JFE TECHNICAL REPORT
No. 27 (Mar. 2022)

# EV ZeroE System

## 1. Introduction

Electrification of automobiles is an extremely effective means of reducing $CO_2$, and the method of using electric power obtained by waste incineration power generation to operate EV waste collecting vehicles has also been discussed up to the present. If realized, it will become possible to construct an energy circulation system in which vehicles are driven by electric power obtained by burning waste, and that power is generated by burning the waste collected by the vehicles. This will make a large contribution to $CO_2$ reduction.

However, due to the short possible travel range with one charge, EV vehicles cannot operate collecting wastes for a full day with a single charge. A waiting time of 30 minutes is necessary, even with a rapid charging system. For this reason, EV vehicles have not been considered suitable for operation in waste collection so far.

Although waiting time was an issue with the conventional technology, the ZeroE System introduced here is a revolutionary system that minimizes waiting time by adopting a battery exchange system, which makes it possible to exchange batteries in a short time, and thus enables all-day operation.

## 2. Overview of the ZeroE System

The ZeroE System is an energy circulation-type system (**Fig. 1**), as described below:

i) battery station is installed in the waste-to-energy (WtE) incineration plant and uses power generated by waste incineration power generation to charge the exchangeable batteries used in battery exchanges.

ii) EV waste collecting vehicles are driven using these batteries, and perform waste collection.

iii) The WtE plant generates power by burning the collected waste, and uses that power to charge the exchangeable batteries.

Because one EV waste collecting vehicle has multiple exchange batteries, when an earthquake or other disaster strikes, it is also possible to transport the exchangeable batteries that are not currently in use to evacuation areas for use as an emergency power source.

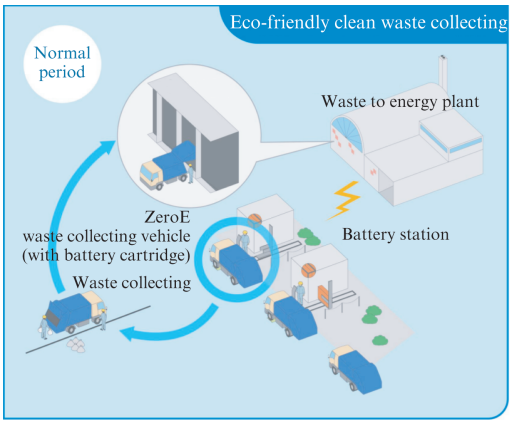


Fig. 1 Normal period

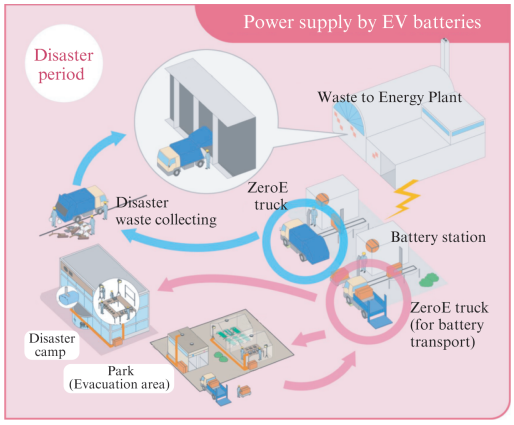


Fig. 2 Disaster period

Considering the frequent occurrence of natural disasters in recent years, this is also an extremely important advantage of the ZeroE System (**Fig. 2**).

## 3. Features of the ZeroE System

### 3.1 System Composition

The ZeroE System consists of a battery station, which is a battery exchange and charging facility, EV waste collection vehicle(s) and the exchangeable batteries. JFE Engineering Corporation handles the design, production and installation of the battery station. The Nissan Atlas F24 truck is used as the base vehicle. Auto Works Kyoto Co., Ltd. is responsible for vehicle electrification and the battery mounting portion, Kyo-

† Originally published in *JFE GIHO* No. 47 (Feb. 2021), p. 71−72

Photo 1 Battery station and battery

Photo 3 Truck used for battery transport


Photo 2 ZeroE waste collecting vehicle with battery cartridge

kuto Kaihatsu Kogyo Co., Ltd. is in charge of the waste collecting equipment, and the batteries are manufactured by Envision AESC Japan Ltd.

### 3.2 Battery Station

Battery exchanges can be completed within 3 minutes from the time the vehicle stops at the designated position in front of the battery station. The exchange operation is simple, and is performed using a remote control switch. Although the batteries used in this system are heavy objects weighing 300 kg, accurate and fast battery exchange is possible by applying JFE Engineering's technology for accurate transportation of heavy objects and the fast transportation technology used in the company's multilevel bicycle parking systems. **Photo 1** shows a battery station and battery.

### 3.3 EV Waste Collecting Vehicle

The Nissan Atlas F24 used as the base vehicle is a somewhat small truck with a gross vehicle weight of 5.25 tons. However, weight reduction was pursued in the study of the EV conversion design, and a maximum waste loading capacity of 1.5 tons was achieved (**Photo 2**). The possible travel range per charge is about 60 km, including power used by the waste collecting equipment.

### 3.4 Battery

The battery capacity was increased substantially from 24 kWh at the start of development to 40 kWh, which made it possible to extend the travel range per charge greatly, from 24 km to 40 km. This was linked to orders received in FY 2018.

### 3.5 Disaster Response

As a battery transport method for emergencies, we propose a method of placing a rack equipped with an inverter on the cargo bed of a light truck, as shown in **Photo 3**, to transport batteries to evacuation areas. It is possible to charge about 5 000 smartphones with one 40 kWh battery. If the battery is used as a power source for personal computers, 250 PCs can be operated for 24 hours.

## 4. Record of Orders Received

In FY 2018, Kawasaki City, Kanagawa Prefecture and Tokorozawa City, Saitama Prefecture each introduced one set of the ZeroE System (1 battery stand, 1 EV waste collecting truck, 3 exchangeable batteries), which are currently in operation.

## 5. Conclusion

Although electric vehicles (EVs) are expected to have a large effect in $CO_2$ reduction, the actual situation is that the possible travel range is still too short to satisfy customers. JFE Engineering's ZeroE System has received an extremely high evaluation from customers for compensating for this problem of travel distance, while also making it possible to respond to disasters. It may be noted that the introduction of this battery exchange-type waste collection vehicle is the first in Japan.

In the future, JFE Engineering Corporation will continue to contribute to society with the world's most innovative technology.

**For Further Information, Please Contact:**

EVPJ Team, Environmental Solutions Sector, JFE Engineering
Phone: (81)45–505–7667 Fax:(81)45–505–7688
https://www.jfe-eng.co.jp/