QUANTIFYING THE URBAN WATER-ENERGY NEXUS IN MEXICO CITY

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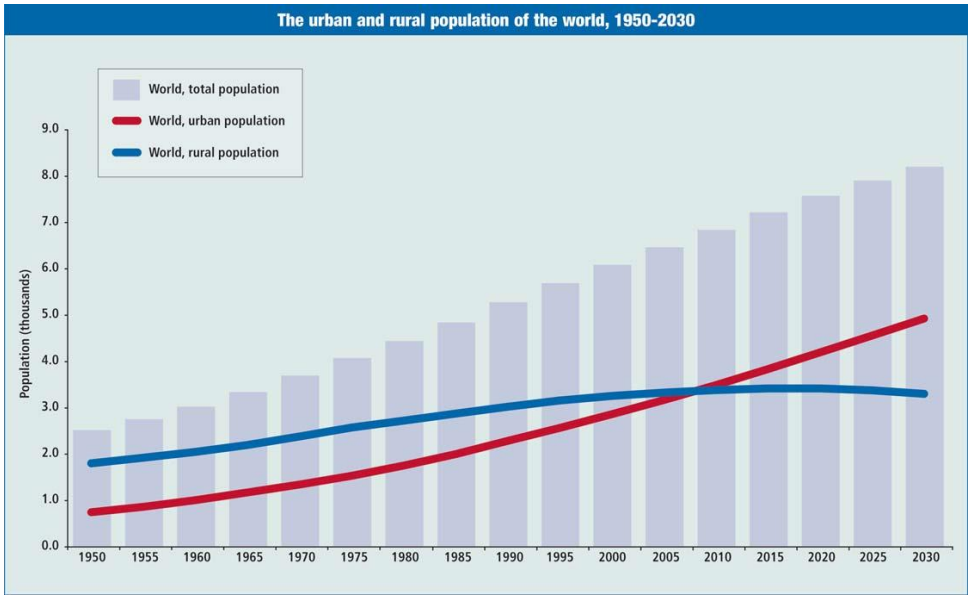
INTRODUCTION



Global urbanisation rapidly advancing

Increase in demand for water, energy

→ these systems are intimitely linked

Energy for pumping, treatment, distribution and heating

Water used for extraction, processing and cooling

Water-system related energy consumption is high (2-8% energy use globally)

Climate impacts?

INTRODUCTION

Aims:

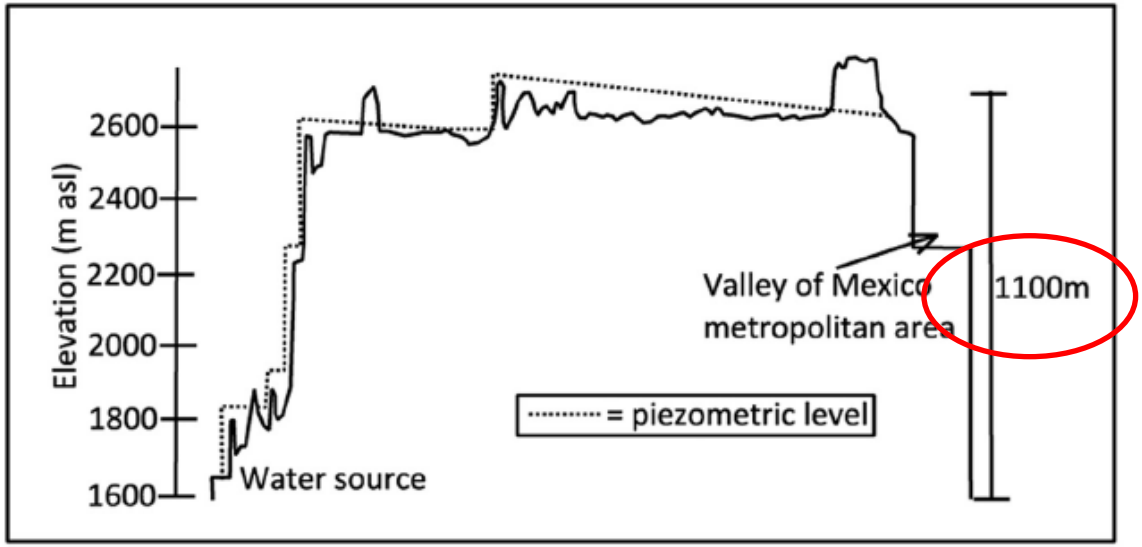
To understand and to quantify the water-energy nexus for the Mexico City water system, including an assessment of potential carbon (equivilent) emissions

To assess the potential impact of water system savings measures on this nexus

CASE STUDY


U.S.A
Monterrey
MEXICO
Gulf of Mexico
Guadalajara
Cancun
Pacific Ocean
Mexico City
BELIZE
GUATEMALA
N
200km

CASE STUDY



8.8 million people

Coverage c. 90%

Demand 250-350 l/cap/day

NRW up to 50%

2 surface, 2 groundwater sources

Local and distant (Lake Chapala) resource overexploitation

City subsidence up to 36 cm/yr

Most wastewater not treated/treated to basic degree

METHODS

Data from primary and secondary sources

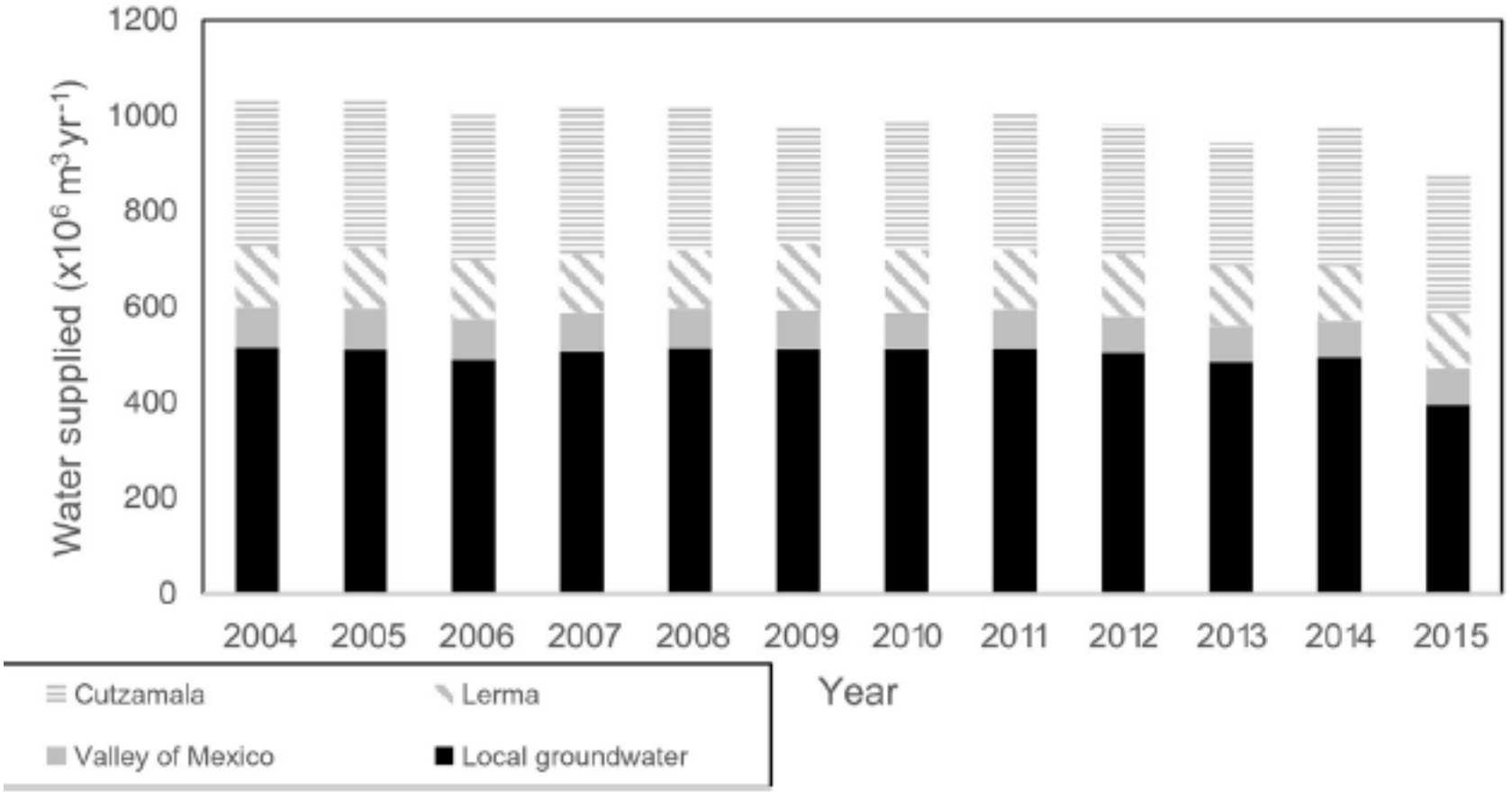
Interviews and raw data collection from local water managers/academics

- -water system statistics (supply, 2004-2015)
- -energy data (energy intensities for 2004-2015, primary data 2013-2015)
- -wastewater statistics (primary data)
- -NRW
- -assess preferred water savings measures

Literature sources as required

- -complemented and completed primary data
- -CO2e factor (from literature; 0.65)

RESULTS: HISTORICAL BASELINE



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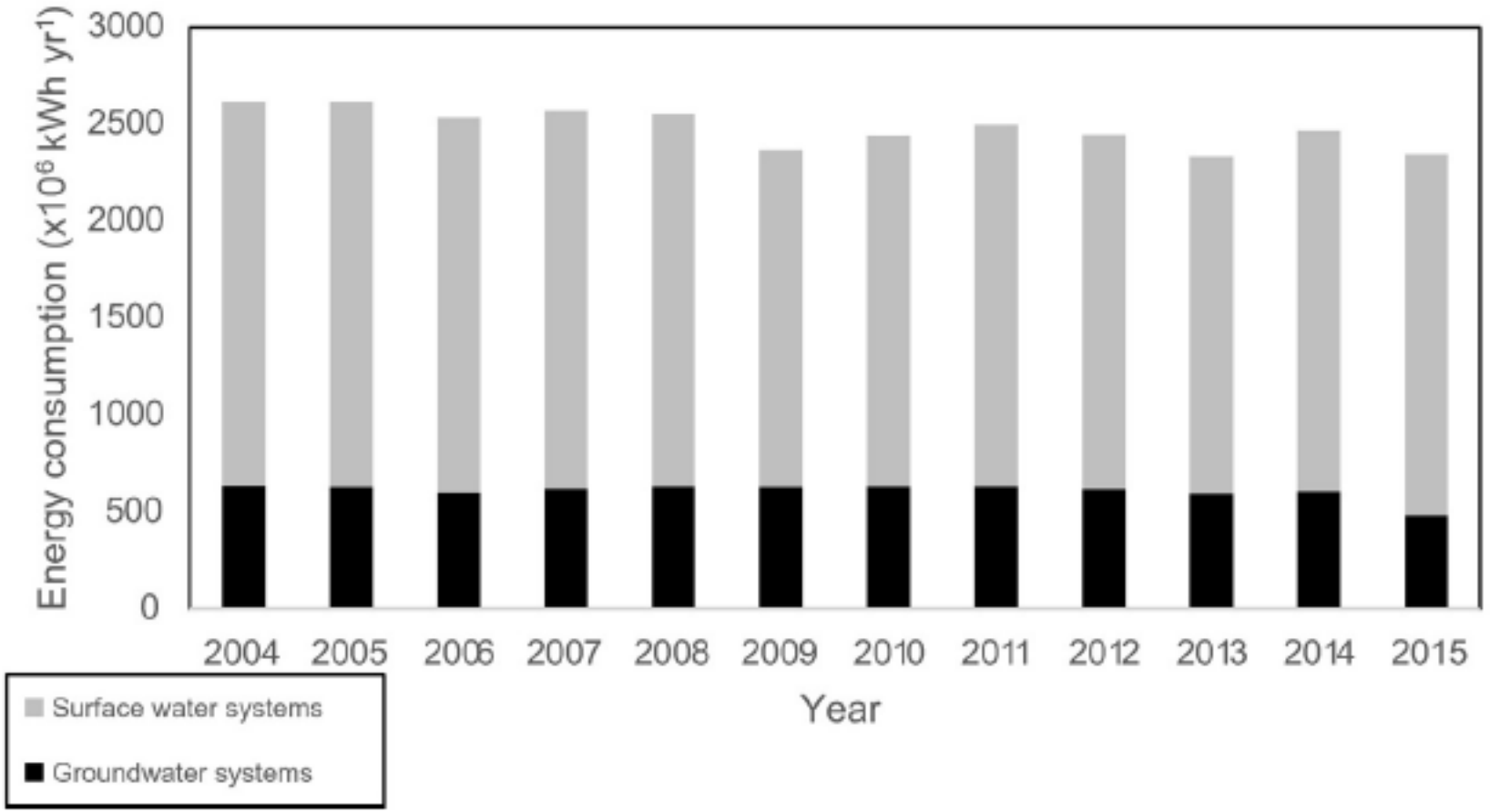

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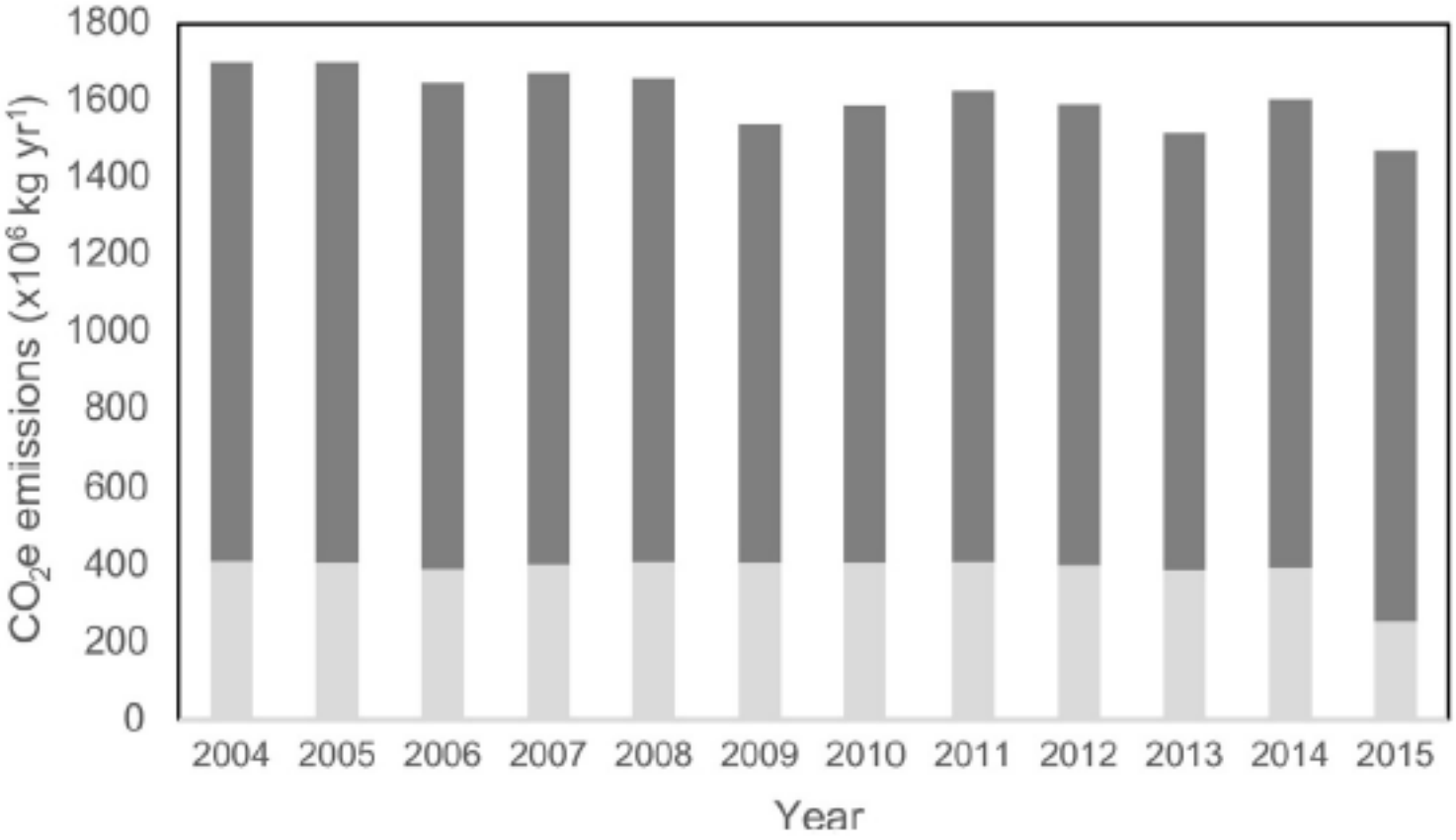


RESULTS: WATER SAVINGS MEASURES

Three options deemed most suitable/feasible:

1) NRW reduction – aim to bring this down to 20% (from 40%)

2) Water pricing reforms – potential water saving = 8%

3) Rainwater harvesting systems – potential saving = 30%

Table 2
Summary of results when water savings measures are implemented in México City. All results assume that the full potential of the savings are realised.

		2015	Leakage	Pricing	RWH
Water supply ($\times 10^6$ m^3 yr^{-1})		879.7	703.8	809.3	615.8
Energy consumption ($\times 10^6$ kWh yr^{-1})		2345	1876	2157	1641
CO_2e emissions ($\times 10^6$ kg CO_2e yr^{-1})	CO_2 emissions factor				
	0.65	1531	1225	1408	1072

DISCUSSION

Water *supply* system consumes 90% of whole water-system energy demand

→ of which most is consumed by the Lerma-Cutzamala joint system (=75% total energy)

Wastewater system consumes little energy

→ vast majority is in treatment (85% energy) even though treated

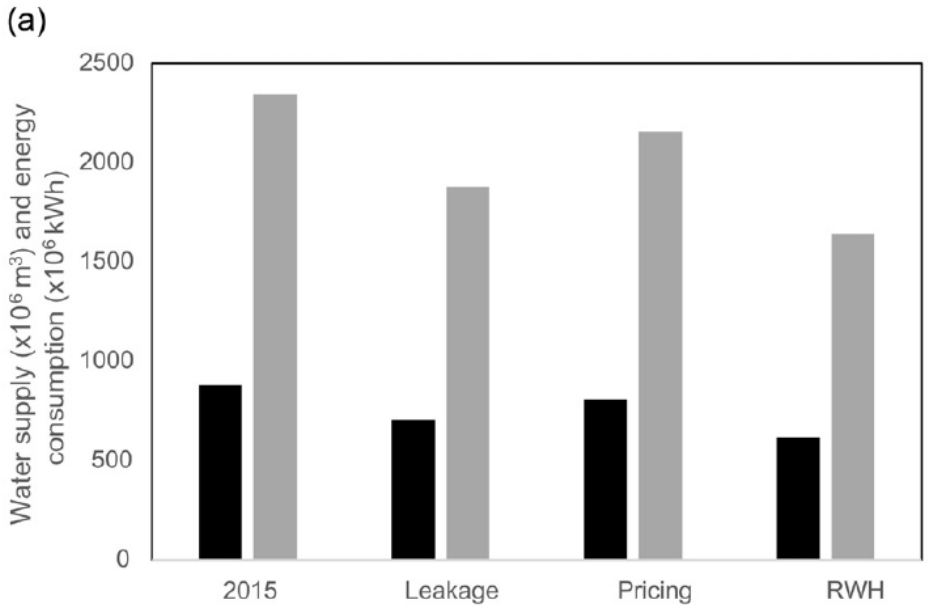
NRW represents a significant, unnecessary use of water and energy resources, and concomitant CO_2e emissions

New WWTP is due to come online. Will treat up to 60% wastewater

→ improved water quality. Energy impact?

DISCUSSION

Water savings measures could have significant impacts for water, energy and CO_2 savings



Comparison to secondary data:

-secondary data appears to overestimate energy use in the supply system
-in wastewater system, treatment overestimated considerably.
-implications for reported energy intensity values

e.g. 2.46 kWh/m3 vs 1 kWh/m3 (for treatment and re-use)

NEXT STEPS

Refine these findings – especially emissions factors for the city

Scenario assessment:

-population
-s-e demand changes
-improvements to current system
-system upgrades (e.g. new WWTP)
-uptake analysis of water savings measures
-possible changes to energy mix

NEXT STEPS

Valek AM., **Sušnik J.,** Grafakos S. 2017. Quantification of the urban water-energy nexus in México City, México, with an assessment of water-system related carbon emissions. *Science of the Total Environment*. 590-591: 258-268. DOI: 10.1016/j.scitotenv.2017.02.234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