

HDR



The goal of this project is to provide the Board with the appropriate data to **make informed decisions on the future of the Agency.**



Task 1. Establishing a Project Baseline

- Technology Options
- Regional Volume Information
- Management Practices



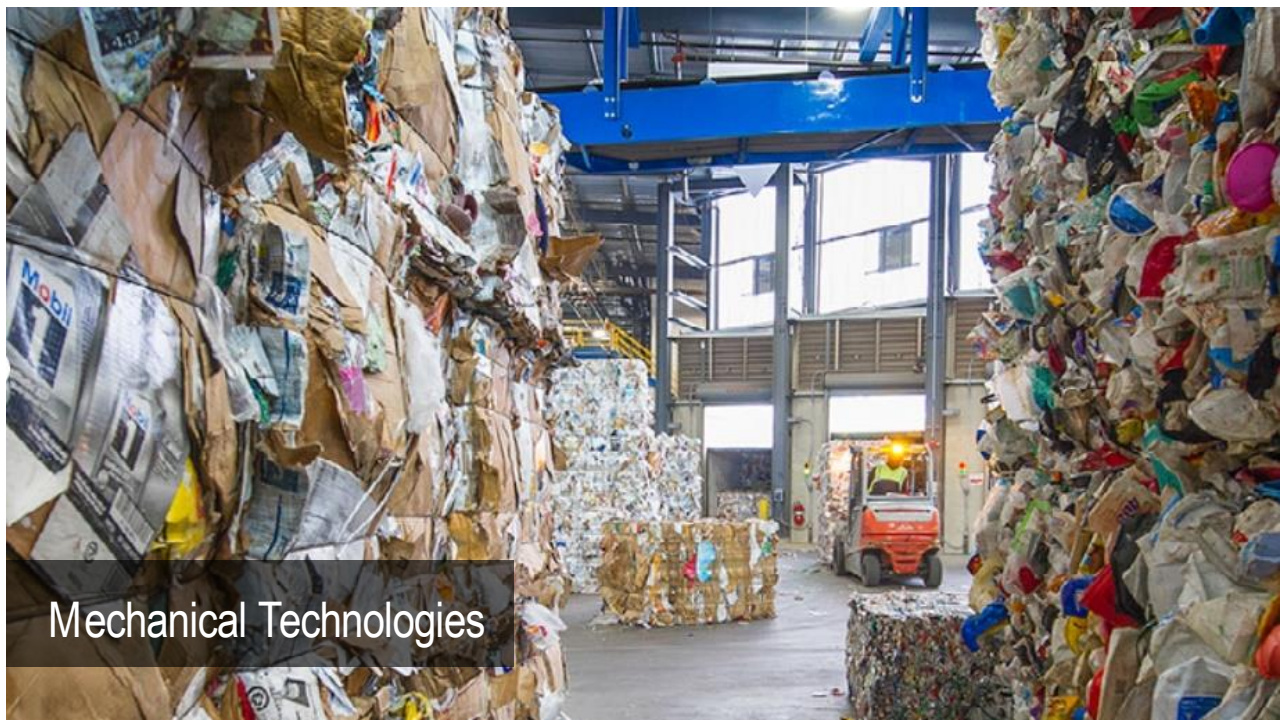
Thermal Technologies



Biological Technologies



Chemical Technologies



Mechanical Technologies



- Direct Combustion
- Gasification
- Plasma Arc Gasification
- Pyrolysis

Thermal Technologies

Direct Combustion

- Commercial – 30+ yrs
- 70+ facilities in US
- MSW waste stream up to 1,000 tpd
- 70%-90% diversion
- Produces energy
- Air Emissions & spent ash managed
- \$80-\$120/ton to manage/operate



Thermal Technologies



Thermal Technologies

Gasification

- Pilot facilities in CA/ Limited commercial in Japan
- No continuous operating MSW facilities in US
- MSW waste stream or select materials
- Typically 100-250tpd @ >90% diversion
- Produces energy
- Air Emissions & spent ash/slag managed
- \$100-\$180/ton to manage/operate



Thermal Technologies

Plasma Arc Gasification

- Pilot in FL, NJ & CN/ Commercial in Japan
- No continuous operating MSW facilities in US
- Hazardous materials & high carbon
- 50tpd-underdetermined @ >90% diversion
- Produces energy
- Air Emissions & spent ash/slag managed
- \$120-\$200/ton to manage/operate



Thermal Technologies

Pyrolysis

- Pilot in CA/ Commercial in Germany (1)
- No continuous operating MSW facilities in US
- MSW waste stream
- 10-100tpd @ unknown diversion
- Produces combustible gases, liquids & char
- Air Emissions & spent ash/slag managed
- \$120-\$180/ton to manage/operate



- **Aerobic Composting**
- **Anaerobic Digestion**
- **Mechanical Biological Treatment**

Biological Technologies



Biological Technologies

Aerobic Composting

- **Commercial – 30+ yrs**
- **Thousands of facilities in US**
- **Green & food waste – 200-400 tpd (typically)**
- **~40% waste diversion**
- **Produces marketable end product**
- **Odor and dust control managed**
- **\$30-\$75/ton to manage/operate**



Biological Technologies

Anaerobic Digestion

- **Commercial – 10+ yrs**
- **~20 facilities in US**
- **Green, food & sludge waste – 10-300 tpd**
- **15-20% waste diversion**
- **Produces biogas for electricity production**
- **Odors and digestate managed**
- **\$90-\$130/ton to manage/operate**



Biological Technologies

Mechanical Biological Treatment

- **Commercial in WV (1yr) and Euro/Asia (25+yrs)**
- **1 facility in US**
- **MSW or select up to 250 tpd**
- **Feedstock pre-process w/ recyclable recovery**
- **Produces biogas for electricity production**
- **Odors, dust and noise managed**
- **\$45-\$100/ton to manage/operate**



- Hydrolysis
- Catalytic and Thermal Depolymerization
- Waste-to-Fuel

Chemical Technologies



Chemical Technologies

Hydrolysis

- **Pilot in US and worldwide**
- **Wood, green waste & paper – TBD tpd**
- **25-30% waste diversion**
- **Market for fuels/gases TBD**
- **Air quality control required**
- **\$50-\$100/ton to manage/operate (approx)**



Chemical Technologies

Catalytic and Thermal Depolymerization

- **Demo/pilot generally worldwide**
- **1 facility in Spain**
- **Plastics and oils up to TBD tpd**
- **10-12% waste diversion**
- **Produces biodiesel**
- **Hydrocarbons managed**
- **\$50-\$100/ton to manage/operate (approximate)**



Chemical Technologies

Waste-to-Fuel

- Demo/pilots in CA, NV/ Commercial in Canada
- Mostly pilot worldwide
- Entire or biomass portion of MSW @ TBD tpd
- 90% waste diversion (approximate)
- Produces fuels (pilot)
- Hydrocarbons managed
- \$80-\$120/ton to manage/operate (approximate)



- Autoclave
- Mixed Waste Processing
- Refuse-Derived Fuel (RDF)

Mechanical Technologies



Mechanical Technologies

Autoclave

- **Demo/pilots worldwide on MSW components**
- **MSW @ approximately 100-300 tpd**
- **35-40% waste diversion (approximate)**
- **Produces low-grade fiber or fuel**
- **Unknown drawbacks (currently)**
- **\$45-\$100/ton to manage/operate (approximate)**



Mechanical Technologies

Mixed Waste Processing

- **Commercial for 30+yrs**
- **6-12 facilities in US & worldwide (>25)**
- **MSW @ approximately 200-1,500 tpd**
- **10-25% waste diversion**
- **Produces recyclables and fuel product**
- **Fines, trash and low-grade plastics managed**
- **\$35-\$75/ton to manage/operate**

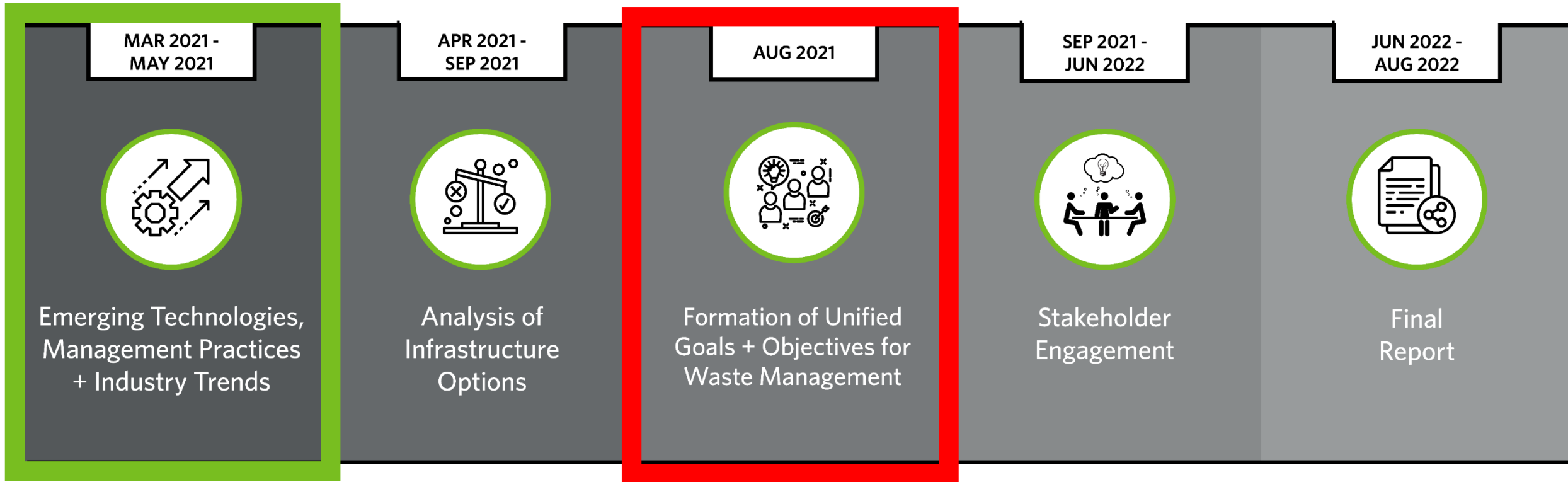


Mechanical Technologies

Refuse Derived Fuel

- Commercial for 30+ yrs
- 20 facilities in US & worldwide (>50)
- MSW @ up to 1,000 tpd
- 60-90% waste diversion
- Produces recyclables and RDF product for energy production
- Odors, noise & dust managed
- \$35-\$100/ton to manage/operate

Scope of Services – Revision to Timeline



What can you expect next?

Goals & Objectives Workshop.

Criteria Alignment = Narrowing of Options.

Focused Infrastructure Options Analysis.