

# 08-Off-Grid Architectures

*Off-Grid Electrical Systems in Developing Countries*

Chapter 4.5–4.12

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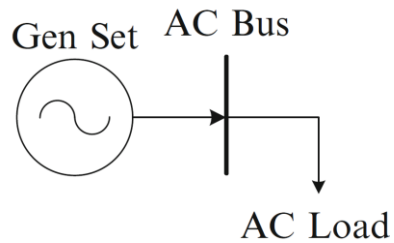
## Learning Outcomes

At the end of this lecture, you will be able to:

- ✓ Understand the common architectures of off-grid systems
- ✓ Identify the components responsible for voltage and frequency regulation and battery charge management

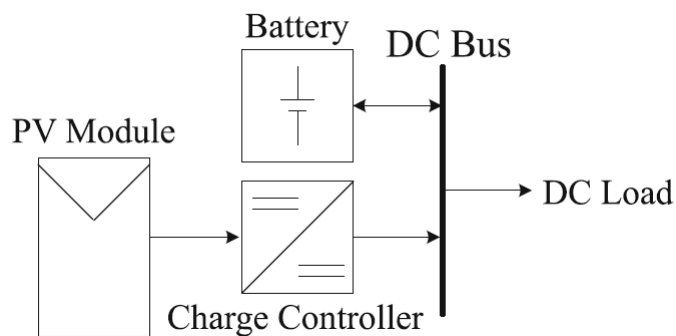
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## Conventional or Biomass Gen Sets



What component is responsible for voltage/freq. regulation?

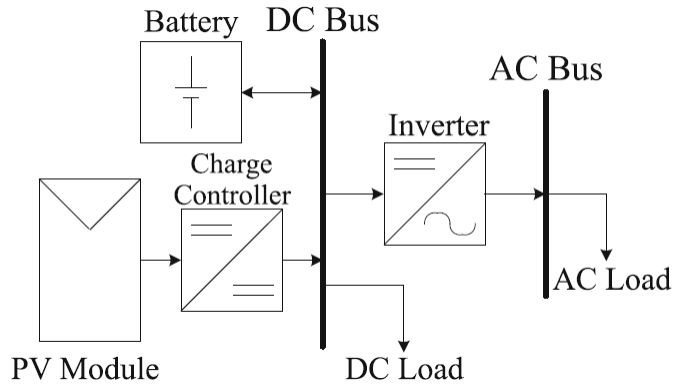
## Photovoltaic System with DC Load



# Photovoltaic System with AC Load

What component is responsible for voltage/freq. regulation?

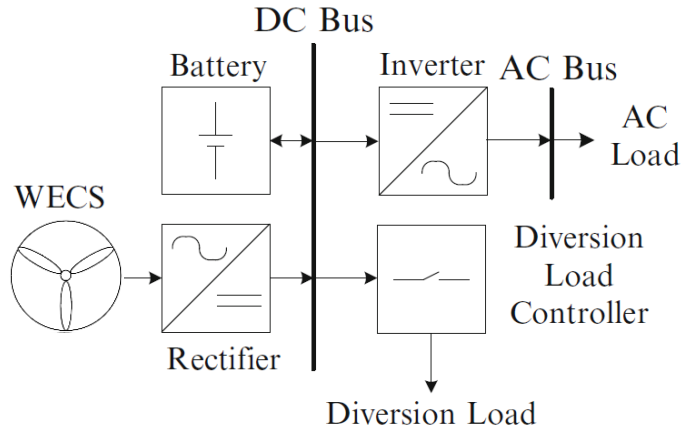
What component(s) is responsible for battery charge management?



# Wind Energy Conversion Systems

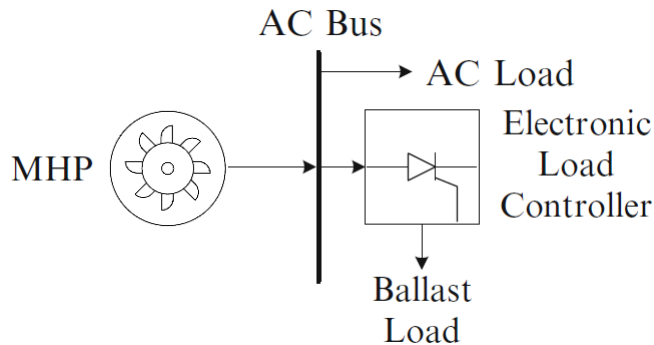
What component is responsible for voltage/freq. regulation?

What component(s) is responsible for battery charge management?



# Micro Hydro Power System

What component is responsible for voltage/freq. regulation?

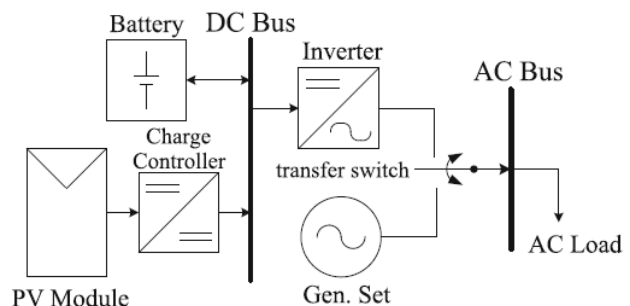


# Hybrid Systems

- Recall that hybrid systems incorporate two or more different energy sources
- One source is often, but not always, a gen set

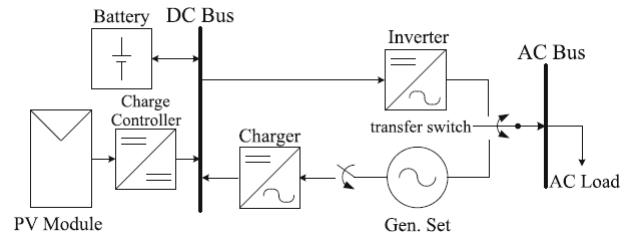
# Hybrid Systems: Switched Architecture

- Gen set is used as a back-up supply in case battery state-of-charge is too low
- Load is supplied by EITHER inverter or Gen Set (not both)
  - no need to synchronize
- Inverter is not bi-directional



## Hybrid Systems: Switched Architecture with Battery Charging

- Separate AC charger enables gen set to recharge battery



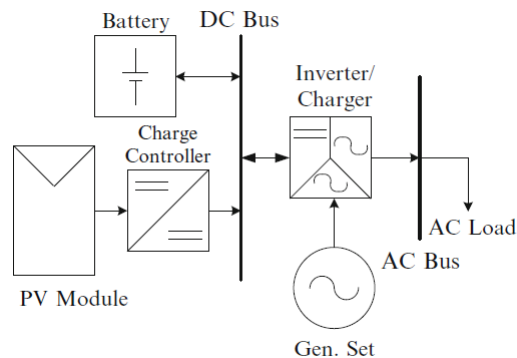
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## Hybrid Systems: Switched Architecture with Battery Charging

- Inverter is bi-directional and can synchronize with gen set
- Gen set power to recharge battery and/or supply load
- Gen set and inverter can simultaneously supply load



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# Hybrid Renewable System

- Two or more different renewable power sources
- Used when sources have complementary characteristics
- Example: sunny during the daytime and windy in the evening



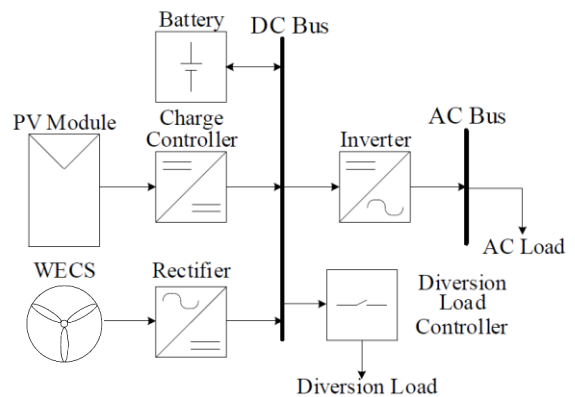
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# Hybrid Renewable System

- PV module and WECS are DC-coupled
- Battery managed by charge controller and diversion load controller



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# Contact Information

Henry Louie, PhD

Associate Professor

Fr. Wood Endowed Research Chair

Seattle University

 @henrylouie

[hlouie@ieee.org](mailto:hlouie@ieee.org)

[www.drhenrylouie.com](http://www.drhenrylouie.com)

Office: +1-206-398-4619

