“Making conservation pay through better construction technologies.”
ABC: THE OTHER GUYS

“We’re the Associated Builders and Contractors (ABC), an organization of more than 200 Merit Shop contractors in Minnesota and over 17,000 Merit Shop contractors across the country.

“When we win a construction contract, we win it on merit... on the basis of qualifications, capacity to perform, and, of course, price. ABC contractors make it their business to work efficiently and complete their jobs on time. Without overmanpowering and without any loss of quality control.

“We’ve grown tremendously in the past 10 years. The reason is simple: we are productive, efficient, and cost conscious. We will continue to seek ways to improve productivity and to keep your construction costs down. And that’s a promise.

“ABC has developed a “construction buyer’s service center” to assist in locating contractors for your next project. ABC will provide you with profiles of contractors in any area of the country with information on volume, bonding ability, man power availability, performance history, and more. This service is available to you at no charge.”

Donald T. Winkelmann
President & Chairman
Winka, MN

Please contact the Minacon ABC division, ABC business development department, 779 10th St., A. W. Washington, D.C., 20036. We’ll be pleased to discuss your project. And that’s a promise.

SEE US AT BOOTH 137 AT THE MINEA CONVENTION

Associated Builders and Contractors, Inc.

8300 Walker, Minneapolis, MN 55418 (612) 920-6220
1973 Winkelman Farm turbine
The Eco-Dome Conservation Campus is located near South Long Lake, SE of Brainerd, MN (5 miles East on Hwy 18 then 5 miles South on CR 23).

Open for Tours M – F, 9am to 5pm.

Awards

- Minnesota Office of Environmental Assistance
- Minnesota Governors Green Building Award
- Minnesota Waste Wise
MISSION

Our mission is to design and build long-lasting, efficient buildings and distributed energy generation systems that conserve nature and reduce pollution. As a result, we design and construct projects that build a more environmentally sustainable economy.

Our motto is “Conservation Pays!®”
UFO – Fueled Company Vehicles

We practice what we preach in our own operations. Most of our vehicles, equipment and machines run on diesel fuels, which are less polluting than gasoline. In addition, we have added technologies to allow our vehicles to run on bio-fuels such as vegetable oils and Used Fryer Oil (UFO Fuel™) from restaurants.
Small Wind 101: An Overview of Small-Scale Wind Electric Systems (less than 100 kw)

Distributed, Clean, Affordable Energy for Homes, Farms & Businesses

Difference is like buying a Train versus a Truck

(www.ecowerc.com)
Small Wind Turbines are less than 100kw and most qualify for Net Metering

Our 3000 watt Whisper was installed in 1997 and is producing enough power for a small home (300 KWH/Month)
Big Wind Turbines (over 100kw) are in a different business class. Net Metering rules allow only up to 40kw per site in MN. All states vary, 0 to 5mw.
Definitions and Terms

Kilowatt = 1 lb of Coal
• Kilowatt Hour: KWH
• KWH / Month / Year

Tax Credit = $ Reduction

Tax Deduction = Based on Bracket

Green Credit = Carbon Grant = Free Money

• Distributed Wind = Plug into existing power lines at site.
• Finders Fees = One percent paid to you for referrals on sales
• Interconnection = Hook up to power company.
Distributed Wind Power Benefits

- Energy on Site
- Smaller Initial Cost
- Save/Make Money
- Easier Permits
- Use Existing Power lines
- Thousands of Locations
- Help Spread the Wealth
Various Turbine Sizes, Types
Brands of Turbines

SMALL: Under 100kw
- Air X
- Whisper
- Skystream
- Bergey
- Ventera
- Jacobs
- Nex Gen

LARGE: Over 100kw
- Vestas
- Zond
- Suzilon
- GE
- NEG Micon
- Nordex
- Northwind 100
# BRAND, SIZE AND COST

<table>
<thead>
<tr>
<th>Turbine/size</th>
<th>Tower</th>
<th>Installed Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Turbines for Farm or Home: Net Metering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventera 10 kw</td>
<td>100’ lattice</td>
<td>$45,000</td>
</tr>
<tr>
<td>Jacobs 20 kw</td>
<td>120’ lattice</td>
<td>$80,000</td>
</tr>
<tr>
<td>Nex Gen 40 kw</td>
<td>120’ mono</td>
<td>$150,000</td>
</tr>
<tr>
<td>Large Turbines for Wholesaling Power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nordex 250 kw</td>
<td>160’ mono</td>
<td>$875,000</td>
</tr>
<tr>
<td>Vestas 660 kw</td>
<td>180’ mono</td>
<td>$1,750,000</td>
</tr>
<tr>
<td>Suzlon 2000 kw</td>
<td>350’ mono</td>
<td>$3,000,000</td>
</tr>
</tbody>
</table>

[Source](www.ecowerc.com)
## Basis for Financial Strategy

Elements for successful financing of Small Wind:

<table>
<thead>
<tr>
<th>Income</th>
<th>Tax Reduction:</th>
<th>Other $ Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales of Power</td>
<td>Tax Credits</td>
<td>USDA / Grants</td>
</tr>
<tr>
<td>Net Metering</td>
<td>Production Credits</td>
<td>Educational Sponsors</td>
</tr>
<tr>
<td>Green Credits</td>
<td>Real Estate Tax Exemption</td>
<td>Advertising/PR</td>
</tr>
<tr>
<td>Feed In Tariff</td>
<td></td>
<td>Antenna Lease</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>Insurance</td>
<td>Interest</td>
</tr>
</tbody>
</table>
Here are the steps for you to get a small wind turbine for yourself

STEP 1. Site Plan

a) Hire an expert to visit your site, provide written estimates of wind resources, itemize costs, options, income, expenses and benefits (planning costs $350 - $750).

b) Site plan drawn up, showing set-backs, buildings, well, septic, directions, mock photos of turbine installed. Look into permit requirements, interconnection and inspections.

c) Make a decision about which tower height, monitoring options, work with educational groups, sponsors, USDA grant, etc.
Potential Tower Obstacles

Legal issues
- City, town, or county ordinances restricting height or requiring minimum setbacks
- Building codes and covenants

Environmental Issues
- Neighbors’ concerns (visual impact, noise)
- Potential physical obstacles (growing trees, planned construction)
Objections are less likely in a rural setting

- Spinning blades perceived as useful
- Talk to neighbors before seeking permit

Noise & Visual Impact

Improved designs have made machines much quieter

- Comparable to central AC unit
- Noise levels fall sharply with distance

1 acre is a good rule-of-thumb minimum property size for a small wind installation capable of powering a farm or large home.
Tower Height Matters

- Wind speed increases with height
- Small increases in wind speed result in large increases in power
- Tall towers needed for clearance above obstacles (turbulence)
- May require a variance or a special use permit (mock up photos)
Height or Distance Needed

Obstruction of the Wind by a Building or Tree of Height (H)

Region of highly turbulent flow

2H

20H

Prevailing wind
Photo of the Tower Site
Photo Mock-Up of Turbine in Place
Wind Data Graph

Lac Qui Parle Hourly Wind Speed
4/2/2002 - 7/2/2002

Wind Speed (mph)

Date/Time

WS40W
Wind Resource Summary for Rollag Site

Minnesota Department of Commerce


Site Description:

<table>
<thead>
<tr>
<th>Latitude: N 46° 43' 51&quot;</th>
<th>Township: 138 N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitude: W 96° 10' 9&quot;</td>
<td>Range: 43 W</td>
</tr>
<tr>
<td>Elevation: 1,440 feet</td>
<td>Section: 31</td>
</tr>
<tr>
<td>Tower Type: NRG tilt-up</td>
<td>Tower Height: 131 feet</td>
</tr>
</tbody>
</table>

Monthly Wind Speed Averages:

<table>
<thead>
<tr>
<th>Month</th>
<th>131 ft AGL mph</th>
<th>98 ft AGL mph</th>
<th>33 ft AGL mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>14.2</td>
<td>6.36</td>
<td>12.4</td>
</tr>
<tr>
<td>Feb</td>
<td>15.0</td>
<td>6.72</td>
<td>13.9</td>
</tr>
<tr>
<td>Mar</td>
<td>14.6</td>
<td>6.54</td>
<td>13.7</td>
</tr>
<tr>
<td>Apr</td>
<td>14.6</td>
<td>6.51</td>
<td>13.6</td>
</tr>
<tr>
<td>May</td>
<td>14.9</td>
<td>6.65</td>
<td>14.2</td>
</tr>
<tr>
<td>Jun</td>
<td>13.3</td>
<td>5.94</td>
<td>12.5</td>
</tr>
<tr>
<td>Jul</td>
<td>12.0</td>
<td>5.36</td>
<td>11.4</td>
</tr>
<tr>
<td>Aug</td>
<td>12.8</td>
<td>5.72</td>
<td>12.0</td>
</tr>
<tr>
<td>Sep</td>
<td>13.4</td>
<td>6.01</td>
<td>12.6</td>
</tr>
<tr>
<td>Oct</td>
<td>15.9</td>
<td>7.11</td>
<td>14.9</td>
</tr>
<tr>
<td>Nov</td>
<td>15.0</td>
<td>6.70</td>
<td>14.0</td>
</tr>
<tr>
<td>Dec</td>
<td>14.7</td>
<td>6.57</td>
<td>13.3</td>
</tr>
</tbody>
</table>

Summary Wind Data:

<table>
<thead>
<tr>
<th>Mean Wind Speed</th>
<th>33 ft AGL</th>
<th>98 ft AGL</th>
<th>131 ft AGL</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 ft AGL</td>
<td>11.0 mph</td>
<td>13.2 mph</td>
<td>14.3 mph</td>
</tr>
<tr>
<td>Maximum, 60-min Mean Wind Speed</td>
<td>52.9 mph at 131 ft AGL – 4/5/2000 6:00 p.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated Wind Power Class</td>
<td>Class 2 (261 W/m² at 131 ft AGL)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WHY JACOBS?

- Proven over 75 years: Oldest Name in USA
- Low Cost ($4 / watt) – High Value
- Good Producer of Power in lighter winds
- USDA comfortable with Jacobs (9006 grant)
- Equipment holds value well (possible 50 year life)
- Ease of operation and interconnection
- Low maintenance - $500 per year average
- UL Approved, Documentation by Engineers
- Power Company acceptance
- Locally made in Minnesota
COSTS OF JACOBS

January 2009 installed price = $74,650

- Total Equipment Cost = $54,250
- Complete Installation = $20,400
  (with 120’ tower, 150’ wire trench and UL 508 Inverter)

Additional Costs May Be Incurred:
- Power Co. Interconnect = $500 to $5000
- UL 1741 Inverter? = $7,000
- USDA Grant Application = $1,200
- Additional Wire/Trench/Building?
- Total Project may cost = $80,000
HOW THE JACOBS SYSTEM WORKS

6 to 1 gear ratio

Wind turbine components

Excess power requirements satisfied by the utility
Excess energy fed to the grid for credit

Utility meter

Breaker Box

Mastermind synchronous inverter

Choke / Regulator

Pier and Pad Foundation
12 yards concrete, 10 feet deep with steel anchors.
WIND POWER:
INCOME - BENEFITS

- Net Metering, 20 years = $60,000
- Tax Credits (IRS and MN) = $40,000
- MACRS Depreciation, avg = $25,000
- USDA 9006 Grant = $20,000
- Antenna Leasing (10 years) = $15,000
- Educational Sponsors (5 yrs) = $5,000
- Finders Fees (from WERC) = $3,500

- 20 year benefits total = $169,500
- 50 year lifetime income = $300,000

(These are estimates based on current knowledge 6-08)
## Basis for Financial Strategy

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<td></td>
<td></td>
</tr>
</tbody>
</table>
### COST BREAKDOWN OF PROJECT

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacobs Wind Turbine 31-20 (complete kit)</td>
<td>$52,600.00</td>
</tr>
<tr>
<td>Tower Base: steel &amp; concrete</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Balance of System: Anchors, Bolts, Fasteners, Braces</td>
<td>$2,600.00</td>
</tr>
<tr>
<td>Site Plan</td>
<td>$-</td>
</tr>
<tr>
<td>Electrician Wiring Labor</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Assemble and Erect 120’ Tower: Labor/Equipment</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Wiring, Conduit, Controls and Switches</td>
<td>$1,750.00</td>
</tr>
<tr>
<td>Permits, Application Work: ($75/hr., as needed)</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Trenching and 150’ of Secondary Wire</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Sales Tax (Exempt)</td>
<td>$-</td>
</tr>
<tr>
<td>Contingencies</td>
<td>$750.00</td>
</tr>
<tr>
<td><strong>TOTAL COST</strong></td>
<td><strong>$70,700.00</strong></td>
</tr>
</tbody>
</table>

### Jacobs Turbine Resale Value (based on existing units with good maintenance)

<table>
<thead>
<tr>
<th>Time</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 5 years</td>
<td>$67,132.41</td>
</tr>
<tr>
<td>After 10 years</td>
<td>$85,679.86</td>
</tr>
<tr>
<td>After 20 years</td>
<td>$139,563.46</td>
</tr>
</tbody>
</table>

---

### COST - BENEFIT ASSUMPTIONS

- Kilowatt hours (per year): 29,000.00
- Federal IRS Tax Credit (dollars): $30,000.00
- Green Credit Rate (dollars): $0.02
- Feed-in Tariff Rate (dollars): $0.25
- Education & Sponsors (per year): $1,200.00
- Antenna Lease Value (per year): $-
- Production Tax Credit: $-
- Maintenance Cost (per year): $500.00
- Insurance Cost (per year): $400.00
- Interest Exp on $50,000: 6%
- Finders Fees (see Cost/Benefit sheet): 1.0% per unit
- Income Tax Rate Estimate: 42%

### PAYBACK CALCULATION

- Project Cost: $70,700.00
- Less: USDA Grant: $-
- Less: Other Grants: $-
- Total Project Cost: $70,700.00

- 20 yr. Average Annual Income and Savings: $6,063.36
- Payback Period (years): 6.4
USDA 9006 ANNUAL GRANT

The following information and documentation will be needed by our WERC staff to properly complete the USDA grant application process (AVERAGE OF 70 PAGES).

1) Your SSN, Farm Tax ID number or Employer Identification Number.
2) Your D.U.N.S number, as assigned by Dun and Bradstreet.
3) What is your form of business organization? Are you applying as an individual, agricultural producer, chapter S Corporation, LLC, etc.?
4) Your NAICS code (North American Industry Classification System)
5) Copies of past three years tax returns, including Schedule C, Schedule F or IRS forms related to Corporation, S Corporation or Partnership filings.
6) Copy of the lease or deed proving control or ownership of the property on which the turbine will be erected.
7) A USGS Map from Natural Resources Conservation Society (NRCS) depicting where your site is located.
8) The legal description for your property.
9) A Plat map for your property
10) Site photographs with at least two photos showing the relationship of farm buildings, trees, and surrounding terrain with the turbine site.
11) Information of funding to cover the full purchase price of the turbine.
12) A description of your business operation
ELMER ARSENEAU FARM, BY ALBANY, Jacobs 31-20 on 140’ tower  Producing 25,000 kwh/year
Complete 20kw turbine and 120’ lattice tower
TURBINES ON A 120’ TOWER INSTALL IN ABOUT 4-6 WEEKS, INCLUDING EXCAVATION, STEEL, FORMS, ANCHORS, CONCRETE, TOWER ASSEMBLY, WIRING, ELECTRICAL AND TOWER TIP UP.

CONCRETE MUST CURE FOR 30 DAYS PRIOR TO INSTALLATION.

THIS TOWER IS 120’, BASE IS ABOUT 14’ ON A SIDE, 90’ ft. sq.
Holly & Paul Neaton Jacobs Wind Turbine
SES Wind: 20kw Jacobs Turbine

Note the antenna rack mounts and anemometers.

Antenna may provide more income than the turbine.
On Site Educational Signage? Open for Public Tours?

Educational Grants for Public Programs, Research

Sponsors Receive Great Advertising, Media coverage
Atwater, MN Jacobs Wind Turbine Completed on 1-11-06
(yes, WERC crews also do the installations in winter)
School of Environmental Studies – Apple Valley, MN

Renewable Energy Education Project includes a Jacobs 20-kilowatt wind turbine, standing 160 feet in the air, and solar panel arrays.
Morrison County Fairgrounds, Little Falls, MN
RECENT CUSTOMER LIST

- Larry Glassman Farm
- Morrison County Fair
- Bob/Sue Meyerson
- John/Patty Persell
- Hunt Utilities Group
- Melody Lane Farm
- Boy’s & Berries Farm
- Prairie Woods ELC
- Tom Clemen Farm (2)
- Dakota Electric (SES)
- Harmon Wilts Farm
- Glen Jacobsen Farm
- Kennedy School
- Johnson Excavating
- Holly / Paul Neaton
- West Central Phone
ANNUAL WERC-WIND SERVICE: $500 (plus mileage)

a. Checking/securing all electrical connections.
b. Checking/securing all key bolts, nuts, straps and mechanical connections.
c. Checking all components for signs of damage (abuse, water, oxidation, galvanic action, etc).
d. Climbing towers and inspecting components of tower.
e. Changing the synthetic gear lube in gear box.
f. Grease the thirteen grease fittings with correct lubricant.
g. Test disc brake system.
h. Conduct standard diagnostic tests on inverter.
i. Cleaning the leading edge of the blades.
# Emissions Reduction Calculations

**Wind Turbine Description:** Jacobs 31-20  
**Rated Turbine Capacity:** 20 kW  
**Predicted Power Output:** 29,000 kW-Hr/Yr  
**Predicted Power Output:** 2,417 kW-Hr/Month  
**Coal Heat Content:** 98,948,000 Btu/Yr  
**Coal Sulfur Content:** 12,300 Btu/Lb  
**Energy Conversion Efficiency (estimate):** 33%  
**Equivalent Coal Usage:** 12.19 Tons/Yr  
**Electrostatic Precipitator Control Efficiency:** 95%

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission Factor (lb/ton)</th>
<th>Emission Reduction (tons/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter (controlled by ESP)</td>
<td>66.0</td>
<td>0.0201</td>
</tr>
<tr>
<td>Particulate Matter less than 10 microns (controlled by ESP)</td>
<td>13.2</td>
<td>0.0040</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>5.0</td>
<td>0.0305</td>
</tr>
<tr>
<td>Hydrogen Chloride</td>
<td>1.2</td>
<td>0.0073</td>
</tr>
<tr>
<td>Hydrogen Fluoride</td>
<td>0.15</td>
<td>0.0009</td>
</tr>
<tr>
<td>Total Nonmethane Organic Compounds</td>
<td>0.05</td>
<td>0.0003</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>114.0</td>
<td>0.6948</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>8.8</td>
<td>0.0536</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>4810</td>
<td>29.3139</td>
</tr>
</tbody>
</table>
NEXT STEP: Planning & Grants

1. Set up Wind Site Plan meeting with an experienced Site Planner
2. Learn local ordinances: tower heights, setbacks, etc.
3. Contact Utility about Net Metering agreement and hookup charges.
4. Learn about USDA (and other grants), antenna lease, taxes. Apply as needed.
5. Place order and schedule installation
“Making conservation pay through better construction technologies.”