Our energy system has allowed for increased industrialization and improved quality of life for the planet's inhabitants, but it has also come with a number of unintended side-effects ranging from greenhouse gas emissions, release of criteria pollutants, and other social and environmental concerns. Supplying all of society’s growing energy demands is hard and has been limited to date to the fossil fuel based energy system in place since the start of the industrial age. Hydrogen, as a flexible, clean energy carrying intermediate, has the potential to be a centerpiece of a future energy system where aggressive market penetration of renewables (wind and solar) are coupled with renewable hydrogen production to meet society’s energy demands using clean, renewable resources while also enabling clean industrial and transportation processes.

A number of key recent changes are bringing hydrogen back into the spotlight: 1) Renewable energy is getting cheaper, and penetration levels are increasing at an exponential pace; 2) the costs of GHG emissions (climate change) and criteria pollutants (health concerns) are being acknowledged and are reaching a point where society is demanding change (renewable portfolio and zero emission vehicle standards); and 3) commercial viability of fuel cell vehicle technology has been demonstrated (commercial vehicles being sold). Hydrogen, as an area of R&D interest (from either the federal or private sectors) has had its ups and downs over the past few decades. Hydrogen has suffered at times from being over-hyped or misunderstood. Claims of fuel cell commercialization, in particular, were in the past (early 2000's) overly optimistic to be polite. The safety concerns of hydrogen have also often been poorly understood or overblown. These situations have arisen, in part, due to a lack of appreciation for the science and data of hydrogen and hydrogen systems.

This presentation will focus on the role of hydrogen at (grid-)scale and the efforts of a large, national effort to evaluate the potential of hydrogen to play a critical role in our energy future. Facts about hydrogen will be shared, as will the vision of how it will fit into our future energy system. Finally, the R&D needs to enable this future will be discussed along with efforts of our R&D team at NREL to address them.