POWER RAIL
USING REGENERATED ENERGY FROM TRAINS

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SINCE 2014, Tokyo Metro—the firm that operates the subway lines that run through downtown Tokyo—has been using regenerated power from subway cars to power the equipment in train stations.

Regenerated power is the current produced when a train applies its brakes. Through a current collector called a pantograph, this electricity is fed back to the aerial wiring and primarily used to power other trains nearby. This has been implemented as one of the energy conservation measures for railways.

Until recently, however, that regenerated power went to waste when there were no other trains nearby. When there was already excess current in the system, in fact, the voltage of the aerial wiring spiked, causing problems in the system’s ability to provide stable electricity to each train car. As a result, the trains were designed to curb excess power generation, ultimately causing a net waste of energy in the system. “Making efficient use of this surplus of regenerated energy was one of the major issues for us,” says Kohta Mantani of Tokyo Metro’s Electrical Division.

Although the regenerated power starts as direct current, it can be converted to alternating current through a station auxiliary power supply unit and used to run the lighting, air conditioning, escalators and other facilities at stations. This means the system feeds the energy back into the station itself rather than wasting it.

“What is revolutionary about the station auxiliary power supply units is not just the technology to convert the current, but their compact size,” says Mantani with enthusiasm. The units, about the size of a large locker, only require about fifteen square meters of space, making them...
The auxiliary power supply unit at Myoden Station on Tokyo Metro’s Tozai Line runs the station’s lighting, air conditioning, escalators and other facilities. The control panel for the auxiliary power supply unit is also extremely compact; the power supply units are only about the size of a large locker, dramatically more compact than the room-sized units used in the railroad industry to date. It is this compact size that makes deployment and setup easy.

One of these units is installed at Myoden Station on Tokyo Metro’s Tozai Line. Its tiny, unassuming presence gives no indication that it is powering the station itself. Mantani laughs: “Unbeknownst to passersby, there is a little beast of a device tucked beside the railway tracks.”

Since deploying this unit in June 2014, Tokyo Metro has yielded an energy savings of 600 kilowatt-hours per day—the equivalent of sixty homes’ worth of energy consumption. Although installed at only one station so far, if the rollout continues it could be possible for trains to produce a major supply of energy for train stations while running.

Myoden Station was picked as the first site because it had the ideal conditions for generating and collecting power, such as a suitable space for the equipment, tracks on a slope that necessitates braking (and thereby produces power) and the train schedules. For these devices to become mainstream equipment, however, they must be refined further to allow for power generation and transfer even under ordinary conditions.

The railway system is already known as a comparatively eco-friendly transit method in terms of lower environmental impact because of its high transportation capacity. For its long-term environmental strategy in the run-up to 2020, Tokyo Metro has set a series of “Minna de Eco” (“Eco by Everyone”) guidelines, which call for total railway energy consumption in 2020 to not exceed 2009 levels. In addition to promoting the use of the station auxiliary power supply units, Tokyo Metro is planning on deploying low-energy train cars that require drastically less power to run than the existing carriages and installing solar generation systems on the rooftops of stations along the Tozai Line, independently pursuing significant eco-friendly changes.