Landscape Modeling: Integration of Feedstock Production, BCTs, and Marketing

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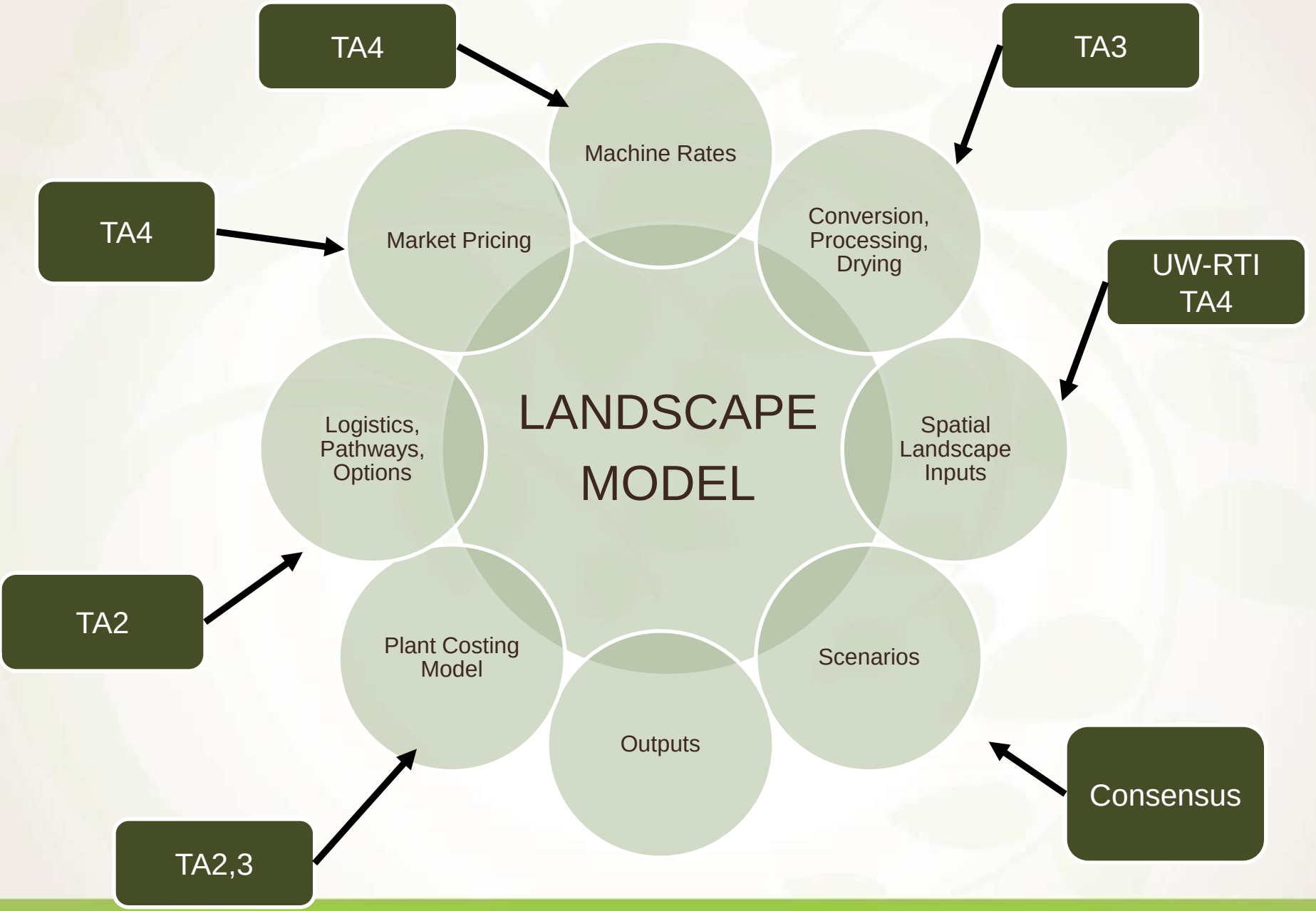
For more information please visit WasteToWisdom.com



LANDSCAPE MODEL - INTEGRATION

FEEDSTOCK AVAILABILITY

Commercial Harvest Left Site

Residues Left Behind

OUTLINE

1. Problem
2. Transportable Concept
3. Supply Chain
4. Methods
5. Regional Results
   - Mobility
   - Scale
   - Grid Energy
   - Products

PROJECT: WASTE TO WISDOM

THE PROBLEM

Forest harvest residues are a business/ operations byproduct. They are often currently burned in forests due to collection, transportation, and market constraints.

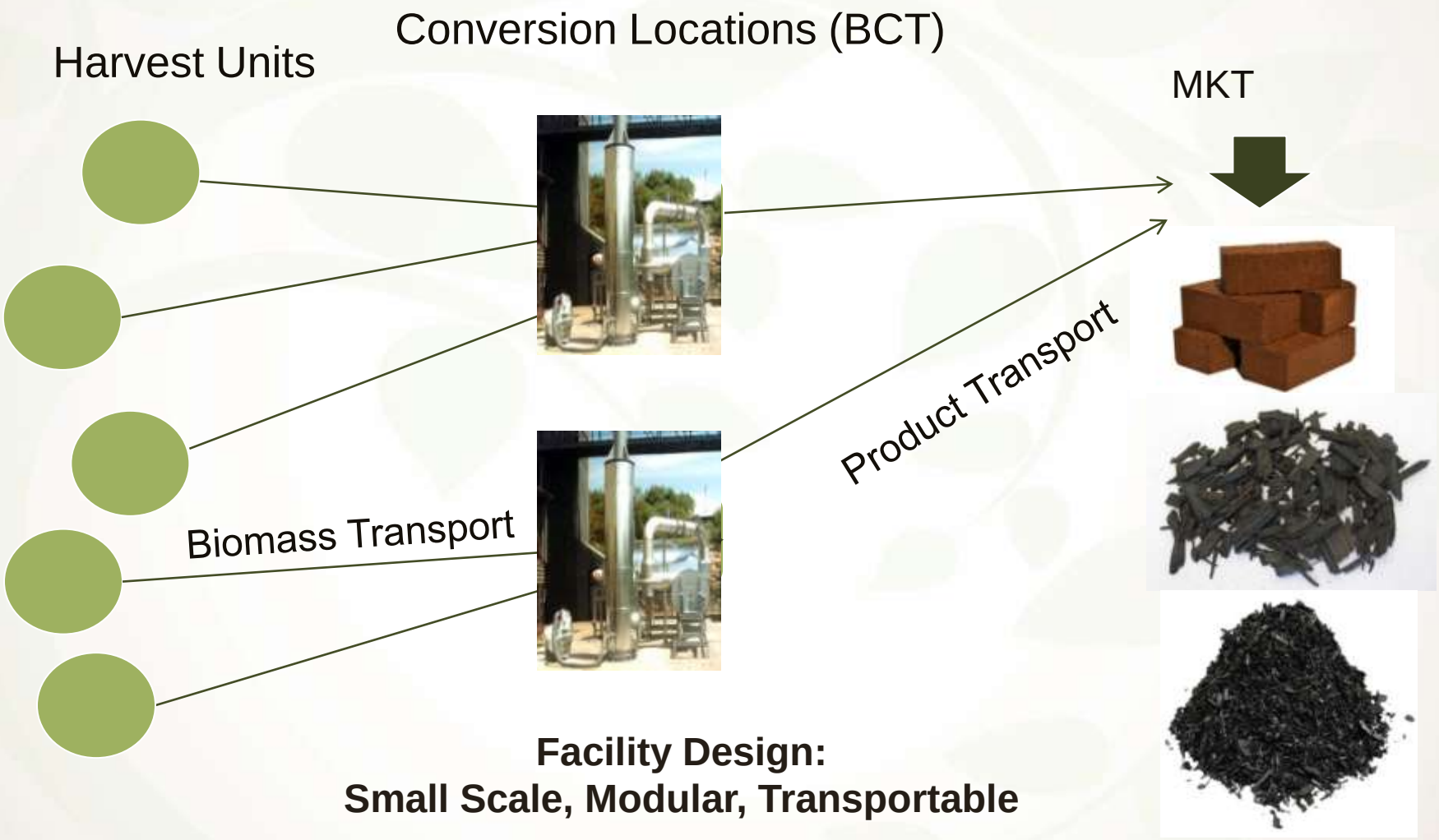
A SOLUTION

Project goal is to explore converting forest residues into valuable bioenergy and bio-based products using transportable conversion facilities.

STUDY QUESTION

Are transportable biomass conversion facilities economically viable?

TRANSPORTABLE BIOMASS CONVERSION FACILITIES



Facility Design:
Small Scale, Modular, Transportable

ADVANTAGES AND DISADVANTAGES

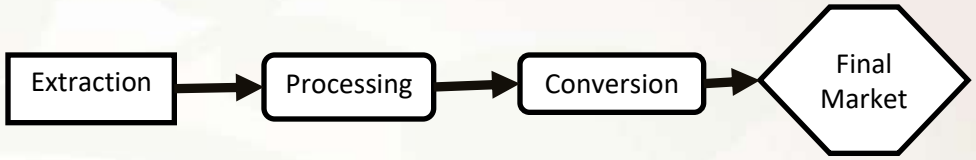
Advantages

1. Reduction in transportation costs
2. Adaptable to evolving feedstock availability
3. Flexible/ modular production capacity

Disadvantages

1. Economies of scale
2. Energy costs compared with grid power
3. Downtime during moves >> loss of productive capacity
4. Limited equipment selection

MAIN MODEL INPUTS



HARVEST SCHEDULE

Main Inputs
- Biomass Availability (Quantity/Timing)
- Road Network
- Extraction Limitations
- Machine Data
- Moisture Content

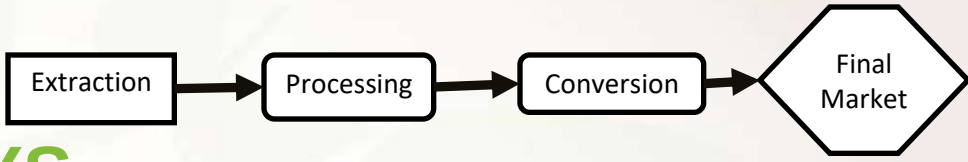
LOGISTICS & CONFIGURATIONS

Key Variables
- Pathways per LX, CLX, BCT
- Trucking Options/Access
- Logical Triggers
- Powerplant Availability
- Facility Type & Scale
- Operating Conditions & Rules

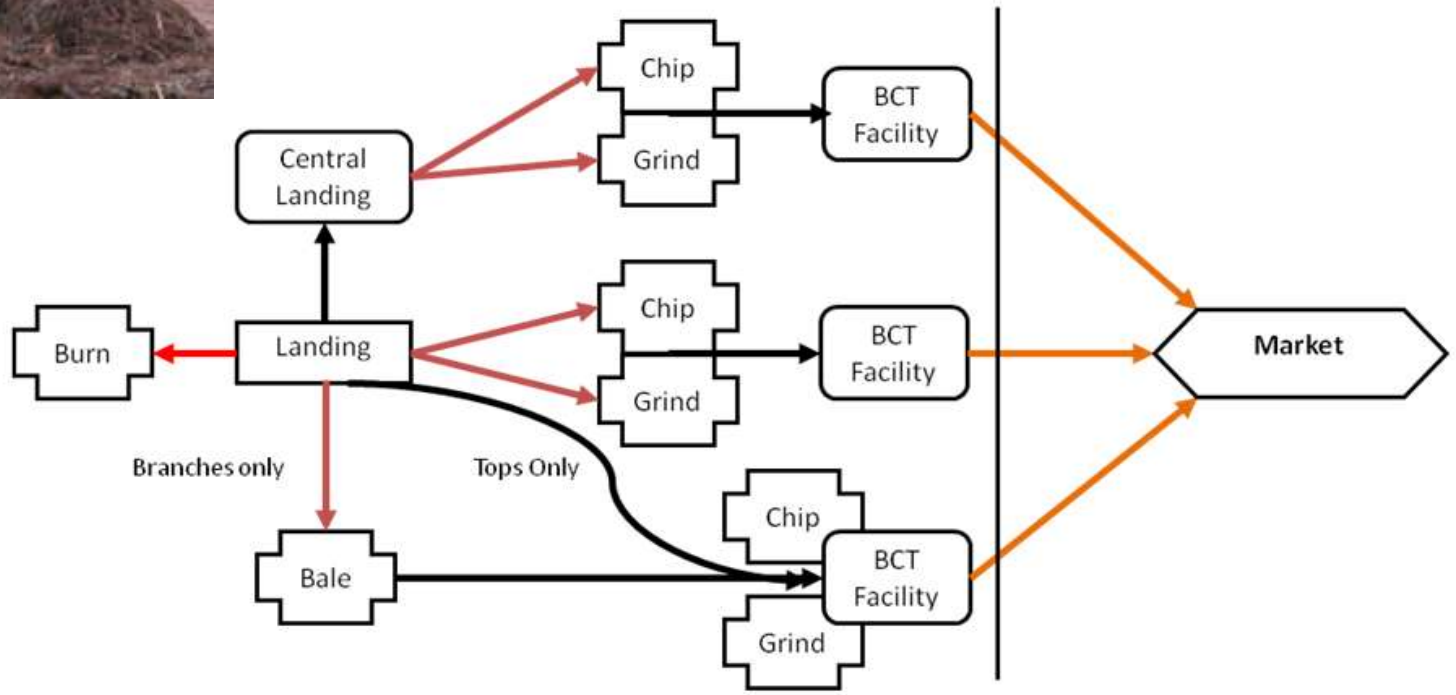
REVENUES & RATES

Major Costs Drivers
- Product Market Prices
- Conversion
- Plant Variable & Capital Cost
- Processing & Utilization
- Mobilization & Transportation
- Supporting Equipment

OBJECTIVE:
Evaluate Transportable Conversion Facility Economics



SUPPLY CHAIN PATHWAYS



Vary Depending on Residue Component, Access, Availability

Biochar | Briquettes | Torrefied Wood

SCOPE OF ANALYSES

Scale & Mobility

- Transportation Efficiencies
- Frequency of BCT movement
- Economies of Scale

Regional Studies

Variable Feedstock & Markets

- Quincy, CA
- Lakeview, OR
- Oakridge, OR (Pulp)
- Port Angeles, WA (Pulp)
- Warm Springs, OR

Logistics & Profitability

- Optimal logistics, pathways, and products to maximize NPV on a Landscape scale

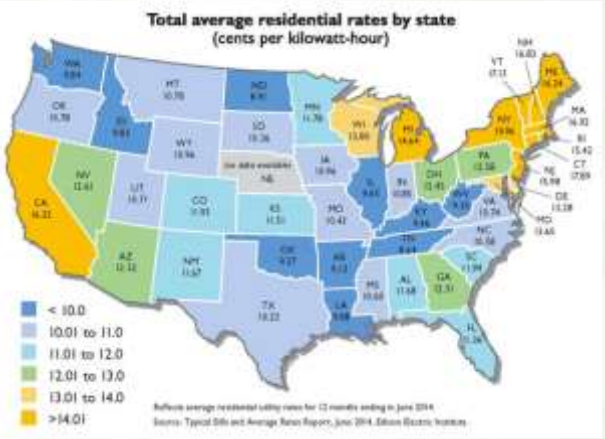
REGIONAL DIFFERENCES

1. Log Specifications and Utilization

2. Truck Regulations

3. Energy Rates

4. Silviculture / Regeneration / Disposal Costs



Question:
Does transportable facility concept make sense?
Where?

REGIONAL CHARACTERISTICS

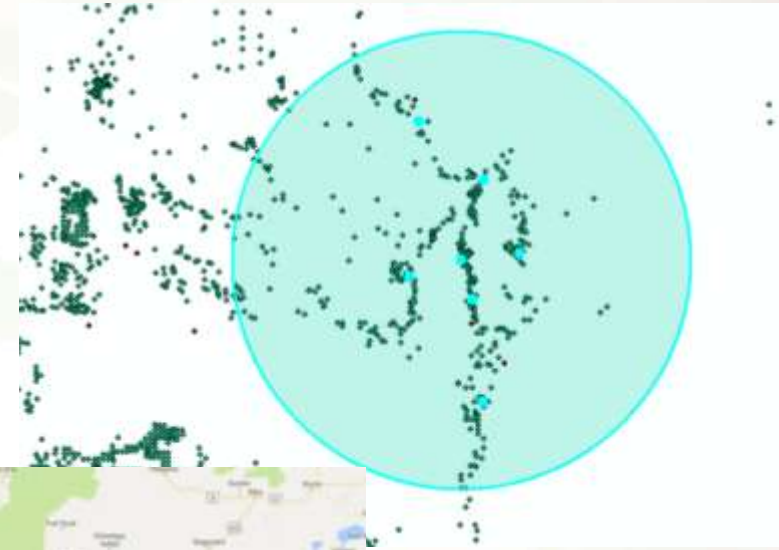
	Biomass Availability Parcel Level Bdt/Ac	% Tops and Pulp Logs	Miles to Product Market	Biomass at Landscape Level Bdt/Ac
Quincy	35	51%	55	1.1
Lakeview	21	53%	94	0.19
Oakridge	**17**	**8%**	**31**	**0.47**
Warm Springs	21	52%	56	0.44
Port Angeles	**30**	**5%**	**53**	**0.83**

5 year Time Horizon

Biomass Availability and Composition

STRATEGIC LEVEL ANALYSES

GOAL	• **EVALUATE BCT COSTS**
CONVERSION FACILITY TYPE	• BioChar | Briquettes | Torrefied Wood
PLANT SCALE	• 15,000- 50,000 BDT/ Year
MATERIAL HANDELING	• SORTED: TOPS & BRANCHES
FEEDSTOCK AVAILALBITY	• 5 Year Time Horizon
PLANT PLACEMENT	• 10 Potential Conversion sites • 1 Central Market Location
MOBILIZATION	• Varies $150,000-300,000/ Move

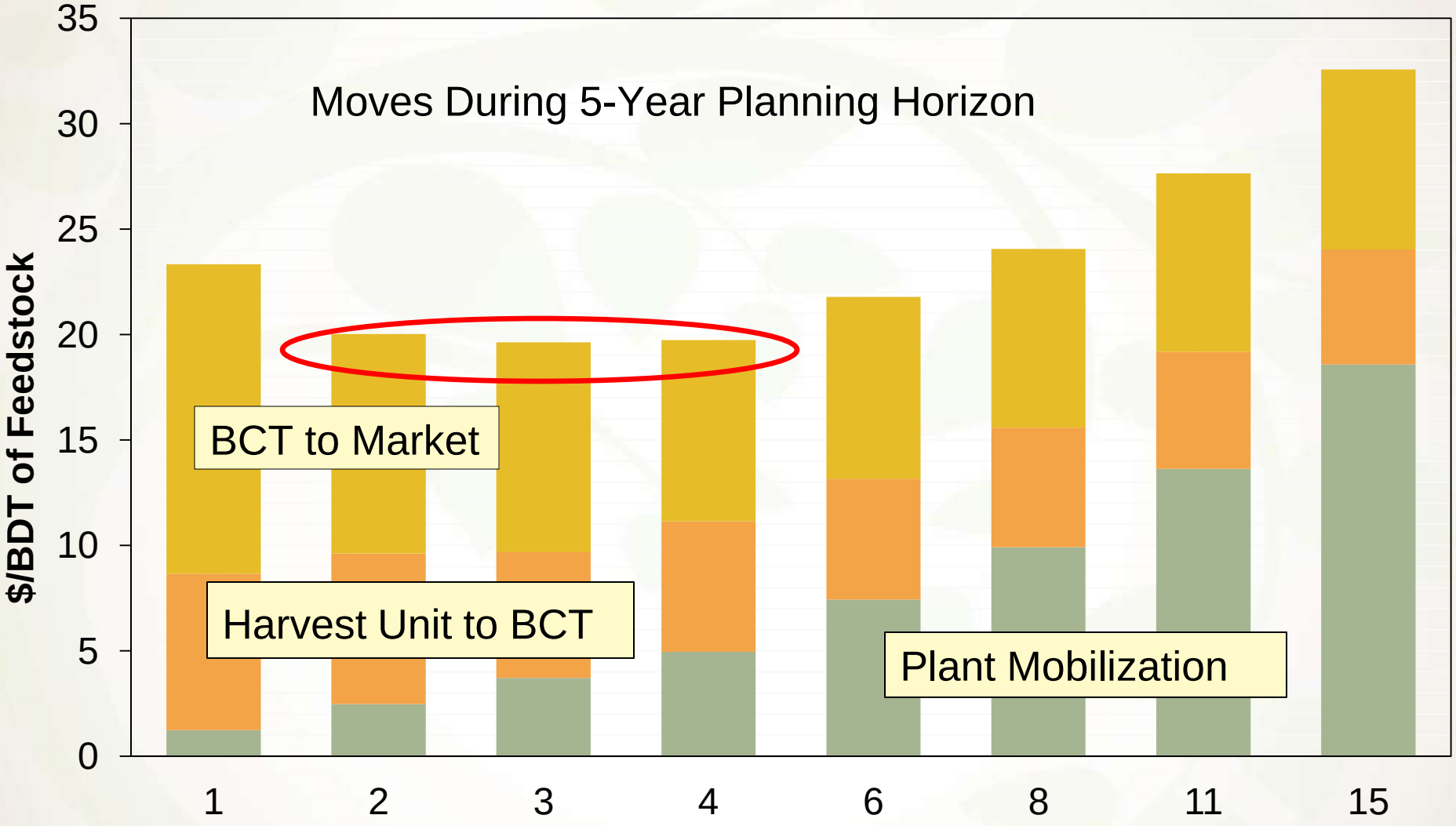


Other Key Comments

a) **Include only costs, no revenues**
b) **Assume 30% Moisture Content**
c) **Parcels/ Volumes from UW – RTI Spatial Analysis**

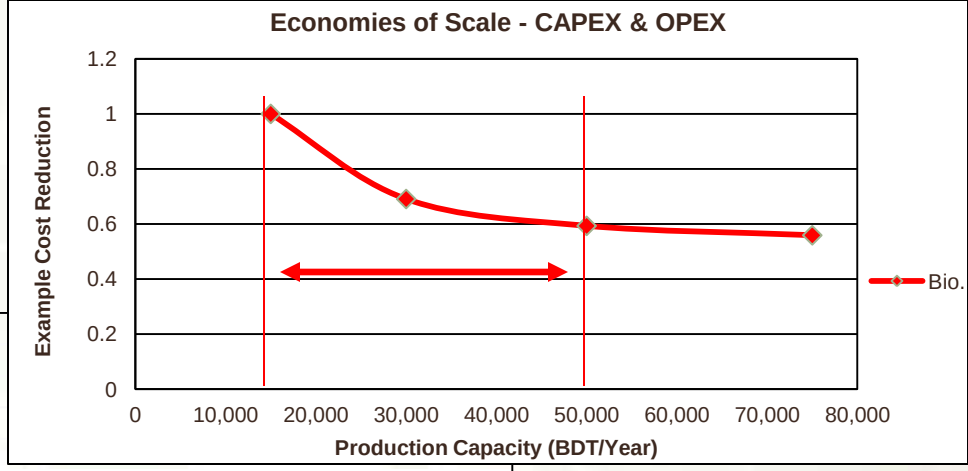
1800 Landings| 5 Year | 5 Regions

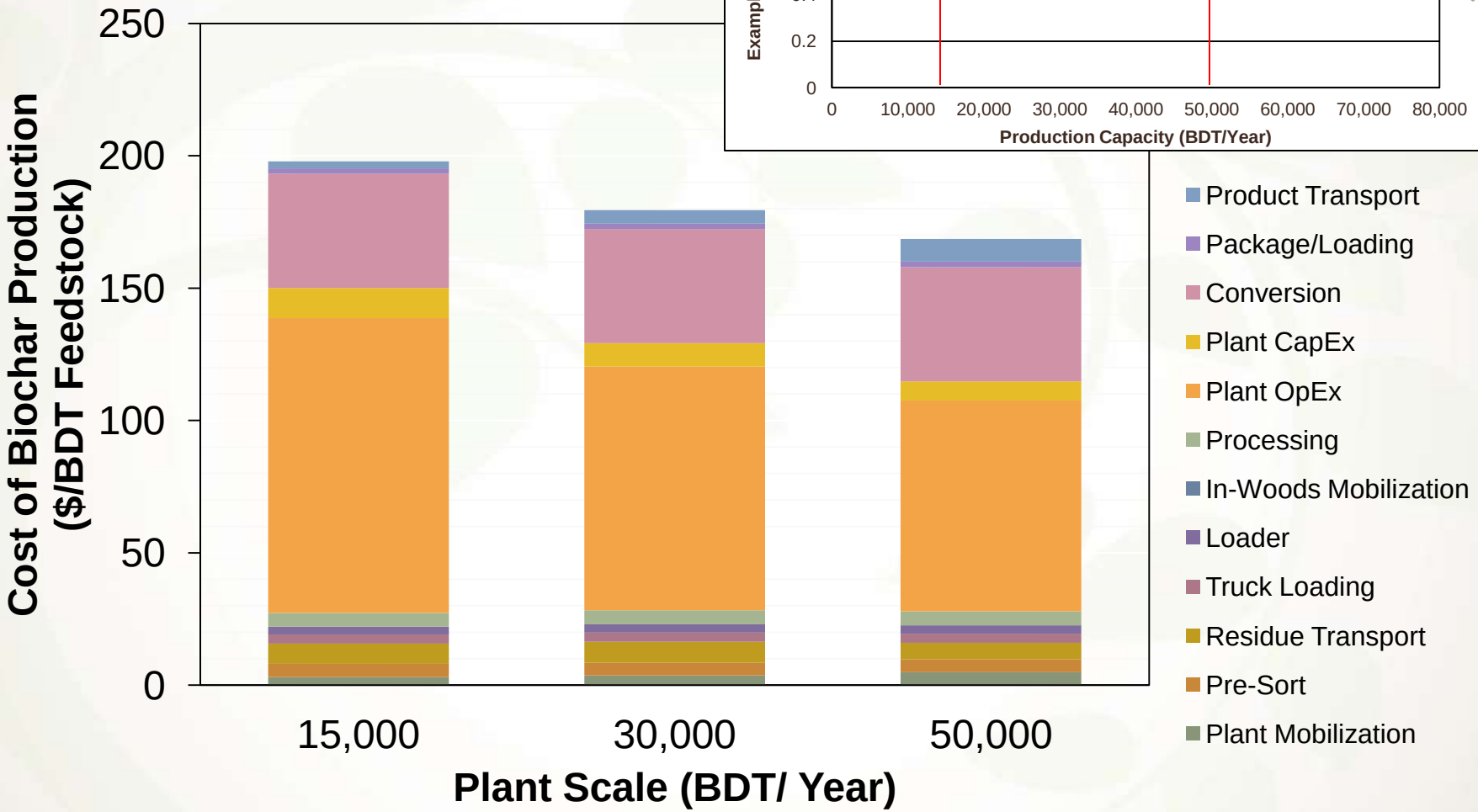
HOW MANY MOVES ARE OPTIMAL?



 # Moves: Tradeoff Transportation costs vs. Mobilization Depends on the Region (Typically 2 - 4)

SCALE

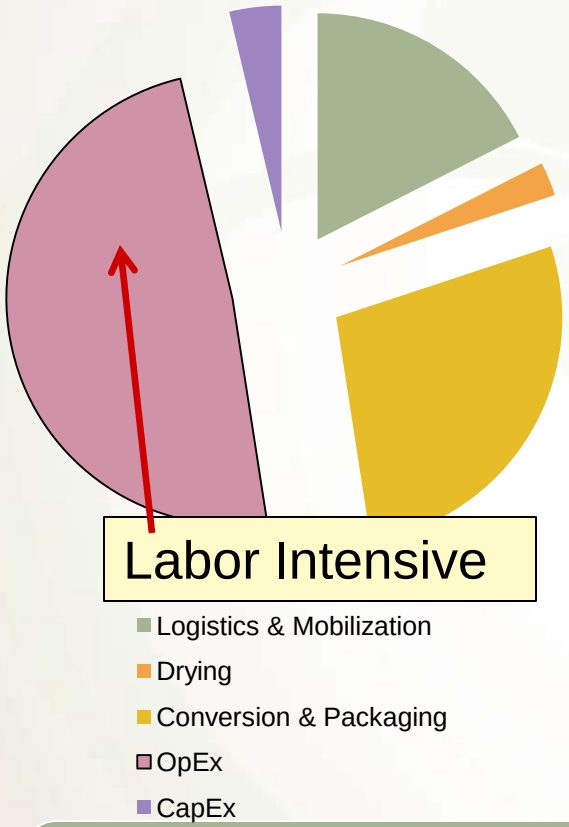




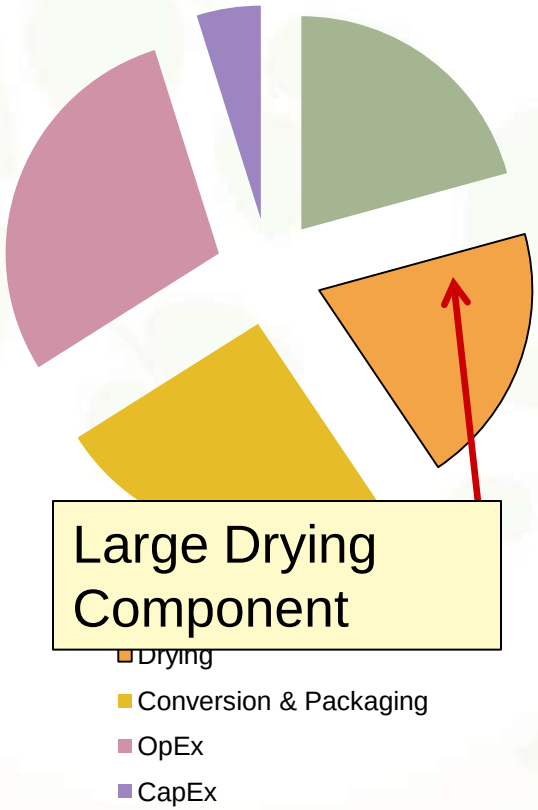
Economies of Scale
Favor Large Scale Design

MAIN SUPPLY CHAIN COSTS

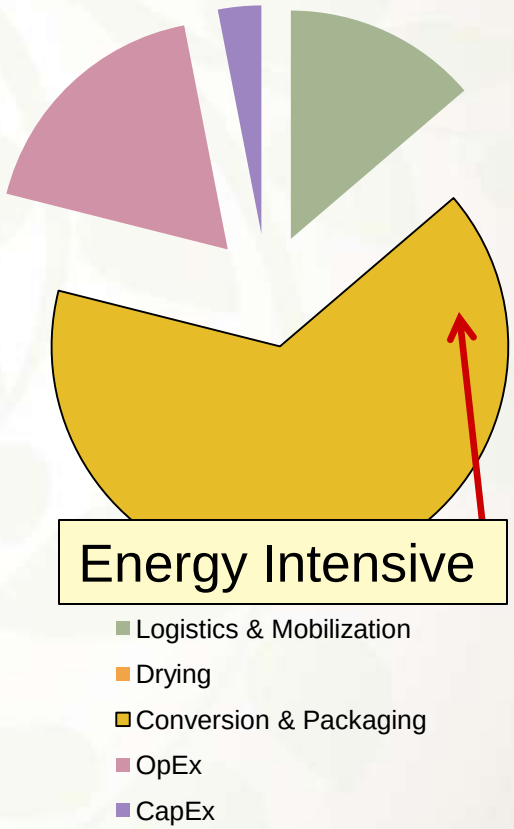
BioChar



Briquette



Torrefied Wood

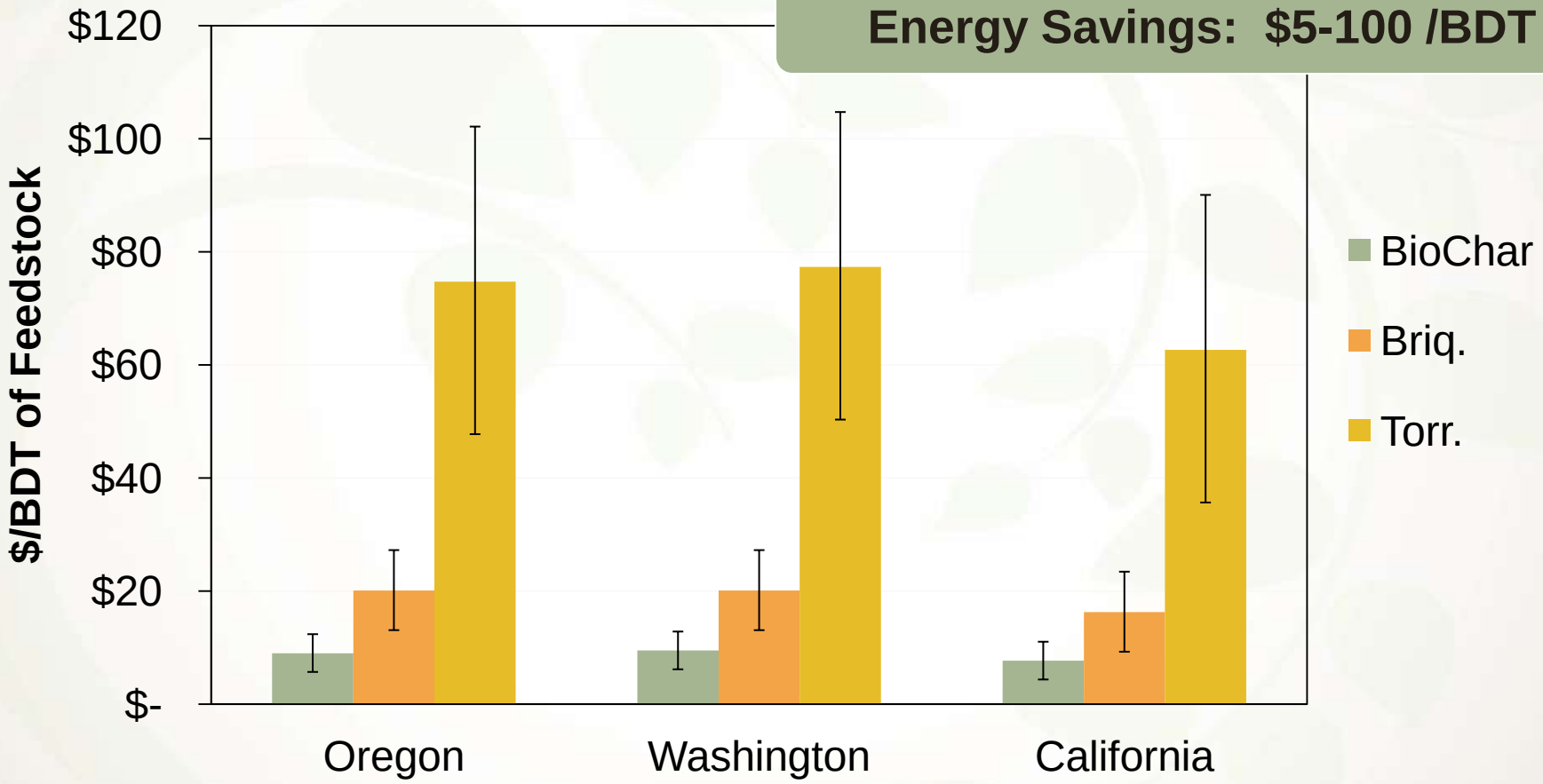


Costs are Dependent on Conversion Technology

ENERGY COSTS

On-Grid vs. Off-Grid Facility

Energy Savings: $5-100 /BDT

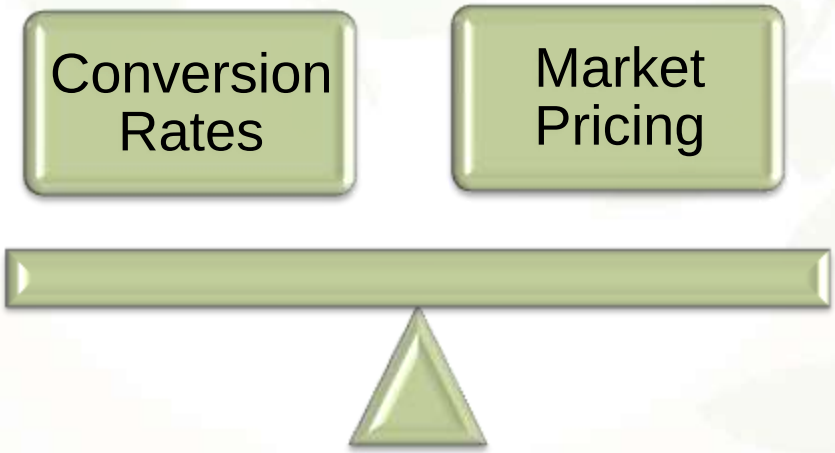


California = Least Incentive to be grid-connected
BioChar = Least Dependent on Energy Costs

KEY VIABILITY FACTORS

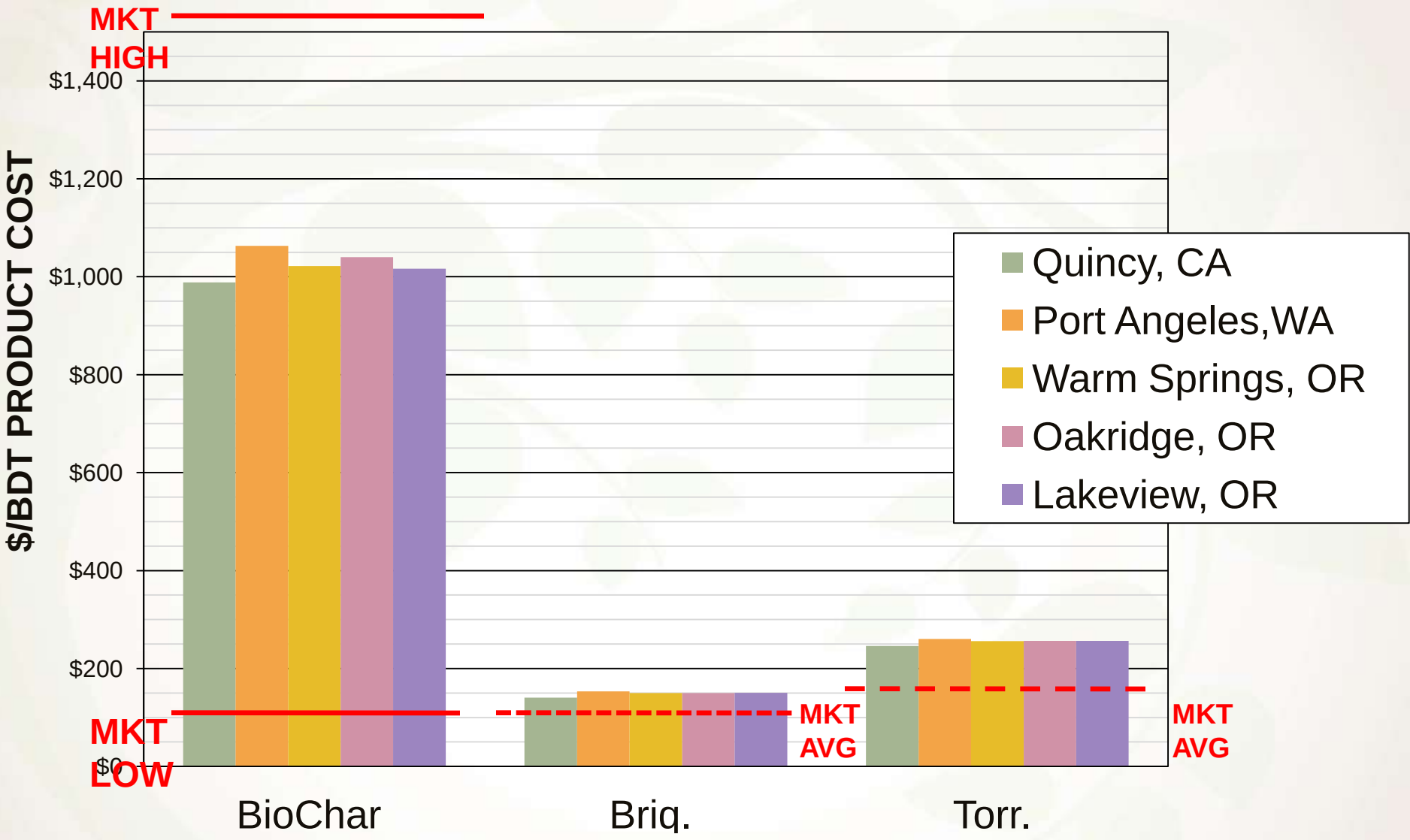
Conversion Rates
Depends on technology chosen

Market Pricing – Per unit price of product
Depend on Assumptions/ Region



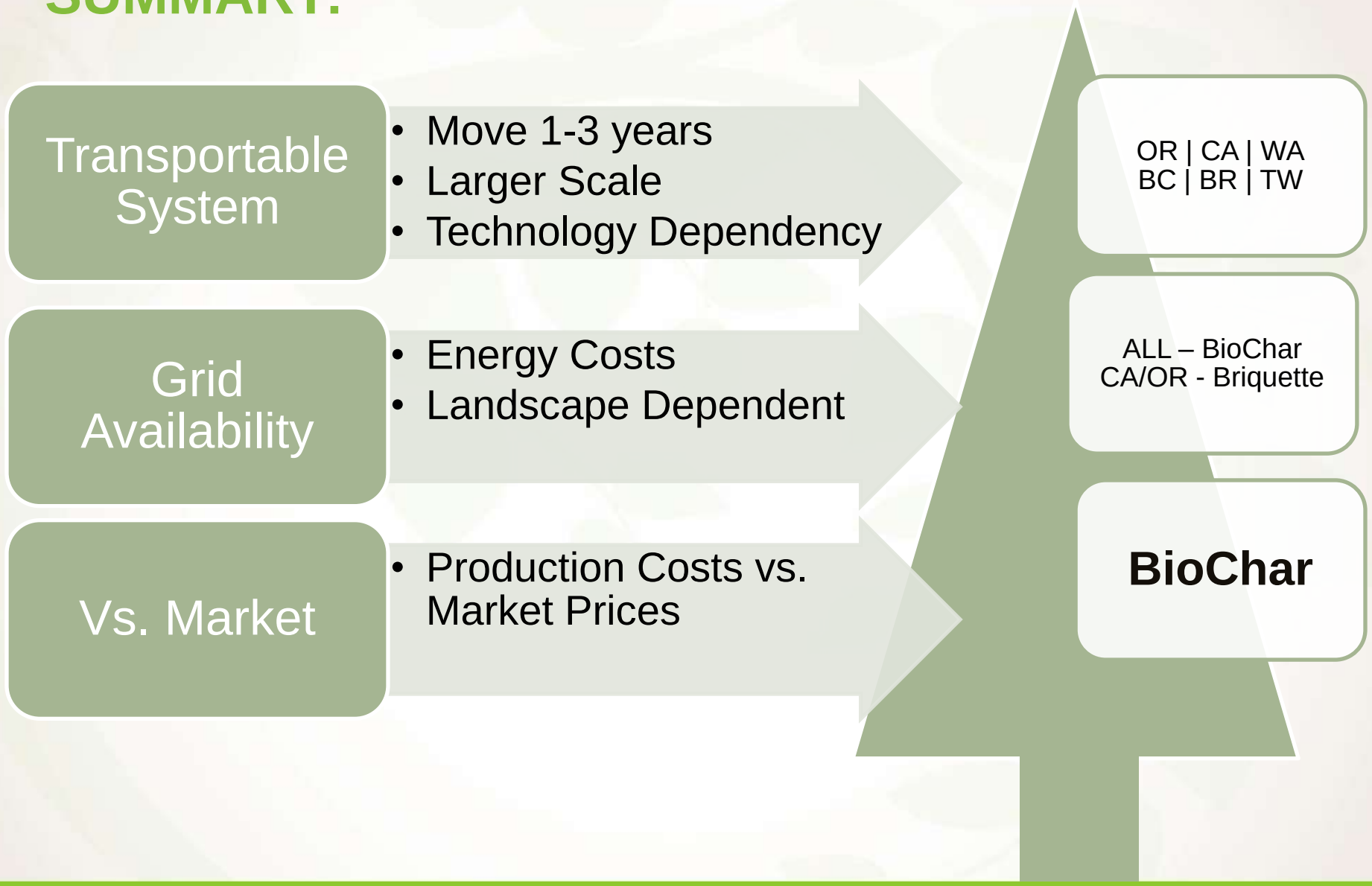
Quantity Produced | Selling Price

WILL THE MARKET SUPPORT THE PRODUCTION COST?



BioChar Likely Best Candidate
Depends on Local & Regional Market Conditions

SUMMARY:



Are transportable biomass conversion facilities economically viable?

Manuscripts in Review

- The Economics of Biomass Logistics and Conversion Facility Mobility: An Oregon Case Study
- A Forest-to-Product Biomass Supply Chain in the Pacific Northwest, USA: A multi-product approach
- Subregional Comparison for Forest-to-Product Biomass Supply Chains on the West Coast, USA

Thank You! QUESTIONS?

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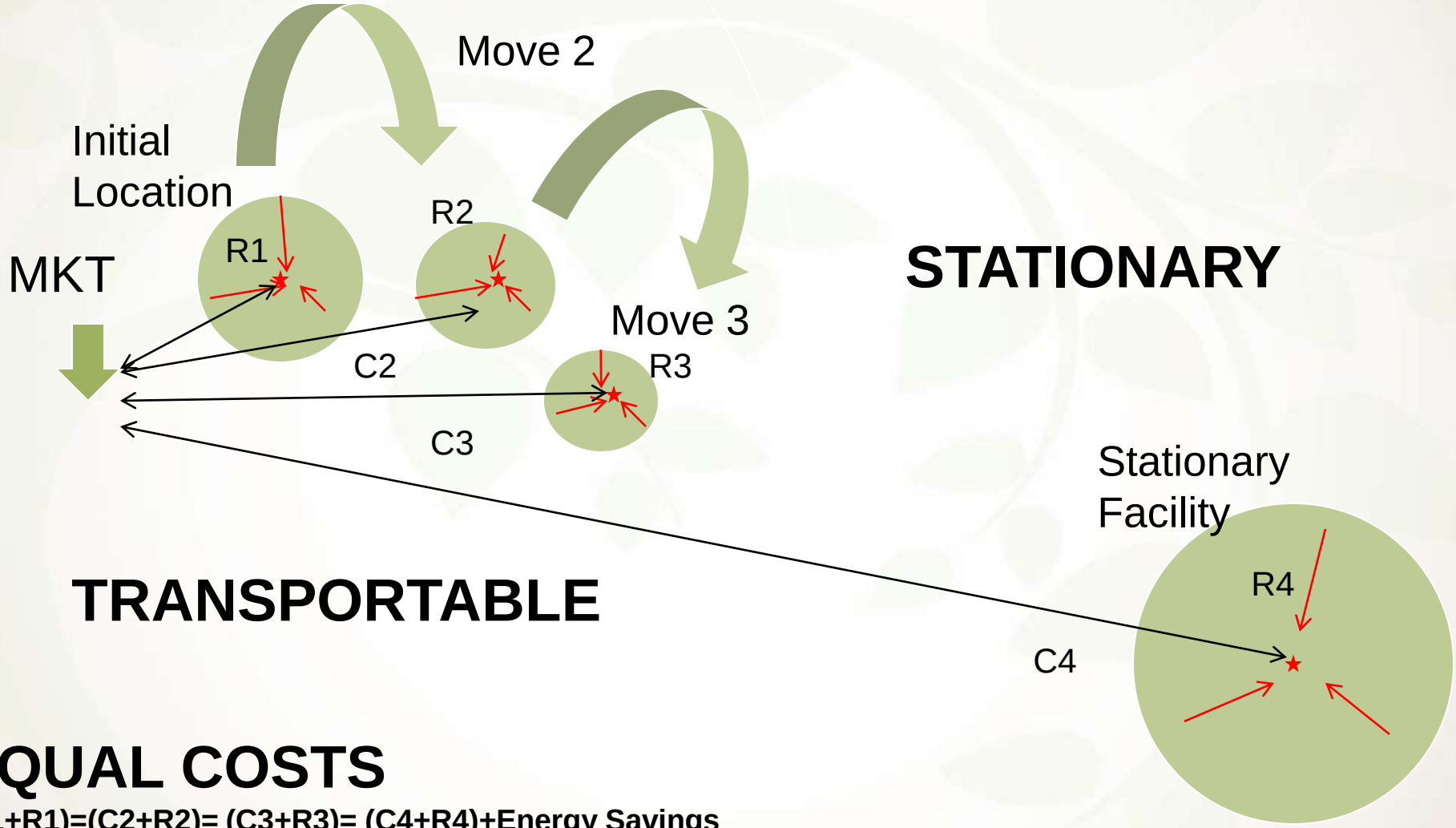
ARE TRANSPORTABLE FACILITIES OPTIMAL?

Energy Savings = Greater Potential Supply Radius (Mi)

	Quincy	Port Angeles	Warm Springs	Oakridge	Lakeview
BioChar	+11	+22	+17	+21	+17
Briquettes	+44	+79	+65	+79	+65
Torrefied Wood	+90	+176	+141	+170	+141
Average Residue Haul Distance	8	13	15	10	12

Can be a Strong Incentive
LARGELY DEPENDS ON LANDSCAPE & PRODUCT

CONCEPTUAL: TRANSPORTABLE VS. STATIONARY?



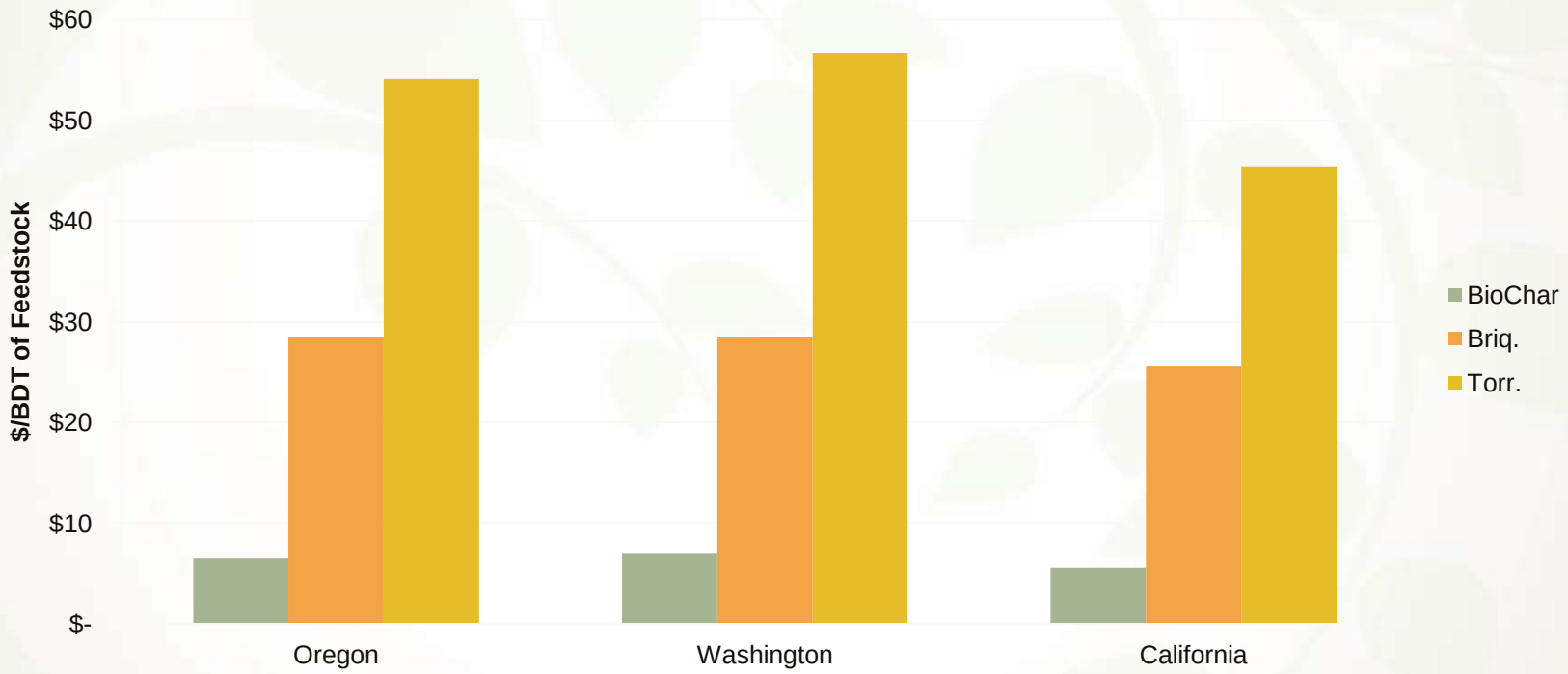
EQUAL COSTS

(C1+R1)=(C2+R2)= (C3+R3)= (C4+R4)+Energy Savings

LARGELY DEPENDS ON LANDSCAPE & PRODUCT

ARE ENERGY COSTS PROHIBITIVE?

Energy: On-Grid vs. Off-Grid Facility Placement



Energy Savings: $6-60 /BDT