Supply and Demand Analysis Workshop

North Central Texas Organic Waste to Fuel Feasibility Study

Project Advisory Group
March 29, 2022

AGENDA

- Welcome & Introductions
- Project Status Update
- Feedstock Supply Analysis
- Fuel Demand Analysis
- Collection Network Analysis
- Potential RNG to Vehicle Fuel Projects
- Next Steps

Virtual Meeting Reminders

1. Please leave your microphone muted unless speaking
2. Use the chat box or raise hand button to ask a question or provide a comment
3. Please state your name prior to asking a question a making a comment
4. Please note that the presentation is being recorded

WELCOME & INTRODUCTIONS

Introductions

- **Breanne Johnson**
  Environment & Development Planner
  NCTCOG
- **Lori Clark**
  Air Quality Program Manager
  NCTCOG
- **Soria Adibi**
  Senior Air Quality Planner
  NCTCOG
- **Melanie Sattler**
  Civil Engineering Professor & Researcher
  University of Texas at Arlington

Introductions

Scott Pasternak
Project Manager
Burns & McDonnell

Scott Martin
Deputy Project Manager
Burns & McDonnell

Debra Kantner
Market Assessment & Feasibility
Burns & McDonnell

Drew Mitrisin
Transportation Planning & Policy
Burns & McDonnell

Eric Weiss
Collection Network Assessment
Burns & McDonnell

Matt Tomich
President
Energy Vision

Phil Vos
Program Director
Energy Vision

Project Advisory Group

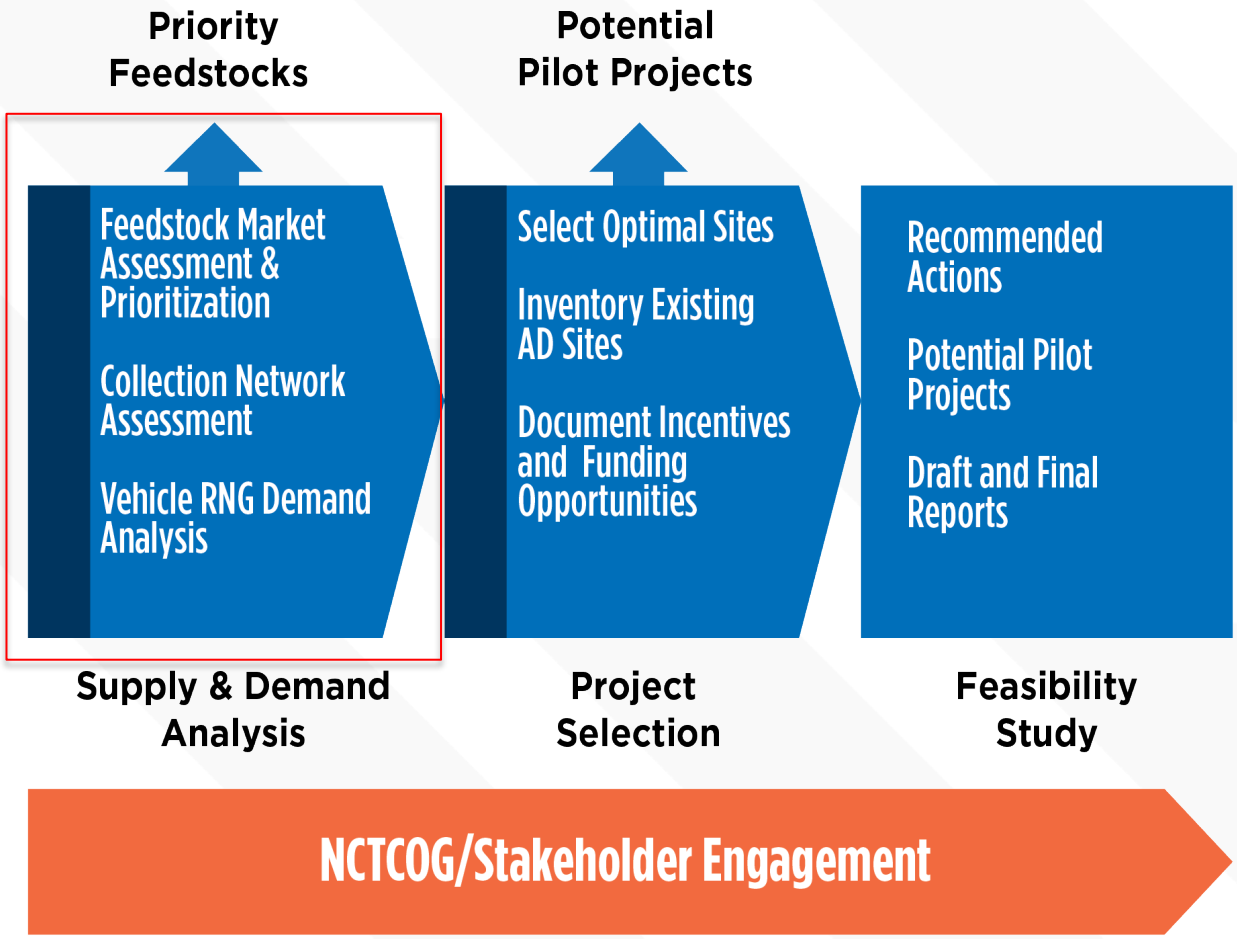
- Joao Pimentel, City of Fort Worth
  This has the potential to benefit the whole Metroplex, and, consequently, Fort Worth.
- Katelyn Hearon, City of Lewisville
  The City of Lewisville is interested in finding sustainable options for sludge disposal.
- Kathy Fonville, City of Mesquite
  Chair of Resource Conservation Council at NCTCOG--interested in how RCC can support this regional initiative.
- Yarcus Lewis, City of Plano
  Achieving greater emissions reductions from the dual benefits of redirecting organic waste emissions to displace fossil fuel usage.
- Jaime Bretzmann, City of Plano
  Interested to learn more about the regional opportunities for waste organics and also about use of the generated fuel gas and digestate.
- Brendan Lavy, Texas Christian University
  Assistant Professor of Sustainability Science at TCU and interested in research that supports sustainability transitions in North Texas.
- Courtney Carroll, Fort Worth ISD
  Would like to better understand the possible uses of all the organic waste produced in school cafeterias.
- Sahana Prabhu, Texan by Nature
  I am interested to learn about anaerobic digestion and renewable energy potentials in North Texas.
- Lynn Lyon, US Gain

PROJECT STATUS UPDATE

Project Background

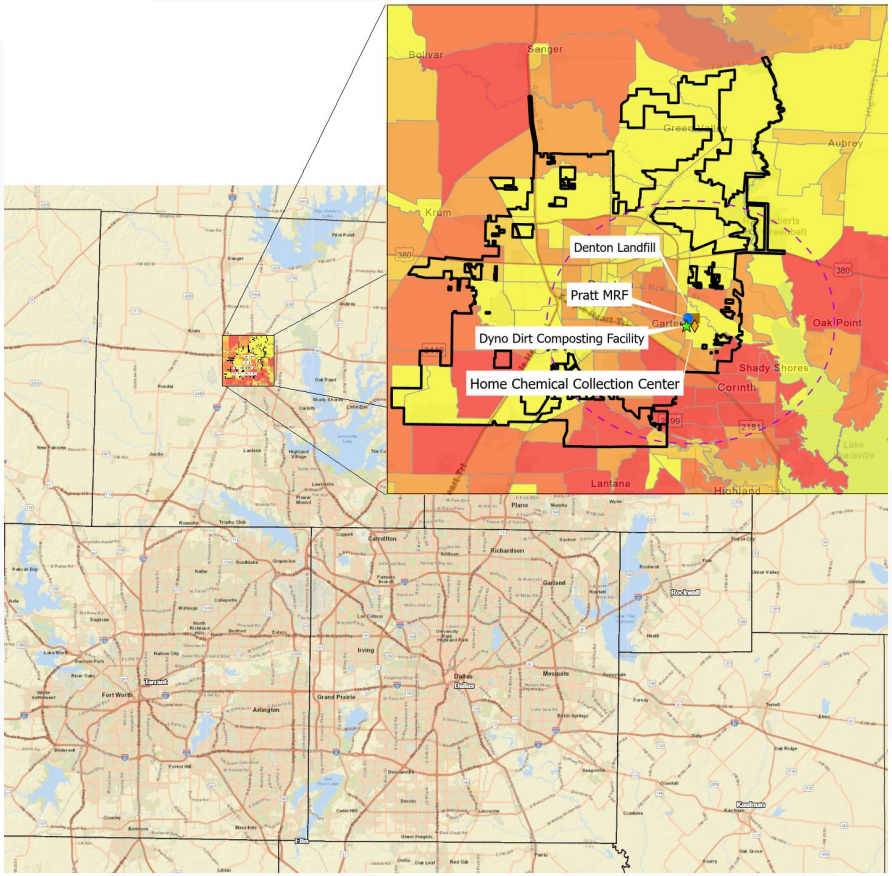
- Goal of the study is to assess the feasibility of using of local organic wastes to produce renewable natural gas (RNG) in new or existing digesters within the region and use the RNG as a transportation fuel.
- NCTCOG and UTA partnering on the study which is supported by a grant from the Environmental Protection Agency (EPA).
- Prior to the study, NCTCOG hosted a series of virtual roundtables to share existing anaerobic digestion and organic waste collection efforts in the region.
- As North Central Texas continues to grow, waste diversion will become increasingly important to both retain landfill capacity and reduce methane emissions.

Project Approach



Workshop Approach

- Analysis presented on a regional level to provide context for high-level discussion.
- As project continues GIS evaluation will advance with a greater level of precision based on ongoing stakeholder engagement and data analysis*.
- Further GIS analysis will be focused on the identified areas of natural gas fuel supply, demand, transportation and distribution infrastructure



*Geographic location shown for example purposes only

FEEDSTOCK ANALYSIS

Feedstock Supply Analysis Methodology

Estimate Organic Waste Quantities

Use available data to:

- Estimate quantities of organic materials generated annually
- Understand other waste-derived biogas resources in the region
- Understand organics-to-fuel potential

Identify Priority Feedstocks

Consider factors such as:

- Types of materials generated
- Existing and future volumes
- Stability and Variability
- Regional scalability
- Stakeholder input
- Others…

Feedstock Supply Materials and Resources


FOOD WASTE


YARD TRIMMINGS

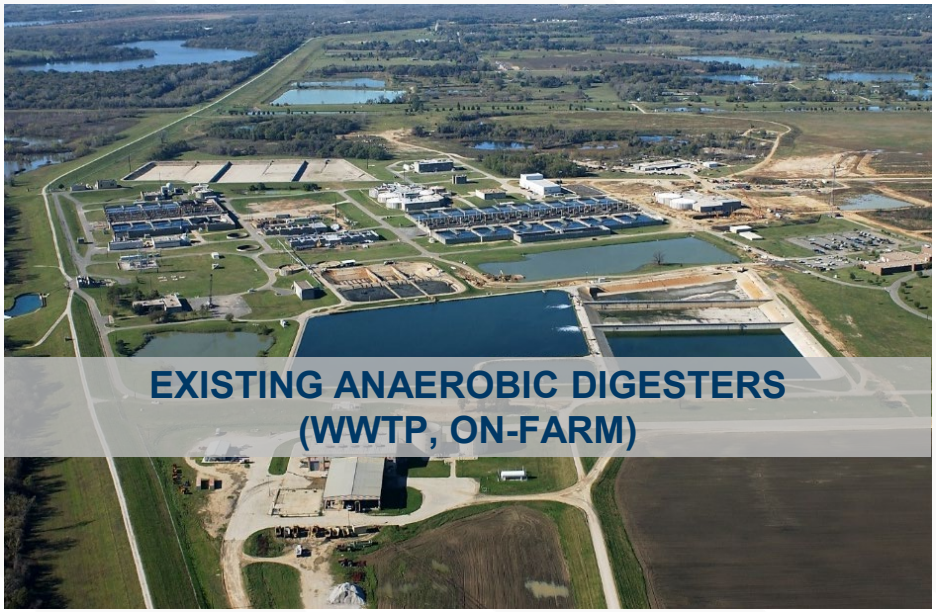

BRUSH


MANURES


CROP RESIDUES


GREASE, SLUDGE, BIOSOLIDS

Existing Biogas Generation Resources

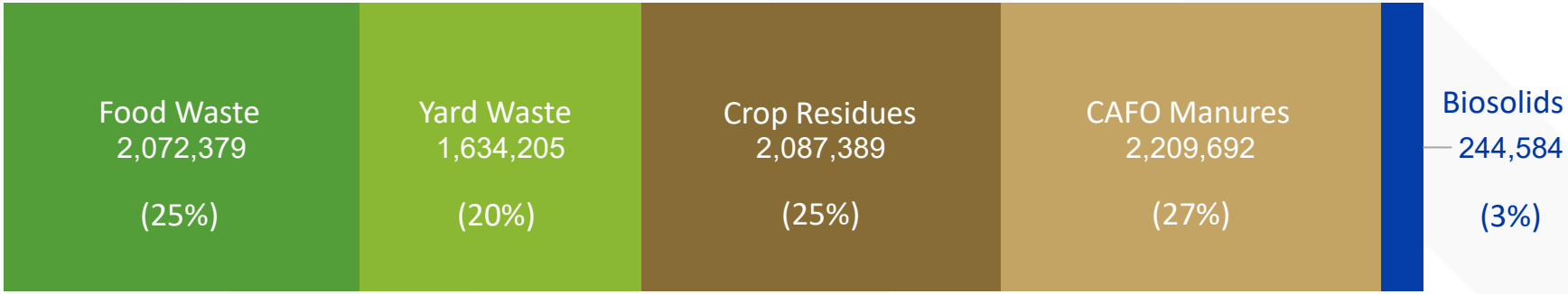


Feedstock Prioritization Considerations

Attribute	Importance
Volumes of Waste	Defines total potential feedstock, and factors such as collection and processing capacity needs.
Material Type	Influences biogas production potential based on properties such as carbon content, lignin, cellulose, etc. Suitable AD technologies vary by material type.
Current Management	Impacts the diversion, environmental, and economic impacts of converting the material to fuel.
Generator Types	Indicate differences in the types of materials, quality (e.g., contamination), consistency (e.g., food production vs. home).
Location of Generated Wastes	Defines collection and routing needs and affects feasibility of potential projects.
Future Volumes and Stability	Indicates future supply and long-term fuel production potential.

Regional Annual Feedstock Generation

8.3 Million Tons of Organics Generated Each Year



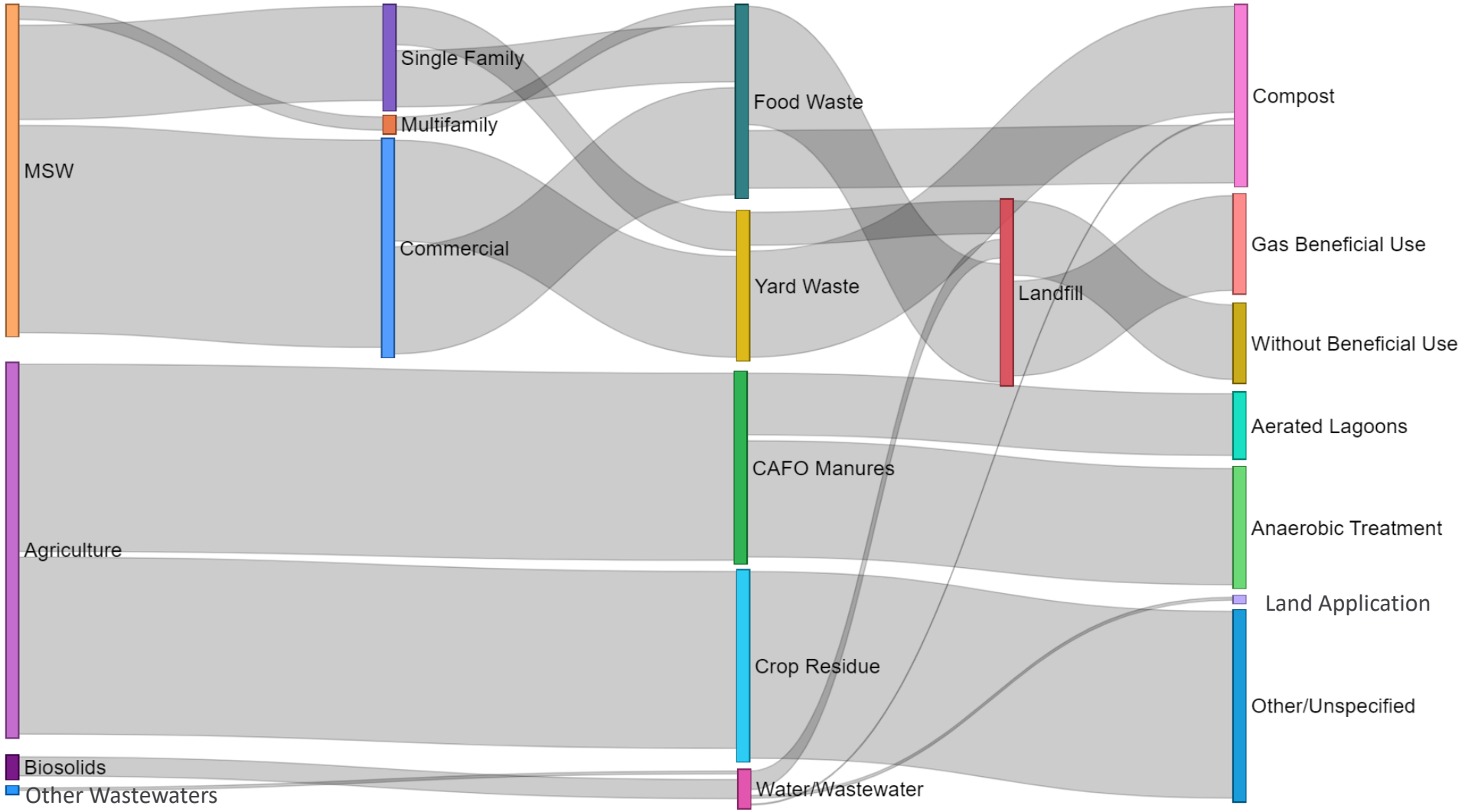
Landfill Biogas:

17 landfills (open and closed)
Collecting 44,000 scfm of biogas

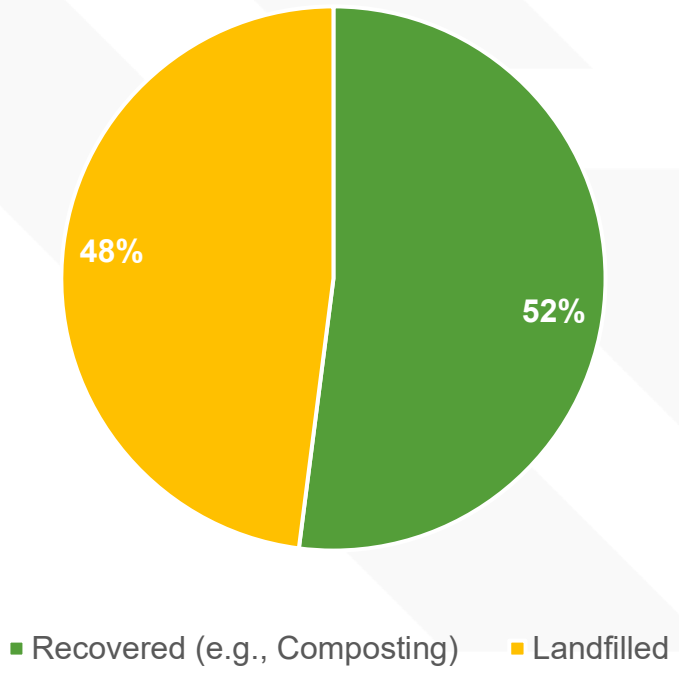
Wastewater Treatment:

47 WWTPs in NCTCOG
8 utilizing anaerobic digestion

Organic Feedstock Material Flow



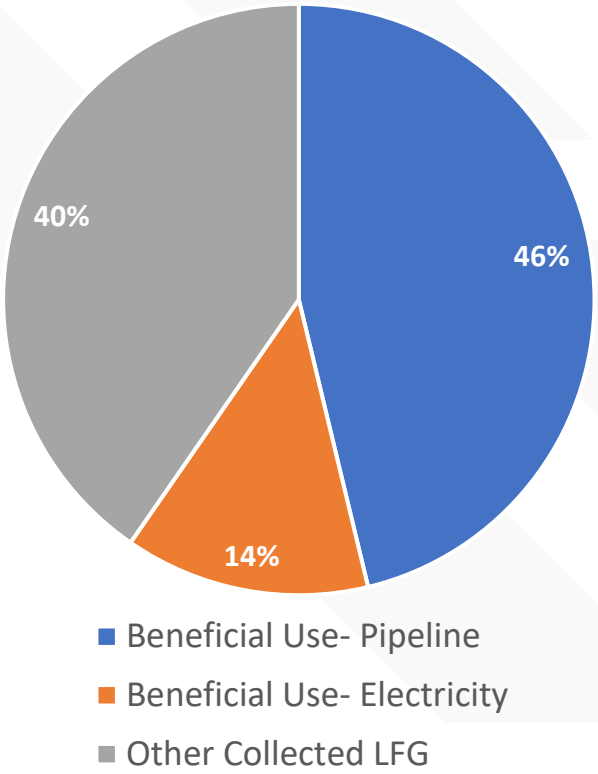
MSW Organics Management in NCTCOG



3.7 million tons MSW organics generated in NCTCOG

- 52% Currently recovered such as through composting
  - Approximately 1.9 million tons total
  - Includes at least 1.38 million tons of composting
- 48% Landfilled
  - Approximately 1.8 million tons

Landfill Gas Management in NCTCOG

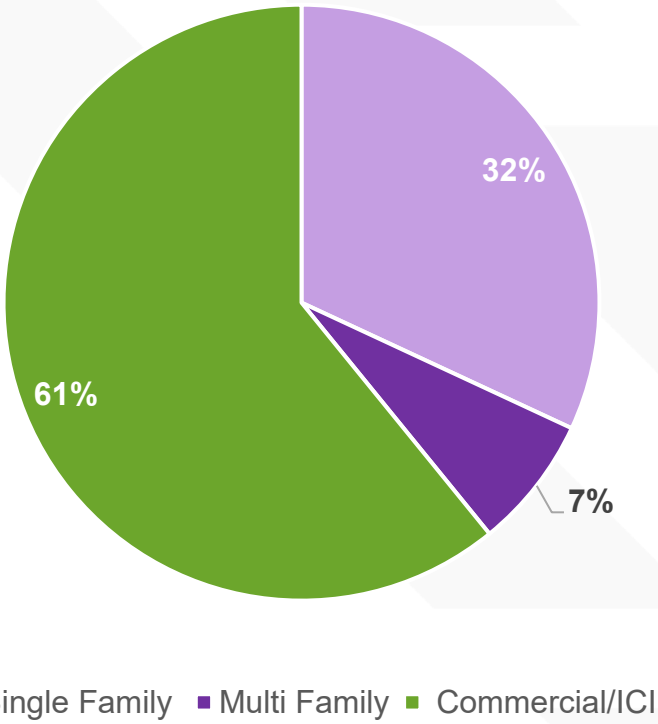


44,000 scfm biogas collected

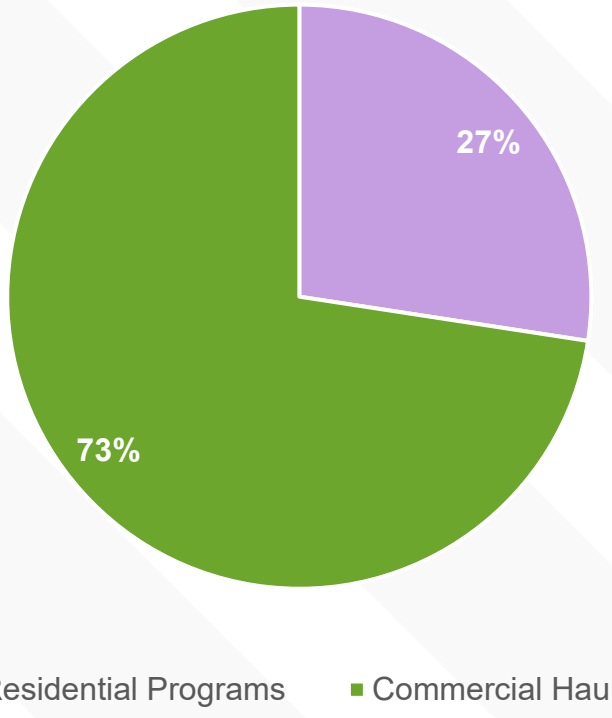
- 46% to high-BTU pipeline gas
  - ~40 million gasoline gallon equivalents (GGE)
- 14% to energy recovery, such as combined heat and power (CHP) projects
- 40% is managed through destruction (flare)

Understanding Material Generators

Food Waste

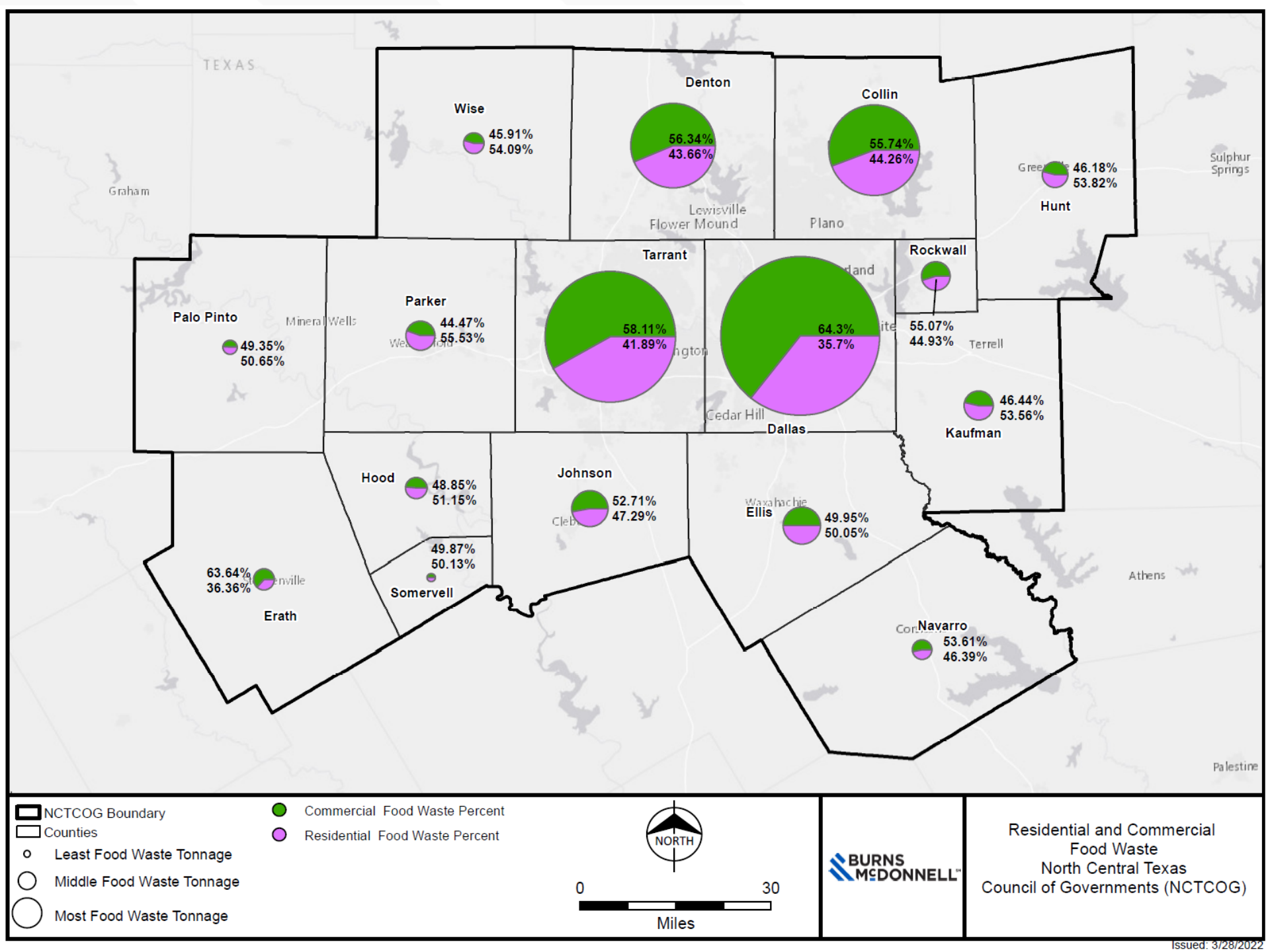


Yard Trimmings



Food Waste Generation by MSW Sector

County	Generated Food Waste (tons)	% from Residential Sector	% from Commercial Sector
Dallas	822,622	36%	64%
Tarrant	557,994	42%	58%
Collin	265,944	44%	56%
Denton	233,986	44%	56%
Ellis	44,933	50%	50%
Johnson	42,676	47%	53%
Parker	27,853	56%	44%
Kaufman	27,166	54%	46%
Rockwall	27,160	45%	55%
Hunt	20,890	54%	46%
Hood	14,808	51%	49%
Erath	14,221	36%	64%
Wise	13,669	54%	46%
Navarro	12,416	46%	54%
Palo Pinto	6,474	51%	49%
Somervell	2,254	50%	50%



Residential and Commercial
Food Waste
North Central Texas
Council of Governments (NCTCOG)

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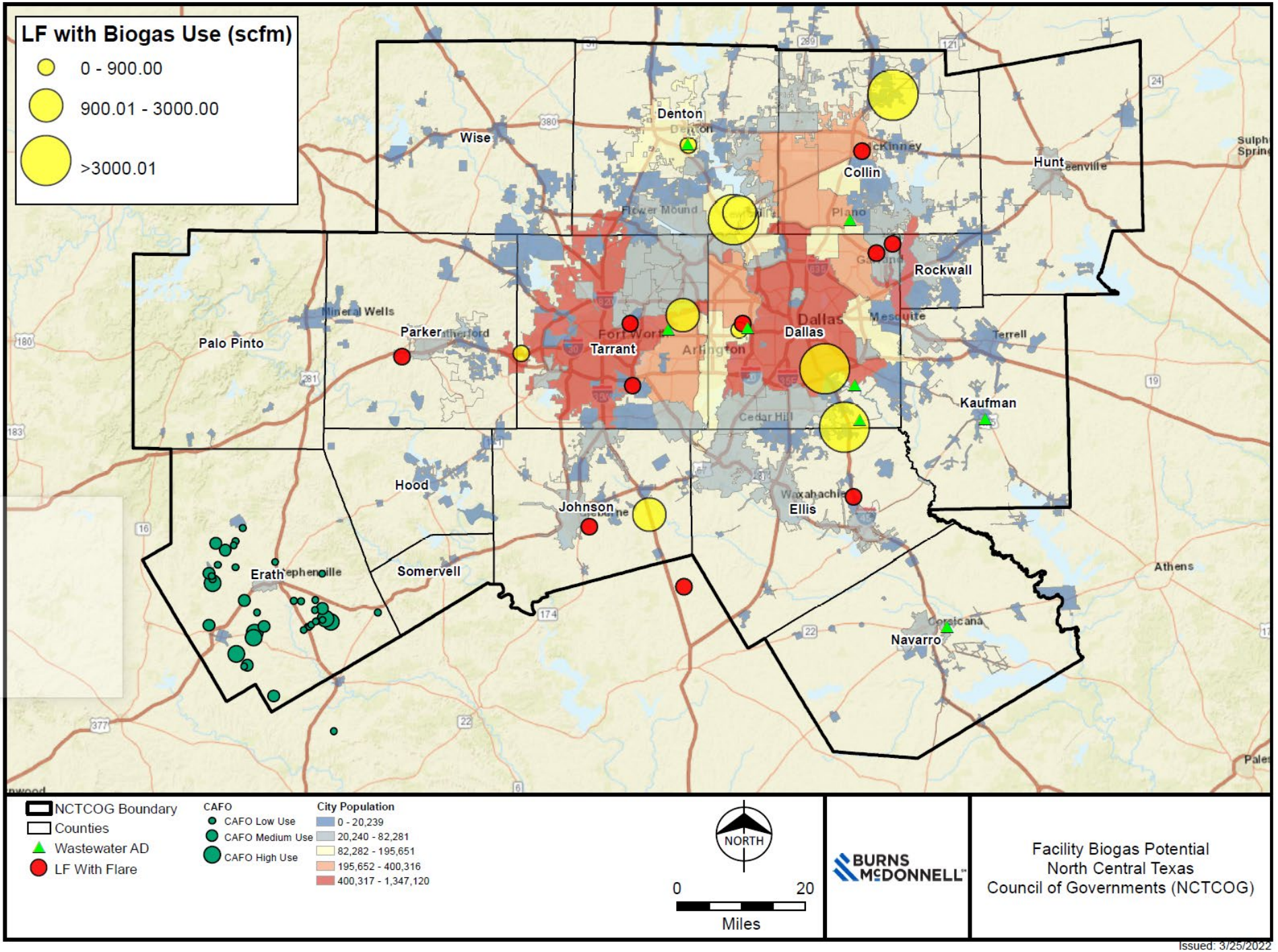
CAFO Manure Management in NCTCOG

Reported Management Method	Number of Facilities	Estimated Waste Generation (tons per year)	% of Total
Anaerobic Treatment	20	1,370,000	62%
Aerated Lagoon	12	725,000	33%
Unspecified/Other	12	120,000	5%

2.2 million tons of CAFO manures are managed in NCTCOG



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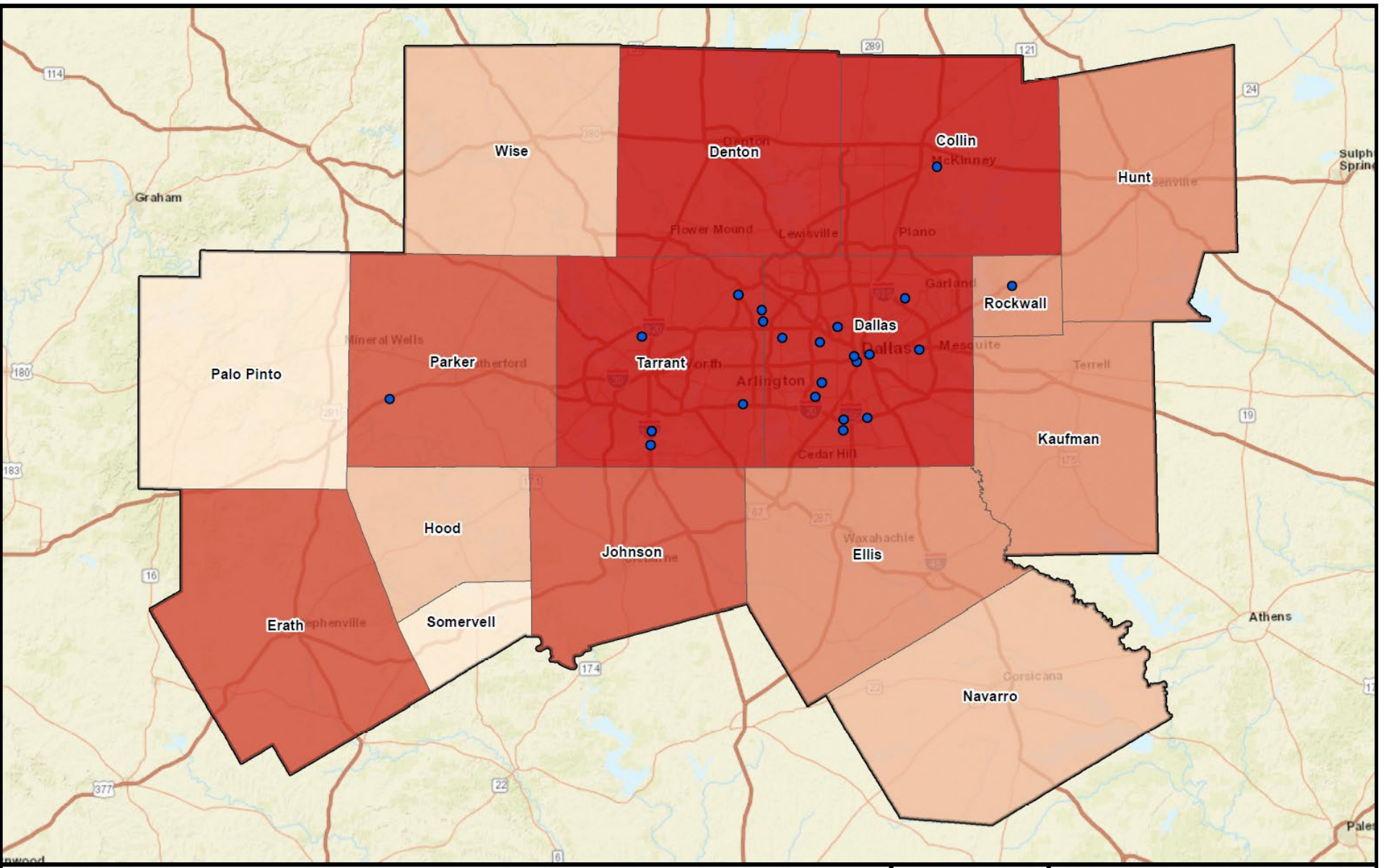


- Compressed Natural Gas Sites
- NCTCOG Boundary
- Counties

Gallons of Gasoline Equivalent Potential Estimates

- 0.00 - 100,000.00
- 100,000.01 - 200,000.00
- 200,000.01 - 1,000,000.00
- 1,000,000.01 - 10,000,000.00
- >10,000,000.01

NORTH

0 30

Miles

BURNS McDONNELL

Compressed Gas Potential
North Central Texas
Council of Governments (NCTCOG)

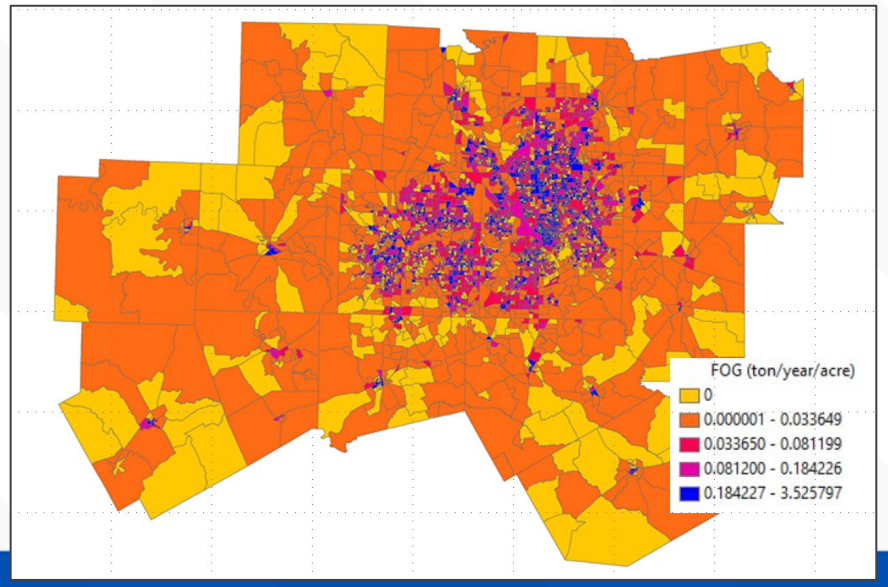
Issued: 3/28/2022

Feedstock Evaluation Next Steps

Detailed geographic and feasibility analysis

- Incorporate region-specific data and findings into UTA's Prioritizing Organic Waste to Energy – Renewable (POWER) Tool
- Evaluate site feasibility of specific projects, based on factors such as:
  - Transportation distance
  - Environmental justice considerations
  - Existing land use
  - Proximity to regional fleets and fuel demand
  - Collection feasibility and needs

Example POWER tool output



FUEL DEMAND ANALYSIS

Methodology: Count and Proportion of Natural Gas Vehicles in the Region

- Burns & McDonnell used the DFW Clean Cities and Texas Department of Motor Vehicles (DMV) datasets to determine counts for the number of natural gas vehicles among three primary vehicle categories
- Using the total "universe" of vehicles in the region (e.g., all powertrains) within each category of the DMV dataset, the proportion of each vehicle category using natural gas was determined

Vehicle Type	NG Vehicle Count		Total Vehicles in Region	NG % of Total Vehicles	
	Low	High		Low	High
Truck: Semi-Trailer	514	683	79,620	**0.7%**	**0.9%**
Bus: Transit	663	1,051	14,887	**4.5%**	**7.1%**
Truck: Refuse	125	186	1,725	**7.3%**	**10.8%**

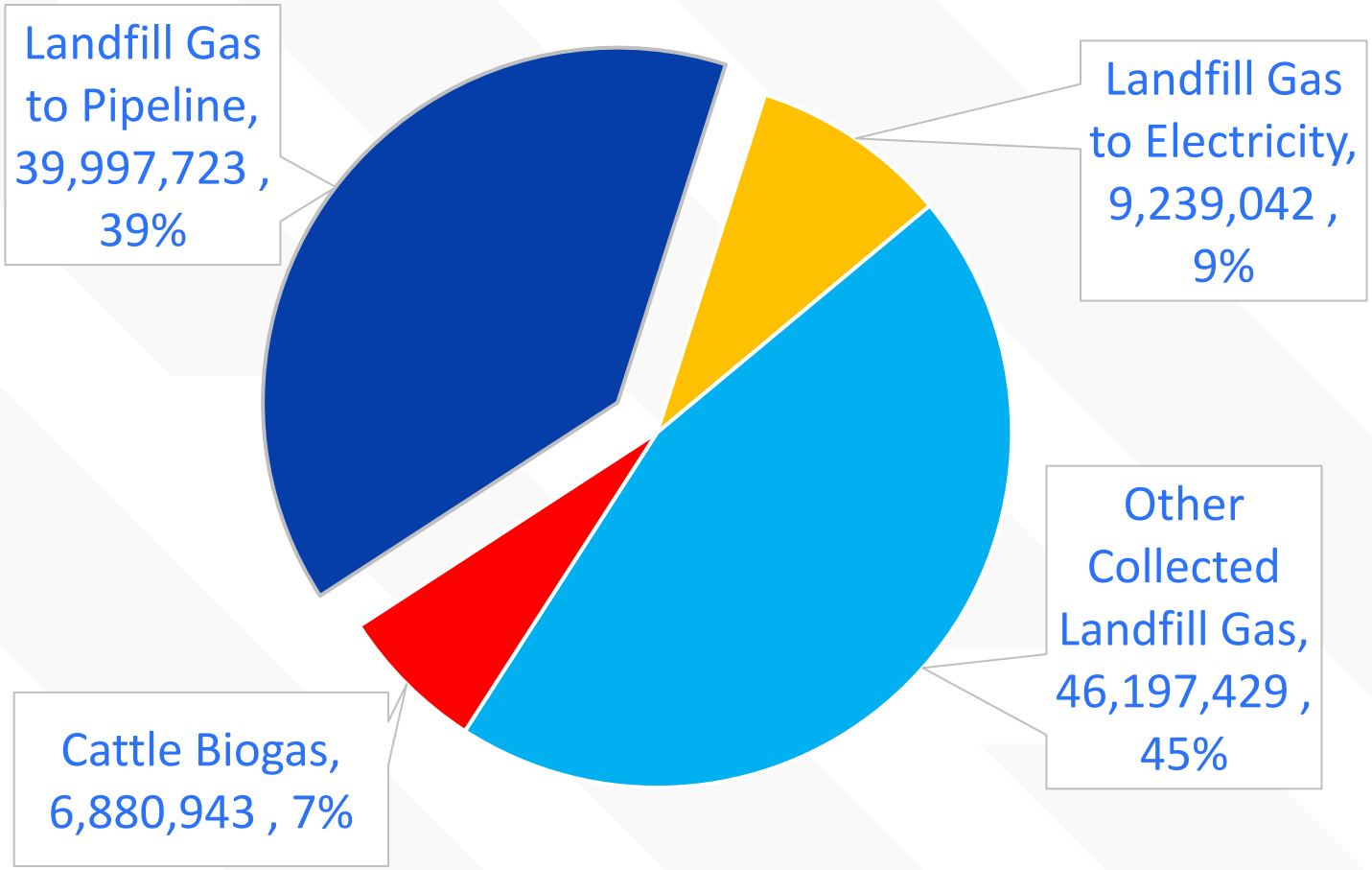
Methodology: Natural Gas Demand

- Burns & McDonnell used the Clean Cities dataset to determine the annual gasoline gallon equivalent (GGE) demand of natural gas for the three primary vehicle categories
- Using the low and high estimates from both datasets, the range of current natural gas demand in the region was determined, as well as the potential natural gas demand based on the "universe" of vehicles in the region

Vehicle Type	Current Natural Gas Demand		Potential Natural Gas Demand
	Low	High	Estimate
Truck: Semi-Trailer	3,830,000	5,089,000	589,380,000
Bus: Transit	7,517,000	11,916,000	161,262,000
Truck: Refuse	334,000	497,000	4,278,000
Total	**11,681,000**	**17,502,000**	**754,920,000**

All units in table are GGE

Existing Biomethane Supply in Region



All units are GGE

Additional biomethane available from WWTP

What-If Scenario 1: Increasing Use of Existing Supply

Vehicle Type	Current % Natural Gas (High Est)	Scenario 1 % Natural Gas	Current Demand (GGE)	Scenario 1 Demand (GGE)
Truck: Semi-Trailer	0.9%	**2.0%**	5,089,000	11,864,000
Bus: Transit	7.1%	**8.0%**	11,916,000	13,502,000
Truck: Refuse	10.8%	**13.0%**	497,000	600,000
Total			**17,502,000**	**25,966,000**

+8.4M

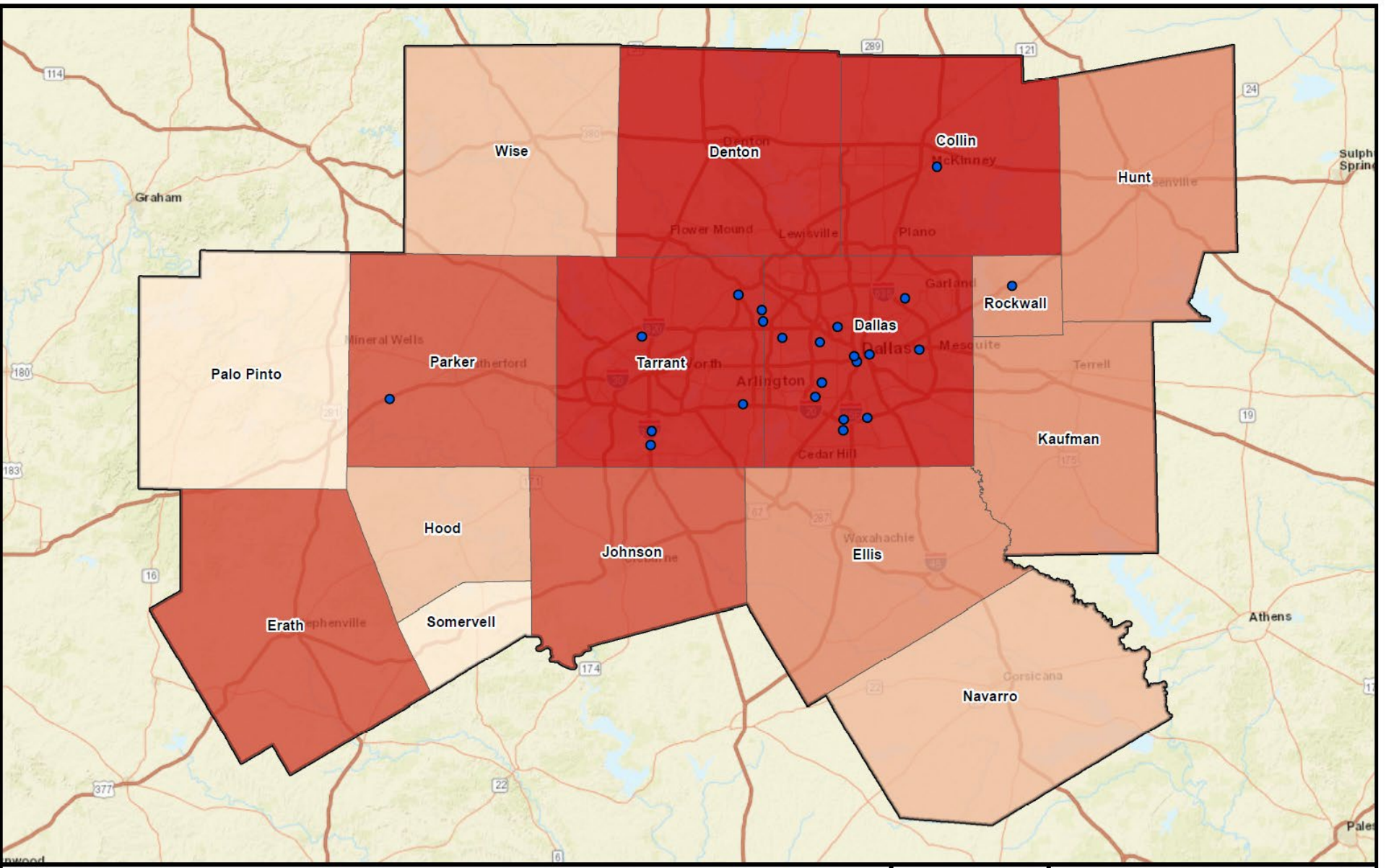
Existing landfill gas-to-pipeline supply sufficient for incremental targets

What-If Scenario 2: Increasing Use Beyond Ready Supply

Vehicle Type	Current % Natural Gas (High Est)	Scenario 2 % Natural Gas	Current Demand (GGE)	Scenario 2 Demand (GGE)
Truck: Semi-Trailer	0.9%	**5.0%**	5,089,000	29,660,000
Bus: Transit	7.1%	**10.0%**	11,916,000	16,878,000
Truck: Refuse	10.8%	**50.0%**	497,000	2,480,000
Total			**17,913,000**	**49,018,000**

+31.1M

Total collected landfill gas supply sufficient for further increases in demand



- Compressed Natural Gas Sites
- NCTCOG Boundary
- Counties

Gallons of Gasoline Equivalent Potential Estimates

- 0.00 - 100,000.00
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- 200,000.01 - 1,000,000.00
- 1,000,000.01 - 10,000,000.00
- >10,000,000.01

NORTH

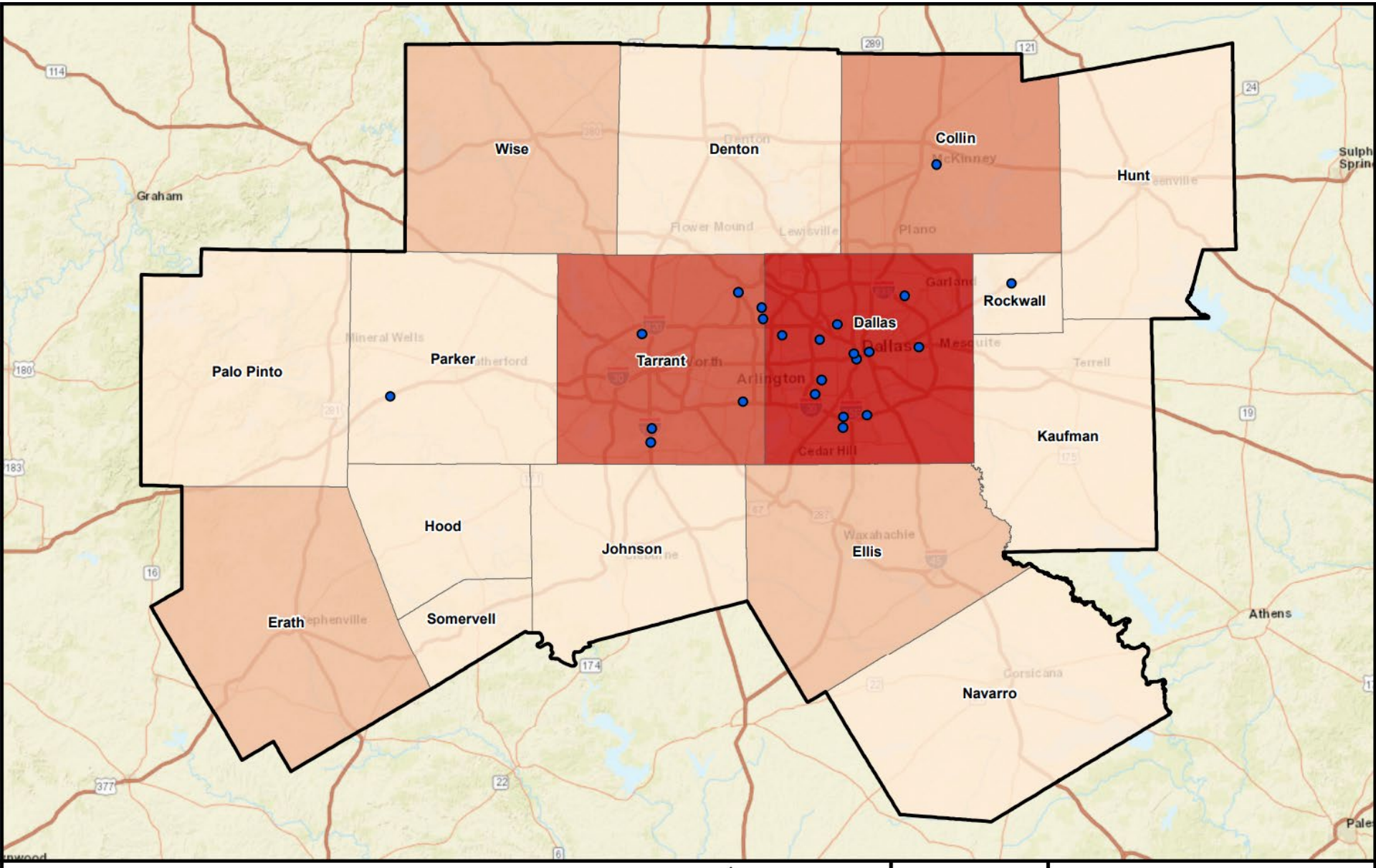
0 30

Miles

BURNS McDONNELL

Compressed Gas Potential
North Central Texas
Council of Governments (NCTCOG)

Issued: 3/28/2022


Wise
Denton
Collin
Hunt
Rockwall
Palo Pinto
Parker
Tarrant
Dallas
Kaufman
Hood
Johnson
Ellis
Somervell
Erath
Navarro
Graham
Mineral Wells
Flower Mound
Lewisville
Plano
McKinney
Garland
Mesquite
Arlington
Cedar Hill
Waxahachie
Athens
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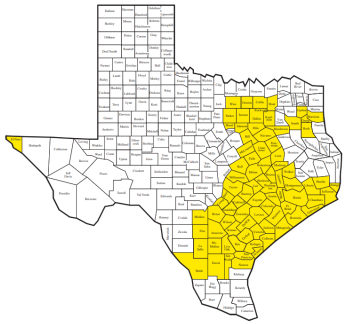
1,000,000.01 - 10,000,000.00
>10,000,000.01
NORTH
0
30
Miles
BURNS McDONNELL
Compressed Gas Demand
North Central Texas
Council of Governments (NCTCOG)

Overview of current/planned stakeholder interviews

- TX NGV Alliance and Clean Energy
  - CLNE confirmed number of vehicles matches their ballpark number
  - Policymaking/incentives can support sustained growth
  - Opportunities for growth in the transit, refuse truck and trucking markets.
  - Large, multinational trucking companies are a major growth opportunity. Delivery vans are an opportunity for electrification or natural gas.
  - Texas Clean Transportation Zone has been a major target for trucking industry fleet transitions, especially for dedicated routes.



TEXAS NATURAL GAS VEHICLE ALLIANCE
From Deep in the Heart of Texas

Clean Energy

and more to come!

Policymaking Considerations

Texas HB 963 (2021)

- Effective as of September 1, 2021
- Creates a used natural gas truck market for larger fleets to sell used trucks
- Allows less capitalized, smaller fleets to invest in NGV
- Policymaking needs to reduce barrier to entry to sustain growth

Texas Emissions Reduction Plan (TERP)

- Administered by Texas Commission on Environmental Quality (TCEQ)
- Offers significant grants for new and upgraded equipment to reduce pollution and improve air quality

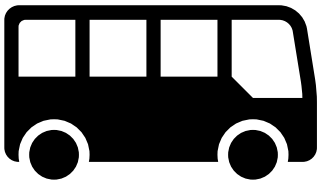
Prioritization of Vehicles for Conversion

Tractor-Trailers

Delivery Vans

- Largest conversion opportunity, slowest rate of conversion to date
- Dedicated routes along TX Clean Transportation Zone
- Large fleets first, smaller fleets to follow

Buses



- Largest per-vehicle source for natural gas demand
- Local transit agencies should continue evaluating natural gas and electric powertrains for their operations

Refuse Trucks

- Highest percentage of natural gas conversions to date
- 50% conversion to RNG by 2025 a viable opportunity

COLLECTION NETWORK ANALYSIS

Organics Collection Network Overview

Residential

- Single-family dwelling units
- Generate yard trimmings, brush and post-consumer food waste
- Serviced using automated side load or rear load solid waste vehicles
- Utilize diesel or natural-gas engine vehicles to provide service

Commercial/Industrial

- Various types of commercial establishments or industrial operations
- Generate pre-consumer and post consumer food waste
- Utilize diesel or natural-gas engine vehicles to provide service

Agricultural/FOG

- Includes agricultural operations such as farming, livestock management and fats, oils and greases
- Generates crop waste, surplus and manure
- Utilize diesel or natural gas engine vehicles to provide service

Separate Organics Collection Considerations

Bag/Bundle

- Collected using rear-load or grapple vehicles.
- Many municipalities collect commingled with other bulky items.
- Consider compostable durable bags that can be manually separated at a transfer station.

Roll-Cart

- Collected using automated side-load vehicles
- Few municipalities in the region have roll-cart organics collection
- Provides capability to commingle yard trimmings and food waste if there is available processing capacity.

On-Site Storage

- Commercial pre-consumer food waste processed and stored on-site.
- Tank serviced via vacuum truck and delivered to available organics processing location.
- Programs being developed to increase commercial establishments implementing this solution around the country.

Municipal Solid Waste Collection Fleets

City	Population	Residential	Commercial	% Natural Gas Vehicles*
Dallas	1,314,610	Y	N	15-30%
Plano	286,980	Y	N	0%
Irving	245,690	Y	N	0%
Garland	242,830	Y	N	0%
Mesquite	145,750	Y	N	0%
Denton	141,000	Y	Y	30-50%
Richardson	117,050	Y	Y	0%
Cleburne	32,270	Y	N	0%
Weatherford	29,060	Y	Y	0%
University Park	22,920	Y	Y	0%

*Based on responses from recent NCTCOG SWMP Vol II Survey and other recent fleet analysis. Percent of Natural Gas Vehicles presented as ranges given ongoing fleet replacement.

- There are opportunities to increase the number of natural gas vehicles that are used by municipal collection programs in the region
- Adopting natural gas vehicles in fleet requires fueling and maintenance infrastructure
- Municipalities need support to overcome challenges with fueling capacity and maintenance equipment and expertise

Commercial Solid Waste Collection Markets

Exclusive/Non-Exclusive Franchise

- Contract authorizing one or more private companies to provide service in a particular area.
- Provides high degree of influence of the collection and processing of material.

Hauler Licensing

- Stipulates haulers of recyclable materials must have a license to operate in the City
- License requirements provide limited influence of the collection and processing of material

Closed Market

- Only the municipality is authorized to collect in a particular service area
- Provides highest degree of control of the collection and processing of material

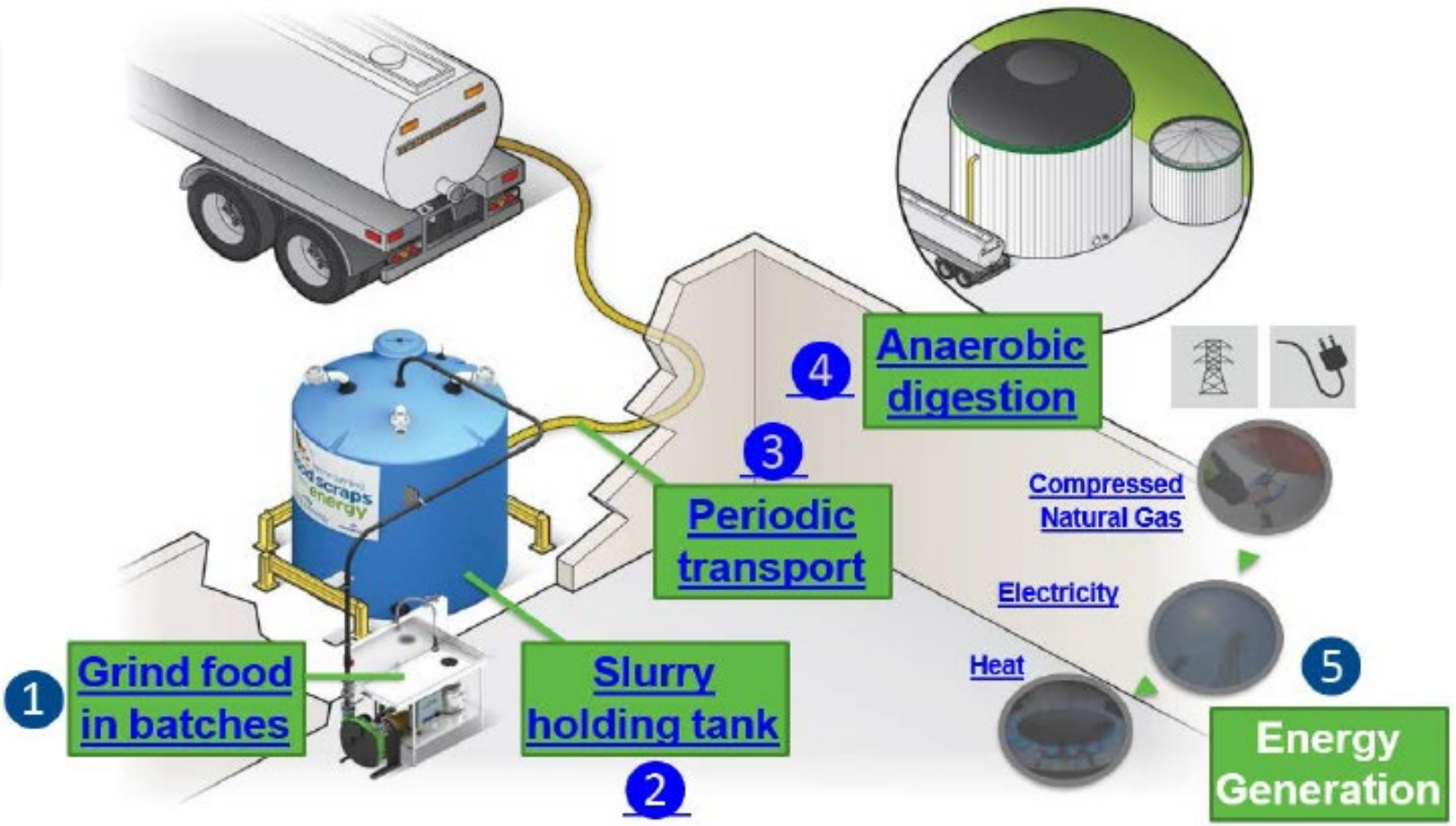
Private Hauler Refuse Vehicle Fleets

- Private sector haulers service commercial generators among the majority of municipalities in the region.
- Large hauling fleets active in the region have existing CNG and RNG vehicles and fueling.
- Commercial market requirements represent opportunity to incentivize private haulers to utilize more natural gas vehicles.
  - Requirements as part of exclusive/non-exclusive franchise systems.
  - Licensing requirements to operate within municipality.

Dallas Commercial Organics Collection Pilot

- Program funded by USDA to target special events and food service establishments.
- Partnership with Dallas County to support healthy food initiative.
- Working with local food waste hauler.
- Intended to be a closed-loop organics recycling program
  - Material processed by collection contractor
  - Compost product to be used at Dallas County Gardens to grow produce.

Commercial Organics Slurry Collection/Processing



Regional Material Management Infrastructure

Ownership of infrastructure in region impacts feasibility of potential projects

Facility*	Public	Private	Total
Landfills	12	10	22
Transfer Stations	7	8	15
Commercial Composting Facilities	2	13	15
WWTP w/ AD	8	0	8

*Based on responses from recent NCTCOG RSWMP Vol II Survey and other recent analysis. Facility information may be updated based on ongoing stakeholder engagement.

Number and location of public facilities determines the ability to pursue opportunities for public-private partnership

Collection Network Assessment Next Steps

Detailed evaluation of collection networks

- Identify strategic geographic areas in the NCTCOG region near potential pilot projects

Operational requirements

- Barriers and opportunities
- Planning level costs based on route densities, distance to end markets
- Financial feasibility of fueling infrastructure (fueling stations, pipelines)

Evaluation of potential partnership models

- Corporate campus
- School district
- Commercial districts
- Private haulers

POTENTIAL RNG TO VEHICLE FUEL PROJECTS

Leverage Existing AD Capacity - City of Dallas Southside WWTP

- Inbound flow of 50-55 Million Gallons per Day (MGD)
  - Solids land applied as a soil amendment
  - Digester biogas fuels internal combustion engines to provide over 40 percent of the plant's electrical needs
  - Treated liquid discharged to Trinity River
- City-wide water conservation efforts reduced the volume of influent flow
  - Facility able to operate with excess capacity
- Co-digestion challenges
  - Accepting solid waste organics
  - Cleaning and transporting biogas to end users

Leverage Existing AD Capacity - City of Denton

- City provides a premium valet service to the downtown area commercial entities
  - 50 premium valet customers are bars or restaurants.
- City awarded grant from NCTCOG to offer high quantity organic waste generators the opportunity to join the pilot.
  - Materials accepted in the pilot include pre- and post-consumer food scraps to include dairy, meat, bread, left overs, fruits, veggies, coffee grounds, and meal discards.
- The material will be macerated and then processed by composting and/or anaerobic digestion at the Pecan Creek WWTP

New Organics Digestion Facility Pilot

- Key considerations for new facility
  - Existing transfer station, gas piping infrastructure and local fueling demand determines feasibility
  - Collection program encourages collection of organics that are separated from the traditional MSW waste stream
  - Requires feedstock guarantees OR municipal control of waste streams
  - Contamination levels and pre-processing requirements
  - Reliable revenue streams including competitive tipping fee (e.g., same or less than local landfills) and financial incentives/credits (e.g., RINs, RECs)
- **Option 1:** Greenfield facility accepting only organic waste (not a WWTP)
- **Option 2:** Capital upgrades to add co-digestion at existing WWTP w/ AD

Next Steps

- Two additional workshops will be held to gather input from the Project Advisory Group
- Topics for each workshop:
  - Workshop #3 – Project Selection
  - Workshop #4 – Feasibility Study Conclusion
- Dates for the workshops have not yet been determined but will take place in 2022

THANK YOU!

CREATE AMAZING.