



Business strategy briefing

TOYO's **Geothermal** initiatives

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Toyo Engineering Corporation

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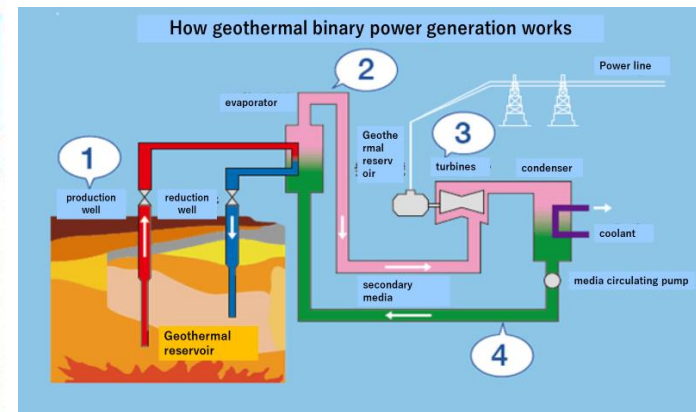
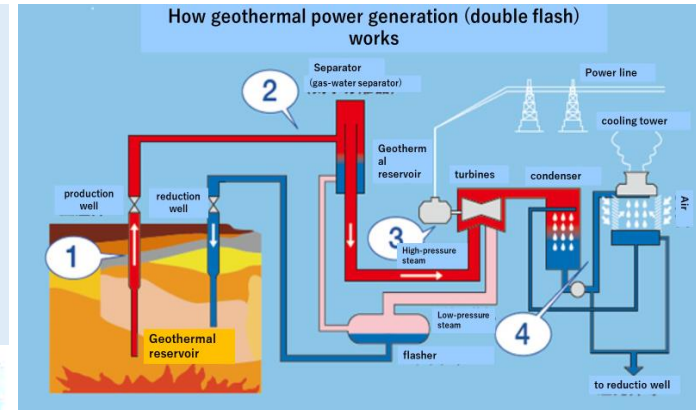
Today's content

1. What is geothermal energy?
 - 1.1 What is Geothermal Power Generation?
 - 1.2 Geothermal Market?
 - 1.3 Why Geothermal Power? What are the challenges?
2. Why Geothermal by TOYO? What is the advantage?
 - 2.1 What are TOYO's efforts to date?
 - 2.2 What is TOYO's experience?
3. Future of TOYO's geothermal business
4. Summary



1.1 What is Geothermal Power Generation?

Geothermal power generation is a method of generating electricity that converts **the heat of magma into electricity**. **Steam power** is generated by turning the turbine using steam and hot water extracted from the geothermal reservoir through the wells. **Binary power** is generated via low boiling fluid when the temperature is low.

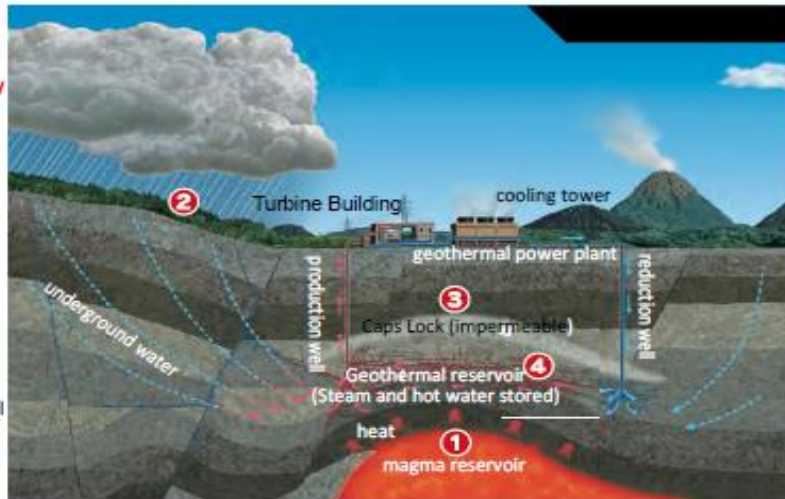


① **magma reservoir**
Heat the surrounding bedrock

② **Rain and river water supply**
Rainwater and river water enter the subsurface and become hot steam and hot water due to the heat of the bedrock surrounding the magma reservoir.

③ **cap rock**
It acts as a lid to trap high-temperature steam and hot water.

④ **Geothermal reservoir**
Hot steam and hot water accumulate beneath the caprock, forming a "geothermal reservoir. From here, steam is extracted through "production wells" and a turbine is turned to generate electricity.



1.2 Geothermal Market?

Indonesia is ranked second in terms of both geothermal resources and installed capacity, achieved rapid growth of approximately 2.3 GW by 2020 and aiming for a 5.7 GW by 2030 (approximately **2.5 times**)*¹.

Japan is ranked third in terms of geothermal resources and 10th in capacity. Japan has set a target of 1.4-1.55 GW (**2.3-2.6 times** the FY2020 level) by 2030.*²

*1 NRE Development in Indonesia, June 16th, 2022 (<https://reinvest.id/assets/source/materials/japan-2022/MS.%20bu%20Cita%20Dewi%20-%20PLN.pdf>)

*2 METI's activities for Enhancement of Geothermal Power Generation (https://www.ena.or.jp/?fname=gec_2019_5_1.pdf)

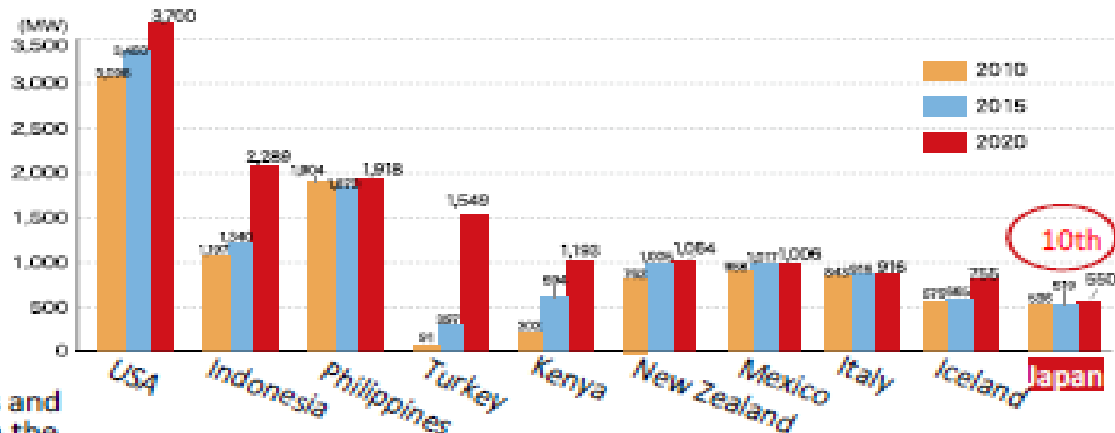
Amount of resources in each country
in the world

順位	国名	資源量(万kW)
1	USA	3,000
2	Indonesia	2,779
3	Japan	2,347
4	Kenya	700
5	Philippines	600
6	Mexico	600
7	Iceland	580
8	New Zealand	365
9	Italy	327
10	Peru	300

※1.5GW=15MW ※1MW=1,000kW

Source: Agency for Natural Resources and Energy (Compiled based on data from the General Resources Energy Investigation Committee, June 2016)

Change in geothermal installed capacity



Source: WGC 2015 & 2020 Update Report

1.3 Why Geothermal Power? What are the challenges?

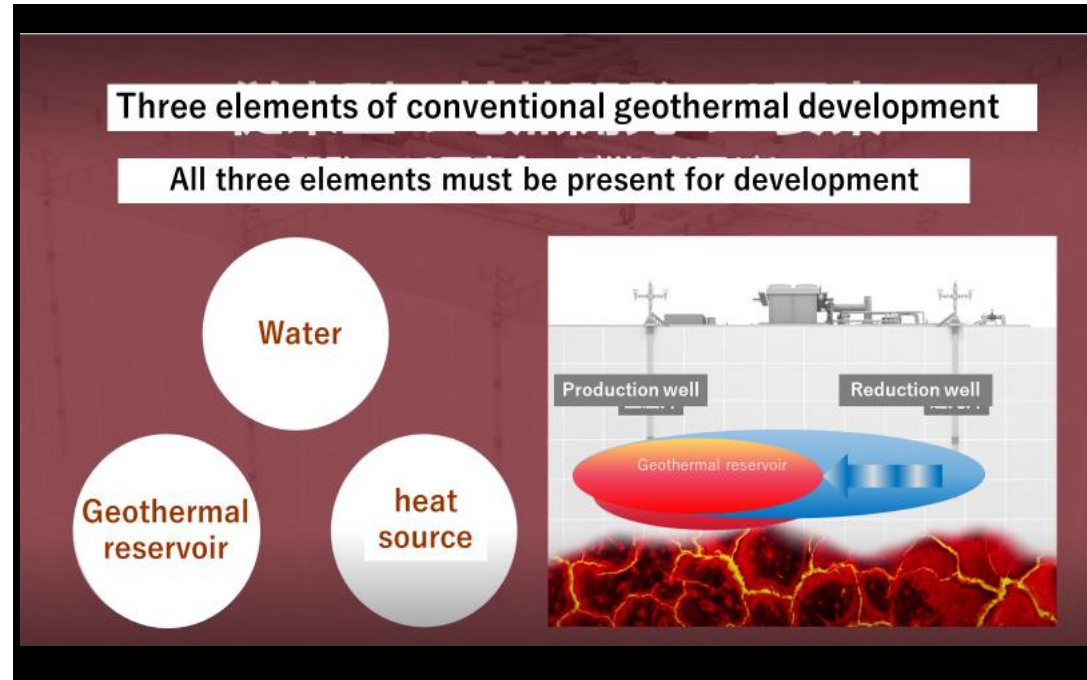
Geothermal power generation is a renewable energy that can be **a base-load power source** with high capacity utilization, independent of weather conditions.

However, the challenges are:

① 3 elements required; Heat source, water, and reservoir (with cracks, fissures, etc) (development risk/depletion risk)

② Scaling and corrosion in tubing and piping

③ Coexistence with hot spring business and restrictions on national parks, etc.



1.3 Why Geothermal Power? What are the challenges?

The closed loop system can generate power by heat collected by water from the ground through the underground dual-tube. The system leads to:

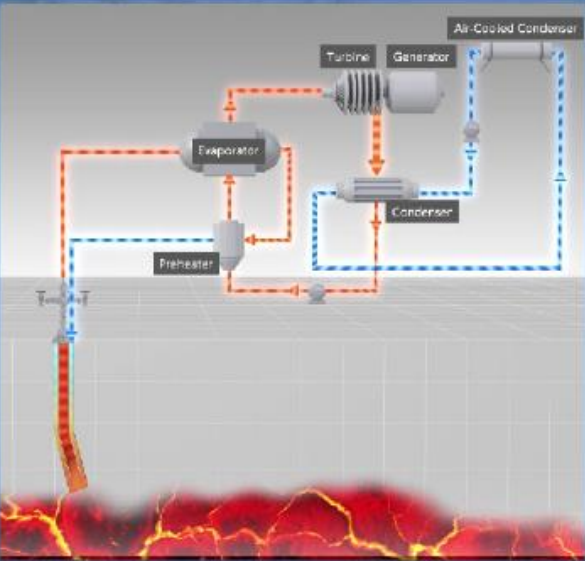
- ① No water and reservoir is required,
- ② No scale or corrosion occurs, and
- ③ There is no interference with the hot spring reservoir, and national parks.

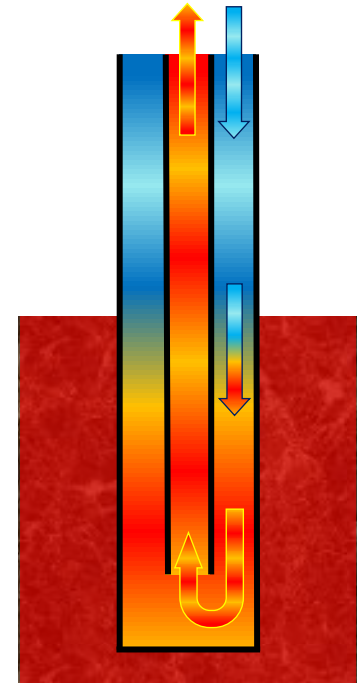
The only required element for the Closed loop system is:

Heat
Source

Production is possible even in the absence of water and geothermal reservoirs

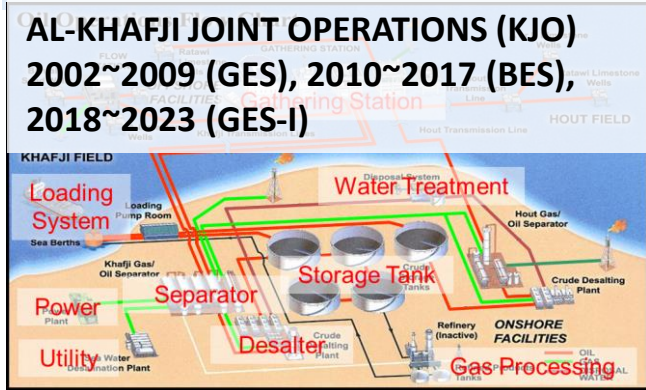
- Application to diverse field conditions
- Application to wells whose production has been interrupted
- Reduce exploration risk





2.1 What are TOYO's efforts to date?

Master plan development experiences - Long-term provision of customer support services (Owners Engineering) for oil & gas development companies (Upstream), mainly in the Middle East, Southeast Asia, and Japan.



Basra Oil Company (BOC), GESA

Lukoil Overseas (Uzbekistan / Iraq), General Engineering Service Agreement (GESA)



Source:
<https://www.lukoil.com/Business/Upstream/KeyProjects/Kandym-Khauzak-Shady>
<https://www.lukoil.com/Business/Upstream/Overseas/WestQurna-2>

2.1 What are TOYO's efforts to date?

Based on our owner's engineering service experience, we have developed our own technologies and are continuously providing support for national policies such as methane hydrate and rare earth. We serve as **a new technology integrator**.

Example 1: Methane Hydrate

Country /
Government

Business
operators



New technology integrator

TOYO core technologies
~DX-PLANT® Monitoring



Supplier core
technologies
~Optical fiber

SILIXA

Local
contra
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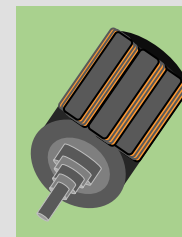
Undergroun
d service
contractor

Equip
ment
vend
or

Example 2: Rare earth

Country /
Government

Business
operators



New technology integrator

TOYO core technologies
Ocean drilling + mineral resource development



Core
technologies
sub-sea
vend
or

Sub-
sea
vend
or

Specializ
ed
engineeri
ng
company

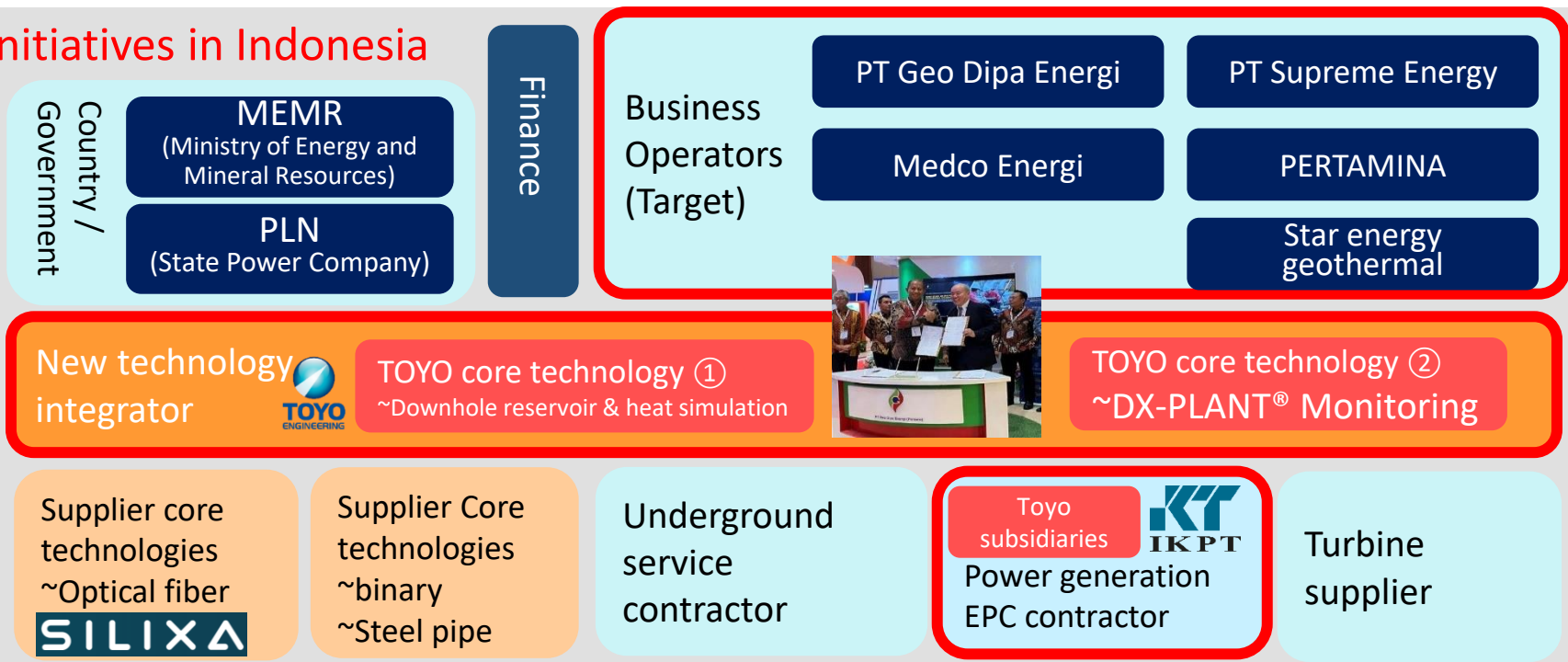
Company
specializi
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2.1 What are Toyo's efforts to date?

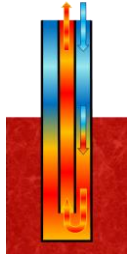
In the field of geothermal energy, TOYO, among players such as the national government, business operators, finance partners, subsurface service contractors, EPC contractors, and turbine suppliers, is responsible for overall integration of new technologies.

Initiatives in Indonesia



2.1 What are Toyo's efforts to date?

Closed loop



+

Surface/Subsurface Integration & Optimization

Drilling efficiency & cost reduction

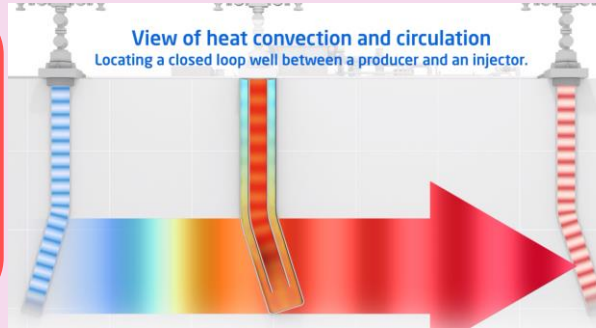
Scale removal

Fracturing

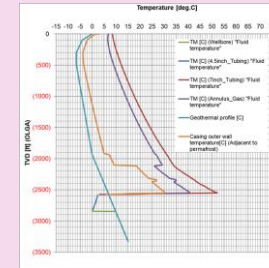
Mineral recovery

EPC (IKPT)

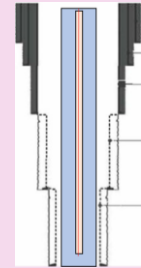
TOYO core technology ①
~Downhole reservoir & heat simulation



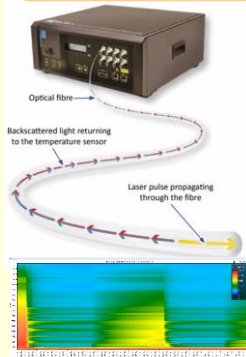
Flow assurance



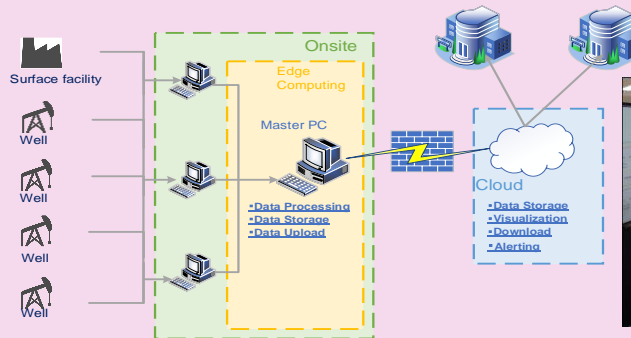
Well design



Supplier Core technologies
~Optical fiber



TOYO core technology ②
~DX-PLANT® Monitoring

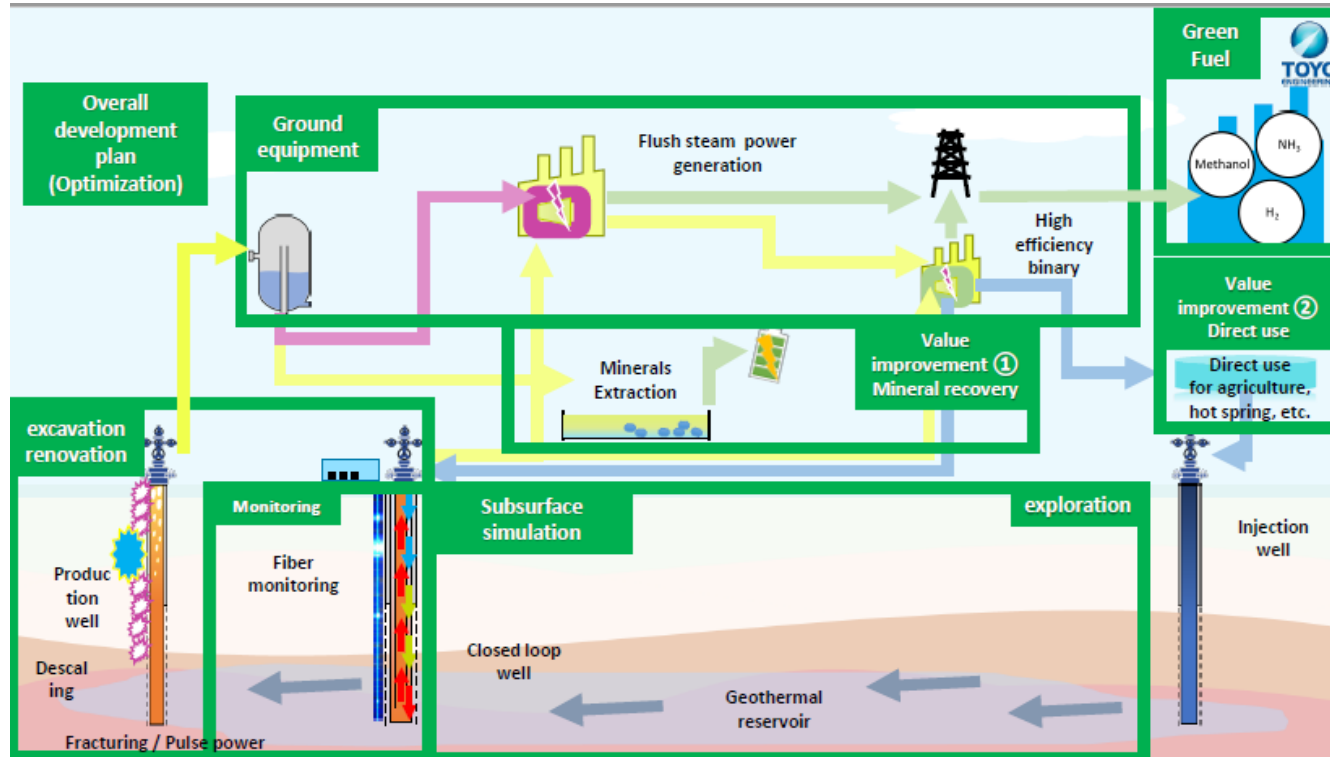


Downhole data acquisition and remote monitoring system



2.1 What are Toyo's efforts to date?

In addition to the closed-loop technology, we are proposing **an overall master plan (optimization)** to the business operators, including monitoring, scale removal, mineral recovery, green fuel, etc.



2.2 What is TOYO's experience?

TOYO has a wealth of experience in Indonesia.

North Sumatera

- '00 DSF-11
- '98 Ammonia/Urea
- '97 Gas Facility
- '95 Gas Facility
- '93 Urea (Revamping)
- '93 Booster Compression
- '92 Ammonia Plant Optimization
- '81 Ammonia/Urea
- '80 Ammonia/Urea

South Sumatera

- '17 Gas Field
- '12 Urea (ACES21)
- '02 Gas Facility
- '93 Effluent Treatment
- '91 Urea (ACES)
- '89 Urea (ACES)
- '75 Urea
- '74 Urea
- '71 Urea

West Java

- '22 Ethylene/Butadiene/Aromatics
- '18 Acrylic Acid
- '18 Butene-1,MTBE & EGF
- '17 Polyethylene
- '17 Butadiene
- '15 Synthetic Rubber
- '15 MRT (Mass Rapid Transit) System
- '13 Ethylene
- '12 Ethylene
- '11 AA / SAP
- '11 Butadiene Extraction
- '08 OCT/Low Pressure Recovery Unit
- '03 CCR/Isomerization

- '02 Ammonia/Urea
- '95 VCM/Caustic Soda
- '93 Polyethylene
- '90 Ethylene/Propylene
- '90 HIPS/SAN
- '90 Styrene Monomer
- '89 Polypropylene
- '88 Research Facility
- '75 Urea

East Java

- '15 Urea (ACES21)
- '95 Coal Fired Power
- '90 Urea (ACES)

Kalimantan

- '11 Ammonia/Urea (ACES21)



2.2 What is TOYO's experience?

Indonesian geothermal plant experience (IKPT, a local subsidiary)

PT Pertamina Geothermal Energy/Marubeni
EPC of FCRS & Power Plant Lumut Balai-1 x 55 MW



PT Pertamina Geothermal Energy
EPC of SAGS Development of Production
Geothermal Unit IV –Lahendong (20 MW)



PT Pertamina Geothermal Energy
EPCC Geothermal Production Facilities and Fluids
Reinjection Unit 1-2-Ulubelu (2x55 MW)



PT Geo Dipa Energi
Dieng Geothermal Small Scale 10
MW Central Java

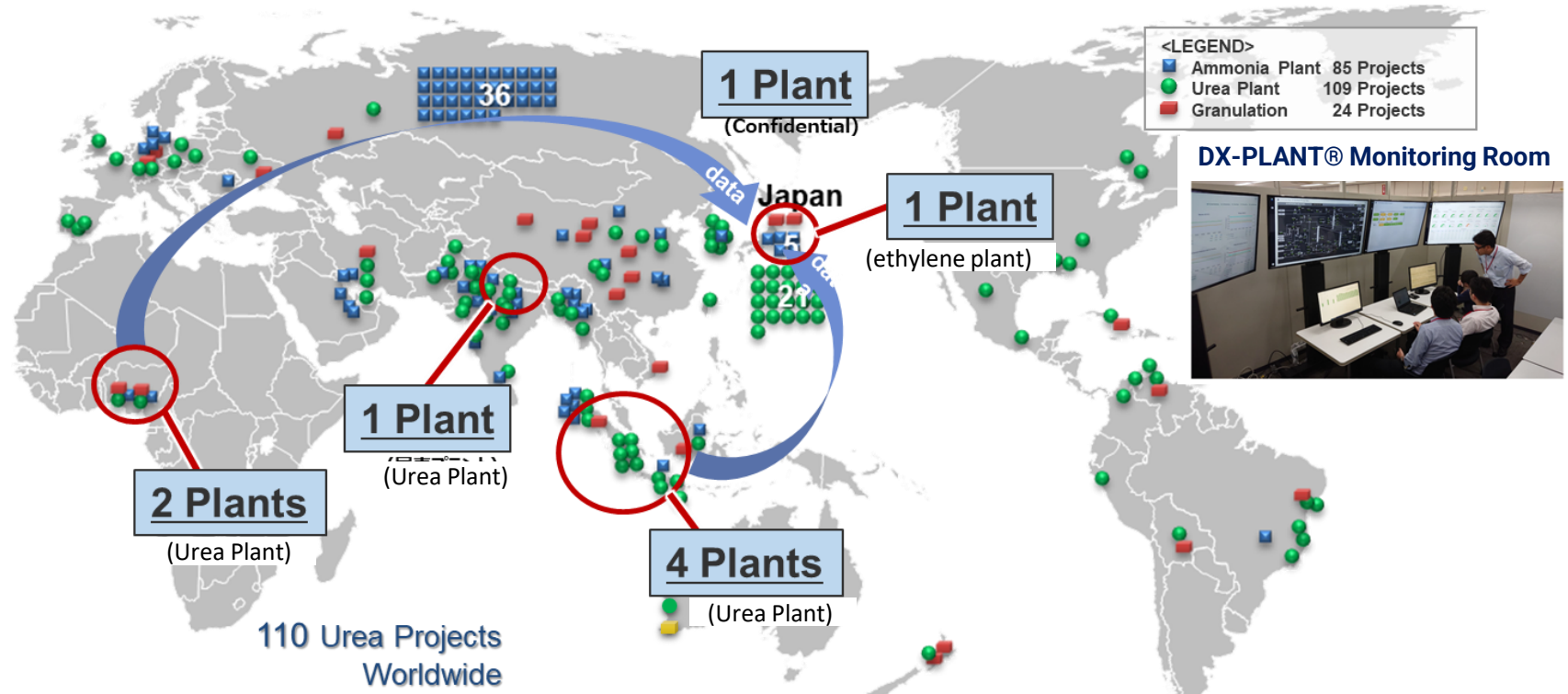


PT Medco Cahaya Geothermal
Blawan Ijen Geothermal, EPCC of SAGS, PBS,
BOP, etc. (31.4MW)



2.2 What is TOYO's experience?

DX-PLANT[®]*1 started operation for the Indonesian national fertilizer companies in 2017. Currently, operating at nine plants worldwide.



*1 Services to support remote management and operational optimization of plants through IoT and data analysis technology

3. What happens to TOYO's geothermal business?

From Indonesia to Japan, and the World! From pilot test to commercialization.
Profit in service/EPC centered on core technology.
In the future, we would like to keep stable earnings from investment/profit share!

Initiatives in Indonesia

Country /
Government


- MEMR
(Ministry of Energy and Mineral Resources)
- PLN
(State Power Company)

Finance

Business Operators (Target)

- PT Geo Dipa Energi
- PT Supreme Energy
- Medco Energi
- PERTAMINA
- Star energy geothermal



New technology integrator  TOYO core technology ① ~Downhole reservoir & heat simulation

TOYO core technology ② ~DX-PLANT® Monitoring

Supplier core technologies ~Optical fiber
SILIXA

Supplier Core technologies ~binary ~Steel pipe

Underground service contractor

Toyo subsidiaries  Power generation EPC contractor

Turbine supplier

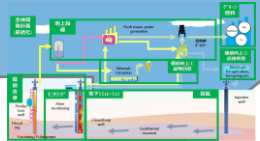
3. Future of TOYO's geothermal business?

2026-2027

2024

2024-2025

Master Plan
with cutting-edge
Technologies,
Technology study
FS



**Closed-loop
Pilot test
Indonesia**



**Monitoring
with Alliance partners**



**Surface/Subsurface
Integration & Optimization**

**Drilling efficiency
& cost reduction**

Scale removal

Commercialization

**Indonesia
Japan**



Service / EPC

Investment/Profit share

4. Summary

Geothermal power generation is promising as renewable energy, which can be a base-load power source.

In Indonesia, the year 2030 target is to increase capacity by approximately 2.5 times, and in Japan by 2.3 to 2.6 times.

Based on its past achievements, TOYO aims to become **a new technology integrator in geothermal fields.**

Closed loop, fiber optic monitoring, DX-PLANT®, etc; these will be tools for solutions, and will optimize the master plans for “Carbon Neutral Geothermal Park”!

From Indonesia to Japan, and the World!
From pilot test to commercialization.

Profit in **service/EPC** centered on core technology.
In the future, we would like to keep **stable earnings from investment/profit share!**

We will create New Geothermal Business in the Carbon Neutral era!



What is TOYO's value?

By combining technologies and
moving the project forward,
with business profitability,
we contribute to the society



Toyo Engineering Corporation

URL <https://www.toyo-eng.com>

For further questions on this material, please contact:

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The forecasts given above are based on information available at the time of compilation and are inherently subject to a variety of risks and uncertainties. Actual results may vary significantly from forecasts due to factors including, but not limited to, changes in the economic or business environment and exchange rate fluctuations.