Water and Energy in the Intermountain West
Considerations and Opportunities While Transitioning to Carbon Neutrality

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18 May 2022

LA-UR-22-24656
The global approach to energy is shifting, with a target of eliminating the net emissions of carbon dioxide within decades.

Rapid Transition Will Be Challenging
- Energy systems evolved gradually over a century → Change may occur over decades
- Communities established their workforce and revenues as energy systems evolved → How can we avoid disruption to communities?

Energy (Transition) & Water Are Linked
- Water is needed in energy production → e.g., cooling water for many processes; feedstock for green hydrogen production; etc.
- Energy is needed in water processing → e.g., purification technologies for nontraditional water sources

How can we transition our approach to energy rapidly AND equitably within regions across the country?
The I–WEST initiative is looking at equitable transition strategies for getting to carbon neutral

Objectives
• Develop a stakeholder-based roadmap to achieve carbon neutrality
• Build regional coalitions to deploy the roadmap

Place-based Approach
• Prioritize regional attributes and societal readiness first, and technologies second
• Explicitly consider non-technological aspects of region—policy landscape, revenue and jobs, workforce, equity, energy & environmental justice

Multiple Technologies and Multiple (Symbiotic) Economies
• Carbon capture, utilization, and storage; clean hydrogen; bioenergy; and low-carbon electricity

Visit iwest.org for more detail and archived material from workshops or email iwest@lanl.gov
Why these six states?

- Existing fossil economy
- Shared characteristics
  - Water challenged
  - Evolving climate & impacts
  - Sovereign Nations and other rural communities
  - High solar, wind, geothermal
  - Energy export—electricity, natural gas
Key Message 1

Water Resources

Water for people and nature in the Southwest has declined during droughts, due in part to human-caused climate change. Intensifying droughts and occasional large floods, combined with critical water demands from a growing population, deteriorating infrastructure, and groundwater depletion, suggest the need for flexible water management techniques that address changing risks over time, balancing declining supplies with greater demands.

from: https://nca2018.globalchange.gov/
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Why emphasize symbiotic economies?

- The future of regional economies is a common concern across the region—despite variation in perspectives on climate
- Multiple solutions (economies) will be needed and they must deploy simultaneously
- Symbiotic economies can accelerate deployment
Achieving carbon neutrality in the I-WEST region means reducing emissions by ~385 million metric tons per year.
Multiple options will be needed to reduce emissions in the region, and each of these “wedges” has implications tied to water.

I-WEST is assessing each of these pathways (wedges):
How big could the wedge be? What are the impacts of each (including water use)?
Water Usage in the Intermountain West
(based on data from waterdata.usgs.gov)
(electricity data from eia.doe.gov)

Water use is dominated by agriculture
• 45M acre-feet per year total
• 80% from surface water

Public water supply is 2nd highest usage
• 3.6M acre-feet per year
• 57% from surface water

Thermoelectric power generation currently uses a small fraction
• 0.4M acre-feet per year (~400k AF/yr)
• 72% from surface water
• Accounts for ~87% of the 300 GW-hrs produced in region; region exports ~24%
Converting all vehicles to hydrogen

- Producing enough hydrogen via steam-methane reforming to fuel all cars/pickups/trucks in region would require ~300k acre-feet/yr\(^{‡}\)

- Producing enough hydrogen via electrolysis\(^{†}\) to fuel all cars/pickups/trucks in region would require ~45k acre-feet/yr

Capturing all point sources of CO\(_2\)

- Capturing all large point sources of CO\(_2\) in region would require ~200k acre-feet/yr based on water-cooled amine technology\(^{‡}\)

- Using air cooling could reduce required water by ~90%\(^{‡}\) (e.g., to ~20k acre-feet/yr)

Storing all captured point-source CO\(_2\) in reservoirs

- Co-producing brine while injecting CO\(_2\) (to manage pressure) could be a nontraditional water source; e.g., storing 200Mt CO\(_2\)/yr could result in ~185k acre-feet/yr water\(^{§}\)

\(^{‡}\) Calculated as the sum of net water required by SMR, natural gas extraction and carbon capture process.

\(^{†}\) Calculated as the sum of net water needed as feedstock and minimal amount needed for solar.

\(^{§}\) Veil (2020) reported 411k acre-feet of produced water from oil/gas operations in the I-WEST region.

Water is an issue throughout the region, but there are opportunities to utilize “produced” water—oil/gas & CO$_2$.

**Different water needs for each generation pathway**

- **Electrolysis**—all of the hydrogen (H$_2$) comes from water
- **Steam methane reforming**—half the hydrogen from water, half from methane; but SMR is a thermal process and requires water for cooling

**Could brine be used for some/all of the water in hydrogen production—e.g., after desalination**

- Produced water from regional oil/gas operations (~411k acre-feet/yr in region)
- Brine co-produced during CO$_2$ injection (potential for ~200k acre-feet/yr in region)
I-WEST is interested in dialog on energy transition and water in order to inform the roadmap

Upcoming Workshop
- Presentations to frame the topic followed by roundtable Q&A with participants and panelists

Recent Seminar
- Mike Hightower—“Emerging Energy Trends and Water Use Innovation in the West”. Video recording can be accessed on Events tab at iwest.org

Listening/Learning Session
- I-WEST team is interested in hearing regional perspectives—schedule a session at iwest.org

General Inquiries & Comments
- Email team at iwest@lanl.gov