Green Car Congress
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Volkswagen Introduces the E-Up! EV Concept

14 September 2009

The E-Up! concept. Click to enlarge.

Volkswagen introduced the E-Up! Concept electric vehicle at the Frankfurt Motor Show. Designed under the leadership of Dr. Ulrich Hackenberg, Member of the Board of Management, Volkswagen Brand, and Head of the Development business area, the E-Up! is based on modules of the New Small Family (earlier post) anticipated in the year 2011, but at 3.19 meters in length, the E-Up! is even more compact. A production version of the E-Up! is due in 2013.

The 3+1 seater is driven by an electric motor with a peak power output of 60 kW (continuous power: 40 kW), and has a top speed of 135 km/h (84 mph). The motor of the front-wheel drive car develops a maximum torque of 210 N·m (155 lb-ft) right from rest. Acceleration from 0 to 100 km/h takes 11.3 seconds; acceleration from 0 to 50 km/h (31 mph) takes 3.5 seconds.

This performance is based first on the electric motor's torque characteristic and second on the low curb weight of the E-Up!, which is 1,085 kilograms (2,392 pounds). Of that weight, the 18 kWh Li-ion battery pack represents 240 kg (529 pounds). Driving range is up to 130 km (81 miles), depending on driving style.

Depending on the available charging infrastructure and the battery's momentary charge state, the storage battery could be charged to up to 80% of its total capacity within an hour. With a 230-Volt household outlet, maximum charge time is five hours. The charge port is hidden behind the folding VW logo on the V-shaped hood of the E-Up!.

The batteries are housed in a special, crash-protected tray in the underbody frame. Air cooling ensures a constant heat balance within the batteries. The fans and heat exchangers needed for this are housed in the front section of the underbody.

Integral drive. The teams of Concept Development (headed by Ralf-Gerhard Willner) and Engine Development (headed by Dr. Jens Hadler) integrated all important drive assemblies and auxiliary assemblies in the engine compartment at the front end in what Volkswagen is calling the "integral drive". The design of an integrated form of the electric drive made a key contribution toward reducing weight and space requirements for the drive unit.

The electric motor, together with the one-speed variable transmission and differential, form the centerpiece of the integral drive. Energy is supplied via a high-power pulse-control inverter, which is combined with the 12-Volt electrical system DC/DC converter and the charger. At 140 kg (309 pounds), the integral drive is also very lightweight.

Design aspects. Although the E-Up! bears a resemblance to previously presented concept vehicles of this new model series—the Up! (city specialist), Space-Up! (microvan) and Space-Up Blue! (fuel cell powered van)—it represents a design stage that reflects the future production car even more closely.

Dimensions of the E-Up! are 3.19 meters (length) x 1.64 meters (width) x 1.47 meters (height). Its wheelbase is 2.19 meters.

The roof of the E-Up! is equipped with solar cells over an area measuring 1.4 square meters. This area—between the rear part of the roof edge spoiler and the front windshield—be enlarged to 1.7 square meters in total by folding down the sun visors that are also equipped with solar cells. The solar cells continuously supply energy to the car's electrical system, and while the vehicle is parked they help to cool the interior by supplying energy to the car's ventilation system.

To improve the electric car's energy economy by avoiding unnecessary loads, actuators such as mirror adjustment and window lifts were designed to be manually operated.

The concept car has a touch-screen based HMI (Human Machine Interface) with intelligent E-Up! specific indicators and assistance functions. During navigation, the system continually monitors the momentary load state of the batteries, for example, as well as activated energy consumers such as lights and air conditioner, momentary traffic data, elevation profiles of potential routes and the locations of

available charging stations. The driver can display these "filling stations" at any time; available charging stations may be reserved within a defined reservation time period.

The charging process can also be precisely planned via the HMI. This lets users charge the E-Up! during a specific time period in which electricity is available at special low rates. The charging process can be activated at any time via an application installed on an iPhone or similar mobile device, even from outside of the vehicle.

From the application users can also query the momentary charge status and vehicle location (the latter via map display) or simply check whether the car is locked. To preserve vehicle battery power the program lets users pre-condition the E-Up! interior. This involves cooling or heating the car's interior as long as the car is still connected to the charging station and is drawing its electrical power from the electrical grid.

3+1 seating concept. The small Volkswagen is a 3+1 seater. This means that the front passenger seat is located 50 mm forward, thanks to the instruments being shifted further forward. This layout increases leg room in the rear behind the front passenger. As a result, two adults can sit comfortably (one front, one rear) on the passenger's side. Stepping into the vehicle is also simplified by an Easy-Entry feature, which allows the front passenger's seat to be pushed up to 270 millimeters away from the rear bench. There is less leg room behind the "normally" positioned driver's seat; the space here was designed as a spare seat.

Additional freedom of movement is provided to rear passengers by lowering the centre tunnel in front of the rear bench seat; it serves as an additional footrest. This enables use of an electric handbrake in the style of the Passat, so that no lever mechanism obstructs the footwell.

To optimize comfort in the rear, the rear seat backrest is split 40/60. When the backrest on the driver's seat is folded down (40% section), stowage capacity is increased from 85 to 180 liters (with loading to the upper edge of the front seat backrest). This stowage space can be enclosed by a load barrier that folds down out from the folded backrest. When the entire rear seating backrest is folded down, a stowage capacity of 320 liters is created—and up to 520 liters when loaded to the roofliner. To transport long objects, the front passenger's backrest can also be folded to a pass-through position. In this configuration, the E-Up! can handle objects up to two meters in length.

Micro-mobility. Volkswagen projects that in the city, after parking the E-Up! people will want to cover shorter distances without a car—from the job to lunch, to the fitness studio, another meeting, whatever is on the day's schedule. For these shorter trips, the Volkswagen "Micro-mobility in the city" concept team has invented zero-emission micro-vehicles. The Kickstep, for example, is an ultra-compact folding scooter. And the electrically powered Microbully is a scooter that fits in the E-Up! load space.

There is also the ped-tric, a folding bike with electric motors built into the wheel hubs that could also make the trip to the city aboard the E-Up! And even the VW_1M, a large electric moped—the size of a carry-on case when not in use—that could be stowed in the E-Up! without even needing to fold down the rear bench seat. The micro-mobility solutions were created at the Volkswagen Design Center in Potsdam.

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That is one pig of a battery.
It takes 22% of the vehicle weight for 80 miles driving ("depending on driving style" - ahem).

It is also not a light car - for its size.
The battery is killing it.
Also, leaving out electric windows will annoy people (these days) and save very little weight.
They need to get a better battery or add a range extender (like the lotus for example), but perhaps they don't have the room.
When cars get this small, you have some serious optimisation to do, and you will never keep everyone happy.
At least it looks better than the Reva.

Posted by: mahonj | September 14, 2009 at 08:39 PM

A 21 kwh ZEBRA battery(Z5-278-ML3X-76) in its case weighs only 182 kg. It could be combined with an electric flywheel for very high acceleration(not needed). This battery shows that the capacity of lithium batteries may not be as high as that of the sodium-nickel-chloride battery. This Zebra battery could take this car more than 100 miles. Every electric car must have at least a tiny fuel powered range extender. A thirteen horsepower OPOC range extender could take this car anywhere it needed to go at nearly full speed all the time. ..HG..

Posted by: Henry Gibson | September 14, 2009 at 11:54 PM

The heavy battery (twice the mass per kWh than Tesla's) and the heavy power train (about 3 times the mass per kW than Tesla's) shows that they need to work a lot more on this vehicle. This could explain why VW first launch it in 2013 two years after several of their competitors. That lateness could cost them dearly.

Otherwise it is a much better vehicle that the Think and the Smart EV that only has a top speed of 62 mph which makes them dangerous slow (almost useless) for highway driving. This VW can at least be used as a commuter vehicle. I expect the final launch version to get a significantly better range as a result of weight reductions with regard to the battery and the power train.

The 'hype' for EVs is quite understandable IMO. The EVs have a huge potential for building a better car. One that drives and accelerates better, one that is low noise and one that can avoid the inconvenience of public refueling. Most importantly, only the pure EVs offer hope that it is possible to stop runaway and dangerous global warming. As long as there are CO2 emitting vehicles on the road with year passing we get closer to a disaster of possible epic proportions. Even a 100 mpg Prius is not going to change that fact.

Posted by: Henrik | September 15, 2009 at 01:44 AM

The problem VW have wrt Tesla is price and utility.
Spending a lot of money on a battery for a car with only 2 seats is OK for an exotic sports car.
It is not OK for an urban runabout.

So VW are up against it: the have to make a car that is reasonably priced, small, fastish (acc. wise), looks OK, has decent range, and a warranty that they can stand over (and sleep at night).

In the absence of a battery breakthrough they are up against it.

It strikes me that the obvious thing to give has to be range - they can either drop it to 20 miles and add a range extender (serial hybrid) or drop it to 40 miles and sell it as an urban runabout (really).

The number of people who never drive more than 40 miles a day (in the city) would be quite large.

Perhaps they could back it up with a temporary swap deal: if you want to go further, you swap it for a Polo or a Golf (for the weekend) and it costs nothing. You might be allowed 10 of these / year.

Maybe VW would be allowed to rent the car while you weren't using it, maybe not.

I think we need something like this to get these things off the ground. It is really a "mental insurance" deal - it would make people feel better about buying the car, but would rarely be used.

(This could be called the "dual car" PHEV solution.)

Posted by: mahonj | September 15, 2009 at 05:52 AM

If the E-Up were mass produced for $10,000 each (4X the Nano price) - it would sell millions.

Posted by: kelly | September 15, 2009 at 07:02 AM

I see this as a promising entry into the market, especially with the innovative 3+1 seating.

I see nothing at all unusual with the weight of the battery, considering it seats 4, has a range of 81 miles, and can reach 84 mph.

I'm curious about Wh/mile or Wh/km, as an energy economy comparison.

Posted by: Will S | September 15, 2009 at 08:37 AM

This could be an impressive and interesting little e-car (as a PHEV).

The e-range cannot be over-restricted because too many people would run out of

charge and create huge traffic jams.

Until such times as batteries performance have reached 400+ Wh/Km and offer 300+ Km range at a decent weight, a PHEV with a very small flexfuel range extender (15 to 30 Kw) makes more sense.

Reducing fuel consumption by 80% to 85% would be very acceptable, as a first step leading to zero GHG full e-vehicles, when battery technologies have matured and cost has dropped to less than 25% of current price.

Posted by: HarveyD | September 15, 2009 at 09:10 AM

correction: should be ... 400+ Wh/Kg...

Posted by: HarveyD | September 15, 2009 at 09:35 AM

"dual car" PHEV solution
mahonj offers yet another sensible answer to the so-called "limited range problem" of BEVs.

Posted by: ai_vin | September 15, 2009 at 11:27 AM

kelly:

Only 2 or 3 countries could build this car for around $10K (with lower cost batteries) and they probably will within 3 or 4 years.

Elsewhere, the retail price could be $30K to $35+K which could reduce sales below the critical point for mass production.

One way around the high production cost may be to import all parts-components and major elements from (you know where) and do the final assembly (only) in Europe, USA or Canada etc. Magna International could do supply the final assemblers.

Posted by: HarveyD | September 15, 2009 at 01:13 PM

Long range electric vehicles are bad economy and bad engineering. ..HG..

Posted by: Henry Gibson | September 15, 2009 at 04:52 PM

May be bad economy and bad engineering but long range is highly desirable from the user standpoint.

But then we only have your word for it without any back up.

Posted by: Mannstein | September 15, 2009 at 06:38 PM

HG:

You may be right about BEVs with the current level of e-storage units development/performance & price.

However, future (2020 ?) quick charge e-storage units @ 1000 Wh/Kg and under $200/Kwh will change the current rules and markets.

Meanwhile, light PHEVs equipped with a very small (15-20 KW) light weight on-board genset could reduce liquid fuel consumption and GHG up to 75% and reduce USA's crude oil imports. BYD may show the way.

Posted by: HarveyD | September 17, 2009 at 03:03 PM

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