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Combined Heat & Power (CHP) from Bioenergy and Waste to Energy (WTE) at Miami-Dade County



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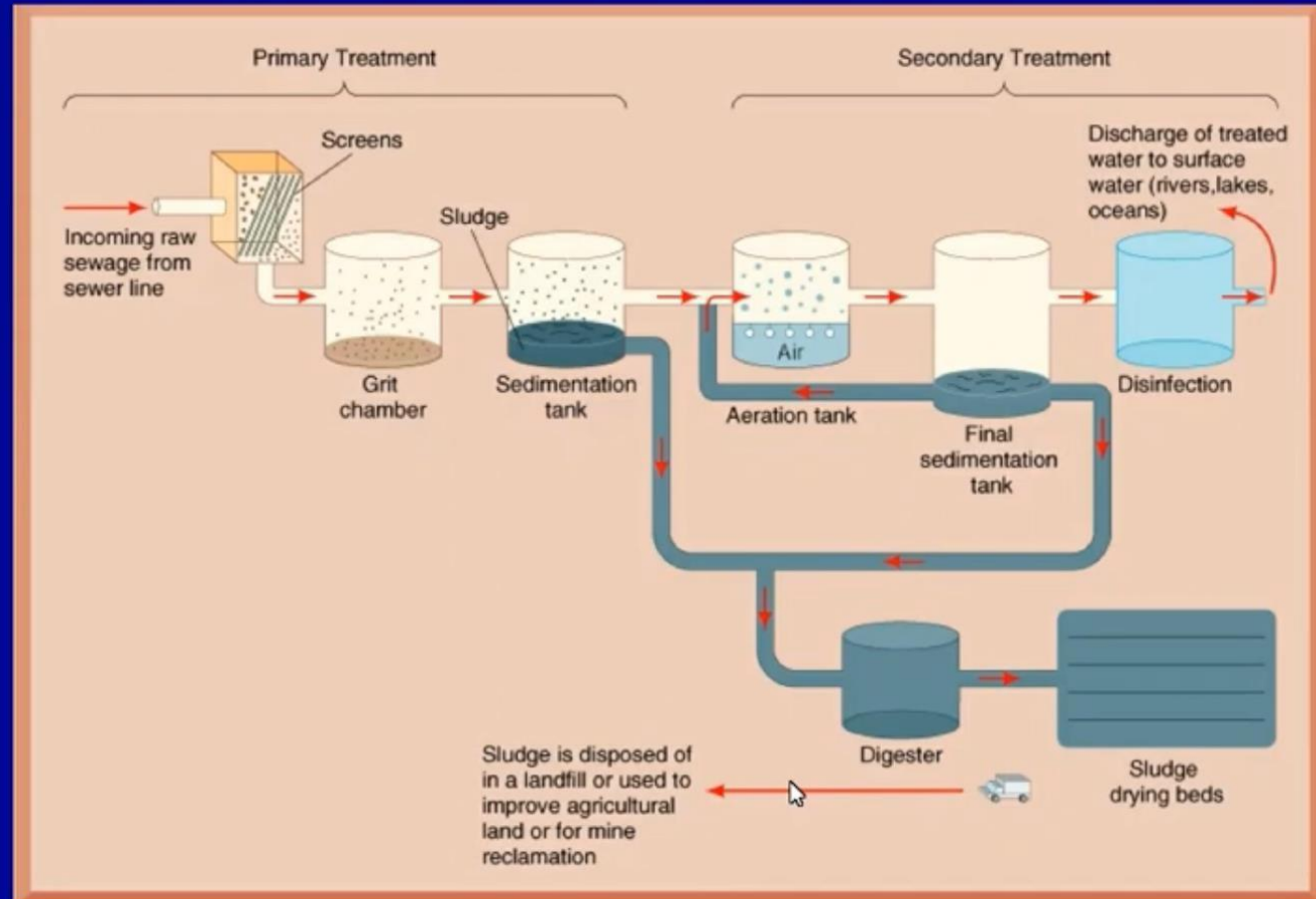
WASD AT A GLANCE

The Miami-Dade Water & Sewer Department (WASD) is the largest water utility in the Southeastern United States, providing high-quality, affordable water & wastewater services to the people of Miami-Dade County.

WASTEWATER TREATMENT PROCESS

- Two Primary Functions
 - Liquid Stream processing for discharge into deep injection wells or Ocean Outfall
 - Solids Treatment for fertilizer

Wastewater Treatment Process



COMBINED HEAT & POWER AND EFFICIENCY INITIATIVES

Waste to Energy Cogeneration - Impact



Cogeneration produces two useful sources of energy



Electricity

- 2-3 MW
- 30% of energy needs



Heat

- Add heat to digesters
- Dry biosolids
- Cool cogeneration building

CURRENT PRACTICE – COMBINED HEAT AND POWER SYSTEMS

Cogeneration of Biogas

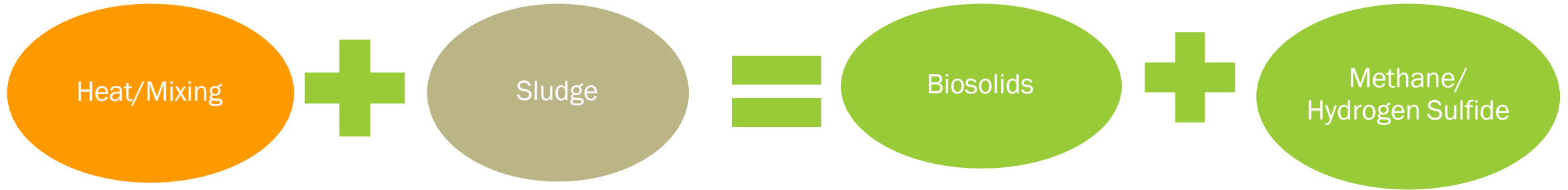
- 36 Anaerobic digesters
 - Waste Sludge
 - Miami Dade County's only Fats, Oil, and Grease(FOG) Receiving Station. FOG is excellent methane producer. Revenue source for county through tipping fees.
 - Future use of Landfill gas
- 4- 1,200 Kw and 4- 2,000 Kw Generators
- Annually Produce 800,000 Wet Tons of Class B Biosolids
- Spend ~\$26 million in electricity annually
- Biogas burned to produce energy for plant operations
- 22 million kWh of electricity generated in 2021
- Capacity to offset 30% of energy needs at two wastewater treatment plants
- ~\$200,000/month in energy savings



WHY COMBINED HEAT AND POWER

| Challenges/Benefits for Combined Heat and Power | Miami Dade Solution |
|---|---|
| Costs | Large Initial investment. Miami Dade has 100% power redundancy with utility power and backup diesel generators |
| Operating CHP not Wastewater Core Competency | Miami Dade employs over 400 employees at our Wastewater Facilities. Skilled electricians and power plant operators already on staff. Otherwise consider third party assistance. |
| Increased Resiliency/lower Energy Footprint | Harvesting methane decreases our energy footprint |
| Methane purity | Cleaning methane from Hydrogen Sulfide, water vapors, and other impurities key to sustainable engine operations. |
| Generator fuel consistency | Miami Dade uses methane spheres for consistent flow. Option available to supplement with natural gas. |

DIGESTER GAS USAGE OPTIONS



- *What do we do with the Methane?*
 - *Cogeneration using Combined Heat and Power (reciprocating engines)*
 - *Digester Heat Renewable Natural Gas*
 - *Flare*
 - *Other lesser used generators: microturbines, fuel cells*
- *Combined Heat and Power*
 - *Methane gas is “scrubbed” to remove vapor and H₂S*
 - *Methane fuels generator power*
 - *Heat exchangers recirculate digester sludge between 96-120 degrees*

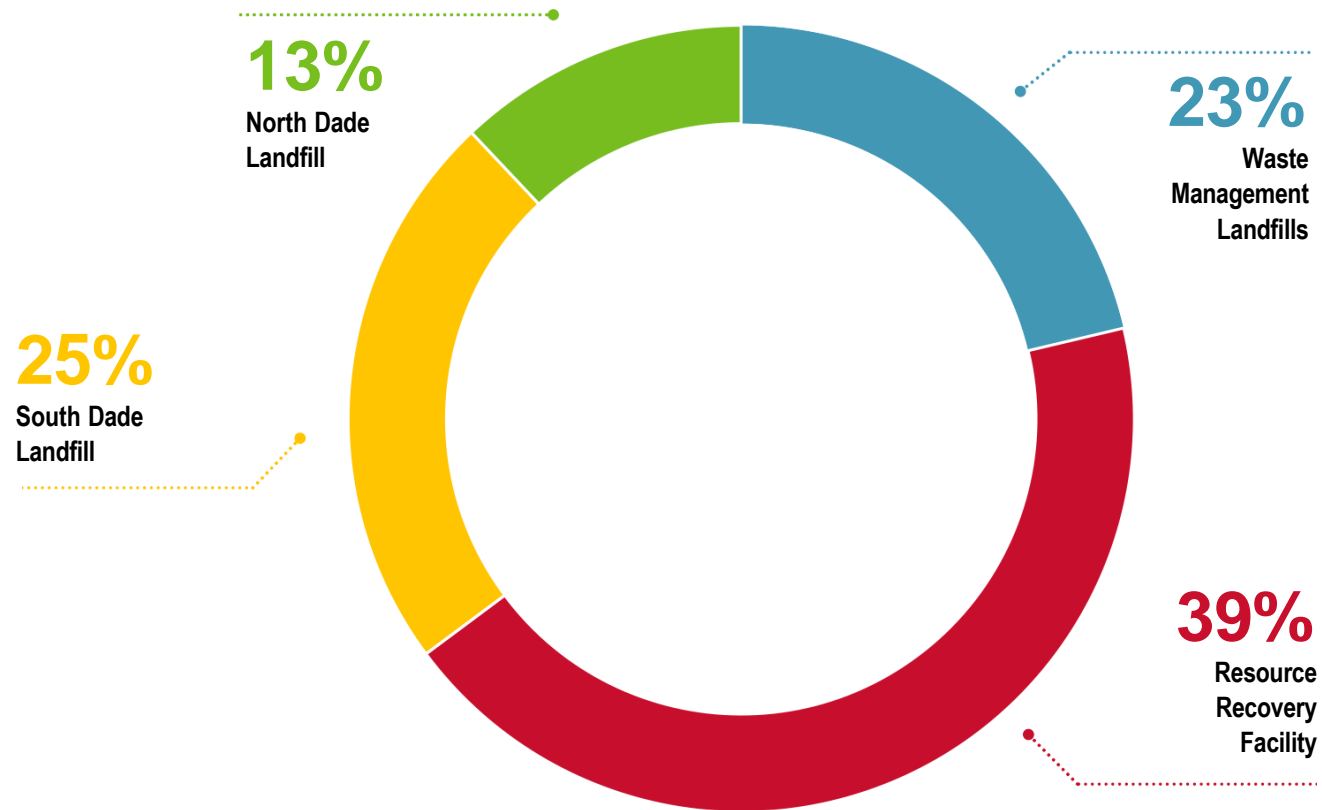
MIAMI DADE SOUTH WWTP CHP BENEFITS

| CHP at SDWWTP | | 2019 | 2020 | 2021 |
|---|--|------------|------------|------------|
| Total Fuel Input (kWh) | | 42,148,138 | 59,418,910 | 64,208,586 |
| Total Fuel Input (MMBTU) | | 143,809 | 202,737 | 219,080 |
| Biogas | | 135,294 | 140,426 | 152,631 |
| Natural Gas | | 8,516 | 62,311 | 66,448 |
| % Biogas | | 94% | 69% | 70% |
| CHP Electricity | | 15,364,269 | 20,824,703 | 22,503,354 |
| Biogas-kWh | | 14,454,461 | 14,424,253 | 15,677,950 |
| Natural Gas-kWh | | 909,808 | 6,400,450 | 6,825,404 |
| CHP Electricity (MMBTU) | | 52,423 | 71,054 | 76,781 |
| Biogas | | 49,319 | 49,216 | 53,493 |
| CHP Thermal (MMBTU) | | 34,976 | 49,875 | 53,896 |
| Biogas | | 32,905 | 34,546 | 37,549 |
| CHP Source Energy (MMBTU) | | 90,739 | 146,073 | 157,490 |
| Biogas-fueled (renewable) | | 82,223 | 83,762 | 91,042 |
| Natural gas-fueled (already included above) | | 8,516 | 62,311 | 66,448 |
| Blended Efficiency | | 63% | 72% | 72% |



WTE Facility

2020 DSWM Waste Disposal



Benefits of WTE in MDC

- Waste (volume) reduction primary benefit
 - Energy recovery
 - Metals recovery
 - Ash reuse
 - Landfill diversion
- Single stream recycling limited regionally
 - Limited processing
 - Contamination
- WTE is proven in MDC



Benefits of WTE in MDC

- Avoid landfill disposal
- Decrease Greenhouse Gas production
 - 1 ton processed equals 1 ton of CO₂e avoided
- Avoid out of county disposal
 - Requires extensive transportation resources
 - County needs to manage 2.5M tons (2031)
 - 400 truckloads daily
 - 100,000 road miles daily
 - \$200,000+ daily (\$62M annually)
 - Excessive carbon footprint
- Extend Comprehensive Development Master Plan (CDMP) compliance



Overview of Processing/ Disposal Capacity

- County currently has several disposal options but with a finite capacity.
- WTE is resource recovery
 - ~37 MM cy of landfill disposal avoided since inception (25 million tons processed, 10:1 space reduction)
 - Energy production to offset GHG
 - 25,000 tons per year metal recovered
- 5 years of operations offsets management of 10 million cubic yards of airspace.
- North Dade Landfill at capacity - 2025



Existing Facility

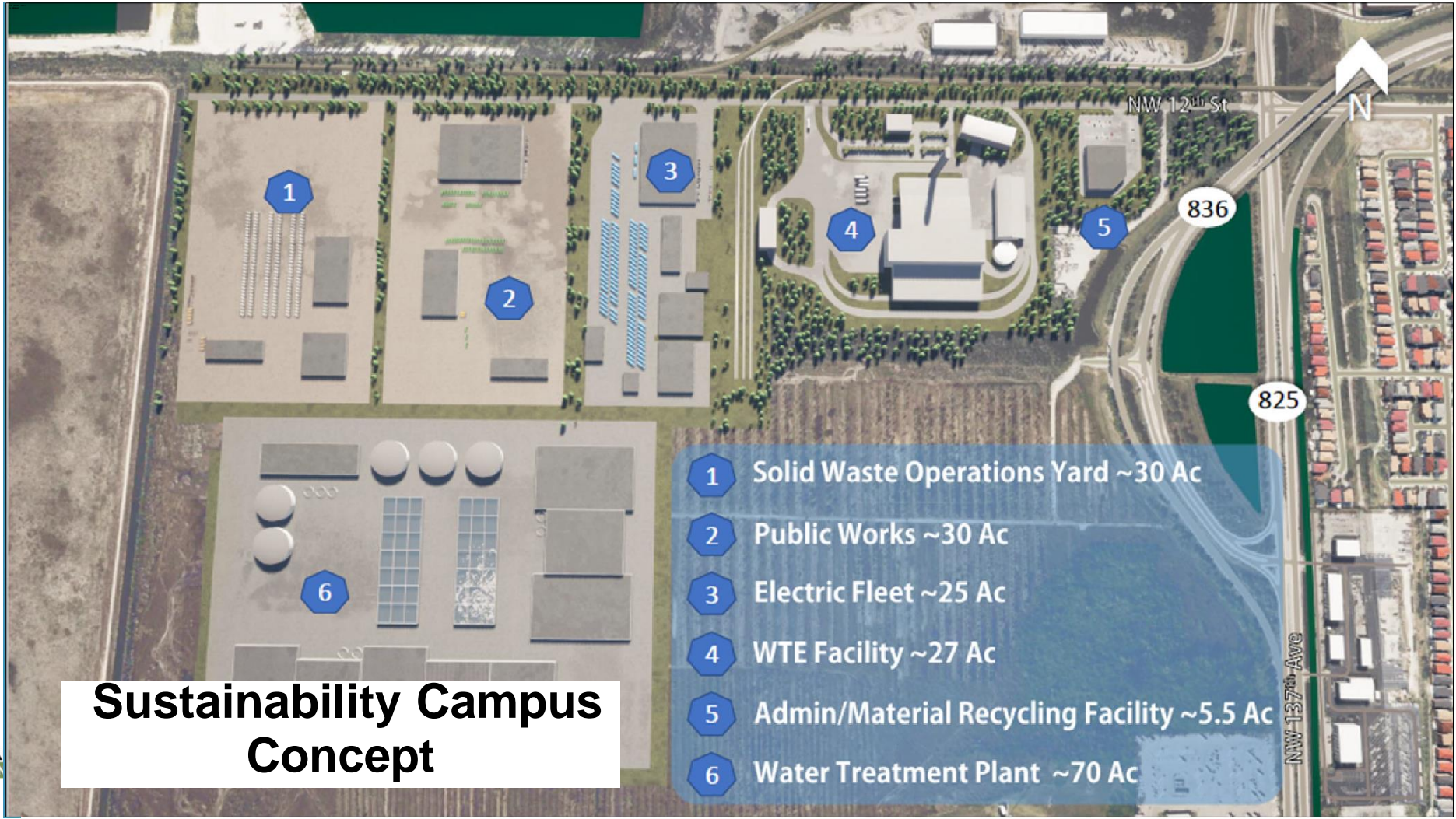
- 40 year old facility
 - Operating and maintenance costs will continue to increase
 - Obsolescence of components
- Outdated technology
 - Solid Waste Authority of Palm Beach County – development analysis led to mass burn
- Excess residues
 - Ash and unders
- Central focus of RRF
 - Waste reduction (landfill diversion)
- Massive Fire in 2023
 - Plant taken offline





MIA
COUN

**Sustainability
Campus Concept**



Sustainability Campus Concept

- 1 Solid Waste Operations Yard ~30 Ac
- 2 Public Works ~30 Ac
- 3 Electric Fleet ~25 Ac
- 4 WTE Facility ~27 Ac
- 5 Admin/Material Recycling Facility ~5.5 Ac
- 6 Water Treatment Plant ~70 Ac

Sustainability Campus

Future Forward Development

- Microgrid for municipal services
- Co-located facilities
 - WWTP
 - EOC
 - EV charging – the future of transportation
 - Transit
 - Refuse collection
 - Light fleet
 - Private industry potential
- Renewable Energy



Thank You.



MD-WASD



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