Solid Waste Authority of Valley County

80% Recycling Goal By 2035

OWL ENGINEERS:
Sharmily Rahman, Bishow Shaha, Zachary Smierciak, Joshua Tronnier, Kaitlyn Luck

Advised by Dr. Daniel Meeroff

2020 SWANA FL/RFT Joint Summit
January 26-28, 2020
Scope of Services

Evaluation
- Four Models
- Recycling Data
- Existing Conditions

Projections
- Population
- Waste Generation

Model Analysis
- Assumptions
- Recycling Rate
- Target Materials
- Proposed Changes

Implementation
- Timeline
- WARM Model
- Cost Analysis
- Recommendation
About Valley County

1,200 Square Miles

Population 400,000

75% by area
Unincorporated

25% by area
Incorporated

Dual Recycling Stream

80% Population
Lives in
Incorporated
Areas
Valley County: Existing Conditions

Waste Composition:
1. C&D Debris (37%)
2. Organics (16%)
3. Fiber (15%)
4. Plastic (7%)

Curbside Collection Availability
- 80% of Single-Family Homes
- 25% of Multi-Family Homes
- 88% of Commercial Buildings

Existing Facilities
- Subtitle D Sanitary Landfill
- C&D Debris Recycling Facilities
- Materials Recovery Facilities (MRF)
- Household Hazardous Waste Facilities (HHW)
- Yard Waste Mulching Program
- Landfill Gas to Energy (LFGTE) Facility
Projections

**Population**

- Population (High)
- Population (Medium)
- Population (Low)

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (High)</th>
<th>Population (Medium)</th>
<th>Population (Low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>400</td>
<td>420</td>
<td>440</td>
</tr>
<tr>
<td>2020</td>
<td>420</td>
<td>440</td>
<td>460</td>
</tr>
<tr>
<td>2025</td>
<td>460</td>
<td>480</td>
<td>500</td>
</tr>
</tbody>
</table>

**Waste**

- Additional MSW for High Population Growth
- MSW at Low Population Growth

In 2035:
- 725k tons

**R² Values**
- \( R^2 = 0.964 \)
- \( R^2 = 0.946 \)
- \( R^2 = 0.976 \)
Model Analysis
General Assumptions

- 2016-2018 data used for recycling rate calculations
- Analysis based on high population growth and corresponding waste projection
- 50% newspaper reduction by 2035 due to digital alternatives
- No existing WTE facility; future adoption was not investigated
California Model

Recycling Rate Calculation:
\[
\text{1 - \frac{\text{Disposed Waste}}{\text{Total Amount of Waste Produced}}}\]

Renewable Energy Credits:
No Credit

Yard Trash Used As Landfill Cover:
Not Counted

Excluded Wastes:
ADC, AIC, Beneficial Reuse, Biomass Conversion, Waste-Tire-Derived Fuel

Beneficial Reuse:
Not Counted As Recycling

2018
55.3%
Florida Model

Recycling Rate Calculation:
Total Amount of MSW Recycled

Total MSW Recycled, Land Disposed, or Combusted

Renewable Energy Credits:
Credit for Renewable Energy Generated
From Solid Waste or LFG As Fuel

Yard Trash Used As Landfill Cover:
Credits Allowed

Excluded Wastes:
Industrial, Mining, Agricultural Operations,
Scrap Metal, Shredder Residue

Beneficial Reuse:
Not Counted as Recycling
(e.g. C&D Debris As Fill)

2018
51.2%

2018
57.9%
Oregon Model

Recycling Rate Calculation:

\[
\text{Total Recycled} + \text{Composted} + \text{Recovered for Energy} \div \text{Total Amount of Waste Produced}
\]

Renewable Energy Credits:
No Credit

Yard Trash Used As Landfill Cover:
Not Stated

Excluded Wastes:
Manufacturing, Industrial, Reconditioned/Reused Materials, Brick/Concrete, Vehicles

Beneficial Reuse:
Filling A Clean Fill = Not Recycling

2018
47.9%
European Union (UK) Model

Recycling Rate Calculation:

\[
\frac{\text{Recycled Amt. of Household Wastes}}{\text{Total Household Waste Amt. (Excluding Certain Categories)}}\]

Renewable Energy Credits:
No Credit

Yard Trash Used As Landfill Cover:
Not Stated

Excluded Wastes:
Energy Recovery, Reprocessing into Materials Used as Fuels or Backfilling Operations

Beneficial Reuse:
Counted As Disposal

2018
48.5%
Model Application: No Program Change in 2035 (Status Quo)

- **FL**
  - RE Recycling Rate: 2018 → 2035 58% → 53%
  - Recycling Rate: 2018 → 2035 51% → 48%

- **OR**
  - Recycling Rate: 2018 → 2035 48% → 46%

- **CA**
  - Recycling Rate: 2018 → 2035 49% → 45%

- **EU(UK)**
  - Recycling Rate: 2018 → 2035 49% → 45%

**Highest recycling rate for FL RE**
Implementation Plan
Residential Recycling

Unincorporated Single-Family

- 2018 Recycling Rate of VC (FL RE): 58%
- 2018 Single-Family Recycling Rate in Unincorporated Area: 4%

Multi-Family

- 2018 Recycling Rate of VC (FL RE): 58%
- 2018 Multi-Family Recycling Rate in VC: 19%
Challenge: Low recycling availability to residences

Solution:

Single-Family Homes in Unincorporated Areas
- Extend curbside recycling pickup
- Requires new bins & 32 additional trucks

Hauled Container System for Multi-Family
- Contract with commercial haulers
- Managed by property owners

Recycling Rate Models:

- FL RE: 58% recycling rate
- FL: 52% recycling rate
- OR: 51% recycling rate
- CA: 50% recycling rate
- UK: 50% recycling rate
Targeting Specific Materials

C&D Debris
Organics
Fiber
Metal
Other
Plastics
Glass

2018 Recycled
2018 Disposed
C&D Recycling Ordinance

Challenge: Large amount of unrecycled C&D debris

Solution:

Two Sources of C&D Debris
- Commercial & Residential
- New Construction & Renovation

USGBC LEED Inspiration & Expedited Permit
- Reasonable to achieve 50%, 75%, 90% recycling

Recycling Rate Models

<table>
<thead>
<tr>
<th>Region</th>
<th>Recycling Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL RE</td>
<td>65%</td>
</tr>
<tr>
<td>FL</td>
<td>59%</td>
</tr>
<tr>
<td>OR</td>
<td>58%</td>
</tr>
<tr>
<td>UK</td>
<td>57%</td>
</tr>
<tr>
<td>CA</td>
<td>57%</td>
</tr>
</tbody>
</table>

Recycling Rate Models

0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
Targeting Specific Materials

- C&D Debris
- Organics
- Fiber
- Metal
- Other
- Plastics
- Glass

2018 Recycled vs 2018 Disposed

Tons

0
50000
100000
150000
200000
250000
300000
Fiber Education Campaign

Challenge: 6% recycling rate in commercial companies

Solution:
Educational Program
- Materials such as flyers, posters, TV ads, webpage upgrades, social medial and bin stickers
- Educational cost increase to $1.10/household
- Compliance bin-tagging similar to Orange County, FL
Targeting Specific Materials

- **C&D Debris**: 240,000 Tons
  - 2018 Recycled: 150,000 Tons
  - 2018 Disposed: 90,000 Tons
- **Organics**: 90,000 Tons
  - 2018 Recycled: 45,000 Tons
  - 2018 Disposed: 45,000 Tons
- **Fiber**: 70,000 Tons
  - 2018 Recycled: 35,000 Tons
  - 2018 Disposed: 35,000 Tons
- **Metal**: 50,000 Tons
  - 2018 Recycled: 25,000 Tons
  - 2018 Disposed: 25,000 Tons
- **Other**: 35,000 Tons
  - 2018 Recycled: 15,000 Tons
  - 2018 Disposed: 20,000 Tons
- **Plastics**: 20,000 Tons
  - 2018 Recycled: 10,000 Tons
  - 2018 Disposed: 10,000 Tons
- **Glass**: 10,000 Tons
  - 2018 Recycled: 5,000 Tons
  - 2018 Disposed: 5,000 Tons
**Plastic Substitution**

**Challenge:** Improving recycling for plastic materials

**Solution:**

**Market for 3D printing alternative filament**
- Polylactic Acid (PLA)
  - Recyclable and compostable plastic
  - Used as 3D printer filament
- Viable substitute for:
  - Polyethylene/PE, Polystyrene/PS, Polypropylene/PP
- PET bottle bill implementation
Targeting Specific Materials

- C&D Debris
- Organics
- Fiber
- Metal
- Other
- Plastics
- Glass

2018 Recycled
2018 Disposed
Organic Waste Anaerobic Digestion

Challenge: Improve recycling of organics

Solution:

Collection & processing of organic wastes

- Requires new bins & 10 specialized trucks
- Waste collected is sent to existing WWTP
  - Installation of liquefiers
  - Renewable energy generation
  - Beneficial soil amendment product

Challenge: Improve recycling of organics

Solution:

Collection & processing of organic wastes

- Requires new bins & 10 specialized trucks
- Waste collected is sent to existing WWTP
  - Installation of liquefiers
  - Renewable energy generation
  - Beneficial soil amendment product
Environmental Impact
WARM Model

Florida RE & Oregon Models

GHG Emissions Reduction

260,000 MTCO$_2$E
($\approx 55,000$ passenger cars)

Conservation of Energy

2.6$\times 10^{12}$ BTU
($\approx 28,000$ household’s)
Implementation and Financial Analysis

- **C&D Recycling Ordinance**
  - 53% (2020-2023)
  - 58% (2023-2025)
  - 65% (2025-2027)
  - 69% (2028-2030)
  - 74% (2030-2035)
  - Cost: $11.70/unit

- **Plastic Substitution**
  - 74% (2020-2023)
  - 69% (2023-2025)
  - 65% (2025-2027)
  - 69% (2028-2030)
  - 74% (2030-2035)
  - Cost: $13.50/unit

- **Curbside Pickup**
  - 53% (2020-2023)
  - 58% (2023-2025)
  - 65% (2025-2027)
  - 69% (2028-2030)
  - 74% (2030-2035)
  - Cost: $12.40/unit

- **Anaerobic Digestion**
  - 53% (2020-2023)
  - 58% (2023-2025)
  - 65% (2025-2027)
  - 69% (2028-2030)
  - 74% (2030-2035)
  - Cost: $27.20/unit
Summary

Evaluation
- Four Models
- Recycling Data
- Existing Conditions

Projections
- Population
- Waste Generation

Model Analysis
- Assumptions
- Recycling Rate
- Target Materials
- Proposed Changes

Implementation
- Timeline
- WARM Model
- Cost Analysis
- Recommendation
EVALUATION OF ROADMAP TO ACHIEVING 80% RECYCLING GOAL FOR SWAVC

SCOPE
- The FAU student consulting team (OWL Engineers) is assisting the Solid Waste Authority of Valley County (SWAVC) in developing a plan to achieve 80% recycling rate by the year 2050.
- Four recycling models (CA, FL, OR, & UK-based FL), & UK) were analyzed.
- Future waste projections for 2019-2040 with recycling rate for 2035 was calculated with no system changes (status quo condition)
- To meet the 80% goal, new policies and strategies were recommended along with detailed cost analysis and timelines for targeted materials

RECYCLING RATE MODELS
- Weight-based recycling model
  - Recycling rate = \( \frac{\text{Recycled material}}{\text{Total waste}} \)
  - Percentage of recyclable material included in waste
- Source reduction counted as recycling

ASUMPTIONS & DATA ANALYSIS
- For 2035 recycling rate calculations, data provided from 2016-2018 was used since the trends are more recent and uniform.
- Infrastructure policies and programs have advanced (e.g., expansion of infrastructure and recycling facilities)
- 80% recycling rate by 2050 was achieved by 2050 since policies are increasing as well.
- No existing WTE facilities currently exist, so future adoption was not investigated.

INCREMENTAL RECYCLING RATE PER FLRC

IMPLEMENTATION SCHEDULE WITH COSTS

CONCLUSION & RECOMMENDATIONS
- Four recycling models were analyzed. The FL model with renewable energy credits (RECs) results in the highest recycling rate.
- 80% recycling rate is achievable by 2039 through a combination of policies and innovative strategies centered on extending extended producer responsibility to unincinerated waste targeting specific materials (C&D, glass, plastics, and organics)
- The total cost to implement those strategies increases the consumer by $17.20 to $20.05, which is less than 1% of the current fee structure.
Thank You...