SWIMS: Solid Waste Infrastructure Modelling System

A full life cycle analysis & material flow analysis based on environmental impacts & costs

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Solid Waste Management Modelling

Solid waste management (SWM) has gradually shifted from providing safe and cost effective disposal of unwanted materials to a system of recovery of material resources and energy. Consequently, SWM has become more complex (Figure 1), and analytical tools are needed to assist decision makers in the development of SWM strategies.

There are currently a plethora of linear SWM models that determine waste treatment infrastructure needs from basic assumptions about current technologies, waste materials and transport methods. The Solid Waste Infrastructure Modelling System (SWIMS) expands upon this by creating a non-linear, dynamic life cycle assessment (LCA) based optimisation tool. SWIMS calculates waste arisings and optimises the pathways that are involved in waste collection, transport and treatment instead of simply associating waste with single facility types and collection methods. The entirety of SWM is therefore simulated with greater realism.

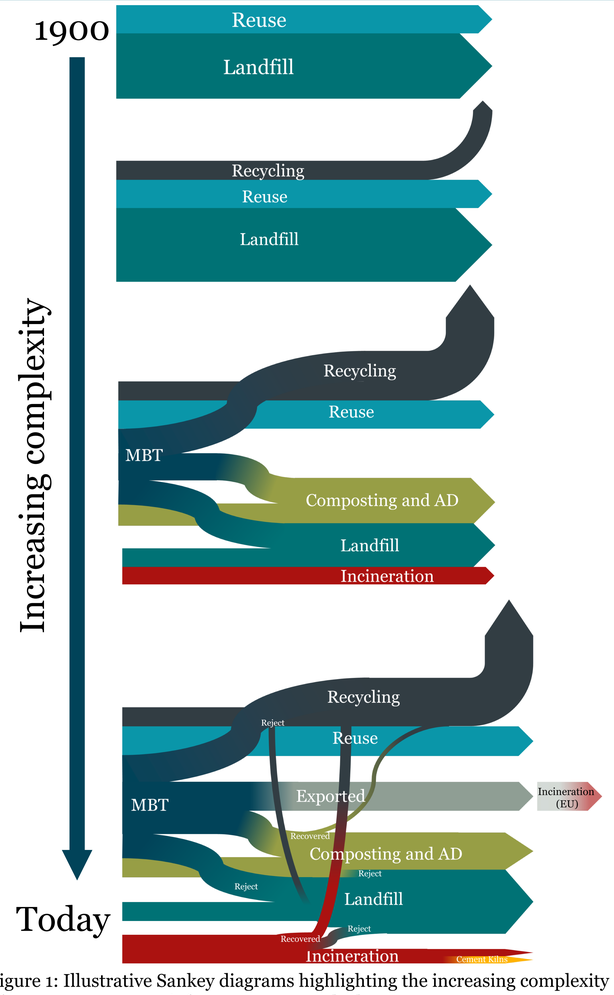

Figure 1: Illustrative Sankey diagrams highlighting the increasing complexity of waste management infrastructure over the last 100 years.

Operating SWIMS

The operation of SWIMS shown in Figure 2 can be broken down into nine main steps which are graphically displayed on the right:

Step 1 – Different producer types produce waste and sort the material into different types of receptacle.
Step 2 - Different areas produce different volumes and compositions of waste. Waste is collated for each area.
Step 3 – Each area will have different collection methods. This limits where the waste can be sent for treatment.
Step 4 – The planner or user can impose rules and strategies within the model to influence how waste treatment is optimised.
Step 5 – All possible treatment orders are generated and run based on the users rules.
Step 6 – Each path order is ranked based on the user settings and the best performing selected for that year.
Steps 7 and 8 – SWIMS forecasts into the future to determine if there will be sufficient infrastructure capacity for future waste arisings.
Step 9 –Each year the model produces a full report for the environmental impacts and costs involved for SWM.

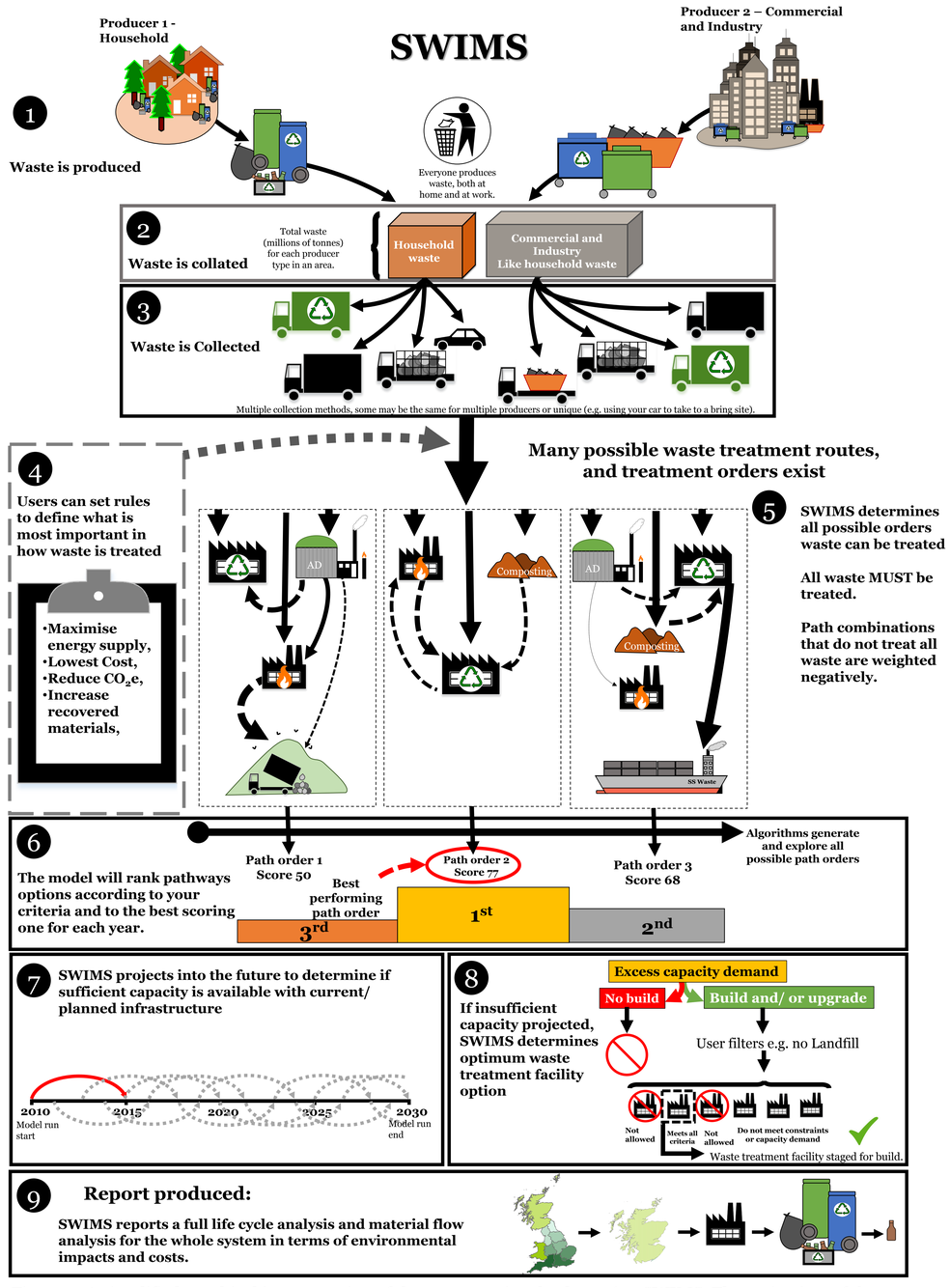

Figure 2: A simplified graphical interpretation of the processes involved running SWIMS. The main aims of the model are to optimise path orders and determine infrastructure needs based on user criteria.

Within NISMOD 2, SWIMS reports energy demand, energy supply, transport demand and water demand whilst directly utilising data from the economic and demographic model.

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