ecm PCB STATOR TECH

CASE STUDY

Lowering Total Cost of Ownership in Data Centers with ECM PCB Stator Technology

SUMMARY

Data centers are the backbone of modern digital infrastructure, supporting everything from cloud computing to artificial intelligence. However, they face mounting challenges in reducing operational costs while maintaining high-performance cooling solutions. With cooling accounting for up to 40% of a data center's total energy consumption[i], inefficient systems lead to unsustainable expenses. Rising shipping and installation costs, tariff fluctuations, and supply chain disruptions further strain budgets, particularly for large-scale projects tracking embodied carbon. Addressing the total cost of ownership (TCO) holistically is crucial for long-term financial and environmental sustainability.

CHALLENGE: REDUCING TOTAL COST OF OWNERSHIP (TCO) IN DATA CENTER COOLING

Data centers must manage several cost factors that impact their long-term viability:

- **High Energy Costs:** Cooling accounts for up to 40% of a data center's total energy consumption, leading to soaring electricity expenses over time.
- **Expensive Logistics & Installation:** Traditional motors are bulky and require more shipping containers, increasing acquisition and installation costs, particularly for large-scale deployments.
- **Tariff & Supply Chain Risks:** Global supply chain disruptions and fluctuating tariffs create uncertainty, driving up costs for imported components.
- **Sustainability Pressures:** Large data center projects must track embodied carbon, making transport, installation, and long-term efficiency critical factors in their decision-making.

SOLUTION: ECM PCB STATOR MOTORS – CUTTING COSTS ACROSS THE LIFECYCLE

ECM's PCB Stator axial flux motors offer a transformative solution by reducing electricity consumption, lowering acquisition and shipping costs, and enabling more efficient supply chain management. Unlike traditional motors, ECM's patented thermal heat pipe design ensures superior thermal stability without requiring supplemental cooling, simplifying integration into existing air-cooled systems.

- **Lower Acquisition & Installation Costs:** ECM's motors are up to 70%[ii] lighter and more compact than conventional motors. Their reduced size allows for more units per shipping container—lowering logistics costs at scale while also reducing embodied carbon in transport and installation. Note in the table below *(p2)* that based on a 40-foot shipping container, ECM's motor can fit hundreds more motors.
- **Electricity Savings Over Time:** With ECM's high-efficiency PCB Stator motors, data centers can significantly reduce energy costs. For a deeper dive into efficiency benefits, see our previous case study on optimizing data center efficiency here.
- **Tariff Mitigation & Supply Chain Security:** ECM's technology supports supply chain diversification through contract manufacturing and vertical integration, reducing reliance on overseas components. Additionally, onshoring production helps data centers avoid tariff uncertainties while creating domestic jobs and strengthening the U.S. manufacturing sector.

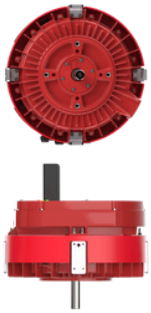
Metric	Radial AC Induction	Radial EC	Radial Synch. Reluctance	Axial Flux (PCB)	ECM Axial Flux (PCB)
Motor					
Mech Power (kW)	3.7	3.7	3.7	3.7	3.7
Speed (RPM)	1800	1800	1800	1800	1800
Torque (Nm)	20	20	20	20	20
Efficiency	IE5 - IES2	IE5 - IES2	IE5 - IES2	IE5 - IES2	IE5 - IES2
Cooling Method*	TEFC	TEAO	TEFC	TEFC	TEAO
Weight (lbs)	120.0 lbs	83.8 lbs	77.0 lbs	85.6 lbs	**49.0 lbs**
Length (in)	18.3	14.5	16.7	12.9	**8.5**
Width (in)	14.3	11.9	7.9	16.4	14.2
Height (in)	11.0	11.1	13.5	16.4	14.2
Volume (ft3)	1.67	1.11	1.03	2.01	**0.99**
Est. Units per 40-Foot Container *iii*	414	593	645	580	**1,014**
Nautical Miles: Port of Boston to Rio de Janeiro *iv*	5,848	5,848	5,848	5,848	5,848
Est. Shipping Cost for 1 Full Container *v*	$1,884	$1,884	$1,884	$1,884	$1,884
Est. Shipping Cost per Motor	$2.70	$2.73	$2.50	$2.78	**$1.59**

Table 1: Crate Shipping Costs Comparison for Various IE5 Motors
****TEFC: Totally Enclosed Fan-Cooled, TEAO: Totally Enclosed Air Over** vi*

REAL-WORLD IMPACT: A LARGE HVAC OEM'S DATA CENTER COOLING INNOVATION

A leading HVAC OEM leveraged ECM's PCB Stator technology to optimize its data center cooling products. The adoption of ECM's motors resulted in:

- **Over 60% reduction in manufacturing costs** through streamlined production and design optimization.
- **Improved regulatory compliance**, exceeding energy efficiency standards such as EnergyStar and Weighted Efficiency Factor (WEF) requirements.
- **Enhanced supply chain resilience** by integrating ECM's motors into a vertically managed production strategy, reducing dependency on overseas components and mitigating tariff risks.
- **Domestic job creation** through onshoring motor production, strengthening local manufacturing capabilities.

CONCLUSION: A SMARTER APPROACH TO DATA CENTER COOLING

By addressing total cost of ownership holistically—spanning acquisition, energy consumption, and supply chain stability—ECM's PCB Stator motors provide a compelling solution for data centers aiming to reduce costs and increase efficiency. The ability to ship, install, and operate these motors with lower costs makes them a game-changer in the industry, helping operators meet sustainability goals while maintaining financial viability.

For more information on how ECM's motors can reduce costs and improve efficiency, visit **our case study archive** or **contact us** today.

i. U.S. Department of Energy. "DOE Announces $40 Million for More Efficient Cooling for Data Centers." (2023).
ii. ECM PCB Stator Tech. "PCB Stator Technology." 2025. https://pcbstator.com/pcb-stator-technology/. Accessed 25 2 2025.
iii. iContainers. "40ft Shipping Container - Dimension, Sizes & Weight Guide." *iContainers*. 2024. https://www.icontainers.com/help/40-foot-container/. Accessed 25 February 2025.
iv. Ports.com. "Seaports: info, marketplace." *Ports.com*. Accessed 25 2 2025.
v. Wolf, Devorah. "Container Shipping Cost Calculator [2025]." *Freightos*. 2023. https://www.freightos.com/freight-resources/container-shipping-cost-calculator-free-tool/. Accessed 25 February 2025.
vi. Olsen, Damien. "Ten Common Types of Motor Enclosures." *Energy Management Corporation*. 17 July 2020. https://gpemc.com/2020/07/17/ten-common-types-of-motor-enclosures/. Accessed 25 February 2025.