

Sourcing and production of waste into energy systems



SOURCING AND PRODUCTION OF WASTE INTO ENERGY SYSTEMS

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In this video you will learn:

- ❑ Background and introduction to waste management
 - ❑ Sources and categories of waste
 - ❑ Waste management system hierarchy
 - ❑ Production of waste into energy systems



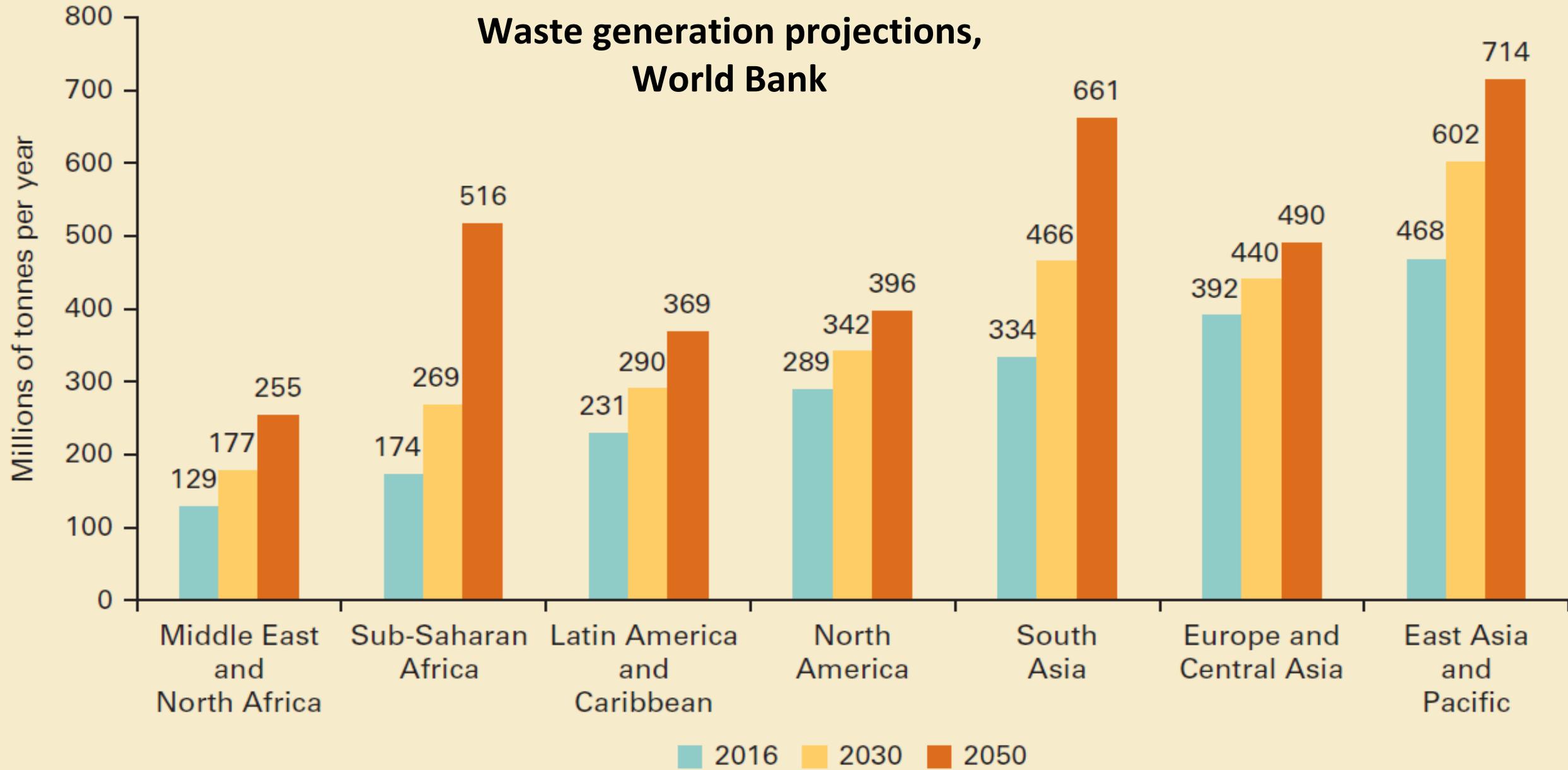
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Background and introduction to waste management

- ❑ According to the World Bank (2022), global waste generation is currently estimated at about 2.23 billion tonnes annually.
- ❑ In Africa, more than 125 million tonnes of municipal solid waste is generated per year.
- ❑ 90% of waste in developing countries is dumped poorly.
- ❑ Mismanaged waste = GHG emissions (methane) and health risks (diseases).
- ❑ Waste-to-energy (WTE) systems can reduce the volume of waste by about 85-95%.
- ❑ WTE systems have the capacity to produce between 500-1000 kwh of electricity.

Waste generation projections, World Bank



Waste and categories

❑ Waste is defined as any substance that has been discarded after its primary use.

❑ Categories of wastes

- Municipal Solid Waste (MSW),
- Agricultural waste,
- Hazardous and non-hazardous waste,
- Wastewater,
- Medical waste



Sources of wastes

Mining



- waste rock
- tailings
- mine water
- chemicals
- and others

Agriculture Forestry



- obsolete pesticides and fertilizers
- organics
- plastics and containers
- manure
- slaughter waste
- and others

Industry



- textiles
- plastics
- chemicals
- ash
- nuclear waste
- and others

Household, commercial and government bodies



- municipal solid waste
- electronics
- medical waste
- tyres
- and others

Construction Demolition



- concrete
- plastic
- wood
- metal
- glass
- and others

Wastewater treatment



- sewage sludge
- solid waste
- chemicals
- and others

Integrated and Sustainable Solid Waste Management (ISSWM)

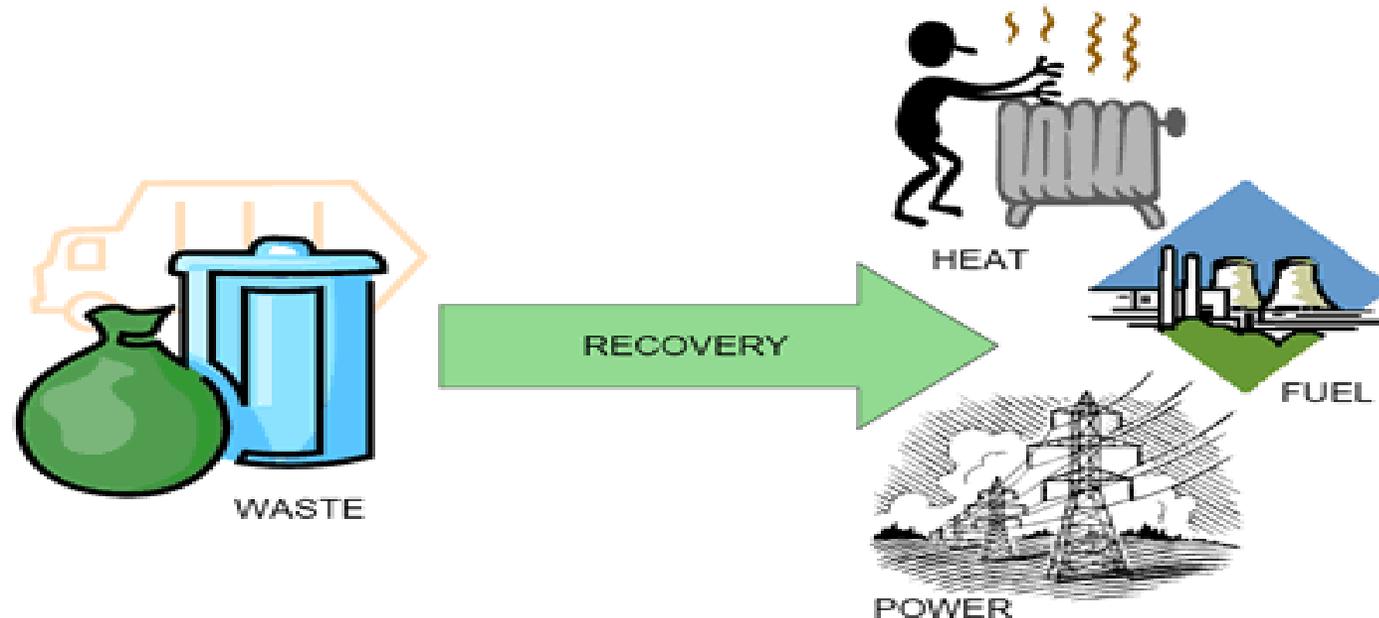
- The waste management hierarchy is based on the most preferred option to the least preferred option starting from the top



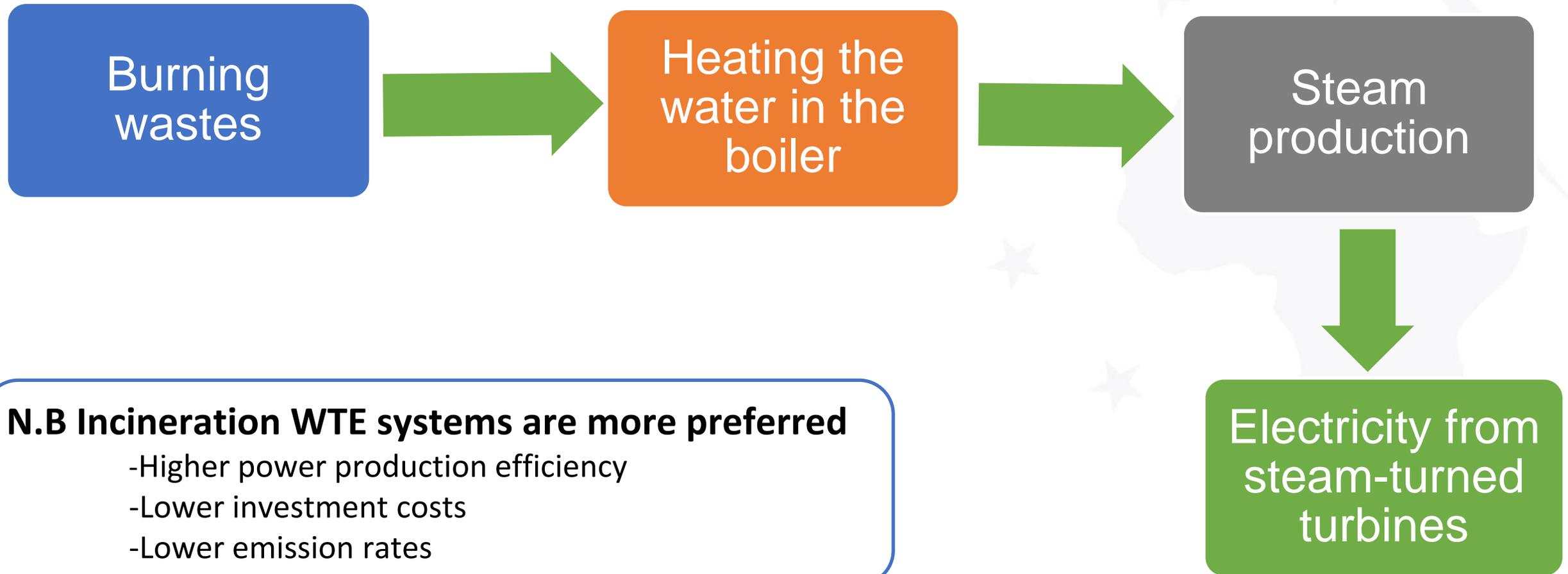
Energy Recovery:

Production of waste into energy systems

- ❑ Generation of energy (electricity and heat) from waste = **WTE**
- ❑ Common waste into energy systems include; **Incineration**, **Gasification** and **Anaerobic digestion**



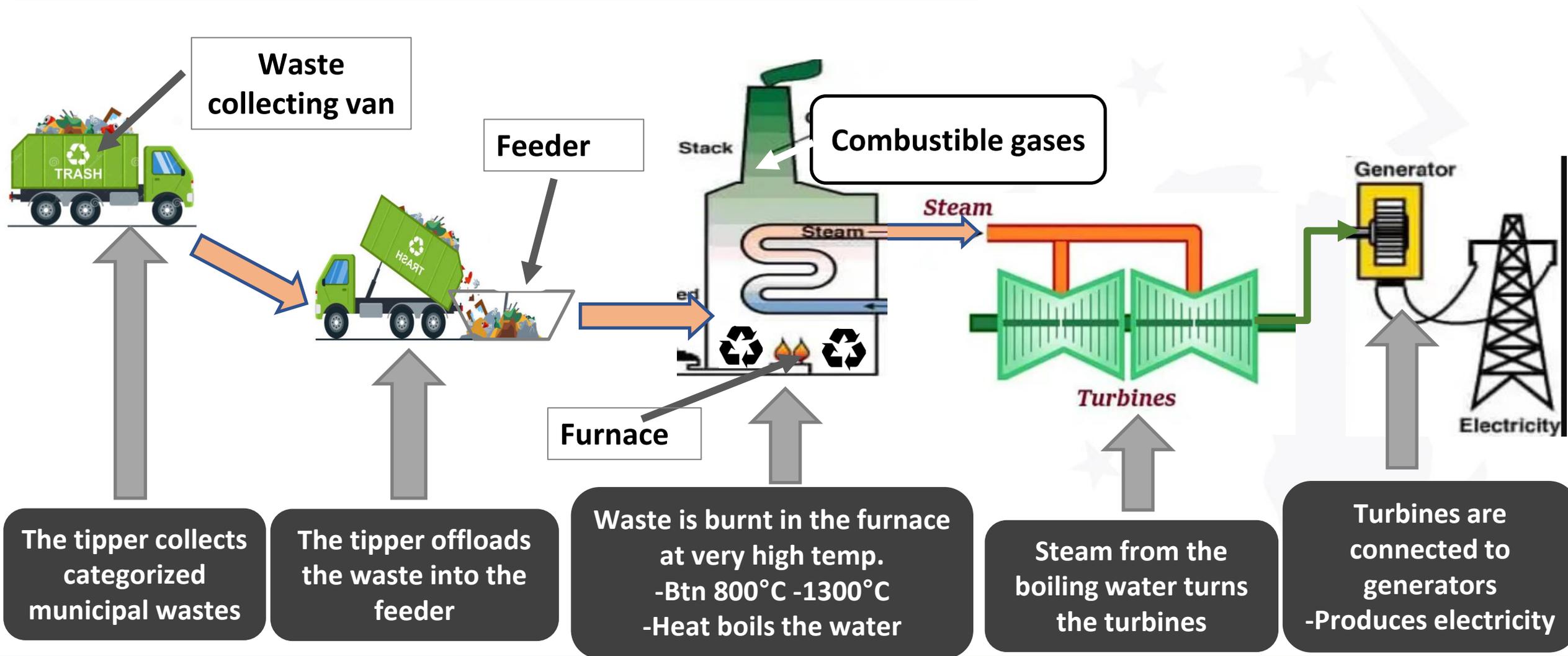
All incineration WTE systems have one operating principle



N.B Incineration WTE systems are more preferred

- Higher power production efficiency
- Lower investment costs
- Lower emission rates

1. Mass burn WTE system



2. Gasification WTE Production Systems

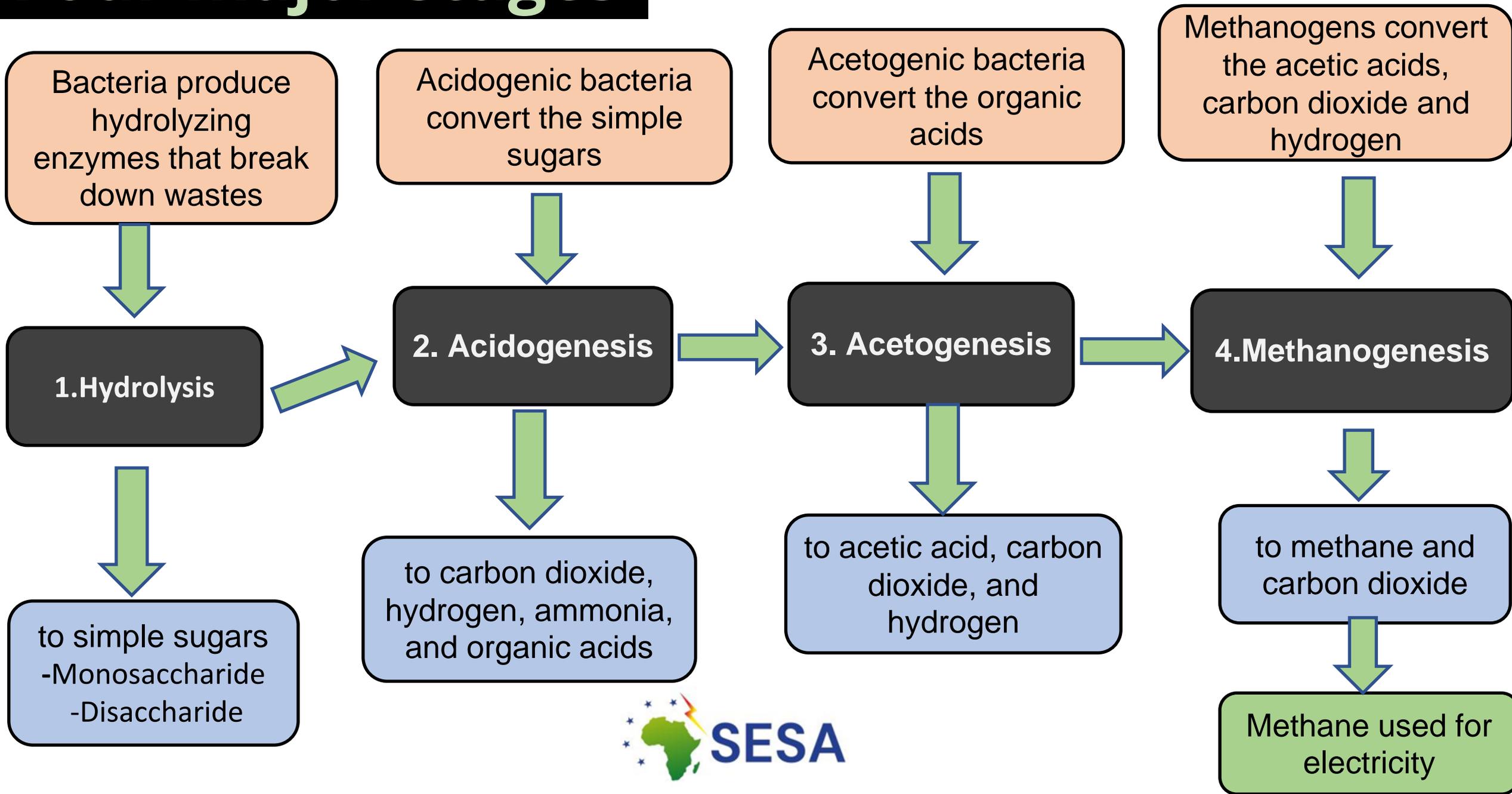
- ❑ Gasification converts MSW to a usable synthesis gas, or syngas.
- ❑ Gasification is a unique chemical process
 - Transforms a carbon-based material, such as MSW or biomass into energy
 - But no actual burning of wastes is involved
- ❑ This reaction combines carbon-based materials (known as feedstocks) with small amounts of air or oxygen breaking them down into simple molecules such as synthetic gas or syngas.



3. Anaerobic digestion

- ❑ Anaerobic digestion (AD) is the process of breaking down plant or animal matter by microbial action in the absence of air, to produce methane.
- ❑ This methane can be captured and burned to produce heat, electricity or a combination of the two.
- ❑ It is used widely in the agricultural sector in the form of small on-farm digesters producing biogas to heat farmhouses and other farm buildings
- ❑ The main types of organic material feedstock used in AD are:
 - Sewage sludge
 - Farm slurry
 - Municipal solid waste (MSW)

Four major stages



Summary

In this presentation we have learnt that:

- Waste Management is a global challenge.
- Sources of waste include; industries, commercial sites, community activities and among others.
- Waste can be a source of energy (heat and electricity).
- Common waste to energy systems include; incineration (mass burn system, moving grate incineration), gasification and anaerobic digestion
- These waste to energy systems are relatively cheap, clean and produce more energy and reduce waste in landfills.

I hope you found this information useful

Thank you!

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