

## Supplementary Material

Information below represents supplementary material to the manuscript “At the crossroad between green and thirsty: Carbon emissions and water consumption of Spanish thermoelectricity generation, 1969-2019”, whose authors are Sara Cano-Rodríguez, Mar Rubio-Varas, and Diego Sesma-Martín.

Table S: Information sources providing data on CO<sub>2</sub> emissions and freshwater consumption for each thermoelectric power plant in Spain.

Power Plant Name	Source of Information for CO <sub>2</sub>	Cooling System	Source of Information for Water
<b>NUCLEAR</b>			
Almaraz 1, 2	No direct CO <sub>2</sub> emissions associated	Once-through	Environmental statements of the electricity utility for the years 2004-2019.
Ascó 1, 2		Cooling tower	Estimated factor based on unpublished data from the owner
Cofrentes		Cooling tower	Environmental Statements for the years 2008-2016, and 2019.
Santa María de Garoña		Once-through	Technical factors from Macknick et al. (2012)
Trillo 1		Cooling tower	Environmental statements of the electricity utility for the years 2004-2019.
Vandellós 1, 2		Once-through (Cooling towers since 2009)	Vandellós I cooled by gas. Vandellós II uses sea water. Since 2009, the power plant operates with an alternative freshwater cooling system.
José Cabrera (Zorita)		Once-through	Technical factors from Macknick et al. (2012)

Power Plant Name	Source of Information for CO <sub>2</sub>	Cooling System	Source of Information for Water
<b>COAL</b>			
Aboño	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Aliaga	Estimated based on factor emission coefficients from plants built about the same time (hereafter, Estimated Time Trend factor) from State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Estimates based on the power plant's operational daybook.
Andorra (Teruel)	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Environmental statements of the electricity utility for the years 2011-2018.
Anllares	State Registry of Pollutant Emissions years 2000-2019	Partial open circuit with cooling tower	Environmental statements of the electricity utility for the years 2009-2015.
As Pontes (U.P.T.)	Estimated Time Trend factor	Cooling tower	Environmental statements of the electricity utility for the years 2011-2019.
Compostilla 1	State Registry of Pollutant Emissions years 2000-2019	Once-through	Technical factors from Macknick et al. (2012)
Compostilla 2, 3, 4, 5	State Registry of Pollutant Emissions years 2000-2019	Once-through (2, 3) Cooling tower (4, 5)	Environmental statements of the electricity utility for the years 2011-2018.
Escatrón	Estimated Time Trend factor	Once-through	Technical factors from Macknick et al. (2012)
Escucha	State Registry of Pollutant Emissions years 2000-2019	Air-cooled condensers	No freshwater uses associated.
Fígols	Estimated Time Trend factor	Once-through	Technical factors from Macknick et al. (2012)
Lada 3, 4	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
La Robla 1, 2	State Registry of Pollutant Emissions years 2000-2019	Partial open circuit with cooling tower	Environmental statements of the electricity utility for the years 2009-2015.

<b>Power Plant Name</b>	<b>Source of Information for CO<sub>2</sub></b>	<b>Cooling System</b>	<b>Source of Information for Water</b>
Litoral de Almería 1, 2 (Carboneras)	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Los Barrios	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Meirama	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Environmental statements of the electricity utility for the years 2010-2017.
Narcea 1, 2, 3	State Registry of Pollutant Emissions years 2000-2019	Once-through (1, 2) Cooling tower (3)	Environmental statements of the electricity utility for the years 2010 and 2012
Pasajes	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Puente Nuevo 1, 2	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
Puertollano (CSE, ENECO)	Estimated Time Trend factor	Cooling tower	Technical factors from Macknick et al. (2012)
Puertollano (ENCASO, ENP, REP)	Estimated Time Trend factor	Cooling tower	Technical factors from Macknick et al. (2012)
Serchs (Cercs)	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
Ujo	Estimated Time Trend factor	Once-through	Technical factors from Macknick et al. (2012)
Velilla del Río Carrión 1, 2	State Registry of Pollutant Emissions years 2000-2019	Once-through (1) Cooling tower (2)	Technical factors from Macknick et al. (2012)
<b>FUELOIL-GAS</b>			
Aceca 1, 2	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Spang et al. (2014)
Bahía de Algeciras 3	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water

<b>Power Plant Name</b>	<b>Source of Information for CO<sub>2</sub></b>	<b>Cooling System</b>	<b>Source of Information for Water</b>
Avilés	Estimates based on carbon emission factor by type of technology published by Red Eléctrica España (REE)	Once-through	No freshwater uses associated. Uses sea water
Besós	Estimated Time Trend factor	Once-through	No freshwater uses associated. Uses sea water
Foix	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
San Adrián 1, 3	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Santurce 1, 3	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
Cristóbal Colón 2	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
<b>FUEL OIL</b>			
Cristóbal Colón 3	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
Almería	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
Badalona 1, 2	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
Bonaire	Estimates based on carbon emission factor by type of technology published by Red Eléctrica España (REE)	N/A	No freshwater uses associated. Uses sea water
Burceña	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water

<b>Power Plant Name</b>	<b>Source of Information for CO<sub>2</sub></b>	<b>Cooling System</b>	<b>Source of Information for Water</b>
Cádiz	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
Castellón 1 y 2	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
Escombreras 4,5	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Guadaira	Estimates based on carbon emission factor by type of technology published by Red Eléctrica España (REE)	Cooling tower	Technical factors from Spang et al. (2014)
Málaga	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
Mata	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
Pequeñas térmicas Cataluña	Estimates based on carbon emission factor by type of technology published by Red Eléctrica España (REE)	N/A	No freshwater uses associated. Uses sea water
Sabón 1, 2	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
San Adrián 2	Estimated Time Trend factor	Once-through	No freshwater uses associated. Uses sea water
Santurce 2	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
Santurce (gas turbine)	Estimated Time Trend factor	N/A	No freshwater uses associated. Uses sea water
<b>Integrated Gasification Combined Cycle (IGCC)</b>			
Elcogas	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)

Power Plant Name	Source of Information for CO <sub>2</sub>	Cooling System	Source of Information for Water
<b>NGCC</b>			
Aceca 3, 4	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
Bahía de Algeciras 3	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
Amorebieta	State Registry of Pollutant Emissions years 2000-2019	Air cooled condensers	No freshwater uses associated.
Arcos 1, 2, 3	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
Arrúbal	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Unpublished data from the owner for the years 2005-2016.
As Pontes	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Environmental statements of the electricity utility for the years 2011-2019.
Baia de Vizcaia	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Besós 3, 4	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Besós 5	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Campo de Gibraltar 1, 2	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Cartagena 1,2,3	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Castejón 1, 3	Estimated Time Trend factor	Cooling tower	Environmental statements of the electricity utility for the years 2006-2016

<b>Power Plant Name</b>	<b>Source of Information for CO<sub>2</sub></b>	<b>Cooling System</b>	<b>Source of Information for Water</b>
Castejón 2	Estimated Time Trend factor	Cooling tower	Technical factors from Macknick et al. (2012)
Castellón 3, 4	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated.
Castelnou	State Registry of Pollutant Emissions years 2000-2019	Air cooled condensers	No freshwater uses associated.
Cristóbal Colón 4	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
El Fangal 1, 2, 3	Estimated Time Trend factor	Once-through	No freshwater uses associated. Uses sea water
Escatrón	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
Escatrón Peaker	Estimated Time Trend factor	Cooling tower	Technical factors from Macknick et al. (2012)
Escombreras 6	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Málaga 1	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Palos de la Frontera 1, 2, 3	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Plana del Vent 1, 2	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Puerto de Barcelona 1, 2	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Sabón 3	State Registry of Pollutant Emissions years 2000-2019	Once-through	No freshwater uses associated. Uses sea water
Sagunto 1, 2, 3	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water

Power Plant Name	Source of Information for CO <sub>2</sub>	Cooling System	Source of Information for Water
San Roque 1, 2	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Santurce 4	State Registry of Pollutant Emissions years 2000-2019	N/A	No freshwater uses associated. Uses sea water
Soto de Ribera 4, 5	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	Technical factors from Macknick et al. (2012)
Tarragona	State Registry of Pollutant Emissions years 2000-2019	Cooling tower	No freshwater uses associated. Uses sea water
Tarragona Power	State Registry of Pollutant Emissions years 2000-2019	Air cooled condensers	No freshwater uses associated.

## References

Macknick, J., Newmark, R., Heath, G., & Hallett, K. C. (2012). Operational water consumption and withdrawal factors for electricity generating technologies: a review of existing literature. *Environmental Research Letters*, 7(4), 045802.

Spang, E. S., Moomaw, W. R., Gallagher, K. S., Kirshen, P. H., & Marks, D. H. (2014). The water consumption of energy production: an international comparison. *Environmental Research Letters*, 9(10), 105002.