



Cleantech Forum **Asia** | Singapore

Lunch Keynote: Water, Waste and Disruptive Technologies in Conservative Industries



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Water, Waste and Disruptive Technologies in Conservative Industries



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Sustainability and Technology

*Presented by A Benedek at Cleantech Forum
Asia*

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Influential Books of the Environmental Movement

- Rachel Carlson, Silent Spring(1962)- First recognition of ecosystem destruction by pesticides
- Paul and Anne Ehrlich, The Population Bomb (1968)- Postulating short term human catastrophe of famines and commodity shortages driven by increased population (3 billion at the time)
- Club of Rome, Limits to Growth (1972) –continuing Ehrlich’s point and expanding it to a detailed model of commodity limits

The Paul Ehrlich and Julian Simon Bet

- A bet on the price of five commodities rising (Ehrlich) or falling (Simon) during the decade between 1980 and 1990
- Ehrlich lost the bet on all five commodities although population rose 800 million during the decade
- Ehrlich then challenged Simon on climate change related changes but Simon refused the bet

How Come Ehrlich and the Club of Rome Were Wrong

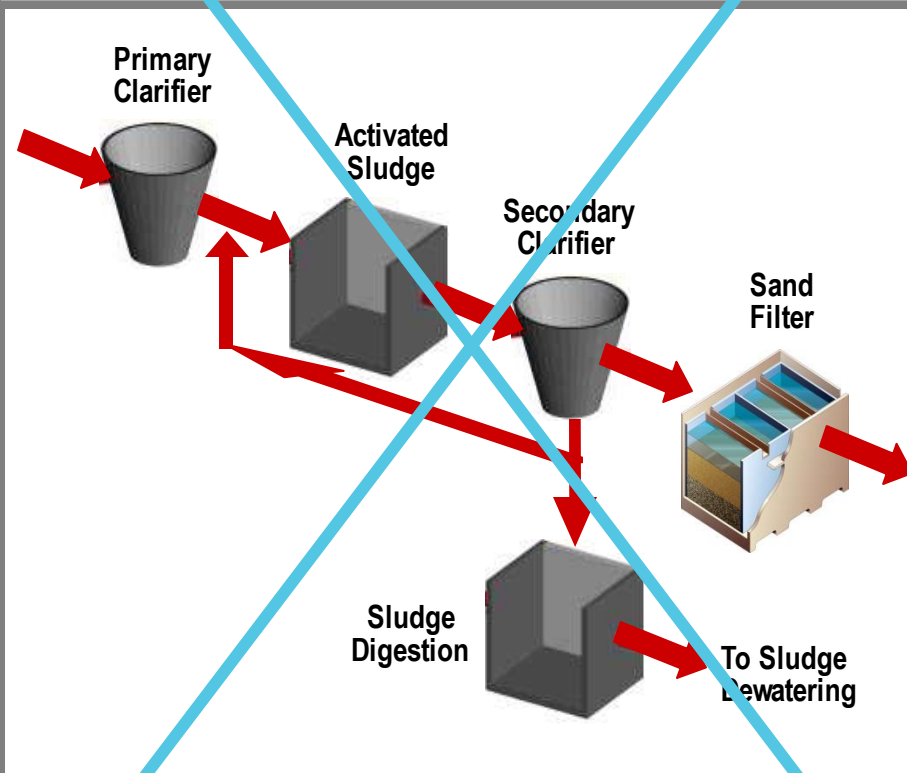
- Those models did not take into account market response to scarcity by business investment and technical innovation
- In spite of growing from 3 to 7.5 Billion since 1970, famines and resource scarcity have been avoided for the majority of the world's population
- One of the technical innovations was the use of low pressure membranes to recycle water led by Zenon

The Creation of Zenon

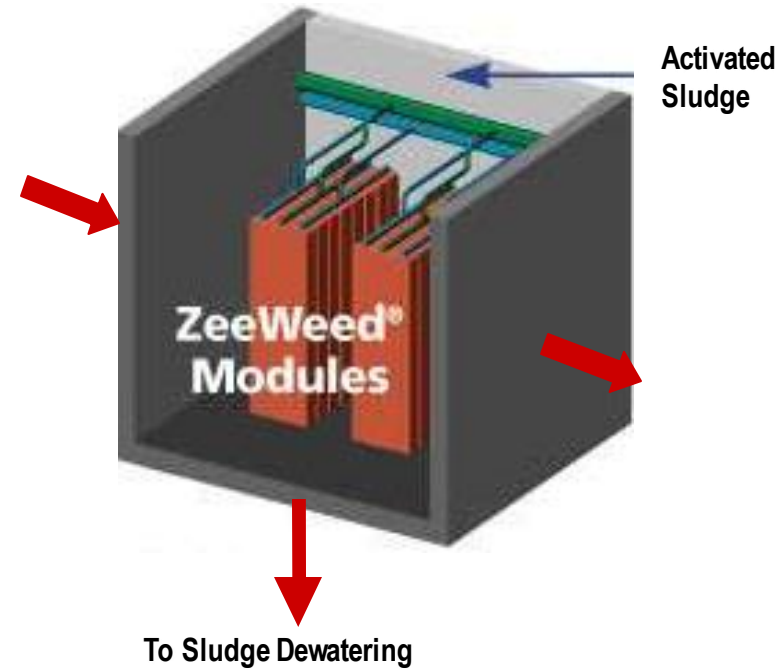
- A fear of a water short world and a desire to find a solution to water pollution by water reuse led Andrew Benedek to leave academia and start Zenon
- Based on nature's ability to separate molecules efficiently and reliably, membranes were chosen as the core technology for water reuse

Making Wastewater Treatment Plants Water Reuse Plants

Conventional Wastewater Process



Immersed Membrane Bioreactor



ZENON Becomes a Success

- ZENON grew steadily from zero in 1980 to 1500 employees and \$250 million in revenue in 2006
- ZENON became the Global Membrane Technology Leader and Revolutionized Wastewater Treatment
- Shareholder value grew at an average of 20 percent per year over the last 13 years while the company was public
- Zenon type membrane projects (MBRs) have grown more than ten fold since 2006 and the market is still growing rapidly.

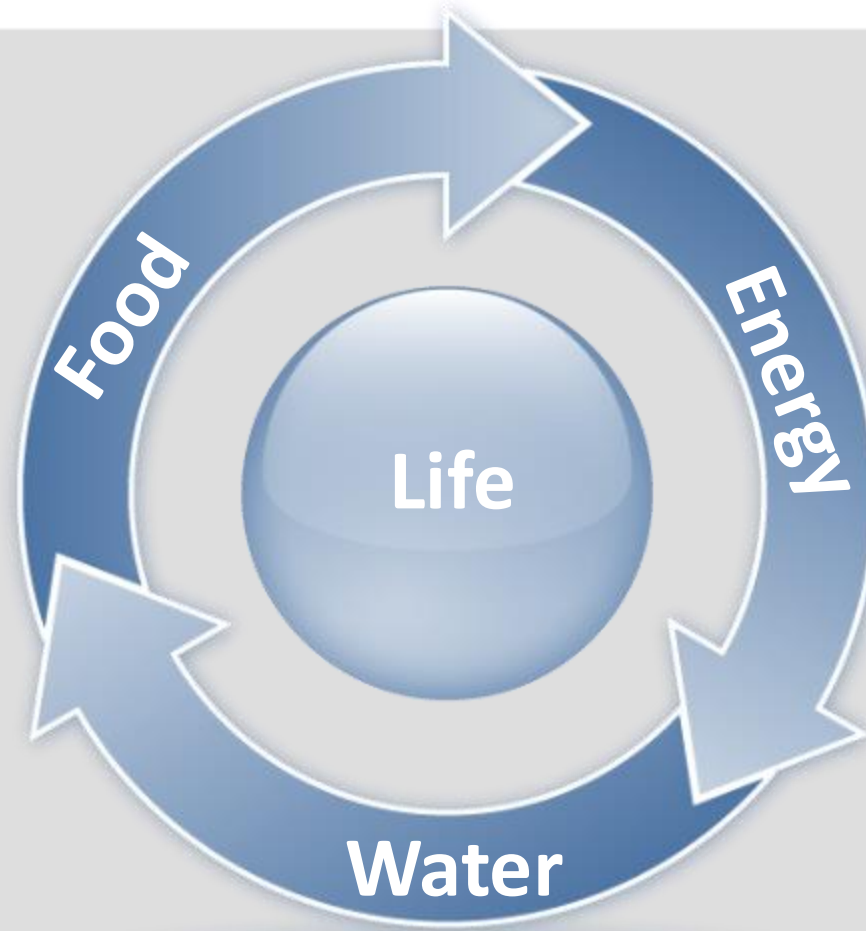
Assets at the Start of ZENON

- Breakthrough Technology....NO
- Business Knowledge.....NO
- Investors/Money.....NO
- Believers in the Vision.....YES

Lessons Learned from the Success of Zenon

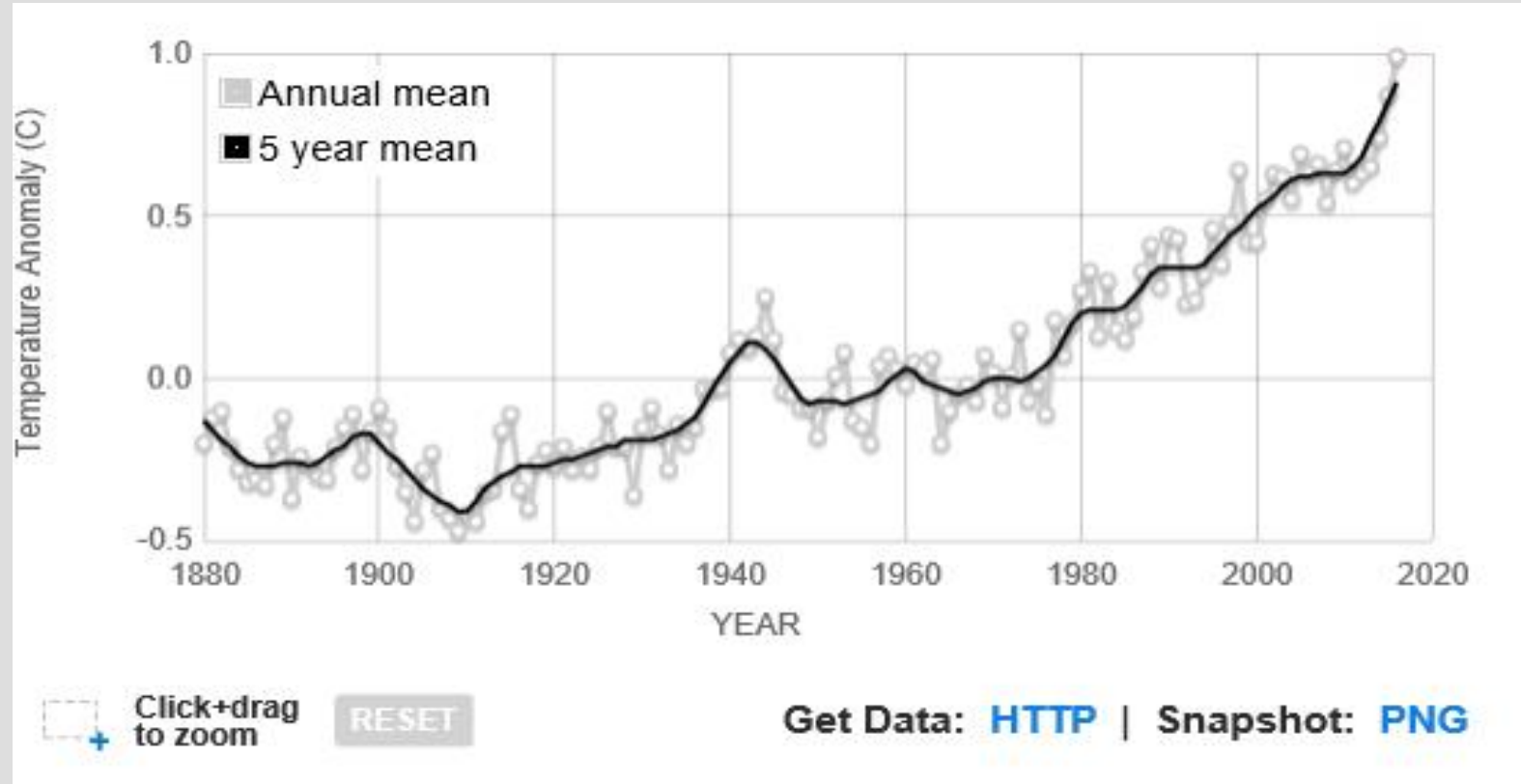
- If a company is focused on serving the world with the right vision, the money will eventually come
- The right people on your team is more important than the right technology
- Patience and self honesty is critical

Human Sustainability: Depends on Access to the Necessities of Life



Population + climate change drives resource depletion

Global Temperature is Continuing to Rise as CO₂ is Rising



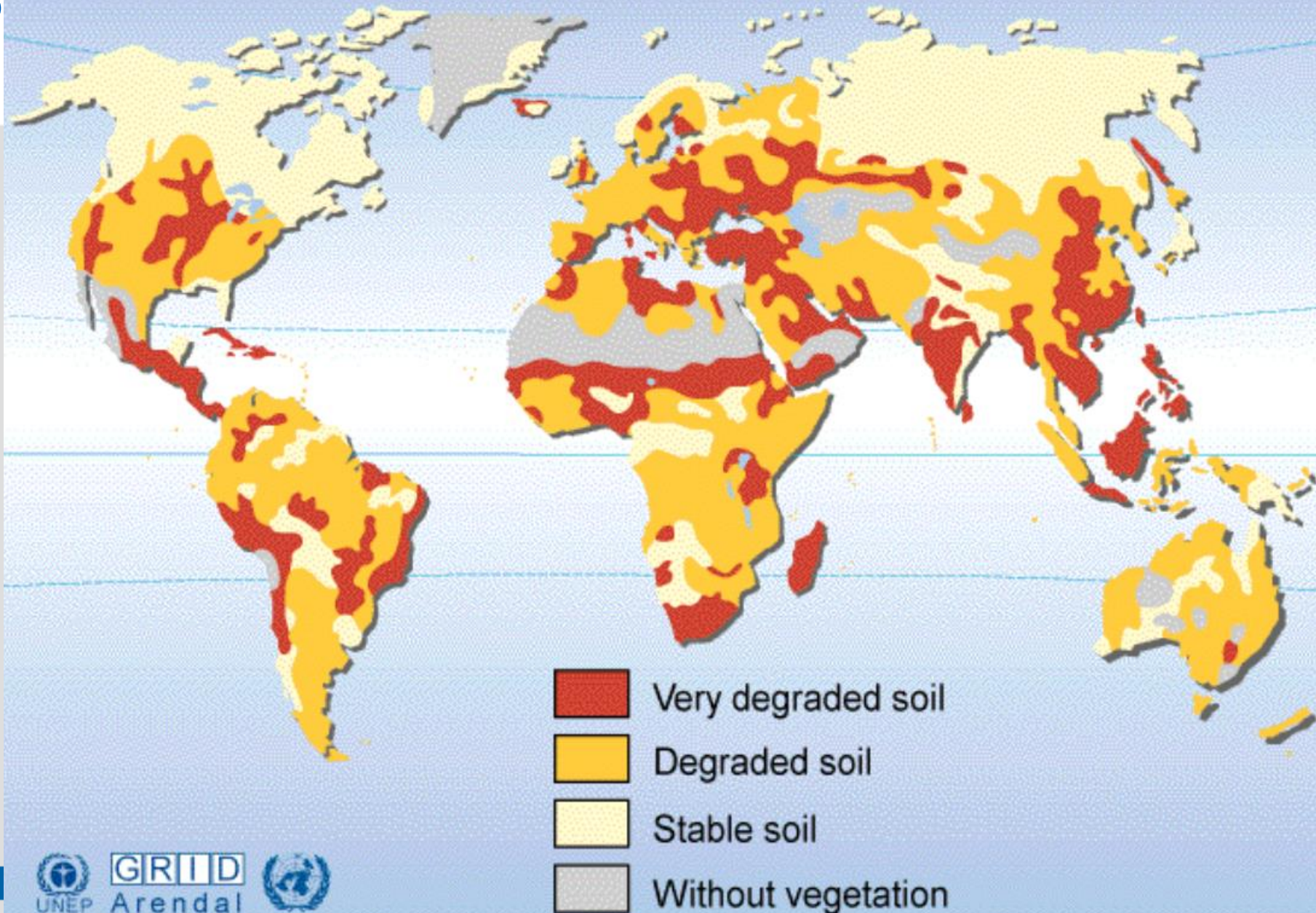
Effects of Climate Change

- Ocean level rising enhancing coastal flooding during storms
- Ocean temperature rise and acidification reduce food supply in the ocean
- More violent weather events
- Drought and Floods
- Desertification

So

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Soil degradation



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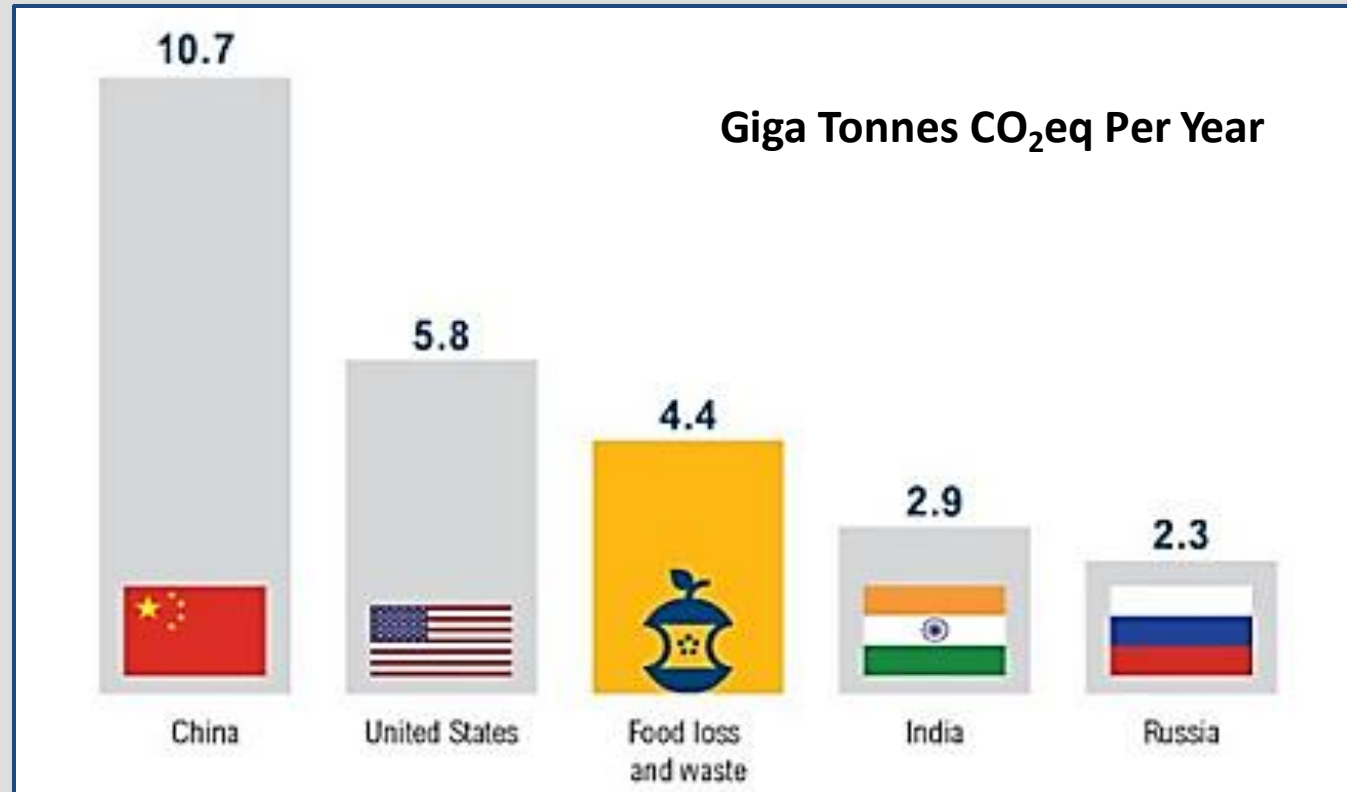
Five Major Reasons for Societies Failing

- Environmental Damage
- Climate Change
- Dependence on Long Distance Trade for Resources
- Violence, Internal or External
- Societal Response to Internal and Environmental Problems

Is the threat to sustainability more real in the 2020s than in the 1980s?

- Yes, because the world now has twice as many people
- Yes, because we now have the effect of climate change
- Yes, because business and technology alone can't solve climate change without coordinated global government action
- Yes, because coordinated global action is not likely in a world divided along national lines
- Yes, because reversing climate change will likely only begin after a catastrophe and will take a long time

GHGs from Food Waste Equals Emissions from All Modes of Transportation Combined



Source: United Nations 2016

The Anaergia Vision: A Zero Organic Waste Future

Wastewater
Biosolids



Source
Separated
Organics



Municipal
Solid Waste



Food
Processing
Waste



Agricultural
Waste



Integrated
Solutions



Renewable
Power



Renewable
Gas



Recyclables

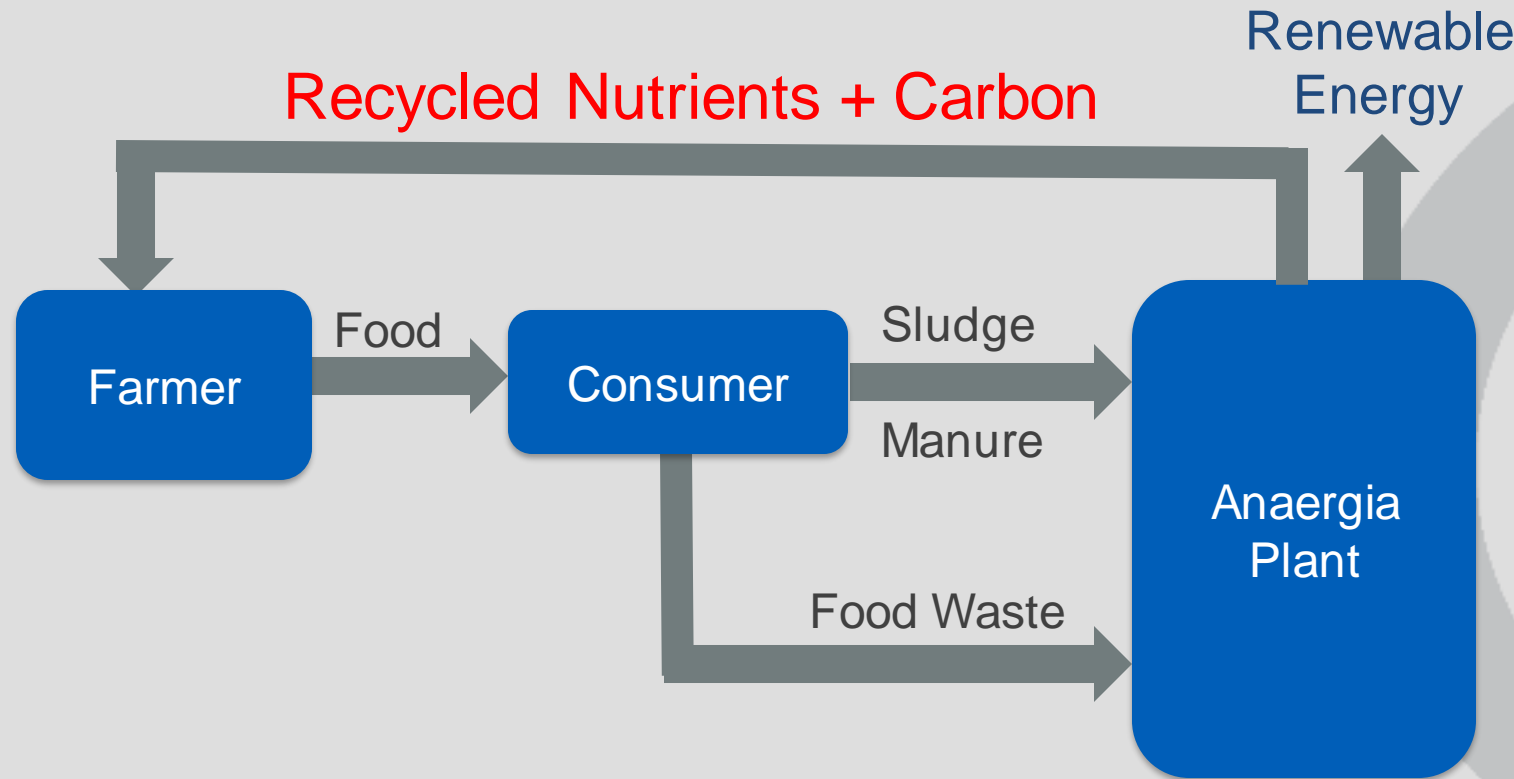


Fertilizer
plus Carbon

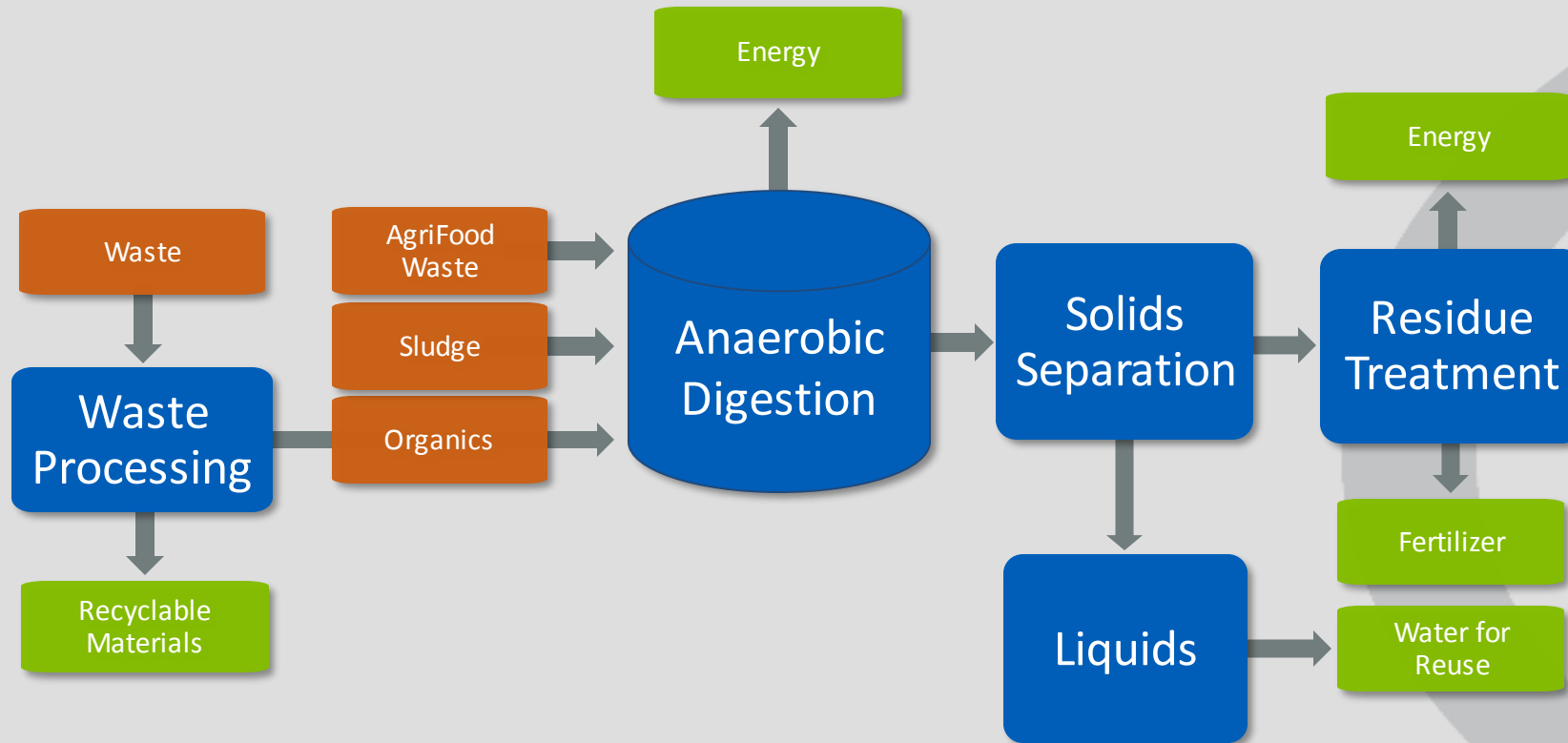


Clean Water

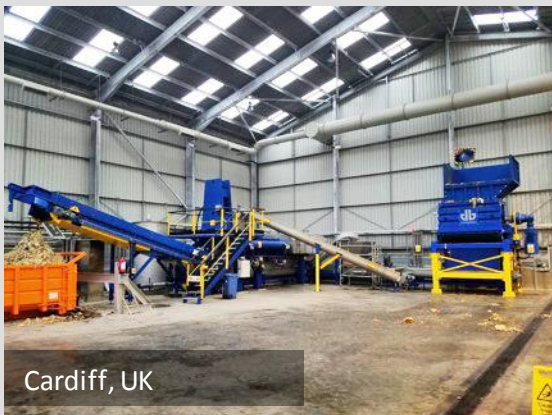
Land Can be Recovered by Recycling Food Waste



Steps to Cost Effectively Recover Value from Waste



Materials Recovery Facilities on Four Continents



Asian Waste Management Practices

- Incineration or landfills are the most common solutions to waste in Asia
- Compared to Europe and North America, Asian waste is very high in organics, 60% is common
- Landfills are running out of space and new landfills are beginning to be hard to permit
- For high organics Asian waste, mechanical biological treatment (MBT) is a better answer than incineration

Summary

- Our planet's ability to sustain human population may be getting dangerously close to systemic breakdown
- Technological innovation and market forces may continue to avert a crisis, especially if aided by a few nation states with foresight. Global government action is unlikely to be successful
- There are clear and manageable technological challenges which are needed for sustaining ourselves and likely to be successful if addressed by focused and sustained efforts