Alternative Energy

Chapter 7: Basic concept of hybrid system

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Chapter Description

- Expected Outcomes
  - Explain the basic concept of hybrid system

Overview

- **Introduction to Hybrid system**
- **Hybrid system – Advantages and Disadvantages**
- **Basic configuration**
- **Components of hybrid power system**
- **Example of hybrid system**

Hybrid system

- Combination of two or more types of system energy sources to produce electricity.
- The system for electricity generation can utilize renewable energy sources such as photovoltaic, wind turbines, wave energy, solar thermal, biomass, hydroelectric or power stations, etc.
- In addition, fossil fuel power plants (e.g. diesel generators, fuel cells or gas turbines etc.) are also can be added.
- The hybrid system size can be several watts up to several megawatts.

Advantages of Hybrid Power Systems

Advantages

- **Reduce fuel consumption** – the operation of diesel generators become more efficient and lower fuel consumption when combining with RE system
- **Low life-cycle cost** – compared to the system using a single power generation (stand-alone PV system or diesel-only power system)
- **Increase system reliability** – independent hybrid power systems provide redundancy and possibly greater overall reliability if the system is properly controlled and maintained.
- **System design flexibility** – a hybrid system depends on the load mix between the genset and the RE resources. (example: the size of the PV array increases, the operating time of the genset goes down, thus lowering the system maintenance as well as prolong the generator life)
- Can be the **most economic** option **–** since the fuel cost is quite expensive while the RE sources is continuously available.
- **Reduce the impact on environmental**

Disadvantages of Hybrid Power Systems

Disadvantages

- **Additional investment cost** – high cost for RE technology and components (batteries, power electronic and control circuits etc.)
- **Limited experience** –local users and supply utilities with RE and hybrid power system technology.
- Generally the systems are more **complex**.
- Require **life-cycle economic analysis** – need detailed power system simulation.

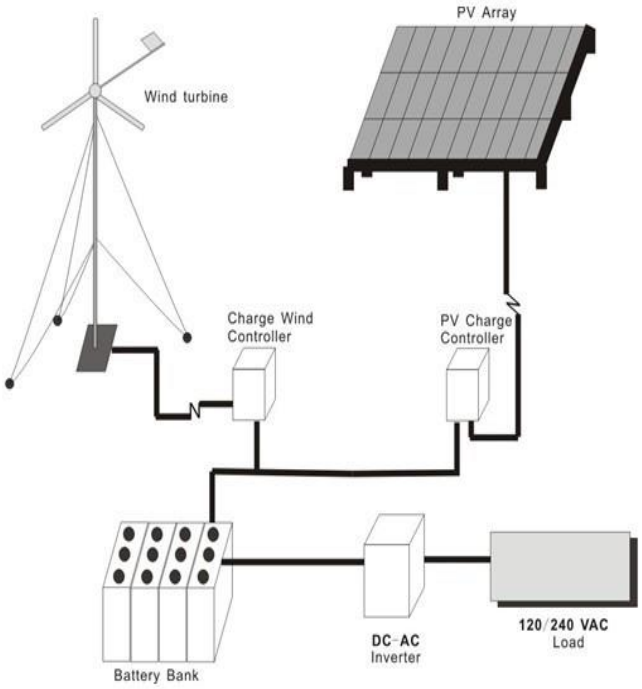
Basic configuration

- General configuration of Hybrid RE system :
  - Mainly based on fossil fuel generators with RE technology used for reducing fuel consumption
  - System mainly relying on RE source with a fuel generator used as a backup supply. Usually used for an extended periods when low power generation from RE or during high load demand.

Components of Hybrid Power System

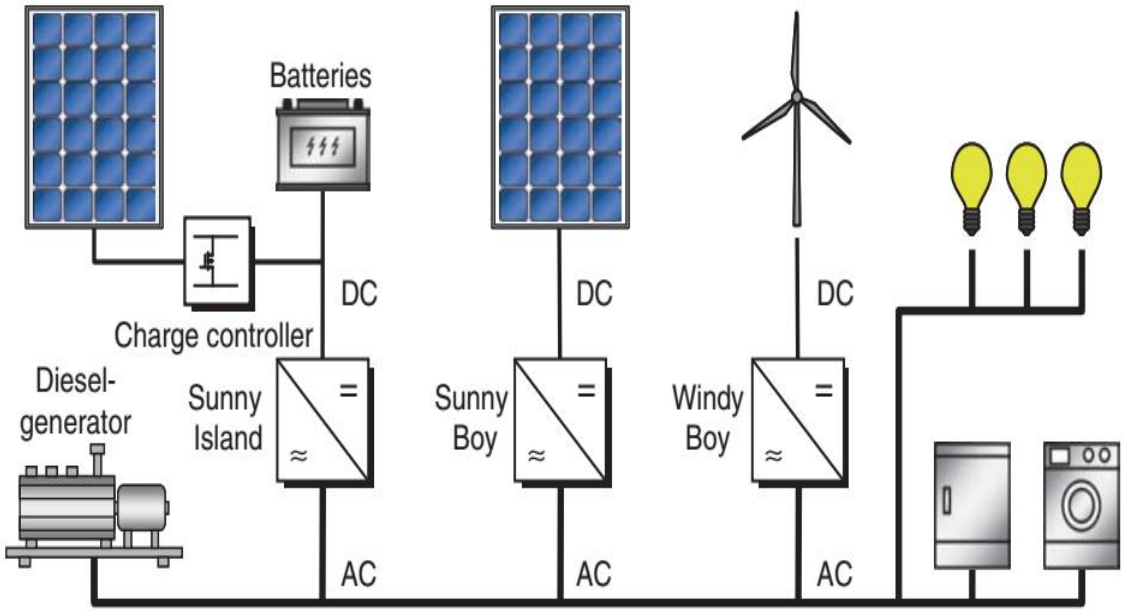
Typical hybridPV system consists of:

- RE sources (eg. PV, wind turbines, biomass, hydro etc.)
- Engine generators (eg. diesel engine);
- Power conditioning and control equipments (inverter, charge controller).
- Battery storage



Example

- Hybrid PV systems can be developed either in pure DC systems, mixed DC/AC systems or as pure AC systems.
- For larger power plant, the system is pure AC systems as they are very flexible and can be easily extended.



Arrangement of a hybrid PV system with pure AC coupling of generators and consumers


спасибо
谢谢
GRACIAS
THANK YOU
ありがとうございました
MERCI
DANKE
धन्यवाद
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