

The carbon footprint of desalination

Topic: Multi Regional Input-Output (MRIO) Models Using Industrial Ecology Virtual Laboratory: Development of Regional IE Lab models and Applications

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This study examines greenhouse gas emissions for 2005–2015 from seawater desalination in Australia, using conventional energies. We developed a tailor-made multi-regional input-output-model. We used the cloud-based Australian IELab and data from Desaldata database. We complemented macroeconomic top-down data with plant-specific desalination data of the largest 20 desalination plants in Australia. The analysed capacity cumulates to 95% of Australia's overall seawater desalination capacity. We considered the construction and the operation of desalination plants. We measure not only direct effects, but also indirect effects throughout the entire value chain. Our results show the following: We identify the state of Victoria with the highest emissions due to capital and operational expenditures (capex and opex). The contribution of the upstream value chain to total greenhouse gas emissions increases for capex and decreases for opex. For capex, the construction of intake and outfall is the driving factor for carbon emissions. For opex, electricity consumption is the decisive input factor. Both in construction and operation, we identify the critical role of the electricity sector for carbon emissions throughout the supply chain effects. The sector contributes 69% during the zenith of the construction phase and 96% during the operating phase to the entire emissions. We estimate the total emissions for 2015 at 1193 kt CO₂e. It is the first study of desalination, where a comprehensive multi-regional model has been created and used for measuring the supply chain impacts. With the aid of our multi-regional model, we can also present regional impacts for the first time.