



Electric Vehicle Route Optimization: Simulation Software



Supply Chains



Transportation

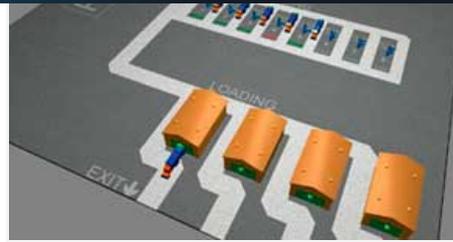
Problem

[Electricite de France \(EDF\)](#) is the largest public electricity company in France. One of its activities is electric charging infrastructure development and energy-efficient vehicle popularization. Within this area, the company launched a project to create a tool for the operative management of delivery by electric trucks in Paris and its suburbs.

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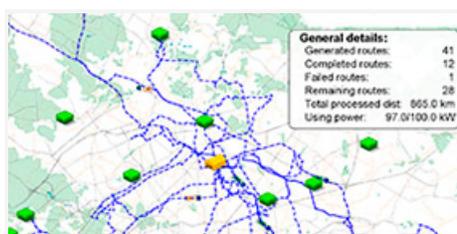
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The EDF specialists built a delivery model in AnyLogic simulation software. To reflect the real system more precisely, they considered several constraints:



- An electric truck shouldn't run out of power during delivery.
- Electric trucks can be charged only at the charging station (depot), and the process takes about eight hours.
- The power of the charging station is limited and distributed among chargers (*born 1, born 2, etc.*) in a particular way.
- The amount of energy an electric truck consumes depends on whether it is loaded or empty.
- The maximum route length is 100 km.

For the delivery route optimization model, the development team used the [agent-based simulation method](#) to describe the electric trucks' operation. For each truck, they defined characteristics (vehicle dimensions, speed, load weight, etc.) and states (waiting, loading, unloading, on route, etc.) that changed over time when the model was run.



Furthermore, in the simulation there were two types of electric trucks with differed battery capacity. The

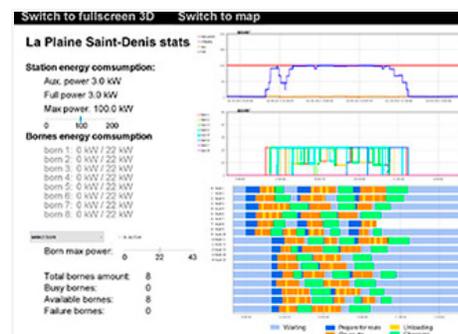
facilities on a [GIS map](#). They also set up [2D and 3D visualization](#) of the charging station and electric trucks. With this, the user could easily switch from the map view of Paris and the suburbs, which enabled observing the whole system work, to a more detailed object operation view.

The outputs of the delivery route optimization model were routes displayed on a GIS map with statistics on the charging station, on each charger, on the trucks' states, and on the order state.

In the simulation, the EDF team could vary traffic density, change some of the preset parameter values, turn chargers on and off, and observe how these changes affected the operation of the entire logistics network.

Results

While working on the project, the EDF team had a delivery route optimization simulation model developed, visualized the logistics network, and collected statistics using AnyLogic software.



The model helped them calculate the optimal number and ratio of electric trucks with different types of batteries in the fleet. They also identified the number of chargers and the amount of power they should have to support uninterrupted and timely delivery of goods by electric vehicles.

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