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Water Research AUSTRALIA

Direct Potable Reuse – a more cost effective water supply option than long distant water transfer or Desalination

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Outline of Presentation

- Water scarcity and importance of recycling water
- Various centralised recycled water systems
- Methodology/Research Approach
- Common treatment technologies and train used to recycle water
- Energy Intensity of various recycled water systems and comparison of those with long distant water transfer and desalination
- Way Forward

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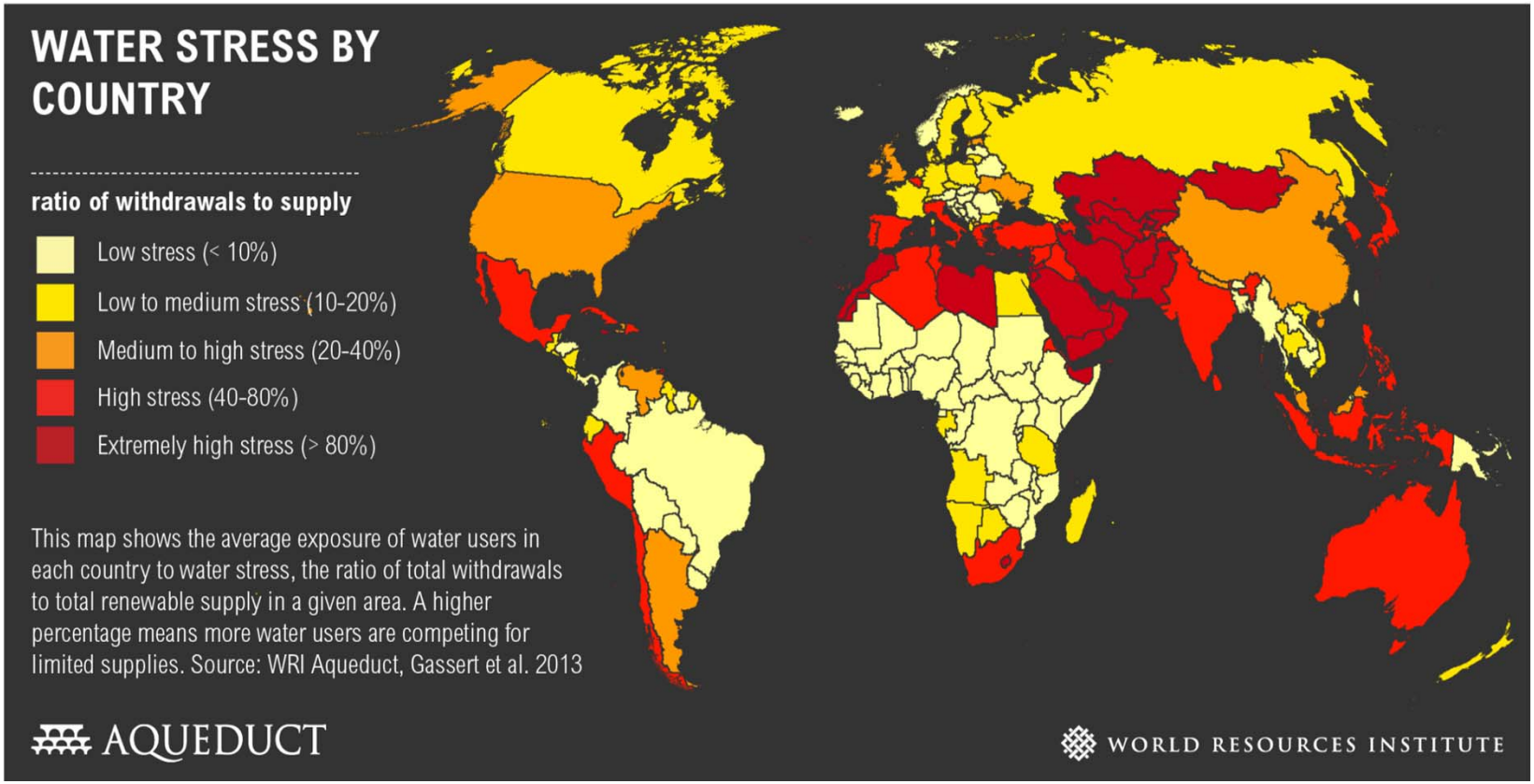
Water Stress by Country



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Climate Change and Drought

- Persisting drought in California
- Millennium drought from 2001-2009 and current drought in Australia
- Drought in India in 2016 affected 330 million people.
- In 2014, 13 provinces in China were subjected to severe droughts, leading to 8.2 million people facing with water shortage.

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Long Distant water transfer cities/State

Southern California
Loss Angeles
San Diego County
Orange County
Adelaide

Chennai Delhi
Bangalore
Mumbai
Ahmedabad
Hyderabad

Countries using Desalination Plants

USA, Australia, Mexico, Spain, Jordan, Israel, Saudi Arabia, Bahrain, Qatar, Iran, UAE, Singapore, Libya, China, India, Pakistan, Algeria

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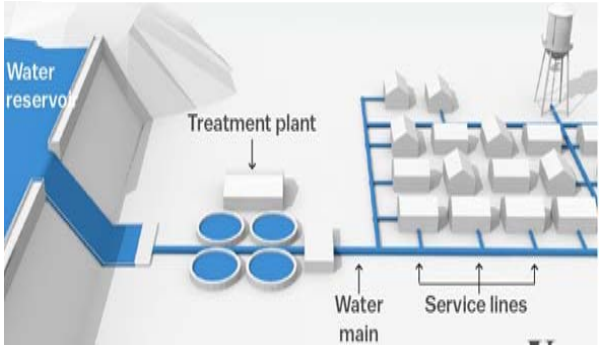
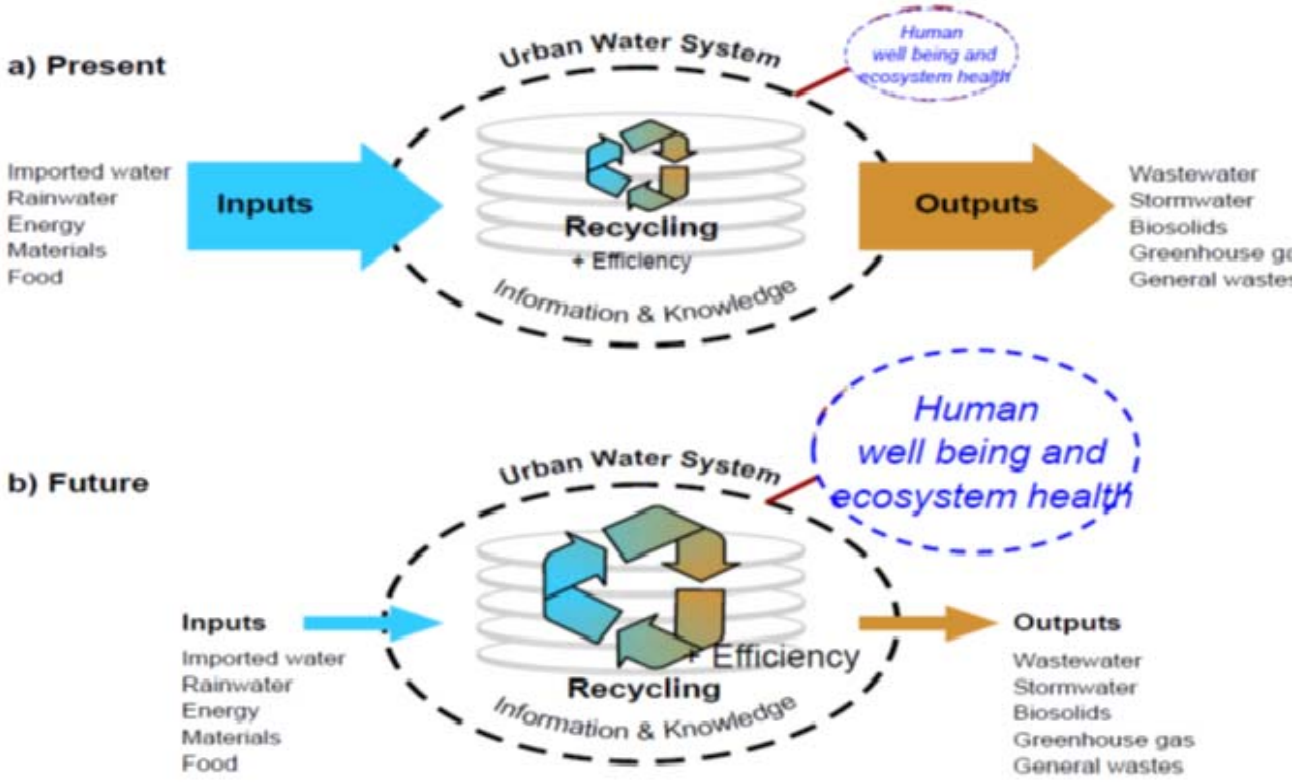
Centralised Water and Wastewater Systems



- Linear System-80% water is wasted and pollutes environment
- Excessive withdrawal of freshwater - surface water and ground water
- Involves high operational cost for energy-energy cost varies from 15 to 80% of operational budget of a water utility
- For water supply, pumping involves more than 80% of total energy use and for wastewater treatment, aeration is the major energy user amounting 65%
- Cities are increasingly moving toward distant sources of water or desalination

Importance of Recycling

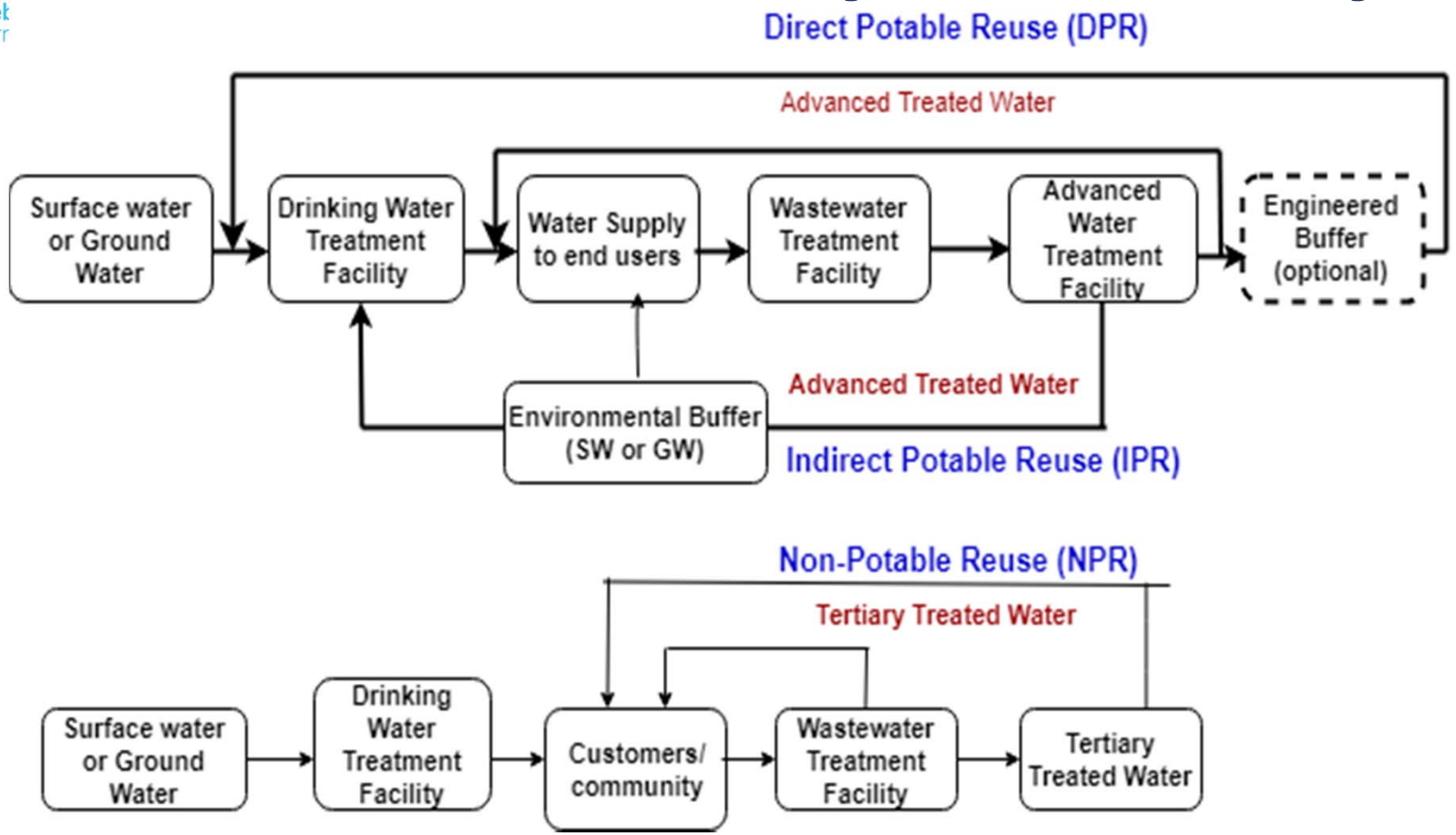


High metabolism
Unsustainable

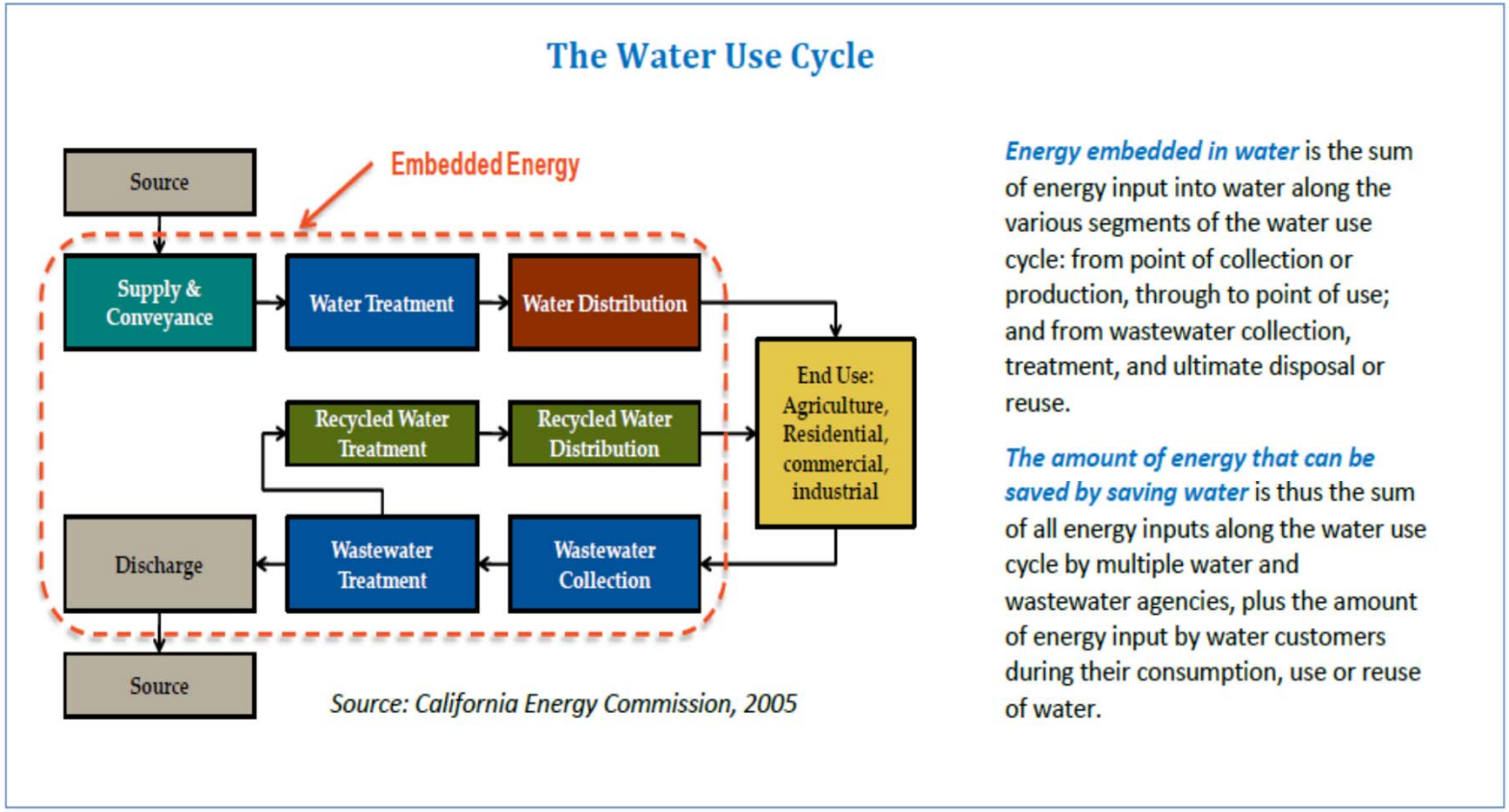
Low metabolism
Sustainable

Ref: Kenway et al., 2011

Centralised Recycled Water Systems

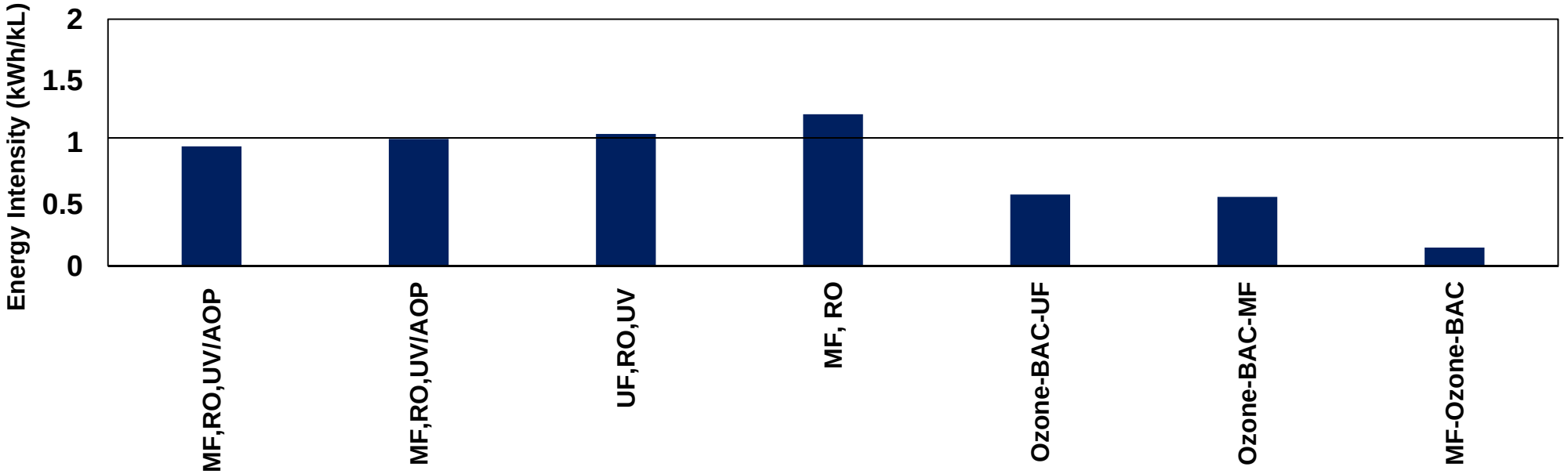


Methodology



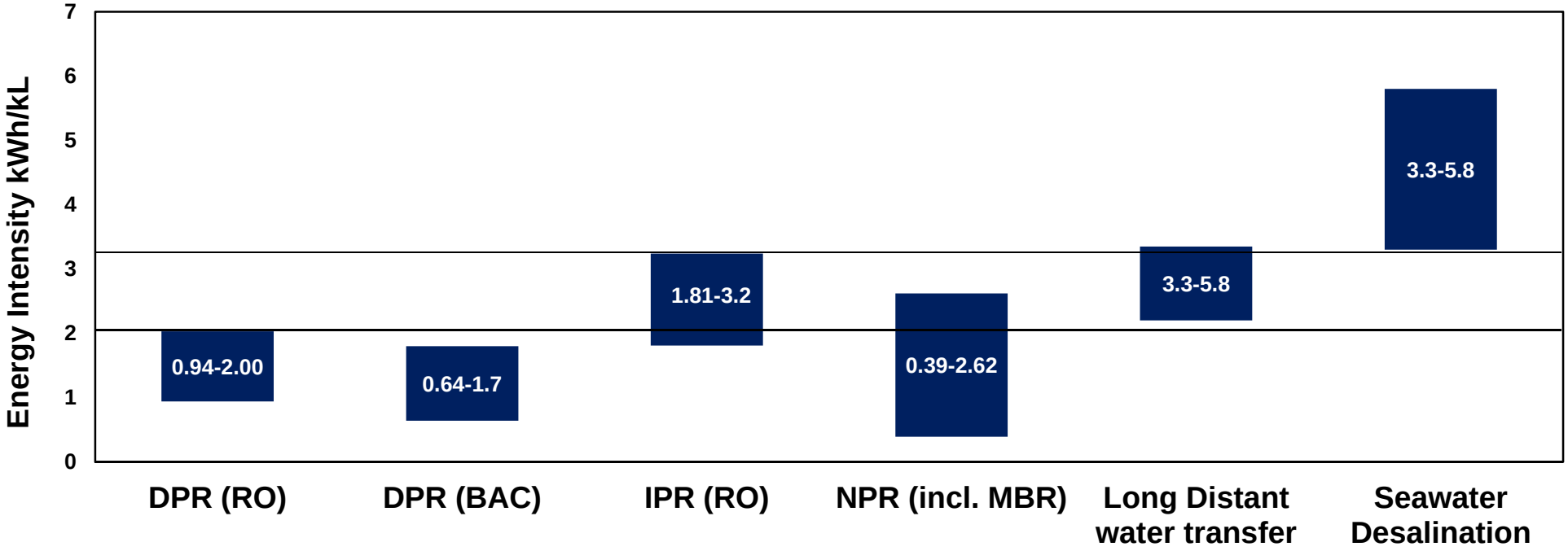
Ref: CEC, 2005

Common treatment technologies and trains to recycle water



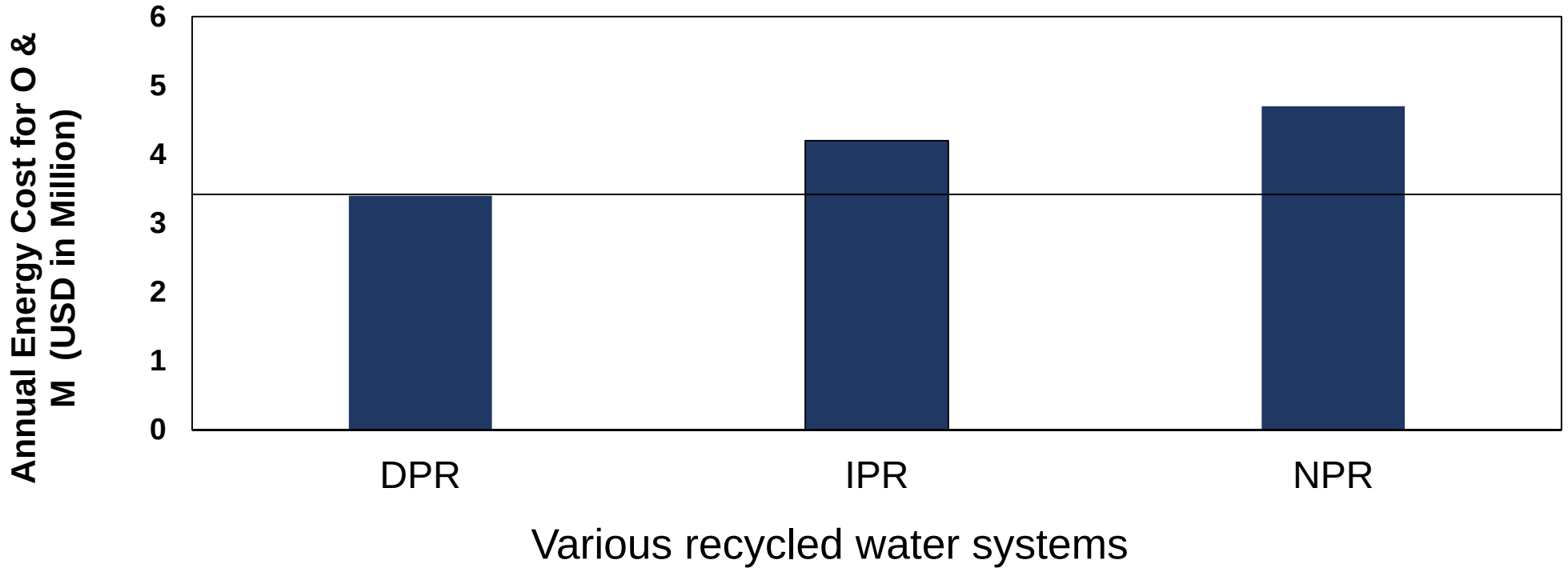
Ref: Cooley and Wilkinson, 2012, ATSE, 2012; EPRI and WRF 2013; Sharma et al., 2012; Hall et al., 2009; Scales et al., 2015; *Van Houtte and* Verbauwhede, 2008)

Energy Intensity of various recycled water systems, and comparison with Long Distant Water Transfer and Seawater Desalination (incl. pumping)



Ref: Chen et al., 2016; Olea, A.E., 2015; Marchi et al., 2014; EPRI and WRF 2013; ISF, 2013 ; Cooley and Wilkinson, 2012, ATSE, 2012; Pellegrin and Kennear, 2012; Hall et al., 2009; Scales et al., 2015; Van Houtte and Verbauwhede, 2008;

Annual Energy Cost of DPR, IPR and NPR of 75 MLD plant (considering energy price USD 13.5/kWh) (including life cycle cost)



Ref: Olea , 2015

Key points from this research

- Long distant water transfer is energy intensive and has environmental consequences and desalination can only be implemented in coastal cities
- DPR can be less energy intensive and more cost effective than long distant water transfer, or desalination or even IPR which requires environmental buffer or NPR which requires dual pipe network and expensive.
- DPR can be appropriate in water stressed cities or where other sources of water are not sufficient to meet water demand or in dense cities where retrofitting is difficult.
- Scale and technologies are two important factors to be considered to recycled water but of course the quality of water should not be compromised at a cost of adverse health impacts.

Next Thinking

- Education: Upskilling planners and engineers in a One Water / integrated water planning approach.
- Education: Creating community awareness on importance of recycled water for potable use.
- Policy: Managing risk and water quality issues for both source and end-uses.
- Research: Develop a strategy for piloting DPR in very water stressed areas

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Thank You

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