GE Energy

Food, Bev & Ag:
Energy - Water - Food

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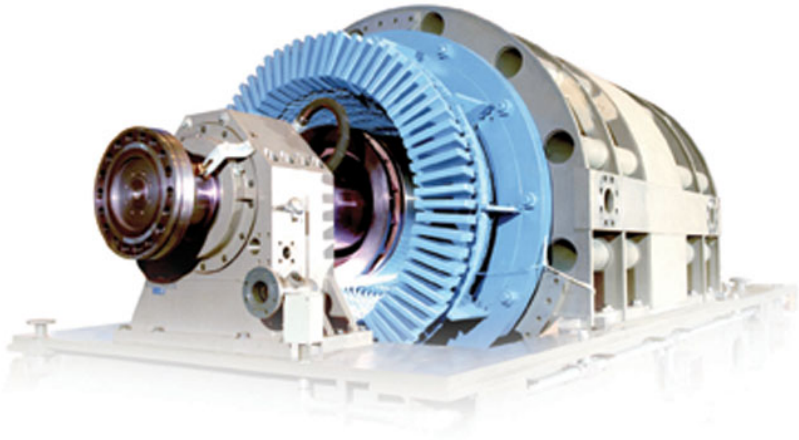
GE… What do you think of?



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GE Energy

25% of GE revenue

Global operations and over 100,000 employees

Oil & Gas

- Drilling & Surface
- Global Services
- Measurement & Control
- PII Pipeline Solutions
- Subsea Systems
- Turbomachinery

Power & Water

- Aeroderivative Gas Engines
- Gas Engines
- Nuclear Energy
- Power Generation Services
- Renewable Energy
- Thermal Products
- Water & Process Technologies

Energy Management

- Digital Energy
- Industrial Solutions
- Converteam

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Diverse energy & water solutions

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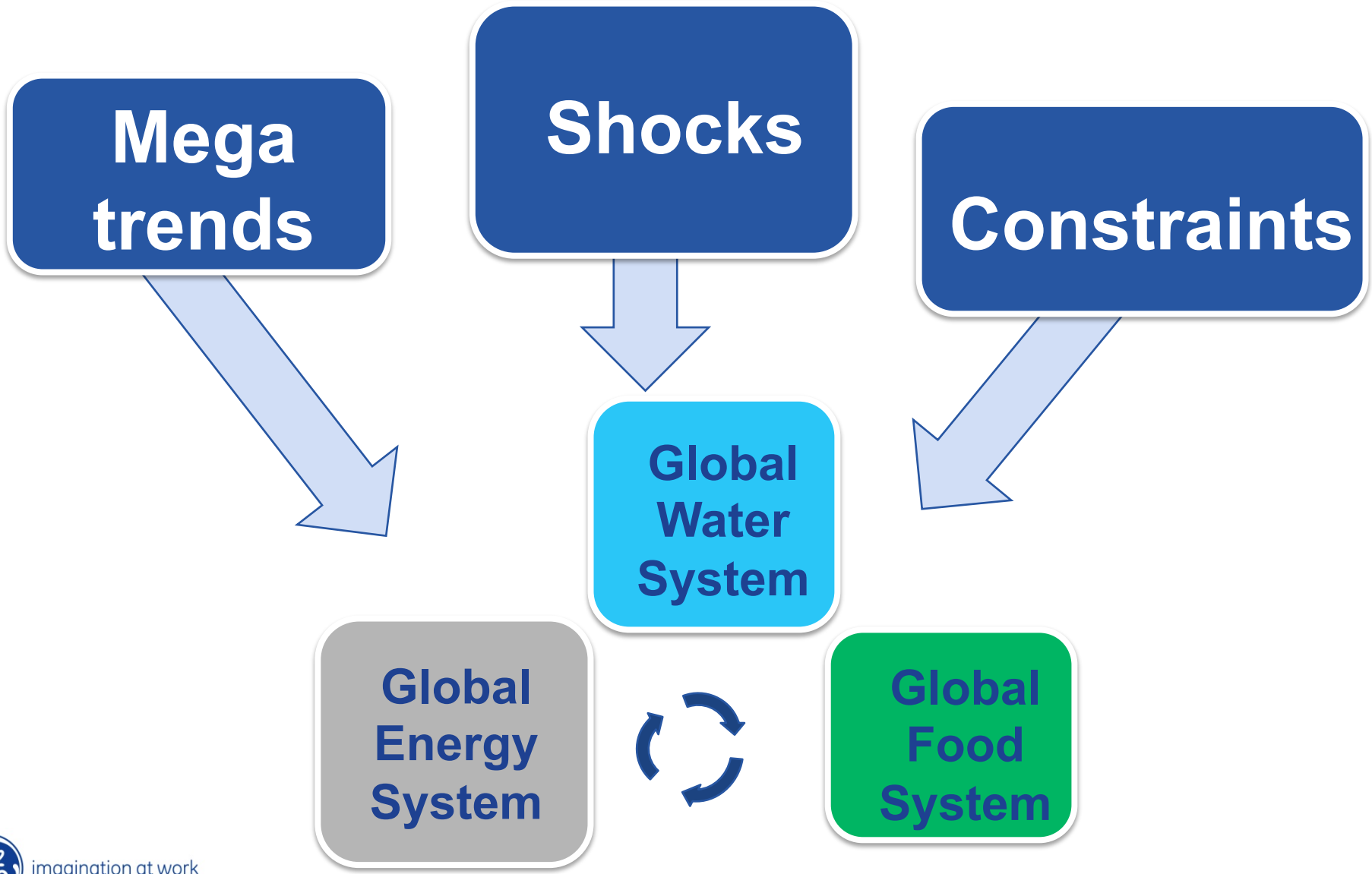
Strategic Landscape

Framing the drivers and interactions



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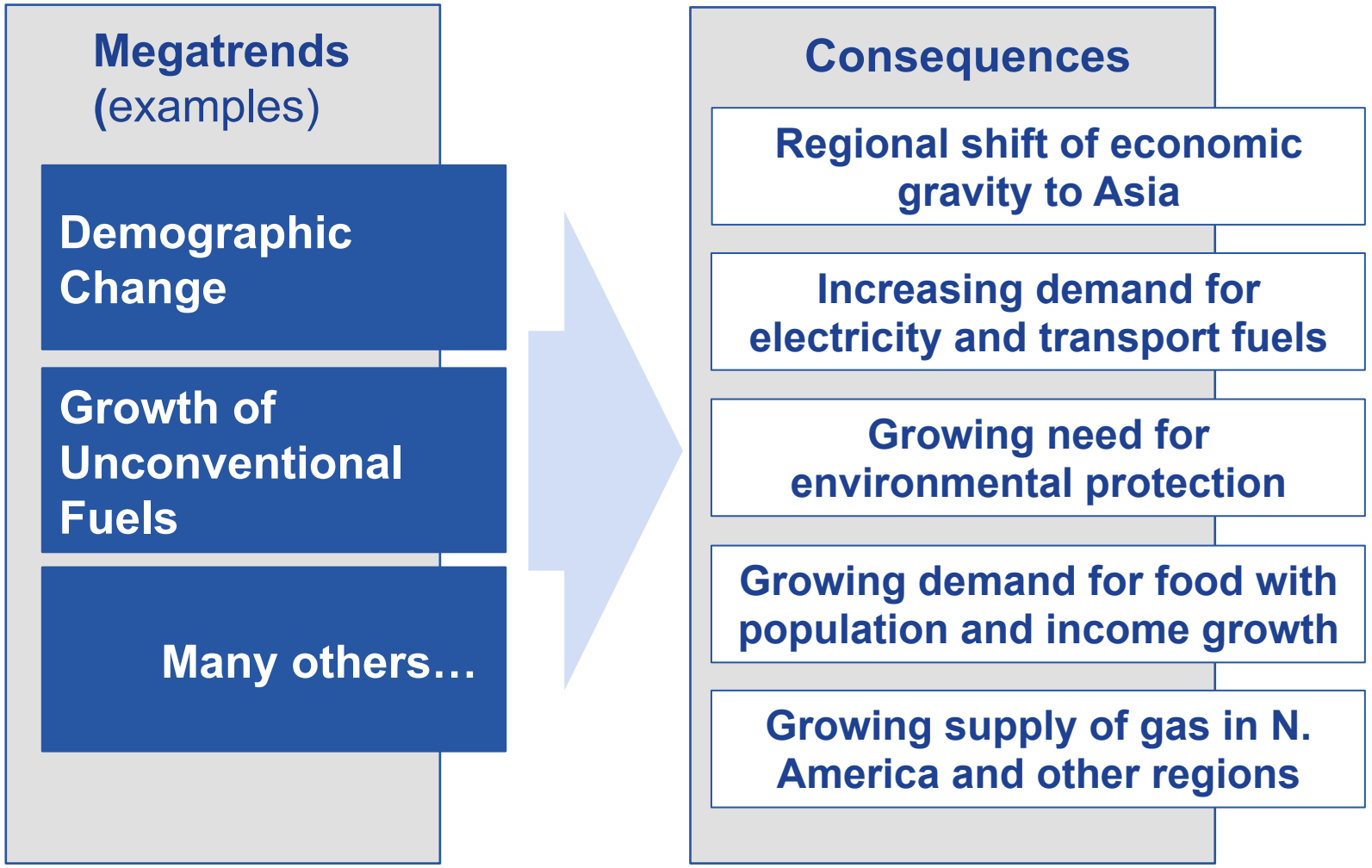
Megatrends and their consequences



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Expanding global middle class

Today **2020** **2030**

Global middle class
(numbers)

1.8 B

3.2 B

4.9 B

85% of growth from Asia

Source: Homi Kharas, "The Emerging Middle Class in Developing Countries," OECD Development Center, January 2010

Source: Krister Flodin illustration; http://www.flodin.biz/wp/

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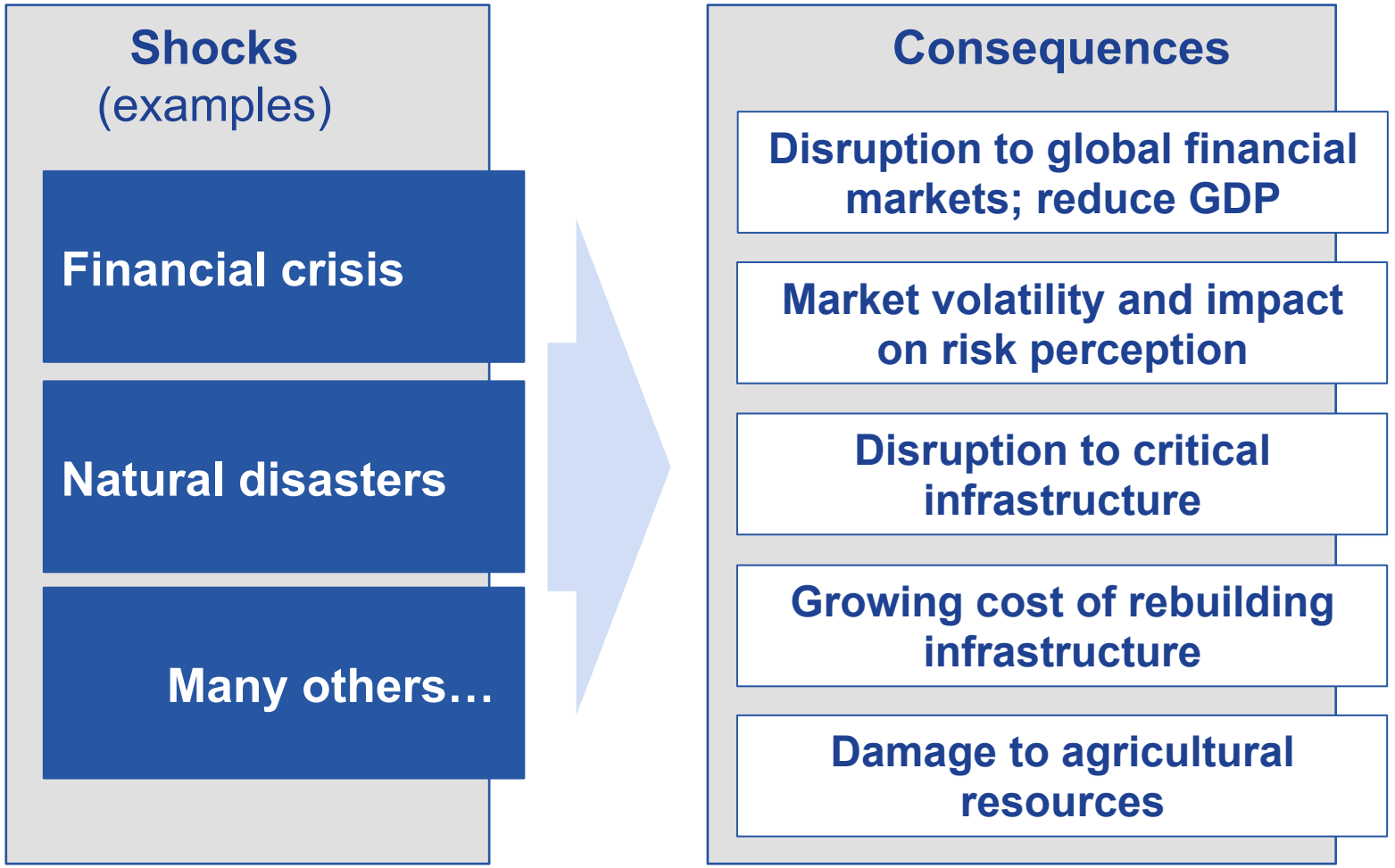
Shocks and their consequences



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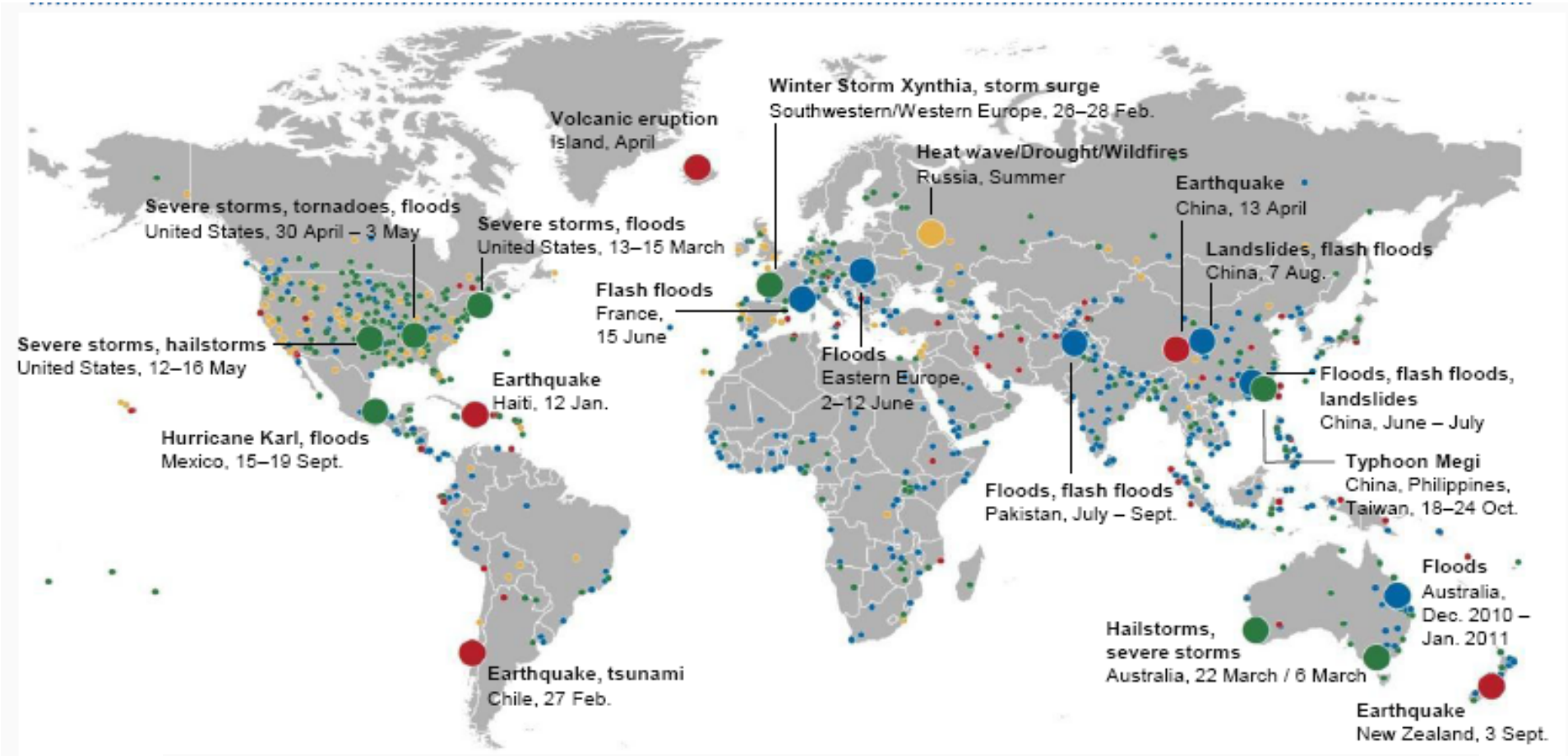
Natural Catastrophes

Over 960 events in 2010



Source: Munich Re, 2011

Constraints and their consequences

Constraints
(examples)

- **Commodities** 
- **Water** 
- **Many others…**

Consequences

- **Increasing fuel and manufacturing costs**
- **Less availability of water resources**
- **Stricter regulation and permitting requirements**
- **More limited availability and competition for land**
- **Growing demand for substitutes**

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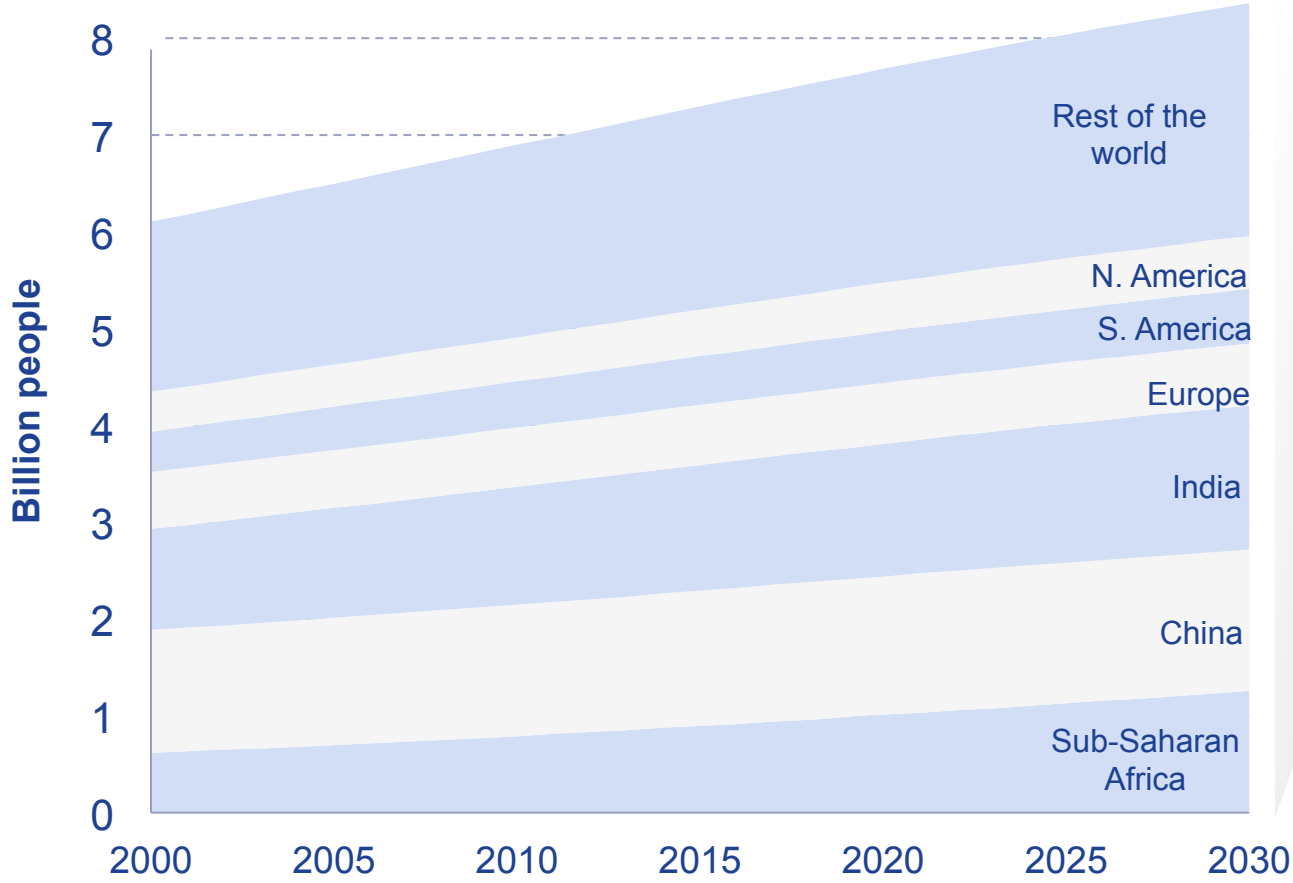
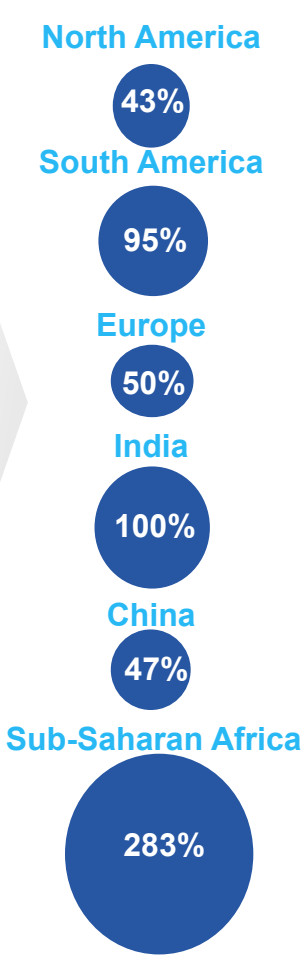
Population growth

Pressure increasing on water resources

Projected world total population: **8.4 billion** in 2030



Increase in annual water demand 2005-2030



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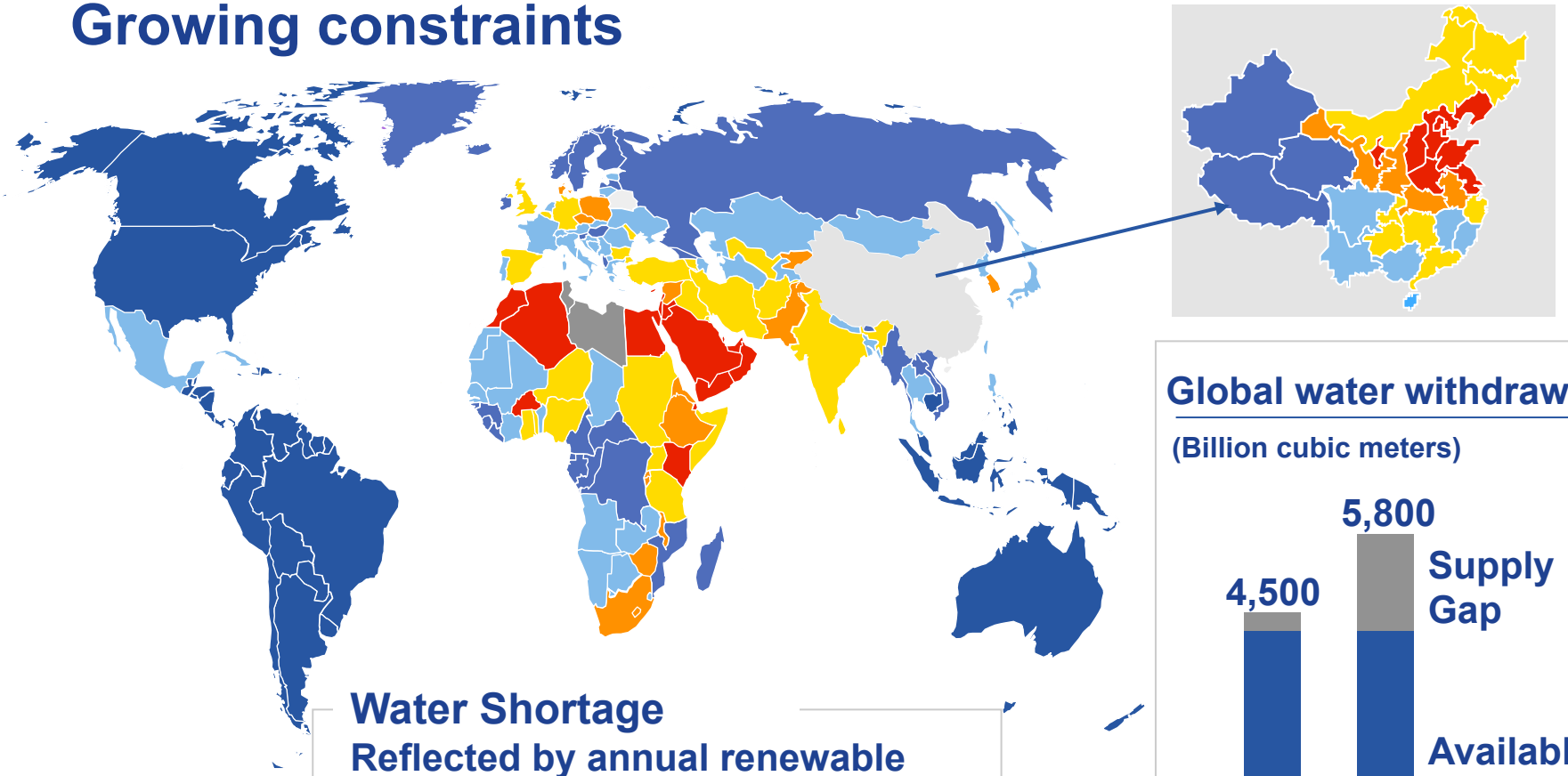
Source: GSP 2011, http://money.cnn.com/galleries/2011/technology/1110/gallery.water_shortage_solutions.fortune/3.html

Future water outlook

Growing constraints



Source: Black, Maggie and Jannet King. *The Atlas of Water, 2009.*

Source: 2030 Water Resources Group, 2009

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Energy-Water Nexus

Constraints force four potential paths

Options

Shift to alternate water source… saline or brackish water

Apply water reduction technologies… closed-loop cooling towers and dry air- cooling

Shift to zero water use technologies… wind, solar PV, gas turbines

Shift resources away from other sectors… agriculture, domestic

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Energy-Food Nexus

Driving sustainability

Energy required to make food… 10 units of fossil energy to produce one unit of food energy

Energy directed to food processes…
10% of US consumption, ~5% of Global energy consumption

1%
Food Processing and Manufacturing

2%
Food Transportation

2%
Agriculture

5%
Packaging, Preparation Refrigeration, Handling Sales and Services

US Energy Budget Spent on Food-

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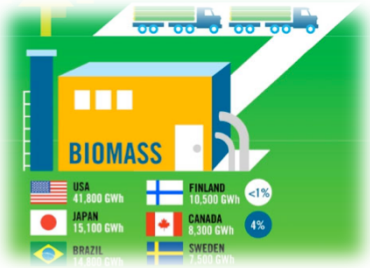
Energy-Food Nexus

Where we can improve efficiencies

Areas to reduce energy needs…

- ✓Ag Waste to Power
- ✓Drip Irrigation
- ✓No-Till Farming
- ✓Laser-Leveling Fields
- ✓GPS Driven Machinery
- ✓Reducing Spoiled & Wasted Food



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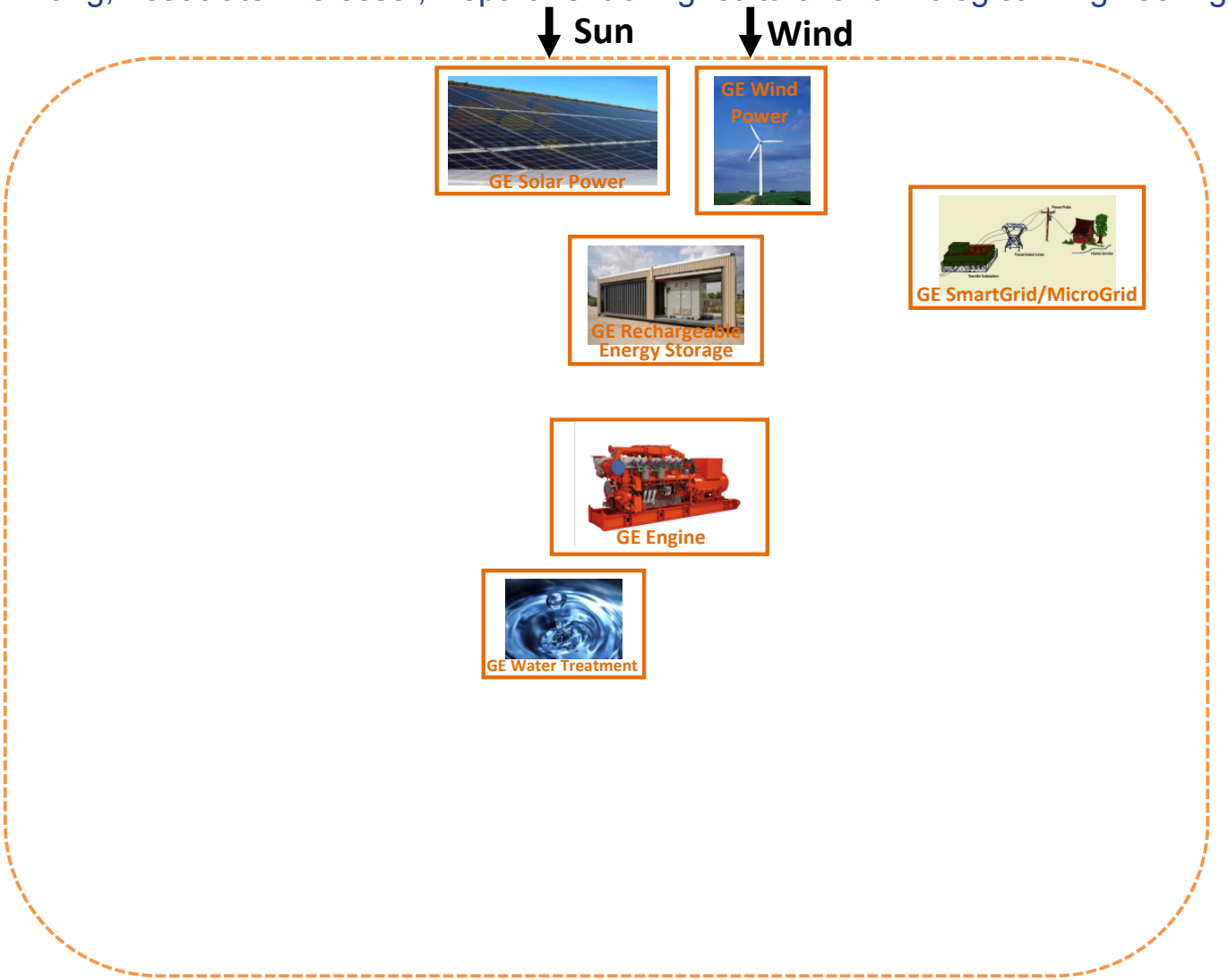
Collaborative efforts with UIUC

Courtesy Dr. Xinlei Wang, Associate Professor, Department of Agricultural and Biological Engineering



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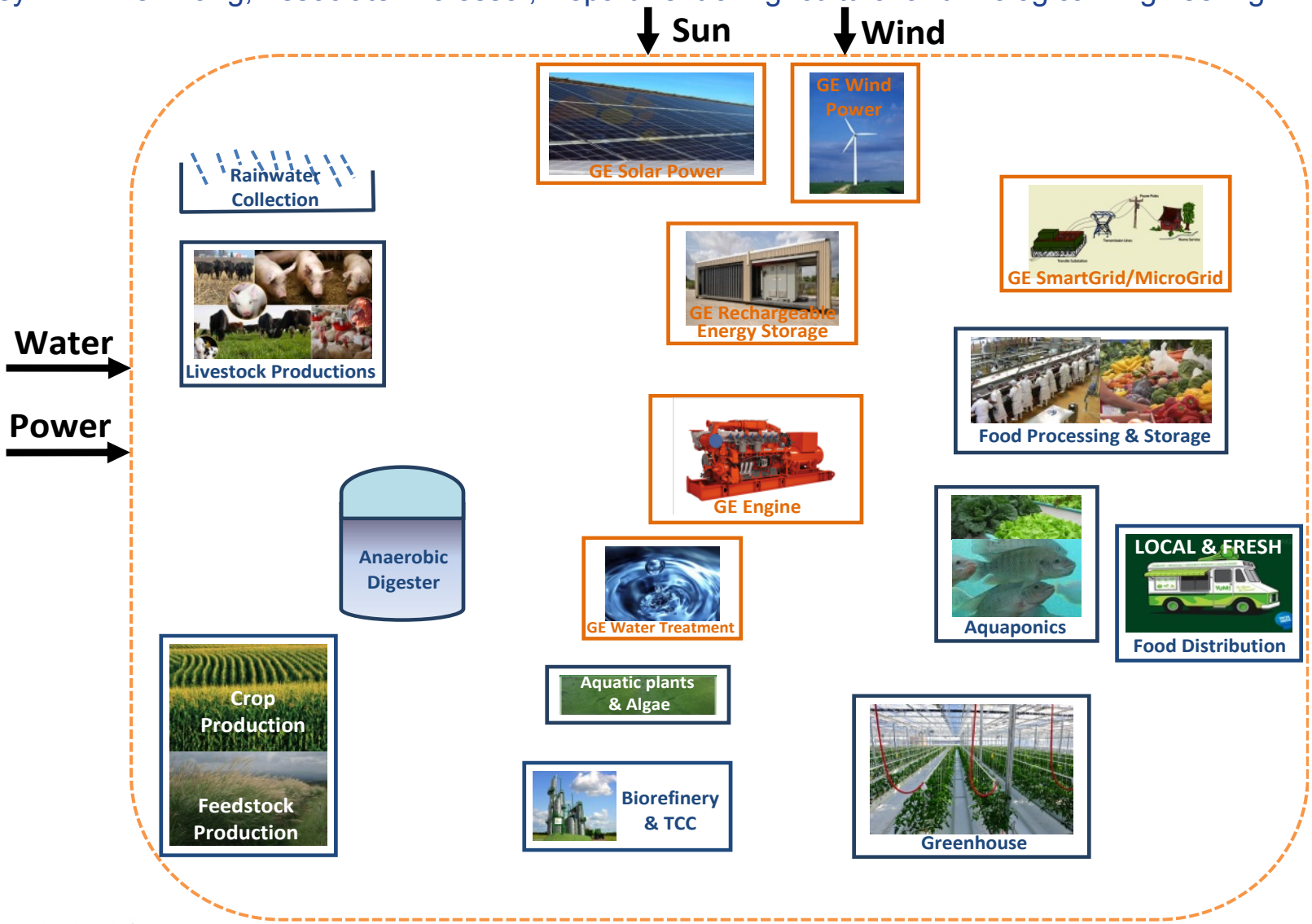

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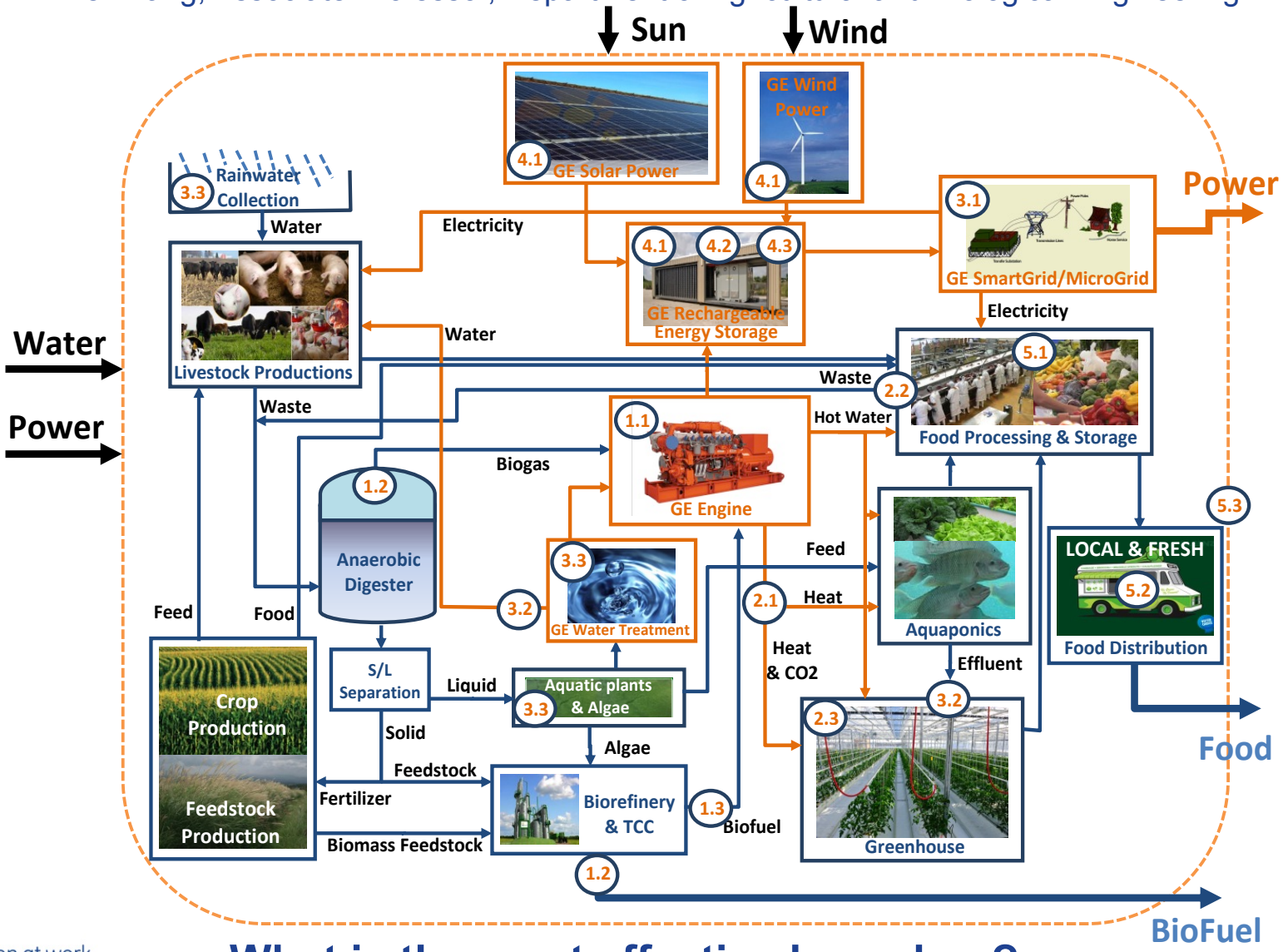

What is the most effective boundary?

Summary

Megatrends, shocks and constraints will shape the future interaction between the global energy, water and food systems

How will this interaction play out in the coming decade?

- **greater crisis, conflict; or**
- **greater application of technology and smart policy**

Where are our greatest gaps in understanding these interactions?

Where can collaborative research be applied most effectively to advance sustainable global water, energy and food systems?

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