

TRANSFER, PROCESSING AND/OR DISPOSAL SERVICES FOR RESIDUAL MUNICIPAL SOLID WASTE FROM THE CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION

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Presented By:

Mr. Joe Anderson

President | Trilogy Financial Group

Mr. Ron Sleight, PE

President | Evergreen Energy



INTEGRATED WASTE-TO-ENERGY (WTE) PLANT – WHY US?

- One of the most knowledgeable and experienced teams with expertise ranging from:
 - Financing
 - Design
 - Procurement
 - Construction
 - Power Generation
 - Operation
- More than 20 years experience will insure a successful project through all phases; feasibility, testing, design, construction, commissioning, and operations
- Commercial scale plants in place and operating
- Proprietary, patented processes



Liquid Waste

Solid Waste

Integrated Waste Management Plant

- ❑ Anaerobic Digestion
- ❑ Water Recovery
- ❑ Pyrolysis

Economic Engine

Output

How is it done?

Intangibles

Tangibles



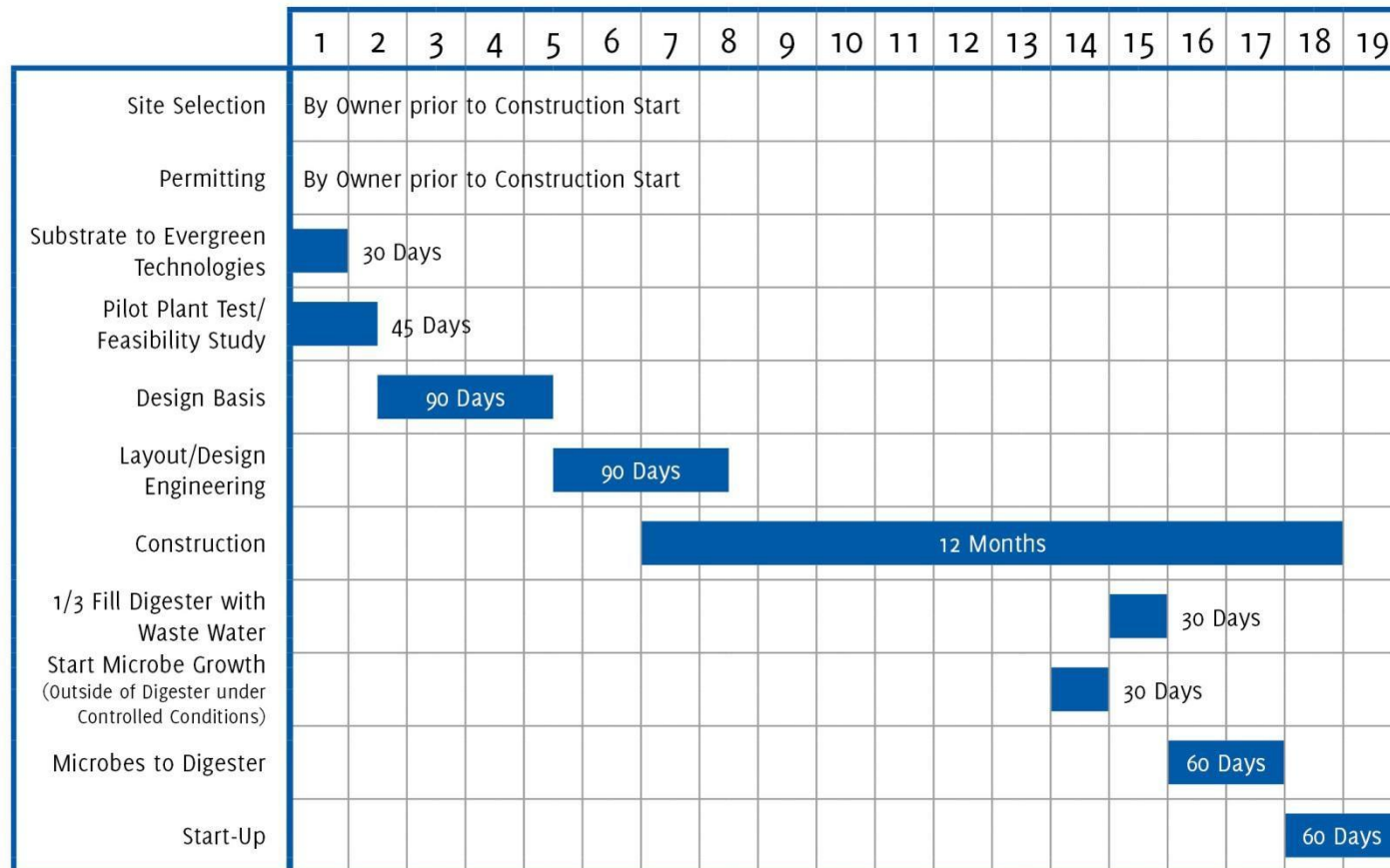
WTE PLANT PROCESS DETAIL

- 50% higher carbon to biogas conversion.
- 30-50% higher biogas energy content than other commercially available digesters.
- Sequestering nitrogen, sulfur and phosphorous in the biosolids.
- Ability to process both liquid (municipal wastewater) and solid waste (MSW), thus increasing the future capacity and life of a wastewater treatment plants (WWTP) and landfills.
- Tires, plastics, and carpets converted into fuel oil.
- Turning the operation costs of WWTPs and landfill management into income from energy, fertilizer, recoverables (metals, glass, etc.) and water sales



SAMPLE PROJECT SCHEDULE

GANTT CHART SCHEDULE: TOTAL PROJECT 19 MONTHS

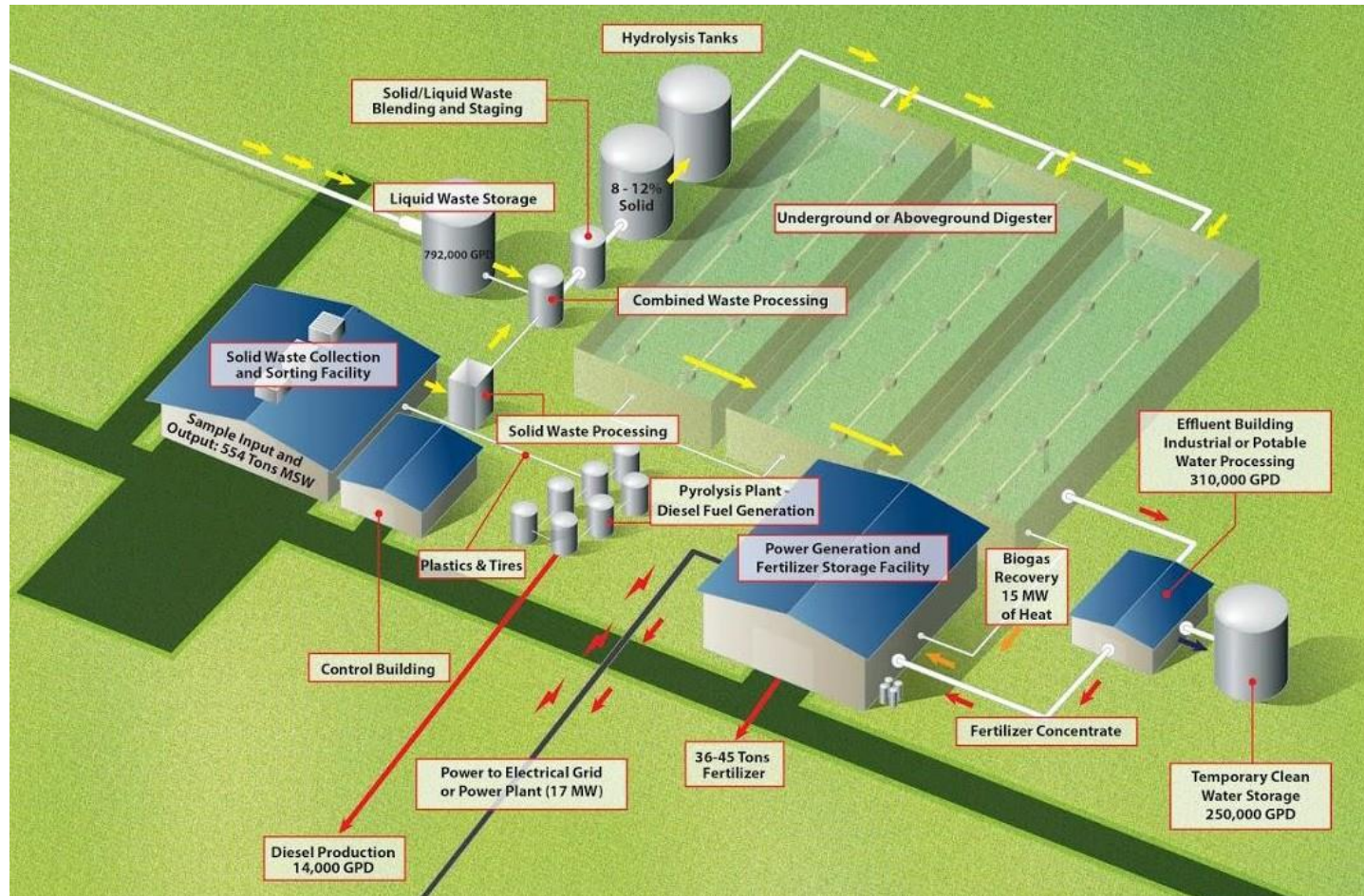


WTE PLANT – WASTE CHARACTERIZATION

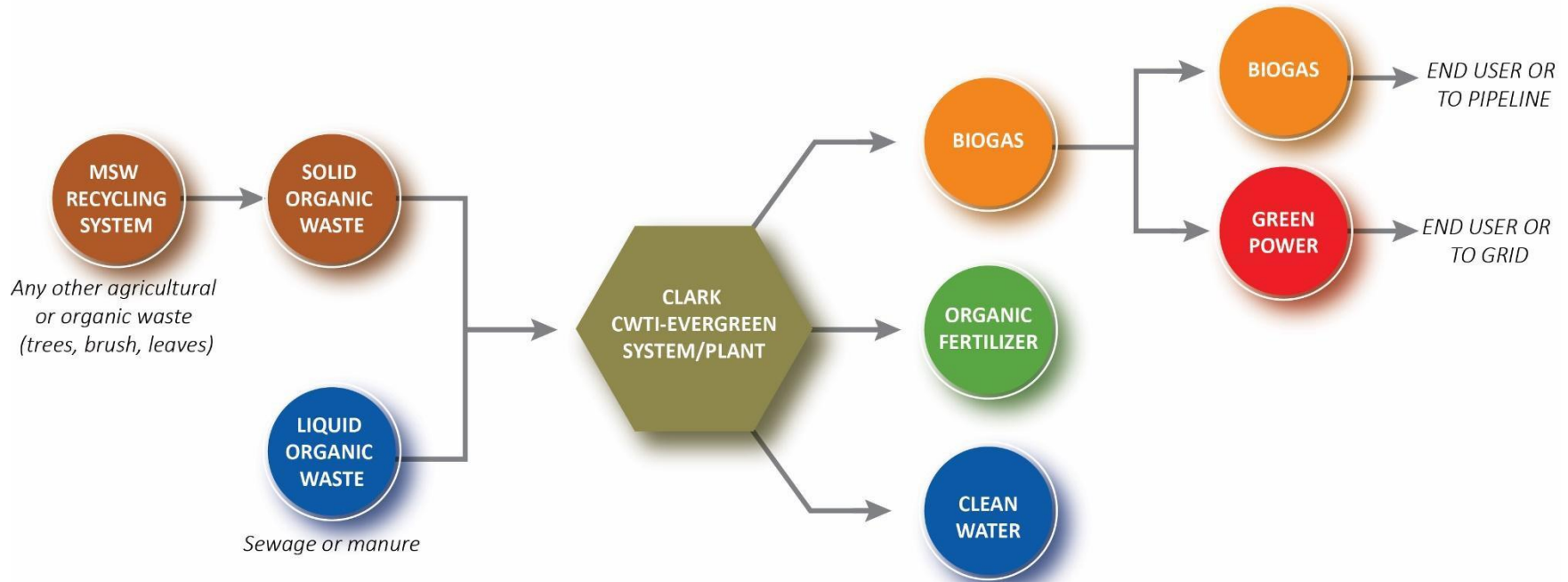
Major Waste Group	Weight Percentage
Paper	22.6%
Green Waste	4.3%
Organics	21.9%
Wood	6.8%
Mixed residue (50% organic)	7.0%
Total Organic Material	62.6%
Plastics	15.6%
Fine plastic (In-organic fraction)	4.2%
Total Plastics	19.8%
Metal	3.7%
Glass	1.8%
Inorganic Fraction	4.1%
Mixed residue	7.0%
Special waste	0.8%
Bulky waste	0.1%
Problem material	0.1%
Total Non-Recyclable	12.1%
Grand Total	100.0%

- Goal – recycle larger portion of mixed residue
- Overall, target 95% recovered waste, 5% non-recoverable waste to landfill

WTE PLANT OVERVIEW



CLARK-EVERGREEN INTEGRATED SYSTEM OUTPUT



THE BENEFITS



Organic Process

- Carbon neutral organic process
- Substitutes for and displaces fossil fuel sources



Green

- Carbon neutral organic process
- Substitutes for and displaces fossil fuel sources



Single Process

- One Process handles all organic waste types
- Recovers irrigation-quality clean water without additional steps



Scalable

- Integrated digestion allows for cost effective modularization
- Each facility can be scaled to an appropriate size, based on feedstock using 90% common, not custom components



Energy

- More renewable green electricity per pound of source material
- Clark-Evergreen biogas is a direct replacement for natural gas in gas-fired electric turbines or gensets.



Cost Effective

- Use virtually any organic source material (wet or dry)
- Eliminate costly treatment steps associated with other processes
- Offset operating costs with revenue generation

RECENT WTE PLANT PROJECTS

Facility Name	Feedstock	Input Quantity	Output	Value(\$)
Biogas Leeuwarden, WTE Plant The Netherlands	Manure/Green Waste	36,000 tons/year	1.4 MWe	15M
Westkern BV, WTE Plant, The Netherlands	MSW Organics/ Manure	75,000 t/yr	10 million m ³ of Pipeline Grade Quality Gas/yr or 5 MW of Electricity	22M
Stadskanaal, WTE Plant Netherlands	MSW	60,000 t/yr	3.0 MWe	16.2M
Atlanta Airport WTE Plant, USA	MSW Organics, Human Waste, Waste Tires	100,000 t/yr	14.3 million m ³ of Pipeline Grade Quality Gas or 7 MW of Electricity 14,000m ³ /yr diesel	45M
Astarta – WTE Power Plant Globino, Ukraine	Beet Pulp, Maize Silage, MSW organics	185,000 t/yr	15 MWe equivalent/ production of 7,000m ³ biogas/hour	75M

GLACIAL LAKES ENERGY – WATERTOWN, SD



PLATTE WEST WATER TREATMENT FACILITY – OMAHA, NE



LOUIS DREYFUS CANADA – YORKTON, SASKATCHEWAN



WASTE-TO-ENERGY AD PLANT OFFTAKE PRODUCTS

1,500 TPD MSW converts to:

940 TPD organics

Organics convert to:



32 MW Electricity – Jenbacher Genset



300 TPD Organic Fertilizer (30% DM) &
Organic fertilizer ($\pm 30\%DM$) & Liquid fertilizer
Liquid fertilizer



0.5 MGD Clean water

WTE PLANT MARKETING, DISTRIBUTION, AND REUSE OF PRODUCTS

Methane Gas

- Converted into electricity and off-take agreement with the city of Detroit Department of Water and Power.

Carbon Dioxide

- Converted into food grade CO₂ and sold to greenhouses, carbonated beverages and/or industrial uses.

Organic Fertilizer (nitrogen, phosphorus, and potassium) NPK

- Class A fertilizer used in a variety of agricultural applications.

Clean Water

- Generated by onsite wastewater treatment plant.

WTE PLANT MARKETING, DISTRIBUTION, AND REUSE OF PRODUCTS

Plastics/Tires

- Liquid fuel rated as fuel oil or bunker fuel, widely used in the transportation and shipping industries.
- Recyclable steel banding, recovered primarily from the pyrolysis of tires.
- Synthetic gas that will be used internally for operating the pyrolysis plant.

Metals

- Ferrous and non-ferrous metals to be sold in the existing recycling market.

Glass

- Convert into various products and sell into the glass recycling market or convert into specialty items including sand blasting glass beads.

JOB CREATION

Create 2 job per 10 tons of MSW per day processed. For a 1,500 TPD WTE Plant, approx. 300 jobs created. Indirect labor created will exceed 1,000 jobs.

WTE PLANT AND ECOPONEX

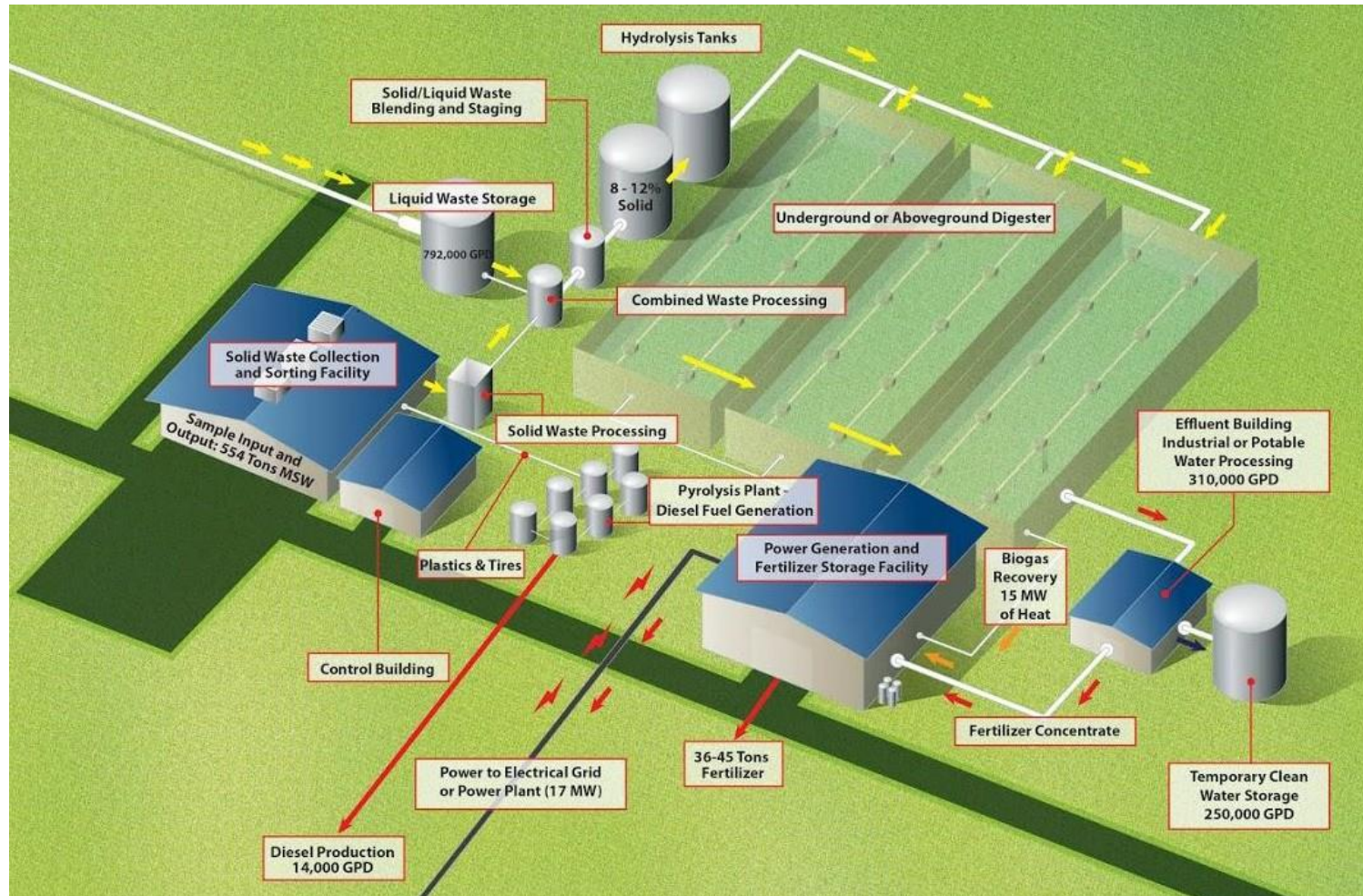
Video [Here](#)



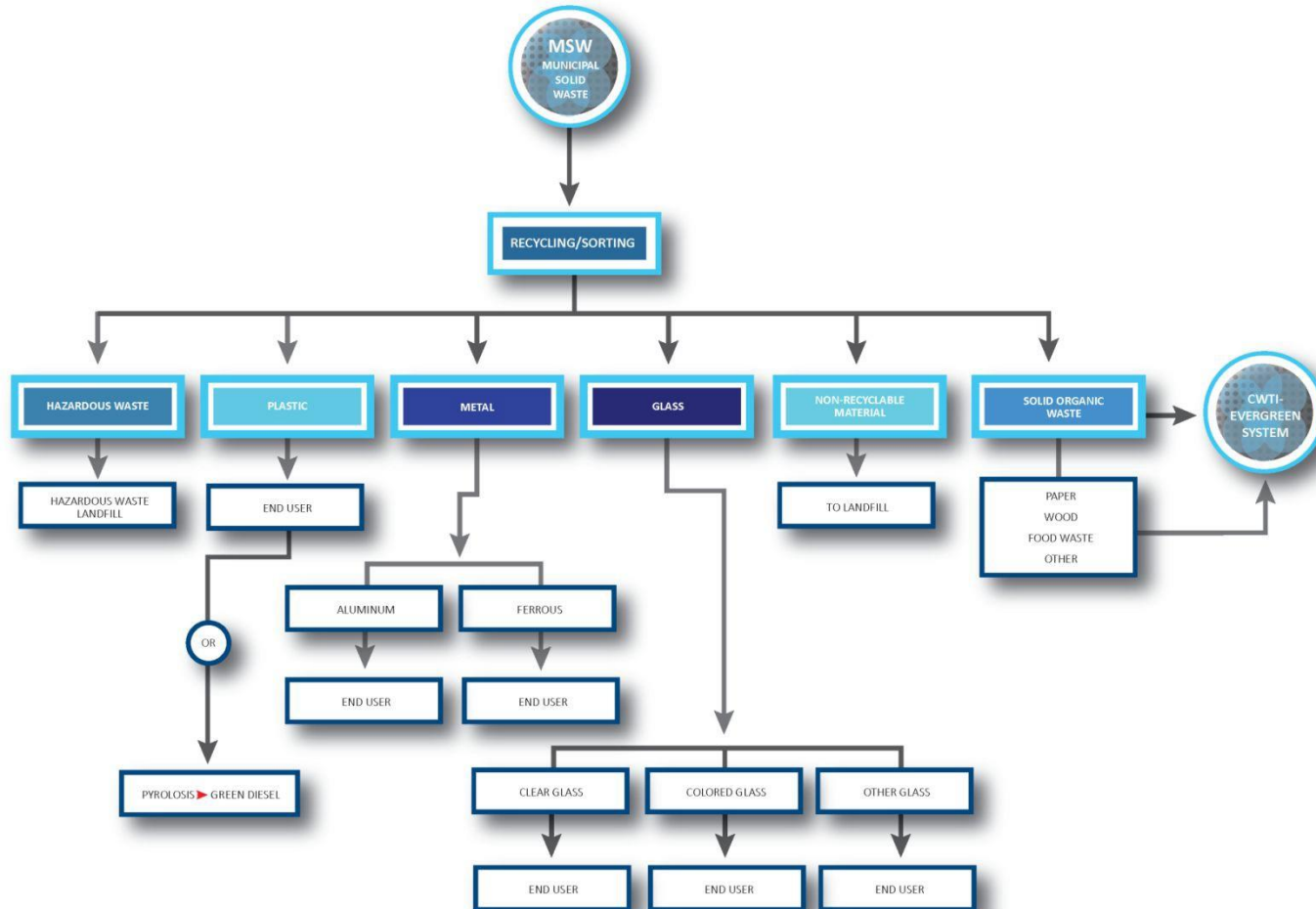
WTE PLANT DEVELOPMENT – NEXT STEPS

1. Assignment of project and TPD feedstock
2. Permitting
3. Financing
4. Finalize design
5. Output contracts

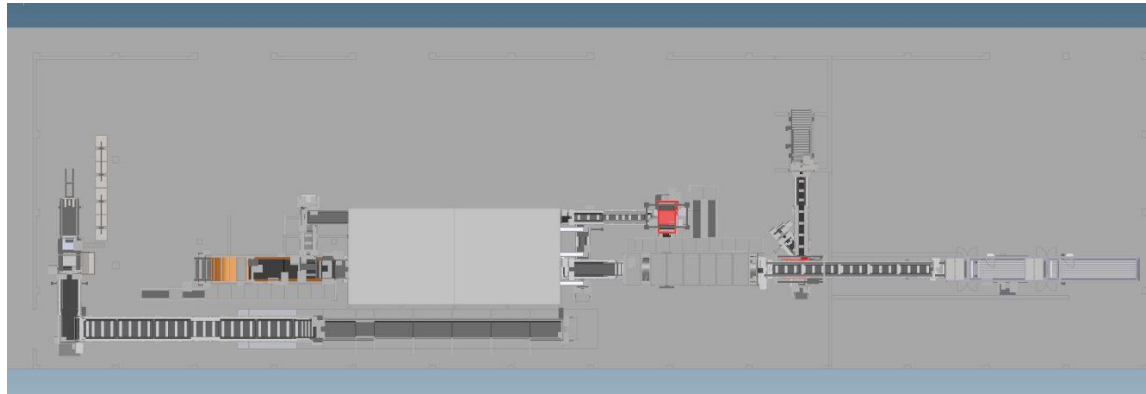
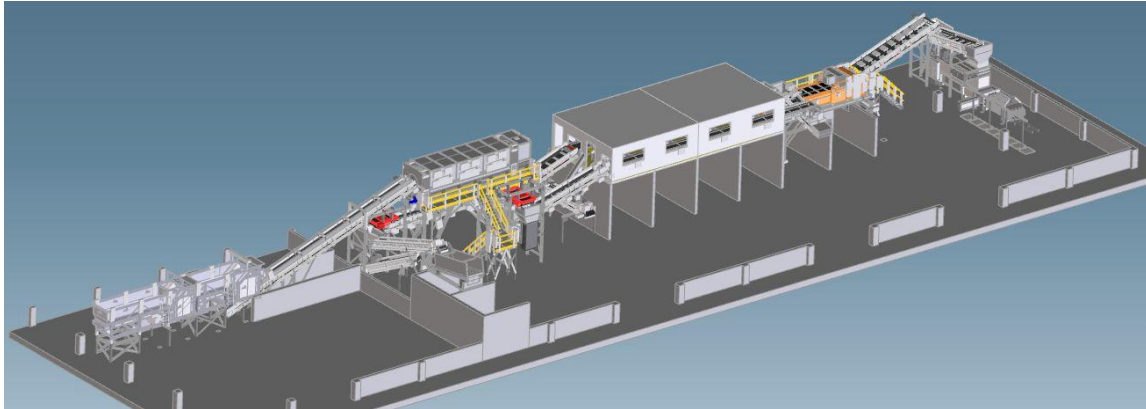
WTE PLANT OVERVIEW – TECHNICAL



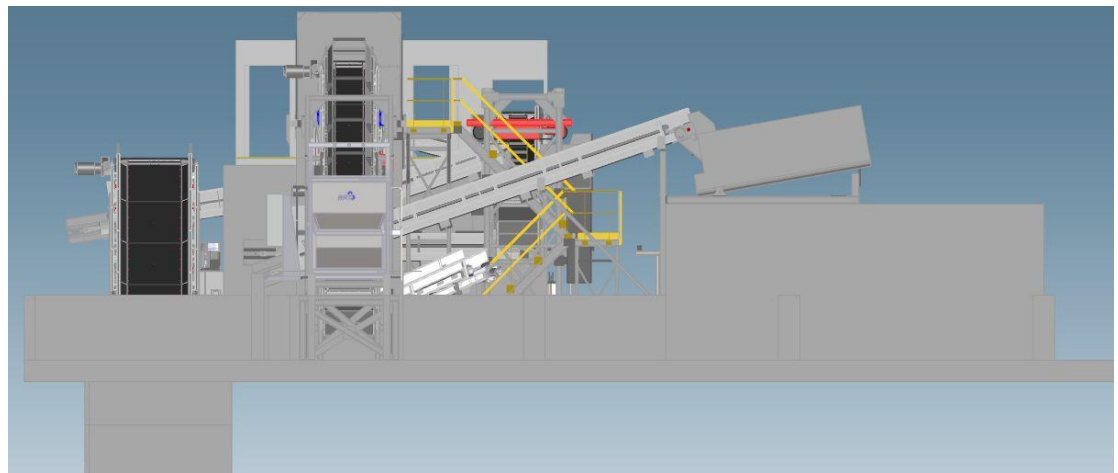
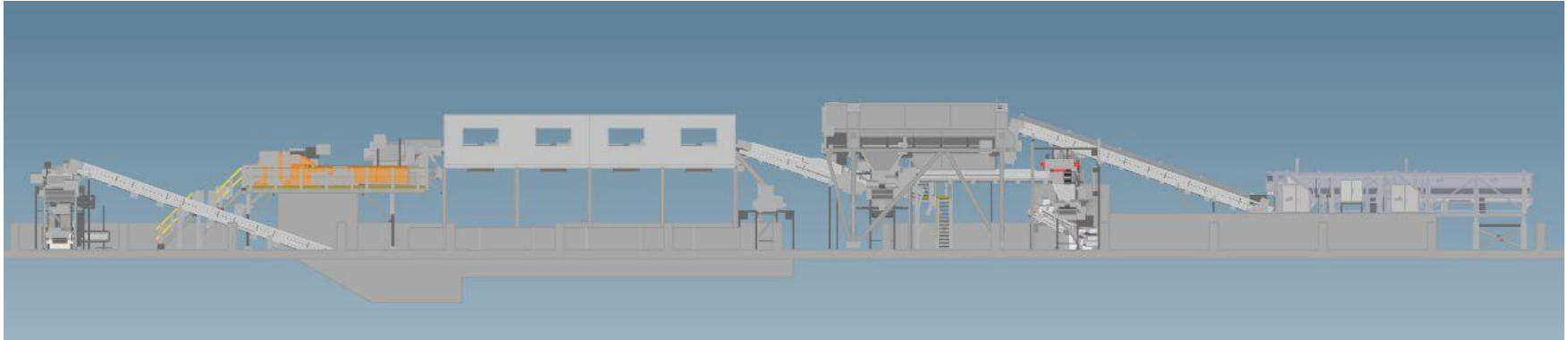
INTEGRATED WASTE MANAGEMENT SORTING



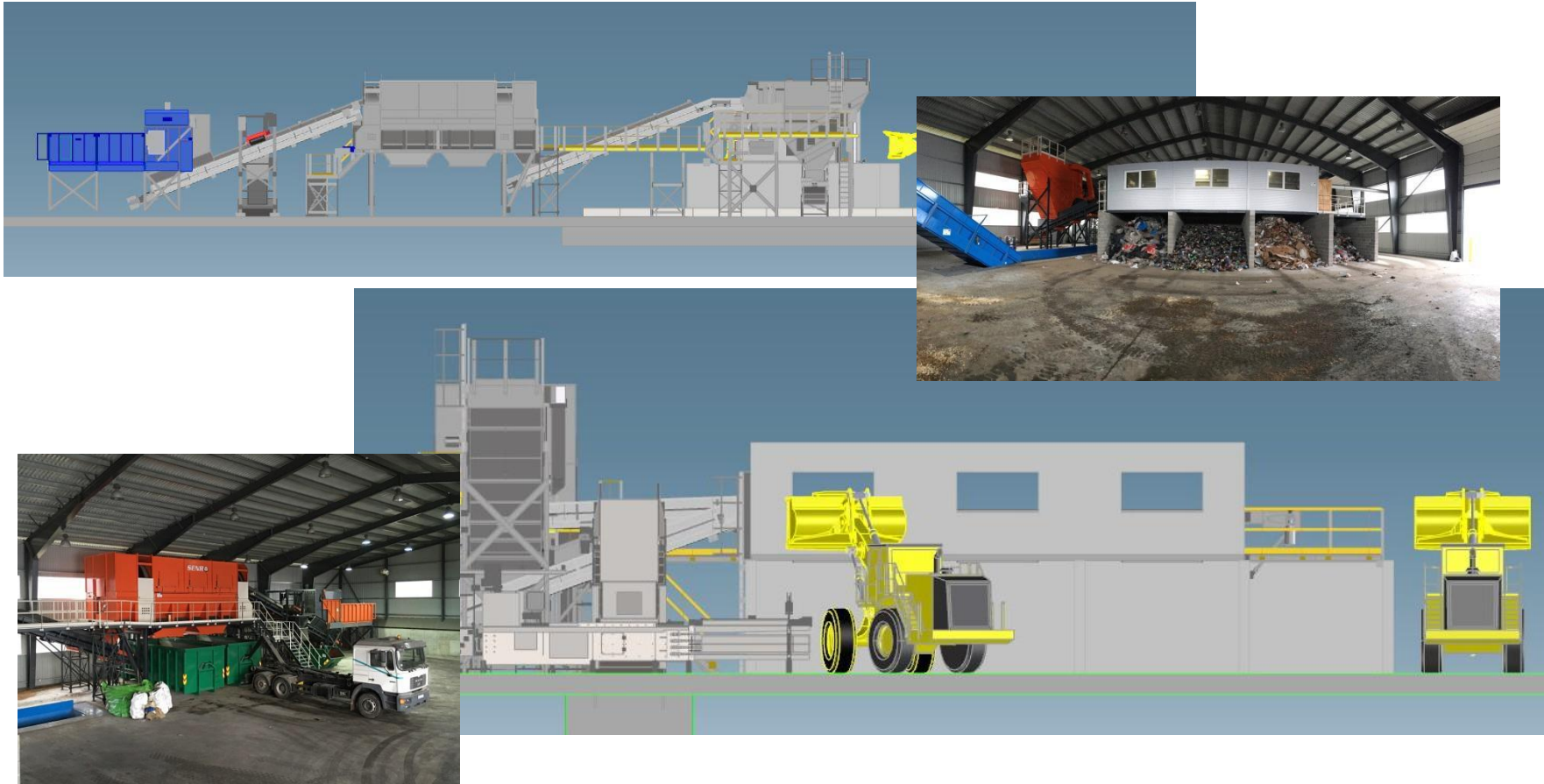
MSW SORTING 25 -100+ T/H



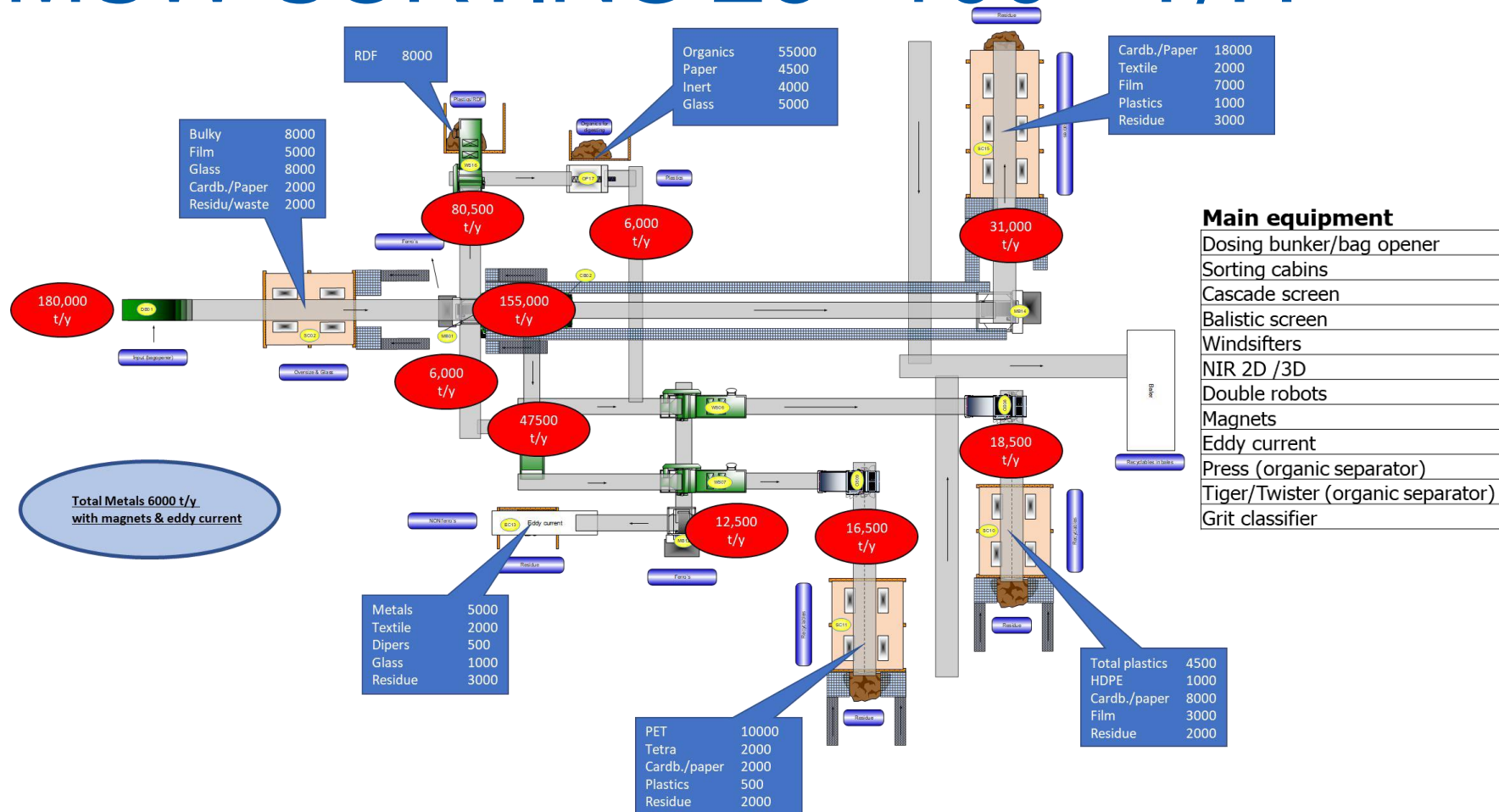
MSW SORTING 25 -100+ T/H



MSW SORTING 25 -100+ T/H

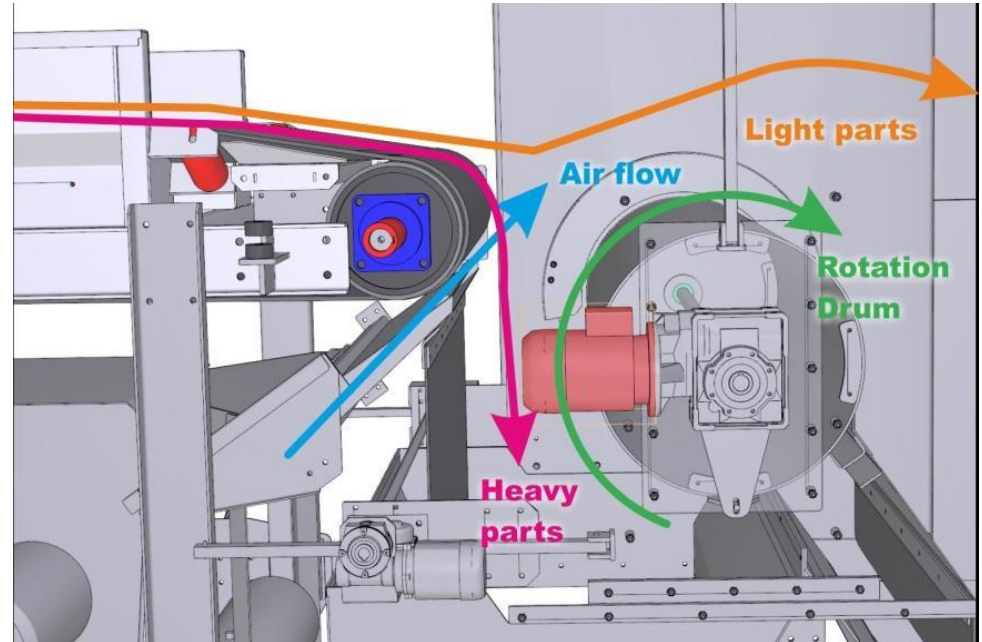


MSW SORTING 25 -100+ T/H



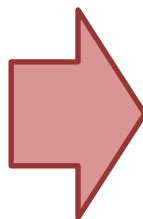
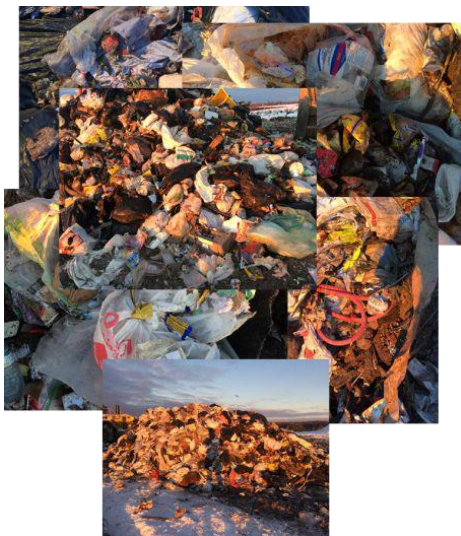
MSW SORTING 25 -100+ T/H

Wind Sifter



MSW SORTING 25 -100+ T/H

Input



Output



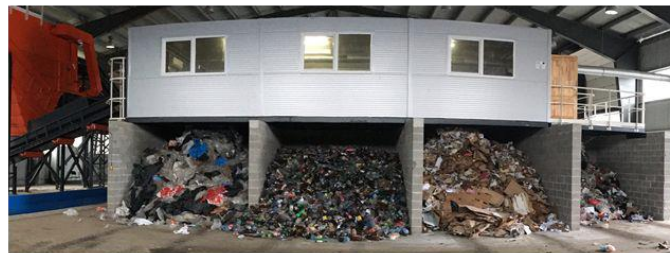
Tetrapack



Paper/card



Wood



Foil - PET - Cardboard - PE/PP



Hard plastics



Organics

And more separated fractions!!

MSW AND OTHER SORTING PROJECTS

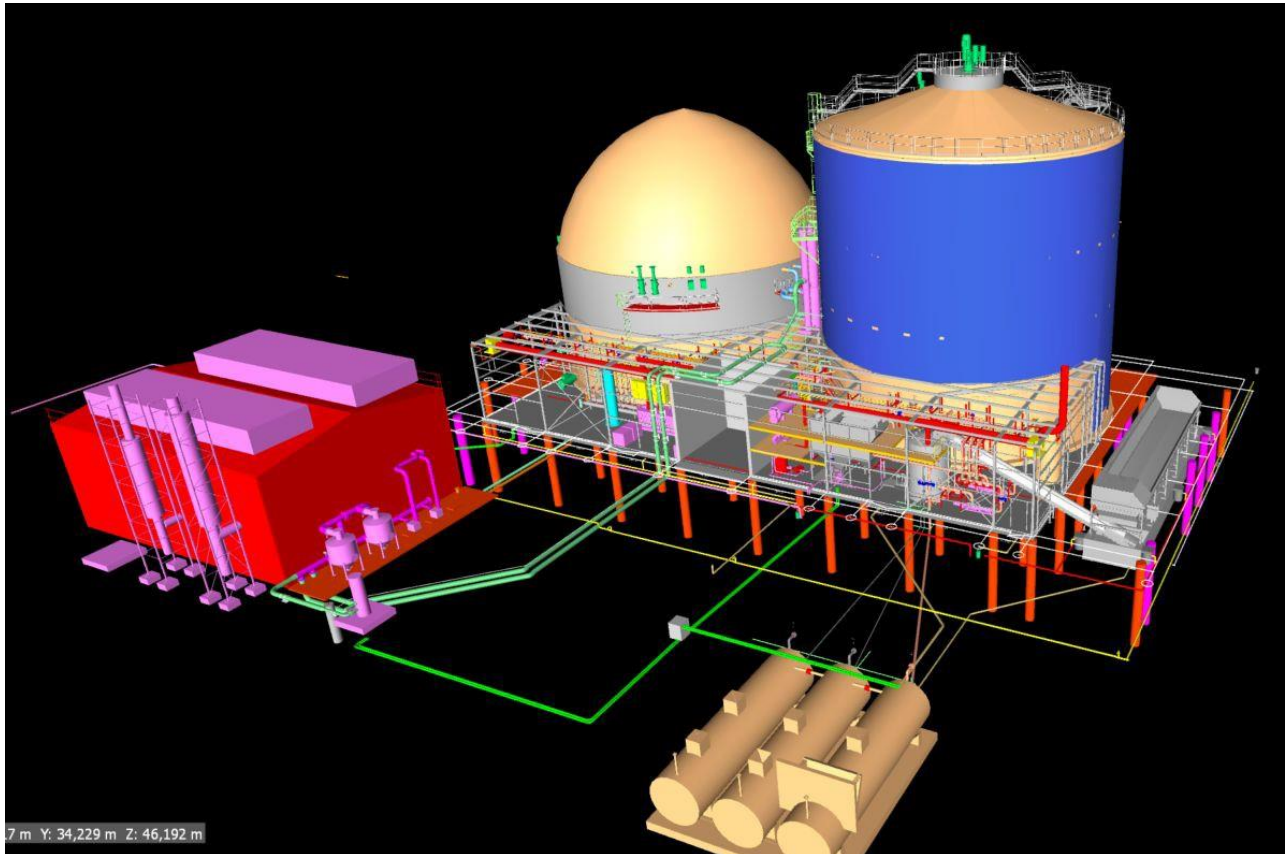
Project and Location	Waste type	Completed	Capacity Tons/hour
Smiles Sunderland, UK	MSW, C&I and C&D	2008	40
Transwaste Hull, UK	MSW and C&I	2009	60
Inashco	Inc. Ash	2012	100
Umicore Be	WEEE	2013	8
Weser Metal	Car batteries	2013	10
DSAlytus, Lithuania	MSW	2014	25
MSW sorting, Middle East	MSW and C&I	2014	10
MSW Panevezys, Lithuania	MSW	2015	30
Telsiai, Lithuania	MSW	2015	25
Daugavpils, Latvia	MSW	2015	20
Van Happen	C&I	2015	25
Utena	MSW	2015	20
Marijampole	MSW	2016	25
Turkey (Bitlis)	MSW	2016	35
EBMUD (US)	SSO	2017	50
Honduras	MSW	2017	40
Mallorca	MSW	2018	40
Leamington CA	Sludge	2018	35
Nexen CA	Oil sands	2019	40
Kootstertille, The Netherlands	MSW	2019	30

WTE PLANT - AD TECHNICAL



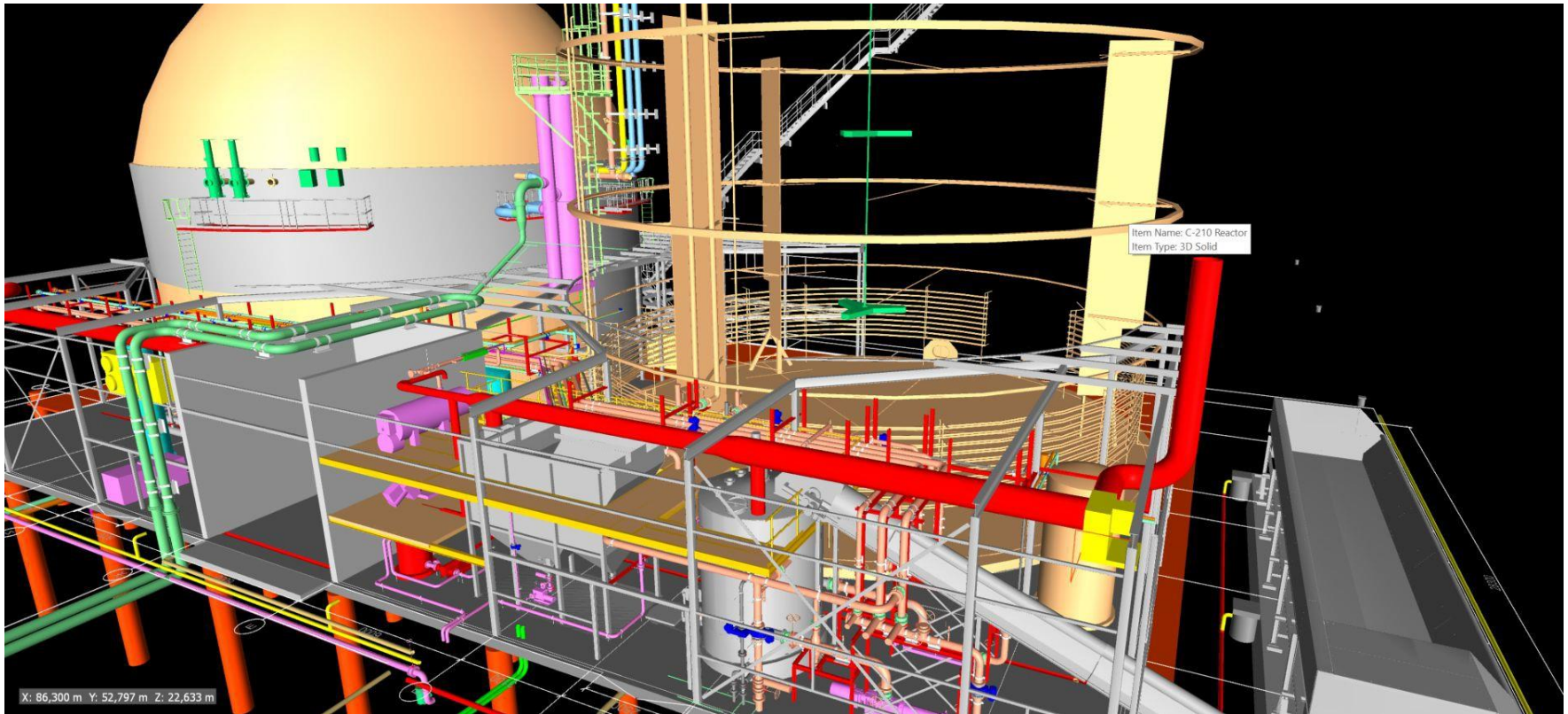
WASTE-TO-ENERGY PLANT, UKRAINE

EPC – Integrated Plant Design



WASTE-TO-ENERGY PLANT, UKRAINE

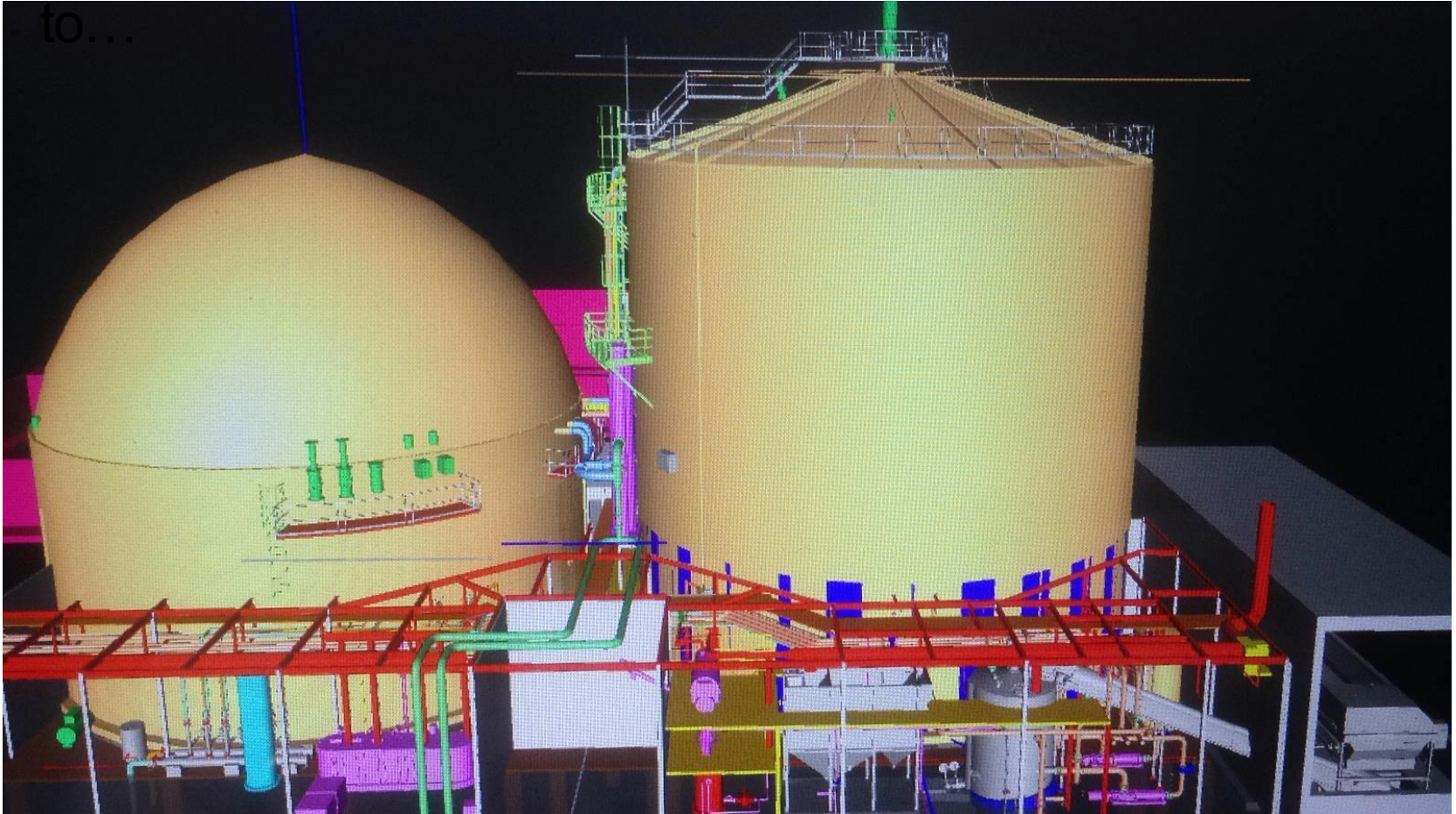
EPC – 3D Design and Clash Detection



WASTE-TO-ENERGY PLANT, UKRAINE

3D Model

to...



WASTE-TO-ENERGY PLANT, UKRAINE

...to Actual
Construction



BIOGAS LEEUWARDEN WTE PLANT – THE NETHERLANDS



<https://www.youtube.com/watch?v=bAcJtF7SKSg>

BIOGAS LEEUWARDEN WTE PLANT – THE NETHERLANDS



BIOGAS LEEUWARDEN WTE PLANT – THE NETHERLANDS



WTE PLANT – PYROLYSIS TECHNICAL



PYROLYSIS PLANT

CONVERT TIRES, PLASTICS, AND CARPETS TO FUEL OIL



OPERATING PYROLYSIS PLANTS

<u>Location</u>	<u>Capacity</u>	<u>Products Produced</u>
Saudi Arabia	240 tons	Fuel Oil, Carbon Black, Steel
Mexico	100 tons	Diesel Fuel, Carbon Black, Steel
China	80 tons	Fuel Oil, Carbon Black, Steel
Mexico	60 tons	Fuel Oil, Carbon Black, Steel
China	60 tons	Fuel Oil, Carbon Black, Steel
Turkey	50 tons	Fuel Oil, Carbon Black
Canada	40 tons	Fuel Oil, Carbon Black, Steel
Dominican Republic	30 tons	Fuel Oil, Carbon Black, Steel
Poland	30 tons	Fuel Oil, Carbon Black, Steel
Austria	30 tons	Fuel Oil, Carbon Black, Steel
Israel	30 tons	Fuel Oil, Carbon Black
Spain	30 tons	Fuel Oil, Carbon Black, Steel
Brazil	20 tons	Diesel Fuel, Carbon Black, Steel
Albania	20 tons	Fuel Oil, Carbon Black, Steel
Canada	20 tons	Fuel Oil, Activated Carbon, Steel

OFFTAKE PRODUCTS

Waste Tires		Waste Plastics and Carpets	
PRODUCT	%BY WEIGHT	PRODUCT	%BY WEIGHT
Fuel Oil	43%-50%	Fuel Oil	75%
Carbon Black (not BioChar)	30%	Carbon Black (not BioChar)	10%
Recyclable Steel	15%		
Waste Syngas	5%-10%	Waste Syngas	5%-10%
Waste Materials	0%-5%	Waste Materials	0%-5%

PYROLYSIS EQUIPMENT



PYROLYSIS EQUIPMENT



PYROLYSIS EQUIPMENT



PYROLYSIS – CONVERSION TO FUEL OIL



The oil can be further refined into higher grades including diesel fuel and gasoline. We propose to make No.6 Fuel Oil.

MODULAR PLANT SIZE



The pyrolysis units are modular in design and work best in pairs. The pyrolysis plant's output and operation, in operating tons per day and total fuel output, can grow to fit the physical site space available. The photographs above are of pyrolysis plants that are constructed and successfully operating in two different countries.

- Plant Sizing Options – 20 tons/day to 500 tons/day++
- Fuel Oil Production – 2,700 gal/day to 66,800 gal/day++
- Largest Operating Tire Pyrolysis Plant (Saudi Arabia) – 240 tons/day

PYROLYSIS PLANT LAYOUT



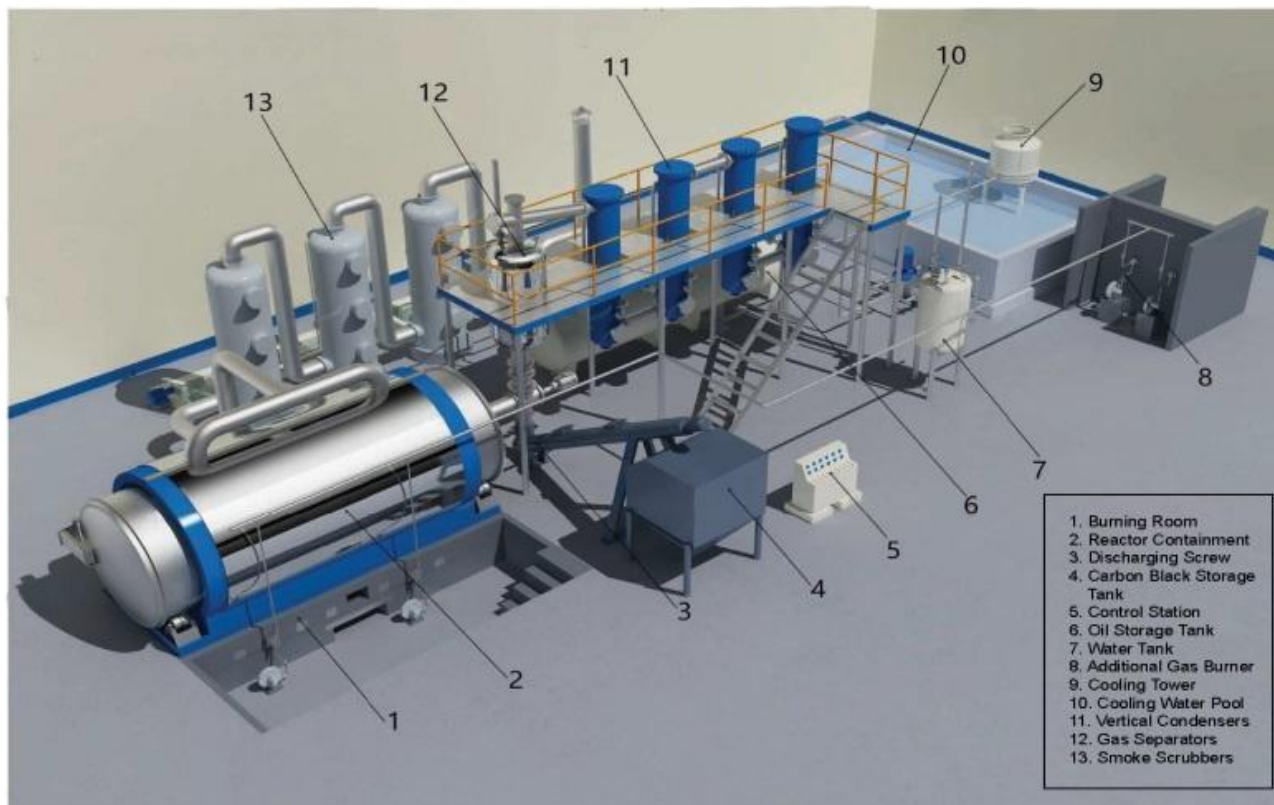
Pyrolysis Company Partner



中国环境保护产业协会会员

China Association of Environmental Protection

10-12 Ton/Day Capacity Waste Tire/Plastic Pyrolysis System Layout



1 of 3

PYROLYSIS PLANT 40 TPD LAYOUT



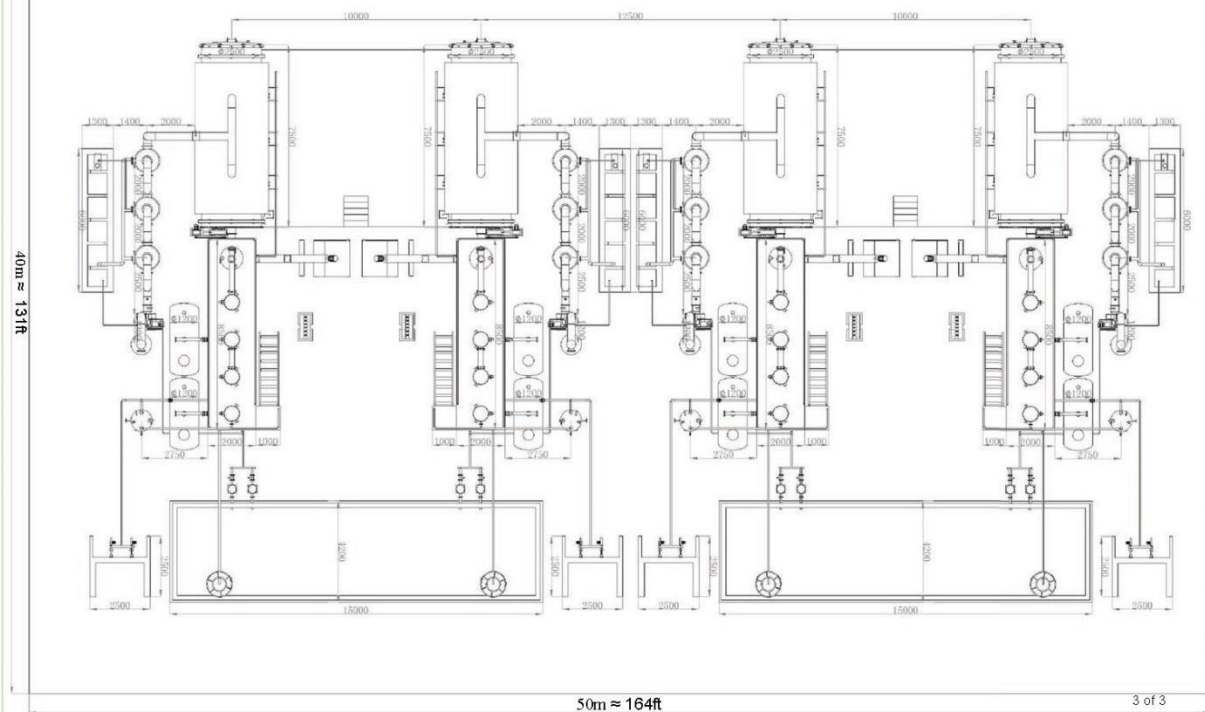
Pyrolysis Company Partner



中国环境保护产业协会会员

China Association of Environmental Protection

40-48 ton/day Capacity Waste Tire/Plastic
Pyrolysis System Schematic Layout



The site requirements for a 40 TPD pyrolysis plant is approximately 2.5 acres. This provides room for a building to house the pyrolysis plant, external storage tanks, bunkers, and meters, tire staging area, and truck loadout area.



WTE PLANT – WWTP TECHNICAL



WASTEWATER AND LANDFILL LEACHATE TREATMENT PLANT



WASTEWATER AND LANDFILL LEACHATE TREATMENT PLANT

