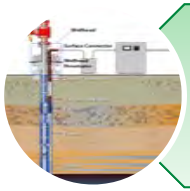
GEOTEK ENERGY, LLC

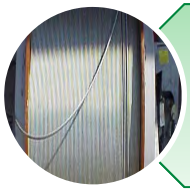
GRAVITY HEAD PUMPS

USING GEOTHERMAL ENERGY TO POWER SUB-SURFACE PUMPS

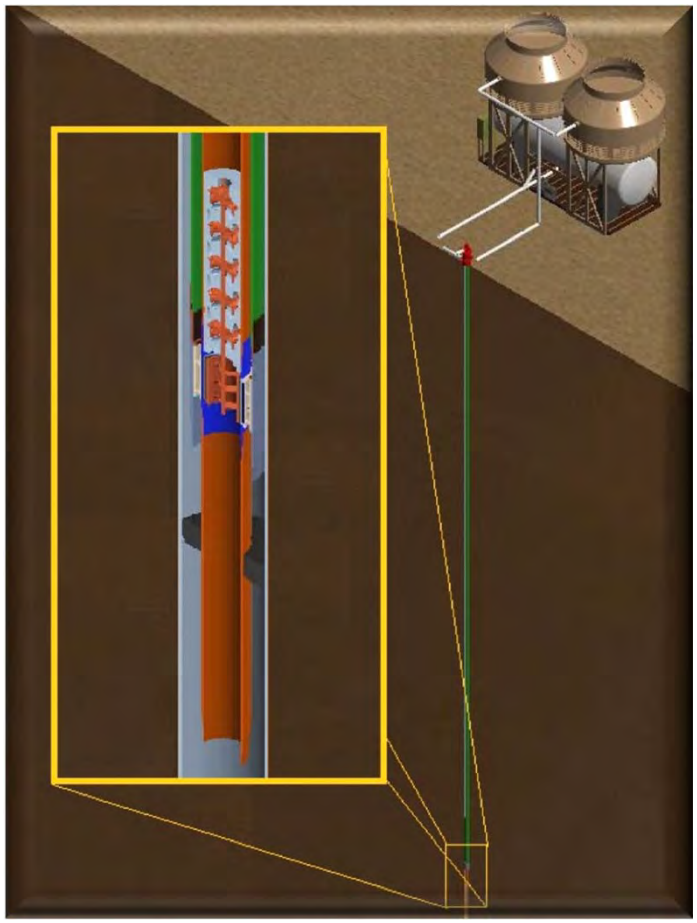


EFFICIENT ALTERNATIVE TO TRADITIONAL PUMPS FOR HIGHER-TEMP CONDITIONS

NO SHAFTS, RODS OR ELECTRICAL CABLES NEEDED



WIRE LINE RETRIEVABLE PUMP FOR EASY SERVICING



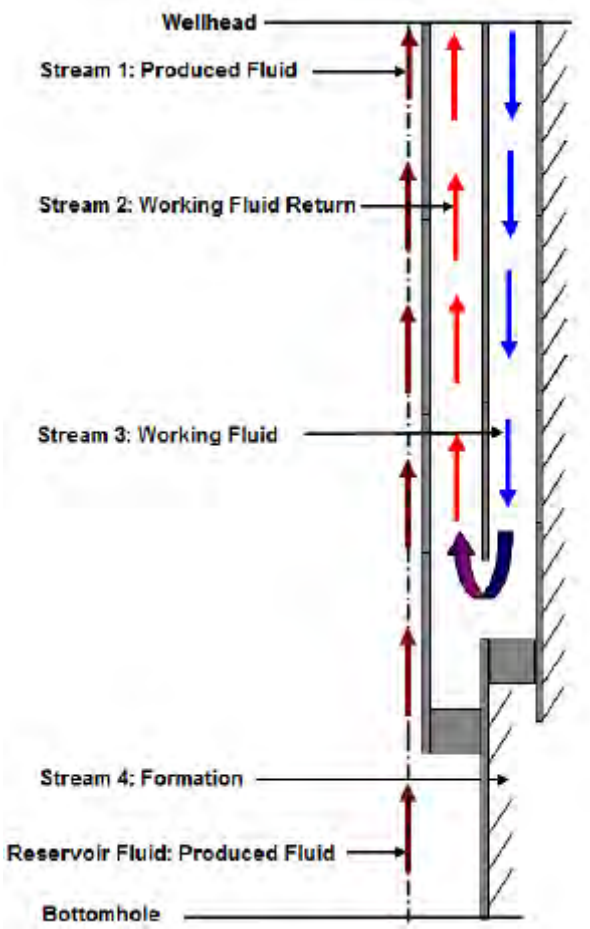
SMU GEOTHERMAL LAB CONFERENCE - GEOTHERMAL ENERGY AND WASTE HEAT TO POWER: UTILIZING OIL & GAS PLAYS

MARCH 12-14, 2013

PRESENTED BY:
MICHAEL PIERCE
ANGEL SANCHEZ

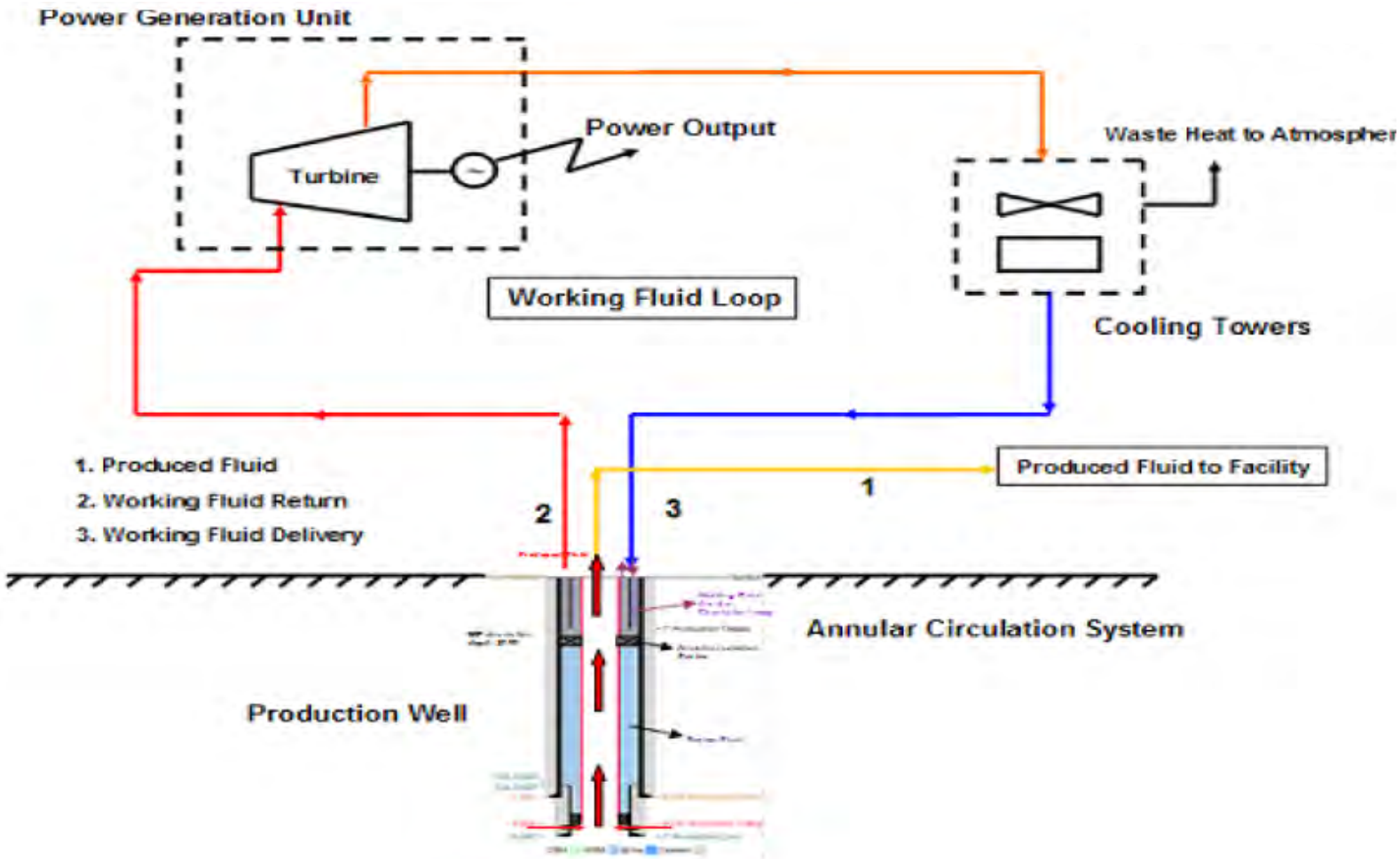
BLADE ENERGY 2011 SMU & GRC PRESENTATIONS

- 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

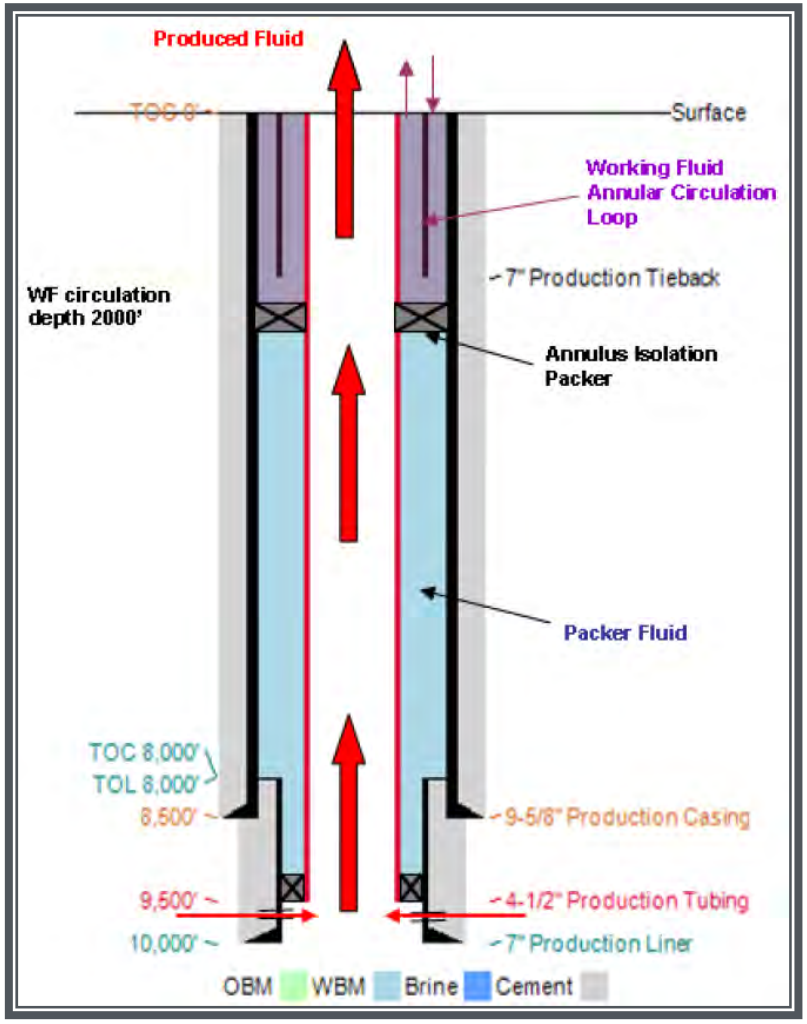


Suryanarayana, Sachdeva, Ceyhan, Ring, Blade Energy Partners, (2011), *System Design Alternatives and their Influence on Geothermal Heat Recovery from Co-Produced Oil and Gas Wells*, GRC Transactions, Vol. 35

BLADE ENERGY 2011 PRESENTATION

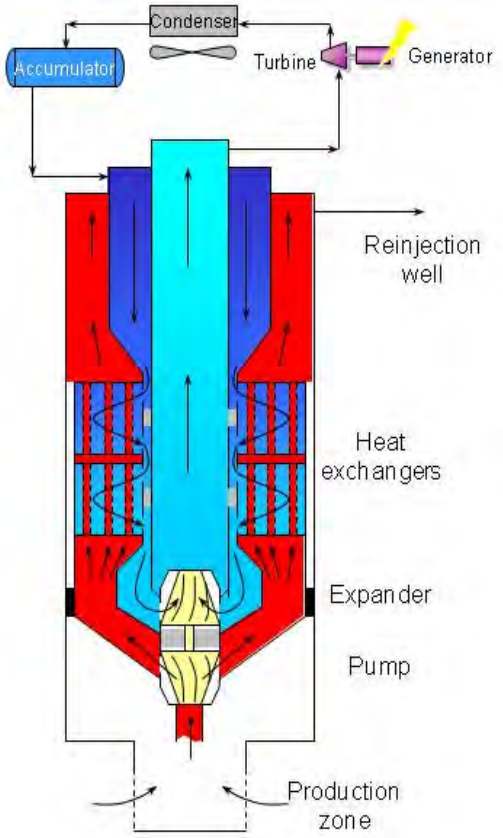


BLADE ENERGY 2011 PRESENTATION



HISTORY OF GRAVITY HEAD ENERGY SYSTEM

- GEOTHERMAL POWER SYSTEM
- WF DRIVES EXPANDER, WHICH DRIVES PUMP
- PROTOTYPE DEVELOPED WITH DOE SUPPORT
- PILOT SCALE FIELD TEST SCHEDULED LATE 2013

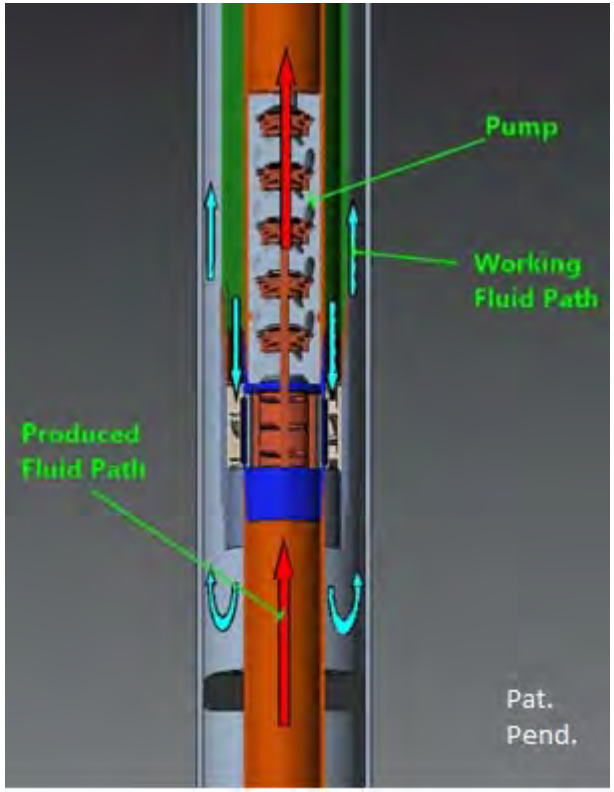


APPLYING GRAVITY HEAD ENERGY TO CO-PRODUCTION

- BLADE ACC SYSTEM WORKS FOR FLOWING WELLS
- GEOTEK GHES INTENDED FOR GEOTHERMAL POWER PROD.
- PROPOSE GRAVITY HEAD PUMP (GHP)
  - USED TO PUMP MODERATE TEMPERATURE WELLS
- CONCEPTUAL CHANGES FROM ACC / GHES FOR CO-PROD.
  - NEW EXPANDER DESIGN
- SURFACE POWER GENERATION IS OPTIONAL

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 – SYSTEM DESIGN

- Simulate conditions for each well
  - ACC and GHES have simulators based on a thermal-hydraulic model
  - Modify code for GHP
- Design considerations
  - Factors affecting optimal design
  - Limited well diameter
  - Resource temperature
  - Control heat transfer

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

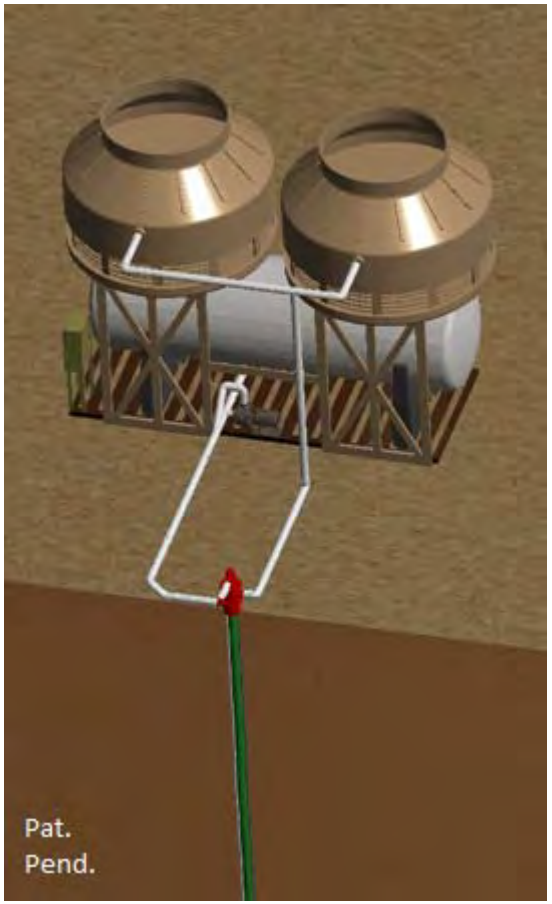
GRAVITY HEAD PUMPS – CONCEPT TO COMMERCIALIZATION

- 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
- GHES in development for several years
  - Major elements designed & production ready
- Sophisticated numerical models for GHES and ACC developed and tested multiple times
- Experienced team prepared to implement GHP

GEOTEK ENERGY, LLC



GRAVITY HEAD PUMP

PUMPING POWER

FOR THE FUTURE