Section 13.
Some of the innovative eco-friendly aspects of the Mountain Lodge project

The project proponents, concept designers, architects, and engineers of the Mountain Lodge project firmly believe that the building should be alive and breathing. Have not only a heart but also a pulse with life going through its veins. It should be functional and intelligent, for example, able to regulate its own temperature and airflow. A building should be creative, unique, and beautiful, an entity that you can fall in love with. If you are fortunate enough to be part of a project such as this, then it should excite you and make you emotive; it should be somewhere that you want to be, a special place where you are comfortable and want to spend your time.

One of the main drivers in designing Mountain Lodge is the fact that it is a completely new creation and whenever we start with a blank sheet of paper, the opportunity must be grasped of not only having an incubator for creativity but also a stage for new technologies to be developed, tested, implemented and showcased. This is not only for the furtherance of innovation but also as an important legacy in providing benefits to our future generations. By investing today in new solutions aimed at environmental sustainability, we are confident that the Mountain Lodge project will help put Sri Lanka on the global map as a 'pioneer' in the development of carbon neutrality within what is becoming a rapidly growing tourism industry.

Through creativity and our investment in the development and implementation of exciting, cutting-edge systems for rainwater harvesting, stormwater and wastewater management, groundwater replenishment along with water heating and electrical generation, we are aiming for Mountain Lodge once up and running to have the lowest environmental impact and be as near carbon neutral as possible. We must remember that water is not a resource; it's a privilege. We hope that Mountain Lodge will be a pioneering project in Sri Lanka and hopefully help to set a new benchmark in water management and sustainability.

Progressive management of water resources

We believe that water in the ground is like money in the bank in that you can't keep making withdrawals unless you make some deposits. We need to try and work with the natural cycle toward water sustainability. Up until now, man has often made the mistake of going into an undisturbed natural area where the rainfall was mostly captured by dense vegetation with a strong root system that not only held together the soil on a hillside but also allowed the rainwater to infiltrate and permeate down into the natural water table below. Then man would come along and build a large concrete building along with tarmac roads and car parks (basically waterproofing the surface of the ground) The problem is then further exacerbated by installing large drainage systems that cause heavy rainfall to immediately run off from the site. For water supply, boreholes are drilled and water is pumped from the ground to use within the building and then, after use, the wastewater goes through a water treatment plant and again out into a drainage system, often directing it off-site to a drain or river. We then wonder why we have droughts in the dry season and floods in the rainy season.

At Mountain Lodge, we are developing many innovative aspects for good water management. These include:

- Groundwater replenishment system
- Stormwater management & flood mitigation
- Rainwater harvesting & storage system
- Thermal-mass
- Pumped-storage hydroelectricity generation system
- Thermal transfer
- Innovative wastewater treatment plant
- Wastewater recycling system

Groundwater replenishment system

At Mountain Lodge, we are installing two groundwater replenishment systems. One is a network of perforated pipes installed under the main car park. Rainwater from the upper road and carpark is directed into a catchment tank that separates the sediment. The rainwater then enters into a manifold system that feeds into the groundwater replenishment system.
The second system catches the rainwater from the long driveway and directs it into a large reverse well. (well is for feeding water into the ground). Our boreholes will be withdrawing less water from the ground compared to that which our groundwater replenishment systems are depositing back into the ground.

Stormwater management & flood mitigation

This system also acts by catching and storing rainwater from the 1,963 m2 roof during a heavy storm, rather than it being allowed to run off, adding to and further exacerbating the already flood-like conditions. This stormwater management system dramatically reduces the harmful effects by capturing excessive water runoff with the added benefit of storing it for later use. Each column around the building has an internal diameter of 1m x 20m in height thus giving a storage capacity of 15,000 ltr x 20 columns = 300,000 ltr.

Rainwater harvesting & storage system

Example of rainwater harvesting: With a building footprint of 1,963 m2 and an annual rainfall of 1,652 mm, 3,242,876 ltr of rainwater could be harvested for the swimming pool and Laundry. This system not only helps with stormwater management but also saves in having to pump 3,242,876 litres of water from the borehole.

Thermal-mass

Another benefit of this system is that the 300,000 ltr of water within the 20 columns around the building will provide a large capacity of thermal mass storage, a method of helping to even out or lessen the spikes of vast temperature differences between the heat build-up during intense sun and the cold of the nights. This will help to keep the building warmer in the nights during the colder times of the year.

Pumped-storage hydroelectricity generation system

Another significant benefit of storing water in the columns around the hotel is that it can be used as a Pumped-storage hydroelectricity system, a type of giant battery to store up potential energy (in the form of a head/pressure of water) that can be transferred into electrical energy in the evenings/nights after the sun has gone down and the solar panels have stopped producing.

During the day when our 1,000 m2 of solar panels are producing a higher amount of electricity than that which we can use (many of our guests are away during the day), the excess electricity can be used to pump water from the well located in the lower garden, 50 meters below the hotel. (30m of height difference within the garden plus 10m average of the 20m columns and 10m average of the 20m well = 50m average height differential.) Using the excess electricity to pump up and fill the columns with cooler water during the day, then when the PV solar panels are no longer producing enough electricity in the evening guests have returned thus increasing demand, the water can be released back down through a hydro-generator to help power parts of the hotel after dark.

Thermal transfer

It can also be used as a thermal transfer system to remove the heat out of and away from the hotel building and transfer it down into the cold earth. This is done by releasing the heated columns of water down into the well/groundwater replenishment system. (Via the hydro-generator) This helps to negate the use of power-hungry AC units to keep the building cool in the evenings during the hotter parts of the year.

Innovative wastewater treatment Plant

A very challenging part of this project has been to develop a modern wastewater treatment plant in a way that could reduce its energy consumption and increase the throughput efficiency of the plant within a smaller footprint, all while exceeding the necessary water quality standards.

We wanted to achieve not only this but also increase the amount of water being recycled therefore reducing the amount of freshwater being pumped from the boreholes.
It seems that oftentimes in the past, there has been a great focus on achieving the required water quality standards for the discharge, but the issue of energy efficiency has sometimes received less consideration. By having each tank slightly lower than the previous, we are able to achieve a gravitational flow-through control of the various sections of the treatment process resulting in a reduction of the amount of electricity used in transferring the wastewater through each stage of the process.

Wastewater recycling system

We estimate that around 16,000 ltr of fresh water will need to be pumped from the boreholes each day (5,840,000 ltr per year) This is only to be used for kitchens, sinks and showers. It then goes into our modern wastewater treatment plant to be recycled and used a 2nd time for flushing the toilets, therefore saving on using fresh borehole water for toilet flushing. It then goes through the wastewater treatment plant again for recycling to be used a 3rd time for garden irrigation. This double recycling (finally going to the garden) plus the rainwater harvesting system (providing water to the laundry and swimming) pool will save annual borehole pumping requirements by 14,922,876 ltr.

Energy-efficient laundry

We have designed a working methodology for the laundry to reduce power consumption for drying and to recycle water within the laundry process. We have developed fresh ways of minimising our environmental impact. These include water filtration and re-use within the soaking, washing, rinsing, and spinning cycles and fresh working methodology so as to help minimise the use of detergents. This will also have a dramatic financial savings regarding the amount of energy used. One of our drying methods uses the heat from the kitchen extractors via a heat exchanger. We will have much lower operational costs, having developed a number of innovative methods for laundry drying and air de-humidification along with energy recovery and re-use systems.

Building Integrated Wind Generation System (BIWGS)

We are proposing to install a Building Integrated Wind Generation System (BIWGS) This allows the air from the high pressure (upwind side) of the building to enter through vents under the overhanging eaves. The air passes through a sealed cavity under a false floor that runs throughout most of the spa area and then passes through a large circular-shaped duct around the central atrium and this is where a series of small wind turbines will be located. The wind is then able to continue on through the low pressure (downwind side) and out through the vents on the opposite side of the building.

This BIWGS has a fourfold benefit. 1st it helps to reduce the pressure differential between the high-pressure side and the low-pressure side helping to reduce internal doors from slamming. 2nd It is able to help towards environmental sustainability by generating a small but useful amount of electricity. 3rd By causing a drag on the high-pressure side, this helps to create a greater low-pressure side. This vacuum effect is used to pull air up and out of the bathrooms and, indeed, out of the whole building, thus creating a flow of fresh air entering into the building. 4^{th,} When there is no wind at all, then some of the air turbines can be electronically controlled to become an extraction system.

Management of organic waste

The waste from kitchens and restaurants is directed through a macerator and then fed down a dedicated waste pipe (under vacuum) to be used for biogas production. The waste from this process is then used to produce compost to enrich our garden soil.

Transformable rooms

Mountain Lodge is an innovative building with many alternative concepts. Eight rooms have the ability to transform within 15-minute from being a 'Family Room' to becoming a 'Junior Suite' and/or a 'Workcation Suite'. We have eight standard rooms that have merged to become four suites, but these could change back again as demand dictates. With such an innovative design, we can quickly transform not only responding to the changing seasonal demands of more family rooms for school holidays, etc., but also the day-to-day changes in demand for the various room types. The design of such large suites and with having an entrance hall and kitchenette allows for the option of having private butler service.

Futureproofing

We have designed the hotel in such a way that, if for some reason the bottom fell out of the tourism market, be it through an act of terrorism, civil unrest or natural disaster, etc., the building is more or less ready to become self-contained and/or serviced residential apartments. Its careful design and layouts of large vertical and horizontal utility ducting allow for futureproofing. If necessary, it could become a home for elders, even a hospital or a school, and therefore not become a redundant hotel but rather transform and continue its economic usefulness within the community.

Privacy

When on the landings within the building, you will have an outside feel because of the natural light, the rain effect, the lush internal gardens, and the floor paved with natural stone. Then, as you approach your front door, you feel like entering into your own home. Once inside after walking through your suite and out onto the balcony, because of the columns, you are unable to see the balcony of any other suite, thus giving complete privacy and a feeling of being in your own home out in the beautiful countryside.

Your Health and Wellbeing Sanctuary

We have many very unique features, such as the chillax cave. It will be a memorable experience for our guests as they are gently transported in a glass-bottomed punt through a cave, across a pond of white quarts, and behind the waterfall to get to the dock of their spa treatment room. Also, post-treatment is very important within a spa, and having somewhere within the immediate vicinity for post-treatment rest, to just chill out or even fall asleep, is a must. The cave will have a beam of natural light flowing through a gentle waterfall.
The Quarts Spa, otherwise known as 'Your Health and Wellbeing Sanctuary', is not only aimed at helping with physical wellness, but sadly, there is a rapidly growing demand for mental well-being programs. The facilities of the Health and Wellbeing Sanctuary will also be able to help people needing these types of supportive treatment programs.

Guest experience

After 8:00 pm, because of the innovative design of the floating decks within the pond, 'The Cave' can quickly transform into a unique venue for evening entertainment. As it's in a cave, we can create a very unique ambience, especially with creative lighting and dry ice/mist floating across the lake behind the musicians' stage.

Noise mitigation

We have focused a great deal on noise mitigation. We are confident that very little acoustic disturbance will be detectable from the musicians within the cave, either in other parts of the hotel, such as the bedrooms below or the roof garden above and that no noise disturbance will be caused to the area around Mountain Lodge.

The evening music within the chillax cave will be suppressed as it is fully contained within the large cave-like room. The materials of the cave walls act as a sound wave damper. The fact that noise would not be able to travel on through the wall, through a corridor void, through another wall, then through the spa rooms and on through the closed outside windows helps to ensure that noise will not be detectable outside the building.

The floor of the cave is a suspended and soundproofed wooden deck above the floor slab and part of it is a pond made up of a 450mm deep tank of water with a void under the tank and then the 150mm floor slab. By using a combination of different building materials such as wood, soundproofing material, air voids, glass, and concrete, because they all have different resonance frequencies, they work together so as to absorb and/or dissipate the sound waves/resonance frequencies, resulting in achieving the desired goal of extremely low level of noise leakage.

Silencing noise from the plant-room

A very common problem in roof-based plant rooms is the noise that is generated through vibration, causing the ceiling slab of the bedroom below (upon which the plant and equipment is set) to resonate and amplify like the skin of a drum. Such annoying noise is derived from electrical switchgear, transformers swimming pool pumps, tanks filling, water flow noise from pipes, filters, etc.

We are planning on having a dense platform where the machinery will be fixed and this to be set into a cradle. The dense platform slab will act as a silencer by absorbing (and thus dissipating) the varying and often conflicting frequencies of resonation. The cradle itself will also act as a secondary resonance absorber and it will also be set on air bag suspension so as to avoid any vibration/frequency from being transmitted or allowed to resonate into the concrete slab below. The whole unit will be resting on girders placed so as to spread the weight along the solid supporting walls.

The use of natural light

We believe that Mountain Lodge may be the only hotel in the world with an internal natural rainbow. We aim to achieve this by working with natural light and water. The large water chandelier within the central atrium is able to be lowered down to become a five-story water/light chandelier and raised up to become a central waterfall feature that beautifully interacts with the low wavelength natural light that streams through the central atrium during sunrise and sunset.

The central sphere/lens located in the centre of the acrylic water feature above the central atrium intensifies the light and beams it down through the central atrium into a parabolic reflector that reflects it back up again so that the light is travelling in both directions. Around mid-day and with the introduction of fine mist (to water the vertical gardens) as the water droplets fill the air, this will cause a full-circle rainbow to appear for both the people up on the landings around the atrium looking down and also the people below looking up.

The hotel is designed and aligned in such a way that the main waterfall feature in the central atrium will give a wonderful light phenomenon during sunrise and sunset. The low-wavelength sunlight shining onto the central waterfall and reflecting through the droplets will provide a visual spectacle akin to that of liquid gold bouncing and reflecting.

Cooling the building

The five-story rain-like waterfall running down through the central atrium of the hotel is not only pleasing to the eye, creating an outside feel but it helps to keep the plants within the vertical gardens hydrated. In higher temperatures, the water is able to evaporate as it falls, creating a natural cooling effect within the central core of the building, akin to that of a giant air conditioning unit.

Ventilation

We have designed an integrated building airflow system. A necessary amount of air can pass around the balcony's French doors and then on through the suite, being pulled through the cupboards and out into the central atrium, thus being able to provide good air quality and temperature. (Being located in Ella with the perfect climate) The extractor fans that are hidden up inside the entrance hall of each room on the sides of the hotel with a breeze are able to generate and provide power to the extractor fans on the non-breeze sides, thus saving electrical energy. The airflow systems can be powered and controlled independently or collectively.

Air extraction

Steam and damp air are drawn out from the bathrooms on a separate ventilation system that is controlled in relation to the amount of hot and cold water that was used. Extraction fans within the bathroom ceiling lead into ducting within the utility shafts. The foul air is led up into a horizontal ducting that exits out through the sides of the building.

Natural air-conditioning/Saving of electricity

The acrylic dome water feature over the central atrium not only looks great from the outside in the roof garden but is able to reflect the low wavelength light at sunrise and sunset down into the central atrium. The water and air travel up through the acrylic quadruple spiral, and then the water runs back down the trough of the outside spiral. This will cause the light to split/refract and reflect beautiful colours on the internal atrium area.

The gaps in the spiral dome are positioned so as to catch any rain while allowing heat from the building to rise and flow out. As the sun rises and becomes stronger, the gaps get closer together, thus reducing the sun's intensity. We are then able to transform this into a sunshade by changing a valve over, allowing a darker-coloured, lighter liquid to temporarily replace the water within the roof dome, thus acting as a massive liquid sunshade over the central atrium. The cooling effect resulting from the five-story water feature within the central atrium along with the sunshade and a unique design of mechanical ventilation to or from each suite helps to keep the building at the optimum temperature without using energy-hungry conventional air conditioning units. This is a natural way of reducing our carbon footprint.

Nature

The inside atrium will have an outside feel with vertical gardens of orchids and other stunning and lush plants. We hope to create an environment to help multiply beautiful creatures such as praying mantis, chameleons, stick insects, butterflies, etc.

Shade

The hotels' large balconies overhang, creating an increasingly shaded area as the sun rises and increases in intensity. The overhang of the balcony above stops the intense sun from beaming into the suites, overheating the rooms and floor slabs (ceiling slabs of the rooms below.)

Heat transfer from the roof slab to the swimming pool

The small streams around the rooftop garden are not only pleasing to the eye but also act as a giant heat exchanger taking the heat from the roof slab and transferring the heat into the swimming pool. This reduces the dependence on swimming pool heating or energy-hungry AC units to keep the spa rooms cool underneath the roof slab.

Accessible utility shafts and ring mains, future-proofing

We have designed a ring-main system for all utilities with easy access for maintenance. This also ensures quick hot water in each room. Other non-water services can be fed in and out in both directions, thus reducing the need to close off utilities during maintenance procedures. By using utility shafts, it becomes easier for building maintenance or the addition of other systems as they are developed at a later date.

Thermal-Mass and reducing carbon mileage

During construction, a good way to reduce noise pollution and carbon mileage is to stop the trucks from transporting off-site the soil being excavated from the basement. Then, to also reduce the number of trucks transporting the sand and gravel aggregates back to the site for making concrete.

We have come up with a method of achieving this by processing the sand and gravel from the soil being excavated. It is basically about recycling and using what we already have on-site. These recycled aggregates will be used for the non-structural adobe concrete that will be used for the internal walls. This will provide good room-to-room soundproofing and also increase the thermal mass of the building.

Recycling during construction

Another area where we can reduce our environmental impact during the construction phase is by recycling the steel that we use for the shuttering. Because the hotel building is designed using a modular and symmetrical method, we are able to use the same steel shuttering panels around twenty-five times. Once all of the concrete work is finished, the steel will be cleaned off, and the sheets welded together to form the tank for the pond inside the spa and also the large infinity swimming pool.

Kitchen design functionality and efficiency

A lot of thought has gone into the design of the kitchen to ensure good workflow and economic functionality. We have an efficient dishwashing layout along with a good flow system of 'raw products in' and 'waste out.' We are implementing a good kitchen layout providing smart food preparation and dispatch organization, thus avoiding the dangers of staff tripping over each other. The kitchen will look like a separate building because of its round design and the fact that it is situated in the middle of the restaurant with its own roof, giving a feel of being outdoors.

The restaurant has a creative layout allowing it to be unobtrusively partitioned off for functions without negatively affecting guest experience or interfering with the general running of the main hotel. The round kitchen also has an innovative way of transitioning its layouts in synergy with the restaurant as it converts into a venue for weddings, conferences, etc.

Kitchen Exhaust System

Air will be pulled from the staff and drivers' quarters (thus, also creating an airflow and cooling effect) this air is passed through a filter and heat exchanger fed by heat from the kitchen extraction system. This warmed air is then fed through the laundry dryer. Heat is also harvested from the fridge and freezer compressors to dry the laundry.

Regenerative drive systems.

We will look at the cost-effectiveness of using regenerative drive systems on the two lifts so that they can generate electricity when descending so as to help towards offsetting the energy costs when the lifts are ascending.

Bio gas enhancement

Mountain Lodge is located at around 1,100 meters above sea level. This cooler climate can have an adverse effect on the production of biogas. We intend to get around this problem and significantly speed up the efficiency of the anaerobic bacteria by having a solar thermal charging system set under the blacktop of the road within the upper car park. This will use a closed-loop water pipe system to take the heat out of the blacktop road of the car park and use it to warm the thick concrete wall and floor of the biogas digester. The thermal-mass of the thick concrete tank set into the ground will iron out any fluctuations in temperature and instead keep the floor and walls of the tank at a steady but warmer temperature and so bring the digester to a more efficient operating temperature.

STAR Deck

The STAR Deck is a unique feature that not only creates a great experience for our rooftop diners but it also allows us to keep the restaurant at an optimum occupancy/atmosphere by being able to expand and contract as demand dictates. Another benefit derived from the STAR Deck is that during the two-and-a-half-year construction phase, we will be able to avoid the cost and unsightly view of a tower crane being onsite. We will instead use a smaller self-erecting crane within the central atrium/core of the building. However, this is not high enough to complete the construction. Therefore, we can use the self-erecting crane to lift the hydraulic booms of the STAR Deck and temporally fix them to the sides of the lift shafts.

We are then able to use the pair of double acting three stage hydraulic booms to lift up the self-erecting crane so as to place a framework underneath. Then after finishing the construction of the top floor we will again use the hydraulic booms to lift and remove the framework and lower the self-erecting crane ready for removal. The hydraulic booms are then able to climb up the inside of the building allowing us to move them to the final operating location. By temporally installing winches inside the booms, they will then be used as a long-reach crane, lifting the final materials up the side of the building and onto the roof slab.

Once all construction is finished, the STAR Deck will consist of three decks that slide out over each other three and a half meters above the pool. (So as not to interfere with the enjoyment of the infinity pool) Guests/diners will have the experience of the restaurant in which they are sitting, slowly moving out above the pool to take advantage of the truly stunning views.

Heat exchanger within the columns

We will install water pipes inside each column's wall on the side facing the sun. Then, by taking the coldest water from the bottom of the pool and pumping it through the solar heat exchanger within the columns, we are able to cool the building while heating the pool.

Combined heat and power plant

Most generators operate at a poor 40% efficiency with 50% of the fuel/energy being lost as heat and a further 10% in electro/mechanical inefficiencies. We will be installing a heat exchanging system to harvest/transfer the otherwise waste heat and use it for heating up the hotel's hot water system on dull rainy days when the existing thermal solar panels fail to produce the total hot water requirements.

During mains power outages or when we are not producing enough electricity from renewables and it becomes necessary to run the generator, then any excess heat over and above what we need for the domestic hot water can be directed to the jacuzzies and swimming pool.

Ayurveda Botanical Gardens

We have extensive grounds where we intend to create botanical gardens growing a vast assortment of ayurvedic plants for our spa's health and wellbeing sanctuary.