Presentation from

2015 World Water Week in Stockholm

www.worldwaterweek.org

IPIECA

Oil and gas sector water management:

From now to 2030

August 2015

THE GLOBAL OIL AND GAS INDUSTRY ASSOCIATION FOR ENVIRONMENTAL AND SOCIAL ISSUES

www.ipieca.org

What is IPIECA?

- Global oil and gas association for environmental and social issues
- Formed in 1974 following the launch of UNEP
- The only global association involving both the upstream and downstream oil and gas industry
- Membership covers over half of the world’s oil production

IPIECA members

Anadarko Petroleum Corporation
БАШНЕФТЬ
BG GROUP
bp
Chevron
CNOOC
ConocoPhillips
EDF
HESS

eni
ExxonMobil
Hunt Oil Company
Husky Energy
INPEX
Kuwait Petroleum Corporation
MÆRSK
Marathon Oil
nexen

noble energy
LIBYA NOC
OMV
PETROBRAS
PETRONAS
Petrotrin
PTTEP
RasGas
REPSOL

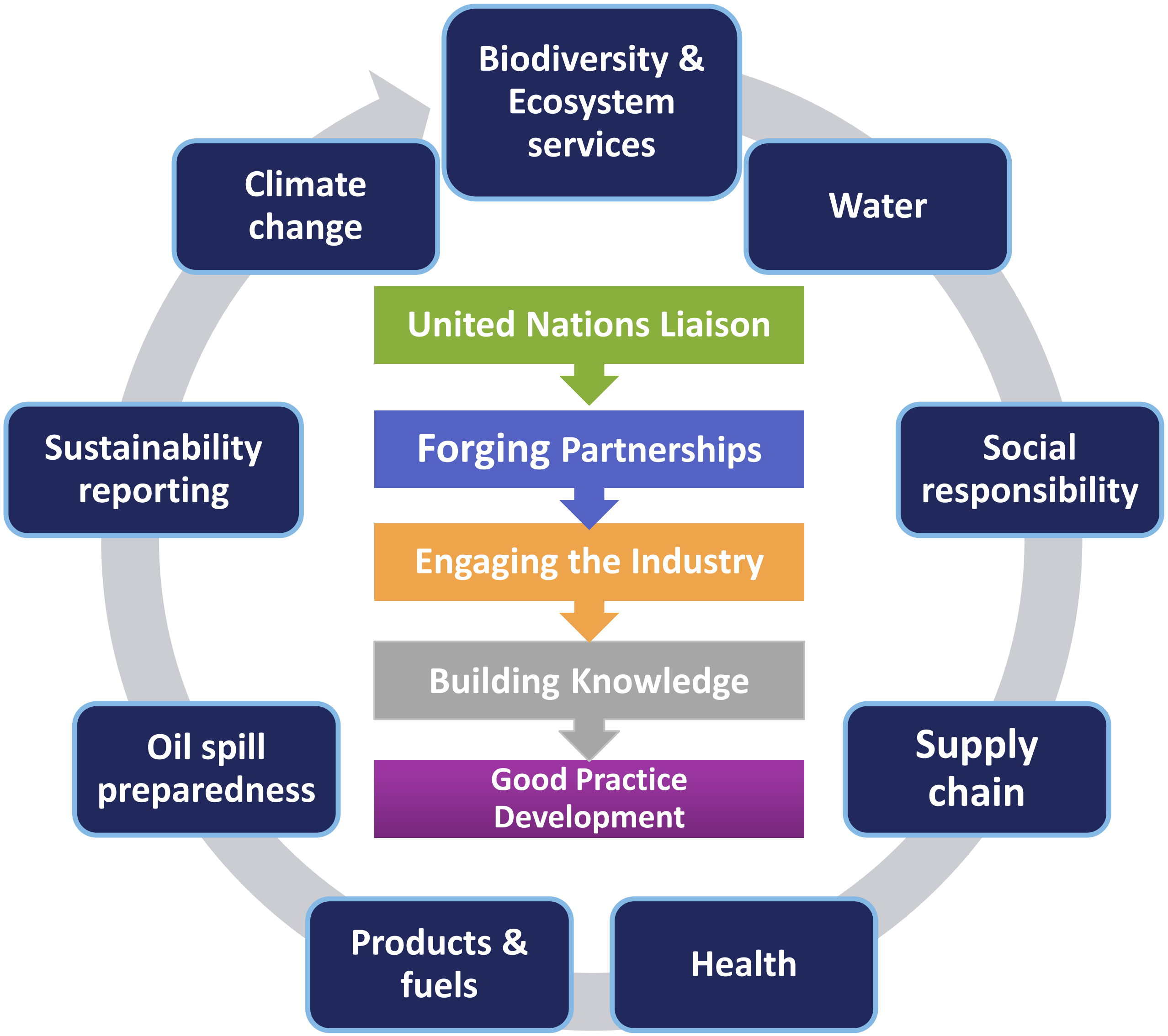
Santos
Saudi Aramco
SNH
Statoil
TALISMAN ENERGY
TOTAL
TULLOW
woodside

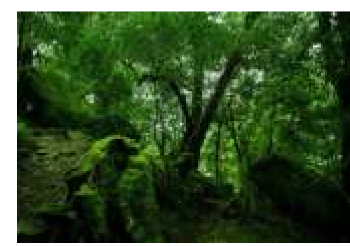
AIP
energy API
appea
ARA
arpel
CAPP Canadian Association of Petroleum Producers
Canadian Fuels Association
concawe

FuelsEurope
ibp
JPEC
IOGP International Association of Oil & Gas Producers
PAJ
sapia
UKpia
World Petroleum Council

IPIECA

Scope of Activity





IPIECA

Water Visioning - Objective

To build a long term vision (to 2030) for water management in the oil and gas sector

The vision will consider:

- Physical quantity and quality trends and constraints
- Future demand and supply
- Policy and regulatory trends
- SDGs
- Societal expectations
- Technological innovation

Overview

PRESENTATIONS	**Future Water Challenges: Understanding Future Water Supply and Demand** • Paul Reig, World Resources Institute
	American Energy: New Perspectives on the Shale Energy-Water Nexus • Amy Emmert, American Petroleum Institute
	Future Direction of the Oil and Gas Sector in Management Water Resources: NGO Perspective • Marielle Canter Weikel, Conservation International
	Water Management at Shell: Global issues – Local solutions • Alfio Mianzan, Shell Corporate Environment
DISCUSSION PANEL	**Future Challenges: Panel Session** • All Panellists
	Summary and wrap up • Alistair Wyness, IPIECA Water Working Group Chair

WORLD RESOURCES INSTITUTE

FUTURE WATER CHALLENGES:
UNDERSTANDING FUTURE WATER SUPPLY & DEMAND

Paul Reig, WRI

2015 World Water Week

FUTURE WATER CHALLENGES:

UNDERSTANDING FUTURE WATER SUPPLY & DEMAND

1. Data limitations
2. Estimating future water supply and demand
3. Water quantity risks and impacts
4. Water policy & governance

1. DATA LIMITATIONS

- Gaps in regional-scale hydrological data
- Certain types of water data are not collected or reliable
- Water quality data is especially limited or unreliable,
- Some countries or regions sill restrict access to water data.
- Some water users and needs are unquantified or unquantifiable

2. ESTIMATING FUTURE WATER SUPPLY & DEMAND

Scenarios of future water supply:

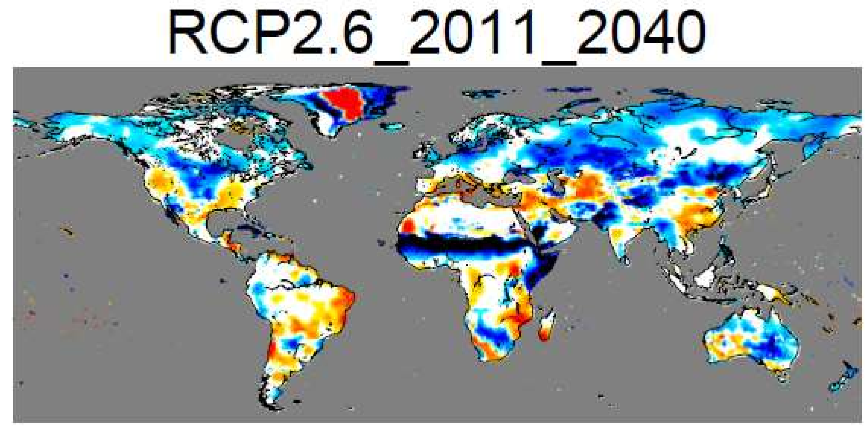
- Impacts from GHG emissions
- Precipitation (Runoff)
- Temperature (ET and PET)
- 4 Representative Concentration Pathways (RCPs)

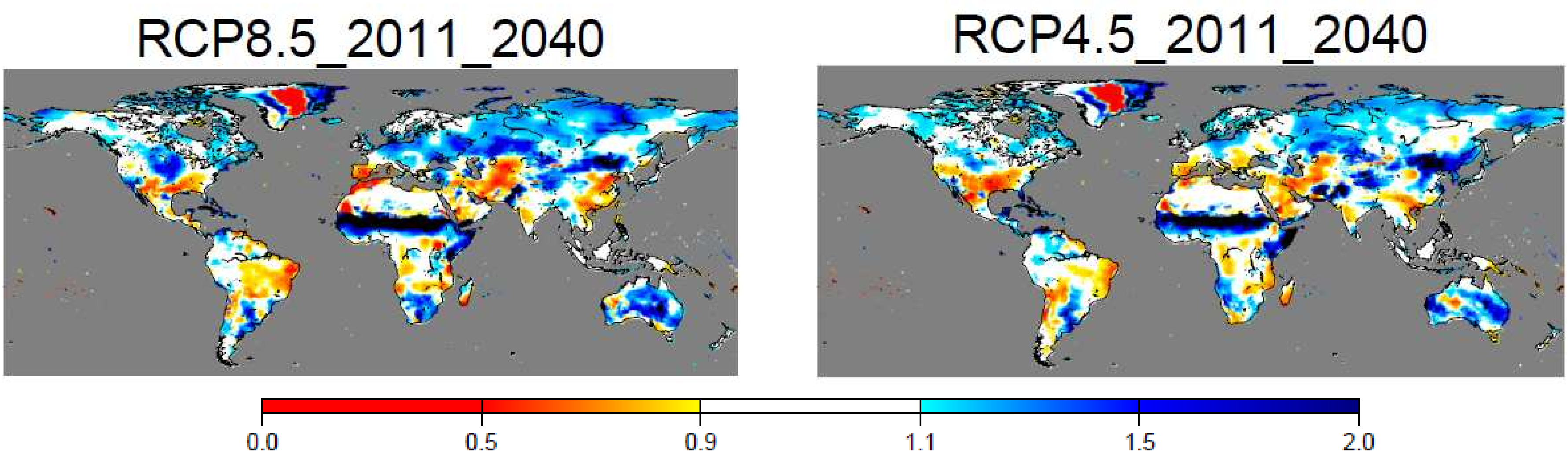
Scenarios of future water demand:

- Impacts from changing population, GDP and urbanization
- Industrial, agricultural, and domestic water demands
- 5 Shared Socioeconomic Pathways (SSPs)

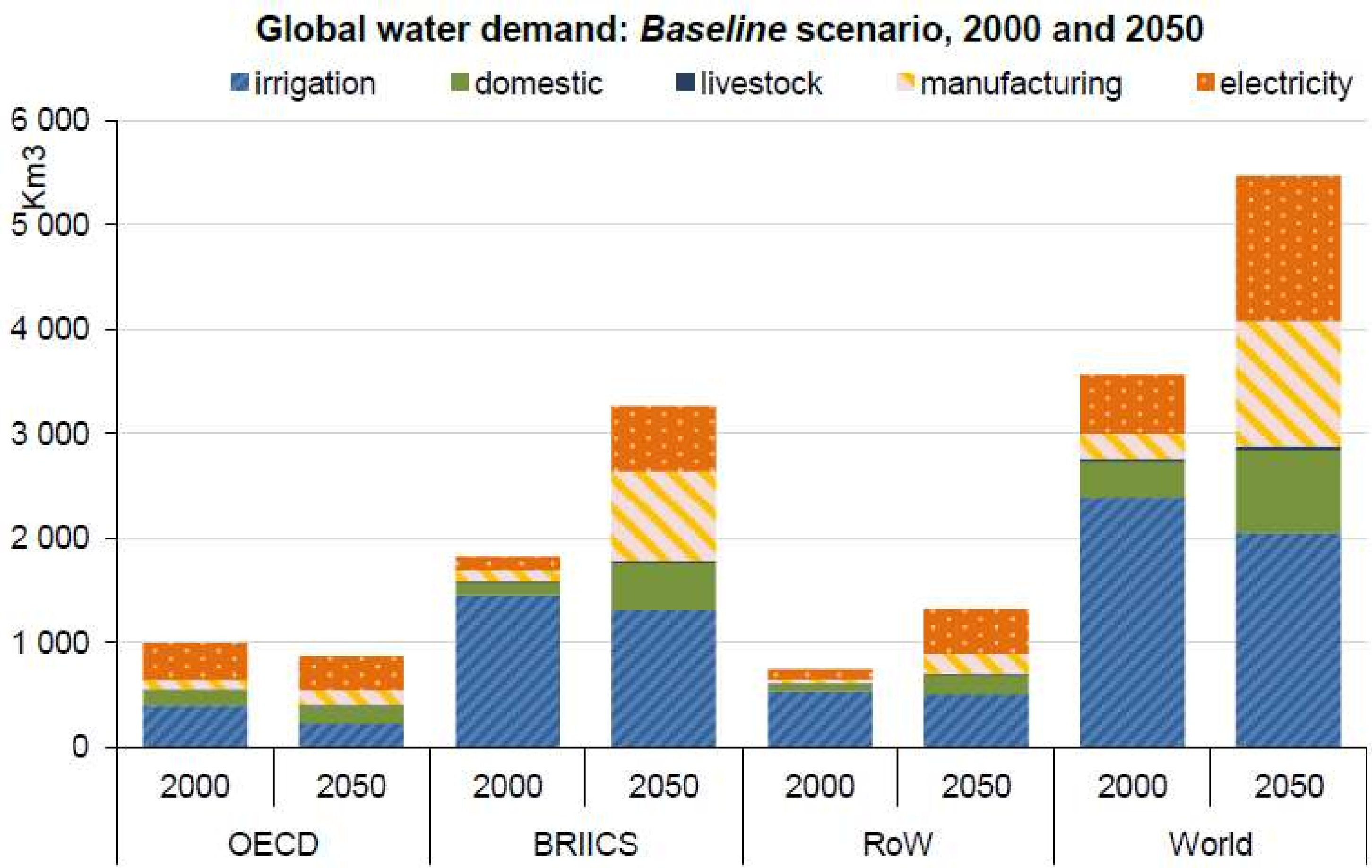
3. WATER QUANTITY RISKS & IMPACTS

Global pattern of change (ratio) in the mean annual runoff from the baseline period (1971–2000) to 2040. Hanasaki et. al (2013)



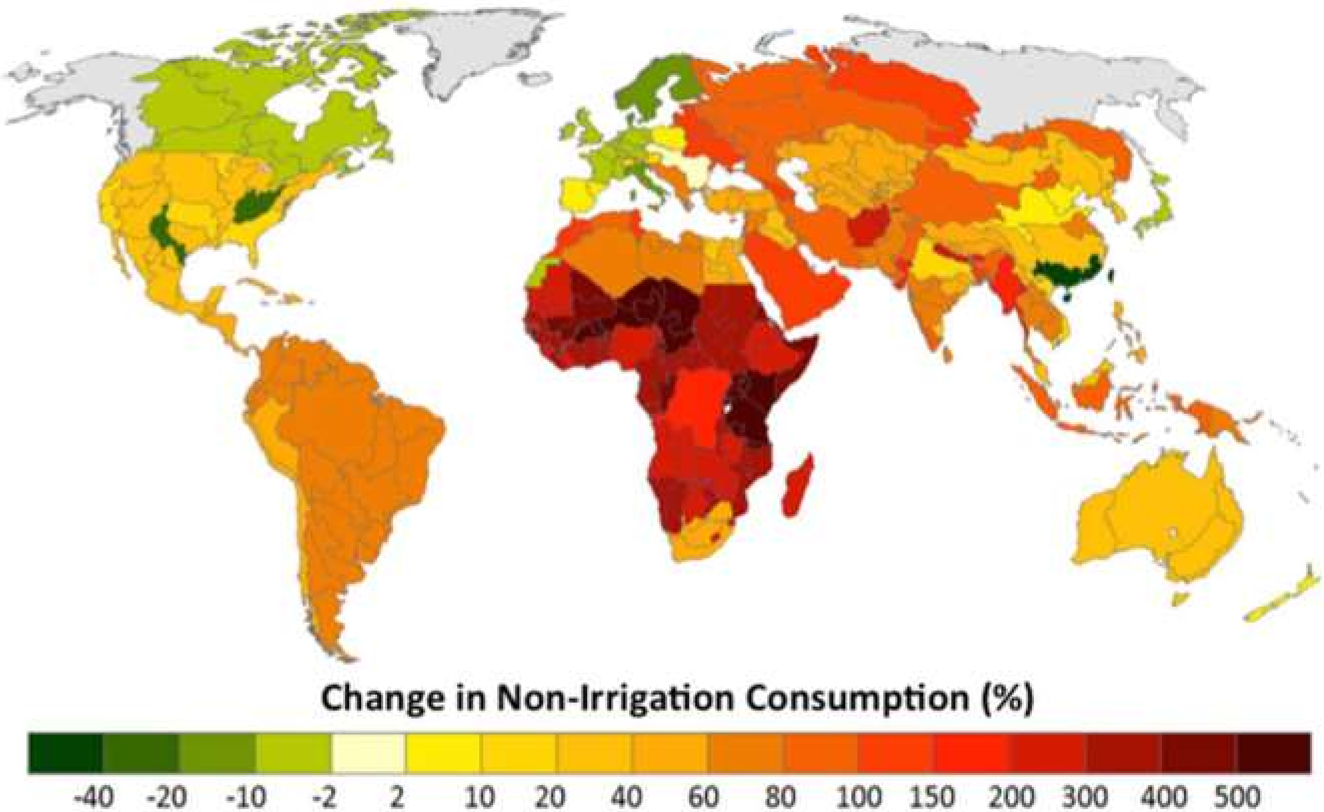


3. WATER QUANTITY RISKS & IMPACTS



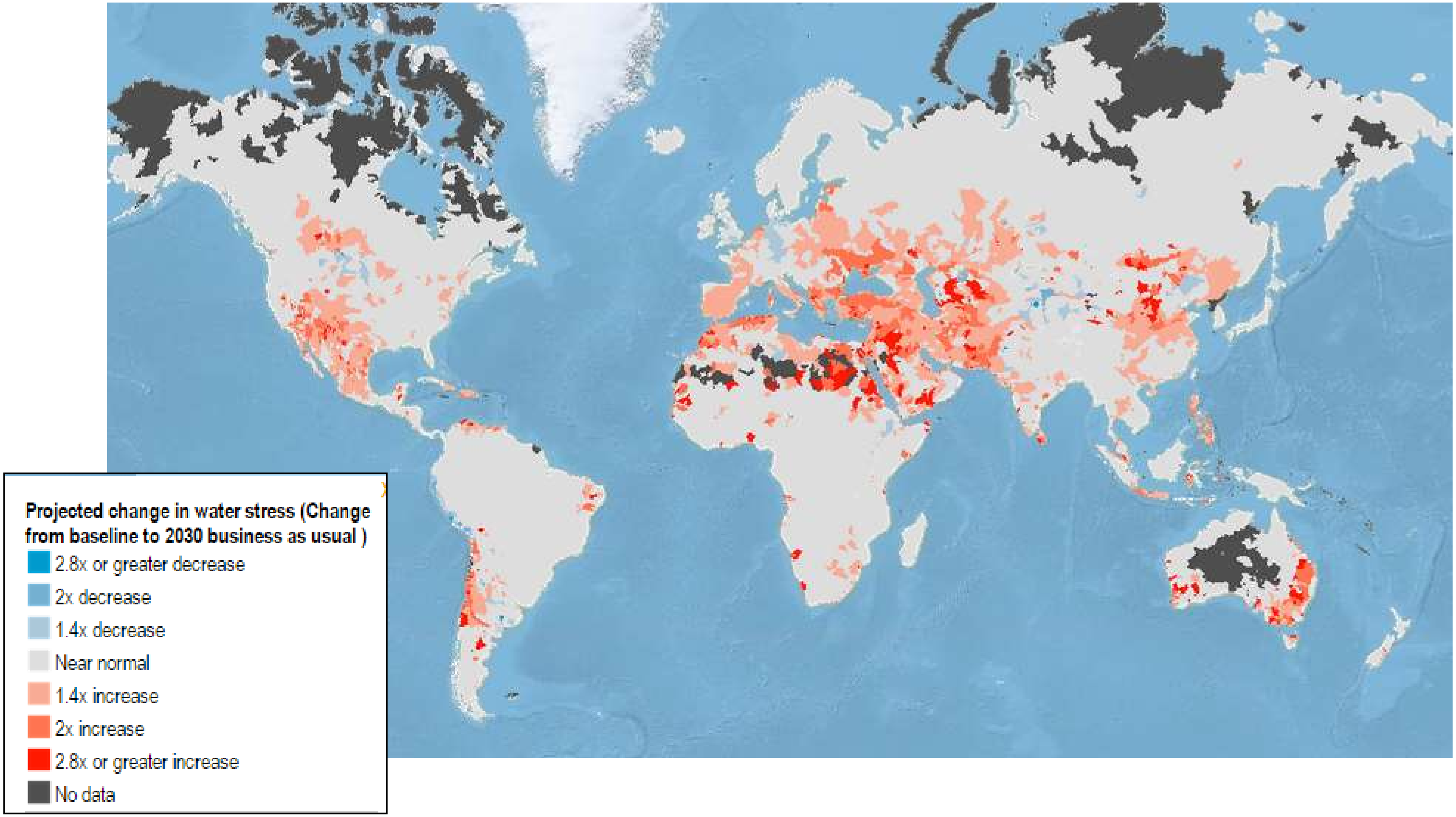
Source: OECD (2012)

3. WATER QUANTITY RISKS & IMPACTS



Source: MIT (2014)

3. WATER QUANTITY RISKS & IMPACTS



3. WATER QUANTITY RISKS & IMPACTS

The road forward

- Increasing water demands pose the largest threat to water security
- Water managers can intervene by curtailing increases in demand
- Adapting to decreasing water supplies in regions where water is already fully allocated will be a significant challenge.
- Some areas that are not expected to get drier may face increased seasonal variability of water supply.

4. WATER POLICY & GOVERNANCE

Water Trends	Policy Reponses
Increasing water demand	▪ Pricing ▪ Rights & Allocations ▪ Standards (e.g. Treatment)
Decreasing water supplies	
Declining water quality	
Unmet needs	
Changing expectations	
Climate change	

4. WATER POLICY & GOVERNANCE

Major governance challenges in 17 OECD countries (OECD 2011)

- Funding gap
- Capacity gap
- Policy gap (i.e. fragmentation of responsibilities)
- Boundary Mismatch (i.e. hydrological vs. administrative)
- Information & accountability gaps

RELATED SESSIONS

Monday August 24th 16:00-17:30
Revealing the Value of Water; Room FH 202

Wednesday August 26th, 16:00-17:30
Managing Change: Future Water Stress and Flood Risk Assessment Tools; Room FH 307

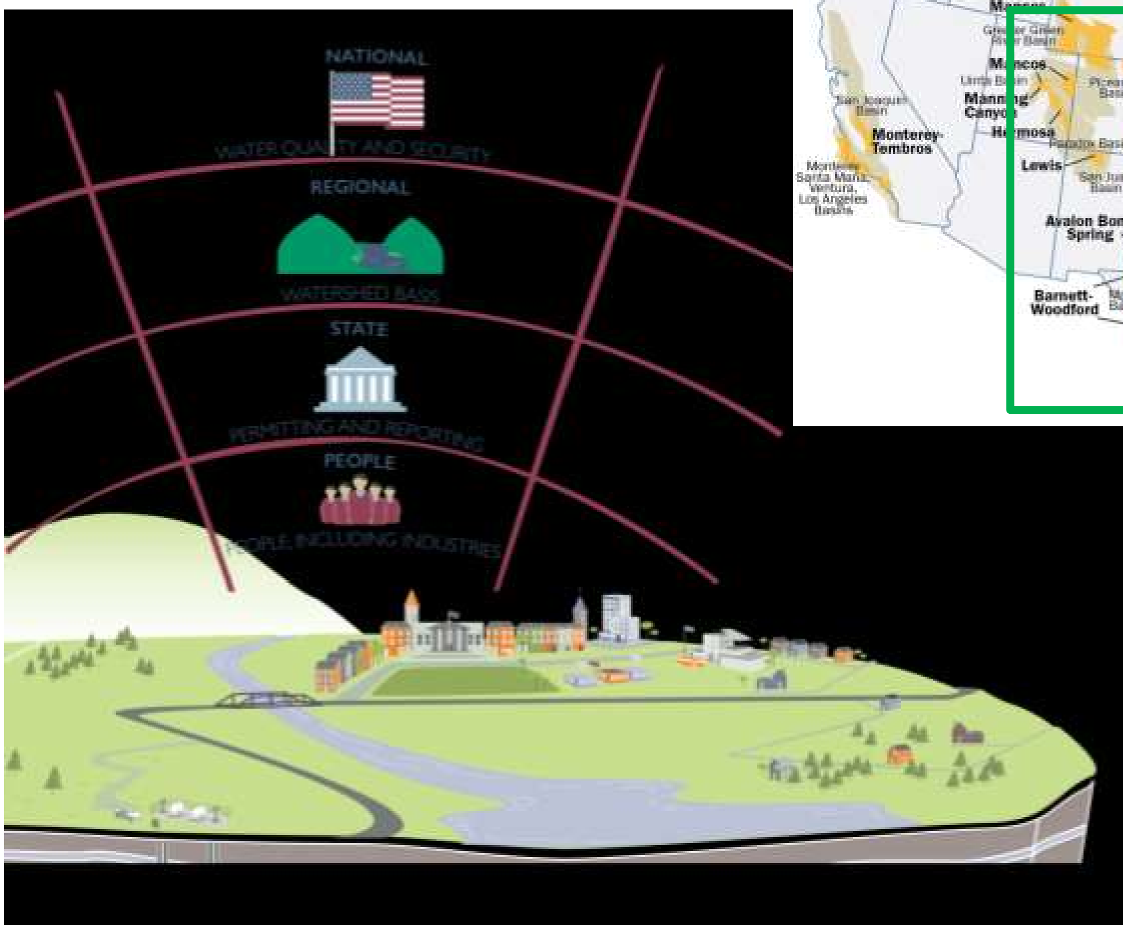
For additional information, please contact:

Paul Reig | Associate, Water Program and Business Center | preig@wri.org

AMERICAN ENERGY:

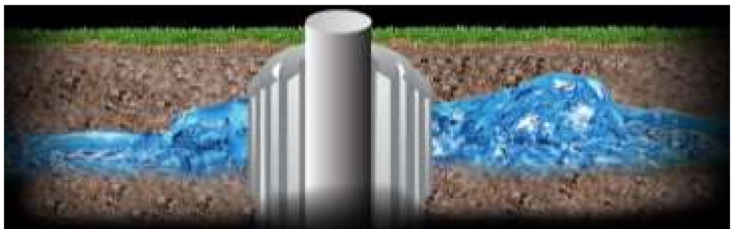
NEW PERSPECTIVES ON THE SHALE ENERGY – WATER NEXUS

In the U.S., states are the primary regulators of resources – including both mineral development and water use.



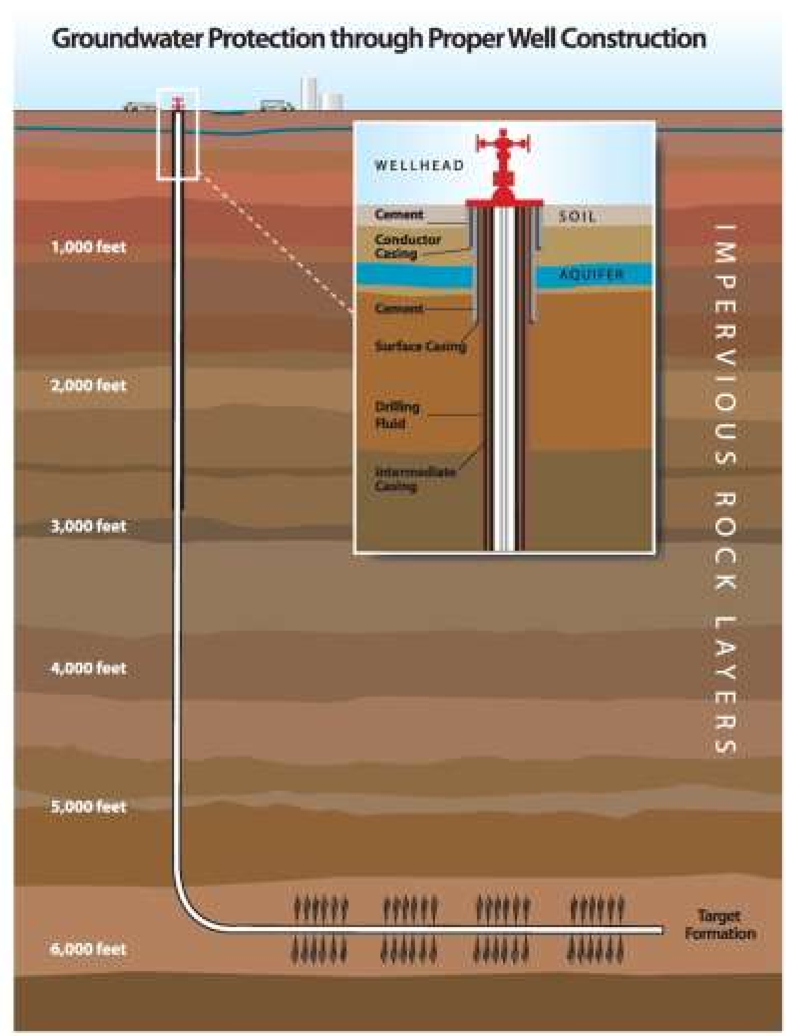
The U.S. approach is consistent with the United Nations Commission on Sustainable Development recommendation that water should be managed at the lowest appropriate level in order to facilitate decentralized decision-making and stakeholder input.

A 2015 draft report by the U.S. Environmental Protection Agency (EPA) confirms that hydraulic fracturing has not led to widespread, systemic impacts on drinking water resources thanks to the safety and effectiveness of state and federal regulations.

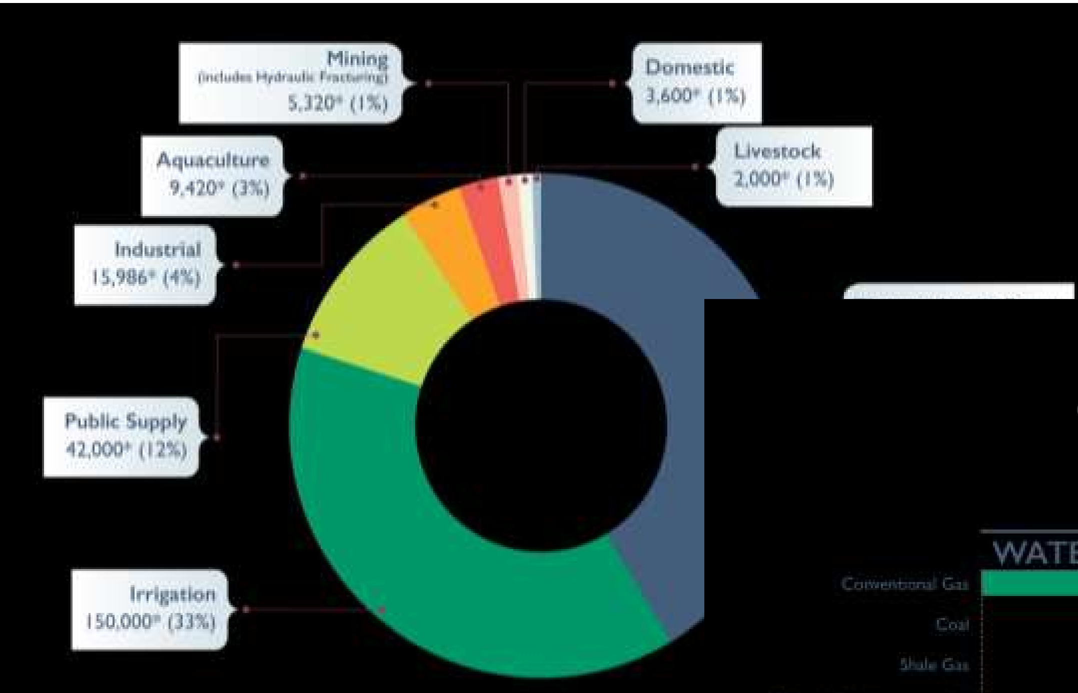


Regulated by Jursidiction

- **Well construction*:** material selection*, performance*, evaluation* – e.g.,
  - Cement regulation*
  - Casing and cementing depth*
  - Cement circulation*
  - Intermediate casing circulation*
  - Production casing circulation*
- **Well integrity*:** Protect groundwater through a combination of redundant steel casing and cement sheaths, mechanical isolation devices
- **Well logging and other testing*:** data gathering tools for formation evaluation, well design and construction

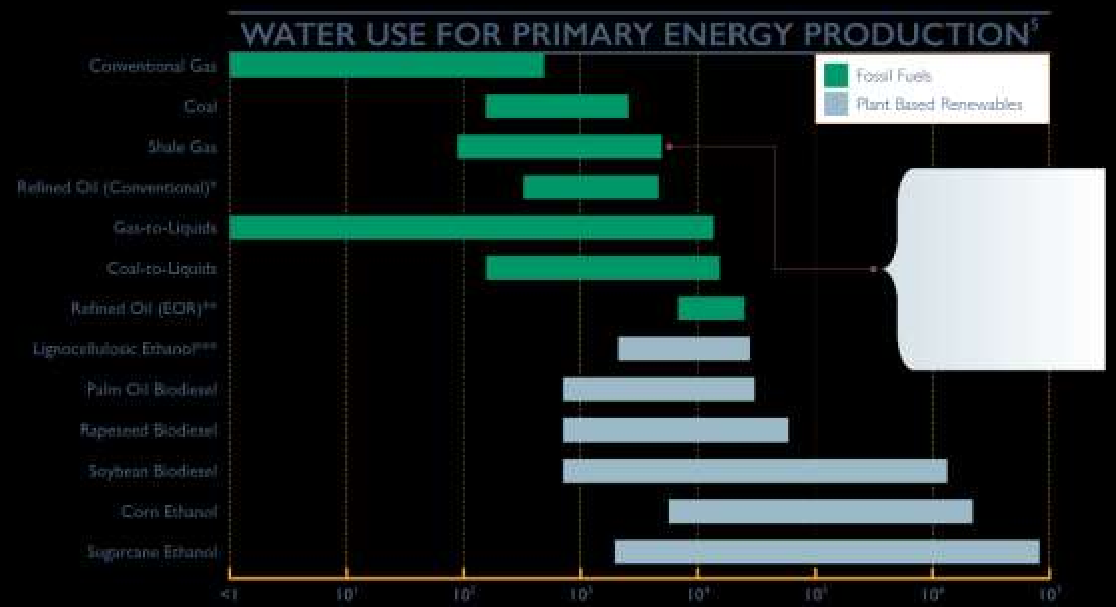


*Also covered by API Standards, Recommended Practices, or Guidance



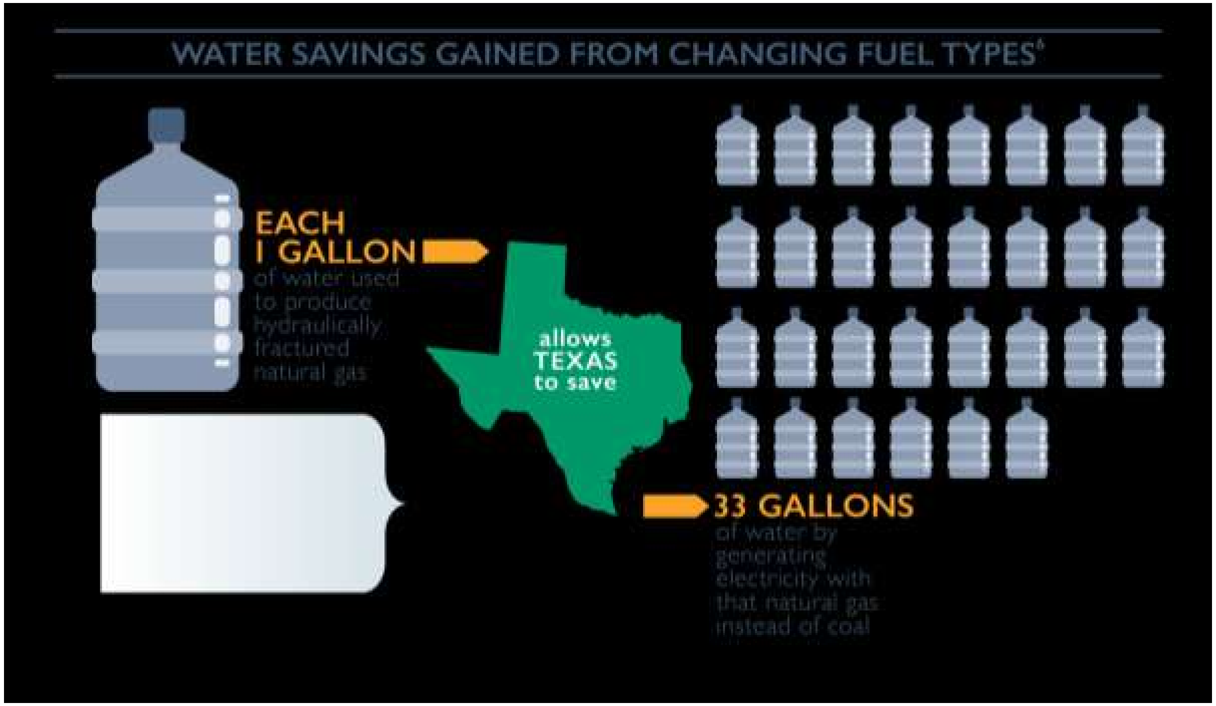
The U.S. oil and natural gas industry produces the hydrocarbon inputs for 56% of U.S. energy production and 28% of US electricity generation by using less than 1% of the country's

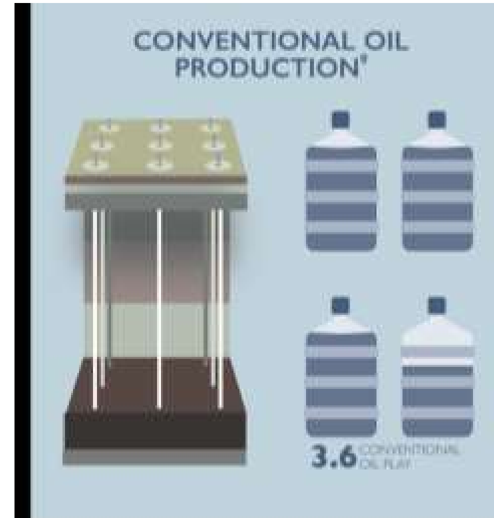
Estimated Use of Water in the United States in 2010, U.S. Geological Survey, Circular 1405

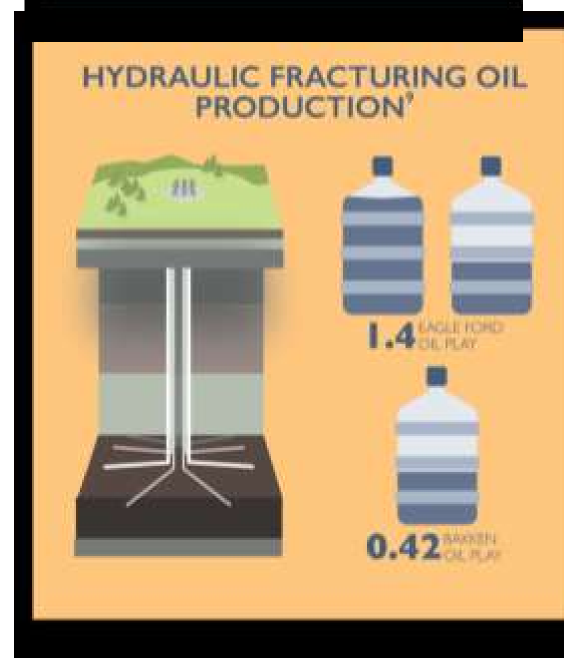


Oil and natural gas are currently relatively water efficient fuels.

5) Water for Energy: Is Energy Becoming the Thirstier Resource?, International Energy Agency, Excerpt from the World Energy Outlook 2012
* The minimum is for primary recovery, the maximum is for secondary recovery.
**Includes CO2 injection, steam injection and alkaline injection and in-situ combustion. ***Excludes water use for crop residues allocated to food production. Notes: Ranges shown are for source-to-carrier primary energy production, which includes withdrawals and consumption for extraction, processing and transport. Water use for biofuels production varies considerably because of differences in irrigation needs among regions and crops; the minimum for each crop represents non-irrigated crops whose only water requirements are for processing into fuels







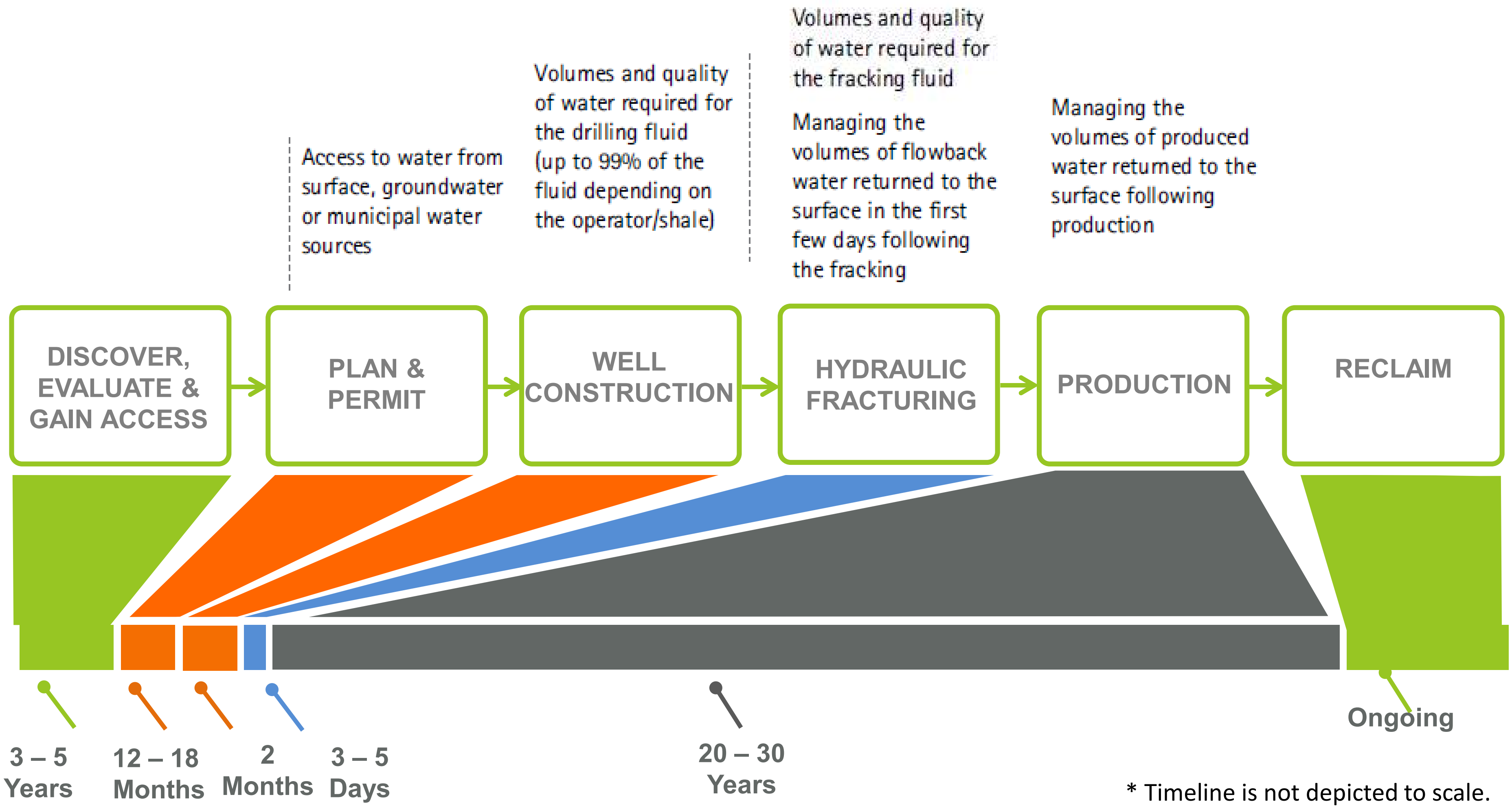
- **Generating electricity from natural gas can result in substantial water benefits; however, hydraulic fracturing is necessary to make accessing those deposits commercially viable.**
- **On a per unit of energy basis, using hydraulic fracturing to recover oil is also more energy efficient.**
- **Without hydraulic fracturing , the U.S. would lose 45 percent of domestic natural gas production within 5 years.**

6) Scanlon et al Drought and the Water–Energy Nexus in Texas (2013) and 9) Scanlon (2014)

Water Management During Oil & Natural Gas Development

To learn more, see:

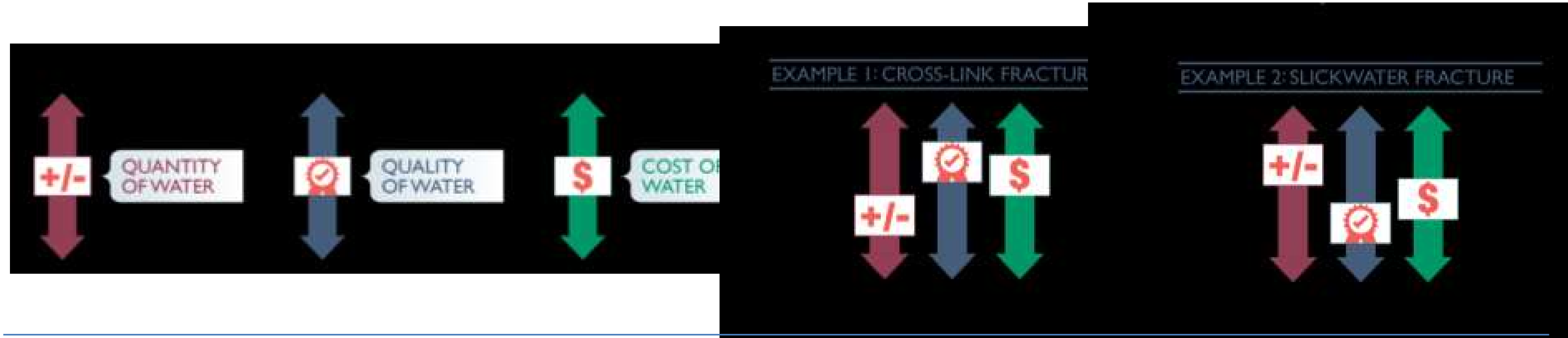
- API HF2: Water Management Associated with Hydraulic Fracturing and
- API RP 100-2: Managing Environmental Aspects Associated with Oil and Gas Operations Including Hydraulic Fracturing

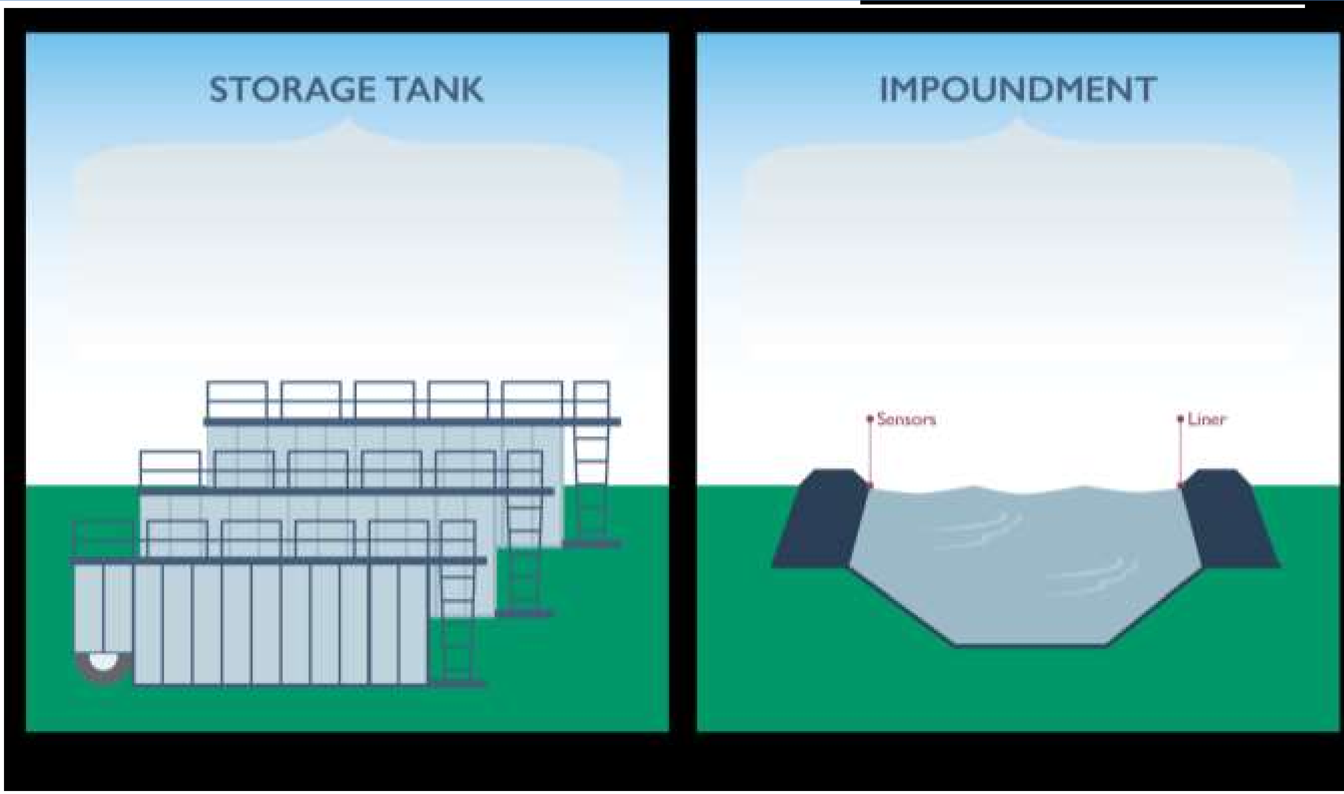


* Timeline is not depicted to scale.

API STANDARDS AND GUIDANCE RELATING TO HYDRAULIC FRACTURING

WITHIN OPERATIONS, WATER CHOICES MAY HAVE TRADE-OFFS

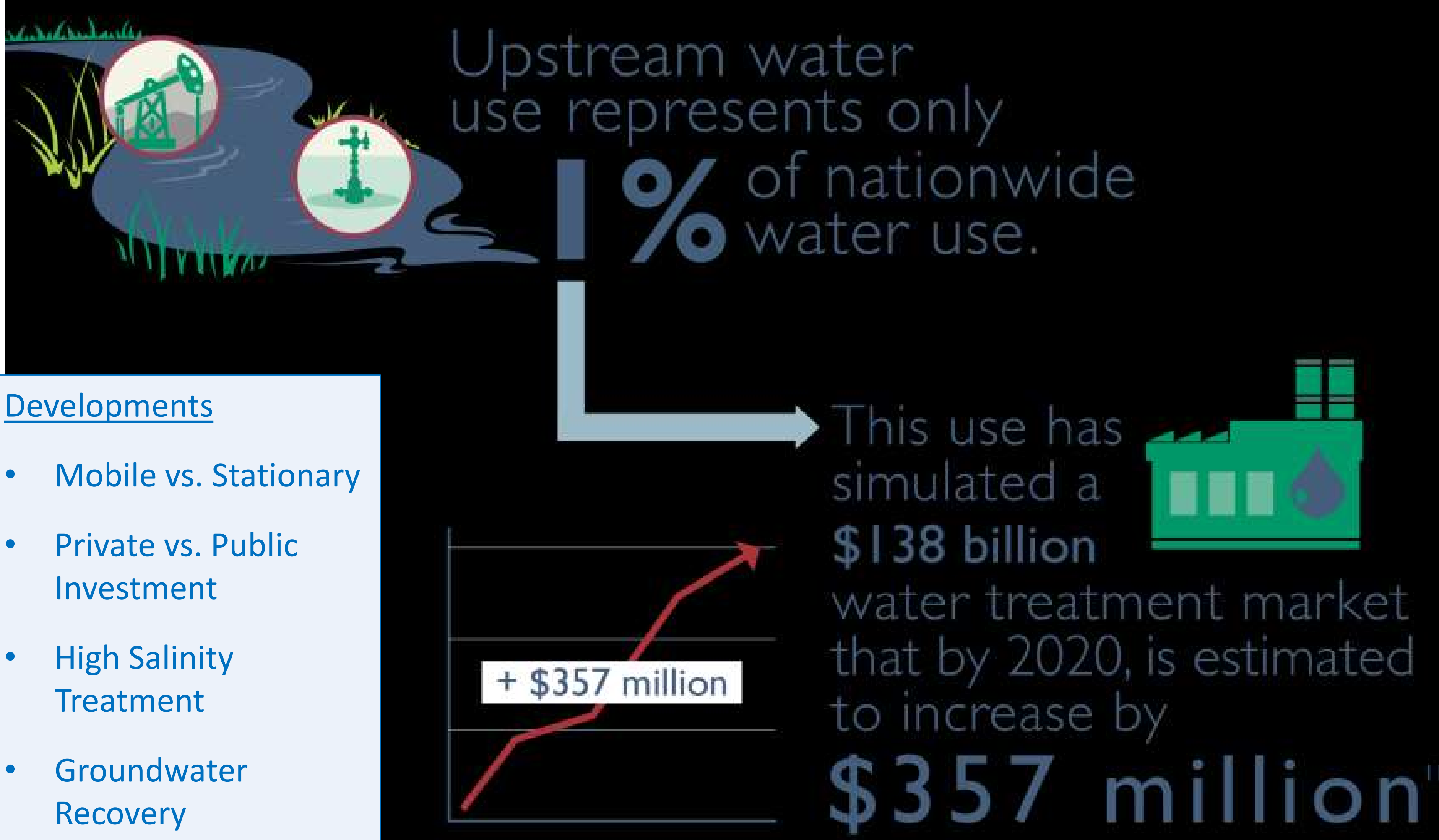




- Tanks isolate waters from the environment, creating closed loop systems.
- Impoundments facilitate evaporation, simultaneously returning water to the water cycle and reducing the amount that will need to be transported for treatment or disposal.

WATER TREATMENT
TECHNOLOGIES ARE GROWING

Advances in water treatment technologies increase reuse and recycling opportunities.



<u>Developments</u>

- Mobile vs. Stationary
- Private vs. Public Investment
- High Salinity Treatment
- Groundwater Recovery

11) Water for US Hydraulic Fracturing: Competitive Strategies, Solutions, & Outlook, 2014-2020, Bluefield Research, November 2014

Questions?

Contact:
Amy Emmert
Senior Policy Advisor
American Petroleum Institute
Tel: +1 (269) 267-3517
Email: emmerta@api.org

Get involved!

Learn the facts & science of shale energy development.

→ **Share** what you know about shale energy with others in your community.

→ **Develop** policies and plans that enable safe & responsible development.

Future Direction of the Oil & Gas Sector in Managing Water Resources:

A NGO Perspective

Marielle Weikel
August 24, 2015

CONSERVATION INTERNATIONAL

Current State of Water Resources

- Water stress and scarcity are increasingly apparent physical effects of climate change, and there are growing pressures on freshwater resources from increasing withdrawals and declining quality (UNEP, 2013).
- The World Economic Forum identified “water crises” as the number one risk in terms of potential impact to the global economy in 2015 (WEF, 2015).
- Under current projections, virtually all freshwater ecosystems and biodiversity will face ecologically significant climate change impacts by the middle of this century, most of which will be detrimental from the perspective of the human livelihoods and communities *(and businesses)* that depend upon them (WWF, 2010).

Freshwater Ecosystems and Biodiversity Risks and Opportunities

- The conservation of freshwater biodiversity is important for the long-term and sustainable supply of raw materials, and to sustain human and ecological communities that depend on it.

- However, the biodiversity value of water resources is not always systematically considered in oil and gas development and/or operations decision-making.

- Only a few of the corporate and water-focused tools and initiatives, including a few tailored to the extractive sector, give attention to the overlap of water and biodiversity and ecosystem services issues.

Trends in Water Management within Oil & Gas Sector

- Companies are increasingly relying on tools and approaches that can help them better identify risks and improve their decision-making processes:
  - IPIECA Global Water Tool
  - GEMI Local Water Tool
  - WRI Aqueduct

- Companies are increasingly making progress in the following areas:
  - Tracking their global freshwater consumption
  - Tracking freshwater intensity
  - Reporting performance (e.g. CDP's Water Disclosure Project)

Opportunities for Water Management Improvement

1. Systematic consideration of not only risks associated with the physical and chemical properties of water resources, but also of impacts to and dependencies on **freshwater ecosystems and biodiversity**

2. Adoption of water-focused performance **targets**

3. Adoption of **watershed –level stewardship approaches** that ensure a clear recognition of the environmental and social dimensions of water management, extend beyond the operational “fence-line”, and take a collaborative approach

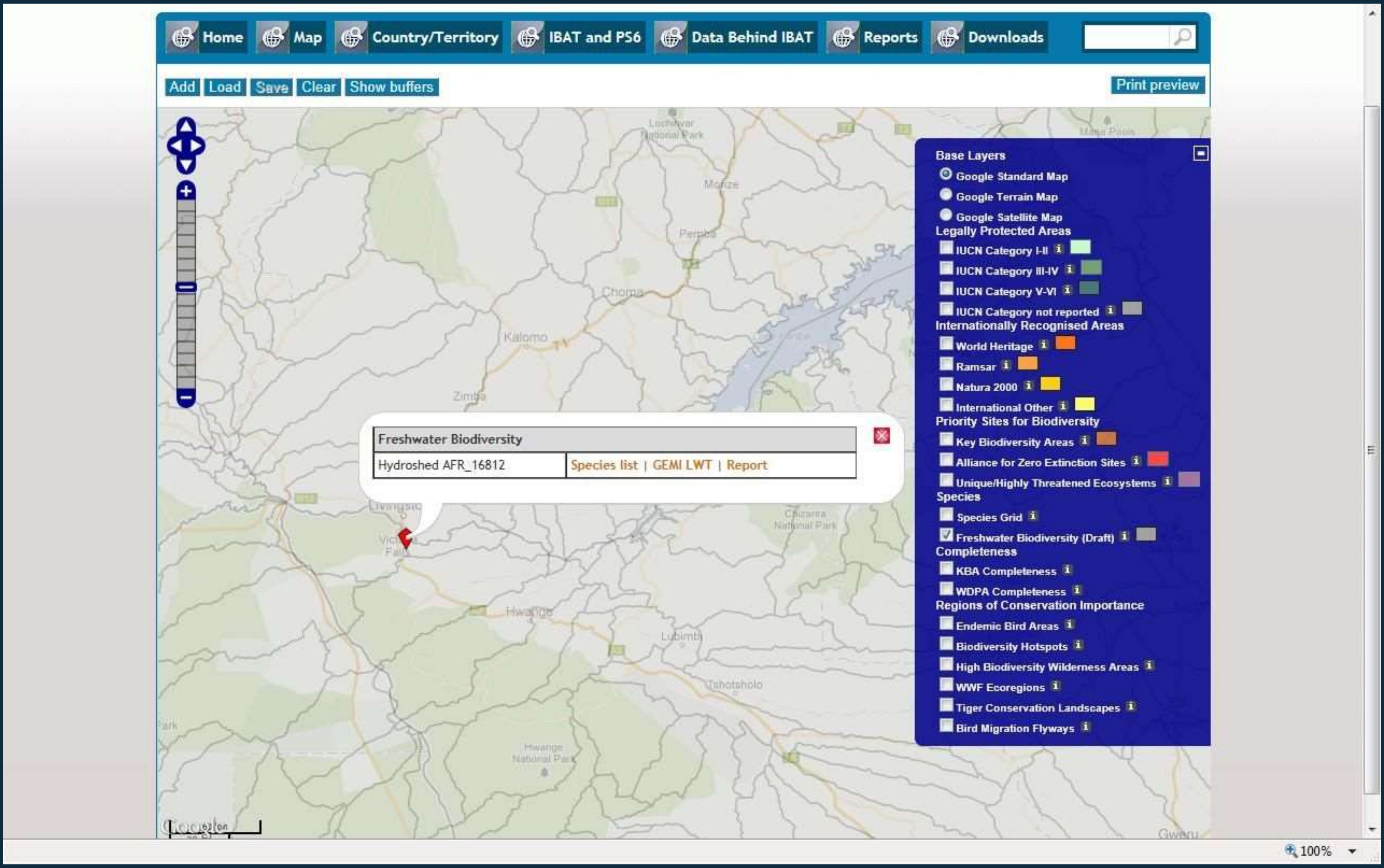
1. Freshwater Ecosystems & Biodiversity – *Integrated Biodiversity Assessment Tool (IBAT)*

- Central database for globally recognized biodiversity information:
  - Key Biodiversity Areas
  - Protected Areas
  - Ramsar Sites
  - IUCN Red List - including freshwater-dependent species

- Freshwater enhancements:

  Allows decision-makers to access up-to-date information for screening potential site-level risks and opportunities to freshwater biodiversity and ecosystems within a project boundary, thus providing additional insight for decision making.

1. IBAT (continued)



2. Performance Targets

- Cue from mining sector – Newmont example

Water targets

Year	Target definition	Target for sites	Target for Newmont
2015	Implementation of the Water Accounting Framework (WAF)	Complete a WAF	**100 percent** of sites to have completed a WAF
2016	Percent implementation against the sites' Water Strategy Action Plans	Complete **100 percent** of actions and achieve **80 percent** of water targets established in the site Water Strategy Action Plan	**100 percent** of sites complete their action plans for the year and achieve their water targets (80 percent in 2016 and 90 percent in 2017)
2017		Complete **100 percent** of actions and achieve **90 percent** of water targets established in the site Water Strategy Action Plan	

3. Watershed-Level Approaches

- Alliance for Water Stewardship
- Water Action Hub
- WASH and Freshwater Conservation Guidelines

Marielle Weikel

Senior Director, Responsible Mining and Energy

Conservation International

mcanter@conservation.org

Thank You!

WATER MANAGEMENT AT SHELL
GLOBAL ISSUES – LOCAL SOLUTIONS

Alfio Mianzan, Business Improvement Manager -
Water and Green Infrastructure

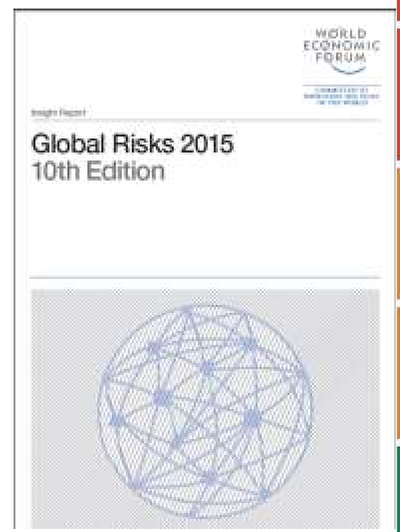
CAUTIONARY NOTE

The companies in which Royal Dutch Shell plc directly and indirectly owns investments are separate entities. In this announcement "Shell", "Shell Group" and "Royal Dutch Shell" are sometimes used for convenience where references are made to Royal Dutch Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to subsidiaries in general or to those who work for them. These expressions are also used where no useful purpose is served by identifying the particular company or companies. "Subsidiaries", "Shell subsidiaries" and "Shell companies" as used in this announcement refer to companies in which Shell either directly or indirectly has control, by having either a majority of the voting rights or the right to exercise a controlling influence. The companies in which Shell has significant influence but not control are referred to as "associated companies" or "associates" and companies in which Shell has joint control are referred to as "jointly controlled entities". In this announcement, associates and jointly controlled entities are also referred to as "equity-accounted investments". The term "Shell interest" is used for convenience to indicate the direct and/or indirect (for example, through our 23 per cent shareholding in Woodside Petroleum Ltd.) ownership interest held by Shell in a venture, partnership or company, after exclusion of all third-party interest.

This announcement contains forward looking statements concerning the financial condition, results of operations and businesses of Shell and the Shell Group. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Shell and the Shell Group to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward looking statements are identified by their use of terms and phrases such as "anticipate", "believe", "could", "estimate", "expect", "goals", "intend", "may", "objectives", "outlook", "plan", "probably", "project", "risks", "seek", "should", "target", "will" and similar terms and phrases. There are a number of factors that could affect the future operations of Shell and the Shell Group and could cause those results to differ materially from those expressed in the forward looking statements included in this announcement, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; and (m) changes in trading conditions. All forward looking statements contained in this announcement are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward looking statements. Additional factors that may affect future results are contained in Shell's 20-F for the year ended 31 December 2014 Royal Dutch Shell's 20-F (available at www.shell.com/investor and www.sec.gov).(These factors also should be considered by the reader. Each forward looking statement speaks only as of the date of this presentation. Neither Shell nor any of its subsidiaries nor the Shell Group undertake any obligation to publicly update or revise any forward looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward looking statements contained in this announcement.

Shell may have used certain terms, such as resources, in this announcement that the SEC strictly prohibits Shell from including in its filings with the SEC. U.S. investors are urged to consider closely the disclosure in Shell's Form 20-F, available on the SEC website www.sec.gov. You can also obtain these forms from the SEC by calling 1-800-SEC-0330.

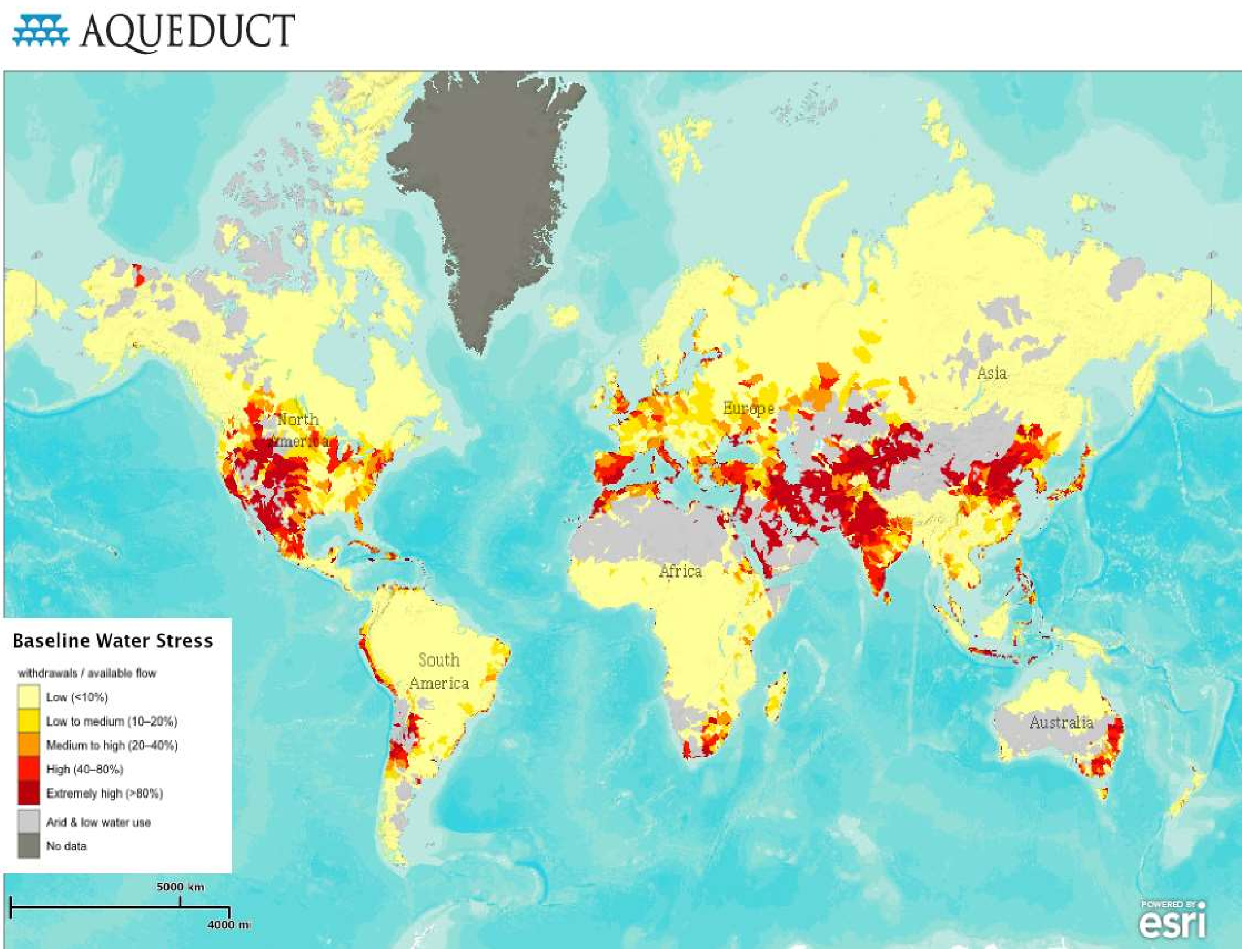
THE RISING EXTERNAL PROFILE OF WATER



2015

- Water crises
- Rapid and massive spread of infectious diseases
- Weapons of mass destruction
- Interstate conflict with regional consequences
- Failure of climate-change adaptation

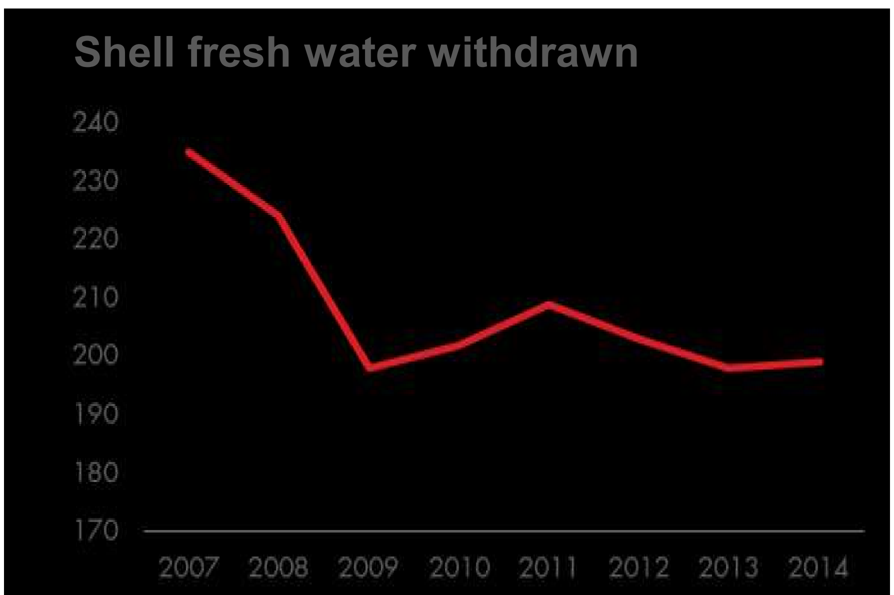
GLOBAL WATER SCARCITY



STRESS NEXUS

WATER MANAGEMENT

- Water regulation evolving rapidly
- Water management plans
  - water scarce areas
  - future water scarce areas



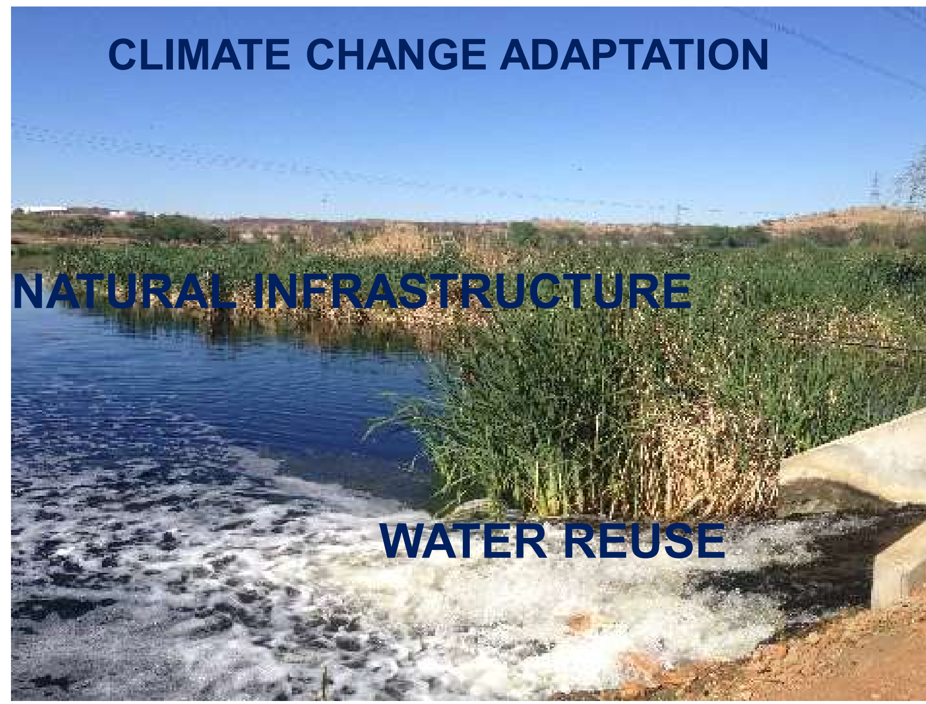
Centre of Excellence in Bangalore:

- Integrated project delivery
- Technical support
- Water R&D

Dawson Creek water reclamation, Groundbirch

COLLABORATION

wbcsd



INNOVATIVE COLLABORATION: WATER RECYCLING AT GROUNDBIRCH

REDUCING FRESHWATER USE: DESALINATION AT PULAU BUKOM, SINGAPORE

WATER OPPORTUNITIES

Water Generated from Operations → Treatment, Transport → Disposal, water reuse, other

Activities

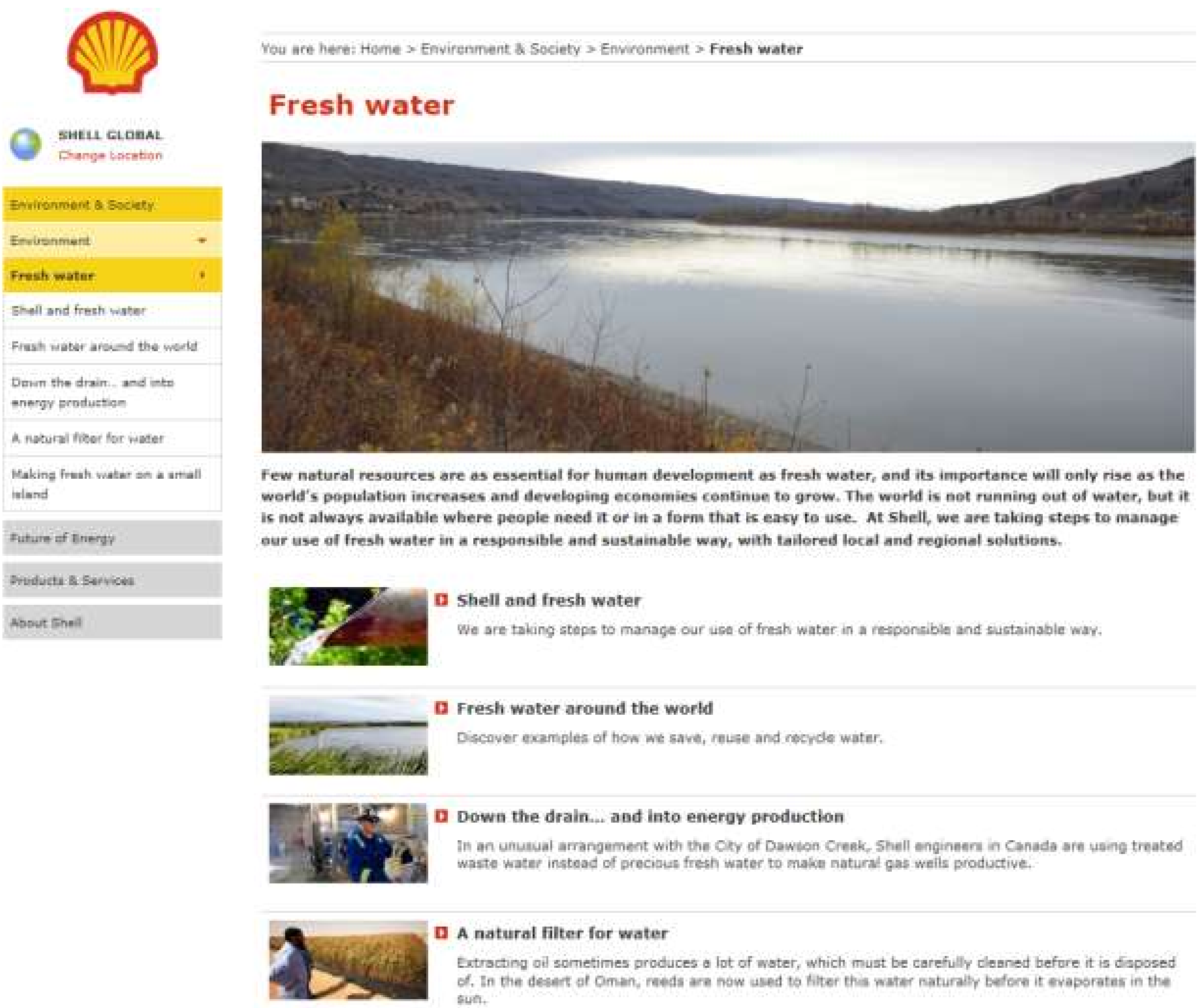
Water Types

Solutions

Destination

FOR MORE INFORMATION

http://www.shell.com/global/environment-society/environment/fresh-water.html



SHELL GLOBAL
Change location

Environment & Society
Environment
Fresh water
Shell and fresh water
Fresh water around the world
Down the drain... and into energy production
A natural filter for water
Making fresh water on a small island
Future of Energy
Products & Services
About Shell

You are here: Home > Environment & Society > Environment > **Fresh water**

Fresh water

Few natural resources are as essential for human development as fresh water, and its importance will only rise as the world's population increases and developing economies continue to grow. The world is not running out of water, but it is not always available where people need it or in a form that is easy to use. At Shell, we are taking steps to manage our use of fresh water in a responsible and sustainable way, with tailored local and regional solutions.

Shell and fresh water
We are taking steps to manage our use of fresh water in a responsible and sustainable way.

Fresh water around the world
Discover examples of how we save, reuse and recycle water.

Down the drain... and into energy production
In an unusual arrangement with the City of Dawson Creek, Shell engineers in Canada are using treated waste water instead of precious fresh water to make natural gas wells productive.

A natural filter for water
Extracting oil sometimes produces a lot of water, which must be carefully cleaned before it is disposed of. In the desert of Oman, reeds are now used to filter this water naturally before it evaporates in the sun.

IPIECA

Future Challenges:

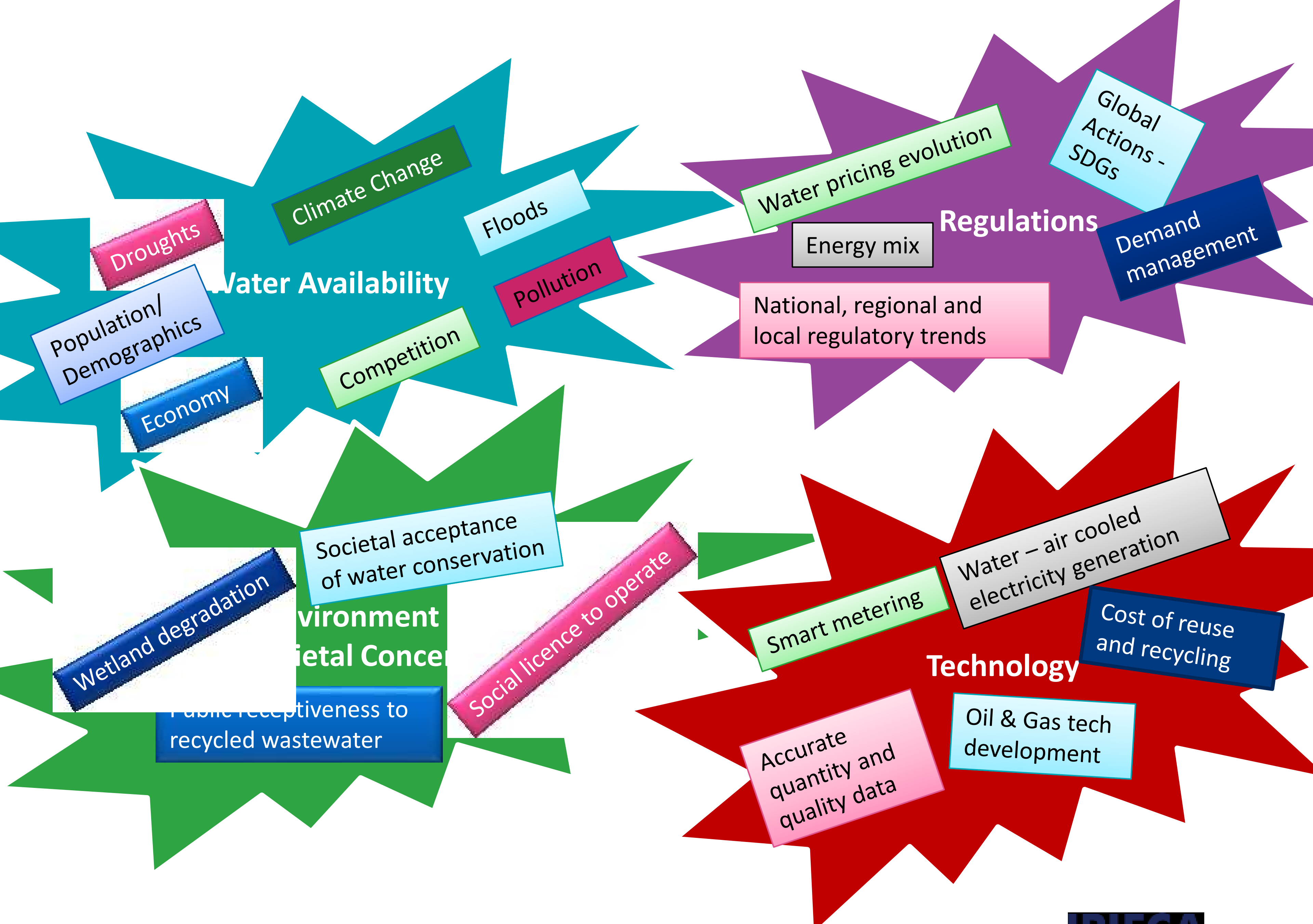
Panel Discussion

THE GLOBAL OIL AND GAS INDUSTRY ASSOCIATION FOR ENVIRONMENTAL AND SOCIAL ISSUES

Alistair Wyness
Water WG Chair

www.ipieca.org

August 2015



Water Availability
Climate Change
Droughts
Floods
Population/ Demographics
Pollution
Competition
Economy
Regulations
Water pricing evolution
Global Actions - SDGs
Energy mix
Demand management
National, regional and local regulatory trends
Societal acceptance of water conservation
Wetland degradation
Social licence to operate
recycled wastewater
Technology
Water – air cooled electricity generation
Smart metering
Cost of reuse and recycling
Accurate quantity and quality data
Oil & Gas tech development

Key future challenges

As prioritised by the IPIECA water working group

- **Demand – supply imbalance, affected by population, economy and climate change**
- **Water price & value evolution**
- **Societal and environmental pressures**
- **Technical development to improve agricultural and industrial water efficiencies?**
- **Regulations (global, national, regional, local)**
- **Overlap between areas of oil & gas development & water stress/scarcity**

IPIECA

Summary:

Wrap Up

Alistair Wyness
Water WG Chair

August 2015

THE GLOBAL OIL AND GAS
INDUSTRY ASSOCIATION
FOR ENVIRONMENTAL
AND SOCIAL ISSUES

www.ipieca.org

For More Information

http://www.ipieca.org/focus-area/water