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Making or Saving Money in Non-Process Engineering Areas for Petroleum Refineries

By Carmagen Engineers

This is part two of our series on making and/or saving money in refineries. What is your best cost-effective tip for refineries is a question we posed to our 180+ engineers. The majority of our engineers have 35+ years of experience, so they know what they are talking about. The following are their answers for the non-process engineering side of the refining industry. There are several "repeat tips" from our first article, since they also apply to the non-process engineering area.

General Tips

- Maintain all equipment in top operating condition including spare motors/steam drivers. This also pertains to offsites and all utility services, steam, plant/instrument air and cooling water.
- Make sure that changes and upgrades are properly noted and changed in all of the manuals and equipment information and materials lists. It is costly and time consuming when equipment is taken out of service for repairs and the replacement or repair material is not compatible because it had been ordered from information that had not been updated according to the last revision.
- Don't fall into the trap of overanalyzing things or automatically believing what the computer output says. Just because we have much more analytical capability than we did 30, 20 or even 10 years ago, does not mean that we always need to use it, or that the output is automatically correct just because the program says so. Only use the "tools" that make the most sense for the particular situation, and be sure that the results from any detailed analysis make sense.
- Work hard to go down the experience curve with at least a one percent improvement every year.
- It is hard to provide a "best" tip for refineries because of their diverse nature. Generally speaking, there will be specific issues at one location that may not exist at another. However, my tip involves finding issues and then directing attention to their correction. Therefore, I offer the following:

One of the most cost effective measures that is generally applicable to all refineries and similar plants is the reduction of operating costs through a survey of current energy uses in combustion and process equipment. This would be followed by recommendations to reduce usage both through non-investment (i.e., operational changes such as reduced excess air) and investment (e.g., new or add-on equipment). The survey would be conducted by a team of individuals with equipment and process expertise.

- Do it right the first time. Do not try to save pennies because you shall pay dollars for it later.

Work Highlights

Reliability & Maintenance



Provided procurement consulting support during an approximate four-month, onsite

assignment for an \$80MM turnaround and improvement project for a Canadian tar sands upgrading facility. During this period, identified multiple improvements to the client's procurement/material management system that reduced the project's overall cost and schedule, and also provided general support to the material coordinators. The overall system improvement recommendations that were made are applicable to the client's general procurement/material management.

Equipment Lifting



Provided heavy lift, civil, and mechanical engineering consulting support to a US client for

their planned FCCU vessel head/cyclone replacement. While the contractor's overall plans were found to be acceptable, recommendations were made in several areas that resulted in several changes being made to some design and procedural details in order to carry out a safe and successful lift.

- Make sure that all stakeholders are aligned with job scope, cost and schedule before proceeding to the next stage. Rework due to misalignment, lack of consensus, and poor understanding of technical and business scope can lead to significant rework costs and ultimately project mortality. **Must make sure that all are paddling in the same direction.**
- Develop a well-defined overarching mission statement and a supporting list of specific business objectives that can be stewarded on a periodic basis and updated at least annually. The specific business objectives should address all key business areas and all primary community and governmental interfaces.

Small Project Execution

With regards to small project execution:

Many companies have alliances with major EPC firms. These firms have organizations in place to execute large capital projects (>\$100 million) and have great difficulty in organizing for smaller projects (e.g., maintenance and capital projects) where the emphasis should be on fit-for-purpose teams that can adapt to small project needs such as utilizing lean teams, multi-functional personnel, streamlined procedures, reduced overhead, etc.

From personal experience, a large project organization culture will execute small projects with a premium of 1.5x to 3x the man-hours in comparison to a small project organization.

Here's another one based on an incident that occurred recently. Again, this is to do with large EPC firms executing small projects in an existing plant. Large EPC firms typically work with a single point of client contact working together in a single project office when executing a Greenfield project.

When executing plant projects, the EPC personnel have difficulty working with the various plant personnel forming the client's operating team. The specific example that came up recently was the EPC project engineer was not able to resolve a request for a hydrotest waiver requested by the turnaround planning group. In an operating plant, the inspection group has the mandate to resolve a waiver request. If there is dissatisfaction with this response, it is appealed to the safe operating management group. If there is better understanding of the plant owner's operating team, decisions can be made more effectively, quicker, and not be subject to future review and recycle.

Maintenance

Reduce scheduled preventative maintenance (PM) by recognizing that for several classes of equipment, PM does nothing to improve the situation and may in fact make things worse by injecting infant mortality type failure mechanisms each time PM is undertaken. Use maintenance and capital resources smarter by improving the reliability and/or availability of potential high Unplanned Capacity Loss (UCL) contributors and/or safety related systems.

Electrical

- Use the latest on-line electrical system diagnosis testing. This can avoid costly outages and be much better than off-line testing.
- Do not live with problems and accept deficiencies.
- Use a zero accident philosophy – ZERO accidents are accepted.
- ALL items should work properly. Only ZERO defects should be accepted.
- Fix/repair all known/identified/defective items ASAP. Problems quickly multiply such as in one instrument being bad in 2 out of 3 voting – another could go bad.

Another way to look at it is – tomorrow will bring an unknown problem – it is easier to fix the ones we know.

Corrosion

Apply a glass fiber reinforced lining to all aboveground storage tank bottoms that have or will experience aggressive internal corrosion.

Welding

Employ experienced workers, fabricators, and contractors.

Assume that they will use their least experienced person(s). Therefore, monitor the work before and during construction, and make sure that the proper inspection is performed upon completion.

The reviews before and during the work are often overlooked, and the refinery relies only primarily on the final inspection. However, finding problems during final inspection may be a safety item, but one must keep in mind that rework costs time and money.



Safety

SAFETY! A structured safety program that includes doing a Job Safety Analysis (JSA) or a Job Hazard Analysis (JHA) before each job is very cost effective because:

- It forces people to plan the details of the task so that equipment is there, the correct tools are used, etc.
- It avoids costly accidents, especially if litigation is involved.

High Tan Crude

The obvious one is to maximize processing of high TAN crude oil by using corrosion inhibitors.

Management

That's easy for me to answer but hard for current manager-types to understand or accept. The reason managers don't want to hear what I'm going to say is because it is a long term cost-saving and quality improvement matter. It is a check that cannot be cashed tomorrow but, when cashed, will yield huge returns.

What any refinery needs are well trained young engineers that are capable of focusing on the growing technical challenges and can apply innovative solutions to the many problems associated with refinery design, construction, operation, and maintenance. The young engineers already have a solid university education. What they need is mentoring by experienced engineers before all of the experience leaves the industry. The type of mentoring program I am suggesting is not a quick fix because it takes time to transfer knowledge, especially knowledge learned from years of experience. So, with this caveat, my cost-saving tip for refineries is:

Establish a true mentoring program for all young engineers that gives them time to absorb knowledge from their experienced mentors.

Storage Tanks

Include in the tank maintenance program keeping soil away from tank bottom projections and shells. This is "dirt cheap" compared to repairing corrosion caused by moist soil accumulating where the tank shell joins the bottom. Over the years, soil tends to blow and accumulate where it meets an obstacle, such as a tank.

Plant Maintenance

Tip #1

Everyone is interested in becoming a Pacesetter in plant maintenance. So here are some Pacesetter characteristics:

- They consider reliability and maintenance during design and do not cut corners;
- They operate within process and mechanical boundaries;
- They use quality, cost-effective materials;
- They have well trained craftsmen;
- They use procedures and checklists; and
- They track and correct failures.

But, the major difference between the average and the Pacesetter is that the Pacesetter implements.

Tip #2

In order to have a cost-effective turnaround, planning needs to start early, anywhere from 8 to 24 months prior to shutdown, depending on the size of the turnaround. Work scope needs to be scrutinized and justified using a risk matrix and only include work needed to accomplish the next run-length. Reviews during planning by an external team can identify areas for improvement.

Plan every maintenance job – no maintenance without a work order and a job plan.

Heat Exchangers

The best cost-effective tip for refinery heat exchangers is to initiate and follow-up on a Refinery Overall Heat Exchanger Reliability Improvement Program. That highly specific Program was implemented at several refineries which resulted in not only decreasing their overall heat exchanger maintenance cost 30%, but also the total absence of process unit downtimes caused by heat exchangers.

Exactly what the Program is and how Carmagen clients can benefit from learning about the experience is presented in the following three short courses:

- Course 406-1. "Refinery Heat Exchanger Reliability Resolution Program for Managers" (4 hours)
- Course 406-2. "Advanced Reliability of Refinery Heat Exchangers for Operations Support" (1 day)
- Course 406-3. "Front End Load of Heat Exchangers for Advanced Reliability in New Projects" (1 day)



Fired Equipment

Focus on efficient operation of fired equipment.

Control Systems

Make your control systems pay off for you!

A careful review of the front of your control panel, or the computer screens in the control room, might give you an insight into some worthwhile – and profitable – efforts that should be made. The bottom line is that all control systems should be doing just that – controlling. Any one of them that is not should be examined to determine the reason that it is not performing.

If the controller is on “Manual,” or if it is on “Automatic” but not holding at setpoint, inquire as to the reason. If it just needs tuning, have a competent technician do that, and follow-up to see if that took care of the problem.

If the problem continues, check the following:

- Have operating conditions changed from the original design conditions?
- Is the control valve (its size, design, or characteristics) correct for this service?
- Should a different controlled variable or a different control medium be used?
- Is the instrument range appropriate for the range of conditions?

Every effort should be made to properly follow-up and resolve these problems. It has been found that where this has been done, significant reductions have been made in wasted energy and/or off-spec products, saving thousands, or tens of thousands, of dollars, depending on the size and nature of the units. An additional benefit will be the reduction in upsets or other operating problems in any downstream units.

Reliability

While it's natural to cut costs in these tough economic times, it's also the best time to invest for the future. Seek opportunities to build efficiency and reliability into your plant's future through robust designs and superior training. Capitalize on resources available from top-notch contractors before your competitors recover.

Planning

The most cost effective tip for refineries is the development of the five-year plan. A good plan provides the direction and support needed to identify and engineer real fixes for the refinery's bad actors and systems. Once this process is started, real progress towards eliminating repeat maintenance costs can be achieved. Without it, the shell game continues.

One example is a five-year plan to reduce heat exchanger maintenance cost. At one location, there was pressure to reduce manpower but the work still needed to be done. On examination of the exchanger system it was obvious that the real problem was in the cooling water system. After engineering a solution, there was no longer a need for the maintenance on those 20 heat exchangers for the next five years. Previous to that change, the heat exchangers were being worked on every day on a rotating basis. Conclusion: Until the need to do the work is eliminated, moving the numbers around is only a shell game.

There are many pieces of equipment in refineries that have an accepted maintenance schedule. Challenging those accepted practices is difficult, but can be very cost effective for the plants and is the only real way to make lasting progress without risk.

In Conclusion

We hope you have been able to glean at least one useful idea from these two articles. Have more money saving tips? Pass them on to us and we will publish them in future editions of this newsletter. We welcome your comments and would like to hear what you think our next question to our engineers should be.

These tips have been provided by many of Carmagen Engineering's equipment and project management engineers. We have ready access to over 180 engineers who span the full spectrum of process and equipment technologies as well as project management services. The average experience level of our professional staff is over 30 years. Please contact Vince Carucci (vcarucci@carmagen.com) if you'd like more information on Carmagen's equipment and project management engineering expertise.

Upcoming: Turnaround Mini-Conference being offered at Carmagen's facility. For details, [click here](#).

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