UNIVERSITY OF LEEDS

Section 4
Microgrid electricity generation

Contributors
James Hammerton, Hu Li, Zahida Aslam, Andrew Ross, Valerie Dupont, Rolf Crook
School of Chemical and Process Engineering
Kang Li
School of Electrical Engineering

Section Contents

UNIVERSITY OF LEEDS

Conventional diesel gen-sets
- Advantages
- Fuel costs

Biomass potential (incl. biofuels)
- Availability, intermittence, reliability
- Technical expertise
- Available datasets

Solar potential
- Availability, intermittence, reliability
- Technical expertise
- Available datasets

Micro- Wind/micro-hydro

Microgrid electricity generation Introduction

Microgrids

UNIVERSITY OF LEEDS

A microgrid

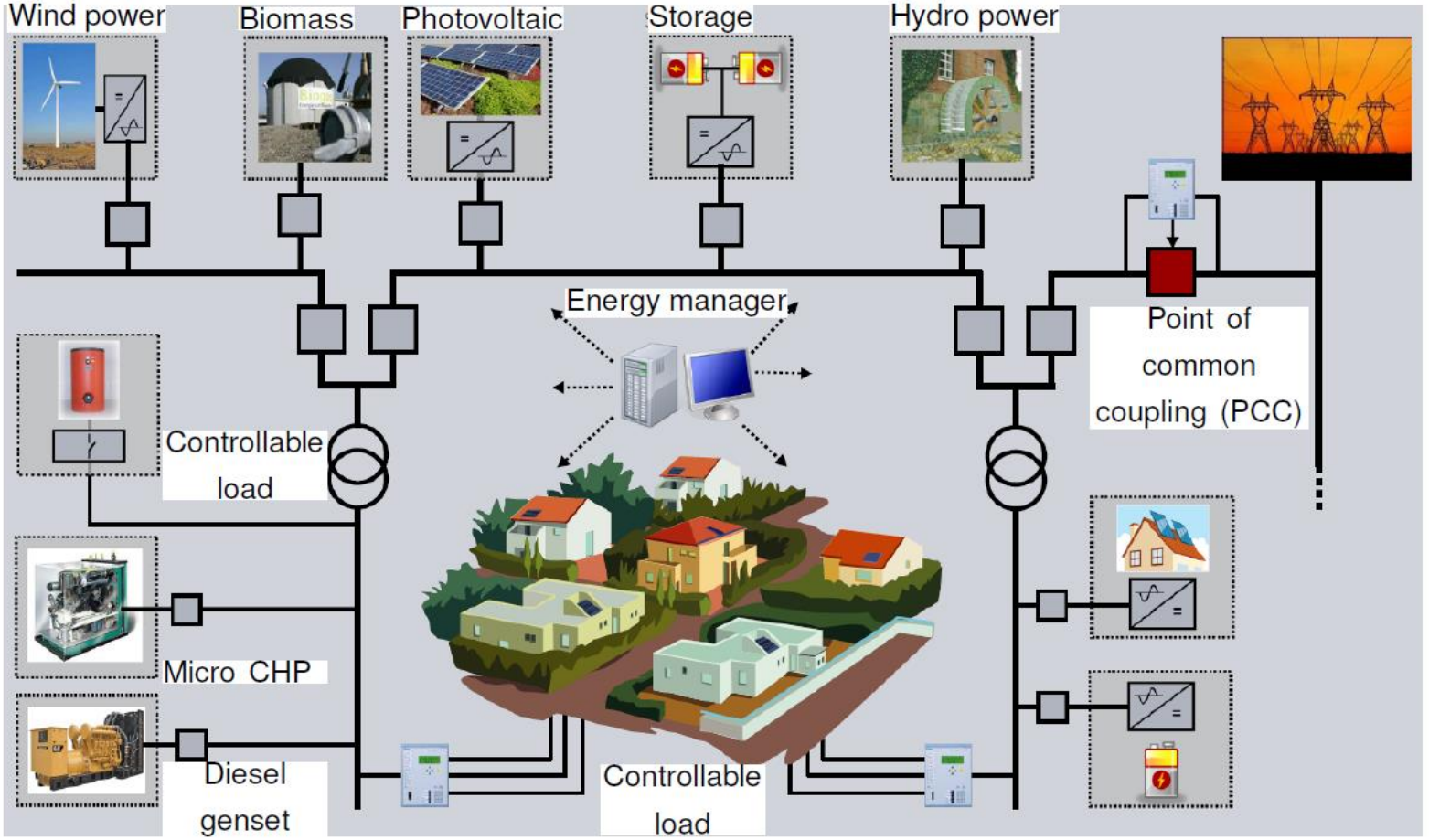
- A part of a larger electrical network that can be controlled by a local operator
- Consists of conventional and renewable generation units, storage devices and loads
- Can typically be operated grid-connected and in islanded mode

Main goals

- Efficient integration of renewable energy sources
- Simplify coordination and control tasks in networks with large share of DG units
- Reduction of energy costs through appropriate energy management
- Increase reliability within the microgrid

Microgrids

UNIVERSITY OF LEEDS



Microgrid generation

UNIVERSITY OF LEEDS

- Power generation to microgrids is commonly provided by small scale generation including renewables (solar PV, Wind, Micro hydro) and Gen-sets fueled with either fossil diesel or biofuels.

- Renewable generation (e.g. wind and solar PV) are both intermittent and seasonal resulting in a constant variation of wind speed, wind direction and irradiation.

- These varying characteristics of the renewable generation resources result in varying electrical power output which need to be managed in the microgrid design.

- Generators can be used to manage the fluctuations in renewable power output in hybrid systems as well as integration of energy storage.

- Generators can operate on Diesel or biofuels including both liquid biofuels (e.g. vegetables oils, biodiesel or bioethanol) or Gaseous fuels (e.g. biogas or syngas).

Renewable energy generation
Solar

UNIVERSITY OF LEEDS

- Once setup needs little intervention
- Batteries for evenings and cloud cover
- Tracking and non-tracking systems used
- Regions with poor electrification usually sunny
- Panels usually imported
- Not necessarily technical capacity

Renewable energy generation
Wind

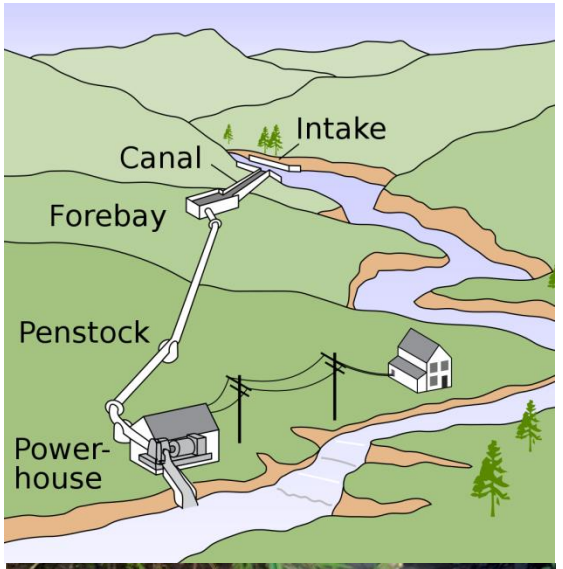
UNIVERSITY OF LEEDS

- Installed with battery or another generation source
- Provides intermittent supply but can meet night loads
- Need dedicated technicians

Renewable energy generation
Microhydro

UNIVERSITY OF LEEDS

- Possibly the go-to option if possible
- Range from several watts to megawatts
- All-day power
- Automatic
- Can have issues with rainy/dry seasons



Non-renewable energy generation
Diesel generators

UNIVERSITY OF LEEDS

- Cheap to buy and flexible
  - Great for backup
- High operational costs
  - Cost of fuel particularly high in rural areas
- Common in any instance where 24 hour uninterrupted supply is needed
- Spare parts available anywhere in the world
- Automatic