

CoEnzyme

Analytics & Decision Optimization

Optimization in oil and gas

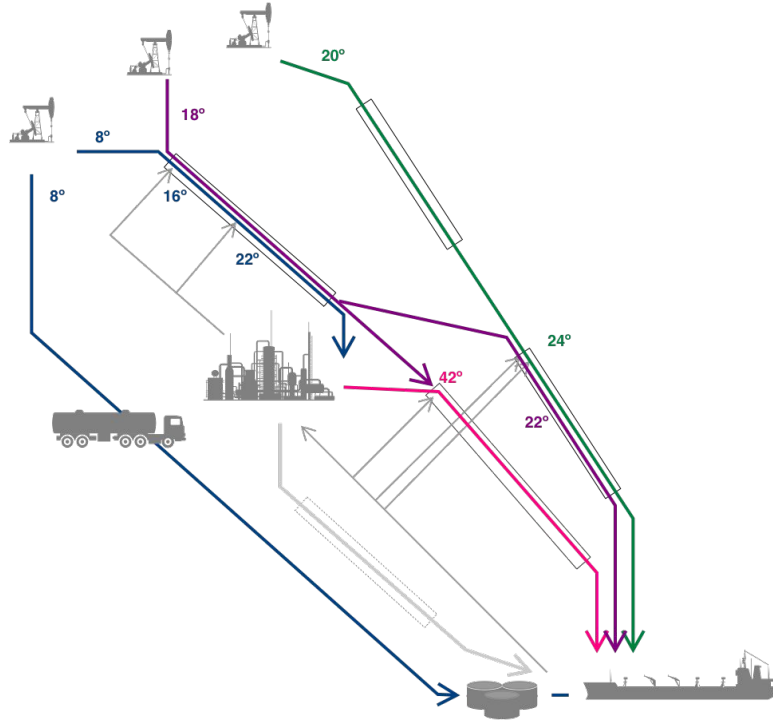
Colton Sturgeon, Unsplash

A large, light-colored industrial pipeline runs diagonally across the frame from the bottom left towards the upper right. The pipeline is supported by dark metal brackets. The surrounding landscape is a flat, open field with sparse vegetation and a clear sky. In the background, there are some industrial structures, including storage tanks and a building, under a bright sky with a few clouds. The word "Pipelines" is overlaid in a large, white, sans-serif font in the center of the image.

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.



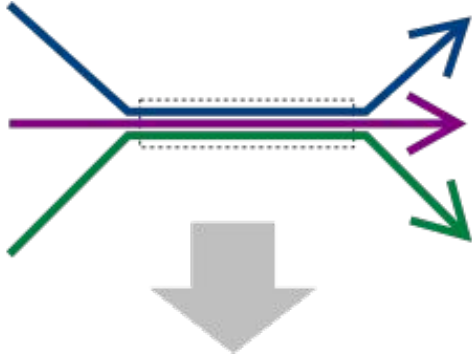
Crude blending for pipeline transportation

Objectives

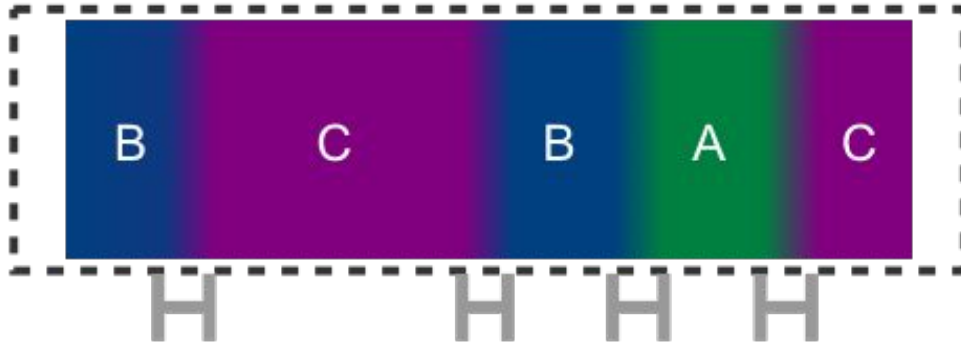
- Minimize the transportation and operation costs
- Reduce the use of naphtha
- Minimize the mixing of crudes of high value
- Minimize the load of the refinery
- Deliver multiple scenarios for managers to evaluate and compare
- Allow manual adjustments of the schedule



Batching and sequencing



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

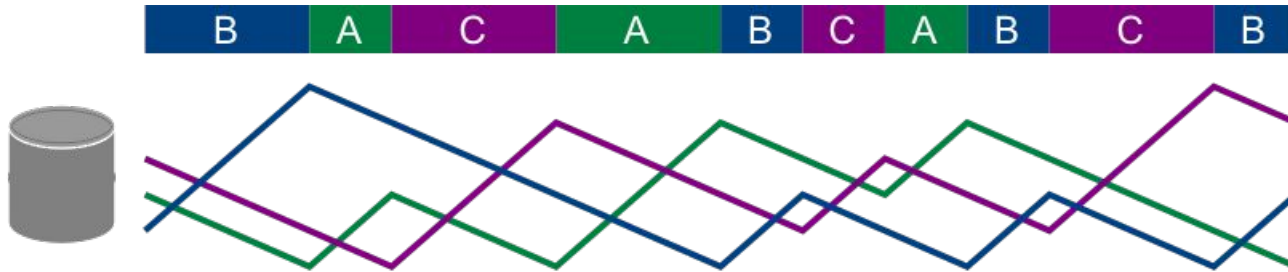




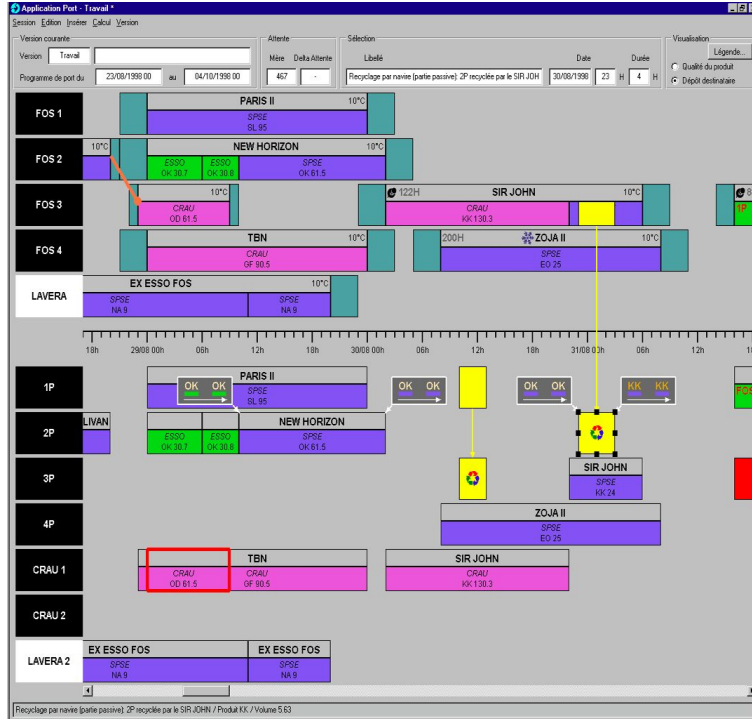
Batching and sequencing

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

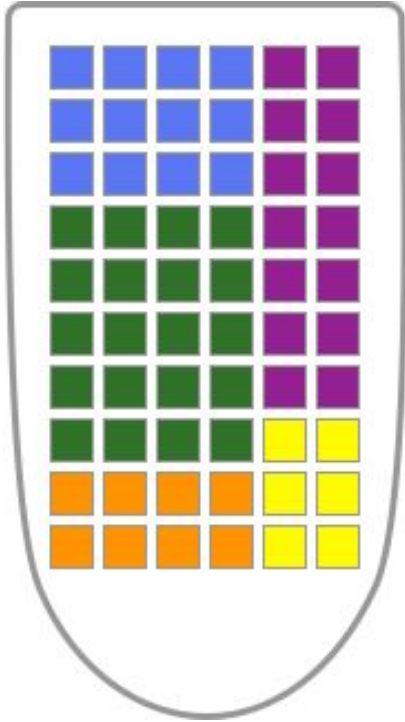


SPSE does an integral planning of the pipeline batches, storage, load in tanker vessels and operation of the maritime terminal.

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



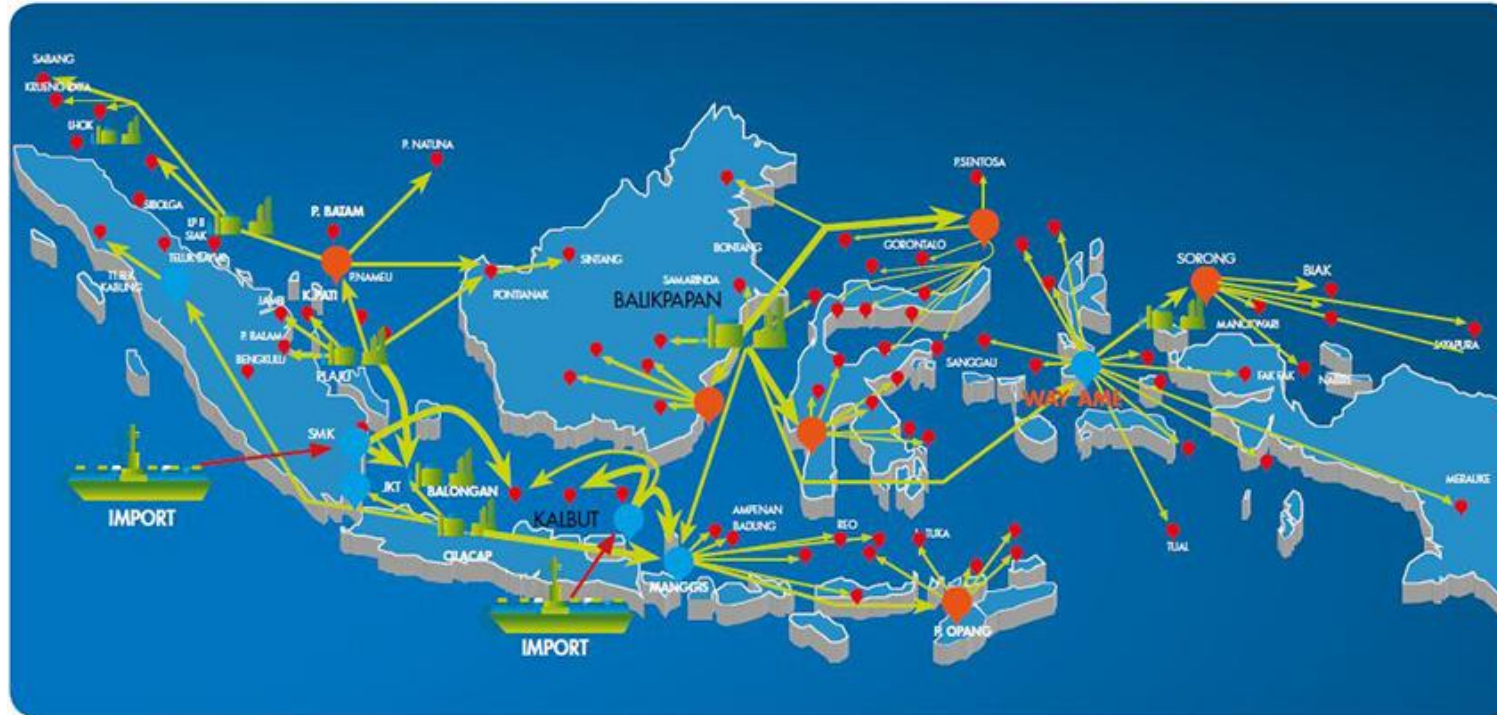
Case : Pertamina



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



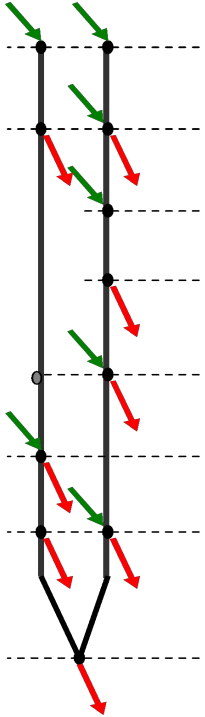


Case Enbridge



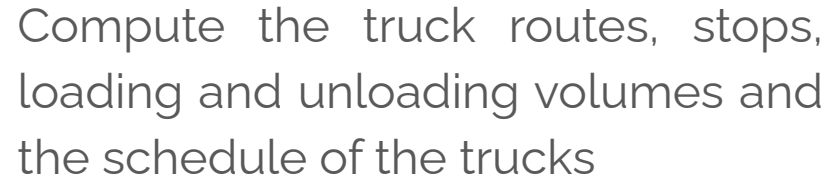
Enbridge routes batches of different grades of oil in pipelines, trying to avoid contamination between successive batches.

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



Tanker trucks







Transportation by tanker trucks

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

A photograph of a large industrial refinery. The scene is dominated by several tall, vertical distillation columns, some of which are emitting white steam or smoke. A dense network of horizontal and vertical pipes, some insulated with white material, crisscrosses the foreground and middle ground. The structure is supported by a complex metal framework. In the background, more industrial equipment and a clear sky are visible. The overall color palette is industrial, with greys, blues, and whites, accented by the yellowish-brown of some pipes and the white steam.

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.

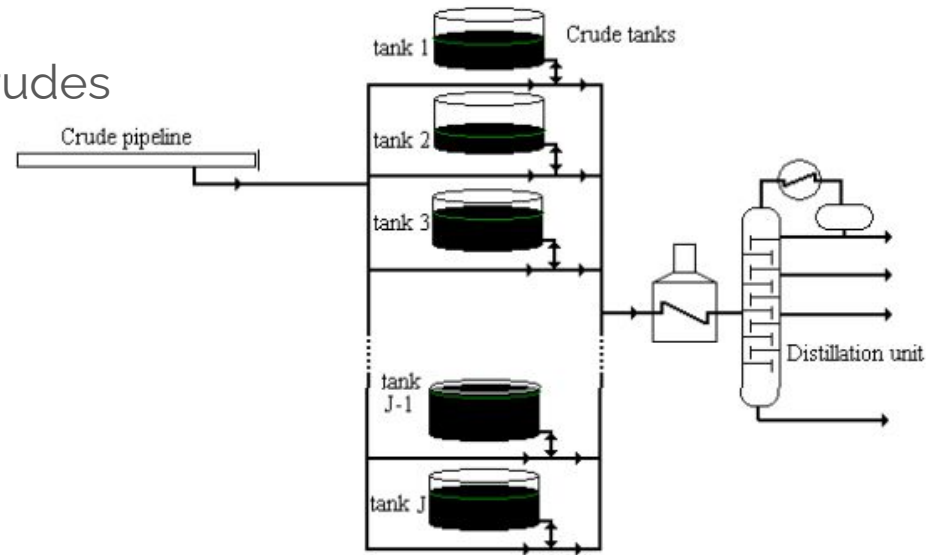
Define a calendar of operations the refinery needs to perform (filling and emptying storage tanks, opening valves, etc)



Refinery planning

Objectives

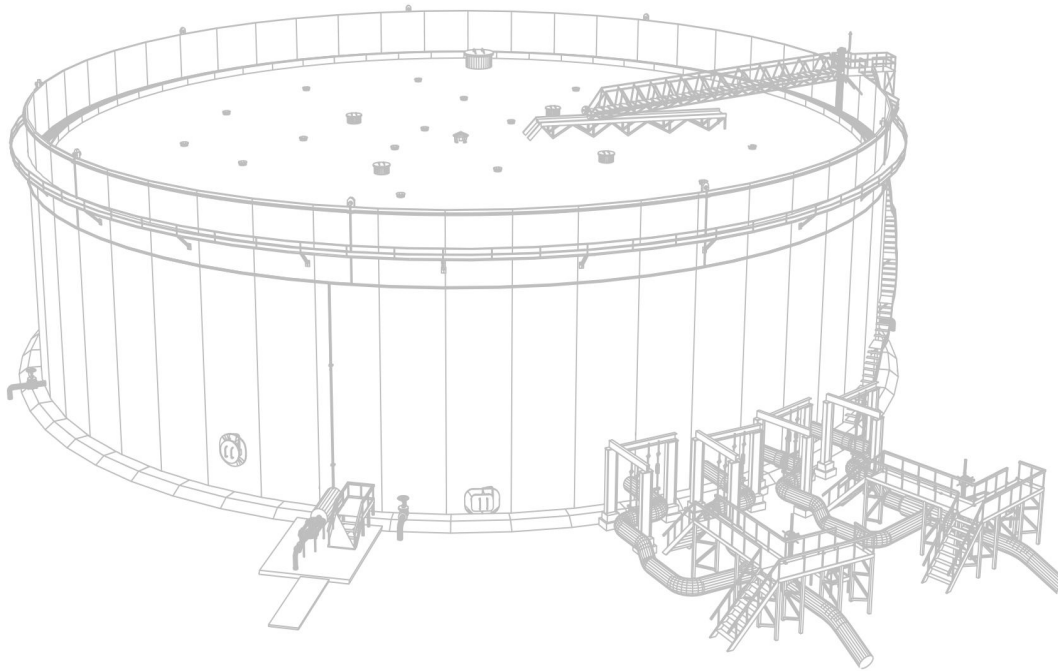
- Maximize profitability
- Take into account availability of crudes
- Keep inventory levels within desired ranges



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

An aerial photograph of an offshore oil platform situated in a large body of water. Two large oil tankers are moored at the platform's piers. The tanker on the left is orange, and the one on the right is blue and red. The platform itself is a complex of metal structures with various pipes and equipment. In the background, a range of mountains is visible under a cloudy sky. The text "Maritime transportation" is overlaid in the center of the image.



Maritime transportation



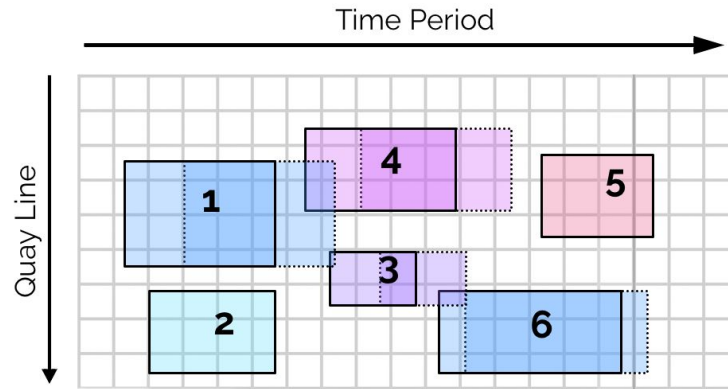
Planning of the departure calendar and the port operations required, like positions and berthing times, filling of tanks, etc.



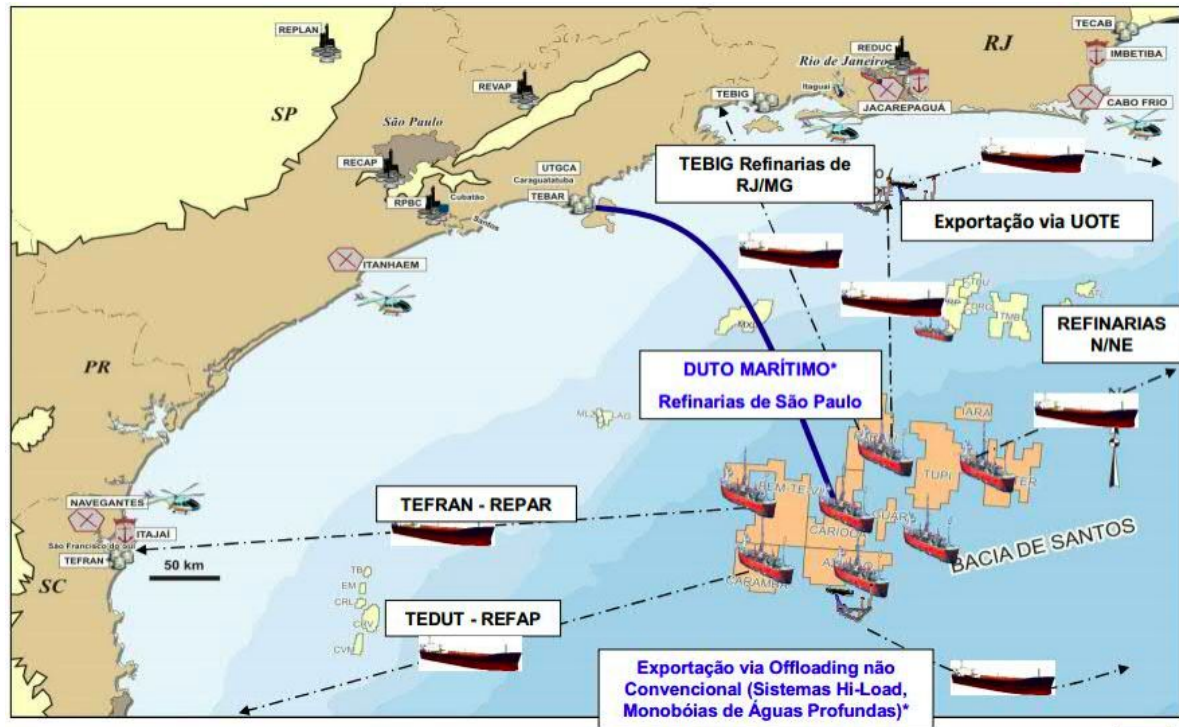
Maritime transportation

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.

A large, complex offshore oil rig is shown against a backdrop of a calm sea and a clear sky. The rig's main body is painted a vibrant red, contrasting with the yellow and blue of its upper levels and the green of its support structure. The structure is a dense network of steel beams, ladders, and platforms. A large, dark, cylindrical object, possibly a storage tank or part of the drilling equipment, is visible on the left side. The rig is supported by a complex system of green-painted steel legs that extend down into the water. The overall scene conveys a sense of industrial scale and complexity.

Maintenance



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

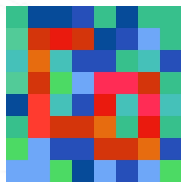




Transportation of teams



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



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