

Best Electric Machine (BEM)

“Higher Purpose” Summary

Real Innovation For A Clean, Efficient, and Sustainable Energy Future

BEM's "Higher Purpose"

- ✓ Democratize Electric Motor-Generator System (EMS) Manufacturing!¹
- ✓ Return The U.S.A. to Leading Global EMS Manufacturer!
- ✓ Greatly Reduce The [Global Harm of RE-PMs Monopolized by a Global Adversary Seeking World Dominance!](#)^{1,2}
- ✓ Return The U.S.A As Fighter Against Human Rights Abuses, Improving Climate Circumstances, and Transforming The Electricity Infrastructure!²

BEM Will Necessarily Be The Go-To Manufacturer of Electric Vehicle (EV) Propulsion Electric Motor-Generator Systems!

¹ An **EMS** is an electric motor (or generator) "system" that includes the *compounding* loss, cost, and size of all enabling components for practical application, such as the motor, gearbox, and electronic controller components.

² As the backbone of the electricity infrastructure, the EMS has a significant impact on global warming, carbon footprint, electricity efficiency & cost

BEM's "Higher Purpose" Opportunity of the Century

- **With "America First Agenda" Pushing Long Overdue Fair & Reciprocal Tariffs And Ethical Products:**
 - ✓ Restore USA Original Dominance in Science, Education, Innovation, and Manufacturing!
 - ✓ Fight Destructive Environmental, Social, Innovation, and Geopolitical Exploitation by the CCP!
 - ✓ Re-Divert the Suction of Offshore Investment back to the Good of USA investment!

***Rather Than Fight Fair Change:
Embrace Opportunity for USA Companies With Real Innovation!***

BEM's "Higher Purpose" Game Change

- **SYNCHRO-SYM E-Motor:**

- ✓ *Only* EMS Manufacturer that *reimagined* EV propulsion with patented IP for the only Symmetric EMS (**S-EMS**) with an Active Rotor! ^{Note 1,2}
 - Most efficient, lightest, smallest, and lowest cost possible: ***Driving higher profits & redefining technology***
 - *Without* rare-earth materials: Eliminates *associated harm by a global adversary's monopoly*

- **MOTORPRINTER:**

- ✓ *Only* EMS Manufacturer that *reimagined* EMS manufacture with patented IP for the only reprogrammable, JIT **EMS 3D Printer!**
 - **With reprogrammable BEM-CAD** for *secure, inhouse*, JIT manufacturing: ***Quickly, Locally & Securely serving customer prototyping and production needs***

BEM's "Higher Purpose" **SYNCHRO-SYM E-Motor**

- ✓ **Eliminates** The Environmental & Geopolitical Harm of Rare-Earth Permanent Magnets (RE-PM) (*by a global adversary seeking world dominance*)!^{Note 1}
- ✓ **Multiplies** the "Performance/Price Ratio" (**PPR**) and Peak Torque by At Least 2-8x With the Same Package Footprint and Design Specification of Today's A-EMS (*lighter, smaller, more efficient, less expensive*)!^{Note 2,3}
- ✓ **Multiplies** The Expected **PPR** of EMS Enabling Packaging Techniques by At Least 2-8x (e.g., *emerging WBG technologies*)!
- ✓ **No Performance-Robbing** Torque Core Saturation, Core Loss, Inductive Reactance, or Cogging!
- ✓ **Reduces** Copper & Electrical Steel Usage per unit of power rating!
- ✓ **Retrofitting Today's Asymmetric EMS (A-EMS) Package With SYNCHRO-SYM Multiplies The Original PPR by 2-8x!**

BEM's "Higher Purpose" MOTORPRINTER

- ✓ **Only EMS 3D Printer Method**^{1,2}
- ✓ **Only SYNCHRO-SYM CAD Tool Interface, called BEM-CAD!**
- ✓ **Eliminates *Unethical Offshoring*** (*to exploit low-cost labor or to avoid global restrictions on RE-PMs by a global adversary*)!
- ✓ **Protects IP & Product Ownership** (*with secure inhouse manufacturing*)!
- ✓ **Solves Unforeseen and Costly Manufacturing Bottlenecks** (*by re-programmable, JIT, additive manufacturing*)!²
- ✓ **Solves Material Handling Issues** (*e.g., emerging nano-materials*)!
- ✓ **Democratizes Distributed Manufacturing** (*e.g., manufacturing franchising*)!

¹ Uniquely uses readily-available, optimally premanufactured layering materials, including electromagnetically superior amorphous or nanocrystalline metal ribbon that otherwise, was impractical for EMS application

² Uniquely 3D Prints a superior thermal management & System of System (SoS) Integration

SYNCHRO-SYM Demonstration

<https://youtu.be/IZ8cxSLLCR8?t=5>

BEM's "Higher Purpose" TAM (>\$370B) ¹

- **Automobile** \$100B+ ²
- Wind Turbines \$45B+ Note 3
- Industrial & Commercial Motors \$220B+ Note 4
- Others
 - Aircraft, including drone fleets, Boats and Ships, Rail and Trucks, Construction Machines (e.g. forklifts, power drills/hammers, backhoes), etc.

BEM's "Immediate" Global TAM is expected to exceed \$100B

¹ Only Served By Today's "Asymmetric" EMS (A-EMS) With a "Passive Rotor" of RE-PMs, Slip-Induction Windings, Reluctance Saliencies, or DC Field Windings!

² The 20KW to 250KW componentized propulsion A-EMS annual market Size for boutique EV manufacturers (e.g., Hypercars) and EV OEMs (e.g., Toyota) by significantly under estimating the A-EMS, which includes controller and gears, to be 3% of the total EV cost

BEM's Competitors' "Lower Purpose" A-EMS

<i>Funded Company</i> ^a	Market	Funding ^b	TAM
<u>Infinitem Electric</u>	<u>Industrial RE-PM PCB</u>	\$350M since 2014 ^d	\$186B
<u>TurnTide Technology</u> ^c	Industrial Synchronous Reluctance	\$491M since 2013	\$186B
<u>Magnix</u>	Electric Airplane	\$74M since 2022	\$13B
<u>H3X</u>	Electric Airplane	\$9M since 2023	\$13B
<u>BMW's 5th Generation E-Drive</u> ^c	Electric Vehicle	\$?	\$100B
<u>DeepDrive</u>	Electric Vehicle	\$34M since Sept. 2024	\$100B
<i>Emerging Company</i> ^e	Market	Amortizing ^b	TAM
<u>Best Electric Machine (BEM)</u> ^c	Electric Vehicles, etc.	Kickstart Sales Plan	\$370B

- a. All are "me-too" Asymmetric EMS (A-EMS) with a "performance-robbing passive rotor" and a remotely placed, estimating field-oriented controller derivative that are typically different technical disciplines from different manufacturers
- b. For "validation (NRE) and commercialization" of an EMS packaging technique
- c. Only EMS manufacturers with the "higher purpose" of eliminating the environmental, human exploitation, and geopolitical harm of RE-PMs.
- d. The funding includes offshoring manufacturing to Mexico
- e. Only BEM's SYNCHRO-SYM is an S-EMS with "performance-contributing active rotor" and "integral" brushless real time emulation control (BRTEC) and 3D Printing Manufacturing

BEM's "Higher Purpose" Accomplishments Note 1

- **BEM's EMS (SYNCHRO-SYM)** delivers at least twice the power and 8x the peak torque with the same A-EMS packaging, size, loss, and cost [*but without [the harm of RE-PMs](#)*]:
 - ✓ *Verified* by [a century of theoretical EMS study & R+D](#) to be the pinnacle in EMS technology! Note 2
 - ✓ *Verified* by *Tangible* BEM Persistent R+D, Prototyping, and Domestic & International Patenting
- **BEM's 3D Printer Method (MOTORPRINTER) for JIT SYNCHRO-SYM Manufacture:**
 - ✓ *Verified* by BEM orchestrating empirical studies with leading manufacturers of amorphous metal and fiber laser cutting [*& now in [fabrication](#)*]
- **BEM's EMS Computer Aided Design Tool (BEM-CAD) for JIT SYNCHRO-SYM design:** Note 3
 - ✓ *Verified* by BEM cross-comparing design results with A-EMS published product specification
- **BEM's Team Developed [*& Executing*] "Validation & Commercialization" Plan:** Note 4
 - ✓ *Verified* by BEM cross-comparing with "[High Value Funded Contestants' A-EMS Validation Plan](#)"

Technology & Market *Verified!* Low Technical or Market Risk!

“Higher Purpose” *Issues & Opportunities*

- **Confusion:** EMS “Terminology” that evolved from a century of *applied A-EMS practice* must be accurately redefined to describe the *theoretical S-EMS practice* enabled by BRTEC! ^{Note 1}
- **Ignoring Facts:** SYNCHRO-SYM is the only stable “symmetric” EMS (S-EMS), which was verified by a forgotten century of *theoretical* EMS study & research and BEM persistent R+D, prototyping, & patents!
- **Conflicts of Interest:** Substantial investment in practicing “me-too” A-EMS packaging, such as RE-PMs, monopolized by the CCP snubs the novel S-EMS technology of SYNCHRO-SYM!
- **Confusion:** SYNCHRO-SYM is a “newly invented” S-EMS circuit and control technology that easily retrofits any A-EMS package but IAW physics, greatly magnifies the Performance/Price!
- **Confusion:** SYNCHRO-SYM is *wrongly* confused with the *unstable* field-oriented controlled, doubly-fed, “induction” A-EMS (WRDF-EMS) with multiphase brush-slip-ring assembly & FOC!
- **Creative Marketing (contrary to physics):** Extraordinary performance/price between “me-too” A-EMSs is easily shown by not fairly providing legacy packaging details, such as standard versus custom frame size, or design specification details, such as operating voltage, maximum load speed, or duty cycle!

Need “Validation & Commercialization!”

BEM's "Higher Purpose" BUSINESS PLAN

- Implement BEM's "[Kickstart Sales Plan:](#)"

- ✓ Amortize "Validation and Commercialization" Cost Over MPV!^{Note 1,2}

- Implement Word-Of-Mouth & Scientific Sales Approach to Reach MPV (AI, Big Data, Digital Tools, etc.)!

- ✓ **Validation:** SYNCHRO-SYM E-Motor Meets Beta (Customer) Testing!³

- Fabricate MOTORPRINTER for JIT *Axial-Flux* Sample Production!
- Redesign the *Verified* Radial-Flux Prototyping With State-of-Art Components, BEM-CAD Axial-Flux Footprint, Alpha (Inhouse), and Beta Testing!
- **Publish/Advertise Validated Results** of Beta Testing To Entice Sales!

- ✓ **Commercialization:** Scale MOTORPRINTER For *Inhouse* Production!⁴

BEM's "Higher Purpose" Team ¹

Today:

- Founder, Chief Technology Officer (Frederick)
- Chief Executive Officer (Kaylyn)
- Chief Operating Officer (Garrett)
- VP Marketing (Carol)

Tomorrow:

- Add Sales & Marketing
- Add CIO for SYNCHRO-SYM
Enabled Products:
 - Compact, Light Weight Wind Turbines
 - Universal EV Power Train Cradle
 - Hydrogen Capture
 - Distributed Power Management

IT'S THE MARKET *NEED* FOR BEM'S HIGHER PURPOSE TECHNOLOGY!
[ITS NOT The Creative Market Plan or The Who's Who Marketing Team!]

¹ BEM's committed team is not the Who's Who of creative marketing that is essential to sell another "me-too" A-EMS product but instead, is sole keeper of S-EMS knowledge base with the IP protection integrity, functional expertise, mission centric flexibility, and ethical resolve to compete against the RE-PM A-EMS juggernaut that is monopolized by a global adversary seeking world dominance by environmental and geopolitical harm!

THANK YOU

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Backup Slides

BEM's SYNCHRO-SYM Vs EMS (or All Others)

Category	Continuous Power ¹	Peak Torque (Power) ¹	cost ¹	Loss ¹	Size ¹	weight ¹	Material Amount ¹	Strategic Rare-Earth Materials ^{1,4}	Inductance (Torque) ⁵	Core Saturation (Torque) ⁶	Compounding rotor Loss, Cost, and Size ⁹	Magnetizing MMF Sharing ¹⁰
S-EMS²	2x	8x ⁷	1/2x	1/2x	1/2x	1/2x	1/2x	No	No	No	No	Yes
A-EMS³	1x	1x	1x	1x	1x	1x	1x	Yes ⁸	Yes	Yes	Yes	No

¹ Per Unit of Power Rating with the same port voltage, air-gap flux density, and packaging and footprint

² The Symmetric EMS (S-EMS) [as only possible with SYNCHRO-SYM with a power producing “active rotor” as only possible with BRTEC] reaches the theoretical limit in EMS performance/price ratio

³ The Asymmetric EMS (A-EMS) with a passive rotor of slip-induction windings, reluctance saliencies, DC field windings or permanent magnets, such as rare-earth permanent magnets (RE-PM), that wastes loss, cost, and size without any power production

⁴ Rare Earth Materials, such as for RE-PMs, are monopolized by a global adversary seeking world dominance with harmful environmental, human exploitation, innovation, and geopolitical consequences

⁵ The lower the inductance (due to “torque MMF cancellation” as a result of symmetrical transformer physics), the faster servo response time

⁶ The lower the core saturation potential (due to Torque MMF cancellation), the higher the peak torque

⁷ Due to Torque MMF cancellation, the air-gap flux density can be designed closer to the saturation limit of the core material and SYNCHRO-SYM uniquely has another degree of power density adjustment, which is torque current magnitude adjustment, over packaging techniques.

⁸ Only RE-PM A-EMS

⁹ The rotor loss, cost, and size of any A-EMS, including the RE-PM A-EMS, are compounded through the Stator. For instance, without a directly-excited (or passive) rotor, the loss of the rotor must be passed through the power producing active stator, which will compound the loss (size and cost) of the stator. In contrast, the rotor and stator of SYNCHRO-SYM are independently excited.

¹⁰ With the symmetry of two independently excited winding sets on the rotor and stator of the S-EMS, as only possible with SYNCHRO-SYM, Magnetizing MMF is shared between the rotor and stator winding sets and as a result, the total winding I^2R loss (and core loss) is halved.