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Food Waste to Renewable Energy Assessment Overview

for Solid Waste Advisory Committee

Waste Minimization and Planning
& Energy Programs Office

June 14, 2022



PENNSYLVANIA FOOD WASTE TO RENEWABLE ENERGY ASSESSMENT
Prepared for the Pennsylvania Department of Environmental Protection



June 2021

FINAL REPORT



Background

- No detailed food waste assessment in past for Pennsylvania
 - High-level estimates at national levels with different methodologies (EPA, ReFED)
- Waste characterization study update in progress
- Serves priorities of both DEP Bureau of Waste Management and Energy Programs Office
- Social and Environmental Impacts of Food Waste
 - USDA estimates 31% of food produced for human consumption was not eaten
 - US EPA estimates food waste to be 24% of municipal solid waste sent to landfills

Report Goals

- ✓ Quantify current Industrial, Commercial, and Institutional (ICI) food waste generation and diversion
- ✓ Inventory anaerobic digestion (AD) and composting facilities currently accepting food waste
- ✓ Identify additional food waste processing capacity available at existing facilities
- ✓ Estimate the reduction in greenhouse gas (GHG) emissions and biogas generation resulting from the current level of diversion
- ✓ Identify best practices for expanding existing compost/AD processing capacity and encouraging additional diversion

Additional Assessment Resources

Data:

- All the data collected and generated for this assessment (down to individual facility information) has been provided in GIS format for further analysis)

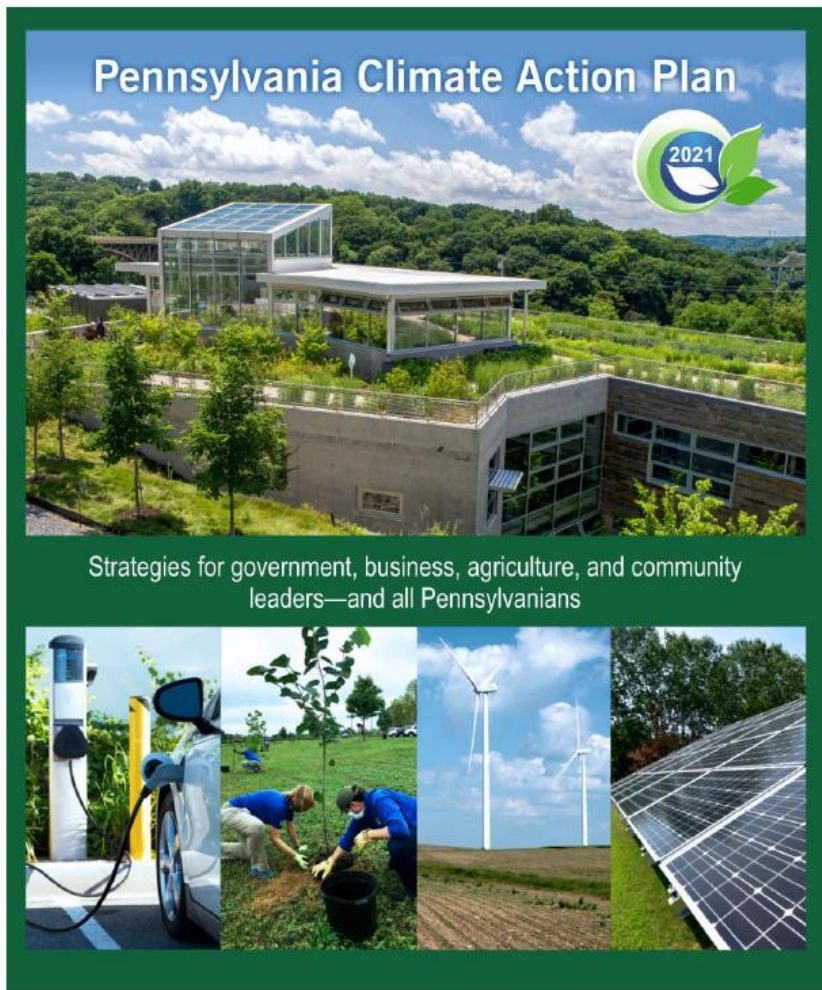
Case Studies:

- Food Waste Generators
 - Weis Markets
 - Square Café and Zero Waste Wrangler
- Food Waste Processors (Anaerobic Digestion)
 - Derry Township Municipal Authority
 - Milton Regional Sewer Authority
 - Reinford Farms
- Food Waste Processors (Composting)
 - Two Particular Acres and FC Partners

▶ Current Actions Around Food Waste Reduction

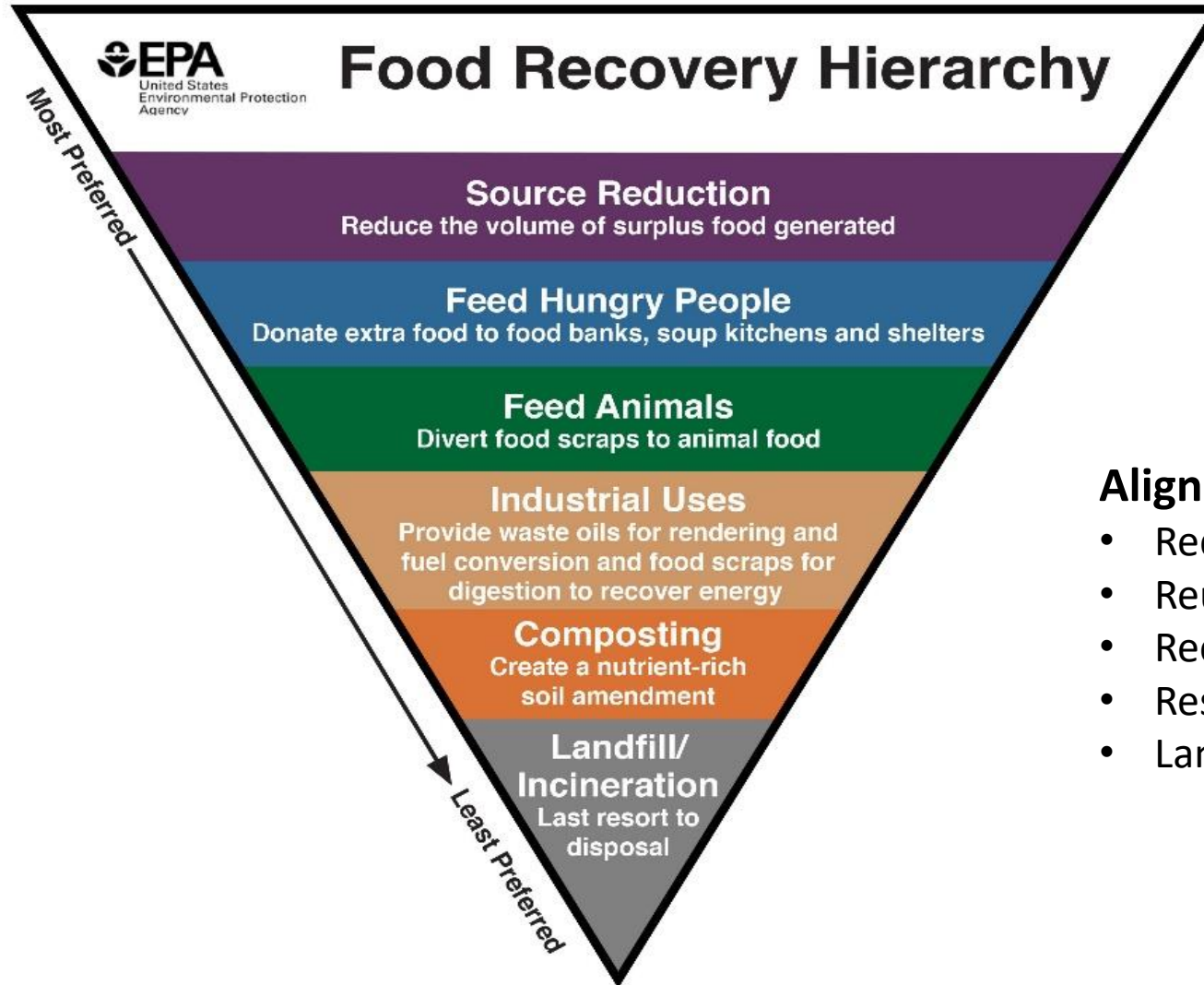
- DEP ***Food Recovery Infrastructure Grant*** (2020)
 - **\$9.6 million** to 145 nonprofit organizations (food banks, shelters, and soup kitchens)
 - Covers costs of equipment to prepare, transport and store food acquired from retailers, wholesalers, farms, processors and cooperatives
 - Funded through Act 101
 - DEP planning to offer program in future years
- Department of Agriculture ***COVID-19 Food Bank Cold Storage Infrastructure Program*** (2021)
 - **\$11.4 million** to 18 food banks covering 67 counties
 - Funded through American Rescue Plan funds
 - Eligible purchases include refrigerators, coolers, freezers, refrigerator trailers and cargo vans, building expansions, and more.
- DEP and PDA having discussions to coordinate future grant and programmatic activities in this area

Relationship to Climate Action Plan



- Assessment conducted at same time as 2021 Climate Action Plan Update – lessons learned were not incorporated into quantified GHG reductions and cost/benefit analysis for CAP
- Climate Action Plan Recommendations around Food Waste:
 - Reduction of food waste as strategy within waste sector
 - Use of food waste as feedstock for increased production and use of biogas / renewable natural gas

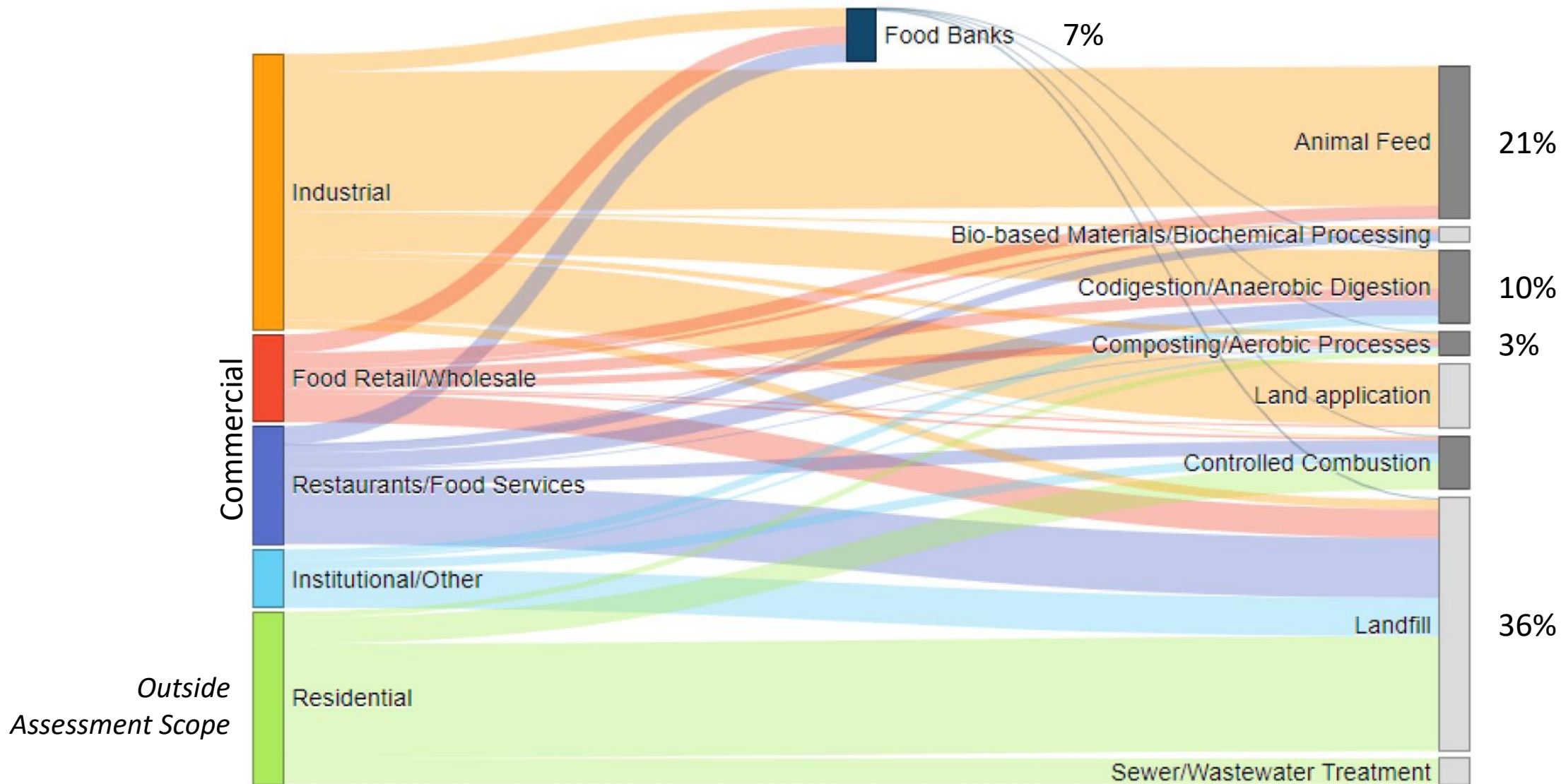
EPA Food Recovery Hierarchy



Aligns with Waste Hierarchy of:

- Reduce
- Reuse
- Recycle
- Resources Recovery (energy)
- Landfilling (disposal)

US Food Waste Management Pathways





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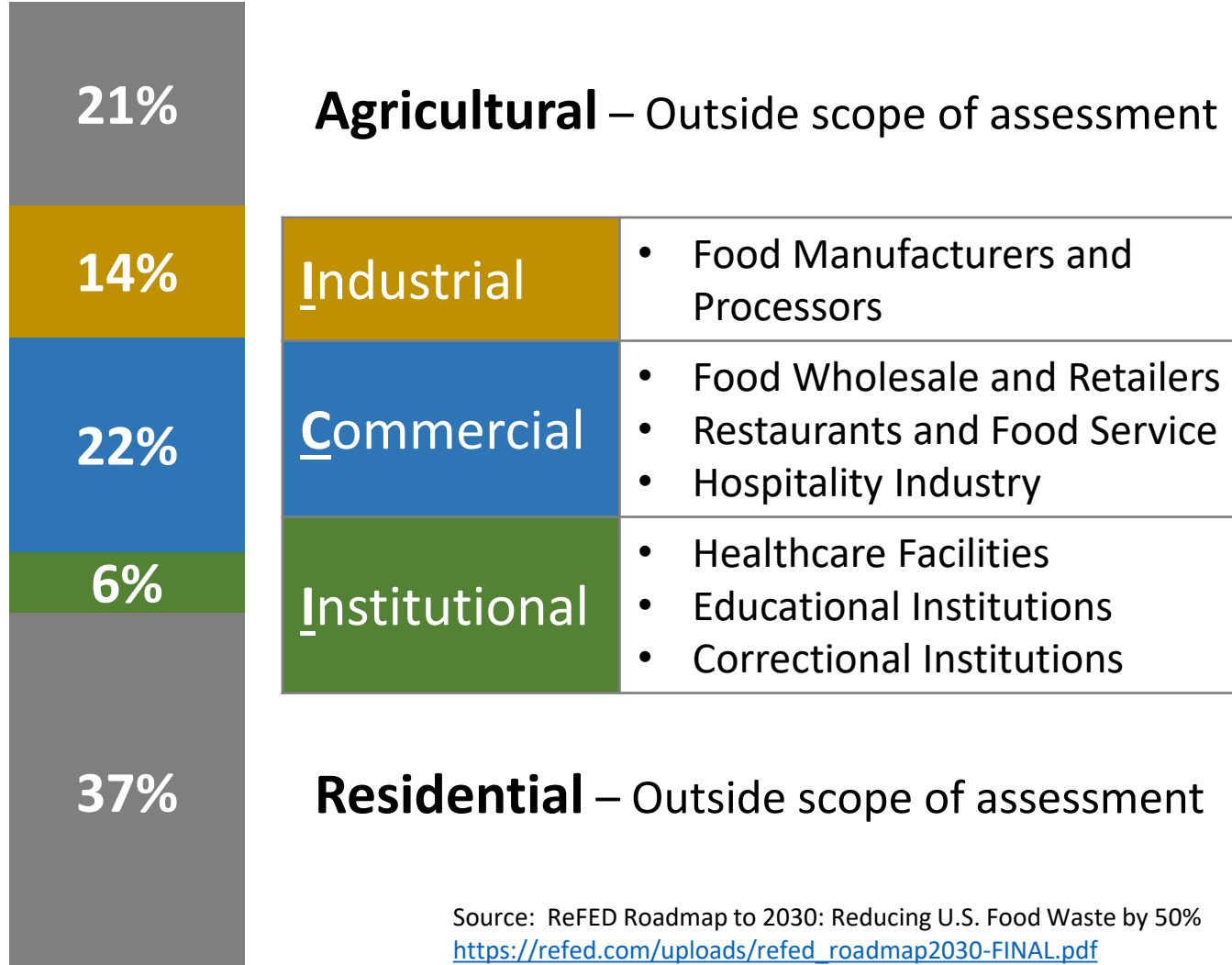
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Food Waste Generation

Assessment Scope: Food Waste Generation

Food Waste Sectors:

Distribution of Food Waste Generation



Source: ReFED Roadmap to 2030: Reducing U.S. Food Waste by 50%
https://refed.com/uploads/refed_roadmap2030-FINAL.pdf

Generation Threshold:

52 tons per year (1 ton per week) per facility is threshold used to focus on identifying diversion potential for generators where it is more likely to be economically feasible to implement food waste reduction strategies

Food Waste Types:

In Scope:

- By-products from food and beverage processing facilities
- Expired and unsold food from retail stores
- Uneaten prepared food from restaurant or cafeterias
- Plate waste

Outside Scope:

- Waste generated at food banks
- Fats / Oils / Greases

Quantification Methodology

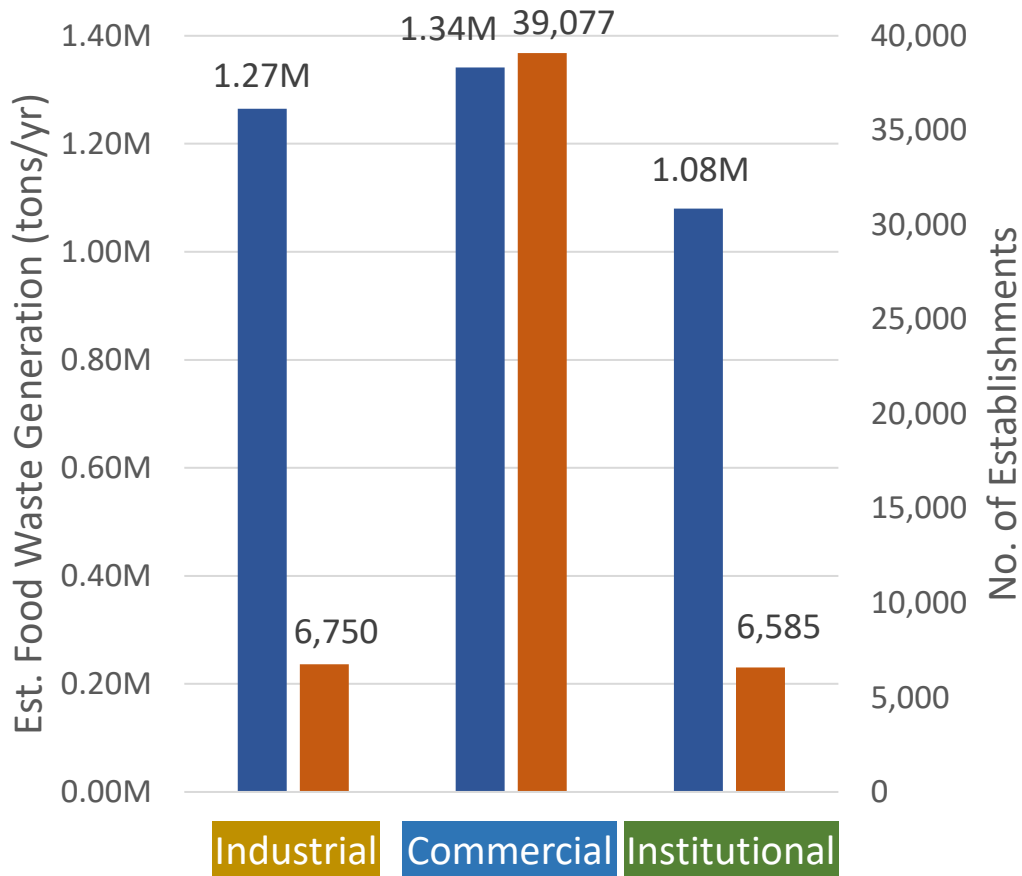
1. Compile food waste generation factors for each sector
2. Compile a statewide database of ICI generator establishments grouped by sector (52,000+ individual generators)
3. Apply generation factors to statewide database to estimate food waste generation by point source

Example Waste Generation Factors

Sector	Subsector	Generation Factor Basis	lbs / unit / year
Industrial	Food Manufacturers and Processors	Annual Sales Revenue	0.05 lb / \$ / yr
Commercial	Supermarkets / Retailers	Employees	3,000 lb / emp. / yr
Institutional	Healthcare	Beds	1,248 lb / Bed / yr

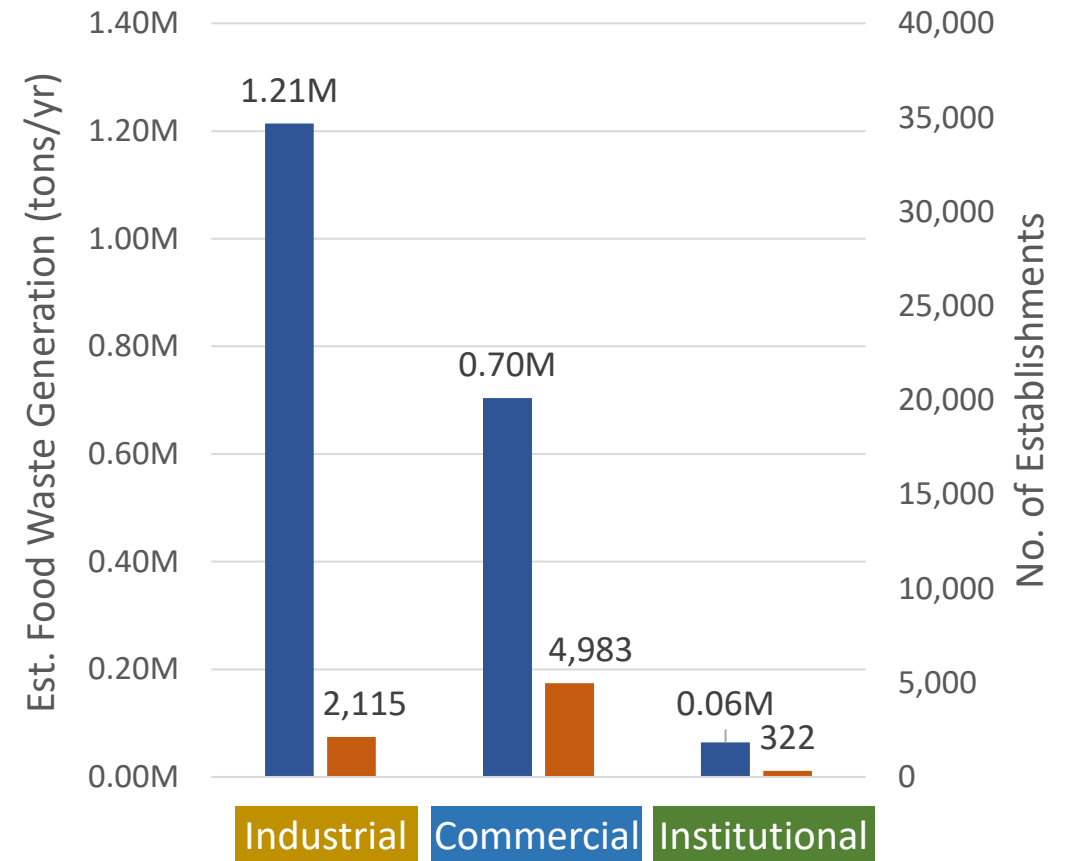
ICI Food Waste Generation in Pennsylvania

All Establishments
2.7 million tons



Remove establishments generating less than one ton per week

Establishments Generating > 52 Tons per Year
2.0 million tons



■ Total Amount of Food Waste Generated ■ No. of Establishments

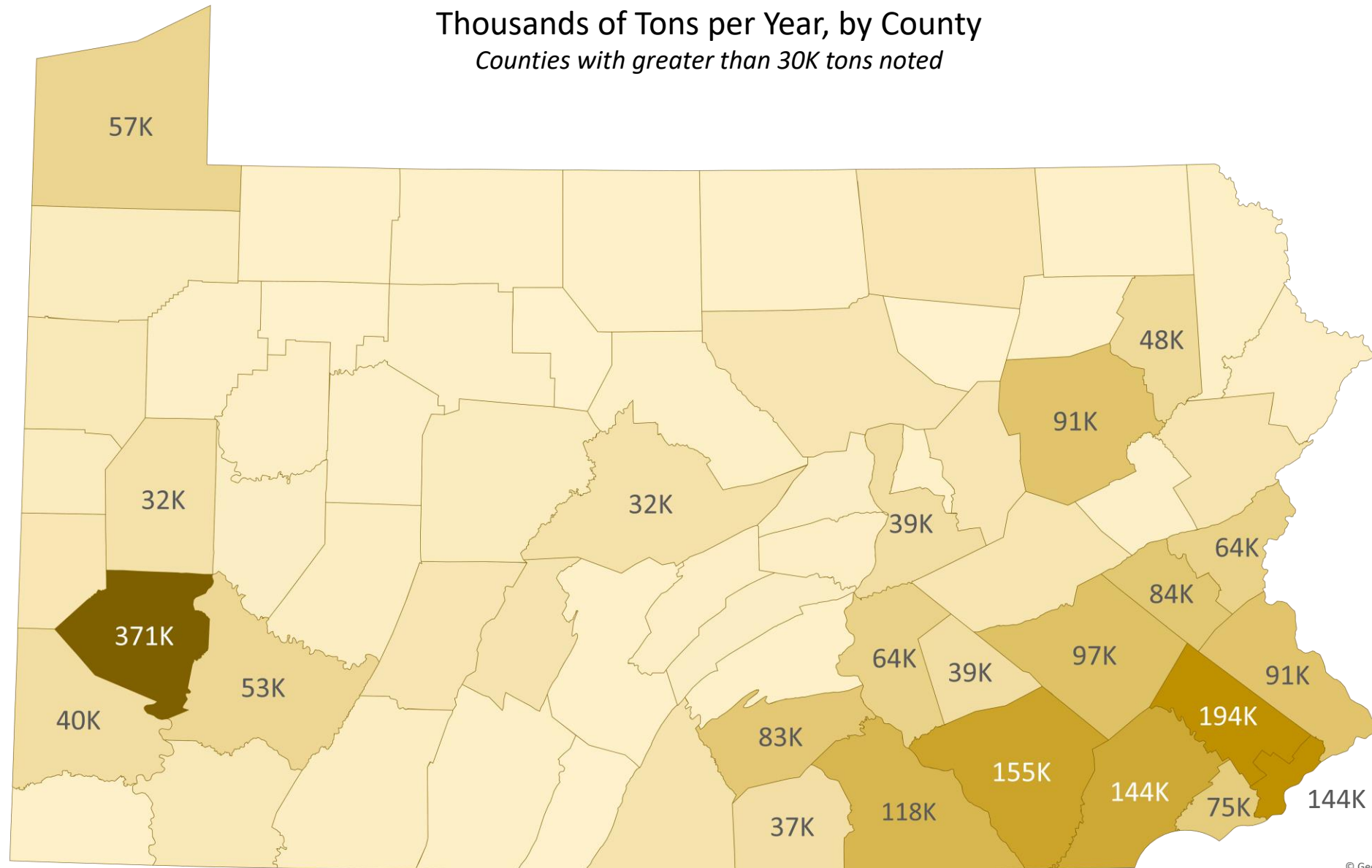
■ Total Amount of Food Waste Generated ■ No. of Establishments

Key Findings: Food Waste Generation

- 14 percent of ICI establishments exceed the 52 ton per year threshold but are responsible for 73% of total statewide ICI food waste generation.
- Of the establishments generating more than 52 tons per year, 95 percent of this waste comes from:
 - Food Manufacturers and Processors (61%)
 - Food Wholesale and Retail (21%)
 - Restaurant and Foodservice (13%)
- The 370 highest-generating establishments are estimated to generate over 46 percent of the total 2 million tons per year.

ICI Food Waste Generation in Pennsylvania

Thousands of Tons per Year, by County
Counties with greater than 30K tons noted





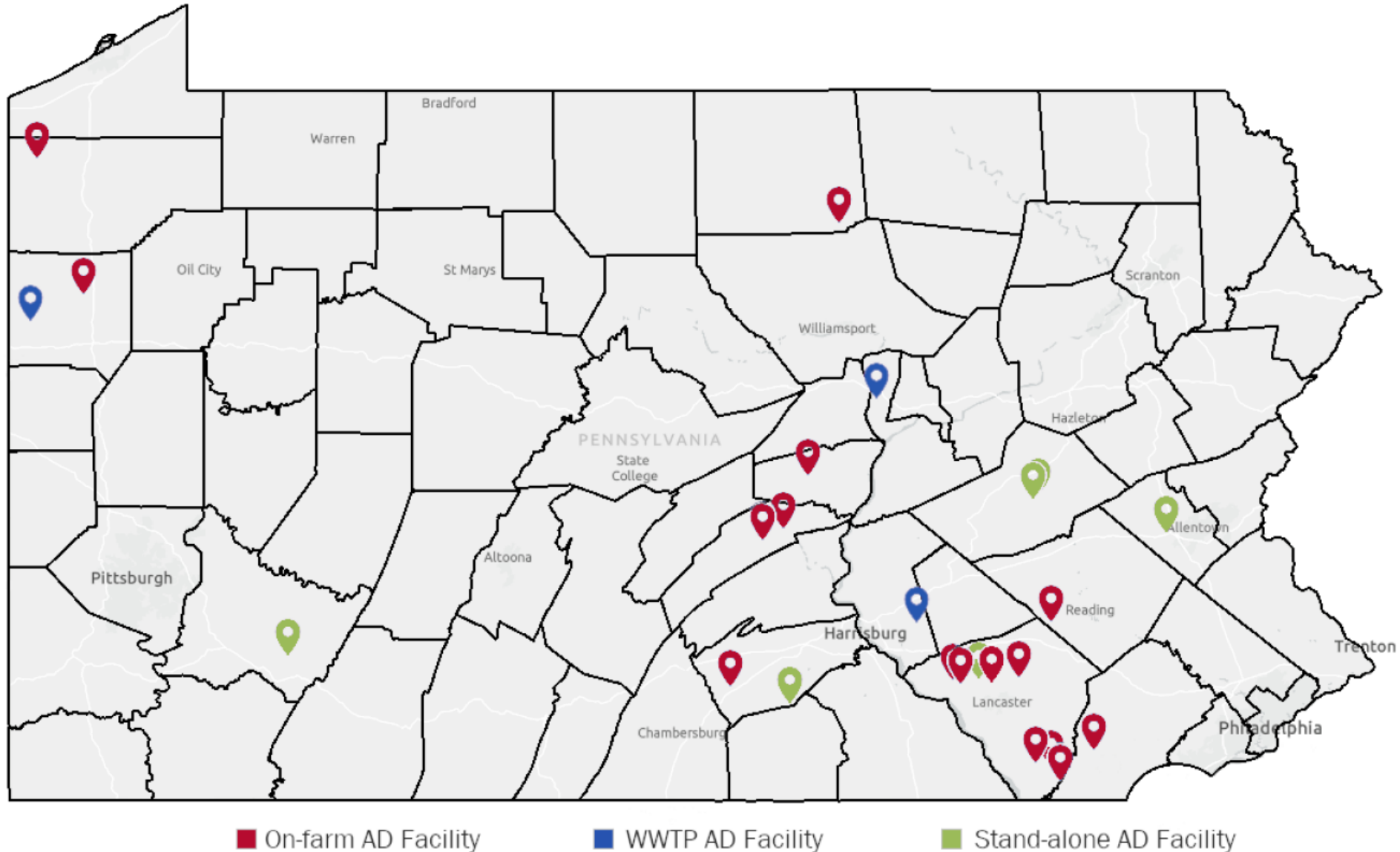
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Organics Processors

AD Facilities Processing ICI Food Waste

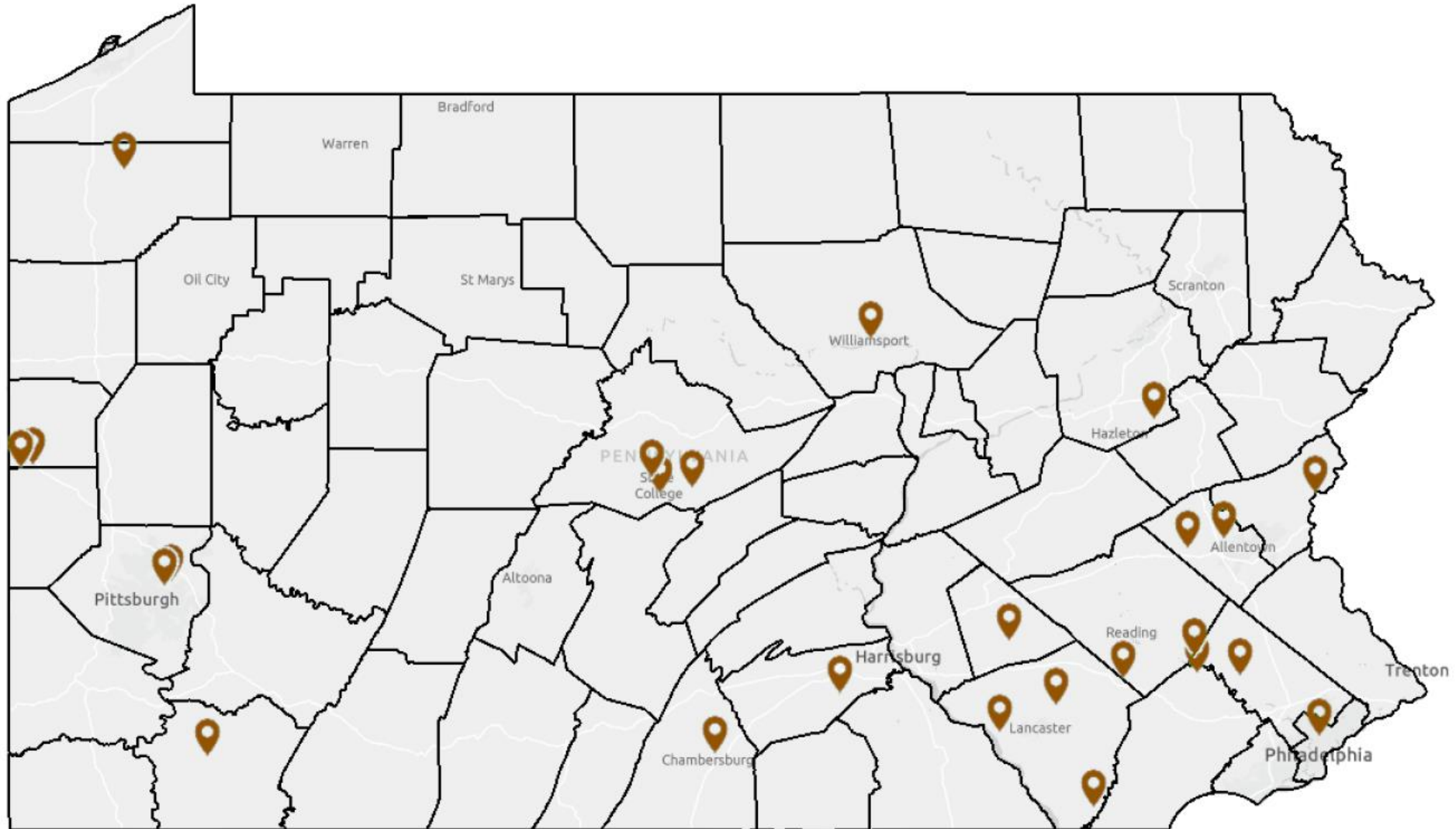


Current Anaerobic Digestion Performance

	No. of Facilities	Current Food Waste Throughput (tons/yr.)	Biogas Generation from Food Waste (million ft ³ /yr.)	GHG Emissions Reduction from Food Waste (MTCO ₂ e/yr.) ^[1]
Subtotals for Respondents				
On-farm AD	9	21,000	114	14,000
WWTP AD	3	20,000	82	13,000
Stand-alone AD	4	39,000	76	26,000
<i>Respondents Subtotal</i>	<i>16</i>	<i>81,000</i>	<i>271</i>	<i>54,000</i>
Estimated Subtotals for Nonrespondents				
On-farm AD	8	12,000	64	8,000
WWTP AD	0	0	0	0
Stand-alone AD	2	15,000	28	10,000
<i>Nonrespondents Subtotal</i>	<i>10</i>	<i>27,000</i>	<i>92</i>	<i>18,000</i>
Grand Total	26	107,000	363	72,000

107,000 tons per year is **5.4%** of the ICI Food Waste from establishments generating more than 52 tons per year

Compost Facilities Processing ICI Food Waste

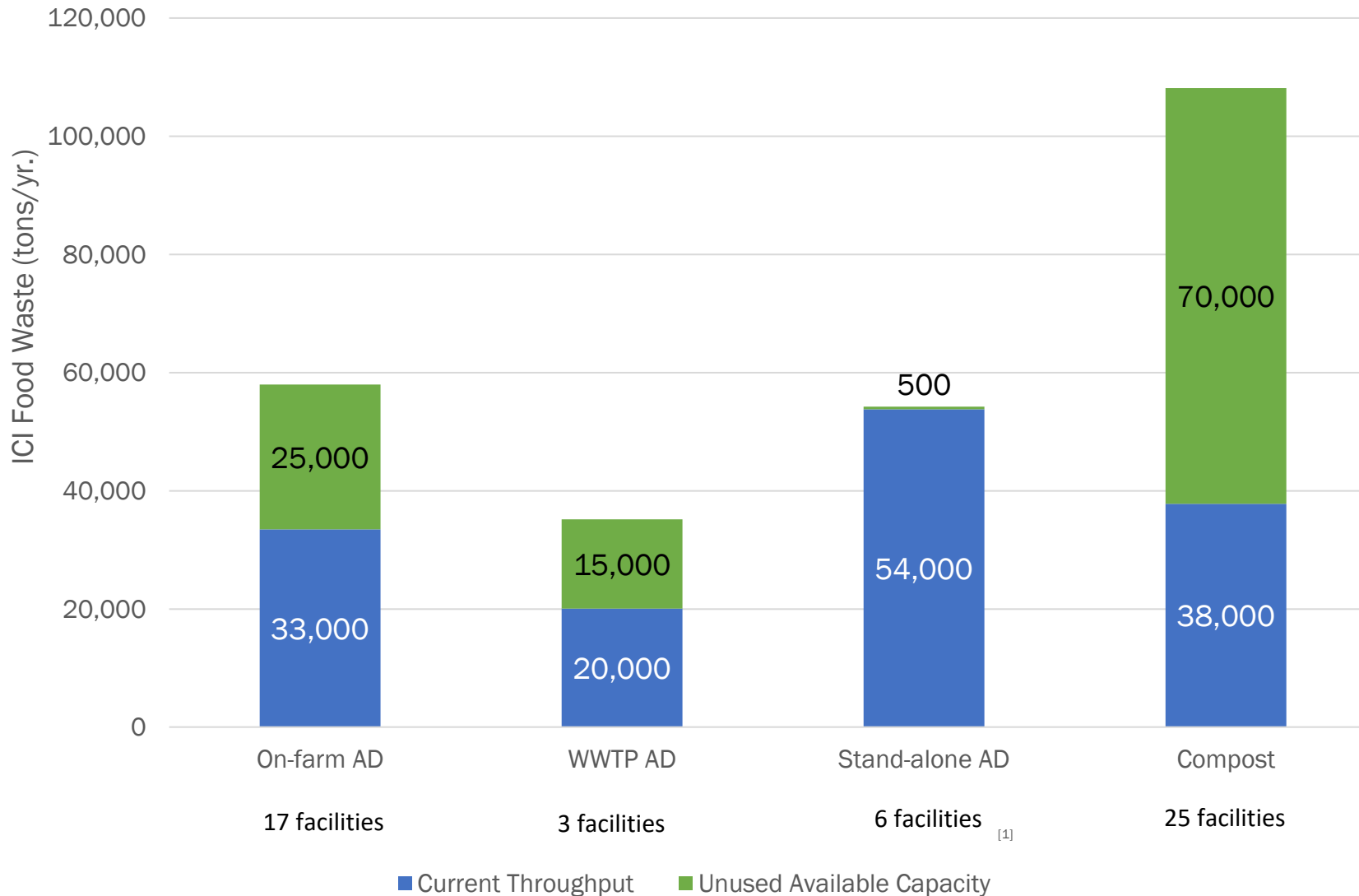


Current Compost Performance

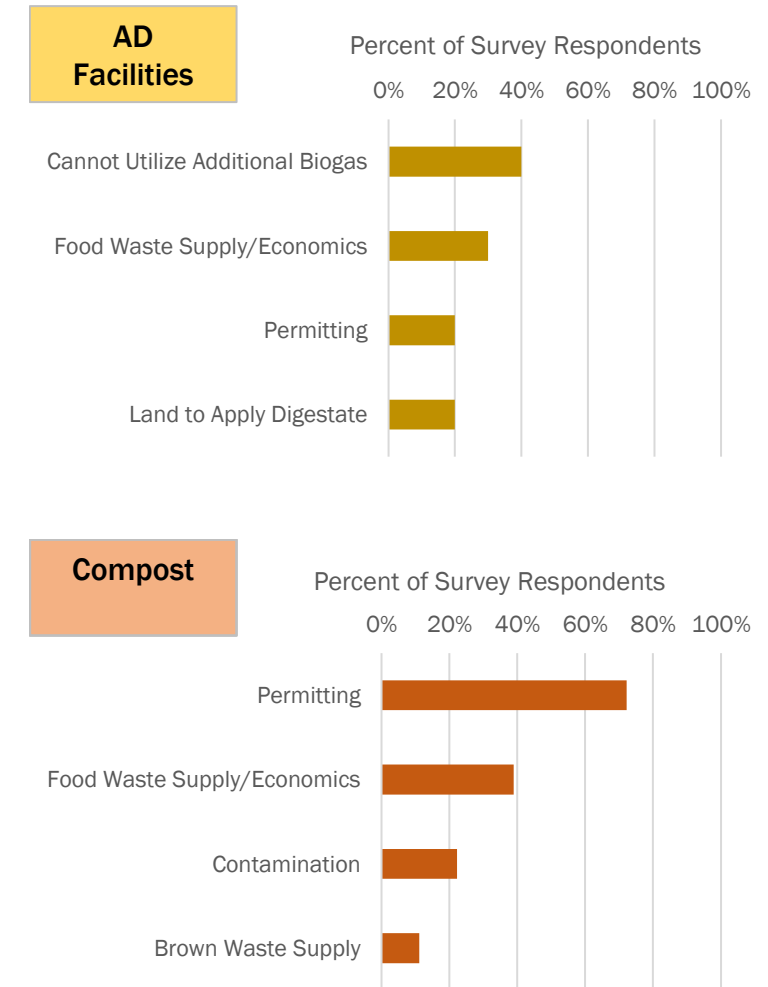
	No. of Facilities	Current Food Waste Throughput (tons/yr.)	GHG Emissions Reduction from Food Waste (MTCO ₂ e/yr.)
Subtotals for Survey Respondents	20	35,000	25,000
Estimated Subtotals for Nonrespondents	5	3,000	2,000
Grand Total	25	38,000	27,000

38,000 tons per year is **1.9%** of the ICI Food Waste from establishments generating more than 52 tons per year

ICI Food Waste Processing Capacity



Barriers to Increasing Capacity:



➤ Upgrading AD Facilities Not Processing Food Waste

- 83 AD facilities (WWTP and on-farm digesters) identified that do not currently process food waste
 - 28 responded to survey
 - Evaluated using Co-EAT model – physical and economic constraints
- 7 facilities potentially capable of co-digesting food waste –
 - Average capital cost to upgrade a single facility is \$3M
 - Upgrading all 7 facilities would provide and additional 77,000 tons of food waste processing capacity each year

Typical Upgrades Required to Process Food Waste

Equipment Type	Capital Cost Estimate
Additional Digester Reactor	\$350k
Larger Capacity Generator	\$300k-\$500k
Effluent Storage Tank	\$8k
Dewatering Equipment	\$400k
Depackaging Equipment	\$400k-\$600k
Buffer Tank	\$40k

Key Findings: Organics Processing

Facility Type	No. of Facilities	Food Waste (tons/yr.)	Biogas Generation from Food Waste (million ft ³ /yr.)	GHG Emissions Reduction from Food Waste (MTCO ₂ e/yr.)
Current Food Waste Throughput				
Digestors	26	107,000	363	71,000
Compost	25	38,000	0	27,000
<i>Subtotal</i>	<i>51</i>	<i>145,000</i>	<i>363</i>	<i>99,000</i>
Unused Available Capacity (using existing infrastructure)				
Digestors	10	41,000	197	27,000
Compost	18	70,000	0	50,000
<i>Subtotal</i>	<i>28</i>	<i>111,000</i>	<i>197</i>	<i>77,000</i>
Additional AD Capacity Accessible via Capital Investment				
On-farm AD	1	6,000	37	4,000
WWTP AD	6	71,000	209	46,000
<i>Subtotal</i>	<i>7</i>	<i>77,000</i>	<i>246</i>	<i>51,000</i>
Grand Total	N/A	333,000	807	226,000

- Throughput currently 145,000 tons per year, which represents 7.3% of ICI food waste from generators producing more than 52 tons per year
- An additional 111,000 tons per year (5.6%) of capacity available by overcoming operational barriers at facilities currently processing food waste
- An additional 77,000 tons per year (3.9%) of capacity through \$20M+ in upgrades to existing AD facilities not currently processing food waste



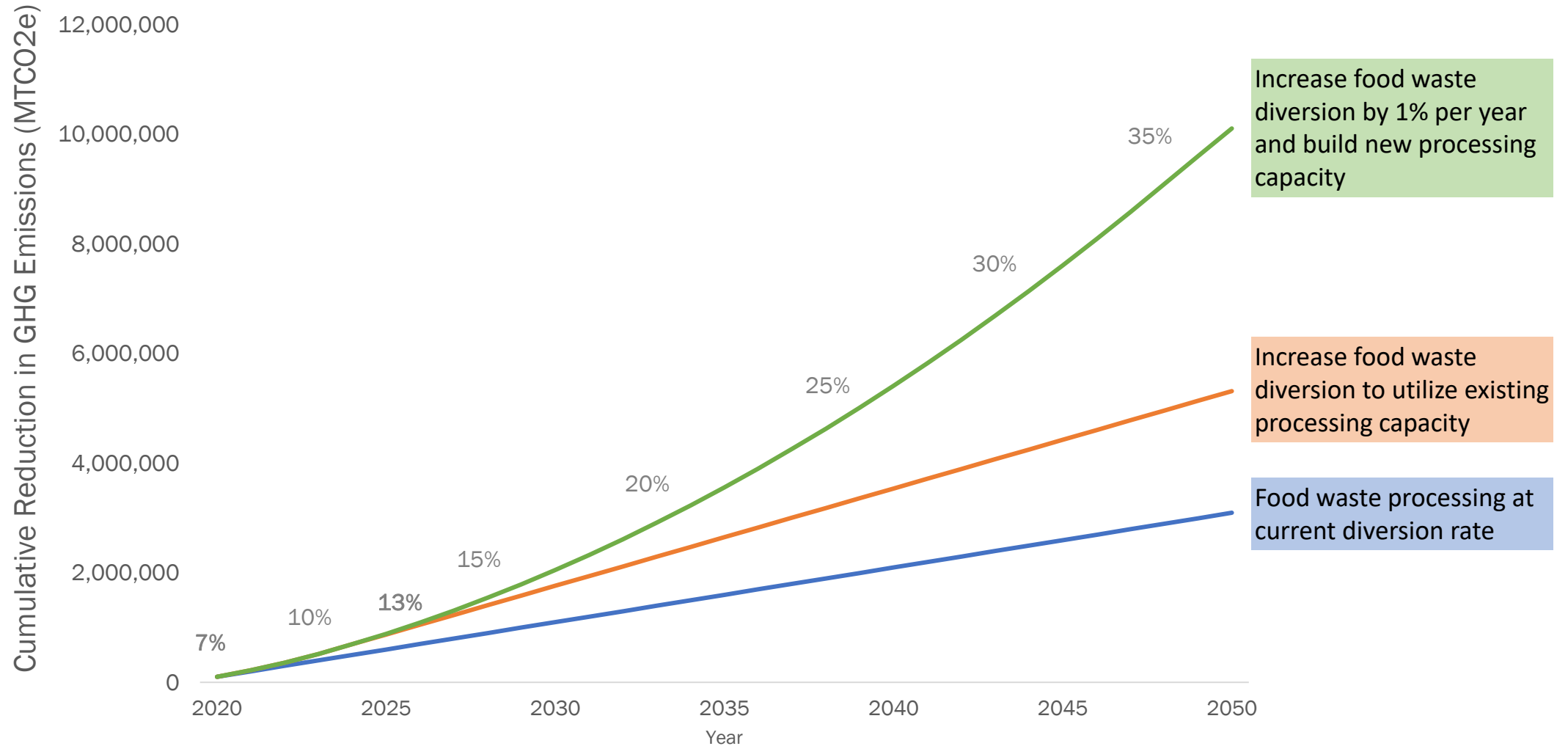
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Greenhouse Gas Emission Reductions and Energy Generation through Food Waste Processing

GHG Emissions Reductions by Scenario



- Current ICI food waste throughput via composting and AD is held constant.
- Unused available AD and composting capacity is utilized and held constant.
- ICI food waste diversion rate via AD and composting is increased 1% per year (combined).

Food Waste Processing Impact on Climate Goals

Parameter	Current Diversion via AD and Composting	Potential Diversion Using All Unused Available Capacity	Potential Diversion at 35% Diversion Rate via AD or Compost
ICI Food Waste Tons Diverted	145,000	255,000	731,000
ICI Food Waste Diversion Rate via Anaerobic Digestion or Composting	7%	13%	35%
GHG Emissions Reduction (MTCO ₂ e/yr.)	99,000	176,000	508,000
Biogas Generation (million ft ³ /yr.)	363	561	1,605

Solid Waste Management sector contributed **2,530,000 MTCO₂e** to Pennsylvania GHG emissions in 2018 (PA Greenhouse Gas Inventory)

- Current diversion (99,000 MTCO₂e) avoids 4.0% in additional emissions
- Unused capacity (77,000 MTCO₂e) could reduce sector emissions by additional 3.0%
- A 35% diversion goal (508,000 MTCO₂e) could reduce sector emissions by additional 16.2%



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Assessment Recommendations & Next Steps

➤ Assessment Recommendations & Next Steps

- **Reinstating/Expanding the Food Recover Infrastructure Grant:** In 2020, program provided \$9.6M Grants to food banks, shelters and soup kitchens to cover the costs of equipment purchases necessary to prepare, transport and store food from ICI establishments generating excess food.
- **Dedicated Resources to Address Food Waste Within DEP:** Creating a Commonwealth wide Organic Management Coordinator and expand capacity to develop and review permits for digestion and composting facilities
- **Establish A Grant Fund for Food Waste-to-Energy Infrastructure:** For existing and new facilities. Emphasis on Environmental Justice communities.
- **Technical Assistance to Largest Food Waste Generators:** Outreach and education program to food manufacturing sector.
- **Leading by Example:** Diversion goals for Commonwealth agencies through GreenGov coordination.



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Q & A

Full assessment can be downloaded at:

<https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Renewables/Pages/Biomass.aspx>