

Hydrating Energy: Water's Impact on our Energy System



My Background



Shil Basu, PE
Principal, Industrial Water Practice Leader

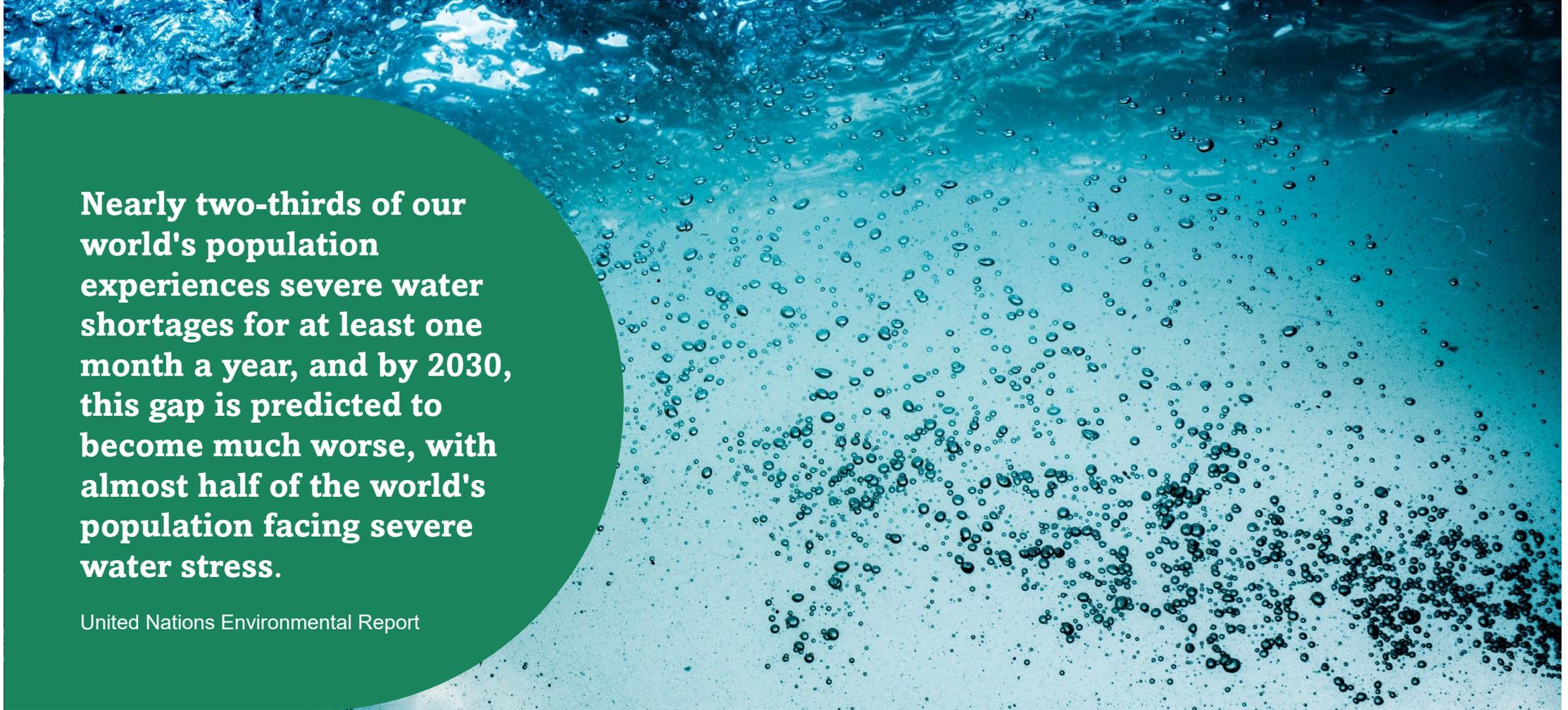
- Chemical Engineer, Case Western 2006
- Avid traveler
- Boston Celtics diehard
- Worked in water since 2006 & in energy and water since 2012
- At Stantec lead our industrial water practice for our US South region, involved with business development and project execution leadership



Sustainability Moment

Nearly two-thirds of our world's population experiences severe water shortages for at least one month a year, and by 2030, this gap is predicted to become much worse, with almost half of the world's population facing severe water stress.

United Nations Environmental Report





Where we are

70+
years of providing consulting, engineering, and project management services

2
Top 10 International Design Firms by Region – United States (ENR, September 2024)

1
Most sustainable corporation among industry peers; Our 5th year of the Global 100 List (2024 Corporate Knights Global 100)

4
Texas & Louisiana Top Design Firms by Market Sector (ENR, May 2024)



STN
Traded on NYSE & TSX

32,000
Employees Globally

450
Locations Worldwide

\$10.06B
Market Cap (as of Feb. 26, 2025) – Stantec Inc



Copilot

Brainstorm gift options

Suggest some holiday gift ideas for my clients that are under \$50 each

Put info in a table

Organize the world's most valuable companies into a table

Prep for an interview

Provide 5 interview questions for an administrative assistant role

Get more done

How can I improve my productivity during remote work?

Improve your workspace

Provide tips on decluttering my workspace for maximum efficiency.

Get hiring tips

How can I evaluate an interview candidate's soft skills?

 [View prompts](#)

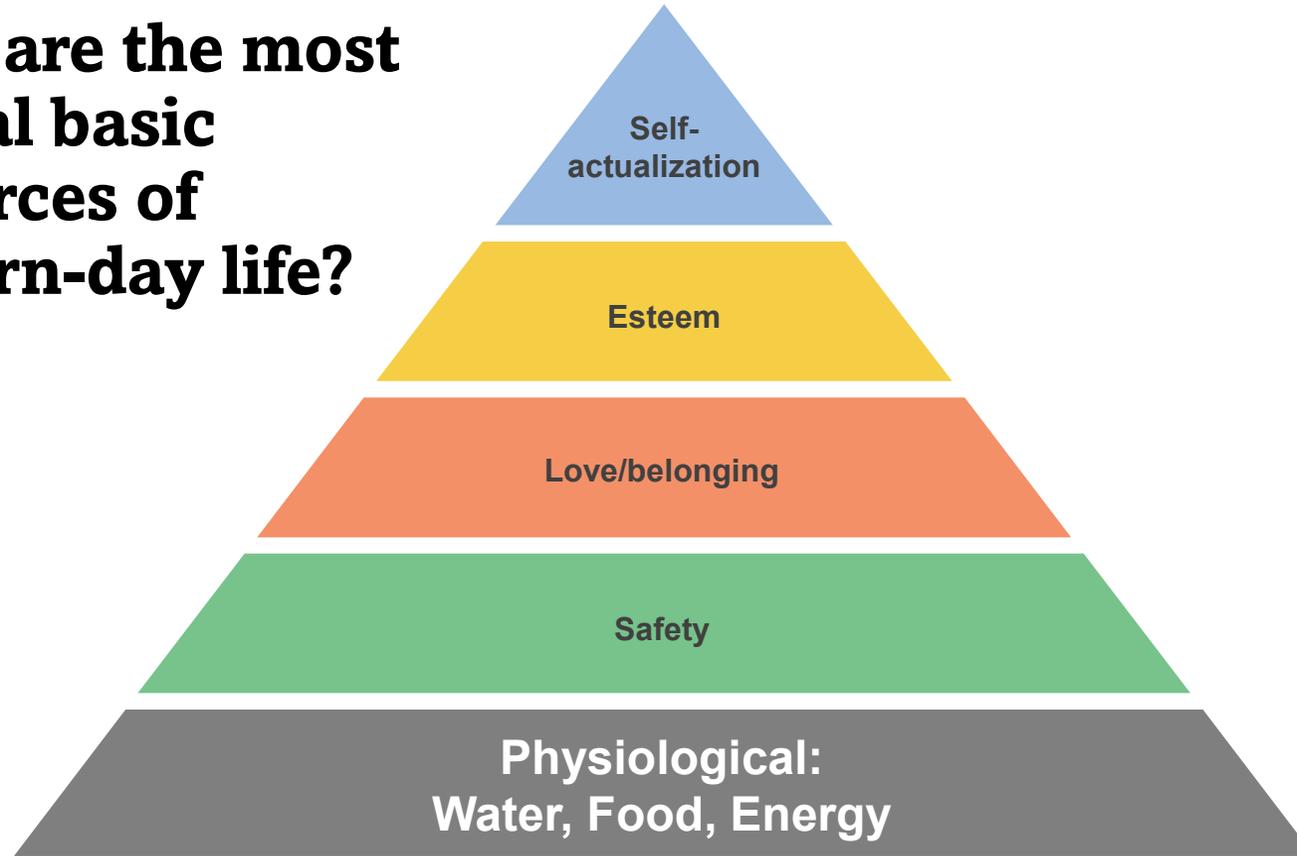
Ask me anything...

I

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What are the most critical basic resources of modern-day life?



Copilot

In modern society, several critical resources are essential for daily functioning and overall development. Here are some of the most important ones:

1. **Water:** Vital for drinking, agriculture, sanitation, and industrial processes.
2. **Food:** Necessary for nutrition and sustenance, with agriculture and food production being key sectors.
3. **Energy:** Includes electricity, oil, natural gas, and renewable sources like solar and wind power, crucial for powering homes, industries, and transportation.
4. **Healthcare:** Access to medical services, medications, and healthcare infrastructure is fundamental for maintaining public health.
5. **Education:** Provides knowledge and skills, fostering innovation and economic growth.
6. **Communication:** Technologies like the internet, mobile phones, and other digital tools enable information exchange and connectivity.
7. **Transportation:** Infrastructure such as roads, railways, and public transit systems facilitate the movement of people and goods.
8. **Housing:** Safe and affordable shelter is essential for well-being and stability.
9. **Sanitation:** Proper waste management and sanitation systems are crucial for public health and environmental protection.

These resources form the backbone of modern society, supporting both individual well-being and collective progress. Is there a specific resource you're particularly interested in learning more about?

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Tell me more about renewable energy. How does education impact society? What are the challenges in food production? [View prompts](#)

Ask me anything... [Help](#) [Feedback](#) [Share](#)

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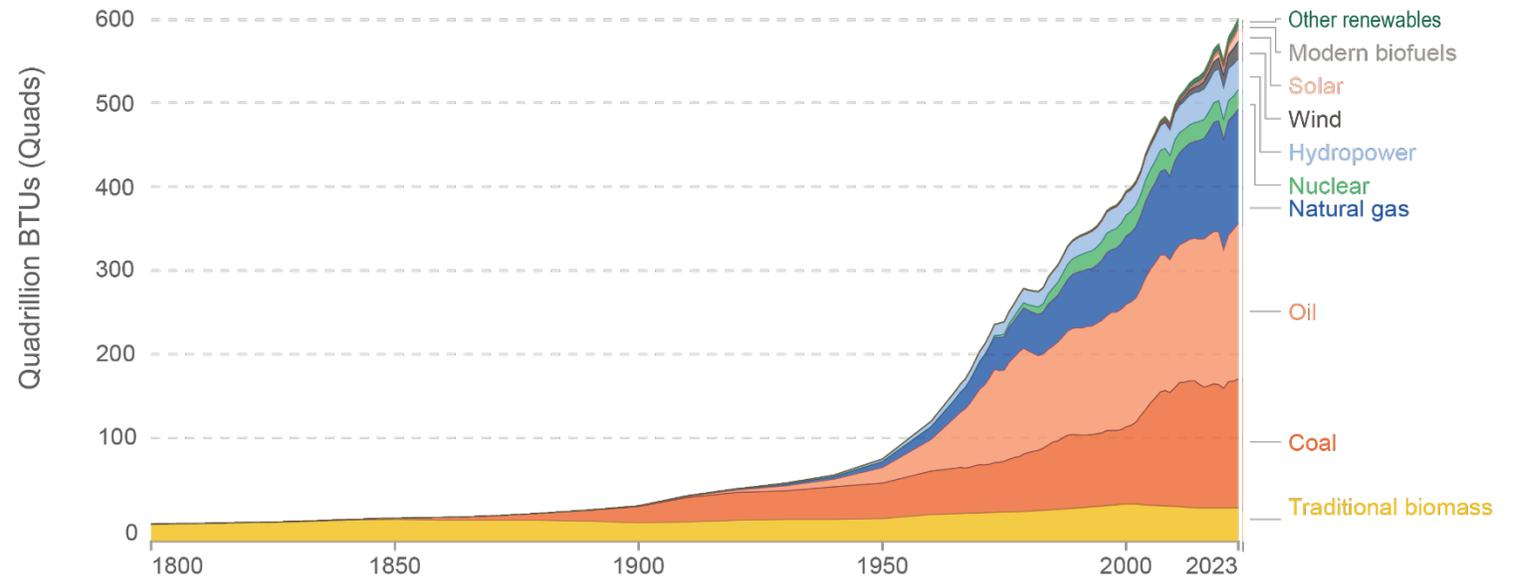


Historical Energy Demand



Global primary energy consumption by source

Primary energy¹ is based on the substitution method² and measured in Quadrillion BTUs



Data source: Energy Institute - Statistical Review of World Energy (2024); Smil (2017)

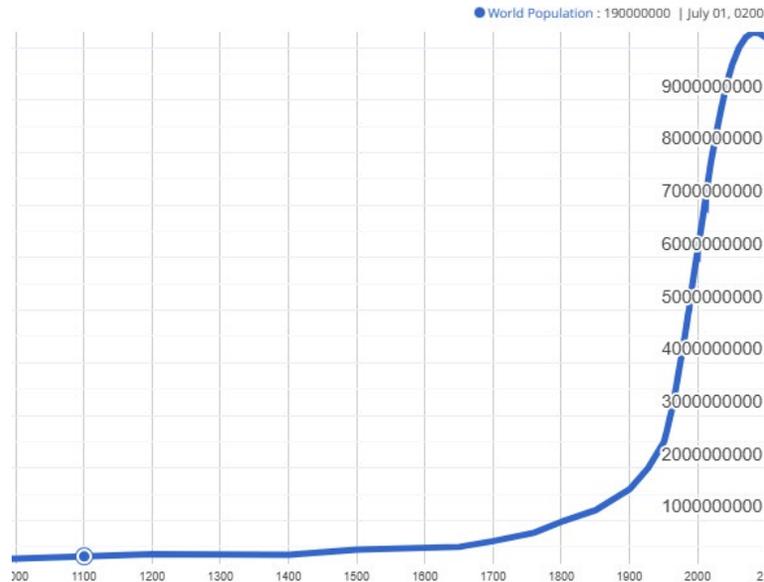
Note: In the absence of more recent data, traditional biomass is assumed constant since 2015.

Adapted to measure data in Quadrillion BTUs



Importance of Energy

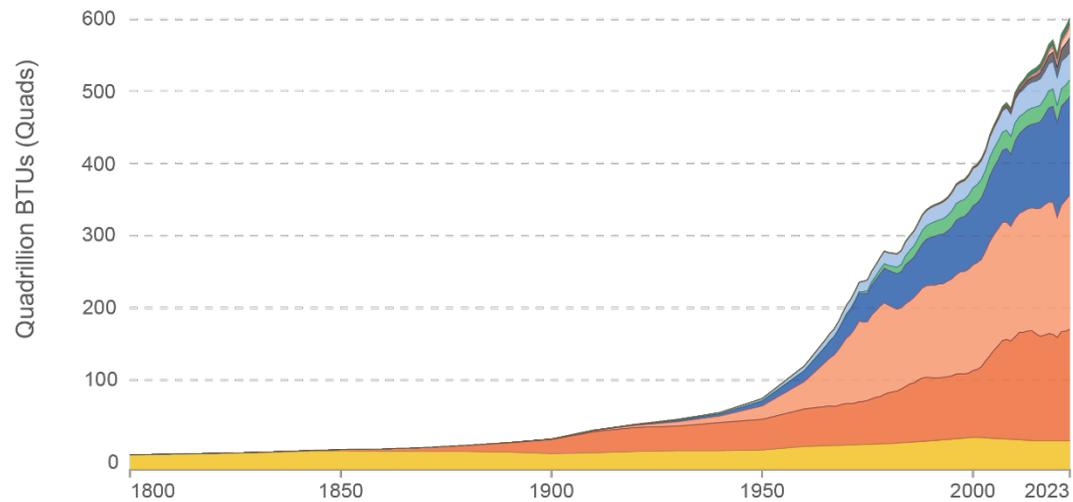
World Population: Past, Present, and Future



Source: <https://www.worldometers.info/world-population/>

Global primary energy consumption by source

Primary energy¹ is based on the substitution method² and measured in Quadrillion BTUs

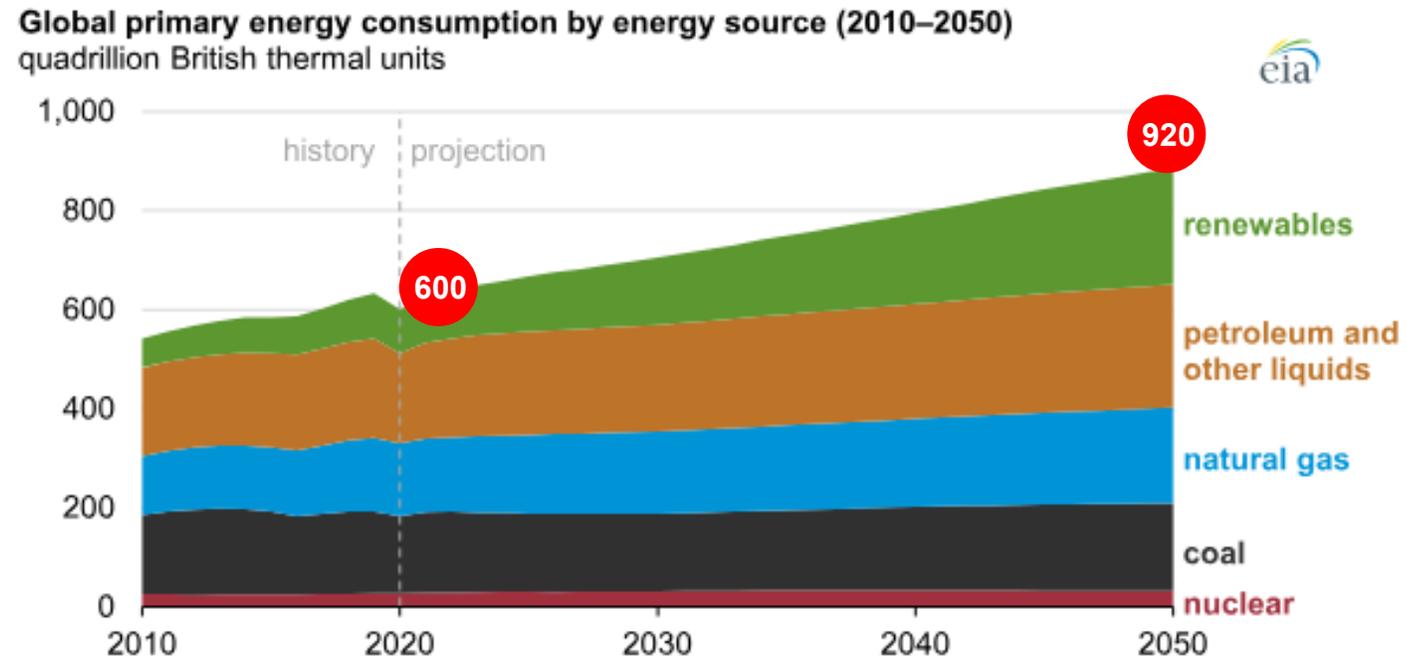


Data source: Energy Institute - Statistical Review of World Energy (2024); Smil (2017)

Note: In the absence of more recent data, traditional biomass is assumed constant since 2015.
Adapted to measure data in Quadrillion BTUs



The Future of Energy



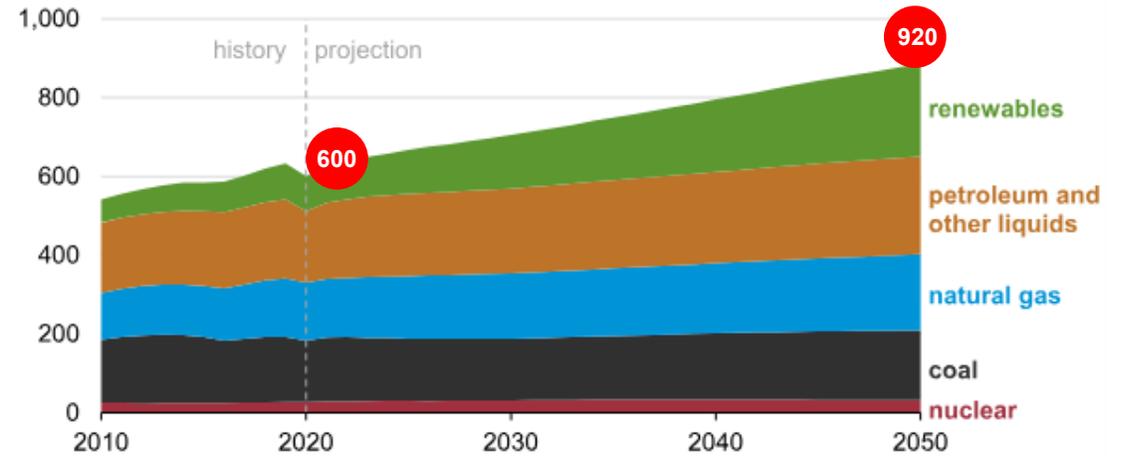
Source: U.S. Energy Information Administration, International Energy Outlook 2021 (IEO2021) Reference case



The Future of Energy

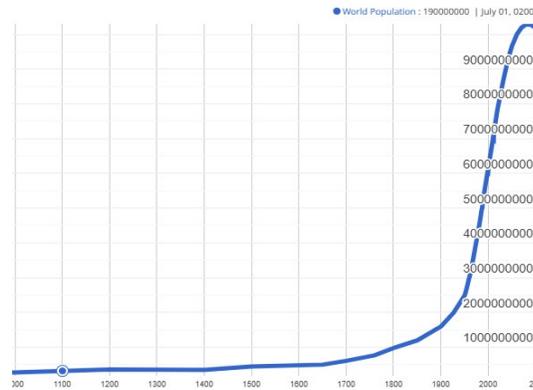
Total → 600 QBTU now,
920 QBTU by 2050
> 50% growth in just 25 years

Global primary energy consumption by energy source (2010–2050)
quadrillion British thermal units



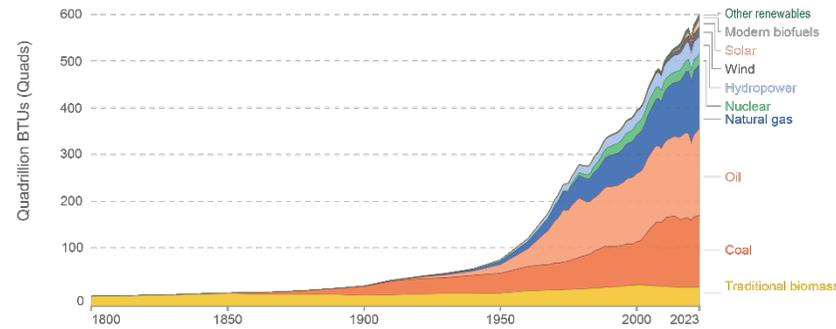
Importance of Energy Summary

World Population: Past, Present, and Future



Global primary energy consumption by source

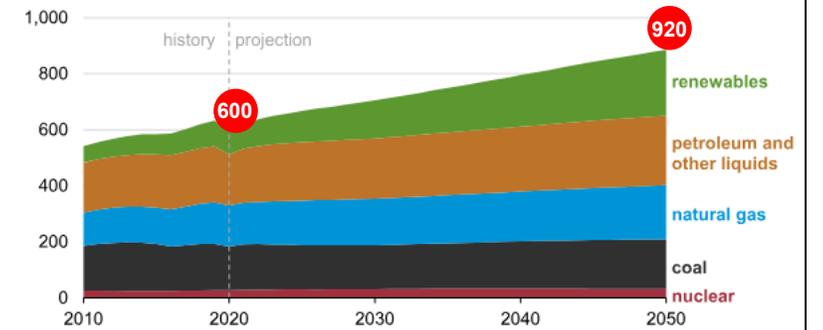
Primary energy¹ is based on the substitution method² and measured in Quadrillion BTUs



Data source: Energy Institute - Statistical Review of World Energy (2024); Smil (2017)

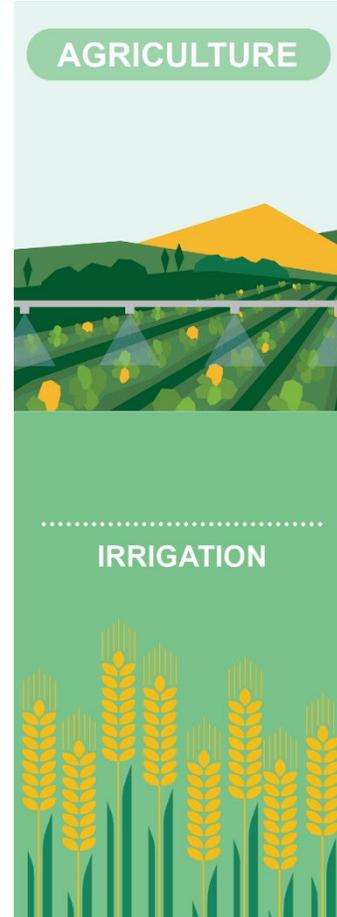
Note: In the absence of more recent data, traditional biomass is assumed constant since 2015. Adapted to measure data in Quadrillion BTUs

Global primary energy consumption by energy source (2010–2050)
quadrillion British thermal units



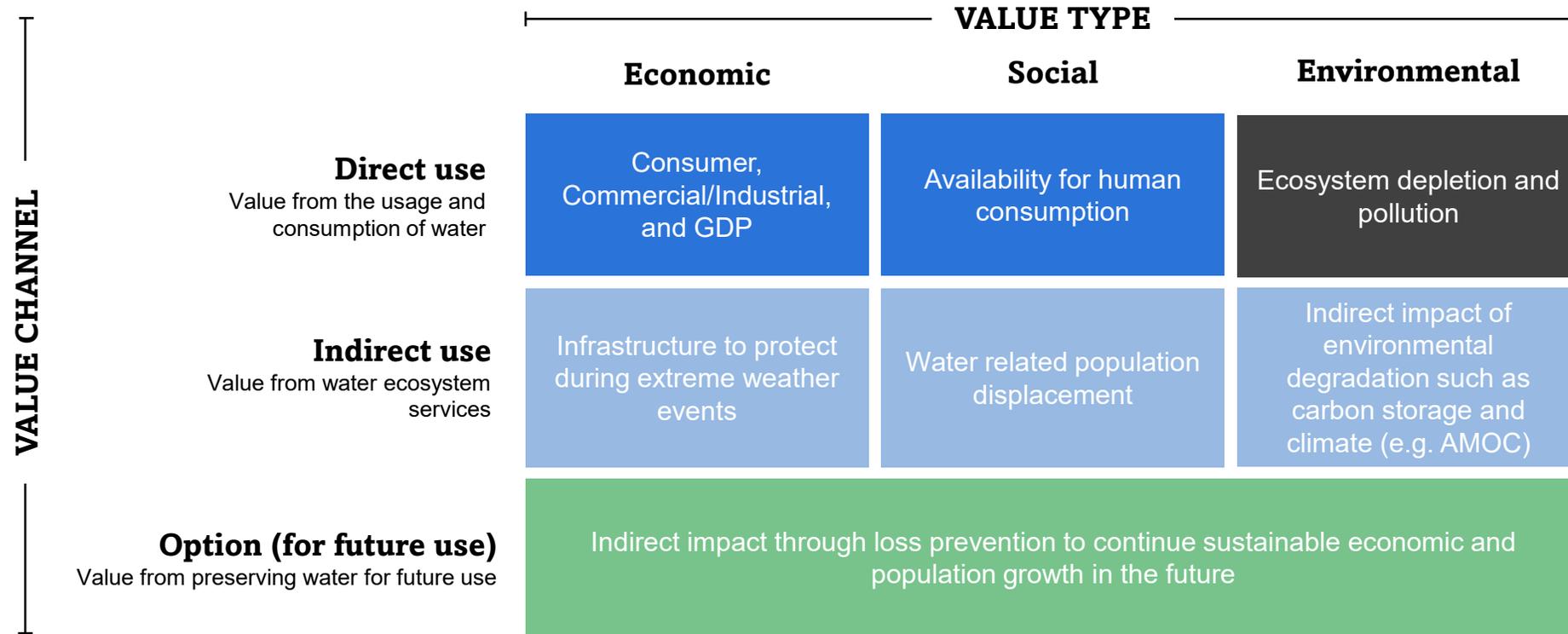
	1927	2025	2050
Population	1 Billion	8.2 Billion	9.7 Billion
Years it took to add 1 Billion	Before 1927 - Eternity After 1927 - 123	12	15
Energy Demand (Quadrillion BTUs)	68.5	600	920
Years for Energy Demand to double	50	40	45

Importance of Water





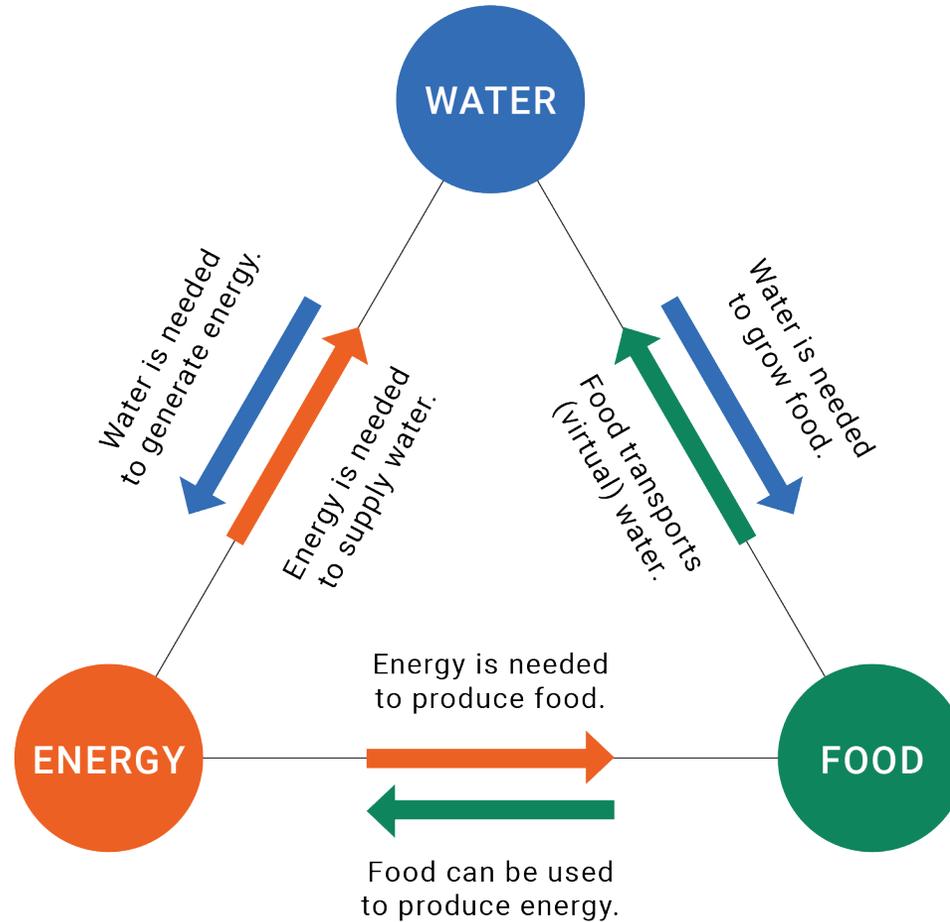
Value of Water



Source: Adapted from BCG analysis



Interdependency of water, energy & food





Interdependency of Water and Energy

		Input	Waste Stream	Intensity
Hydrocarbon Based	Coal	Cooling and Flue Gas Desulfurization	Cooling and Flue Gas Desulfurization Wastewater	High
	Oil & Gas (Upstream)	Enhanced Oil Recovery Frac Water Drilling	Produced Water	High
	Oil & Gas (Downstream)	Process Water	Industrial Wastewater	Medium
	Liquified Natural Gas	Cooling	Cooling Wastewater	Medium
	Renewable Natural Gas	High Organic WW Source	Digestate	Fundamental
Non-Hydrocarbon Based	Nuclear	Cooling Reactor Tubes	Cooling Wastewater	High
	Hydrogen	Feed for Electrolyzers	RO Brine	Fundamental
	Geothermal/Enhanced Geothermal	Injection, Cooling, Drilling, Stimulation, Pressure maintenance	Geothermal Wastewater	Fundamental
	Solar Manufacturing	Washing	Industrial Wastewater	Medium
	Critical Minerals Mining	Mineral Rich Brine	Waste brine	Fundamental
	Hydroelectric	Water as Potential Energy	NA	Fundamental
	CCUS	Cooling	Cooling Wastewater	Medium

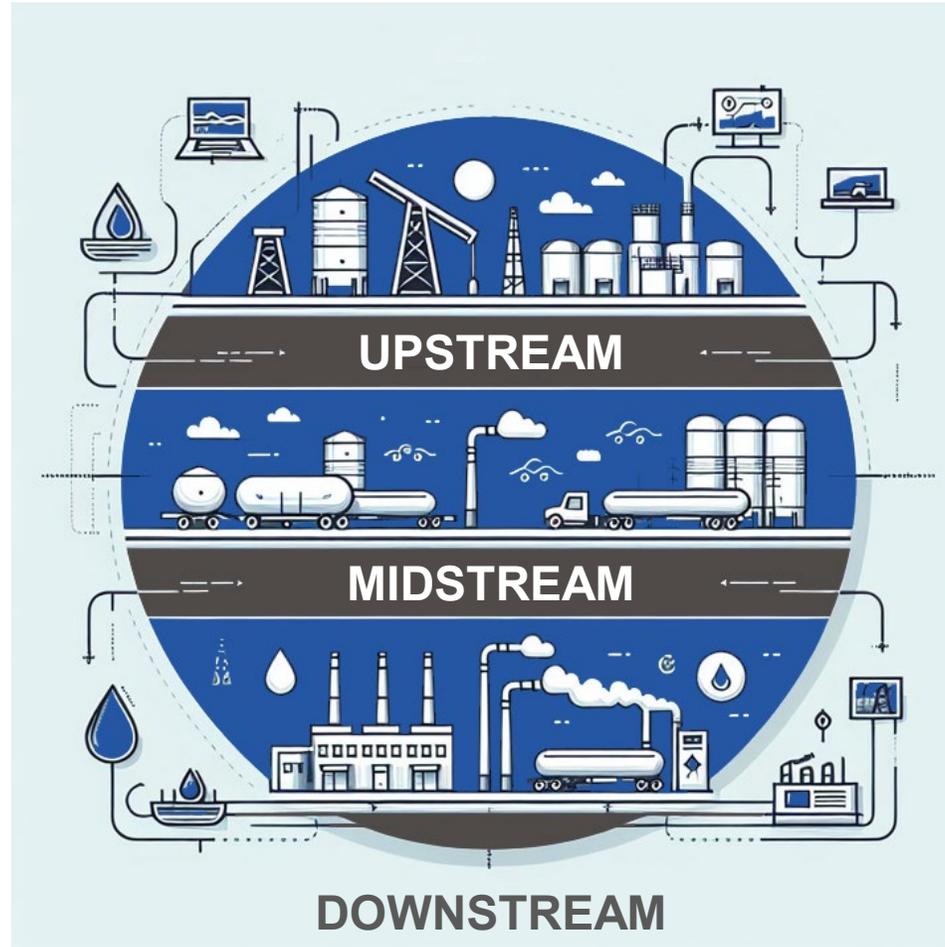


Examples/Case Studies



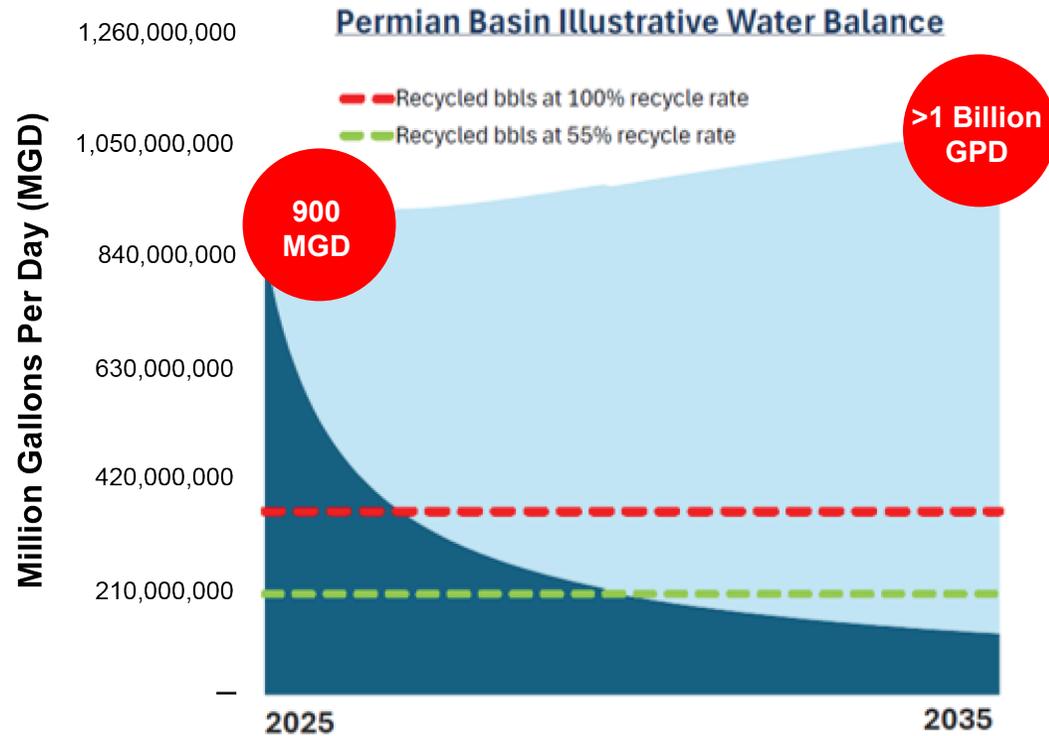


Oil & Gas Industry



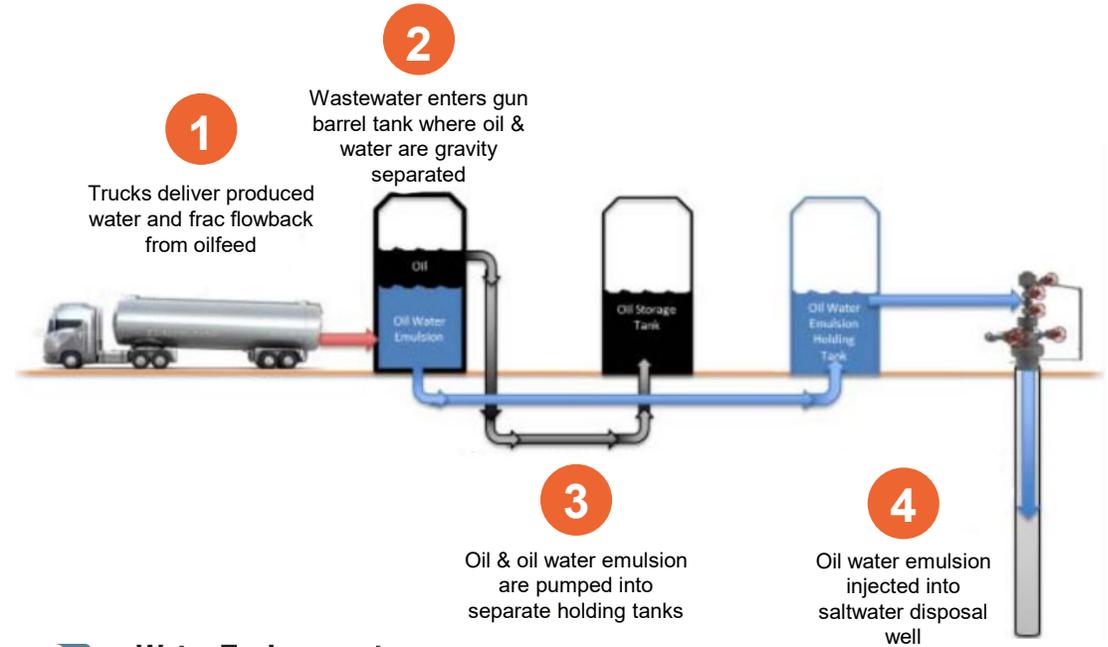


Produced Water in the Permian Basin



Adapted from Source: Water Management: Relentless Progress and Evolution
Scott Mitchell, CEO of Deep Blue

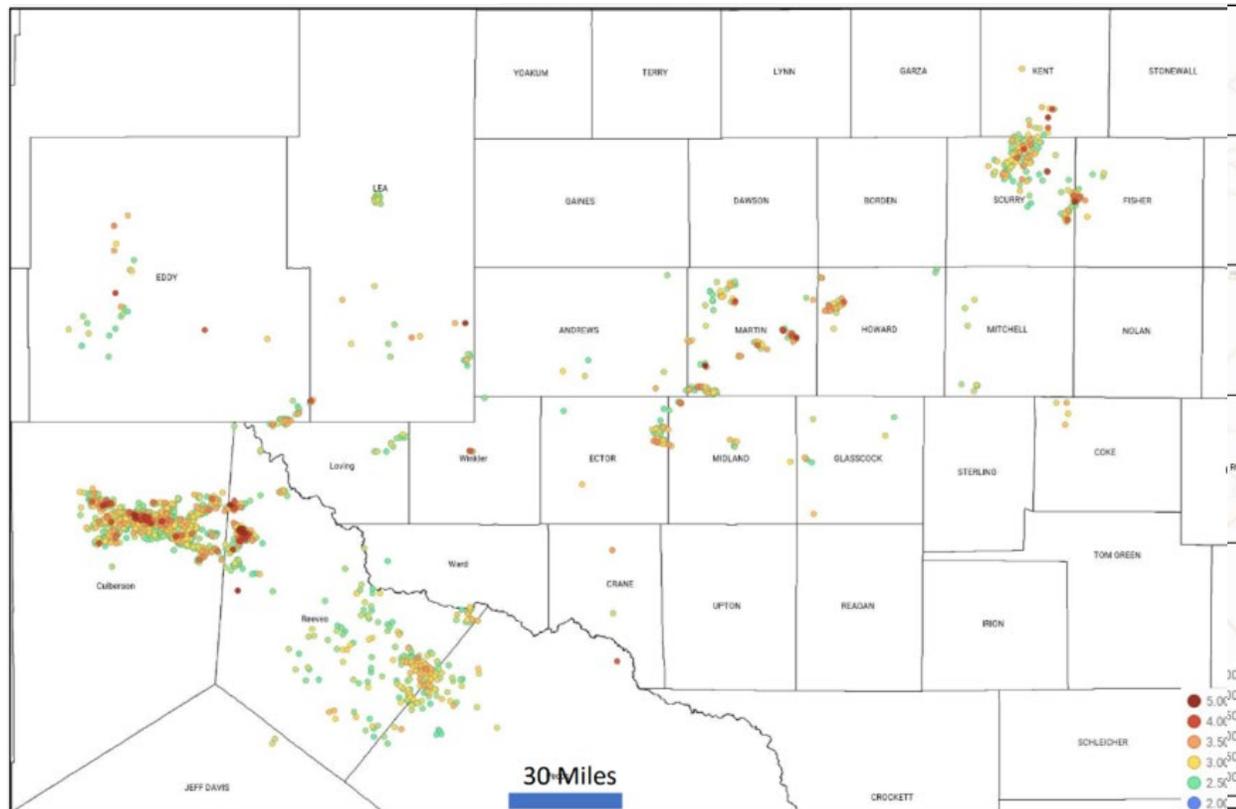
Unconventional PW Disposal Most water is disposed of in SWDs





Challenges: Induced Seismicity

USGS M3+ 2016-Current





Challenges: Reservoir Capacity



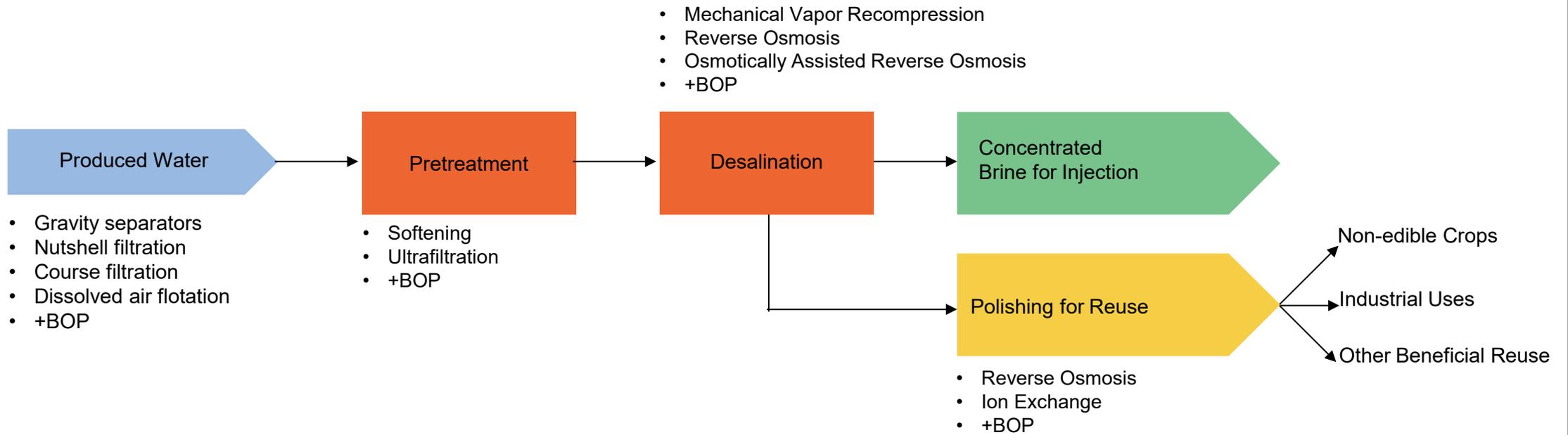
Sources: ESRI; Google; Railroad Commission of Texas



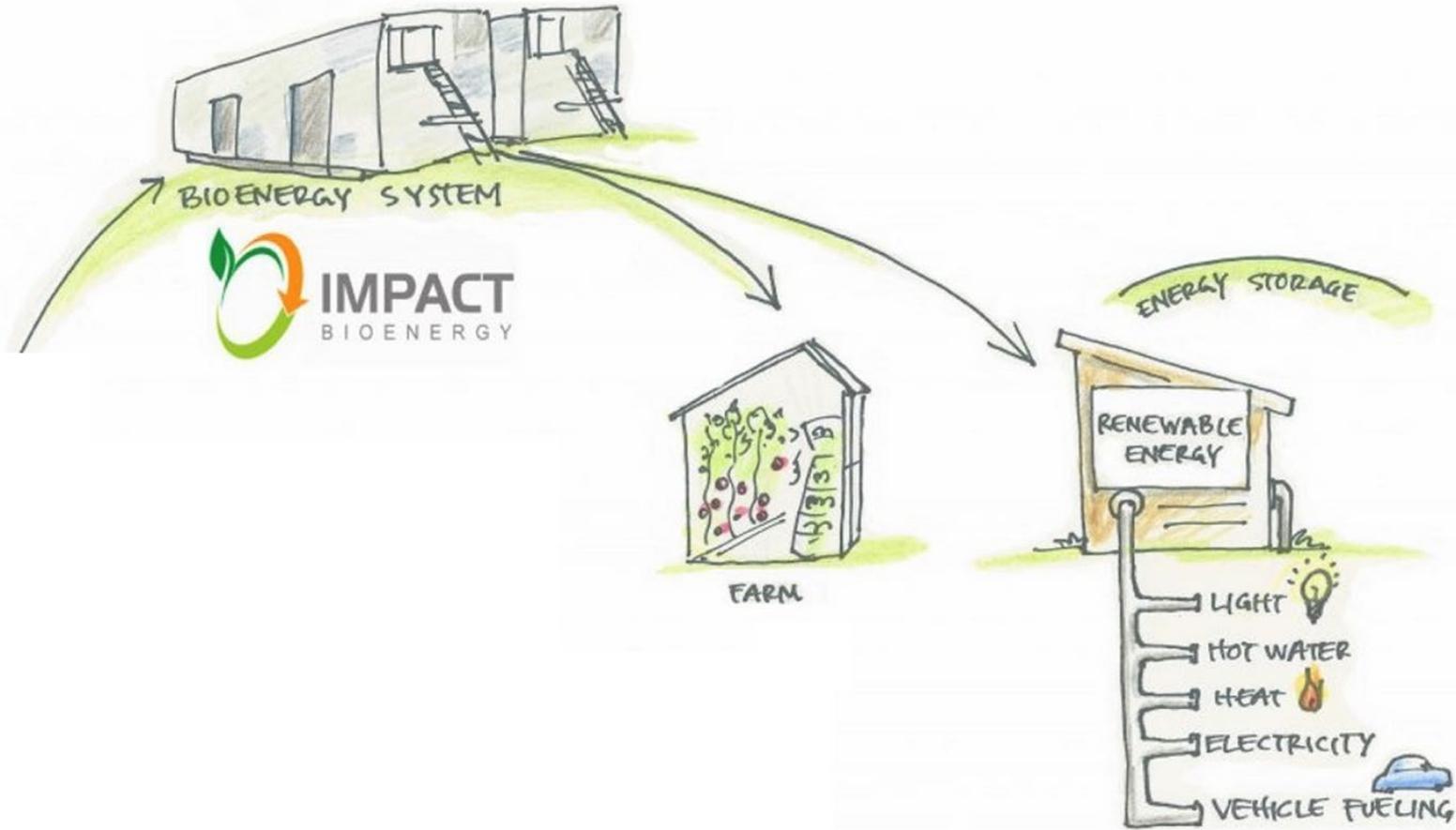
Source: <https://www.texasmonthly.com/news-politics/west-texas-geyser-oil-well-chevron/>



High Level Example Block Flow Diagram



Anaerobic Digestion for RNG Production





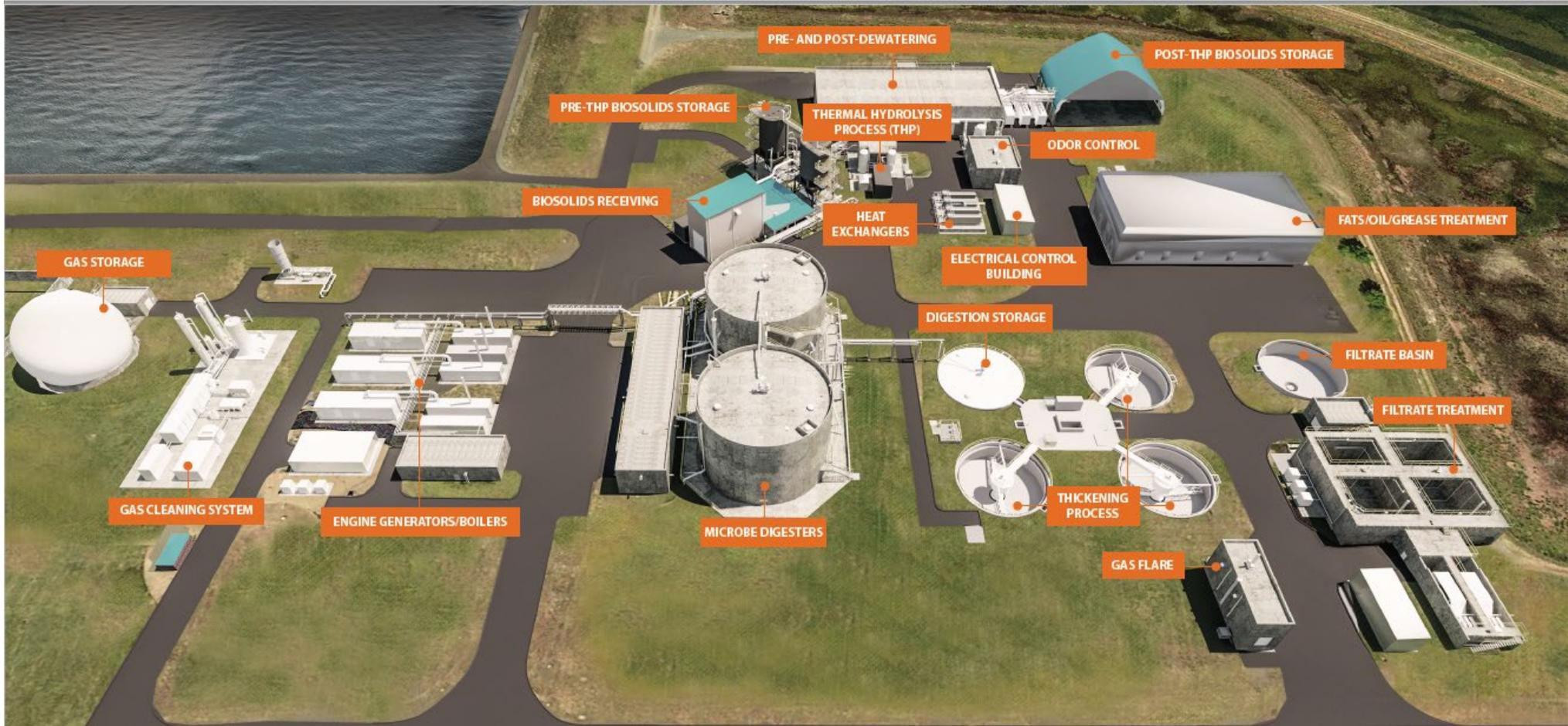
Piscataway WRRF Bioenergy Project

- Most technically advanced project the Washington Suburban Sanitary Commission (WSSC) has constructed in its 100-year history.
- 120 MGD facility from five of WSSC's facilities
- Constructed March 2024
- Makes biogas and Class A biosolids
- The biosolids used as a soil additive for the surrounding communities.
- Biogas for internal use to cleaned to run three 1.5 MW engine generators to provide standby power.
- Rejected heat will raise steam for the THP in co-fired boilers
- Addition gas treated to pipeline quality and injected into the Washington Gas pipeline.

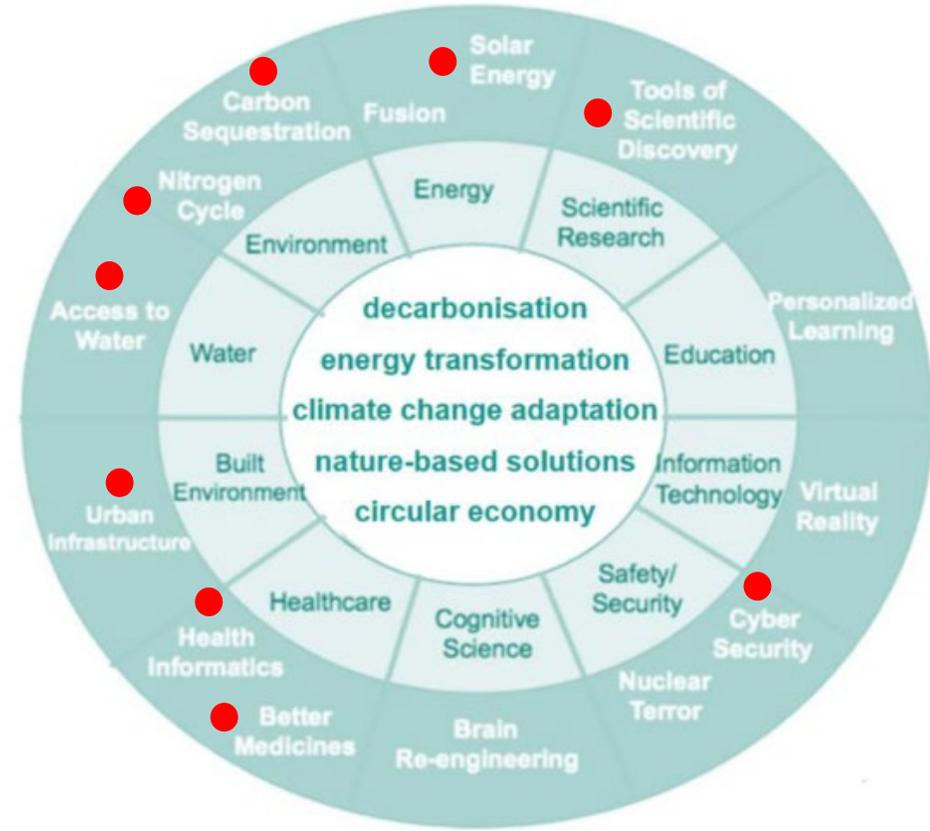
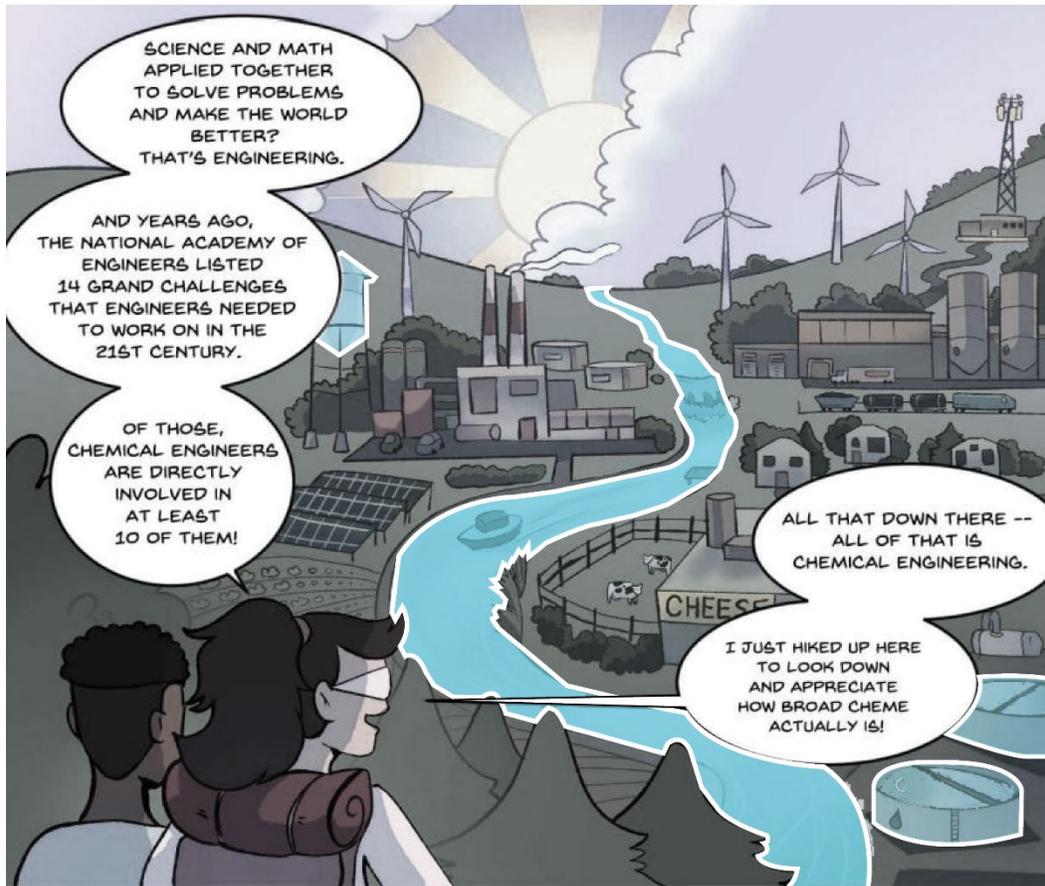




Piscataway WRRF Bioenergy Project



Role of Chemical Engineers





Thank you

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