CCR PLATFORMING
HOW TO CREATE A PERFORMANCE UPGRADE PLAN



1971 1974 1978 1988 1991 1993 1996 2001 2004 2006 2010 2011 2014 2016 2017 2019 2021

Honeywell
UOP

SCENARIO:
Your refinery manager wants options to increase CCR Platforming Unit profitability. There is also a plan to increase the length of time between major turnarounds. She's requested a plan for upgrading CCR Platforming Unit performance and needs it fast!

Day-to-day refinery operations take up most of your time and it's hard to consider the request in the context of everything going on. How do you get started? What can you do to respond quickly?



IT STARTS WITH A PLAN!

You can develop a CCR Platforming “Performance Upgrade Plan” within one month (or even less).

TIP: Start off your planning using a “Five Ws and one H” mindset for information-gathering. Who/what/where/when/why/how are great questions to ask at very beginning of a program.

The timing for the CCR Platforming performance upgrades themselves depends on the scope and direction that you take (and what your management approves).

A strong “Performance Upgrade Plan” can help you and your company execute faster. The plan needs to be flexible and include logical “check-in” points with management and technical experts to obtain feedback. Use your actual CCR Platforming Unit operating history and operating data as the facts to gain acceptance and obtain approvals to make changes.

TIP: Wherever possible, provide an estimate of the timeline to implement each performance upgrade and the economic benefits expected. This helps your company prioritize and budget.

Identifying performance upgrades is an iterative process. While developing your CCR Platforming “Performance Upgrade Plan”, a good practice is to meet with your management and key stakeholders several times to update progress and get some feedback.



CCR PLATFORMING PERFORMANCE UPGRADE PROGRAM

(in five steps)

Before constructing a “Performance Upgrade Plan”, it is important to consider the key steps:

1. Context Setting
2. Benchmarking
3. Identifying Improvements
4. Execution of Upgrades
5. Measuring Results and Control Plan (to lock-in gains)

The five-steps are described as they pertain to developing a CCR Platforming “Performance Upgrade Plan”.

SEE WORKSHEET 1 – EXAMPLE PROGRAM CHARTERS

1

CONTEXT SETTING – DEVELOP A PROGRAM CHARTER

A “Performance Upgrade Plan” starts with understanding management objectives and constraints for the CCR Platforming upgrades.

TIP: Ask for how the upgrade project fits in with the current refinery plan/strategy and company priorities. This can help identify key areas to focus on initially and set the tone for the project when you are communicating with stakeholders.

You will need to identify and articulate the specific Performance Upgrade Program goals. Timeline, budget constraints, who is involved, and the measures for success (KPI’s etc.) are all important factors to implement the CCR Platforming upgrades. Organizing, getting this in print, and gaining your company’s acceptance on the program are key for “Context Setting”.

In project management terms, organizing the objectives and constraints for a program is often called “developing a Program Charter”. The time spent on setting a Program Charter will certainly pay off. You can use the Program Charter to begin meetings or correspondences on the subject for pre-alignment. The document can easily be updated/revised as the project evolves and changes.

UOP can help you get started and has included a pdf with example Program Charters for several typical CCR Platforming upgrades. If you send us an email we can send you a spreadsheet that is easily editable for your objectives. Please check how well the UOP CCR Program Charter matches your company’s documentation requirement. Is there anything missing that UOP can help you with?

2

BENCHMARKING – UNDERSTAND CURRENT CCR PLATFORMING SITUATION

A CCR Platforming “Performance Upgrade Plan” depends on a solid understanding of both the Unit history and how the Unit is currently operating. With that information, it becomes easier to see where the performance gaps are, both in terms of reformate production metrics and Unit onstream reliability.

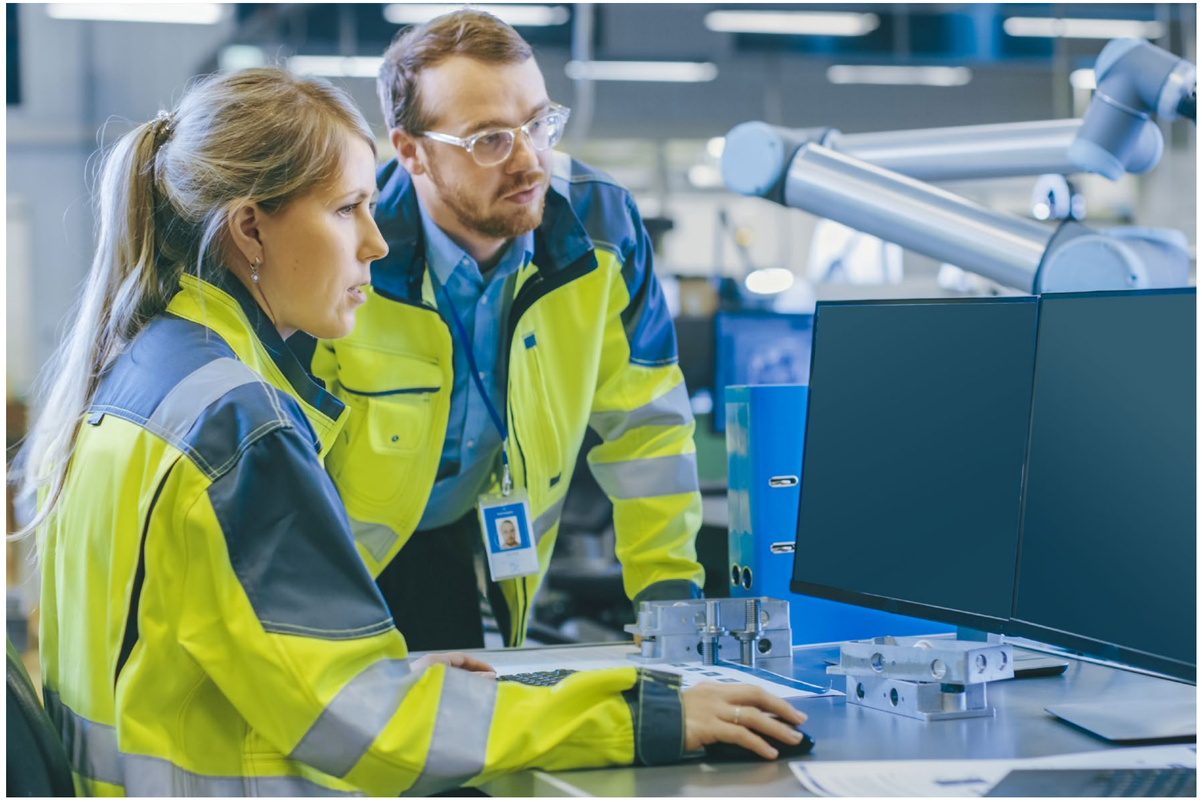
Benchmarking activities can be further subdivided into several categories.

2.1 - INFORMATION GATHERING

The first part of benchmarking is to locate and organize existing Unit operations data and historical information.

Unit operations data should be gathered from sources that your company normally uses and is familiar with. You may need to go to operation data prior to the last turnaround for a “longer view” of Unit operating performance. You may want to look at how the Unit was operating before that turnaround to form a solid comparison.

Historical information such as planned/unplanned shutdowns, major equipment repairs, and catalyst/adsorbent changeouts should also be documented and tracked. An effective way to organize historical information of this type is to construct a Unit “timeline”.



TIP – Your organization’s people are the key resource to tap! Ask a broad group of people if they knew of a similar program in the past. What happened before and where are the materials and information saved? What were the learnings from the program? What would they do differently this time?

We have included a link to a downloadable spreadsheet with example information sources. These are intended as a start point for your consideration and there are likely many other sources.

SEE WORKSHEET 2- INFORMATION REQUIRED

2.2 - PERFORMANCE ANALYSIS

The second part of benchmarking is to analyze the full information already available for the CCR Platforming unit. The analysis is intended to summarize the current capability of the Unit and identify Unit performance gaps, problematic issues, and equipment trouble-spots that can help improve Unit profitability.

Unit operating data should first be evaluated in the way that your company normally uses and is familiar with. Use your regular daily reports/charts as well as monthly reports to get started. Then do some additional plotting of CCR Platforming key data.

- Typical plots include feed composition (PONA), feed rate, reactor inlet temperatures vs. prediction/LP model, reactor inlet temperatures vs. product RONC, C5+ or Aromatics yield vs. prediction, H2 purity, and CCR burning trends. This should also include monitoring for past learnings about reliability from your unit or ask UOP or a refinery subject matter expert about other parameters to trend.
- Make plots for (a) the last calendar year, and (b) since the last turnaround or catalyst reload.
  - the “last calendar year” data is useful to identify periods of “good data” with steady feed rate and product RONC, complete GC analytical and a material balance 100 +/-2%. Reformate yields can be more accurately calculated for that period, and a cross check of reformate production with tankage might be possible.
  - the longer timeframe data is informative about percentage of time the Unit operates at high & low capacity, or with different feeds/product objectives.
- As you analyze data, try to identify data gaps, quality/frequency of GC analysis, flowmeter calibration/range issues and other inconsistencies. Look at feed contaminants and catalyst analytical data to check feed pretreatment NHT performance.

TIP – Check the CCR Platforming General Operating Manual for recommended analysis and sample frequency.



2.3 IDENTIFY PROCESS PERFORMANCE GAPS

After the Performance analysis, the next benchmarking step is to check how the CCR Platforming Unit actual performance compares to the expected performance.

The suggested starting point to identify gaps is with a "UOP Data Review" by a UOP Technology Services CCR Platforming specialist. A UOP Data Review can identify the Unit performance gaps, if any, and the possible countermeasures that can be taken to improve CCR Platforming performance. It can also highlight additional actions that should be taken for Benchmarking, or as part of a larger Performance Upgrade Program.

After the data review, you can start to check the reforming yield performance more closely. As mentioned previously, the best data for yield calculations are for periods of "good data" with steady feed rate and product RONC, complete GC analytical, and a steady material balance 100 +/-2%.

Some refineries do a periodic full material balance test as a routine operation. The material balance tests are done at normal feed rate, with steady feed composition and product RONC (or operating severity) conditions, running the test for 2-3 days. Full material balance analytical samples are taken in that period and then the Unit material balance closure is carefully checked. This data allows for more accurate understanding of the CCR Platforming reformate and hydrogen yield performance.

Once there is material balance data available, you can request that UOP provide a detailed CCR Platforming yield estimate for those conditions to compare with yields developed from the material balance test results.

TIP - If you have a large material balance offset, or if you have not done a full material balance check in a while, then it may be helpful to engage UOP Technical Services to assist you. UOP can help with troubleshooting the mass balance, come to site for the material balance test, or even develop the material balance worksheet.

UOP offers a wide range of services to help you with benchmarking and gap analysis for your CCR Platforming unit.

- **UOP PremierPLUS Connected Services** including UOP Data Reviews and Performance Benchmarking
  - Tracks fundamental process unit operation variables and advanced process unit operation parameters vs aggregated anonymous operation data from similar units.
  - Purpose is to optimize Unit operations and identify areas of improvement.
- UOP Field Operating Service assistance for material balance test runs and hydraulic surveys.
- **CCR Platforming Health Check** for comprehensive identification of gaps, economics for gaps, and actionable recommendations including possible upgrades. Consulting and program management are available.
- **UOP CCR Platforming Technology Upgrade Workshop** including Engineering, Service, Catalyst and other experts.
- CCR Platforming yield estimates for catalyst upgrades
- **UOP Process Revamp Studie**s for debottleneck projects, reliability improvements or other performance upgrade projects.

SCENARIO CHECK-IN

You've collected a lot of background and identified how the unit is currently performing. You've let the data and unit history speak for itself – it's clear where you're coming from.

Looking at what you've collected, you've found more than a few ways to improve. You have ideas for improvements and want to confirm with others which opportunities should take priority. You're pretty sure that there's a combined feed exchanger leak which is dragging down your product octane, but how do you communicate the urgency to fix it? Is this the highest impact project to drive to completion?

It's time to assemble a team to assess these ideas.



3

IDENTIFYING IMPROVEMENTS

After you developed and analyzed the Benchmarking information, then it is recommended to get your whole Site team together to discuss performance improvement areas.

One way to do this is using a “Brainstorm Event”. The brainstorm can be done in two parts (2 hours each).

DAY 1

Present a summary of the CCR Platforming current situation

- Program Charter, Current Unit Performance, and Unit Timeline
- From your benchmarking analysis, present the Unit performance gaps, problematic issues, and equipment trouble-spots that could be addressed to help improve Unit profitability. Estimate economic impacts of the gaps if possible.
  - Try to identify & focus on the 3-5 most impactful issues.
  - Provide assessment of information “decision making quality” and recommendations from your perspective.
  - Consider if a dedicated material balance test run, a UOP data review, CCR Platforming Health Check, or CCR Platforming Technology Upgrade workshop would provide additional crucial information.
- Summarize next CCR turnaround - key actions and downtime currently planned.
- Get Site team feedback if there are any concerns or missing information.
- Ask them to think about Performance Upgrades for DAY 2.



DAY 2

Brainstorm ideas for performance upgrades. In addition to your Site team, you might include technical specialists from UOP to participate (and Q&A). You might lead the discussion and get a second person to capture and write all the ideas.

TIP – Use a spreadsheet with a different tab for each subject. You can pre-populate items before meeting to ensure they are mentioned.

Topics:

- CCR Process Objectives Feed Rate & RONC (Near Term & Longer Term)
  - Any major revamp needed or envisioned?
  - Brainstorm Subjects (pre-populate some items to get discussion going)
  - Operations
    - Maximize yields and reduce unplanned shutdowns
    - Training needs
  - Equipment
    - Provide reliable operation at design capacity and duty
    - Known problems and repair plan
  - Catalyst and Adsorbents
    - Maximize yields & protect catalysts and equipment
  - Controls & Monitoring
    - Improve diagnostics to quickly identify performance gaps
    - GC/Analytical; LIMS system; online analyzers – What are peers doing?
  - Energy Intensity; Environmental
    - Fired fuel; compression BHP; CCR vent gas
  - CCR Platforming Technology Upgrades Available
    - Reactor internals; shutdowns management technology
- Follow-up - After meeting, organize and categorize Brainstorm items in several dimensions. The intent is to organize ideas in a way that allows prioritization, budgeting, and assignment of people for follow-up. After you have this, then issue meeting notes capturing all the comments and your analysis.

We have included a link to a downloadable spreadsheet showing a way to organize brainstorm items. This is intended as a starting point.

- Communication with your Site team is critical for upgrading the CCR Platforming Unit performance. Visually organizing information can help get changes accomplished. We included an example analysis of brainstorm items intended to identify items for fast action. See Figure A.

SEE WORKSHEET 3 - EXAMPLE BRAINSTORM LIST

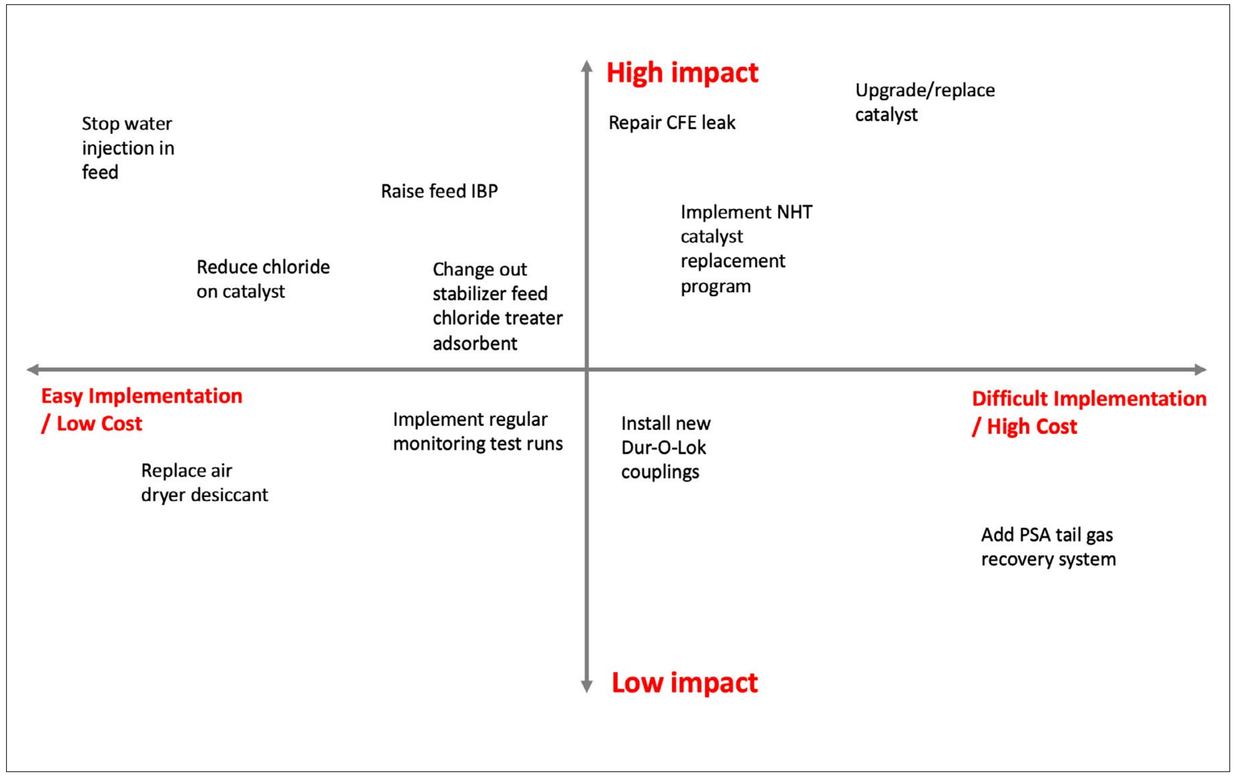


FIGURE A - The items shown are on two Dimensions relative to other items.

4

EXECUTING PERFORMANCE UPGRADES

After the Brainstorm there will be further clarification and tuning of the Performance Upgrade Plan.

You will need to meet with your management and key stakeholders to get feedback on which items should be acted upon immediately, which need to undergo further funding approvals, and which items are definitively ruled out.

KEY: Document the “act immediately”, “get funding”, or “no action” decision made using a comprehensive list of the Performance Upgrade Plan possible improvements. When a “no action” decision is made, note the decision date and provide a short reasoning. This helps keep the program focused and avoids returning to items that were already considered.

TIP: A best practice is to include estimated costs and implementation timing on your comprehensive list. It helps with management decision making. A Subject Matter Expert, UOP, or experienced project leaders at the refinery can make a quick estimate to help prioritize (even if it has +/- 50% margin of error). Fast is more important than precise at this stage.

With the action plan in hand, it’s time to implement the upgrades. The specific work will be as varied as the possible projects. In some cases, this means a procedure change, in others a revamp project with a major turnaround. Some examples include new operations or maintenance training, addition of new routine tasks like quarterly material balance test run, replacement of spent adsorbents, upgrading to a new catalyst regeneration control system from UOP for improved CCR reliability, or anything else identified in the brainstorm phase.



TAKEAWAY: Know the plan, know the expected results, and be ready to adapt if needed. Leveraging the Subject Matter Experts in your organization or from UOP can help you overcome barriers as you are executing the performance upgrades.



SCENARIO CHECK-IN

The leak on the combined feed exchanger was confirmed by radioactive tracer analysis. Management decided to repair it at the next turnaround, and now that turnaround has been completed. With the repair implemented, the refinery manager wants to see the results.

You are well prepared because you've performed a material balance test run after the restart. Compared to the test when you were making the plan, the reactor temperatures are 10°F lower and there's 2% more reformate without losing product quality.

Pleased with that result, she then asks what you're doing about the salts build-up in the stabilizer column. You are ready for that question too. Your plan had recommendations for on-line water wash that was implemented. You also recommended procedural changes that included new once per month testing of the stabilizer feed chloride treater outlet stream for chloride breakthough.

How did you know to make those procedural changes?

5

MEASURING RESULTS AND CONTROL PLAN (TO LOCK-IN GAINS)

The overall philosophy is this: you've presented your plan for improvement. You've implemented the plan. Now, show the results of your plan.

Ultimately, the value of any improvement is only realized when you can measure it and sustain it. In the upgrade plan, specifically describing how to measure program results builds confidence with management and can actually lead to your plan being funded!

MEASURING RESULTS

Measuring results doesn't need to be complicated. The same tools described to analyze performance in Section 2.2 can also be used. UOP PremierPlus Performance Benchmarking is a great way to continuously monitor your CCR Platforming Unit against operating peers and your own history.

A material balance test can take a close look at operations for a few days to verify the results. Or a UOP data review can show these results sustained over time.

SUSTAINING RESULTS

The job isn't over after the Performance upgrade plan is complete, as old habits can return and changes can be temporary and cause Unit performance to regress. A Control Plan can help to sustain the upgrades and lock in improved performance. This is especially crucial for changes in operating or maintenance procedures, as old habits tend to return. Documenting the upgrades and ensuring they are incorporated in the standard Unit routines is an important part of your Control Plan. Requirement to measure results routinely in the refinery with a way to verify that it remains will keep your legacy on the unit alive.

IT STARTS WITH A PLAN
AND IT ENDS WITH A PLAN

You've made a plan, you've executed a plan, and you've measured the results to sustain the plan. Now all that remains is to make sure the plan can be easily adapted for the future. The completed Performance Upgrade Plan can serve as a roadmap for the future.



SCENARIO WRAP-UP:

A few years have passed, and you've changed roles to be the process engineering lead for another part of the refinery. A new engineer comes to you asking for help to develop a plan for improvement of the CCR Platforming unit performance. You are all set for that question. Your Performance Upgrade Plan & report are a great starting point for the new engineer and can set the context for a new performance upgrade plan...

For More Information
For more information about CCR Platforming Upgrade Plan, contact your Honeywell account manager.

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