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Techniques to Reduce Operating Costs for Increased Reserves and Profitability

Philip E. Hart
Excalibur Ventures, Inc.
Focus on Adding Value

➔ **TOPIC 1:** Improvements of an Accounting System

**TOPIC 2:** Benefits of Incremental Well Costs Analysis

**TOPIC 3:** Operational Techniques to Decrease Expenses

**GOAL:**

Accurate Incremental Analysis + Cost Reductions = Increased Reserves & Profits
Accounting System Improvements

1. Field: Easy input improves accuracy
   - One-page chart of accounts for expenses
   - Each equipment assigned ID to input

2. Accounting: Use allocations based on actuals
   - Electricity $ by KW-HR estimate vs nameplate
   - Chemical $ by well (Variable) vs lease/field (Fixed)

<table>
<thead>
<tr>
<th>Well ID</th>
<th>Chem 1 Vol</th>
<th>Chem 1 $</th>
<th>Chem 2 Vol</th>
<th>Chem 2 $</th>
<th>Total $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well 1</td>
<td>3</td>
<td>50</td>
<td>2</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>Well 2</td>
<td>2</td>
<td>35</td>
<td>4</td>
<td>200</td>
<td>235</td>
</tr>
</tbody>
</table>

3. Office: “True” incremental individual well costs
**Case Study #1: Detailing Accounting Data**

Total Pump Repair = $400,000 / Year

10 Pumps = $40,000 / Year Average

Detail ➔ Pump P01 = $20,000 / Year

Detail ➔ Pump P10 = $80,000 / Year

Field ➔ Cleaned out discharge scale & slower speeds

Result ➔ Saved $255,000 / year in repairs (↓64%)

**Takeaway:**

Individual equipment cost locates problems
Focus on Adding Value

TOPIC 1: Improvements of an Accounting System

➔ TOPIC 2: Benefits of Incremental Well Costs Analysis

TOPIC 3: Operational Techniques to Decrease Expenses
Develop Incremental & Individual Costs

Total Cost ($/Well/Month)

Fixed 25%
Lease Average $/Well/Month

Incremental 75%
Individual Well $/Well/Month

OR

Fluid Injection ➔ $/bw
Artificial Lift ➔ $/bf

--- Better Allocations ---
Fuel, Chemicals & Labor
**Case Study #2:** 1150 Wells@ 2300 bopd, 150,000 bwpd

Profitability at Various Well Conditions

<table>
<thead>
<tr>
<th>Major Category</th>
<th>Avg. Incremental $/Well/Month</th>
<th>Well 1 @ 2 bopd 300 bwpd</th>
<th>Well 2 @ 2 bopd 10 bwpd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>109</td>
<td>85</td>
<td>75</td>
</tr>
<tr>
<td>Fuel</td>
<td>248</td>
<td>563</td>
<td>22</td>
</tr>
<tr>
<td>Chemical</td>
<td>78</td>
<td>176</td>
<td>7</td>
</tr>
<tr>
<td>Wells</td>
<td>83</td>
<td>140</td>
<td>40</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>522</strong></td>
<td><strong>842</strong></td>
<td><strong>153</strong></td>
</tr>
</tbody>
</table>

*Profit

**253**

-67

622

Result ➔ Shut-in 100 uneconomic wells with side benefits
### Case Study #3:
Reactivated 50 Shut-In Wells for $2.5 Million

<table>
<thead>
<tr>
<th></th>
<th>Average Cost</th>
<th>Incremental = 80% of Average</th>
<th>25% Cost Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of Return (ROR)</td>
<td>Loss</td>
<td>18%</td>
<td>93%</td>
</tr>
<tr>
<td>Return on Investment (ROI)</td>
<td>0.14</td>
<td>1.13</td>
<td>2.75</td>
</tr>
<tr>
<td>Reserves (BOE)</td>
<td>(Zero)</td>
<td>1,814,000</td>
<td>3,236,000</td>
</tr>
</tbody>
</table>

Incremental Analysis & Cost Reductions Add Reserves
Acquisition Summary 1:

- Purchased $24MM with $1 MM/year cashflow
- Lowered Costs 25%
- Reactivated Wells
- Drilled Wells (15% ROR ➔ 35% ROR ➔ 80% ROR)
- Increased & Realigned Waterflood Injection
- Production Increased from 6,700 to 11,100 bopd (↑ 67%)
- Valuation >>$300MM (↑ 12X)
Focus on Adding Value

TOPIC 1: Improvements of an Accounting System

TOPIC 2: Benefits of Incremental Well Costs Analysis

➔ TOPIC 3: Operational Techniques to Decrease Expenses

Three New Improved Ideas
Searching for Expense Reductions (Part 1)

A. Utilize All Personnel - “Two Heads Are Better Than One”

- Encourage Ideas for Improvements

  ➔ ➔ Remove Fear of Failure for Personnel

  “I have not failed. I’ve just found 10,000 ways that won’t work.” Thomas Edison

- Failures can save money

  - 72 well cleanout of BaSO4 scale saves $306,000

    ➔ Old Way = $11,000/rig job with 100% Success

    ➔ New Way = $4,000/coiled tubing job w/ 25% failures + $11,000/extra rig job (↓39%)
Searching for Expense Reductions (Part 2)

B. Vendor list of supplies or type of chemicals

- $200,000/year for 900 ball valves for 700 injectors
  ➔ Changed type & double valved = $180,000/yr saved

- $180,000/year for demulsifier in pipeline
  ➔ Cut off chemical for friction loss = $180,000/yr saved

On/Off

Choke

(↓90%)
C. Contracts

- **Electrical**
  - Rate negotiation saved $300,000/yr (14%)
  - Consolidate 5 meters to 1 meter = $100,000/yr saved

- **Condensate**
  - Location sold 20% more BBLs

(Payout 9 months)
Searching for Expense Reductions (Part 4)

D. Major lease operating expenses (LOE)

▪ Labor – 25% to 40% savings
  ➔ Developed “repair truck”
  ➔ Changed pulling rig type – $160,000/yr saved (25%)

▪ Water injection filter design (Rope to stainless screen)

Saved $400,000 / year in Well Cleanouts

▪ Artificial lift, electricity, chemicals (details to follow)
Focus on Rod Pumps
Case Study #4: Rod Pump Repairs

1. Set up database – track failures and future causes

2. Failures
   - Tubing holes
   - Rod wear
   - Corrosion due to rod wear
   - Corrosion from improper chemical application
   - Rod failures from stress

61% failure reduction = $1.7 MM/year savings
### Pumping Failure Database Sheet

#### Well Solutions:

- **A. Corrosion hole from wear**
  - Manual tubing rotator

- **B. Rod compression**
  - Add sinker bars
  - Change design

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**WELL NAME:** Tubing Rotation Reduces Failures

**WELL ID:** JOB # 15

<table>
<thead>
<tr>
<th>Failure Date (Month/Day/Year)</th>
<th>Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Pulled (Month/Day/Year)</td>
<td></td>
</tr>
<tr>
<td>Pulling Unit #</td>
<td></td>
</tr>
<tr>
<td>DAYS OFF PRODUCTION:</td>
<td></td>
</tr>
</tbody>
</table>

---

**FAILURE TYPE**

Tubing Split

**Tkg Corrosion Hole** | 1 |

Polish rod break/Scoured
Sucker rod body break

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**FAILURE CAUSE (A = primary, B = Future)**

**Wear**

- C02 Corrosion (jagged, interconnected)
- O2 Corrosion (smooth large broad pits)
- H2S Corrosion (smooth, isolated pits)
- CaCO4 Scale

**Compression (cracks on 1 side of rod)**

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Compliments of Omega Technologies Inc.
**Manual** Tubing Rotators Reduced Tubing Leaks by 83%

**Takeaway:** Manual rotation 5x tubing life
Artificial Lift Focus on Gas Lift Gas Systems
1. Low compressor suction pressure increases brake HP

2. Action ➔ Record rates & pressures (use same gauge)

3. Bottlenecks wasting energy:
   - Separators with high PSI to transfer water & oil
   - Line restrictions (Gathering, GLG, Transfer)
   - Gas lift valve designs
Case Study #5: Gas Lift Gas (GLG) Compressor Savings

GOAL ➔ Increase GLG from 18 MMCFD to 20 MMCFD

Optimization: Saved $276,000/year over prior fuel & rentals

1. Reduced anticipated HP by 17%
2. Raised suction pressure
3. Lowered separator pressures
4. Extra facility modifications = $50,000
5. Old wells increased > 100 bopd (10%)

Takeaway:
Reduce Bottlenecks & Optimize Designs
Focus on Electricity
1. Centrifugal pumps are less energy efficient than PD pumps
   “Ideal operating” centrifugals 20 to 45% less efficient
   Choked centrifugals waste even more energy

2. Centrifugals have lower initial installation costs

**Takeaway:**
Balance Installation Vs Operating Costs
Chokes, Variable Speed Drives (VSD) and PD Pumps

- 60 HZ
- 20% Waste (32 HP)
  - Or
  - VSD at 55 HZ (26 HP)
  - Or
  - PD Pump (18 HP)

- 55 HZ
- 1000 BFPD

Head Feet

Efficiency
Pump Operations (Saved $500,000/year)

Case Study #6: Turned off 2 of 3 centrifugal feed pumps
Savings = $100,000 per year by less choking (↓66%)

Case Study #7: Turned off centrifugal & start triplex pumps
Savings = $400,000 per year (↓30%)

Takeaway: Less Choking or Utilize PD Pumps
Focus on Wellhead Chemicals
Continuous Wellhead Chemical Injection

1. Chemical Pump
2. Chemical Line
3. Wellhead Fluid
4. Sidestream
5. Diluted Chemical Flush
Sidestream Flush Restrictor (SFR) Improvements

1. Old sidestream in 300 wells = 75 bfpd/well (not metered)
2. Installed sidestream flush restrictors for 7 bfpd/well (↓ 90%)
   - High friction hose replaces needle valve
   - Self-cleaning filter to prevent plugging

Compliments of Omega Technologies Inc.
Case Study #8: Installed 700 Sidestream Flush Restrictors

1. Reduced sidestream from 75 to 7 BFPD per well
2. Savings = $400,000 per year in electricity
3. Slowed down wells 30% ➞ ≈ $600,000 per year savings
4. Less plugging of line = Better chemical use
5. Three (3) month payout with over $1MM per year savings

Takeaway:
Less Sidestream Flush = Less Cost or More Oil
Focus on Positive Displacement Pumps
Reducing Vibrations in Triplex / Quintaplex Pumps

Typical Pulsation Dampener

- Bladders, Gas Charges
- More Vibrations
- Higher Investment

Versus

Large Header Design
- No Bottles
- No Moving Parts
- Special Header Design
- Less Vibrations

Omega Technologies Inc. Design
Case Study #9: Acoustic Header Reduces Pump Vibrations

Takeaway:
Reduce Vibrations with Acoustically Designed Headers

No Dampener
Peak  310 PSI

Acoustic Header
Peak  22 PSI
Acquisition Summary 2:

- Purchased $22MM with $2.5 MM/year cashflow
- Lowered Costs (Gas Lift, Pump Dampeners, etc)
- Low Resistivity Pay downdip of 100% SW added 1.8 mmbo
- Reactivated / Recompleted / Drilled Wells
- Increased Water Flood Injection
- Production Increased from 270 to 1,500 bopd (↑ 450%)
- Valuation >>$90MM (↑ 4X)
Summary

TOPIC 1: Improvements of an Accounting System
➔ Develop more accurate accounting values

TOPIC 2: Benefits of Incremental Well Costs Analysis
➔ Utilize individual well costs for decision making
  
  Added 3.2 MMBO with 50 Reactivations

TOPIC 3: Operational Techniques to Decrease Expenses
➔ 19 operational improvements saved $4.4 MM/year

  10 year savings PW@10% = $28MM
The “Goal” ➔ Accurate Incremental Economics + Cost Reductions = Additional Reserves & Value

Preventive Maintenance
Thank You!

Any Questions or Ideas to Share?
Your Feedback is Important

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