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The road to resilience – managing the risks of the energy-water-food nexus

World Energy Perspectives

Financing Resilient Energy Infrastructure

Name of presenter | date and name of event

About the World Energy Council

Principal impartial network of leaders and practitioners promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all.

UN-accredited global energy body, representing the entire energy spectrum:

- Over 3000 member organisations in almost 100 countries
- Representing all energy technologies
- From governments, private and state corporations, academia, NGOs and energy-related stakeholders

Informs global, regional and national energy strategies:

- Hosts high-level events, including the World Energy Congress 2016
- Publishes authoritative studies
- Works through its extensive member network to facilitate the world's energy policy dialogue

What is at risk?

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Meeting energy demands

Secure energy is critical to maintaining and driving economic growth.

Delivering social benefits

Energy must be accessible and affordable at all levels of society.

Minimising environmental impacts

The impact of energy production and energy use on the environment must be reduced.

About the report

- ‘The road to resilience – managing the risks of the energy-water-food nexus”:
  - Launched at the Asia Pacific Energy Leaders’ Summit in New Zealand, 17 March 2016
  - Presented to the Asia-Pacific Economic Cooperation (APEC) working group
  - Available on www.worldenergy.org/publications

- The second in a series of reports that addresses the need for more investment and system change to combat the new emerging risks, including extreme weather, the energy-water-food nexus and cyber risks.

The energy-water-food nexus

- In 2010, the World Energy Council released a report on "**Water for Energy**" insisting on **necessity for policymakers** to set **energy policies considering water availability**
- The report highlighted policy measures and conditions to **accelerate the entry of technologies** which would decrease the water footprint of energy
- Since then**, technologies** such as "recirculating" systems as opposed to "once-through" systems, the adoption of dry cooling, improvements in desalination processes and reusing water from oil extraction have been progressively **deployed to reduce the water footprint of energy**

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The energy-water-food nexus

The **energy-water-food nexus** is the term used to describe the **interdependencies**, and sometimes **competing demands**, between **water usage** and the **production of energy and food** – an issue that triggers economic and social challenges amongst numerous stakeholders.

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Key findings

The challenges raised by the nexus

- Energy is the **second largest freshwater user** after agriculture
- Water **is used all along the energy value chain** in primary energy production (coal, oil, gas, biofuels)
- **98% of the power currently produced needs water**
- Analysis in Nature Climate Change highlight that from 2014 to 2069 **reductions in usable water capacity could impact two thirds of the 24,515 hydropower plants analysed** and **more than 80% of the 1,427 thermal electric power plants** assessed

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Resilience comes at a cost

- **Technologies to make energy infrastructure more resilient** to the risks posed by the energy-water-food nexus often **increase the cost of development**
- Increased resilience would add to the IEA's estimate of USD 48-53 trillion in cumulative global investments needed in energy infrastructure by 2035.
- The **private sector** will have a **crucial role** in meeting this challenge.

Risks are likely to intensify

- The risks posed by the energy-water-food nexus will become more significant because of **growing demand for energy, water and food**

  Some of the regions that are currently water stressed are also likely to see significant growth in population

- Alongside growing demand, **uncertainty about water availability and quality will increase -** driven by climate change impacts
  - Declining fresh water availability
  - Increasing temperatures of ocean waters
  - More extreme weather patterns

Increasing the financial obstacle

- **Lack of knowledge on water issues** and **lack of modelling tools** to adequately reflect risks posed by the nexus in energy infrastructure investment decisions
- **Large economic stakes**: in 2015, hydropower facilities in Brazil sustained economic of more than USD 4.3 billion due to drought-related energy and water rationing measures
- **Increasing uncertainty** concerning future availability of water for energy and **risks of stranded assets** make **long term investment decision more and more complex**

A major geopolitical challenge

- **Cross-border cooperation is a key issue**: 261 international trans-boundary basins cover 45% of the earth's land surface, serve 40% of the world's population and provide 60% of the earth's entire freshwater volume

- This affects the operation of planned and proposed energy infrastructures and there is a **need to ensure that adequate cross-border water management frameworks are in place**.

All technologies are not equivalent

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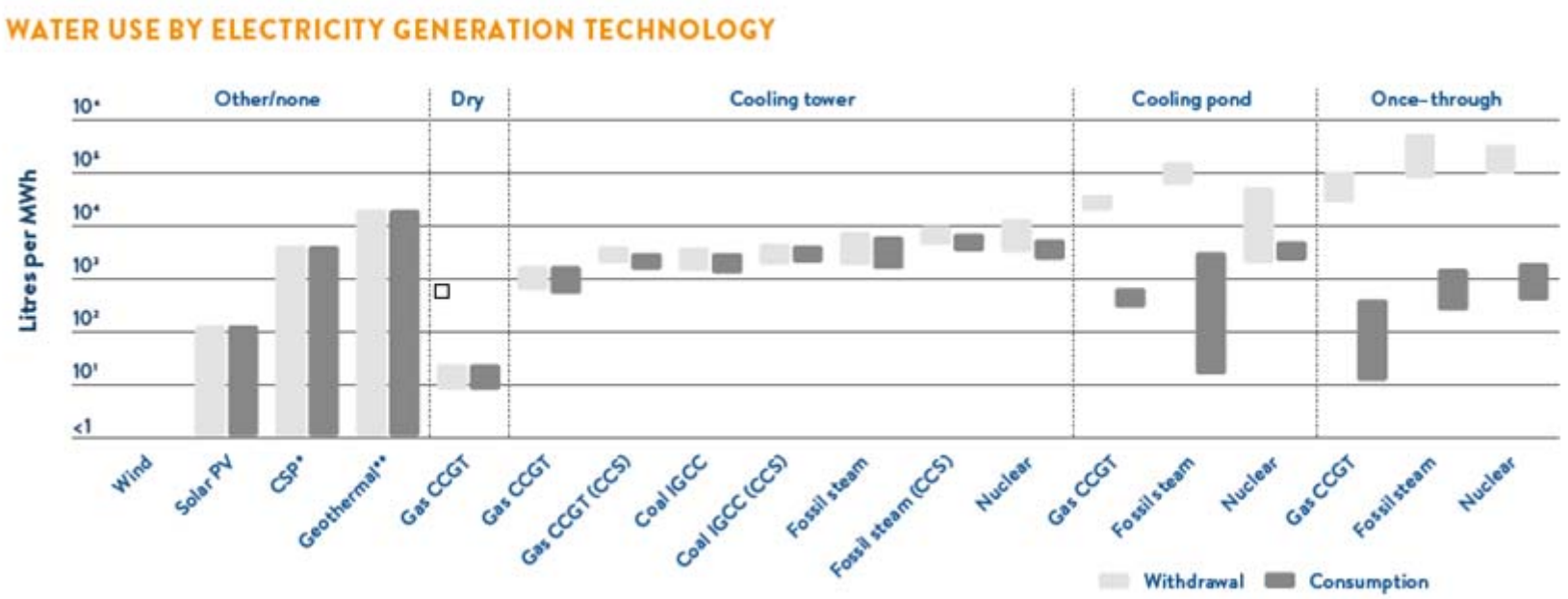

Early analysis indicates that the overall water footprint of the energy sector could be lowered if more power or heat were produced by renewables such as wind, photovoltaics, or natural gas, as they show comparatively low water usage.

Strong regional disparities

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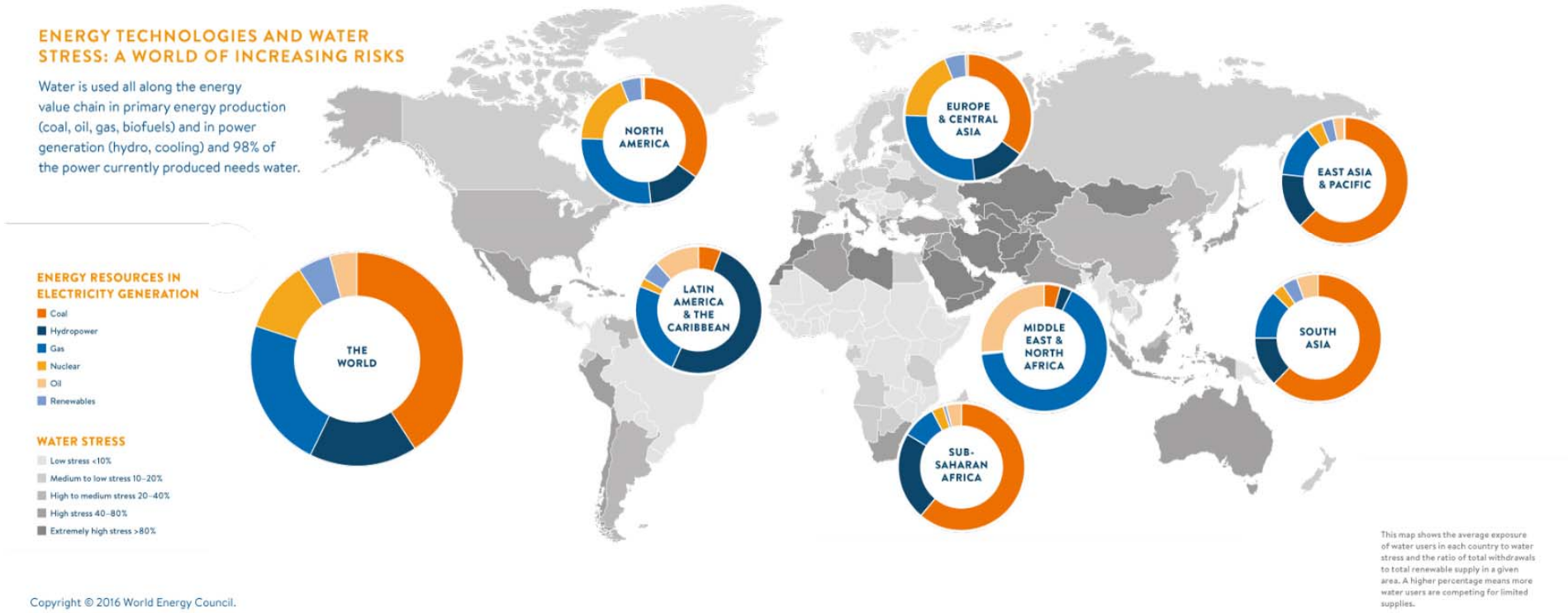

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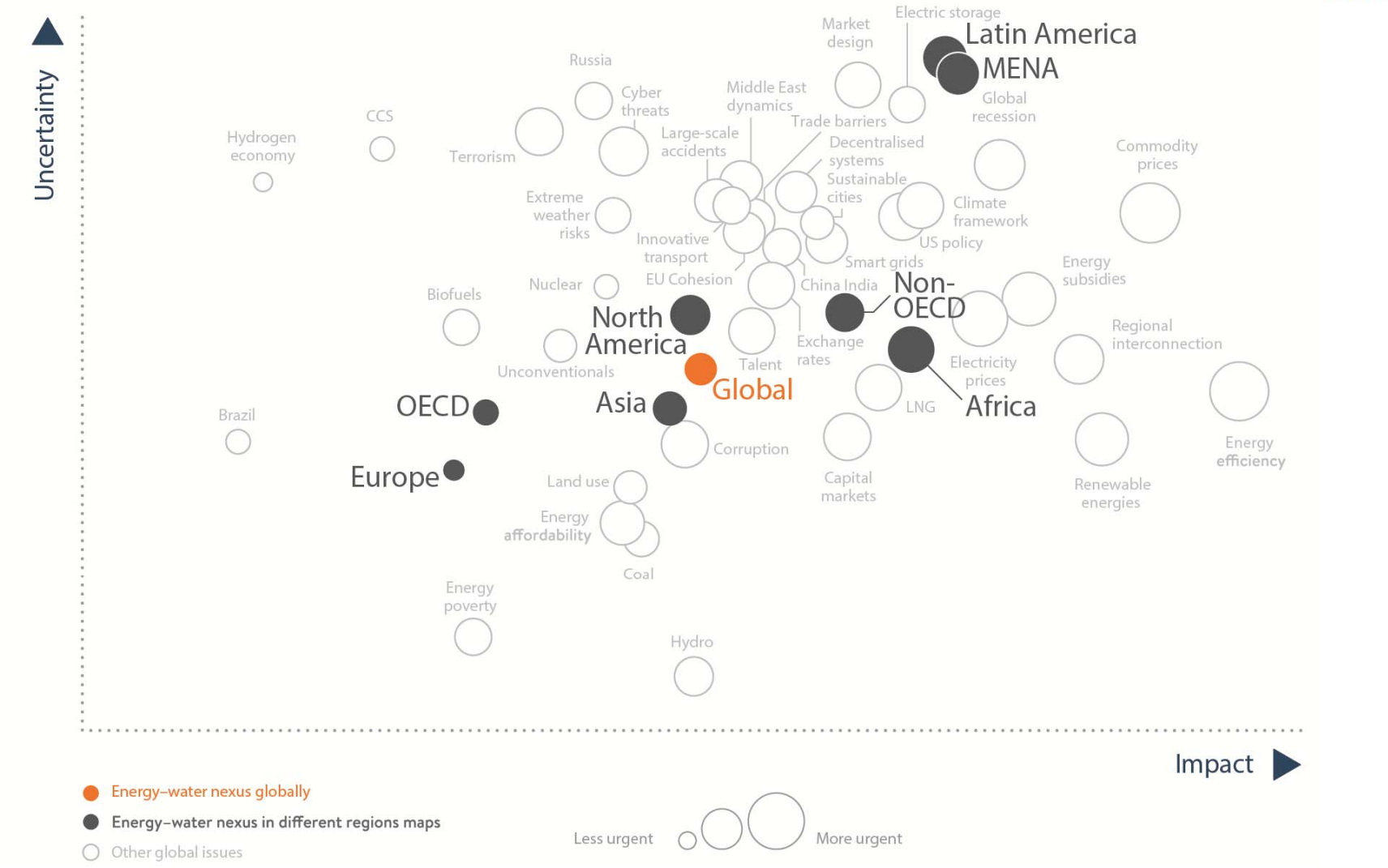
Energy-water nexus 2016



Recommendations

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Integrate nexus in energy infrastructure projects

1. Project developers need to be able to **better understand the water footprint of energy technology choices** being considered in order to mitigate the risks of potential stranded assets

2. Risk assessments should reflect a **comprehensive understanding of long-term risks** by incorporating different **climate and hydrological scenarios** in financial analyses.

   This shows investors that environmental and social considerations have been accounted for in the design of energy infrastructure

Integrate nexus in energy infrastructure projects

3. Water scarcity **has to be taken into account** and, where possible**,** **priced appropriately** to establish an accurate risk profile that reflects the local context. If no market price can be used, companies can use a shadow water price.

   Water management and pricing policies must be tailored to ensure that other policy objectives, such as equity considerations, are also met.

Have a reliable and enforceable regulatory and legal framework

4. **Transparent** and **predictable regulatory and legal frameworks are needed** to promote efficient solutions to balance the interests of competing users and provide certainty to investors.

   Governments must **improve water resources monitoring** and implement **sound water governance** to facilitate planning of resilient energy infrastructure by **reducing the risk of unforeseen policy or regulatory changes**

   This requires **managing water resources over entire river basins and stakeholders** to address water rights across sectors and jurisdictions

Use appropriate instruments to minimise finance cost and stabilising returns

5. The financial services and insurance industries offer **financial instruments** to address adverse weather impacts, weather-related volume exposures and electricity price volatility combined with unplanned power outages.

   These products **are still relatively limited**, but could be used to hedge such risks as water scarcity. They can help stabilize income volatility and reduce risks for investors.

Call for action

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Thank you

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Annex: regional impacts and energy resources

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Region 1: Asia

MALAYSIA, 2014

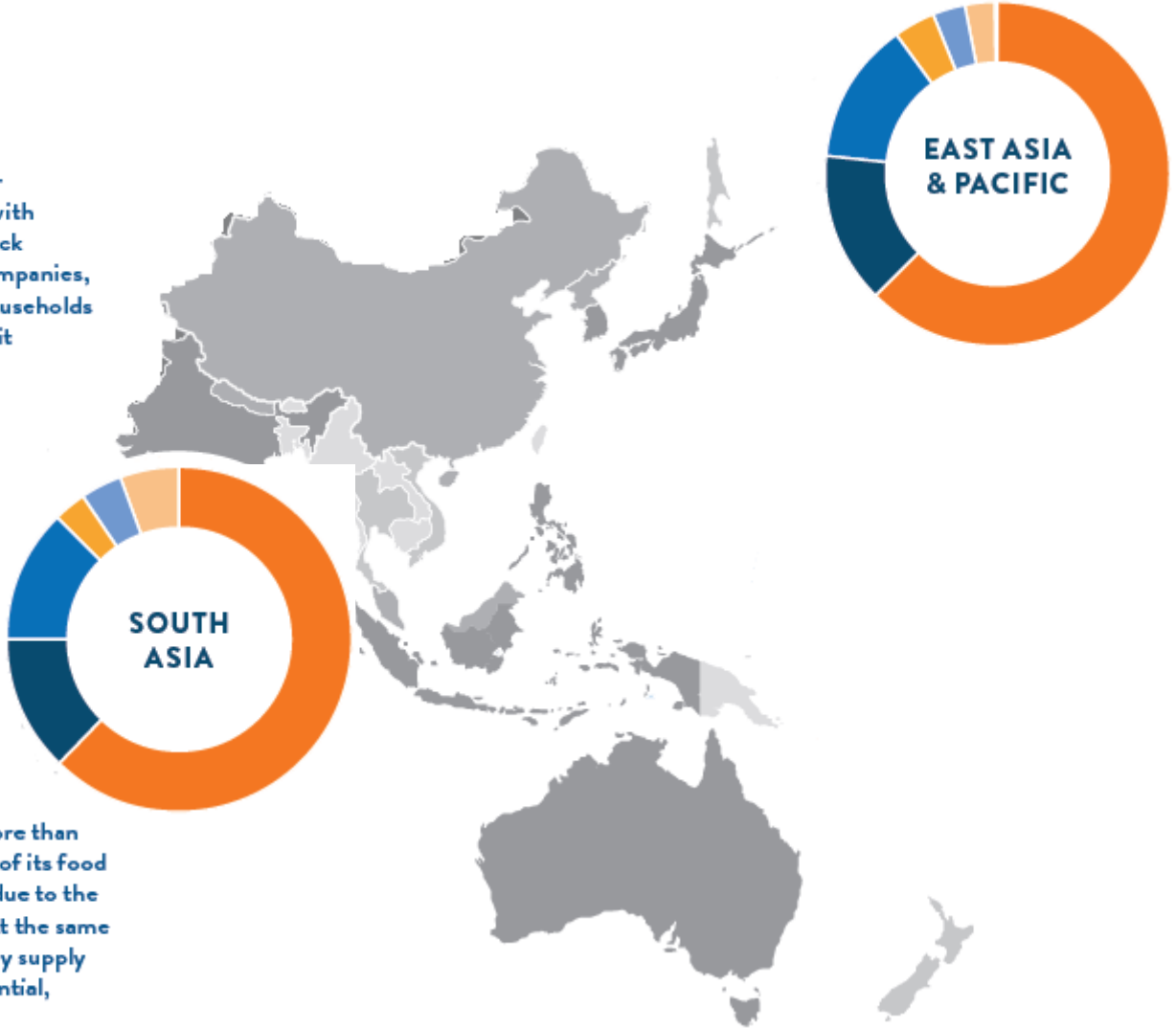
The state of Selangor suffered a severe water crisis caused by hot, dry weather combined with infrastructural problems and political deadlock between the state government and water companies, resulting in water rationing for millions of households and industries, leading to multi-million ringgit economic losses.

CHINA, MAY 2011

The Yangtze River was affected by its worst drought in 50 years due to a lack of rainfall downstream impacts from large-scale wate diversion projects. The water shortages aff 4.4 million people with its impact on agricu drinking supply, transportation, and hydro utilisation, which dropped by 55% in Hunan province in the month of April alone.

PAKISTAN, 2015

The Indus River Basin, which accounts for more than 95% of Pakistan's irrigation and the majority of its food production, is facing increased water stress due to the impacts of climate change on glacial flows. At the same time the country is looking to increase energy supply by tapping into the area's hydroelectric potential, estimated at around 50,000 MW.



Region 3: MENA

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ALGERIA, 2015–2016
Water-strained Algeria is unable to access its domestic shale gas reserves – the largest in the world – due to the arid desert landscape where 95% of the nation's shale plays are located, as well as strong social opposition based on real or perceived threats to agricultural water needs.

EGYPT, 2015
Egypt's Intended Nationally Determined Contribution calls for adaptation measures to respond to the impacts of climate change on its electricity sector, including the impacts on hydropower plants of changes in rainfall rates and rain distribution across different regions.

SAUDI ARABIA, 2008
After decades of tapping underground water resources for irrigation in a bid to achieve grain self-sufficiency, Saudi Arabia had to abandon the plan in light of rapidly depleting water supplies along with the persistent energy intensity of desalination. Between 2007 and 2010, Saudi Arabia's wheat production declined by more than two-thirds.

SYRIA, 2008–2011
Severe water shortages caused by drought and mismanagement helped to cause the displacement of an estimated 1.5 million people. This coincided with rising fuel prices, which tripled overnight in response to fuel subsidy cuts in 2008, and consequently put a strain on food prices. All of this contributed to the nation's social unrest in the build-up to civil war.

IRAQ, 2014
A lack of reliable water supply to oil fields in the south of Iraq has significantly hampered capacity growth at some of the nation's most significant fields, in part due to disputes over the implementation of a multi-billion dollar common seawater injection scheme. One major plant, West Qurna-1, reported that output had fallen almost 40% between 2013 and 2014 and named water shortages as one of the reasons.

Region 4: North America

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CANADA, AUGUST 2015

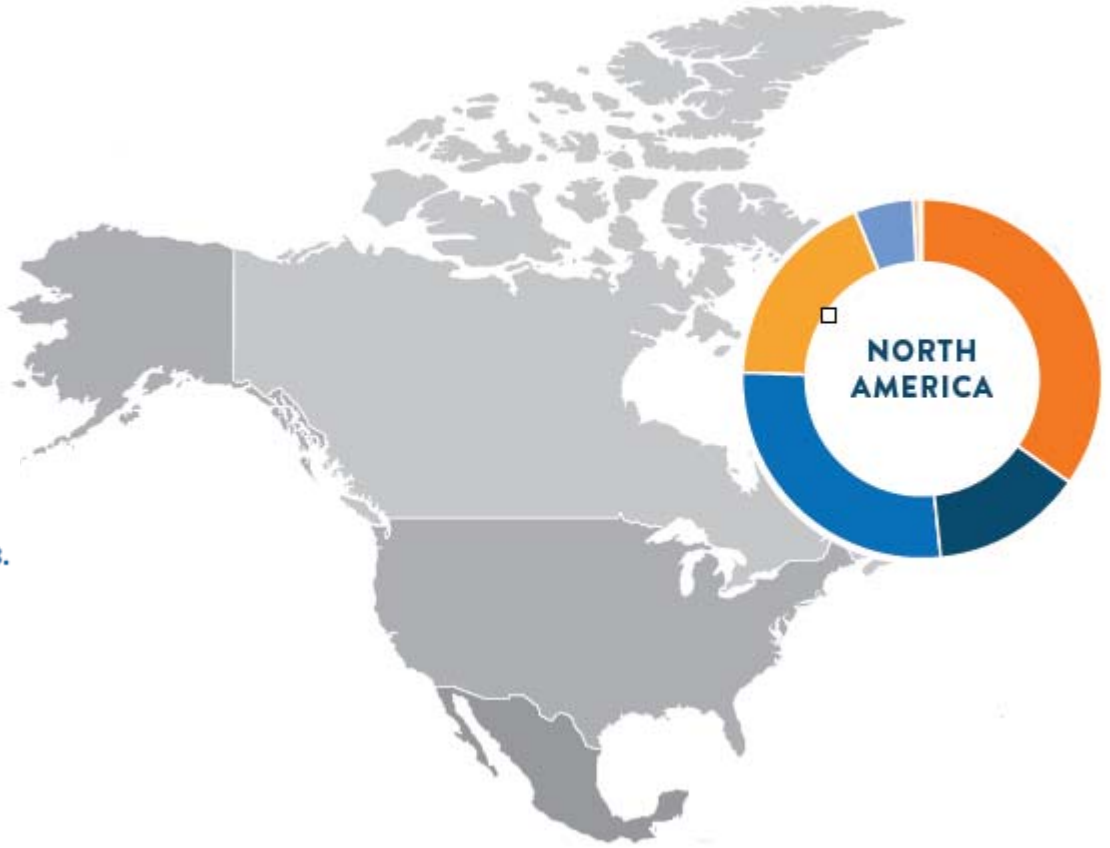
Regulators suspended a number of licenses for oil and gas operators withdrawing water from the Upper Athabasca River in the context of a dry regional climate and diminished river flows. Researchers anticipate that withdrawal disruptions caused by low water levels will rise by up to 40% by 2040, leading to a 22% increase in interruptions to oil sands operations overall.

UNITED STATES, 2007–2008

Rising US biofuel production under incentives set by the EPA's renewable fuel standards and the diversion of corn supplies to ethanol were indicated as a key cause of a 38% rise in US food prices from 2007–2008.

UNITED STATES, 2014

The state of New York banned hydraulic fracturing in the face of social opposition and potential concerns over water contamination, along with various health complaints.



Region 2: LAC

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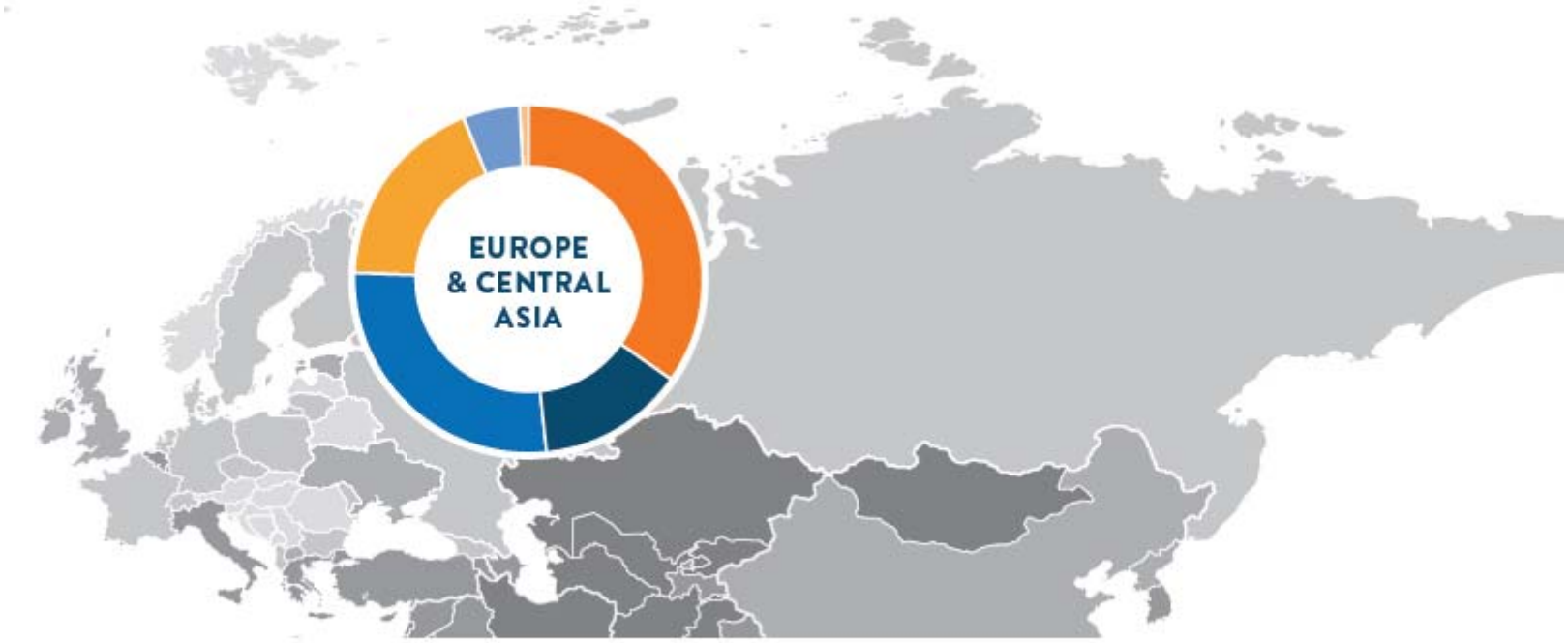
PERU, 2008

Ongoing disputes over water rights and pollution in the Rio Santa watershed escalated as local farmers blockaded the Laguna Parón, angry that the upstream hydroelectric plant was failing to allow lake water releases fit for irrigation. Water scarcity is expected to continue due to the recession of Peru's tropical glaciers, which have lost over 22% of their combined surface area since the early 1980s.

BRAZIL, 2015

Hydropower facilities in Brazil sustained economic losses of more than USD$4.3 billion due to drought-related energy and water rationing measures

Region 6: Europe and Central Asia



POLAND, 2015

Efforts to establish energy security through large -scale shale gas exploitation to tap an estimated 187 trillion cubic feet of favorable shale gas resources were put on hold due to disappointing test results, as well as regulatory uncertainty and social resistance that alleged environmental damage, including water supply contamination.

UNITED KINGDOM, JUNE 2015

Controversy around the introduction of hydraulic fracturing and concerns around the impact on water supplies, public health, and the natural environment, led to the rejection of a fracking exercise by Lancashire county council and the planned exploitation of an estimated £140 billion of shale gas reserves.

Region 5: Sub-Saharan Africa

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RWANDA, 2015

Competing demands of agriculture, industry, and household use in a region of long-standing water stress had led to an annual water short-fall of some 330 cubic meters for Rwanda. A 66 billion Rwandan franc initiative will include a water allocation framework and key strategies including rain harvesting, ground water recharge, and multi-purpose dams that can be used for hydroelectricity, irrigation, and domestic water supply.

SOUTH AFRICA, 2015

Water scarcity threatens the viability of South African coal production given the water-intensiveness of coal technologies which is used to generate around 90% of its domestic electricity supply. Mitigation efforts to address the effects of acidic water leaking from abandoned mines into surrounding water ecosystems have cost 30 billion rand.