COLORADO HYDROGEN NETWORK

www.colorado-hydrogen.org

Monthly Meeting
18 March 2025

Agenda

- Coming events
  - Colorado Climate Week Mar 24-26
  - Hydrogen Symposium at School of Mines Apr 7-8
  - Geologic Helium & Hydrogen Conference, April 9 -10 Denver
- Tutorial: Failure of Imagination
- Saoradh hydrogen report released
- Drive Clean event
- 3 fuel station grant is holding
- Podcast

COLORADO HYDROGEN NETWORK

Coming Events

Colorado Climate Week (Mar 24-26) is a premier gathering of cleantech innovators, policymakers, corporate leaders, and investors committed to driving actionable change for a sustainable future. Sponsored by Colorado Cleantech

Register and agenda at: coloradoclimateweek.com

Admission is Free!

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Climate Week - Day 1

MONDAY, MARCH 24: CSU SPUR Hydro Building, DENVER

- Climate Solutions Made in Colorado: Success Stories from the Front Lines
- Quantum Leap: Computing our way to climate solutions
- Pulling Back Carbon: Technologies Shaping Colorado's Climate Future
- Fusion Forward: Engineering the Energy Revolution
- **Hydrogen in the Rockies**: From Vision to Infrastructure
  - Buford Barr, New Day Hydrogen
  - Will Evans, Monolith
  - Sam Morton, Koloma
  - Paul Nelson, Saoradh Enterprise Partners
- Resilient, Regenerative, and Scalable: Innovations in Agriculture in a Changing Climate
- The Hard Thing About Hard Things, Renewable Energy Edition
- **Hydrogen** Panel II
  - Paul Nelson, Saoradh Enterprise Partners
  - Aaron Lang, Foley Hoag
  - Steven Christensen, Xcel
- Manufacturing
- Scaling New Heights: Climate Tech and VC funding in Colorado
- Deploy, Deploy, Deploy: Colorado's Strengths & Ecosystem in Project Development

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Climate Week – Day 2

TUESDAY, MARCH 25: INDUSTRY RINO STATION 3827 Lafayette St, DENVER

- How AI is Supercharging Climate Tech
- Full Circle: Transforming Waste into Worth
- A Practical Discussion on Climate Tech: Fireside Chat
- Our Liquid Lifeline: Water Technologies and Climate Change
- Home Electrification: Observations from the Front Lines
- Digging Deeper: Smart Mining for Colorado's Clean Energy Future
- The Gridlock Problem: Unlocking Transmission for a Renewable Future
- Happy Hour 5 to 7 PM: INDUSTRY RiNo Station, Denver

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Climate Week – Day

WEDNESDAY, MARCH 26: SHERATON DENVER DOWNTOWN, DENVER

1550 Court Pl., Denver, Colorado, 80202

- Policy/State Government
- Innovations in Wildfire: Preparedness and Resilience
- Trail Blazers & Risk Takers: First of a Kind (FOAK) Projects Transforming Climate Action
- The Heat Below: Unlocking Geothermal's Potential
- Halliburton Labs Finalists Pitch Day

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Coming Events

Admission $50
Register: tinyurl.com/h2mines25

COLORADO HYDROGEN NETWORK

Monday, April 7: 11:15am – 5:00pm (MT), Ben H. Parker Student Center, Grand Ballrooms

Time	Topic	Presenters
11:15am	Registration	
11:45am	Lunch and Plenary Speaker	**Dr. Douglas Wicks**, Program Director, Advanced Research Projects Agency-Energy
12:30pm	Session 1: **Geologic Hydrogen**:	Research Highlights: **Dr. Yaoguo Li**, Professor, Geophysics, Colorado School of Mines Panel Discussion: *Moderator*- **Dr. John Bradford**, VP for Global Initiatives, Colorado School of Mines Panelists: **Dr. Travis McLing**, Directorate Fellow and Chief Geologist Critical and Strategic Minerals, Idaho National Laboratory **Zainub Noor**, Director, Technology and Innovation, Halliburton Labs **Dr. Douglas Wicks**, Program Director, Advanced Research Projects Agency-Energy **Dr. Mengli Zhang**, Research Assistant Professor, Geophysics, Colorado School of Mines

Monday, April 7 (continued), Ben H. Parker Student Center, Grand Ballrooms

Time	Topic	Presenters
2:15pm	Session 2: **Storage & Transportation:** Research Highlight, Panel Discussion	Keynote Speaker: **Dr. Chris San Marchi**, Distinguished Member of the Technical Staff, Sandia National Laboratories Panelists: **Dr. Muhammad Arafin**, Vice President Research & Development, EVRAZ North America **Dr. Dongchun (Mary) Qiao**, Principal Engineer, ABS **Dr. Andrew Slifka**, Mines '98, Materials Research Engineer, NIST
3:45pm	Session 3: **Utilization:** Research Highlight, Panel Discussion	Keynote Speaker: **Dr. Dimitrios C. Kyritsis**, Associate Dean for Academic Affairs, College of Technology and Design, Neom University

Networking Reception: 5:00 – 7:00pm (MT), Atrium, CoorsTek Center for Applied Science and Engineering

Tuesday, April 8: 8:30 – 11:00am (MT), Ben H. Parker Student Center, Grand Ballrooms

Time	Topic	Presenters
8:30am	Breakfast	
9:00am	Session 4: **Electrolyzers and Fuel Cells**	Keynote speaker, Research Highlight, Panel Discussion
Symposium concludes at 11:00am		

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Geologic Helium & Hydrogen Conference

- April 9-10 in Denver
- Lectures and Exhibit Hall
- CHN will be an exhibitor
- Presented by the
  Rocky Mountain Association of Geologists
- Info at www.rmag.org

Hydrogen From Geology is Likely the Lowest-Cost Source

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Geologic Helium & Hydrogen Conference Agenda

Day 1 - Morning

- Keynote: Overview of Global Helium Market and Outlook for Helium Supply and Demand
- Helium Exploration on the Sierra Grande Uplift-Merging Old Methods with Modern Science
- The Paradox Basin Akah Formation: Implications for Solving North America's Rapidly Depleting Helium Resource
- He: N2 Ratios of Gases and What They Can Tell Us About Basement Generating Capacity of Helium
- The Search is On: Techniques for Natural **Hydrogen** Exploration
- Magnetic and gravity data applications for exploring shallow basement resources, including elemental gases such as **hydrogen** and helium
- Seal Integrity for Natural **Hydrogen** Exploration: The Role of Fluid Properties and Tectonic Stresses
- Reevaluation of the Lyons Sandstone Formation of Southern Colorado as a Helium Reservoir based on the latest drilling by Blue Star Helium
- Helium in the Las Animas Arch Area of Colorado and Kansas: Production and Potential
- Petrophysical Model development and testing of the Permian Chase Group
- Regional Groundwater Excess Helium Isotopic Compositions as a Tool for **Hydrogen** and Helium Prospecting
- Mapping Geologic **Hydrogen** Prospectivity in CONUS Part I: Geologic Inputs
- Mapping Geologic **Hydrogen** Prospectivity in CONUS Part II: Mapping Methodology

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Geologic Helium & Hydrogen Conference Agenda

Day 1 – Afternoon

- Expanding the Giant Part 2: The Salt Compartmentalization and Gas Migration
- **Hydrogen** and Helium Potential, Holbrook Basin, Arizona
- Geochemistry of Well Gases From the Holbrook Basin, Arizona
- Geochemical Characterization of the Geologic **Hydrogen** Potential of Northeastern Minnesota
- Exploring the potential of Banded Iron Formations for geologic **hydrogen** generation
- Building a Regulatory Framework for Helium and **Hydrogen** Production from the Ground Up in Minnesota
- Helium East of the Mississippi River in North America, Steven Tedesco
- The Geology of the Topaz Helium Project, Duluth Complex, Minnesota
- On the Estimation of Geologic **Hydrogen** and Helium Resources in Texas
- Exploring Natural **Hydrogen** in the Southwest of France
- Code Comparison Study for Modeling Geologic **Hydrogen**

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Geologic Helium & Hydrogen Conference Agenda

Day 2 – Morning

- Keynote: What Makes a Successful Helium/**Hydrogen** Prospect?
- Combining Old and New – Unlocking the fractured Witswatersrand Formation Reservoir of the Helium and Methane play of South Africa
- The Virginia Witwatersrand-type Helium Deposit, South Africa: New Constraints on the Origin and Evolution from Gas Geochemistry
- Developing a Tool for Helium Prospecting Using Legacy Rock Samples – Relating Residual Helium and Other Volatiles in 10 Legacy Cores to Helium Tests Using Rock Volatiles
- Application of Wellsite Mass Spectrometry for Helium Resource Development
- Soil Gas in Modern Resource Exploration
- Understanding the Subsurface Helium System in Manitoba and Evaluating the Potential for Economic Concentrations by Analyzing Entrained Volatiles in Legacy Cuttings
- Report 120 - the Alberta Energy Regulator & Alberta Geologic Survey 2021-2023 Aeromag Data Acquisition: Implications for Helium Exploration
- Exploring for Helium + Hydrocarbons in Western Alberta - the HeHC Strategy
- Potential for **Hydrogen** & Helium Storage in Salt Caverns in North America,
- Working Gas Cycling and Produced Water Impacts **Hydrogen** Reservoir Performance in Temporary Geologic Storage
- Evaluation of Potential Geochemical and Microbial Challenges Associated with **Hydrogen** Storage in Porous Media

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Geologic Helium & Hydrogen Conference Agenda

Day 2 – Afternoon

- Helium Production from Devonian Beaverhill Lake at the Knappen Field, SE Alberta
- **Hydrogen** and Helium in Saskatchewan: Is There an Analogue Relationship in Saskatchewan's Uranium Deposits?
- Benefits of Pressure Swing Adsorption for Helium Separation
- Modular **Hydrogen** Purifiers
- Helium Recovery from U.S. Shale Gas: New Opportunities for the LNG Sector
- CO_2, What You Need to Know About this Molecule. Production, Distribution, Marketing and the Several Commercial Applications
- Fair Market Valuations of Helium and **Hydrogen** Exploration & Production Companies
- Helium Markets and Trends
- Geologic and Strategic Insights Reveal the State of Play in the Natural **Hydrogen** Industry

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Coming Events

Hydrogen Technology Expo North America –
The Future of Hydrogen Innovation
10,000 attendees, 500 exhibitors, 200 speakers, and 100+ hours of content.
June 25-26 Houston, TX
Register at: www.hydrogen-expo.com

Hydrogen Technology Expo Europe
October 21-23 Hamburg Messe, Germany
Register at: www.hydrogen-worldexpo.com

Tutorial
Failure of Imagination

Failure of Imagination

- Failure of imagination
  - A phrase applied to an unforeseen event that in hindsight should have been predictable
  - A failure to imagine or consider possible outcomes beyond ”business as usual”
- Failure of imagination in the context of Clean Energy
  - Clean energy sources
    - Far more than just wind and solar
  - Distributed vs Centralized energy systems
    - The grid is changing.

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Clean Energy Sources

- In the past
  - Similar fossil power plants were deployed everywhere
  - Energy on the grid flowed one way
- In the future
  - Type of energy source utilized depends on location
    - Using the most abundant energy (wind, geothermal, natural hydrogen, etc)
  - Grid needs to be bi-directional
    - More like an exchange
  - Sources will be smaller, more varied and geographically distributed
  - On-site generation may avoid the use of the grid entirely
    - Avoiding new transmission lines
    - Some micro-grids may be quite large (data centers).

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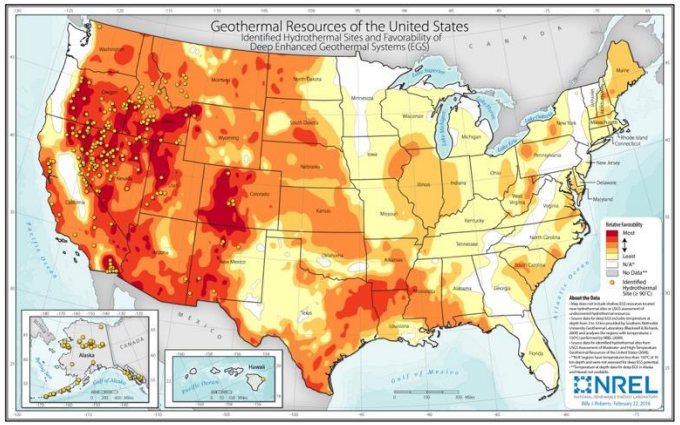
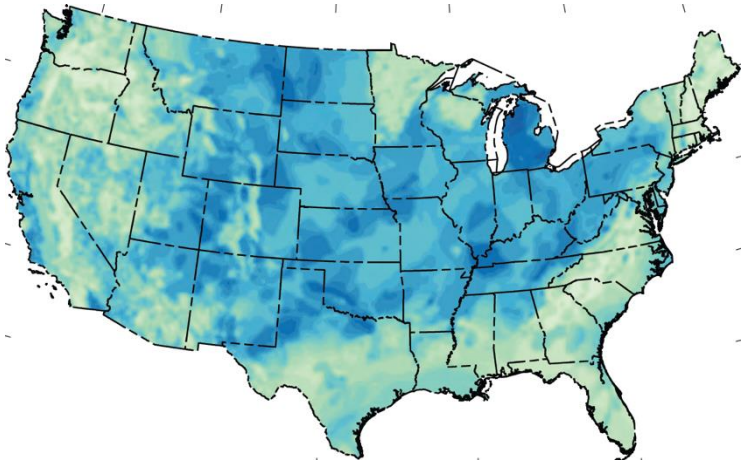
Clean Energy Sources

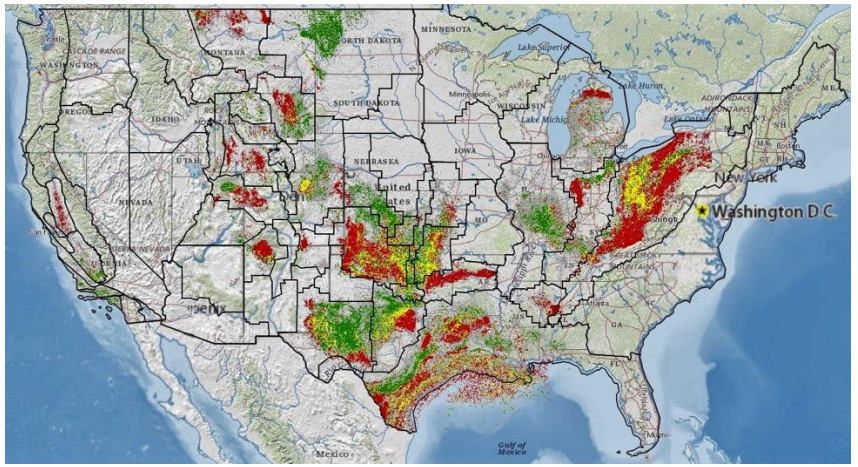
Geothermal



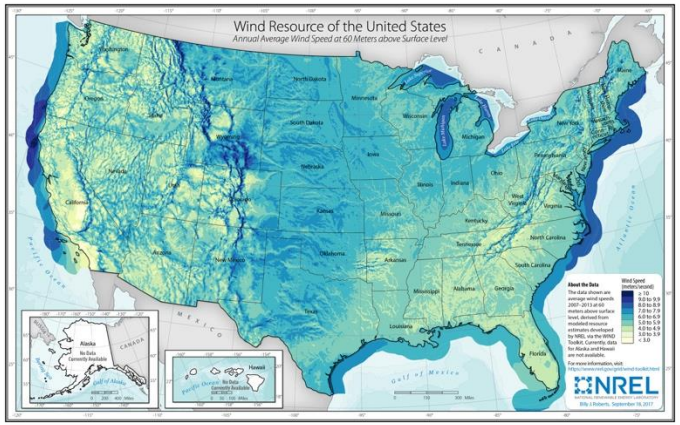
Natural Hydrogen



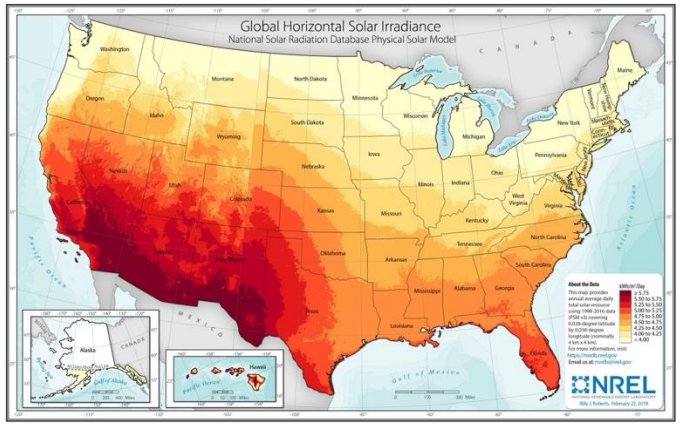
Petroleum Wells in the US (For Underground H2 Generation)

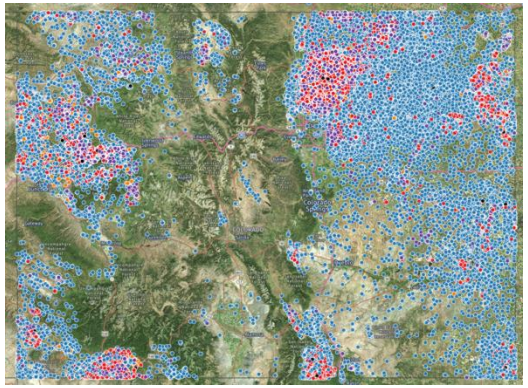


Wind



Solar





Colorado Abandoned Oil Wells (Blue)

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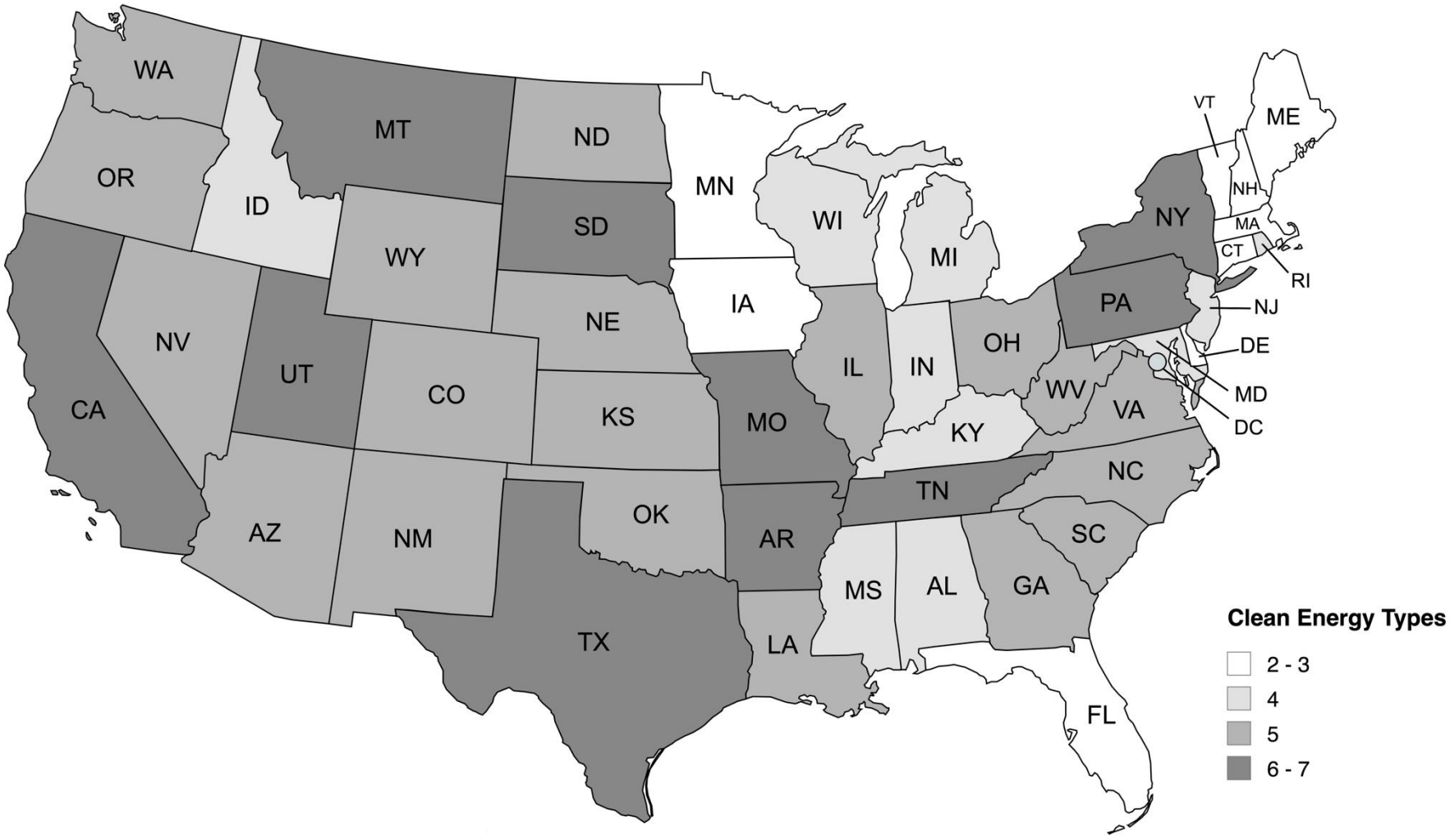
Number of Clean Energy Types by State



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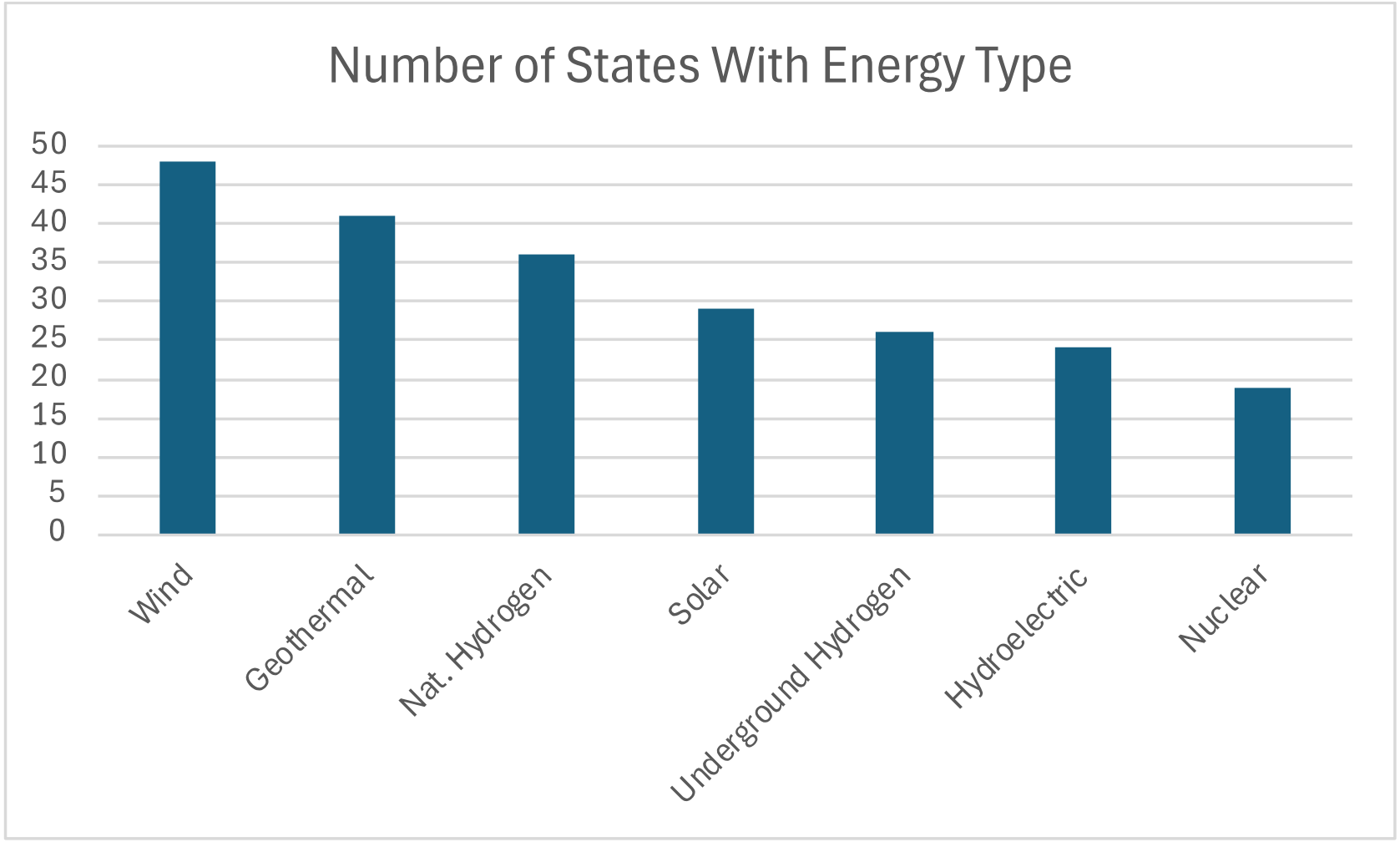
Number of States With Each Energy Type



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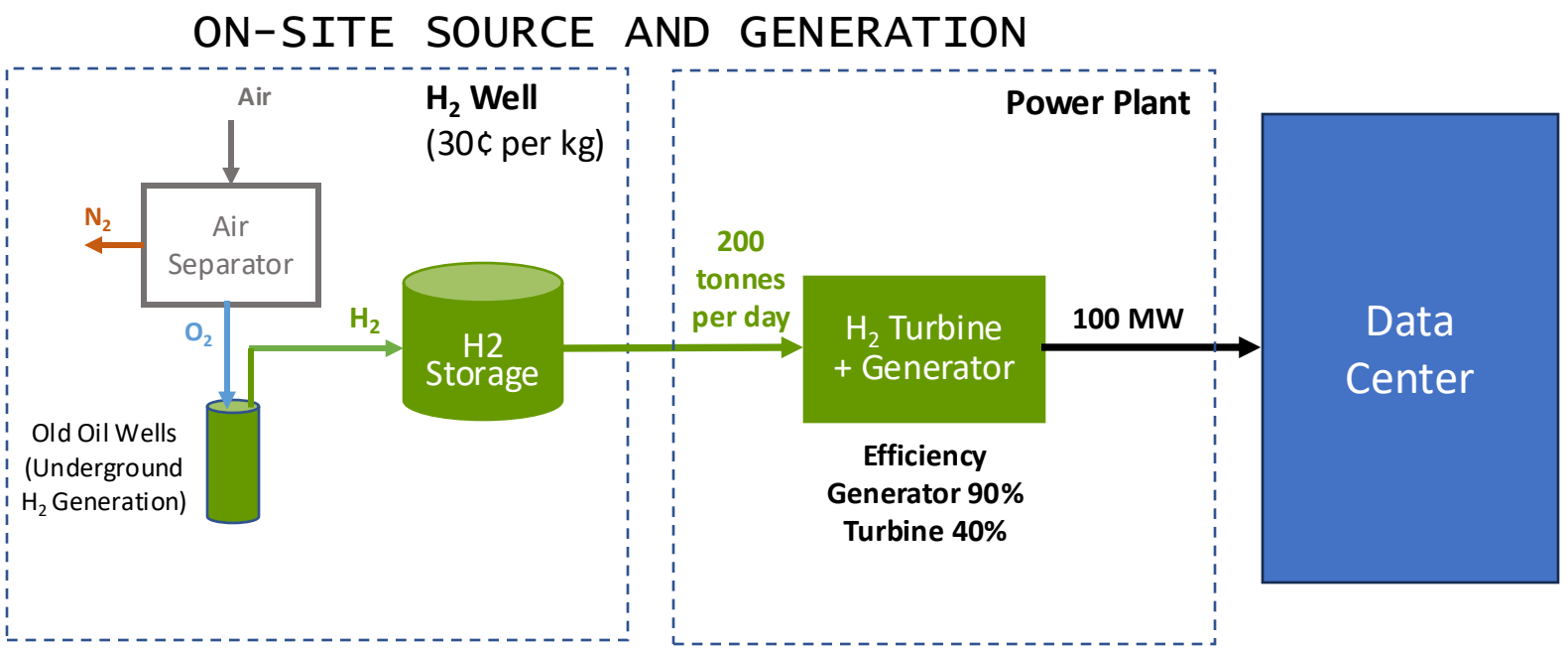
On-Site Energy Example - Data Center



Quantity	
Elect output kW	100,000
Elect Gen eff	0.90
Turbine eff	0.40
H2 kW input	277,778
H2 kWh per hour	277,778
kWh/kg	33.33
kg per hr	8,334
kg per day	200,020
tonnes per day	200

Energy Cost	
$/kg	$0.30
$/day	$60,006
kWh/kg	33.33
kWh/day	6,666,667
$/kWh	$0.009

Double-click to see formulas

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Take-Aways

- There are a lot more Clean Energy sources than we commonly hear about
  - Wind, Solar, Geothermal, Natural Hydrogen, Geologic Hydrogen, Hydroelectric
- Expanding transmission lines may not be necessary
  - With on-site energy source and generation

Clean Energy Technology is Changing Fast
We Need to Update our Opinions Weekly

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Saoradh – Hydrogen Transportation Report

- Saoradh has just released a "Hydrogen Transportation Report"
- Comprehensive 453-page report analyzes the utilization of hydrogen in six transportation markets
  - Medium- and heavy-duty (MD/HD) trucks,
  - Buses, cargo ships, commercial aircraft, rail
  - Material handling equipment
  - Provides insight into market size and trends
- Other notable focus areas include
  - Policies, hydrogen derivatives
  - Airports and seaports
  - Early-stage companies
  - Hydrogen demand for SAF
  - TCO for MD/HD trucks

SEP is offering this report to CHN members at a 15% discount. In addition, SEP will donate 15% back to CHN. **Use discount code CHN25.**

You can learn more on the Saoradh website: **saoradh.com**

Executive Summary: **tinyurl.com/SEPtransExSum.**

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Drive Clean Event Feb 26 - Report

Presented by Drive Clean Colorado in partnership with NREL and the Colorado Energy Office

Agenda

- Trends and New Solutions for Clean Transportation
- Clean Cities and Communities – Partnering in the West and Beyond
- Show Me the Money – Update on Funding for Clean Transportation in Colorado
- Ask Me Anything: Accelerating Infrastructure for Clean Fleets
- Panel: Driving Clean Fleets Forward – Colorado Fleet Case Studies
- Cybersecurity in Transportation
- Hydrogen Fleets in Colorado & Beyond
  - Moderator: Buford Barr, New Day Hydrogen
  - Roy Hensler, Rising Creek Transportation
  - Brendan Doner, Breathe Transportation
  - Frank Bruno, Via Mobility Services
- First Responders Working Group Report Out
- Charging Smart Cohort Update
- Clean Fleets for School Districts Group
- Renewable Natural Gas / Recaptured Methane

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Three Hydrogen Fuel Station Grant

- CSU and New Day Hydrogen have an ongoing contract from the Federal Highway Administration to deploy three hydrogen fuel stations
- Funding originates with the Inflation Reduction Act (IRA)
  - Funding is still in place
- March 12 – “Hydrogen tax credits on safer ground after 21 House Republicans publicly oppose elimination of IRA incentives”

“Watch This Space” for Updates

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CHN Membership

- Help support CHN with a paid membership
  - $50/year individual (tax deductible)
  - $200/year start-up (tax deductible)
  - $1,000 and up for corporations based on size (includes CCIA membership)
- Membership dues help us sponsor events like *Colorado Hydrogen Day*
- A way for everyone to help contribute to our efforts
  - Giving you a sense of ownership.
- www.colorado-hydrogen.org/join .

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Membership in the Colorado Hydrogen Network has been provided as a joint membership in both CHN and our parent organization, the Colorado Cleantech Industries Association (CCIA). CCIA's dues are tailored for established companies, but CHN stakeholders include many individuals and start-up companies, many of whom would like to have a stake in supporting CHN.

So new in 2024, we're adding CHN-only dues so that individuals and start-up companies can help support the organization. These dues are voluntary and tax deductible. The rate for start-up companies is limited to the first 2 years of membership. The complete set of annual dues is shown in the table.

	CHN Only		Corporate Membership			
	Individual	Start-up (2 years)	1-20 Employees	21-50 Employees	51-150 Employees	151+ Employees
Annual Dues	$50	$200	$1,000	$2,500	$5,000	$10,000
Tax Deductible Donation	✓	✓				
CCIA Membership included			✓	✓	✓	✓

Why Join?

CHN is a non-profit organization devoted to advocating for hydrogen infrastructure and educating, so everyone is welcome to participate in the organization whether they pay dues or not. But here are the benefits of donating:

- Help to support and grow CHN
- Allows CHN to sponsor events
- To be invested and engaged in CHN
- Enable CHN to eventually have paid staff
- Your name and logo on the CHN members page on the website

Join Individual / Start-up

Join Corporate

Donations

Since CHN can now accept tax-deductible donations, we invite everyone to consider donating to the organization. (UNDER CONSTRUCTION, COMING SOON)

Donate

Participation Will Continue to be Open to All At No Charge

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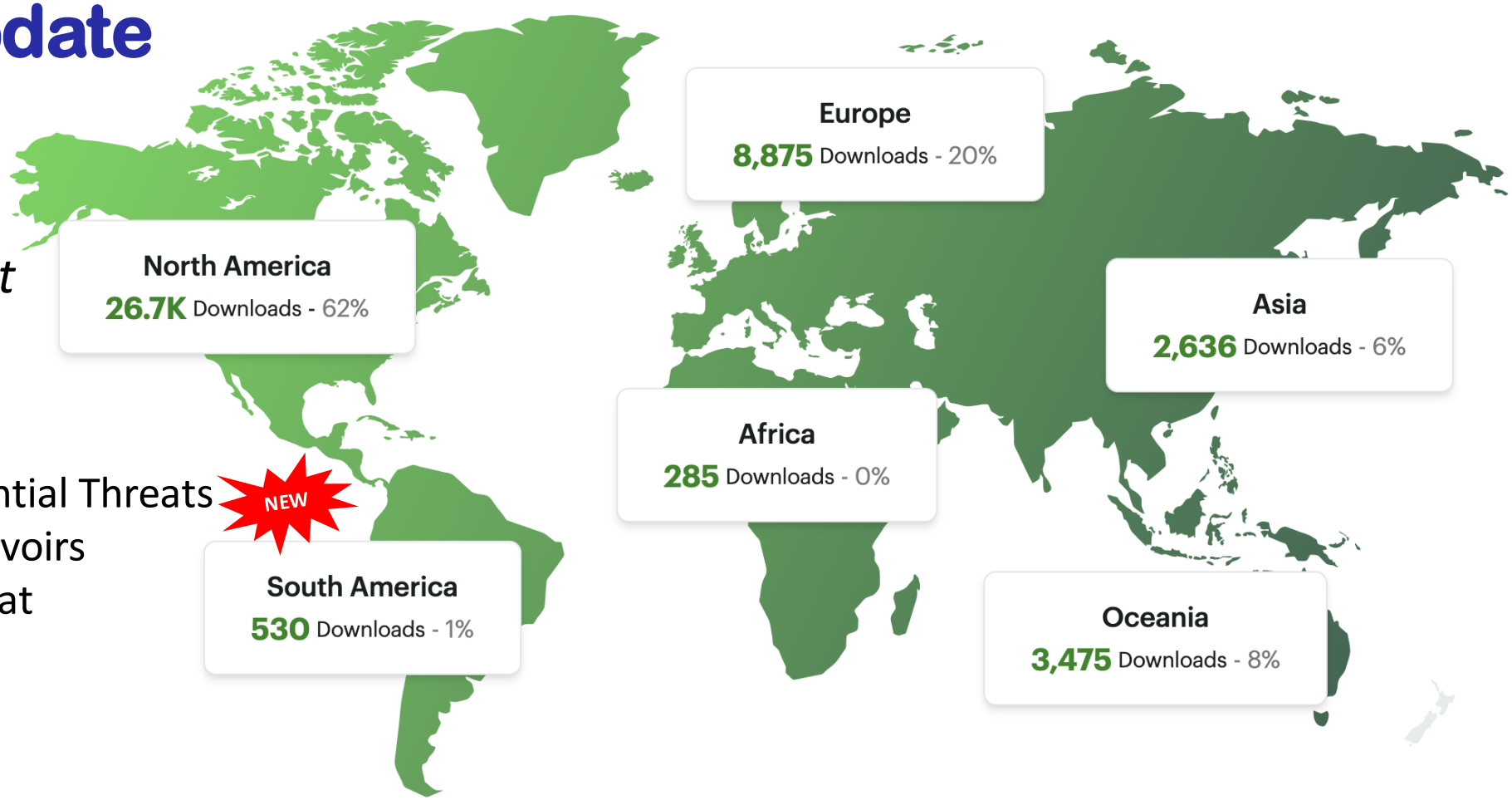
Podcast Update

The *HydrogenNowCast*

- 89 episodes
  42,500 downloads
- Recent episodes
  - Psychology of Existential Threats
  - Bio H2 from oil reservoirs
  - Hydrogen Mtn Retreat
  - TFL Podcast
  - Hydrogen transport



HydrogenNowCast

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Podcast

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