EFFICIENT, INNOVATIVE LUBRICANT AND GREASE PRODUCTION

Prepared for:

CIS FUELS AND LUBRICANTS CONFERENCE

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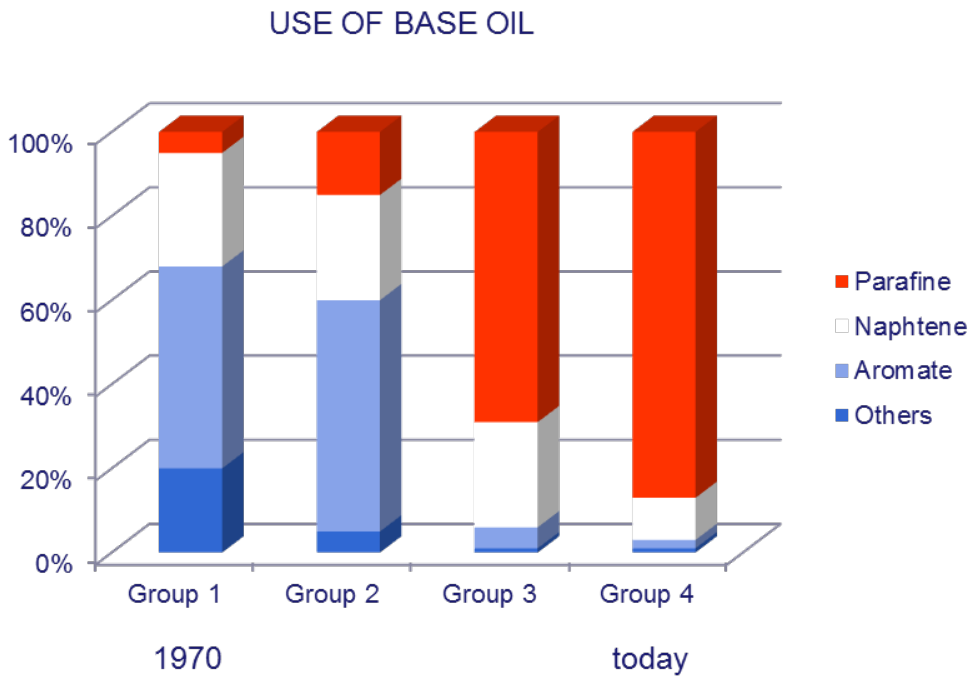
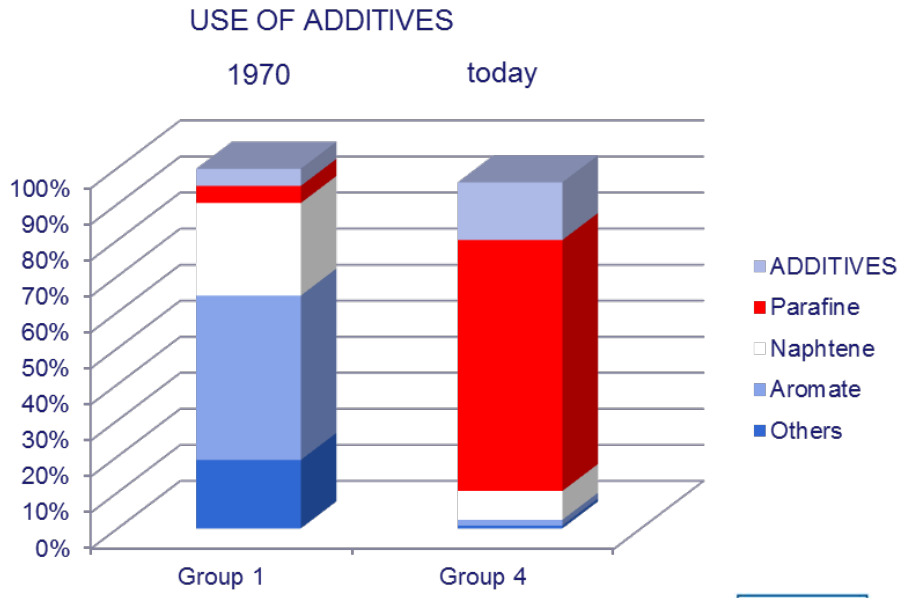
The Lube Oil Market

The market development is of course not uniform and is marked by the following features:

- **It is a market with hard competition.**
- **It is a growth market.**
- **It is a developed market.**
- **Success strategies in these markets are:**
  - lowest production cost
  - highest practicable product services and quality
- **It is a market that is partly overheated.**
- **And, finally, it is also a market of changes.**

Lubricants Product Variety
Raw Material Diversity





The Lube Oil Blending Plant is Part of the Supply Chain!

BUSINESS ENVIRONMENT FOR LUBRICANTS

Legislation

Emission Control Technologies

Technology & Innovation

Vehicle Manufacturer (OEMs)

SUPPLY CHAIN PLANNING

SUPPLIER

SOURCE

STOCK

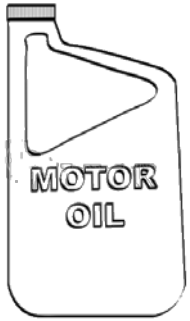
STORE

SELL

SHIP

CUSTOMER

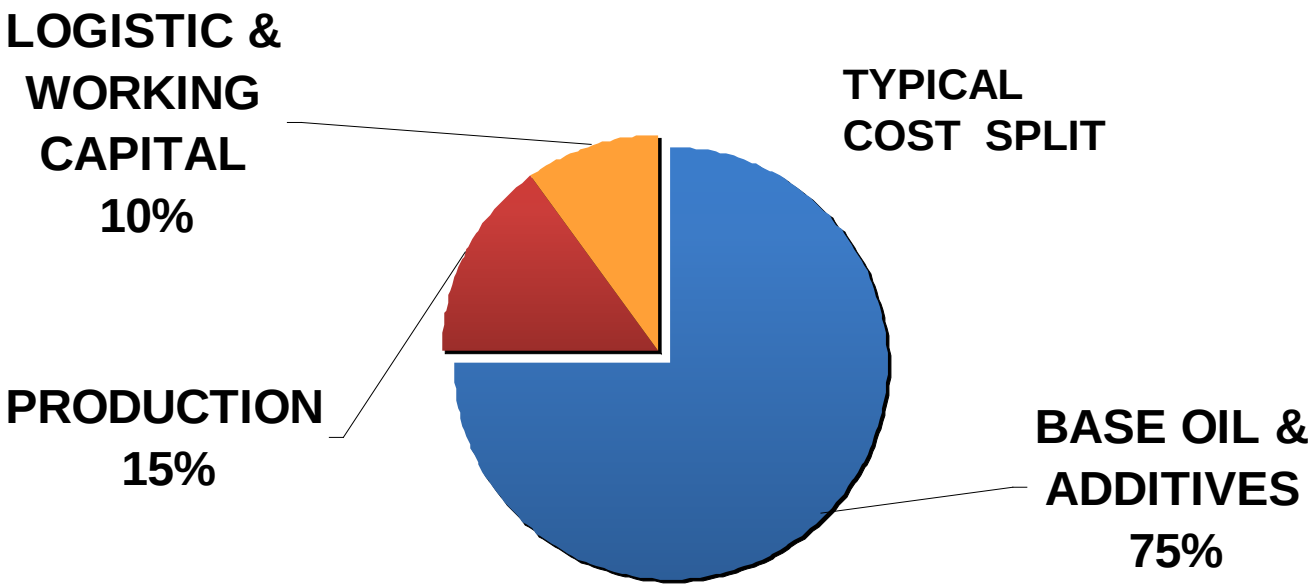
SUPPORT SERVICES



Type of LOBP could be:

- **The plant as part of an multi national**
- **Contract blending without own brand name**
- **Independent manufactures with own brand**

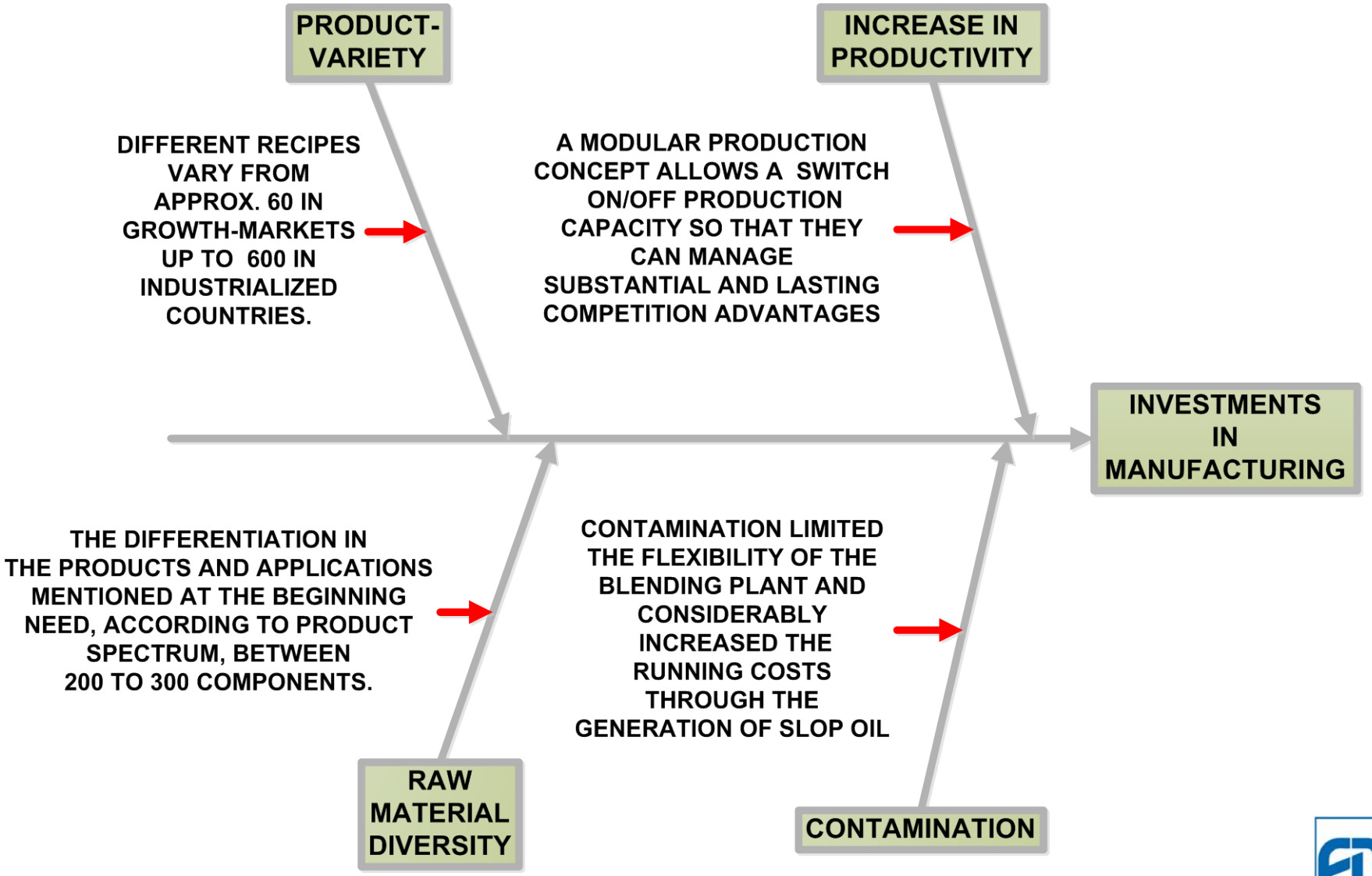
Typical Cost Structure of a Lube Oil Blending Plant



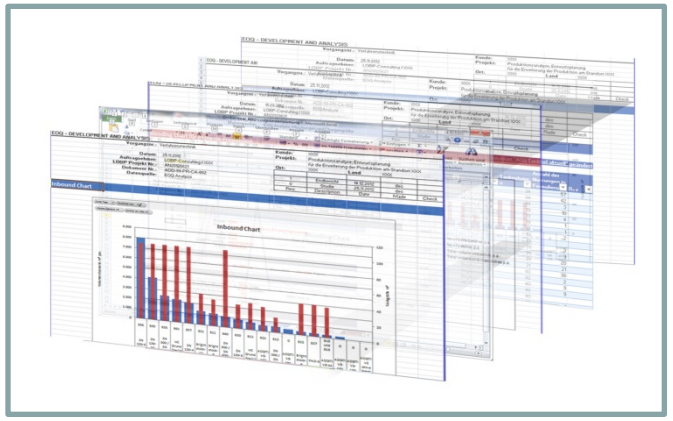
Savings Potential

- Base oil & additives > reduce giveaways by precise dosing
- Production > reducing slop oil and rework
- Working capital > reducing energy, clever investments; automation

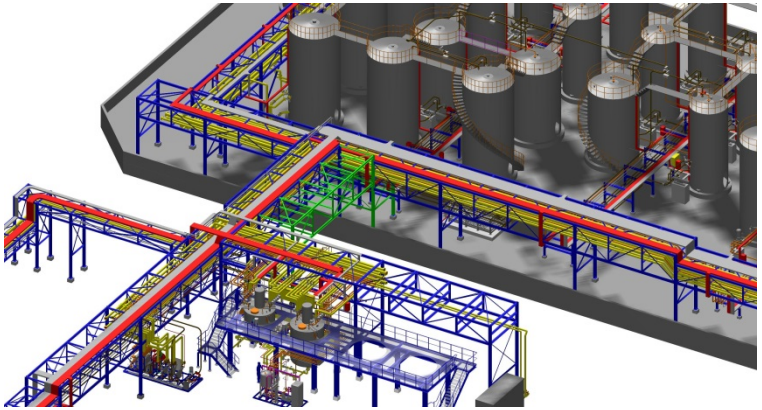
A Make: Lubricants Blending and Packaging



Concept of Lube Oil Blending Plant



Tools and Systems



3D-Planning

Soft Facts
Ecology
Communication
Aesthetics
Identity

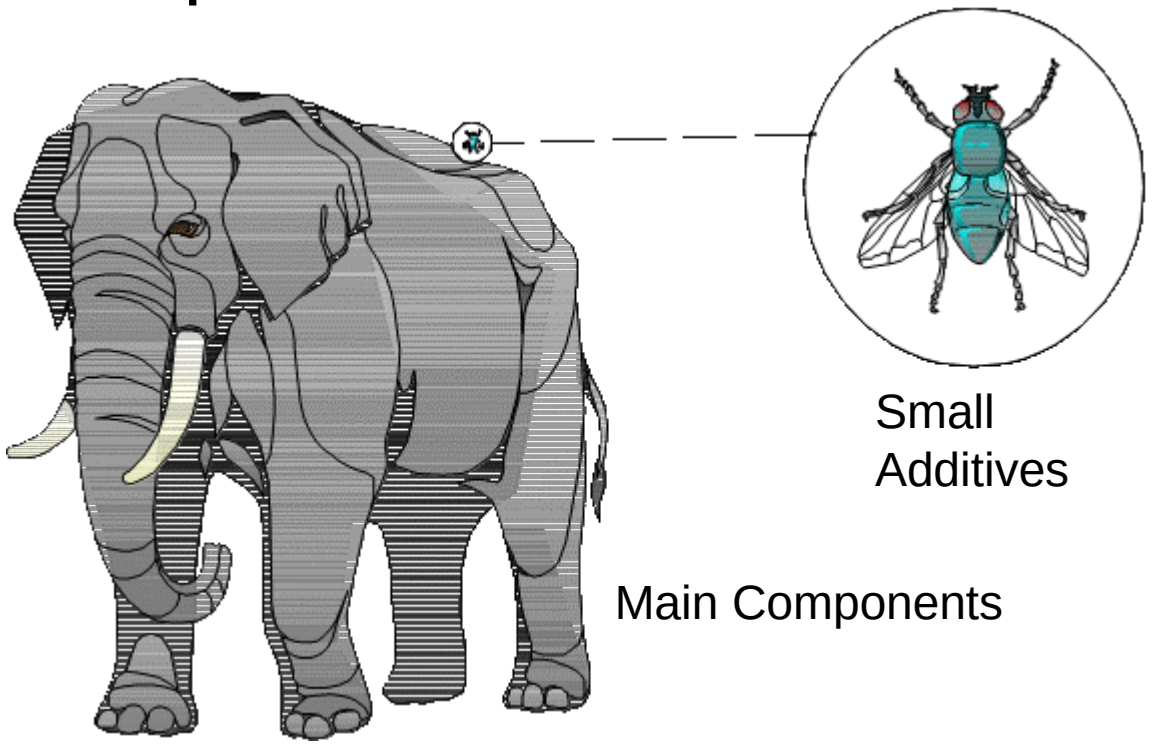
Hard Facts
Changeability
Technology
Productivity
Energy

Simulation / Lube Oil Blending Plant Model

Accuracy and Precision of each Component

1. **Accuracy and Precision**
   Target of each component is ±1% to pass the tests in the lab at the first time

2. **Batches Changeability**
   is typical in the range of 1 to 100 or more

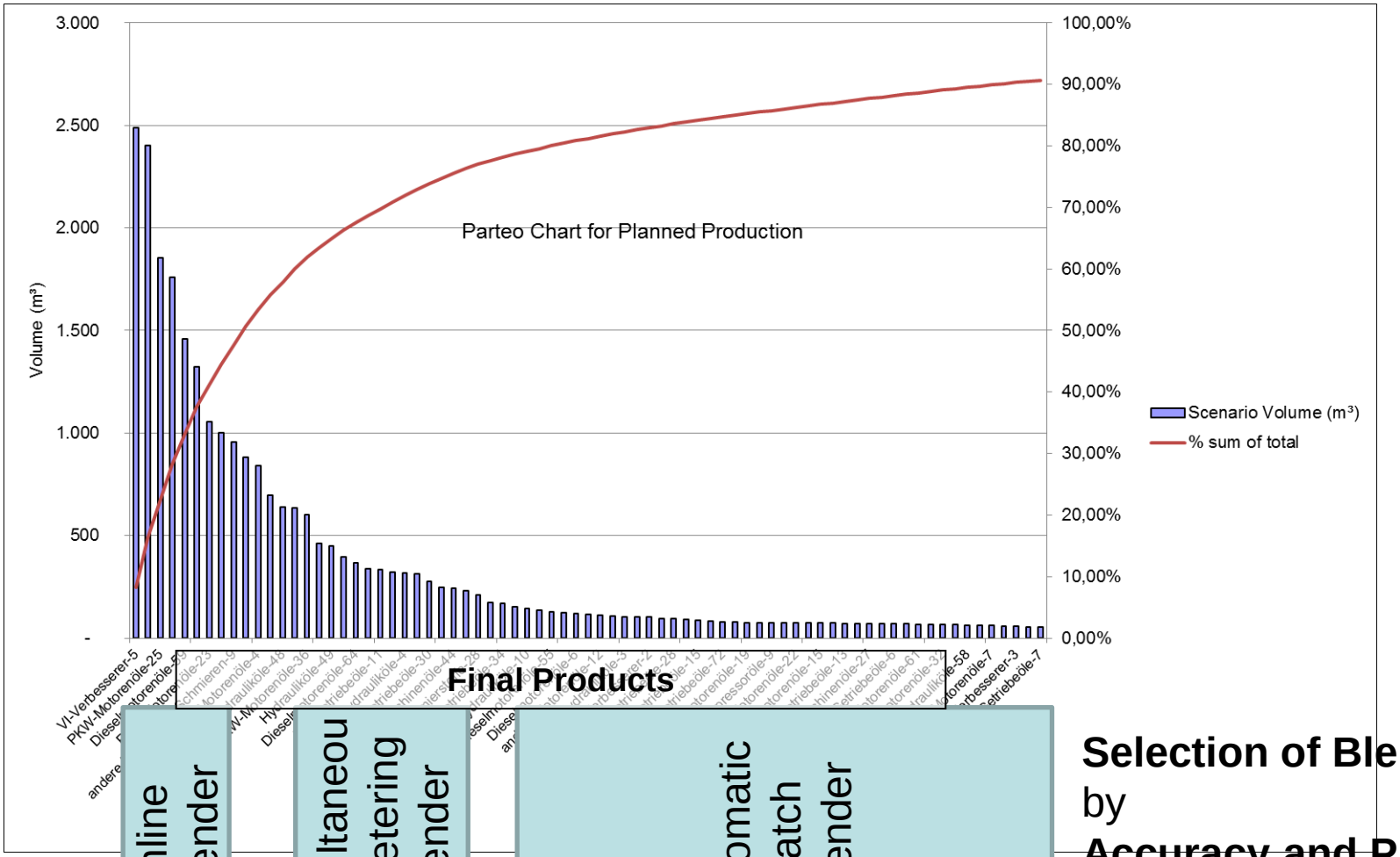


Small Additives

Main Components

The process using different dosing technologies like inline blender, batch blender, and the like will reduce the potential source of error and thus reduce the risk of out-of-specification results.

Planned Production & Typical Selection of Blenders



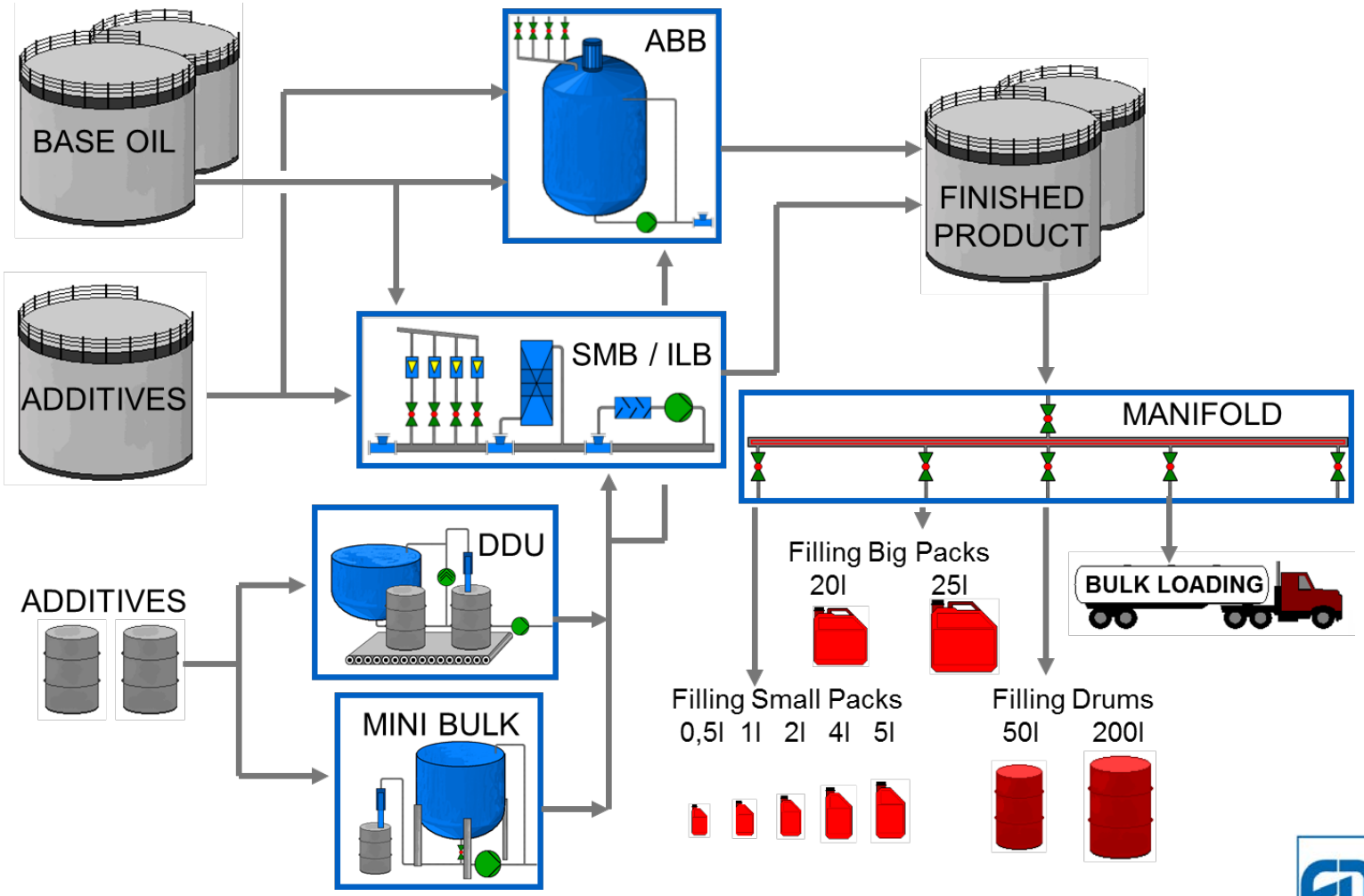
Inline blender

Simultaneous metering blender

Automatic Batch Blender

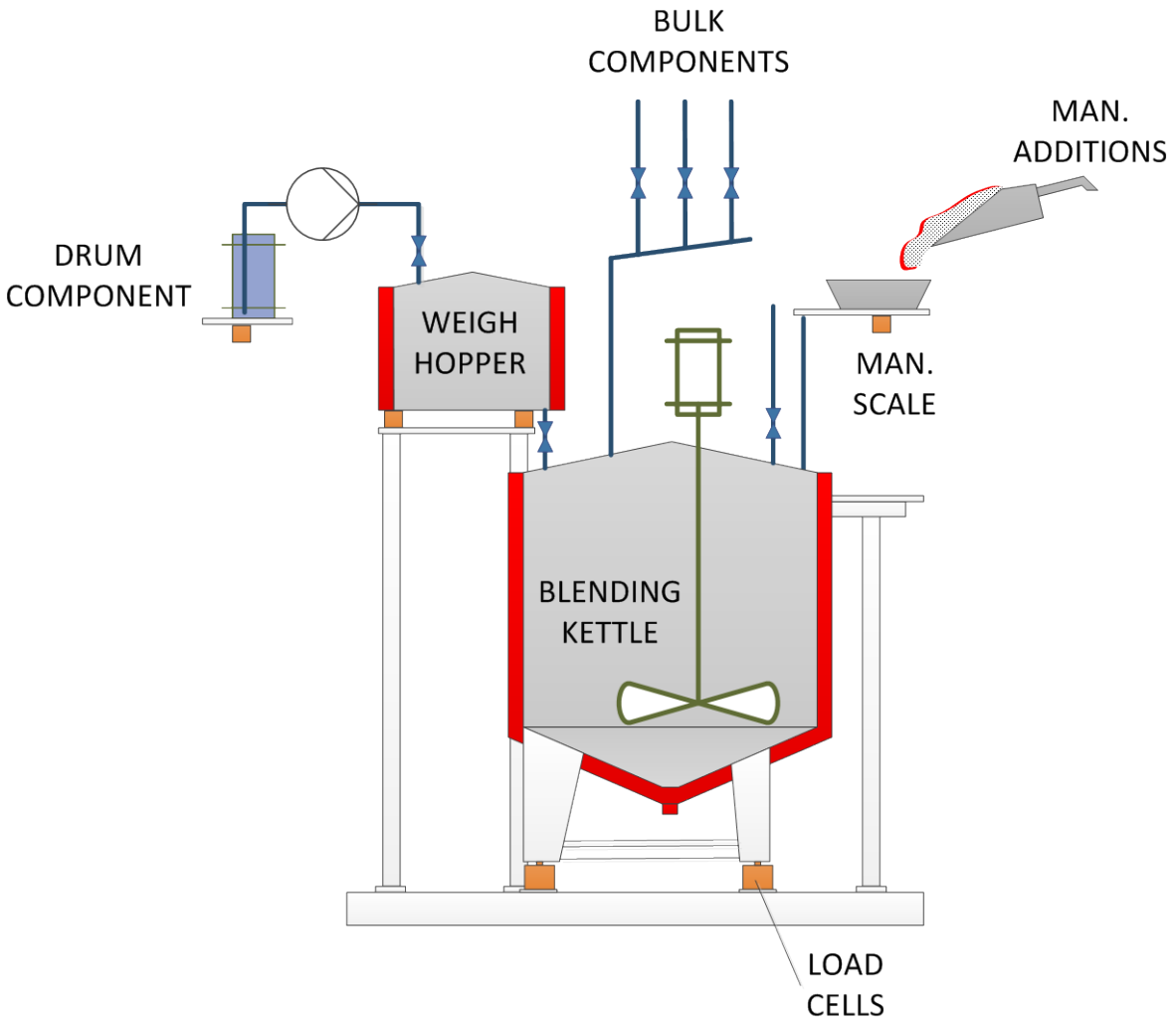
Selection of Blenders
by
Accuracy and Precision &
Batch Changeability

Typical Process Layout

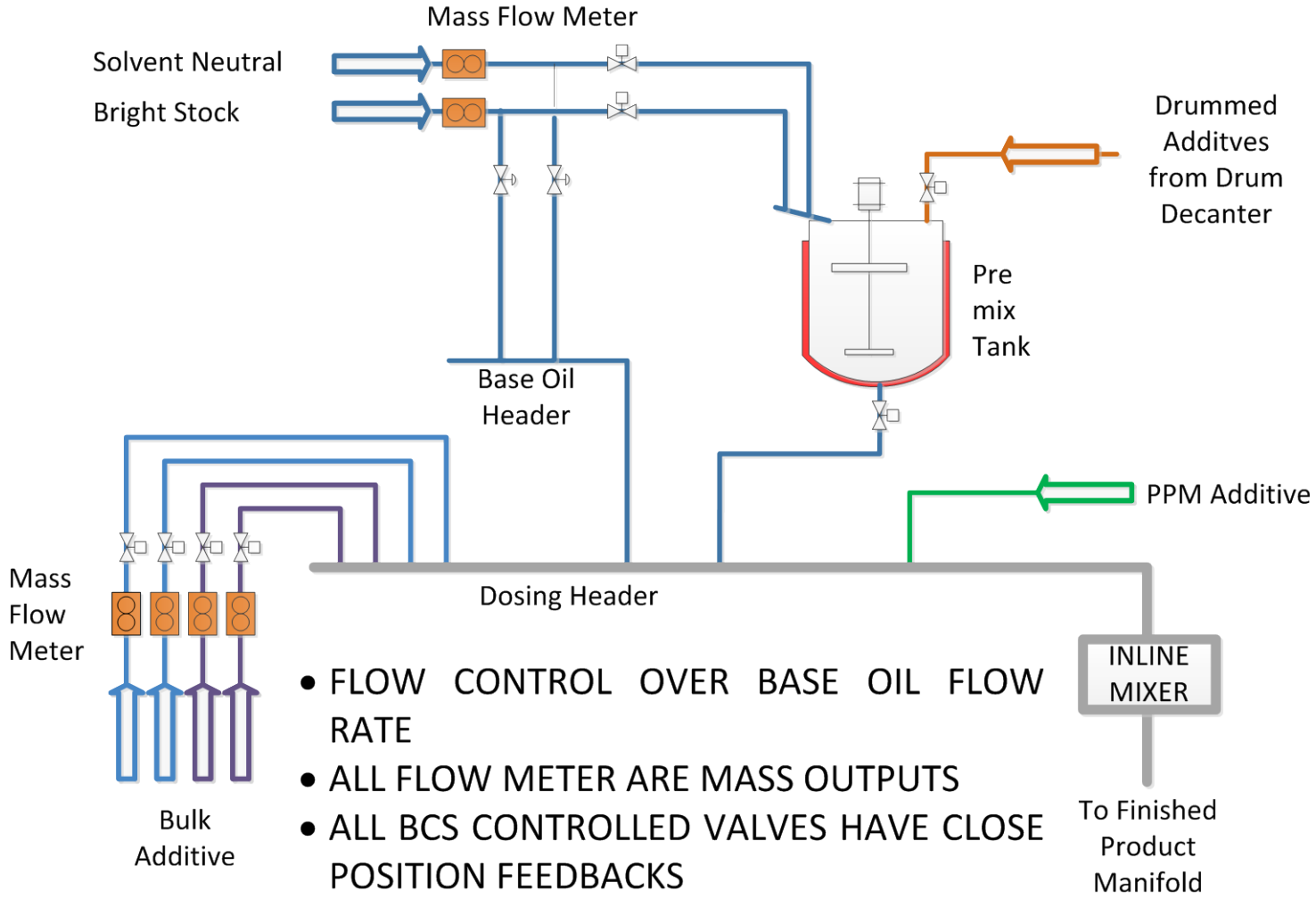


Automatic Batch Blender

Example of a Load Cell-mounted Blending Unit



Metering Blender as Inline or Simultaneous Operation



Metering Blender as Inline or Simultaneous Operation

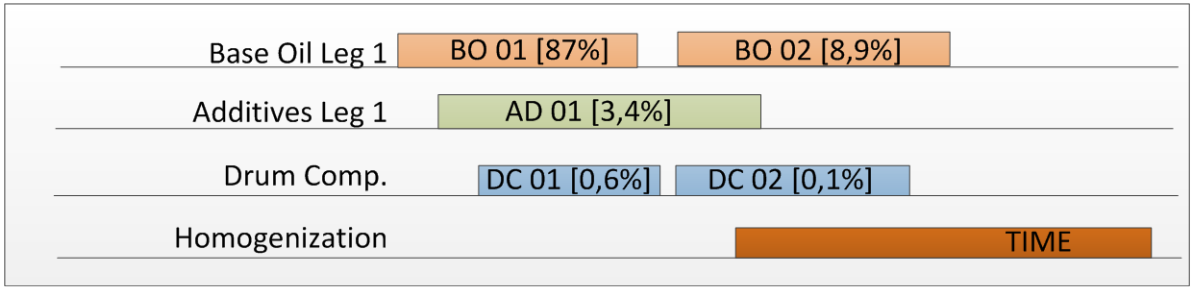
Simultaneous Metering Blender (SMB):

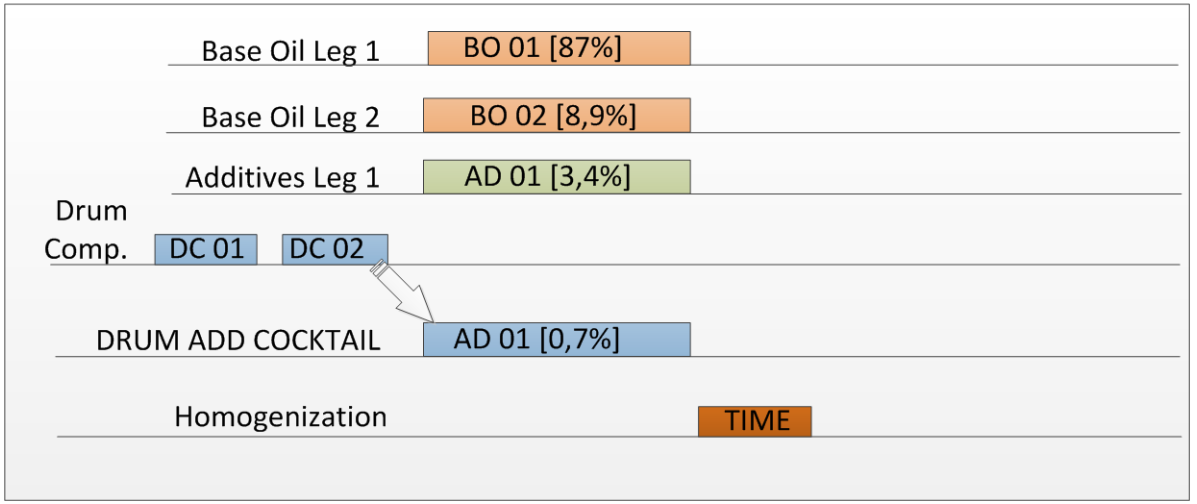
- Sequence Operation
- Homogenization mainly in the Finished Product Tank TANK

Inline Blender (ILB):

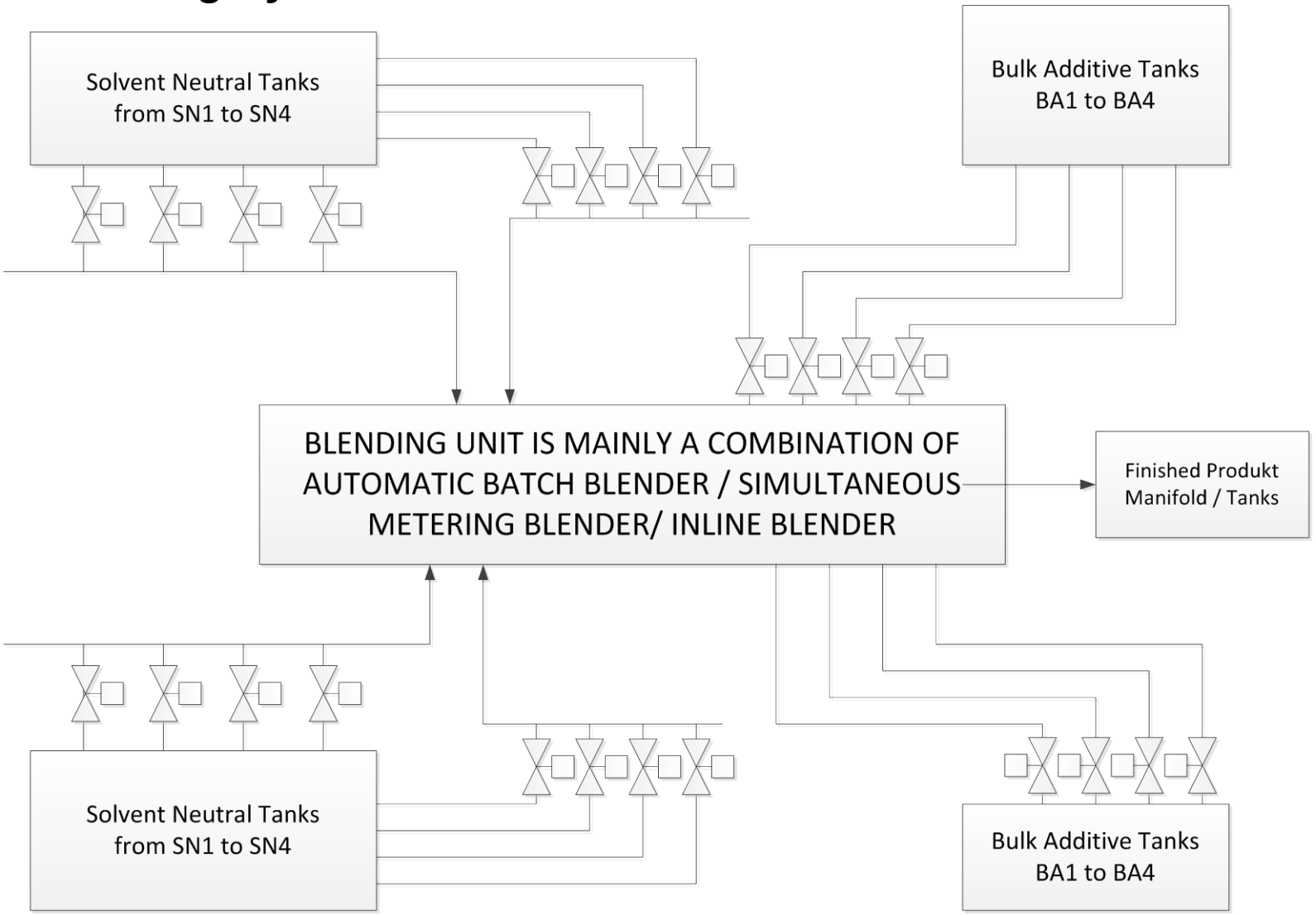
- Proportional Operation
- Homogenization mainly in the Blending Header

Typical Motor Oil



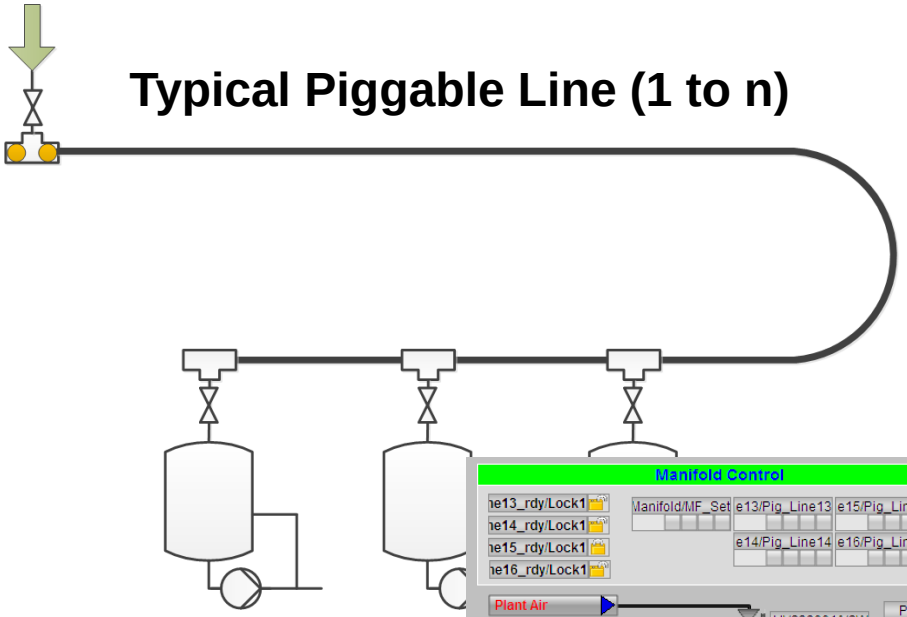


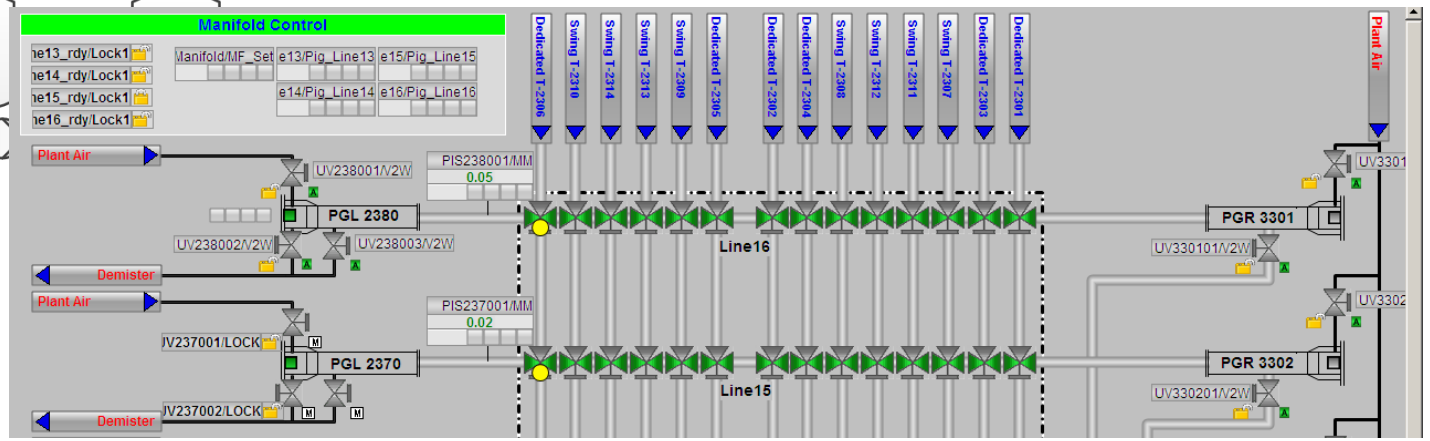
Typical Blending System



Typical Piggable Product Line

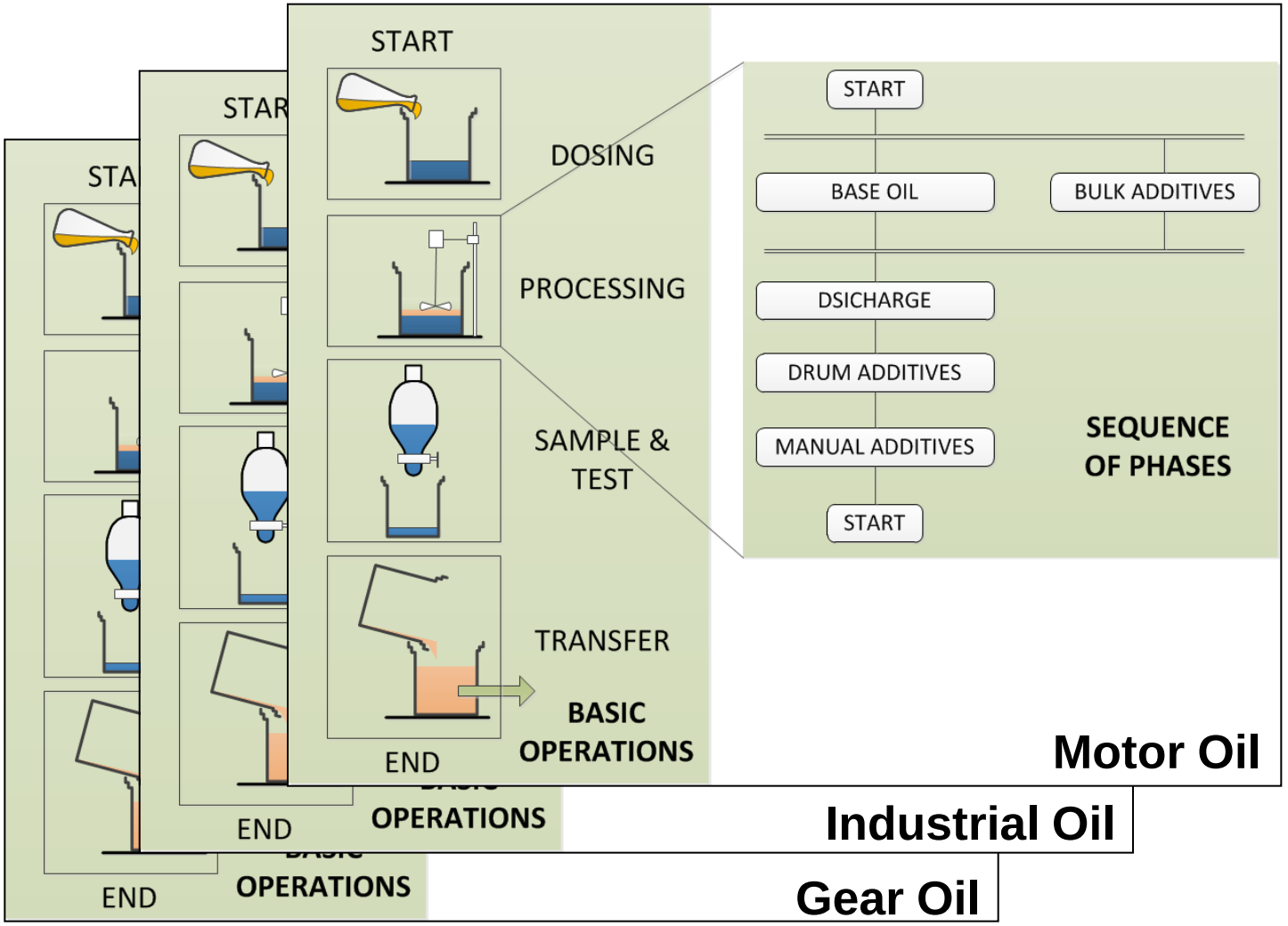
Typical Piggable Line (1 to n)





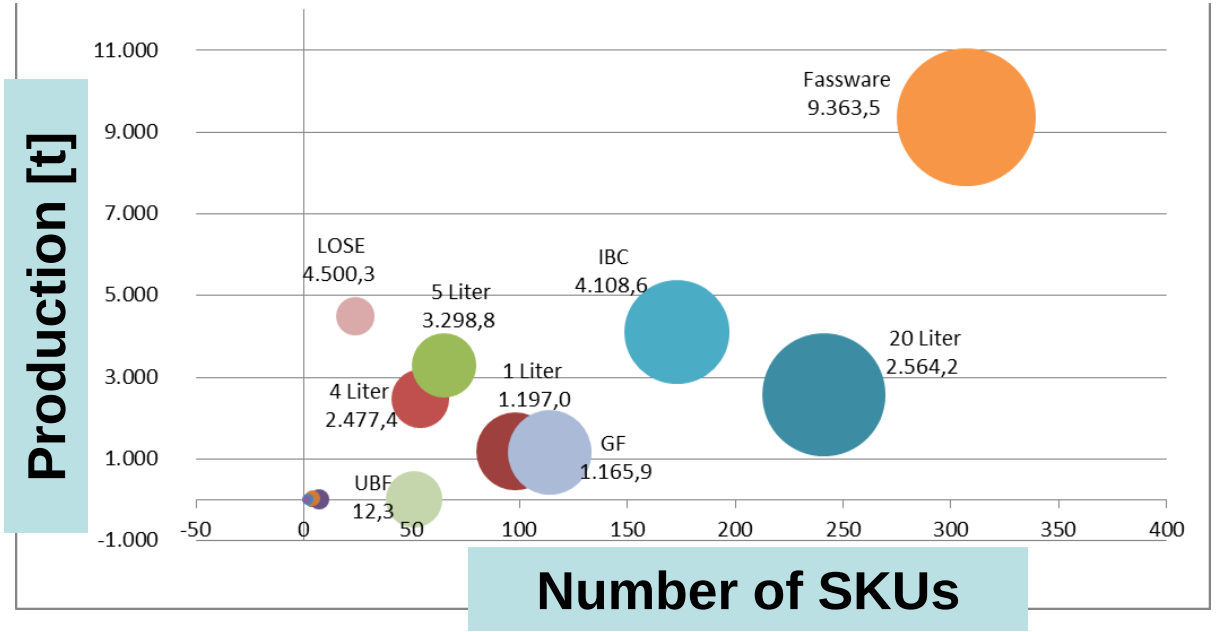
Manifold Operation (n to n)

Automation Functions



The lubricant plants are mostly designed as **'multiple product / multiple line plants'.**
High flexibility in the production can only be reached by **Automation.**

When handling the complexity in the filling area, some principles should be taken into account.



Product Grouping
The Stockkeeping Units (SKUs) must be classified into product groups which all have a similar packaging type.

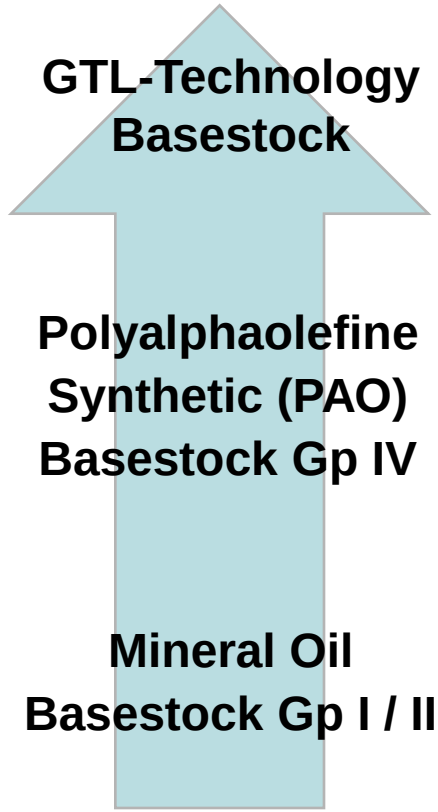
These groups can then be prioritized based on packaging complexity and minimum change over times for the filling machine.

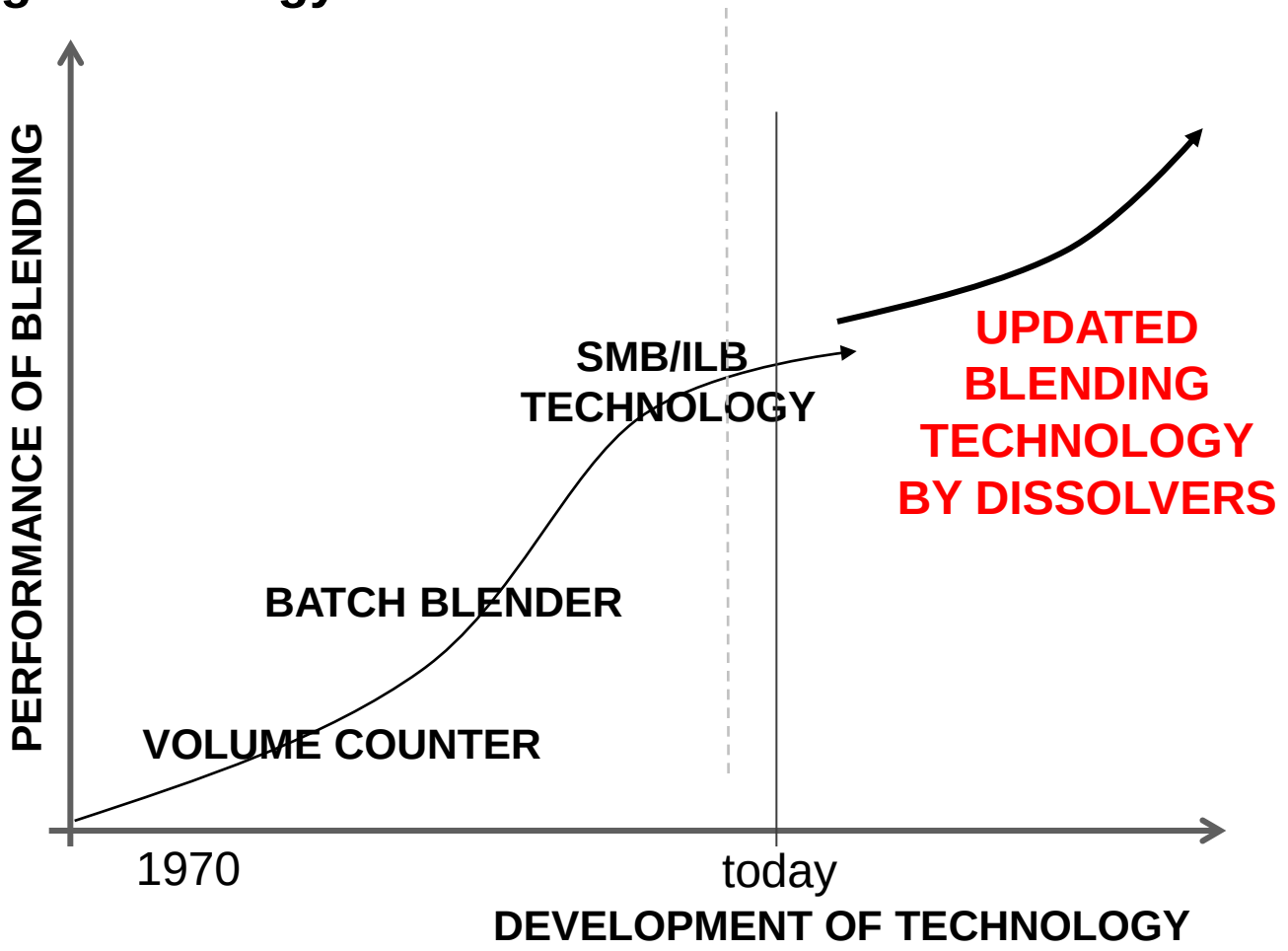
Pareto Principle (80:20)
This method is based on the premise that 80% of the production area associated with the top 20% packaging handled by the filling area (fast mover).

Filling Layout & Warehousing

The Filling & Warehouse Management should make every effort to meet the continuing demands and guarantee a well-organized filling & warehousing to achieve short delivery times of lubricants.

Development in Blending Technology





Advanced lubricants production updates to meet the stringent requirements of the modern formulation of lubricates.

Development in Grease Production Technology

Main Types of Grease Manufacturing Processes available:

A. Conventional atmospheric process
B. Continuous grease process
C. Pressure saponification process
D. Single kettle process

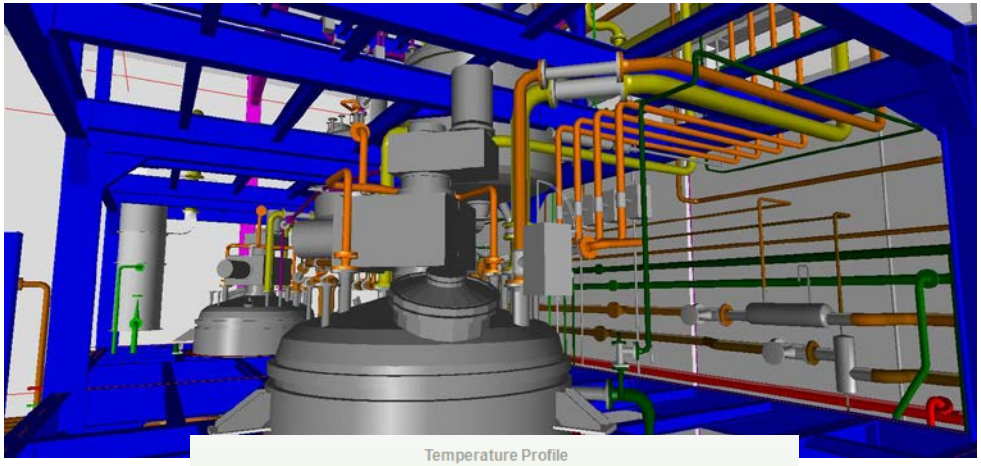
In my opinion the pressure saponification process will be suitable for a wide range of different greases.

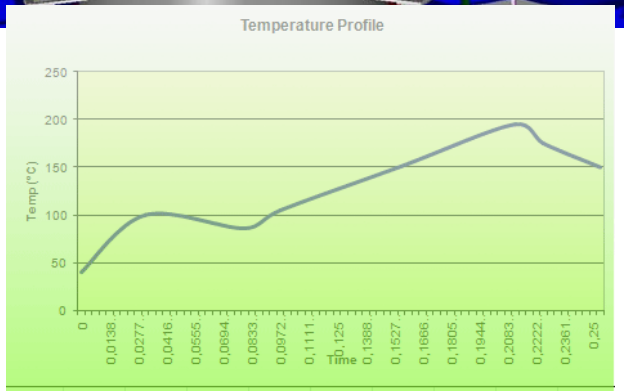
- Medium investment costs
- Very short cooking time, so short effective average batchtime, so high output
- Medium energy costs
- Very flexible in all kind of raw materials processing
- Economical percentage of soap ingredients

Development in Grease Production Technology

Process in Combination with Formulas

Producing high-quality greases for a competitive price is not only a question of selecting the right process, but also of well-balanced specifications.





Cooking Kettle:

Step	Description
1	Add OIL 1 and azelaic acid. Heat to 100°C with mixing.
2	At 100°C, verify azelaic acid has dissolved, then turn off heat. Add 12-hydroxystearic acid and allow to dissolve. Temperature will begin to decrease.
3	Add OIL 2 and allow batch temperature to cool to below 85°C.

- Thermal fluid heating systems up to 280°C
- Cooling system
- Pressure up to 8bar
- Anchor stirrer frame and product loaded scrapers
- Automation

Summary

Production Plant Overview