HYDROGEN AMERICAS SUMMIT

CO-HOSTED BY

sec Sustainable Energy Council

U.S. DEPARTMENT OF ENERGY

10 – 11 OCTOBER 2022 | WASHINGTON D.C., USA

COMMERCIAL STRATEGIES & PARTNERSHIPS TO DEVELOP CLEAN HYDROGEN

EXECUTIVE SUMMARY

Written by: **Kelly-Marie Tuthill,** Government Relations & Speaker Manager**, Sustainable Energy Council**

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#H2Americas Summit

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Introduction

The message delivered at this summit is clear, it is time for hydrogen to progress **from hype… to happening!** It is time to realise hydrogen as a tool to help meet our climate goals of net-zero carbon emissions by 2050. This goal is not something we can do alone. No government, no private company and no scientist can achieve this goal without a robust network of partnerships. There is no silver bullet, we will need all the technological innovation humanity can accomplish to meet the diversity of energy supply we need.

So how do we work together?

There is no harm in a little healthy competition to motivate governments, companies and researchers to develop the policies, projects and products we need to accelerate the clean hydrogen sector and drive down the cost of hydrogen to **$1** for **1kg** within **1 decade.** The main focus, however, should be on partnerships and knowledge sharing in order to scale up the industry to commerciality and provide the much needed energy security,

During the summit we learn the details of the **REPowerEU** initiative, launched in response to the invasion of Ukraine to wean Europe off Russia's gas because energy security is national security. We hear many speakers suggest that Europe is further down the road to realising the hydrogen economy yet our European colleagues repeatedly sing the praises of the $9.5bn dedicated to clean hydrogen in the **Infrastructure Investment and Jobs Act** and the $3/kg tax incentive for zero-carbon hydrogen in the **Inflation Reduction Act recently** passed in the U.S. Making it clear how much policies like this are highly sought after around the world.

Can we achieve our goals?

Not without challenges. We hear a detailed case study on how Costa Rica has achieved a clean energy ecosystem utilising hydrogen to decarbonise hard to abate sectors such as transportation. We reflect upon the Hindenburg disaster, has this damaged the reputation of hydrogen? Perhaps it has, but we have the experience, the technological advancement and the demand to build public trust and position hydrogen as the fuel of the future.

Here at the **Sustainable Energy Council** we believe in the ingenuity of the leaders in the hydrogen sector, from R&D, to investment, to entrepreneurship and government leadership.

Thank you!

We would like to thank the **U.S. Department of Energy** for being our co-host, our speakers for the valuable insights they provided and finally we would like to thank you for your commitment to developing hydrogen in the Americas and the world.

We look forward to hosting the industry again in **Washington, D.C.** in **2023** to strengthen the partnerships built this year and turn our hydrogen visions into reality.

See you next year!

COMMERCIAL STRATEGIES & PARTNERSHIPS TO DEVELOP CLEAN HYDROGEN

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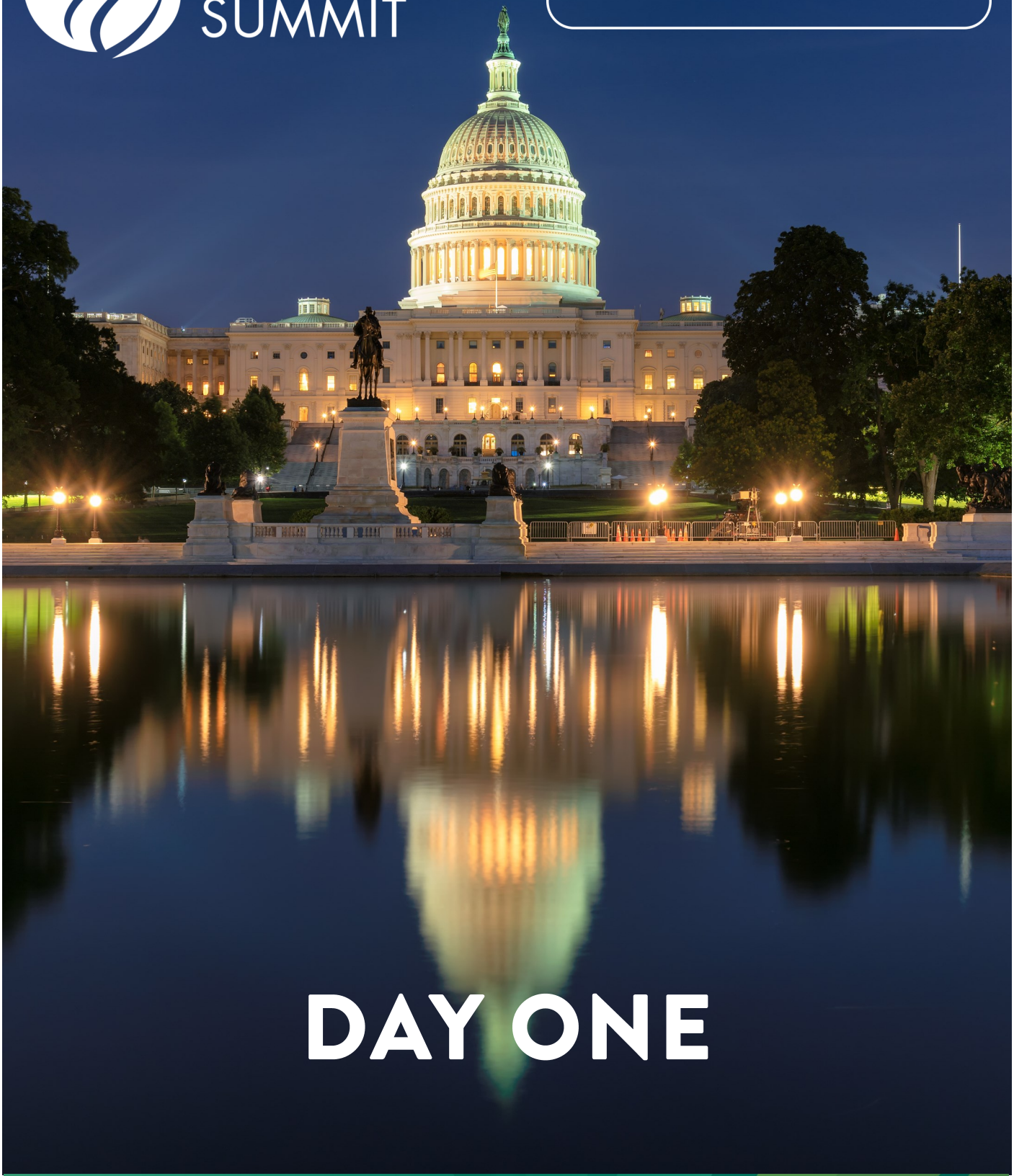

DAY ONE

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#H2Americas Summit

SUMMIT DAY ONE

OPENING KEYNOTE ADDRESSES

Catalina Zuliani, Product Director, **Sustainable Energy Council** sets the stage for the **Hydrogen Americas Summit 2022** by welcoming all participants to the historic city of Washington D.C. **Catalina** shares how the **Sustainable Energy Council** and the **U.S. Department of Energy** are excited to co-host this :

"International meeting to accelerate clean hydrogen projects, policies & partnerships."

Dr Sunita Satyapal, Director, Hydrogen and Fuel Cell Technologies Office, **Office of Energy Efficiency and Renewable Energy** and DOE Hydrogen Program Coordinator, **U.S. Department of Energy** is welcomed to the stage by Catalina as the "Mother Theresa of Hydrogen". **Dr Satyapal** thanks the team who have organised the event before she asks the audience to raise their hands to show how long they have been in the hydrogen industry. She welcomes those new to the hydrogen family and thanks long timers for their commitment informing us she has quarter of a century of experience.

The Hon. Jennifer Granholm, Secretary of Energy, **U.S. Department of Energy** takes the stage. First, she thanks **Dr. Satyapal** comparing her to the hydrogen atom itself "small but mighty". **Secretary Granholm** shared they have $8 billion for clean hydrogen hubs, $1.5 billion for electrolysers, and tax credits to incentivise production of clean hydrogen. **Secretary Granholm** also stressed the need for energy security as economic security as we fight both climate change and navigate the changes to energy supply since Putin's invasion of Ukraine and stressed the need for global collaboration to build resilient supply chains in democratic nations.

"Its probably the most exciting and critical time for hydrogen"

Dr. Sunita Satyapal, Director, Hydrogen and Fuel Cell Technologies Office, **Office of Energy Efficiency and Renewable Energy** and DOE Hydrogen Program Coordinator, **U.S. Department of Energy**

"Our goal is to get clean hydrogen down to the cost of $1 for 1kg within 1 decade"

The Hon. Jennifer Granholm, Secretary of Energy, **U.S. Department of Energy**

SUMMIT DAY ONE

OPENING KEYNOTE ADDRESSES

Ali Zaidi, National Climate Advisor and Assistant to the President, **White House Climate Policy Office** thanks **"Gigawatt Granholm"** for her introduction and work as **Secretary of Energy** to the **United States of America**. He begins by addressing when he first engaged in hydrogen as a fuel source for the clean energy transition with the small ambition that hydrogen could transform the economy by repowering forklifts yet now we see hydrogen as an essential tool in decarbonising hard to abate sectors. He thanks participants for the change they have ushered by investing in hydrogen and believing in the development of technology that has led to the growth in potential uses for hydrogen today. Finally, he lays out the Biden administration's approach to the energy transition:

3 Key Points to "set the course to save the planet"

1. **Decisive Decade "This is a no excuses moment in the history of the world"**
2. **Made in America "Let us sprint in our decisive decade and build that future"**
3. **Empower Workers & Communities "Core to the DNA of Biden's Climate Action"**

"An exciting frontier region, Newfoundland and Labrador is the most easterly point in North America and home to abundant natural resources.

Strategic location for hydro, wind, wave, solar and hydrogen development, our province is thriving and set for expansion."

The Honourable Andrew Parsons, KC
Minister of Industry, Energy and Technology, Member for Burgeo – La Poile,
Newfoundland and Labrador

The Honourable Andrew Parsons, KC gives us an overview of the historic, industrial and cultural aspects of **Newfoundland and Labrador** setting the scene for the region which has larger onshore wind capacity than most offshore projects and has the second highest run off of fresh water in Canada, meaning there is no need for desalination, abundant salt caverns for storage, high ESG, effective legal systems which provides certainty for shareholders. Finally **Newfoundland and Labrador** is strategically positioned between North America and Europe.

SUMMIT DAY ONE

OPENING KEYNOTE ADDRESSES

The Hon. John Bel Edwards, Governor of Louisiana, **United States of America** conveys why he believes Louisiana is the key location in the USA to invest in hydrogen. We go on to learn that Louisiana's economy has relied heavily on oil and gas, making this also a significant part of their cultural identity despite being the state most heavily impacted by climate change. Louisiana is the only Gulf South State with a commitment to have net-zero carbon emissions by 2050 and a climate action plan in place to achieve this. **Governor Edwards** acknowledges that the energy transition is being driven by the private sector, in fact, a project to produce hydrogen from natural gas with carbon capture in the state has already been announced by **Air Products.** He invites participants to visit the state a see for themselves why this is a key location to invest in hydrogen.

"We are absolutely certain that hydrogen energy is going to be an important part of Louisiana's future and that Louisiana will be an important part of hydrogen energy's future."

The Hon. John Bel Edwards, Governor of Louisiana, **United States of America**

AIR LIQUIDE: HYDROGEN ACCELERATING THE ENERGY TRANSITION

Adam Peters, Chief Executive Officer**, Air Liquide North America** is the first Private Sector speaker to take to the stage. He opens his Keynote Address by informing us that **Air Liquide** also has a thriving business in Louisiana which connects to the previous Keynote Address delivered by the **Governor of Louisiana.**

"The US Gulf Coast is one of the World's leading hydrogen production basins. Air Liquide produces nearly 5 billion cubic metres a year of hydrogen in the US annually and well over half of this is in the US Gulf Coast"

Adam Peters, Chief Executive Officer**, Air Liquide North America**

He goes on to identify other areas in the Americas where Air Liquide have hydrogen projects including Las Vegas, Nevada where they have the largest liquid hydrogen plant in the world . **Air Liquide** also have strategic projects in Canada and Latin America and are pursuing projects in Chile to decarbonise hard to abate sectors. He predicts that by 2030 in the US alone, hydrogen the could support 700,000 total jobs across the value chain, which has the power to transform communities. This puts hydrogen at the heart of America's clean energy ecosystem.

SUMMIT DAY ONE

SESSION 1

CLEAN HYDROGEN LEADERS IN THE AMERICAS: PROJECTS, POLICIES & INVESTMENTS

CHAIR
Julie Cerqueira, Principal Deputy Assistant Secretary, Office of International Affairs**,**
U.S. Department of Energy

PANELISTS
Adam Peters, CEO, **Air Liquide North America**
Geoff Tuff, U.S. Hydrogen Practice Leader**, Deloitte**
Dan Yankowski, President**, Linde Gases North America**
Matt Murdock, CEO, **Raven SR**

Julie Cerqueira chairs **Session 1** which brings together senior representatives from some of the leading companies in the clean hydrogen sector to discuss projects, policies and investments critical to transform the Americas energy landscape and fulfil the goal of cutting the cost of clean hydrogen to **$1** per **1 kilogram** in **1 decade.**

Following short introductions by each speaker, **Julie** kicks off the discussion stating that **hydrogen has been hyped before,** and asking, **what is different now that is going to help us overcome some of the barriers to adopting clean hydrogen at scale?**
The key takeaway from the panelists here is that the demand has increased along with collaboration between the public and private sector. Incentive packages such as the funding provided by the **US Government** in the **Inflation Reduction Act** are a key driver to making it much more attractive to investors.

So, **what is driving the demand, is it consumers, is it the energy crisis?**
Dan acknowledges that whilst there has always been a demand, with the invasion of Ukraine impacting the demand for ammonia to produce food, hydrogen is a feedstock for ammonia that can help solve this problem.
Geoff is keen to ensure that to attract investment you need to solve the problems for the end users.
Matt shares how due to the fears of energy security that being able to produce energy locally and help the local community solves multiple problems simultaneously.
Adam raises the key point that hydrogen can solve problems in decarbonising mobility such as maritime and rail that battery vehicles cannot solve, which helps create the markets that make sense as advised by **Geoff.**

The panelists conclude that there is no one silver bullet and there will be different solutions in different regions which requires collaboration between governments and the various companies along the supply chain.

"We have to shift from an old world of thinking about competitive advantage to working together across industries, across public private partnerships to create what we think of as collaborative advantage or adaptive advantage."

Geoff Tuff, Sustainability and Climate Leader for Energy, Resources & Industrials | U.S. Hydrogen Practice Leader**, Deloitte**

SUMMIT DAY ONE

SESSION 2

ACCELERATING NEW BREAKTHROUGH TECHNOLOGIES & LOWERING COSTS

CHAIR
Andrew Hinkly, Managing Partner, **AP Ventures LLP**

PANELISTS
Rick Beuttel, VP of Hydrogen Business, **Bloom Energy**
Bernhard Voll, Senior Technical Expert**, SMA Sunbelt Energy GmbH**
Alex Savelli, Managing Director, Hydrogen Technologies - Americas**, Cummins**
John Oyen, Manager of Business Development, Energy Industries**, ABB Process Automation**
Robert T. Do., M.S., M.D., Chief Executive Officer, **SGH2 Energy Global Corporation**

Andrew Hinkly is the chair of **Session 2** where the panel discuss what actions are needed by the main stakeholders and the key challenges in the built environment with clean tech innovation.

The panel commences with each speaker providing an overview of their background and the evolution and sources of the technologies at each of their companies, some spanning over 70 years. Panelists agree that there is no one solution to the problem of transitioning to clean energy, which echoes the words of other sessions we have heard so far. They agree that we will need to embrace all the technologies available, including technologies yet to be invented because diversity of supply is crucial and as demand increases this will enable the projects to scale up to an industrial level. The panel reiterate how the **Inflation Reduction Act** will contribute to the growth of the hydrogen industry along with the **Infrastructure Investment and Jobs Act**

We dive deep into the specific plans and strategies that these organisations have in order to meet the targets laid out earlier by **Secretary Granholm**, in the short term for clean hydrogen costs to be **$2** per **kilogram,** with the long term goal to get clean hydrogen down to the cost of **$1** for **1kg** within **1 decade.**
Rick informs us that for **Bloom Energy,** 3/4 of the cost for electrolyser hydrogen is the cost of renewable electricity.
Alex reveals that **Cummins** have a goal to reduce the cost of electrolysers by 50%.
John enlightens us that **ABB** have developed software that can help meet this target.
Bernhard from **SMA Sunbelt Energy GmbH** provides examples from the dramatic reduction in cost for solar technologies over the past 20 years which makes it clear, whilst there are challenges the goal I still within reach.
Robert of **SGH2 Energy Global Corporation** adds the need to drive down the cost of storage and transportation.

The discussion makes it clear that in order to achieve this ambitious target there is a lot of work to do, but if the whole ecosystem works together across the supply chain, these targets can be met.

"We have the technology. We have the believers in the technology. We have the industry which believes in the market. We have the financiers who want to finance them. And, finally, we have the governments who understood that we need to do something about climate change"
Bernhard Voll, Senior Technical Expert**, SMA Sunbelt Energy GmbH**

SUMMIT DAY ONE

SPOTLIGHT: U.S. GOVERNMENT INITIATIVES FOR CLEAN HYDROGEN

So far, the message has been abundantly clear that to reach the goal of getting the cost of clean hydrogen down to **$1** for **1kg** within **1 decade** there will need to be a collaborative effort, not just between the various private companies along the supply chain, or the investors, but from government too. We have already heard about the **$9.5bn** dedicated to clean hydrogen in the **Infrastructure Investment and Jobs Act** and the **$3/kg** tax incentive for near zero-carbon hydrogen in the **Inflation Reduction Act.** This emphasises the importance of our Spotlight session on the **U.S. Government initiatives for Clean Hydrogen** with the following distinguished speakers:

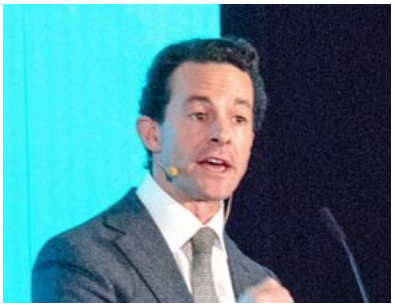
- **Dr Sunita Satyapal,** Director, Hydrogen and Fuel Cell Technologies Office, **Office of Energy Efficiency and Renewable Energy** and DOE Hydrogen Program Coordinator, **U.S. Department of Energy**
- **David Livingston,** Senior Advisor, Office of the Special Presidential Envoy for Climate, **U.S. Department of State**
- **Christine Harada,** Executive Director, **Federal Permitting Improvement Steering Council**

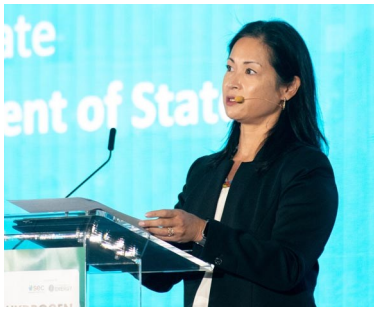
"No one can whistle a symphony. It takes a whole orchestra to play it.- H. Luccock"

Dr Sunita Satyapal
Director, Hydrogen and Fuel Cell Technologies Office,
Office of Energy Efficiency and Renewable Energy
DOE Hydrogen Program Coordinator, **U.S. Department of Energy**

"No Government alone can catalyse the change that we need to take place across the clean energy economy."

David Livingston, Senior Advisor, Office of the Special Presidential Envoy for Climate, **U.S. Department of State**





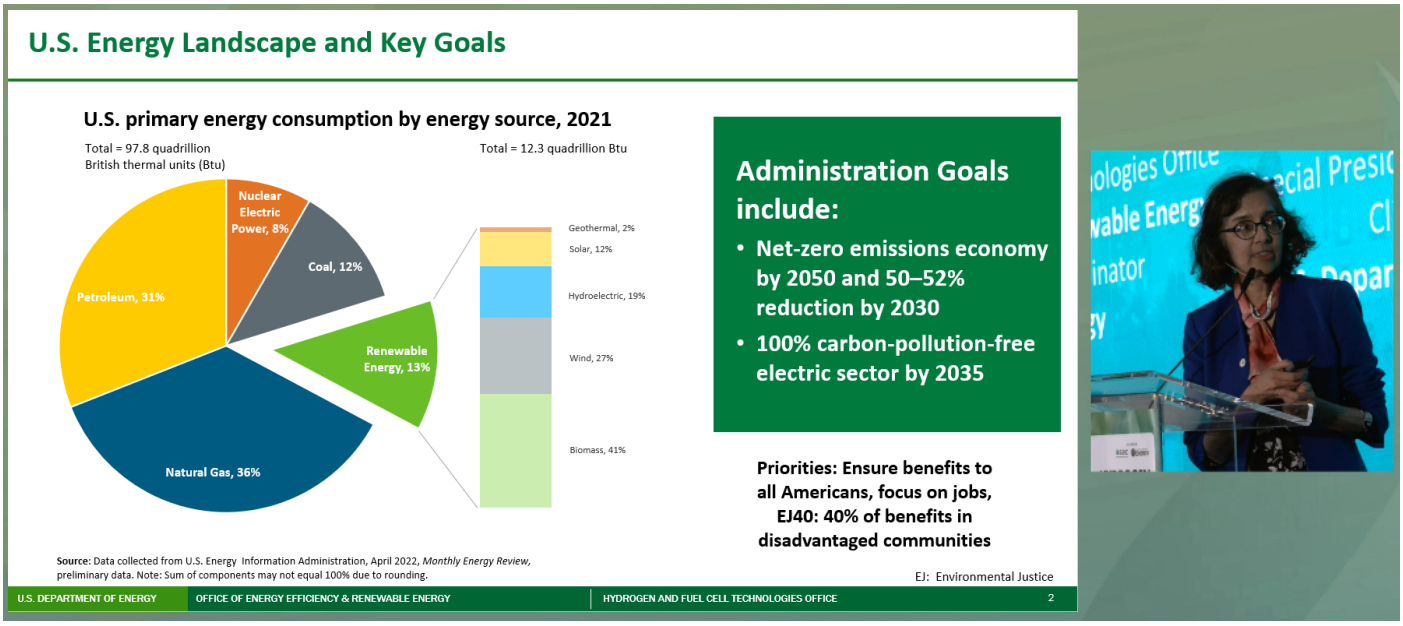
"[Hydrogen] is absolutely vital to accomplishing President Biden's goals of 100% clean electricity grid by 2035 and net-zero carbon emissions by 2050."

Christine Harada, Executive Director, **Federal Permitting Improvement Steering Council**

SUMMIT DAY ONE

SPOTLIGHT: US GOVERNMENT INITIATIVES FOR CLEAN HYDROGEN

Dr Sunita Satyapal, Director, Hydrogen and Fuel Cell Technologies Office, **Office of Energy Efficiency and Renewable Energy** and DOE Hydrogen Program Coordinator, **U.S. Department of Energy**



Dr. Satyapal shares a short presentation covering the **U.S. Department of Energy's** national goals, and highlights the urgency in which they need to be achieved given the climate crisis, energy security, economic concerns and of course, the war in Europe.

Dr. Satyapal breaks down the 3 main pillars of the **U.S. Department of Energy's National Clean Hydrogen Strategy and Roadmap.**

1. **Target strategic, high-impact end uses**
2. **Reduce the cost of clean hydrogen**
3. **Focus on regional networks**

Finally, **Dr. Satyapal** stresses the importance of collaboration both nationally and internationally.

The Hydrogen and Fuel Cell Technologies Office have developed an online resource called **H2 Matchmaker** that helps connect hydrogen producers, end-users and other stakeholders to facilitate regional clean hydrogen hubs and support the private sector. This will be a useful tool to help build partnerships whilst applying for the Hydrogen Hubs FOA.

H2 Hubs Funding Opportunity Announcement (FOA)

FOA Released

6 to 10 H2 Hubs for a combined total of $6B to $7B

Concept papers due 11/7/22
Full applications due 4/7/23

Submit any questions:
h2hubs@hq.doe.gov

SUMMIT DAY ONE

SPOTLIGHT: US GOVERNMENT INITIATIVES FOR CLEAN HYDROGEN

David Livingston, Senior Advisor, Office of the Special Presidential Envoy for Climate, **U.S. Department of State**

David Livingston shares how despite working for the government, a lot of his work is paradoxically focused on:

"Enabling and empowering and unleashing private sector ingenuity, capital formation, investment and innovation, in the clean hydrogen economy through novel public private partnerships."

David reports on his recent trip with **Secretary Kerry** who chaired **President Macron's One Planet Sovereign Wealth Fund Summit.** There were $37 trillion in assets under management from some of the largest institutional investors in the world. This summit focussed on three pillars, one of which was clean hydrogen.
He then goes on to explain the **First Movers Coalition,** a partnership between the 10 governments (including the U.S.), the World Economic Forum and 55 members from leading global corporations with the initiative to decarbonize hard to abate sectors such as: Aluminium, Aviation, Chemicals, Concrete, Shipping, Steel, and Trucking . These sectors represent over 30% of global carbon emissions today.

He echoes the sentiments shared by **Bernhard Voll**, Senior Technical Expert**, SMA Sunbelt Energy GmbH** in the previous session by showing the Solar cost journey and how additional funding of **$5bn** could have driven costs down by almost 50% in 5 years between 1985 and 1990, avoiding the decades it took to achieve commerciality.

The **First Movers Coalition** are ready to bring credit worthy counter parties that can lead to real offtake agreements for clean hydrogen in this decade.

SUMMIT DAY ONE

SPOTLIGHT: US GOVERNMENT INITIATIVES FOR CLEAN HYDROGEN

Christine Harada, Executive Director, **Federal Permitting Improvement Steering Council**

Christine Harada's role at The Permitting Council is to ensure that hydrogen can become a reality, to partner with companies, to implement projects and assist with permitting them to start producing green hydrogen.

The agency was created to make the permitting process more collaborative, better coordinated, more transparent and efficient. There are 18 different infrastructure sectors under the Permitting Council. Hydrogen is one area that is currently lacking representation on the permitting dashboard. The FPISC is very uniquely positioned to bring all the stakeholders to the table.

So how does it work? See below for the **FAST-41 Funding and Transfer Authority.**

- FAST-41 establishes the **Environmental Review Improvement Fund**, which is available to the Executive Director to administer, implement, and enforce the Act.
- IIJA expanded this authority to expressly include staffing the Office of the Executive Director (OED), and to support of the role of the Permitting Council as a **"Federal center for permitting excellence,"** including supporting interagency detailee and rotation opportunities, advanced training, enhanced support for agency project managers, and sharing information and lessons learned.
- The Executive Director also **may transfer funds to Federal agencies, and state, tribal, and local governments** to facilitate timely and efficient environmental reviews and authorizations for covered projects.

SUMMIT DAY ONE

SESSION 3

HYDROGEN GLOBAL SUPPLY CHAINS: LINKING AMERICAS WITH GLOBAL PARTNERS

CHAIR
Andy Steinhubl, Chairman, **Center for Houston's Future (CFH)**

PANELISTS
Dr. Fiona Simon, CEO, **Australian Hydrogen Council**
Randolf Weterings, Senior Program Manager New Energy System, **Port of Rotterdam**
Sean Strawbridge, CEO, **Port of Corpus Christi Authority**
Benoit Chedal-Anglay, Commercial Director Americas – Global Solutions, **Axens**

Session 3 commences with a Keynote Address by **Fiona Simon,** followed by a series of presentations delivered by each panelist before **Andy Steinhubl** leads the panel discussion.

Andy Steinhubl has participated in multiple initiatives on creating the Greater Houston Hydrogen Hub
Dr. Fiona Simon delivers a frank Keynote, emphasising energy security as integral to national security and how crucial a functional supply chain will be utilising hydrogen as a tool for food security and finally how vital global collaboration is to make it happen.
Benoit Chedal-Anglay addresses the imbalance between producers and consumers of hydrogen by suggesting alternative carriers to ammonia such as MethylCycloHexane (MCH). He echoes **Fiona** regarding the need for cross-border trade flows.
Randolf Weterings educates us that the **Port of Rotterdam** is the largest seaport in Europe with 50% of their total throughput being energy based which delivers 30% of Europe's total energy demand. **Port of Rotterdam** believe that 90% of their hydrogen will come from import by 2050 and expect until 2030 ammonia will be the main carrier for hydrogen. **Randolf** agrees with **Fiona** on the importance of hydrogen hubs and global collaboration.
Sean Strawbridge discusses cultivating hydrogen at scale with the **Port of Corpus Christi** being the largest export gateway for U.S. produced energy. **Sean** anticipates that with the current situation with Russia, manufacturing will migrate from Europe to nations with more stable energy security, thus enhancing the remarks by **Fiona** at the start of the session quoted here.

"The need for diversity of supply has become so clear this year. In a world where oil and gas can be (and are) used by hostile nations as bargaining chips, using the sun and wind to make electricity - and storing and exporting it as hydrogen and its derivatives - fundamentally supports nations' and regions' energy, economic and national security "

Dr. Fiona Simon, CEO, **Australian Hydrogen Council**

SUMMIT DAY ONE

SESSION 3

HYDROGEN GLOBAL SUPPLY CHAINS: LINKING AMERICAS WITH GLOBAL PARTNERS

CHAIR
Andy Steinhubl, Chairman, **Center for Houston's Future (CFH)**

PANELISTS
Dr. Fiona Simon, CEO, **Australian Hydrogen Council**
Randolf Weterings, Senior Program Manager New Energy System, **Port of Rotterdam**
Sean Strawbridge, CEO, **Port of Corpus Christi Authority**
Benoit Chedal-Anglay, Commercial Director Americas – Global Solutions, **Axens**

Andy Steinhubl opens the discussion with a **question around the importance of export access from the standpoint of the development of regional hubs.**

Fiona is first to respond by illustrating how exports are the key driver in Australia, particularly to Japan, Taiwan and South Korea. Although it is more difficult, it is likely that we will need to replace LNG with hydrogen where possible. The USA will need to produce hydrogen domestically and decarbonise their hydrogen. We see some healthy competition between **Australia** and **Port of Corpus Christi** over their exports to Japan.

Sean invites us to consider how energy is now more important from a geo-political standpoint revealing that Japan is now investing more in its' military than ever before due to tensions in the region and are looking for a reliable source to provide energy imports. These demands cannot be met solely by the USA especially given the impact of the war in Europe on global energy supply.

Benoit addresses the prediction that by 2050 a third of hydrogen worldwide will be delivered by North America, another third will be China and the last third will be the rest of the world, meaning there will be room for everyone to export hydrogen. Once again the notion that there is no one silver bullet enters the discussion.

Randolf acknowledges how more regions are starting to focus on hydrogen. **Port of Rotterdam** has been working with **Port of Corpus Christi** since early 2020 prior to the Biden administration's incentives and want to Import hydrogen from Texas by 2026. However, there are some barriers to this, such as the certification system which needs to be standardised internationally.

> **"There is no sovereignty that can survive without energy. "**
>
> **Sean Strawbridge,** CEO, **Port of Corpus Christi Authority**

As we move into the audience Q&A, panelists discuss the steps needed to convert existing infrastructure to be used for hydrogen and what changes will be needed. Once again we hear how the **IIJA** and **IRA** will help with this and shows the U.S. Government is taking this seriously. One delegate asks, **"is there a strategy so we [U.S. Ports] don't compete against each other but we cooperate and be more strategic?"**

Sean confirms that the **American Association of Port Authorities** recognises that energy transfer ports provide a critical role in the national economy.

SUMMIT DAY ONE

FIRESIDE CHAT

AIR PRODUCTS: VISION FOR A GLOBAL HYDROGEN ECONOMY

David Livingston, Senior Advisor, Office of the Special Presidential Envoy for Climate, **U.S. Department of State**

Seifi Ghasemi, Chairman, President and Chief Executive Officer, **Air Products**

"If you are serious about climate change we cannot rely on electrification to solve the problem."

Seifi Ghasemi
Chairman, President and Chief Executive Officer
Air Products

David Livingston who shared his work on the **First Movers Coalition** during the **Spotlight** on **US Government Initiatives for Clean Hydrogen** takes on the role of session chair for the **Fireside Chat** on **Air Products' Vision for a Global Hydrogen Economy** with **Seifi Ghasemi,** Chairman, President and Chief Executive Officer, **Air Products,** the world's largest supplier of hydrogen.

During this session we revisit some key themes that come to the surface repeatedly throughout the summit.

Once more it is clear that hydrogen will play a large role in decarbonizing hard to abate sectors, something both **Air Products** and the **First Movers Coalition** are focused on.

Seifi Ghasemi reiterates the significance of the funding dedicated to clean hydrogen in both the **Infrastructure Investment and Jobs Act** and the **Inflation Reduction Act.** Further solidifying government cooperation through incentives and public private partnerships are fundamental to accelerating the hydrogen economy and achieving net zero targets. The main obstacle, however, is driving the demand.

David Livingston

"If you had a number one ask, to governments and to the private sector players out there to generate the demand signals that are needed, what would you ask?"

Seifi Ghasemi

**"Very simple, please put in a Global Carbon Tax.
A Global Carbon Tax will take care of the demand immediately."**

SUMMIT DAY ONE

SESSION 4

GLOBAL PARTNERSHIPS & INTERNATIONAL STANDARDS TO FACILITATE TRADE

CHAIR

Kristine Wiley, Vice President, Hydrogen Technology Center**, GTI Energy**

PANELISTS

Johannes Wieczorek, Deputy Director-General, Climate Change Mitigation in Mobility and Environmental Protection**, German Federal Ministry of Digital and Transport**

Rich Gottwald, President & CEO, **Compressed Gas Association**

Patrick Hartley, Leader**, CSIRO Hydrogen Industry Mission**

Dr. Amgad Elgowainy, Senior Scientist and Distinguished Fellow, **Argonne National Laboratory**

Kristine Wiley leads the discussion on **Global Partnerships & International Standards to Facilitate Trade**. The session goes further in depth on the existing partnerships bringing together speakers across the globe from the USA to Europe and to the Asia-Pacific region fostering the international collaboration that is imperative to accelerating the hydrogen economy and meeting our shared goal of net zero carbon emissions by 2050.

Johannes shares his answer to **Kristine's** first question: **what international partnerships are being developed to expand hydrogen's role in our energy system?** First, he makes it clear that Germany will remain a net importer of energy and with the Russian invasion of Ukraine they are actively seeking partnerships to diversify their energy supply. Second, he explains the double auction process for **H2Global** which has €900 million of government funding to help ramp-up the international hydrogen market. We discover there are discussions underway for a European Hydrogen Bank to provide investors with more certainty and finally we learn of the **REPower EU's** target to reach the goal of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of imports by 2030 which will require international partnerships.

CGA are based in North America, and develop standards here but their members are international companies. **CGA** participate in groups such as **ISO, IHC** and the **UN** with the goal to harmonise standards internationally which will be key for driving growth and giving companies confidence to engage in the industry. The **International Harmonization Council (IHC)** is supported by four regional associations: **Compressed Gas Association (CGA), Asia Industrial Gases Association (AIGA), European Industrial Gases Association (EIGA)** and **Japan Industrial and Medical Gases Association** (**JIMGA**).

> **"In order for us to really advance hydrogen we need a lot of collaboration and coordination across regions"**
>
> **Kristine Wiley,** Vice President, Hydrogen Technology Center**, GTI Ener-**

Patrick notes that **HySupply** is a partnership between Germany and Australia at the Feasibility Study phase. He also discusses Australia's involvement as a country we **IEA** and **IPHE** and the importance of sharing best practices internationally so we can develop together faster.

Dr. Elgowainy shares that the **DOE** hydrogen office is a prominent member of the **IPHE** with a task force called **Hydrogen Production Analysis** who develop and harmonise methods for carbon accounting of hydrogen to ensure the value is based on consistent methodology.

An audience member raises the concern that since there are no international standards yet some conflict each other and asks about global standardisation around permitting. **Rick** answers the question acknowledging there is a huge amount of work to be done before the international trade of hydrogen can become a reality.

SUMMIT DAY ONE

SESSION 5

COMMERCIAL OPPORTUNITIES FOR CLEAN HYDROGEN IN DECARBONIZING HARD TO ABATE SECTORS

CHAIR
Frank Wolak, President and CEO, **Fuel Cell and Hydrogen Energy Association (FCHEA)**

PANELISTS
James C. Kenney, Cabinet Secretary**, New Mexico Environment Department**
Eric Guter, Vice President, Hydrogen for Mobility, **Air Products**
David Burns, VP Clean Energy, **Linde**, SEC Hydrogen Advisory Board Member
Tomeka McLeod, VP Hydrogen, US**, bp**
Kristoffer Dahlberg, CFO and Director of BD & Origination (act.), **Aker Horizons Asset Development**

Frank Wolak chairs **Session 5** which begins with a Keynote Address from **James C. Kenney** who shares **New Mexico's** vision to **build a foundation for a thriving clean hydrogen economy that de-risks and values private sector investment.** New Mexico are providing low interest loans for the long haul trucking industry to close the financing gap. **James** shares their **Western Inter-State Hydrogen Hub** effort with Colorado, Utah and Wyoming encouraging the audience to meet with their representatives.
Tomeka shares the plans and strategies **bp** have to decarbonise hard to abate sectors. **bp** focus on 3 key areas for projects:

1. **Big industrial clusters where they have the opportunity to provide companies with carbon capture storage.** Earlier this year they announced an MOU with Linde to decarbonise their assets on the U.S. Gulf Coast.
2. **Opportunities to decarbonise their own assets.** 40% of their refining capacity is based on their U.S. refineries so they will look at CCUS here along with ways they can provide hydrogen to the surrounding local areas.
3. **Opportunities for bp to be an exporter.** They have an Australian Renewable Energy Hub which provides renewable energy domestically and exports hydrogen and ammonia to Asian markets. They will look at how they can replicate this project in the US.

David shares that **Linde** have the goal to reduce 35% of their emissions by 2035 and are looking to decarbonise their existing assets. They are developing the first hydrogen powered ferry in Norway, the first hydrogen powered train network in Germany and finally they are developing liquid fueling of heavy duty trucks.
Eric reveals that as far back as 2012/13 **Air Products** retrofitted two of their world scale grey hydrogen facilities with carbon capture and storage technology in conjunction with the **DOE.**
Kristoffer, like several other speakers throughout the summit, highlights the impact of the tragic events in Ukraine. The demand for importing energy from Norway has substantially increased since the invasion and one of the ways Norway can help their neighbouring countries in Europe is by exporting green ammonia.
As in **Session 4,** an audience member enquires with the panel on the timeline of getting assets permitted and there is a clear consensus that there is a lot of work that needs to be done to ensure the process is safe, efficient and streamlined so we can meet the 2050 net zero goal.

> **"Hydrogen is unique in that it is one of the few areas to achieve decarbonisation in hard to abate segments."**
>
> **Frank Wolak,** President and CEO, **Fuel Cell and Hydrogen Energy Association (FCHEA)**

SUMMIT DAY ONE

SESSION 6

CEO PANEL: OPPORTUNITIES IN FUTURE HYDROGEN MARKETS 5-10 YEARS

CHAIR
Sarah Jane (SJ) Maxted, CoS/COO Deloitte's public sector sustainability, climate and equity**, Deloitte**

PANELISTS
Matthew Blieske, CEO**, LIFTE H2**
Vasilis Gregoriou Ph.D., Chief Executive Officer & Executive Chairman of the Board, **Advent Technologies Holdings, Inc**.
Michael Perschke, CEO, **QUANTRON**
Richard Voorberg, President, North America, **Siemens Energy**

We draw the day to a close with a panel of CEO's who share their vision of what is needed to establish a functioning hydrogen supply chain and how we connect to end-user markets across the Americas.
SJ moderates a lively panel which provides us with lots of food for thought. Panelists agree that mobility and industrial sectors will be the first to decarbonise with hydrogen whereas power generation, shipping and aviation will take some time to progress. Throughout this panel we revisit some key themes that have been discussed in previous sessions, the opportunities, the challenges, the war in Ukraine and how **REPower EU** will help Europe transition away from Russia's Natural Gas supply and instead trade with the rest of the world. We hear how government grants are necessary and can help kickstart the sector, but private equity and venture capital funding must follow so the industry can scale up independently.

"If we do it right, in 5 years this is going to be a major industry."

Vasilis Gregoriou Ph.D., Chief Executive Officer & Executive Chairman of the Board, **Advent Technologies Holdings, Inc**.

"There is no supply chain right now to sell your product. You have to build it. That's a challenge, but its also an opportunity."

Matthew Blieske, CEO**, LIFTE H2**

"We can't make hydrogen an addict to government subsidies."

Richard Voorberg, President, North America, **Siemens Energy**

"What we need is an industrial policy which is independent of whatever party is ruling. Because at the end of the day we are in a global energy transformation. It's not local, it's one planet and if it burns on one side we see the effect on the other side."

Michael Perschke, CEO, **QUANTRON**

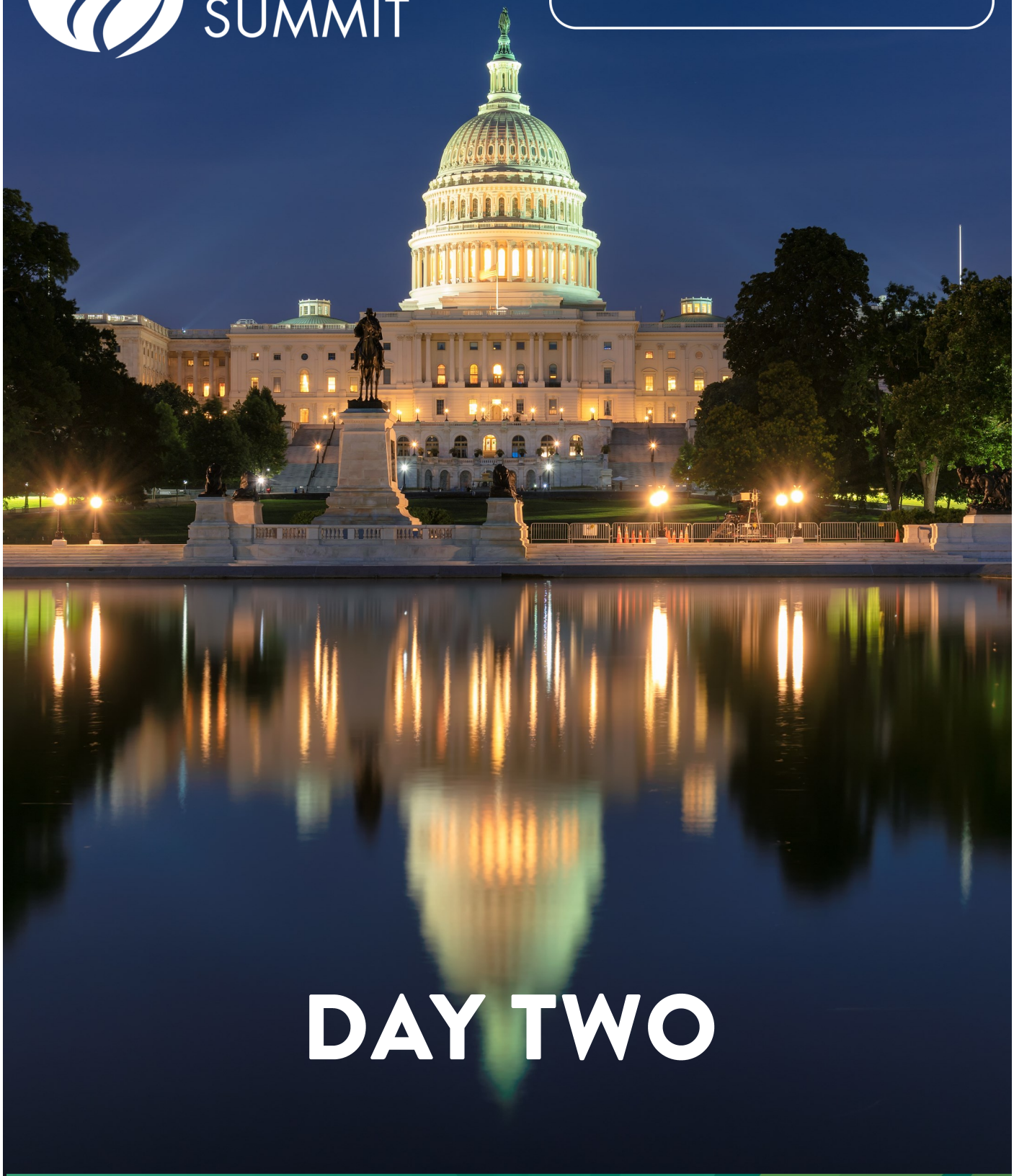
COMMERCIAL STRATEGIES & PARTNERSHIPS TO DEVELOP CLEAN HYDROGEN

HYDROGEN AMERICAS SUMMIT

CO-HOSTED BY

sec Sustainable Energy Council

U.S. DEPARTMENT OF ENERGY



DAY TWO

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SUMMIT DAY TWO

KEYNOTE ADDRESSES

Catalina Zuliani, Product Director, **Sustainable Energy Council** welcomes participants back for **Day Two** of the **Hydrogen Americas Summit. Catalina** summarises **Day One** where we heard from:

"Government and Private Sector Leaders on the policies and partnerships they are embarking on to develop hydrogen technologies, supply chains and global trade".

Finally **Catalina** outlines the schedule for **Day Two** before reminding guests to return their badges at the end of the day as part of our commitment to sustainability.

H.E. Stuart Richard Young, Minister of Energy and Energy Industries, **Government of Trinidad & Tobago** shares **Trinidad & Tobago's** history in the energy sector and their vision for the future. **Trinidad & Tobago** have been exploiting oil for over 100 years, and their gas industry is over 25 years old, so they have a hydrocarbon economy.

"We've become increasingly important in providing energy security. Not only for the region but we've been doing so at a global level."

Minister Young positions **Trinidad & Tobago** as a key player in the energy transition. In 2021 they were the 2nd largest ammonia exporter in the world. They are currently doing studies to see where carbon can be sequestered in the ground, and studies to see the capabilities of wind farms in the Atlantic and are preparing to sign off on a new solar project. This shows there are several opportunities to produce green hydrogen in **Trinidad & Tobago .**

Hon. Bruce Ralston, Minister of Energy, Mines and Low-Carbon Innovation, **Government of British Columbia** starts by reminding us of the key message delivered by **Secretary Granholm** in her Keynote Address on **Day One** and subsequently reflected in the panel discussions that followed:

"The U.S. Inflation Reduction Act is a Game Changer!"

We learn that **British Columbia** is the first province in Canada to release a comprehensive hydrogen strategy which includes direct support to stimulate production and partnerships with industry to establish hydrogen hubs.

The U.S. and Canadian governments are working together to standardise carbon intensity measures and streamline regulatory frameworks, focussing on key issues that were discussed throughout **Day One.**

SUMMIT DAY TWO

KEYNOTE SESSION:

EUROPE – AMERICAS HYDROGEN COLLABORATION & OPPORTUNITIES

Jon André Løkke, President, **Hydrogen Europe**, Board Member, **Nel Hydrogen**

We have heard the importance of global collaboration as a key focus point raised in almost every session on **Day One**, which shows the relevance of this Keynote Address on the collaboration between Europe and the Americas delivered by **Jon André Løkke**.

Jon covers in detail the **REpowerEU** plans before comparing the different approaches the **EU** and **US** have to reach the common goal of **net zero carbon emissions by 2050** which can be seen on the slide above.

Hydrogen Europe wrote a letter to **Ursula von der Leyen**, President, **European Commission** urging her to use the **US Inflation Reduction Act** as a shing example of how to accelerate the hydrogen sector, reiterating the praise the act has received throughout the summit thus far.

Jon shares how the support that **Nel Hydrogen** has received from the **U.S. Department of Energy** has been critically important to their success within PEM Electrolysis.

"You sitting here in this room are critically important to make sure that this is just a bit more than announcements, a bit more than just ambitions."

Jon André Løkke, President, **Hydrogen Europe,** Board Member, **Nel Hydrogen**

SUMMIT DAY TWO

SESSION 7

FINANCING THE AMERICAS CLEAN HYDROGEN DEPLOYMENT

CHAIR
Shannon Angielski, Principal, **Van Ness Feldman**, President, **Clean Hydrogen Future Coalition**

PANELISTS
Jigar Shah, Director, Loan Programs Office, **U.S. Department of Energy**
Nicole Faucher, CEO/CIO & Founder, **BEAM Capital LLC**
Bill Elrick, Executive Director, **California Hydrogen Fuel Cell Partnership**
Sarah Ladislaw, Managing Director of US Program, **Rocky Mountain Institute (RMI)**

Our first panel discussion of **Day 2** chaired by **Shannon Angielski,** investigates how we finance hydrogen projects in the Americas, starting with the **DOE's Loan Program** and where some of the gaps exist in the financing of the hydrogen ecosystem.

Jigar reminds us that the **DOE** has been working on this for several decades. He disagrees with previous speakers who have compared this to the solar industry as there are still genuine debates around what companies and technologies to use considering there are transport challenges with hydrogen that don't exist with solar. There is also the concern that if you burn hydrogen and ammonia incorrectly you get **NOx emissions which can be significantly worse than CO_2 emissions.**

Nicole explains how the current market is set up for shorter term investments and to move the needle on a clean hydrogen economy we need long term strategic capital from investors. She also believes the hydrogen industry needs to partner with the battery industry, however there are challenges here as batteries can catch fire.

Bill discusses what they have learned in California and how the policies and support mechanisms needed to start the market are different than the ones they are looking at to accelerate and scale up. He shares that whilst the annual grants were good in the beginning this didn't lead to the profitability needed to encourage businesses to invest long term. As a result they have launched their **Clean Transportation Program.**

Sarah calls to attention the fact that we are trying to do something very complex very quickly with the hydrogen economy means we have less time to look through the risks of various business models.

Following an audience question **Nicole** shares there is a lot of confusion in the investment industry around the risk return relationship regarding sustainability projects. We need to identify the right investors. The big corporate players need to work with the Wall Street Private Equity Infrastructure. **Jigar** agrees and advises we need to do **what it takes to get the technology across the bridge to bankability into full market acceptance.**

Bill suggests that by putting as much funding into fuel cells as we did for batteries we may entice manufacturers to come forward. He proposes that we need to move the infrastructure ahead faster so the hydrogen economy can progress.

> **"We can't reinvent the future energy of how we are going to power a better planet using yesterday's financing models."**
>
> **Nicole Faucher,** CEO/CIO & Founder**, BEAM Capital LLC**

SUMMIT DAY TWO

SESSION 8

HYDROGEN MOBILITY APPLICATIONS & SOLUTIONS IN LAND, SEA, AIR

CHAIR
Roxana Bekemohammadi, Founder & Executive Director, **United States Hydrogen Alliance**

PANELISTS
Rudolf Coertze, CTO**, ZeroAvia, Inc.**
Brady Ericson, President Fuel Systems and Aftermarket, **BorgWarner**
Brad Ring, President Clean Mobility, **Faurecia North America**
Lance Follett, Chief Legal Officer & Executive Vice President, **Westport Fuels**
Parker Meeks, President and interim CEO**, Hyzon Motors**

Roxana Bekemohammadi chairs the panel discussion which covers the opportunities hydrogen presents for decarbonization of the mobility sector.

Rudolf shares **ZeroAvia's** ambitious vision for the future of aviation to be carbon free by developing hydrogen and electric planes. They plan to use gaseous storage for planes within the next three years. The refueling time and rate is a challenge in the gaseous domain. Larger aircrafts will also find refulling time and rate challenging and will need a significant amount of liquid hydrogen. There is an emission question around boil off control and pressure control of the cryogenic tank particularly overnight when the aircraft isn't in use.

Parker provides an overview of **Hyzon Motors** long term goal of using liquid hydrogen to be the future lowest cost option for fueling trucks. They plan to have a 700 mile targeted demonstration of a liquid hydrogen fuelled truck by next year. **Hyzon Motors** cannot bring trucks to market without the full ecosytem in play.

Brady declares that anyone who uses a truck can be their customers. He also believes that we will need to use hydrogen as a fuel along with electric. They plan to convert existing fleets to **Hydrogen ICE** and that this will be the quickest way to get hydrogen on the road while liquid hydrogen is still in development.

Lance acknowledges the general consensus that we need to decarbonise now and trusts that fuel cells will play an important role in this. **Westport Fuels** have developed a lot of cyrogenic technology.

Brad announces that **Faurecia North America** is agnostic to fuel cells or ICE, they want to store the hydrogen and can work with all the companies on the panel. They work with virtual pipelines, delivering in containers, onboard storage and supplementing the network.

An audience member enquires regarding the safety of refueling stations. **Parker** answers, suggesting that it is likely that we will need professionals onsite to assist with the refueling as opposed to the driver refueling their own vehicle as we do with petrol or diesel.

"Safety is extremely critical."
Roxana Bekemohammadi
Founder & Executive Director
United States Hydrogen Alliance

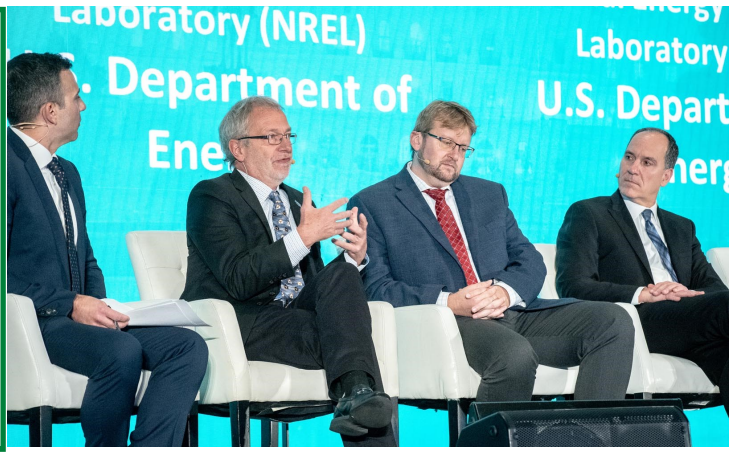
The Hindenburg disaster has been touched on multiple times during the summit, so it is integral for the hydrogen sector to ensure safe practice in order for it to thrive and for both end users and investors to buy in.

SUMMIT DAY TWO

SPOTLIGHT: U.S. RESEARCH LABS DRIVING HYDROGEN ADVANCEMENT

CHAIR
Jeff Marootian,
Senior Advisor for Energy Efficiency & Renewable Energy, Office of the Secretary, **U.S. Department of Energy**

SPEAKERS
Dr Martin Keller, Director, National Renewable Energy Laboratory (NREL), **U.S. Department of Energy**
Dr Brian Anderson, Director, National Energy Technology Laboratory (NETL), **U.S. Department of Energy**
Dr John Wagner, Director, Idaho National Laboratory (INL), **U.S. Department of Energy**



Without the world leading research conducted in laboratories in the U.S. we will not be able to realise our ambitions for hydrogen as a tool to decarbonise in the energy transition. This session shines a spotlight on the work that goes on in the National Laboratories with a short presentation by each director and audience Q&A.

"We feel there will be a lot of work needed to be done on the systems integration of hydrogen within our whole system."

Dr Martin Keller, Director, National Renewable Energy Laboratory (NREL)
U.S. Department of Energy

"There's an opportunity to provide economic revitalisation through the energy transition."

Dr Brian Anderson, Director, National Energy Technology Laboratory (NETL)
U.S. Department of Energy

"During periods of low cost or even negative pricing on the grid they [nuclear plants] can divert that energy into making hydrogen."

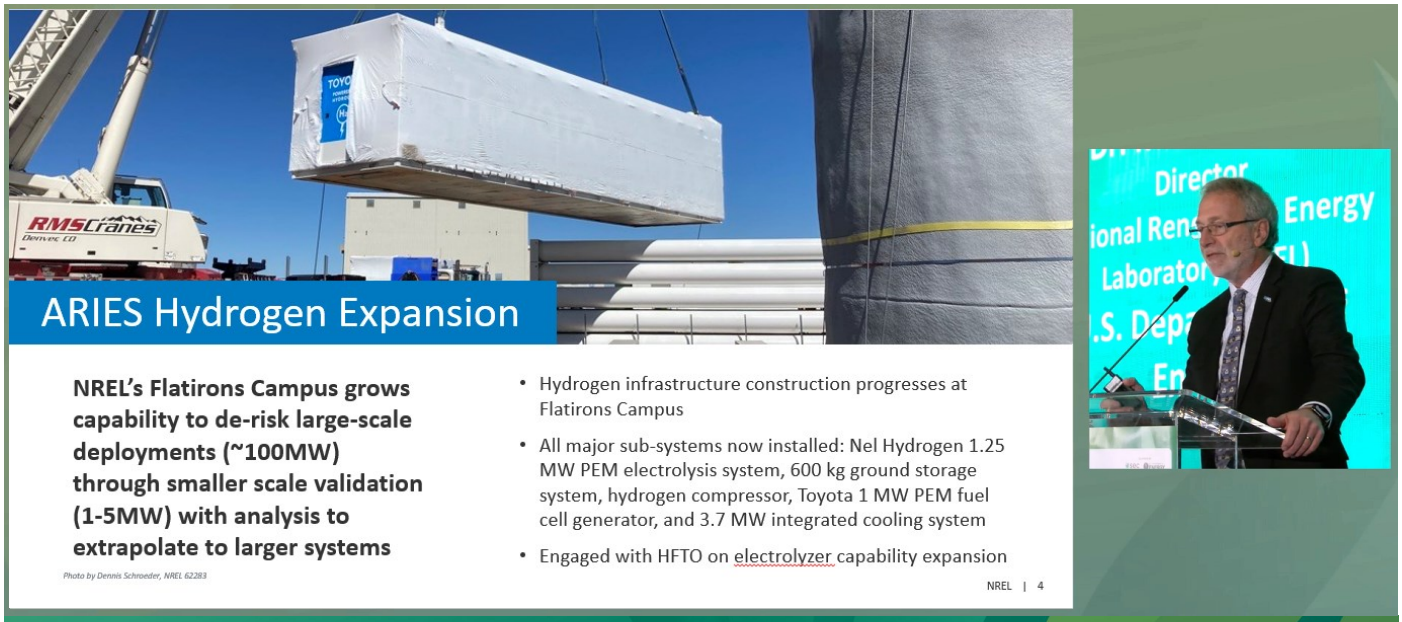
Dr John Wagner, Director, Idaho National Laboratory (INL)
U.S. Department of Energy

SUMMIT DAY TWO

SPOTLIGHT: U.S. RESEARCH LABS DRIVING HYDROGEN ADVANCEMENT

Dr Martin Keller, Director, National Renewable Energy Laboratory (NREL), **U.S. Department of Energy**

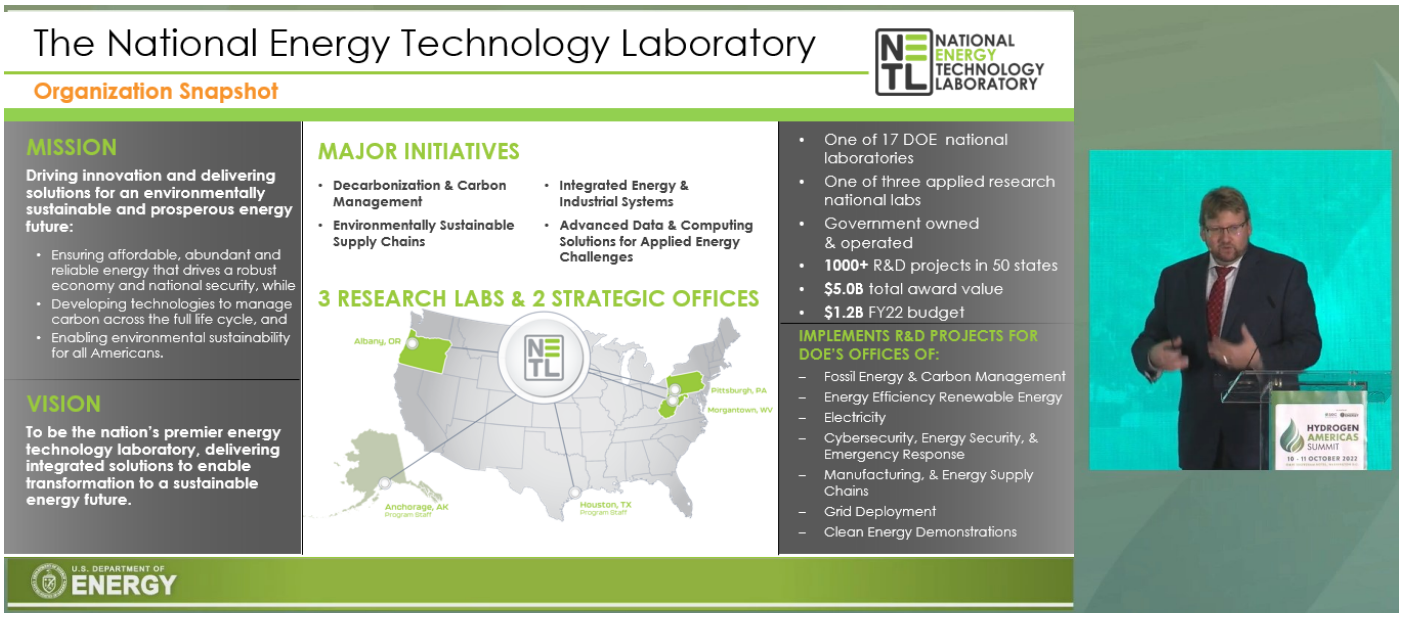
Dr Keller shares how the vision for producing hydrogen at scale has really taken off in recent years. He mentions the possible applications of hydrogen, from transportation to industry and also storage. **NREL** are focussed on accelerating the scaling up of hydrogen and you can see a snapshot of this in the slide above. **NREL** is collaborating with industry to help systems integration which is outlined in the slide below. Once again we hear that **"Partnerships are key for larger impact."**



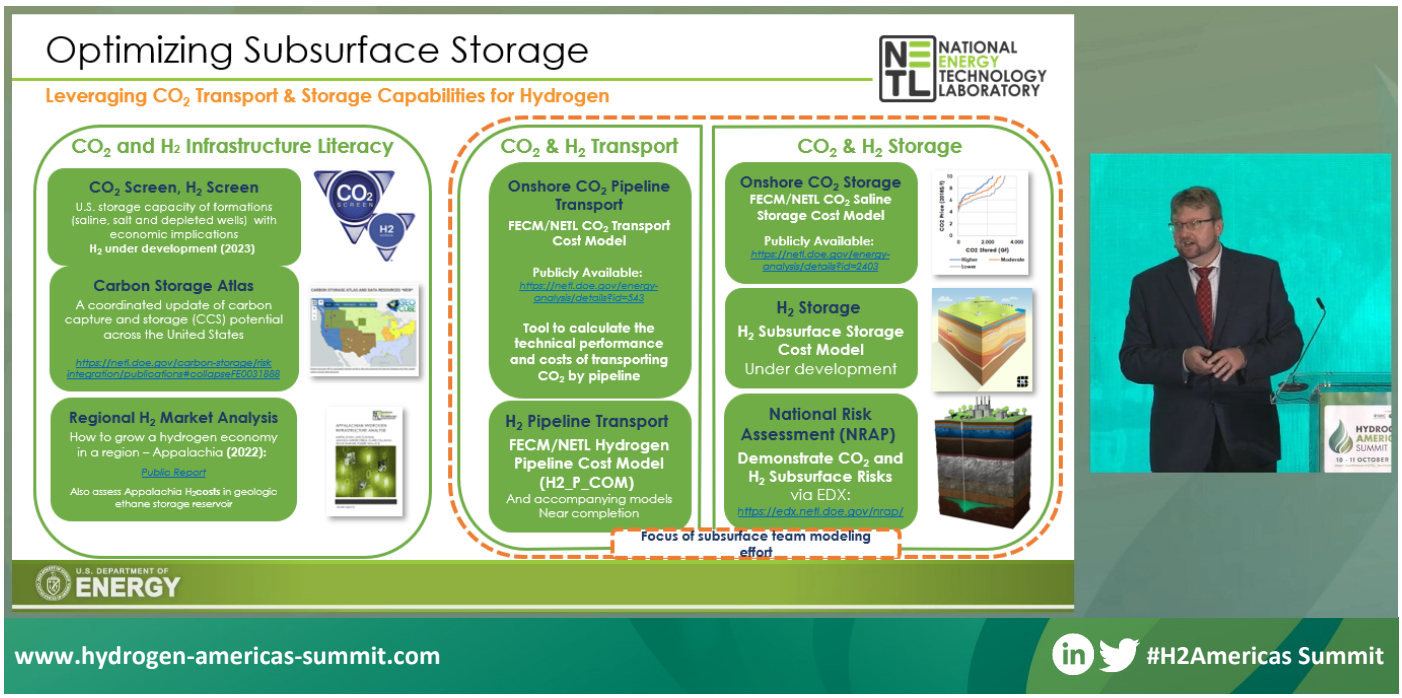
SUMMIT DAY TWO

SPOTLIGHT: U.S. RESEARCH LABS DRIVING HYDROGEN ADVANCEMENT

Dr Brian Anderson, Director, National Energy Technology Laboratory (NETL), **U.S. Department of Energy**



Dr Anderson shares **NETL's** plans to decarbonise coming from a Fossil Energy background. You can see a snapshot in the slide above. Below you will see how **"This is a great opportunity for us to leverage and learn from decades of research in the areas of CO_2 transportation."**



SUMMIT DAY TWO

SPOTLIGHT: U.S. RESEARCH LABS DRIVING HYDROGEN ADVANCEMENT

Dr John Wagner, Director, Idaho National Laboratory (INL), **U.S. Department of Energy**

Dr Wagner informs us that at **INL** their primary focus is nuclear energy. His presentation covers how nuclear can integrate with clean energy solutions such as hydrogen in an efficient and effective way. The laboratory also focuses in physical and cyber security for both human and climate based threats since extreme weather can have a negative impact on infrastructure. Below you can see various nuclear power plants that are working towards hydrogen production.

SUMMIT DAY TWO

SPOTLIGHT: U.S. RESEARCH LABS DRIVING HYDROGEN ADVANCEMENT

CHAIR
Jeff Marootian,
Senior Advisor for Energy Efficiency & Renewable Energy, Office of the Secretary, **U.S. Department of Energy**

SPEAKERS
Dr Martin Keller, Director, National Renewable Energy Laboratory (NREL), **U.S. Department of Energy**
Dr Brian Anderson, Director, National Energy Technology Laboratory (NETL), **U.S. Department of Energy**
Dr John Wagner, Director, Idaho National Laboratory (INL), **U.S. Department of Energy**

Jeff Marootian who chairs the session, leads with some questions before opening up to the audience.
On the topic of de-risking, **Jeff** asks **John** to elaborate on high temperature electrolysis and how we can de-risk by integrating thermal sources. **John** advises they have been working with various private companies by performing different tests to refine the performance.
Next, we go to **Brian** to investigate the production of clean hydrogen from natural gas. Almost 95% of the hydrogen made worldwide today is made from natural gas. Beyond CCUS, **Brian** advises that to really ensure our hydrogen is clean we have to start at the wells to check for methane leaks and develop the relevant sensors needed to pick up on leaks.
Finally, **Jeff** encourages **Martin** to tell us what the **ARIES: Advanced Research on Integrated Energy Systems** means for the future. **Martin** indicates the facility allows us to retrieve live data from live systems to bring them together, for example to work out how we can run electrolysers on intermittent power sources.
An audience member who is a new investor in hydrogen would like to know if the **DOE's** goal of **$1 for 1kg of hydrogen within 1 decade** requires breakthrough technologies, or if it is achievable with existing technology. **Martin** responds expecting that we are likely to need a combination of both existing technologies and innovation. He is optimistic that we can meet this goal. **Brian** answers a question covering de-risking CCUS, he regards funding as key to ensure you can continue to perform demonstrations at scale.

An audience member expresses an interest in the **Inter-Agency Working Group** and the workforce developments for the clean energy economy. **Brian** shares an initiative at **NETL** which has partnered with various agencies to create the worker training programs to align with the skills that the future of the clean energy sector needs. **John** describes how important this is for the future of the energy industry and due to the speed of growth there is a great need for talent development. There are many jobs available that don't require a degree so they are able to open opportunities to people that perhaps wouldn't have historically had these options available to them. This reinforces the notion that the hydrogen economy can transform communities as expressed earlier by **Adam Peters,** Chief Executive Officer**, Air Liquide North America .**

SUMMIT DAY TWO

SESSION 9

ACCELERATING CLEAN HYDROGEN INFRASTRUCTURE, STORAGE, TRANSPORTATION & DISTRIBUTION

CHAIR
Vanessa Z Chan, Ph.D., Chief Commercialization Officer & Director of the Office of Technology Transitions **U.S. Department of Energy**

SPEAKERS
Lori Cobos, Commissioner, **Public Utility Commission of Texas**
Dr Richard Mackay, R&D Manager, **Molecular Products**
Laura Parkan, Vice President, Hydrogen Energy Americas, **Air Liquide**
Ben Wilson, Chief Strategy and External Affairs Officer, **National Grid**
Franklin Chang Díaz, CEO**, Ad Astra Rocket Company**
Dr Helmut Lademann, Electrochemical Expert and MD of R2 GmbH**, R2**

We begin **Session 9** with a Keynote Address from **Commissioner Cobos,** followed by a technical presentation by **Dr Richard Mackay** which sets the stage for a panel discussion that addresses some of the key obstacles we need to overcome in order to realise the hydrogen economy.

How will we transport hydrogen?
Will liquid hydrogen replicate the LNG economy?
How do we link the value chain from production to industry and end-use consumers?

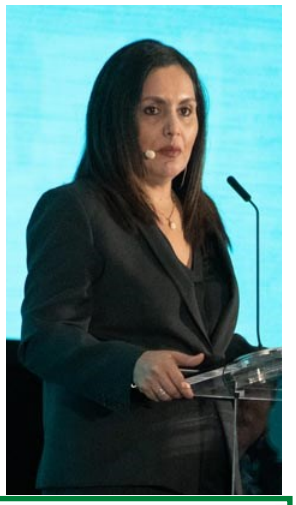
SUMMIT DAY TWO

SESSION 9

ACCELERATING CLEAN HYDROGEN INFRASTRUCTURE, STORAGE, TRANSPORTATION & DISTRIBUTION

"Texas is ripe for investment in clean hydrogen solutions."

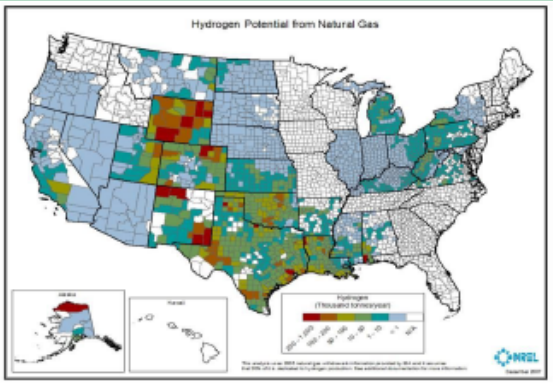
Lori Cobos, Commissioner, **Public Utility Commission of Texas**

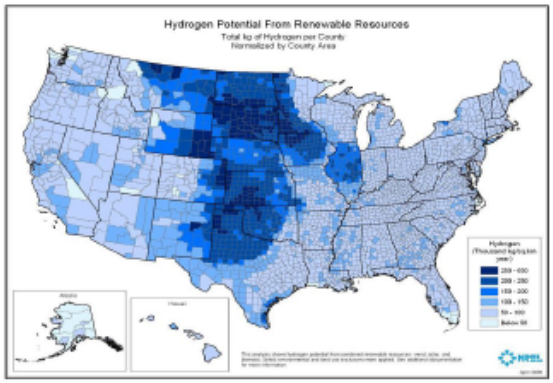


Commissioner Cobos presents the outlook on the future of hydrogen in Texas mapped out in the slide below. Three of the four operational Salt Caverns in the world can be found in Texas which can be used for hydrogen storage. We are reminded of the strategic partnership between **Port of Corpus Christi** and **Port of Rotterdam**, who both had speakers on the previous panel discussion **Session 3: Hydrogen Global Supply Chains: Linking Americas with Global Partners** which took place on **Day One.**

Texas has the resources, infrastructure, workforce, and export capability to lead in clean hydrogen solutions.

- Texas is the 9th largest economy in the world and among the fastest growing economies in the United States.
- Texas produces a third of all hydrogen in the U.S.
- Texas has large underground storage facilities, including the largest underground hydrogen storage facility in the world in Beaumont, Texas.
- Texas has a strong oil and gas, industrial, and manufacturing base in the Gulf Coast Region that is actively pursuing hydrogen solutions.

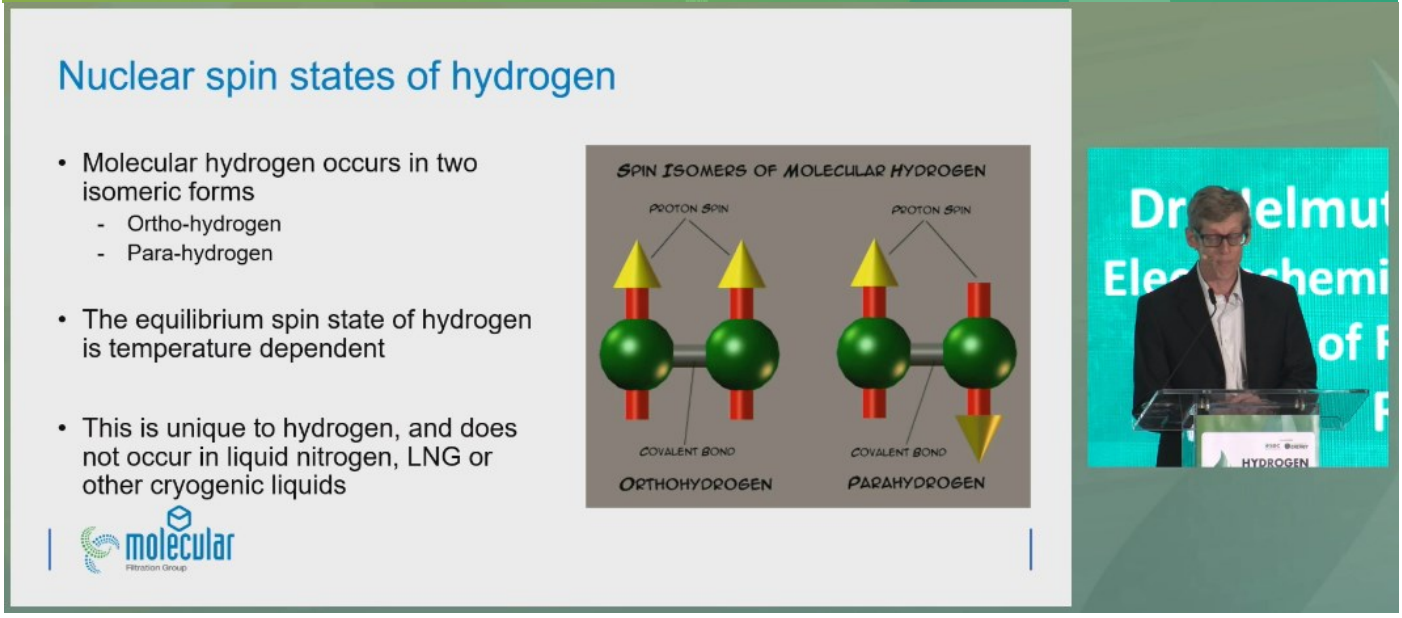




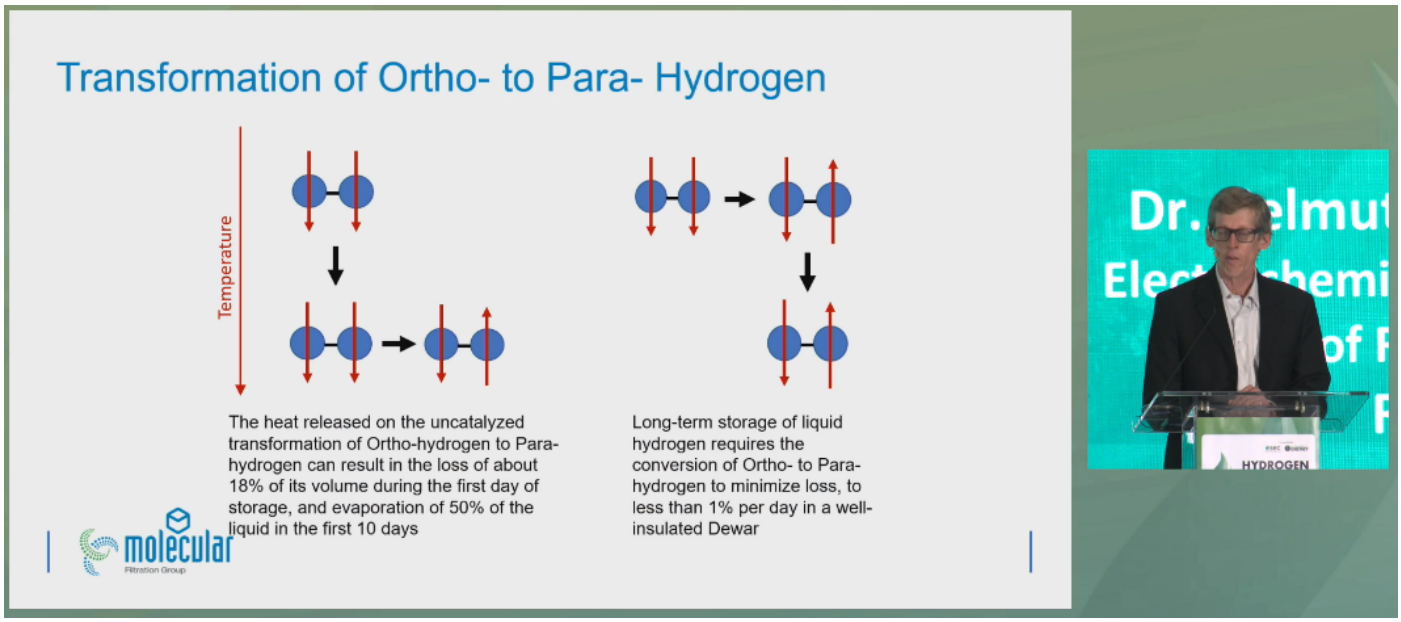
SUMMIT DAY TWO

SESSION 9

ACCELERATING CLEAN HYDROGEN INFRASTRUCTURE, STORAGE, TRANSPORTATION & DISTRIBUTION



Dr Richard Mackay, R&D Manager, **Molecular Products** delivers a technical presentation which covers the challenges we face with liquid hydrogen. We can see this detailed in the slides here, specifically the options for how we manage boil off.



SUMMIT DAY TWO

SESSION 9

ACCELERATING CLEAN HYDROGEN INFRASTRUCTURE, STORAGE, TRANSPORTATION & DISTRIBUTION

CHAIR

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Franklin Chang Díaz, CEO**, Ad Astra Rocket Company**
Dr Helmut Lademann, Electrochemical Expert and MD of R2 GmbH**, R2**

"Costa Rica is the perfect laboratory to do small scale demonstrations that have all the components and pieces put together."

Franklin Chang Díaz, CEO**, Ad Astra Rocket Company**

Vanessa Z Chan, Ph.D. who chairs the session starts the discussion by asking what the U.S. can learn from Costa Rica. **Franklin** has been working on clean hydrogen in Costa Rica to create an ecosystem where clean hydrogen is used to power transportation. Costa Rica has already been able to decarbonise their electricity. **Franklin** informs us that it started as a joint project with an oil refinery to build the first small electrolysis plant. They then partnered with various private companies for the U.S. and Costa Rica despite push back from governments and investors.

Ben demonstrates his views on how we manage the chicken and egg dilemma between supply and demand concluding that we must identify the early use cases. He offers praise to the **IRA** as being a game changer in scaling up from small scale expensive projects to large scale low cast projects putting the U.S. at the forefront of accelerating hydrogen. **Laura** dives into the importance of standardisation to develop the industry, providing examples such as nozzles and universal safety standards.

Dr Lademann educates us on safety measures. **R2** are currently working on a project to certify electrolysers. He feels the biggest problem we have is the need to progress quickly.

Dr Mackay responds to **Vanessa's** question regarding the possibility of overcoming the technical challenges we face for storage within the accelerated timeline. He explains that various technologies exist to assist with the storage process and work is continually being done to improve them with ongoing research and development to meet the targets set.

Commissioner Cobos believes that the continual development of the technology to drive down cost and improve the processes to make hydrogen a viable resource will be key as regulators evaluate the balance between reliability and cost.

Vanessa asks the panel to share their key concerns in accelerating the industry and where the government helps or hinders.

Ben shares his concerns that sometimes the best technology isn't necessarily the one that is adopted on a mass scale, using electrification as an example of a technology that is promoted by policy but perhaps isn't always the appropriate solution.

Franklin stresses that we need to be very serious about safety regulations to ensure the long term growth of the industry.

Laura emphasizes the importance of momentum with the public private partnerships to ensure we keep moving forward.

Dr. Lademann proposes that we need to make the industry attractive to young engineers as we see less people choosing science as a career choice. He believes this is something that starts in schools with the education system.

Dr. Mackay's main challenge at the moment is test capabilities for liquefaction since there are very few facilities to do this.

Finally, **Commissioner Cobos** is focussed on ensuring Texas has a reliable, resilient power supply based on renewables as the population grows .

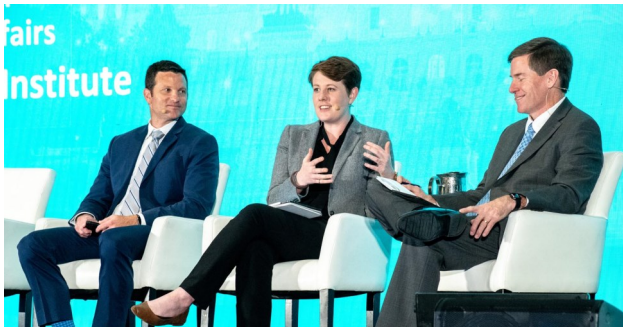
SUMMIT DAY TWO

SESSION 10

NUCLEAR AND HYDROGEN: OPPORTUNITIES FOR THE FUTURE

CHAIR
John F. Kotek,
Senior Vice President of Policy Development and Public Affairs**,**
Nuclear Energy Institute

SPEAKERS
Dr Kathryn Huff, Assistant Secretary, **Office of Nuclear Energy**
Steve Chengelis, Director of Transformative Nuclear Technologies,
Electric Power Research Institute (EPRI)



John F. Kotek leads the panel discussion opening with a question for **Kathryn** touching on the **DOE's** plans to advance the nuclear and hydrogen agenda. We learn that nuclear represents the largest single source of clean electricity in the U.S. It is expected that nuclear will be used as a power source for some of the hydrogen hubs. **Steve** lays out the role the next generation of nuclear plants will play with hydrogen. **EPRI** span the entire portfolio of the energy value chain. They have two initiatives currently in action. The first is with **GTI** focussing on low carbon power generation and low carbon energy carriers. The second is called **READi** which is looking at how to make the electrical grid more resilient and adaptable to extreme weather events triggered by climate change which echoes the points made by **Dr John Wagner** during the **Spotlight** on **U.S. Research Labs Driving Hydrogen Advancement. EPRI** is investigating how they can offer more than solely providing electricity to the grid such as district heating, cooling and power, chemical production, hydrogen production and fusion which is starting to show a lot of promise. **John** advances the discussion towards safety. A key consideration we have heard raised multiple times throughout the summit. **Steve** reassures us that hydrogen has been used at nuclear plants for some time and the plants are designed to withstand missiles. We also discover 80% of the world's nuclear power plants are members of **EPRI.** An audience member references Japan's recent safety issues surrounding nuclear which is answered by **Kathryn.** She shares the exciting news that Japan are reopening all their land based plants, tying in how they are leading in the hydrogen sector too. **Steve** adds that Japan are also planning to build new plants. The discussion moves to France who have some plants currently shut. **Kathryn** makes it clear the nuclear plants operate at the highest possible safety standards, and part of that process is to shut a plant down in the event you need to maintain those standards.

> **"There may be chances to create really large quantities of hydrogen at a single point."**
> **Dr Kathryn Huff**
> Assistant Secretary
> **Office of Nuclear Energy**

> **"When I think about the future and how do we get to the zero carbon by 2050. I think we're seeing an energy transformation that will be unprecedented in time, scale and scope."**
> **Steve Chengelis**, Director of Transformative Nuclear Technologies, **(EPRI)**

John responds to some questions submitted virtually surrounding the cost of energy. He concludes that the best system to achieve low cost, reliable, energy is a marriage between the best attributes of both nuclear and renewables.

> **"As part of the Inflation Reduction Act there was a production tax credit for existing nuclear plants put in place, again, to ensure well run plants weren't shut down for economic reasons."**
> **John F. Kotek,** Senior Vice President of Policy Development and Public Affairs**, Nuclear Energy Institute**

SUMMIT DAY TWO

FINAL KEYNOTE ADDRESS

David M. Turk, Deputy Secretary, **U.S. Department of Energy**

As the summit draws to a close and we prepare for our breakout sessions **Dr Satyapal** returns to the stage to introduce the esteemed speaker **David M. Turk**, Deputy Secretary, **U.S. Department of Energy** who delivers the **Final Keynote Address**. With a long history in the energy sector, we learn that he was previously Deputy Executive Director of the **IEA.**

David M. Turk starts by thanking the team of people responsible for putting the event together. He references **Secretary Granholm** calling hydrogen a **"Swiss Army Knife for Climate Action"** during her **Opening Keynote Address** on **Day One.**

"Our Clean Hydrogen Future isn't going to just happen. We need to do some work."

He revisits the benefits from both the **Infrastructure Investment and Jobs Act** and the **Inflation Reduction Act** which has been covered extensively over the course of the summit receiving praise across the board.

David M. Turk announces winners of phase one of the **U.S. DOE's Hydrogen Shot Incubator Prize.**

Winners include **BoMax Hydrogen** Associate Sponsors of this event. Followed by:

- **Gold Hydrogen Team**
- **Electro-Active Hydrogen**
- **Evolve Hydrogen Inc.**
- **H3**
- **Biomass Super Gasifier**
- **NX Fuels Inc.**
- **Pax H2(O)**
- **The Hope Group**

"There is a lot of opportunity for governments to engage governments and the private sector through these partnerships."

David M. Turk, Deputy Secretary, **US Department of Energy**

David M. Turk concludes his speech by emphasising the importance of partnerships, between governments, between private companies and between governments and private companies. He expresses the DOE is looking forward to more collaboration moving forward.

SUMMIT DAY TWO

BREAKOUT SESSIONS

Breakout Session 1A: Regulations & Policies to Harmonise the Hydrogen Sector

Led by: **Shannon Angielski,** Principal, **Van Ness Feldman**, President, **Clean Hydrogen Future Coalition**
Janet Anderson, Senior Technology and Policy Advisor, **Van Ness Feldmann**

Given the recent enactment of some key federal policy tools, **Shannon** and **Janet** discuss additional key policies and regulations needed to scale and stimulate clean hydrogen market demand.

One key topic of interest they discuss is the notion of a carbon tax, something **Seifi Ghasemi,** Chairman, President & Chief Executive Officer, **Air Products** raised during his Fireside Chat. **Janet** believes this is a tool that Europeans and Canadians can rely on more than the U.S. **Shannon** agrees this will be a difficult policy to enact in the U.S. without public pressure driving political action.

Breakout Session 2A: Precious Metals for Hydrogen: how to enable cost reduction and sustainable supply?

Led by: **Uve Kupka,** President, **Heraeus Precious Metals**
Dr. Philipp Walter, Executive Vice President, New Business Development, **Heraeus Precious Metals**

Precious Metals, in particular Iridium, have been often reported as a bottleneck and drawback for PEM Electrolysis, thinking about high cost and security of supply. **Uve** and **Philipp** from Heraeus Precious Metals would like to create some transparency and give some answers on Precious Metals (in particular Iridium) and PEM Electrolysis. 40% of the announced electrolyser capacity is PEM Electrolysis. As an organisation they exclusively refine precious metals.

Iridium cannot be mined as a separate metal, it is always a by-product from either platinum mining, copper mining or nickel mining. 80% of iridium comes from South Africa.

Breakout Session 3A: Hydrogen Safety & Best Practices

Led by**: Nick Barilo,** Executive Director**, Center for Hydrogen Safety**

Nick Barilo leads the discussion on hydrogen safety urging caution since hydrogen is new as a fuel and energy carrier.

The three parts to safety he chooses to focus on are;

1. **Implement regulations, codes and standards**
2. **Utilize best safety practices**
3. **Be invested in safety**

He stresses the need to thoroughly evaluate the safety early on in any hydrogen projects.

Vision

- The Center for Hydrogen Safety (CHS) is a global non-profit dedicated to promoting hydrogen safety and best practices worldwide

Mission

- Support and promote the safe handling and use of hydrogen across industrial/commercial uses and applications in the energy transition
- Provide a common communication platform with a global scope to ensure safety information, guidance and expertise is available to all stakeholders

SUMMIT DAY TWO

BREAKOUT SESSIONS

Breakout Session 1B: The Most Energy-Efficient Way to Make Green Hydrogen

Led by: **Deborah Maxwell, PhD,** Chief Science Officer, **BoMax Hydrogen, LLC**
Chris Simuro, Board of Managers, **BoMax Hydrogen, LLC**

BoMax Hydrogen LLC, one of the winners of the **U.S. DOE's Hydrogen Shot Incubator Prize** have developed a patented technology to produce green hydrogen that is; light activated, made on-site on demand at the point of use, made at ambient temperature/ pressure, it uses no rare earth minerals, all the components are inexpensive and finally, the technology is scalable. They have a prototype that can power a fuel cell to run a demo train, set of lights or fan. When they use sunlight to make green hydrogen they have a carbon footprint of zero.

Breakout Session 2B: Transatlantic Solutions for Hydrogen in Long-Haul-Trucking

Led by: **Michael Perschke,** CEO, **QUANTRON**

Quantron want to create an ecosystem with partners. They have 56 million trucks on the road in Europe which need to be transformed from diesel to zero emissions, using hydrogen fuel cells to decarbonise. **Quantron** is now expanding to North America.

An audience member enquires why **Michael** favours hydrogen fuel cell over hydrogen ICE. His reason for this is that ICE releases **NOx** emissions which are significantly more harmful to the environment than **CO_2.** He urges us not to neglect this and says we should avoid these where possible by using fuel cells. We heard this concern in **Session 7: Financing the Americas Clean Hydrogen Deployment** raised by the speaker **Jigar Shah,** Director, Loan Programs Office, **U.S. Department of Energy.**

Breakout Session 3B: Ensuring Hydrogen's Sustainability

Led by: **Beth Trask,** Vice President, Energy Transition, **Environmental Defense Fund**
Dr. Tianyi Sun, Climate Scientist, **Environmental Defense Fund**

Environmental Defense Fund close the day with an interactive fireside chat on hydrogen's role as an indirect greenhouse gas depending on how you use it. Hydrogen can either be beneficial to the climate or, in some cases hydrogen emissions can be worse than fossil fuels. **Dr. Sun** is keen to ensure we have high quality sensors that can quantify emissions. **Dr. Sun** echoes the concerns raised by the previous speaker **Michael Perschke** and **Jigar Shah** surrounding **NOx** emissions. To combat this we will need high quality 30 second response time sensors to monitor hydrogen leaks and locate the origin to minimise the indirect greenhouse gas emissions from hydrogen.

HYDROGEN AMERICAS SUMMIT

CO-HOSTED BY

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U.S. DEPARTMENT OF ENERGY

10 – 11 OCTOBER 2022 | WASHINGTON D.C., USA

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