Long-Term Disposal Open House

September 30, 2024

October 9, 2024

King County
Department of
Natural Resources and Parks
Solid Waste Division

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- Scroll down and click on Rename
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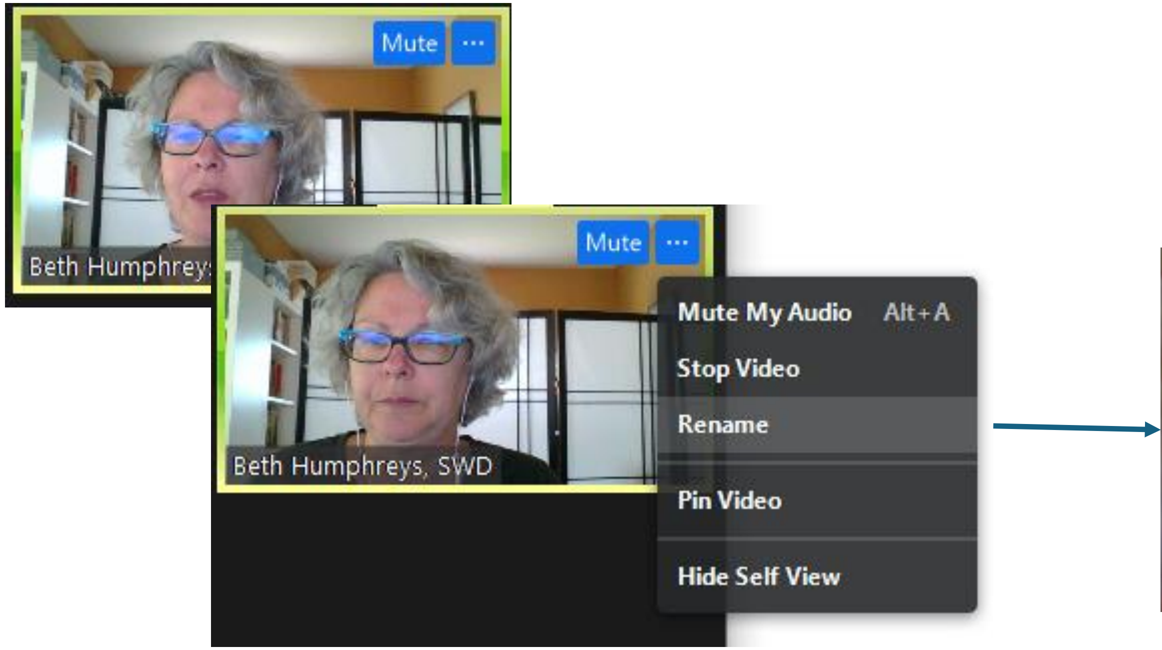

From the Participants list, find your name

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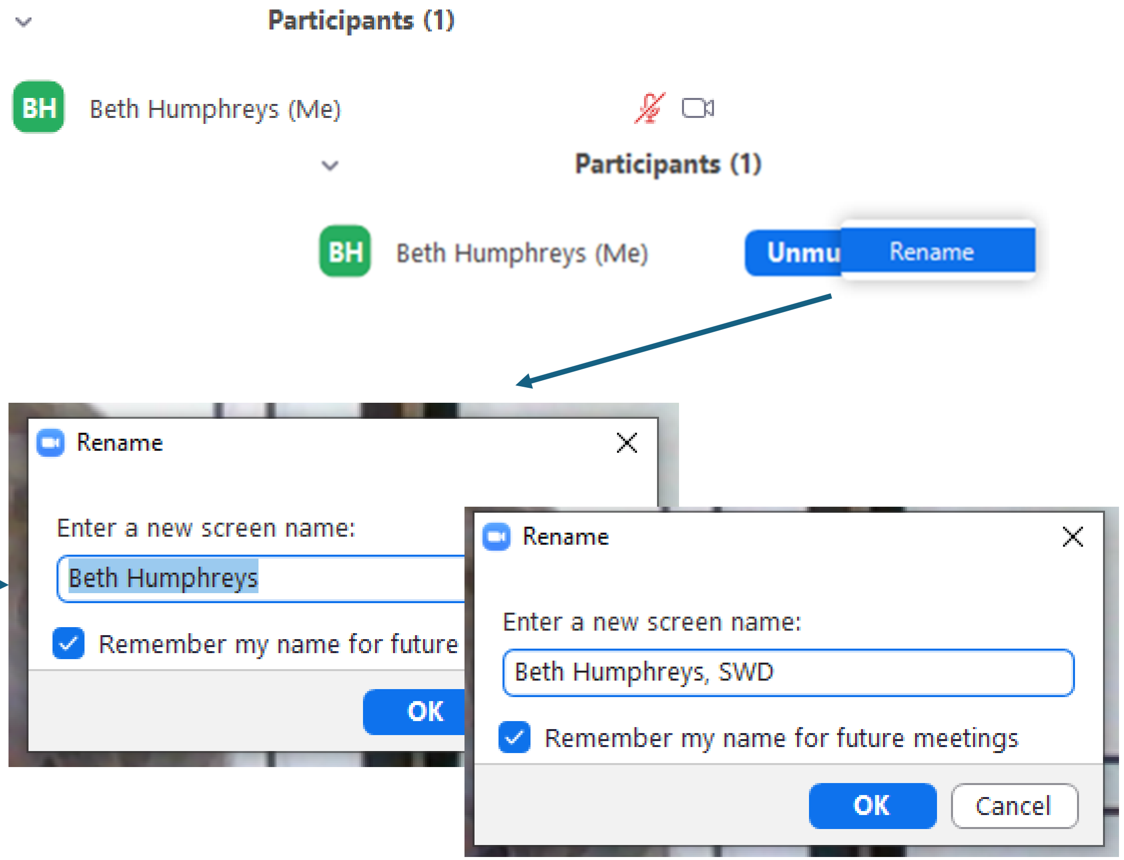


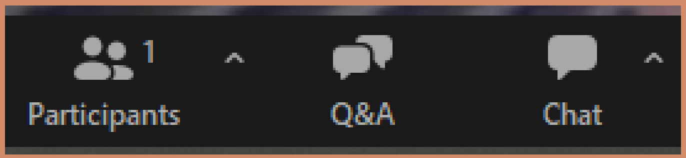
Welcome

Objective

To provide a history and summary of SWD’s Long Term Disposal Analysis and an opportunity for feedback and questions from our community and policy partners.

Agenda

- Long-Term Disposal History
- Study Criteria Overview
- Analysis of 3 Options: Pyrolysis, Gasification, and Refuse-Derived Fuel
- Break (5 min)
- Analysis of 2 Options: Mass Burn and Waste Export by Rail
- Next Steps
- Q&A (Please utilize Q&A function)



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Why a Long-Term Disposal Study?

- Cedar Hills Regional Landfill is expected to reach capacity by 2040
- Interlocal Agreement (ILA) states that MSWAC responsibilities include developing recommendations for the Comprehensive Solid Waste Management Plan (Comp Plan)
- 2019 Comp Plan states that the decision on Long-Term Disposal will be made in the next Comp Plan
- Re+ (pre-disposal efforts) extend the life of the landfill and reduce costs associated with long-term disposal

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Previous Work

2019 Comp Plan
- Previous Studies
- Possible Options
- Criteria

2020-2021
- Reminders to MSWAC that LTD Study will occur after launch of Re+
- Oct 2021 MSWAC feedback requested on consultant study parameters

2022
- January: RFP Issued
- December: Tetra Tech signed to conduct LTD Study

2023
- LTD Study underway, criteria and assumptions transmitted
- July: Advisory Comp Plan Subcommittee created
- Updates to MSWAC in February and May

March 2024
- Comp Plan Subcommittee disbanded

April 2024
- Subgroup Meeting #1: LTD History and Criteria Overview

May 2024
- Subgroup Meeting #2: Gasification, Pyrolysis, Refuse-Derived Fuel

June 2024
- MSWAC/SWAC Decision on eliminating 3 options
- Subgroup Meeting #3: Mass Burn & Waste Export by Rail

August 2024
- Subgroup Meeting #4: Mass Burn & Waste Export by Rail Environmental and Economic Criteria

October 2024
- Draft Report Due

Regular updates to Advisory Committees

Past Studies

2 Consultant Studies were used to inform long-term disposal discussion during the 2019 Comp Plan.

Very soon after the Comp Plan was adopted, another study just focused on WTE vs Waste Export was also completed.

These studies were shared with consultants as a starting point for evaluating options for the current Comp Plan Update.

- R·W·BECK — Comparative Evaluation of Waste Export and Conversion Technologies Disposal Options (2007)
- NORMANDEAU ASSOCIATES ENVIRONMENTAL CONSULTANTS — Waste-to-Energy Options and Solid Waste Export Considerations (2017)
- ARCADIS — Waste-to-Energy and Waste Export by Rail Feasibility Study (2019)

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Considered 3 Options

- Waste Export
- Waste to Energy/Mass Burn
- Maximization of the Landfill
  - *This option was selected and approved in the 2019 Comp Plan*
- The next disposal option after Cedar Hills closes was not chosen at this time

Long Term Disposal in the 2019 Comp Plan

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LTD in the 2019 Comp Plan

Future Technologies to Consider

In addition to Mass Burn and Waste Export:

- Gasification
- Pyrolysis
- Plasma Arc Gasification
- Anaerobic Digestion

Evaluation Criteria to consider

A list of evaluation criteria to screen long-term disposal options was created.

6 major categories:

- Environmental
- Economic
- Operating History
- Availability
- Social
- Contract and Operational Requirements

A total of 38 sub-categories were listed

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TETRA TECH

King County

WIH RESOURCE GROUP
Environmental & Logistical Solutions™

CASCADIA
CONSULTING GROUP

ERG

King County
Long-Term Waste Disposal Options Study

Tetra Tech Team

October 9th, 2024

Criteria Overview

Evaluation Criteria

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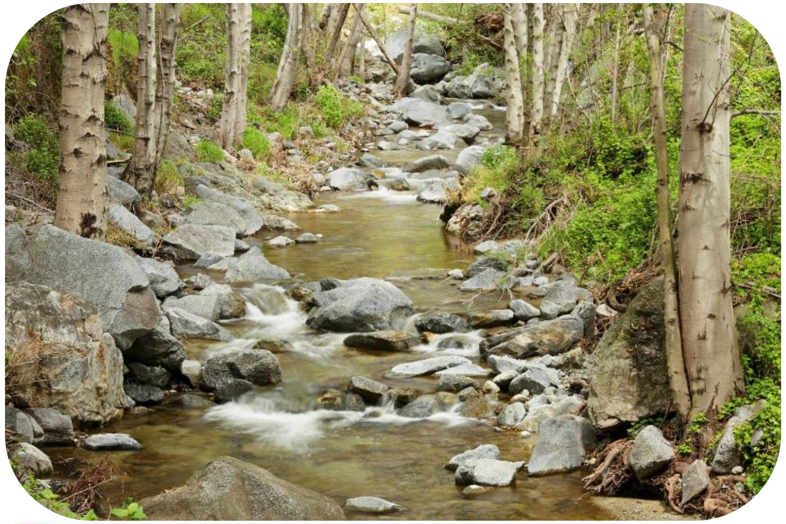
1. **Economic**
   Considers capital/operating costs, revenue, cost per ton & financial risks.
2. **Operating History**
   Considers proven operating history of performance; safety, regulatory and environmental compliance at capacity needed.
3. **Logistics**
   Considers operating life of facility; siting, permitting, design and construction requirements and compatibility with current collection system.
4. **Social**
   Considers social impacts (including ESJ) on livability and character of communities (traffic, noise, odor, air, groundwater) and social benefits (job creation).
5. **Capacity**
   Considers minimum waste requirements, waste composition, tonnage flexibility, and residual waste management.
6. **Environmental**
   Considers energy production, water consumption, air & water quality, climate change and human health.



RDF, Gasification & Pyrolysis

Refuse Derived Fuel (RDF) Process

- Process for preparing material to meet end user energy requirements.
    - Helps offset fossil fuel usage.
- Materials received include post-recycled refuse from a Mixed Waste Processing facility pursuant to Re+.
- Process to meet end use markets includes shredding, sorting, screening, removal of inert materials and can also then be pelletized.
- End-product typically shipped to local or out-of-state markets.
- This process is typically used for Construction & Demolition waste and/or commercial/industrial waste, limited for processing MSW.

RDF Considerations

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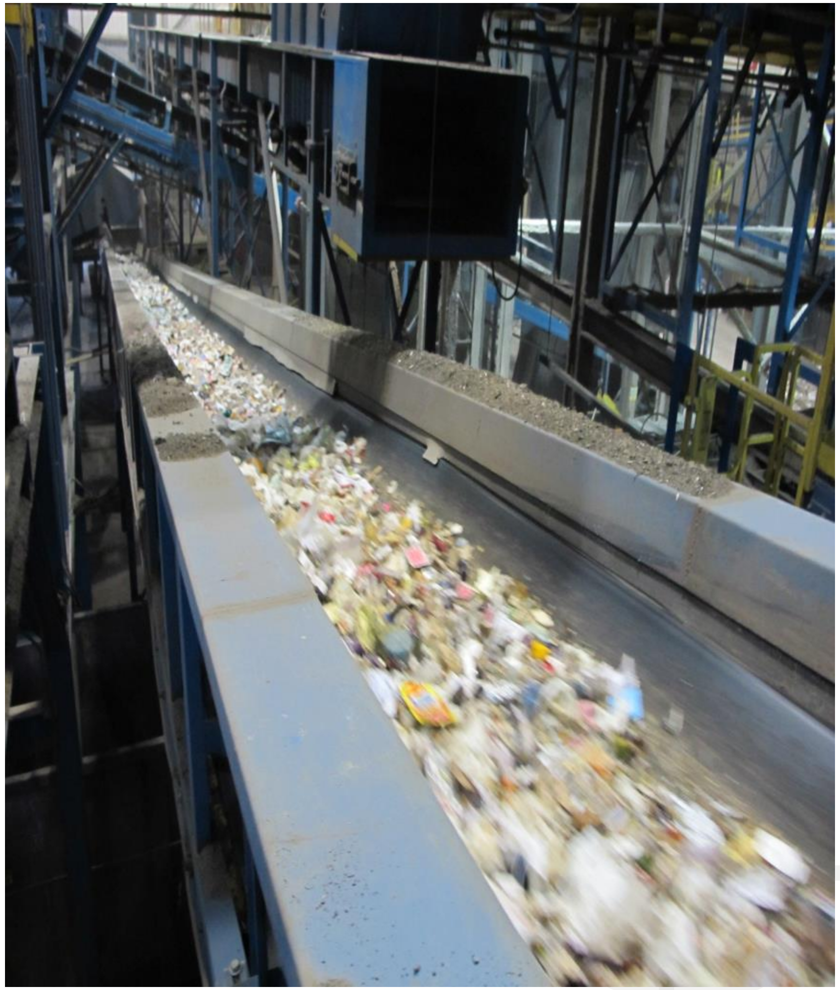
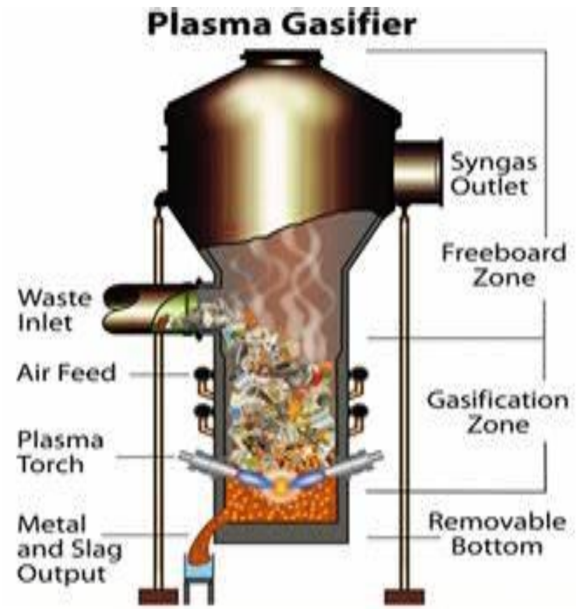
- End-markets required - cement plants, power plants or other industrial processes.
- Only high energy materials can consistently be converted to RDF; competition exists for preferred RDF feedstock.
- Existing RDF technology is capable of processing amount of waste from the 3 tonnage scenarios, limitation is end-markets.
- Opportunities for end markets are limited due to technical challenges with chlorides in MSW, permitting requirements (users may need to obtain solid waste facility permits) and competition for feedstock. Contracts are typically for a one-year period.
- Projected end-product quantities (300,000 to 800,000 tpy) would need stable markets.
- Residue requires transport and disposal at a landfill.
- Cost per Ton (2040$): $109 - $153/per ton (high to low tonnage scenarios) dependent on end market availability & requirements. If reliable markets not available, end-product needs to be stored or disposed in landfill.



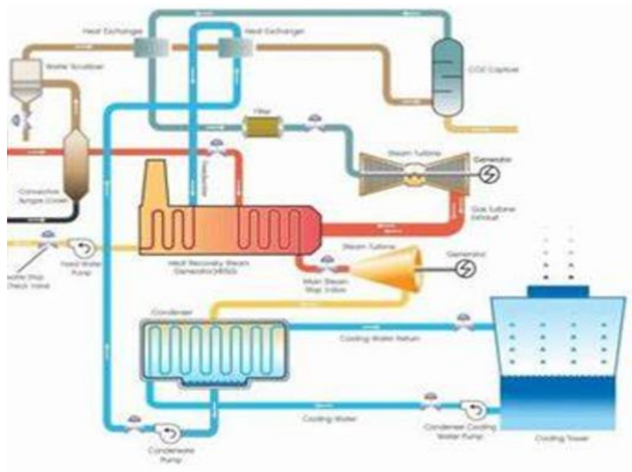
Gasification Process

Three parts to gasification:

Pre-Processing



Syngas Processing



- Pre-processing required to similar to producing RDF.
- Syngas composition dependent on type of materials gasified.

Gasification Considerations

- No operating facilities that meet King County's capacity needs. Most are demonstration/pilot plants under 20,000 tons per year and process a homogeneous feedstock such as biomass (organics/woodwaste), plastics, coal or tires.

- Largest facility in North America was in Edmonton, Canada (110,000 t/year) with limited operations over the past 10 years and is scheduled for retirement. (CAPEX in 2013 was $175M).

- Syngas quality unpredictable from heterogeneous materials such as municipal solid waste.
    - Affects syngas cleaning options

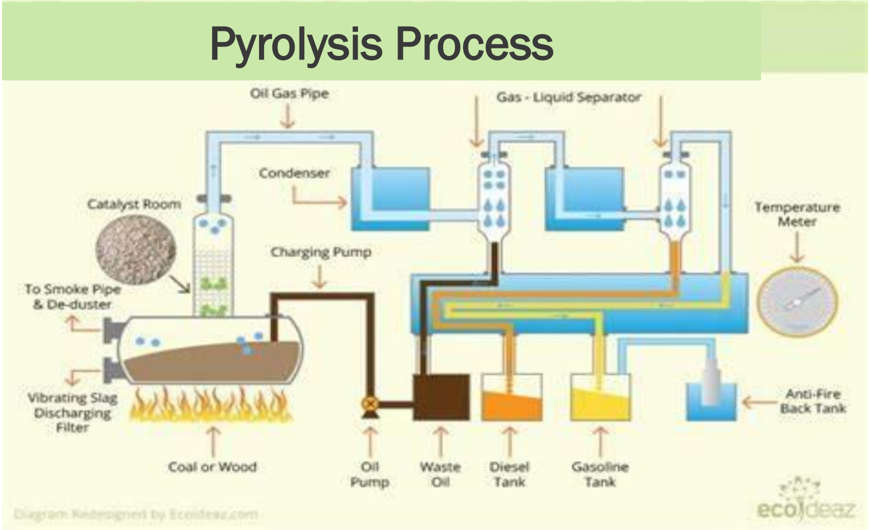
- Residue requires transport and disposal at a landfill.

- Cost per Ton (2040$): $267 - $323/per ton (high to low tonnage scenario) dependent on revenue sales. Estimates based on limited reference facility.

Pyrolysis Process

- Pre-processing required - similar to producing RDF.
- End-products dependent on what is put into the pyrolysis process.
- Best suited for consistent materials such as wood, coal or plastics.

Pre-Processing



Pyrolysis Considerations

- No operating facilities that meet King County's capacity needs. Small scale pilot projects @ 3k-18k tons/year.
- Operation of pyrolysis units still being developed – unproven technology.
- End-products are unpredictable from heterogeneous materials such as municipal solid waste.
- Preferred feedstocks include plastics, biomass and tires.
- Residue requires transport and disposal at a landfill.
- Cost per Ton ($2040 Range): $355 - $419/per ton (high to low tonnage scenario) based on Gasification costs since components and feedstock are similar (no reference facilities) and potential revenue sales.

Major Criteria Comparison for RDF, Gasification and Pyrolysis

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	RDF	Gasification	Pyrolysis
Operating History	No operating facilities for MSW at proposed processing capacities.		
Logistics	• Medium difficulty siting and permitting. • 5-7 years	• Difficult siting and permitting. • 7-10 years	
Social	• Siting to consider Environmental & Social Justice/Equity impacts on Communities around potential facility locations and transport corridors. • RDF has highest local traffic impacts of all options. • Gasification and Pyrolysis generate most local jobs. • Local Odor, Noise, Groundwater impacts low for each option. Air impacts higher for Gasification and Pyrolysis.		

Major Criteria Comparison for RDF, Gasification and Pyrolysis

	RDF	Gasification	Pyrolysis
Capacity	No markets for projected tonnages.	No operating plants at proposed capacity.	
Economic (Medium Tonnage Cost in 2040$)	$134/ton	$281/ton	$380/ton
Environmental	Low environmental impacts due to replacing bituminous coal. High human health impacts due to burning plastics.	Not able to be assessed due to significant data gaps (i.e. impact factors for materials missing or not comparable to those for landfill, Mass Burn and RDF).	

RDF, Gasification and Pyrolysis Evaluation Summary of Findings

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RDF

- Proven performance at small scale/homogenous feedstock. No plants currently operating in similar tonnage ranges.
- Replaces coal resulting in low environmental impacts but higher human health impacts.
- Cost effective option at or $109 - $153/per ton (2040$) if stable markets available. If markets not available, option not viable (landfill disposal would be the alternative).
- Markets for projected quantities of MSW RDF (300,000 to 800,000 tpy) limited due to technical challenges with chloride content, permitting requirements and competition for preferred feedstock.
- Risky long-term disposal option due to lack of markets to take projected volume of material.

Gasification and Pyrolysis

- No operating facilities that meet King County's capacity needs and operation of gasification units still being developed.
- Not currently viable as long-term disposal option based on unproven operating history at scale and for MSW feedstock.

Options not considered further in LTDO Study due to inability to process proposed King County tonnages.

5 Minute Break

Waste Export by Rail & Mass Burn

Waste Export by Rail (WEBR) Process

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- A WEBR option would export compacted MSW in intermodal containers via railroad transportation to an out-of-county landfill.

- WEBR from Washington municipalities is **well-established**, having been utilized successfully since the 1990s (City of Seattle, Snohomish County, Kitsap County, Thurston County, Skagit County)

- A specific location for the intermodal yard for the waste export option (as well as the other Study disposal options) is not identified, rather **a general area for assessing transport distances** was used.
    - Improvement and equipment costs for Intermodal Facility (IMF) to accommodate King County waste included in Rail Transport and Disposal rate.

- **Freight rail and trucking complement each other for intermodal shipment**, and freight rail's role as a long-distance partner has enabled trucks to leverage their speed and agility for short hauls.

WEBR Considerations

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- Washington State Rail Plan 2019-2040 projects 0.4% annual decline (to 110 million tons) to 4.1% annual growth (to 321 million tons) by 2040, Even under the high growth scenario, **projected growth shouldn't significantly impact KC WEBR program of 1 million+ tons/year** (verbally confirmed in interviews with railroads).

- To minimize their risk, **railroads typically want contracts of five (5) to ten (10) years.** This will greatly affect future pricing projections and expose the County to higher disposal rate risk.

- **Recent Rail Cost Per Ton (Bundled Rates for Transport & Disposal):** Higher tonnage, legacy contracts from $46.75-$57.25/ton (established in early 1990s, 2001). $75-$90/ton based on recently published contracts, lower tonnages (2021, 2023).

Double-Stack Rail Transport is the Standard Configuration of WEBR

Mass Burn Background

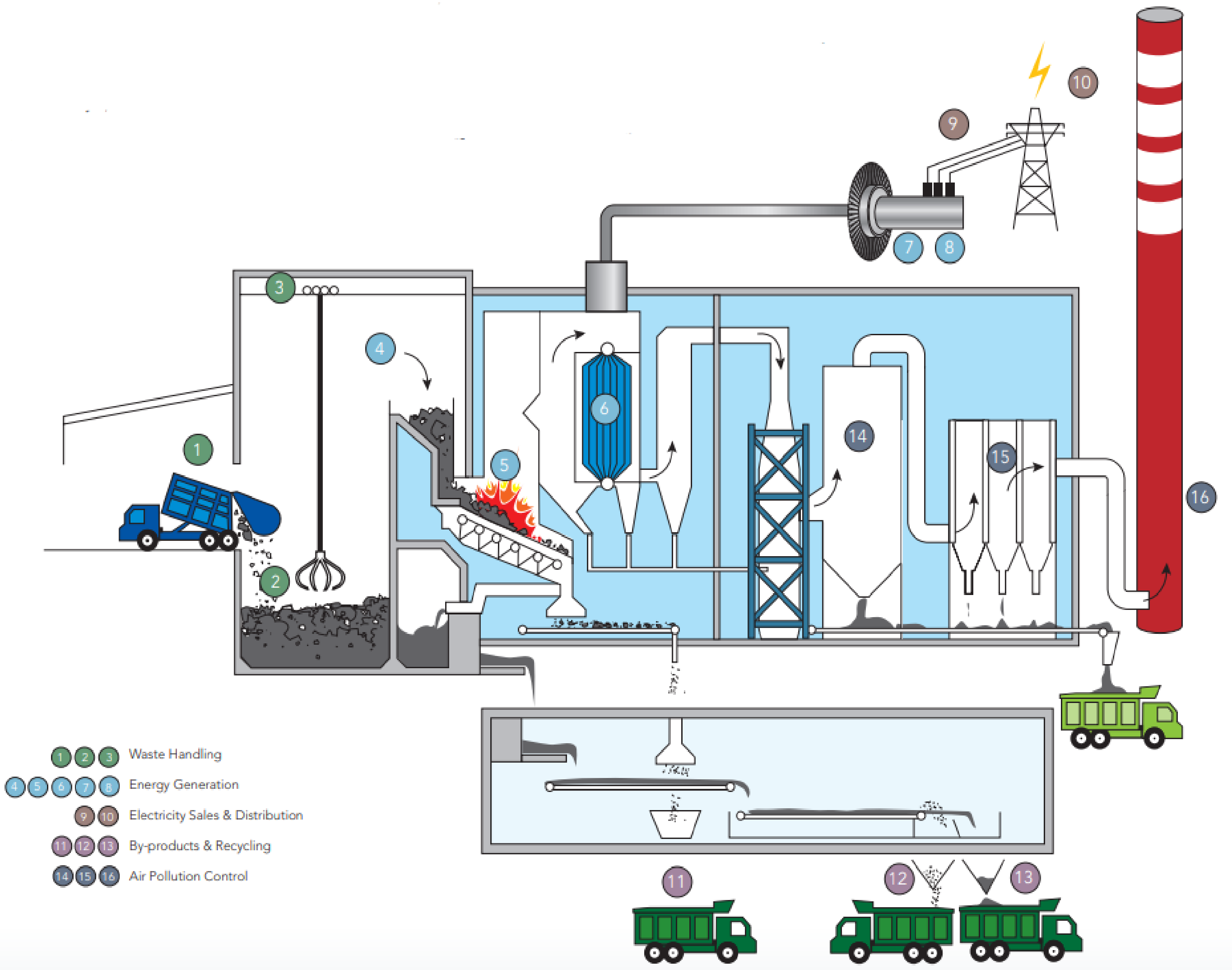
- Over 2,000 operating facilities worldwide since early 1960s, mostly in East Asia and Europe. Japan manages 70% of its solid waste through Mass Burn facilities.
- Established in US since 1970s with 73 operating facilities, mainly in eastern US where landfill capacity is limited and landfill tip fees high.
- Facilities in Western US:
  - Vancouver, British Columbia
    - (850 TPD / 310,250 TPY)
  - Spokane, Washington
    - (800 TPD / 292,000 TPY)
  - Portland, Oregon (Marion County)
    - 550 TPD / 200,750 TPY)
  - Stanislaus, California
    - (800 TPD / 292,000 TPY)
  - Long Beach, California – Closed in early 2024
    - (1,380 TPD / 503,700 TPY)

Osaka, Japan (adjacent to Universal Studios)

West Palm Beach, Florida

Mass Burn Process

- Can produce 550 kWh/ton of solid waste.
- No pre-processing required.
- Many proven facilities at size that can meet King County's processing capacity.
- As shown, more than half of facility is designed for pollution control meeting stringent environmental control standards and for energy recovery.
- High energy recovery potential
  - Steam, hot water, electricity.
- Removes metals for recycling.
- 20% Ash Residual.



Mass Burn Considerations

- Reduces waste 90-95 percent by volume and 75 percent by weight.
- Broad criterion for acceptable waste, can take a broad range of energy values and material types.
- Ash residue would need to be disposed of in a special ash monofill (transport required to one of 3 WEBR landfills with ash monofills).
- Difficult to site and permit.
- High Capital Cost.
  - Cost per Ton (2040$ Range): $221 - $266/per ton (high to low tonnage scenarios).

Durham/York WTE facility in Ontario

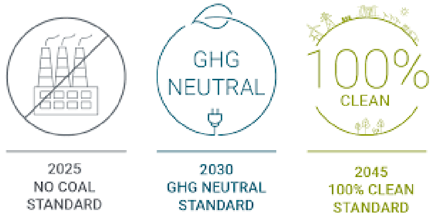
Clean Energy Regulatory Impacts on WtE

CETA – Clean Energy Transformation Act (2023)

- Consumer-owned electric utilities transition to clean, renewable, non-emitting resources for retail customers.
- Eliminates coal-generated power by 2025; GHG neutral by 2030; utilize 100% renewable or zero-carbon resources by 2045.
- Energy from waste is not defined as renewable.
- Electricity can be used for parasitic loads and sold out of State; in-State sales limited to wholesale customers and district heating.

CCA – Climate Commitment Act (2021)

- Reduces GHG via cap-and-invest. Funds GHG reduction projects.
- Covers WtE and landfills that emit more than 25,000 tons CO2 equivalent per year. Landfill emissions may be exempt.
- Compliance will make WtE more costly to comply.
- Pending outcome of November, 2024 Ballot Initiative 2117 to repeal CCA.



Operating History & Logistics Criteria Evaluation Results – Medium Tonnage

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	MASS BURN	WEBR
Proven Performance	Both have proven performance for over 30 years.	
Safety Record	Similar safety record.	
Environmental & Regulatory Compliance	Similar environmental and regulatory compliance.	
Operating Life of Facility	20 to 40 years.	• Over 300 years of combined end destination landfill life. • Longer operating life than Mass Burn.
Siting, Permitting and Construction Considerations	• 7-10+ years to site, design, permit and construct a site. • More difficult than WEBR.	No siting. permitting or construction requirements of a new facility.
Compatibility with Existing Collection System	Both have high compatibility with existing collection system.	

Social Criteria Evaluation Results - Medium Tonnage

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	Mass Burn	WEBR
Environmental Justice & Social Justice/Equity (ESJ)	Siting to consider Environmental & Social Justice/Equity impacts on Communities around potential facility locations and transport corridors.	
Number of Jobs Created	48 jobs created More job creation with Mass Burn than WEBR.	10 jobs created
Number of Truck/ Trips Per Day (one way)	180 More truck trips for Mass Burn than WEBR due to ash disposal and metals recycling.	144
Other Potential Neighborhood Impacts (Air/ Odor / Noise / Groundwater)	Potential neighborhood impacts at Mass Burn facility and WEBR IMF similar except Air impacts which are higher for Mass Burn. Greater impacts for WEBR to transport and dispose at end destination landfills than Mass Burn.	

Capacity Criteria Evaluation Results - Medium Tonnage

	Mass Burn	WEBR
Waste Type Composition and Acceptance	Both options accept non-hazardous municipal solid waste.	
Capacity/Minimum Waste Required	Both options capable of processing required tonnages.	
Waste Volume / Tonnage Flexibility	Has a broad acceptance criterion. Can take a broad range of energy values and material types. Has the ability to ramp up or down operations but not as flexible addressing significant changes in tonnage than WEBR.	Both serving railroads indicated that tonnage scenario volume could be accepted although traffic and congestion as capacity is used on railroads is a factor in the future.
Residuals Management	Ash residual would need to be disposed of in a special ash monofil.	No residual waste to be managed.

Updated Mass Burn and WEBR Cost Comparison

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Economic Subcriteria – Medium Tonnage (2040$):

	WEBR	Mass Burn
Annualized Capital Costs	$337,855	$86,707,211
Annual Operating Costs	$71,817,560	$53,863,170
Annual Disposal Costs (Residuals)	$0	$23,221,011
Annual Electricity & Metal Recycling Revenue	$0	($9,730,372)
Total Annual Costs [1, 2]	$72,155,415	$154,061,020

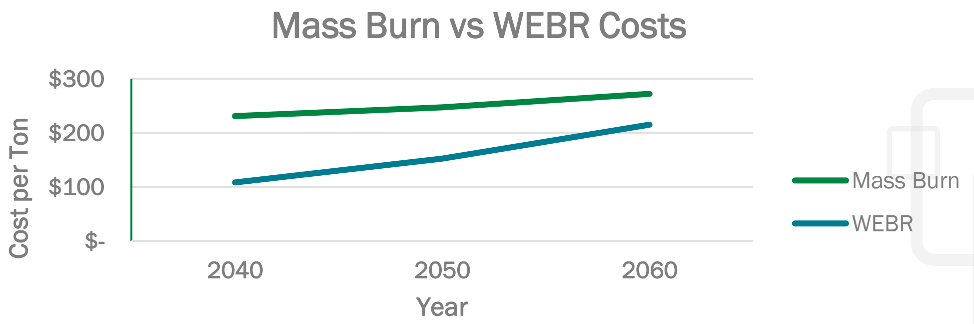
[1] WEBR = Equipment + Rail Transport + Disposal Costs.

[2] Mass Burn = Annualized Capital + Operating Costs + Disposal Costs – Revenue.

Cost Per Ton Comparison Table – Medium Tonnage[1]:

	WEBR (Med. Tonnage)	Mass Burn (Med. Tonnage)
Cost per Ton (2040$)	$108.19/ton	$230.99/ton
Cost per Ton (2050$)	$152.52/ton	$247.08/ton
Cost per Ton (2060$)	$215.06/ton	$272.16/ton

[1] Mass Burn has flatter growth rate as the majority of costs are CAPEX which remain constant over 30-year debt service term. Other costs increase with assumed inflation rate.



Environmental Criteria Methodology & Parameters

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Life cycle assessment (LCA) approach used. Impact parameters selected to represent modeled outputs widely used in LCA and scientific literature.

Models and Data Sources

Process emissions: Municipal Solid Waste Decision Support Tool (or MSW-DST): EPA-commissioned, peer-reviewed tool that evaluates environmental impacts of specific waste management strategies or existing systems using LCA optimization framework. Similar to EPA's Waste Reduction Model (WARM) but includes more impact categories.

Transport: GREET (Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation) – Argonne National Lab life cycle model.

Energy Grid: U.S. Energy Information Administration

Criteria Factors Evaluated

Energy Production

- Non-renewable energy demand

Water Consumption

Water and Air Quality

- Eutrophication potential
- Acidification potential
- Smog formation potential

Climate Change

- Global warming potential

Human Health

- Human health toxicity (cancer potential)

Criteria Factors Not Evaluated – reliable and comparable impact factors not available.

Energy Production

- Total energy demand

Human Health

- Human health toxicity (non-cancer potential)

Options Not Evaluated

Gasification and Pyrolysis

Since both technologies are comparatively new, both had significant data gaps, such as missing impact factors for materials or impact factors that were not comparable to those for landfill, mass burn and RDF.

Life Cycle Impacts and Offsets

Process

- **Direct impacts of operating the facility**, such as water use, fuel combusted onsite, air emissions, wastewater discharges, surface water discharges
- **Upstream impacts of external inputs needed to operate the facility**:
  - Grid electricity production (including associated upstream impacts of fossil fuels used to generate electricity)
  - Fossil fuels extraction, transport, and refining
  - Extraction and production of other material inputs and energy sources

Transport

- **Direct impacts of fossil fuel combustion**
- **Upstream impacts of grid electricity production** for operating electric vehicles (including associated upstream impacts of fossil fuels use to generate electricity)
- **Upstream impacts of fossil fuels** extraction, transport, and refining
- Extraction and production of other transportation inputs and energy sources

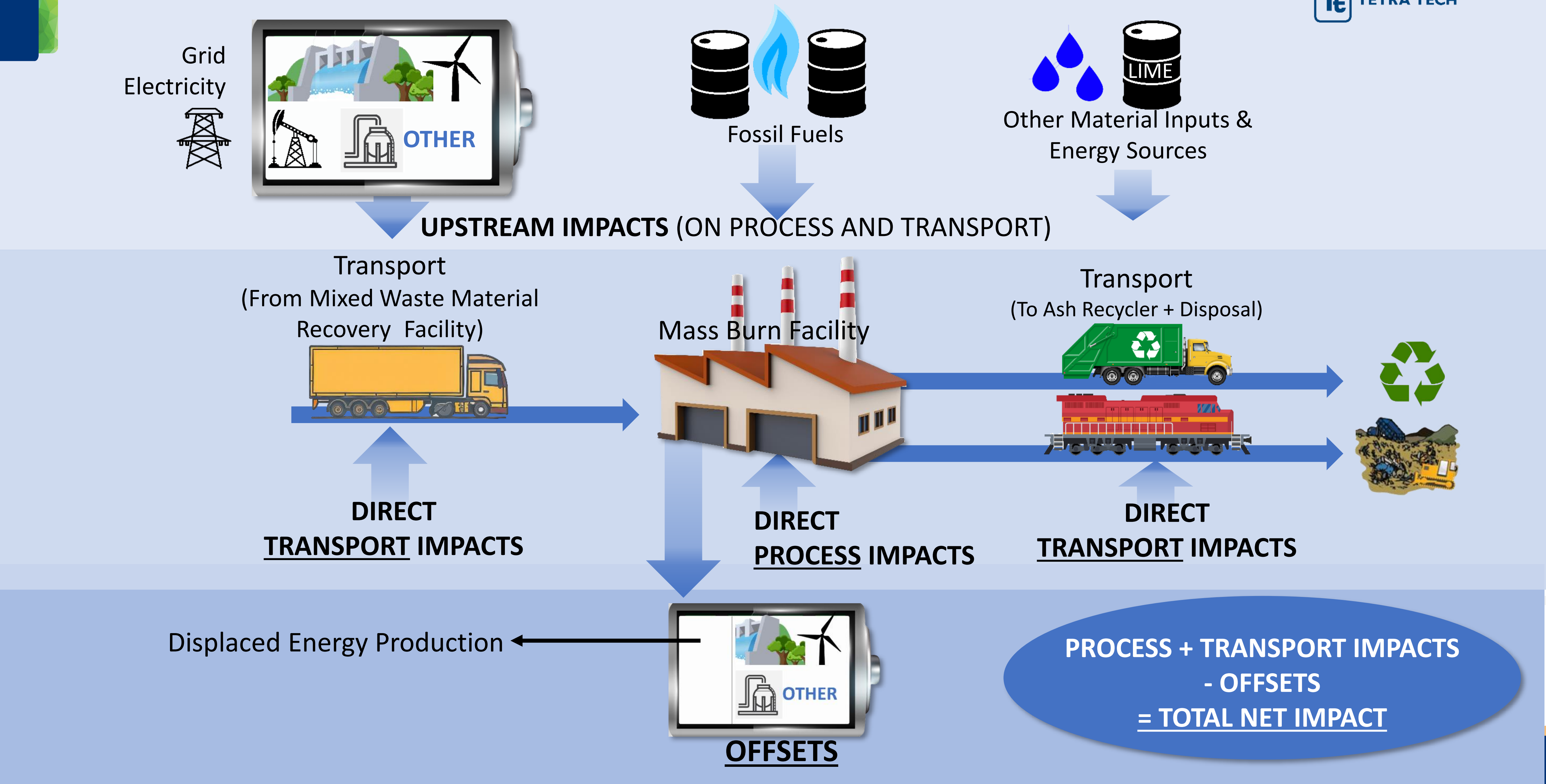
Offsets

Assumes that electricity and RNG sold by the facility will displace other energy generators (likely the highest cost generators). Both facilities sell energy.

- Therefore, we offset (count as benefits) impacts avoided by reducing this product:
  - Grid electricity production **including upstream impacts (e.g., extraction and refining)** of fossil fuels used to generate electricity
  - Conventional natural gas production **including upstream impacts (extraction and refining)**
- That is, other generators will reduce energy production by the amount WEBR/Mass Burn sell.
- Mass Burn generates more energy than it consumes. Mass Burn reduces net fossil fuel demand while WEBR increases it.

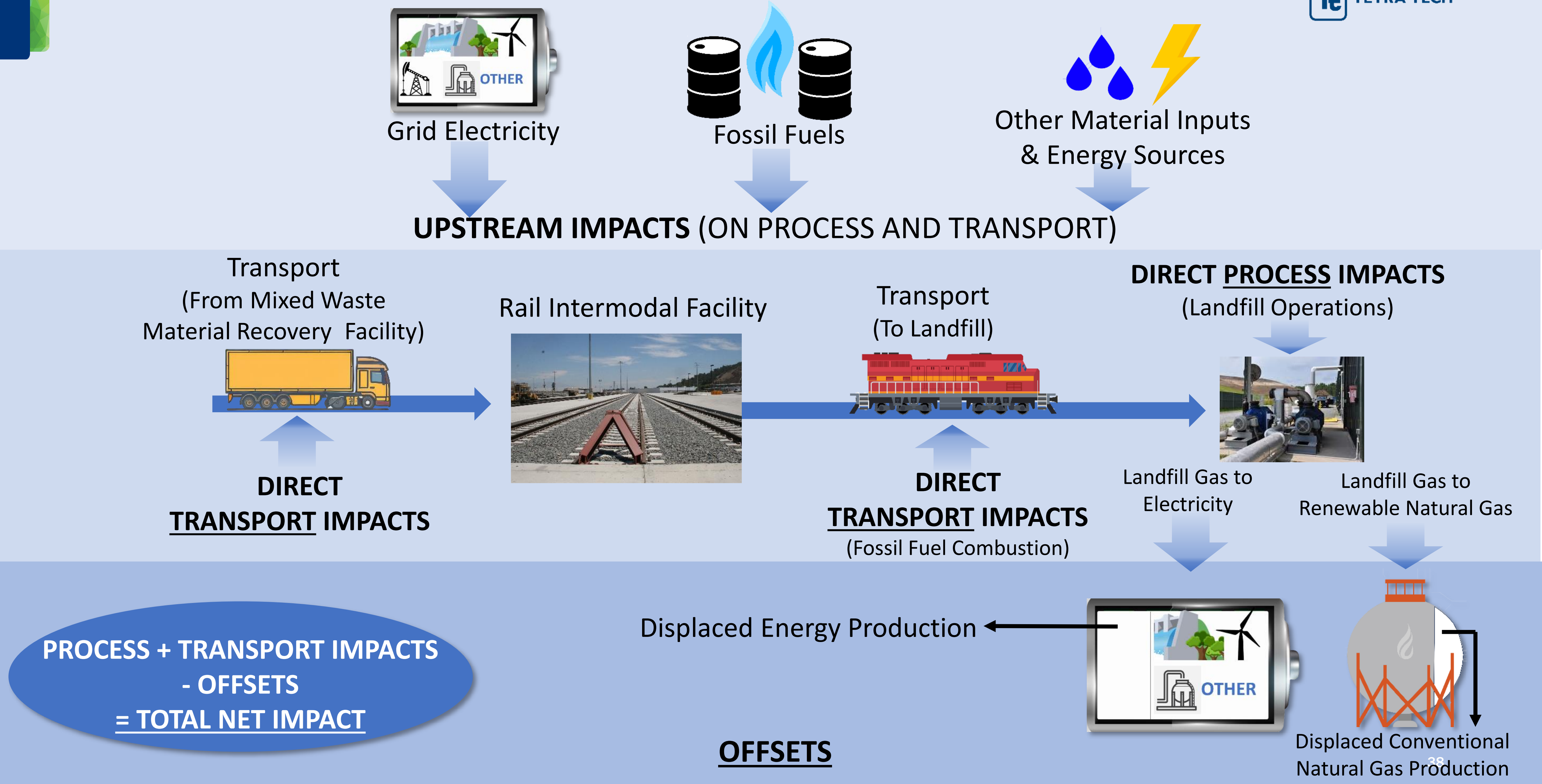
Total Net Impact = Process + Transport – Offsets

Life Cycle Environmental Impacts and Offsets – Mass Burn



Life Cycle Environmental Impacts and Offsets - WEBR

TETRA TECH



Environmental Criteria Evaluation Results
Mass Burn Generates More Energy Per Ton of Waste Than WEBR

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- In WEBR, only putrescibles (e.g., food, yard waste, wood, and paper) can decompose into methane, and some of the methane escapes before landfill capping.
- In Mass Burn, both plastics and putrescibles are converted into energy products, so more energy is generated from the same ton of waste.
- To provide a direct comparison of the two, the energy ratios on this slide assume all captured LFG is used to generate electricity and none is refined to RNG.

	High Tonnage	Med Tonnage	Low Tonnage
WEBR: Putrescible tonnage percent in 1 ton	57%	51%	46%
Mass Burn: Putrescible plus plastic percent in 1 ton	72%	70%	63%
Energy per ton from Mass Burn versus WEBR assuming all electricity (no RNG)	**11.6** times more	**17.0** times more	**12.6** times more

Environmental Criteria Evaluation Results
Mass Burn Versus WEBR

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- Mass Burn produces over **10 times** the amount of energy as WEBR for a given ton of waste
  - **More** energy produced = **Higher** offset electricity amounts = **More** fossil fuel use avoided
- Fossil fuel impacts include releasing **CO_2** (GHGs), **NOx** and **VOCs** (smog), **SO_2** (acidification)
  - Impacts include **upstream production of fossil fuels** (extraction, transportation, refinement), in addition to direct impacts of combustion for energy
- **Much higher** energy offset amounts in Mass Burn = **Better scores** on most environmental criteria

Environmental Criteria Analytical Breakdown – Medium Tonnage

Environmental Factor	Mass Burn	WEBR	Primary Sources and Summary Results
Non-renewable energy demand (MJ)			
Process	595,243,864	**506,768,197**	• **WEBR**: direct use of fossil fuels and electricity in landfill operations and transport (minimal offsets from electricity sold to grid). • **Mass Burn**: use of fossil fuels and electricity during process; offsets from energy sold to grid. • **Summary**: Mass Burn generates so much energy, it offsets the fossil fuel and nuclear portion of the electricity grid, creating a net decrease in non-renewable energy demand. WEBR does not.
Transport	**4,751,357**	72,606,823	
Offsets	**(1,295,270,427)**	(39,379,260)	
Net Total	**(695,275,206)**	539,995,760	
Water consumption (L H20)			
Process	**26,707,074**	28,369,580	• **WEBR and Mass Burn**: Reduced evaporation from hydropower reservoirs by offsetting grid electricity. Also includes water usage at landfill and Mass Burn facilities. • **Summary**: Both WEBR and Mass Burn reduce net water consumption, mainly through offsetting the hydropower component of the electricity grid; impacts largely created outside King County. Because Mass Burn replaces so much more electricity, its net decrease is much larger than WEBR's.
Transport	**1,275,363**	2,101,637	
Offsets	**(17,716,809,037)**	(524,107,394)	
Net Total	**(17,688,826,600)**	(493,636,177)	

Green highlight shows avoided impacts (negative value is a good result).
Bold text shows the lesser comparative impact.

Environmental Criteria Analytical Breakdown – Medium Tonnage

Environmental Factor	Mass Burn	WEBR	Primary Sources and Summary Results
Acidification potential (kg SO2 eq)			
Process	**107,459**	354,591	• **WEBR**: fossil fuels for landfill equipment (on-road diesel). • **Mass Burn**: process combustion (includes emissions scrubbers) and electricity inputs. • **Offset sources**: fossil fuels replaced for electricity generation. • **Summary**: Diesel usage from landfill equipment makes WEBR increase net acidification potential; impact created outside King County. Mass Burn generates so much energy that it offsets the fossil fuel portion of the electricity grid, which creates a net decrease in acidification potential; impact largely created outside King County.
Transport	**28**	344	
Offsets	**(155,397)**	(12,354)	
Net Total	**(47,910)**	342,581	
Eutrophication Potential (kg N eq)			
Process	**74,140**	194,282	• **WEBR**: landfill leachate (collected and sent to water treatment plant) • **Mass Burn**: production of lime used as a process input. • **Summary**: Both WEBR and Mass Burn increase eutrophication potential. Both impacts largely outside King County. Replacing grid electricity and conventional natural gas have minimal offsetting impact here.
Transport	**750**	9,749	
Offsets	**(6,695)**	(669)	
Net Total	**68,196**	203,362	

Green highlight shows avoided impacts (negative value is a good result).

Bold text shows the lesser comparative impact.

Environmental Criteria Analytical Breakdown – Medium Tonnage

Environmental Factor	Mass Burn	WEBR	Summary Results
Global Warming Potential (MT CO2 eq)			
Process	93,736	**63,750**	• **WEBR Process**: The portion of methane not captured as LFG in collection systems and fossil fuels used in landfill equipment and transport. • **Mass Burn**: combustion of plastics in the facility. • **Avoided electricity offsets**: reduced use of fossil fuels to generate electricity (including impacts of production) • **Avoided natural gas offsets**: avoided production impacts by replacing conventional natural gas with RNG. • **Summary**: Both WEBR and Mass Burn increase global warming potential. WEBR process and both offset impacts largely created outside King County. • **Note**: Following IPCC standards, CO2 associated with burning organics is not counted toward global warming potential, and organics that do not decompose in the landfill are counted as a carbon sink.
Transport	**366**	5,619	
Offsets	**(76,444)**	(13,782)	
Net Total	**17,658**	55,588	

Green highlight shows avoided impacts (negative value is a good result).
Bold text shows the lesser comparative impact.

Environmental Criteria Analytical Breakdown – Medium Tonnage

Environmental Factor	Mass Burn	WEBR	Summary Results
Smog Formation Potential (kg O3 eq)			
Process	530,228	**30,566**	• **Primary sources**: combustion of fuels like gasoline, diesel, and coal under certain conditions. • **WEBR**: diesel used in rail transport. • **Mass Burn**: offsets that reduce fossil fuel used to generate grid energy. • **Summary**: Fuel usage from rail transport makes WEBR increase impact; impact largely created outside King County. Mass Burn generates so much energy that it offsets the fossil fuel and biofuel portion of the electricity grid, which creates a net decrease in smog formation potential; impact largely created outside King County.
Transport	**411,589**	5,352,929	
Offsets	**(3,650,455)**	(368,499)	
Net Total	**(2,708,638)**	5,014,996	
Human Health Toxicity – Cancer Potential (CTUh)			
Process	10,519,047	**7**	• **Mass Burn**: Burning of plastics in Mass Burn releases toxic chemicals into the environment that has the potential to harm human health by increasing cancer potential. • This is not about causation or actual cases. • **Summary**: Mass burn creates significantly more cancer potential than WEBR; impact created inside King County.
Transport	0	**0**	
Offsets	(0)	**(0)**	
Net Total	10,519,046	**7**	

Green highlight shows avoided impacts (negative value is a good result).
Bold text shows the lesser comparative impact.

Environmental Criteria Evaluation Results - Medium Tonnage

Environmental Factor	Mass Burn	WEBR
Resource Conservation	• Creates heat that can be used to generate electricity and/or industrial/residential heating.[1] • Similar opportunities for resource conservation.	Landfill gas is converted to electricity or renewable natural gas.
Compatibility with Waste Prevention and Recycling	• Metals removed during pre-processing for recycling. • May impact recycling behaviors for public with knowledge that recyclables would be converted to energy.	Does not provide near-term additional opportunity for waste prevention or recycling.

[1] This is only a benefit if markets to sell the electricity exist. It is noted that the Environmental analysis for the Study assumed electricity generation for Mass Burn.

Mass Burn Evaluation Summary of Findings

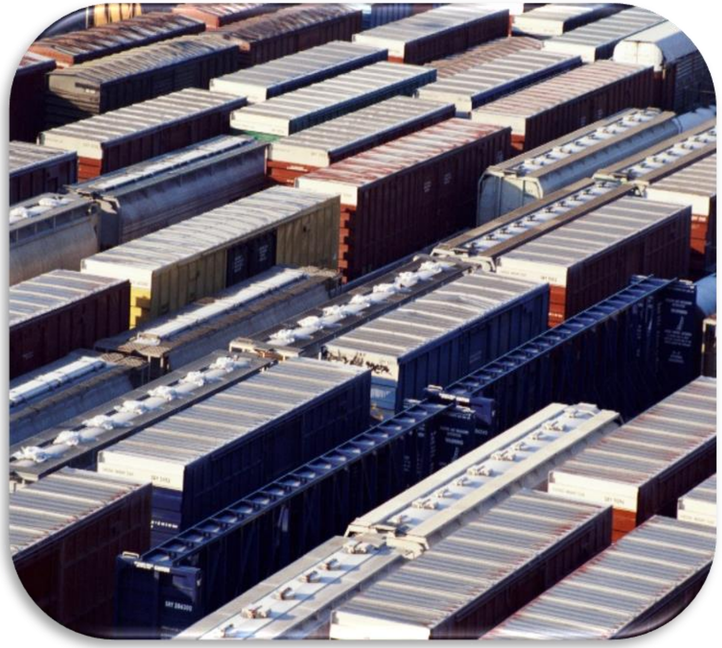
TETRA TECH

- Established technology for quantities and types of waste projected for King County.
- Capital costs higher than WEBR, typically requiring energy markets and economies of scale to ensure financial feasibility.
- CETA restricts electricity from WtE facilities for grid sale to retail customers in WA limiting revenue potential to out of state or in-State wholesale customers or for district heating. Assumed potential interstate sale of electricity for study. WtE facilities subject to CCA cap-and-invest program unless repealed.
- Process produces air emissions that require proper treatment and management.
- Residuals include fly ash and bottom ash waste that require treatment and disposal at ash monofill.
- High level of public opposition due to air pollution concerns.
- Life Cycle environmental impacts similar or less than WEBR except for human health – cancer potential. However, more of the impacts are created inside King County at the facility. Assessment considered upstream, direct, and downstream global impacts to process and transport waste and offsets for replacing grid electricity and conventional natural gas.

WEBR Evaluation Summary of Findings

TETRA TECH

- Established disposal option for other municipalities in Washington State.
- Contracts with railroads typically 5 to 10 years.
- Adequate rail and landfill capacity per railroad and landfill operators.
- WEBR costs significantly lower than Mass Burn for study period based on current contract pricing for rail transport and disposal.
- Traffic and congestion as capacity is used on railroads is a factor in the future.
- In recent years, Snohomish and Skagit counties have had to close transfer stations due to service interruptions by Burlington Northern and Santa Fe (BNSF) Railway. Existing contracts cover alternative disposal due to service interruptions.
- Life cycle environmental impacts similar or higher than Mass Burn except for human health – cancer potential. However, more of the impacts are created outside King County because waste is exported to out-of-County landfills.



Decision Timeline

Sept 2024
- Sept 30th Virtual Open House #1

Oct 2024
- Oct 9th 9am Virtual Open House #2
- SEPA Process Kick-Off
- Draft Study comment period

Nov 2024
- Long Term Study Report finalized, publication of findings

Dec 2024
- SCA PIC Presentation

2025
- Presentations to Cities on LTD Study findings

2025 - 2026
- SEPA Comment Periods
- Periodic updates on LTD SEPA Process to MSWAC/SWAC

2026
- Final EIS
- Presentations to Cities on Final EIS
- ILA Partners prepare and submit LTD recommendation through MSWAC
- SWAC submits letter of recommendation
- Executive finalizes decision, Comp Plan Draft is updated

2027-2028
- Comp Plan Adoption Process

Highlighted text are opportunities to give feedback ahead of decision making

TIMELINE IS SUBJECT TO CHANGE

Q&A