The water metabolism of the most arid region in the world, Antofagasta

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Goal & Scope

Antofagasta represents an interesting study case over of an arid region along with a complex legislative system.
In this context, the objective of the study is to describe the water metabolism of Antofagasta through the analysis of the materials, infrastructures and flows of the region. The latter will then allow us to elaborate the environmental impact assessment of the system and to evaluate the administration of the water in that area. The final step will therefore be to formulate recommendations over the administration, the mining activity and the ongoing projects for the desalination plants.

Introduction

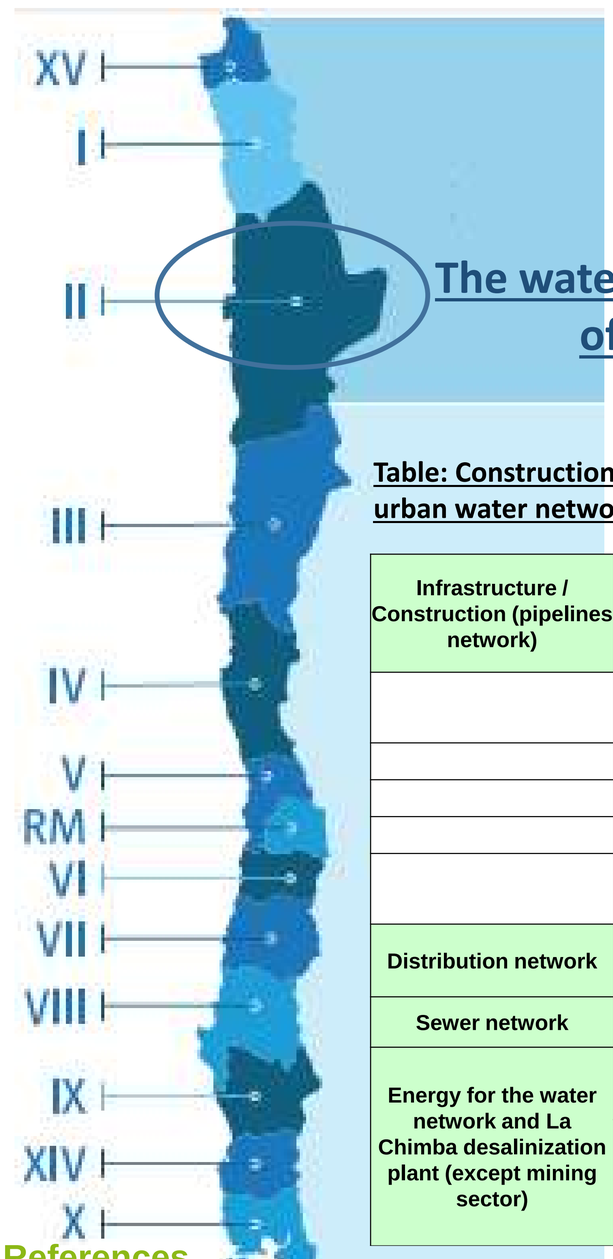
The research analysis takes place in Chile, a country that extends over 756,950 km², in a long strip of land bounded between the Andes and the Pacific Ocean (This is Chile, 2017). The geography of Chile is characterized by a multitude of different landscapes, which makes it an extremely rich country in terms of biodiversity. Indeed its territory stretches from the glaciers of the Antarctic, to the most arid desert in the world. The latter is the Atacama desert, that extends over 105 000 km² in the northern part of the country. This peculiar ecosystem involves the regions of Arica and Parinacota, Tarapacá, Antofagasta, Atacama and the North of the Coquimbo region (Wright, 2006).
In this study we decided to focus on Antofagasta, the region number 2. Over its 126.049,10 km², the climate is mostly emblematic of the desert, with extremely low precipitations (on average a total of 1.7 mm annually) (clima temps, 2017). Indeed the Andes block the eastern winds that condense and allow rainforests on that side, leaving the other versant extremely arid (Extreme Science, 2017). The region presents a population of about 493.984 habitants (Gobierno Regional de Antofagasta, 2017) and an economy mainly dominated by the mining industry (Live and Invest Overseas, 2017).
Indeed in this peculiar context of water scarcity, the different actors such as indigenous communities, mining companies, industrial agricultures and urban hubs, are competing for the access to this natural resource (Chile Sustentable, 2012; Molina Otarola, 2006). Moreover the conditions are exacerbated by the complex legislation that since 1981 moved towards the privatization of the water rights (Bauer, 1998; Budds, 2009). Given the consequences in terms of high prices, desalination plants have been introduced in the system and continue to expand over the coast, trying to amend the increasing water demand. However desalinated water supply has consequences in terms of energy use as well as other environmental drawbacks. Given the complexity of the situation, Antofagasta embodies a compelling case of water system to analyze. Indeed it can be relevant to understand how this scarce resource has been administered so far, what water network was achieved and the consequences in terms of the environmental impacts.

Materials & Methods

The reconstruction of the water network is using data from the Superintendencia de Servicios Sanitarios (SISS), the regulatory authority that supervises the private water and sewerage concessionary companies. Additional data is also obtained from the Empresa Concesionaria de Servicios Sanitarios (ECONSSA), responsible for the ensuring the access to potable water and sanitation services. Finally the data related to the mining sector is issued from the Consejo Minero.

Future Research

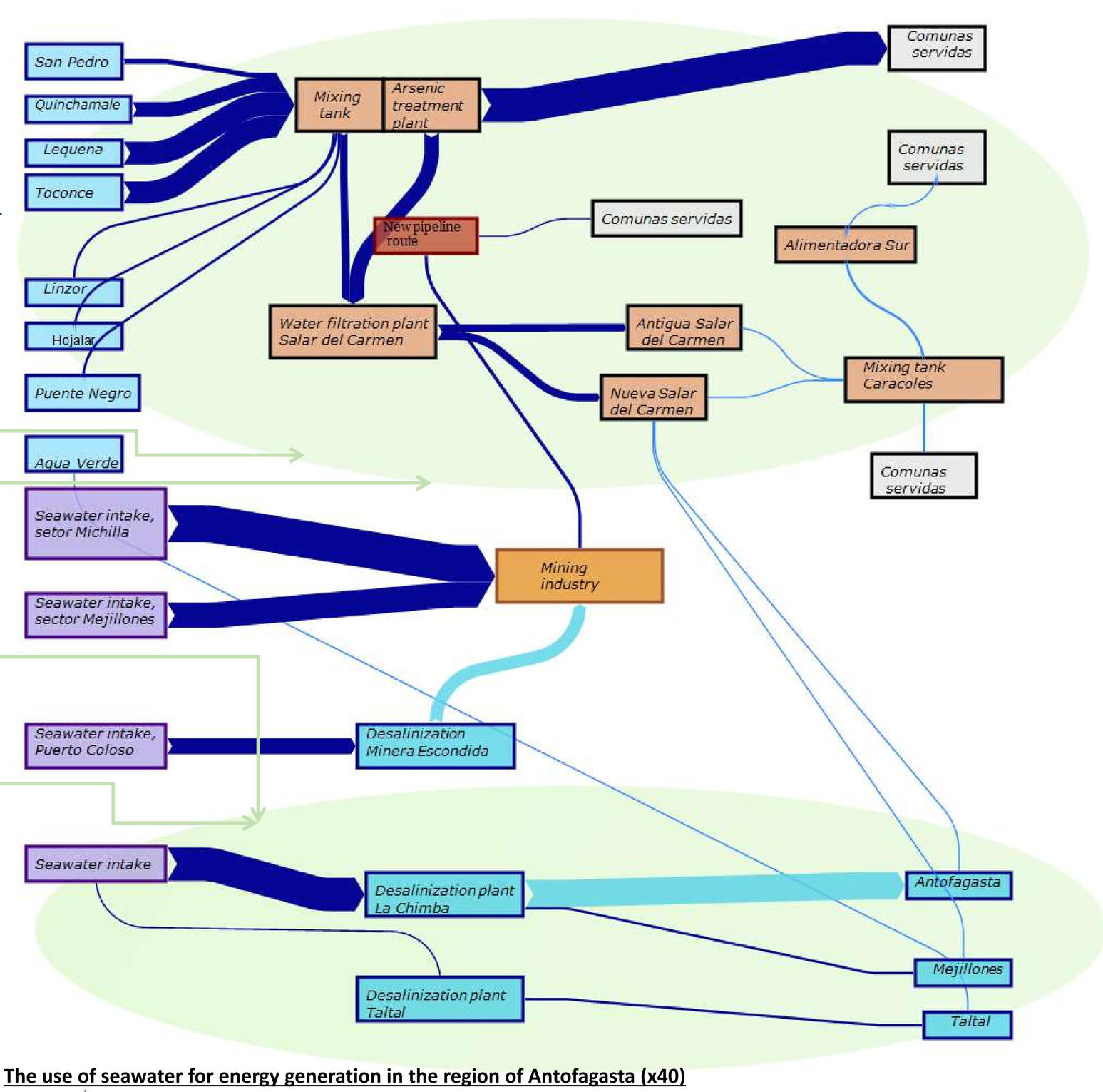
So far we certainly assessed that the water flows are mainly used by the industrial sector (essentially energy and mining). Hence the population is primarily supplied with desalinated water, which production is exceptionally energy-intensive. The next steps in order to achieve the objectives of this study firstly consist in the estimation of the energy used in the water network. Indeed, with the final description of the system in terms of infrastructure, water flows and energy used, it will be possible to elaborate the environmental impact assessment. We expect to be able to conclude over the mining industry contribution to the ecological footprint of the region. Further observations will focus on the advantages and drawbacks of the desalination plants, considering also the ongoing projects for the extension of the existing plants and the creation of additional ones. Finally, the evaluation of the system could serve as an example for other countries experiencing similar water issues.



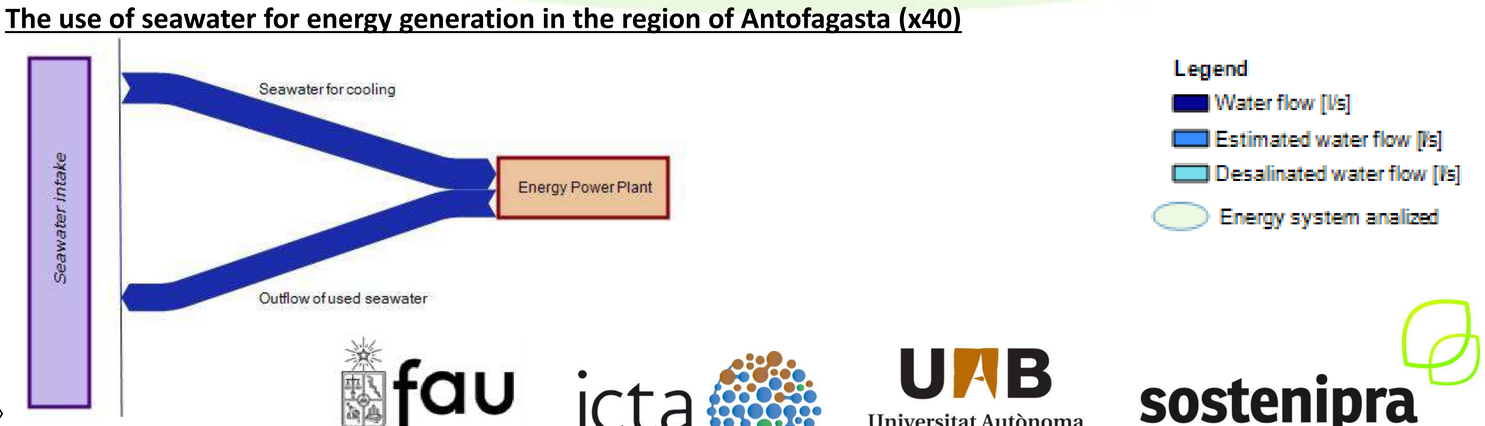
The water flows in the region of Antofagasta

Table: Construction and energy use for the urban water network of Antofagasta

Infrastructure / Construction (pipelines network)	Materials	Length (in km)
	Fibrocement	221.6
	Ductile Iron	636
	HDPE	67.5
	PVC	40.5
	Other materials	661.442
Distribution network		1304
Sewer network		1045
Energy for the water network and La Chimba desalinization plant (except mining sector)	in MW	in thousand $
	97	5.824.424



The use of seawater for energy generation in the region of Antofagasta (x40)



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