New Technologies and Drivers in the Indonesian Coal Industry

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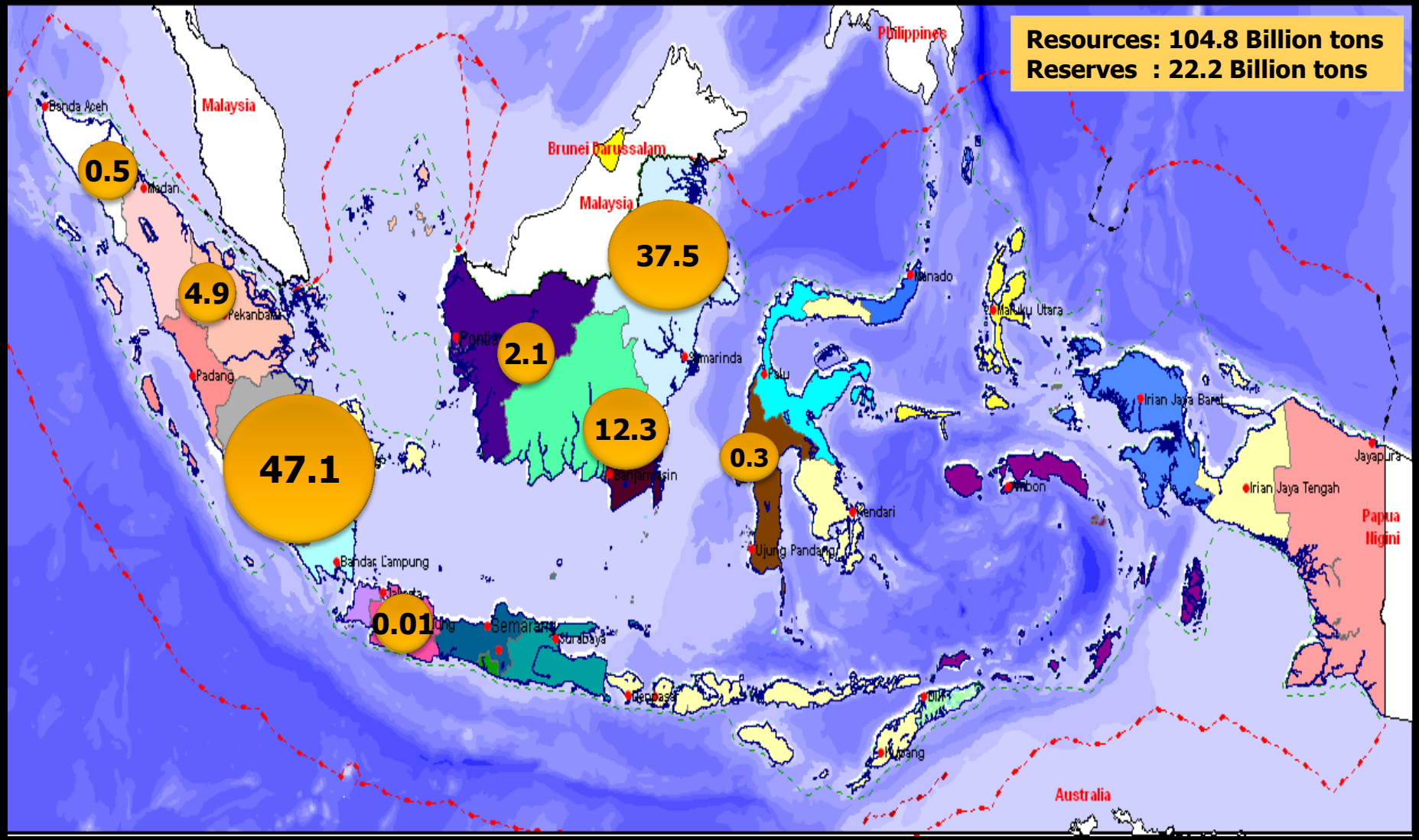
Agency of R & D for Energy and Mineral Resources
Ministry of Energy and Mineral Resources
The Republic of Indonesia

Outline

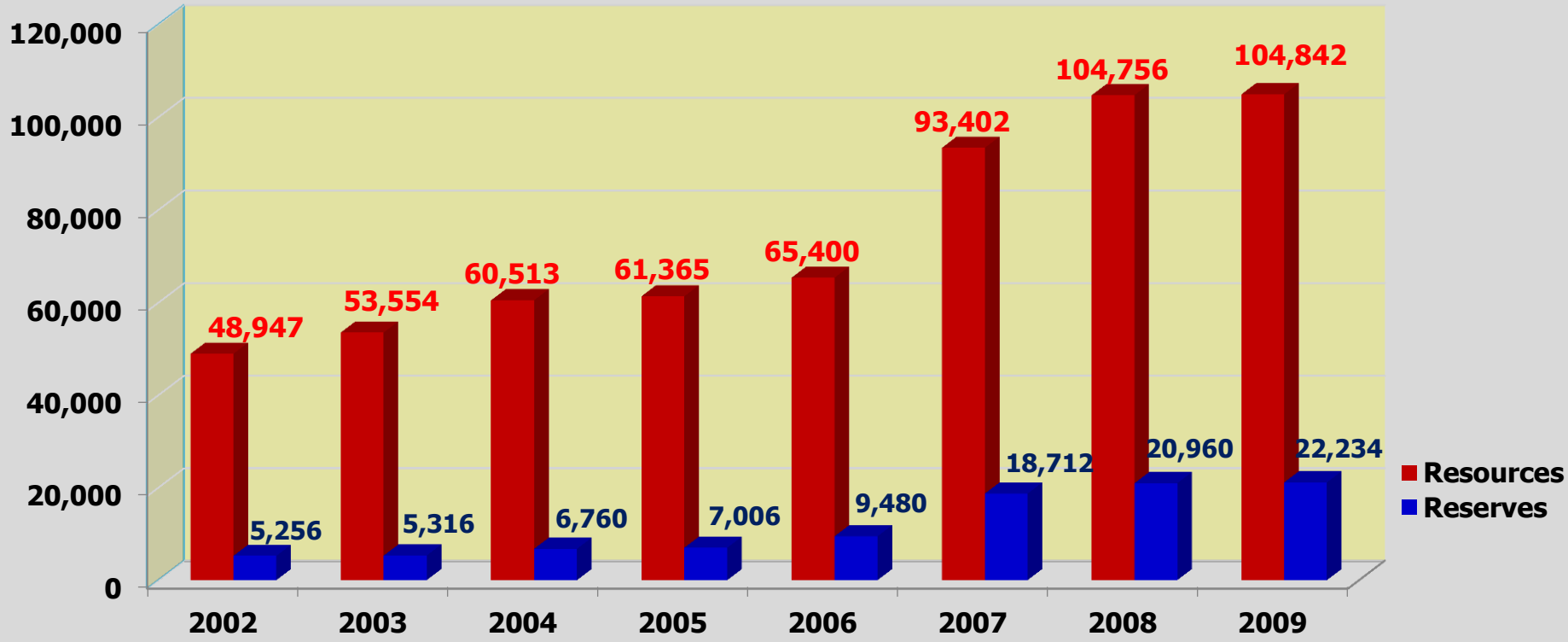
- Introduction
- Current Figures of Indonesian Coal Industry and Future Expectation of Indonesian Coal Industry
- Prospect of Coal Utilization Technologies
- Development of Coal Industry
- Concluding Remarks

Distribution of Coal Resources



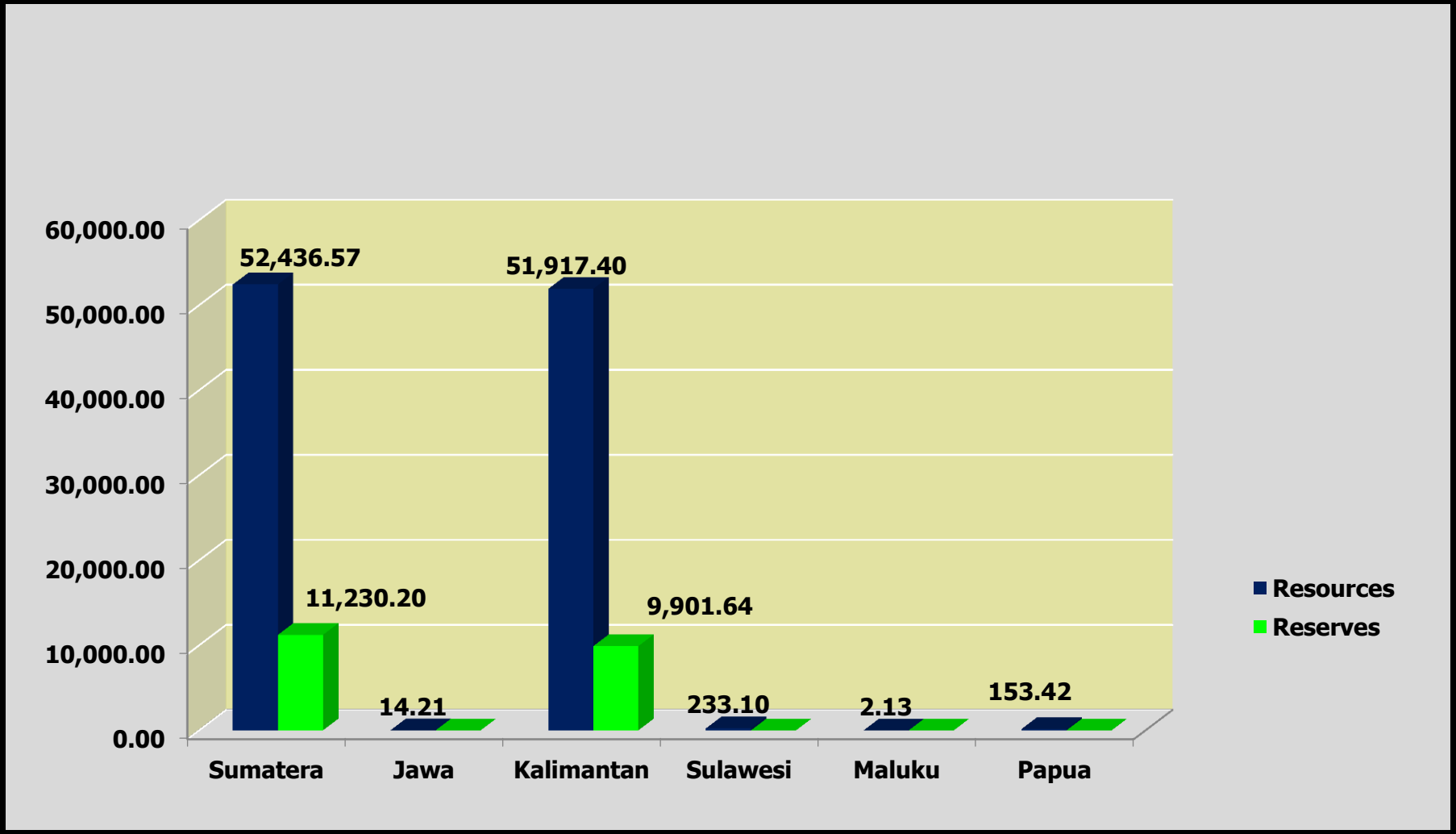
Source: Centre for Geological Resources, 2009

Resources and Reserves of Coal in Indonesia (2002-2009), Million Ton



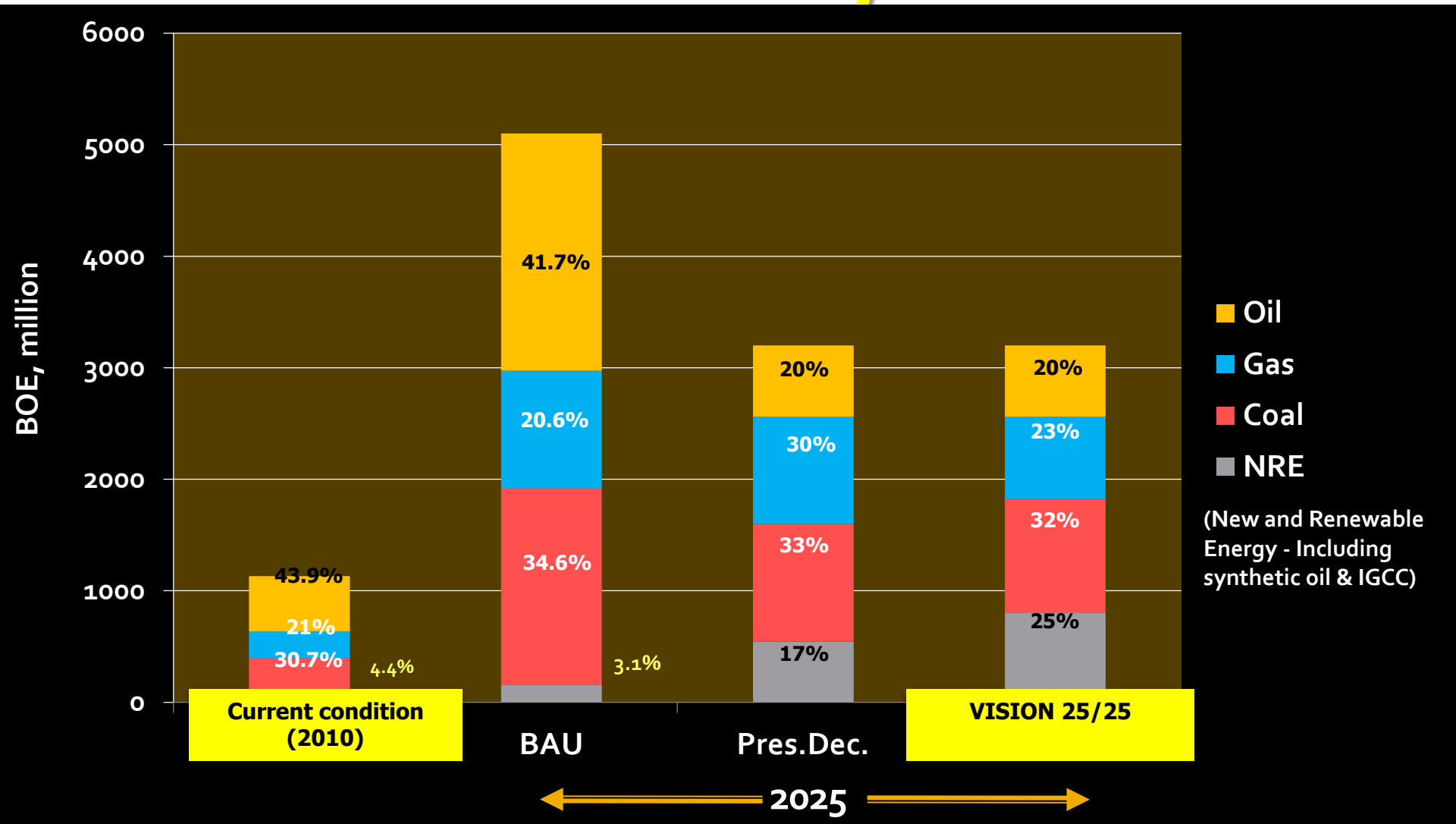
Source : Geological Agency, 2009

Distribution of Resources and Reserves of Coal in Indonesia (2009), Million Ton



Source : Geological Agency, 2009

New Energy Policy Direction
Vision 25/25



Source: National Energy Council; Blueprint of Energy Management 2006-2025

Policy Related to Utilization of Low Rank Coal

Objective:

- To increase the share of coal for domestic energy supply
- To increase added value of Low Rank Coal (LRC)
- To develop Clean Coal Technology (CCT)

Instrument:

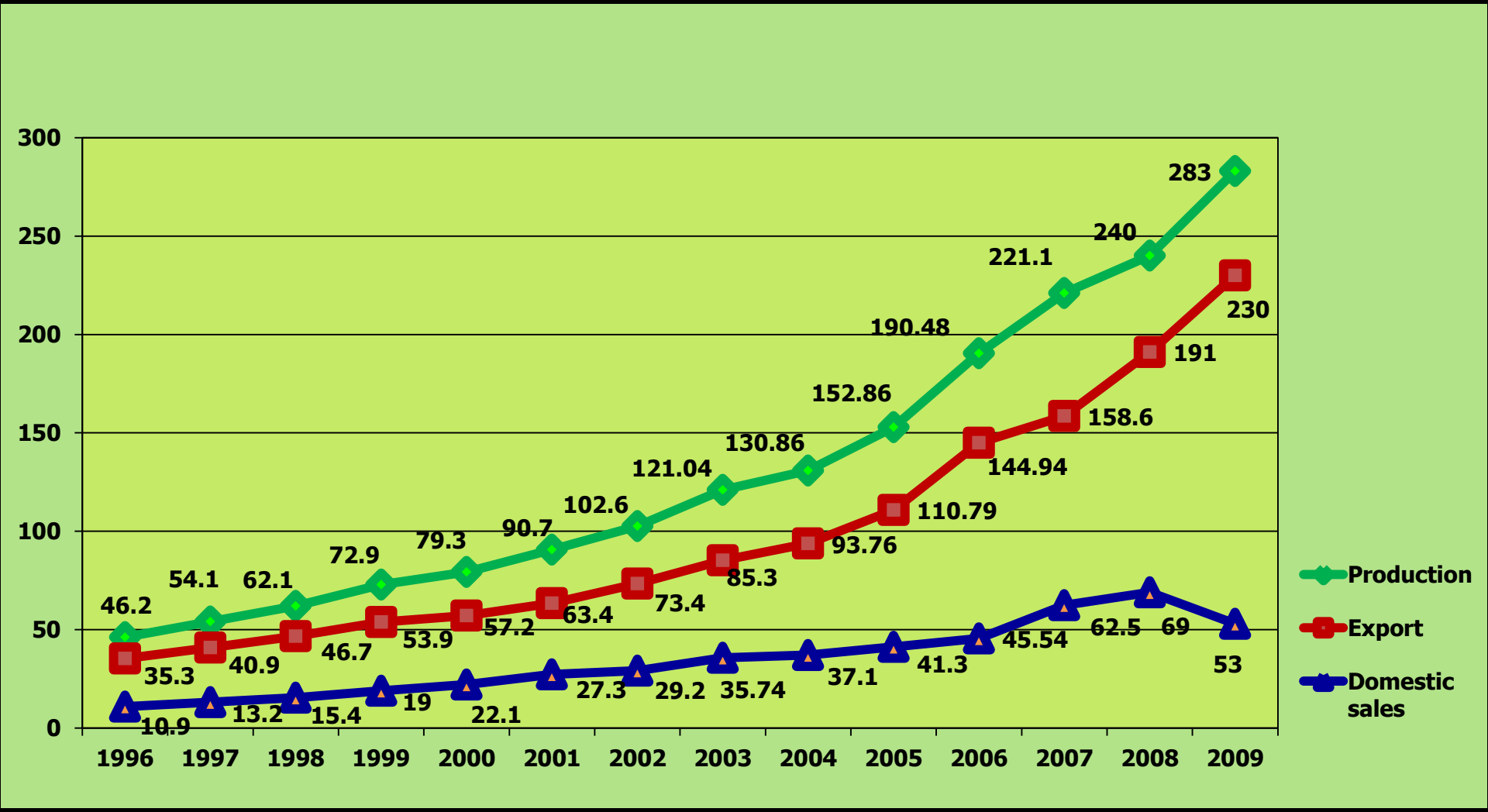
- Establishment of Directorate General for New, Renewable Energies and Energy Conservation
- Promotion of new energy policy direction: Vision 25/25
- Preparation of regulation on added value of LRC

***Source*:**

- *Law No. 30/2007 about Energy*
- *Law No. 4/2009 about Mineral and Coal Mining*
- *Presidential Decree No. 5/2006 about National Energy Policy*
- *Blueprint of Energy Management 2006-2025*

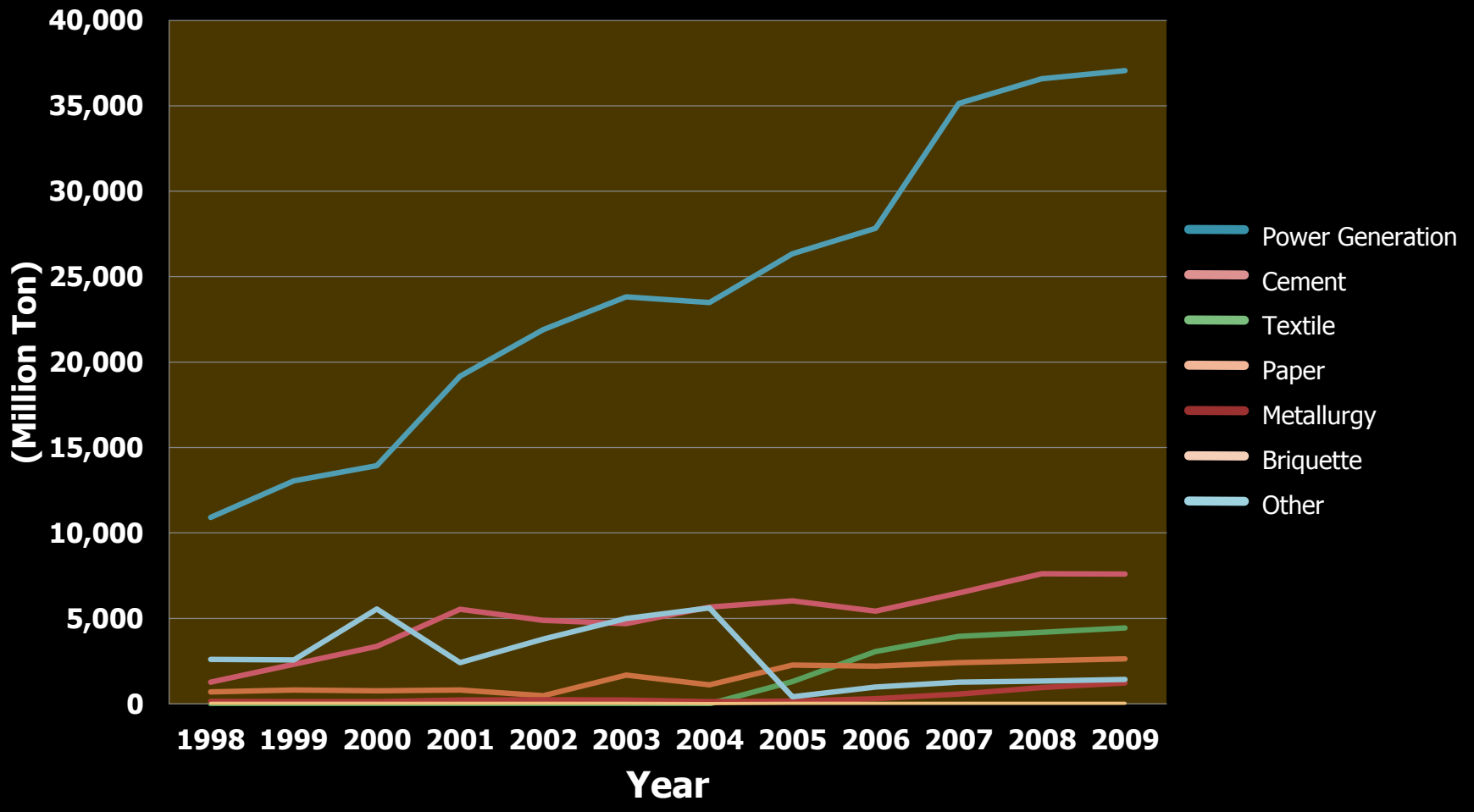

Current Figures of Indonesian Coal Industry

Indonesian Coal Production, Export and Domestic Sales (1996-2009), Million Ton



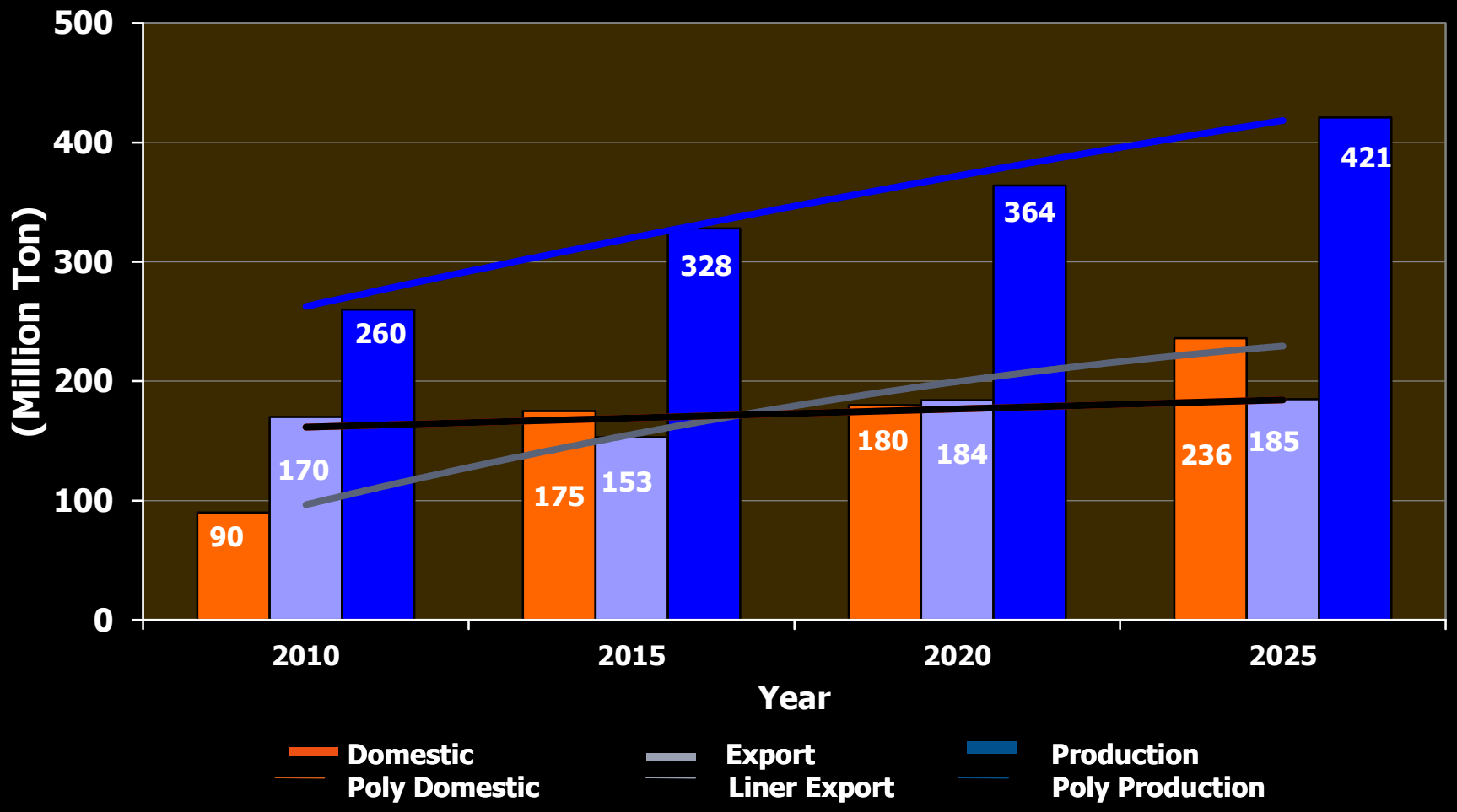
Source : Directorate General of Mineral, Coal and Geothermal, 2009

Current Coal Domestic use (1998-2009), Million Tons



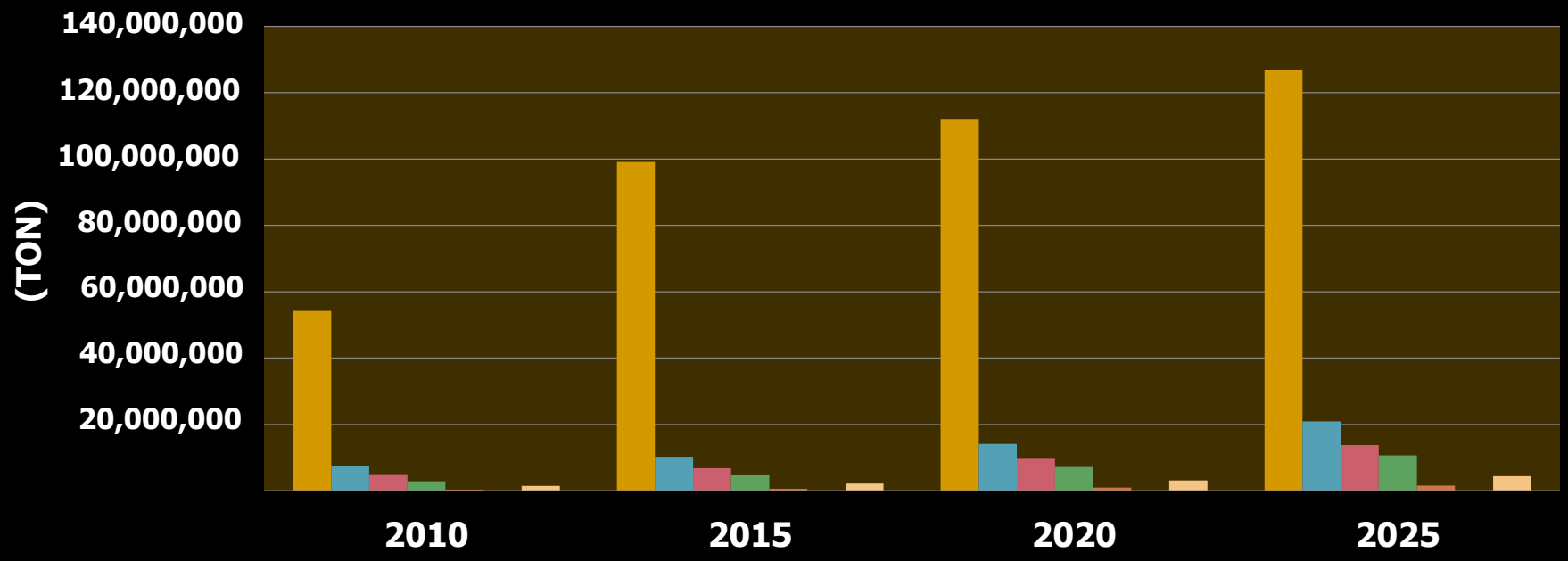
Source : Directorate General of Mineral, Coal and Geothermal, 2009

Projected of Indonesian Coal Production, Export and Domestic Sales (2010-2025)



Source : Directorate General of Mineral, Coal and Geothermal, 2009

Projected Coal Domestic Use (2010-2025)

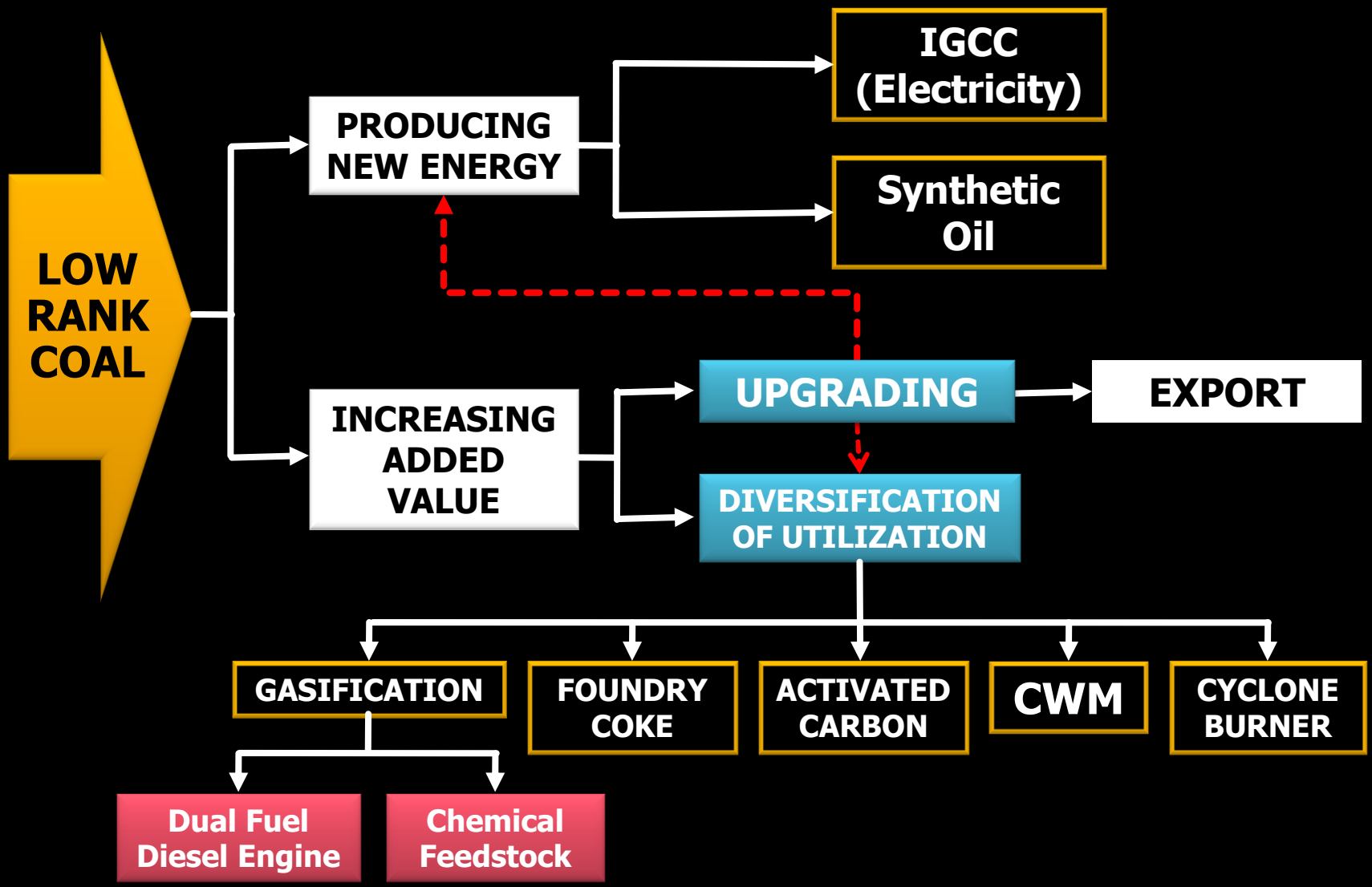


	2010	2015	2020	2025
Power Generation	54,193,118	99,100,000	112,130,000	126,860,000
Cement Industry	7,600,000	10,214,480	14,147,160	20,868,545
Textile Industry	4,704,325	6,774,383	9,620,712	13,760,828
Paper Industry	2,855,631	4,651,599	7,121,054	10,712,989
Metallury	325,905	602,229	982,173	1,534,820
Briquette	26,716	31,032	36,966	45,598
Others	1,502,318	2,163,387	3,072,358	4,394,497

Source : Directorate General of Mineral, Coal and Geothermal, 2009


Current
Development of
CCT in Indonesia

New Technologies for LRC Utilization



Coal Upgrading

Definition:

Coal upgrading is a process to convert LRC to produce a dry upgraded coal which has low moisture content and high calorific value.

Benefit:

- **Increased coal value**
- **Improved thermal efficientcy**
- **Stabilized coal quality feed for the existing industries**
- **Reduced transport costs**
- **Reduced emissions: CO_2, SO_X, NO_X and particulates**
- **Prevent physical degradation into fines/dust reduction**

Development of Coal Upgrading

- **Upgraded Brown Coal (UBC)**

UBC reduces moisture (free and inherent) of LRC up to 80% and increases the CV up to >6,000 kcal/kg based on slurry dewatering process. ARDEMR in cooperation with JCOAL Japan, pilot plant of 5 t/d has been operated since 2003 in Palimanan, Cirebon and demonstration plant of 1,000 t/d is operated in Satui, South Kalimantan since 2008. The design of the commercial plant is in progress in combination with FS.

- **Binderless Coal Briquetting (BCB)**

Demonstration plant of 1 Mt/y has been constructed at Tabang mine, East Kalimantan by PT Gunung Bayan in cooperation with White Energy Co. & PT Kaltim Supa Coal. Coal of 4,200 kcal/kg (gar) can be upgraded to 6,100 kcal/kg (gar) using flash dryer to remove mainly free misture. Comm. plant of 5 Mt/y is under preparion.

- **Coal Upgrading Briquetting (CUB)**

The process is based on evaporative drying, using a flash dryer to remove mainly free moisture. The plant is comm. in USA. PT Bakti Energi Persada is reviewing the design.

- **Rotary Drum Dryer**

Two coal companies implement this technology in cooperation with chinese company on the pilot plant. This technology normally only remove free moisture of the coal.

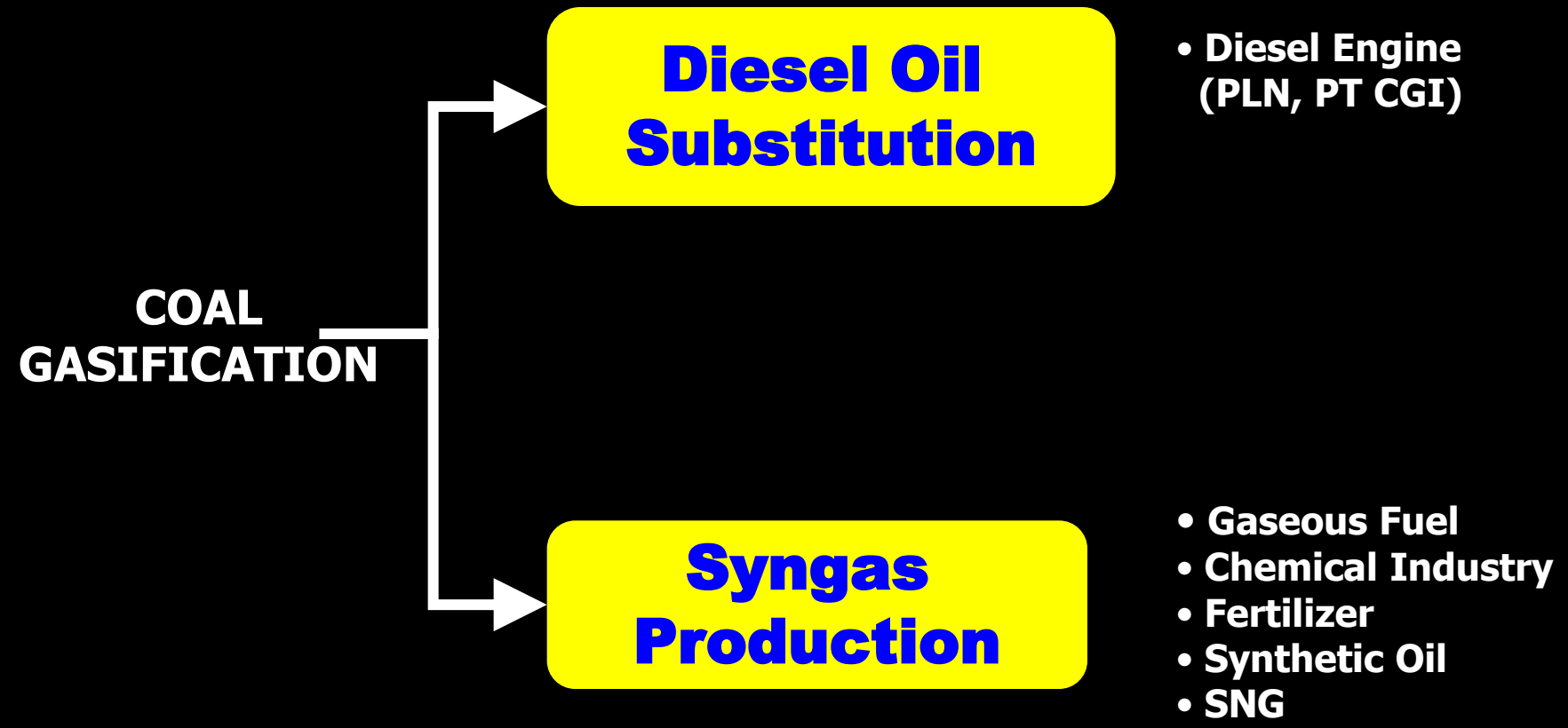
- **Coal Drying Briquetting (CDB)**

The process is based on steam tube dryer. *tek*MIRA is developing the technology on bench scale unit (BSU).

Coal Gasification

Conversion of coal in a reactor into gaseous product (esp. CO & H_2) either without or with reactant (air, oxygen, steam, carbon dioxide or mixture of them). CO and H_2 can be processed into CH_4 (SNG).

Application of Coal Gasification



Development of Duel Fuel System for Diesel Engine

- R & D on the utilization of coal gas for diesel engine has been started since 2007. A pilot plant consisting of coal gasifier of 1 m diameter and diesel 250 kVA cap. using manual and non-turbo system has been installed and operated since March 2008.
- The coal gasifier which has purification system can produce clean gas having low tar and particulate contents. The coal gas can be used to fuel diesel engine using dual fuel system.

- Up to 60-70% of diesel fuel can be substituted by coal gas, and finally production cost of electricity can be reduced.
- Next program will be development of prototype plant consisting of gasifier of 2 m diameter and diesel engine of 450 kVA using automatic and turbo system.

Development of Syngas

- Study on the production of syngas using new technology twin fluidized bed coal gasifer (TIGAR) for fertilizer plant has been carried out in cooperation with Japan (IHI and Sojitz) and PT Pupuk Sriwijaya.
- A prototype plant of 50 tpd will be constructed in PT Pupuk Kujang Cikampek, West Jawa. The prototype plant will be integrated into fertilizer plant and syngas product will be directly utilized for production of fertilizer.
- First commercial plant is expected to be constructed in 2015.
- Syngas production has been commercially proven in many countries, but the problems to develop the technology in Indonesia are as follows:
  - No market guarantee for syngas
  - Price of coal gas cannot compete with price of natural gas
  - Infrastructure is required for coal and syngas product

Development of Formed Coke

- Since 1993, ARDEMR has successfully developed formed coke for foundry, by applying double process technology (patent being proposed).
- A pilot plant of 1 ton per day capacity has been constructed at Palimanan, Cirebon.

- The quality of formed coke is better than that of imported coke from China, especially of heating value and ash content i.e. 7,800 kcal/kg and 2%, respectively.
- The formed coke has been tested and accepted in foundry industries as a based coke and charge coke.

Development of Activated Carbon from Coal

Definition:

Activated carbon is a porous material, that remove organic and inorganic compounds from liquids and gases by a process known as adsorption.

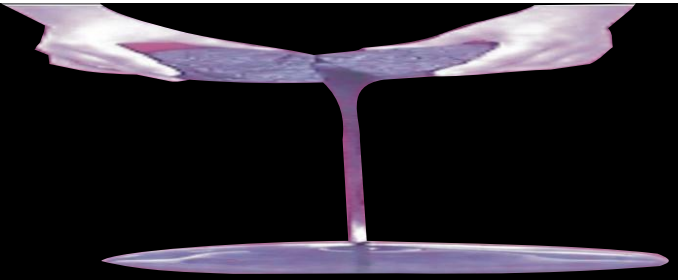
Benefit:

Activated carbon could be used for waste water treatment, water purification, flue gas treatment (desulphurization, denitrification, mercury capture), decolorization, deodorization, etc.

R & D Activity:

- Production of activated carbon from LRC using rotary kiln and cyclone burner at the 1 t/d capacity pilot plant in Palimanan, Cirebon has been carried out successfully to produce good quality product since 2009. The product can be used for liquid waste treatment
- Design of commercial plant with a capacity of 3,000 t/y is in progress in combination with Feasibility Study

Development of Coal Water Mixture (CWM)



Definition:

CWM is a mixture of ground powder coal, water and small quantities of additives, having fluid characteristic with a viscosity equivalent to heavy/marine fuel oil.

General advantages of CWM:

- **Can be handled in a similar way to heavy fuel oil.**
- **No spontaneous ignition, no explosion hazard and no dust problem.**
- **No pulverizing and drying processes are required before combustion.**
- **Stable boiler operation similar to that of heavy/marine fuel oil.**

Economy of CWM:

- **Conventional tank facilities instead of yard facilities for loading, storage, and transportation of pulverized coal, enable cost reduction.**
- **Short start-up time, low minimum load and quick load change for boilers can be expected similar to those of heavy/marine fuel oil.**

R & D of CWM:

- **CWM preparation using upgraded LRC in pilot scale of 4 t/d capacity is operated in Palimanan, Cirebon since 2010.**
- **In cooperation between ARDEMR and NEDO Japan, CWM demonstration plant of 10,000 t/y capacity is under construction in Karawang, West Jawa.**

Development of Cyclone Burner

- Cyclone Burner could replace fuel oil burner of industria facilities, among others: boiler, oil heater, rotary kiln, heat exchanger, metal smelter, rotary dryer, calciner, annealing kiln and kettle heater.
- Characteristics: short /long flame, vertical/horizontal positio and high intensity.
- Cyclone Burner could save the fuel cost of 60-70%.

Asphalt Mixing Plant of 750 kg coal/hour

Development of Coal Industry

Development of Coal Industry

- Currently, most of the Indonesia coal has been sold for export markets, only about 25% is used for domestic need.
- The main user of the coal is electricity accounting to more than 50%, followed by cement, textile, pulp, metallurgy and others.
- In the last 15 years, domestic coal consumption showed significant increase. The fast growing of coal demand currently was mainly driven by the 10,000 crash-program of electricity development. The use of coal for electricity is still cheaper compared with other energy resources. Therefore, there is no new technology that drives the coal industry in the country.
- In the future, coal production and domestic use are expected to continuely increase in line with the implementation of new technologies based on clean coal technology. However, incentives for coal down stream industries and infrastructure development are needed to accelarate the implementation of new technologies.
- The Government has guaranted the domestic coal demand through high projection of future domestic coal use.

Concluding Remarks

1. Indonesia still rely on the availability of coal for energy supply due to its massive reserve compared to other fossil energy reserves.
2. The targeted energy mix to the year of 2025 shows that coal is very significant in national energy supply both as primary energy in electric power generation as well as in various other industries.
3. Implementation of new coal technology will contribute to both added value and the global climate issues by minimizing the harmful effect to the environment through clean coal technology.
4. International cooperation including research and development collaboration and technology transfer will accelarate the drivers of Indonesian coal industry.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