Optimization of Naphtha Feedstock Blending for Integrated Olefins-Aromatics Plant Production Scheduling

Y. Ota, K. Namatame, H. Hamataka, K. Nakagawa and H. Abe
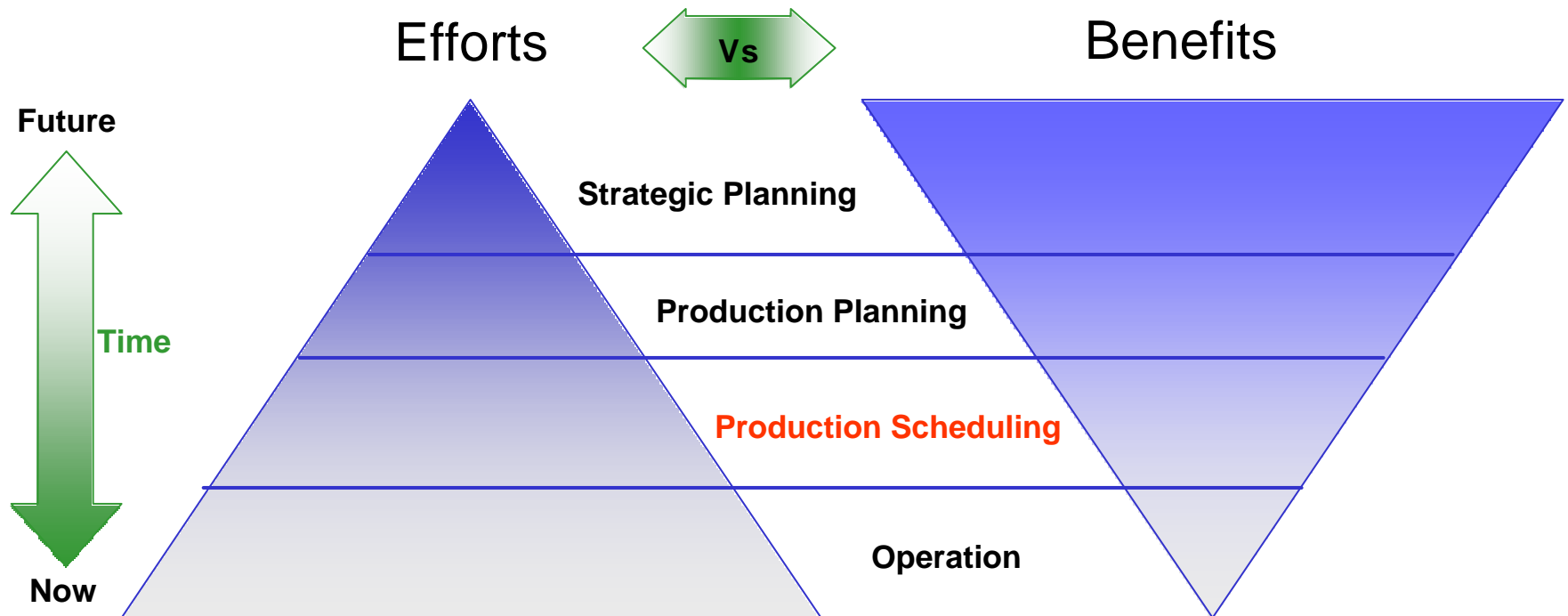
Mitsubishi Chemical Corporation

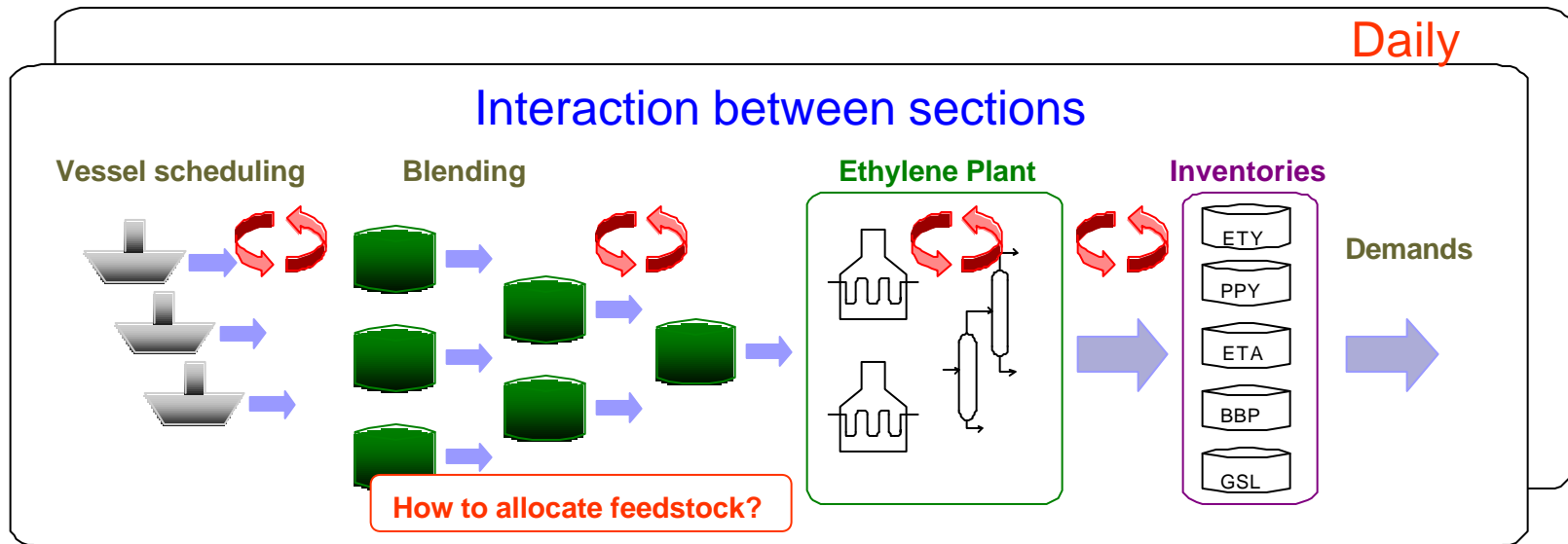A. Cervantes, I. B. Tjoa and F. Valli

MC Research & Innovation Center

Hierarchy of Decisions in Business Activities

↙ Optimization efforts for improving profitability

Efforts   Vs   Benefits

Future

Time

Now

Strategic Planning

Production Planning

Production Scheduling

Operation

Here we focus on production scheduling

Issues in Ethylene Plant Production Scheduling

Daily

Interaction between sections

Vessel scheduling   **Blending**   **Ethylene Plant**   **Inventories**

ETY
PPY
ETA
BBP
GSL

Demands

How to allocate feedstock?

Model requirement:

- Accurate (rigorous) daily production model
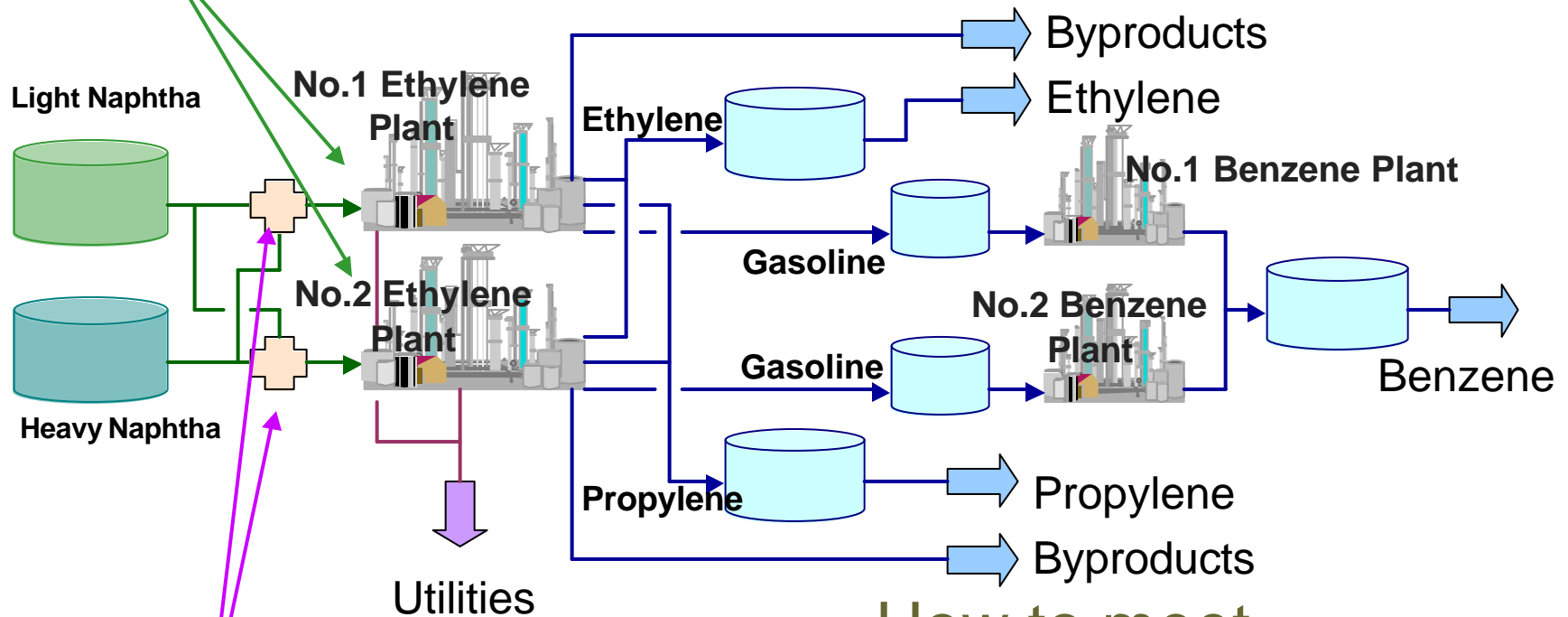- Mixed Integer Nonlinear model

Main Focus:

Find *optimal feedstock allocation* for daily production scheduling,
for meeting production demands

Case Study: Real Production Scheduling for 2 Ethylene and 2 Benzene Plants

Production target?

Optimal composition?

How to meet Production Objective?

Light Naphtha

Heavy Naphtha

No.1 Ethylene Plant

No.2 Ethylene Plant

Ethylene

Gasoline

Gasoline

Propylene

Utilities

Byproducts

Ethylene

No.1 Benzene Plant

No.2 Benzene Plant

Benzene

Propylene

Byproducts

# Modeling and Solution Approach

↙ **Modeling approach**

- Unit operation model building capability
- Equation based modeling approach
  - » MINLP model
- Modeling platform: GAMS modeling language
- Model size
  - » Continuous variables ~ 60k
  - » Binary variables ~ 1k

↙ **Solution approach**

- » Process knowledge based decomposition strategy
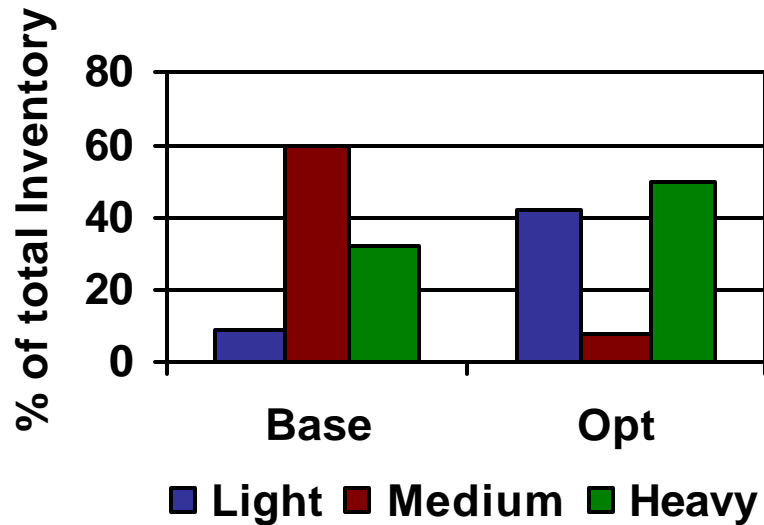- » Use standard solvers:
  - – **MILP: OSL**
  - – **NLP: ConOpt**
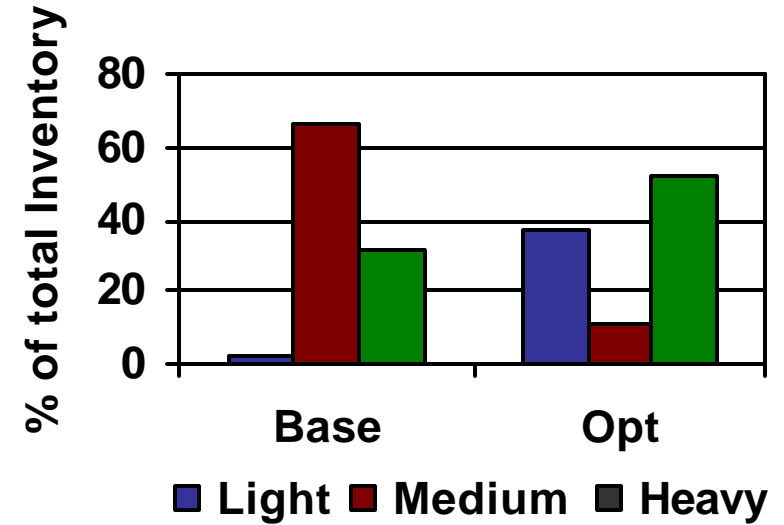
Naphtha Properties

Composition of Charging Tanks

Y-axis: SG
X-axis: Periods

Legend: MAN_T1, MAN_T2, OPT_T1, OPT_T2
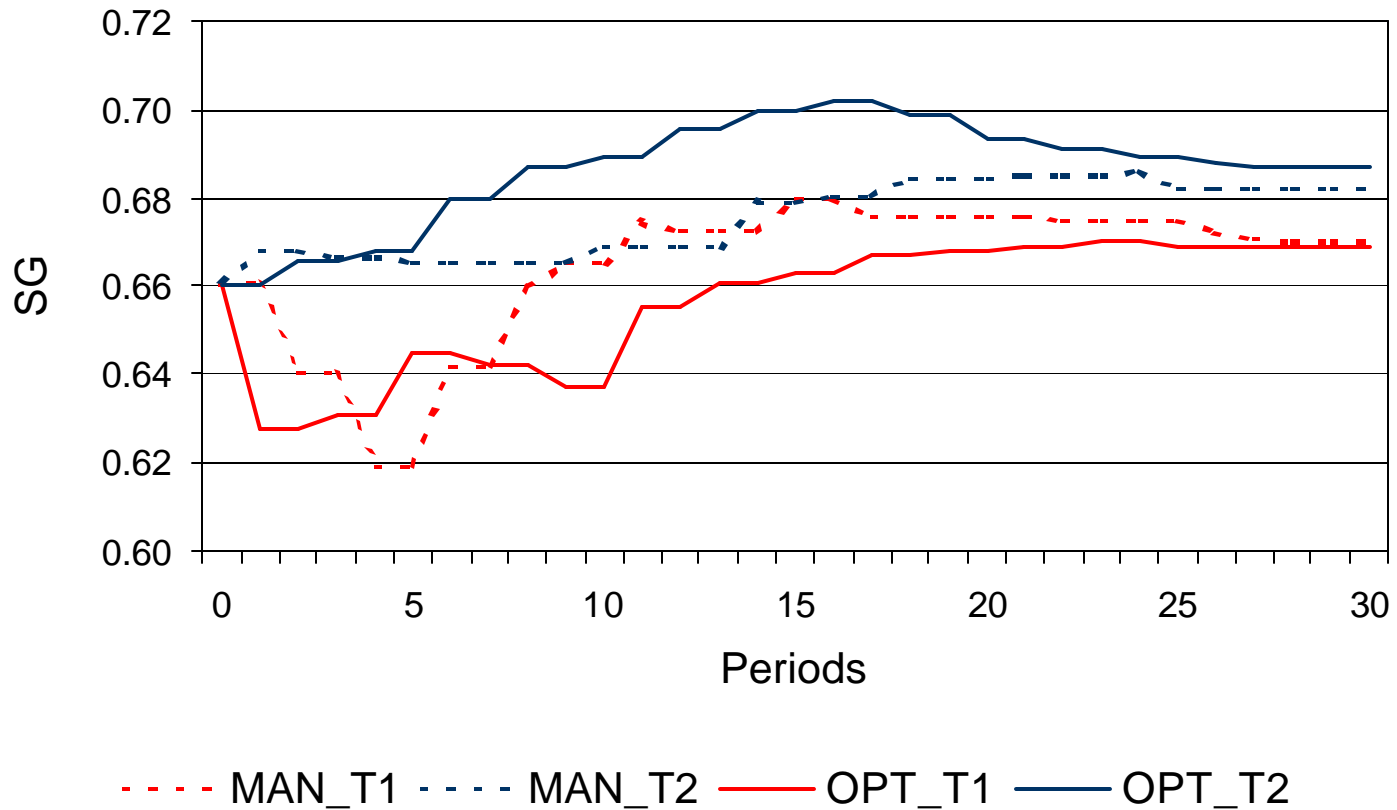
Naphtha Inventories

☑ Fixed ETY & PPY Demands   ☑ Max ETY & PPY Productions

Application Manager