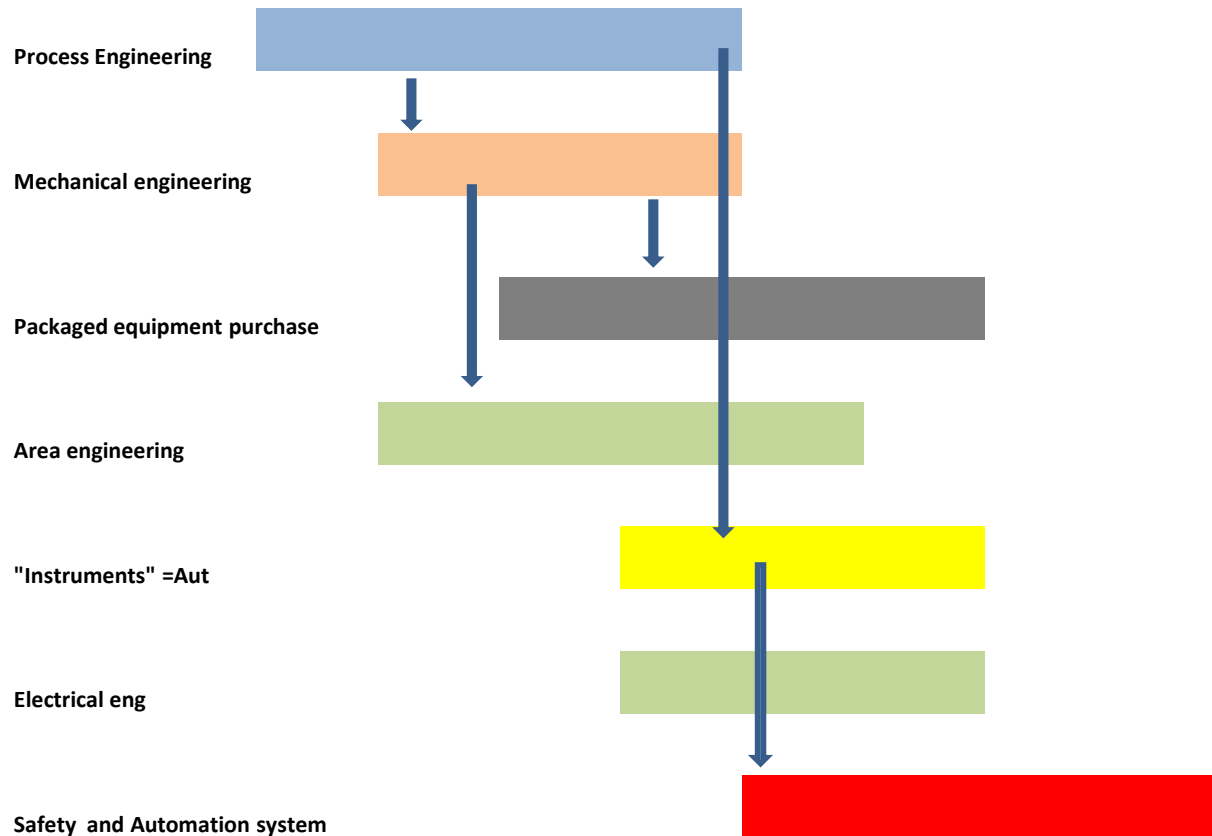


Key elements of Systems Engineering

Industrial Automation

- More than Process control/BOP as taught in PT.
- More than shown on P&IDs
- The main tool to meet project targets on:
 - Business objectives and presumptions
 - Safety
 - Manning; operations and support
 - Robustness, uptime, commissioning
 - Product quality, flexibility, feedstock/energy use
- Tight cooperation between more skills req'd.

Traditional engineering



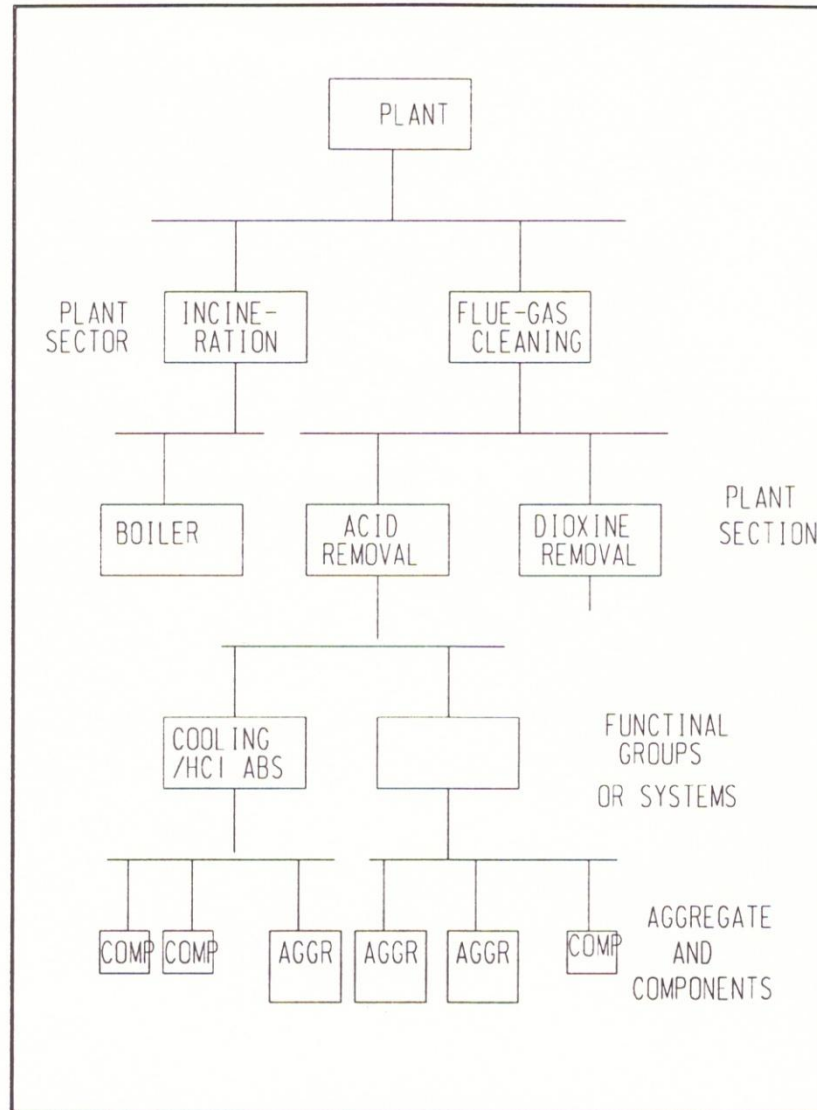
System:

- Certain parts of the world that at a certain point in time is considered by somebody to have certain interconnected things in common.
- Here: Interconnected elements serving a distinct functional purpose, having defined boundaries and interfaces.
- Functional breakdown to subfunctions and subsystems, and finally integral components

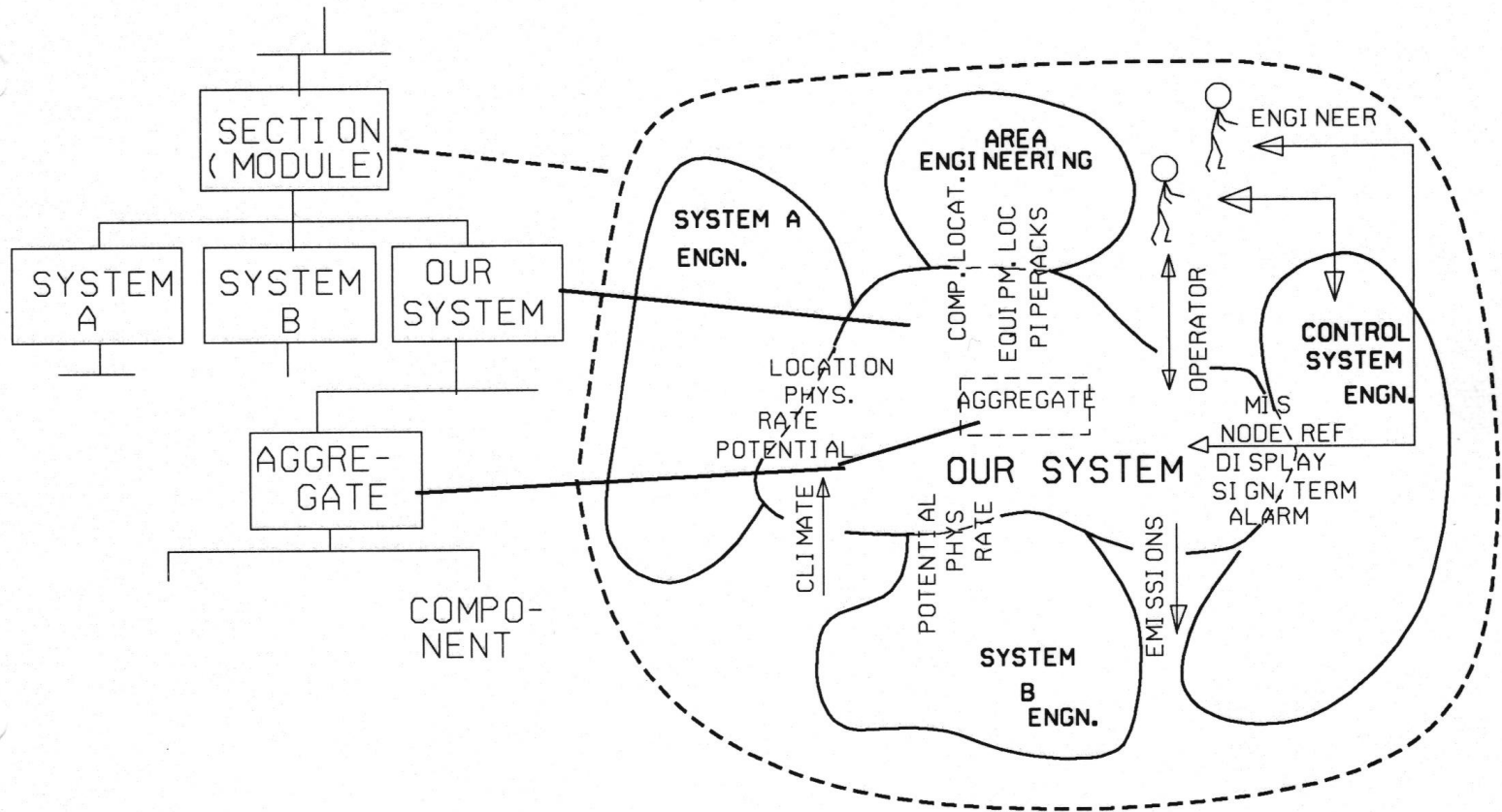
Systems Engineering

- Design systems top-down to meet main functional objectives, based on general equipment characteristics in a multi-discipline team.
- Find suitable commercial technology elements, and iterate top down and bottom up designs to give desired service/performance.
- Scrutinise behaviour for interface disturbances
- Scrutinise behaviour for critical component failure
- (Re)iterate architecture, prepare systems specification, release for volume engineering and implementation.

Breakdown structure



Interface focus



Block diagram

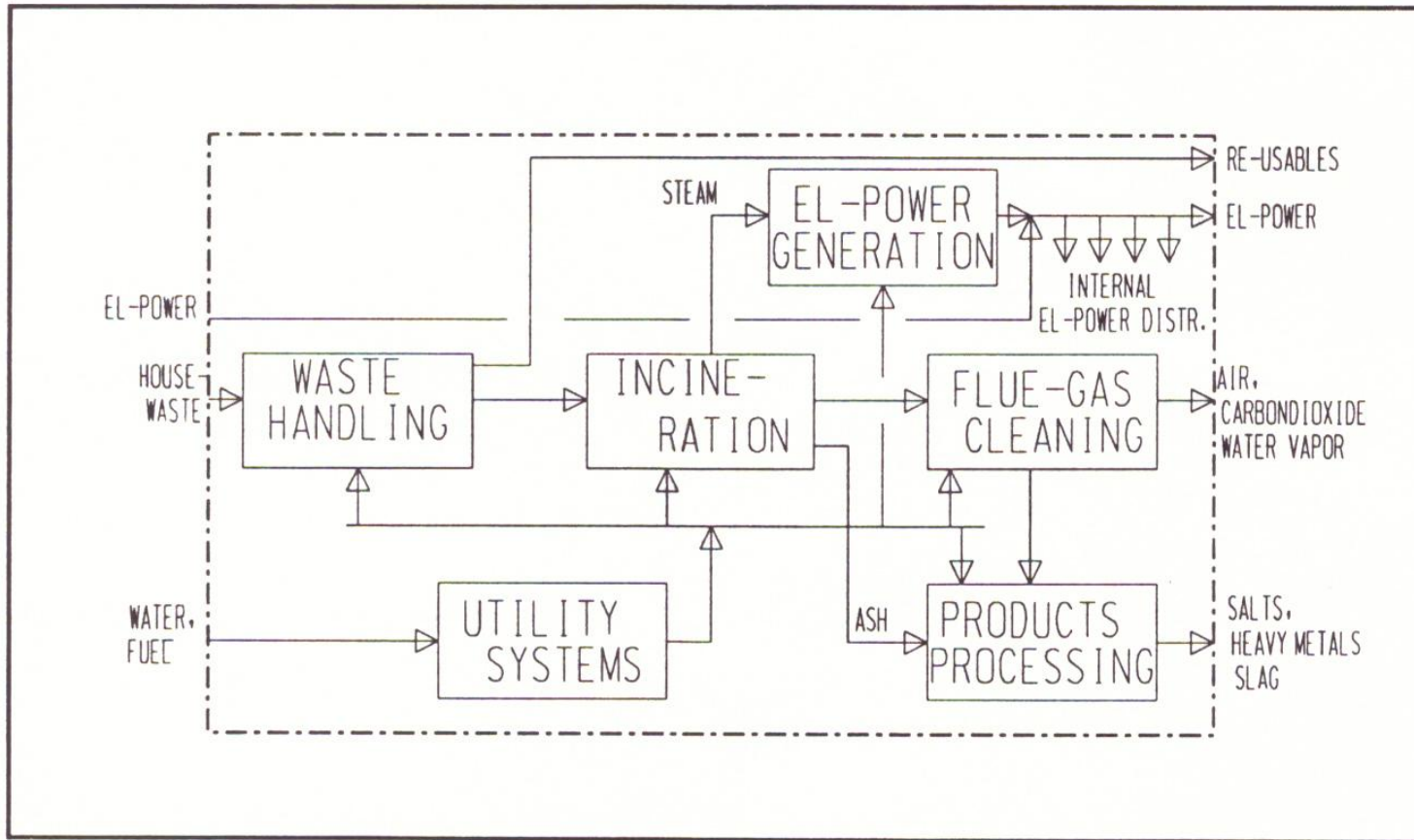
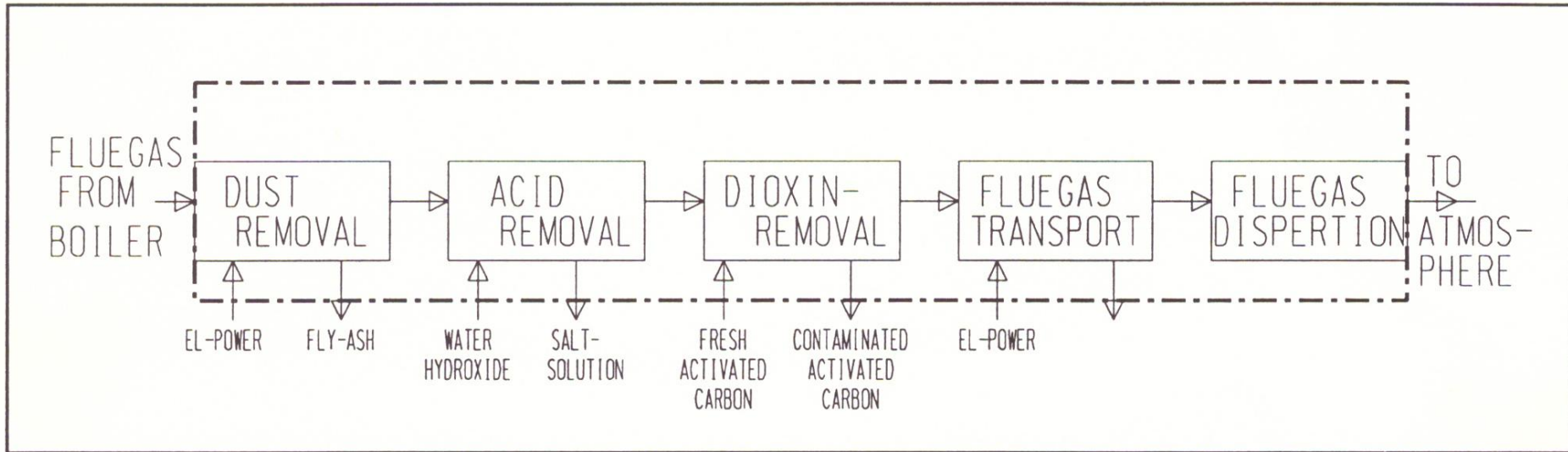


Figure 2. Waste-to-energy plant process flow.

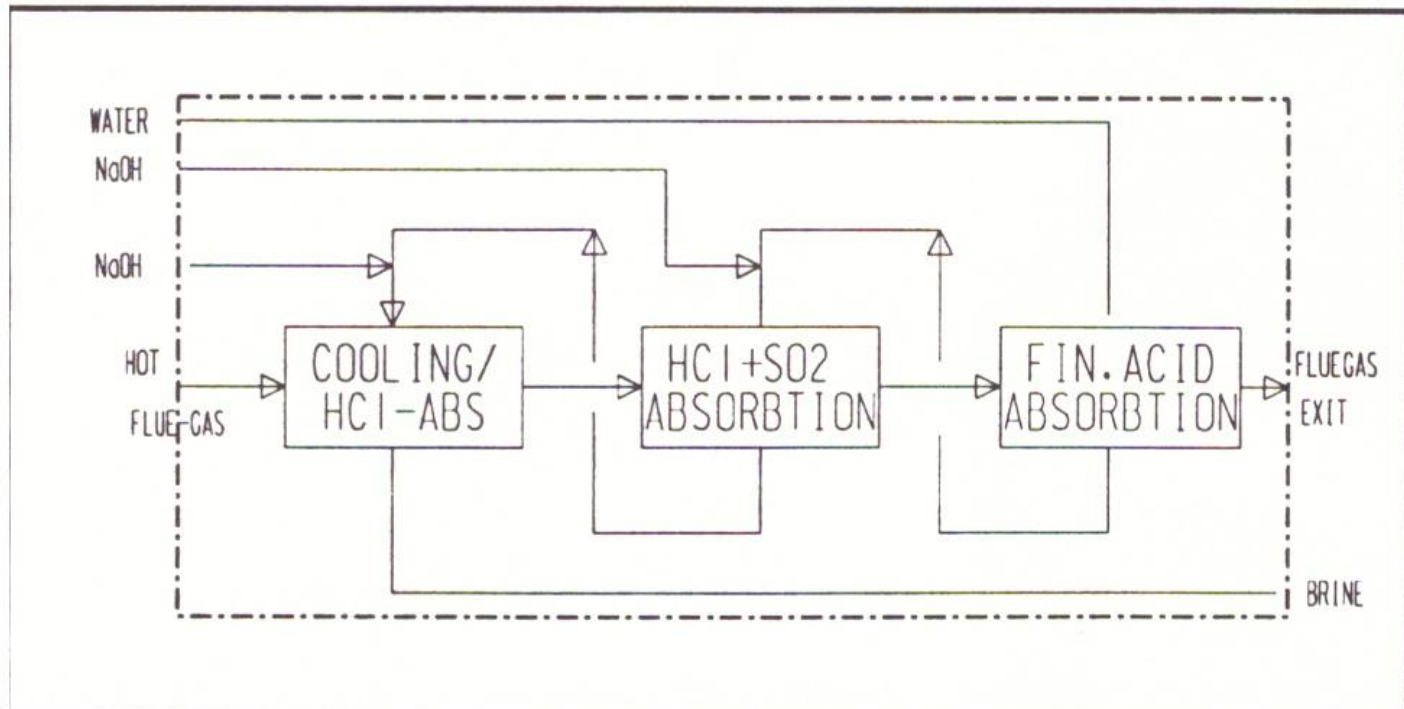
Functional breakdown

Flue-gas treatment:

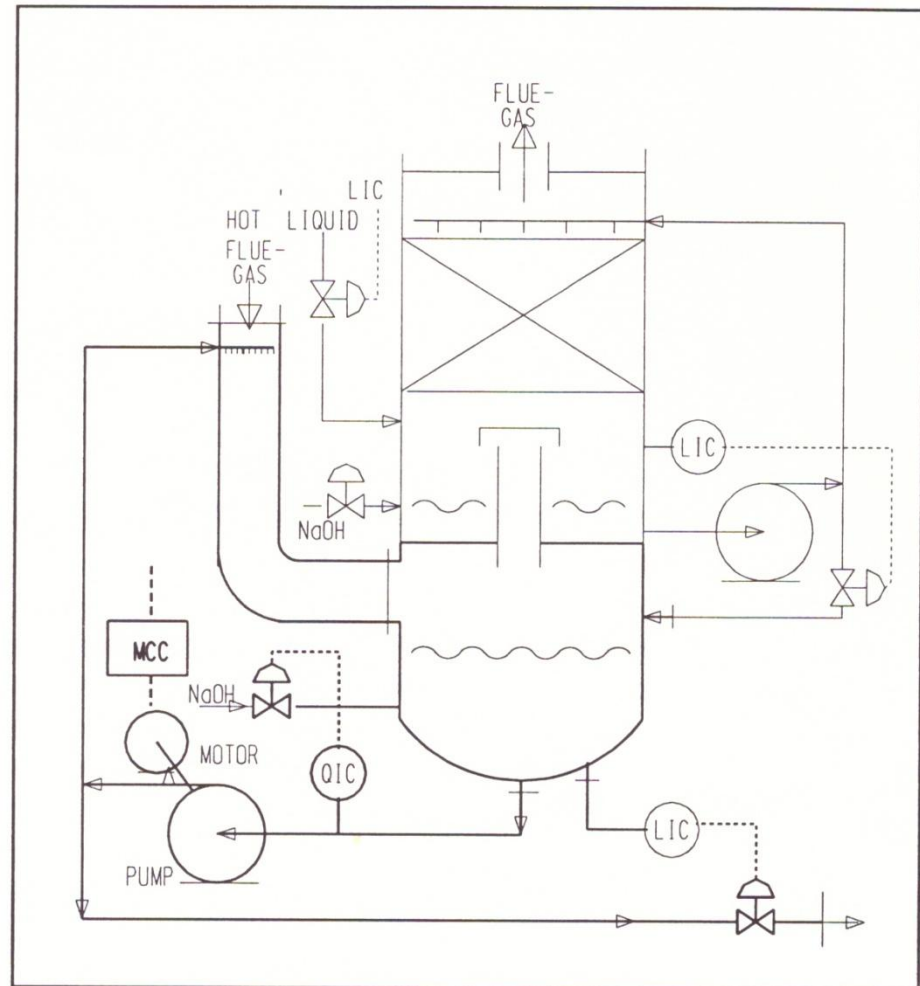


Further breakdown,

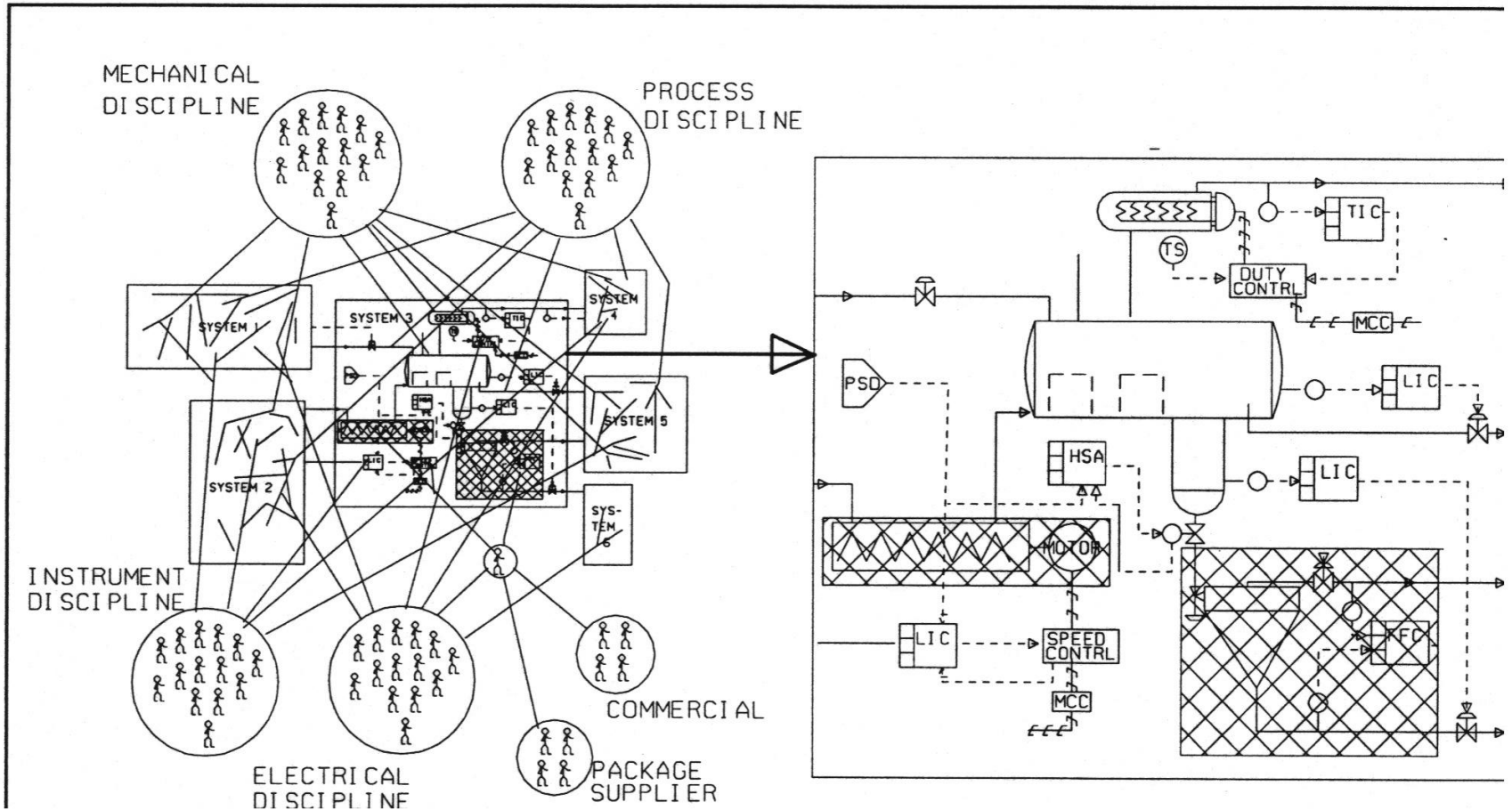
- Acid removal



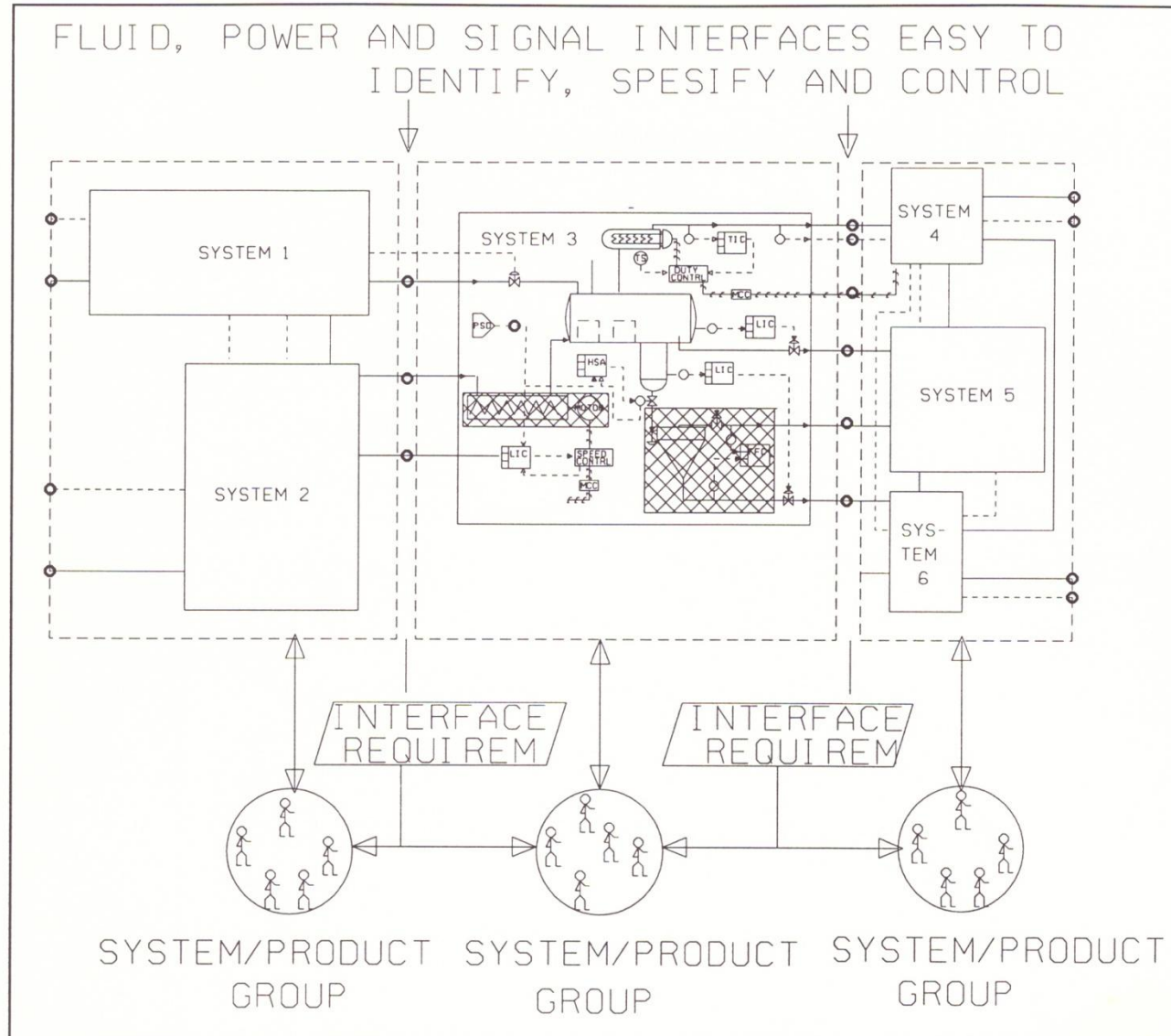
Units/components



Traditional discipline engineering



System core development



Packaged equipment integration

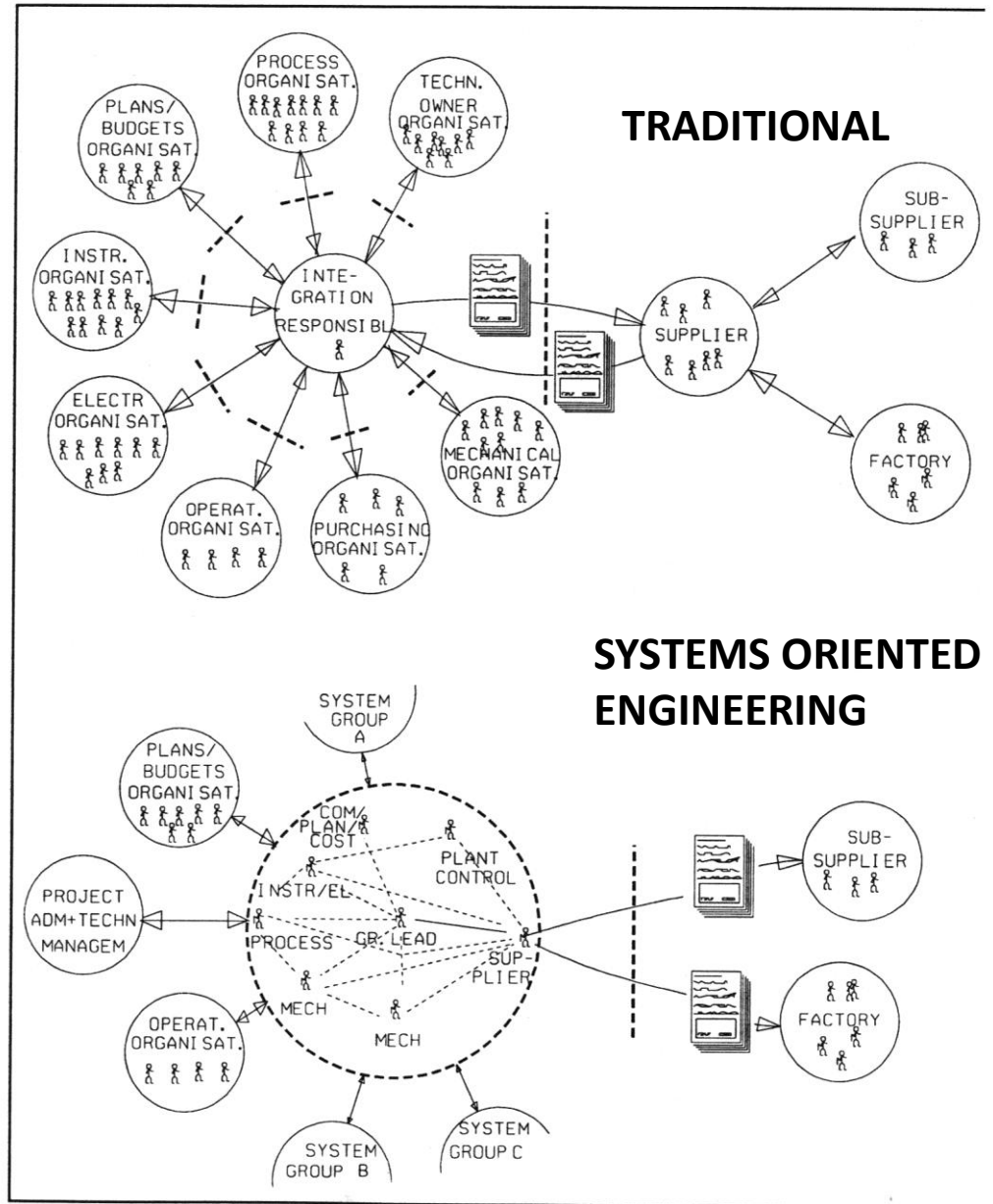
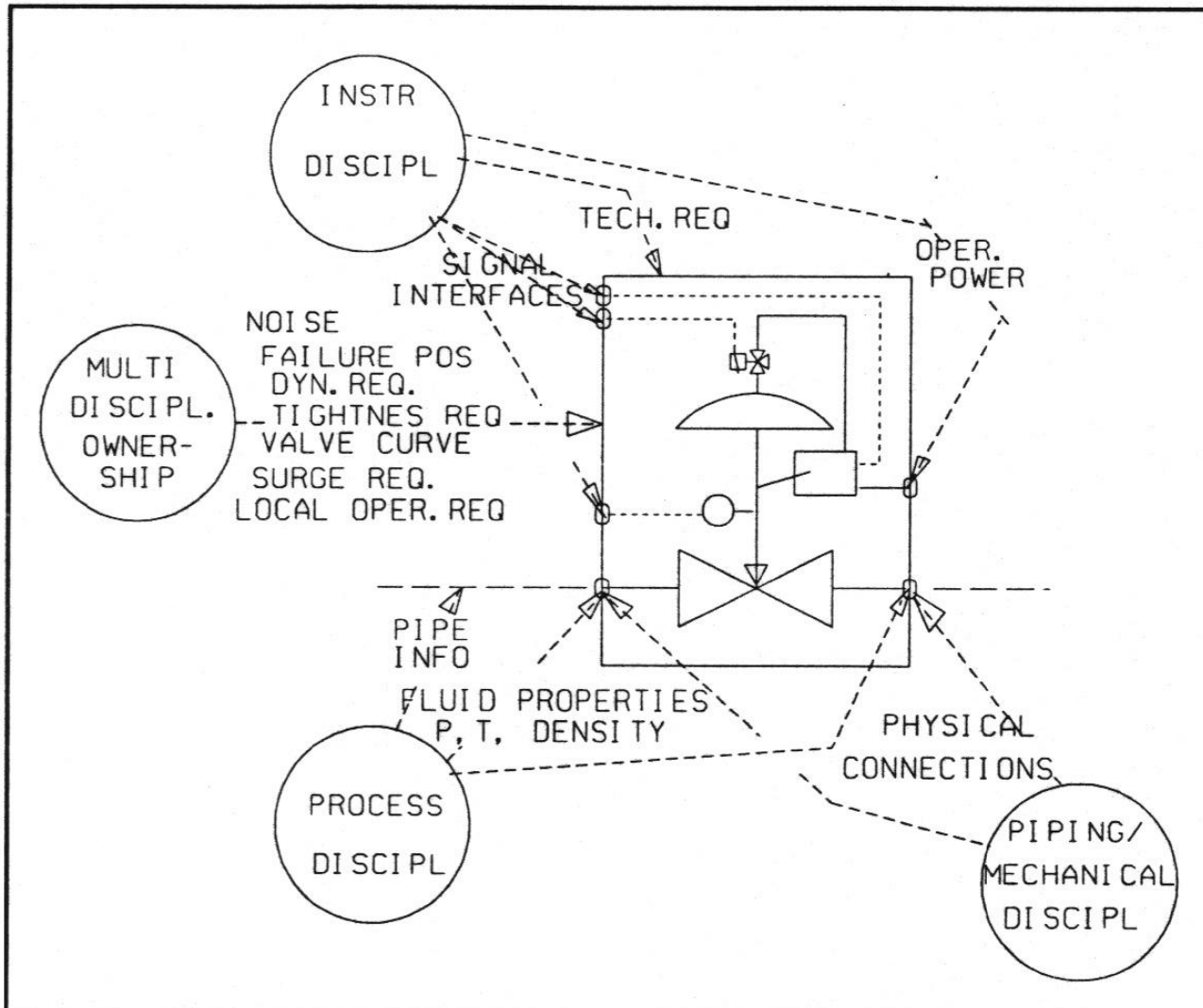
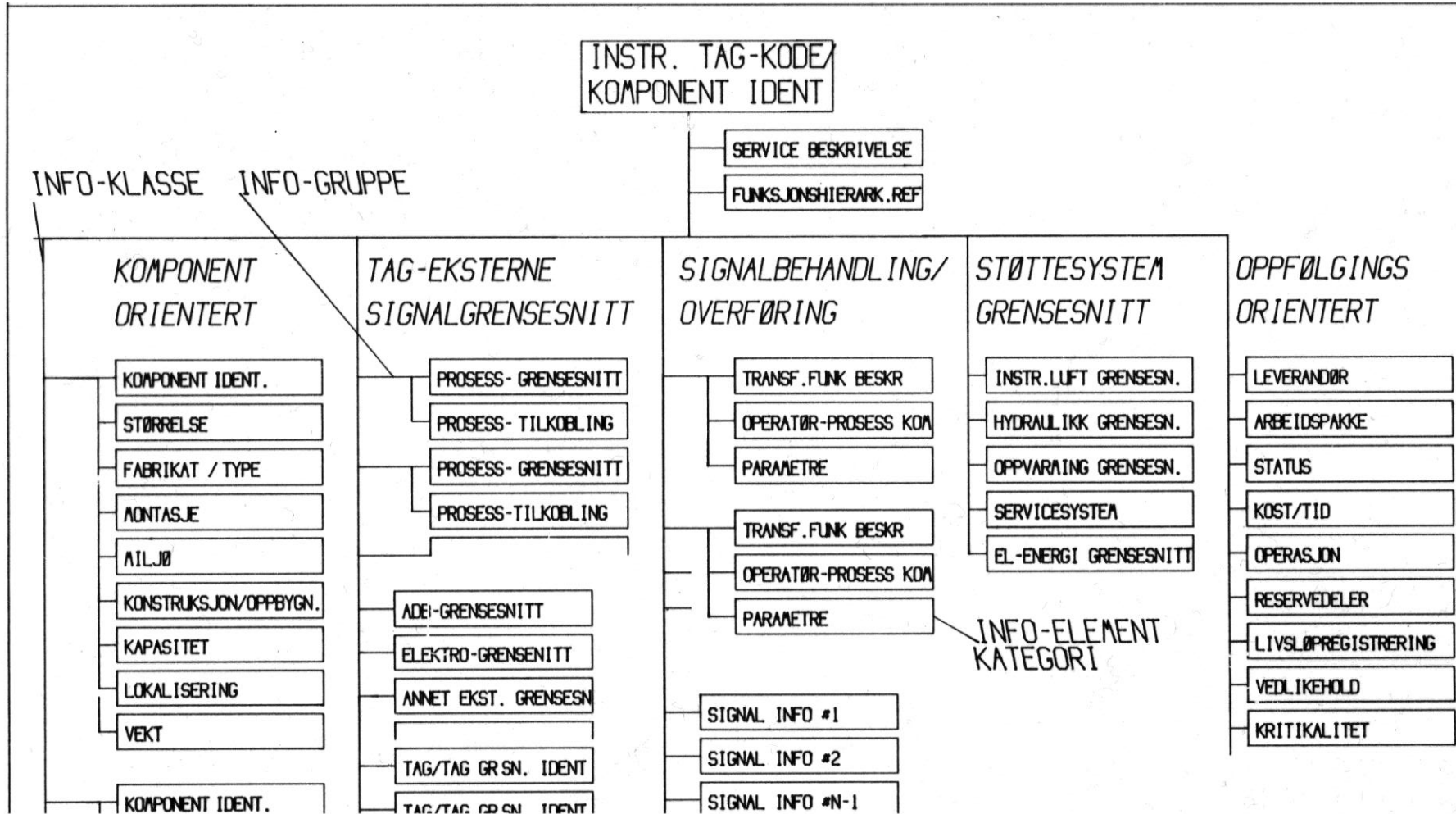


Figure 2. Comparison of traditional and systems oriented engineering organizational structures.

Simple unit, complex interface relations



Info-attributes valve



Systems engineering & integration



