

# ILCD importer for Brightway

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# Introduction

**What** ? Importer for datasets in ILCD data format.

**Why** ? There is a ton of open data in ILCD format, but an importer was missing

**Who** ? Work started in the Brighton Hackathon 2022. Continued mostly by Miguel F. Astudillo



Examples of ilcd data sources

Geographical coverage i

- None -

Reference year i

- None - - None -

Free or for sale i

☐ Free (3265)

☐ For sale (12098)



# Features

Extracts and processes the data needed for calculations and more:

- Metadata: contacts, licenses, intended application ...
- Parameters (just parsed, transformation into brightway2-parameters is not done)

Example of parameters

parameter_name	CW
parameter_comment	[kg] Cooling water losses
parameter_mean_value	0.391
parameter_minimum_value	None
parameter_maximum_value	None
parameter_std95	0
parameter_formula	$78.2 * \text{weight} * 0.005$
parameter_distrib	None

# Features

Conforms to bw2io “standards”

- **Extractors**
- Transform **strategies**
  - unit conversion
  - Map to biosphere3
  - Transforms uncertainty (stat-arrays)
  - ...
- All wrapped in an **importer class**

```
class ILCDImporter(LCIImporter):  
    ... def __init__(self, dirpath, dbname):  
    ...     self.db_name = dbname  
    ...     self.data = ILCDExtractor._extract(dirpath)  
    ...     self.data = setdb_and_code(self.data, dbname)  
  
    ...     self.strategies = [  
    ...         rename_activity_keys,
```

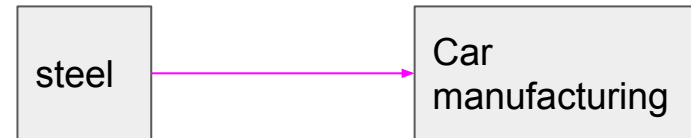
# Features

Use life cycle models (product system models) if available.

The files in the “lifecyclemodels” folder contain the connexions between different activities / nodes in the product system model

## Folders in an ILCD dataset

Name	
contacts	
external_docs	
flowproperties	
flows	
lifecyclemodels	
processes	
sources	
unitgroups	



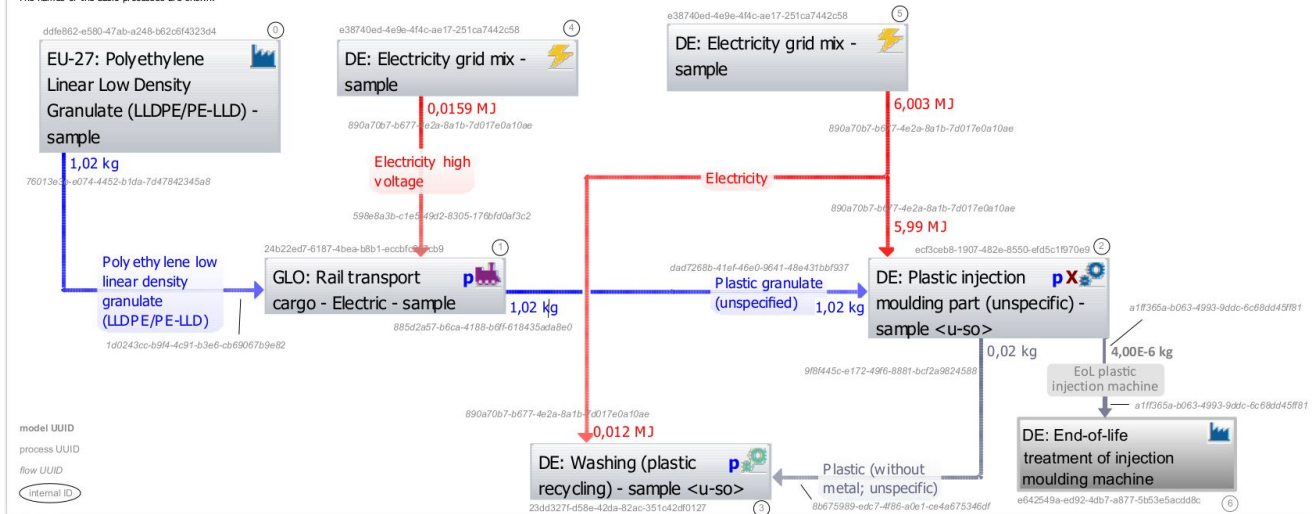
# Benchmark

We use as example a test dataset provided by JRC (link) and compare for each activity against the **OpenLCA** import

## Product system model of test file (JRC)

eILCD-example - LDPE injection moulding parts model; production mix, at plant; 5 parts at 0.2 kg/part

10062015-194a-41b8-8fa6-49a999c6d101  
Process plan: Reference quantities  
The names of the basic processes are shown.



# EoL treatment of injection moulding

Brightway		End-of-life treatment of injection moulding machine	
		DE	
End-of-life treatment of injection moulding machine	DE		1.000000
Carbon dioxide, fossil	(air,)		0.972077
Carbon monoxide, fossil	(air,)		0.000362

## Inputs/Outputs: End-of-life treatment of injection moulding

### Inputs

OpenLCA

Flow	Category	Amount	Unit
 EoL plastic injection machin	End-of-life treatment	1.00000	 kg

### Outputs

Flow	Category	Amount	Unit
 Carbon dioxide, fossil	Emission to air/unspeci	0.97208	 kg
 Carbon monoxide	Emission to air/unspeci	0.00036	 kg

Perfect match



# Electricity grid mix

Inputs/Outputs: Electricity grid mix - sample, production mix <1kV

▼ Inputs

OpenLCA

Flow	Category	Amount	Unit	Costs/Reve	Uncerti
Energy, primary, from water	Resource/in water	0.55515	MJ		none

▼ Outputs

Flow	Category	Amount	Unit	Costs/Reve	Uncerti
Carbon dioxide, fossil	Emission to air/unspeci	0.17208	kg		none
Carbon monoxide	Emission to air/unspeci	0.00016	kg		none
Electricity; consumption mi	Energy carriers and te	3.60000	MJ		none

Brightway

Electricity grid mix - sample

DE

Electricity grid mix - sample

DE

3.600000

Carbon dioxide, fossil

(air,)

0.172077

Carbon monoxide, fossil

(air,)

0.000162

Energy, potential (in hydropower reservoir), converted

(natural resource, in water)

0.555149

Perfect match

# Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD)

## - sample

Brightway		Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD) - sample	
		EU-27	
Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD) - sample		EU-27	1.000000
Carbon dioxide, fossil		(air,)	1.572077
Carbon monoxide, fossil		(air,)	0.004621
Energy, potential (in hydropower reservoir), converted		(natural resource, in water)	60.155514

### Inputs

OpenLCA

Flow	Category	Amount	Unit
Energy, primary, from...	Resource/in water	60.15551	MJ

### Outputs

Flow	Category	Amount	Unit
Carbon dioxide, fossil	Emission to air/...	1.57208	kg
Carbon monoxide	Emission to air/...	0.00462	kg
<b>Polyethylene low li...</b>	<b>Materials prod...</b>	<b>1.00000</b>	<b>kg</b>

Perfect match

# Washing (plastic recycling) - sample

Brightway	Washing (plastic recycling) - sample		
	DE		
Washing (plastic recycling) - sample	DE		1.000000
Electricity grid mix - sample	DE		-0.600000
Plastic injection moulding part (unspecific) - sample	DE		-0.970000
Carbon dioxide, fossil (air,)			0.037208
Carbon monoxide, fossil (air,)			0.000066

Missing connexions to water process  
(not defined in the dataset)

## Inputs/Outputs: Washing (plastic recycling) - sample, production mix, at 1

### Inputs

OpenLCA

Flow	Category	Amount	Unit
Electricity; consumption mix, at consumer; /	Energy carriers and tech	0.60000	MJ
Plastic (without metal; unspecific)	End-of-life treatment	1.00000	kg
Water (process water)	Materials production/C	water	kg

### Outputs

Flow	Category	Amount	Unit
Carbon dioxide, fossil	Emission to air/unspeci	0.03721	kg
Carbon monoxide	Emission to air/unspeci	6.62077E-5	kg
Plastic (unspecified)	End-of-life treatment	out	kg
Water (waste water, untreated); slightly org.	End-of-life treatment	water	kg

# eILCD-example - 5 parts at 0.2 kg/part

```
AB.loc[:,('eILCD-example - 5 parts at 0.2 kg/part', 'DE')].replace(0,np.nan).dropna().to_frame()
```

✓ 0.0s

Inputs/Outputs: eILCD-example - 5 parts at 0.2 kg/part

Inputs OpenLCA

Flow	Category	Amount	Unit
Energy, primary, from water power	Resource/in water	62.28679	MJ
Water (process water)	Materials production/C	0.08000	kg
Water (tap water); production mix, at	Materials production/C	0.39100	kg

Outputs

Flow	Category	Amount	Unit	Costs
Carbon dioxide, fossil	Emission to air/unspeci	1.89196	kg	
Carbon monoxide	Emission to air/unspeci	0.00499	kg	
Plastic part (unspecified)	Systems/Unspecific pa	1.00000	kg	
Water (waste water, untreat	End-of-life treatment	0.08000	kg	

Brightway





eILCD-example - 5 parts at 0.2 kg/part  
DE

eILCD-example - 5 parts at 0.2 kg/part	DE	1.000000
Carbon dioxide, fossil	(air,)	1.891965
Carbon monoxide, fossil	(air,)	0.004985
Energy, potential (in hydropower reservoir), converted	(natural resource, in water)	62.286789

Missing connexions to water process  
(not defined in the dataset)

# Rail transport cargo - Electric - sample

Brightway		Rail transport cargo - Electric - sample	
		GLO	
Rail transport cargo - Electric - sample		GLO	1.0
Polyethylene Linear Low Density Granulate (LLDPE/PE-LLD) - sample		EU-27	-1.0

Inputs		OpenLCA	
Flow	Category	Amount	Unit
 Cargo at departure	Materials produ...	1.00000	 kg
 Electricity; consumpti...	Energy carriers a...	3.6 * spec...	 MJ

Missing some electricity consumption

Outputs			
Flow	Category	Amount	Unit
 Cargo at destination	Materials prod...	1.00000	 kg

# Plastic injection moulding part (unspecific) - sample

Brightway

Plastic injection moulding part (unspecific) - sample

DE

Rail transport cargo - Electric - sample	GLO	-1.020000
Electricity grid mix - sample	DE	-4.642200
Plastic injection moulding part (unspecific) - sample	DE	0.979996

Inputs

OpenLCA

Flow	Amount	Unit
Cargo at destination	material	kg
Electricity; consumption mix, at consumer; AC	electricity	MJ

<

Outputs

Flow	Amount	Unit
EoL plastic injection machine	0.002 * EoLmach	kg
Plastic (without metal; unspecific)	waste	kg
<b>Plastic part (unspecified)</b>	<b>weight</b>	<b>kg</b>

Missing connexions to  
unspecified processes

# Summary of comparison

The imported activities are mostly correct but some connexions are missing.

One reason may be that OpenLCA allows to define models with “unspecified” providers.

# Conclusions

- First approximation to an ILCD importer (it does most of the work but not all)
- Working with the ilcd data format is not easy.
- Potential improvements:
  - Parameterise exchanges using .. [brightway2-parameters](#)
  - Improve strategies for unlinked biosphere flows.
  - Test with datasets with uncertainty information



Let's test it

Go to jupyter notebook

Questions ? suggestions ?