



Applications of Small Wind Turbines

David Wood

NSERC/ENMAX Industrial Research Chair
in Renewable Energy, University of Calgary



Topics

Remote Power Systems with Wind Turbines
Research and Development Needs





Remote power system with a small wind turbine from 1924

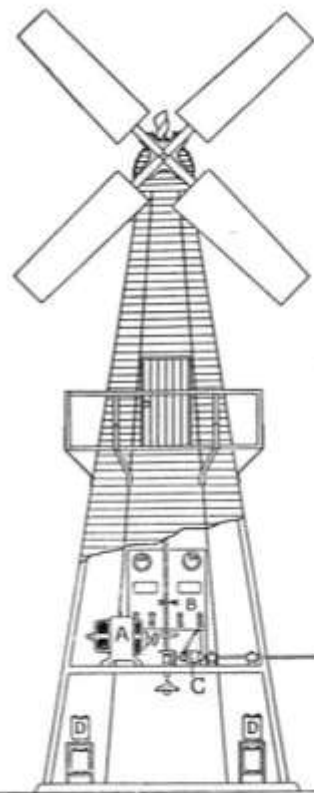
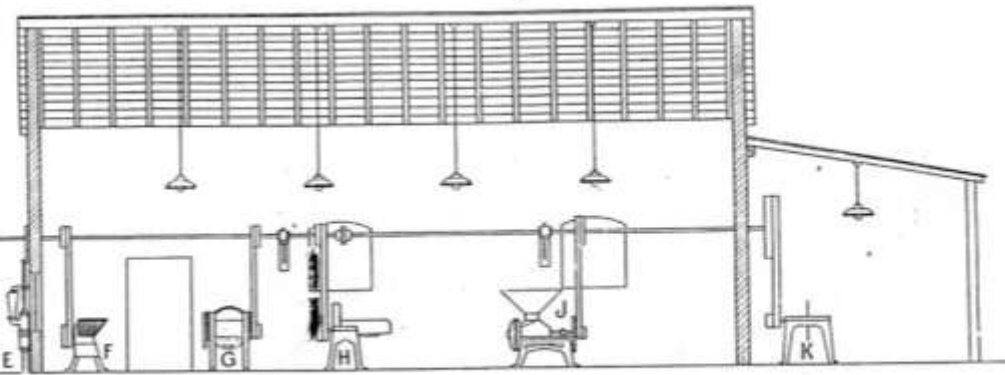


Diagram of BURNE PATENT WINDMILL showing arrangement for Electrical Plant and alternative adaption for driving Farm Machinery.



A—Dynamo.
B—Switchboard.

C—Clutch.
D—Battery.

E—Pump.
F—Pulper

G—Cake Breaker
H—Chaff Cutter.

J—Cornmill.
K—Sawbench.

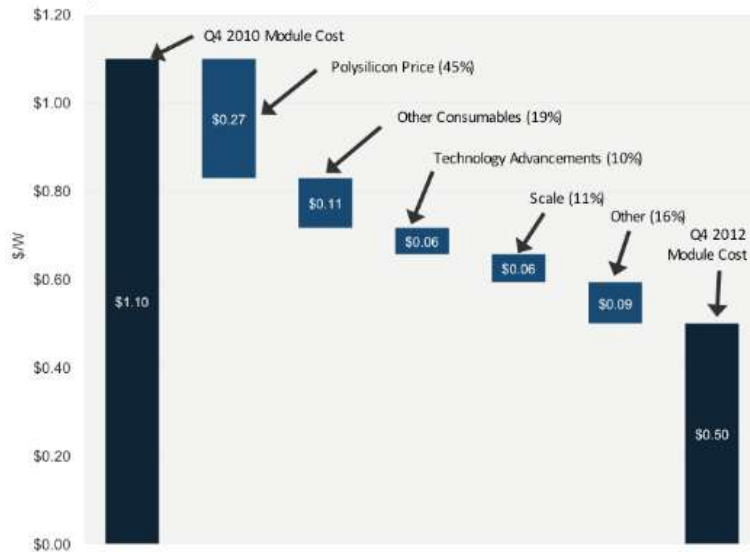


The variety of small wind turbines vs the uniformity of large ones

Challenges for Small Wind Turbines

PV prices have dropped ~ 20% per year since 2005

FIGURE: Contribution of Key Drivers Toward Module Cost Reduction, Best-in-Class China Producer, Q4 2010-Q4 2012



Source: PV Technology and Cost Outlook, 2013-2017



but PV is not effective at very high latitudes

- Low winter production when power is most needed

Challenges for Small Wind Turbines



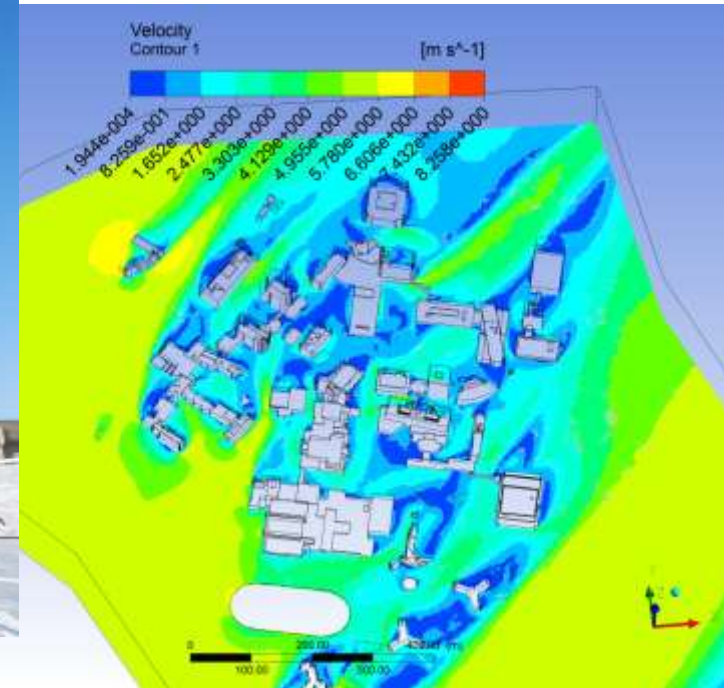
- Icing!
- Poor reliability and maintenance
- Can remote condition monitoring be used to improve reliability and reduce maintenance?



Challenges for Small Wind Turbines



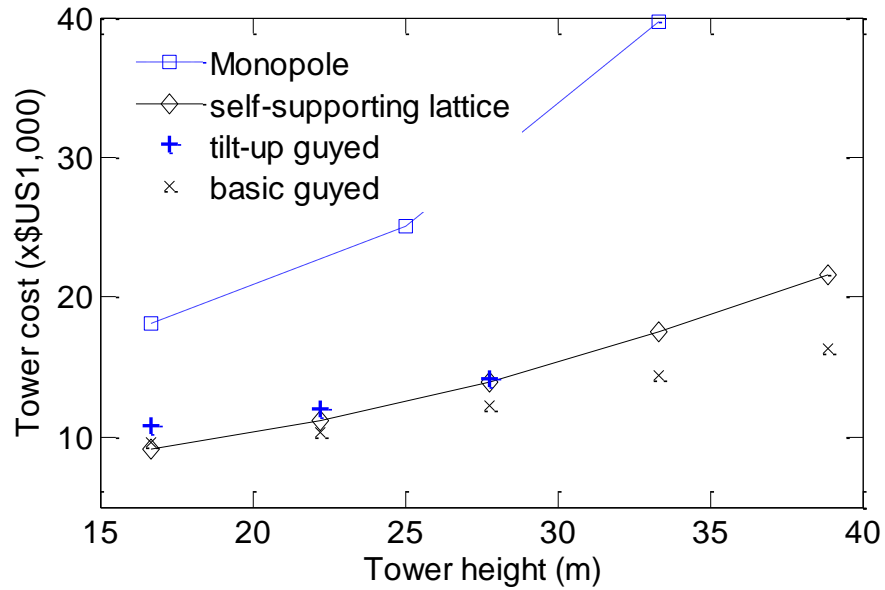
22 m anemometer
mast in Calgary cost
~\$30,000



Wind resource assessment is expensive experimentally or computationally

Tower Prices for a Bergey 10 kW wind turbine

Lattice towers are cheaper so why use monopoles?



Lattice tower



Monopole



Guyed tower



Challenges for Small Wind Turbines

System integration and operation for remote power systems

Most remote systems are designed incrementally i.e. wind turbine control is left to the wind turbine

How to optimize design and implement maximum power point tracking in the rectifier?

