Industrial Use Case

Requirements:
• Optimal use of resources and equipment
• Steam network management
• Reduction of energy consumption and environmental impact

Context

Resource allocation in petrochemical sites:
• The industrial practice for handling the distribution of shared resources is a direct negotiation between plant managers in the petrochemical complex.

• The management structure is decentralized as the plants are operated by different business units.

Objective: Ensure the balancing of the resource networks without sharing sensitive data such as local models, prices of products and costs of resources.

Individual plants have local economic targets and technical constraints and a large number of manipulated variables.
Challenge

Centralized optimizing solutions are infeasible:
• Local data is not available.
  ▶ Market conditions are specific to the plants and not shared within the site.
  ▶ Local models are unknown.
• Computational issues (complexity of local models)

Therefore distributed solutions must be realized.

Proposed Solution

Price-based coordination for distributed optimization without sharing details about the local plants.

Price-based coordination does not require transparency of the local variables of the subsystems. The prices for the resources are set based on the information about resource use.

The proposed scheme works as follows:

1. The coordinator sets and communicates the initial prices.
2. Local optimizers calculate the optima of the individual plants (including utilization of the shared resource networks) and send this information to the coordinator.
3. The coordinator checks whether the global constraints are satisfied and terminates the coordination if the local solutions satisfy the global constraints.
4. If not, the prices are updated and sent again to the local plants and the procedure continues.

Left: A part of the petrochemical site; Right: Network imbalance over iterations of the price-based coordination

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