DATASMART LCI Package

Manual

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Introduction

DATASMART LCI Package is a dataset for North American SimaPro customers provided by Long Trail Sustainability (LTS). This dataset was originally developed to create a North American focused dataset, based on a combination of US LCI v.1.60 and Ecoinvent v.2.2 data, modified specifically to be representative of U.S. operations. In an effort to continually provide more data, DATASMART has expanded to a larger dataset, covering more regions and industries, containing data developed by LTS and data submitted to LTS by companies and researchers.

Overview: What's in the DATASMART LCI Package?

DATASMART consists of a wide range of materials and processes inclusive of U.S. natural gas from hydraulic fracturing, U.S. 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. life cycle inventory (LCI) data, many life cycle assessment (LCA) practitioners utilize ecoinvent, which is primarily European data, or US LCI, which has limited data. Wherever possible, DATASMART replaces links in the ecoinvent v.2.2 unit processes with U.S.-specific data, including electricity, natural gas, soybeans, etc. The dummy processes in the US LCI 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 Product Category Rules (PCRs) that require US LCI data with the dummy processes replaced with appropriate data.

Over 700 original datasets are included in DATASMART, covering such industries as textiles, packaging, bio-materials and dairy; all 50 U.S. state, 13 Canadian provinces and territories and 10 U.S. eGRID electricity mixes have also been added. It also includes critically reviewed branded data.

The DATASMART LCI Package is developed and maintained by LTS with one to two updates a year. It is currently only sold as a package and available in SimaPro for SimaPro 9 license holders.

Citing the DATASMART LCI Package:

LTS. 2019. DATASMART LCI Package. http://ltsexperts.com/services/software/datasmart-life-cycle-inventory/ Accessed on <Date>.

DATASMART DATA

All specific and relevant documentation for each individual process can be found in the documentation fields in SimaPro itself. DATASMART data is primarily unit level data and is labelled with U in the process name. In the case that data must remain confidential and these details cannot be included, the data is included at the system level and labelled with S in the process name.

Method

The LTS 2019 Method, created by Long Trail Sustainability, covers commonly used endpoint and midpoint impact categories, containing the ReCiPe endpoint categories, cumulative energy demand, climate change and water use (see Table 2).

Table 1: Selected impact categories and corresponding methods and units of measure for the LTS Method.

Impact Category	Method	Units
Human Health	ReCiPe 2016 Endpoint (H) V1.03	DALY
Ecosystems	ReCiPe 2016 Endpoint (H) V1.03	Species.yr
Resources	ReCiPe 2016 Endpoint (H) V1.03	$
Cumulative Energy Demand	CED V1.11	MJ
Climate Change	IPCC 2013 GWP 100a V1.03	kg CO_2 eq.
Water Use	ReCiPe 2016 Midpoint (H) V1.03	m3

DATASMART Original Data

DATASMART includes over 700 original datasets developed by LTS and submitted by companies and researchers. Submission into the database entails an extensive review of the data to ensure accuracy. This data includes data across many industries, including metals, agriculture, textiles, etc. Notably, DATASMART data includes:

- The 50 U.S. state electricity mixes and 10 eGrid mixes at high, medium and low voltage levels.
- Electricity mixes for the 13 Canadian provinces and territories at high, medium, low voltage levels.
- 75 Chinese specific manufacturing processes, submitted by Ecovane, part of PRé's Partner network.
- Household activities, including clothes washing and drying and dishwashing.
- Textile production processes including fabric treatment, cutting and sewing, and more.
- Strawberries and milk from the U.S. Dairy Greenhouse Gas Carbon Footprint project.

- Many packaging processes, including recycled containerboard and corrugate and molded pulp, including YFY Jupiter's branded straw-based npulp.
- Many more.

Energy Mixes

LTS has created specific energy and electricity mixes to represent recent conditions in the U.S. This data is more frequently updated and more specific than data found for U.S. energy in other databases.

The underlying electricity and natural gas mix are based on 2015 U.S. Energy Information Administration data. See Table 2 for more details.

Table 2: Underlying U.S. electricity mix (Source: U.S. EIA)

	2015
Hard coal	33.17%
Oil	0.69%
Natural gas	32.70% (47% shale)
Industrial gas	0.16%
Petroleum coke	0.16%
Nuclear	19.55%
Hydro	6.11%
Cogen	0.103%
Geothermal	0.39%
Solar PV	0.61%
Wind	4.68%
Canadian imports	0.31%
Mexican imports	0.03%

Approximately 0.53% from waste to energy is not modeled due to the use of the cut off method in ecoinvent. Negative pumped storage has been ignored. Other gases split equally between industrial gas and petroleum coke.

The split for the imported electricity from Canada (90%) and Mexico (10%) is estimated from the U.S. EIA Electric Power Annual 2015 report.

U.S. State electricity mixes

The 50 U.S. state electricity mixes (production + import) are based on 2016 U.S. EIA data. This is reflected in the high, medium and low voltage electricity processes as well.

U.S. eGRID electricity mixes

The 10 U.S. eGRID regions (see map in Figure 1) are included at the production, high, medium and low voltage levels:

- Alaska Systems Coordinating Council (ASCC)
- Florida Reliability Coordinating Council (FRCC)
- Hawaiian Islands Coordinating Council (HICC)
- Midwest Reliability Organization (MRO)
- Northeast Power Coordinating Council (NPCC)
- Reliability First Corporation (RFC)
- SERC Reliability Corporation (SERC)
- Southwest Power Pool (SPP)
- Texas Regional Entity (TRE)
- Western Electricity Coordinating Council (WECC)
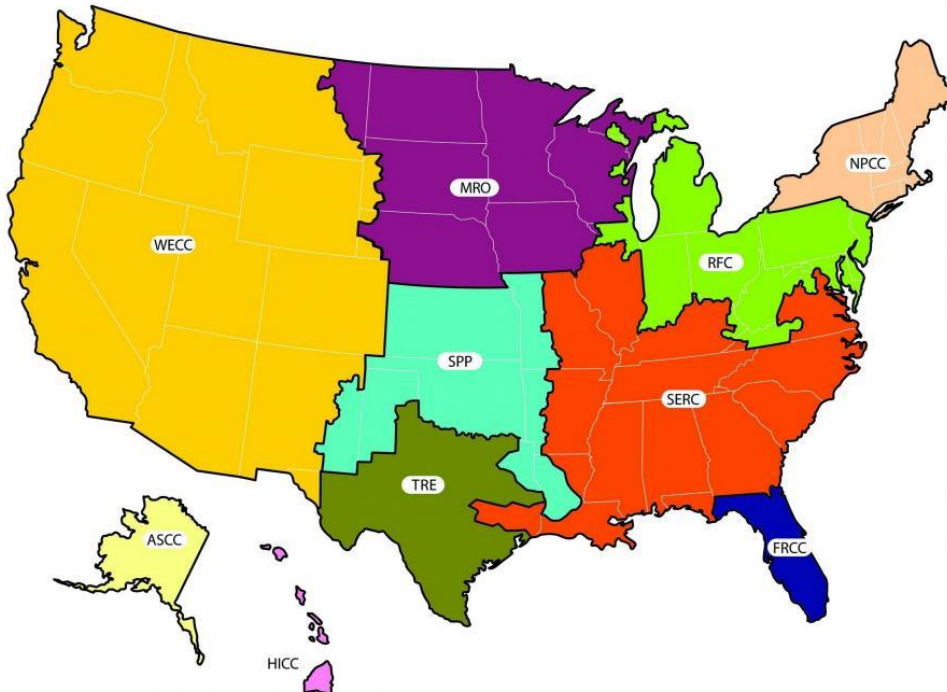
This is a representational map; many of the boundaries shown on this map are approximate because they are based on companies, not on strictly geographical boundaries.
September 2015

Figure 1: Map of U.S. eGRID Subregions (Source: U.S. EPA)

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Table 3 details the electricity sources for each eGRID mix.[1]

Table 3: 2016 U.S. eGRID mixes (Source: U.S. EPA)

	Coal	Oil	Natural gas	Petrol. Coke	Nuclear	Hydro	Bio-mass	Geoth-ermal	Solar	Wind
ASCC	10%	13%	49%	0%	0%	25%	1%	0%	0%	3%
FRCC	16%	1%	67%	1%	13%	0%	2%	0%	0%	0%
HICC	15%	67%	0%	1%	0%	1%	6%	3%	1%	6%
MRO	51%	0%	8%	0%	13%	5%	2%	0%	0%	20%
NPCC	2%	1%	46%	1%	31%	13%	4%	0%	0%	3%
RFC	39%	0%	25%	1%	30%	1%	1%	0%	0%	3%
SERC	32%	0%	35%	0%	26%	3%	2%	0%	0%	0%
SPP	40%	1%	32%	0%	4%	2%	1%	0%	0%	19%
TRE	26%	0%	48%	0%	11%	0%	0%	0%	0%	14%
WECC	23%	0%	30%	0%	8%	24%	1%	2%	4%	7%

Canadian Provinces and Territories Electricity Mixes

The average Canadian electricity mix and the 13 Canadian provinces and territories electricity mixes (see map in Figure 2) were added, based on data from the Government of Canada, National Energy Board in 2019. High, medium and low voltage electricity processes were also created for these mixes.

- Alberta
- Ontario
- British Columbia
- Saskatchewan
- Manitoba
- Yukon
- Northwest Territories
- Nunavut
- Quebec
- New Brunswick
- Newfoundland and Labrador
- Nova Scotia
- Prince Edward Island
- Canada

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[1] FRCC and HICC also have <1% of "other" which were modeled as the highest fuel contributor.

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Figure 2: Map of Canadian Provinces and Territories (Source: Sporcle)

Table 4 details the electricity sources for each Canadian provinces and territories mix.

Table 4: 2019 Canadian Provinces and Territories Electricity Mixes (Source: Government of Canada, National Energy Board)

	Coal	Gas	Oil	Nuclear	Hydro	Biomass	Geo-thermal	Solar	Wind
Canada	9%	9%	1%	15%	60%	1%	1%	1%	4%
Alberta	45%	45%			3%	2%	2%		5%
Ontario		5%		60%	26%	1%	1%	1%	7%
British Columbia		2%	1%		90%	3%	3%		1%
Saskatchewan	47%	34%	0%		14%	1%	1%		4%
Manitoba					97%	1%	1%		2%
Yukon		2%	6%		92%				
Northwest Territories		2%	57%		39%				2%
Nunavut			100%						
Quebec					95%	1%	1%		4%
New Brunswick	21%	10%	2%	36%	20%	2%	2%		7%
Newfoundland and Labrador			5%		94%	1%	1%		

Nova Scotia	58%	14%	4%		9%	2%	2%		12%
Prince Edward Island			1%			1%	1%		98%

Modified Ecoinvent 2.2 Data

DATASMART replaces links in the ecoinvent v.2.2 unit processes with U.S.-specific data (largely energy and fuel) in order to better represent production in the U.S. It contains over 3,000 modified ecoinvent datasets, such as chemicals, metals, energy, transport and waste treatment processes. This data is also used in the background of the DATASMART original datasets.

Data Selection

Some data were not modified completely with upstream U.S. specific processes and can be ignored. This data has been moved to a category called "alternative" data or "Non-RNA processes." Therefore, we recommend considering the "alternative" data obsolete and ignoring this data. If this data has been used in your projects, we suggest that you select the appropriate Ecoinvent 2.2 data in its place.

LTS has left a recommended process in the main folder and moved the processes which should not be used to the "Non-RNA processes" folder. The following symbols are used to represent the geography of the country that the original process was based on.

Symbol	Country
-	RER (Europe)
**	DE (Germany)
*	CH (Switzerland)

We selected the recommended processes according to the following decision tree:

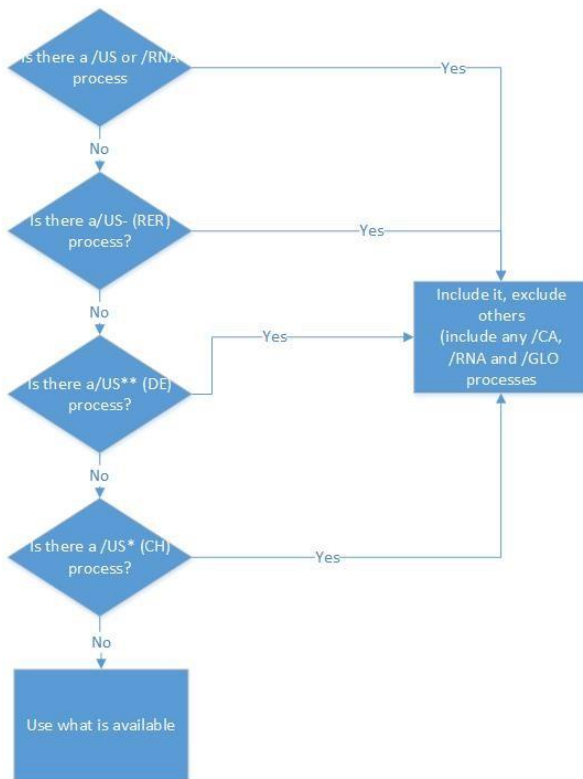D A T A S M A R T L C I P a c k a g e
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Figure 3: Decision tree used to select data for use in modified ecoinvent 2.2 data.

The decision tree was based on LTS's empirical experience with U.S. manufacturers indicating that a European average was more similar to the U.S. condition than a particular country average and that manufacturing conditions in Germany are in general more similar to the U.S. 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 the parent category name.

Modified US LCI 1.60 Data

The US LCI database contains "dummy processes" (i.e. an empty process; no environmental burdens) and recommends that these dummies be filled. DATASMART replaced 146 of the 186 dummy processes with an ecoinvent proxy using U.S. energy (detailed in *DATASMART - US-EI Dataset - Dummy USLCI Processes Replaced with Proxies.xlsx*, which is available upon request). 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. The end result is a more comprehensive database that better represents U.S. operations. DATASMART can fill the requirements of Product Category Rules (PCRs) that require US LCI data with the dummy processes replaced with appropriate data.

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