



Integrated Energy Pyrolytic Conversion System

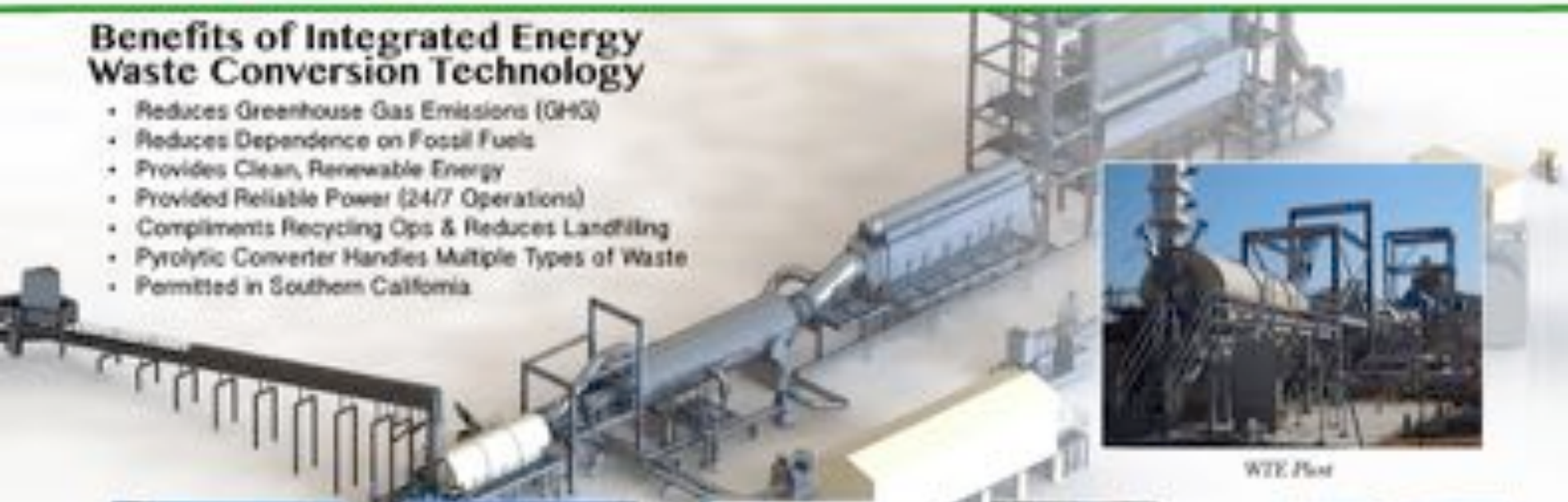




**CONVERTING WASTE PROBLEMS
INTO CLEAN ENERGY SOLUTIONS**

Benefits of Integrated Energy Waste Conversion Technology

- Reduces Greenhouse Gas Emissions (GHG)
- Reduces Dependence on Fossil Fuels
- Provides Clean, Renewable Energy
- Provides Reliable Power (24/7 Operations)
- Complements Recycling Ops & Reduces Landfilling
- Pyrolytic Converter Handles Multiple Types of Waste
- Permitted in Southern California



WTE Plant



Thermal Oxidizer



Waste Heat Boiler



Steam Turbine Generator



Air Cooled Condenser



Air Pollution Control

Pyrolytic Waste Conversion-to-Energy

Integrated Energy Pyrolytic Thermal Converter

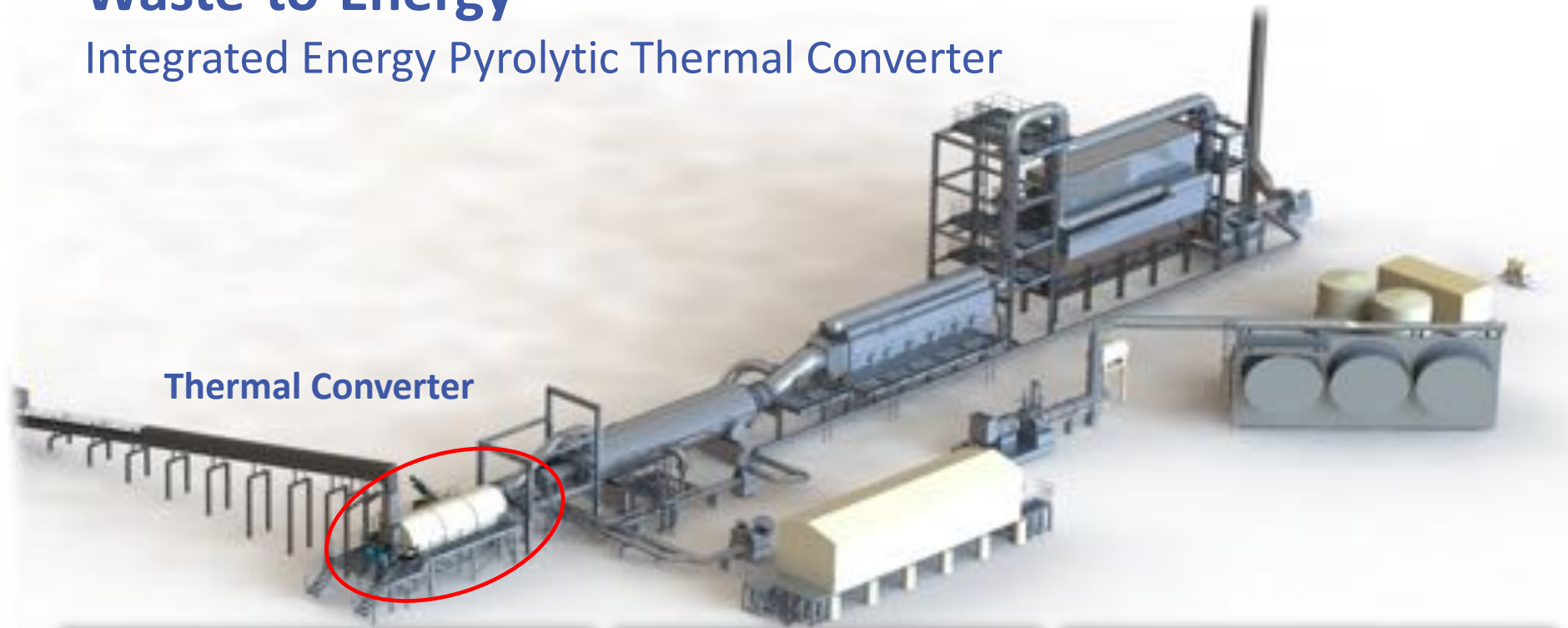
- MSW is processed to 2-inch minus with most of the metals removed and a moisture content that does not exceed 40% - a dryer may be required when moisture content of MSW is high
- Prepared MSW is heated using an external heat source.
- Energy is recovered from flue gases to assist with heating.
- MSW conveyed through the Pyrolytic Converter with a (2) screw augers & paddle system
- In this chamber, MSW is converted into syngas and char
- Syngas proceeds to the thermal oxidizer
- Char is collected from Pyrolytic Converter and sent to landfill or other



Waste-to-Energy

Integrated Energy Pyrolytic Thermal Converter

Thermal Converter



Waste Conversion-to-Energy

Thermal Oxidizer



Thermal Oxidizer

FLUE GAS
RECIRCULATION

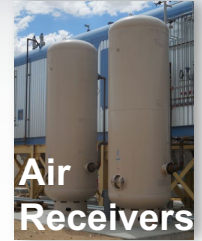
- Oxygen (air) is now added to the syngas
- Syngas from the pyrolyzer is combusted.
- Combustion products (flue gas) then proceeds to HRSG
- Flue gas can be recirculated to reduce emissions
- A portion of the heated combustion products can be returned to the pyrolyzer



Thermal Oxidizer

Waste Conversion-to-Energy

HSRG – Waste Heat Boiler

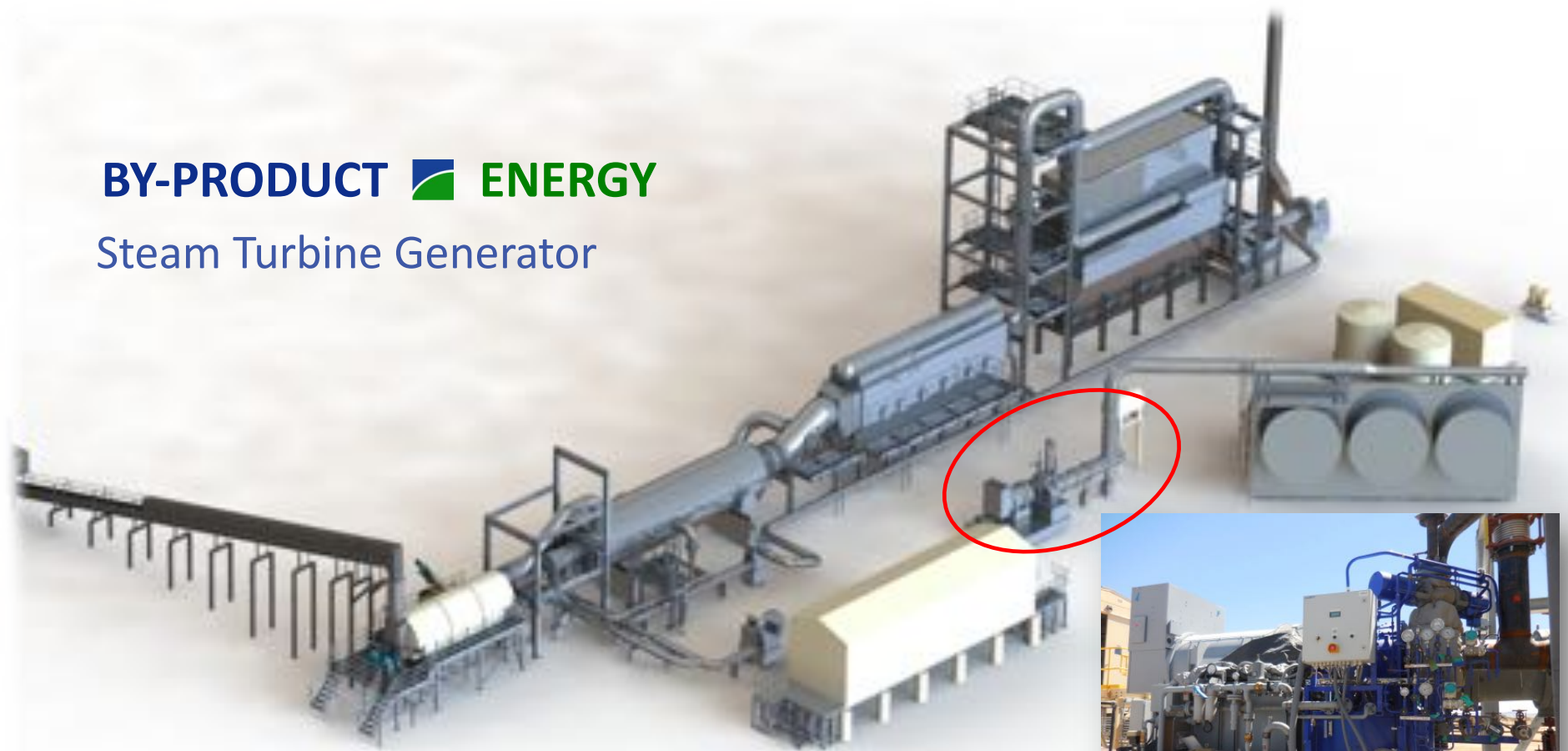


- The hot, fully combusted gases generate waste heat used to create steam.
- Feed water comes from a water treatment system (condenser, deaerator)
- Flue gases are then sent along for pollution control.
- Steam is sent to a steam turbine for production of electricity.
- Pressure is 700 psig. / Temperature is 750F.
- Boiler blow-down water will go to drain.
- Reverse Osmosis system will provide water for boiler water treatment.



BY-PRODUCT ENERGY

Steam Turbine Generator

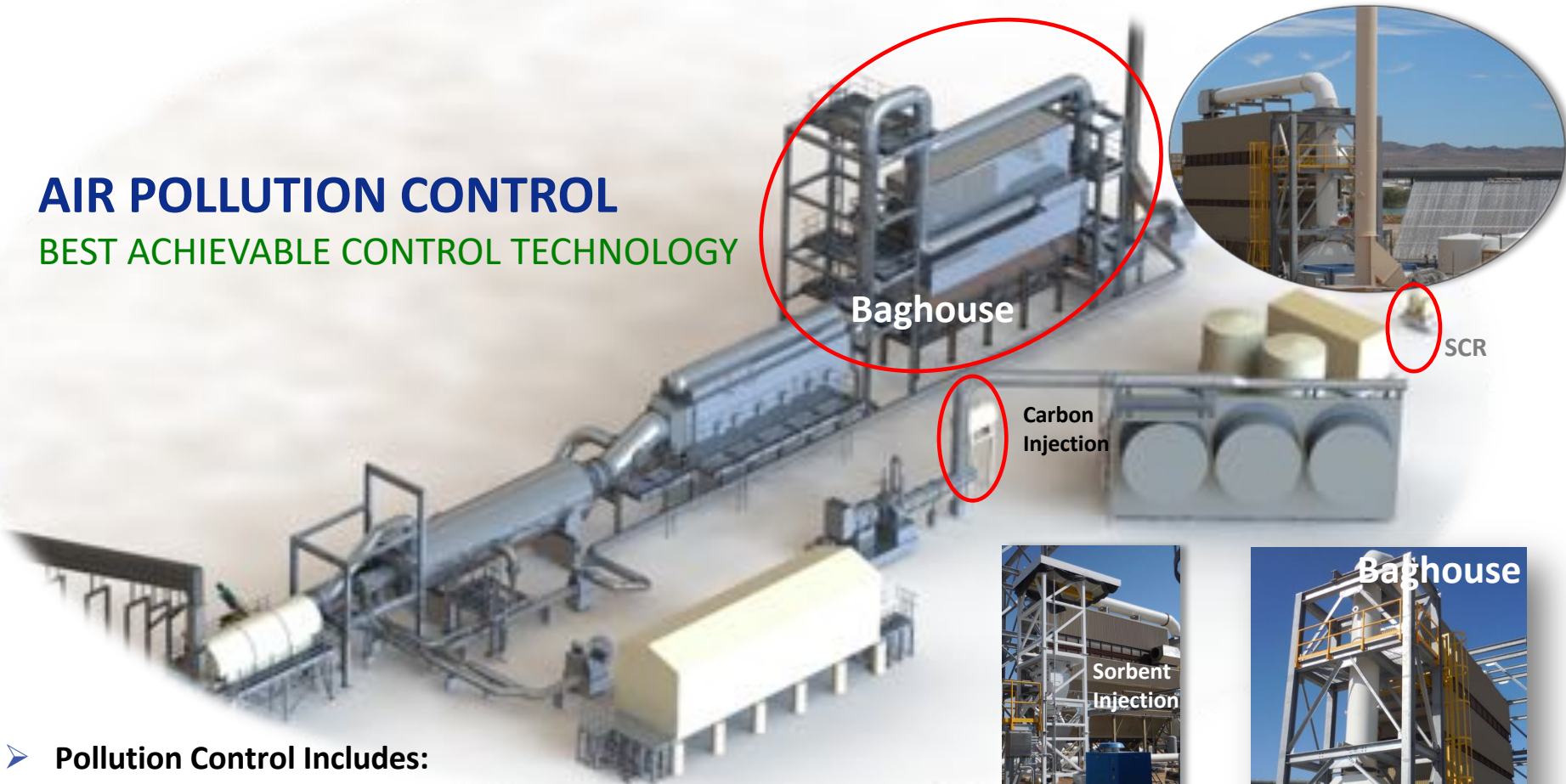


- Steam Turbine Generator will produce energy from the steam generated in the Waste Heat Boiler as part of this process. The energy produced will be used to power the plant as well providing energy for export to be used for operations on the military installation.

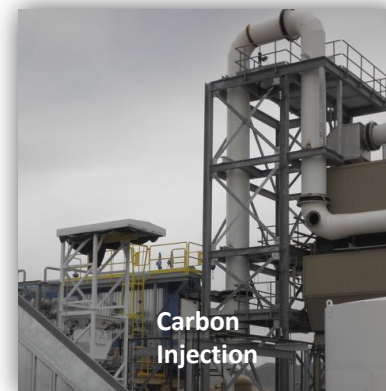


AIR POLLUTION CONTROL

BEST ACHIEVABLE CONTROL TECHNOLOGY

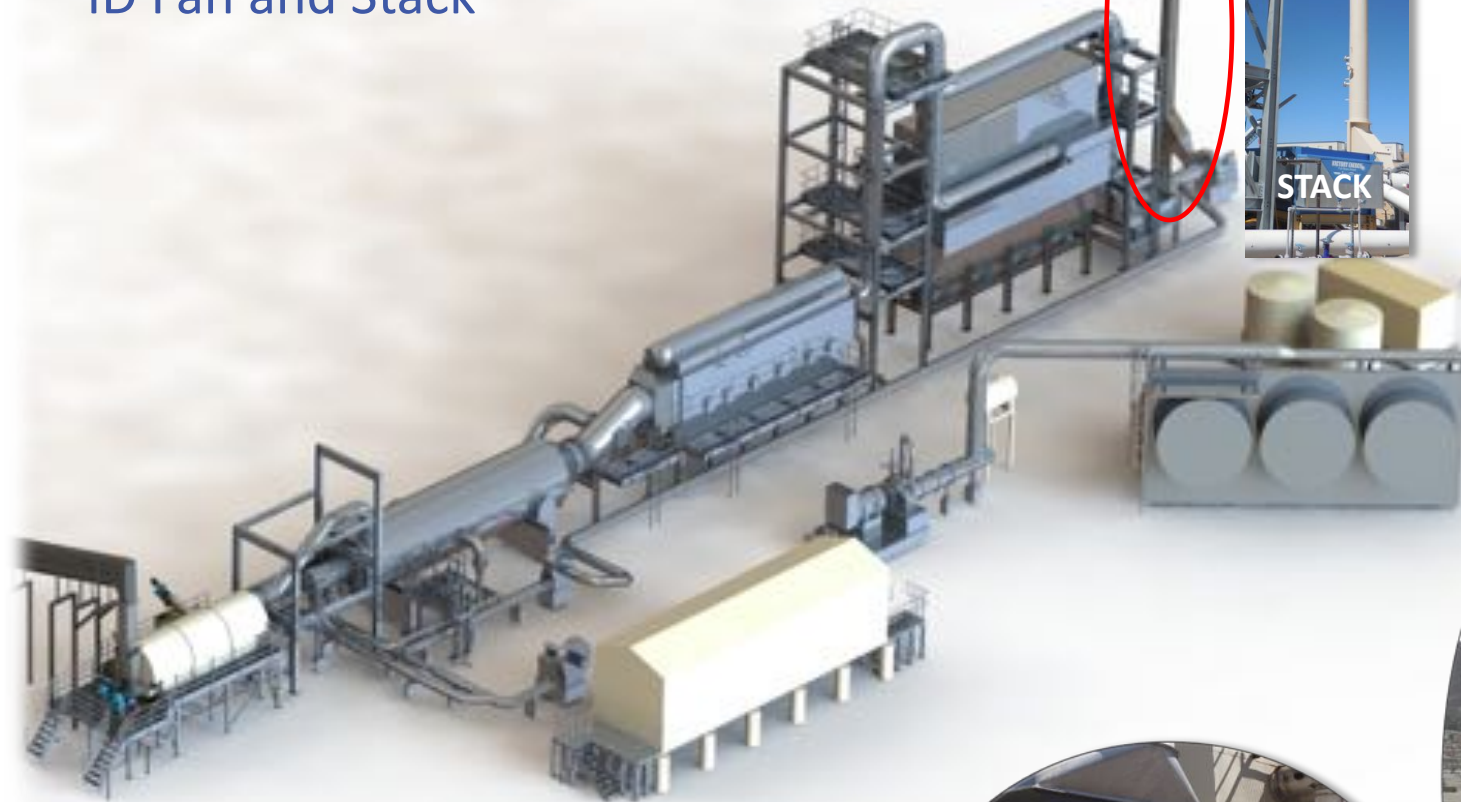


- **Pollution Control Includes:**
 - Baghouse - particulate removal
 - Dry scrubber - water spray cools the exhaust gases & removes pollutants - BACT
 - Activated carbon injection (mitigating furans & dioxins)
 - Selective Catalytic Reduction (SCR) - NO_x control
 - Mist eliminator - prevents carry-over of large droplets containing pollutants
 - Packaged system, purchased from a single vendor.



Waste Conversion-to-Energy

ID Fan and Stack



- The Induced Draft Fan (ID Fan) draws the combustion products through the system.
- No continuous emissions monitoring system on the stack is required for smaller plants. This will vary depending on the volume of waste processed each day and may be required as per local Air District.



Pyrolytic Waste Conversion

Air-Cooled Condenser



- Air-cooled condenser takes exhaust steam from the turbine outlet and condenses it into water for the water treatment system and eventual return to the boiler.
- Wet-Cooled Condensers can be used when water is readily available. This method of cooling is more efficient and can generate up to 12% more energy output.

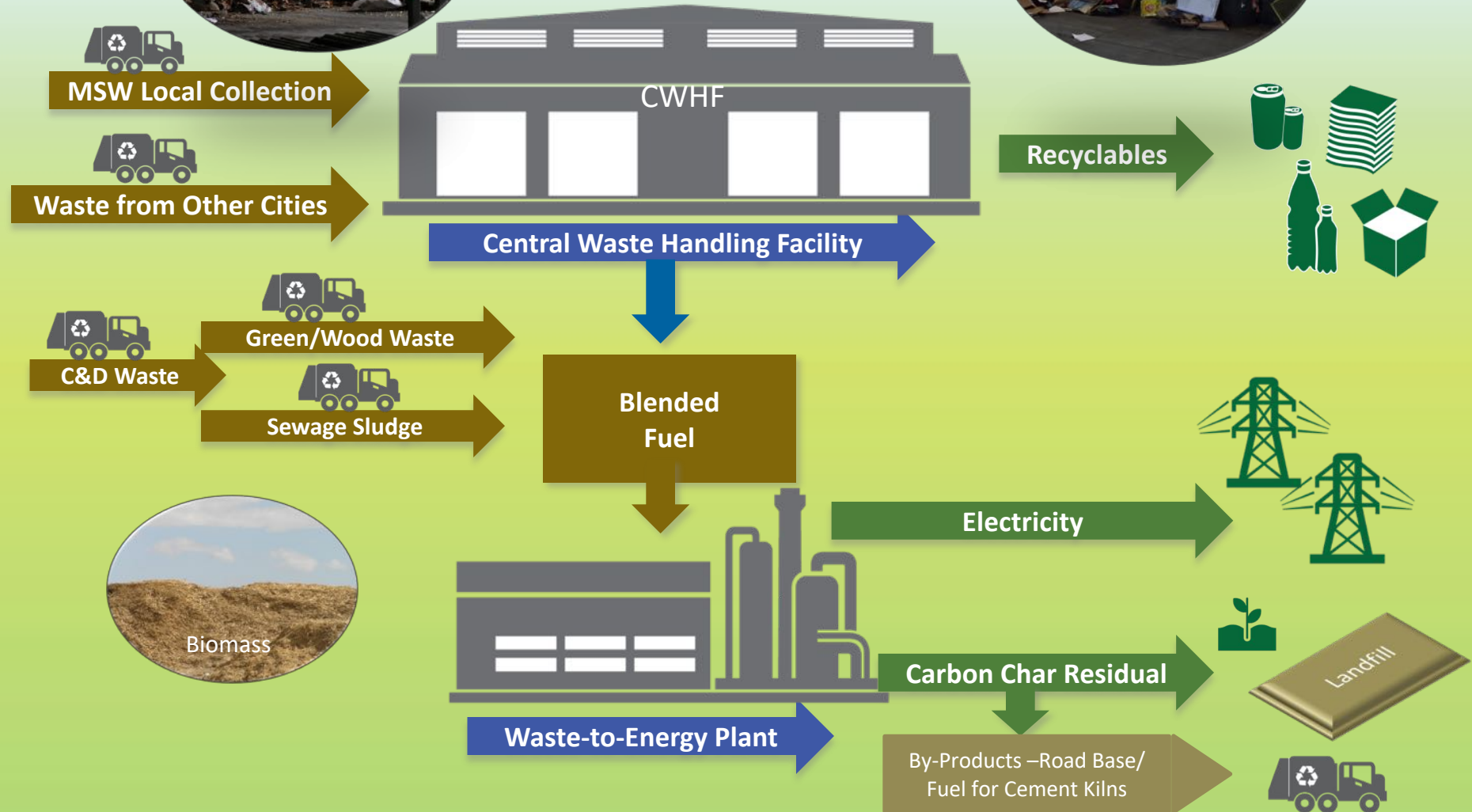


Pyrolytic Waste Conversion



Road to Net Zero Waste & Energy

General Process Flow Diagram



BY-PRODUCTS

REVENUE STREAMS AND SECONDARY MATERIALS FOR BENEFICIAL USE





The design and operation of the Waste Conversion Facility has the potential to have multiple revenue streams that could support the facility economically. These revenue streams need to be evaluated in an initial feasibility to determine the viability of a successful Waste Conversion Facility for a community.

Tipping Fees for the waste and the cost of electricity will drive the economics of a project, and the additional revenue streams for the additional recyclables, such as metals. Must be able to support the project. This is a major reason why a Feasibility Study can help in determining next steps based on economic evaluation and also in the best design to maximize the energy by-products (Electricity, District Heating and Uses for Steam)



FORT IRWIN, CALIFORNIA

STATUS OF CONVERSION TECHNOLOGY PROJECT

-  Developer was “Terminated” by the U.S. Army/Ft. Irwin at the end of 2016
-  Final determination of the Waste Conversion Plant took over a year to complete
-  WTE was dismantled in 2018 as part of the contract termination
-  Fort. Irwin still plans on building a Waste-to-Energy plant using a Conversion Technology – RFP issued April 2018 through the Defense Logistics Agency (DLA) Energy

Notice of Opportunity

National Training Center Fort Irwin (NTC Fort Irwin)

Energy Savings Performance Contract (ESPC) Task Order under the Department of Energy's (DOE),
Offered by the DLA Energy Solicitation: SP0604-18R-0413

(Notice of Opportunity was issued on April 5, 2018 and Proposals due May 7, 2018)

“NTC Fort Irwin is interested in pursuing the installation, operation, and maintenance of a Waste to Energy plant. The Government is pursuing an on-site Waste to Energy plant to realize energy savings as compared to the cost of the commercial utility electrical power. The ESCO will be responsible for the project design, installation, maintenance, repair and replacement, and operation, including the distribution of the generated electricity from the Waste to Energy plant to the installation through the Southern California Edison (SCE) transmission lines. The ESCO shall coordinate approval and operating permitting from all involved regulatory agencies and utility company. “

“NTC Fort Irwin produces approximately 14,000 tons of municipal waste. Due to it being a remote and isolated installation, NTC Fort Irwin is one of few Army installations that owns and operates its own landfill through Government Owned, Contractor Operated (GOCO) operation.”

“NTC Fort Irwin is interested in a Waste to Energy plant that will consume all solid waste, used tires, medical waste, and some hazardous waste produced by the installation within the fence line of its 460 acres of permitted landfill.”

ENVIRONMENTAL BENEFITS FOR WASTE CONVERSION TO ENERGY

**AN INTEGRATED SOLUTION WITH CONVERSION TECHNOLOGIES
WILL HAVE NET AVOIDED GREENHOUSE GAS EMISSIONS**

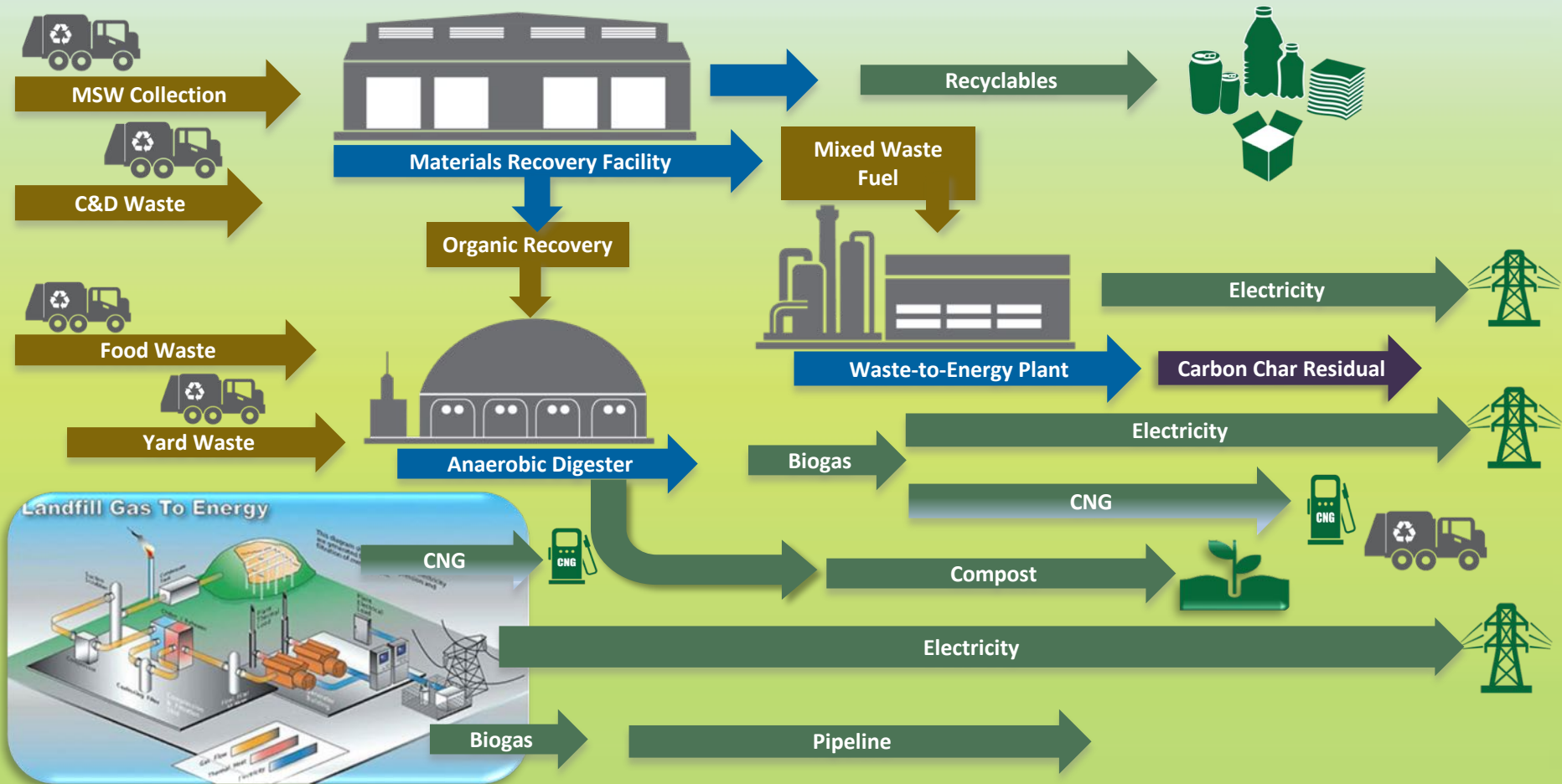
With this project, Fort Irwin will be taking steps toward the U.S. Army's "Net Zero" initiatives; A Waste Conversion Facility will help achieve these goals of Net Zero Waste, Energy and Water.

An Integrated Materials Recovery Facility (MRF) with a Conversion Technology will achieve a net reduction in cumulative greenhouse gas emissions as compared to landfilling post-recycled residuals from a mixed-waste MRF. This project is limited by the volume of waste generated each day, and therefore, will not have the benefit of integrating multiple technologies.

However, there are opportunities for communities to strive for an integrated solution using several Conversion Technologies that will optimize the reduction in GHG emissions and maximize the energy outputs.

Zero Waste Integrated Solution

Community-Based Waste Conversion Facility





WASTE-TO-ENERGY

THE ROAD TO ZERO WASTE AND A STEP TOWARD ENERGY INDEPENDENCE

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