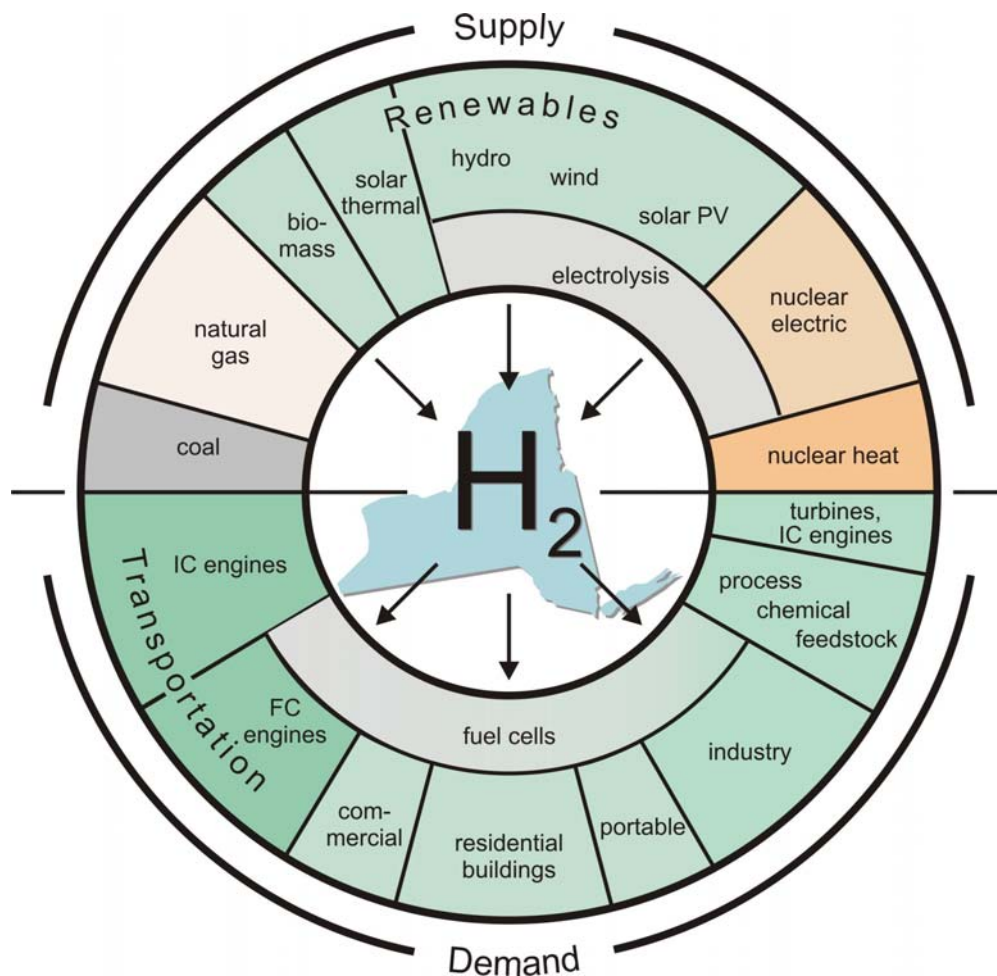


VISION

for the Hydrogen Energy Economy In New York State



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LOOKING TO THE FUTURE

This document presents the New York State Hydrogen Energy Vision. New York State offers certain competitive advantages in assuming a leadership role in the transition to a hydrogen economy. Some of these advantages include: political interest and funding; access to global financial markets; relatively favorable utility policies toward distributed energy; strong educational institutions, research facilities, and industrial base; large markets for energy, transportation, and electric power; and a strategic location with respect to regional energy infrastructure, including the New England states, the mid-Atlantic states, and the Canadian provinces of Ontario and Quebec. If these advantages are exploited, it is possible that by 2020 New York State will be a leader in hydrogen energy.

This Vision establishes far-reaching goals for increasing the role of hydrogen and hydrogen related products in a sustainable energy economy in New York State. Achieving this Vision will require technical advances and cost reductions leading to a compelling value proposition for industry, consumers, and policy makers. It will require educating the public, adopting model codes and standards, and identifying an appropriate mix of market incentives and public policies to remove the barriers facing hydrogen energy technologies. Also it will require continued growth and competitiveness in renewable energy technologies. These measures will help make hydrogen energy part of the every day lives of the people of New York State and contribute to the state's economic development, energy security, and environmental quality.

As with any Vision, barriers to achieving our goals exist. The support needed must come from collaborative efforts among industry, as well as between industry and local, state, and federal government. Communication and cooperation will be required to overcome the technical, market, and policy challenges impeding the implementation of hydrogen energy systems.

The Vision is based on the following premises:

- ◆ The hydrogen economy will be the ultimate destination.
- ◆ Hydrogen and electricity will be the dominant energy carriers.
- ◆ Sustainable development is key. Near-term emphasis will be based on conventional domestic resources such as hydroelectric power and reforming natural gas while longer-term emphasis will be on renewable production methods (wind, biomass, and photovoltaics). Nuclear-assisted production of hydrogen will also play a significant role. Heat from nuclear power plants can be compatible with several high temperature thermochemical hydrogen production methods and high temperature electrolysis.
- ◆ Clean hydrogen is the motor fuel of the future. NYSERDA and New York transportation agencies will work together to install hydrogen refueling stations from New York City to Buffalo over the next ten years. Much care will be taken to ensure that the future hydrogen fueling infrastructure will not become prematurely outdated but will keep pace with the development and deployment of hydrogen vehicles so as to support the demands of future vehicles and fleets.
- ◆ Emphasis will be placed on the needs for better electrolyzers, fuel cells, storage, purification, and fueling stations. Hydrogen fuel cell improvement is the primary focus for stationary power generation.

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- ◆ The magnitude of the infrastructure investments will be the key barrier in the transition to the hydrogen economy. New York State will attract hydrogen energy investments from the public and private sectors.
 - ◆ Relative emphasis will be placed on distributed and centralized production, storage, and delivery systems. Hydrogen will continue to be used in industrial and manufacturing processes as well as an energy carrier.
 - ◆ New York State will have a supportive, hydrogen-friendly business climate.

This Vision supports the spirit of both the U.S. Department of Energy's *National Vision of America's Transition To A Hydrogen Economy – To 2030 And Beyond*, February 2002 and NYSERDA's, *Planning New York's Energy Future – A Three-Year Strategic Outlook 2004-2007*. This Vision calls for a strong mix of technology, policy, and market-based solutions. Finally, this Vision affirms that hydrogen energy can offer great opportunities for contributing to New York State's economic, energy, and environmental needs.

VISION

By 2020, New York is widely recognized as the Renewable Clean Energy State and its sustainable hydrogen economy is in place and rapidly growing. As a result of a coordinated and integrated state-wide effort, New York is a world leader in hydrogen technology development and deployment in many markets including energy, electric power, and transportation. Hydrogen is a publicly accepted energy carrier and fuel due to its safety, cost competitiveness, and availability in New York State. Hydrogen is a key part of the New York energy mix and operates in a complementary manner with other energy sources and carriers. Hydrogen is well-integrated with regional systems, including the Northeast and Mid-Atlantic States and Canada. State-wide networks for clean, efficient, and secure hydrogen production, storage, and delivery have been established. Most fueling stations in the State have hydrogen fueling capacity. Hydrogen energy is part of the every day lives of the people of New York State. New York's favorable business and regulatory climate has attracted many new jobs and high-tech industries and its competitive advantages in R&D, market pull, and access to financial markets have all contributed to its success.

VISION GOALS

To further define the New York State Hydrogen Energy Vision, the following goals were established. It is a starting point from which to measure future progress in achieving the Vision.

VISION GOALS FOR THE HYDROGEN ENERGY ECONOMY IN NEW YORK STATE

SECTOR	2010	2015	2020
Electric Power	<ul style="list-style-type: none"> 50 MW of new installed distributed generation capacity uses H2 from renewable resources. 	<ul style="list-style-type: none"> 250 MW of new installed distributed generation capacity uses H2 from renewable resources. 	<ul style="list-style-type: none"> 500 MW of new installed distributed generation capacity uses H2 from renewable resources.
	<ul style="list-style-type: none"> H2 produced via central and distributed electricity. H2 used to fuel distributed power. 	<ul style="list-style-type: none"> At least one 1000 MW Integrated Gasification Combined Cycle (IGCC) plant installed and produces H2 and electricity. 	<ul style="list-style-type: none"> 5% of NY transportation fuel is hydrogen generated by the electric utility industry.
	<ul style="list-style-type: none"> State incentives encourage private investment in H2 development in NYS Significant cost reduction achieved in fuel cells. 	<ul style="list-style-type: none"> Build up of hydrogen distribution, including liquid H2 delivery from Buffalo (hydroelectric resources). 	<ul style="list-style-type: none"> Large scale integration of renewables and H2 storage. Renewable-based H2 electricity is cost competitive with other electricity options. H2 production from nuclear and wind (on- and off-shore).
Transportation	<ul style="list-style-type: none"> 10 public transportation demonstration projects are in non-attainment areas. Codes and standards are in place. 	<ul style="list-style-type: none"> 50 demonstration fleets and 20 retail stations (from New York City to Buffalo). 70 natural gas fueling stations have added H2 fueling capability. 	<ul style="list-style-type: none"> H2 consumer vehicles available and H2 refueling widely available. H2 fueling infrastructure keeps pace with H2 vehicle development and deployment. H2 replaces at least 10% of transportation fuels.
Infrastructure	<ul style="list-style-type: none"> Model codes for buildings are in place state-wide and training for code officials. 	<ul style="list-style-type: none"> Certification and training for all H2 technicians. 	<ul style="list-style-type: none"> NYS is home to a national H2 testing and training facility for technicians and code officials.
	<ul style="list-style-type: none"> Designate a "H2 City" in each NYS region. 	<ul style="list-style-type: none"> Liquid H2 delivery from Buffalo. 	<ul style="list-style-type: none"> State-wide delivery network and decentralized facilities co-exist.
	<ul style="list-style-type: none"> Technologies available for H2 production via thermal decomposition using waste heat. 	<ul style="list-style-type: none"> State-wide network of biogas H2 generators. Incentives in place that reward low-carbon processes. 	<ul style="list-style-type: none"> H2 produced cleanly from multiple sources to meet demands.

NEXT STEPS

The hydrogen energy economy in New York State can become a reality. The appropriate mix of technology development, in combination with market and public policies, can develop critical integrated hydrogen energy systems for transportation fuel, heat, and electric power. These systems, supported by a suitable infrastructure, can achieve the market goals over the next 20 years.

This Vision provides the framework for action. Its challenging, yet realistic, goals have defined the destination. The roadmap that follows will chart the technical development and demonstrations needed to achieve market deployment of hydrogen energy systems. The Roadmap will also outline the institutional and policy changes needed to remove the barriers to economically and environmentally sound development of sustainable hydrogen energy systems.

The Roadmap will build on the promising, ongoing activities in New York State involving research, development, and demonstration of hydrogen energy systems that include government, universities, and the energy and fuel cell industries. Alliances can be formed to establish a state hydrogen industry cluster that is focused on building the value chains of the hydrogen economy (production, storage, distribution, and point of use or application). The hydrogen economy is generally defined as the point where hydrogen energy is competitive with other forms of energy. A sustained, collaborative effort is needed to achieve this Vision.