Water scarcity: technology is not the problem – its decision making

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Overview

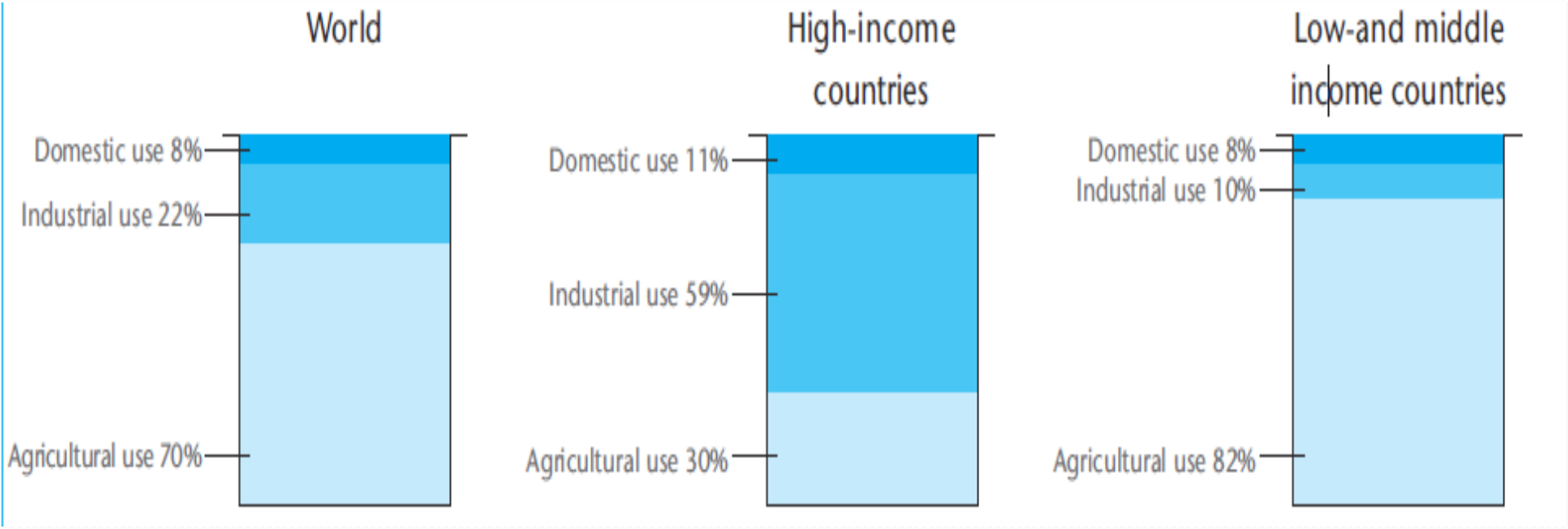
- Global situation
- Water scarcity in Kazakhstan, Brazil and the UK
- Doing things differently
- Implementing change

Global current situation

- 9 countries possess 60% of the world's available fresh water supply
- Since 1900 >11 million people have died and >2 billion people have been affected by drought
- Groundwater is crucial for the livelihoods of 1.5 billion rural households in Africa and Asia
- Nearly all Middle East countries suffer from water scarcity
- No water no business:
  - ~35% of industrial water use in the USA and China relates to energy production
  - Production processes, chemical reactions, product components, waste disposal
- Transboundary water management is very challenging

UNISDR, 2011; Corcoran et al., 2010; nationalinterest.org

Who uses freshwater?



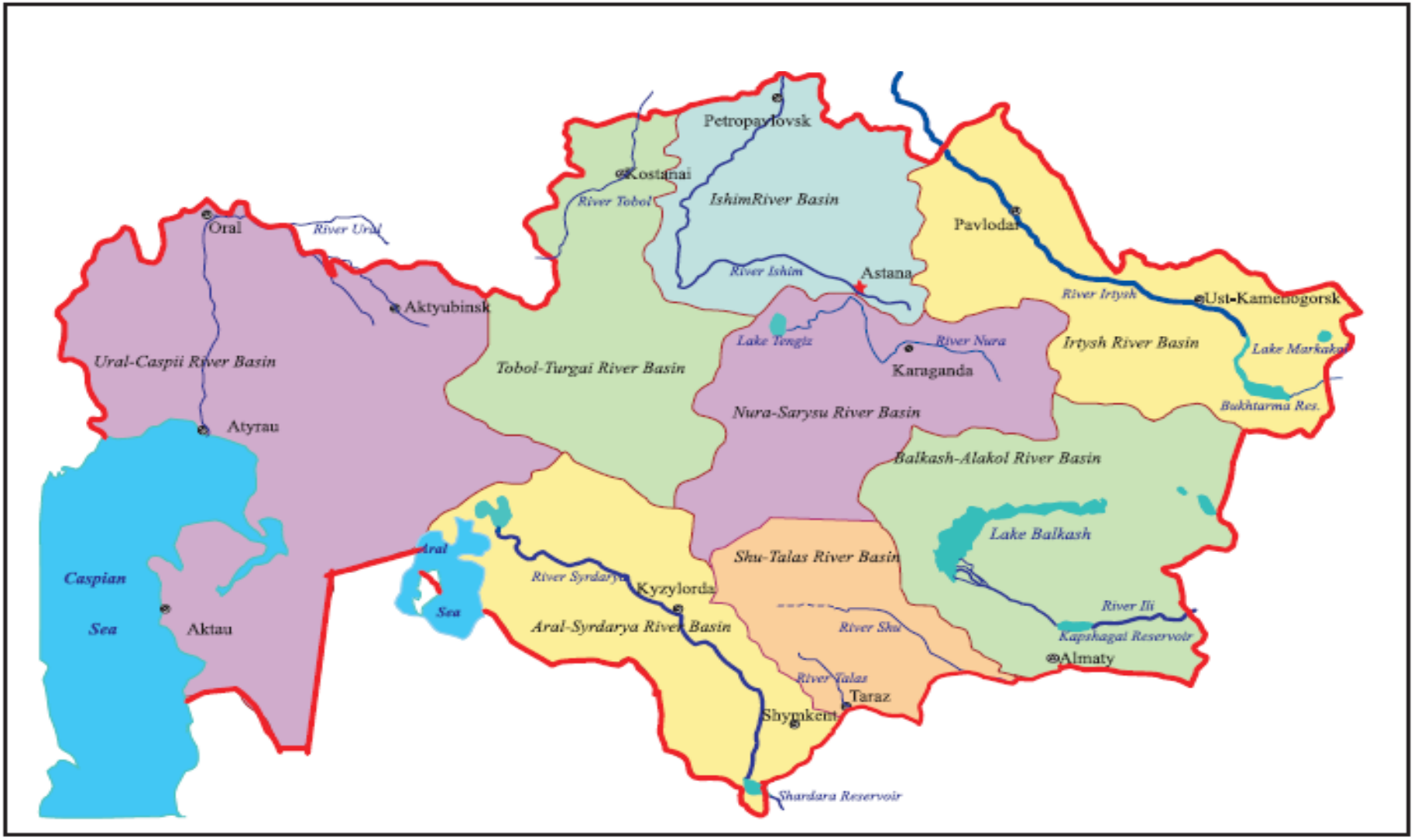
World Business Council for Sustainable Development, 2006

Global situation – moving forwards

- More water will be needed to produce more food for 3 billion more people
- Improved lifestyles / changing diets require more water and more energy
- Water withdrawals predicted to increase by ~ 25% in developing countries
- Agricultural water consumption estimated to increase by ~19% by 2050
- A 60% increase in demand for energy over the next three decades
- Other economic sectors will continue to compete for water resources

UNEP, 2007 and 2011, World Business Council for Sustainable Development, 2006

Main river basins in Kazakhstan



Source: *Water Resource Committee of the Republic of Kazakhstan*

Current situation: Kazakhstan

- Water consumption: Agriculture (75%); industry (18%); domestic (7%)
- 75% population receive piped water (household or stand pipe; 30% losses)
- 50% of water pipelines in Astana do not meet quality standards
- Water use per capita: 206 l/d (Almaty); 10-16 l/d (North Kazakhstan and Zhambyl)
- In urban areas, 56-69% of wastewater collected; 10-85% is treated
- Water loss during irrigation: 65-70%

WHO/UNICEF Water Supply Statistics, 2015

Transboundary water management

- Operation of the Toktogul Reservoir (Uzbekistan, Kyrgyzstan)
- Abstraction from the Irtysh and Ili rivers (China)

RFA (2013)

Drying up of the Aral sea - impacts

Latin-America: general context

- Population growth, expanded industrial activity, high irrigation demand
- Ten-fold increase in total water extraction over 20th century; grew by 76% from 1990-2004
- Glaciers are receding affecting water supply of ~ 30M people
- Droughts occur regularly e.g. Brazil - 2002, 2003, 2010, 2012, 2013, 2014-2016

UNEP, 2010

Brazil: current situation:

- 12% of the world's freshwater; semi-arid regions in the NE
- Water use: Agriculture (54%); domestic (25%); industry (17%)
- Average per capita use = 166 l/d
- Water supply coverage:
  - Urban = 97%
  - Rural = 85%;
  - Variations: 47% (N) and 69% (NE)
- Water distribution losses = 37%
- 48% domestic sewage collected of which 39% is treated

Droughts in Brazil

- Rainfall (400-1500 mm/year): evapotranspiration (2,000-3,000 mm/year)

2012 and 2013 drought:

- Almost all rain-fed agriculture destroyed
- Majority of cattle died, were transferred or sold for a lower price
- Small family farmers in the semi-arid regions are most vulnerable - lost ~ 95% of beans, maize and manioc crops

2014-2016 drought: Cantareira system, Sao Paulo

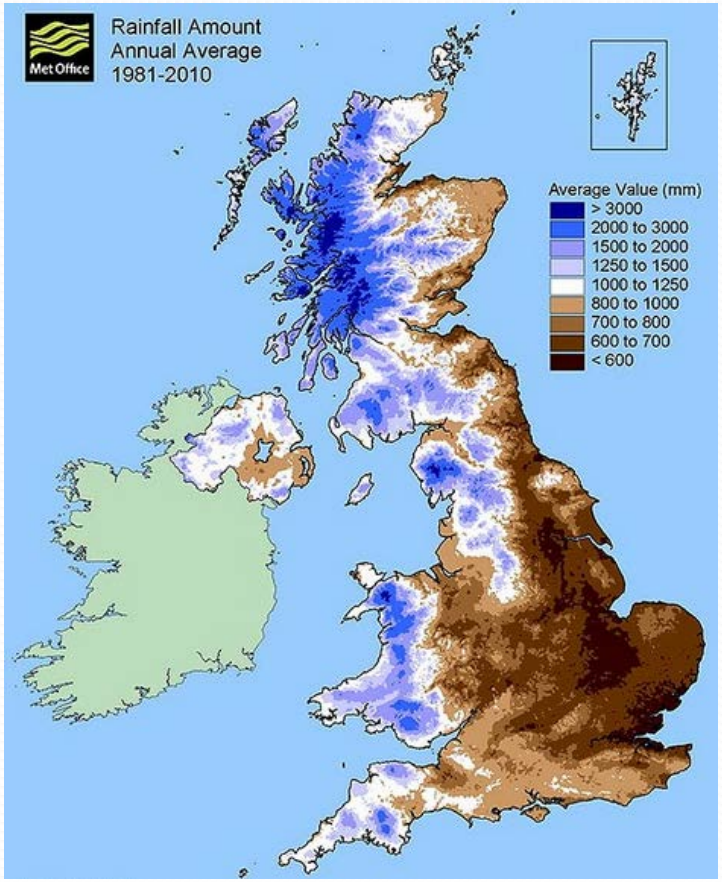
http://www.telegraph.co.uk/news/picturegalleries

Impacts?

- Water rationing in 93 cities
- 70% of Brazil's electricity is generated by hydropower
  - Energy rationing
  - Lights and internet cut for days - residents and business
  - Blackouts (high demand for air conditioning)
- Chemical, beef and coffee manufacturers halting production
- Residents hoarding water led to an outbreak of dengue
- Poor affected most - short of water for drinking, cooking and washing

UK: general context

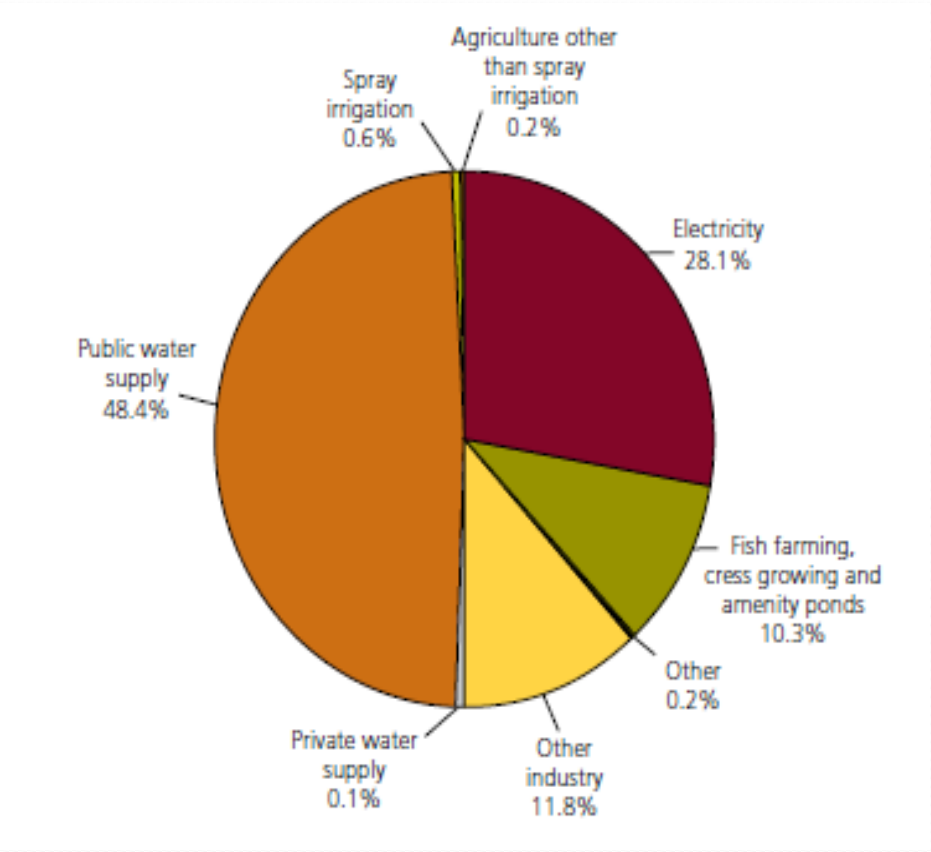
- Rainfall: <700mm - >3000mm
- UK climate trend towards milder winters and hotter summers
- Average per capita water use: 150 l/d
- Water distribution losses ~ 25%
- UK water companies:
  - supply around 16,600 Ml/day of drinking water across the UK
  - currently a supply/demand surplus of ~2,000 Ml/day,
  - modest deficits in some water resource zones



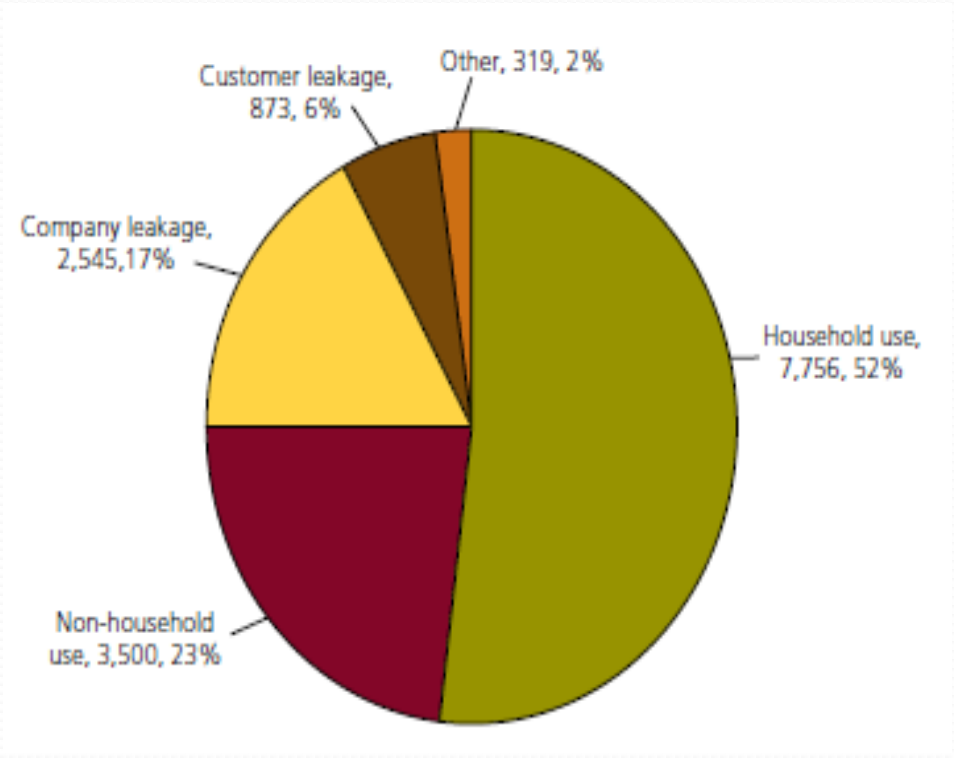
Met Office, 2015

Use by sector

Licensed abstractions, England and Wales (%)

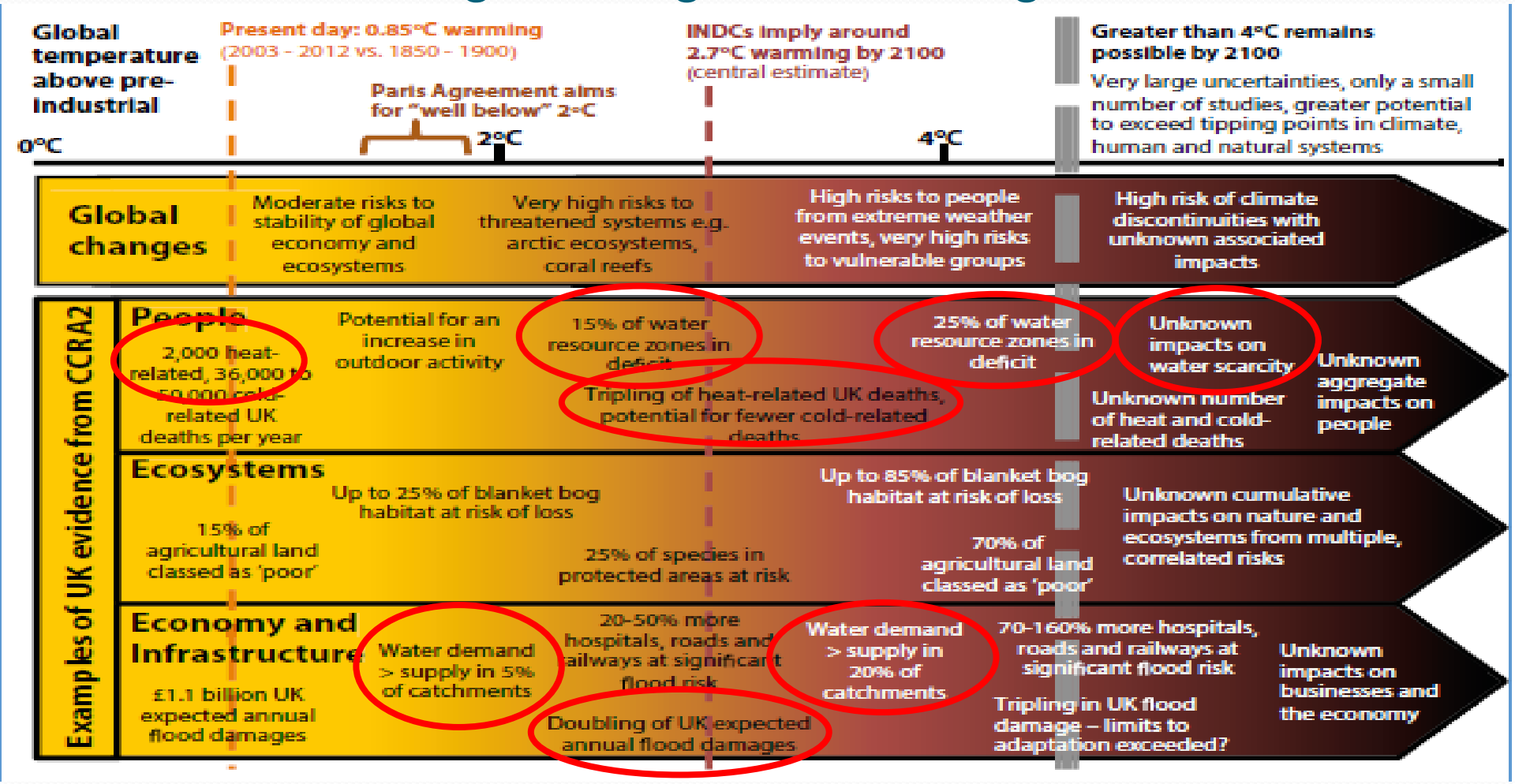


Public water supply, England and Wales (Ml/day &%)



Ofwat, 2007

Magnitude of UK climate change impacts for various degrees of global warming



UK Climate Change Risk Assessment 2017 Evidence Report

UK: predications moving forwards

Nationally the UK projected to be in deficit :

- 5 – 16% of total demand in the 2050s,
- 8 – 29% of the total demand time in the 2080s.

Difficult trade-offs between sectors

- Household water supply interruptions
- Crop production in parts of England and Scotland become unviable
- Reduced electric and hydroelectric power generation
- Business operations impacted
- Shrink–swell processes damage surface and buried infrastructure
- Saltwater intrusion risks to aquifers, farmland and habitats

Cascading infrastructure failures across interdependent networks

UK Climate Change Risk Assessment 2017 Evidence Report

Doing things differently (1): Sustainable urban drainage systems

- Treat stormwater as close as possible to its source
- Infiltration/detention followed by discharge at a controlled rate
- Jointly address stormwater control from water quantity, water quality and public amenity perspectives
- Used individually, in a treatment train or in combination with conventional piped systems

Types of SUDS

Benefits of green infrastructure

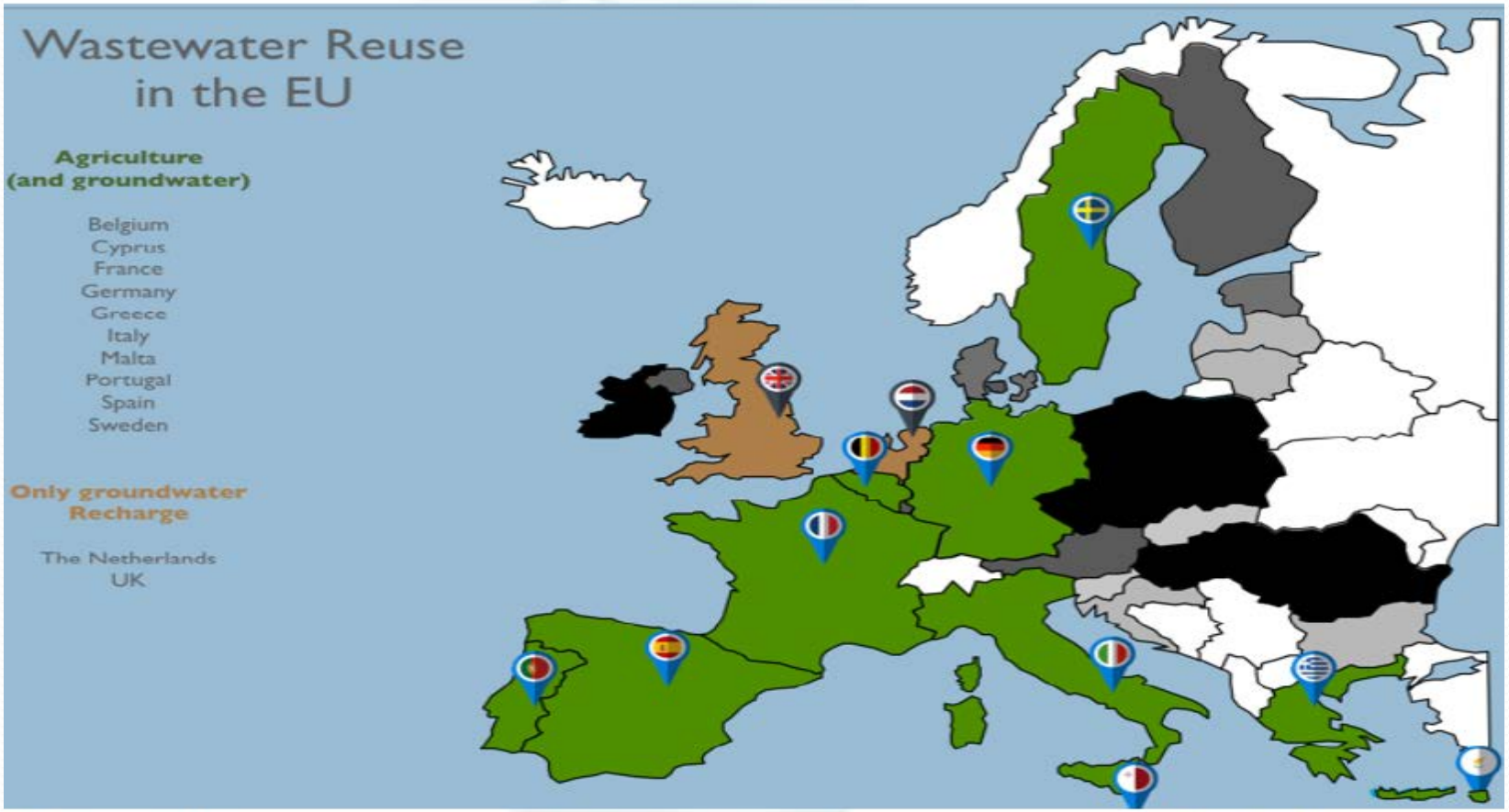
- Reduce surface runoff volumes
- Enhance surface water quality
- Mitigate urban heat island effect
- Enhance air quality
- Provide habitat
- Physical and mental health well-being

Doing things differently (2): Wastewater reuse

- 60/193 countries reuse wastewater for different purposes
- Agriculture (51 countries), municipal use (33 countries), groundwater recharge (26 countries)
- More common in regions with water scarcity e.g. Middle East and North Africa
- Water quantity, quality, reliability of supply and economic benefits

Toci, 2016

Wastewater reuse in the EU (Toci, 2016)



cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

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Implementing change

We have the technology to:

- Reduce water consumption
- Reduce leakages
- Reuse wastewater in irrigation
- Reuse wastewater as a potable water source
- Many examples of industry reducing water use by 80-90%
- Multiple benefits of green infrastructure

Implementing change

We have the money

- Global GDP (2014) $77.83 trillion
- U.S. advertising expenditure in 2014 = $180.12 billion
- Global bottled water market 2015 = $200.3 billion
- Bottled water market in the UK (2010 to 2015) = £1.43 billion
- Manchester United resigned Paul Pogba £89 million

The Statistics Portal, no date

Creative partnerships across sectors

- More ambitious, strategic and co-ordinated action by water users to significantly reduce demand
- Long lead times involved requires longer-term planning
- New, stronger or different government policies or implementation activities – learn from transboundary water management practices?
- Municipalities/businesses prioritise cost-effective water management
- The scientific community
  - to develop technologies to get the most value out of the water cycle
  - to improve understanding of water resources and their cross-sector management