Thirsty for Data Water Use and the Projected Data Center Boom in Texas

Erin Kinney, Senior Research Scientist, Houston Area Advanced Research Center

Thirsty Data: Water Use and the Projected Data Center Boom in Texas

Erin Kinney, PhD and Margaret Cook, PhD

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HARC

Data Centers

Physical facilities that house computing infrastructure, including servers, storage devices, and computational and networking equipment, to store and manage digital operations and data. A data center's' energy and water needs can be substantial. A large hyperscale data center can consume the same energy as about 80,000 U.S. households.

Data centers house computing infrastructure

Houston Advanced Research Center

HARC applies science to drive energy, air, water, and resilience solutions for a sustainable and equitable future.

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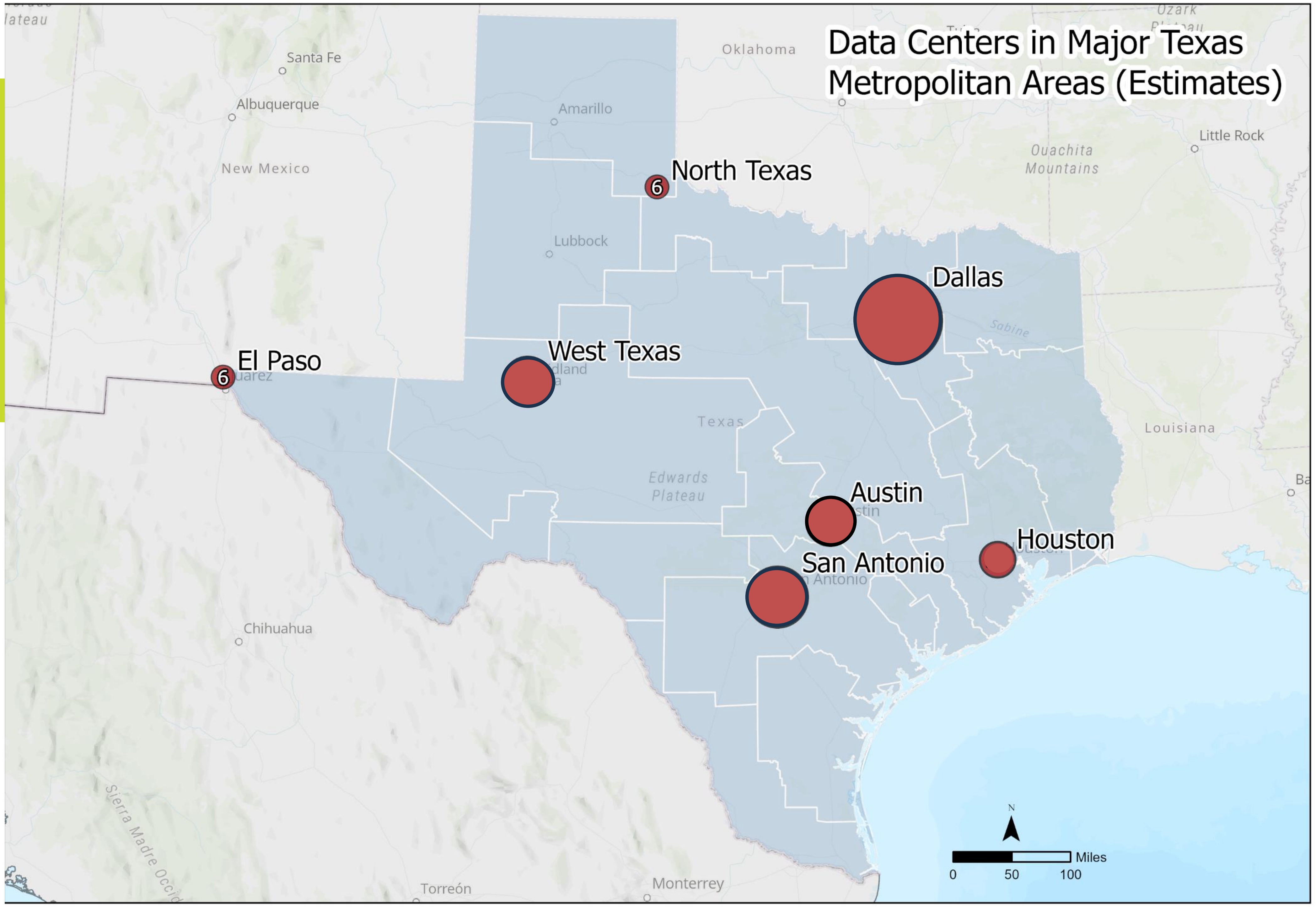

Information on data centers obtained from the Baxtel website. The North Texas location represents an approximate grouping of data centers near Wichita Falls, Pampa, & Dumas. The West Texas location represents an approximate group of data centers between Amarillo, Pecos, Abilene, & Fort Stockton.

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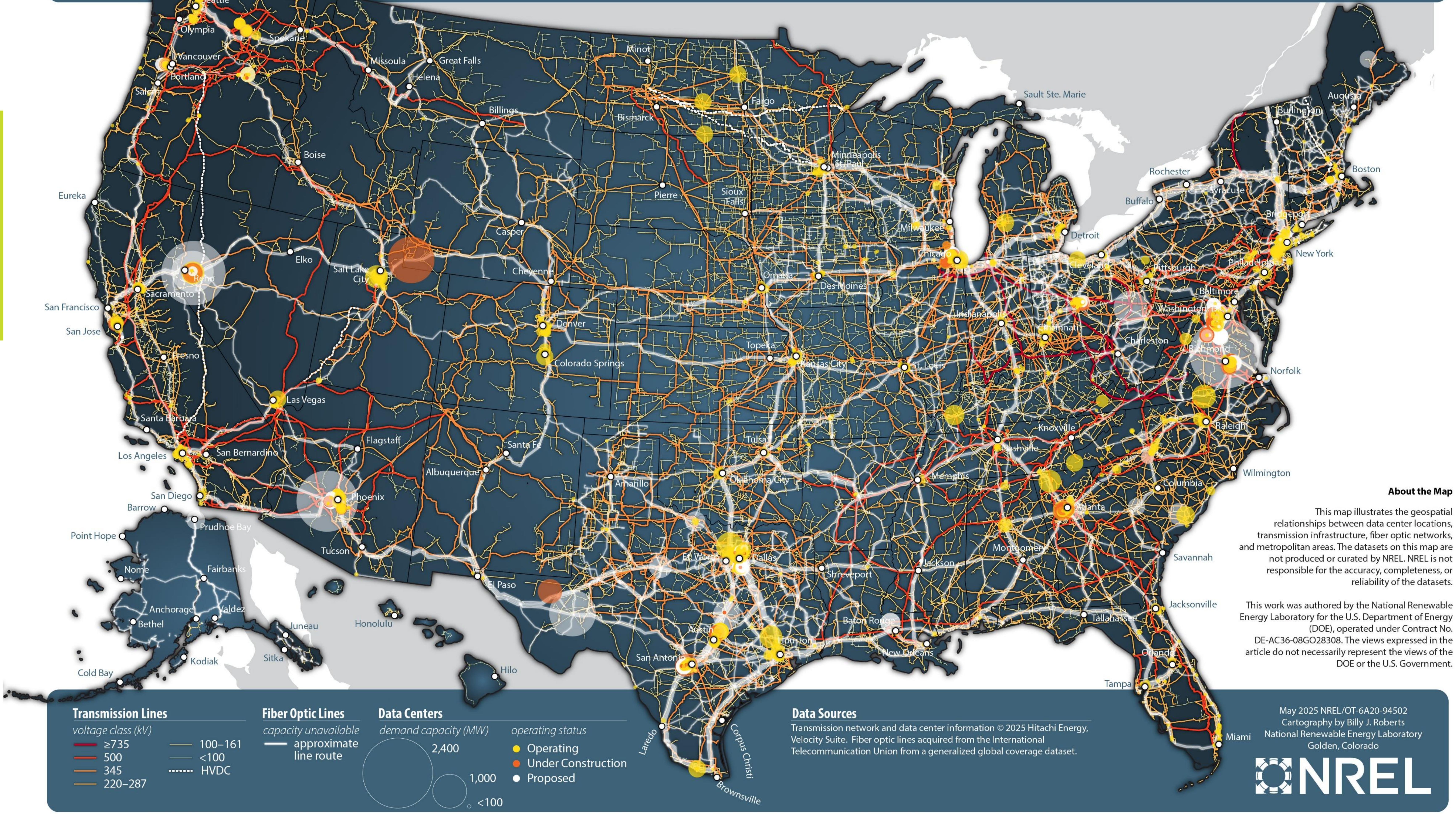
Texas Data Centers

As of 2025, Texas had 464 facilities (according to Baxtel):

- 197 in Dallas Fort Worth (3rd largest market in US)
- 48 in Houston (12th largest market)
- 60 in San Antonio
- 53 in Austin
- 59 in West Texas
- 74 more sites under construction and more in planning and development

Data Center Infrastructure in the United States, 2025



About the Map

This map illustrates the geospatial relationships between data center locations, transmission infrastructure, fiber optic networks, and metropolitan areas. The datasets on this map are not produced or curated by NREL. NREL is not responsible for the accuracy, completeness, or reliability of the datasets.

This work was authored by the National Renewable Energy Laboratory for the U.S. Department of Energy (DOE), operated under Contract No. DE-AC36-08GO28308. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government.

Data Sources

Transmission network and data center information © 2025 Hitachi Energy, Velocity Suite. Fiber optic lines acquired from the International Telecommunication Union from a generalized global coverage dataset.

May 2025 NREL/OT-6A20-94502
Cartography by Billy J. Roberts
National Renewable Energy Laboratory
Golden, Colorado

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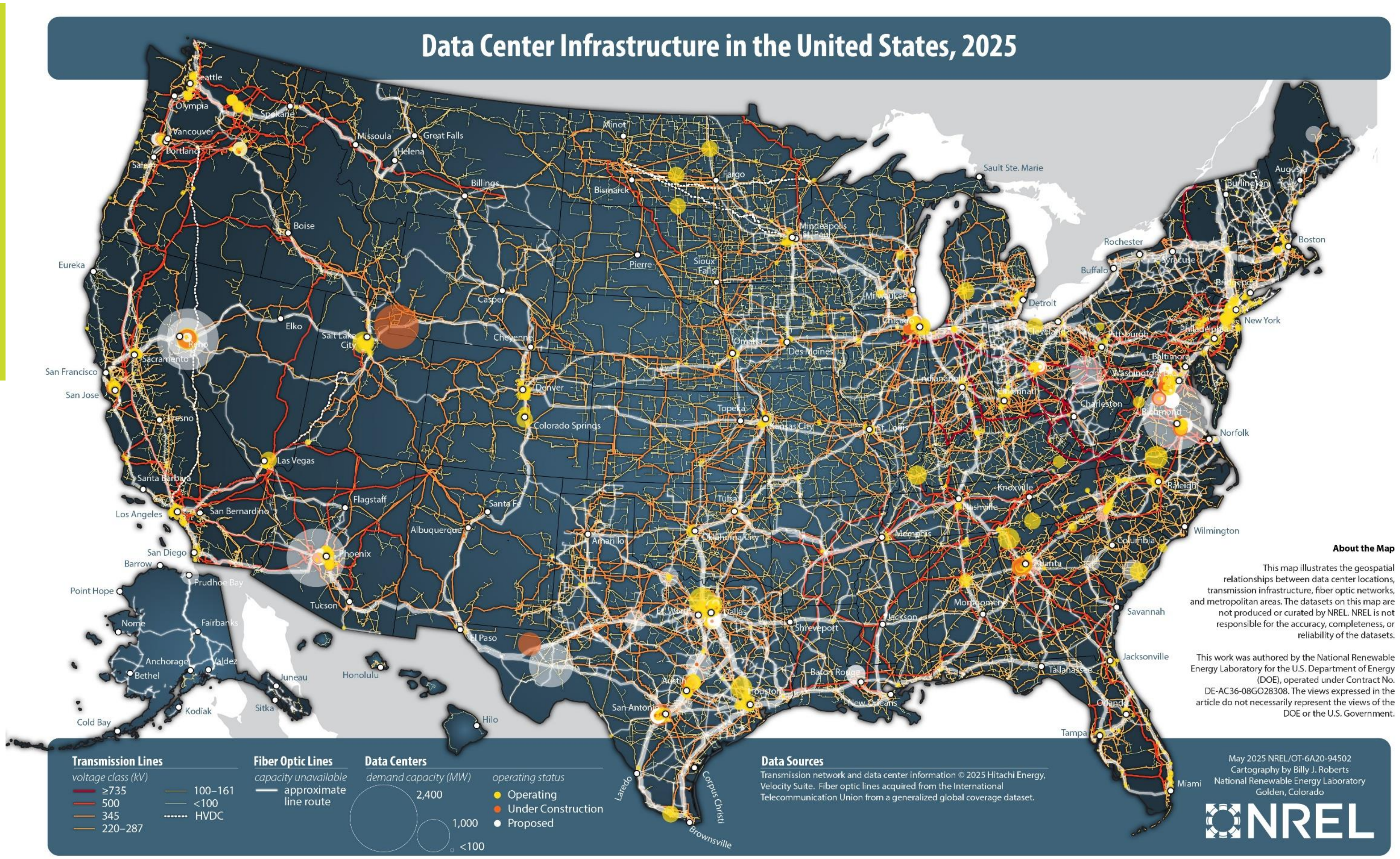
Siting Decisions



- Land lease
- Power price
- Adjacent to fiber
- Floodplain and other building considerations
- Ability to source water (if needed)
- Proximity to labor force
- Distance from residential and other permitting considerations

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Data Center Energy Demands

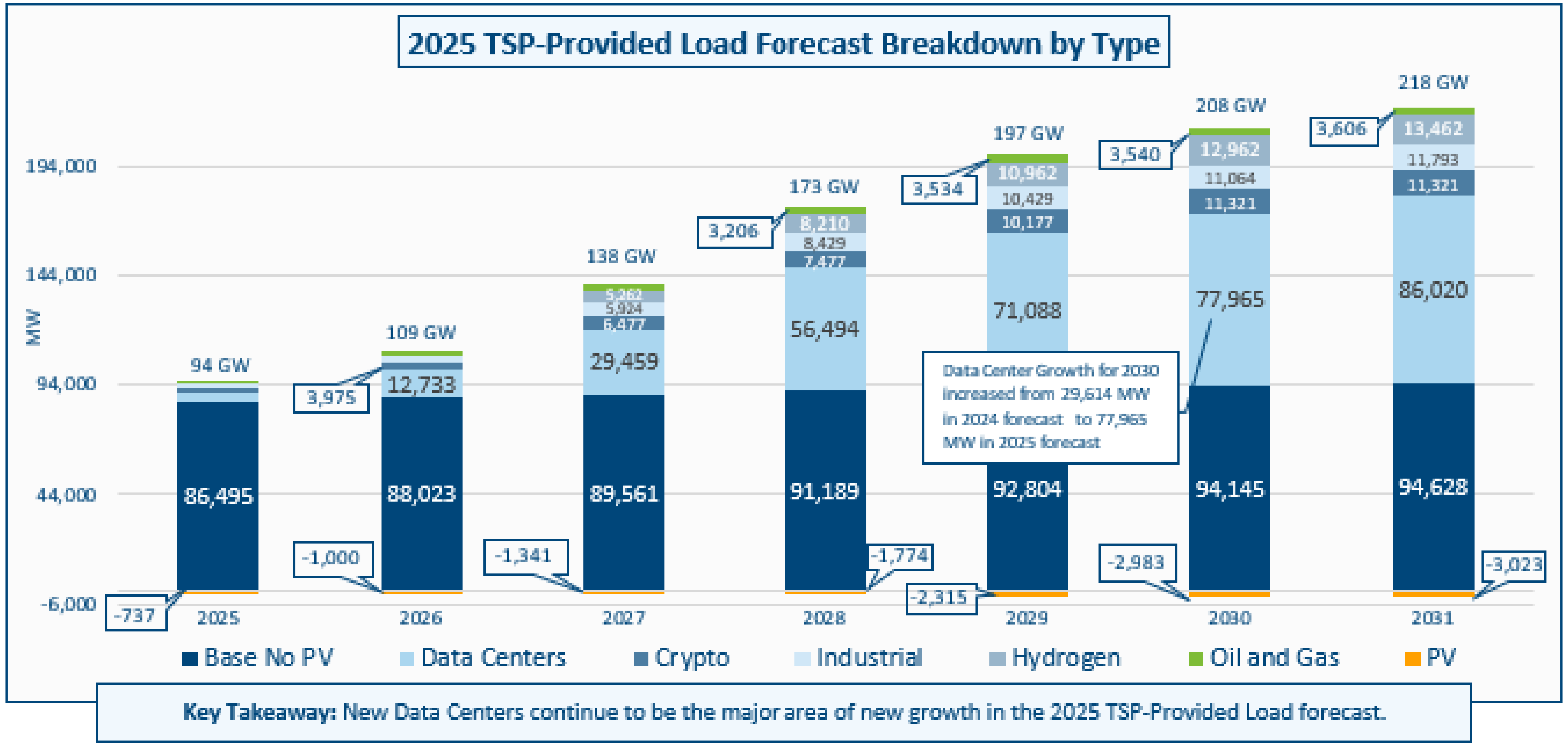

Figure 1 Long-term Load Forecast for 2025-2031 provided by ERCOT on April 7, 2025 shows data centers contributing to major electricity sector demand growth.[13]

*PV is "behind the meter" rooftop photovoltaic solar—solar providing power to a home or business rather than to the grid

By 2030, ERCOT expects DC growth to increase ~10 fold

If running at full-steam, data center demand would occupy 75% of total currently available electric generation capacity (2025)

Data Centers historically have high water needs for cooling

- Direct at the data center
- Indirect at power plants

Estimated Water Demands

- **Est. water demand**: average ~**95 gals/MWh** [LBNL 2024]
- **Direct water use:** evaporation through a chiller or cooling tower – new withdrawals occur to replace vaporized water with freshwater, recirculates
- **Wastewater:** largely blowdown - water removed from cooling supply to prevent excessive concentration of dissolved solids (it gets too briny)
- **Indirect water use:** at power plants for cooling
- **Individually:** water demand may not be large
    - **Collectively:** Rapid growth rate, large localized presence and impacts

Factors Influencing Water Use

Amount of water use depends on

- Cooling type used (right)
- The size of the data center,
- The type of data center (hyperscaler, crypto, etc.),
- The computing equipment needing cooling
- How many times the water is cycled and any wastewater produced

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Cold Plate Cooling

Cooling hottest components in non-immersed loop

Dry Cooling

Heat transferred through cool air. Higher energy demand. Not possible for all data center types.

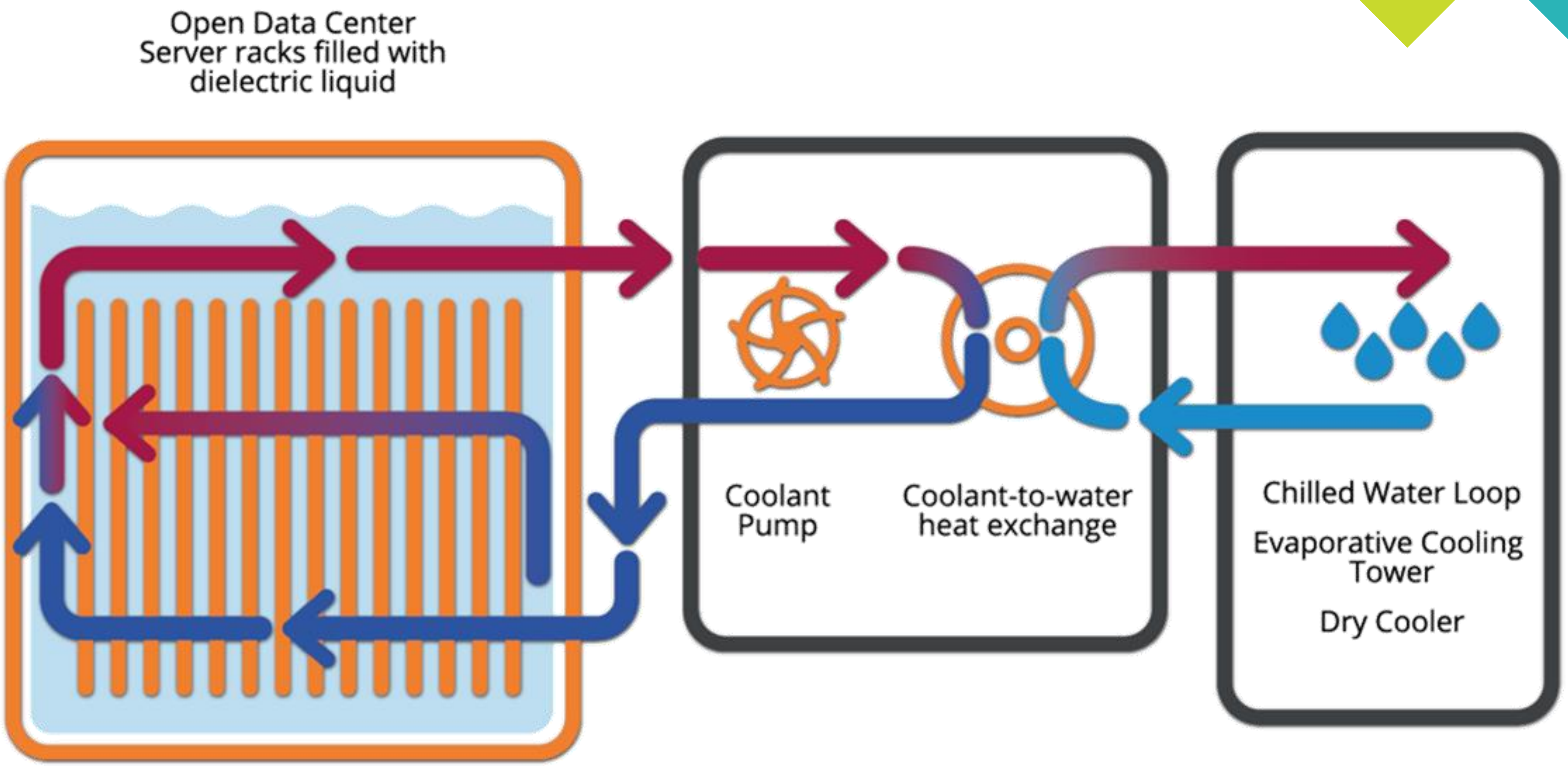
One-Phase Cooling

Servers immersed in oil-based liquid. Heat exchanged to liquid then water. Hot water sent to cooling tower (evaporates).

Two-Phase Cooling

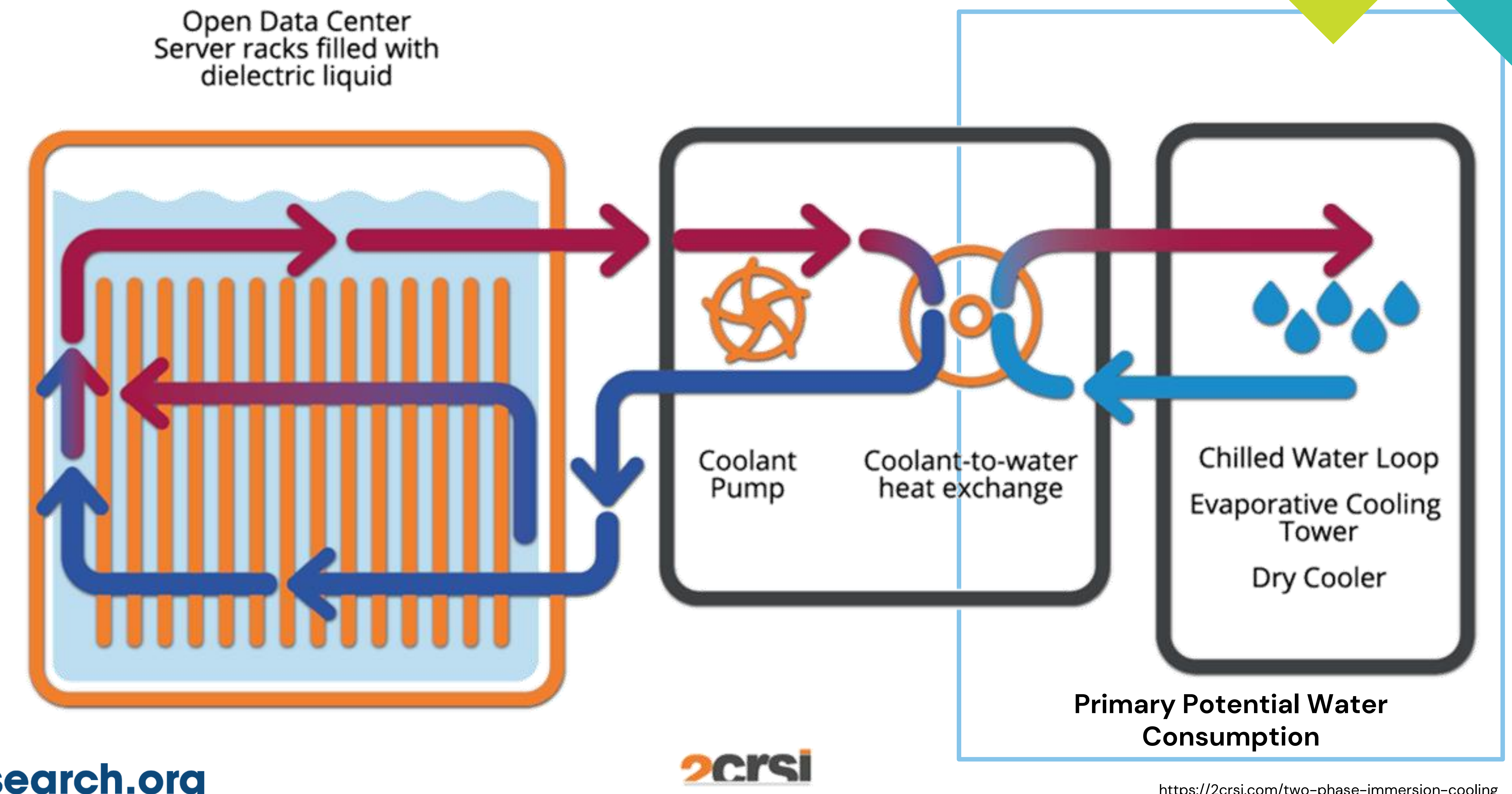
Servers immersed in chemical liquid. Heat causes liquid phase change. Heat exchanged with water.

One-Phase Immersion Cooling



https://2crsi.com/two-phase-immersion-cooling

One-Phase Immersion Cooling



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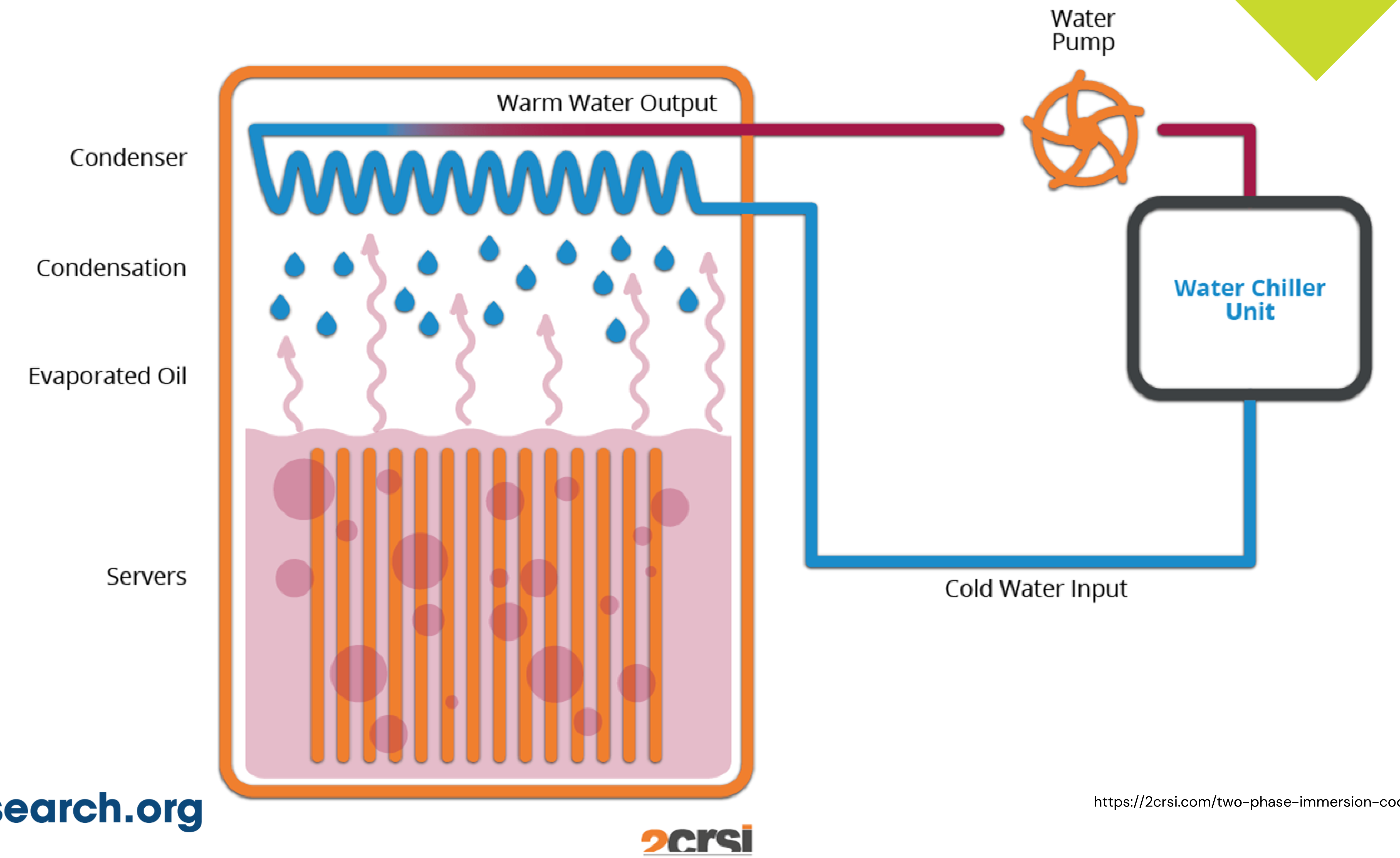
Two-Phase Immersion Cooling



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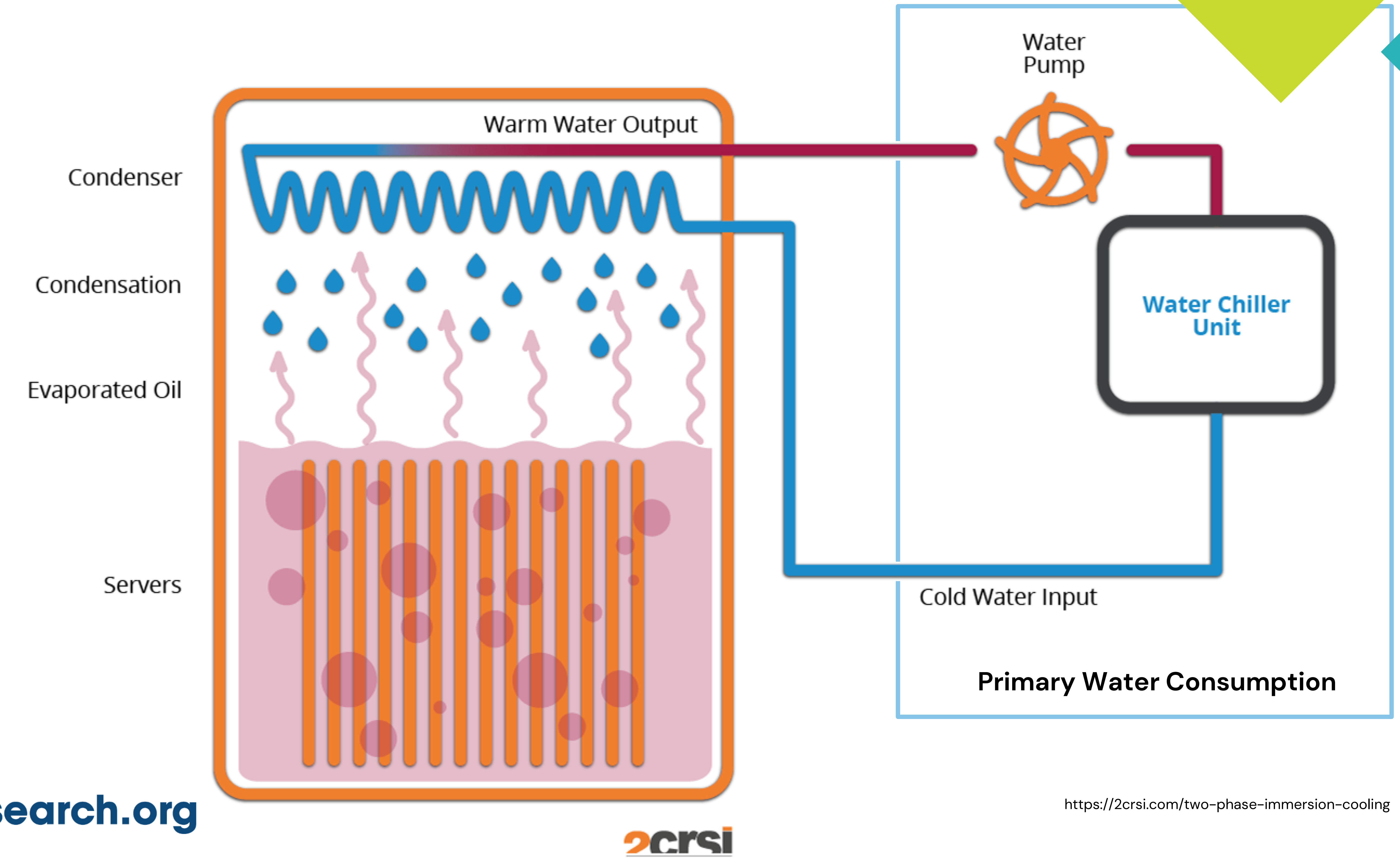

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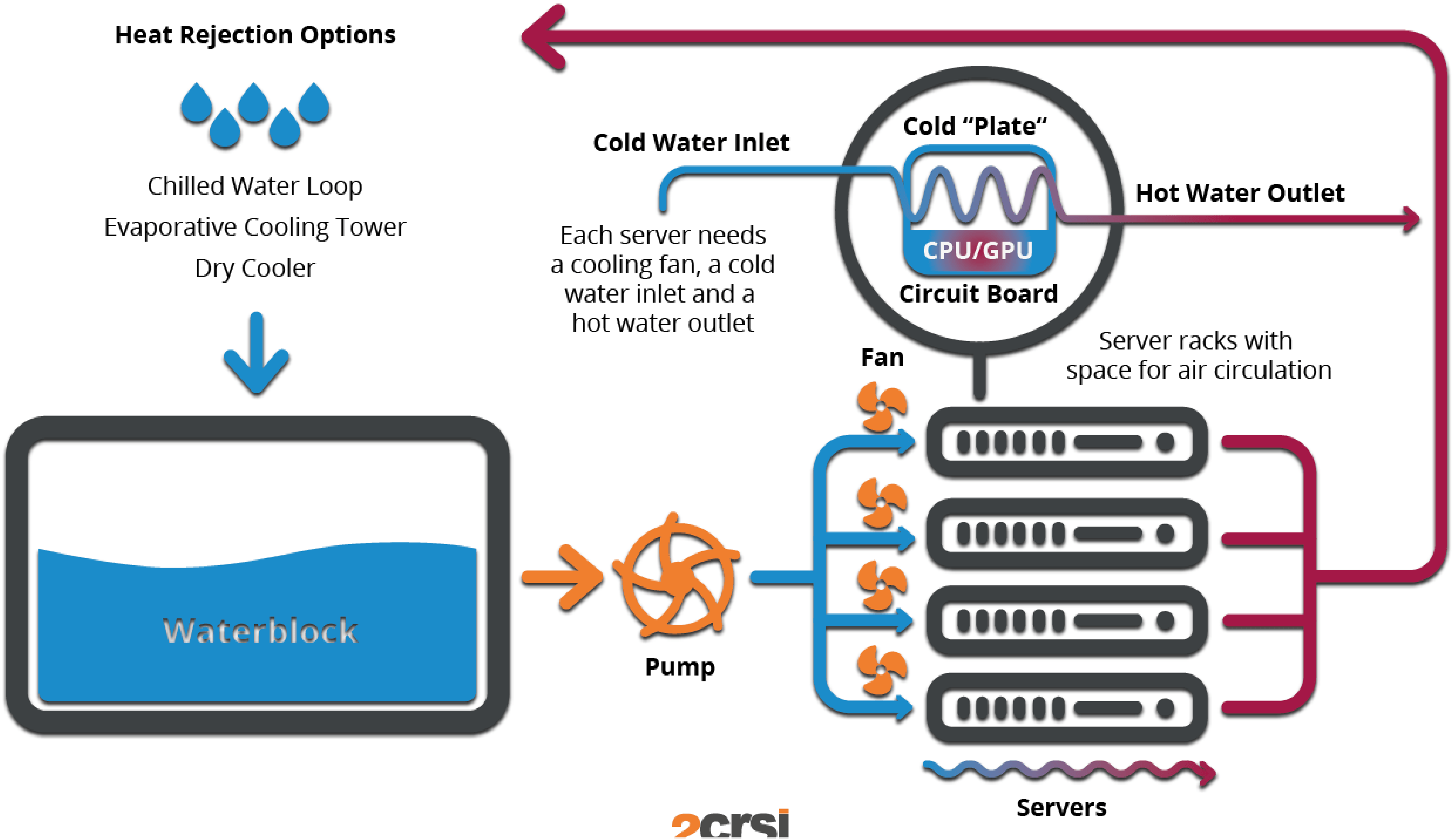
Direct / Cold Plate Cooling



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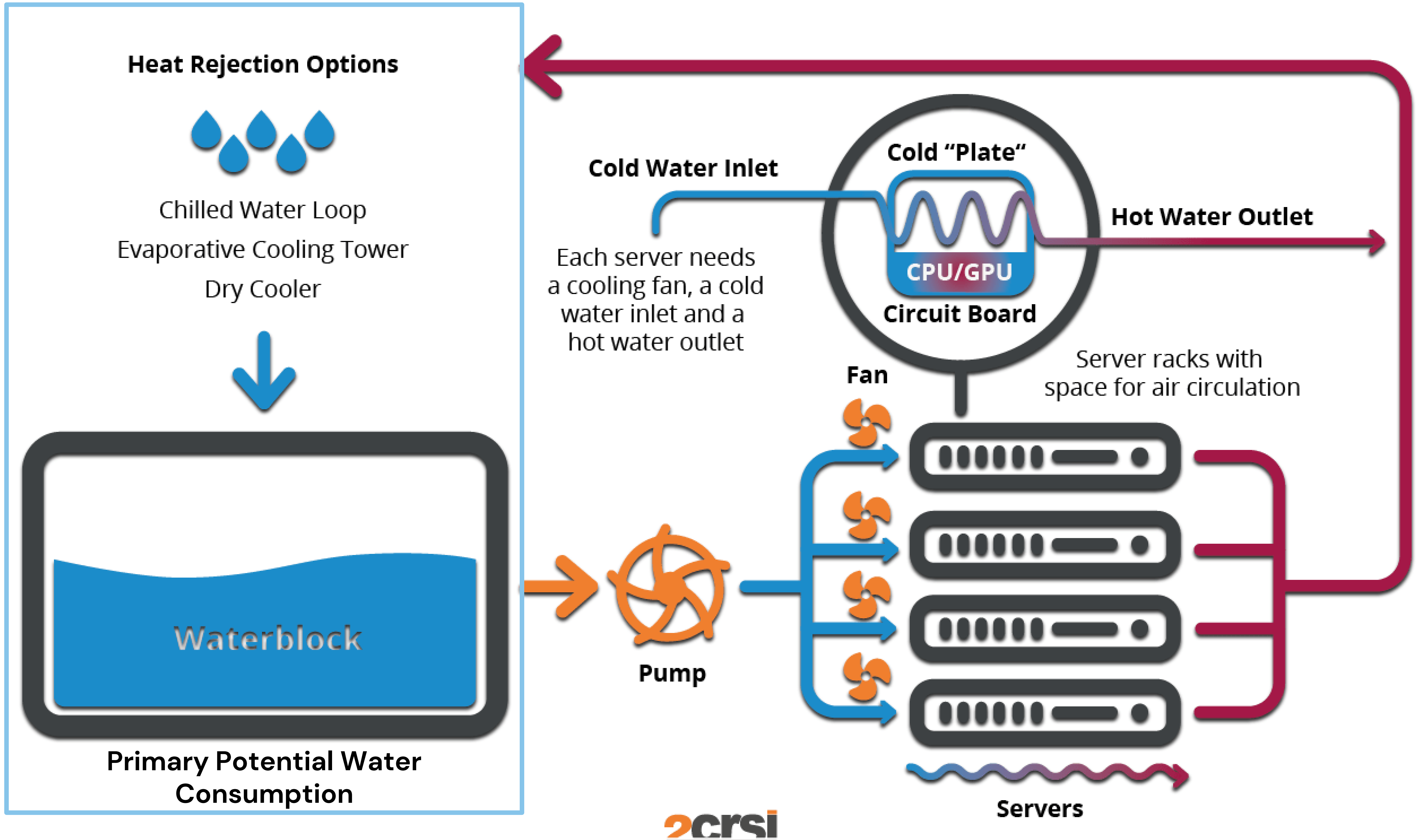
https://2crsi.com/direct-liquid-cooling

Direct / Cold Plate Cooling



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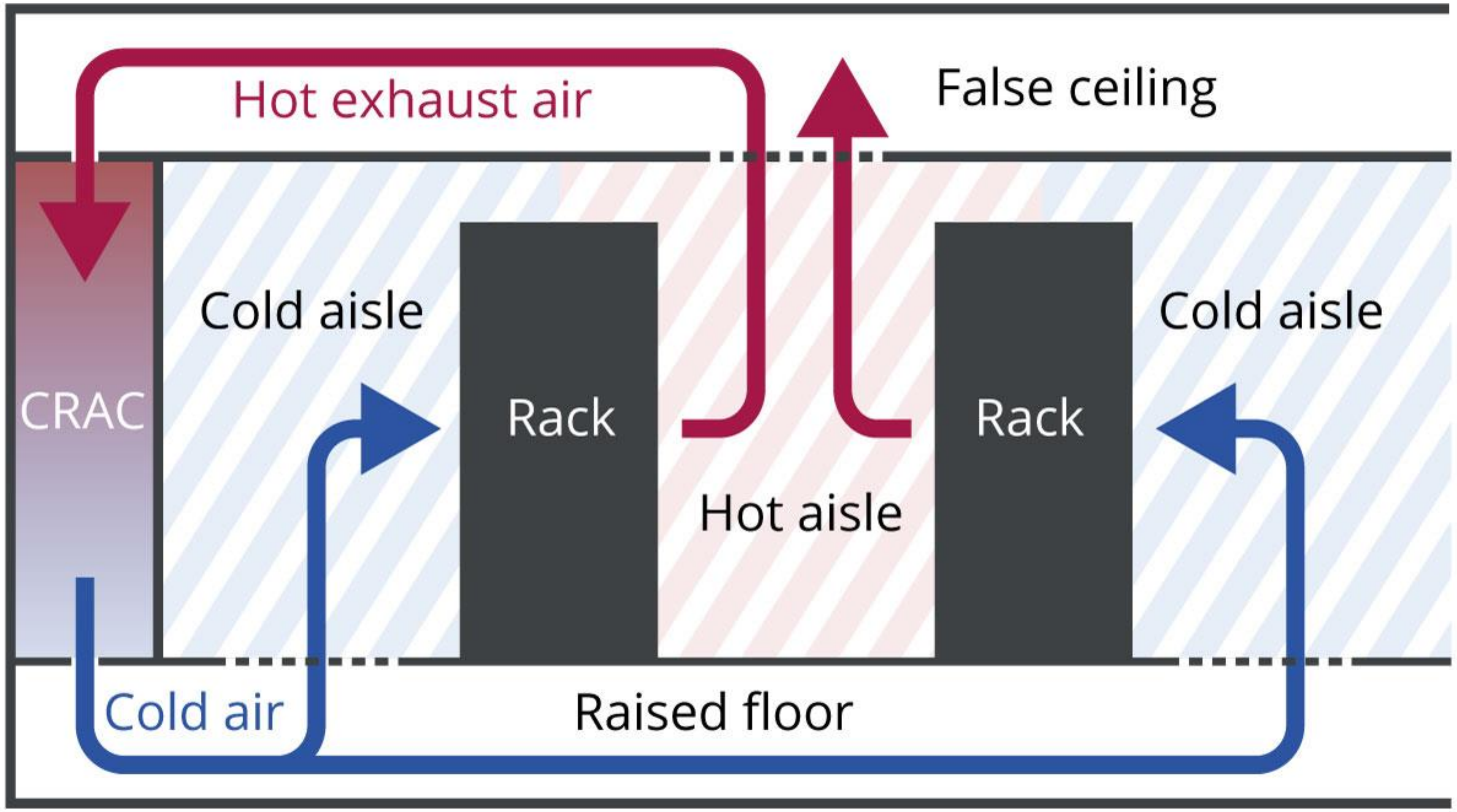
Air Cooling / Dry Cooling



https://2crsi.com/air-cooling

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Estimated Water Demands

- 2025 estimated total consumption
  - 34 Bgal water/year for cooling (direct) and 15 Bgal at power plants (indirect)
  - 0.8% of 2020 estimated annual water demand (2022 State Water Plan)

- By 2030
  - Up to 78 GW power consumption – some grid, some onsite
  - Data centers could account for 29-161 Bgal (98-494 kAF) by 2030 or 0.5-2.7% of 2030 estimated annual water demand (2022 SWP)
    - *Localized demands, large local impacts*

OpenAI Stargate facility in Abilene, TX (Data Center Dynamics)

Case Study on Stargate, Abilene, TX

- 1.2 GW hyperscaler w/ natural gas turbines
- Cooling: Closed-loop direct-to-chip (DTC) liquid cooling system recirculates water internally with ***water-cooled chillers*** to get rid of heat
  - Water-cooled chillers: 4.9-7.6 Bgal/year
  - Hybrid water/air chillers: 0.6-1.3 Bgal/year

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Challenges of Estimating Water Demands of Data Centers

- Data uncertainty
  - Lack of transparency from data centers
  - Few published studies available
- Data center water *growth* is not in our current or upcoming state water plan
- Municipalities don't have the most up-to-date data to make informed choices
  - Borrowing against future water needs

Reducing Water Demands

- Technology or management changes (right)
- Leverage investment
- Public-private partnerships
- Possible policy drivers:
    - Incentives for water lean strategies
    - Water saving ordinances
    - Look to the energy sector re: large demands – fees and studies required
- One Water framing

Water-Lean Technology

Use water-lean energy technologies like solar, wind, and natural gas turbines; reduce water on-site

Dry Cooling

Use dry cooling at data centers and power plants (energy penalty – use w/ water-lean energy)

Alternative Water

Use alternative sources of water like municipal reuse & onsite grey water

Reduce Energy On-site

Energy-efficient operations and scheduling non-peak demand periods

Without **proactive planning** and an integrated policy framework for data centers, their unchecked expansion could **strain Texas' infrastructure** and jeopardize progress toward reliable, sustainable, and resilient energy and water systems

Next Steps

- Policy Recommendations from NWF & HARC (right)
- Talking about it!
- Support for Communities
  - Community collaboration
- Better transparency
  - Not just how DCs propose to reduce their water needs, but specifically how much water they will need

Policy Review

What state, county and local policies exist
What have other states enacted
What are barriers

Policy Recommendations

Include Water Demands in Water Planning
What has TX done for Energy Policy

State, County, Local Guidance

How can Counties and Municipalities change their policies or how they apply them

Community Support

Check lists and guidance documents
Questions to Ask

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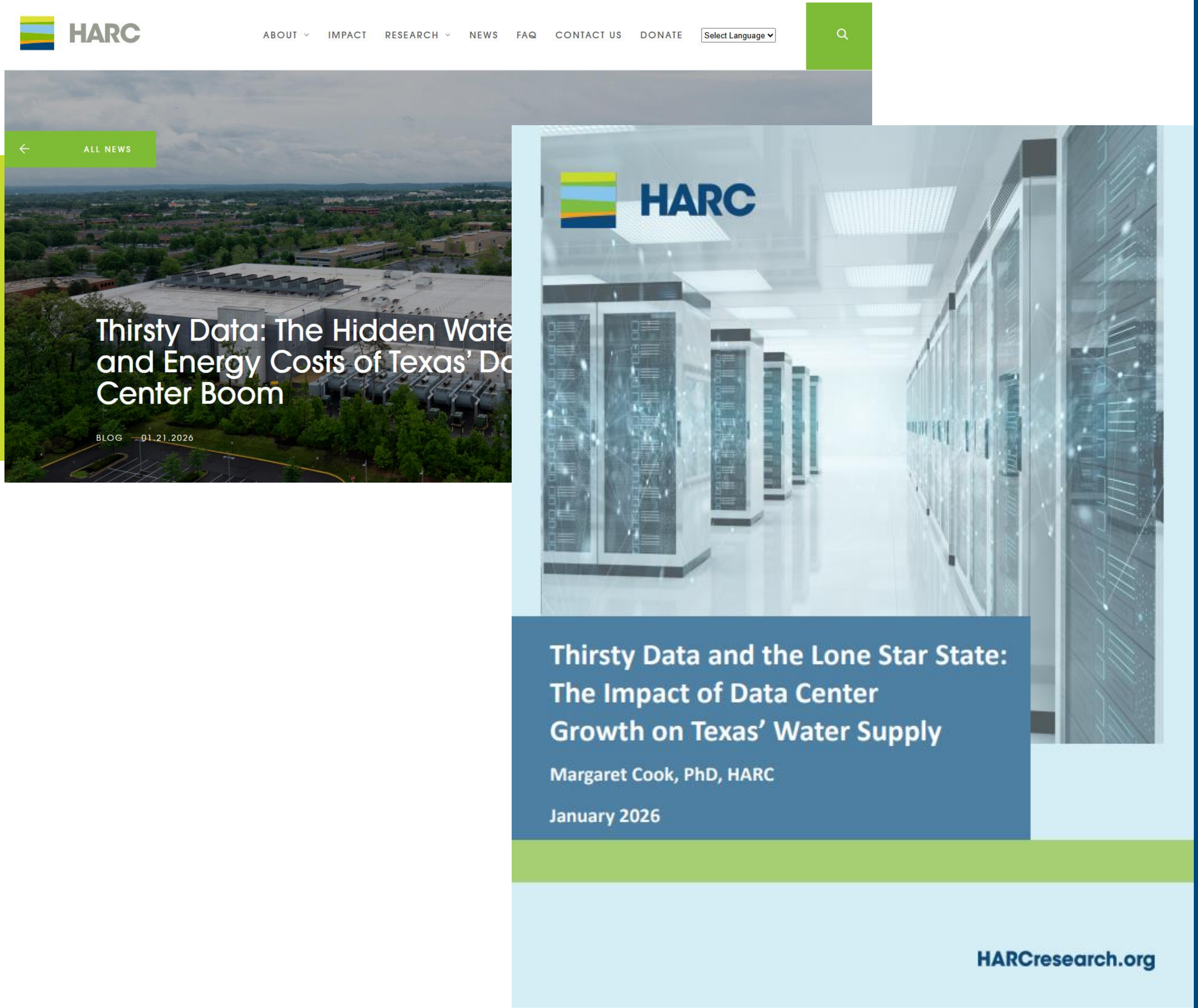

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- Thirsty Data White Paper
- Thirsty Data blog
- Powering Texas' Digital Economy: Data Centers and the Future of the Grid (UH & HARC)
- Energy Crossroads Podcast
- White paper on Data Centers and Air Quality (HARC)
- Upcoming Water Policy Brief (NWF & HARC)

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Ultimately, **better data will lead to better planning.**

Short term, **demands** and **impacts will be biggest locally.**

The best solutions will include **transparency**, **water-lean technology**, **wholistic approaches to management**, and **public-private partnerships.**

CONTACT US

For further information, contact HARC at (281) 364-6000 or visit www.HARCresearch.org.

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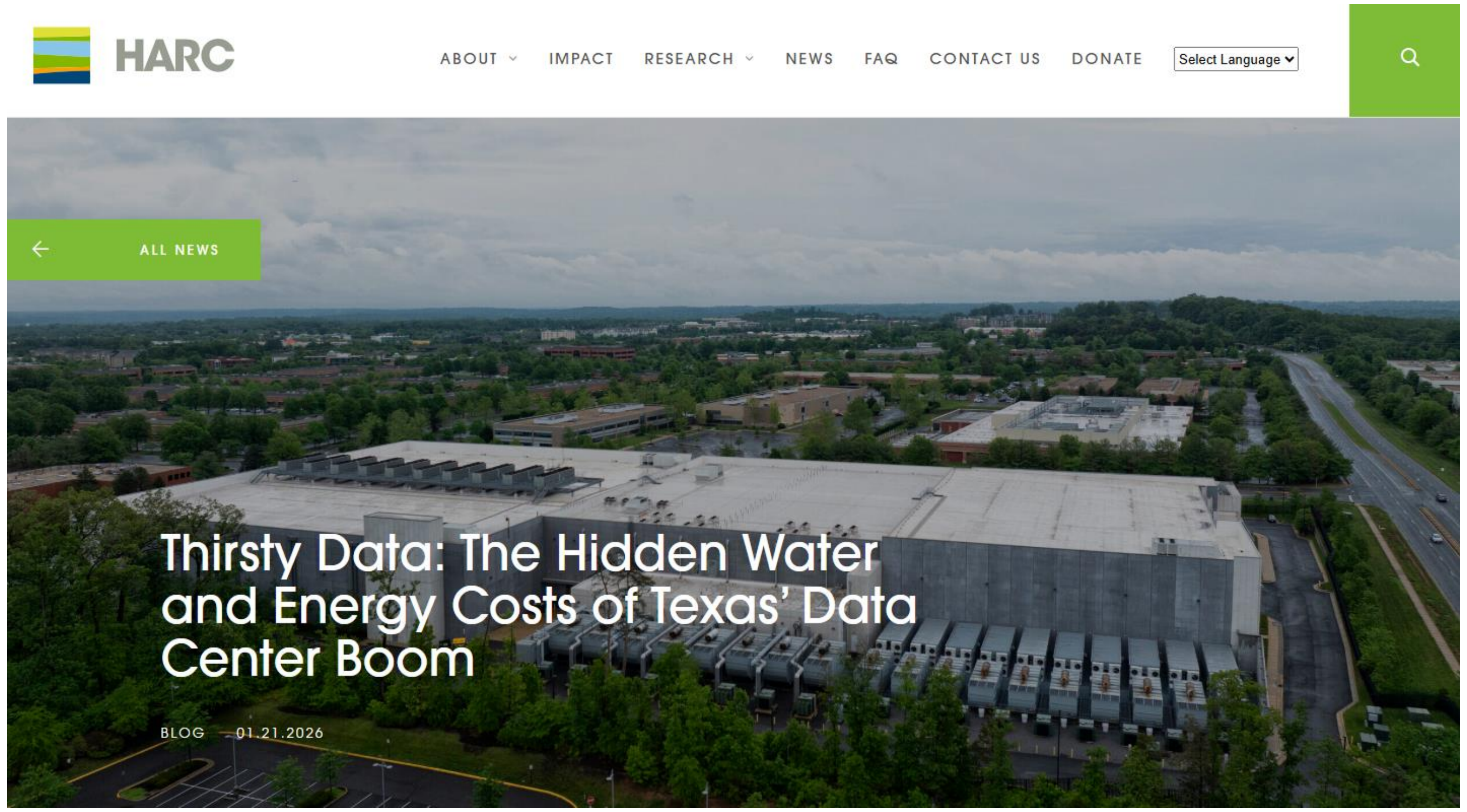
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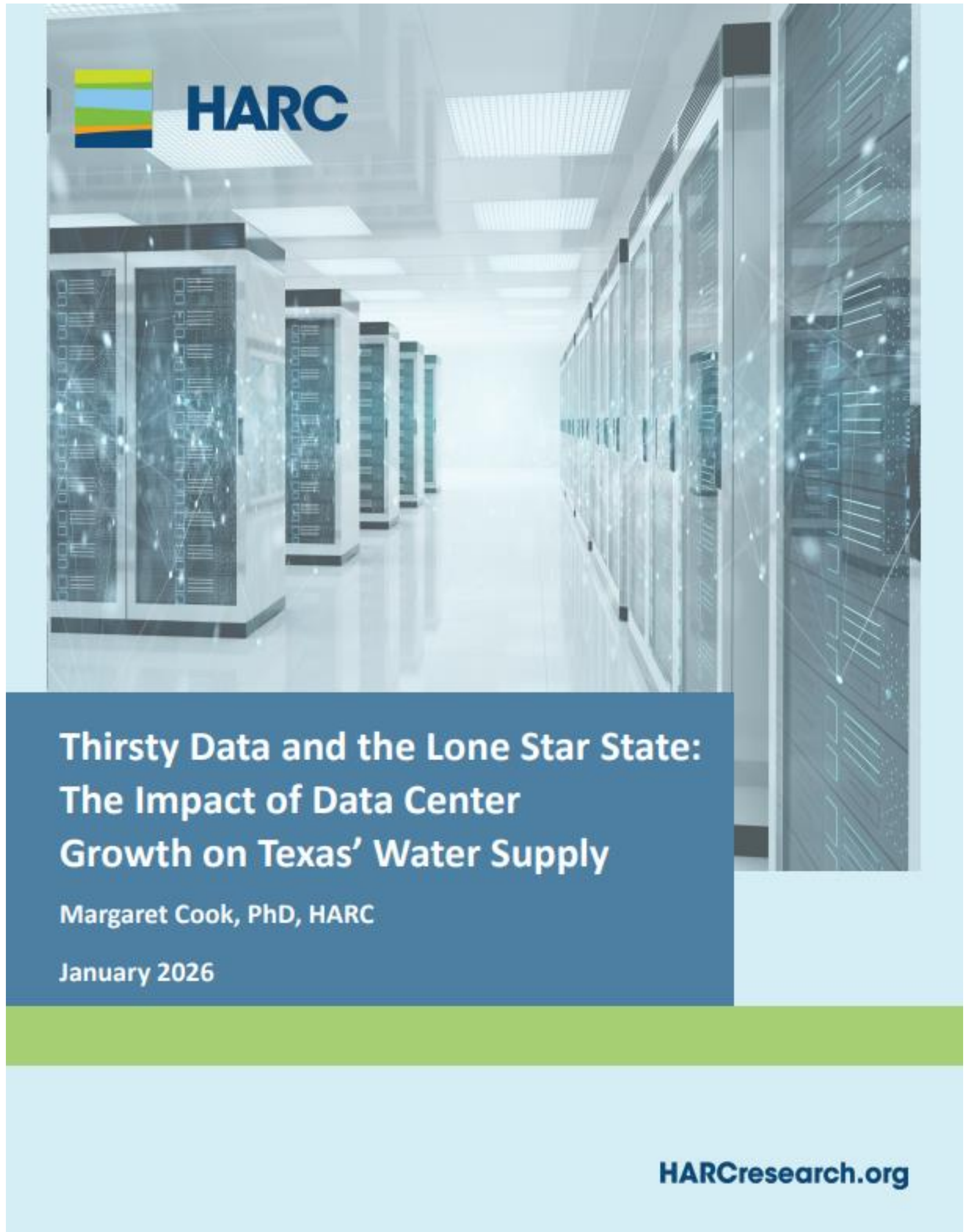
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Thirsty Data and the Lone Star State: The Impact of Data Center Growth on Texas' Water Supply
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