

# Global energy demand has adverse effects on freshwater resources of less developed nations

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A coal-fired power plant. Credit: UKERC

Global energy demand from developed nations has an adverse impact on freshwater resources in less developed nations according to a new study.

While current energy policy focuses on preventing greenhouse gas emissions, the results show that freshwater impacts also need to be considered when deciding future national and international energy policies.

Freshwater is used by the energy sector along the complete supply chain from extraction and conversion of raw material through to generation of power.

The collaborative study of freshwater consumption associated with energy usage, led by the University of Southampton and published in *Proceedings of the National Academy of Sciences* today, found that petroleum demand within a nation typically drives consumption of [freshwater resources](#) internationally, whereas gas and electricity demand drives freshwater consumption within the nation itself.

The research found that this international demand for fresh water can contribute to pressures on water resources in regions of the world that currently experience water scarcity.

The Principal Investigator of the study, Dr Felix Eigenbrod, Associate Professor (Spatial Ecology) at the University of Southampton's Centre for Biological Sciences, says: "The growing geographic disconnect between [energy demand](#), the extraction and processing of resources, and the environmental impacts associated with [energy production](#) activities makes it crucial to factor global trade into sustainability assessments.



An electricity pylon. Credit: UKERC

"These energy-driven pressures on freshwater resources in areas distant from the origin of demand should be considered when designing policy to ensure the security of both fresh water and energy supplies. While much of the debate around energy is focussed on [greenhouse gas emissions](#), our findings highlight the need to consider the full range of consequences of the world's demand for energy when designing energy and environmental policies."

Using a combined trade and water model, the researchers compared freshwater consumption associated with energy production supply chains of three energy sectors (petroleum, gas, and electricity) across the world.

While freshwater consumption by the electric and gas sectors largely occurs within countries where the demand for energy originates (91 per cent and 81 per cent respectively), over half of freshwater consumption for the petroleum sector comes from international sources (56 per cent). In the UK, 75 per cent of freshwater consumption for the petroleum sector is from international sources, with 43 per cent of gas and 87 per cent of electric freshwater consumption coming from domestic sources.

The study also found that while the USA and China have similar levels of freshwater consumption associated with their petroleum sectors, the international freshwater footprint of the USA is three times higher than that of China. Understanding differences in national and international reliance on freshwater resources to meet energy demand is key to ensuring water and energy security. As China relies more on its domestic freshwater resources it can directly manage issues relating to their security, this contrasts with the USA who may be more exposed to water and energy shortages outside their direct control.



Lead author Dr Robert Holland, also from the University's Centre for Biological Sciences, said: "Based on mapping patterns of freshwater consumption associated with energy sectors at subnational scales, our analysis also reveals that pressure on freshwater resources associated with energy production happens in a number of freshwater scarce river basins globally. Identifying critical geographic areas and supply chain hotspots provides a focus for resource management actions to ensure global energy and freshwater security. Understanding the role of international trade in driving pressures on [freshwater](#) resources is key to meeting these challenges."

Co-investigator Professor Gail Taylor from the University of Southampton said: "This study provides us with the first glimpse into the global environmental consequences of energy supply to nations. In the future we hope to apply the approach more widely to consider other [energy](#) carriers such as biofuels."

**More information:** Global impacts of energy demand on the freshwater resources of nations, *PNAS*,  
[www.pnas.org/cgi/doi/10.1073/pnas.1507701112](http://www.pnas.org/cgi/doi/10.1073/pnas.1507701112)

Provided by University of Southampton

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