

“The Good Garbage”: Waste to Water in the Small Island Environment of St. Barthélemy

by
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Photographs by Russell Fielding and Diane Fielding

Introduction

Throughout the world, small islands that are not immediately adjacent to larger landmasses experience several common problems related to infrastructure and public services. Aspects of the physical geographies of these islands—especially their insularity and remoteness—require that a variety of infrastructural systems be designed to operate independently of larger grids and to fit within a small scale. Among many others, specific challenges exist in the areas of energy production, waste disposal, and water supply.

Energy Production

According to the International Scientific Council for Island Development (ISCID), small islands are ideal sites for the testing and refining of sustainable energy production systems:

The traditional limitations in the energy field like distance from the major grids, small scale, distribution difficulties and the lack of large conventional markets, are more than offset by the extreme abundance of renewable energy sources... in island regions. In fact, we would go as far as to say that islands have become genuine laboratories of the future of energy sustainability.

(Marín 2004, 2)

While the ISCID's optimism is well-received in academic settings, where the “island as laboratory” concept has taken much purchase since at least the earliest days of biogeographical study (Sauer 1969), many island governments and energy industries remain unconvinced, as noted by Notton and colleagues (2011, 652): “Thus, the most usable power plant for small islands is diesel engines.” This

trend may be on the cusp of changing, however, as fossil fuel costs continue to increase and both islanders and tourists demand more sustainable solutions.

Waste Disposal

An island's ability to handle its municipal and industrial waste is directly related to the size of its physical land area and its population. On islands with extreme population density, such as Manhattan, the export of trash is the only option. Larger or more sparsely populated islands may relegate some of their land area to landfills. Incineration is also widely practiced—both as a centralized activity and on the household scale. Issues of air pollution are well documented with regard to incineration. One major argument against the implementation of sustainable waste management solutions has been that landfills are relatively cheap and abundant in mainland settings and on large islands such as Great Britain (Read, et al. 1998). However, this line of reasoning applies less in small island contexts. Islands, by virtue of their naturally limited land area, have added incentive to develop efficient methods of waste disposal.

Seawater Desalination

Small oceanic islands—especially those without significant surface water or groundwater reserves—often experience the plight of Coleridge's *Ancient Mariner*: “Water, water everywhere/Nor any drop to drink.” People living on small, dry islands often rely on rainwater catchment as their primary source of freshwater. This system involves the inherent risk of reliance upon the weather for sustenance and leaves little recourse during droughts and regular dry seasons except for rationing,

doing without, or importing fresh water. Climate change further exacerbates this uncertainty. Desalination is an effective option on some islands, but many more are unable to provide enough water through this process, owing to the inherent expense—both financial and in terms of energy consumption. Eric Swyngedouw (2013) has recently highlighted the attendant politico-social issues that can surround the development of desalination facilities in mainland settings and there is no reason one should not apply, and even amplify, his findings in island contexts as well.

Synthesis on St. Barthélemy

Several islands throughout the world's oceans have endeavored to resolve these challenges through technological development and investment. The key to such solutions often is often found in the combination of efforts and integration of technologies in order to solve multiple infrastructural goals at once. One salient example of such integrated technologies is the case of the waste-to-energy (WTE) facilities, as discussed in the context of small islands by Rodríguez (2011). While many varieties of WTE facilities exist, most involve the capture and redirection of thermal energy released from the incineration of municipal and/or industrial waste. This energy is then used to perform work such as the production of electricity or desalination of seawater. Scrubbers remove pollutants from the exhaust smoke of WTEs, with varying degrees of success. Owing to their efficiency and ability to address multiple sustainability issues, WTE facilities are often seen as being ideal to small island settings. While they may be ideally suited, WTE facilities are still expensive, requiring



Figure 1. The Eden Rock Hotel, a luxury resort on St. Barth

large initial investments. Wealthy islands, or those with political ties to wealthy nations, are often in the best position to invest in WTE facilities and other sustainable technologies.

Such is the case in St. Barthélemy. As an overseas collectivity (*collectivité d'outre-mer*) of France, St. Barthélemy benefits from the cultural, political, and economic ties with the mother country. Additionally, the island's niche focus on luxury tourism (Figure 1) brings foreign capital into St. Barthélemy (Figure 2) at a pace unrivaled by most of the island's Caribbean neighbors (Cousin and Chauvin 2013). Indeed, the local government of St. Barthélemy has recognized its peculiar position within the region and the opportunities presented to serve as an example of sustainable development to the rest of the insular Caribbean, as evidenced by the government's investment in WTE facilities. Currently, a combined WTE facility is in operation outside of St. Barthélemy's capital, Gustavia, providing thermal energy to the island's seawater desalination plant and offsetting that normally energy-intensive industry's electricity demand.

The Setting: History of an Island

St. Barthélemy (also called St. Barth or St. Bart's) is a small island of about 23 km², located in the Leeward Islands of the Lesser Antilles (Figure 3). It was sighted by Columbus on his second voyage and named for the navigator's brother, Bartolomeo. Prior to European discovery, St. Barth had been known as *Oualanao* by the Carib people who, owing to the island's lack of fresh water, visited occasionally but made no permanent settlements. This reason for the lack of permanent indigenous settlement should have served as foreshadowing for the coming colonialists.

The island was colonized by the French in the mid-17th century, ceded to Sweden in 1784 in exchange for free trading rights in the port of Göteborg, and kept as Sweden's only Caribbean territory until 1878 when it was returned to France. In St. Barth today, one sees multiple references to the near-century of Swedish association, including the blue flag with a yellow Scandinavian cross, which flies from many of the island's flagpoles

(Figure 4). Printed text in some public and private establishments is translated into English, for the tourists, but also into Swedish, as a nod to the island's history. Many street signs in Gustavia present the French name as well as the Swedish. Gustavia is paired with Pitea, in Sweden, as its sister city.

St. Barth remained a poor colony for the first half of the twentieth century, isolated without an airport until the late Rémy de Haenen—one of the island's most celebrated residents—cleared an airstrip (Figure 5) that today remains one of the shortest and most difficult landings in the world (Figure 6). During the 1950s, St. Barth was “discovered” by American celebrities and millionaires. Some wealthy families established their presence more permanently: the Rockefellers built a large house on the island's west end, near Colombier, and the Rothschilds did the same on the east coast, by Grand Cul-de-Sac. The infrastructure began to catch up: electricity came in 1962 during de Haenen's tenure as the island's mayor. However, fresh water was still a



Figure 2. Yachts lie moored in and outside of Gustavia harbor.



Figure 3. Map of St. Barthélemy.

problem. Each home relied on its own cistern, with two larger reservoirs on high points at either end of the island.

During the following decades, more development gradually transformed St. Barth from a small, dry island, known

for its duty-free port, fishing, and salt ponds, to a small, dry island, known for its luxury tourism.



Figure 4. Flags representing (L-R) the European Union, the island of St. Barth, France, and Sweden fly in front of the main government building in Gustavia.



Figure 5. The St. Barth airport and the nearby villages of Lorient (left) and Saint-Jean (right).

Consume and Discard

With a 2011 population of 9,057 (Cotis 2011), and visitors numbering in the tens

of thousands annually, the infrastructure demands on St. Barth are considerable, especially during the winter tourist season. During that high season, cars and motor

scooters choke the island's steep, narrow streets and parking spaces along the boardwalk in Gustavia become as sought-after as the quayside berths where the



Figure 6. Planes must approach very close to the top of a hill in order to land on St. Barth.

multi-million dollar yachts are docked (Figure 7).

Owing to its negligible agricultural and manufacturing outputs, St. Barth imports nearly everything that its residents and visitors consume. The high-end, luxury niche market targeted by the tourism sector has led to what one research team has identified as “competitive consumption” (Cousin and Chauvin 2013, 191). These researchers describe late-night revelries in which business magnates, celebrities, and other super-rich attempt to out-spend and out-consume one another, rewarded with exclusive—yet highly visible—seating in the island’s gathering places where they may consume imported beverages costing thousands of dollars per bottle.

The packaging and other detritus associated with these commodities is collected at the island’s waste disposal plant, located just outside Gustavia in



Figure 7. Yachts in Gustavia harbor.



Figure 8. Unsorted municipal solid waste piled outside the incinerator.

what some maps identify as the *Zone Industrielle*. This area, fronted by the village of Public, is home to the commercial port, where vessels not bearing tourists load and unload their wares. Here, enormous piles of solid waste are sorted into essentially three categories: that which can be burned, that which must be sent off-island, and that which can be repurposed.

This industrial zone features none of the sights and smells of the rest of the island. Decomposing organic trash replaces the scent of frangipani, bougainvillea, and fresh-baked *pains au chocolate* while separated piles of crushed glass, cubed aluminum, non-working appliances, and general trash stand in stark relief to the raked beach sand, quaint villas, and landscaped gardens of the St. Barth seen by most visitors (Figure 8). Though the site may remain unseen by most, everyone on St. Barth—residents and visitors alike—experiences its effects.

Each day, a careful sorting process unfolds in which industrial and municipal solid waste is brought to the facility, sorted into categories, and processed. The sorting has, in theory, begun in the home or at the public trash receptacle. An island-wide information campaign provides instructional fliers to residents and placards that urge tourists, in English, to put waste “in the good garbage,” in order to facilitate the sorting process that happens at the incinerator site (Figure 9).

When the waste is sorted, the first category includes items that can be recycled, but not on the island. At the incinerator site, in the spaces allotted for the appliances, batteries, aluminum cans, and steel, stand neat stacks of similar things, all sorted under signs bearing their designations—here only in French, as there is no need to translate to English and certainly not into Swedish (Figure 10). Vegetable-based oils and petroleum products stand

in separate vats. All of this waste will be shipped to various ports—Guadeloupe, Miami, France—where it will be recycled or turned into scrap.

The second category is made up almost entirely of glass, as this is the one form of waste that can be repurposed locally on St. Barth. After being separated by hand from all other forms of waste, glass is crushed into a fine powder for industrial use (Figure 11). Those whose job it is to sort the glass spend their shifts—heavily gloved—pulling corks from empty wine bottles, twisting off caps from expensive *eaux minérales*, and shaking burned-out sparklers from expensive bottles of champagne (Cousin and Chauvin 2013). This glass powder will later provide insulation for water pipes and electrical conduit running under the island’s roads and sidewalks.

Finally there is the combustible waste. All vegetal trimmings, paper



Figure 9. A sign urging the public to sort trash before discarding.

products, and other organics, as well as most plastics are piled as fuel for the island's incinerator (Figure 12). One day of drying under the tropic sun is usually sufficient preparation for the combustibles (Figure 13). Once dried, the fuel is lifted into a chute where it feeds a constantly burning flame (Figure 14). The incinerator needs at least twenty-five metric tons of material per day to maintain its optimal burn rate. Thirty-five is better. Fifty is the maximum. The island just produces enough material to make incineration sensible. During the slow season of summer, when jet-setting tourists are more likely to be found in the Mediterra-

nean than the Caribbean, the incinerator occasionally shuts down, owing to a lack of fuel. When the flame goes out, it can take days to return the operation to its optimal temperature.

A closed-loop system for evaporation and condensation of water is connected to the incinerator. Once water is heated by the combustion of waste, steam is sent to the nearby desalination plant, where its thermal energy is used in the production of fresh water. During the low season, the steam alone provides enough energy for the production of freshwater through evaporation. When demand is high, an electricity-powered reverse

osmosis process is added. Imported diesel serves as the fuel for the generation of electricity.

Critics of waste incineration often focus on the air pollution inherent in the process. The incinerator on St. Barth certainly introduces chemicals and particulates to the atmosphere, though scrubbing processes are in place to at least limit both. Further independent research is needed to quantify these pollutants. This lacuna represents a remarkable opportunity for an atmospheric chemist to conduct serious and necessary research in a breathtakingly beautiful setting. However, when evaluating the costs and benefits of a system such as this, it is important to consider the processes that are being replaced. In the case of waste management on St. Barth, the incinerator largely replaces two methods of waste disposal that were common on the island before its introduction. According to long-time residents Alexandra Defontis and Bruno Magras (*pers. comm.*), most residents either burned household waste at home or simply dumped it directly into the sea. Each of these informants now plays a direct role in the waste-to-energy program on St. Barth.

Magras, a St. Barth native and now the island's political leader ("*Président de la Collectivité d'Outre-Mer de Saint-Barthélemy*"), reflects on the gravity of his position: "I'm concerned about my island, my future, my kids' future. I'm not out to destroy what I received." While the building of the current WTE incinerator in 2002 was based on a decision by the French government, Magras takes credit for the island's original municipal incinerator, built in 1979. This first incinerator did not produce electricity or energy for desalination, but it did serve to centralize waste disposal and offered an alternative to the then-current practices of waste disposal—the aforementioned household-level burning or nearshore dumping. Magras' approach to renewable energy production is nuanced, however. He is against wind power—the large, offshore turbines would be "too ugly;" against large scale solar energy—open land is too scarce; and against a proposed cable supplying power from nearby St. Martin—a plan that would increase the island's dependence as well as its vulnerability to hurricanes. Magras does support the capture of solar energy at the household level; however he worries that installation of photovoltaic cells atop the famous red tile roofs of Gustavia would reduce a popular aesthetic.



Figure 10. Discarded appliances are stacked, waiting to be shipped off-island for recycling.

Deffontis, another St. Barth native, now works as an official at the incinerator (her title: “*Directeur du Service de Propreté*”) and praises its effectiveness in dealing with the “biggest problem” faced by the island during the high tourist season: the availability of fresh water. According to Deffontis (*pers. comm.*), hotels and rental villas are given priority in the distribution of municipal water. Prior to desalination, when rainwater catchment was the primary source of the island’s freshwater, households would carefully measure the reserves in their dwindling private cisterns as wealthy tourists lounged by “infinity pools” and deckhands washed their employers’ yachts along the quay. Today water is more readily available, but only inasmuch as combustible trash is produced on the island. As shall be examined below, several challenges exist that threaten to disrupt this precarious system.

Challenges

While the incinerator does appear to have achieved a form of equilibrium within the environment and society of St. Barth, the system is not without challenges. Here I discuss three of issues related to the effectiveness of the incinerator that are most commonly mentioned on the island.

Hurricanes

Located within the Leeward Islands of the Lesser Antilles, St. Barth often finds itself in the path of Atlantic tropical cyclones. The most recent major storms to make landfall on St. Barth were Hurricane Omar in October of 2008 and Hurricane Earl in August of 2010. The French authorities on St. Barth use the color-based French tropical cyclone scale as opposed to the Saffir-Simpson Scale used throughout much of

the English-speaking Caribbean and North America. This *Tableau des Alertes Cycloniques*, developed by Météo-France (2013) originally for use in the southern Indian Ocean to monitor storms near La Reunion, ranks tropical cyclones by color, based on average wind speed over a ten-minute interval. During less-powerful storms (yellow and orange), the incinerator is able to maintain operation. During larger hurricanes (red), it must stop.

Lack of Compliance

When the incinerator began operation in 2001, islanders were asked to begin sorting their trash at home. Prior to that time, no sorting had been necessary, as there were only two streams of waste disposal: into the landowner’s onsite burn pile or directly into the sea. When the sorting regimen began—and still to this day, in some cases—some residents



Figure 11. Aluminum cans (left) and ground glass powder (right).

refused to participate. Trash collectors would find metals and plastics in the bins meant to contain only organic waste or they would find all of a household's waste combined in the same receptacle. These small acts of civil disobedience were interpreted as statements against the regulation of waste disposal and the continued modernization of the island. However the lack of compliance continually puzzles the incinerator's management, especially considering the multiple grassroots environmental protection campaigns that St. Barth has seen, for example, the homemade cigarette disposal stations installed at many of the island's beaches (Figure 15).

The government responded to the public's failure to thoroughly sort household waste by streamlining the waste management system and marketing the new system through bilingual fliers and placards (Figure 16). The new campaign features a

stylized pelican—reminiscent of the birds on either side of the official seal of St. Barthélemy—reminding residents that they need to manage “ONLY 2 TRASH BAGS!” (“2 *POUBELLES SUFFISENT!*”). One bag is for combustibles and the other is for recyclables. This campaign has met with varying success but continues to place receptacles in visible public areas and to distribute instructional, bilingual literature that stresses the ease and importance of separating household trash. While some parallel English slogans are found on the literature, only the French side proclaims that “*Trier c'est Gagner!! S'abstenir c'est détruire!!*” (“Sorting is winning!! Refraining is destroying!!”).

Composting

Currently, the government of St. Barth is in the process of establishing an island-wide composting program. While compo-

sting is usually seen as an environmentally beneficial activity, incinerator managers worry that the program will divert combustible organic material away from the incinerator and that they may not continue to receive enough fuel to keep the operation going efficiently. At present, the incineration is occasionally halted during the slow summer season for want of fuel. The establishment of a new waste management stream may divert enough material away from the incinerator to make its operation inefficient at best, impossible at worst.

Further, with little agriculture beyond household gardens, it is unclear what the ultimate use of the compost will be. Certainly the “kitchen garden” has a long history of relevance to household self-sufficiency in the Caribbean (Kimber 1966; Richardson 1983; Fielding and Mathewson 2013); however, with its dry climate and rocky soils, St. Barth has not traditionally supported small-scale



Figure 12. A worker observes operations inside the incinerator facility.

agriculture at the level of some of its Caribbean neighbors.

Still, in March 2013, the government acquired a piece of land adjacent to the incinerator that is to be used for composting. At present, when the composting program will begin, how it will be received, and what its results will be remain unknowns.

Discussion and Conclusions

The lessons learned from St. Barthélemy help to show that the insular Caribbean is a dynamic region, full of diverse cultures and real-world sustainability crises—not merely a place where carefree holidays are spent. Though, like many practiced tourism-based economies, St. Barth has effectively addressed these crises in the background, providing water and waste disposal virtually out-of-sight to its visitors. The section of the island where the waste-incineration powers water-generation,



Figure 13. Combustible waste drying and being moved.



Figure 14. A worker inspects the flame inside the incinerator facility.

ironically named *Public*, is the least-visited by the public. A high road bypasses the area, connecting Gustavia with the airport and the beaches of St. Jean. Quietly industrial, *Public* privately provides for the truly public areas of the island. Still, from the center of the incinerator's courtyard, with triaged recyclables stacked to one side and an enormous mountain of combustibles piled in front, it is possible to look past the waste and glimpse the electric blue water of the Caribbean Sea. Somewhere under that bright surface lies an intake valve, where seawater is pumped onshore to be made fresh, in a process fueled by the burning of champagne corks and trimmings of bougainvillea.

St. Barth is mountainous but small. Clouds created by orographic lifting are often carried west by the trade winds, beyond the island's shore, their precipitation falling uselessly upon the surface of the Caribbean Sea. Even today, when freshwater can be made, rain falling on the roofs of St. Barth is still seen as a godsend. The author recalls ducking into a tiny



Figure 15. A homemade cigarette-disposal site at a beach on St. Barth.



Figure 16. A bilingual flier urging residents to separate their household waste.

jewelry shop called *Bijoux de la Mer*, “Jewels of the Sea,” during a rare cloudburst in Gustavia. The tourists in the shop waited out the shower by trying on expensive Tahitian pearls, but the shopkeepers—members of an old St. Barth family—stepped out into the rain, hands raised, whispering “*merci*” for the gift of freshwater. The raindrops falling on the roof may have seemed to them more precious than the pearls being sold inside, but the most valuable commodity from the sea was being produced just over a small hill, through the unglamorous but indispensable process of waste-powered desalination.

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