RECYCLING & INTEGRATED PLANNING:

Steps for the Most Cost-Effective GHG Reduction Strategies

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MANY SOLID WASTE MANAGEMENT OPTIONS FOR COMMUNITIES

- Incentives
- Programs/services
  - City / private
- Policies/legislation
- Infrastructure/facilities
  - City / private

COMMUNITIES HAVE MULTIPLE GOALS & DRIVERS ...

- Extending landfill life; address overuse
  - Cheaper, more nimble than new infrastructure
- Improving efficiency of diversion
- Citizen demand / Politics
- Goals / diversion / mandates (tons)
- Total Cost and Cost efficiency
- Environmental impacts (GHG, toxicity, resources), jobs, other goals

Scores of potential choices… How to select…?

US GREENHOUSE GAS EMISSIONS SOURCES - CONVENTIONAL

Electricity, building energy use responsible for about 1/3 of GHG emissions

| Source: USEPA, 2005 |

PERSPECTIVE: PROGRAMS MODELED

- Solid waste:
  1. Pay-as-you-throw (PAYT)
  2. Residential curbside recycling (CS Recy.)
  3. Yard waste (composting not AD)
- Calculation approach (tons → GHG; costs...)
  - (Base case, normalized)

ENERGY ALTERNATIVES ANALYZED

- Residential Weatherization
- Programs, generation, including renewables...
- Commercial Lighting
- Solar

**RELATIVE JOB IMPACTS**

- Direct install, broad programs create more jobs
- Fewer jobs from appliance programs
  - No installation
  - Equipment not all made in US or the relevant state
- Recession...

**JOB CREATION ALSO DIFFERENTIATES PROGRAMS**

**RELATIVE COST, JOBS PER MTCE FOR RECYCLING & ENERGY**

**OTHER CONSIDERATIONS / POLICY GOALS**

- Cost
- Environmental
- Jobs
- Perspective / Authority
- Speed
- Retention
- NEBs
- Other

Source: Phase 1 draft figures, Skumatz Economic Research Associates, Inc. (SERA)
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OTHER PROGRAM

CONSIDERATIONS

- Authority to implement
  - Perspectives – city / county vs. utility
  - Cities / counties may also consider recycling, transportation, other strategies
  - Conducted similar analysis of recycling programs

OTHER POLICY

CONSIDERATIONS

- Speed & coverage
  - Affected by budgets, potential
  - Some programs fast ... some ramp-up
  - Relatively large size per commercial installation helps speed MTCE achievements
  - Cost, training, verification, etc. of weatherization programs can slow ramp up
  - Ramp-up comparisons; budget staging

OTHER POLICY

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PARTICIPANT EFFECTIVE AS A RATIO OF DIRECT EFFECTS

- Indirect benefits
  - Significant value - multiples of direct impacts
  - Societal (mostly enviro & jobs, but...)
  - Utility
  - Participant - maximize full value given budget...?
  - Out of pocket costs / funding (different perspectives)
  - Reliability, many others...

TIME TO RAMP UP TO DELIVERY MTCE - RELATIVE

- Retention
  - Reflected in EULs / lifetimes
  - Lower for CFL programs; higher for weatherization / retrofit
  - Consider consistently in cost computations
  - Values for behavioral as potential part of portfolio not well demonstrated...

Program / Portfolio Selection

- Integrated planning in MTCE terms
- Multi-objectives
  - Beyond kWh, kW, B/C
  - Craft portfolios beyond technical, economic, etc...

Multi-Attribute Priority Assignments

<table>
<thead>
<tr>
<th>Weights (1)</th>
<th>Wgts (2)</th>
<th>Wgts (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost/MTCE</td>
<td>100%</td>
<td>40%</td>
</tr>
<tr>
<td>1 / jobs</td>
<td>0%</td>
<td>30%</td>
</tr>
<tr>
<td>Speed</td>
<td>0%</td>
<td>30%</td>
</tr>
<tr>
<td>Authority</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Retention, NEB, funding, other...

Costs per kWh, cost per MTCE, and many other criteria

Source: Phase 1 project figures, Skumatz Economic Research Associates, Inc. (SERA)
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Scores under different weights

A: 50% cost, 20% jobs, 30% time
B: 1/3 each
C: half cost, half jobs
D: half cost, half time
E: 1/3 cost, 1/3 time, 1/3 NEBs

Integrated planning for MTCE objective

Supply curves

- Total (previous), cumulative
- Annual (EE smaller, SW exhaust faster)
- Delivery supply curve...
DEVELOPING PORTFOLIO – MULTI-ATTRIBUTE

<table>
<thead>
<tr>
<th>Rankings</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost ($/MTCE)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Dotted line 1 year
Dashed line 10 year

WHAT WORKS? PROGRAM AND COST ANALYSIS

Tradeoffs and cost-effectiveness within Solid Waste Options...

EFFICIENT, EFFECTIVE PROGRAM OPTIONS / “WINNERS”

<table>
<thead>
<tr>
<th></th>
<th>High Diversion Impact</th>
<th>Strong Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pay As You Throw (PAYT); incentives</td>
<td>✓</td>
<td>✓ C/E</td>
</tr>
<tr>
<td>Every Other Week (EOW) Rcy, YW, Gbg</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Single Stream, fewer streams, containers</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Education</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Mandates and Bans</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

PAY-AS-YOU-THROW / RECYCLE & $AVE

OTHERS AS WELL: analysed containers, sign-ups, charge structures, same day, Curbside, landfill costs, etc.

SERA MAPPING PATH TO GHG GOAL INCLUDING DIFFERENT PROGRAMS (YEARS & PROGRESS)

Percent of GHG Goal

Years to goals; cost implications...

US GREENHOUSE GAS EMISSIONS (REVISED)

Local Passenger Transport 12%
Building Energy Use 31%
Inter-city Passenger Transport 7%
Food 12%
Provision of Goods & Materials 38%

Source: USEPA Prelim; from Allaway (ORDEQ)

WHAT WORKS?

Tradeoffs and cost-effectiveness within Solid Waste Options...
**PAYT - EFFECTIVE AND COST-EFFECTIVE**

- Effectiveness – biggest impact
  - Includes waste prevention
  - More C/E than alternatives
  - One of top 3 drivers from leading US states
- Strengths & Weaknesses
  - Political will
- Ordinance vs. Contract
- Why Cities, Haulers should favor PAYT
- BMPs – recycling, size, containerization, incentive

**EFFICIENCIES: ALTERING COLLECTION FREQUENCY**

- It’s all about the stops!
  - Every other week (EOW) recycling
    - Lose some recycling
    - Significant savings – ~half the stops/labor/equipment
    - Carts, education
  - EOW – Add Yard Waste or YW + Food
    - Alternate Recy / Organics – nearly “free” (only tip change)
    - Lose percentage points – GAIN whole new stream! & already separate!
  - EOW Trash
    - Optional vs. system wide; multiple examples; optimize STOPs
    - Tailor collections to need (YW weekly? EOW Daily?)

**EFFICIENCIES: SINGLE STREAM RECYCLING & LARGE CARTS**

- Strong quantitative impacts from fewer streams & large containers
  - IP processing infrastructure available
  - Higher recycling
  - Participation, convenience, diversion
  - Significant cost savings (autom)
  - MF and Commercial Benefits
  - Glass issue.
  - Progress in recycling collection must stay parallel with trash collection
  - 96 gallon containers are a huge source of the impact (even without SS)!

**WHERE DOES EDUCATION FALL?**

- Comp plans & stakeholder meetings always recommend / agree on education...
  - No one has to DO or CHANGE anything...
- Impacts rarely measured
  - SERA study / gathered data on 130 campaigns
  - Same kind of statistical analysis
  - Comparison to SERA research on CBSM
WHAT WORKS?
PROGRAM & COST ANALYSIS

MAKING EDUCATION & OUTREACH MORE EFFECTIVE

- Don't focus on traditional outreach.
- Self-efficacy
- Market indirect benefits
- Social marketing ROI (CBSM)

WHERE IS THE “BIG BANG” FOR THE BUCK?

- Mandates & Bans

Spend the capital where there’s impact...

EFFICIENCIES: MANDATES / BANS

- Mandatory Pay, Mandatory SSO, Bans
  - Similar; in place in the most successful cities
  - Recycling, organics
- Residential & Commercial programs
- Enforcement key to success
  - Where, who, penalties – many options
- Barriers? Political will.

BANS, MANDATES – SETTING THE STAGE

- Processing capacity (chicken / egg)
- Space for recycling
- Enforcement capacity
- Technical assistance & education

Overall –
- economics and
- politics
RECENT SERA STUDY - IMPACT COMPARISON

COMPARISON – EASY (EZ) VS. MANDATES / BANS

OTHER

- Certainly other options, streams, etc. (C&D), but…

DECISION-MAKER DILEMMA

MAKING SENSE OF THIS? WHAT DO THE NUMBERS SAY?

- Quantitative guidance – large opportunity to increase diversion efficiently!
  - Consider BEFORE new infrastructure ($) (demand side)
  - Options: incentives, EOW, SS/containers, Education, mandates, new streams
- To reach highest levels of diversion – if goals are important – might have to act aggressively...
  - Pussyfooting won’t do it: spend political capital where it will make a difference...

THANK YOU!!

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