

SECTION 6

REDUCING LIFTING COSTS

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Presented
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IN THIS SECTION WE DISCUSS:

- PRACTICAL STEPS TO EVALUATE POWER COSTS**
- OTHER STEPS-MORE TIME, RESOURCES, AND CAPITAL**
- EXPERIENCED BASE TIPS ON REDUCING POWER COSTS**
- EXAMPLES OF POWER REDUCTION**
- DOWNHOLE WATER SEPARATION TECHNOLOGIES**
- CYLINDER CYCLONE SEPARATORS**

POWER COST REDUCTION

PRACTICAL STEPS-SIMPLE-DON'T ASSUME THEY HAVE BEEN DONE

LOCATE AND ANALYZE POWER BILLS

- GET 1 YEAR'S WORTH OF ALL YOUR POWER BILLS**
- PUT IN MONTHLY ORDER AND READ CAREFULLY**
- CONSTRUCT A SPREADSHEET INCLUDING BFPD**
- LOOK FOR TRENDS OR UNEXPLAINED ANOMALIES**
- ASK-DO COSTS CHANGE MAKE SENSE?-ARE THERE PENALTIES OR LATE CHARGES?, DO YOU NEED POWER? IS THE MATH OK?**

PRACTICAL STEPS CONTINUED

GET FREE OUTSIDE HELP:

- CONTACT YOUR UTILITY REPRESENTATIVE ABOUT YOUR CONTRACT**
- ASK FOR EXPLANATION OF YOUR RATES**
- ASK FOR THE BEST RATES-TO LOWER YOUR BILL**
- LOOK AT YOUR OPERATIONS-ASK HOW TO BENEFIT FROM VARIOUS RATES**

PRACTICAL STEPS CONTINUED

GET INTO THE FIELD

- INVENTORY YOUR ELECTRICAL MOTORS**
- DETERMINE YOUR EXPECTED POWER COMSUMPTION-
AGREE WITH BILL?**
- TALK TO FIELD EMPLOYEES ABOUT HOW THEY MANAGE
POWER USAGE-GET THEM ACCOUNTABLE**
- LOOK AT HOW EQUIPMENT IS OPERATED AND WHAT TIMES**
- FIND POWER METERS, VERIFY THEY ARE YOURS-MATCH
THEM WITH THE BILLS**
- LEARN HOW TO READ METERS**
- COPY DOWN POWER-METER INFO, VERIFY METER FACTORS**

PRACTICAL STEPS CONTINUED

STEP BACK AND ANALYZE

- **DETERMINE IF YOU ARE OPERATING FOR THE BEST RATE**
- **DETERMINE IF LARGE, INTERMITTENT LOADS (PUMPS) CAN BE OPERATED AT NON-PEAK HOURS TO REDUCE DEMAND (KNOW THE TIME WHEN RATES CHANGE)**

PRACTICAL STEPS CONTINUED

TAKE ACTION

- **SET GOALS FOR POWER USAGE AND COSTS**
- **ASSIGN PERSONNEL RESPONSIBILITIES**
- **EMPLOYEE AWARENESS**
- **LOOK FOR *ELEPHANTS* –FOCUS ON LARGE LOADS**
- **CHANGE TO BEST RATE STRUCTURE FOR OPS**
- **FOLLOW UP ON POWER USAGE AND COSTS**
- **MAKE POWER REDUCTION AN ANNUAL TRAINING**

OTHER STEPS-TAKE MORE TIME, RESOURCES AND CAPITAL.

- LOOK FOR ALTERNATE ELECTRICAL PROVIDERS**
- TALK TO YOUR ELECTRIC CO-OP-IF YOU DON'T HAVE ONE-
CREATE ONE**
- CHECK OUT PERFORMANCE CONTRACTING-HOW TO GET PAID
TO REDUCE YOUR POWER CONSUMPTION**
- TALK TO OFFSET AND LOCAL OPERATORS**

OTHER STEPS –TAKE MORE TIME, RESOURCES AND CAPITAL

- LOOK FOR INDUSTRY WORKSHOPS ON POWER USAGE**

- CHECK OUT OTHER KNOWLEDGE; PTTC, INTERNET, TRADE JOURNALS, TRADE ASSOCIATIONS**

- WORK TO GET AVAILABLE RATE STRUCTURES CHANGED**

OIL FIELDS HAVE A VERY DESIRABLE FLAT LOAD PROFILE

EXPERIENCE –BASED TIPS

- MAINTAIN LOW FLOWLINE PRESSURE**

KEEP CLEAN

VALVES FULLY OPEN

MINIMUM PIPING RESTRICTIONS

- PROPERLY SIZE ELECTRIC MOTOR**

**REPLACE WORN OUT WITH RIGHT SIZE AND
MORE EFFICIENT MOTORS-WATCH OUT FOR
UPSIZING SYNDROME OR ON –SHELF SYNDROME**

**SIZE AS CLOSE TO LOAD REQUIREMENTS AS
POSSIBLE-ESPECIALLY FOR ELECTRICITY \$
BASED ON CONNECTED HP AND NOT ACTUAL
USE**

TIPS CONTINUED

- PRODUCE WITH A FULL PUMP BARREL**

- FOR MAXIMUM LIFT EFFICENCY**

MATCH PUMP DISPLACEMENT WITH FLUID INFLOW

CHANGE SPM, SL,

USE TIMERS OR POC

CHANGE PUMP SIZE

PROPER DOWNHOLE GAS SEPARATOR

TIPS CONTINUED

- **PROPERLY TIGHTEN SHEAVE BELTS**

TOO LOOSE-MOTOR ENERGY LOST

TOO TIGHT-BELT AND BEARING LIFE REDUCED

- **USE AS LONG A STROKE AS POSSIBLE**

- **SELECT OPTIMUM PUMPING UNIT GEOMETRY**

USE MODERN WAVE EQUATION PREDICTIONS

- **OPTIMIZE DIRECTION OF ROTATION**

BASED ON PEAK LOAD OCCURENCE

- **MAINTAIN PROPER BALANCE**

TIPS CONTINUED

- **TAKE ADVANTAGE OF INTERRUPTIBLE POWER RATES WHERE ECONOMICAL TO DO SO. SAVINGS CAN BE 10—30%**
- **EVALUATE EXISTING INJECTION SYSTEMS TO IDENTIFY INEFFICIENCIES THAT RESULT IN EXCESS POWER USE**
- **CONSIDER OPERATING COSTS ASSOCIATED WITH I^2R LOSSES (LINE LOSSES) WHEN SIZING CONDUCTORS-USE THE LARGEST SIZE ECONOMICALLY**
- **USE ODP (OPEN DRIP PROOF) MOTORS INSTEAD OF TEFC (TOTALLY ENCLOSED FAN COOLED) MOTORS**

TIPS CONTINUED

- **USE AN AMP METER TO MEASURE THE CURRENT DRAWN BY EACH MOTOR-SHOULD BE 70% OF NAMEPLATE. IF BELOW 50% POWER IS WASTED**
- **USE KW-H METERS INSTEAD OF AMP METERS TO MEASURE *POWER CONSUMPTION* WHEN ANALYZING OPERATING COSTS**
- **CONSIDER INSTALLING ENERGY EFFICIENT MOTORS WHEN EXISTING MOTORS REQUIRE REWINDING. TYPICAL PAYBACK ON ENERGY SAVINGS IS LESS THAN ONE YEAR**

TIPS CONTINUED

- **EVALUATE THE ECONOMICS OF IMPROVING THE POWER FACTOR OF YOUR SYSTEM**
- **EVALUATE GAS TOLLING (EXCHANGE OF GAS FOR ELECTRICITY)**
- **BE AWARE AND MAKE IT PART OF YOUR OPERATING PLAN TO REVIEW YOUR RATES AND CONTRACT WHEN SIGNIFICANT CHANGES IN YOUR FACILITIES ARE MADE.**

EXAMPLES OF POWER/COST REDUCTIONS

TEJON-GRAPEVINE FIELD-KERN COUNTY, CALIF

- **20% COST SAVINGS BY CHANGING TO BETTER RATE**
- **5% COSTS SAVINGS BY SWITCHING WATER DISPOSAL PUMP TIME**
- **2% COST SAVINGS BY PUMPING OIL EARLIER IN THE DAY**

TIDELANDS OIL

- **MOTORS WERE SIGNIFICANTLY OVERSIZED-REPLACED WITH RIGHT SIZE WHEN FAILURE OCCURRED.**
- **FOUGHT FOR RATE CHANGE-SAVINGS OF UP TO 36% ON SOME OF THEIR METERS.**

OTHER EXAMPLES OF POWER/COST REDUCTION

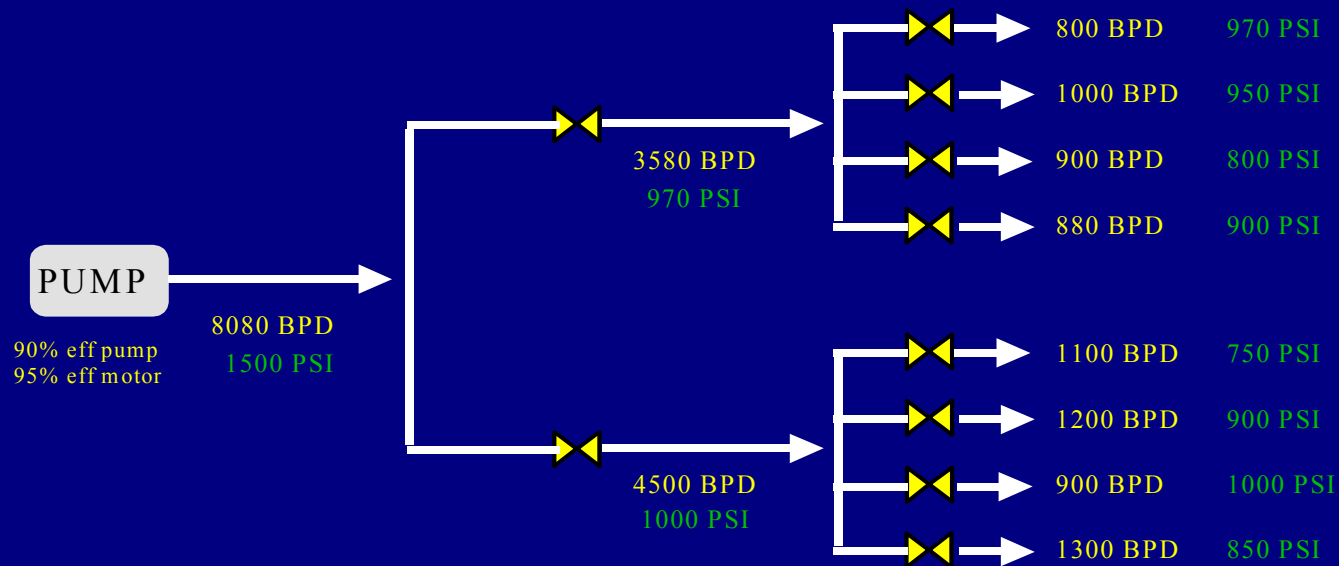
CHAMPLIN

**HAD ACCESS TO TWO ELECTRIC SERVICE PROVIDERS WHICH
HAD TWO DIFFERENT RATE STRUCTURES**

- INSTALLED EQUIPMENT TO SWITCH BETWEEN
SUPPLIERS AT DIFFERENT TIMES OF THE DAY-POWER
COSTS REDUCED 30%-PAYOUT IN ONE YEAR**

OTHER EXAMPLES OF POWER/COST REDUCTION

INLINE CHOKES BEFORE



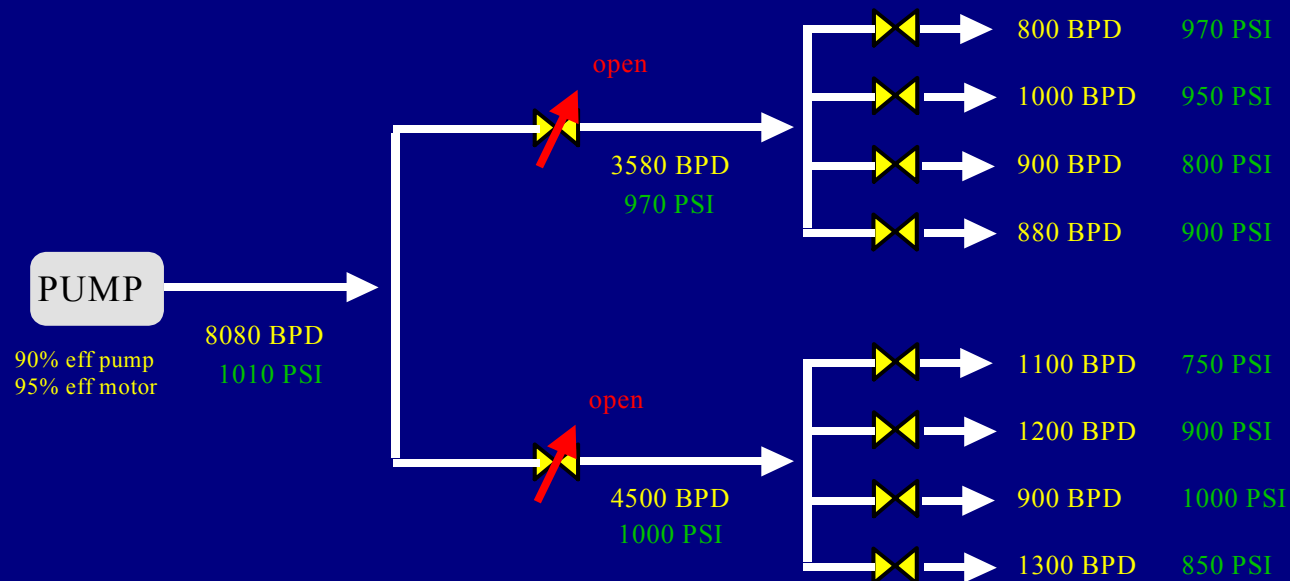
INJECTION COSTS @ \$.04/kwh

\$5,180/month

\$62,165/year



INLINE CHOKES OPENED



INJECTION COSTS @ \$.04/kwh

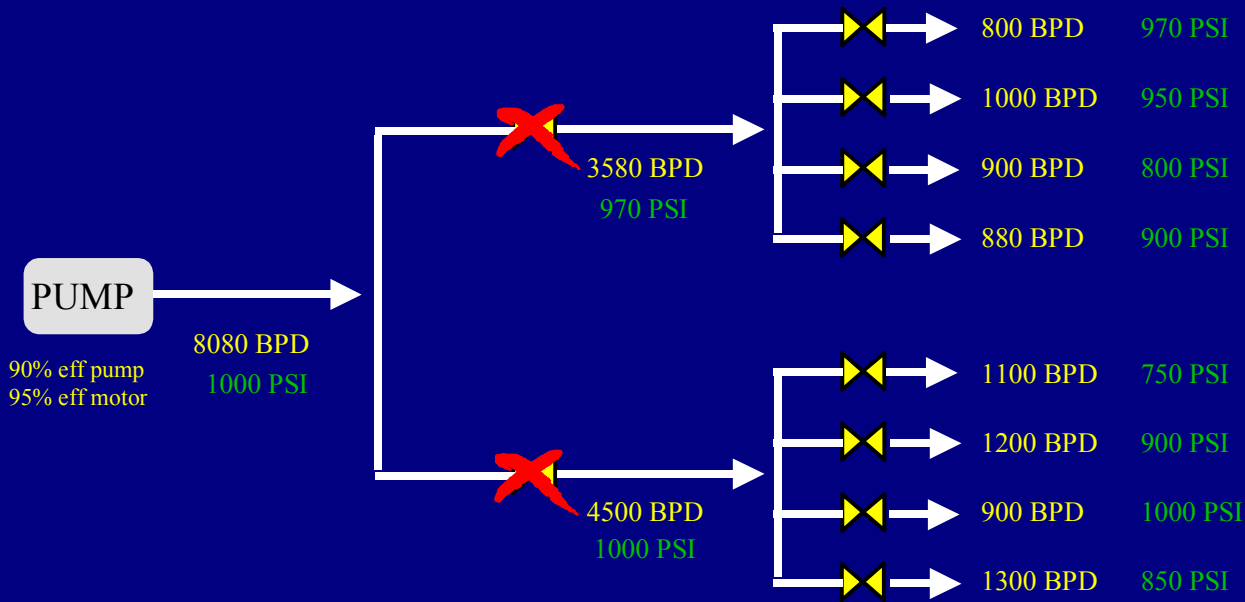
\$3,488/month

\$41,857/year

Savings
\$20,307/year

CONOCO

INLINE CHOKES REMOVED



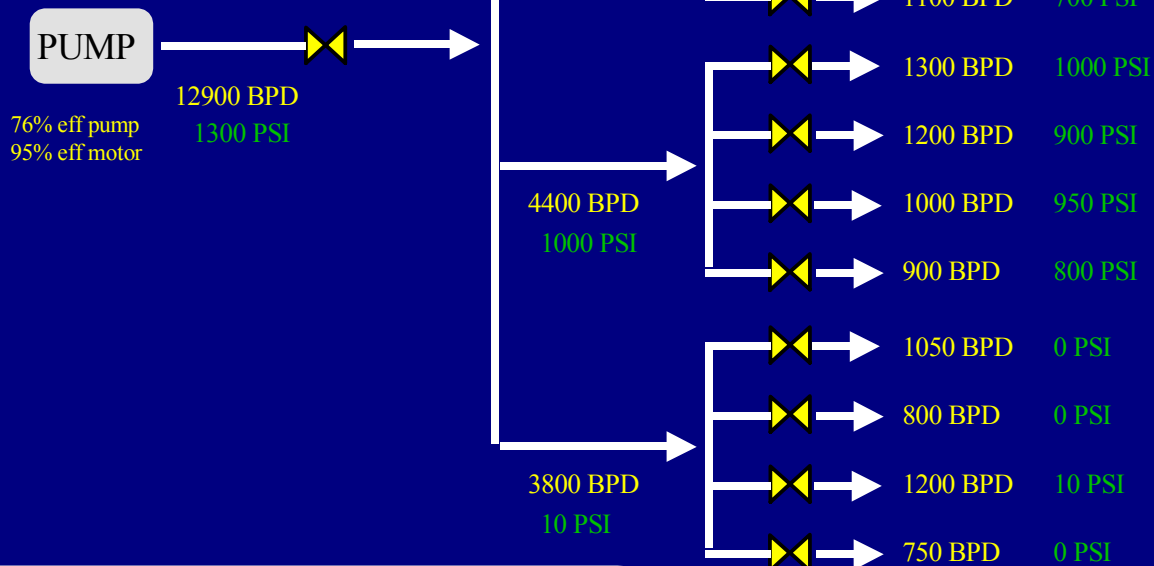
INJECTION COSTS @ \$.04/kwh

\$3,453/month
\$41,443/year

Savings
\$414/year add
\$20,721/year total

CONOCO

LOW PRESSURE HEADER BEFORE

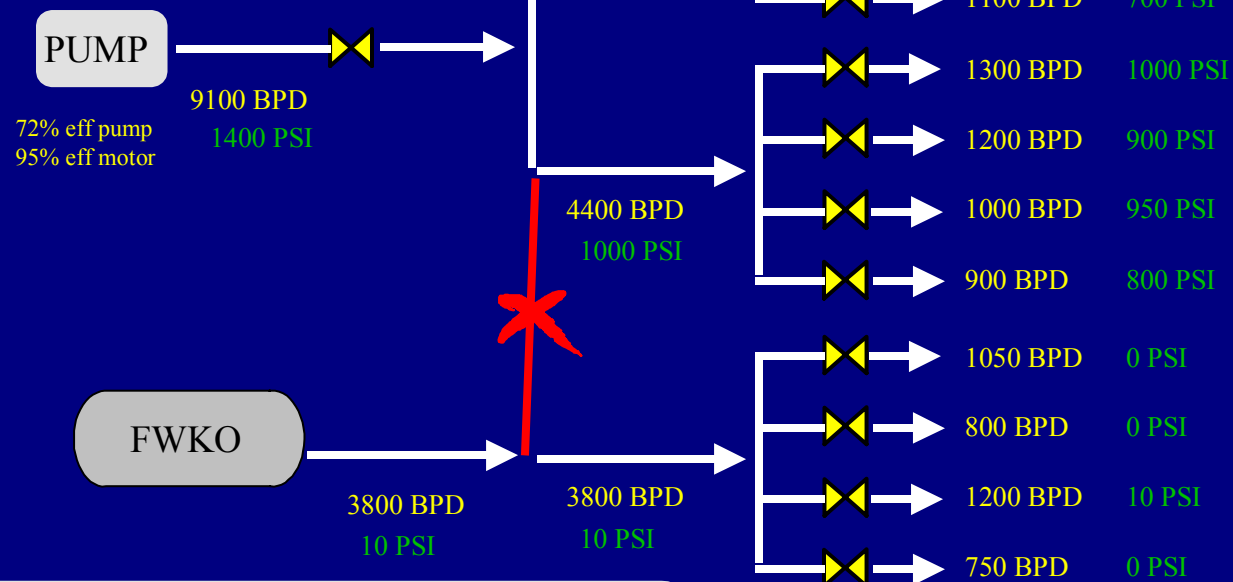


INJECTION COSTS @ \$.04/kwh

\$8,488/month
\$101,860/year



LOW PRESSURE HEADER TO FWKO



INJECTION COSTS @ \$.04/kwh

\$6,806/month

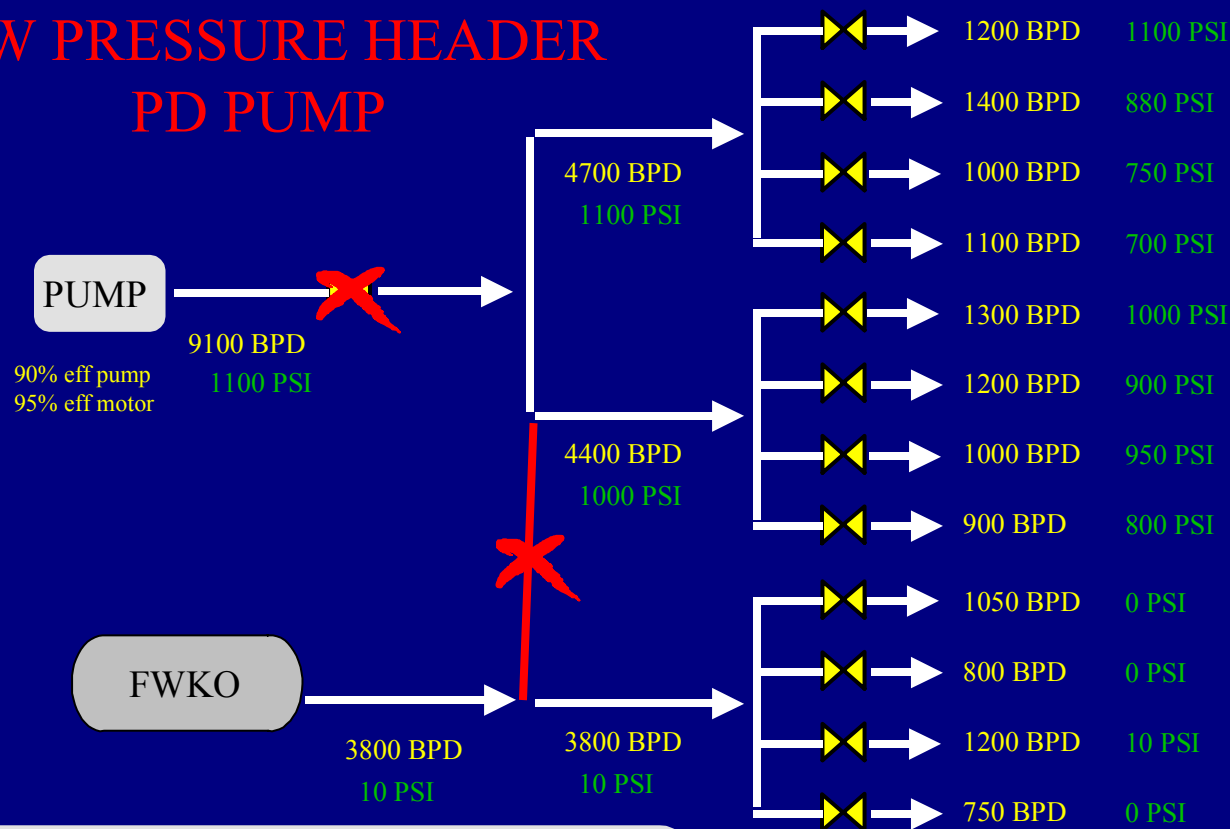
\$81,681/year

Savings

\$20,179/year

CONOCO

LOW PRESSURE HEADER PD PUMP



INJECTION COSTS @ \$.04/kwh

\$4,279/month

\$51,348/year

Savings

\$30,333/year add

\$50,512/year total



ON-SITE POWER GENERATION

NEED TO LOOK AT IF:

HIGH UTILITY RATES, AVAILABLE LOW-COST OR NON-MARKETABLE GAS, REDUCED LEASE INCOME, HIGH ENERGY DEMAND

TWO GENERATOR TYPES AVAILABLE

- SYNCHRONOUS –TYPICALLY-NO POWER AVAILABLE-OPERATOR WISHES TO SEVER TIES-USES A SYNCHRONOUS GENERATOR WITH GAS ENGINE**
- INDUCTION-LOWER COST INDUCTION MOTOR WITH A GAS ENGINE-SUPPLEMENTS LEASE POWER TO REDUCE COSTS-DOES NOT REPLACE UTILITY'S FUNCTION OF PROVIDING MOTOR STARTING AND PEAK DEMAND NEEDS.**

INDUCTION SYSTEM GENERATOR APPLICATION

- COST OF ELECTRICITY IS HIGH > \$.07KW-H**
- COST OF GAS IS LOW**
- EXAMPLE**
 - A 125 HP SYSTEM WITH \$1.50 GAS AND A \$.07 KWH RATE SAVED THE OPERATOR \$37,500 ANNUALLY IN POWER COSTS**
- INDUCTION SYSTEMS ECONOMICALLY APPLIED IN MULTIPLE ROD LIFT BEAM PUMPS, IN WATERFLOODS, AND SWD RECIP PUMPS FOR HI-PRESSURE WATER INJECTION, AND WITH ESPS**

GLOBAL POWER SYSTEMS, LLC OUT OF BOSSIER CITY, LA MARKETS AN INDUCTION GENERATOR SYSTEM- THEY WILL DO YOU AN ECONOMIC ANALYSES-HAVE 12 MONTHS OF YOUR UTILITY BILLS AND A CERTIFIED GAS COMPOSITIONAL ANALYSIS.

DOWNHOLE OIL WATER SEDPARATORS (DOWS)

THIS TECHNOLOGY IS RELATIVELY NEW AND BEING REFINED AND IMPROVED WITH EACH SUCCESSIVE INSTALLATION.

TWO BASIC TYPES HAVE BEEN DEVELOPED

- HYDROCYCLONE-TYPE**

 - BETTER FOR HIGH VOLUMES**

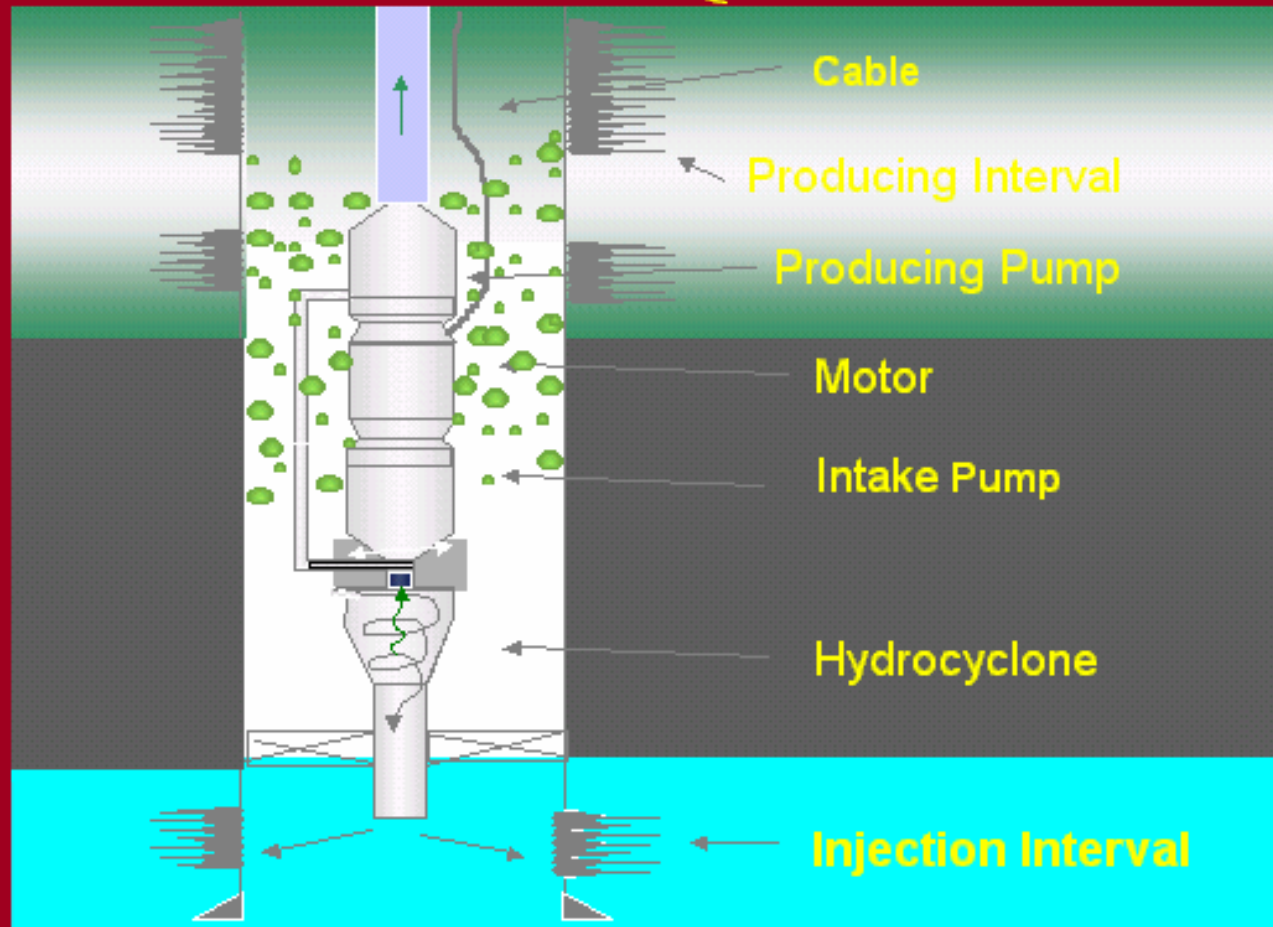
 - MORE EXPENSIVE**

 - PAIRED WITH ESP'S, ROD PUMPS, PROG. CAVITY PUMPS**

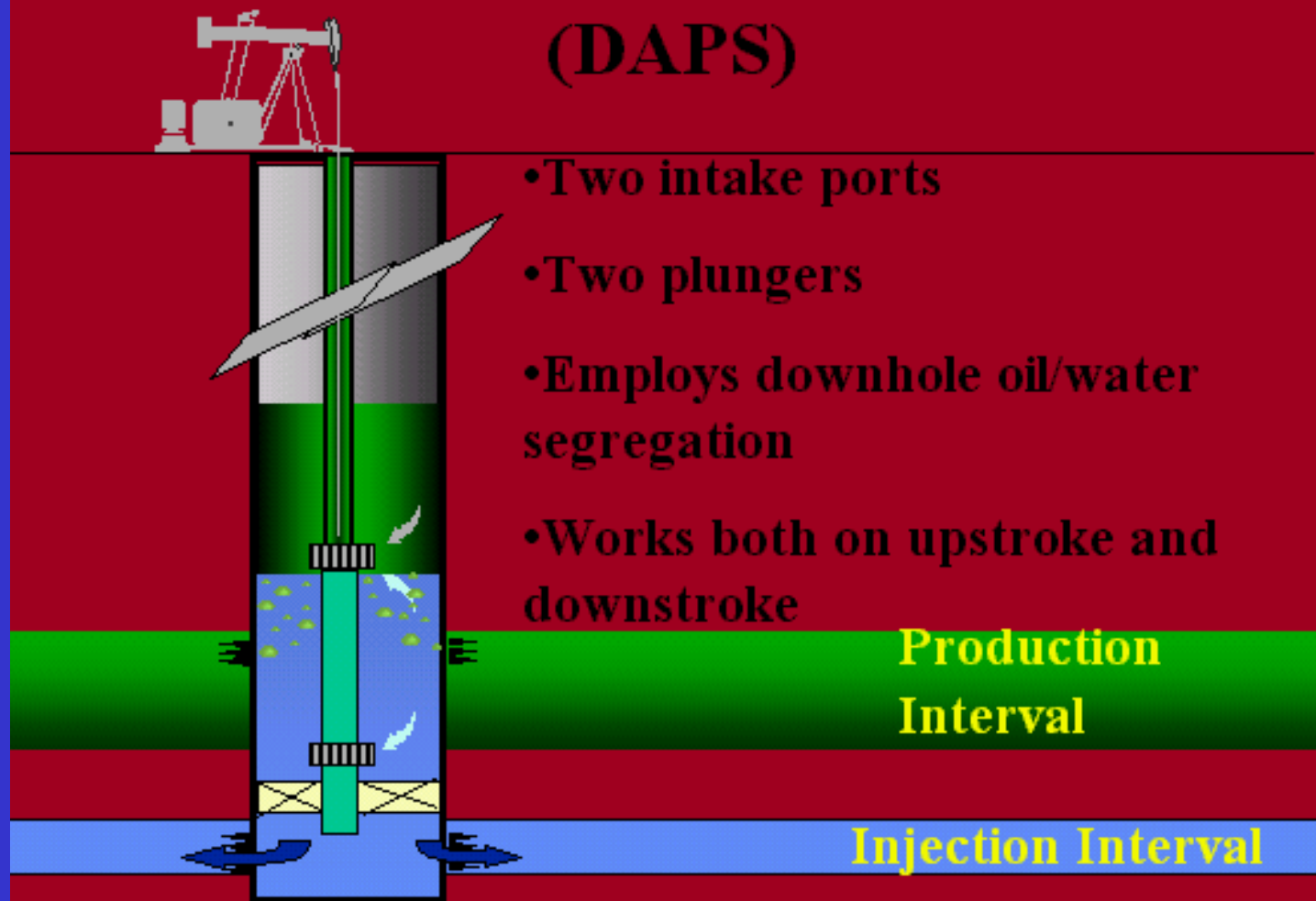
- GRAVITY SEPARATOR-TYPE**

 - USED ONLY WITH ROD PUMPS**

C-FER's AQWANOT



Dual Action Pumping System (DAPS)



DOWS

CONVERSION COSTS TO A DOWS SYSTEM IS RELATIVELY EXPENSIVE

**EXAMPLE: COST OF OF ESP DOW SYSTEM= 2-3 TIMES ESP
COST OF GRAVITY TYPE= \$15-20,000**

DOWS NOT COST EFFECTIVE FOR ALL WELLS

- KNOWLEDGE OF RESERVOIR AND PRODUCTION HISTORY**
- FAVORS HIGH WATER TO OIL RATIO**
- SUITABLE INJECTION ZONE ISOLATED FROM PRODUCTION ZONE**
- COMPATIBLE WATER CHEMISTRY**
- GOOD MECHANICAL INTEGRITY**

DOWS CONTINUED

TRACK RECORD IS MIXED-SOME SYSTEMS RUNNING FOR TWO YEARS-OTHERS LASTED ONLY A FEW DAYS

EVALUATION BY ARGONNE NATIONAL LAB-JAN 1999

- 37 INSTALLATIONS-21 HYDROCYCLONE, 16 GRAVITY**
- 27 IN CANADA, 10 IN US**
- 17-5.5 in CSG, 14-7in CSG, 1-8.625in CSG, AND 5 UNSPECIFIED**
- 20 IN CARBONATE RESERVOIRS, 16 IN SANDSTONE**

OIL INCREASE 47 % IN CARBONATES, 17% IN SANDSTONES

DECREASE IN H2O 88% IN CARBS, 78% SANDSTONES

DOWS CONTINUED

- **VOLUME OF OIL INCREASED IN 19**
 - **VOLUME OF OIL DECREASED IN 12**
 - **VOLUME OF OIL SAME IN 2**
 - **VOLUME UNSPECIFIED IN 4**
-
- **29 TRIALS SHOWED A DECREASE IN WATER BROUGHT TO THE SURFACE**
 - **DECREASE RANGED FROM 14% TO 97%**
 - **22 OF 29 EXCEEDED 75% REDUCTION**

DOWS CONTINUED

SOME FUNCTION PROBLEMS;

- LOW INJECTIVITY OF DISPOSAL ZONE**
- INCOMPATIBLE FLUIDS**
- INSUFFICIENT ISOLATION OF ZONES**

RESULTS IN RECYCLING WATER AND DROPPING OIL RATES

- PLUGGIN BY FINES**
- CORROSIONA AND SCALE PROBLEMS**

FOR MORE ON DOWS:

GO TO

ALL CONSULTING WEBSITE

<http://www.all-lic.com/DOWS/overview.htm>

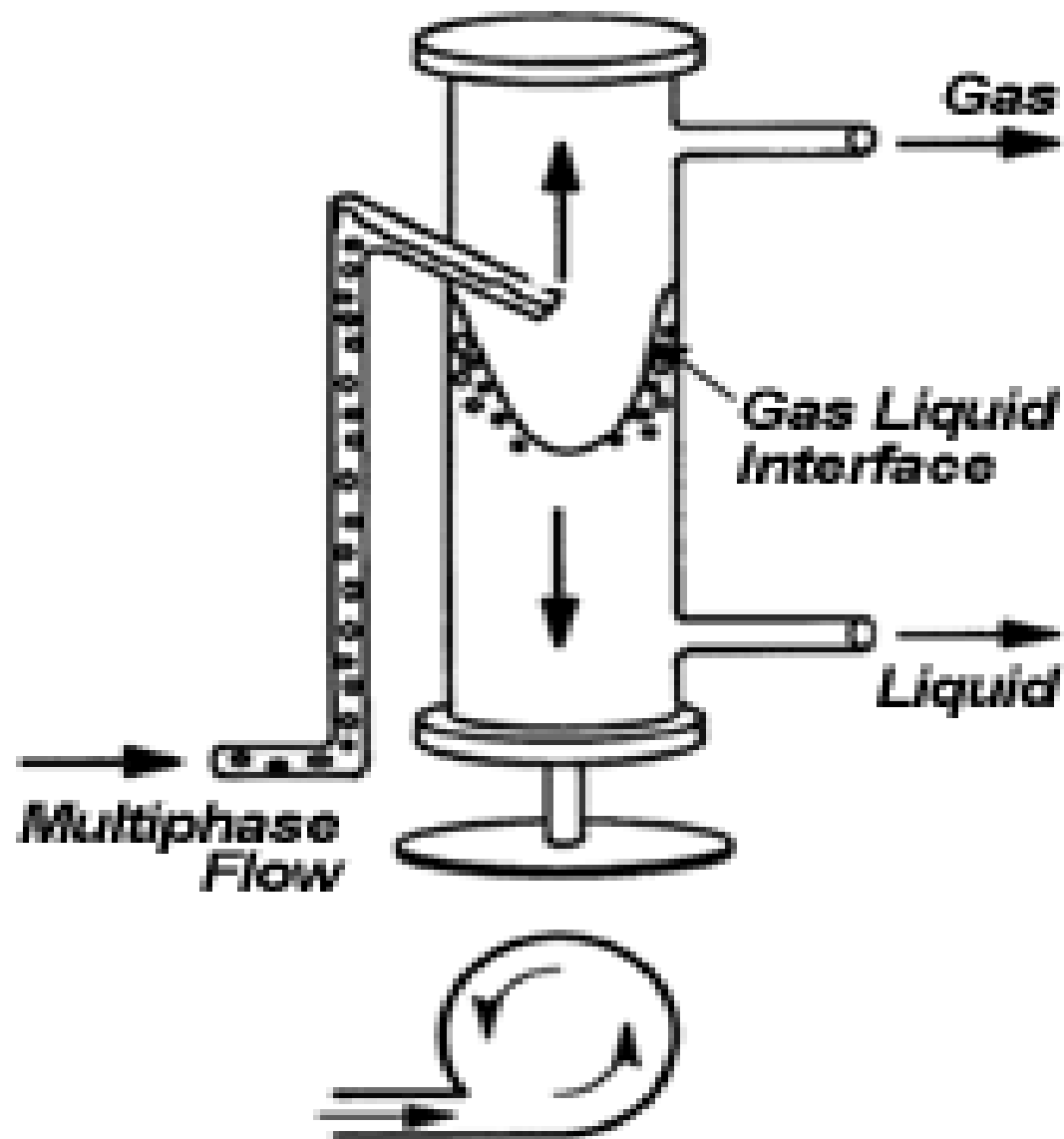
REGULATORY POSITIONS ON DOWS

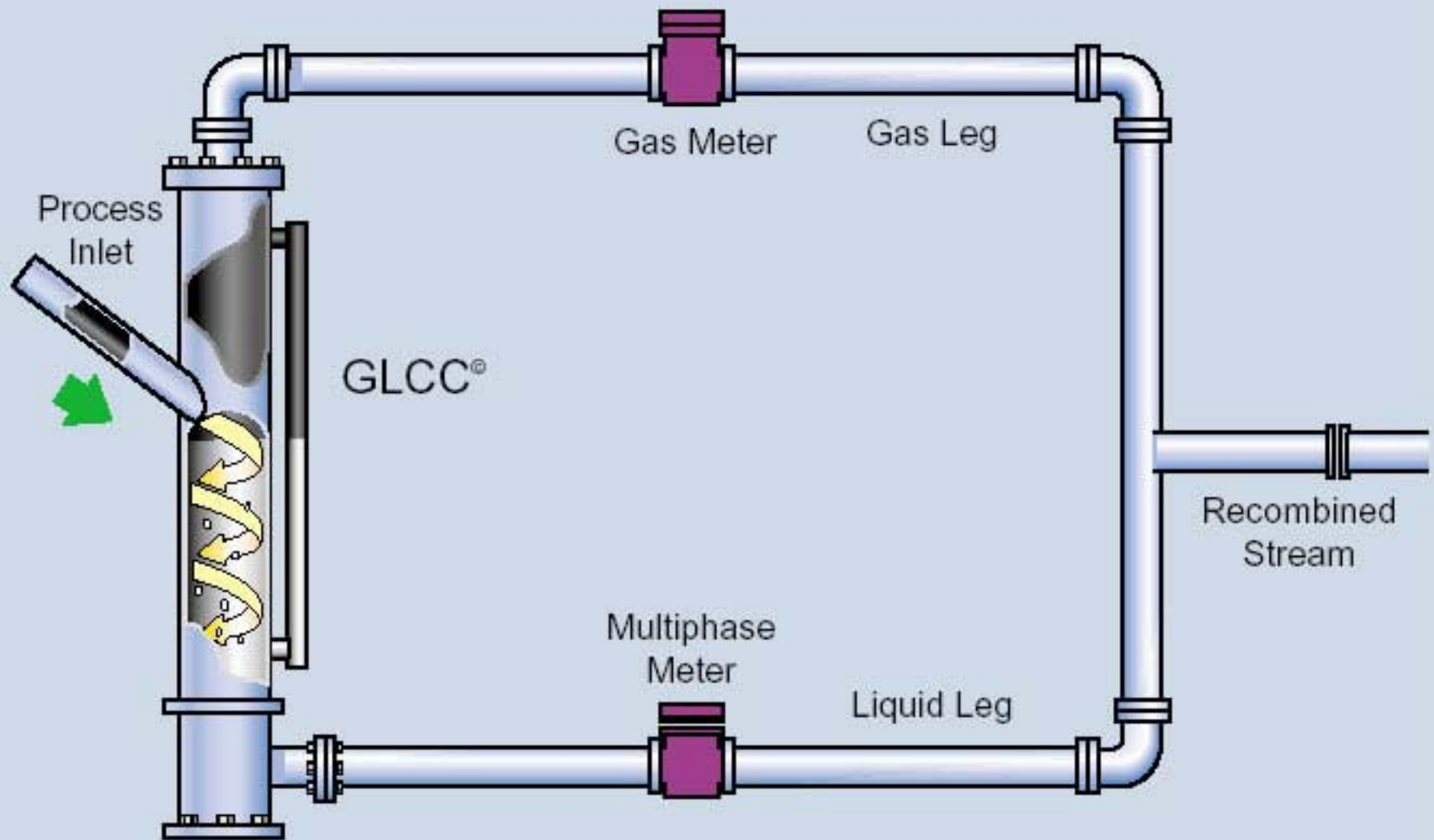
EPA-NO FORMAL POSITION

**COLORADO, OKLAHOMA, TEXAS, AND LOUSIANA –HAVE
REGS OR ADMINISTRATIVE GUIDELINES**

CYLINDRICAL CYCLONE SEPARATORS

- SIMPLE IN CONSTRUCTION
- COMPACT
- LOW WEIGHT
- LOW CAPITAL AND OPERATIONAL COSTS
- WORLD WIDE-350+GAS-LIQUID UNITS; 50 IN OKLAHOMA
- MOST ARE FOR AUTOMATED WELL TESTING, BULK SEPARATION, GAS KNOCKOUT, AND PRE SEPARATION
- COULD BE IDEAL CANDIDATE FOR REPLACING FWKO
- LOOK AT FOR LOW GAS, HIGH WATER CUT MARGINAL WELLS.





**TULSA UNIVERSITY SEPARATION TECHNOLOGY PROJECTS WITH
13 INDUSTRIAL COMPANIES, DOE, AND THE OKLAHOMA CENTER
FOR THE ADVANCEMENT OF SCIENCE AND TECHNOLOGY
DEVELOPED:**

- **GAS-LIQUID CYLINDRICAL CYCLONES (GLCC)**
- **LIQUID-LIQUID CYLINDRICAL CYCLONES (LLCC)**
- **GAS-LIQUID-LIQUID CYLINCRICAL CYCLONES (GLLCC)**

**DESCRIPTIONS OF THE THREE CYLINDER CYLONES ARE GIVEN
IN THE MANUAL**

FOR ADDITIONAL INFO:

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