



Presentation from
**2016 World Water
Week in Stockholm**

www.worldwaterweek.org

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The Great Water Grab

How the Coal Industry is Deepening the Global Water Crisis



image Boy collects water from a community tap near Matimba coal fired power station, Waterberg, South Africa - December 2013. © Shayne Robinson/Greenpeace

Coal water demand analysis

The great water grab – report released March 2016

- First of a kind evaluation of water impacts of coal power plants. Covers the water demand of:
- 1800 GW of coal power plants at end of 2013 (8359 units)
- 1300 GW of proposed coal power plants (2668 units)
- Coal mining water demand on the national level

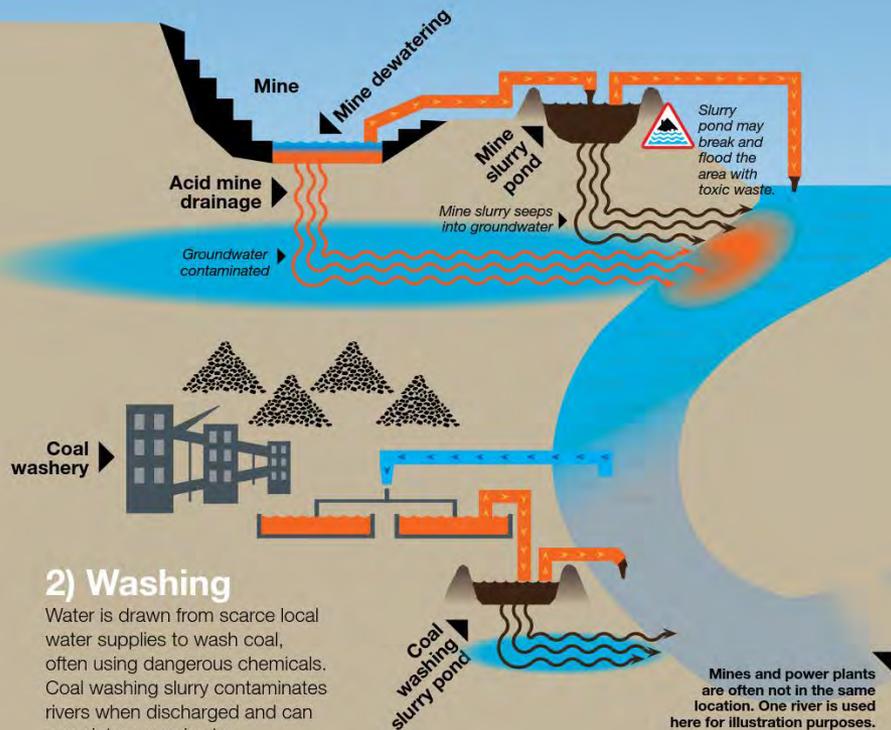
www.greenpeace.org/thegreatwatergrab/

- Continued analysis of water demand of coal power plants in China and India
- Investor briefing on India's coal water crisis

Coal has water impacts from mining to cooling and waste coal ash.

1) Mining

Large quantities of groundwater are pumped out to access the coal. Mine slurry seeps into local water supplies. Acid mine drainage is a major cause of long-term pollution of surface and ground water and is notoriously difficult to treat.

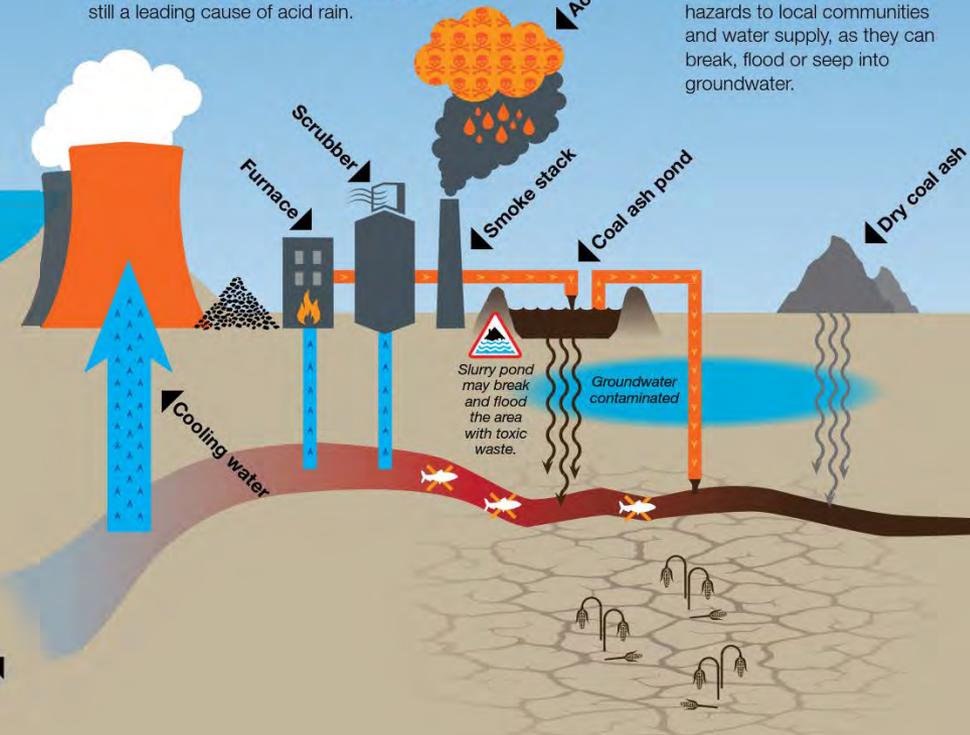


2) Washing

Water is drawn from scarce local water supplies to wash coal, often using dangerous chemicals. Coal washing slurry contaminates rivers when discharged and can seep into groundwater.

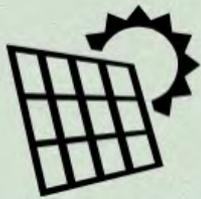
3) Cooling

Water is used for cooling, running the steam turbine and washing out the coal ash. A 500MW coal plant using once through cooling can empty an Olympic sized swimming pool of water every 3 minutes. Water is also needed to operate scrubbers to remove pollutants such as mercury, sulphur dioxides and nitrogen oxides. Despite that, burning coal is still a leading cause of acid rain.



4) Waste

Burning coal produces huge quantities of toxic waste which is stored in large coal ash ponds and ash dump sites. These coal waste impoundments are long term hazards to local communities and water supply, as they can break, flood or seep into groundwater.



WATER USE BY POWER PLANTS



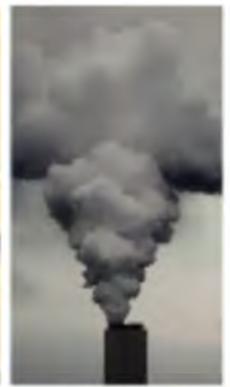
WIND

SOLAR

NATURAL GAS

NUCLEAR

COAL



0
Litres

100
Litres

750
Litres

2550
Litres

2600
Litres



When it comes to energy, we have choices

This is how much water is required to provide an average European with power for 1 year (to produce 1 Megawatt-hour of electricity)

Source: National Renewable Energy Laboratories, "A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies", 2011

How much freshwater does the global coal industry use currently?

Consumption = **19 billion m³ / year** (not returned to source)

Coal power plants = 84% of water consumption

Coal mining = 16% of water consumption

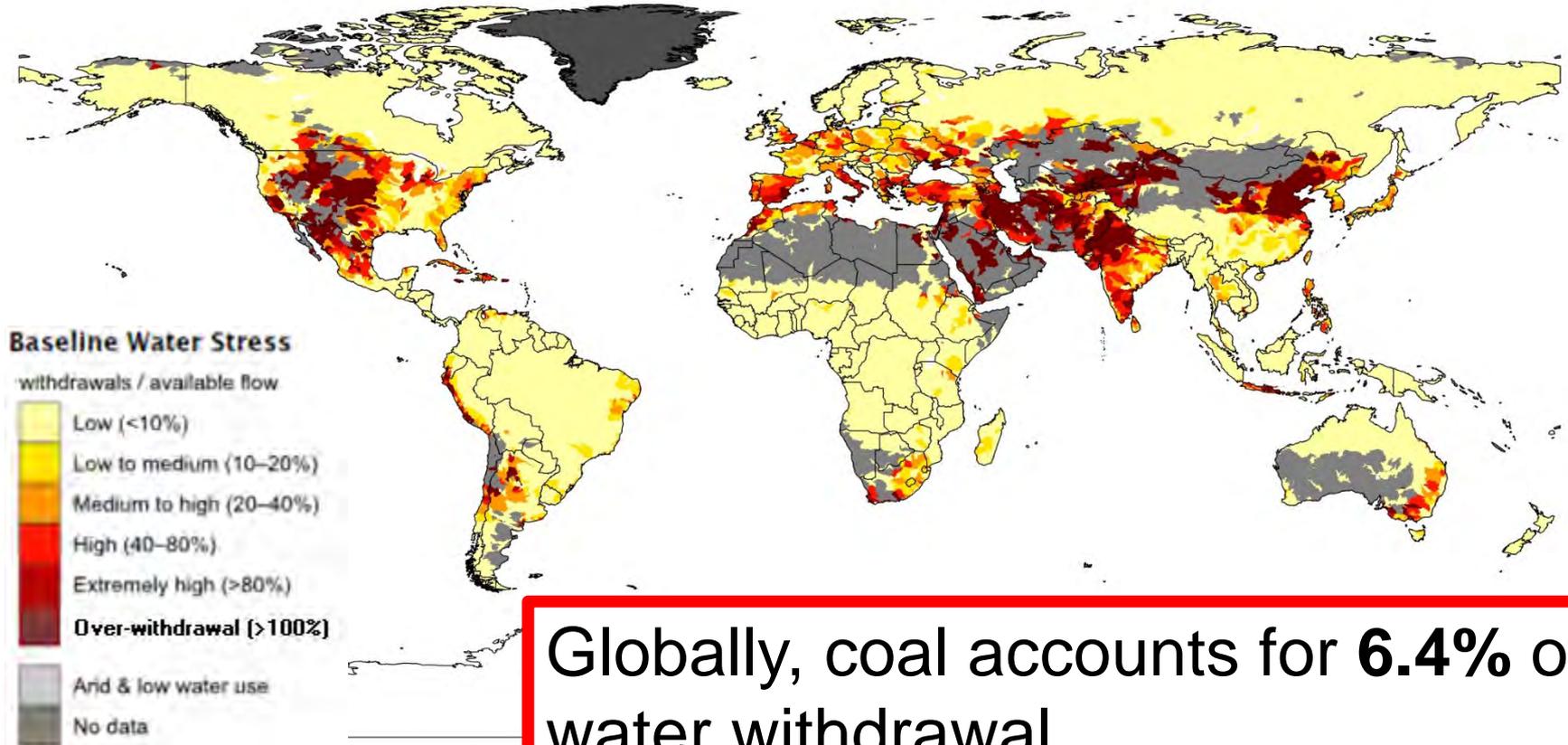
Putting it in human terms:

WHO recommends 50L/day per person for the most basic needs.

Coal industry consumes as much water as the basic water needs of 1 billion people.

Often in areas of severe water stress

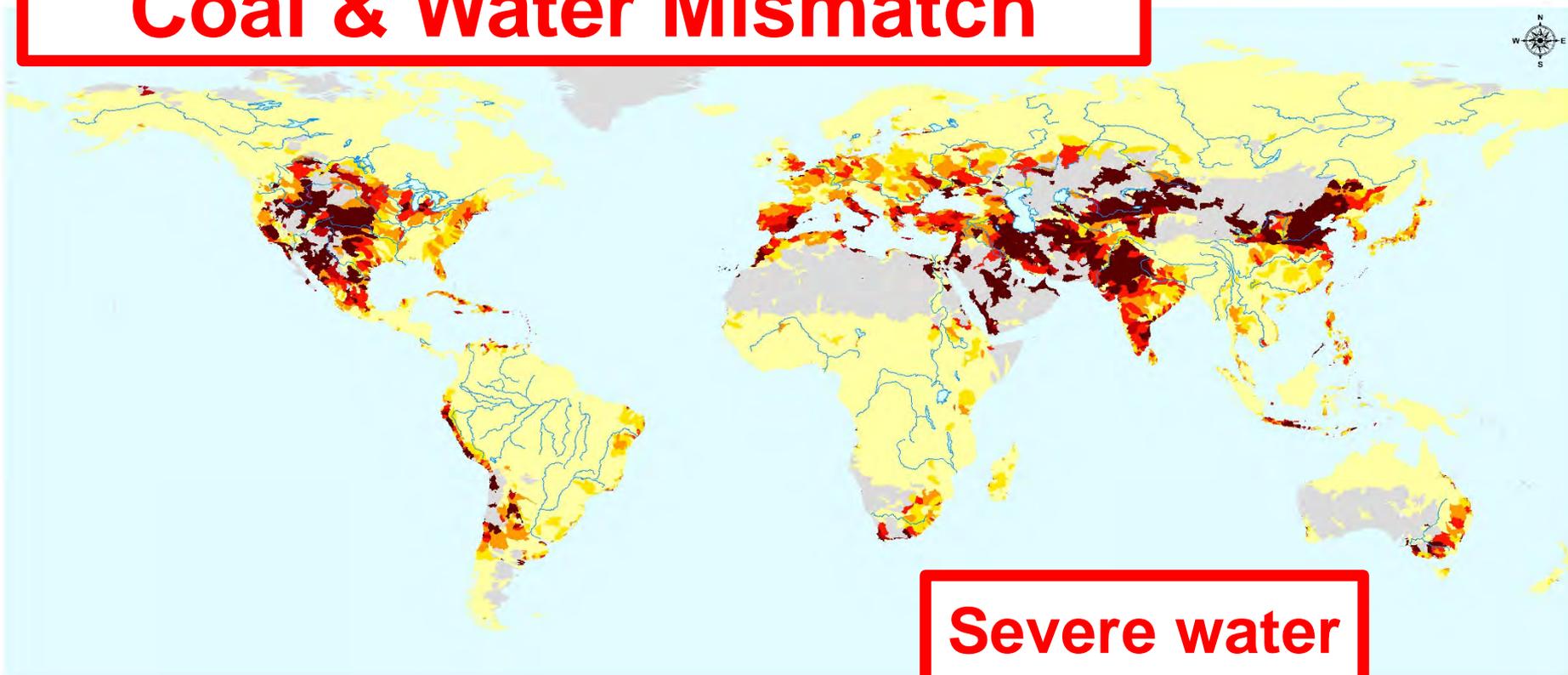
Widespread & serious over-withdrawal of water



Globally, coal accounts for **6.4%** of water withdrawal.

In coal basins, coal's share is much higher, at **12%**.

Coal & Water Mismatch

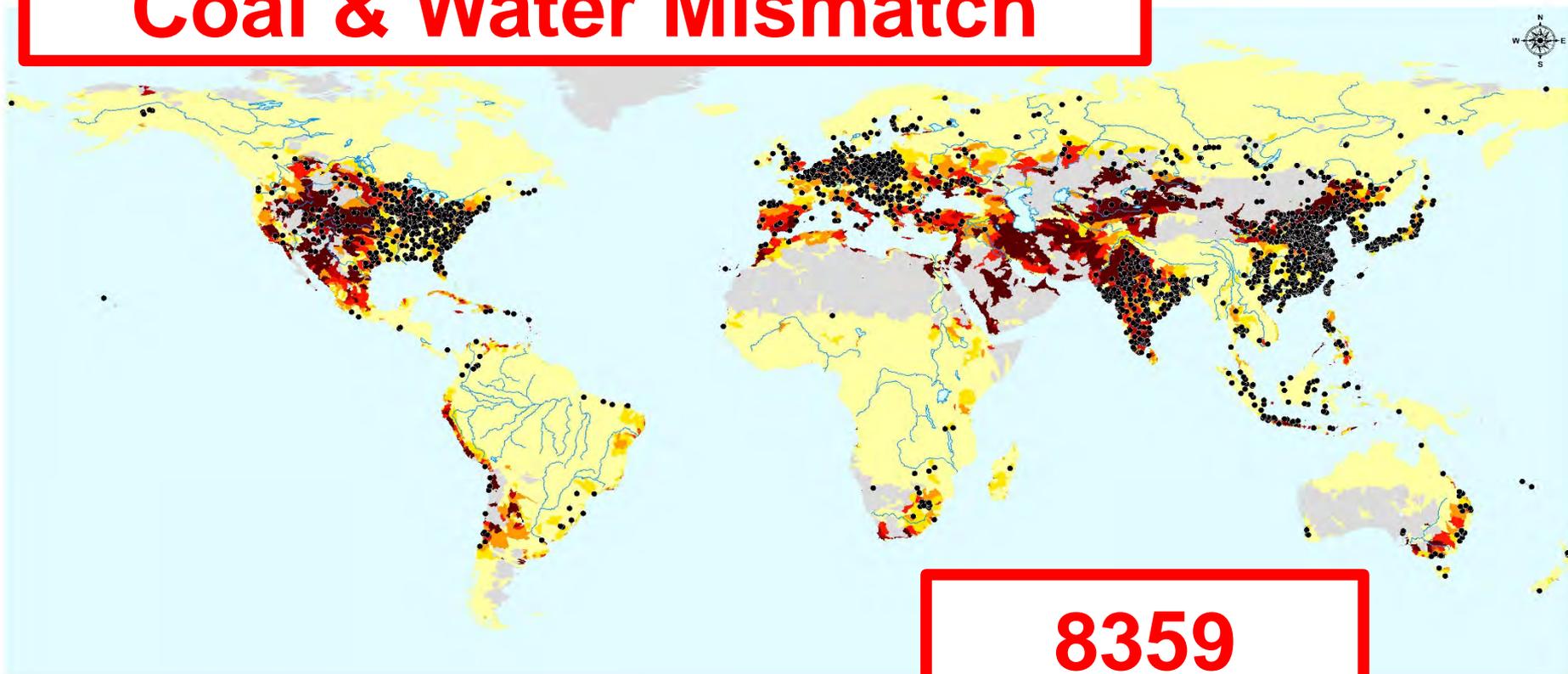


Severe water stress globally

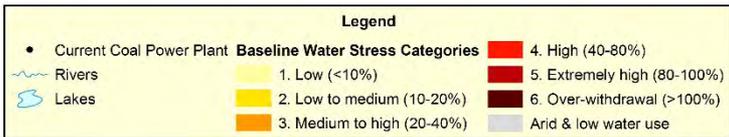
Legend

Rivers	Baseline Water Stress Categories	4. High (40-80%)
Lakes	1. Low (<10%)	5. Extremely high (80-100%)
	2. Low to medium (10-20%)	6. Over-withdrawal (>100%)
	3. Medium to high (20-40%)	Arid & low water use

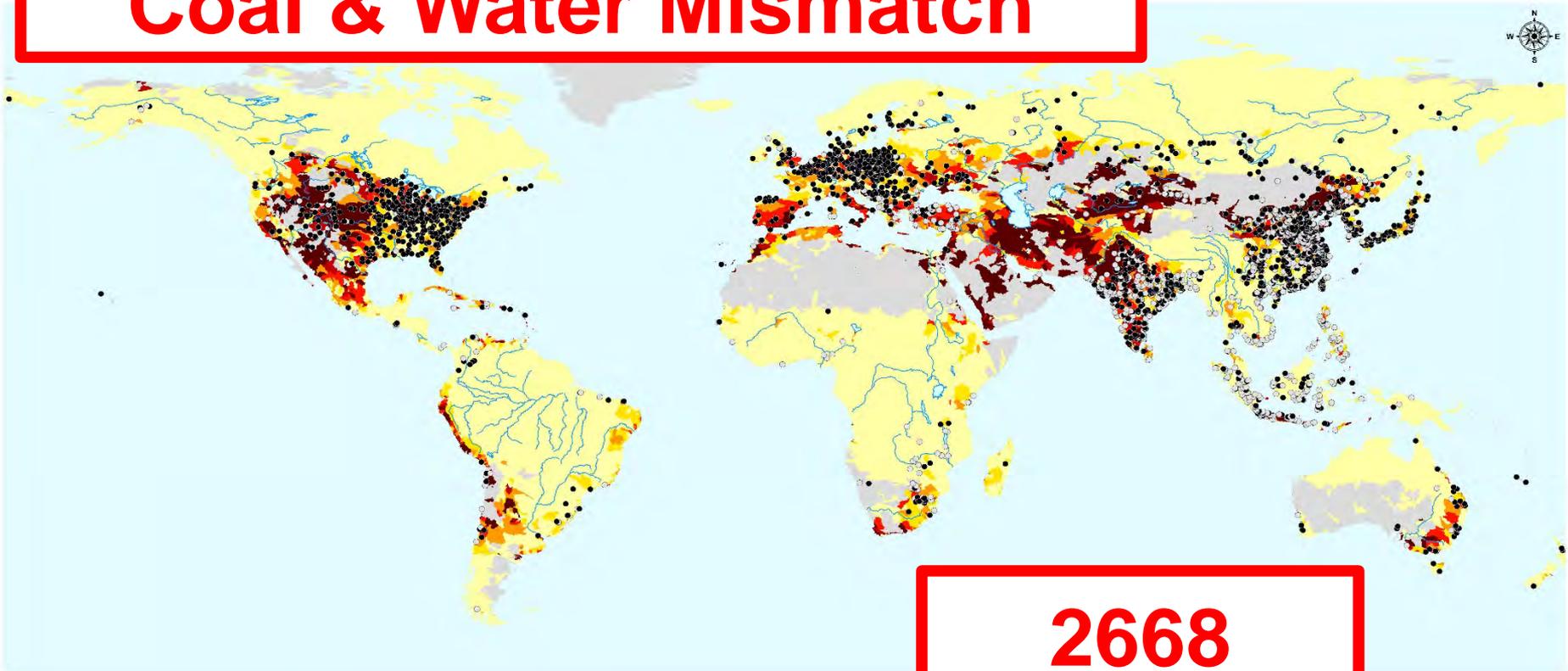
Coal & Water Mismatch



8359
existing coal
plants



Coal & Water Mismatch



2668
proposed
plants

Legend		
● Current Coal Power Plant	Baseline Water Stress Categories	■ 4. High (40-80%)
○ Proposed Coal Power Plant	■ 1. Low (<10%)	■ 5. Extremely high (80-100%)
~ Rivers	■ 2. Low to medium (10-20%)	■ 6. Over-withdrawal (>100%)
☪ Lakes	■ 3. Medium to high (20-40%)	■ Arid & low water use

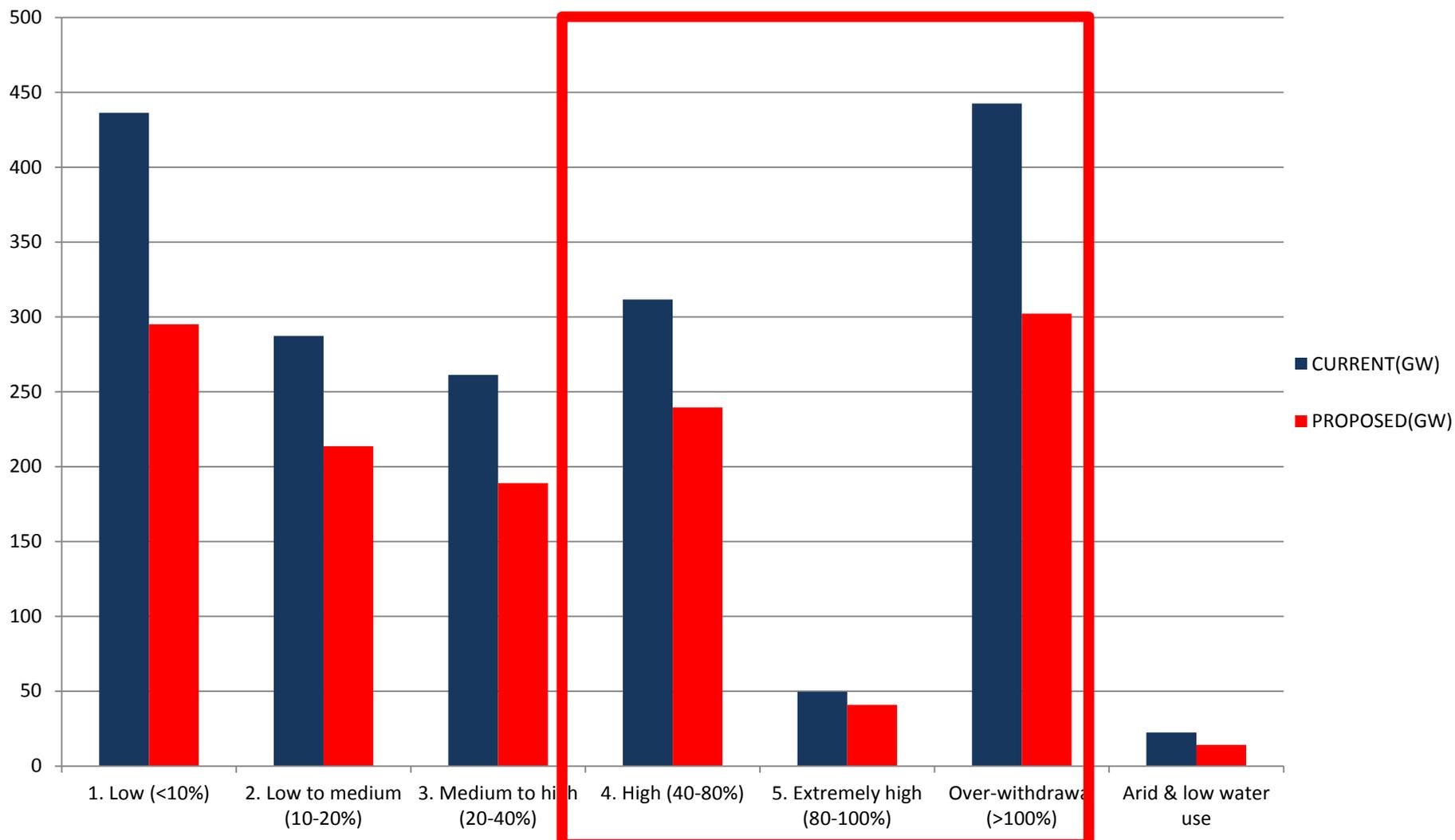
Top Findings

Existing power plants

- Existing coal plants consume 19 billion m³ of fresh water per year globally, enough for 1 billion people.
- 44 % of existing plants are in high water stress areas
- 25 % of plants in over-withdrawal areas, which we call “red-list” areas. Many of these areas consume water resources extremely fast.
- China has 45 % of it’s coal power fleet in red-list areas.
- India has 24 % of it’s coal power fleet in red-list areas.
- US has 6.8 % coal power fleet in red-list areas.

Proposed plants: significant share in high water risk regions

Distribution of coal plant capacity in Baseline Waterstress categories

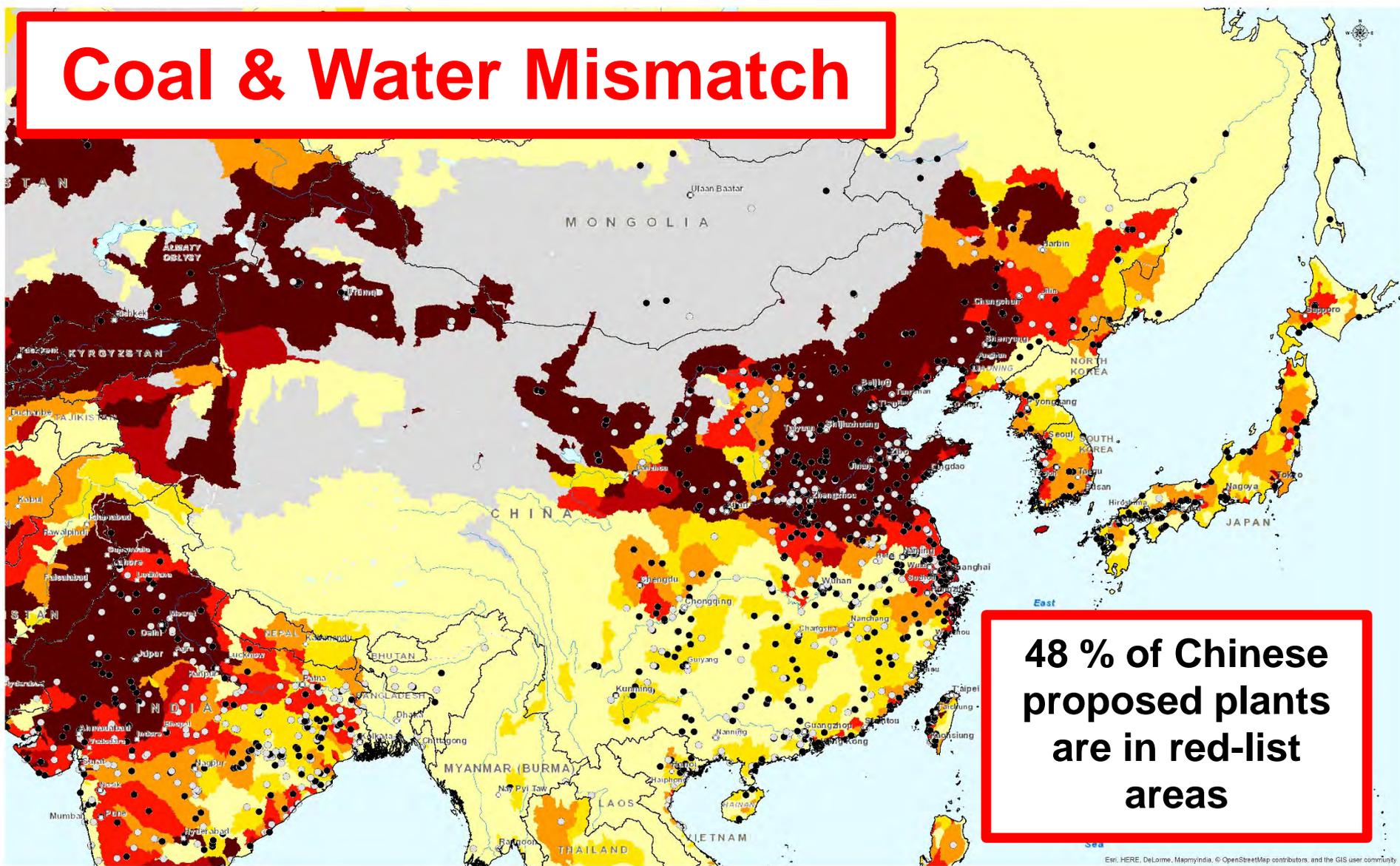


Top Findings

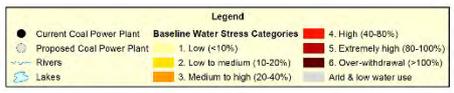
Proposed power plants

- Proposed plants capacity of 1300 GW would nearly double global fresh water consumption to 36 billion m³
- 45 % of the proposed coal plants are in high water stress areas
- 25 % of the plants are in areas with over-withdrawal of water, “red-list” areas
- 48 % of Chinese proposed plants are in red-list areas
- 13 % in India’s and Turkey’s proposed plants are in red list areas

Coal & Water Mismatch

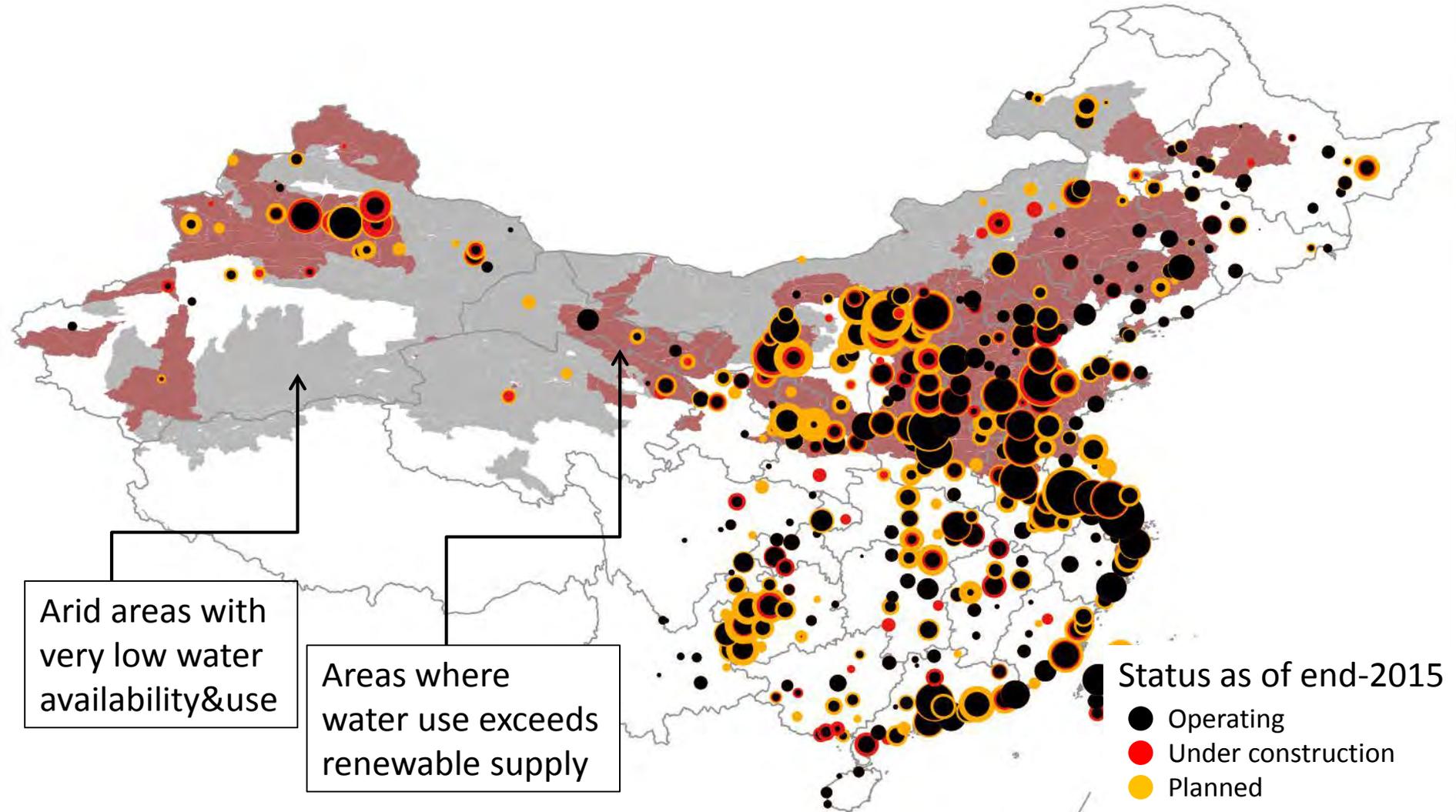


48 % of Chinese proposed plants are in red-list areas



Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

China: 48% of new coal power plants are in water overwithdrawal areas



China key findings

- Existing coal power plants in China consume 7.4 billion cubic meters of water annually
- Proposed coal power plants would increase water consumption to 11.6 billion cubic meters
- Equal to basic water use of 63 million people
- Increasing competition between water for agriculture and urban water users regionally.

China key findings

- Water policy has relied on water transfer projects, water permits trading and groundwater utilization
- Resulted on overuse of water, with ecosystems drying and groundwater levels dropping

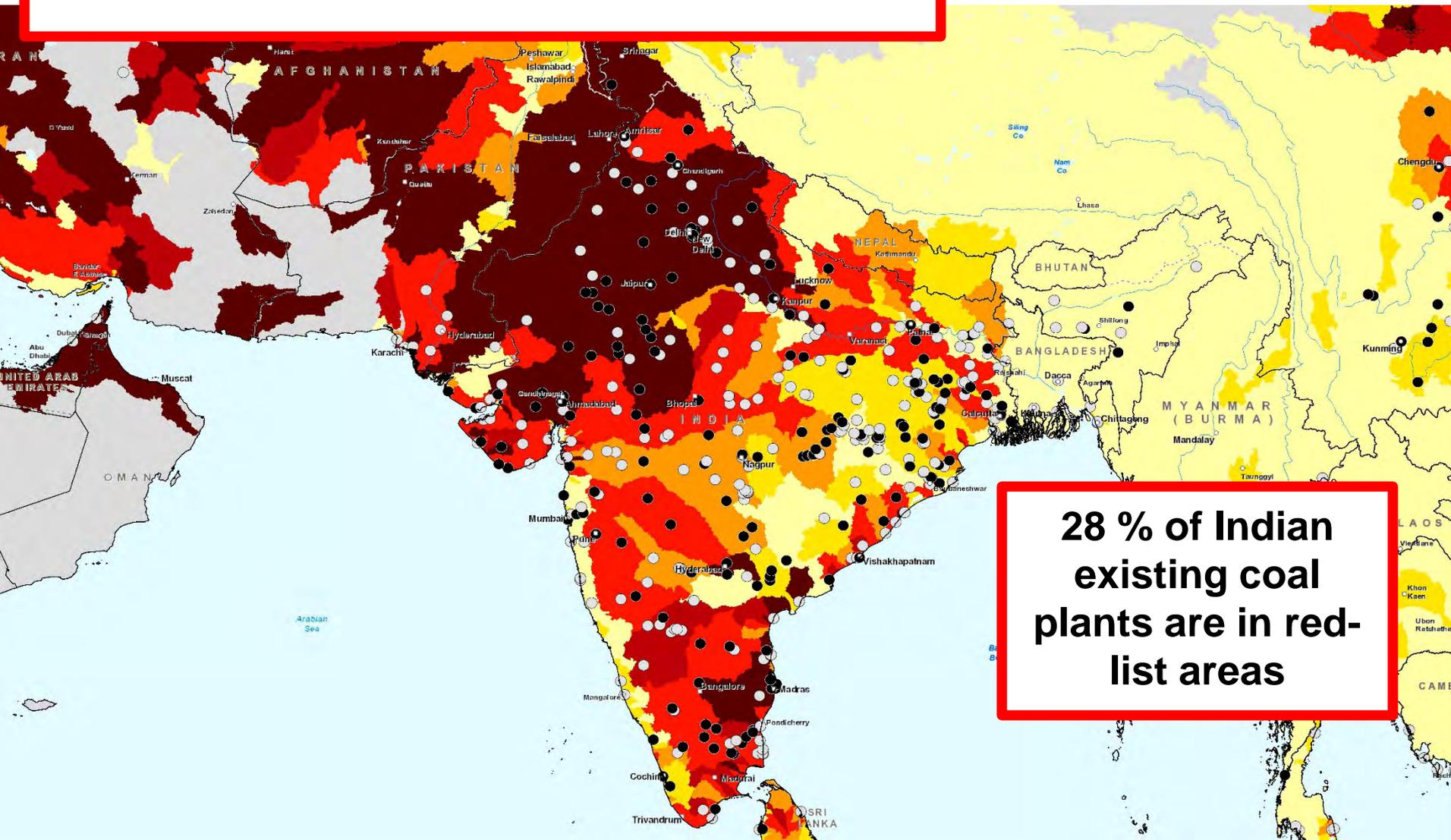


China key findings

- Air cooling promoted in dry areas, but these plants still demand significant amounts of water for handling pollution.
- Air pollution control also increases risks of water pollution
- We expect Chinese water policy to tighten after critical water stress levels reached, affecting urban water and major agricultural bases.



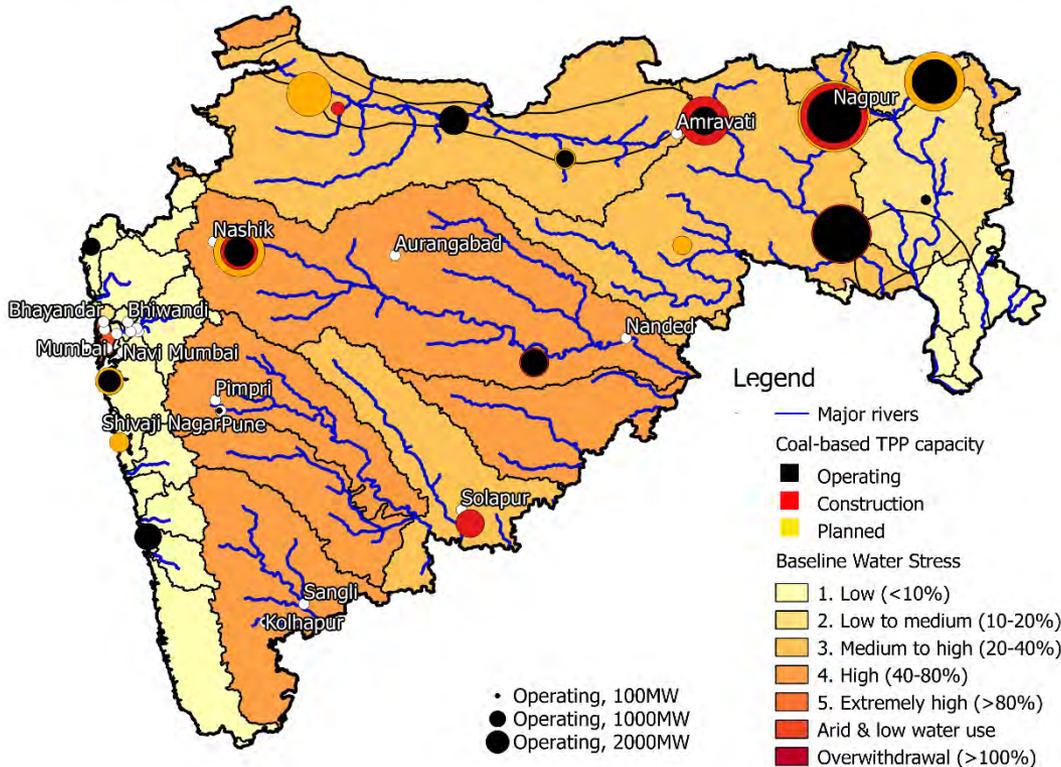
Coal & Water Mismatch



India water crisis

Coal plants in India shut down by water crisis 2016
Drought affecting 30 % of India

WATER SCARCE REGIONS AND
THERMAL POWER PLANTS (TPP) IN MAHARASHTRA.

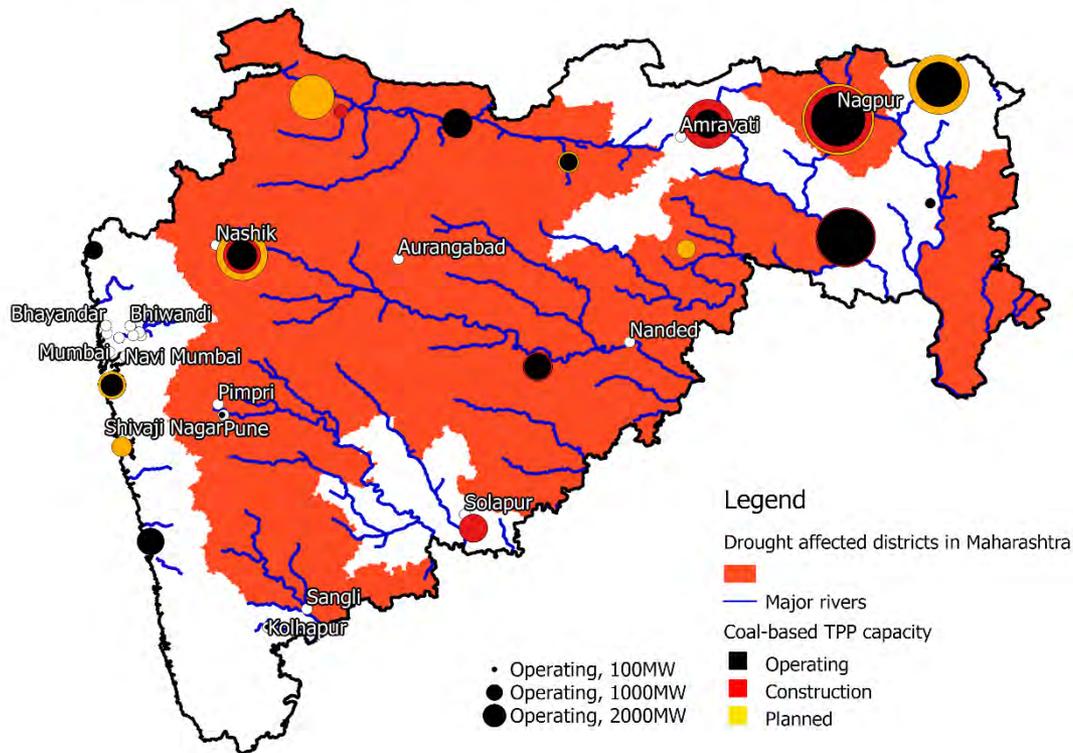


- One of the worst droughts affecting 300 million people, in 10 states.
- Maharashtra one of the hardest hit states.
- Coal water demand seems to have previously underestimated in energy planning

India water crisis

Coal plants in India shut down due to water crisis

DROUGHT AFFECTED REGIONS(2016) AND THERMAL POWER PLANTS (TPP) IN MAHARASHTRA.



- Coal plants in Maharashtra consume 275 million m³ per year, enough fresh water for 15 million people
- Water reservoirs last spring at 19 % of normal levels.
- Government planning using sewage water for cooling coal plants, which will be challenging.
- Costs of coal power increase with sewage water cooling, purification, water transfers, air or hybrid cooling.

India water crisis

Coal plants in India being shut down due to water crisis

INVESTOR BRIEFING

- Water shortages threaten coal company revenues
- Coal plants shut downs due to lack of water in 2016 created losses of more than 560 million USD.
- Ministry of power planning to to shut down old coal plants 37 GW, or 12 % of the capacity, quoting water and pollution as reasons.
- Solar PV competing with lower costs than coal



In conclusion

- Precarious overuse of water: many regions are running a deep water deficit and heading towards water crunch points.
- Coal industry is a big water user: 12% of total withdrawal in the coal basins, but often not reflected in energy planning.
- Competition for water with other users inevitable and unfolding on unprecedented scale.
- Governments waking up to severity of water crisis too late, only after crisis emerges, risking human needs or power production.
- Significant and abrupt policy risk for energy investors