Value-Added Benefits of csLIFT Implementation

TWP-002 Rev. O

Introduction

During the past five years, eProduction Solutions has worked with a vast array of oil and gas companies. The csLIFT suite of products has been implemented in fields with as few as 20 wells to fields with over 3,000 wells. These installations have been made in primary recovery fields to tertiary recovery fields undergoing water, CO_2, or steam flooding. csLIFT products have been installed in new fields with no automation in place and in mature fields, which have been automated for over a decade. Over the history of all these installations, we have documented the value-added benefits and rationale for implementation of the csLIFT suite of products. This paper describes the cashflow enhancement benefits in the primary areas of an oil and gas field operation, as a result of implementing csLIFT software.

The paper describes the cash flow enhancement benefits of implementing csLIFT in the following different categories:

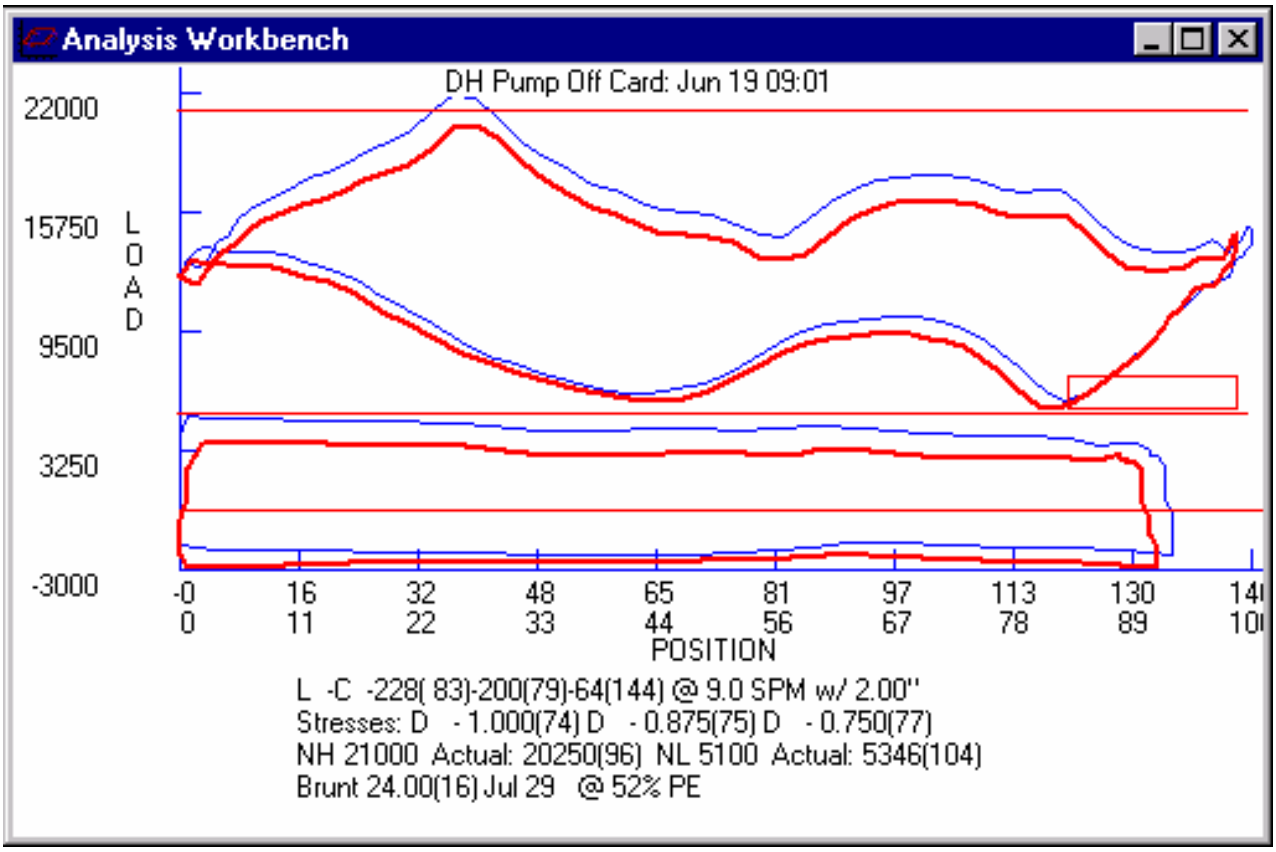
- Increased Production
- Reduced Operating Costs and Well Failures
- Individual Well Management
- Efficiency in Field Operations
- Efficiency in Computer Operations and Automation
- Conclusion

Since not all oil fields are the same, some of these benefits may not be applicable to your specific site. Therefore, an Excel '97 worksheet file and example field justification is downloadable from eP to assist you developing possible cost savings and production improvement associated with installing and using csLIFT in your specific field or area.

Increased Production

Fine-Tuning Wells As Well Behavior Changes

The analytical features of csLIFT allow the user to make changes to the operational parameters of the wells. Changing the pump-off point is an example of a parameter change that can be used to fine tune production. By monitoring the performance of the well on a daily basis, the operator can make small changes to the pump-off point that can decrease the span of fluid level fluctuations.



csLIFT provides both surface and downhole cards for detailed analysis.

In addition, using the various csLIFT optimization tools, lower operating fluid levels are often achieved, which increases total fluid production. Assuming the same oil cut is applied to this increased fluid production, recovery of oil increases on a proportional basis.

Increased Runtime / Decreased Downtime

The concept of managing wells by "exception" promotes the ability to keep downtime to a minimum in two ways. First, when a well does go down, the operator can be notified immediately – even if the operator is off the property. Second, csLIFT tools provide indications that a well may be heading toward a failure of one type or another. With the second case, the user can prevent downtime rather than react to it by correcting the factors that are leading the well into a failure condition.

Early Detection of Production-Robbing Problems

Problems that reduce the production of a well can be seen through trends and displays of historical data. By examining the downhole card of a beam-pumped well, a user of csLIFT can identify problems such as traveling valve and standing valve leaks, barrel / plunger fit, friction, unanchored tubing, and gas compression.

Design Wells for Optimal Performance

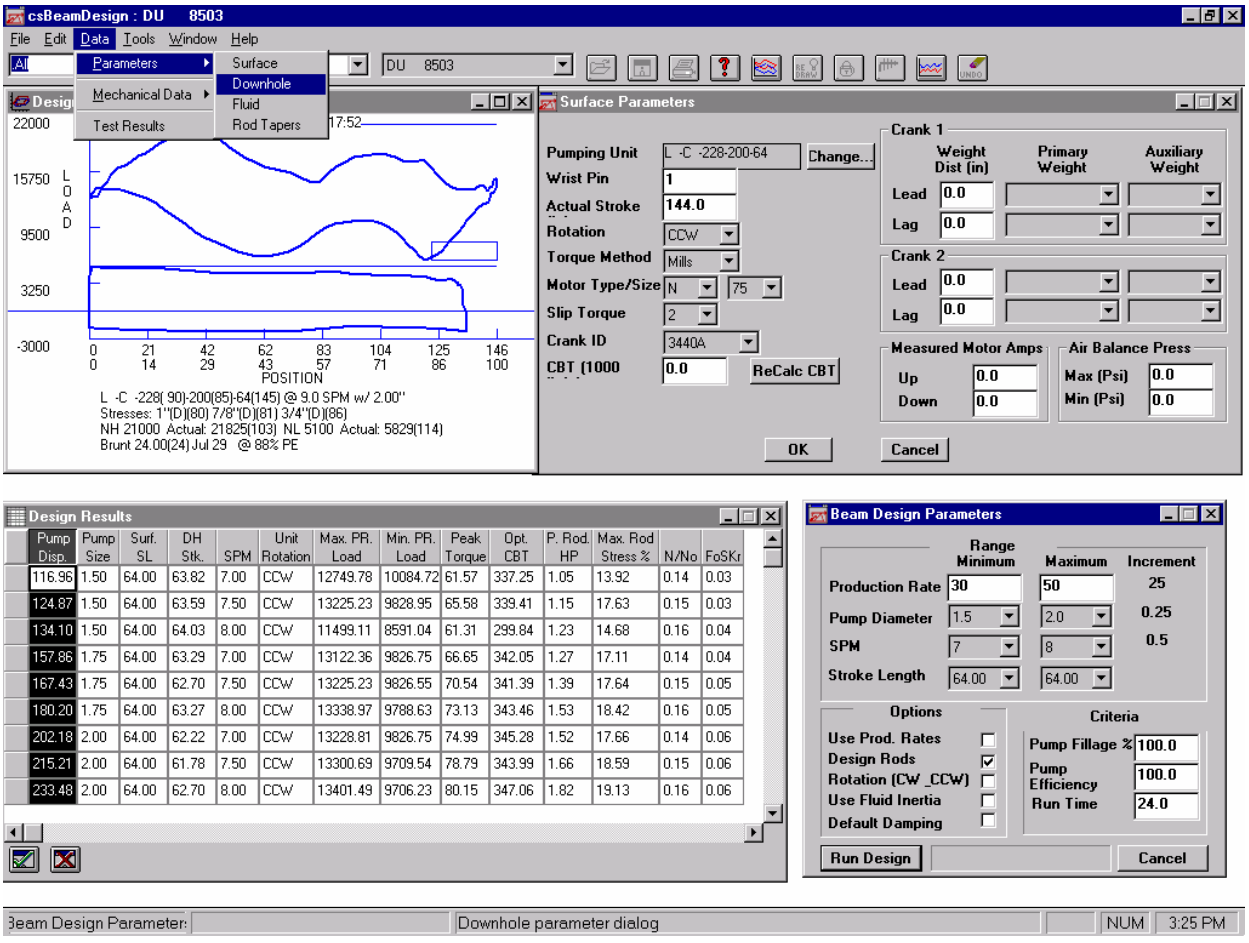
csLIFT provides tools for designing beam pumps and submersible pumps. By using "what-if" analysis, the user of the software can experiment with different parameters in a virtual environment before actually making changes in the field.

From the combination of increased runtime along with pumping installation optimization, eP software typically improves production in the range of 2% to 10%, depending on the current producing conditions.

Reduced Operating Costs & Well Failures

Reduced Electrical Costs by Optimizing Pumping Unit and Motors

csLIFT goes beyond a basic SCADA system's ability to merely monitor and report on the data from wells. Analytical tools are built into the software so a user can perform a detailed analysis on the data without moving the data into another product.

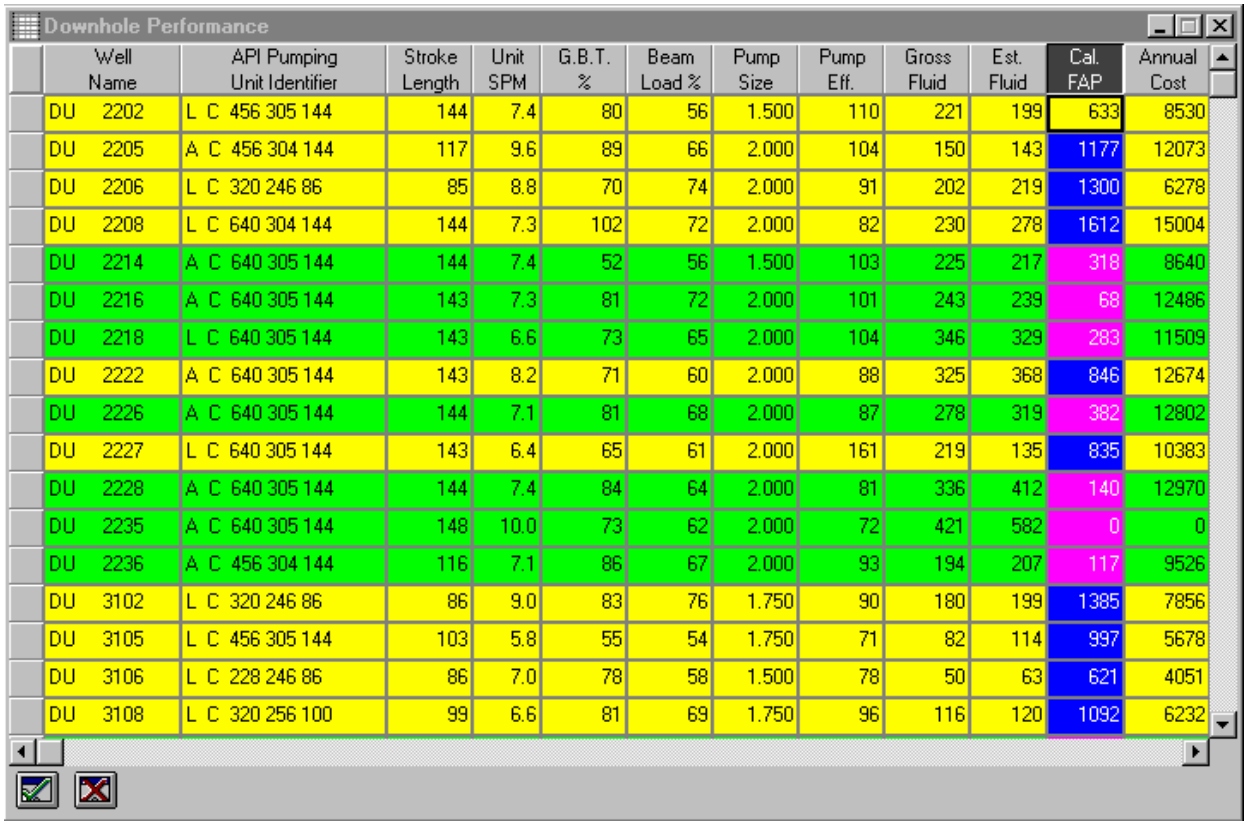


For beam pumping installations, the user can evaluate different pumping units and motors as well as over one hundred other parameters in a virtual "what-if" scenario. Rather than actually making the expensive changes at the well, csBeamDesign provides the user with a way to compare various parameter changes so the user can optimize each installation for pumping unit and motor size, rod design, or displacement matched to inflow.

csBeamDesign provides the user with the ability to do "what if" analysis in designing or redesigning beam wells.

From our field experience and customer dialog, the installation of eP software (and optimizing electrical usage) will reduce total field electrical consumption in the range of 10% to 30%.

Reduced Regular Shooting of Fluid Levels



Downhole Performance

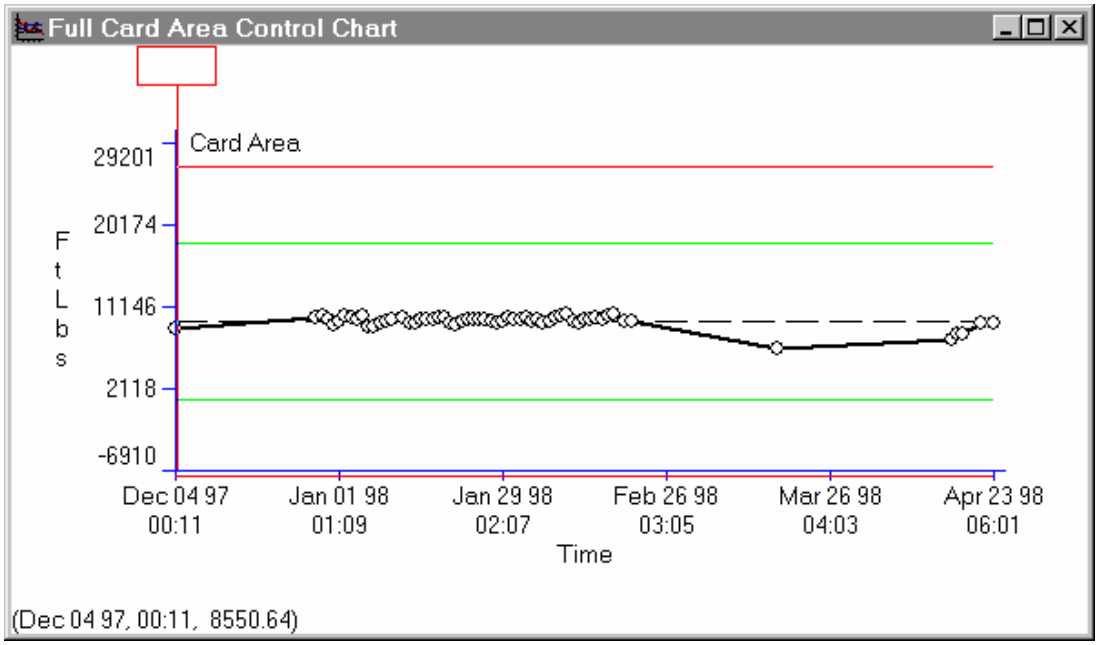
Well Name	API Pumping Unit Identifier	Stroke Length	Unit SPM	G.B.T. %	Beam Load %	Pump Size	Pump Eff.	Gross Fluid	Est. Fluid	Cal. FAP	Annual Cost
DU 2202	L C 456 305 144	144	7.4	80	56	1.500	110	221	199	633	8530
DU 2205	A C 456 304 144	117	9.6	89	66	2.000	104	150	143	1177	12073
DU 2206	L C 320 246 86	85	8.8	70	74	2.000	91	202	219	1300	6278
DU 2208	L C 640 304 144	144	7.3	102	72	2.000	82	230	278	1612	15004
DU 2214	A C 640 305 144	144	7.4	52	56	1.500	103	225	217	318	8640
DU 2216	A C 640 305 144	143	7.3	81	72	2.000	101	243	239	68	12486
DU 2218	L C 640 305 144	143	6.6	73	65	2.000	104	346	329	283	11509
DU 2222	A C 640 305 144	143	8.2	71	60	2.000	88	325	368	846	12674
DU 2226	A C 640 305 144	144	7.1	81	68	2.000	87	278	319	382	12802
DU 2227	L C 640 305 144	143	6.4	65	61	2.000	161	219	135	835	10383
DU 2228	A C 640 305 144	144	7.4	84	64	2.000	81	336	412	140	12970
DU 2235	A C 640 305 144	148	10.0	73	62	2.000	72	421	582	0	0
DU 2236	A C 456 304 144	116	7.1	86	67	2.000	93	194	207	117	9526
DU 3102	L C 320 246 86	86	9.0	83	76	1.750	90	180	199	1385	7856
DU 3105	L C 456 305 144	103	5.8	55	54	1.750	71	82	114	997	5678
DU 3106	L C 228 246 86	86	7.0	78	58	1.500	78	50	63	621	4051
DU 3108	L C 320 256 100	99	6.6	81	69	1.750	96	116	120	1092	6232

By taking advantage of the wave equation for downhole analysis, csBeamAnalysis provides an accurate calculation of the fluid level of a beam-pumped well based on loads from the downhole card. The time and expense of regularly shooting fluid levels can be greatly reduced. Historical trends of calculated fluid levels are also possible.

csBeamAnalysis displays the calculated fluid above the pump (FAP).

Reduced Chemical Costs by Optimizing the Chemical Treatment Plan

In csBeam, the user is provided with card area trends. This trend is an excellent way to track any change in downhole conditions, including friction at the pump. If the trend is on an upward slant, it is an indication that friction on the pump is increasing. Experience with individual wells using this trend enables the operator to better schedule maintenance such as chemical treatments and pump changes.



The area of the surface card is displayed in a chart for easy analysis.

Chemical Treatments Are Less Frequent But Effective

By frequently analyzing the performance of the wells and incorporating a well analyst's experience with the historical information provided by csLIFT software solutions, the user has accurate information that can help in more efficiently scheduling chemical treatments.

From our field experience and customer dialog, the installation of eP software (and optimizing chemical usage) will reduce total field chemical consumption in the range of 10% to 30%.

Diagnose Problems without Pulling Rods Or Tubing

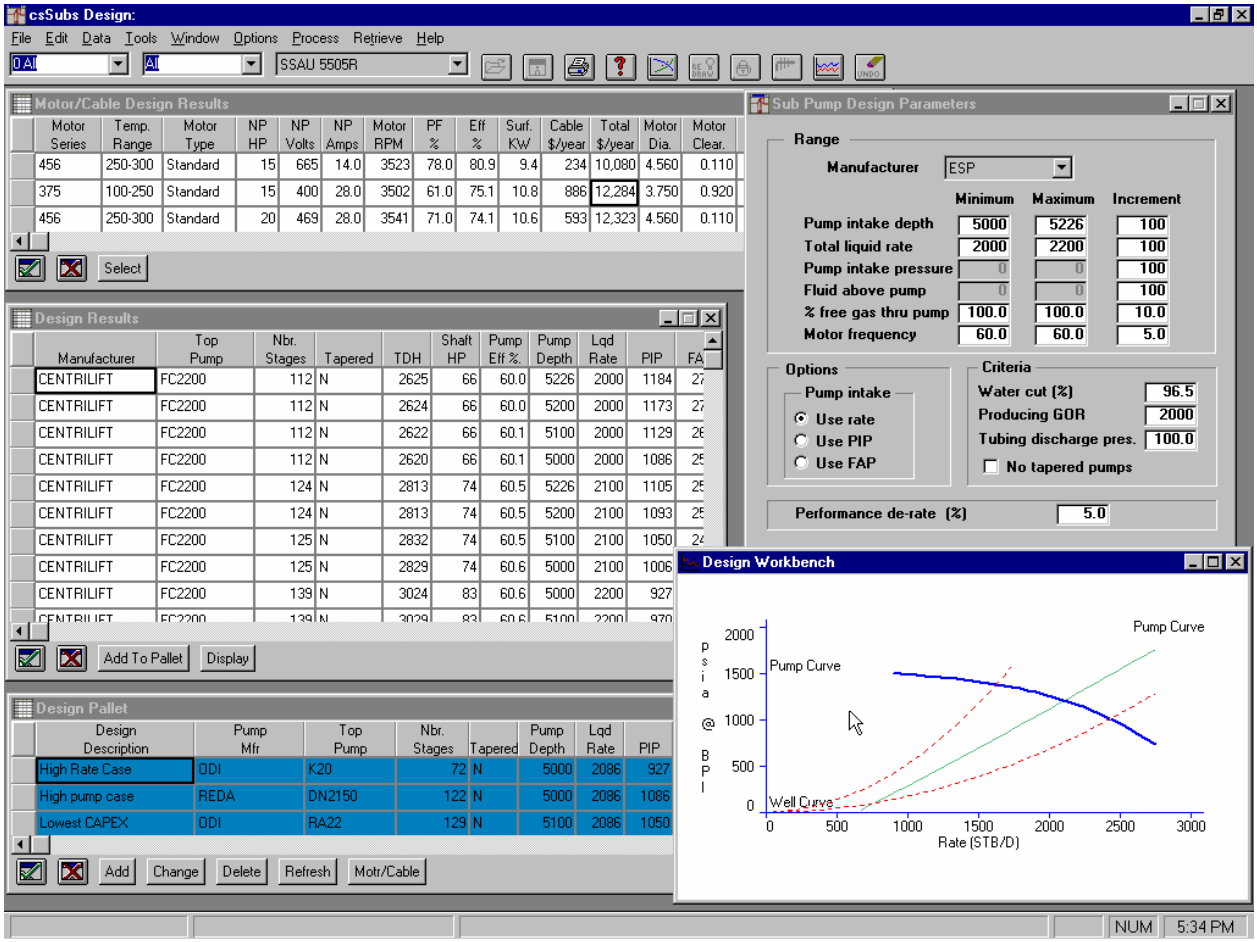
By fine tuning the rod pump controllers, csLIFT provides the ability for the user to minimize rod stress and fluid pound. csLIFT brings the necessary information from the well to your desktop. Many problems and their causes are obvious based on the data received from the well. Examples of these include:

- Pump Wear
- Excess Friction
- Rod Overstress
- Gas Compression
- Gearbox Overload
- High Fluid Level Detection
    - Tubing Anchor Slippage / Movement

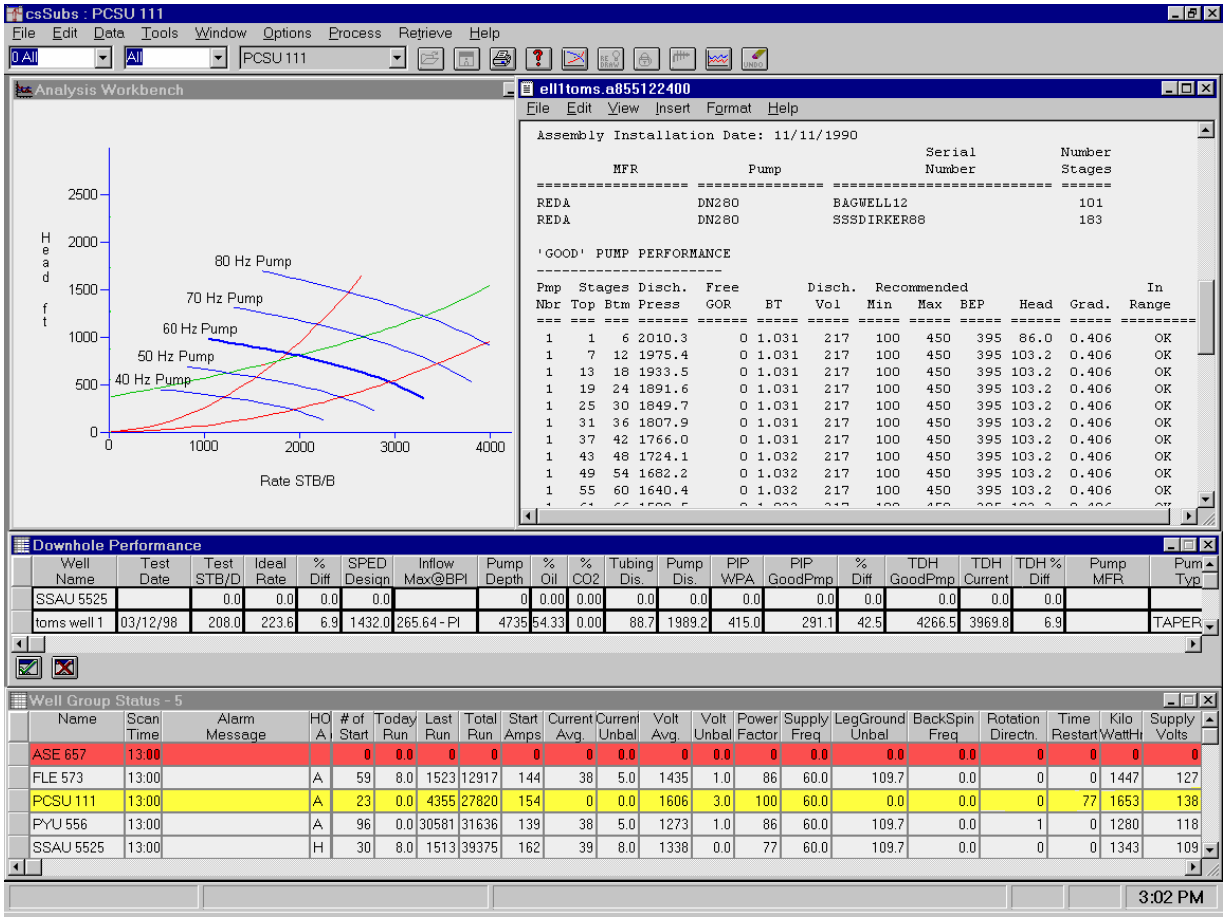
From our field experience and customer interaction, the installation of eP software (and correct diagnosis followed by the appropriate corrective actions) will typically reduce repair and maintenance expense by 10% to 30% per year.

Reduced Pump Failures in ESPs

Most ESPs fail because they are not sized correctly initially, or more commonly, the reservoir characteristics change over a period of time. For example, if the fluid becomes more gassy, the pump can operate in a sub-optimal manner. The csSubmersible suite of tools provides a design tool to more accurately design the initial pump installation, and an analysis tool to identify changes in reservoir characteristics, so the operator can make decisions concerning future operational design changes, if needed.



csSubsDesign allows a submersible pump to be designed or redesigned in a virtual, "what-if" paradigm.



csSubsAnalysis provides detailed analysis of ESP performance based on real-time data.

Individual Well Management

Well Management by Exception

Rather than requiring an operator to examine each well's status every day, csLIFT uses the concept of management by exception to provide information about anomalies in alarm or color-coded fashion. The software alerts the user to any parameter that is out of an ordinary operating range as defined by the user. This allows the user to focus on prioritizing recognized problems, rather than searching for problems that may or may not exist.

Early Detection of Well Performance Degradation

By monitoring the runtimes of each well in a field, csLIFT provides the first indication of a change in the operating conditions of the well. Further inspection may show an increase in the area or size of the card, excessive gearbox torque, and a reduction in the rate of fluid pumped, etc. The information presented from each of those indicators provides the user with a strong start in recognizing problems at an early stage and taking appropriate measures to fix them.

Comparison of Well Test to Theoretical Limits and Target Values

Since the csLIFT Suite provides an integrated set of tools, the user has the ability to use information from different parts of the production operation to evaluate the state of the wells and production facilities. The well test information can be compared to the calculated fluid production of each well, and the total from the wells (feeding a particular facility) can be compared to the actual metered sales from that facility.

Notification of Wells Operating Out Of Parameters Based On Artificial Lift Analysis

Beyond exception notification from RTU parameters, csLIFT provides notification and alarms based on the analytical calculations performed within the software.

Early Detection of Changing Wells Due to Automation

Alarms can be programmed to alert csLIFT users that a well has begun to run too long or not long enough. The user can even be alerted after hours through call-out programs that can page or call with information about the alarm.

Routine Management and Reporting

csLIFT's modules provide historical reports and graphs that represent normal operating conditions for a well. Since this data is a part of the csLIFT database, it can be used for calculating accurate production data. The installation of eP software (and operating by exception) will redirect manpower to better focus on corrective and optimization measures. This prioritizing of operating staff time and redirection of the existing personnel to work on immediate needs is effectively equal to hiring additional staff.

Typically, effective manpower improves beyond the pre-csLIFT application to a point where this (effective manpower) can offset new expenses to maintain RPC / RTU equipment.

Efficiency In Field Operations

Reduced Windshield Time

Since data is presented "on-screen" in the production office, and is presented in a way that facilitates easy scanning of a large number of wells, companies that use csLIFT have found that they can substantially reduce the time necessary for someone to visit and personally inspect each well. Wells still need to be visited, but site visit frequency can be reduced substantially, which frees personnel for priority problem solving or other proactive activities. From past experience, site visits to each well have been reduced from daily to weekly or monthly, depending upon the operating philosophy of individual companies.

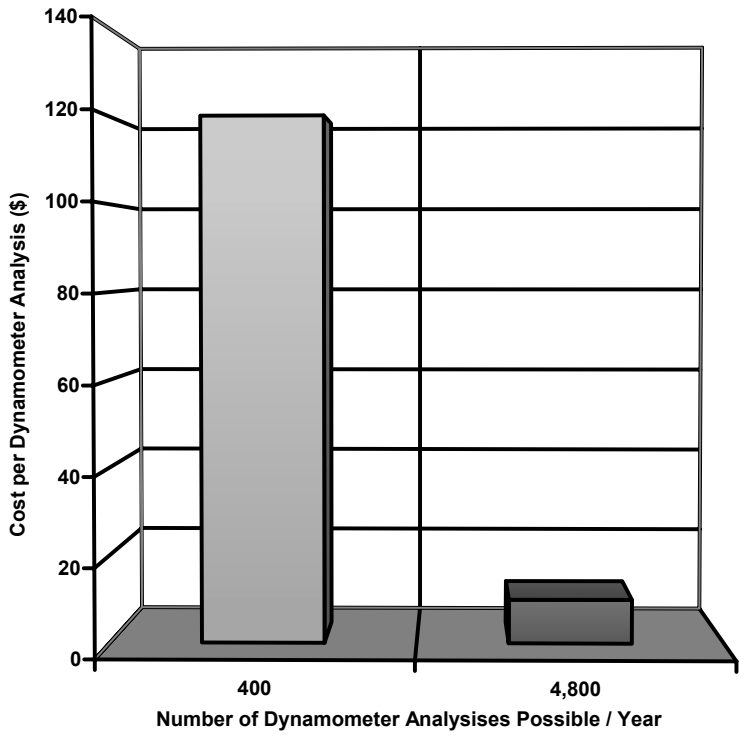
Two examples of cost reduction in "reduced windshield time" include:

- More effective dynamometer collection
- More effective fluid level collection.

More Effective Dynamometer Collection

Assume that a well analyst can make 400 "on site" dyno runs per year, or an average of about 8 surveys per week. Assume the total cost of dynamometer collection for one year is $48,000 or $120 per dyno survey. Further, assume that the same well analyst can analyze 100 wells using dynamometer surveys gathered by csBeamAnalysis in one week. At 12 times faster collection pace per year or 4,800 dyno surveys, and using the same $48,000 annual survey cost, this would equate to a per dyno cost of $10 ($48,000 / 4,800). Instead of analyzing 400 wells in a year's time, simple math dictates that 4,800 dyno surveys can be taken using csBeamAnalysis during the same one-year period.

Dynamometer Time Redistribution



The graph depicts this example as a one-year phase-in redistribution of well analysts' time.

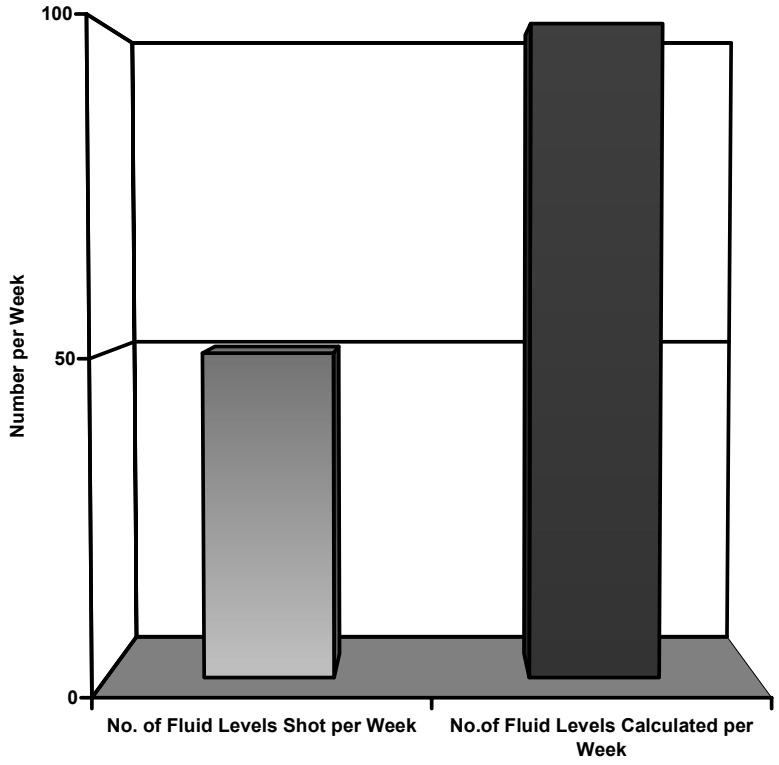
The real advantage of this example is time redistribution, which could then take the form of:

- More analytical time for optimizing lift equipment
- Proactive maintenance of RPCs, RTUs, and PLCs
- Attention to those remote or "low impact" wells, not previously covered by the dyno surveys.

Often, just the collection of well data on so-called "low impact" wells will reveal inappropriate operating practices, which can present upside opportunities, dramatically reversing the prevailing perception of remote wells or fields.

More Effective Fluid Level Collection

Assume that a well analyst can shoot ten fluid levels per day and charges $17.50/hour. Over one year, the total fluid levels collected would be approximately $33,600 or about $14 per fluid level collected. Assume that 100 calculated fluid levels per week are collected by using calculated fluid levels gathered by csBeamAnalysis. Over a one-week period, twice as many fluid levels are collected. Therefore, the fluid level collection cost would drop to about $7 each.



Assuming the same one-year phase-in as before, the graph depicts the relative savings or time redistribution. This redistribution of time could be better utilized for optimization of lift equipment.

Alarm Notification and Management

Reduce or eliminate answering services

csLIFT is integrated with current state-of-the-art call-out systems. These call-out systems take over the role provided by the answering services. An answering service typically only helps in calling people when problems are detected by automation systems. csLIFT installations not only provide detection but also provide more specific information regarding the cause of the problem, enabling field personnel to make improved decisions in case of emergencies. Because of the client / server solution, personnel can also take corrective action from their homes.

Reduce or eliminate 24 hour duty

An operator can be paged or called after hours because of an alarm and be given information about the problem. More than that, the operator does not need to leave his home to get detailed information about what is happening at the field. He can use PC Anywhere or NT's RAS service to connect to the system remotely and see this information.

Comprehensive power management system to reduce electrical costs

For almost all oil fields, electrical costs account for a substantial percentage of the operating costs. Because of the flexibility in configuration and various tools provided by csLIFT, operating companies have used the following solutions to help reduce their electrical costs.

By using the information provided by csLIFT, scheduled shutdown of intermittent pumping wells during peak power demand can optimize power consumption, saving considerable expense. The customized startup of wells can aid in controlling spikes in power consumption after a power shutdown has occurred. In essence, this becomes a reverse peak shaving scheme to reduce power consumption during general peak usage.

csLIFT can be used to ensure power utilization at any given time does not cross a certain threshold, thereby benefiting both the operating company and the power company.

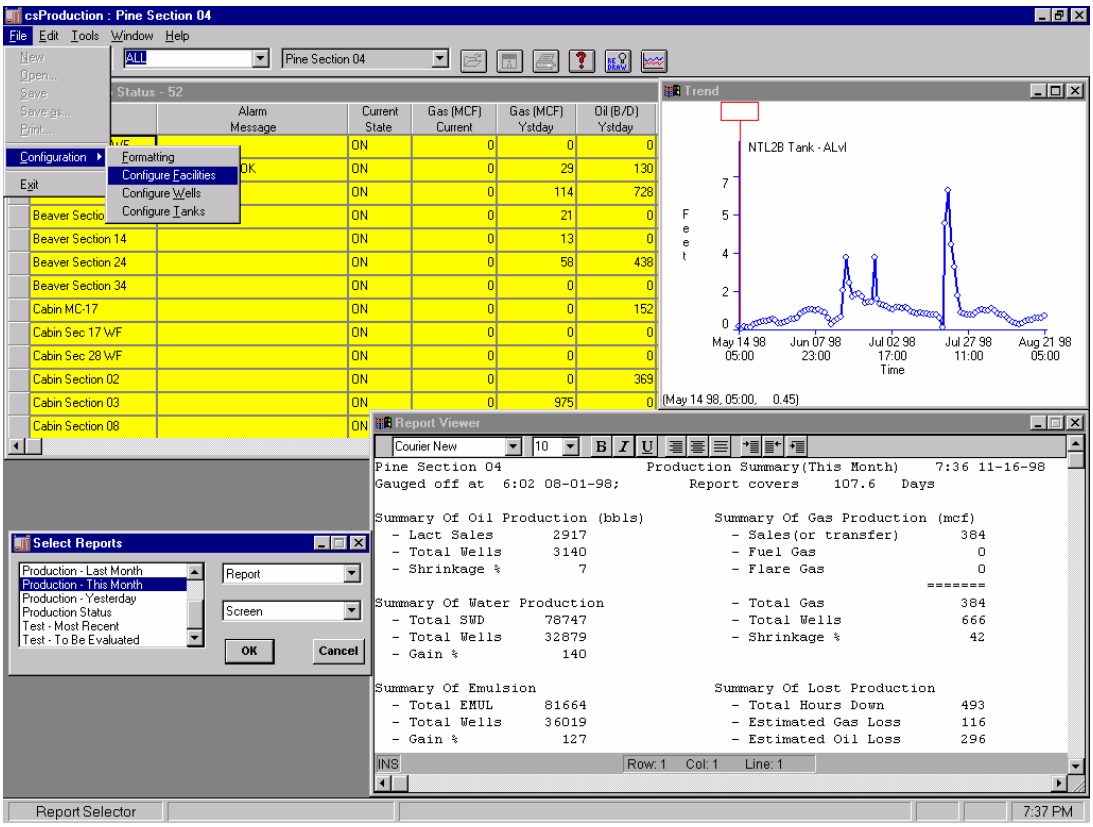
Advanced Field Control Reduces Fluid Spills and Loss Prevention

Because csLIFT is an integrated field system, it allows for field wide control that is typically not present in other SCADA systems. For example, it includes several standard control features for an oil and gas field, such as shutting down wells when tank levels are exceeded and controlling injection volumes in conjunction with tank levels based on pressure and volume set points.

As a result of this advanced capability, the operator has a higher level of confidence in detecting leaks and avoiding the costs associated with clean up of oil or salt water spillage. The operating company also spends less time addressing issues with landowners, landmen, lawyers, and negotiators.

Daily Production Reporting

csLIFT provides a comprehensive daily production report, which provides estimated production based on the downtime and the last known good well test of each well, shrinkage analysis by comparing the tested production to LACT meter readings, and estimated lost production due to downtime of wells.



csProduction provides current information about daily, weekly, and monthly field and well production.

The production summary report can be obtained *daily* for different areas of the field or the whole field. Based upon the information presented in the production summary report, field management and personnel can better optimize their resources and prioritize which areas need attention.

Proactive Maintenance versus Reactive Maintenance

Since csLIFT helps identify problems before they occur, field personnel can be proactive on regular field maintenance work. For example:

1. Tubing anchors that are not holding, do not have enough tension, or that are slipping can be identified and tagged for immediate correction. Such proactive maintenance will prevent actual production losses, rod and tubing "friction" failures, and possible casing leaks.
2. Daily examination of data for gearbox overloads or rod string overstress can prevent expensive failures through proactive correction and /or optimization.

Efficiency in Computer Operations and Automation

There are several features in csLIFT designed to reduce the on going costs associated with day to day operations in an oil and gas field.

Reduced Installation and On Going Maintenance Costs

Adding wells, facilities, or RTUs to the system is a simple task that can be done by the on-site user of the system. This reduces the amount of time that eP's personnel must be on location during the initial set up of the system and eliminates the need for support when new wells, facilities, and RTUs are added to an existing system.

Reduced System Administration Requirements

EP's customers are provided with an administration tool that can be used for many system changes and as a trouble-shooting tool. csAdmin allows the system administrator to start and stop processes, monitor performance of the system, and set up the groups and filters that are the basis for managing by exception.

Reduced Support Costs Due to Single System Solution

Since csLIFT is an integrated software system, a user does not need to move data through several different applications for different tasks. An example of this is the use of well test information when evaluating wells. For example, when exploring the analytical data provided by csSubsAnalysis or csBeamAnalysis, the user merely clicks a button inside the program and is presented with the production data from the csWellTest module.

No Cost Associated with Data Access to Everyone Everywhere

csLIFT is based on Windows NT client-server technology. It fits into most corporate networks because NT is accepted as a standard in the computing industry. With the use of WANs or Intranet technology, a company can provide real-time monitoring, analysis, and optimization across the entire enterprise. There is no additional infrastructure cost associated with providing data to anybody on the network.

Reduction in Communication Infrastructure Costs

csLIFT communicates with a large number of hardware device types in the field. It is not uncommon to have a variety of hardware protocols being used in a field. Since csLIFT can support multiple protocols on a single frequency, there is no need to have multiple licensed radio frequencies in a field. There is also greater flexibility available to csLIFT customers since they can choose the best hardware solution for each area of their field and not be constrained by protocol issues.

Reductions in Computing Hardware Costs

csLIFT is a software solution only and does not use a proprietary hardware platform. That frees the customer to purchase any hardware that runs Windows NT, which is required for the csLIFT software. The customer can shop around for the best hardware platfrom based on price, reliability, and availability at the time. Many companies already have a preferred equipment provider and are free to choose the hardware solution from their preferred provider.

Migration from Old Proprietary RTUs And Systems

Obviously, many oil fields already have existing hardware. Because csLIFT can communicate with multiple protocols on a single frequency, a csLIFT installation allows customers to migrate from a legacy hardware solution to modern PLCs on an incremental basis and not have to replace all the legacy hardware at the same time.

Simplifies disaster recovery

The csLIFT software solution has a number of features built into it to simplify disaster recovery. Some of them are:

- csLIFT can be implemented in a complete redundant "hot standby" configuration. In the event of a computer failure on the primary machine, the secondary machine takes over in less than one minute. The "hot standby" solution uses industry standard technology and is available at an insignificant cost.
    - Hardware configuration parameters for each RTU are stored in the csLIFT database. In case of a lightening storm or power outage when hardware devices may lose their configuration, csLIFT allows you to simply replace the hardware in the field and download all the stored configuration data back to the RTU. This alone can save hours of reconfiguration time, depending upon the level of hardware loss.

Reduced Data Management Costs

One hidden cost facing oil and gas companies is that of data management. Most oil fields have a significant amount of on-going data management issues. csLIFT helps reduce the data management costs in an oil and gas field in the following manner.

Since csLIFT provides solutions for facility monitoring and analysis, well monitoring, analysis and design, automated and manual data entry, there is no need to have a large number of systems in an oil and gas field. The single system approach reduces the amount of effort that companies have to spend doing data migration and management between multiple systems such as.

- SCADA system
- Manual entry system
- Artificial lift system for analysis and design of rod pumping wells
- Artificial lift system for analysis and design of ESP wells
- Local databases for production management and reporting
- Databases for regulatory reporting
- Workover management system

- Drilling system

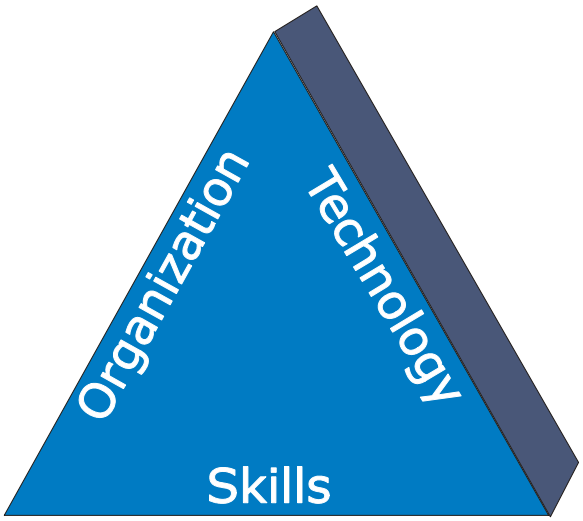
Because csLIFT is already integrated with reservoir analysis tools such as OFM and DSS, there is no added cost in interfacing csLIFT to the reservoir tools used in most oil and gas companies today.

csLIFT integrates seamlessly with SQL databases. csLIFT creates a shadow database, which can be any SQL compliant database like MS Access, SQL/Server, or Oracle. The data in the shadow database can be used to seamlessly integrate csLIFT with other production and financial applications.

csLIFT improves productivity in the oil and gas field because of the built in integration between the different modules. For example, a person evaluating the efficiency of beam wells is automatically presented with a surface and downhole card collected during each well test. The cards help the person determine the cause of any anomaly in the well test data.

Conclusion

A csLIFT implementation will impact the entire operation of the oil and gas field. The following diagram shows the relationship between technology, skills, and organization.



The benefits described are always a result of the combination of changes in production operations in all the three areas. It may involve changes in job roles and responsibility in field personnel. eProduction Solutions has a skilled staff of trainers to provide the necessary training to ensure that the installation and deployment of this technology is successful.

The estimates cited by eP are based on field experience, customer dialog, and expert input. These benefits and typical improvements do not represent any firm reliable benefits and should be used as a guide to estimate the potential benefits in your particular situation.

As the leading provider of oil and gas production automation systems, **eProduction Solutions**, based in Houston, Texas, pioneered the market for single-source automation software for producing oil and gas fields. This software is used by major oil and gas companies to run over 15,000 wells around the world.

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