Towards 100 GW Solar Capacity in India

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Challenges in Centralised Solar deployment

- Centralised Solar Plants [80% deployments]
  - At about Rs 2.40 per kWh, competes well with thermal power plants

- Concerns about Business viability?
  - Are the plants really viable at this low price?
    - Have we bid too low and will land up like telecom!
  - Panels obtained at $0.25 to $0.30 per W: is there dumping!
    - Are they using the good-quality solar-panels?
    - Will the delivery really take place? Or will the projects be left incomplete?

Are we going to import 100 GW equipment?

- Concerns about Indian Manufacturing
  - Solar Panels
    - Can Indian manufacturers compete even with anti-dumping duties?
    - Are their quality concerns?
    - Have they been upgrading their technologies?
      - Polysilicon: Siemens Reactor or FBR?
      - Slurry based cutting or Diamond-cut Wafers?
      - BSF Multi-crystalline cells or PERC / HIT mono-crystalline cells?
  - Inverters
    - When will we make our own Inverters and be able to compete in cost / quality terms?

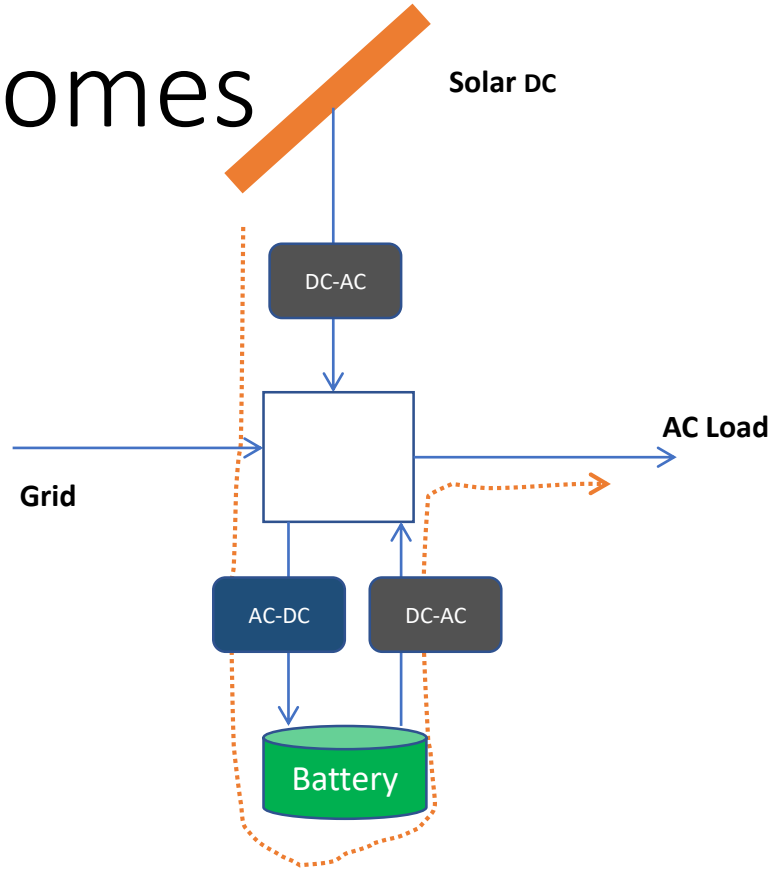
Centralised plants Concerns –grid balancing

- A medium term concern, as the share of renewable power on the grid increases
- Will we be able to use all the power?
  - Power available only when sun is there!
    - Power needs to be consumed instantly on generation: matching demand with supply at every instant
  - Should we add storage? What is the price of stored solar power?
    - Rs 10 per kWh?
  - How much storage to use?
    - What would be the effective price per kWh?

Decentralised Solar Installations [20% share]

- Office and Industry Deployments: greater than 10 kW solar
  - Business viability exists
  - Grid connected with Reverse metering
  - Business can save on Power bills
    - Indian PV manufacturers can win: some quality concerns remain
    - Quality concerns with deployment remain: Would require remote monitoring and accounting to ensure quality
    - Inverters still largely imported!
    - Bi-directional meters imported
- Homes and Small Office deployments
  - Not doing well: makes little business sense!

For small solar deployments at homes

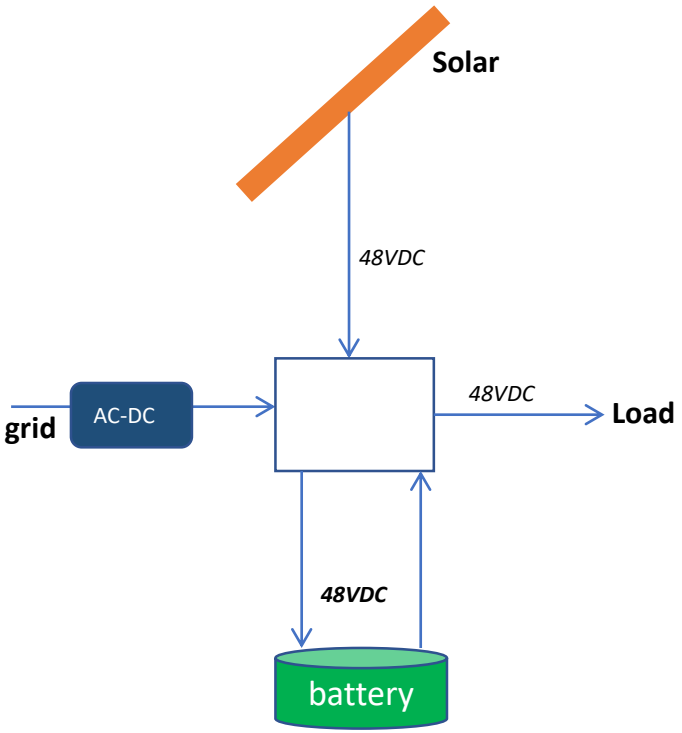


- Losses kill the systems at 200 Watts Solar
  - Solar gives DC output: conversion to AC is 15% loss
  - Solar will require battery back-up
    - Batteries use DC: conversion to DC has 15% losses
    - Battery output is DC: Conversion to AC has 15% losses
  - Total Losses is 45% + battery losses
- Appliances are now all DC
  - LED lighting, all electronics use DC input: conversion has 10% to 30% losses
  - Induction motor fans alone uses AC: BLDC /SR motor fans consume 30W as opposed to 72W for AC fans: uses only DC

Volume prices similar for fans

LED tube life much longer (DC powering enhances reliability)

Are we ready to take a leap and move to Solar-DC



- AC Vs DC debate took place between Edison (for DC) and Tesla (for AC)
  - AC won because of lower losses for transmission after the advent of transformers
- Is it time to move over to DC Micro-grid at homes and offices for the same reasons: Lower Losses?
  - Can India take lead: will solve access problems, enable solar-homes to flourish
- Solar –DC connected to grid
  - Solar Panel
  - Battery
  - DC Appliances
  - Highly efficient usage of Power
    - Low-power from grid alone converted from AC-DC

DC Microgrid for home: Solar-DC Inverterless

125W panels
- Upto 500W

Designed as an expandable product, still keeping losses low

230V AC

125W to 500W 48V DC (and possibly 150W uninterrupted AC) Power with BLE prepaid recharge

Monitored using Bluetooth / GPRS

1 kWh VRLA or 0.5 kWh Li Ion battery
- Up to 5 kWh possible

Solar-DC deployment in 15000 homes

- Electrified 4000 off-grid homes in Jodhpur and Jaisalmer districts of Rajasthan
  - Tough terrain, no road connectivity, sandstorms, lack of local resources
- 30000 homes in Assam and Manipur is getting done up in hills
- Deployments in eight states in one or two villages each with on-grid
  - Where power situation is bad
- Deployment widely at IITM homes, hostels, lecture hall Complex
  - IIT Tirupati and IIT Kochi also using




Conclusion

- If 100 GW solar in near future and 500 to 800 GW solar in ten to 15 years is to happen
  - Great progress so far with Centralised Solar
  - Several issues, including Make in india has to be handled

- Decentralised Solar will need a new thrust
  - Will not only add to solar PV target
  - But also a solution for India's electricity access