

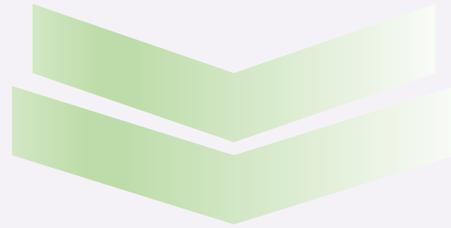


Pemanfaatan Energi Panas Bumi

Sentot Yulianugroho
PT Pertamina Geothermal Energy

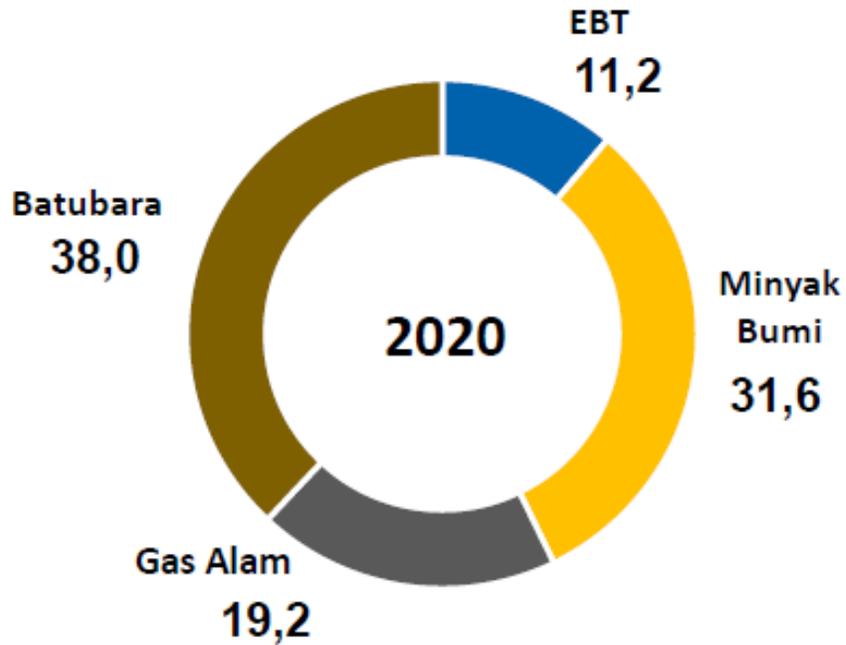
September, 2021

Setiap orang butuh energi, khususnya energi listrik



FAKTA & REALITA

**BAURAN ENERGI PRIMER
MASIH DIDOMINASI ENERGI FOSIL**



**POTENSI EBT BESAR,
PEMANFAATAN MASIH RENDAH**

	POTENSI	PEMANFAATAN
SURYA	207.800	182,3 (0,1%)
HIDRO	75.000	6.286,7 (8,4%)
BIOENERGI	32.600	1.916,4 (5,9%)
BAYU	60.600	154,3 (0,3%)
PANAS BUMI	23.700	2.175,7 (9,2%)
SAMUDERA	17.900	0 (0,0%)
TOTAL	417.600	10.715,4 (2,6%)

Courtesy of DirPabum EBTKE, September 2021

	2015	2016	2017	2018	2019	2020
Prosentase EBT di Bauran Energi Nasional	4,97	6,13	6,67	8,54	9,18	11,20

Courtesy of Rektor Unhan, September 2021

KOMITMEN SEKTOR ENERGI MENUJU *NET ZERO EMISSION*

UNFCCC - COP21, Desember 2015



Leaders Summit on Climate, 22 April 2021

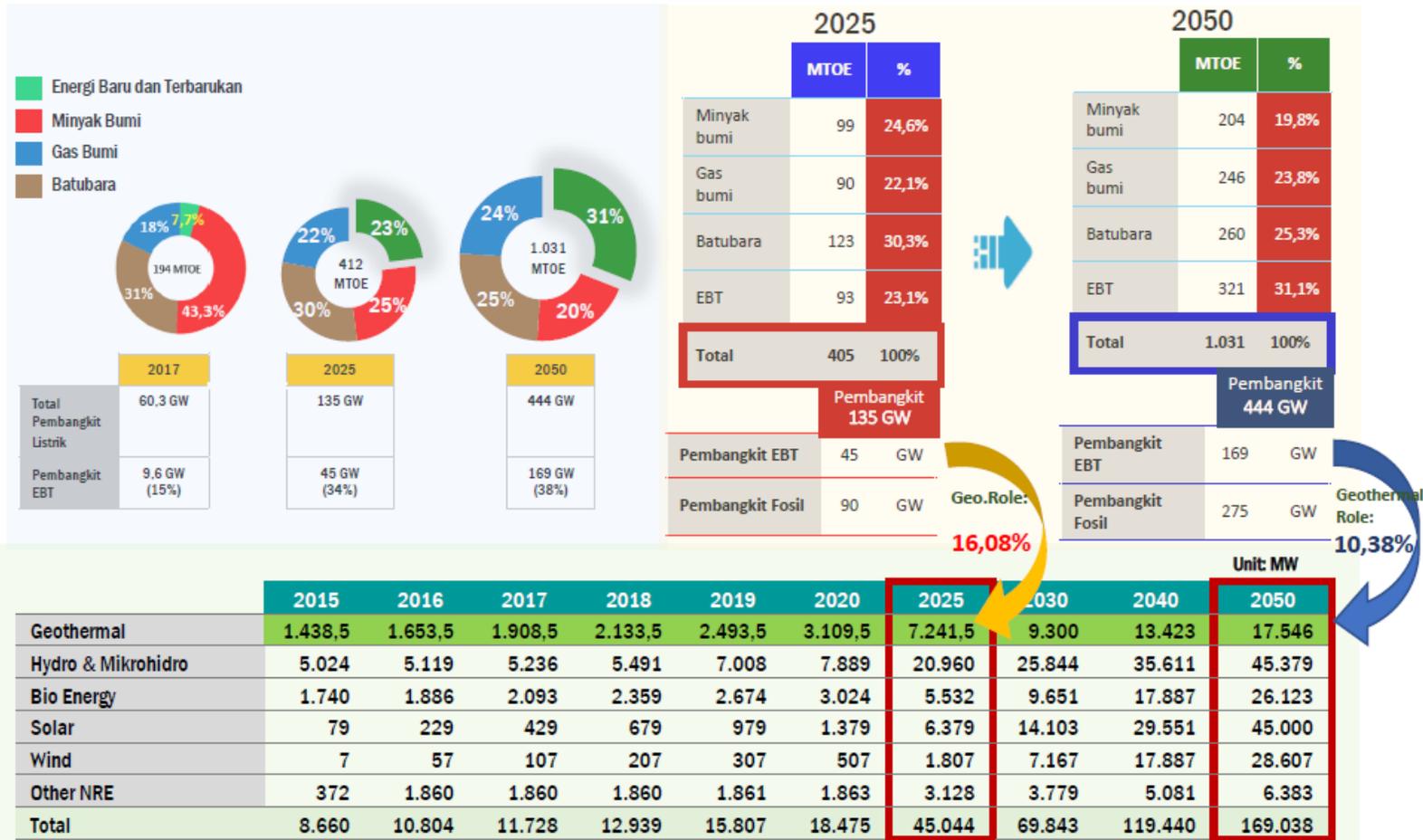


Komitmen Nasional 2021-2030:

- A** Amanat UU No 16/2016 tentang Pengesahan Paris Agreement: menurunkan emisi GRK 29% (kemampuan sendiri) atau 41% (dengan bantuan internasional) pada 2030 sesuai NDC;
- B** Sektor energi menurunkan emisi GRK sebesar 314-398 Juta Ton CO2 tahun 2030, melalui pengembangan energi terbarukan, pelaksanaan efisiensi energi, dan konservasi energi, serta penerapan teknologi energi bersih.
- A** Melaksanakan aksi konkrit perubahan iklim melalui moratorium konversi hutan dan lahan gambut menurunkan kebakaran hutan hingga 82%;
- B** Mendorong green development melalui pengembangan Green Industrial Park seluas 12.500Ha di Kalimantan Utara;
- C** Membuka investasi terhadap transisi energi melalui pengembangan biofuel, industry baterai lithium, dan kendaraan listrik.

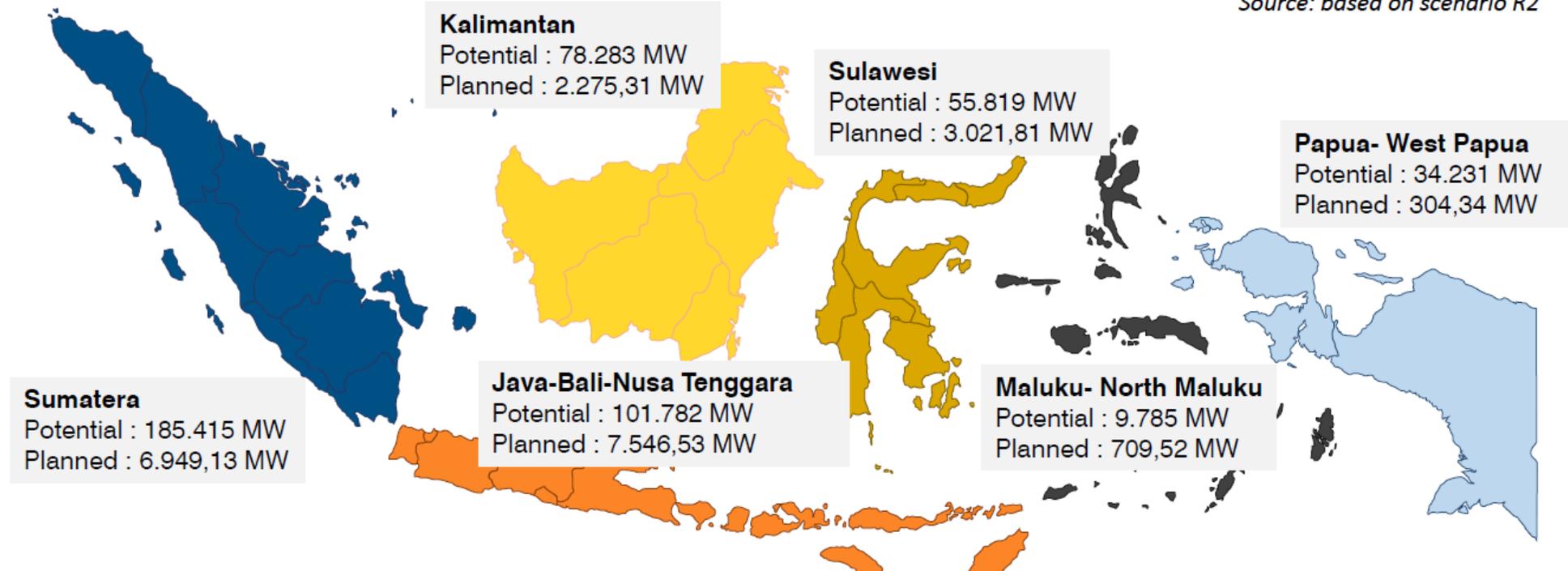
Kebijakan Energi Nasional (KEN)
PP No. 79 Tahun 2014

Rencana Umum Energi Nasional (RUEN)
Pepres No. 22 tahun 2017



National RE Potential and Development Plan (Draft RUPTL PLN 2021 – 2030)

Source: based on scenario R2



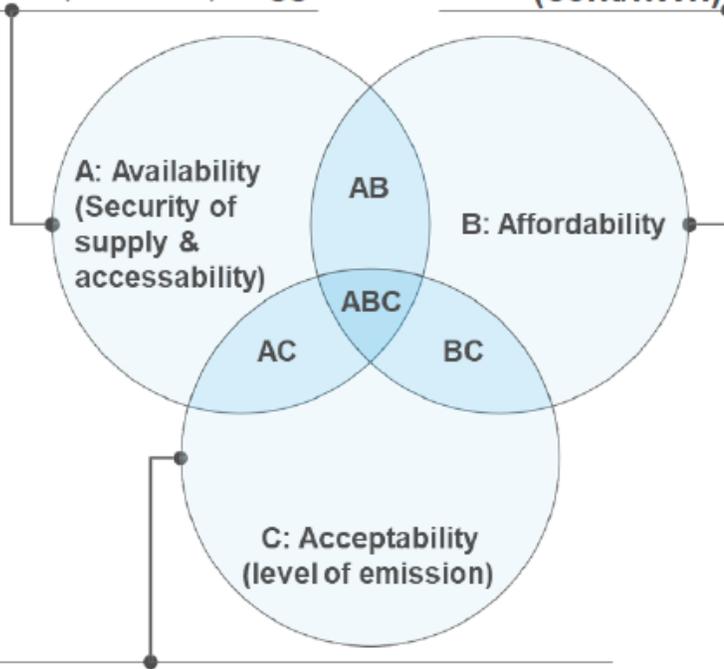
No	POWER PLANT TYPE	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
1	HYDRO	544	207	409	401	2.622	846	712	2.264	2.080	597	10.682
2	SOLAR	73	1.069	714	1.786	1.849	97	424	249	152	38	6.450
3	WIND			33	192	15	60					300
4	BIOENERGY	12	58	94	191	328	135	85	45	30	21	999
5	GEOTHERMAL	136	108	195	131	546	100	345	400	419	40	2.420
6	PUMP STORAGE					1.040			943	1.010	250	3.243
	Total	765	1.442	1.445	2.700	5.360	1.238	1.566	3.902	3.691	946	20.852

Courtesy of Dirjen EBTKE, Juni 2021

Penyediaan listrik harus memenuhi 3 prinsip (Trilemma Energi): Keamanan Pasokan, Keekonomian, dan Level Emisi

Ketersediaan sumber daya lokal merupakan faktor utama penentu keamanan pasokan dan langsung berkaitan dengan **kemajuan ekonomi nasional**. Indikator ketersediaan: potensi energi primer (**GJ/area**) tinggi.

Listrik merupakan enabler industri sehingga **keekonomian tarif listrik** menentukan **kemajuan perekonomian nasional**. Karakteristik yang diharapkan: **LCOE (cent/kWh)** rendah.



Level emisi per kapita Indonesia termasuk **rendah**.

Penurunan bagian dari Nationally determined contributions (NDCs) Indonesia pada global community, walaupun **tidak langsung** terkait *national interest* saat ini. Karakteristik pembangkit yang diharapkan: produksi **CO₂/kWh** rendah.

Area perpotongan pada diagram:

Area	Kondisi	Implementasi di Indonesia
AB	Pasokan energi primer aman & terkendali, harga terjangkau, namun belum memenuhi kriteria emisi	PLTU Batubara
BC	Harga terjangkau dan rendah emisi, namun keamanan pasokan tidak terjamin	EBT Intermittent: solar PV
AC	Pasokan terjamin dan terkendali serta rendah emisi, namun mahal	Geothermal
ABC	Kondisi ideal yang diinginkan: listrik yang suplainya terjamin, murah, dan rendah emisi.	?

Sumber: PLN, 2021

Courtesy of Rektor Unhan, September 2021



Pengembangan Panas Bumi di Wilayah Timur

Penugasan Kepada BUMN



Penyederhanaan Perizinan

Penugasan Survei Pendahuluan dan Eksplorasi



Geothermal Fund + Government Drilling

Upaya Terobosan Pemerintah

PEMBIAYAAN INFRASTRUKTUR ENERGI TERBARUKAN DAN PEMBERIAN INSENTIF

Skema Pembiayaan Infrastruktur ET :

1. Swasta
2. Kerja sama Pemerintah dengan Badan Usaha (KPBU), Public-Private Partnership (PPP)
3. Swasta – BUMN/BUMD
Penyertaan modal Negara (PMN)
4. *Joint Venture* (Swasta – BUMN/BUMD)
5. APBN/APBD

Pembiayaan/Fasilitas:

- PISP (Pembiayaan Infrastruktur Sektor Panasbumi)
- GEUDP (Geothermal Exploration Upstream Development Project)
- GREM (Geothermal Resource Risk Mitigation)

Pembiayaan/Fasilitas lainnya:

SDG Indonesia One and Subsidized Loans through PT SMI Green Bond /Sukuk

Insentif

Insentif Fiskal:

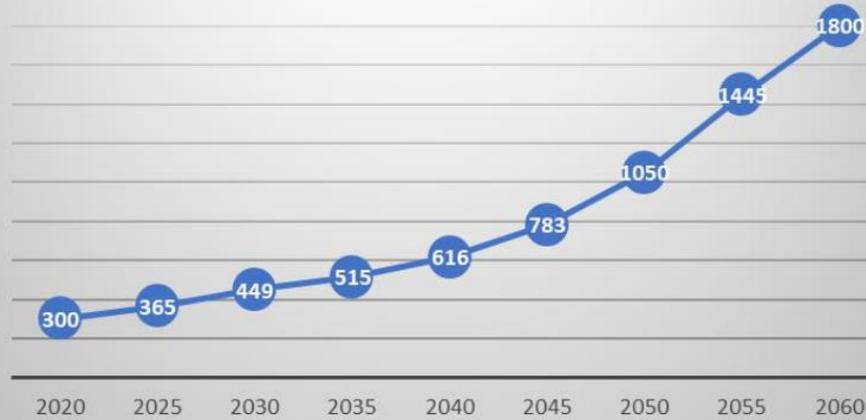
- **Tax Allowance**
Pengurangan 5% PPh selama 6 tahun
- **Import Duty Facilitation**
 - Pembebasan Bea Masuk 2 tahun untuk Mesin dan Peralatan.
 - Pembebasan tambahan 2 tahun untuk bahan baku untuk perusahaan yang menggunakan mesin dan peralatan lokal (min.30%)
- **Tax Holiday**
5-20 tahun keringanan pajak, maks. 100% pengurangan pajak penghasilan untuk investasi min. Rp 500 miliar
- **Mini Tax Holiday**
Keringanan pajak 5 tahun, maks. Pengurangan pajak penghasilan sebesar 50% untuk investasi Rp 100 - 500 miliar

Insentif Non-Fiskal:

Insentif untuk Biofuel oleh BDPDKS

Courtesy of DirPabum EBTKE, September 2021

TOTAL TWh

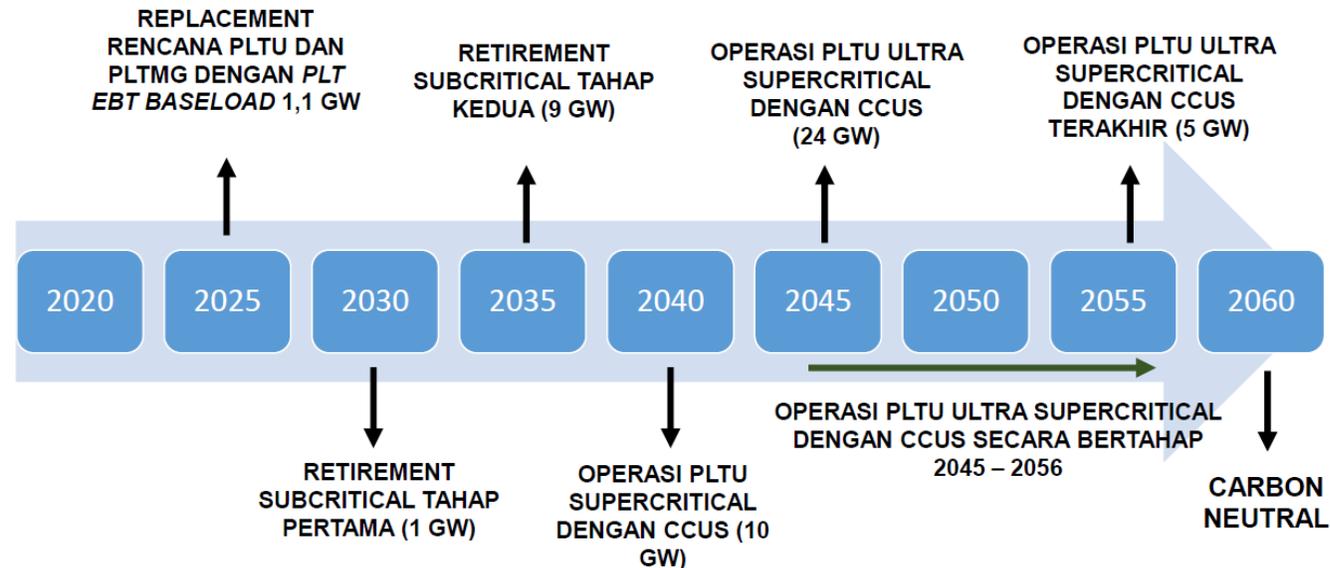


- ❖ Produksi energi nasional sebagai *basecase* diperkirakan akan mencapai 300 TWh.
- ❖ Luncuran dari Proyek 35 GW didominasi oleh fossil fuel mengingat proyek tersebut dirancang pada tahun 2015, dan akan beroperasi sampai dengan PPA berakhir dengan perkiraan tambahan kapasitas baru sebesar 21 GW (120 TWh),
- ❖ Proyeksi produksi energi tahun 2060 akan menjadi 1.800 TWh. Ada gap energi sebesar 1.380 TWh dengan kondisi setelah seluruh Program 35 GW beroperasi.
- ❖ Sisa gap sebesar 1.380 TWh (kapasitas daya sekitar 230 GW) akan diisi dengan pembangkit EBT.

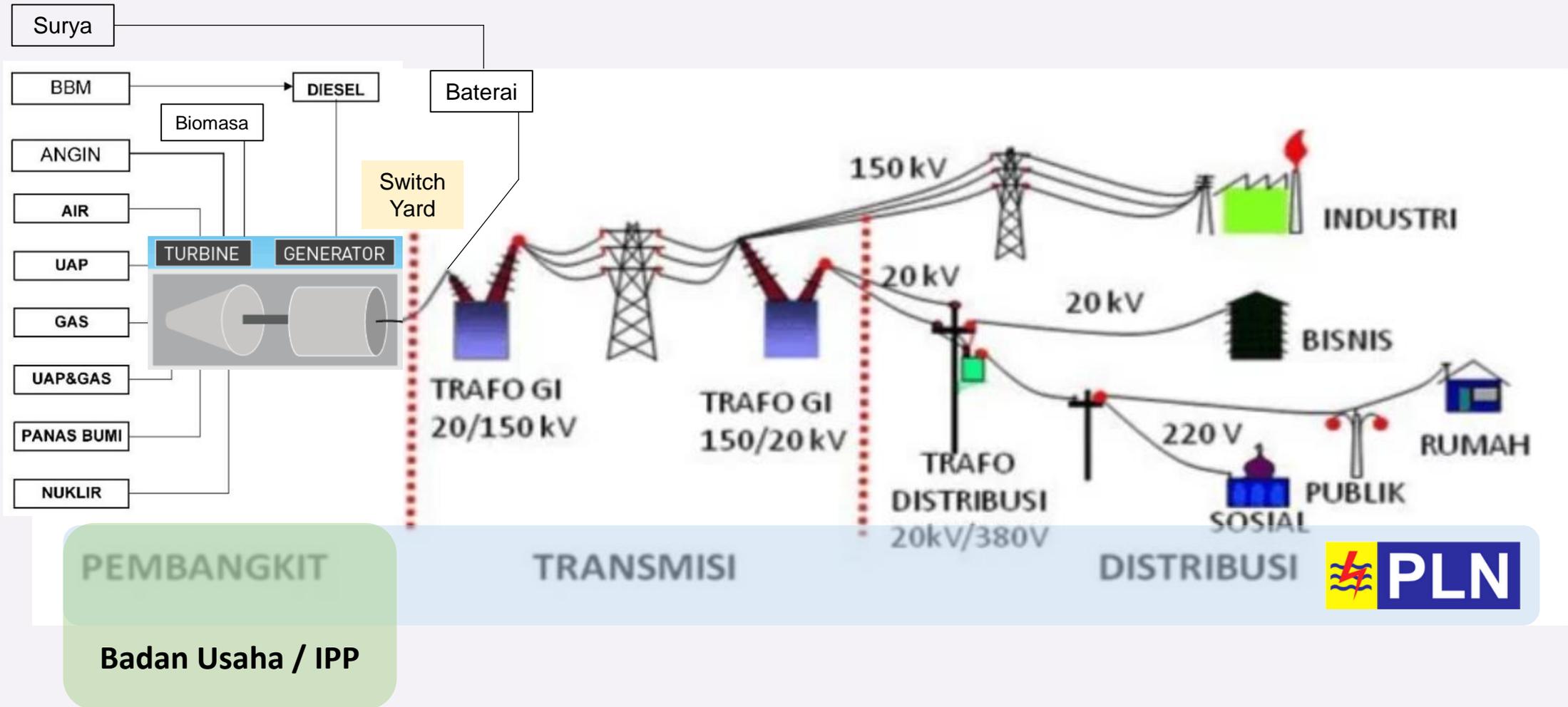
Courtesy of DirMPE PLN, September 2021

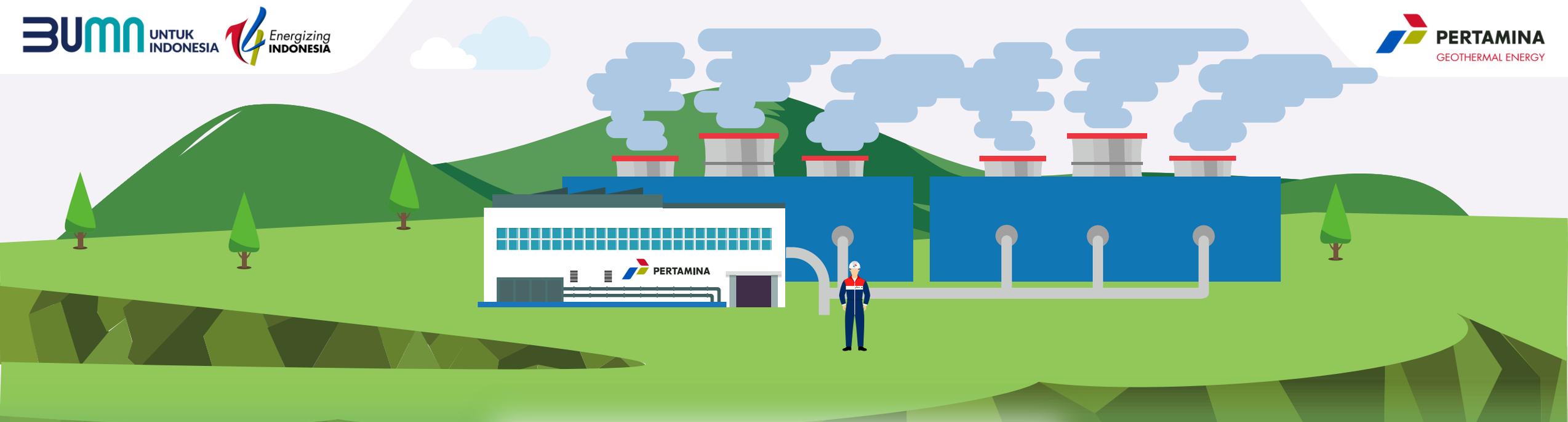
PLN's decarbonization commitment

- No new coal plants awarded after 2022
- 23% renewables mix by 2025
- Exit from coal-fired plants by 2056
- Achieve carbon neutrality by 2060



Pembangkitan Energi Listrik





Panas Bumi



Reykjavik Using Fossil Fuels

Kota Reykjavik (Iceland) dengan bahan bakar minyak & batubara



Reykjavik Using Geothermal

Kota Reykjavik (Iceland) setelah pemanfaatan energi panasbumi (geothermal)



Natural Resources

Renewable Resources



 GEOTHERMAL STEAM



 GROUND WATER



 SEA WATER WELLS



 HOT WATER (POTABLE)



 COLD WATER (POTABLE)



 POWER/ELECTRICITY



 CO2



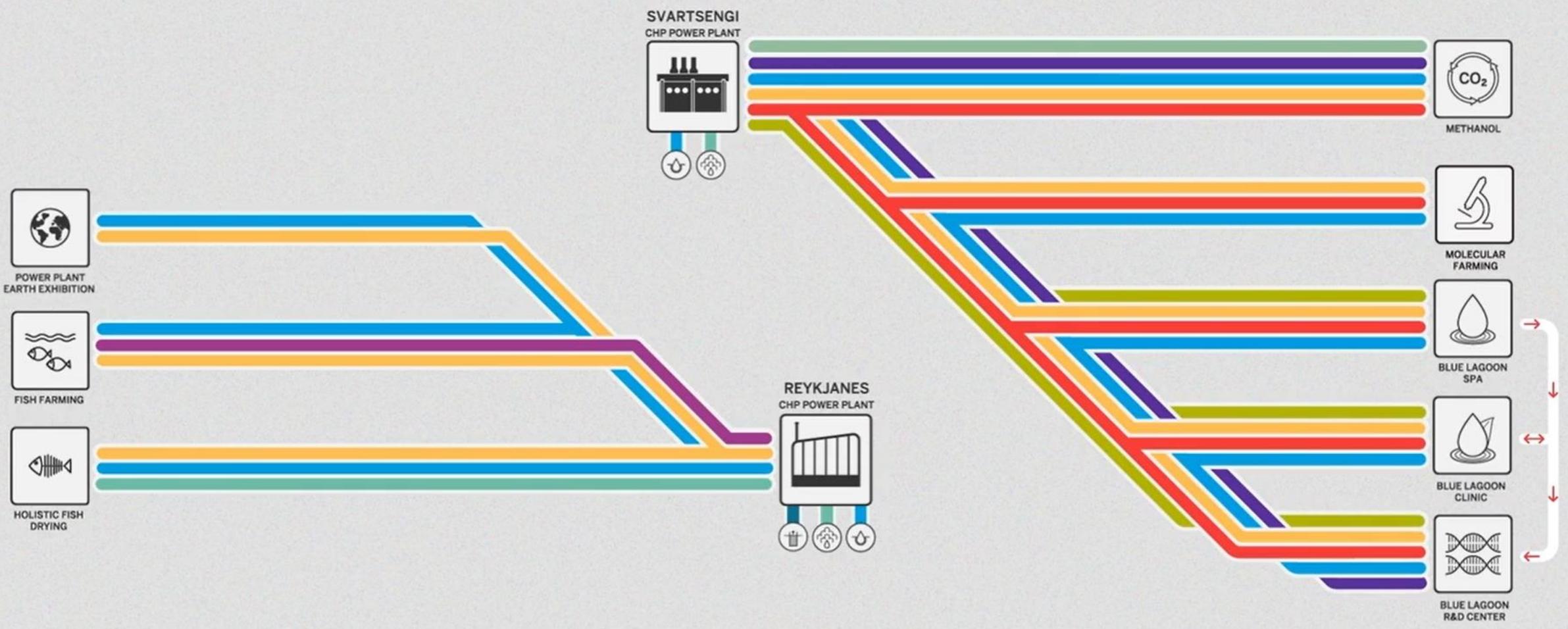
 PURE/LAVA FILTERED SEA WATER



 STEAM



 GEOTHERMAL WATER/BRINE

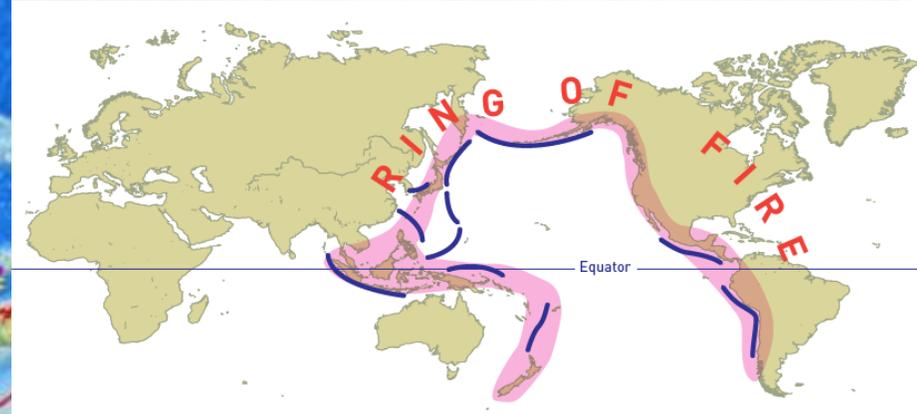
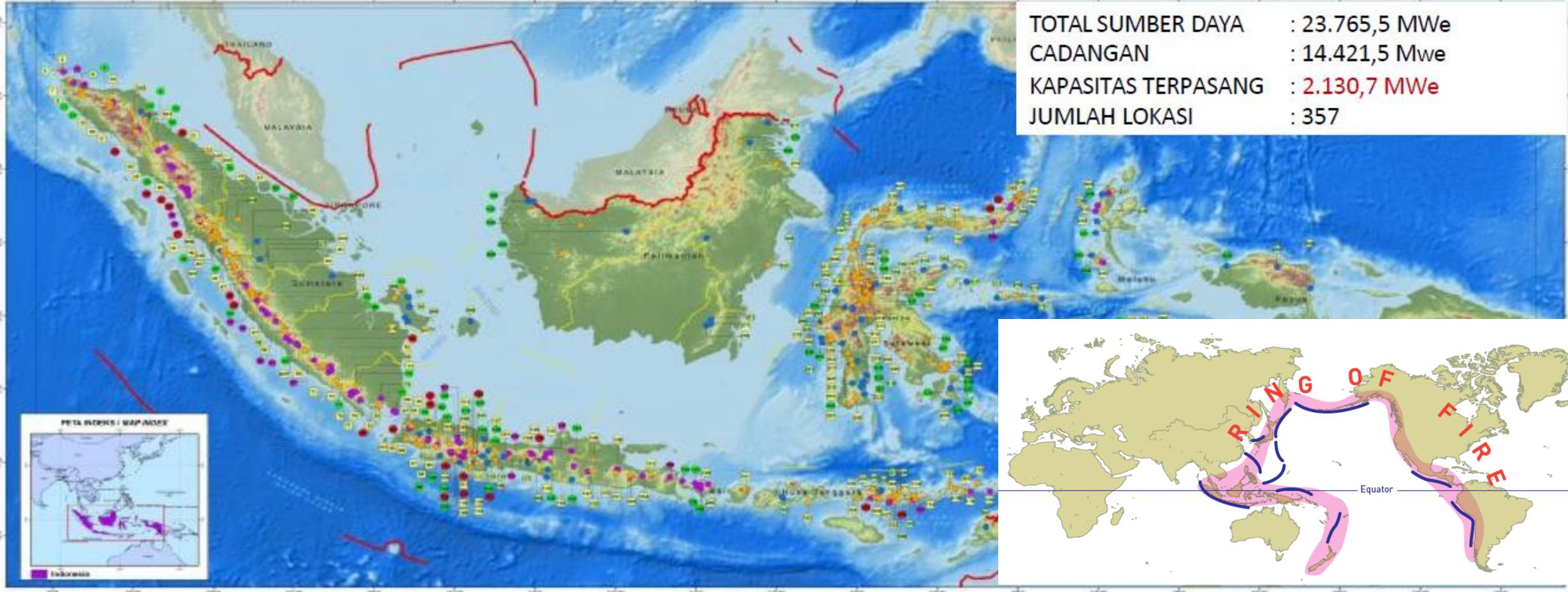


DISTRIBUSI DAN SUMBER DAYA PANAS BUMI INDONESIA

BADAN GEOLOGI
GEOLOGICAL AGENCY

 KEMENTERIAN ENERGI DAN SUMBER DAYA MINERAL
MINISTRY OF ENERGY AND MINERAL RESOURCES

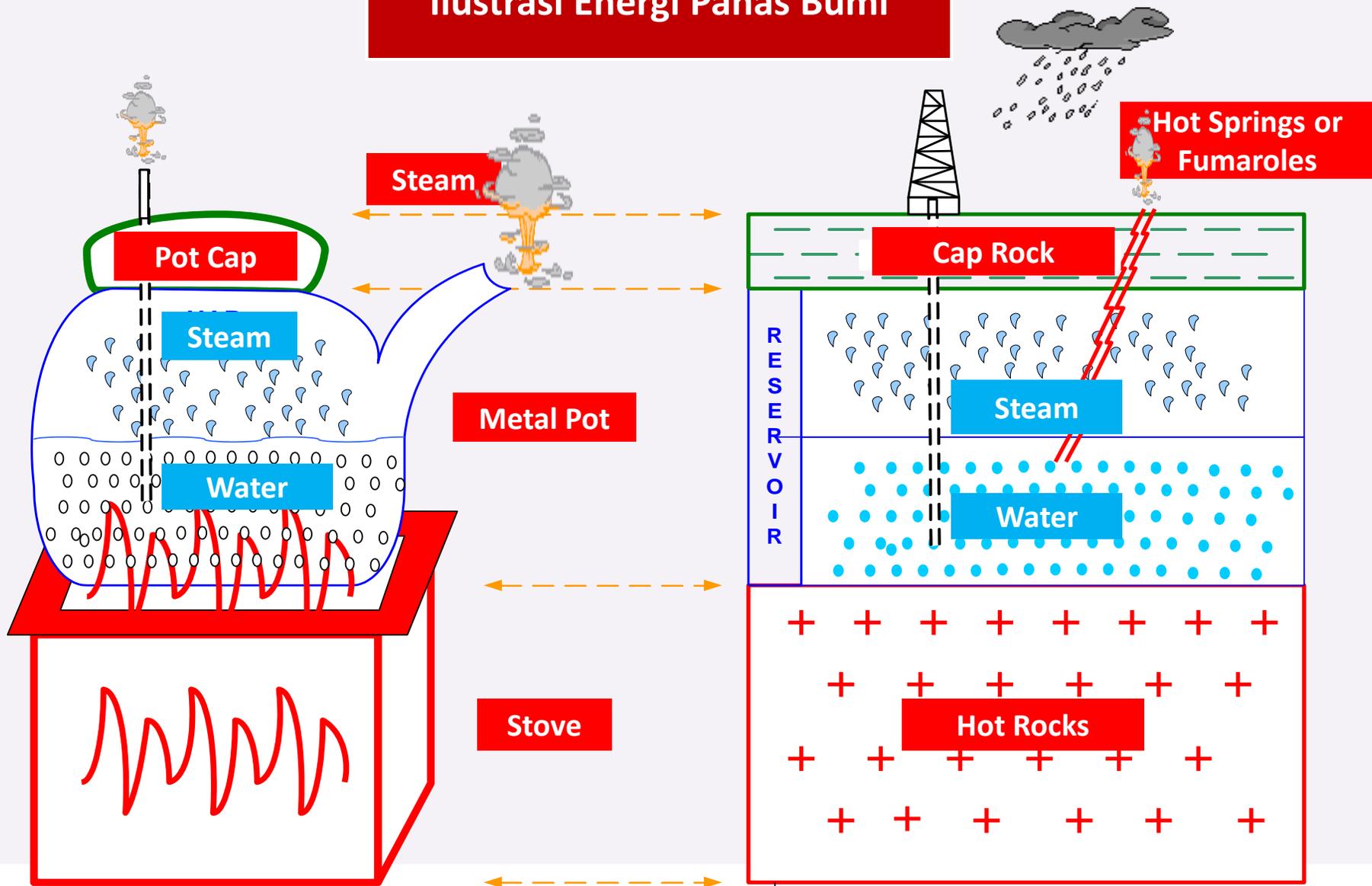
PUSAT SUMBER DAYA MINERAL BATUBARA DAN PANAS BUMI
CENTER FOR MINERAL COAL AND GEOTHERMAL RESOURCES



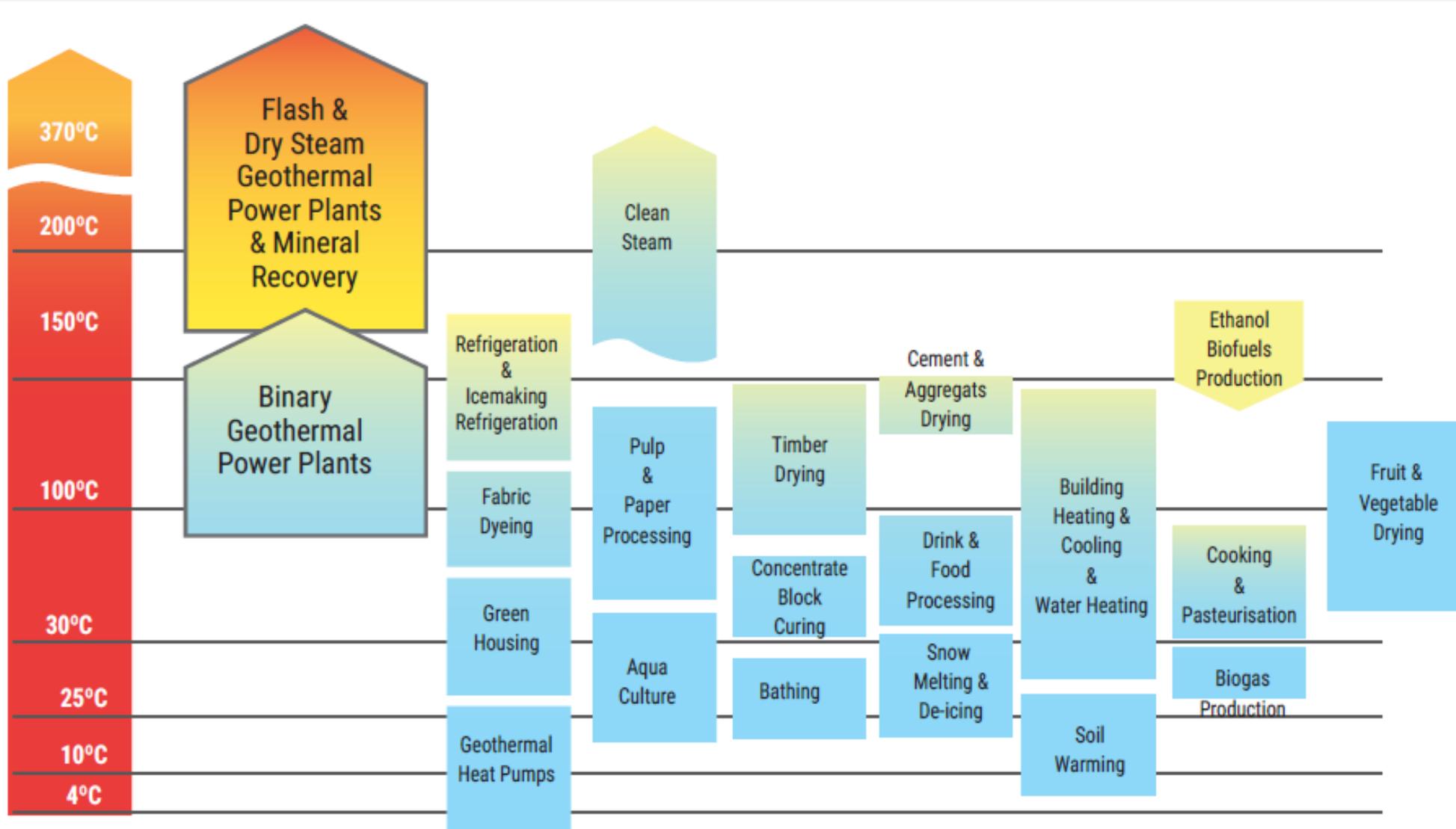
Sumber: Badan Geologi, Desember 2020

Courtesy of Rektor Unhan, September 2021

Ilustrasi Energi Panas Bumi

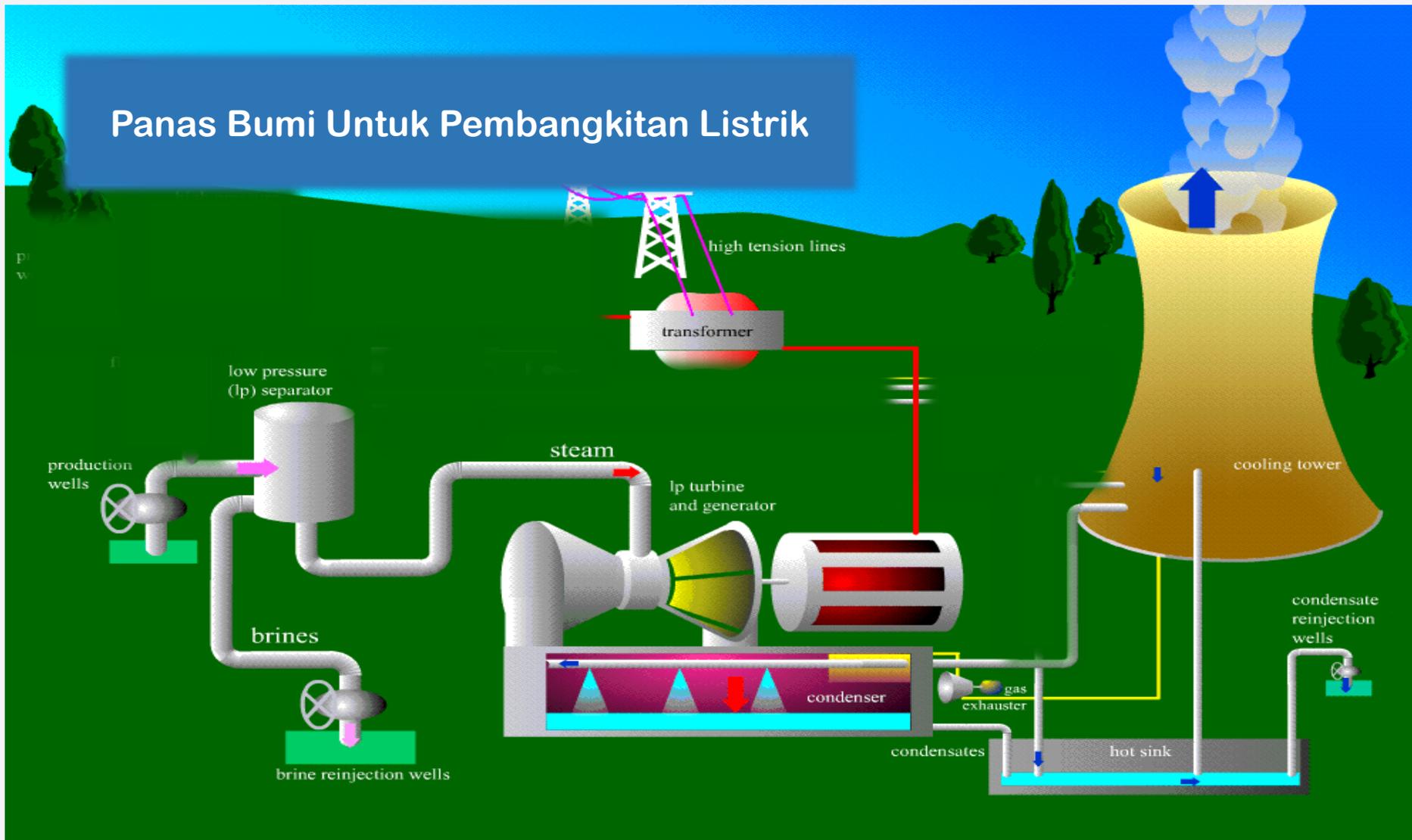


Pemanfaatan Energi Panasbumi

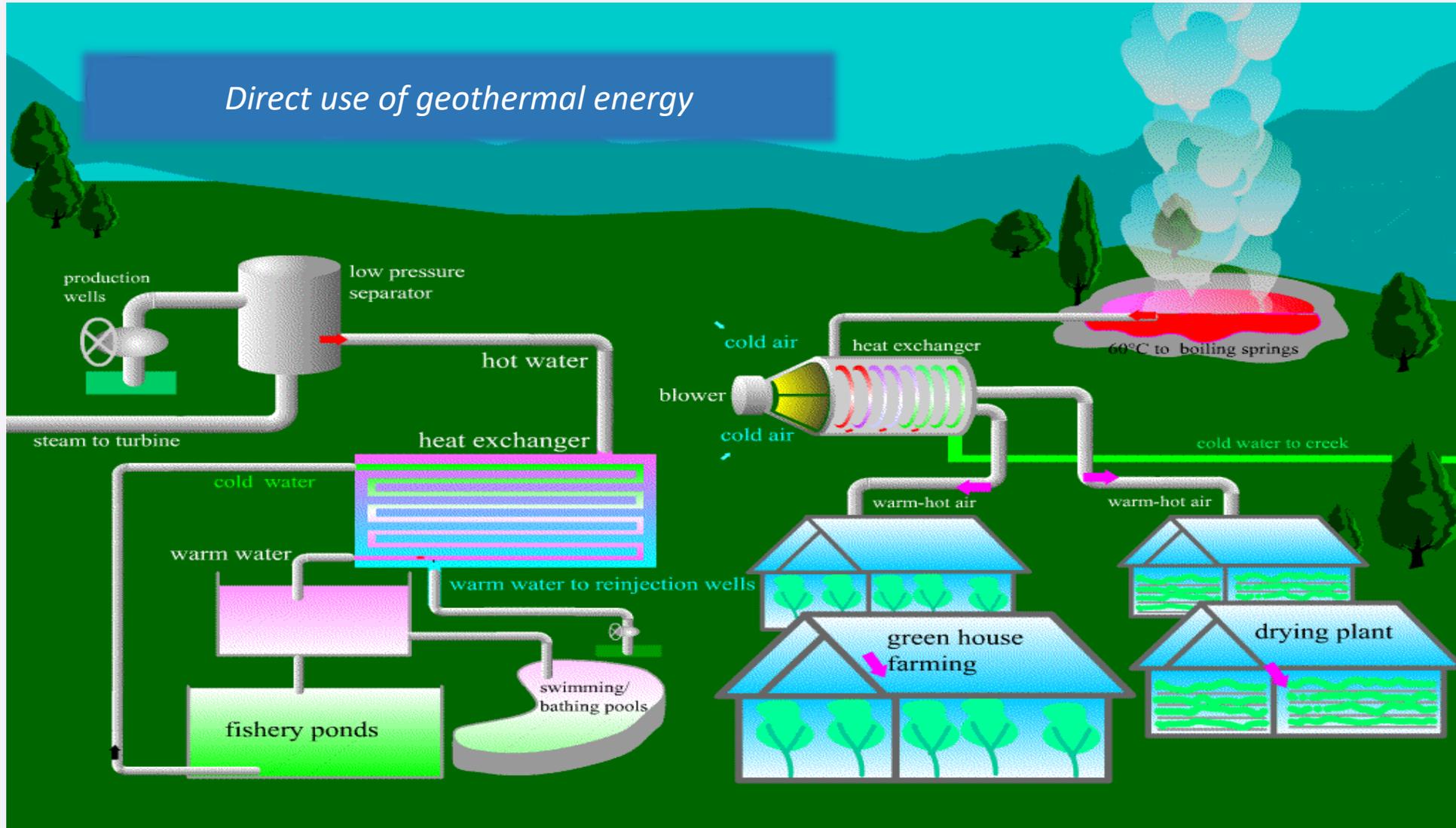


Sumber: ScienceDirect.com

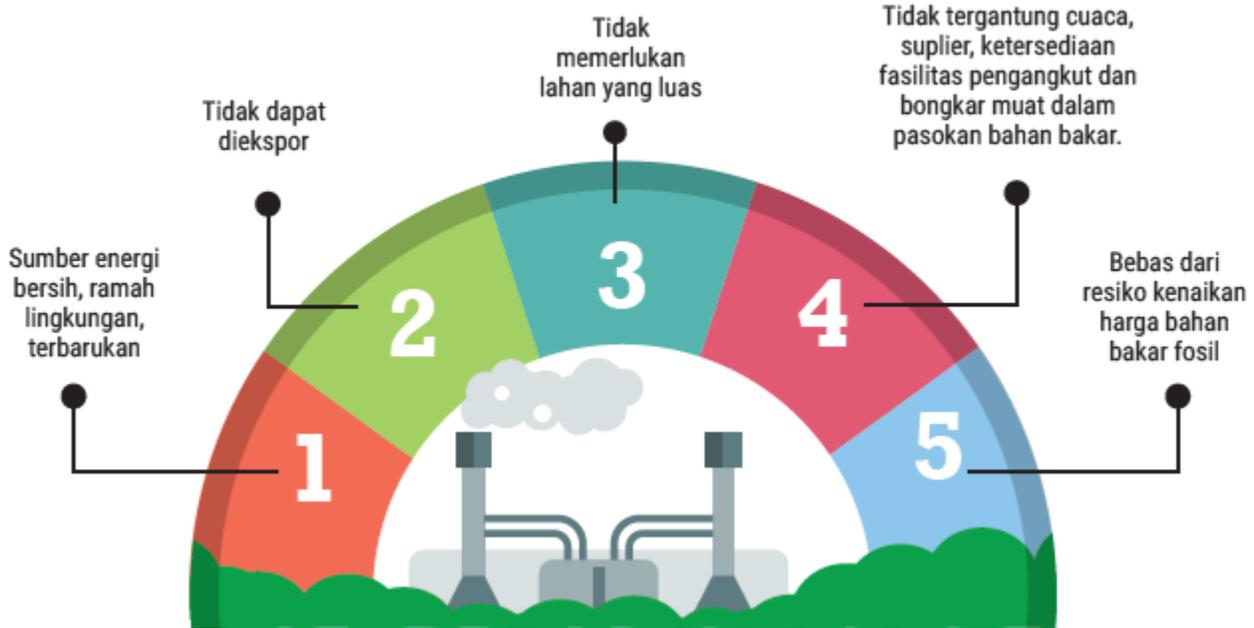
Pemanfaatan Panas Bumi Secara Tidak Langsung



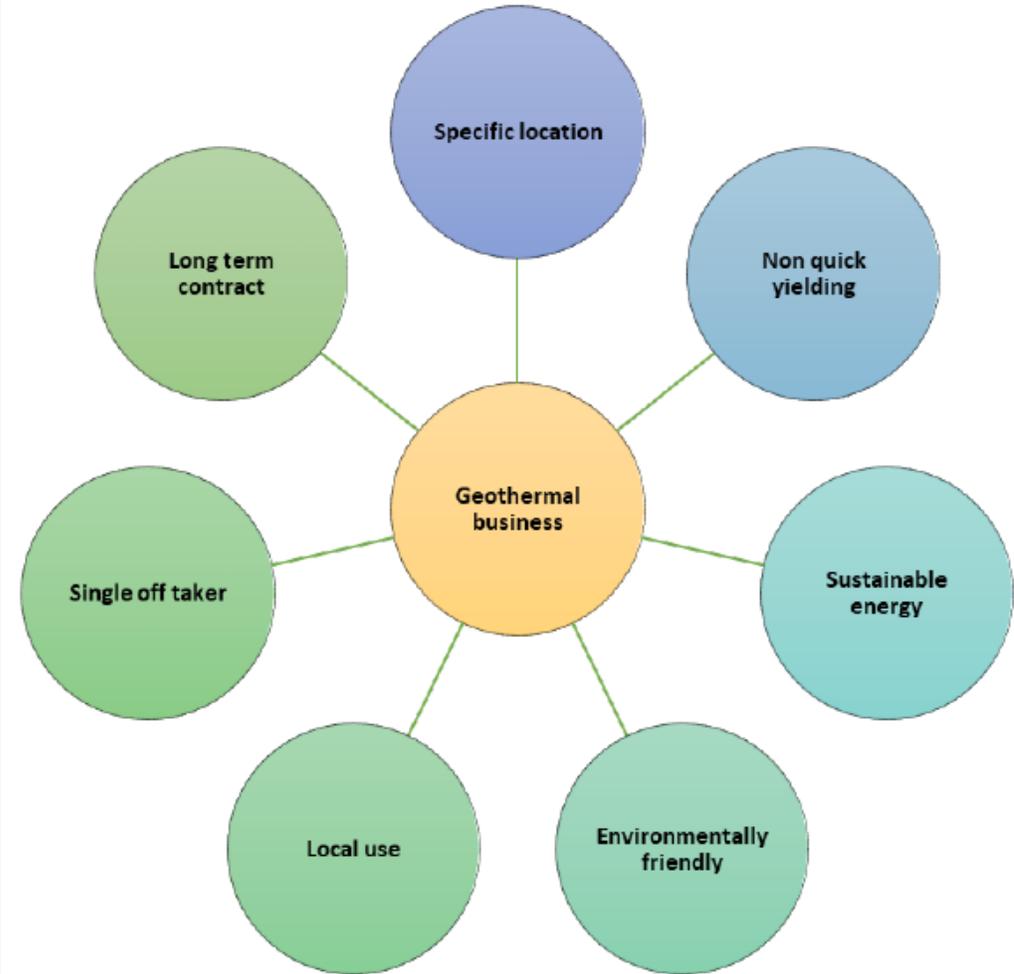
Pemanfaatan Panas Bumi Secara Langsung



Karakteristik Energi Panas Bumi

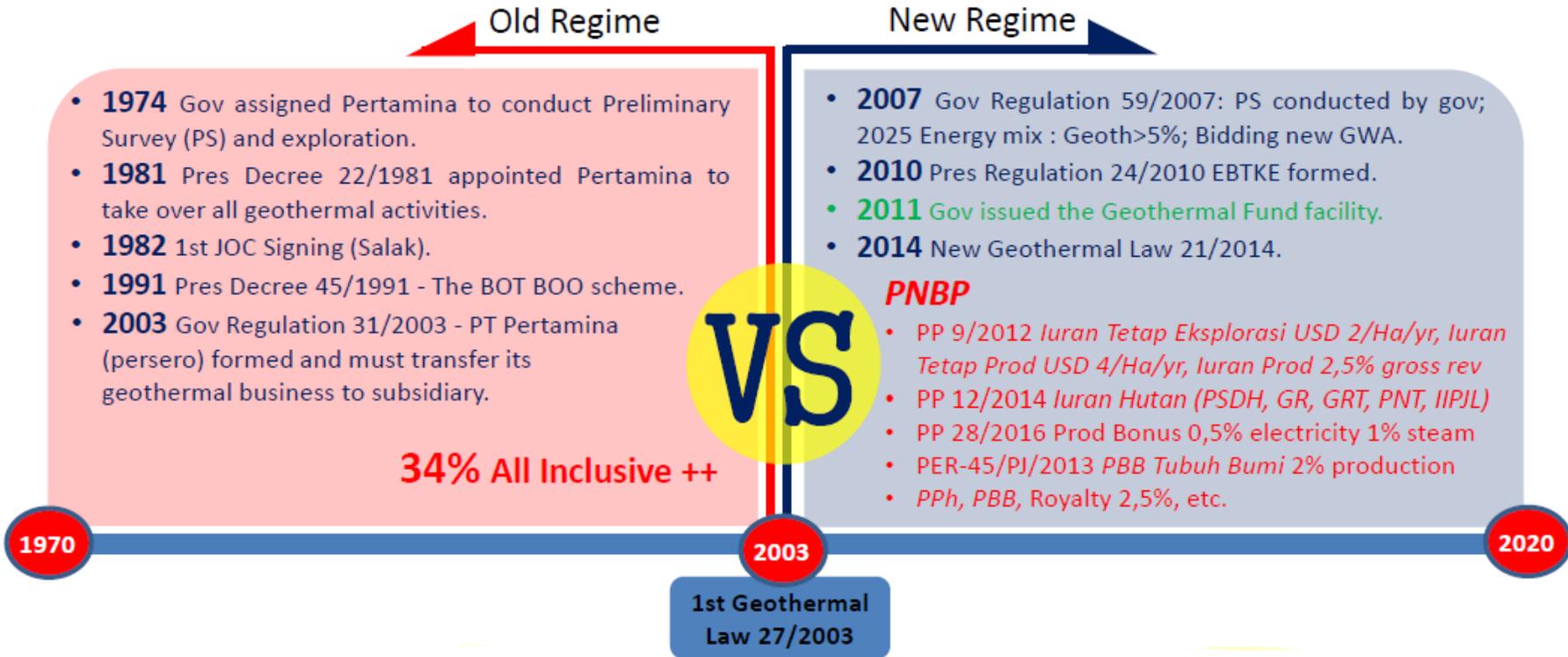


Geothermal Business Characteristics



Sumber: Timilsina (2020)

Courtesy of Rektor Unhan, September 2021



Courtesy of Jati Permana (PGE), Juli 2020



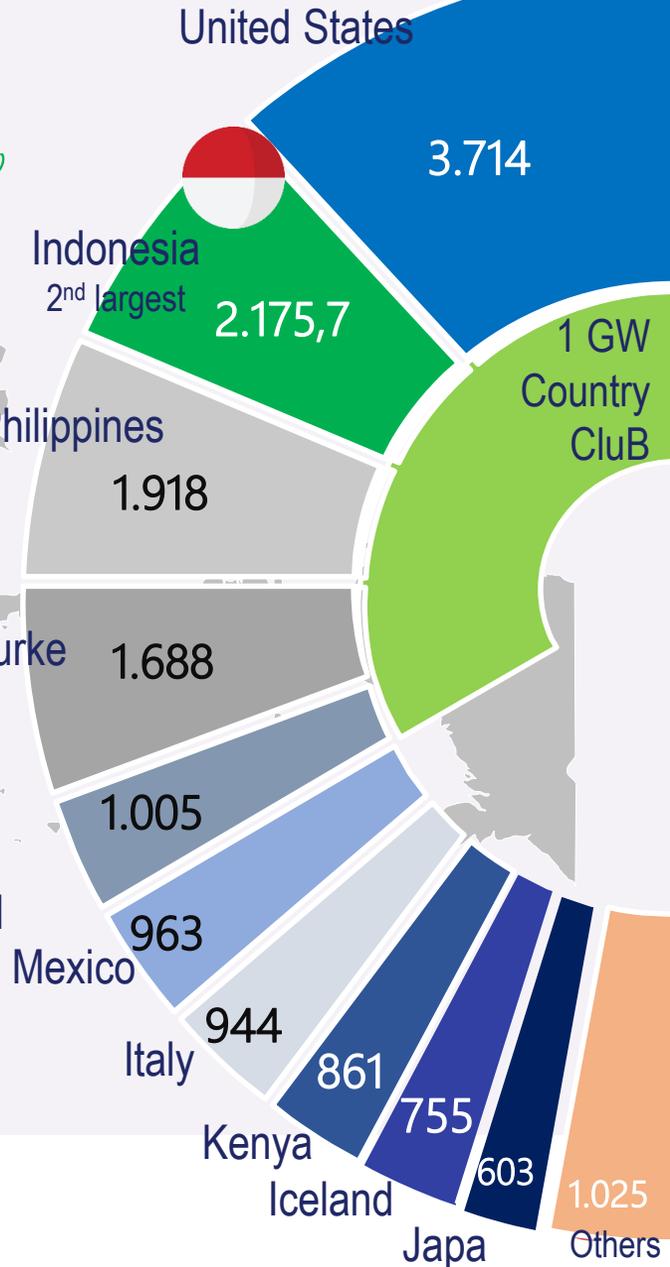
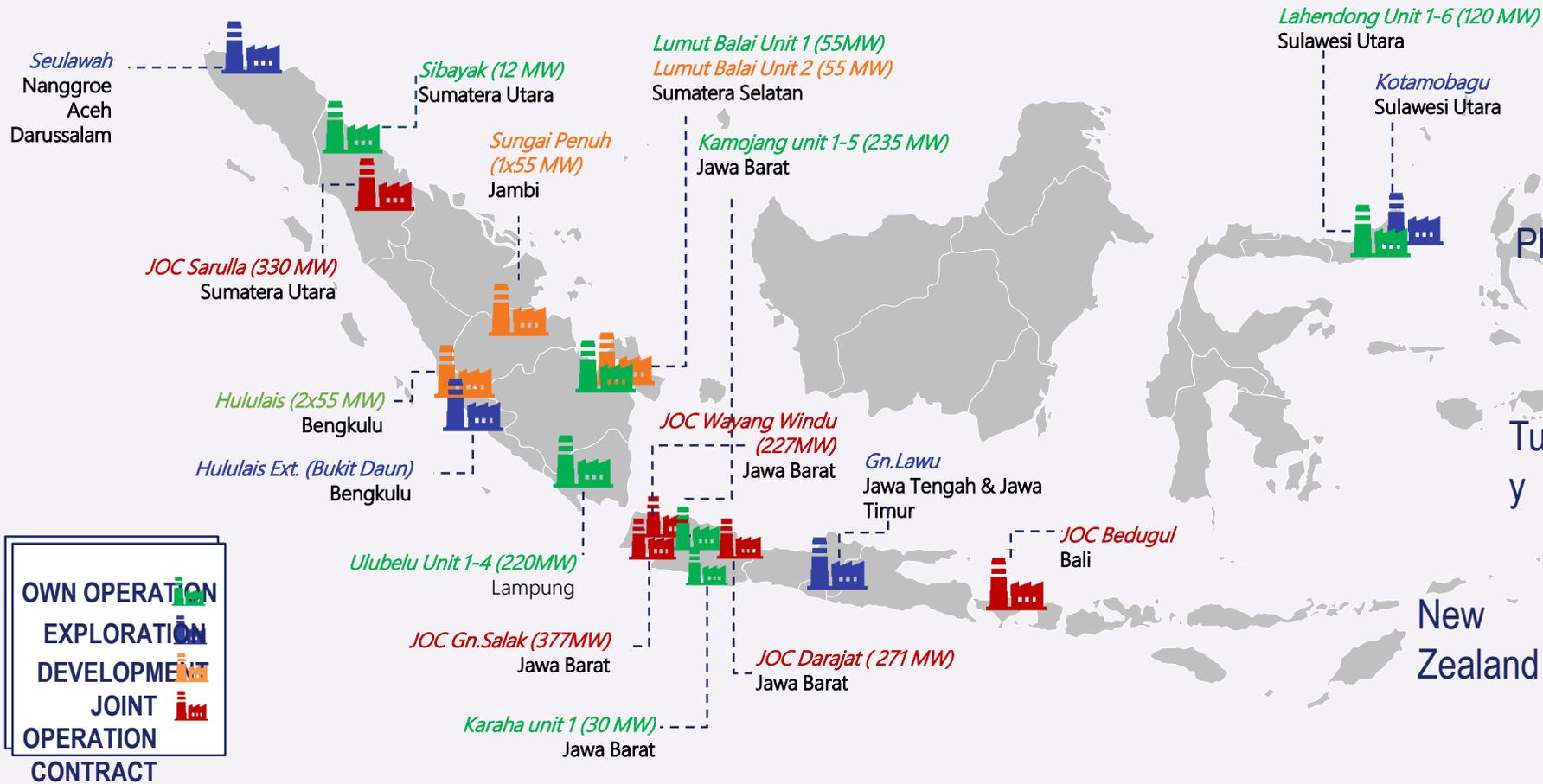
Geothermal License :

1. Kuasa Pengusahaan
2. Joint Operation Contract
3. Izin Pengusahaan Sumber Daya Panas Bumi
4. Izin Panas Bumi



WILAYAH KERJA

PGE mengelola 15 Wilayah Kerja dengan total kapasitas terpasang dalam Wilayah Kerja PGE sebesar 1.877 MW (Operasi Sendiri 672 MW & Kontrak Operasi Bersama 1.205 MW)



OWN OPERATION
EXPLORATION
DEVELOPMENT
JOINT OPERATION
CONTRACT

88% Dari kapasitas terpasang Panas bumi di Indonesia berada dalam Wilayah kerja PGE

37 Years of Geothermal Generation in Indonesia by Pertamina

Historical Small Scale Geothermal Power Plants – Back Pressure Turbine (Monoblock)

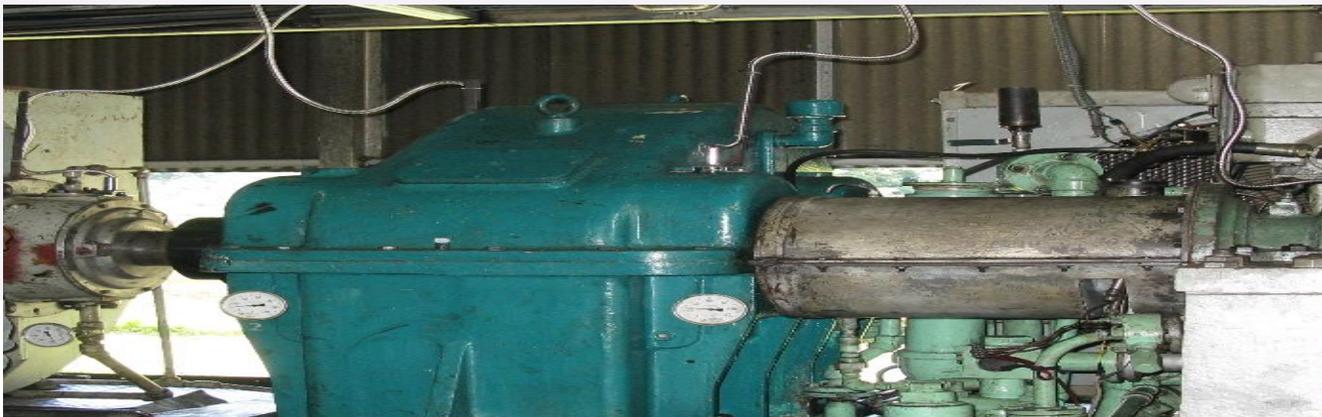
- ❑ **KAMOJANG (KMJ)** - The Monoblock has been operated from 1978-1988 with 250 kW of electricity generation.
 - The steam was supplied from five production wells – KMJ-6, KMJ-7, KMJ-8, KMJ-9 and KMJ-10.



John W. Lund, "The Basics of Geothermal Power Conversion", Geo-Heat Center, Oregon, USA

- The Monoblock has been operated in 1980 at Dieng geothermal field with 2000 kW (2 MW) of electricity generation.
- In 1995, the Monoblock has been moved to Sibayak field and successfully operated from 1996 to 2009.

❑ **Sibayak (SBY)**

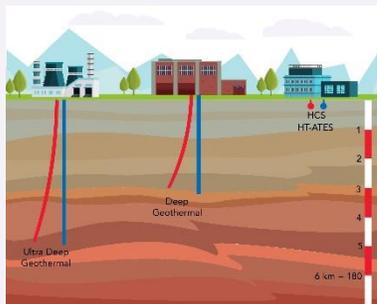


TURBINE	
Manufacturer	: Westinghouse / 1942
Model / Type	: Back Pressure
Speed	: 6543 Rpm
Rating (kW/HP)	: 2000 / 2680
Blade Stage	: 5
Steam Flow	: ± 36 t/h
Inlet Pressure	: 6.89 bar

EXPLORASI

Notice Of Resource Confirmation (NORC)

Head of Agreement



Survei 3G

EKSPLORASI

1-2 Tahun

2-3 Tahun

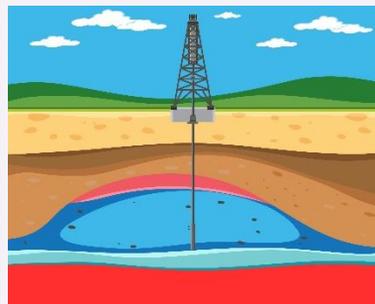
EXPLOITASI

Notice Of Intend to Develop (NOID)

Ground Breaking

Proses Negosiasi & Power Purchase Agreement

COD



EKSPLOITASI



FEED

2-3 Tahun



EPCC



PRODUKSI

> 30 Tahun

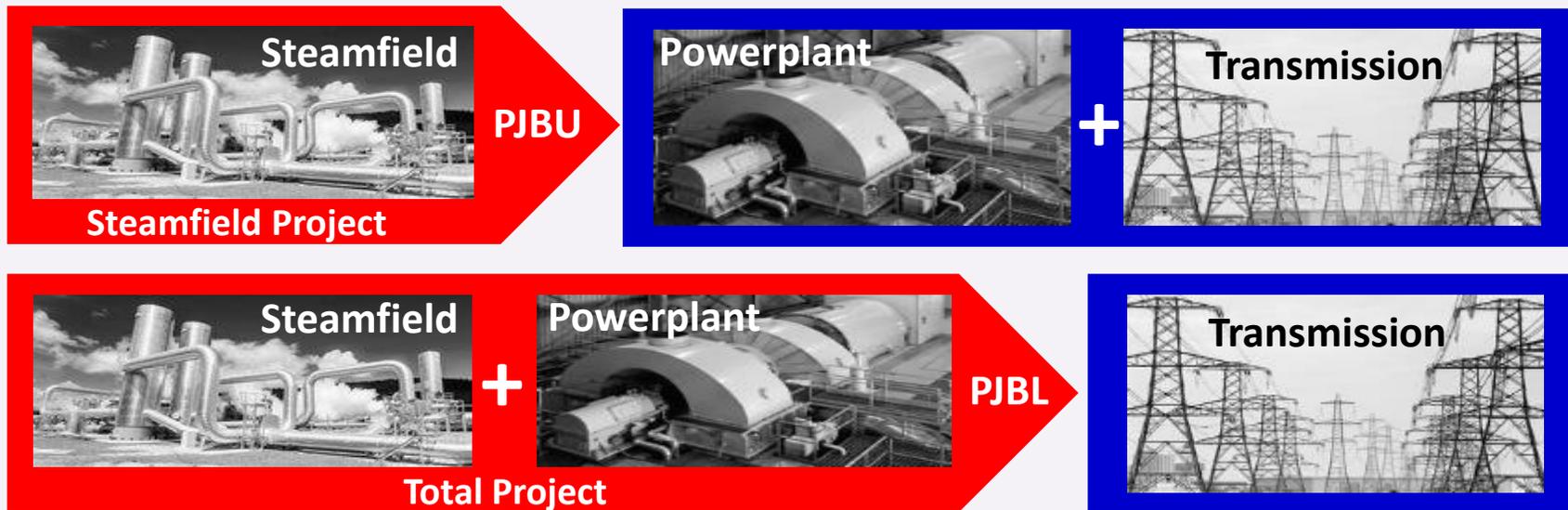
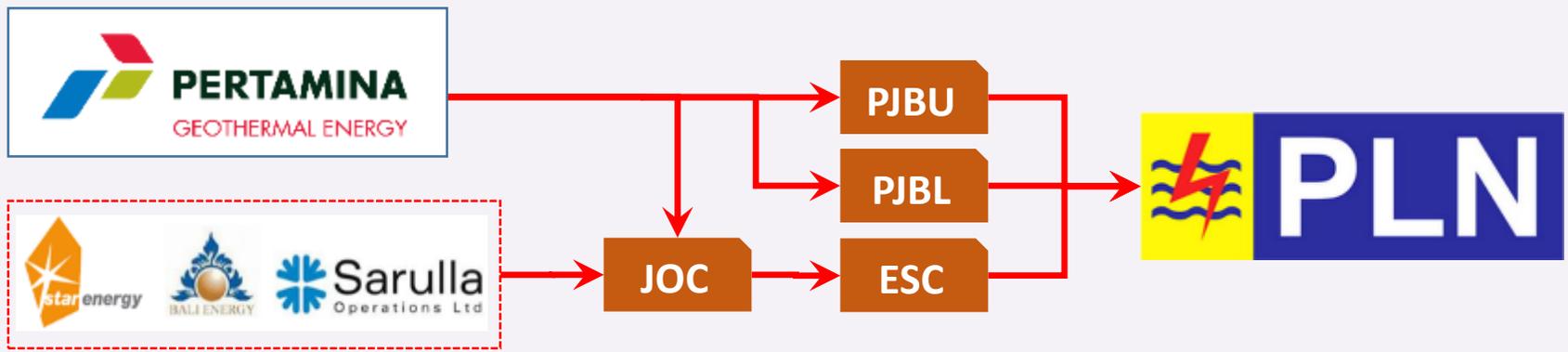
KEGIATAN

- Perijinan : Ijin Lokasi, IPPKH, IMB, SIPPA, AMDAL, dll.
- Persiapan Lokasi (Pembebasan Lahan)
- Pemboran Sumur Eksplorasi
- Infrastruktur dan Konstruksi.
- Survey Geologi, Geokimia, Geo Fisika

- Perijinan : Ijin Lokasi, IPPKH, IMB, SIPPA, AMDAL, dll.
- Persiapan Lokasi (Pembebasan Lahan)
- Pemboran Sumur Eksplorasi dan Reinjeksi
- Infrastruktur dan Konstruksi PLTP, IUPTL.

- Operation & Maintenance (O & M)
- Manajemen Reservoir
- Pemboran Sumur make up

Skema Bisnis





BEYOND ENERGY

Multi-Track Development Geothermal Energy



Brines to Power

- Potentially 200 MW in various area
- Incremental development
- Expansion of a low temp energy utility
- Capex efficient



HYDROGEN

- 100 kg/day in Ulubelu Area
- Green hydrogen production through water electrolysis (H₂O)
- Plan to be marketed to refineries/chemical plants or as raw material for making green methanol



Agrobusiness

- Commercialization of agro resources (cloves, coffee, flowers, mushrooms, vegetables, livestock and essential oil production)
- Optimization of low temp energy (steam/brine) and CO₂, as well as economic empowerment of the surrounding community



Geothermal Tourism

- Utilization of high tourism potential in the Lahendong field
- Development of tourist objects with the concept of geothermal parks (hot springs, manifestation tours, and geothermal education)



Silica Extraction

- Production of high quality silica from an extraction plant with a capacity of 7,000 tons / year in Hululais field



H₂S Removal & CO₂ Liquefaction

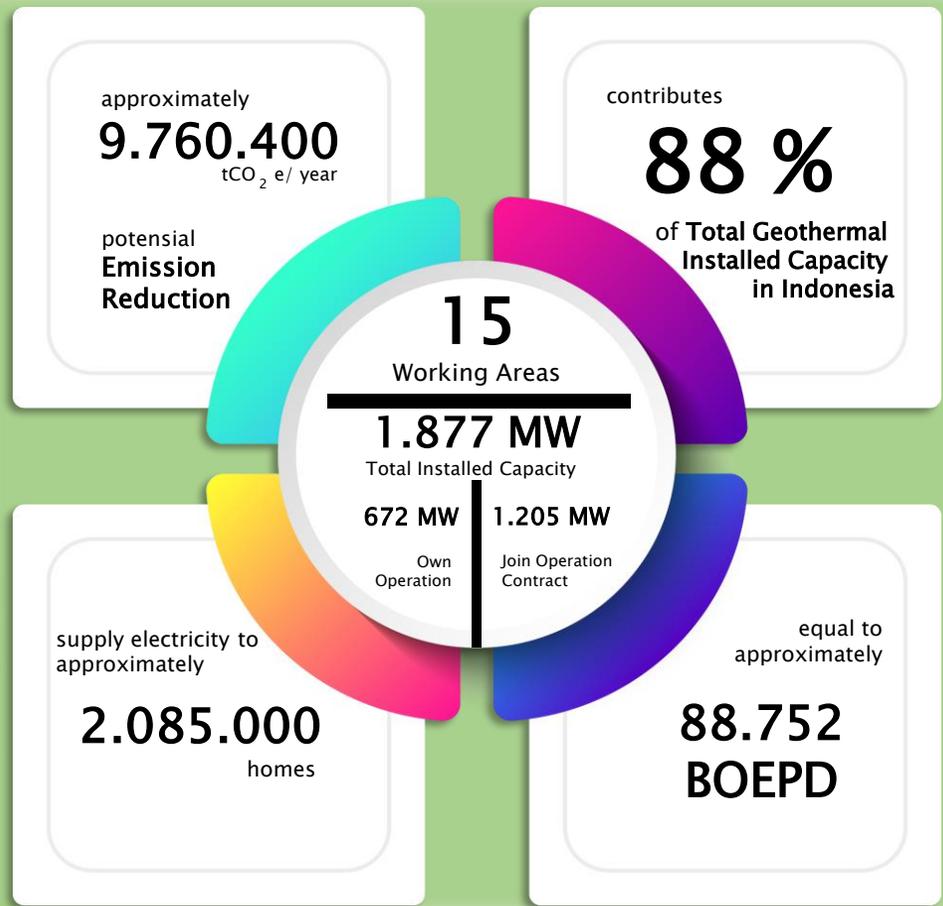
- Reducing H₂S & CO₂ emission
- Dry Ice production

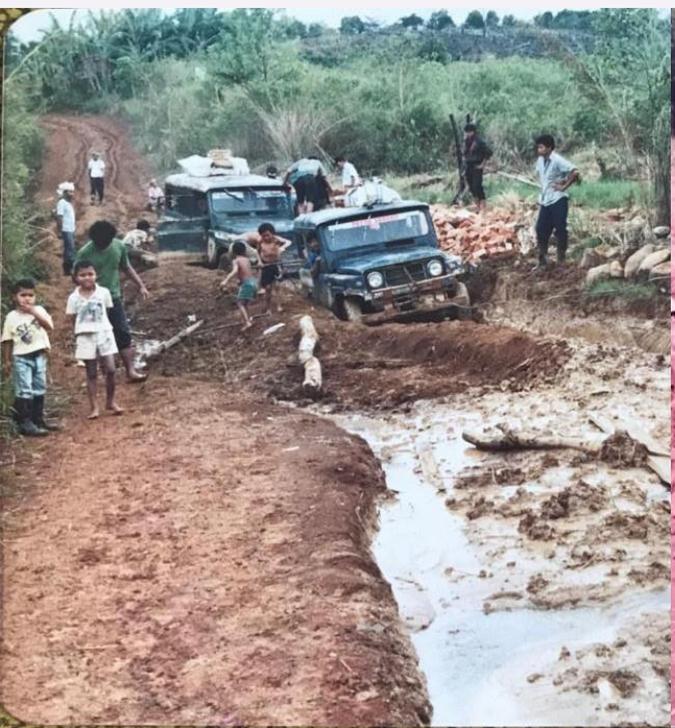


CO₂ Methanol

- Reducing CO₂ emission
- As a fuel mixture (Pertamina's A20 program) or for export markets

Multiplier Effect





Before



After

Environment, Social & Government (ESG)



ENVIRONMENT

- Green power generator : 672MW
- CO2/emisi reduction : 9.760.400 tCO e/ year
- Biodiversity : PKEK Kamojang, Domba Garut, Bunga Krisan, Kambing Saburai, Kera Yaki
- Circular economy/waste management : Bank Sampah



SOCIAL

- Social economic dev. : Local Hero
- TKDN : 53% (year 2020)
- Safety & Wellbeing : Covid19 education, mitra binaan
- Inclusiveness in employment : women worker in operation area



GOVERNANCE

- Corp. Governance : GCG score 94,906%
- Anti Bribery Management System : Sertifikasi ISO 37001-2016
- Asosiasi Profesi : API

Biodiversity



JAVANESE EAGLE CONSERVATION

Kamojang Area,
West Java

GARUT LAMB BREEDING

Kamojang Area,
West Java



CELEBES CRESTED MACAQUE (YAKI) CONSERVATION

Lahendong Area,
North Sulawesi

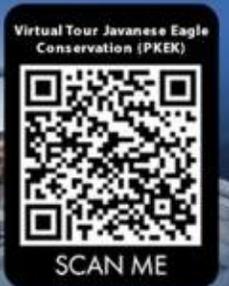
SABURAI GOAT BREEDING

Ulubelu Area,
Lampung



CHRYSANTHEMUM FLOWER CONSERVATION

Lahendong Area,
North Sulawesi



    pge.pertamina



10 PROPER EMAS

Hingga saat ini, PGE telah memperoleh PROPER EMAS 10 kali



83,9

Rata-rata Hasil studi Indeks Kepuasan Masyarakat (IKM) tahun 2020

Capaian ComDev



21 anak

Mantan anak jalanan yang telah

dibina dan diberdayakan melalui wadah "Anak Punk Wani Robah"



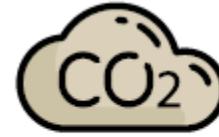
1.746 balita

Jumlah total balita yang menerima

Pemberian Makanan Tambahan (PMT) dari PGE Area Kamojang

89 Ton

Sampah yang telah dikelola dan direduksi melalui program bank sampah sejak dibentuk tahun 2014



Pengurangan emisi sebesar **0,052704 ton CO₂/tahun** dari implementasi SIPHO



Rp104,8 Juta/tahun

Omzet rata-rata petani kentang Paus Pertato

43.613 orang



Total pengunjung Pusat Konservasi Elang Kamojang (PKEK) (2014 - 2020)

Eco-Village

- Kampung Sawahlega
- Kampung Gekbrong
- Kampung Nangewer



220 orang

Petani kopi telah memanfaatkan inovasi "Geocoffee"



SROI 1:3,47

Program Pengembangan Bibit PAUS PERTATO, yang artinya manfaat yang diperoleh masyarakat mencapai 3,47 kali dari nilai investasi

Tujuan Pembangunan Berkelanjutan



Peningkatan Kualitas Pendidikan



Peningkatan Kualitas Kesehatan



Pembangunan Infrastruktur dan Sosial

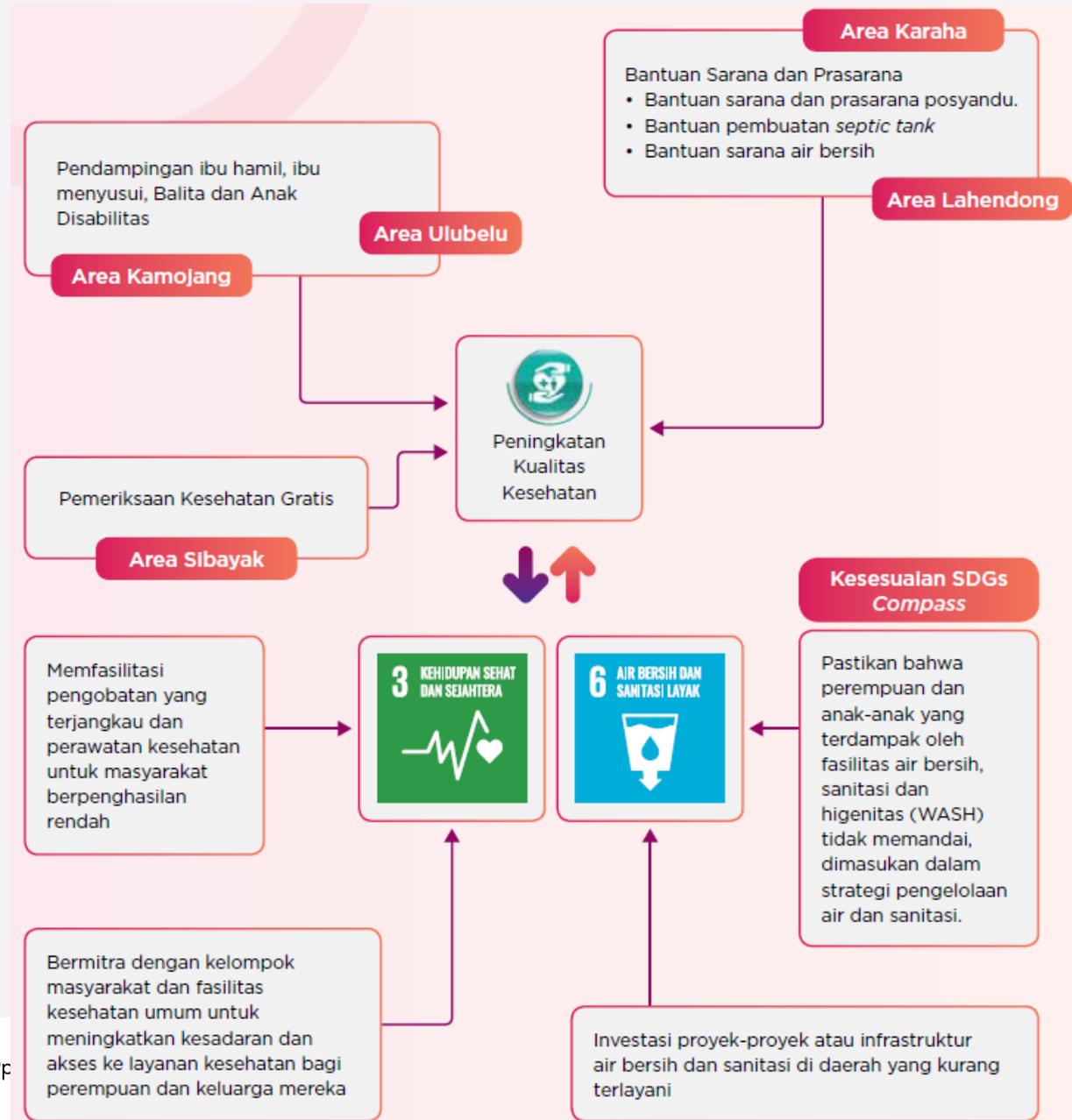
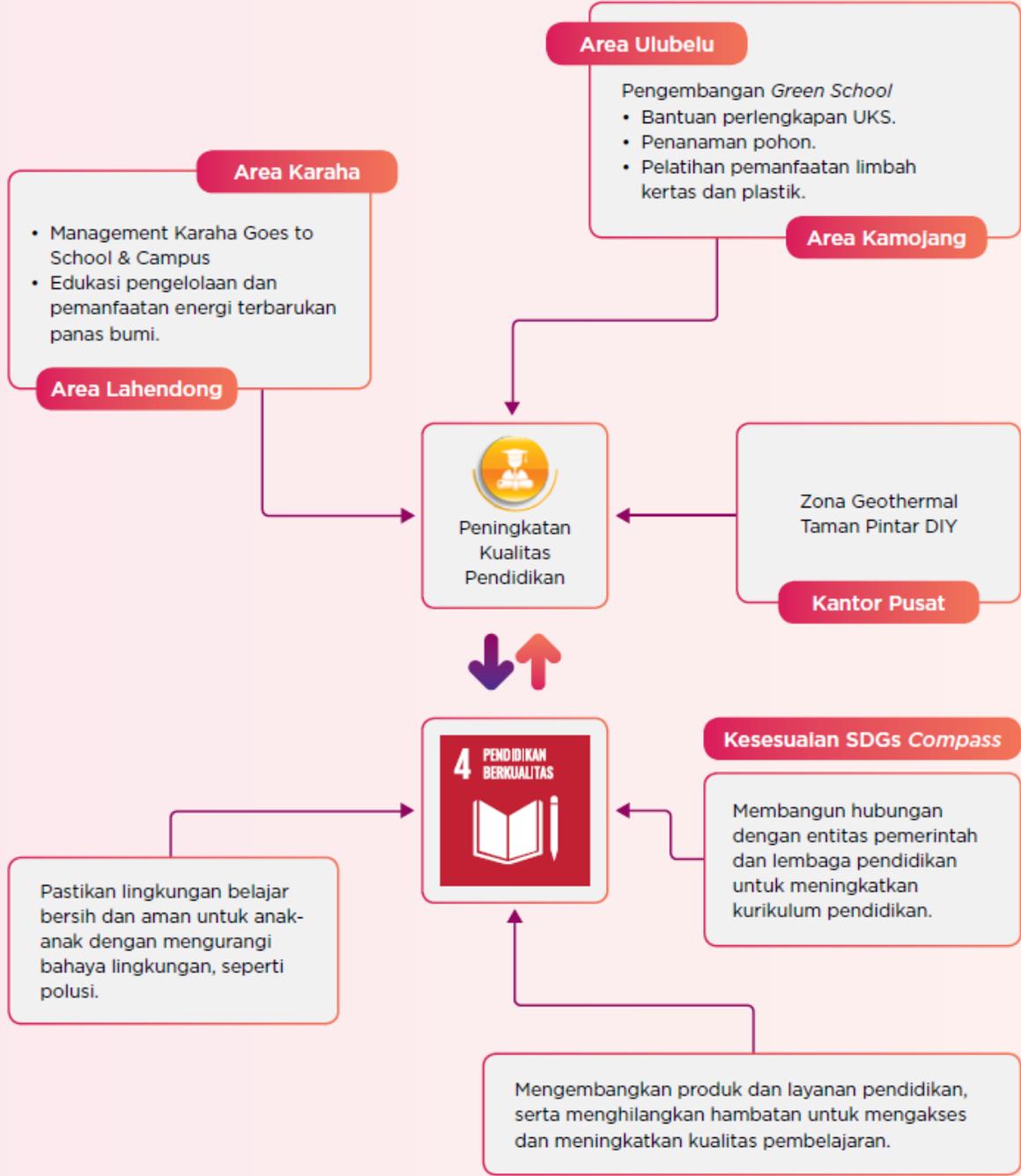


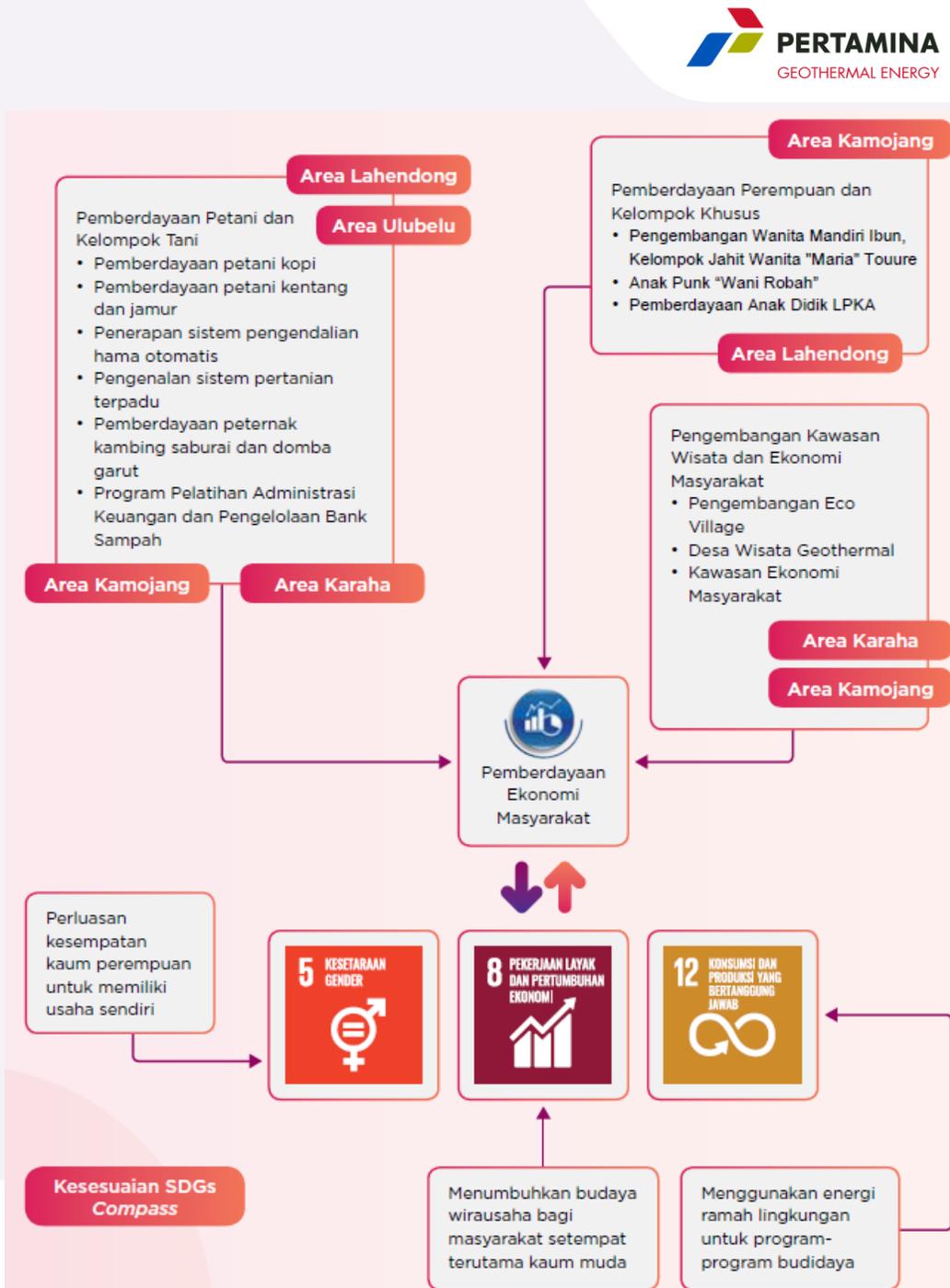
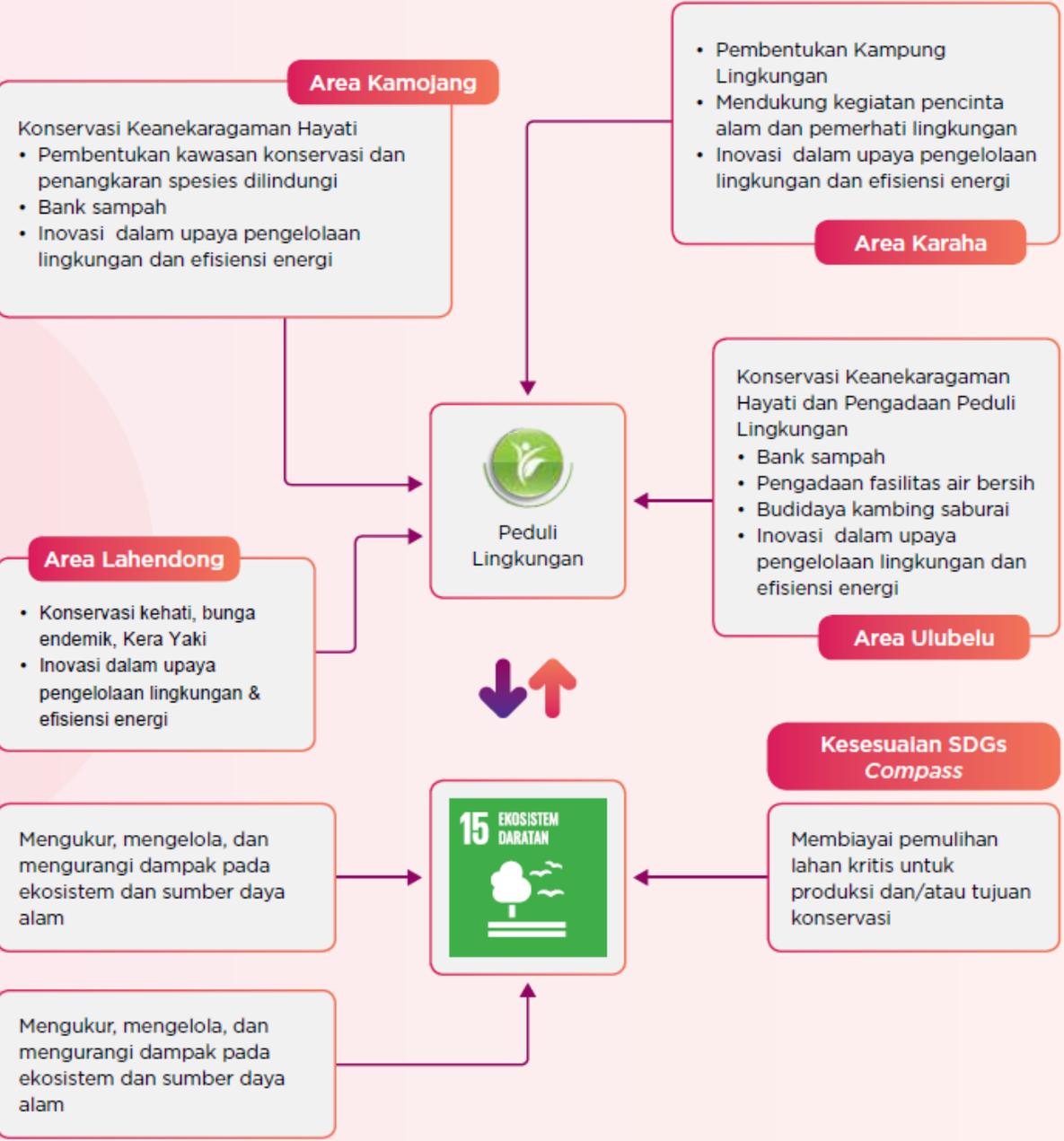
Pemberdayaan Ekonomi Masyarakat



Peduli Lingkungan

Pilar TJSL





Award & Achievement

Remarkable Achievement
10 Gold PROPER in a row
means excellent consistency



10 GOLD PROPER IN A ROW

Kamojang awarded **Gold PROPER** (PGE the one and only geothermal entity ever received gold proper 10 times in a row)



Accreditation & Certification

- Accreditation : ISO 17025 (Laboratorium)
- Certification : 1. ISO 9001 (Quality)
2. ISO 14001 (Environment)
3. ISO 45001 (O&HS)
4. ISO 37001 (Anti Bribery)

Patent

1. Registered 17 National Patents and 1 International Patent acknowledge by USA, New Zealand, Iceland, Philippines, and Turkey
2. Commercialized 1 patent :
“Pengukuran Real-time Laju Alir Massa dan Entalpi Dua Fasa dengan Menggunakan Alat Ukur Perbedaan Tekanan”

ASEAN ENERGY AWARDS

2020 PGE Kamojang Area become The Winner of Special Submission from their CSR Program “Geotato”.

IAGI EXPLORATION AWARDS 2020

PGE Kamojang Area : Best in Geothermal Category, Best Technical Category & Best People Development.

K3 AWARDS 2020

PGE Lahendong Area reach Zero Accident Awards from Indonesia’s Ministry of Manpower.

NUSANTARA CSR AWARDS

2020 PGE Kamojang Area become Best of the best in Nusantara CSR Awards 2020 because manage to reach 11 awards.

DHARMA KARYA ENERGI & SUMBER DAYA

PGE Kamojang Area receive this award from their CSR Program “Geotato”.

 **Challenges in INDONESIA**

Commonly Faced By The Developer



Resource Location

Most of geothermal potential in Indonesia is in forest areas, some of them even spread in National Park.



Electricity Demand

Geothermal power plant development is constrained by the local electricity demand (limited).



Upfront Investment

Geothermal development requires massive investment with the highest risk in exploration phase.



Exploration Phase Funding

Currently, Lenders are still reluctant to fund geothermal exploration phase project.

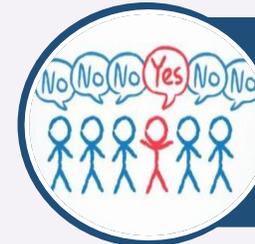
Specific Challenges



Geothermal Viability

Current tariff policy does not reflect the benefits (externality) and rate of return of the geothermal business.

Current tariff regulation (MEMR Regulation No. 50 /2017 and its amendments) not sufficient enough to encourage geothermal Development



Permit & Social Issues

There are resistance, both from the local community and the local government, in some of the Projects.



Regulation

Some overlapping between regulations.

- Tropical Rainforest Heritage of Sumatera (TRHS) vs GR No. 79 / 2014 and GR No. 108 / 2015 and Law No. 21 / 2014.
- Law No. 17 / 2019 vs Law No. 21 / 2014 and GR No. 108 / 2015

Terima Kasih



energizing you