

LEGISLATIVE REFERENCE LIBRARY  
TP324 .S82 1985  
- Status of fiber fuel use in Minnes  
3 0307 00063 4413

851035

# Status of Fiber Fuel Use in Minnesota With Emphasis on Automated Systems

APRIL 1985

TP  
324  
.S82  
1985



**Department of Natural Resources  
Division of Forestry  
and the  
Fiber Fuels Institute**

This document is made available electronically by the Minnesota Legislative Reference Library as part of an ongoing digital archiving project. <http://www.leg.state.mn.us/lrl/lrl.asp>  
(Funding for document digitization was provided, in part, by a grant from the Minnesota Historical & Cultural Heritage Program.)

**Prepared by: Minnesota Department of Natural Resources  
Division of Forestry  
Box 44, DNR Building  
500 Lafayette Road  
St. Paul, Minnesota 55146**

# **STATUS OF FIBER FUEL USE IN MINNESOTA**

## **With emphasis on automated systems**

The fiber fuels industry in Minnesota is growing. Producers, consumers and associated service industries are all feeling the effects of this growth and occasionally the frustration of not having a ready source of industry information. This summary of the status of the fiber fuels industry in Minnesota is intended to alleviate some of the latter frustrations.

### **TABLE OF CONTENTS**

### **PAGE**

|  |                   |
|--|-------------------|
| <b>Chronology of increased fiber fuel use in Minnesota</b> | <b>1</b>          |
| <b>Fiber fuel resources in Minnesota</b>                   |                   |
| <b>Wood fuel availability</b>                              | <b>2</b>          |
| <b>Peat fuel availability</b>                              | <b>4</b>          |
| <b>Agricultural residue fuel availability</b>              | <b>5</b>          |
| <b>Current fiber fuel users in Minnesota</b>               | <b>6</b>          |
| <b>Consultants in the fiber fuels industry</b>             | <b>8</b>          |
| <b>Fiber fuel suppliers</b>                                | <b>10</b>         |
| <b>Sources of fiber fuel information</b>                   | <b>11</b>         |
| <b>Minnesota Pollution Control Agency</b>                  | <b>12</b>         |
| <b>Fuel cost comparisons</b>                               | <b>back cover</b> |



# CHRONOLOGY OF INCREASED FIBER FUEL USE IN MINNESOTA

## Prior to 1970

- A small number of wood industries burn residue for energy and waste disposal.
- Ottertail Power Company uses wood energy to produce electricity at a small plant in Bemidji.
- Annual consumption of wood for residential heating approaches 200,000 cords.

## 1970 to 1975

- The Arab oil embargo causes a dramatic increase in fossil fuel prices.
- Grand Marais School District Converts the first Minnesota school to wood energy.
- Residential fuelwood consumption increases.

## 1976 to 1980

- Wood pelletizing plants are established at Marcell and Stillwater. The Stillwater plant fails.
- Schools at Laporte, St. Joseph and McGregor convert to pelletized wood fuel.
- Residential fuelwood consumption increases to 1.3 million cords annually.
- Thirteen wood industries and three nonwood related companies convert to wood energy.
- Two "Minnesota Coal" conferences in Brainerd bring industry, government and community leaders together to examine the use of wood for energy.
- DNR initiates the Minnesota Peat Program and the Peat Inventory Project.
- The Grand Rapids Regional DNR Headquarters becomes the first state facility to convert to wood energy.

- A study by Minnesota Energy Agency and DNR shows adequate non-industrial wood resources to support substantial wood energy development.

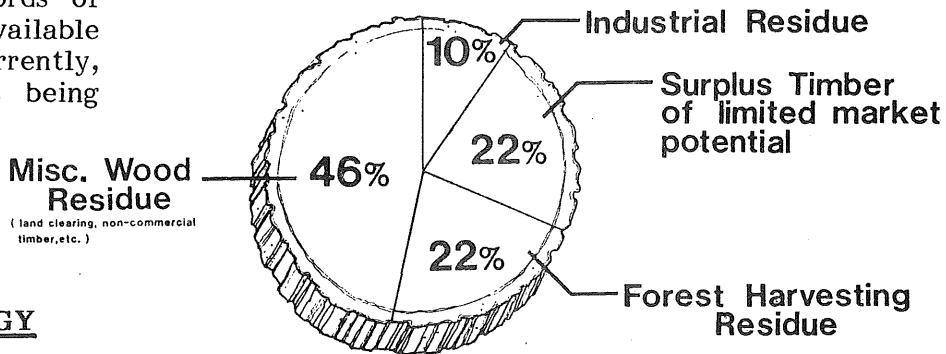
## 1981 to the Present

- Wood fuel briquetting plants are established at Pine River, Grand Rapids, Blackduck, Rice, and Virginia. Wood fuel pellets are produced in Gilbert, Crosby and Marcell. Densified wood fuel production capacity exceeds market demand.
- Northwest Economic Development Corporation installs residential pellet furnaces as part of a fuel assistance program.
- Blandin Paper Company builds a large scale wood residue fired co-generation plant at Grand Rapids.
- Aitkin Ironworks installs a wood fired central heating system to provide heat for their plant and five public buildings in Aitkin.
- DNR installs wood burning systems at four sites.
- The Western Lake Superior Sanitary District began using wood chips to incinerate sludge at Duluth.
- The Fiber Fuels Institute is formed to promote the Minnesota bio-fuels industry.
- Legislation is passed to permit third party financing of state facility heating system fiber fuel conversions.
- Peat is harvested by private firms for DNR combustion testing. Peat fuel combustion testing is done at Virginia Public Utilities, U.S. Bureau of Mines, and U of M Duluth.
- Almost 200 commercial and industrial scale facilities are using fiber fuel energy (70 schools, 30 public institutions, 35 wood industries, over 50 private organizations).

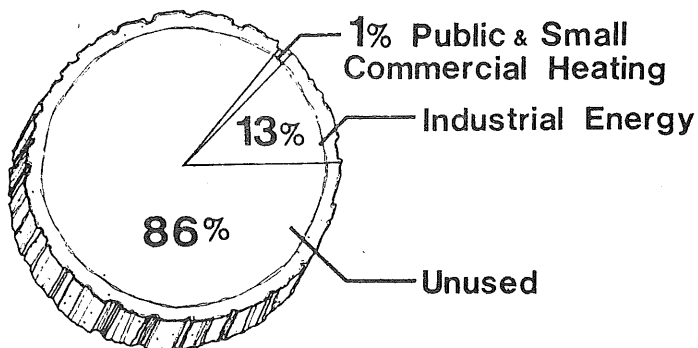
# WOOD FUEL AVAILABILITY

An equivalent of 4 million cords of Minnesota wood residue is available annually for energy use. Currently, only 14% of this resource is being used.

## SOURCES OF WOOD FOR ENERGY



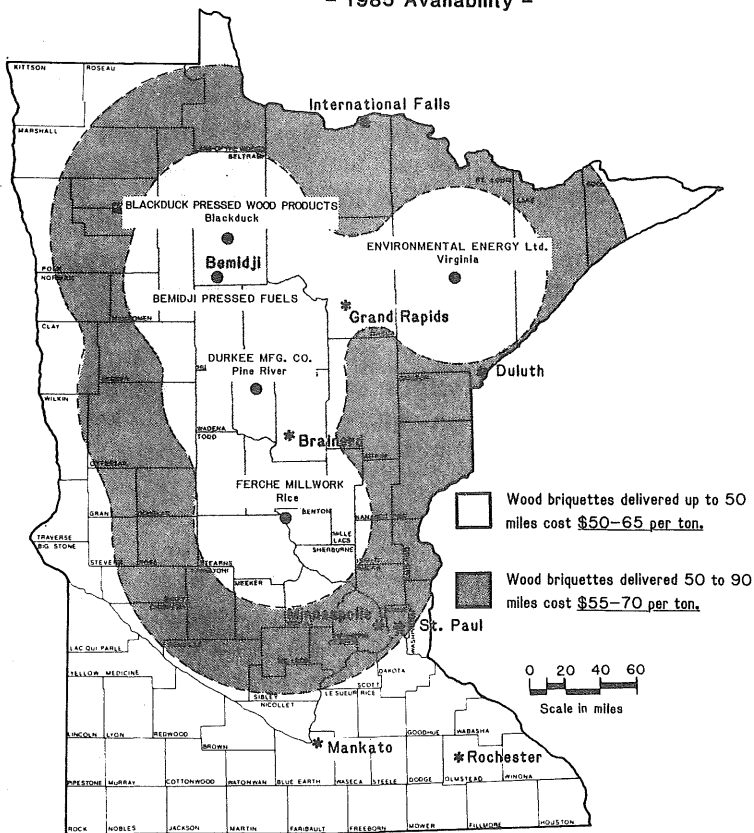
## USES OF WOOD FOR ENERGY



Commercial wood fuel is available in the form of densified wood briquettes, densified wood pellets, chips and mill residue.

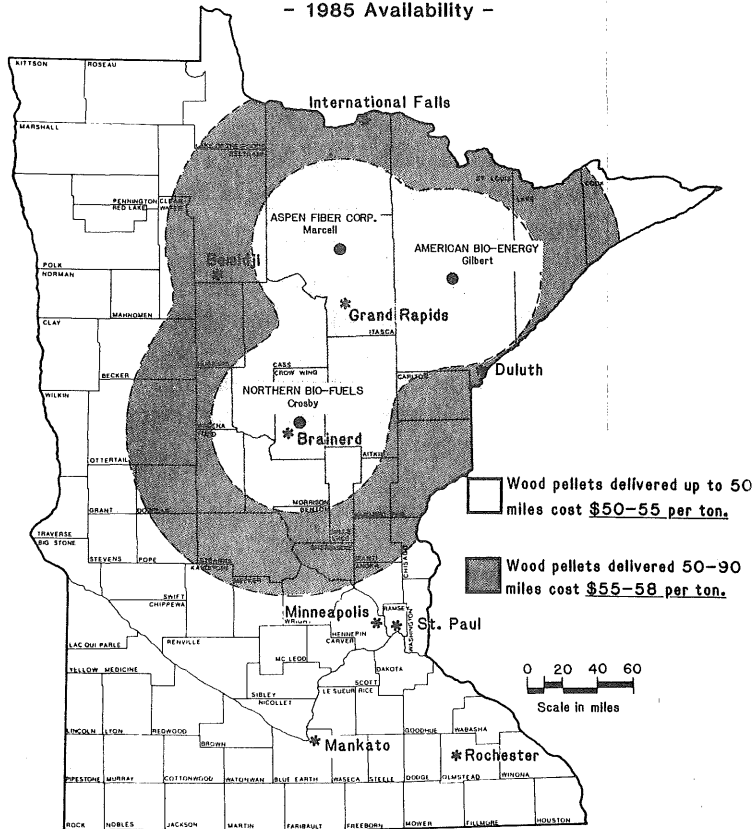
### DENSIFIED WOOD BRIQUETTES

- 1985 Availability -



### DENSIFIED WOOD PELLETS

- 1985 Availability -

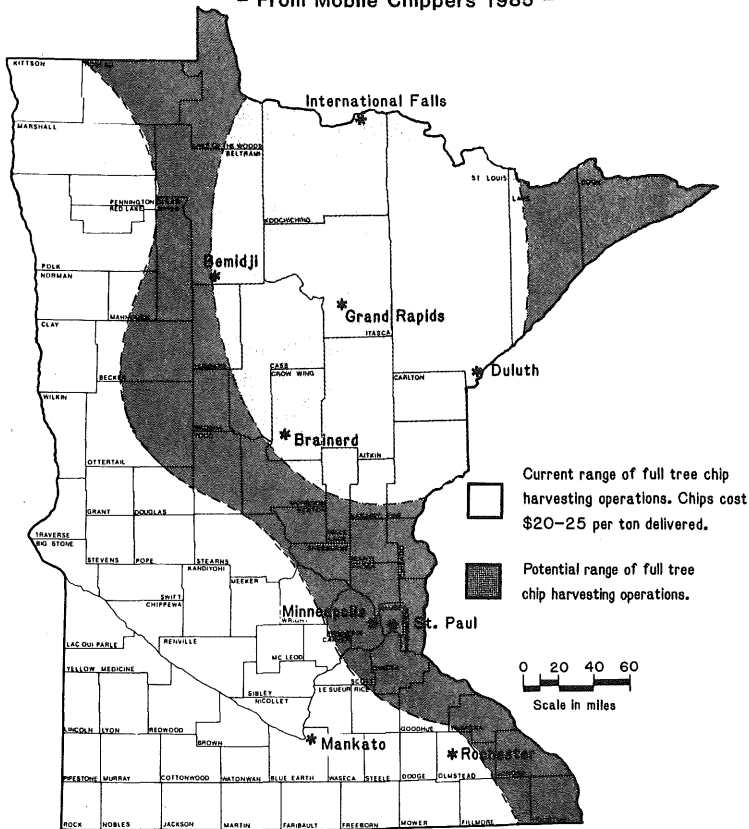


Source: Minnesota Department of Natural Resources, Division of Forestry, 1985.

Source: Minnesota Department of Natural Resources, Division of Forestry, 1985.

**GREEN WOOD FUEL CHIPS**

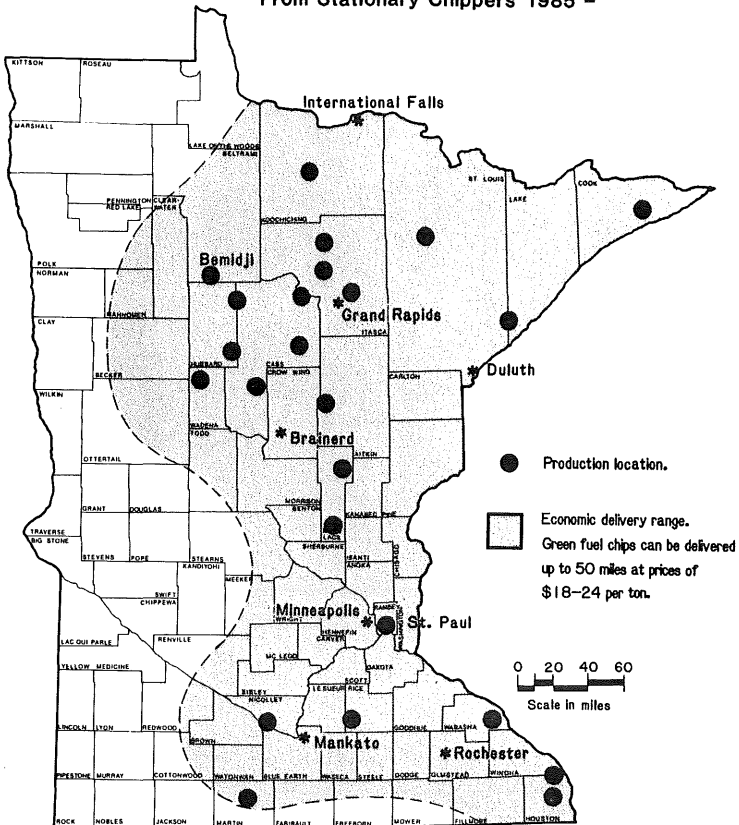
- From Mobile Chippers 1985 -



Sources Minnesota Department of Natural Resources, Division of Forestry, 1985.

**GREEN WOOD FUEL CHIPS**

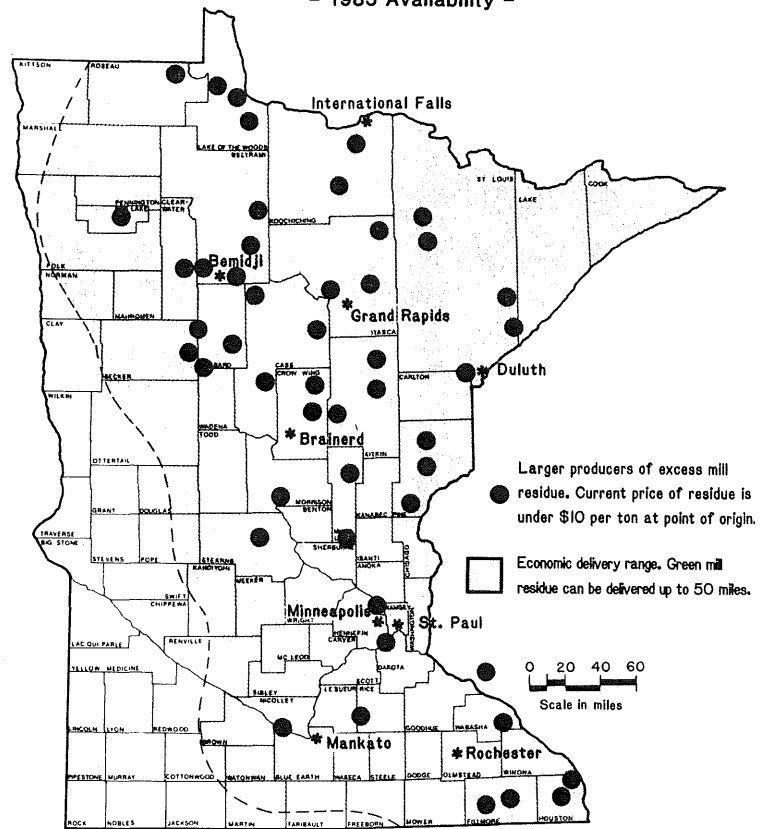
- From Stationary Chippers 1985 -



Sources Minnesota Department of Natural Resources, Division of Forestry, 1985.

**SAWDUST and BARK**

- 1985 Availability -



Sources Minnesota Department of Natural Resources, Division of Forestry, 1985.

For more information on the availability of wood for energy, contact:

Minnesota Department of Natural Resources  
Division of Forestry  
500 Lafayette Road, Box 44, DNR Bldg.  
St. Paul, Minnesota 55146  
Phone: (612/296-6491)

# PEAT FUEL AVAILABILITY

Minnesota contains between 6 and 7 million acres of peatland. Deposits are found throughout the state, except in the extreme southwest and southeast. Large, contiguous peatlands occur in the northern half of the state, while smaller, scattered peatlands occur in the southern half.

Approximately 50 percent of the state's peat resource is publicly owned, with most of the public ownership concentrated in the northern part of the state. It is estimated that approximately 10 percent of Minnesota's peatlands have energy potential. About 90 percent of these peatlands would be suited for milled peat harvesting, 10 percent would be suited for sod peat.

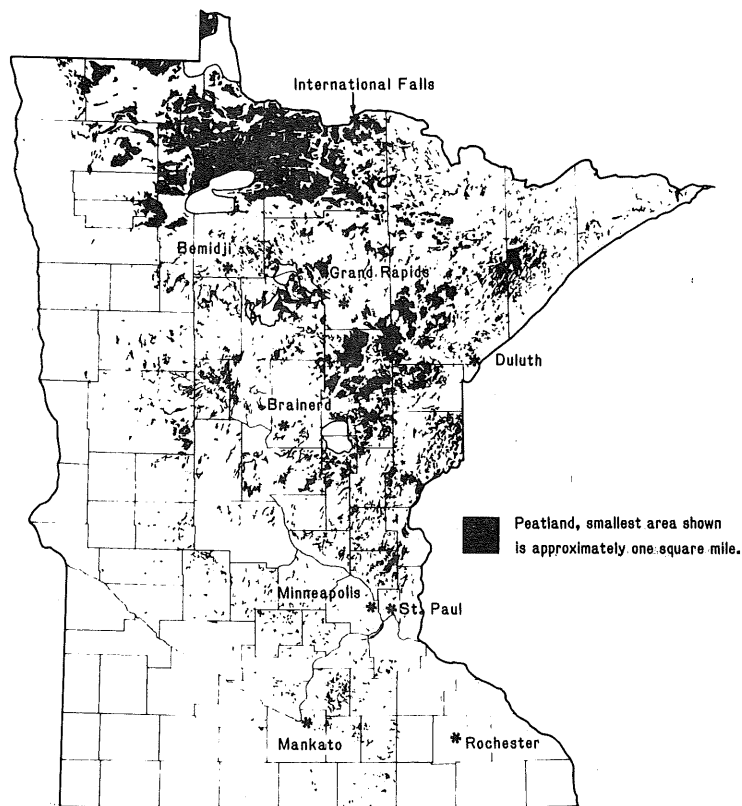
## Some Milestones in Minnesota Peat Energy Development

- 1984. A private firm mined 9,500 tons of fuel peat for use in DNR testing program.
  - Tests using peat pellets and sod peat have led the Virginia Public Utilities Commission to contract for up to 6,000 tons of sod peat during 1985, the first large contract for fuel peat in Minnesota.
  - Tests at U of M, Duluth have shown that peat in either pellet or sod form can be used as feedstock in a gasifier.
  - The largest test of fuel peat ever conducted in North America (25,000 tons of peat) will commence at the Minnesota Power and Light Laskin Station in 1985.
  - Blandin Paper Company is currently testing 1,500 tons of peat fuel in their co-generation plant.
  - Boise Cascade has become interested in peat fuel for their International Falls paper mill.
- The Hibbing Public Utility conducted a test burn of 1,000 tons of peat fuel in March - April 1985.
  - Cambridge State Hospital has successfully tested pelletized peat fuel.

## For Further Information Contact:

Minnesota Dept. of Natural Resources  
Division of Minerals  
Box 45, DNR Building  
500 Lafayette Road  
St. Paul, Minnesota 55146  
(Telephone: 612-296-4807)

## MINNESOTA PEAT RESOURCES



Source: Minnesota Department of Natural Resources, Peat Project, 1975.



# AGRICULTURAL RESIDUE FUEL AVAILABILITY

Agricultural residue is the fiber remaining after the harvest of crops. Fiber left from the harvest of such crops as sunflowers and flax is currently processed into densified fuel pellets on a small scale by a few Minnesota and North Dakota feed millers.

Highlights of talk given by E.C. Miller, Northwest Experiment Station, University of Minnesota, to the June 1983 National Fiber Fuels conference at Crookston, Minnesota.

- Agricultural fiber resources for processed fuel are readily available today.
- The 250,000 acres of sunflowers planted annually in the Red River Valley produce 125,000 tons of reasonably easy to collect field residue in addition to sunflower seed hulls.
- Minnesota produces 10.2 million dry tons of crop residue per year. A million dry tons would fuel 2,000 small high schools or 216 average hospitals.
- Herbage as a crop grown for energy could have a potential to add an additional 12.7 million dry tons annually to Minnesota's fiber fuel resource.
- Harvesting equipment is well known and available. There are 40,000 balers in Minnesota.
- Roadside grasses produce about 2 tons per acre. The roadside between Crookston and Grand Forks (20 miles) could fuel 200 homes.

Optimum use of crop residues will require careful consideration of the alternate uses—soil and environment protection, feed for livestock, or energy and industrial purposes. We think that the need to maintain soil productivity should be the first consideration. If residues are needed for erosion control or maintenance of

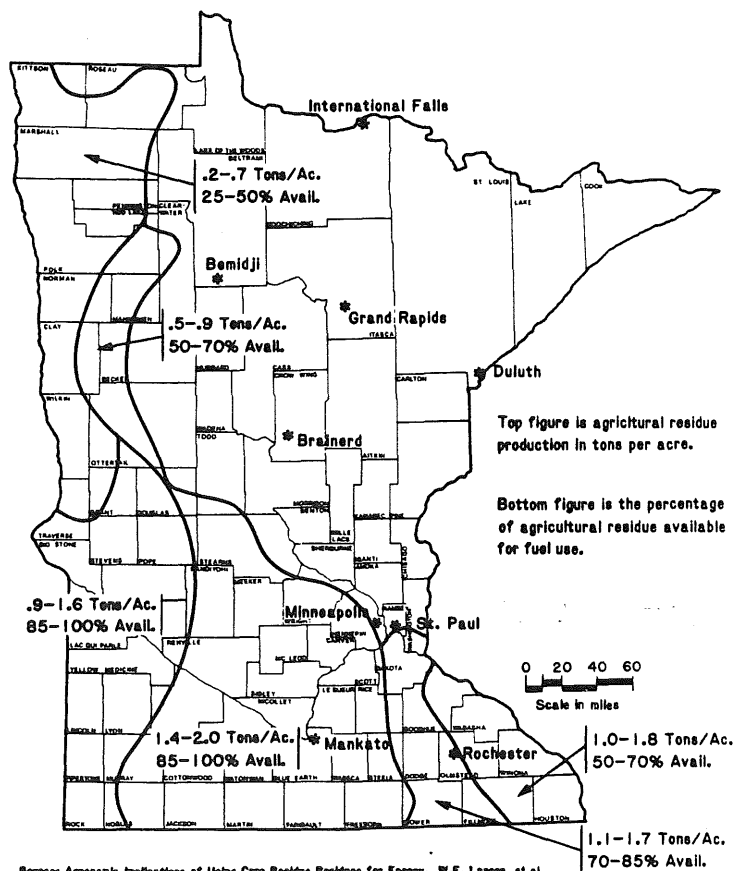
soil structure, and economically feasible alternatives are not available, then residues should remain on the land. However, if the soil's needs can be met with partial or total removal of crop residues, then there should be no objection to their removal. We caution, however, that any removal of residue from the field should be done only with a full understanding of the possible consequences.

Source: Crop Residue Removal and Tillage. M.J. Lindstrom, et al.

For Further Information Contact:

Minnesota Dept. of Energy and Economic Development  
900 American Center  
150 East Kellogg Boulevard  
St. Paul, Minnesota 55101  
(Telephone: 612-297-1291)

## CROP RESIDUE PRODUCTION AND AVAILABILITY



# CURRENT FIBER FUEL USERS IN MINNESOTA

## SCHOOLS / UNIVERSITIES

### Using Densified Wood Fuels (pellets & briquettes)

1. Laporte
2. St. Josephs School & Church, Red Lake Falls
3. McGregor
4. Clearbrook
5. Walker
6. Floodwood
7. McIntosh
8. Northome
9. Cohasset
10. Swanville
11. Bigfork
12. Gonvick
13. Greenbush
14. Badger
15. Clarissa
16. Red Lake Falls High
17. Littlefork
18. Goodridge
19. Park Rapids High School
20. St. Scholastica
21. Pine River High School
22. Pine River Elementary
23. Backus
24. Menahga
25. Blackduck
26. Grand Rapids Sr. High\*
27. Silver Bay High School
28. Grand Rapids Middle School
29. Bovey Middle School
30. Coleraine High School
31. Keewatin/Middle Elementary
32. Gilbert
33. Biwabik
34. Aurora
35. Cass Lake Elementary
36. Cass Lake High School
37. Duluth Central
38. Pequot Lakes
39. Crookston High School
40. Barnesville
41. Onamia
42. Mt. Iron
43. Dilworth
44. Argyle High School\*
45. Battle Lake\*
46. Park Rapids Middle School
47. Rothsay
48. Waubun
49. Crookston High School  
Crookston Elementary\* (2 bldg)
50. Eden Valley\*
51. Parkers Prairie\*
52. Roseau\*
53. Murphy Elem., Grand Rapids\*
54. Forest Lake Elem. Grand Rapids\*

### Using Green or Dry Wood Fuels

55. Grand Marais
56. Bemidji Middle School
57. Hill City
58. Barnum
59. Aitkin High School<sup>1</sup>
60. Bemidji High School\*
61. Two Harbors High School
62. Two Harbors Elem. (2 bldgs)
63. Ely\*
64. Buhl (gasification)
65. Babbitt\*
66. Chisholm
67. Staples AVTI
68. Moose Lake\*
69. Staples High School\*
70. Carlton\*
71. Bemidji State University\*
72. St. Cloud State University\*

### Under Consideration - Fuel Type Undetermined

73. Sandstone
74. Motley

## GOVERNMENT / PUBLIC ORGANIZATIONS

### Using Densified Wood Fuels (pellets & briquettes)

1. Virginia Public Ut., Virginia
2. St. Louis Co. Garage, Virginia
3. Itasca Co. Garage, Bigfork
4. DNR: General Andrews Nursery, Willow River
5. DNR: Scenic State Park Shop, Bigfork
6. Northwest Experiment Sta., Barn, Crookston
7. DNR: French River Hatchery, Duluth
8. Community Center, Floodwood
9. Chisholm/Hibbing Airport\*
10. Itasca Memorial Hospital, Grand Rapids
11. DOT District Office, Bemidji
12. DNR Regional garage/shop, Grand Rapids
13. DNR: Tower Soudan State Park (two units)
14. Giant's Ridge Ski Complex

### Using Green Wood Fuels

15. DNR: Regional Hdqts., Grand Rapids
16. Grand Marais Hospital
17. Aitkin Co. Courthouse
18. Aitkin Public Utilities
19. Aitkin City Hall<sup>1</sup>
20. Grand Marais Recreation Complex
21. Grand Marais School Bus Garage
22. Western Lake Superior Sanitary District, Duluth
23. Aitkin Co. Jail<sup>1</sup>
24. Riverview Hospital, Crookston\*
25. St. Gabriels Hospital & St. Francis Campus, Little Falls
26. Shakopee Correctional Facility\*

### Under Consideration - Fuel Type Undetermined

27. Camp Ripley Military Reservation
28. Brainerd State Hospital (gasifier)
29. Ah Gwah Ching Nursing Home

## FOREST PRODUCTS INDUSTRY

### Using Green or Dry Wood Fuels

1. Potlatch Corp, Cloquet
2. Potlatch, Inc., Bemidji
3. Potlatch, Inc., Cook
4. Blandin Paper Co., Grand Rapids
5. Blandin Wood Products, Grand Rapids
6. Boise Cascade Corp., Int'l Falls
7. Diamond Match Co., Cloquet
8. Superwood Corp., Duluth
9. Superwood Corp., Bemidji
10. St. Regis Paper Co., Sartell
11. Northwood Panelboard, Bemidji
12. Woodcraft Ind., St. Cloud
13. Foreston Dimension Co., Foreston
14. Lake Elmo Hdws., Lake Elmo
15. Anderson Windows, Bayport
16. Marvin Windows, Warroad
17. H.C. Hill & Sons, Cook
18. Woodland Container, Staples
19. Hedstrom Sawmill, Grand Marais
20. Thompson Hdw. Lbr., Mpls.
21. Foldcraft Co., Kenyon
22. Tuohy Forest Products Corp., Chatfield
23. Bagley Kiln & Component Parts, Bagley
24. Anoka Sawdust & Shavings, Anoka
25. Rajala Sawmill, Bigfork
26. Rajala Timber Co., Deer River
27. Corcoran Timber Co., Bemidji
28. Remer Timber Co., Remer
29. Ferche Millwork, Inc., Rice
30. Woodland Container, Aitkin
31. Aspen Fiber Corp., Marcell
32. Blackduck Pressurized Wood, Blackduck
33. Tri-State Forest Products, Hokah
34. Durkee Manufacturing, Pine River
35. Brainerd Hardwoods, Brainerd
36. Warrenwood Inc., Rice

## PRIVATE BUSINESSES / ORGANIZATIONS

### Using Densified Wood Fuels (pellets & briquettes)

1. Coca Cola Bottling Co., Crookston
2. Associated Plumbing, Crookston
3. Red Pine Alfalfa, Crookston
4. Eichhof Building, Crookston
5. LePier Tire, Crookston
6. Glenmore Foundation, Crookston
7. D&J Machine Shop, Brainerd
8. Anderson Construction Co., Brainerd
9. Anaco Mfg. Co., Ironton
10. Spaulding Hotel, Crosby
11. Crosby Theater, Crosby
12. Crosby Car Wash & Laundromat, Crosby
13. Osterberg Furniture Store, Mora
14. Dan & Jerry's Green House, Buffalo
15. Gessell Feed Mill, Swanville
16. Rivard Quality Seeds, Argyle
17. Gustafson Apts., Warren
18. Mjolnessen Shop, Felton
19. Thompson's Green House, St. Joseph
20. Village Laundromat, Aitkin
21. Pine River Group Home, Pine River
22. GT Auto Parts, Floodwood
23. Baptist Church, Floodwood
24. Lutheran Church, Floodwood
25. Floodwood Hardware, Floodwood
26. Northern Mfg. & Engineering, Staples
27. Roy Apts., Grand Rapids
- 28-32. Turkey raising operations, Swanville area
33. Camp Shamneau, Motley
34. Jesus is King Church, Thief River Falls
35. Herbies Market, Red Lake Falls
36. Berger Apts. & Store, Erskine
37. Garth Meschke Turkey Farm, Little Falls

### Using Green Wood Fuels:

38. Poly Foam Inc., Lester Prairie
39. Len Busch Greenhouse, Hamel
40. Park Rapids Greenhouse, Park Rapids
41. Earl Holasek Greenhouse, Chanhausen
42. Advance Machine, Bloomington
43. Aitkin Ironworks, Aitkin
44. St. James Catholic Church, Aitkin<sup>1</sup>
45. Midway Service Station & Laundromat, Grand Marais
46. North Shore Dairy & Laundromat, Grand Marais
47. North Shore Bldg., Grand Marais
48. Bearskin Lodge, Grand Marais
49. Gehling Implement, Preston
50. The Crest Motel & Supper Club, Caledonia
51. Humble Stove Co., Rushford
52. Tomteboda Motel, Grand Marais
53. Chef Reddy Foods, Park Rapids\*

### TOTAL FIBER FUEL USERS: (Operational, Planning, Approved or Under Construction)

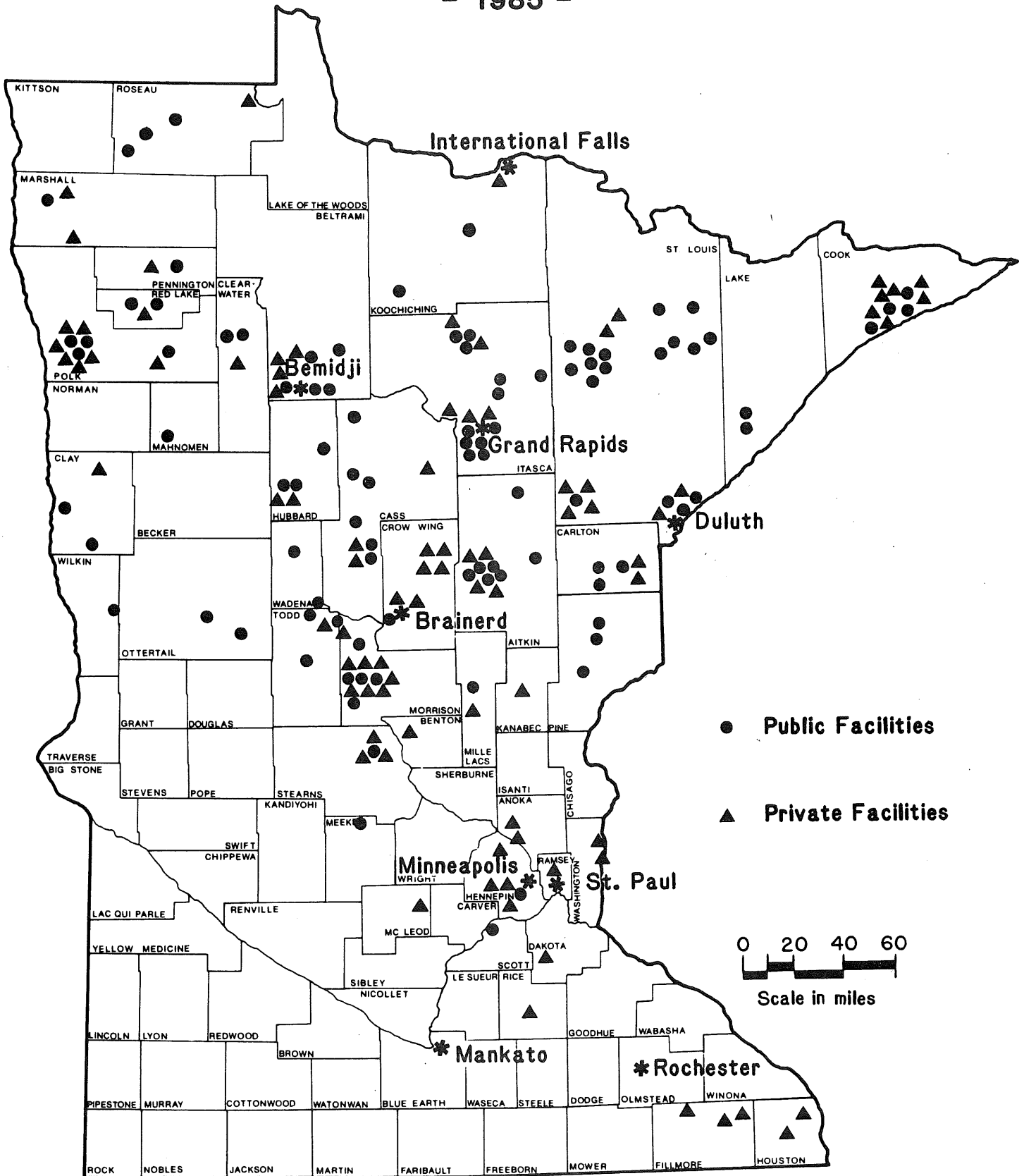
|  |    |
|--|----|
| Schools/Universities . . . . .             | 74 |
| Government/Public Organizations . . . . .  | 29 |
| Forest Products Industry . . . . .         | 36 |
| Private Businesses/Organizations . . . . . | 53 |

TOTAL 192

\* Approved or Under Construction.  
<sup>1</sup> Purchase steam from Aitkin Iron Works.

# FACILITIES USING FIBER FUELS FOR ENERGY

- 1985 -



Source: Minnesota Department of Natural Resources, Division of Forestry, 1985.

# CONSULTANTS IN THE FIBER FUELS INDUSTRY

Consultants are listed by company name and services offered. See the following page for complete company addresses and telephone numbers.

|                                      | SERVICES           |        |                     |                 |              | SYSTEM TYPES |          |                |              | SIZE        |            |               |                    |            |
|--------------------------------------|--------------------|--------|---------------------|-----------------|--------------|--------------|----------|----------------|--------------|-------------|------------|---------------|--------------------|------------|
|                                      | Equipment Supplier | Design | Project Feasibility | System Analysis | Installation | Green Fuel   | Dry Fuel | Densified Fuel | Gasification | Residential | Commercial | Institutional | Co-Generation Etc. | Industrial |
| (1) Anchor Gas Co.                   | ●                  |        |                     |                 | ●            |              |          |                | ●            |             | ●          | ●             |                    | ●          |
| (2) Aqua - Chem, Inc.                | ●                  | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (3) Architectural Resources, Inc.    |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             |                    | ●          |
| (4) Aspen Fiber Corp.                |                    |        | ●                   | ●               |              | ●            | ●        | ●              |              | ●           | ●          | ●             |                    | ●          |
| (5) Blesi - Evans Co.                | ●                  | ●      |                     | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (6) California Pellet Mill Co.       | ●                  | ●      | ●                   | ●               |              |              |          | ●              |              |             | ●          | ●             |                    | ●          |
| (7) Edeskuty & Associates            |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (8) Energy Consult Corp.             |                    |        | ●                   | ●               |              | ●            | ●        | ●              | ●            | ●           | ●          | ●             | ●                  | ●          |
| (9) Energy Control Engineering       |                    | ●      | ●                   | ●               | ●            |              | ●        | ●              |              |             | ●          | ●             |                    | ●          |
| (10) Energy Resource Systems         | ●                  | ●      | ●                   | ●               | ●            | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (11) Eumurian & Associates           |                    | ●      | ●                   | ●               |              |              |          |                | ●            |             | ●          | ●             |                    | ●          |
| (12) Floyd M. Hovarter & Assoc.      |                    |        | ●                   |                 |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (13) Fluidyne Engineering Corp.      | ●                  | ●      | ●                   | ●               | ●            |              | ●        | ●              |              |             | ●          | ●             | ●                  | ●          |
| (14) Forest Fuels, Inc.              | ●                  | ●      | ●                   | ●               | ●            | ●            | ●        | ●              |              | ●           | ●          | ●             |                    | ●          |
| (15) GRO Engineering & Sales, Inc.   |                    | ●      | ●                   | ●               |              |              | ●        | ●              |              |             | ●          | ●             |                    | ●          |
| (16) HDR Techserv                    |                    | ●      | ●                   | ●               | ●            | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (17) Horty - Elving & Assoc.         |                    | ●      | ●                   | ●               |              | ●            |          |                |              |             | ●          | ●             | ●                  | ●          |
| (18) i.e. Associates                 |                    | ●      |                     | ●               |              | ●            | ●        | ●              |              |             | ●          | ●             |                    | ●          |
| (19) LWSM Consulting Engineers       | ●                  |        | ●                   |                 |              |              |          | ●              |              | ●           | ●          | ●             |                    | ●          |
| (20) Mechanical Consulting Engineers |                    | ●      |                     | ●               |              | ●            | ●        | ●              |              |             | ●          | ●             | ●                  | ●          |
| (21) M.E.S. Corp.                    |                    | ●      | ●                   | ●               | ●            | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (22) Michland, Cooley & Erickson     |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (23) N.T.H., Inc.                    | ●                  | ●      | ●                   | ●               | ●            | ●            | ●        |                |              |             | ●          | ●             |                    | ●          |
| (24) Paul Stegmeier                  |                    |        | ●                   | ●               |              | ●            | ●        | ●              |              | ●           | ●          | ●             |                    | ●          |
| (25) Peat Energy Systems             | ●                  | ●      | ●                   | ●               | ●            | ●            | ●        | ●              | ●            | ●           | ●          | ●             |                    | ●          |
| (26) Posko Associates, Inc.          |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            | ●           | ●          | ●             | ●                  | ●          |
| (27) Richwood Company                | ●                  | ●      | ●                   | ●               |              | ●            | ●        | ●              |              | ●           | ●          | ●             |                    | ●          |
| (28) Robert O. Brown Co.             |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (29) R.W. Gorman Assoc., Inc.        | ●                  | ●      |                     |                 |              | ●            | ●        |                |              |             | ●          | ●             |                    | ●          |
| (30) Sam Stewart & Assoc.            |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              |              |             | ●          | ●             | ●                  | ●          |
| (31) Spaulding Engineering Ltd.      |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              | ●            |             | ●          | ●             | ●                  | ●          |
| (32) TKDA                            |                    | ●      | ●                   | ●               |              | ●            | ●        | ●              |              |             | ●          | ●             | ●                  | ●          |
| (33) TSP One, Inc.                   |                    | ●      | ●                   | ●               | ●            | ●            | ●        | ●              |              |             | ●          | ●             | ●                  | ●          |

# CONSULTANTS IN THE FIBER FUELS INDUSTRY

- |   |  |   |
|---|--|---|
| <p><b>(1)</b> Anchor Gas Company<br/>Anchor Energy Division<br/>Marshall Johnson/Addison Kilibarda<br/>Virginia, Mn. 55792<br/>(1-800/662-3586)</p>                         | <p><b>(13)</b> Fluidyne Engineering Corp.<br/>David DeCoursin<br/>5900 Olson Hwy<br/>Mpls, Mn. 55422<br/>(612/544-2721)</p>                                      | <p><b>(24)</b> Paul Stegmeier<br/>2334 Buford Ave.<br/>St. Paul, Mn. 55108<br/>(612/644-3848)</p>   |
| <p><b>(2)</b> Aqua - Chem, Inc.<br/>Energy Systems Division<br/>Donald Love/Richard Wright<br/>Box 421<br/>Milwaukee, Wis. 53201<br/>(414/961-2894)</p>                     | <p><b>(14)</b> Forest Fuels, Inc.<br/>Bob Despot/Wayne Cummings<br/>1020 Washington St.<br/>Brainerd, Mn. 56401<br/>(218/828-0904)</p>                           | <p><b>(25)</b> Peat Energy Systems<br/>Bruce Schmidt<br/>P.O. Box 69<br/>Rosemount, Mn. 55068<br/>(612/423-5181)</p>  |
| <p><b>(3)</b> Architectural Resources, Inc.<br/>Parnell Satre, P.E.<br/>704 East Howard St.<br/>Hibbing, Mn. 55746<br/>(218/263-6868)<br/>Duluth Office: (218/727-8481)</p> | <p><b>(15)</b> GRO Engineering &amp; Sales Inc.<br/>G. Raymond Olson<br/>11420 West Park Ridge Dr.<br/>Minnetonka, Mn. 55343<br/>(612/545-6492)</p>              | <p><b>(26)</b> Posko Associates, Inc.<br/>Tom Posko<br/>20720 W. Watertown Rd.<br/>Waukesha, Wis. 53186<br/>(414/786-7200)</p>  |
| <p><b>(4)</b> Aspen Fiber Corp.<br/>John Fisher<br/>1112 East 1st St.<br/>Duluth, Mn. 55805<br/>(218/728-2582)</p>  | <p><b>(16)</b> HDR Techserv<br/>Don Krebs/Jim Booty<br/>300 Parkdale 1<br/>5401 Gamble Dr.<br/>Mpls, Mn. 55416<br/>(612/544-7741)</p>                            | <p><b>(27)</b> Richwood Company<br/>Bob Jacenko<br/>P.O. Box 723<br/>Detroit Lakes, Mn. 56501<br/>(218/847-1668)<br/>Mpls Office: (612/721-5068)</p>                              |
| <p><b>(5)</b> Blesi - Evans Company<br/>Mark Evans<br/>2533 24th Ave. So.<br/>Mpls, Mn. 55406<br/>(612/721-6237)</p>  | <p><b>(17)</b> Horty - Elving &amp; Assoc.<br/>Jim Elving<br/>505 East Grant St.<br/>Mpls, Mn. 55404<br/>(612/332-4422)</p>                                      | <p><b>(28)</b> Robert O. Brown Company<br/>Robert Brown<br/>6885 Washington Ave. So.<br/>Edina, Mn. 55435<br/>(612/941-8843)</p>  |
| <p><b>(6)</b> California Pellet Mill Co.<br/>Bob Massengill<br/>2524 118th Lane NW<br/>Coon Rapids, Mn. 55433<br/>(612/332-1400)</p>  | <p><b>(18)</b> i.e. Associates<br/>Tom Abeles<br/>3702 E. Lake St.<br/>Mpls, Mn. 55406<br/>(612/721-5066)</p>  | <p><b>(29)</b> R.W. Gorman Assoc., Inc.<br/>Richard W. Gorman<br/>200 So. Washington Ave.<br/>Washburn, Wis. 54891<br/>(715/373-2632)</p>   |
| <p><b>(7)</b> Edeskuty &amp; Associates<br/>Joseph V. Edeskuty/<br/>Robert VonEdeskuty<br/>730 2nd Ave. So.<br/>Mpls, Mn. 55402<br/>(612/333-6675)</p>                      | <p><b>(19)</b> LWSM Consulting Engineers<br/>Leonard Lundquist/Kenneth Schultz<br/>821 Raymond Ave.<br/>Suite 300<br/>St. Paul, Mn. 55114<br/>(612/642-9771)</p> | <p><b>(30)</b> Sam Stewart &amp; Associates<br/>Sam Stewart<br/>1171 W. Co. Road B<br/>Suite S207<br/>Roseville, Mn. 55113<br/>(612/636-9811)</p>                                 |
| <p><b>(8)</b> Energy Consult Corp.<br/>Mark Mason / Jim Fisher<br/>310 Cedar St.<br/>St. Paul, Mn. 55101<br/>(612/224-1700)</p>   | <p><b>(20)</b> Mechanical Consulting Engineers<br/>William Harrington<br/>1545 6th St.<br/>P.O. Box 11095<br/>Green Bay, Wis. 54307-1095<br/>(414/499-0451)</p>  | <p><b>(31)</b> Spaulding Engineering Ltd.<br/>Roy Spaulding<br/>1821 University Ave.<br/>St. Paul, Mn. 55104<br/>(612/644-5676)</p>   |
| <p><b>(9)</b> Energy Control Engineering<br/>William B. Webb<br/>18565 Simonet Drive<br/>Elk River, Mn. 55101<br/>(612/441-2345)</p>  | <p><b>(21)</b> M.E.S. Corp.<br/>Jack Klepp<br/>625 4th Ave. So.<br/>Mpls, Mn. 55415<br/>(612/339-8862)</p>   | <p><b>(32)</b> TKDA<br/>Jim Sebesta/Art Heuer<br/>2500 American Nat'l Bank Bldg.<br/>St. Paul, Mn. 55101<br/>(612/292-4400)</p>   |
| <p><b>(10)</b> Energy Resource Systems<br/>Walt Horton/John Erickson<br/>2025 West Co. Rd C<br/>Roseville, Mn. 55113<br/>(612/631-1681)</p>                                 | <p><b>(22)</b> Michland, Cooley &amp;<br/>Erickson (M.C.E.)<br/>Suite 1352<br/>625 4th Ave. So.<br/>Mpls, Mn. 55415<br/>(612/339-4941)</p>                       | <p><b>(33)</b> TSP One, Inc.<br/>Virginia Zeitz<br/>7301 Ohms Lane, Suite 480<br/>Mpls, Mn. 55435<br/>(612/830-0070)<br/>Duluth: (218/722-6892)<br/>Rochester: (507/288-8155)</p> |
| <p><b>(11)</b> Eumurian &amp; Associates<br/>9707 Janero Ct. No.<br/>Mahtomedi, Mn. 55115<br/>(612/426-3291)</p>  | <p><b>(23)</b> N.T.H., Inc.<br/>Clinton Nesseth/Bryce Nesseth<br/>Barron, Wis. 54812<br/>(715/537-3686 or 3861)</p>  |   |
| <p><b>(12)</b> Floyd M. Hovarter &amp; Associates<br/>P.O. Box 46<br/>Ashland, Wis. 54806<br/>(715/682-8024)</p>  |  |   |

# FIBER FUEL SUPPLIERS

## DENSIFIED FUEL PELLETS

(Wood, Peat, Agr. Residues)

Alfalfa Pelleting Lmt.  
(Sunflower)  
West Fargo, N.D. 58078  
(701)282-4421

American Bio-Energy  
(Wood & Peat)  
P.O. Box 848  
Gilbert, MN 55741  
(218)749-1818

Aspen Fiber Corporation  
(Wood)  
P.O. Box 14A  
Marcell, MN 56657  
(218)832-3600

Fenco  
(Peat)  
Rt. 1, Box 94  
Iron, MN 55751  
(218)744-3976

Forest Fuels Corp.  
(Wood)  
P.O. Box 205 B1  
Mason, WI 54856  
(715)746-2452

Froelich Feed Co.  
(Sunflower)  
P.O. Box 197  
LaMoire, N.D. 58458  
(701)883-5311

Great Lakes Peat Products  
(Peat)  
Cotton, MN  
(218)482-3487

Jask Biomass Products  
(Flax)  
Watertown, S.D. 57201  
(605)262-1965

LaCrosse Mill Co.  
Cochrane, WI 54622  
(608)248-2222

Northern Bio-Fuel  
(Wood & Peat)  
P.O. Box 1  
Crosby, MN 56441  
(218)546-5677

Northern Sun Products  
(Agr. Residues)  
Gonvick, MN 56644  
(218)487-5279

Grand Rapids Wholesalers  
(Wood)  
P.O. Box 101  
Grand Rapids, MN 55744  
(218)326-9477

Biomass Energy Supply, Inc.  
(Wood)  
Marquette, MI 49855  
(906)228-5353

Tretter Peat  
(Peat Sods)  
Rt. 1  
Pierz, MN 56364  
(612)468-6046

U.P. Bio-Energy  
Menomine, MI  
(906)863-7853

Watson Turf Nursery  
(Peat)  
Rt. 2, Box 59A  
Bethel, MN 55005  
(612)753-1132

Westway Trading Co.  
(Sunflower)  
Box 588  
Mapleton, N.D. 58059  
(701)282-5010

Whetstone Pelleting  
(Flax & Sunflower)  
Rt. 1, Box 52  
Milbank, S.D. 57252  
(605)432-5160

Wildung Alfalfa Mill  
(Agr. Residues)  
P.O. Box 405  
Owatonna, MN 55060  
(507)451-2316

Rapid River Grain & Seed Co.  
(Wood & Peat)  
Box 458  
Baudette, MN 56623  
(218)634-2041

Rivard Quality Seeds  
(Agr. Residues)  
Box 303  
Argyle, MN 56713  
(218)437-6638

Wenstrom Hardware  
(Wood)  
P.O. Box 327  
Floodwood, MN 55736  
(218)476-2343

The Peatalizer People  
(Peat)  
P.O. Box 305  
Red Lake Falls, MN 56750  
(218)253-4243

## DENSIFIED FUEL LOGS AND/OR BRIQUETTES

Bemidji Pressed Fuels  
(Wood)  
Jim Hensel  
P.O. Box 126  
Bemidji, MN 56601  
(218)335-6792

Blackduck Pressed Wood Products Inc.  
(Wood)  
Blackduck, MN 56630  
(218)835-4616

Durkee Mfg. Co., Inc.  
(Wood)  
Box 69  
Pine River, MN 56474  
(218)587-4432

Environmental Energy, Ltd.  
(Wood)  
P.O. Box 1208  
Virginia, MN 55792  
(218)749-6440

Ferche Millwork, Inc.  
(Wood)  
Box 85  
Rice, MN 56367  
(612)393-2288

Nagel Lumber Co.  
(Wood)  
Land-O-Lakes, WI 54540  
(715)547-3842

Phoenix Corp.  
(Wood)  
Shawano, WI 54166  
(715)526-3171

## GREEN FUEL SUPPLIERS

Green wood fuel is generally available from three sources:

Wood Processing Industry  
Tree Service Companies  
Full Tree Chippers

### Wood Processing Industry

There are over 700 sawmills and 1,000 secondary manufacturers statewide that can supply wood residues in the form of bark, sawdust, slabs and edgings, cut-offs, shavings, and sanderdust. Of the sawmills, about 30 have debarking and chipping machinery that produce chips which are available for fuel.

### Tree Service Companies

Most municipalities throughout the state are serviced by tree service companies. Most of these companies have facilities that produce chips which are available for fuel.

### Full Tree Chipper Operations

The following is a partial list of full tree harvesting operations which could supply green chips for fuel:

Bergstom Logging Company  
RR 9, Box 586  
International Falls, MN 56649  
(218)377-4482

McCabe Forest Products  
119 West Lewis Street  
Duluth, MN 55803  
(218)724-8070

Arthur Newgren  
RR 1  
Cromwell, MN 55726  
(218)644-3630

Roger Anwiler  
RR 2, Box 55A  
Bovey, MN 55709  
(218)245-1057

Alvin Lindquist  
Hill City, MN 55748  
(218)697-8296

Korhonen Timber Products  
221 East Park Drive  
Hibbing, MN 55746  
(218)263-7420

Katzenberger Logging  
Cook, MN 55723  
(218)666-2275

Alvin Hasbargen  
Birchdale, MN 56629  
(218)634-2174

Ratzlaff Logging & Lumber  
508 1st Street  
Princeton, MN 55371  
(612)389-3801

Larry Pelland  
Loman, MN 56654  
(218)279-3344

Richard A. DeMars  
Ray, MN 56669  
(218)875-3375

Dave Baumgarten  
Superior Forest Products  
2555 London Road  
Duluth, MN 55812  
(218)728-5159

Bill Peterson  
Mesabe Logging  
Cook, MN 55723  
(218)666-2975

Ken Hendrickson/Larry Mannausau  
Northwoods Chipping, Inc.  
International Falls, MN 56649  
(218)276-2316

Ken Ziemba  
Littlefork, MN 56653  
(218)278-6735

Stanley Bairds  
Stan's Skidder Service  
Big Falls, MN 56627  
(218)276-4441

## DENSIFIED FUEL LOGS

## AND PELLETS

Forest Fuels, Inc.  
1020 Washington St.  
Brainerd, MN 56401  
(218)828-0904

Nordhiem Sheet Metal Co.  
1st St. & Minnesota Ave.  
Bemidji, MN 56601  
(218)751-3923

# SOURCES OF FIBER FUEL INFORMATION

| SOURCE   | TYPE OF INFORMATION  |
|--|--|
| Minnesota Dept. of Energy & Economic Development<br>900 American Center<br>150 East Kellogg Boulevard<br>St. Paul, Minnesota 55101<br>(Telephone: 612-297-1291)      | Agricultural Residue Resources<br>General Information<br>Financial Resources           |
| Minnesota Dept. of Natural Resources<br>Division of Forestry<br>Box 44, DNR Building<br>500 Lafayette Road<br>St. Paul, Minnesota 55146<br>(Telephone: 612-296-6491) | Wood Resources<br>Fiber Fuel Users<br>Fiber Fuel Producers                             |
| Fiber Fuels Institute<br>310 Cedar Street<br>St. Paul, Minnesota 55101<br>(Telephone: 612-224-7366)  | Fiber Fuel Standards<br>Fiber Fuel Sources, Users,<br>Producers<br>General Information |
| U.S. Dept. of Energy<br>1617 Cole Boulevard<br>Golden, Colorado 80401<br>(Telephone: 303-231-1000)   | Information on all areas of<br>renewable energy, including<br>fiber fuels.             |
| University of Minnesota<br>202 Kaufert Lab<br>2004 Folwell Avenue<br>St. Paul, Minnesota 55108<br>(Telephone: 612-373-2393)  | General information on the<br>industrial/commercial use of<br>wood for energy.         |
| Minnesota Dept. of Natural Resources<br>Division of Minerals<br>Box 45, DNR Building<br>500 Lafayette Road<br>St. Paul, Minnesota 55146<br>(Telephone: 612-296-4807) | Peat Resources<br>Peat Combustion<br>Peat Energy Development                           |
| Iron Range Resources & Rehabilitation Board<br>Box 411<br>Eveleth, Minnesota 55734<br>(Telephone: 218-744-2993)  | Peat Harvesting<br>Financial Resources   |

# MINNESOTA POLLUTION CONTROL AGENCY

## Synopsis of State Rules That Apply to Fiber Fueled Installations and Conversions

The following is a brief synopsis of State statutes and rules that pertain to air pollution and the owners or operators of fiber fueled boilers or heating equipment.

This synopsis is not intended to represent any State statute or rule in its entirety. Please consult the appropriate reference or the Minnesota Pollution Control Agency (MPCA) for additional information.

### Permits

An owner or operator of any fiber fueled boiler or heating device that has a rated heat input of more than five (5) million BTU's per hour is required to obtain a permit from the MPCA. Such a permit is required prior to construction of new equipment or modification of existing equipment. Minn. Statute 116.081, Subd. 1, (1982); 6 MCAR § 4.4303; 6 MCAR § 4.4001.

The owner/operator of fiber fueled equipment, should be prepared to provide the following information which is routinely requested by the Agency for issuance of a permit:

1. A completed MPCA boiler data sheet for the new or modified boilers and for any remaining boilers at the site.
2. Available test data of a similar installation provided by the equipment suppliers or other sources.
3. Layout and detail drawings that are available for the boiler, the building, the wood products fueling system and the wood products storage facility.
4. A listing of the suppliers and specifications of the wood fuel.
5. The anticipated annual usage of the wood fuel.
6. Assurance from the manufacturer that the equipment will meet all applicable State and federal air emission standards.

7. Written manufacturer's operating instructions which will result in the most efficient combustion and will enable the equipment to meet emission limits. Assuming they are available, and if not, they should be created by the manufacturer at the user's request.

Permit Applications or Additional Information can be Obtained by Contacting:

George Vasilakes  
Division of Air Quality  
Minnesota Pollution Control Agency  
1935 West County Road B2  
Roseville, Minnesota 55113  
(Telephone: 612-296-7325)

### Emission Standards

The owner or operator of a fiber fueled boiler or heating device must meet two (2) criteria to be in compliance with State emission limits.

First, gases emitted to the atmosphere from the device must not exceed 20% opacity (smoke density). 6 MCAR § 4.004.

Second, particulate matter in the exhaust gases must not exceed 0.4 or 0.6 pounds of particulate matter per million BTU's of heat input, depending on the age of the device and location in the State. 6 MCAR § 4.004.

Note: Units smaller than five (5) million BTU's heat input per hour are not exempt from these standards.

### Stack Testing

The MPCA has the authority to request the owner/operator to conduct a stack test in order to demonstrate compliance with emission standards. The cost of stack testing is the responsibility of the owner/operator. 6 MCAR § 4.4304.

### Enforcement

The MPCA has the authority to seek prosecution, civil penalties, injunction, or other legal remedies for violations of emission standards or permit requirements. Minn. Statute 115.071 (1982).



# FIBER FUELS INSTITUTE

310 Cedar Street  
Suite 400  
St. Paul, Minnesota 55101

114 South Main Street  
Crookston, Minnesota 56716

Phone: 612/224-7366

Phone: 218/281-1776



## Fuel Cost Comparisons Per Million BTUs

| Fuel                   | Price    | Cost Per Million BTUs of Useable Heat |
|------------------------|----------|---------------------------------------|
| <b>Electricity</b>     | Per KWH  | Per MM BTUs                           |
|                        | \$ .035  | \$10.79                               |
| 3,415 BTUs/kwh         | .045     | 13.87                                 |
|                        | .055     | 16.96                                 |
|                        | .065     | 20.05                                 |
| Eff.=95%               | .075     | 23.11                                 |
| <b>#2 Oil</b>          | Per Gal. | Per MM BTUs                           |
| 138,000 BTUs/gal.      | \$ .90   | \$ 8.16                               |
|                        | 1.00     | 9.06                                  |
|                        | 1.10     | 9.98                                  |
|                        | 1.20     | 10.88                                 |
| Eff.=80%               | 1.30     | 11.79                                 |
| <b>Propane</b>         | Per Gal. | Per MM BTUs                           |
| 90,600 BTUs/gal.       | \$ .60   | \$ 8.49                               |
|                        | .65      | 9.20                                  |
|                        | .70      | 9.91                                  |
| Eff.=78%               | .80      | 11.32                                 |
| <b>Natural Gas</b>     | Per MCF  | Per MM BTUs                           |
| 1 million BTUs/MCF     | \$4.00   | \$ 5.00                               |
|                        | 4.50     | 5.63                                  |
|                        | 5.00     | 6.25                                  |
|                        | 5.50     | 6.88                                  |
|                        | 6.00     | 7.50                                  |
| Eff.=80%               | 6.50     | 8.13                                  |
| <b>Firewood</b>        | Per Cord | Per MM BTUs                           |
| 20 million BTUs/cord   | \$40.00  | \$ 3.64                               |
| Air Dried              | 60.00    | 5.45                                  |
|                        | 80.00    | 7.27                                  |
|                        | 100.00   | 9.09                                  |
| Eff.=55%               | 120.00   | 10.91                                 |
| <b>#5 &amp; #6 Oil</b> | Per Gal. | Per MM BTUs                           |
| 143,000 BTUs/gal.      | \$ .60   | \$ 5.25                               |
| Low Sulfur             | .65      | 5.69                                  |
|                        | .70      | 6.12                                  |
|                        | .75      | 6.56                                  |
| Eff.=80%               | .80      | 7.00                                  |

| Fuel  | Price   | Cost Per Million BTUs of Useable Heat |
|---|---------|---------------------------------------|
| <b>Wood, Peat, Agri. Fuel Pellets or Briquettes</b> | Per Ton | Per MM BTUs                           |
| 8,000 BTUs/lb. @ 8% M.C.                            | \$50.00 | \$ 4.00                               |
|   | 55.00   | 4.41                                  |
|   | 60.00   | 4.81                                  |
|   | 65.00   | 5.21                                  |
|   | 70.00   | 5.60                                  |
| Eff.=78%  | 75.00   | 6.01                                  |
| <b>Eastern Coal</b>                                 | Per Ton | Per MM BTUs                           |
| 13,250 BTUs/lb.                                     | \$70.00 | \$ 3.39                               |
|   | 75.00   | 3.63                                  |
|   | 80.00   | 3.80                                  |
|   | 85.00   | 4.11                                  |
| Eff.=78%  | 95.00   | 4.60                                  |
| <b>Western Coal</b>                                 | Per Ton | Per MM BTUs                           |
| 9,000 BTUs/lb.                                      | \$40.00 | \$ 2.96                               |
|   | 45.00   | 3.33                                  |
|   | 50.00   | 3.70                                  |
|   | 55.00   | 4.07                                  |
| Eff.=75%  | 60.00   | 4.44                                  |
| <b>Wood Chips</b>                                   | Per Ton | Per MM BTUs                           |
| 4,700 BTUs/lb. @ 45% M.C.                           | \$18.00 | \$ 2.95                               |
|   | 20.00   | 3.27                                  |
|   | 22.00   | 3.60                                  |
|   | 25.00   | 4.09                                  |
| Eff.=65%  | 30.00   | 4.90                                  |
| <b>Lignite</b>                                      | Per Ton | Per MM BTUs                           |
| 7,000 BTUs/lb.                                      | \$40.00 | \$ 3.81                               |
|   | 45.00   | 4.29                                  |
|   | 50.00   | 4.76                                  |
| Eff.=75%  | 60.00   | 5.71                                  |
| <b>Peat</b>   | Per Ton | Per MM BTUs                           |
| Sods or Milled                                      | \$20.00 | \$ 2.45                               |
| 6,000 BTUs/lb. @ 30% M.C.                           | 25.00   | 3.06                                  |
|   | 30.00   | 3.68                                  |
| Eff.=68%  | 35.00   | 4.29                                  |

\*Useable heat costs are *comparable*. The cost per million BTUs as received (gross heating value) of each fuel is divided by the firing efficiency to yield the cost per million BTUs of useable (net) heat. For example: (1) #2 oil has 7.25 gal. per million BTUs. At 90¢ per gal., the as-received cost per million is 7.25 gal. x 90¢ = \$6.53. \$6.53 ÷ 80% efficiency = \$8.16 per million BTUs of useable heat. (2) Fiber fuel briquettes or pellets have 16 million BTUs per ton as received. At \$60.00 per ton, the as-received cost per million BTUs is \$60 ÷ 16 = \$3.75. \$3.75 ÷ 78% efficiency = \$4.81 per million BTUs of useable (net) heat.

