

Chapter 2

Lecture # 1-3

- **Overview**
- **Batch vs. Continuous Process**
- **The Input-Output Structure of the Process (Part 1)**

Chapter 2 Overview

Title: The Structure and Synthesis of Process Flow Diagrams

Objectives:

- 1) Show that the evolution of any chemical process follows a similar path.
- 2) Provide a framework to generate alternative PFDs for a given process.

Chapter 2 Overview

Factors determining choice of alternative route

- Cost of raw materials
- Value of by-products
- Complexity of the synthesis
- Environmental impact of waste materials

Chapter 2 Overview

Five step process to tackle a conceptual process design

- 1) Batch vs. continuous.
- 2) Identify the Input-output structure.
- 3) Identify and define recycle structure of process.
- 4) Identify and design general structure of separation system.
- 5) Identify and design heat-exchanger network or process energy recovery system.

Designing New Process:

[1-2-3-4-5]

Analyzing Existing Process:

[5-4-3-2-1]

Batch vs. Continuous

- **Batch process** is one in which a finite quantity (batch) of product is made during a period of a few hours or days.
- **Continuous process** is one in which feed is sent continuously to a series of equipment, with each piece usually performing a single unit operation.

Batch vs. Continuous

Factors to Consider (Table 2.1)

- Size
 - Batch < 500 tonne/yr ~ 1.5 tone/day
(< 2 m³ of liquid or solid per day)
 - Continuous > 5000 tonne/yr
- Flexibility
 - Batch can handle many different feeds and products – more flexible
 - Continuous is better for smaller product slate and fewer feeds

Input – Output Structure

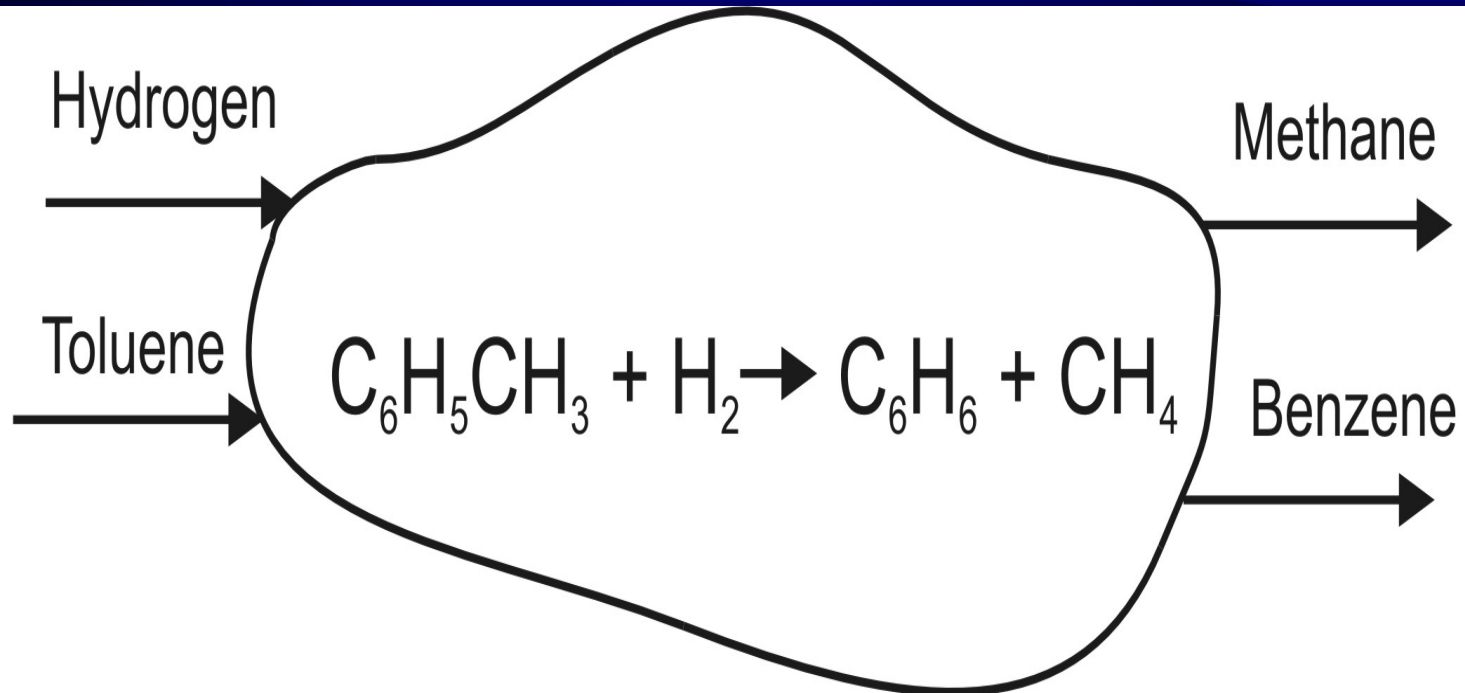


Figure 2.1: Input-Output Structure of Process Concept Diagram for the Toluene Hydrodealkylation Process

Input – Output Structure

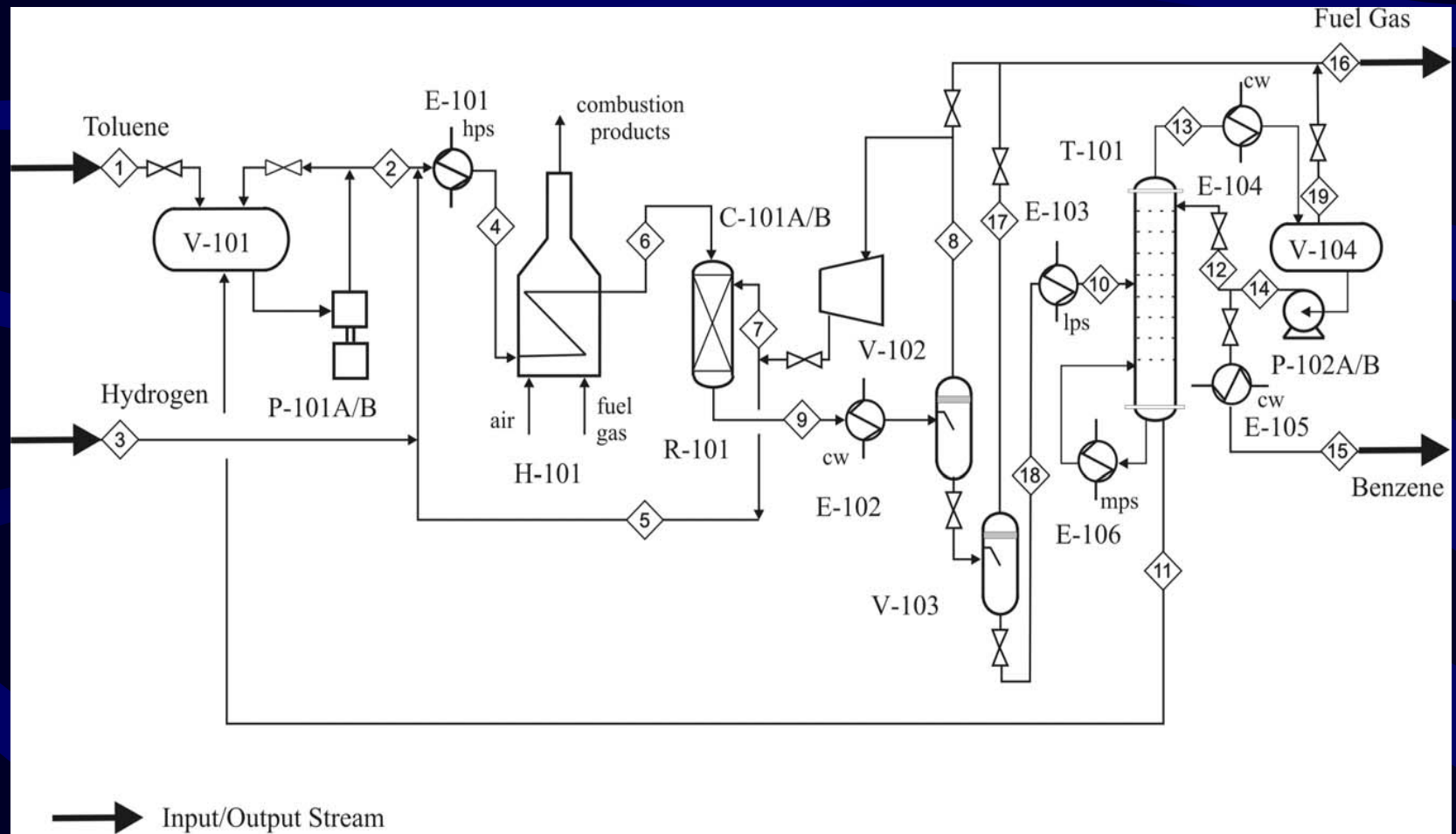


Figure 2.2 Input Output Streams on Toluene Hydrodealkylation PFD

Input – Output Structure

Important factors to consider in analyzing the overall input output structure of a PFD

- Chemicals not consumed are either required to operate a piece of equipment or are inert material.
- Any chemical leaving a process must have either entered in one of the feed streams or have been produced by a chemical reaction within the process.
- Utility streams are treated differently from process streams. Utility streams rarely directly contact the process streams. They usually provide or remove thermal energy or work.

Input – Output Structure

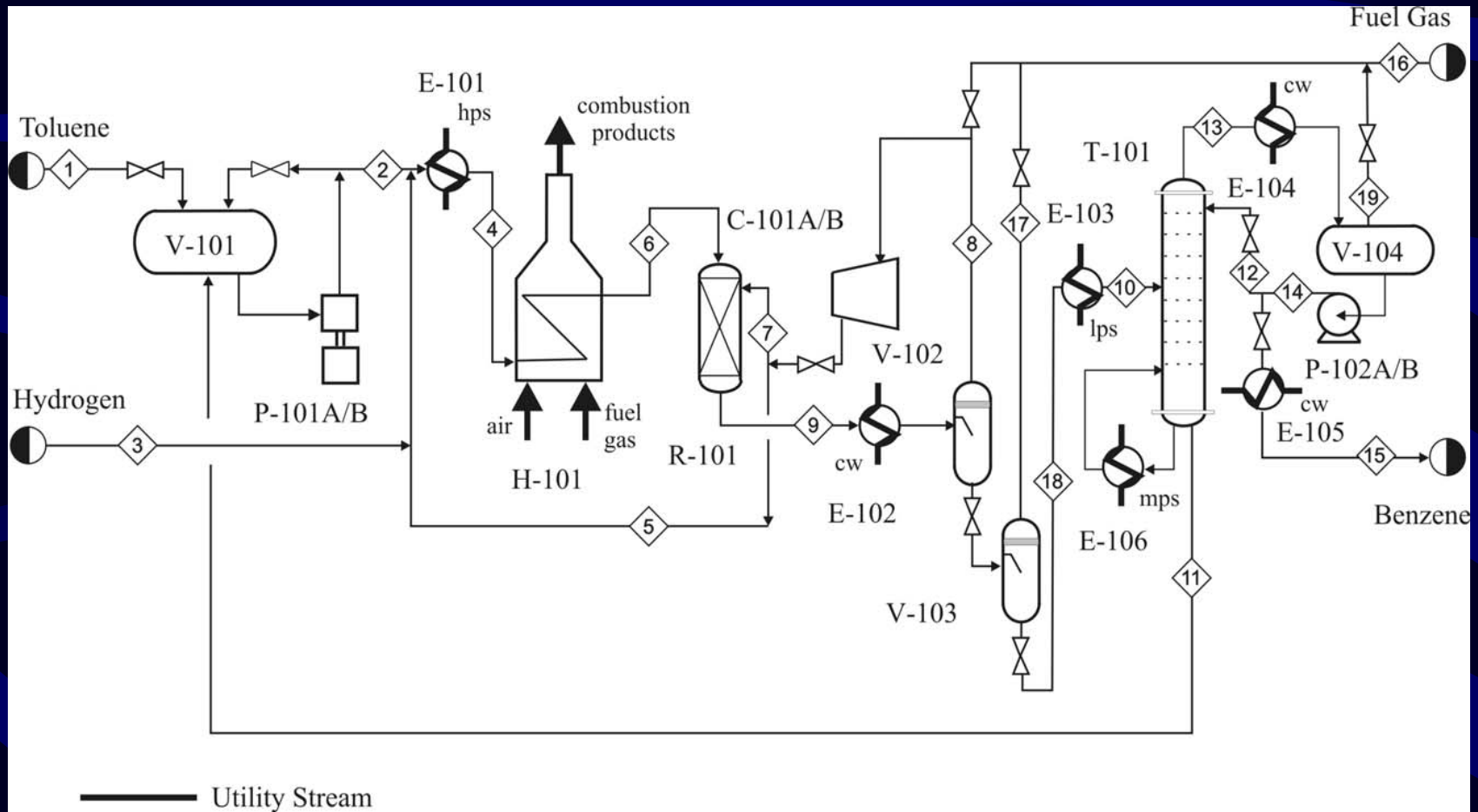


Figure 2.3: Identification of Utility Streams on the Toluene HDA PFD

Input – Output Structure

