

Metro | Agenda

Meeting: Solid Waste Alternatives Advisory Committee (SWAAC)
Date: Wednesday, April 13, 2016
Time: 10:00 a.m. to Noon
Place: Metro, Council Chambers

The purpose of the Solid Waste Alternatives Advisory Committee is to develop policy options that, if implemented, would serve the public interest by reducing the amount and toxicity of waste generated and disposed, or enhancing the effectiveness and sustainability of the system through which the region's solid waste is managed.

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|-----------------|-----------|---|--|
| 10:00 AM | 1. | CALL TO ORDER AND DECLARATION OF A QUORUM | Matt Korot |
| 10:02 AM | 2. | COMMENTS FROM THE CHAIR AND SWAAC MEMBERS | |
| 10:07 AM | 3. | ** CONSIDERATION OF SWAAC MINUTES FOR FEBRUARY 25, 2016 | |
| 10:10 AM | 4. | METRO'S STRATEGIC PLAN TO ADVANCE RACIAL EQUITY, DIVERSITY AND INCLUSION | Paul Slyman
Juan Carlos Ocaña-Chiu
Cassie Salinas |
| | | <i>Purpose:</i> <ol style="list-style-type: none">To introduce SWAAC members to this plan, which will be a significant driver of how Metro does its work in the future.To share initial ideas about how Metro, SWAAC members and interested parties could learn from each other's work on equity, diversity and inclusion. | |
| | | <i>Outcomes:</i> <p>SWAAC members gain a basic understanding of the plan and preliminary ideas are identified for future information exchange.</p> | |
| 10:45 AM | 5. | WOOD WASTE MARKET ALTERNATIVES STUDY | Andy Sloop |
| | | <i>Purpose:</i> <p>To summarize the research findings from this project, which is intended to identify and assess options for improving the capacity, stability and environmental outcomes of markets for the region's urban wood waste.</p> | |
| | | <i>Outcomes:</i> <ul style="list-style-type: none">Understanding of the research findings.Comments on the findings and input on next steps. | |
| 11:20 AM | 6. | UPDATE ON SWAAC SUBCOMMITTEE ON MATERIAL RECOVERY AND CONVERSION TECHNOLOGY FACILITY REGULATORY CHANGES | Bruce Walker |

Continued on back...

- 11:40 AM 7. CITIZEN COMMUNICATIONS TO SWAAC AGENDA ITEMS**
- 11:55 AM 8. PREVIEW OF THE NEXT MEETING'S AGENDA AND FINAL COMMENTS Matt Korot**
- 9. ADJOURN**

- * Material available on the Metro website.
** Material will be distributed in advance of the meeting.
Material will be distributed at the meeting.

Upcoming SWAAC Meetings:

- Wednesday, May 11, 2016 from 10 a.m. to 12 p.m. (noon) at the Metro Regional Center
- Wednesday, June 8, 2016 from 10 a.m. to 12 p.m. (noon) at the Metro Regional Center

For agenda and schedule information, call Matt Korot at 503-797-1760, e-mail: matt.korot@oregonmetro.gov.
To check on closure or cancellations during inclement weather please call 503-797-1700.

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 **Metro** | *Meeting minutes*

Meeting: Solid Waste Alternatives Advisory Committee
Date/time: Wednesday, February 25, 2016; 10:00 a.m. to Noon
Place: Metro Council Chambers

The purpose of the Solid Waste Alternatives Advisory Committee is to develop policy options that, if implemented, would serve the public interest by reducing the amount and toxicity of waste generated and disposed, or enhancing the effectiveness and sustainability of the system through which the region's solid waste is managed.

Attendees

Mike Leichner, Pride Disposal
Bruce Walker, City of Portland
Theresa Koppang, Washington County
Kathy Kaatz, City of Tualatin
Alando Simpson, City of Roses Disposal & Recycling
Audrey O'Brien, Oregon Dept. of Environmental Quality
Keith Ristau, Far West Recycling
Matt Korot, Metro
Casey Camors, City of Milwaukie
Amy Roth, Association of Oregon Recyclers
Scott Keller, City of Beaverton

1. CALL TO ORDER AND DECLARATION OF A QUORUM

Chair Matt Korot called the meeting to order and declared a quorum.

2. COMMENTS FROM THE CHAIR AND SWAAC MEMBERS

Chair Korot reviewed the agenda items and reminded members that there will be not be a SWAAC meeting in the month of March. The next regularly scheduled meeting is Wednesday, April 13, 2016.

3. CONSIDERATION OF SWAAC MINUTES FOR JANUARY 13, 2016

The minutes of the January 13, 2016 SWAAC meeting were approved.

4. SOLID WASTE ROADMAP: TRANSFER SYSTEM CONFIGURATION

Tim Collier of Metro and Dan Pitzler of CH2M presented the options that staff developed for answering the project question: what model of the public-private system of waste transfer systems best serves the public interest, now and in the future? Mr. Collier and Mr. Pitzler sought input from SWAAC members on the options, which will be shared with the Metro Council at its March 1, 2016 work session.

Mr. Pitzler noted that Metro staff and the Transfer System Configuration Task Force agree on the following elements:

- **Self-Haul:** Existing system works well, no need for substantial new service
- **Household Hazardous Waste:** Use additional round-up events if supplemental service is desired (beyond service provided at Metro Central and Metro South transfer)
- **Commercial Food & Residential Food/Yard Debris:** on hold until there is more clarity about the direction of the region's food recovery program

Moving beyond those elements, Mr. Pitzler noted that the challenge in answering the project question is that in the ideal world, the transfer system would be designed to minimize cost and maximize benefits to the public, but the reality is that the services that support public benefit are expensive and require higher levels of public support.

In developing options for Council consideration, staff used the following evaluation criteria:

- 1) Minimize GHG emissions
- 2) Recognize prior and future investments
- 3) Flexible and adaptable to change
- 4) Sustainable finance with efficiencies passed on to ratepayers
- 5) Minimize system costs
- 6) Practical to maintain and administer
- 7) Level playing field for all participants

The four options to be presented to Council, along with pros and cons associated with each, were outlined in the presentation.

Regarding Option 1, which would maintain the status quo of keeping tonnage caps and periodically adjusting them, Ms. Koppang asked for clarification on why staff identified the Metro tip fees as an imperfect benchmark for private facility rates. Mr. Collier replied that although private station fees may be substantially the same as Metro's, the assumption was made that the underlying cost structures of public and private systems are different.

Regarding Option 2, which would seek to allocate tonnage based on optimizing public benefits (e.g., reduced vehicle miles traveled, resulting in reduced GHG and cost), Mr. Collier commented that this option had previously been tried without success. Mr. Simpson asked what happened in that situation. Mr. Ehinger replied that it was difficult to identify which transfer station was actually closest for haulers to use because while their routes might be closest to one station, the yards where they park their trucks at the end of the day might be closest to another.

Mr. Collier shared that the consensus recommendation from the industry task force was that the status quo should be retained, with a few modifications:

- Provide flexibility to increase tonnage allocations in order to lower emissions, get collection cost efficiencies and meet market demand
- Ensure that new allocations don't reduce current tons to current private stations
- Provide funds from the regional system fee to private stations that provide non-economic services that provide public benefits.

Mr. Collier shared that input from local government solid waste staff was that understanding private transfer station costs would be of great benefit to their collection-related regulatory duties. Even imperfect transparency would be better than virtually no transparency, which is what they have now. They also feel it is important to ensure that public investment is not stranded.

Mr. Collier finished by saying that staff will ask Metro Councilors the following questions at the March 1, 2016 work session:

- Is there one particular option you prefer to the status quo?
- Are there features of an option you would like to add to the status quo or would like to explore further?
- Is there a hybrid option you would like staff to evaluate?

Chair Korot opened the floor for comments and input on the options. Mr. Collier reviewed the timeline, noting that the goal of the Council work session next week is to narrow the options, with the goal to go back to Council in May with a final recommendation.

Mr. Walker noted it appears there has been some movement in the industry position. The consensus recommendation of industry seems like a strong statement and it sounds like people are on board; was that the case? Mr. Leichner acknowledged there was a lot of a back and forth on the options and impacts, but ultimately the group agreed that the system is working. The big issue is that when facilities need more tonnage because the area has grown or due to traffic congestion, it is difficult to get a "bump" from Metro. The task force is looking for flexibility, with a different method than an increase throughout the whole system because each facility in the industry is in a different position.

Mr. Simpson noted that his concern with the system is managing growth. For example, looking at infrastructure and housing demand in Portland, Metro utilizes the urban growth boundary. He asked if within this system, for example, we would focus on the ethos of this area to minimize greenhouse gases or would we just allow sprawl? Mr. Simpson applied this analogy to our waste system. We have the opportunity to make modifications and create a progressive dialogue. The population is increasing and waste volumes are projected to go up. What would be most beneficial for the system and for people in region? Mr. Simpson sees us on the precipice of becoming a true 21st century, sustainable ecosystem. On the other hand, would we choose to become subservient or taken over by market forces? We should not be "for sale." How do we maintain the connectedness of this region, the foundational culture/way of life/world view that keeps us prosperous? He gave essentially this same speech to the task force and felt it was a great meeting.

Ms. Koppang asked Mr. Simpson to clarify what he sees as outside forces. His reply noted that we are speaking in terms of billions of dollars from various entities, such as developers. He has witnessed the other systems being taken over by outside forces, as it comes down to economics. As regulators and government agencies, we have the opportunity to prevent that from happening in our region. Having a free-for-all market is not best for the solid waste industry or for the region. It would not be equitable for people, small businesses or government agencies.

Ms. Koppang asked if the vision Mr. Simpson sees of outside forces is similar to the waste systems in the cities of Seattle or San Francisco where there is huge consolidation. Mr. Simpson replied that he inquired about the cap on hauling customers in Portland. It appears to him that was put in place to protect local participants; if the cap were not there, it would be a different ball game now.

Mr. Walker noted that one of the industry task force's comments was that the tonnage allocation should not reduce tonnage to the private system. He inquired about public stations, too. There is a balancing act that recognizes both the public and private stations. Mr. Leichner agreed that Metro must have a place at the table and stated that this had been under discussion at the task force meeting. Both public and private stations need stability. Mr. Simpson commented that there must be a station of last resort, there should be some flexibility and freedom of choice, and Metro plays an important piece in that.

Mr. Walker said that he originally had reservations about the task force process and may have sounded skeptical. He is impressed to see the agreement. Good work!

Ms Koppang said that it doesn't sound like whatever decision the Metro Council makes now precludes something different happening in the future. The Regional Solid Waste Management Program (RSWMP) is under review and the landfill capacity issue has the potential to impact Washington County. She asked Mr. Collier whether he would agree that what the Council decides in 2016 doesn't preclude changes in future? Mr. Collier agreed, noting that this decision gives us a common understanding of where we start from with future discussions.

Ms. Koppang added that we always want more services, which equal more cost. She is pleased that it has been put in context with advanced material recovery, and that we are continuing to look for innovations. Mr. Leichner commented that when we are looking at how a transfer station can provide more services or how to make innovations work, there is always a cost to be considered. Any facility, public or private will be keeping future rates in mind, and will need to follow the market rate.

Mr. Korot reminded the group that the options and recommendations will go to Council next week, and we will hear back from Mr. Collier in April (*Note: this has been moved to May*).

5. **SOLID WASTE CODE CHANGES**

Warren Johnson of Metro reviewed the proposed updates and housekeeping changes to Metro Code Title V, and sought input from SWAAC on the general scope and content of the proposed changes. He also sought endorsement from SWAAC members on whether to initiate a formal public comment process on the proposed changes.

The proposed improvements and housekeeping changes are intended to make the Code more:

- Consistent and easier to understand
- Resilient and adaptive to change
- Transparent with implementation details in administrative procedures.

Mr. Johnson walked through the proposed changes in detail. The detailed changes and a summary guide to them were made available to SWAAC members, interested parties and the public prior to the meeting.

Ms. Koppang asked for clarification on exemptions for solid waste reloads. Mr. Johnson explained that currently the activity of reloading solid waste requires a license. If waste is consolidated at a facility and sent to another facility it is considered reloading. Under current code, any waste hauler that reloads its own waste within its contiguous franchised collection area and delivers the waste to a transfer station is exempt from Metro's licensing requirements. However, a license would be required if that same facility were to receive waste from a third party hauler or deliver its waste to a disposal site. Both operations have the same potential impacts and in Metro's view these facilities should have the same licensing requirements.

In regard to removing automatic granting of authority, Mr. Johnson explained that under current code Metro must make a decision within 120 days of receiving a complete application. If Metro was unable to do so, the default would be an agreement to extend the request by 120 days or deny the application. Staff would like to make it clear that they would still try to hold to 120 days, but would like to take as much time as needed for all of the information to be gathered, if necessary.

The substantive changes proposed for Chapter 5.02 (disposal charges and user fees) are:

- Require the use of scale weights for determining the amount of Metro area waste in mixed loads and remove alternative options
- Establish clear and consistent process for adopting administrative rules, standards, and procedures

Ms. Koppang requested clarification regarding required scale weight documentation. Mr. Johnson responded that the proposed change seeks to remove the subjectivity concerning this issue. When asked how many businesses this might affect, Mr. Johnson replied that only two non-system licensees would be affected at this time.

Ms. Camors asked if the non-system license application fee amounts had been updated. Mr. Johnson said that the fees had not changed. He said that the fees are intended to cover staff time, but the amount does not actually do so. Ms. Camors suggested that the fees could be updated as part of the code change. Mr. Johnson agreed that it would be good to consider that.

Mr. Johnson then explained the process for the code change proposal moving forward. Under direction from the Council, staff presented a high-level check-in to SWAAC last month and presented the details of the proposal at this meeting. Staff is looking for an endorsement to take the proposal to a public notice process. At the end of a 60-day review period, staff would evaluate comments, prepare a response and come back to SWAAC for discussion and feedback on the next steps.

Mr. Johnson asked for comments on the content and the scope of the proposed changes. He asked the committee members if they generally support initiating a public notice process with a 60-day review period; and if there are any suggestions for layout changes or clarity.

Ms. Camors commended staff for a job well done. Mr. Walker wondered if staff has received any other comments on the content. Mr. Johnson replied that there have been two comments received: one on definitions and one on fee and rate setting. Mr. Walker observed that many of the changes are framed as housekeeping and consistency. A broader example, though, is the problem of shredding electronics and inappropriate activity at one facility. This seems beyond housekeeping. Mr. Johnson clarified that not all changes were intended to be housekeeping and there are some substantive changes. Staff is not trying to hide that, and feels these changes are generally supported. Staff has tried to identify those, but if there is something that needs more discussion, staff would like to know that. Ms. Roth suggested highlighting what is new and what is a change with separate colors to make them clear. Mr. Korot noted that in the lists of changes that Mr. Johnson provided, everything seems to have equal weight and standing, and, given Ms. Roth's and Mr. Walker's comments, the list may not accurately convey the differences between items.

Mr. Ristau noted an inconsistency that under the proposed changes the COO could extend the term of a facility license for one year, but only six months for a non-system license. Mr. Johnson stated the licenses for facilities are granted for five years and non-system licenses are granted for two years, so the proposed extensions were intended to reflect the length of terms for the different types of licenses.

The group supported initiating a 60-day public comment period. Ms. Roth asked if Metro would publicize the public comments and changes made in response to them, and Mr. Johnson stated they would be made public. Ms. Kaatz asked if comments would come back to SWAAC, and Mr. Johnson noted that they will be consolidated and provided to the committee, along with staff responses.

6. UPDATE ON SWAAC SUBCOMMITTEE ON MATERIAL RECOVERY AND CONVERSION TECHNOLOGY FACILITY REGULATORY CHANGES

Mr. Walker, as the subcommittee's liaison to SWAAC, provided an update on the discussions held to date. He commented on the complexity of the subject matter, noting that it requires a whole range of discussion and some of the subcommittee members are very involved in the solid waste system and others came in with fresh eyes. There has been an exchange of background information, including the video done by Washington County on the history of solid waste. Dylan de Thomas of Resource Recycling spoke at the second meeting on market

conditions. Mr. Walker gave a report on the history of recycling in Portland. He pointed out the when he spoke of customers doing "wishful recycling" (placing unacceptable items in their

recycling because they hope they will be recycled) he was corrected by Mr. Vinod Singh of Far West Recycling who said let's call it what it is -- contamination.

Mr. Walker related that Metro attorney Shane Abma covered the broad authority that Metro has to regulate facilities, in alignment with state law and home rule authority as contained in the Metro charter and passed by the voters. Mr. Abma urged the subcommittee to set aside, in that forum, disagreements over authority and to work on the questions at hand. Some committee members disagreed, which exemplifies the complexity of the issues. Mr. Walker commended Dan Blue for his efforts in framing and providing information for the committee. Mr. Walker offered to share additional insights on request.

7. CITIZEN COMMUNICATIONS TO SWAAC AGENDA ITEMS

Jeff Murray from EFI followed up on Mr. Walker's update of the MRF-CT subcommittee meetings. There are some strong concerns regarding regulating source-separated single stream materials, but he is appreciative that Metro has given them the opportunity to address these issues. There are also concerns with the housekeeping code changes. They are not just housekeeping, but policy changes. He and others went to the Council with a concern that the proposed changes were moving too quickly. They were hoping for conversation, not just a presentation to SWAAC. Mr. Murray feels there are least a couple of meetings needed to have more conversation about the implication of these changes. Normally, he feels, these reservations would be addressed before it goes to public comment.

Terrell Garrett of Greenway Recycling spoke regarding the code changes associated with Metro's proposed regulation of wood yards and electronic waste. Doesn't this fall under the purview of the subcommittee, he asked. Mr. Korot responded that the original packet of potential code changes had all of these components combined and were brought forth together for public comment. Upon consideration of those comments, the Council directed staff to commission a subcommittee to further evaluate two areas (material recovery/conversion technology facility requirements and fee and tax exemptions). The other provisions Mr. Garrett is speaking about were not deemed to need the same level of review. Mr. Johnson concurred that the two issues were singled out under direction of the Council. Mr. Garrett stated that wood yard and electronic waste facility regulation have the same legal questions that have been brought up for material recovery and conversion technology. These represent facilities that Metro has never regulated before and Mr. Garrett feels these code changes should be looked at by the subcommittee.

8. PREVIEW OF THE NEXT MEETING'S AGENDA AND FINAL COMMENTS

As noted earlier, the March SWAAC meeting has been canceled, and the April 13, 2016 meeting agenda items are yet to be determined. The agenda will be distributed ahead of the meeting and posted on the Metro website.

9. ADJOURN

The meeting was adjourned at 11:45 a.m.



MAKING A GREAT PLACE TOGETHER



Strategic Plan to Advance Racial Equity, Diversity and Inclusion

Racial Equity Approach

- ▶ **Equity vs.
Equality**



Racial Equity Approach

- ▶ Why racial equity?
- ▶ Barriers vs. service



Racial Equity Approach

- ▶ Economic strategy for prosperous region



Informed Approach

- ▶ **Community Engagement**
- ▶ **Staff Engagement**



Informed Approach



Informed Approach

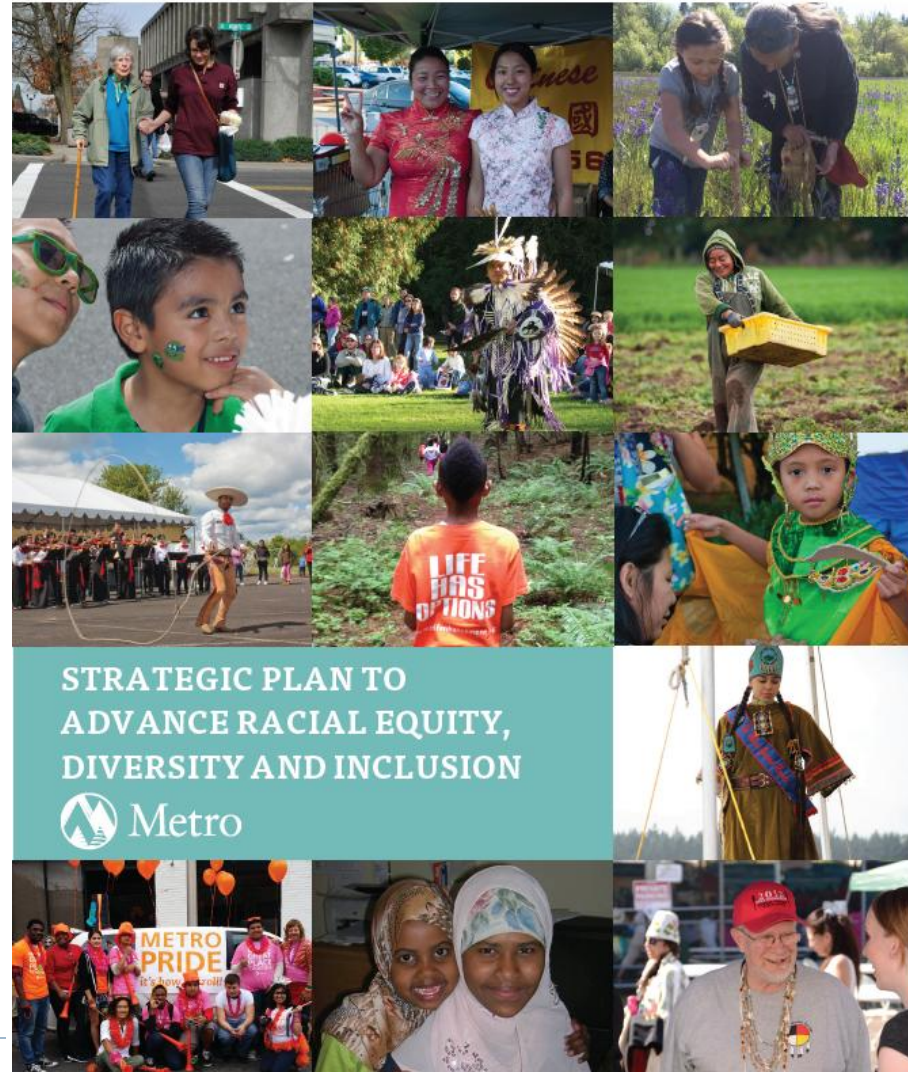
- ▶ Organizational self-assessment related to racial equity



What's in the Plan?

- ▶ Goals, objectives and action items
- ▶ Equity analysis and decision-support tool
- ▶ Evaluation foundation

DRAFT Winter 2016



What's in the Plan?

- ▶ Integration with the Diversity Action Plan
- ▶ Department-specific equity action plans



A. Metro convenes and supports regional partners to advance racial equity



B. Metro meaningfully engages communities of color



C. Metro hires, trains and promotes a racially diverse workforce



D. Metro creates safe and welcoming services, programs and destinations



E. Metro's resource allocation advances racial equity



Next steps

- ✓ Public comment and discussion period
- ✓ Final Plan Review
- ✓ Council Adoption



Questions?

DO YOU HAVE COMMENTS?

www.oregonmetro.gov/equity



Contact the DEI Team

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Urban Wood Waste Options Study – Phase II

SWAAC Presentation

April 13, 2016



Andy Sloop, Metro

Aaron Toney, Good Company



Metro | *Making a great place*



Overview

- Background
- Project Description
- Market Research
 - Methodology
 - Results
 - Findings
- Details Environmental Analysis
 - Methodology
 - Results
 - Review of Significant Analysis Assumptions
- Conclusions and Options



Project Purpose

- Identify and assess options
- For maintaining and improving
- End-market capacity, stability and environmental outcomes
- Can be implemented within next 10 years
- Emphasis on actions Metro can take



Wood Waste Tonnage

	Disposed	Recovered	Generated
Painted/Treated/NR	129,000	0	129,000
Not Painted/Treated	58,000	106,000	164,000
TOTAL	187,000	106,000	293,000

Phase 1 Scope

- Studied 13 options
- Literature review
- Interviewed 30 industry leaders, wood scientists and researchers
- Surveyed 16 potential markets
- Analyzed public policy landscape
- Outlined alternatives for further consideration



Options Studied In Phase 1

- Animal bedding
- Biochar
- Cellulosic fuels
- Composite panelboard
- Densified fuels
- District heat
- Dry AD
- Erosion control
- Export hog fuel
- Industrial hog fuel
- Pulp
- Reclaimed building materials
- Refurbished pallets
- Remanufactured lumber products

Phase 2 Scope

- Builds on findings of Phase I Study
- Compared three most practical fates for UWW
 - Status quo - hogged fuel
 - Production of densified fuels (pellets, logs, etc.)
 - Production of engineered wood panels



Phase 2 Research Questions

1. What are requirements, level of interest and scale of target end-markets?
2. What changes, if any, are needed in how UWW is collected and processed to meet these requirements?
3. Are there actions Metro can take to support and/or catalyze these changes?
4. What are the lifecycle environmental implications of each fate analyzed?
5. What is significance, if any, of recent state legislation relating to woodstove smoke (HB 3068 and SB 752)

Market Research Methodology

- Identify interested, proximal manufacturers
- Interviewed manufacturers to define requirements (e.g., feedstock specs, pricing, demand, level of interest)
- Interviewed recyclers regarding current infrastructure and practices
- Generated sample equipment layouts and budgets
- Analyzed research findings to determine changes needed to meet end-market requirements



Findings

- Traditional hogged fuel remains a viable option for 3 – 5 years
 - “Stable but Fragile”
- Pellets for industrial fuel offers potential
 - UWW prohibited for use in residential stoves but allowed for industrial use
 - Western Oregon Wood Products is a potential customer @ around \$12-15/ton.
- Hogged fuel to charcoal briquettes offers potential
 - Kingsford torrefaction (Springfield)
 - Verify scale and health impacts

Findings

- Particle board furnish is not a viable option
 - No interest from industry
 - High cost to use UWW and meet stringent standards
 - Recent attempts to use UWW have failed due to contamination (esp. non-ferrous), particle size and uniformity, and species variation
- Small scale combined heat/power (CHP) in or near Metro area may be an option
 - Existing buildings, industrial park-like greenhouses, small-scale district heating



Findings

- Preparation of fiberboard and densified fuel feedstocks is identical and requires investment in additional infrastructure which may not pencil for many existing processors
- These feedstocks require extremely clean, unpainted, untreated UWW material with no contamination whatsoever.
- Removing the “clean” material from the existing hogged fuel stream would result in engineered wood products being landfilled



Environmental Analysis Methodology

- Compared Three Potential Fates for UWW
 - Hogged fuel to combined heat and power
 - Production of wood pellets for residential use
 - Production of MDF which is ultimately landfilled
- Metrics for Comparison
 - Greenhouse gas emissions
 - Particulate matter – emissions not exposure
 - Energy



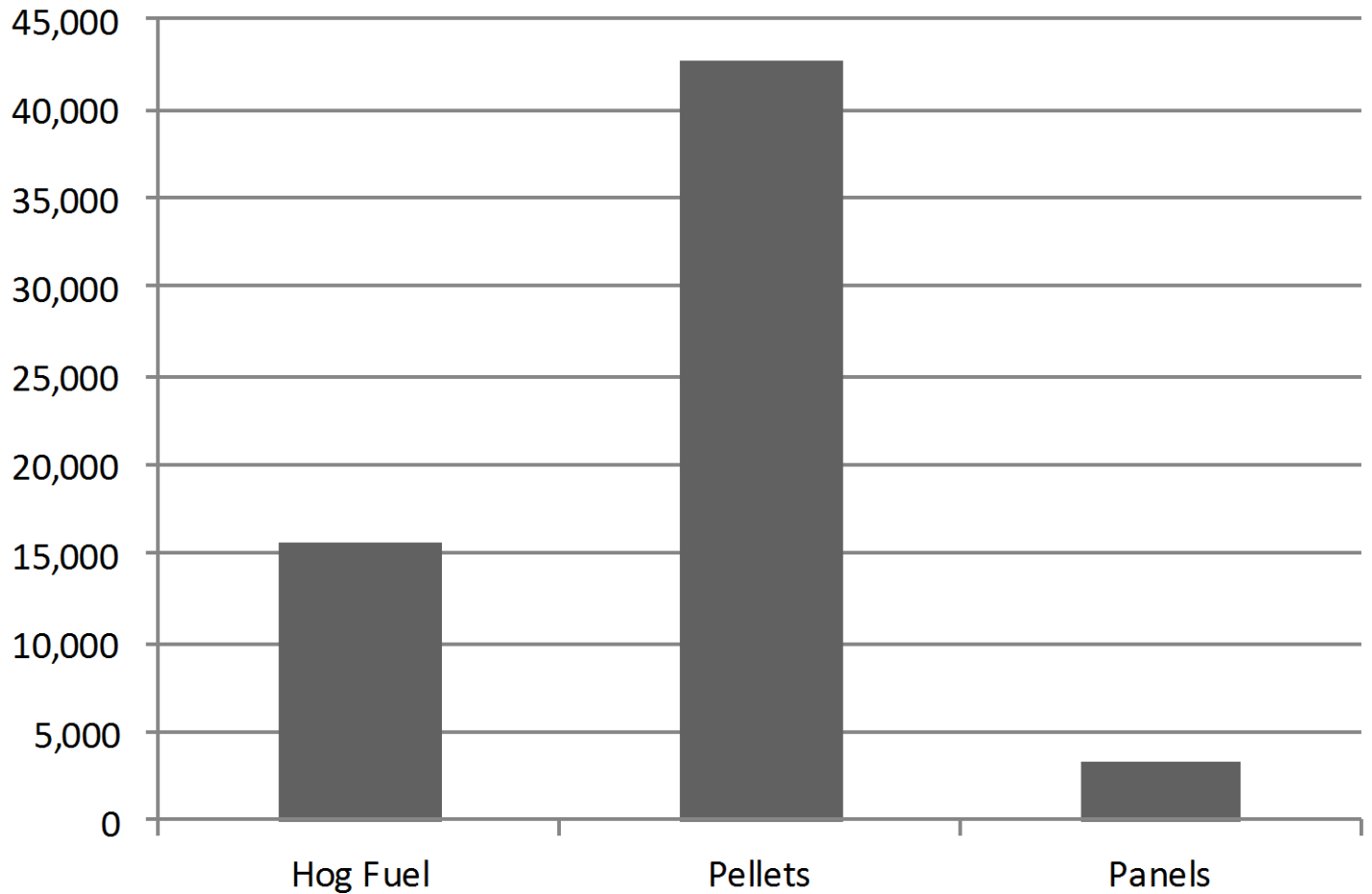
Methodology (continued)

- Based heavily on EPA's WARM methodology
- Considered lifecycle of materials and energy
- Significant conceptual assumptions are required – particularly for GHG impacts
- Considered a number of scenarios, based on assumptions



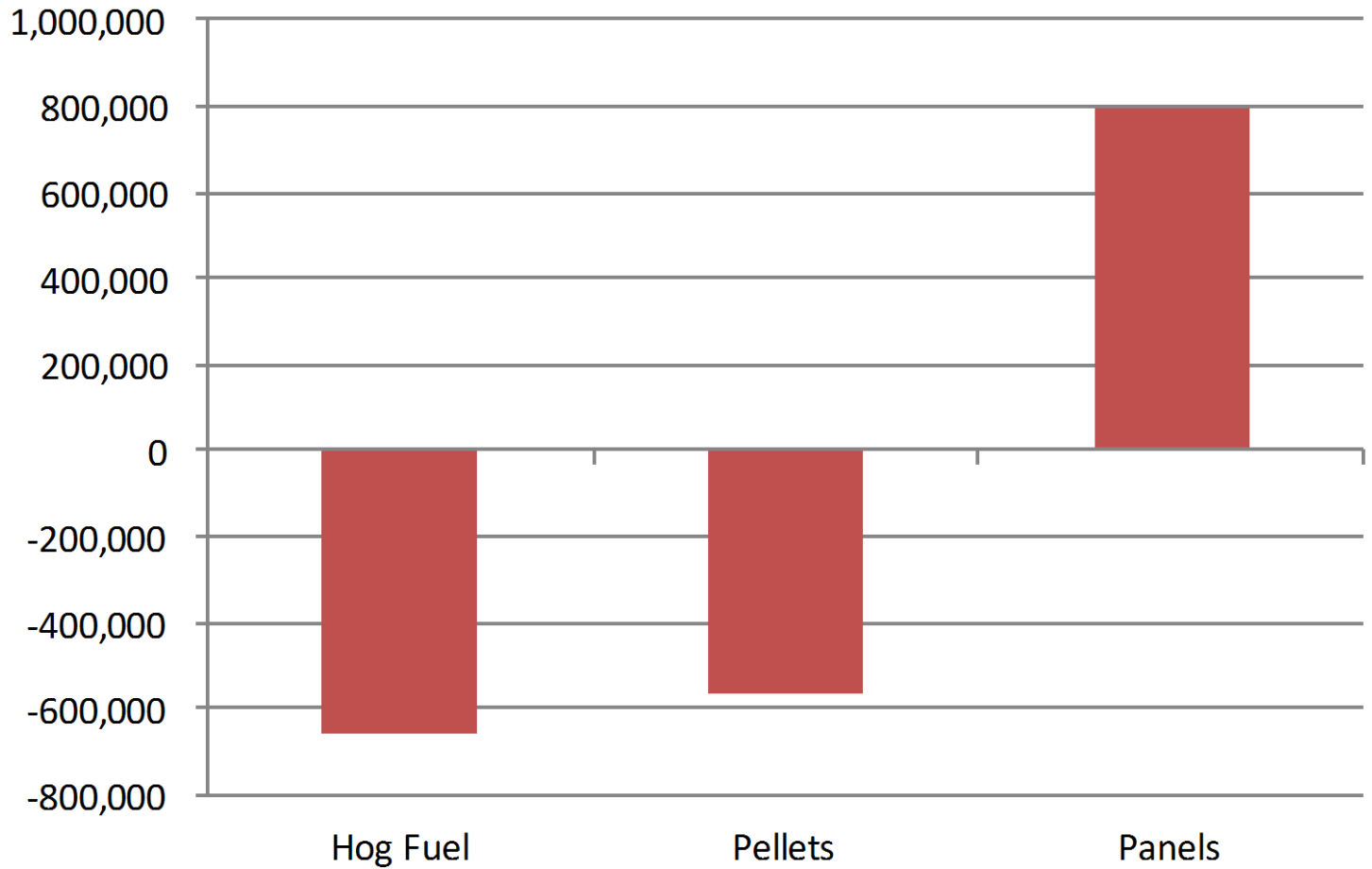
Panels produce fewest emissions

Particulate Matter (kg PM₁₀)



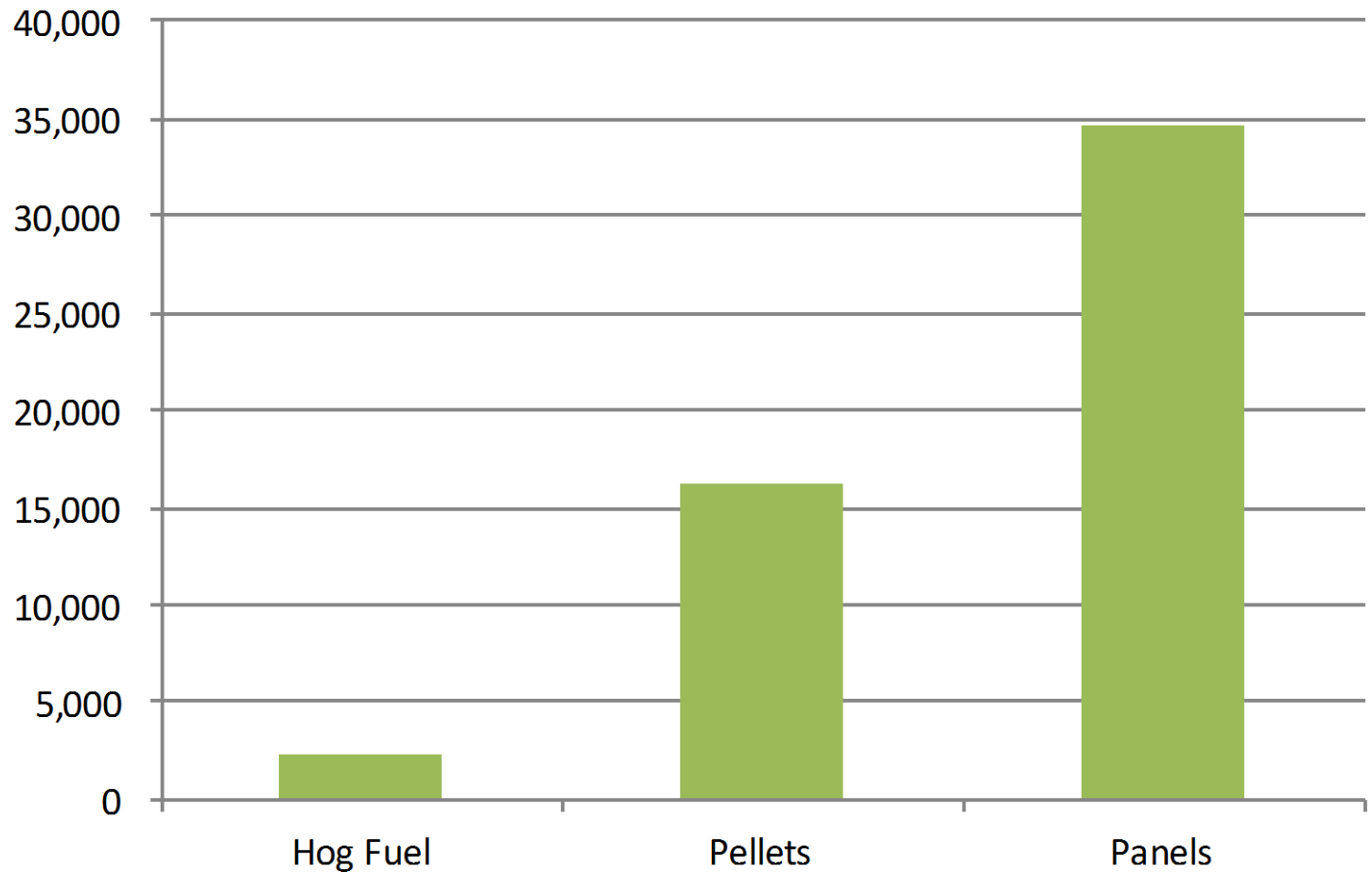
Hog Fuel / Pellets perform best

Energy (MMBTU)



Hog Fuel performs best*

Greenhouse Gases (MT CO₂e)



Conclusions and Options

- Hogged fuel is the most viable alternative over the next 3 to 5 years
- Particle board furnish is not a viable option
- Potential future options for further exploration
 - Pellets for domestic or international industrial markets
 - Kingsford charcoal products
 - Small combined heat and power energy system



Possible Metro Actions

- Continue work on enhanced salvage and reuse
- Distribute Final Report to intermediate processors and end markets; do follow-up phone calls to assess likelihood of private infrastructure investment
- Consider having policy discussion regarding planned versus laissez faire evolution of the UWW system
- Determine break-even scale for pellet feedstock facility selling pellets at \$12/ton
- Factor wood-related scenarios into Covanta analysis
- Revisit more promising Phase 1 options that were not included in Phase 2 investigation (e.g., biochar).

Thank you

Q&A



GHGs – Effect of Significant Assumptions

