

AN ELECTROCHEMICALLY REGENERATIVE HYDROGEN-HALOGEN ENERGY STORAGE SYSTEM

General Electric Co.

The General Electric Co. carried out tests on a 0.05 ft.² hydrogen-chlorine cell as a function of temperature and pressure. Pressures up to 10 atmospheres and temperatures up to 80 °C were investigated. Increasing the pressure increases the discharge performance of the cell considerably because of the increased solubility of chlorine. Increase in temperature improves both the charge and discharge performance because of the reduction in the membrane resistivity.

General Electric also investigated hydrogen-bromine cells, low cost carbon bromine electrodes gave equivalent performance to noble metal electrocatalysts. Cell performance was investigated in the HBr concentration range of 5 - 40%.

Recent publications

- 1 J. F. McElroy, Hydrogen-halogen energy storage system development, *Final Rep. Contract No. 410127-5, January 20, 1978.*
- 2 J. F. McElroy, Hydrogen-chlorine breadboard system tests, *Contract No. 456604-5, September 29, 1978.*
- 3 J. F. McElroy, Hydrogen-chlorine breadboard system tests, *Contract No. 456604-5, December 31, 1978.*

HYDROGEN/CHLORINE ENERGY STORAGE SYSTEM: SAFETY, PERFORMANCE AND COST ASSESSMENT

Oronzio de Nora

Oronzio de Nora (ODN) has carried out a complete study of a 20 MW/200 MW h H₂/Cl₂ energy storage system with emphasis on safety and cost aspects of such a plant. An H₂/Br₂ system has also been considered as a comparison to the base case. One of the most significant results of this study was confirmation of the fact that a high performance safe plant could be constructed using only equipment already available and tested on stream in

analogous conditions. ODN made cost assessments based on suppliers quotations and ODN field data. These have to be taken as a very realistic figure. Estimates were also made of plant parasitic losses and overall electric to electric efficiencies. Plant costs were divided into energy related and power related costs. For the H_2/Cl_2 system, these were \$456/kW and \$73/ kW h. For the H_2/Br_2 system the costs were \$431/kW and \$67/kW h. Overall efficiencies, including parasitic, inverter and rectifier losses were 67% for the H_2/Cl_2 system and 70% for the H_2/Br_2 system.

Recent publications

- 1 P. M. Spaziante, G. C. Scioli, R. Trota and A. Perego, Hydrogen/chlorine energy storage system: *Safety, Performance and Cost Assessment, Final Report, Contract No. 451857-5, February, 1979.*

OPTIMIZATION STUDY OF HYDROGEN/HALOGEN ENERGY STORAGE SYSTEMS

Clarkson College

This investigation includes a multidimensional optimization study of the H_2/Cl_2 and H_2/Br_2 systems. Data from BNL, General Electric Co. and Oronzio de Nora were used in these studies. An objective function was defined as the plant capital equipment cost divided by the product of the efficiency times the charge energy input. Plant operating conditions which minimized this function were determined. A significant finding was that increasing the chlorine pressure decreased overall plant cost. This minimized pump cost and parasitic pumping losses. Another significant finding was that the optimum current density of operation from a system point of view was between 100 mA/cm^2 and 200 mA/cm^2 .