**Summary**

# Production of Hydrogen Using Nuclear Energy

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One of the leading methods for the future production of hydrogen is nuclear energy. The fundamental characteristics of nuclear energy offer several potential advantages for hydrogen production: avoidance of the production of greenhouse gases, production of hydrogen near the final market (versus production using natural gas, which requires transport via long-distance pipelines), production rates per reactor that match the projected need for hydrogen, and the availability of large resources of uranium fuel. Several types of reactors are being considered for hydrogen production, and several methods exist to produce hydrogen, including thermochemical production (heat plus water yields hydrogen and oxygen) and high-temperature electrolysis (heat plus electricity yields hydrogen and oxygen). A broad perspective of nuclear hydrogen futures is described.

## SUMMARY

The world's production of hydrogen is approaching 50 million tons per year. Most of the hydrogen is produced from natural gas by steam reforming. The size of plant used to produce hydrogen via natural gas is growing rapidly. The newest plant on order for hydrogen production will produce 300 million cubic feet per day. If this quantity of hydrogen were produced using nuclear energy, the reactor would require an output of 2400 MW(t). Thus, the size of hydrogen production plants now matches the size of large commercial nuclear reactors. Moreover, the present hydrogen demand is sufficiently large to support hydrogen production using nuclear energy. If a full-scale hydrogen economy develops, the energy requirements for hydrogen production will match those for electricity. As a consequence of these changes, there is a rapidly growing interest in producing hydrogen using nuclear energy.

The characteristics of hydrogen production from nuclear energy are different from those associated with many other sources of hydrogen. In addition to using the large available resources of uranium fuel and avoiding the production of greenhouse gases, nuclear energy makes it possible to produce hydrogen near the final market, thus eliminating the long-distance pipelines associated with transport of natural gas. Nuclear reactors are typically located 50 to 200 kilometers from large cities. This limits the pipeline distance required for delivery of nuclear-produced hydrogen compared with that for most other methods of hydrogen production. Because a significant cost to the customer is the cost of hydrogen delivery, hydrogen from nuclear reactors has potentially a significant advantage because the delivery infrastructure is smaller.

Multiple methods of hydrogen production using nuclear energy are being investigated. This includes alternative reactor types (briefly described) and alternative methods to convert heat and water into hydrogen (briefly described).

From a longer-term perspective, nuclear energy may be more competitive for the production of hydrogen than electricity. Because hydrogen can be produced at a constant rate and then stored in large underground caverns (whereas electricity cannot be stored efficiently), the constant output of a nuclear plant is potentially more compatible with the production of hydrogen than with electricity.