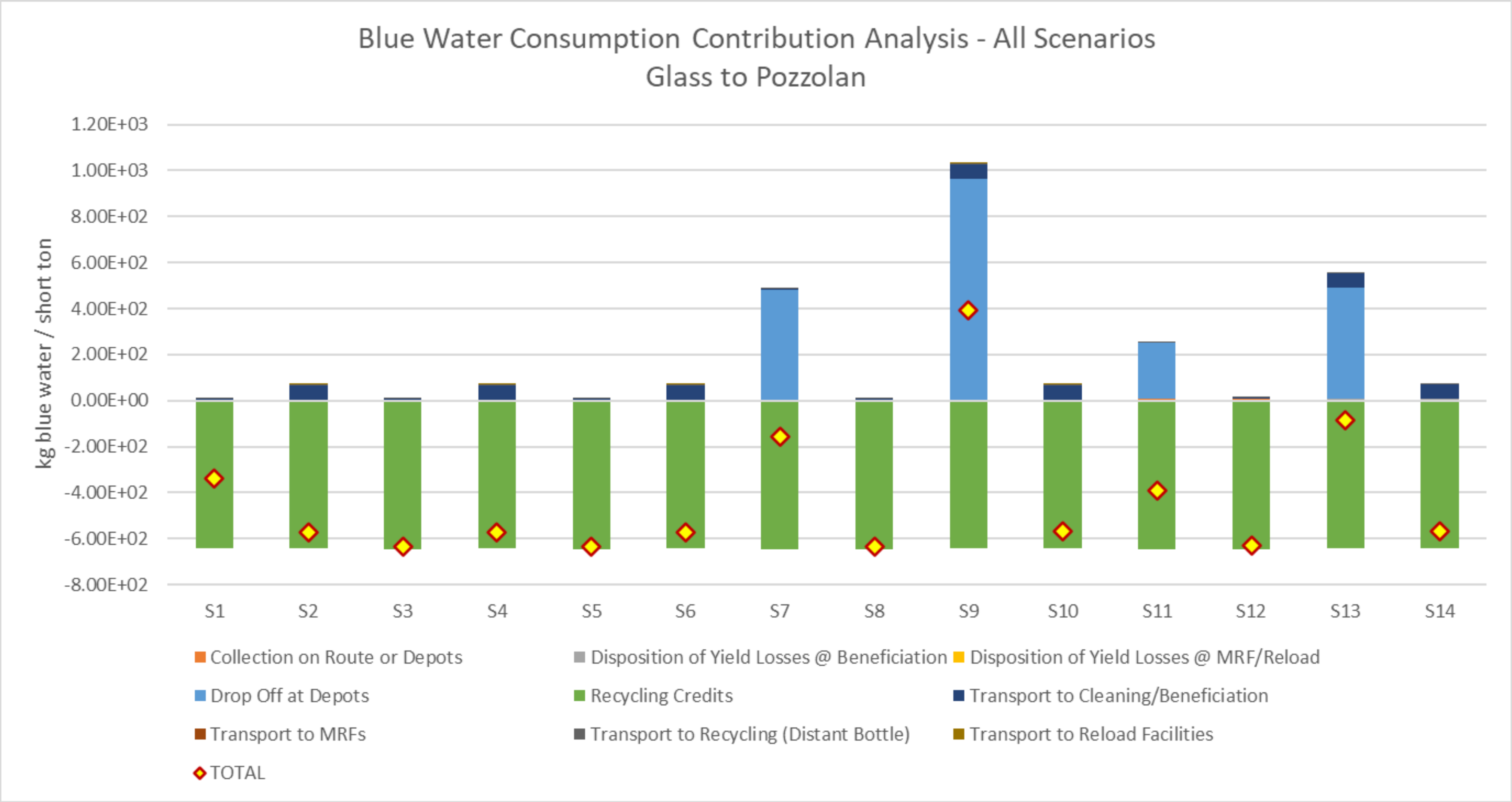
LCIA Results – Smog Formation Potential (SFP)



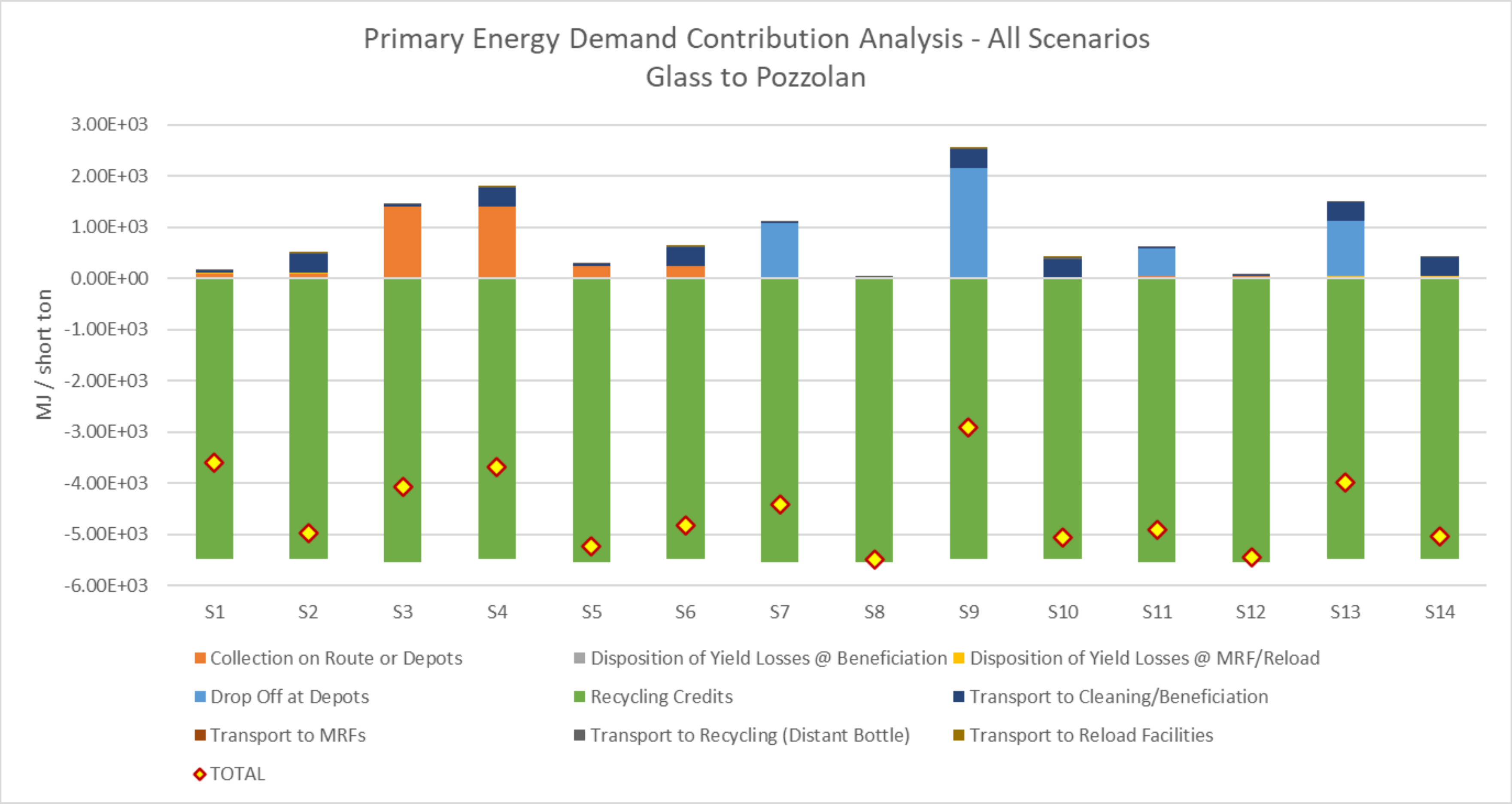
Indicator Results – Fossil Resource Use



Indicator Results – Bluewater Consumption



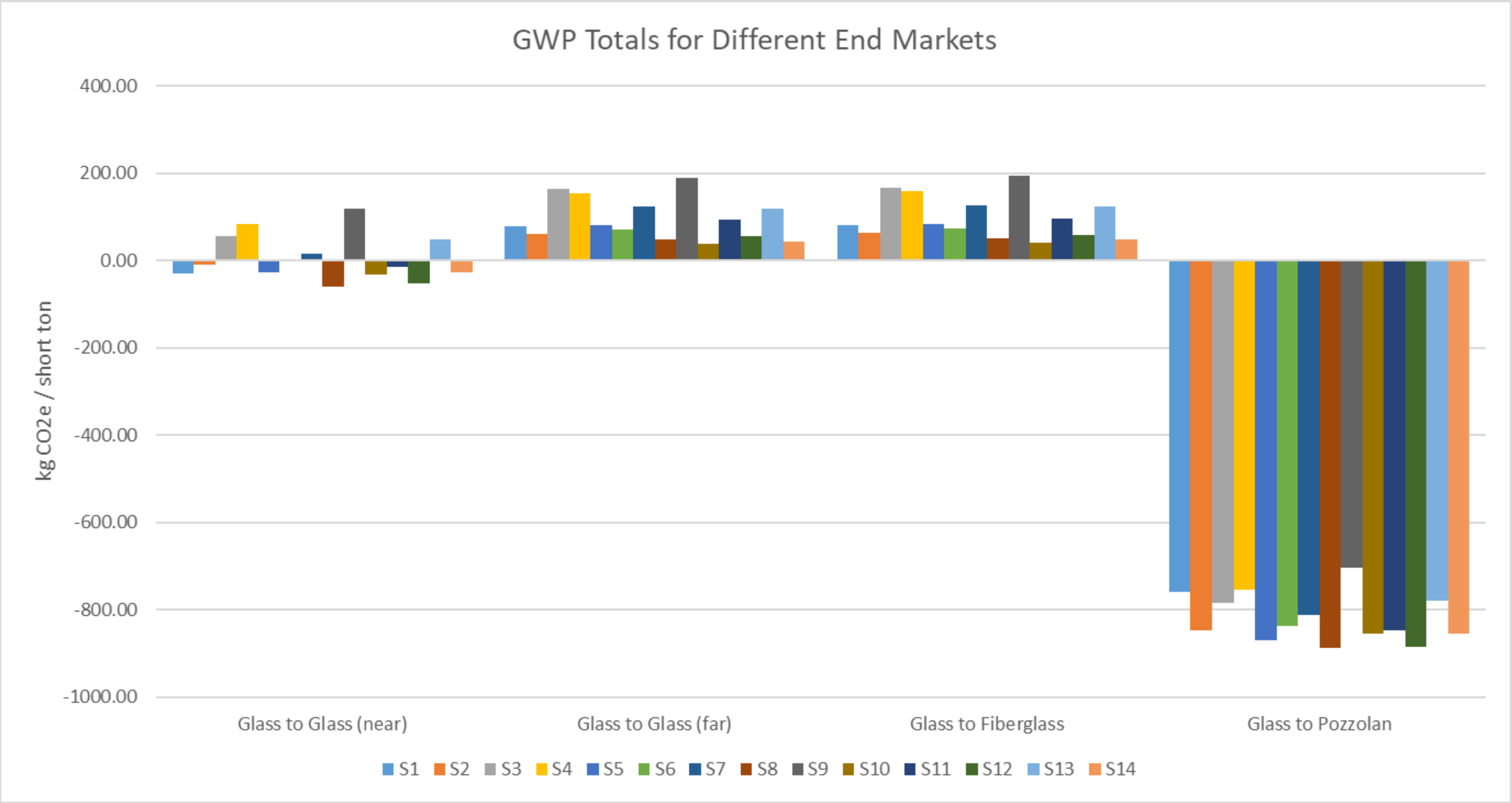
Indicator Results – Primary Energy Demand (PED)



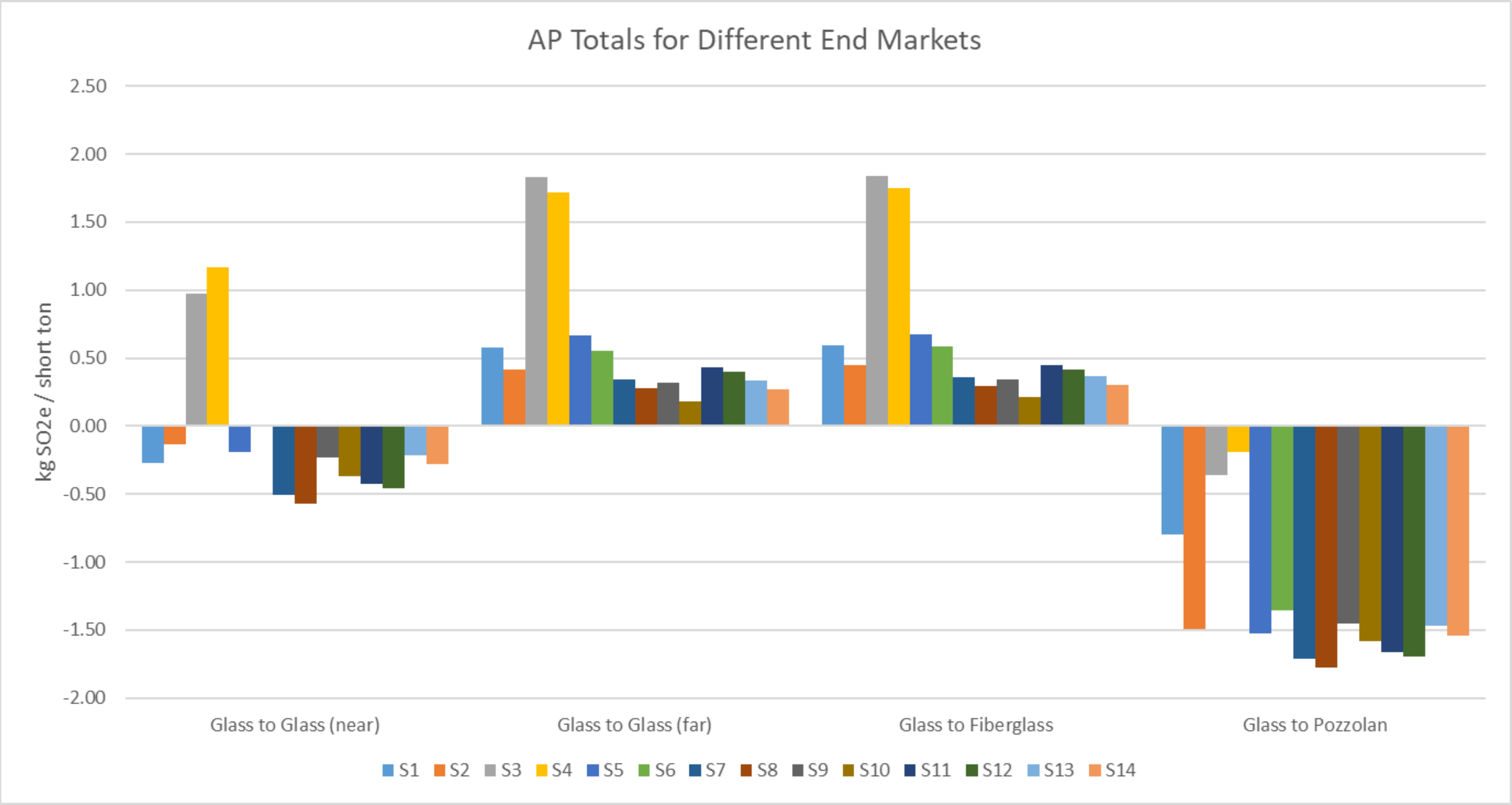
Comparison of End Markets

Glass to Glass vs. Glass to Fiberglass vs. Glass to Pozzolan

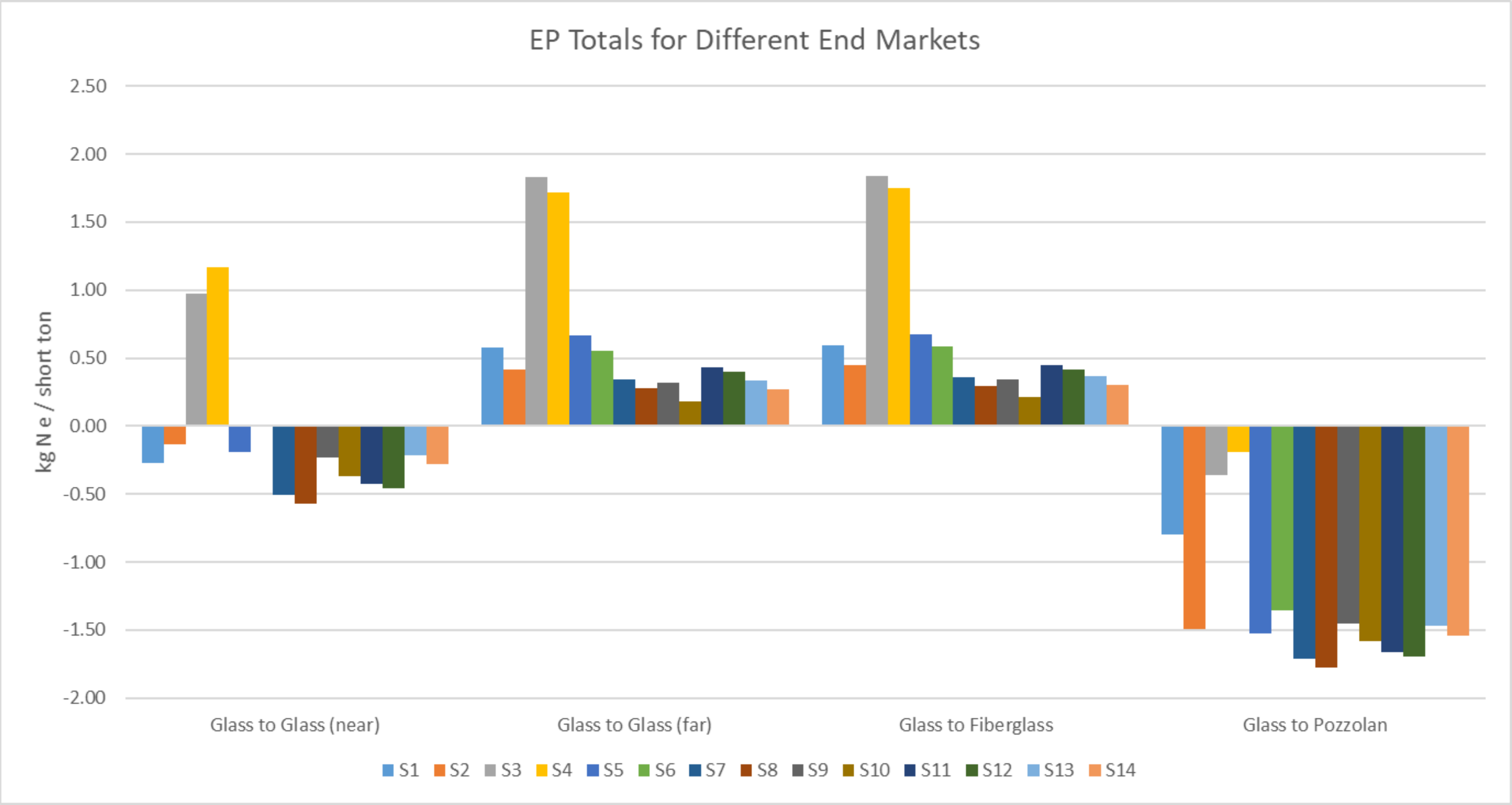
LCIA Results – Global Warming Potential (GWP)



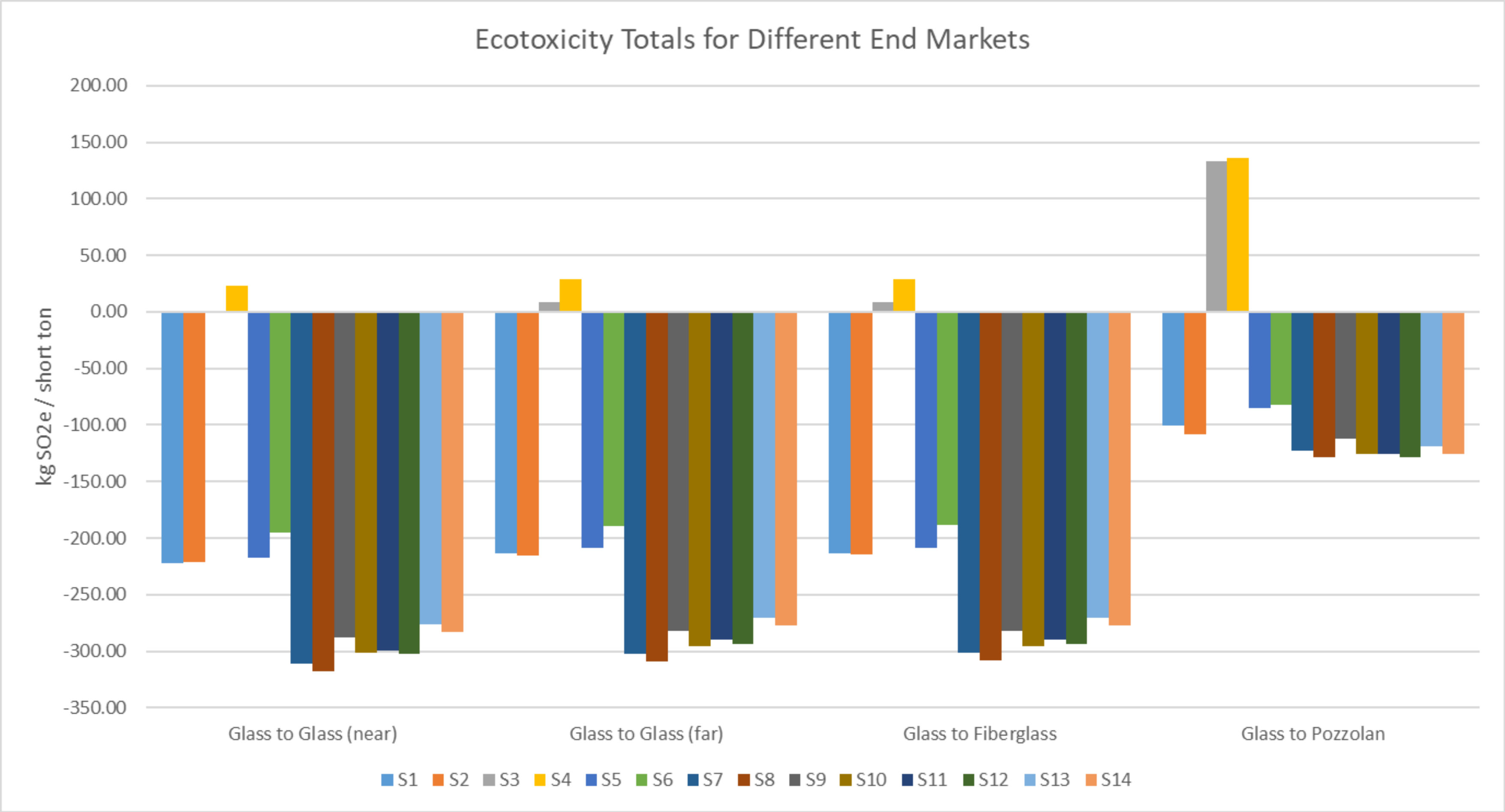
LCIA Results – Acidification Potential (AP)



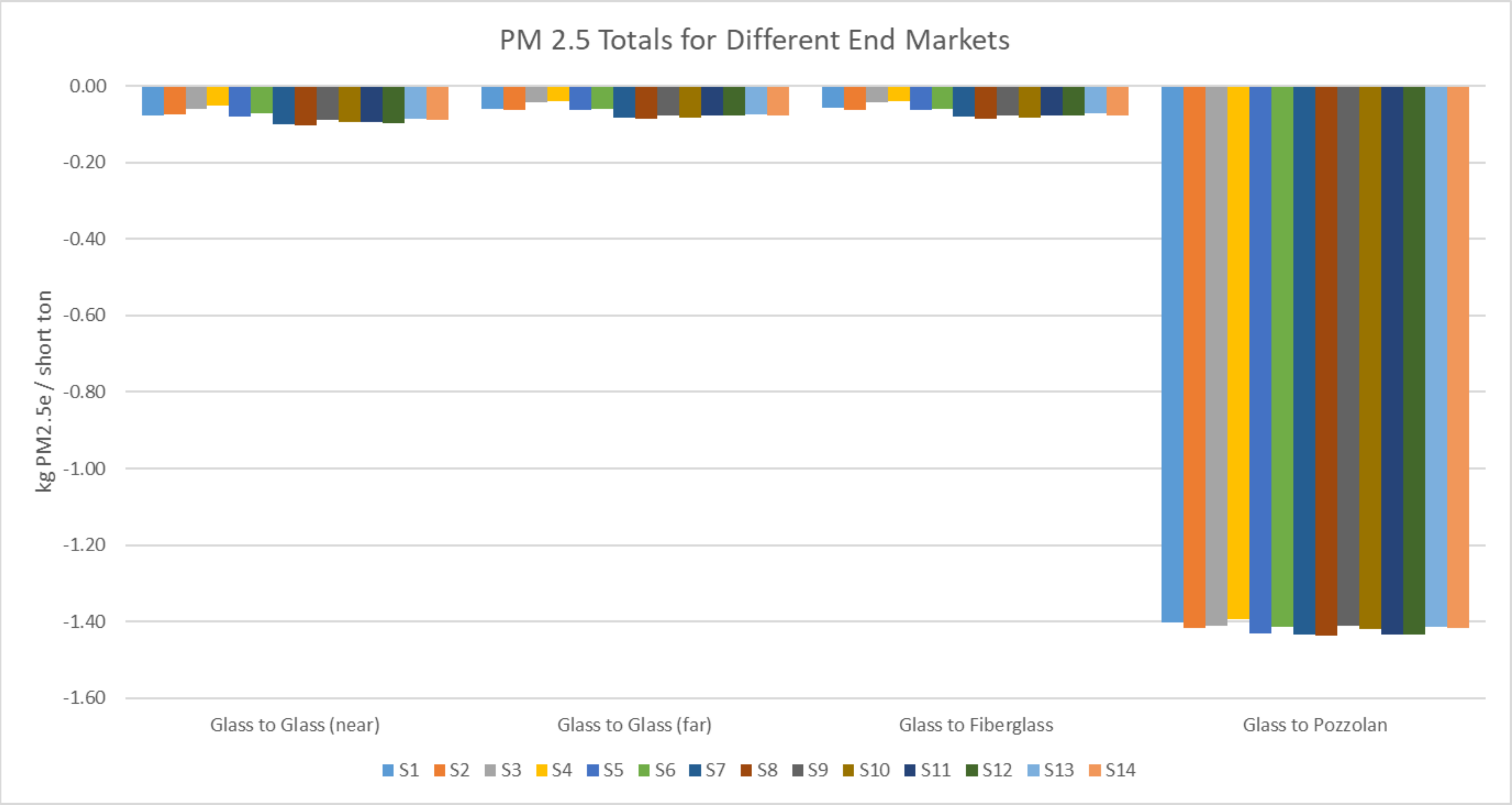
LCIA Results – Eutrophication Potential (EP)



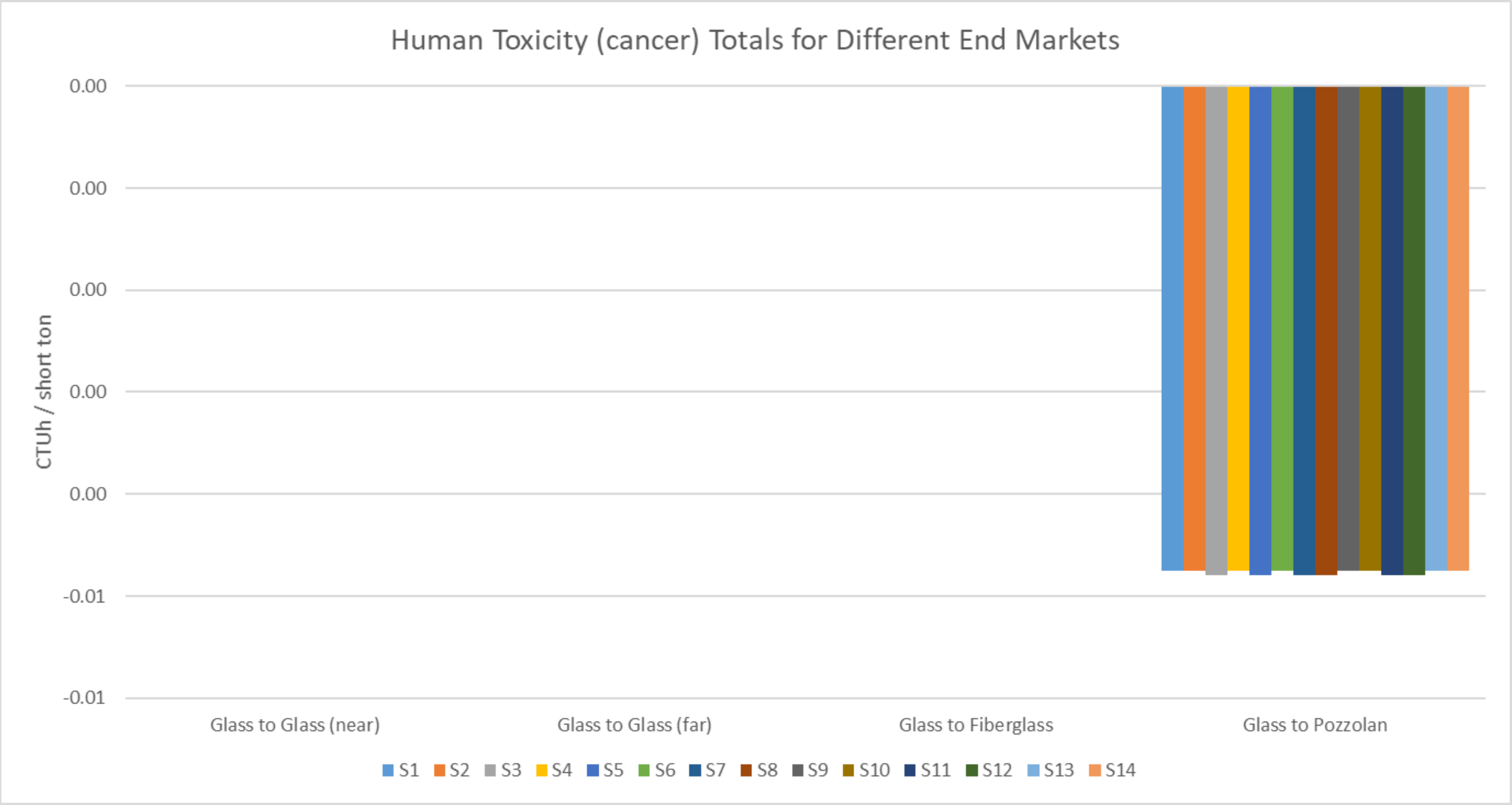
LCIA Results – Ecotoxicity Potential (ETP)



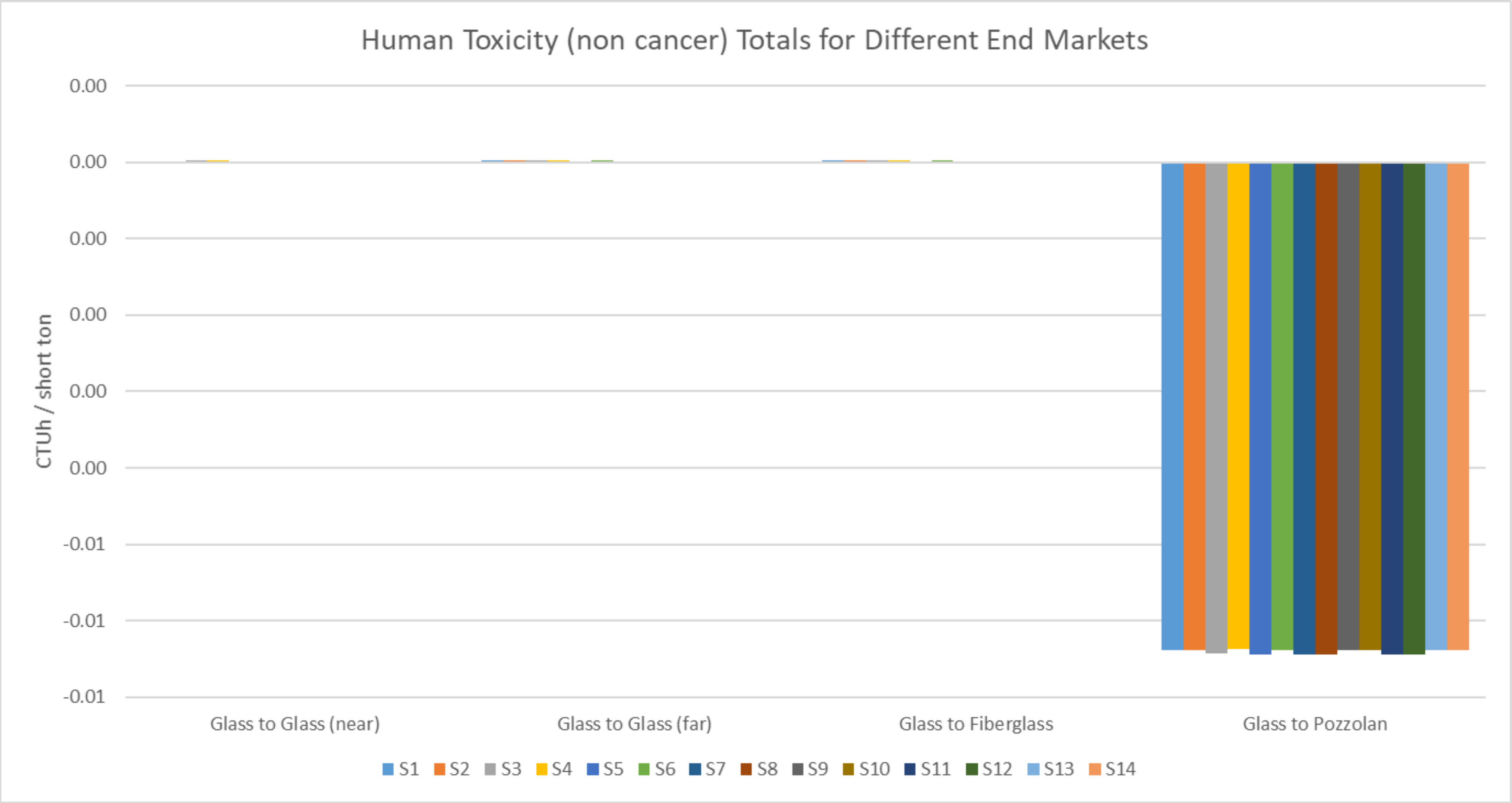
LCIA Results – Particulate Matter (PM 2.5)



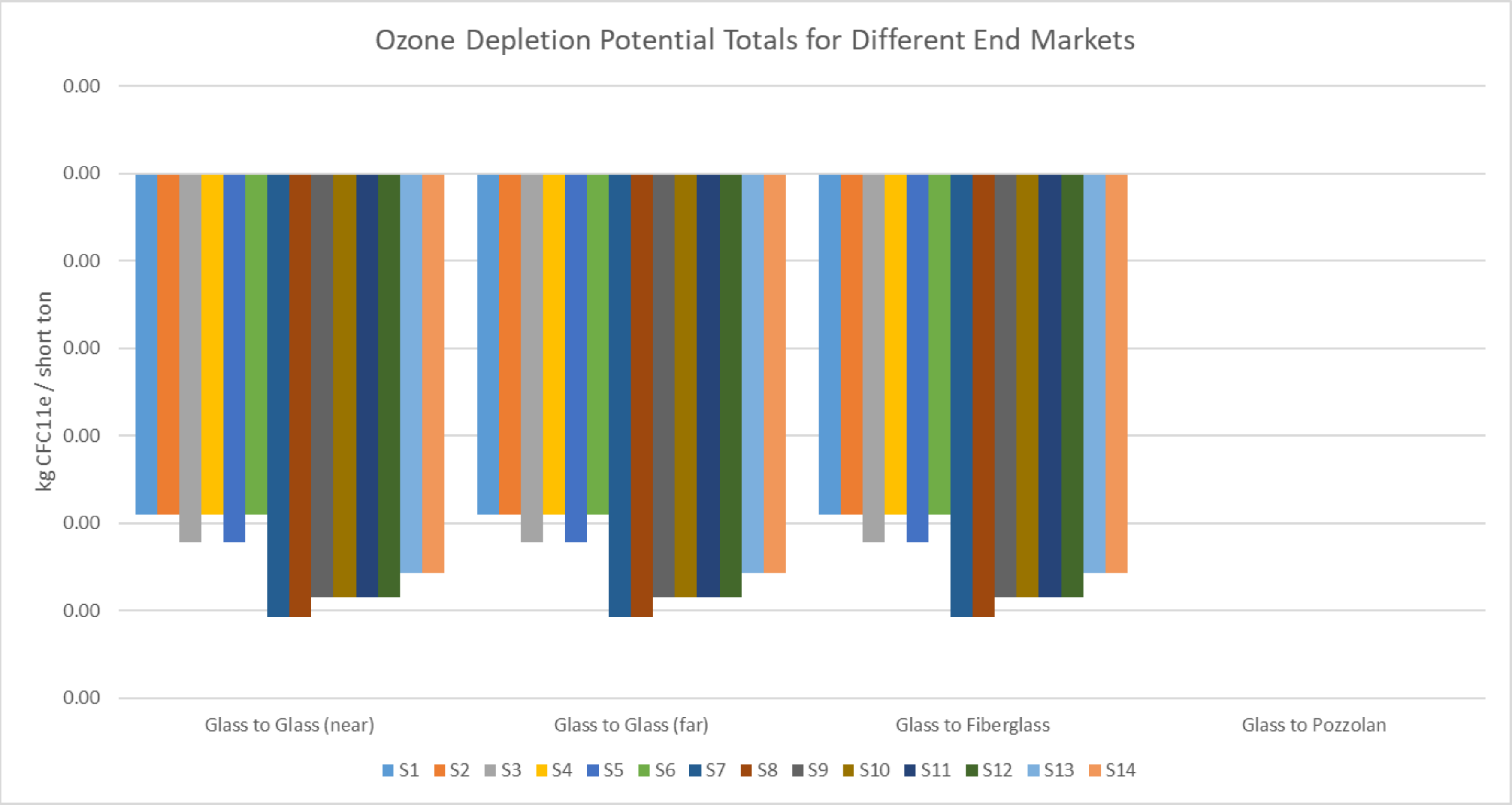
LCIA Results – Human Toxicity Potential (Cancer)



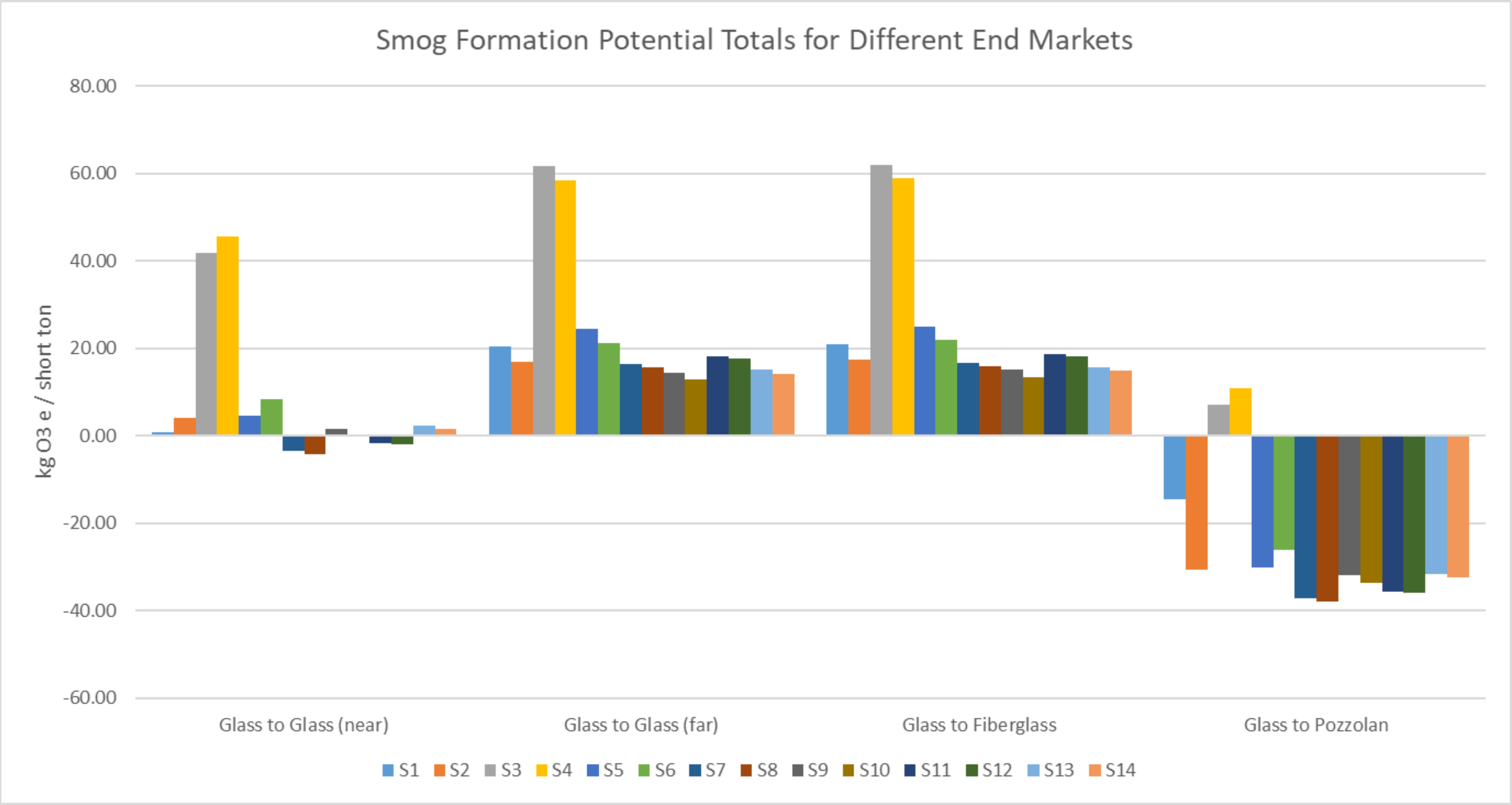
LCIA Results - Human Toxicity Potential (NonCancer)



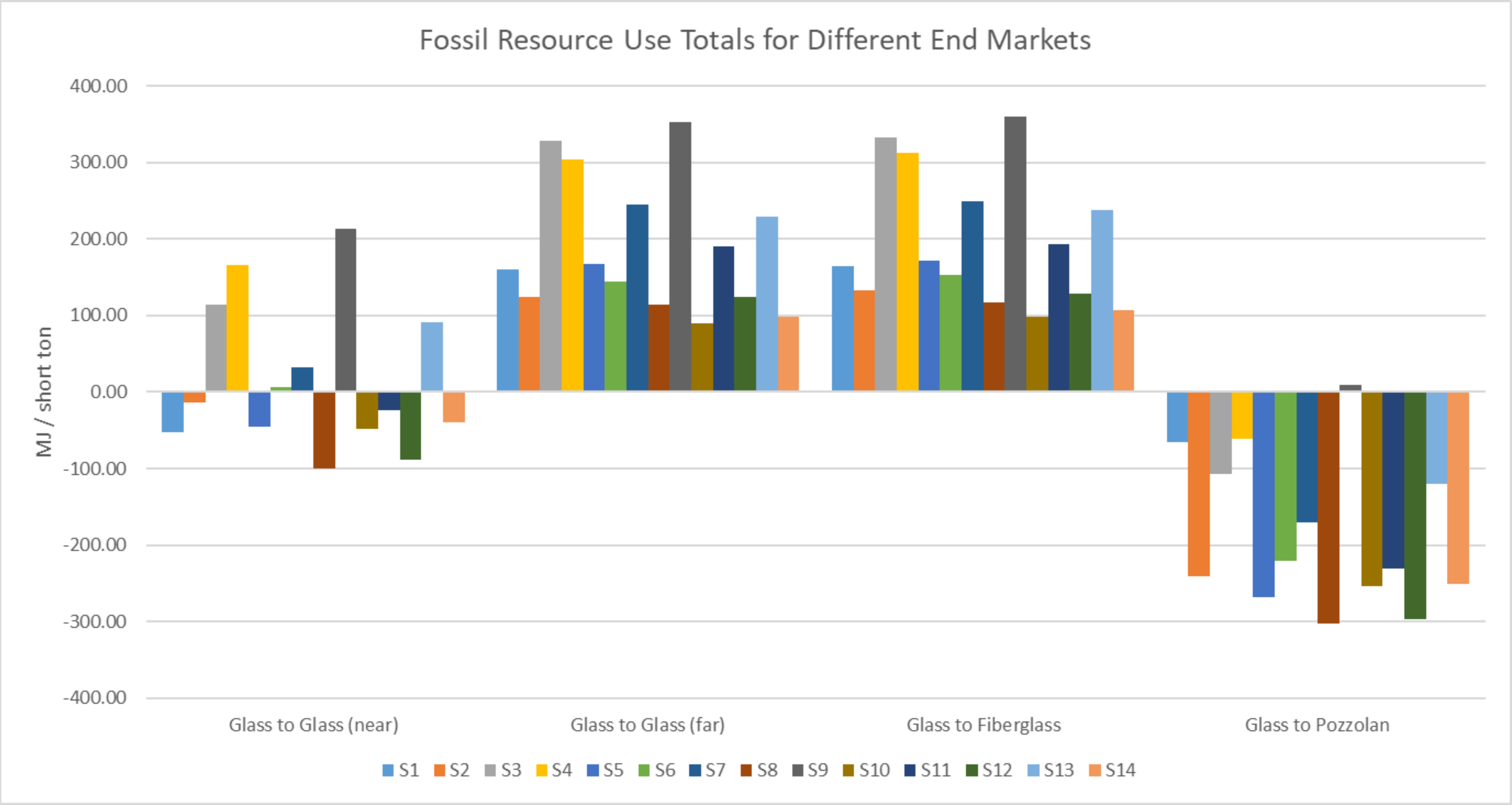
LCIA Results – Ozone Depletion Potential (ODP)



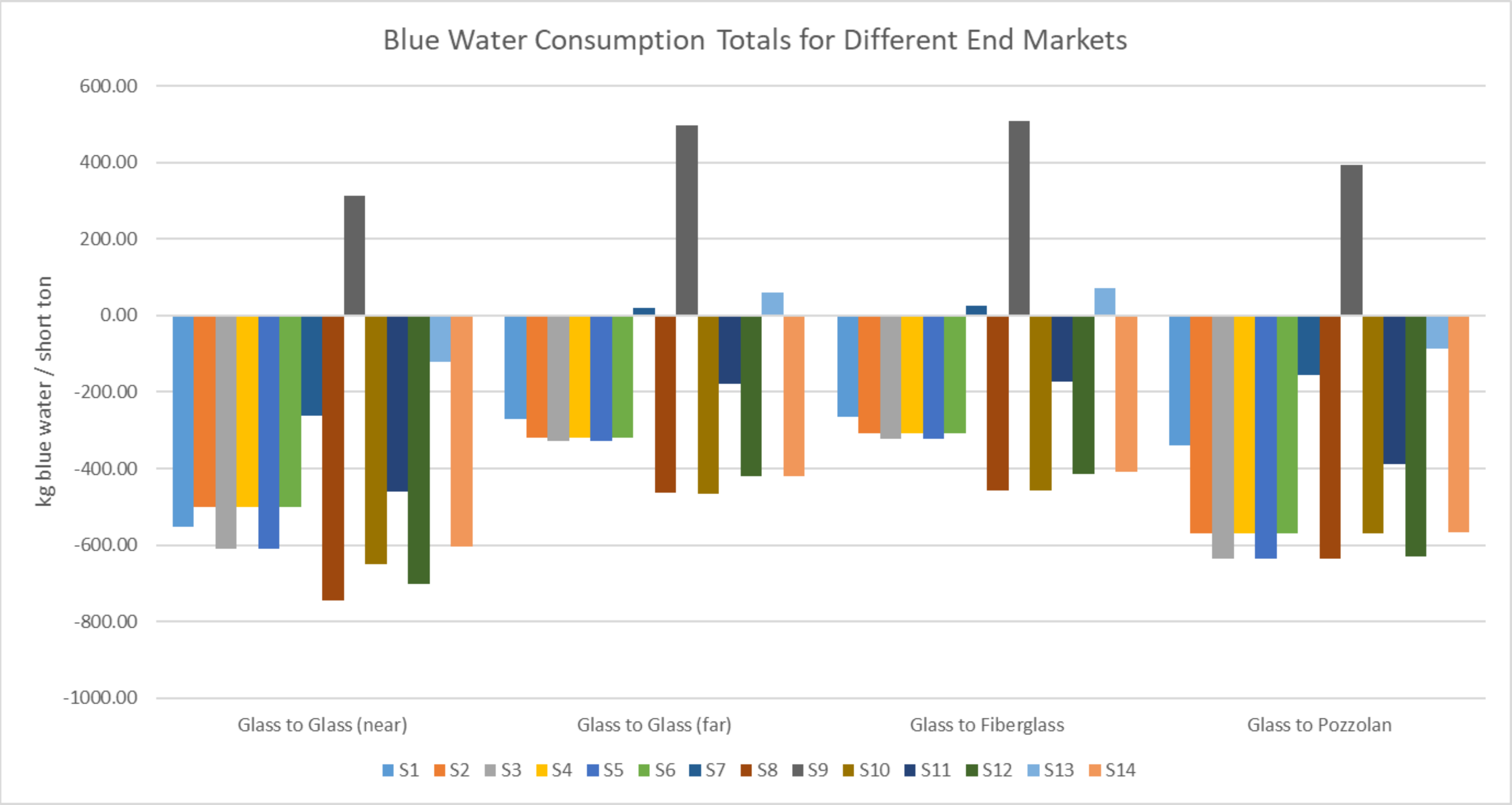
LCIA Results – Smog Formation Potential (SFP)



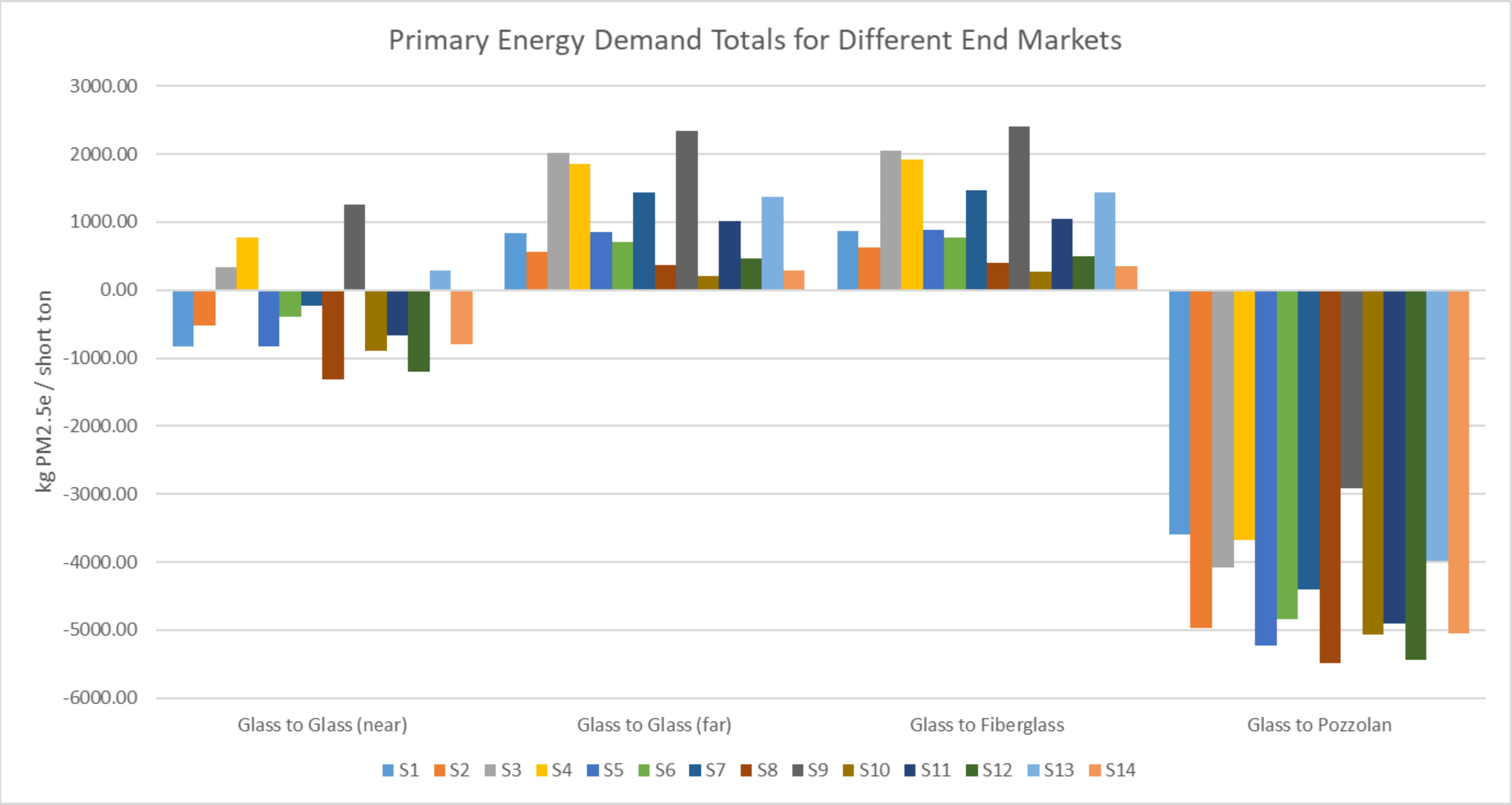
Indicator Results – Fossil Resource Use



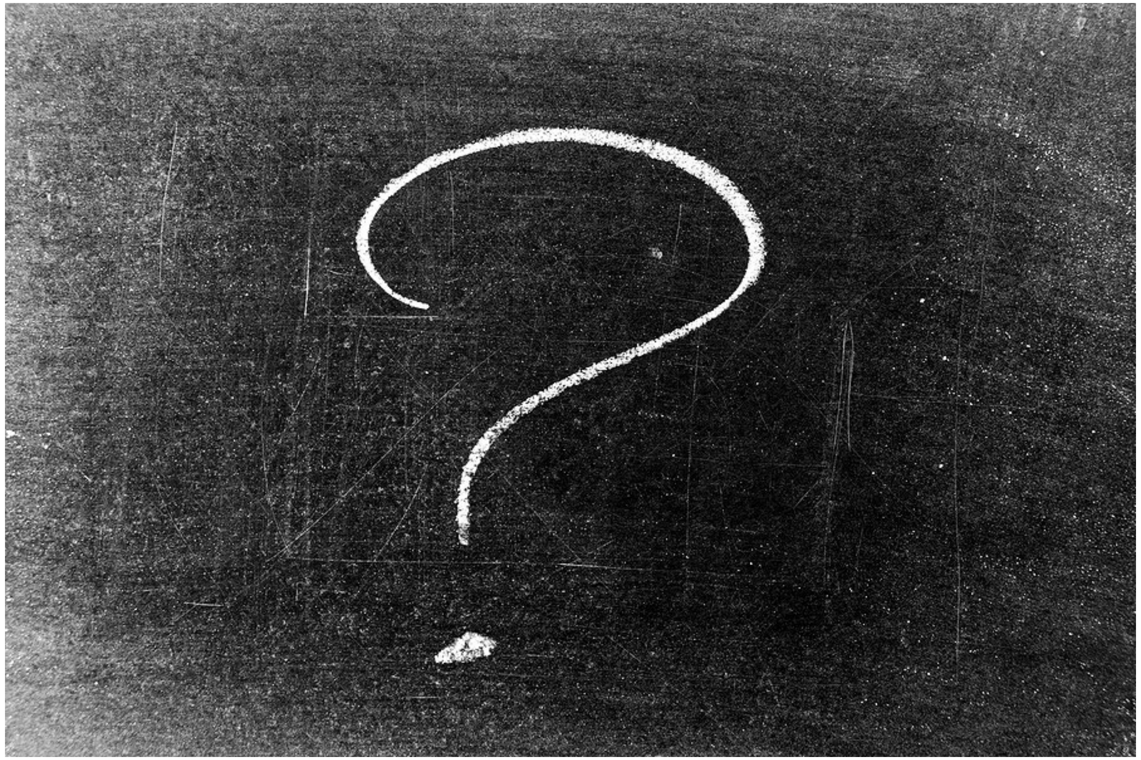
Indicator Results – Bluewater Consumption



Indicator Results – Primary Energy Demand (PED)



Key Findings



- **The End Market is critical** for realizing the benefits of glass recycling.
  - Closed loop recycling is not necessarily better than open loop.
- **Convenience of drop-off sites matters**
  - idea of marginal vs additional transport was an important variable influencing results.
  - Site density seemed to influence results, though not consistently across impacts and scenarios.
  - Less transport was required in the Metro region leading to fewer impacts
- **On-route collection in a dedicated truck** led to higher impacts than a combined truck
- **Drop-off and on-route recycling may (or may not) be comparable**, it depends on the factors associated with drop-off site convenience and user behavior.

Assumptions and Limitations

Assumptions

- Average distance traveled for drop-off (additional) is 4-16 miles (so 8-32 miles round trip) all of these emissions are allocated to glass recovery and so do count towards the impacts of this system.
- Average distance traveled for drop-off (marginal) is 4-16 miles (so 8-32 miles round trip) however the emissions are allocated to the primary purpose for the trip (e.g. grocery store) and so do not count towards the impacts of this system.
- Transport for drop-off is by passenger vehicle
- Transport to mechanical recycling is by truck
- Model assumes 1:1 substitution for primary material production as a recycling credit. In other words, for each unit of glass recovered (after losses are accounted for) an equivalent unit of primary production is avoided (e.g. Primary Glass, Fiberglass or Portland Cement).

Assumptions and Limitations (cont.)

Limitations

- No direct human health exposures are accounted for by processors of this material (e.g. those handling glass at the recycling facility)
- The effects of mismanagement of these materials (e.g. litter) are not accounted for in the model or impact results.
- The model is sensitive to assumptions of yield loss (10-30% for bottle and fiberglass, whereas this is not an issue for pozzolan, since small particles/fines are recovered for use as a cement replacement).

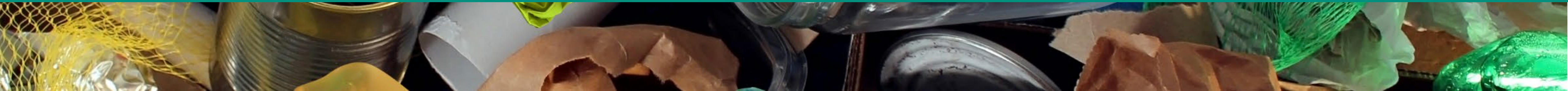
Feedback and/or Questions

Thank You!

Peter Canepa (peter.canepa@state.or.us)

Lunch Break

The meeting will resume at approximately 12:30 p.m. PT



Framework for Recycling Acceptance Lists and Initial DEQ Recommendations (first batch)

David Allaway
Oregon DEQ Materials Management Program

Technical Workgroup on Materials Lists

July 19, 2022

Framework

Material	Opportunity to Recycle Obligation			PRO collection	No mandate
	Depot	On-route	Uniform statewide collection list		

Initial DEQ recommendations (paper)

Material	Opportunity to Recycle Obligation			PRO collection	No mandate
	Depot	On-route	Uniform statewide collection list		
Corrugated cardboard: uncoated, recycle-compatible coated, and pizza boxes	✓	✓	✓		
Waxed corrugated cardboard					✓
All kraft paper (brown paper bags, paper mailers)	✓	✓	✓		
High-grade office paper	✓	✓	✓		
Newspaper/newsprint	✓	✓	✓		
Shredded paper				✓	
Others TBD					

Initial DEQ recommendations (metals)

Material	Opportunity to Recycle Obligation			PRO collection	No mandate
	Depot	On-route	Uniform statewide collection list		
Aluminum food and beverage cans	✓	✓	✓		
Steel cans, including empty and dry steel paint cans	✓	✓	✓		
Scrap metal less than 30” in length and 30 pounds in weight	✓	✓	✓		
Aluminum foil and pressed foil products				✓	
Others TBD					

Initial DEQ recommendations (plastics)

Material	Opportunity to Recycle Obligation			PRO collection	No mandate
	Depot	On-route	Uniform statewide collection list		
Clear PET bottles ≥ 6 ounces in volume	✓	✓	✓		
Pigmented/opaque PET					✓
Natural and colored HDPE bottles ≥ 6 ounces in volume	✓	✓	✓		
PP bottles ≥ 6 ounces in volume	✓	✓	✓		
Small plastic containers < 6 ounces in volume					✓
Polyethylene film and wrap				✓	
PP film and wrap					✓
PP woven bags					✓

Initial DEQ recommendations (plastics, continued)

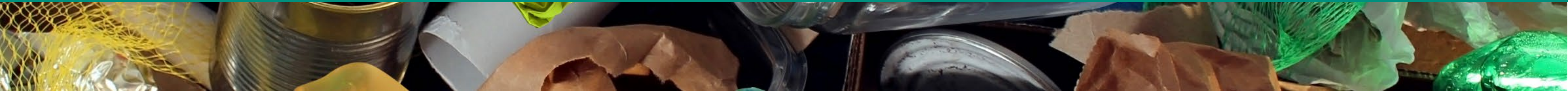
Material	Opportunity to Recycle Obligation			PRO collection	No mandate
	Depot	On-route	Uniform statewide collection list		
EPS and other "peanuts" (flowable loose fill)					✓
EPS products (e.g., coolers, insulation)					✓
All other EPS food serviceware and packaging, *excluding block/rigid white foam*					✓
PE and PP block and sheet foams					✓
Others, TBD					

Initial DEQ recommendations (multi-material)

Material	Opportunity to Recycle Obligation			PRO collection	No mandate
	Depot	On-route	Uniform statewide collection list		
Multimaterial flexible packaging/films					✓
Others, TBD					

Recycling Depots: User Behavior

David Allaway
Oregon DEQ Materials Management Program
Technical Workgroup on Materials Lists
July 19, 2022



User survey results (transfer stations)

Site (County)	Survey size	Recycling % of Total	Additional Distance Traveled (miles)				
			Average	Min	25% percentile	75% percentile	Max
Salem-Keizer TS (Marion)	147	70%	7.7	1	4	10	30
North Marion TS (Marion)	60	58%	8.3	1	3	14	20
Manzanita TS (Tillamook)	66	91%	2.3	0	0.5	3	15
Tillamook TS (Tillamook)	40	95%	11.9	1	5.25	16.75	30
Pacific City TS (Tillamook)	58	83%	5.6	1	3	6.25	9
McMinnville TS (Yamhill)	39	77%	8.6	0.25	**	**	17
Astoria TS (Clatsop)	39	54%	3.25	1	2	3.25	8

**Different survey questions resulted in insufficient sample size to calculate

User survey results (transfer stations, cont.)

Site (County)	Survey size	Recycling % of Total	Additional Distance Traveled (miles)				
			Average	Min	25% percentile	75% percentile	Max
Glenwood TS (Lane)	82	54%	9.1	0	3	10	70
Cottage Grove TS (Lane)	39	49%	5.2	0.06	2.5	6.5	20
Florence TS (Lane)	36	44%	4.8	1	1.4	4.5	22
Rattlesnake TS (Lane)	17	18%	3.3	1	1.5	4.5	7
Unweighted average, all transfer stations	**11 (n=634)**	**63%**	**6.4**	**0.7**	**2.6**	**7.9**	**22.6**

User survey results (recycling only)

Site (County)	Survey size	Recycling % of Total	Additional Distance Traveled (miles)				
			Average	Min	25% percentile	75% percentile	Max
D&O Garbage and Recycling (Marion)	11	N/A (100%?)	3.5	1	2	4.5	7
Food 4 Less Medford (Jackson)	31	42%	2.3	0.25	2	3	5
Ray's Market Phoenix (Jackson)	9	33%	3.7	2	3	4.5	5
Ray's Mkt. Jacksonville (Jackson)	31	0%	0	0	0	0	0
Sherm's Thunderbird Market Medford (Jackson)	15	0%	0	0	0	0	0
Ray's Mkt. Central Point (Jackson)	30	0%	0	0	0	0	0
Rogue C.U. Medford (Jackson)	26	15%	1.1	0.5	0.9	1.5	1.5
Unweighted average, all recycling-only depots	**6 (n=153)**	**27%**	**1.2**	**0.5**	**1.0**	**1.5**	**1.9**

Scenarios proposed for evaluation (Draft)