



GEOCAP
Geothermal Capacity Building Program Indonesia - Netherlands

Study Guidelines GEOCAP trainings 2017

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COOPERATING COMPANIES & UNIVERSITIES



GEOCAP

Geothermal Capacity Building Program Indonesia - Netherlands



INAGA



University of Twente,
Faculty ITC



IF technology



University of Indonesia



DNV GL



Gadjah Mada University



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Earth Sciences



Delft University of
Technology, Department
of Geotechnology



Netherlands
Organisation for Applied
Scientific Research

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1 WORKSHOP FOR ENGINEERS

Development and use

This course was developed by UGM and DNV GL team that has the following members:

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The purpose of this course is enable geothermal power plant personnel especially the engineers to perform their design, operation and maintenance activities.

Location

The course will be held in 5 days training from 9 -13 October 2017. Location will be at Yogyakarta, Indonesia.

Abstract

One of the problems during the exploitation stage of geothermal development is how to maintain the output of the resource. It is a natural situation when there is an output decline during the development due to the fluid extraction. However, a significant decline of the output can be observed for many fields around the world. The possible causes of the decline can be from subsurface condition and/or upper-surface facilities. Most of the problems found in the upper-surface facilities is caused by the lack of understanding on the behavior of the field, design, operation and maintenance activities of the power plant. Therefore, the understanding on the above subjects is very important. Based on the above conditions, the main of the course consists of basic knowledge, geothermal equipment plant, Reliability Centered Maintenance (RCM) in geothermal power plant.

Target group

The target groups of course are practitioners, trainers/lecturers. To attend this course, the entry level of the participants should be graduated from under graduated level or have experiences in geothermal related works.

Content and Duration

The five-day course content is designed as follows:

- I. Regulation in geothermal development
 - a. Overview of geothermal regulation
 - b. Overview of electricity regulation
- II. Basic knowledges on Fluid Mechanics
 - a. Basic theory (fluid properties, fluid flow, basic equations, dimensional analysis)
 - b. Single-phase flow in pipes
 - c. Two-phase flow in pipes
 - d. Fluid flow measurements
- III. Basic knowledges on Heat Transfer
 - a. Modes of heat transfer (Conduction)

- b. Modes of heat transfer (Convection)
- c. Flow through tube banks
- d. Heat exchangers
- e. Heat rejection
- IV. Introduction to geothermal power plant system and technology
 - a. Basic thermodynamics, 1st, 2nd law, efficiencies, exergy
 - b. Rankine Cycle
- V. Type of cycles in geothermal
 - a. ORC, Dry system, Flash system, Binary system
 - b. Assignment/Exercise
- VI. Wellbore model and geothermal power plant in Indonesia
 - a. Wellbore-reservoir model
 - b. Geothermal power plant in Indonesia
- VII. Geothermal power plant main components
 - a. Basic concept of fluid production, separation and transmission
 - b. Introduction of power plant component (wellbore and wellhead, separator, turbines)
 - c. Introduction of power plant component (condenser, cooling tower, gas/steam ejector)
- VIII. Standards of geothermal power plant design
 - a. Overview of relevant standards for geothermal power plant design
 - b. Overview of material use prescribed by these standards
- IX. Geothermal power plant safety
 - a. Hazards in geothermal development
 - b. General safety issues and measures during operation
 - c. Risk assessment at geothermal power plant
 - d. Personal Protective Equipment
- X. Basic operation, Maintenance and Reliability in geothermal power plant
 - a. Definition and objective of maintenance and reliability
 - b. Type of maintenance
 - c. Planning and scheduling in maintenance program
 - d. Operation & maintenance of main equipment in geothermal power plant
- XI. Inspection techniques, sampling and reporting
 - a. Failure mode
 - b. General visual guidelines for inspection
 - c. Nondestructive inspection techniques
- XII. Field visit
 - a. Lecture on company profiles, operation, maintenance, problems
 - b. Observing surface facilities wellpad and monitoring system
 - c. Power plant visit

Learning outcomes

After completing the series of this course, the participants are expected:

- To understand the Regulation in geothermal
- To understand the basic knowledges on Fluid Mechanics
- To understand the basic knowledges on Heat Transfer
- To understand the geothermal power plant system and technology and types of cycle in geothermal
- To understand the geothermal power plant main components
- To understand the standards of geothermal power plant design
- To understand the geothermal power plant safety
- To understand the basic operation, Maintenance and Reliability in geothermal power plant
- To understand the inspection techniques, sampling and reporting

Study load

Study load is defined as the amount of time needed by the student or participant to study the course. This includes all activities: self-study, following lectures, conducting assignments, practical, field work, etc. Please fill in the following table:

Activity	Number of hours
Self-study of the materials and the assignments	-
Lectures	43
Supervised practical	-
Project based learning	-
Preparation for assessment	-
Field work/trip	5
Total	48

Teaching and learning methods

Learning and teaching methods are:

- Lecture
- Individual assignment

All these activities are conducted in a face to face setting in the class room and/or the field.

Assessment

The assessment formats are taken as:

- Assignment
- Presentation

Study materials

The study materials used in the course are:

- Articles
- Hand-outs

Teaching materials

The teaching materials available for teaching this course.

- Power point

Course structure

The study load is spread in time as shown in the following timetable.

Main Topic	Sub Topic	Day-				
		1	2	3	4	5
Introduction	Program of the course					
	Trainers and participants					
	Regulation in geothermal development					
Basic knowledges on Fluid Mechanics	Basic theory (fluid properties, fluid flow, basic equations, dimensional analysis)					
	Single-phase flow in pipes					
	Two-phase flow in pipes					
	Fluid flow measurements					
Wellbore model and geothermal power plant in	Wellbore-reservoir model					
	Geothermal power plant in Indonesia					

Main Topic	Sub Topic	Day-				
		1	2	3	4	5
Indonesia						
Basic knowledges on Heat Transfer	Modes of heat transfer (Conduction)					
	Modes of heat transfer (Convection)					
	Flow through tube banks					
	Heat exchangers					
	Heat rejection					
Introduction to geothermal power plant system and technology	Basic thermodynamics, 1st, 2 nd law, efficiencies, exergy					
	Rankine Cycle					
Type of cycles in geothermal	ORC, Dry system, Flash system, binary system					
	Assignment					
Geothermal power plant main components	Basic concept of fluid production, separation and transmission					
	Introduction of power plant component (wellbore and wellhead, separator, turbines)					
	Introduction of power plant component (condenser, cooling tower, gas/steam ejector)					
Standards of geothermal power plant design	Overview of relevant standards for geothermal power plant design					
	Overview of material use prescribed by these standards					
Geothermal power plant safety	Hazards in geothermal development					
	General safety issues and measures during operation					
	Risk assessment at geothermal power plant					
	Personal Protective Equipment					
Field Trip	Visit Thermal Manifestations					
	Operation and company profiles					
	Observing surface facilities Wellpad and monitoring system					
	Power plant visit					
Basic operation, Maintenance and Reliability in Geothermal Power Plant	Definition and objective of maintenance and reliability					
	Type of maintenance					
	Planning and scheduling in maintenance program					
	Operation & Maintenance of main equipment in geothermal power plant					
Inspection techniques, sampling and reporting	Failure mode					
	General visual guidelines for inspection					
	Nondestructive inspection techniques					