



SMU GEOTHERMAL LAB CONFERENCE -
GEOTHERMAL ENERGY AND WASTE HEAT TO
POWER: UTILIZING OIL & GAS P

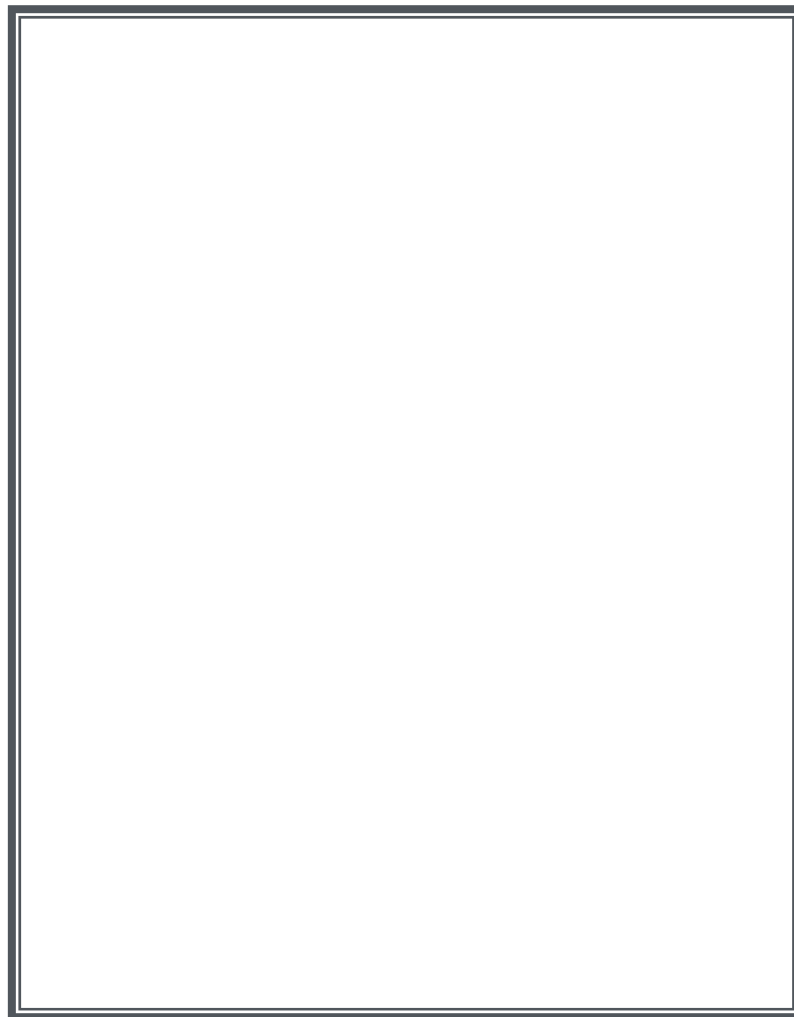


BLADE ENERGY 2011 SMU & GRC PRESENTATIONS

- ANNULAR CIRCULATION
CO-PRODUCTION (ACC) SYSTEM
- TRANSFER HEAT FROM
PRODUCTION STREAM TO
WORKING FLUID IN WELLBORE
- USE WORKING FLUID VAPOR TO
GENERATE POWER ON SURFACE

Suryanarayana, Sachdeva, Ceyhan, Ring, Blade Energy Partners, (2011),
*System Design Alternatives and their Influence on Geothermal Heat Recovery from Co-
Produced Oil and Gas Wells*, GRC Transactions, Vol. 35

BLADE ENERGY 2011 PRESENTATION



HISTORY OF GRAVITY HEAD ENERGY SYSTEM

- GEOTHERMAL POWER SYSTEM
- WF DRIVES EXPANDER, WHICH DRIVES PUMP
- PROTOTYPE DEVELOPED WITH DOE



GRAVITY HEAD PUMPS

- HOW DOES IT WORK?
- REQUIRES ONE MORE INTERNAL STRING
- MINIMAL ADJUSTMENTS TO THE WELLHEAD
- EXPANDER-PUMP ROTATES AT HIGH SPEED
- NO MOVING PARTS AT SURFACE
- CAPABLE OF REMOTE OPERATION

GRAVITY HEAD PUMPS

- CAN INSTALL DEEPER THAN SHAFT-DRIVEN PUMP
- ELIMINATES POWER SOURCE AND CABLES NEEDED FOR ESP
 - HIGHER ALLOWABLE OPERATING TEMPERATURE
- INHERENTLY CLEAN WORKING FLUID RUNNING EXPANDER
- PUMP CAN BE RETRIEVED & INSTALLED BY WIRE LINE TO MINIMIZE DOWNTIME & REDUCE COSTS

GRAVITY HEAD PUMP APPLICATIONS

- MANY OIL WELLS TODAY HAVE A HIGH WATER CUT
- THOUSANDS OF OIL/WATER WELLS CAN USE THIS PUMPING SYSTEM TO ELIMINATE NEED FOR POWER
- HUNDREDS OF LINE SHAFT AND SUBMERSIBLE GEOTHERMAL PUMPS CAN BE REPLACED DUE TO CAPEX AND OPEX
- APPLICABLE FOR ON/OFFSHORE LOCATIONS

GRAVITY HEAD PUMPS – CONCEPT TO COMMERCIALIZATION

- POTENTIAL MARKET
 - ENHANCE HYDROCARBON PRODUCTION IN HIGH WATER CUT WELLS
 - GENERATE POWER FROM WATERED OUT WELLS
- ESTIMATE # OF WELLS BY STATE
- COMPETING TECHNOLOGIES
- FABRICATION COSTS
- POWER PRODUCTION (IF INCLUDED)

GRAVITY HEAD SYNERGIES

- SHARES BASIC ELEMENTS OF DEVELOPED TECHNOLOGIES
- GHERS IN DEVELOPMENT FOR SEVERAL YEARS
 - MAJOR ELEMENTS DESIGNED & PRODUCTION READY
- SOPHISTICATED NUMERICAL MODELS FOR GHERS AND ACC DEVELOPED AND TESTED MULTIPLE TIMES
- EXPERIENCED TEAM PREPARED TO IMPLEMENT GHP

