Little House on the Internet

Accessing Today's Technology from a Remote Location

Alan Gross & Jane Townsend

Covered water pipes (left) lead to the island house from the Southeast.

Authors with the completed array on the carport roof.

When we moved from the island of Manhattan to the small Caribbean island of Bonaire (pop. 15,000), we thought we were going about as far as possible from the hectic life we knew in New York City. But after a couple of years in a pleasant residential neighborhood overlooking the sea, we realized that we had just traded urban America for suburban Caribbean, and that was not quite enough. Thus began our project to combine our love for our new island and its people with our desire to get further away from it all and "back to nature."

But could two former city dwellers really make the necessary changes for living off the grid? We were realistic enough to know that we were not willing to give up the luxuries that we had worked so hard to achieve. Could we do it without creating too much work for ourselves during our retirement years? Our electrical and plumbing experience before this project amounted to flipping switches and turning on faucets.

Finding Our Own Sunspot

The first step was to find the perfect location for a remote home—good wind, views, and privacy. Wind would be very important because it is the ideal air conditioner for this environment. While the temperature is a fairly constant 85°F (29°C) with high humidity, the strong trade winds keep it comfortable most of the time.

Our land search turned into a two year adventure. In the end, several old and new friends formed an association to purchase 305 hectares (750 acres) of remote, rolling land on the windy and uninhabited east side of the island. The group agreed that the prime goal of the development was to preserve forever the natural beauty of the land.

We spent a long time drafting the 40-some restrictions that ultimately became a permanent part of the deeds. The two dozen lots are large, about 12 hectares or 30 acres each, but each owner can actually use only 1/3 of the land. No major trees or cactus can be destroyed, and no clear-cutting is allowed. Lots can never be subdivided, and only two houses can be built on each 30 acre lot. About 50 acres is held in common as parklands and roads.

The "butterfly" roof collects water in the center, and drains it down the end columns for storage until needed.

In addition to struggling with Dutch law (Bonaire is part of the Netherlands Antilles), we had to learn about dirt-road building, aerial and land surveying, and land development. In the process, we discovered how to protect and preserve the land, and how to prevent run-off and erosion. We also learned about siting a home to capitalize on the natural advantages of the location without destroying it.

So Far, So Good

Once we had the site, we had to determine how anyone could possibly live there, since it is several miles from the local utilities. Water was the primary consideration. Bonaire is a desert island with far more evaporation than the 22 inch (56 cm) average annual rainfall. It has little potable ground water, and no running streams. Could two people with four large dogs, a cat, and frequent visitors survive on six cubic meters (1,600 gallons) of water trucked in every two weeks, or was there a way to capture enough of the limited rainfall?

Tying in to the power grid would be impractical and, frankly, not even desirable. The island system is a hodgepodge of more-or-less 250/127-volt, 50 cycle electricity that will regularly fry sensitive electronic equipment. Other issues included the harsh elements: salt air, high winds off the sea, and intense UV exposure, since Bonaire is only 12.5 degrees off the equator. We needed to find materials and equipment that would withstand the elements with minimal effort from us.

Minimal effort was a key point since we were, after all, retired. We had no desire to be constantly painting and repairing, and we are not what you would call do-it-yourselfers. We would rather curl up with a good book than work out with a hammer and paint brush. So we had a lot of learning to do.

Speeding the Learning Curve

A borrowed copy of the Real Goods *Solar Living Sourcebook* got us going, and we found more education in several helpful texts. We even attended a short course at the Solar Living Center in Hopland, California. This two-day course went far toward eliminating our innate fears about energy self-reliance.

Shade/rain drop-down louvers, decks, and facia are recycled plastic lumber chosen for resistance to climate and insects.

Sub-arrays were assembled in the shade, then hoisted to the roof.

We then subscribed to *Solar Today* and *Home Power.* With this preparation, it was possible to start making some plans.

The information breakthrough came when the island got its own Internet provider. This gave us access to a world of information on every possible topic. We would no longer be limited to the one or two poorly stocked local stores for materials and supplies. With the Internet, we could shop the entire world to find what we needed. All of a sudden, the project seemed doable.

An Active Approach to Passive Cooling

Before designing the electrical system, however, we needed a house design. The primary criteria were energy efficiency, preserving the existing environment, lots of outdoor living, and the ability to collect rainwater without gutters that could clog up. Unfortunately, most books we bought focused on solar design for cold climates. Fortunately, the architect we found in Curaçao, Dito Abbad, of PLAN'D2, knew the climate well and how to work with it. As a result, the house is a big wind-control machine that can find cool breezes no matter where they come from, and can also slow down the 30 to 40 mph (13–18 m/s) gusts that often blow through.

The house features a wide center hall clerestory to vent heat up and out, lots of louvered doors, windows, and walls to adjust to the conditions, and a butterfly-shaped roof for water collection without gutters. We extended the overhangs, and built shading structures to reduce the need for air conditioning (called "erko" here on the island—phonetic for the Papiamentu "airco"). With our house design settled, we went to work on the energy systems.

Powerful Decisions

Solar, wind, or a combo? We knew we could not live with the constant noise of a generator. The decision not to use wind was made after helping a friend lower and raise his wind generator a couple of times for maintenance. Not for us, we said. The maintenance required in our salty environment was a lot more than we were ready to commit to.

We started by cruising the obvious Web sites, but quickly found ourselves unable to make rational choices. The technical descriptions were puzzling for beginners. We got good advice from several sources, but found it hard to choose among them.

What we really needed was a "referee." Enter Johnny Weiss of Solar Energy International (SEI). We had purchased Johnny's videotape on solar energy, along with several others on a variety of subjects. We were

Twenty-four Siemens SP-75 PVs provide 1,800 watts.

impressed with his down-to-earth approach, so we contacted him at SEI via email. Not only did he get back to us quickly (which, by the way, several others did not), he was instantly helpful, providing guidance and answers to some of our basic (sometimes stupid) questions.

After a couple of months of email correspondence, we set up a consulting relationship, and even arranged for Johnny to be on hand for the installation. This last part wasn't too difficult, since he is a scuba diver, and Bonaire is one of the premier dive spots in the world. Our connection with Johnny and SEI has proven to be one of the best decisions of our entire process. His advice was always balanced. He offered choices instead of answers and, more importantly, had a rationale for his position. Even now, he's just an email away when we encounter problems.

Shedding Some Light

First off, we reviewed our electric bills for the past four years and were shocked to see how much electricity we consumed—an average of about 50 KWH per day! Was this possible? We double-checked and, yes, it was real. Of course we used electricity for cooking, and we had a swimming pool pump running every day of the year.

Next, using one of the worksheets we came across, we developed a spreadsheet divided into specific areas (kitchen, office, lighting, laundry, swimming pool, etc.). We approached each section with the goal of minimizing usage without depriving ourselves of essentials. These essentials included individual night reading locations, computer work, lap pool for exercise, full cooking capabilities, and a laundry facility with a dryer for the rainy season. We kept reminding ourselves that we had worked too hard before retirement, and did not want to struggle at this phase of our lives.

Among the easy choices early on were to switch from electric cooking to propane, change from halogen and incandescent lamps to compact fluorescents (CFLs) for lighting, eliminate the laser printer in favor of an ink-jet, use a portable music system, and trade in the electric ice cream maker for an in-freezer type. It turned out that all of these changes improved our lifestyle instead of hindering it. But we still came up with a figure of 12 KWH per day.

Easing the Load

Next, we seriously analyzed our lighting needs, and found that we were using multiple fixtures or bulbs when single lights could do the job. So we decided to have as many fixtures as we wanted, but to have each one individually switched. Instead of doing without, we would just have to remember to turn each light off when not in use. We put glass blocks in key areas for light penetration (without heat), and insisted on a switch for the TV and microwave to cut out phantom loads.

Two huge Yuasa HUP 2 volt lead-acid cells are lifted to the power room. Total battery capacity is 1,275 AH at 48 VDC.

We then dug deeper into the specific use of various appliances and office tools, and worked out a better estimate of just how many hours per week they were really needed. This was progress, but it was still a heavy energy overhead. We decided to retire our two PowerMacs in favor of new PowerBook laptops for less energy consumption and more computing power. It not only helped the usage chart, but also freed us from the office.

By changing the 24 volt swimming pool pump and septic tank aerator to solar-direct, there was even more savings. These would do fine with about six hours of strong sun year-round. The swimming pool pump only needs to run about eight hours a day, and uses two 85 watt BP modules. We use one of those floating sanitizers (Floatron) to boost the chlorine power. The septic tank aerator will do the job running during the day only, on a 120 watt Kyocera PV panel. Our invisible dog-containment "fence" uses two 25 watt Unisolar modules.

Dual Trace SW5548 inverters make mounting the power panel a group effort.

Then came the realization that, if we were to use a diesel generator as a *backup* power source, we could tie certain tasks to the genny and drop their loads from the plan. So we bought a water-saving Asko washer and dryer (both 240 VAC). The plan is to use them once a week on the generator and top off the batteries at the same time. We will also be able to use the generator for power tools, or for future 240 VAC air conditioning if we need it for the two low-wind months of September and October.

We also went looking for a gas stove that required little electricity—no clock, and no glow plug, which uses a great deal of electricity to ignite the gas. After exhaustive searches for a stove with spark ignition, we thought we had found one. On the word of a salesperson, we made our purchase and were happy. When the stove arrived, we found that it had not one but three glow plugs. This was a major communication breakdown. Our advice is to get the manual for each appliance, and read it yourself before you purchase.

We've decided to live with the glow-plugs for now. Fortunately, we use the stovetop much more than the oven, broiler, or griddle. The top burners *do* have spark igniters. So far the stove has not been a major drain, and it looks as if we will be okay.

Finally, A System Plan

With the painless changes to our load profile, we had a more realistic energy budget of 4 to 5 KWH per day, instead of the wasteful 50 we had started with. The system would still need to be a large one, because we did not want to be constantly upgrading in the future, with all the attendant shipping and importing hassles.

The result was a 1.8 KW solar-electric system with a 15 KW Kohler diesel generator backup. These are married to a Yuasa battery bank of twenty-four 2 volt tubular cells. The 1,275 AH capacity should provide five to seven days reserve in the rainy season. So far, we have had no problem living within these limits. Just a year ago it would have been unthinkable that we could have reduced our usage so much.

In fact, our current usage averages about 5.5 KWH per day (110 amp-hours at 48 V)—right on target. We have lived here for over six months, including all of our rainy season. On most days, our batteries have been completely topped up by the sun. This year was one of the wettest and cloudiest years in recent history. We really *needed* the generator only one time, but we use it weekly to exercise it.

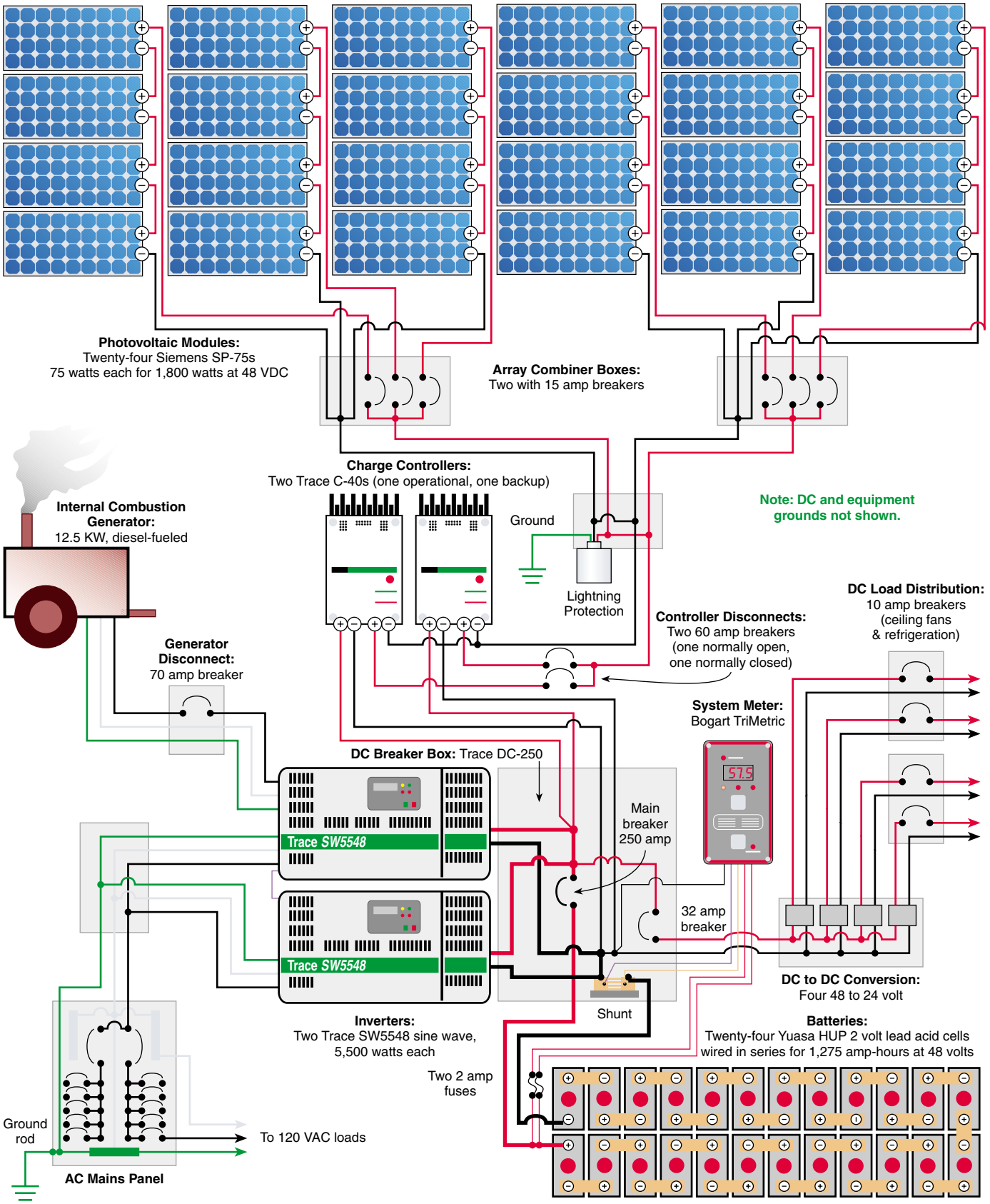
Once the type and size of the system was decided, it was time to work on the specific system components. Again, Johnny really proved his value. We were lost in a maze of controllers, inverters, circuit breakers, cables, and connectors ad nauseum. We jumped from one Web site to the next trying to make sense of all the elements. With Johnny's guidance, we were able to map out the proper components and ancillary parts so that when installation day arrived, everything was on hand.

The Y2K Bug Bites

After four months of planning, it was time to place the orders. We started in December of 1998 with a planned shipping date of mid-May 1999. This would allow us to ship our container—which also carried our appliances, fixtures and lots of building materials—before the start of the hurricane season. Six months lead time should give us a nice cushion, right? Wrong!

We were among the few real victims of the Y2K problem, as orders for renewable energy components soared, and manufacturers went on back order. Lead

Alan Gross & Jane Townsend's PV System



Gross / Townsend System Loads

Qty.		Watts	Hrs / Day	Days / Wk	Av. WH / Day
Office					
2	PowerBook computers	45	2.0	3.0	77.1
1	Epson printer	86	2.0	3.0	74.1
1	Tape drive	75	0.5	1.0	5.4
1	Hitachi monitor	135	2.0	0.1	3.9
1	Umax scanner	300	0.1	0.1	0.4
1	Polaroid scanner	75	0.1	0.1	0.1
				Office Total	161.0
Kitchen					
1	Vestfrost freezer	45	12.0	7.0	540.0
1	Microwave	1,700	0.2	4.0	194.3
1	Asko dishwasher	600	1.0	2.0	171.4
1	Food processor	400	0.1	0.5	2.9
1	Blender	350	0.1	1.0	2.5
1	Mixer	120	0.3	0.5	2.1
				Kitchen Total	913.2
Lighting					
2	Bedroom	20	2.0	7.0	80.0
12	Assorted others	13	0.5	7.0	78.0
8	Kitchen	11	0.3	7.0	26.4
3	Laundry and workshop	30	1.0	2.0	25.7
1	Bathroom ceiling	22	0.8	7.0	16.5
5	Hall and patio	13	0.2	7.0	10.8
1	Kitchen (halogen)	20	0.5	7.0	10.0
1	Office	13	2.0	2.0	7.4
1	Pantry	22	0.3	7.0	5.5
1	Bedroom ceiling	22	0.2	7.0	4.4
2	Carport	22	0.1	5.0	3.1
1	Den	13	0.2	5.0	1.9
2	Storage room	22	0.2	1.0	1.3
				Lighting Total	271.0
Household					
1	UV purifier	30	24.0	7.0	102.9
1	Security, kitchen	420	0.1	7.0	42.0
5	Security, windows	420	0.1	2.0	30.0
2	Tool chargers	35	1.0	2.0	20.0
				Household Total	194.9
Entertainment & Communications					
1	Cell phone base	25	24.0	7.0	600.0
1	Fax	120	1.0	7.0	120.0
1	TV	375	2.0	0.5	53.6
2	Radio chargers	40	1.5	2.0	34.3
1	Stereo	55	2.0	1.0	15.7
2	VCR and DVD	30	2.0	0.5	8.6
				Entertainment/Communications Total	832.1
				Total AC Watt-Hours Per Day	2,372.2
DC Device					
1	Sun Frost RF16 24 V	120	6.3	7.0	750.0
1	Sun Frost R19 24 V	63	9.1	7.0	574.6
7	Ceiling fans 24 V	20	1.0	3.0	60.0
1	Solar Force 48 V pump	15	3.0	7.0	45.0
				Total DC Watt-Hours Per Day	1,429.6
				Total AC and DC Watt-Hours Per Day	3,801.8

times were running through the summer at best. We had to make changes. How about a Vestfrost freezer instead of the Sun Frost we had planned on? Better decide today—there is only one left in stock. Panel prices seemed to change by the hour. What was the best buy per watt? Let's go with the SP-75s. Our Trace meter became a Bogart TriMetric.

On and on it went. Then we struck one of the reefs on the Internet Sea. Our appliance supplier, who we found on the Internet—and who had been paid fully in February for April shipment—suddenly disappeared. No more Web site, no answer via phone ("this mailbox is full") or email, and faxes wouldn't go through. They were bankrupt. Our stuff was gone. Fortunately, American Express covered the entire loss with their insurance program. We scrambled around and were able to replace all the missing items on very short notice—thanks to Abot Mills, a great appliance company in Miami.

Shipping dates slipped by two months, but finally the container arrived in early July. And there it sat for the next two months, with twelve expensive, pre-filled monster batteries all the way at the back. Would they be okay sitting in a solar-baked container for another two months until the house got closer to completion? "Nothing to do but wait and see," counseled Johnny via email.

Johnny arrived to supervise in mid-September with Steve Sloan, a contractor and diving buddy who came along to help. The house was not as far along as originally planned. The roofer, who was not found over the Internet but on a neighboring island, failed to show up. So we had to rush back to the computer to find a material that could be used for potable water, and could be applied by the existing work crew. Just two days before Johnny arrived, the roof surface was ready for mounting the panels.

Unwelcome Insolation

What was planned as a supervisory role for Johnny and Steve quickly changed to sweaty hands-on installation, since the work crew was busy trying to finish the house before the start of the rainy season. While Bonaire is out of the hurricane belt, the Atlantic hurricanes do steal our trade winds during September and October. The entire installation was done under extremely uncomfortable conditions: 90-plus degrees with 85 percent humidity and little or no wind. Half a day in the intense equatorial sun left us all beat. How the builders worked for eight hours each day is a mystery.

Our paralleled Trace SW5548 inverters came pre-installed in the Power Panel System, which was good. But it was big and heavy, and had to be muscled up

several temporary steps to the battery room and then onto the wall. Twelve 250 pound (113 kg) two-cell battery modules had to make the same trip. Fortunately, the true character of the Bonaireans came to the fore as the house crew gladly provided the necessary muscle.

Craig Carni and the crew at Two Seas built a beautiful battery box that will keep the local lizards off the cables and keep the system clean. They also built custom aluminum roof racks, designed to stand up to the strong winds and salty air. They are in a fixed, low-slant position since Bonaire is so near the equator. With email, faxes, and cellular calls from the roof of the house (which was the only place the cellular phone would get a signal), we were able to have day-to-day installation discussions with Craig.

Staying Connected

Johnny and Steve had to leave before the installation was complete, but at least we had DC refrigeration, and the electrician knew the plan. However, we also had an unexplained voltage drop whenever a load was applied to the AC side. Emails flew among Johnny, Trace, and us until we got a clear reading on the problem. The manual, which was downloaded from the net to be sure it was the latest version, failed to make it clear that the pre-installed computer cable has to be removed before the parallel master-slave cable is installed. The Trace engineers explained this point, and the inverters were working properly within minutes.

The first week in the house delivered three terrifying electrical storms. These sent us back to the Internet once again, to learn about lightning protection. At one site, visitors could give specifics on their location and receive a risk assessment. After scoring 9.5 out of a possible 10 as high risk, we quickly tracked down some suppliers of the necessary equipment. Again it was responsiveness that led to our purchase decision. Roger Harney of Harger Lightning Protection provided so much information and help so quickly that we never even considered the other sources.

Drinking, Bathing, & Swimming

A well was not a realistic choice, since most groundwater here is brackish. So we opted for a water supply system consisting of collected rainwater and truck-delivered drinking water. The water purification system (filtration plus UV) was designed and built by Offshore Marine Laboratories of Fort Lauderdale, communicating via email and fax.

Windy Dankoff and his crew quickly solved pumping and pressure problems. The 48 volt Solar Force pump provides sufficient water for domestic use. The system gives us the ability to safely shift back and forth between truck water and the rain collection if necessary. We have been using about 1.75 cubic meters (470 gallons) of water per week. We had it trucked in until our rainwater tank started overflowing, and then switched to rainwater, which is all we have used since December.

The muscle (and brains) behind the completed photovoltaic installation.

But where to store all that rainwater? A big tank was necessary because almost all of Bonaire's rain falls in a two or three month season. A glass-lined tank would be preferred, but to bring a fifty ton capacity tank to the island was outrageously expensive. Back to the Internet. Lots of choices, but all of them had serious drawbacks, except a glass-impregnated modular tank system made in Japan by Bridgestone. Since it shipped flat and in sections, the cost was about the same as a locally constructed tank, but without the leaching, cracking, and pH problems of concrete.

Swimming pools are relatively new on Bonaire, and the local technique for building them is to make concrete block walls and plaster them inside. They usually leak. We wanted a poured concrete structure, but needed advice on the best way to seal the walls to assure easy maintenance. Our lap pool will use a Dankoff Solar 24

Gross / Townsend System Costs

Description	*Cost (US$)*
Kohler generator, ROY 15	11,000
24 Siemens SP-75 modules	9,576
Trace Power Panel (dual)	8,950
24 Yuasa tubular batteries, 2 V cells	7,660
Two Seas custom battery enclosure	1,900
Two Seas UNI-GR-12 roof rack	1,300
Miscellaneous cables, conduit, hardware	1,000
4 DC/DC voltage converters, 48/24	636
240/120 VAC transformer	350
PolyPhaser DC 48 V lightning protector	319
2 Trace #4/0 inverter cables	318
Trace parallel stacking interface	292
Bogart TriMetric meter	230
3 Delta AC lightning arrestors, LA 302R	138
2 R/T DC load center	108
4 Square D DC breakers	36
Total	$43,813

VDC centrifugal pump. This pool pump is wired for solar direct, or it can be connected to the battery bank in case of extended cloud cover. So far, this has not been installed, since the swimming pool hasn't been finished yet. It has been too wet this year to allow the concrete to dry sufficiently to seal and paint.

On the Web, we found Victor deFontenay, who provided excellent suggestions for our pool. We thought he must have stayed up nights thinking about our problem, since his replies were always available first thing in the morning. Then we found out that Vic is located in Australia! We also found Conrad Nelson at a company called EnduroSeal. We wanted to be able to seal the concrete of the pool and house foundation. Conrad was also very responsive via email with advice, instructions, and speedy shipping.

Getting Rid of Wastewater

After considering a composting toilet, and deciding that we weren't ready for that, we planned a four-chambered septic tank. But this meant putting the effluent back into the ground. What little groundwater that exists here is precious, and we didn't want to pollute it with wastewater. To make the outflow a lot safer and to control odors, we decided to aerate the waste before returning it to the soil. This proved to be one of the most difficult research problems to solve.

We first started looking at "sewage systems" with the search engines. This didn't go very far since most of the pre-packaged systems are highly energy dependent and designed for larger needs. Next we looked at aquarium, pond, and aquaculture systems, but still without success.

Finally, Windy Dankoff put us in contact with Jim Keeton of Keeton Aqua. Jim's company specializes in aquaculture, but he has been playing with the idea of getting into the sewage aeration business. This concept was so new that we never even saw a plan until the finished product arrived in Johnny's luggage. It's a solar-direct air compressor forcing air through a large diffusing stone. The diffusing stone (which creates billions of bubbles of air) sits in the third chamber of the septic system. The air pump is mounted in a plastic box on the outside of the septic tank. To insulate it, we built a small pump house around the plastic box. This seems to limit the noise, and still allows for enough cooling of the pump.

Lumber & Non-Lumber

Remembering that our goal for living with nature during our retirement years was to keep everything simple and not labor-intensive, we decided to use recycled plastic lumber for much of the decking and non-concrete needs. On the Net, we found U.S. Plastic Lumber, and Phoenix Recycled Plastic Lumber. Unfortunately, all the plans for our house were in metric scale and designed for standard timber. First we had to convert metric to English scale. Then we had to recalculate the lumber needs to allow for more supports, since the plastic lumber is more flexible than real lumber, and needs 12 inch centers instead of 16 inch.

After hours of agonizing conversions, we finally were able to place the order. Recycled plastic lumber is ideal, not only for its lack of maintenance in a salty, humid environment, but also because we are living on land originally owned by termites. Surprisingly, it looks very "natural" in this environment.

For the windows and doors, we needed a termite-resistant hardwood that was responsibly harvested. Via the Web, we could research wood properties, colors, and suppliers. We downloaded hundreds of pages of exotic information, and finally made a decision. The lumber we chose (Iroko) was purchased from a "green" source in Holland. And it is exactly what we expected it to be from the photos and descriptions on the Net. We also found a wood sealant via the Internet (Sealodeck), which met the specifications of low labor with high protection from UV, water, and salty air.

So we wouldn't have to keep painting our cement block construction every year (perhaps we are just lazy), we decided to use an acrylic stucco finish (Duroplex from Triarch Industries). This is a color-impregnated material that goes on like plaster but has the strength of light

steel. It should provide years of low-maintenance wear in this rugged environment.

Instead of traditional gypsum board ceilings, we found HardiSoffit which is a pressed cement-fiber product. This should hold up better against rain, high humidity, and insects. It was discovered while surfing the net for cement sealants. Who knew the product even existed? It certainly was not available on this small island, so we had to find a supplier (again, via the Internet) who could ship it down.

We bought stainless steel screws from Swan Secure via the net, some stainless steel legs to support the kitchen cabinets from a kitchen fabricator (Bellama) in California, stainless steel sink faucets from Grohe in Europe, a special, commercial aluminum shelving system from Italmacelli in Italy, and a retractable glass and aluminum "wall" from Henderson in England. All metal items had to be either stainless steel or aluminum because of the salty environment. Most of the hardware (hinges, door handles, etc.) came from Holland, since Bonaire has regular shipments from there.

We also learned how to build an electrified farm fence to keep local livestock away from our trees. We bought an electric fencing system via email from Kencove Fencing. It uses a Parmak fence charger, which is powered by a small built-in PV panel. Light fixtures from California and New York, and special small CFL bulbs from Springlamp in Ohio were all available to us, thanks to the World Wide Web.

The telephone/fax/Internet access problem has not yet been solved. We have been trying a Motorola fx 2500 (TDMA) which was designed for offshore locations. Unfortunately, the signal is not clean enough for digital transmission, and we can neither fax nor log on to the Net. So for now we make our Net connections when we are in town. If you have ideas or suggestions about remote telecommunications, we'd love to hear from you.

The Internet is Energy Efficient

As we sit on our patio watching the ocean pound Bonaire's windward shore, we wonder why a project that appeared so daunting at first seems so simple now. The answer is the Internet. We were able to find the information, people, and products we needed. And once we overcame the initial fear, we even had the nerve to try a number of innovative building techniques and products. Most have worked out well. We're glad we are living in an energy-efficient, environment-sparing home which is not labor intensive and does not require great sacrifices.

Even in this remote part of the world, it is possible to access the best technologies and some of the most helpful people who deal with these technologies. It seems that the same qualities we appreciate in making face-to-face purchases also can be accessed on the Internet—personal attention, responsiveness, honesty, and reliability.

Unfortunately, the same potential problems exist on the Internet as well—inflated promises, lack of follow-through, bad products, and rude treatment. Strangely enough, it seems no harder to choose good suppliers electronically than in person. In fact, since everything has to be reduced to writing, a lot of the hype falls by the wayside, or is more easily spotted.

Of course, the project was more than we bargained for. But we have learned a lot about the technology, and about the people who make it work. Given a choice, we'd do it again in just about the same way. And it was today's technology that made it possible for us to "get back to nature."

Access

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Fax: 707-459-1833 • sales @2seas.com
www.2seas.com • Battery box and panel rack

Technical Consumer Products Inc., 300 Lena Dr., Aurora, OH 44202 • 800-342-1496 or 330-995-6111
Fax: 330-995-6188 • sales@springlamp.com
www.springlamp.com • Compact fluorescents

RCH Fanworks, 2173 Rocky Creek Rd., Colville, WA 99114 • 800-529-6306 or 509-685-0535 Fax: 509-684-5199 • info@fanworks.com www.fanworks.com • DC fans

Charles Kendall, Kencove Farm Fence, 344 Kendall Rd., Blairsville, PA 15717 • 800-KENCOVE or 724-459-8991 • Fax: 724-459-9148 electricfence@kencove.com • www.kencove.com Electric fencing

Kyocera Solar, Inc., 7812 East Acoma, Scottsdale, AZ 85260 • 800-544-6466 or 480-948-8003 Fax: 480-483-6431 • info@kyocerasolar.com www.kyocerasolar.com • Vestfrost freezer

Kohler Power Systems, Kohler, WI 53044 800-544-2444 or 920-565-3381 • Fax: 920-459-1646 www.kohlergenerators.com • Generator

Trace Engineering, 5916 195th NE, Arlington, WA 98223 • 360-435-8826 • Fax: 360-435-2229 inverters@traceengineering.com www.traceengineering.com • Inverters

Roger Harney, Harger Lightning Protection, 301 Ziegler Dr., Grayslake, IL 60030 • 800-842-7437 or 847-548-8700 • Fax: 847-548-2292 sales@harger.com • www.harger.com • Lightning protection

Sun Frost, PO Box 1101, Arcata, CA 95518-1101 707-822-9095 • Fax: 707-822-6213 info@sunfrost.com • www.sunfrost.com • Refrigerators

Rob Kauffmann, Sealoflex, 2516 Oscar Johnson Dr., Charleston, SC 29405 • 800-770-6466 or 843-554-6466 Fax: 843-554-6458 • sealoflexrk@mindspring.com www.sealoflex.com • Roofing material

Jim Keeton, Keeton Industries, Inc., 300 Lincoln Ct., Suite H, Fort Collins, CO 80524 • 970-493-4831 Fax: 970-493-4921 • keeton@keetonaqua.com www.keetonaqua.com • Septic tank aerator

Victory deFontenay, deFontenay Pool & Fountain Design Consultancy • vic@pool-information.com www.pool-information.com • Pool information & consulting

Windy Dankoff, Dankoff Solar Products, 2810 Industrial Road, Sante Fe, NM 87505 • 505-473-3800 Fax: 505-473-3830 • pumps@danksolar.com www.danksolar.com • Water pumps

Andre Kramer, Offshore Marine Labs, 2200 S. Federal Hwy, Ft. Lauderdale, FL 33316 • 877-MAKE-H20 or 954-524-5433 • Fax: 954-524-8909 makeh2o@aol.com • www.offshore-marine.com Water purification