Eco Cinco House
Sanctuary Belizes' s Highest Quality Home Is Its Most Affordable

From the street, this house may look like that of its tropical counterparts, but the performance of this home is what sets it apart. This home is built well above the code minimum of not only Belize but also US Hurricane zone codes. Performance for this home includes storm resistance, indoor air quality, comfort, energy efficiency, durability, low maintenance, and built to the highest level of building science. This 2375 sq ft home is currently being sold for $579,000 including lot, septic, and landscape. This is an incredible value for any home in Belize, especially in the highly sought after Sanctuary Belize development.

This home was designed for versatility in terms of use. The 10' raised home is focused around an open concept living area with ceilings soaring to over 14'. This area contains the kitchen, dining, and living room of the home. All rooms in this home enjoy access to exterior decks, highlighted by the 14' wide sliding door off the living room. Both sides of the home enjoy a luxurious master bedroom suite with private bathrooms. There is also a powder room guest bathroom off the living area. The lower level contains a carport, and enclosed, conditioned laundry / utility room. Entertaining and families were both considered and though of with the design of this home.

You get a sense of how sustainable elements were combined with amenities to provide true comfort and appeal. This is first realized as you transcend up the front stairs to the home with LED accent lighting centered on each stair riser. This adds great aesthetics, safety, and energy efficiency. You may also notice the 5kw solar array that can allow this home to be off grid.

What you won't realize from looking at the stucco exterior is the quality that is built into the walls here. This home is built from ICF (insulated concrete forms). This type of construction has many benefits including energy efficiency, air tightness, steel reinforced concrete walls, and speed of install. An ICF wall is 6" of concrete sandwiched between 2 pieces of 2 ¾" EPS insulation. These block install like logos, act as the form for the concrete pour, and have grooves built in for steel rebar. The forms then stay in place to give you a R-22 wall. Beyond that the stucco is installed over a ¾" ventilated rainscreen. The outside of the ICF wall is wrapped with a Tyvek weather resistant barrier. The windows are all flashed into this protective layer. Then screens are installed at the top and bottom of the wall as wel as above and below all windows. After that, wood furring strips are installed vertically between the insect protected vents. The stucco is then applied with wire reinforcement to the rainscreen, thus off the weather barrier by ¾" inch. Stucco is a porous material so we know it will absorb some moisture. Dealing with that realization instead of ignoring it, these plans allow for any moisture to drain via gravity in the open air space a away from the house from the base flashing at the bottom of the wall. Any residual moisture can then dry from the ventilation loops created from the top and bottom wall horizontal vents. This makes sure water has a place to drain, is not forced into the home through the pressure of the stucco right against the structural wall, and allows the stucco to dry out it either direction. This will prolong the life of the stucco and color of stucco.

As you enter the custom made door with arch top window, you come into the open concept living area. You are immediately flanked by two waterfalls made from locally sourced river rock. The Barba de Holote locally sustainably harvested custom kitchen cabinets give you an exotic kitchen feel with a traditional styling. This area really creates an indoor that really invites in the outdoor, emphasized by the 14' door to the rear porch that runs the entire length of the home. The back yard savannah setting with tall palmettos and topical

trees brings in the harmony with nature. The American Clay natural earthen plaster is made from Caribbean sand and sea shells. The travertine floors and granite countertops come close in proximity, just across the border of Mexico. As you look up towards the peak of the 14' ceiling, you notice the 10' diameter ceiling fan. This Big Ass Fan, moves as much air as 11 standard fans, but with less than a third of the energy of 1 standard ceiling fan. This helps cool the home with very little energy demand. The home was designed with cross ventilation in mind as well. All windows and doors are placed as to make sure cross ventilation occurs in every direction. Also all six sides of the home are insulated and have thermal mass within that insulated envelope. This is another passive cooling strategy, as that thermal mass stays cool throughout the days. In order to further decrease the cooling load on the home needed for ideal comfort, an EZ Breathe balanced ventilation unit helps dehumidify both the house and incoming fresh air. The major factor in comfort in Belize is not temperature as much as it is relative humidity. Once you reduce the latent load (humidity) of a home, you dramatically decrease the cooling needed for optimal comfort. Comfort is the main driver in doing this, and comfort is superior in this house.

This home is optimized for energy efficiency with a super efficient building envelope. All sides, top, and bottom of this home are insulated which reduces the cooling load on the building. This insulation detailing coupled with our air tight details makes this home much more efficient than any other homes in the area. In fact the energy modeling shows that this home would use $800-$1000 USD a year in utility costs if we did not have solar (comparing the buildings alone with no renewables). What this does is help decrease the size of the solar array needed to get to net zero energy. This home takes the Sustain-A-Building Belize approach of conservation first. By spending the right about of money on the envelope (insulation and air sealing of exterior surfaces), we decrease the load on the home and the size of the more expensive solar panels. The 5kw solar array produces about 24KWH a day with a battery bank that can store 60 kWH a day with 24 batteries.

The ICF walls provide us with a R-22 (that actually performs higher due to thermal mass). The ceiling is air sealed, and has Knauf Eco Batt insulation. This GreenGuard Children & Schools certified insulation has no added urea formaldehyde and contains the highest level of recycled content of any insulation on the market. On top of the roof we have installed a R 6.5 polyiso insulation with a radiant barrier to deter radiant energy. The addition of a light colored metal roof help to further keep that insulation cool which makes it perform better. The slab and beams are all wrapped in R-10 rigid foam board insulation. Thus there is a continuous air barrier and thermal barrier around the home just like a cooler. A key feature of the home is that there is at least 1/3 of our insulation value outside the air barrier of the home. This key detail ensures we do not have a dew point within our wall assembly. When there is a dew point in a wall, there is condensation. Condensation can then turn into mold with the right relative humidity, which is common in Belize. WUFI, a hygrothermal modeling software, is used to assure moisture will not be a problem in our walls. WUFI is a modeling software that analyzes all the layers of a wall assembly together as an assembly with historic local weather over several years. This analyzes vapor diffusion and liquid transport in that wall in that climate, as assesses any chance of condensation, dew point, or mold. Doing this prior to design is key to ensure a highly durable envelope assembly.

The windows also add to the efficiency of the home. These windows are low e coated with argon insulated gas panes. The German frames are thermally broken, and also have well engineered German hardware. These tilt turn windows either pull in like a casement window to open fully, or the top can be tilted in to allow airflow. The tilt function allows windows to be open in the rain to get airflow, but not let the rain in. Also one can utilize

the tilt function while they are not home. You still get the outside air breeze but leaves the window engaged with frame for security.

The insulation coupled with the passive strategies and dehumidification create a home that does not require very much active cooling with AC, even in Belize. This home has a ductless minisplit in each bedroom for a total of two, whereas most homes of this design would have 3-4. Less minisplits to create the same comfort means a huge savings in energy cost, as cooling can be the major cost driver of energy in a home in Belize.

The insulation and tightness of the home not only lead to better energy efficiency, but they also lead to a healthier home. Also a lot of attention has been paid to water and moisture. Since over 95% of building failure happens due to moisture, that also becomes a concern for both health but also longevity and durability of the home. Every type of moisture and water has a plan to help health and durability:

1. *Bulk Water* - This is handled through building science detailing and redundancy. Two is better than one, and the extra layer is your insurance policy.
2. *Interstitial Condensation* - Assemblies Modeled in WUFI assuring no dew point or risk of mold in the walls. 1/3 of R value outside air barrier. The air barrier and thermal barriers are separate and continuous.
3. *Conductive Condensation* - Eliminated due to exterior insulation and thermally broken walls.
4. *Vapor Drive of Humid Moist Air Into Wall* - This risk factor has been eliminated due to the air tightness of the walls. In Belize, the humid air wants to drive inside. In most homes this happens all over. In this home that has been eliminated due to air tightness.
5. *Interior Occupant Related Moisture* - Both bathroom are equipped with Panasonic Whispergreen bath fans that work on occupancy sensor. When these sense movement they turn on for a preset time at a preset exhaust flow to exhaust moisture and odors from the bathrooms
6. *Capillary Action* - Water can travel against gravity through a wicking behavior called capillary action. We have eliminated this risk by applying a capillary break to the concrete between any different concrete pours (ie columns and beams to floor deck, deck to wall connection). Concrete is also never placed in direct contact with wood; a capillary break is always installed between to make sure rot and decay do not become as issue.

A side benefit of this air tightness ensures insects, rodents, and dirt cant get in. If air can get in, critters can too. Stop the air and stop the critters from taking occupancy in your home. When critters are doing their thing as the hang out in a buildings gaps and cracks, that makes the leaking air there not so fresh.

This all goes to prove the old wives tale of "A House Should Breathe" meaning leak, is false. A house should be " Built Tight, Ventilated Right, and Have The Ability To Dry Out if it gets wet". That is how a home should be built as this one is, following all the laws of physics and building science.

The health of this home actually started during construction. Low VOC materials were used throughout, but that's not enough. Most of the materials used were GreenGuard Children & Schools Certified (now GreenGuard Gold). This is a lab that certifies building products for meeting a strict guideline of promoting good indoor air quality. Products used that met this criteria were paints, glues, adhesives, caulks, insulation, and air sealing products. The American Clay walls also help clean the air, regulate humidity, and enlighten moods with the release of negative ions.

As stated earlier, building science is the core philosophy of Sustain-A-Building Belize Ltd. The redundancy of the window flashing details are case and point, and Sustain-A-Building Belize backs that up with a 10 year warranty on leaks in windows, walls, or the roof.

Building a home for durability also requires thinking about severe weather risks. High winds and hard rains pose a threat to any building. This home plans for this through Fortified for Safer living techniques to ensure a home that will survive and thrive after a severe weather incident. The ICF walls with reinforced concrete is the strength of the home. The roof is tied down into those ICF walls with anchor both and ties that hold the building together. Many hurricanes can find air leakage, and in turn create a hole in the wall. Once that happens in severe wind, the uplift can tear a roof off. This homes air tightness significantly reduces that risk because the air can't get in to create that uplift. The windows are all Miami Dade rated impact resistant. The roof deck had the seams air sealed, and also flashed with a waterproofing membrane before the exterior foam and metal roofing was installed. This helps to make sure that even if the house loses a section of metal roofing, the home will remain water resistant. These factors all will guarantee this home to outperform any other in a major storm, and ensure this home will be here in great condition for many years. That is what durability and longevity are all about.

When talking about sustainability or green building, one can not forget about water. This home did not forget either. All of the faucets and showers are Water Sense rated as high efficiency low flow faucets. Even with less gallons per minute, these well engineered Kohler fixtures won't let you know your saving water with the comfort and water pressure you need. The toilets are all dual flush Water Sense rated toilets as well. The hot water in the home is supplied through a GE Geospring hot water tank. This system has a built in heat pump that extracts the heat out of the air to heat the water. This unit is 93% efficient. They cooler air released after the heat is extracted is what helps to cool the laundry room.

Just remember, Building Science means true quality and this home certainly has more building science than any other in the area, and maybe even all of Belize. Not only were the construction techniques orientated in this fashion with high quality products, but the end result of the home was performance tested, as all homes built by Sustain-A-Building Belize are. We use blower door testing equipment, in conjunction with thermal imaging cameras, and smoke machines in order to ensure performance at completion.

This home could all be yours, and in a couple years you can enjoy the fruits of your very own orchard right on site while relaxing in Paradise! It's even an investment you can pass down for generations due to the building science behind it. And if its an investment you seek, but your not ready to make the move yet, Sustain-A-Building Belize will guarantee you a 5.5% annual return through a rental agreement backed by both Sustain-A-Building Belize, and the developer, Sanctuary Belize.