SELAMAT DATANG REKAN MEDIA

PESERTA PELATIHAN

GEOTHERMAL ENERGY

Moch. Abadi

Jakarta, 25 September 2021

INTRODUCTION

Nama	**: ----------**
Media	**: ----------**
Pengalaman	**: ----------**

THE PRESENTER

BACKGROUND AND EXPERIENCES

MOCH. ABADI is a mechanical engineer, graduated from TRISAKTI UNIVERSITY

He experienced in Oil & Gas Industry for more then 30 years, both onshore & offshore operations, Refinery & Production **(STANVAC , PERTAMINA and ARCO)**

He also experienced in Persian Gulf, Tehran Iran, Lavan - Island, Bakersfield, Coles Levee, Santa Barbara, Los Angeles, Tulsa, Oklahoma, Texas USA

CERTIFIED TRAINER FROM:
USA : National Safety Council – Mary Land - USA
H.R. Presenter – AMA Chicago - USA
INDONESIA : BNSP, NAKERTRANS

CERTIFIED ASSESSOR IN OIL & GAS

FROM: INDONESIA - BNSP

CURRENT STATUS:

As President Director of PT. Rekayasa Technology Global, as Head of JSK – Petroleum Academy – Jakarta and As Director of Training & Certification of Indonesia Petroleum Community

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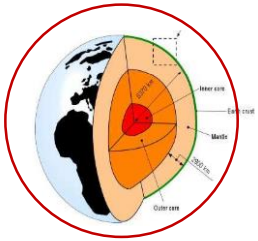
AGENDA

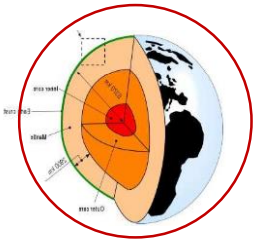
GEOTHERMAL ENERGY

NO	CONTENTS OF DISCUSSION (Interactive)	HOURS
I	**MORNING SESSION** **1. Background Why Geothermal Energy** **2. Introduction to Geothermal Energy** a) Historical of Geothermal Energy b) Type of Geothermal Energy c) Location of Geothermal Sources **3. Indonesia & World Geothermal Energy**	**09.30 – 11.50**
II	**QUIST SESSION** • Quist concerning Geothermal Energy • Announcement of the winner	**11.50 – 12.00**



BACKGROUND

Why Geothermal Energy



Indonesia has huge geothermal potential about 40% of the world's resources and its source is almost unlimited amount of heat generated by the earth's core.

Indonesia has set a zero – emission target by 2060

And to stop the construction of coal steam power plants by 2025

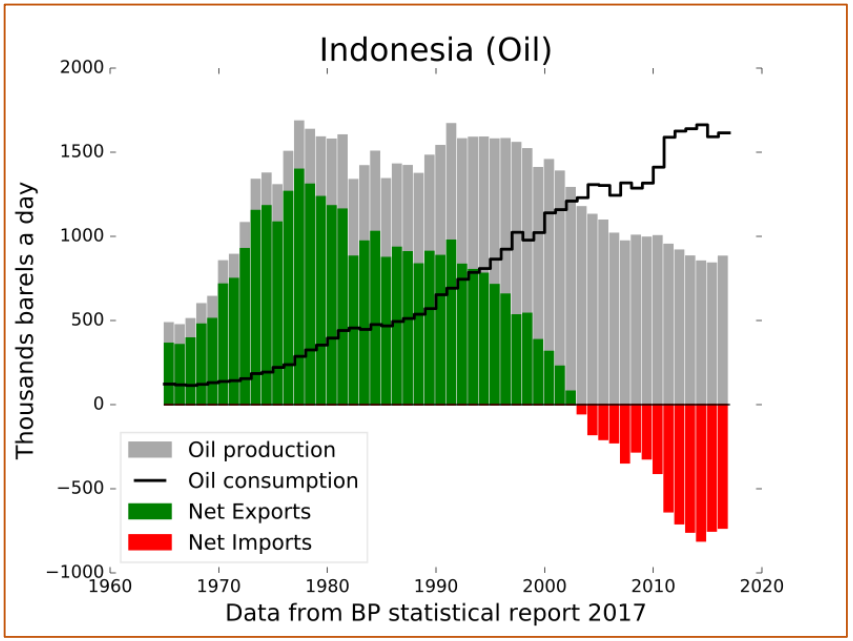
Geothermal energy is environmental – friendly compare to fuels generated from fossil

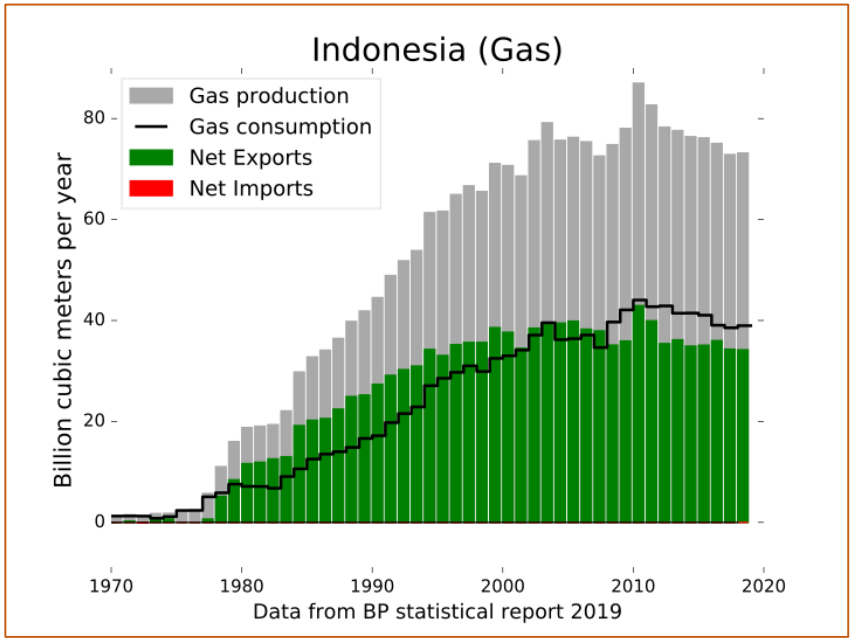
FORCASTING FUTURE
Oil & Gas Production

AS WE ALL KNOW THAT FOSSIL ENERGY IS CLASSIFIED AS

NON RENEWABLE ENERGY

Where estimating reserves getting less and less due to exploration & exploitation, while the requirement of energy is continue increasing

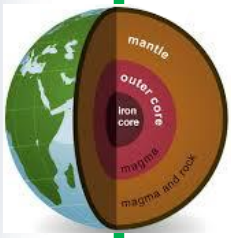




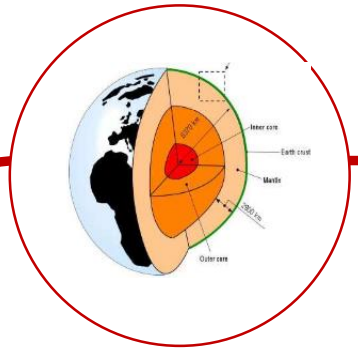
INTRODUCTION

Geo Thermal Energy

GEOTHERMAL BASICS



With increasing concerns of global warming, green energy sources are becoming more important.

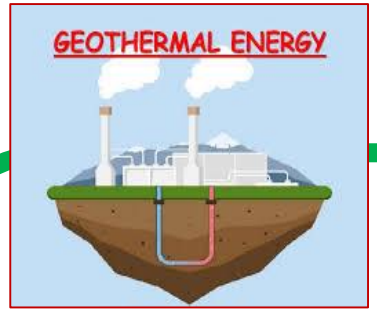


GEOTHERMAL BASICS

Geothermal energy is energy stored below earth's surface.

Geothermal Energy is heat energy from deep inside the earth.

Heat is brought near the surface by thermal conduction, by **intrusion** into **earth's crust** of **molten magma** originating from the **mantle** and by circulation of ground water to great depth.



Geothermal Basics

Hydrothermal Energy, **Geo Pressured Energy** and **Magma Energy** all result from concentration of the earth's heat in discrete regions of the subsurface by geological processes.

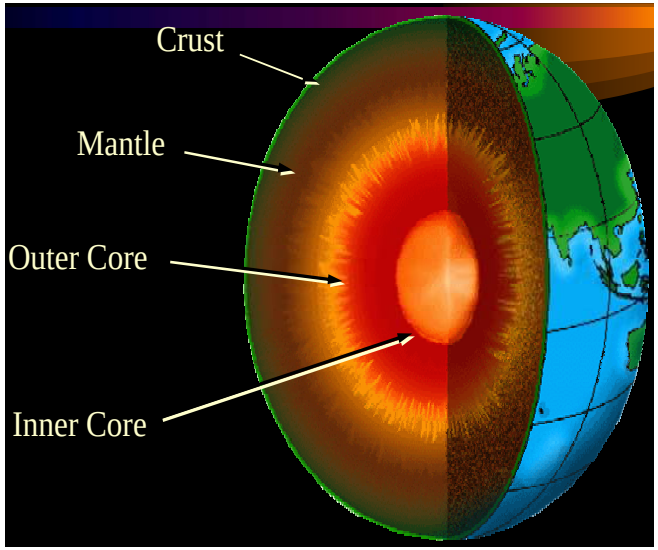
Hot Dry Rock Energy occurs at depth of 6 – 8 km everywhere beneath the surface as a results of worldwide increase of temperature with depth in the earth..

While other renewable energy sources depend on **the sun,** geothermal energy originates **in the earth's interior.**

GEOTHERMAL ENERGY

(Energi Panas Bumi)

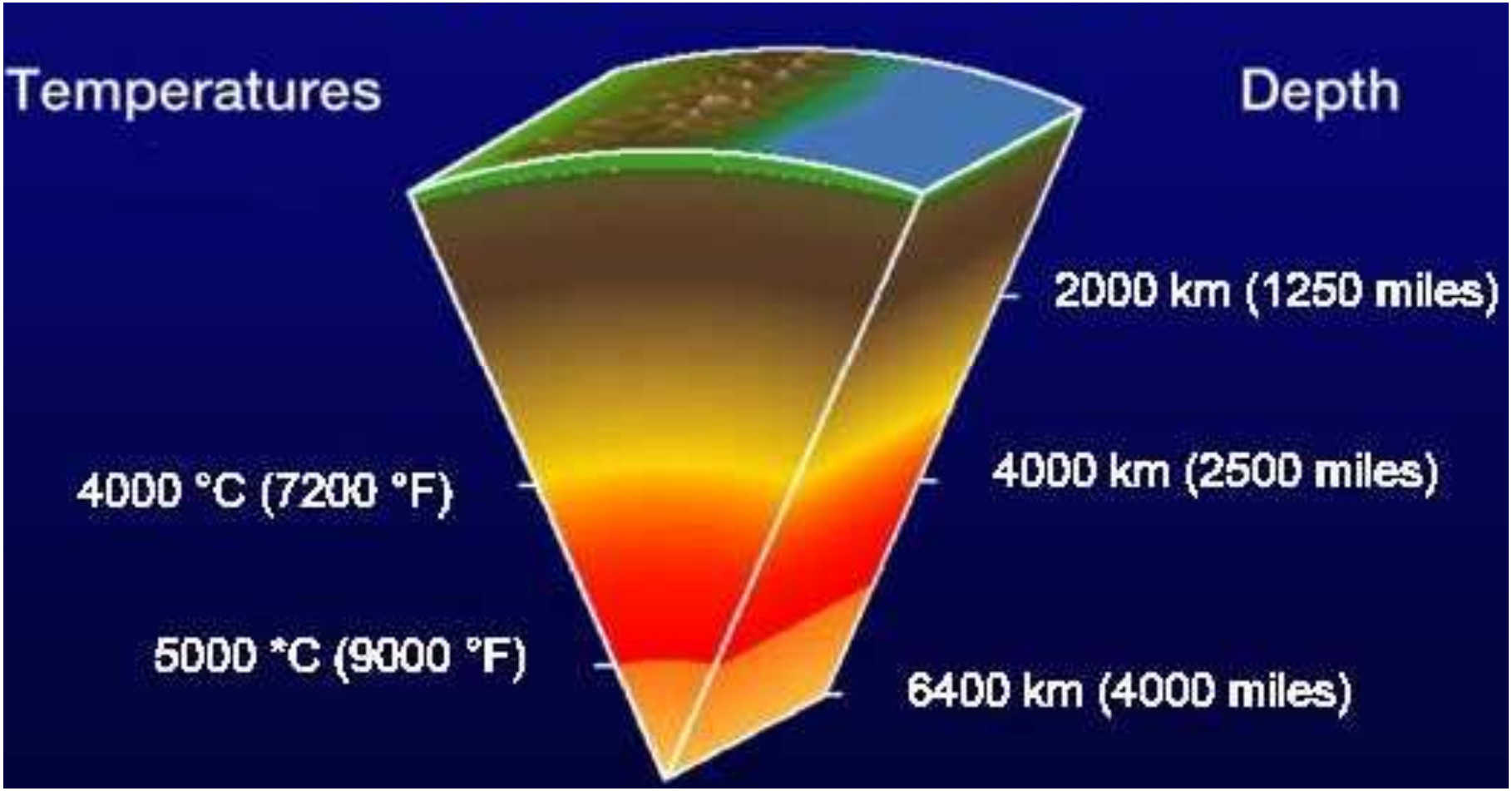
GEO	→	EARTH	→	BUMI
THERMAL	→	HEAT	→	PANAS



Geothermal energy is the thermal energy in the Earth's crust which originates from the formation of the planet

The high temperature and pressure in Earth's interior cause some rock to melt and solid to behave plastically, resulting in parts of the mantle convecting upward since it is lighter than the surrounding rock and temperatures at the core - mantle boundary can reach over 4000 °C (7200 °F)

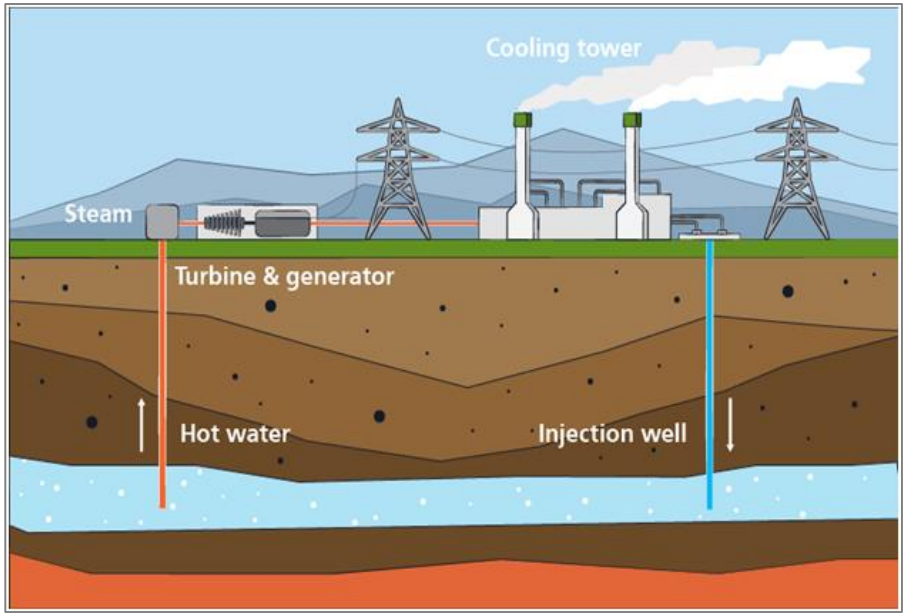
TEMPERATURE IN THE EARTH



GEOTHERMAL ENERGY

GEO → EARTH → BUMI

THERMAL → HEAT → PANAS

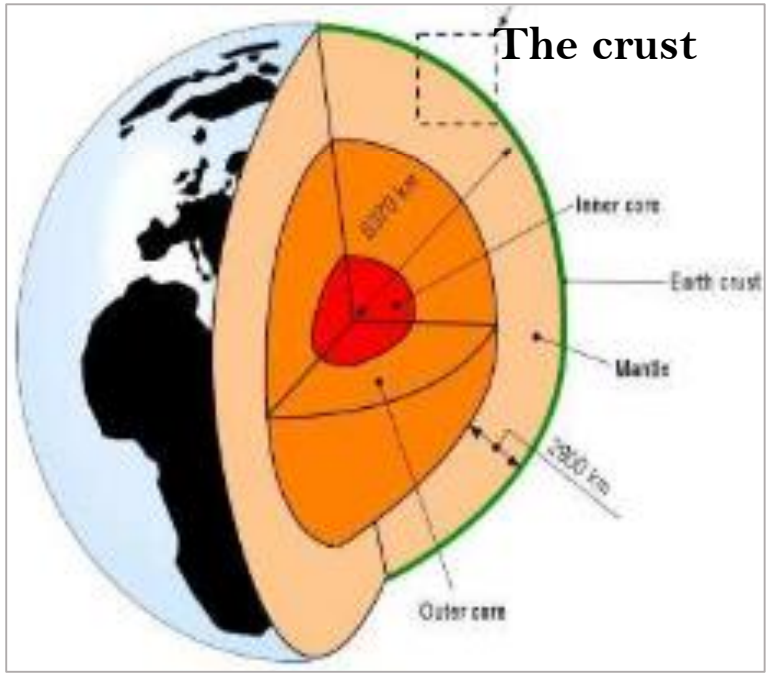


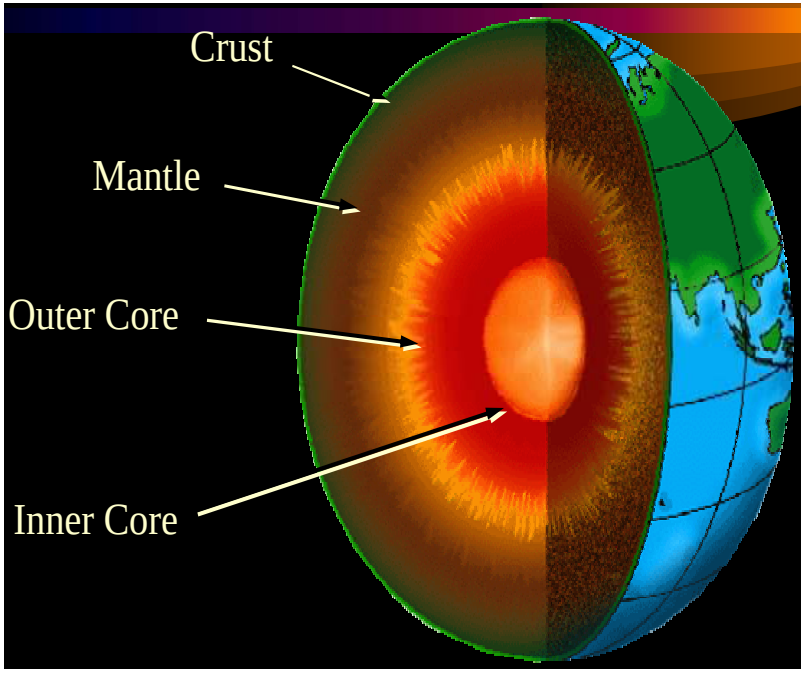
GEOTHERMAL ENERGY

- Earth heat can be found anywhere in the world.
- But the high-temperature energy that is needed to drive electric generation stations is found in relatively few places.

- Geothermal energy is heat energy from deep inside the earth.
- Heat is brought near the surface by **thermal conduction.**
- By intrusion into earth crust of molten magma originating from the mantle and by circulation of ground water to great depth.

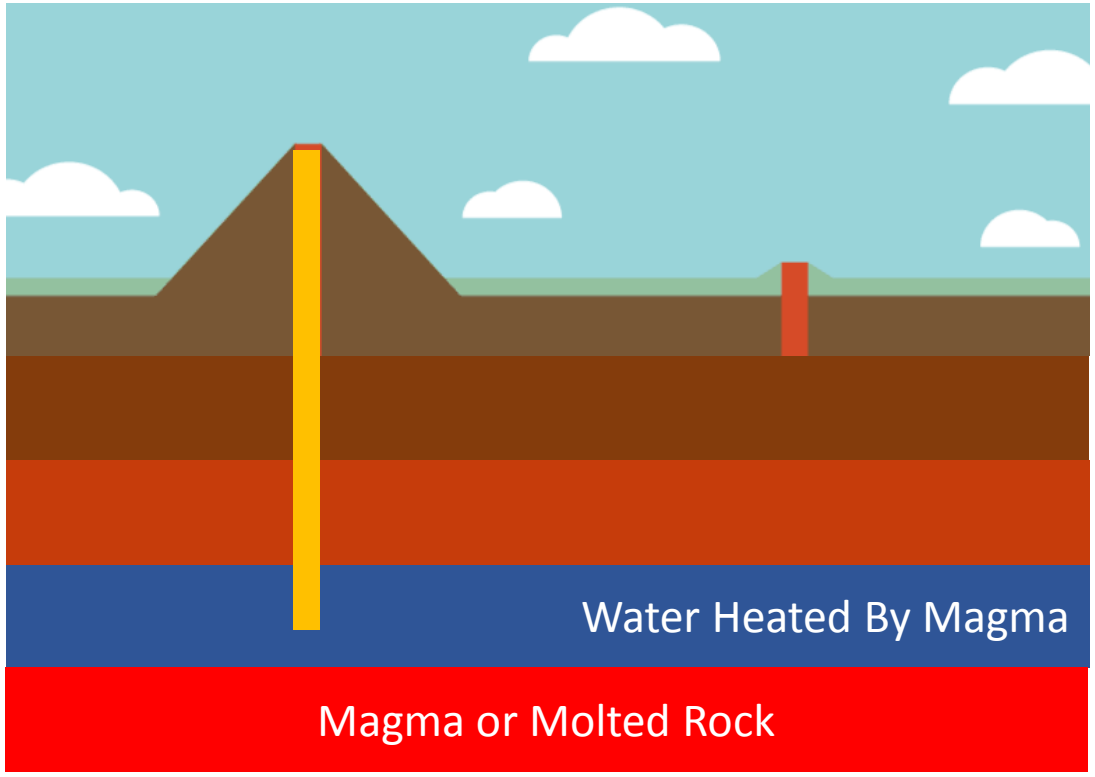
The crust has a thickness of ∽ **20-65 km** in continental areas and ∽ **5-6 km** in oceanic areas, the mantle is roughly **2900 km thick,** and the core, ∽ 3470 km in radius.

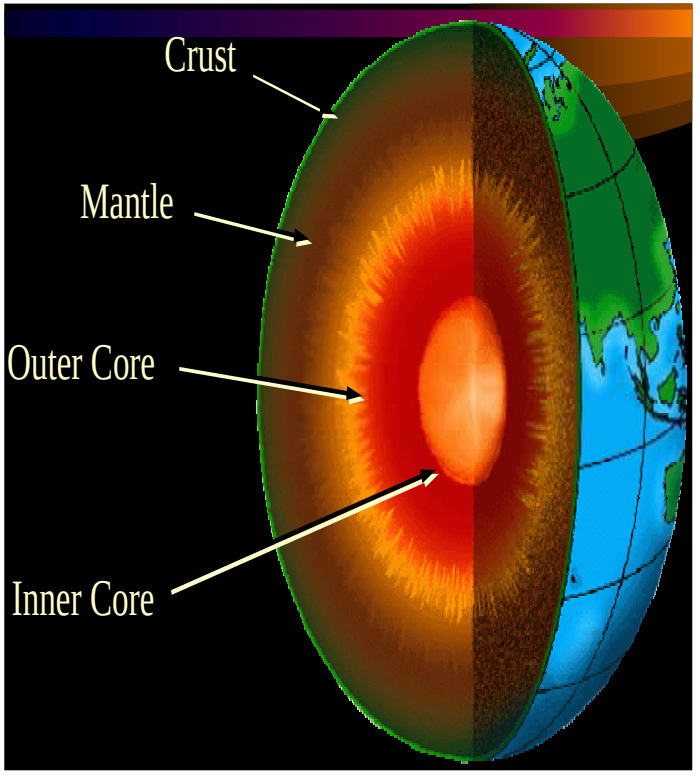




GEOTHERMAL RESERVOIR ARE POOLS OF WATER HEATED BY MAGMA DEEP BELOW THE SURFACE.

Water or steam can escape from cracks in he earth in the form of geysers (sometime as magma from volcano). The ability to harness the steam is what powers a geothermal power plant.

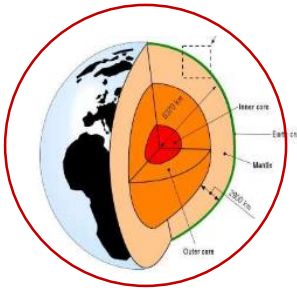




GEOTHERMAL POWER DOES NOT REQUIRE THE BURNING OF ANY FOSSIL FUELS.

The hot water or steam used is returned to the ground after it is used where it can be used again, which makes it

A RENEWABLE ENERGY SOURCE AS WELL.



INDONESIA - RING OF FIRE

Indonesia has a huge of geothermal potential in the world since the location of the country is in the ring of fire in volcano line.

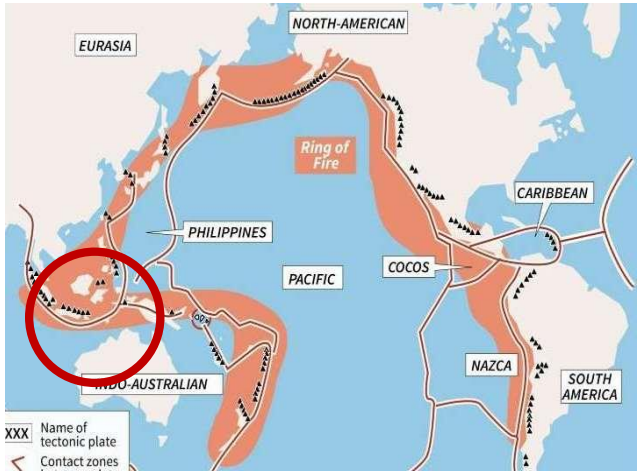
Approximately 28.91 GW geothermal energy potential is **spread across 312 locations** on several islands such as Java, Sulawesi, Sumatera, Bali, Nusa Tenggara and Sulawesi,.

Beside geothermal energy create clean power and Environmental Friendly compare to conventional fuel sources such as coal and other fossil fuel, the geothermal energy is also renewable and sustainable energy.

POTENTIAL OF RENEWABLE ENERGY

As a source of renewable energy for both power and heating, geothermal has the **potential to meet 3-5% of global demand by 2050.**

With economic incentives, it is estimated that by 2100 it will be possible **to meet 10% of global demand**



RING OF FIRE

Geothermal electric plants were traditionally built exclusively on the edges of tectonic plates where high-temperature geothermal resources are available near the surface.


PACIFIC RING OF FIRE

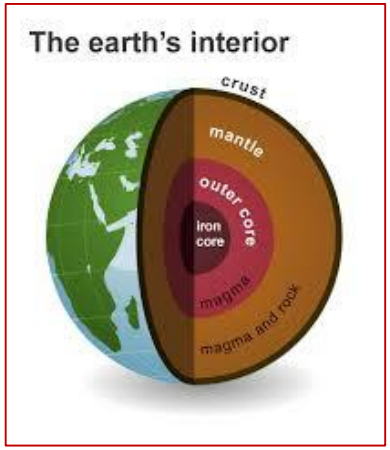


PLATE TECTONICS THEORY

The crust has a thickness of ∽ 20-65 km in continental areas and ∽ 5-6 km in oceanic areas, the mantle is roughly 2900 km thick, and the core, ∽ 3470 km in radius.

Their physical and chemical characteristics vary from the surface of the Earth to its center.

The outermost shell of the Earth - lithosphere, is made up of the crust and the upper layer of the mantle; with thickness from < 80 km in oceanic zones to > 200 km in continental areas, and behaves as a rigid body.

Below the lithosphere is the asthenosphere, 200-300 km in thickness, with 'more plastic' behavior.

RENEWABILITY & SUSTAINABILITY

Terbarukan & Berkelanjutan

Renewability and Sustainability

Geothermal power is considered to be renewable because any projected heat extraction is small compared to the Earth's heat content.
The Earth has an internal heat content of approximately 100 billion times the 2010 worldwide annual energy consumption.

CAN GEOTHERMAL ENERGY RUN OUT

Geothermal energy is a renewable energy and will never depleted.
Abundant geothermal energy will be available for as long as the earth exists

TYPES OF GEOTHERMAL RESOURCES

1. HOT ROCK ENERGY

2. MAGMA ENERGY

1. HOT DRY ROCK, HDR

There are many geothermal prospects that have **high temperature** but are **lacking fluid in the formation** or the **permeability is too low** to support commercial development.

These systems can be **"enhanced"** by engineering the reservoirs through hydraulic fracturing.

TYPES OF GEOTHERMAL RESOURCES

1. HOT ROCK ENERGY

2. MAGMA ENERGY

2. MAGMA ENERGY

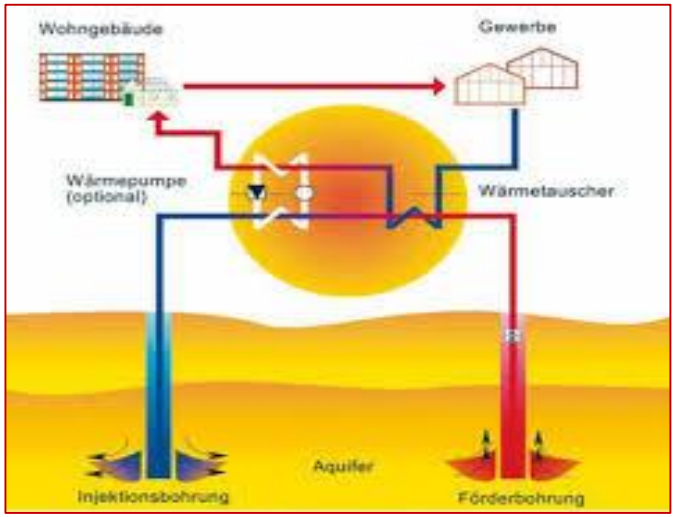
The next geothermal resource is the one that goes directly to the source of the heat, namely, a magma body relatively close to the surface of the Earth.

- The concept is to drill a well into the magma, insert an injection pipe, and pump cold water down the well under great pressure.

- The cold fluid will solidify the molten magma into a glassy substance that should crack under the thermal stress imposed on it.

If the water can be made to return to the surface by passing upward through the cracked, extremely hot glassy material, it would reach the surface hot and ready for use in a Rankine-type power plant.

GEOTHERMAL RESOURCES

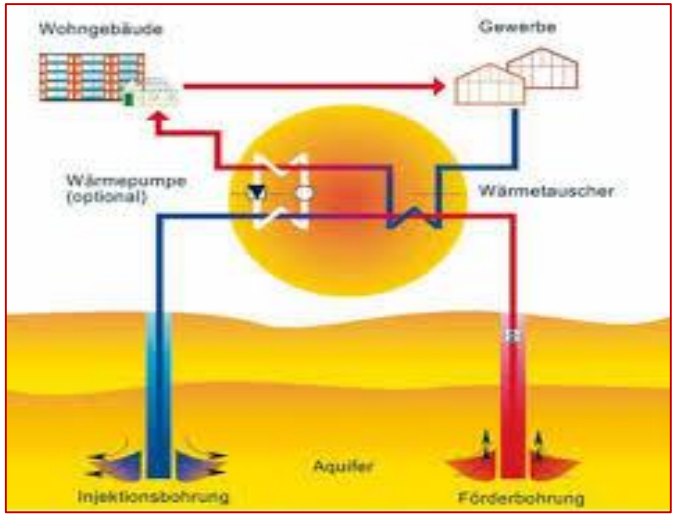


Geothermal energy, in the broadest sense, is the natural heat of the Earth. Immense amounts of thermal energy are generated and stored in the Earth's core, mantle and crust.

At the base of the continental crust, temperatures are believed to range from **200 to 1,000°C,** and at the center of the earth the temperatures may be in the range of **3,500 to 4,500°C.**

The heat is transferred from the interior towards the surface mostly by conduction, and this conductive heat flow makes temperature rise with increasing depth in the crust on average **25-30°C/km.**

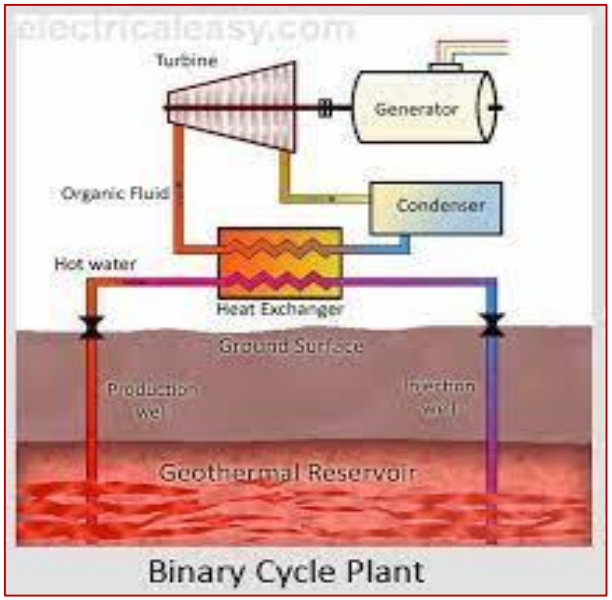
GEOTHERMAL RESOURCES



Geothermal production wells are commonly more than 2 km deep, but rarely much more than 3 km at present.
With an average thermal gradient of 25-30°C/km,

In some area such as a 1 km well in dry rock formations would have a bottom temperature near 40°C in many parts of the world (assuming a mean annual air temperature of 15°C) and a 3 km well 90-100°C.

How Geothermal Energy Works

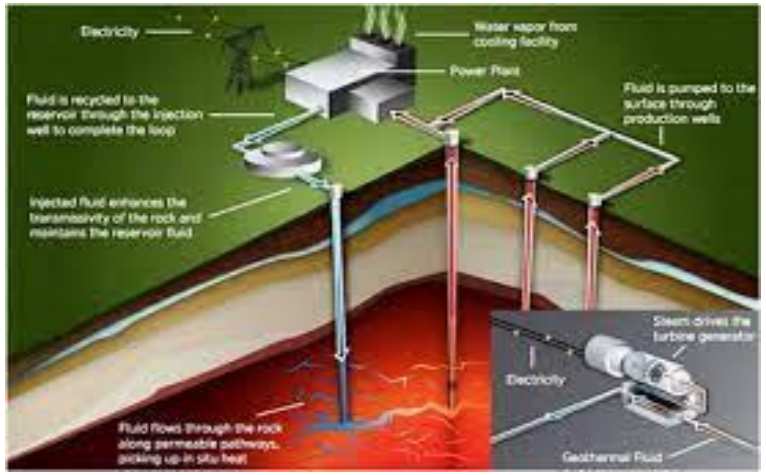


There is a natural source of power found below the surface of the earth that has been around for centuries.

Underground, far below us, there are pools of water heated by magma (or molten rocks).

These pools of water make up our geothermal reservoirs. Harnessing the power of the earth's temperatures to power, heat or cool our homes and businesses is the essence of geothermal power.

THERE ARE TWO DIFFERENT KINDS OF GEOTHERMAL ENERGY:



1. **SHALLOW GEOTHERMAL** energy that exploits only sub-surface resources in order to heat/cool individual or collective buildings (with a heat pump)
2. **DEEP GEOTHERMAL** energy that exploits deeper resources in specific contexts to produce electricity and/or heat for cities or industrial applications

TECHNOLOGY DESCRIPTION

There are three main types of Geothermal Energy Plants that generate power in slightly different ways.

1. Dry Steam Power Plant

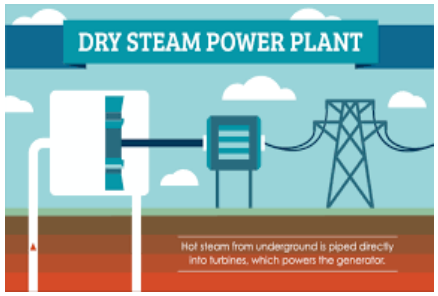
(Dry Superheated Steam)

2. Flash Steam Power Plant

a. Single Flash Cycle Power Plant

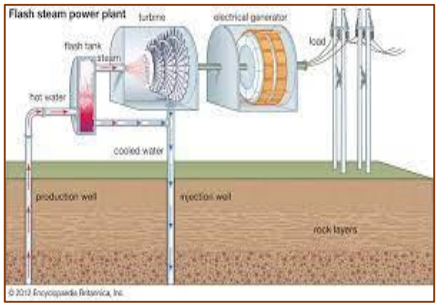
b. Multi Flash Cycles Power Plant

3. Binary Cycle Power Plant



1. DRY STEAM POWER PLANT

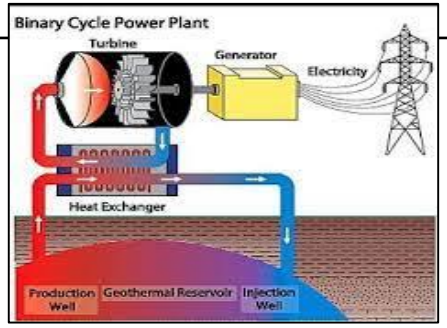
(Dry Superheated Steam)



2. FLASH STEAM POWER PLANT

a. Single Flash Cycle Power Plant

b. Multi Flash Cycles Power Plant



3. BINARY CYCLE POWER PLANT

GENERAL

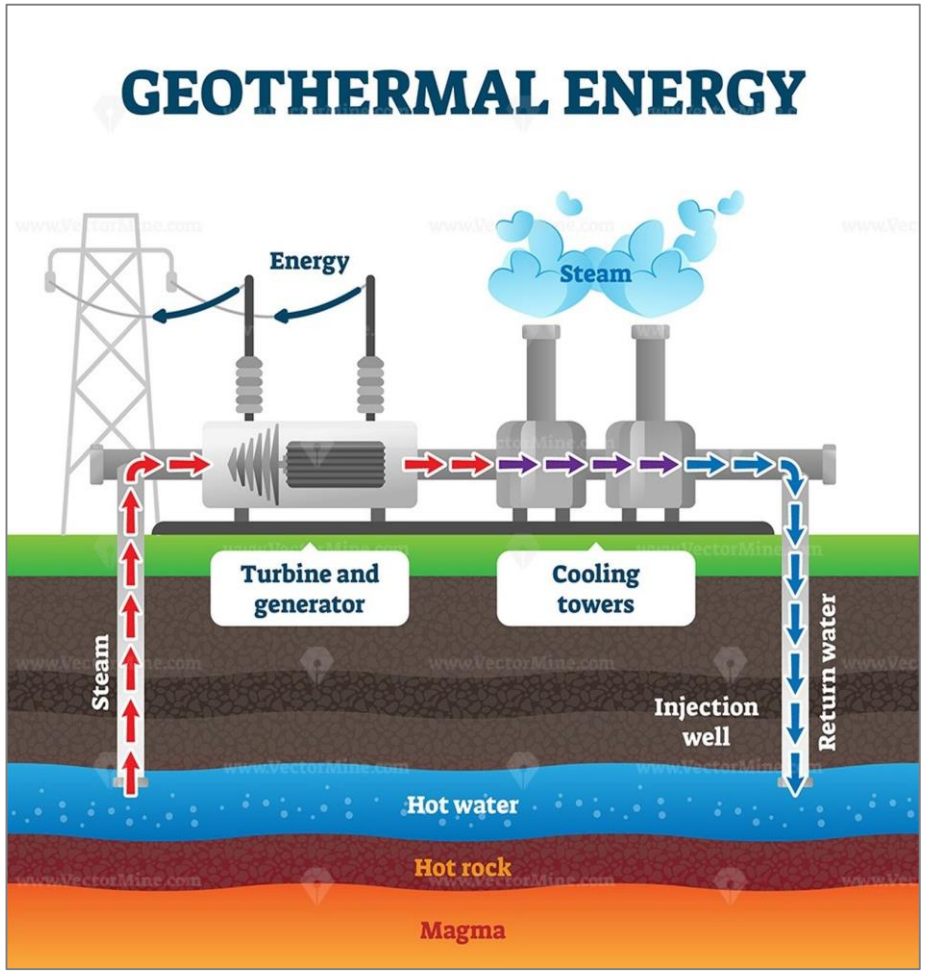
- In dry steam reservoirs, the dry steam is obtained by digging wells that are 7000–10,000 feet deep, after which the steam is transported through pipe from the well to the turbine generator in order to generate electricity.

- Dry steam plants are the most common types of geothermal power plants, accounting for about half of the installed geothermal plants.

- They work by piping hot steam from underground reservoirs directly into turbines from geothermal reservoirs, which power the generators to provide electricity.

- After powering the turbines, the steam condenses into water and is piped back into the earth via the injection well.

TECHNOLOGY DESCRIPTION



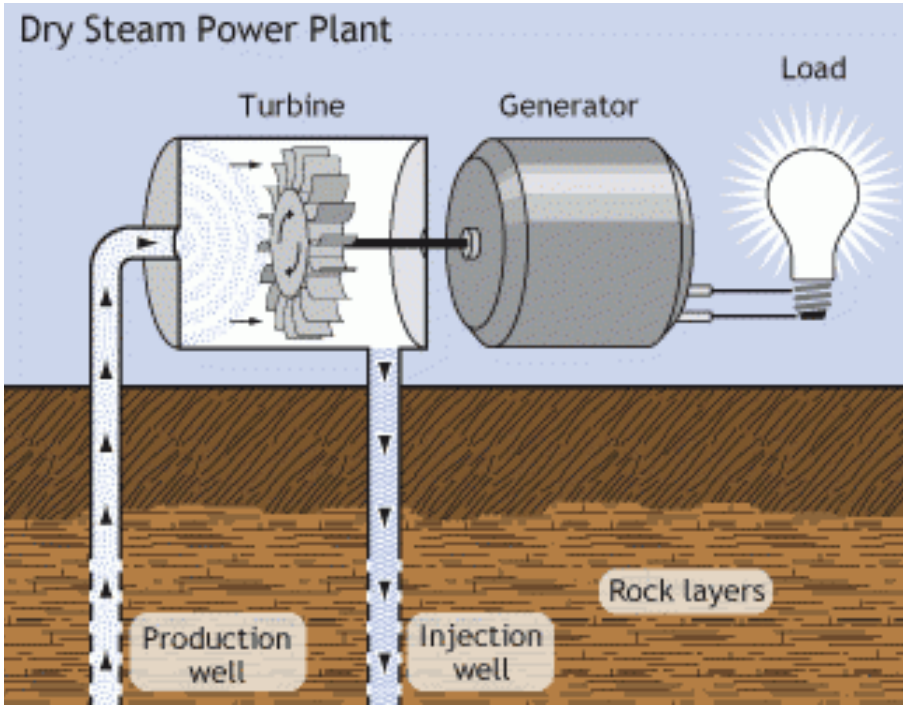
SUPERHEATED STEAM POWER

Superheated Steam is dry steam resources are rare but are simplest and least costly to develop.

Naturally occurring steam can be used in a standard steam turbine to generate electricity.

The steam can produced from geothermal wells is fed directly to **the steam turbine** using insulated pipelines

TECHNOLOGY DESCRIPTION



Dry steam plants use hydrothermal fluids that are primarily steam.

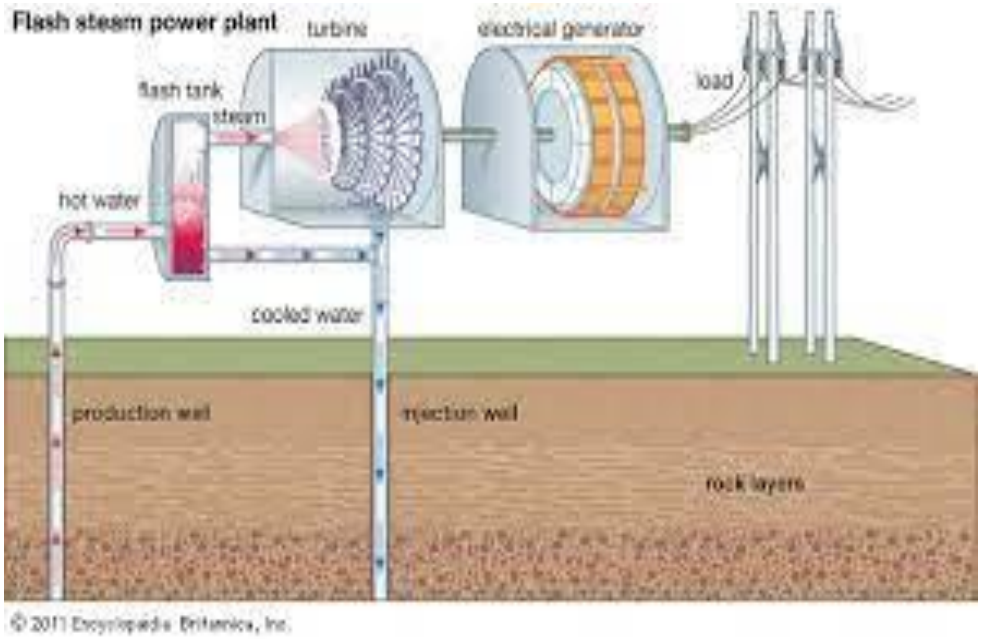
The steam travels directly to a turbine, which drives a generator that produces electricity.

Dry steam power plants systems were the first type of geothermal power generation plants built (they were first used at Lardarello in Italy in 1904).

Steam technology is still effective today at currently in use at The Geysers in northern California, the world's largest single source of geothermal power.

TECHNOLOGY DESCRIPTION

FLASH STEAM PLANTS ARE THE MOST COMMON TYPE OF GEOTHERMAL POWER GENERATION PLANTS IN OPERATION TODAY.



FLASH STEAM PLANTS

Fluid at temperatures greater than 360°F (182°C) is pumped under high pressure into a tank at the surface held at a much lower pressure, causing some of the fluid to rapidly vaporize, or "flash."

The vapor then drives a turbine, which drives a generator.

If any liquid remains in the tank, it can be flashed again in a second tank to extract even more energy.

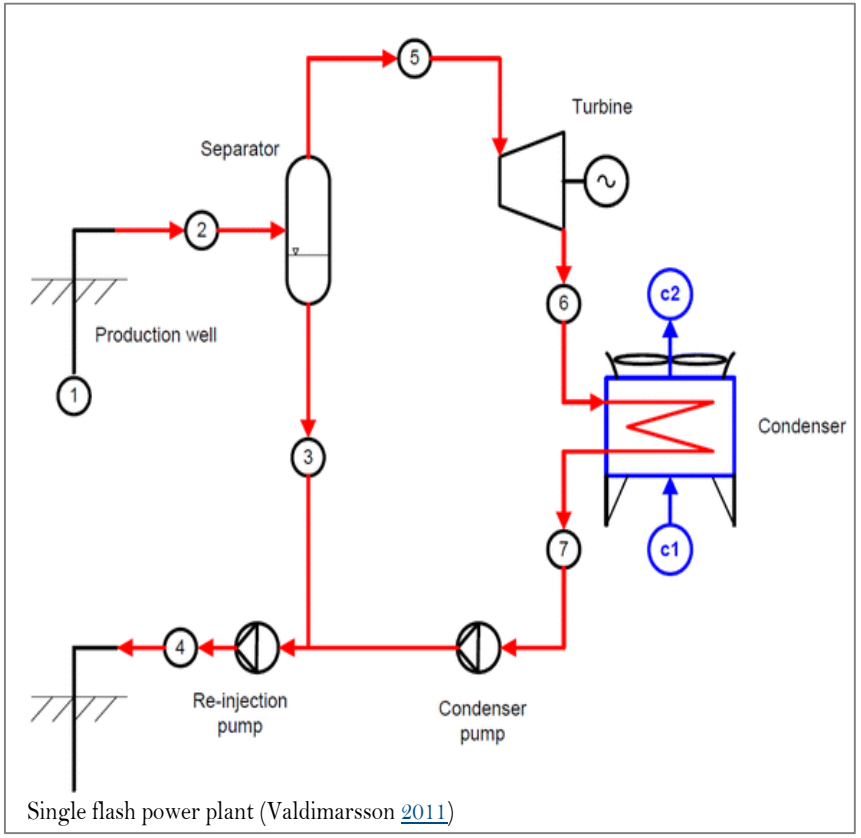
TECHNOLOGY DESCRIPTION

In a single flash steam power plant, the geothermal fluid is in liquid state which is expanded through an expansion valve resulting in two-phase flow.

This mixture of liquid and vapor is directed to a separator kept at a constant temperature and pressure, so that the liquid and the vapor are separated from each other.

The produced vapor is directed to the steam turbine to generate electricity while the remaining liquid is re-injected to a re-injection well.

a) SINGLE FLASH CYCLE



Single flash power plant (Valdimarsson 2011)

a) SINGLE FLASH CYCLE

If the geothermal fluid is in a compressed liquid state, it partially flashes into steam in the well – bore as it rises to the surface.

Additional steam is separated in the flash tanks and fed to the "Steam Turbine".

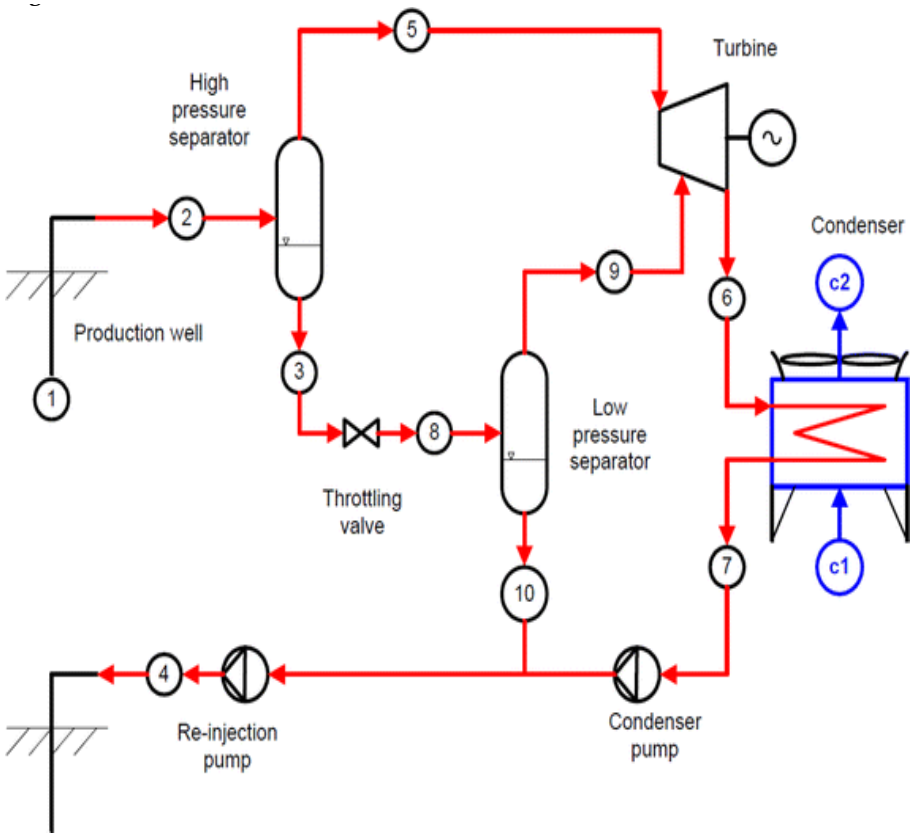
The remaining liquid is then disposed off on the surface or rem- injected back into the reservoir.

TECHNOLOGY DESCRIPTION

The double flash steam power plant has the same working principles as the single flash power plant except that in the former, two separators are used which result in both high- and low-pressure steam flows that run the steam turbine.

Double flash geothermal power plants produce a higher power output than single flash geothermal power plants but at a higher cost.

TECHNOLOGY DESCRIPTION



Dual flash power plant (Valdimarsson 2011)

b) DOUBLE FLASH CYCLE

If resources temperature are sufficiently high the fluid can be flashed the remaining liquid twice or more.

Flashing occurs in the well and in the separators on the surface.

This separated high – pressure steam is fed to the high – pressure stages of turbine.

The liquid fraction from the first stage - separator is flashed again in the second - stage separator.

The additional steam is fed to the low - pressure stages of turbine.
Where the additional second flash stage increases the plant efficiency by about 20% compared to a single flash system

TECHNOLOGY DESCRIPTION

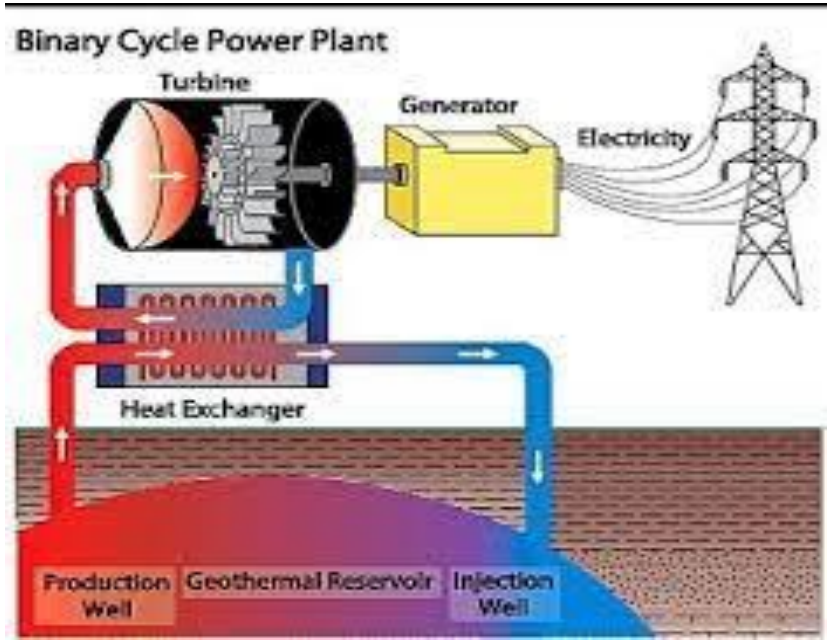
Binary cycle geothermal power generation plants differ from Dry Steam and Flash

Steam systems in that the water or steam from the geothermal reservoir never comes in contact with the turbine/generator units.

Low to moderately heated (below 400°F) geothermal fluid and a secondary (hence, "binary") fluid with a much lower boiling point that water pass through a heat exchanger.

Heat from the geothermal fluid causes the secondary fluid to flash to vapor, which then drives the turbines and subsequently, the generators.

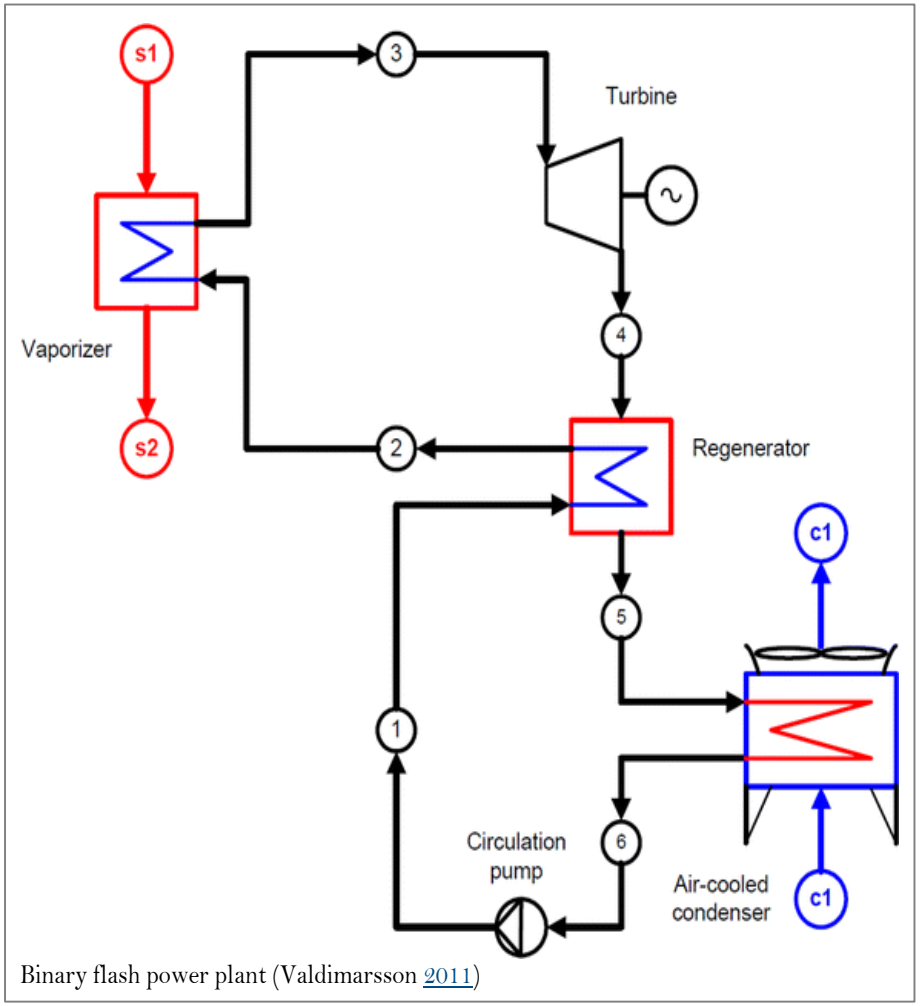
BINARY CYCLE POWER PLANTS



Binary cycle power plants are closed-loop systems, and virtually nothing (except water vapor) is emitted to the atmosphere.

Because resources below 300°F represent the most common geothermal resource, a significant proportion of geothermal electricity in the future could come from binary-cycle plants.

TECHNOLOGY DESCRIPTION



Binary flash power plant (Valdimarsson 2011)

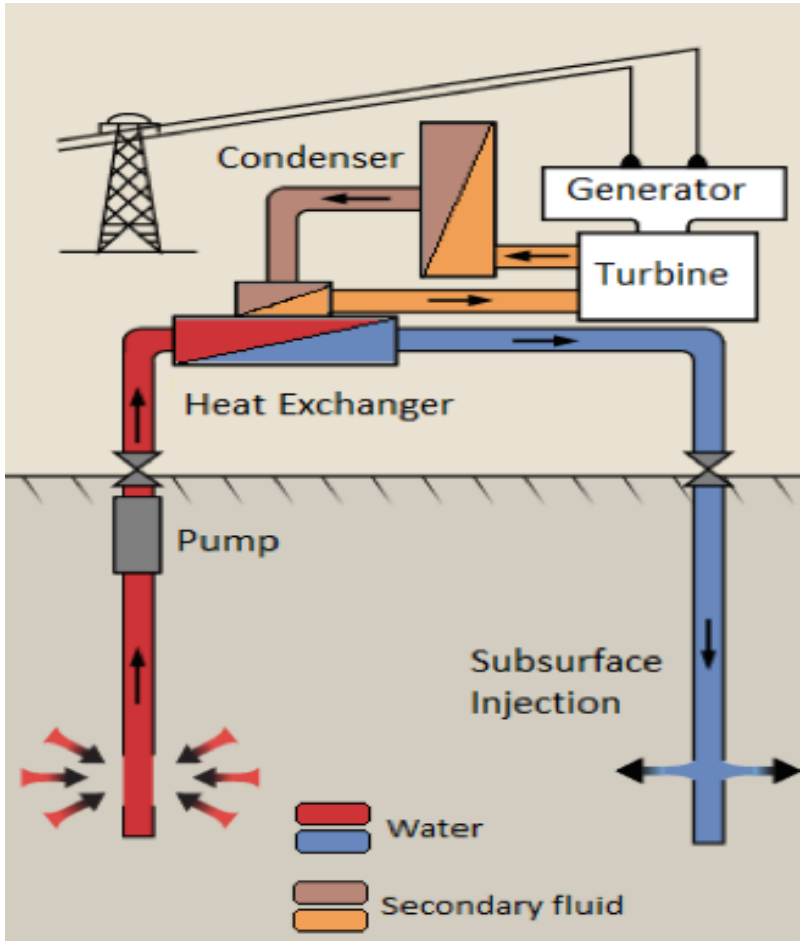
c) BINARY CYCLE

If resources temperature are low (100°C to 180°C, then the hot water is used to boil a working fluid in a Heat Exchanger, usually some organic compound with a very low boiling point.

The vapor produced by heating the organic compound is expanded in the the turbine to generate power.

After condensations the fluid is recycled through the Heat Exchanger in closed cycle. AS a closed loop system, Binary Geothermal Power Plants produce No Air Emissions

TECHNOLOGY DESCRIPTION



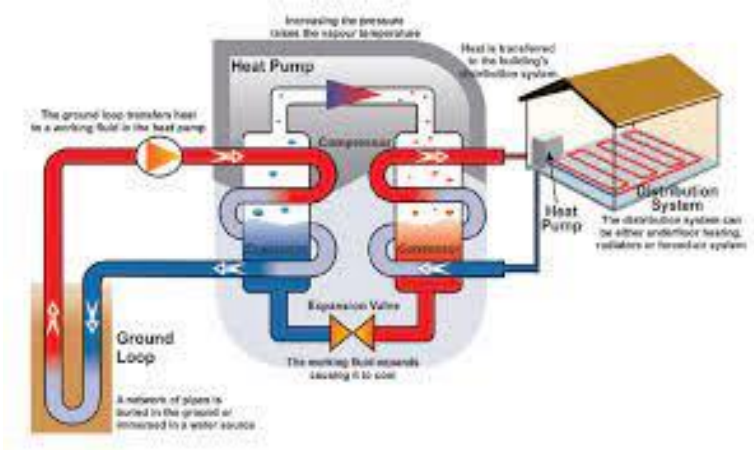
c) BINARY CYCLE

If resources temperature are low (000C to 1800C, then the hot water is used to boil a working fluid in a Heat Exchanger, usually some organic compound with a very low boiling point.

The vapor produced by heating the organic compound is expanded in the the turbine to generate power.

After condensations the fluid is recycled through the Heat Exchanger in closed cycle.
AS a closed loop system, Binary Geothermal Power Plants produce No Air Emissions

GEOTHERMAL HEAT PUMPS



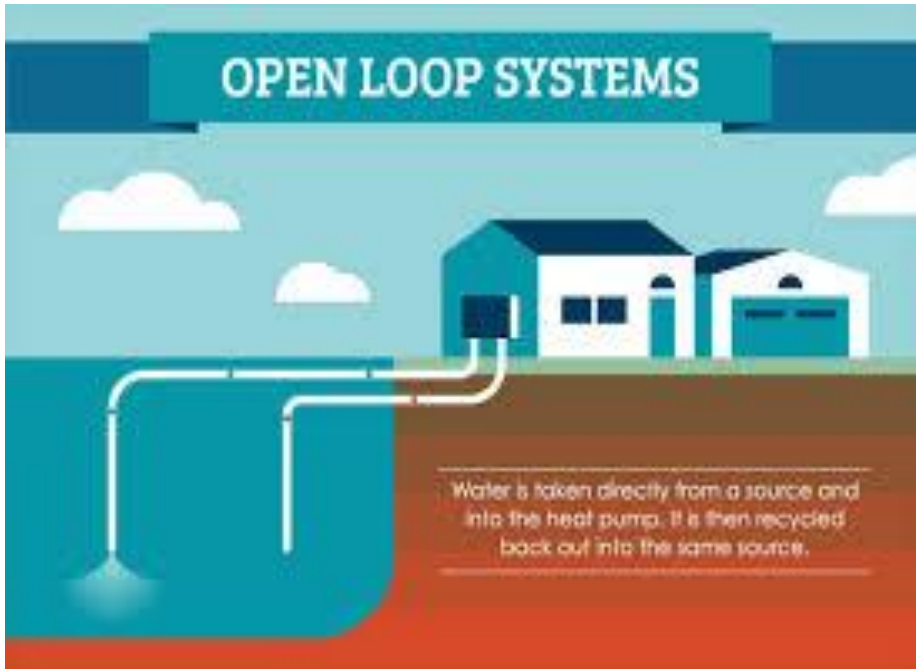
GEOTHERMAL HEAT PUMPS

Powering your home with a geothermal heat pump allows you to harness the temperatures below the surface of the earth to heat or cool a structure.

Even though the temperatures above ground fluctuate during the seasons throughout the years, the temperature below the surface remains consistent between 50℉ - 60℉ year round.

There are four types of pumps, three closed-loop systems and open-loop systems. Each depends on the type of soil, climate conditions and land available.

HOT WATER POWER



LIQUID DOMINATED RESOURCES ARE MORE COMMON.

LIQUID DOMINATED RESOURCES ARE MORE COMMON.

If resources temperature are fairly high (> 170^{0}C), the liquid / water can be partially flashed to the steam in a tank maintained at a much lower pressure, for use in a steam turbine.

If temperature are moderate (100^{0}C to 180^{0}C), the heat in the liquid can be used to vaporize a secondary organic working fluid, and produce using "Binary Cycle Plant"

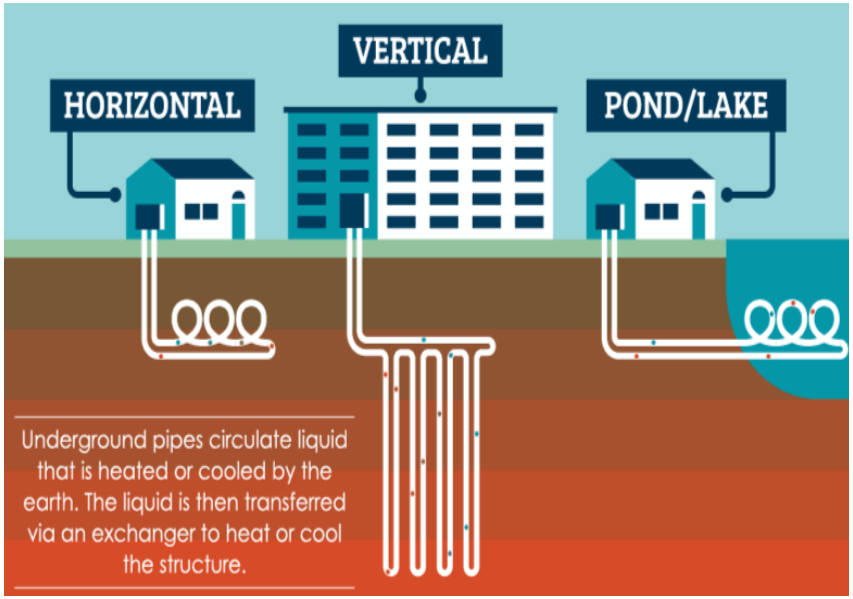
CLOSED LOOP SYSTEMS

Closed loop horizontal systems are the most cost-effective for residential areas.

For larger commercial buildings, closed loop vertical systems are more often used.

These can sometimes go down 400 feet deep.
Closed loops constructed under or in a pond or lake are usually the cheapest.

CLOSED LOOP SYSTEMS



In closed loop systems, a water/antifreeze mixture circulates through a loop of pipes underground (or beneath a body of water) and into a building.

In the winter (as shown above), the temperatures underground are warmer than the air, so the fluid pumping in is warmer. Then the electric compressors and heat exchangers transfer the heat through ducts in the building.

In the summer, the pipes draw heat away from the building and it is absorbed into the earth or water.

Since the fluid is already cool in the summer and warmer than the air in the winter, the heater/AC system doesn't have to work nearly as hard.

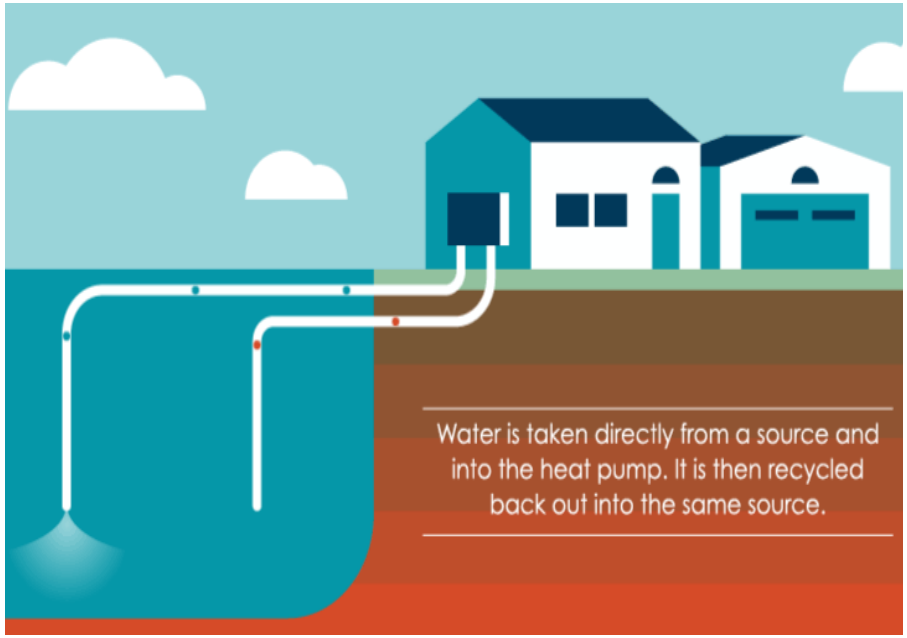
OPEN LOOP SYSTEMS

In open loop systems, the water is taken directly from a water source and into the heat pump where it then can either be recycled back into the same source or pumped into another water source (without polluting).

The only difference with the water going in and out is a slight change in temperature. Although these can be cheaper, they also require a steady flow of water capable of powering your home.

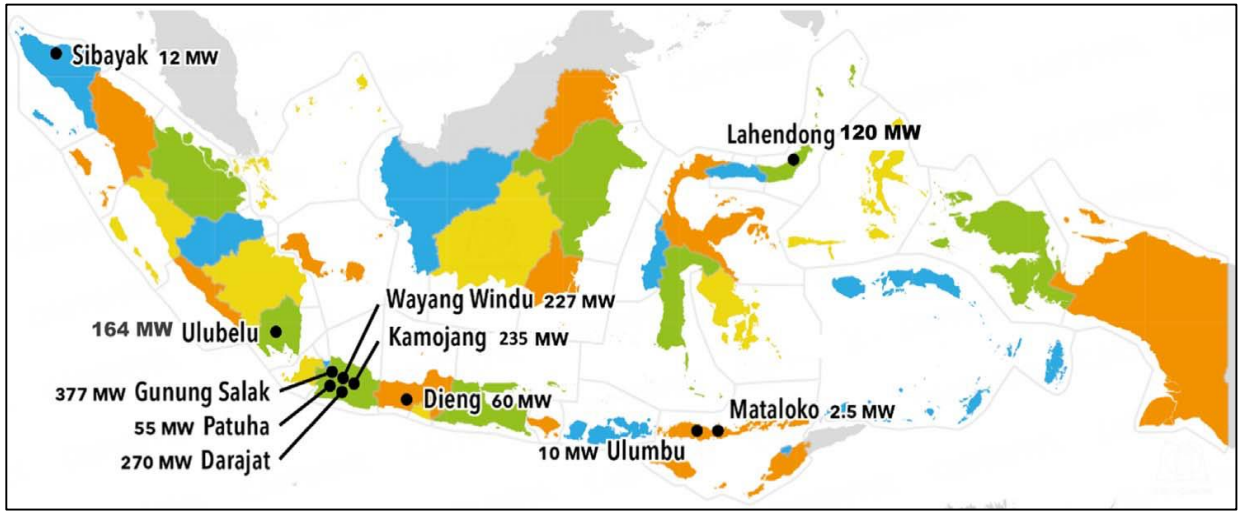
Since geothermal energy is a renewable natural resource, think of it like a gift from the earth that keeps giving.

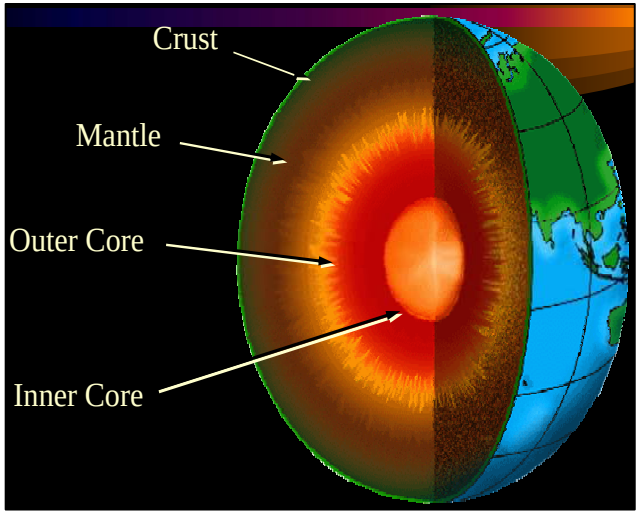
OPEN LOOP SYSTEMS



These four types of geothermal heat pumps can be used all over the country due to the constant temperature below the surface, but they vary in efficiency and cost savings.

GEOTHERMAL POWER PLANT IN INDONESIA.



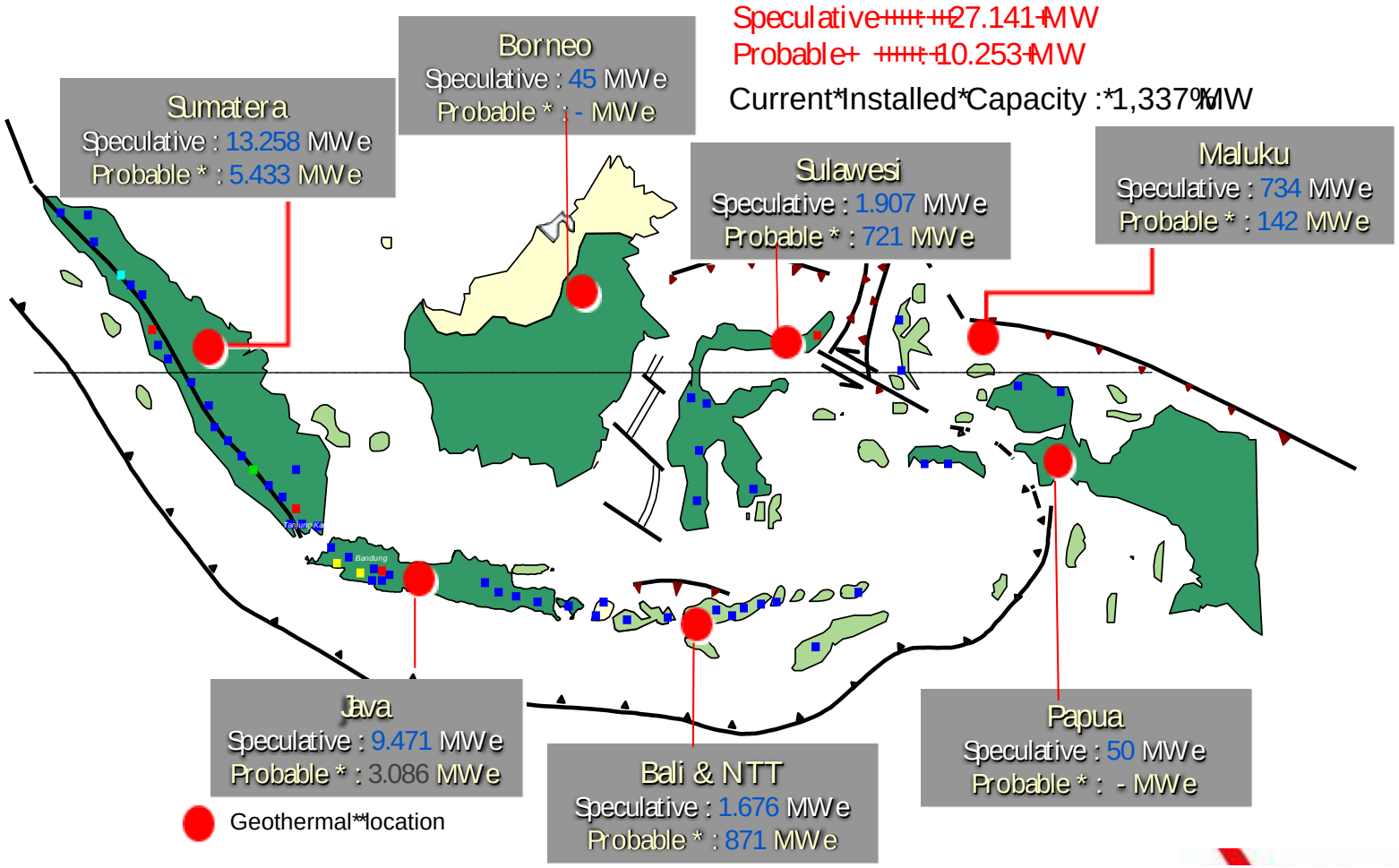


No	Field	Unit	Total Capacity	Reservoir	Technology
1	Sibayak	Monoblok 2 MW. Unit-2–3, 2 × 5 MW	12 MW	Water dominated	Single-flash
2	Ulubelu	Unit-1–3; 3 × 55 MW	165 MW	Water dominated	Single-flash
3	Salak	Unit-1–3, 3 × 60 MW. Unit 4–6 3 × 65.6 MW	377 MW	Water dominated	Single-flash
4	Wayang Windu	Unit-1: 110 MW Unit 2: 117 MW	227 MW	Water dominated	Single-flash
5	Patuha	Unit 1: 55 MW	55 MW	Water dominated	Single-flash
6	Kamojang	Unit-1: 30 MW Unit 2–3: 2 × 55 MW Unit 4: 60 MW Unit 5: 35 MW	235 MW	Vapor dominated	Dry steam plant
7	Darajat	Unit-1: 55 MW Unit-2: 94 MW Unit 3: 121	270 MW	Vapor dominated	Dry steam plant
8	Dieng	1 × 60 MW	60 MW	Water dominated	Single-flash
9	Lahendong	Unit 1–6: 6 × 20 MW	120 MW	Water dominated	Single-flash
10	Ulumbu	Unit 1–4: 4 × 2.5 MW	10 MW	Water dominated	Single-flash
11	Mataloko	2.5 MW	2.5 MW	Water dominated	Single-flash
Total			1533.5 MW		

INSTALLED GEOTHERMAL ELECTRIC CAPACITY

CAPACITY (MW)					% NATIONAL	% GLOBAL
NO	COUNTRY	2007	2010	2020	ELECTRICITY PRODUCTION	GEOTHERMAL PRODUCTION
1	UNITED STATE	2687	3086	3714	0.3	29
2	PHILIPINE	1969.7	1904	1918	27	18
3	**INDONESIA**	**992**	**1197**	**2133**	**3.7**	**11**
4	MEXICO	953	958	962.7	3	9
5	ITALY	810.5	843	944	1.5	8
6	NEW ZEALAND	471.6	628	1005	10	6

!!I NDONESI A'S!WORLD!LEADI NG!GEOTHERMAL!PROSPECT



SEBARAN 13 PLTP YANG TERPASANG

DARI WILAYAH BARAT SAMPAI WILAYAH TIMUR INDONESIA

NO	WILAYAH KERJA	KAPASITAS - MW	OPERATOR
1	PLTP Sibayak – Sinabung, Sumatera Utara	12	PT Pertamina Geothermal Energy
2	PLTP Sarulla Sibual-buali, Sumatera Utara	330	Sarulla Operation Ltd
3	. PLTP Ulubelu Waypanas, Lampung	220	PT Pertamina Geothermal Energy
4	PLTP Salak Cibeureum – Parabakti, Jawa Barat	377	PT Star Energy Geothermal Salak. Ltd
5	PLTP Wayang Windu Pangalengan, Jawa Barat	227	Star Energy Geothermal Wayang Windu
6	PLTP Patuha Pangalengan, Jawa Barat	270	PT Geo Dipa Energy
7	PLTP Kamojang Kamojang – Darajat, Jawa Barat	235	PT Pertamina Geothermal Energy

SEBARAN 13 PLTP YANG TERPASANG

DARI WILAYAH BARAT SAMPAI WILAYAH TIMUR INDONESIA

NO	WILAYAH KERJA	KAPASITAS - MW	OPERATOR
8	PLTP Darajat Kamojang – Darajat, Jawa Barat	270	Star Energy Geothermal Drajat
9	PLTP Dieng Dataran Tinggi Dieng, Jawa Tengah	60	PT Geo Dipa Energy
10	PLTP Karaha Karaha Bodas, Jawa Barat	30	PT Pertamina Geothermal Energy
11	PLTP Matalako Matalako, NTT	2.5	PT Perusahaan Listrik Negara
12	PLTP Ulumbu Ulumbu, NTT	10	PT Perusahaan Listrik Negara
13	PLTP Lahendong Lahendong – Tompaso, Sulawesi Utara	120	PT Pertamina Geothermal Energy

Khusus untuk PLTP Karaha, baru beroperasi secara komersil pada tanggal 6 April 2018.
Dengan beroperasinya PLTP Karaha ini mampu melistriki 33 ribu rumah di Tasikmalaya dan sekitarnya.

Pencapaian ini merupakan realisasi dari program 35.000 MW yang dicanangkan pemerintah, di mana akan meningkatkan kehandalan sistem transmisi Jawa-Bali dengan tambahan suplai listrik sebesar 227 Giga Watt hour (GWh) per tahun. (**es,** sumber esdm.go.id)

WILAYAH KERJA
PERTAMINA GEOTHERMAL ENERGY

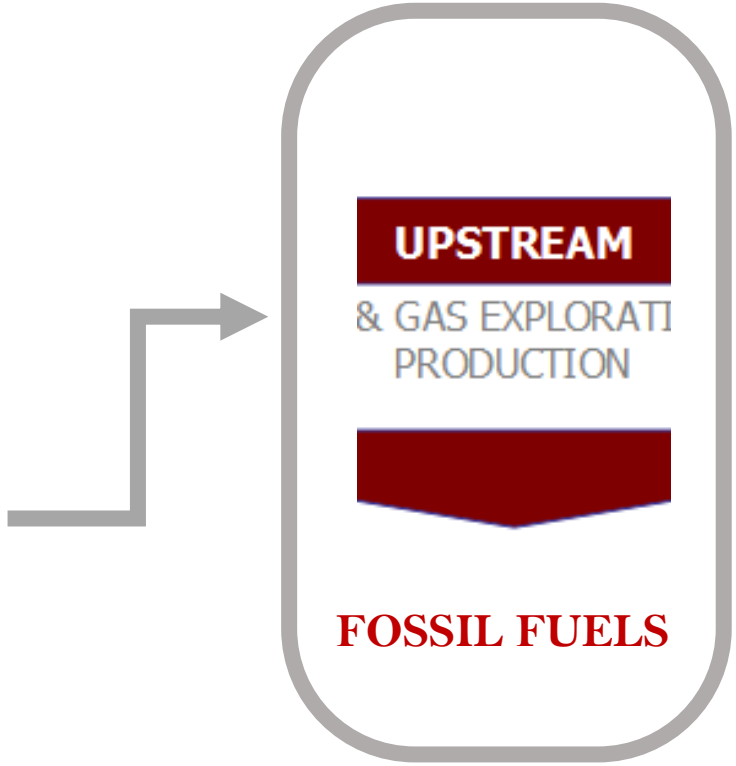
PERTAMINA
GEOTHERMAL ENERGY PROJECT

No	Project Name	Location	Capacity (MW)	Project Type
1	Lumutbalai Unit 1&2,	Sumatera Selatan	2 x 55 MW	Total Project
2	Lumutbalai Unit 3&4,	Sumatera Selatan	2 x 55 MW	Total Project
3	Ulubelu Unit 3&4,	Lampung	2 x 55 MW	Total Project
4	Kamojang Unit 5	Jawa Barat	30 MW	Total Project
5	Lahendong Unit 5&6	Sulawesi Utara	2x20 MW	Total Project
6	Kotamobagu Unit 1&2	Sulawesi Utara	2 x 20 MW	Steam Supply
7	Hululais Unit 1&2	Bengkulu	2 x 55 MW	Steam Supply
8	Sungai Penuh Unit 1	Jambi	55 MW	Steam Supply
9	Karaha	Jawa Barat	30 MW	Total Project

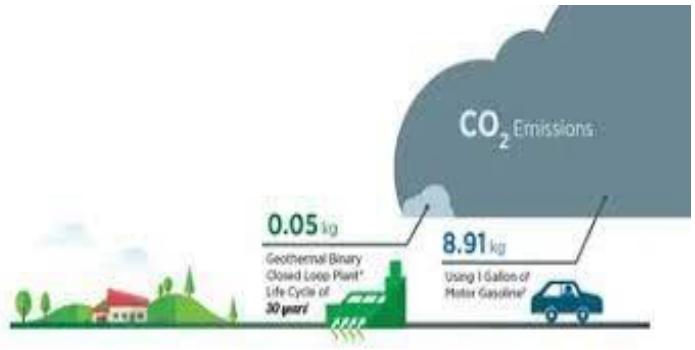
Geothermal Energy Advantages & Disadvantages

BENEFITS OF GEOTHERMAL POWER

- Provides clean and safe energy using little land
- Is renewable and sustainable
- Generates continuous, reliable "baseload" power
- Avoids importing and benefits local economies
- Offers modular, incremental development and village power to remote sites



CONSERVES FOSSIL FUELS & CONTRIBUTES TO DIVERSITY IN ENERGY SOURCES



WHAT ARE DISADVANTAGES OF USING GEOTHERMAL ENERGY?

DISADVANTAGES OF GEOTHERMAL ENERGY

- **Geothermal energy has high initial capital costs**
- May release harmful gases even though little
- Suited to a particular region. ...
- **Geothermal heat pumps have to be powered by fuel oil**
- Can cause surface instability. ...
- Extremely high temperatures required.

ENVIRONMENTAL EFFECT

MOST OF THOSE EFFECTS, HOWEVER, CAN BE MITIGATED WITH CURRENT TECHNOLOGY TO MINIMIZE THE EFFECTS TO THE ENVIRONMENTAL.

THE ENVIRONMENTAL EFFECT OF GEOTHERMAL DEVELOPMENT ARE AS FOLLOWS:

- The changes in land use associated with exploration and plant construction
- Noise level and sight pollution (discharge of water & gases)
- Some Foul odors form H2S and CO2 gases
- Potential of Soil subsidence

ENVIRONMENTAL IMPACTS

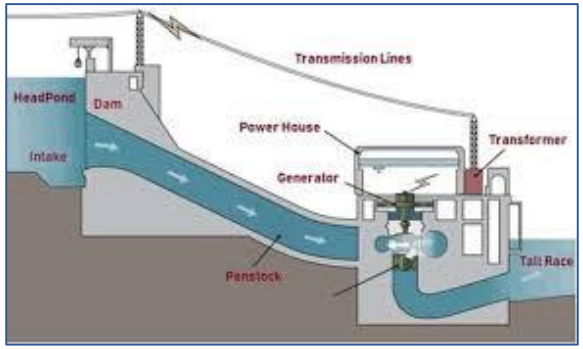
SOURCES OF POLLUTION

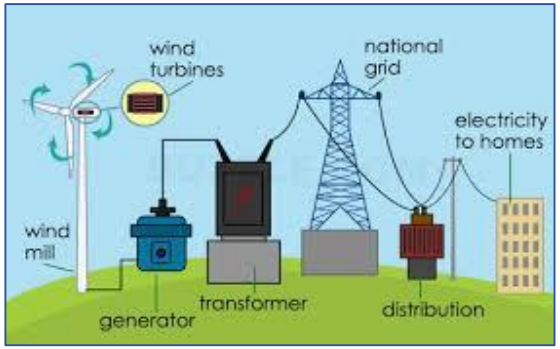
In most cases the degree to which geothermal exploitation affects the environment is proportional to the scale of its exploitation.

Impact	Probability of occurring	Severity of consequences
Air quality pollution	L	M
Surface water pollution	M	M
Underground pollution	L	M
Land subsidence	L	L to M
High noise levels	H	L to M
Well blow-outs	L	L to M
Conflicts with cultural and archaeological features	L to M	M to H
Social-economic problems	L	L
Chemical or thermal pollution	L	M to H
Solid waste disposal	M	M to H

COUNTRY THAT USES 100 % OF RENEWABLE ENERGY

Iceland to day generate 100% of its electricity with renewable. Where 75 % of that from large hydro Power and 25 % from geothermal

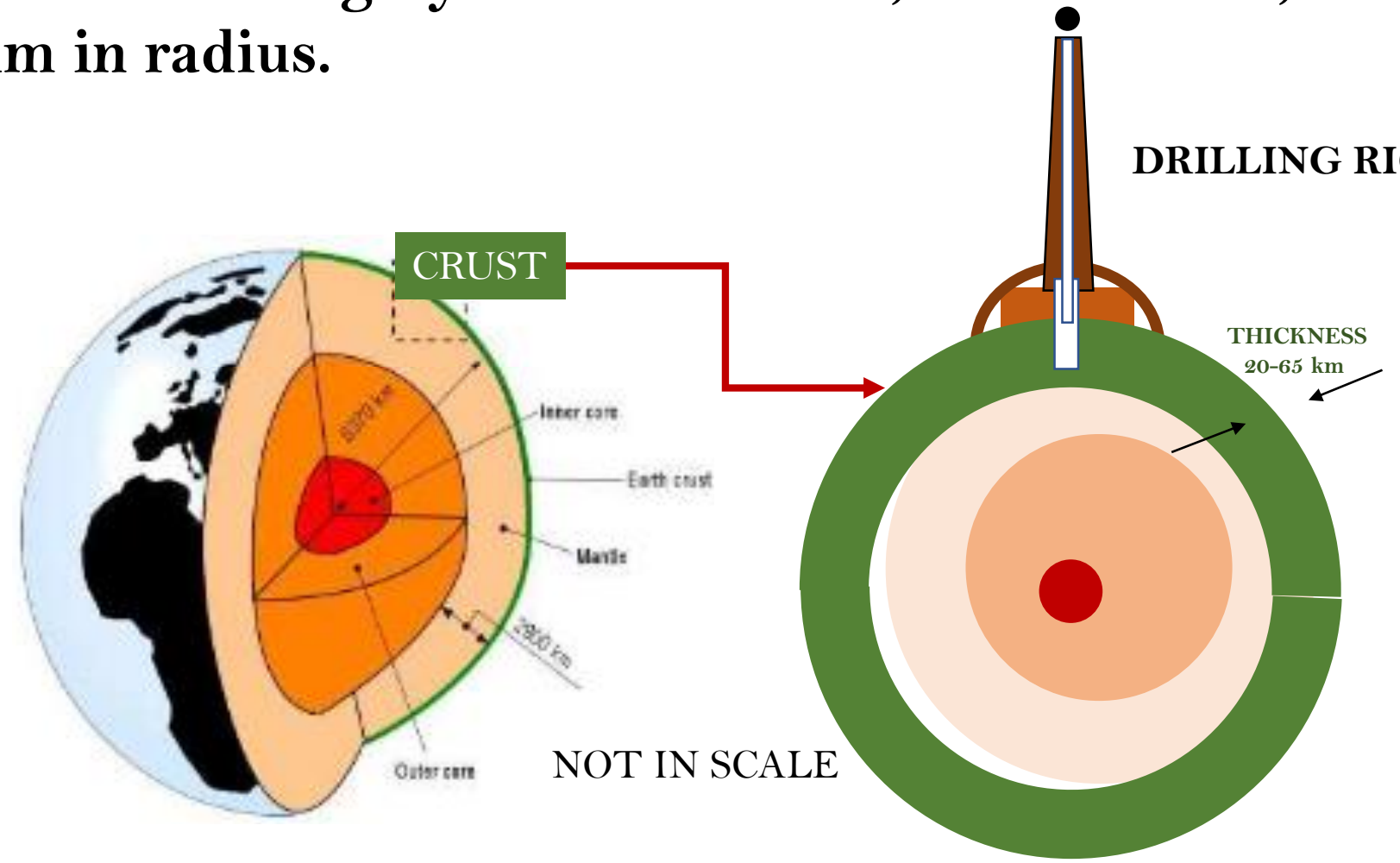




SETTING UP
A GEOTHERMAL POWER PROJECT

1. EXPLORATION
2. WELL DRILLING & TESTING
3. RESERVOIR ENGINEERING
4. POWER PLANT DESAIGN
5. FLUID HANDLING
6. ENVIRONMENTAL CONTROL

The crust has a thickness of ~ 20-65 km in continental areas and ~ 5-6 km in oceanic areas, the mantle is roughly 2900 km thick, and the core, ~ 3470 km in radius.



SETTING UP
A GEOTHERMAL POWER PROJECT

The development of a successful geothermal energy project relies on variety of specialized technology. Cost effective use each technology is crucial:

1. EXPLORATION

THE FIRST STAGE of development of a geothermal plant begins with explorations to find a reservoir at an economically useful temperature & depth with adequate permeability and volume,

EXPLORATION RELIES on surface measurement of subsurface geological., geochemical * geophysical conditions.

INTEGRATION OF DATA from a wide variety sources to develop a good conceptual model of the system is most important.

EXPLORATION

OBJECTIVES OF GEOTHERMAL EXPLORATION:

Objectives of geothermal exploration:

1. To identify geothermal phenomena.
2. To ascertain that a useful geothermal production field exists.
3. To estimate the size of the resource.
4. To determine the type of geothermal field.
5. To locate productive zones.
6. To determine the heat content of the fluids that will be discharged by the wells in the geothermal field.
7. To compile a body of basic data against which the results of future monitoring can be viewed.
8. To determine the pre-exploitation values of environmentally sensitive parameters.
9. To acquire knowledge of any characteristics that might cause problems during field development.

2. WELL DRILLING & TESTING

Drilling of wells is done to measure subsurface temperatures and flow rates, measure other subsurface conditions and to produce and re – inject the geothermal fluid.

After each well is completed then injection tests are run in order to study the characteristics related to temperature, pressure, chemistry and permeability of formation.

All the above data are used by engineering for field development project. (Geothermal Energy Plant and resources utilization)

3. RESERVOIR ENGINEERING

Information gathered from subsurface measurement and well testing is used to generate and refine a model of how the reservoir works.

These models are used to optimize energy extraction and maximize the economic lifetimes of resources.

Reservoir engineering determines major design considerations such as location depth flow rate, configuration and number of production & injection wells

4. POWER PLANT DESIGN

Geothermal Power Plant design depends on the physical characteristics of the geothermal fluid.

Ability to accommodate changes in fluid pressure, enthalpy and non – considerable gases content that may take place in later part of the system lifespan is also important.

Dry steam power plants at the **Geysers Field in California** have been online since 1960 and have proved to be cost competitive with other generating sources.

Single And Dual Flashes Steam Power Plants are widely used in the US and world wide.

Binary Technology has been successful using resource temperatures as low as 100^0C

5. FLUID HANDLING

Chemical constituents in some geothermal fluids can cause scaling, corrosion or mechanical erosion of wells, gathering / injection systems and surface facility equipment.

Recent research has yielded major advances.

Injection of carbonate scale inhibiting compounds into production wells;

Use of crystallized – clarifier technology and pH modification to control silica scaling.

Polymer concrete liners or pipes and CO_2 resistant cements for production wells have helped overcome brine handling problems.

6. ENVIRONMENTAL CONTROL

Environmental impacts associated with geothermal direct use project are often minimal

H_2S EMISSIONS to atmosphere, land use and disposal of solid wastes are hazards to be tackled to meet strict environmental regulation.

Although the intensity of these hazards varies from site to site, development of appropriate control technologies has facilitated sound geothermal system

SUMMARY

- **Geothermal energy is a renewable energy source that has been utilized economically in many parts of the world for decades.**
- **A great potential for an extensive increase in worldwide geothermal utilization has been proven.**
- **Geothermal energy is independent of weather conditions and has an inherent storage capability which makes it especially suitable for supplying base load power in an economical way.**
- **One of the strongest arguments for putting more emphasis on the development of geo-thermal resources worldwide is the limited environmental impact compared to most other energy sources.**


Thank
you