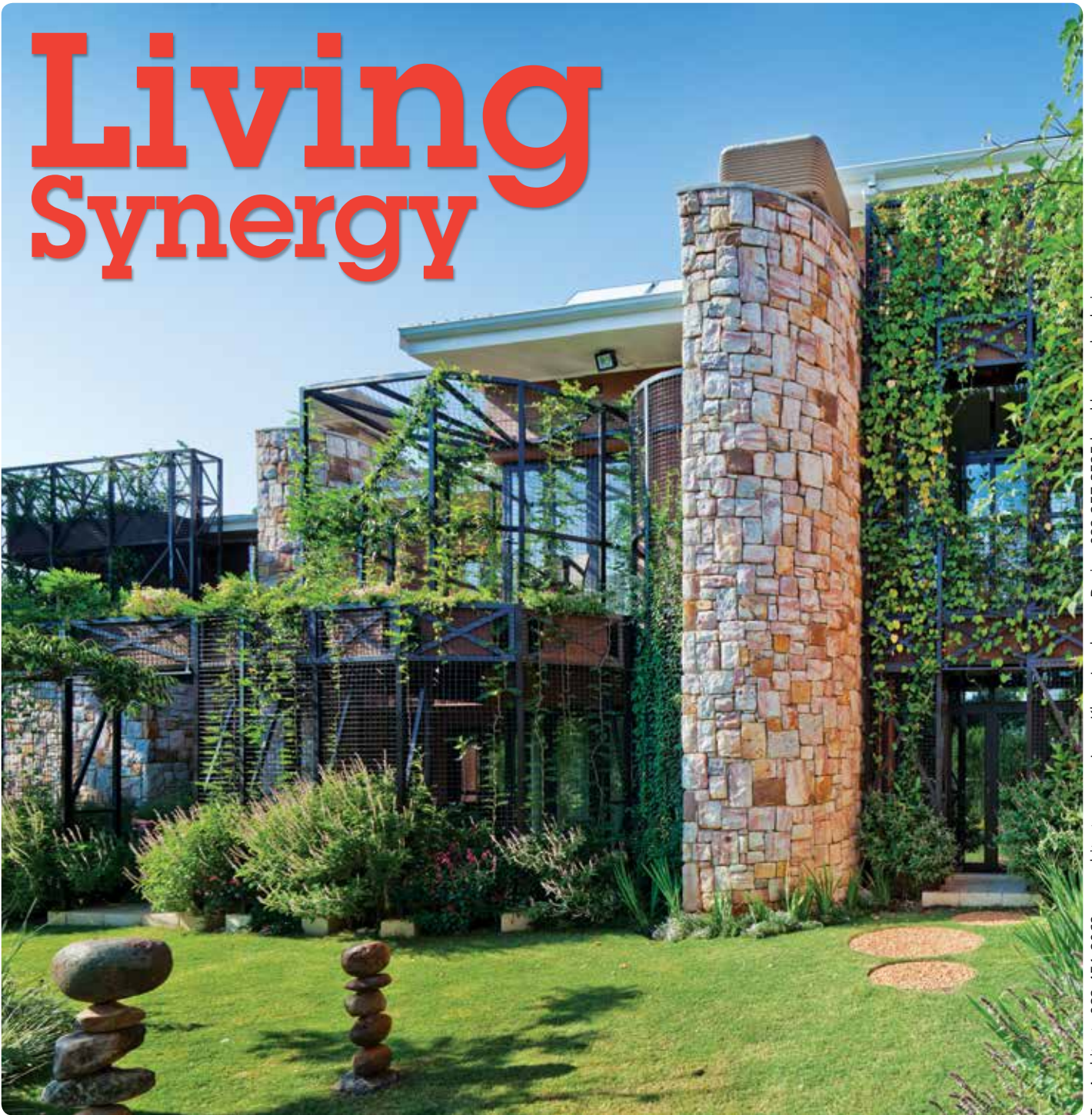


Living Synergy



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Words: Natalie Boruvka **Images:** Leon Krige

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idden in the heart of Joburg's northern suburbs there's a house that embraces its natural environment by thriving on the interconnectedness of its interior and exterior

Ken Stucke, director of Joburg-based Era Architects, has been specialising in environmentally responsive architecture for the past 30 years. He recently completed a remarkable residential project in Sandton that presented him with the opportunity to implement the energy-efficient, sustainable design principles that he has to date been exploring. "I knew it had the makings of an enormously challenging and rewarding commission when my client told me he wanted a house that could operate even if the Johannesburg City Council failed completely," he says. Gradually as they progressed with the project, Ken was able to convince his client of the 'bigger picture' of a design underscored by a cohesive accountable approach to the environment rather than just the need to service its own needs in terms of electricity, water supply and waste treatment. After two full years of designing and refining the systems, the result is a home which in no way compromises on luxury and comfort to perform at optimally efficient levels.

Realising the reduction of the structure's footprint was put into

practice right at the start. The existing house was carefully soft-stripped and all the re-usable, reclaimed materials, which included electrical and sanitary fittings, windows, doors, cupboards, roof coverings and timber, were donated to charity. All the excavated masonry was crushed on site and re-used to backfill trenches and level the sub-divided portion of the site. The reduction of construction waste was one of a series of conditions included in a unique environmental clause that Ken wrote up specifically for the contract. The clause also cites minimisation of rainwater runoff, protection of the soil against contaminating products used in the construction process and advocates the use of paints, sealers, sealants and adhesives low in toxicity and VOC's. "It is worrying that as yet no legislation in South Africa exists concerning this but," he adds hopefully, "along with the new Occupational Health and Safety regulations now being implemented, it should be next."

Ken's years-gathered expertise comes to the fore in the design of the structure. It is built in a manner that creates a comprehensive thermal envelope using insulated cavity walls and floors, exposed concrete soffits and double glazed windows. The resulting high thermal mass acts like a battery or store, absorbing heat from the occupants and the environment during the day thereby having a



cooling effect, and at night releasing the absorbed energy when it is cooler and warmth is needed. "It acts much like a flywheel but the stabilising is of the cycle of heat from day to night." Passive design principles further encourage optimal energy efficiency by minimising summer sun and optimising winter sun. The house has been situated as far to the south of the site as possible, thereby opening up the north side to the sun and the garden. In addition the plan has been stepped to open up on the eastern side and offer shade on its western side. "This enables the house to co-operate effectively with mornings that are cool where the sun is welcome and, conversely, provide shade in the afternoons when it is hot," Ken explains.

The house's northern façade is distinguished by three stone chimneys and several planted shading screens which create 'bubbles' of tempered micro-climates onto which the house opens. Using perennial creepers planted in large pots, these 'outdoor rooms' encourage integration of the external and internal spaces in both summer and winter. Deciduous plants like black-eyed susie and wisteria create shade in summer and provide a burst of colour but losing their leaves in winter allows the sun to warm up the rooms they front. Bush violet, another indigenous climber, provides a contrastingly evergreen screen for the house and makes for an excellent

bird nesting spot. "All the creepers and ramblers do not require any pruning and perfectly suit the 'wild mix' that we envisioned for the façade," explains landscaper, Leon Kluge.

The chimneys are not just an aesthetic element. Located at the top of each is an evaporative cooler. A standard machine, it acts simply as a fan blowing hot, dry outside air through a wet tissue-like medium. As the air passes through the medium, the water in the medium evaporates, and cool, moist air is dispersed which is then blown down the chimney entering into the internal spaces of the building through louvers. "The ventilation these air conditioners provide is best appreciated on the hot, dry summer's days that the Highveld is subject to." Interestingly each stone chimney is mirrored by a 'green' or planted chimney. They function in a similar way but by means of atomizer sprays – like those found at restaurants – that spray a mist and create a falling column of cool moist air that floods the outside micro-climate spaces that the building opens onto.

In fulfilling the client's desire for the house to be able to function independently of the Eskom grid, seven solar thermal panels and two photovoltaic arrays, one comprising 24 panels and the other 20, have been installed on the roof. The thermal panels heat water which is stored in a 1000 litre tank to be used in the home and for



all the domestic water requirements and the underfloor heating. The photovoltaic panels feed two inverters that cleverly control the amount of electricity fed into the main distribution board. Likewise, the house generates its own water supply. Rainwater, harvested from the roof and stored in four 10 000 litre Jojo tanks situated above ground, is filtered and distributed for non-potable use in the house. The council water that does enter the house and is immediately put through a particle filter, then a carbon filter and finally, an ultra-violet filter. From here it is fed directly to three potable taps. It is also able to feed the whole house through a bypass system that shuts off the rainwater supply if needed.

Even waste water generated in the house is recovered and treated in a two-phase digester system before being stored in an on-site dam with a capacity of 60 000 litres. Water from paving runoff and subsoil drainage is also collected directly in the storage dam. "The water recycling strategy called for a wetlands approach where," explains Ken, "the combination of a circulation pump and cascading rock waterfalls oxygenate the water during its treatment process." Leon patterned together a selection of eight indigenous plants such as Egyptian papyrus, water parsnip and cut-leafed clover, an aquatic fern, all carefully selected for their filter-aiding properties.

"The plants in the wetland, and surrounding garden, were selected to provide food for birds, and in order to achieve that," explains Leon, "we had to attract insects for insect-eating birds, use plants with fruit and seeds for fruit and seed-eating birds, and of course provide a source of nectar for the lovely humming birds." Fish have been introduced to the dam and frogs have begun to colonise the area resulting in a flourishing biodiversity.

What makes the project extraordinary is that the entire design in its interior and exterior components functions like a natural ecosystem where every part is inter-related and co-dependent. "The waste treatment system supplies the irrigation system which feeds the planting and this in turn plays an integral role in the comfort and quality of the internal environment. So if someone uses the wrong toilet cleaner, for example, this can have a ripple effect throughout all the systems causing the house to overheat due to the shading plants dying. "Managed correctly, these systems are ever improving, rather than most mechanical solutions that deteriorate as they get older," informs Ken. "As they become more established, the systems will grow more robust and require less maintenance, and in this way the house will actually progress with age."