



Mr. Paul Greene

North America's RNG Ecosystem Case Studies and Best Practices

Paul Greene

June 2025

GreeneTec Introduction

- First founding member of American Biogas Council in 2010 and first elected chair
- See:
 - www.greene-tec.com
 - www.biogas.tv
- Biogas RNG Advisory business since 2022

Biogas Markets

- Agriculture
 - Manures
 - Processing Waste (DAF Float, etc)
- Food Manufacturing Waste
- Landfill Gas
- Food Waste – Preconsumer, Grocery Store, Restaurants
- Municipal Wastewater Treatment
- Post Consumer Food Waste

Drivers

- A few USA states have landfill ban directives to keep organic waste out of landfills
 - Connecticut, Massachusetts, California, New York City
- Low Carbon Fuel Standards for Transportation
- SAF – Several states are creating tax credits
- Section 48 Investment Tax Credit created a big wave of projects in late 2024.
- Canadian Clean Fuel Regulation (CFR) is very good for both Canadian and American RNG.

Policy

- National Policy
 - RFS – RINS
- State Policy
 - CA LCFS
- Canada
 - CFR (Clean Fuel Regulation)



The future

- All eyes are on the upcoming 45Z Production Tax Credit
- People now building the projects that were registered in 2024 deploying the ITC
- Looking at new fuels like aviation fuels and Maritime

Renewable Fuel Standard

- Rewards RIN credits for food waste, manures, biosolids and landfill gas
 - D3 RINs (Cellulosic Biofuels) are trading at about \$33 per mmbtu
 - D5 RINs (Advanced Biofuels) are trading at about \$14 per mmbtu

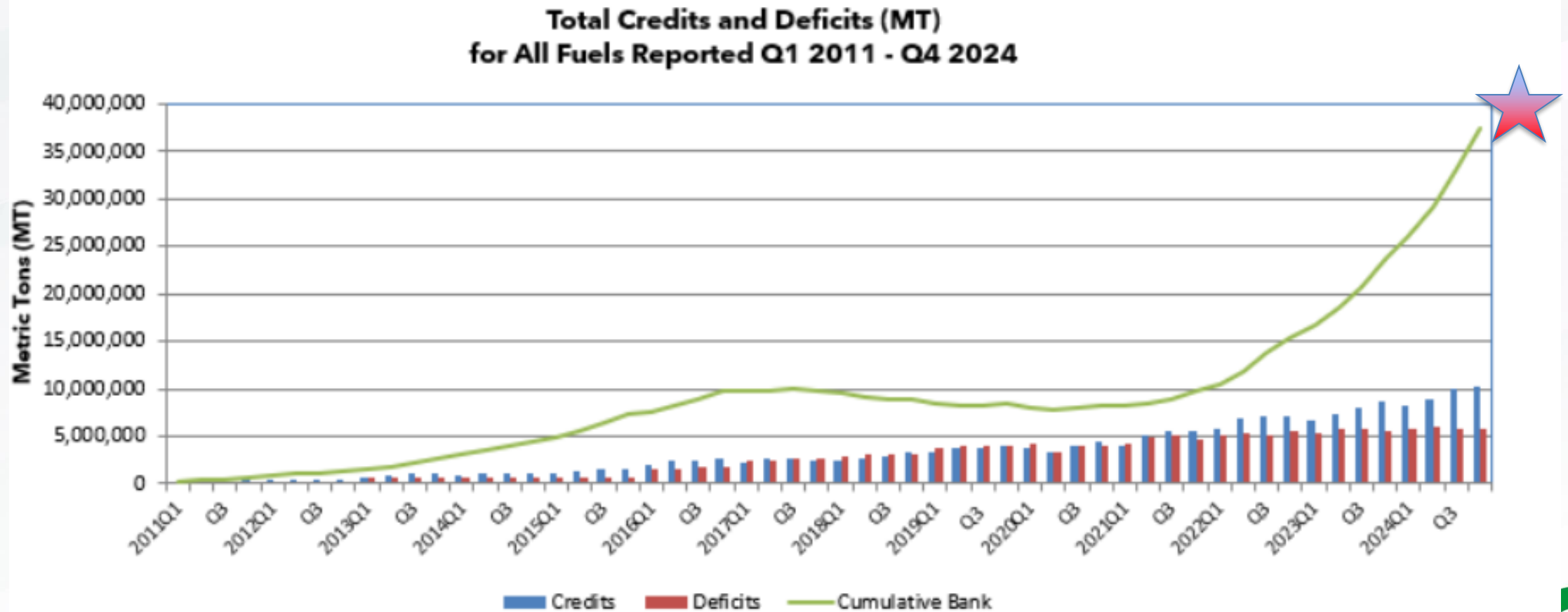
The 2025 Budget Battle

- The “Big Beautiful Bill”.
- Terminates
 - Section 45V for Hydrogen
- Section 45Z is a low carbon fuels tax credit.
 - Unclear if negative carbon intensity scoring will be allowed
 - A production tax credit now good until 2027 but looks like it will be extended to 2031
- Investment Tax Credit – Section 48 expired

Trends

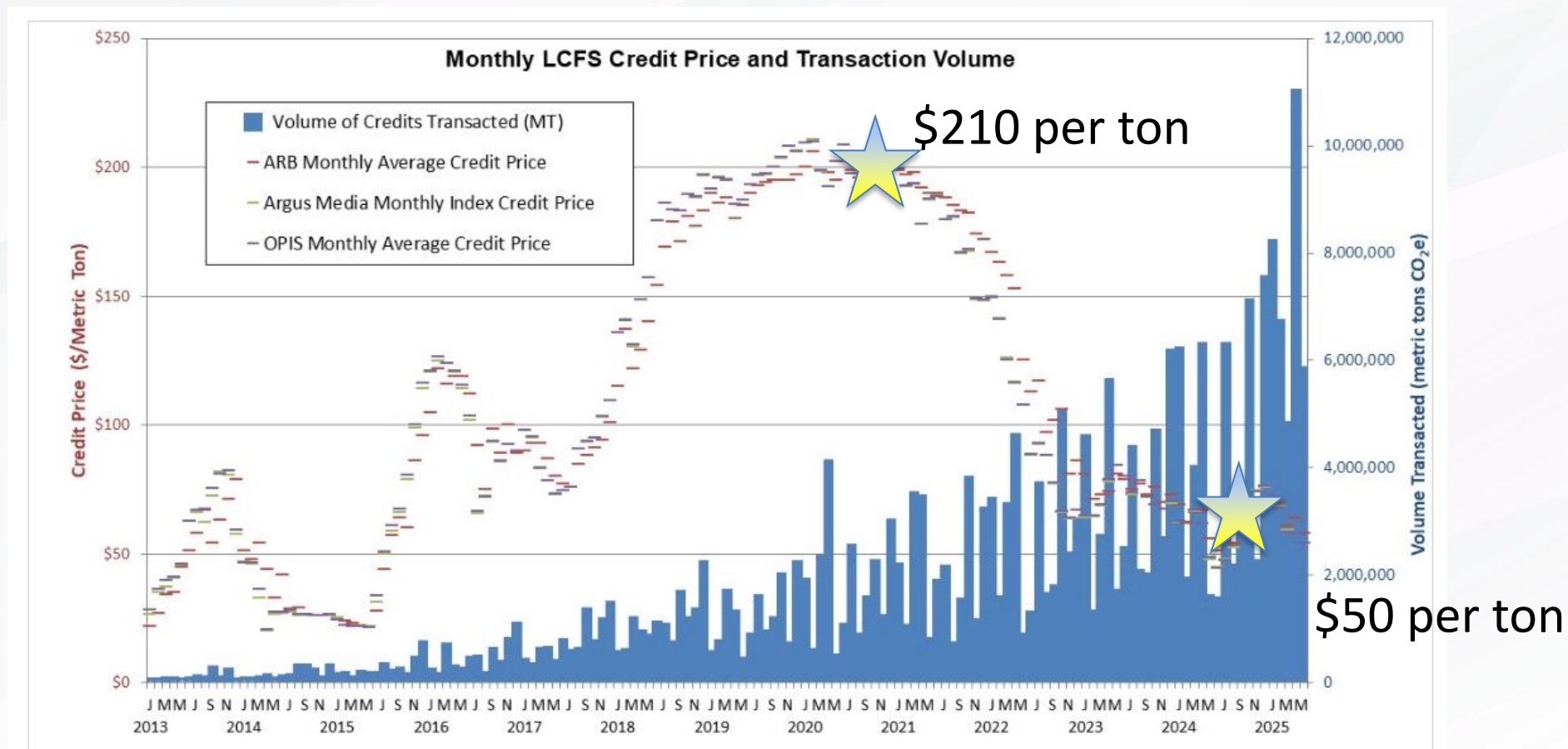
- California LCFS Prices – softened from \$100+ to \$45 per ton
 - CA LCFS was the catalyst for the USA boom in the RNG business from 2020 to 2023
- D3 RIN prices have softened to \$2.50 each
- Regulatory uncertainty

California carbon bank is full of credits the program is very popular



California LCFS Prices

have reached a new normal



Tax Code

- Section 48 ITC – Need to have “safe harbored” the project before 1/1/2025

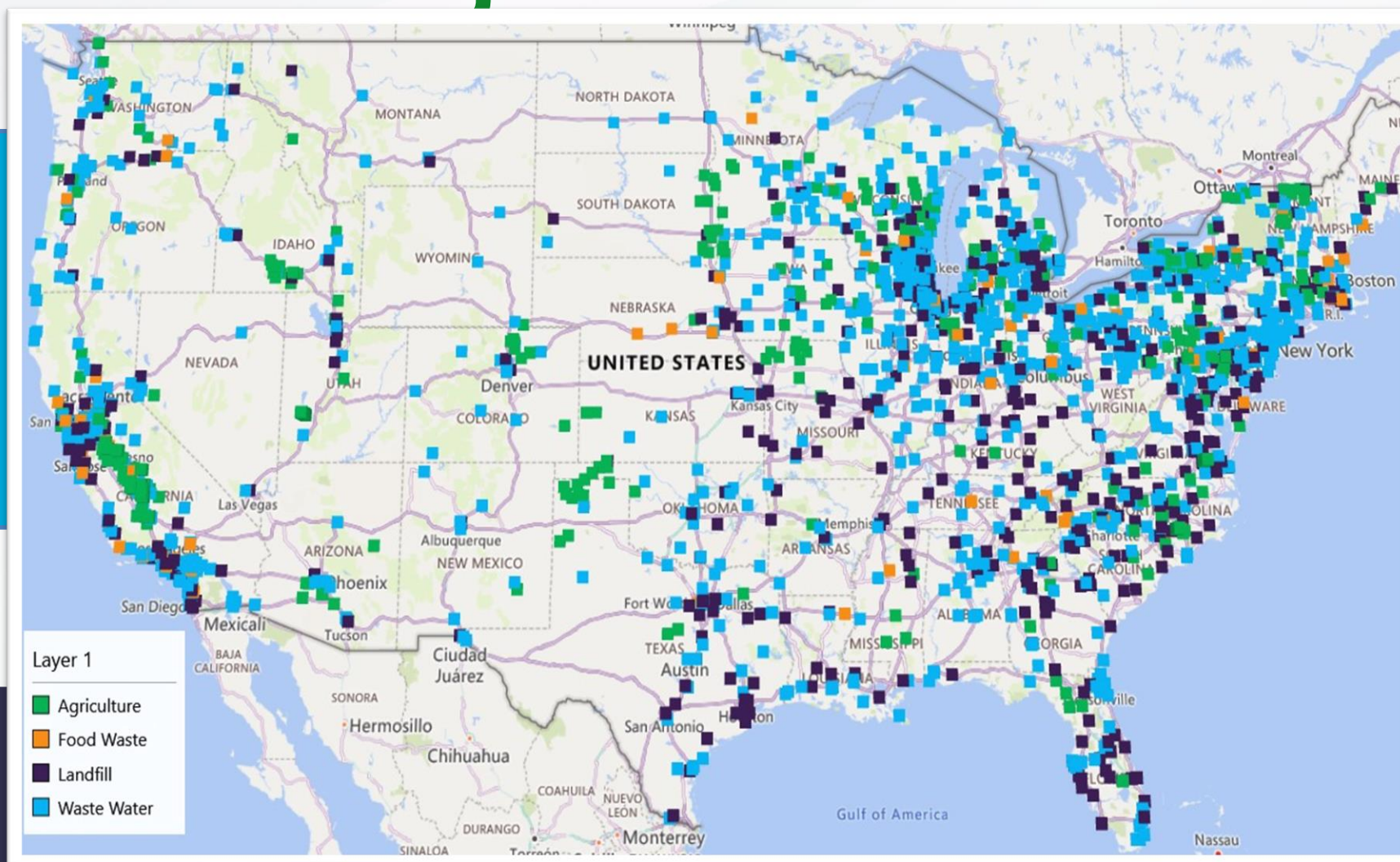
The U.S. Biogas Market

Operational Biogas Systems: 2,494

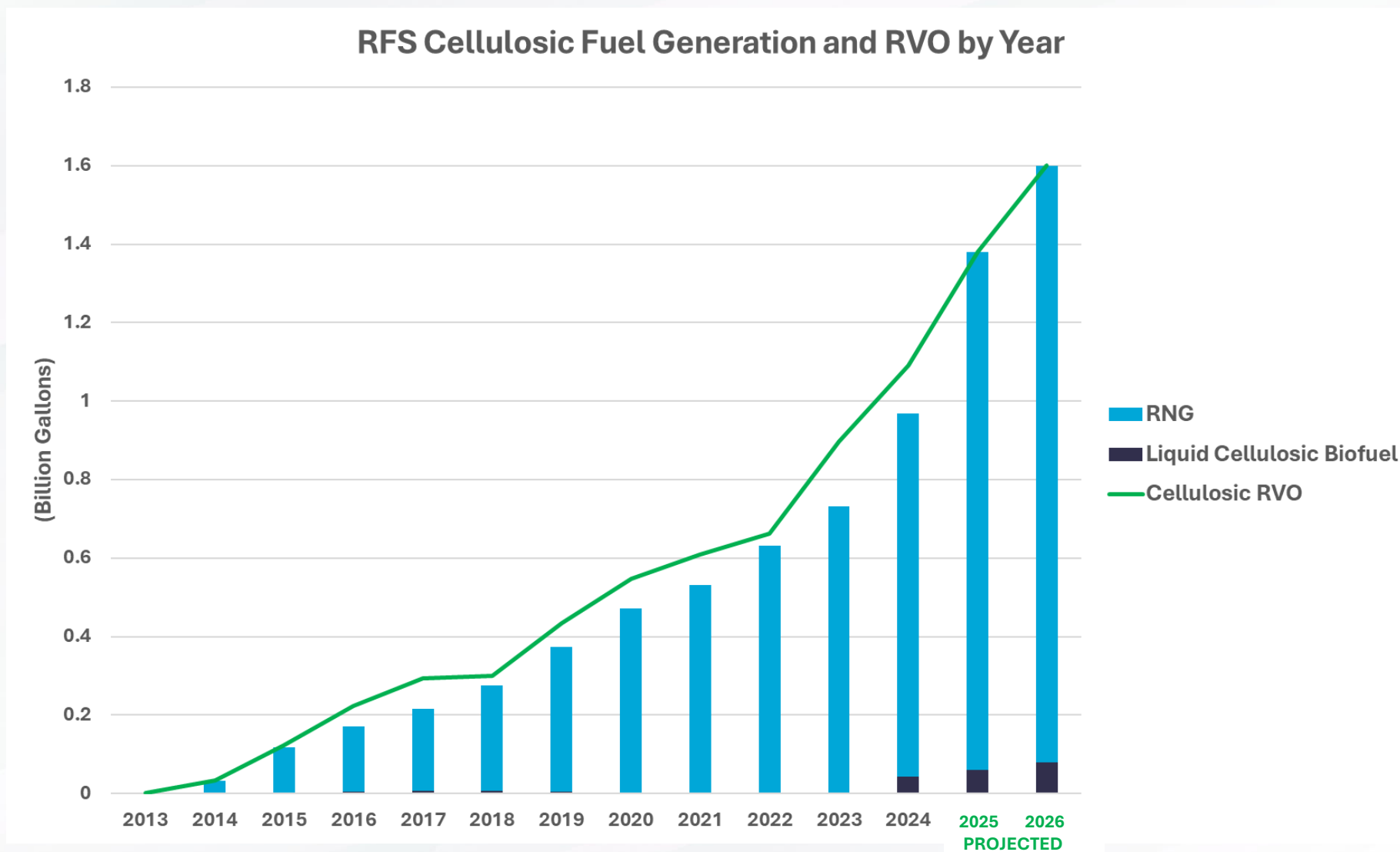
- 576 RNG
 - 1,400 Electricity
-
- 609 on Farm
 - 1,189 Wastewater
 - 113 Food Scrap
 - 583 at Landfills

Potential New Biogas Systems: 17,000

- 11,200 on Farms
- 3,750 Wastewater
- 1,370 Food Scrap
- 730 at Landfills

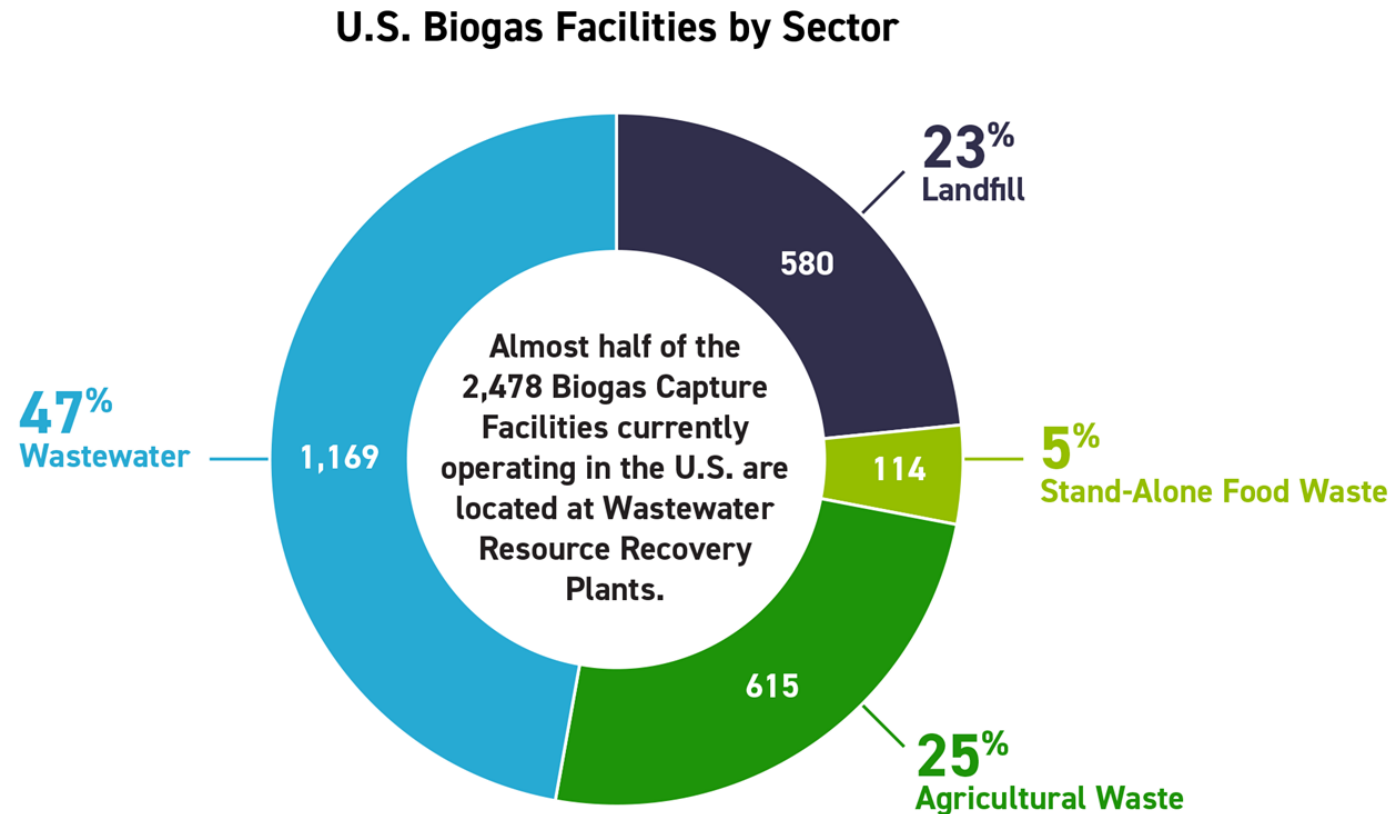


Growth of US Biogas Use in Transportation



April 2025

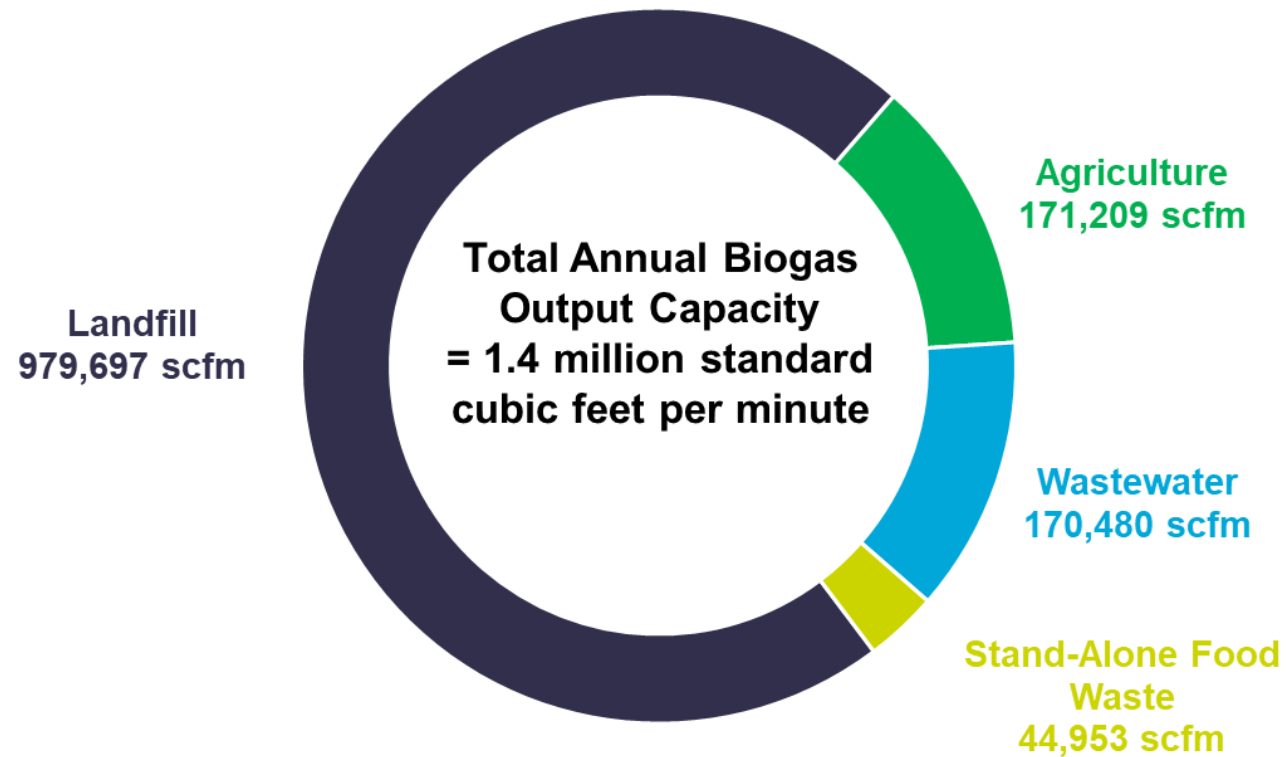
Biogas Systems In The U.S. By Feedstock Source, 2024



2024 Growth: 5.4%	
Landfill	+4.3%
Agriculture	+18.0%
Wastewater	+0.4%
Food Waste	+2.7%

U.S. Biogas Production Capacity (scfm)

Total U.S. Biogas Production Capacity at end of 2024



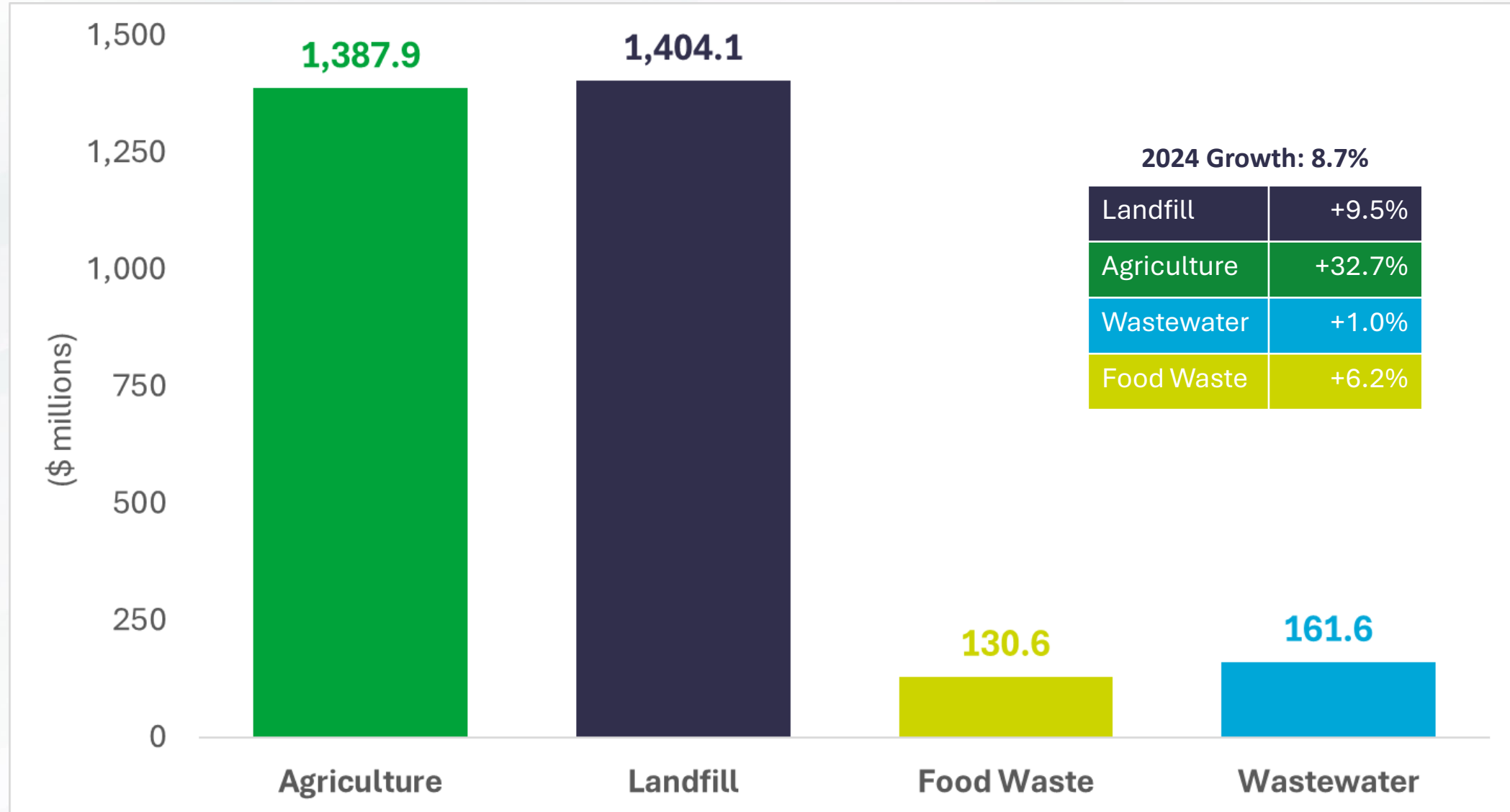
2024 Growth: 10.6%	
Landfill	+12.3%
Agriculture	+13.9%
Wastewater	+0.9%
Food Waste	+2.4%

Total U.S. Biogas Production Capacity, 2015-2024

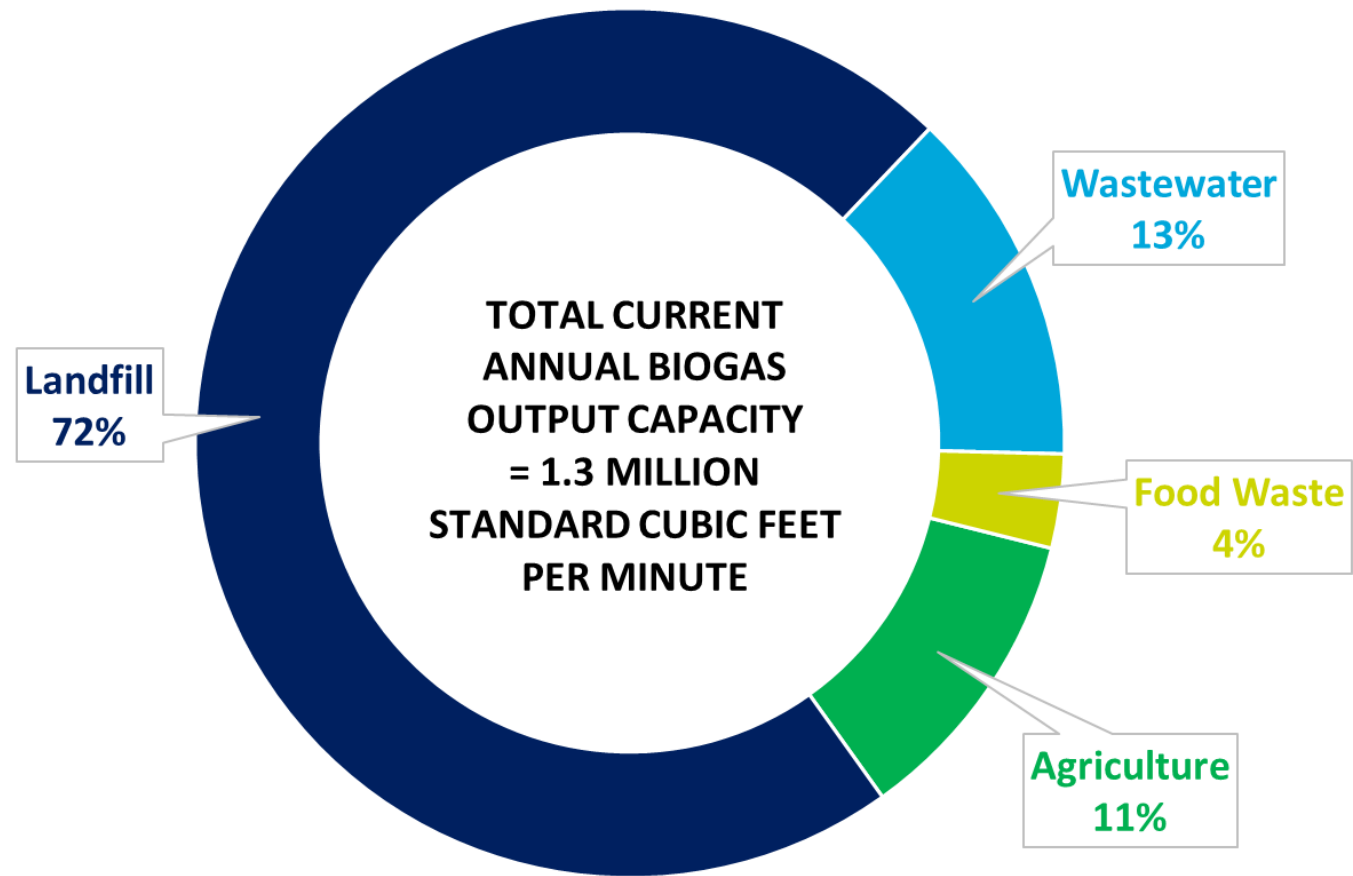


NOTE: Production is attributed to the year system went into operation.

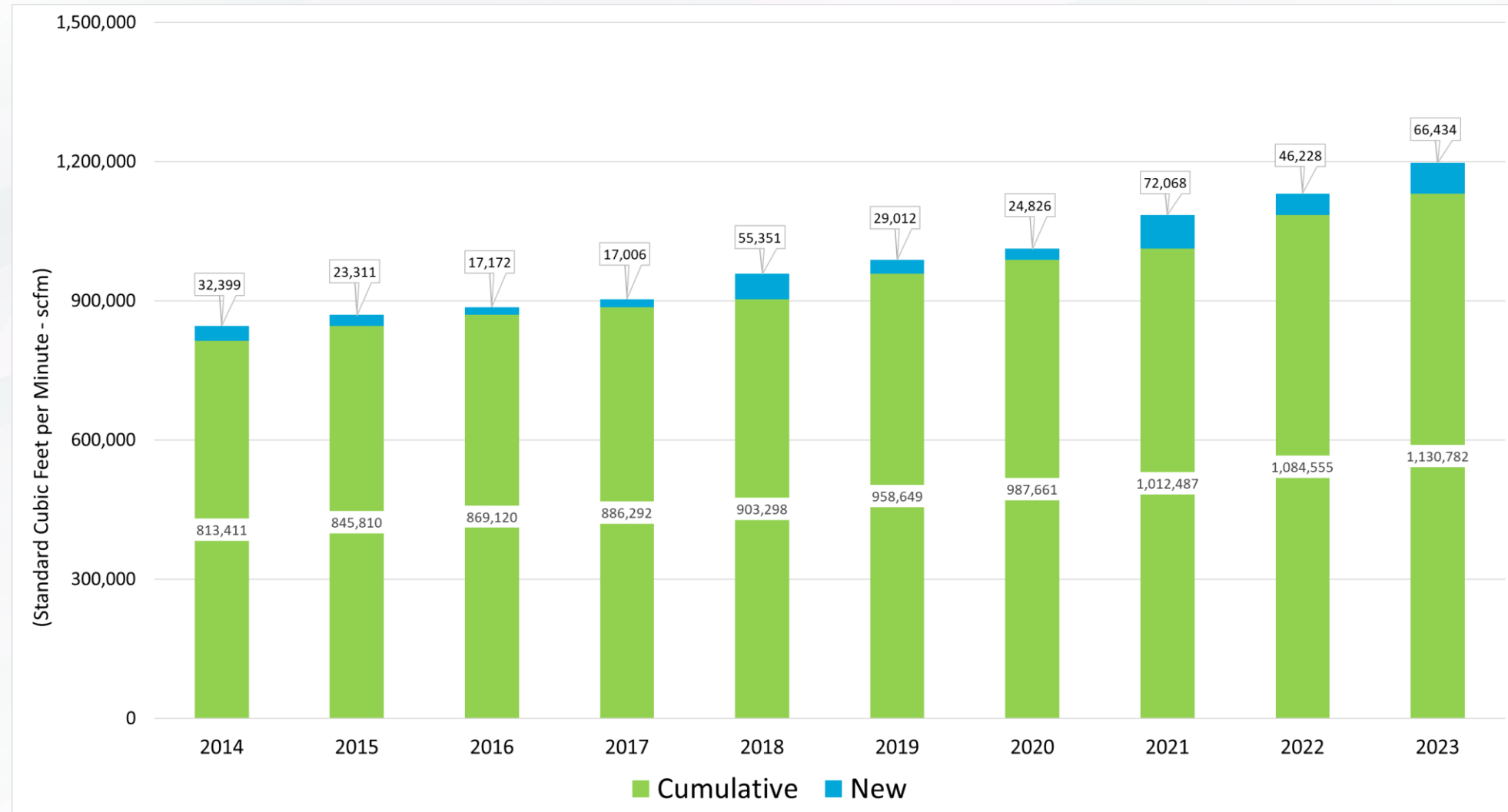
\$3B of Capital Came Online in 2024



Total U.S. Biogas Production Capacity



US Biogas Output, 2014-2023 (scfm)

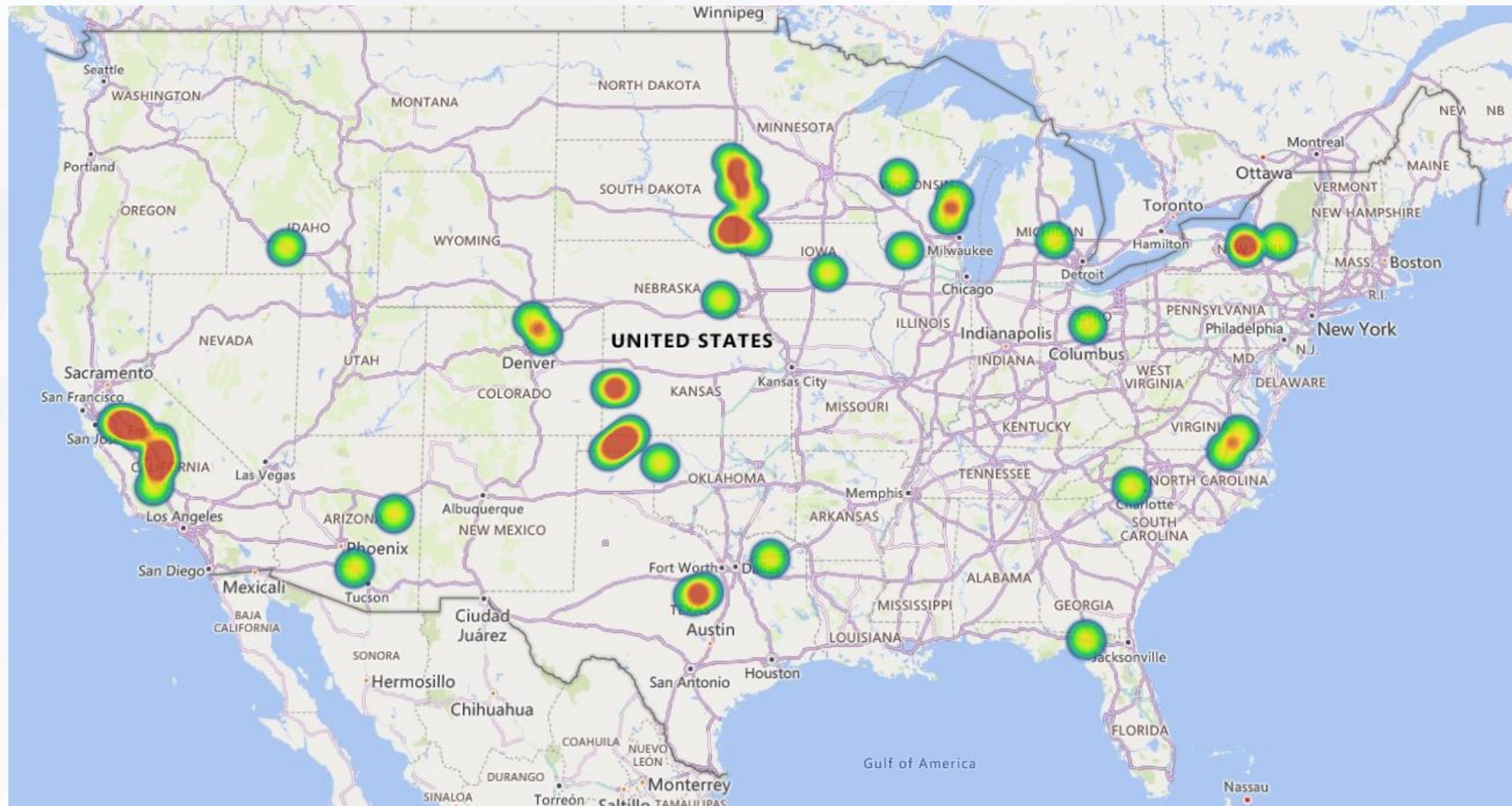


4/10/2024

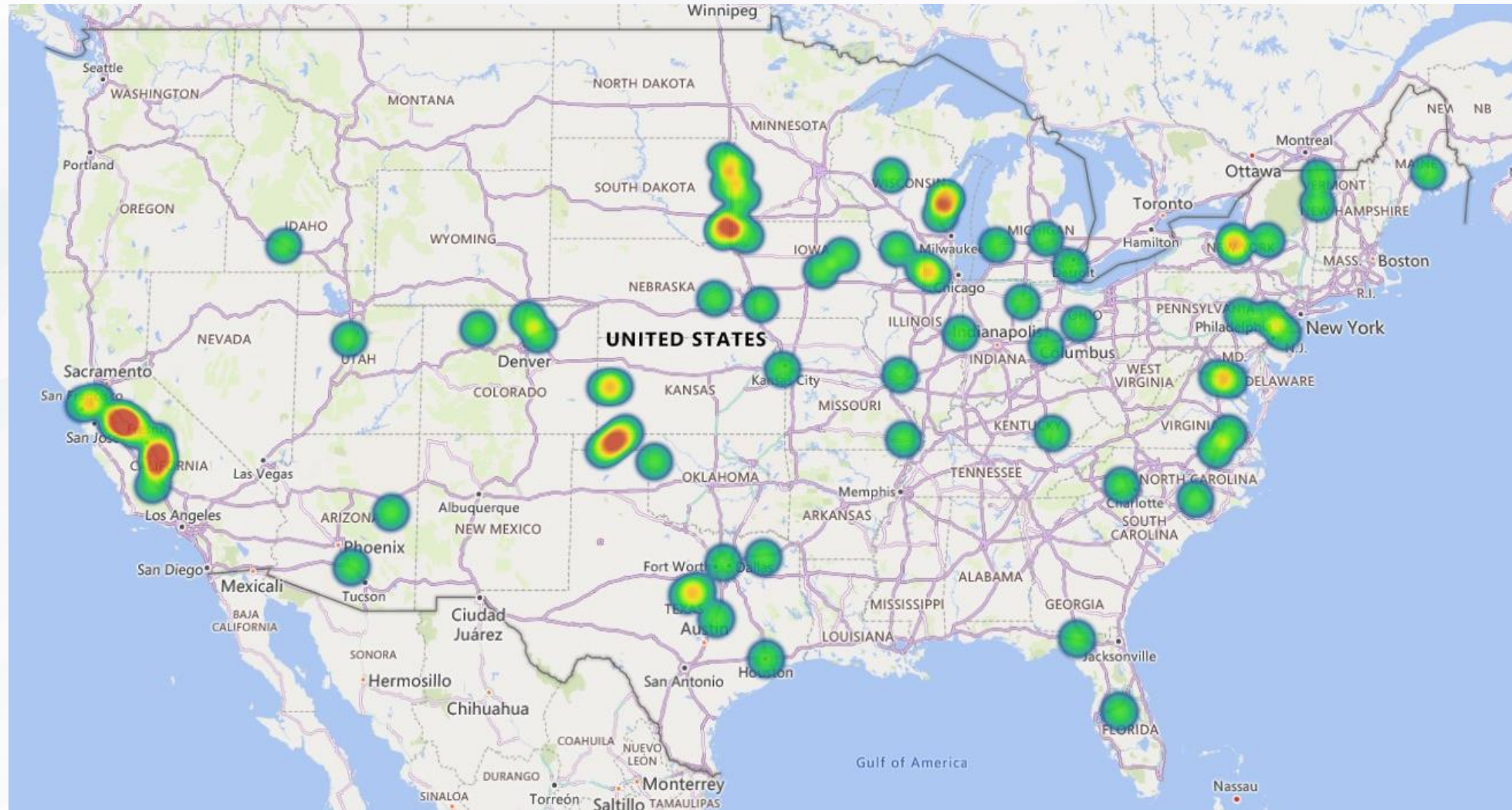


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Main Centers of U.S. Biogas Production on Farms

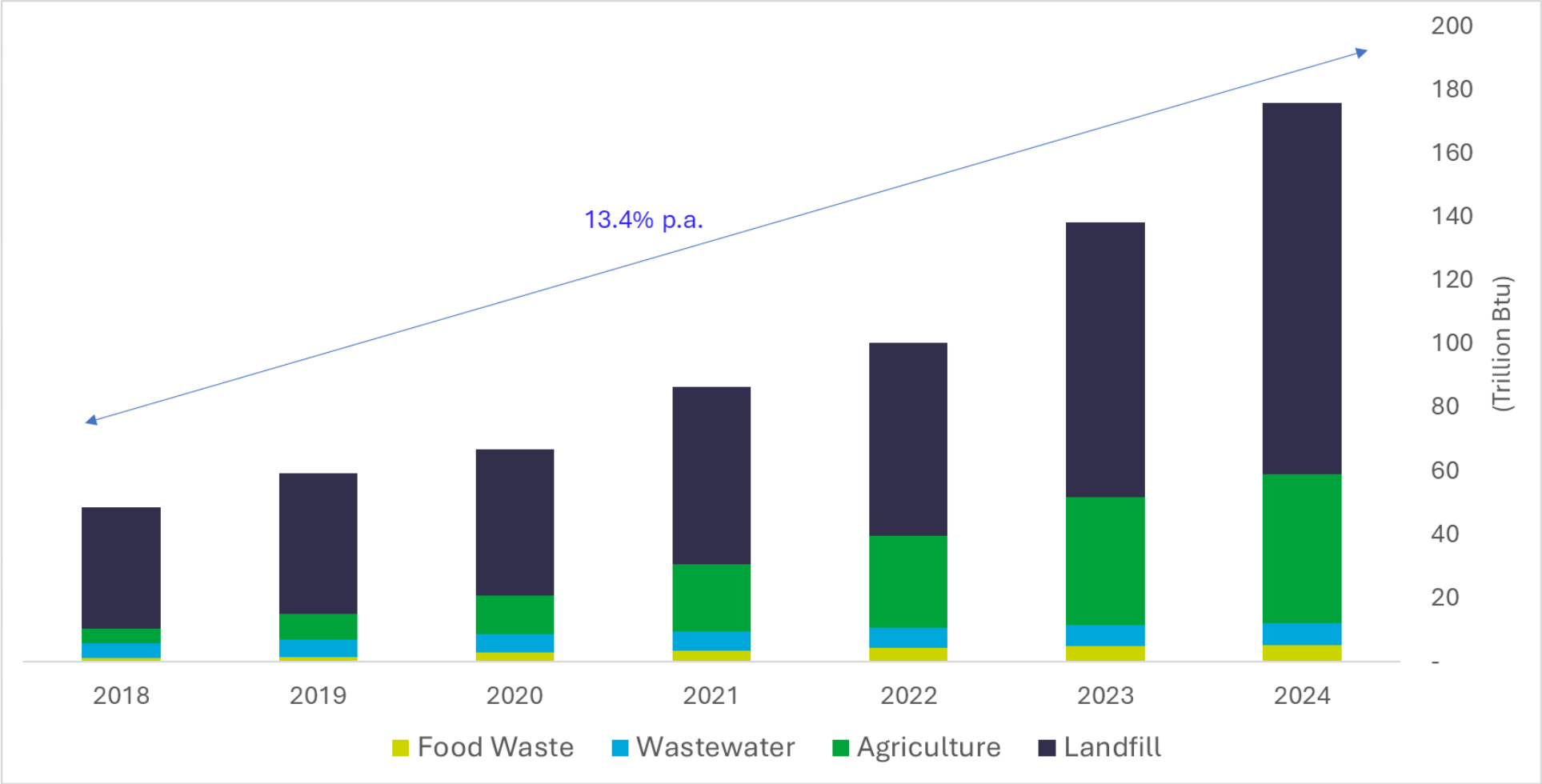


New Biogas Production Capacity Added in 2024



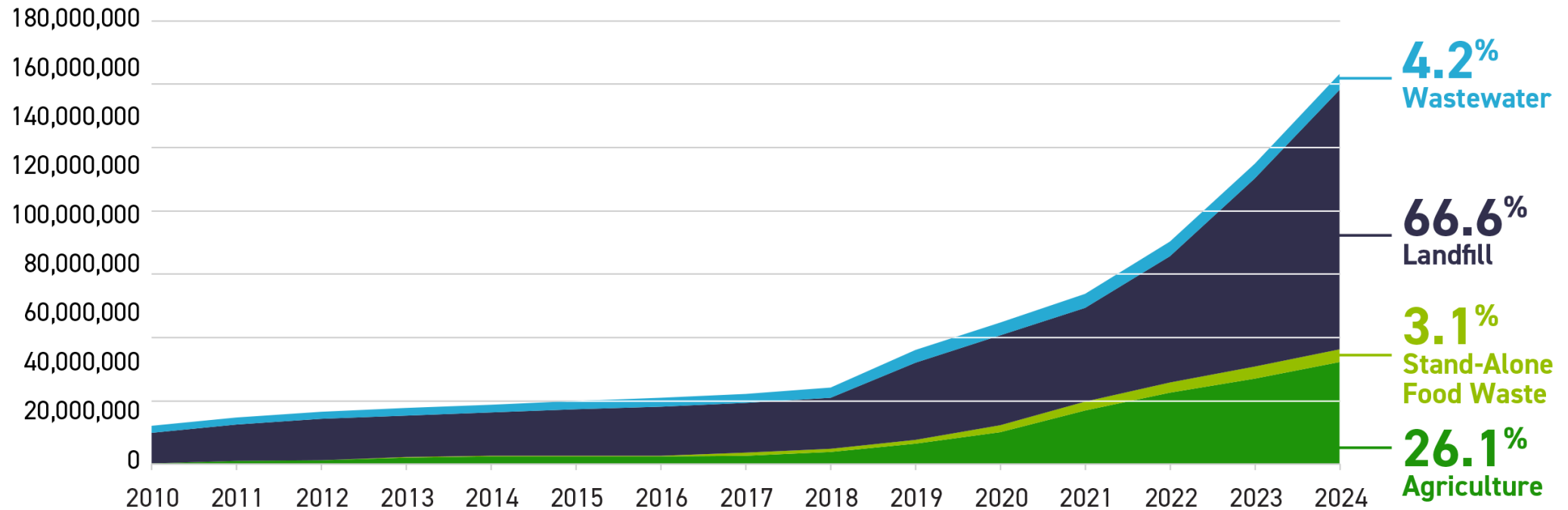
March 2025

U.S. RNG Production by Feedstock, 2018-2024 (Trillion Btu)



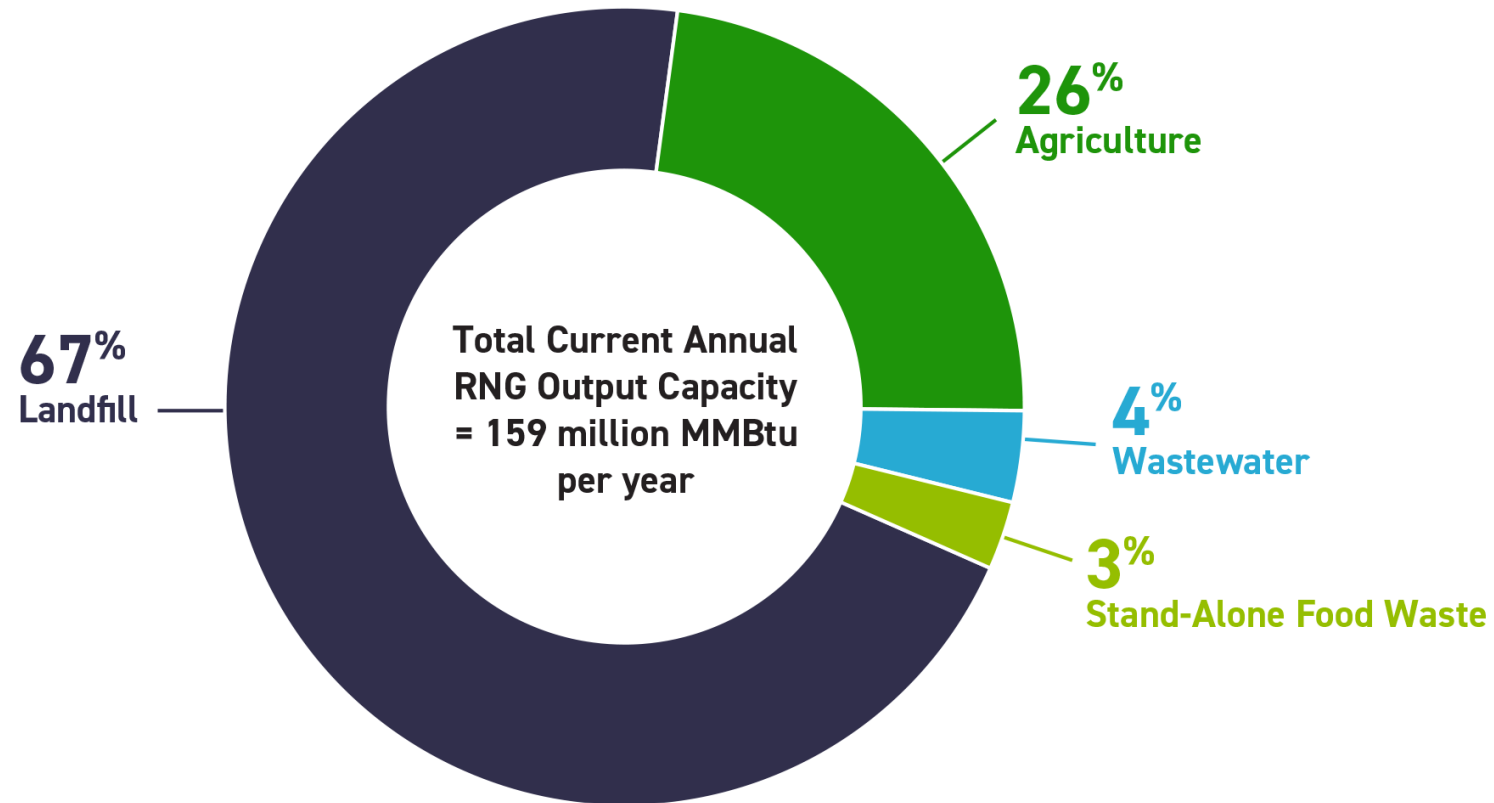
RNG Capacity 2010-2024

RNG Output Capacity by Sector, 2010-2024 (MMBtu)



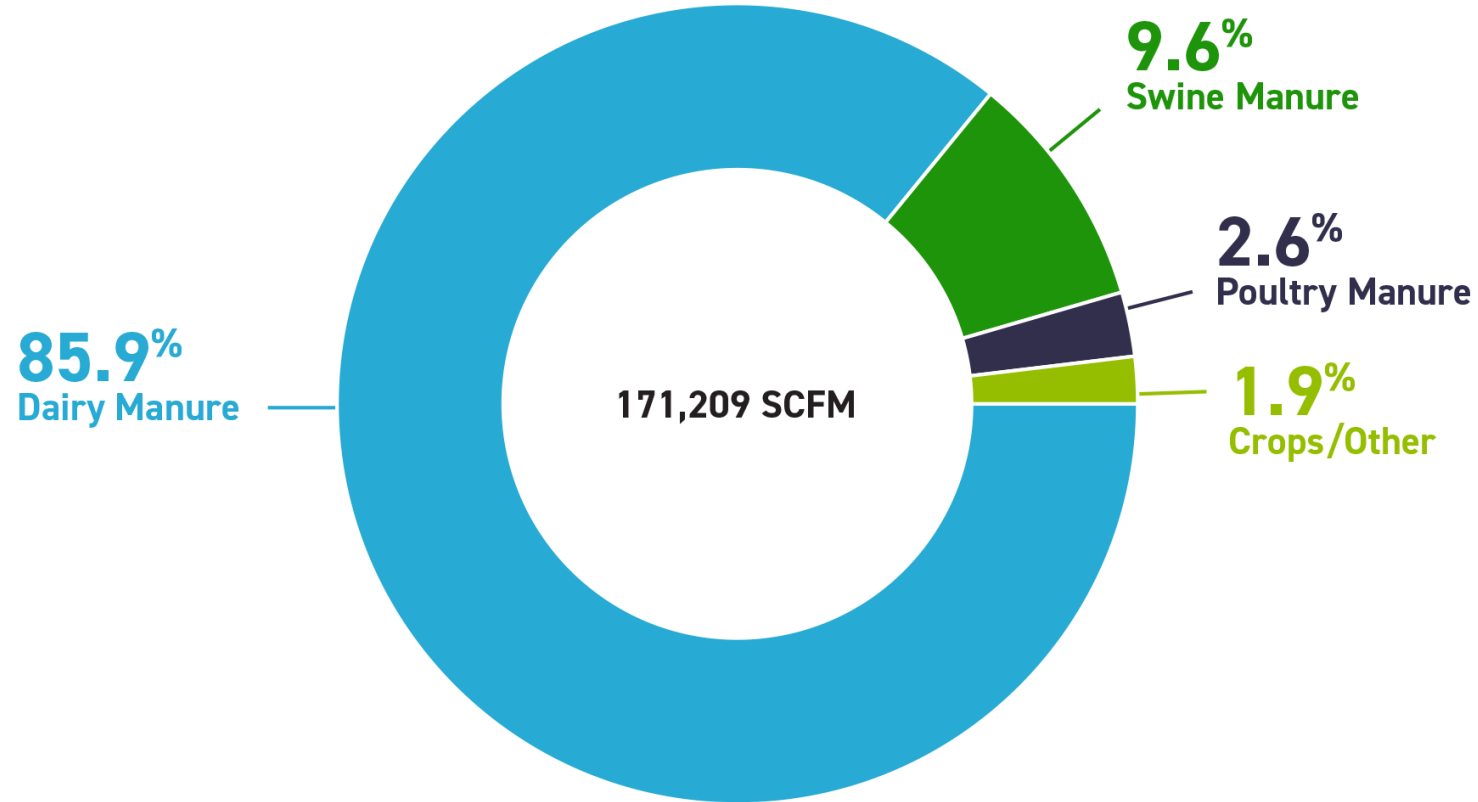
RNG Capacity by Sector

RNG Production Capacity at end of 2024, (MMBtu)

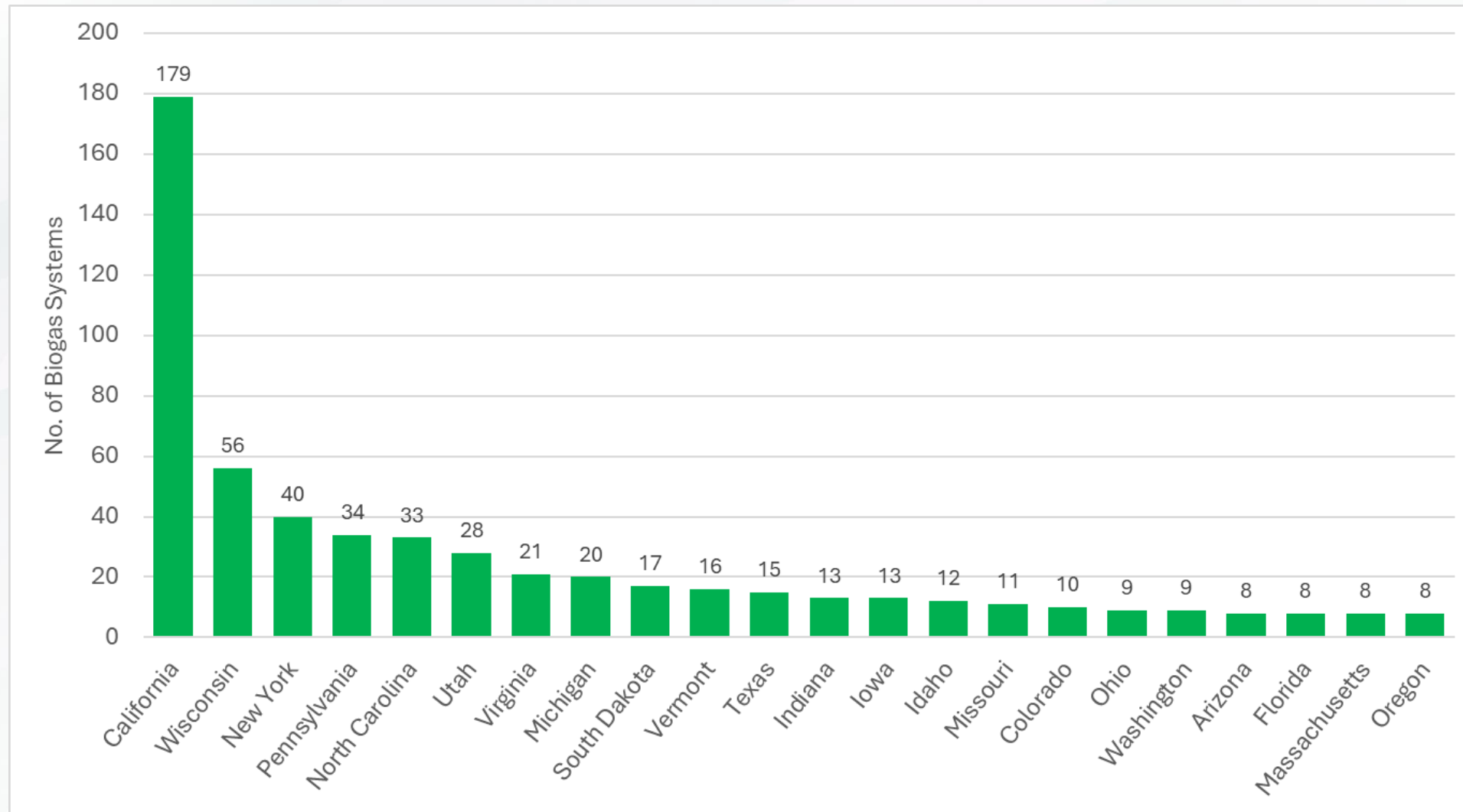


Farm-Based Biogas Capacity

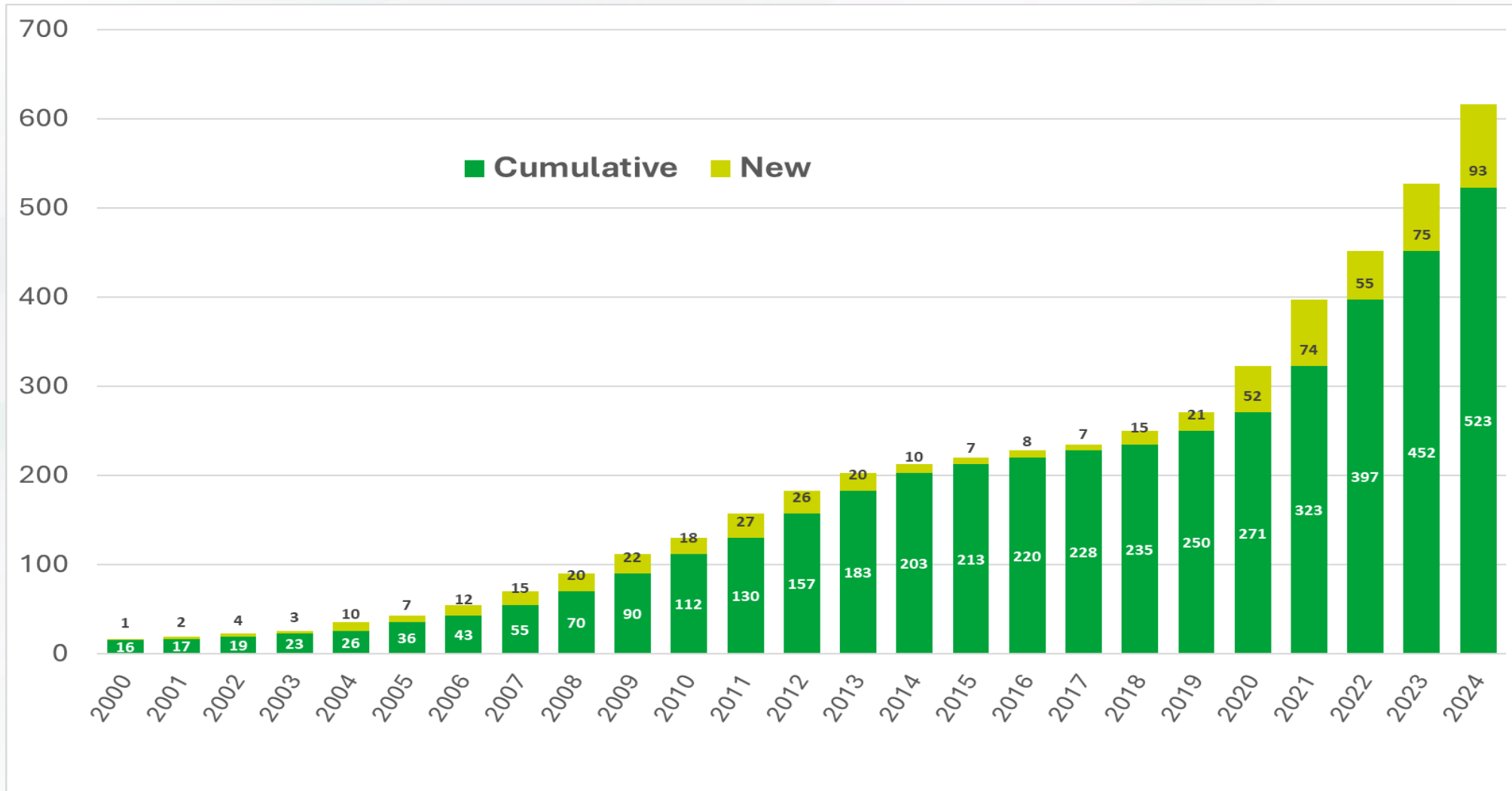
Farm-Based Biogas Production Capacity by Primary Feedstock at end of 2024



Operational On-Farm Biogas Systems by State, 2024

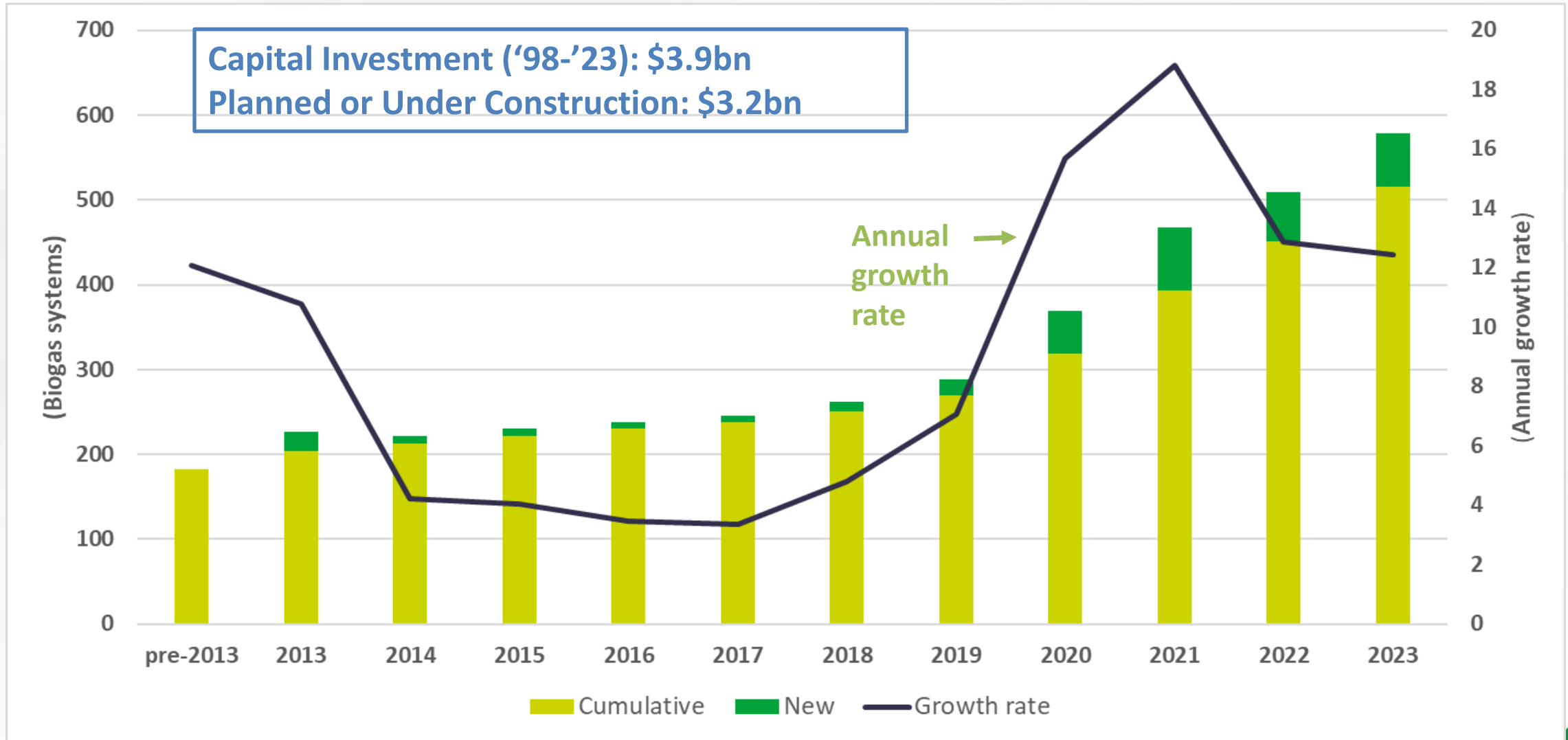


US Farm-based Biogas Systems, 2000-2024

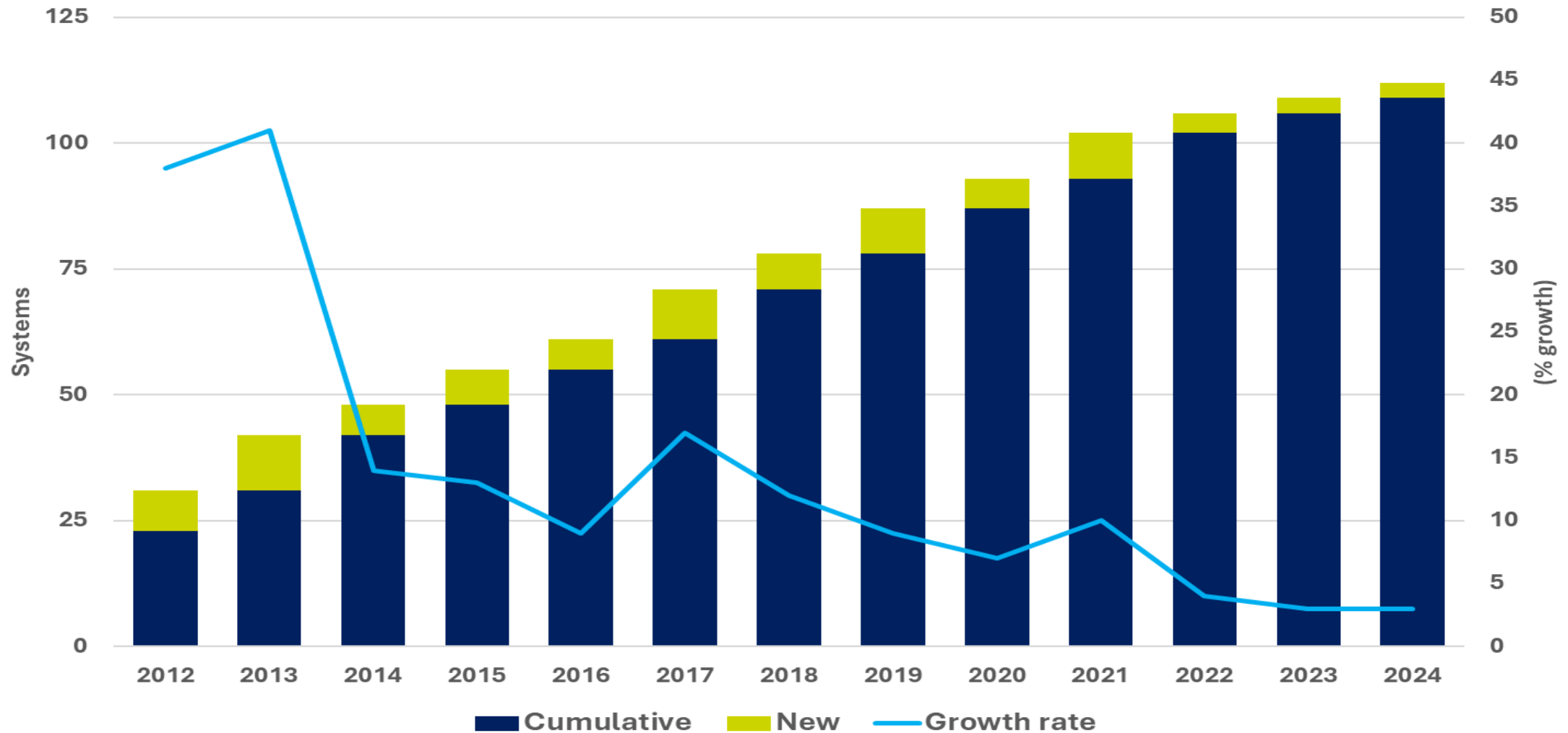


616 operational
farm-based biogas
systems in 2024

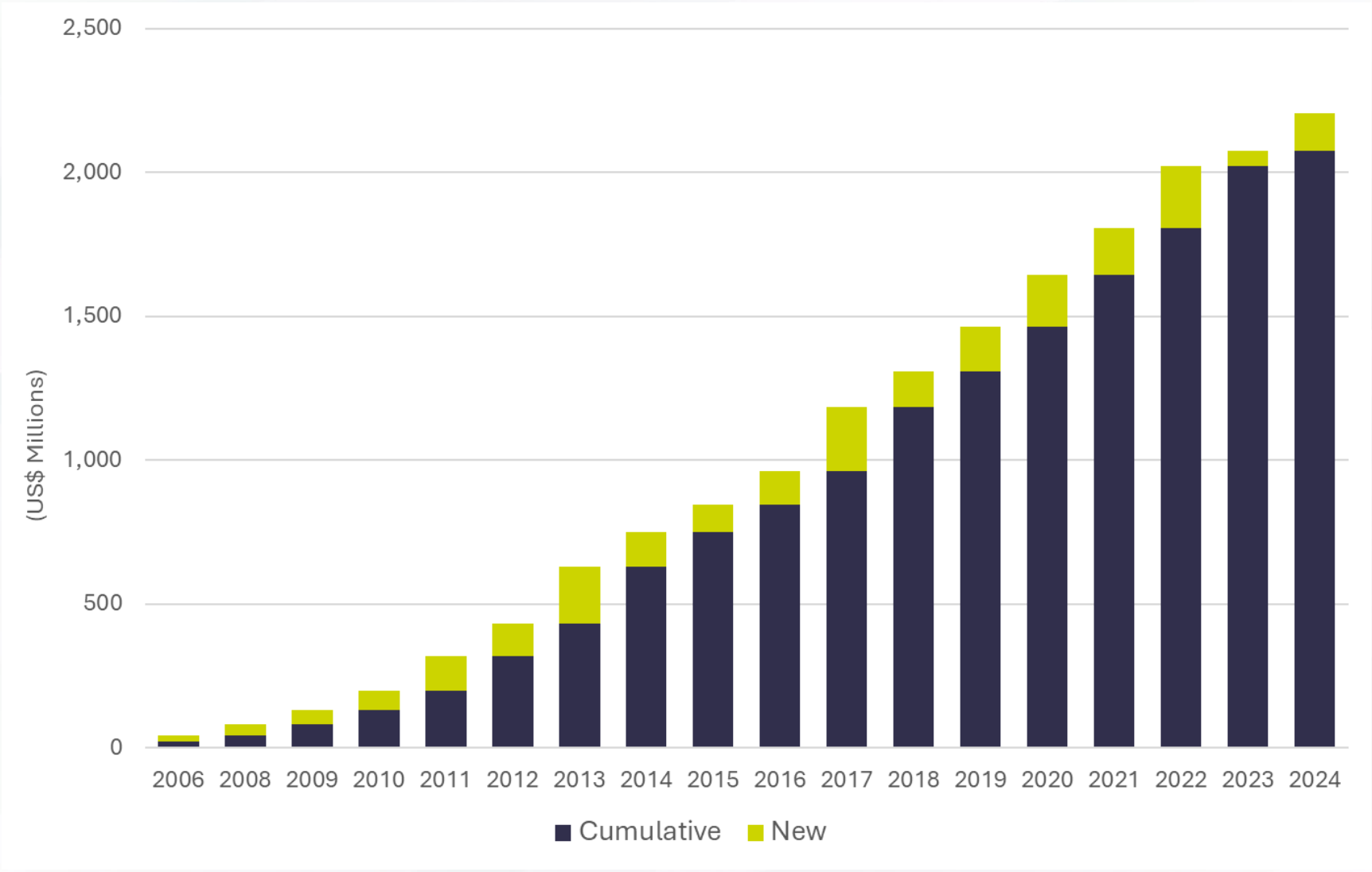
Farm-based Biogas Systems in the US



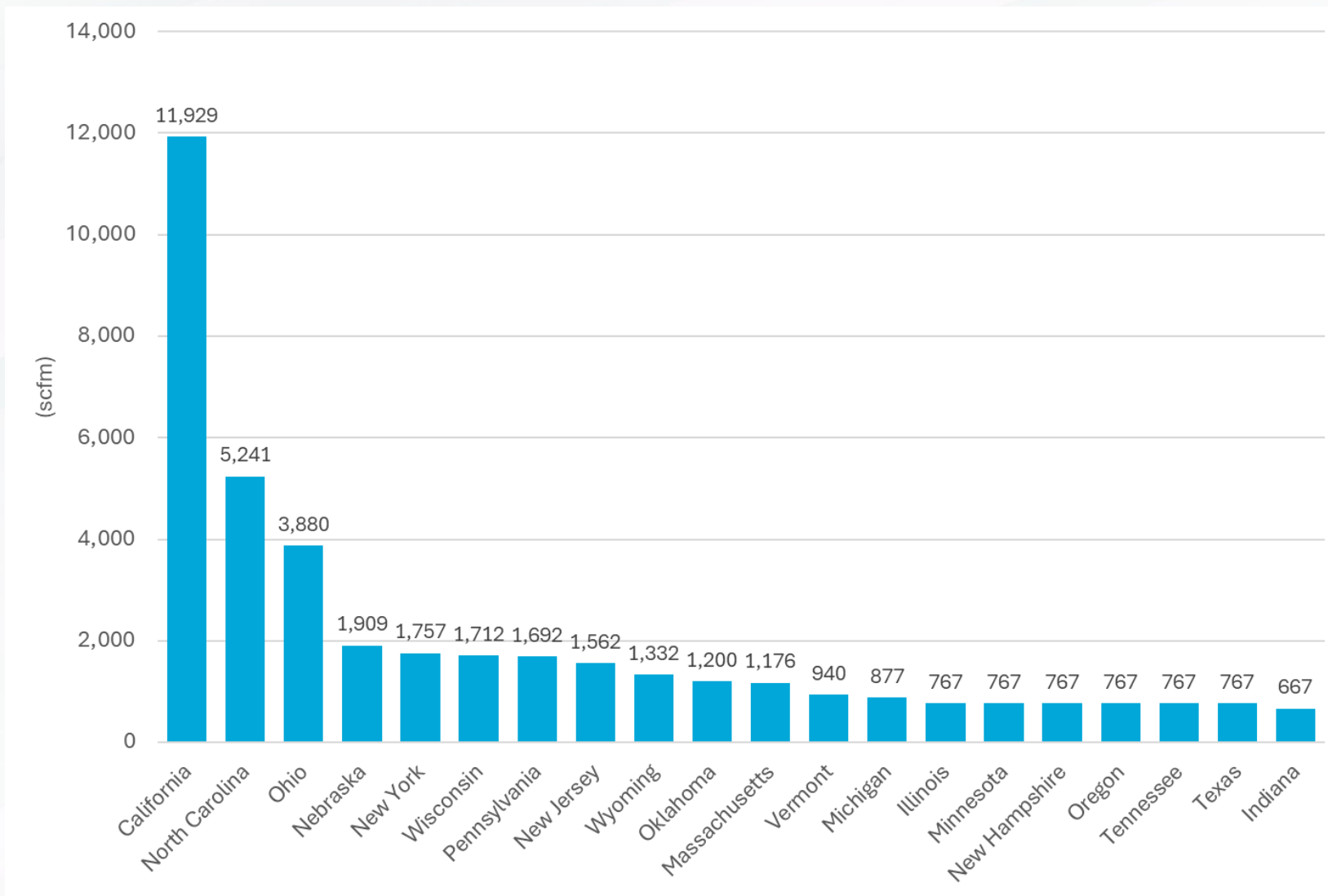
Stand-Alone Food Waste Biogas Systems, 2012-2024



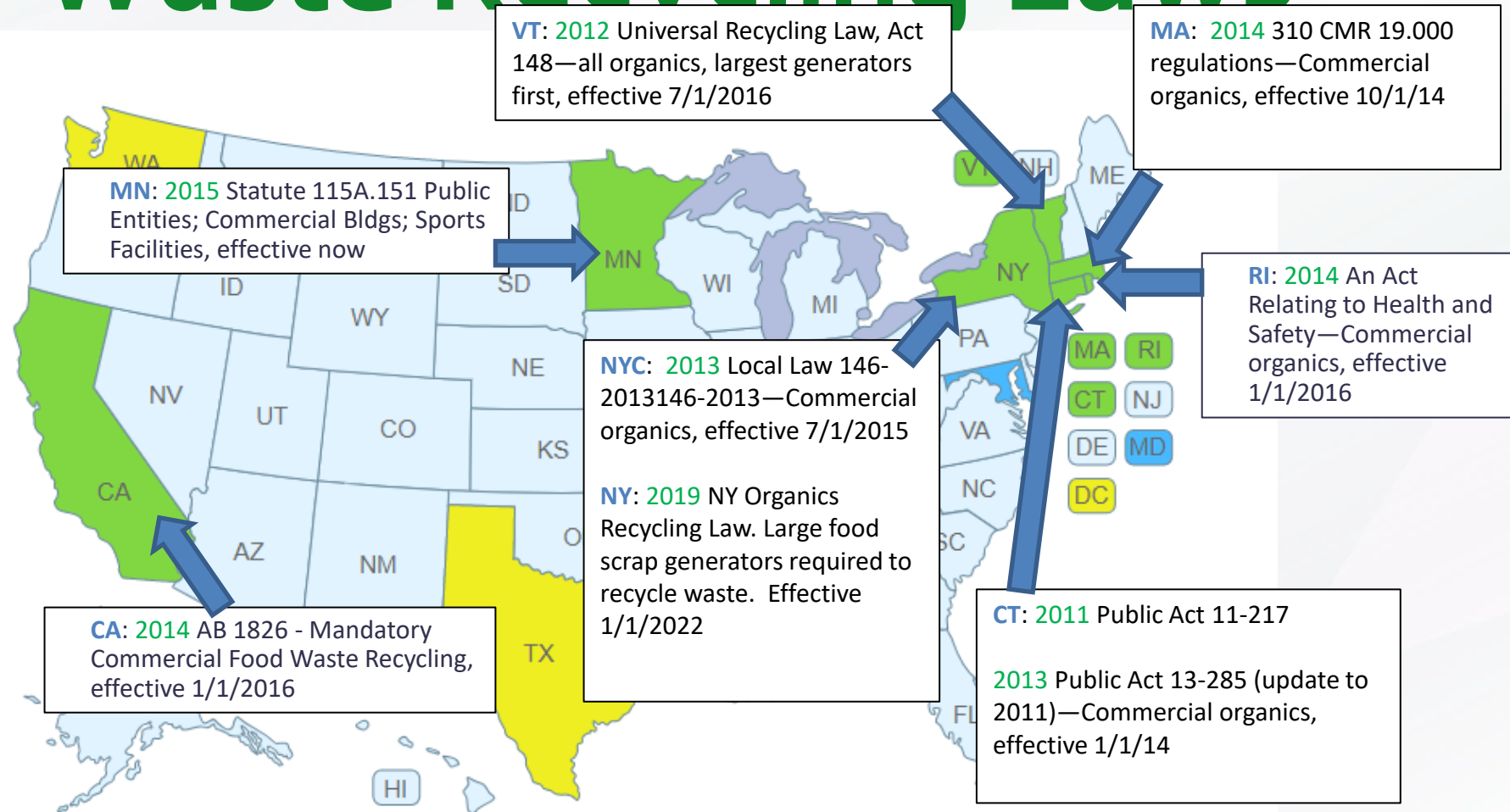
Capital Investment in Standalone Food Waste Biogas Systems



Total Biogas Production Capacity at Standalone Food Waste Facilities by Leading States, 2024



10 States Have Food Waste Recycling Laws



PROJECTS - USA



Green Era – Chicago, IL

100,000 tons per year
Of food waste from
Food manufacturing

200,000 mmbtu per year
Of RNG

Solids depackaging system



Synthica – Cincinnati Ohio

- 190,000 tons of food waste per year
- RNG into the natural gas pipeline



Dairy Farms, Iowa

USA – BIOSTREAM DEPLOYMENTS 11 SITES 19 UNITS



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Warsaw, North Carolina

Food Waste Digesters

Creation of RNG

45,000 m³ of digesters

Waste from processing of
Proteins (Hogs, chickens)



Jessup, Maryland

100,000 tons of food waste
Per year

190,000 mmbtu of RNG per year

Food waste from local food
Manufacturing

BTS Bioenergy



Gila Bend, Arizona

Dairy Manure Digesters

Creation of RNG

10,000 milking cows



San Bernardino, California

100,000 tons of food waste/ year

Creation of electricity from biogas

Extensive digestate treatment with
Reverse osmosis water filters



THANK YOU

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