

Waste Management



إدارة المخلفات

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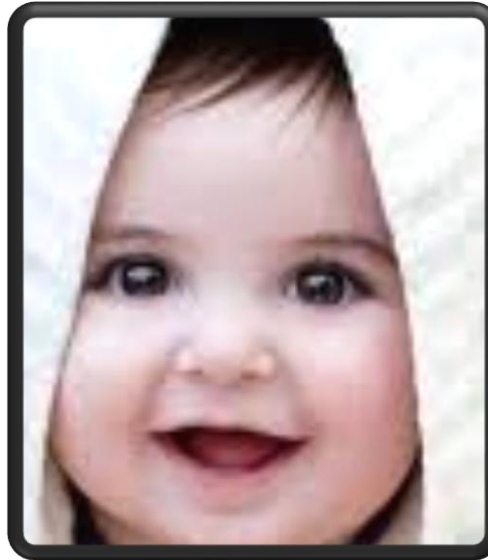
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Lecture Strategy



Please



1- Smile



2- Respect the
lecture time

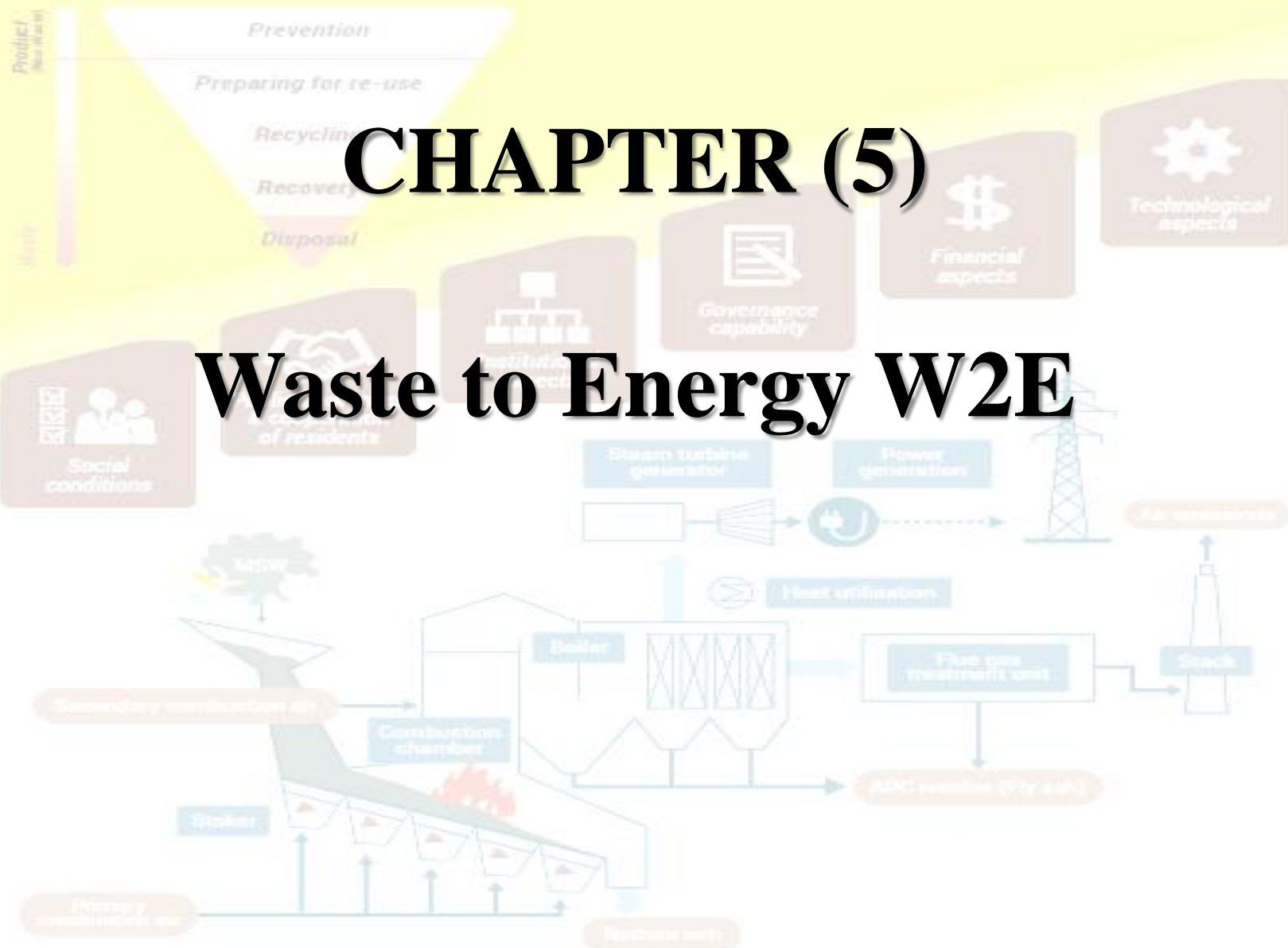


3- Make your mobile Silent



CHAPTER (5)

Waste to Energy W2E



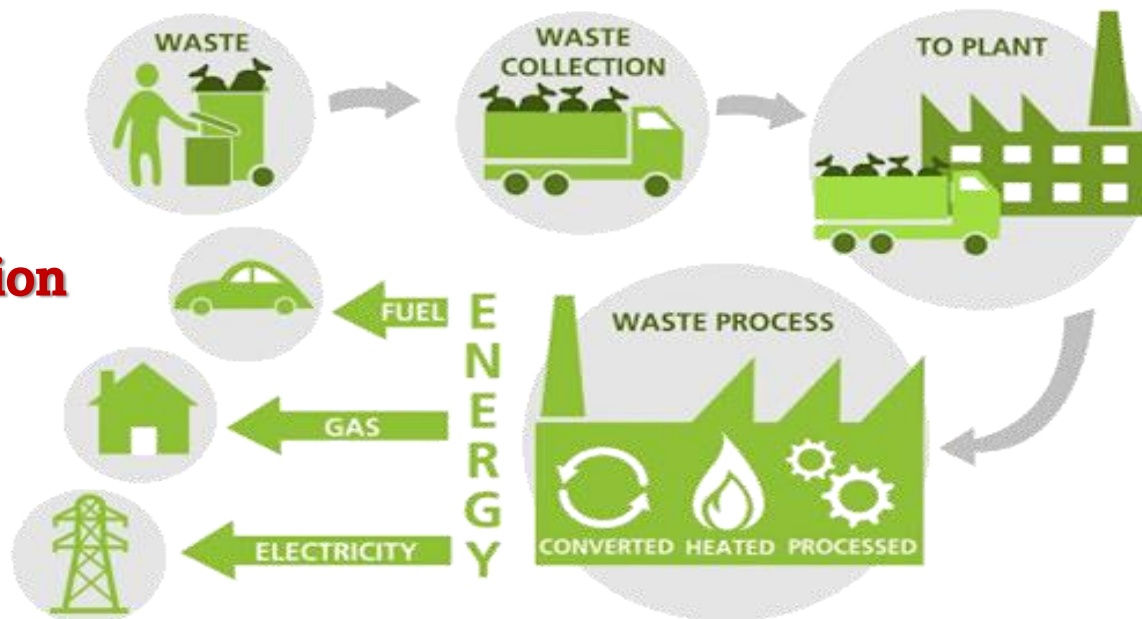
What is Waste to energy W2E?



- **Waste-to-Energy (WtE)** refers to processes that generate energy from waste.
- Among various WtE technologies, **Incineration**, is the most common and established.
- Focus on incineration: converting waste to energy through combustion.
- Provides an alternative to landfills while generating electricity or heat.

Benefits of WTE:

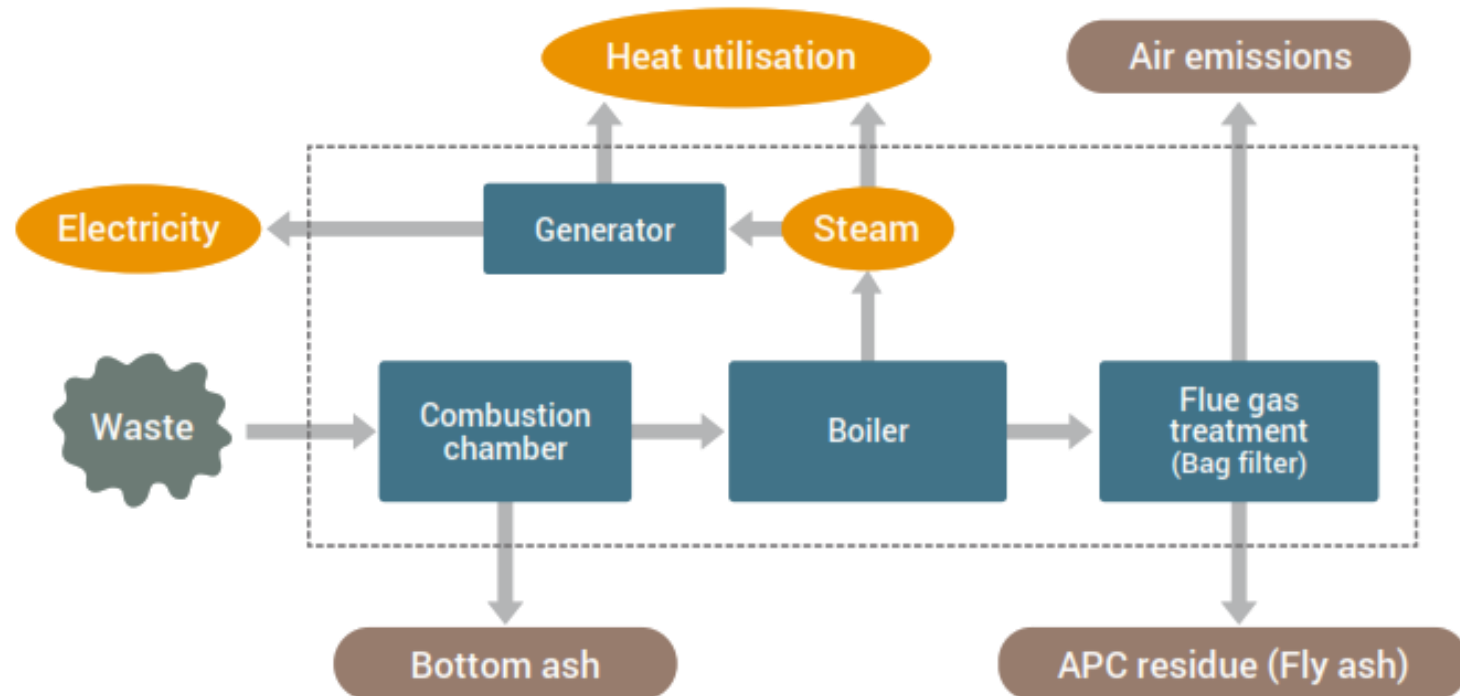
- **Waste reduction**
- **Renewable energy production**
- **Reduction of landfill usage**



What is Incineration?



- **Incineration involves high-temperature combustion of waste materials.**
- **Converts municipal solid waste (MSW) into energy (electricity or heat).**
- **Reduces the volume of waste by up to 90%.**
- **Can significantly reduce landfill usage.**
- **Typically involves advanced filtration to remove harmful pollutants.**

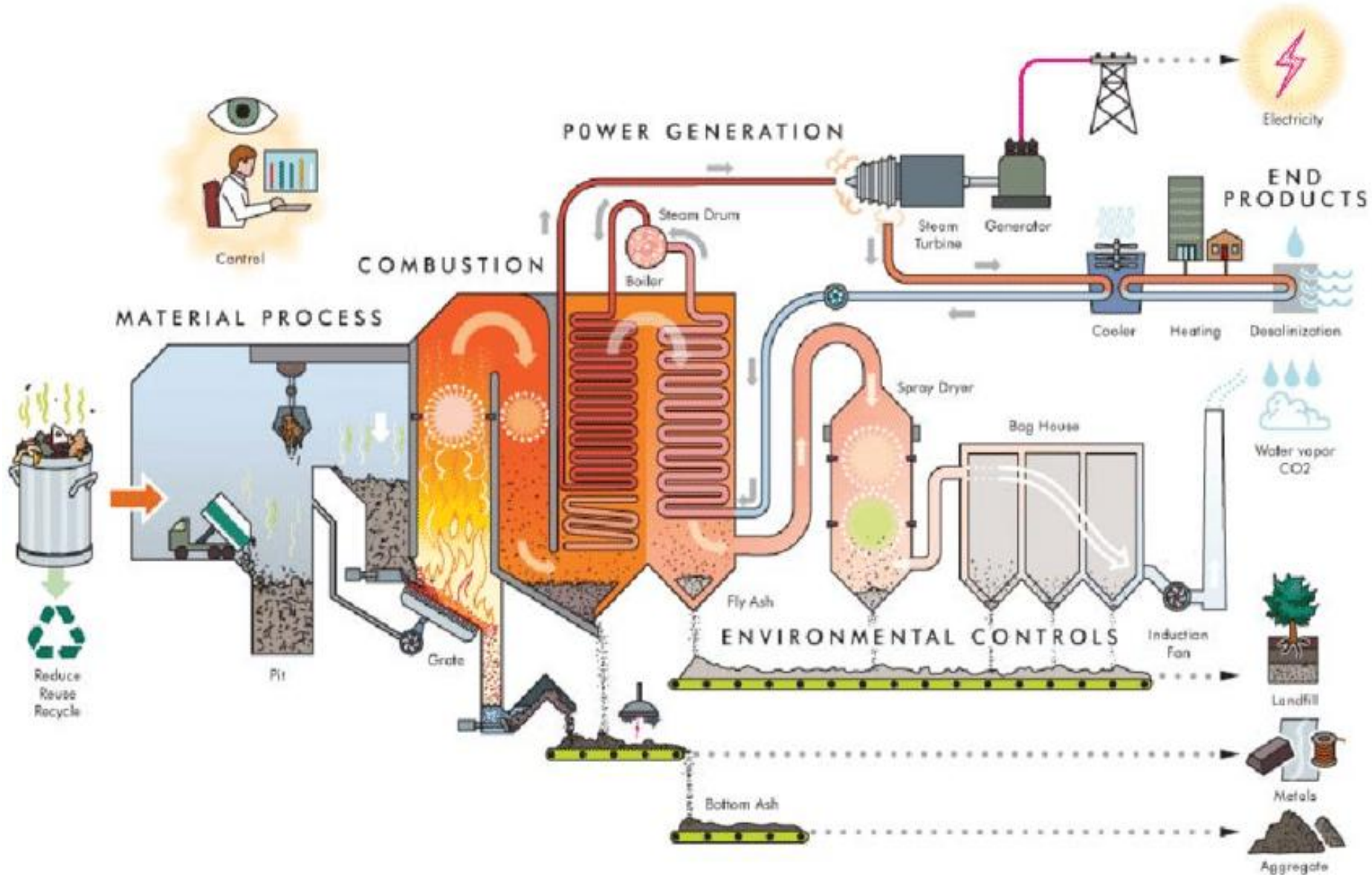


What is Incineration?



- **Waste Collection and Sorting:** Separate recyclables from waste.
- **Combustion:** Burn the remaining waste at 850-1,000°C in a furnace.
- **Energy Recovery:** Heat produces steam, driving turbines to generate electricity.
- **Flue Gas Treatment:** Remove pollutants from exhaust gases.
- **Ash Handling:** Collect bottom ash for disposal or recycling.

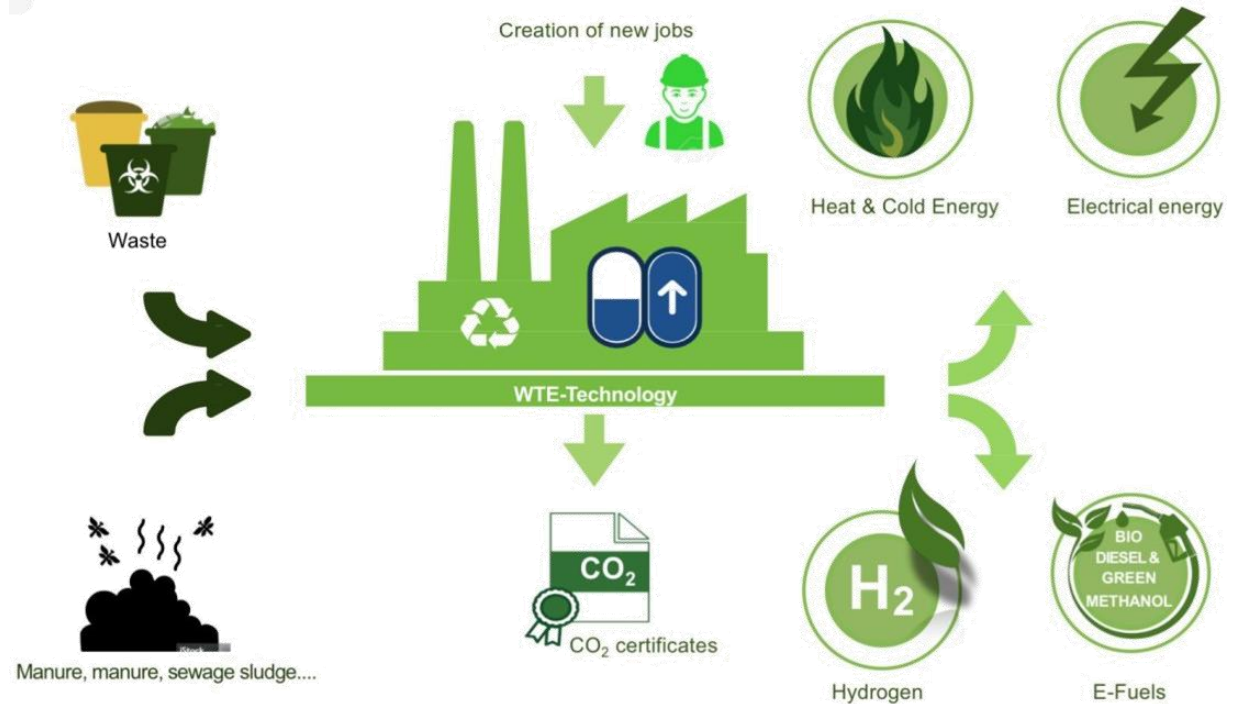
What is Incineration?



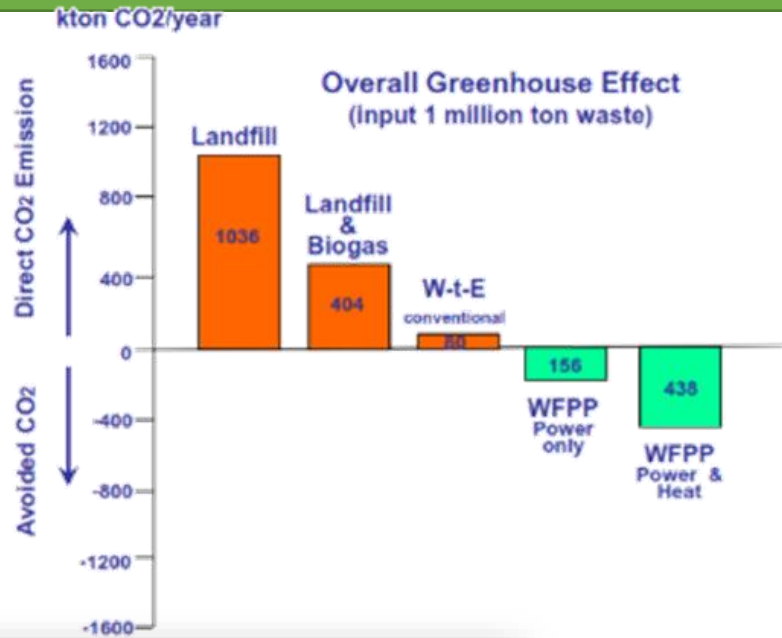
Environmental Benefits of WTE



- Reduces dependence on fossil fuels by providing renewable energy.
- Lowers greenhouse gas emissions compared to landfills.
- Reduces the amount of waste sent to landfills, decreasing environmental contamination.
- Helps in managing organic waste, which can produce methane if left untreated in landfills.



Environmental Benefits of WTE



Economic Benefits



- Energy production from waste can reduce energy costs.
- Creation of jobs in waste management and energy production sectors.
- Reduction in the costs associated with landfills, such as land and maintenance.
- Contribution to the circular economy by recycling materials and creating products.

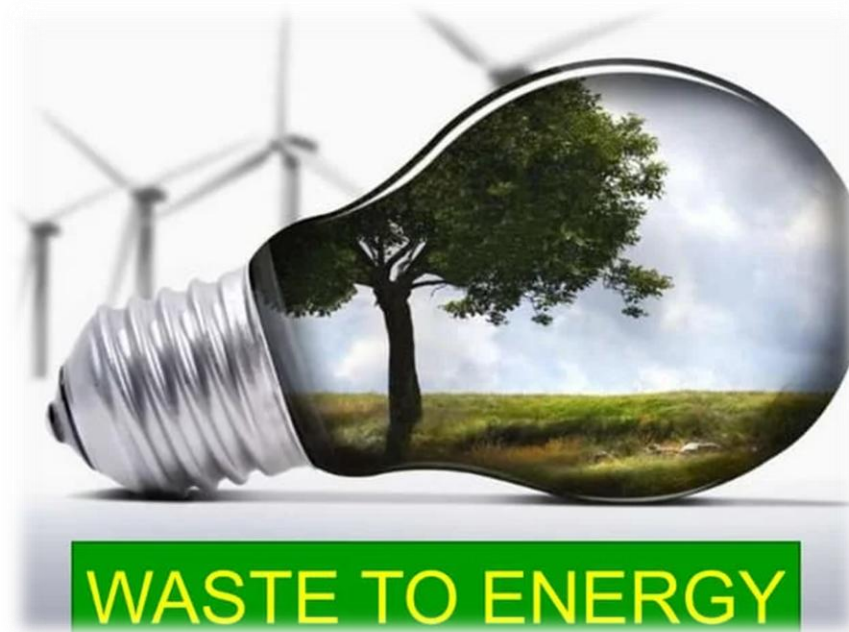


- Job Creation
- Reduced Reliance on Fossil Fuels
- Compliance with Waste Reduction Targets
- Community and Public Health

Challenges of Waste to Energy



- Public resistance to waste incinerators.
- High initial investment in technology and infrastructure.
- Pollution concerns (e.g., dioxins from burning waste).
- Competition with recycling programs.
- Limited availability of waste material for energy production.





Challenges of Waste to Energy



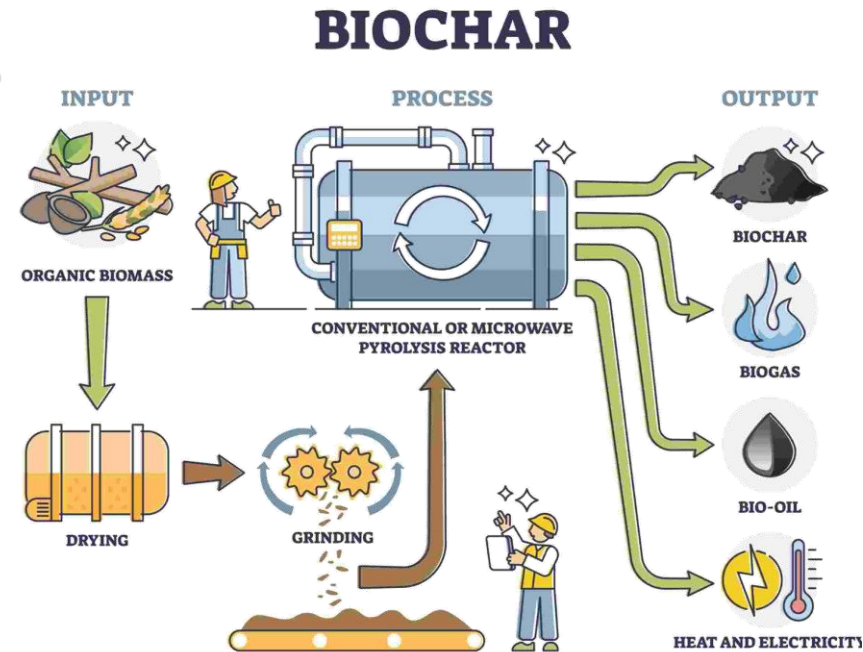
Waste to Energy



Pyrolysis



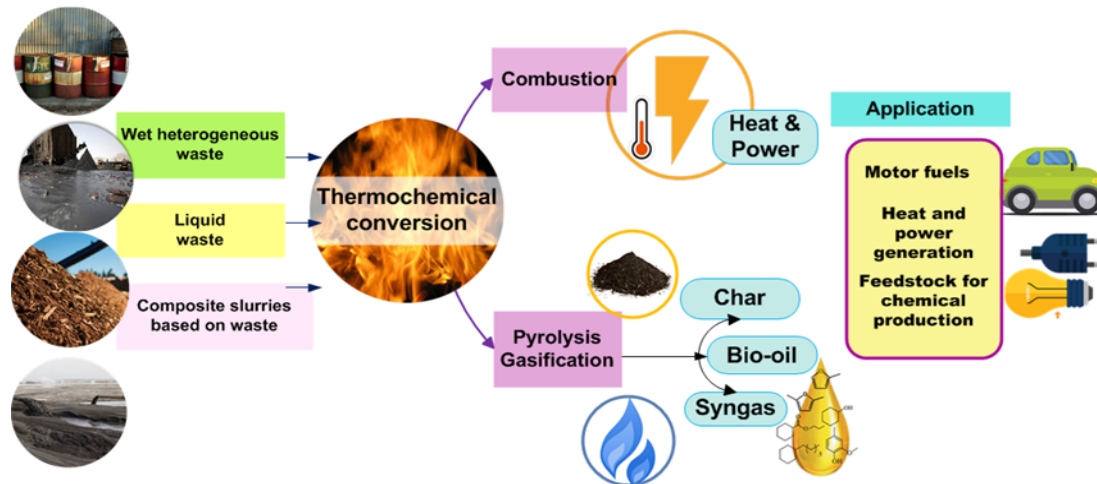
- Pyrolysis is a thermal decomposition of waste material in the absence of oxygen.
- It converts organic waste (biomass) into valuable products: bio-oil, gas, and charcoal.
- It is a promising WtE technology because of its ability to handle diverse waste streams.
- Pyrolysis offers an efficient and cleaner alternative to conventional incineration.



How Does Pyrolysis Work?



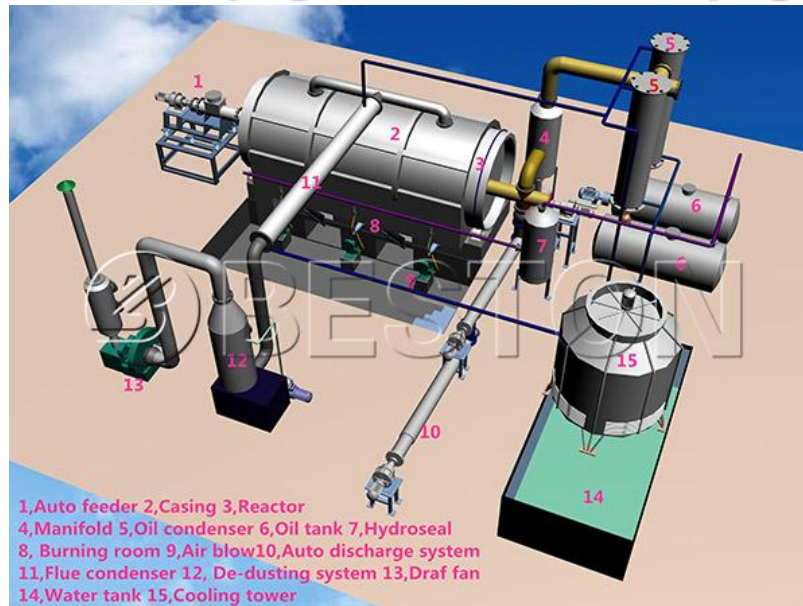
- 1. Heating of Waste:** Waste is heated in a reactor to high temperatures (300-900°C) without oxygen.
- 2. Thermal Decomposition:** Organic materials break down into smaller molecules.
- 3. Product Separation:** The products include solid (charcoal), liquid (bio-oil), and gas (syngas).
- 4. Energy Recovery:** The syngas can be used for generating electricity or as fuel.



Components of a Pyrolysis System



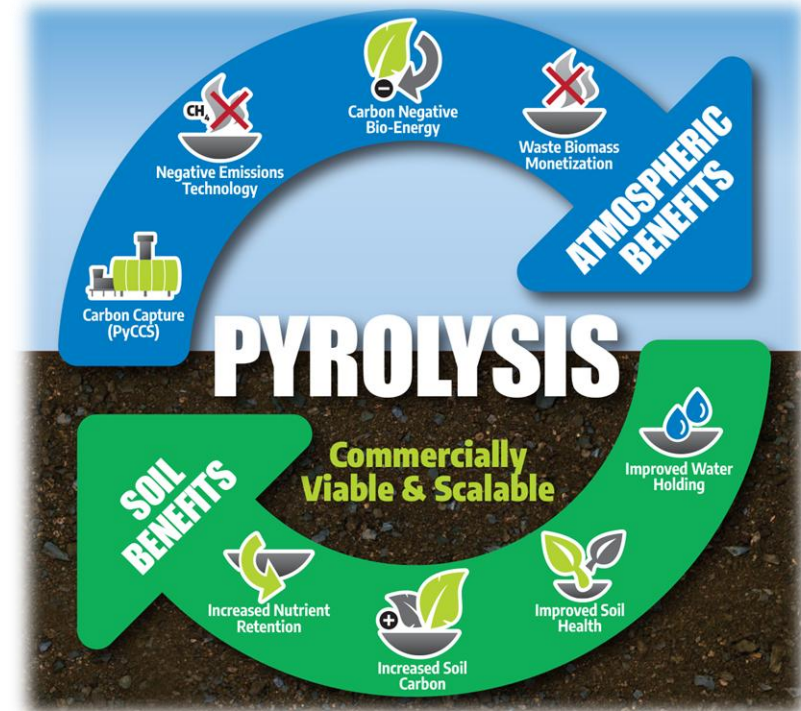
- **Reactor:** Where the waste is heated in the absence of oxygen to break down into smaller molecules.
- **Condensation Unit:** Used to cool the vapors and convert them into liquid bio-oil.
- **Gas Cleaning System:** Removes impurities from the gas produced (syngas).
- **Energy Recovery System:** Utilizes syngas for electricity generation or heating



Benefits of Pyrolysis



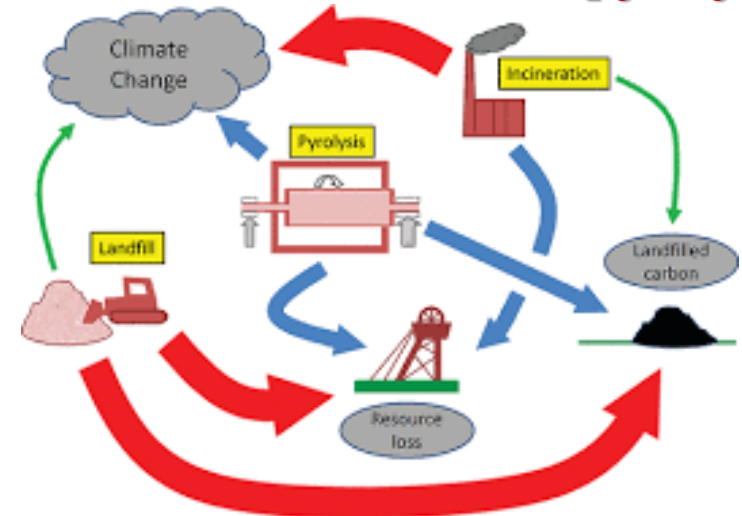
- **Waste Reduction:** Reduces the volume of waste by converting it into valuable products.
- **Energy Recovery:** Generates renewable energy through syngas.
- **Carbon Sequestration:** Charcoal produced can be used for carbon storage.
- **Cleaner Alternative:** Lower emissions compared to incineration



Environmental Considerations



- **Air Emissions:** Pyrolysis is cleaner than incineration but still produces gases that need treatment.
- **Bio-oil Handling:** Bio-oil can be corrosive and requires careful storage and handling.
- **Carbon Footprint:** Pyrolysis can reduce the carbon footprint compared to landfilling or incineration.
- **Waste-to-Product:** By converting waste into bio-oil and charcoal, pyrolysis supports circular economy principles.



Challenges of Pyrolysis



- **High Capital Costs:** Establishing pyrolysis plants is capital intensive.
- **Product Quality Control:** Variability in feedstock can impact the quality of bio-oil.
- **Energy Input:** Pyrolysis requires significant energy input for heating the waste material.
- **Public Perception:** Some concerns about the long-term viability and safety of pyrolysis systems.





*Thank
you*

