

FAA CENTER OF EXCELLENCE FOR ALTERNATIVE JET FUELS & ENVIRONMENT

# Financial Methodology and Impact for Facility Repurposing a Pulp Mill into an AJF Facility

Project 001

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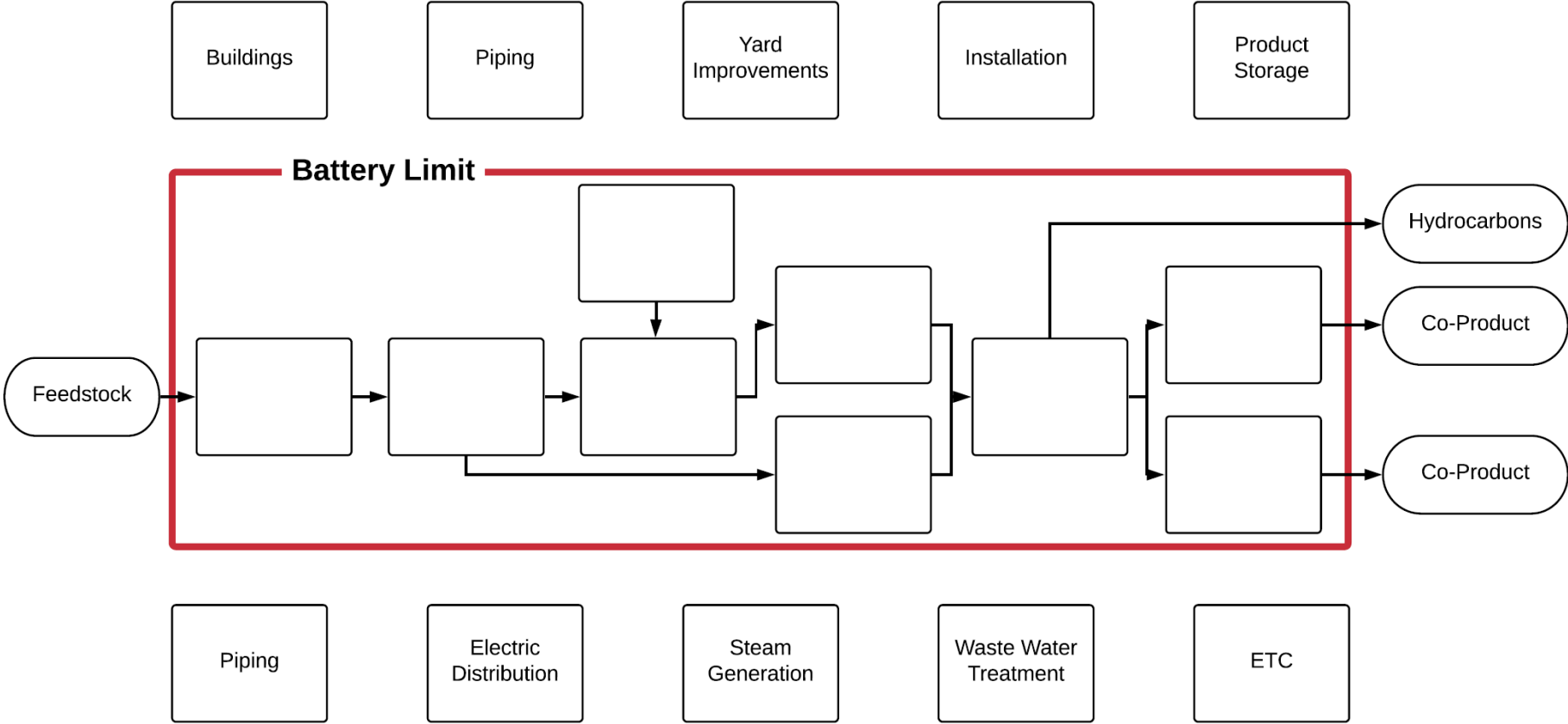
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- Repurpose existing facility by estimating capital costs with the ratio factor method
- Levels of repurposing
- Controlling Variables
  - Facility scale
  - Site Cost
  - Level of repurposing
  - Process variables
- Results
  - Standard cases
  - Case Study

# Process Modeling



# Required Information for a Techno-Economic Analysis

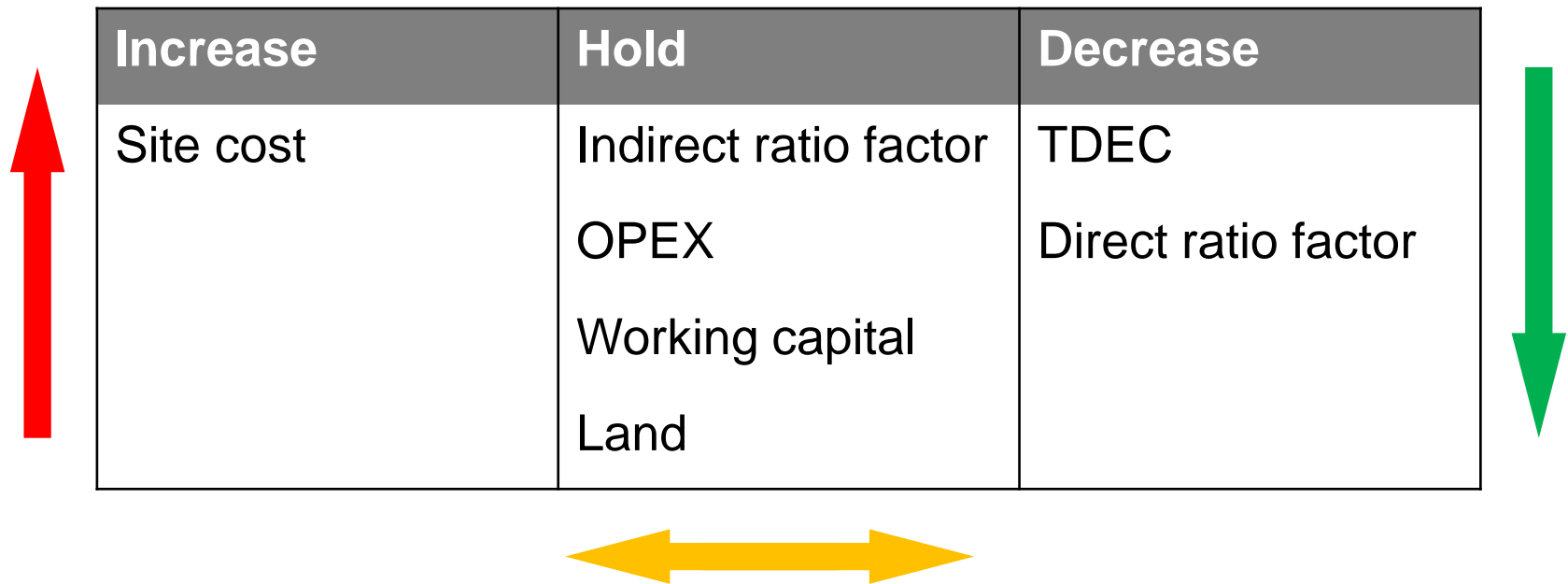
CAPEX	OPEX	Financial Assumptions
TDEC	Fixed	Discount rate
Direct costs	Variable	Equity
Indirect costs		Inflation
Site cost		Cost year

$$FCI = (DC_{rf} + IC_{rf}) \cdot (TDEC)$$

*TDEC = total delivered equipment cost*

*FCI = fixed capital investment*

# Impact of Repurposing



Increase	Hold	Decrease
Site cost	Indirect ratio factor OPEX Working capital Land	TDEC Direct ratio factor

Solid-Fluid Processing Plant	
Direct Costs	(% TDEC)
Delivered Equipment Cost	100
Installation	39
Instrumentation and Controls	26
Piping	31
Electrical Systems	10
Buildings (greenfield)	47
Yard Improvements	12
Service Facilities	55
Total Direct Plant Costs	320
Indirect Costs	
Engineering and Supervision	32
Construction Expenses	34
Legal Expenses	4
Contractor's Fee	19
Contingency	37
Total Indirect Plant Costs	126
Ratio Factor for FCI	446



Service Facilities	
Steam Generation	9.4
Steam Distribution	3.1
Water Supply/Cooling/Pumping	5.7
Water Treatment	4.1
Water Distribution	2.5
Electric Substation	4.1
Electric Distribution	3.1
Gas Supply/Distribution	0.9
Air Compression/Distribution	3.1
Refrigeration	3.1
Process Waste Disposal	4.7
Sanitary Waste Disposal	1.3
Communications	0.6
Raw Material Storage	1.6
Finished-Product Storage	4.7
Fire Protection System	1.6
Safety Installations	1.3

# Repurposing Levels



Level	Repurposed Assets	Example
Low	Buildings, yard improvements, portion of the service facilities	Shuttered pulp mill
Medium	pretreatment blow gas system, yard improvements, portion of the service facilities including boilers	Operational pulp mill
High	pretreatment department, yard improvements, portion of the service facilities including boilers	Operational acid bisulfite pulp mill

# Generalized Ratio Factor Method for Repurposing



Ratio Factor Elements	Greenfield	Low	Medium	High
Other Direct	206	206	206	206
Buildings	47	7	7	7
Yard Improvements	12	0	0	0
Service Facilities	55	52	5	5
Total Direct Costs (DC)	320	265	218	218
Total Indirect Costs (IC)	126	126	126	126
FCI (direct + indirect)	446	391*	344*	344*

Adapted from Peters et al. 2003<sup>1</sup>, \*FCI ratio factor not applied to TDEC, use equation

$$FCI_{RP} = (DC_{rf} \cdot TDEC_G) + (IC_{rf} \cdot TDEC_{RP}) + Site - Land$$

*RP = repurposed*

*G = greenfield*

*rf = ratio factor*

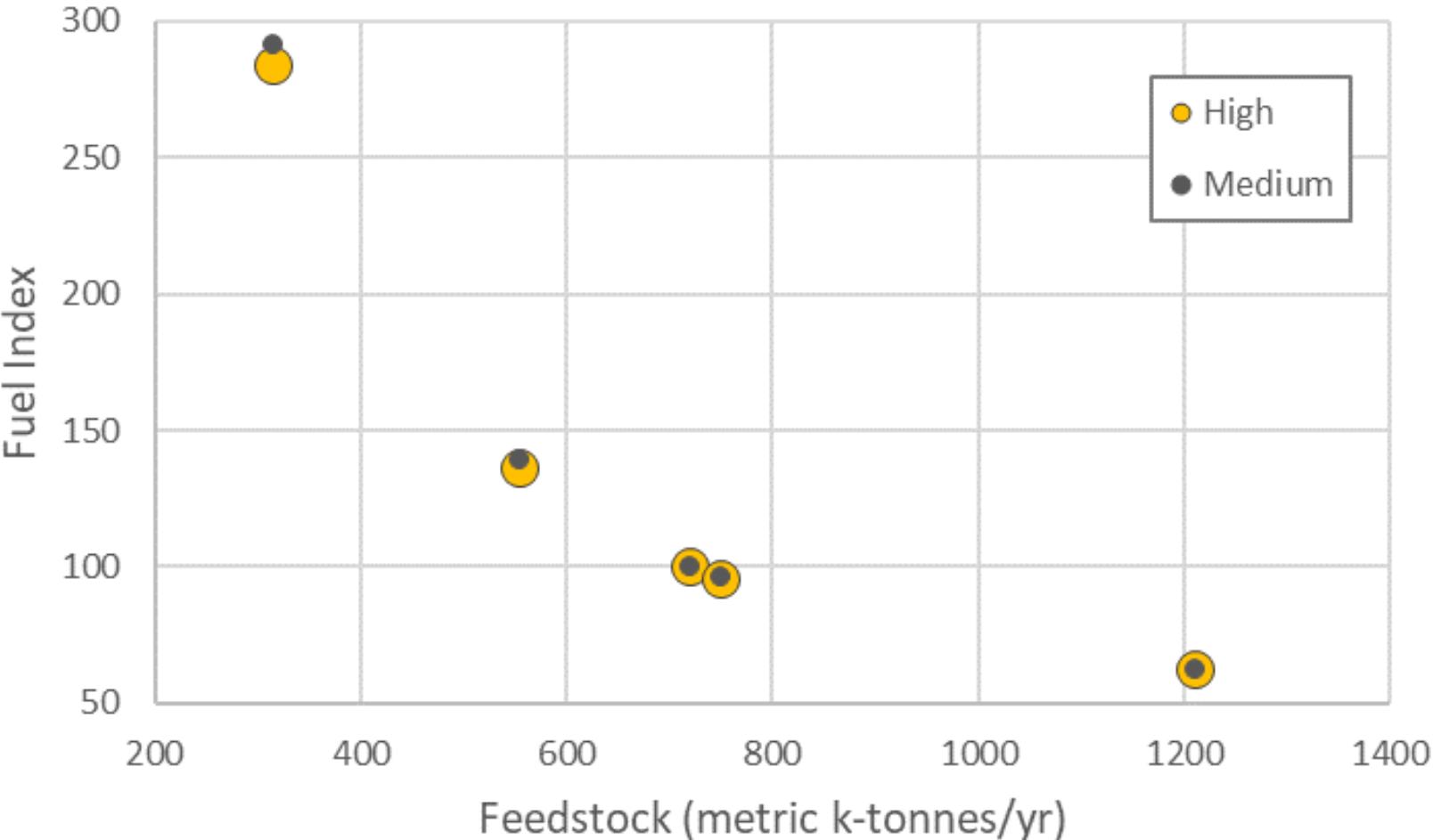


# Controlling Variables



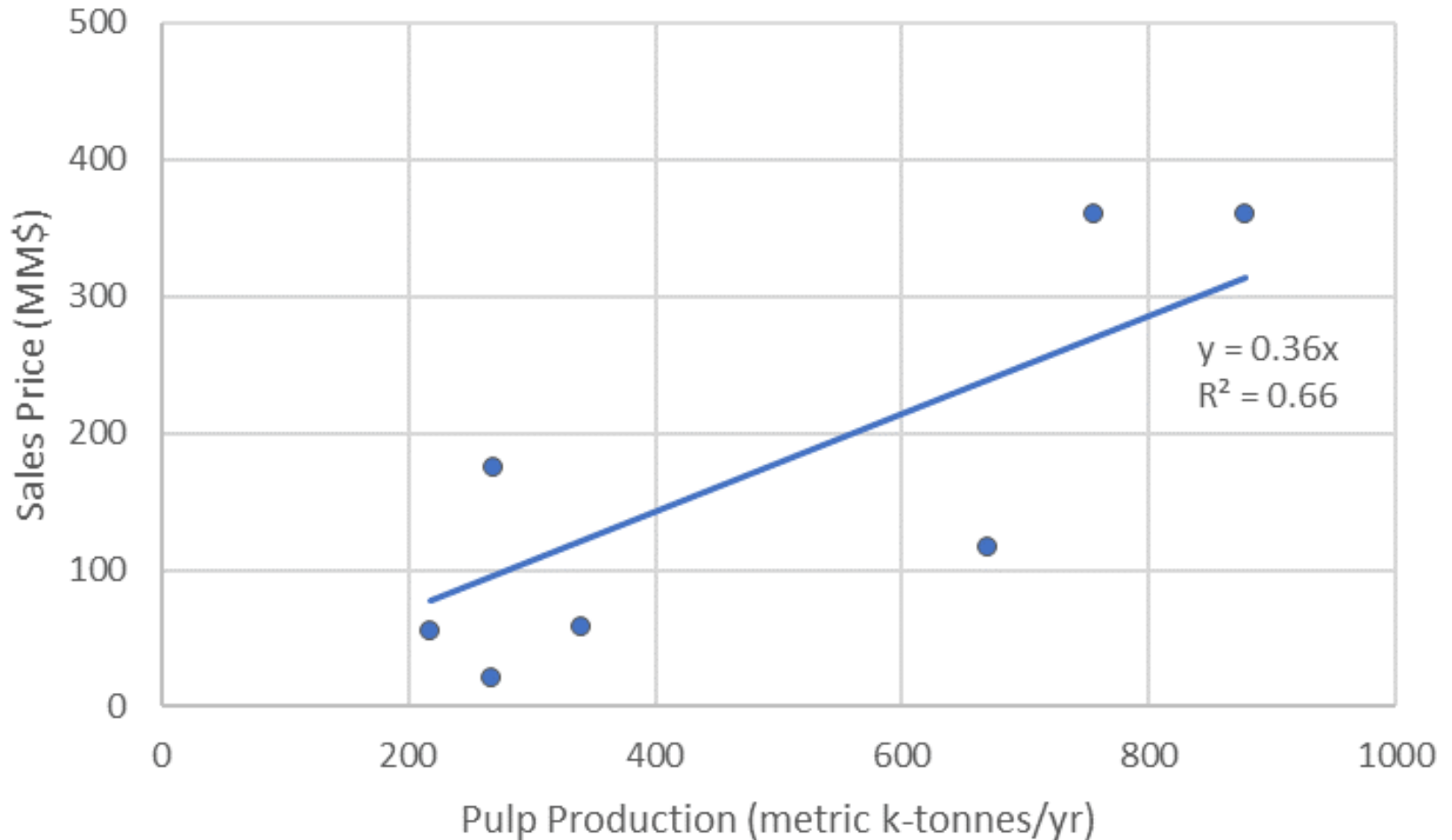
- Facility Scale
- Site Cost
- Repurposing Level
- Process Variables

# Facility Scale

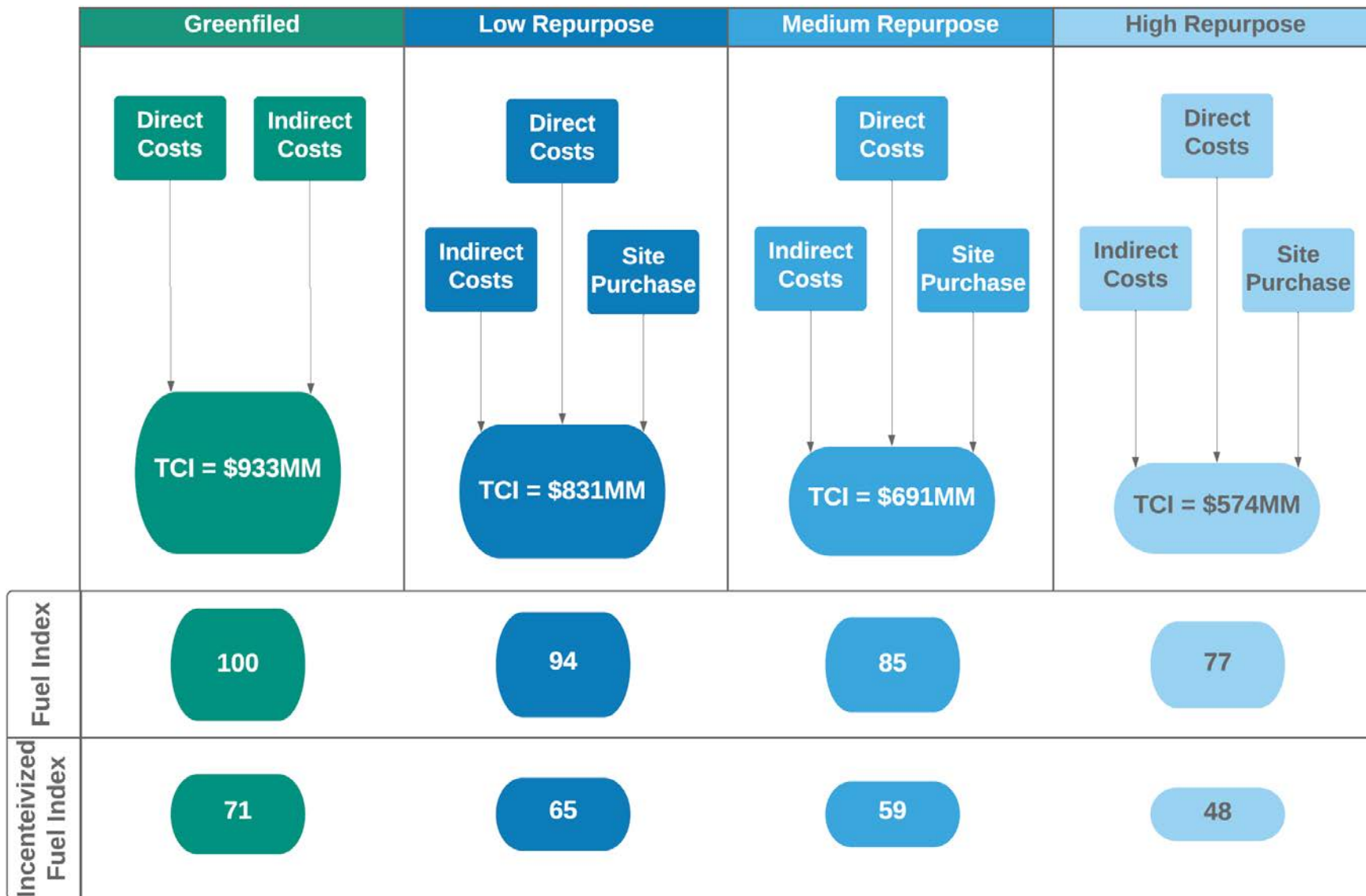


preliminary results – do not cite or quote

# Site Purchase Cost



# Repurposing Level



5-year national average values for: electricity<sup>10</sup>, natural gas<sup>11</sup>, feedstock \$65/t mill gate<sup>12</sup>

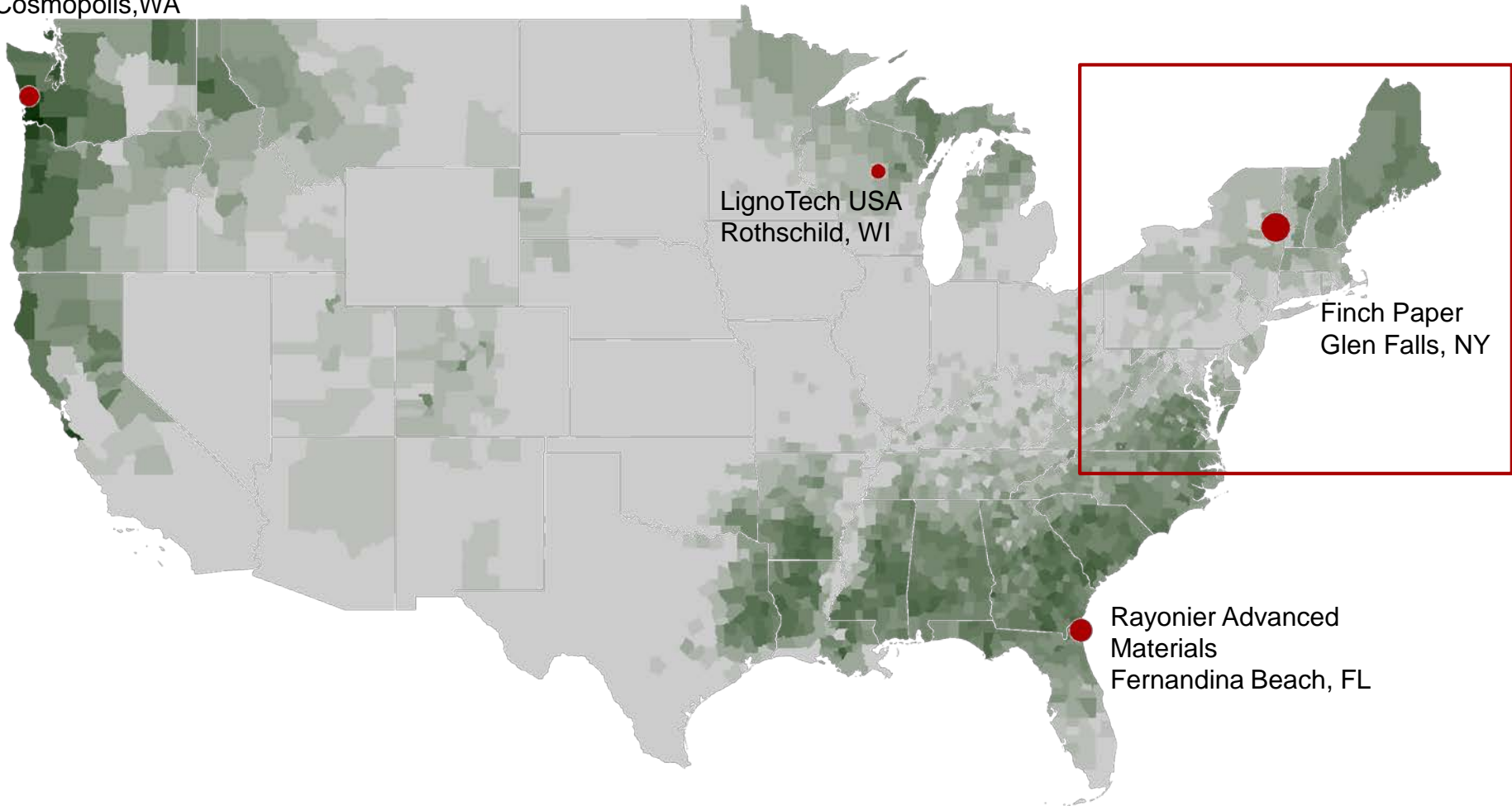
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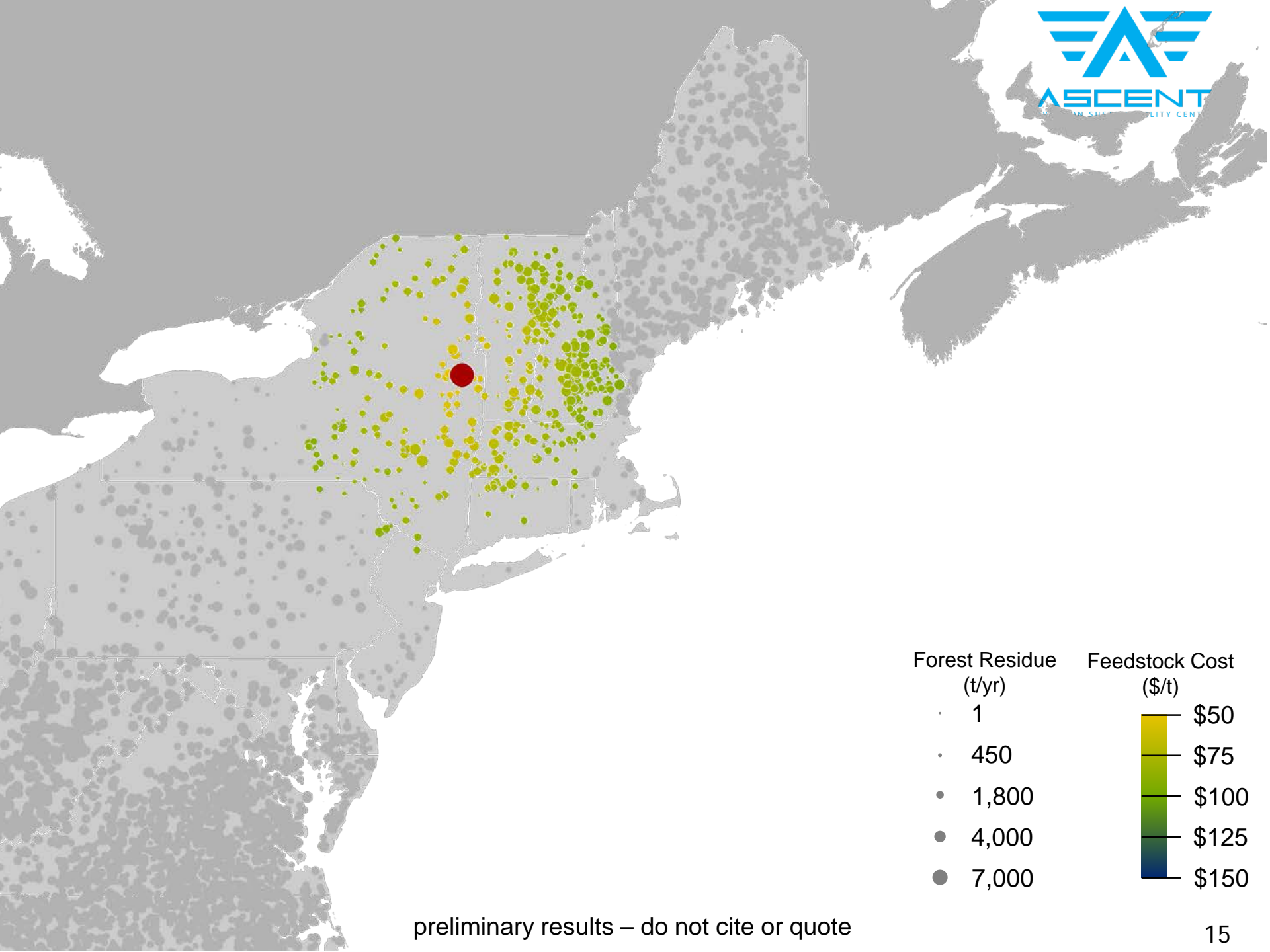
# Process Variables



- Feedstock Cost
- Feedstock Composition
- Pulping time

Cosmo Specialty Fibers  
Cosmopolis, WA





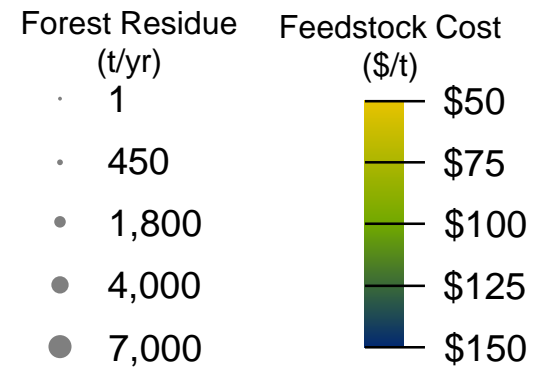
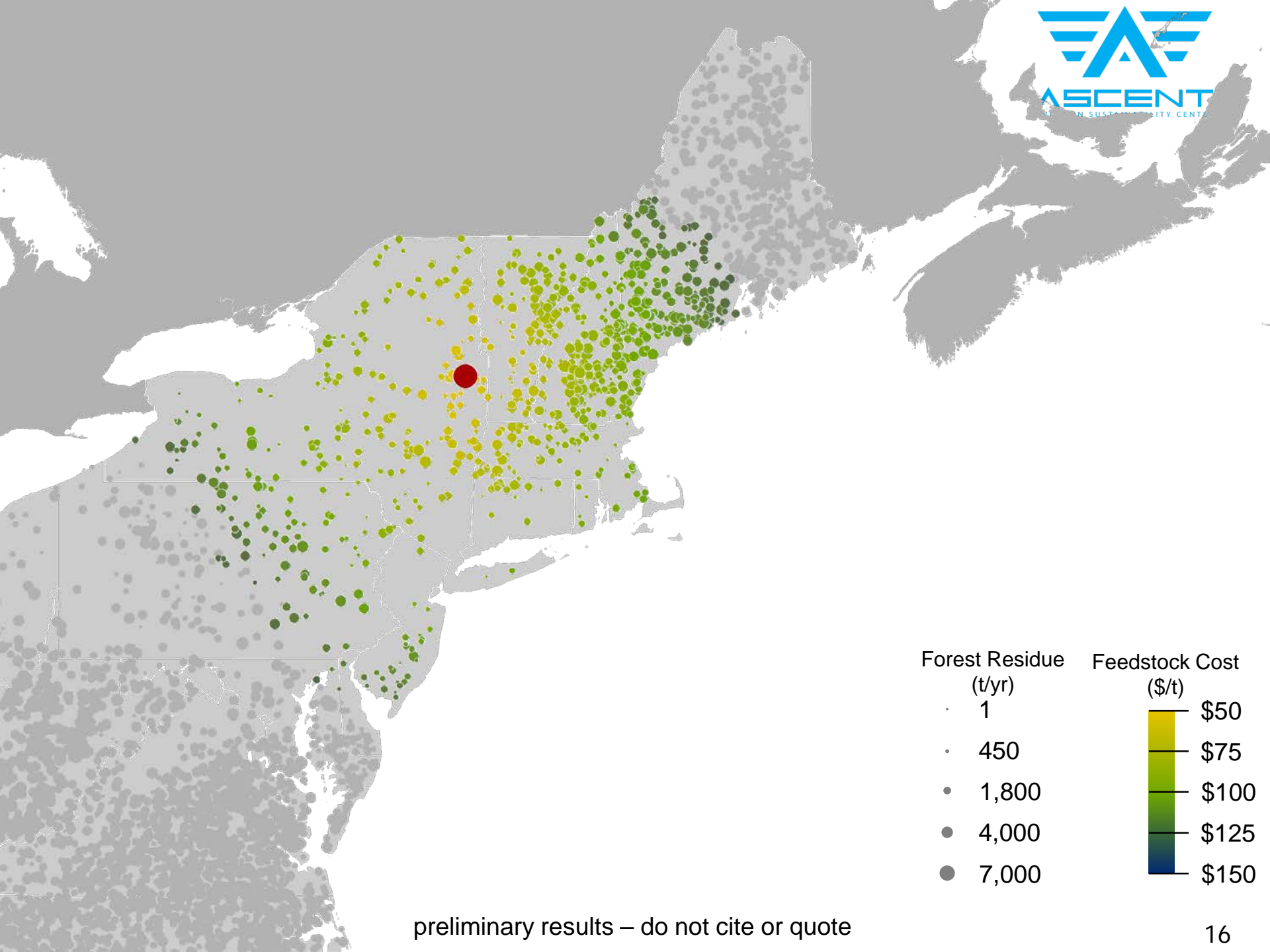
Forest Residue  
(t/yr)

- 1
- 450
- 1,800
- 4,000
- 7,000

Feedstock Cost  
(\$/t)

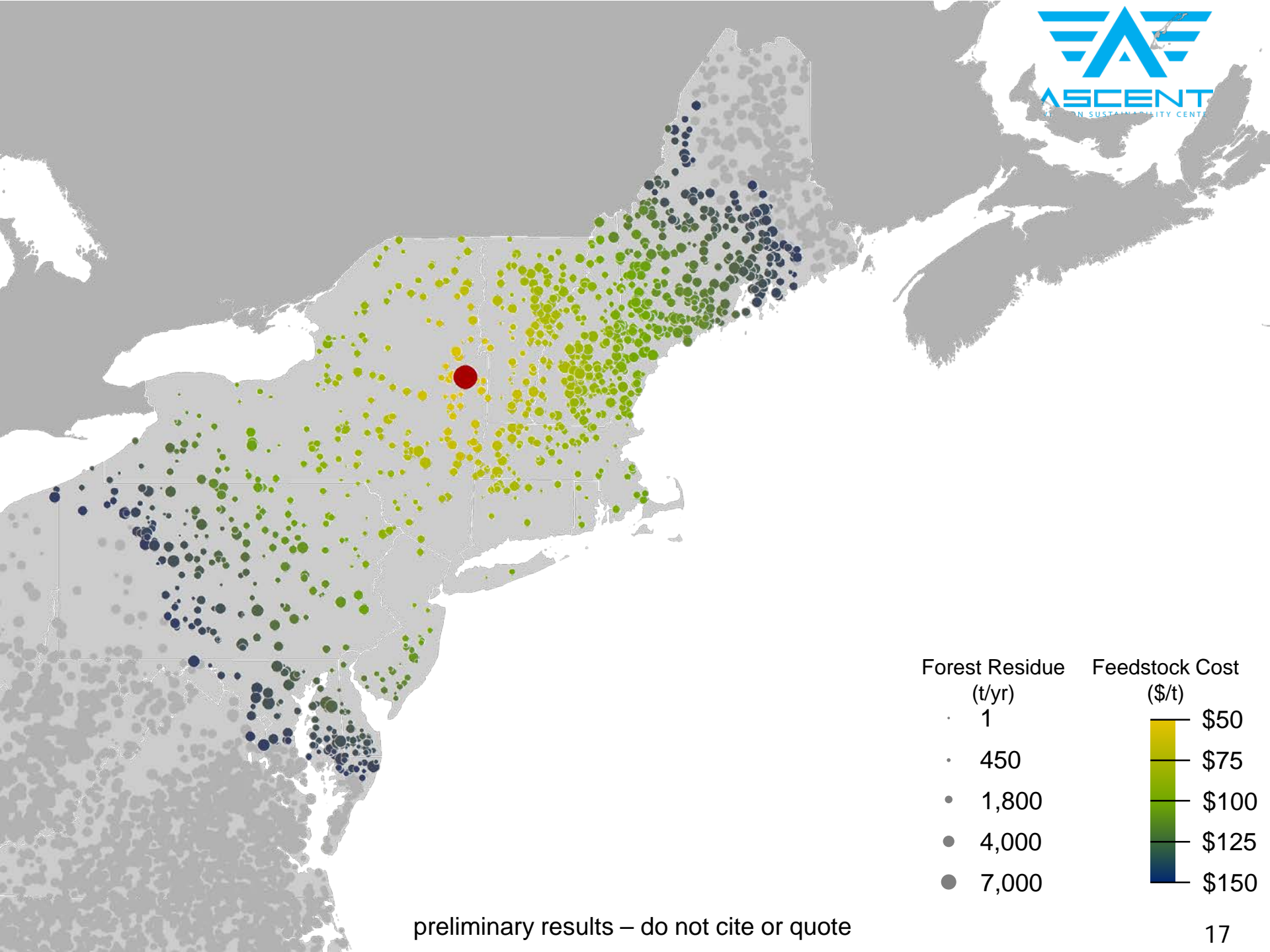
- \$50
- \$75
- \$100
- \$125
- \$150

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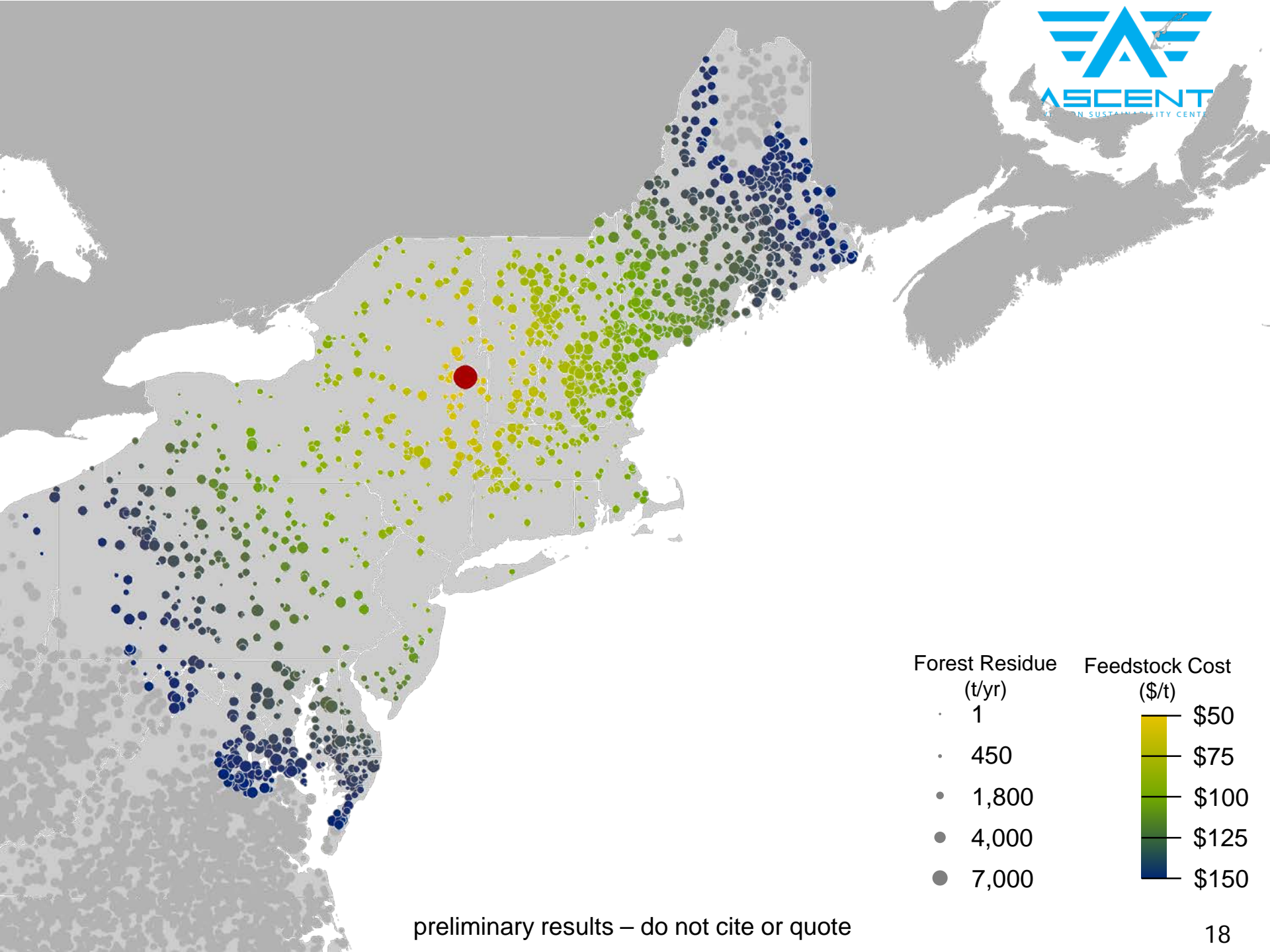


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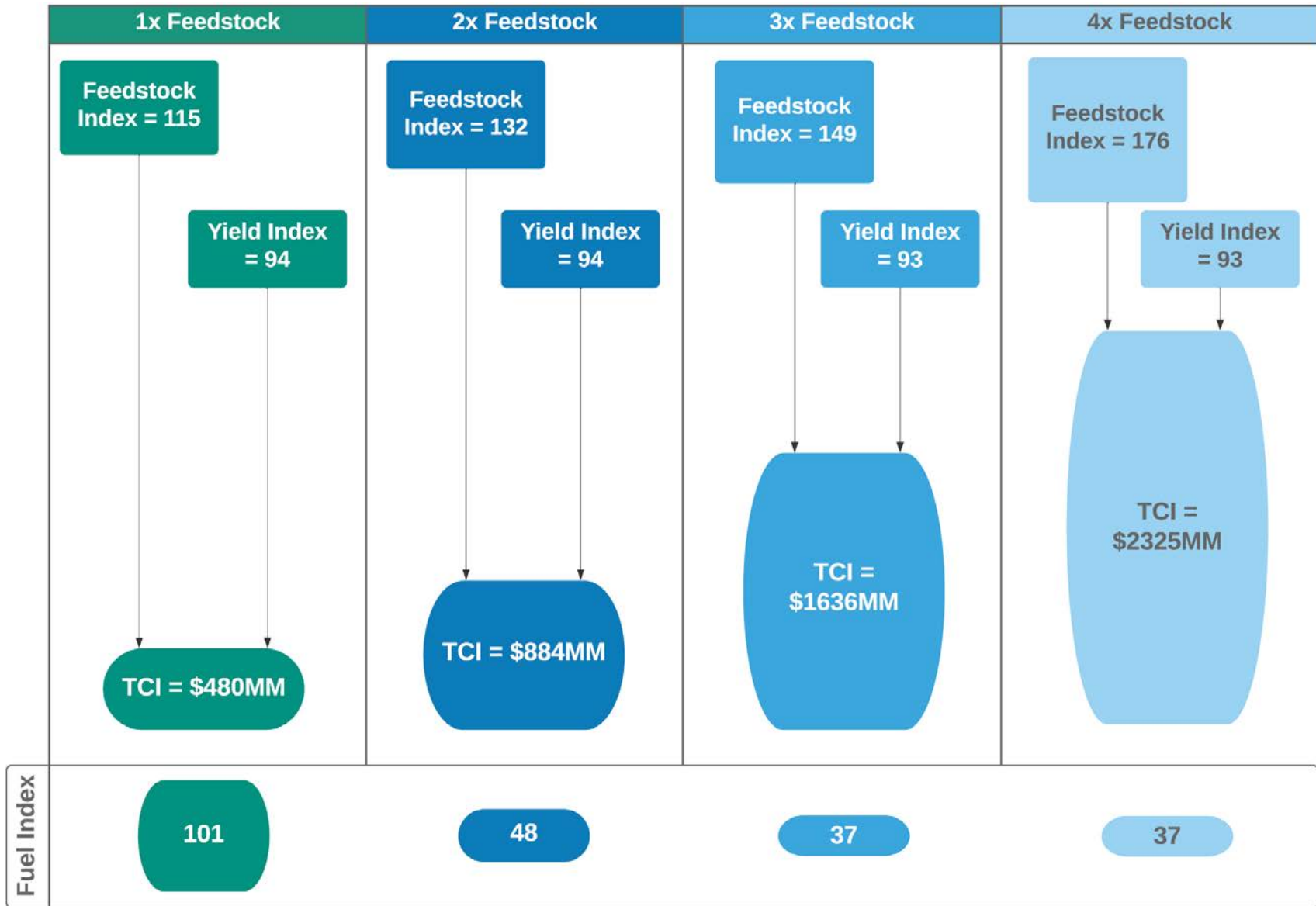


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preliminary results – do not cite or quote

# Finch Paper



# Observations



- Repurposing lowers MSP
- Accurate results require greenfield and repurposed TDEC values
- Inclusion of site purchase cost matters
- Facility scale is more important than: electricity, natural gas, labor and feedstock prices
- Existing incentives may not be enough to reach price parity unless facilities are very large, requiring \$1 billion+ to repurpose.

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