Image: Linde Engineering

Hydrogen-Distraction to Just Energy Transition

Presented By:

Tó Nizhóní Áni (Sacred Water Speaks)

Jessica Keetso, Community Organizer

Eleanor Smith, Community Organizer

TÓ NIZHÓNÍ ÁNÍ

"SACRED WATER SPEAKS"

EST. 2000

What TNA is Doing

- Providing information since <u>early 2021</u>, to help communities make a better, more informed decision on hydrogen
- An informed community, is a strong, more resilient, healthier and safer community

Projects and Pipelines Proposed Near or On Navajo

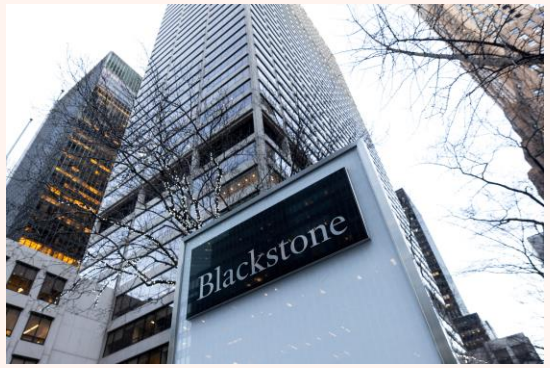
Hydrogen Projects (NM side)

- Escalante Power Plant, Prewitt, New Mexico (Blue)- Tallgrass Energy owns 75%, Newpoint Gas, LLC owns 25%
- Libertad, 1 project will be located in San Juan County, and another will be located in Lea County (Green/Turquoise)
- Navajo Agricultural Products Industry (NAPI), Farmington, New Mexico (Blue)
- Avangrid hydrogen project near the Four Corners Power Plant

Hydrogen Pipeline (NM and AZ)

- Greenview Logistics LLC Pipeline Project: Route threw Navajo Nation includes 13 Chapters: Cameron, Coalmine-Canyon, To'Nanees'Dizi, Tonalea, Shonto, Kayenta, Dennehotso, Mexican Water, Sweet Water, Teec Nos Pos, Red Mesa, Gadii'ahi/To'Koi, Hogback

Who's-Who



Blackstone- Asset management firm specializing in areas such as real estate, private equity, and hedge fund solutions. It manages a trillion dollars worth of assets and generates billions of dollars in revenue. In 2019 Blackstone purchased 100% of the membership interests in Tallgrass Energy.

Tallgrass Energy- Energy company and energy infrastructure company with offices in Denver, Kansas City and Houston. Tallgrass owns and operates more than 8,300 miles of natural gas across the U.S. In 2021 Tallgrass acquired a 75% membership interest in the Escalante Power Plant. The company also created the subsidiary GreenView Logistics LLC Pipeline Project.

GreenView Logistics LLC Pipeline Project- Owned by Tallgrass Energy; Incorporated in 2022, this entity is developing the pipeline that will potentially run through the Navajo Nation. Under GreenView there are several companies contracted to survey the pipeline route.

4 Corners Clean Energy Alliance- Nonprofit 501c(4) organization that started within the past 2 years. Tallgrass has stated they helped the group to organized around hydrogen. Several members of 4CCEA's board also being Tallgrass employees. To see who is on their team visit https://fourcornerscleanenergyalliance.org/meet-our-team/

Contractors

https://www.linkedin.com/in/kenneth-krenke-79418313

- **Red Skies Survey and Mapping** (centerline staking and survey)
- **Encompass Services** (centerline staking and survey)
- **Dinétahdóó Cultural Resources Management, LLC** (archaeological and ethnographic surveys)
- **Logan Simpson** (cultural surveys)
- **Parametrix** (cultural surveys)
- **Zoology Unlimited** (biological surveys)
- **Insignia Environmental** (biological surveys)
- **Stantec** (paleontological surveys)
- **WBS** (constructability)
- **Sonoran Land Resources** (land and right-of-way) 520-829-6169

Hydrogen on Navajo Timeline

Milestone	Date
NM Legislative Session/Introduction of Hydrogen Bills	December 2021-February 2022
To Nizhóní Ani Began Community Outreach and Informational Sessions on Navajo (1st Resolution)	December 2021
DOE Announces Request for Information (RFI) for H2Hub Implementation	February 15, 2022
RFI Responses From Potential Developers/Partners Due	March 21, 2022
Funding Opportunity Issued	September 9, 2022
Concept Paper Due	November 7, 2022
Concept Paper Released to Public (Redacted)	November 15, 2022
Encourage/Discourage Notifications (Both SHINe and WISHH were encouraged)	December 2022
TNA began to see GreenView/Tallgrass at chapter meetings	Early 2023
Full Application Due (Community Benefits Agreement was supposedly apart of this application)	April 7, 2023
TNA Contacted DOE Informing of Chapter Resolutions and Requesting Copy of Proposal	May 1, 2023
Deadline for Replies to Reviewer Comments	May 31, 2023
TNA Received Response Back from DOE	June 15, 2023
Pre-Selection Interviews	Summer 2023
Funding Awarded (SHINe and WISHH not funded)	October 13, 2023
NM Governor Announce Commitment to Hydrogen Hub	October 13, 2023
GreenView/Tallgrass Presentation to RDC	April 22, 2024
TNA Hydrogen Informational Summit	June 26, 2024

4 Issues with Hydrogen

- Pipeline
- Water
- Climate Change
- Community

Hydrogen Pipeline

Pipeline Safety Concerns

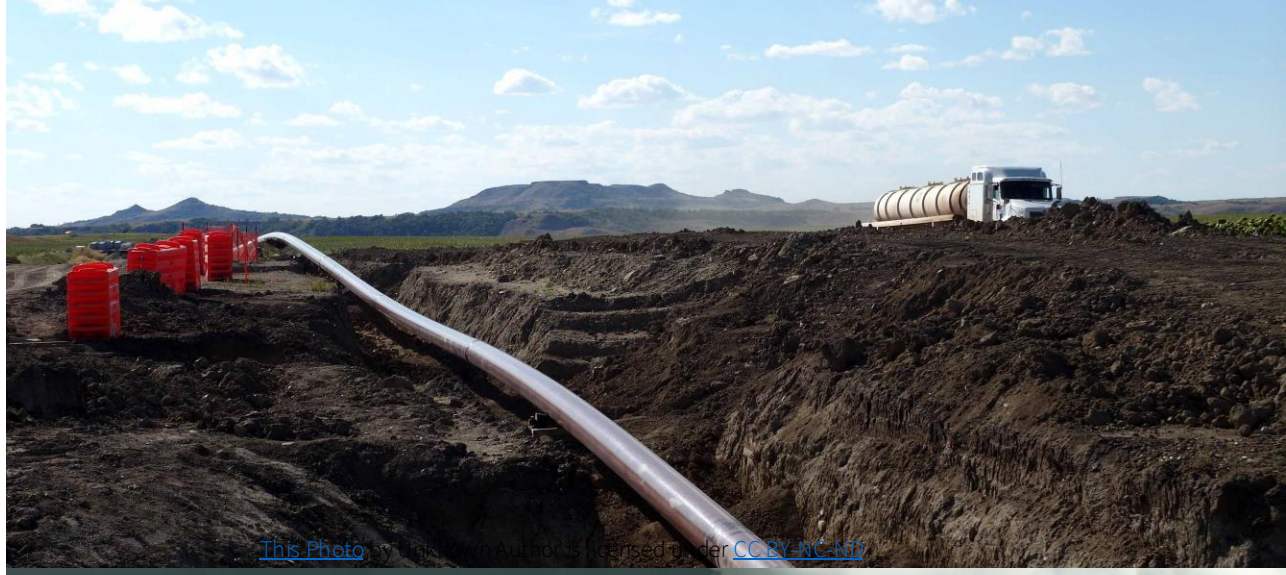
Hydrogen corrodes metal, causing pipeline cracks and leaks that could cause explosions and dangerous hydrogen fires

Pure Hydrogen is HIGHLY explosive

Scarce infrastructure on Navajo

Few Hazmat Trained Emergency Responders on Navajo

Encroachment Concerns



Hydrogen Developer Messages:

"You are eating it right now"

"Hydrogen is not a greenhouse gas"

"There is no drilling involved"

"Hydrogen is everywhere"

"It's what makes up water"

"Hydrogen makes up 60% of your body"

"It's a green energy"

"It doesn't use water"

"It makes up the universe"

Compounds with hydrogen (H) atoms

H_2O – Water

C6H5NO2 – B vitamin used to turn food into energy; found in most enriched products like cornmeal

(C6H10O5)n – the starch in potatoes

LiOH – mainly consumed in the production of cathode materials for lithium-ion batteries

$^{7}Li\ ^{2}H$ – the fuel for thermonuclear weapons aka hydrogen bombs

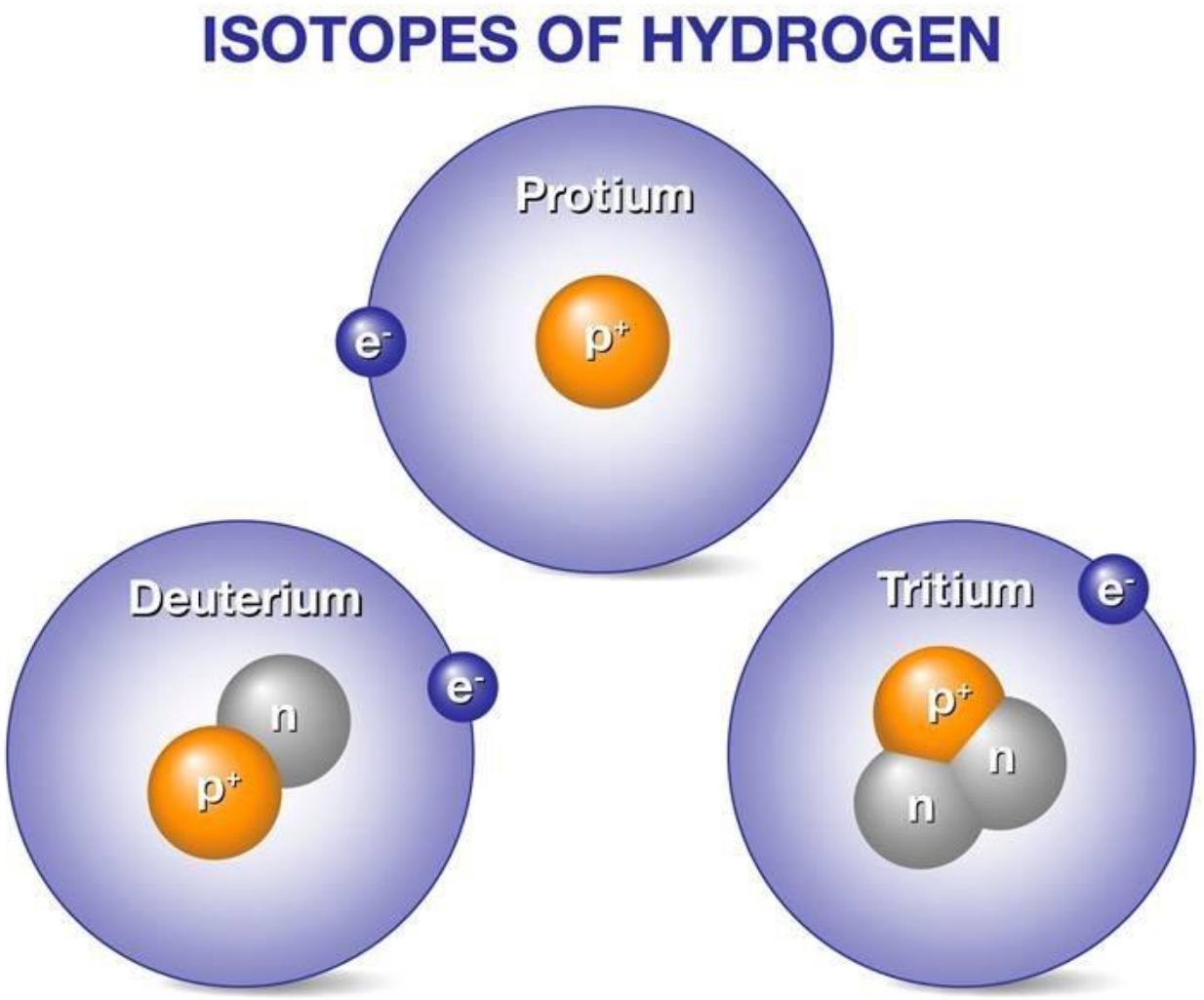
2NAD+ – a coenzyme central to the metabolism; used in the glycolysis process which powers cells and mitochondria

3H – one of the isotopes of hydrogen used in safety signs because of its radioactive properties

Hydrogen Isotopes (atom varieties)

- Natural hydrogen is a mixture of two stable isotopes ^{1}H and ^{2}H and one radioactive isotope ^{3}H.
- Protium, ^{1}H, has no neutrons in its nucleus and is the most common form of hydrogen, with an atomic mass of ~1.0078 Da (dalton) and an isotopic abundance of ~99.972% of all hydrogen on Earth.
- Deuterium, ^{2}H, contains one proton and one neutron in the nucleus giving it an atomic mass of ~2.014 Da, with an abundance on Earth of ~0.028% complementing that of ^{1}H to yield ~100%.
- Tritium, ^{3}H, bears one proton and two neutrons in its nucleus yielding an atomic mass of ~3.016 Da. Tritium is radioactive with a half-life of 12.32 years.

- https://youtube.com/shorts/xcO1yCAO-pI?si=lm7wYIiVojiWPBBA



https://www.visualcapitalist.com/the-elemental-composition-of-the-human-body/

Hydrogen Gas (H2)

Hydrogen gas (H2) which is 2 hydrogen atoms joined together by a covalent bond consisting of 2 shared electrons.

OR H – H

SAFETY DATA SHEET

Hydrogen

Airgas
an Air Liquide company

Section 1. Identification

GHS product identifier	:	Hydrogen
Chemical name	:	hydrogen
Other means of identification	:	Dihydrogen; o-Hydrogen; p-Hydrogen; Molecular hydrogen; H2; UN 1049
Product type	:	Gas.
Product use	:	Synthetic/Analytical chemistry.
Synonym	:	Dihydrogen; o-Hydrogen; p-Hydrogen; Molecular hydrogen; H2; UN 1049
SDS #	:	001026
Supplier's details	:	Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
24-hour telephone	:	1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status	:	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	:	FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :

Signal word	:	Danger
Hazard statements	:	Extremely flammable gas. Contains gas under pressure; may explode if heated. May displace oxygen and cause rapid suffocation. Burns with invisible flame. May form explosive mixtures with air.

Precautionary statements

General	:	Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Approach suspected leak area with caution.
Prevention	:	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Response	:	Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leakage, eliminate all ignition sources.
Storage	:	Protect from sunlight. Store in a well-ventilated place.
Disposal	:	Not applicable.
Hazards not otherwise classified	:	In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

How Hydrogen is Used Today

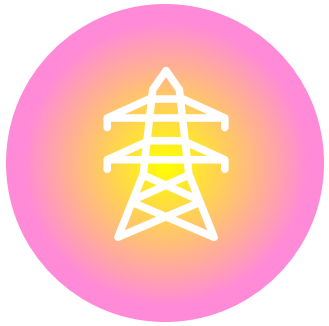
- Refining petroleum
- Treating metals
- Producing fertilizer for use in industrial agriculture
- U.S. petroleum refineries use hydrogen to lower the sulfur content of fuels
- The use of hydrogen for transportation and utilities are still emerging markets

How Hydrogen Is produced

Steam-Methane Reforming

Hydrocarbon (natural gas) is put under **intense pressure** using steam (H_2O) to produce Hydrogen (H) and Carbon Dioxide (CO_2). Carbon Dioxide is removed leaving Hydrogen.

95% of the world's H_2 production comes from the SMR process.

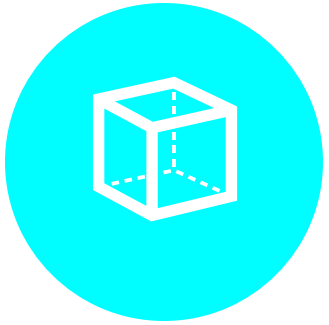


Water-Electrolysis

Electricity (hydrocarbons or renewable energy) is used to split water (H_2O) into hydrogen (H_2) and oxygen (O).

This process is **water and energy intensive**. Less than 0.1% to 4% of global hydrogen production today comes from water electrolysis.

The only byproduct is oxygen without any carbon emissions.



Methane-Pyrolysis

Methane (CH_4) is **heated** to a high temperature using electricity, splitting it to create a gaseous Hydrogen (H_2) and solid Carbon (C).

Methane-pyrolysis **requires high-temperatures** to achieve high-conversion rates.

Solid-carbon by-product has many industrial applications and could be sold at $0.4/kg -$2/kg to generate additional revenue.

Excess unsold carbon could be stored in geological storage or unused coal mines. It can be handled, transported and stored at a fraction of the cost of gaseous CO_2.

Gasification

Converts organic (coal) or fossil fuel based into carbon monoxide, hydrogen, and carbon dioxide.

Achieved by reacting materials at **high temperatures** without combustion with controlled amount of oxygen

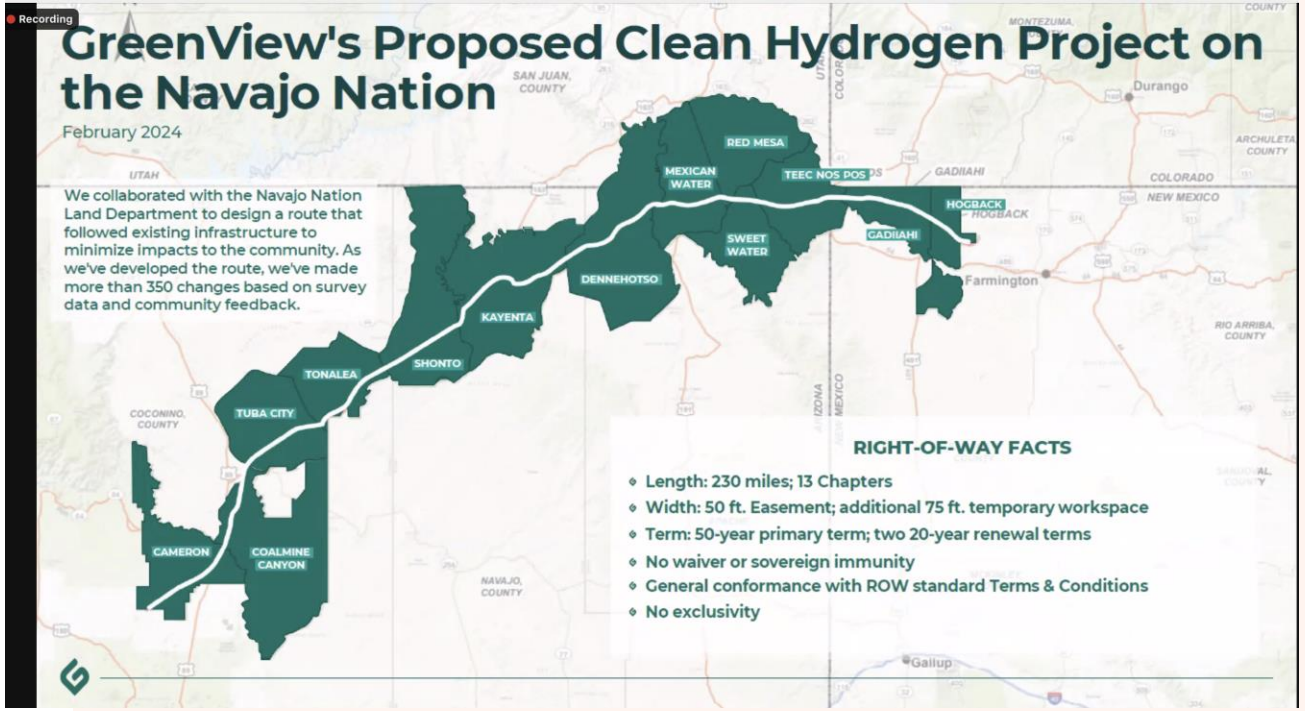
Hydrogen Colors

Green	Water Electrolysis (Splitting of water) Renewable energy	Gray/Black	Steam Methane Reforming No CO_2 capture, released into atmosphere Most common form globally
Blue	Steam Methane Reform (Natural gas is put under pressure via steam to produce H_2 and CO_2) **CO_2 is captured and stored underground (CCS). Tech no reliable.**	Brown	Gasification of coal H_2 produced from coal/lignite No CO_2 capture, released into atmosphere **Very polluting process**
Pink	Water Electrolysis (Splitting of water) Powered by nuclear energy	Yellow	Water Electrolysis (Splitting of water) Powered by grid electricity
Turquoise	Methane-Pyrolysis of gas (Thermal splitting of methane) Instead of CO_2, solid carbon (C) is produced, stored or sold.	White	Naturally occurring deposits found underground; no viable strategy to obtain at scale. Possible to generate it artificially or produce it as a byproduct of industrial processes.

Pipeline Specifications

Overview

- Hydrogen (gas form); potentially mixed with ammonia
- Buried underground 4 feet deep
- Use horizontal drilling in places there is rock
- Pipe will go under the LCR at Cameron



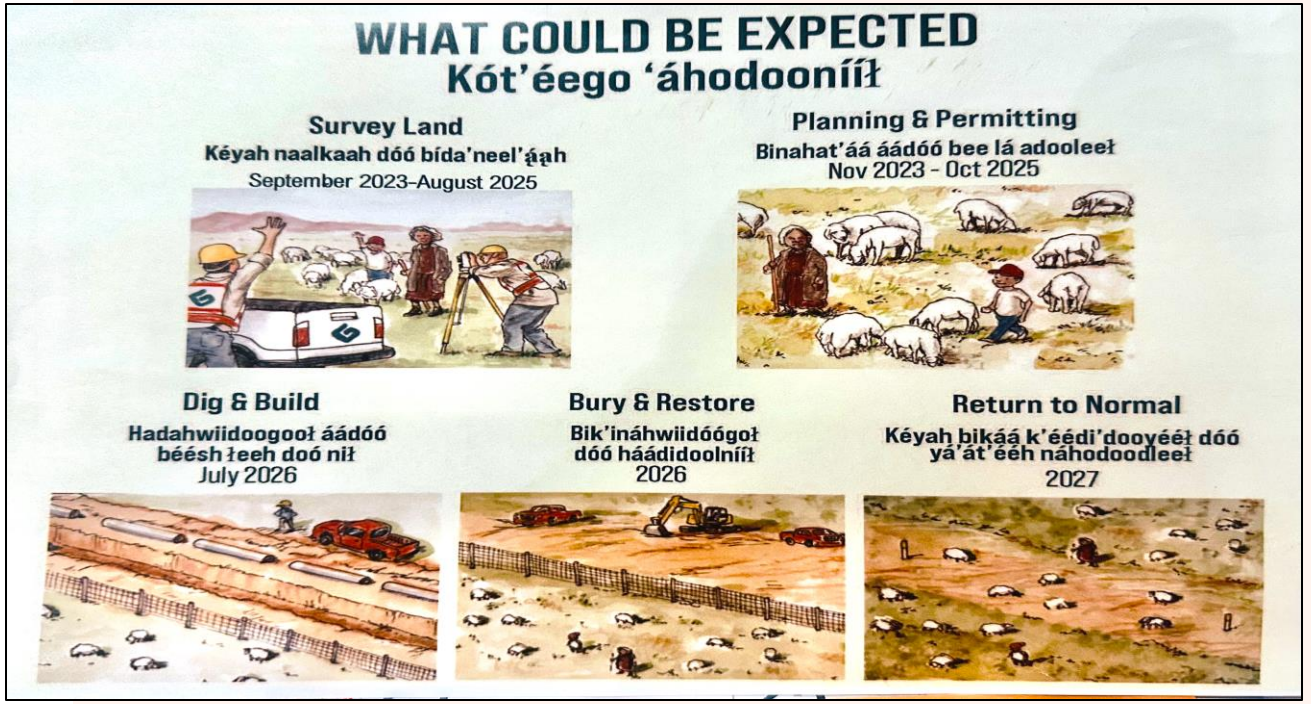


Image Source (pipeline): https://www.coloradonaturalgas.com/right-of-way
Image Source ("What Could Be Expected"): GreenView

Hydrogen Gas Flammability and Combustion

Flammability Range

Hydrogen's range is broad 4.0-75.6% in air and 4.0-94% in oxygen. Therefore, air and oxygen should be kept from mixing with hydrogen inside confined spaces. By comparison methane's flammability limits are between 5-15% in air.

Hydrogen burns faster than methane. Hydrogen tends to explode/detonate with extreme energy release and high temp. Heat radiation tends to be in the ultraviolet spectrum rather than infrared heat radiation associated with methane fires. This means hydrogen burns in air a pale blue to transparent flame, which may increase the risk of injury.

Depending on the flammable conditions, pressure, and concentration of hydrogen, a mixture exposed to ignition sources may combust by either deflagration(subsonic combustion) or detonation (supersonic combustion, not possible in the open air).

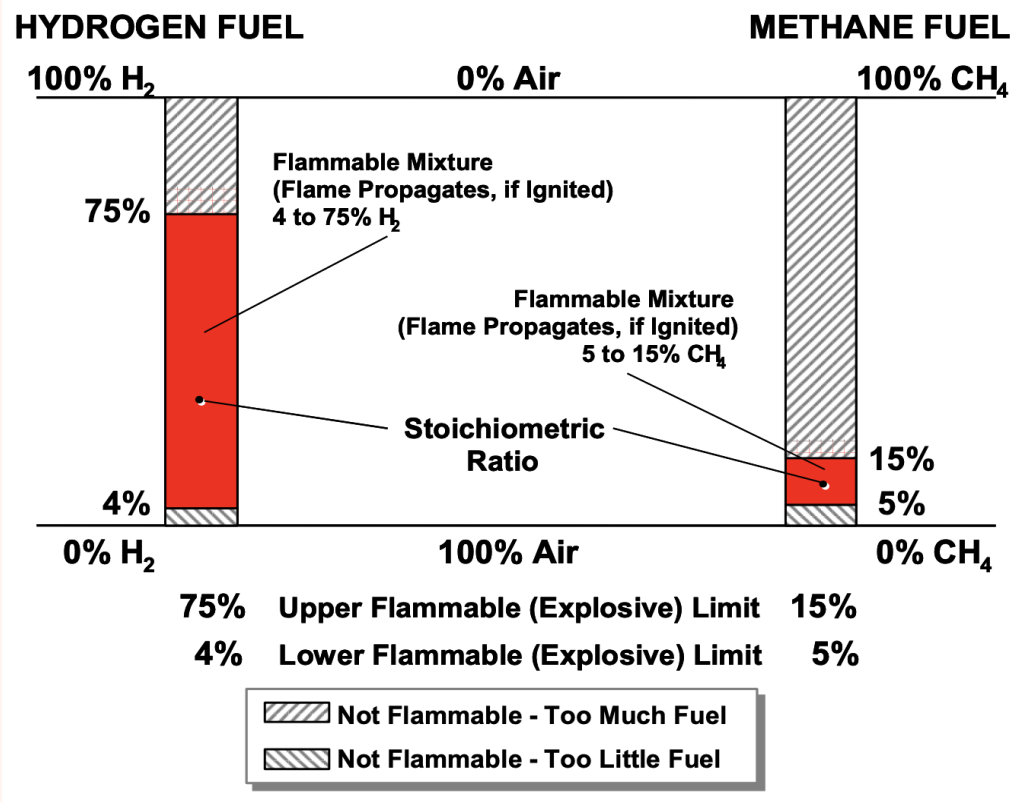


Image Source (pipeline): https://www.coloradonaturalgas.com/right-of-way
Image Source: Flammability Graph-
Image Source (flame comparison): https://h2tools.org/hydrogen-compared-other-fuels

Hydrogen Gas Autoignition, Sensitivity, and Reactivity

Autoignition

Autoignition occurs when a mixture of gases or vapor ignites spontaneously with no external ignition source and after reaching a certain temperature. The autoignition temp for hydrogen is 560 degrees Celsius or 1,040 degrees Fahrenheit.

Ignition Sensitivity

Hydrogen is sensitive to electrostatic discharge. It also requires only 0.02 millijoules of energy to ignite the hydrogen-air mixture, which is less than 7 percent of the energy needed to ignite natural gas.

Reactivity

Finely divided platinum and some other metals will cause a mixture of hydrogen and oxygen to explode at ordinary temperatures.

Video: https://www.youtube.com/watch?v=ZhBIlOeaLgw

1 Watt = 1 Joule per second

60 Watt light bulb is using 60 Joules of energy per second once you turn it on

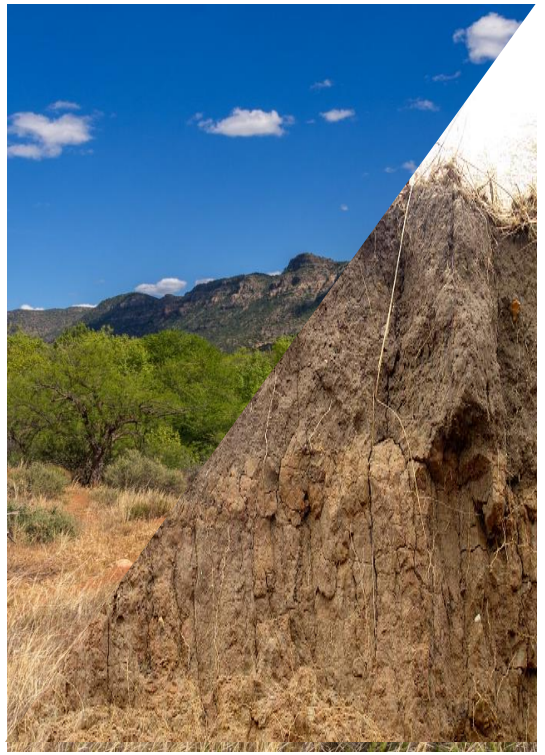
1 Joule = 1000 Millijoules

Image Source: US Dept of Labor- https://www.osha.gov/green-jobs/hydrogen/fire-explosion#:~:text=lower%20flammability%20limit.-,Hydrogen%20used%20in%20the%20fuel%20cells%20is%20a%20very%20flammable,that%20a%20flame%20is%20present.

Image Source: https://www.flickr.com/photos/jsjgeology/49952867917

A campfire can reach up to 1650 ℉ (900℃), with an average temperature being 900 ℉ (482℃). Many of our ceremonies require outdoor fires (e.g. Ndaa' and Yei Bi Chei)

On the NN (27,000 sq. miles) there are only 8 individuals who are HAZMAT certified, who could potentially respond to an incident. In comparison, 1 fire dept in Las Vegas has 15 individuals who are HAZMAT certified (106 sq. miles).



Topsoil ranges from 2-10 inches. Recovery time varies for topsoil. Generally, it takes 1,000 years to generate 3 centimeters of topsoil. Some studies have found that full reestablishment of perennial plant cover took 76 years in disturbances like fire, land clearing and road building.

The developers have said that people and communities will not be able to build in the ROW area, however, activities like grazing can continue.

Pipeline Infrastructure

Current Pipeline Infrastructure in the U.S.

Currently, there is only 1,600 miles of hydrogen pipeline in the U.S., while natural gas pipeline networks make up 3 million miles. This will be Tallgrass/Greenview's first hydrogen pipeline.

Pipe Material

Austenitic stainless steels, aluminum (including alloys), copper (including alloys), and titanium (including alloys) are generally applicable for most hydrogen service applications. High-strength steels (above 100 ksi) are more susceptible to hydrogen embrittlement, so the use of thicker, low-strength steels is sometimes recommended for hydrogen pipelines. Polymer/fiberglass-reinforced pipes have been used in specific applications such as for in-plant piping at moderate temperatures. As is the case with natural gas pipelines, welding is the preferred joint technology for hydrogen pipelines.

Pipeline Corrosion

This is the oxidisation and electrochemical breakdown of the structure of a pipe used to convey any substance. It is the leading cause of failure in onshore transmission pipelines in the U.S. More research is needed to determine what the appropriate coating, inhibitors, and odorants would protect against embrittlement. Hydrogen pipeline embrittlement occurs when atomic hydrogen diffuses into the base metal leading to brittle and fractured metal, esp. to high strength steel.

Causes of Incidents

Corrosion, excavation damage, human error, material failure, natural force damage, other outside force damage, and all other causes.

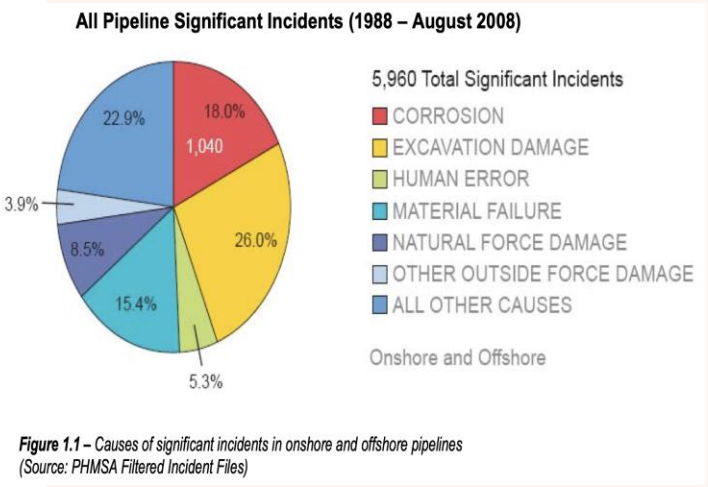
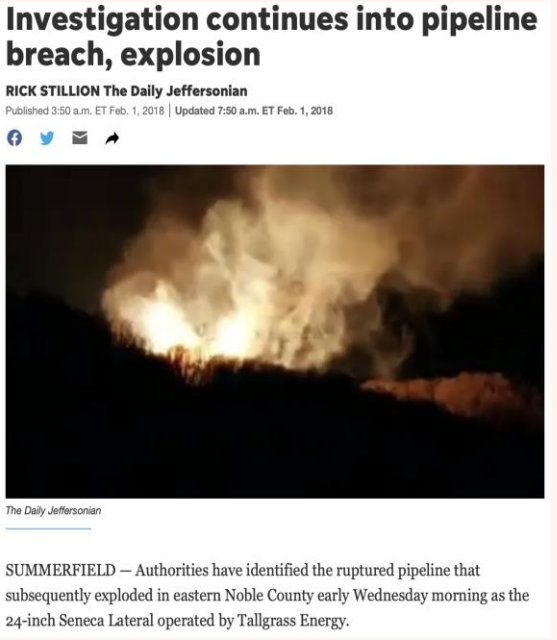


Figure 1.1 – Causes of significant incidents in onshore and offshore pipelines (Source: PHMSA Filtered Incident Files)



Investigation continues into pipeline breach, explosion

RICK STILLION The Daily Jeffersonian

Published 3:50 a.m. ET Feb. 1, 2018 | Updated 7:50 a.m. ET Feb. 1, 2018

The Daily Jeffersonian

SUMMERFIELD — Authorities have identified the ruptured pipeline that subsequently exploded in eastern Noble County early Wednesday morning as the 24-inch Seneca Lateral operated by Tallgrass Energy.

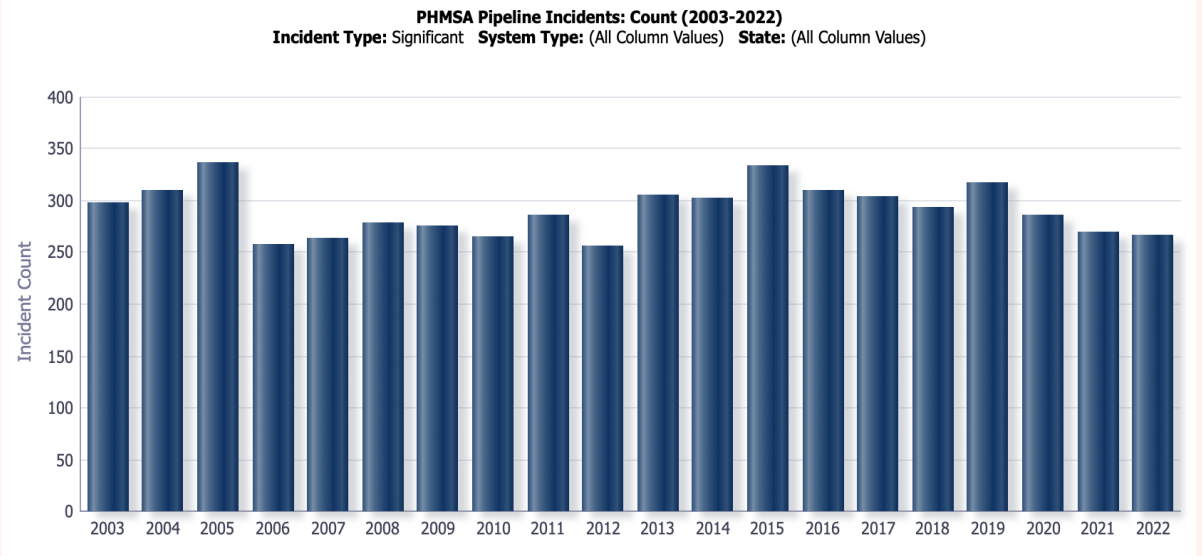


Image Source: U.S. Dept of Transportation Pipeline and Hazardous Materials Safety Administration

Pipeline Monitoring

Leakage

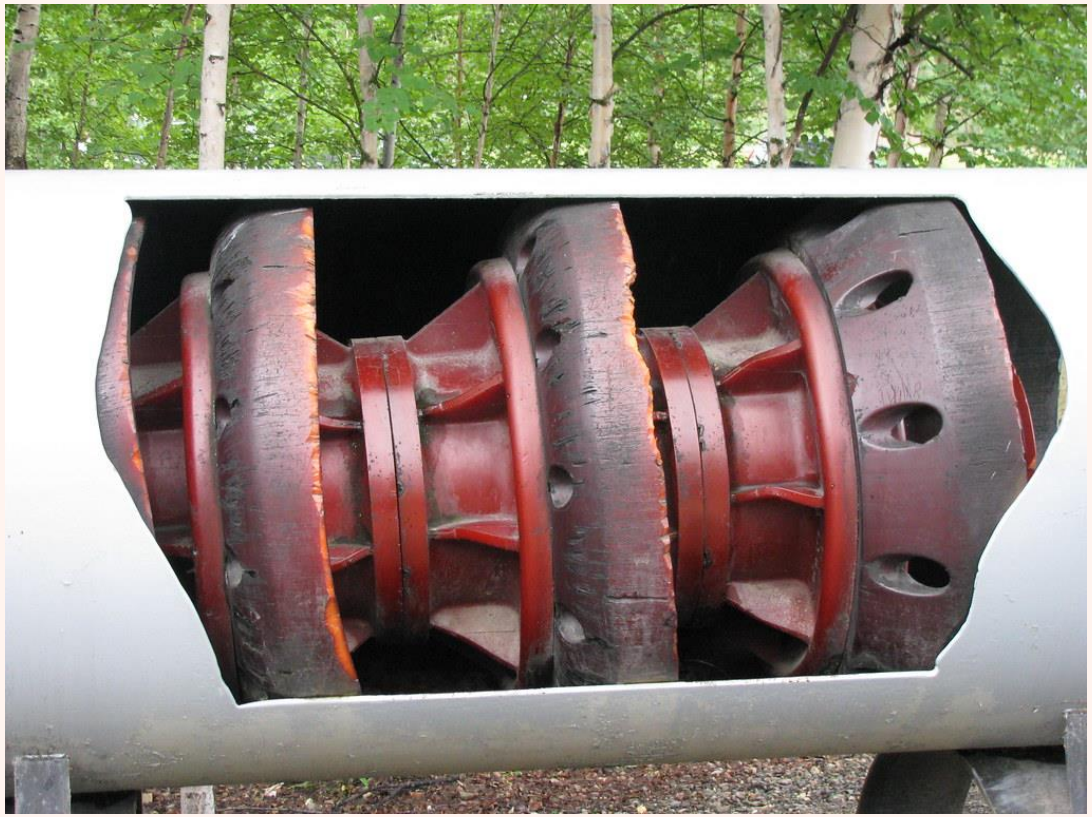
Being a small atom and 8 times lighter than methane, hydrogen is more “slippery” than natural gas, and more likely to leak.

Pipeline Inspection Gauges or Gadgets (PIG)

PIG operation is a common practice in the petroleum and gas industry. It is applied to inspect and clean the pipeline. Currently, GreenView representatives have indicated that their PIG will monitor the pipeline bi-annually, checking the structural integrity and for leakages. Is this good enough?

PIG Failure Report *

Greenview representatives have indicated that they have conducted a risk assessment, and the risk of an incident is the same as a person getting hit by lightning (1 in 15,300).



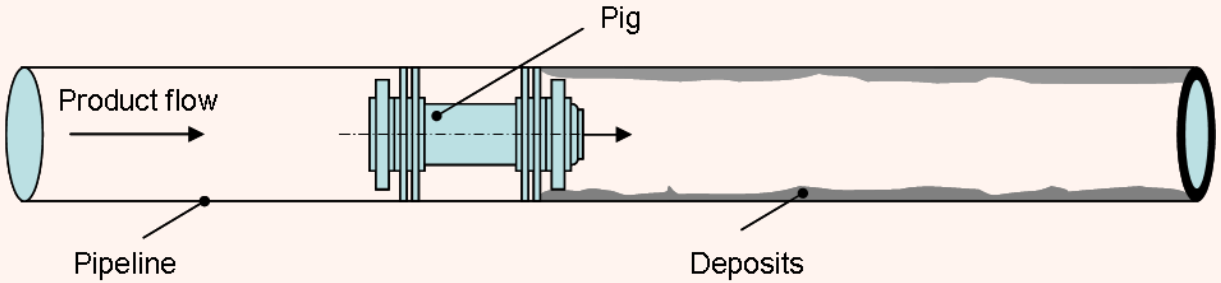


Image Source: https://en.wikipedia.org/wiki/File:Cleaning_pig_in_a_pipeline.png
Image Source: https://www.flickr.com/photos/arthur_chapman/3925456879

Hydrogen Pipeline Regulations

Navajo Nation Regulations

Navajo Nation Minerals Department- does not have hydrogen regulations or laws for generation, transportation, or consumption of hydrogen gas.

2013 Navajo Energy Policy- has no hydrogen section and only encourages infrastructure development such as pipeline.

State Regulations

Arizona Corporation Commission (ACC)- does not have hydrogen pipeline regulations.

Public Regulatory Commission (PRC)- defers to CFR 49

Federal Regulations

U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA)- CFR 49 Part 192- Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards

Example: "Each operator shall maintain, modify as appropriate, and follow the plans, procedures, and programs that it is required to establish under this part"

Example: 192.615 Emergency Plans-Each operator shall establish written procedures to minimize the hazard resulting from a gas pipeline emergency. At a minimum, the procedures must provide for the following…Establishing and maintaining adequate means of communication with the appropriate public safety answering point (*i.e.,*9-1-1 emergency call center)

Conclusion: The company hasn't given specifics about the pipeline and it's hard to determine what safety standards apply

U.S. Environmental Protection Agency (EPA)- Does not have regulations for hydrogen; EPA does have mandates for hydrogen production units that are owned by a petroleum refinery who must report their greenhouse gas emissions.

Bureau of Land Management (BLM)- Does not have regulations;

Federal Energy Regulatory Commission (FERC)- Does not have regulations; representative indicated that FERC laws have been made out crisis

Off-Takers, Resource Export, and Exploitation

Off-Taker

The Navajo Nation is <u>not</u> currently an off-taker therefore not a direct beneficiary. Tallgrass has identified potential off-takers in Yuma (agriculture) and the Las Vegas Hub.

Raw Resource Export

Poor countries with small economies export raw materials for example, cocoa, iron ore, and raw diamonds. Rich countries export (at a higher price than the poor countries) more complex products such as chocolate, cars, and jewels. If poor countries want to get rich, they should stop exporting their resources in raw form and concentrate on adding value to them. Otherwise, rich countries will continue to stay rich and on top of that creates better jobs for their people.

Exploitation of Land

SHINe partner ASU have stated that the Navajo Nation is ideal because of its "significant presence of available [and] undeveloped land". Navajo Nation is only acting as a transportation corridor for the pipeline displacing future local economic development along Hwy 160.

2030s Southwest H2 Vision (Inclusive of GV & Third-Party Pipelines)

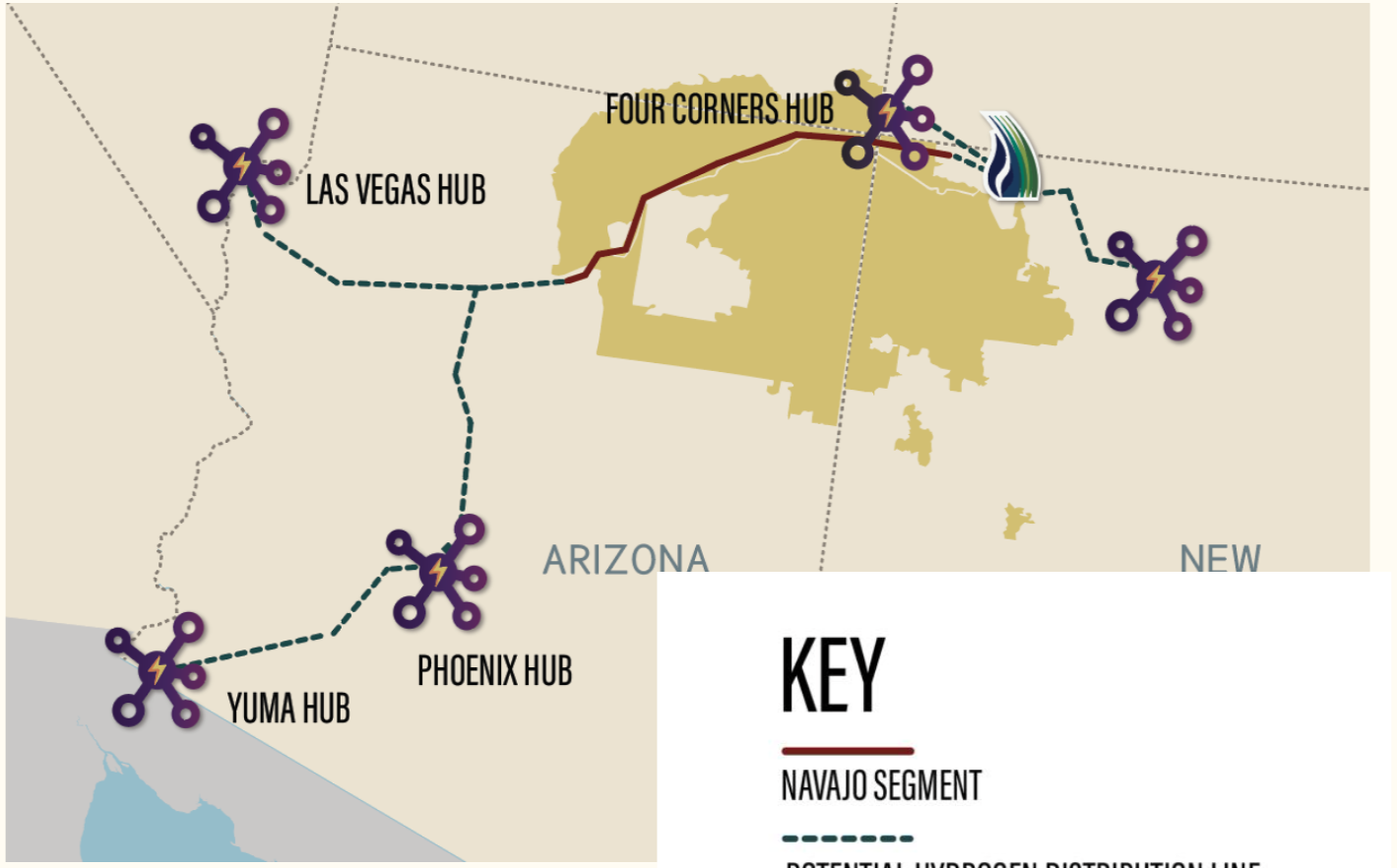


Image Source: (Both) Greenview/Tallgrass

Water

Hydrogen production requires massive water use.

The Navajo Nation, located in the desert Southwest, has been in a decades-long Mega Drought, so water is very scarce.

Navajo water sources are not only limited, but also compromised due to industrial contamination, climate change, etc.

About 30% of Navajo households still struggle with access to clean running water.

The Navajo Nation should be opposed to more industrial water uses due to its water scarcity.

Water Challenge

REUTERS® World Business Markets Sustainability Legal Breakingviews Technology Invest

Climate & Energy | Environment | Water Management | Renewable Fuels | Refining

Biden's green hydrogen plan hits climate obstacle: Water shortage

By **Valerie Volcovici**

July 3, 2023 11:47 AM MST · Updated 2 months ago

[1/4] Liquified petroleum gas vessel Zita Schulte is seen docked at the port of Corpus Christi, Texas, U.S., May 15, 2023. The Gulf Coast port is in the running for up to $1 billion available under President Joe Biden's 2021 Infrastructure Investment and Jobs Act to create a regional hub to produce *Acquire Lice*... **Read more**

- According to a Rystad Energy analysis, “Nine of the 33 projects on the Department of Energy’s shortlist for hydrogen hubs are in highly water-stressed regions.” New Mexico being one of those regions.
- Water use for hydrogen production. Hydrogen needs long-term access to water. Project developers have not stated where they will get the water and for how long these water sources will be used. Many water sources on Navajo especially in the Northern regions are limited or compromised due to contamination, drought, climate change, etc. This should make Chapters hesitant or opposed to more industrial use of water.

Water Use In Hydrogen Production

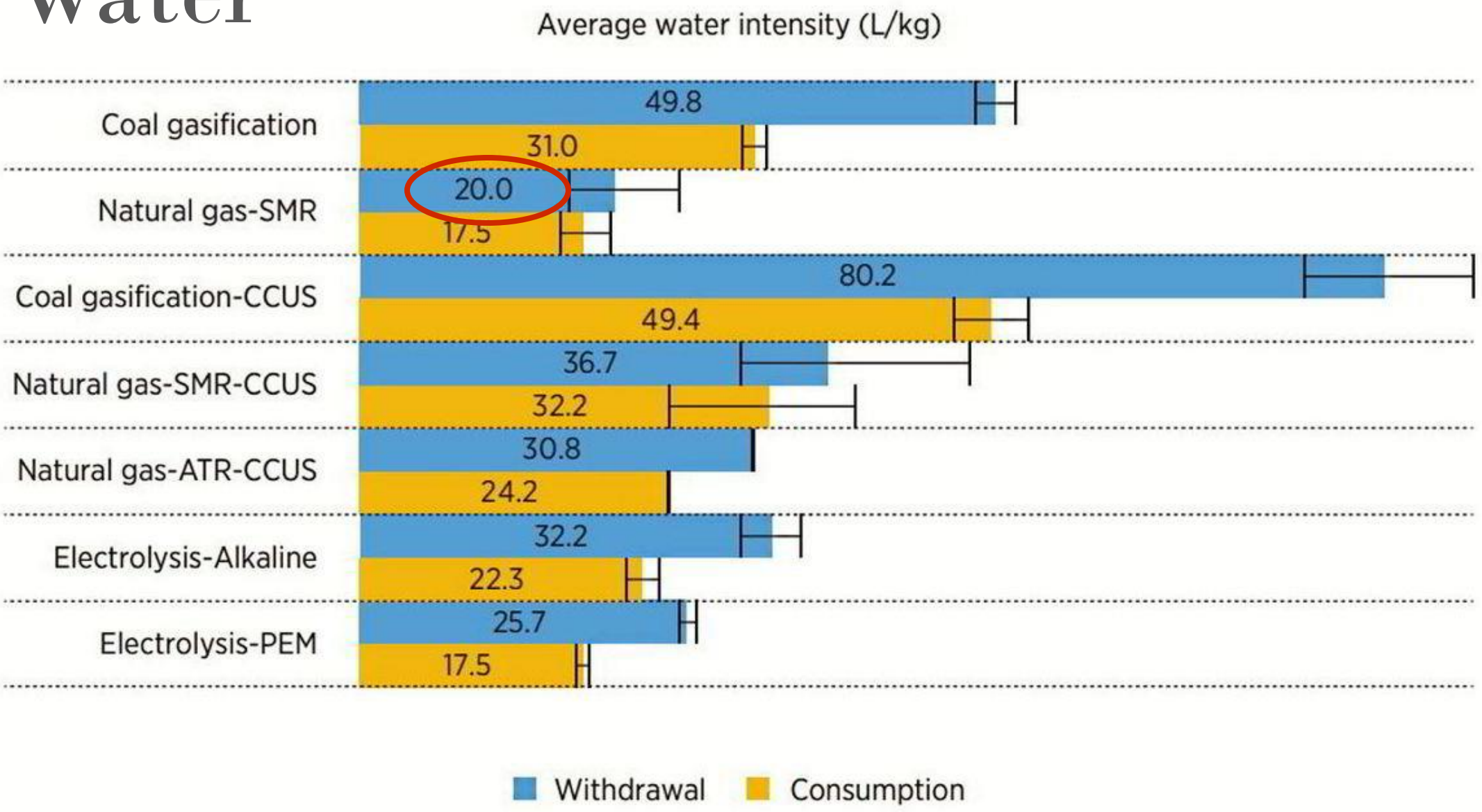
Image Source: https://www.flickr.com/photos/sfupamr/14601885300

Current hydrogen production from fossil fuels uses a considerable amount of water to produce steam and for cooling. Renewable hydrogen production requires a similar, if slightly higher amount of water for the process of electrolysis. On top of that carbon capture and storage (CCS) systems increase hydrogen production's water demand*. Since renewable hydrogen requires large amounts of renewable energy, and the best renewable wind and solar resources are often found in desert regions, water use by hydrogen projects has been raised as a concern.

If water is scarce, the best option would be to find a way to avoid producing one kilogram of hydrogen, instead focusing on direct electrification of sectors and only prioritizing green hydrogen for niche hard to decarbonize sectors where electrification is just not feasible.

*Depending on CCS technology (post-combustion CCS, Pre-combustion CCS, Direct Air CCS, and Bioenergy with CCS) the water footprint of CCS ranges from 0.74 to 575 m^3 (195.487 to151,899 gal) H2O/ton of CO2. The widespread deployment of CCS to meet the 1.5 C climate target would almost double anthropogenic water footprint.

Water

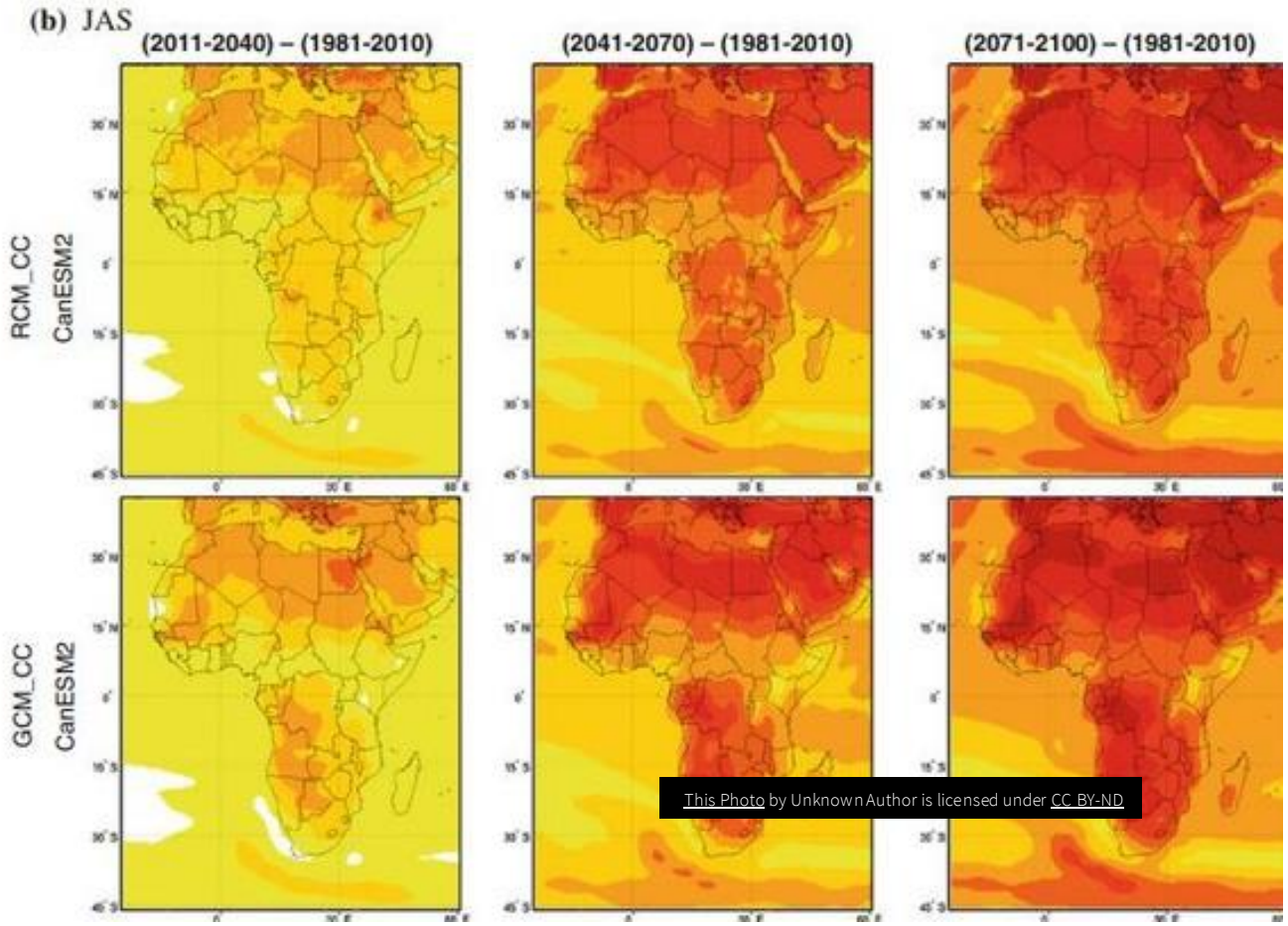

Average water intensity (L/kg)
Coal gasification
49.8
31.0
Natural gas-SMR
20.0
17.5
Coal gasification-CCUS
80.2
49.4
Natural gas-SMR-CCUS
36.7
32.2
Natural gas-ATR-CCUS
30.8
24.2
Electrolysis-Alkaline
32.2
22.3
Electrolysis-PEM
25.7
17.5
Withdrawal
Consumption

Water Example

It's **20 Liters of water per kilogram of hydrogen** specifically for SMR/blue hydrogen. 20 L = 5.28 gallons, so ~5 gallon per 1 kg of hydrogen. **One 55-gallon barrel will create about 11 kg of hydrogen**. The biggest blue hydrogen plant in the US will come online in 2026, located in Louisiana, this energy complex will make **1,773,049 kg** of hydrogen per day. So, the amount of water it will use is about nine million (**9,367,799.8652**) gallons or one hundred and seventy thousand (**170,323.634**) 55-gallon barrels per day. This is enough water to meet the average need of **31,226 households** in the US (per day). On Navajo, NTUA gives services to about 45,000 homes, so the water needs for the Louisiana project could cover 75% of the households on Navajo.

1 of these ⇨ creates ~ 11 kg of blue hydrogen

Image Source of water barrel: https://www.uline.com



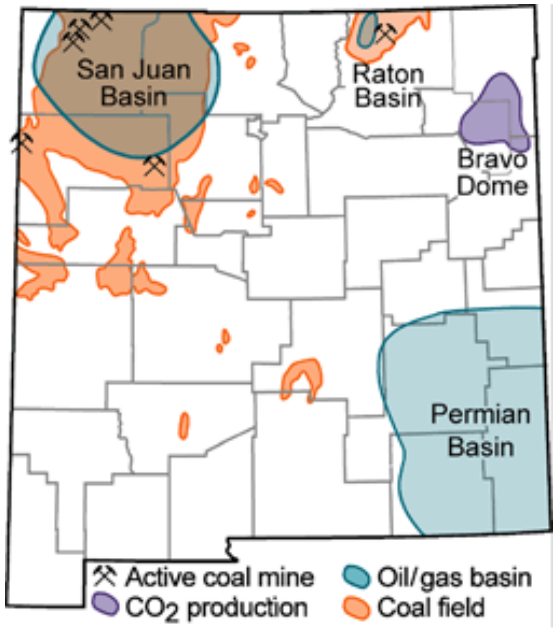
Climate Change & Global Warming

Blue & Grey Hydrogen Production uses fossil fuels of natural gas and methane, causing more Greenhouse Gas Emissions that increase Global Warming of our Mother Earth.

1: Blue/Gray Hydrogen Production Includes Methane Extraction

- The feedstock for blue and gray hydrogen is methane gas, 95% of all current hydrogen production in the U.S. is considered blue or gray. Hydrogen developers are is currently looking at producing hydrogen from natural gas in the 4 Corners region/San Juan Basin.

- Methane is the second most abundant greenhouse gas and 25 times as potent as carbon dioxide at trapping heat in the atmosphere. Methane emissions are responsible for nearly a third of the total warming the planet has experienced so far. Human activities like industrial agriculture and fossil-fuel production have dumped millions of metric tons of additional methane into the atmosphere. The concentration of methane has more than doubled over the past 200 years.



New Mexico Producing Basins, image courtesy of the New Mexico Bureau of Geology and Mineral Resources

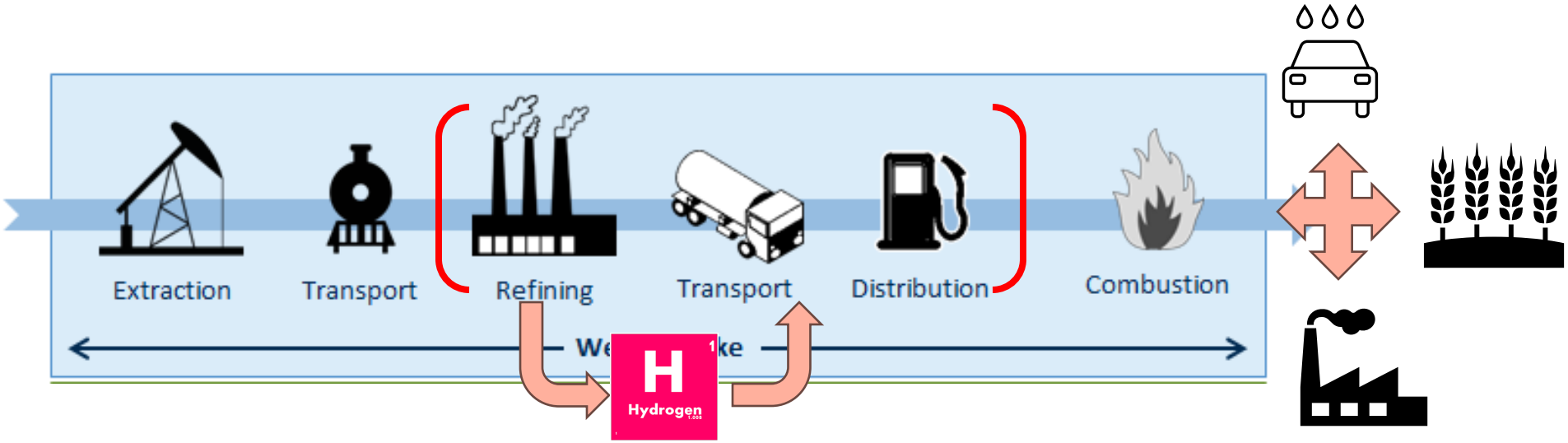
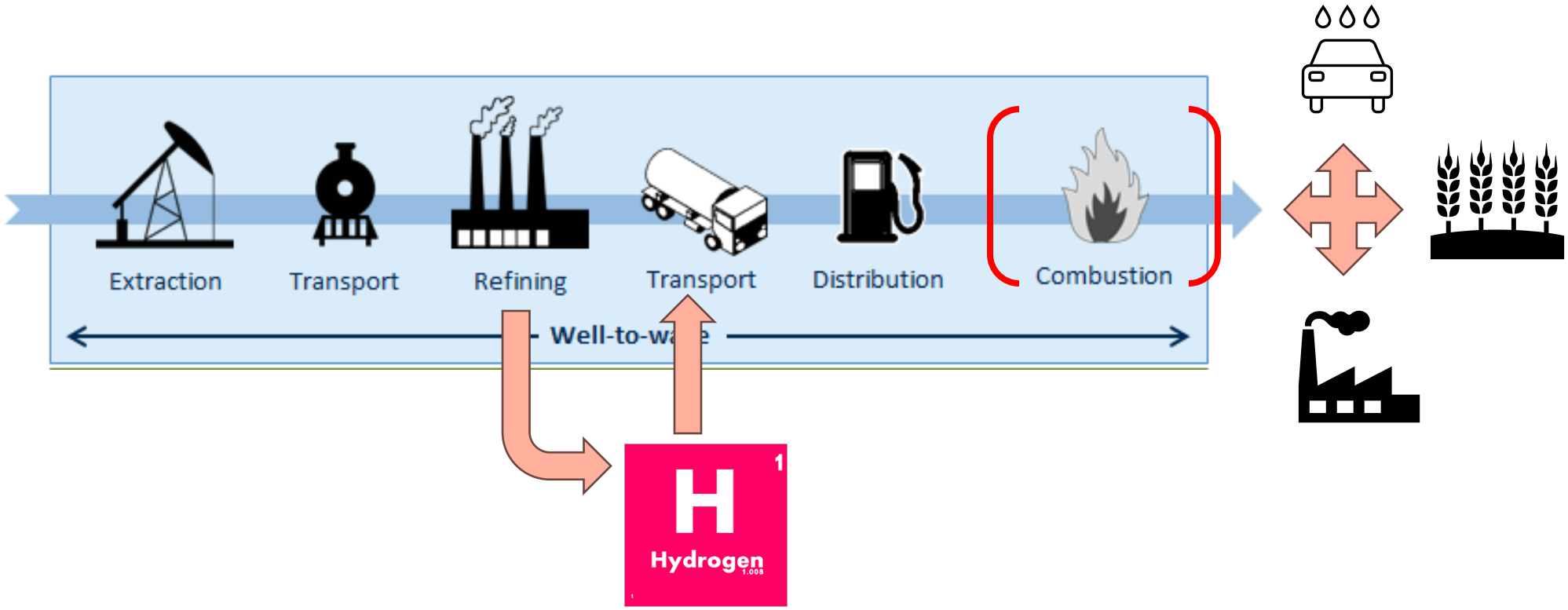


Image Source: https://www.icao.int/environmental-protection/Pages/AltFuels_LifeCycle-Box.aspx
Modifications by: Jessica Keetso



2: Hydrogen Combustion

- Combusted hydrogen to produce electricity or power industrial process, burns very hot. That heat drives oxygen and nitrogen in the atmosphere to form NOx, a pollutant that creates smog and harms public health while also contributing to global warming. This effect is considered to represent 20% of the warming potential of hydrogen. According to the EPA, nitrous oxide molecules stay in the atmosphere for an average of 121 years and the impact of 1 lb. of nitrous oxide on warming the atmosphere is 265 times that of 1 lb. of carbon dioxide.

3: Hydrogen Leakage

- Hydrogen is an indirect greenhouse gas. Hydrogen reacts with hydroxyl radicals and tends to increase tropospheric methane and ozone and increases stratospheric water vapor. A study produced by climate scientists at the Oslo-based CICERO Centre for Climate Research has found that leaked hydrogen has a global warming effect around 12 times greater than emitted CO_2. This is because hydrogen has a significant amplifying effect on the warming impact of certain greenhouse gases like methane and ozone, even though it is not itself a greenhouse gas.

- Hydrogen released into the atmosphere also ends up transforming into water vapor in the stratosphere. While water vapor in the lower troposphere does not cause warming, vapor higher up in the atmosphere creates a greenhouse effect. According to IEER reports this accounts for about 30% of the warming potential of hydrogen.

Images Source: https://www.worldatlas.com/geography/what-is-the-atmosphere.html

Community

Although Hydrogen Developers began plans in 2021, they finally community engagement until Fall 2023.

Tó Nizhóní Ání began community engagement in 2021 with impacted chapters along the pipeline route.

9 of the 13 impacted chapters have passed Opposing Resolutions to Greenview’s proposed Hydrogen Pipeline through their communities.

In October 2023, the US Dept of Energy announced they did NOT select or fund the NM or AZ Hydrogen Hubs.

Community Consent

Nambia and Navajo have similar environmental injustice and community consent concerns

Ex: “The relationship between EU and African countries is not an uncomplicated one, and the search for renewable energy is no exception. Generally speaking, production of green hydrogen poses a large scale of risks…[including]…potential human rights violations and environmental concerns…[such as]…land-use conflicts, forced resettlement, and water scarcity...The biggest concern, however, is the export of renewable hydrogen to European countries without meeting the local needs first. Notably, only 35 % of Namibia’s population in rural areas has currently access to electricity. Yet, Namibia has signed memoranda of understanding for the export of green hydrogen…”- *Denisa Skládalová*

Navajo Chapter Resolutions

	Chapter Name (Impacted Chapters in Bold):	Date Passed:	Opposing/Supporting Hydrogen:
1	Eastern Navajo Agency Council	03/05/2021	Opposing
2	Rocksprings	12/13/2021	Opposing
3	Sheepsprings/Tooh Haltsooi Council of Naataanii	12/16/2021	Opposing
4	To'Nanees'Dizi/Tuba City	03/05/2023	Opposing
5	Tolani Lake	05/15/2023	Opposing
6	Shiprock	06/08/2023	Opposing
7	Aneth	06/20/2023	Opposing
8	Teec Nos Pos	06/26/2023	Opposing
9	Beclabito	07/14/2023	Opposing
10	Sweet Water	09/15/2023	Opposing
11	Coalmine-Canyon	09/30/2023	Opposing
12	Red Mesa	10/12/2023	Opposing
13	Mexican Water	10/24/2023	Opposing
14	Kayenta	12/21/2023	Opposing
15	Tonalea	08/15/2024	Opposing
16	Dennehotso	09/20/2024	Opposing
17	Shonto	03/17/2024	Supporting
18	Hogback	02/18/2024	Supporting
19	Gadíí'ahí/TóKo'í	03/14/2024	Supporting
20	Cameron		No Resolution

NOTES RE: UNETHICAL PRACTICES

Hogback and Gadíí'áhí/Tóko'í Chapters had initially passed Opposing Resolutions; however, Greenview admitted offering gift cards to these chapter voters when Greenview's Supporting Resolutions were passed at these two chapters. Dooda (No) Hydrogen, a community grassroots group wrote a letter to the Navajo Nation calling out Greenview's offering of gift cards as unethical practices. NN-RDC Vice-Chairman Rickie Nez told Greenview to stop the gift card practices in an RDC meeting.

Navajo Chapters *Supporting* Hydrogen via Resolution: Notes of Unethical Practices

1. **Shonto** — *Passed on March 17, 2024;* ***We recommend rescinding due to possible conflict of interest (i.e., chapter official works for GreenView/Tallgrass)***
2. **Hogback** — *Passed although initially started off opposing the project;* ***We recommend rescinding due to unethical practices (i.e., bribery)***
3. **Gadii'ahi/To'koi** — *Passed although initially started off opposing the project;* ***We recommend rescinding due to unethical practices (i.e., bribery)***
4. Inscription House — ***Greenview/Tallgrass listed this chapter as supporting but the Chapter does not have a supporting resolution in their possession***

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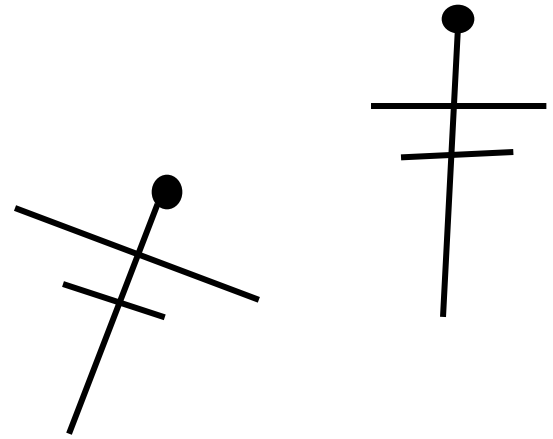

Questions?

You can find more info at our website

www.tonizhoniani.org

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