CoEnzyme
Analytics & Decision Optimization

Optimization in oil and gas
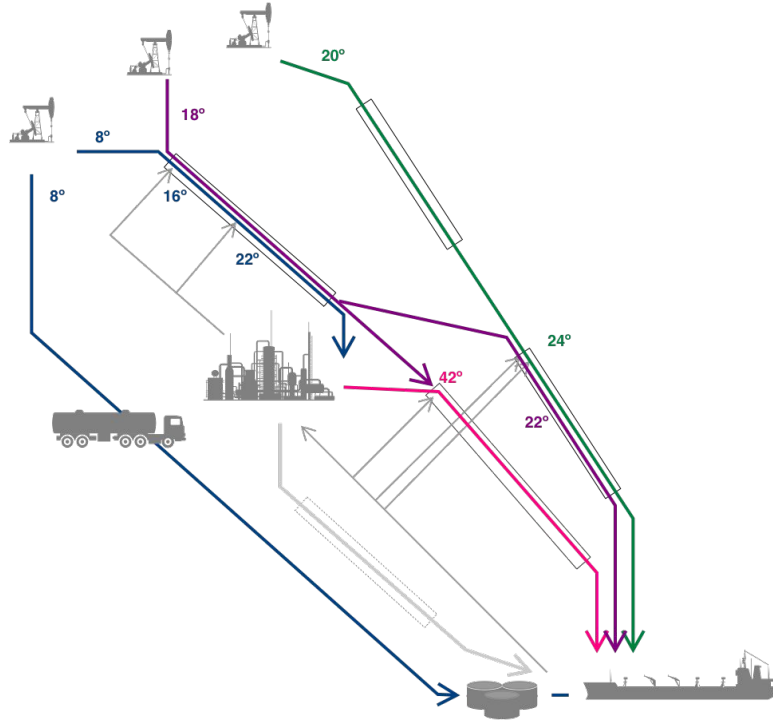
Pipelines

Crude blending for pipeline transportation

Compute the blends of heavy and light crudes with naphtha to comply with pipeline operational restrictions (API, sulfur, acidity).

Compute which crudes are better transported by pipeline or by tanker truck.

# Crude blending for pipeline transportation

Objectives

- Minimize the transportation and operation costs
- Reduce the use of naphtha
- Minimize the mixing of crudes of high value
- Minimize the load of the refinery
- Deliver multiple scenarios for managers to evaluate and compare
- Allow manual adjustments of the schedule

Batching and sequencing
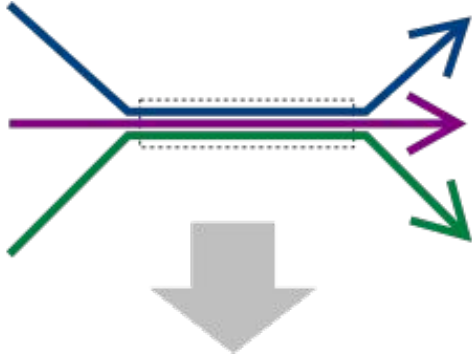
Compute the size and the sequence of oil batches that go through the pipeline
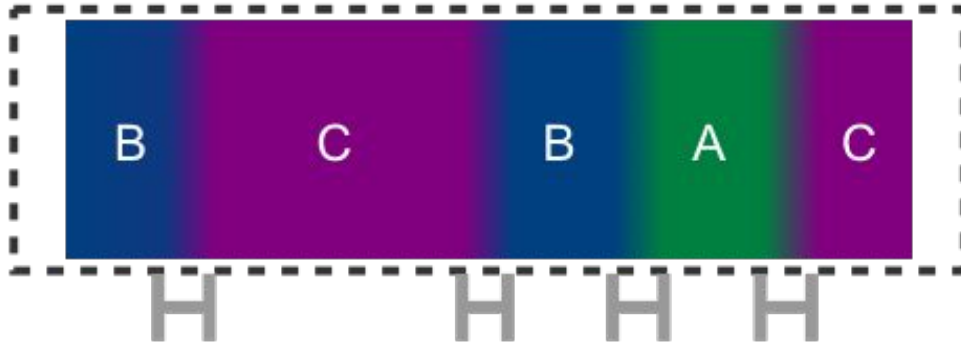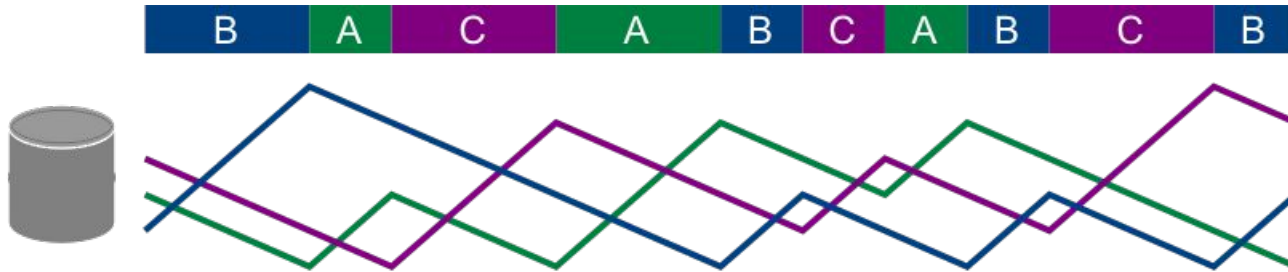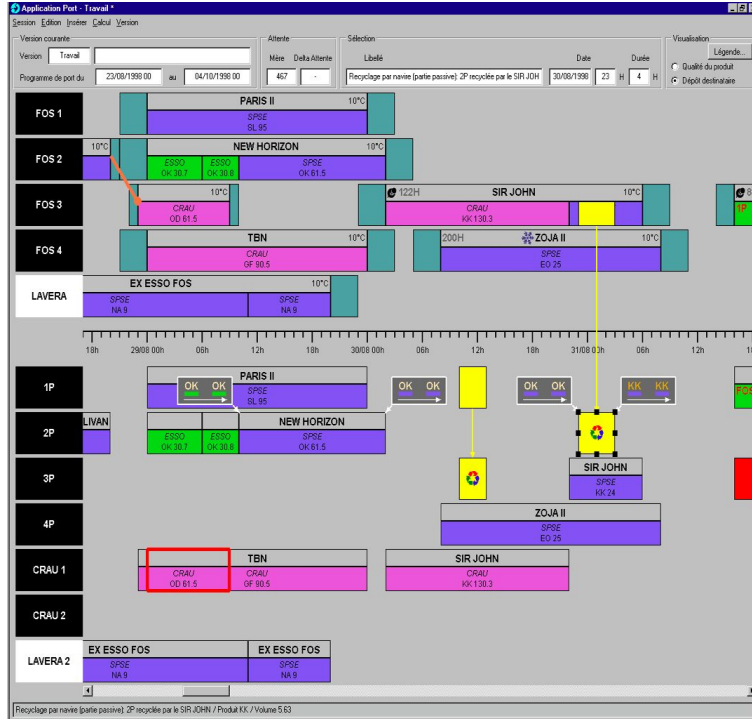
Batching and sequencing

Objectives

- Optimize the size of the batches
- Keep the inventory levels of products within the desired levels
- Minimize the energy consumption in the transportation process
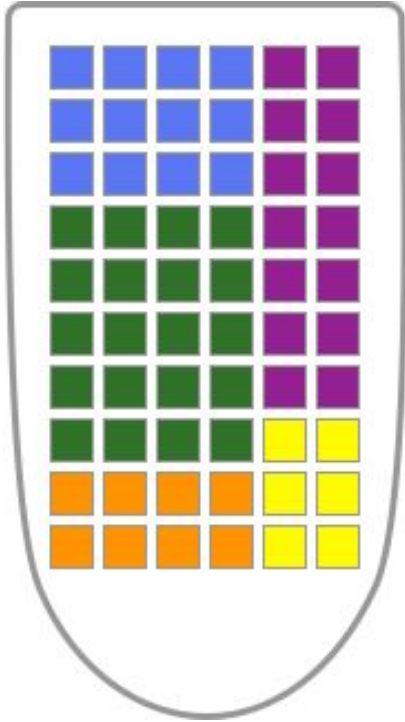- Minimize the contamination between batches

Case : SPSE

SPSE does an integral planning of the pipeline batches, storage, load in tanker vessels and operation of the maritime terminal.

Synchronizing these operations reduces the waiting time of the vessels and therefore the total operation costs.
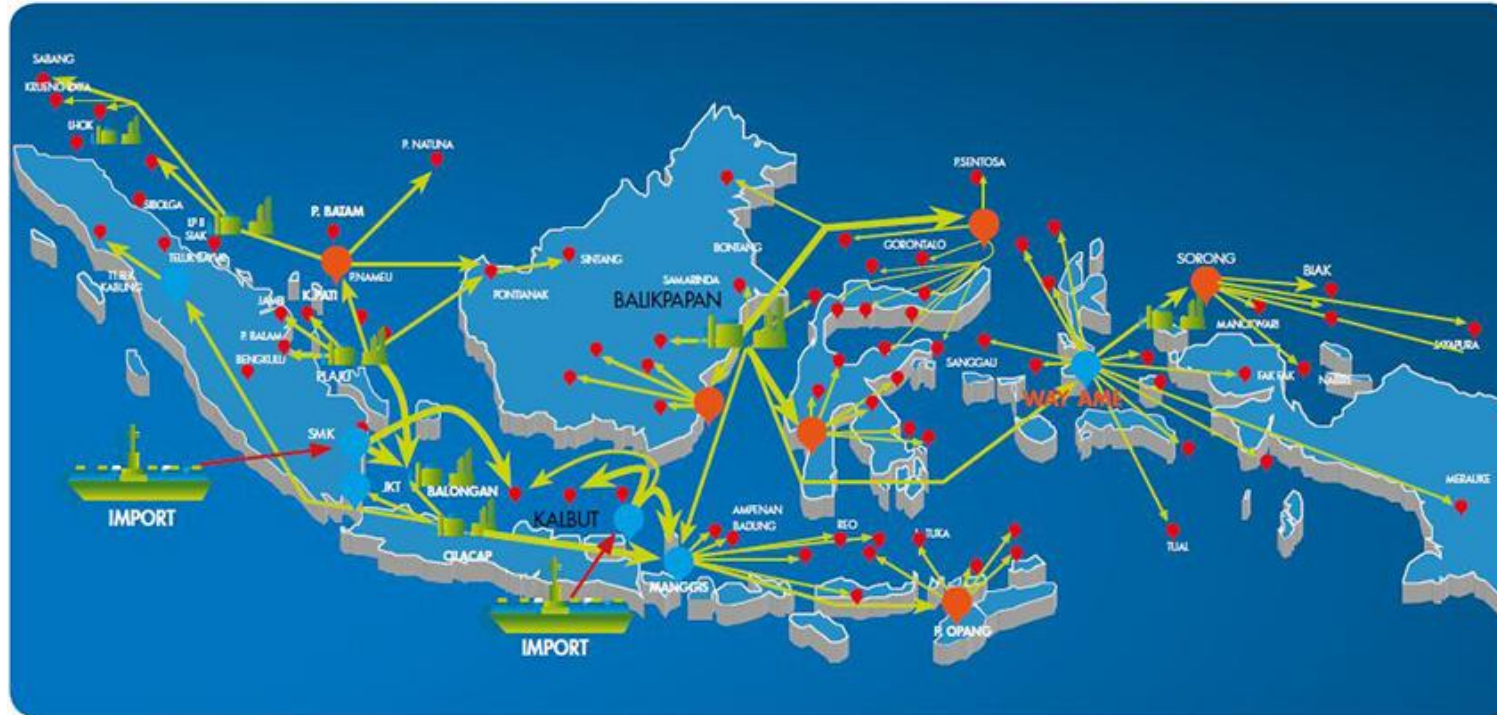
Case : Pertamina

Because of the large amount of islands in Indonesia, Pertamina moves oil by boat (150+).

The problem is to load the right amount of products in bays of the vessel, and to take into consideration the transportation time for inventories to remain within the desired ranges.
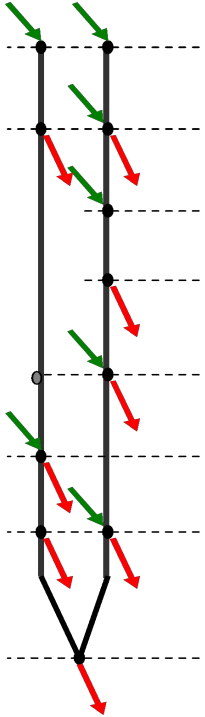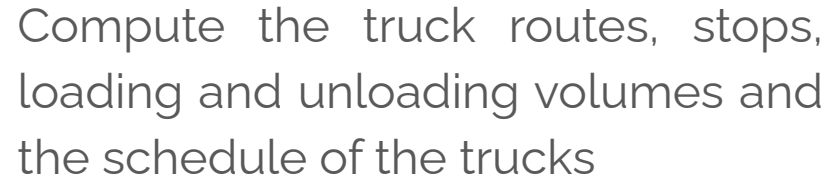
Case : Pertamina

Case Enbridge

Enbridge routes batches of different grades of oil in pipelines, trying to avoid contamination between successive batches.

There are multiple entry and exit points, and storage tanks that act as buffers

Tanker trucks

Transportation by tanker trucks

Compute the truck routes, stops, loading and unloading volumes and the schedule of the trucks

Transportation by tanker trucks

Objectives

- Minimize the transportation cost
- Minimize the violation of customer preferences
- Comply with customer time windows
- Comply with labor laws for all workers involved in the operation
- Keep inventory levels between desired ranges

Refineries

Refinery planning

Decide the types and amounts of crudes of different grade to be refined, and the blends to be produced, based on the current oil prices.
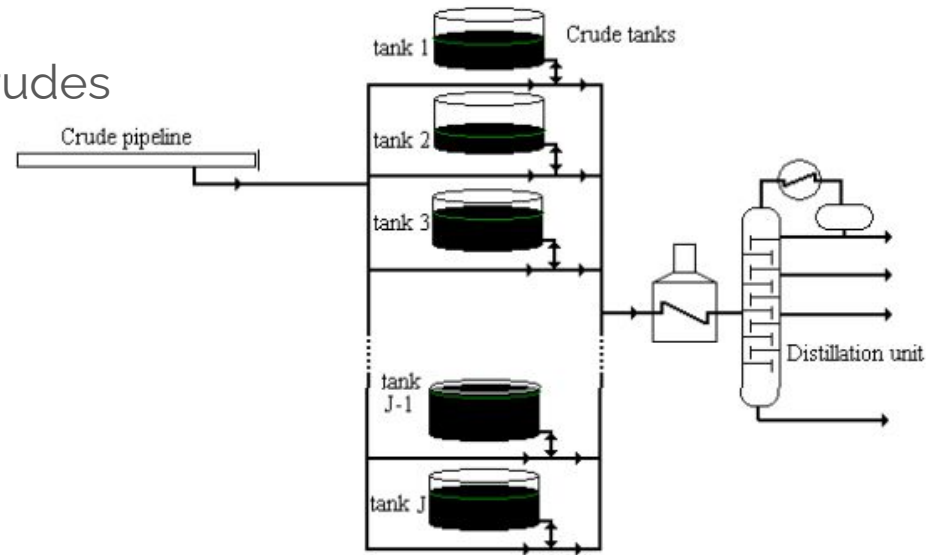
Define a calendar of operations the refinery needs to perform (filling and emptying storage tanks, opening valves, etc)

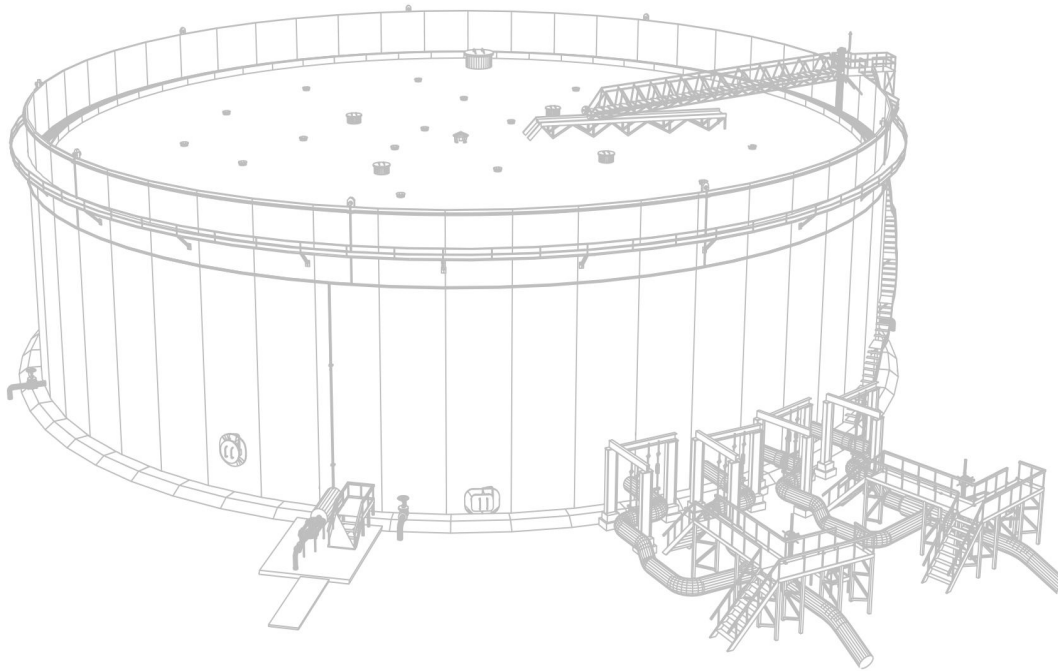# Refinery planning

Objectives

- Maximize profitability
- Take into account availability of crudes
- Keep inventory levels within desired ranges

Storage

Storage

Choose which storage tanks to fill and the duration of the filling and emptying operations.

Storage

Objectives

- Minimize the number of almost empty tanks
- Minimize the number of tank swaps
- Minimize the reaction time when last minute changes are needed
- Minimize the disruption of existing plans when last minute changes need to be done

Maritime transportation
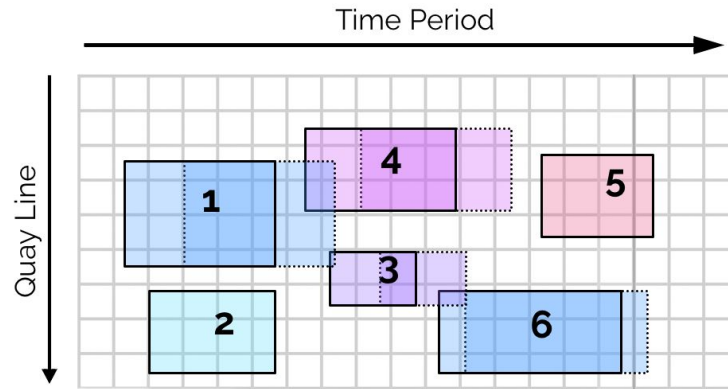
Maritime transportation

Planning of the departure calendar and the port operations required, like positions and berthing times, filling of tanks, etc.
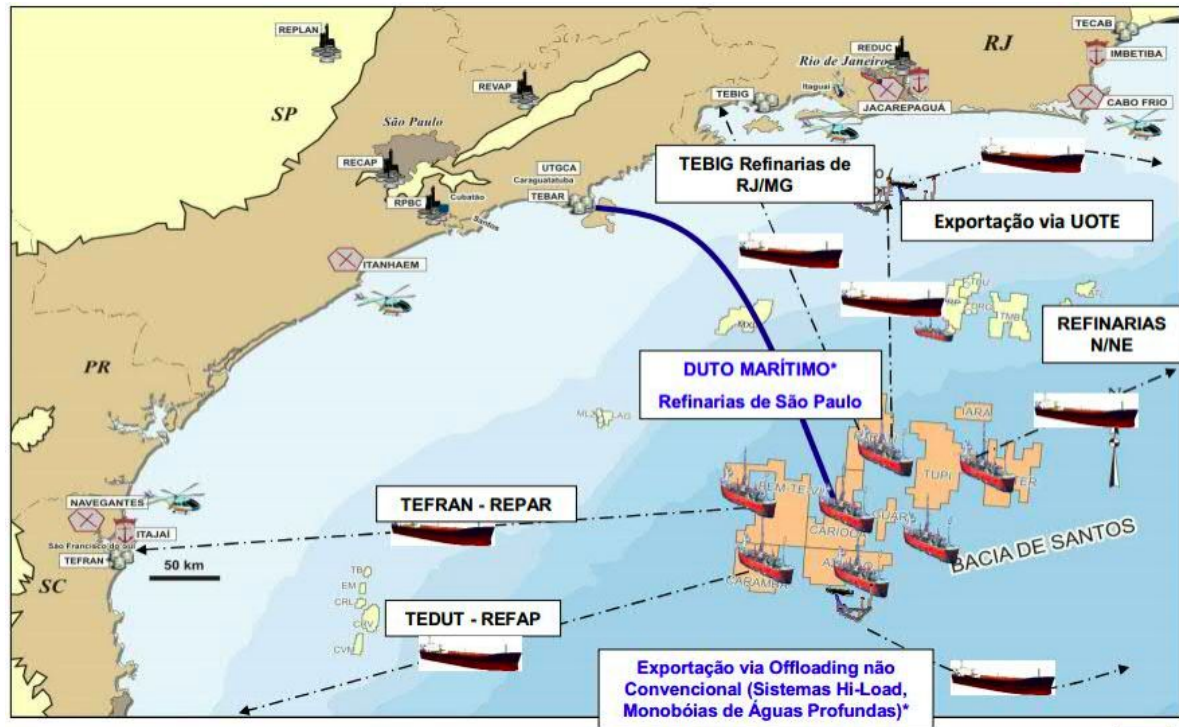
Maritime transportation

Objectives

- Minimize delays
- Minimize the impact of a delayed vessel over the whole plan
- Reduce the reaction time with respect to last minute changes

Caso : Petrobras

Petrobras moves crude by boat and pipeline between the extraction point and refineries at shore.

Maintenance

Adzim Musa, Unsplash

Equipment maintenance

Forecast the rate of failures based on historical data

Compute the calendar of preventive maintenance interventions to minimize the impact on operations

Compute the routes and schedules of maintenance teams

Equipment maintenance

Objectives

- Minimize the time equipment are immobilized
- Minimize the risk of equipment failure with to preventive maintenance
- Minimize the personnel needed to do the maintenance
- Comply with labor law

Maintenance of both fixed equipment (pipelines) and mobile equipment (trucks) can be planned.

Project planning

Project planning

Decide in which projects invest over a 20 years horizon : increase of pipeline capacity, new wells, new refinery, renewal of equipment

Need to be taken into consideration

- Annual budget
- Project expected profitability
- Project risk
- Different scenarios of oil price evolution

Case : Pemex

Pemex computes an investment plan for pipeline and refinery capacity increase projects, over a 20 years horizon.

Selected projects for each year need to remain within a the annual budget.

Investments are evaluated based on expectation of cumulative benefits and risks.
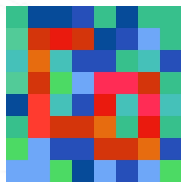
Other use cases

Transportation of teams

Petrobras plans the workforce shifts and transportation to their platforms by helicopter (2000 people, 40 helicopters)

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