

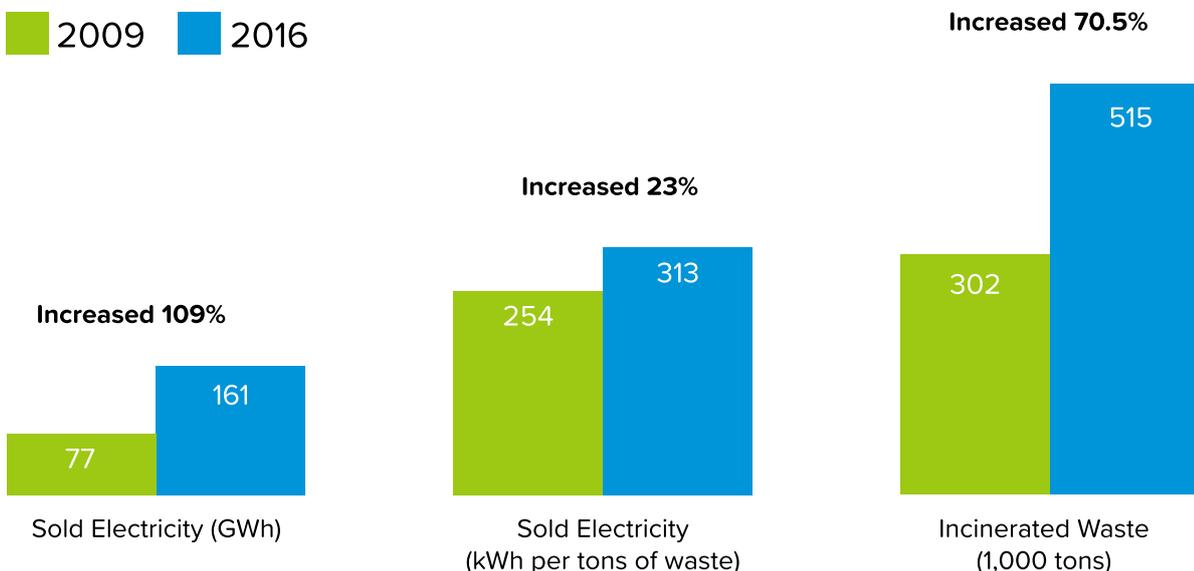
## Efficient electricity generation reaches Macau: ECOVE works closely with the local government to recover resources for energy

### Macau Refuse Incineration Plant



- **Area:** 45,000 m<sup>2</sup>
- **Type of waste:** MSW (60.2%), Commercial waste (18.0%), Industrial waste (11.8%), Bulky waste (10.0%)
- **Calorific value:** 1,700 Kcal/Kg
- **Capacity:** 1,728 metric tons per day across six furnaces
- **Power output:** 21.7 MW
- **Type of Grate Stoker:** Martin GmbH

2009 2016



## Background

Tourism represents a large sector of Macau's economy. In 2016, the 600,000 residents of Macau welcomed more than 30 million tourists, who helped generate a daily rate of 2.1 kg of waste (compared to Hong Kong's daily rate of 1.39 kg per capita). The Macau Refuse Incineration Plant is an efficient way to manage this waste without putting unnecessary pressure on its 30.5 km<sup>2</sup> of territory, giving residents and visitors a clean living environment and efficiently using municipal waste to generate electricity.

*“ECOVE has processed 3,070,974 tons of waste over 7 years, enough to fill 7,226 Olympic-size swimming pools”*

## Overview

Before the Macau Refuse Incineration Plant was constructed in 1992, most of Macau's waste was deposited into landfills. As an increasing number of tourists and residents generated more and more waste, Macau felt acute pressure on its limited land supply. To this end, the Macau government changed its disposal policy to waste incineration supplemented by landfill. Thereafter, the Macau Refuse Incineration Plant managed to dramatically reduce waste volume entering landfills.

With the intention of seeking a reliable company to take over operations of Macau's only incineration plant, the Macau government launched an international tender for Operations and Management of the plant in 2008. ECOVE, partnered with local company Consulasia, won the bid; shortly thereafter, we joined forces with Consulasia to establish Sinogal - Waste Services Co., Ltd. to manage the Macau Incineration Plant — today, Sinogal is the biggest environmental company in Macau.

## Why ECOVE?

### **A solid reputation built on experience**

ECOVE has already established itself as the biggest environmental company in Taiwan. Over twenty years successfully operating and managing EfW plants and actively cooperating with the Taiwanese government at all levels, gives the government confidence they can trust ECOVE to efficiently operate and manage their EfW plants.

By fostering a close partnership with local Macanese company Consulasia, we are able to supplement our knowledge and skill with local insight on the environment and culture in

Macau. This inside advantage helped ECOVE offer competitive proposals and quotations to out-compete other notable companies in the industry, such as Suez Environment (France), Covanta Energy (USA), Keppel Seghers Engineering (Singapore), and CGS (a Veolia subsidiary in Macau).

## Unbeatable efficiency

### Greater efficiency, fewer costs

After our first six months taking over operations at the Macau Incineration Plant, we increased sellable electricity by 18%, clearly demonstrating we can efficiently generate electricity from waste internationally just as well as in Taiwan. Thereafter, we continuously upgraded and improved our systems to ensure the incineration plant operates with ever greater efficiency. As a result, we processed 60% more waste in 2016 than we did in 2010, and generated 12% more electricity per ton of waste. This electricity represents 3.2% of Macau's total energy use, supplying electricity for the equivalent of 33,000 households.

Our emphasis on efficiency has not only resulted in completely covering the cost of essential waste management services in Macau, our in-depth knowledge of relevant technologies also allows us to further reduce government expenditure. For example, in 2015 we installed a lime separation device that both reduced chemical use in the facility by an amount equivalent to 1 million Macau Patacas (USD 125,000) and also cut down on sulfur oxide emissions.

## Data-driven Operations

### Using data to advance efficiency

As Macau only has one incineration plant, it cannot afford too many unplanned shutdowns. To ensure both short- and long-term operations remain stable and efficient, ECOVE has pioneered the Maintenance Management Information System (MMIS) to improve efficiency by consistently collecting and analyzing data throughout our operations including: the amount of waste received and processed, steam and power generated, electricity sold, chemicals used, emissions, incinerator temperature, and the operating parameters of critical devices.

The MMIS analyzes the accumulated data; afterwards, our specialists conduct in-depth analyses to precisely predict when plant equipment needs to be replaced, which avoids unnecessary downtime due to malfunctioning equipment. After nearly ten years managing six furnaces at the Macau Refuse Incineration plant, we have experienced less than one unplanned shutdown per year, massively reducing unnecessary costs and complications.

## Contribution and Collaboration

### Cooperating with the government, benefitting communities

When ECOVE first took over operations in 2008, we focused on transferring technology and knowledge rather than permanently relocate an all Taiwanese staff to manage the plant. As there were no trained professionals available to manage the plant at the time, we originally relocated 40 specialists to support the transition— gradually recruiting and training locals to operate the system. As of today, 60% of employees are Macanese citizens and 35% are from China, the Philippines, and Sri Lanka.

At ECOVE, we are committed to collecting and analyzing data and assembling annual reports, providing useful information to the Macau government — as a result, we have become one of Macau’s leading environmental advisors. We emphasize active cooperation with local government and communities to ensure the public is informed of how the EfW plant positively affects their community. We welcome thousands of visitors and government officials to the Macau Refuse Incineration Plant every year — we offer guided tours of the facility in order to educate our visitors on incineration operations and the importance of using global resources efficiently.

*“ECOVE’s personnel are very hard-working, experienced, and humble. We’re very happy to work with them if we have more opportunities in the future.”*

**Helder José Moura dos Santos**

Managing Director of Consulasia