CENTURION RESIDENTIAL
ESTATE & COUNTRY CLUB

Centurion HOA
Alternative energy options
March 2019

Purpose of presentation

To share information related to alternative energy options with home owners.

Disclaimer:
Information contained in presentation is solely for information sharing purposes only .
Costing and concepts shared should not be interpreted as definitive numbers.

Contents

- Alternatives for cable theft and load shedding
- Typical Solar PV system for individual houses
- Solar PV options for individual houses
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- Micro Grid PV options
- Battery power back up system
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- Energy storage technologies

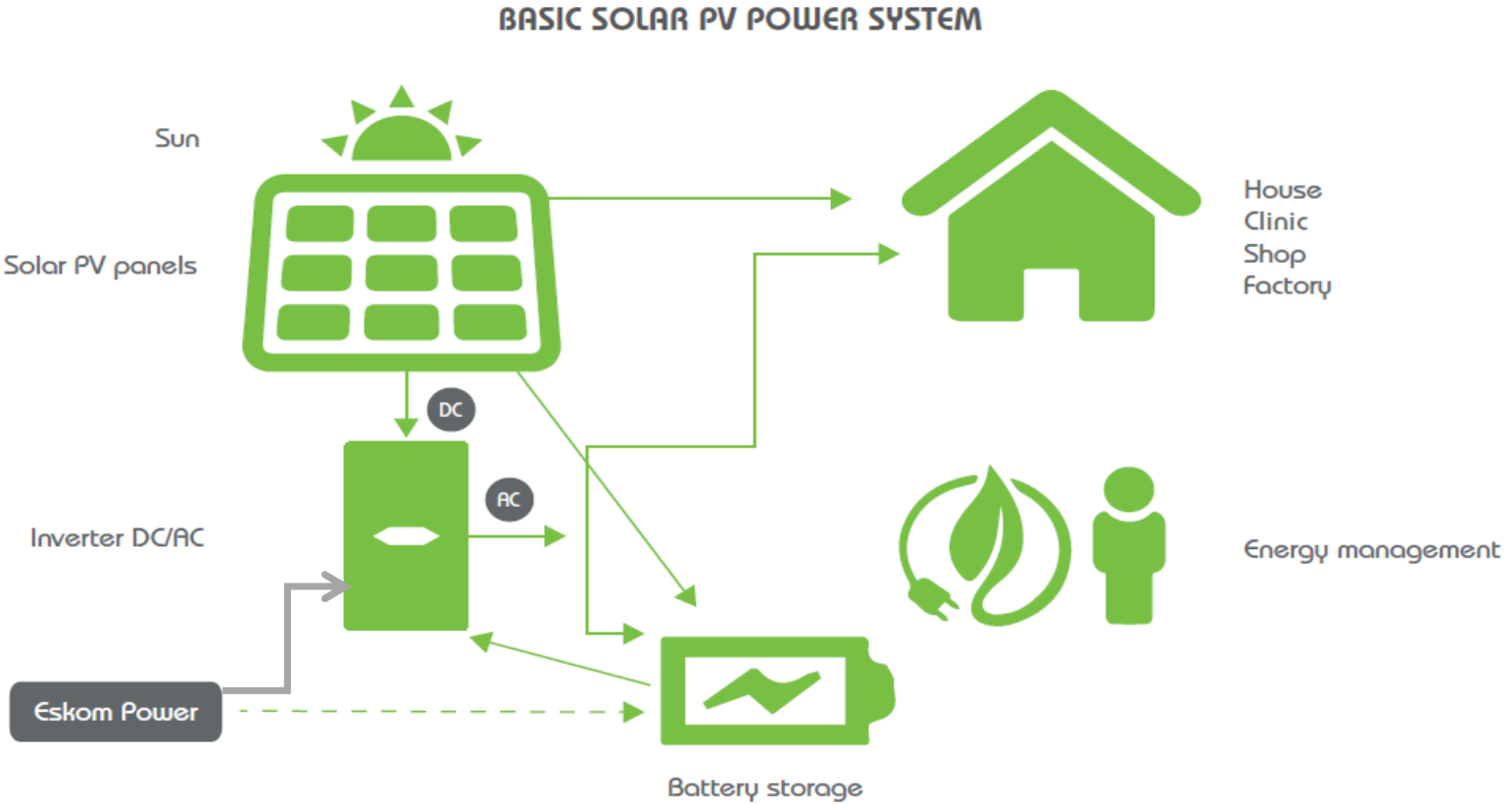
Alternative options to circumvent cable theft and loadshedding in Eastern part of Estate

Grid linkage

- Link Eastern part of Estate with Western part of estate with a current limiter, and or gridlock controller set as say 500 KVA on incomer side and an export limiter to municipal grid on Eastern part.
- Install smart metering in all properties in Eastern part to monitor power consumption.
- Install automatic electric geyser switch off system in event of no power.
- Install link activator to be activated only when no power in Eastern part.
- As soon as power is returned the link is de activated.
- Important to ensure that electric geysers are switched off before emergency power is supplied to dwellings, this can be done auto with smart metering.
- Also possible to install a system where only residents that need power acknowledge electronically whether they need power or not on control system.
- Propose to do more detailed pres to HOA on utility metering and technical detail and costing of this option.

Typical Solar PV system for individual houses

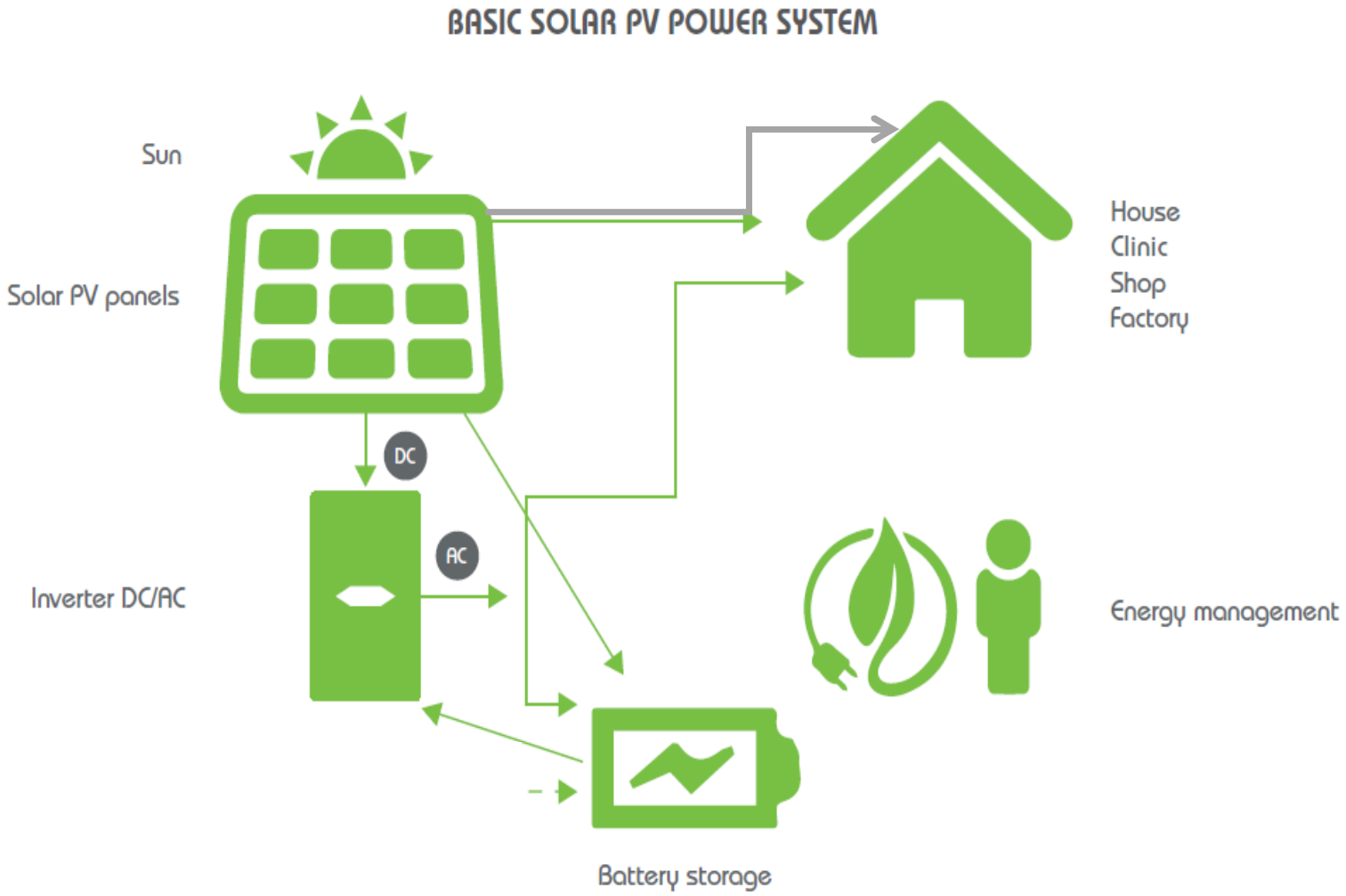
- Typical house needs a 3 to 5 KVA solar PV system to power lights, refrigerators, freezers, computers, TV's. Items excluded are electrical ovens, electrical geysers, underfloor heating, swimming pool pumps.
- Typical grid tied and energy storage layout.



Solar PV options for individual houses

- Grid tied without any energy storage Costs: R 80 000/5KVA system. No emergency power storage ie dependent on grid but can auto link with standby generator. Business case only on power saving and normally a 5 to 7 year payback.
- Grid tied with battery energy storage: Costs R 150 000/5KVA system. Grid tied with approximately 6 hours battery back up power in event of municipal grid failure. Payback 10 to 11 years.
- Grid tied with net metering, Tshwane still in process to allow feedback into grid. Same as above but much better payback ie 4 to 5 years. No storage.
- Full off grid…..expensive..need to design for peak power etc etc
- Common denominator in all solar options is to first improve home energy efficiency by installing solar geysers(18 months pay back), LED lighting and inverter based air cons to decrease power peak load and only then size solar system to save Capex.

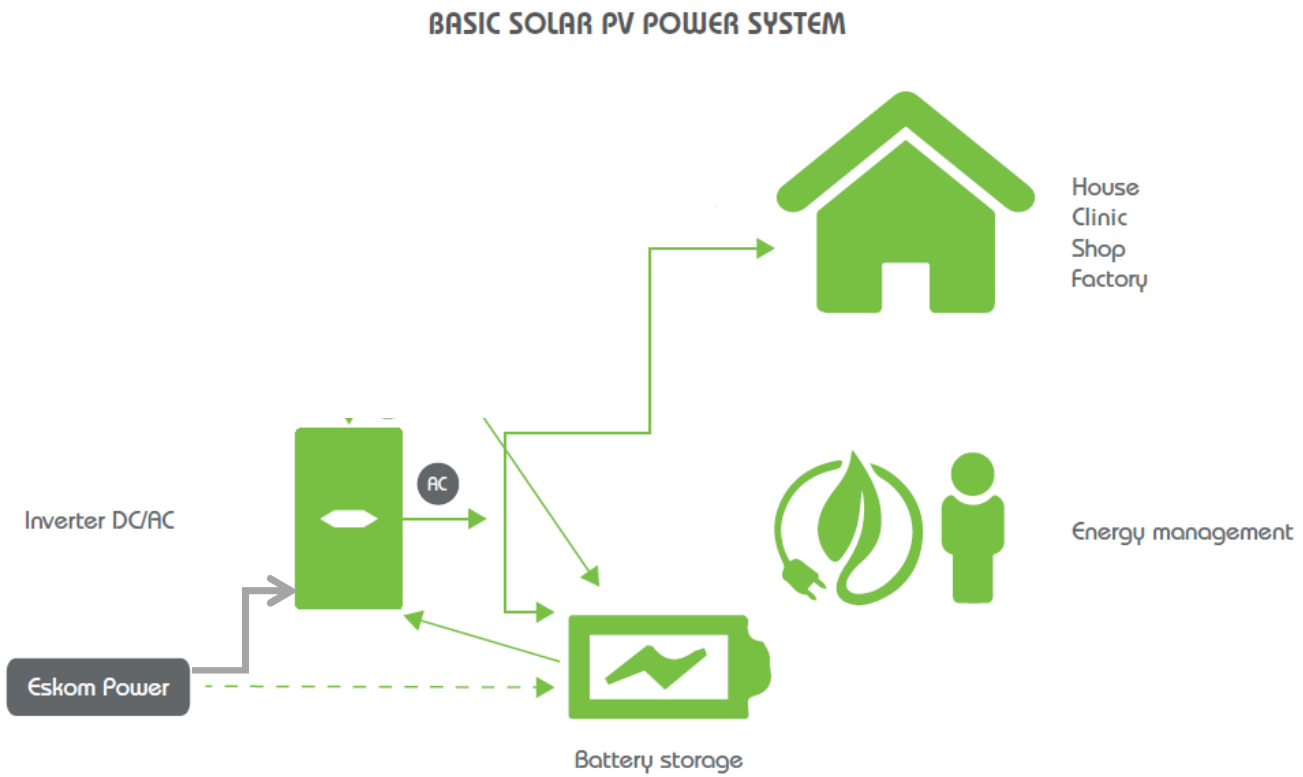
Full Off grid system



Alternative energy options for home owners

- Install diesel/petrol power generator as back up. 7.5KVA approx R15 000. Disadvantage is noise…and very high running costs ito diesel and petrol, 8 times higher than Solar.
- Install only inverter and battery storage system to charge batteries while power is on and then draw power when munic power is off. 5KVA inverter and 12 batteries, approx R 90 000. 6 hours of power for normal home.
- Smaller 3KVA battery inverter power back up system for TV, lights and smaller appliances, 4 to 6hours. Cost approx R 20 000. (3KVA inverter, 4 x 100Ah batteries)

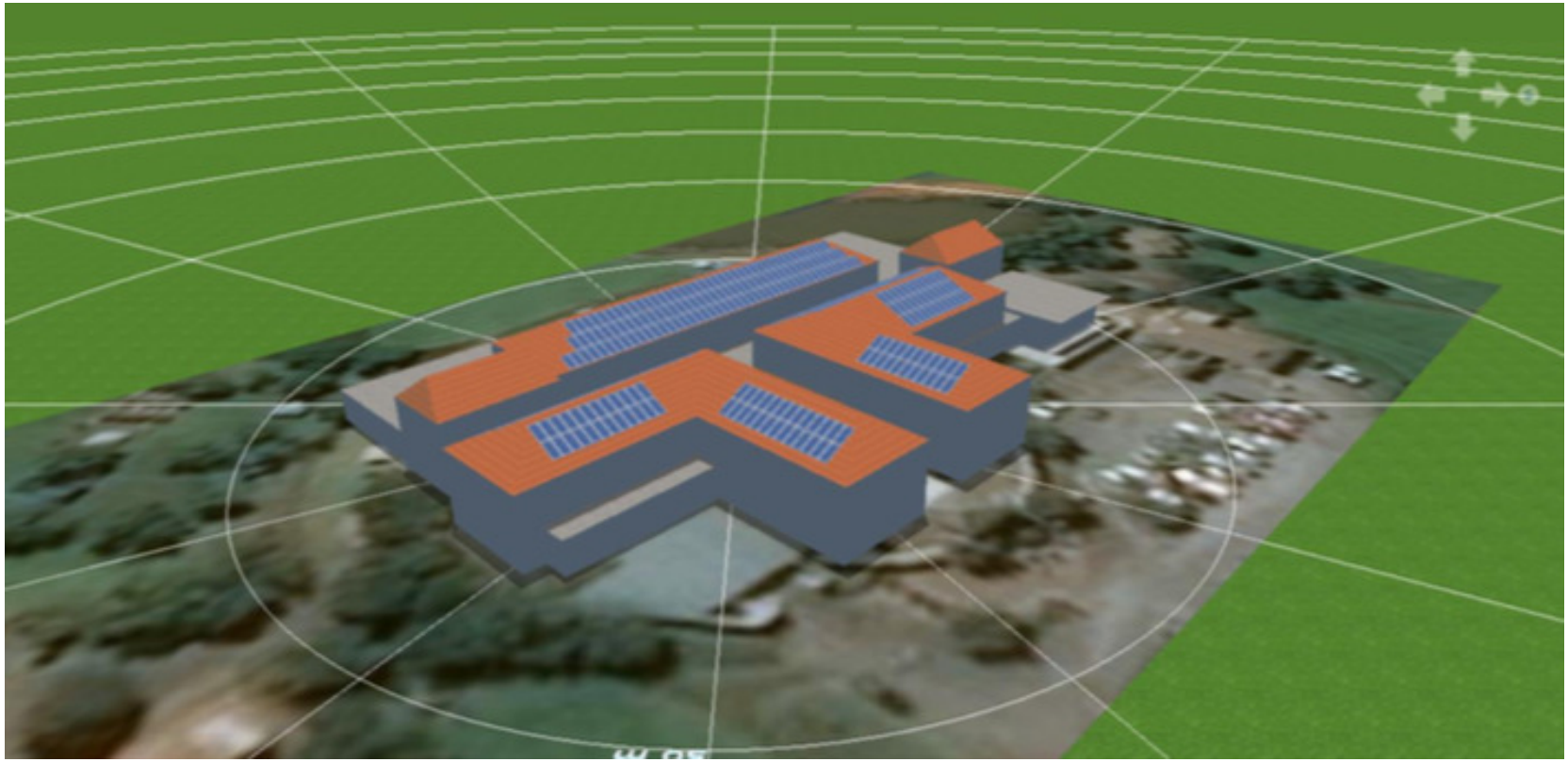
Battery power back up system



Micro Grid PV options

- Microgrid option for roof and ground mounted solar PV system if land and roof space is available. Need 1 ha of land to install a 1 MW solar PV plant, equivalent to 200 households.
- Install 1 MW plant at a cost of approx R 13m, obtain PPA's from households to buy power for at least 10 years to enable financing. Households can then buy energy at a price of 15 to 20 % cheaper than munic tarriffs. The power plant is operated as a micro grid munic within the greater muncipality.
- Central club building power needs can be supplied by erecting a solar car parking area utilizing 1200 square meters to generate 160 KVA supplying the club building with its power needs during day. The cost for a 160KVA system without energy storage amounts to approx R 2.6m.
- Energy storage for night time will however be expensive , ie R0.8 m for 6 hour battery energy storage. Difficult to create a sound business case for off grid energy storage, ie maybe better to connect system to a standby diesel generator at lower capex costs but much higher opex.
- Elegant solution is to register grid for net metering and store electrons on grid.

Example Club building rooftop



Energy storage technologies

- Battery storage, Lithium ion, Pb Acid, Vanadium PO cells
- Super Capacitors..1,6 million cycles, 30 year life, R 50 000 for 3.5kwh storage.

Type	Li Ion	Lead Acid	Super Cap
Installed Capacity (kWh)	25	25	25
Qty	10	10	5
Draw down	80%	50%	100%
Effective capacity (kWh)	20	12,5	25
Capital Cost (Supply & Install)	R 198 086	R 72 500	R 394 513
R/kWh	9 904	5 800	15 781
Cycles (Taken at 1/ day)	4 500	2 200	1 000 000
Life expectancy (Years)	12	6	30 years plus
Cost ratio compared to lowest	2,73	-	5,44
Years/ Cost Ratio before breakeven with the lowest (Years)	16	-	33

- **Energy storage very expensive, but a lot of research in process to develop more affordable storage solutions.**

Conclusion

- Definitely possible to circumvent cable theft and load shedding impact on eastern part of estate by linking grid inside Estate and limiting power supply to prevent overloading.
- Solar geysers definitely a sound business case for home owners.
- Solar PV systems now viable with 7 year payback and even shorter if Eskom tariffs increase by more than 7% per annum. Technology is also modular and scale able, ie start with smaller system ie 2 KVA and scale up over time to 5 KVA on home.
- Energy storage still expensive but lot of research ongoing.
- As soon as Tshwane provide net metering regulatory framework the grid could be used as storage and business case for small scale Solar PV will improve dramatically.