Ecube Labs

**Founded** 2011

**CEO** Sean Gwon

**Website** www.ecubelabs.com

**Business** Smart Waste Solutions
Ecube’s Vision

Smart solutions that empower cities to become clean and green.

Global Leader in IoT Waste Solutions

- **Economic**: significant savings from optimizing waste operations
- **Smart**: arbitrary decisions replaced by data driven ones
- **Eco-Friendly**: low carbon footprint and less fuel emissions
Our customers see substantial improvements

reflects actual data from current customers

- waste overflow minimized by as much as 97%
- waste collection frequency reduced by up to 98%
- operational savings of at least 1/3

Impact

Our solutions make a distinct impact.

What are common operational issues in waste management?

1. inefficient and unnecessary collections
2. high operational costs
3. waste overflow
Our Products

CleanCUBE (solar-powered trash compactor) P.06

Video CleanCUBE P.14

CleanFLEX (fill-level sensor) P.16

CleanCALL (on demand collections) P.18

CleanCityNetworks (waste monitoring platform) P.20

CleanTRACK (vehicle location tracker) P.22

CCNx (fleet monitoring & route optimization solution) P.24

CleanScaleNetworks (waste weight monitoring) P.26

Order Process P.27
CleanCUBE

solar-powered trash compactor

Powerful Waste Compaction and Fill-Level Monitoring

The CleanCUBE compacts waste using a force measuring up to 700 kg to hold up to 8 times more waste than conventional bins. Users can monitor estimated fill-levels and collections using our online platform, CleanCityNetworks.

Customization and Safety Features

Optional features are available such as advertising panels, design modifications, and wifi hotspots. Compatible with industry-standard wheelie bins, the CleanCUBE comes in three sizes: 100/120/240L. Hand detection and special locking mechanisms provide safety while anti-rust coating and a shock resistant exterior ensure durability.
# CleanCUBE

## Pricing (MSRP)

<table>
<thead>
<tr>
<th>Compacting</th>
<th>100 L</th>
<th>120 L</th>
<th>240 L</th>
</tr>
</thead>
<tbody>
<tr>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
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<table>
<thead>
<tr>
<th>Non-Compacting</th>
<th>100 L</th>
<th>120 L</th>
<th>240 L</th>
</tr>
</thead>
<tbody>
<tr>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
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</tbody>
</table>

*CCN subscription is additional. Shipping & installation not included.*
CleanCUBE Options

Hopper
Closed aperture operated by handle

Hopper + Foot Pedal
Closed aperture operated by handle or foot pedal

Ashtray
Safely stores smoldering cigarettes

Prices

100 L
★★★

120 L
★★★

240 L
★★★★

(US Dollars)
# CleanCUBE Options

**Wi-Fi Hotspot**
* additional data rates apply

**Audio Speaker**
* not available with wifi option

**Panel Vinyl Wrap**
* price per panel

**Full Vinyl Wrap**
* frame, top cover and all panels

<table>
<thead>
<tr>
<th>Sizes</th>
<th>Wi-Fi Hotspot</th>
<th>Audio Speaker</th>
<th>Panel Vinyl Wrap</th>
<th>Full Vinyl Wrap</th>
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</thead>
<tbody>
<tr>
<td>100 L</td>
<td>★★★★</td>
<td>★★★</td>
<td>★★★★</td>
<td>★★★★</td>
</tr>
<tr>
<td>120 L</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★★</td>
<td>★★★★</td>
</tr>
<tr>
<td>240 L</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★★</td>
<td>★★★★</td>
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Prices (US Dollars)
The CleanCUBE has the option to come equipped with a print display for announcements or advertisements. Whether on one side or both, the ad panels are easy to change and offer a modern image that conventional trash cans lack.

**CleanCUBE Ad Panel**

Put the CleanCUBE to work by generating ad revenue or displaying public service announcements.
CleanCUBE Ad Panel

Prices

- **100 L**
  - A2 Print
- **120 L**
  - A1 Print
- **240 L**
  - A1 Print

A1 = 594 x 841 mm
A2 = 420 x 594 mm

*To order ad panels on both sides, simply double the price.*
CleanCUBE Technical Specifications

Compactor

- Force: max 700kgf
- Compression Cycle: approx. 40 seconds
- Motor Size: 1/6-HP DC geared motor
- Drive System: geared motor with X-frame drive (patented)
- Control System: smart microcontroller-based automated system

Safety Features

- Rated IP45 for ingress protection
- CE, FCC/IC, K-Mark certified
- Hand detection safety sensor
- Fire detection sensor and fire suppression
- Access locks for front door, top and side covers
- Optional stability mounting brackets
- RoHS compliant
- Polycarbonate protective cover for solar panel

Communication and GNSS Features

- Communication: GSM/WCDMA module
- Location: GPS module
CleanCUBE Technical Specifications

Available in three sizes, the 120L and 240L models are compatible with standardized 120L and 240L wheelie bins. Charging/power options are available in solar, AC, or hybrid (solar and AC).

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>100 L</th>
<th>120 L</th>
<th>240 L</th>
</tr>
</thead>
<tbody>
<tr>
<td>610 × 610 × 1167</td>
<td>624 × 762 × 1440</td>
<td>740 × 840 × 1536</td>
<td></td>
</tr>
</tbody>
</table>

- **Net Weight**
  - 100 L: 150 kg
  - 120 L: 170 kg
  - 240 L: 194 kg

- **Compacted Trash**
  - 100 L: 100 L
  - 120 L: 120 L
  - 240 L: 240 L

- **Uncompacted Trash**
  - 100 L: 500 L
  - 120 L: 600 L
  - 240 L: 1,200 L

**Additional Options**
- A1/A2 size advertisement panel with acrylic cover
- A1/A2 size LED backlit advertisement panel
- Audio speaker
- WiFi hotspot
- Black and grey standard colors (custom colors available on large orders)
- Custom graphic vinyl wraps available

**Power**
- System Voltage: 12 Volts DC
- Power Consumption: 15Wh/day average
- Battery: silicone
  - 100L: 12V 36Ah
  - 120L: 12V 46Ah
  - 240L: 12V 46Ah
- Solar panel: crystalline silicon solar module
  - 100L: 35W
  - 120L: 55W
  - 240L: 55W
- LED status indicator icons
Due to its high power consumption, the Video CleanCUBE must be powered by an AC adapter.

Ecube is the first to integrate video panels into smart trash bins. We also offer an online platform for remote management of all your multimedia content. Update your entire fleet from one convenient location. Outdoor or indoor models are available with varying levels of brightness for optimized visibility. Waterproof and dustproof to withstand elements.

*Due to its high power consumption, the Video CleanCUBE must be powered by an AC adapter.

Video
CleanCUBE

Featuring a crisp motion picture display for a distinctively smart, modern and premium feel.
# Video CleanCUBE

**Specs & Pricing (MSRP)**

<table>
<thead>
<tr>
<th>LCD Display Type</th>
<th>Indoors</th>
<th>Outdoors</th>
<th>Indoors</th>
<th>Outdoors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Sided</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
</tr>
<tr>
<td>Double-Sided</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
</tr>
</tbody>
</table>

- **100 L**
  - Size: 648 x 692 x 1170 mm
  - Video Screen (32”): 413 x 719 mm

- **240 L**
  - Size: 840 x 950 x 1566 mm
  - Video Screen (43”): 530 x 942 mm

*The multimedia management portal costs $— per month for each Video CleanCUBE (covers 2GB of data and does not include CCN).*
CleanFLEX Versatile Applications

Attachable to various containers such as large dumpsters, public trash cans and clothes donation bins, the CleanFLEX’s rotating sensor allows for installations in a versatile range of settings.

Our ultrasonic sensor measures fill levels and sends it to our online IoT platform, CleanCityNetworks, where users can analyze data and optimize their collection schedules.

$___ each  CCN subscription is additional
CleanFLEX Technical Specifications

Size and Weight
- Size: 80 × 85 × 53 mm
- Weight: 350g

Fill Level Sensor
- Measurement technology: ultrasonic/sonar sensor 40KHz
- Range: 2 to 400 cm
- Accuracy: solid materials ±4 cm, liquids ±1 cm
- Resolution: 1 cm

Other Features
- Temperature sensor: for high heat or fire detection
- Location technology: GNSS GPS L1 C/A Code

Communication
- GPRS over GSM: 850/900/1800/1990 MHz
- WCDMA over UMTS: 800/850/900/1700/1900/2100 MHz
- LPWAN: LoRa / NB-IoT / LTE Cat.M1 available
- Subscriber Identity Module: USIM 2FF, 3FF

Durability
- Ingress protection rating: IP67
- Impact rating: IK10
- Operating temperature: -30 to 80 °C

Power
- Battery type: 3.6V high performance lithium battery (D-type)
- Battery life: approximately 5 years

Physical Properties
- Material: ABS/Polycarbonate
- Installation: optional mounting brackets available if needed

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1 Accuracy may vary depending on the configuration and the solid material being measured.
2 At a setting of 4 transmissions per day with satisfactory network quality. Battery life will vary according to network strength and transmission frequency, anywhere from 1 to 10 years.
Compact Device with Multiple Uses

The CleanCALL can be used for waste collection requests, trash pickup confirmations, as an emergency alarm, etc. It communicates wirelessly and can be easily installed in a variety of settings. The device features a simple one button operation and an LED indicator showing the current status. Managers can use the device to respond promptly to collection needs or emergencies, minimizing response times.

$\_\_\_\_\_\_\_\_ each  CCN subscription is additional
CleanCALL Technical Specifications

Size and Weight
- Size: 70 × 70 × 33.5 mm
- Weight: 125 g

Features
- Temperature Sensor (for high heat or fire detection)

Device
- Input: Push Button
- Charging Port: micro USB-B type

Communication
- LPWAN: NB-IoT available
- Network: USIM card provided

Durability
- Ingress Protection Rating: IP67
- Impact Rating: IK10
- Operational Temperature: 20 to 80 ºC

Power
- Battery Type: 3.6 V (2200mA x 2 = 4400mA)

Physical Properties
- Material: ABS/Polycarbonate
- Installation: optional mounting brackets available if needed

70 mm
33.5 mm
70 mm
CleanCityNetworks

Online platform for monitoring waste collections and fill levels from IoT devices.

Monitor Fill-Levels and Collections

CleanCityNetworks provides users the ability to monitor Ecube products and optimize collection routes based on current fill-levels. It also displays other product details (battery status, GPS location, collection history, etc.).

Globally Accessible Online Platform

CleanCityNetworks is accessible around the clock, anywhere in the world on a desktop (web browser) or smartphone (mobile app). Easy to use and maintenance-free as no installation is required.
Increase operations efficiency with CCN

CCN Pricing

products compatible with CleanCityNetworks

CleanCUBE
solar-powered trash compacting bin

CleanFLEX
fill-level sensor

CleanCALL
on demand collection requests

CleanTRACK
vehicle location tracking device

Price per unit (includes data communication charges)

$___ per month

1 Year
$___ (13% savings)

3 Years
$___ (27% savings)

3+ Years
$___ (47% savings)
CleanTRACK

Vehicle Data Collection Device

CleanTRACK utilizes GPS and OBD modules to report crucial data from collection trucks to our cloud platform, CCNx. Users can then check how collection routes are unfolding and manage fleets more efficiently using data-driven decisions.

Comprehensive Data and Analytics Reports

Through CleanTRACK, users can monitor a vehicle’s GPS position, RPM, engine oil levels, temperature, tire air pressure, engine torque, battery voltage, fuel efficiency, coolant temperature, and rapid accelerations. It equips the user to identify anomalies and prevent accidents.

$___ each

CCN subscription is additional
CleanTRACK Technical Specifications

Size and Weight
- Size: 63 × 125 × 25 mm
- Weight: 140 g

Features
- OBD: 11 of 12 data fields
  - speed, RPM, accelerator pedal, engine oil temperature, intake air temperature, outside temperature, coolant temperature, air volume, atmospheric pressure, engine torque, car battery voltage
- BLE 4.1

External Port
- SMA¹ Female: LTE Antenna
- RP-SMA Female: BLE Antenna (2400 ~ 2500 MHz; 5150 ~ 5850 MHz)
- SMAW250: OBD port
- 2.5 Pie Jack: external GPS
- DC Power Port: outer diameter ø5.5 / inner diameter ø2.1

¹SMA: antenna connector specifications

Communication
- GPRS over GSM: 850/900/1800/1990 MHz
- WCDMA over UMTS: 800/850/900/1700/1900/2100 MHz
- Network: USIM card provided

Power
- Employs vehicle power: 12 ~ 24 V
Machine learning technology in CCNx analyzes waste generation and fill level data to provide optimized collection routes. In addition, it enables users to observe the driving habits of their truck drivers. Based on such data, users can manage their fleet, collection equipment and labor force with greater efficiency, minimizing costly maintenance and repair expenses.

Collection Route Optimization

Machine learning technology in CCNx analyzes waste generation and fill level data to provide optimized collection routes. In addition, it enables users to observe the driving habits of their truck drivers. Based on such data, users can manage their fleet, collection equipment and labor force with greater efficiency, minimizing costly maintenance and repair expenses.

Mobile App for Haulers

Once optimized collection routes are calculated, each vehicle driver can follow the navigation provided and assigned by the CCNx mobile app. In addition, haulers can report issues or malfunctions that are observed along the route by uploading notes or photos. Once a collection is complete, CCNx will direct the driver to the next collection point.
CCNx Price

- product monitoring / virtual garbage bin setup / fleet management / specialized CCNx tablet / vehicle data collection

<table>
<thead>
<tr>
<th>CleanCityNetworks</th>
<th>CCNx</th>
<th>CCNx Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>$__ per month</td>
<td>$__ a month</td>
<td>CCNx tablet**</td>
</tr>
<tr>
<td>(per IoT device)</td>
<td>(for each vehicle)</td>
<td>OBD module**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CleanTRACK $__</td>
</tr>
</tbody>
</table>

*For clients using CCNx with conventional bins, a fee of $100-400 per month applies (depending on the quantity of bins).
** Contact us for prices.
Monitor the Weight of Trash Collected

CleanScaleNetworks is an add-on feature of CCN that enables users to keep track of how much waste each hauler truck collects. Software in the weight scale is integrated with CCN to monitor the weight, edit/delete entries, monitor statistics, vehicle details, and weight statistics by selected periods. Corporations and local municipalities can use this data to optimize their budgets and operations.

$___ per month (for each scale)  *An initial setup charge applies.
Order Process
CleanCUBE & CleanFLEX

01 Initial Contact
- phone or online inquiry (email)
- sales specialist responds
- a consultation is set up to determine the context, scope, purpose, and needs

02 Price Quotation
- a price quote is sent based on consultation
- details of quantity, installation, and any additional costs are discussed
- after discussions are finalized, an invoice is sent within 1-2 days

03 Order & Manufacture
- invoice is confirmed by customer
- once payment is received, manufacturing begins
- lead times for manufacturing vary according to product and quantity (for a quantity of 100+: CleanCUBE 6-8 weeks, CleanFLEX 1-4 weeks)

04 Delivery
Once products are ready, delivery is arranged to the installation site or a designated address.
- [Ocean Freight]
  - America: 30-40 days
  - Europe: 40-50 days
  - Australia: 20-30 days
  - Asia: 15-20 days
- [Air Delivery]
  - Worldwide: 7 days

05 Installation
Depending on the region, staff from Ecube Labs or a partner company will install products. Installation period will vary according to quantity.
Baltimore is giving residents new reasons to take pride in their city.

Baltimore, the largest city in Maryland with a metropolitan area population of 2.8 million, is taking bold steps to become a smart city of the future. Since September 2018 the city has deployed solar-powered CleanCUBEs to clean up its streets and go green. It has immediately seen a drastic drop in waste collections resulting in less fuel emissions and traffic congestion. And by using cloud software, city officials can optimize collection schedules and quickly identify unsightly overflow. Hoppers have also been equipped with wireless locks to prevent terrorism ahead of big events. Residents are enjoying safer and cleaner streets and finding renewed pride in the city's image.

Solution

- 308 CleanCUBEs installed over 3 months
- A possible deployment of 4000 CleanCUBEs under consideration
- No more ambiguity, waste volume can now be analyzed online to identify areas with high waste generation so collection routes can be optimized

Results

- Collections dramatically reduced by 98.5% for compacting CleanCUBEs (general waste only) from twice a day per bin to an average of once a month
- Waste volume down 97.7% from previous conservative estimates
- Haulers can visually check bins with low levels and skip them saving time, fuel emissions, traffic congestion, and money
- Recycling volume is averaging 2,665 liters per bin each month enabling the city to measure recycling diversion rates
- Waste overflow incidents minimized to an average of once a day
- Online ability to lock hopper openings to ensure safety before large scale events
Everland KOREA

amusement park
252 CleanCUBEs
collections reduced by 94%

Everland successfully eliminated overflowing bins and established a smarter waste management plan to cement its position as the premier theme park in South Korea

As the 17th most visited amusement park in the world with 6.3 million visitors a year (over 17,200 per day), preventing waste overflow is critical for the park’s image. Therefore it was typical for the park to schedule numerous collections throughout the day even during peak operating hours. Once CleanCUBEs were installed, its waste compaction feature allowed the park to postpone collections to the evening. CleanCityNetworks also empowered park staff to identify and remedy daytime overflow right away, keeping waste out of sight for guests.

Solution
- conventional waste bins replaced with 252 solar-powered CleanCUBEs
- with the park’s zero tolerance for waste overflow, fill level thresholds were set to lower levels than default as a preemptive measure
- park staff trained extensively on new bins, operational methods, and environmental goals

Results
- using CleanCityNetworks to identify waste overflow, incidents minimized to an average of once a month for the entire park with 6 months recording no overflow incidents at all
- massive savings in collections and operational costs
- high-season: collections reduced 87% from once every 9.4 hours to once every 72 hours
- mid-season: collections reduced 94% to once every 7.6 days
- one-third reduction in waste management expenses
- collections scheduled in the evening, out of sight from most guests
By implementing innovative smart city solutions, Melbourne plans to continue dominating the rankings as the world’s most liveable city.

A cosmopolitan city with a population of 4.8 million and 30 million visitors a year, Melbourne’s top priorities include aesthetics and cleanliness. Without any data on waste generation, trash collections involved emptying bins multiple times a day to minimize overflow, an eye sore to residents and tourists. Since deployment of CleanCUBEs in early 2018, the city has been able to dramatically lower its collection frequency, quickly remedy overflow, and maximize efficiency by identifying times, seasons, and areas with high levels of waste. CleanCUBEs have helped the city uphold the highest standard of living for its residents.

**Solution**

- conventional waste bins replaced with 397 solar-powered CleanCUBEs in the city’s business district
- CleanCityNetworks employed along with CleanCUBEs to provide key data and custom notifications so the city can optimize collections and remedy trouble incidents

**Results**

- monthly collection frequency has fallen 96.3% from an estimated average of one collection every 6 hours to an actual average of once every 7 days
- cloud data reveal monthly waste volume has fallen by 95.4% compared to previous conservative estimates of volume generation from conventional bins
- overflow incidents minimized to an average of 11.5 per month (only 2.38% of all CleanCUBEs see any overflow in a given month)
Simon Properties purchased CleanCUBEs for two of their outdoor malls in its commitment to provide a premium experience for both customers and tenants.

In spring 2018, nine CleanCUBEs were deployed at the San Francisco Premium Outlets in Livermore, California. During peak months, the mall was faced with the challenge of upholding facility aesthetics (i.e., floors, décor, restrooms) with a limited custodial team. For the first time ever, CleanCityNetworks provided property managers with actual waste generation data helping them adjust collection frequency and freeing up their custodial team from unpleasant duties like emptying waste and helping them focus on keeping their facilities looking clean and pristine.

Solution

- conventional waste bins replaced with 9 solar-powered compacting CleanCUBEs
- CleanCUBEs help companies go green by being powered by the sun and by dramatically reducing the number of plastic bin liners used

Results

- trash volume averaged 3,300 liters a month during high traffic months and 1,314 gallons a month the rest of the year
- on peak months (June-August) collections dropped 98% from an estimated 10 collections a day per bin to an actual frequency of 0.2 collections a day
- on non-peak months collections dropped 98.3% from an estimated 5 collections a day per bin to an actual frequency of once every 13.2 days (or 0.08 collections per day)
- custodians freed up from frequent and arbitrarily scheduled waste collections so they can focus on upholding the premium feel of the property
- waste overflow minimized to one incident over the entirety of 8 months
Ecube Labs Worldwide as of April 2019

- Worldwide deployment: 9,010 units
- Companies we’ve served: 244
- Cities with our products: 127
Number of Fill Level Data Points Collected

150,000,000

as of March 2019
Attainment

2012.08 Acquired ‘Venture Business Certification’
2013.06 ISO 9001/14001 Certification
2013.07 Global strategic partnership with Vodafone
2014.05 Acquired ‘Green Certificate’ from Korea’s Environmental Industry & Technology Institute
2014.11 Acquired quality certification K Mark (CleanCUBE)

Award

2011.07 Grand prize at the ‘Europe-Korea Business Plan Competition’ by European Chamber of Commerce in Korea
2011.10 Grand prize at ‘2011 Youth Entrepreneurship Exhibition Korea’ by DreamBizForum
2013.12 Minister prize at ‘Korea Creative Economy Award’ by Ministry of Science and ICT
2013.12 Pollutec Innovation Badge at International Environment Exhibition
2014.06 Green Management Award by Ministry of Trade, Industry and Energy
2016.11 The Most Recognized Enterprise in Korea (Governmental Prize)
2017.06 M2M Green Excellence in Technology innovation award from Frost&Sullivan
2017.06 WeGO Smart Sustainable City Award from Goyang City

Activity

2015.10 IoT pilot project at Bukchon Village, Seoul
2016.01 IoT project in Seoul (Seodaemun district)
2016.04 IoT project in Seoul
2016.07 CleanFLEX PoC started at Dublin Airport, Ireland
2016.12 CleanCUBEs in Goyang City (Gyeonggi province)
2017.01 Pilot project in Washington D.C. & LA’s Hermosa Beach
2017.06 Tender for CleanCUBEs in Ghent, Belgium
2017.07 Pilot project in Chula Vista, California
2017.10 Tender for CleanCUBEs in Melbourne, Australia
2017.12 CleanTRACKs in Goyang City
2018.01 Tender for CleanCUBEs in Baltimore, US
2018.02 CleanCUBEs in Everland
2018.09 CleanCUBEs in shopping centers operated by Simon Properties

Ecube Labs History

2011.07 Ecube Labs Co., Ltd founded
2013.05 R&D center opened
2014.10 Gimpo factory registered
2016.07 US office launched
2016.09 Gimpo factory expansion and relocation
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