SPE-501-18

Ideal state benchmarking and application of benchmark energy factor for industrial systems and processes

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Preface

This is the first edition of CSA SPE-501, *Ideal state benchmarking and application of benchmark energy factor for industrial systems and processes*.

The CSA Technical Committee on Energy Efficiency of Industrial Equipment, as part of its strategic planning, has endorsed the development of user-oriented standards. Historically, the Technical Committee has developed energy efficiency standards for industrial equipment, where the equipment's efficiency is determined in a certified laboratory. Future opportunities for industrial energy savings are expected to come from measurement of energy performance of an industrial system at the facilities location using benchmarking methodologies. Once benchmarking has been accepted as an accurate, reliable, and comparable method of estimating energy savings, energy management initiatives can be implemented to monitor the energy performance thereof.

This Publication summarizes a novel approach to ideal state benchmarking of industrial systems and processes. Dedicated papers have been published by BC Hydro at various international conferences and in journals: the American Council for Energy-Efficient Economy (ACEEE), the Institute of Electrical and Electronic Engineers (IEEE), and the *Journal of Energy in South Africa* (JESA). This Publication provides the basics necessary to benchmark the energy efficiency performance of industrial systems and processes by using a dimensionless indicator called the benchmark energy factor (BEF).

CSA Group acknowledges the development of this Publication was made possible, in part, by the financial support of Natural Resources Canada, BC Hydro, Manitoba Hydro, Hydro-Québec, Canadian Electricity Association, Ontario Ministry of Energy, and Nova Scotia Department of Energy.

This Publication has been reviewed by the Technical Committee on Energy Efficiency of Industrial Equipment.

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0 Introduction

In today's economic environment, business sustainability requires highly efficient technological processes that will increase the business's competitiveness. Businesses require the utilization of energy to run processes using the most cost-effective way whereby waste energy is minimized and energy productivity maximized.

The main drivers of energy efficiency are:

a) energy availability;
b) energy reliability;
c) energy productivity;
d) energy cost-effectiveness; and
e) energy sustainability.

One of the barriers to energy efficiency improvement is the lack of an accurate, repeatable and comparable benchmarking methodology. It is proposed that an ideal state benchmarking methodology is actionable if based on technical and scientific principles.

Traditional benchmarking methodologies used for industrial systems and processes (ISP) are typically based on those being used in commercial and residential sectors, which are commonly established on historic patterns and profiling. In many ways, the benchmarking process was adapted to analytical work by recording endless numbers in worksheets and regressions for normalization. This is because conventional ISP benchmarking is based on mimicking the best practice in the industry.

CSA SPE 500 demonstrated that results based on using best practice as a reference, are not effective due to the large variability of independent and dependent parameters. These parameters need adjustments that cause baseline inaccuracies requiring permanent and tedious normalization activities.

1 Scope

This Publication presents the framework of the new concept of "essential energy benchmarking" as a new form of ideal-state benchmarking for energy performance. It provides the basics necessary to benchmark the energy efficiency performance of an ISP by using a dimensionless indicator called the benchmark energy factor (BEF).

This Publication is a reference document for the application of essential energy benchmarking to industrial systems and processes with defined system boundaries and essential energy modelling. The essential energy model of an ISP is the basis of design and must be quantifiable by its fundamental thermal, mechanical, chemical, electrical, and/or quantum-mechanical energy components.