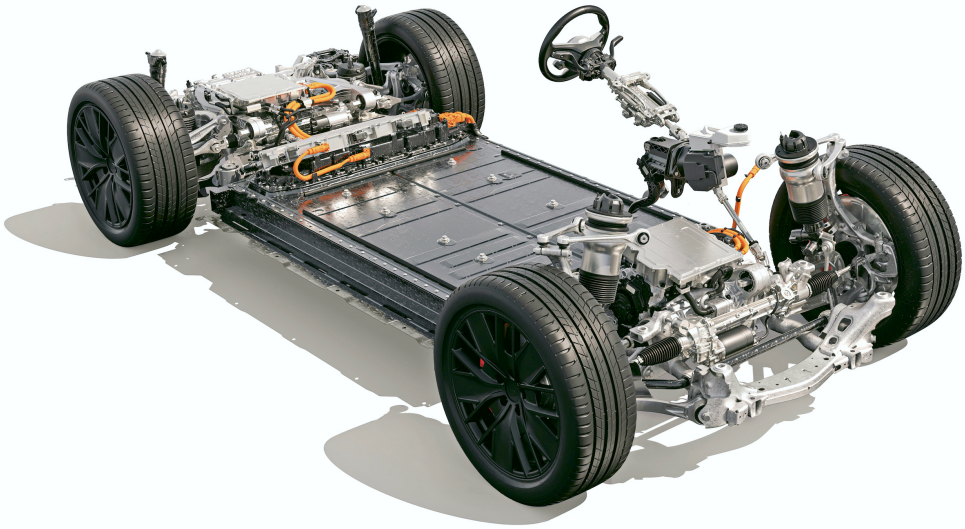

One for all

16/03/2023 Intelligent platform strategies reduce the time and costs involved in developing electric vehicles. Porsche Engineering has extensive expertise in platform development and supports its customers from the initial concept idea all the way to the production-maturity vehicle. The result is platforms that are flexible and positioned for the future.

One single platform for a multitude of vehicle models: This approach has been followed for years now for combustion-engine vehicles, helping to develop a large number of different models and derivatives and to bring vehicles to series production at justifiable expenditure of time and money. In production, the approach results in economies of scale: Fewer components in high volumes reduce component costs and ensure high product quality. Volkswagen was one of the pioneers of a consistent platform strategy with its Modular Transverse Matrix (MQB). Since 2012, it has formed a shared foundation for a large number of models with gasoline or diesel engines. More than 32 million vehicles based on this platform have been produced across the Group. Volkswagen was quick to apply the principle of the MQB to electric vehicles with its Modular Electric Drive Matrix (MEB), improving development and production efficiency in this field, too.

The new Premium Platform Electric (PPE), developed in tandem by Audi and Porsche, adds to the

electric vehicle platform concept's scope of application. For Porsche, this creates new opportunities to launch high-volume models with high technical standards at profit, thus taking the electrification of its portfolio another step further. The Stuttgart sports car manufacturer intends for more than 80 percent of its new deliveries to be fully electric by 2030. The PPE makes it possible to capitalize on the benefits of an all-electric platform in a variety of ways. One example, beyond package and space, is integrating the lithium-ion battery into the underbody. In fleshing out the design amid the conflicting requirements of range, performance and sustainability, Porsche remained true to its philosophy by focusing on travel time. At the same time, the architecture offers lots of leeway when it comes to the wheelbase, track width, and ground clearance, allowing for a variety of performance levels for models with either rear- or all-wheel drive in different segments.

An independent character

This flexibility allows Porsche models to retain their strong, independent character. To start off with, system output will cap at 450 kW, with maximum torque at more than 1,000 Nm. The first Porsche based on the PPE will be the all-electric Macan. With its 800-volt architecture, powerful latest-generation electric motors, and advanced battery and charge management, this model offers the level of electric vehicle performance you'd expect of Porsche. The successor to the acclaimed compact SUV has its sights set on becoming the sportiest model in its segment. Besides reproducible best-in-class driving performances, development goals include a range suitable for long-distance travel and high-power fast charging.

The benefits a platform for electric vehicles might offer are obvious—designing one, however, presents the engineers with a highly complex challenge. A myriad of aspects need to be taken into account, while some of the development goals stand in outright opposition to one another. This is generally true for any kind of vehicle, but applies especially to those with electric drives. After all, the individual drive components offer greater leeway when it comes to design than you get with a combustion engine—for example, in setting up the platform for broad scalability or making it flexible enough to allow the modular drive system to serve as a basis for entirely different vehicles. The platform makes it possible to implement rear-wheel, all-wheel, or front-wheel drive simply by choosing the position of the electric motor or even by adding another one— something a combustion engine does not allow.

Over the years, Porsche Engineering has acquired extensive overall system expertise from projects in this field, enabling the developers to optimally coordinate platform concepts. Today, the company's service portfolio covers all steps along the entire process chain for platform engineering—from the initial project idea to detailed platform definition. In most cases, the foundations are laid by an initial feasibility study, which examines whether a project is technically viable within the specified framework parameters. This takes the customer's subjective preferences and converts them into objective, physically testable and measurable properties.

Computer-aided engineering

The next step is to work out the concept dimensions. The development team determines all of the vehicle's and its components' relevant dimensions. "This way, we keep on refining development further and further until we get a digital study of the vehicle as a whole," explains Humberto de Campos do Carmo, Senior Manager Vehicle Concepts and Package at Porsche Engineering. Precise specifications are created using simulations, for example for the shape of the body-in-white, for the battery, the seats, the powertrain, and the body support structure. Computer-aided engineering culminates in a virtual model, referred to as a digital mock-up (DMU), which includes definitions of the main components. At this point, the project version passes to the vehicle manufacturer in order to develop it further into a production-maturity vehicle.

Here, too, Porsche Engineering continues to support its customers in development, simulation, and testing of components, systems, and the complete vehicle. "Porsche Engineering's comprehensive expertise makes the collaboration particularly valuable for us, as it provides us with seamless support across all areas and departments," says Klaus Bernhard, Senior Manager Physical Architecture Platform and Dimension Concept at Porsche. "This cuts down on coordination work and makes development easier, because you always need to think of an electric vehicle platform as a holistic system. It's the only way significant development content like crash safety, package, center of gravity, weight, and functions can be considered in parallel."

Showcasing the brand to its best advantage

With this in mind, it's easy to see how the battery plays a key role. It's the electric vehicle's energy store, of course, but for reasons of installation space and weight, it should also act as an integral part of the crash structure and underbody reinforcement and be a component of the cooling system. "Porsche specifically uses the flexibility of the platforms to design vehicles that bring the brand-specific characteristics of Porsche sports cars to the fore—high suitability for everyday use and outstanding driving performance," says Bernhard.

This includes, for example, the design of the driver's seat and the seating position, which must be ergonomic, sporty yet comfortable, and suitable for a broad customer group worldwide. The overriding principle of platform development is that you should not start on a specific vehicle project until the platform has been defined. After all, it is only then that the individual development goals can be balanced in the best possible way and components such as the battery, front and rear axles, or even the size of the wheels, be designed optimally. Any changes after the fact are very time-consuming and costly, and sometimes just downright impossible. Many—often the smaller—automobile manufacturers don't consider how a platform strategy might benefit them when they set out to develop a vehicle project. "It's a shame, but it happens again and again that people get in touch with us when they already have a vehicle model and then want us to develop further derivatives—which the platform isn't suitable for at all," says de Campos do Carmo. "This puts the manufacturer up against a choice: Develop an

entirely new platform or compromise and choose a solution that doesn't meet all requirements."

One example of a customer that sought cooperation with Porsche Engineering at an early stage, thereby saving considerable development expenses, is a customer that was planning to launch an electric vehicle model series. “Even the first drafts for the platform took scalability into account, and we also developed a modular system for the most important vehicle systems,” explains de Campos do Carmo.

For the different wheelbases of the various vehicle models, for example, the development team defined the increments so that, for each wheelbase increase, the next-in-line battery module would plug the gap in the vehicle underbody. This way, the customer can cover all intended vehicle segments—from compact cars to sedans to SUVs— with one single platform.

High flexibility required

Another aspect when designing a modern platform is its future viability. Even if, for example, the first plans only include rear-wheel drive vehicles, other options should also be accommodated at this point. This way, the platform will be able to handle vehicle models that haven't even been brought to table yet, for example front-wheel or all-wheel drive variants. A high degree of flexibility is just as important for the design, as there needs to be room to integrate future technologies.

After all, electromobility and its components, like batteries and electric motors, as well as the electrical systems and electronics architecture, are progressing in leaps and bounds. “Due to a platform's long lifetime, you can't predict the innovations you'll need to be integrating into the vehicle in a few years' time when you're designing the platform,” explains Bernhard. De Campos do Carmo adds: “When developing a new platform, you always have to weigh up which technologies will be ready for series production within that timeframe, and in which form they'll end up being incorporated into the platform.”

Summary

Platform concepts have aided in the development of different models and derivatives and the launch of production vehicles with reasonable time and cost for years now. For electric vehicles they offer many benefits. Designing one, however, presents a highly complex challenge: A myriad of aspects need to be taken into account, while some of the development goals stand in outright opposition to one another. Porsche Engineering supports its customers from the initial concept idea all the way to the production-maturity vehicle.

Info

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