BMW NA 50th Anniversary | 50 Stories for 50 Years

Chapter 35: "BMW goes electric: From the 1602 to the ActiveE"

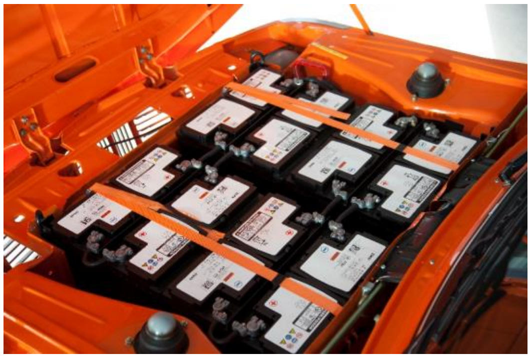
Written by: Jackie Jouret

No industry wants to be regulated, and it goes without saying that automakers dislike regulation. Yet even those automakers most opposed to regulation have to admit that it can prod them into making safer and more efficient cars, or even to develop entirely new product lines.

That's exactly what happened after 1966, when the State of California enacted the world's first vehicular emissions regulations, followed in 1970 by the federal Clean Air Act that would require smog testing of all new vehicles from 1972-on. In response to that legislation, BMW began replacing carburetors with fuel injection, creating the 2002 tii and other models that not only emitted fewer pollutants but used less fuel and produced more power than their carbureted counterparts.

Reducing motor vehicle emissions was a step in the right direction, but eliminating them entirely would be even better. To meet that goal, at least at the tailpipe, automobile manufacturers would need to shift from internal combustion engines to the battery-electric powertrains that were common in the late 19th and early 20th centuries, but which faded from use as gasoline became widely available.

BMW wasn't building cars during the first electric age, having been founded as an aero engine manufacturer in 1916 and only adding motorcycles and cars in 1923 and 1928, respectively. The company didn't make its first foray into electromobility until 1972, when BMW premiered its first electric car during the Olympic Games being held right across the street from its Munich headquarters.



At first glance, the Elektro 1602 looked like an ordinary BMW two-door, and as such it drew less attention than BMW's futuristic Turbo Concept, which also debuted during the Munich Olympics. As a harbinger of the actual future, however, the Elektro was far more significant, pacing the Olympic marathon and speed-walking events in near-silence and with zero tailpipe emissions.

The Elektro 1602 was powered by 12 lead-acid batteries, and its range was limited to about 44 miles. That may have been an optimistic estimate: BMW had built not one but two Elektro 1602s, and it's rumored that one took over from the other when the marathon passed through a tunnel. In any case, the car's range couldn't be improved upon without adding considerable battery weight to the vehicle, so BMW began exploring liquified hydrogen as its preferred route to zero-emissions mobility.

In the meantime, electric vehicles received a major boost from the US government's Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976. That legislation provided funding to develop the battery-electric powertrains that would become increasingly important after 1990, when the State of California instituted its Zero Emission Vehicle mandate. From 1998-on, ZEVs would need to constitute 2 percent of all vehicles sold in California, the nation's largest market for automobiles and one of the largest worldwide.

Even while focusing on hydrogen power, BMW experimented with electric cars that could meet California's ZEV mandate. The E1 and E2 concepts of 1991 used sodium-sulfur batteries for a theoretical range of 155 miles, but those were ultra-lightweight city cars, and the technology didn't fare as well in a series-production BMW. In 1995, the company built a small fleet of 3 Series coupes that used the standard four-cylinder internal combustion engine not to drive the rear wheels but to charge the sodium nickel chloride battery and extend the car's range beyond 27 miles. It wasn't a success.

"The E36 electric vehicles were terrible," said Rich Brekus, then head of product planning and strategy for BMW NA. "Karl-Heinz Ziwica was head of compliance, and I asked him if it was possible to make gasoline cars that would pollute the same amount of NOx and hydrocarbons as the power plant used to produce the electricity. It was theoretically possible, so we met with the California Air Resources Board, which agreed to back off on the electric vehicle mandate if we built Partial Zero Emissions Vehicles that would put out one-tenth of the US standard for pollution, with zero evaporative emissions and a ten-year warranty."

Indeed, when California's ZEV mandate was set to increase to ten percent in 2003, the state adjusted that figure to allow credits for Partial Zero Emissions Vehicles like BMW's new Super Ultra Low Emissions Vehicles. "Now millions of PZEVs are on the road, and it's made a huge difference to the quality of air in California," Brekus said.

In 2007, BMW announced its new Efficient Dynamics program, which chairman Norbert Reithofer said would reduce BMW's overall fleet emissions by 25 percent by the year 2020. (It's worth noting that BMW, like the European Union, focused exclusively on reducing CO2 emissions, which relate directly to fuel consumption, while excluding the NOx emissions that the US and its states regulate.) At the same time, BMW concluded its experiments with liquified hydrogen, which had proven impractical as a motor fuel. Instead, the company would focus on improving efficiency by reducing vehicle weight—a somewhat Quixotic goal—and by offering ever-more-efficient internal combustion engines alongside new hybrids and battery-electric vehicles.

The latter would be developed separately, under the rubric of Project i. An in-house think tank led by Dr. Ulrich Kranz, Project i wasn't merely about developing a viable EV, but about understanding how we would live and move about in the not-so-distant future. Having determined that human populations were increasingly concentrated in "megacities" with 15 million or more inhabitants, Project i set about creating a so-called Megacity Vehicle that would emit neither noise nor pollution, and which would take up as little space as possible in those crowded urban environments.

By focusing on urban mobility, Project i managed to avoid one of the biggest psychological drawbacks of electric mobility: range anxiety. As the Elektro 1602 and later 3 Series had demonstrated, the usable range of electric cars had long been hampered by the limited storage capacity of their batteries. Fortunately, research was underway that would begin to solve that problem.

Since the 1970s, engineers had been developing lithium-ion batteries, which combined high capacity with relatively light weight and rechargeability. By 1991, these new batteries had been widely adopted for use in consumer electronics, and in 1998 they found their first automotive application in Nissan's experimental Altra EV. In 2003, the AC Propulsion T-Zero was designed by Tom Gage to use lithium-ion batteries, and it inspired Tesla Motors' engineers Martin Eberhard and Marc Terpenning to do the same on the Tesla Roadster, which reached the public in 2008. With an EPA-rated range of 244 miles, the Tesla Roadster could nearly match that of an internal-combustion vehicle, and it was as quick as any supercar.

Lithium-ion batteries would power the Megacity Vehicle being developed by the Project i team, which reached its first prototype stage as the MINI E. The MINI was chosen for its small size, which mirrored that of the planned Megacity Vehicle, and for its ability to accommodate Gage's AC Propulsion battery-electric powertrain following the removal of its rear seats.

That powertrain used 1,088 lithium-ion cells strung together within a 573-pound battery back, which gave the MINI E the equivalent of 201 horsepower. It could accelerate from zero to 62 mph in 8.5 seconds en route to a top speed of 95 mph. Needless to say, it would have to be driven far more sedately to achieve its claimed 156-mile range.

Though BMW tested 50 of its MINI E prototypes in Munich and Berlin, 450 would be tested in the US—specifically in Los Angeles, New York City, and New Jersey—and with ordinary customers at the wheel rather than engineers. According to Rich Steinberg, then Head of Electric Vehicle Programs for BMW of North America, the locations were chosen for their proximity to BMW NA workshops, where the cars could be serviced if needed. "The dealers weren't trained in high voltage yet. We also had 'flying doctors' who would be dispatched to service vehicles at a local dealer if needed."

As another benefit to testing vehicles in California, the program would help BMW of North America earn significant Zero Emissions Vehicle credits, as well as lowering BMW's Corporate Average Fleet Economy rating in the US.

It would also draw plenty of interest from customers eager to go electric. When the program was announced, BMW received thousands of applications, from which it selected participants on the basis of their driving habits and ability to install a charging system in their home garage. That factor proved more complicated than expected when the cars used a plug developed in Europe. “It didn’t have UL approval, and local electrical inspectors made home installation a real chore,” Steinberg said.

The cars would be leased to customers for one year, though that was later extended for a second year. The price was set at $850 per month, and customers would be required to provide feedback on the experience.

In May 2009, Pacific Palisades, California resident Peter Trepp became the first customer to take delivery of a MINI E. A venture capitalist specializing in clean energy funding, Trepp blogged about his experiences beginning with his acceptance to the program and the installation of the 50-amp charging outlet in his home garage. That was crucial, since public charging was basically nonexistent. Upon taking delivery, Trepp noted that the MINI E handled like a sports car despite carrying some 600 additional pounds of battery weight compared to a standard MINI, and that its regenerative braking feature made it unnecessary to touch the brake pedal except in emergencies. Driving enthusiastically, Trepp reported 95-100 miles of range on a full charge, and he didn’t miss the sound of an internal combustion engine or having to stop for gas.

Living in sunny Southern California, Trepp didn’t get to experience the biggest downside to battery-electric driving: severely reduced range and performance in cold weather. “They were absolutely miserable on cold days,” said Jim McDowell, then head of MINI USA. “If you used the heat, you had a very short range, which meant you had to pick between heat and getting home.”

That deficiency was addressed during the second phase of Project i testing, which would be done not in a MINI but in the BMW ActiveE, a battery-electric version of the 1 Series Coupe. The ActiveE got a much-improved battery developed in collaboration with SB LiMotive, a joint venture between Samsung and Bosch. The battery had its own liquid cooling system to help maintain storage capacity regardless of outside temperatures, and it could be activated while the car was plugged into the power grid. “That will allow you to pre-heat or pre-cool the cabin from your smartphone instead of using the battery of the car,” said Steinberg.

The battery was actually three “energy storage units” located where a normal vehicle would place its engine block, transmission, and fuel tank. The electric motor sat directly over the rear axle, and the car was driven by its rear wheels just like any other 1 Series coupe. Even with better thermal management, however, the ActiveE failed to improve upon the MINI E’s range of approximately 100 miles under normal driving conditions, though that could be extended somewhat using the new ECO PRO mode. The car was heavier than the MINI E, and its zero-to-62 mph acceleration was slightly slower at 9.0 seconds.

BMW built some 1,000 ActiveE prototypes, of which 700 came to the US for real-world testing. MINI e test driver Trepp had opted to renew his MINI e lease for a second year, which put him at the top of the list for an ActiveE in 2012. He didn’t blog about his experiences with that car, but reported upon taking delivery that the ActiveE had “more refinement, more gadgets, more BMW. The MINI E was great, but the ActiveE is a step up, to be sure.”

Not everyone who tested an ActiveE had leased one from BMW. The cars were also available to those using BMW’s DriveNow car-sharing service, another component of Project i which operated in several European cities as well as San Francisco from 2011 to 2019. (From 2016 to 2019, the program operated as ReachNow in Seattle, Portland, and Brooklyn.) Car sharing was an important part of Project i's mission, as it would allow BMW to expand its customer base beyond traditional ownership models. Unfortunately, local parking codes made it inordinately difficult to place cars throughout cities, dooming the program in virtually every important market.

With both prototype electric vehicles, BMW of North America and its customers played a major role in the development of a new powertrain, one that was set to take on increasing importance within BMW and throughout the world. The cars also helped develop BMW's "circular" product economy, as the batteries from cars taken out of service were repurposed to provide stationary energy storage, particularly where solar or wind is used for generation.

Customers helped to perfect the technology, and their feedback also allowed BMW to understand what customers wanted and expected from their cars, and to deliver that when the company's battery-electric vehicles went into production. "What do they need in terms of range anxiety? What do they need from a public charging network?" Steinberg asked.

BMW also learned about customers' charging habits, which varied from country to country. "In Europe, they wait until they need to plug in, but American drivers plug in every day," said Dr. Herbert Negele, who was responsible for electrification projects at BMW AG from 2007 to 2010. "Maybe it's the Wild West…you know you need to stock up on water when it's available!"

Somewhat counterintuitively, that behavior helped alleviate the concerns of utility companies fearful of overtaxing the electrical grid while also encouraging the use of renewable energy sources like wind and solar."Having a large fleet of EVs across America that could absorb and consume the energy from a renewable like wind is a benefit to the utilities, and vice-versa," Steinberg said. "If there's a real peak demand load and there are a lot of EVs plugged in, the grid allows the supplemental energy from these vehicles to flow back into the grid so they don't have to fire up the plant to generate more energy."

That sounded almost impossibly futuristic in 2012, and yet it's become today's EV reality. A sizable percentage of EV drivers have installed solar panels on the roof of their homes, helping to reduce not just tailpipe emissions but energy consumption overall. That's been the goal of regulators in California and worldwide for decades, and EVs have been crucial to achieving it.

It's worth noting that much of that reality was made possible by Tesla, a company that BMW didn't take seriously even as Tesla was introducing its full-size Model S in 2012. With the Model S—developed using a $465 million loan from the US Department of Energy—Tesla achieved what traditional automakers had long thought impossible: a 300-mile range. That allowed the Model S to roam farther afield than any electric car of its day, even across the US thanks to Tesla's extensive charging network. More recently, the company has begun offering solar roof tiles that generate electricity for driving and daily life, and battery storage systems for containing it. Regardless of what one thinks of the company in 2025, or its safety record throughout, Tesla Motors deserves credit for making electric vehicles viable, and for furthering the acceptance of EVs among the driving public.

In the meantime, BMW pressed forward with its Megacity Vehicle, the BMW i3, which would share the range limitations of the MINI E and ActiveE. Overcoming those limitations would take another decade, and an entirely new generation of vehicles.

—end—