BIO-OIL BRIEFING

RENEWABLE OIL INTERNATIONAL, LLC

OTTAWA, ONTARIO, CANADA

FLORENCE, ALABAMA, US

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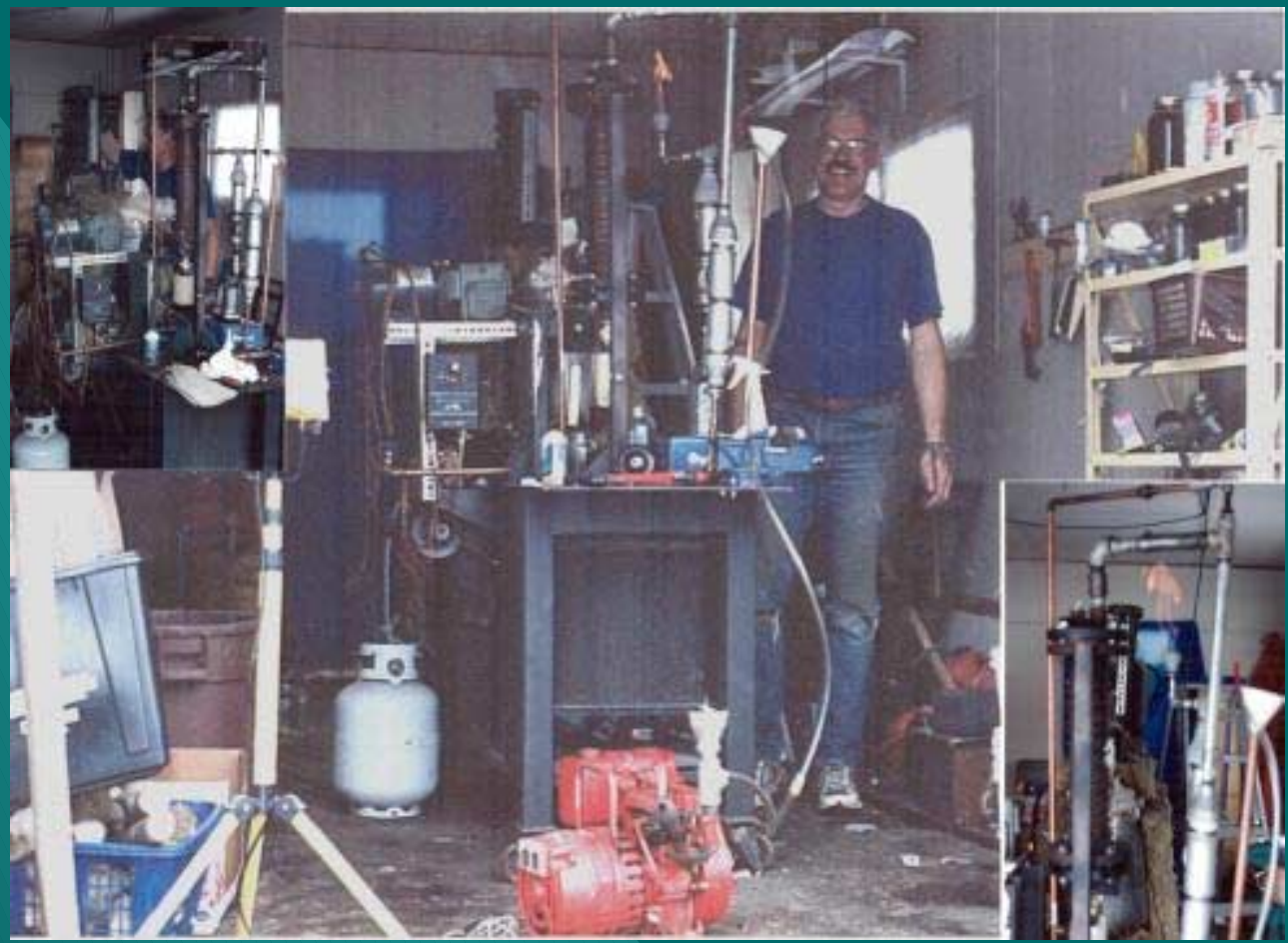
STATUS

- 1 kg/hr Bench Scale for R&D
- 5 tpd demonstration plant in construction for chicken litter disposal in Alabama
- 24 tpd non-energy commercial plant using same basic concept as pyrolysis

Bench Scale Unit



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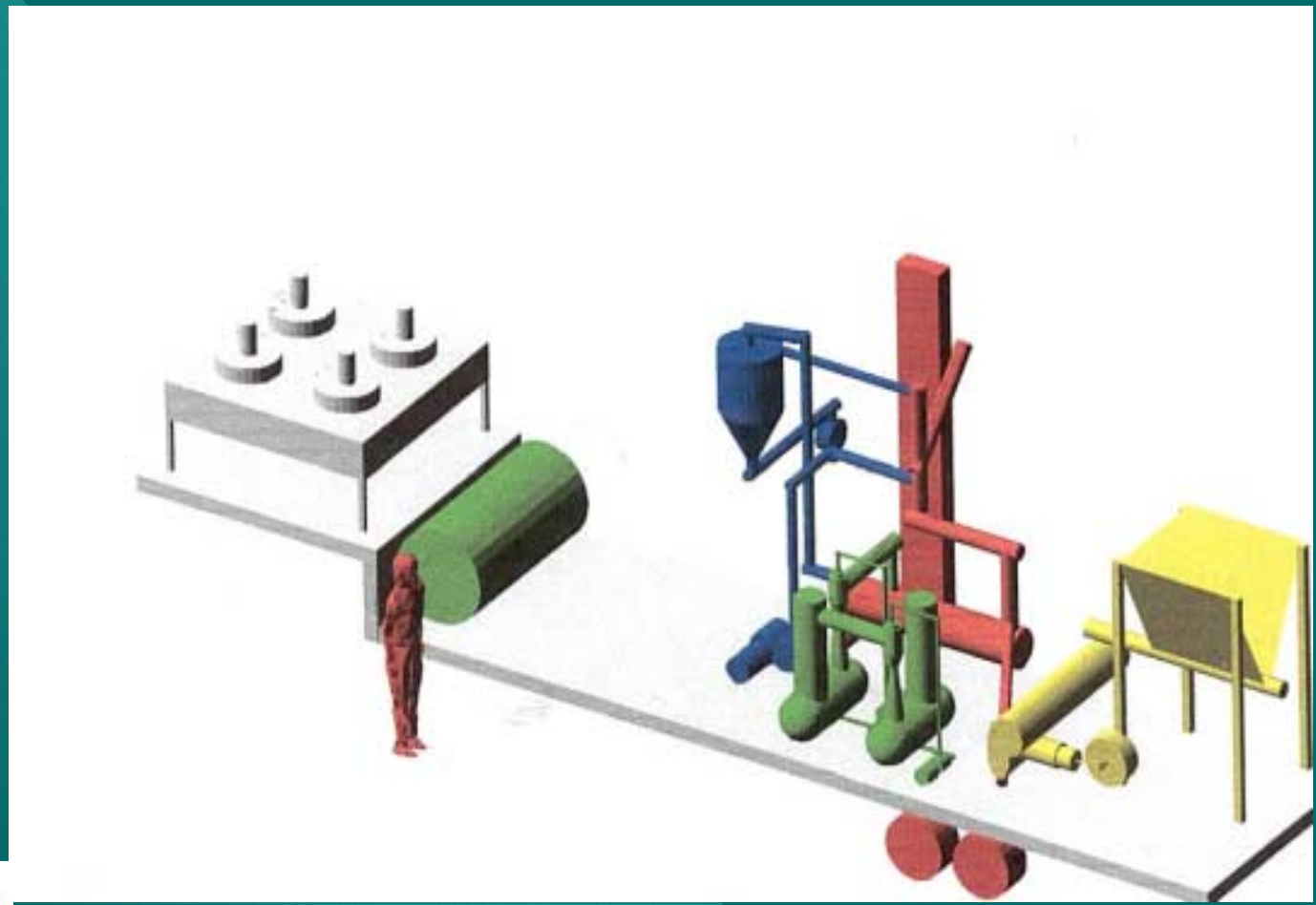
5 tpd (dry)



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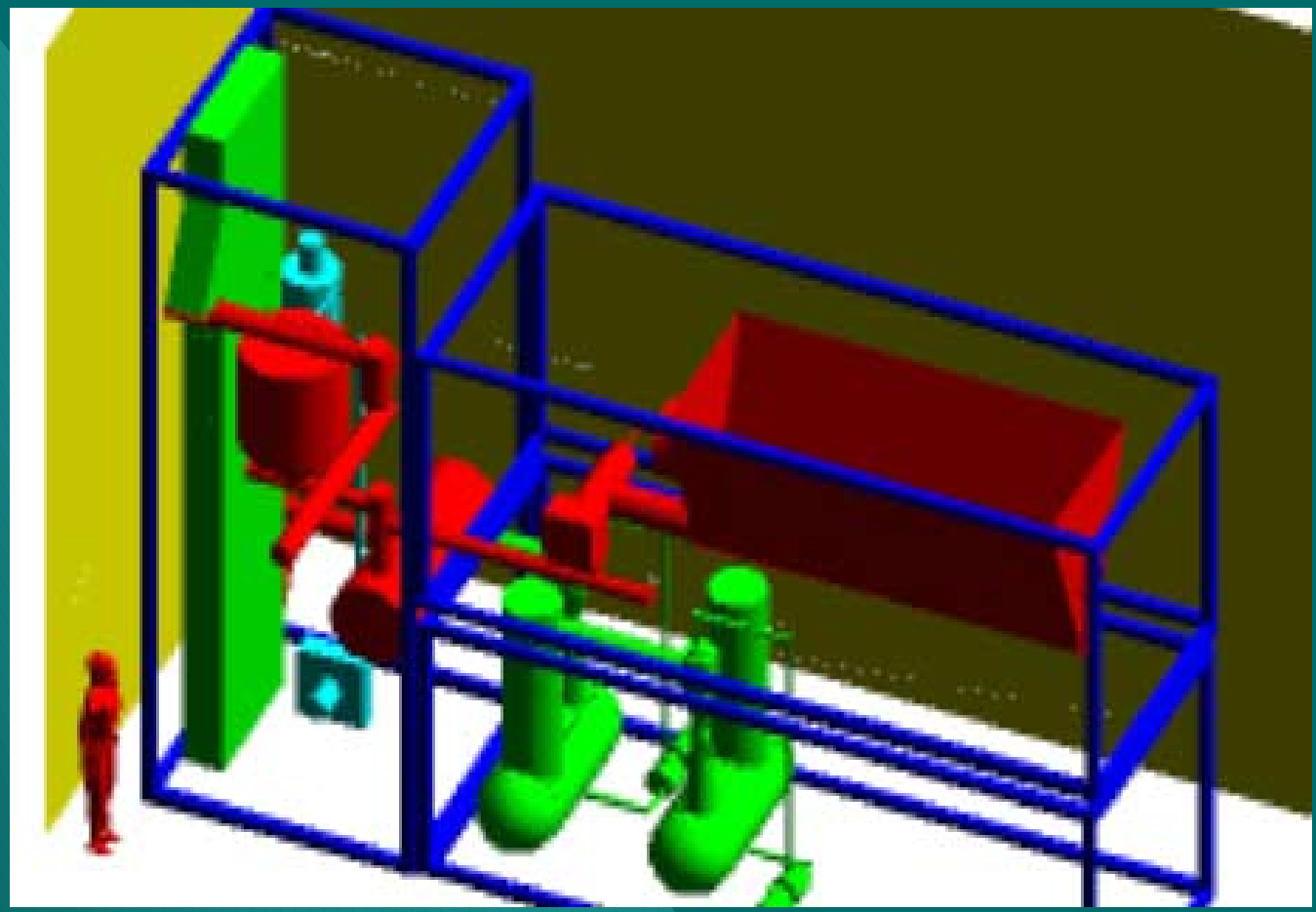
120 tpd (dry)



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Economies of Scale

- 5 tpd plant capital costs approximately $250,000
- 120 tpd plant capital costs estimated $1.2 million
- 120 tpd plant modular design, build around half size shipping containers.
- Modules fabricated in shop and shipped to site for final assembly
- Can be moved if biomass "dries up"

Economic Impact

- 75 tpd plant will produce 4 MW of electricity as combined cycle
- 120 tpd plant can produce 4 MW of electricity without heat recovery or co-generation
- A 120 tpd plant generates 9 direct jobs plus another 7 wood harvesting jobs.
- As a boiler fuel or for co-firing, a 120 tpd plant can offset 8000 gallons of fuel oil per day

Biorefinery Concept

- ROI is not currently involved in the extraction of any chemicals or other products.
- ROI's oil is similar in chemistry to that produced by others and therefore the possibility exists to produce other higher value products.

Co-Locating of Bio-oil Production

- Biomass is a low density material and ROI's modular approach allows plants to be located close to the generation source
- Presently working with a sawmill operator in Mass. to convert sawmill residue to bio-oil that can be trucked offsite to end users.
- Also investigating the use of waste heat from electrical generating system for dry kilns.

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Environmental Challenges and Benefits

- Co-firing reduces the environmental impact of coal to energy systems.
- The overall energy efficiency of distributed power systems can approach 80%, a significant increase over 27 - 30% efficiency for centralized power plants
- Sustainability is the key. Biomass supply has to be fully sustainable and economic.

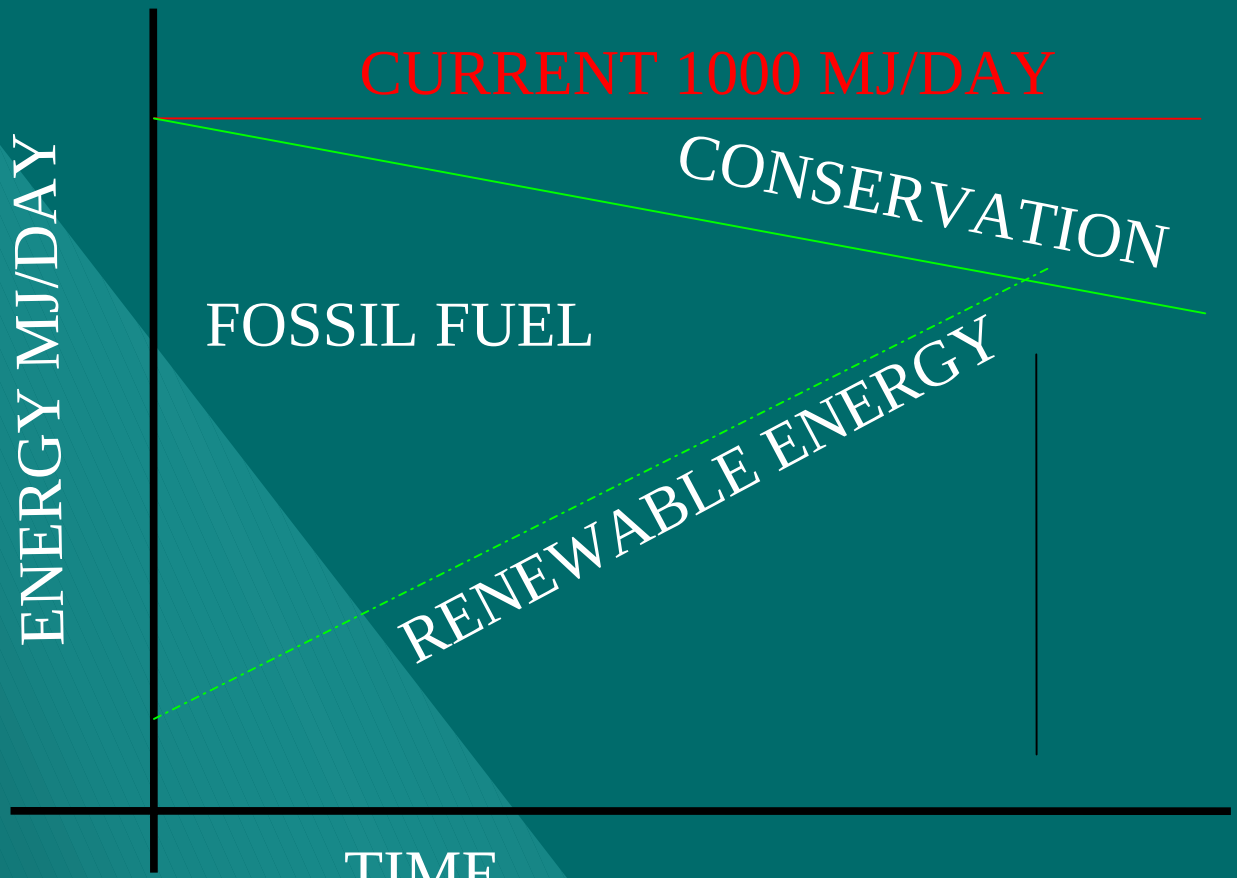
Downstream Research Needs

- Internal combustion or Stirling Engines for simple conversion of bio-oil to mechanical energy.
- Alternatively a simple bio-oil gasification technology to eliminate problems with internal combustion engines.
- Broader range of gas turbines to tap the smaller markets.

What Can Government Do

- Recognize the real value of bio-oil producton
- That is take into the accounting picture the fact that bio-oil creates local jobs instead of the outflow of money from local regional and national economies.
- Set realistic goals for renewable power production and create the environment whereby those small companies can flourish

Perspective



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