Principles:

1. Stack gases are free from visible soot and smoke for 98% of the active pyrolysis time: Minimal smoke at start up and burn out.

2. Basic design must be able to be tuned for multi-fuel capability - no dependencies on a single type of feedstock. Jatropha beans, cherry pits, nut shells, rice hulls, and densified grass are examples of preferred feed stocks with few, if any, other uses. Each feedstock type is likely to require a specific tuning of the system.

3. Wind proof in strong gusts;

4. When tested with soft wood pellets, the Biochar harvest is 20%, +/- 2% of the feedstock weight. The biochar must also pass the 6 simple tests [see appendix]. In the field, the yield will vary with feedstock type, moisture content, form factor, size, etc.

5. Must be capable of being made locally with locally sourced materials;

6. Must have the lowest possible cost consistent with “good enough” durability. Cost of ownership over 36 months must be reasonable given local economic conditions.

7. Basic assembly requires minimal equipment and minimal training.

8. Open sourced solutions favoring co-creation and “Open Knowledge” are given equal weight with for-profit solutions.

9. Health, agricultural, environmental, and economic benefits documented to show the efficacy of the solution over one, three, and five year periods. Ability to self document reduced illnesses, increased crop yields, environmental benefits, and economic gains.

Appendix: Six simple biochar tests:

Test #1: Smoke -- If the smoke at the end of pyrolysis last 60 seconds or less, this is a very good indicator that there is not too much residual “junk” left in the biochar. If the smoke greatly diminished in two minutes or less, this is also a good sign.

Test #2: Floaters -- Stir the pot with the quenching water and the biochar in it. Use a nail or a stick or a screw driver etc. There should be very few “floaters” in the water. Charcoal that floats is not as absorptive as biochar the sinks in very short order. Absorption is good and is the desired result. Discard the floaters.

Test #3: Brown bits -- Look for “brown bits” of incompletely charred feedstock. This is an indication of incomplete and uneven pyrolysis. Discard the brown bits.

Test #4: Clear water -- Is the quenching water clear or milky? Clear is good. Milky indicates the presence of too much ash. This suggests that the pyrolysis was too hot and too fast and some of the charcoal was actually burned down to ash. If this is the case, your harvest of biochar is less than optimal. It may also suggest that the pH of your biochar is not neutral.

Test #5: Smell -- Scoop out as much biochar as you can from the cool quenching water. Put it right up to your nose and smell it. It should have no oder. If it smells of old fires, creosote, then it is dirty and you may well want to discard it.

Test # 6: Hugh McLaughlin's "no soap test". Take some of the freshly water quenched biochar from the quenching pot. "Grind" the biochar into your skin as it you meant it to stay there forever. Now rinse your hands off in the clean quenching water. Does the biochar come off with no soap? If yes, then it is not oily. This is good. If not, and it is oily, you may want to discard the biochar.