Development of aerodynamics of the facelifted Enyaq and Enyaq Coupe models

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Abstract: The thesis summarizes the development of aerodynamics of the facelifted Enyaq and Enyaq Coupe models (MY 2025) in the technical development department of Skoda Auto. Through the gradual optimization of selected parts, aerodynamics has been improved, with a positive impact on the car's range. Several features and modifications contributed to improving Enyaq's already good aerodynamics, such as the new front end with the Modern Solid design, which features a slimmer Tech-Deck Face with an optimized transition to the hood, sealing the air duct behind the radiator grille, improved flow around the front wheels thanks to new air curtains and new alloy wheels on offer. CFD simulations and validation measurements were widely used during the development.

1 Introduction

Automotive aerodynamics is a technical discipline focused on the interaction between airflow and vehicle shape. Its optimization directly affects energy consumption, driving stability, noise levels, and overall comfort. Škoda Auto, as an established manufacturer of passenger vehicles, systematically integrates aerodynamic principles into the design of its models. The Enyaq, the brand's first fully electric vehicle built on the MEB platform, underwent structural and visual updates as part of its 2025 facelift. Although primarily aimed at design enhancement, these changes also led to measurable improvements in aerodynamic performance. The aim of this article is to describe the technical aspects of these modifications and their impact on the vehicle's aerodynamic efficiency.

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2 Škoda Enyaq and Enyaq coupé

The successful electric vehicle Škoda Enyaq has been offered in a new form since 2025. The updated model features a design aligned with the Modern Solid language and improved aerodynamics resulting in extended driving range. The drag coefficient (Cx) of the Enyaq model decreased from 0.256 to 0.245 compared to the previous version, while the Enyaq Coupé improved from 0.234 to 0.225. These are among the best values in this segment. Thanks to the improved aerodynamic drag coefficient and other changes, the vehicle's range increased by up to 7 km (WLTP cycle).

2.1 Project and Timeline

The project began in 2021 and followed a timeline that included several key phases—from initial design concepts through testing to final approval. It was classified as a "minor facelift," focusing on changes to the front section of the vehicle, primarily using virtual methods without physical prototypes. During development, 1,600 CFD simulations of external aerodynamics were conducted. The project also included extensive validation and later homologation measurements in the FKFS wind tunnel, totaling 110 hours of testing.

2.2 Aerodynamic Optimization within the Facelift

The improvement in the aerodynamic drag coefficient is the result of changes in the shape and function of several components across different areas of the vehicle. The design modifications were limited to the front of the car, and thus most aerodynamic enhancements are concentrated there. The optimized elements include:

- *Air Curtain* – The shape of the front bumper corner was refined to ensure optimal airflow around the front wheels while preventing air from entering the rear wall of the wheel arch. A central island surrounds the driver assistance sensor within the wheel cutout trim.
- *Upper Grille Transition* – The upper grille, now referred to as the Tech-Deck, features a smooth, frameless design that transitions seamlessly into the hood without causing flow separation. The hood latch lever within the gap is now better sealed.
- *Tighter Airflow Management* – Air passage to the heat exchangers has been further sealed using two-component air guides. The soft sections of these guides press more tightly against surrounding parts, minimizing unwanted leaks.
- *Wheel Portfolio* – As part of the facelift, several wheel designs were replaced with new, aerodynamically optimized versions. These improvements include reshaped aluminum rims or the addition of plastic covers.

- *Rear Underbody Deflector* – Although the rear section of the vehicle remained unchanged in terms of component shape, a new underbody cover with a rubber deflector was developed for the wagon variant to further harmonize the wake flow. However, this part was ultimately not included in the final production phase.

Figure 1: Overview of Optimized Areas within the Facelift

Attention was also given to tests and simulations concerning snow accumulation on the vehicle, aimed at protecting sensor functionality under winter conditions. To assess the impact on driving range, various accessories were tested and simulated, including roof boxes and towbar-mounted cargo boxes.

2.3 CFD simulations

The data center in Mladá Boleslav is designed to handle demanding aerodynamic simulations, the development of assistance systems, electromobility, and digital twins. Its computing capacity is equivalent to the performance of more than 60,000 standard PCs. According to the latest ranking [1], Škoda Auto a.s.'s corporate supercomputer placed 138th among the most powerful systems globally. With a performance exceeding 8.4 petaflops/s, it represents the most powerful computing infrastructure in the commercial sector in Central and Eastern Europe.

2.4 Experimental measurements in the aerodynamic tunnel

Experiments in the aerodynamic tunnel focused on validating Computational Fluid Dynamics (CFD) methods, determining sensitivity to changes, and fine-tuning virtual techniques for further application. This phase involved advanced measurement techniques – dynamic surface pressure sensing on the car body using in-house developed pressure strips, video recording of yarn movement with subsequent image analysis to visualize wake regions and flow separation boundaries, as well as wake traversing behind the wheels and rear of the vehicle using a multi-directional probe arm. Additionally, airflow through heat exchangers was monitored, enabling a detailed comparison between virtual simulation and actual flow behavior in the engine compartment.

Figure 2: Př Overview of optimized areas within the facelift (A – wake traversing zone, B – traversing arm monitoring the wake behind the front wheel, C – visualization of the measured total pressure field behind the front wheel, D – visualization of measured flow fluctuations using video analysis of yarn oscillation, E – overall view of the experimental vehicle in the aerodynamic tunnel)

In the final phase of the project, an additional set of aerodynamic measurements was conducted, this time focused on obtaining aerodynamic data for determining the vehicle's homologation values. Various equipment configurations were tested to assess their impact on the drag coefficient (Cx) and, consequently, on the vehicle's range within the WLTP process.

2.5 Summary

The Škoda Enyaq model has positioned itself among the top electric vehicles in terms of aerodynamics. The Coupe version, achieving a drag coefficient of Cx = 0.225 [2] in its facelifted form, currently stands as the best-performing slanted back BEV with the hight of over 1.6m (SUV). Even the standard Enyaq variant performs excellently with a Cx = 0.245 [3], confirming Škoda's strong emphasis on efficient airflow around the vehicle and its impact on energy consumption and driving range.

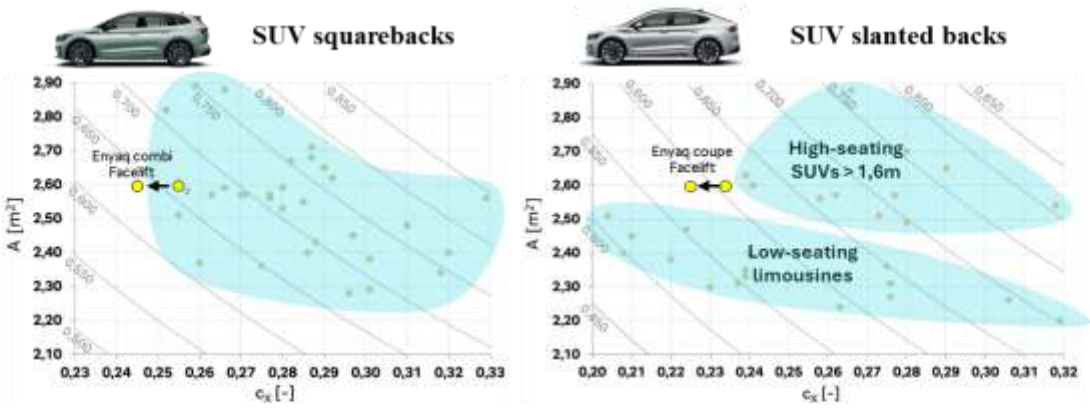

Figure 3: Overview of drag coefficient and frontal area values among competitors

3 Reference list

[1] List of largest HPC https://www.top500.org

[2] Press-kit for the Enyaq Coupe Facelift MY2025 model on Skoda Auto website https://www.skoda-auto.com/models/range/new-enyaq-coupe

[3] Press-kit for the Enyaq Facelift MY2025 model on Skoda Auto website https://www.skoda-auto.com/models/range/new-enyaq