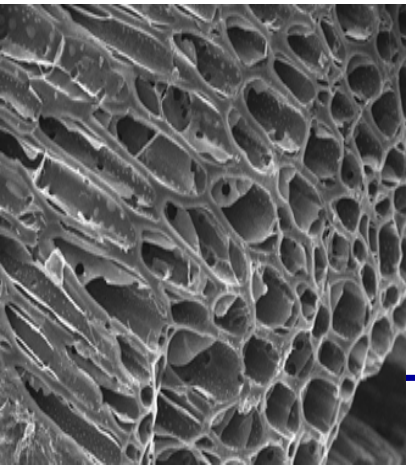

Fixed Carbon Biochar Potential of Palm Oil Empty Fruit Bunches as a Carbon Sequestration in Agricultural in Indonesia

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Outline

Introduction

1. Biochar as a carbon sequestration
2. Palm Oil Solid Wastes & Indonesia EFB Potential
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4. Calculation of Carbon Sequestration
5. Nationally Potential Reduction, Agricultural Sector
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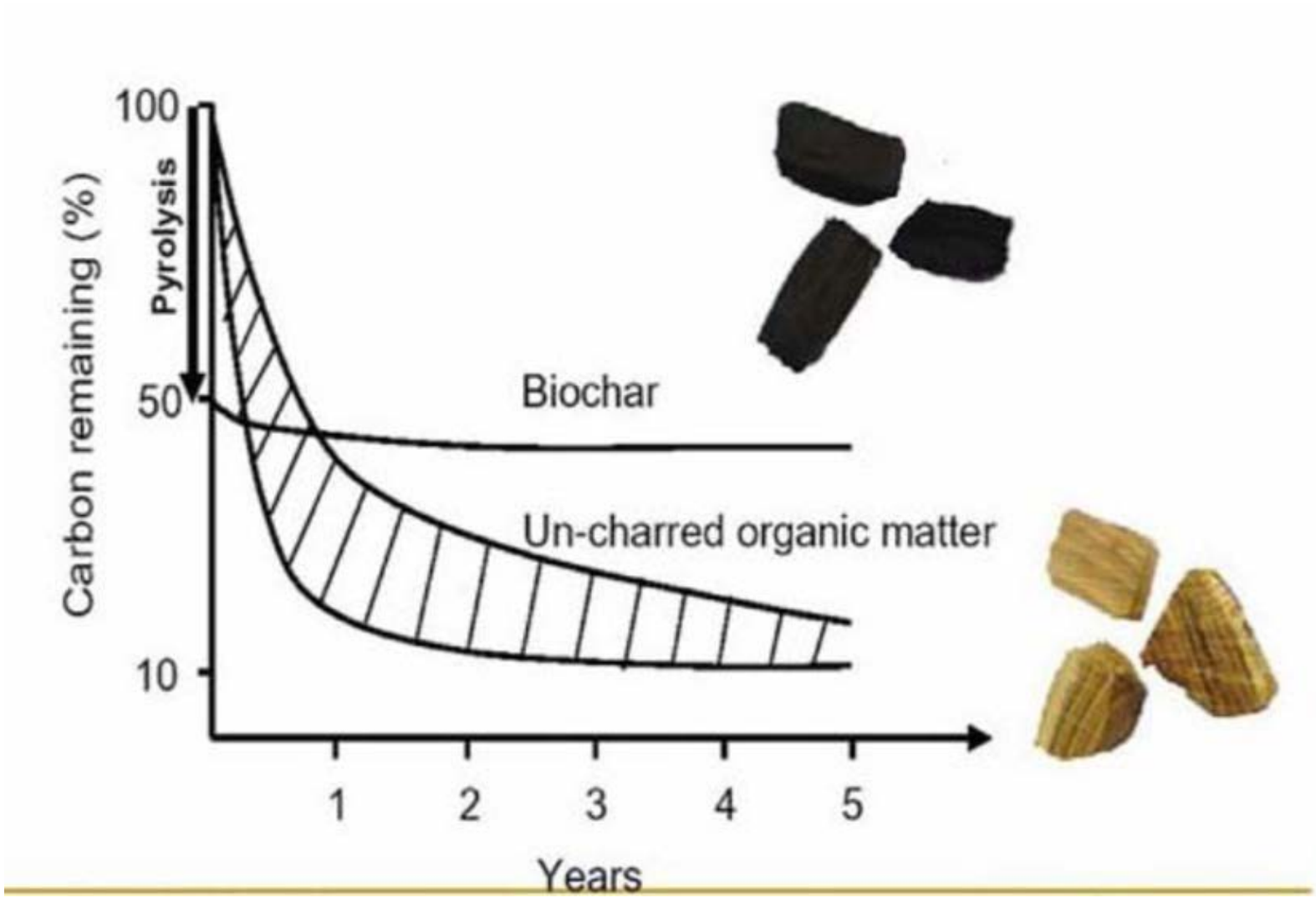
Conclusion

Biochar as a carbon sequestration

- Terra Preta Invention in the Amazon
- Lehmann (2006) : The Essential of Stability of Biochar
- Maturity/Stability Level of Biochar (Spokas, 2010)
- Shackley and Sohi explanation (2011)

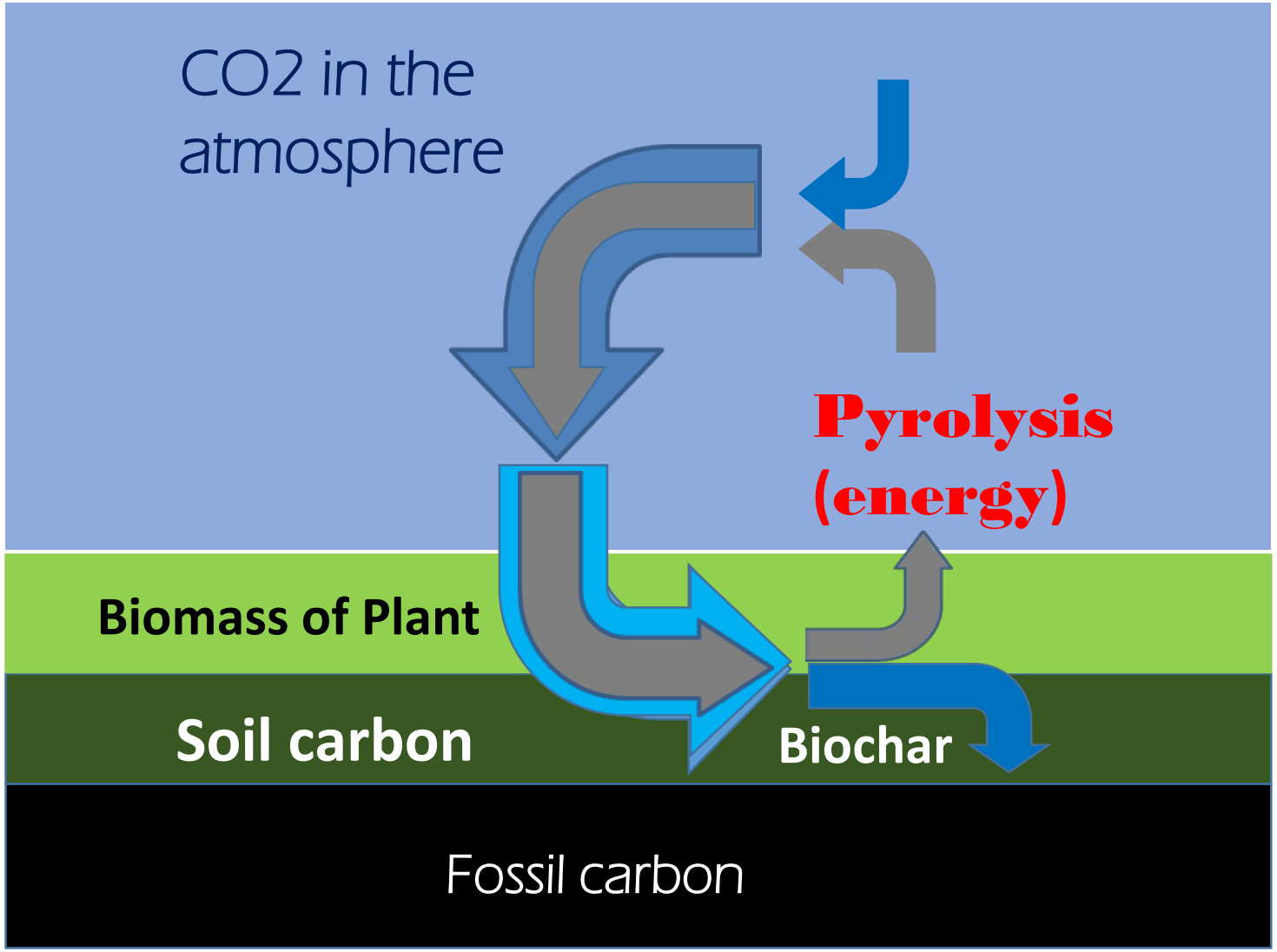
The Essential Stability of biochar (Lehmann, 2006)



Biochar Stability Level Using O/C Ratio (Spokas, 2010)

Ratio	Characteristic Value	Application Stability
O/C	< 0.2	> 1,000 Years
	0.2 < O/C < 0.6	100 < Years < 1,000
	> 0.6	< 100 Years

Biochar Carbon Sequestration Principles (Source: Shackley and Sohi 2009)



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Solid Wastes of POM, 60 T/Hour Capacity (Hidayat *et al.* 2017)

Biomassa Input (FFB):

- 1.644 T/day

Solid Wastes Ouput:

- 107 T Shell/day
- 256 T Fibres/day
- 379 T EFB/day

Biomass Utilization for Boiler:

- 100 T Shell/day
- 231 T fibre/day

Solid Wastes Left:

- **23 T Fibre/day**
- **7 T Shell/day**
- **379 T EFB/Day**

Indonesia EFB Potential

Year	Area (Ha)	Total CPO Production (Ton)	Solid Wastes (Ton)		
			EFB	Fibres	Shell
2017	12.307.677	35.359.384	33.053.337	19,985,739	9,992,869
2016	11.914.499	33.229.381	31.062.247	18,781,824	9,390,912
2015	10.527.791	31.070.015	29.043.709	17,561,313	8,780,656

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Biochar and Energy

- Pangala (2016) -> Produce biochar and energy environmentally
- Less than 1 hour
- No need input energy, just trigerring
- Produce economically
- Produce energy negative emission (as system)
- EFB Biochar rendemen 28%

Characterization Result

No.	Parameter	Unit	Result
1.	pH		10,20
2.	Iod absorption	mg/g	229,1
3.	Absorption of Blue Methylene:	mg/g	58,50
4.	Surface area	m2/g	216,90
5.	Porosity		Figure 5
6	Elemental		Figure 6

No.	Parameter	Unit	Result
1.	Volatile Matter (VM):	%	17,54
2.	Fixed Carbon:	%	68,17
3	Ash Content:	%	14,29
4.	O/C:		0,45
5.	VM/C:		0,26

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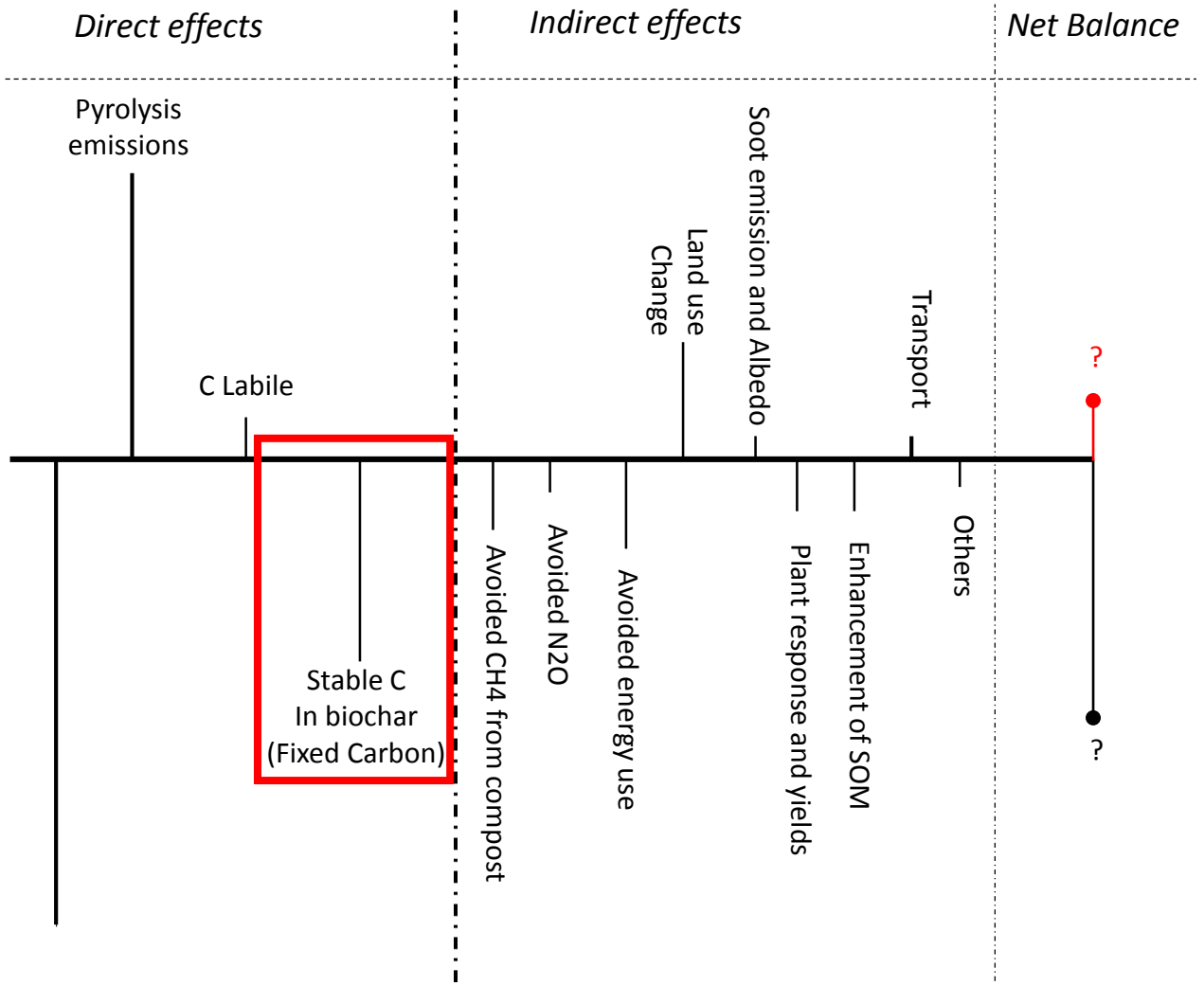
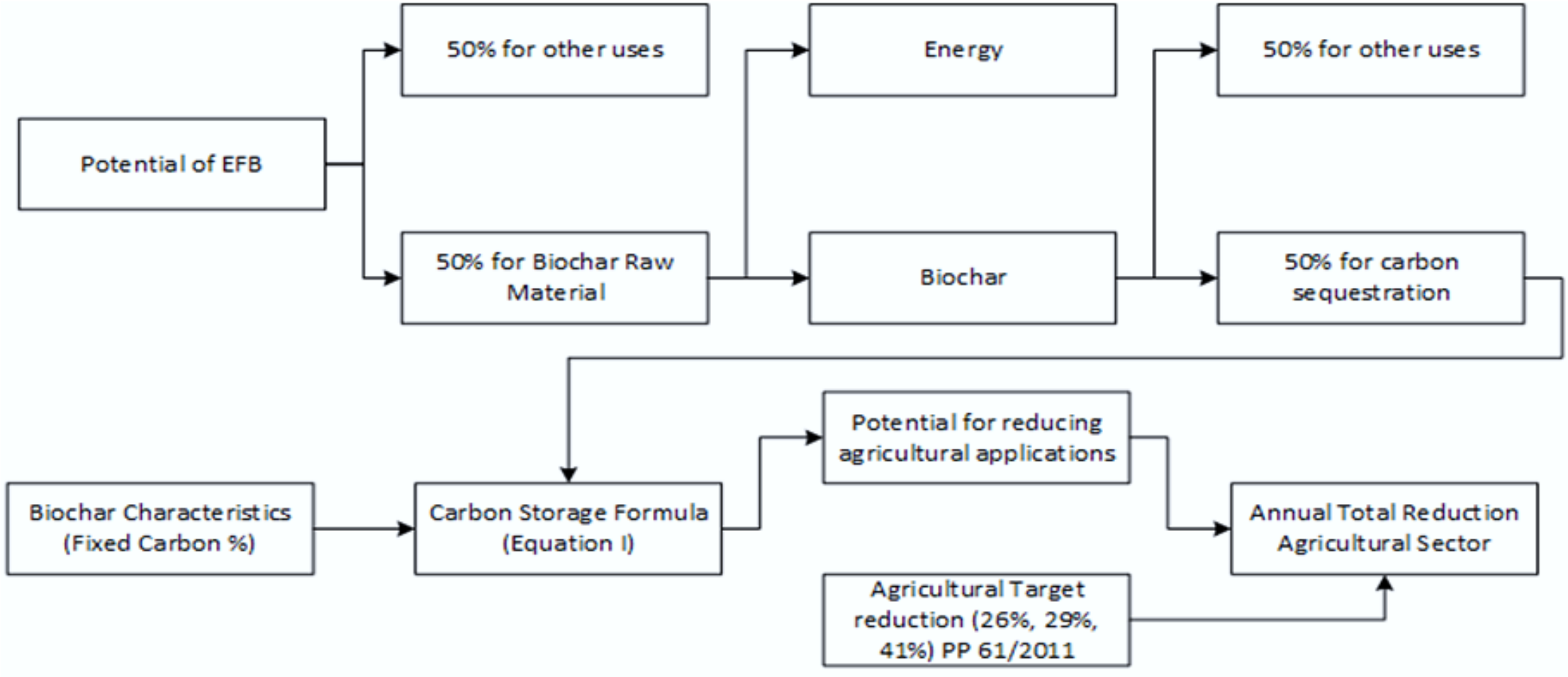
Calculation of Fixed Carbon Sequestration



- $Carbon\ Sequestration\ Potencial\ (Fixed\ Carbon) = Amount\ of\ Biochar\ \ x\ \%\ Fixed\ Cabon\ Content\ x\ 3{,}67$ (I)

Agricultural potential annual reduction GHG (Fixed Carbon Content of EFB Biochar



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Nationally Application Calculation of Potential Reduction in Agricultural

Reduction Target	Agricultural Target Reduction (MT CO2e)	Total EFB Needed for 100 POM @60 T/day	Potential of Biochar EFB As Carbon Sequestration (MT/Annual)	Persent Potential Annual Reduction from Target	Years Needed for 100% Target
26%	8.00	37,900	1.42	17.73 %	5.6
29%	8.92	37,900	1.42	15.90 %	6.3
41%	12.62	37,900	1.42	11.25 %	8.9

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Application Challenges

- Study regarding biochar, understanding and socialization is still limited.
- Legally PP 61/2011 is not included in the Indonesian RAN GRK
- Paradigm of Biochar need to be shift
- Sustainable biochar is needed to build

Bruckman and Klinglmüller (2014), List of challenges

- High costs of biochar production
- Impacts on soil properties
- Proof of climate change mitigation potential
- Sustainability
- Health risks
- Development of a biochar market

Conclusion

- The potential for fixed carbon of EFB biochar as a carbon sequestration application in agricultural produces **significant results** reduction: 17.73%/year for 26% target; 15.90% /year for 29% target and 11.25%/year for 41% target reduction in agricultural sector.
- With this system carbon sequestration will be **easy to verify** and calculate initial applications using only simple laboratory test data of fixed carbon content and the amount applied to calculate equivalent GHG reduction.

Suggestion

- Further research regarding various potential reductions such as those presented by Scholz (2014) needs to be done to complement the overall calculation of the potential of this application.
- In Indonesia, a biochar application research center should be developed for various other sustainable biomass feedstocks.

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Thank You