CHAPTER 11

Polygeneration systems in industry

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11.1 Introduction

The global energy demand is increasing steadily with the increasing population and improving living standards. Coal and oil will continue to cater to the majority of total global energy demand for several upcoming decades [1]. Though fossil fuel-based energy systems are reliable and economical, emissions from fossil fuel-based energy conversion units are an issue of great concern. It is observed that in the year 2017, the global energy production value was close to 14,035 Mtoe (millions of tonnes of oil equivalent), which was appreciably higher than that in the year 2000, which was close to 10,019 Mtoe [2].

Greenhouse gas emissions must be reduced for a safe and sustainable future. The European Union (EU) has fixed a target to reduce the emission of greenhouse gases by 20% in 2020 [3] and 40% by 2030 [4] relative to the level of 1990. Replacing fossil fuel-based systems with renewable ones will help to reduce the emission of greenhouse gases. The EU has targeted ensuring a 20% share for renewable energy systems by 2020 and a 32% share for renewable energy by 2030. However, in the year 2017, only 13.5% of the global energy supply was from renewable and biofuel resources [2]. On the other hand, coal and oil catered to about 59% of the global energy demand in that year. Thus the use of only renewable energy will not be sufficient to address the issue of global warming.

Global energy consumption and the associated greenhouse gas emissions can also be reduced effectively by improving energy utilization efficiency. Delivery of different energy utilities may be integrated into a single polygeneration unit to ensure improved energy efficiency and hence lower carbon emissions. Decentralized polygeneration units can effectively utilize locally available renewable resources to ensure the energy security of a locality, too.

Biomass is a widely available natural resource. Thus biomass-based polygeneration has numerous possibilities. Jana and De [5] proposed to use agricultural waste in a polygeneration system to produce power, refrigeration, utility heat, and ethanol simultaneously. The same authors [6] also evaluated the technical and economic feasibilities

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