



WORLD  
RESOURCES  
INSTITUTE

# 4<sup>TH</sup> FORUM ON THE CLIMATE- ENERGY SECURITY NEXUS: WATER & ENERGY

*How Climate Change-Induced Water Stress  
Affects the Energy Sector*

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BETSY OTTO, GLOBAL DIRECTOR, WATER PROGRAM

# Water-energy-food nexus



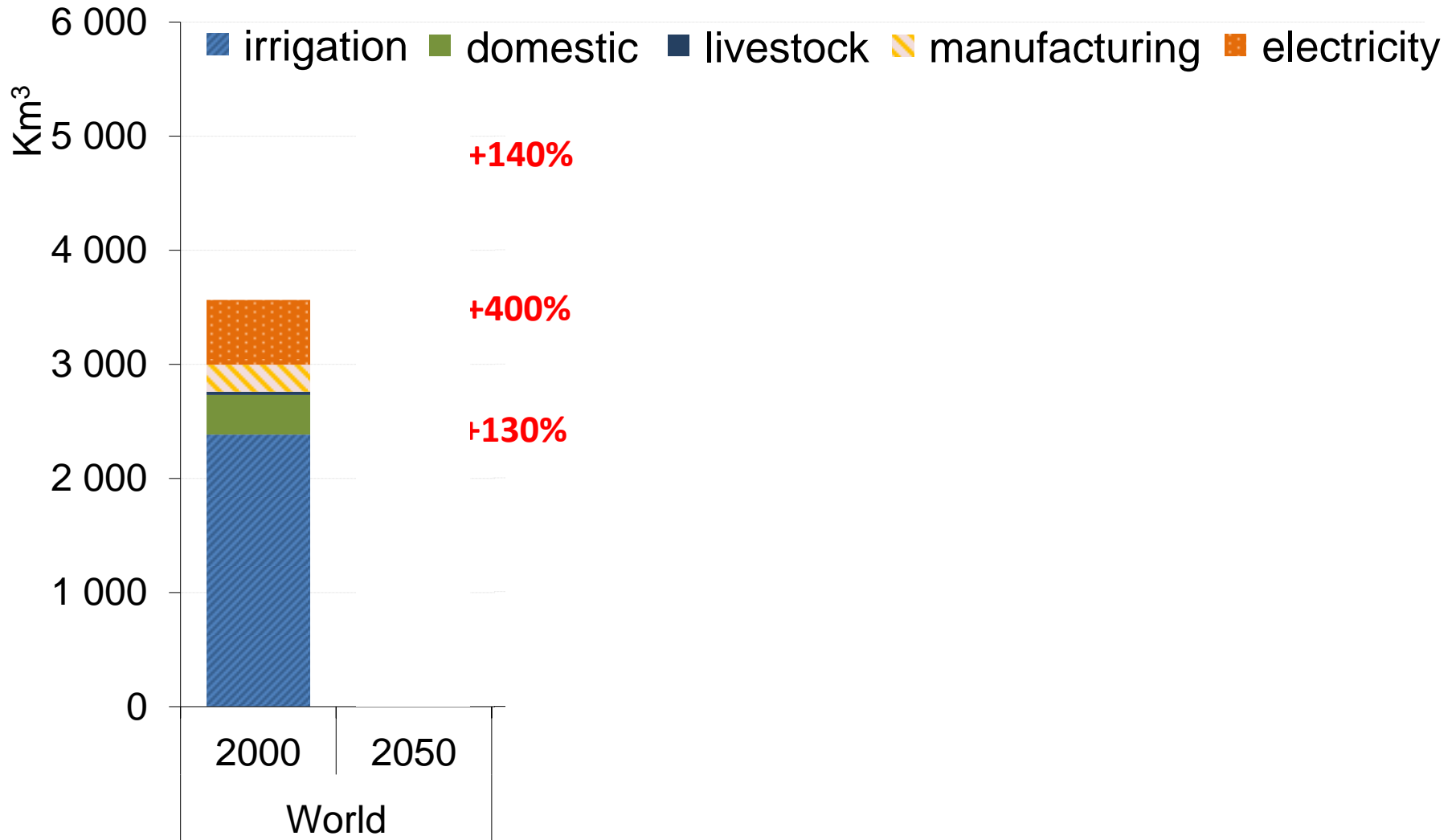
# The Water Challenge 2050

**55%** increase in global water demand

**40%** global population in areas of severe water stress

# Environmental Outlook to 2050: Water

Global water demand: *Baseline* scenario, 2000 and 2050





# The Energy Challenge

## Energy demand will increase...

- **24%** developing world without access to electricity
- **35%** growth in electricity demand by 2035

(IEA Baseline scenario)

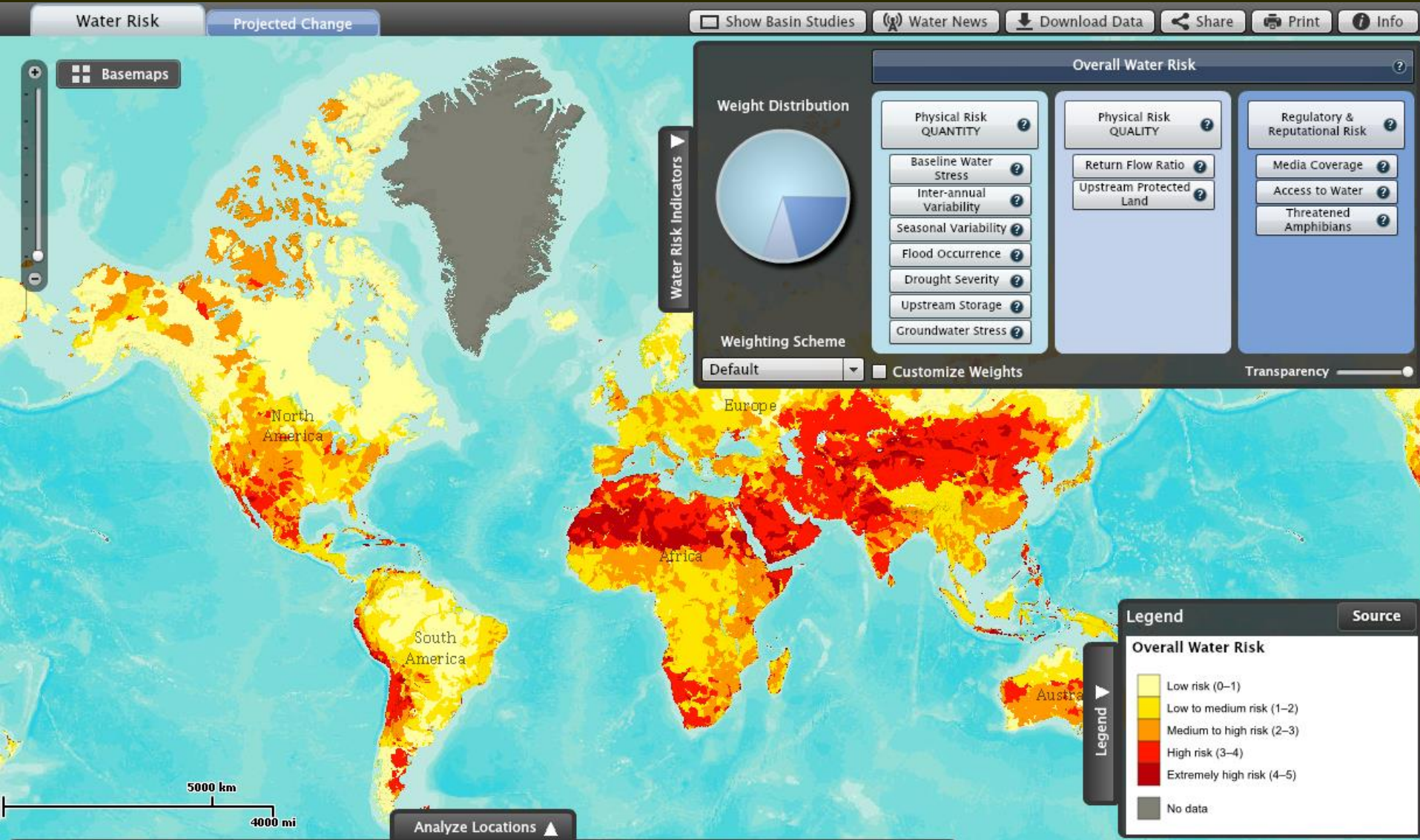
## ...and so will energy's water demand:

- **15%** total water withdrawals for energy
- **20%** increased withdrawals by 2035, but...
- **85%** increase in consumption

(IEA New Policies scenario)



# AQUEDUCT GLOBAL WATER RISK MAPPING



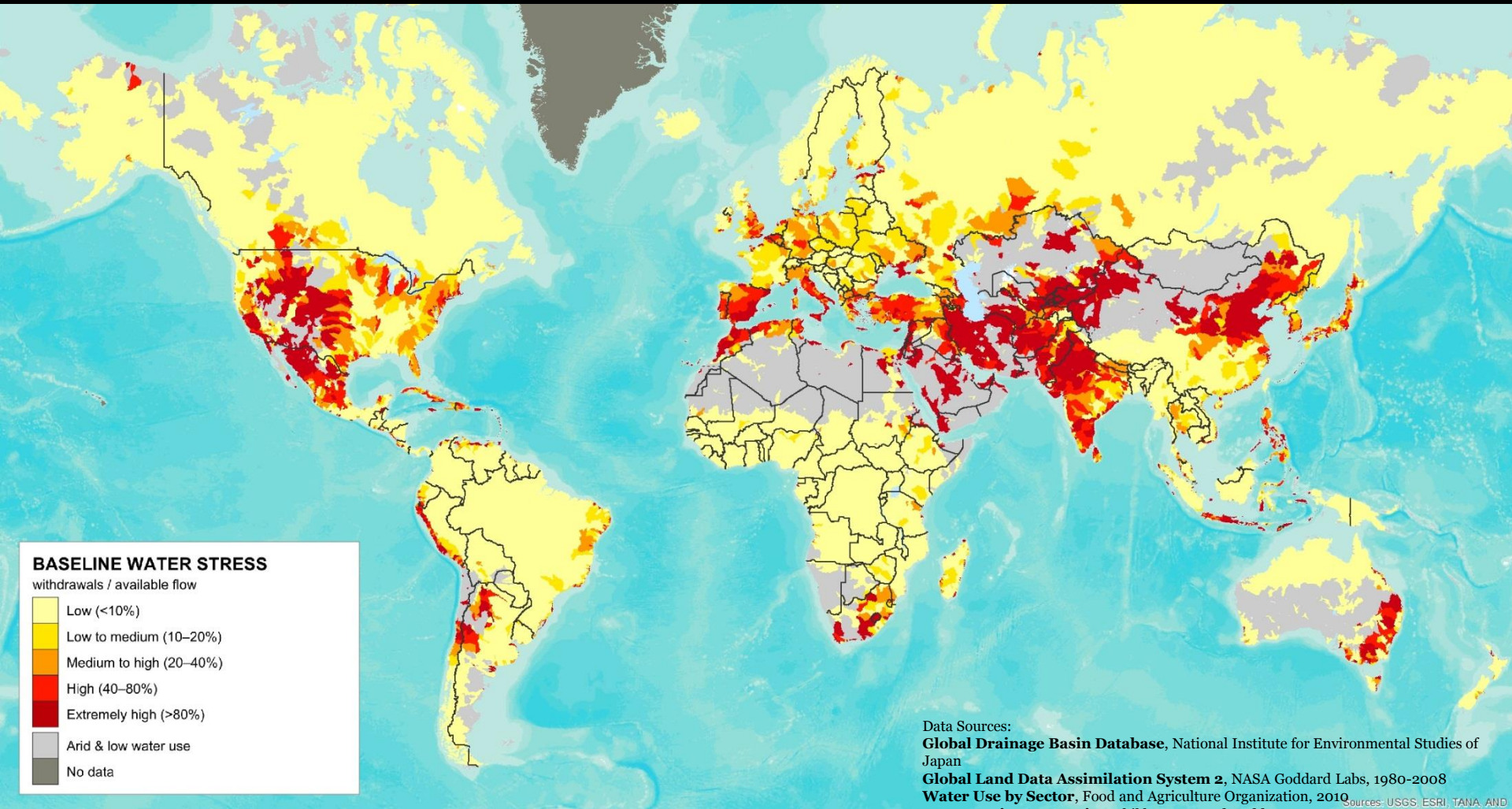
# **WORLD'S LEADING WATER INFO. PLATFORM**

- 15,000 catchments**
- 12 indicators**
- All open data publicly available**
- Projected water stress for 2020, 2030, 2040**



# BASELINE WATER STRESS

total annual water withdrawals (municipal, industrial, and agricultural) expressed as a percent of the total annual available flow; higher values indicate more competition among users





# AQUEDUCT IN USE: 2014 HIGHLIGHTS

MULTINATIONAL  
COMPANIES



PUBLIC SECTOR



INVESTOR



Bloomberg



## Water for Energy



## Energy for Water

# WATER for ENERGY



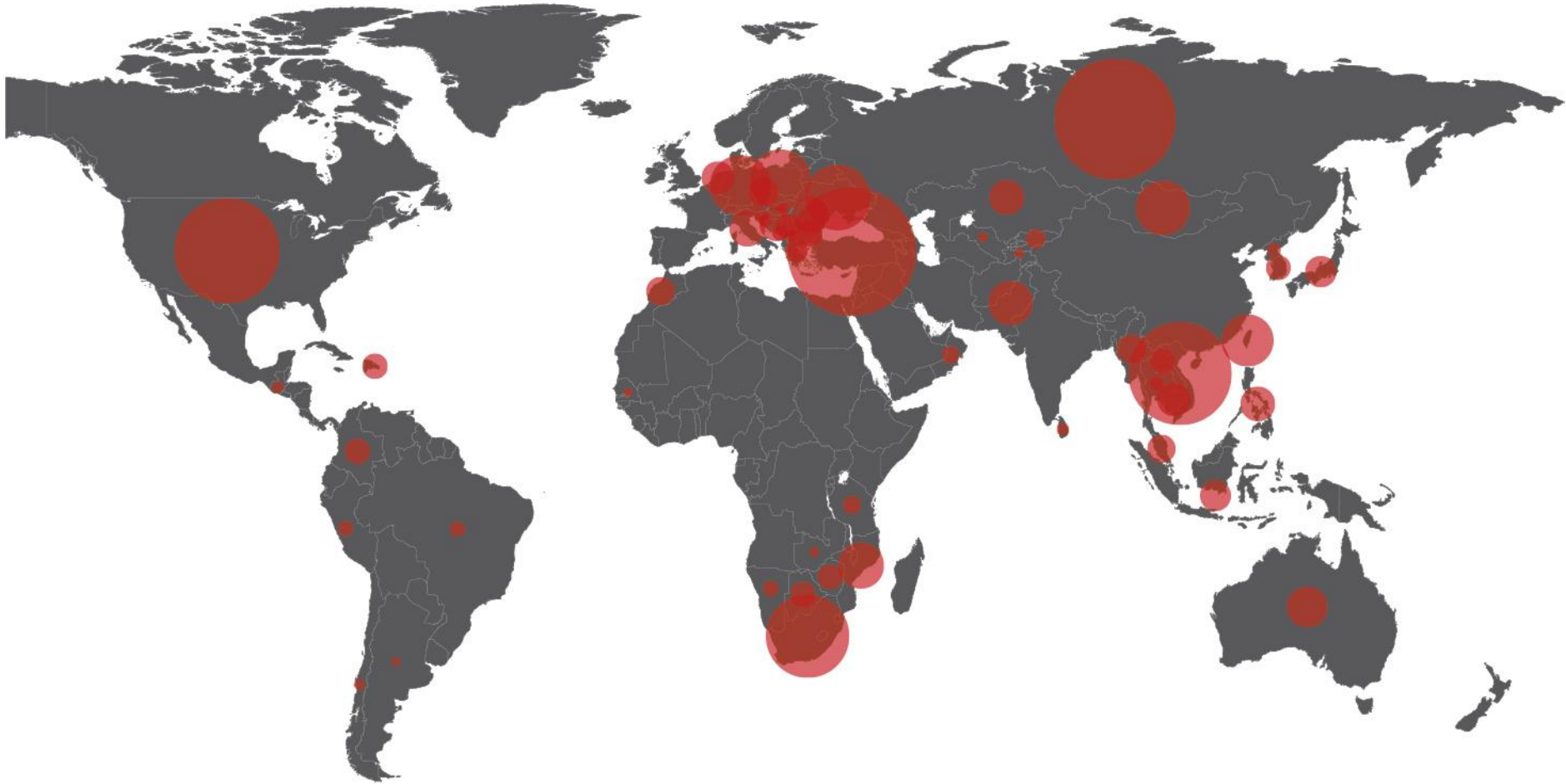
# COAL PRODUCTION AND WATER STRESS

## MANY COUNTRIES FACE MEDIUM TO HIGH WATER STRESS & VARIABILITY

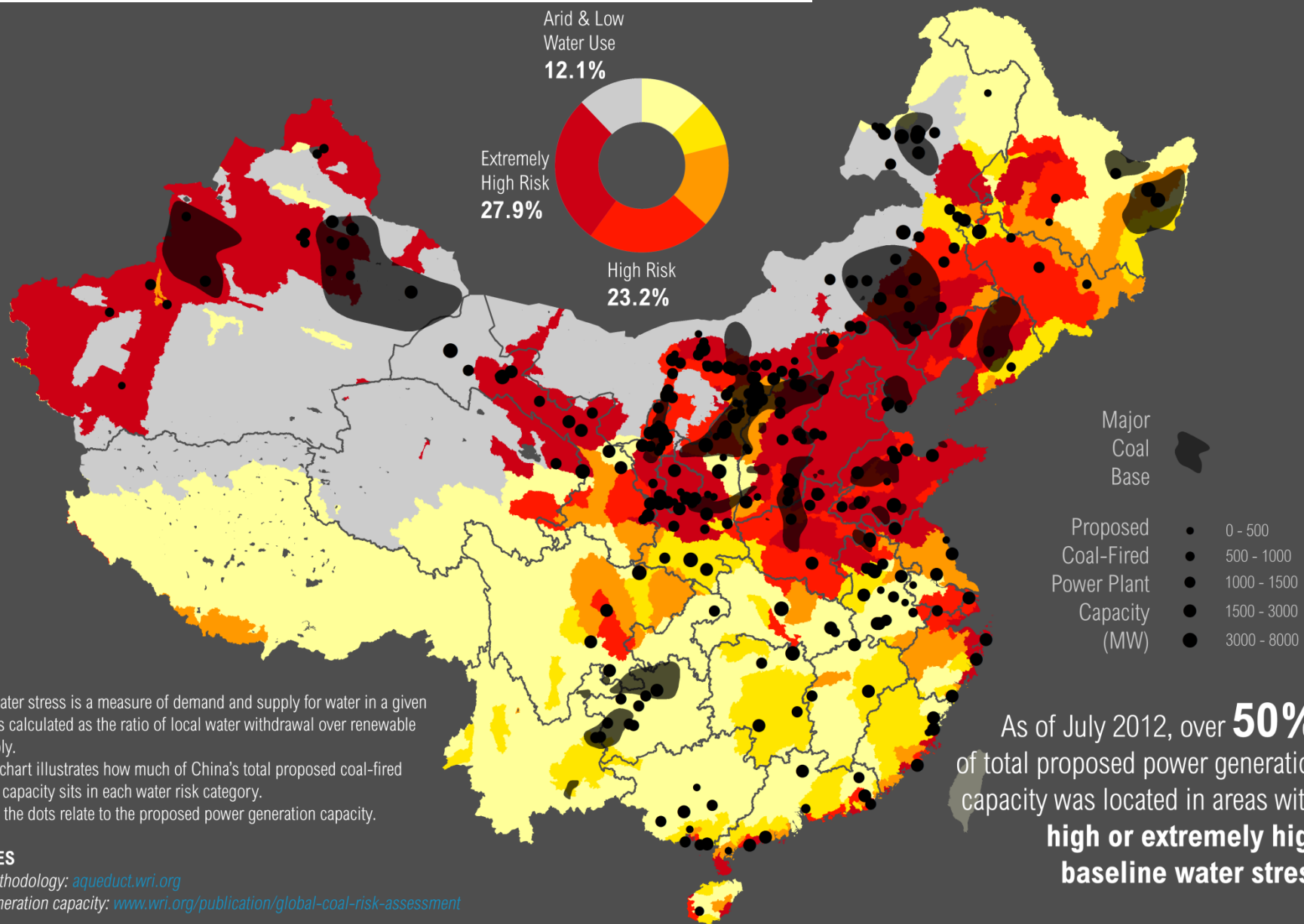
<i>Ranking</i>	<i>Country</i>	<i>Water Stress Level</i>	<i>Seasonal Variability</i>
1	Kazakhstan	Extremely High	High
2	India	High	Extremely High
3	South Korea	High	High
4	Australia	High	Low to Medium
5	Indonesia	High	Low to Medium
6	Japan	High	Low to Medium
7	South Africa	High	Medium to High
8	China	Medium to High	Medium to High
9	U.S.	Medium to High	Low to Medium
10	Germany	Low to Medium	Low
11	Poland	Low to Medium	Low
12	Russia	Low to Medium	Low to Medium
13	Colombia	Low	Low to Medium

Luo et. al., April 2014, "Identifying the Global Coal Industry's Water Risk."

# COAL | PROPOSED NEW COAL POWER CAPACITY



# THREATS TO ENERGY



**NOTE**

- 1. Baseline water stress is a measure of demand and supply for water in a given area, and is calculated as the ratio of local water withdrawal over renewable water supply.
- 2. The donut chart illustrates how much of China's total proposed coal-fired generation capacity sits in each water risk category.
- 3. The size of the dots relate to the proposed power generation capacity.

**REFERENCES**

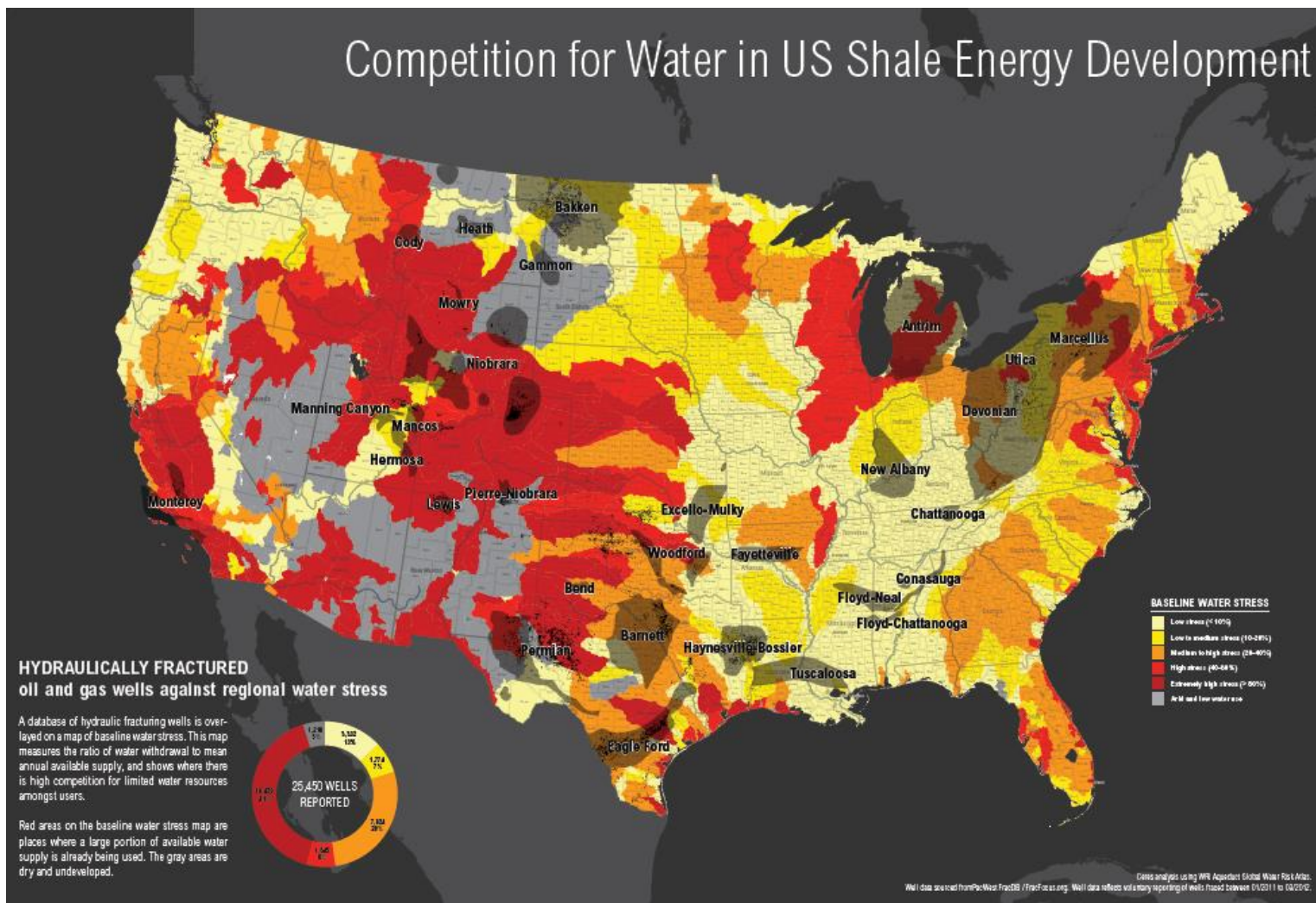
Aqueduct methodology: [aqueduct.wri.org](http://aqueduct.wri.org)  
Proposed generation capacity: [www.wri.org/publication/global-coal-risk-assessment](http://www.wri.org/publication/global-coal-risk-assessment)





# THE PRESENT: SHALE GAS

## Competition for Water in US Shale Energy Development



# GLOBAL WATER RISKS – SHALE GAS

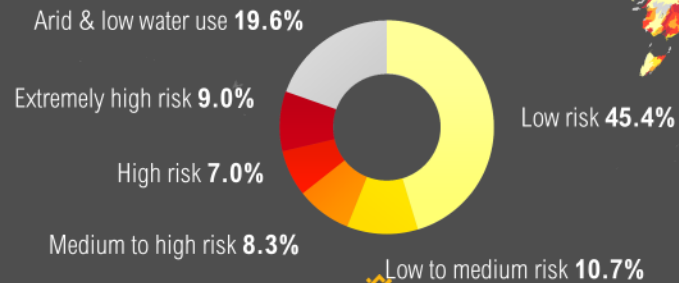
- **First-ever maps of** water risks to shale gas plays globally
- Every major shale deposit around the world
- Country deep dives: United Kingdom, United States, Australia, China, Poland, Mexico, South Africa, and more
- Stress, supply variation by season, year, groundwater stress, population density

# ENERGY / WATER: GLOBAL SHALE

## Baseline water stress

Source: WRI Aqueduct

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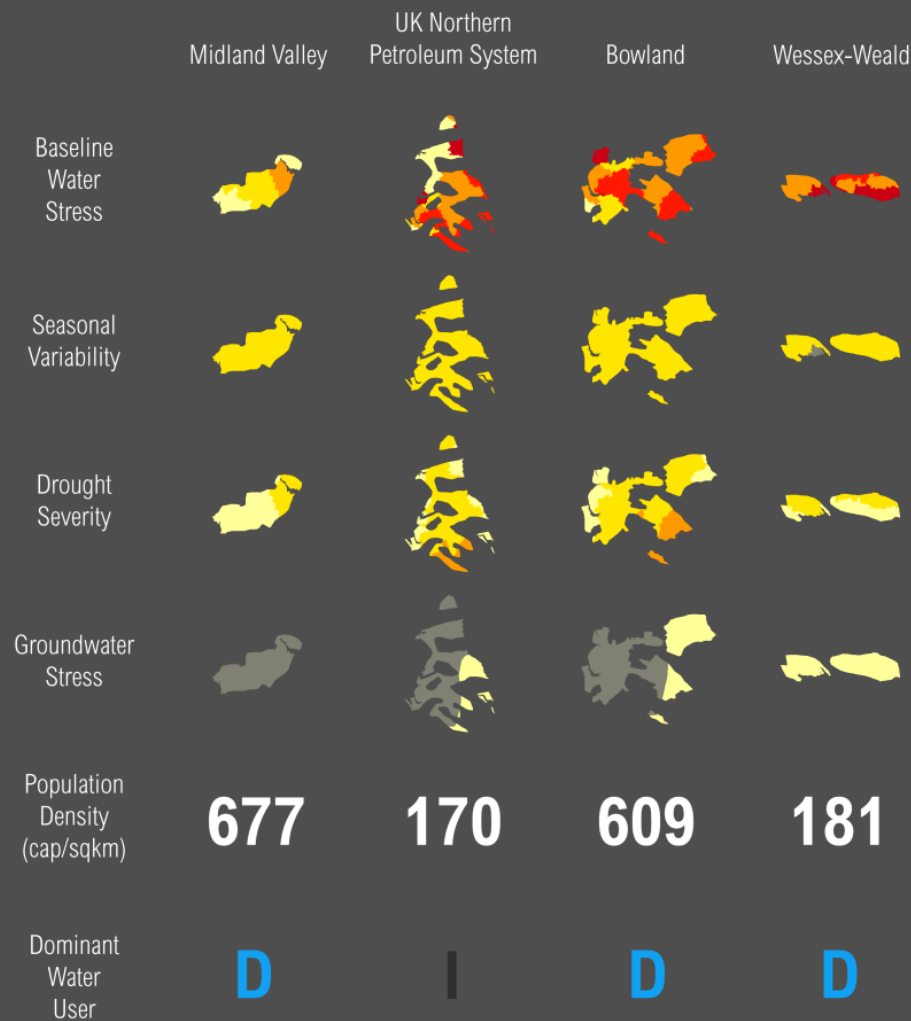
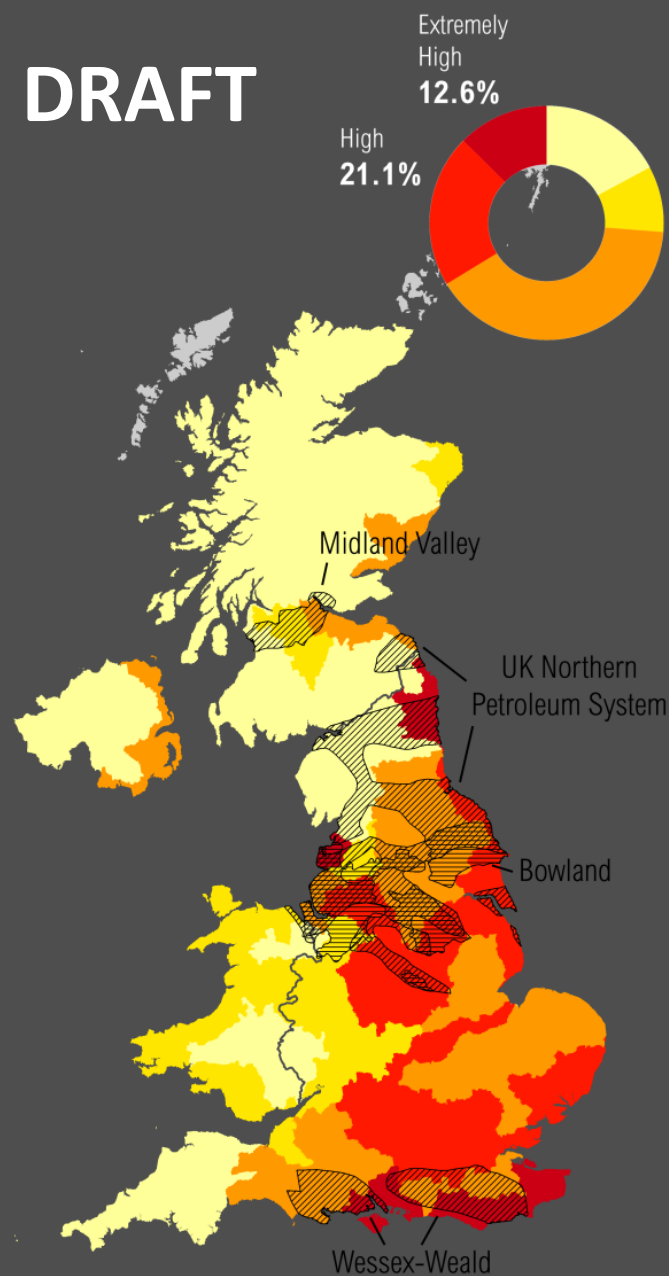


GLOBAL SHALE PLAYS AND **BASELINE WATER STRESS**

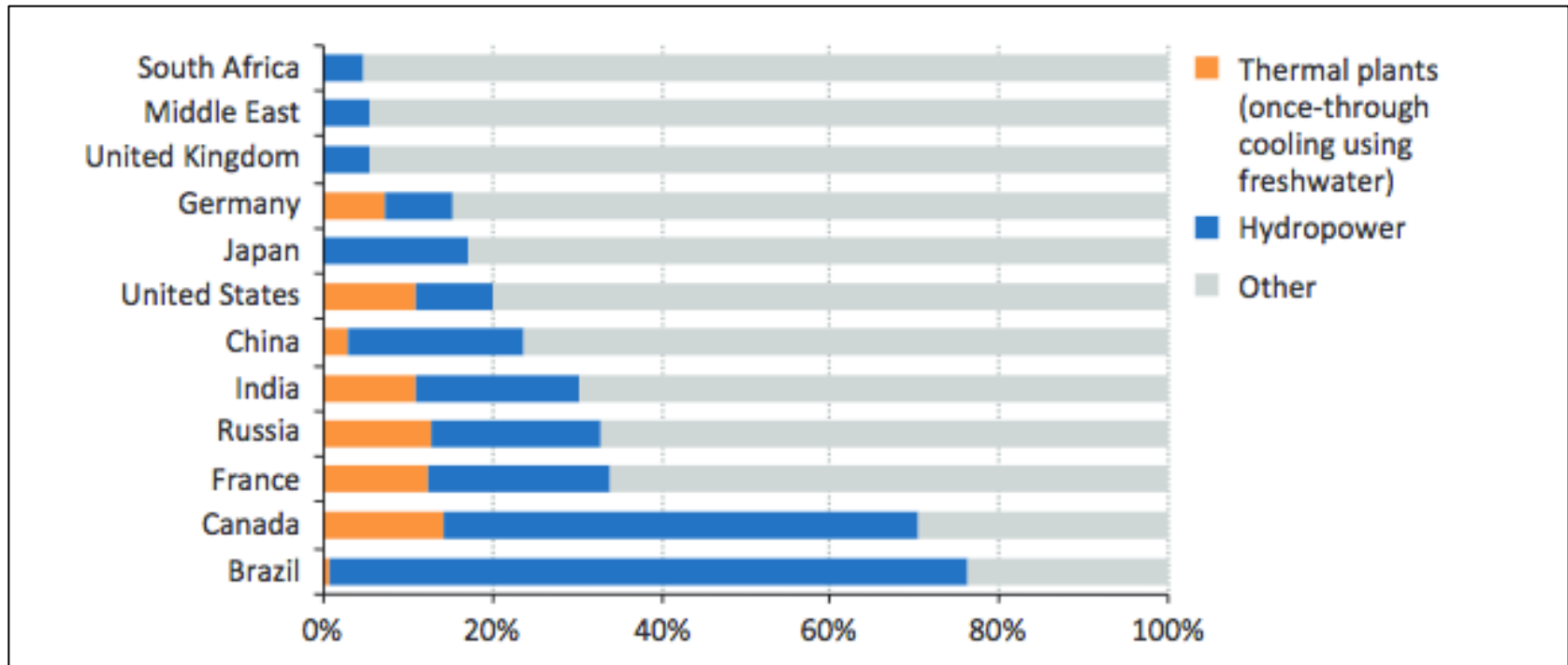


DRAFT

UNITED KINGDOM SHALE PLAY VS **BASELINE WATER STRESS**



# Share of Power Generation Capacity with Freshwater Once-Through Cooling and Hydro in Selected Countries, 2010



ENERGY

*and*

WATER

# California Water Conservation Act (2009)

- 19% of California electricity use is for water
- Law mandates 20% reduced water use by 2020
  - 1.9-2.6 trillion gals (~7.2 to 9.8 bcm)
- Lower water demand will reduce electricity needs
  - 2.3 trillion kWh/hr
  - 1.4 m metric tons GHGs





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**THANK YOU!**

Betsy Otto, World Resources Institute