Inter-Parliamentary Union

For democracy. For everyone.

Technologies, policies and regulation

for wastewater reuse

WaterLex

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Historical wastewater reuse for aquaculture, India

- Non-treated wastewater & urban runoff from Calcutta
- **Employment and protein: 1’000 tons of fish per year**
- But toxic chemical pollution

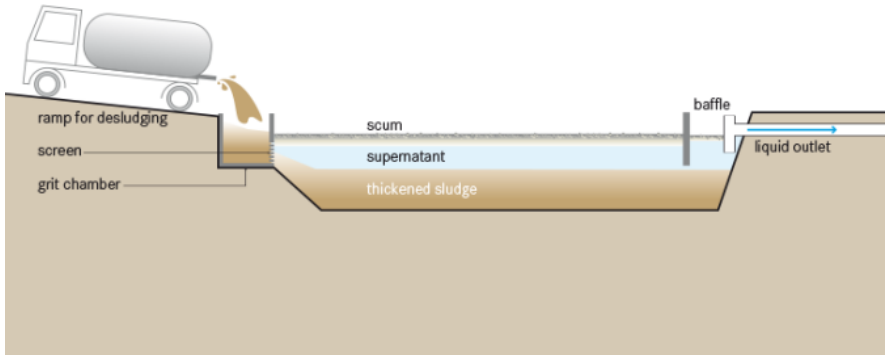
Historical wastewater reuse for agriculture, Mexico

- Land is irrigated with wastewater from Mexico City
- Restricted irrigation excludes raw vegetables but health risks

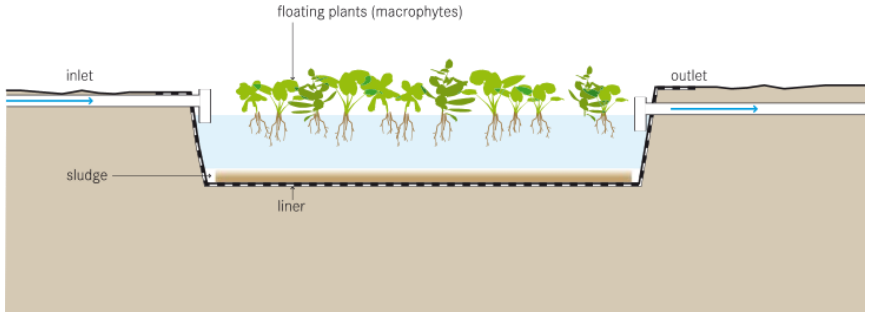
➤ **World's largest WWTP 1.5 billion USD – irrigation and biogas**

Wastewater treatment in artificial ponds and lagoons

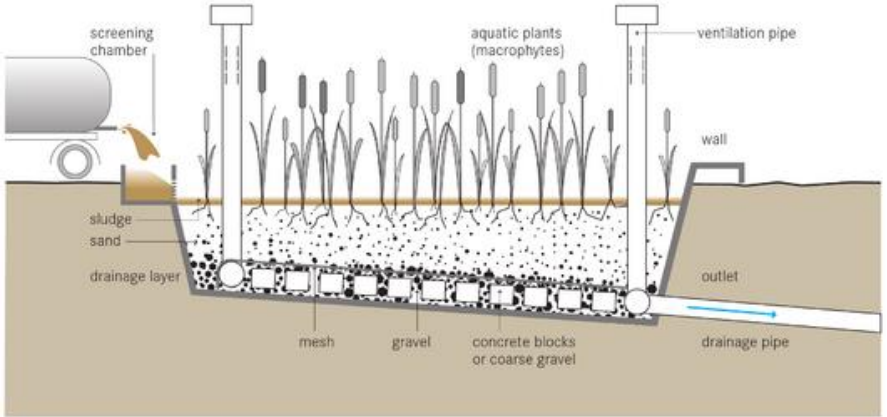
Thickening ponds



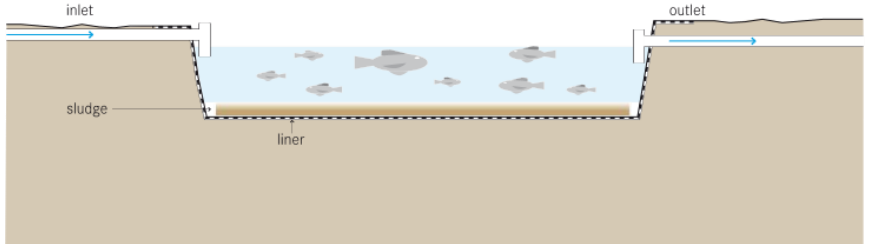
Floating Plant Pond



Planted drying beds



Fish Pond (Aquaculture)



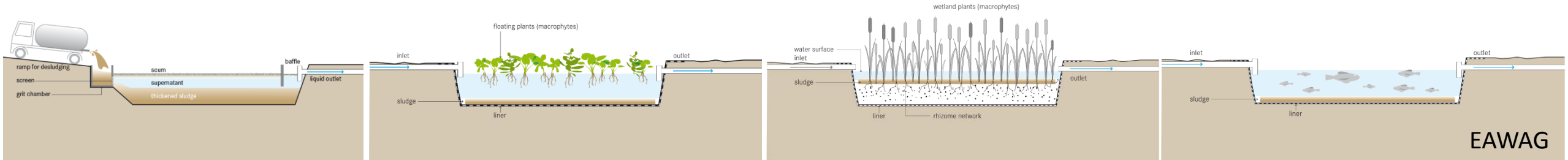
EAWAG

Wastewater treatment in artificial ponds and lagoons

- Cheap but long-term maintenance (analysis of cost for investment)

- Insects, odours, do not remove chemical pollutants

➤ **Effluents can be used, local regulations and reuse options**



Market-based approaches

- 80% of the jobs depend on water-related services (global economy)

- **Renewable energy (ex. biogas or faecal pellets)**

- Can offset wastewater treatment cost

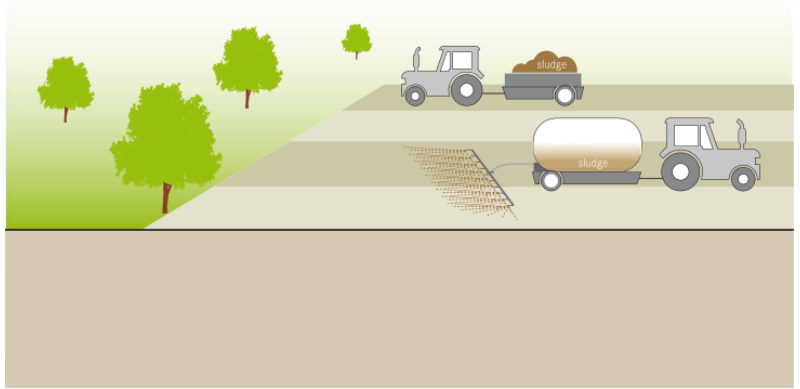
Market-based approaches

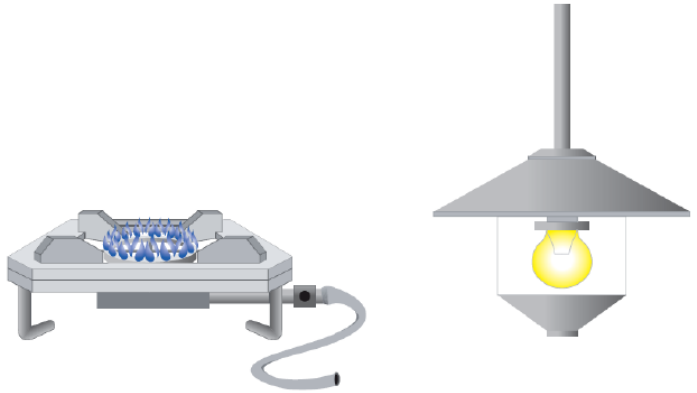
Market value (USD) of different products derived from faecal sludge

(per tonne of dry weight)

	Soil conditioner	Fuel biogas electricity	Protein
Dakar	7		22
Accra	7	31	29
Kampala	16	32	26

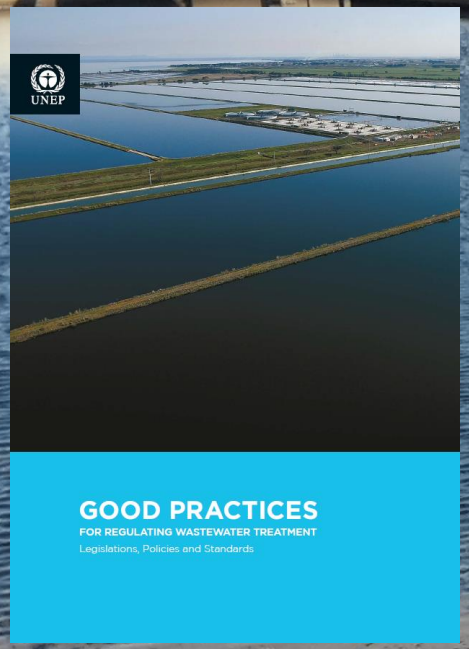
Unwillingness to use faecal sludge products (social/cultural/religious acceptability & taboos)





Diener et al., 2014

Ex. National regulation/technologies for wastewater treatment



Institutional stakeholders

Laws & policies

Technologies

Florian Thevenon

WATER SITUATION

- Climate & population → Water scarcity. Water consumption reduced by 40%

➤ **Wastewater is a valuable resource**

- Agriculture, municipal, industrial commercial uses, also environment

Australia: Environmental awareness & lagoons

TECHNOLOGIES

➤ **The largest lagoon-based wastewater treatment plant & biodiversity**

- 580 municipal plants
- 92% of the collected wastewater is treated

Melbourne Water

Australia: Environmental awareness & lagoons

GOVERNANCE

- Federal country

- **But homogenous approach: The National Water Initiative**

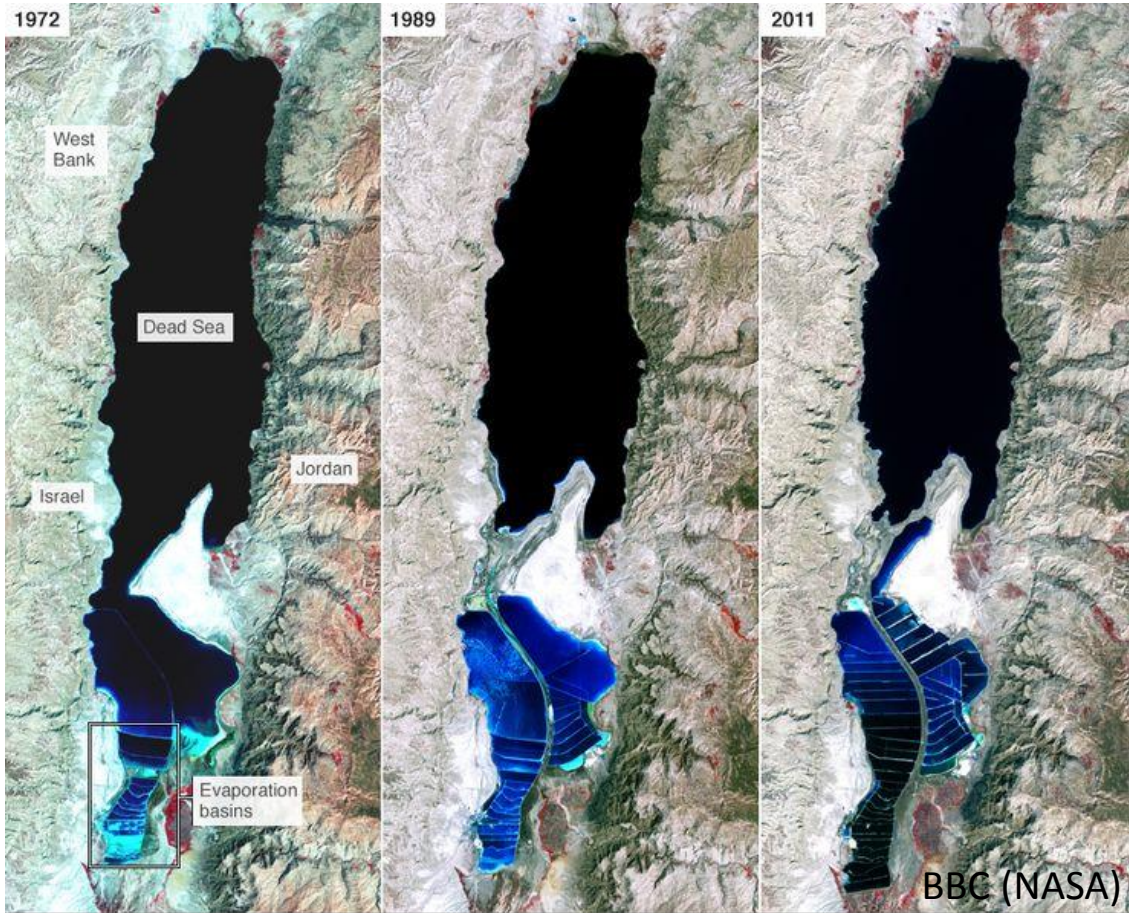
- Water conservation & recycling initiatives

Melbourne Water

Jordan: Policy effectiveness & wastewater reuse

WATER SITUATION

- Aggravation of the water scarcity
- Institutions & cooperation
- **Well designed policy & stakeholders**



BBC (NASA)

Jordan: Policy effectiveness & wastewater reuse

GOVERNANCE

- The Wastewater Management Policy

- **Treated effluents considered as a water resource**

- The National Water Strategy

Sumaya Agha (Zaatari camp)

Jordan: Policy effectiveness & wastewater reuse

TECHNOLOGIES

- 34 treatment plants (one in the 1960s)
- ~ 98% of the collected wastewater is treated
- **➤ ~ 90 % being reused in agriculture, rivers & industries**
- But accumulated treated sludge considered as a waste

USAID

Singapore: Unique holistic approach

WATER SITUATION

- Water as a national priority

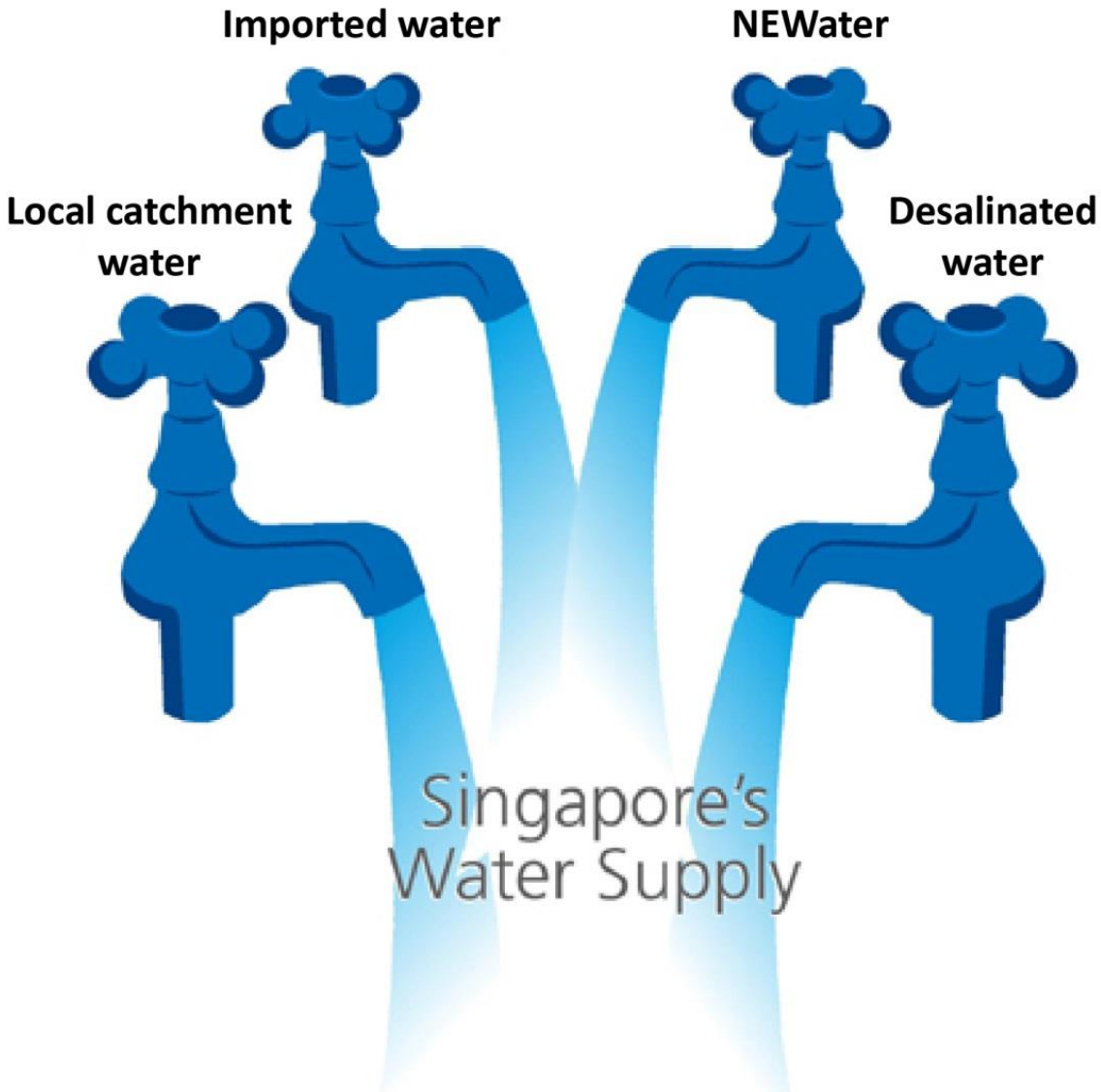
- **99.5% of the collected wastewater is treated**

- 7 wastewater treatment plants

Singapore: Unique holistic approach

TECHNOLOGIES

"Four National Taps":



- **Drinking water can be produced from wastewater using reverse osmosis**

Singapore: Unique holistic approach

GOVERNANCE

- Holistic approach

  Policy axis

  Institutional axis

  Legislation axis

- **Innovation: Food waste and wastewater to produce energy**

South Africa: A Human Rights-Based Approach

WATER SITUATION

- Legal framework based on racial segregation until 1994

➤ **A new legislation for wastewater**

25% no access to sanitation services

57% connected to wastewater treatment

TECHNOLOGIES

- A better efficiency of water use
- ~1000 treatment plants, but many need investment
- **New granular sludge technology**
  Dutch Public-Private Partnership

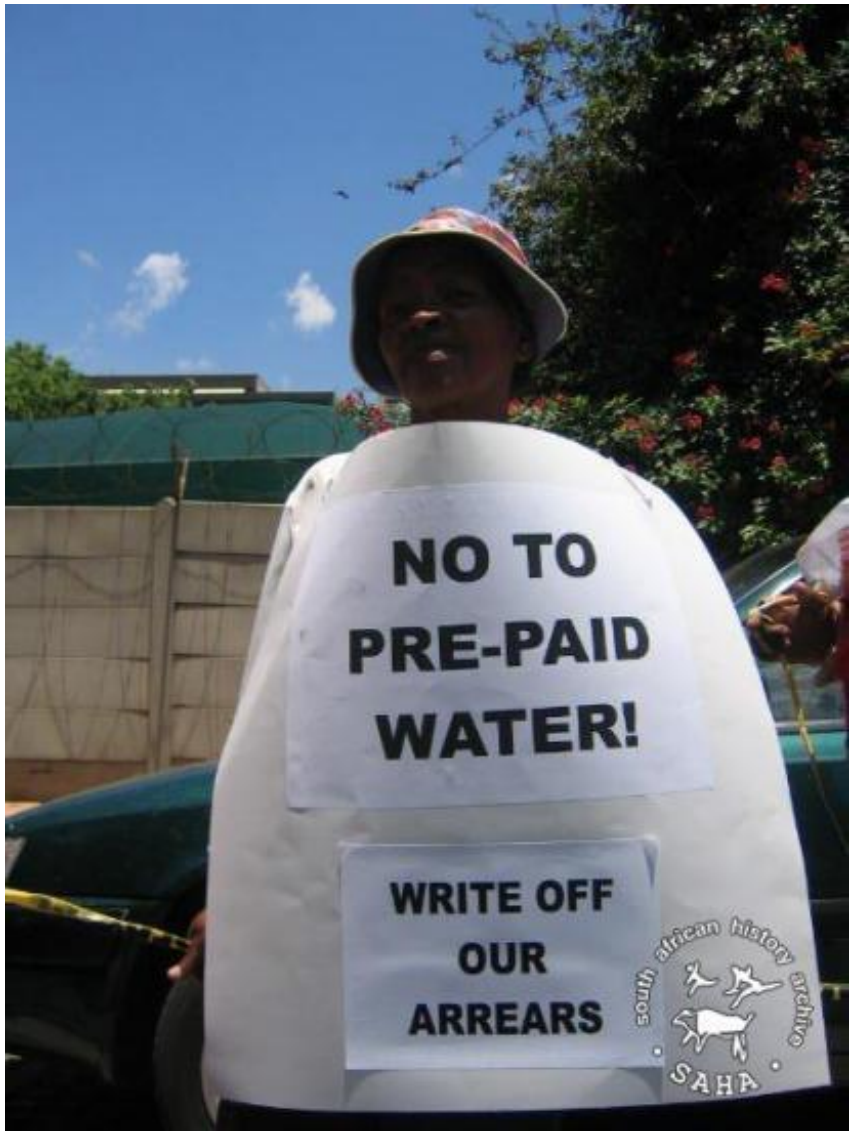
Nereda

GOVERNANCE

- **Policy based on a human rights-based approach**

- Recognition before the UN General Assembly

- The Free Basic Sanitation Implementation Strategy

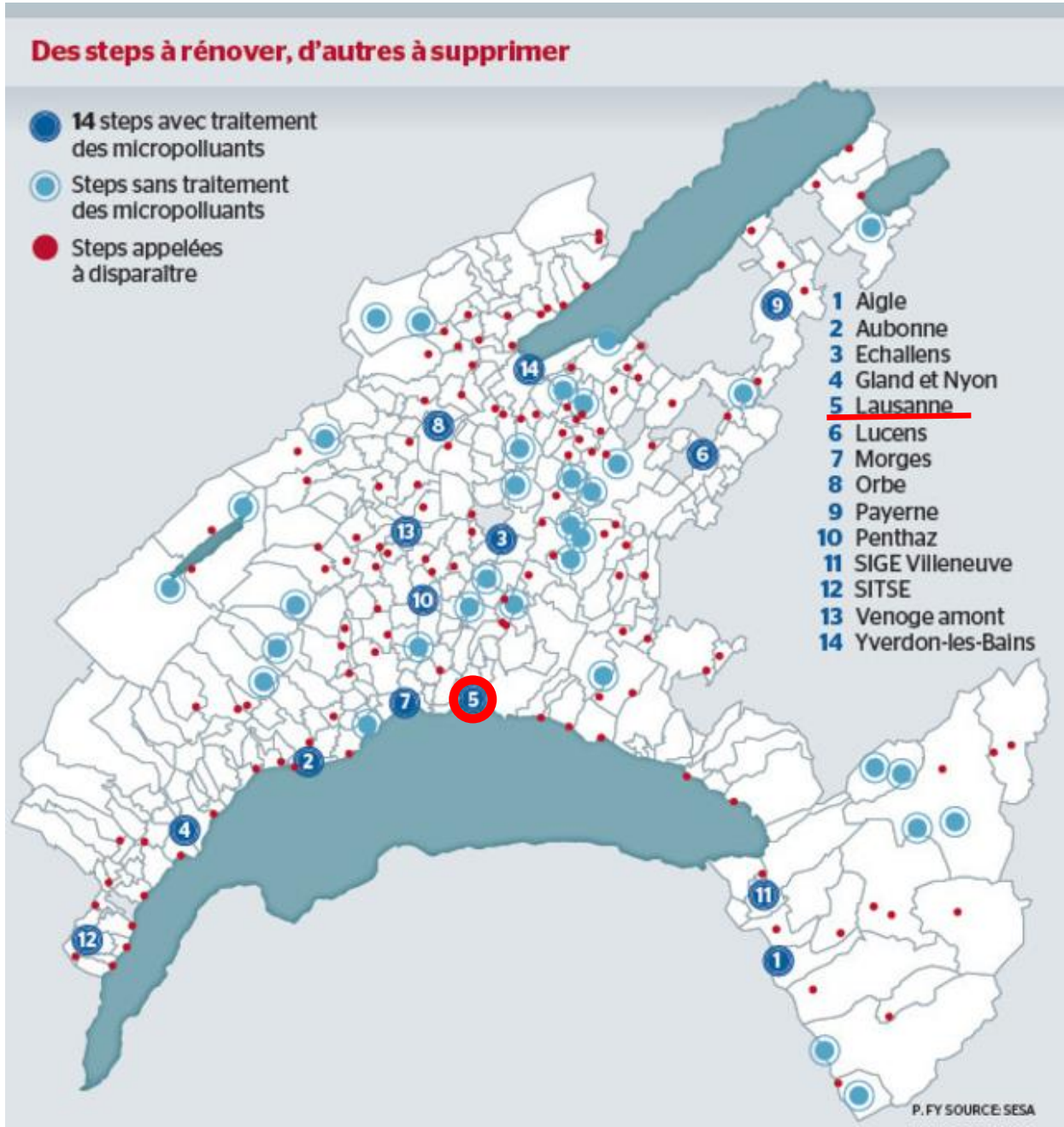


Switzerland: New tax for upgrading wastewater treatment plants

- **Swiss Parliament amended the Water Protection Act**

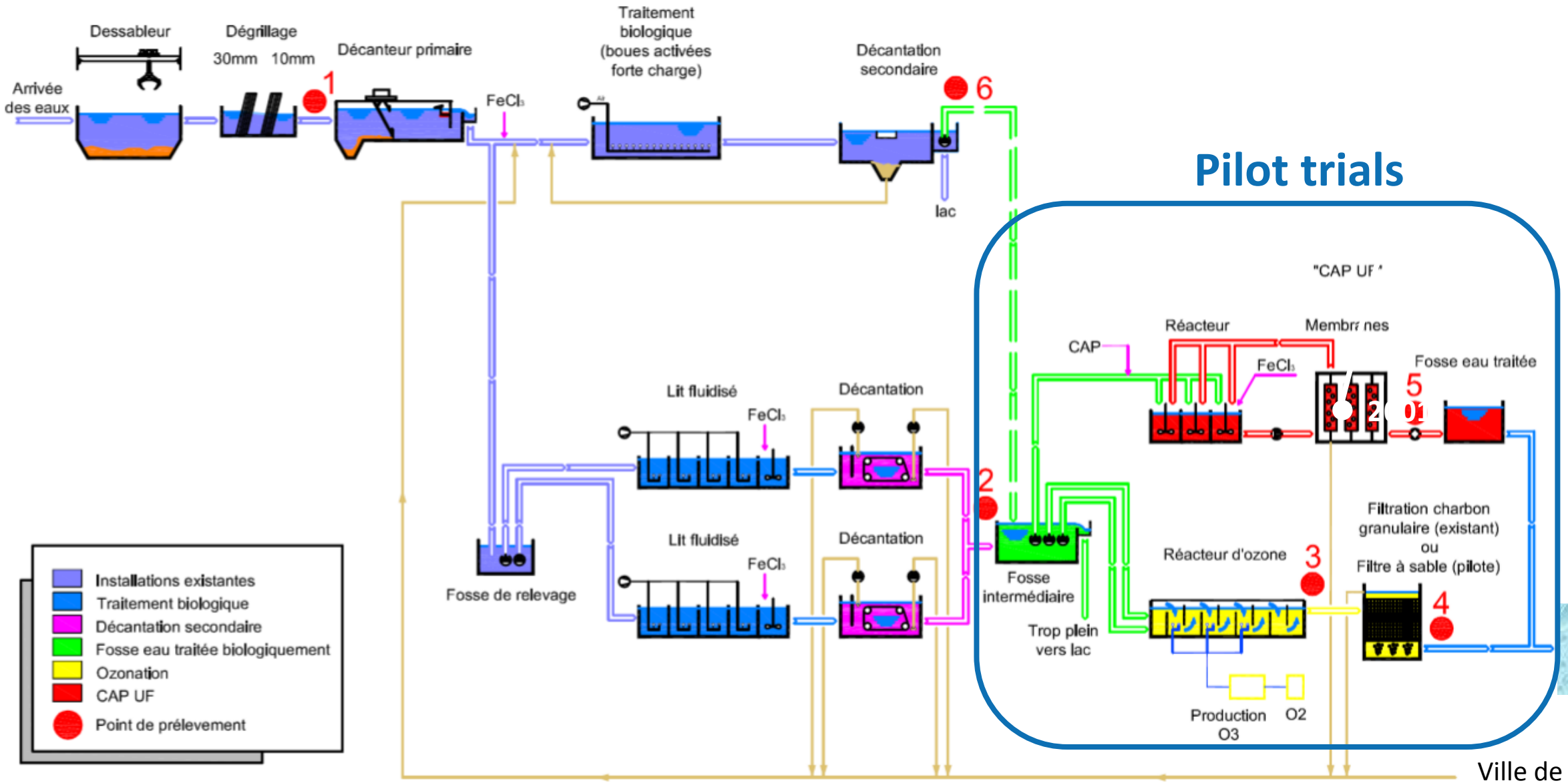
- First country with a (Federal) legislation obliging large cities to treat micropollutants from wastewater

- 100 wastewater treatment plants to be upgraded. Financed by a new tax of 9 euros until 2040



Lausanne: 300 million € for treating micropollutants

Pre-treatment	Primary	Secondary/Tertiary	Micropollutants (20 to 80% treated)



Pilot trials

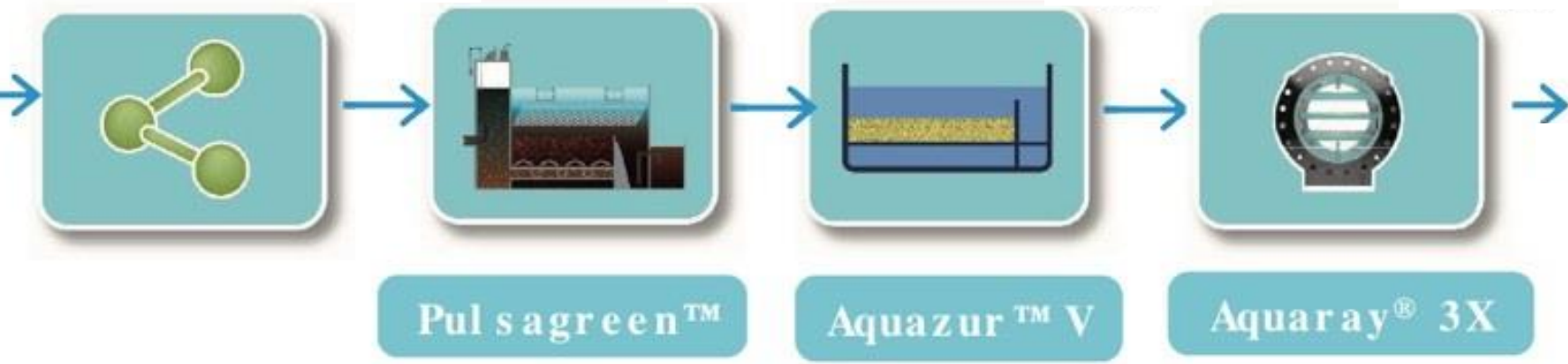
Lake Geneva

Ville de Lausanne

Lausanne: Treatment of micropollutants in municipal wastewater

- 58 potentially problematic substances monitored

➤ **0.1-0.15 € per m^3 treated, financed by new Federal tax of 0.11€ on water bill**

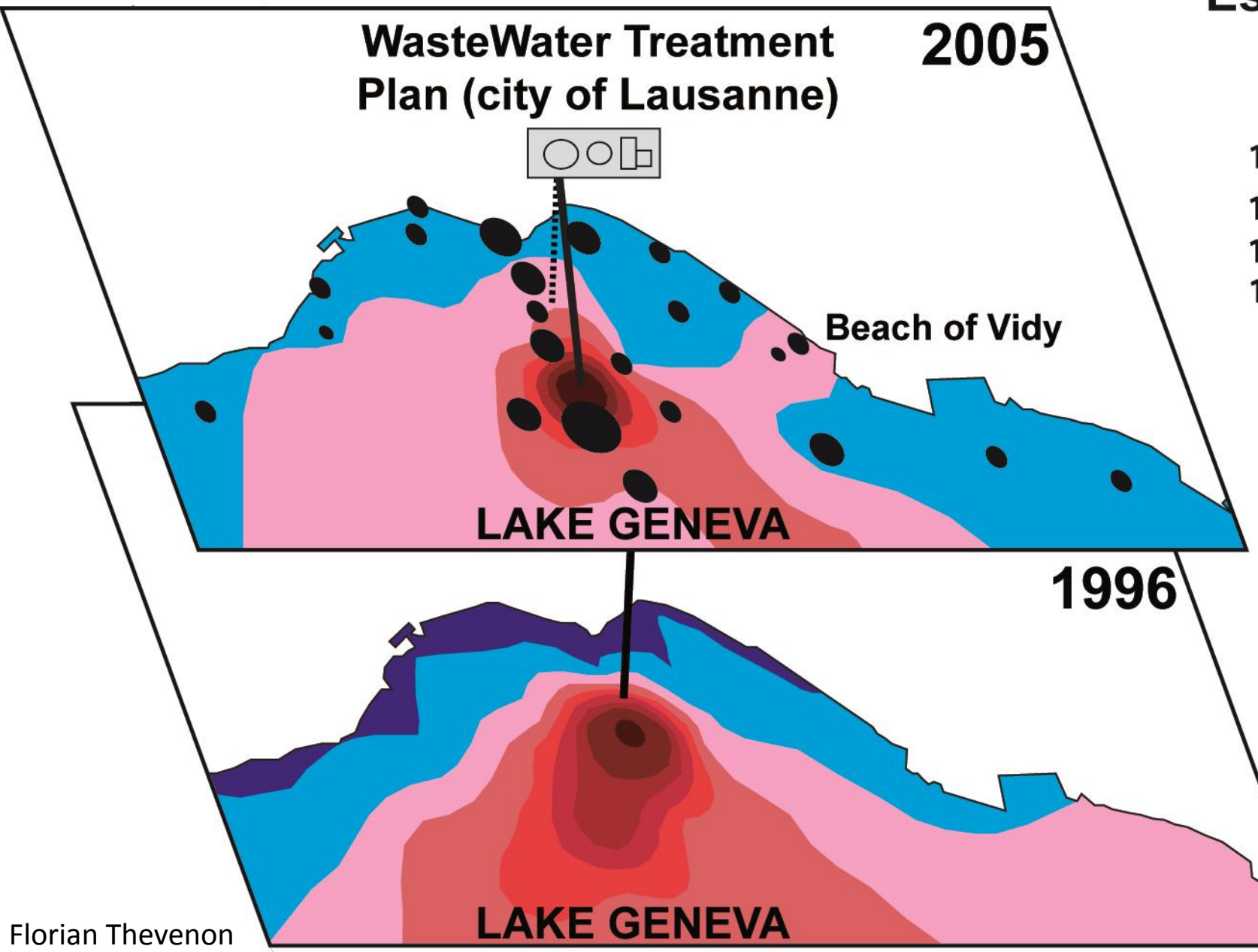


Ozonation | **Activated charcoal** | Sand filters | UV Disinfection

Lausanne: increasing population, wastewater treatment challenges

- Site (road and lake) & archaeological artefacts
- **24h/24h wastewater treatment for 200’000 inhabitants (400’000 in 2040)**
- Pollution by treated and non treated wastewater in the bathing Bay

Lausanne: increasing population, wastewater treatment challenges



Escherichia coli
(CFU/g)

- $>10^6$
- 10^5-10^6
- 10^4-10^5
- 10^3-10^4
- 10^2-10^3

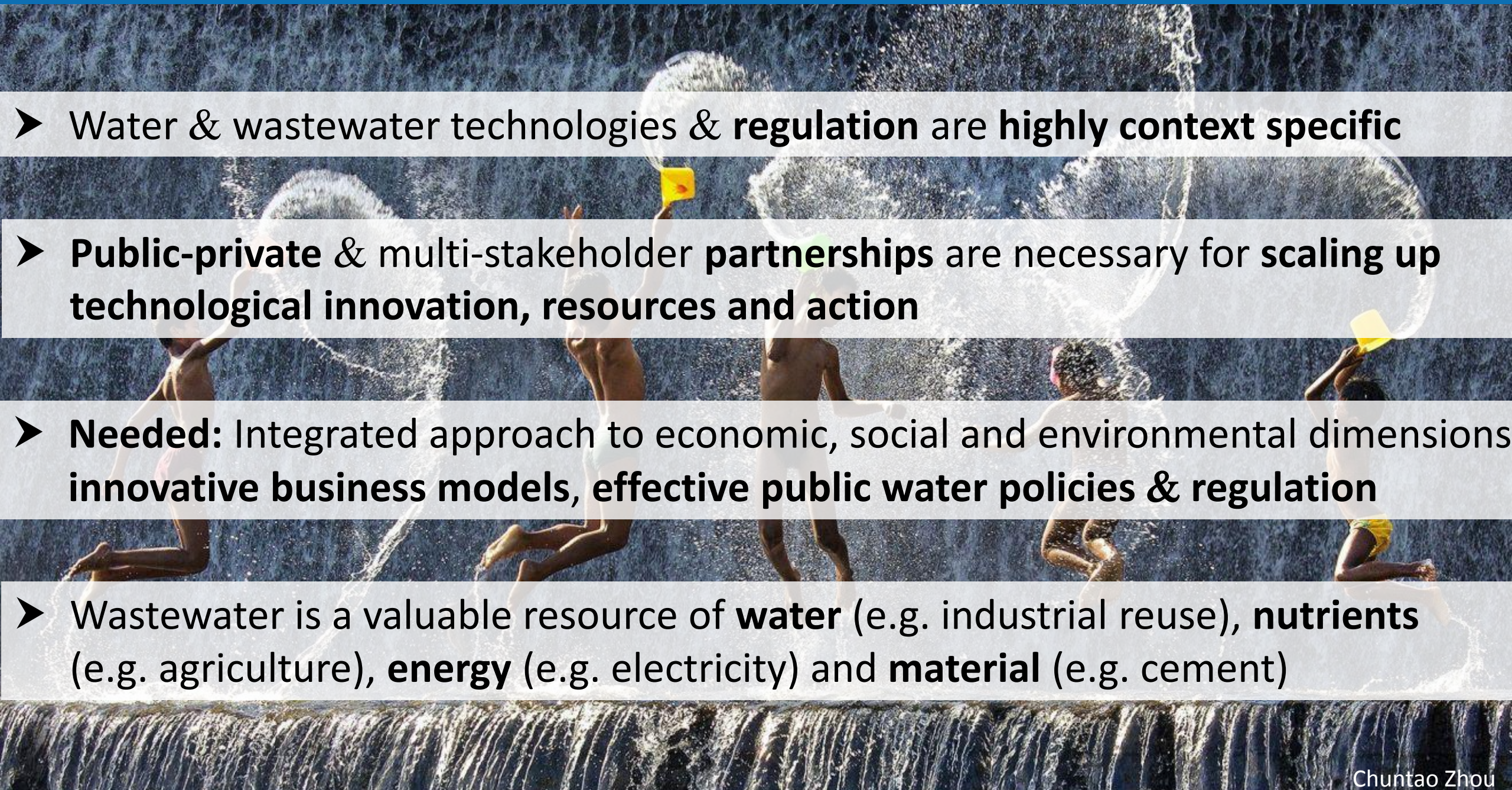
Mercury
(µg/g)

- 5
- 4
- 3
- 2.5
- 2
- 1.5
- 1
- 0.5
- <0.5

SCIENCE & water quality data to find solutions and to improve water governance

Florian Thevenon

The need of regulation: Legislation, Policies and Standards



- Water & wastewater technologies & **regulation** are **highly context specific**
- **Public-private** & multi-stakeholder **partnerships** are necessary for **scaling up technological innovation, resources and action**
- **Needed:** Integrated approach to economic, social and environmental dimensions **innovative business models**, **effective public water policies & regulation**
- Wastewater is a valuable resource of **water** (e.g. industrial reuse), **nutrients** (e.g. agriculture), **energy** (e.g. electricity) and **material** (e.g. cement)

Thank you for your attention

Chuntao Zhou