Biofuel Development from Biomass Stock

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This presentation explores the opportunities and challenges of converting biomass into biofuels as a pathway toward sustainable energy in Indonesia. Biomass sources such as agricultural residues, forestry waste, palm oil by-products, municipal waste, microalgae, and dedicated energy crops hold significant potential to replace fossil fuels while mitigating climate change impacts.

Indonesia generates vast amounts of biomass, including ~155 million tons of agricultural residues and ~7.9 million tons of forestry residues annually, with an estimated energy potential exceeding 359 PJ. Key conversion routes include bioethanol, biodiesel, and sustainable aviation fuel (SAF). Bioethanol can be derived from lignocellulosic materials like rice straw and oil palm residues, though challenges remain in pretreatment, logistics, and farmers' adoption. Oil palm empty fruit bunches (OPEFBs) and palm fatty acid distillates (PFAD) represent abundant feedstocks, showing technoeconomic feasibility for scaling up second-generation biofuels.

National policy targets for bioethanol and biodiesel are ambitious, with Indonesia moving toward B40–B50 biodiesel blends and expanding bioethanol mandates (E5 to E10). However, infrastructure constraints, high production costs, and limited market penetration remain barriers. Emerging research highlights lignin and microalgae as promising SAF feedstocks, with potential greenhouse gas reductions exceeding 90%.

The roadmap for SAF production anticipates reliance on HEFA processes using palm-based feedstocks (PKO, POME, UCO), with the need to diversify toward AtJ, FT, and PtL pathways beyond 2040. Overall, biomass-to-biofuel technologies can enhance Indonesia's energy security, support climate commitments, and provide economic opportunities, but require stronger policy support, infrastructure development, and technological innovation to achieve large-scale adoption.

Keywords: Indonesia; biomass; bioethanol; biodiesel; SAF; decarbonization; economic viability.