

Assessing the Environmental Impacts of Household Water Supply: A Case Study Considering Consumption Patterns within a Life-Cycle Perspective

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Table S1. List of Ecoinvent processes used in the inventory

	Well water	Tap water	Bottled water
Inputs from the technosphere (materials/fuels)	N/A	-Chlorine, gaseous {RoW} market for Cut-off, S -Aluminium sulfate, powder {RoW} market for aluminium sulfate, powder Cut-off, S -Lime, hydrated, packed {RoW} market for lime, hydrated, packed Cut-off, S -Diesel, burned in diesel-electric generating set, 18.5kW {GLO} diesel, burned in diesel- electric generating set, 18.5kW Cut-off, S	-Polypropylene, granulate {GLO} market for Cut-off, S -Corrugated board box {RoW} market for corrugated board box Cut-off, S -Blow moulding {RoW} blow moulding Cut-off, S -Injection moulding {RoW} processing Cut-off, S -Packaging film, low density polyethylene {RoW} production Cut-off, S -Kraft paper, unbleached {RoW} production Cut-off, S -Transport, freight, lorry 16-32 metric ton, EURO3 {RoW} transport, freight, lorry 16-32 metric ton, EURO3 Cut-off, S -Ozone, liquid {RoW} production Cut-off, S -Polyethylene terephthalate, granulate, bottle grade {GLO} market for Cut-off, S

Inputs from the technosphere (electricity/heat)	-Electricity, low voltage {CL} market for Cut-off, S*	-Electricity, medium voltage {CL} market for Cut-off, S*	-Electricity, medium voltage {CL} market for Cut-off, S*
Waste and emissions for treatment	-	-	-Wastewater from water fabrication {GLO} market for Cut-off, S

* Updated to year 2020 with data from CNE (2020) [16]

Table S2. Average survey validation results by dimension and corresponding free-marginal Kappa values.

Dimension	Average	Free-Marginal Kappa
Sociodemographic description	3.89	0.79
Access to water sources	3.78	0.67
Water consumption for personal hygiene	3.91	0.81
Water use for cleaning	3.79	0.64
Tap water consumption	3.97	0.90
Outdoor water use	3.96	0.88
Water saving habits	3.99	0.96

Table S3. Average survey validation results by category and corresponding free-marginal Kappa values

Category	Average	Free-Marginal Kappa
Coherence	3.91	0.81
Relevance	3.91	0.83
Clarity	3.91	0.78
Sufficiency	3.86	0.68

Table S4. Specific water consumption per appliance or activity.

Appliance or activity	Specific consumption	Unit	References
Showering	6.8	L/min	Castillo-Ávalos et al. (2013) [20]
Irrigation	8.5	L/min	Castillo-Ávalos et al. (2013) [20]
Washing machine	6.0	L/kg-load	Castillo-Ávalos et al. (2013) [20]
Toilet flushing	3 or 9	L/flush	Castillo-Ávalos et al. (2013) [20]
Dish washing	4.6	L/min	Castillo-Ávalos et al. (2013) [20]
Tooth brushing	4.6	L/min	Castillo-Ávalos et al. (2013) [20]

Table S5. Statistical parameters of the drinking water production system inventory

Chillán system	Average	Max	Min	SD	Mode	p value*
Electrical energy (kWh/m ³)	0.03	0.09	6.1 x10 ⁻³	1.15 x10 ⁻²	3.60 x10 ⁻²	<0.0001
Chlorine gas (kg/m ³)	2.60 x10 ⁻³	4.55 x10 ⁻³	1.60 x10 ⁻³	3.94x10 ⁻⁴	2.00 x10 ⁻³	<0.0001
Calcium hydroxide (kg/m ³)	3.00 x10 ⁻⁴	1.18 x10 ⁻²	0	1.21 x10 ⁻³	0	<0.0001
Oil consumption (kWh/m ³)	5.58 x10 ⁻⁵	1.05 x10 ⁻²	0	4.80x10 ⁻⁴	0	<0.0001
Aluminium sulfate (kg/m ³)	8.30 x10 ⁻³	0.10	0	1.40x10 ⁻²	0	<0.0001
Northeastern extraction system	Average	Max	Min	SD	Mode	p value*
Electrical energy (kWh/m ³)	1.34	9.81	0	1.57	0	< 0.0001
Chlorine gas (kg/m ³)	8.99x10 ⁻⁴	5.26 x10 ⁻³	0	8.36 x10 ⁻⁴	0	< 0.0001
Northern extraction system	Average	Max	Min	SD	Mode	p value*
Electrical energy (kWh/m ³)	0.79	2.28	0	0.16	0.76	< 0.0001
Chlorine gas (kg/m ³)	1.90 x10 ⁻³	5.98 x10 ⁻³	0	2.36 x10 ⁻⁴	2.00 x10 ⁻³	< 0.0001
Oil consumption (kWh/m ³)	1.52 x10 ⁻³	0,21	0	1.11 x10 ⁻²	0	< 0.0001
Southern extraction system	Average	Max	Min	SD	Mode	p value*
Electrical energy (kWh/m ³)	0.80	5.65	0	0.46	0	< 0.0001
Chlorine gas (kg/m ³)	1.23 x10 ⁻³	3.52 x10 ⁻³	0	6.76 x10 ⁻⁴	0	< 0.0001
Oil consumption (kWh/m ³)	2.56 x10 ⁻³	0,45	0	1.95 x10 ⁻²	0	< 0.0001
Southeastern extraction system	Average	Max	Min	SD	Mode	p value*
Electrical energy (kWh/m ³)	0.96	1.35	0	0.15	1	< 0.0001
Chlorine gas (kg/m ³)	1.21x10 ⁻³	1.64 x10 ⁻³	0	1.38x10 ⁻⁴	1.00 x10 ⁻³	< 0.0001

Max: Maximum observed value; Min: Minimum observed value; SD: Standard deviation. * p value represents the results of the Shapiro-Wilks test

Annex S1. Survey used in the study

I. Sociodemographic Description

1.- How old are you?

2.- What is your occupation?

3. Complete with the number of members of your family group (living in your home) in each indicated age range.

- a) younger than 12 (children): _____
- b) from 13 to 19 (teenagers): _____
- c) from 19 to 60 (adults): _____
- d) over 60 (seniors): _____

4.- Approximately what is your total household income (include the incomes of everyone who works or receives a pension or any other monetary income)?

- a. Under \$320,000 CLP
- b. Between \$320,001 and \$960,000 CLP
- c. Between \$960,001 and \$1,600,000 CLP
- d. Over \$1,600,000 CLP

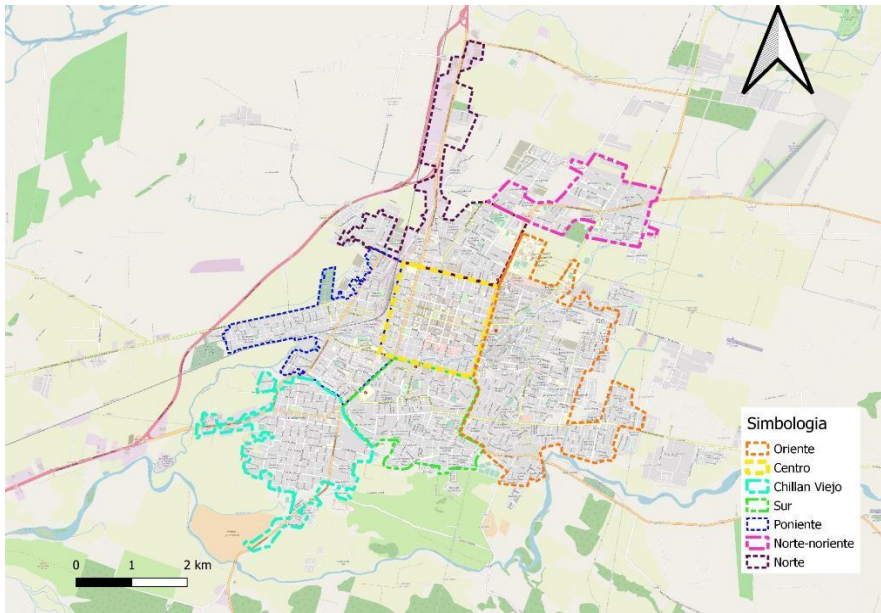
5.- What type of home do you live in?

- a. Apartment
- b. House
- c. Interior house

6.- What area of the city is your home located in?

- a) East
- b) Center
- c) Chillán Viejo
- d) South
- e) West
- f) Northeast
- g) North

If you wish, you may specify the area or neighborhood you live in: _____.



II. Access to water sources

7.- Do you have access to the city tap water network?

- a. Yes
- b. No

8.- If your previous response was “Yes,” approximately how much is your monthly charge for tap water service? _____

9.- Do you have a subsidy related to the payment of your tap water bill?

- a. Yes
- b. No

10. Approximately what amount is covered by the subsidy?

11.- Do you have a well or driven well at your home?

- a. Yes
- b. No

12.- If you have access to a well, what do the members of your household use the water you draw from the well for? (mark all the options that apply)

- a. Irrigation
- b. Laundry
- c. Toilet flushing
- d. Sink
- e. Dish washing
- f. Cooking food
- g. Pool
- h. Drinks (including preparation of tea, coffee, powdered juices, and others)
- i. Other. Specify: _____

13.- If you have access to well water, during what time of the year do you use it? (mark all the options that apply)

- a. Summer (January to March)
- b. Autumn (April to June)
- c. Winter (July to September)
- d. Spring (October to December)

III. Water consumption habits related to personal hygiene

14.- How often do you estimate that each member of your household uses the shower in a week?

- c. Children and teenagers (0 to 19 years old): _____ times a week
- d. Adults and seniors (20 years and older): _____ times a week

15.- How many minutes on average do you estimate that each shower last?

- a. Children and teenagers: _____ minutes
- b. Adults and seniors: _____ minutes

IV. Water use habits related to cleaning

16.- How often, on average, is laundry done in your home?

R- _____ times a week

17.- What load size do you usually wash in your washing machine?

- e. Full load
- f. Medium load
- g. Low load
- h. I don't have a washing machine

18.- How many times a day do you estimate that your household washes the dishes? R-_____times a day

V. Water intake habits

19.- Approximately how many glasses of water or juice, or cups of tea/coffee (250 mL) do you estimate that each person in your household consumes a day? Do not include in your estimate consumption of carbonated beverages, bottled juices, mineral or bottled water, or commercially purchased beverages drinks.

- i. Children and teenagers:
 - i. 3 glasses or below per day
 - ii. Between 4 and 6 glasses a day
 - iii. Between 7 and 10 glasses a day
 - iv. More than 10 glasses a day
 - v. More than 10 glasses a day
- j. Adults and seniors:
 - i. 3 glasses or below per day
 - ii. Between 4 and 6 glasses a day
 - iii. Between 7 and 10 glasses a day
 - iv. More than 10 glasses a day
 - v. More than 10 glasses a day

20.- If bottled water or mineral water is consumed in your household, how often do you estimate that each of the following formats is purchased? Complete only the information that applies to you.

- a. Half-liter (500 cc) bottles: _____ times a week
- b. 1.6-liter bottles: _____ times a week
- c. 5-liter bottles: _____ times a week
- d. 10-liter bottles: _____ times a week
- e. Others (specify): _____

VI. Outdoor water consumption habits

21.- If you have a yard, how many times a week in each season of the year do you water it? Complete only the information that applies to you.

- k. Summer (January to March): _____ times a week
- l. Autumn (April to June): _____ times a week
- m. Winter (July to September): _____ times a week
- n. Spring (October to December): _____ times a week

22.- Which watering system do you use?

- a. Automatic sprinklers
- b. Sprinklers manually connected to a hose
- c. Hose, no nozzle
- d. Hose, with a nozzle to regulate the flow
- e. Other (specify): _____

23.- How long does it take to water the yard in each season of the year? Complete only the information that applies to you.

- a. Summer: _____ minutes
- b. Autumn: _____ minutes
- c. Winter: _____ minutes
- d. Spring: _____ minutes

24.- If you have a pool at home, how many times a year do you fill it? (leave the cell empty if your answer is negative)

R- _____ times a year

25.- What is the approximate volume of your pool? (leave the cell empty if your response is negative)

- a. Up to 1,500 liters (for example, children's pool)
- b. Between 1,501 and 3,000 liters (for example, medium-sized above-ground pools)
- c. Between 3,001 and 10,000 liters (for example, large above-ground pools or medium-sized built-in pools)
- d. Over 10,000 liters (for example, built-in pools)

VII. Saving habits

26.- Does your household have dual-flush toilets (two flush buttons: one for urine and another for feces)?

- a. Yes, in all toilets
- b. Yes, but only in half of the toilets
- c. Yes, but in less than half of the toilets
- d. No

27.- Does your household have low-flow faucets or aerators in the sink(s), shower(s), or dishwasher? (mark all the options that apply)

- a. Yes, in all showers
- b. Yes, in all sinks
- c. Yes, in all dishwashers
- d. Yes, but only on half of the sinks, showers, and dishwashers.
- e. Yes, but on less than half of the sinks, showers, and dishwashers.
- f. No

28.- When brushing their teeth, do the members of your family leave the water off?

- a. Children and teenagers: Yes/No/I don't know
- b. Adults and seniors: Yes/No/I don't know

29.- Is your washing machine water efficient?

- a. Yes
- b. No
- c. I don't know

30.- In your household, do you use any type of water reuse strategy (for example, use water from the sink to flush the toilet)? If the response is affirmative, please briefly describe it (otherwise leave blank).

R-_____