

Niagara 2016 Symposium on MICROGRIDS

October 20-21, 2016, Queen's Landing Hotel, Niagara-on-the-Lake

MicroGrid Demonstration for Electrification and Overseas Business in Africa

Jongnam Weon, Hakju Lee, Jungsung Park, Wookyu Chae, Seongchul Kwon
wjn@kepco.co.kr, jureeya@kepco.co.kr, jindulfa@kepco.co.kr, microgrid@kepco.co.kr, seongchul.kwon@kepco.co.kr
 KEPCO Research Institute(KEPRI), South KOREA

Introduction

- Shortage of electric power system in Africa isolated areas
 - Electrification rate of Mozambique : 17% → 25% ('20)
 - Diesel Gen → Low stability, economics
- Remote MicroGrid for Electrification

- Target site : Mahanhane (Maputo)
 - Objective : Supply of electricity to 50 households and school, etc.
 - Photovoltaic Gen, BESS(Battery Energy Storage System), Diesel Gen, Distribution Line



System Design

- Estimation for load profile of target site
 - Africa rural area : 1 household → (average) 1.36kWh/day
 - Residential : 68kWh / Common : 40kWh / Reserve : 40kWh → Total 150kWh/day
 - Peak : 22kW / Average : 6kW

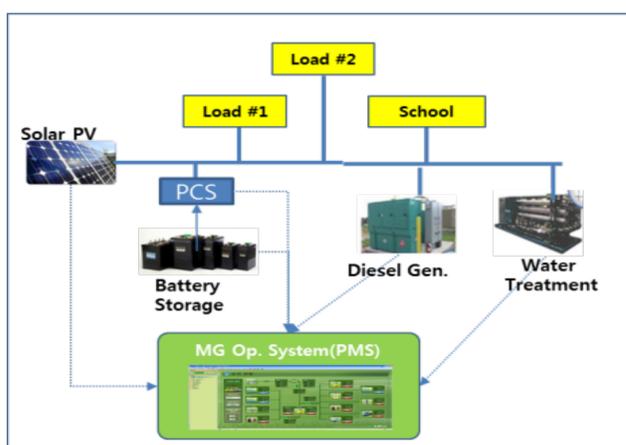
- Source mix
 - HOMER : Microgrid Engineering Tool
 - Result

PV	BESS	Bio Diesel	※ COE(Cost of Energy) \$0.48
80kW	200kWh	10kW	

Optimization Cases: Left Double Click on simulation to examine details.														
Architecture	PV1000	PV (80)	Gen10	Gen20	(200*1kWh L)	Converter	Dispatch	COE	NPC	Operating Cost	Initial Capital	Ren. frac.	Fuel	Hours
	80.0	10	200	25	CC	W0.48	W339.994	W2.271	W310.625	95.5	845	277		
	80.0	10	200	25	CC	W0.49	W350.249	W2.438	W318.725	93.7			1,057	184
	80.0	10	200	25	CC	W0.50	W353.412	W2.057	W326.825	95.3	804	263	58	10
	100.0	10	200	25	CC	W0.55	W391.098	W27.250	W38.825	0	15,118	4,527	5,484	896
	100.0	20	200	25	CC	W0.57	W406.832	W1.872	W382.625	98	377	123		
	100.0	20	200	25	CC	W0.58	W409.152	W29.273	W30.725	0			21,617	3,533
	100.0	20	200	25	CC	W0.59	W414.580	W1.846	W390.725	97.4			442	78

- Practical result (Limited budget, Purchasable capacity)

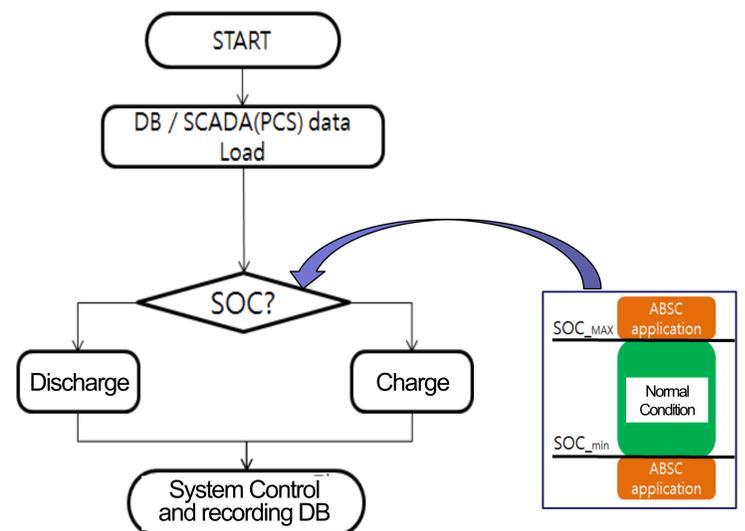
PV	BESS	Bio Diesel
50kW	100kWh	20kW



[System Diagram]

Operation Strategy

- Optimal and automatic operation with BESS
 - BESS : Control of Voltage & Frequency of system
 - Charging/Discharging depending on load
 - Monitoring SOC(Stage of Charge) of BESS (Limit power of gen, disconnect of load)



[Control Room]



[BESS]



[Bio diesel Gen]



[PV gen]

Conclusion

- Rural electrification with Korean MicroGrid system
 - Improvement of life quality
- MOU between KEPCO & FUNAE
 - Planning Follow-up project
- Increase MicroGrid system for electrification



[Completion ceremony]



[MOU signing ceremony]