

Waste management in ecoinvent v.3

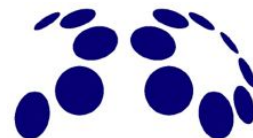


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- **Concepts for waste disposal activities in ecoinvent v3**
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Waste disposal processes in previous ecoinvent instalments

- **Goal: Inventories of disposal of particular waste materials (e.g. paper, plastic, glass) reflecting material properties**
- **Technology: typical, country-average, generic (i.e. not single plant)**
- **Reference country: usually Switzerland or Western Europe**
- **Reference year: 2000**

Waste disposal processes in previous ecoinvent instalments

- **Municipal incineration** municipal waste fractions
- **Sanitary landfill** municipal waste fractions
- **Hazardous waste incineration** e.g. waste oil
- **Residual waste landfill** inorganic polluted waste
- **Underground deposit** non-radioactive industrial waste *
- **Wastewater treatment** municipal sewerage
- **Landfarming/spreading** liquid wastes
- **Building waste sorting** sorting of materials from mixed rubble
- **Electronics waste sorting** (Lehman/Hischier 2007 for consumer IT)
- **Mining waste, tailings impoundments** sulfidic ore metals (2007), uranium (2009) coal (2010)

* Treatment and final storage of radioactive waste is inventoried by Dones/Bauer in nuclear power LCI

Some 400
disposal datasets
(ecoinvent v2.2)

Waste disposal processes in previous ecoinvent instalments

A typical waste disposal dataset in previous ecoinvent instalments:

disposal, paper, 11.2% water, to municipal incineration//kg//CH

= 1 kg of specific material (waste paper)

fed into specific disposal activity (municipal incineration in CH)

i.e. one dataset simultaneously represents

- a material choice and
- a disposal activity choice

By choosing a certain disposal dataset, an author of an LCI of a waste-producing activity already pre-determined the type of disposal

Waste disposal processes in previous ecoinvent instalments

- **Excel tools** were available that created Ecospold.v1 inventory files
- **New waste materials** could be added by the user in the tool to create new disposal inventories
- The Excel tool would **calculate a new inventory** based on the given waste composition
- **Use of Mass Flow Accounting MFA and elemental transfer coefficients TK** (e.g. no direct cadmium emissions from a waste not containing cadmium)
- **Essentially the excel tool incorporates a waste-specific model** of the disposal process
- **Excel tools available for incineration (municipal/hazardous waste), landfills (sanitary/residual), wastewater treatment, landfarming**

Waste disposal processes in eiv3

- a) Separation of activities and their product flows
- b) The decision "Is a material a waste or not?" is not required to be made by the dataset author, but *can* be passed on to the database model
- c) Parameterisation of datasets
- d) Expandable concept with the ability to include additional waste materials and waste disposal technologies

a) Separation of activities and their product flows

In prior ecoinvent versions:

Process = its Product

e.g. the **manufacturing process** 'reinforcing steel, at plant' provides the **output product** 'reinforcing steel, at plant'

e.g. the transport **service process** 'transport, passenger car' provides the **service output** 'transport, passenger car'

e.g. the disposal **service process** 'disposal, waste, to municipal incineration' provides the **service output** 'disposal, waste, to municipal incineration'

In ecoinvent v3:

Activity

Product

An activity and its output product(s) are not the same

e.g. 'steel mill' 'reinforcing steel'

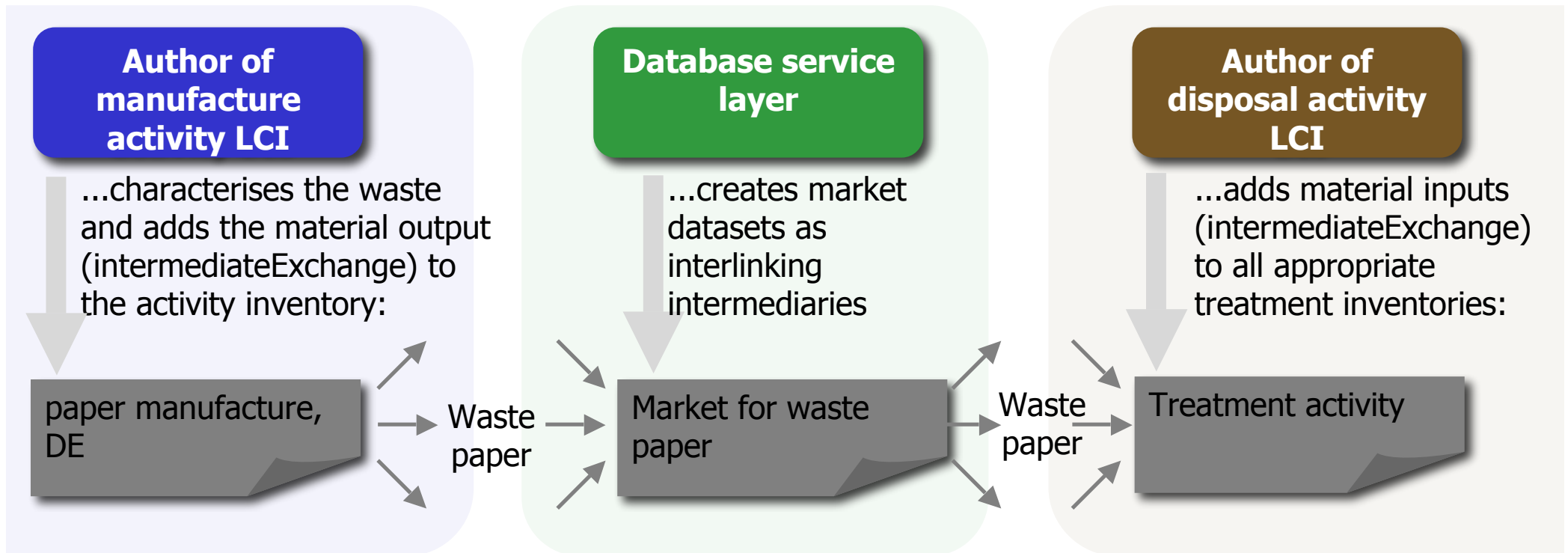
e.g. 'transport, car' 'transport, car'

e.g. 'treatment of waste' 'waste' (uptake)

a) Separation of activities and their product flows

- In ecoinvent v3 a dataset author wanting to inventory a waste material disposal **does not need to specify a disposal activity**, but merely **characterise the (waste) output material**, e.g. 'waste paper'
- In the database model this material enters a **treatment market** appropriate for the geographic location of the activity.
- The **database service layer** will automatically determine which treatment activities are available within that market
- Either **recycling activities** or **final disposals** (landfill, incineration) are possible treatment activities...
- ...but the dataset author **does not need to determine the downstream waste fate in such detail** (...but can choose to do so with 'hard' ActivityLinks)

Ad a) Waste disposal processes eiv3



Responsibilities of the author of manufacture processes:

- Choose appropriate waste material
- Optionally adapt waste characteristics
- Inventory correct waste mass per functional unit of process

Responsibilities of the author of disposal processes:

- Create disposal activity dataset that can treat all suitable waste

b) No prior judgement on waste or not

In prior ecoinvent versions:

Waste (output) to disposal

Input to recycling (from cut-off)

System boundary

Disposal process

Downcycling/Recycling process

In ecoinvent v3:

Output material (IntermediateExchange)

Input material (IntermediateExchange)

Any activity that can take up an (unwanted) output material

Any activity that can take up an (unwanted) output material AND convert it into a marketable good

c) Parameterisation of datasets

- **What previously were calculation routines in Excel tools which calculated ecospold1 inventories ...**
- **....are incorporated into the datasets itself in ecoinvent v3 by use of**
- **Parameters (freely usable variables)**
e.g. gross efficiency of heat recovery
- **Properties (variables attached to materials/IntermediateExchanges)**
e.g. lower heating value
- **Mathematical relations, connecting the variables**
using a variant of Open Document Formula Language
- **Properties of outputs can also be made dependent of inputs**
e.g. composition of incineration ashes

Ad c) Waste material characteristics

- **Characteristics:** generic default values are set, but can be altered (*) by the dataset author
 - **Descriptive name**, e.g. "waste paper" (IntermediateExchange name)
 - **Chemical composition**, i.e. content of cadmium, carbon, water etc... (*)
 - **Upper & lower heating value**, in MJ/kg (*)
 - **Burnability** (1/0 = burnable/inert) (*)
 - **Degradability** in a sanitary landfill within first 100 years (kg/kg) (*)
- NEW Binning type:** if known, the waste bin this waste is discarded into; e.g. mixed municipal waste, separate paper collection, DS Gelbe Tonne, littering... which can determine the downstream fate (*)
- NEW Collection type:** if known, the way waste is hauled away from the waste producer; e.g. municipal collection, direct transport (*)

d) Expandable concept

- Any kind of activity being able to take up a 'waste material' becomes a **treatment activity** (disposal, recycling, speciality production etc.)
- Definitions of **new (waste) material** IntermediateExchanges can be added
- Existing generic material definitions can be **adapted by the user**
- Combinations of (waste) material and binning type allow for flexible and detailed modelling

ecoinvent v3 / Ecospold2 is aimed at expanding the supply and sources of inventories. Concepts for waste management inventories must be flexible for future additions

Ongoing Project

- Ecoinvent inventories for **municipal waste incineration** are currently being updated within a project on wood products led by Frank Werner
- Existing excel MSWI tools are updated to a more recent reference year and converted into **parameterized ecospold2 datasets**
- Also included is an update of the **residual material landfill** model
- **Not included are all other disposal activities** (sanitary landfill, wastewater treatment, Building waste sorting, mining waste etc...)
- **Project ends mid-2013**

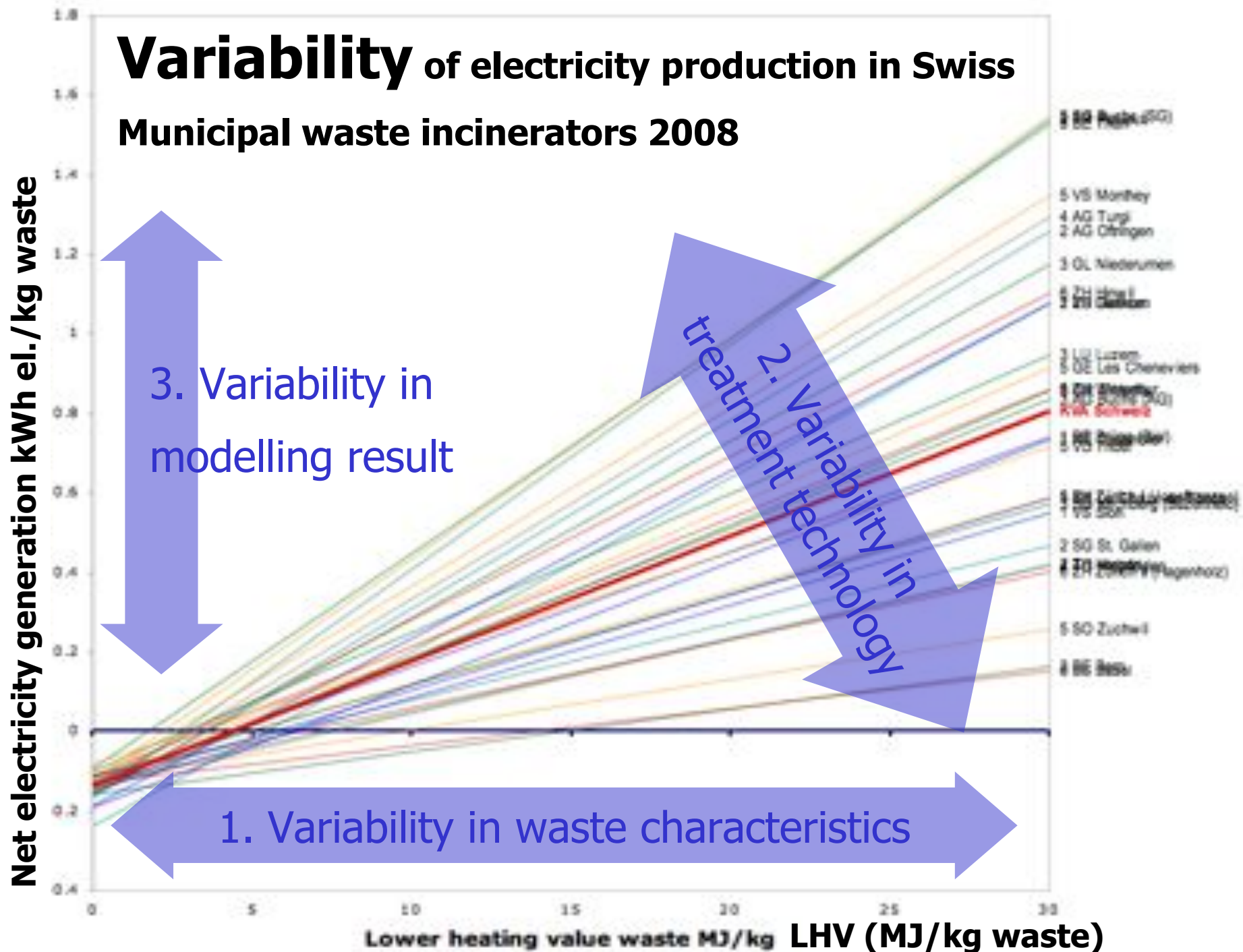
Thanks for your attention and

**... see you
downstream!**

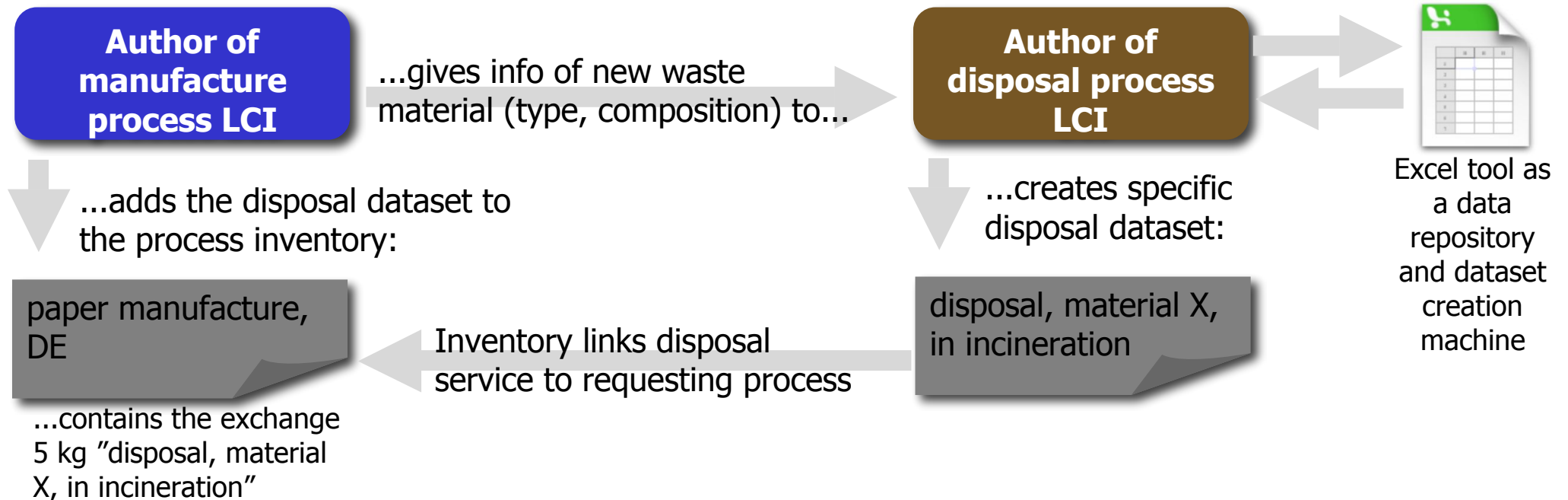
River Trannon



Variability of electricity production in Swiss Municipal waste incinerators 2008



Waste disposal processes in previous ecoinvent instalments



Responsibilities of the author of manufacture processes:

- Choose appropriate waste material and waste disposal type
- Inventory correct waste mass per functional unit of process

Responsibilities of the author of disposal processes:

- Record waste material characteristics
- Create waste-specific disposal datasets