

BUILDING A WORLD OF DIFFERENCE

THE NEXUS OF ENERGY & WATER

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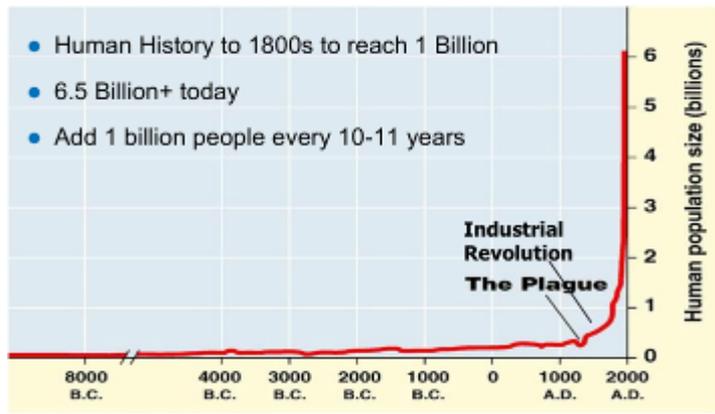


26 July 2011



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DRIVING FORCES



Population Growth, Urbanization

Economic Development



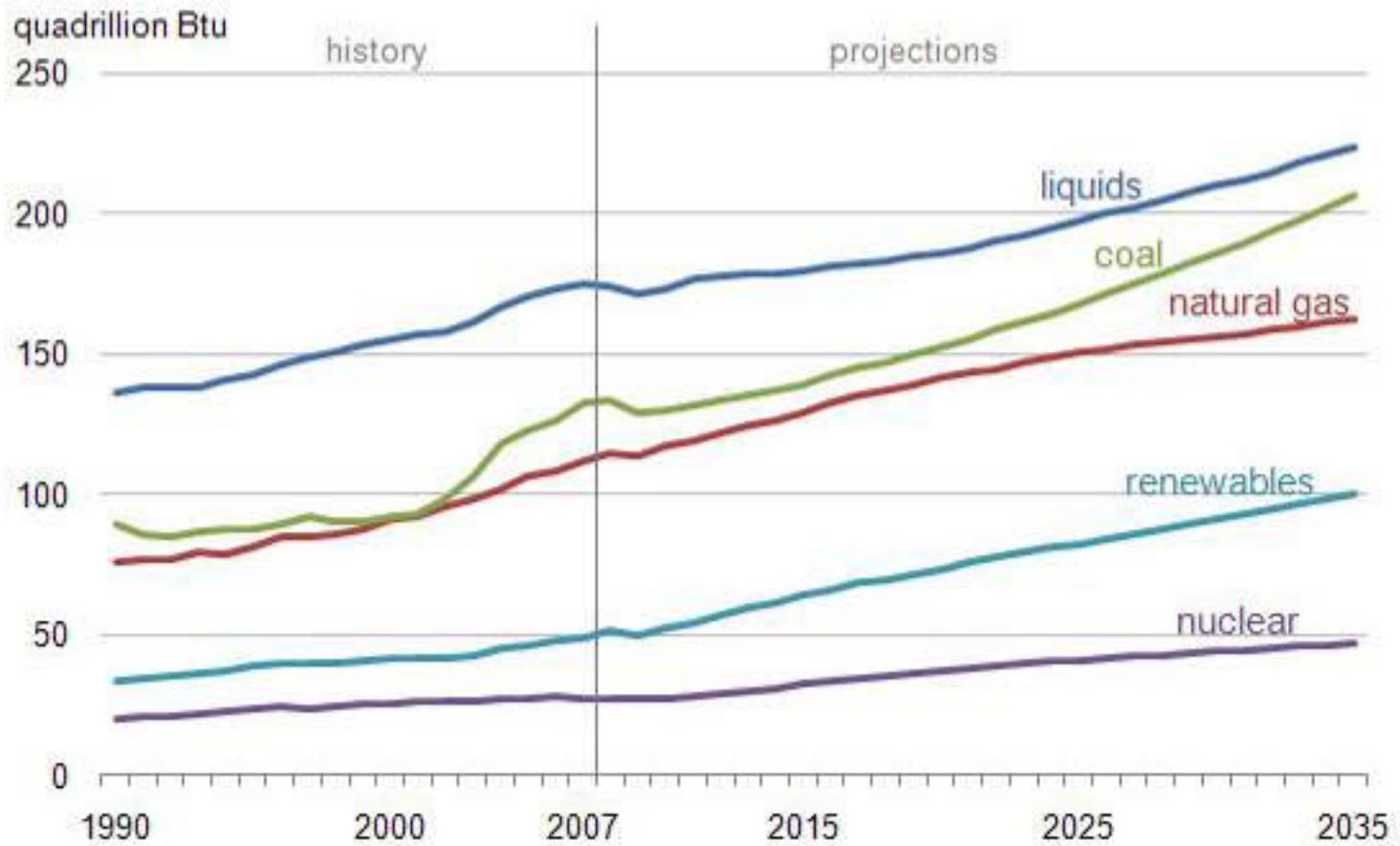
Improved Standard of Living in Emerging Countries



Climate Change



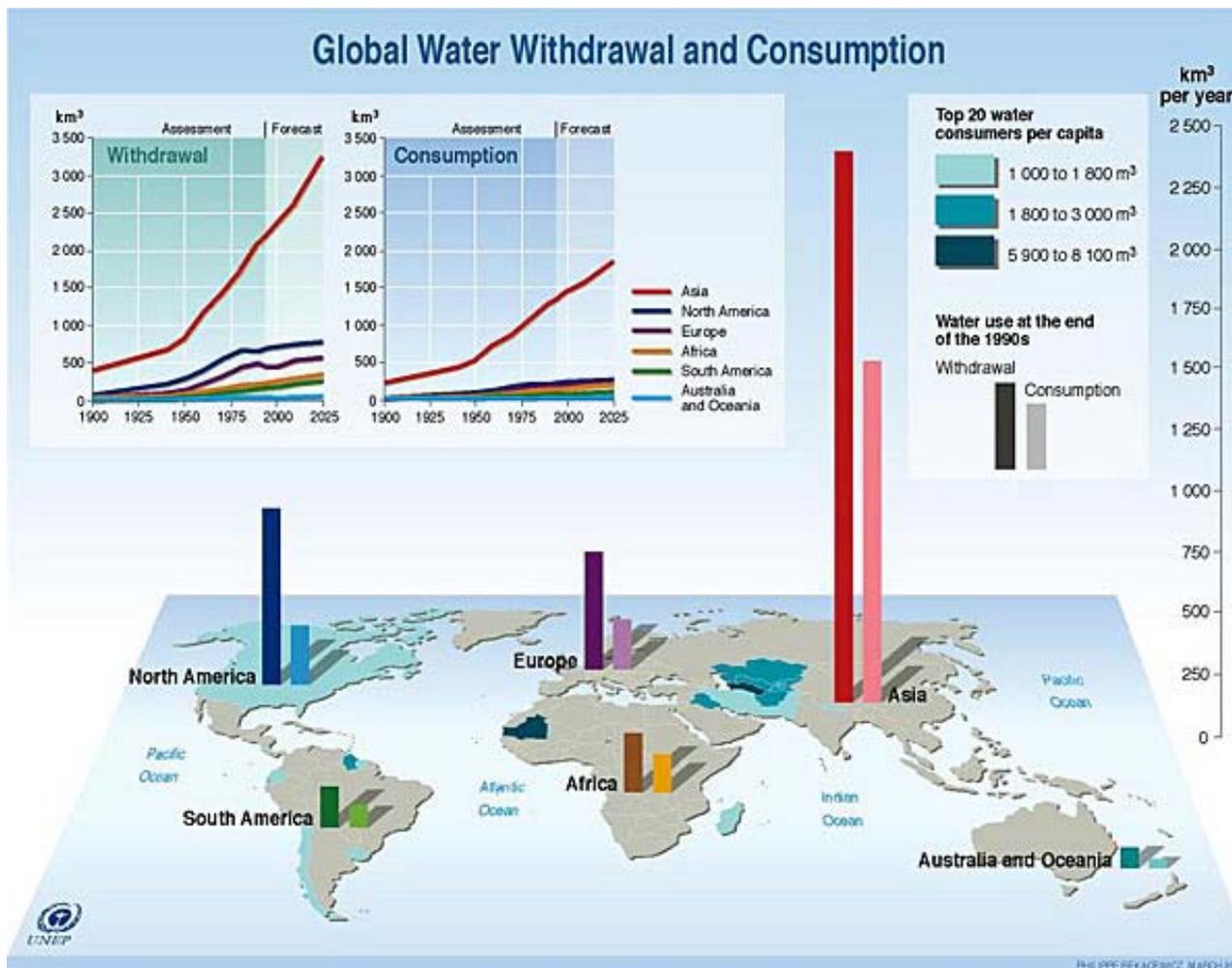
WORLD ENERGY USE INCREASES BY 50% FROM 2007 TO 2035



Source: Energy Information Administration (EIA), May 2010.



AND GLOBAL WATER DEMAND ALSO CONTINUES TO INCREASE



Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999; *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000, Paul Harrison and Fred Pearce, *AAAS Atlas of Population 2001*, American Association for the Advancement of Science, University of California Press, Berkeley.



WHAT KEEPS WATER & ENERGY INDUSTRY LEADERS UP AT NIGHT?

- ✓ Economic pressure
- ✓ Public pressure
- ✓ Political / policy pressure
- ✓ Sustainability / climate change pressure
- ✓ Pressure to innovate



THE NEXUS OF ENERGY & WATER

Water's Impact on Energy

Energy's Impact on Water
Technology Intersections

Energy, Water, &
Sustainability –
Assessing Options



WATER'S IMPACT ON ENERGY



CHANGING PERCEPTIONS OF THREE KEY STAKEHOLDERS



Consumers and Customers



Policy Makers and Politicians



Industry Owners and Leaders



CHANGING PERCEPTIONS OF THREE KEY STAKEHOLDERS



Consumers and Customers



Policy Makers and Politicians



Industry Owners and Leaders



IF YOU WANT TO SAVE WATER, TURN OFF THE LIGHTS!

*An 8 oz. glass of water requires the same amount of energy as running a 60-watt light bulb for an average of 30 minutes

**Virginia Polytechnic Institute*



Large amounts of electricity are required to acquire and process water, and large amounts of water are needed to produce electricity.

HOW MUCH WATER DOES A GOOGLE SEARCH USE?



1/10 of a teaspoon of water

***March 2009, Goggle searches reach 293 Million per day**

CHANGING PERCEPTIONS OF THREE KEY STAKEHOLDERS



Consumers and Customers



Policy Makers and Politicians

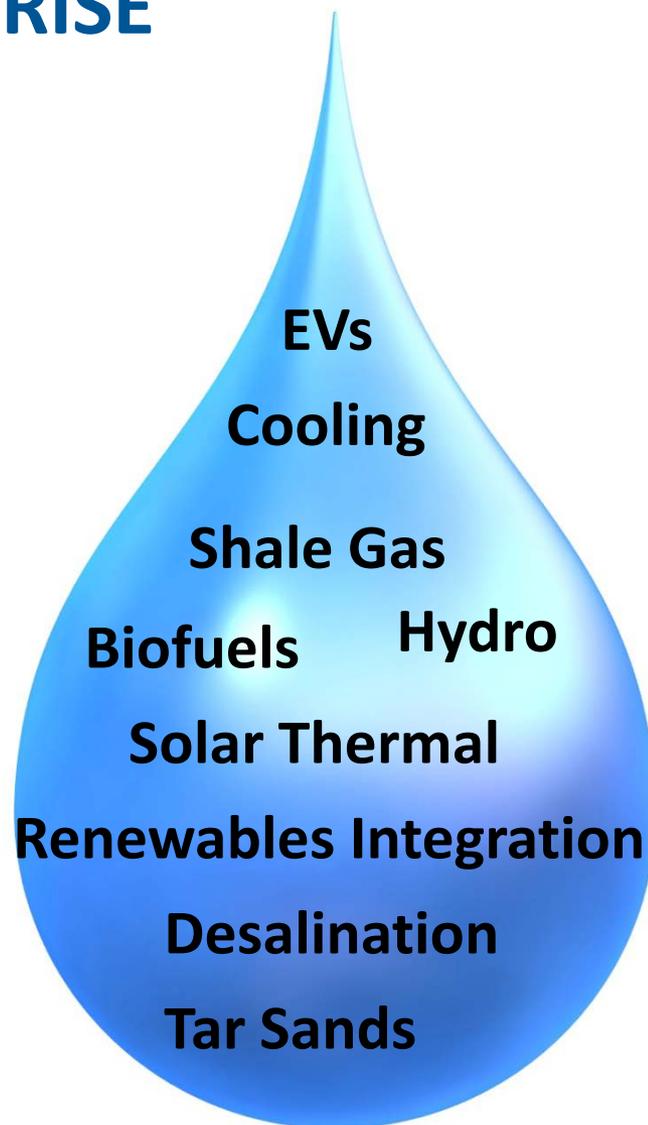


Industry Owners and Leaders



PUBLIC POLICY TO ENTERPRISE PERSPECTIVE

- Public policy clearly needs to address energy-water nexus
- Long-term viability of both essential energy and water services
- Many areas of mutual dependency
- Enterprise perspective
 - Supply planning decisions
 - Operational paradigms



CHANGING PERCEPTIONS OF THREE KEY STAKEHOLDERS



Consumers and Customers



Policy Makers and Politicians



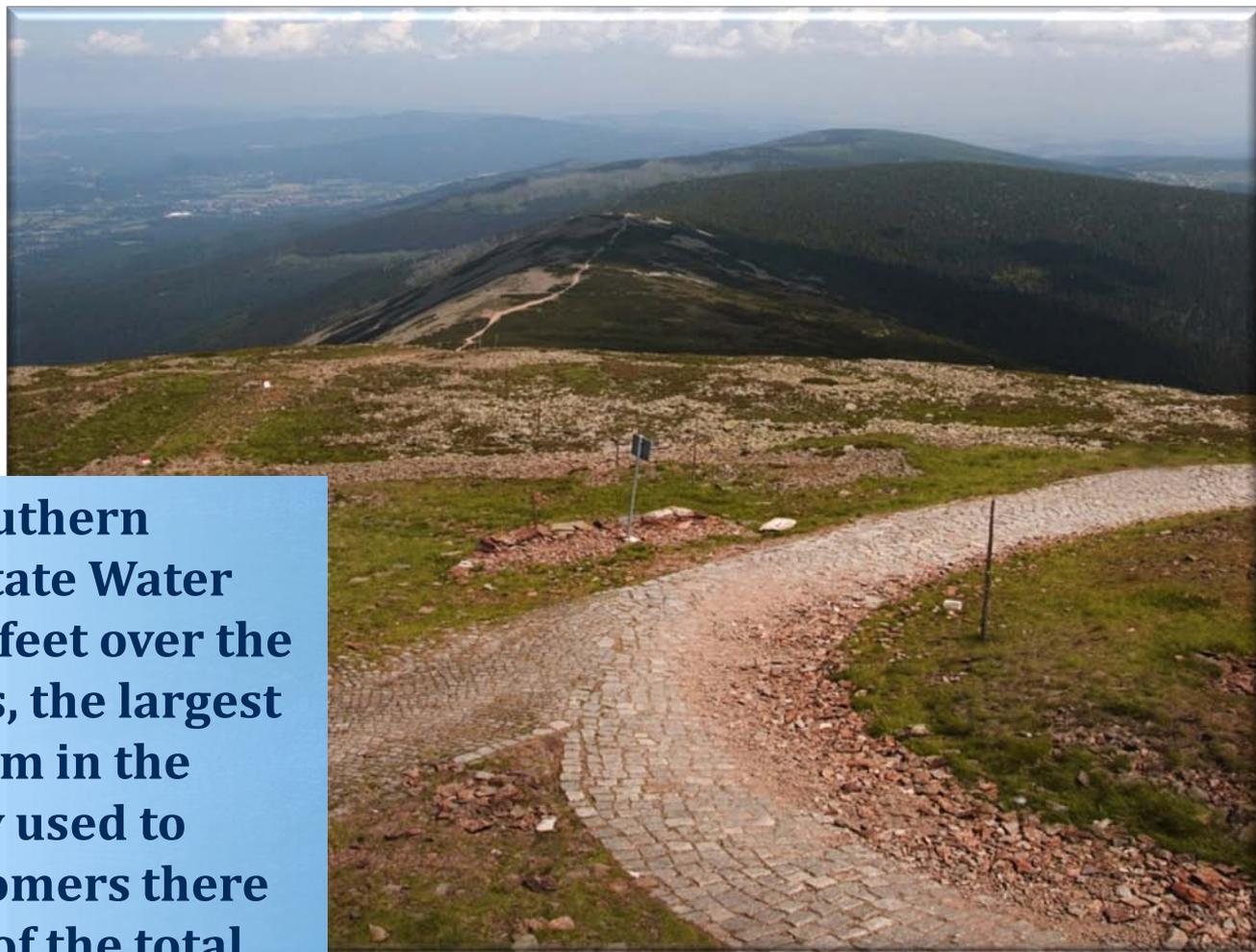
Industry Owners and Leaders



THE NEXUS OF WATER AND ENERGY



WATER AND ENERGY ARE INEXTRICABLY INTERTWINED



Water supplied to Southern California from the State Water Project travels 2,000 feet over the Tehachapi Mountains, the largest lift of any water system in the world. The electricity used to deliver water to customers there is equal to one-third of the total average household electricity use. (*NRDC and Pacific Institute*)

ENERGY USE AND COSTS IN WATER VALUE CHAIN

- Second largest operating cost, after labor
- Current financial distress for water / wastewater utilities
- Spectrum of measures to shrink energy costs, increase energy (and water) efficiency
 - Leakage
 - Energy management data
 - Equipment choice
 - Process optimization
 - Peak demand shifting
 - Micro-hydro
 - Digester gas capture / use
 - Biosolids

Energy consumption for the water and wastewater sectors is expected to increase by 33 percent in the next 20 years because of global population growth. (Source: [Watergy](#))



HIERARCHY OF ENERGY-EFFICIENT OPTIONS FOR WATER

- Reduce demand where possible (directly or indirectly)
- Meter all consumption
- Delay demand to less carbon intensive periods, where possible
- Use energy efficiently (e.g., avoid standby or partly loaded equipment)
- Purchase and install energy- and water-efficient devices / appliances
- Supply energy efficiently (e.g., combined heat & power and cooling)
- Recover energy and water where possible (e.g., biogas)
- Use renewable energy (viewing waste as a renewable fuel)
- Use low carbon energy (e.g., hydro)
- Use conventional energy for the rest
- Use carbon markets to meet any further obligations

HOLISTICALLY CONSIDER THE WHOLE

Think globally

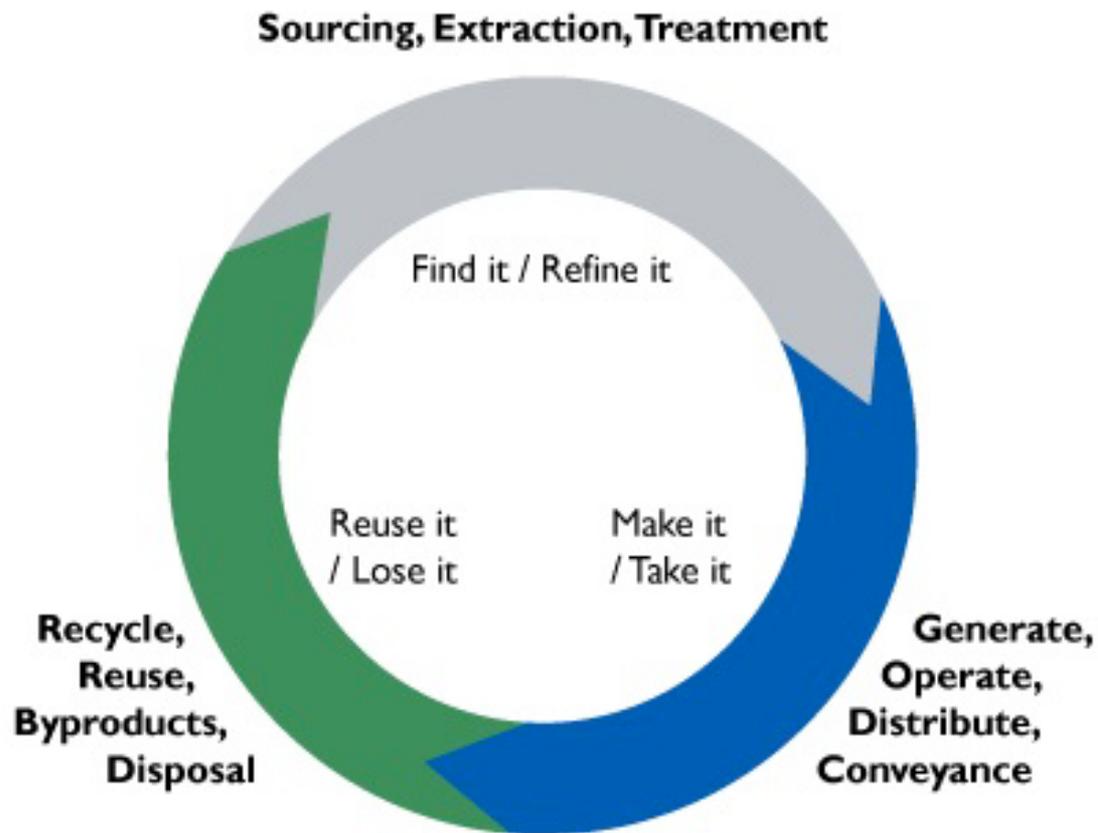
Integrate across
multiple sectors

Avoid silo-ed
thinking



The developed world often takes a constant supply of potable water for granted, unaware of the growing challenges facing the world's water supply.

The Basic Interdependency of Energy and Water



Electric utility industry leaders say water supply is top environmental concern and water management top business issue in 2011 survey.



ENERGY'S IMPACT ON WATER TECHNOLOGY INTERSECTIONS



THE ENERGY PUZZLE

Alternative Fuels

Energy Storage

Smart / Strong Grid, Smart Meters

Electric Transportation (PHEV)

Micro-Generation

Regulation

Electric Power Generation

Consumer Behavior

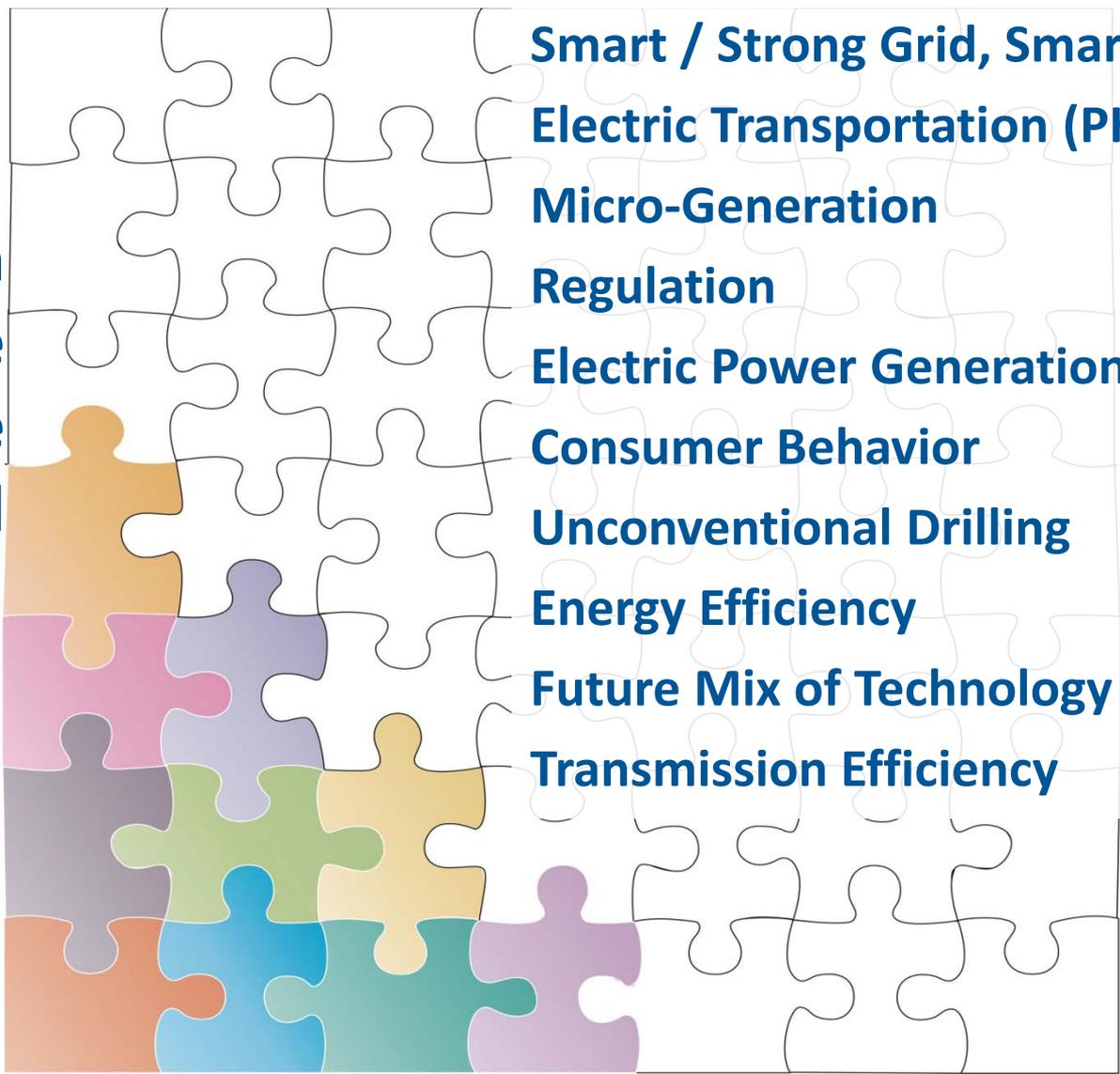
Unconventional Drilling

Energy Efficiency

Future Mix of Technology

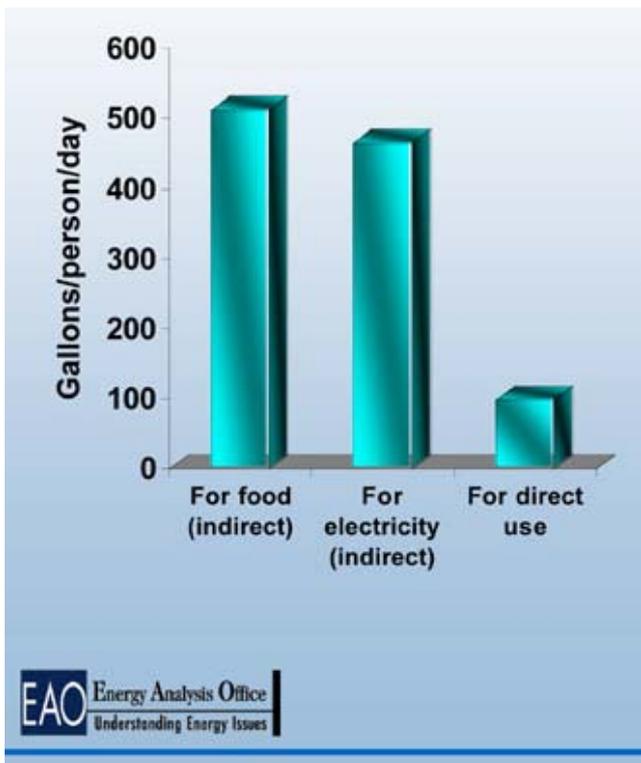
Transmission Efficiency

Solutions in
all these
areas will be
required

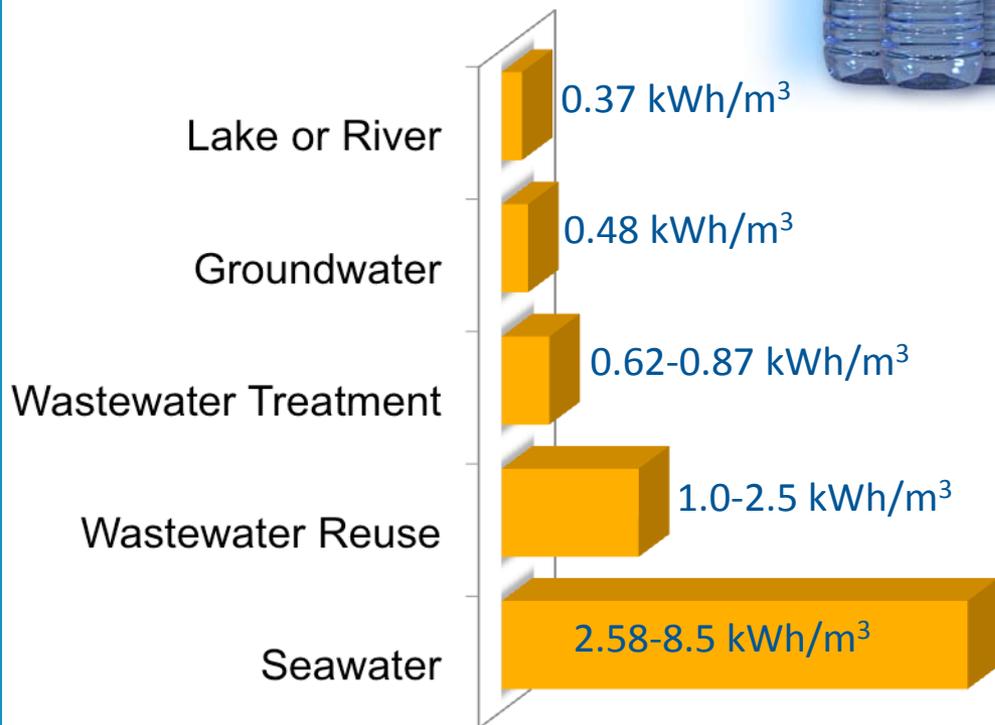


ENERGY AND WATER ARE INTENSELY INTERDEPENDENT

Water used to produce household electricity exceeds direct household water use



Energy required to deliver 1 m³ of treated water from:

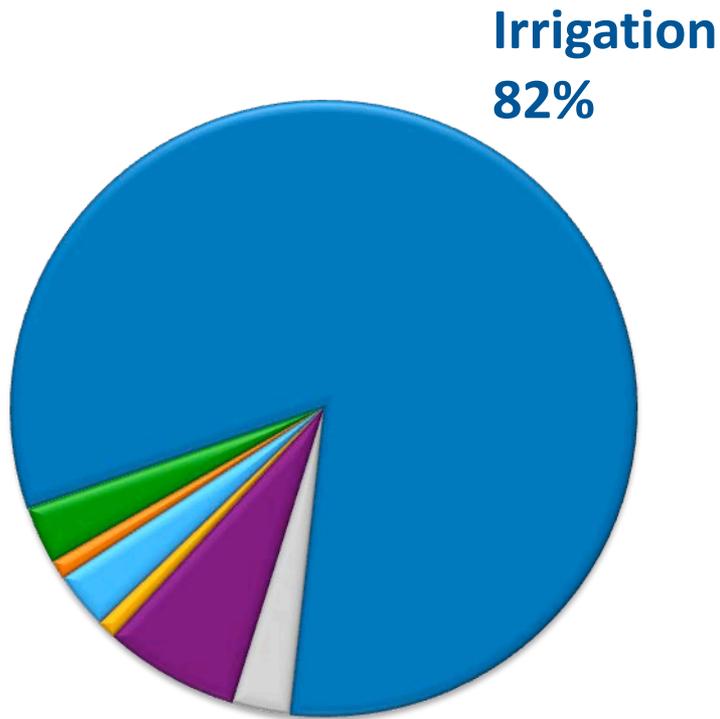
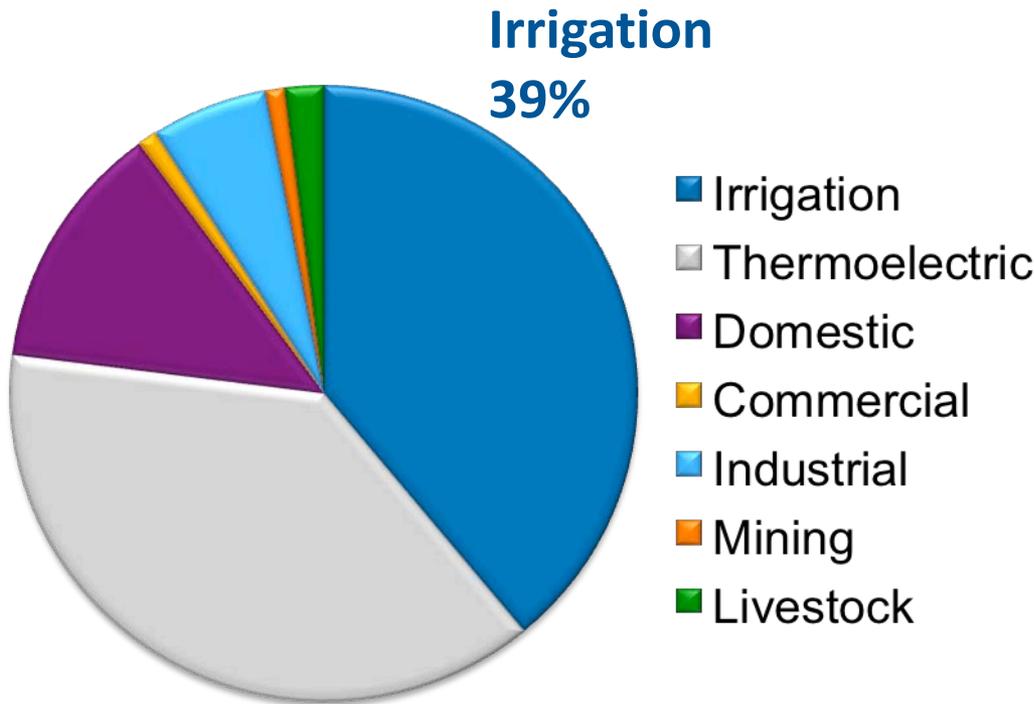


Source: Amended diagram based on Scientific American, October 2008.

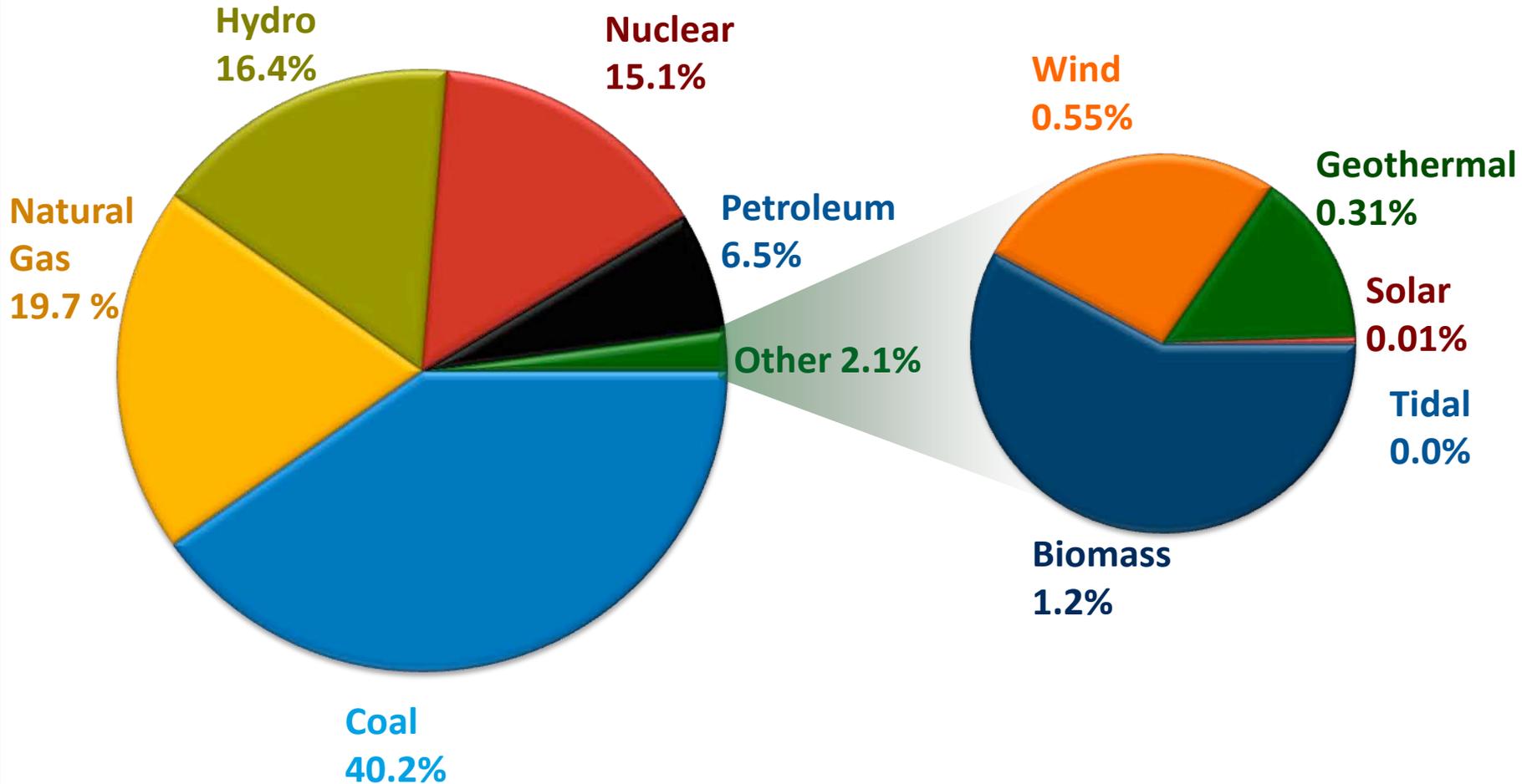
ELECTRICITY PRODUCTION REQUIRES SIGNIFICANT WATER

Withdrawal

Consumption



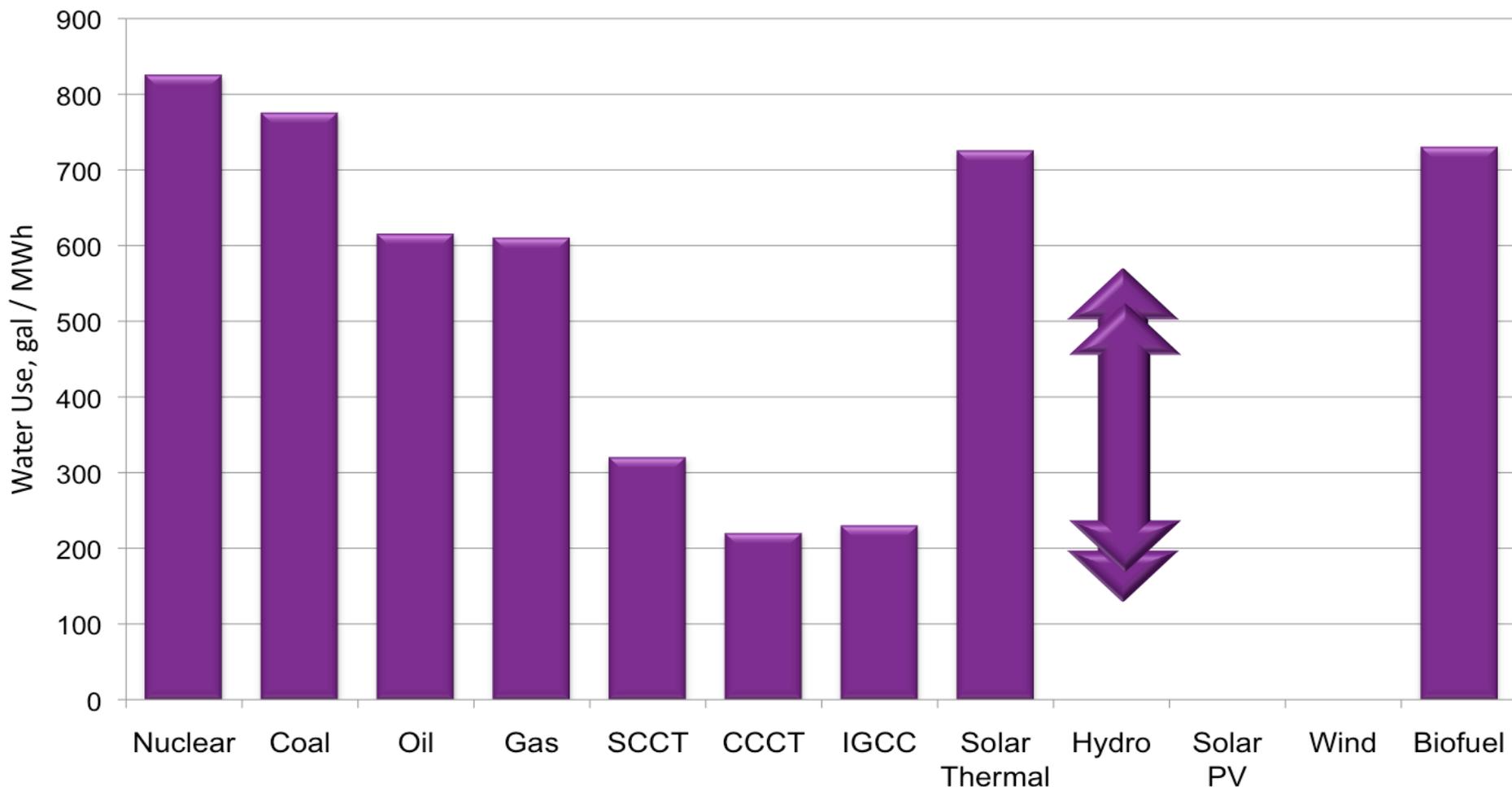
WORLD NET ELECTRICITY GENERATION BY SOURCE*



*Energy Information Administration, U.S. DOE, 2007.



WATER WITHDRAWAL BY POWER PLANT TECHNOLOGY



A modified generation mix would change water demands

WATER USE AND COSTS IN ENERGY VALUE CHAIN

- Energy: Largest user of water
- Cooling and feedwater needs for thermal generation
- Current siting and permitting issues
- Likely regulatory trends on water usage
- Longer term regulatory and climate scenarios
- Risk reduction strategies
 - Lower gross generation
 - Cost / risk / flexibility in cooling
 - Alternative water supplies
- Smart Grid: Water utilities piggy-backing on customer connectivity



WATER SOLUTION STRATEGIES FOR ENERGY

- Integrate energy and water resource planning / management
 - Reduced generation / water demand
 - Diversified energy mix
- Advanced technologies
 - Dry / hybrid cooling
 - Increase thermal conversion efficiency
- Alternative water supplies
 - Recycle / recapture water within plant
 - Gray / reclaimed / brackish water
 - Sub-stratum water
 - On-site desalination
- Consumer behavior / DSM0



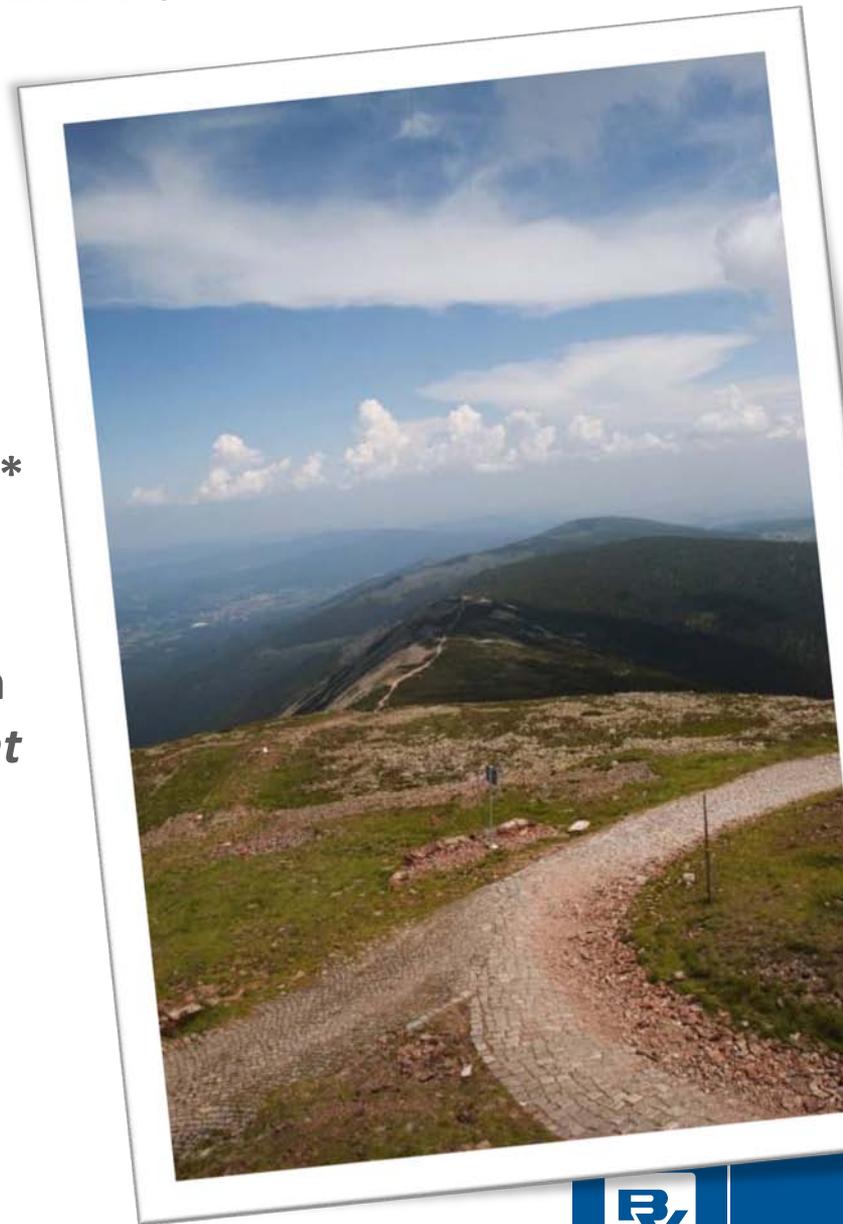
ENERGY, WATER & SUSTAINABILITY – ASSESSING OPTIONS



WHAT IS “SUSTAINABILITY?”

- Energy-water nexus shows need for sustainability perspective
 - Growing demographic and economic needs for energy and water
 - Many inter-related long term issues
- Sustainability is “the capacity to endure”*
 - Not just business continuity
 - Integration of economic, social and environmental spheres (triple bottom line) to “*meet the needs of the present without compromising the ability of future generations to meet their own needs*”
- No commonly accepted definition yet in utility industry

*Source: *The Brundtland Report, 1987.*



WHY BE CONCERNED?

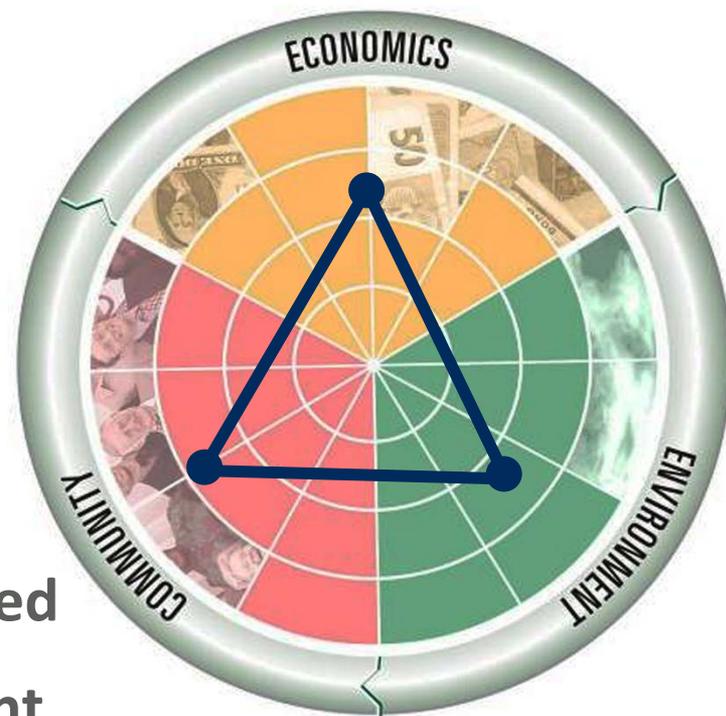
- Global path not sustainable
- Exponential demand growth
- Increasing marginal resource costs
- Scramble for commodities control
- Potential climate change impacts
- Uncertain technological progress
- Fiduciary responsibility
- Compliance with current and future legislation, governance, regulations
- Potential “no-losers” improvements to supply chain efficiency



How to incorporate in enterprise decision process?

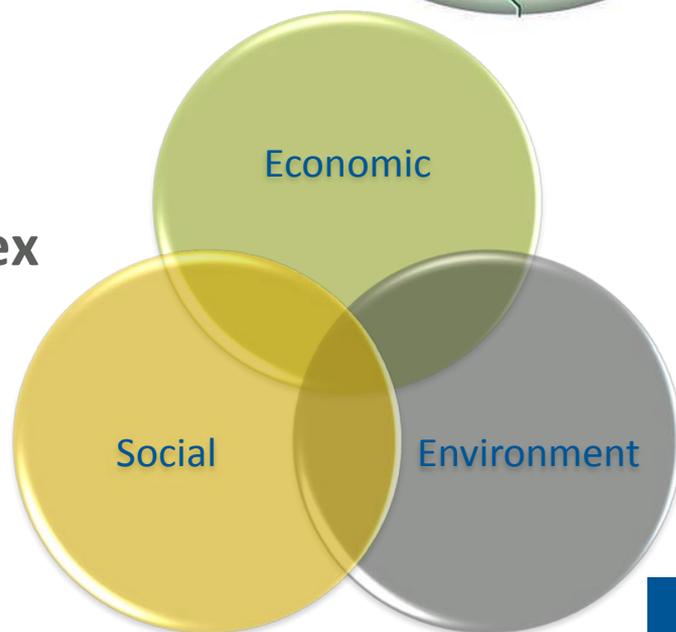
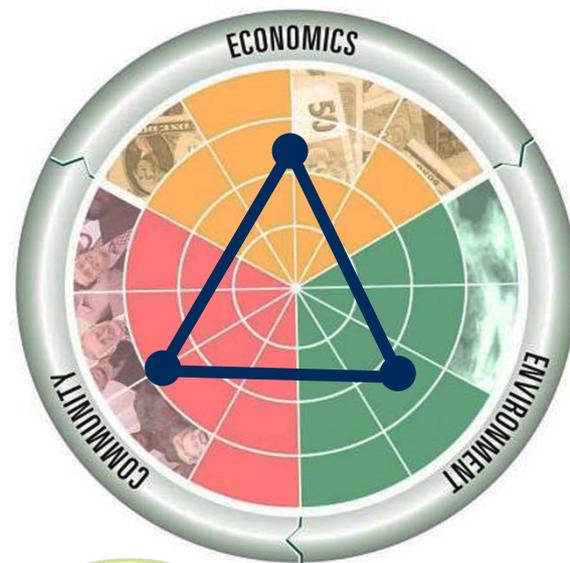
SUSTAINABILITY IS MORE THAN BEING “GREEN”

- Integrating and balancing the “3 Ps” or “triple bottom line” (TBL)
 - Planet (environment)
 - People (social)
 - Profits (economic)
- Can be project- or enterprise-focused
- Economic drivers still very important
- Decision makers (and stakeholders) determine weightings
- Must be commercially feasible



BEYOND ENERGY AND WATER USAGE

- Footprinting
 - Carbon, GHG, other emissions
 - Energy, water footprint
 - Materials footprint
 - Waste, toxicity footprints
- Community improvement index
- Financial / economic measures
- Habitat health and diversity index
- LEED incentives
- “Embodied” carbon and life cycle analysis
- Other client-specific measures



CONCLUDING REMARKS



Energy and water interdependency
... need to plan together

Water getting scarcer
... solutions are expensive

Technologies available and evolving
... change the mix, do more with less

All stakeholders
... a call to action

Black & Veatch Launches Nexus of Water & Energy Microsite: (www.nexuswaterenergy.com)

The site includes a Water+Energy in Action interactive map. This map shows success stories as well as challenge areas.

Black & Veatch - Windows Internet Explorer

http://www.nexuswaterenergy.com

File Edit View Favorites Tools Help

Google Search Google.com Internet Explorer News Internet Start Letter Writing Suggestions MapQuest.com Yahoo Search Engine

Black & Veatch

NEXUS OF WATER AND ENERGY

Search Search

HOME WATER+ENERGY IN ACTION ENERGY IMPACTS WATER WATER IMPACTS ENERGY KEY FACTS WHAT YOU CAN DO

Large amounts of electricity are required to acquire and process water, and large amounts of water are needed to produce electricity. If we want to meet our water and electricity needs, a new approach is needed.

Upcoming Events | to all events

Singapore International Water Week (SIWW)
July 4-8, 2011
Suntec Singapore International Convention & Exhibition Centre in Singapore

Hydrovision International 2011
July 19-22, 2011
Sacramento Convention Center in Sacramento, California

84th Annual Water Environment Federation Technical Exhibition and Conference (WEFTEC)
October 15-18, 2011
Los Angeles Convention Center in Los Angeles, California

Latest News | to all news

How El Paso is beating the worst drought in a generation
By Suzanne Goldenberg, The Guardian
27 June 2011

Sound water management has put the border town on the Rio Grande leagues ahead of its neighbours, but robust growth rates mean local

The Facts

Global energy use is expected to increase by 50 percent by 2025. Total electricity consumption of the water and wastewater sectors alone will grow 33 percent in the next 20 years.

Water+Energy in Action

Large amounts of electricity are required to acquire and process water and large amounts of water are needed to produce electricity. If we want to meet our water and electricity needs, a new approach is needed.

Nexus of Water and Energy

Building a **world** of difference.®

Together



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