



**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



Technical University  
Bandung



Utrecht University, Faculty of  
Geosciences, Department of  
Earth Sciences



Delft University of  
Technology, Department  
of Geotechnology



Netherlands  
Organisation for Applied  
Scientific Research

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# 1 WORKSHOP FOR OPERATORS

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## Development and use

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

1. Nasruddin – UI
2. Tom Geurink – DNV GL
3. Kees van den Ende – DNV GL
4. Bart in 't Groen – DNV GL

The purpose of this course is enable geothermal power plant personnel especially the operators to perform their operation activities.

## Location

The course will preferably be held in the days before the IIGCE conference on 2<sup>nd</sup>, 3<sup>th</sup> and 4<sup>th</sup> of August. Location will be at conference site or in a hotel nearby.

## Abstract

Operation of geothermal power plants requires insight in the engineering and construction of the power plant and its main components, because the operator must be aware of the equipment he is working with. The main purpose of the operator during the operation stage of geothermal deployment is to maintain the output of the resource. It is a natural situation when there is an output decline during the deployment 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 behaviour of the field, operation and maintenance activities of the power plant. Furthermore, the operator is responsible for the safety on the site when the plant is running. 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, safety and inspection techniques applied for geothermal power plants.

## 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 three-day course content is designed as follows:

- I. Introduction
  - a. Introduction to the program of the course
  - b. Introduction of trainers and participants
- II. Overview Power Plant Design
  - a. List of Geothermal Power Plant in Indonesia
  - b. Methodology of power plant development
  - c. Dry steam cycle
  - d. Flash steam cycle (double and single)
  - e. Binary cycle: Organic Rankine Cycle (ORC)
- III. Introduction of Power Plant
  - a. Main component: Steam turbine

- b. Main component: Condenser
  - c. Main component: Steam Ejector
  - d. Main component: Cooling Tower
  - e. Other components
- IV. Standard of geothermal power plant design – 2 hours
  - a. Overview of relevant standards for geothermal power plant design
  - b. Overview of material use, prescribed by these standards
  - c. Overview of other requirements for inspections and maintenance in geothermal power plants Tools in power plant operations
- V. Geothermal power plant safety
  - a. General safety issues and measures during operation
  - b. PPE
- VI. Basic of operation, maintenance and reliability in geothermal power plant
  - a. Definition and objective of maintenance and reliability program
  - b. Type of maintenance
  - c. Planning and scheduling in maintenance program
  - d. Maintenance of main equipment in geothermal power plant
  - e. Performance measurement and management
  - f. PLN Standard of O&M Power Plant in Indonesia
- VII. Inspection techniques, Sampling and reporting
  - a. Failure mode (general introduction)
  - b. General visual guidelines for inspection:
  - c. Operation and failure reporting

### Learning outcomes

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

- To understand the implementation of the overview of a geothermal power plant design
- To understand safety issues and measures in a geothermal power plant
- To understand the equipment used for inspections in geothermal power plants
- To understand the concept and principles of identifying high risk components
- To understand the concept of proactive maintenance

### 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	23
Supervised practical	1
Project based learning	-
Preparation for assessment	-
Field work/trip	-
<b>Total</b>	<b>24</b>

### 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
Introduction	Program of the course			
	Trainers and participants			
Overview Power Plant Design	Geothermal Power Plant in Indonesia			
	Methodology of power plant development			
	Dry Steam Cycle			
	Flash Steam Cycle (Double and Single)			
	Binary Cycle: Organic Rankine Cycle (ORC)			
Introduction of Power Plant	Steam Turbine			
	Condenser			
	Steam Ejector			
	Cooling Tower			
	Other components			
Standard of Geothermal Power Plant Design	Overview of Relevant Standards for Geothermal Power Plant Design			
	Overview of Material Use, Prescribed by These Standards			
	Overview of other requirements for inspections and maintenance in geothermal power plants			
Geothermal power plant safety	General safety issues and measures during operation			
	PPE			
Basic of operation, maintenance and reliability in geothermal power plant	Definition and objective of maintenance and reliability			
	Type of maintenance			
	Planning and Scheduling in Maintenance Program			
	Maintenance of Main Equipment in Geothermal Power Plant			
	Performance Measurement and Management			
	PLN Standard of O&M Power Plant in Indonesia			
Inspection techniques, Sampling and Reporting	Failure Mode (General Introduction)			
	General Visual Guidelines for Inspection			
	Operation and failure reporting			