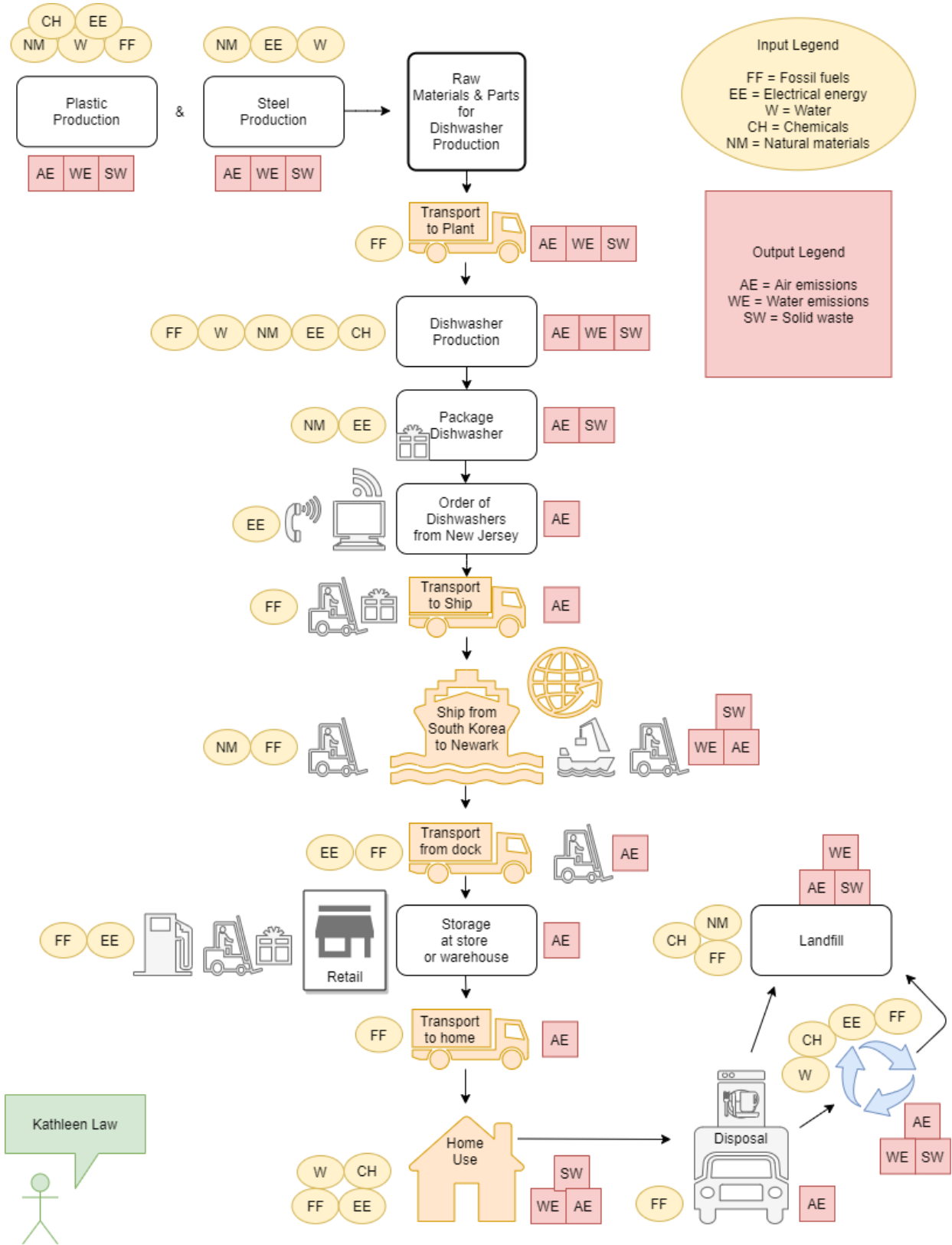


Life Cycle Analysis Diagram



Kathleen Law

The goal and scope of this analysis was to perform an inventory of the life cycle of a dishwasher, from cradle to grave. This is a general analysis, as there are no numbers worked into the diagram. There will however, be examples of dishwasher GHG numbers later. The boundaries of this assessment are items directly linked to the dishwasher, including production, transport, use, and disposal. This diagram will not illustrate secondary inputs and outputs, such as those needed to produce transport vehicles, for example: forklifts, trucks, or ships; build warehouses or manufacturing plants; or acquire materials for computers, wireless internet, cranes at the port, or fueling stations.

Dishwashers are made mostly of steel and plastic. Both items are made through processes requiring several natural materials, such as processed iron ore, using special techniques, and fuel/power. Many people may only consider the home use portion of their dishwasher, without realized the great input and lengthy travel needed to get the appliance into their home. Once in the home, the average dishwasher will last eight years before needing replaced (www.canstarblue.com.au/appliances/dishwasher). While in the home the dishwasher will run a few times a week, using electricity to run, water, natural gas to heat the water, and chemicals as soap. The life cycles of the hot water heaters and soap are also not considered in this diagram.

Once the dishwasher is deemed trash, it sits on the curb until someone collects it. From there, it may either be partially recycled and then sent to the landfill, or it may just go whole, to the landfill, where it adds to the trash and emissions.

Social Media Post



Lovearth
Dishwashers
Home convenience without sacrifice.

Ways we are working to help you sleep better at night...

- *Better interior layout, so you can wash more dishes, properly, the first time!
- *Return your old dishwasher to us, for us to recycle, and receive 20% off your brand new **Lovearth dishwasher!**
- *We are currently working toward moving all our production to North America, to cut down on transport emissions, as well as employing stricter manufacturing guidelines.

@lovearth Shop at lovearth.com

Here at Lovearth Dishwashers, we begin by creating a great interior design, to fit many items and ensure that they all come out clean, without having to prewash or rewash (like my old dishwasher). We also offer a discount to motivate brand loyalty and bring in new customers, while making sure our product, and other dishwashers are being treated correctly at end of life.

It would be great to be entirely made in America, to create more jobs and limit transport; we would at least, move to all North American production. Keeping production close to home would allow us to partner with trusted vendors who follow strict environmental guidelines and use sustainability decision tools, as we do.

Greenhouse Gas figures from “A guide to household manual and machine dishwashing through a life cycle perspective” by Gabriela Porras, et al.

<https://iopscience.iop.org/article/10.1088/2515-7620/ab716b>

Table 1. Performance standards for standard-sized residential machine dishwashers.

Standard	Annual energy use (kWh/yr)	Water use per cycle (gal/cycle)
Federal ^a	307	5
Energy Star ^b	270	3.5
Stainless Steel ^d	270	3.5
Plastic ^d	270	3.5
Energy Star Most Efficient ^c	240	3.2
Max Tech ^a	180	2.2

^a Federal Energy Conservation Standards for residential dishwashers [12, 13].

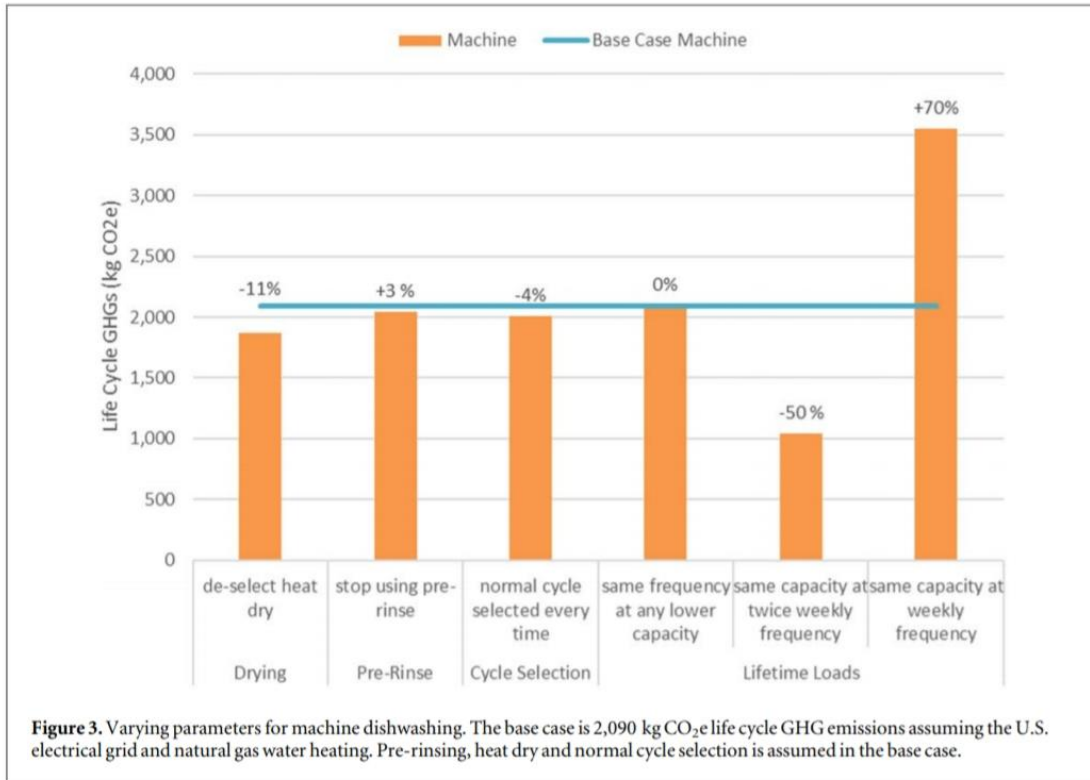
^b Energy Star Program Requirements. [14].

^c Energy Star Most Efficient recognition in 2019 requires that machines reach a minimum Cleaning Index of 70 [15].

^d The stainless steel and plastic machines in this study meet minimum Energy Star standards.

Table 2. Material by mass for stainless steel tub machine dishwasher model.

Material	Mass	
	(kg)	(%)
Plastic		
Polypropylene (PP)	4.34	9.57
Low Density Polyethylene (LDPE) Film	2.19	4.82
Polyethylene Terephthalate (PET)	1.02	2.26
Nylon	0.70	1.55
LDPE Resin	0.67	1.47
Polystyrene (PS)	0.51	1.13
Polyoxymethylene (POM)	0.34	0.75
EPDM/Rubber	0.48	1.06
Polypropylene/Ethylene Propylene Diene Terpolymer (PP/EPDM)	0.22	0.48
Poly(p-phenylene oxide)/Polystyrene (PPO/PS)	0.18	0.39
Polyvinyl Chloride (PVC)	0.12	0.26
High Density Polyethylene (HDPE)	0.12	0.25
Acrylonitrile butadiene styrene (ABS)	0.05	0.12
Thermoplastic polyurethane (TPU)	0.04	0.08
Polycarbonate-Acrylonitrile butadiene styrene (PC-ABS)	0.03	0.07
Polycarbonate (PC)	0.01	0.02
Vinyl	0.001	0.002
Total	11.01	24.26
Metal		
Stainless Steel	19.4	42.6
Galvanized Steel	4.34	9.57
Zinc	0.22	0.49
Aluminum	0.17	0.36
Copper	0.15	0.33
Total	24.3	53.39
Other		
Mastic	6.96	15.3
Cardboard	1.43	3.14
Wood	0.86	1.89
Wiring Harness	0.43	0.94
Pulp	0.25	0.54
Printed Circuit Board (PCB)	0.23	0.51
Total	10.14	22.35
TOTAL MODELLED MASS	45.39	100.00
TOTAL MACHINE MASS FROM MANUFACTURER	47.17	



It is interesting how much the total greenhouse gas emissions may be affected by a few different selections each wash cycle. I will be sure not to let my dishwasher go through the heat-dry cycle anymore! When I purchase a home, I will save up for all EnergyStar appliances and keep them in good-working order.

Table 6. Best-and worst-in-class for Energy Star certified standard-sized residential machine dishwashers.

	Best-in-class	Stainless Steel ^b	Plastic ^b	Worst-in-class
Annual Energy Use ^a (kWh)	199	270	270	307
Annual Energy Cost (\$)	12.0	32.0	32.0	41.0
Annual Emissions (kg CO ₂ e)	373	505	505	575
Water use per cycle (gal)	1.95	3.50	3.50	5.00

^a Annual Energy Use and Annual Energy Cost are based on electric water heating.

^b The stainless steel (KDTM354ESS) and plastic (WDF330PAH) are the models selected in this study.