Future Earth Water-Energy-Food Nexus Workshop

The Water-Energy-Food Nexus and its linkages to the SDGs

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THE WATER-ENERGY NEXUS IN SOUTH AFRICA: ENERGY SYSTEMS PLANNING

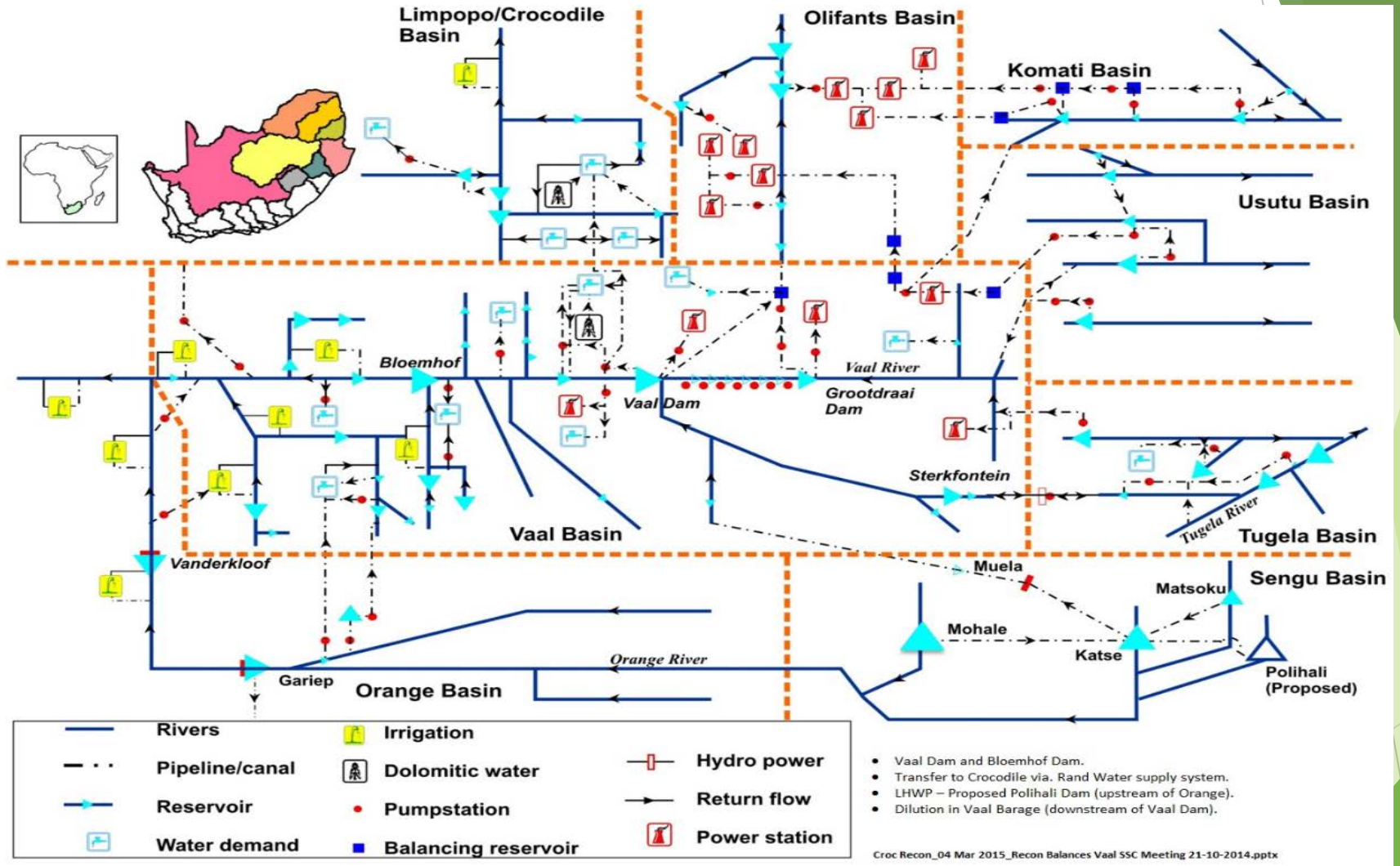
Fadiel Ahjum
mf.ahjum@uct.ac.za

ERC
ENERGY RESEARCH CENTRE
University of Cape Town

www.erc.uct.ac.za

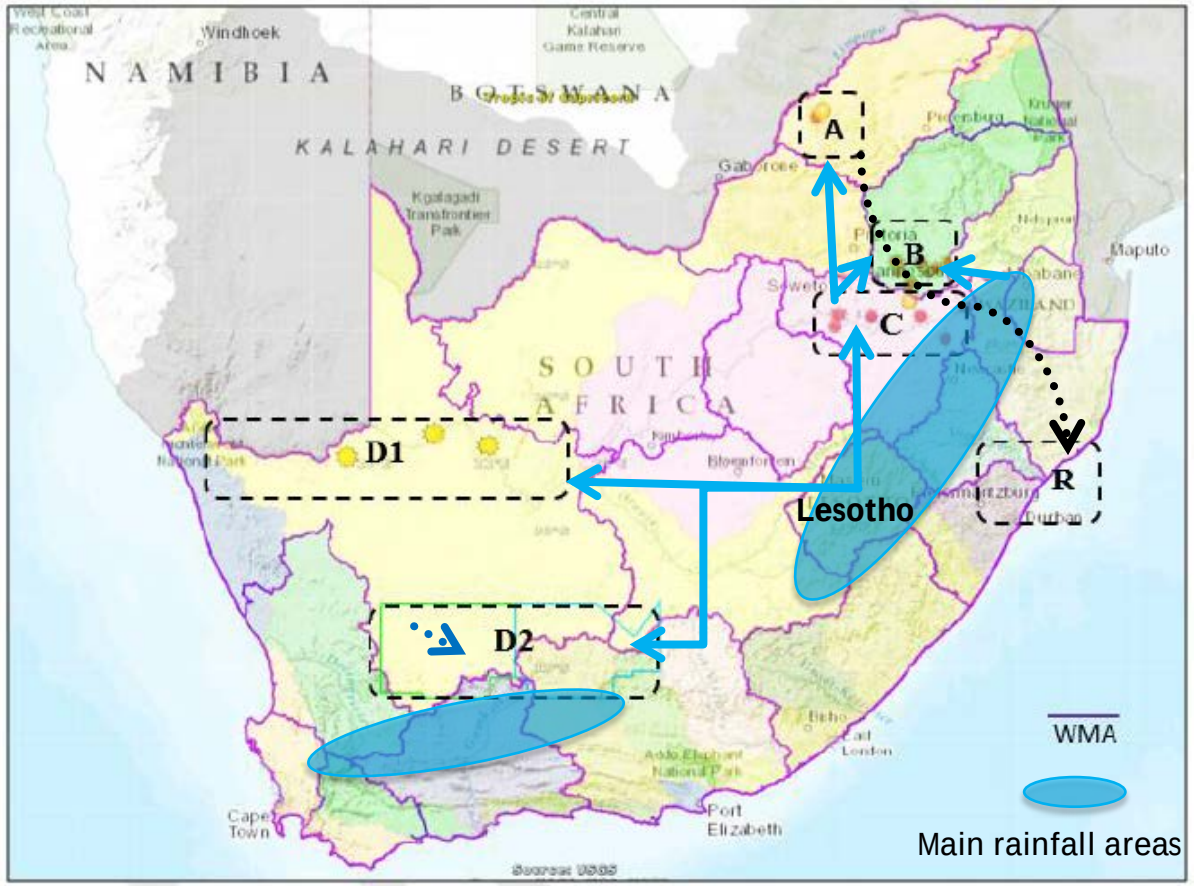

Planning for a Resilient
Energy Supply System in an
Uncertain Future

South African Water-Energy Network



- Water for power supported by major inter-basin transfers
- The transfer and treatment of water is very sensitive to energy costs

Regional Energy Sector Growth and Bulk Water Supply



Water Supply Regions:

A – Waterberg:-	New Coal (Mining,Power & CTL)
B - Upper Olifants: -	Existing Coal
C - Upper Vaal:-	Existing: Coal & Crude Inland Refinery
D1 - Orange River:-	CSP
D2 - Orange River:-	Shale Gas (Mining & Power)

R - Richards Bay Coal Export Terminal:– Washed coal transport for seawater cooled coal power plants

Ground water

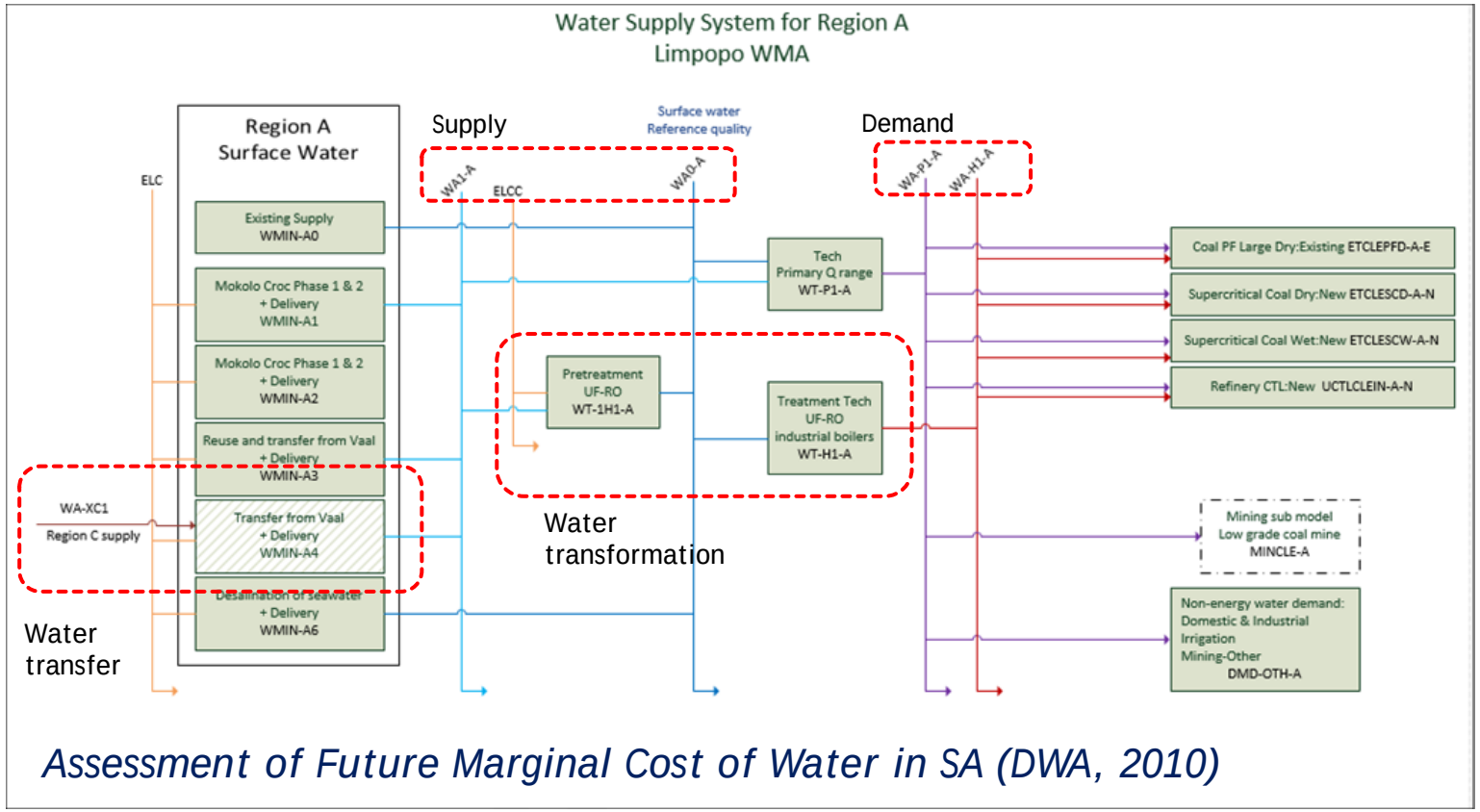
Surface water transfers

Coal by rail

- Water-energy regions of interest

Thirsty Energy: South Africa, World Bank (2015)

Incorporating Water Supply Infrastructure in Energy Supply

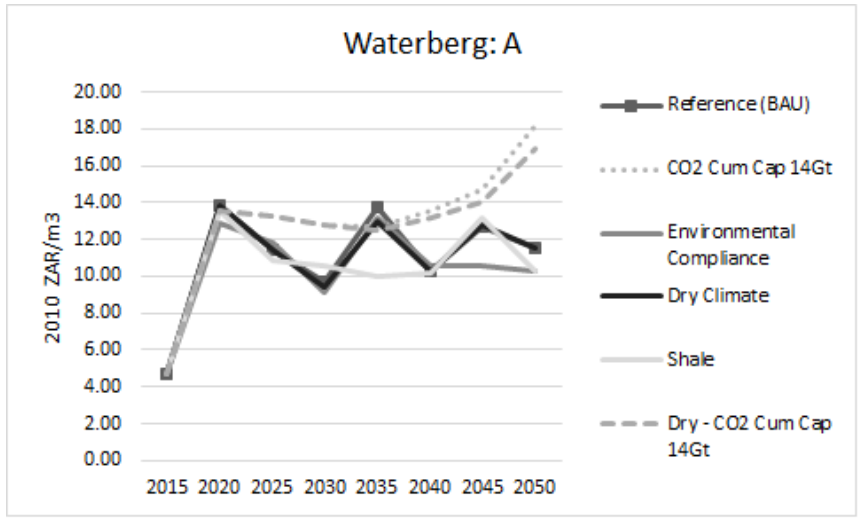


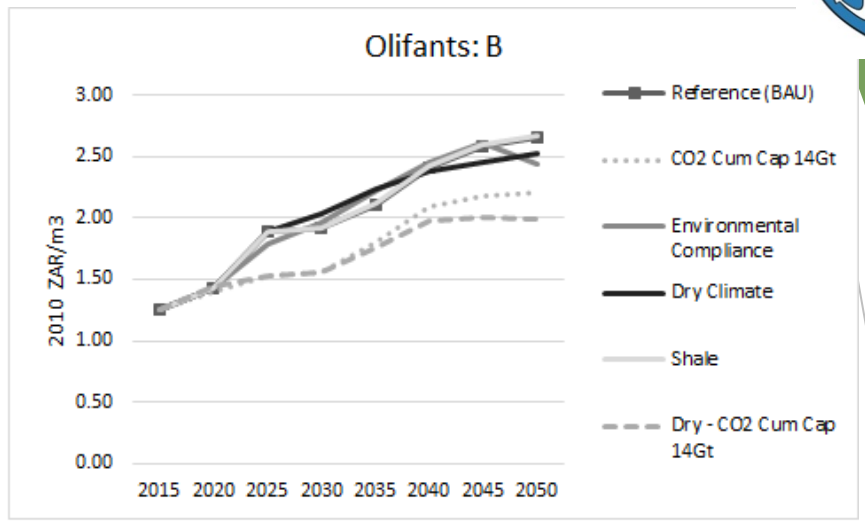
Assessment of Future Marginal Cost of Water in SA (DWA, 2010)

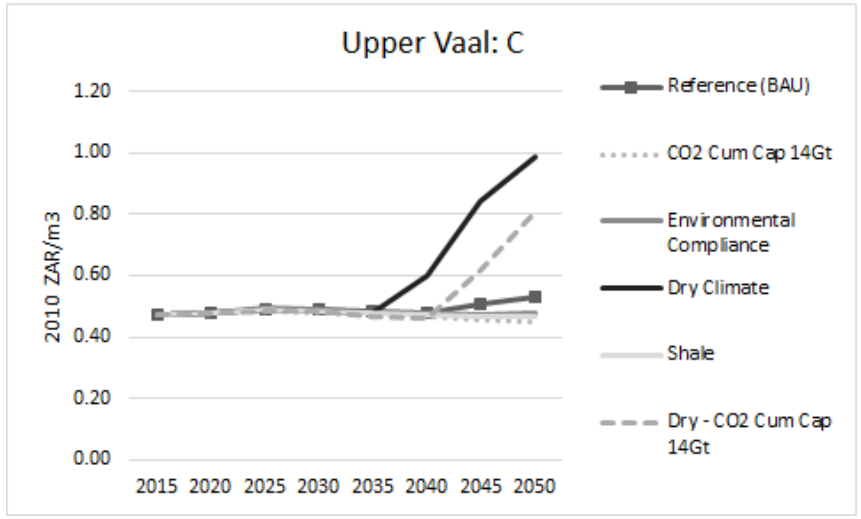
- The water subsystem is introduced by means of explicit water supply and infrastructure options for each of the Water Supply Regions where major energy facilities are found, and their associated energy consumption (e.g. electricity for pump-stations or diesel for truck transport)
- Individual water supply projects (or schemes) based on the DWA study: ***Assessment of Future ...al Cost of Water in SA (2010)***

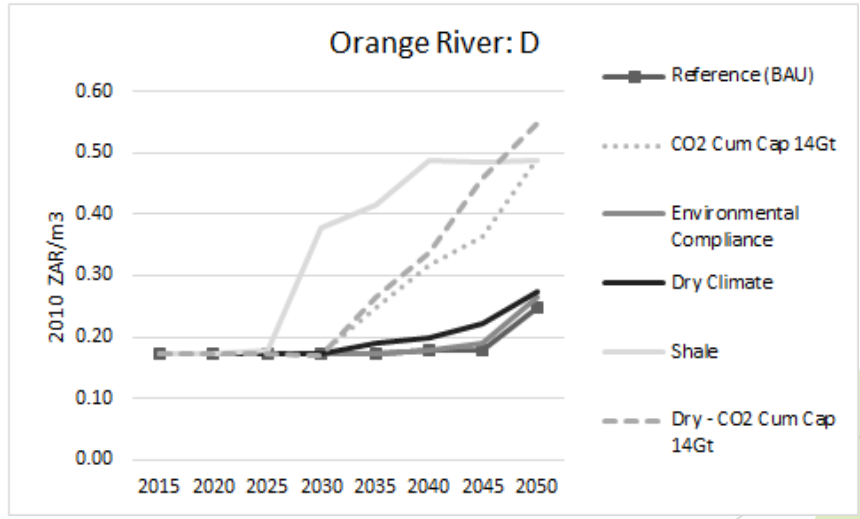
Thirsty Energy: South Africa, World Bank (2015)

Average Cost of Regional Water Supply by Future Scenario









- CO2 cap scenarios may result in stranded water infrastructure in Region A
- CO2 cap scenarios, shale gas extraction escalates water supply costs in Region D
- Climate scenarios drive water costs in region C due to increasing non-energy demands

Thirsty Energy: South Africa, World Bank (2015)

Integrated-Modelling Helps Inform Prudent Policy Choices

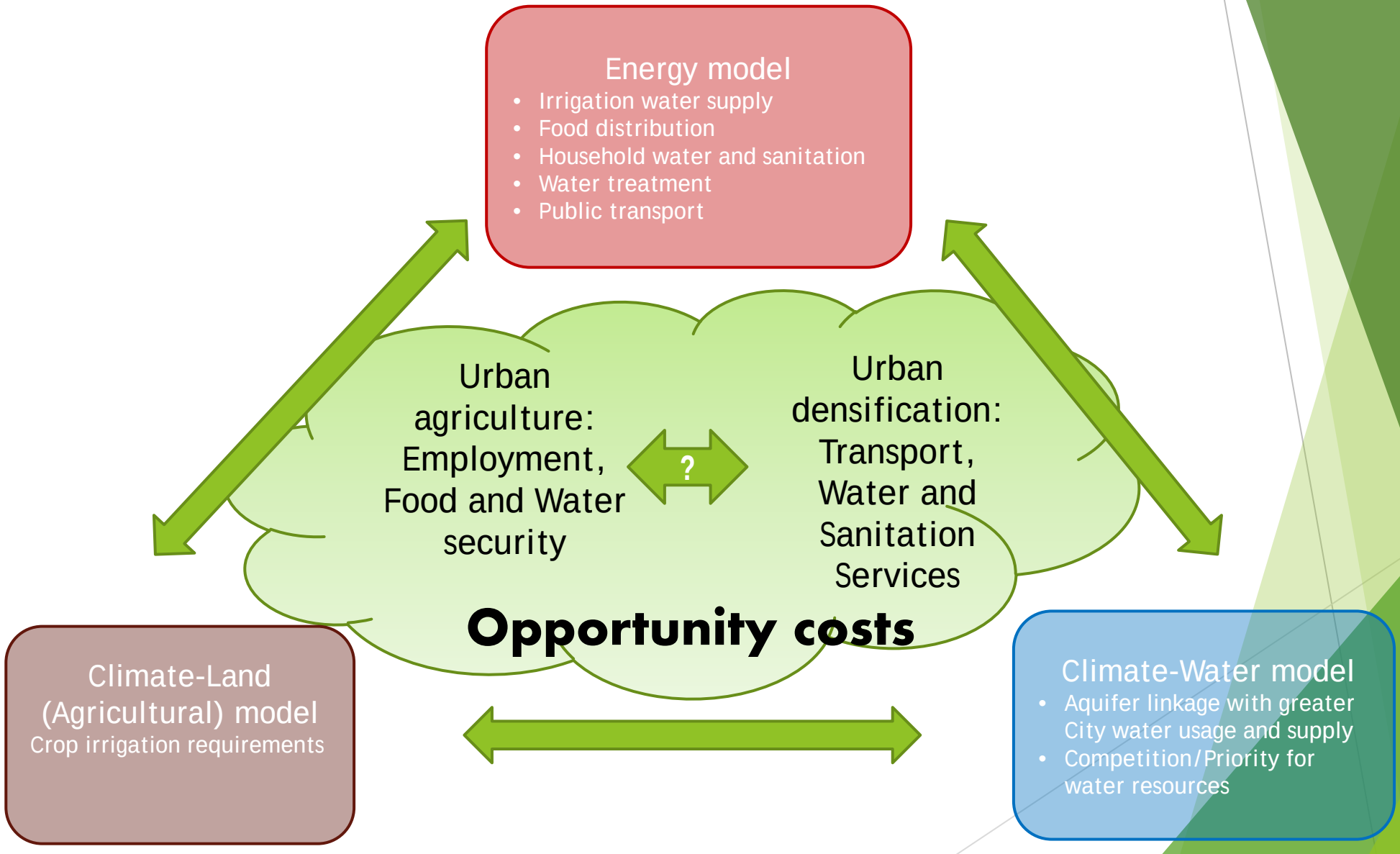
- Energy supply choices influenced by water cost and quality
- A future of escalating water supply costs is likely in the absence of cost reflective tariffs and rethinking the water economy

Assessing resource inter-dependencies:

- Improves our understanding of regional and national trade-offs in resource utilisation planning. E.g. regional water supply implications of expanding the electricity sector at minimal societal cost with the available water supply

- Leads to a better understanding of the sensitivity of the linkages:
  i. The climate resilience of the integrated water supply network
  ii. The risk of stranded water-energy infrastructure
  iii. A future energy system requires equivalent planning for the supporting water infrastructure.

City Scale Planning: Livelihoods Impact

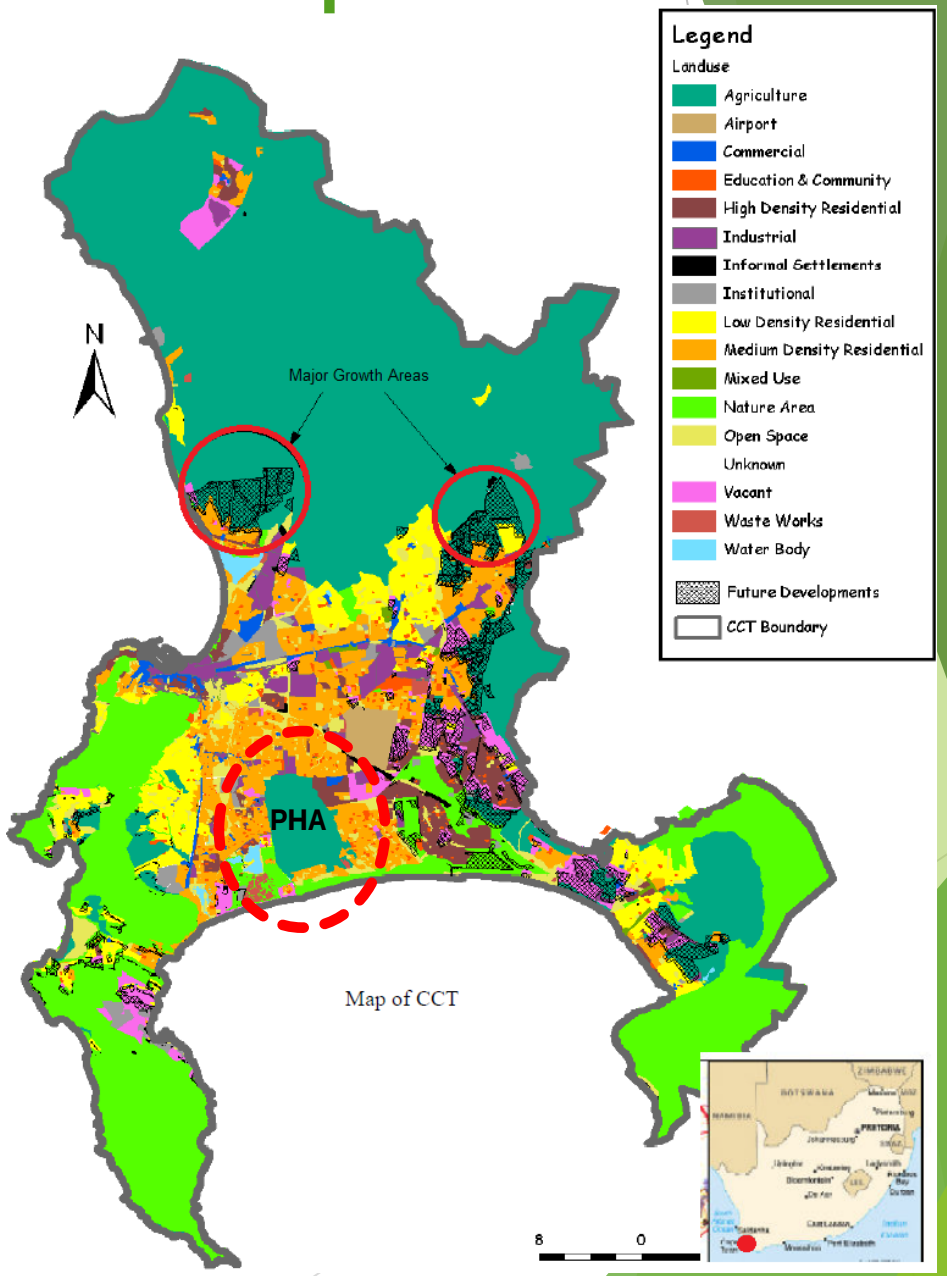


Livelihoods Impact: A City of Cape Town Example

The Philippi Horticultural Area (PHA)

Examining CLEW tradeoffs in the context of urban food security vs low cost housing in the City of Cape Town.

"The rapid growth of the City is associated with the urbanisation of poverty"



Water scarcity?

Different interpretation based on indicators used:

Data requirements

1) Basic: 'water stress index': renewable freshwater resources available per person.

2) Account for actual demand and alternative supply: *measuring scarcity as the proportion of total annual water withdrawals relative to total available water resources.*

3) Assess consumptive use and adaptive capacity (IWMI): economic vs physical water scarcity.

4) ' Water poverty index' (community scale). Assesses: (1) the level of access to water; (2) water quantity, **quality and variability**; (3) water used for domestic, food, and productive purposes; (4) capacity for water management; and (5) environmental aspects.

Understanding water scarcity: Definitions and measurements (White, 2012)