

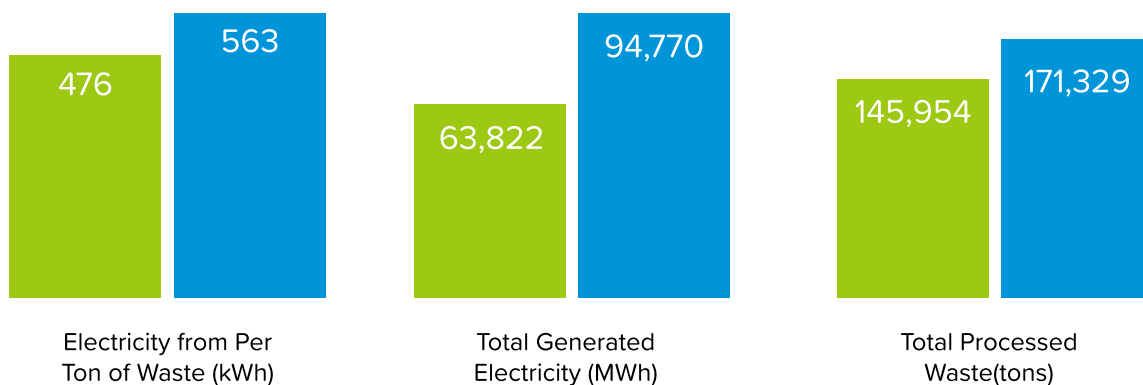
Achieving Efficiency and Protecting Ecosystems in Miaoli

Miaoli Energy-from-Waste Plant



- **Area:** 39,316m²
- **Type of waste:** MSW & Industrial Waste
- **Calorific value:** 2,300Kcal/Kg
- **Capacity:** 500 metric tons per day across 2 furnaces
- **Power out put:** 11.8MW
- **Type of Grate Stoker:** MartinGMBH

2008 2016



Background

Miaoli County is a largely agrarian economy of around 560,000 residents, representing 1,820 km² of mountainous terrain running along the western coast of Taiwan. The rich culture and natural landscapes attract ten million tourists to Miaoli every year. As tourism and agriculture both depend on a clean environment, the local government and citizens place great importance on environmental protection. As the Miaoli Energy-from-Waste plant is surrounded by rich wetland and forest ecosystems, ECOVE actively cooperates with the local government and community to ensure neither the natural environment nor local communities are negatively affected by the county's energy-from-waste incineration operations. In addition to providing clean electricity to its citizens, the Miaoli EfW Plant has helped reduce the need for landfills — eight former landfills have been recovered and transformed into parks or recreation facilities, greatly improving the quality of life for Miaoli citizens.

“The Miaoli EfW Plant avoids 39,085 tons of carbon dioxide equivalent emissions per year, an amount that would require 8.3 New York Central Parks to absorb.”

Overview

The first and only incineration plant in Miaoli, the Miaoli EfW Plant, was a Public-Private-Partnership (PPP) completed in 2008 in order to solve the waste problem in Miaoli. We worked together with our parent company CTCI — integrating the latter's reliable construction and engineering services and Ecove's environmental technologies and experienced Operations and Management — to create an effective solution, without burdening the government with a costly initial investment. Shortly thereafter ECOVE created a specialized company, the ECOVE Energy Miaoli Company, to be responsible for fundraising, operations and maintenance at the Miaoli EfW Plant.

The site planned for the Miaoli EfW Plant had been being used as an open dumpsite for several years. In order to ensure no leftover waste would poison the soil or groundwater, we carefully removed all the garbage that had been dumped by previous generations before beginning construction of the EfW Plant. As the Miaoli EfW plant is the only EfW plant in Taiwan located near a coastal wetland, a very delicate and ecologically rich ecosystem, we spared no effort in modifying both construction and operations to preserve the integrity of this fragile ecosystem, even reducing the original size of our plant when we discovered it jeopardized the health of the surrounding environment. We understand the importance of environmental protection — we continue to conduct quarterly environmental tests to ensure the surrounding ecosystems continue to thrive, without losing sight of continuously advancing operational efficiency.

Why ECOVE?

Taiwan's only successful Build-Operate-Transfer (BOT) EfW Plant

Our strong track record for successfully operating incineration plants has steadily grown since we began our first EfW operation in 1995. ECOVE is a unique environmental company in that it has access to engineering, procurement and construction (EPC) capabilities through its parent company, CTCL. As such, ECOVE is the only environmental company in Taiwan to have successfully implemented a BOT EfW Plant, as we are able to handle every aspect of the project — from investment to construction to operation. Because we continuously work to advance efficiency, we are able to generate enough revenue from electricity production to keep waste processing fees low — providing the government with a necessary service for a fraction of the cost of traditional incinerators.

Unbeatable efficiency

Proprietary technologies increase energy and reduce emissions

For over twenty years, we have amassed extensive knowledge and skill to efficiently convert waste, a valuable resource, into usable electricity. In 2016, the Miaoli EfW Plant generated 15% more electricity per ton of waste than we did in 2008 — 476 kWh per ton of waste in 2008 versus 563 kWh in 2016. At the same time we have reduced the amount of bottom ash and fly ash generated between 2008 and 2016 by 5.5% and 4%, respectively.

ECOVE's technical know-how and years of experience help the Miaoli EfW Plant avoid expensive and potentially damaging boiler shutdowns. Over the past three years, the boiler has averaged at 95% availability. Not only does this outperform Taiwanese incinerators that hover around an average of 85% boiler availability, but it's on par with European environmental leaders, such as Germany with 95.8% and the Netherlands with 94.8%, according to the most recent statistics published in 2012.

Without losing focus on improving efficiency, we also ensure all our facilities are in accordance with the proper environmental health and safety standards, consistently improving the quality of air and water emissions — as our Miaoli facility is located near a wetland, our emphasis on environmental protection is especially important. For example, our exclusive Automatic Combustion Control (ACC) system continuously refuels the incinerator with refuse and automatically adjusts oxygen levels. This ensures a steady burn, cutting carbon monoxide and flue gas emissions by 51.9% and 6.2% respectively, increasing the stability of steam output by 21.4% and reducing labor hours by over 96%.

Data-driven Operations

Big data drives efficiency

Our advanced Operation Results System (ORS) automatically processes, identifies and analyzes anomalies in the data more precisely and less labor-intensively than the traditional method. The intelligent design can then use all the collected data to analyze long-term trends, reducing labor hours by 80%, and allowing ECOVE specialists more time to find blind spots in the data and further increase efficiency.

The Maintenance Management Information System (MMIS) was developed to uncover the underlying problems behind equipment failure. The MMIS compiles past equipment failure and maintenance records to create a cause analysis that allows supervisors to determine the root of the problem. Thereafter, improvements or upgrades can be made accordingly, and future incidents of failure can be reduced.

To use the data more efficiently, we integrated ORS, MMIS, and the Electrical Power Monitoring System (EPMS), our other proprietary system, to create the IOI (Important Operations Information) app. This software constantly collects and analyzes 69 million data records per day across all operations, allowing associated personnel to stabilize operations, either by preemptively addressing equipment failure or by making upgrades and improvements to the plant.

Contribution and Collaboration

Working together to create win-win solutions

In 2015, the local government implemented the cross-regional waste cooperation disposal policy; as a result, the Miaoli EfW Plant has expanded waste management services to neighboring cities. The Miaoli EfW has seamlessly welcomed the increase in waste — 35% of waste processed in the Miaoli EfW Plant now comes from surrounding cities — and has contributed an additional \$100 million NTD to the local government annually.

In 2014, ECOVE cooperated with the Miaoli Environmental Protection Bureau to develop the Miaoli EfW facility into a certified environmental education facility. ECOVE has held many environmental educational workshops, including a workshop educating the local government and community on the importance of wetland ecosystems. This helps the local community better understand the importance of the environment and how to help protect it.

We cooperate with residents and the local government to keep them informed about their local environment by carefully monitoring air and water quality and ecological health of the surrounding wetlands. We compile this information into reports that demonstrate the EfW

plant operates harmoniously with the surrounding wetlands and community. The Miaoli EfW Plant has also helped reduce our global carbon footprint — in 2015, it received an Environmental Protection Agency award for cutting carbon dioxide emissions by 6,366 tons and was the first incineration plant in Taiwan to acquire the Carbon Label.

“ECOVE has been improving equipment, processes, and practices for a long time — this is why we are always becoming more efficient.”

Peter Wang

Director of Miaoli EfW Plant