

# Transportation Study for Proposed Food Waste to Energy Facility at Solano Wind Farm Site

Sacramento Municipal Utility District  
URS / B&V

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# Location of Solano Wind Farm Site





# Objectives of Proposed Project

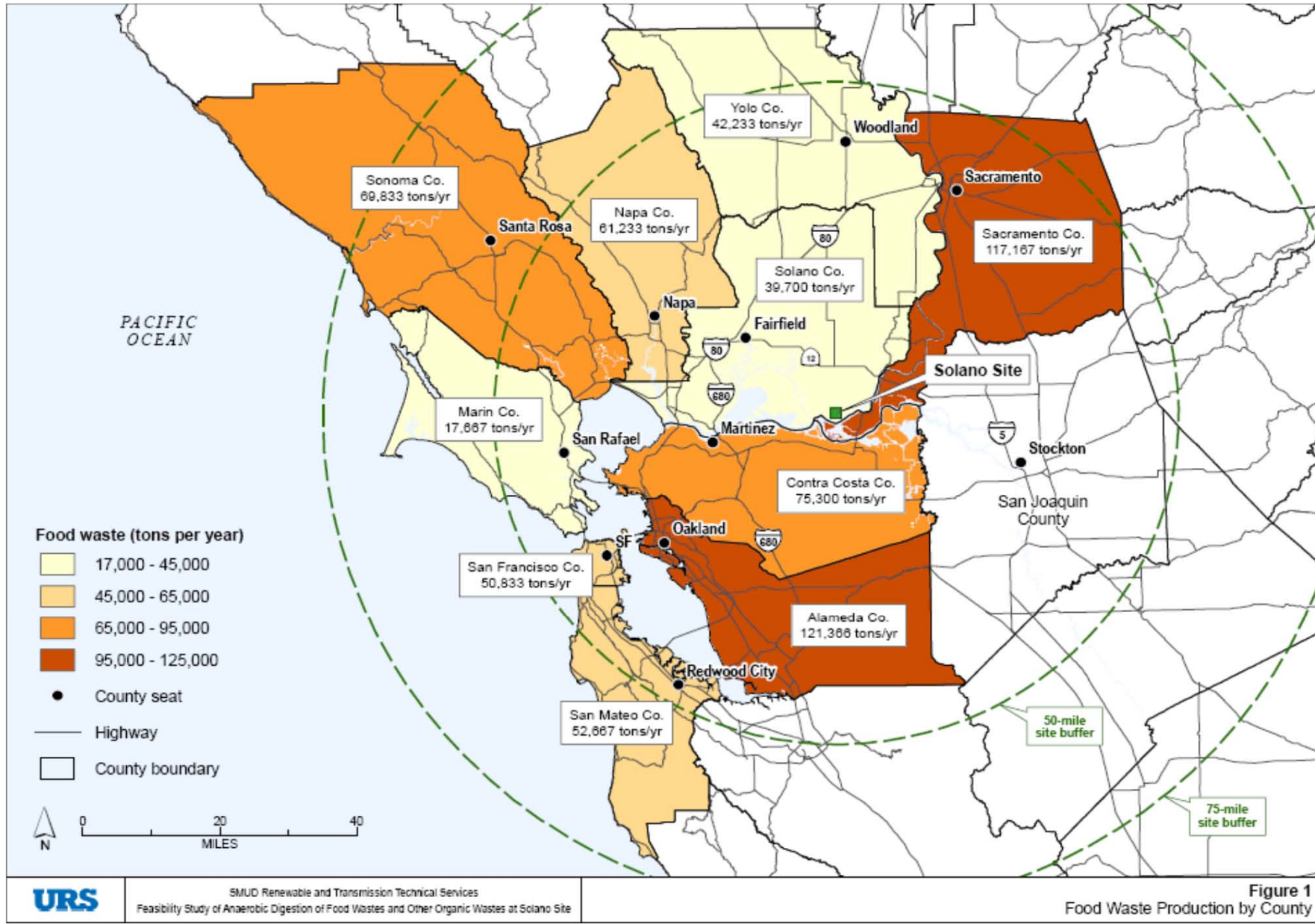
- Anaerobic Digestion of Food Wastes and Other Organic Wastes to Produce Biogas
- Co-Locate at the Solano Wind Farm Site
- Centrally Located to Large Population Centers in San Francisco Bay Area
- Help SMUD reach its Green Energy Goal of 33% by 2020

# Resource Potential Near Solano Site

COUNTY	Municipal Food Waste, dry ton per year	Food Processing Waste, dry ton per year
San Francisco	15,250	0
Marin	5,300	0
Sonoma	10,950	10,810
San Mateo	15,800	0
Alameda	36,300	0
Contra Costa	21,900	0
Napa	3,850	14,460
Yolo	4,550	1,340
Sacramento	35,150	0
Solano	10,200	180
TOTAL	159,250	26,790



# County Study Area



# Transportation Study Elements

- Study costs and emissions associated with transport of food wastes to the Solano Site:
  - Truck
  - Rail
  - Barge



# Emissions Assessment

- Estimated the avoided greenhouse gas (GHG) and oxides of nitrogen ( $\text{NO}_x$ ) emissions that may result from employing anaerobic digestion vs. landfill disposal of the same food waste streams
- Emission Factors of transportation of food wastes included in the assessment



# Estimated Biogas Production of Proposed Facilities

Parameter	Units	Facility Capacity, wtpd		
		500	1,000	1,500
Biogas Produced	MMSCF /day	2.07	4.13	6.20
Methane Content	%	60	60	60
Methane Generation	MMBtu /day	1,240	2,480	3,720



# Emission Assessment Factors

- Waste decomposition in landfill
- Methane combustion in on-site combined heat and power (CHP) facility or cleaned and piped to existing Cosumnes Generation facility
- SMUD and California Grid-supplied electricity emission factors
- Waste transportation emission factors

# Truck Transport: Driving Distance from County Seat to Solano Site

County Seat	Driving Distance, miles
San Francisco	68
San Rafael	65
Santa Rosa	74
Redwood City	91
Oakland	62
Martinez	43
Napa	40
Woodland	46
Sacramento	50
Fairfield	23





# Truck Transport

- Handling and trucking costs beyond a 50 mile distance would be prohibitive
- Approximately 63 percent of the technical food waste resources are available within a 50 mile driving distance

# Barge Transport: Distances from Ports to Solano Site

County	Nearby Port	Barge Distance, miles
San Francisco	Port of San Francisco	48
Marin	Port of Richmond	40
San Mateo	Port of Redwood City	70
Alameda	Port of Oakland	43
Contra Costa	Port of Richmond	40
	Mare Island	30
	Antioch	5
	Pittsburg	5
Sacramento, Yolo	Port of West Sacramento	55
San Joaquin	Port of Stockton	31



# Barge Transport

- Currently no barge landing facilities at the Solano site – estimated cost: \$50MM
- A barge landing is being considered for future wind turbine projects on the property – presents potential cost sharing opportunity



# Waste Transportation Emission Factors

Mode of Transport Type / Diesel Fuel	CO <sub>2</sub> Grams per ton-mile	NO <sub>x</sub> Grams per ton-mile
Truck	64.96	0.732
Train	24.39	0.654
Barge	17.48	0.469





# Emissions Assessment Results

- Emissions avoided are represented as negative numbers while emissions emitted are represented as positive numbers
- Net emissions avoidance is calculated on the basis of a baseline of sending the waste to landfills vs. the proposed project

# Transport Emissions

- Differential in emissions: hauling waste to the anaerobic digester site vs. hauling to landfills is dependent upon:
  - the location where the waste is originating
  - also a function of the mode of transport, specifically truck, train, barge, or some combination of these





# Waste Transportation Emission Differentials

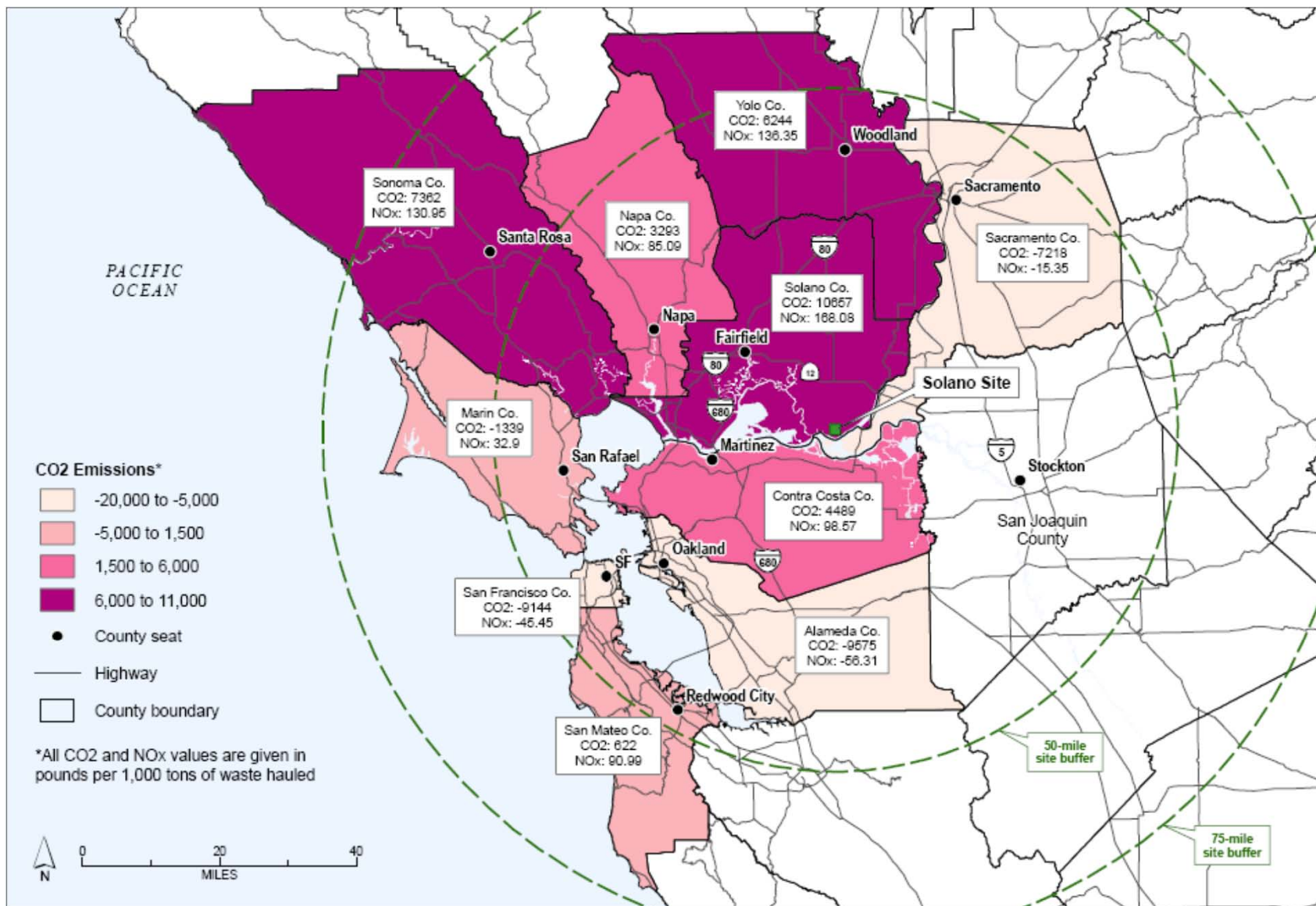
- Analysis assumptions:
  - the method of transport is a combination of truck and barge
  - 1,000 tons of waste per day is removed from each location

# Waste Transportation Emission Differentials

County	CO2 lbs	NOX lbs
<b>Alameda</b>	<b>-9,580</b>	<b>-56</b>
Contra Costa	4,490	99
Marin	-1,340	33
Napa	3,290	85
<b>Sacramento</b>	<b>-7,220</b>	<b>-15</b>
<b>San Francisco</b>	<b>-9,140</b>	<b>-45</b>
San Mateo	622	91
Solano	10,700	168
Sonoma	7,360	131
Yolo	6,240	136



# Transportation Emission Differentials for 1,000 Tons of Waste



SMUD Renewable and Transmission Technical Services  
Feasibility Study of Anaerobic Digestion of Food Wastes and Other Organic Wastes at Solano Site

Figure 2  
Transportation Related Emission Differential for 1,000 Tons of Organic Waste



# Conclusions

- Hauling waste from Sacramento, Alameda, and San Francisco counties would result in a net decrease in transportation-related GHG and NO<sub>x</sub> emissions for the 500, 1,000 and 1,500 tons per day capacity scenarios
- Barge transport is the most cost efficient and lowest emissions solution if the required infrastructure is in place

# Questions?

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