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### Potential Energy Generation from Agricultural Residue in Indonesia

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## Abstract

Indonesia has great potential of biomass sources from their agricultural residue, which can potentially be used for alternative energy generation. This preliminary research explores the most suitable technology for energy generation from agricultural residue and its challenge for application in Indonesia. The study showed that biomass utilization via the direct combustion process is recommended for energy generation. It is also reported that the pretreatment process of drying and washing, are required to increase the fuel quality and plant efficiency.

## Introduction

- Palm oil, corn plant, and paddy rice are the top 3 (three) producers of agricultural residue in Indonesia, which generated total residue of 189 million ton in 2017<sup>2</sup>
- The main agricultural residues follow:
  - Empty fruit bunches (EFB), mesocarp fibers, and palm kernel shells (PKS) are left after palm oil production<sup>2</sup>.
  - Corn stover remains after corn harvesting<sup>2</sup>.
  - Rice husk and rice straw are the by-products of rice production<sup>2</sup>.

*This poster explores the potential for energy generation from agricultural residue, as well as technologies and challenges for its implementation in Indonesia.*

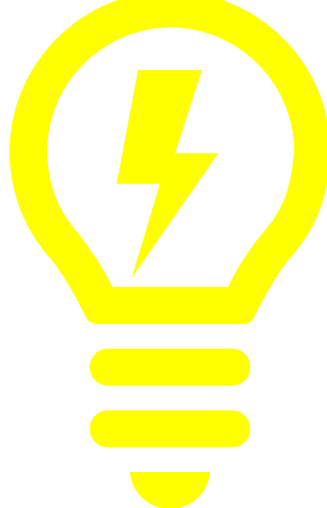
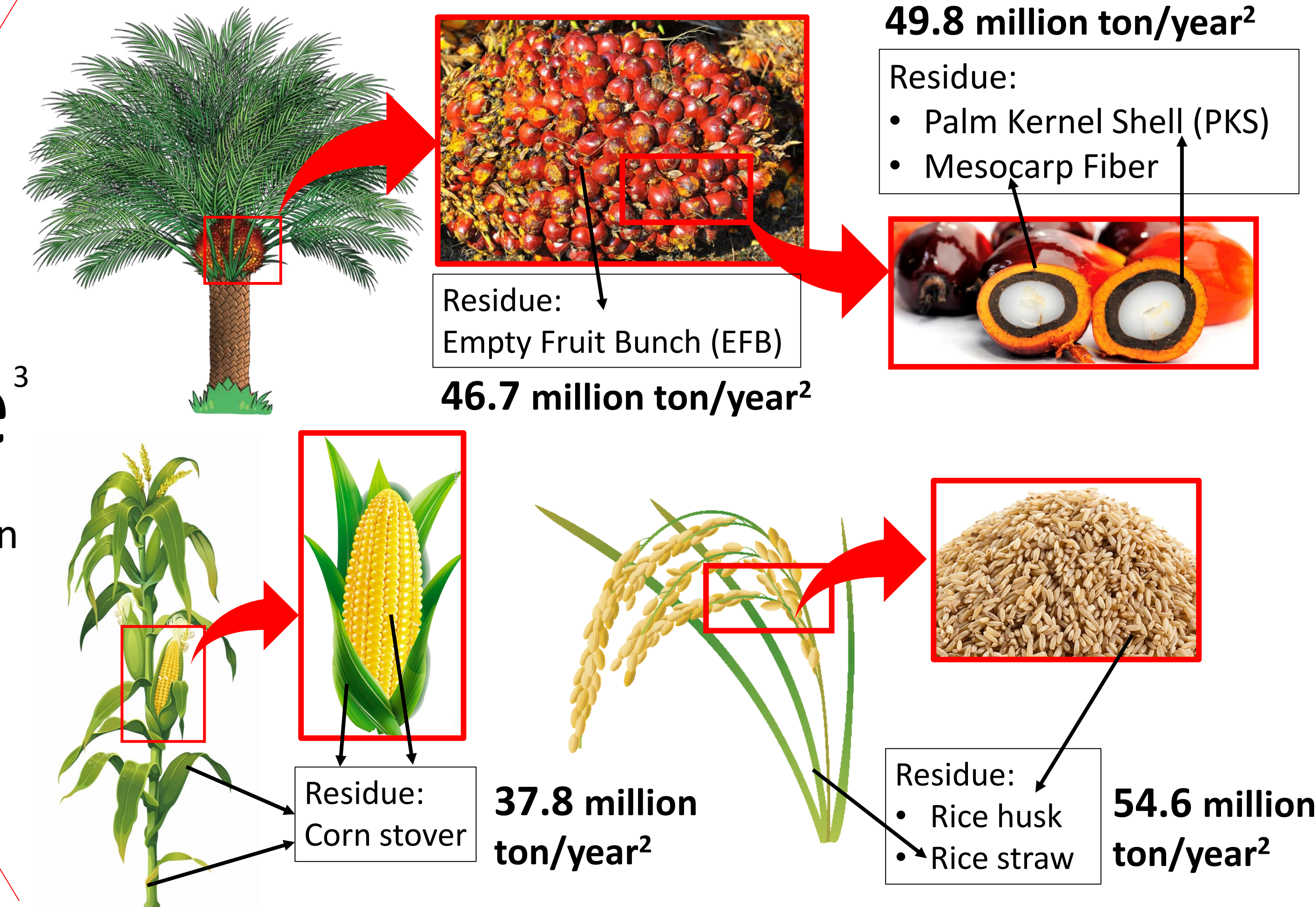
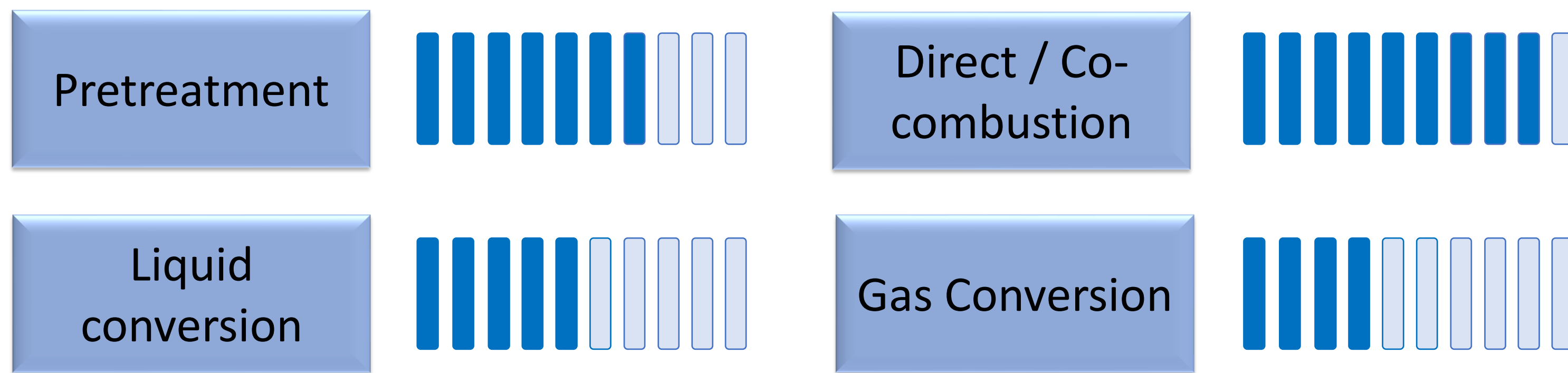
 **33 GWe<sup>3</sup>**  
55% of Indonesia's electricity generation in 2016<sup>4</sup>

Figure 1



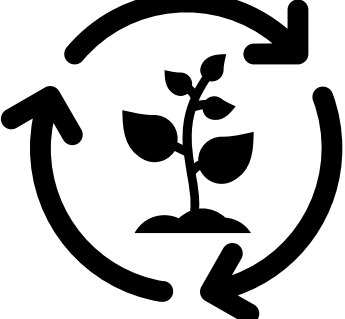
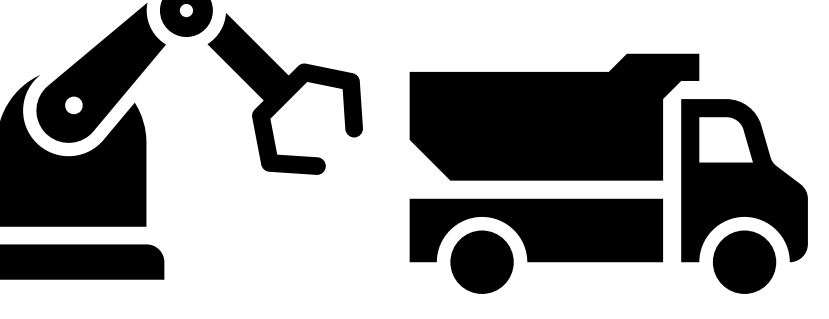
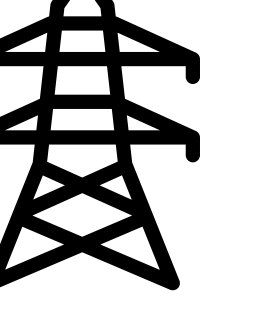
Illustration of agricultural product and residue of palm oil, corn plant, and paddy rice<sup>1</sup>



## Technological Readiness and its Availability in Indonesia<sup>5</sup>



## Challenges

-  Removal of moisture and ash<sup>6,7</sup>
-  Size Reduction<sup>8</sup>
-  Crop rotation and management<sup>5</sup>
-  Material handling and distribution<sup>5</sup>
-  Grid connectivity<sup>9</sup>

## Conclusions

- 1** Technology Recommendation: Pretreatment & Combustion
- 2** Required pretreatment:
  - Moisture removal: drying
  - Ash removal: washing
  - Size reduction
- 3** An integrated biomass energy generation system

## Note

<sup>1</sup> Figure of palm oil tree and its product are taken from (PNG Wave), (123RF), and (Food Revolution Network, 2019). Figure of corn plant and its product are taken from (DLPNG) and (PNG Item). Figure of paddy rice and its product are taken from (PNG Wave)  
<sup>2</sup> Calculation in (Ishikawajima-harima Heavy Industries (IHI) & Institut Teknologi Bandung (ITB), 2020) from data production in 2017 from (Ministry of Agriculture, Republic of Indonesia. (2019))  
<sup>3</sup> Estimated from coal with calorific value 21 MJ/kg, and from assumption in (Detik, 2017), which stated that 4.8 million ton coal/year is consumed by 2,800 MW coal power plant

<sup>4</sup> Comparison with data of total power plant capacity in Indonesia in 2016 from (PwC, 2017)  
<sup>5</sup> From (International Energy Agency, 2017)  
<sup>6</sup> Study of moisture removal by (Li, Zhang, Finney, Sharifi, & Swithenbank, 2012) and ash removal by (Nurdiawati, Novianti, Zaini, Sumida, & Yoshikawa, 2015)  
<sup>7</sup> Figure of ash is taken from (Storyblocks)  
<sup>8</sup> From (Kratky & Jirout, 2010)  
<sup>9</sup> From (International Energy Agency Bioenergy, 2017)

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