School of Environmental and Forest Sciences

UNIVERSITY of WASHINGTON

College of the Environment

CINTRAFOR

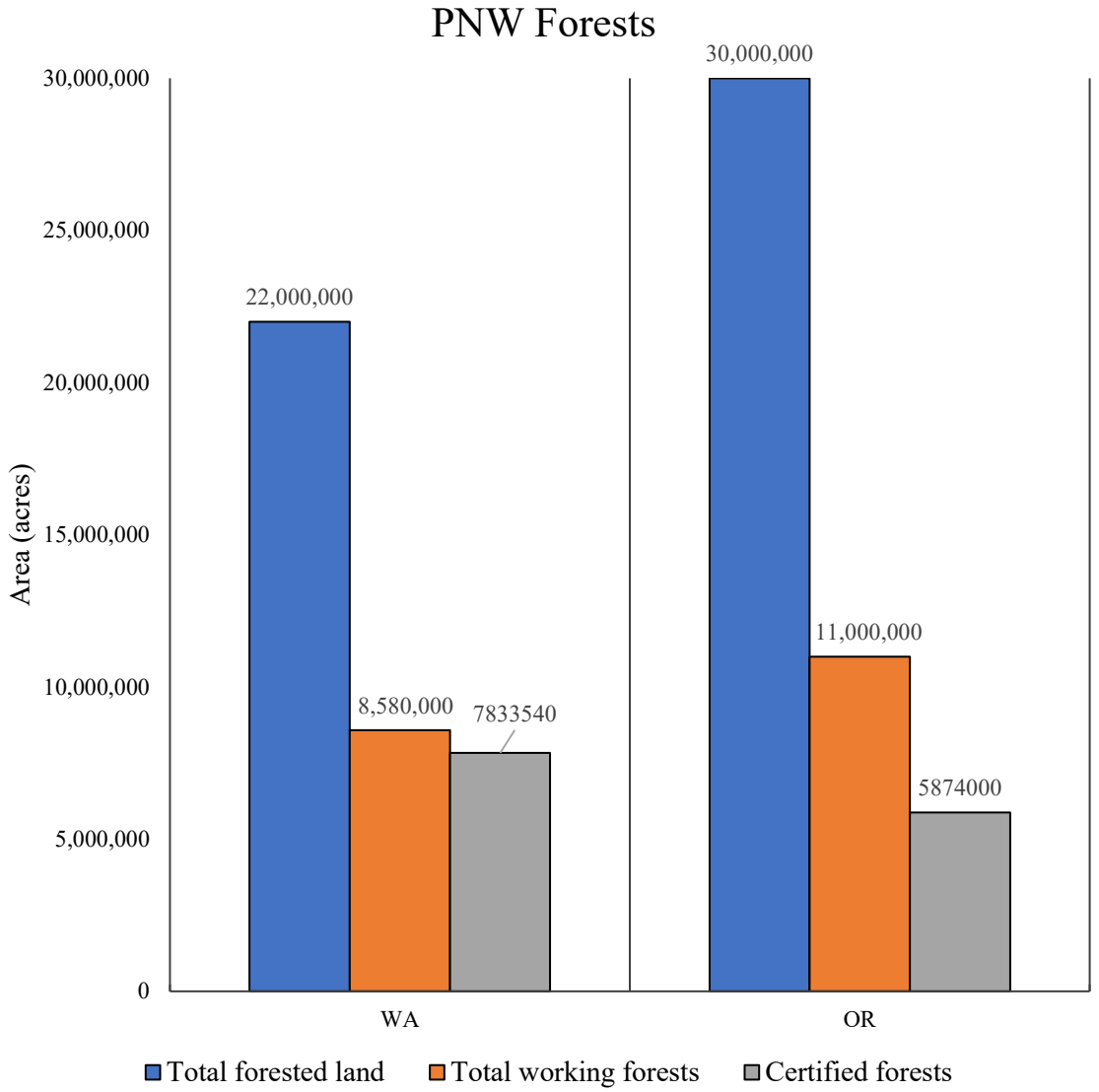
Center for International Trade in Forest Products

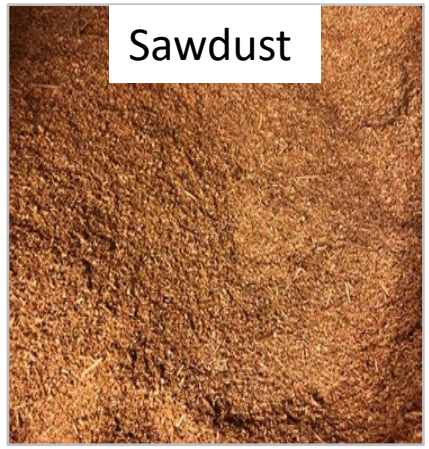
Environmental and Economic Impact of Export Oriented Residual Biomass Pellet Trade between the PNW and Japan

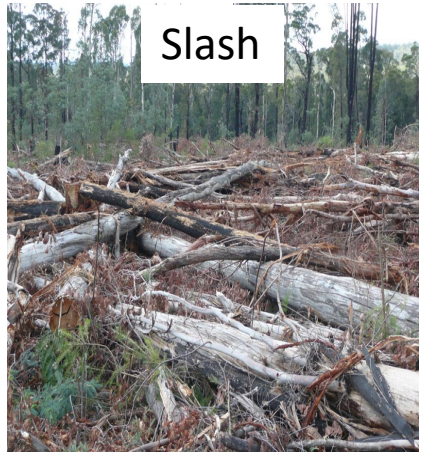
Presented by

HEMALATHA VELAPPAN

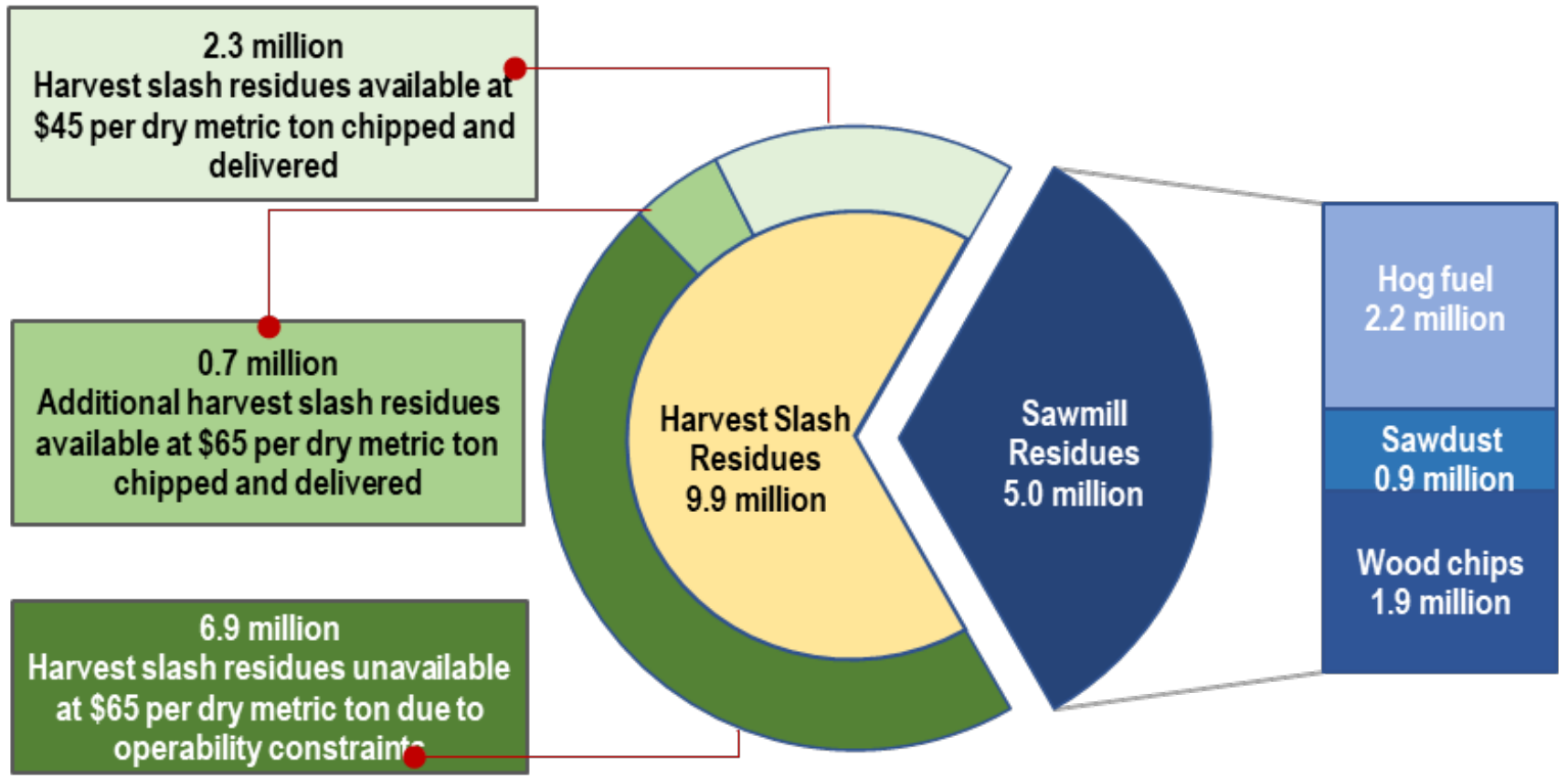
Forestry in the PNW







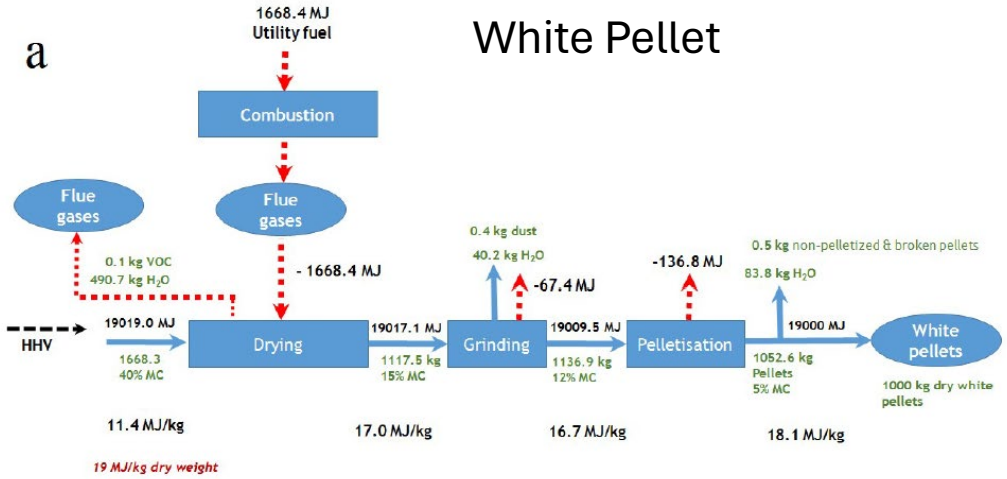
Forest residues available in the PNW



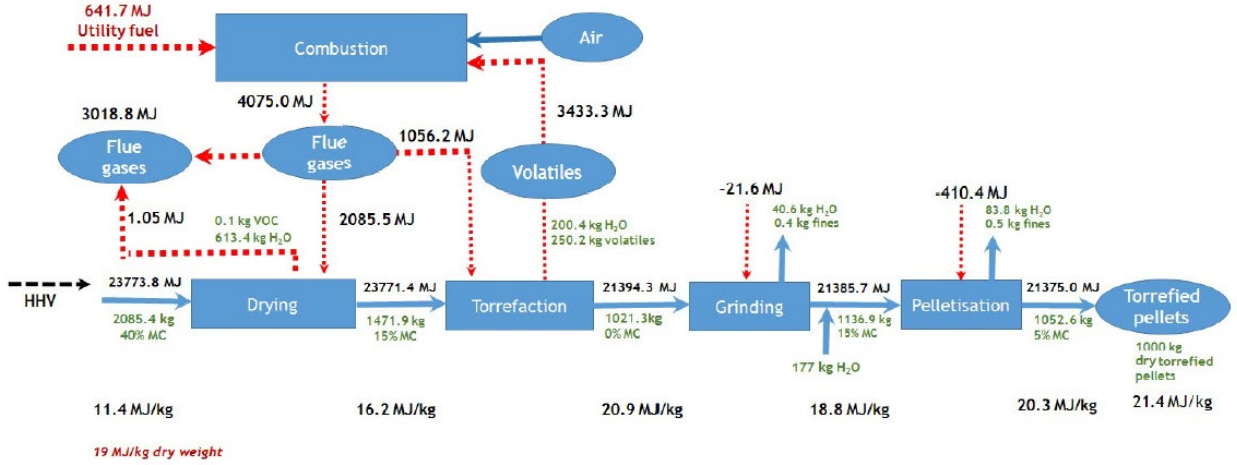
Between 2 – 4 million dry metric tons of these residues can be available

Wood pellets from residual biomass

White Pellet



Torrefied Pellet



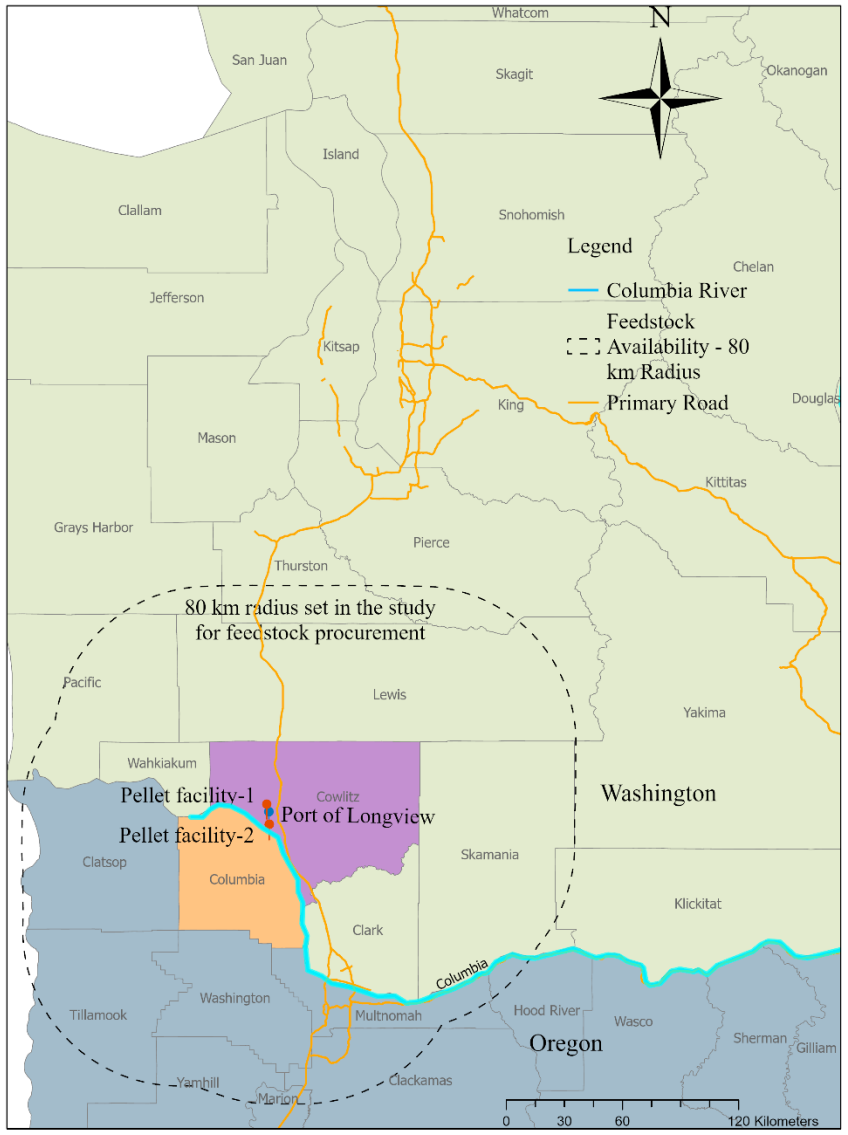
Quality of the pellet we tested

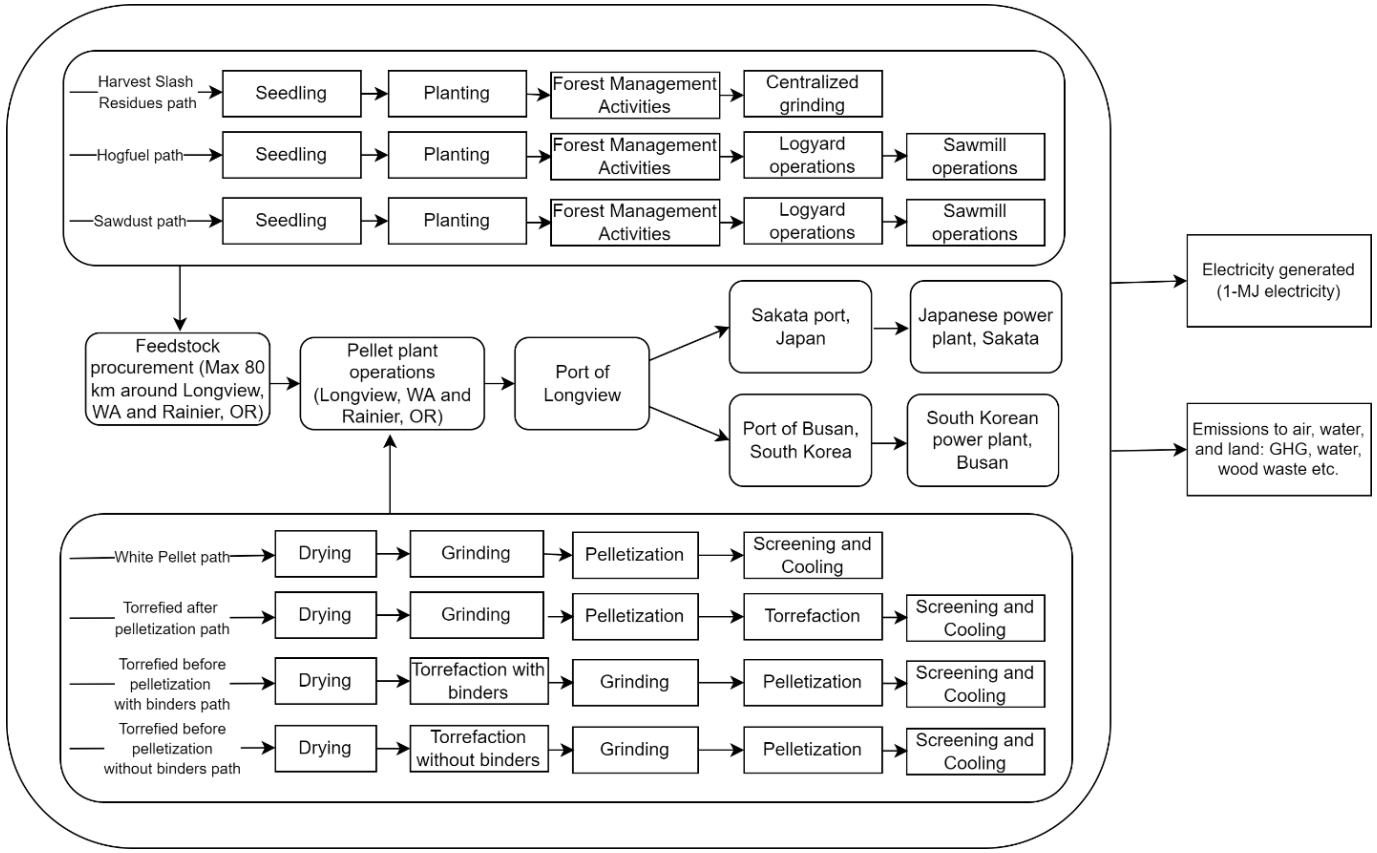
Tested for	ISO Standards	White Pellets		Torrefied Pellets	
		Mill Residues	Slash Residues	Mill Residues	Slash Residues
Pellet Durability Index (%)	Above 96.5%	86.78	91.72	72.75	NA
Fine content (%)	Below 4%	7.055	2.785	16.22	NA
Moisture Content (%)	Below 10%	7.24	5.517	3.975	3.39
Ash (%)	Below 4%	1.83	0.687	10.81	0.49
Nitrogen (%)	Below 0.3%	0.215	0.16	0.24	0.1
Sulfur (%)	Below 0.05%	<0.01	<0.01	<0.01	<0.01
High Heating Value (MJ/kg)	Above 18.6	21.63	21.42	20.85	21.13
Low Heating Value (MJ/kg)	Above 16.5	20.18	19.81	19.2	19.48

Green indicates the pellets have either met or surpassed the ISO standard for the quality parameter

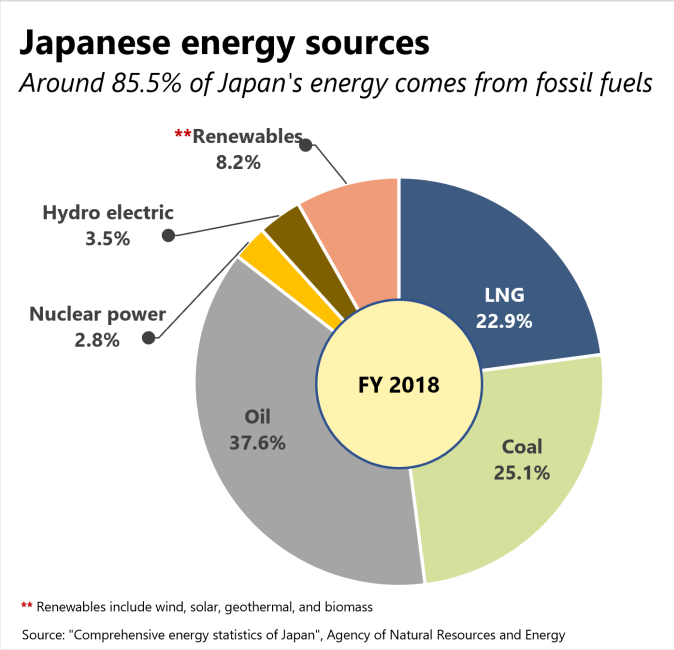
Red indicates failure to meet the ISO standard for quality parameter

Potential logistics and System boundary





Pellet Demand in Japan



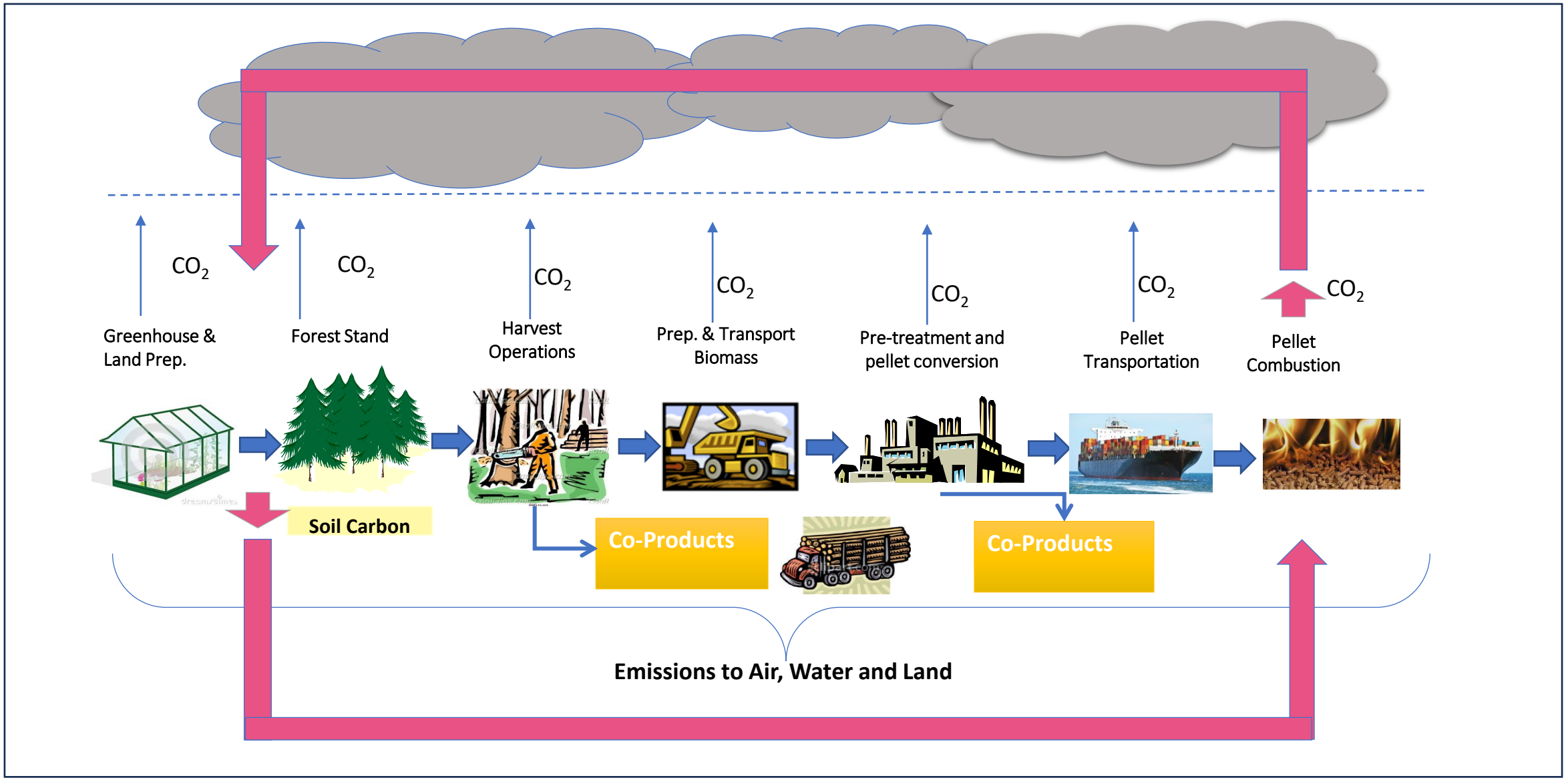
Biomass * 6

	Methane fermentation gas (derived from biomass)	Woody biomass derived from thinned wood	
		2,000kW or more	Less than 2,000kW
FY2018 (reference)	39 yen + tax	32 yen + tax	40 yen + tax
2019			
FY2020			
2021			
Lead time	20 years		

74.42 USD/GJ

- JAPAN HAD SET A BIOMASS POWER TARGET FOR FY 2030 AS 3.7% TO 4.6% WHICH IS 20% OF ITS RENEWABLE GENERATION.
- THIS TARGET WOULD CREATE A BIOMASS DEMAND OF AROUND 13-18 MILLION METRIC TONS (MT) PER YEAR BY 2030
- THE FEED-IN TARIFF SYSTEM ENCOURAGES FURTHER ADOPTION

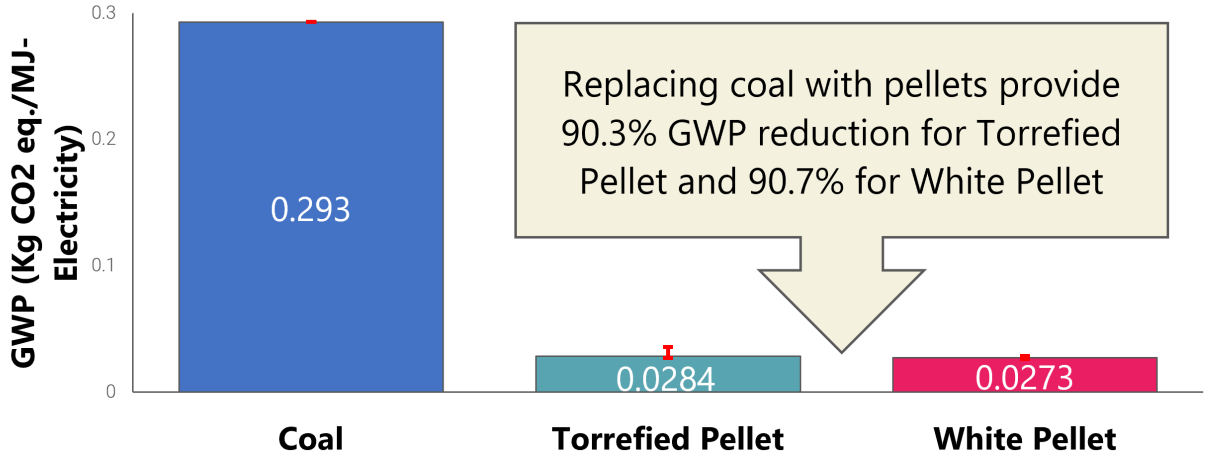
Pellet Life Cycle – SimaPro analysis



Environmental Impact of pellet vs coal

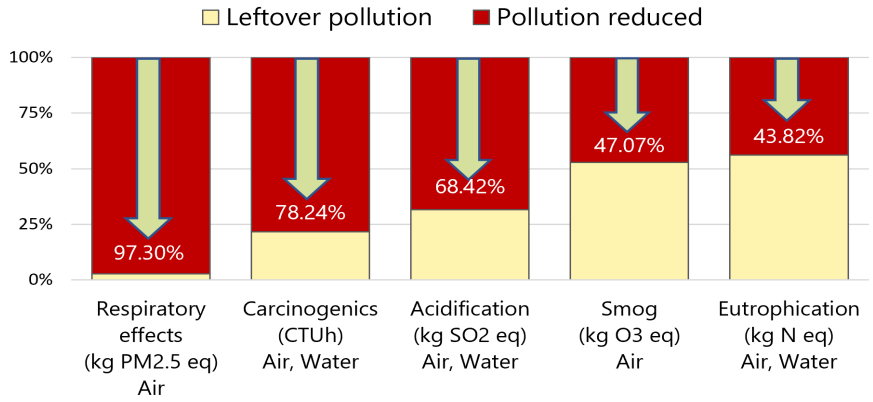
Pellets vs Coal

Average Global Warming Potential (GWP) Impact (Kg CO2 eq.) to generate 1 MJ-electricity

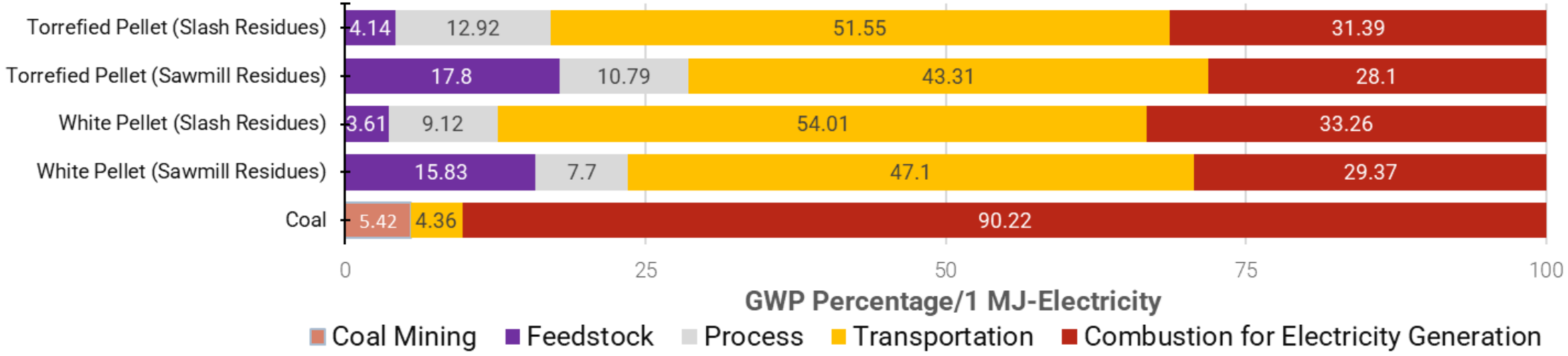


Pollution Reduction

Utilizing harvest slash for wood pellet production instead of burning substantially reduces local air and water pollution



*Percentage reduction is calculated accounting the life cycle emissions of pellet



Cost Benefit Analysis – Pellet vs Coal

Costs	Benefits
Initial investment – 10 to 65 million	Producer surplus - current Japanese import price 197 USD/mt (average 156 USD/mt)
Operations and Maintenance – 125 to 178 USD/metric ton	Avoided slash burning costs and externalities
Cost associated with externalities in transporting, producing, and burning pellets	Reduced negative externalities by coal
Consumer surplus	

- Although even the lowest priced pellets are not cost-competitive with coal, the BCA allows to compare coal and pellets in a social surplus perspective.
- The externalities of emissions associated with coal burning are a cost to the society which is not reflected in its price.
- The results of this study showed that these externalities outweigh the loss of consumer surplus producing a positive net benefit NPV in the range of $11 B for over 10 years.
- High initial investment is a barrier to enter this market.

Conclusion

1. Pellets produced from residues in average produce 90% less greenhouse gas emissions (GHG) compared to coal.
2. Pellets produced from harvest slash residues, which are otherwise burnt, emits least amount of GHG. Additionally, utilizing the slash residues for producing pellets instead of burning will reduce the local PM2.5 pollution by 66% (white pellets) and 69% (torrefied pellet).
3. Transportation which majorly made up of marine transportation contributes to most GHG emissions in the entire pellet supply chain.
4. Substituting regular pellets with residual pellets has great benefits to the planet. These benefits come mostly from the avoided pile burning externalities because the raw materials used to produce residual pellets are residues diverted from burning. These residues have less/negligible price and utilizing them as raw materials can reduce the overall pellet production cost.
5. Economically substituting coal with pellet may not be beneficial for Japan but considering the hidden environmental costs produced a net social benefit.

Thank you!

Any questions?