WWTPs and the Renewable Fuel Standard

Bruce Smith
U.S. EPA, Office of Research and Development

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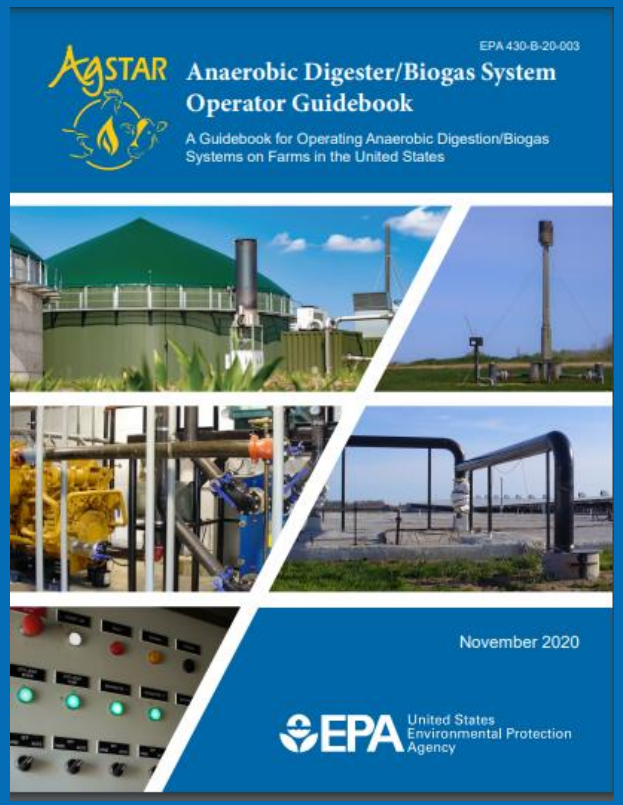
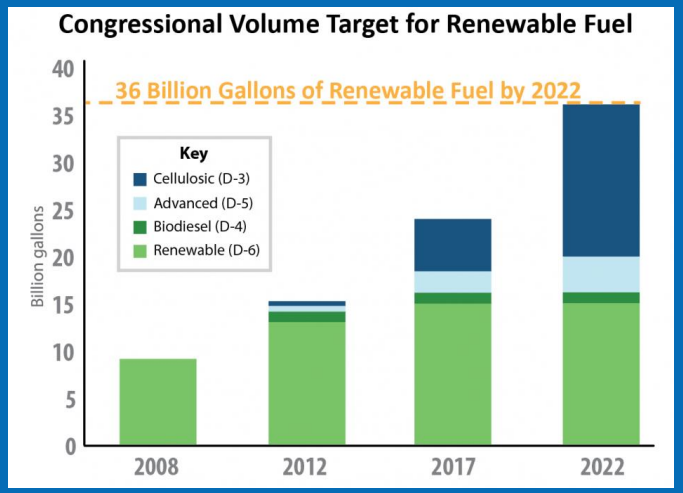
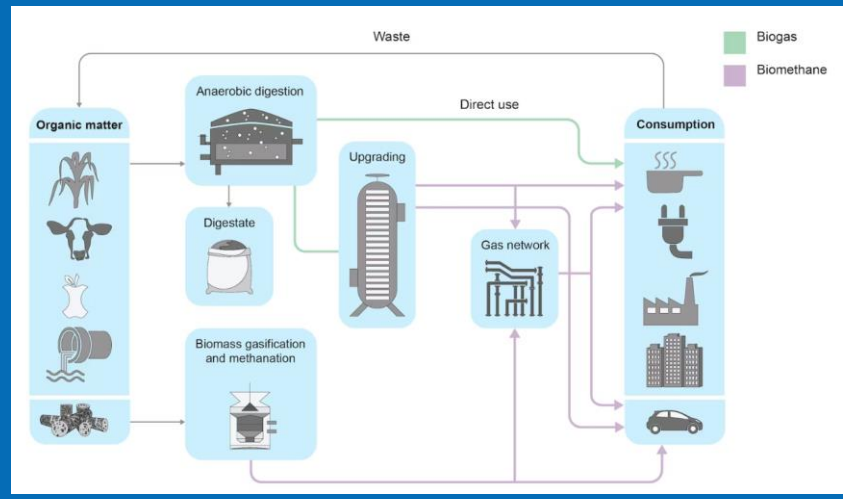




https://www.epa.gov/renewable-fuel-standard-program



https://www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth/an-introduction-to-biogas-and-biomethane

What We'll Cover

- WWTP Renewable Natural Gas
- Renewable Fuel Standard
- EPA Resources
- Local Projects and Opportunities
- Questions

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WWTP Renewable NG – Production

- Anaerobic digestion (AD)
  - 3 (or 4) step process
  - Various options (thermo/meso, sequential/batch/plug flow/TPAD)
  - Pretreatment advances – enhanced hydrolysis
- Operational and performance parameters
- Key gas pollutants (moisture, Hydrogen sulfide, Siloxanes)
- Gas quality needed (esp. methane percentage)

WWTP Renewable NG – Current Status

- Approximately 14,000 municipal wastewater treatment plants in U.S.
- Less than 10% produce biogas via anaerobic digestion
- About 1/3 flare the gas
- Less than 15% used gas for combined heat and power systems
- Remaining use gas to heat digesters

WWTP Renewable NG – Opportunity

Possible U.S. production

- approximately 160 trillion Btu in chemical energy alone flow through WWTPs every year [1]
- Estimates of 128 trillion BTU from wastewater biogas (over 15% of current transportation consumption) [2]
- Only about 40% of biogas recovered [3]
- In most cases, AD will not produce enough biogas to efficiently recover energy unless the influent flow rate is greater than 5 mgd [4]

[1] Seiple, T. E., Skaggs, R. L., Fillmore, L., and Coleman, A. M. (2020). Municipal wastewater sludge as a renewable, cost-effective feedstock for transportation biofuels using hydrothermal liquefaction. Journal of Environmental Management 270, 110852.

[2] https://www.nrel.gov/docs/fy14osti/60178.pdf

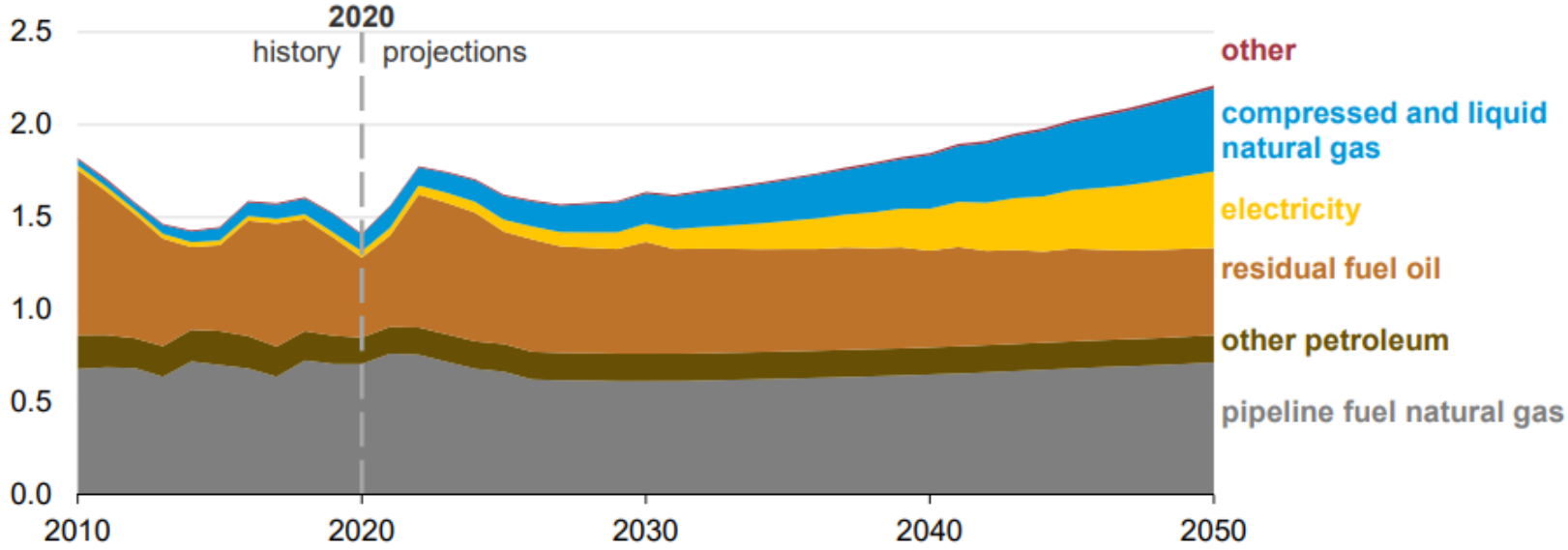
[3] Rauch-Williams, T., Marshall, M. R., and Davis, D. J. (2018). Baseline Data to Establish The Current Amount Of Resource Recovery from WRRFs. Retrieved from https://www.wef.org/globalassets/assets-wef/direct-download-library/public/03--- resources/WSEC-2018-TR-003

[4] EPA (2007). Biomass Combined Heat and Power Catalog of Technologies, Combined Heat and Power Partnership

Transportation Consumption Estimate

Transportation sector minor petroleum and alternative fuels consumption

Transportation sector consumption of minor petroleum and alternative fuels
AEO2021 Reference case
quadrillion British thermal units



eia | Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021* (AEO2021) www.eia.gov/aeo 3

Renewable Fuel Standard – Program Elements

Renewable Fuel Standard (**RFS**)

- created under the Energy Policy Act of 2005 (EPAct)
- expanded under Energy Independence and Security Act of 2007 (EISA)

- National policy requires **volume of renewable fuel** to replace or reduce the quantity of petroleum-based transportation fuel, heating oil or jet fuel.
- Must achieve a **reduction in greenhouse gas (GHG) emissions** as compared to a 2005 petroleum baseline.
- **Four renewable fuel categories** :
  - Biomass-based diesel
  - Cellulosic biofuel
  - Advanced biofuel
  - Total renewable fuel
- Obligated parties are **refiners or importers of gasoline or diesel fuel**.
- Compliance is achieved by blending renewable fuels into transportation fuel, or by obtaining credits (called "Renewable Identification Numbers", or RINs) to meet an EPA-specified **Renewable Volume Obligation (RVO)**.

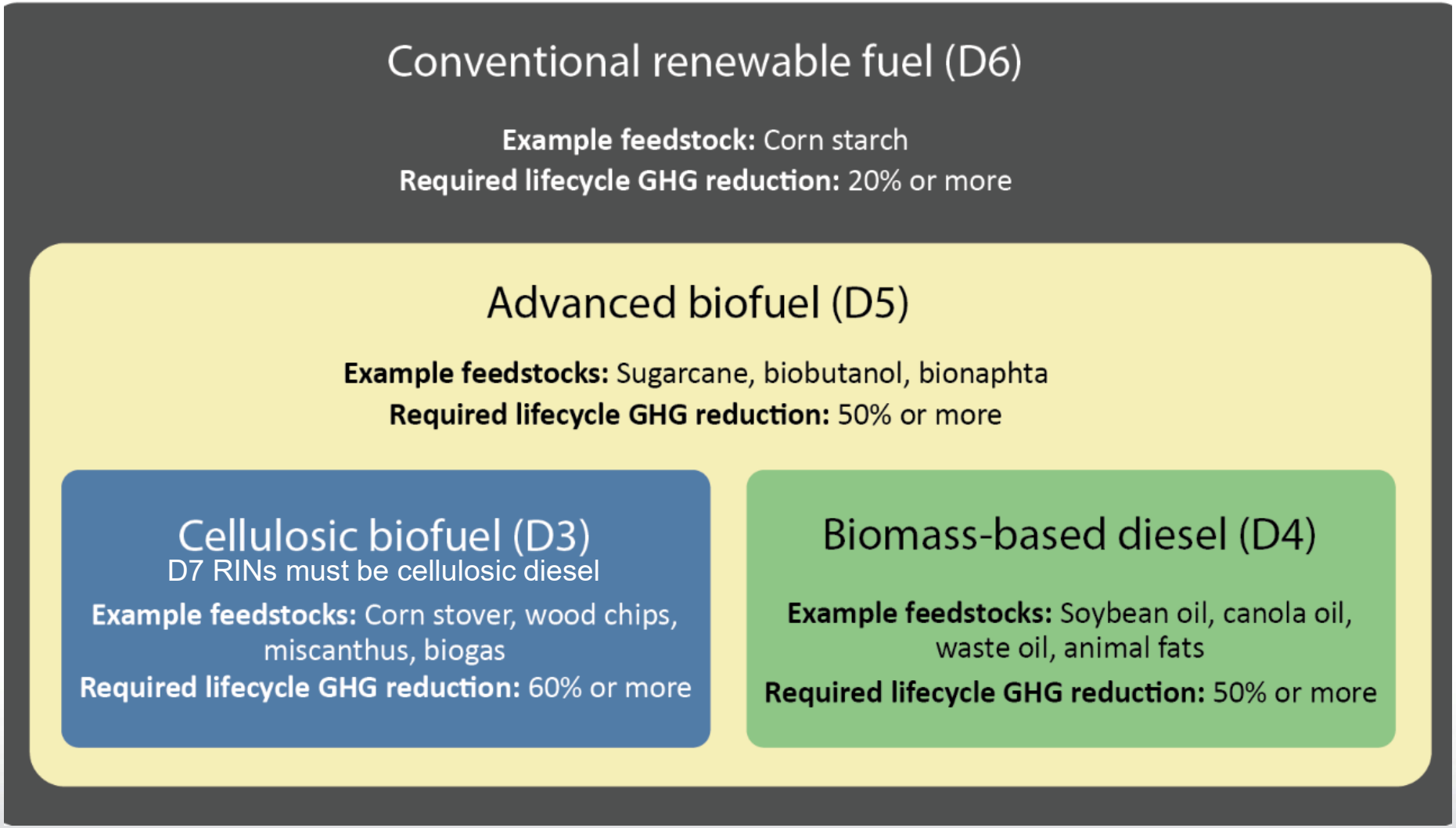
EPA RFS Program: https://www.epa.gov/renewable-fuel-standard-program

Renewable Fuel Standard – Basic Framework

- Obligated parties - refiners or importers of gasoline or diesel fuel.
- EPA specifies an overall annual Renewable Volume Obligation (RVO). Each obligated party calculates its RVO itself, based on its annual gasoline volume.
- Compliance achieved by blending renewable fuels or by obtaining/trading credits (call “Renewable Identification Numbers” or RINS)
- RINs are generated when a producer makes a gallon (or gallon equivalent) of renewable fuel

Renewable Fuel Standard – GHG Reduction

FUEL NESTING SCHEME FOR RENEWABLE FUEL STANDARD



https://www.epa.gov/renewable-fuel-standard-program/renewable-fuel-annual-standards

Renewable Fuel Standard – Fuel Pathways

3 Critical Elements

Feedstock

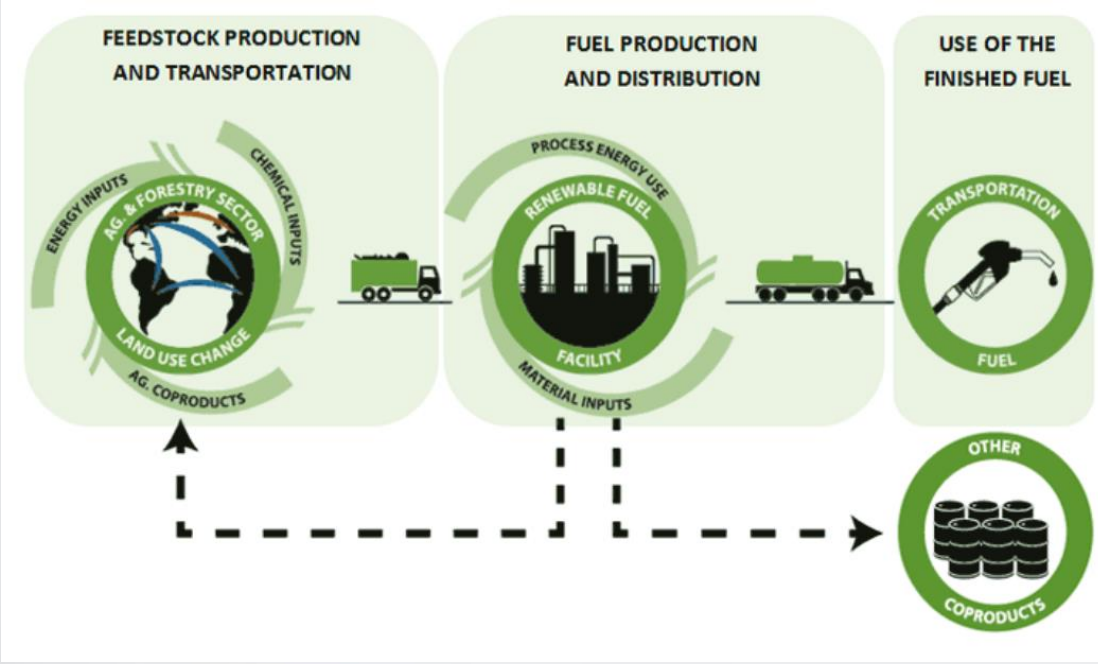
Production Process

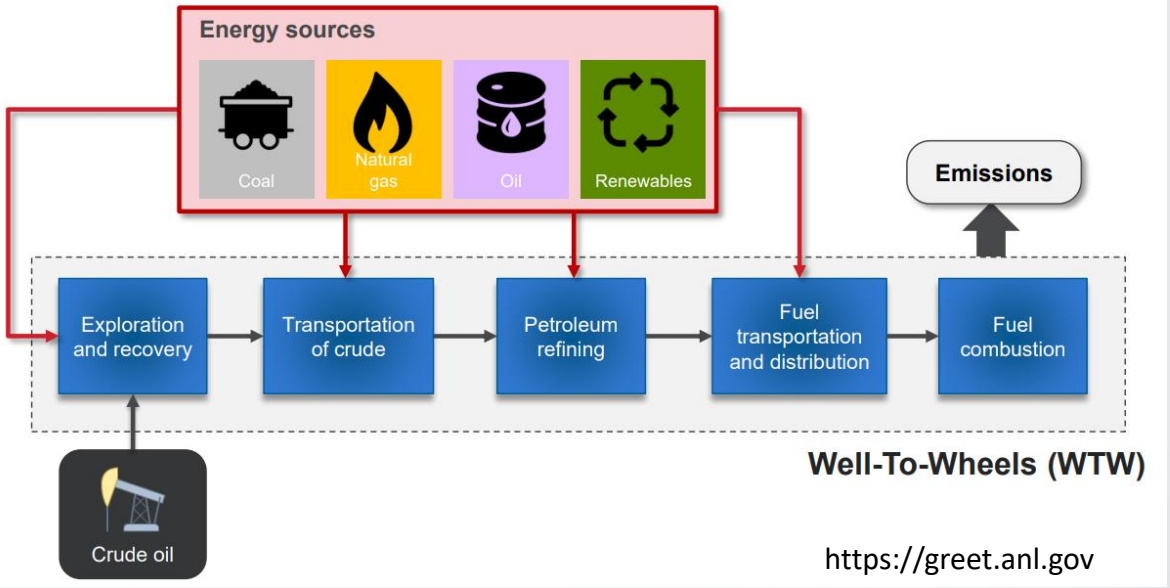
Fuel

Renewable Fuel Standard – GHG LCA

Lifecycle GHG emissions of the renewable fuel are compared to the lifecycle GHG emissions for gasoline or diesel.

Direct emissions + Significant indirect emissions



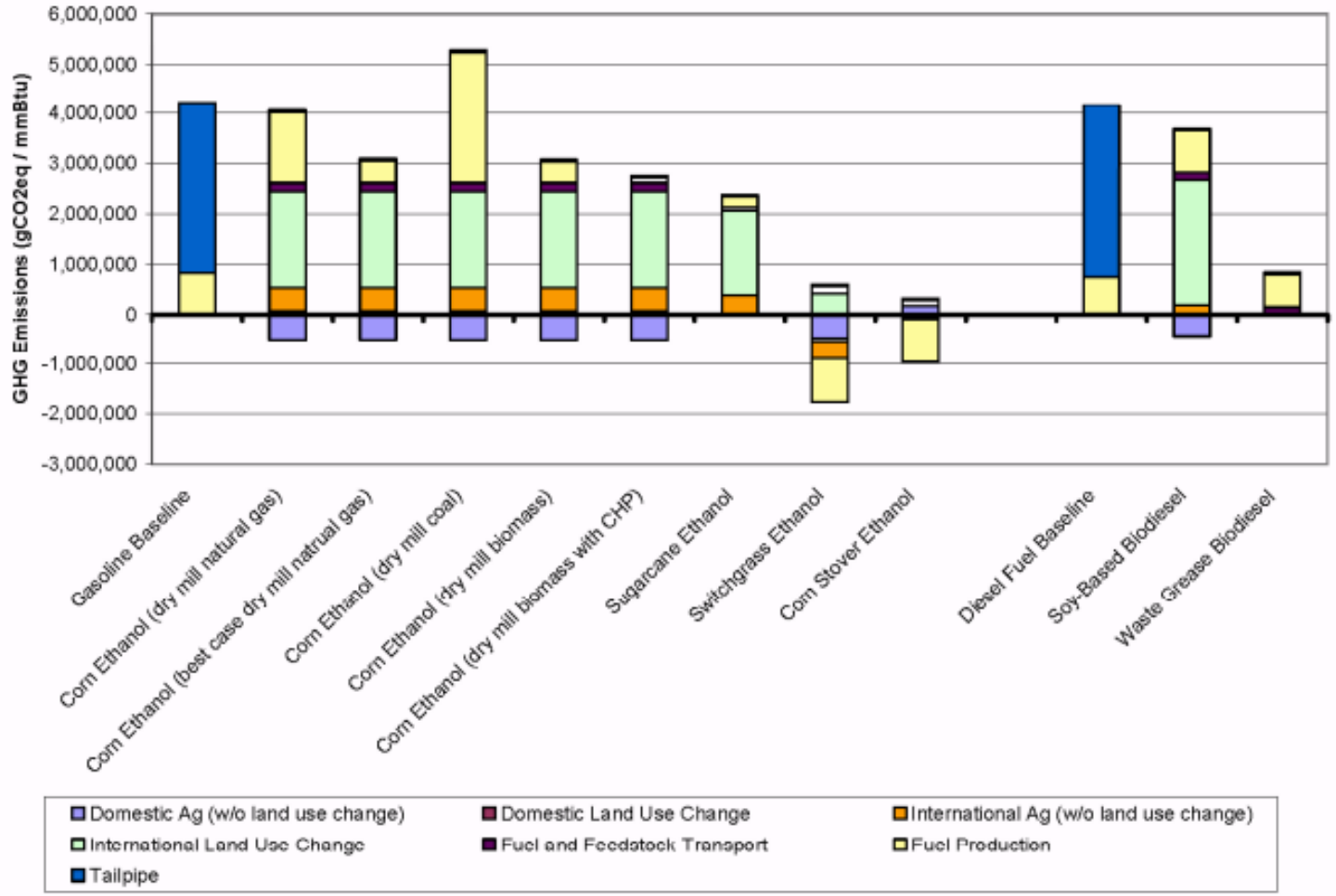


https://greet.anl.gov

https://www.epa.gov/renewable-fuel-standard-program/lifecycle-analysis-greenhouse-gas-emissions-under-renewable-fuel

Renewable Fuel Standard – GHG LCA

Figure 1. Net Lifecycle Greenhouse Gas Emissions By Lifecycle Component With 100 Year Time Horizon And 2% Discount Rate.



From EPA Lifecycle Analysis of Greenhouse Gas Emissions from Renewable Fuels EPA-420-F-009-024

Renewable Fuel Standard – Fuel Pathways

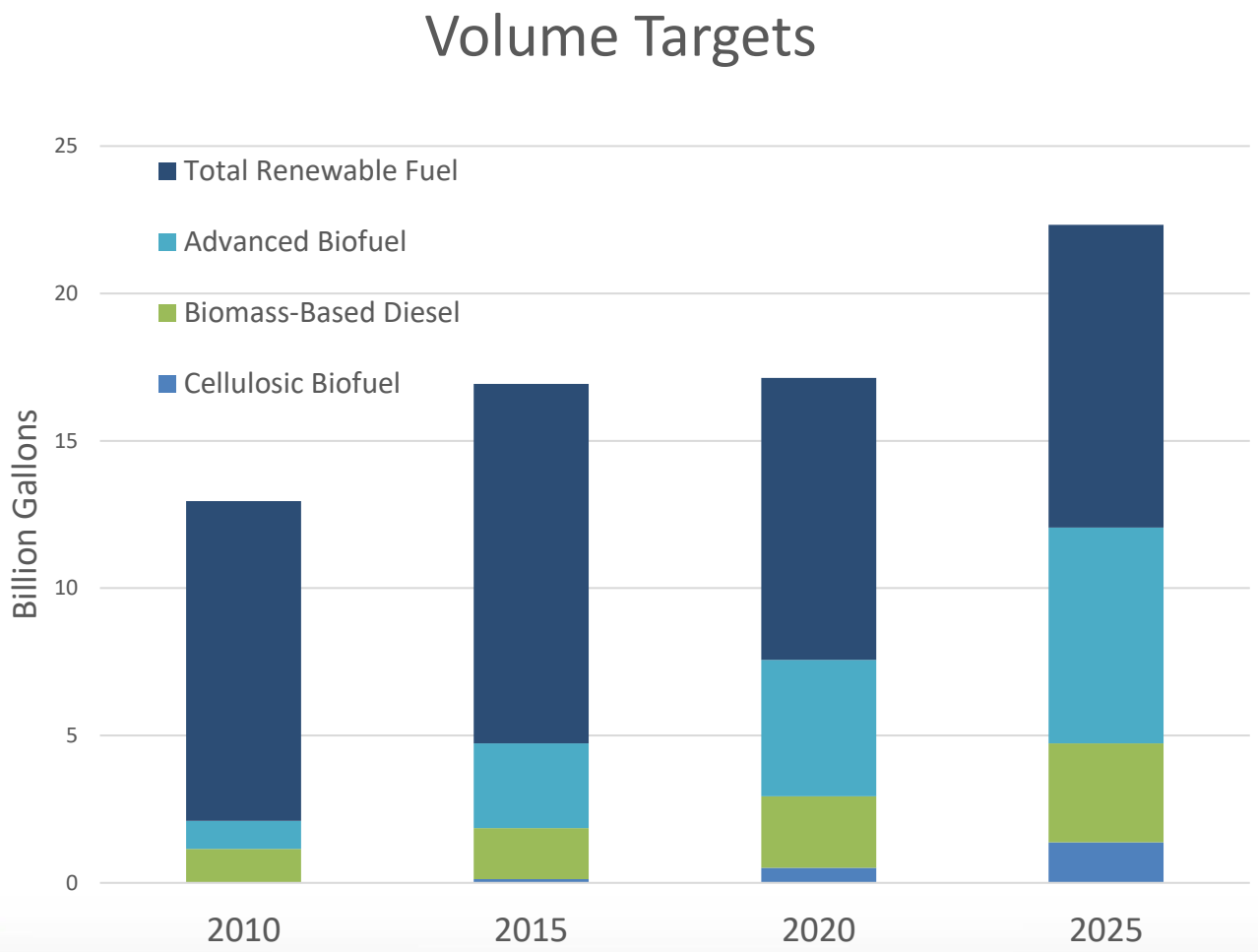
Approved Pathway for Renewable Fuel

Generally Applicable Pathways

Fuel type	Feedstock	Production process requirements	D-Code
Renewable Compressed Natural Gas, Renewable Liquefied Natural Gas, Renewable Electricity.	Biogas from landfills, municipal wastewater treatment facility digesters, agricultural digesters, and separated MSW digesters; and biogas from the cellulosic components of biomass processed in other waste digesters.	Any	3 (cellulosic biofuel)

https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel

Renewable Fuel Standard – Volume Targets

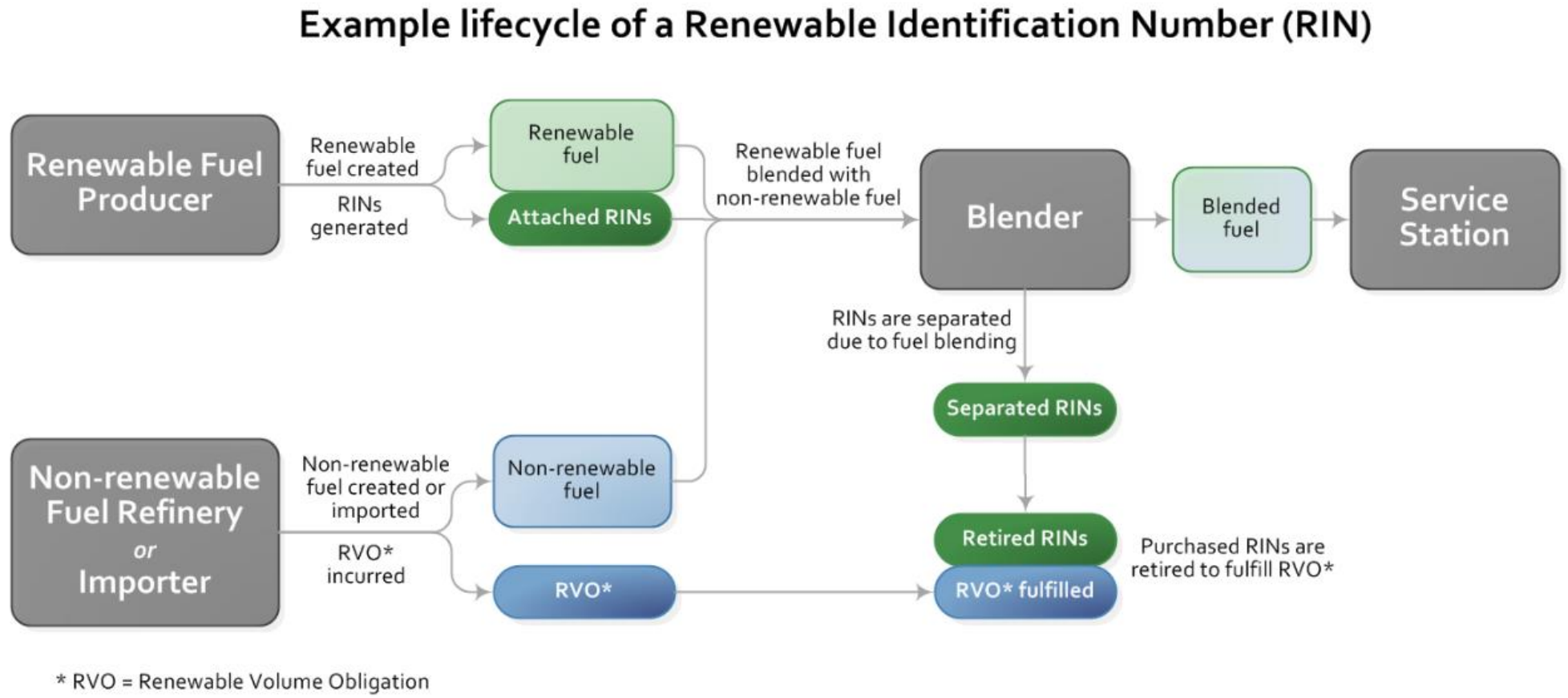


Approximately 167 billion gallons of gasoline and diesel were reported in 2020

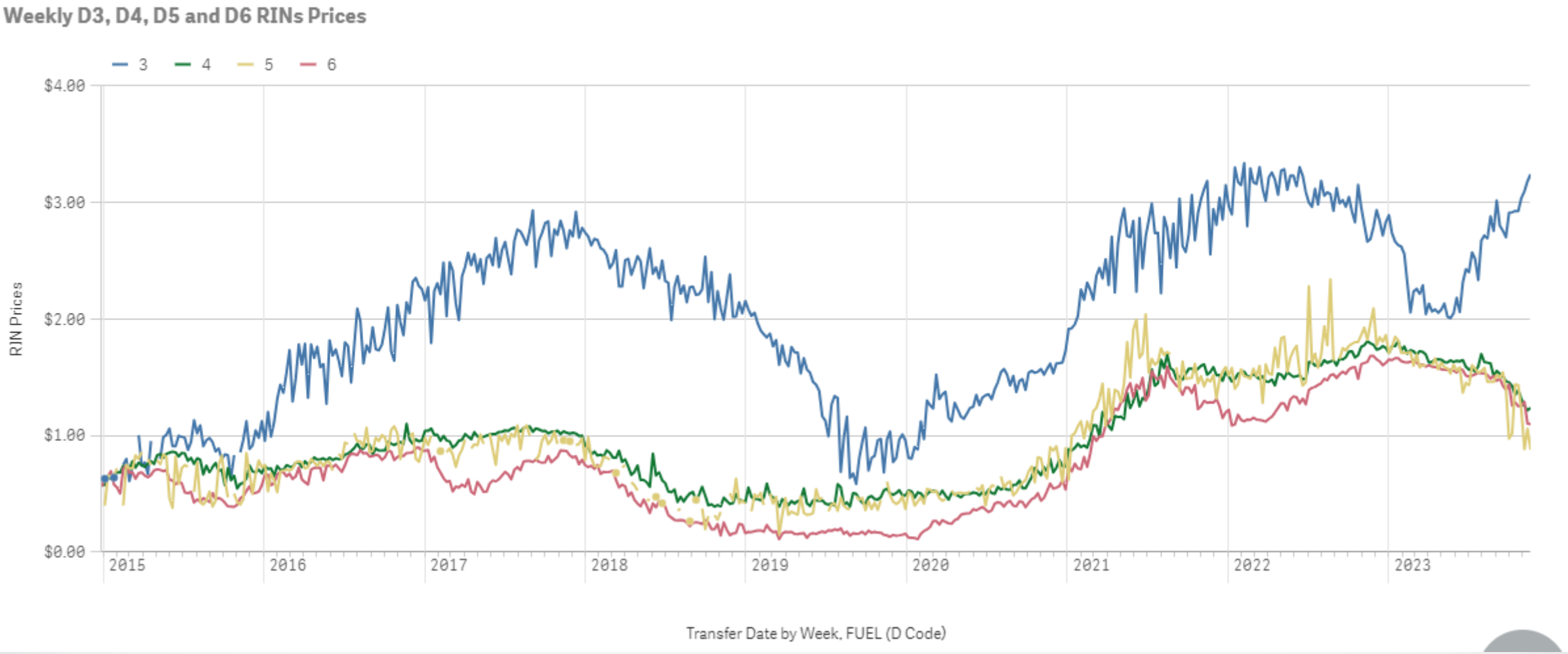
https://www.epa.gov/fuels-registration-reporting-and-compliance-help/annual-compliance-data-obligated-parties-and

EPA RFS Program: https://www.epa.gov/renewable-fuel-standard-program

Renewable Fuel Standard - RINS



Renewable Fuel Standard - RINS



https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information

Resources

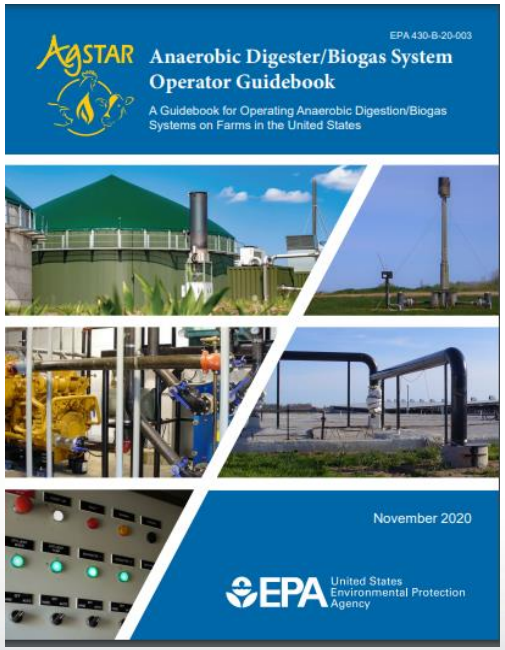
Anaerobic Digestion (AD)

https://www.epa.gov/anaerobic-digestion

Biogas Toolkit

https://www.epa.gov/agstar/biogas-toolkit

Anaerobic Digester/Biogas System Operator Guidebook



Biogas Wastewater Assessment Technology Tool (BioWATT)

View

https://www.globalmethane.org/resources/details.aspx?resourceid=1913

Food Waste to Energy: How Six Water Resource Recovery Facilities are Boosting Biogas Production and the Bottom Line

Local Projects

Synthica St. Bernard

Anaerobic Digestion Facility at Little Miami Plant

- **Diverts Waste from Landfill for Beneficial Reuse:**)
- **Reuses Biogas as Energy Source:** It will be reused onsite as a renewable energy source to run other plant operations.
- **Construction** is anticipated to start in 2024 and run through 2028.

Contact

QUESTIONS?

Bruce Smith, PE
Environmental Engineer
Integrated Water Resources Branch
Water Infrastructure Division
US EPA Office of Research & Development
(513) 569-7087
Smith.Bruce@epa.gov