

Domestic Use of Energy Conference

30 March – 1 April 2015

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## Study Objectives

- This study is focused on the energy management within a microgrid. Software simulations are done with Simulink / Matlab / SimPowerSystems.
- Control reaction effects must be visible to parameter changes
- A Stokvel charge share concept is proposed wherein state of charge of batteries and user consumption will determine how grid loads are controlled.

## Motivation for research input

- Microgrids can be a better solution to rural community electrification
- Microgrids are expanding and energy management within needs to be considered
- A Stokvel charge share concept is proposed wherein state of charge of batteries and user consumption will determine how grid loads are controlled.

## Intelligent Central Energy Management System for Remote Community Microgrid

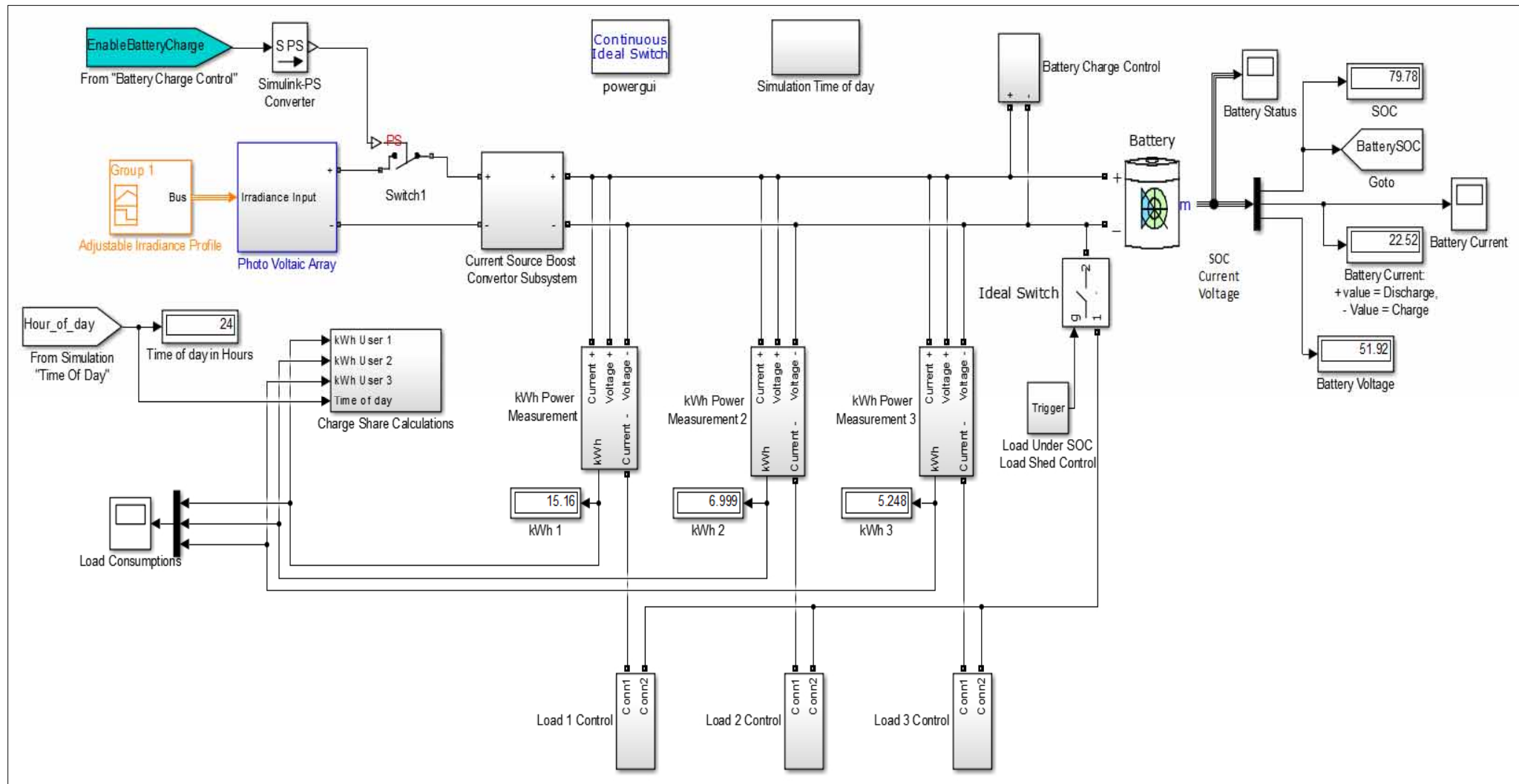


Bird's eye view of the 13.5 kW PV system in  
Makueni County, Kenya.

## **Why focus on DC Microgrid Energy management ?**

- Cost saving by excluding Inversion Equipment
- Point of Common Coupling to National grid is not required
- Energy source holders have limited energy holding capacities
- Communities are wide spread and do not live close to each other
- Control algorithms help to share and provide suitable energy over the entire grid to all the loads

# Intelligent Central Energy Management System for Remote Community Microgrid

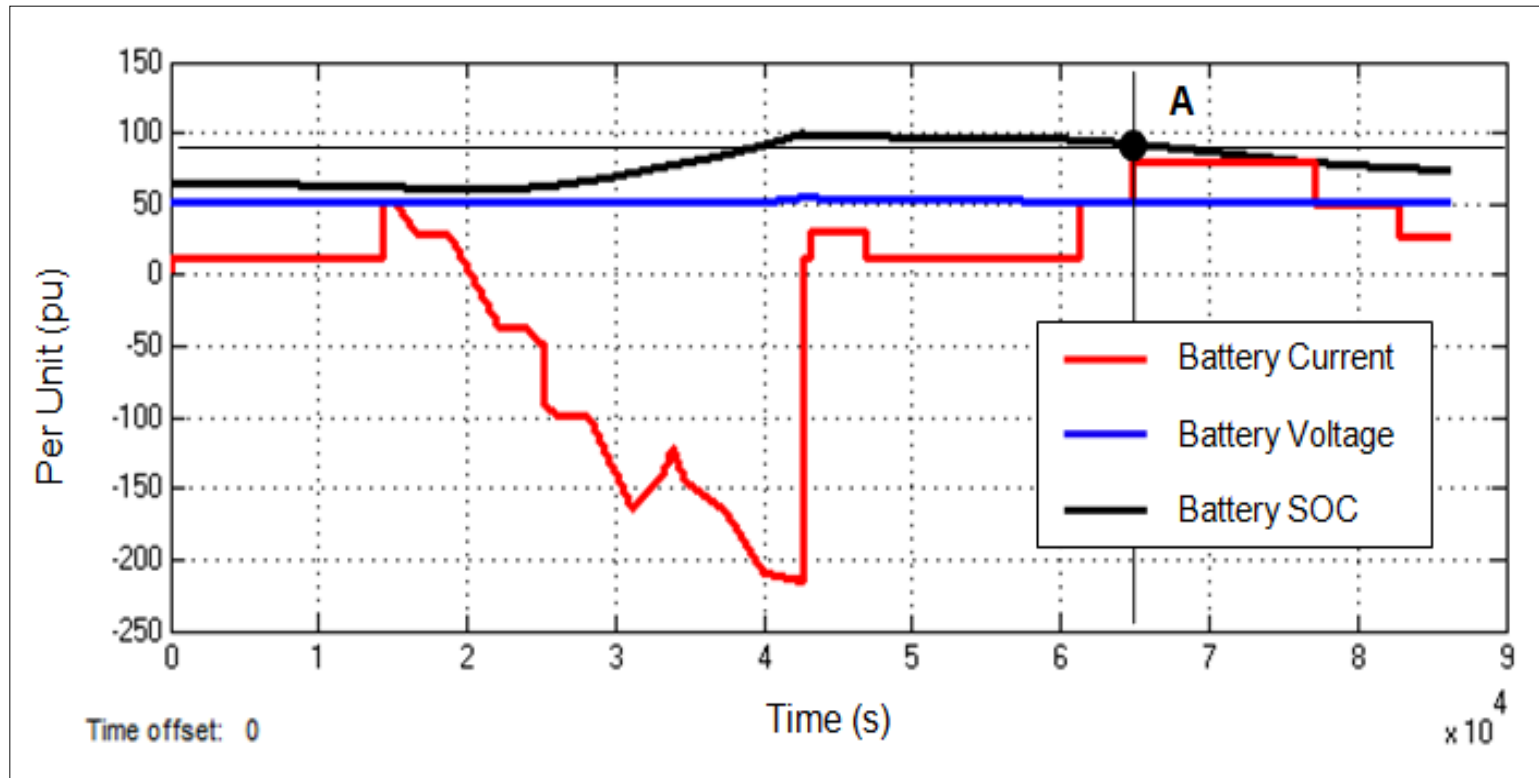


System Model in Matlab



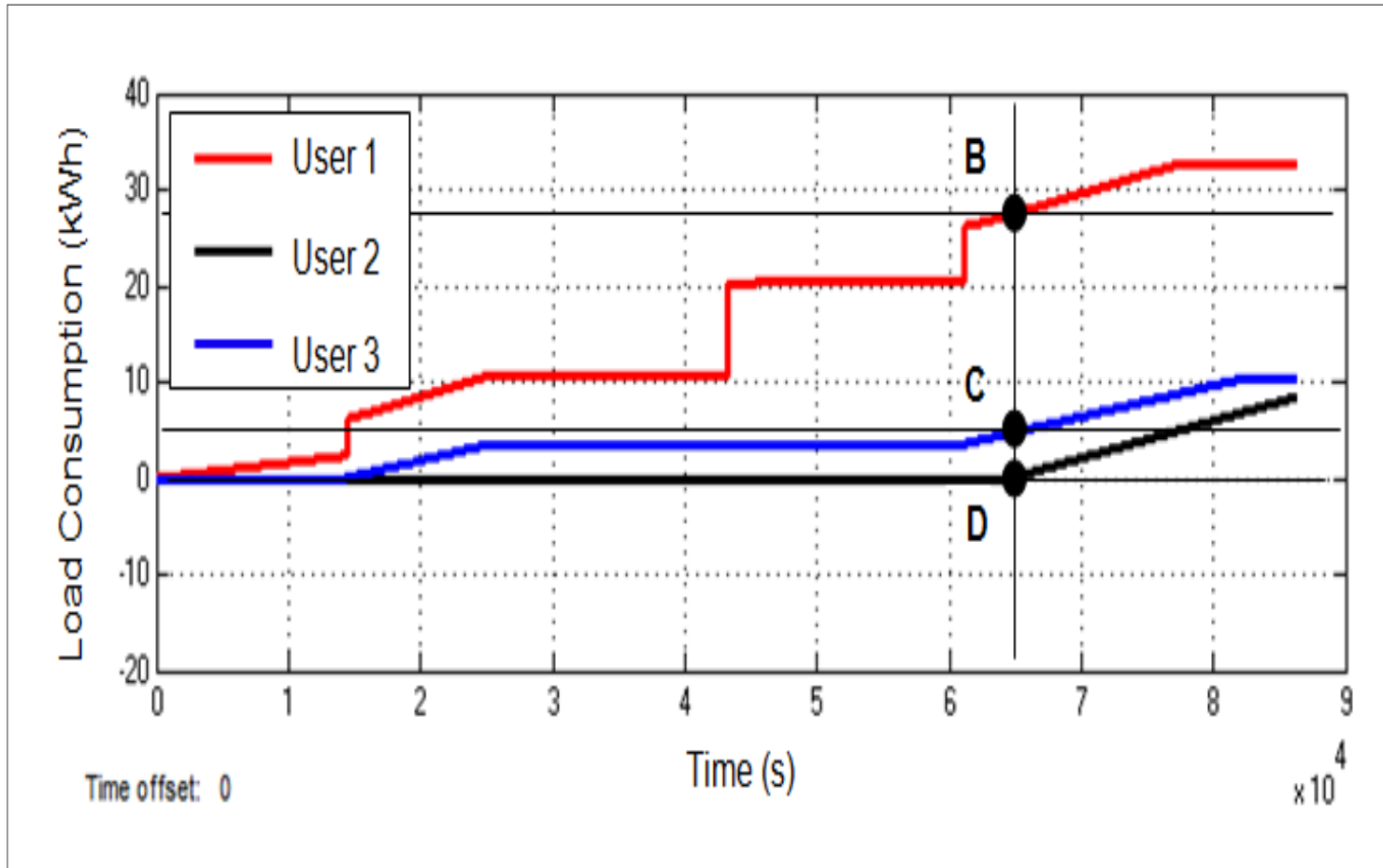
$$kWh_{per\ user} = \frac{1 - \left( \frac{kWh_{User}}{kWh_{Total\ Users}} \right) \times kWh_{Usable\ Battery\ SOC}}{[N_{Users} - 1]}$$

Charge Share Formula:

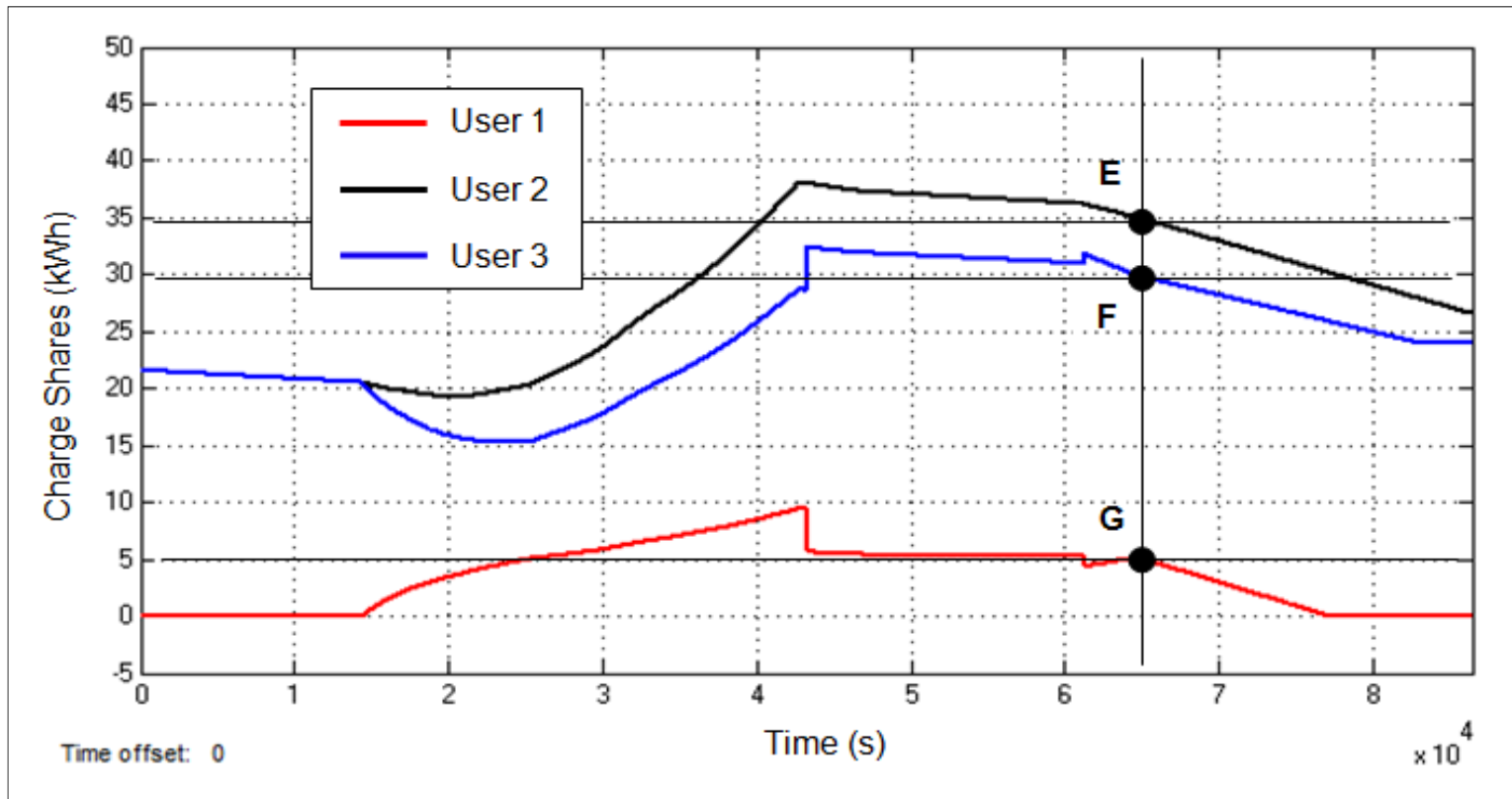


Battery status describes bus voltage, battery current and battery SOC fluctuations.





User load consumption shows the daily use of energy as consumed by each grid user



Energy Charge share quantities are calculated on a continuous basis and shared between each user by the Algorithm at 18:00

<b>User</b>	<b>Energy consumption during day (kWh)</b>	<b>Charge energy left for each load to use after 18:00 (kWh)</b>	<b>% Energy reserved for each load to be used at night from remaining SOC</b>
<b>1</b>	28	5.15	7.58%
<b>2</b>	0	34	50.00%
<b>3</b>	5	28.85	42.42%
<b>Total</b>	33	68	100.00%

## CONCLUSIONS

- System allows every user a quantifiable share of energy during the day time and night, depending on the energy requirements from the users and the duration of energy use
- Most significant Consumer user has been allowed the smallest charge portion of the remaining SOC to be used at night
- Smallest energy user has been allowed a bigger charge share of energy.
- Formula can be applied to any grid size and amount of power users

**QUESTIONS**

