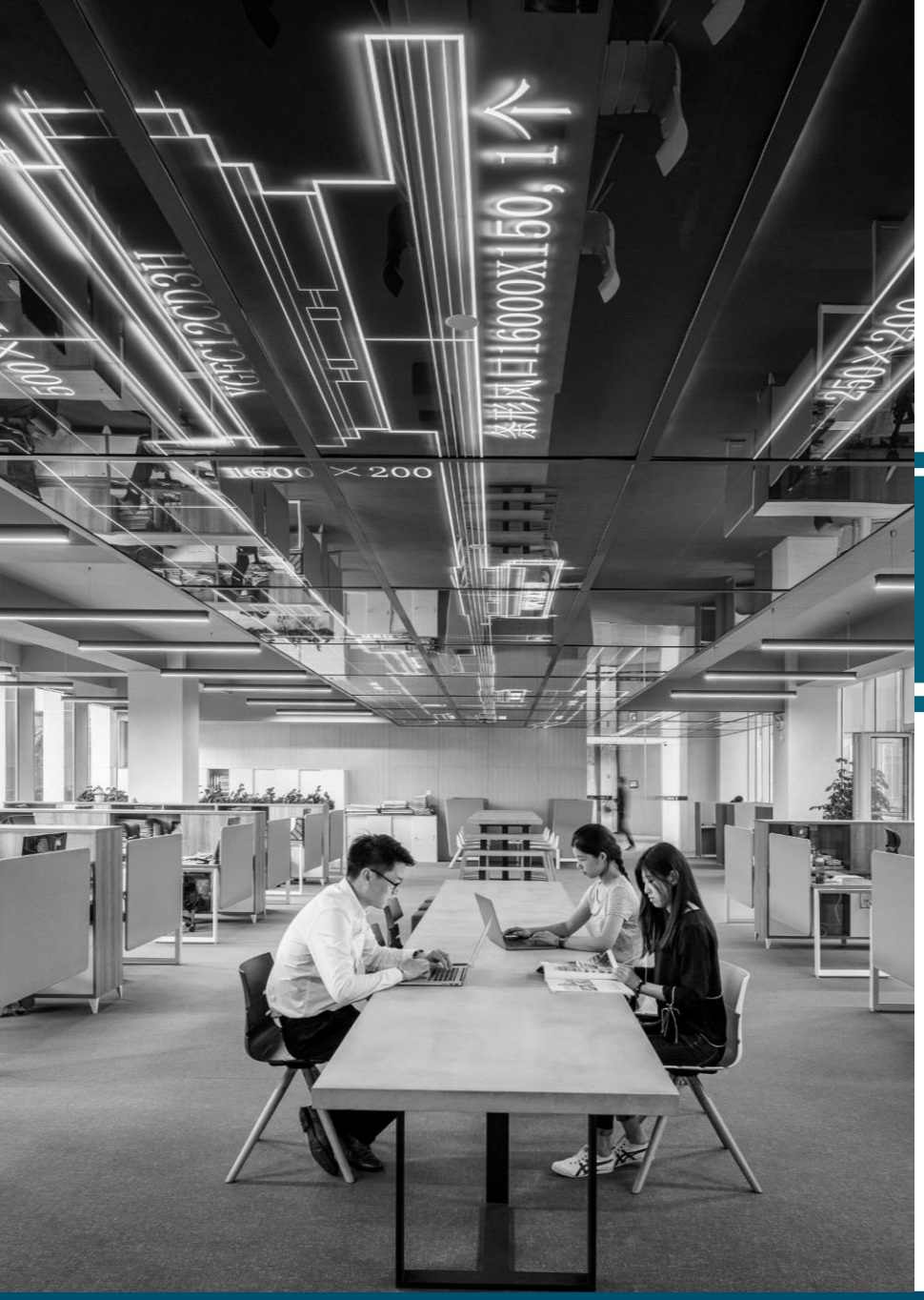
Human Resource Development Agency EMR

Ministry of Energy and Mineral Resources, Republic of Indonesia

A Strategy to Achieve NZE Goals in Energy Sector: Human Capital Approach

The 42nd JCCP International Symposium

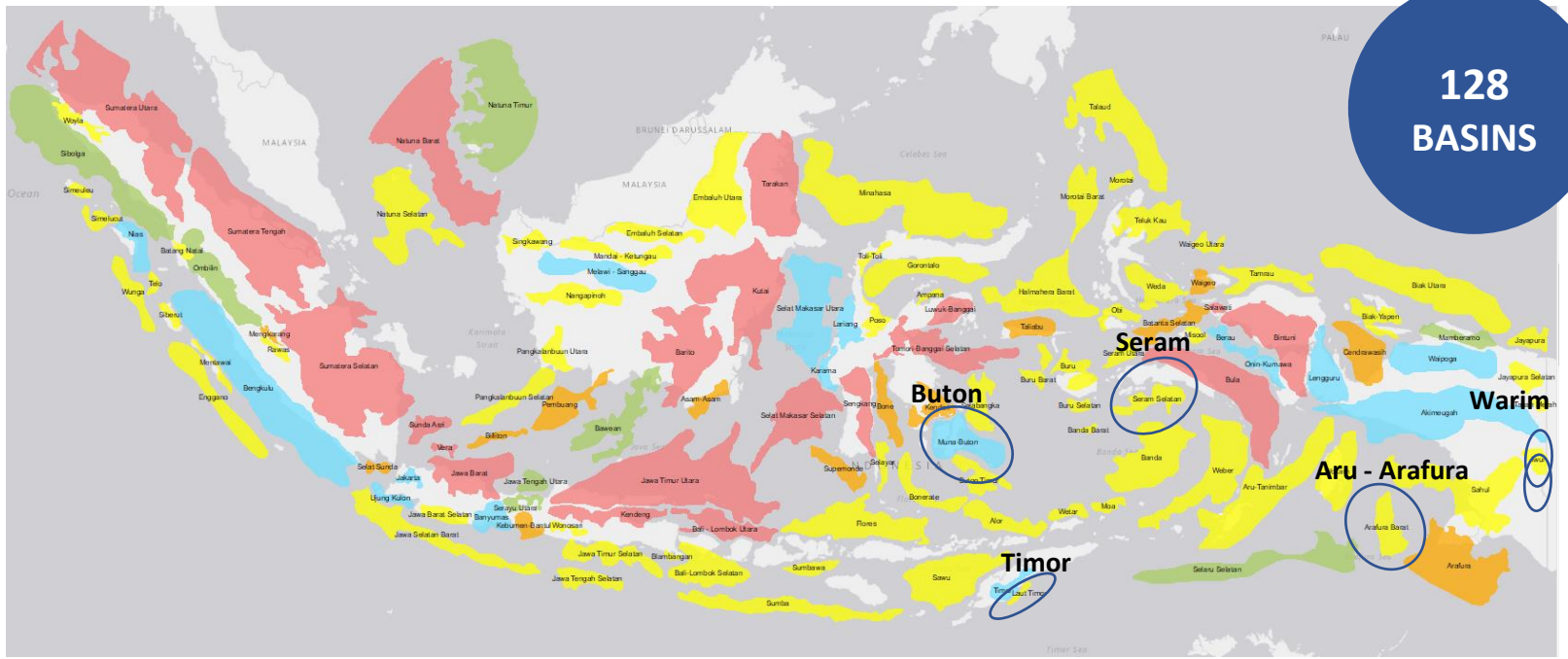
By Prahoro Nurtjahyo - Head of HRD Agency EMR, MEMR



Indonesia’s Potential

Oil And Gas Potential

68 UNEXPLORED BASINS



Producing Basin	20 Basins
Drilled, Not Yet Producing	8 Basins
Hydrocarbon indicated	19 Basins
Drilled, No Discovery	13 Basins
Un-drilled	68 Basins

Proven Reserves:

2.36 BBO and

42.93 TCF Proven Reserves

**) ESDC status 31 Desember 2021*

172 Contract Area*

98 Production CA

74 Exploration CA**

**) per 30 September 2022*

***) including 3 working areas, waiting Government Policy & termination of 25 working areas*

± 1000 O&G Fields

± 30,000 Wells

126 Proven Play

832 Field/Structure, and

110 BBOE Discovered Vol. Inplace

> 460,000 km² Working Area Onshores & Offshores

630 Platform

Operation Offshore Platform	522	unit
Not Operated	102	unit
Already Abandonment	6	unit
Total	630	unit

3 LNG Plant

12 LPG Plant

19 FPSO/FSO/FPU

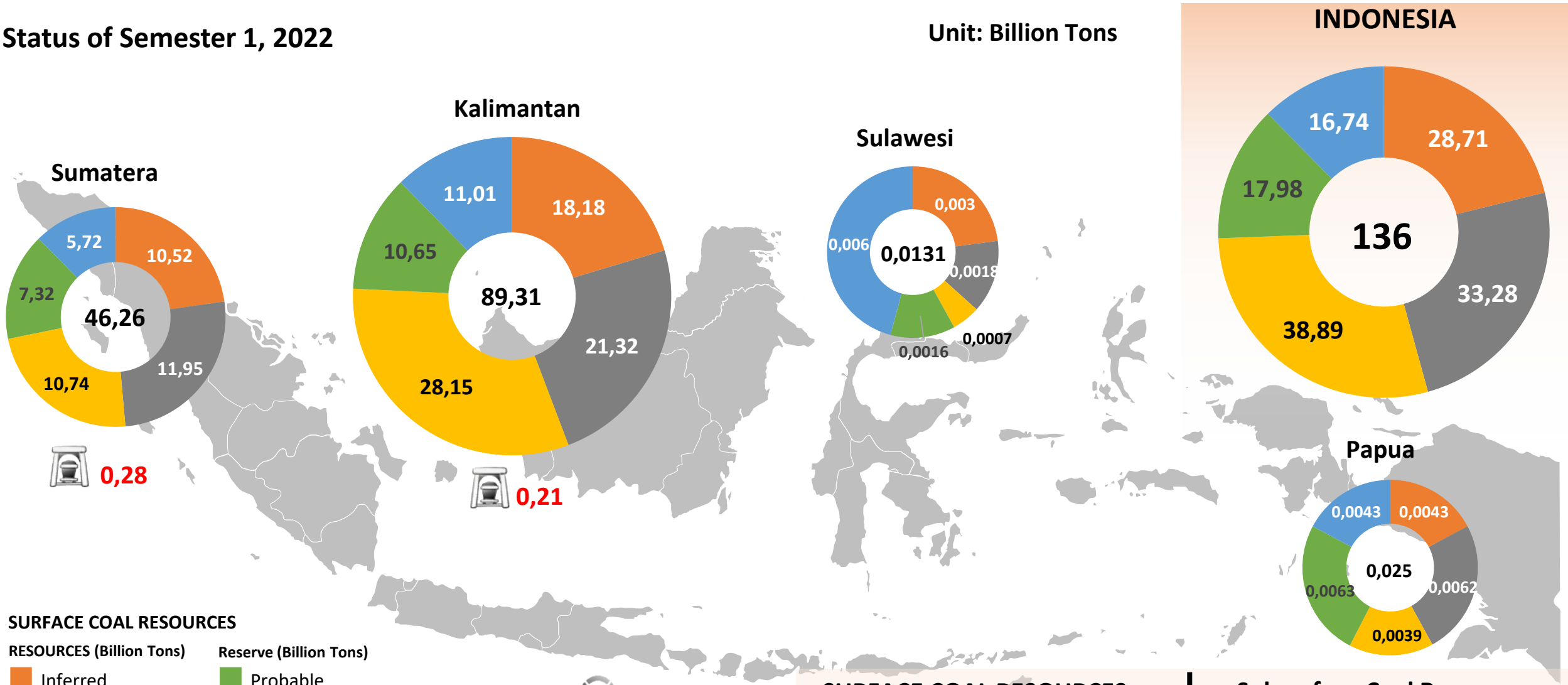
~20,300 km Pipeline

Source: MEMR, 2023

Indonesia's Coal Potential

Status of Semester 1, 2022

Unit: Billion Tons



SURFACE COAL RESOURCES

RESOURCES (Billion Tons)
- Inferred
- Indicated
- Measured

Reserve (Billion Tons)
- Probable
- Proved

Subsurface Coal Resources (100 – 500 M)

1662 Location

Source: MEMR, 2022

SURFACE COAL RESOURCES

Resources : 100,88 Billion Tons
Reserve : 34,72 Billion Tons

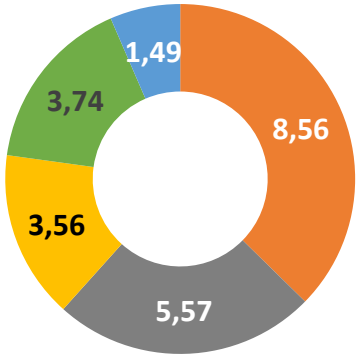
Subsurface Coal Resources

Resources : 0,49 Billion Tons
Reserve : 0,17 Billion Tons

Indonesia's Mineral Potential (Status of December 2021)

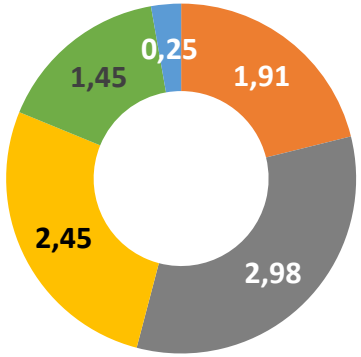
Unit: Billion Tonnes of Ore

Nickel



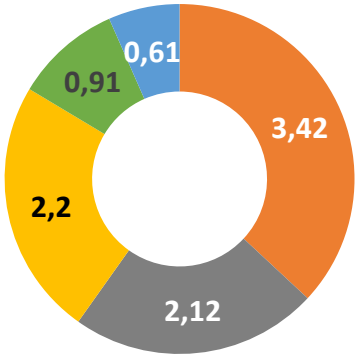
RE	RS
17,69	5,23

Primary Iron



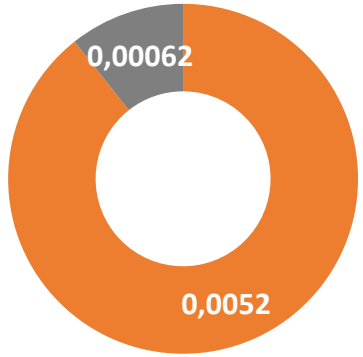
RE	RS
7,35	1,70

Lateritic Iron



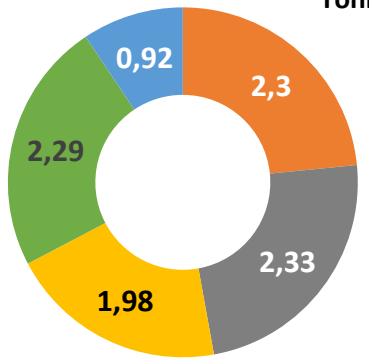
RE	RS
7,75	1,53

Sediment Iron



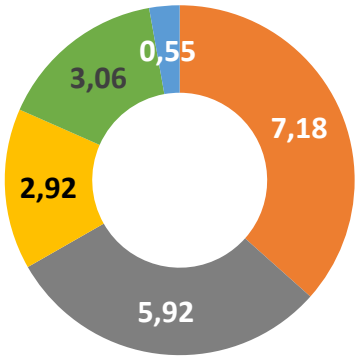
RE	RS
5,82	-

Bauxite



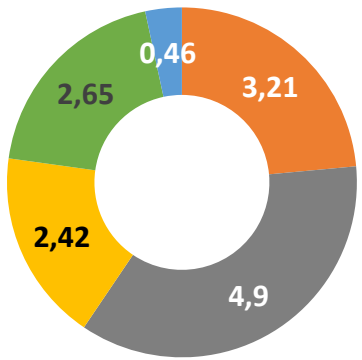
RE	RS
6,63	3,22

Primary Gold



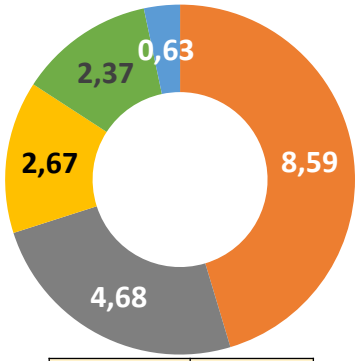
RE	RS
16,03	3,62

Silver



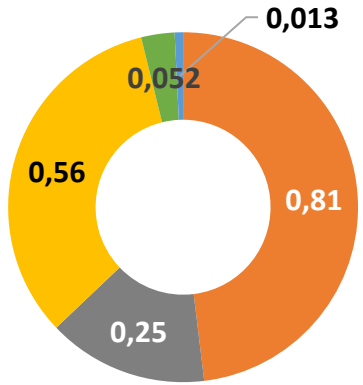
RE	RS
10,55	3,12

Copper



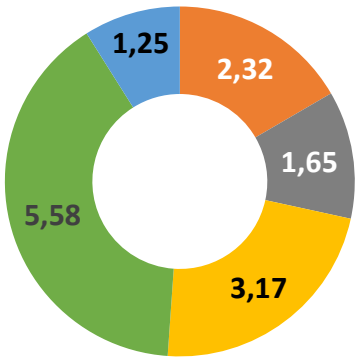
RE	RS
15,95	3,02

Alluvial Gold*



RE	RS
1,63	0,065

Lead*



RE	RS
7,16	6,84

RESOURCES (RE) Inferred Indicated Measured

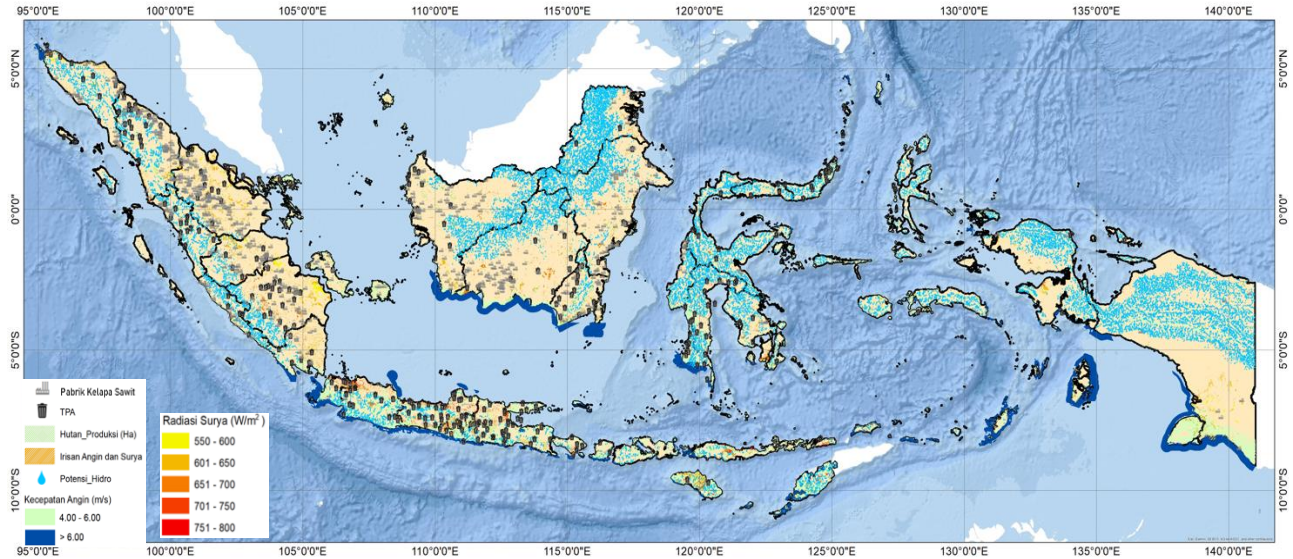
RESERVE (RS) Probable Proved

* Units in billion m3

Source: MEMR, 2022

INDONESIA'S NRE POTENTIAL

Indonesia has large, widespread and diverse NRE potential to support national energy security and achieve NRE mix targets



"0.3% of the total potential has been utilized so that the opportunity for NRE development is very open, especially supported by environmental issues, climate change, and increased electricity consumption per capita."

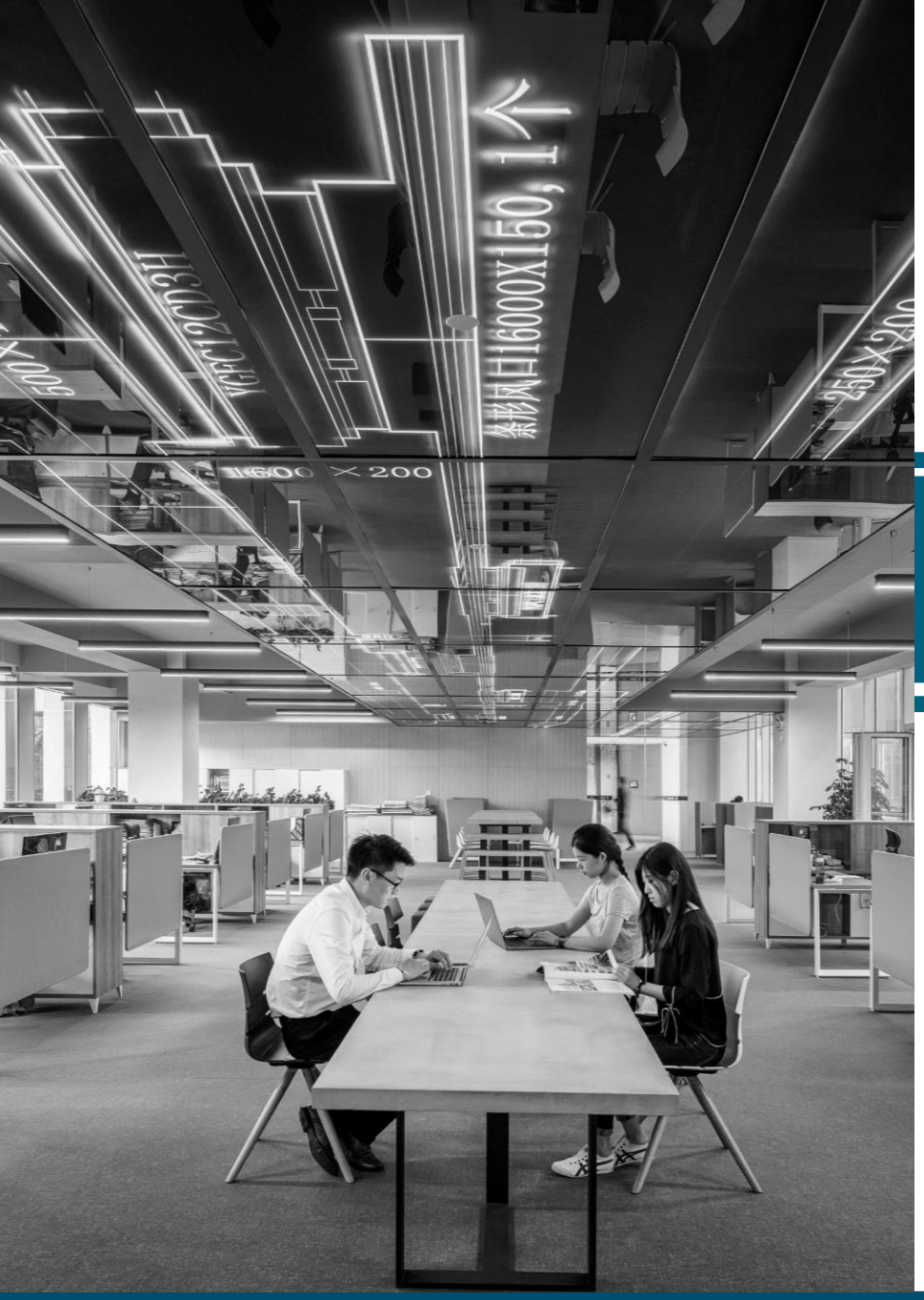
NRE POTENTIAL AND UTILIZATION

ENERGy	POTENTIAL (GW)	UTILIZATION (GW)
SOLAR	3,295	0.27
HYDRO	95	6.69
BIOENERGY	57	3.09
WIND	155	0.15
GEOTHERMAL	24	2.36
OCEAN	60	0
TOTAL	3,686	12.56

Note:
Nuclear Potential: Uranium 89,483 tonnes - Thorium 143,234 tonnes

- Hydro potential is spread throughout Indonesia, especially in North Kalimantan, NAD, West Sumatra, North Sumatra, and Papua
- Solar potential is spread throughout Indonesia, especially in NTT, West Kalimantan and Riau which have higher radiation
- Wind potential (> 6 m/s) is mainly found in NTT, South Kalimantan, West Java, South Sulawesi, NAD and Papua
- Ocean Energy potential is spread throughout Indonesia, especially Maluku, NTT, NTB and Bali
- Geothermal potential is spread in the ring of fire area, including Sumatra, Java, Bali, Nusa Tenggara, Sulawesi and Maluku

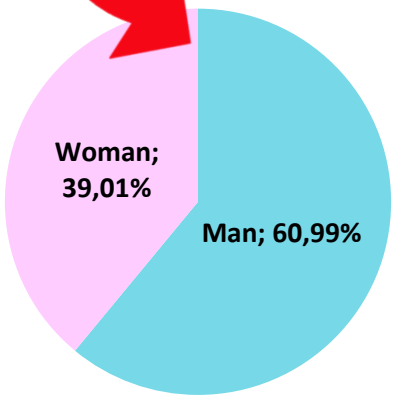
Source: MEMR, 2023



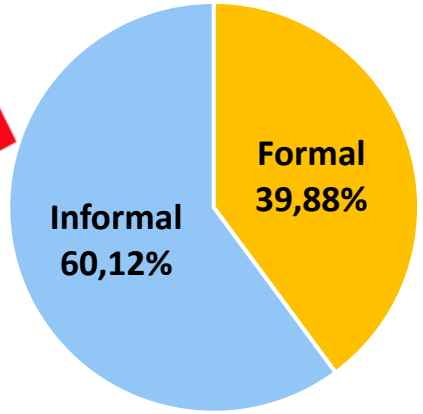
Human Capital

Human Capital - Conditions & Employment Challenges

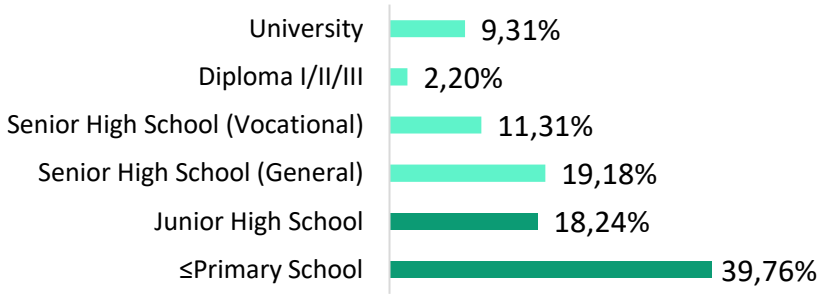
Labour Force Participation Rate
146.62 Million
69.30 % of the working age population



Working
138.63 Million
94.55 %

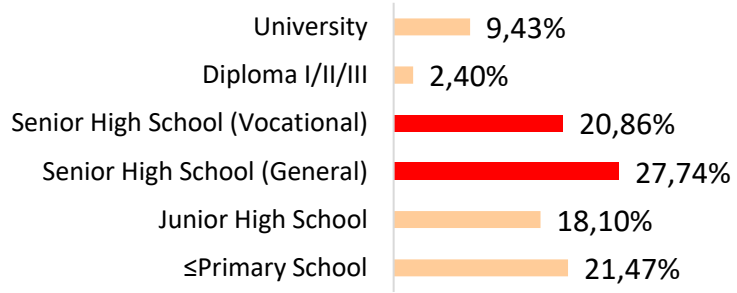


% based on Educational Attainment



Unemployment Rate
7.99 Million
5.45%

% based on Educational Attainment



CHALLENGES

2,61 Million new workforce *(BPS, Februari 2022)*

5.45 % Unemployment

58 % labour with educational level Junior High School and below

60.12 % Informal Labour

23 Million jobs affected by automation (McKinsey, September 2019)

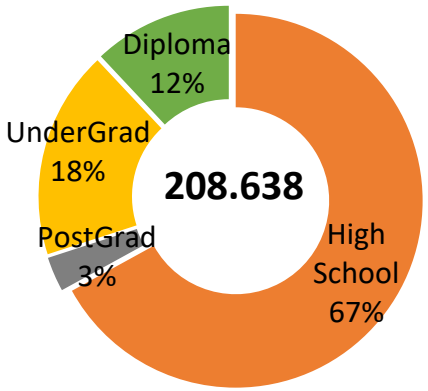
Source: BPS, February 2023

*) Population 15 Years of Age and Over : 211.58 Million

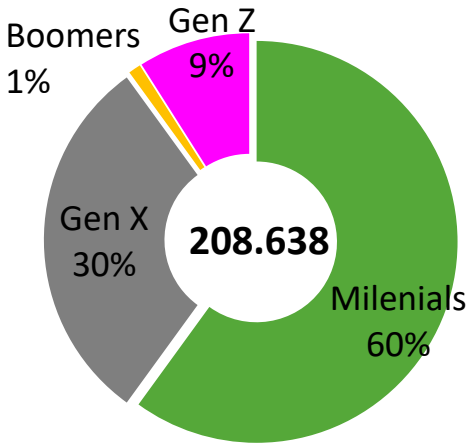
Energy Sectors Workforce

Energy Cluster (Pertamina, PLN)

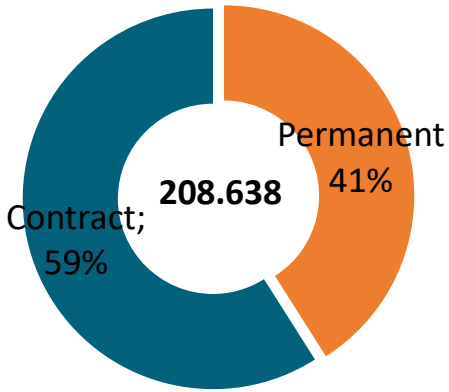
Educational



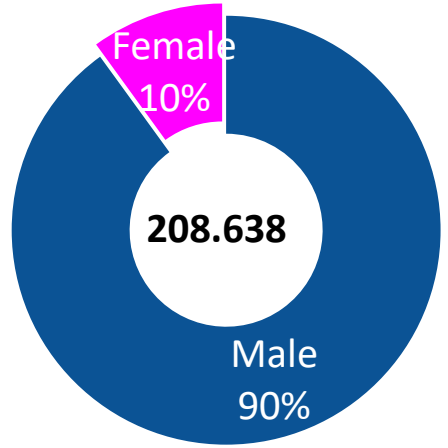
Generation



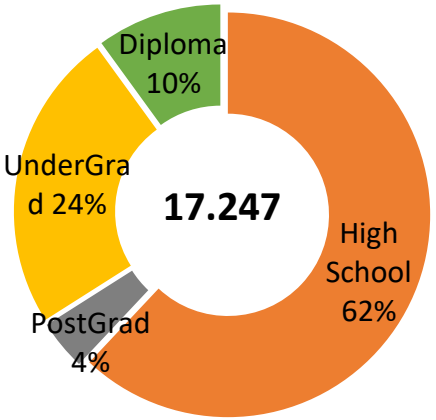
Type of Contract

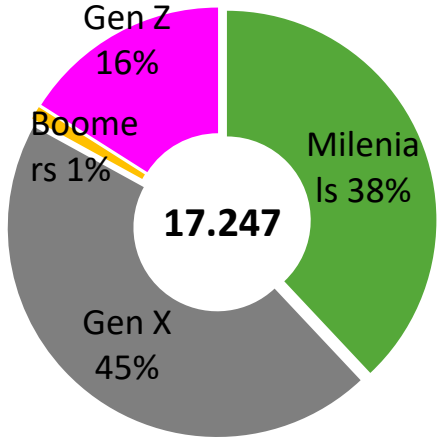


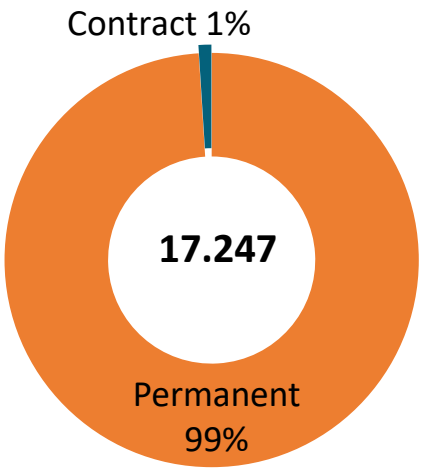
Gender

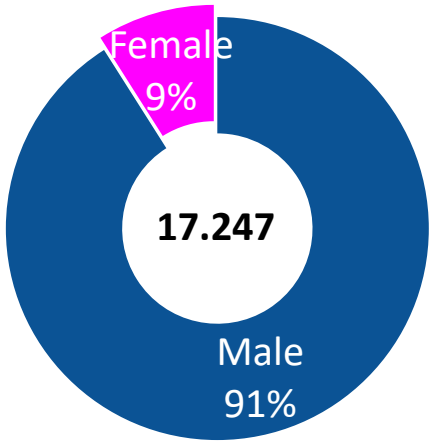


Mineral & Coal Cluster (Inalum)









Source: BUMN, Annual Report 2021

Digital Impact to Future Workforce

BPSDM

Energy and Oil&Gas Cluster

Top Demand Reductions

- Building Cleaning & Pest Control Workers
- Sales Rep, Wholesale & Manufacturing
- Other Protective Service Workers
- Other Installation, Maintenance & Repair Occupations
- Plant and System Operators
- Financial Clerks
- Secretaries and Admin Assistants
- Motor Vehicle Operators
- Financial Specialists
- Other Office & Admin Support

Top Demand Additions

- Engineers
- Computer Occupations
- Business Operations Specialists
- Operations Specialties Managers
- Drafters, Engineering Technicians, Mapping Technicians
- Lawyers, Judges, & Related Workers
- Advertising, Marketing, Promotions, PR, Sales Manager
- Counselors, Social Workers, Other Community Specialists
- Other Teachers and Instructors

Mineral & Coal Cluster

Top Demand Reductions

- Building Cleaning & Pest Control Workers
- Sales Rep, Wholesale & Manufacturing
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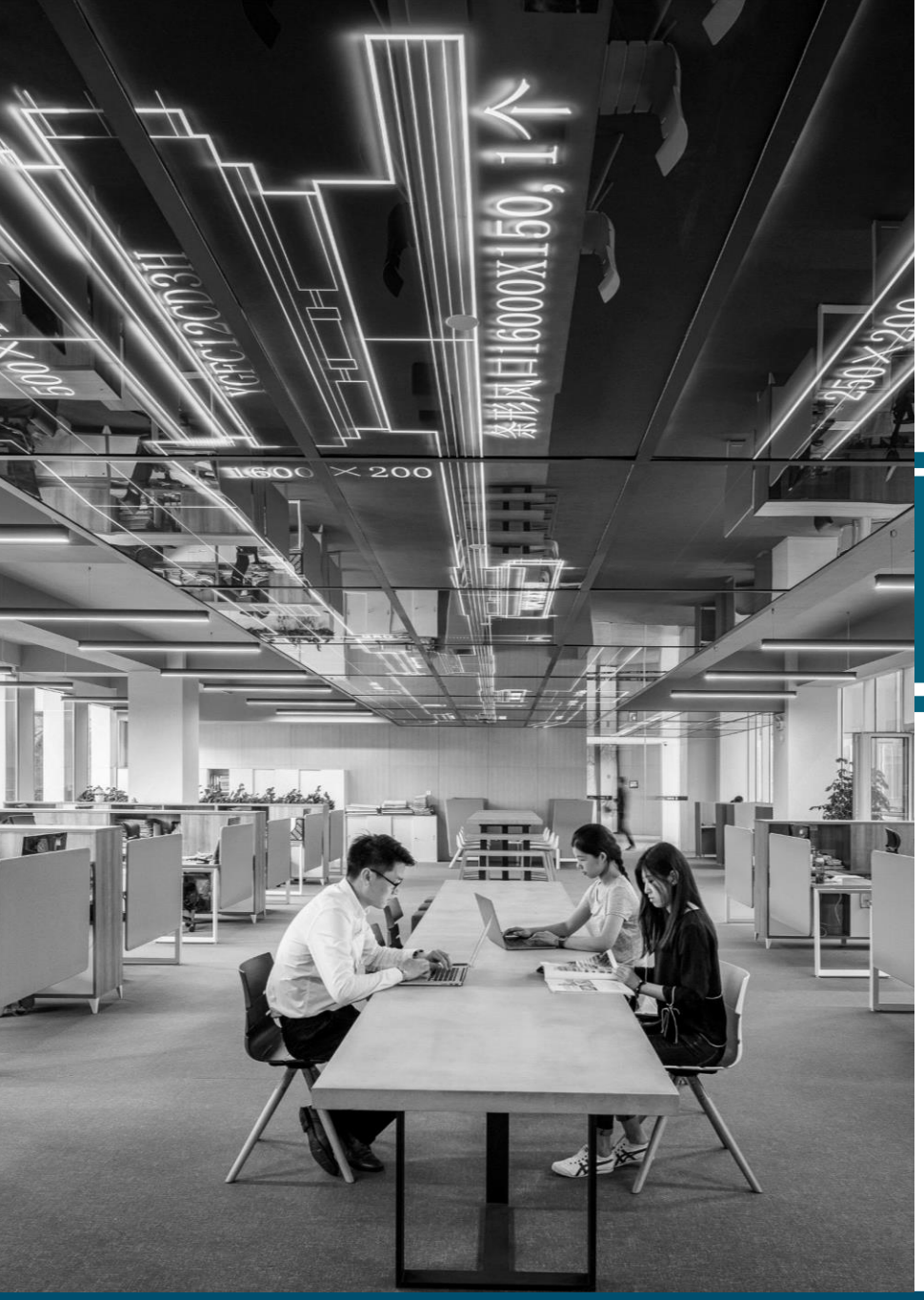
Source: BCG Analysis using medium technology adoption assumption; KBUMN Headcount data collected from 94 BUMNs (Febuary, 28th 2022)



NZE Roadmap

ENERGY TRANSITION ROADMAP TOWARDS CARBON NEUTRAL

1) **Timeline of strategic actions to achieve net zero emission in the energy sector.**
2) **This Roadmap will be a form of joint commitment between the government and stakeholders to realize NZE in 2060 or sooner.**

2021 – 2025

2025: Emision Reduction 231.2 Mio ton CO_2e

Supply:
- NRE Development in accordance with RUPTL PT PLN (Persero) 2021-2030
- Utilization of Rooftop PV
- Waste to energy development acceleration
- Development of small-scale biomass PP
- Cofiring for existing CFPP

Demand:
- Induction cooker used by 8.1 million HH
- 300 thousand electric cars and 1.3 million electric motorcycles
- Gas network for 5.2 million HH
- Dimethyl ether to become substitute of LPG for HH
- Mandatory biodiesel 30% by 2025

2026 – 2030

Supply :
- NRE Development in accordance with RUPTL PT PLN (Persero) 2021-2030
- Pump storage from 2025

Demand:
- Induction cooker used by 18.1 million HH
- 2 million electric cars and 13 million electric motorcycles
- Gas network for 10.2 million HH
- Biofuels in the industrial and transportation sectors reach 40%
- Energy Management and MEPS for 11 equipment

2030: Emision Reduction 327.9 Mio ton CO_2e

2031– 2035

2035: Emision Reduction 388 Mio ton CO_2e

Supply:
- Green Hydrogen development starting 2031
- Massive Battery Energy Storage System (BESS) in 2034
- Installed capacity geothermal PP reach 11 GW in 2035

Demand:
- Induction cooker used by 28.2 million HH
- 9.3 million electric cars and 51 million electric motorcycles
- Gas network for 15.2 million HH
- Biofuel use is maintained at 40%
- Expansion of application of Energy Management and MEPS

2036 – 2040

Supply:
- Nuclear utilization for power generation starts from 2039
- The development of Variable Renewable Energy (VRE), especially solar PV, is more massive, followed by wind turbine PP on both onshore and offshore starting 2037.

Demand:
- Induction cooker used by 37.9 million HH
- 23 million electric cars and 101 million electric motorcycles
- Gas network for 20.2 million HH
- Biofuel use is maintained at 40%
- CCS for cement and steel industries from 2036
- Low carbon for shipping

2040: Emision Reduction 629.4 Mio ton CO_2e

2041– 2050

2050: Emision Reduction 1,043.8 Mio ton CO_2e

Supply :
- Green hydrogen to replace natural gas for high temperature heating processes starting from 2041
- Primary energy utilization from NRE is higher than the fossil

Demand:
- Induction cooker used by 46.6 million HH
- 50.2 million electric cars and 163 million electric motorcycles
- Gas network for 22.7 million HH
- Biofuel use is maintained at 40%

2051 – 2060

Supply :
- Zero emissions from power sector and 129 million tons of carbon emission remains in the industrial and transportation sectors
- All electricity is generated by NRE

Demand:
- Induction cooker used by 54.3 million HH
- 65 million electric cars and 175 million electric motorcycles
- Gas network for 22.7 million HH
- Utilization of CCS in industry up to 13 million ton CO_2
- Projected demand for electricity consumption is 1,942 TWh or equal to 5,862 kWh/capita

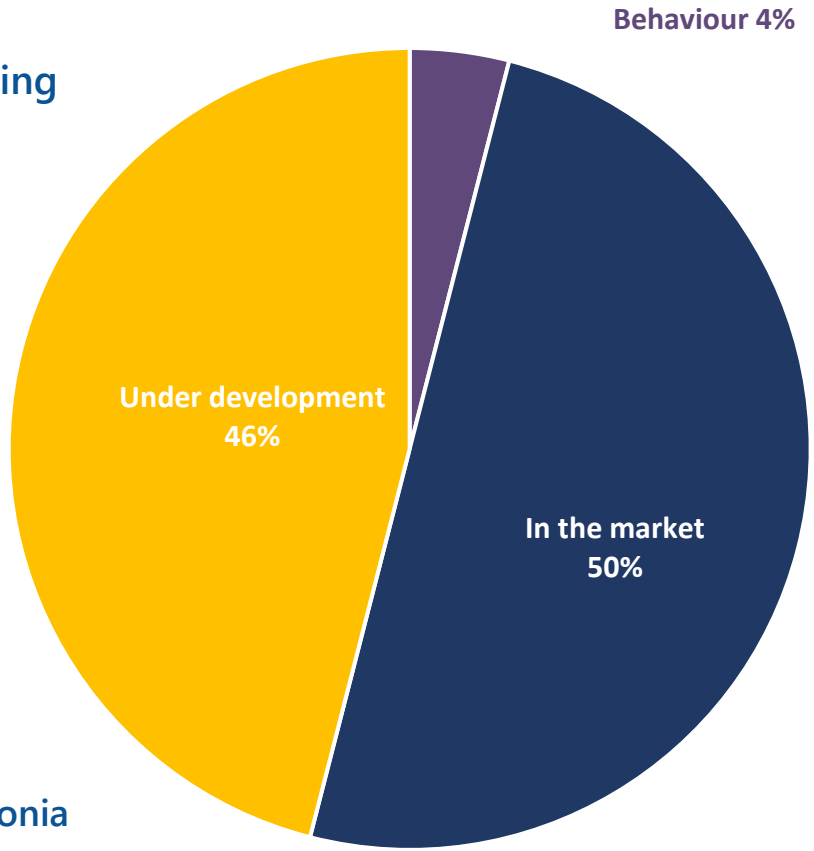
2060: Emision Reduction 1,789 Mio ton CO_2e

Innovative low emission technologies such as CCS/CCUS can be applied under certain conditions to existing fossil power plants to accelerate emission reductions in the transition towards cleaner and greener energy

*) PLTU pada Wilus PLN dan Non-PLN: Maksimal 30 tahun dan IPP 25-30 tahun (sesuai PPA)

ENERGY TRANSITION – TECHNOLOGY & INNOVATION

CO_2 savings by technology maturity in 2050, NZE scenario



Refrigerant-free advanced cooling

Advanced batteries

Next-generation biofuels

CO_2 capture from cement

Hydrogen-based steel

Small modular reactors

Synthetic liquid fuels

Electrolytic hydrogen for ammonia

Autonomous trucks

Optimised heat pump with storage

Direct air capture

Ammonia-powered ships

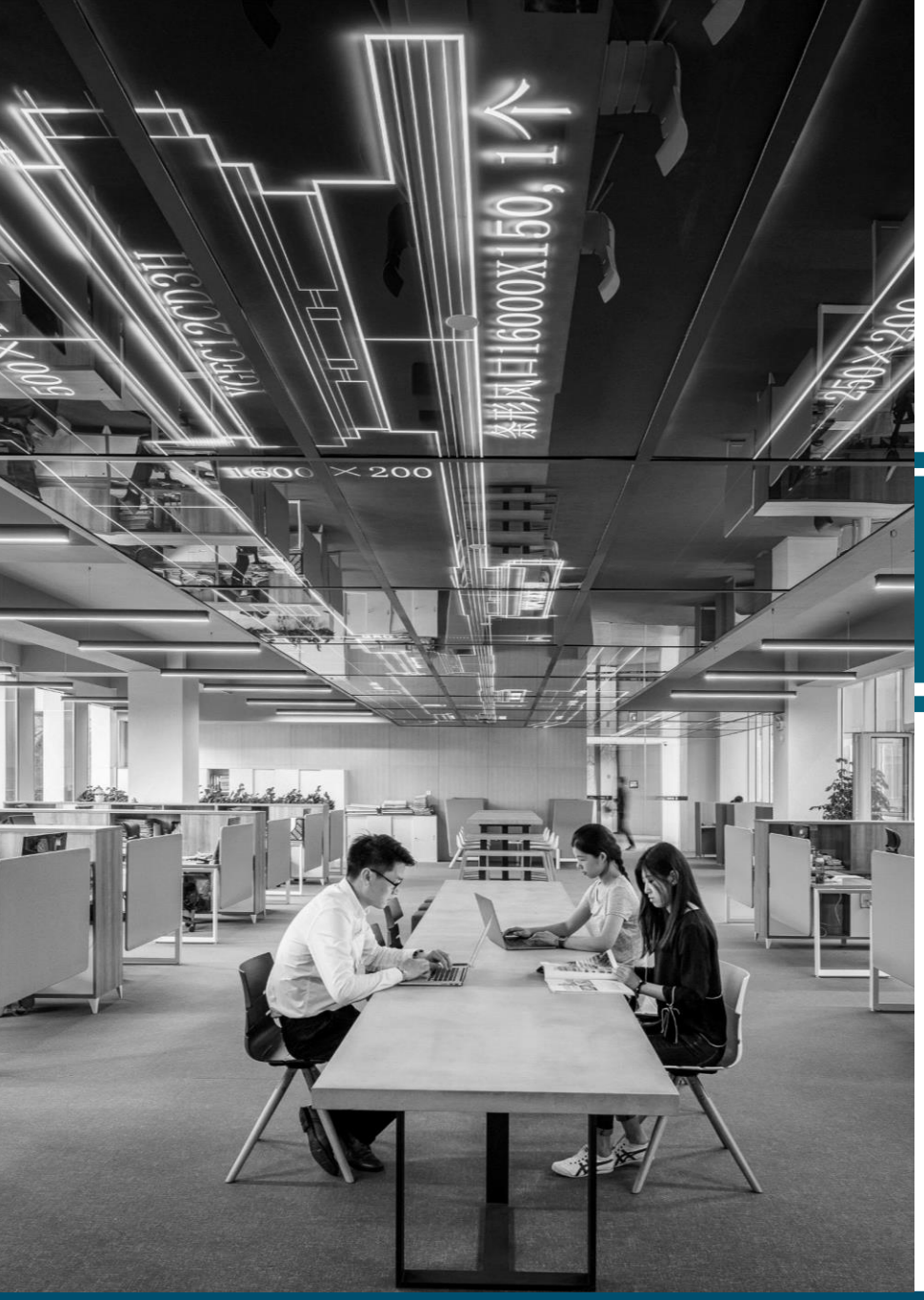
Electrolytic hydrogen for methanol

Building-integrated storage

Electric steam crackers

Unlocking the next generation of low-carbon technologies requires more clean energy R&D and $90 billion in demonstrations by 2030; without greater international co-operation, global CO_2 will not fall to net-zero by 2050.

Source: IEA



Strategy

NRE DEVELOPMENT SYNERGY AND COLLABORATION

The support of all parties is needed in the development of NRE to be run optimally

NRE Development Challenges:

1 Economy & Technology

Technological innovation in the NRE sector encourages the reliability of the electric power system and creates more competitive prices.

2 Local Content

Consideration of technology mastering, project implementation, and the readiness of supporting industries in both technical and economic aspects.

3 *Supply & Demand*

The development of NRE power plants and Non-Electricity takes into account the balance of **supply & demand growth at affordable prices**.

4 Project Implementation

Ease of licensing and **land preparation** as well as de-bottlenecking in the implementation of NRE projects.

Pentahelix

SOE & PRIVATE

Carrying out business/business activities of power plant and fuel, services, job creation, contribution to state revenues and economic activities

ACADEMY

Creating NRE innovations that can be directly utilized by the community, increasing quality human resources and encouraging technology transfer

MEDIA

Educating public concerning the importance of NRE and disseminating Government programs to the community

GOVERNMENT

Formulate policies, regulations, national standards, guidance and supervision, as well as facilitators in the development of NRE

COMMUNITIES & NGOs

NGOs act as counterweights and government partners, provide advocacy/assistance for the community, carry out positive campaigns and take an active role in the development of NRE

Potential Cooperation

BPSDM

INCREASE KNOWLEDGE

- **Education Programs for Degree (i.e. Master & Doctoral Degree, Double Degree Program, Student Exchange, Fast Track Program)**
- Cooperation with Universities and Research Institution
- Government Officers exchange
- Courses
- International Workshop

STANDARD TRAINING PROGRAMS

- **Scaling up technologies (i.e. OSL, Learning Methodology)**
- Training for Trainer
- Guest Lecturer
- Expert for Development Curriculum

COOPERATION WITH INDUSTRIES

- **Internship/Secondee Program for government officer**
- Learning innovative technologies and techniques from Industries
- Expert instructors

THANK YOU