The Value of Water Energy Production

Oklahoma Governor's Water Conference

October 18, 2011

Trish Horn, OGE Energy Corp.

PRESENTATION OVERVIEW

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- Energy and water both critical resources that are inextricably linked
- Security and economic health of U.S./Oklahoma depend on maintaining supply of both energy and water
- Each is essential input for productive, comfortable and healthy human societies
- Both are derived from natural resources; their use by humans creates a series of impacts on the sustainability of ecosystems
- Future usage and technologies
- Employing water/energy stewardship

ENERGY AND WATER ARE LINKED

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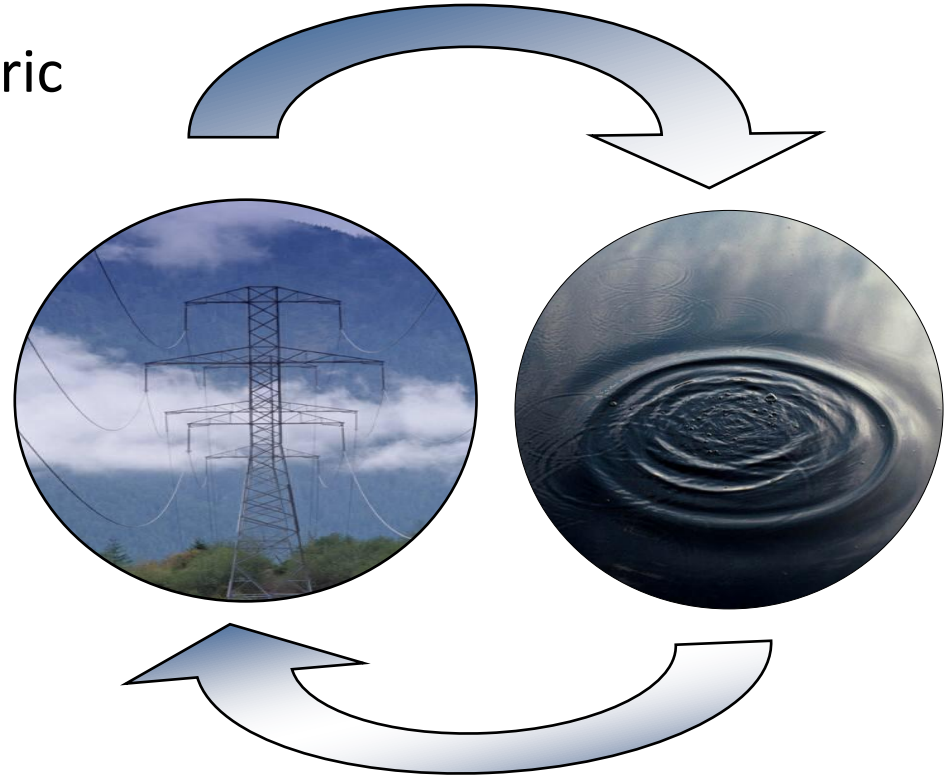
Energy Requires Water

- Thermoelectric generation (coal, gas, nuclear)
- Oil & Gas Operations
- Refining of Energy
- Hydropower



Water Requires Energy

- Water production, processing, distribution and end-use needs
- Pumping
- Conveyance and Transport
- Treatment

WITH ALL YOUR POWER + WHAT WOULD YOU DO?

Adapted from Sandia National Laboratory 2009

Energy uses significant amounts of water

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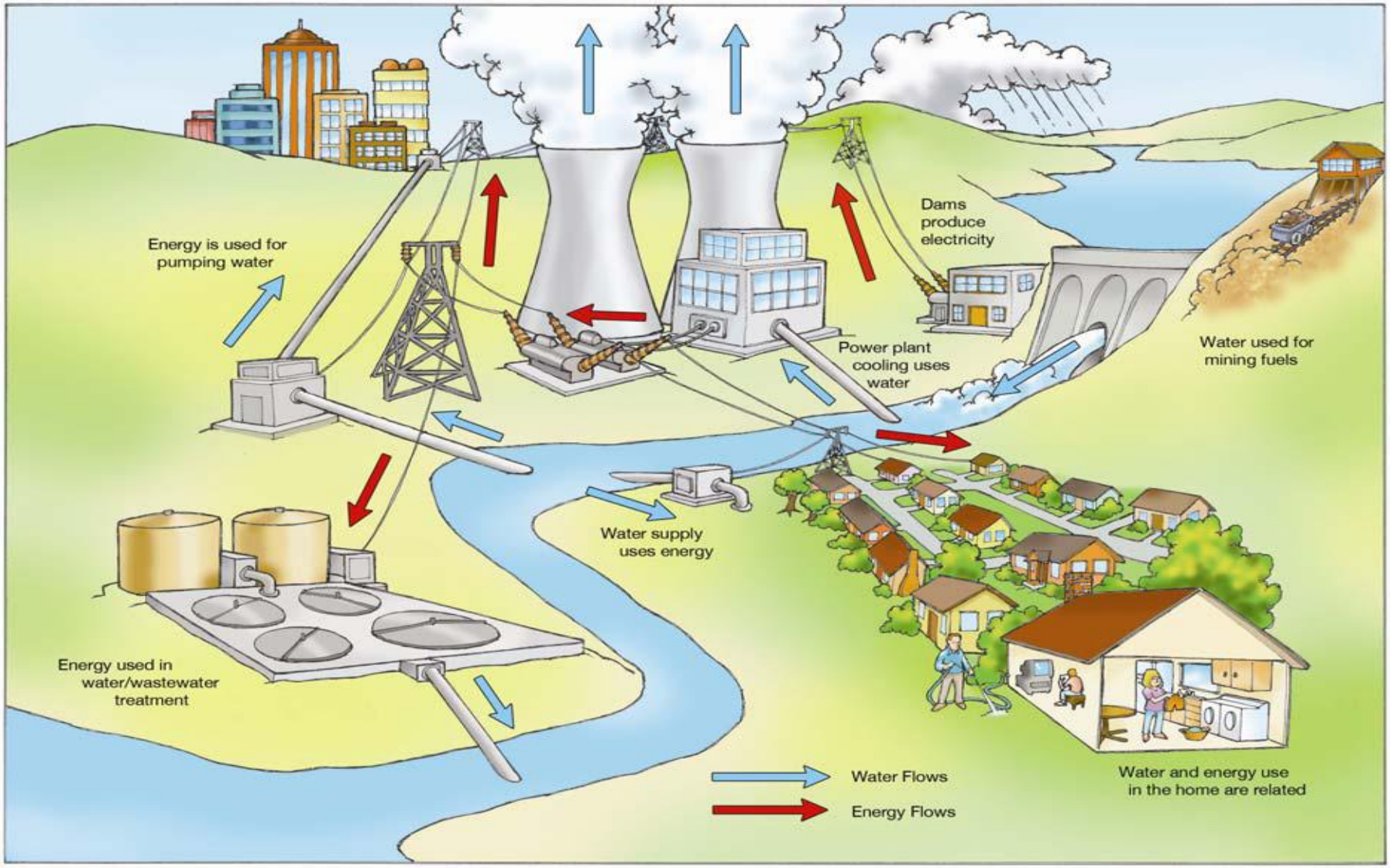

WITH ALL YOUR POWER WHAT WOULD YOU DO?

Water uses significant amounts of energy

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Energy consumers

- Supply and conveyance
- Wastewater collection and treatment
- Treatment
- Distribution
- Wastewater discharge

Some factoids

- Electricity = 75% of municipal water processing and distribution cost
- 4% of US power used for water supply and treatment

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Water – Energy relationship
What does it impact?

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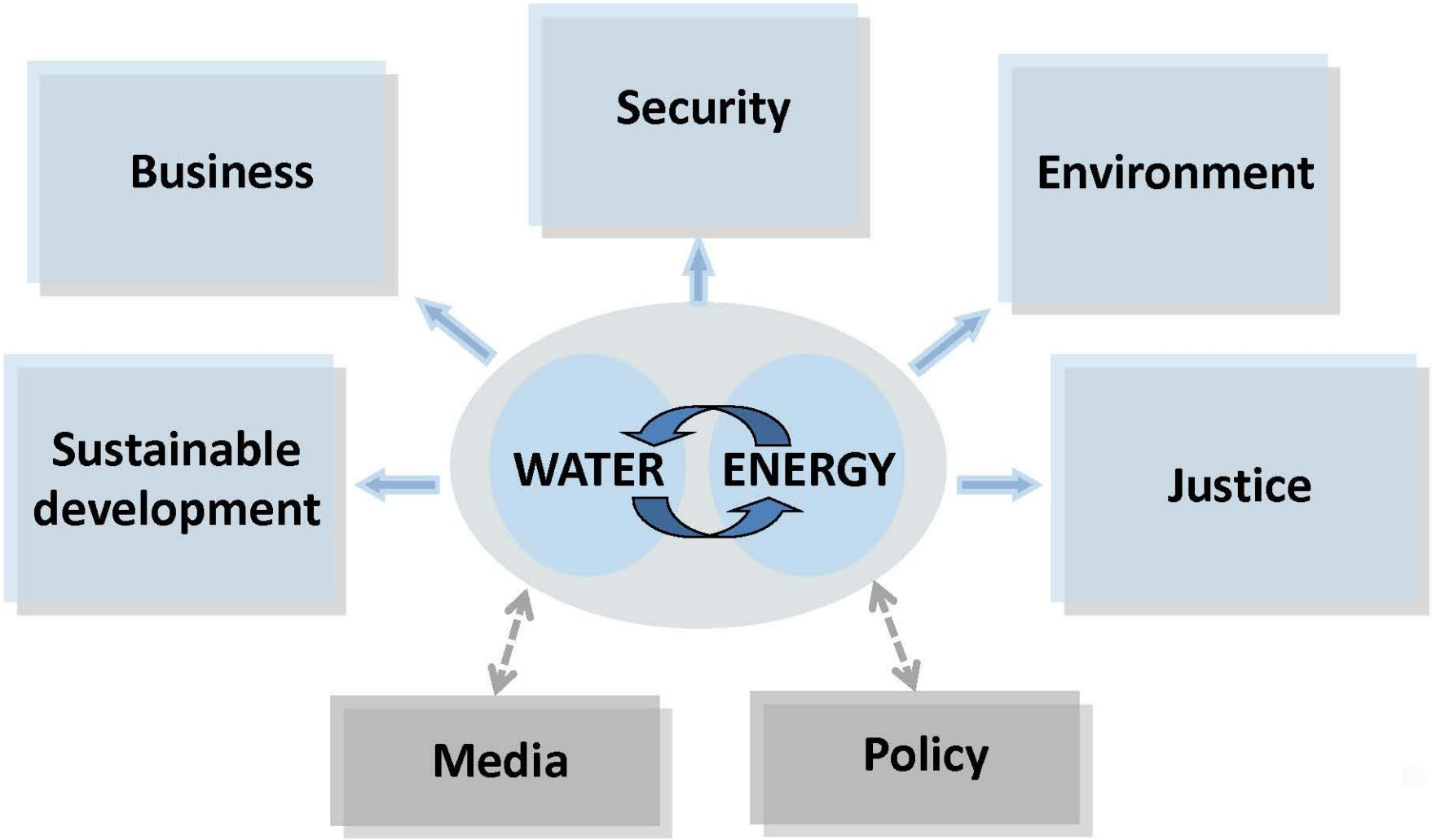

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Water-Energy relationship impacts

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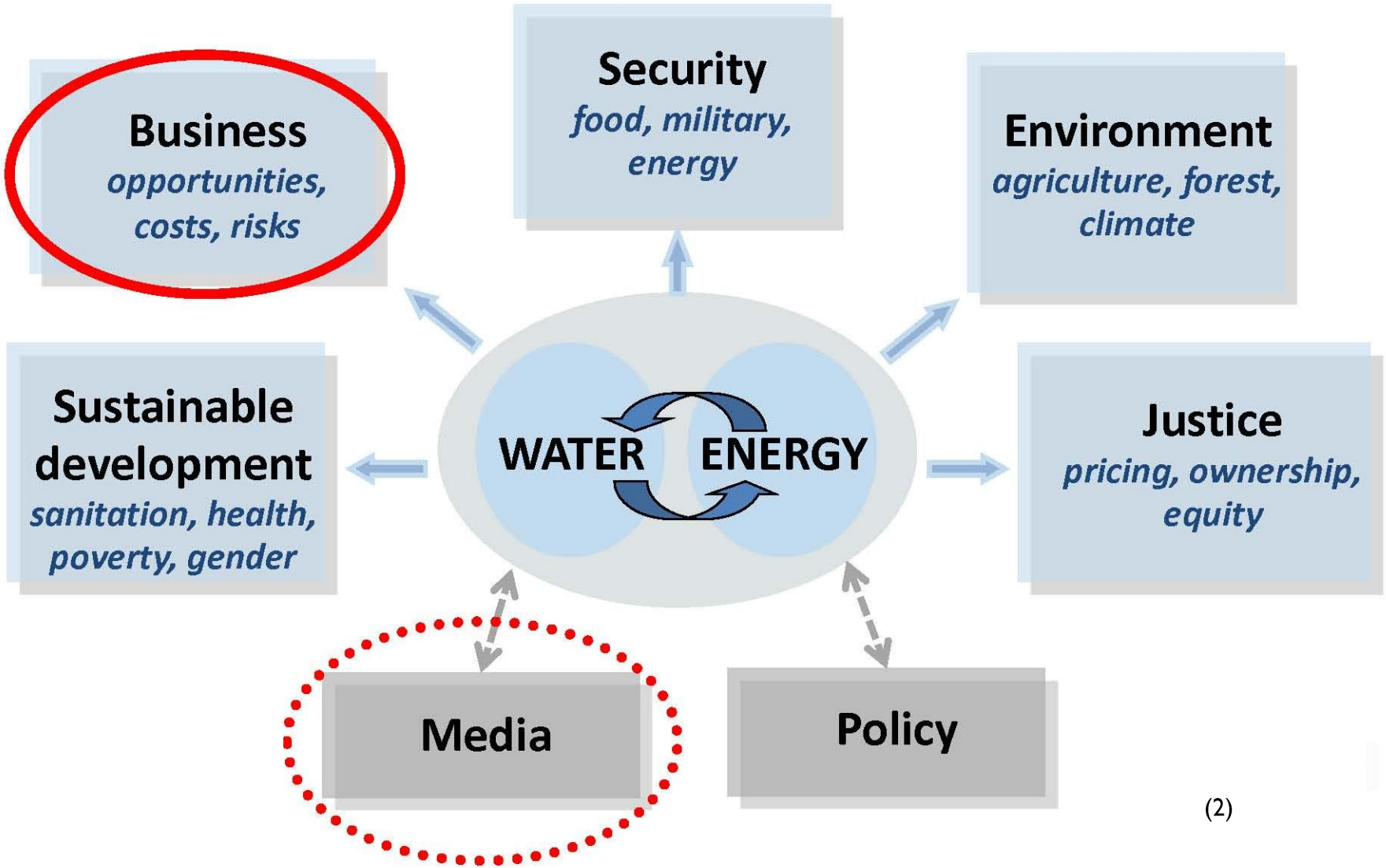

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WITH ALL YOUR POWER + WHAT WOULD YOU DO?

TRENDS – ENVIRONMENT AND BEYOND

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- Energy industries' game changers
  - Electric generation
    - Environmental regulation implications (control or alternative sources of generation)
    - Renewables/new technologies
    - Costs and reliability issues
  - Oil & Gas drilling/refining/production
    - New shale gas and oil development
    - Hydraulic fracturing
    - Oil sands
  - Biofuels
  - New alternatives that are in development

- New areas - customer choice and efficiency, demand side management; technology development; renewable energy,
- Industries' challenge: supply affordable, reliable energy

Freshwater withdrawals and consumption - worldwide

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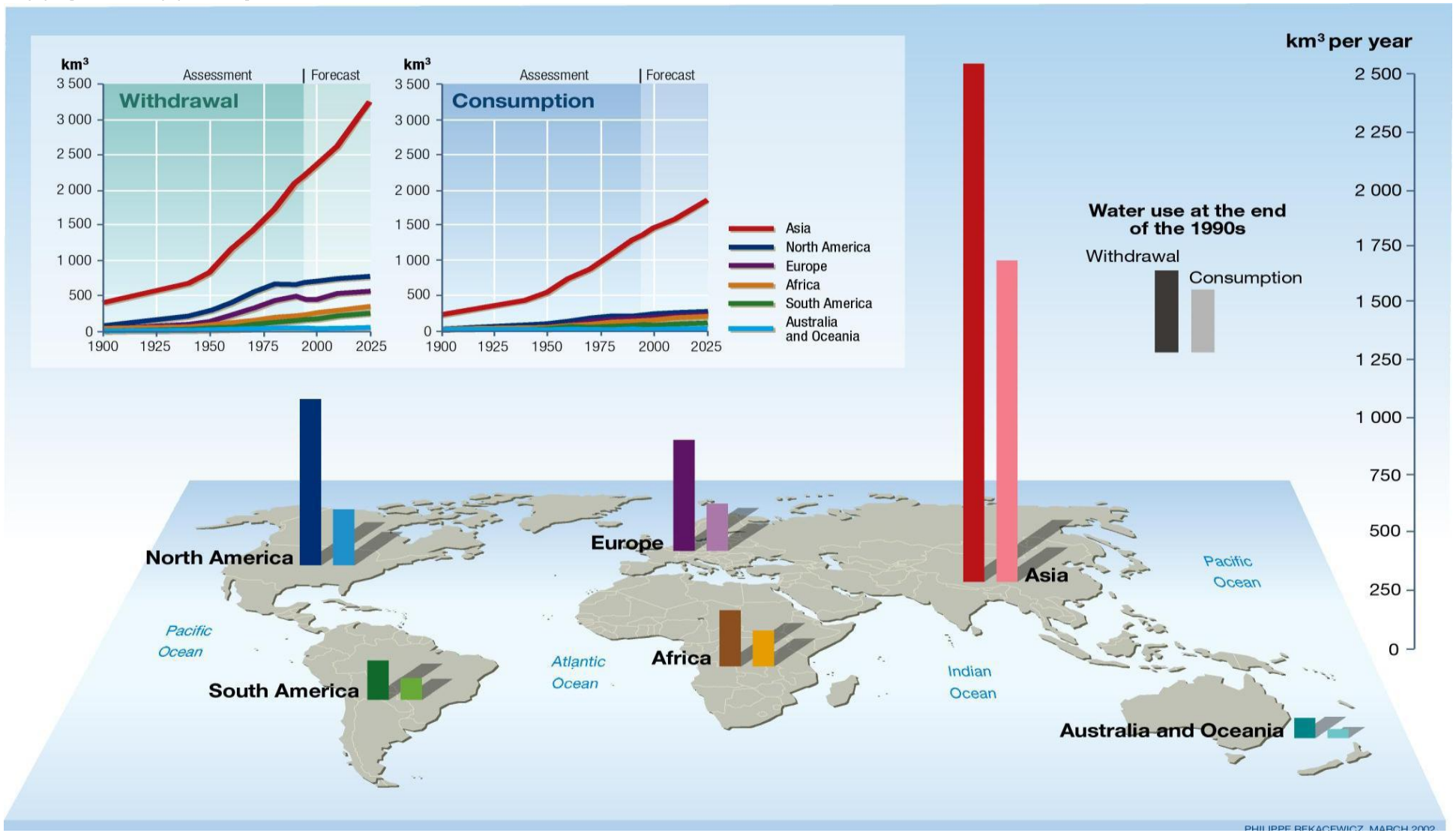

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Freshwater consumption – 84% agriculture

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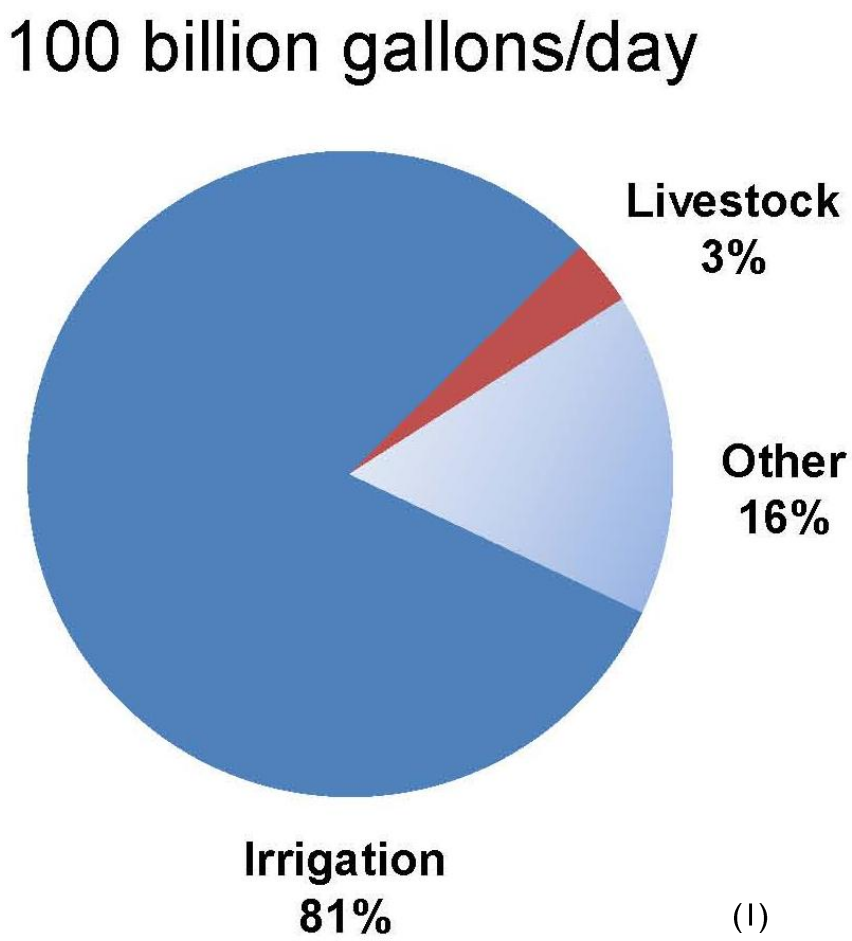

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The rest of consumption 15% – domestic, energy and industrial/commercial

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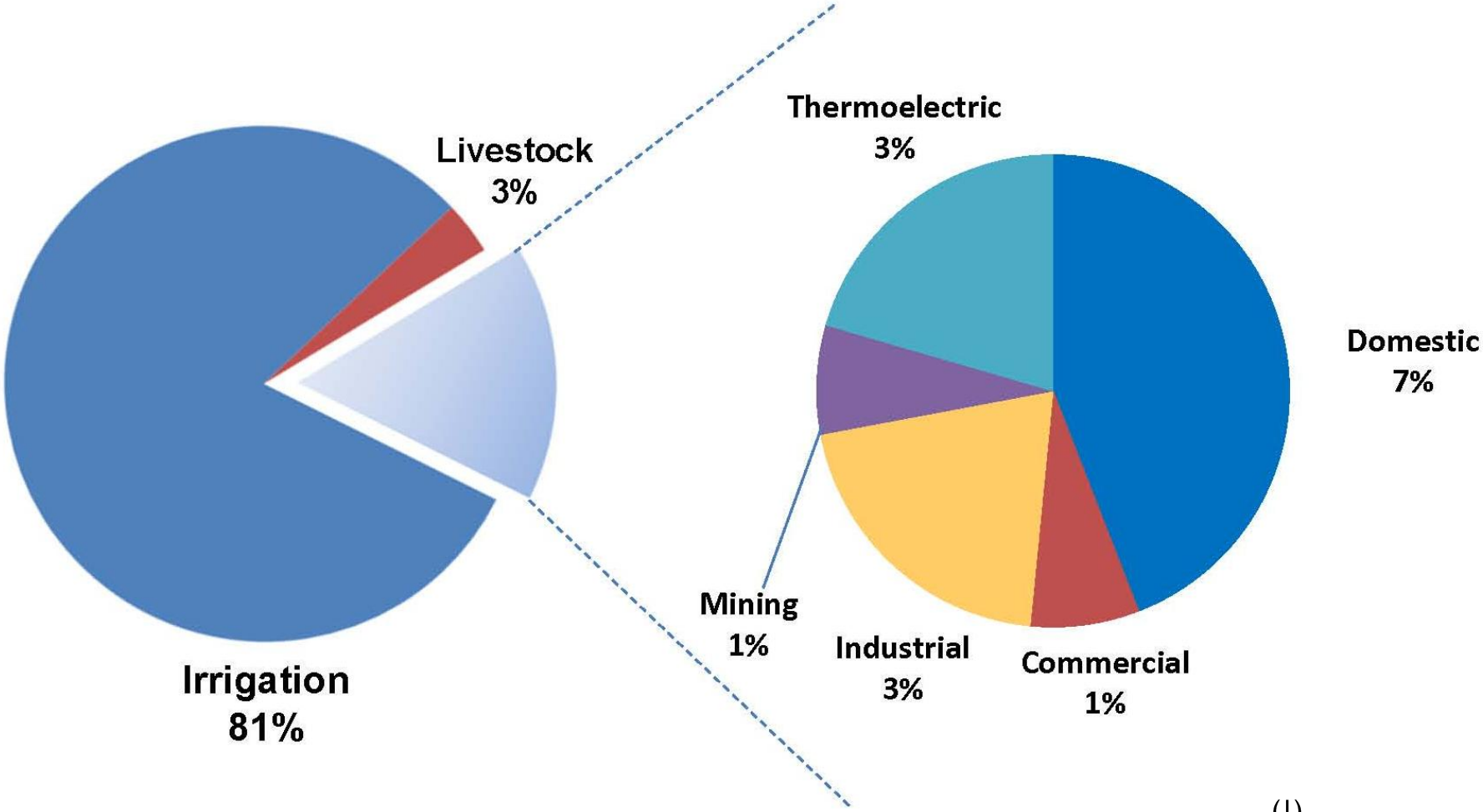

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Water used per BTU energy produced

- What is a BTU?
- 1 million BTUs – the energy required to drive 200 miles

Biofuels water consumption dwarfs traditional energy production

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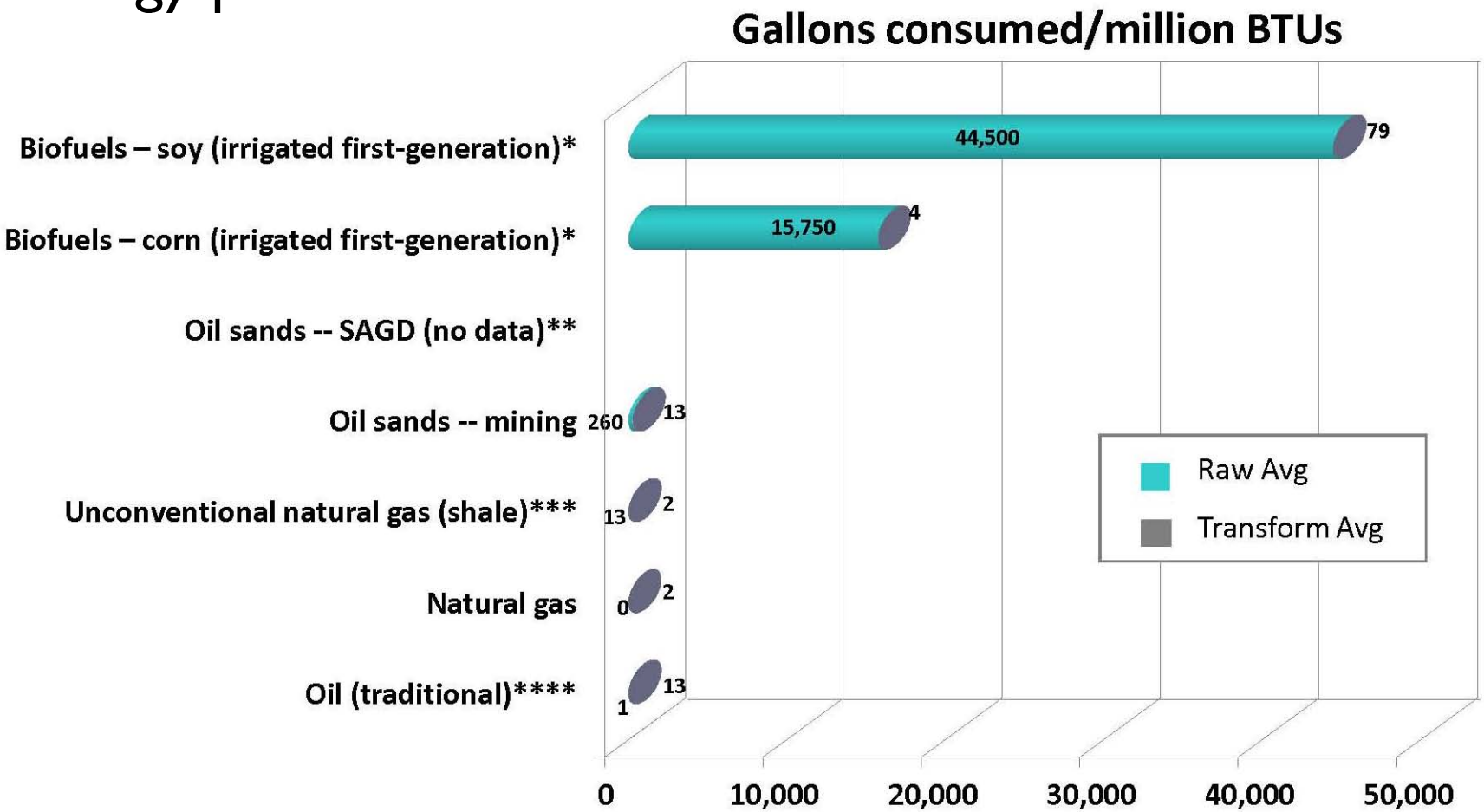

*excludes non-irrigated (majority of soy and corn), second and third generation ag waste, cellulosic camelina, jatropha, algae, etc.

**constitutes large part of future oil sands growth

***data captured before boom in hydraulic fracturing

****data excludes water flooding and EOR techniques incl $C0_2$ injection, etc.

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Oil sands - water intensity increasing

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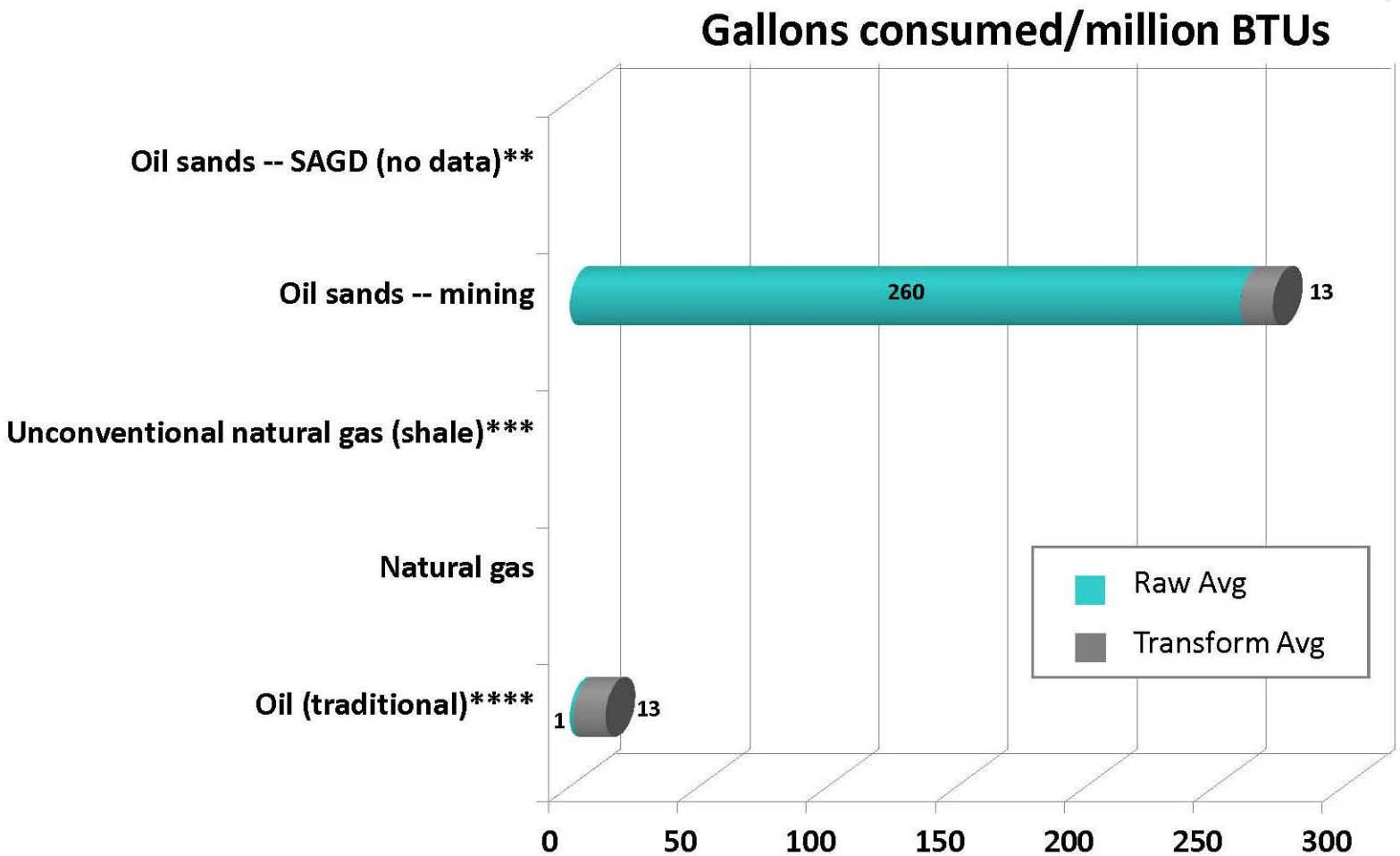

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WITH ALL YOUR POWER WHAT WOULD YOU DO?

Natural gas drilling – water intensity increasing

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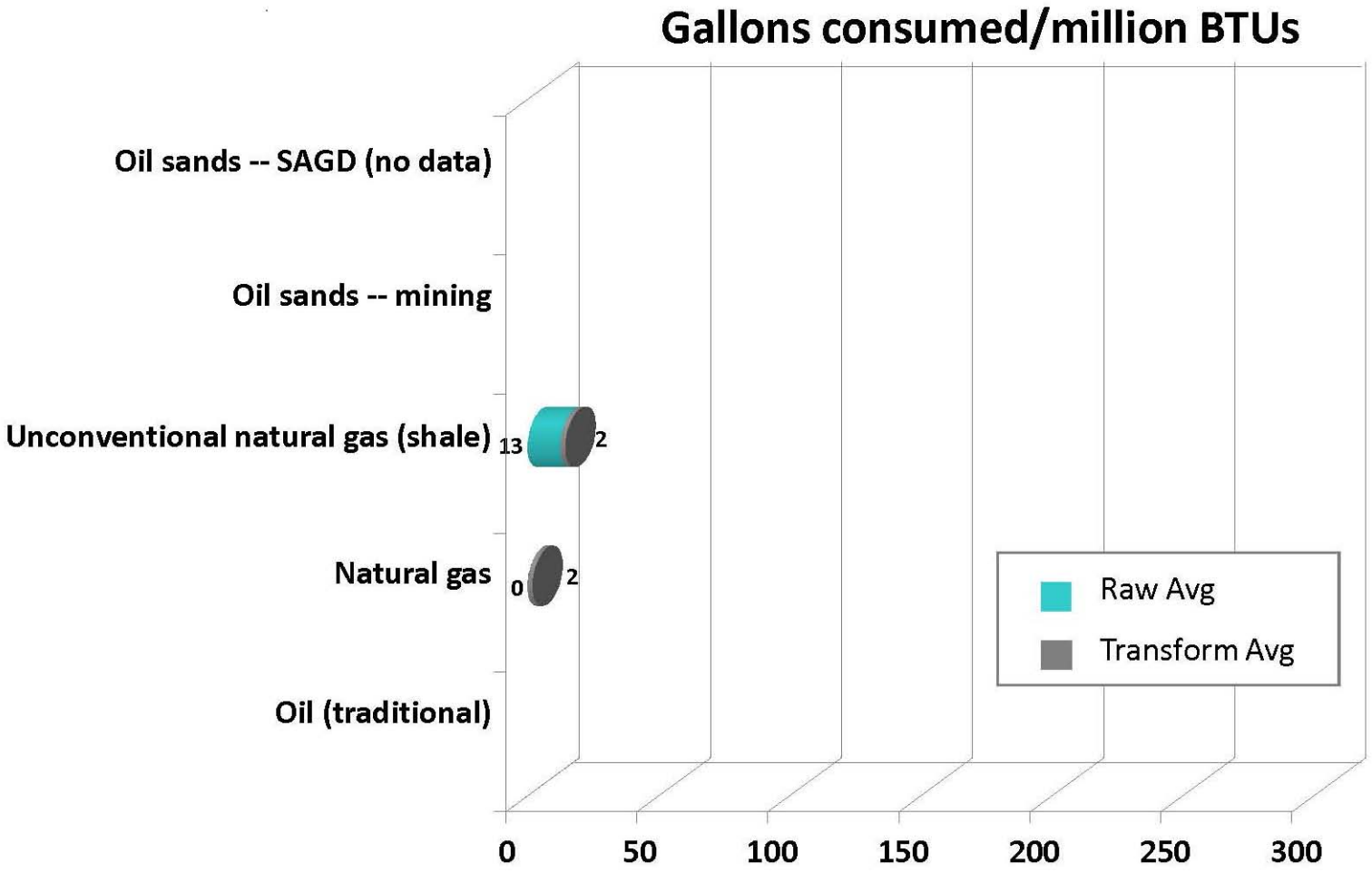

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Natural gas compared to oil

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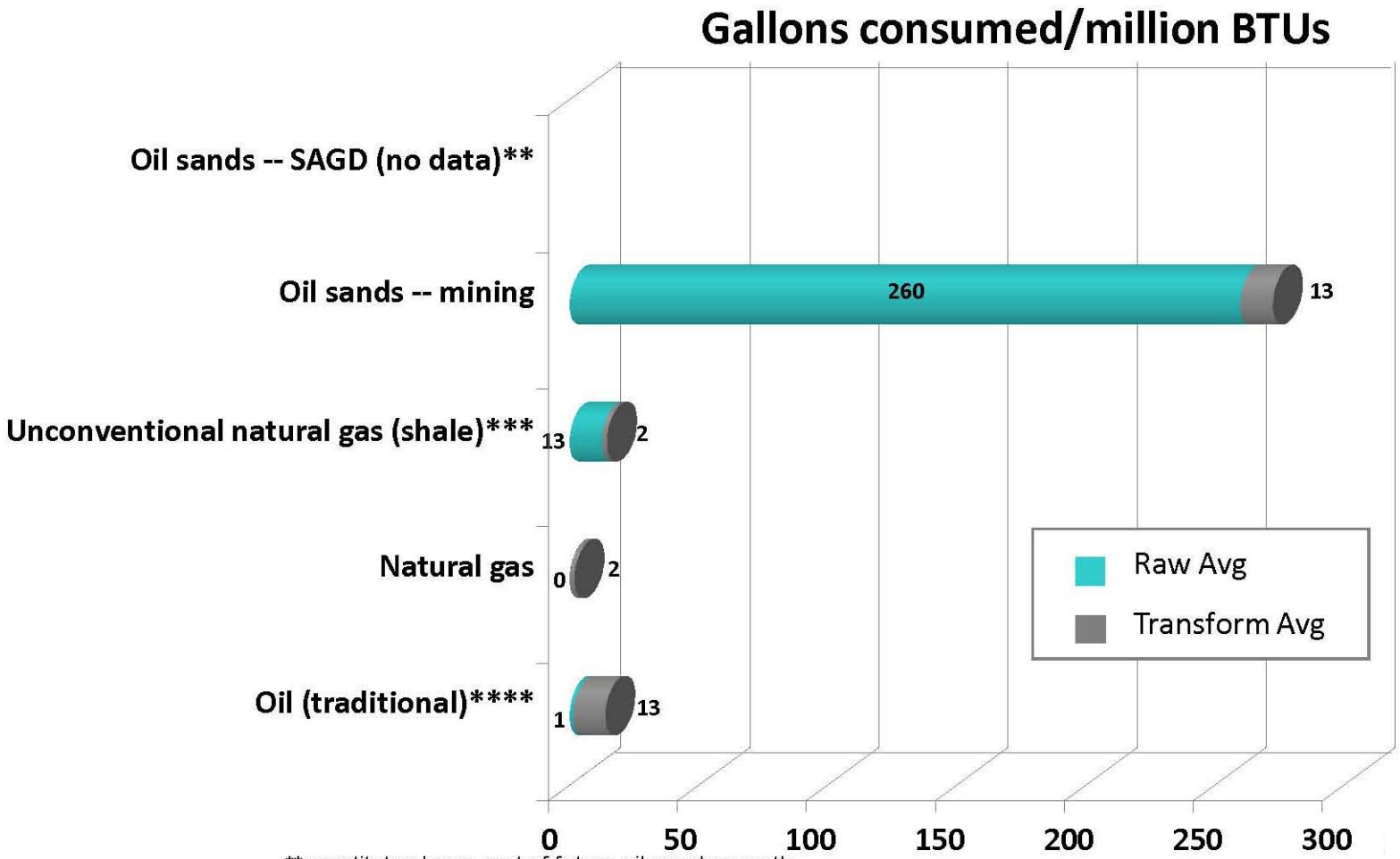

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WITH ALL YOUR POWER WHAT WOULD YOU DO?

Water used per MWh of Energy
What is a MWh?

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- 1 KWh = 1,000 Wh

  10 – 100@ light bulbs/hr
- 1 MWh = 1,000 KWh = 1million Wh

  roughly, plasma screen TV/yr)

- Watt: a standard unit of power that specifies the rate electrical energy is dispersed
- Watt-hour (Wh): a measure of power over time

Electricity generation – water for cooling

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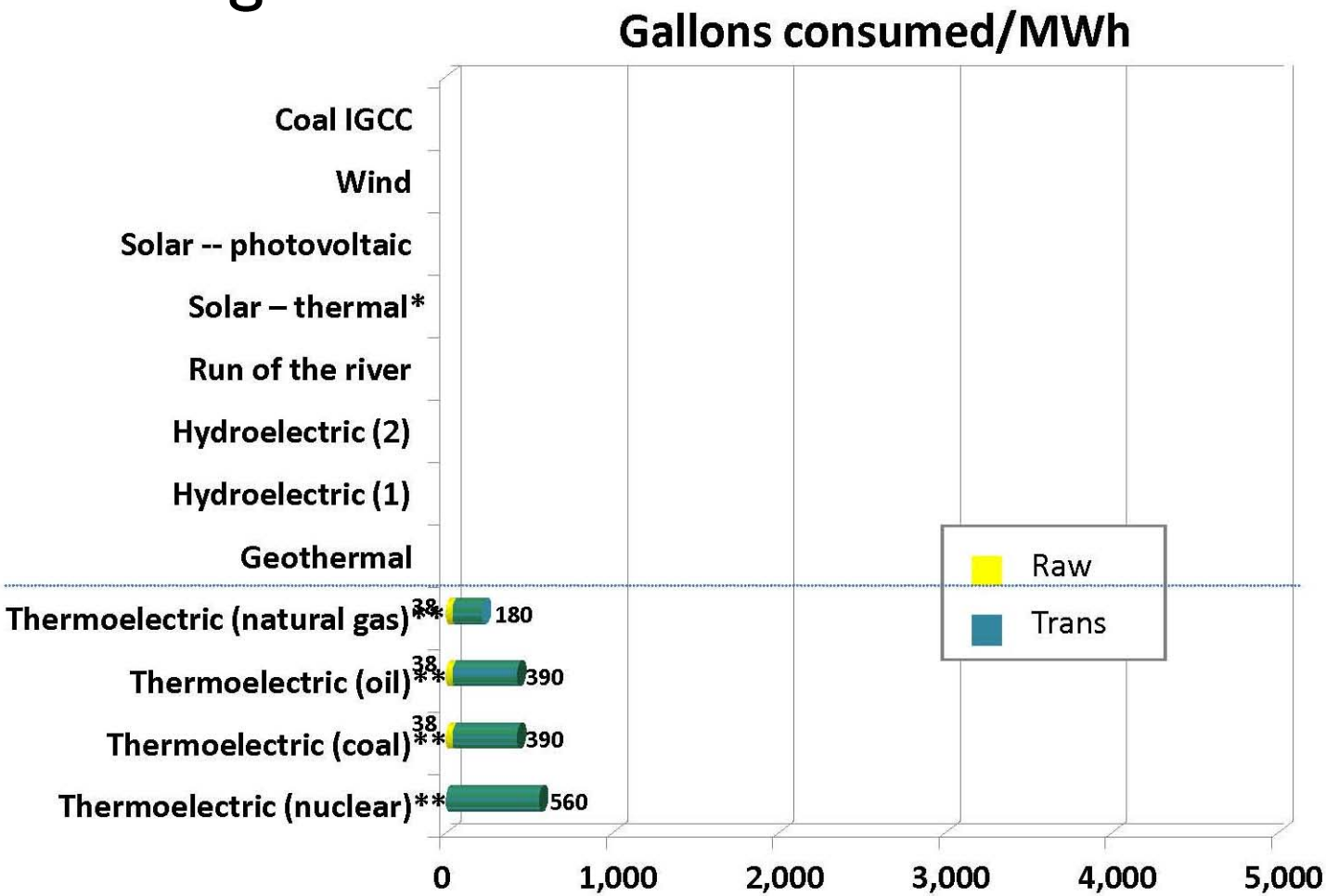

*installed base only

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"Cleaner" electricity -water consumption

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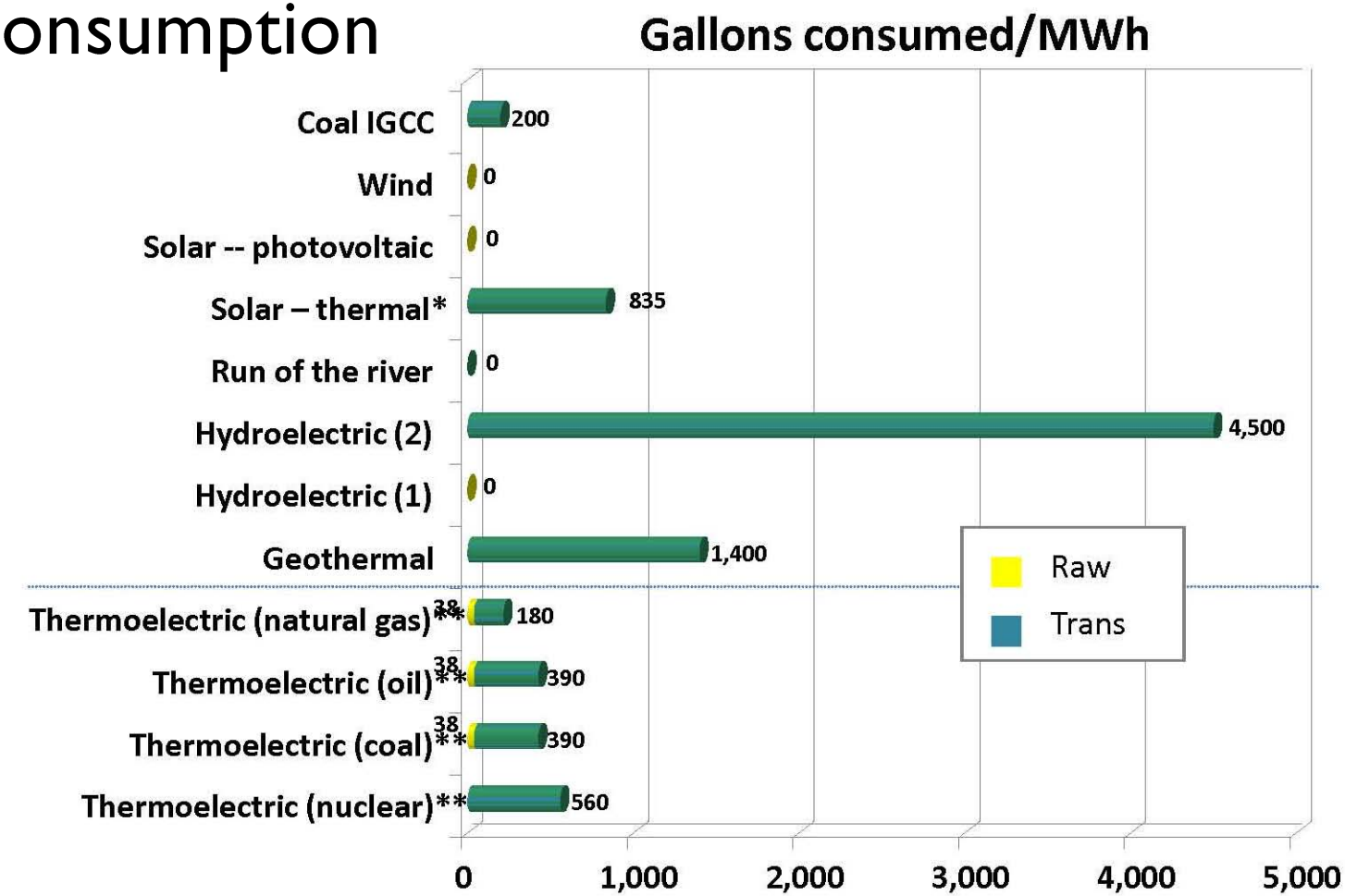

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WITH ALL YOUR POWER WHAT WOULD YOU DO?

Getting the facts correct

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- Evaluate energy/water implications
- Enable decisions on energy/water impacts based on facts
  - Oil & Gas
  - Power generation
  - Alternative energy sources
    - Wind
    - Solar
    - Hydro
    - Biofuels
- Future actions – impacts

Water – Energy relationship
What does it impact?

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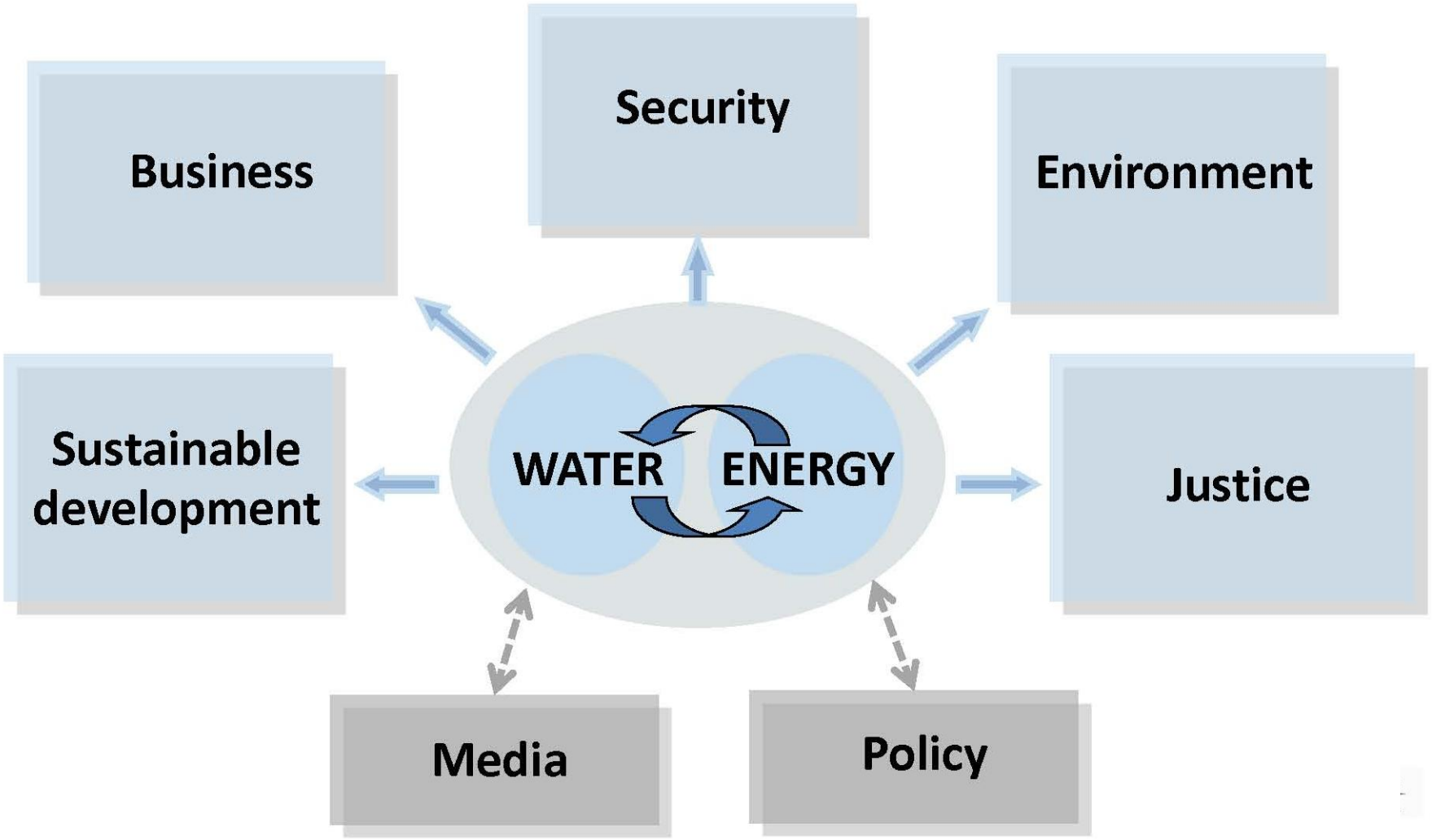

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The Value of Water

WHAT CAN WE DO TOGETHER?

WITH ALL YOUR POWER WHAT WOULD YOU DO?

WHAT OG&E IS DOING …

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- Water Stewardship
  - Conservation of fresh water
  - Recycle/Reuse
  - Employing uses for waste water
  - New generation – more efficient water usage
  - Public uses of cooling lakes – recreation/wildlife
- Installing Smart Grid
  - Empowering customers with information to make energy choices that conserve and are efficient
- Providing Programs for Energy Conservation
  - Less energy used – less water required
- Expanding Renewable Energy

WITH ALL YOUR POWER + WHAT WOULD YOU DO?

2010 OG&E WATER WITHDRAWN

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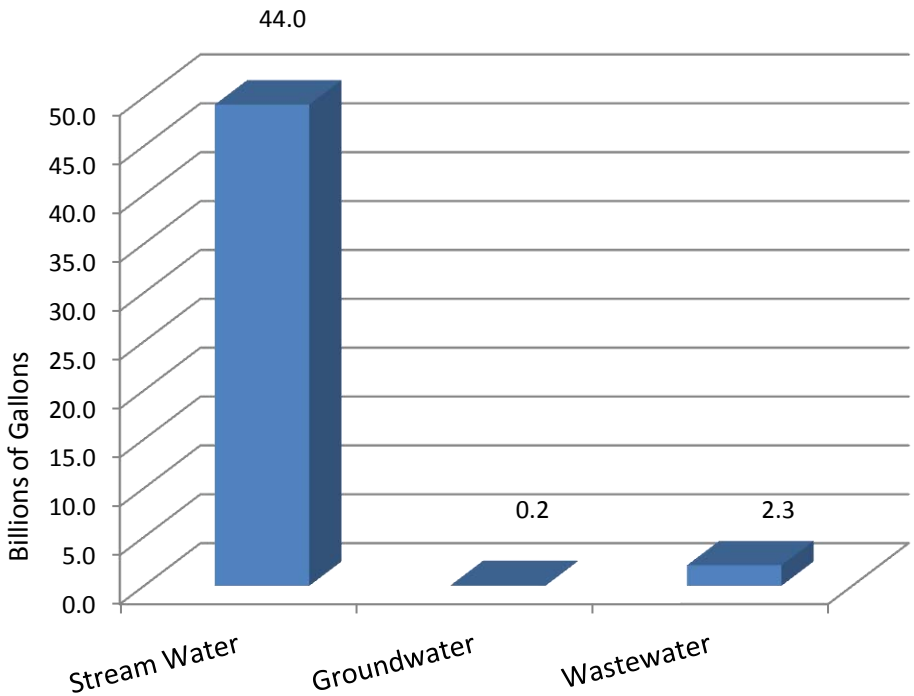
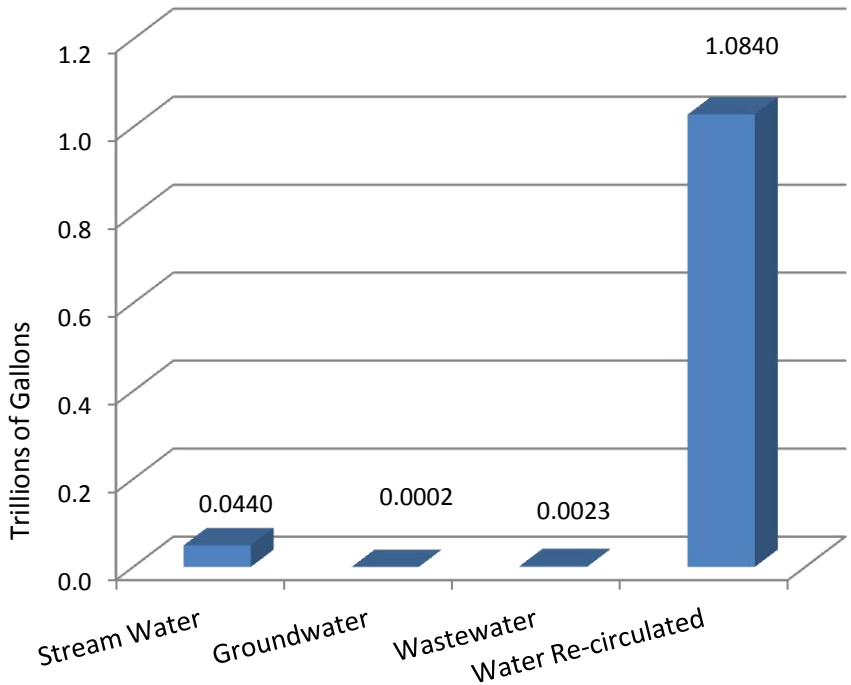
Total Water Withdrawn (approx 25% consumed)

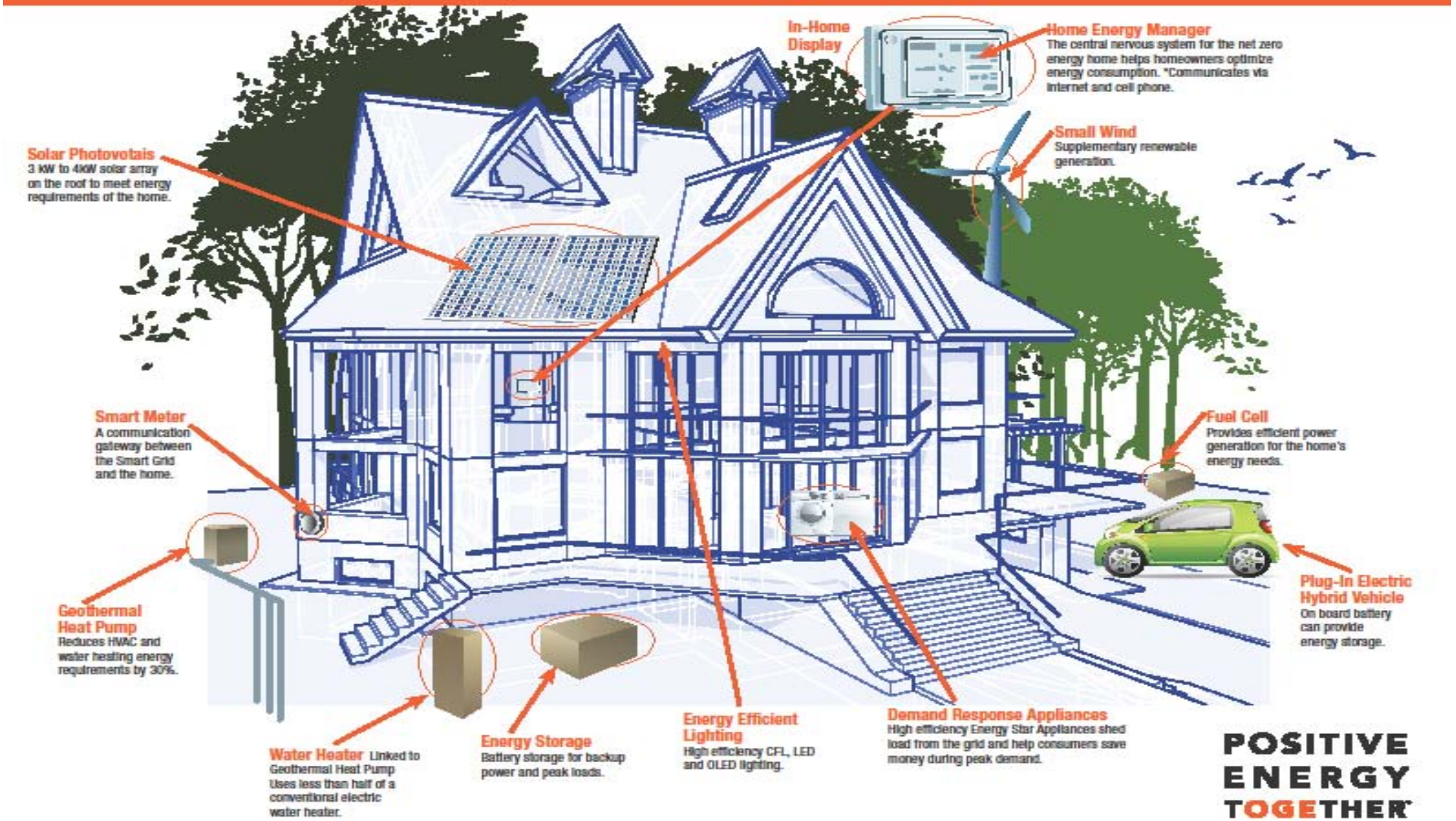


Total Water Withdrawn and Total Volumes Recycled/Re-circulated



WITH ALL YOUR POWER WHAT WOULD YOU DO?

A view of a customer's Positive Energy Home in 2020



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IN CONCLUSION –WATER AND ENERGY

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- A reliable water supply source is indispensable to energy industries and the citizens of Oklahoma
- A reliable and affordable source of energy is vital to a good quality of life for Oklahoma
- By partnering and working together, we can make energy choices and decisions that conserve and protect our valuable water resources
- OGE wants to empower you to make energy choices that are good for you, good for our Oklahoma water plan and good for Oklahoma.

SOURCES

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1) U.S. Department of Energy. "Energy Demands on Water Resources: Report to Congress on the Interdependency of Energy and Water." last modified December 2006.

2) World Policy Institute-EBG Capital Analysis --based on US Department of Energy, 2006.

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