Climate, Land, Energy and Water Strategies in the City of Cape Town

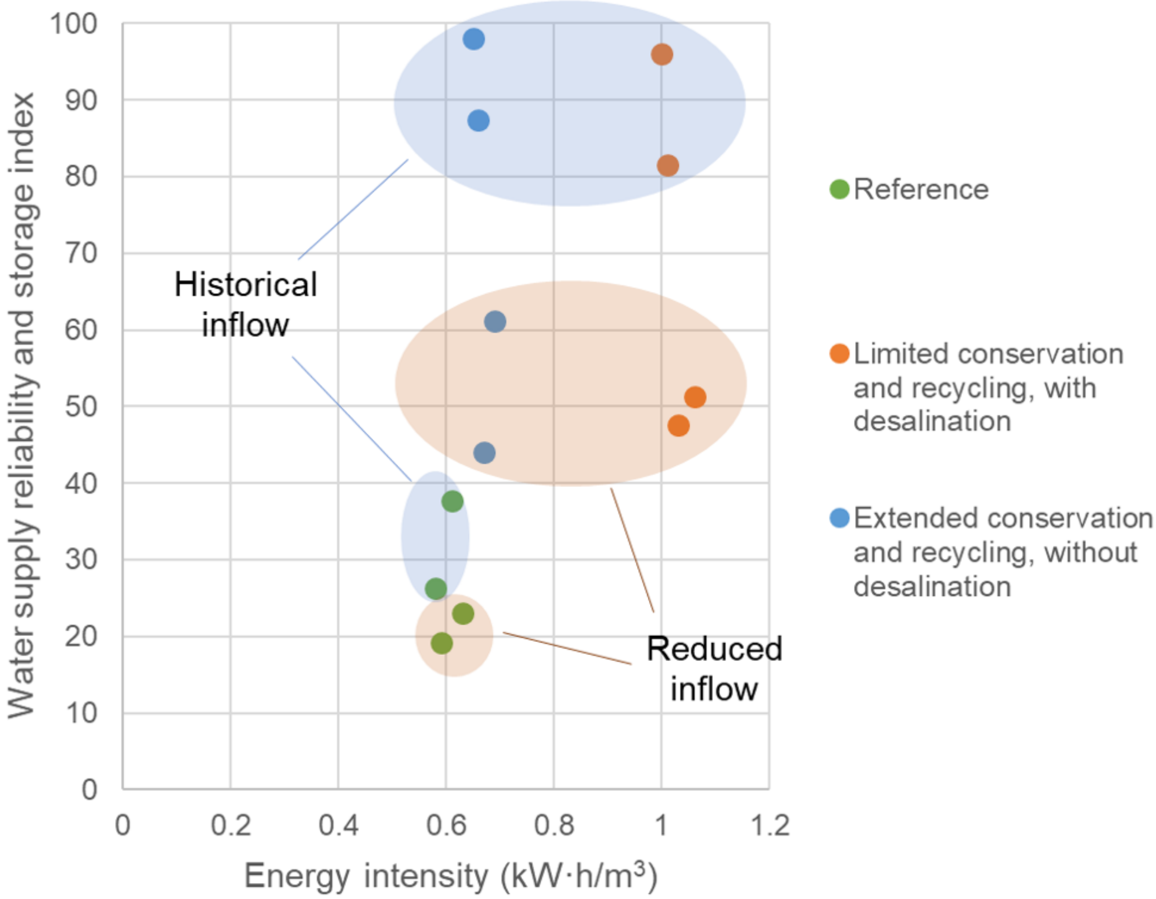
Sustainable Development Goals Addressed

Organization, Institution or Company
Energy Research Centre, University of Cape Town, South Africa and International Atomic Energy Agency (IAEA)
Location of project site, Country
Cape Town, South Africa
Brief narrative description of objective/project/activity/initiative
Owing to population growth, water demand in Cape Town is already threatening to outstrip supply. This is expected to be exacerbated by further declines in water inflows from reduced precipitation and increased evaporation due to climate change. With support from the IAEA, researchers in South Africa applied an integrated CLEW (Climate, Land, Energy and Water) framework to analyse future options for water supply and demand in Cape Town, tracking energy–water interactions arising from changing needs for water treatment and pumping, along with possible future desalination demands. The experts utilized an integrated energy–water software model — the Cape Town Water Energy System Analysis Tool — as well as a model of crop water demand from the South Africa Water Research Commission to represent agricultural areas within the city boundaries. Several scenarios were developed based on variations in future water demand, supply, treatment requirements and dam operations, and several policy and technology options were analysed including: water conservation and demand management; ground water augmentation from aquifers; additional surface water supply; reuse of secondary treated effluent; advanced effluent recycling; and sea water desalination. The scenarios and policy response options were evaluated in terms of energy intensity, water supply reliability and system water storage.
Economic, environmental and climate benefits, challenges and lessons learned
The analysis indicates that the City of Cape Town's water system is particularly vulnerable under conditions of high water demand growth combined with reduced water inflows due to climate change impacts. Under these conditions, water reliability and dam levels are expected to decline significantly without policy intervention. While sea water desalination can address reliability, it comes at the cost of higher energy intensity. On the other hand, other interventions (such as extended conservation, effluent recycling) have the potential to support multiple objectives across a range of scenarios. In any case, a variety of policy interventions are likely to be required to ensure a safe and secure water system in the future.
Additional information: website addresses and contacts
AHJUM, F., HUGHES, A., FANT, C., Climate, Land, Energy and Water Strategies in the City of Cape Town, Energy Research Centre, University of Cape Town, Cape Town (2015). F. Ahjum, A. Hughes and C. Fant, Climate, Land, Energy and Water Strategies in the City of Cape Town, Final Report, IAEA Coordinated Research Project on Assessing Interdependencies between Energy, Water, Land use and Climate Change, Energy Research Centre, University of Cape Town, South Africa. IAEA (2020). Integrated Assessment of Climate, Land, Energy and Water, Vienna, Austria, https://www.iaea.org/publications/13558/integrated-assessment-of-climate-land-energy-and-water

IAEA (2019). The IAEA Framework for Integrated Assessment of Climate, Land, Energy and Water, IAEA Factsheet, Vienna, Austria, https://www.iaea.org/sites/default/files/19/06/iaea-framework-for-integrate-assessment-of-climate-energy-and-water.pdf

IAEA (2018). IAEA Methodologies and Models for Sustainable Energy Planning, IAEA Brief, Vienna, Austria, https://www.iaea.org/sites/default/files/19/02/iaea-methodologies-and-models-for-sustainable-energy-planning.pdf

See also, https://www.iaea.org/topics/energy-planning/capacity-building



Water supply energy intensity, reliability and system storage, 2030, Cape Town. The figure presents results for three combinations of water conservation measures and desalination ('Reference', 'Limited conservation and recycling, with desalination' and 'Extended conservation and recycling, without desalination') under two inflow scenarios indicated by the shaded areas ('Historical' and 'Reduced').