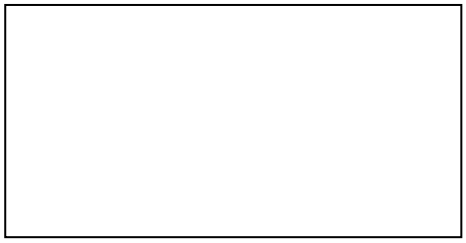
MICHELIN ACTIVE WHEEL

2008 Paris Motor Show
October 2008

Press Kit



MICHELIN
A better way forward

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Michelin Active Wheel: the reinvented wheel

In 2008, Michelin has reinvented the wheel, enabling the unveiling of two cars at the Paris Motor Show that usher in a totally new era.

In 1895, André and Edouard Michelin, the brothers who founded the Group that bears their name, transformed the automobile wheel by adding a tire for the first time. Their innovation endures to this day.

More than a century later, Michelin wants its latest innovation to enjoy the same success as its illustrious predecessor in 1895.

In 2008, the transformation is truly revolutionary—no more engine under the front or rear hood, no more traditional suspension system, and no more gearbox or transmission shaft thanks to the Michelin Active Wheel. **That's because all essential components have been integrated into the wheel itself.** Cars equipped with this integrated solution deliver an array of unique advantages. In a sense, the Michelin Active Wheel is an intelligent wheel capable of propelling cars without gasoline, while ensuring suspension and braking functions to provide unrivaled road handling and comfort.

The Michelin Active Wheel inaugurates a new era in road transportation in which a car's road, safety, energy and environmental performance achieve unprecedented levels. **This is because of a miniature traction engine and an electrical suspension system incorporated into the wheel.** These technologies developed by Michelin have made it possible to complete rethink the automobile.

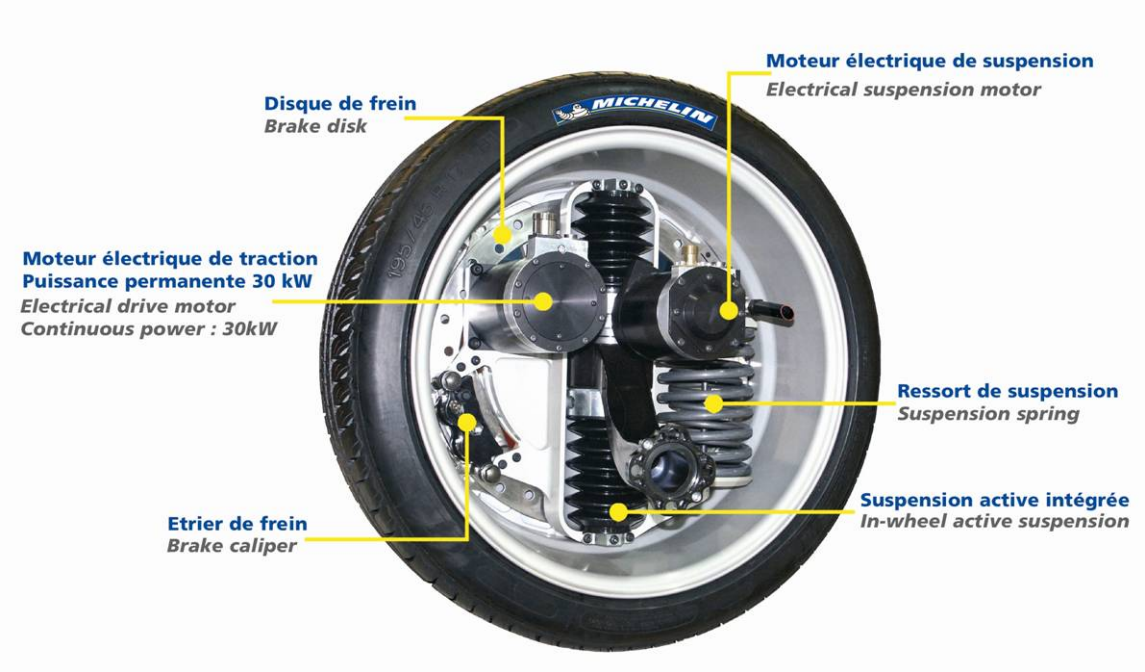
The most advanced illustration of this achievement is the new Venturi Volage, which is being unveiled in a world premiere at the 2008 Paris Motor Show. Fitted with the Michelin Active Wheel, the car is a roadster that is well ahead of its time. And with good reason… With its innovative design that is free of all constraints (like the need to house an engine) and its electrical drive motor, the Venturi Volage delivers outstanding road performance, safety and comfort—all in an environmentally friendly vehicle.

The second vehicle—the new WILL—is built through a partnership involving Heuliez, Michelin and Orange. The world's first example of an EV capable of holding its own against traditional automobiles, this small-size vehicle can be adapted for use as both a passenger car and a utility vehicle. The WILL provides a practical solution to road transportation concerns in the areas of energy resources, urban pollution and personal safety.

Reducing component size: the technological innovation behind the Michelin Active Wheel

The key to the Michelin Active Wheel's technological breakthrough is its compact traction motor and integrated suspension system. By reducing the size of these components, Michelin has made it possible to reinvent the wheel.

For the first time ever, the wheel integrates not only the brake disk but what's more the vehicle's electrical drive motor and suspension motor (*see illustration below*).



Depending on the amount of power or type of usage desired, a given vehicle may integrate four motors (one in each wheel) or two motors (in the front wheels, for example). In this way, the Michelin Active Wheel allows automobile manufacturers to continue designing both two and four-wheel drive cars.

With the Michelin Active Wheel, the energy that powers the integrated motor is always electric, whether it comes from a lithium ion or other type of battery, a fuel cell, and/or supercapacitors. In all cases, these power sources offer two important benefits—**zero pollution and optimal comfort**—since vehicles equipped with the Michelin Active Wheel emit no greenhouse gases. What's more, electrical power trains are extremely quiet, which is an advantage not only to passengers but above all to people outside the vehicle. In short, a car powered by the Michelin Active Wheel solution is like a breath of fresh air in urban environments.

The major accomplishment of the Michelin Active Wheel is to deliver outstanding performance both on the road and with regard to the environment, as demonstrated by the new WILL car. Its two engines housed in the front wheels make the car extremely responsive. As for the Venturi Volage, with its four motorized Active Wheels, it offers impressive performance in the areas of acceleration and road holding.

This dynamism is underpinned by a suspension system that sets new standards in road holding and comfort. With the Michelin Active Wheel, the vehicle's suspension is no longer mechanical but electrical. This unique system features extremely fast response time—just 3/1000th of a second. All pitching and rolling motions are automatically corrected.

The Michelin Active Wheel greatly simplifies the vehicle design process by making the mechanical components on a conventional car superfluous. Vehicles powered by the Michelin Active Wheel have no need for a gearbox, clutch, transmission shaft, differential or shock absorbers. This in turn makes cars lighter and thus more energy efficient. As a result, the vehicle can achieve an operating range in line with motorist expectations.

The Michelin Active Wheel is clearly a game changer, providing an effective and elegant response to today's critical road transportation issues: energy (quantity, diversity and cost), greenhouse gas emissions, urban congestion and urban pollution.

With the Michelin Active Wheel, a new, realistic approach to the automobile

The Michelin Active Wheel challenges a lot of conventional wisdom about the automobile.

Thanks to the Michelin Active Wheel, an EV can be redesigned from top to bottom since all key components—the engine, electrical suspension systems, tire and brakes—are now integrated in the wheel. In this way, the Michelin Active Wheel opens new possibilities for creative solutions in at least five different areas:

- Design.
- Energy savings and pollution abatement.
- Safety.
- Comfort.
- Adapting vehicles to usage needs.

Simplifying vehicles creates new opportunities in vehicle design by freeing styling teams from constraints previously thought to be inevitable. These include the elimination of the engine block, a considerable reduction in weight, the possibility of a totally flat floor on future prototypes, and chassis design that is fully focused on interior space and passenger safety.

A lighter vehicle also means a sharp reduction in energy consumption.

In fact, an EV emits no pollutants when on the road. Its environmental impact depends solely on how the electricity is produced. For example, using the WILL in a country where electricity is produced by hydroelectric power plants or renewable energy sources will result in very low indirect emissions of CO_2 per km. This would represent less than 10 g in Sweden, 20 g in France and 80 g in Germany.

This reinvented wheel also makes unprecedented improvements in active safety, meaning the avoidance of accident risks. The integrated electrical suspension system with four independent wheels is perfectly adapted to controlling pitching and rolling motions. This new electrical chassis control enhances vehicle stability and road holding. As for passive safety (i.e. protecting passengers in the event of an accident), the front of the vehicle where the engine was previously located is now entirely dedicated to impact absorption.

The permanent control of chassis movements and noise-free electrical engine combine to provide unparalleled comfort.

Research and Development to support Michelin's vision of road transportation

A better way forward is Michelin's corporate baseline. In just a few words, it sums up the commitment of a manufacturing company dedicated to designing and producing tires that are ever safer and more fuel-efficient. The new Michelin Energy Saver, also unveiled at the 2008 Paris Motor Show, is further proof of that commitment.

Even as it continues to make breakthrough advances in tire technology, Michelin is exploring other technological paths and looking beyond the tire alone. Indeed, development of the Michelin Active Wheel began 12 years ago.

The Michelin Active Wheel and fuel-efficient tires—a segment in which Michelin pioneered back in 1992—both reflect the same corporate vision and priorities.

Road transportation is confronted with major challenges. The future decline in petroleum resources comes at a time when demand for energy has reached record levels. This will lead to a number of breakthroughs in the automobile industry. With the forced reduction in vehicle energy consumption, a market for electric mobility solutions will emerge and vehicles will adapt to increasingly urban lifestyles. Against this backdrop, the "post-oil" era will obviously involve an array of technologies.

Michelin is drawing on all aspects of its expertise to meet these challenges. In particular, this will involve the development of tires capable of further reducing vehicle fuel consumption. Michelin's research and development teams are fully focused on halving the amount of fuel consumed by tires by 2030. However, meeting the challenges of road transportation also involves innovations like the Michelin Active Wheel. By itself, this new-era wheel makes it possible to design all-new vehicles.

The Michelin Active Wheel also illustrates the Group's day-to-day focus on technology, always with a commitment to improving tire performance in all areas. And therein lies the strength of Michelin's capacity for innovation. Michelin tires must deliver not only energy savings but also enhanced safety and longevity. With Michelin Active Wheel, cars can deliver superior performance, both on the road and with regard to the environment.

And only by combining outstanding performance in all areas can road transportation be truly sustainable.