

Biochar Demonstration Project Economic Analysis

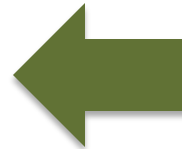
Biochar Conversion Unit
Demonstration Tour

April 24, 2015

Demonstration Project Purpose



\$1775/ acre



Producers Guide for Biochar Use

Produce
Biochar to Sell

Produce
Biochar for
On-Farm Use/
In-Forest Use

Production unit must be large enough to achieve economies of scale needed to break even or make profit. The T-1000 thermal conversion unit and the Adam-Retort are examples of larger scale biochar technologies.

Production should keep up with biomass waste disposal needs. Back-yard biochar kilns and conservation burn techniques are two ways to produce biochar for on the farm or in the forest use.

Retail

Wholesale

Crops

Animals

Filtration

California Retail Sellers
Permit Required

Product Registration and
License through the
CDFA

Label Approved by
FFLDRS

THP required to sell
forest biomass products

California Wholesale
Sellers Permit Required

No project registration
or license required for
bulk soil amendment
sales (110 lbs. or more)

No label requirement for
bulk soil amendment
sales

THP required to sell
forest biomass products

No sellers permits, licenses or THPs required if biochar is not being sold

Revenue

- Raymond Baltar of the Sonoma Biochar Initiative completed a market study for the project
 - Interviewed 52 composter, landscape stores, garden stores & nurseries in Mendocino, Humboldt and Sonoma Counties to gauge interest in biochar
 - 64.7% had heard of biochar
 - 63.6% had customer inquiries about it
 - Only 6% actually carry biochar in blended products at this time
 - 98% of those who carry biochar expressed interest in carrying RFFI's North Coast Biochar depending on price and quality
 - Willits Soil Co and Dirt Cheap from Ft. Bragg expressed the most interest in purchasing North Coast Biochar in large quantities
- RFFI is selling North Coast Biochar bulk for \$1.50 /lb most is going to Willits Soil Co. for soil blends that are then re-sold
- RFFI is also selling some bulk directly from the Branscomb Production site

Costs- Analysis Parameters

- Based on first 18 days of operations
- Includes all Operational Costs- Fixed and Variable
- Branscomb Analysis is meant to serve as a baseline for potential future operations - not as the most cost effective way to operate
- 4 scenarios of future operation are analyzed to understand future economics moving forward
- Looked at Break even price of Biochar, Return on Investment (ROI) and Payback period for each scenario

Branscomb Production Numbers

Best Day

- 7.08 hrs of production
- 7794 lbs of biomass used
- 812.5 lbs of char produced
- 114.7 lbs of char/hr
- Total Cost/ Unit of Production \$2.92

Worst Day

- 1.5 hrs of production
- 908 lbs of biomass used
- 69 lbs of char produced
- 64 lbs or char/ hr
- Total Cost/ Unit of production \$22.93

Figure 1- Costs as a Percentage by Type

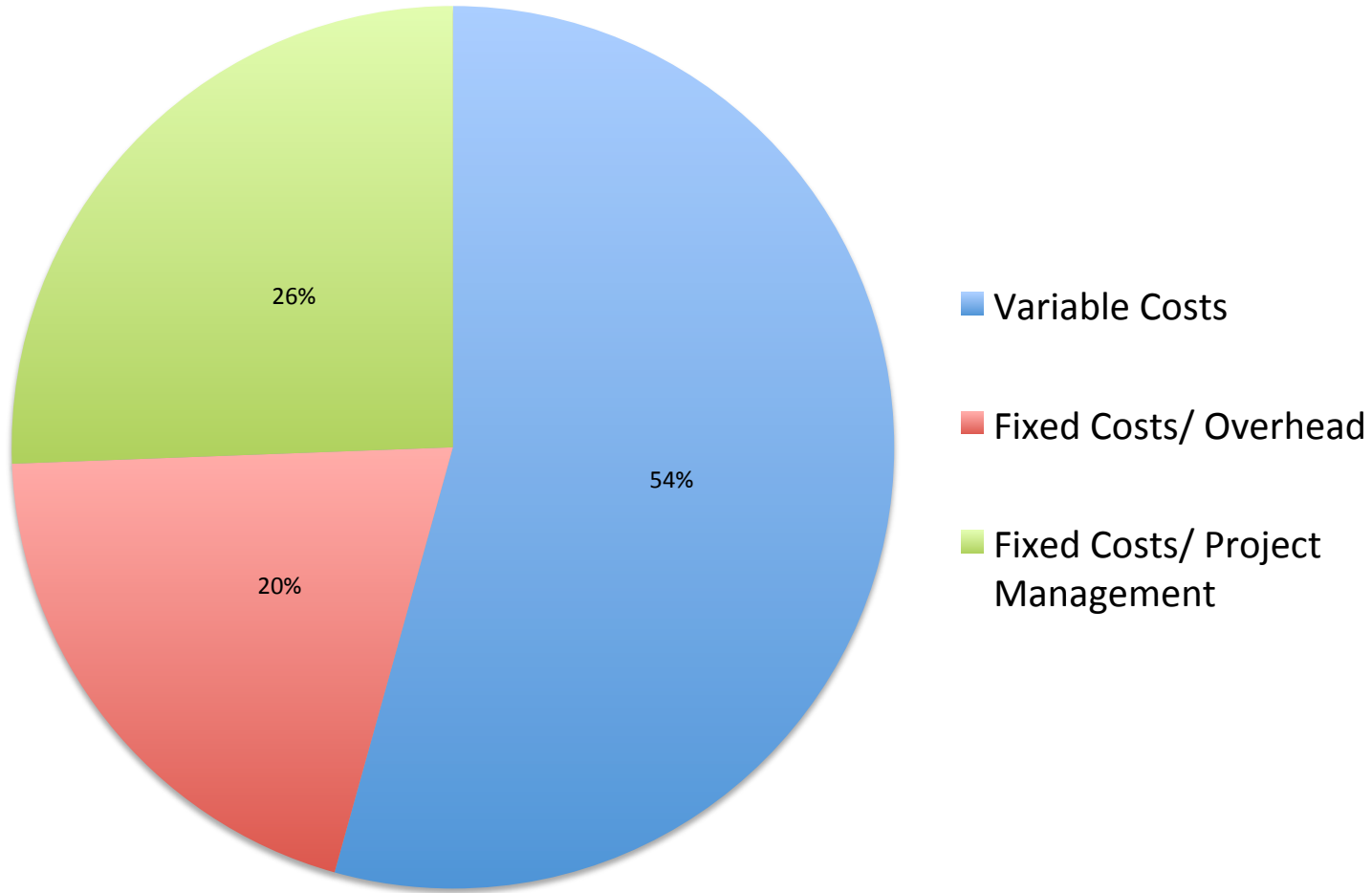
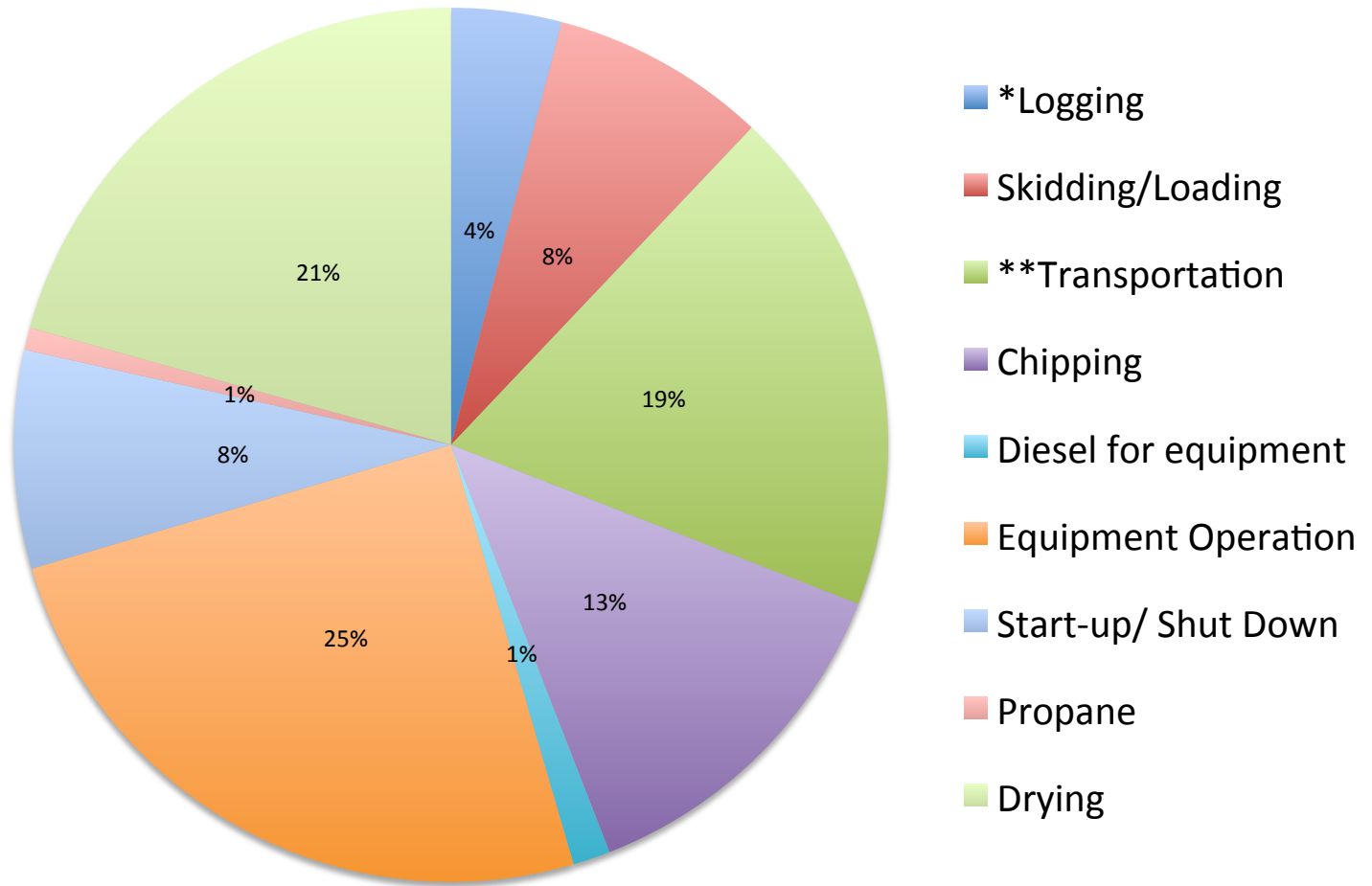


Figure 2- Variable Costs as a Percentage by Type



Drying Costs?

- Found that the chip needed to be 20% moisture or less
- Fresh chips averaged about 40%-50% moisture
- Required spreading and solar drying method to bring moisture down
- High cost of drying is related to paying the operator to spread chips and then re-pile cover re-spread and repeat based on the forecast
- To bring this cost down you either need an efficient drying system or to only operate during dry times of the year

Figure 3- Total Variable Costs by Type per Day

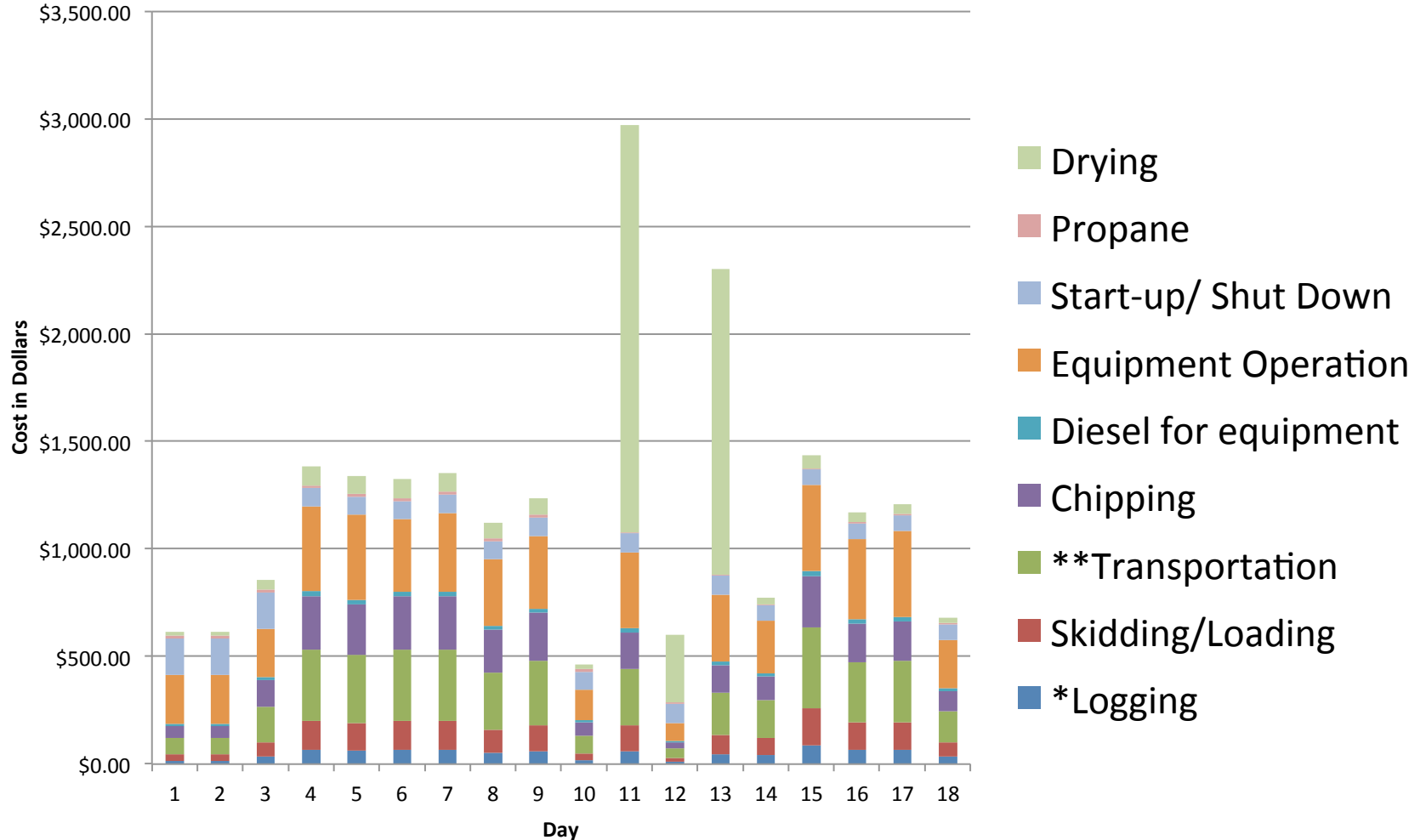


Figure 4- Variable Costs per Unit of Production Per Day

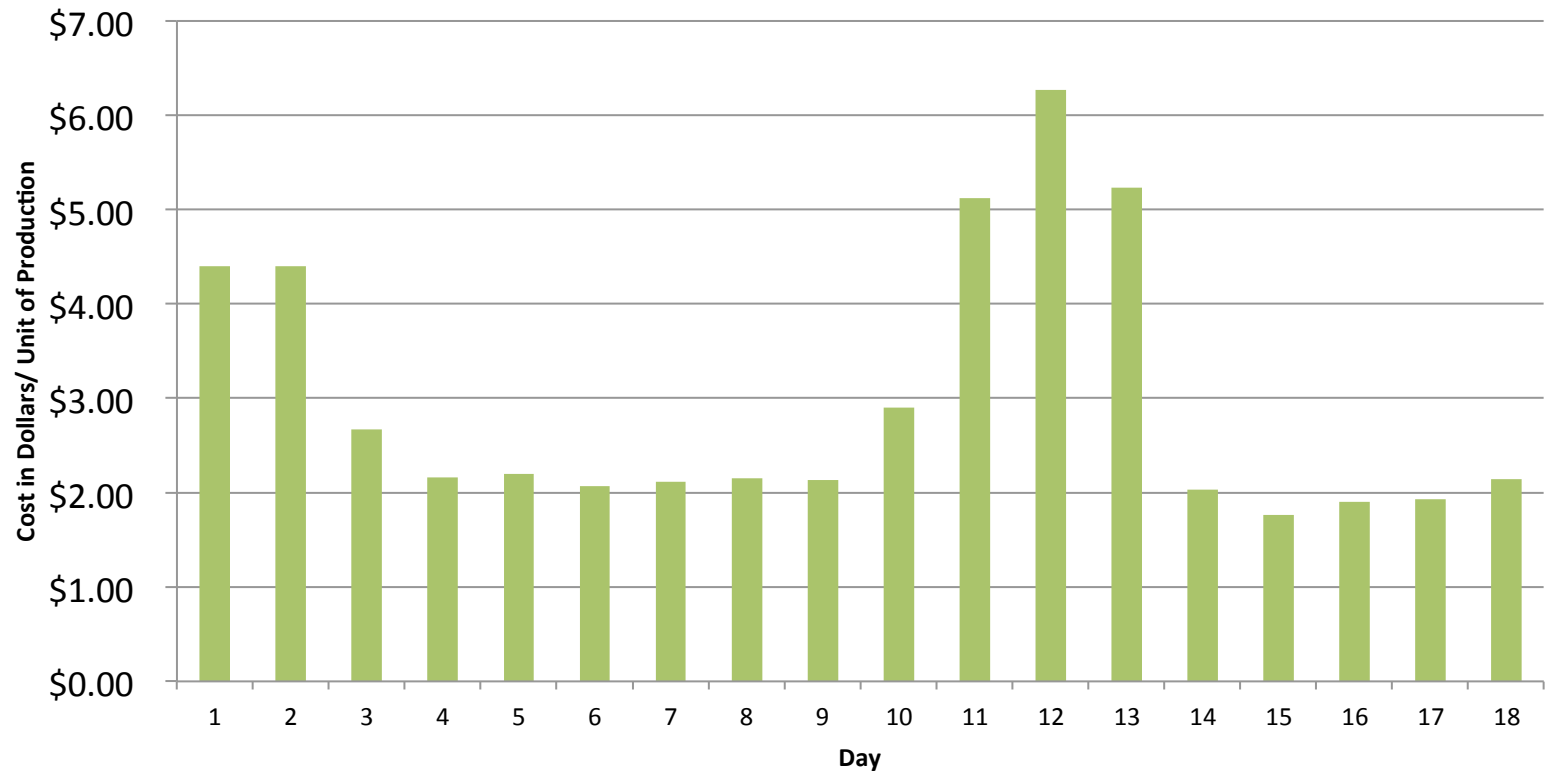


Figure 5- Fixed Costs by Type

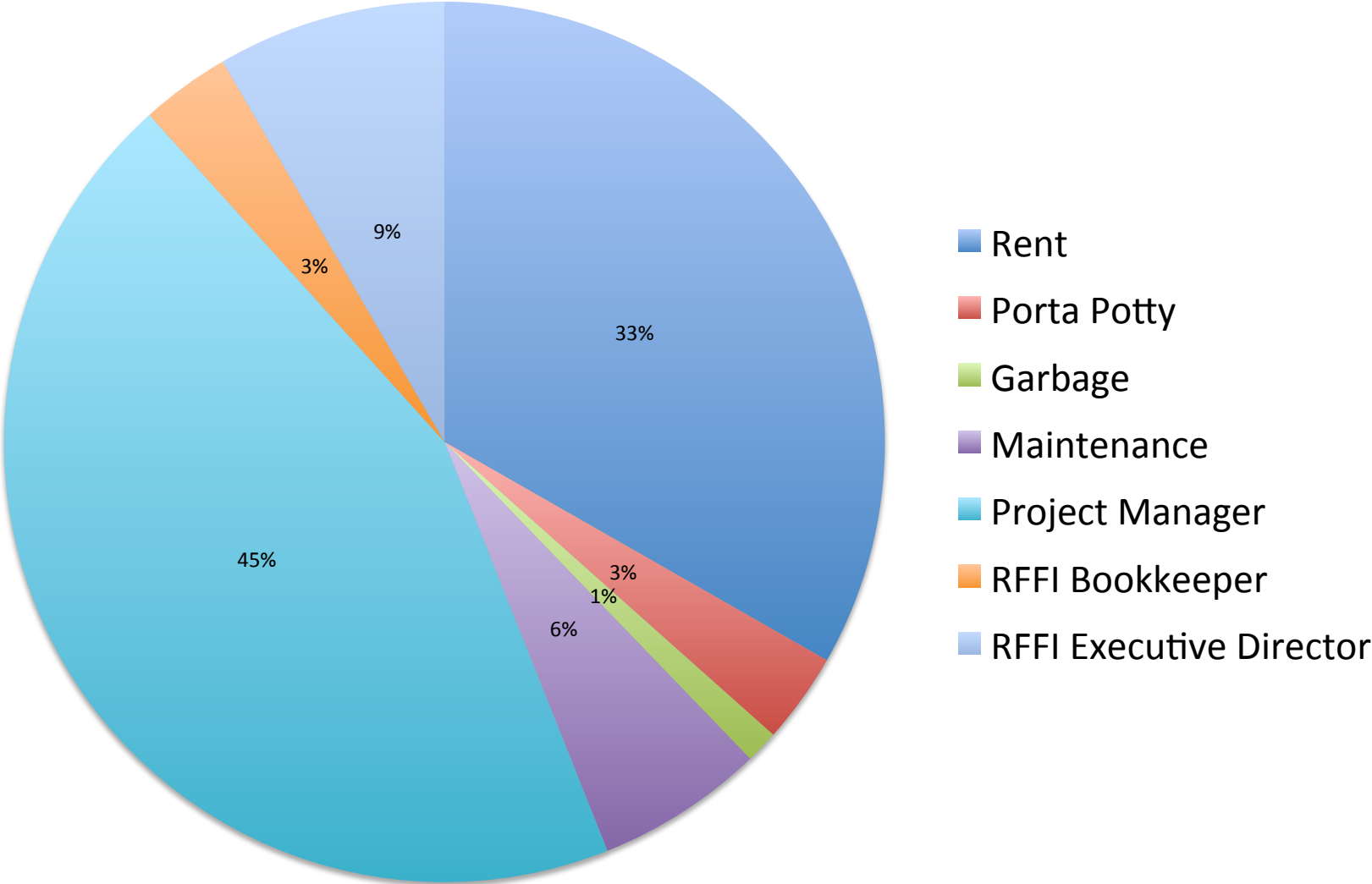
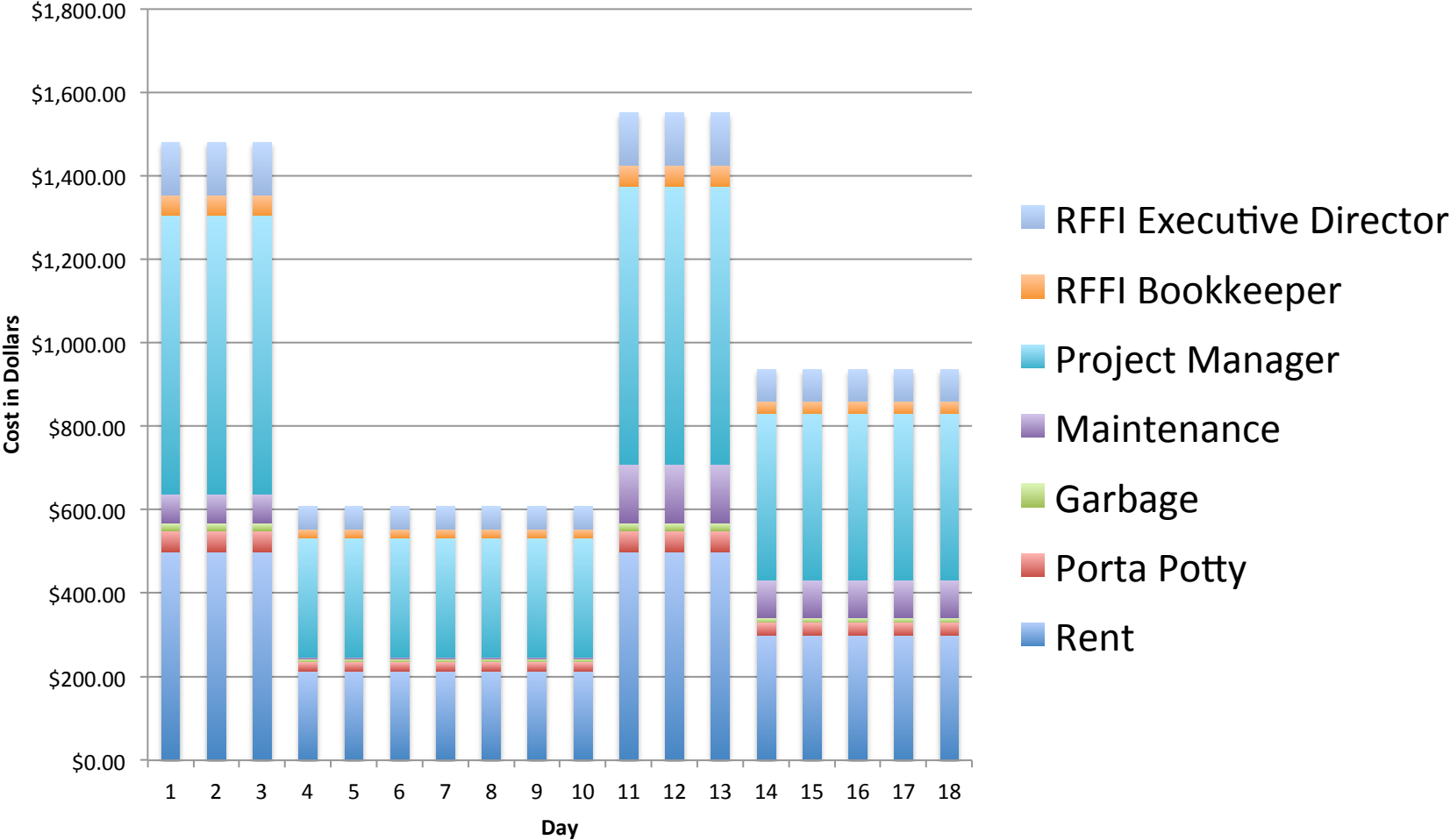


Figure 6- Fixed Costs per Operational Day



Capital Costs

- Equipment Purchase \$190,000
- Equipment Improvements \$3357.12
- 55 Gallon Steel Drums \$4,212.60
- Generator 0
- Equipment Installation/ training \$5291.03
- Tarps \$664.9
- Water System \$164.09
- Propane Tanks/ Torches \$316.71
- Other Equipment \$88.87
- Total = \$204,095

Branscomb Production Bottom Line

- \$2.92/ lb Break Even Price on our Best Day
- Selling Biochar for \$1.50 / lb
- Current operations lose \$1.42 / lb of biochar produced
- Successfully provides a baseline for alternate scenarios

Scenario 1- RFFI Changes

- Move Unit Closer to Forest
- Operate with Dry Chips
- Use Biomass from Less Costly Sources (50% from slash piles that would be burned)
- Reduce Operator Salary to \$46.44/hr
- Operate as efficiently in the future as our best day (Now average 10% better than our previous best day)
- Reduce Lease to \$750.00/ mo.
- Operate 15 days/ month on average
- Take out CEO line item
- Pay project manager \$45 hr rather than \$50

Results

- Total Costs per unit of production = \$1.46/ lb.
- \$0.04 profit per unit of production
- Payback Period = 1.7 years
- Five Year ROI= 188.61%

Scenario 2- Avoided Costs

- Builds on Scenario 1
- Includes the avoided cost of not having to manually remove biomass on the acreage treated and paid for by the biochar project
- \$500.00 / acre for manual biomass removal
- Net effect of reducing logging costs

Results

- Net Profit = \$0.05 per unit
- Payback Period 1.37 years
- 5-Year ROI= 264.65%

Scenario 3- Externalities

- Include following externalities:
 - GHG reduction
 - Water savings
 - Reduced Fertilizer Run-off
 - In-the-forest benefits of biomass removal

Results

**Net Benefit/ Unit = (Total Revenue/ Unit - Total Cost/ Unit) +
(Value of Positive Externalities)**

Net Benefit/ Unit= .05 + X

Where X equals the value of Positive Externalities

If X equals a value between \$0.00 and \$0.10

Then,

-ROI = 264.56% to 943.22%

Scenario 4 – Private Investor

- No grant funding for capital costs
- Can get cheapest source of biomass (\$80/BDT Delivered)
- Owner of the land that the unit operates on
- Operator makes \$35.00/ hour
- No CEO cost

Results

- Total cost = \$1.28 per unit
- Net Revenue = \$31,763.49/ yr
- Payback period of 6.42 years
- 10 year ROI = 55.63%

Additional Points

- Future Price for Biochar can Change
- Water, Water, Water! Policy change could create additional demand for biochar
- Under Scenario 1-3 a landowner removes tanoak from 26 + acres per year at less cost than applying herbicides
 - Real impact will require multiple Biochar Conversion Units located in every watershed on the North Coast

Project Learning's

- 1) Biochar Production and Sales can put economics into forest rehabilitation and can serve as an alternative to herbicides
- 2) The non-profit / grant funded model or having the a unit attached to a specific forest feedstock source will ensure that forestry goals are met vs private investor may look to simply maximize profit with cheapest biomass input
- 3) Biggest hurdle is chip drying- future projects need to acquire a dryer or only operate in dry times of the year

Next Steps

- Complete processing of logs currently decked in Usal at the Branscomb Mill Site
- Looking to move the unit closer to the forest to implement Phase II – Commercial Production
- Make all of our project findings available via the RFFI website (including the econ analysis and market study)

<http://www.rffi.org/Biochar.html>

Questions?

- Judith@rffi.org
- 707-984-8969
- <http://www.rffi.org/Biochar.html>

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