

# Niagara 2016 Symposium on MICROGRIDS

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## MicroGrid Demonstration for Electrification and Overseas Business in Africa

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### 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

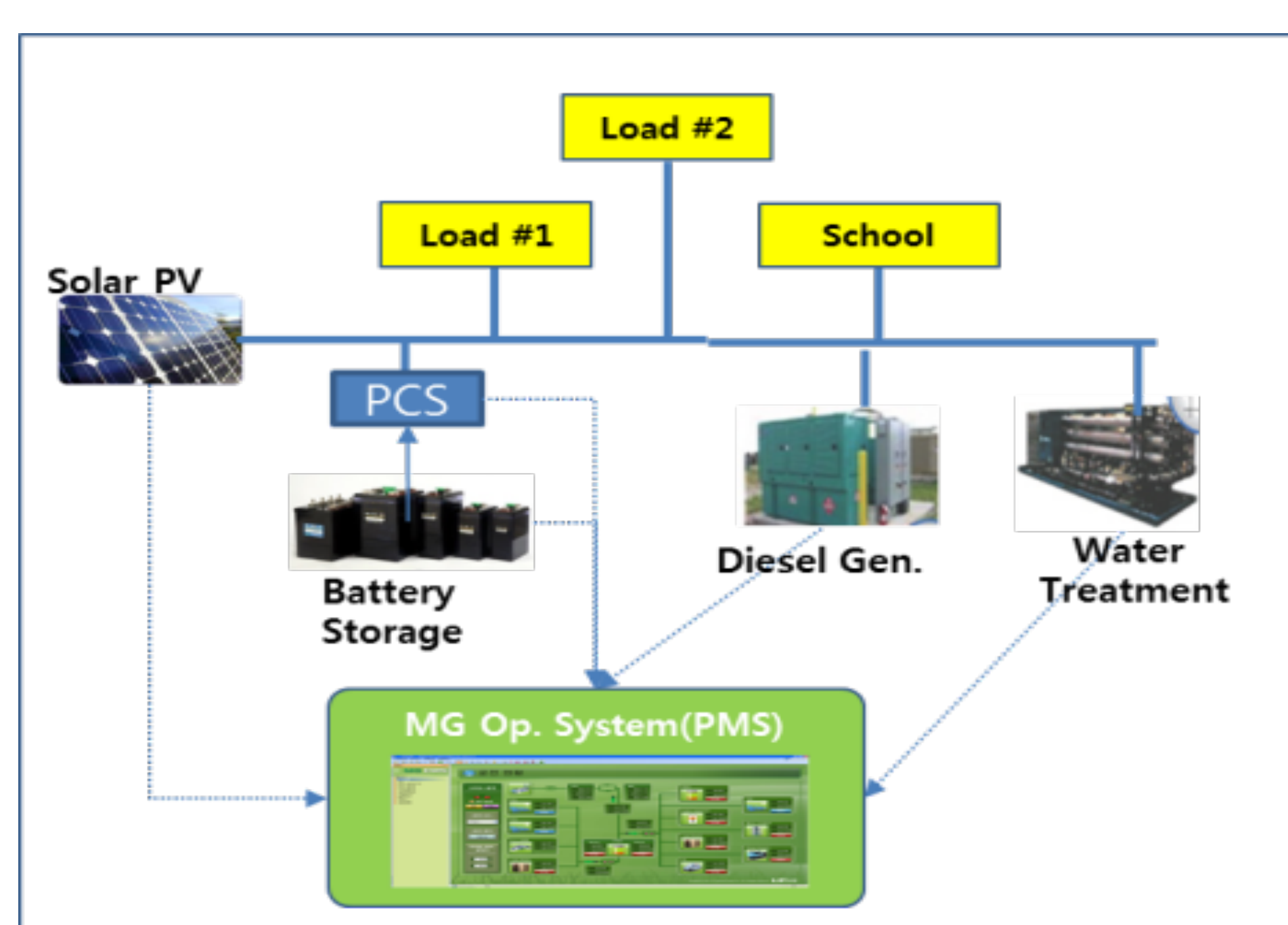
- Source mix
  - HOMER : Microgrid Engineering Tool
  - Result

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

Optimization Cases: Left Double Click on simulation to examine details.											
Architecture						Cost			System		
PV1000	PV 800	Gen10	Gen20	(200*1kWh L)	Converter	COE	NPC	Operating Cost	Initial Capital	Ren. frac.	Gen10
(kW)	(kW)	(kW)	(kW)		(kW)	(\$/kWh)	(\$)	(\$/yr)	(\$)	(%)	Hours
80.0	10	200	25	CC	W0.49	W339,984	W2,271	W310,625	95.5	845	277
80.0	20	200	25	CC	W0.49	W350,249	W2,438	W318,725	93.7		1,057
80.0	10	200	25	CC	W0.50	W353,412	W2,057	W326,825	95.3	804	263
100.0	10	200	25	CC	W0.55	W391,098	W27,250	W38,825	0	15,118	4,527
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
100.0	20	200	25	CC	W0.59	W414,580	W1,846	W390,725	97.4		442

- Practical result (Limited budget, Purchasable capacity)

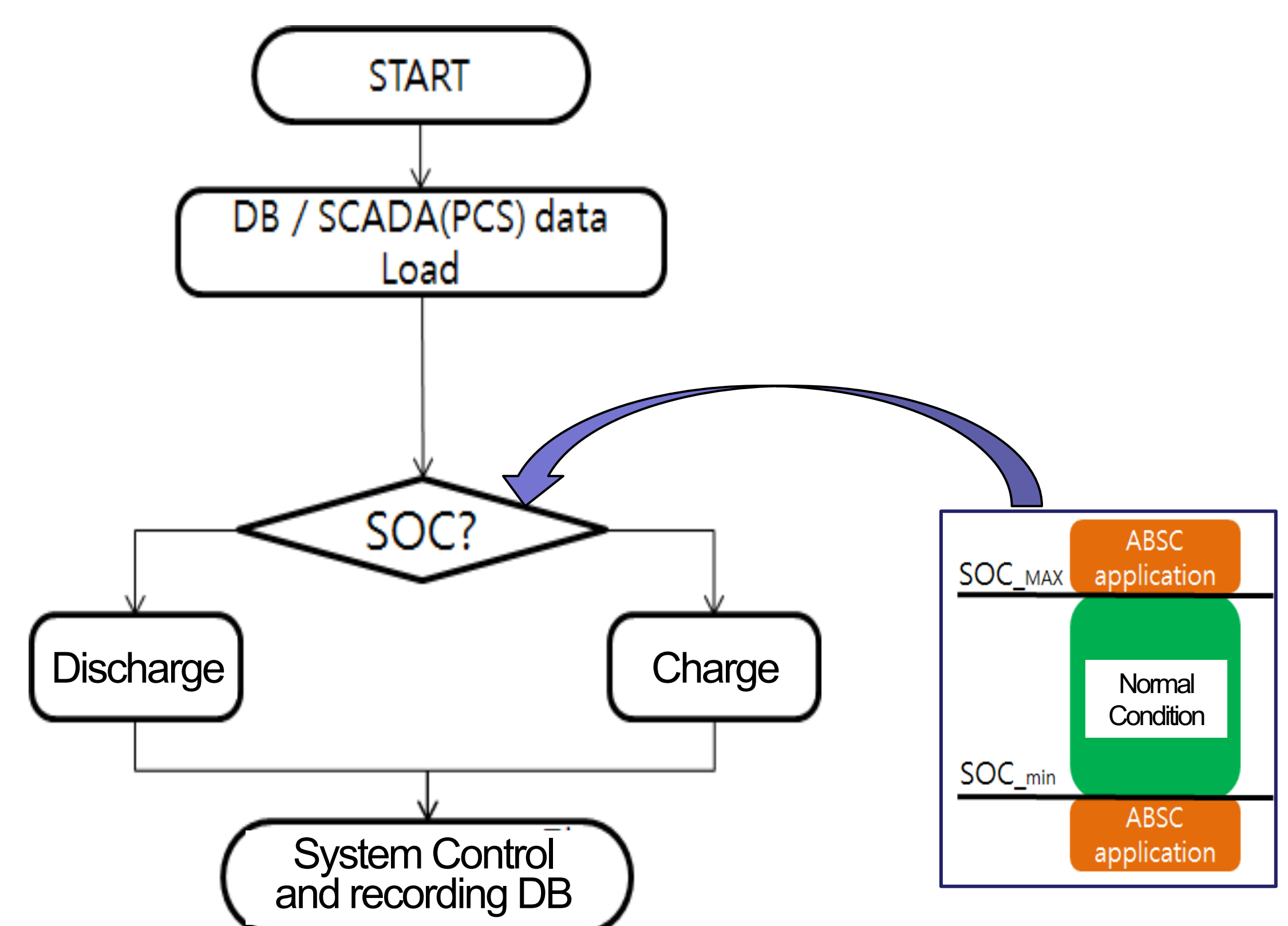
PV	BESS	Bio Diesel
50kW	100kWh	20kW



[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]