UVAL

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UTILITY SYSTEM REPORT

RADISSON SAFARI LODGE DEVELOPMENT

THE KRUGER NATIONAL PARK

1. Background:

Malelane Safari Resort Investments (Pty) Ltd. is developing a 120-key tented lodge/hotel close to Malelane in the Kruger National Park. The hotel will be managed by a world class hotel operator with construction expected to start in 2015 on completion of the EIA, building design, construction planning and financial close.

The proposed hotel boasts a truly unique location in the Kruger National Park with the Crocodile River bordering the concession.

The developers would like to enhance the environmental sustainability of the property and highlight its "green credentials" as these will play a significant role in positioning the venue in the market place. Consequently, the developers will design and manage the hotel with these objectives in mind: Energy and water supply will be operated at world class efficiency levels while the use of renewable energy – to the largest extent possible - will be given priority over thermal resources.

The purpose of this memo is to outline what Utility Value Engineering believes is the optimal utility solution for the project in terms of system design, operational performance, overall sustainability and cost.

UVAL is proposing a turn-key, utility solution (Effi-Gen), whereby significant CAPEX is reallocated within the construction budget while long-term OPEX (utility supply costs, plant operations and maintenance) is fixed at competitive levels for a period of up to 15 years. In other words a key operational requirement and recurring cost factor (utility services) is to be optimally managed and less prone to budget and cost fluctuations.

Special consideration has been given to the supply of electricity with a number of options being reviewed. These include the recommended scenario of the hotel operating “off-grid”. This means discarding the option of Eskom grid supply that would involve a supply line upgrade and subsequent cabling into the Kruger National Park.

It is our recommendation to favour so called embedded power generation (energy self-supply) using a combination of solar PV generation with local storage, thermal generation (diesel generator) and a range of gas fired appliances.

The combination of this energy supply composition and use of highly efficient appliances and infrastructure, will take this property “off-grid” in a truly sustainable fashion: Environmentally, operationally and financially.

2. Objective:

The goal is to present a managed utility system solution that will significantly optimize utility and energy management, system performance and total utility costs at the property.

The solution discussed here will encompass:

- Turn-key installation and operation of a hybrid energy generation plant (Solar PV plant, battery storage, diesel generator)
- Turn-key installation and operation of water treatment and sewerage treatment plants
- Associated electrical and wet services reticulation and infrastructure
- Design and recommendations of energy efficient appliances across the property: HVAC, lighting, hot water and motorized systems

The solution will in its entirety create tangible benefits in terms of better operational management leading to financial and environmental improvements, which eventually will enhance the guest experience and the overall viability of the project.

The solution design and business case calculations have been based on scenarios in terms of the proposed size of the solar PV generation plant. The design alternatives have then in turn been benchmarked against the option of bringing in Eskom supply for the property.

Effi-Gen Option 1

300 kW Solar PV plant, 400 kW Diesel Engine with 1300 kWh battery storage by use of 3400 Sq. Meters of roof space from: Parking bays (145x15m2) and Main Buildings (500 m2)

500 kW Eskom Supply

The viability of this option is at this stage highly speculative. Firstly, an application has to be lodged with Eskom for a 500 kW supply to be cabled across the river and into the Park. The extension will require an upgrade of the existing supply line outside the Park and also require additional environmental impact studies.

It is assumed that the Eskom supply option will cost an estimated R1 million in infrastructure coupled with a connection fee of similar magnitude. More importantly, the implementation time can be estimated at 3 years from application, given the particular complexity of the location and Eskom processing times in general.

The Effi-Gen option is also the way to guarantee timely supply of electricity to the property without having to run diesel generators for the initial 3 years "Eskom" wait with the inherent risk of delays above and beyond the 3 years estimated from time of filing the application with Eskom.

4. Technical Solution:

UVAL has completed an initial assessment of the expected utility loads (electricity, gas and water). The subsequent desk top analysis has resulted in an outline of what would be the optimal combination of energy supply and energy efficient infrastructure.

The proposed Effi-Gen solution will reduce energy consumption to an absolute minimum for a property this size, however without compromising service standards, guest experience and staff welfare. The low baseline consumption will improve the feasibility of the project and also improve the net impact of the solar powered electricity generation despite the limited space available.

The total energy solution will consist of the following turn-key solution supply:

- 300 kW Solar PV Plant & 1200 kWh Battery Bank
- Covered parking for vehicles purpose built for solar PV generation
- Covered plant area and rooftop solar PV panels in the service yard and Back of House area.
- 400 kW Diesel Generation Engine with noise insulation
- Electrical and wet reticulation across the property
- Energy Monitoring Management and Control System
- Hot water: Heat Pump water geysers in all guest rooms, heat pumps in front of house/back of house
- Bio System Sewage treatment plant
- Water treatment plant

Further essential recommendations include:

- Evening Breeze air condition in all 120 rooms (to be reviewed)
- Inverter based air condition units in all other areas with cooling requirements
- LED lighting infrastructure across the property (rooms, FOH/BOH, outside)

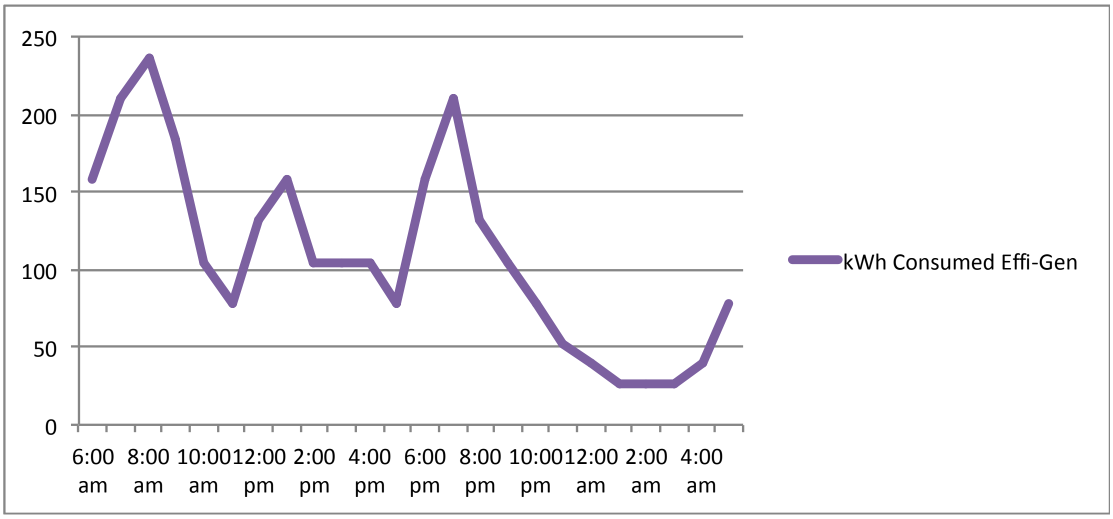
Load Profile:

Based on initial input from various stakeholders and UVAL's own experience from the hospitality sector, we have made the following load estimations:

Rooms: Evening Breeze A/C with an average of 10 operating hours/day. LED lighting and solar water geysers for hot water supply. Monthly average of 215 kWh per room leading to 26.000 kWh per month for all 120 rooms.

FOH/BOH: Inverter AC's, LED lighting and solar water geysers and heat pumps used across these areas. Extensive use of LPG appliances in the kitchen (80% of the load) with most laundry services done off-site. This leads to an average monthly load of 52.000 kWh for this segment

Total Load: Is estimated roughly 80.000 kWh per month with a peak demand of 250 kW giving the below representative 24 hour load profile:



5. Supply Composition:

To cater for the above mentioned loads, the following has been assumed in terms of generation and storage capacity.

To service the estimated average demand of 80.000 kWh per month including a 10% buffer, a tentative plant design using the following parameters can be considered:

300 kWp solar plant installed on the shaded parking roofs and usable roof space at the main building, utility plant room, guest rooms etc. (3800 m2 of usable space assumed for solar)

400 kW noise insulated diesel generators with an *average 5% utilisation* on the primary engine and the secondary engine serving purely as back up.

1200 kWh battery storage plant installed in separate air conditioned plant room.

5.1. Plant Production Cycle (24hr):

By pairing the above plant with the estimated demand, the following average 24 hour load cycle can be expected:

PLANT 24H PRODUCTION CYCLE			*Storage*	1000	kWh	*Genset*	400	kW				
	6:00 am	7:00 am	8:00 am	9:00 am	10:00 am	11:00 am	12:00 pm	1:00 pm	2:00 pm	3:00 pm	4:00 pm	5:00 pm
Hourly Demand	157	210	236	183	105	79	131	157	105	105	105	79
Hourly Solar PV Production	42	98	163	216	252	273	273	252	216	161	98	42
Hourly PV Power Balance	-115,54	-111,66	-73,22	32,37	147,49	194,55	142,13	95,07	110,99	55,73	-6,82	-36,92
Accumulated Power Balance	-116	-227	-300	-268	-121	74	216	311	422	478	471	434
400 kW Generator Production	0	400	0	0	0	0	0	0	0	0	0	0
Hybrid Average Power Balance	-116	288	-73	32	147	195	142	95	111	56	-7	-37
Accumulated Power Balance	-116	173	100	132	279	474	616	711	822	878	871	834
Hourly Storage Discharge %	-72,22%	-43,38%	-50,70%	-47,47%	-32,72%	-13,26%	0,95%	10,46%	21,56%	27,13%	26,45%	-3,69%
Hourly Storage Level kWh	278	566	493	525	673	867	1009	1105	1216	1271	1264	963
"Wasted kWh"	722	434	507	475	327	133	-9	-105	-216	-487	-751	37

	6:00 pm	7:00 pm	8:00 pm	9:00 pm	10:00 pm	11:00 pm	12:00 am	1:00 am	2:00 am	3:00 am	4:00 am	5:00 am
Hourly Demand	157	210	131	105	79	52	39	26	26	26	39	79
Hourly Solar PV Production	0	0	0	0	0	0	0	0	0	0	0	0
Hourly PV Power Balance	-157,25	-209,67	-131,04	-104,83	-78,62	-52,42	-39,31	-26,21	-26,21	-26,21	-39,31	-78,62
Accumulated Power Balance	277	67	-64	-169	-247	-300	-339	-365	-391	-418	-457	-536
400 kW Generator Production	0	0	0	400	0	0	0	0	0	0	0	0
Hybrid Average Power Balance	-157	-210	-131	295	-79	-52	-39	-26	-26	-26	-39	-79
Accumulated Power Balance	677	467	336	631	553	500	461	435	409	382	343	264
Hourly Storage Discharge %	-19,42%	-40,38%	-53,49%	-23,97%	-31,83%	-37,07%	-41,01%	-43,63%	-46,25%	-48,87%	-52,80%	-60,66%
Hourly Storage Level kWh	806	596	465	760	682	629	590	564	538	511	472	393
"Wasted kWh"	194	404	535	240	318	371	410	436	462	489	528	607

The profile indicates ample generation capacity is available with an average peak battery drain of 35% with very little waste estimated even at peak solar generation hours.