

Supplementary Data Files

Supplement to: Serrano-Tovar T. et al (2019), Structuring an integrated water-energy-food nexus assessment of a local wind energy desalination system for irrigation, *Science of the Total Environment*, <https://doi.org/10.1016/j.scitotenv.2019.06.422>.

The temporal scale of analysis is one year, specifically the calendar year 2015.

LOCAL (DESALTED) WATER SUPPLY (DESALINATION PLANT):

SIZED PROCESSOR				
Extensive variables of flows and funds in a year				
Type of variable	Variable	Description	Value	Unit
Fund	Land use	Surface of the desalination plant & pumping system	450	m ²
		Surface of the 200.000 m ³ capacity reservoir	9,500	m ²
	Human activity (HA)	Operation & Maintenance	2,640	hours
	Production capacity	Nominal desalted water production capacity	1.8	Mm ³
Internal Flows	Electricity use	Pumping system and other services	756	MWh
		desalination plant	2,847	MWh
	Electricity source	Required electricity from the wind farm	2,675	MWh
		Required electricity from the grid (fossil)	929	MWh
External Flows	Sea water	Annual extraction	1.7	Mm ³
Environmental load	Brine	Production of brine	1	Mm ³
Output	Desalted water	Production capacity in 2015	0.7	Mm ³

In the following table the values of the variables are divided by the output: 0.7 Mm³.

UNITARY PROCESSOR				
Intensive variables per m³ of produced water in a year				
Type of variable	Variable	Description	Value	Unit
Fund	Land use	Surface of the desalination plant & pumping system	667	ha/Mm ³
		Surface of the 200.000m ³ capacity dam	14,080	ha/Mm ³
	Human activity *	Operation & maintenance	3,913	hour/Mm ³
		Nominal desalted water production capacity	2.6	Mm ³ /Mm ³
Internal Flows	Electricity use	Pumping system and other services	1.1	kWh/m ³
		desalination plant	4.2	kWh/m ³
	Electricity source	Required electricity from the wind farm	4	kWh/m ³
		Required electricity from the grid (fossil)	1	kWh/m ³
External Flows	Sea water	Annual extraction	2.5	Mm ³ /Mm ³
Environmental load	Brine	Production of brine	1.5	Mm ³ /Mm ³

*The economic reading of the desalination plant:

Costs of the personnel (7 workers)	152,400	€/year
External company in charge of maintenance	174,400	€/year
Desalted water price	0.83	€/m ³

LOCAL (WIND) ELECTRICITY SUPPLY (WIND FARM):

SIZED PROCESSOR				
Extensive variables of flows and funds in a year				
Type of variable	Variable	Description	Value	Unit
Fund	Land use	Surface of the wind farm	8,800	m ²
	Human activity	Operation & maintenance	660	hour
	Power capacity	Power capacity	2.9	MW
		Nominal power capacity	11,000	MWh
External Flows	Wind	Wind hours &	3,800	hour/y
		wind velocity	7.8	m/s

To calculate the output from the wind farm, it is important to take into consideration that an amount of 71.15% is sold to the grid and the rest, 28.85%, goes to the desalination plant:

<i>Electricity produced</i>	<i>Average wind energy production</i>	9,276	MWh
<i>Destiny of electricity</i>	<i>71.15 % sold to the grid</i>	6,601	MWh
	<i>28.85 % goes to the desalination</i>	2,675	MWh

Dividing the extensive variables by 9,276 MWh, the unitary processor is obtained:

UNITARY PROCESSOR				
Intensive variables per MWh of produced electricity in a year				
Type of variable	Variable	Description	Value	Unit
Fund	Land use	Surface of the wind farm	0.95	m ² /MWh
	Human activity*	Operation & maintenance	0.07	h/MWh
	Power capacity	Power capacity	0.000	MW/MWh
		Nominal power capacity	3	MWh/MWh
External Flows	Wind	Wind hours &	3,800	hour/y
		wind velocity	7.8	m/s

Approximately 32% of the power capacity is used. This value is in the expected range of Utilization Factors of windmills 30-40%.

*The economic reading of the wind farm:

Costs of the Operation & Maintenance of the whole farm (2 workers)	26	€/MW in a year
Price of the wind energy sold	65	€/MW in 2015

LOCAL FOOD SUPPLY (FARMING COOPERATIVE)

The table below represents the sized processor for the biophysical accounting for the **farm**. Fund elements are the land used and the human activity required, that is, the hours of work per year, considering that farmers work 40 hours per week for eleven months of the year.

SIZED PROCESSOR				
Extensive variables of flows and funds in a year				
Type of variable	Variable	Description	Value	Unit
Fund	Land use	Surface of the crop	282	ha
	Human activity*	Operation & maintenance	239	Mhour
Internal Flows	Water use	Required water	1.5	Mm ³
Output	Total production	Estimated average production	23,681	Ton
	Associated Revenue	Average market price	18	M€

Regarding the water use, from the 1.5 Mm³ of water required for the whole farm, an amount of 0.7 Mm³ comes from the desalination plant and the rest (0.8 Mm³) from nearby aquifers.

*The economic reading of the farm would be the following:

Costs of personnel (\approx 1000 workers)	20,400,000	€/year
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ECONOMIC AGENT SOSLAIRES CANARIAS SL:

The total cost (**investment**) of the entire Soslares Canarias S.L. installation is the following:

Desalination	1,600,000	€
Pumping System	210,000	€
Water reservoir	88,000	€
Wind Farm	2,200,000	€
Civil	430,000	€
Associated	60,000	€
Piping	350,000	€
Total	4,938,000	€

Below, the **subsidies** received since the beginning of the SWRO desalination project:

Regional economic incentives	132,000	€
Insular Water Council	30,000	€
Industry energy efficiency	60,000	€
Total	222,000	€

Today, there are no subsidies anymore for the wind farm and the desalination plant.

It is important to notice that the period of **tax depreciation** of Soslares Canarias S.L. is 12 years and the period of **book depreciation** 4.6 years. The water reservoir is currently in an amortization period:

Water Reservoir	300,000	€
Fencing	86,000	€
New hydraulic installations	150,000	€
Total	536,000	€