

# DC Nanogrids: A Low Cost PV Based Solution for Livelihood Enhancement for Rural Bangladesh

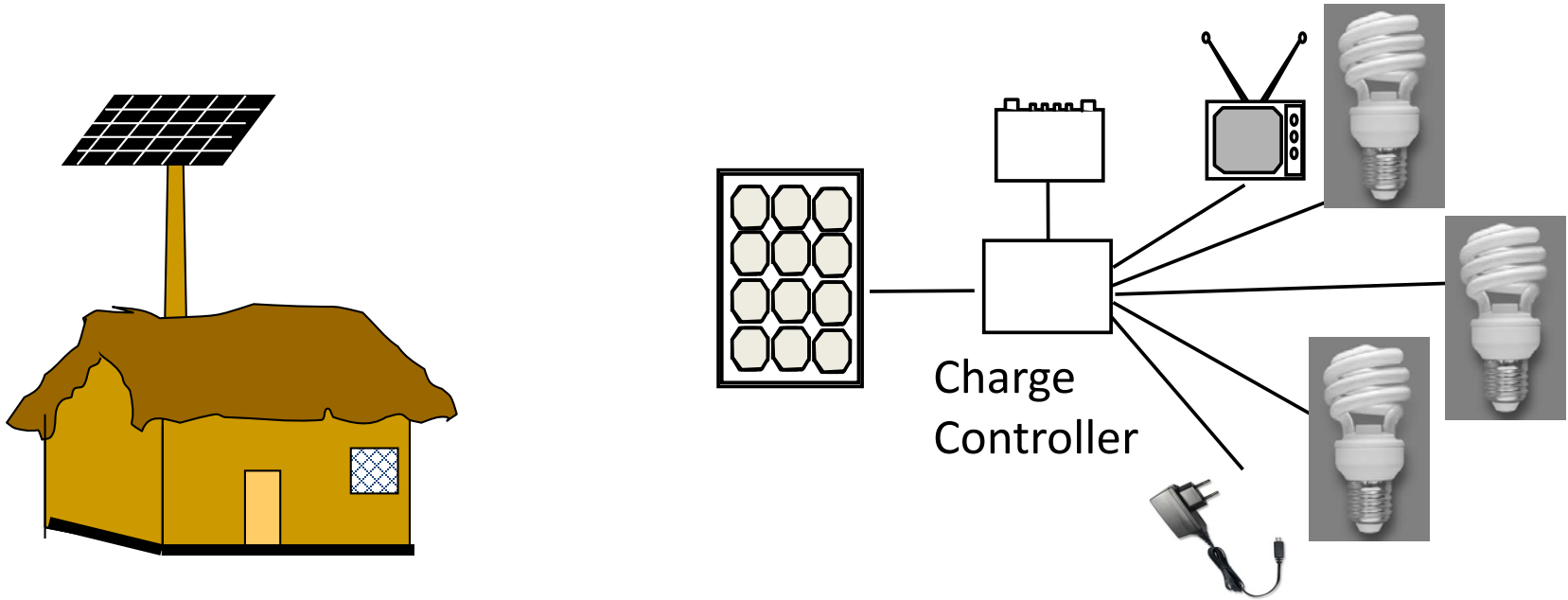
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# Solar Home System: A Success Story



- SHS is simple and competitive for home lighting costs against kerosene lamps
- It provides opportunity to have access to entertainments like TV
- It gives them access to low power hi-tech gadgets like lap tops
- Provides opportunity for mobile phone charging

# SHS: Limitations

- Main disadvantage of SHS is its low energy output
  - Fans cannot be used in hot summer months
  - Facilities like irrigation, the most important requirement for the agro-sector, is not possible
  - Excess energy produced during bright summer months is wasted

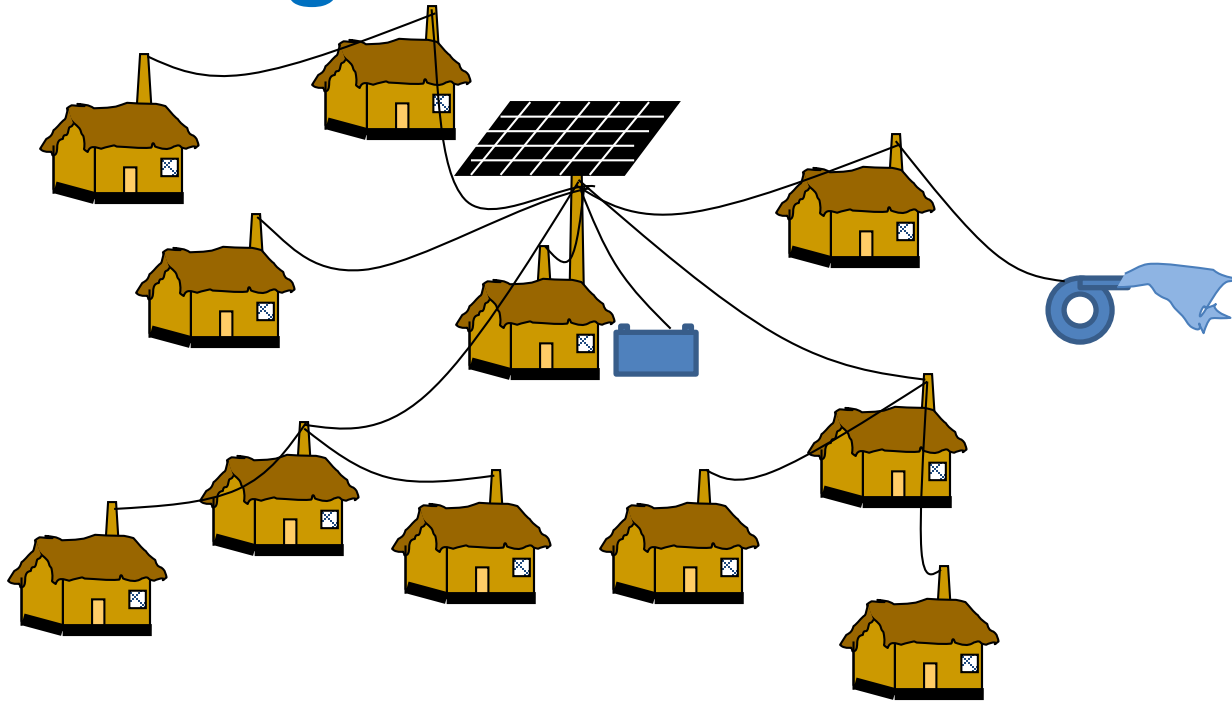
# Some Important Observations

- Typical load demand in a rural house hold in Bangladesh is less than 100W: Typically 3x5W lamps, 2x15W fan and one 25W TV
- Other than household usage, irrigation is the most important energy consuming sector. Irrigation is, however, a seasonal need
- In rural Bangladesh houses are clustered together and there can be 15-20 households within a radius of 100m

# Nano-grid: A Community Based System

- If a larger PV installation serves 15-20 households, there can be following benefits
  - Average installation cost per Wp is less
  - Better designed systems possible with additional facilities like irrigation during the bright summer months
  - Battery size can be reduced significantly
  - Unlike mini/microgrids, no transmission line needed

# Nano-grid: The Basic Concept



- A PV system of around 1.5-3.0kWp is placed at a convenient location
- A battery bank (~ 500-700AH, 12V) is placed close by
- 10-20 households are connected to the system
- One small pump is connected to irrigate around 5-10 acres of land

# DC Nano-grid:A Proposition

- No inverter is used
- PV panels will be connected in series to generate higher voltage (like 220V)
- Pumps will run from 10.00 am to 2.30pm directly from PV during the bright summer months. Rest of the time the PVs will charge the batteries. This ensures lower energy cost for irrigation.

# Why Irrigation is so Important??

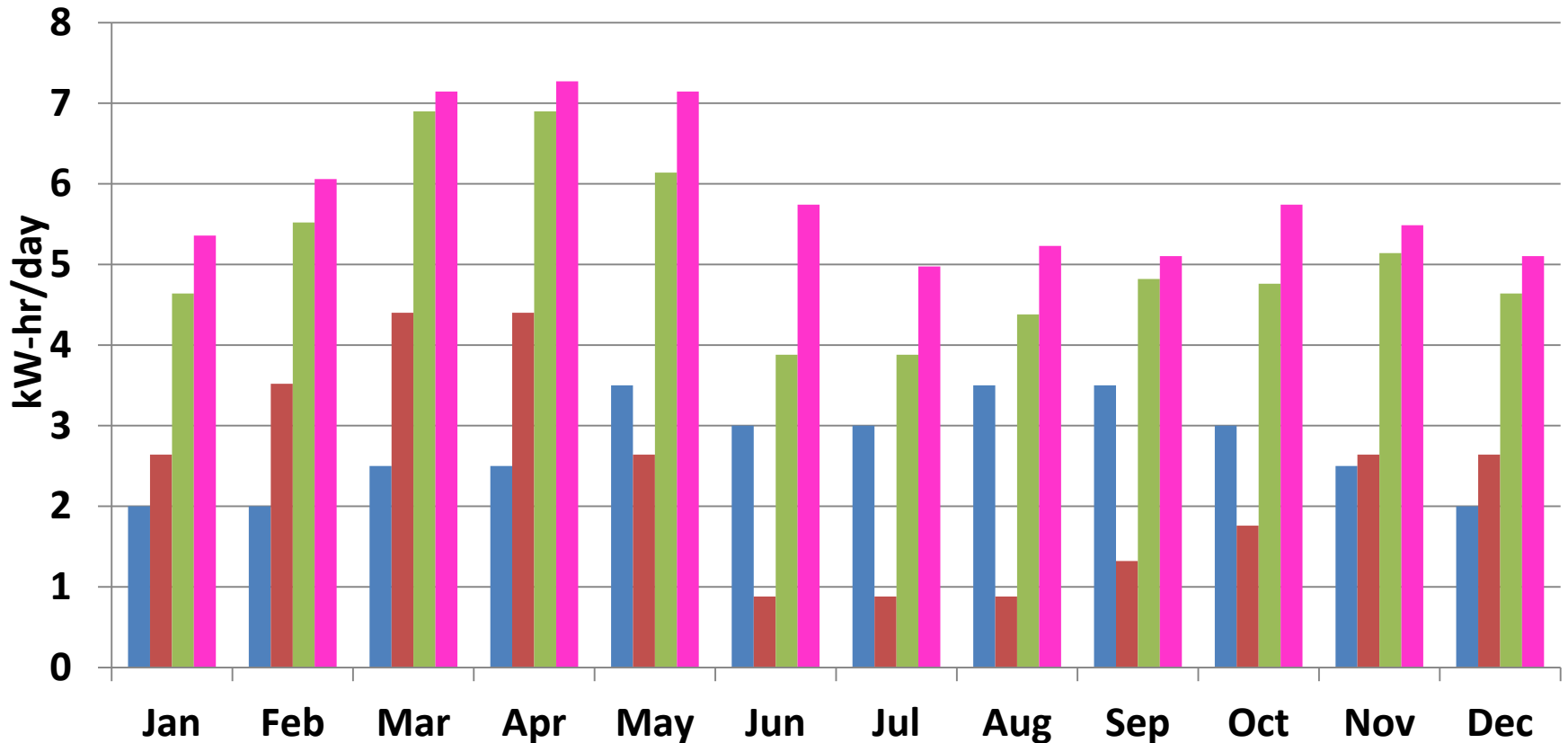
- Bangladesh is predominantly an agricultural country and agriculture is the main source of livelihood in rural areas
- Irrigation is a necessity for crop production in dry months, the main cropping season
- There are 1.7m diesel pumps used for irrigation in Bangladesh costing USD 1.0bn
- Irrigation water costs around 20-25% of the crop produced



# Nano-grid System Energy Balance

Estimates for 1.9kWp PV, 10 households and one 1.1kW pump

■ Load HH   ■ Load Irr.   ■ Total Load   ■ PV energy at load



# Energy cost

- Based on IDCOL type financing (50% grant, 30% loan at 6% interest, 20% equity) the energy price is
  - For House holds – USD 0.35/kW-hr
  - For irrigation – USD 0.19/kW-hr
  - Meter charge USD 2.5/month
- Average bill per household per month – USD 4.4
- Average irrigation energy cost per season – USD 87.5  
(less than 10% of the price of crop produced)

Thank you