Achieving multi-million dollar results does not need to cost millions of dollars in consulting fees. It just takes a focused effort by experienced Carmagen engineers – engineers who have done this before and know how to achieve maximum results from your investment.

<table>
<thead>
<tr>
<th>AN APPROACH TO BECOMING COMPETITIVE:</th>
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<tbody>
<tr>
<td>• Assessing maintenance effectiveness</td>
<td></td>
</tr>
<tr>
<td>– Define parameters to measure effectiveness</td>
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<tr>
<td>– Identify organizational barriers which exist</td>
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<tr>
<td>– Establish the incentives for change</td>
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<tr>
<td>– Pinpoint the procedures which need to be upgraded</td>
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<tr>
<td>• Benchmarking the competition</td>
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<tr>
<td>– Cost indices</td>
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<tr>
<td>– Reliability parameters</td>
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<tr>
<td>– T/A performance</td>
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<tr>
<td>– Routine maintenance prioritization</td>
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<tr>
<td>– Overtime performance</td>
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<tr>
<td>• Establishing improvement objectives</td>
<td></td>
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<tr>
<td>– Select long term and annual improvement targets and simple measures of success</td>
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<tr>
<td>– Define the organizational and procedural improvements required</td>
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<tr>
<td>– Develop a plan to achieve maintenance excellence</td>
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<tr>
<td>– Implement actions and follow-up</td>
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</table>

<table>
<thead>
<tr>
<th>CARMAGEN ENGINEERING’S ROLE:</th>
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<tbody>
<tr>
<td>• Conduct an initial assessment of your current maintenance effectiveness</td>
<td></td>
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<tr>
<td>– Estimate your competitive position</td>
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<tr>
<td>– Define preliminary opportunities for improvement</td>
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<tr>
<td>– Identify highest pay-out organizational and procedural changes</td>
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<tr>
<td>• Work with your personnel to develop alignment for action plans to implement improvement</td>
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<tr>
<td>– Establish priority action plans</td>
<td></td>
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<tr>
<td>– Define resource requirements</td>
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<tr>
<td>– Develop timelines and milestones</td>
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<tr>
<td>• Assist with training/implementation of selected improvements, for example:</td>
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<tr>
<td>– Organizational communication and team building</td>
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<tr>
<td>– Redefining roles/responsibilities</td>
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<tr>
<td>– Developing improved procedures</td>
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<tr>
<td>+ Budgeting</td>
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<td>+ Daily work prioritization</td>
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<tr>
<td>+ T/A planning</td>
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</table>
DO YOU WANT TO REDUCE MAINTENANCE AND IMPROVE RELIABILITY?

Introducing Carmagen Reliability and Maintenance Programs

Which statement best characterizes your primary objective?

A. Reduce Maintenance Costs
B. Reduce Downtime by Shortening the Duration of Turnarounds
C. Extend Run Length Between Shutdowns and Turnarounds
D. All of the Above

If you answered yes to any of the above, you should contact Carmagen for our unique three pronged approach to reduce maintenance costs and improve reliability. Choose any one or all three programs.

Carmagen Engineering – Where Experience Counts

4 West Main Street, Rockaway, NJ 07866

Website: www.carmagen.com • E-mail: carmagen@carmagen.com
Certain decisions have a measurable impact on both plant maintenance costs and reliability in any plant. Carmagen Engineering, Inc. (CEI) prides itself on its ability to help your staff identify those vital few decisions and implement strategic changes, while retaining focus on necessary day-to-day tactical tasks. We can help you and your staff to:

- Assess overall maintenance effectiveness
- Incorporate the best features of industry practices into your operations
- Define and achieve specific improvement objectives for reliability and maintenance in both organizational design and procedures

**Areas of Focus:**

- Maintenance Philosophy
- Goals and Objectives
- Work Planning and Scheduling
- Staffing and Contract Control
- Maintenance Work Procedures
- Technical Support and Training
- Organization Design
- Safety
- Proactive Maintenance
- Budget and Cost Control
- Process Operations

CEI professionals can help you identify weaknesses in your current maintenance practices and introduce you to the Best Practices used by world-class organizations. Implementation will reduce maintenance costs and improve reliability. While some recommendations will require minimal effort and yield immediate savings, others will take longer to implement. CEI maintenance professionals will guide you through each step.

<table>
<thead>
<tr>
<th>Typical Application</th>
<th>Program scope, team composition (joint CEI and refinery staffing), duration, cost and benefits vary to match a client's needs and opportunities. An example application of Maintenance Management for a medium-size refinery can be characterized as follows:</th>
</tr>
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<tbody>
<tr>
<td>Team Composition</td>
<td>A team of 2 – 4 experienced maintenance professionals will collaborate with your staff to evaluate your maintenance practices, identify opportunity areas, and prepare a plan for eliminating roadblocks to improvement.</td>
</tr>
</tbody>
</table>
| Duration            | Preparation: ~ 2 – 4 Weeks  
On-site Program: ~ 2 Weeks  |
| Benefits            | 15 – 30% reduction in maintenance costs |
Carmagen Engineering, Inc. (CEI) has been highly successful helping its clients plan and execute effective turnarounds. The relatively small cost of our services was repaid many times over in tangible savings. While some practitioners merely focus on the nuts and bolts details, the CEI strategic program can reveal often neglected yet essential keys to success, such as:

- Management’s role in clarifying competing objectives and monitoring T/A results
- Alignment among divisions and departments to achieve mutually agreed T/A goals
- Effective procedures for screening, planning, budgeting, and scheduling T/A work

**Assess Current Effectiveness:**
- Define Key Performance Measures for T/As
- Identify Organizational Barriers
- Estimate Anticipated Improvement Incentives
- Pinpoint Major Areas of Opportunity

**Benchmark the Competition:**
- Cost and Schedule Indices
- Run Length Predictability
- T/A Planning Milestones
- Accuracy for Predicting Work
- Critical Path Optimization

**Develop Implementation Plan:**
- Assemble T/A Milestone Plans Matching Pacesetters
- Define Action Steps and Assign Responsibilities
- Estimate Costs and Resources Required
- Identify Training Needs
- Build Communication Plan and Reporting Protocols
- Compile Implementation Schedule

**Typical Application**
Program scope, team composition (joint CEI and Refinery staffing), duration, cost and benefits vary to match a client’s needs and opportunities. An example application of Turnaround Management for a medium-size refinery can be characterized as follows:

<table>
<thead>
<tr>
<th>Team Composition</th>
<th>A team of 2 – 3 experienced maintenance professionals will collaborate with your staff to examine your turnaround practices, identify areas for improvement, and prepare a plan for eliminating roadblocks to improvement.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration</strong></td>
<td>On-site Program: 1 – 2 Weeks</td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td>Up to 2 year increase between T/As and 1 – 2% higher plant availability</td>
</tr>
</tbody>
</table>
Invite a Carmagen Engineering, Inc. (CEI) Maintenance Professional into your plant to show you how to reduce the cost and duration of your next Turnaround. Alternatively, combine Turnaround Excellence with the strategic Turnaround Management program to continue improving the efficiency and effectiveness of all your future Turnarounds.

### Months to T/A

<table>
<thead>
<tr>
<th>Stage</th>
<th>Work Duration</th>
<th>CEI Consultants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Review</td>
<td>2 Days</td>
<td>1 CEI Consultant</td>
</tr>
<tr>
<td>Scope Review</td>
<td>1 Week</td>
<td>1-2 CEI Consultants</td>
</tr>
<tr>
<td>Execution Review</td>
<td>1 Week</td>
<td>1-2 CEI Consultants</td>
</tr>
</tbody>
</table>

#### Planning Review
Establish the T/A Planning Basis and Objectives
- Identify Major Work Items Requiring Shutdown
- Set Expectations for Cost and Duration
- Quantify Marginal Lost Production Cost/Day
- Establish Run Length and Reliability Objectives for Ensuing Run

#### Scope Review
Justify Major Work List Items Consistent with the T/A Planning Basis and Objectives
- Estimate Costs and Benefits Associated with Each T/A Work Request
- Identify Work Requests that can be Estimated or Deferred from T/A
- Define Preparation Work and Schedule
1 **Maintenance Management**

Strategic initiative for improving a refinery’s ability to manage all aspects of Maintenance by:

A. Identifying major improvement opportunities
B. Quantifying opportunities through Benchmarking
C. Recommending Best Practices to close gaps
D. Removing barriers that could impede implementation

**Components**

- Leadership
- Organization Design
- Performance Measurement and Analysis
- Goal and Target Setting
- Effective Maintenance Planning
- Efficient Maintenance Execution

2 **Turnaround Management**

Focused slice of Maintenance Management enabling a refinery to continuously improve performance in all future Turnarounds

**Deliverables**

T/A Best Practices

3 **Turnaround Excellence**

Focused slice of Maintenance Management enabling a refinery to continuously improve performance in all future Turnarounds

**Three Key Steps**

- Planning Review to clarify objectives
- Scope Review to eliminate unnecessary work
- Execution Review for speed and efficiency
IT’S YOUR CHOICE

Take advantage of Maintenance Management to improve your entire maintenance program or choose Turnaround Management to focus attention on these intensive high profile events. Alternatively, choose both programs to tap into the full spectrum of CEI maintenance expertise.

Reliability and Maintenance Management Strategy

- Assess Current Effectiveness
- Benchmark the Competition
- Organizational Design
- Planned and Preventative Maintenance Programs
- Strict Work Screening
- Effective Planning
- Efficient Execution
- Estimate Costs & Benefits for Recommended Improvements
- Identify and Eliminate Barriers to Rapid Implementation

Leadership
- Drive Performance

Analysis
- Define Baseline
- Set Goals

Identify Best Practices

Plan Implementation

Evaluate Performance
- Revise Goals

Implement
- With Constancy of Purpose

Communicate Results
- Recognize Achievements
## APPROACH:
- Joint Carmagen/Refinery Team assesses current maintenance practices and identifies improvements
- Practices are compared with those employed by refineries with a demonstrated track record of excellence in maintenance
- Prioritized opportunities of modified practices are identified and a phased action plan is developed to assist the refinery in implementing the agreed changes
- Expected improvements include lower maintenance and increased reliability through fewer unplanned shutdown/extended T/A intervals

## TYPICAL PARAMETERS:
- Duration (elapsed), weeks: 2-8
- Cost, k$: 20-150
- Number of Consultants: 2-4

**DEPENDING ON SCOPE/PLANT COMPLEXITY**

## CONSULTING TEAM MAKEUP/ CREDENTIALS:
- Senior R&M Specialist (Lead Role)
- Process Operations Specialist
- Materials/Corrosion/Inspection Specialist
- Equipment Reliability Specialist

**30 + YEARS OF EXPERIENCE WITH MAJOR INTEGRATED REFINERS**

## BENEFITS:
- One quartile improvement in mechanical availability
- Savings of 25-30% of Maintenance Costs
- Increase of 2 years between T/A
- Increase of 1-2% in plant availability

**INTERESTED?**
Carmagen’s staff of over 180 skilled specialists in all Process, Non-Process (Equipment), and Project Management disciplines is available to support client’s implementation plans.

Contact Jerry Lacatena at Carmagen Engineering, Inc. to discuss your needs.