PON 5322 Pre-Bid Webinar
Hydrogen Solicitation
(Fed Cost Share)

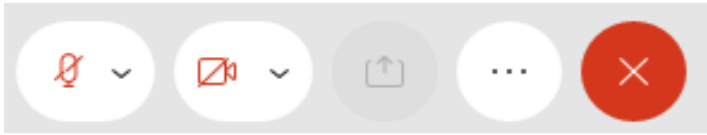
NEW YORK STATE OF OPPORTUNITY. | NYSERDA

June 7th, 2023

Meeting Procedures

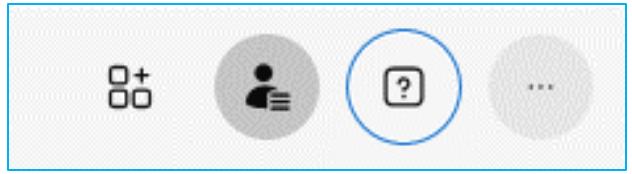
Participation for Attendees:

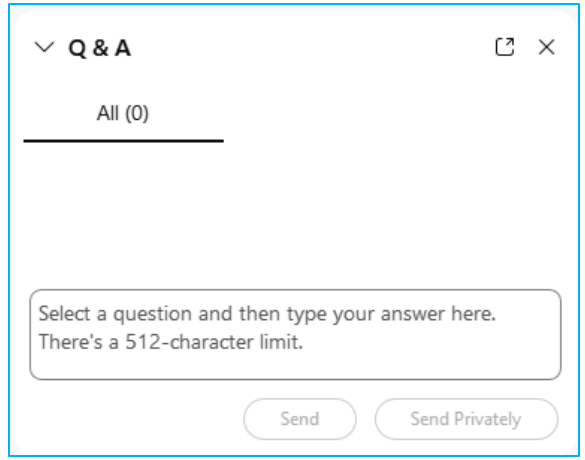
> Attendees will be muted upon entry.



You'll see  when your microphone is muted

> Questions and comments may be submitted in writing through the Q&A feature at any time during the event. Click the icon in the lower right corner to open the feature.





> If technical problems arise, please contact John Campagna: john.campagna@nyserda.ny.gov

Agenda

- **Welcome and introduction**
- **New York’s Hydrogen Opportunity**
- **PON 5322 overview**
- **PON 5322 technical challenge areas**
- **Q&A**

Stay Connected and Informed

- **Today's slides and recording will be post at our hydrogen program page: nyserda.ny.gov/hydrogen**
- **FAQ will be posted at PON 5322 Solicitation Detail Page**
- **For additional questions about PON 5322, please email pon5322@nyserda.ny.gov**
- **Sign up for our email distribution list to stay tuned for future announcements: nyserda.ny.gov/hydrogen**

Register to be a Technical Reviewer

- **If you'd like to be considered by the NYSERDA Hydrogen & Clean Fuel program as a technical reviewer for this and future solicitations, please fill out the online form which will be available on this page in a couple of weeks.**
  - If selected, the technical reviewer will be assigned to a designated scoring committee and be responsible for reviewing R&D proposals submitted to NYSERDA.
  - Technical reviewers must sign a non-disclosure agreement (NDA) and have no conflicts of interest before accessing proposals.
  - Only those technical reviewers not submitting proposals to PON 5322 will be considered for scoring committee for this solicitation.

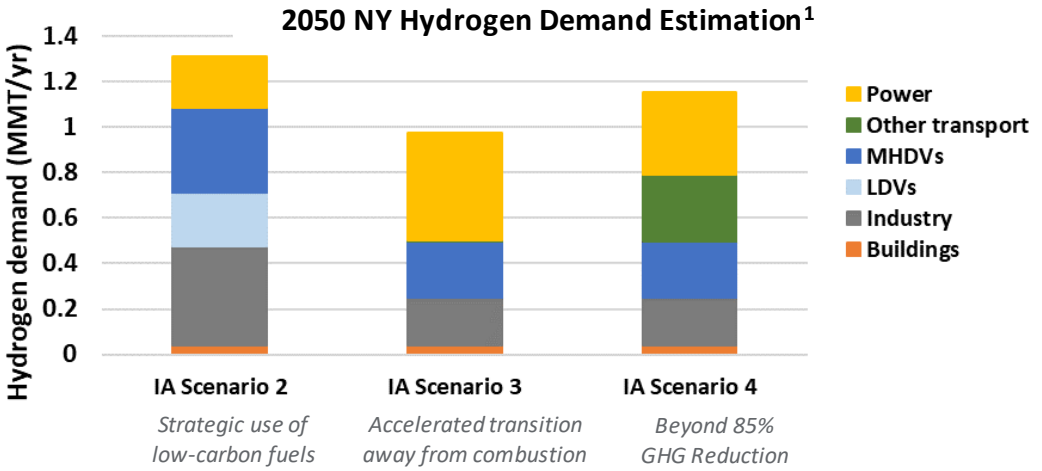
New York's Hydrogen Opportunity

Clean hydrogen will play a key role in New York to decarbonize hard-to-electrify sectors, ensure a reliable grid, and provide a resilience solution[1,2]

- By 2030, initial market adoption of clean hydrogen is expected in several applications (including MHD FCEV, and high temperature industrial process). Additional promising end-use applications include district heating and non-road transportation such as aviation and rail.
- Additionally, hydrogen-based resources can reduce curtailment, provide firm zero-carbon capacity during extended periods of low renewable output. Analysis shows that NY needs 18-23 GW zero-carbon capacity to maintain system reliability to achieve 100% zero-emission grid by 2040.
- Hydrogen demand will reach 120-180 TBtu across all scenarios, accounting for 5-11% of final total energy demand by 2050.

New York is Committed to:

- *70% renewable electricity by 2030*
- *10 GW distributed solar by 2030*
- *6 GW energy storage by 2030*
- *9 GW offshore wind by 2035*
- *100% zero-emission electricity by 2040*
- *85% reduction in GHG emissions by 2050*



1 - Appendix G: Integration Analysis Technical Supplement NYS Climate Action Council Scoping Plan
2 - NY's 6GW Energy Storage Roadmap

Continued research, development, and demonstration (RD&D) is key to advancing a full portfolio of options.

NYS Hydrogen Strategy Analysis

- **Hydrogen market and technology analysis - NREL**
  - Potential hydrogen market opportunities in NYS: production, demand, storage and distribution.
  - Hydrogen research and development gap analysis,
  - Cost and performance projection for production & application.
- **Hydrogen policy options – E3**
  - Review policies used in other jurisdictions to foster hydrogen development
  - Evaluate strengths and weakness of each policy option
  - Analyze air quality, health and safety policies related to hydrogen.
- **Economic and supply chain development – Energetics and IEC**
  - Understand existing companies positioned to expand into hydrogen space in NYS
  - Identify NYS competitive advantages
  - Assess the jobs impact & identify unique skillsets required across hydrogen supply chain.

PON 5322 Overview

- **Available Funding:** total up to $10M to help proposers with cost share for federal funding award in order to advance clean hydrogen R&D projects in New York. Final NYSERDA award is contingent on the proposer(s) successfully executing a federal funding contract.
- **Proposal due:** June 28, 2023, by 3pm EDT
- **Four challenge areas**
  1. Hydrogen applications to decarbonize industrial process heat
  2. Clean hydrogen production and integration with renewable energy
  3. Mitigation of nitrogen oxides (NOx) emissions
  4. Hydrogen storage technologies, including bulk storage and storage in limited footprint areas
- **Example of federal FOAs relevant to PON5322***
  1. H2Shot by the Office of Hydrogen and Fuel Cell Technologies
  2. Earthshot by the Office of Science
  3. Electrolyzer manufacturing by the Office of Energy Manufacturing & Supply Chains
  4. Industrial Decarbonization by the Industrial Efficiency and Decarbonization Office
  5. H2 Electrolysis by the Office of Hydrogen and Fuel Technologies

***Please note that opening the PDF files in the links work best in a browser window other than Google Chrome, e.g., in Microsoft Edge.**

Funding Categories

Three (3) **funding categories based on TRL** with funding caps per project

Funding Category	Estimated Technology Readiness Level (TRL)	Maximum NYSERDA Funding Per Award
Category A: Feasibility & Research Studies	1-3	$400,000
Category B: Product Development	4-6	$1,000,000
Category C: Pilot & Demonstration Projects	7-9	$2,000,000

Eligible Applicants

Must be Applying for Federal Funding:

- Proposers must have submitted or be in the process of submitting a concept paper or proposal for DOE/federal funding, aligned with NYSERDA's solicitation challenge areas
- Final NYSERDA awards are contingent on successful federal funding award and contract

New York Eligibility Depends on Funding Category:

- Entities with physical location in NY eligible as prime- or sub-recipient for all funding categories
- Non-NY entities eligible as prime- or sub-recipient for Pilot/Demo Projects only IF demonstration site is in New York
- Non-NY entities only eligible as sub-recipient for Research Projects and Product Development

Required documents

Each proposal must complete and include the following:

- Attachment A: Proposal narrative
- Attachment B: Executive summary slide
- Attachment C: TRL/CRL calculation worksheet
- Concept paper submitted to federal funding agency
- Proof of federal funding status *(e.g. award letter, encourage/discourage notice)*
- Executive Order 16 Acknowledgement *(PDF form to fill out, sign, and upload)*

Optional document:

- Disclosure statement *(PDF form to fill out only if they have any conflicts to disclose)*
- Supporting documents *(maximum 10 pages total, such as letter of commitment for demonstration site, letter of support from a utility company, etc.)*

Challenge Area 1: Hydrogen Applications to Decarbonize Industrial Process Heat

- **Industry in New York accounts for 9% of the state's GHG emissions**
- **Focus on hard-to-electrify industrial process heat at 100°C ≤ T < 500°C and T > 500°C**
- **In New York this accounts for 62% of the total heat consumed in industry**
- **Hydrogen presents a decarbonization opportunity**
  - Hydrogen gas combustion can provide high heat with no carbon emissions
  - Hydrogen as a process input could reduce the need for high temperature process heat, or allow for sourcing process heat through electrification
  - Challenges of deploying hydrogen in industry:
    - Redesign of industrial equipment to manage combustion of hydrogen instead of natural gas
    - Ensuring industrial process reliability and final product quality
    - Mitigation of nitrous oxide (NO_x) emissions (See challenge area #3)
- **Example projects:**
  - Novel materials and coatings that withstand hydrogen embrittlement and high temperatures
  - New furnace/oven/kiln designs that can safely and efficiently combust hydrogen
  - Technologies that use hydrogen as a decarbonizing process input, like direct reduced iron (DRI)

Figure 1: NY Industry Heat Grade Breakdown

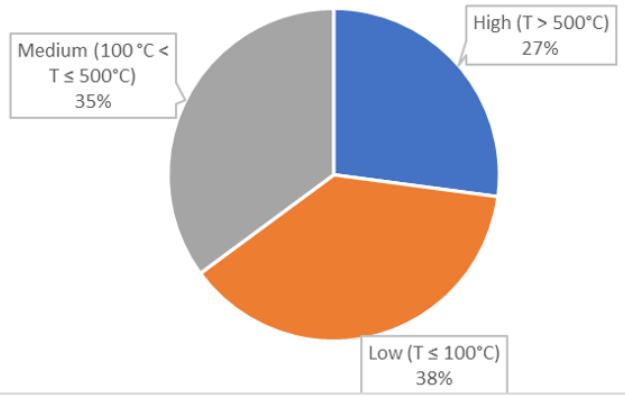
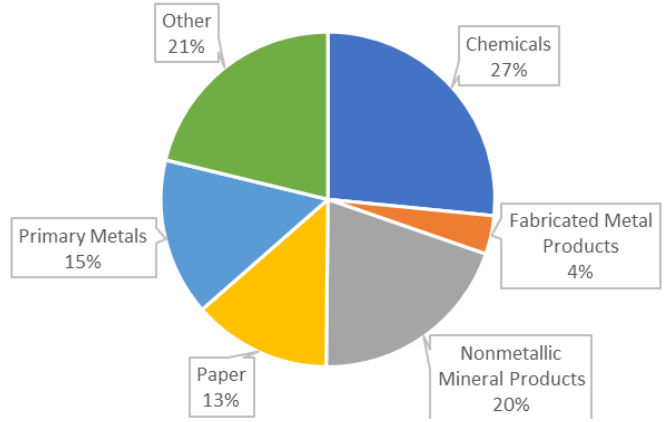
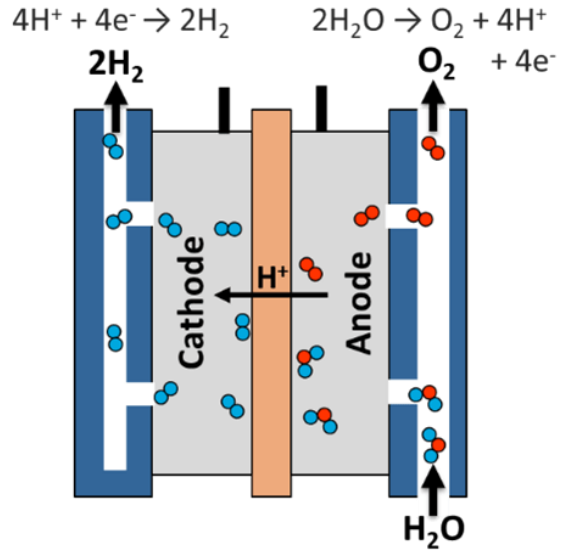


Figure 2: Breakdown of Medium- and High-T Heat



Challenge Area 2: Clean hydrogen production and integration with renewable energy resources

- **New York's Climate Act calls for 70% renewable electricity by 2030 and 100% zero emissions electricity by 2040**
- **New York aims to build 9GW of offshore wind by 2035 and 10GW of distributed solar by 2030**
- **Increased renewable footprint presents opportunity for clean electrolytic production of hydrogen**
  - Producing green electrolytic hydrogen at scale is a new approach compared with more established and carbon intensive processes using fossil-fuels
  - Challenges stem from:
    - Scarcity of materials for catalysts for electrodes in PEM electrolyzers
    - PEM electrolyzer durability & stacking
    - Integration of electrolyzers with renewable and grid electricity
- **Example projects**
  - Electrolyzer optimization and controls for direct coupling with intermittent renewable technologies
  - Integration of electrolysis systems with energy storage technologies such as batteries
  - High temperature solid oxide electrolysis system coupled with a clean thermal energy source
  - Advancement in electrode, membrane, or catalyst technology to enhance component and system durability and lifetime
  - Saltwater-capable electrolysis (desalination via reverse osmosis coupled with electrolyzers or development of catalysts for direct saltwater electrolysis) utilizing clean electricity



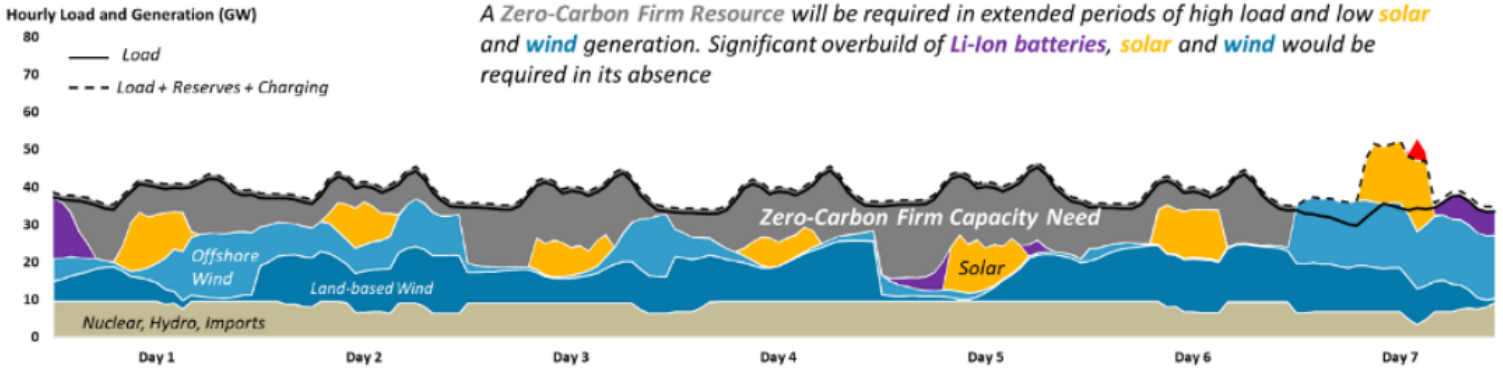
Electrolyzer Cell

Image Source: DOE EERE

Challenge Area 3: Mitigation of nitrogen oxide (NOx) emissions from hydrogen combustion

- **Hydrogen combustion, while carbon-free, has led to stakeholder concerns regarding NOx emissions**
  - Hydrogen combustion may be needed for hard-to-electrify sectors including industrial heat or large-scale co-generation (steam/electricity) or district heating
  - NOx control technologies well understood for fossil fuel combustion, but little data on 100% hydrogen combustion is available from real world settings
  - Opportunities exist to change combustor technology and optimize combustion process to specifically accommodate hydrogen combustion
- **NOx control options:**
  - Making changes to combustion equipment and process
  - Installing NOx control equipment at the exhaust (e.g., Selective Catalytic Reduction or SCR)
- **Example projects:**
  - Combustor technology, advanced combustion controls or optimization
  - Post-combustion cleanup and treatment (e.g., SCR)
  - Studies showing the cost and performance tradeoffs of minimizing NOx emissions
  - Demonstration projects to test the performance and effectiveness of NOx control and mitigation strategies in real-world hydrogen combustion systems

Challenge Area 4: Hydrogen storage technologies for bulk storage and limited footprint areas



Zero Carbon Firm Capacity Need Over a Challenging Winter Week in 2040

Source: New York State Energy Storage Roadmap

- **Increase in renewable electricity footprint will result in temporal imbalances between peak demand and generation, and hydrogen may be an important solution in addressing these challenges**
- **Batteries can manage temporal supply and demand imbalances on the scale of 4-8 hours, but a zero-carbon firm resource like green hydrogen is needed to manage imbalances on weekly and seasonal scales**
  - New York anticipates the need for 18 GW of firm capacity to meet peak demand needs for periods greater than 8 hours by 2040 and at least 17 GW of battery storage for short-term peaking needs (4-8 hours) (NYS Energy Storage Roadmap)
- **Challenges: Low volumetric energy density of hydrogen gas currently requires high pressures or energy intensive liquefaction for compact storage, or large spaces like salt caverns for bulk storage**
- **Example projects:**
  - Assess the feasibility, potential extent, and costs of hydrogen storage in onshore or offshore geologic formations in NY
  - Materials-based storage technologies, e.g. metal hydrides and metal-organic frameworks at ambient temperatures
  - The demonstration of physical hydrogen storage media that increase volumetric energy density & reduce costs
  - Studies of chemical carriers that can easily and reversibly store and release hydrogen

Q&A