Introduction

RCP

Plant Overview

13400 South Kedzie Avenue Robbins, IL 60472
Operational 1997-2000 at 50 MW per hour
Refuse burning
Current retrofit for clean-burning wood biomass renewable, wastes from construction, tree timming
75% construction waste
25% "green" wood

Problem:

Plant generates waste heat and greenhouse gases
No plan to efficiently utilize green wood
Portion of incoming wood too small to burn efficiently

Solution:

Capture waste heat and route it to productive uses
Sort incoming wood supply by size
Utilize some carbon dioxide in greenhouses

Quantify heat to be captured with counter flow heat exchanger
Determine the requirements and market for biochar
Measure the feasibility of using the heat and/or exhaust for greenhouses
Choose a pellet mill able to increase efficiency of RCP
Analyze cost-benefit of heat exchanger, pellet mill, process lumber and biochar furnace
Investigate means to secure enough green wood to continuously supply the power plant each year

Biochar Group

- Determine the requirements for continuous/batch production of biochar
- Perform a cost/benefit analysis of each option in terms of capital expenditure, operating costs and expected revenue.
- Report our findings to Robbins Community Power.

Wood Supply Group

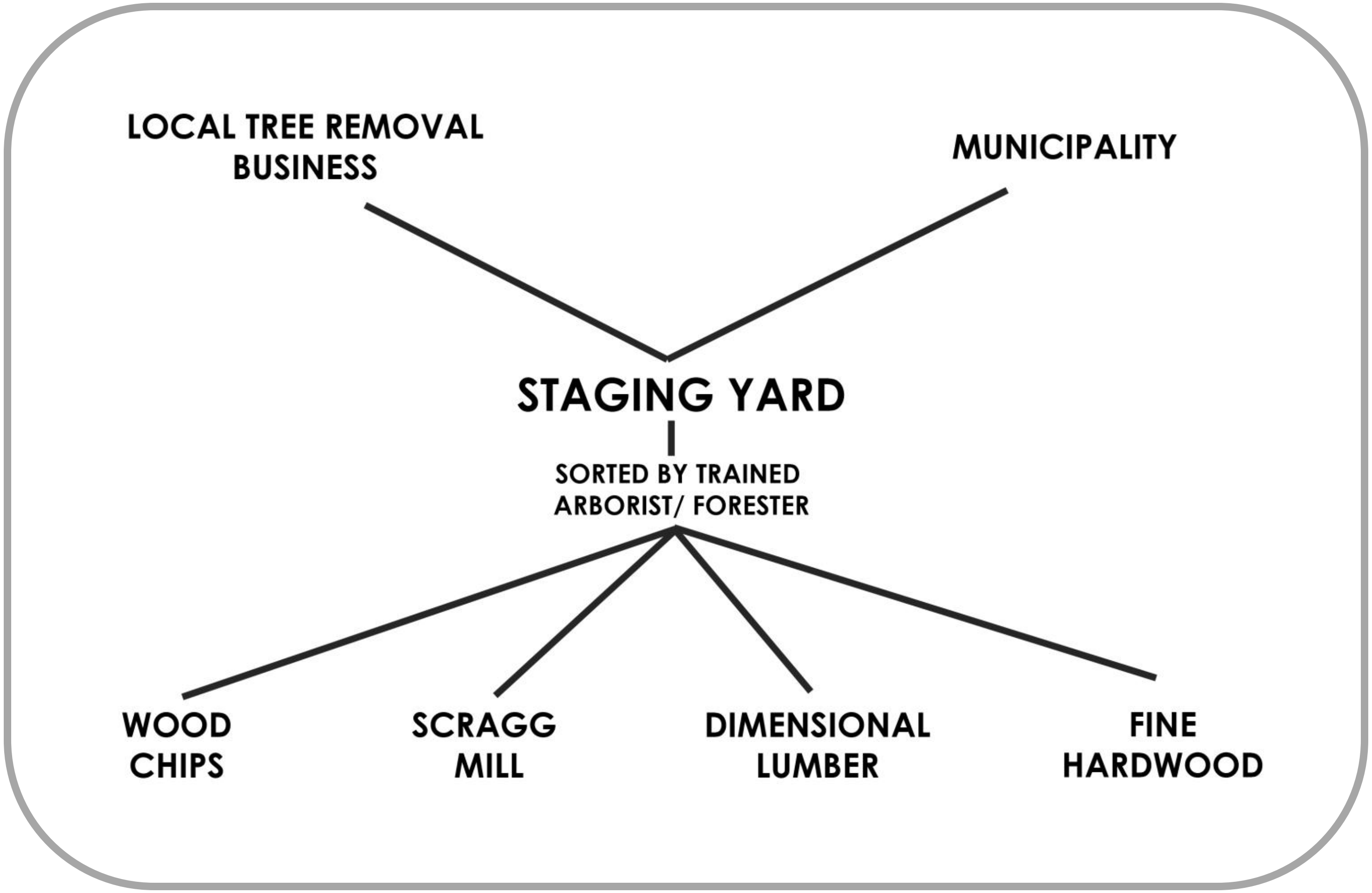
- Communications and connections with local mulch dealers and city refuse groups
- A proposal for the means to providing the plant with a quarter of its fuel supply as green Wood

Greenhouse Group

- Plan for a plant visit
- Expected data include final carbon dioxide emissions levels after the proposed solution is instated.
- Potential products resulting from research are to be multiple solution possibilities. These include fresh produce or other plant products.

Marketing Group

- Suggest reasonable solutions to RCP for utilizing waste heat of the flue gas
- Transform waste energy into a source of revenue or a cost-reduction method.
- Perform a cost/benefit analysis of an exchanger in terms of capital expenditure, operating costs and expected revenue.

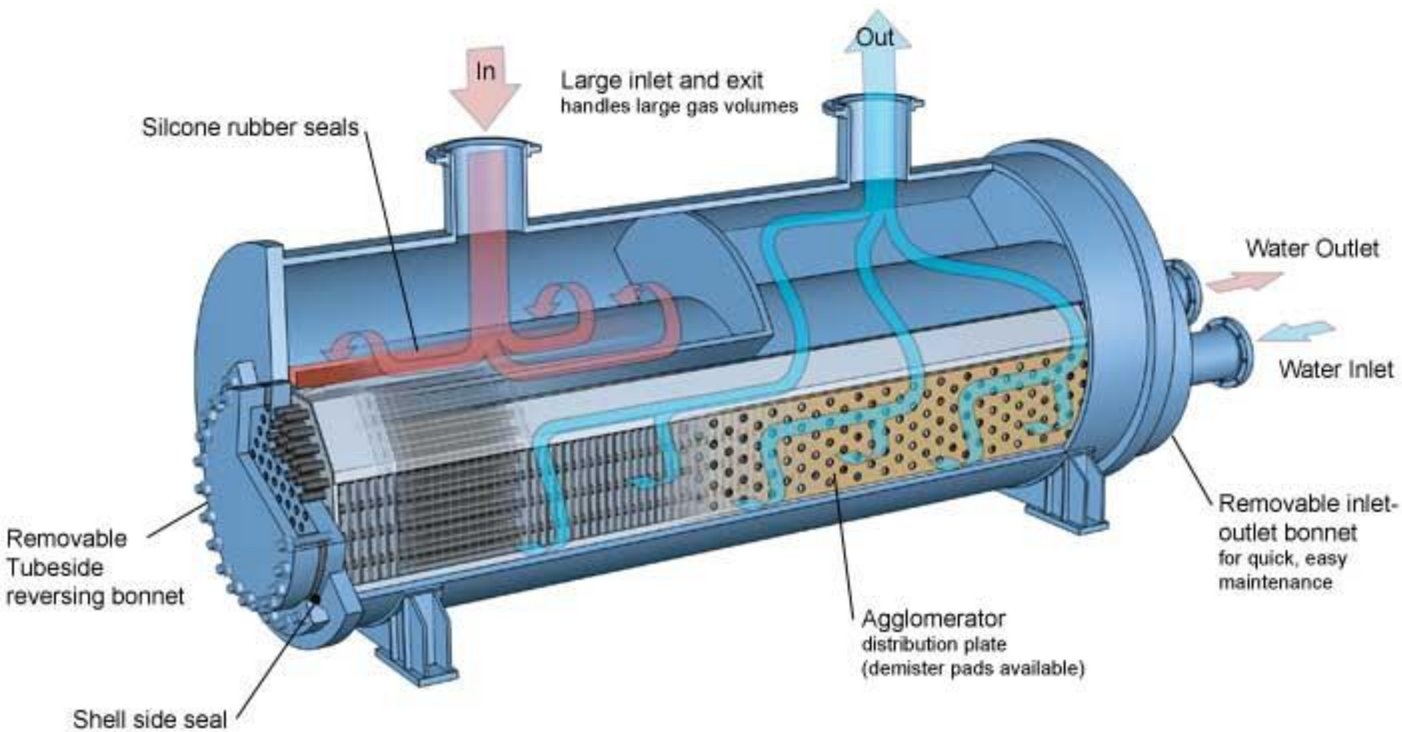

LOCAL TREE REMOVAL BUSINESS
MUNICIPALITY
STAGING YARD
SORTED BY TRAINED ARBORIST/ FORESTER
WOOD CHIPS
SCRAGG MILL
DIMENSIONAL LUMBER
FINE HARDWOOD

Value of tree

40ft 20" DBH Ash ≈ 282 BDF
$\pi \times (.8333ft)^2 \times 40ft \times 48lb/ft^3 \approx 2$ tons
Worth:
As kiln dried lumber = $472.85
As wood chips at $20/ton ≈ $40

WE COULD CHARGE $10 PER TON AND STILL MAKE MONEY

- Utilize waste heat from RCP
- Design a heat exchanger for flue gas
- Use parameters determined during the summer
- Determine value of heat
- Calculate total area for ~5MW heat transfer
- Conference with Combustion Engineering
- Cost analysis
    - Exchanger itself
    - Structure


In
Out
Large inlet and exit
handles large gas volumes
Silcone rubber seals
Water Outlet
Water Inlet
Removable Tubeside reversing bonnet
Removable inlet-outlet bonnet
for quick, easy maintenance
Agglomerator
distribution plate
(demister pads available)
Shell side seal

Develop a theoretical process to upgrade low value feed

Robbins Community Plant cannot use fine particles as they don't burn efficiently:

- Very small particles < 0.25 inch will be pelletized
- Intermediate (0.25-1 inch) can be used to make biochar, bio-oil and syngas

Step 1
Grow plants to capture CO2

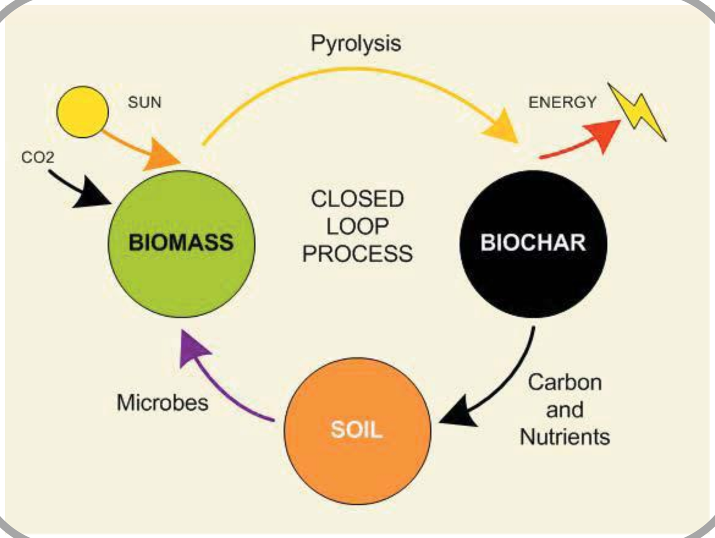
Step 2
Pyrolize for energy

Step 3
Sequester biochar in the "garden"

Step 4
build soils rich in stable carbon

Step 5
repeat to help solve climate crisis

- Met with potential bio-char client
- Identification of process for bio-char and related products (bio-oil, syngas)
    - Slow pyrolysis
    - Optimum operating conditions
    - Energy balance
- Ongoing research on economics of slow pyrolysis and pelletizer



Propose a solution that could by-pass the use of the 300ft smokestack

- To do this carbon dioxide and heat will have to be removed from the flue gas before it can be emitted into the atmosphere

Grow trees in greenhouses using excess heat and carbon dioxide to make power plant a sustainable entity

- 18-20 acres of land for use along Cal-Sag canal

Research into carbon sequestration via algae growth for biofuel and crop growth in greenhouses

- Algae ponds produce approximately 2000 gallons/acre/year of biofuel
- Trees of 25in BHD absorb about 50lbs/year
- Research into C3 in comparison to C4 plants has revealed that C3 plants absorb more CO_2 gas on a mass basis

Contacted IEPA about carbon dioxide emission standards and regulations

In communication with MWRD about land use and leasing opportunities

- Land lease available through competitive biding

Preliminary greenhouse designs and renderings have been made

Obstacles

Difficulties in locating reliable sources online and in research journals

Contacting organizations and people who have necessary project information

Anticipated challenges

Calculating exact heat and CO_2 absorption and emission values

Calculating cost of anticipated solution technique

Economics: worthwhile to Robbins or related industries?

Questions?