

WORLD
in Stockholm,
August 31-September 5, 2014
WATER
WEEK

Presentation from the
2014 World Water Week in Stockholm

www.worldwaterweek.org



Understanding the links

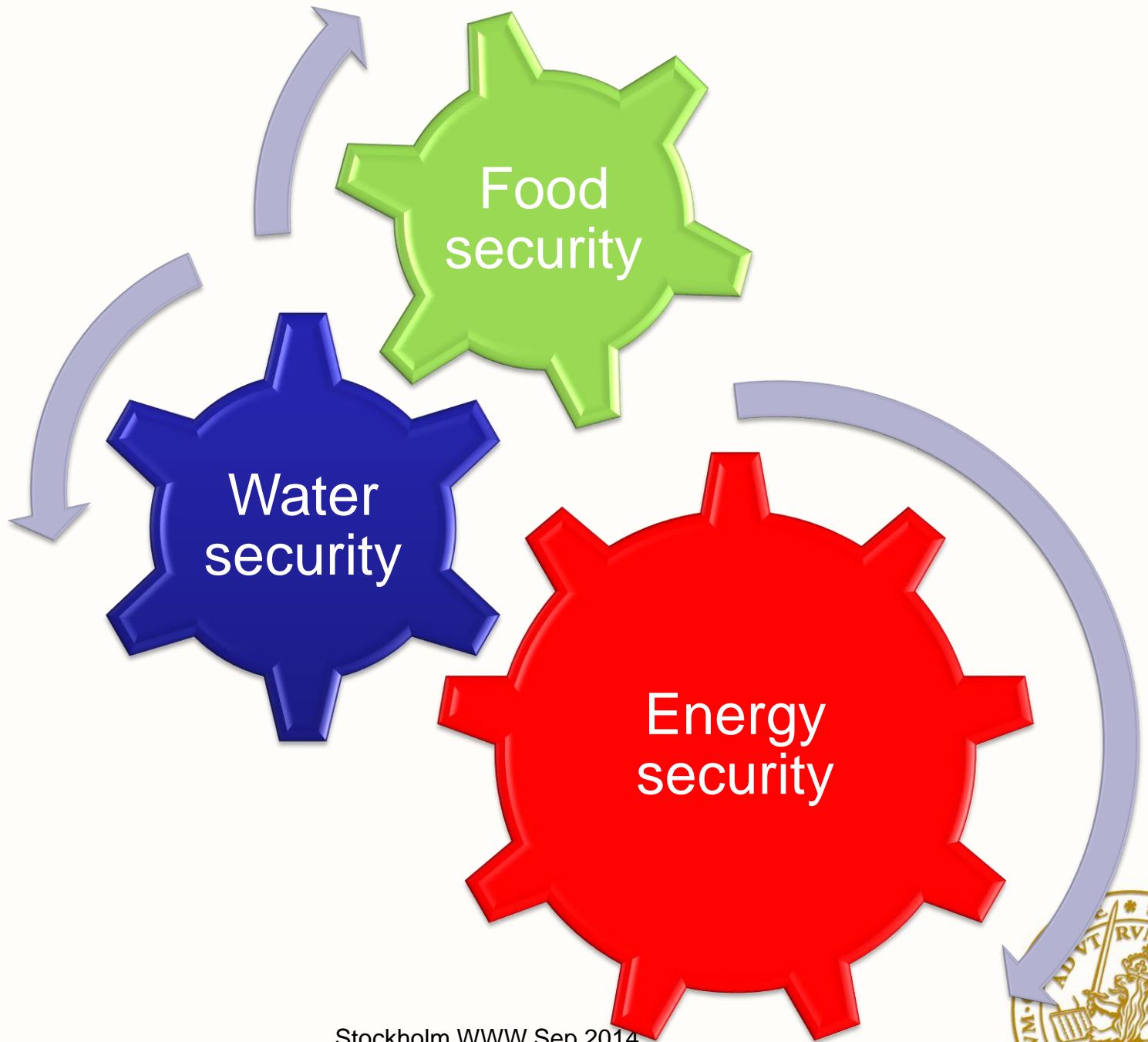
Energy generation –

Water resources - Environment



Gustaf Olsson

Lund University, Sweden
Stockholm World Water Week
3 Sep. 2014

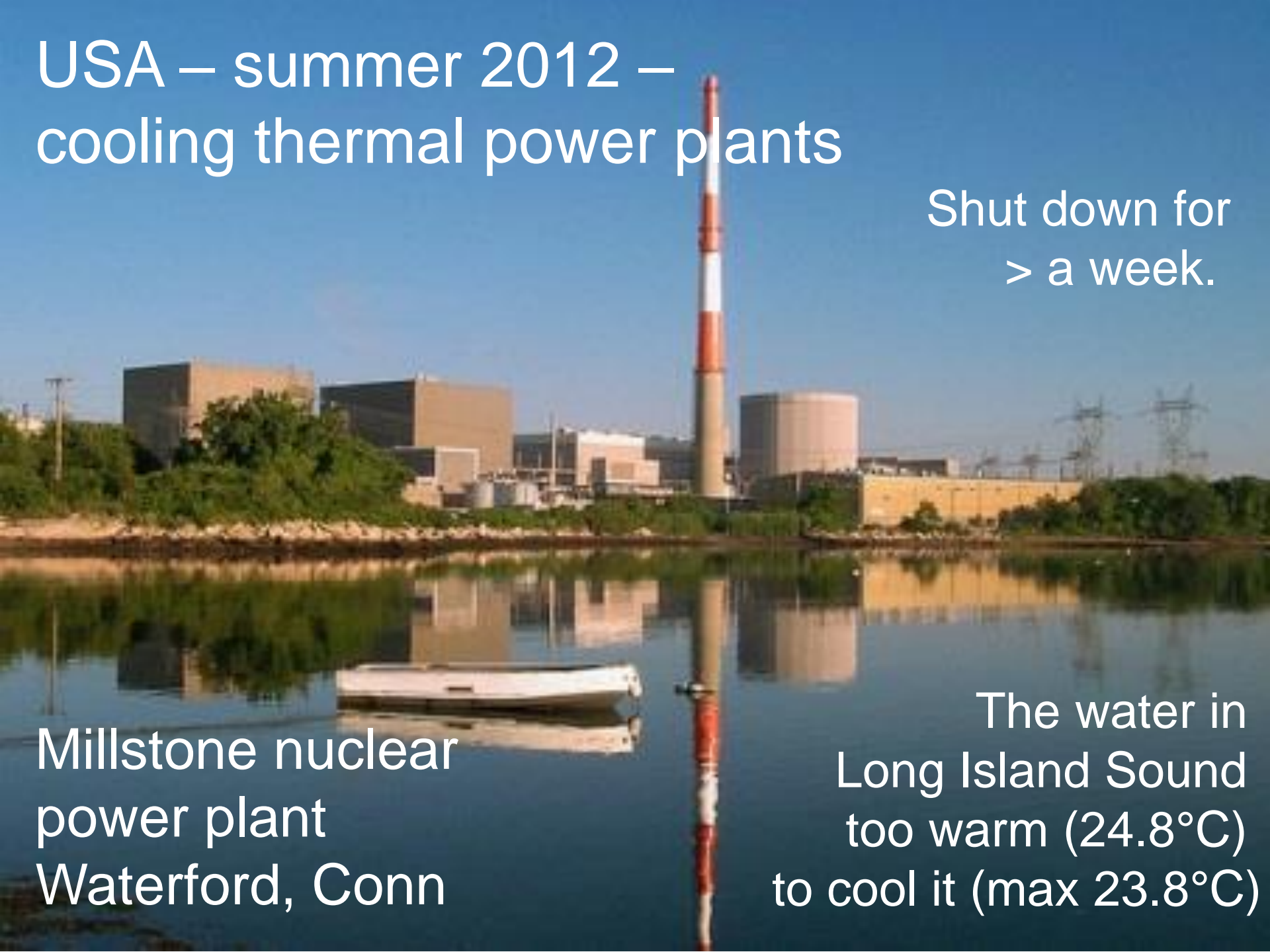


USA – summer 2012 – cooling thermal power plants

Shut down for
> a week.

Millstone nuclear
power plant
Waterford, Conn

The water in
Long Island Sound
too warm (24.8°C)
to cool it (max 23.8°C)



France 2003 – the hot summer

A photograph of a nuclear power plant at sunset. Two large cooling towers are in the foreground, emitting thick plumes of white steam that rise into the sky. In the background, a large containment dome is visible, partially obscured by the setting sun. The sky is a mix of blue, orange, and yellow, with some wispy clouds. The overall scene is dramatic and somewhat somber.

“Nuclear plants forced to cut back were partly responsible for the deaths of over 10,000 people”

Nuclear capacity reduced 7-15% during 5 weeks -- too warm cooling water

Evaporation (site specific!)

Upstream withdrawals - downstream ecology

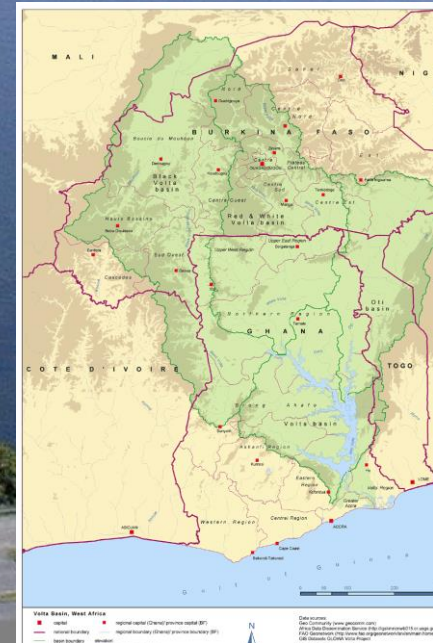
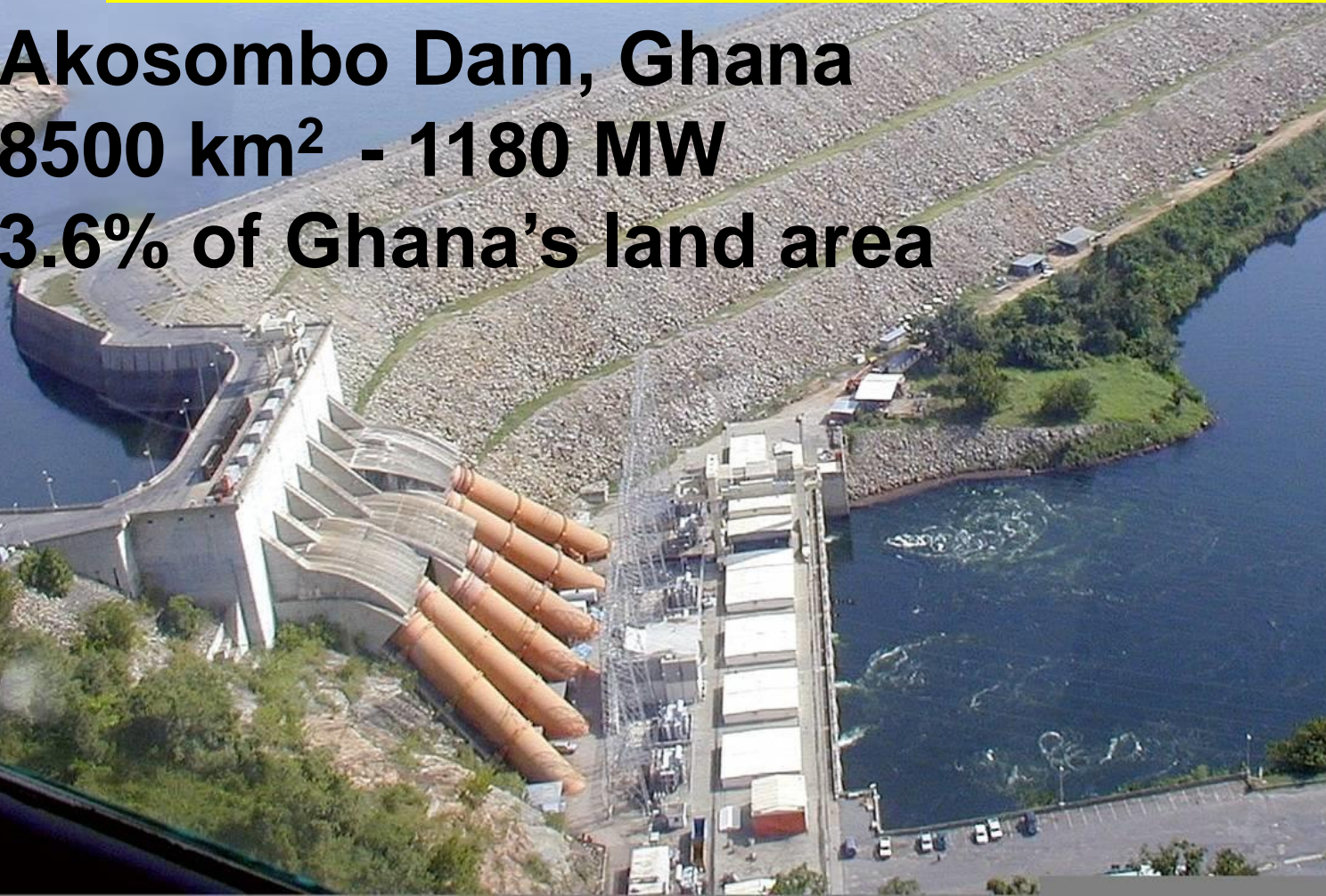
Transboundary issues

Risk vs. economy

Akosombo Dam, Ghana

8500 km² - 1180 MW

3.6% of Ghana's land area



Roughly 200 tanker trucks deliver water for the fracturing process.

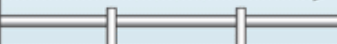
A pumper truck injects a mix of sand, water and chemicals into the well.

Natural gas flows out of well.

Recovered water is stored in open pits, then taken to a treatment plant.

Storage tanks

Natural gas is piped to market.



0 Feet

Water table

Well

1,000

2,000

3,000

4,000

5,000

6,000

7,000

Hydraulic fracturing

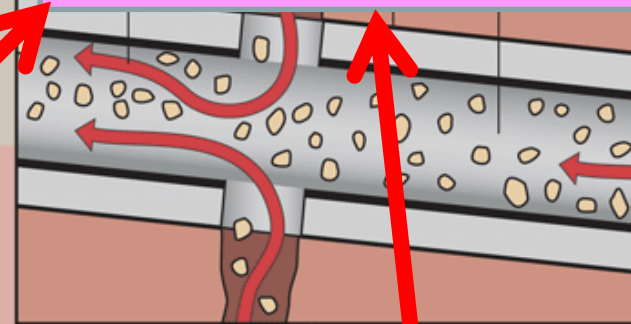
across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes

15 – 20,000 m^3 of water

Down to 3000 m

Up to 100 Mpa
Up to 265 liters/s

**Water quantity
Water
contamination**



Fissures

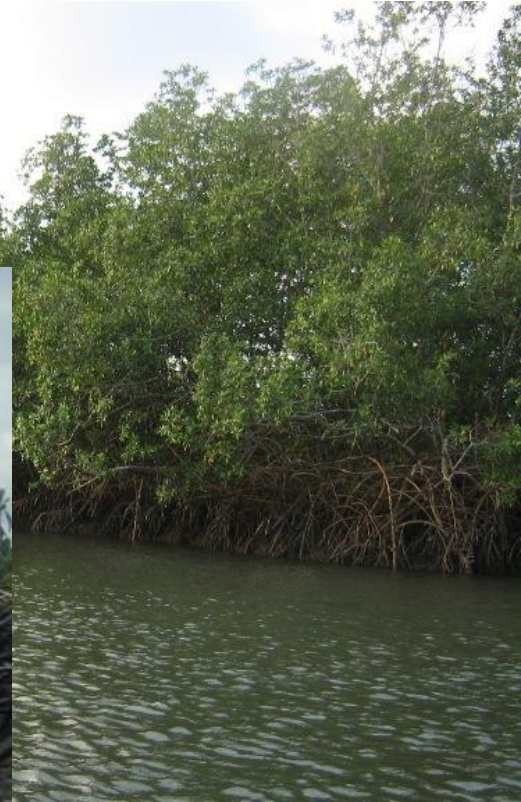
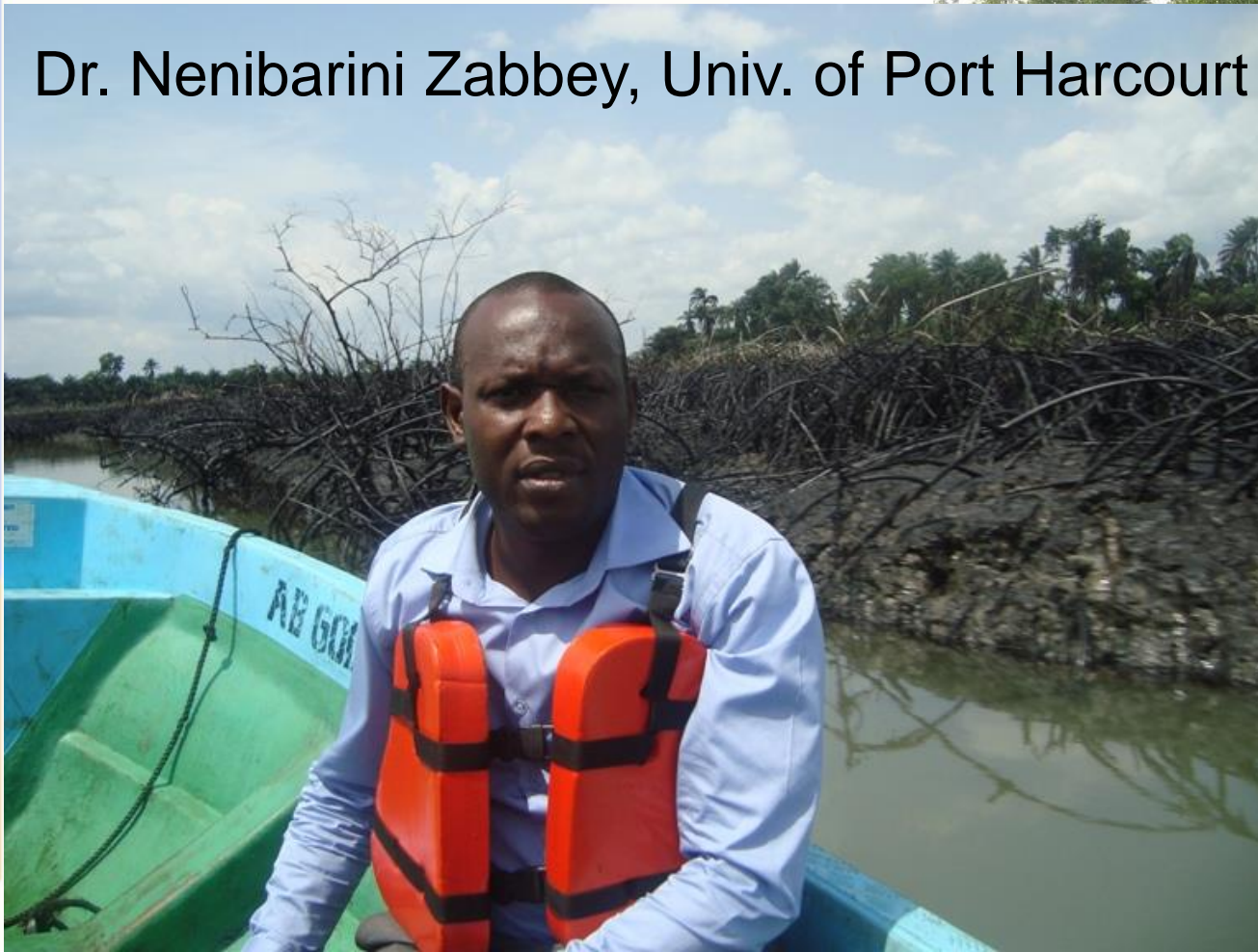
About 750 chemicals listed as additives

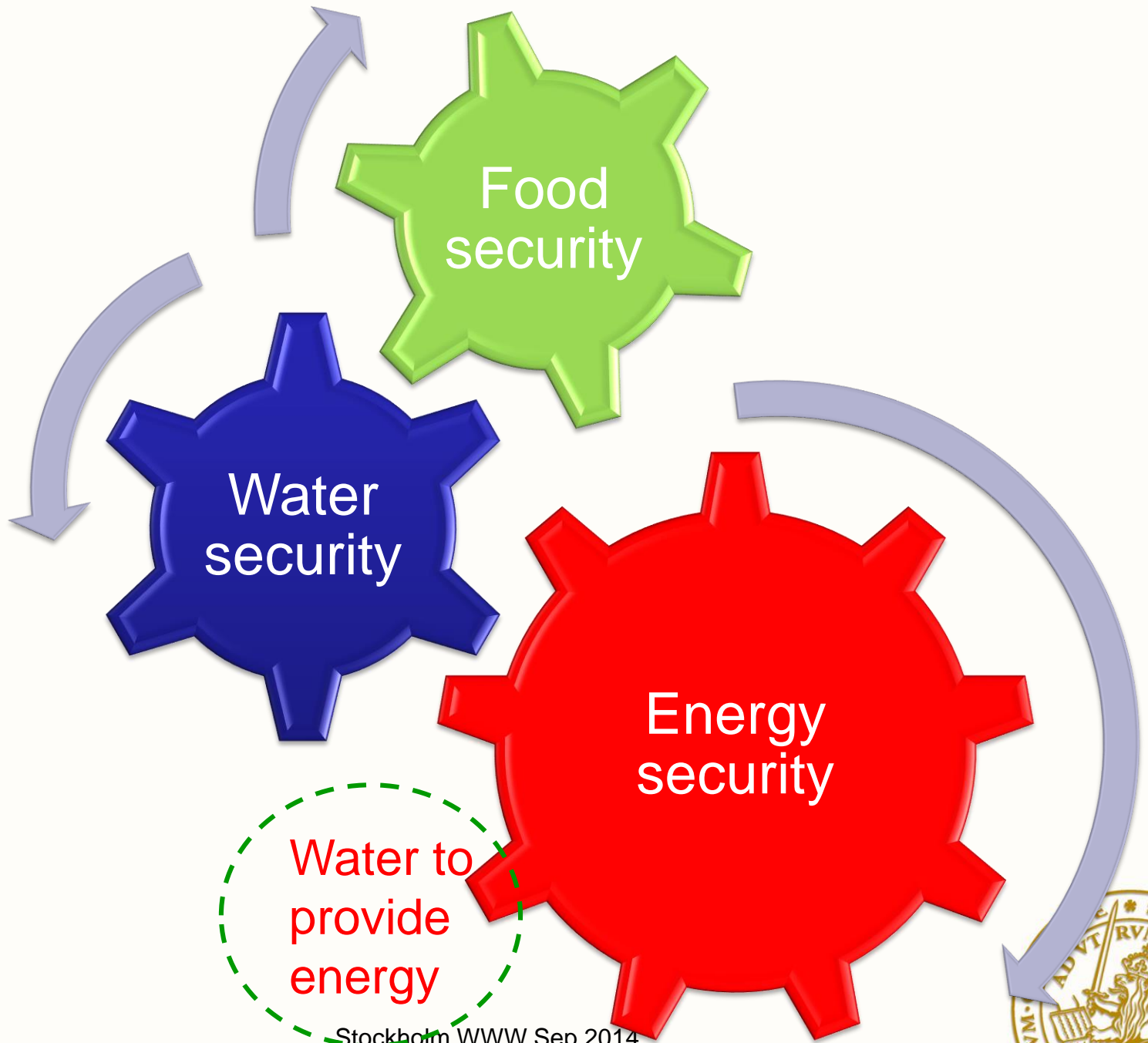
The shale is fractured by the pressure inside the well.

Niger Delta wetland

Sivibilagbara swamp
before oil spill

Dr. Nenibarini Zabbey, Univ. of Port Harcourt





Water to provide energy

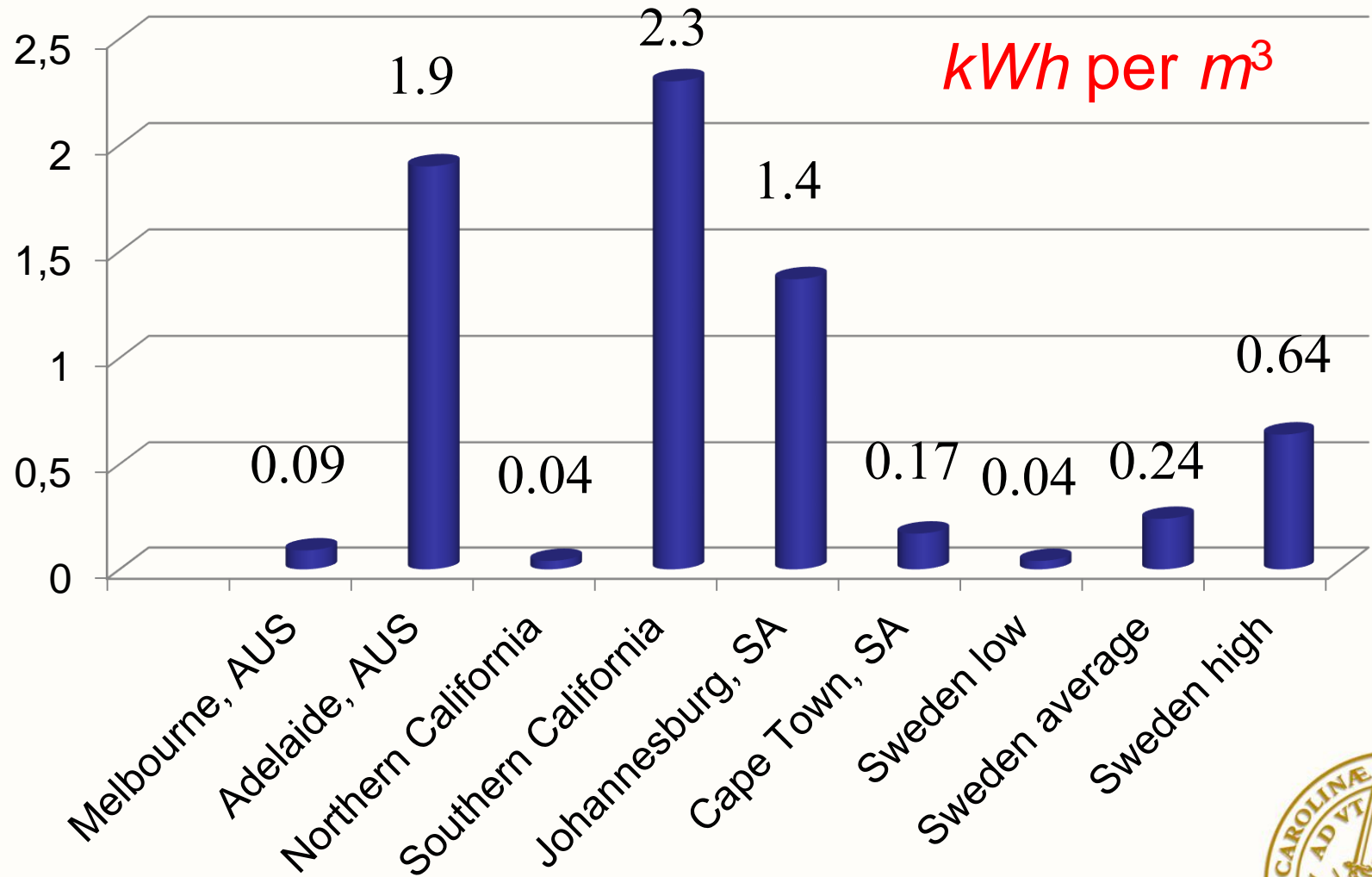


Energy cost to produce cold water

	kWh / m ³
Surface water	0.5 - 4
Recycled water	1 - 6
Desalination	4 - 8
Bottled water	1000 - 4000



Pumping from source to waterworks



Clean Water Requires Energy!

- **Pumping**
 - Having efficient pumps for **adequate** flows
 - Operating at **dynamically** changing flows and pressures
- **Aeration in wastewater treatment**
 - Adequate compressors
 - Controlling the air flow for **variable** loads

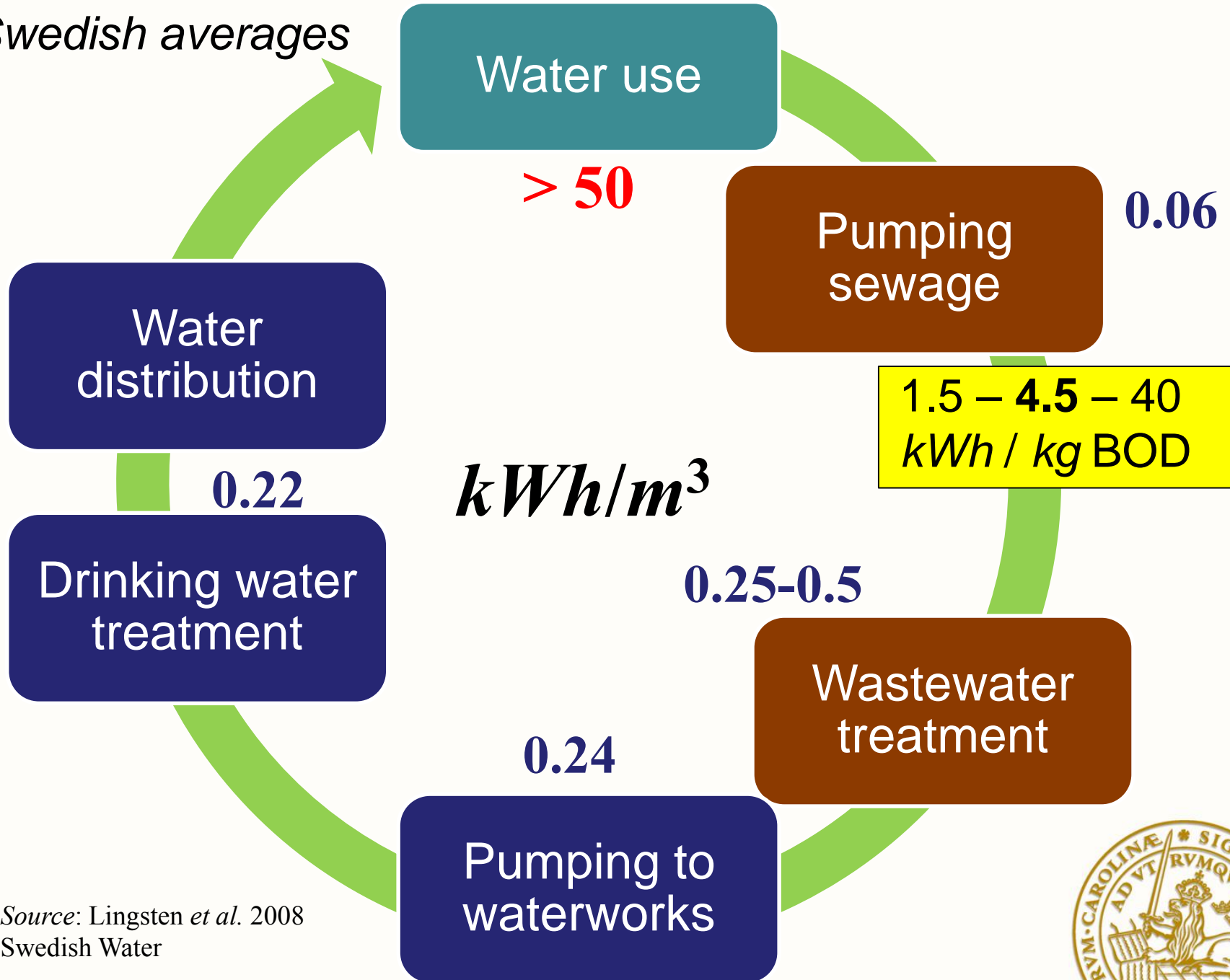


Increase efficiency!

Minimize air flow!



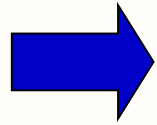
Swedish averages



Source: Lingsten et al. 2008
Swedish Water

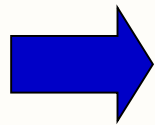


With increasing water scarcity....



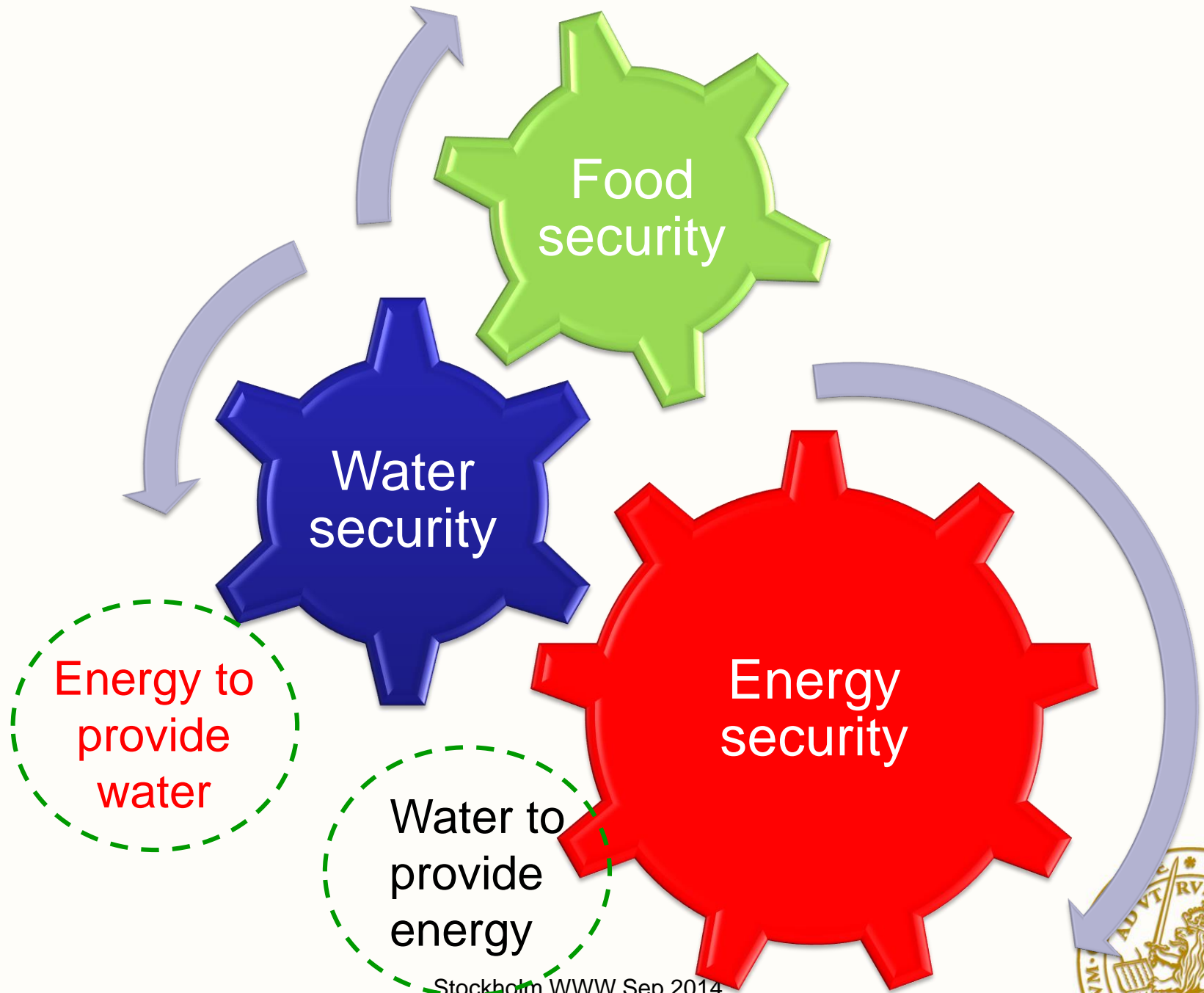
**Increased energy
for pumping
(deeper – longer)**

**Impaired, reused,
brackish, sea water**



**New technologies to
access/treat water
will use more energy**





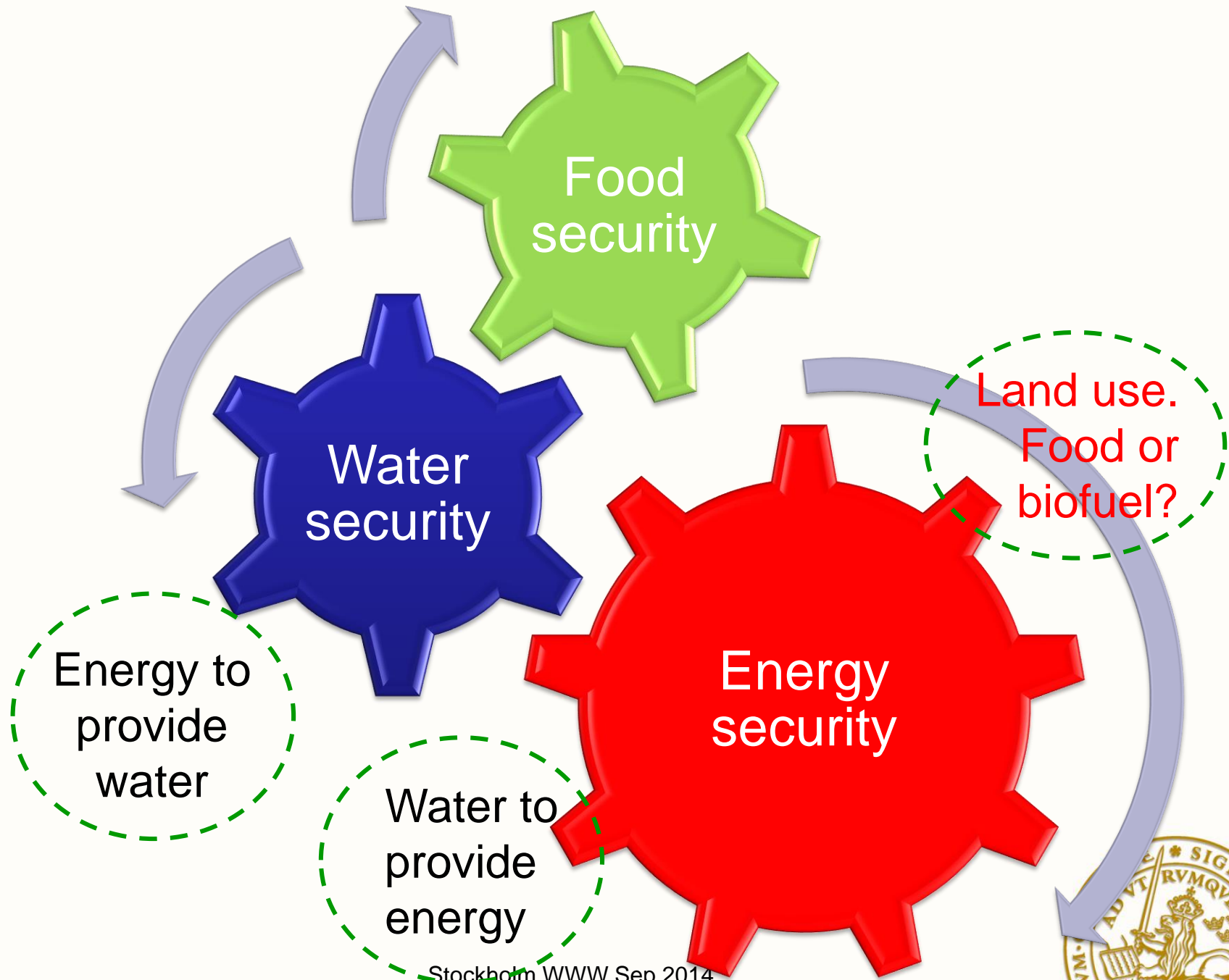
**Summer 2012 in USA –
worst drought since the 1950s -
80% of agricultural land was affected.**

Price of corn soared

Corn for ethanol or for food?

**USA - corn for ethanol production:
2000: 7% of supply
2014: 40% of supply**

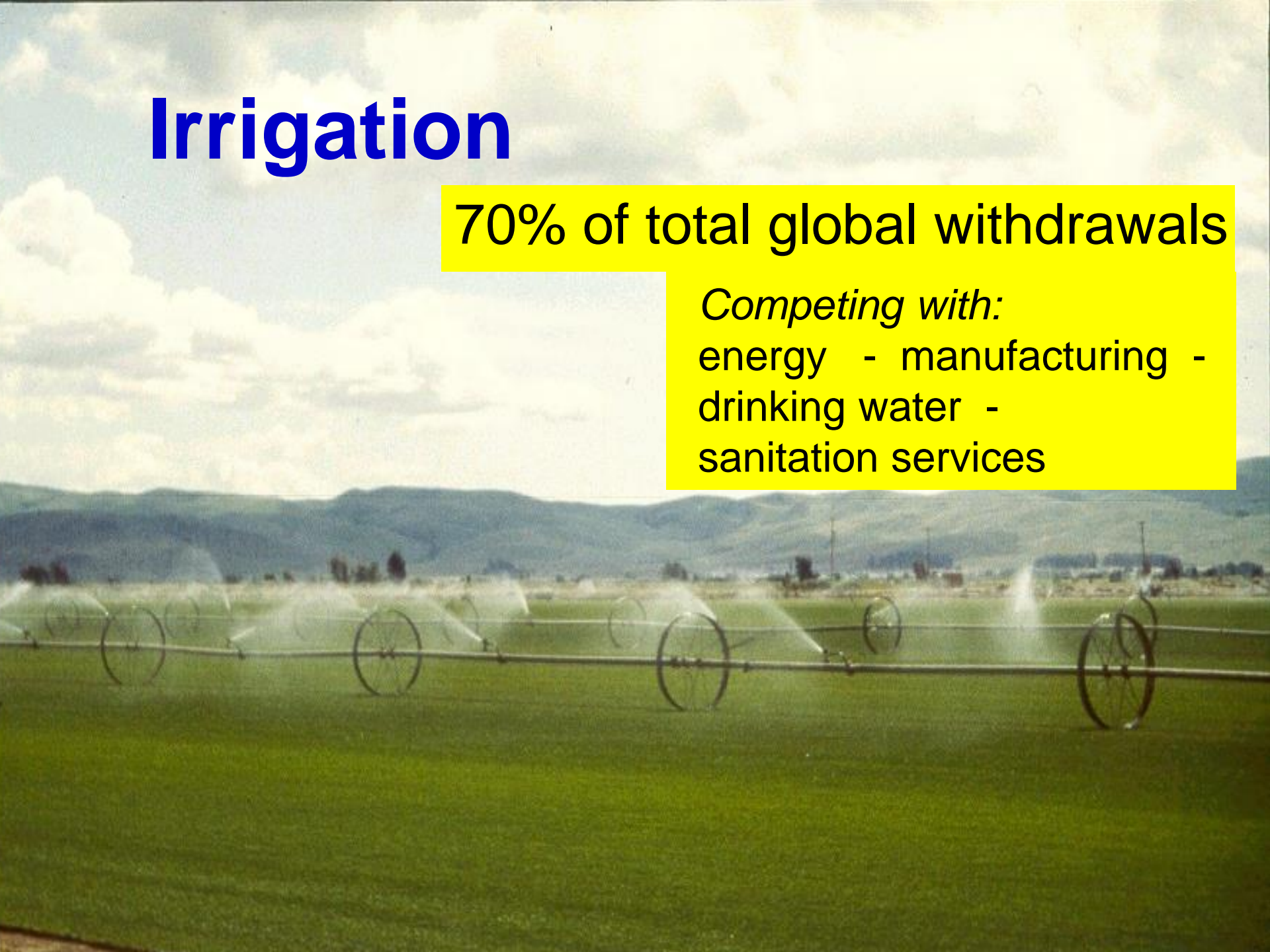




Irrigation

70% of total global withdrawals

Competing with:
energy - manufacturing -
drinking water -
sanitation services



Water for food

- More than **90%** of freshwater withdrawals in most of the **world's least developed countries**
- Without improved efficiencies, agricultural water consumption is expected to **increase** by about **20%** globally by 2050



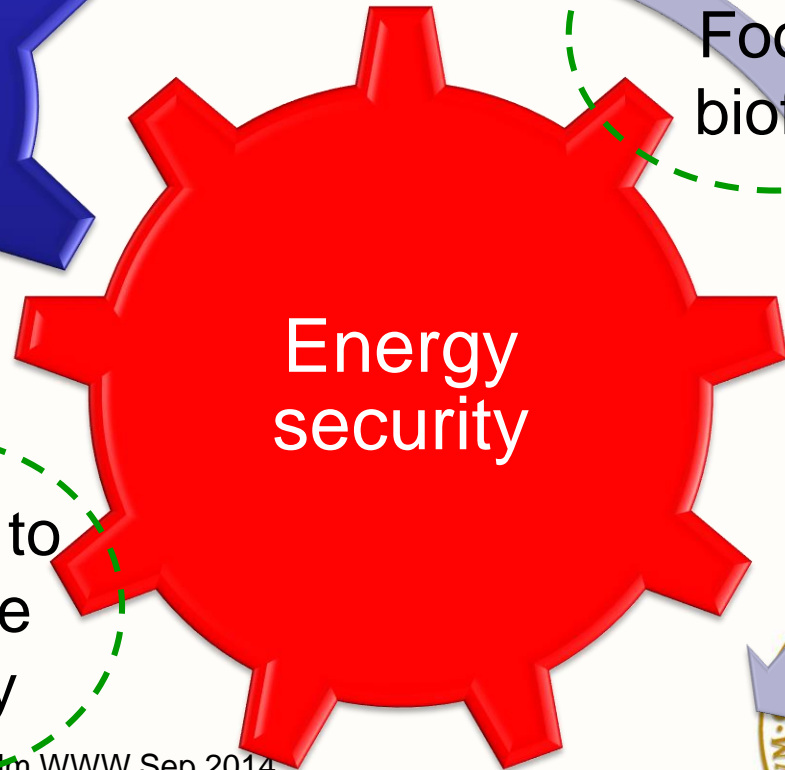
Water supply and quality for food production



Impact of agriculture on water supply and quality



Land use. Food or biofuel?



Energy to provide water

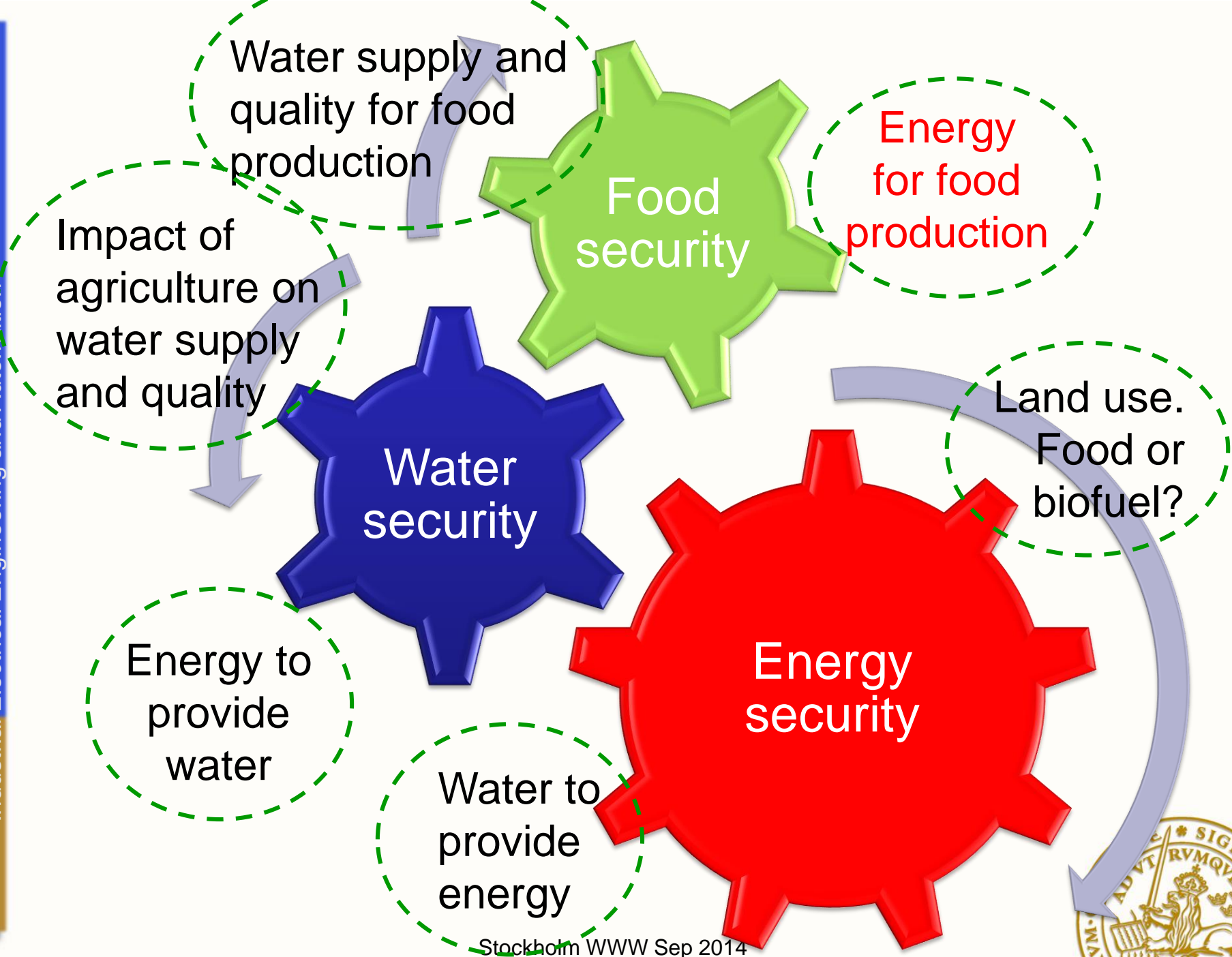
Water to provide energy

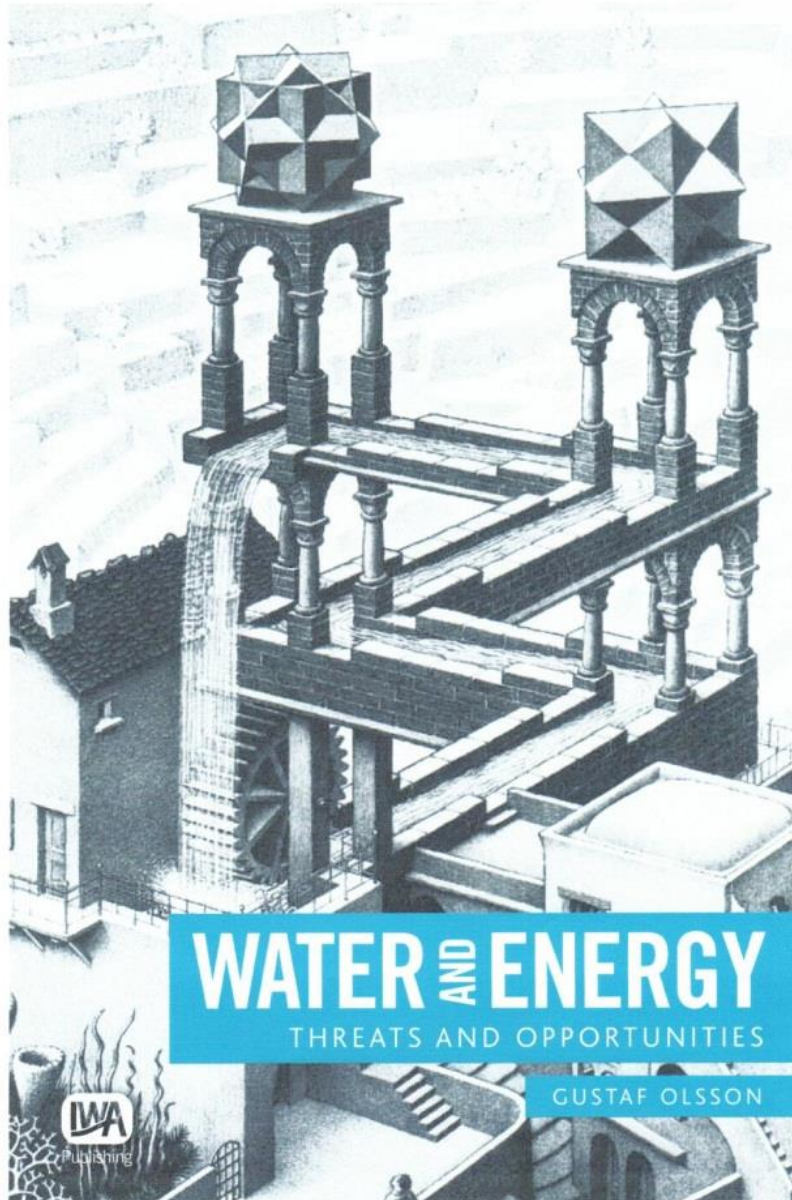


Energy for food

- The food production and supply chain accounts for about ***one-third*** of total global energy consumption.
- Water requires ***little or no treatment*** – most of the energy is for ***pumping***







Thank you!

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IWA Publishing 2012

