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## Audi e-tron – Prediction of remaining electric range

Whether you're driving around the corner, commuting to work, or going on vacation: When you're on the road in an electric car, reliable range indications form the basis for planning all your mobility needs. Statutory test cycles as the basis for range indication can only serve as a general guide for planning since, in practice, range is impacted by numerous parameters. In addition to external factors such as congestion, route topography, or outside temperatures, driver-specific influences including individual driving style or the use of comfort features also play an important role. The remaining range display in the all-electric e-tron models from Audi passes this test in flying colors by factoring in all relevant parameters and providing a realistic picture. On top of that, the route planner ensures that any necessary charging stops on the trip are ideally planned into the route. Route planning can either be set up from inside the car or prior to departure using the convenient myAudi app.

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### **Consumption history, outside temperature, and other parameters make for a realistic calculation**

Predictive, reliable, and dynamic: Audi e-tron models give drivers the choice between two different options to calculate the range, one with and one without the route planner as part of the Audi Multi Media Interface (Audi MMI). Without the technical support of the satnav and the route planner, the calculation of the remaining range rests on recent consumption values. The system also reflects driver-specific properties, such as an especially sporty or economical driving style. Isolated special factors, such as energy-intensive passing maneuvers, are reliably averaged out, ensuring a realistic calculation.

In addition to consumption data from the drive and onboard power systems, the car's distribution point and electrical nervous system, remaining range calculation also factors in thermal management data (heating or AC) or the use of additional comfort features such as seat or steering wheel heating. Also considered are the selected driving mode, individual car configuration, load, and climactic conditions. In this way, the range display represents the most recent consumption data and projects them into the future, without additional data from the route planner.

### **Clever algorithms recognize the difference between laid-back country driving and winding roads**

For route-based range calculation, the recent consumption data is supplemented with additional data from the route planner, which is available in all e-tron models. This means

the system considers the topography along the planned route as well as divides the planned route into sections for calculation purposes. Each stage of the route is then assigned an expected driving speed. This fine division into small sections facilitates highly precise calculation. Other parameters used include the probability of open highway along the route and expected congestion. Urban traffic, traffic jams, blocked traffic, speed limits, and main through roads all have a live influence on the calculation. Unlike retrospective range display, route-based calculations are capable of differentiating, from the moment a trip begins, whether it is a laid-back drive down country roads at an average of 80 km/h and summer temperatures or a trip to your next ski vacation on highways and winding roads in a frosty environment with the heat on full blast.

### **No external data connection: Calculation takes milliseconds right in the vehicle**

Data analysis highlights include dynamic adjustment of the remaining range that takes external and vehicle-related factors into account. External factors include real-time congestion data, which is gathered continuously and directly reflected in the calculation.

Examples of vehicle-related factors include changes in usage behavior related to comfort features or sudden changes in driving behavior. If, for example, the heating or air conditioning is switched on or off, the remaining range is immediately recalculated, often resulting in visible adjustments to the range display. This lets drivers see, at a glance, how their behavior affects the range. With the computing power being located directly in the vehicle in Audi e-tron models, data calculation takes only a few milliseconds. This eliminates the need for a connection to an external data processor. As a result, the system functions autonomously and is not dependent on sufficient mobile data coverage.

The Audi e-tron route planner is a new software development that was first used in all-electric models in the MIB 2+ generation of the modular infotainment toolkit. Since 2020, the third generation of the modular infotainment toolkit (MIB 3) has brought even greater functionality to the e-tron route planner with ten times the computing power. The everyday utility of the advanced route planner is further increased by a new algorithm: Daily updated data on charging points and alternative routes, both optimized for the requirements of e-vehicles, lend drivers improved support. Examples of daily updated data include detailed information such as payment and authentication options, precise operator data, and any access restrictions.

### **Time-optimized route planning favors high-power charging**

When looking for suitable charging points along the route, Audi makes sure there is always



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a reliable basis for planning with the route planner. To ensure the shortest possible travel time, only as many charging stops are suggested as are necessary to reach the destination safely. If the route or consumption change, for example due to unforeseen traffic jams or the use or deactivation of comfort features, possible or necessary charging stops are also adjusted. For example, two short stops to charge at a station with high-power charging points can save time compared to one long stop at a charging station with lower-power charging points. Alternative routes with better charging infrastructure are also considered when calculating the ideal total travel time. The Audi e-tron route planner favors HPC (high-power charging) charging stations.

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