

Reed canary grass
as a pellet fuel stock
in Michigan's Eastern Upper
Peninsula

Clay Lake Plain

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Current heating sources

- **Electricity**

Current heating sources

- Electricity

- Mature industry, safe and reliable, inexpensive to purchase appliances, convenient, but...

- May be expensive to operate now, and price will only go up

- Majority fired by fossil fuels

Current heating sources

- Electricity
- Natural gas/propane

Current heating sources

-
- Natural gas/propane where natural gas unavailable
 - Very high energy content,
 - Mature industry, but...
 - Increasing expensive
 - Fossil fuel
 - Not locally sourced

Current heating sources

- Electricity
- Natural gas/propane
- Traditional Wood

Current heating sources

- Electricity
- Natural gas/propane
- Traditional Wood
 - Can be locally sourced
 - Carbon neutral, but
 - Inconvenient,
 - Emissions?

Pellets?

- Wood pellets
 - Becoming a mature industry,
 - More convenient than traditional wood,
 - Locally sourced, but...
 - Expensive to purchase appliances and pellets
 - Pellets not always available

Other fuel stock for pellet stoves?

- Grain?

- Mature industry, supply chain established, but...
- Competing with food supply
- High inputs to production:
plant, cultivate, harvest,
process

Other stock?

- Grass?

- Easy to harvest and work with
- Perennial cover crop, but...
- Not a mature industry
- Question of energy payback?

- I decided to look into it,
especially as ...

I watched our propane bill
escalate...

- Don't have a woodlot
- Do live in an old hayfield
that's been overrun with reed
canary grass

RCG pellets already in use

- Scandinavia
- New England/Quebec, some work in Ontario
- Other grasses in use in plains states
- No one in Michigan was making RCG pellets

Phase I

- Obtained funding from Michigan Biomass Energy Office
- Looked at per acre yield and energy content at 6 typical reed canary grass fields in EUP Clay Lake Plain
- Estimated energy required to harvest and process into pellets

Results of Phase I

- Energy content: 8,000 BTU/lb (as expected)
- RCG yield about 1t/acre (as expected)
- With some inefficiencies incorporated, that equates to 3 acres of RCG pelletized and burned in a pellet stove = 800 gal propane

Conclusion of Phase I

- Seems feasible energetically

But is it workable?

- **How hard is it to make pellets?**

But is it workable?

-
- How expensive is the equipment to make and burn pellets?

But is it workable?

-
-
- How well will they burn?

Phase II

- Harvested about ½ acre of a reed canary grass field in November 2008
- Purchased a hammer mill and small, PTO-driven, flat-die pellet press from Pellet Pros, Kewaunee, IL
- Ground and pelletized RCG

Grinding

- Easy to grind, but...
- Fines escape easily
- At this scale, labor intensive

Pelletizing

- Run mill at 750 rpm PTO speed
- Add material, for first 15 minutes won't stick, re-run the material
- After material and dies and rotor is warm, begins to stick together if recipe is right
- Pellets cool quickly
- Screen out fines (can be re-run)
- Place in sealed bag or bucket
- At this scale it is labor intensive

Recipe 1

- 1, 5-gallon bucket of ground reed canary grass,
- 1 gal ground corrugated cardboard,
- 200 mL of used fryer oil
- 400 mL of water
- Stir with paint stirrer on a hand drill

Recipe 2

- 1, 5 gallon bucket of ground reed canary grass
- 800 mL of wet spent brewer's grain
- Stir with paint stirrer on a hand drill

Recipes

- Both work
- Grain works a bit better, but is not as readily available, and spent brewer's grain can be used as livestock food.

A disadvantage

A disadvantage

- Squirrels like the pellets.

Burning the pellets

- Purchased Quadra-Fire multi-fuel stove
- Mounted it on a trailer to make a portable display unit
- Works very nicely, very convenient
- Not inexpensive

Burning pellets

- Pellets feed well
- Stove throws out plenty of heat
- Emissions minimal

Compared to wood pellets

- Harvesting equipment widely available
- Easy to make pellets, minimal processing
- Slightly less dense but could be due to type of press
- Grass pellets have low emissions, more ash

RCG pellets

- proven feasible on this small scale

Phase III

- Compare BTU output, ash output of wood v. RCG pellets
- Will be doing that this autumn

Benefits of RCG pellets

- Local sourced, carbon neutral, inexpensive fuel source
- Potential income source from marginal lands
- Harvesting RCG does not compete with food chain or wildlife use – in fact, makes use of a nuisance species.
- But I do not advocate planting additional acres of RCG

Commercializing?

- Resource base is definitely here
- Grass pellets require less energy to make than wood pellets, but...
- Grinding, mixing and pelletizing needs to be made less labor intensive
- Other equipment could do that

Another issue

- Timing the harvest
- Ideally very late in season, saves nutrients and drier material, but...
- Autumn can be very wet around here
- Would we need other harvest equipment? Harvest, grind and blow into a tank all in one pass in a wet field?

Establishing customer demand

- Price point?
- Requires education:
 Unfamiliar fuel
- Requires special stove
- Legal in town?

Attention all you inventors
out there:

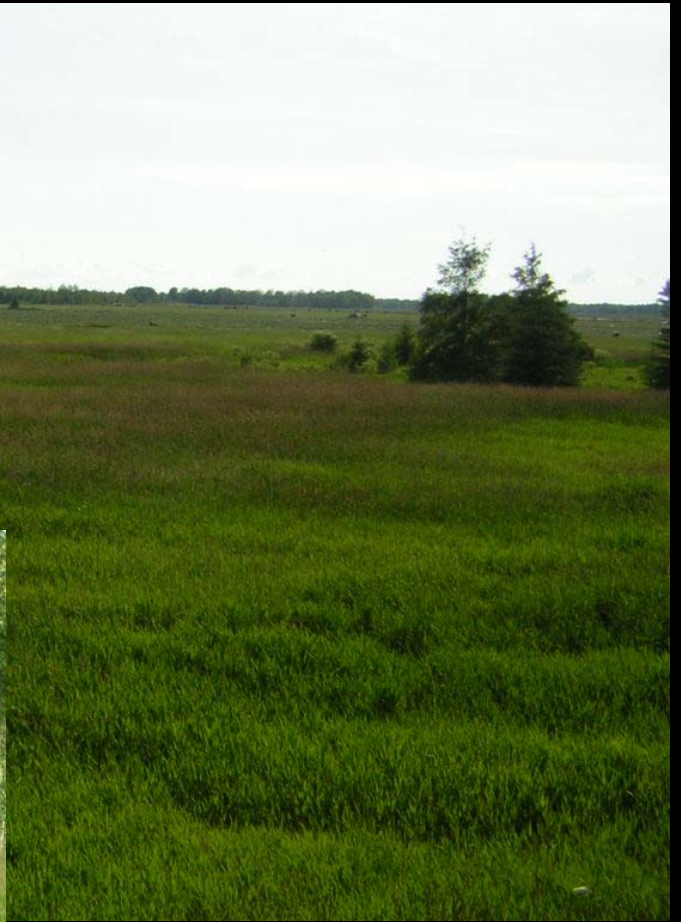
- Retrofit pellet drives?
- Pellet drives for hot water systems?

Next step

- Get together a group of people interested in investigating this at a commercial scale
- Think through how to make it workable on larger scale and the customer issues
- Do a business plan
- If it looks favorable, go into production

Business models

- A company
- Several companies
- A co-op



**RCG field,
Dafter MI**



Nov harvested RCG



**Hammer
mill**



Pellet
press



Pellets
in use