

## Exercise 2 – Secondary Data

Apart from the primary data, secondary data is also necessary to model processes and attribute the necessary environmental burdens to them. Usually Electricity and Transport are secondary datasets that can be obtained from public databases and other sources, as this data is easily found on the internet, for instance on governmental websites or on scientific literature.

The figures below are screenshots from the Sri Lanka Sustainable Energy Authority<sup>1</sup>, and the NATION newspaper, both are public data sources for the Sri Lanka energy mix dataset you want to create.

However, for the dataset you also need to account for the emissions from the energy production which are not provided and might require more research.

Take a look on the data provided and create an Energy Mix for Sri Lanka, it should be representative for the time period of 2015-2016.

### Energy mix:



**Sri Lanka Energy Balance**  
Compiled by Sri Lanka Sustainable Energy Authority

Home	Electricity	Petroleum Products	Biomass	Energy Balance	Economic Indicators	Grid Emission	Conversion Factors	Coal																																																																																										
Home	<b>Gross Electricity Generation (GWh)</b>																																																																																																	
Electricity Data	Select Year <input type="text" value="2011"/> to <input type="text" value="2015"/> <input type="button" value="Update Table"/> <input type="button" value="Export to Excel"/>																																																																																																	
Overview	<b>Links</b>																																																																																																	
Electricity Generation	Gross Generation of Thermal Power Stations Gross Generation of Hydro Power Stations																																																																																																	
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Energy Balance	Gross Electricity Generation - CEB Power Plants (GWh)																																																																																																	
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<sup>1</sup> <http://www.info.energy.gov.lk/>

Self Generation By Customers	0.00	0.00	0.00	0.00	0.00	Gross Electricity Generation Off Grid Systems (GWh)
Off Grid Systems-Industrial	0.00	0.00	0.00	0.00	0.00	
Off Grid Systems-Non Industrial	0.00	0.00	0.00	0.00	0.00	
Sub Total Off Grid - Conventional	0.00	0.00	0.00	0.00	0.00	
<b>Off Grid Systems - Non Conventional (GWh)</b>						
	2011	2012	2013	2014	2015	
Small Hydro, Industrial	7.07	7.07	7.07	7.07	7.07	7.07
Small Hydro, Household	3.58	3.69	3.69	3.69	3.69	3.69
Solar Photovoltaic, Household	7.60	8.01	8.01	8.01	8.01	8.01
Wind Energy, Household	0.01	0.01	0.01	0.01	0.01	0.01
Sub Total Off-Grid, Non-Conventional	18.26	18.77	18.77	18.77	18.77	18.77
<b>Total Generation Sri Lanka</b>						
	2011	2012	2013	2014	2015	
Total	11,599.87	11,897.62	12,024.32	12,848.88	13,225.55	
<b>Summary - 1 - CEB Grid</b>						
	2011	2012	2013	2014	2015	
CEB Hydro	3,972.67	2,726.72	6,010.10	3,649.72	4,904.41	
CEB Wind	2.66	2.32	2.32	2.13	1.07	
CEB Thermal	2,531.68	3,432.62	2,795.78	5,269.10	5,524.39	
IPP Thermal (Gross)	4,352.33	4,983.85	2,023.94	2,675.20	1,272.03	
SPP Hydro	600.57	564.69	908.39	902.17	1,064.72	
SPP Thermal	0.00	0.00	0.00	0.00	0.00	
SPP Solar	1.11	2.00	1.68	1.47	1.87	
SPP Biomass	31.63	22.17	26.39	41.39	57.31	
SPP Wind	88.95	144.48	232.26	270.32	342.13	
NmP Solar	0.00	0.00	4.69	18.60	38.84	
Hired Thermal	0.00	0.00	0.00	0.00	0.00	
Gross Generation to CEB Grid	11,581.61	11,878.85	12,005.55	12,830.11	13,206.77	
<b>Summary - 2 - CEB Grid</b>						
	2011	2012	2013	2014	2015	
CEB Hydro	3,972.67	2,726.72	6,010.10	3,649.72	4,904.41	
Thermal, CEB, IPP and Hired	6,884.01	8,416.47	4,819.72	7,944.30	6,796.42	
CEB Wind	2.66	2.32	2.32	2.13	1.07	
New Renewable Energy	722.26	733.34	1,168.72	1,215.36	1,466.04	
Net-metered Projects	0.00	0.00	4.69	18.60	38.84	
Gross Generation to CEB Grid	11,581.61	11,878.85	12,005.55	12,830.11	13,206.77	
Generation Growth Rate: CEB Grid (%)	7.1	2.1	0.3	6.6	2.3	
<b>Summary- Sri Lanka</b>						
	2011	2012	2013	2014	2015	
CEB Hydro	3,972.67	2,726.72	6,010.10	3,649.72	4,904.41	
Thermal, CEB, IPP and Hired	6,884.01	8,416.47	4,819.72	7,944.30	6,796.42	
CEB Wind	2.66	2.32	2.32	2.13	1.07	
New Renewable Energy	722.26	733.34	1,168.72	1,215.36	1,466.04	
Net-metered Projects	0.00	0.00	4.69	18.60	38.84	
Self-Generation by Customers	0.00	0.00	0.00	0.00	0.00	
Off-Grid, Conventional	0.00	0.00	0.00	0.00	0.00	
Off-Grid, Non-Conventional	18.26	18.77	18.77	18.77	18.77	
Gross Generation Sri Lanka	11,599.87	11,897.62	12,024.32	12,848.88	13,225.54	
Generation Growth Rate Sri Lanka (%)	7.4	2.6	1.1	6.9	2.9	

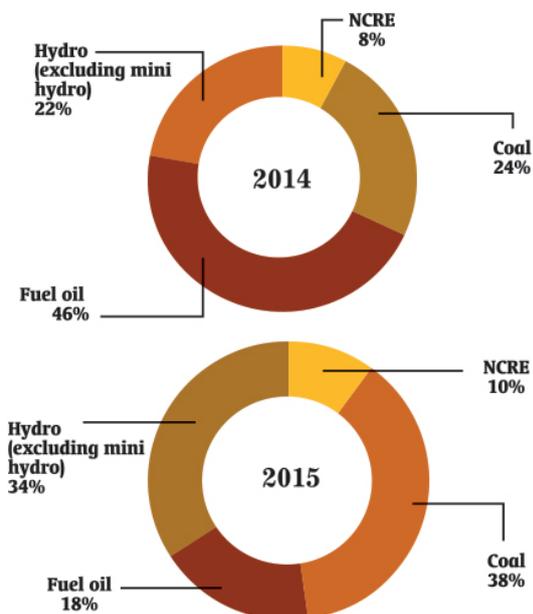
# Sri Lanka's energy mix

By Azhar Razak - Mar 26, 2016 👁 2460 💬 0

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## Electricity generation mix (Jan-Aug)



**Solar power** Grid-connected solar power has only recently been introduced. The only operational commercial-scale solar-powered facility is the Buruthakanda Solar Park of 1.2 MW, operated by the Sri Lanka Sustainable Energy Authority (SLSEA).

Sri Lanka's electricity demand per year is estimated to be at 2300 megawatts with the island's present generating capacity being around 3900 megawatts.

**Hydroelectricity** Currently, ten large hydroelectric power stations are in operation, with the single largest hydroelectric source being the Victoria Dam. Although a large portion of the country's hydroelectric resource is tapped, the government continues to issue small hydro development permits to the private sector, for projects up to a total installed capacity of 10 MW per project.

**Thermal power** Thermal power stations in Sri Lanka run on diesel, other fuel oils, naphtha or coal. The Norochcholai Coal Power Station, the only coal-fired power station in the country, was commissioned in late 2011. The plant has since added 900 megawatts of electrical capacity to the grid.

**Wind power** The first commercial grid-connected wind farm is the 3 MW Hambantota Wind Farm, northwest of Hambantota. The government policy limit of 10 MW per wind project significantly decreases economies-of-scale, further straining such developments.

**Geothermal power** Geothermal power is under research, although no power stations of this type are operational.

**Nuclear power** The CEB has included a 600MW nuclear power plant as an option in its plans for 2031.

Source: <http://nation.lk/online/2016/03/26/sri-lankas-energy-mix.html>

After exhaustively researching you came to the conclusion that the detailed inventory of Sri Lanka energy production isn't available, therefore you decided to adapt datasets from other countries.

Onecoinvent you found the following datasets on which you could base Sri Lanka energy mix emissions, choose the dataset you find more appropriate to adapt to Sri Lanka.

**electricity production, hydro, reservoir, alpine region | electricity, high voltage | cut-off, U**

<b>Inputs</b>			
Flow	Category	Amount	Unit
Energy, potential (in hydropower reservoir), converted	Resource/in water	3.79	MJ
hydropower plant, reservoir, alpine region	4220:Construction of utility projects/4220a: Construction of utility pro...	4.04E-13	Item(s)
lubricating oil	192:Manufacture of refined petroleum products/1920:Manufacture of refine...	7.56E-06	kg
Occupation, water bodies, artificial	Resource/land	0.00345	m2*a
Transformation, from unknown	Resource/land	2.30E-05	m2
Transformation, to industrial area, built up	Resource/land	2.30E-07	m2
Transformation, to water bodies, artificial	Resource/land	2.28E-05	m2
Volume occupied, reservoir	Resource/in water	0.15	m3*a
waste mineral oil	382:Waste treatment and disposal/3822:Treatment and disposal of hazardou...	-7.56E-06	kg
Water, turbine use, unspecified natural origin	Resource/in water	0.81	m3
<b>Outputs</b>			
Flow	Category	Amount	Unit
Dinitrogen monoxide	Emission to air/low population density	7.70E-08	kg
electricity, high voltage	351:Electric power generation, transmission and distribution/3510:Electr...	1	kWh
Methane, biogenic	Emission to air/low population density	1.40E-05	kg
Water	Emission to air/unspecified	29.22168	kg
Water	Emission to water/unspecified	0.78078	m3

**electricity production, wind, 1-3MW turbine, onshore | electricity, high voltage | cut-off, U**

<b>Inputs</b>			
Flow	Category	Amount	Unit
Energy, kinetic (in wind), converted	Resource/in air	3.87	MJ
lubricating oil	192:Manufacture of refined petroleum products/1920:Manufacture of refine...	5.83E-05	kg
transport, freight, lorry 7.5-16 metric ton, EURO3	492:Other land transport/4923:Freight transport by road	4.31E-12	t*km

waste mineral oil	382:Waste treatment and disposal/3822:Treatment and disposal of hazardou...	-5.83E-05	kg
wind turbine network connection, 2MW, onshore	4220:Construction of utility projects/4220a: Construction of utility pro...	1.85E-08	Item(s)
wind turbine, 2MW, onshore	4220:Construction of utility projects/4220a: Construction of utility pro...	1.85E-08	Item(s)
<b>Outputs</b>			
Flow	Category	Amount	Unit
electricity, high voltage	351:Electric power generation, transmission and distribution/3510:Electr...	1	kWh

### electricity production, hard coal | electricity, high voltage | cut-off, U

<b>Inputs</b>			
Flow	Category	Amount	Unit
hard coal	051:Mining of hard coal/0510:Mining of hard coal	0.63581	kg
hard coal ash	239:Manufacture of non-metallic mineral products n.e.c./2394:Manufacture...	-0.10858	kg
hard coal power plant	4220:Construction of utility projects/4220a: Construction of utility pro...	1.33E-11	Item(s)
SOx retained, in hard coal flue gas desulfurisation	351:Electric power generation, transmission and distribution/3510:Electr...	0.00073	kg
water, completely softened, from decarbonised water, at user	360:Water collection, treatment and supply/3600:Water collection, treatm...	0.0871	kg
Water, cooling, unspecified natural origin	Resource/in water	0.06639	m3
water, decarbonised, at user	201:Manufacture of basic chemicals, fertilizers and nitrogen compounds, ...	2.90323	kg
<b>Outputs</b>			
Flow	Category	Amount	Unit
Acenaphthene	Emission to air/low population density	6.10E-11	kg
Acrolein	Emission to air/low population density	3.47E-08	kg
...			

### heat and power co-generation, biogas, gas engine | electricity, high voltage | cut-off, U

<b>Inputs</b>			
Flow	Category	Amount	Unit

biogas	382:Waste treatment and disposal/3821:Treatment and disposal of non-haza...	0.34433	m3
heat and power co-generation unit, 160kW electrical, common components for heat+electricity	4220:Construction of utility projects/4220a: Construction of utility pro...	3.91E-08	Item(s)
heat and power co-generation unit, 160kW electrical, components for electricity only	271:Manufacture of electric motors, generators, transformers and electri...	3.91E-08	Item(s)
heat and power co-generation unit, 160kW electrical, components for heat only	281:Manufacture of general-purpose machinery/2811:Manufacture of engines...	3.91E-08	Item(s)
lubricating oil	192:Manufacture of refined petroleum products/1920:Manufacture of refine...	0.00023	kg
waste mineral oil	382:Waste treatment and disposal/3822:Treatment and disposal of hazardou...	-0.00023	kg
<b>Outputs</b>			
Flow	Category	Amount	Unit
Carbon dioxide, biogenic	Emission to air/low population density	0.65358	kg
Carbon monoxide, biogenic	Emission to air/low population density	0.00038	kg
Dinitrogen monoxide	Emission to air/low population density	1.96E-05	kg
electricity, high voltage	351:Electric power generation, transmission and distribution/3510:Electr...	1	kWh
Methane, biogenic	Emission to air/low population density	0.00018	kg
Nitrogen oxides	Emission to air/low population density	0.00012	kg
NMVOC, non-methane volatile organic compounds, unspecified origin	Emission to air/low population density	1.57E-05	kg
Platinum	Emission to air/low population density	5.48E-11	kg
Sulfur dioxide	Emission to air/low population density	0.0002	kg

Assume this composition of the electricity production mix in Sri Lanka and calculate an overall data set based on the data sets listed above.

<b>Electricity, high voltage, production mix - Sri Lanka</b>				
<b>Inputs</b>				
Flow		Amount	Unit	%
electricity production, hydro		0.3714	kWh	37.14%
electricity production, wind		0.0008	kWh	0.01%
electricity production, nuclear		0.0000	kWh	0.00%
electricity production, fossil fuels and coal		0.5146	kWh	51.46%
electricity production, others (biomass, solar, etc.)		0.1139	kWh	11.39%
<b>Outputs</b>				
Flow	category	amount	unit	
electricity, high voltage	351:Electric power generation, transmission and distribution	1	kWh	