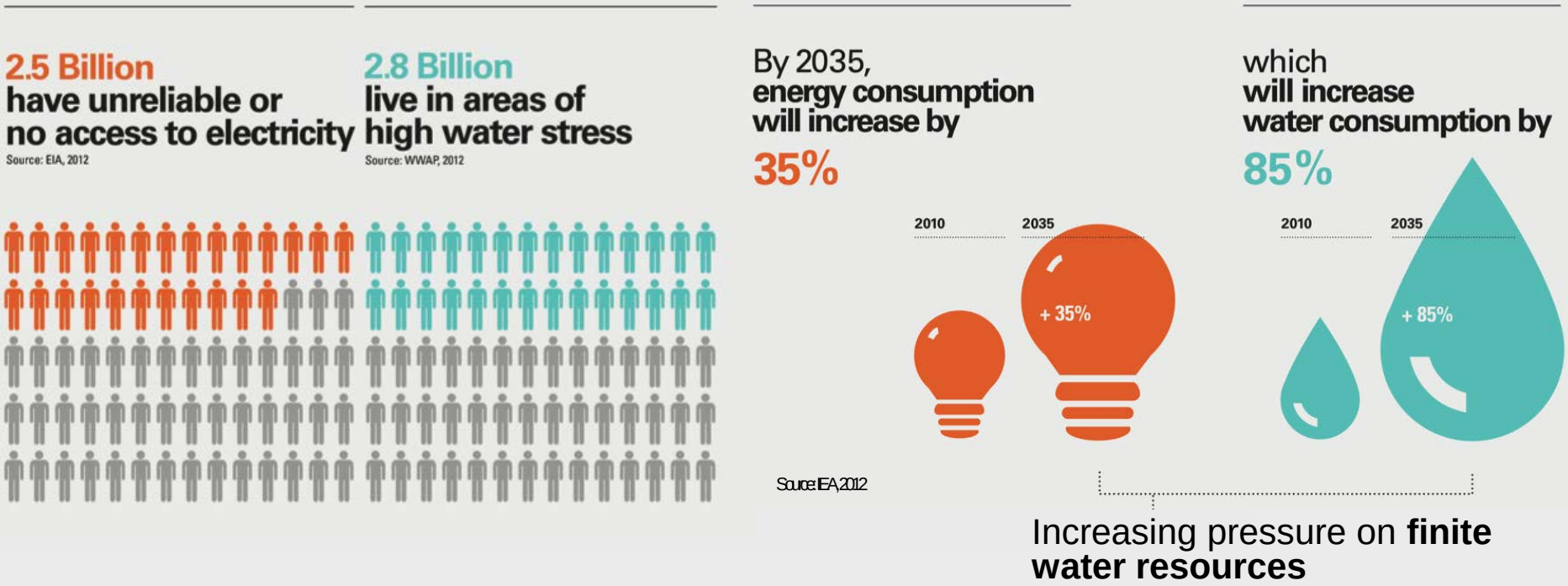
thirsty energy

Will Water Constrain Our Energy Future?

WORLD BANK GROUP

Why is the energy-water issue **important?**

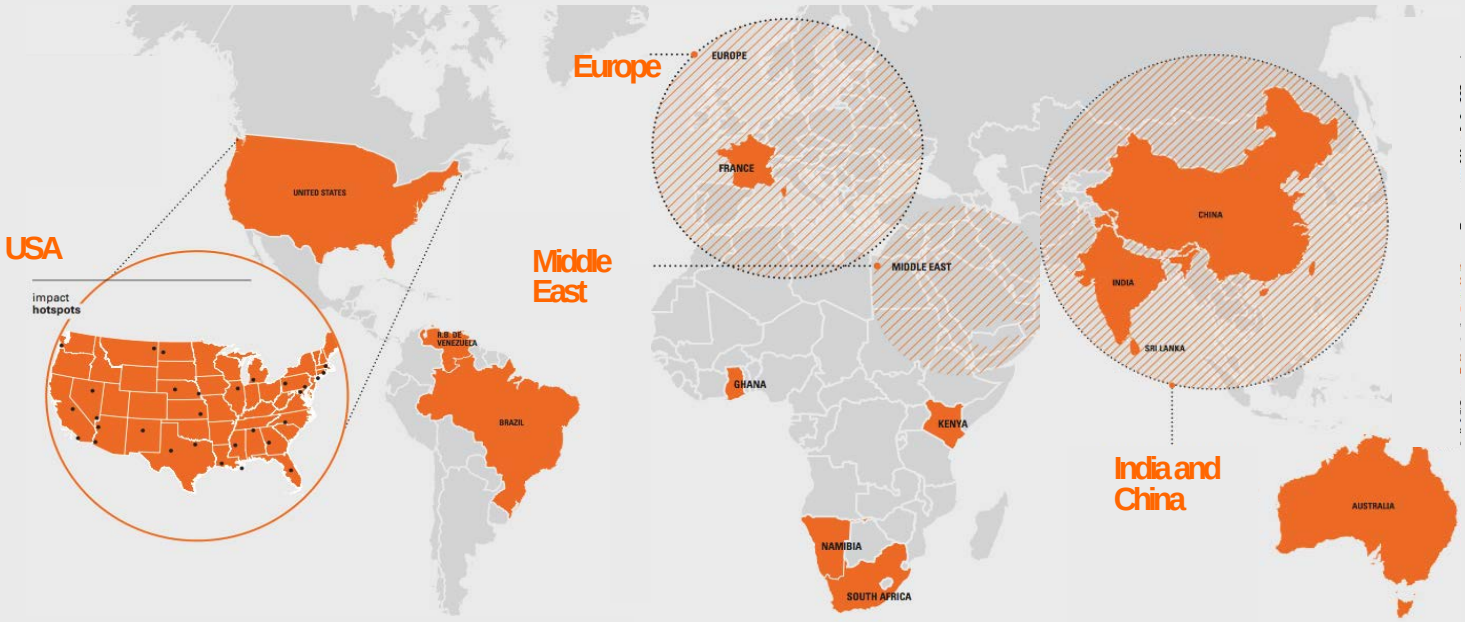
Of the **7 Billion people on Earth today**,



→ **Water scarcity is increasing** as demand for water intensifies with population and economic growth

→ **Climate change is exacerbating** water and energy challenges

Water constraints are presently **impacting the energy sector**



- In the **U.S.,** several power plants have had to shut down or reduce power generation due to low water flows or high water temperatures.
- **In India**, a thermal power plant recently had to shut down due to a severe water shortage.
- **France** has been forced to reduce or halt energy production in nuclear power plants due to high water temperatures threatening cooling processes during heat-waves.
- Recurring and prolonged droughts are threatening hydropower capacity in many countries, such as Sri Lanka, China and Brazil.

Energy sector needs water and is **vulnerable to water issues**

water risks for **energy sector**

Increased water temperatures
can prevent power plants from cooling properly

Decreased water availability
can affect thermal power plants, hydropower, and fuel extraction processes due to their large water requirements

Regulatory uncertainty

Sea level rise could impact coastal energy infrastructure

Water quality can impact energy operations if it is not regulated and managed adequately

Power plants shut down or decreased power generation

Hydropower capacity reduced

Permits to locate power plants or extraction facilities denied

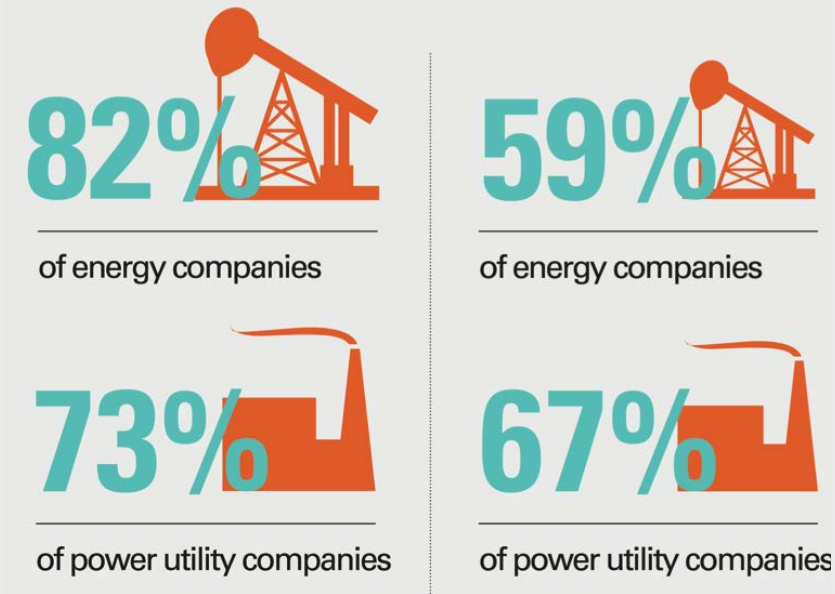
Financial losses CAPEX and operational costs increase

Social and political instability

the energy sector recognizes the magnitude of the issue

Impact on the world's top **energy and power** companies

Source: CDP Global Water Report, 2013



Indicate that **water is a substantive risk** to business operations

Have experienced **water-related business impacts** in the past 5 years

However, the majority of companies surveyed do not appear to be planning corollary increases in the breadth and scale of their water risk management practices

We need to understand better this interdependency and the sector differences

Need more data

- on the water use (withdrawal, consumption, discharge) and water pollution by the energy sector
- on the water needs of the water sector

Temporal and regional differences

- Unlike the GHGs, which are a global problem, water issues are a regional/local problem. For example, at a national level, the percentage of water used for gas extraction might look very small, but in the extraction areas, that percentage might be very critical, potentially impacting the water resources at the local level.
- Temporal changes in water availability (through the year and in the future, with climate uncertainty) make it challenging to understand potential impacts on the energy sector (dry seasons and unforeseen droughts can make a power plant shut down, incurring high financial losses)

Need to contextualize solutions

- The water and energy nexus is thus, a very regional/local problem
- We need specific solutions for each region/area

We also need to understand **and quantify tradeoffs**

Dry cooling vs cost of electricity

Dry cooling systems require no water for their operation, but decrease efficiency of the plant:

- increasing capital and operational costs
- increasing GHG emissions per kwh

Water for energy vs. water for agriculture

The value of water for energy might be higher regarding economic outputs, but agriculture is often required for

- national security reasons (food)
- social reasons (people employed in the agricultural sector)

Water – GHG tradeoff

Some policies to reduce GHG emissions can increase water requirements by the energy sector if not designed properly

- biofuels, carbon capture…

Understand Environmental impacts and trade-offs

Hydropower

Assessing tradeoffs, environmental and social impacts and exploring the use of multipurpose dams is necessary for sustainable development

the challenge: how do we plan & how do we design our investments in a sustainable way?

Political-level challenges impede effective planning:

- The two sectors have been regulated separately
- Current energy planning is often made without considering changes in water availability and quality, competing uses or the impacts of climate change.

Challenges in securing enough water for energy and energy for water will increase with population and economic growth and climate change

Stronger integrated planning will be necessary to evaluate tradeoffs, find synergies, and ensure sustainable development

Thirsty Energy initiative

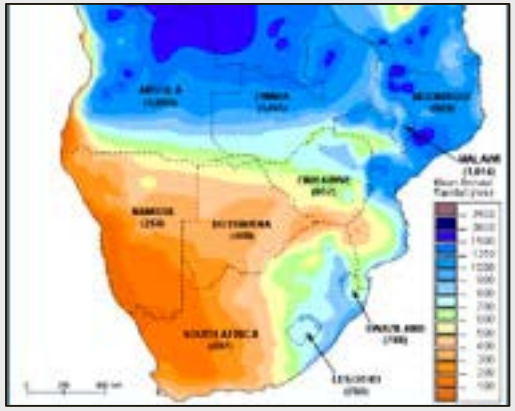
GOAL: to contribute to a **sustainable management and development** of the water and energy sectors by **increasing awareness and capacity** on *integrated planning* of energy and water investments **identifying and evaluating trade-offs and synergies** between water and energy planning.

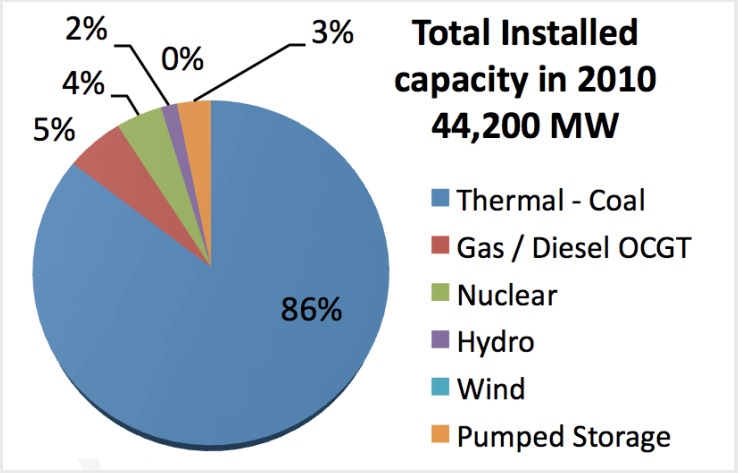
1. **Rapid assessments in priority basins/countries**
2. **Implementation of case studies using existing tools when possible**
3. **Knowledge dissemination, advocacy and capacity building**

THIRSTY ENERGY: Methodological approach

- **Demand Driven , Entry point is Energy Sector**
- **Engagement with relevant stakeholders from day 1**, involving local partners from energy and water sectors to identify potential constraints and synergies
- **Build on existing country knowledge and modeling tools** whenever possible to ensure continuity and sustainability of initiative
- **Flexible modeling framework** to facilitate tailored analyses over different geographical regions and challenges
- **Economic tools to assess the tradeoffs between competing sectors** and to provide policy recommendations to mitigate potential effects
- **Robust treatment of risk and uncertainty, incorporating the long-term effects of climate change**
- **Case studies or pilots to illustrate the different challenges** that are most relevant for client countries.

South Africa:
the case of A Water Scarce Country





- Water scarce country with very stressed basins in terms of water allocation
- Coal Thermal Power plants account for almost 90% of the power capacity installed
- Competition for water across sectors will increase – Power plants have priority, which could negatively affect other sectors such as agriculture
- Fracking for Shale Gas is being explored, which will put additional pressure on water resources

Need for Water and Energy Integrated planning to achieve a sustainable future and avoid water scarcity problems in the next years

Sources - Top: CSIR, Bottom: ESKOM and Department of Energy of South Africa

Potential Policy Questions

- If we account for the cost of water supply, do energy options such as wind, solar PV (and dry cooling) become more economic? Should we invest in them to be more water secure?
- What happens if we force all new power plants to use dry cooling? In term of costs, CO2, etc. Does this policy lower the cost of the overall system (accounting for the water costs of the alternative scenario)?
- What are the impacts of FGD systems on water demand?
- Would it make more sense to build future plants near the ocean and transport the coal?
- Are there any areas that can face water constraints?
- Can future climate uncertainty (droughts and floods) affect the energy sector?
- What about competition of water for other sectors? Who are the winners and losers?

CASE STUDIES: MOROCCO

Background

- Recent merge of power and water utility (ONEE) → **potential for synergies and integrated planning**
- **Water constraints can impact growth,** increasing competition for water across sectors (esp. irrigation); ambitious renewable targets for 2020 to meet 7% annual growth in electricity consumption; **Climate change vulnerability**

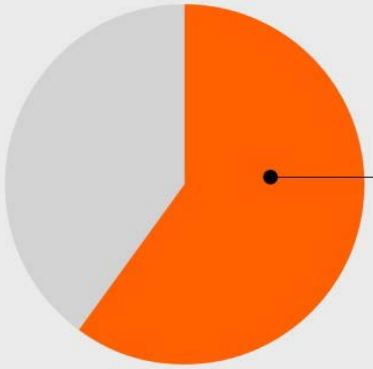
Status

- **First Stakeholder Workshop has been convened.** It was preliminarily decided, that two activities will be undertaken:
  - **at the national level,** focusing on the first national integrated energy and water vision, flagging potential future constraints, and including all relevant stakeholders in the government, private sector and others.
  - **at the utility level (ONEE),** focusing on identifying synergies and integrated strategies to improve the efficiency of the utility
    - **Optimized Planning of ONEE Water and Power Needs**
    - **Wastewater Reuse for Power**
    - **Power Transmission Lines vs Water Transfer**

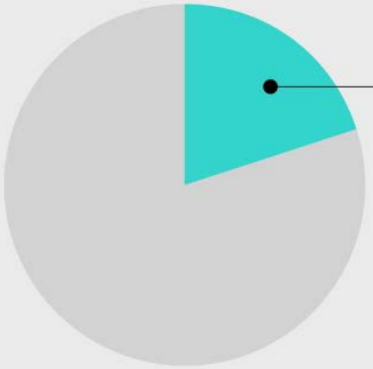
Next Steps: **Second Stakeholder Workshop : June 2015**

CASE STUDIES: CHINA

- China's "Big Five" Power Utilities are **all highly exposed to water disruption**
- Most energy reserves and power plants are **located in water scarce areas**, sectoral growth increasing due to population growth, climate change
- **Pollution problems & degraded resources**
- **expansion plans for coal power plants in China** might not be feasible due to water scarcity issues (Bloomberg, 2013)



Northern China is home to over 60% of the country's thermal power capacity



but has just 20% of the country's renewable freshwater supply

Source: Bloomberg, 2013

CHINA: FOCUS ON ENERGY BASES

- Work concentrates on 4 energy bases: Shanxi, Ordos Basin, Eastern Inner Mongolia, and Xinjiang
- Bases concentrate on coal mining, coal chemical, thermal power generation, oil and gas development
- Southwest region will less constrains of water

Partners

Form stronger alliances. The challenge presented by the nexus is too large for any country, region, development finance institution or implementing agency to tackle alone

Funding Partners:

- Water Partnership Program
- ESMAP
- Korea Trust Fund for Green Growth

Private Sector Reference Group

- Abengoa
- Électricité de France (EDF)
- Alstom
- Veolia

Other collaborating partners

- International Energy Agency (IEA)
- Stockholm International Water Institute
- World Resources Institute (WRI)
- UN Water / Sustainable Energy For All
- GIZ
- Others

What next?

- **Ongoing initiative:** Interest growing from several countries and regions
  - Brazil: Sao Francisco Basin
  - Indonesia
  - Mexico
- **Outcomes:**
  - Innovative tools, approaches and solutions developed and implemented to help Bank teams and countries 'green' their growth
  - Policy guidance and Improved design of investments, strategies and plans in energy
  - Knowledge deepened in the water and energy nexus
  - Energy-water integrated planning practice enhanced
  - Water mainstreamed in the energy sector
  - Improve interdisciplinary collaboration among sectors

A World Bank Initiative

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Thank You

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