TAIWAN INT'L WATER WEEK

Water Leaders Summit

Irreplaceable Water Value

Introduced by: Dr. Chien-hsin Lai

Director-General
Water Resources Agency, MOEA

Oct 14, 2021

TAIWAN INT'L WATER WEEK

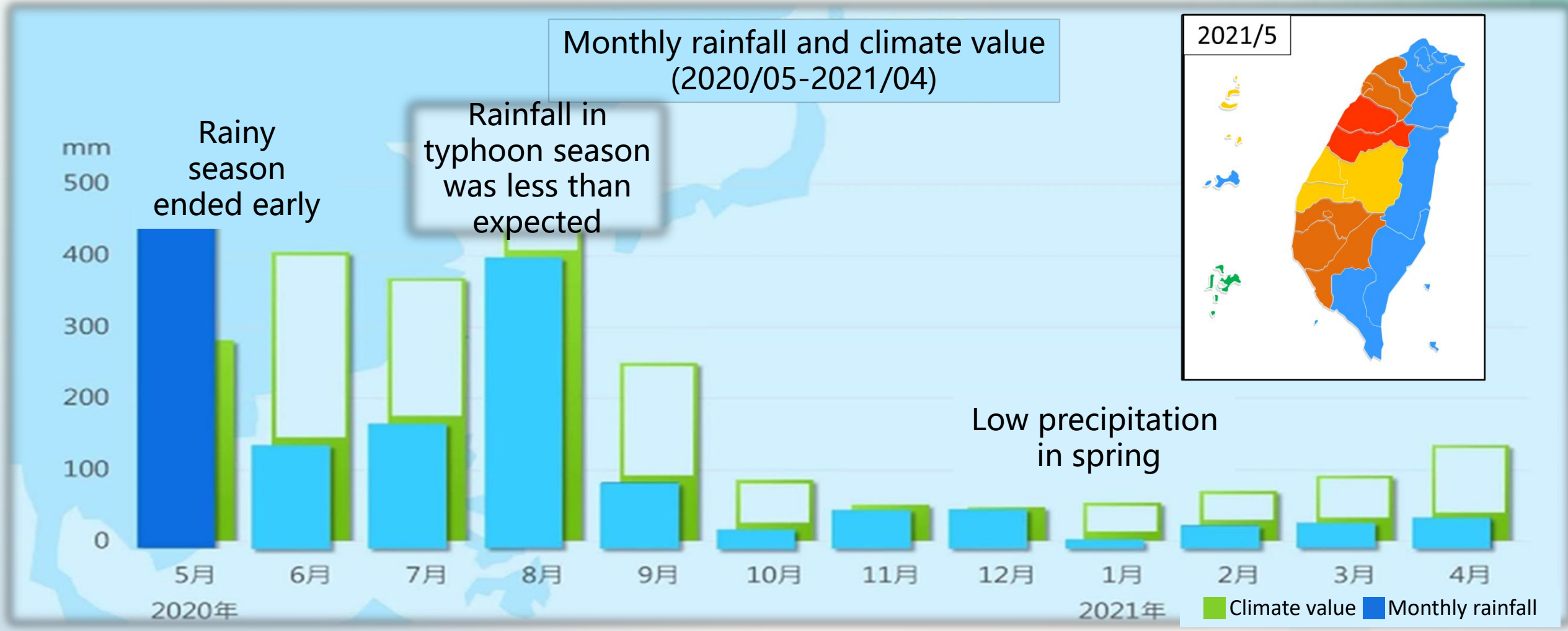
2021 the Severest Drought

Annual rainfall 880mm is 1/3 of historic average

Monthly rainfall and climate value (2020/05-2021/04)

Rainy season ended early

Rainfall in typhoon season was less than expected



Low precipitation in spring

Listen to the rain, deeply touched!

May 24, at Shihmen Reservoir

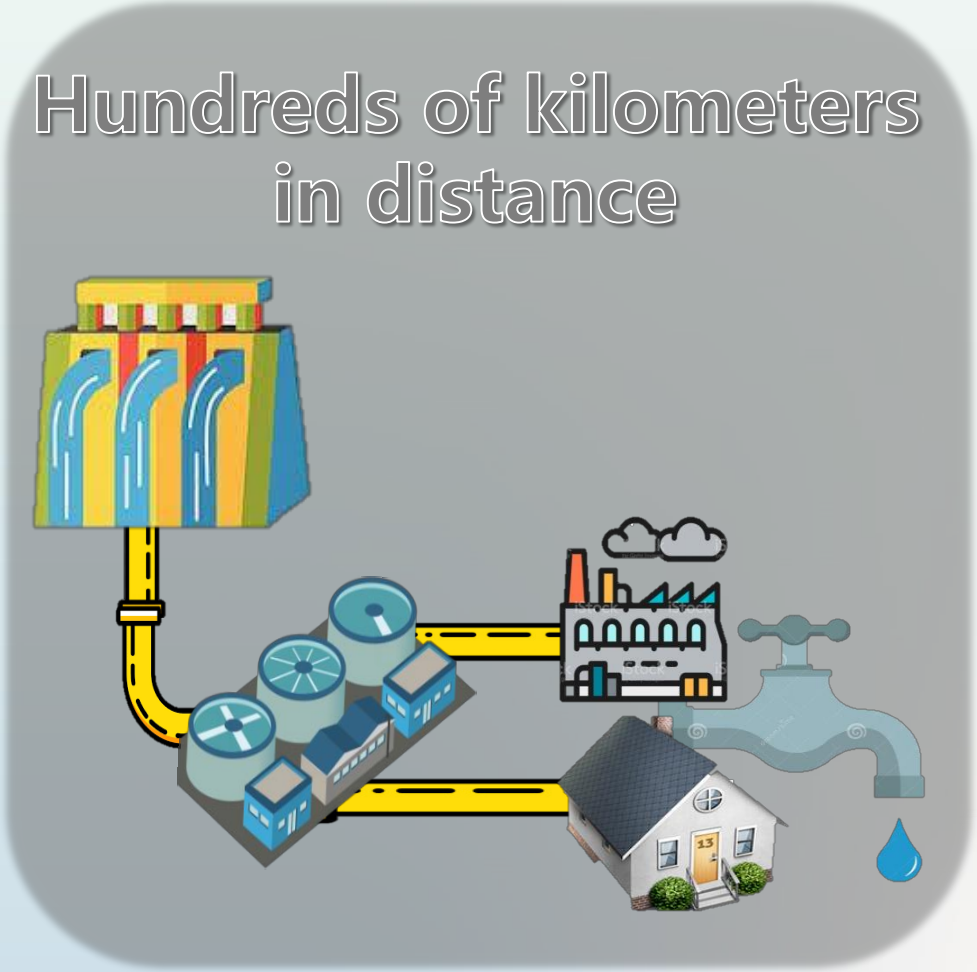
Echo to the World – Water Value and Water Resources

- ✓ **UN World Water Development Report 2021:**
  - **Water is irreplaceable; its value cannot be simply measured by price and shall not be treated as cheap merchandise.**
  - **Being under-recognized and under–valued, leading to wastful & poor management of water resources**

Source & Photo Credit: U.N. web site; DQ (https://dq.yam.com/) ; Al Jazeera Media; CNA News; China Times Group; Business Today

Recognizing Water Value – Thinking & actions will change

How hard is it from headwater to faucet?



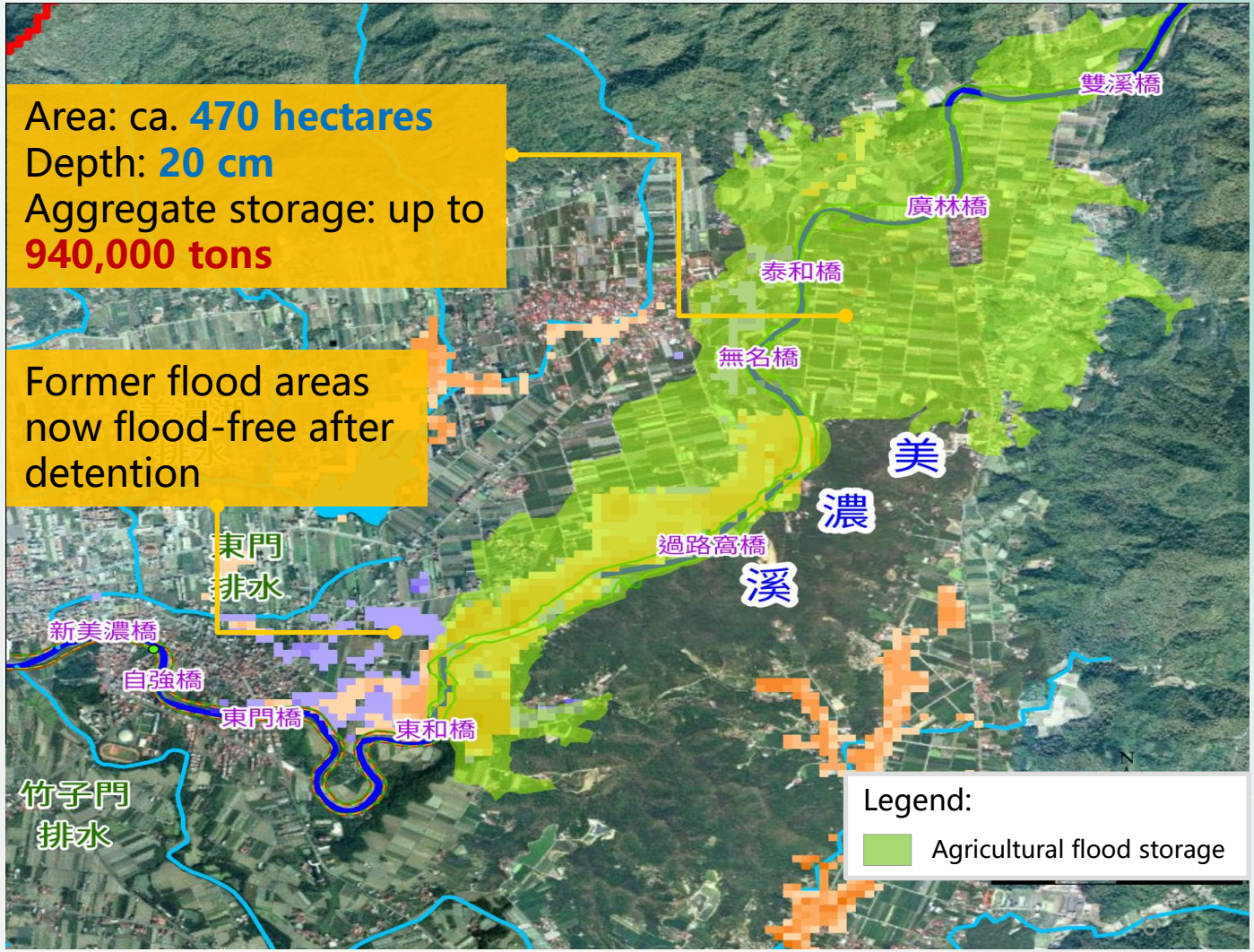
1. Thinking: cherish water resources while mindset changed!
2. Action: value water environment while conservation rooted in behavior!
3. Technology: recycling and reuse while technology promoted!

Valuing water resources- Turning detained flood into water resources

Cultivate Water Incentives

Upstream catchment of Meiyou River

- ✓ Overflow weir, gate controls
- ✓ Storing up to **940,000 tons**



Valuing Water Resources-
Pearl Beads Project, sharing water resources

Northern (Scale-up Feitsui southbound dispatch)

Southbound dispatch

Bansin Project Phase II

Taoyuan-Hsinchu Main

Dispatch Diversion (Nanshi River to Shihmen Reservoir)

Pipeline Joining-up (Liyutan northbound to Miaoli)

Reservoirs dispatch (Shihmen Reservoir to Hsinchu)

North-/southbound dispatch

Pipeline joining-up (Miaoli to Taichung)

Improved pipeline connectivity (Taichung to Yunlin)

Central (bottleneck get-through)

Pipeline Joining-up (Zhuo Main & Chianan Irrigation)

Reservoirs dispatch (Zengwen to Nanhua)

Northbound dispatch

Pipeline Joining-up (Nanhua to Gaopin)

Pipeline joining-up (Kaohsiung to Tainan)

Southern (Scale-up Dispatch Support)

Complete

Under construction

Planned

Valuing Water Environment- Integration the Blue & Green for a new water environment

Water environment integrating environment, ecology, landscaping, aesthetics and flood prevention

Ex situ conservation

Manmade nest box

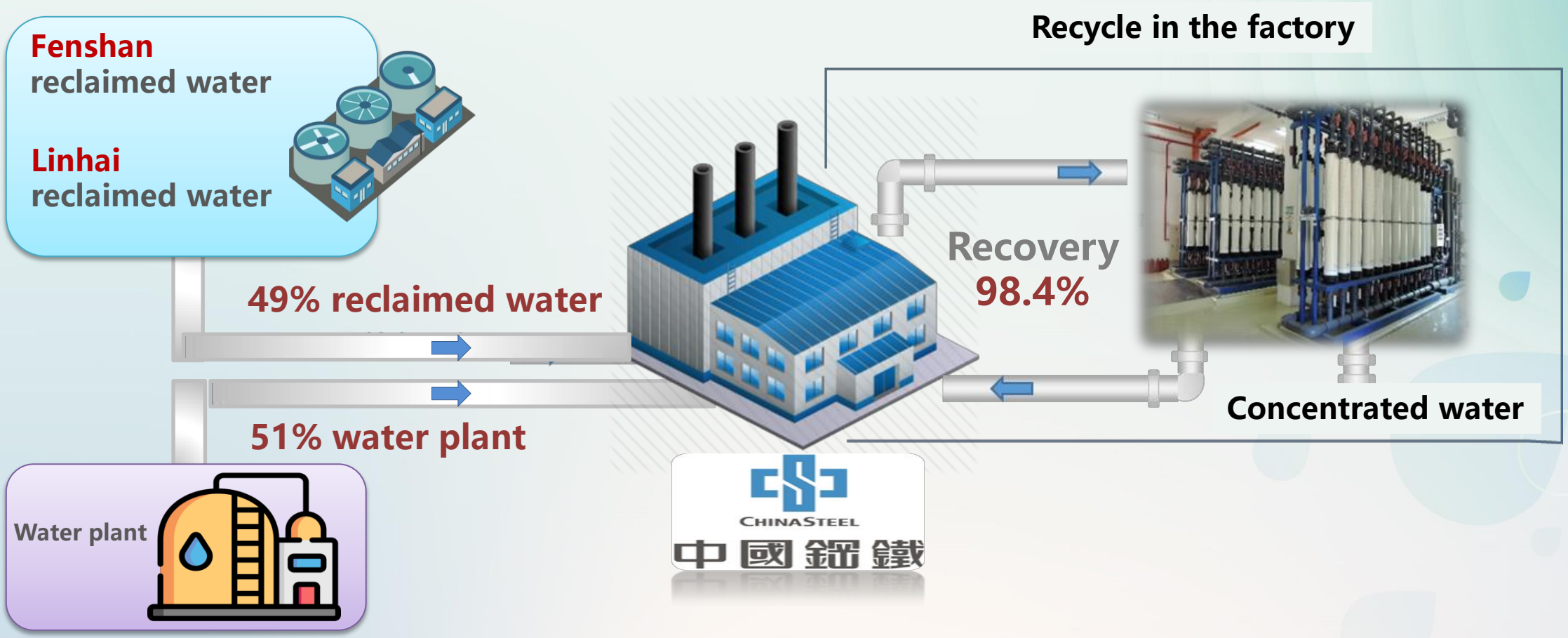
Restoration of indigenous flora habitat

Constructed wetland

Photo Credit: ETToday.net

Recycling and Reuse-
ESG vs Businesses vs Reclaimed Water

- ✓ **Improving reuse rate: 88.39% among science parks; 72.9% among industrial parks**
- ✓ **Government: built 11 reclaimed water plants; businesses support reclaimed water**



Experiences Share & Exchange from Taiwan

Thinking, action, & technology:

Thinking transformation→ cherish water resources;

Action-based conservation→ value water environment;

Technology application→ recycle and reuse.

Cross-domain cooperation & public-private partnership:

Climate disasters reduction by government-business-public participation;

Sustainable water by cross-domain cooperation & public-private partnership.

Thank you!

Water Pricing for the Future

Presented at Taiwan International Water Week 2021—Taipei
'Water Leaders Summit-Irreplaceable Water Value'

Professor Quentin Grafton
The Australian National University
14 October 2021
(quentin.grafton@anu.edu.au)

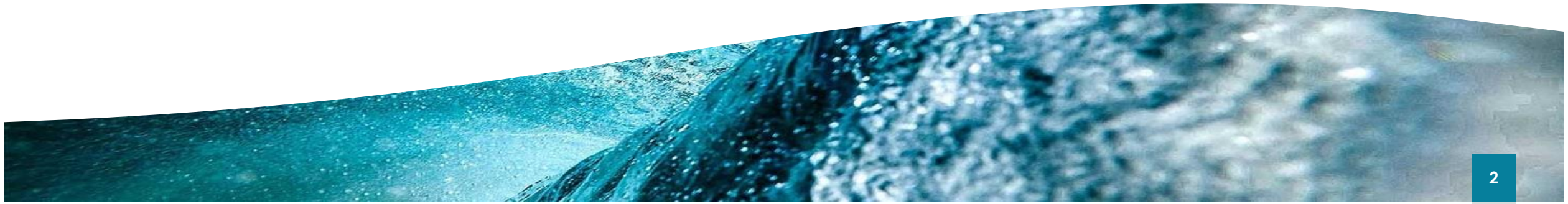
WATER JUSTICE HUB
WATER JUSTICE FOR ALL

Outline

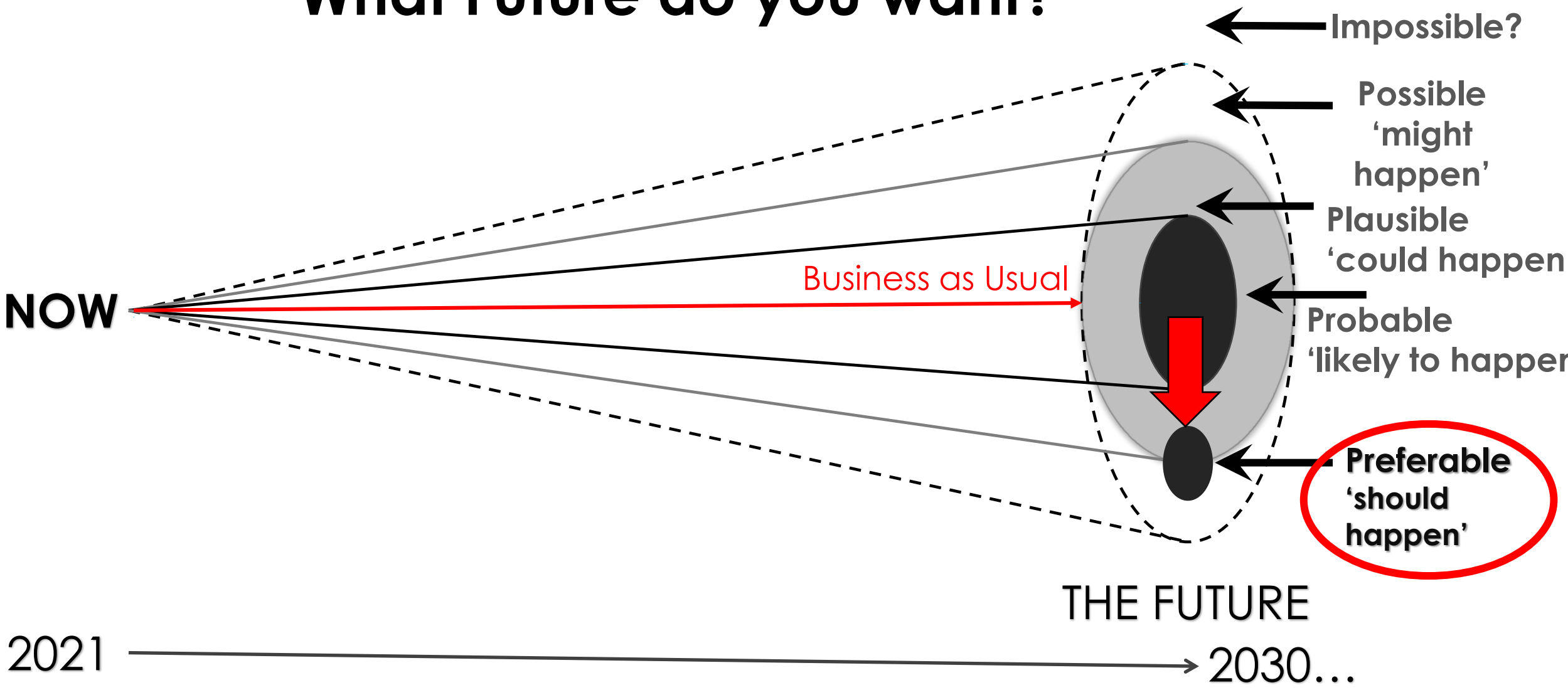
I. Water Markets

II. Urban Water Pricing

III. Case Study of 'Future' Water Pricing



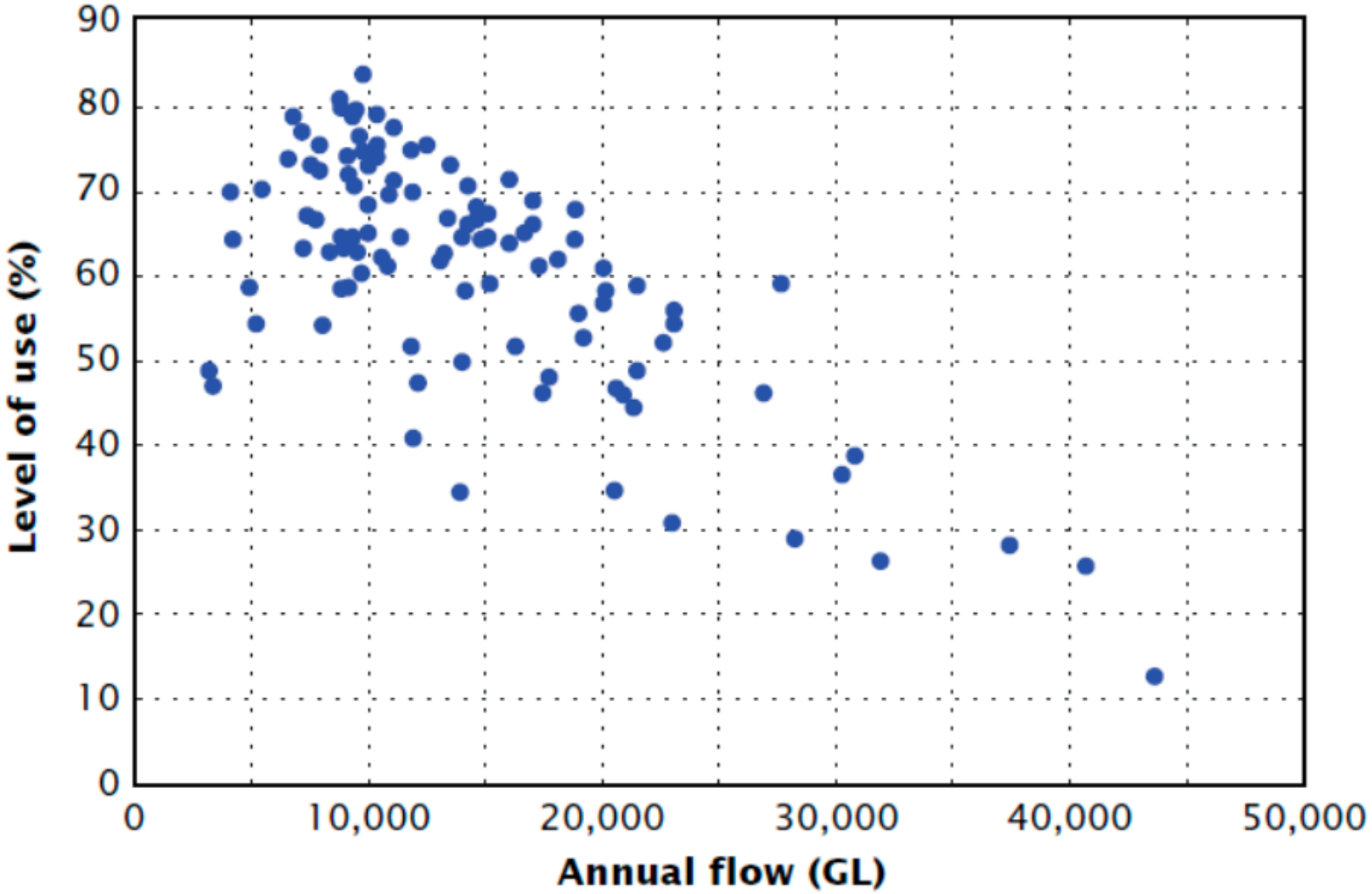
What Future do you want?



Adapted from Hancock and Bezold 1994

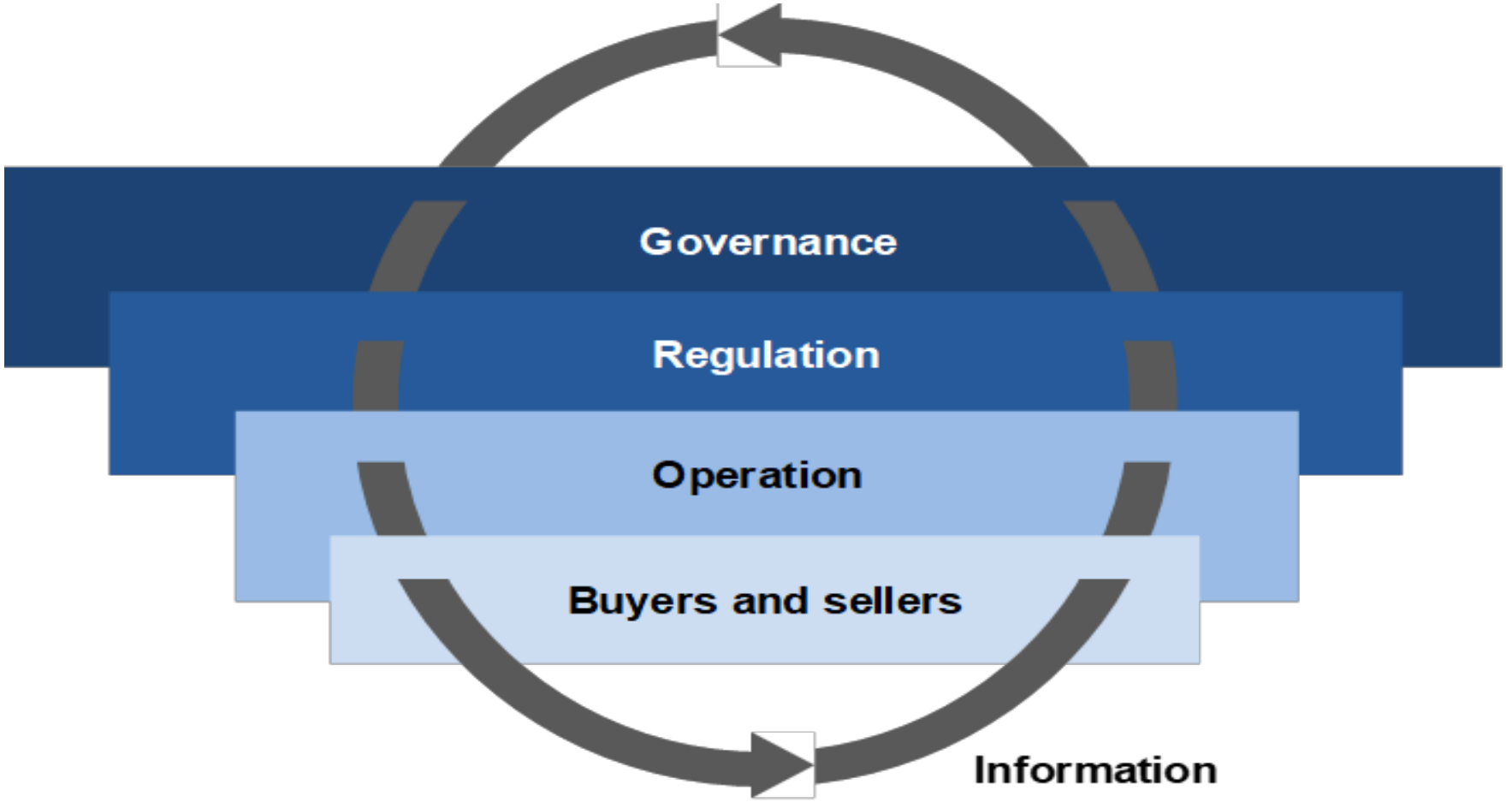
I. Water Markets

Surface Water use versus Basin natural Stream Flow



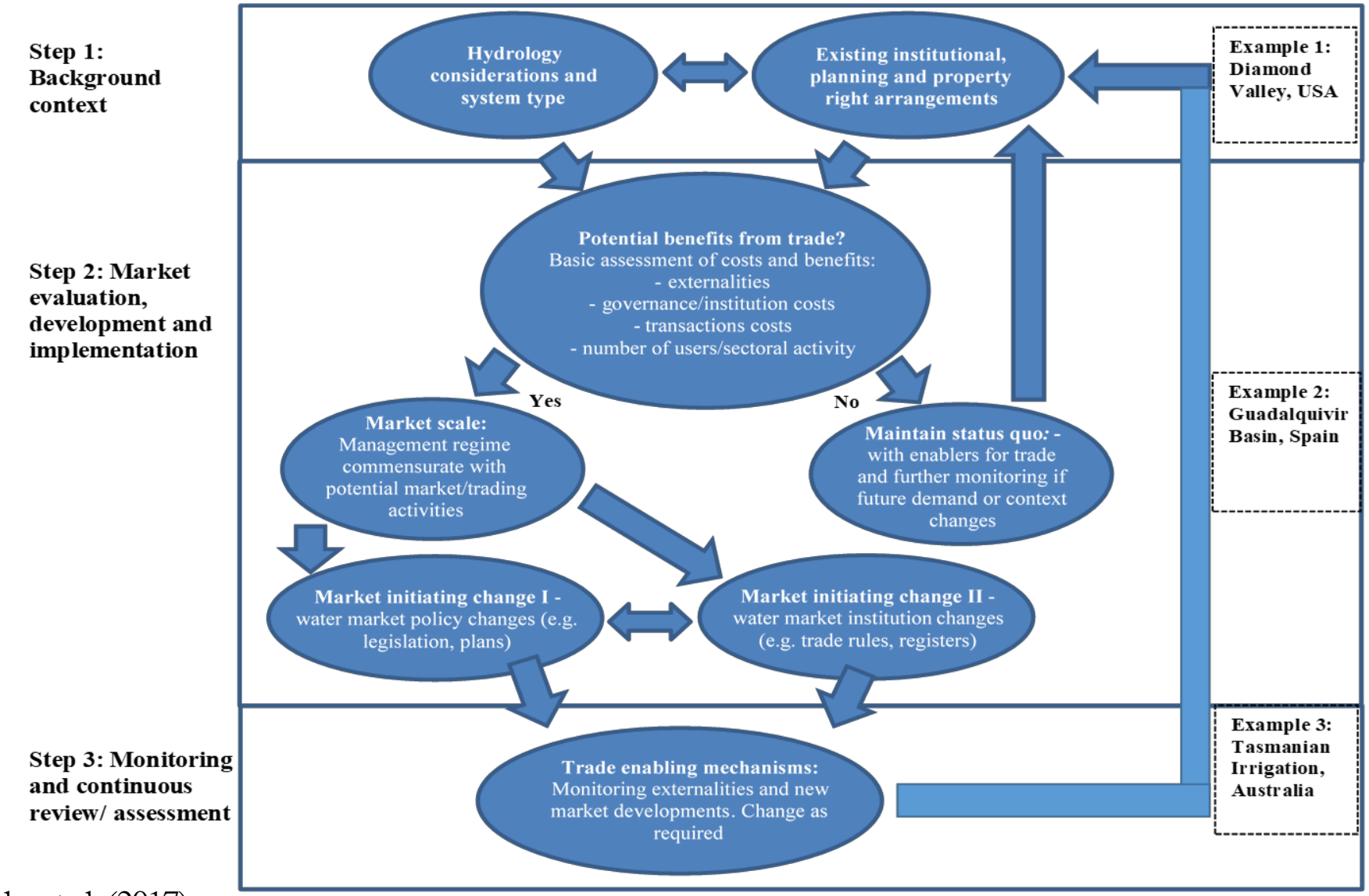
Source: Prosser et al. 2021

Governance, Regulations & Operations of Markets



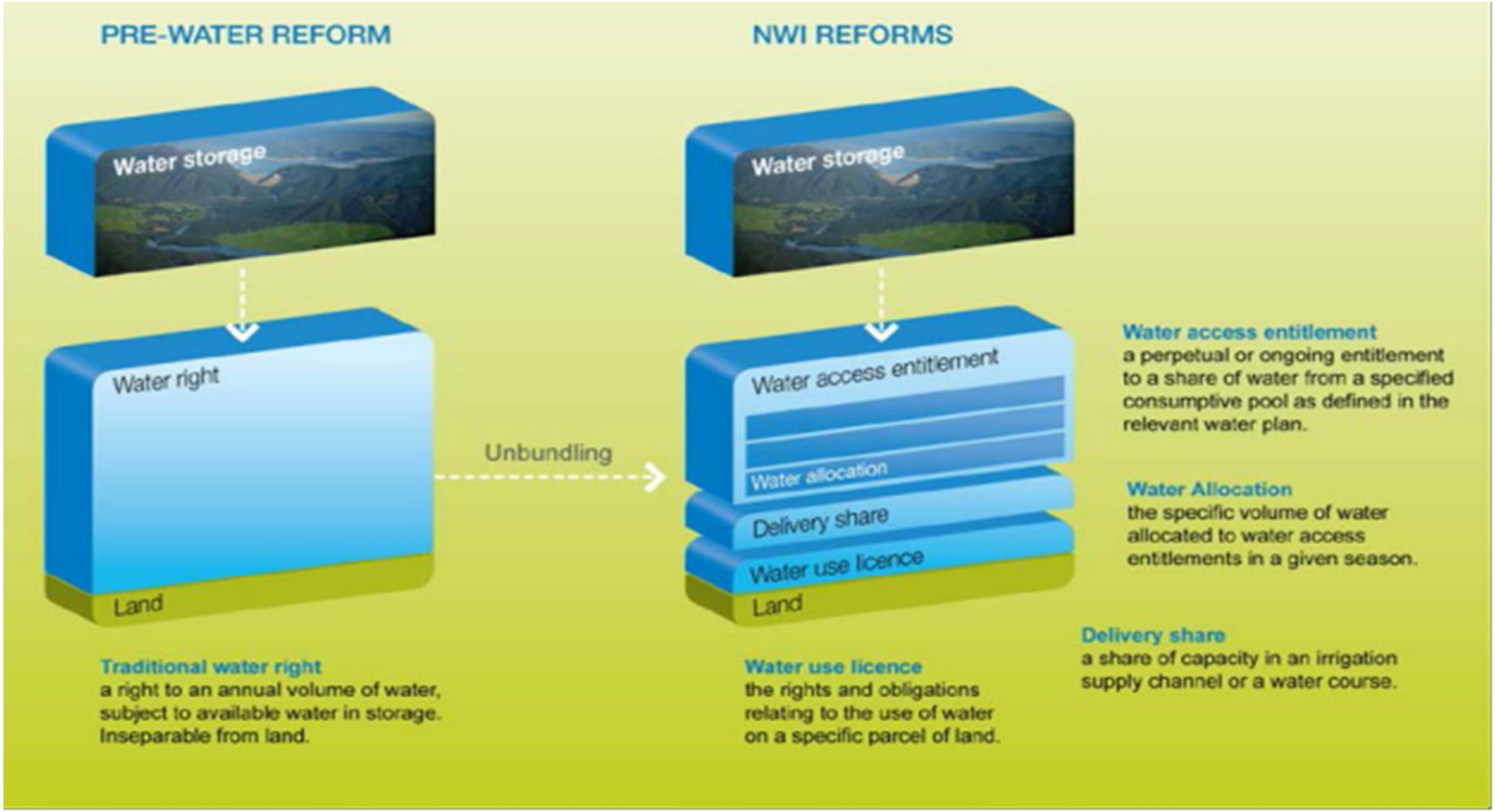
Source: ACCC (2021)

Water Markets Readiness Framework



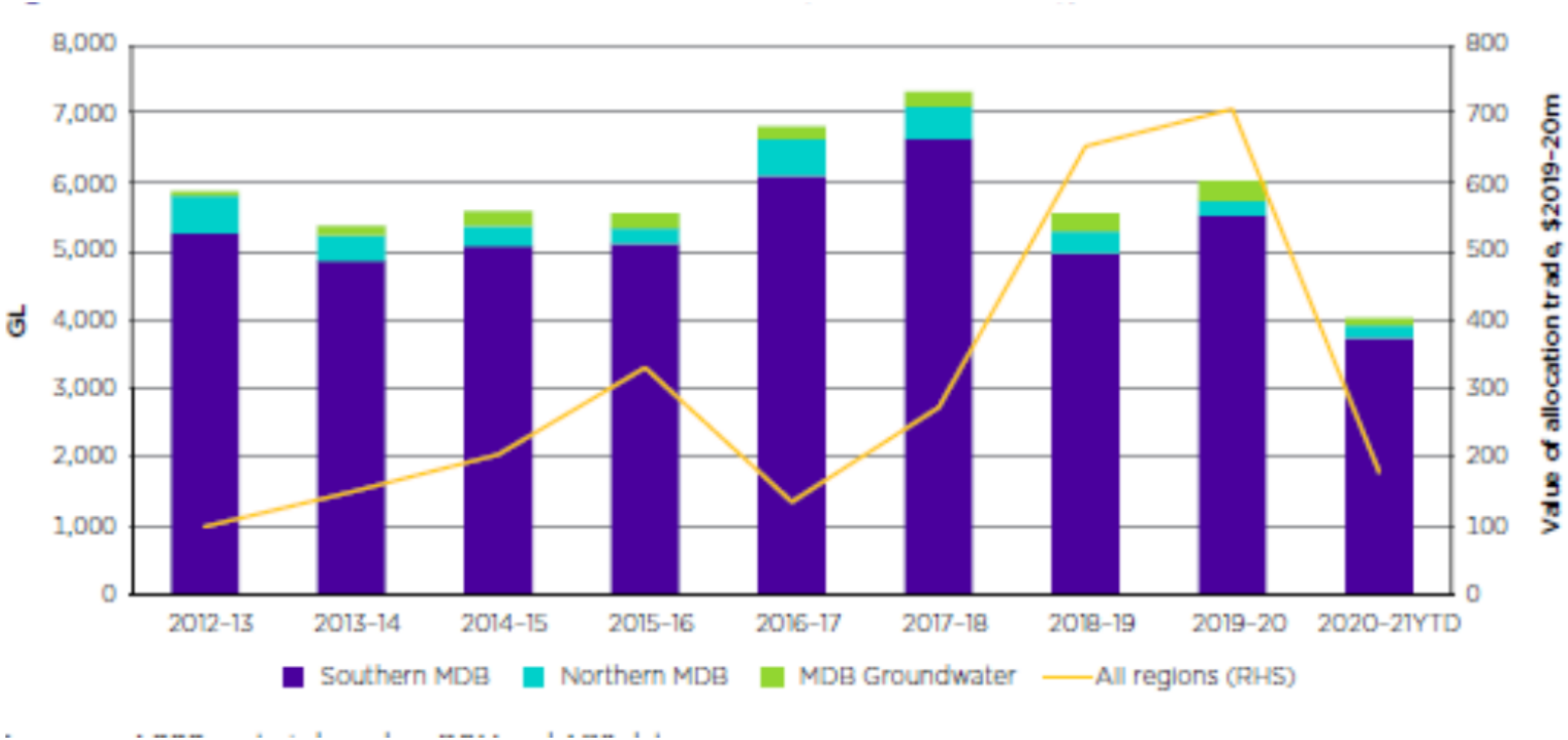
Source: Wheeler et al. (2017)

Unbundling of Water Rights



Source: National Water Commission (2011, p. 84)

Water Allocations Trading in the Murray-Darling Basin



Source: ACCC (2021)

Water Storages and Water Market Prices

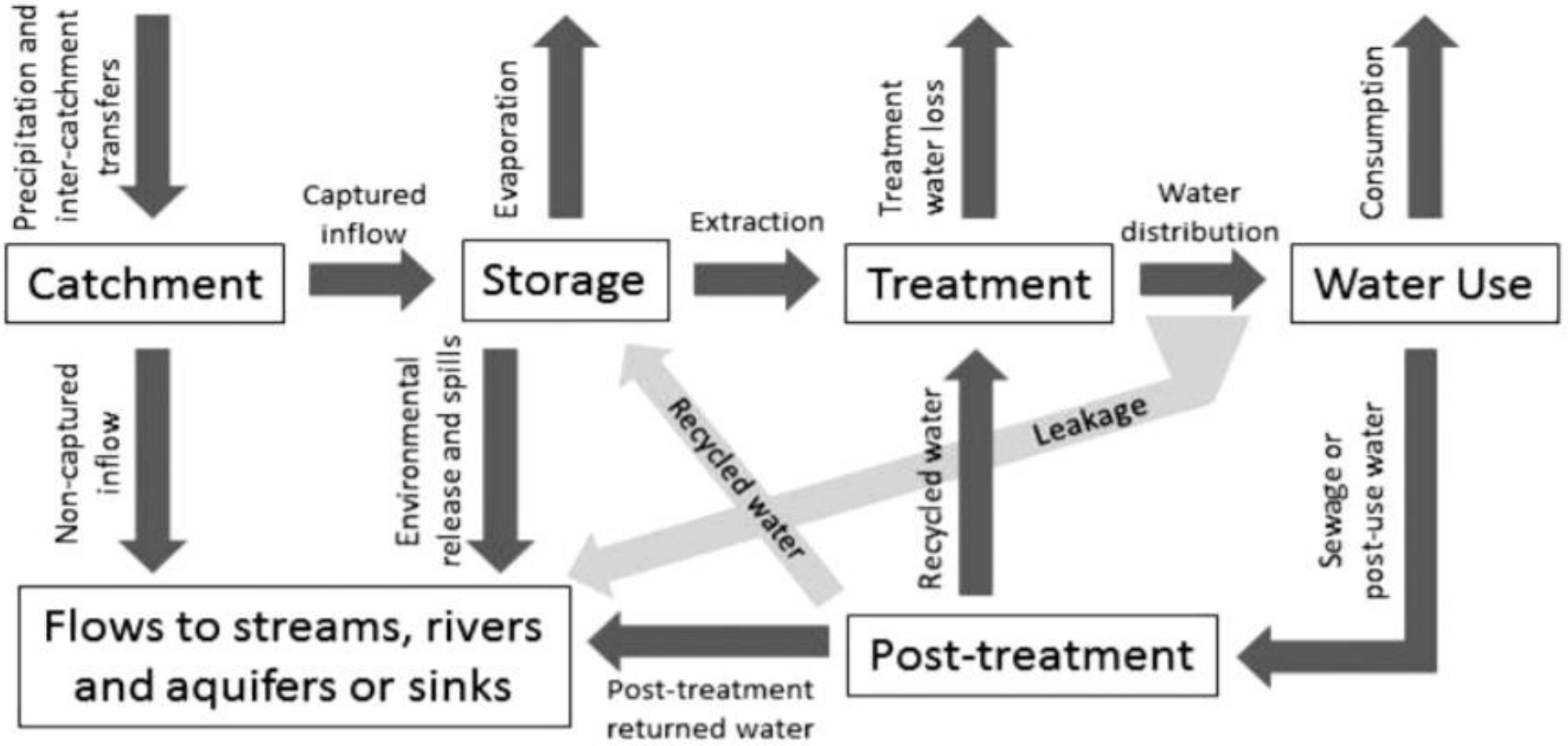
Source: ACCC analysis based on New South Wales, South Australia and Victoria response to voluntary information request, Waterflow data, Bureau of Meteorology (for storage data) and Australian Bureau of Statistics, Cat. No. 6401. Provisional estimates.

Notes: For price series: Basin State voluntary information request data used up until 31 October 2019 (solid line); Waterflow data thereafter (dashed line). VWAP = Volume-weighted Average Price.

Source: ACCC (2021)

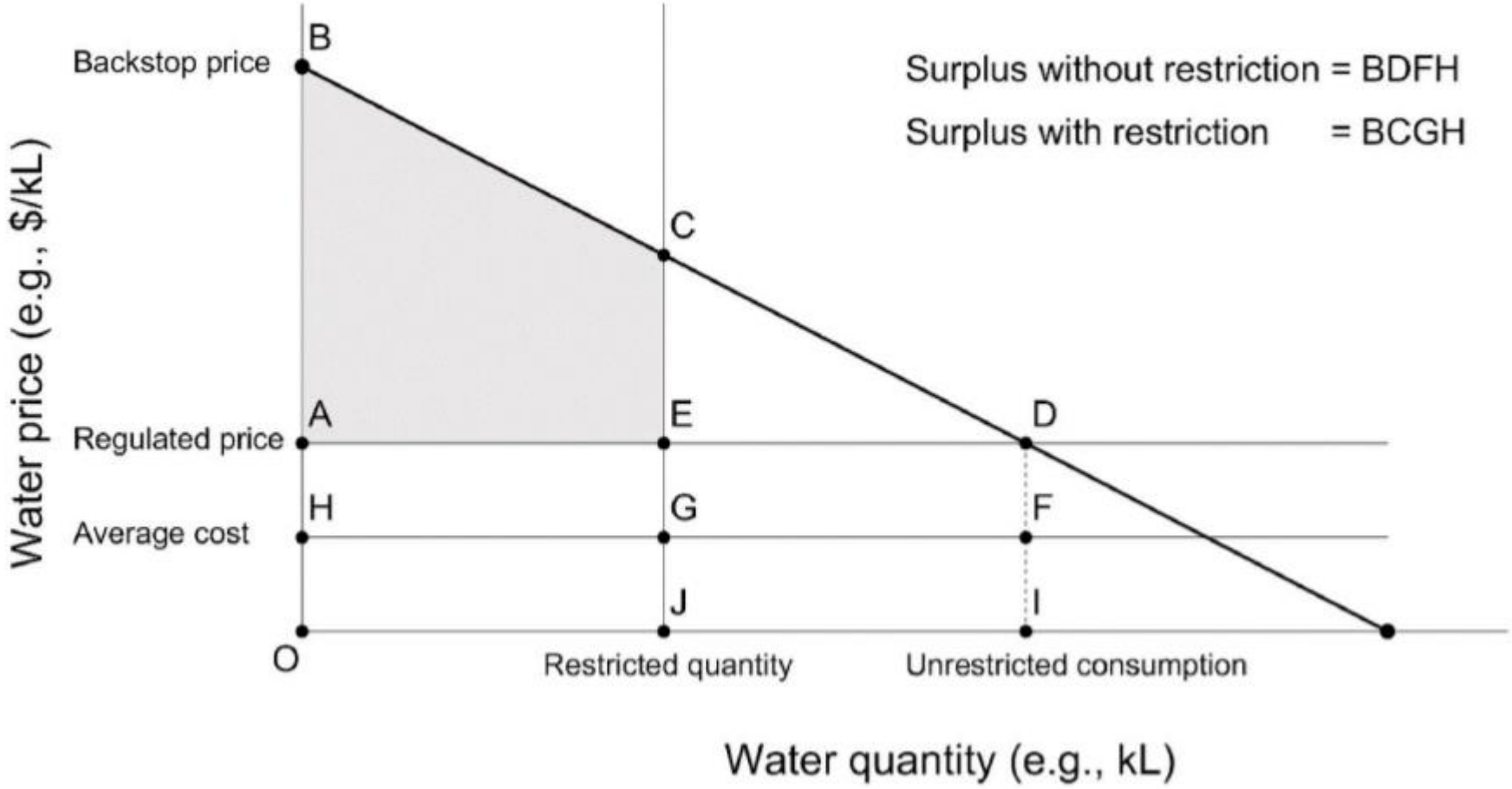
II. Water Pricing

Key Flows and Stocks in an Urban Water Supply



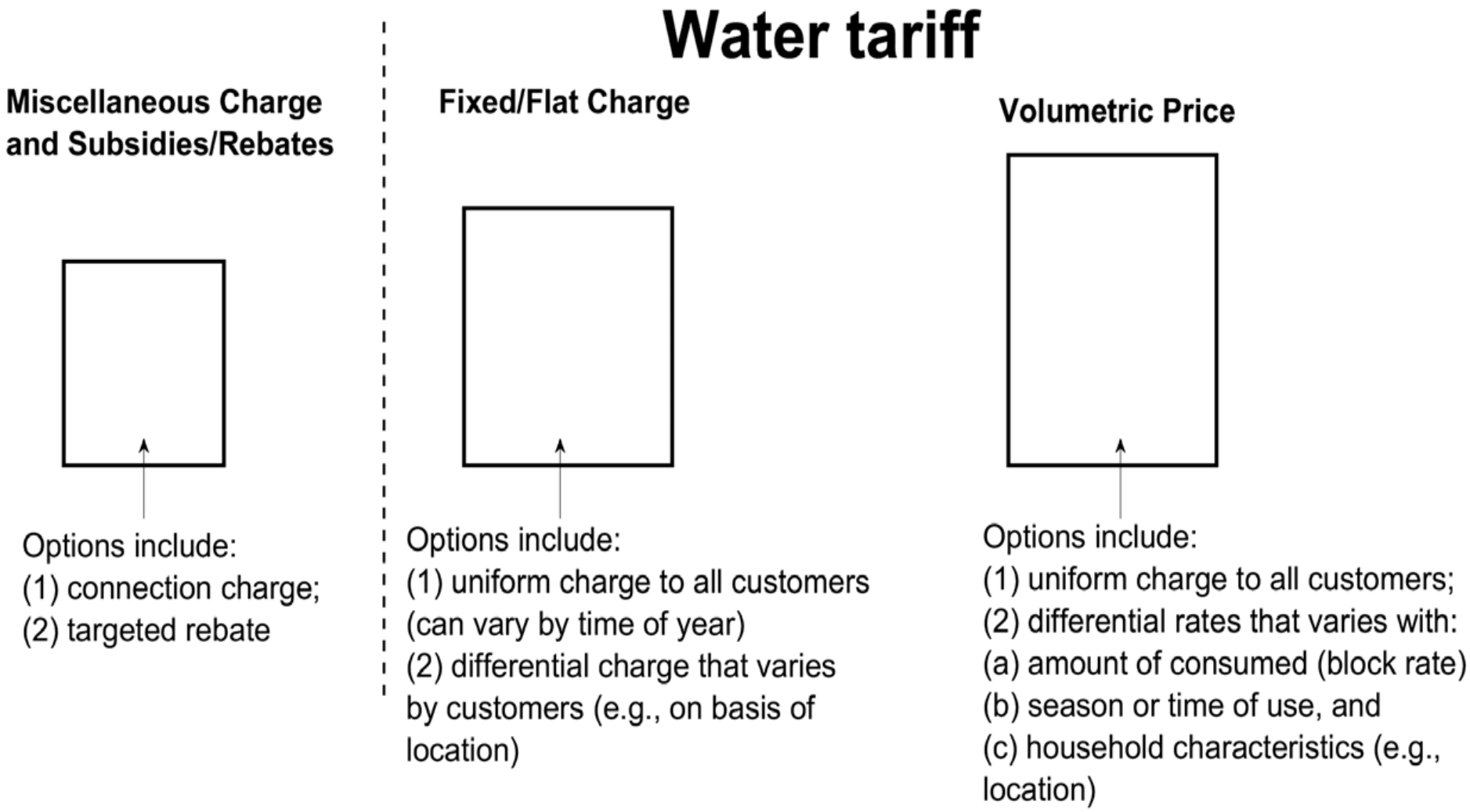
Source: Chu & Grafton, 2018

Pricing versus Rationing



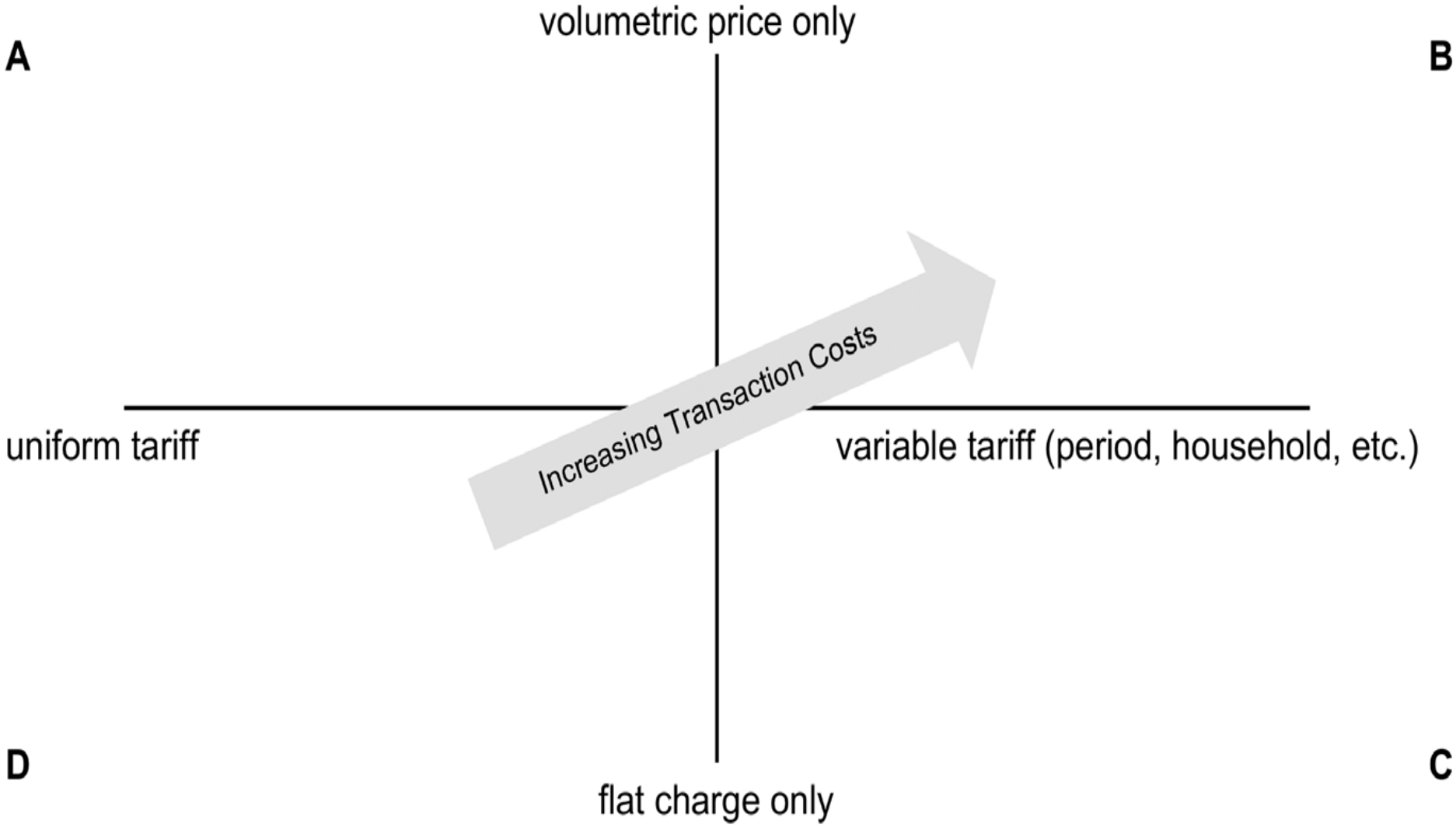
Source: Chu & Grafton, 2021

Water Tariff Structures



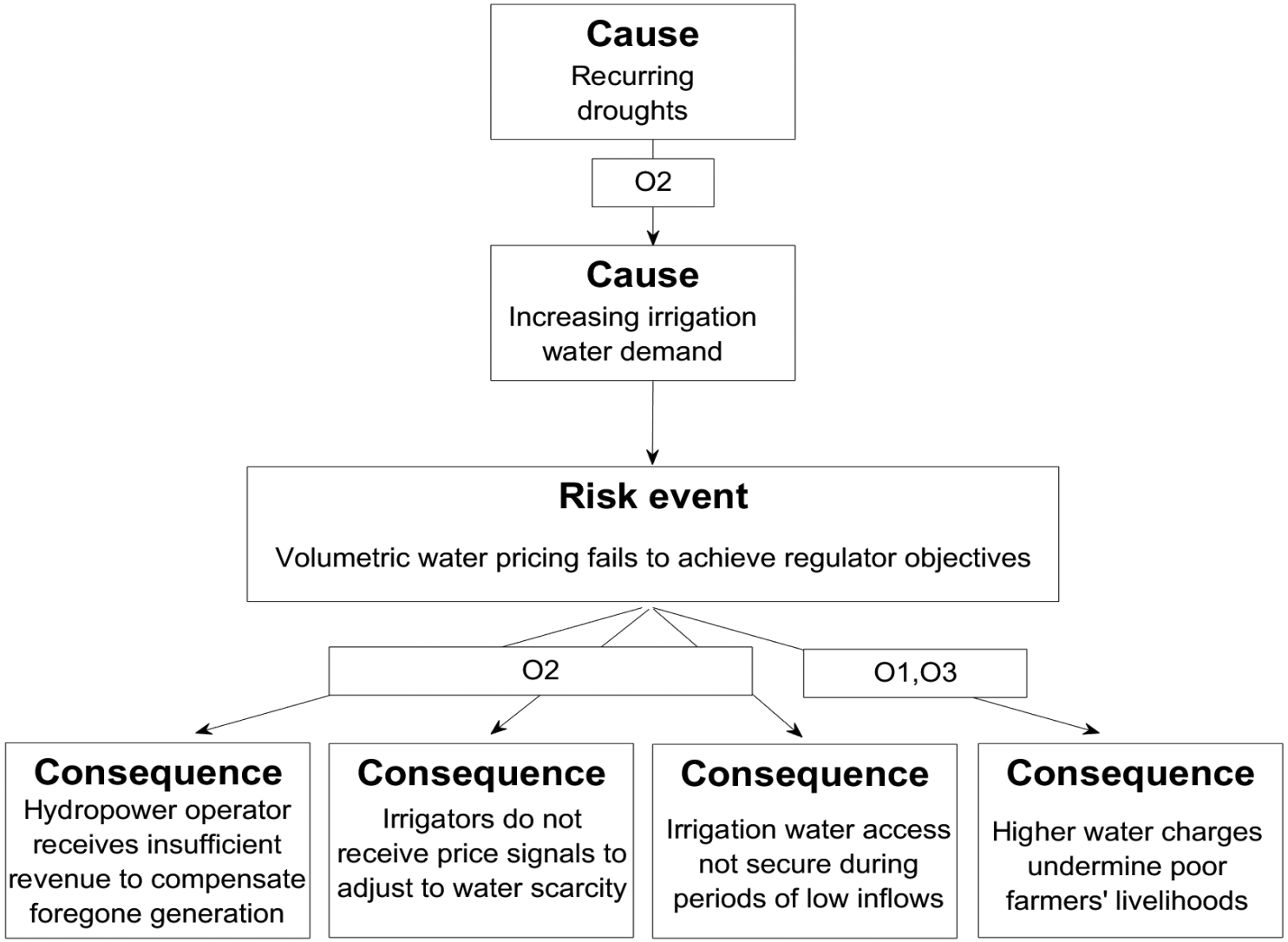
Source: Grafton et al. 2020

Water Pricing Options



Source: Grafton et al. 2020

Risks & Options to Respond to Droughts

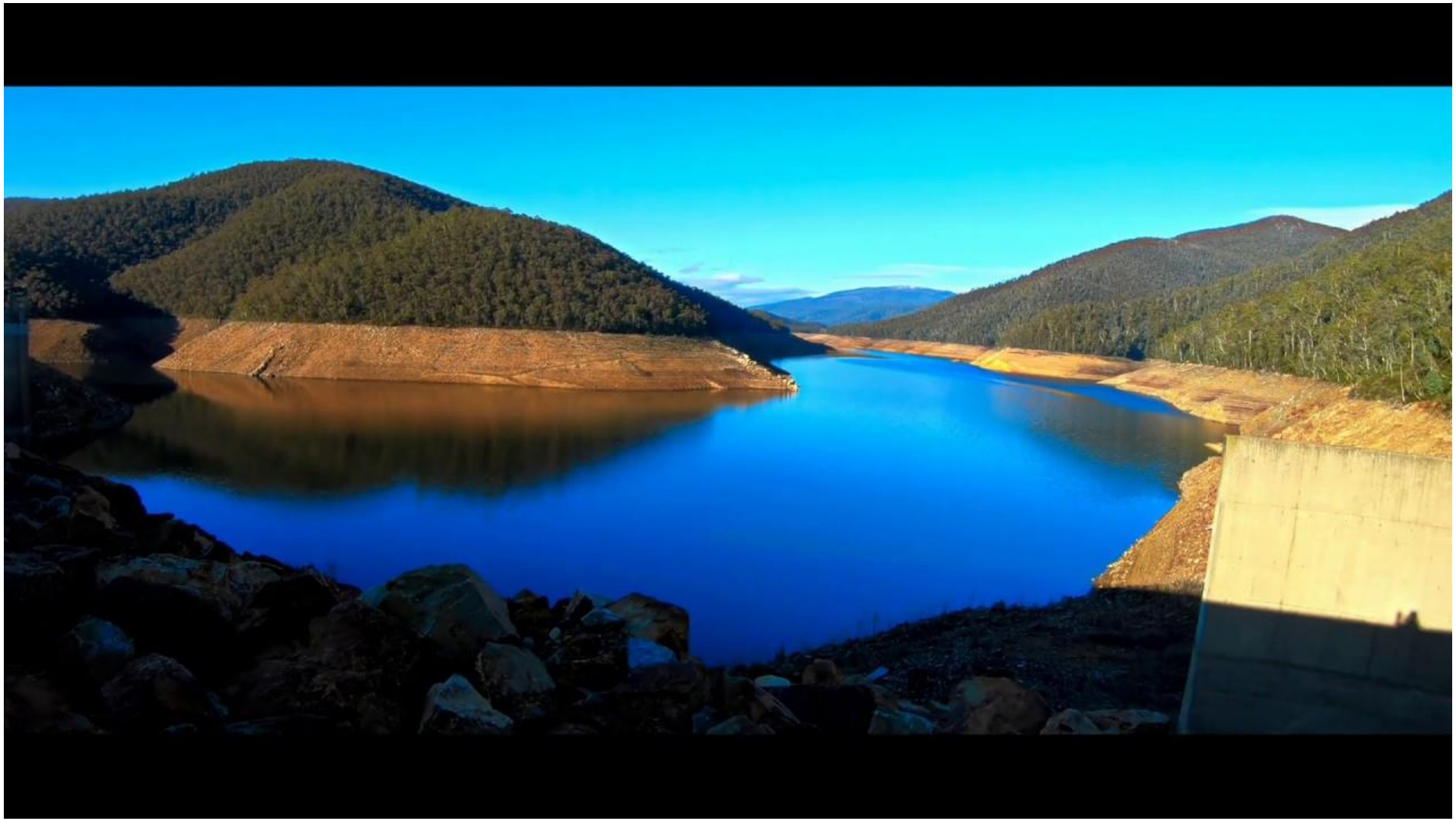


Options

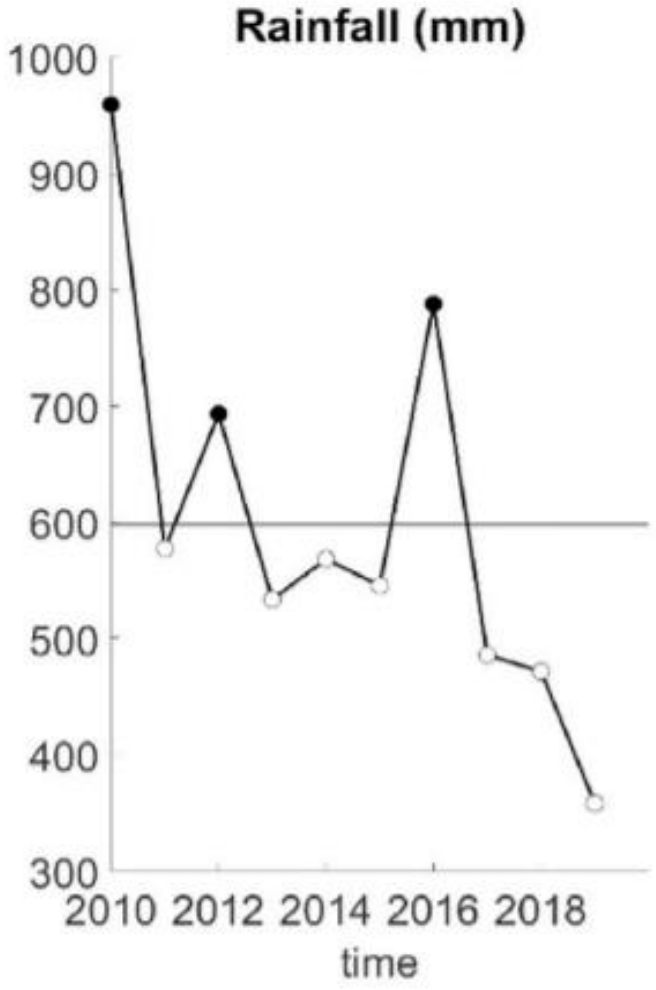
O1. Hydropower operator subsidies metering charges for poor farmer
O2. Seasonal water pricing
O3. Agricultural extension programs

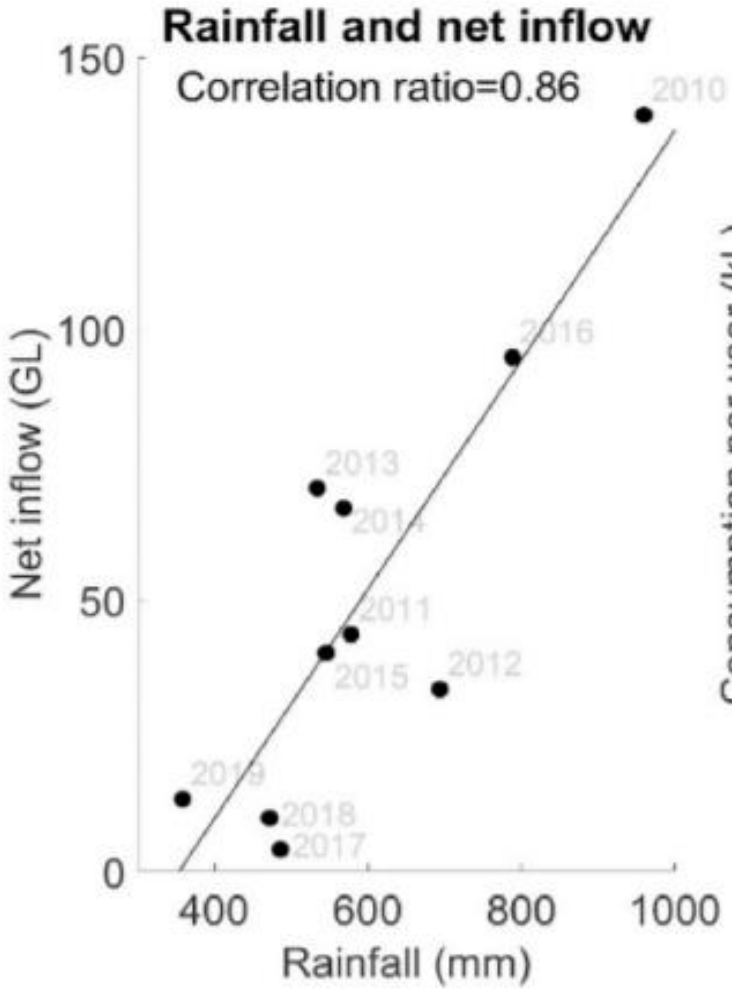
Source: Grafton et al. 2020

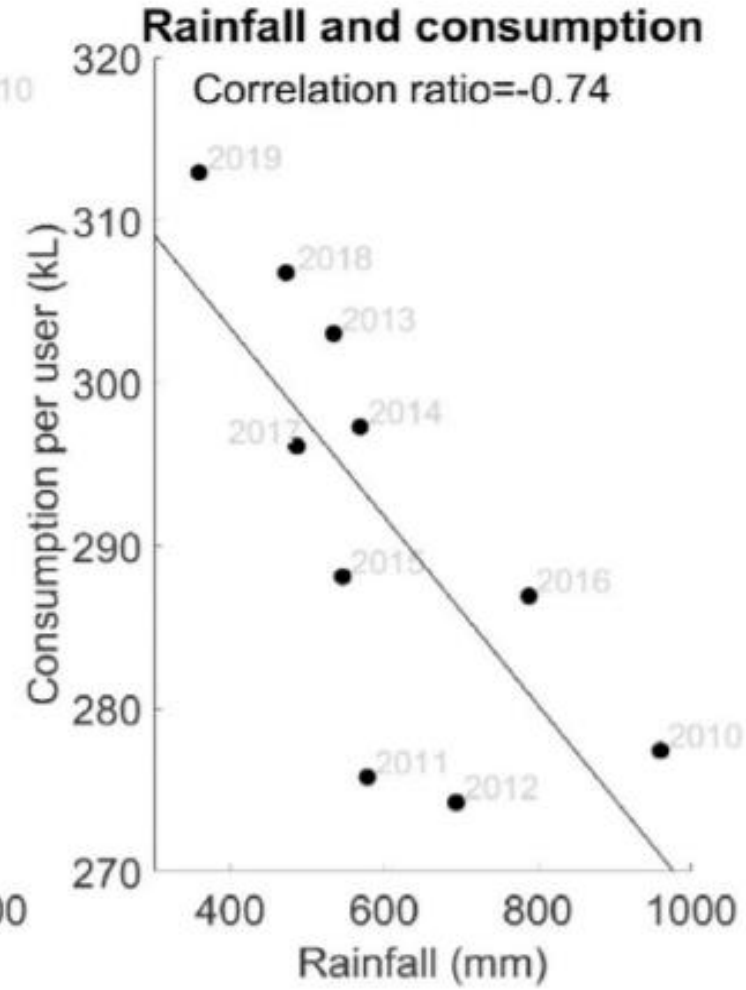
III. Case Study of 'Future' Water Pricing



Rainfall, Net Inflows, and Water Consumption

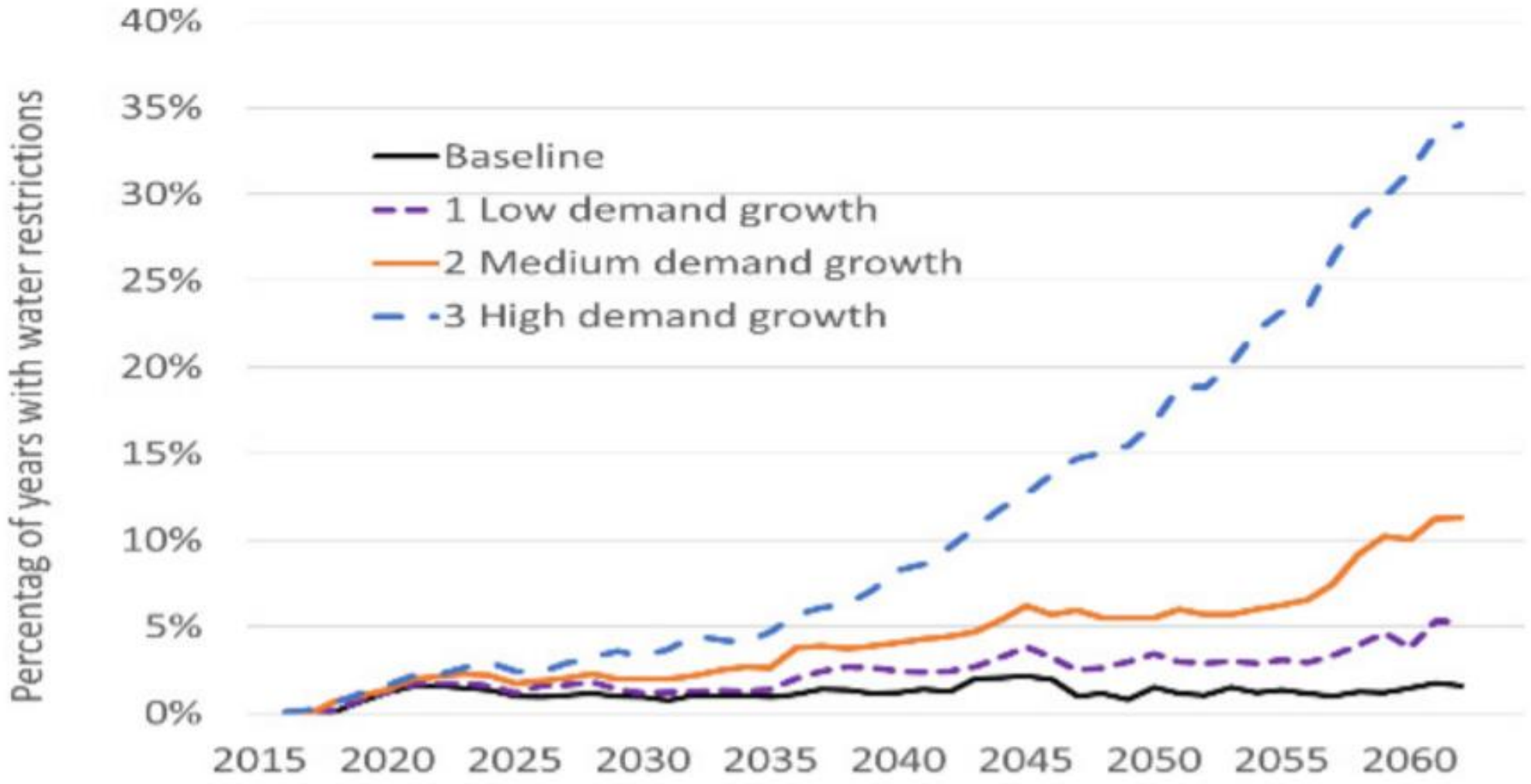






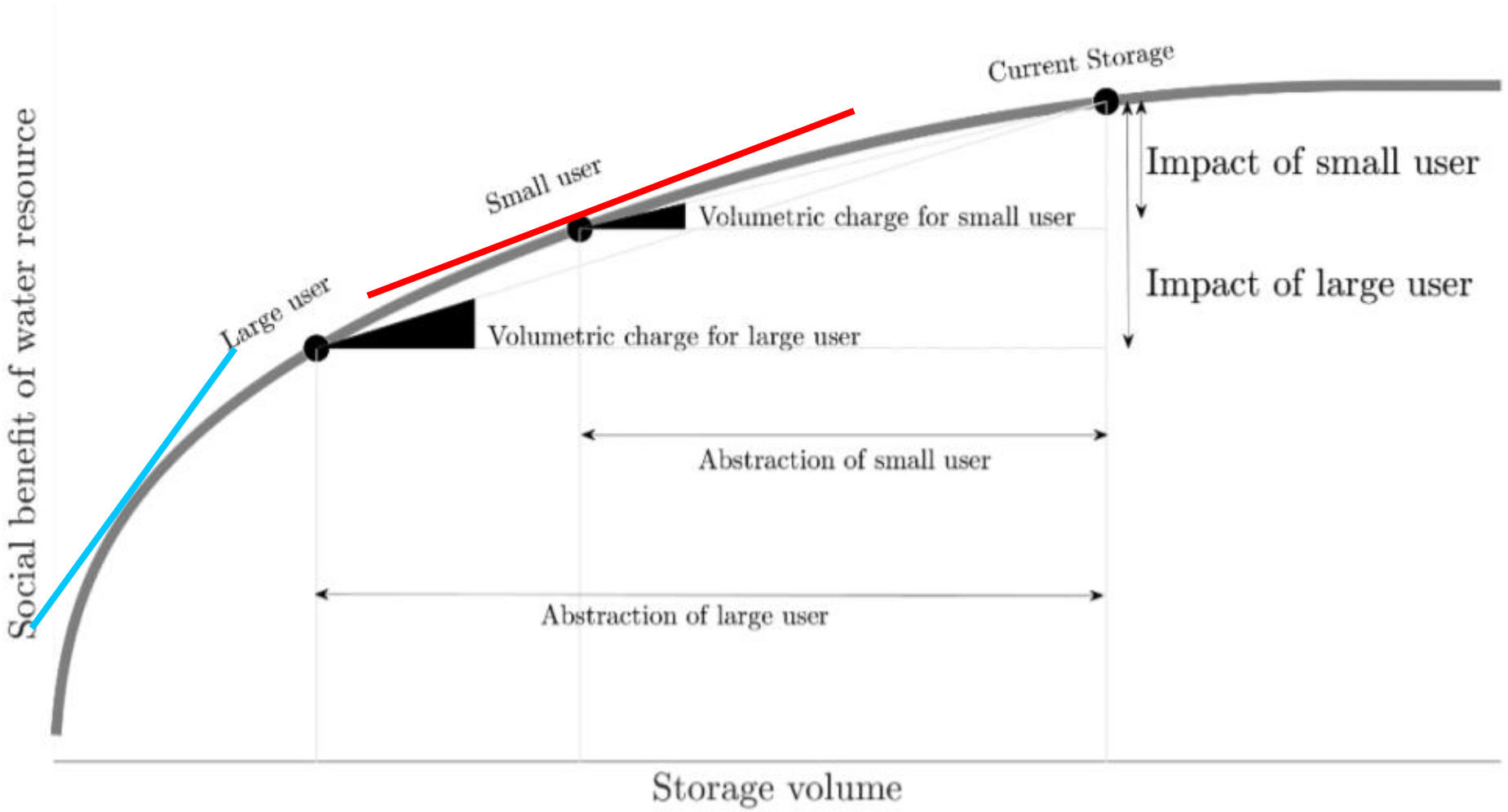
Source: Chu & Grafton, 2021

Probability of Water Restrictions with Population Growth



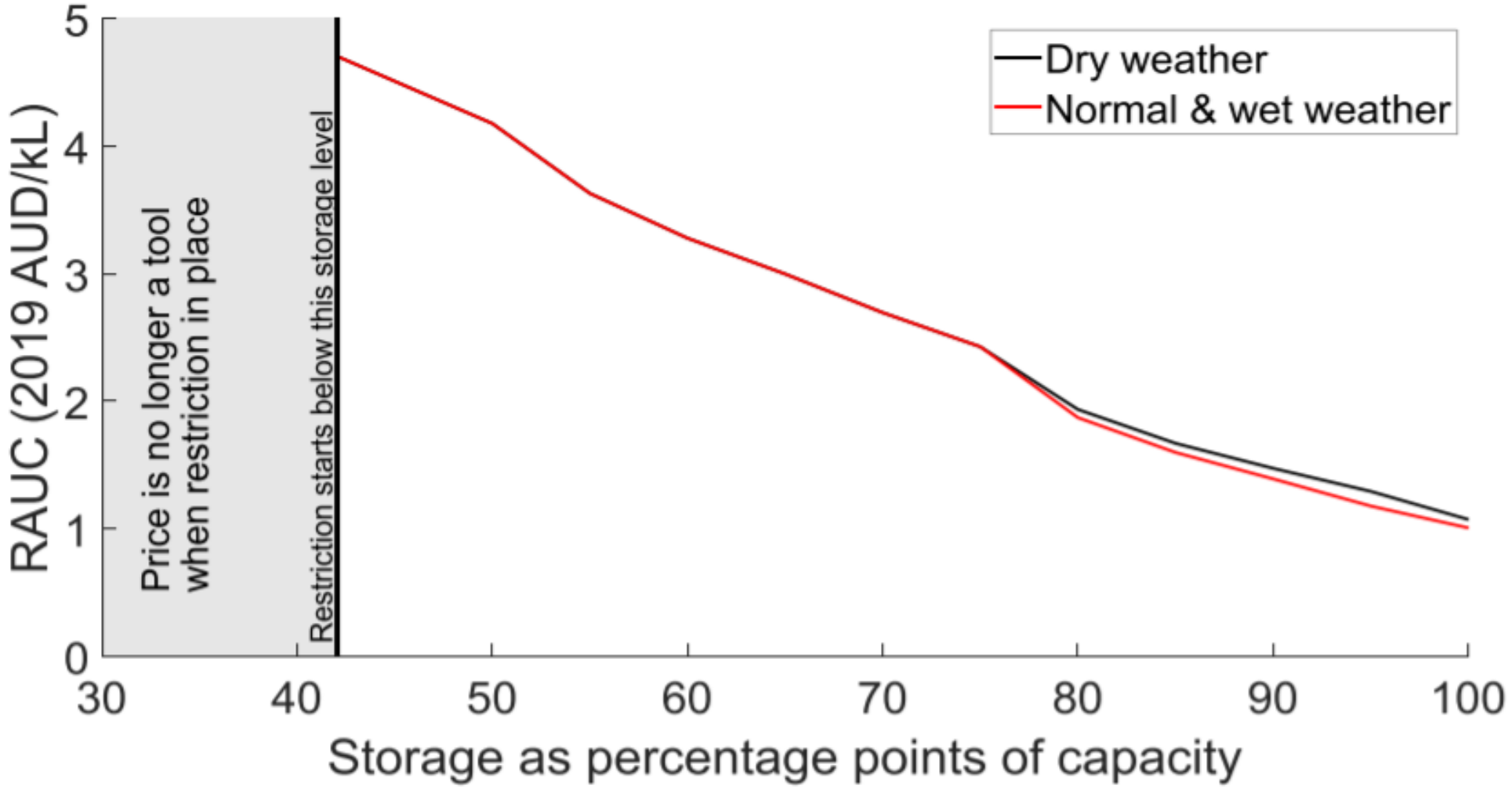
Source: ICRC (2016, f. 4.8)

Water Storages, Water Use and Social Benefit of Water



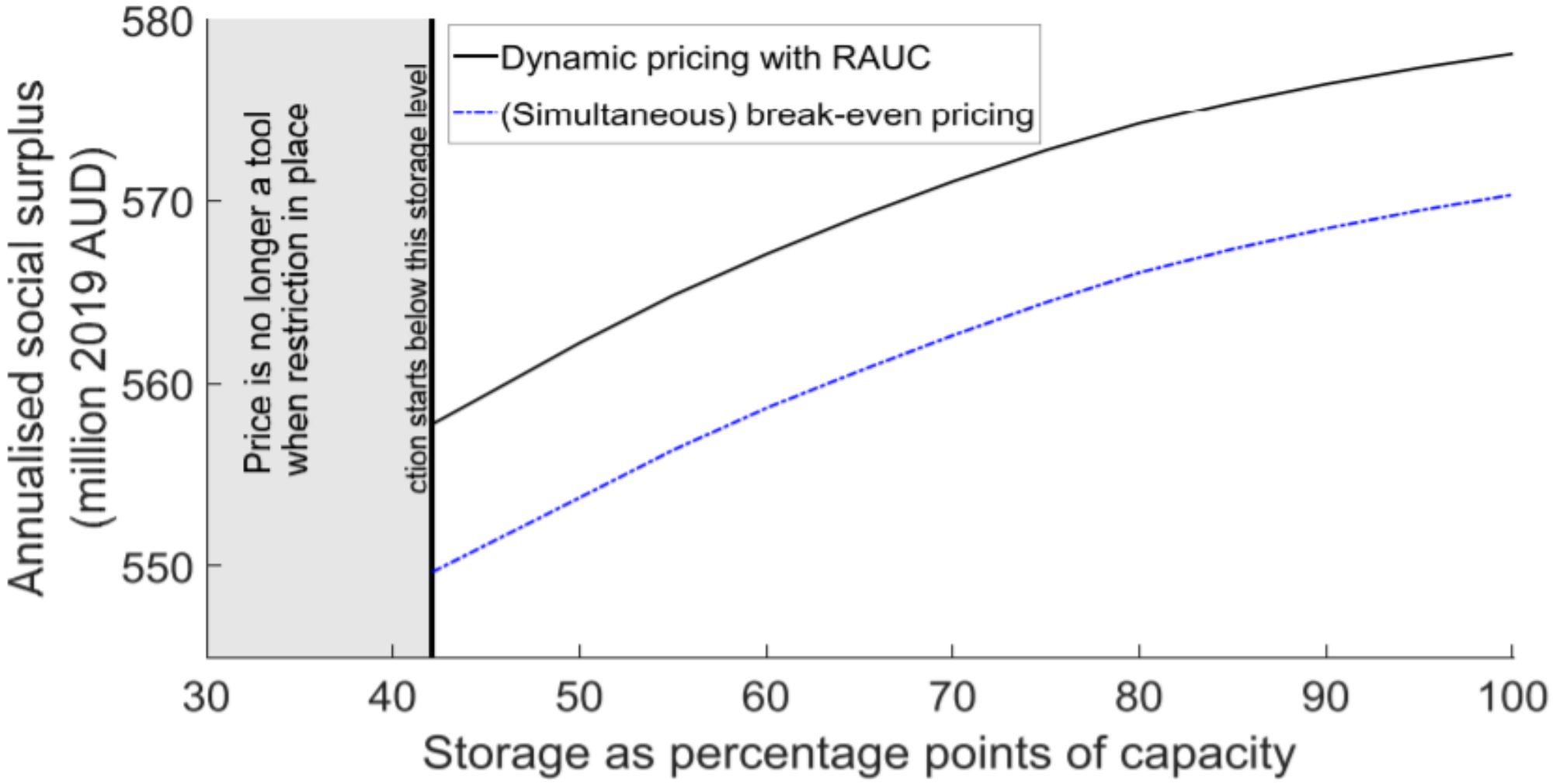
Source: Chu & Grafton, 2019

Risk-adjusted User Cost (RAUC) for the base year 2019



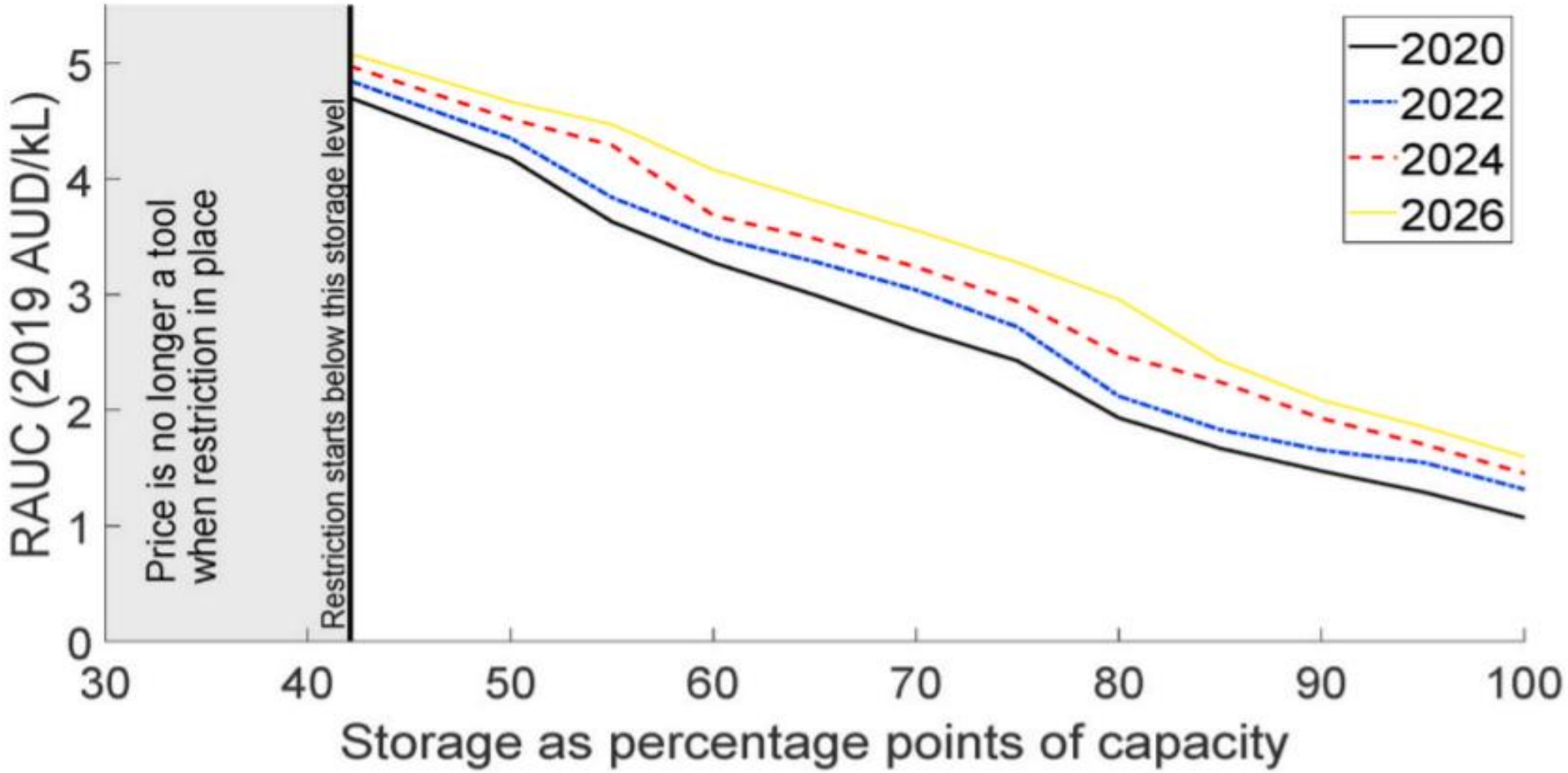
Source: Chu & Grafton, 2021

Optimal Pricing (with Risk-adjusted User Cost)



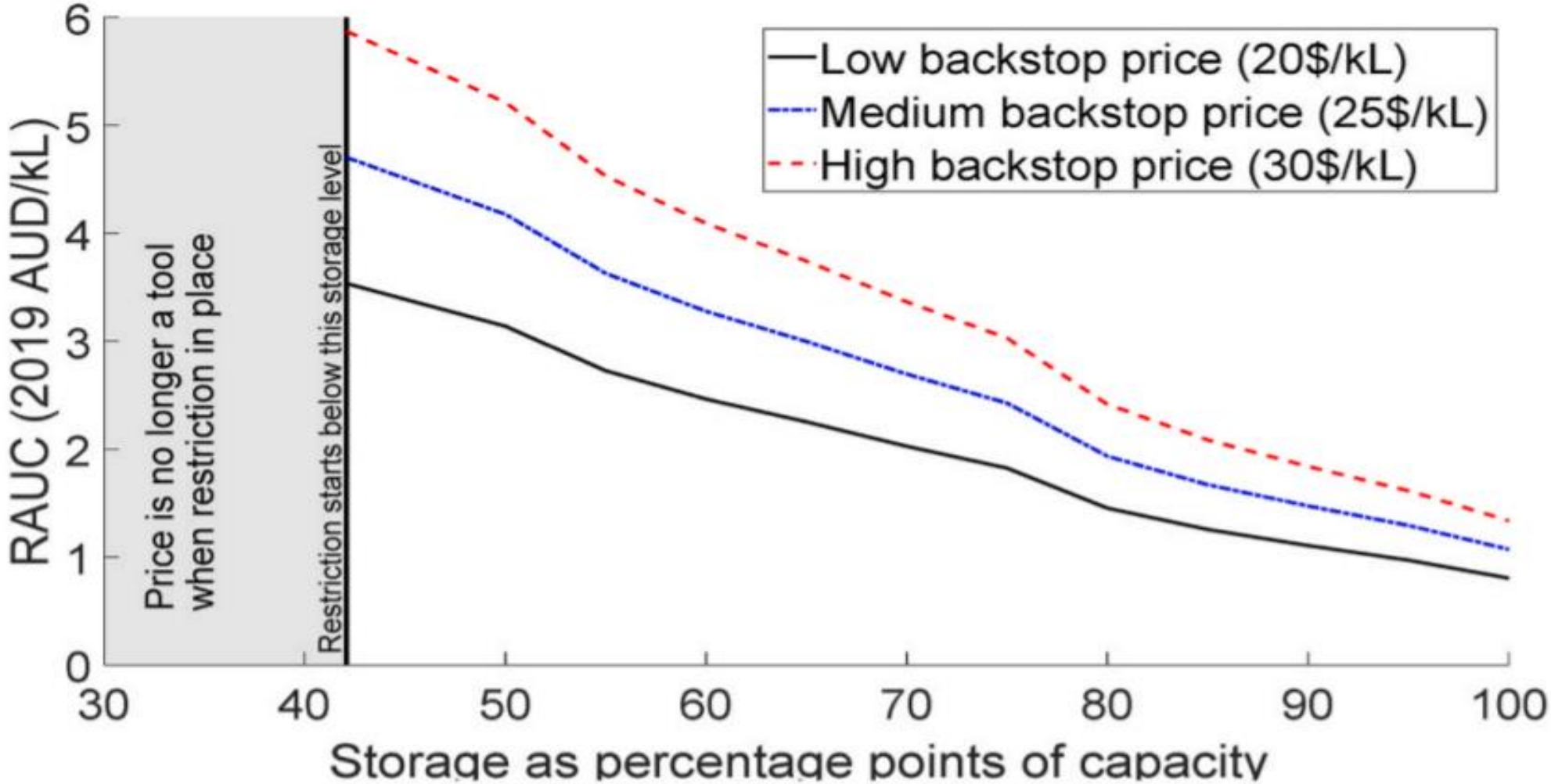
Source: Chu & Grafton, 2021

Inter-temporal Dynamics of Risk-adjusted User Cost (RAUC)



Source: Chu & Grafton, 2021

Effect of 'Backstop' (or alternative water source) Cost



Source: Chu & Grafton, 2021

Thank you!

(quentin.grafton@anu.edu.au)

Selected Readings

Australian Competition & Consumer Commission (2021). Murray-Darling Basin water markets inquiry - final report. https://www.accc.gov.au/system/files/Murray-Darling%20Basin%20-%20water%20markets%20inquiry%20-%20Final%20report_0.pdf

Chu, L. and R.Q. Grafton. (2019) Short-term Pain for Long-term Gain: Urban Water Pricing and the Risk-adjusted User Cost. Water Economics and Policy 5(2), 1871005 (2019). https://doi.org/10.1142/S2382624X18710054

Chu, L. and R.Q. Grafton (2021) Dynamic Water Pricing and the Risk-Adjusted User Cost (RAUC). Water Resources and Economics 35 100181: https://doi.org/10.1016/j.wre.2021.100181

Grafton, R.Q., L. Chu and P. Wyrwoll (2020) The Paradox of Water Pricing: Dichotomies, Dilemmas and Decisions. Oxford Review of Economic Policy, Volume 36, Number 1, 2020, pp. 86–107 https://academic.oup.com/oxrep/article/36/1/86/5696684

Hancock, T. and C. Bezold (1994) Possible Futures, Preferable Futures. *Healthc Forum Journal* 37(2): 23-29. https://www.researchgate.net/publication/13166132_Possible_futures_preferable_futures

ICRC. (2016) Technical Paper 2: Marginal Cost pricing in the ACT, Tariff Review 2016, Regulated water and Sewage Services in Report 4 of 2016.

National Water Commission (2011), Water markets in Australia: a short history, National Water Commission (NWC), Canberra. https://apo.org.au/node/27438

OECD (2015) Water Resources Allocation: Sharing Risks and opportunities. https://read.oecd-ilibrary.org/environment/water-resources-allocation_9789264229631-en#page1

Productivity Commission (2018) Murray-Darling Basin Plan: Five-year assessment, Final Report no. 90, Canberra, Australia. https://www.pc.gov.au/inquiries/completed/basin-plan#report

Prosser, I.P., F.H.S. Chiew and M. Stafford-Smith (2021) Adapting Water management to Climate Change in the Murray-Darling Basin, Australia *Water* 2021, 13 https://www.mdpi.com/2073-4441/13/18/2504

Wheeler, SA, Loch, A, Crase, L, Young, M & Grafton, RQ (2017), 'Developing a water market readiness assessment framework', *Journal of Hydrology*, vol. 552, pp. 807-820. https://www.sciencedirect.com/science/article/pii/S0022169417304614#:~:text=%20Developing%20a%20water%20market%20readiness%20assessment%20framework,further%20refinement%20and%20discussion%20of%20the...%20More%20

Building Back Better – Reframing Water Agenda

Water Leaders Summit TIWW 2021

14 October 2021

KALA VAIRAVAMOORTHY, Executive Director, IWA

water is recognized as a priority

ipcc
INTERGOVERNMENTAL PANEL ON
climate change

Weapons of mass destruction	Weapons of mass destruction	Weapons of mass destruction	Failure of climate change mitigation and adaptation
Extreme weather events	Extreme weather events	Failure of climate change mitigation and adaptation	Weapons of mass destruction
Water crises	Natural disasters	Extreme weather events	Biodiversity loss
Major natural disasters	Failure of climate change mitigation and adaptation	Water crises	Extreme weather events
Failure of climate change mitigation and adaptation	Water crises	Natural disasters	Water crises

The Global Risk Report

but why then is it not on the political & business agenda?

- It's on the **political** agenda, but not in the right sequence
  events, my dear boy, events

we need to reverse the sequence
('prevention & cure' **NOT** 'rescue and recovery')

- It's on the **business** agenda, but we need to better articulate the **value of water**

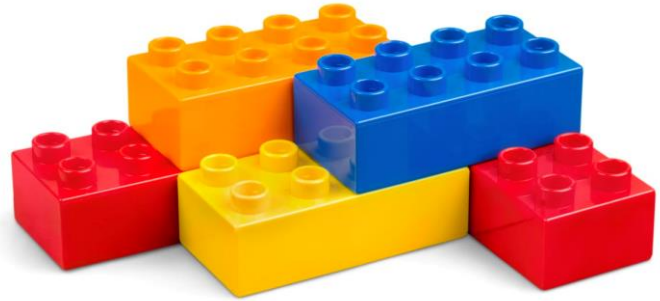
we need to value the diverse benefits & spill-over effects

opportunities to reverse the sequence

BUILD
BACK
BETTER

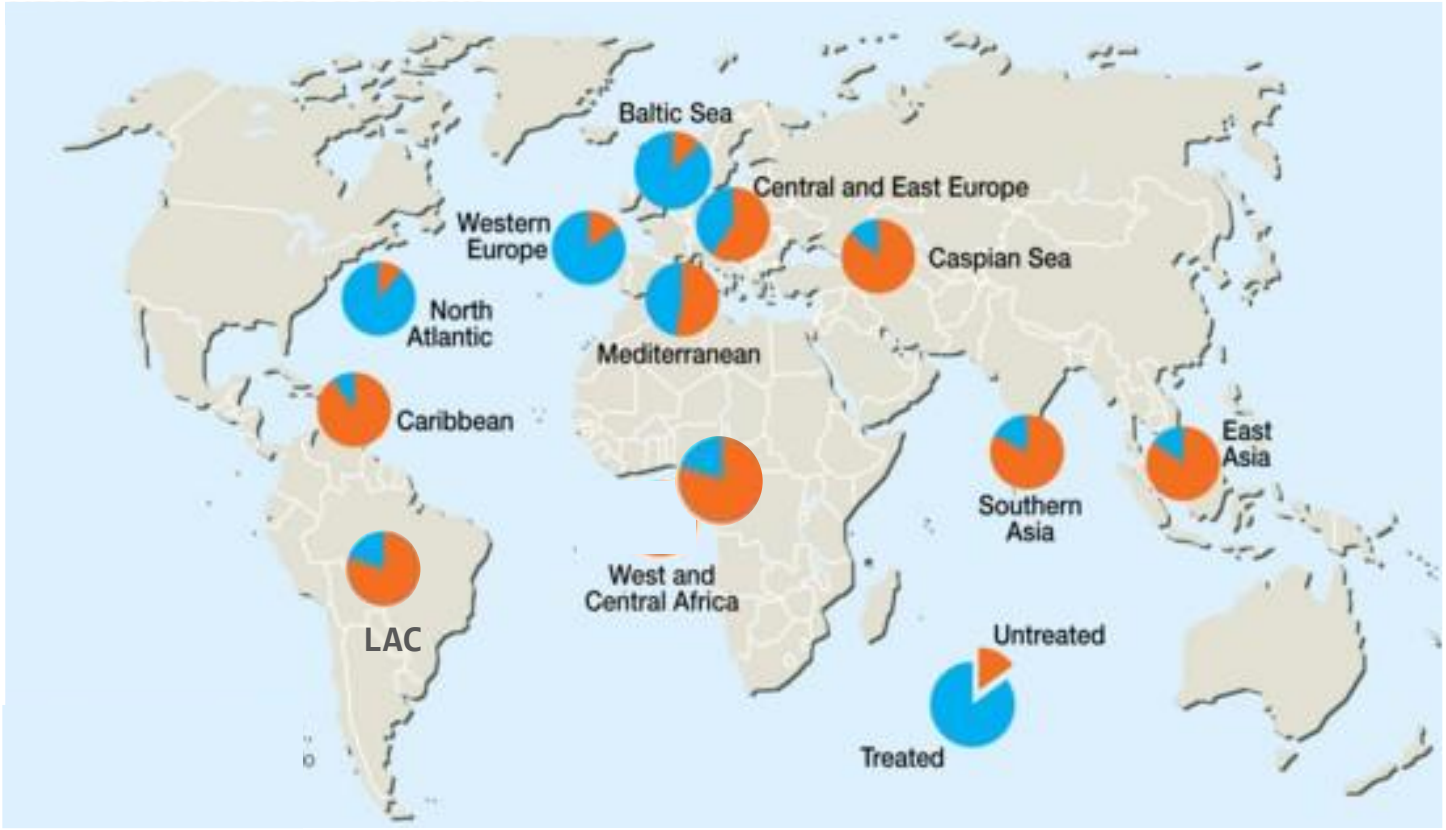
need to RESET water management in the context of new narratives

- historically a building block of the **high carbon economy**
- now water should become a building block for the new **low carbon economy** (particularly in global south)

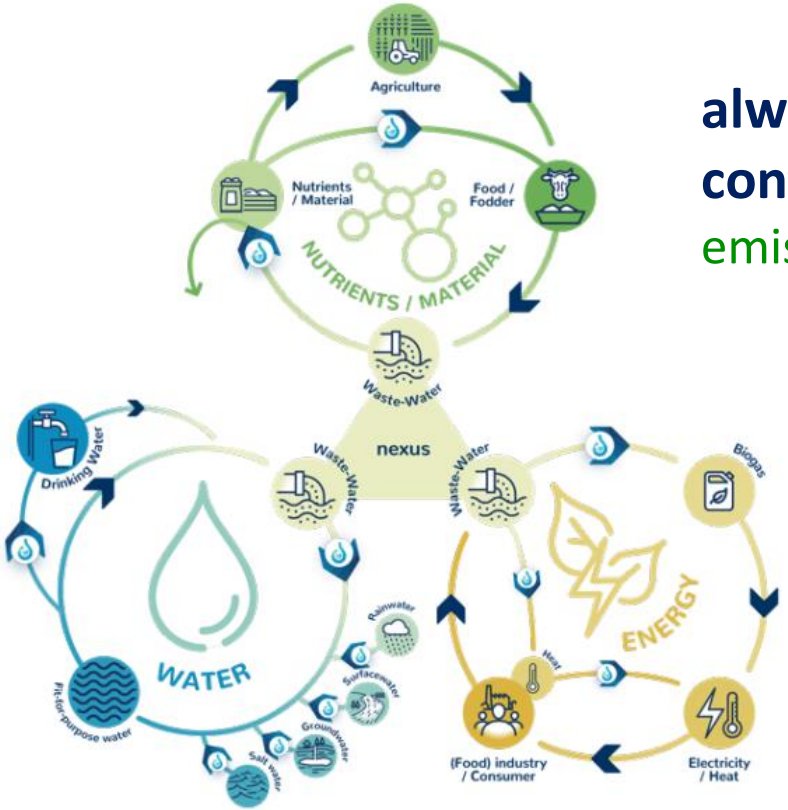


wastewater is the key

80% of wastewater is NOT treated



next 20 years golden age for wastewater & sanitation - opportunities to “leapfrog”



always now described within the context of the circular economy

emissions, efficiency, resourcefulness

next 20 years golden age for wastewater & sanitation - opportunities to “leapfrog”

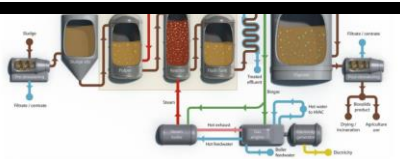
build

- sma
- ene
- imp
- bac

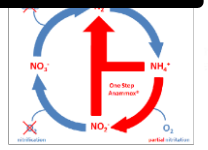
INDIA

- **increase #STPs by 50% -** 145 under construction + 70 proposed
- **700+ FSTPs committed**

BR



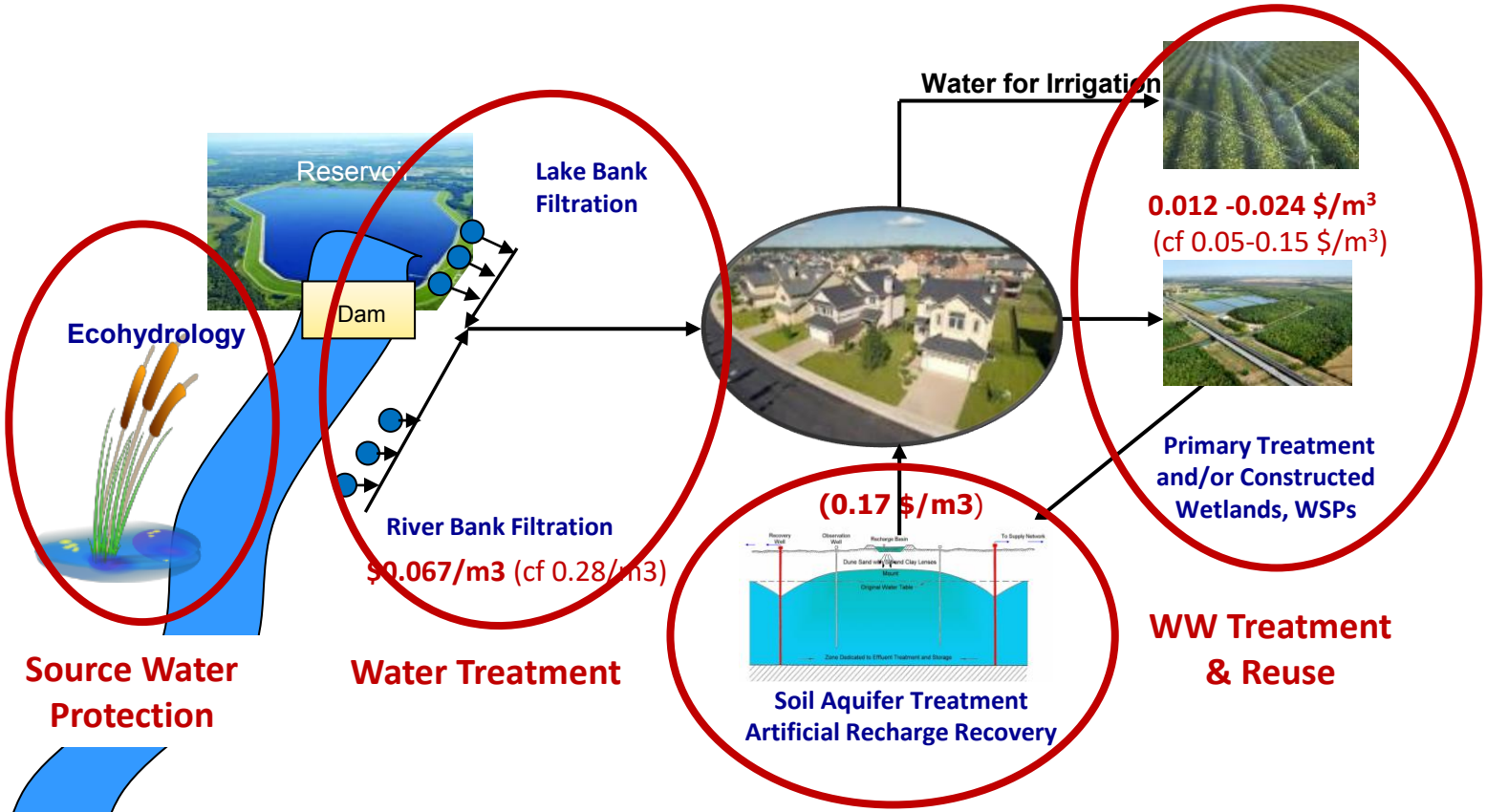
Thermal Hydrolysis



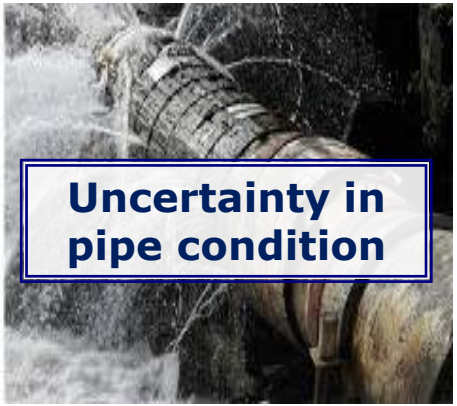
Anammox

Adv. Control

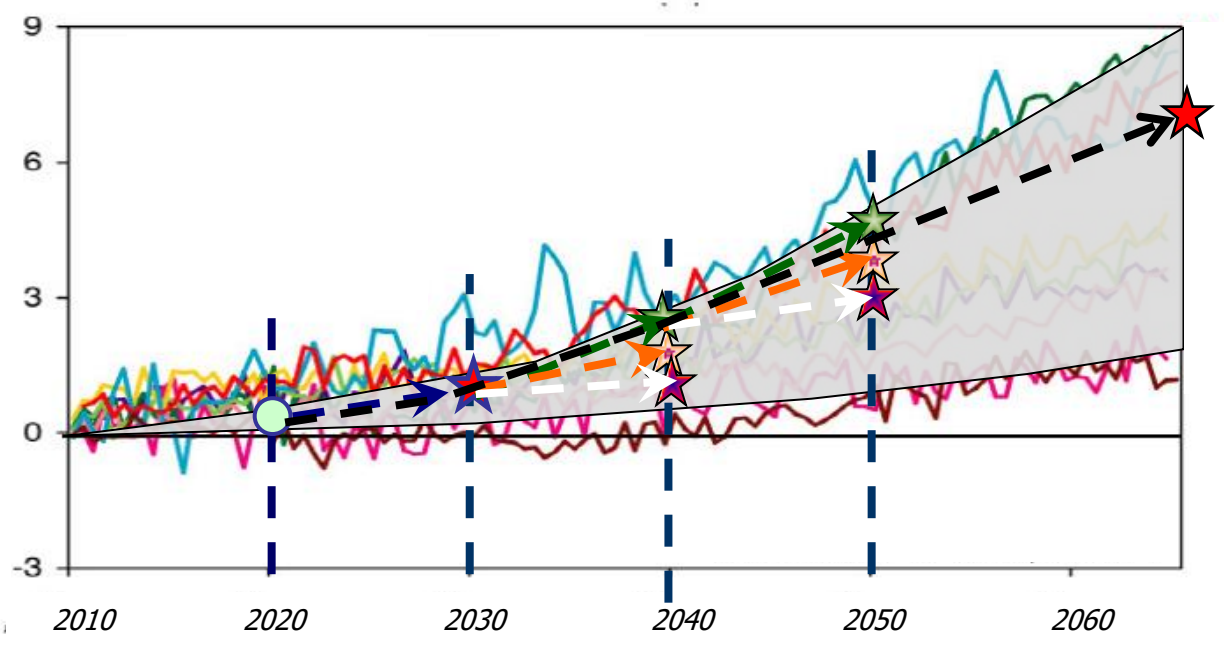
Nature based (green) solutions can support resiliency & decarbonize



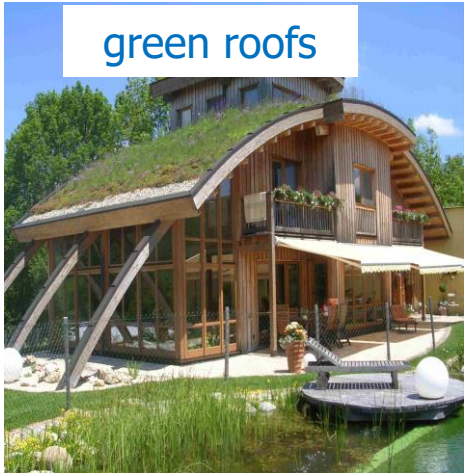
we are living in an uncertain world



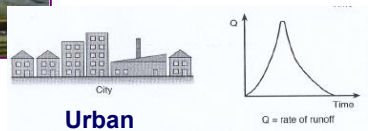
Resiliency requires adaptive/flexible systems for an uncertain world

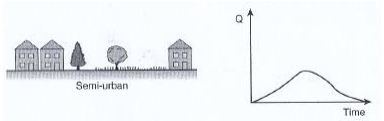


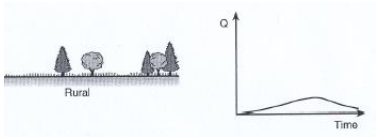
Nature based solutions provide adaptive capacity



Nature based solutions provide adaptive capacity







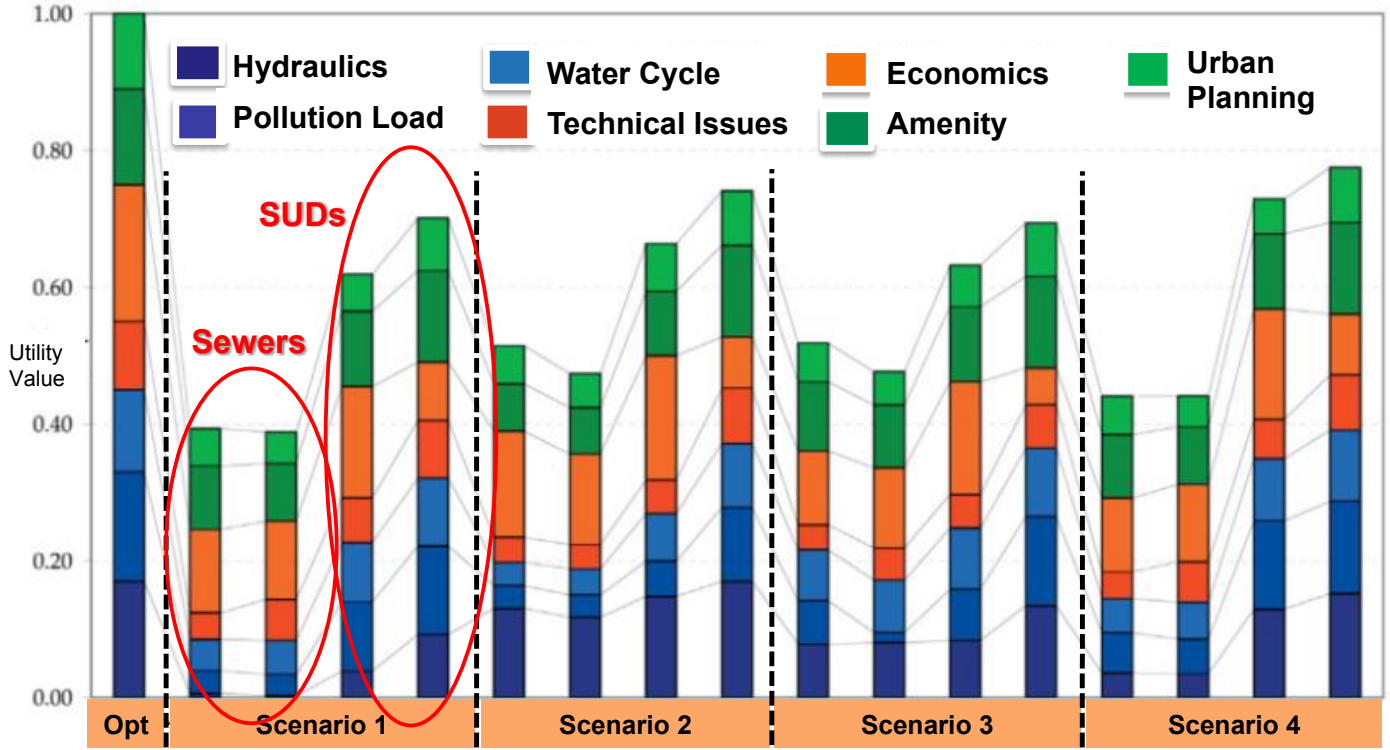
Urban

Urbanization

Early Urban

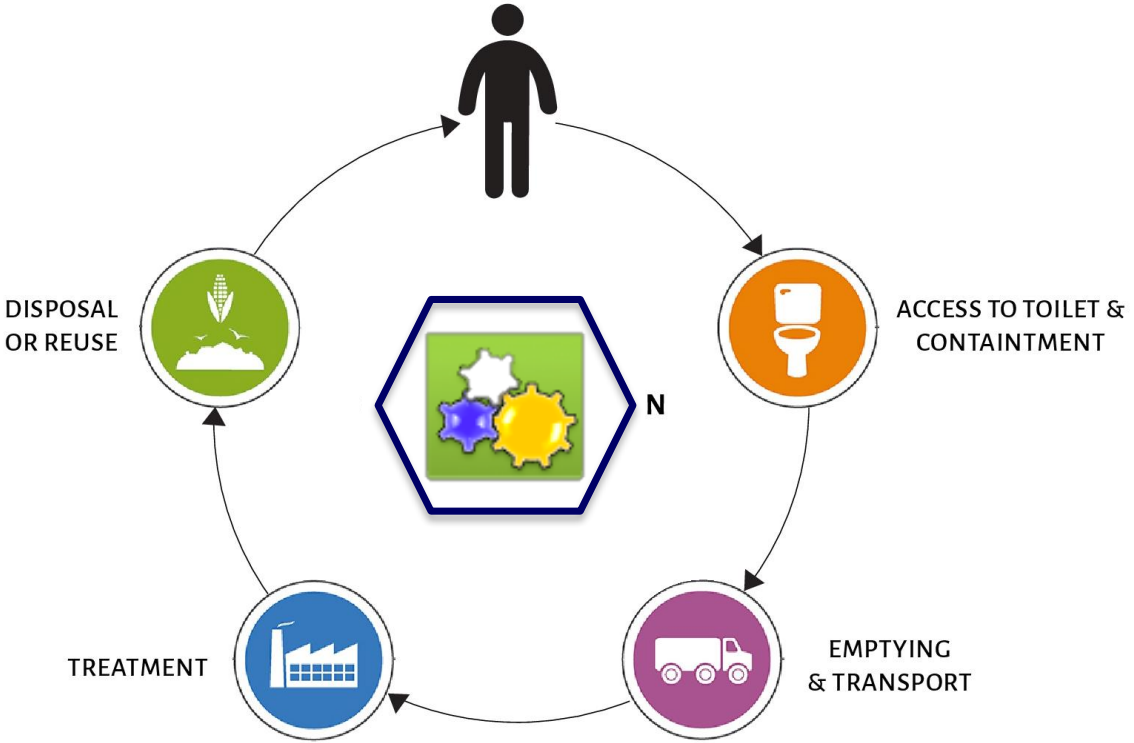
SUDs are green & provide greater resilience

Case Study: Kupferzell Germany



Eckart, Sieker, Vairavamoorthy (2010)

Decentralized systems have adaptive capacity

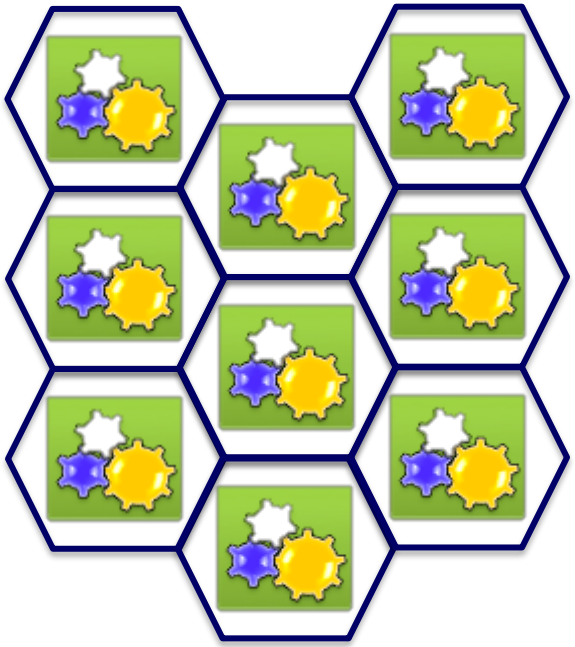


Decentralized systems have adaptive capacity

Decentralized systems well suited for:

- adjusted growth (to deal with rapid growing cities)
- increased resiliency (dampens the propagation of failures)
- minimize energy for reuse

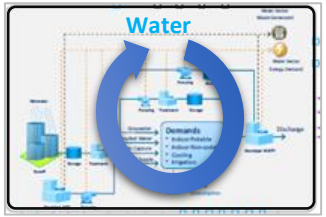
‘urban form’ can help or hinder



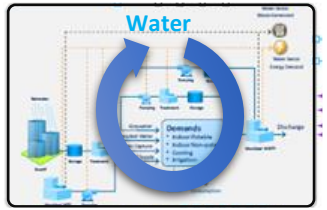
changes in perspective

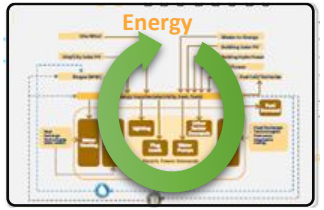
we’re dealing with a system of systems

It’s ok to optimize at sub-system level

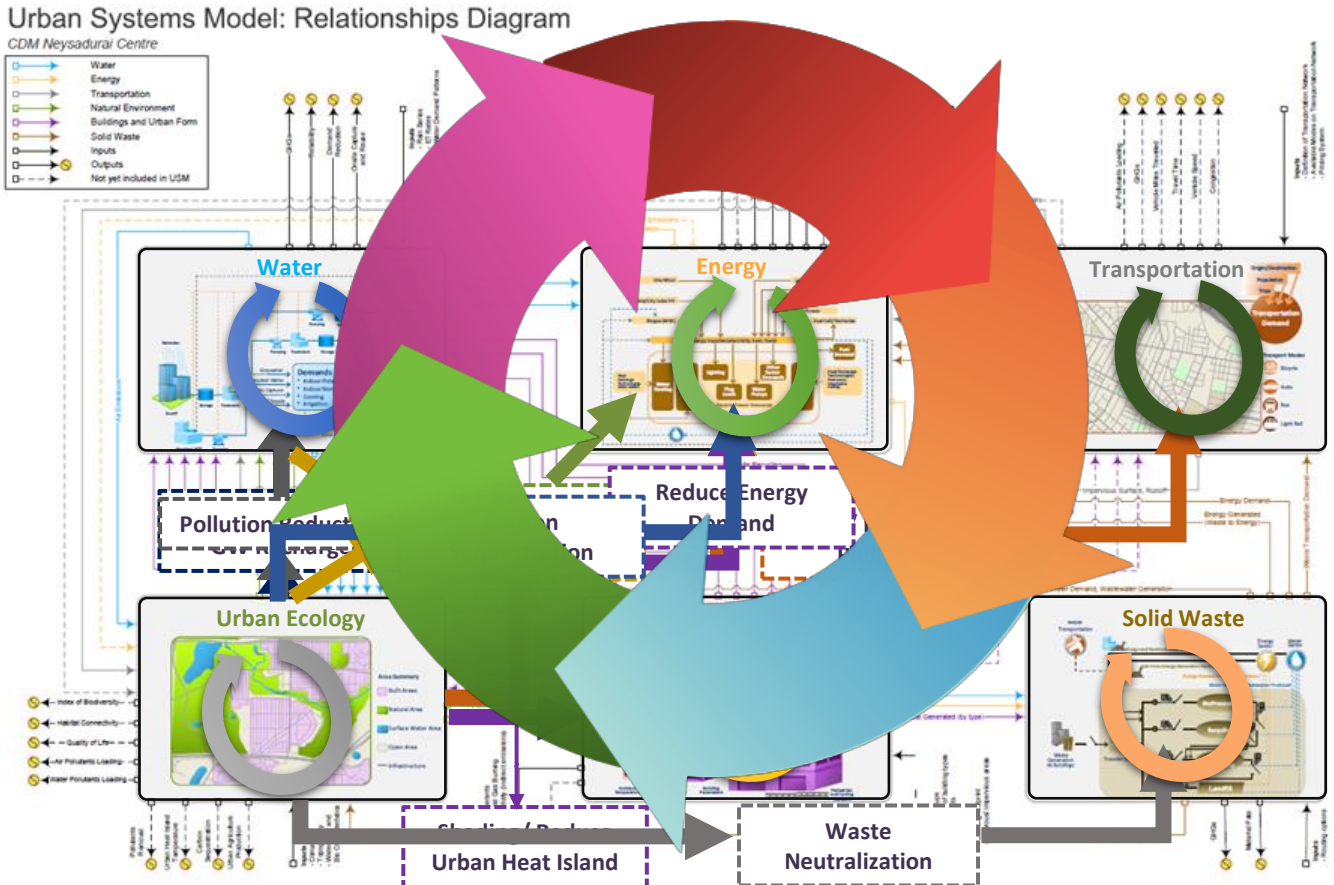


It’s ok to optimize at sub-system level





But we need to recognize that we're dealing with a 'system of systems'



digital water

enabling us to transition towards
green, resilient, and inclusive growth

Digital ecosystem - connected assets

integration of data &
sophisticated analysis

real-time
online

EDS uses ANN to process pressure and flow sensor signals in near real-time to detect and forecast pipe bursts and leaks

4 V's

3.6 billion camera phones in use

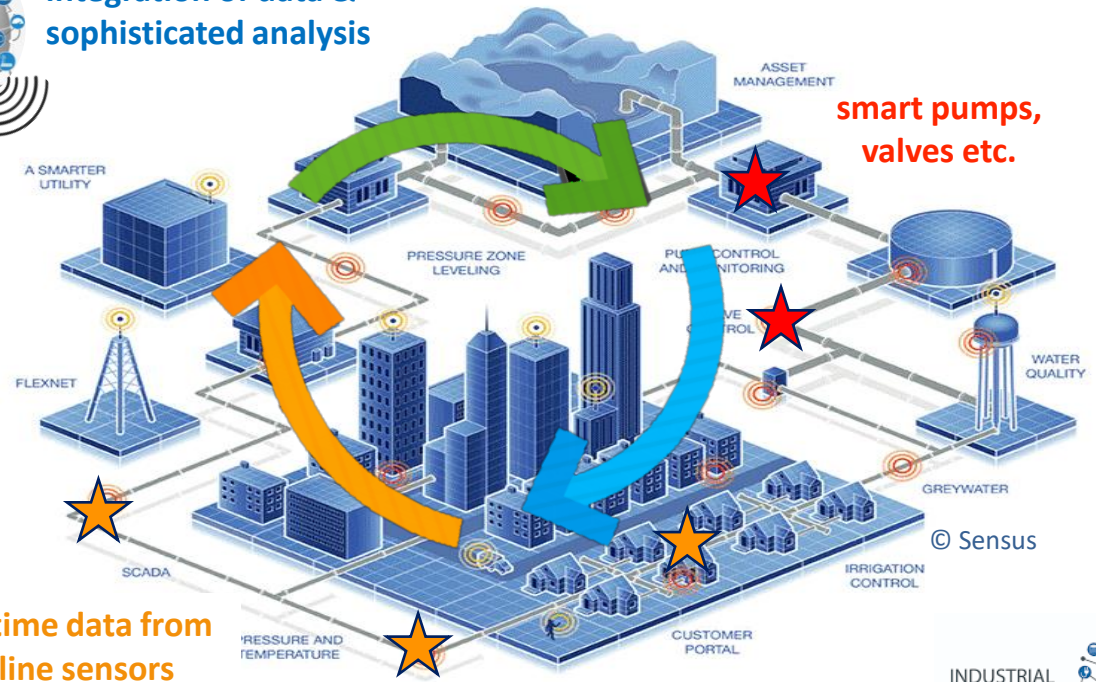
30 billion RFID tags embedded into our global ecosystem

250 million smart meters in Europe by the end of 2020

Digital ecosystem – silent running

integration of data & sophisticated analysis

smart pumps, valves etc.



© Sensus

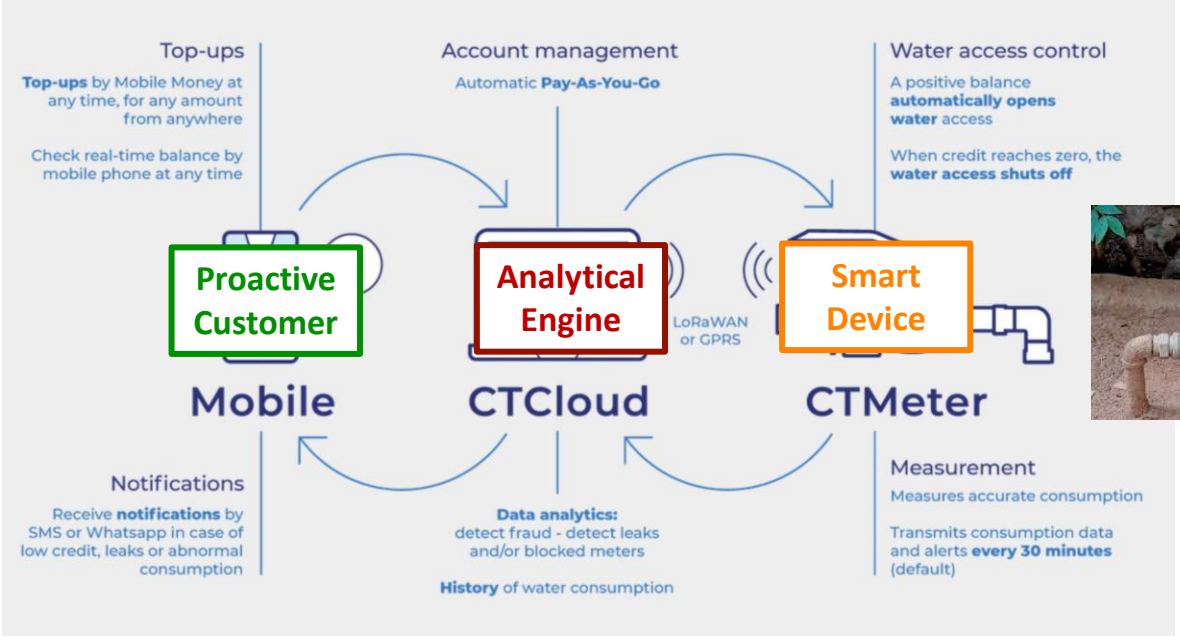
real-time data from online sensors

INDUSTRIAL INTERNET OF THINGS

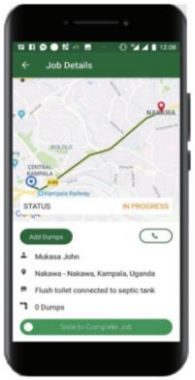
Efficient water use – inclusive

the international water association

Smart Water Prepayment (pay-as-you-go)



Smart sanitation - inclusive



- Kampala Capital City Authority (KCCA) GIS-based mobile app
- Ensures more regular, efficient & effective management of septic tanks
- Links **Pit Emptiers** with **Customers** via **Call Center**
- App created over 5,000 pit-emptying jobs with 63% increase in income

We need to change the default setting for sustainable water management

- **Celebrate** water use efficiency, resource use efficiency, extraction of value from waste streams
- **Promote** systems that are more integrated, hybrid grey & green, multi-use & multi-functional, distributed
- **Encourage** approaches and solutions that are flexible and offer increased levels of immunity to hydrologic cycle

We need to change the default setting for sustainable water management

- **Recognise** the complex value of water and encourage a systems view to better capture the diverse benefits & spill-over effects
- **Stimulate** innovation & investments by coupling a better articulation of the values of water with related policy instruments
- **Embed** all the above into institutional strengthening & building
- **Support** the trail-blazers – share success stories with others

Choices Before Us