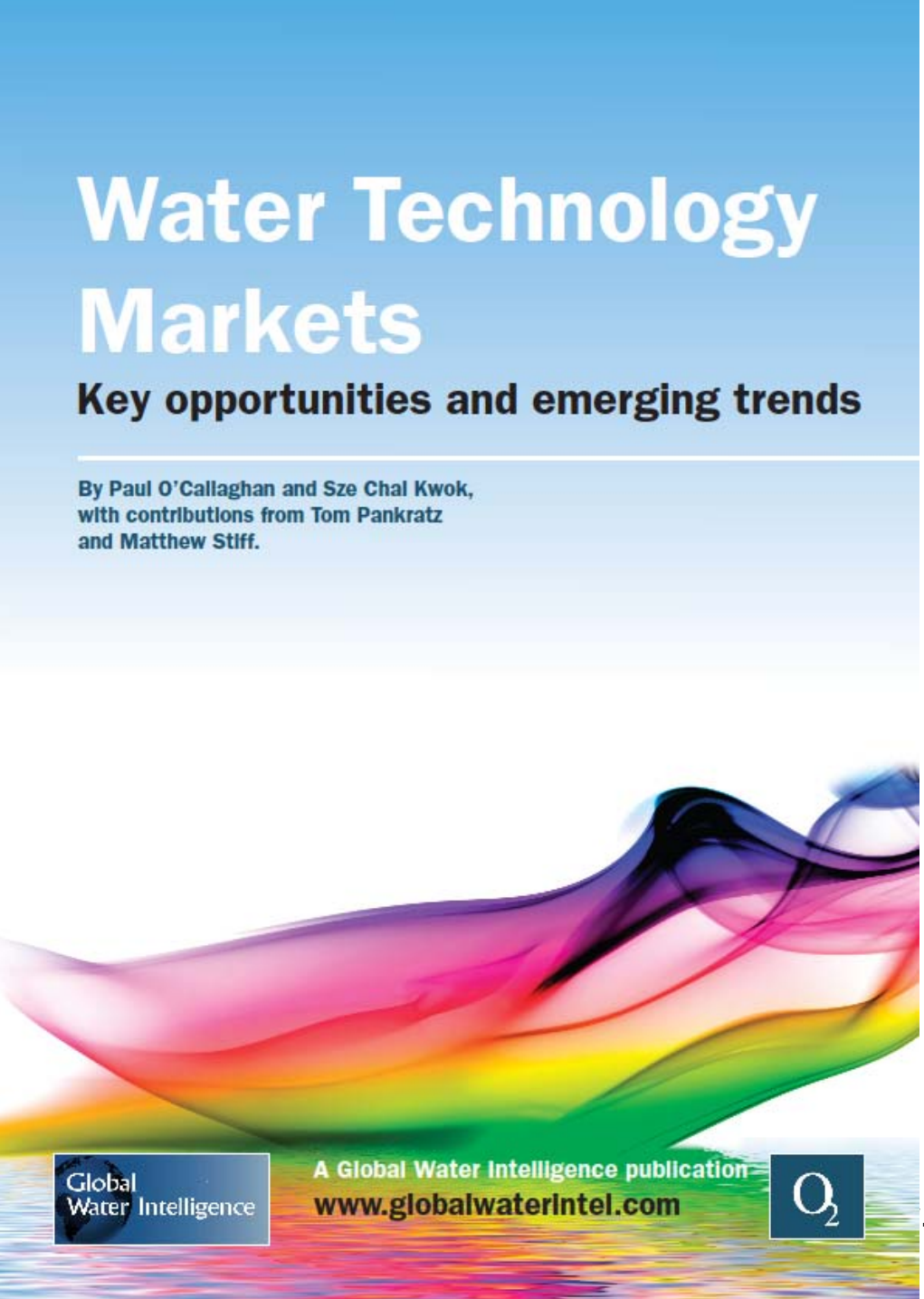

Water & Energy

Water Innovations Alliance

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Complete Paper available for download @ www.o2env.com

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Our Current Water System

1. Our current water system is inefficient and energy intensive

2. Due to mounting global pressures we can no longer afford an inefficient and energy intensive system

3. This is driving radical change and creating opportunities for technology development.

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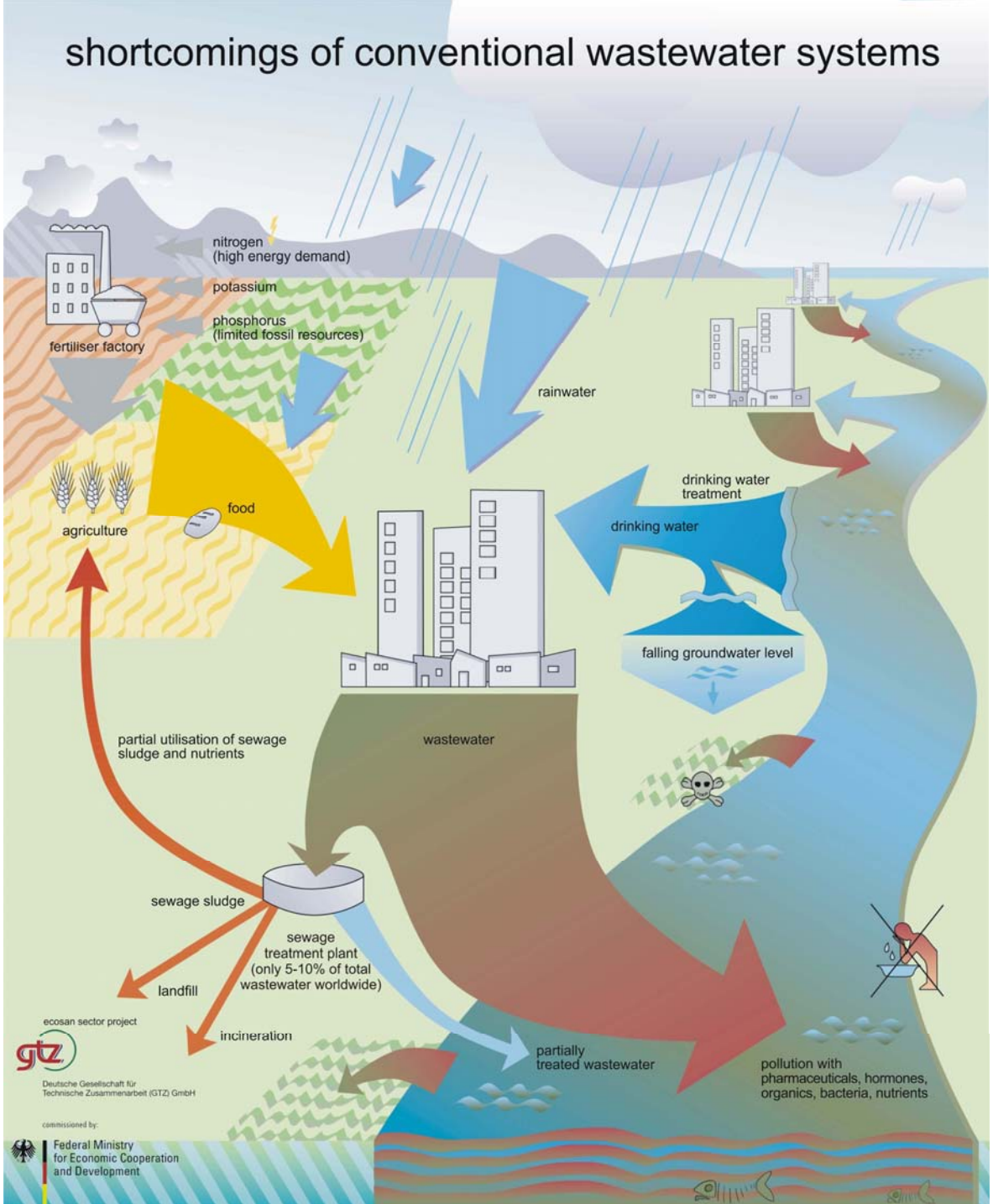
shortcomings of conventional wastewater systems



Energy footprint of Water

- In the Unites States Water services represents between **1% - 5% of total national energy use**
- 2-3% of total global energy consumption is utilised in the pumping and treatment of water for industrial and residential use.
- **30%-60% of a city's energy bill is associated with the provision of water services,**
- U.S. **water-related energy use** is equivalent to **13% of the nation's electricity** consumption.
- The **carbon footprint** currently associated with moving, treating and heating water in the U.S. **represents 5% of all U.S. carbon emissions**

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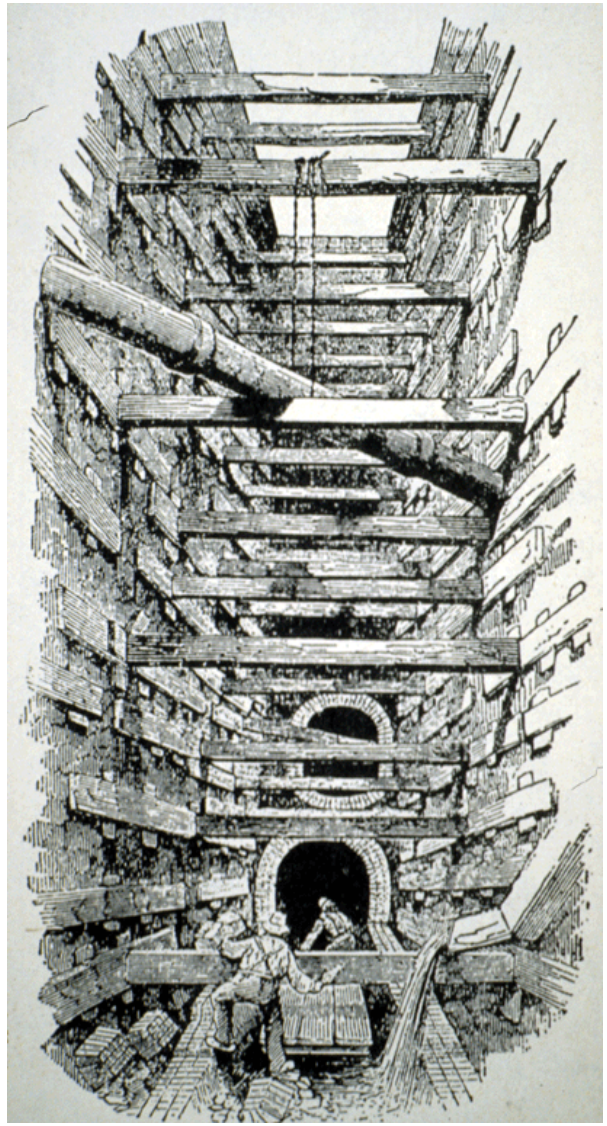
How we arrived at where we are today

- 1850 – the Water Closet and the Sewer adopted.
- 1914 – the Activated Sludge Wastewater Treatment Process invented

At this time there were less than 2 Billion people in the world mostly rural

- Today: 6 Billion people, mostly urban
- Future: Population and urbanisation are set to increase.



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Environmental Concerns led to Construction of WWTP's

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Intelligent Design or Evolution?

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The Future - energy associated with providing water services will increase

- Increasing Population
- Urbanisation
- Climate Change
- Groundwater depletion
- Water scarcity
- Rising energy costs and GHG emissions.
- Addition of water services in the developing world

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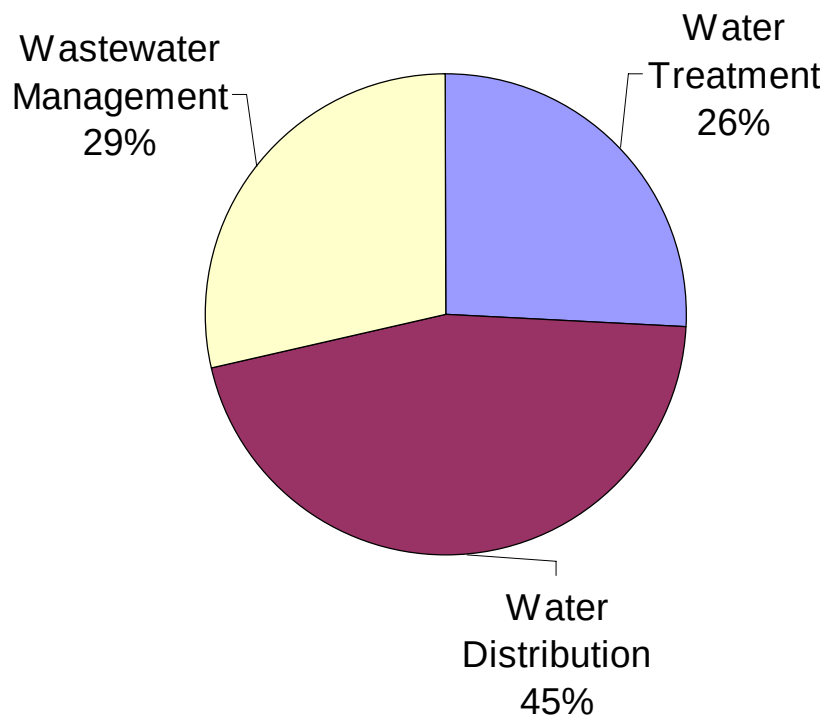
Energy Used to Provide Water Services

- Energy to Transport Water
- Energy to Treat clean Water
- Energy to treat waste Water



Source: Deidder, G.T., 2008

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There is Energy in Wastewater

- *The energy in the wastewater produced by one person each day could power a 100 watt light bulb for 5 hours*

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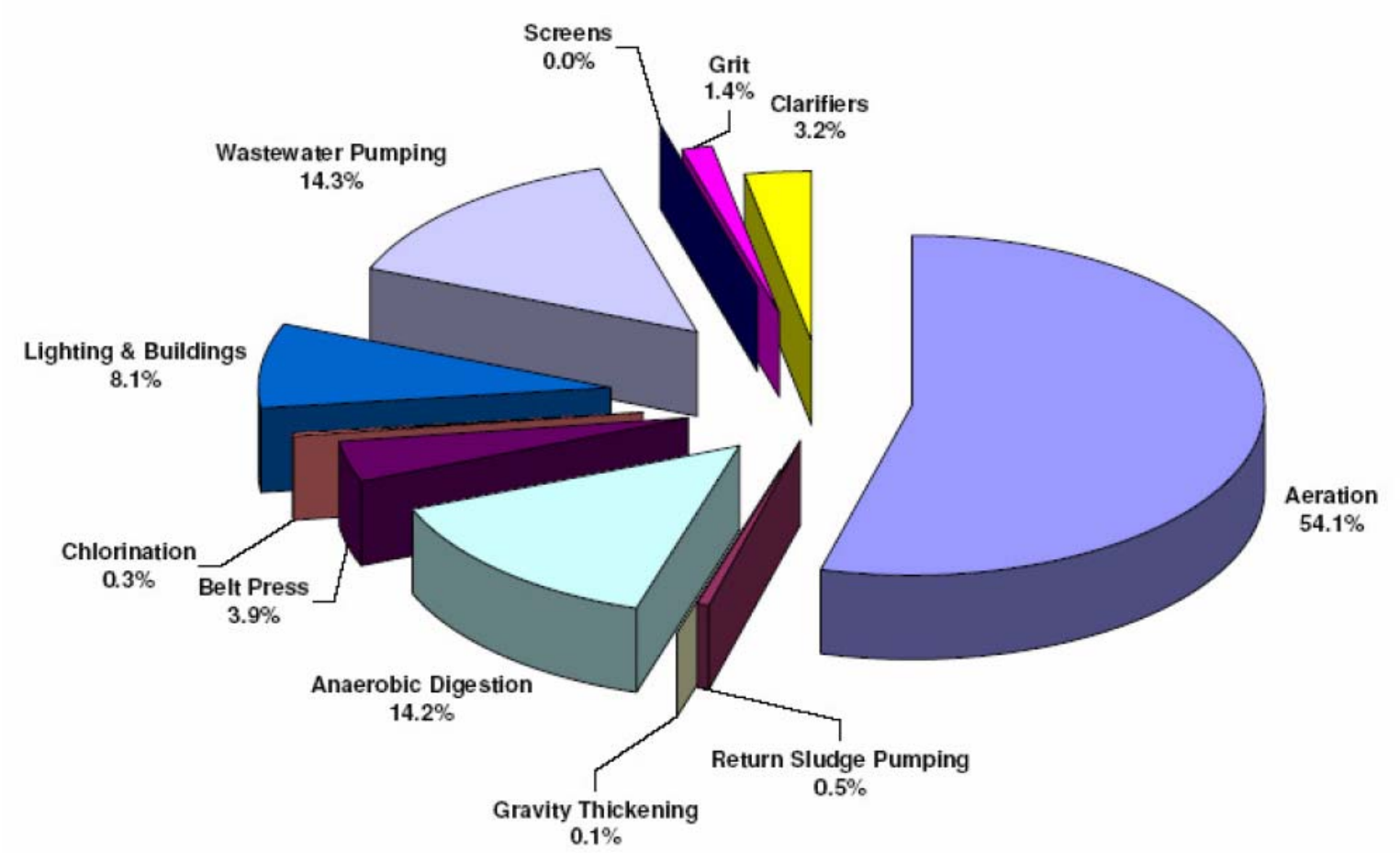
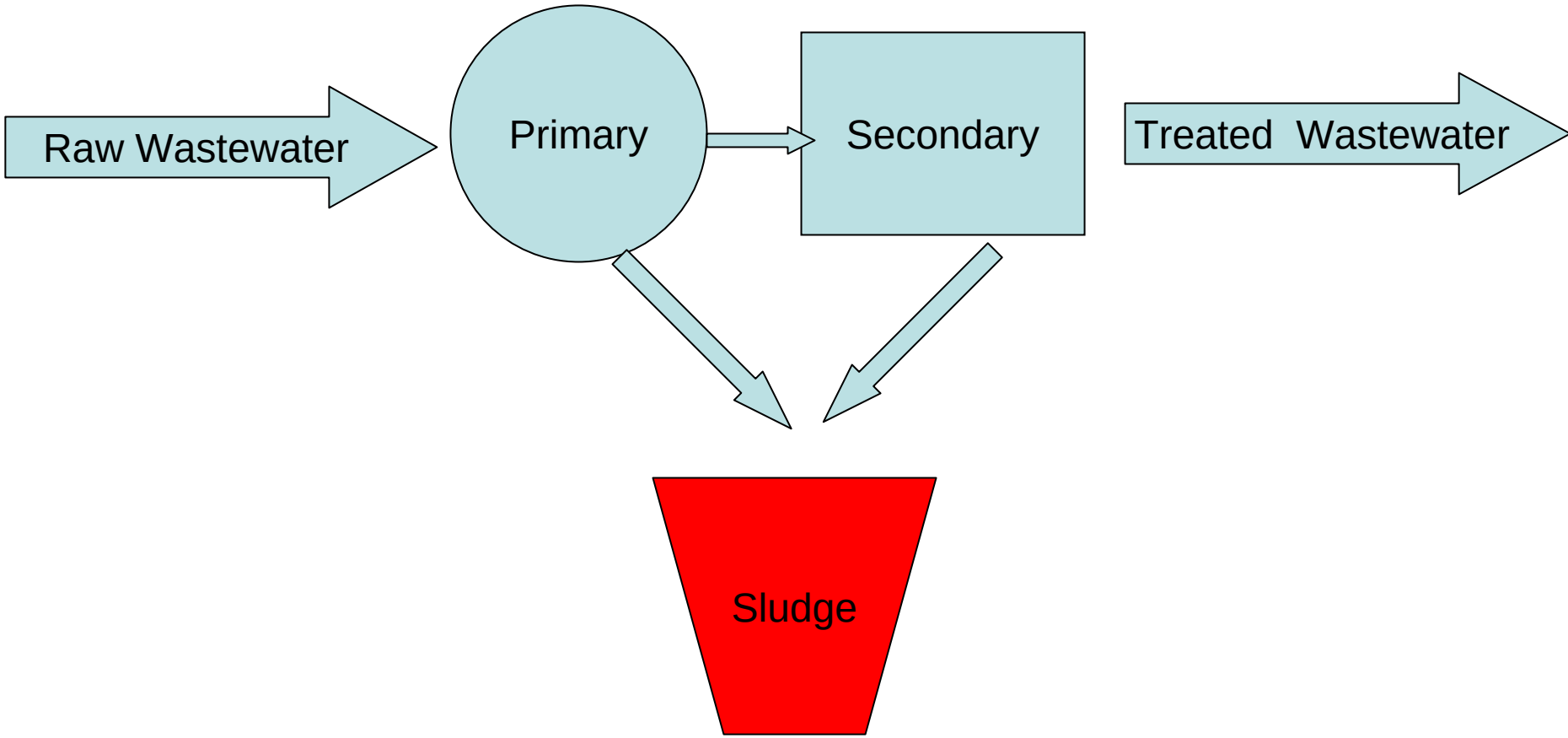
Energy to Treat Wastewater



Electricity Requirements for Activated Sludge Wastewater

Derived from data from the Water Environment Energy Conservation Task Force *Energy Conservation in Wastewater Treatment*

Opportunities for Energy Recovery in Wastewater



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Sludge to Energy Technologies

- Sludge to Syngas — Gasification – *e.g. KOPF*
- *Sludge to Biogas* — *Anaerobic digestion +/- pre-treatment*
- Biogas Utilisation — *Microturbines / Stirling Engines/ Fuel Cells*
- Sludge to Oil: — Pyrolysis *e.g. STORS*
- Sludge to Fuel: — Carbonisation & Torrefaction *E-coal and E-Fuel*
- Supercritical Water Oxidation: *Aquacritox*

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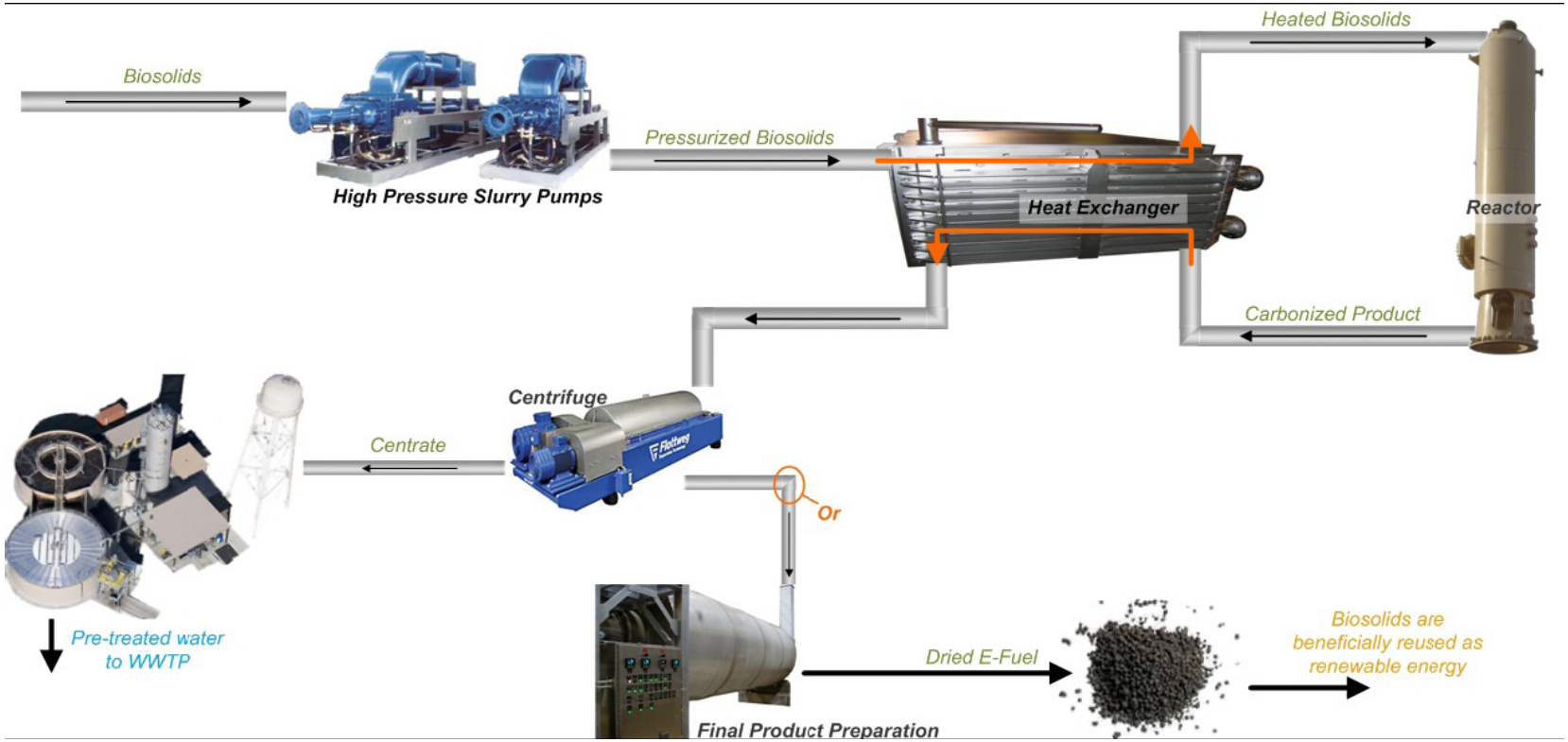
Slurry Carb Process



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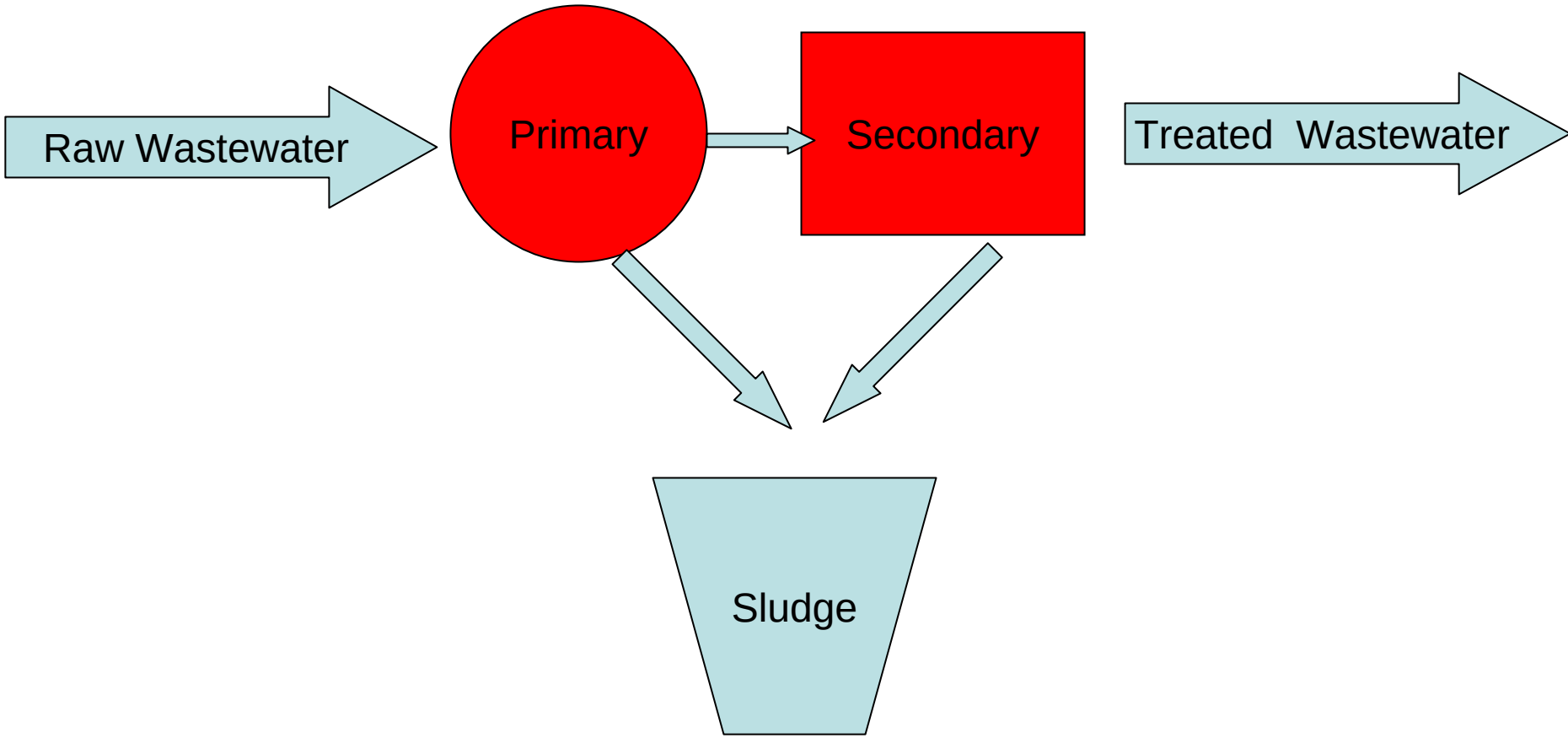
Opportunities for Energy Recovery in Wastewater



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Energy from Wastewater

- **Anaerobic Membrane Bioreactors**
  - Proposed demonstration plant at the Masdar Ecocity in Abu Dhabi.
- **Microbial Fuel Cells**
  - The Israeli company EMEFCY is marketing the MEGAWATTER process which does just this.
- **Advanced Primary Treatment**
  - Micromedia Filtration have a demonstration plant operating in Woodsville, New Hampshire

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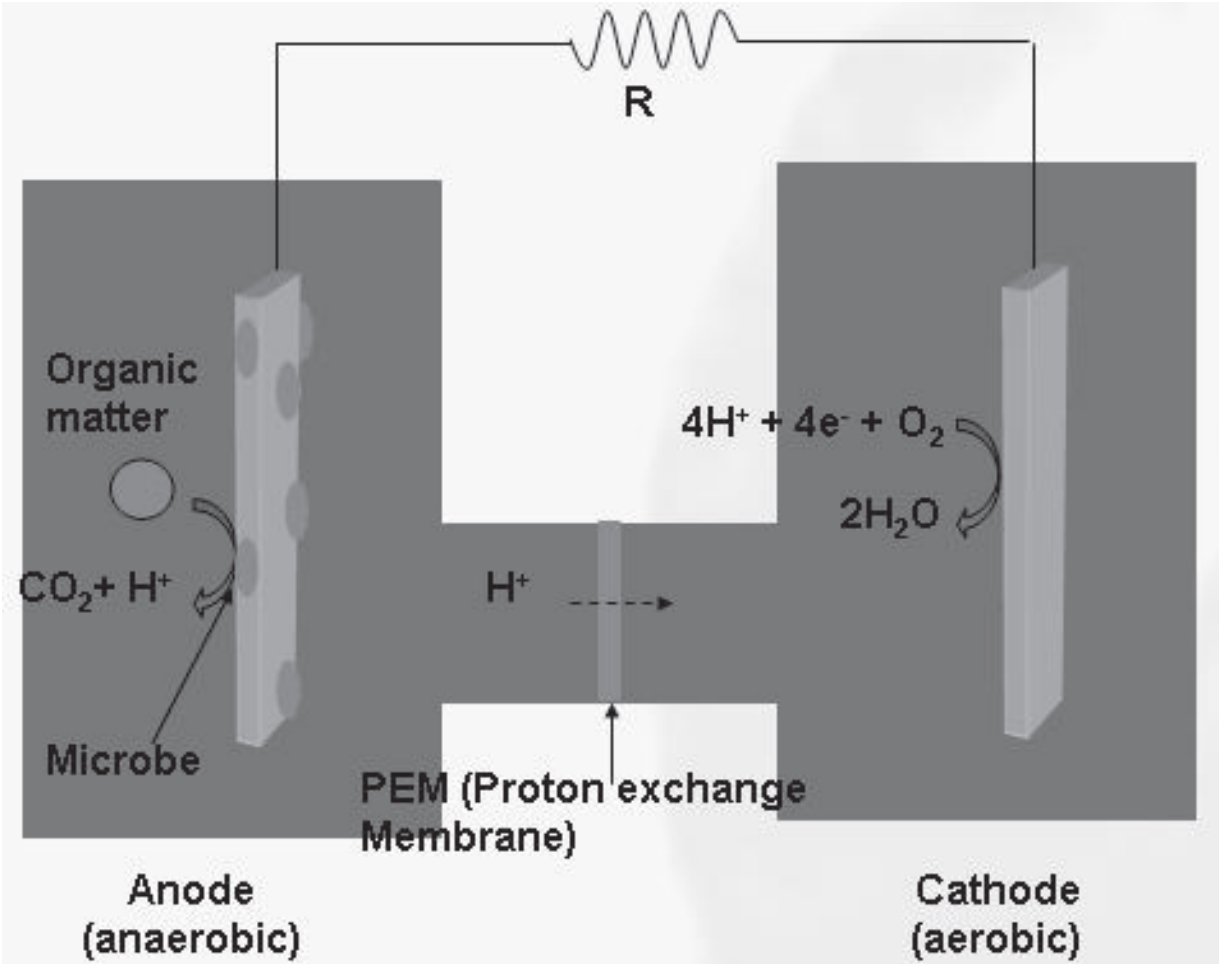
Microbial Fuel Cell



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Energy efficient methods of meeting water challenges

- Water quantity
  1. Increased Efficiency: e.g. Irrigation & Leakage
  2. Alternative models for providing water services: e.g. decentralised, rainwater use
  3. Water Re-use - 30% <energy than Desal
  4. Forward Osmosis for Desalination
- Water quality
  - Have different grades of water
  - Recover energy from wastewater
  - Alternative model: **source separation and re-use**

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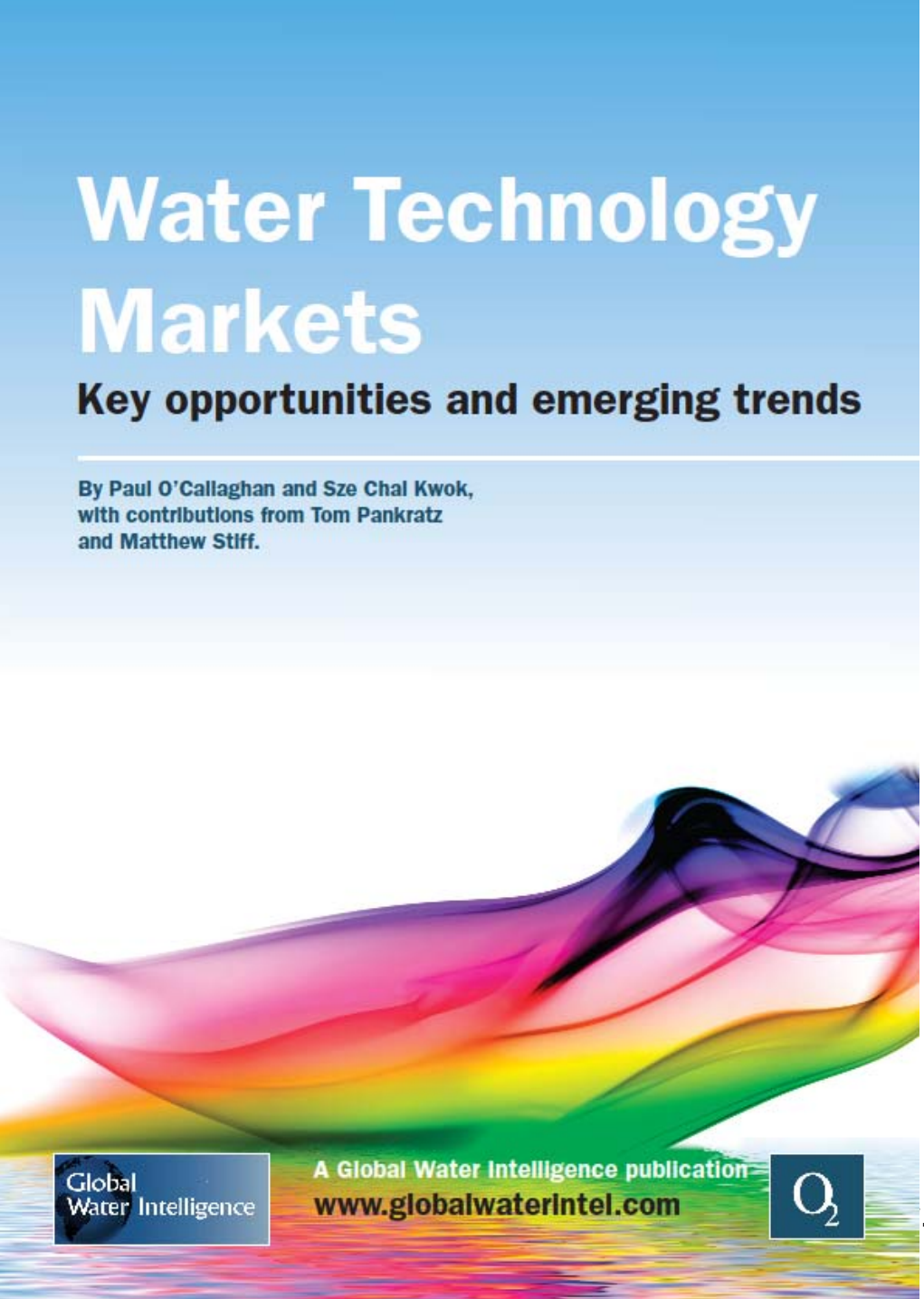

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