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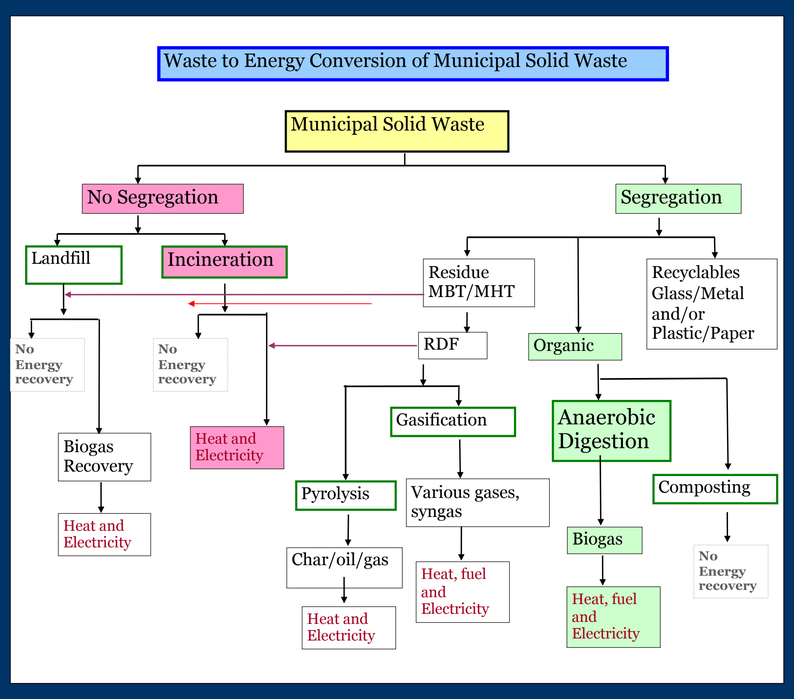
# Life Cycle Assessment of Waste to Energy Processes: Incineration and Anaerobic Digestion

Energy Recovery Facility at Marchwood (Incineration) ©Anuda Tawatsin

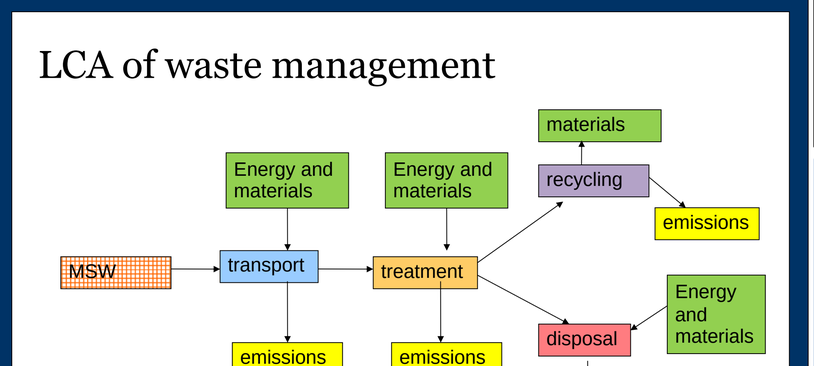
## Research Aim

1. To determine which parameters exert influences on energy performance and environmental impacts for decision-making of energy recovery from municipal solid waste through Incineration and Anaerobic Digestion, by using Life Cycle Assessment with WRATE software.
2. To use this understanding to create a simplified assessment and screening methodology.




## Life Cycle Assessment (LCA)

LCA is an environmental management tool that evaluates inputs, outputs and potential environmental impacts of a product or service or system for the whole life cycle (Mcdougall et al., 2001)




## Waste Generation

| Household Waste | kg/day/ person | Mil. tonnes/ year |
|---|---|---|
| England (Defra, 2012) | 1.18 | 22.9 |
| Thailand (Pollution Control Department, 2012) | 0.65 | 15.98 |

## Waste to Energy (WtE)

Waste can be utilised for energy through processes such as Incineration with energy recovery or Anaerobic Digestion

## Research Questions

1. What are the environmental impacts of these WtE processes?
2. How much energy is recovered?

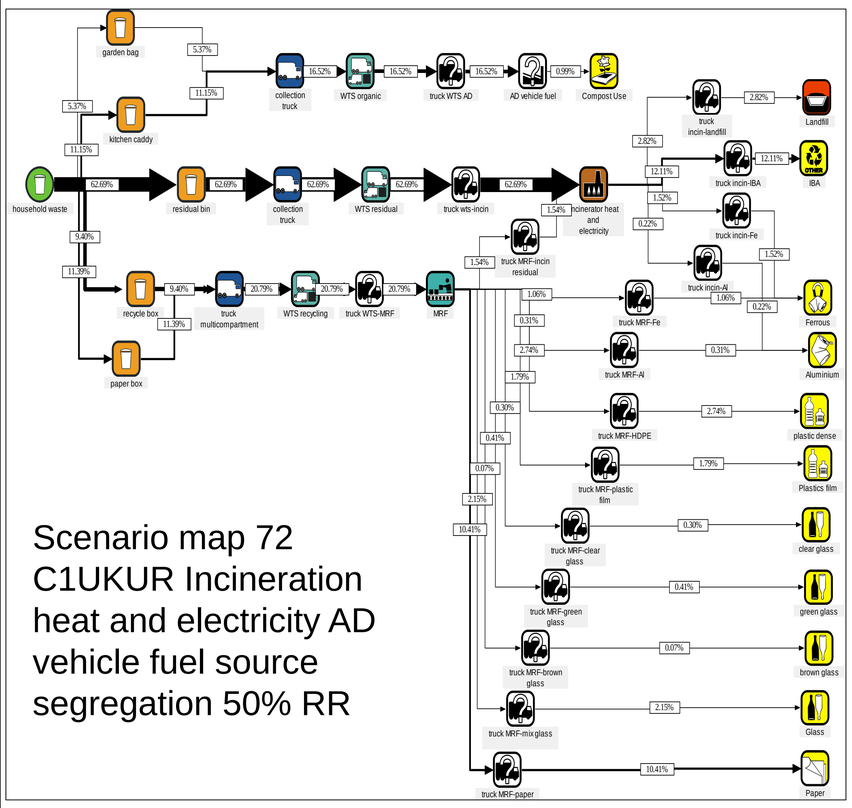
## Methods

1. Conduct LCA on 4 sets of scenarios for 4 different areas, UK Urban area, UK Rural area, Thailand Urban area and Thailand Rural area.
2. Rank the scenarios and create a simple decision making tool

## Scenario planning

From the 4 areas, 422 scenarios were created by alternating the following parameters;

1. WtE process (Incineration/ AD/ combination of both)
2. Energy recovery type (Electricity/Heat/ CHP/ Vehicle Fuel)
3. Recycling Scheme (No recycling/ Post Process recycling/ Post collection recycling/ Source Segregation)
4. Recycling Rate (25%, 43%, 50%)




Scenario map 72 C1UKUR Incineration heat and electricity AD vehicle fuel source segregation 50% RR

## Results

The highest ranking scenarios for energy recovery of 3,515.3 MJ per person are in Thailand Urban area '28 C1 Incineration for heat and Anaerobic Digestion for vehicle fuel with no recycling' and '32 C1 Incineration for heat and Anaerobic Digestion for vehicle fuel with post process recycling'

Anaerobic Digestion Plant at Ludlow ©BiogenGreenfinch

## Results (cont.)

The highest ranking scenarios for environmental impact :
-For UK urban area is 09 IN UKUR Incineration for heat and electricity Post collection recycling
-For UK rural area is 60 C1 UKRU Incineration for heat and electricity and Anaerobic Digestion for vehicle fuel Post collection recycling
-For Thailand urban area is 14 IN THUR Incineration for heat Source segregation 34% RR
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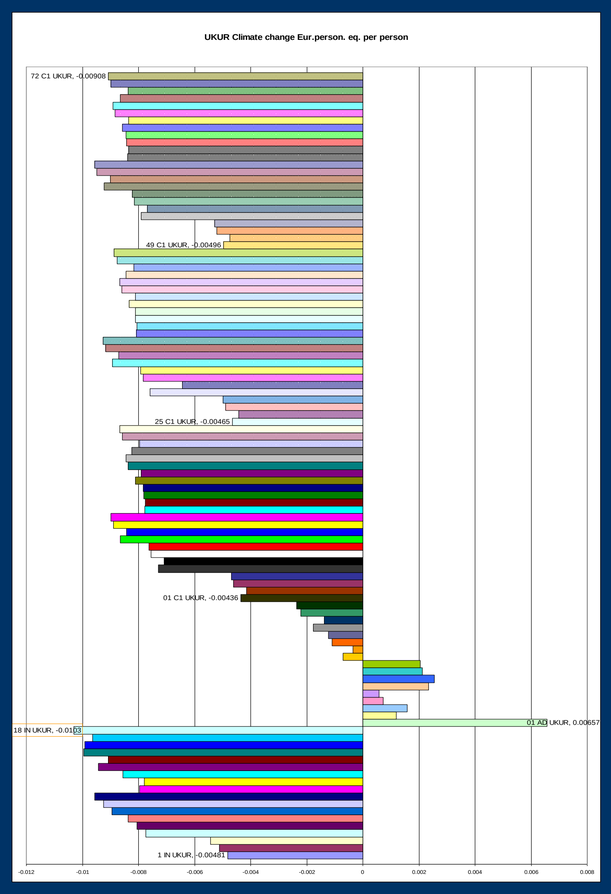


The parameters exerting the greatest influence in order are; 1) WtE technology 2) Recycling scheme with Recycling rate as a subset 3)Energy Recovery type.
Population density also affects the outcome, Electricity mix and waste composition are the main varying parameter that WRATE uses so both greatly affect the results.

For source segregation scenarios to rank higher than post collection recycling scenarios the capture rate must be very high to almost approaching 100% so that the amount of materials recycled can offset the burdens.

***References***
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