GEOCAP
Geothermal Capacity Building Program Indonesia - Netherlands

GEOTHERMAL RESERVOIR AND PRODUCTION ENGINEERING KNOWLEDGE AND SKILLS

This course was developed within WP 1.04 of the GEOCAP program

Figures captured from CalEnergy's video

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About the course

This 2-week course targets at reservoir and production engineering using lectures, exercises, assignments and background reading material.

Main components of the course are:

- Basics of geothermal systems and reservoir engineering and reservoir geo-mechanics
- Flow measurements and production testing
- Well testing procedures for reservoir characterization
- Numerical geothermal reservoir modelling

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Learning objectives

Objective of the course is to provide the participants with an understanding of the dynamic behavior of geothermal reservoir and with the application skills to assess those reservoirs.

This includes knowledge about reservoir engineering and working skills with tools to evaluate and model the reservoir, like well testing and numerical reservoir modelling.

The course aims at a multidisciplinary approach using concepts from geology, physics, and engineering.

Target group

- Target group of the course are Master Students, PhD students and Industrial professionals.
- Participants should have basic knowledge about reservoir geology, flow mechanics, and mathematical modeling. Examples of sufficient prior educational background include students with a BSc degree in Petroleum Engineering, Geophysics, Mining, Geology, Chemical Engineering, Mechanical Engineering, Physics.

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Training Program

Day- 1

a. Main component of Hydrothermal System

i. Types of hydrothermal system
ii. Rock properties
iii. Conceptual model
iv. Key questions about reservoir
v. Exercise: look at reservoir rocks

b. Fundamentals of Dynamic Reservoir Engineering

i. Reservoir dynamics (mass & heat flow)
ii. Two-phase flow
iii. Exercise

Training Program

Day - 2

a. Reservoir Geomechanics

i. Fundamentals (stress, strain, elasticity, failure, equilibrium eqs)

ii. Coupling with flow

iii. Notes on applications (compaction, HF, subsidence, fault stability, seismicity)

iv. Exercises

b. Identification of reservoir characteristics and key parameters from logging, downhole measurements and well completion

i. Well logging (lithology, porosity, acoustics)

ii. Downhole measurements (PTS, LOT/minifrac)

Training Program

Day - 3

a. Identification of reservoir characteristics and key parameters from logging, downhole measurements and well completion (cont'd)

i. Well completion tests

ii. Exercise

b. Production engineering

i. Fundamentals of production engineering

ii. Wellbore modeling for steam well

iii. Wellbore modelling for two-phase flow

iv. Exercise

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Day - 4

a. Production engineering cont'd

i. Stimulation (lifting; well discharge; acidizing)

ii. Exercise

b. Flow measurements and production tests

i. Steam wells
- Vertical discharge using Lip pressure method
- Measurement of steam using orifice plates

ii. Two-phase wells
- Horizontal discharge using Lip pressure method
- Separator method

i. Exercise

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Training Program

Day 5, 6 and 7 **Well testing**

a. Transient testing

b. Fundamentals
   i. Injection & Falloff test
   ii. Transient temperature
   iii. Pressure Drawdown & Buildup test
   iv. Interference test
   v. Naturally fractured reservoir (Dual-porosity /Dual permeability)
   vi. Testing hydraulically fractured wells
   vii. Tracer test

c. Exercise using Sapphire with academic licenses
   i. Falloff test
   ii. Buildup test
   iii. Interference test
   iv. Temperature test

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Training Program

Day 8, 9, 10 Geothermal Reservoir Modelling

a. Lectures
   i. Principle and methodologies
   ii. Lumped model – distributed parameter model
   iii. Conceptual development model
   iv. Development of computer model
   v. Data preparation for modelling
   vi. Modelling process
   vii. Natural state modelling
   viii. Chemical modelling (show PHREEQC or TOUGHREACT)
   ix. History matching
   x. Performance forecasting

b. Case study with TOUGH2

Course Assessment

For university students, a Certificate with a grade will be provided, based on an assessment of

- Results of exercises 25%
- Result of assignment well testing 25%
- Result of assignment on reservoir modelling 25%
- Examination 25%

For industry participants the assessment will be documented with a Certificate of attendance, or with a certificate with grade, if requested

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