



Why BEM Is Different

This document summarizes BEM's forensic assessment of the advanced electric-machine-system market.

Purpose: *To provide the commercialization framework for evaluating BEM as the developer of a new integrated electric-machine technology, engineering design, and manufacturing platform rather than as an incremental improvement to conventional passive-rotor electric-machine systems.*

1. A New Electromagnetic Architecture

Key Point: *BEM is commercializing a fundamentally different electromagnetic architecture—not another improved passive-rotor electric motor-generator machine system.*

BEM is not commercializing another permanent-magnet, induction, reluctance, or field-excited electric motor-generator system (EMS) with incremental improvements in packaging, materials, and control for performance differentiation. Rather, BEM is commercializing a new electromagnetic architecture—the Symmetric Electric Machine System (S-EMS)—an electromagnetic architecture whose theoretical foundations have long been understood but whose practical commercialization became possible only through advances in power electronics, digital control, high-frequency magnetics, advanced materials, additive manufacturing, and the invention of Maintenance-free, Brushless and Sensorless Real-Time Emulation Control (BRTEC).

In BEM terminology, conventional machines remain electromagnetically asymmetric electric-machine systems (A-EMS) with an active stator contributing working electromagnetic power but a passive rotor that cannot contribute working power while consuming up to half of the electric machine size, loss, and cost, while typically operating under a derivative of field-oriented control (FOC). Permanent-magnet, induction, field-excited, and reluctance-saliency machines are implementation categories of the passive-rotor architecture rather than separate electromagnetic architectures. In contrast, SYNCHRO-SYM implements the electromagnetically Symmetric Electric Machine System (S-EMS), in which both the stator and rotor independently contribute working electromagnetic power while operating under the coordinated control of BRTEC. Together, SYNCHRO-SYM™ and its enabling BRTEC™ real-time control technology that employs a new magnetic-sharing™, solid-state transformer (SST) power conversion technique, BEM-CAD™, and MOTORPRINTER™ establish an integrated technology platform intended to more than double achievable price-performance relative to an A-EMS designed under comparable constraints while creating a sovereign domestic manufacturing capability.

2. Third-Party Technical Validation

Key Point: *Independent industrial evaluation advanced beyond technical review into commercialization negotiations.*

Unlike many startup claims that rely primarily on internal testing, BEM's technology progressed through multiple prototype generations and received independent engineering evaluation. Lincoln Electric independently evaluated the technology through its engineering organization and concluded that it represented a transformational advancement. That evaluation progressed to negotiation of a commercialization agreement valued at approximately **\$4 million plus an 8% royalty** on the retrofitted product line. The program ended because of circumstances unrelated to the technology itself, providing unusually strong third-party validation.

3. Commercialization Tools Already Exist

Key Point: *BEM-CAD is a computer-aided design tool for the S-EMS architecture, not merely another CAD tool for the A-EMS architecture.*

BEM has substantially reduced commercialization risk through the development of BEM-CAD, the CAD environment specifically developed for the design, optimization, thermal analysis, electromagnetic analysis, manufacturability, cost estimation, and commercialization of S-EMS machines.

4. Manufacturing Is Part of the Innovation

Key Point: *MOTORPRINTER is a manufacturing platform, not merely another production process.*

MOTORPRINTER is more than an additive-manufacturing process. It is a portable, scalable, ultra-low-tool-wear, programmable domestic manufacturing platform intended to enable rapid, low-waste, low component inventory production of advanced axial-flux electric machine integral-frame-wound-cores using modern magnetic materials. Conventional additive manufacturing optimizes the deposited material for the printing process. MOTORPRINTER reverses that paradigm by optimizing the deposited material for the performance of the electric machine being manufactured. As a result, MOTORPRINTER may uniquely use high-performance materials, such as amorphous or nanocrystalline ribbons, that in the past, could not be used in electric machines.

5. Domestic Manufacturing Is a Strategic Advantage

Where several competitors have relied upon global supply chains or offshore manufacturing, BEM's long-term objective is domestic engineering and manufacturing while eliminating dependence on consequential rare-earth permanent magnets.

6. Technical Risk

Unlike many electric-machine startups that seek funding before meaningful hardware validation, BEM has completed multiple prototype generations, laboratory validation, controller development, manufacturing development, and commercialization planning. The remaining activities are production engineering, certification, customer qualification, and manufacturing scale-up.

7. Commercialization Risk

The principal remaining challenge is commercialization—manufacturing scale-up, certification, customer qualification, and market entry—rather than demonstrating the underlying electromagnetic architecture.

8. Historical Risk

Historically, the S-EMS remained largely an academic construct because the coordinated real-time control of an active rotor was not practical. Only recent advances in high-power semiconductors, digital signal processors, high-frequency magnetics, modern materials, and real-time control algorithms have made commercial implementation feasible with the invention of BRTEC. Consequently, investment over the past century has focused almost exclusively on improving conventional passive-rotor architectures—including permanent-magnet, induction, reluctance, and field-excited machines—because the enabling technologies required for practical S-EMS implementation did not yet exist.

9. The Investment Thesis

BEM represents a technology platform rather than a single EMS product. The combination of SYNCHRO-SYM, BRTEC, BEM-CAD, and MOTORPRINTER provides an integrated architecture, control system, design environment, and manufacturing platform capable of approximately doubling the achievable price-performance of today's asymmetric electric machine systems under comparable design constraints while simultaneously establishing a sovereign domestic manufacturing capability.

Closing Summary

Most EMS startups have received substantial venture investment by incrementally improving the conventional passive-rotor architecture, including its permanent-magnet, induction, field-excited, and reluctance-saliency implementations, through advances in packaging, materials, and control. BEM addresses the same market objectives through a fundamentally different active-rotor architecture enabled by modern electronics, digital control, advanced materials, engineering innovation, and programmable manufacturing. Combined with BEM-CAD and MOTORPRINTER, SYNCHRO-SYM represents not simply another EMS, but a complete electric-machine technology and manufacturing platform designed for domestic commercialization.

Accordingly, BEM should not be evaluated as another EMS company, but as the developer of a new electric-machine technology platform whose integrated electromagnetic architecture, control technology, engineering environment, and manufacturing platform together establish a new foundation for future electric propulsion systems.

For strategic investment, OEM partnerships, manufacturing collaborations, technical discussions, or BOE Work Packages, please contact:

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