CASE STUDIES

Example: Upstream Field Management

Operation of upstream oil and gas facilities is a complex process involving numerous assets that may be dispersed over a wide geographic area. These assets may include production platforms, gas-gathering networks, transmission pipelines, gas treatment plants and mid-stream NGL or LNG production facilities. Maximizing the production rate of valuable hydrocarbons from these facilities requires careful and continuous co-ordination between the assets. Any point within the production system may be a bottleneck, and disruption of operations at any asset may require a response that affects the whole system.

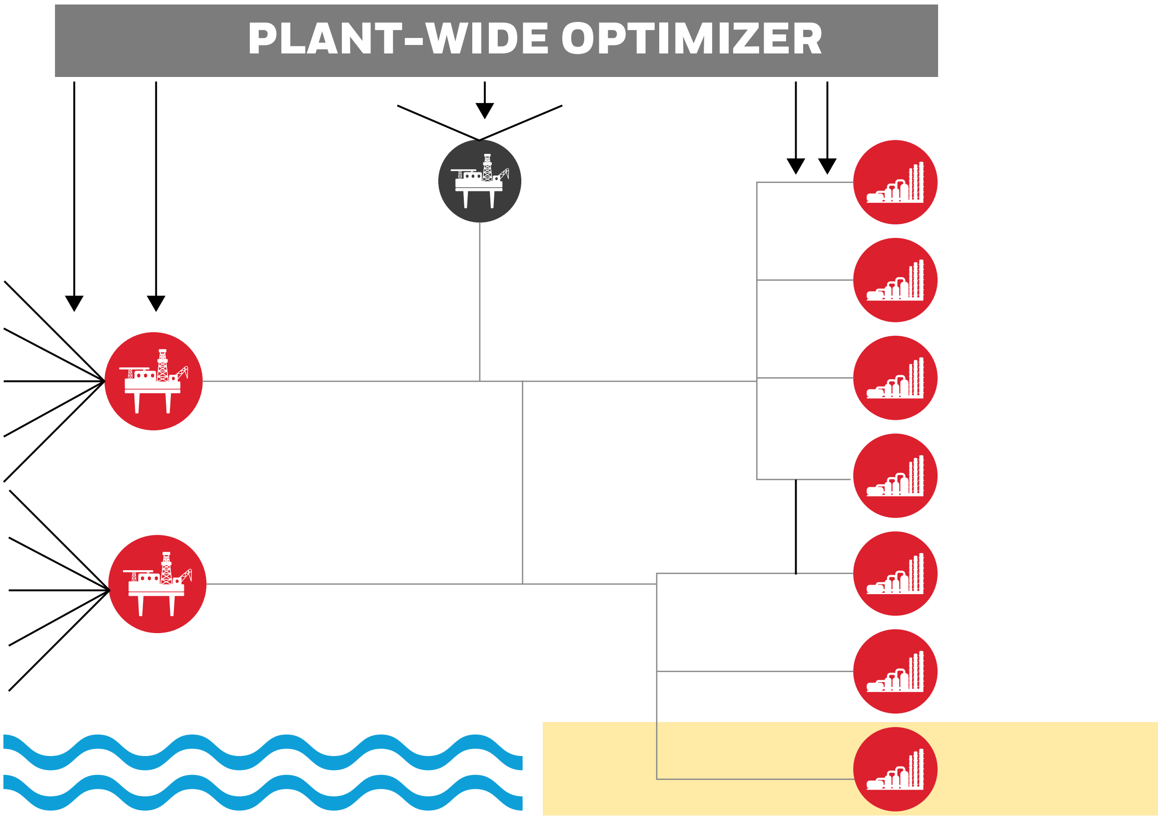

Figure 2: An example of a complex upstream production network Honeywell Forge APC Plant-Wide Optimizer has been deployed to manage these complex upstream networks. The optimizer objective in this case is to maximize the production of valuable hydrocarbon products from the overall facilities, manage the pressure and other constraints within the piping networks, and set the throughput of the various gas processing facilities onshore. The dynamic interactions between variables are recognized, back-pressure effects are accounted for, and production is distributed between downstream facilities in the most efficient way. The Plant-Wide Optimizer delivers maximum utilization of the available assets, leading to higher hydrocarbon production and improved yield of high-value products. The flexibility and responsiveness of the system to any external changes, such as ambient conditions, is also greatly improved.

Example: End to End Optimization of an Oil Refinery

From a functional perspective, control and planning departments in an oil refinery are almost always dependent on one another. Planning relies on control to implement its' operating plan, while control relies on planning to set the operating targets for the entire plant at the most profitable operating point possible.

The problem, historically, is that these two functions have not always worked together in an optimum way. For example, operating targets produced by the planning department might call for a unit charge rate that is not currently attainable due to constraints on the unit. In this case, operations must determine what the unit charge rate should be. In an ideal world, this feedback, the fact that the planning target is not achievable, should be shared with Planning, but how often does this happen? And doesn't that throw the validity of the planning solution into question; the fact that it was predicated on a unit charge rate that was not feasible? There are issues on the other side of this problem as well. What if the planning model assumes, for example, a unit charge rate maximum limit that is less than that which is currently achievable? This would appear to mean that money has been "left on the table". It seems like there should be a better way.

Honeywell's Honeywell Forge Plant-Wide Optimizer solution fills this void. The coordinating optimizer uses a pre-existing planning yield model to provide an initial steady-state gain matrix, and the relevant model dynamics can be fleshed out from the historical operating data of the facility. It controls the product inventories, manufacturing activities, and product quality. Its embedded economic optimizer, which is furnished with the same planning model structure and economics, reproduces the off-line planning optimization on-line and in real time.

The cascading layers provide the coordinating Honeywell Forge Plant-Wide Optimizer with future predictions of secondary CVs/MVs and the operating constraints inside every unit. With this supplemental information, the real-time planning solution of the two-tier MPC cascade has real time feedback and will now honor all the unit-level operating constraints and guarantee feasibility.

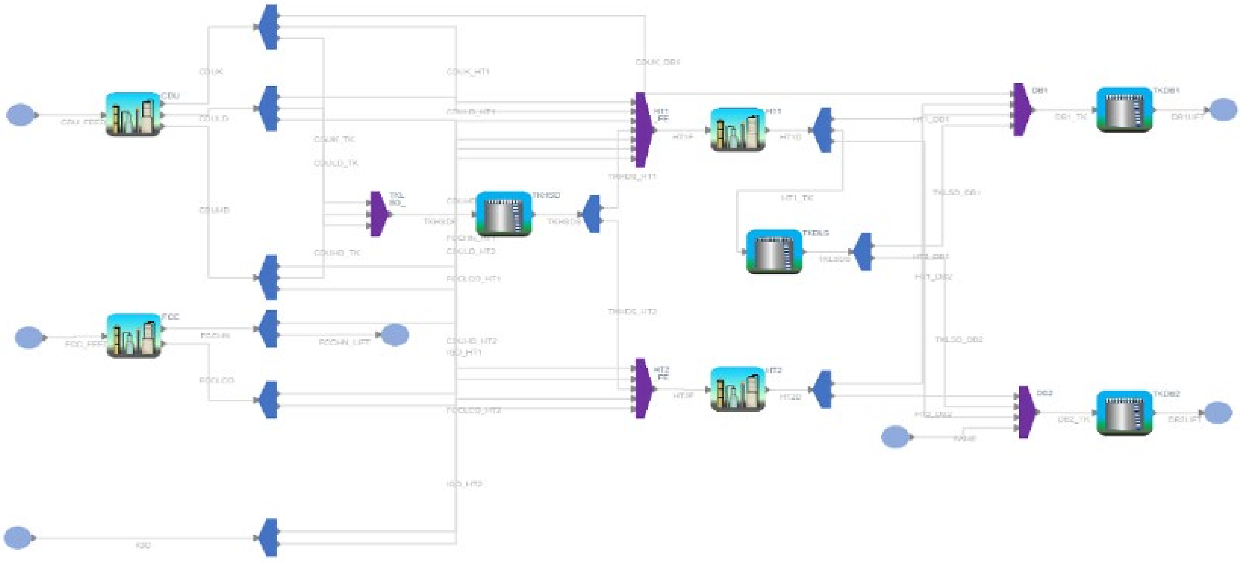

Figure 3: An example of an oil refinery network

Jointly, the MPC cascade provides simultaneously decentralized controls at the low level with fine-scale MPC models and centralized planning optimization at the high level with a coarse-scale yield model, all in one consistent cascade control system.

The main benefit areas for refiners are to reduce product quality giveaways, optimize intermediate component production (tied heavily to the first benefit), to make more high value products with same feed, or to potentially handle new feed type.

Another area to consider is the way in which planning of the on-site process unit and off-sites, or blending, is typically executed. There is typically a plan generated that sets the process unit key operating targets such as rates, cut points and reactor severities, with the ultimate goal of meeting final product demand in the most optimum (economical) way possible. In parallel with this, there is often a rigorous planning exercise in the off-sites areas, considering the blending component volumes, qualities, inflows, and of course the final product quantities and volumes. This is also an economic optimization. As can be seen, however, these two processes, tend to operate in a somewhat independent manner. Another point to be made is that the Blend Planning executed in the Off-sites areas never has the luxury of driving the component volumes or qualities, by reaching back and setting the process unit key operating parameters. They are essentially “making the best” of the lot that they are given. So, while it is commonplace to think that a top-shelf off-sites operation will drive quality giveaways down to a minimum, this is virtually impossible to do in the steady state sense unless the process units are actually producing component volumes and qualities in alignment with product demand and optimum component recipes. This “Tale of Two Planners” story is another problem that Plant-Wide OPtimizer seeks to resolve; by solving the on-site and off-site planning problems simultaneously.

CONCLUSION

APC Engineers are always looking for the next challenge, new ways to add value to their site.

As they turn their sights on the implementation of Plant-Wide Optimization strategies, several things become clear. First off, the traditional control and optimization tools like APC and steady state Optimization, while they can certainly be a part of a plant-wide solution, cannot do it alone. Additionally, reusing existing model information, such as a planning model, can provide a good foundation for a site wide strategy. Incorporating Honeywell's Plant-Wide Optimizer effectively provides a solution that combines the broad optimization objectives of a planning model with the up to the minute constraint awareness of an APC controller. The technology can and has been applied to a variety of vertical industry problems, including a metal production complex, upstream oil and gas facilities and oil refineries.

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For more information

Learn more about how Honeywell Forge Advanced Process Control Visit: http://hwll.co/AdvancedProcessControl or contact your Honeywell Account Manager.

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