

# The e – ASIA Joint Research Program (JRP) Workshop

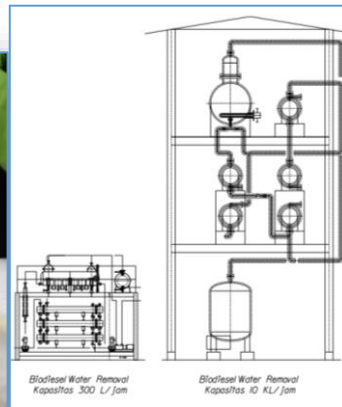
## Biofuel (Biodiesel) Implementation: Opportunity & Challenges

By

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National Research and Innovation Agency

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# 1. Introduction

## **Research Group for the Development and Utilization of Biofuels**

Energy Conversion and Conservation Research Center

Energy and Manufacture Research Organization

National Research and Innovation Agency

# Research Group for the Development and Utilization of Biofuels



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## Biodiesel Plant Design Engineering



### Biodiesel Processing:

- Process Optimization
- Feedstock Diversification
- Product Quality Assessment (SNI 04-7182-2006)
- Product Quality Upgrading

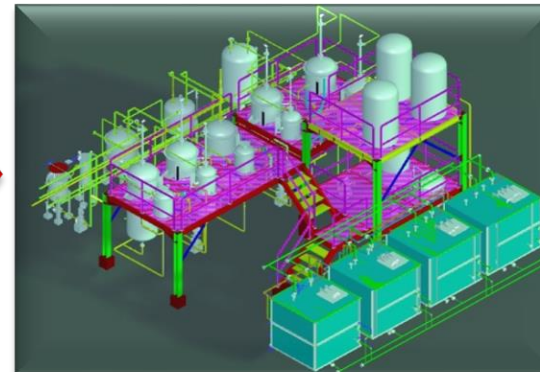
1. Engineering Design :
    - Conceptual
    - Basic Design
    - Detailed Design
  2. Construction
- Commissioning  
Supervision  
Promotion  
Socialization  
Training

### Goals :

1. Optimum Process Design
2. Enhancement of Biodiesel Quality (Stability of Biodiesel Product)



Increasing industrial competitiveness



# Road Test dan Static Engine Test

## Research to Prove Feasibility and Technology Demonstration Steps

### 1. Road Test 2002

- Toyota Kijang LX 2.5 L (2001)
- Jakarta – Pekanbaru – Jakarta (5000 Km)

### 2. Trial of B10 on buses

- September – December, 2004
- 23 employee pick-up and drop off buses

### 3. Road & Static Engine Test 2004

- Isuzu Phanter LV 2.5 L (2004)
- Jakarta – Denpasar – Jakarta (20.000 Km)

### 4. Test the effect of biodiesel – diesel fuel mixture on emissions and diesel engine performance (2007)

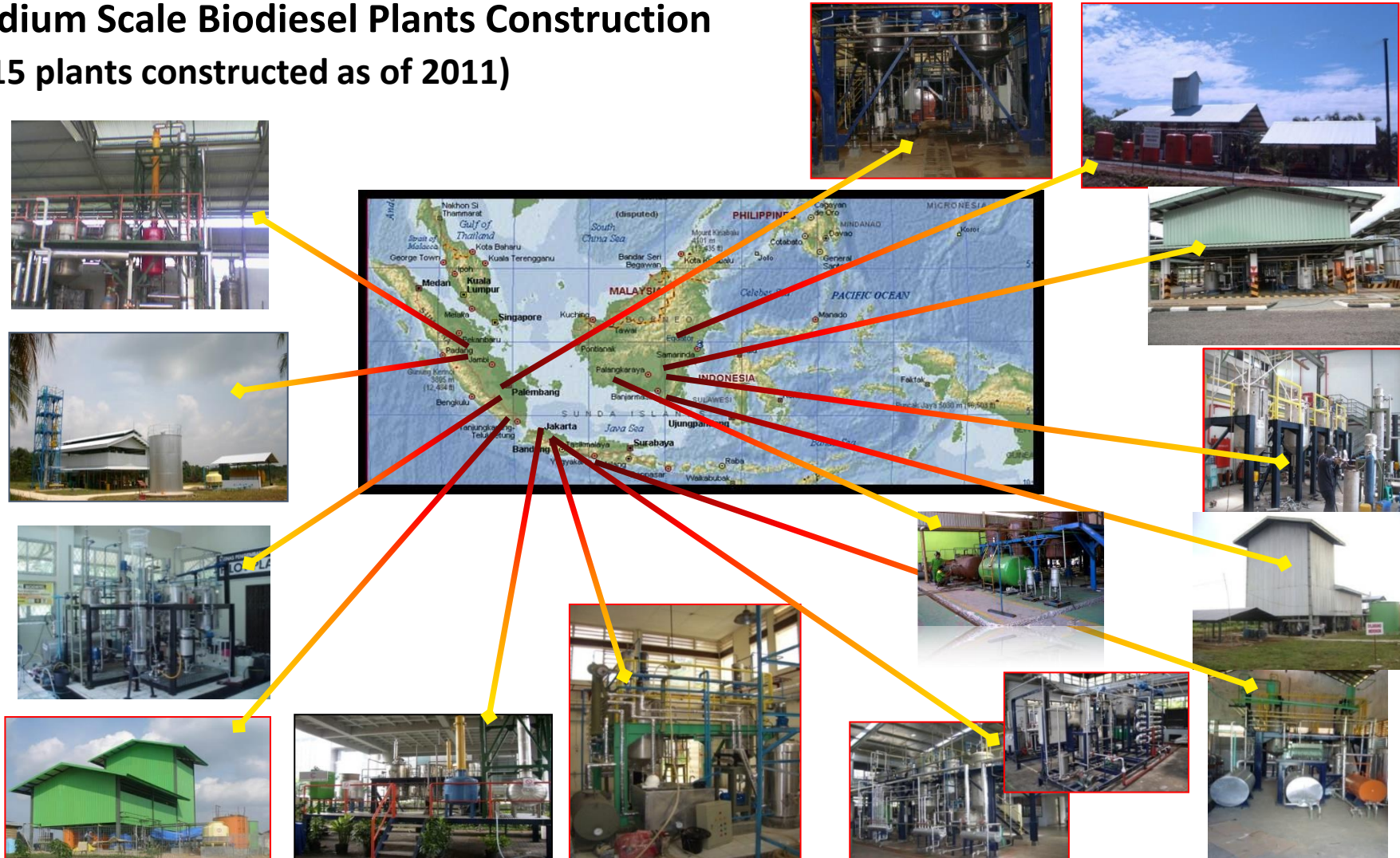
- Toyota Kijang Inova Diesel 2.5 L (2005)
- B0, B10, B20, B30, B50 dan B100



# Product Development

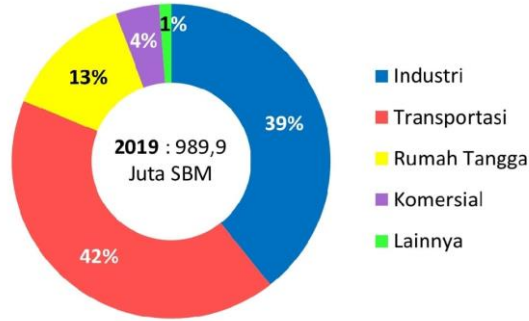
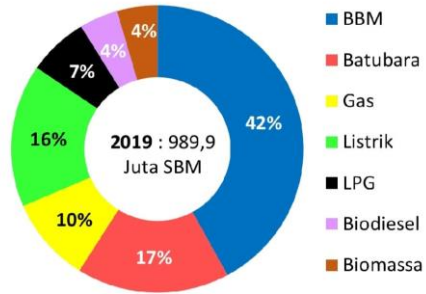
## Scaling up to Prove Feasibility and Technology Demonstration Steps

### Small to Medium Scale Biodiesel Plants Construction (15 plants constructed as of 2011)



## **2 . National Biofuel Program**

# Why Biofuel?



Air quality in big cities in Indonesia, especially in Jakarta is decreasing

- ✓ Energy fulfillment still depends on fossil energy
- ✓ Limited oil reserves
- ✓ Currently, Indonesia has become a net oil importer
- ✓ The still high use of fuel has resulted in a drain on the country's foreign exchange due to imports
- ✓ NZE Commitment



**Biofuel raw materials are abundant**



**The availability of new technology and the support of R&D data**

**Government Policy**

**National Biofuel Program**

**The Ideas emerge from problems, needs, industries and market openings**



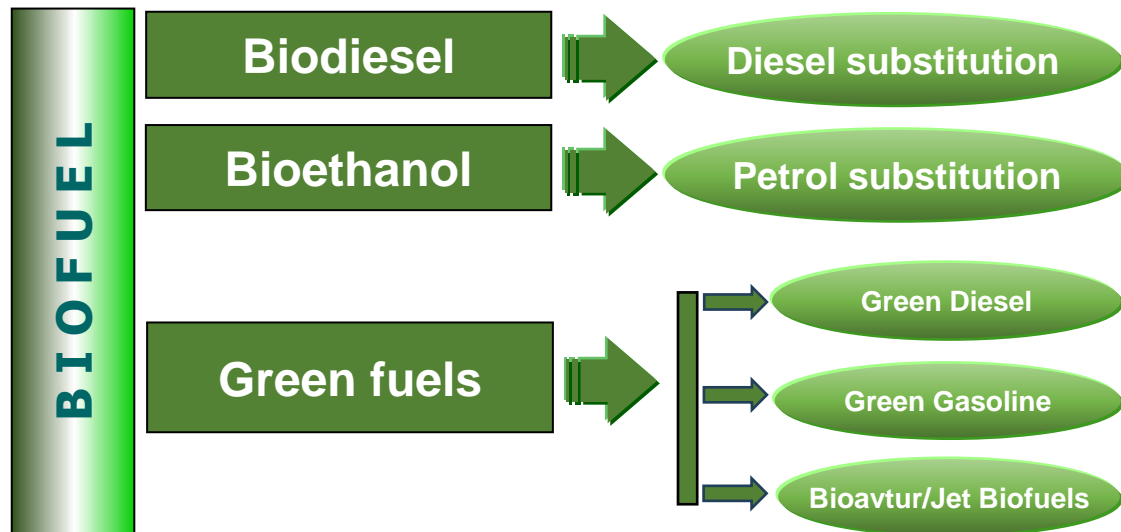
# The General National Energy Plan (RUEN)

## Presidential Decree (Perpres) No. 22/2017

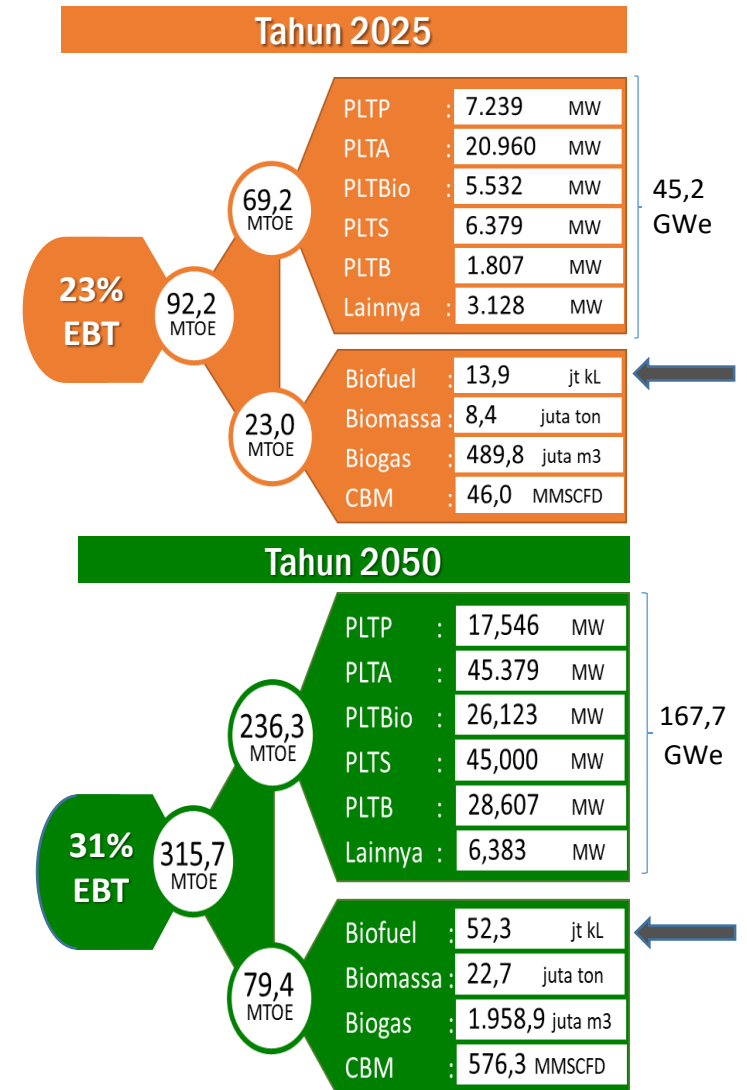
As a detail of the national energy policy (KEN), the government issued a general national energy plan (RUEN) in 2017 which was ratified through a presidential regulation.

RUEN contains detailed targets and programs that will be implemented by the government in order to achieve the targets that have been proclaimed in the KEN. Some of the important targets in RUEN, including:

- (1) NRE Power Generation Capacity is 45.2 GW in 2025 and 167.7 GW in 2050
- (2) Renewable fuels (Biofuel, Biomass, Biogas and CBM) of 23 MTOE in 2025 and 79.4 MTOE in 2050.
- (3) Emission reduction of 476 million t-CO<sub>2</sub>-eq in 2025 (34.8%) and 2726 million t-CO<sub>2</sub>-eq in 2050 (58.3%)



Source : DJEBTKE, 2022





## **3 . Current Status of Biodiesel Program**

# 2021 Palm Oil Production & Distribution Map

## 2021 Production, 48.094 Mil Ton

- DOMESTIC - 18.022 Mil Ton, 37%
- EXPORT - 30.072 Mil Ton, 63%

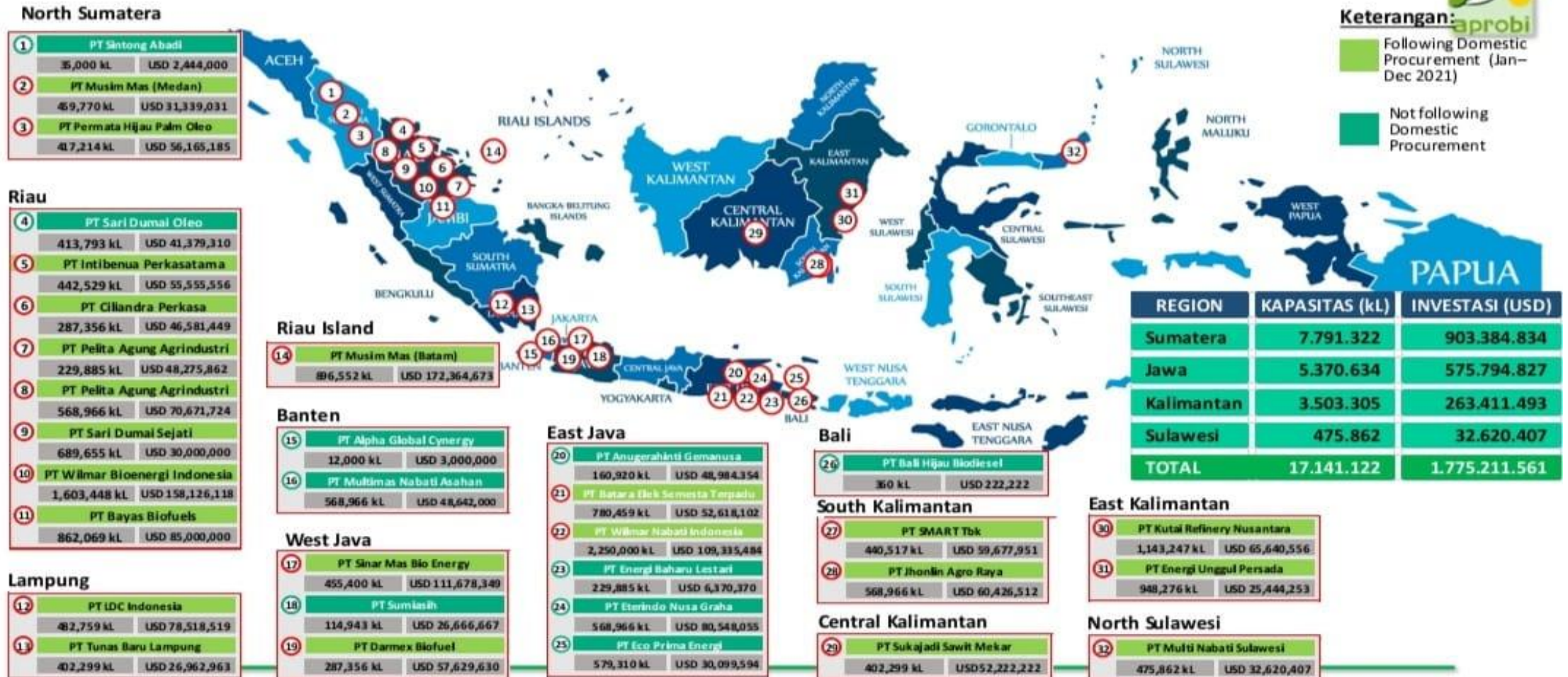


Biodiesel Production for domestic took 15% from the 2021 Palm Oil Production

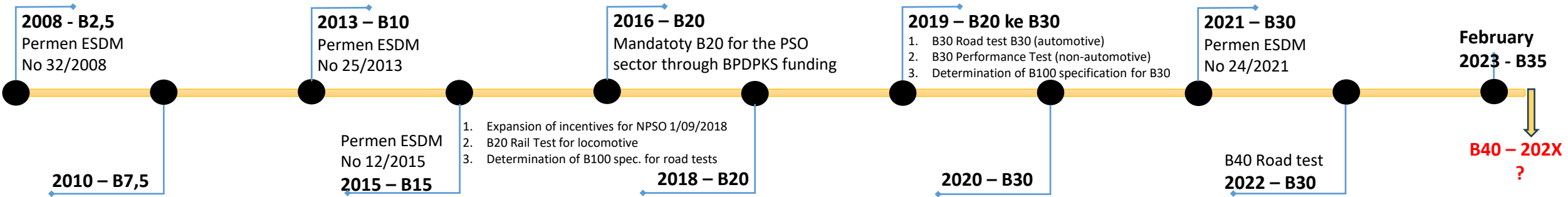
2022 projection, Biodiesel domestic will use about 17% from 2022 Palm Oil Production.

# Current installed capacity of the biodiesel industry in Indonesia

## INSTALLED CAPACITY OF BIODIESEL INDUSTRIES



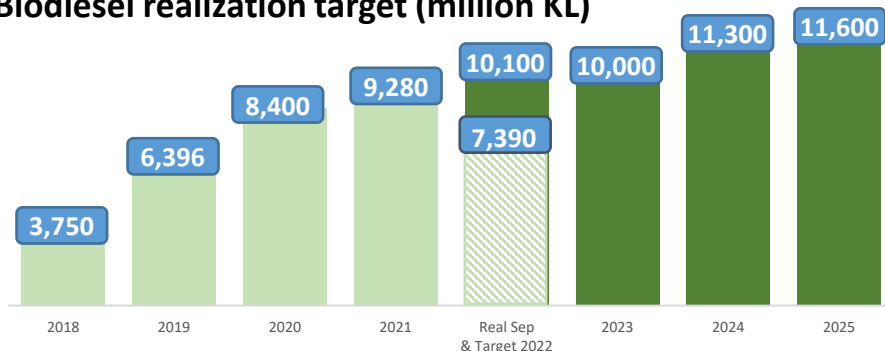
# Biofuel development – B30 Mandatory & B40 Road Test



Mandatory biodiesel stage (based on the regulations of the Minister of Energy and Mineral Resources (Permen ESDM) No. 12/2015)

SEKTOR MANDATORI BIODIESEL	APRIL 2015	JANUARI 2016	JANUARI 2020	JANUARI 2025
Usaha Mikro, Perikanan, Pertanian, Transportasi, dan Pelayanan Umum (PSO)	15%	20%	30%	30%
TRANSPORTASI NON-PSO	15%	20%	30%	30%
PEMBANGKIT LISTRIK	25%	30%	30%	30%
INDUSTRI DAN KOMERSIAL	15%	20%	30%	30%

## Biodiesel realization target (million KL)



Realization of foreign exchange savings in 2021 : IDR 66 trillion

Source : DJEBTKE, 2022

## B40 ROAD TEST preparation

### TEST VEHICLE

- Otomotif ≤ 3,5 Ton
- Otomotif > 3,5 Ton

### MILEAGE

- 40.000 KM; > 3,5 Ton
- 50.000 KM; ≤ 3,5 Ton

### FUEL

- B30D10 with mixed formula of 30% Biodiesel (B100\*) + 10% Diesel Biohidrokarbon/HVO (D100) + 60% diesel fuel (B0)
- B40 with mixed formula of 40% Biodiesel (B100\*) + 60% diesel fuel (B0)

## Activity timeline



### PREPARATION

- Finalization of technical road test
- Funding discussion
- Fuel preparation
- Test vehicle preparation + driver

### Catatan:

B100 specifications refer to the Director General's decision Number 189.K/10/DJE/2019

### ROAD TEST IMPLEMENTATION

- Test vehicle monitoring
- Fuel monitoring
- Performance test

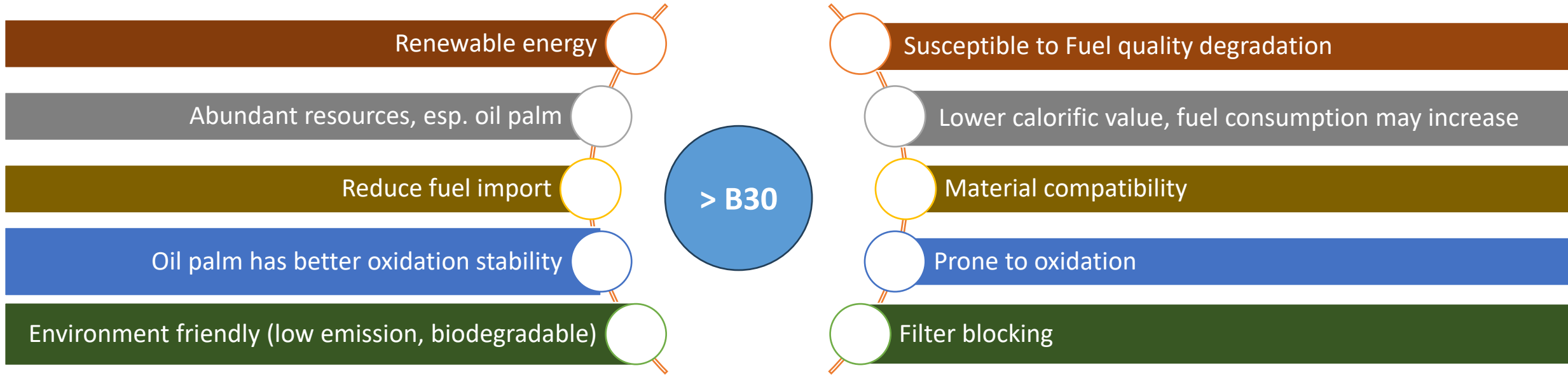


### REPORTING

- Test result recommendation
- Recommendations for revised SNI biodiesel specification

## 4 . Closing

# Research topics needed for the sustainable use of fuel with higher levels of biodiesel mixture



## Research required

Low-Cost  
Production

Alternative  
raw material

Design  
Engine Euro  
4 – 5

Proper  
Handling &  
Storage

Water  
removal

Compatible  
Elastomer  
and metal

Adsorbent  
and  
Additive

Glycerol  
Utilization

Filtration



## Biodiesel implementation in Indonesia: Experiences and future perspectives

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### ARTICLE INFO

**Keywords:**  
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Indonesia  
High ratio blending  
External cost  
Polluters pay principle

### ABSTRACT

Indonesia leads the world in biodiesel usage, with B35 (a mixture of 35 % biodiesel and 65 % diesel fuel) as its nationwide standard. The success of biodiesel program is primarily influenced by factors such as encompassing supply, demand, regulatory frameworks, economic considerations, and environmental impact. This comprehensive study delves into Indonesia's biodiesel program, drawing insights from practical experiences and recent research findings. Additionally, it puts recommendations aimed at ensuring the long-term sustainability of biodiesel program. The economical feasibility of mixed biodiesel and diesel fuel (Bxx) depends on the scheme and formula for determining the Biodiesel Market Index Price in Indonesia. Exploiting the emission advantage of biodiesel within "polluter pays" principle could potentially position it as a compelling alternative to conventional diesel fuel. The discussion focuses on the establishment of a carbon tax and the internalization of the external cost of using biodiesel as part of energy policy. In summary, this review provides a reference for other countries that are either in the initial stage of starting or considering the implementation of a biodiesel utilization program in their countries and identifies the existing gaps in the further development of sustainable fuels.

Thank you

### 1. Introduction

In 2021, the Indonesia's primary energy source, which made up for approximately 87.8 % of the total, relied mainly on coal, oil and natural gas. Moreover, the transportation sector, which stands as the largest energy consumer, met 93.8 % of its needs with petroleum-based fuels [1]. The heavy dependence on fossil fuel has two significant implications: firstly, it exerts pressure on foreign exchange reserves due to the necessity for imports [2], and secondly, it leads to an increase in greenhouse gas (GHG) emissions as a result combustion of hydrocarbons originating from fossil energy sources. Furthermore, the Paris Agreement mandates that the Indonesian government is obliged to submit a contribution report on GHG emission reduction as detailed in its Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC).

Indonesia has made a commitment to reducing emissions by ratifying the Paris Agreement by Law No. 16/2016 addressing ratification of the Paris Agreement to the UNFCCC. Indonesia has set a target of reducing greenhouse gas emissions nationally by 29 % unconditionally (with its own efforts) and 41 % with adequate international support in 2030 according to the NDC document that has been submitted to the UNFCCC [3]. To ensure sufficient energy availability, maintain high quality,

ensure affordability, and align with environmental targets as outlined in the NDC document, the Indonesian government, in collaboration with the National Energy Council (DEN), conducted a thorough review of the Grand National Energy Strategy (GSEN). This strategic assessment, spanning the medium-term period from 2020 to 2040, encompasses initiatives including increasing oil lifting and upgrading fuel refineries, optimizing the use of natural gas, promoting the growth of electric vehicles, and encouraging the development of New and Renewable Energy (NRE). All these measures aim to reduce oil imports while promoting sustainability and emission reduction [4]. The Indonesian government's commitment to encouraging fuel diversification in the transportation sector, particularly through the implementation of biofuels (BBN), is clearly exemplified in the energy transition program outlined in the National Energy Policy (KEN). The biofuel program in Indonesia officially began around 2006, with its initial implementation for the public service obligation (PSO). It then continued to mandatory implementation in 2008. Several reasons derived the implementation of the biofuel program in Indonesia at the time. Firstly, it aimed to ensure energy security and resilience. Secondly, it was designed as a poverty alleviation initiative. Thirdly, it addressed to improve environmental quality.

The urgency of using biofuels was also driven by rising fuel prices which increased significantly up to 150 USD/barrel [5]. While Indonesia has been an oil-importing country (net importer) since around 2004, the

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