



**DataSmart LCI Package  
Manual**

**Version 2.2.4  
2016**

**DataSmart LCI Package is a dataset representative of the North American region** provided by EARTHSHIFT containing expanded USLCI data and modified Ecoinvent v.2.2 data sets, as well as over new 700 processes covering such industries as textiles, packaging, bio-materials and dairy and all 50 U.S. state electricity mixes. The end result is a database that better represents U.S. operations.

### DataSmart details:

DataSmart consists of a wide range of materials and processes inclusive of new US natural gas from hydraulic fracturing, updated (2010 actuals) US natural gas mix, geothermal electricity generation, textile production processes, waste treatment processes for white goods and electronics, Chinese based pulp and paper data, updated energy modelling and much more.

Currently for U.S. LCI data, many LCA practitioners utilize Ecoinvent, which is primarily European data, or USLCI, which has limited data and is in large part incomplete. Wherever possible the DataSmart replaces links in the Ecoinvent v.2.2 unit processes with US-specific data, including electricity, natural gas, soybeans, etc. The Dummy processes in the USLCI data are replaced with a close proxy. The end result is a database that better represents U.S. operations. DataSmart can fill the requirements of PCRs that require USLCI data with the dummy processes replaced with appropriate data.

Additionally, over 700 custom datasets are included in DataSmart, covering such industries as textiles, packaging, bio-materials and dairy and including all 50 state electricity mixes have been added. It includes also critically reviewed branded data.

The latest update included 47 new processes and 9 updated processes. Now for the first time there is US specific landfill processes to cater for the much needed US landfill disposal data. Also included in the update were new metals and other materials data.

*The DataSmart LCI Package is developed and maintained by EARTHSHIFT with one to two updates a year. It is currently only sold as a package and available in SimaPro for SimaPro 8 license holders and in openLCA by our partners GreenDelta.*

### Citing the DataSmart LCI Package:

EARTHSHIFT. 2016. DataSmart LCI Package (US-EI SimaPro® Library).

<http://earthshiftsustainability.com/services/software/datasmart-life-cycle-inventory/> Accessed on <Date>.

## What's in the DataSmart LCI Package?

### Material datasets

Agriculture	Electronics	Plastics	Wood
Ceramics	Metals	Minerals	
Chemicals	Fuels	Paper & Board	Dairy products
Construction	Glass	Water	Packaging

### Processes datasets

Agriculture	Glass	Power plants	
Cardboard	Metals	Ventilation	
Compressed air	Painting	Water use	Textiles
Electronics	Plastics	Wood	Household activities

### U.S. Landfill Data

The landfill processes are based on extensive research and consultation with experts. These processes are modeled with full documentation, and parameterization of key data inputs. These key data inputs include landfill gas yield 0-2 years, 2-100 years and 100-500 years, landfill gas captured, flared and emitted, landfill gas oxidation rate, and electricity credit generated as a result of landfill gas capture. The model documentation includes description of the landfill gas generation model and input parameters. These input parameters can be tweaked by the user, if the data need to be customized.

### Metals Data

Over 10 new metal processes have been added, including Beryllium, Germanium and Rhenium. They are either European or global data. Data for the metals is obtained from Nuss and Eckleman (2014).

### Natural Gas – U.S. specific data & improved mixture

The dataset includes U.S. natural gas from hydraulic fracturing and a new U.S. natural gas mix created based on 2010 actuals, as well as a geothermal electricity process. The U.S. electricity mix was updated using these processes.

**The following processes reroute to the U.S. natural gas mix:**

Natural gas, at long-distance pipeline /RER\* US-EI U

Natural gas, at long-distance pipeline/CH\* US-EI U

(these processes have been renamed to /US- and /US\* respectively)

### Improved natural gas modeling

Todd Krieger of Dupont and his team have been carefully considering the energy flows in both the US-EI and the ecoinvent libraries and have found inconsistencies in the use of higher heating values and lower heating values as the fuels move through the supply chain. In addition to working with ecoinvent to improve this consistency in ecoinvent 3, Todd provided EARTHSIFT with his suggestions for improving the natural gas mixture in the US-EI library. We have implemented his suggestions. Other changes include a move of the fugitive emissions during the life of the well from the well itself (infrastructure) to the extracted natural gas. **As a result, analysis using U.S. electricity or natural gas from the US-EI will show higher emissions than before. Many thanks to Todd and his team for their valuable contributions!**

To continue fleshing out the USLCI data, the US-EI includes the natural gas at extraction site with a 23% shale gas mix.

### Dry material disposal processes

The dataset includes waste treatment processes that no longer include the water content in the mass. This allows these processes to be applied directly kilogram for kilogram of dry material disposed. Waste scenarios use these new processes and reflect the latest data available from the EPA. Waste scenarios for White Goods and Electronics also exist. Additional waste types for electronics components were added and these are used in the new waste scenario.

### Consumption electricity mixes are available for all 50 states.

LCA practitioners now don't have to create a custom electricity mix or rely on the U.S. average, which can be drastically different than states where there is an increased use of nuclear or renewables. We've updated the U.S. electricity mix to 2011 data and added state by state electricity mixes. The electricity usage indicator was added to all new state mixes.

### Algae Biodiesel

EARTHSIFT participated in an algae biodiesel study with Sandia Labs a few years back. DataSmart includes the data from that study which included data from two operational facilities, one cultivating algae and the other creating diesel from algae oil. Many thanks to Sandia Labs for conducting the study and allowing the data to be made public.

## Textile production

Over 20 new processes for textile production have been added, including knitting, weaving, fabric dyeing, and synthetic yarn production.

Due to the extensive use of dye in many industrial processes and the lack of available data, we've created a system level process of the U.S. Input Output data for dyes and pigments to use as a placeholder. While this data will overestimate the impacts of dye in some cases, it may still underestimate the impacts of the most toxic dyes. More information on this process can be found in the U.S. Input Output library.

## Strawberries and Milk: Dairy Data from the U.S. Dairy Greenhouse Gas Carbon Footprint project

The U.S. Dairy Association recently published data in the USDA Digital Commons for milk and cheese products. We were unable to bring this data from the Digital Commons into SimaPro, however, Greg Thoma of the University of Arkansas who did the study was kind enough to send us his SimaPro project, which is what has been implemented in the current version of the US-EI library. This version may not match the data in the Digital Commons. **As an added bonus, this dataset contains data for strawberries!**

## Packaging Processes

Over 10 new packaging process have been added, including recycled containerboard and corrugate and molded pulp, including YFYJupiter's branded straw-based npulp.

## Household Activities

For any product with a use phase, it is often an environmental hotspot. The new database includes several household activities including clothes washing and drying and dishwashing.

## No More Dummy Processes

The USLCI database has been modified by entering ecoinvent proxy data into many of the dummy processes. These processes have been renamed "Proxy" and moved to a proxy folder. This version of the US-EI library contains all of the newer USLCI datasets already in SimaPro and a few of the newer ones that have yet to be included. A more detailed description of this database and its terms follows.

## Detailed Description and Other Revisions

Specifically, for the USLCI Database 146 of the 186 dummy processes were replaced with ecoinvent proxies using U.S. electricity (Dummy USLCI Process Replaced with Proxy.xlsx). Some of the dummy processes were not replaced if they were not available in the ecoinvent dataset, or if they were intentionally empty because

they followed the cut-off approach. For the ecoinvent dataset, all processes using electricity from Switzerland or one of the European regions (RER, UCTE, CENTREL or NORDEL) were indirectly adapted to instead use U.S. electricity. This was done by rerouting electricity production/ distribution to US electricity production/ distribution in the following processes:

Electricity, medium voltage, production UCTE, at grid/UCTE U  
Electricity, low voltage, at grid/CH U  
Electricity, low voltage, production UCTE, at grid/UCTE U  
Electricity, medium voltage, at grid/CH U  
Electricity, medium voltage, production NORDEL, at grid/NORDEL U  
Electricity, high voltage, production UCTE, at grid/UCTE U  
Electricity, production mix UCTE/UCTE U  
Electricity, low voltage, production RER, at grid/RER U  
Electricity, medium voltage, production CENTREL, at grid/CENTREL U  
Electricity, low voltage, production CH, at grid/CH U  
Electricity, medium voltage, production CH, at grid/CH U  
Electricity, medium voltage, at grid/DE U

Process names were changed to show the US nature of the new processes:

/CH changed to /US\*  
/RER changed to /US-  
/DE changed to /US\*\*

Available US processes were also substituted for non-US processes in the ecoinvent datasets:

Fluosilicic acid, 22% in H2O, at plant/RER U	Fluosilicic acid, 22% in H2O, at plant/US U
Soya oil/RER	Soybean oil, at oil mill/US U
Grain maize IP, at farm/CH U	Corn at farm/US U
Potatoes IP, at farm/CH U	Potatoes, at farm/US U
Rape seed IP, at farm/CH U	Rape seed, at farm/US U
Rape seed extensive, at farm/CH U	Rape seed, at farm/US U
Soy beans IP, at farm/CH U	Soybeans, at farm/US U
Wheat grains IP, at farm/CH U	Wheat grains, at farm/US U

No other work was done to adapt the ecoinvent library, and because of geographic differences other than those modified, there is no guarantee that the resulting inventory is closer to the US reality than the original ecoinvent dataset. For additional information on the original process, see the Ecoinvent System Description.

Most materials with non-mass units have been duplicated with mass units. This allows them to be used easily in Product Stages.

### Parameterized Semiconductor Oxidation Data

We've included the parameterized semiconductor oxidation process from Murphy et al.

### Uncertainty

We've continued to add uncertainty to data in the combined dataset. This is an ongoing process.

### U.S. Fresh Water Source

All fresh water use in RNA processes has been modified to a U.S. water source that will be picked up by most of the water scarcity methods.

### A number of methods, including:

- **The ES Method** (A method found useful by many of our clients which includes indicators for human health, ecosystem quality and resources (from ReCiPe (H)), as well as climate change (from IPCC 100 year), water depletion (from ReCiPe (H)), and cumulative energy demand.)
- **The GPP (Global Protocol on Packaging) method**
- **Methods found in several PCRs including: Printers (ULE), North American Concrete; and the Sustainable Apparel Coalition.**
- **Electricity Usage**

### New U.S. processes added to account for exports

Some U.S. processes from the US-EI library have been added as system level processes to account for exports. As an example, the AOCC (American Old Corrugated Container) used in making recycled pulp in China uses waste corrugate imported from the U.S. The waste corrugate has been duplicated in the ecoinvent library to better account for the U.S impacts. If the user wants to better understand the supply chain of these system processes, we recommend they make a copy of the higher level process and change the link to the appropriate data in the US-EI library.

### **New Detergent and Water Use Processes**

Some processes added to the US-EI library have been converted into European processes by substituting U.S. data with RER data. These include the detergents and water use processes.

### **Updated Chinese Electricity & New Processes**

The Chinese electricity data has been updated to 2011. Some additional Chinese processes have been added, including tap water, at user.

### **More Electricity Data**

Electricity mixes have been added for Taiwan, Honduras and El Salvador.

### **Improved Capability to Account for Electricity Usage**

A newly created substance called electricity usage, found under resources, has been added to all Production + import electricity processes. Adding this resource to a method or using the new Electricity Usage method will give a good indication of total grid electricity used. A few processes pull in the grid electricity without imports and these will be missed.

### **Data you shouldn't use**

Some data that came with the original US-EI was not modified when the specific electricity mixes were changed, and in many cases have a strange mix of upstream processing in this context. This data has been moved to a category called Non-RNA data. If this data has been used in your projects, we suggest that you select the appropriate Ecoinvent 2.2 data in its place.

We also found that users were not consistent with the selection of which transformed process to use. To make it easier for new users, EARTHSHIFT has left a recommended process in the main folder and created an alternative folder for other data that might be used. We selected the recommended processes according to the following decision tree:



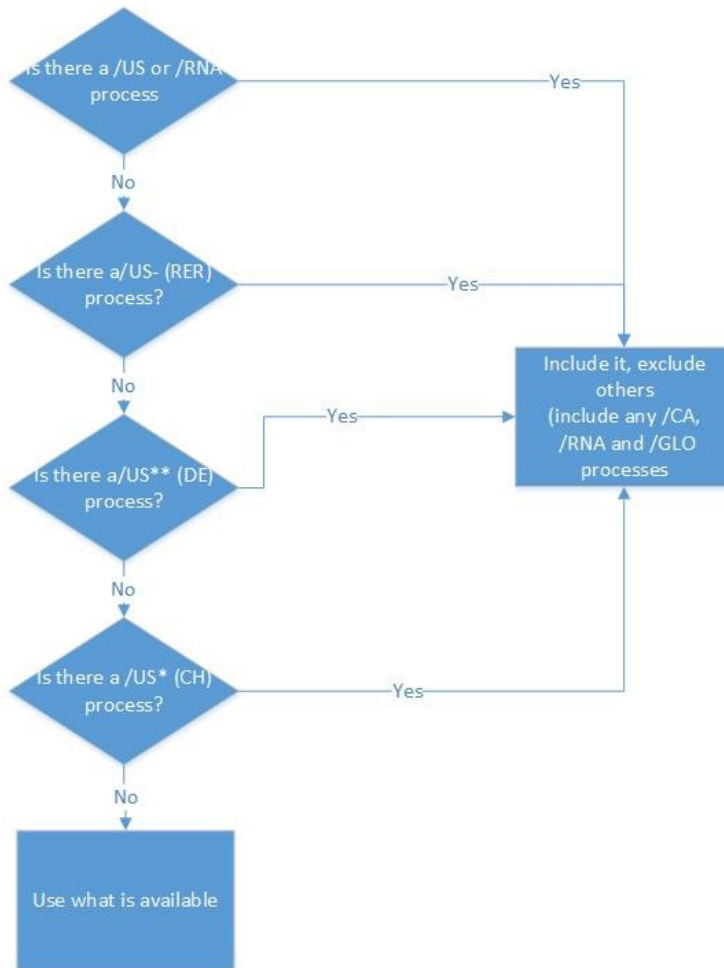


Figure 1: Decision tree used to select data for use in the US-EI main datasets.

The decision tree was based on EARTHSHIFT’s empirical experience with US manufacturers indicating that a European average was more similar to the US condition than a particular country average and that manufacturing conditions in Germany are in general more similar to the US than in Switzerland. If this is not the case for a particular piece of data, it can still be found under a subcategory with the same name as the parent category with the word “alternative” after.

For newcomers to LCA, we recommend not using alternative data unless the user has a specific reason to.