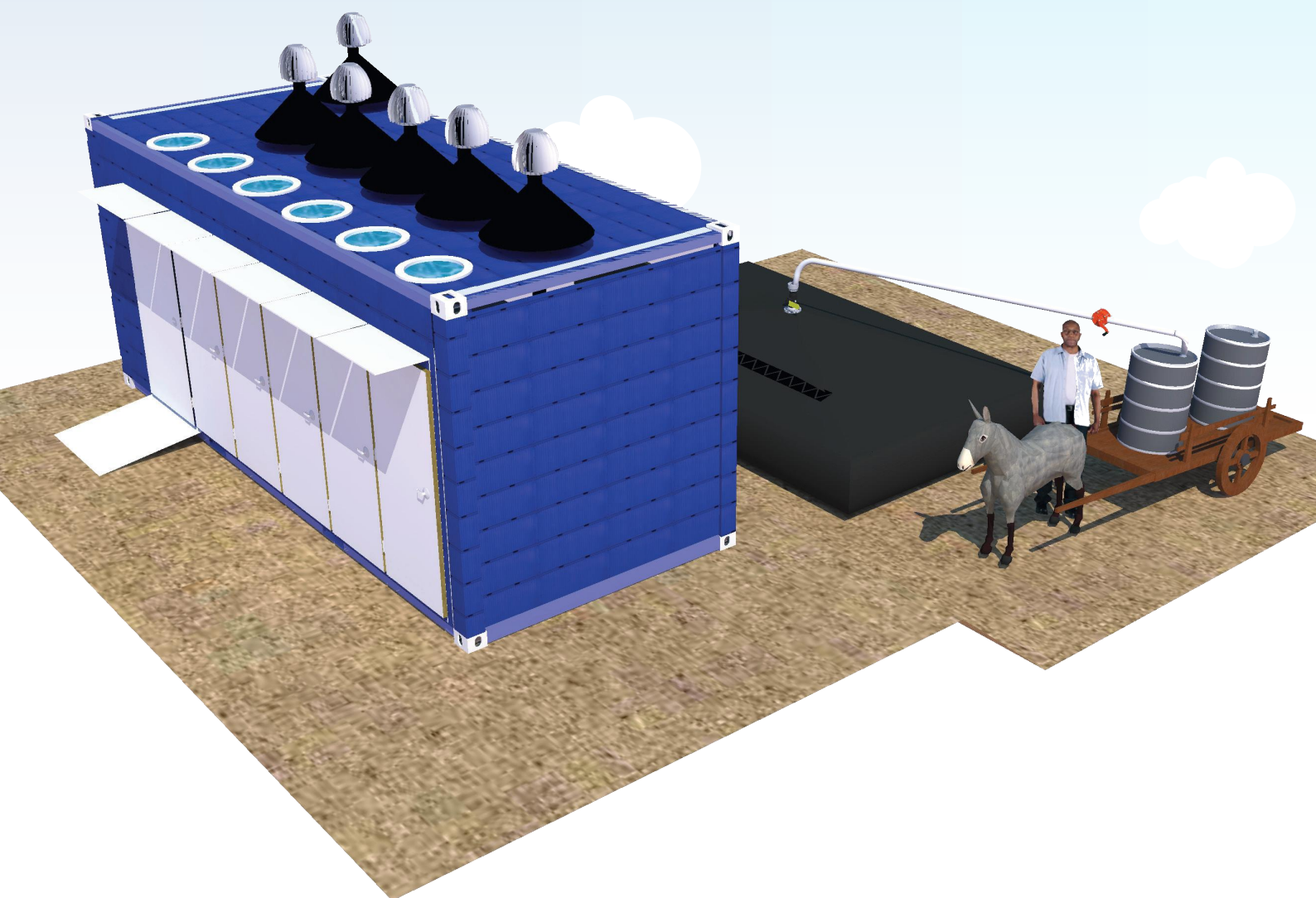




ECOSEC container solution for refugee camp

BILL & MELINDA
GATES foundation





Summary

The shipping container solution, developed by the cooperative Ecosec is a ready-to-use autonomous waterless sanitation solution for refugee camps oriented towards the re-use of urine in self service as fertilizer by local farmers. With six cubicles, including one disabled-access, the sanitation bloc is able to provide sanitation for 200 people per cabin in the long term. Water-free, but without any need for sawdust, it is simple, hygienic and aspirational, with robust, mechanical components.

The main characteristics of the Ecosec container solution are the following:

- **High capacity** : With six cubicles, including one disabled-access cubicle, the cabin can potentially be used by 120 women/hour and 400 men/hour.
- **Stand-alone**: Operating without water and without any external energy requirements except the sun, the Ecosec container requires no connection and is therefore ready-to-use as soon as it is in position. Ventilation is created by heat and therefore functions better when the sun is stronger.
- **Hygienic**: The container works without needing to add sawdust after use. It is clean, with no sign of previous users, and has an antibacterial-gel dispenser for hand washing. The composite surfaces are smooth and easy to clean, giving an enhanced hygiene sensation. There is no pollution of ground water, and no possibility for flies to leave the inside of the hermetic container.
- **Very low maintenance** : Needing not any additives, urine is separated by gravity into a bladder tank placed at a lower level (50cm below). Faecal matter needs to be transferred every 10 days from a small box (65 litres) in a tank (400 litres) – an operation requiring about 10 minutes every 600 “solid” uses of the toilet. The Ecodomeo throne is one of the Urine-Diverting Dry Toilet (UDDT) technologies requiring the least maintenance on the market.
- **Waste-to-value outputs** : Urine contains 80% of the nutrients ejected by humans. Separation at source allows for the collection of sterile urine into a separate tank, which is the best way to re-use it for agricultural purposes in a hygienic way. Our partner, LabaronneCitaF, have worked on urine collection in bladder tanks for more than 10 years, and have developed a hand pump placed on the outlet of the tank as a urine self-service for farmer to use urine as fertilizer.
- **Viable** : The toilet system, developed by our partner Ecodomeo, is 100% mechanical and has been used in public toilet cubicles for over eight years. The pedal-operated system, made from Inox metal and robust plastic, is particularly reliable over time.
- **Adapted to wipers and washers** : This product works equally well with users who are wipers or those who are washers. The water used for washing is transferred to the urine tank, and paper used for wiping will be composted in the faeces tank. The mechanics of the system are not affected even by the use of strong paper for wiping.
- **Mobile and flexible** : Transportable on a truck with a crane or constructed on wheels, the number of cubicles can be modified, urinals can be added, a version for different size containers (e.g. 10' or 40') could be developed. The size of the bladder tank can also be modified.
- **Local production**: Besides the Ecodomeo system and the bladder tank, all parts of the container can be constructed, updated and repaired in the country of use, enabling full appropriation of the product and much longer use of the device.

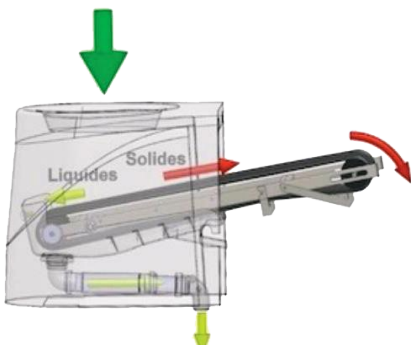
Description of the technology

• Dimensions :

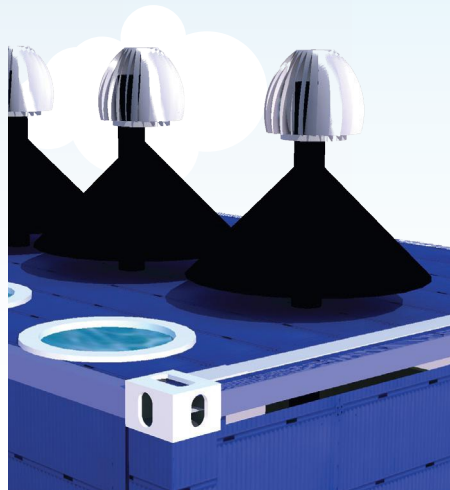
- The 20 foot container: 2.33m (width) x 5.9m (length) x 2.38m (height)
- Transportable with a crane truck type / width <2.5 m or set up on wheels
- Maintenance door situated at the back of the container

• The Throne – User interaction : The Ecodomeo system, developed by Emmanuel Morin, works without water, sawdust and odor. Operated by a foot pedal, the treadmill separates urine from faeces in order to treat them distinctly.

All toilet components are made from stainless steel or hard plastic and are resistant to even the harshest environments. The concept is based upon a simple, mechanical system requiring minor intervention to install and with a low risk of technical failure. In addition, the low maintenance requirements make this technology particularly convenient and useful.



- **The aeration:** The aeration is enhanced by two systems: (1) a black metal sheet fixed on the exhaust pipes in order to create a strong air flow; and (2) an air turbine fixed on top of the pipes to increase the air flow. In the absence of sawdust is very important that air flow is consistent.



- **Faecal matter :** One of the main advantages of this system is that faecal matter is separated, isolated and treated without dilution in water, therefore represents a very limited volume of fairly dry matter.

The system is composed of small, plastic, 65 litre containers placed behind each cubicle (right behind the toilet) and two 400 litre metal composter bins inside the container which will be used alternately for filling up and treatment. The maintenance operations are minor, requiring about 10 minutes for each small box every 600 "solid" uses, in order to empty small boxes into the larger metal bin. All manipulations are done in a hermetic container within which there is a special fly trap.

Once a 400 litre wheeled-bin is full, it is moved outside the container, via a ramp, and heated up to 70°C for three days in order to sterilize the contents. This will be done by making a fire underneath the metal bin to "sanitise" it. A black metal tank can get fairly hot if placed under the tropical sun for several days.

The fact that faecal matter is treated inside the hermetic container drastically cuts the risks of contamination either of ground water, potable water and food.

- **Urine :** The standard version proposed here contains a 10m³ bladder tank for urine, developed by our partners, Labaronne CitaF, which filled by gravity from the container. If the urine is not used by farmers, a soak well will be constructed beside of the container, and connected to the bladder tank overflow.



Re-use of urine : With around 80% of the nutrients ejected by the human body being in urine, the waste-to-value interest is focused on the urine collected. and the selfservice installed for local farmer. To facilitate easy re-use of urine, a hand pump is placed on the outlet of the tank allowing farmers to collect and use this urine as fertilizer.

To counter the very small risk of the presence of pathogens in urine, over the past two years Ecosec, in conjunction with IRSTEA, has developed a buried drip irrigation system which directs urine straight to the plant roots. This buried system prevents any transmission of pathogens from slightly hazardous urine to humans.

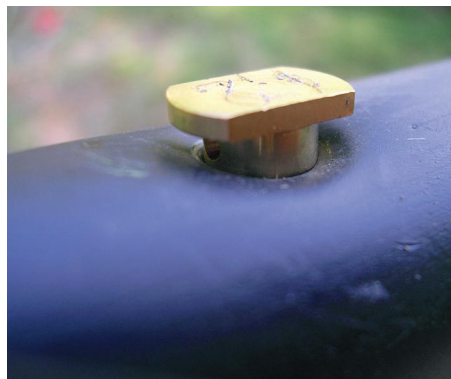
- **Labour requirements for the system (role, typical salary, and hours/day or hours/week) :** Besides cleaning the toilet, supplying toilet paper and filling the antibacterial gel distributor, if urine is collected autonomously by farmers, the only labour requirements for a container system serving 500 people are:
- Transferring faecal matter from five small boxes to one big tank: ~30 minutes every 10 days
- Sanitizing faecal matter when the 400 litre tank is full: about 5 hours work to set up a fire under the metal tank once a month.



Without urine

Diluted urine

Pure urine



Track record :

- The [Ecodomeo](#) system has been installed on more than 400 sites since 2007 and for the past five years no complaints at all have been raised with its inventor, Emmanuel Morin.
- [LabaronneCitaf](#) has been involved in humanitarian interventions for over 10 years and has designed a bladder tank especially resistant to urine.
- Ecosec, through its founder Benjamin Clouet, brings seven years of experience in sanitation design and sanitation

marketing, including the development of the [Easy Latrine in Cambodia](#). This solution went through a [series of adaptations](#) to arrive at [the final products](#). The container solution proposed here, carries forward these lessons, and draws on technologies designed, tested and currently in use in [Montpellier](#).

- Partners, [HomeBlock](#), specialize in adapting containers for a wide range of needs.

• The challenges of delivering sanitation solutions in refugee camps are well known to the design team. This group of professionals have united to deliver a simple and robust product solution that responds precisely to the needs of this aggressive environment.

Costs and prices :

Capital cost

The Ecosec container, in the presented version, costs €41,500 produced in their Montpellier workshops (South of France). Given that a container with six cubicles could provide sanitation for 200 people, this represents an investment of \$USD 0.05/day/user over ten years.

Operational costs

A significant advantage of this technology is the minimal cost of operational.

Maintenance costs are the following:

- Transfer from small box to the 400 litre tank: 30 minutes every 10 days, so 1½ hours/month.
- Sanitization of the 400 litre tank when full: 5 hours/month.

In addition to the cleaning service of 1 hour/day, the operational needs in terms of time required are therefore potentially as low as 36,5 hours/month so 438 hours/year. Giving a price for this service depends on the average salary for this type of work in the country of use. In East Africa an average of 150 USD/month should be close to reality.

The location of the point/s of sale

Ecosec's founder, Benjamin Clouet, has been involved in humanitarian work for years, and is passionately committed to transferring technologies and capacities to local users. In this case, we would envisage that after a testing period to confirm the container as a pertinent response for refugee camps in a particular location, the construction of these containers would be gradually transferred to the country where they're most needed.

At the beginning of the project, the only technical part that would have to be assembled in France is the throne itself, discussions can be carried on the way to transfer technology locally later. For the rest of the container, Ecosec would be pleased to change its mission from container provider to consultant helping to setup local production, training workers and setting up urine re-use programs in the country where these containers are the most needed.

A brief description of the approach

This container has been designed to be extremely simple and convenient to set up as there's no need for connection, no need for energy, system is ready-to-use and the maintenance is very low. It's actually even better than plug-and-play, because there's no plug.

For the day-to-day care, basic training would revolve around ensuring that the person in charge could clean the toilet, re-fill toilet paper rolls or provide water and plastic jar for washers, and re-fill hand gel. Two operations are however important: the unfolding of the bladder tank (done once) and the sanitisation of the faeces when the 400 litre box is full, which represents a few hours every month.

The local input would be on the waste-to-value part of the project, local farmers would need to be trained on the value of urine as a fertiliser and how to use it.

A brief description of how the installed solution could be sustained after the end of the project

All parts are mechanical, no electricity is needed and the throne system is made from Inox and dry bearings. The pipes and pipe connections are standard 50mm valves. Spare parts would be provided and training should be provided on what to do in the case of a hole in the bladder.

If local farmers start to appreciate the value of urine as a fertiliser, and if the toilets are kept clean, the appropriation of the product will be stronger. Even if the maintenance is low, daily cleaning is still necessary for any shared sanitation solution to be sustainable. Charging for the use of toilets in order to finance the maintenance and the consistent cleaning, or developing user-groups responsible for cleaning and maintenance, are ideas that could be developed according to the implementation location.





Detailed views

