The use of LCA within the Environment Agency

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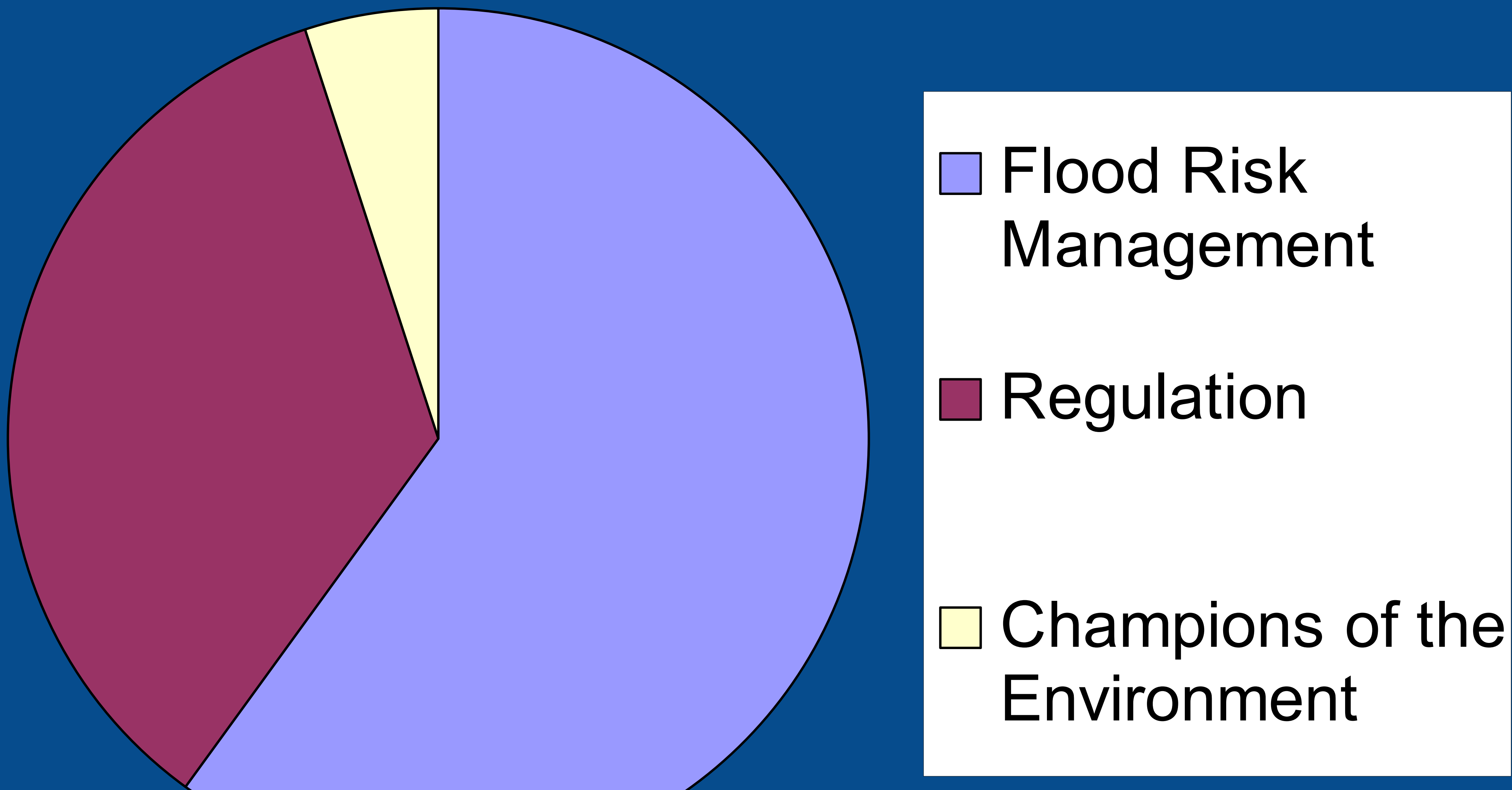
Outline

- What does the Agency do & how does Science fit?
- Questions asked of us in Science
- Examples of LCA use
  - Pressures and challenges of using LCA
  - Importance of Stakeholder Engagement
  - Messages that we give with results

What does the Agency do?



hat questions do we answer in Science?

- External Policy Makers
  - How is this policy going to affect the environment?
  - What is the better environmental option?
  - Is the EU position environmentally sound?
  - A pressure group is claiming this. Is it true?

- Internal Policy Makers (HO Policy)
  - Can you provide evidence to support this policy?
  - What will be the effect of this regulation?
  - How should we advise Government?

Examples of LCA in the Agency

- Solvent recovery
- Tyres
- Home composting
- Effects of ELV targets (collaboration with Defra)
- Nappies
- Carrier bags
- WISARD / WRATE

Agency

Nappies

- Product LCA
- Disposable and reusable nappies
- Why?
  - Classic LCA
  - Looking at total environmental impacts
  - Disposable nappies seen as major part of municipal waste stream
  - Previous studies carried out before ISO 14040
  - Previous studies could be considered biased

Stakeholder Engagement

- Advisory Board
- Reflecting many angles
  - AHPMA/Proctor and Gamble
  - Women's Environmental Network/Real Nappy Assn
  - DEFRA
  - Local Authority

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Fair comparison

- 2.5 years average use per child
- Disposable nappies – similar composition
- Reusables – diverse range

Behavioural factors

- Number of changes per day
- Age of potty training
- Use on more than one child
- Washing temperature
- Tumble drying
- Ironing

Will there be a definitive answer?

- Unlikely due to complexity of issue
- BUT
  - Classic LCA carried out thoroughly
  - Advisory board
  - Highlight where impacts occur
  - Allow informed decision making
  - Steer improvements
- Results will be published shortly

Carrier Bags

- Very similar issues to nappies
  - Emotive
  - Political
  - Diverse product range
  - Visible litter
  - Makes for a good news story
  - Behavioural issues will affect results
  - Similar stakeholder engagement
- Similar methods used
- Unlikely to report results before end of year

WRATE

Environment Agency

e and Resources Assessment Tool for the Environm

lified life cycle software for waste management

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ERM

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Associ

Why LCA for waste?

- Considers the whole system, across life cycle
- Minimises environmental burden-shifting
- Impacts of waste operations are balanced against benefit of any materials/energy replaced
- Shows that all waste management options have costs and benefits
- Provides science-based information for developing consensus

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How does LCA help improve waste systems or technologies?

- Mitigate climate change and other impacts
- Future proof against rising energy and materials costs
  - manage activities better by eliminate inefficiencies/carbon hotspots in system
  - innovative carbon and resource-efficient waste technologies likely to lead the market

Resource-efficient waste systems likely to be the most economically viable over long contracts

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What is WRATE?

- **W**aste and **R**esources **A**ssessment **T**ool for the **E**nvironment
  - LCA-based decision support tool for waste management
  - For municipal waste (and similar wastes)
  - Designed for waste managers and LCA practitioners (standard and expert versions)
  - 150 waste processes
  - Calculates carbon footprint and provides check on other environmental issues

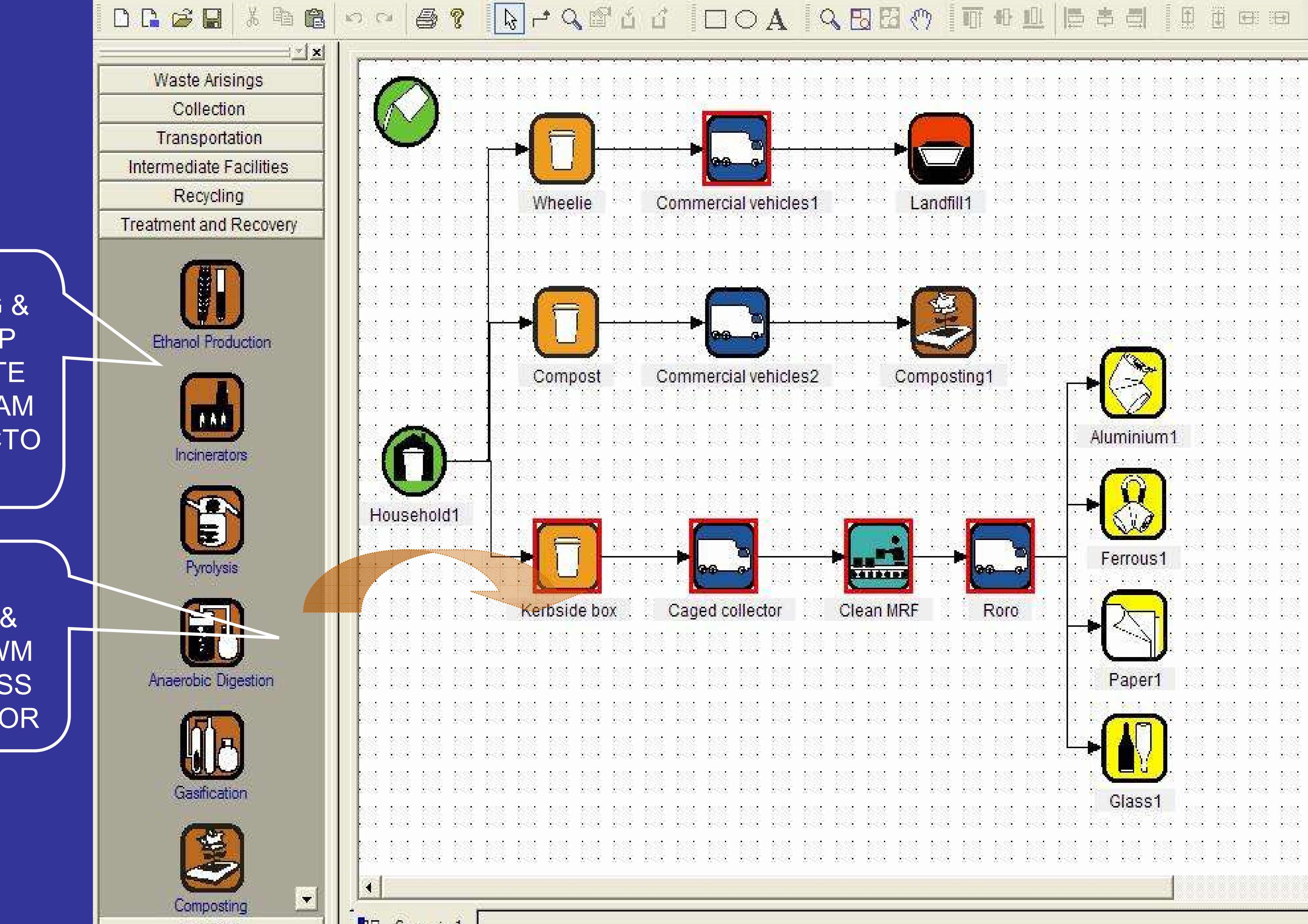
Why WRATE?

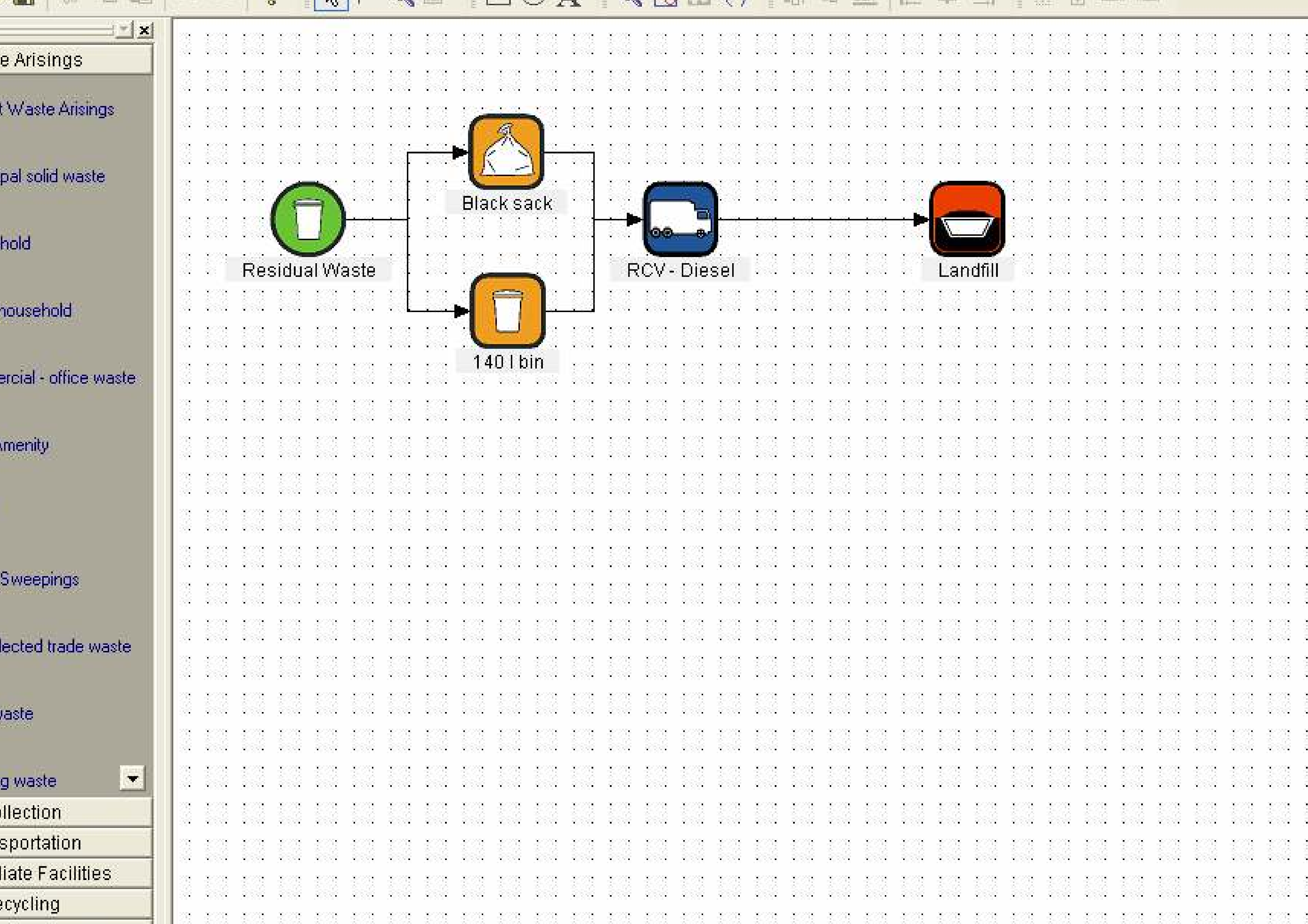
Waste strategy 2007: WRATE recommended life cycle tool for

- informing decisions on waste infrastructure options and;
- estimating global warming emissions of local waste strategies

Tool for toolbox for SEA/SA

- DEFRA practice guidance for Municipal Waste Strategies
- ODPM companion guide for PPS10


Waste Arisings
Collection
Transportation
Intermediate Facilities
Recycling
Treatment and Recovery
Ethanol Production
Incinerators
Pyrolysis
Anaerobic Digestion
Gasification
Composting
Wheelie
Commercial vehicles1
Landfill1
Compost
Commercial vehicles2
Composting1
Household1
Kerbside box
Caged collector
Clean MRF
Roro
Aluminium1
Ferrous1
Paper1
Glass1


Black sack
Residual Waste
RCV - Diesel
Landfill
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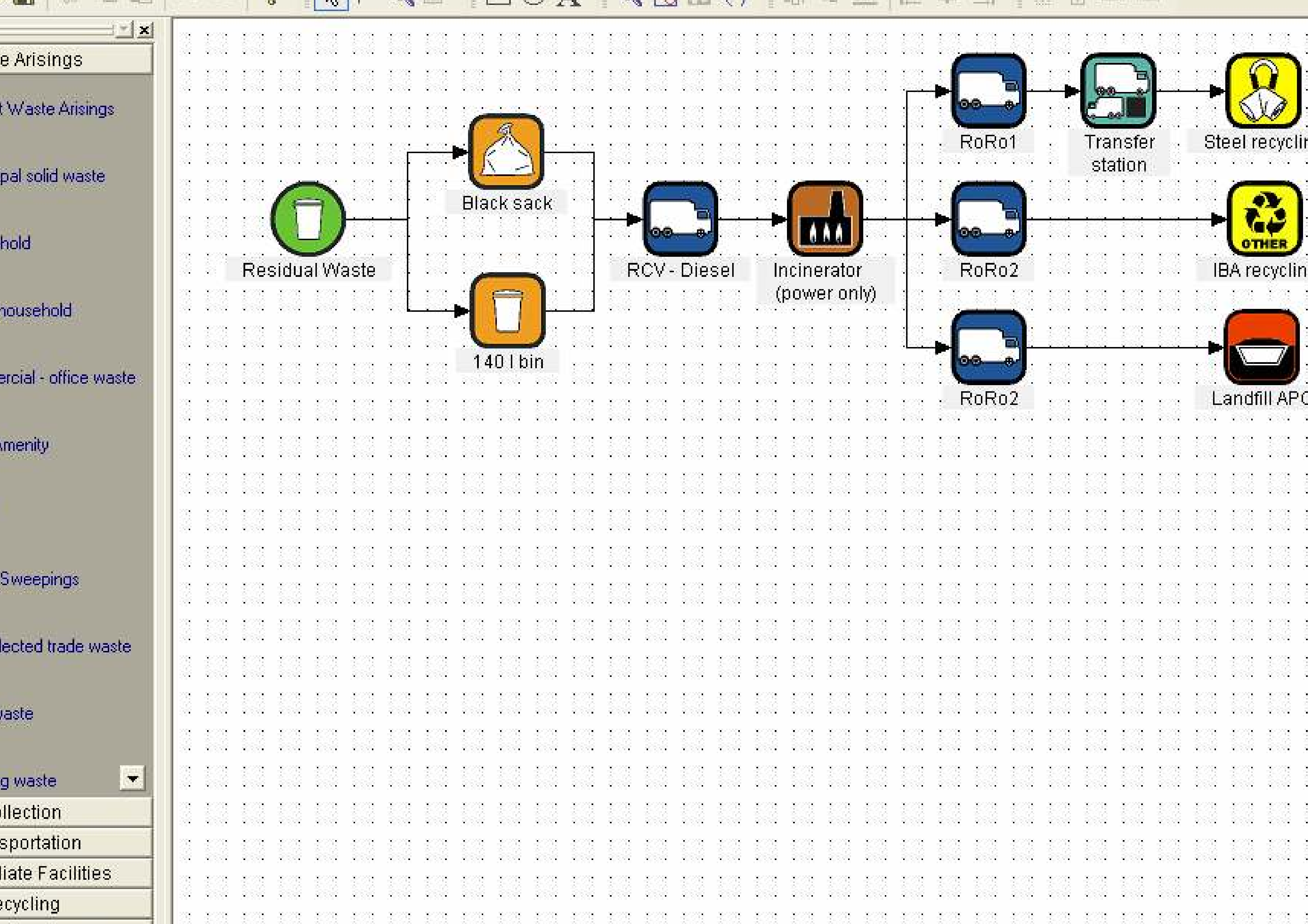

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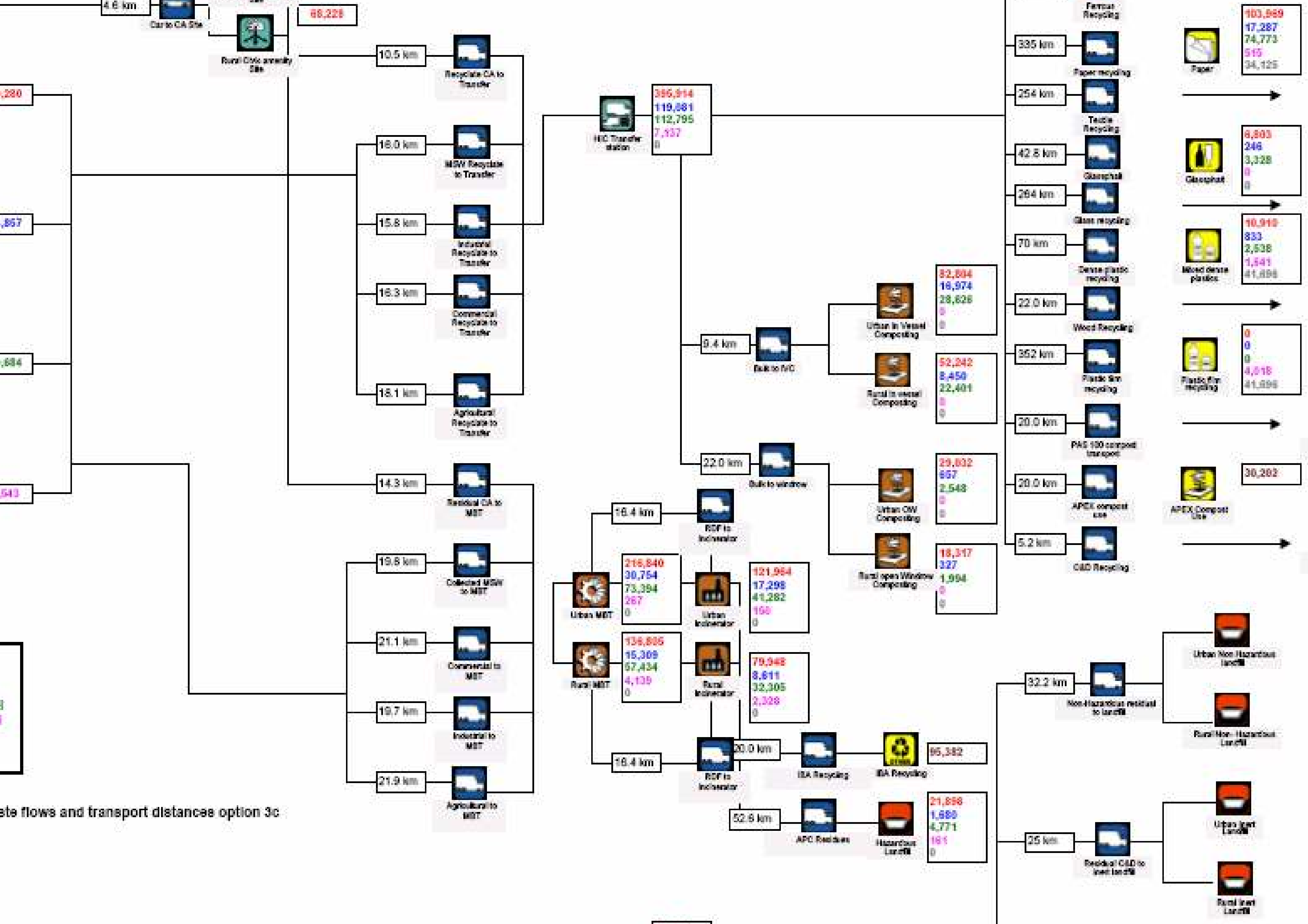


...ste flows and transport distances option 3c nent Agency Default Impacts ☑ Normalisation

Impact Assessments	Show Graph	Unit	LF	Incin (power only)
resource depletion	☐	kg antimony eq.	-709	-3977
ater aquatic ecotoxicity (FAETP inf.)	☐	kg 1,4-dichlorobenzene eq.	1326	-15807
ation (AP)	☐	kg SO2 eq.	104	-182
ication (EP1992)	☐	kg PO4--- eq.	321	45.5
varming (GWP100)	☒	kg CO2 eq.	211995	-102400
oxicity (HTP inf.)	☐	kg 1,4-dichlorobenzene eq.	3757	-34432

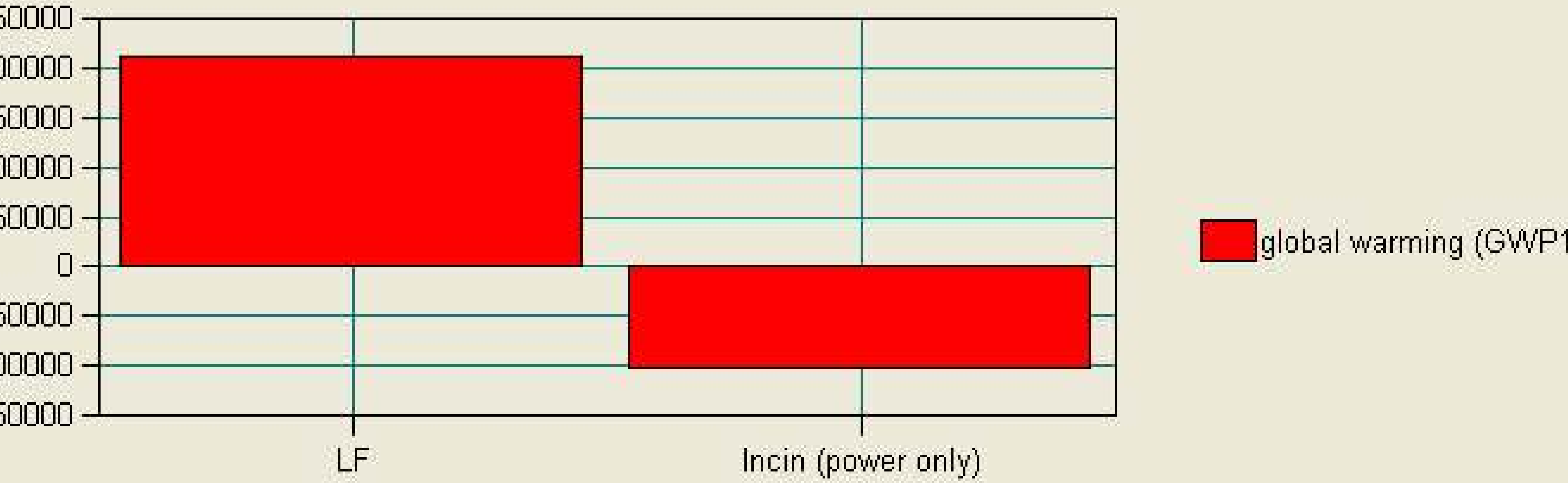
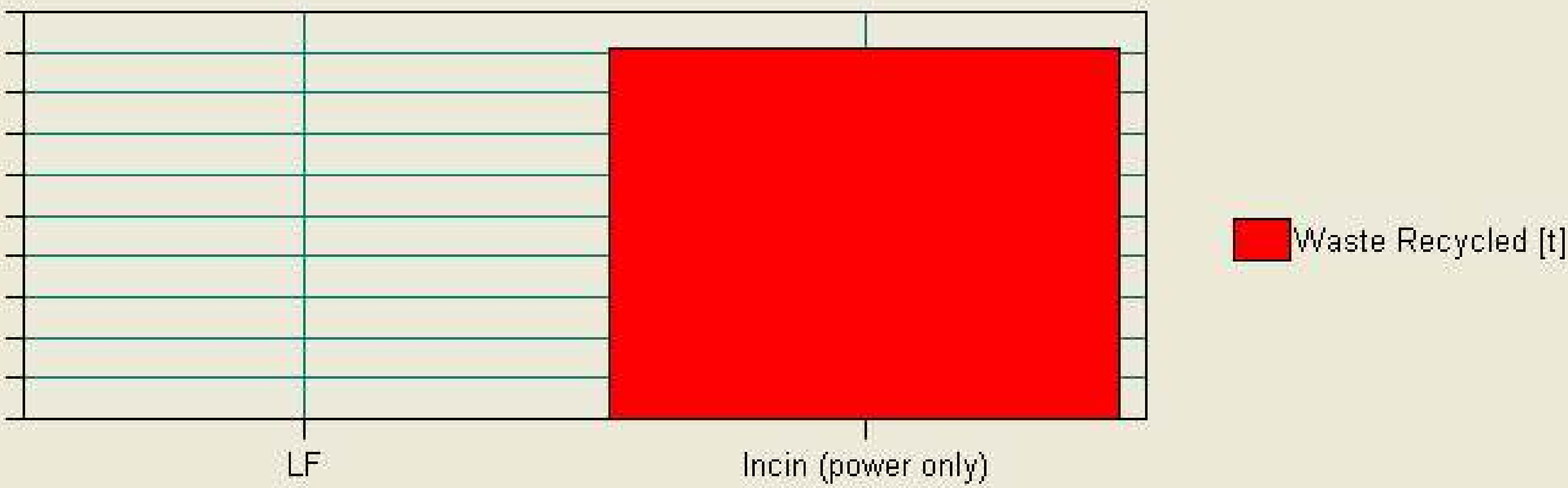
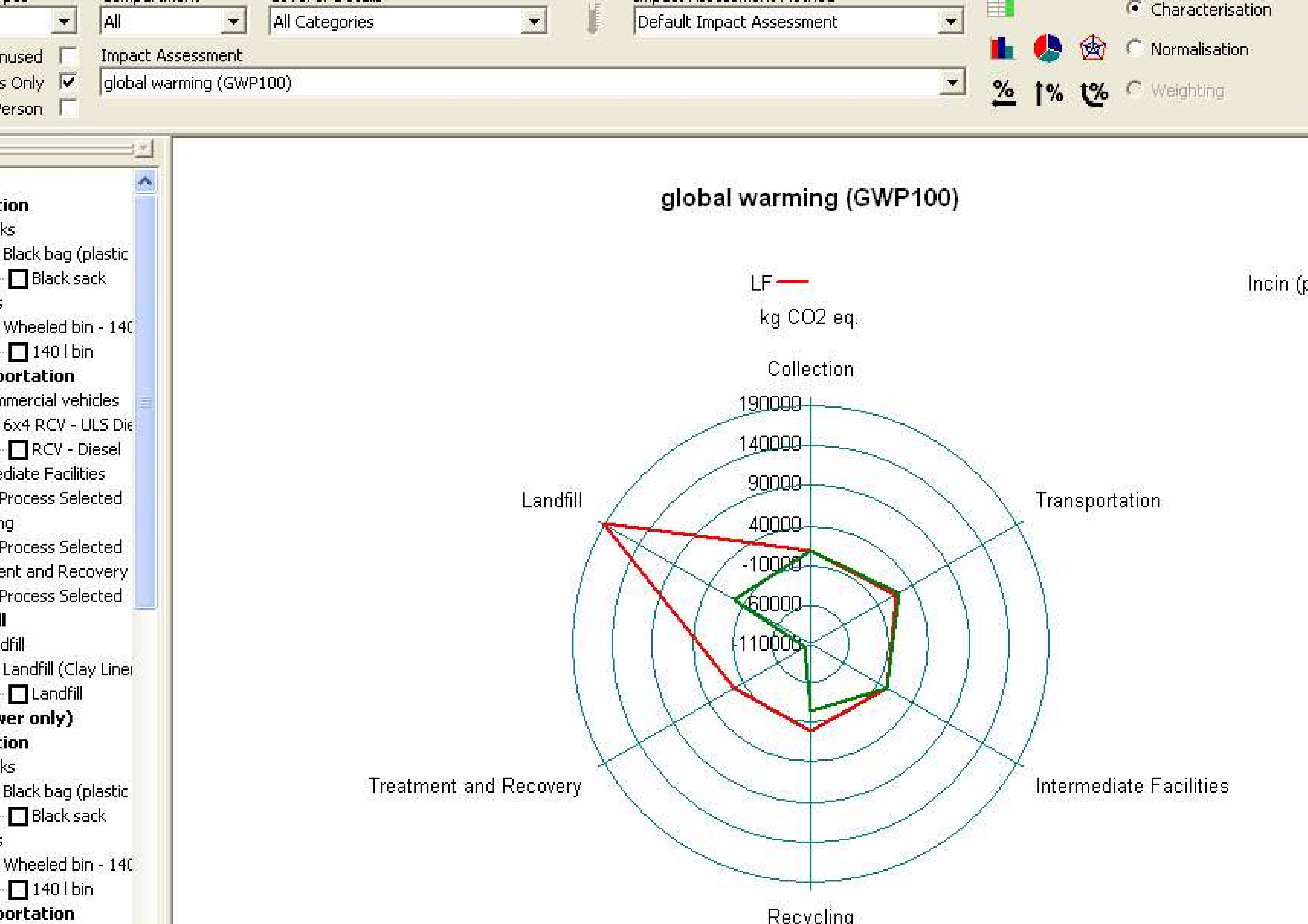


Chart Total Project Waste tonnes Co

ect Headline Indicators	Show Graph	LF	Incin (power only)
adeable Waste Landfilled [t]	☐	729	0
Recovered [MJ]	☐	547180	2284689
ke [ha]	☐	0.004	0.000999
Landfilled [t]	☐	1000	38.9
Recovered [t]	☐		1000
Recycled [t]	☒		18.2




All
All Categories
Default Impact Assessment
Characterisation
Normalisation
Weighting
Impact Assessment
global warming (GWP100)
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Person
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Black bag (plastic
Black sack
Wheeled bin - 140
140 l bin
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6x4 RCV - ULS Die
RCV - Diesel
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Process Selected
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Process Selected
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Landfill (Clay Liner
Landfill
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Black bag (plastic
Black sack
Wheeled bin - 140
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global warming (GWP100)
LF
Incin (p
kg CO2 eq.
Collection
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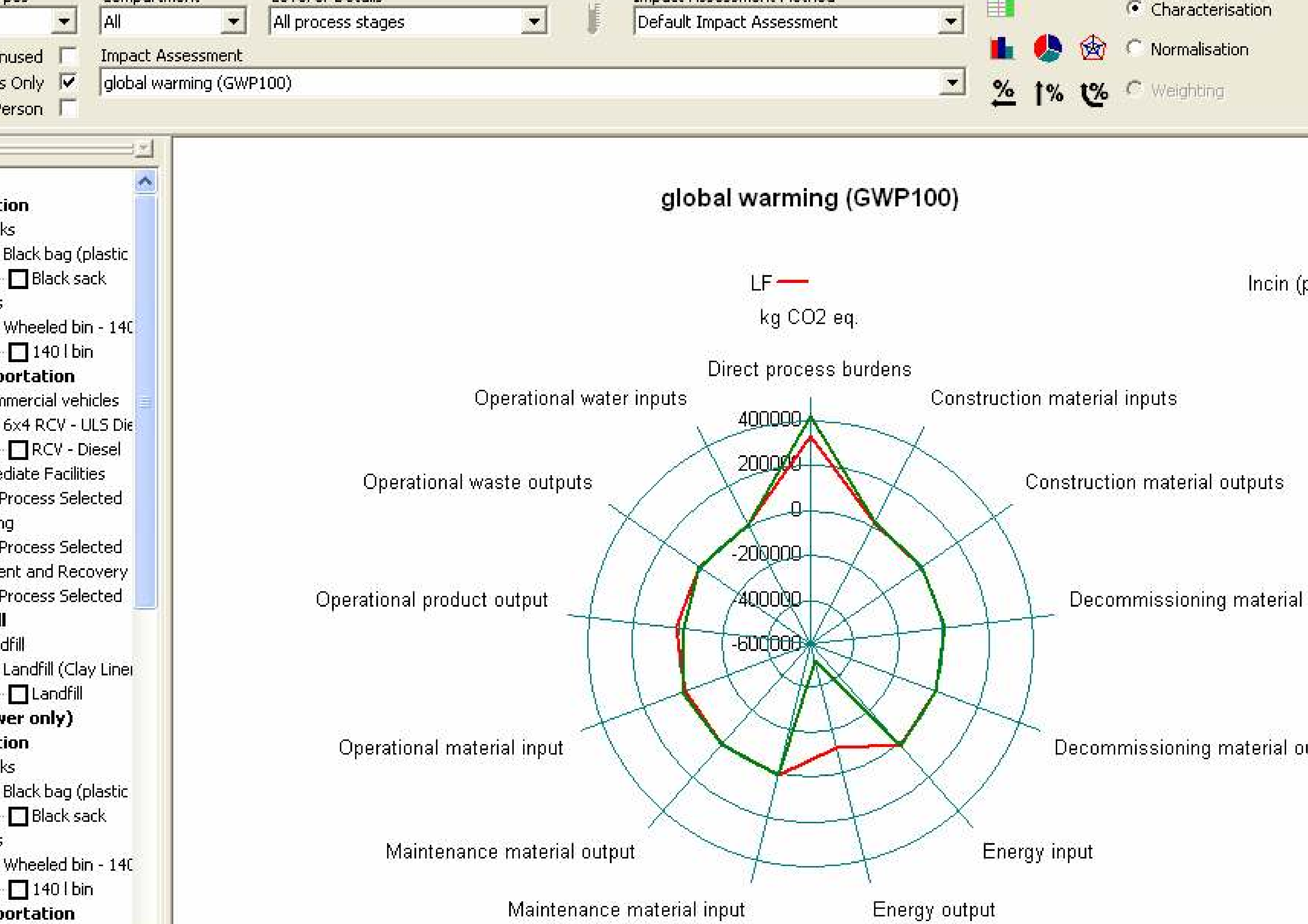
140000
90000
40000
-10000
-60000
-110000
Landfill
Transportation
Treatment and Recovery
Intermediate Facilities
Recycling


All
All process stages
Default Impact Assessment
Characterisation
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Wheeled bin - 140
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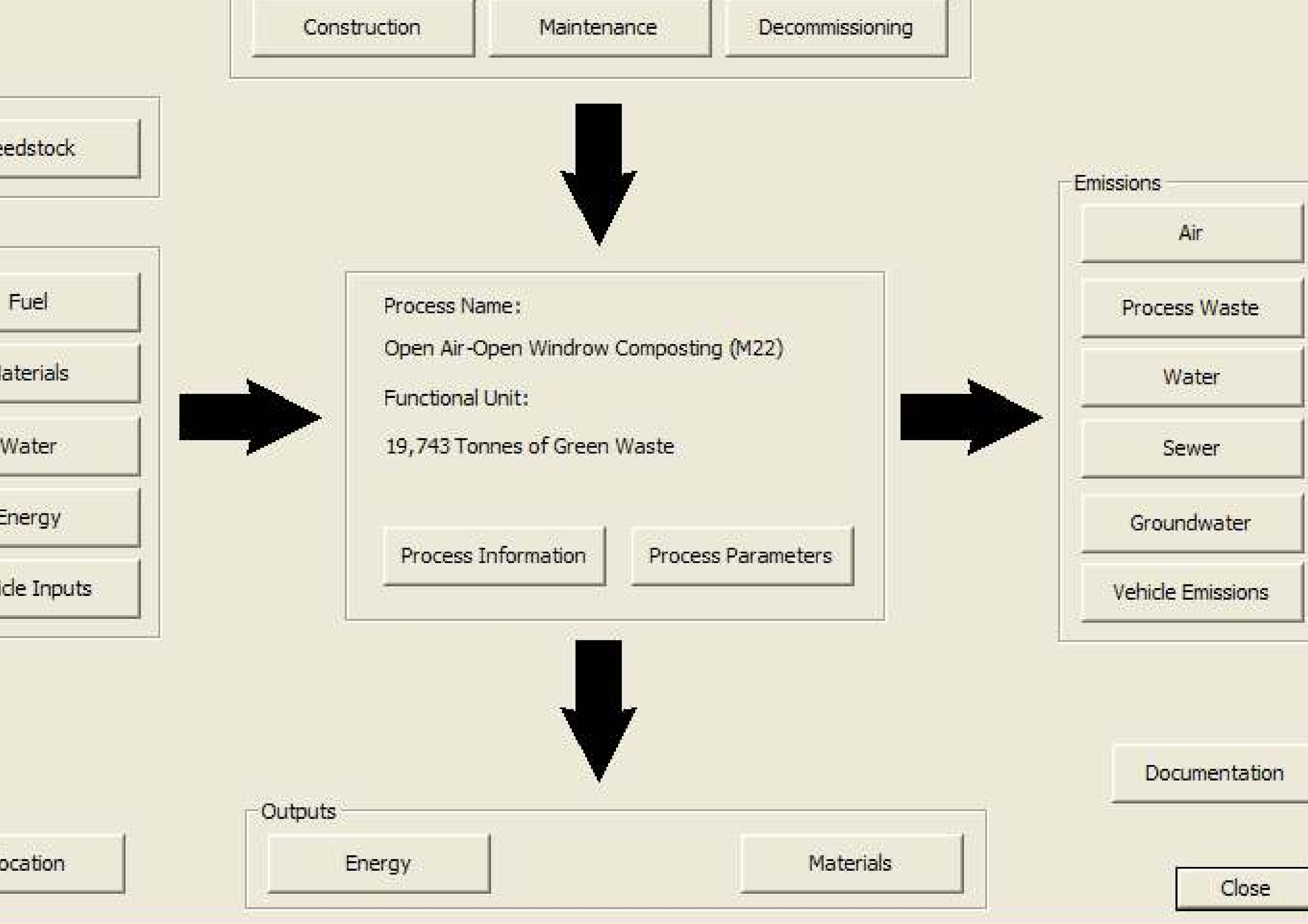
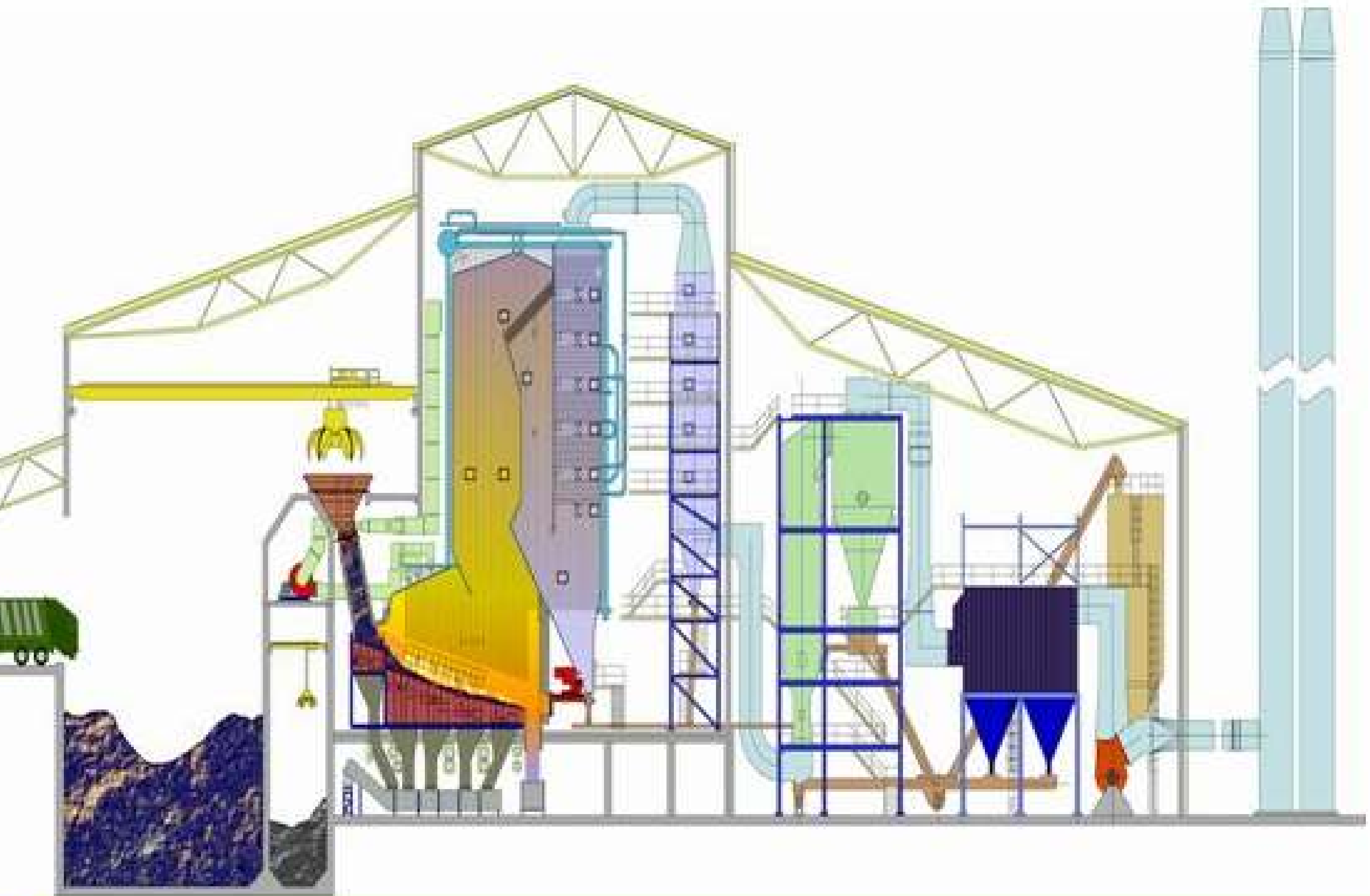
kg CO2 eq.
Direct process burdens
Construction material inputs
Construction material outputs
Decommissioning material
Decommissioning material ou
Energy input
Energy output
Maintenance material input
Maintenance material output
Operational material input
Operational product output
Operational waste outputs
Operational water inputs
400000
200000
0
-200000
-400000
-600000


Construction
Maintenance
Decommissioning
eedstock
Fuel
laterials
Water
Energy
icle Inputs
Process Name:
Open Air-Open Windrow Composting (M22)
Functional Unit:
19,743 Tonnes of Green Waste
Process Information
Process Parameters
Emissions
Air
Process Waste
Water
Sewer
Groundwater
Vehicle Emissions
Documentation
ocation
Outputs
Energy
Materials
Close

oval of contaminants. This comprises a reactor/cyclone system where lime slurry is sprayed in to remove acid gases and carbon is injected to remo
ioxins. A bag filter plant to remove particulates, lime & carbon follows this. These are removed from the filters by mechanical conveyors to a silo & th
disposal off-site. The cleaned flue gases finally vent via a 70m high stack. A separate stack serves each incinerator line. There are also several
th the boiler plant. The incineration off-gases are continuously monitored for hydrogen chloride, sulphur dioxide, carbon monoxide, oxides of nitrogen, vo
particulates, oxygen & water. Spot samples of incinerators off-gases are monitored for dioxins, hydrofluoric acid, carbon dioxide & metals.

ation of the steam from the turbine exhaust is achieved using cooling water abstracted from the River Tees. The steam condensate is returned to the
boiler, feedwater, make-up & treatment system. Liquid effluent from the boiler feedwater treatment plant is discharged to the public sewer in Haverton
s from the buildings & areas of hardstanding around the site, together with the liquid effluent from the boiler feedwater treatment plant, pass via an oil wate
lic sewer. Any other process water arising is collected in a storage tank & recycled.

Schematic [ISO 1.1.6.3]



lingham.

rate Incineration of Municipal Solid Waste with Electricity Generation

alance

Waste input		
	Quantity	Units
Mass	215886.1	tpy
Stated carbon content	29.79	%
Carbon content used	29.79	%
Total organic carbon	64313.77	tpy

Activated carbon		
	Quantity	Units
Mass	42.29	tpy
Stated carbon content	98	%
Carbon content used	98	%
Total organic carbon	41.44	tpy

FURNACE

Balance		
	Quantity	Units
Total input	64355.21	tpy
Total output	62797.5	tpy
Difference	**2.4**	%

Flue gas
Mass of CO2
Carbon content
Total organic carb

APC residues
Mass
Stated carbon con
Carbon content us
Total organic carb

Bottom ash
Mass
Stated carbon con
Carbon content us
Total organic carb

rgy Production

energy	quantity (MJ)	quality	background	allocation	comment
	72000000	Measured		=([USER_TOTAL.NET_CV]/[TYPICAL_TO	2500 kW for 8000 hrs. Electricity used b
	57600000	Measured	heat, natural gas, at industrial f	=([USER_TOTAL.NET_CV]/[TYPICAL_TO	2000 kW for 8000 hrs. Energy used by

te Output

product	quantity (Kg)	quality	destination	transport	distance (Km)	hazardous	moisture content (	calorific valu
Air Pollution Control Residue A	2200000	Measured	Landfill	Road	100	☑	0	0
Bottom Ash BA 1	8095000	Measured	Landfill	Road	5.5	☐	0	0
Bottom Ash BA 2	15000	Estimated	Landfill	Road	5.5	☐	0	0
						☐		

ssions

rden	subprocess	destination	quantity (Kg)	quality	background	allocation	
xide (NO)	Process	Air	27863.81	Measured	Nitrogen oxides (NO and NO2	=([USER_TOTAL.NET_CV]/[TYPICAL_TO	Taken from 25 p
	Process	Air	79.4	Measured	Non-methane volatile organic c	=([USER_TOTAL.CARBON_C]/[TYPICAL_	Taken from 25 p
s, NO and NO2	loader	Air	125.6	Estimated	Nitrogen oxides (NO and NO2	=([USER_WASTE_FRACTIONS_TOTAL]/[	5000 litres of of
ter - PM10	loader	Air	14.44	Estimated	Particulates - PM10 and smalle	=([USER_WASTE_FRACTIONS_TOTAL]/[	5000 litres of of
ide	loader	Air	74.25	Estimated	Carbon Monoxide (CO) / air / k	=([USER_WASTE_FRACTIONS_TOTAL]/[	5000 litres of of
volatile organic c	loader	Air	25.31	Estimated	Non-methane volatile organic c	=([USER_WASTE_FRACTIONS_TOTAL]/[	5000 litres of of
e, fossil	loader	Air	13236.45	Estimated	Carbon dioxide (CO2) / air / kg	=([USER_WASTE_FRACTIONS_TOTAL]/[	
	Process	Air	3.6	Measured	Antimony / air / kg	=([USER_TOTAL.ANTIMONY_SB]/[TYPIC	Taken from sing
	Process	Air	3.6	Measured	Arsenic / air / kg	=([USER_TOTAL.ARSENIC_AS]/[TYPICA	Taken from sing
	Process	Air	2.9	Measured	Chromium / air / kg	=([USER_TOTAL.CHROMIUM_CR]/[TYPIC	Taken from sing
	Process	Air	3.6	Measured	Cobalt / air / kg	=([USER_WASTE_FRACTIONS_TOTAL]/[	Taken from sing
	Process	Air	4.2	Measured	Copper / air / kg	=([USER_TOTAL.COPPER_CU]/[TYPICAL	Taken from sing
In)	Process	Air	70.6	Measured	Manganese / air / kg	=([USER_TOTAL.MANGANESE_MN]/[TYP	Taken from sing
	Process	Air	3.6	Measured	Vanadium / air / kg	=([USER_WASTE_FRACTIONS_TOTAL]/[	Taken from sing
	Process	Air	3.2	Measured	Tin / air / kg	=([USER_WASTE_FRACTIONS_TOTAL]/[	Taken from sing
	Process	Air	2.9	Measured	Lead / air / kg	=([USER_TOTAL.LEAD_PB]/[TYPICAL_T	Taken from sing
e - Biogenic	Process	Air	36641168	Measured	Carbon dioxide, biogenic / air /	=([USER_TOTAL.CARBON_BIO]/[TYPICA	Taken from 25 p
e, fossil	Burner Start up	Air	130900	Estimated	Carbon dioxide (CO2) / air / kg	=([USER_WASTE_FRACTIONS_TOTAL]/[	Fossil carbon c
e (SO2)	loader	Air	8.42	Estimated	Sulfur dioxide / air / kg	=([USER_WASTE_FRACTIONS_TOTAL]/[	5000 litres of of

Key sensitive data for new processes

- Considerable intra-technology variation
- Data required
  - Waste feedstock composition
  - Main operational inputs – electricity, fuel used, water, materials etc.
  - Materials recovered and final destination
  - Process wastes and destination
  - Emissions to air (e.g. CO_2, SO_x, NO_x, metals)
  - Emissions to water (NO_3, PO_4, metals)

Where has WRATE been used?

- Assessing current & proposed municipal waste management schemes
- Benchmarking waste technologies
- In outline business case for PFI procurement
- Government policy development

Distribution of software

- Annual licence
- Academic licence is available for teaching purposes
- Continually updating the software
  - New processes
  - Improved functionality
  - Background databases as they become available

Contact details

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