



Rotor and stator components Composants rotor et stator

Opportunity description

Paris, July 2023

Manufacturers of rotor/stator plates play a crucial role in the multifaceted e-motor value chain – significant potential for job creation in France

Synthesis by domain

Market attractiveness

- Metal plates for rotors and stators make a highly attractive market, driven by the electrification of European vehicle sales, as well as steel lamination technological advancements driving up prices
- Manufacturers of rotor/stator plates play a crucial role in a multifaceted value chain, serving primarily as suppliers to Tier-1 subcontractors, mostly e-motor assemblers

Market accessibility for French players

- Market for rotor/stator plates is characterized by significant CAPEX requirements needed to set up production lines with rolling mills and cutters
- Rotor and stator plates manufacturing necessitates stamping and lamination capabilities and "know-how", both of which France possesses with recognized expertise

Attractiveness for France

- French manufacturers are well-suited to produce rotor/stator plates, all as part of a global strategy to build a French ecosystem around the e-motor and its components
- But rotor/stator plates industrialization will have a limited contribution both on French economy resilience and balance of trade, as it remains a product produced in all of France's main neighboring countries
- Moreover, France could play a greater role in cold plates manufacturing with "green steel" production, becoming a major factor of choice in location for new factories



Rotors and stators, forming the basis of the e-motor, are manufactured by laminating, cutting and assembling steel sheets

Rotor and stator overview and main characteristics

View of an E-motor



- Focus in this document on components made out of metal sheets
- 2 key components in an electric motor:
- Stator: immobile part of an electric motor and magnetic counterpart to the rotor, its function is to guide the magnetic field within the electric motor
- Rotor: moving/rotating part of an electric motor, The rotor sits between the poles of the stator
- Rotor and stator are manufactured with **laminated construction**:
- Magnetic cores (rotor core, stator core) are made of individual metal sheets, also known as sheet laminations, each of which is insulated from the other by a coating a few micrometers thick
- Individual sheets are stacked on top of each other and baked or screwed together to form a sheet stack – a stack of laminations represents a magnetic core and thus a rotor or stator

Rotor/stator plates market is growing at 11% p.a. driven by both penetration of BEVs and volume, as well as steel price increase

Rotor and Stator plates - Market evolution and trends

Rotor/Stator plates European market size evolution [EUR bn; 2023; 2028; 2035]



Rotor/Stator plates market drivers

		Trends
Electric Vehicle (EV) Idoption	• EVs rely on electric motors, which require steel laminations for their core construction. As the demand for electric vehicles continues to rise, so does the need for steel laminations	
Steel lamination echnological idvancements	 Steel laminations with optimized magnetic properties and reduced core losses contribute to enhanced motor efficiency, making them a crucial component in modern automotive applications and driving up prices 	
Steel price increase	 Europe has decided to introduce a carbon tax on non-European companies, which will probably lead to a rise in steel import prices At the same time, risk for production capacity for systems in Europe to shrink due to the lack of competitiveness 	

1) Low : EBIT below 5% of revenue ; Medium : EBIT between 5% and 10% of revenue ; High : EBIT above 10% of revenue

Source: Roland Berger

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Stator & Rotor value chain



French players or players with significant capacity in France 1

Focus on stator & rotor plates

Main value chain threats are the rising importance and globalization of Chinese suppliers as well as forward integration of steel producers

Value chain potential evolution



Rotor/stator plates market holds considerable appeal as it is expected to remain technologically stable and offers business opportunities beyond the automotive industry

Market attractiveness – Other criteria



1) Generators, Pumps, Compressors

Induction and Radial PSM motors are the most relevant technologies for the automotive market today

Automotive e-motor technologies

Design				Radial				Axial		
Rotor speed vs stator field Asynchronous				Synchronous						
Rotor field generation		Induction		Permanent magnet		Current excited	None – usage reluctance	Permanent magnet ²⁾		
E-Motor type		Induction moto	r	PSM		EESM	SRM	A-PSM		
E-motor characteristics	Spec. power 1) [kW/kg]						\bigcirc			
	Manufacturing costs ²⁾							\bigcirc		
	Peak	\bigcirc								
	Technology maturity					•		\bigcirc		
E-motor automotive applications	LV – primary drive		Ŷ		⇒			Used for luxury vehicles		
	LV – secondary axle		ス		Ŷ	• 7	Verv limited use in			
	LV – High end	\bigcirc	\Rightarrow		Ŷ	○⇒	Automotive as of today			
	MD and HD CV		Ň		Ň	$\bigcirc \Rightarrow$				
 Best in class (absolute scale) Worst (absolute scale) Dominate share (absolute scale) No share (absolute scale) Decreasing by 2030 Increasing by 2030 										

Source: Roland Berger project experience

Market for rotor/stator plates is characterized by significant CAPEX requirements, but establishing production facilities in proximity to assembly lines would be a logical choice

Market accessibility – Assessment



— Technical barriers to entry

• The presence of **technical entry barriers is limited** in the rotor stator plates industry, as it primarily consists in mastered processes such as stamping

• The primary challenge resides within the **design stage for** the upcoming rotor/stator generation, constituting the Limited technical barriers



- Availability of the necessary skills

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— Manufacturing CAPEX

main area of complexity

• Associated CAPEX investment of EUR 40-50m for new production lines including rolling mills and cutters to produce 40 kilo tons of plates of steel





- Traction from French OEMs

- Tier-1 suppliers and OEMs aim to **manufacture rotor and stator plates in proximity to assembly lines** due to their limited mobility and transportation challenges
- Opportunity for OEMs to integrate vertically due to their manufacturing assets for body-in-white components
- Close proximity to client locations required for logistics cost competitiveness: OEMs and tier-2 suppliers tend to favor production sites located in close proximity to their assembly plants



Two industrial models coexist, with smaller plants addressing regional markets and the largest addressing global ones – Market leader with EU footprint in Italy only

Attractiveness for France – Industrial set-up



Main benefit of rotor/stator manufacturing for France is the number of jobs created but impact on the country's balance of trade and economic resilience remains limited

Attractiveness for France – Impact for France & other economic social benefits



Direct Employment & Other related benefits



Hypotheses:

- c. 80% market share for EU rotor/stator plates manufacturers in 2035
- For a plant : c. 100 FTEs including machine management, testing and quality control

Revenue generated per FTE is estimated to be around c. EUR ~1 m



