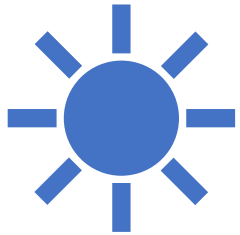
Hanover Wind Turbine Update

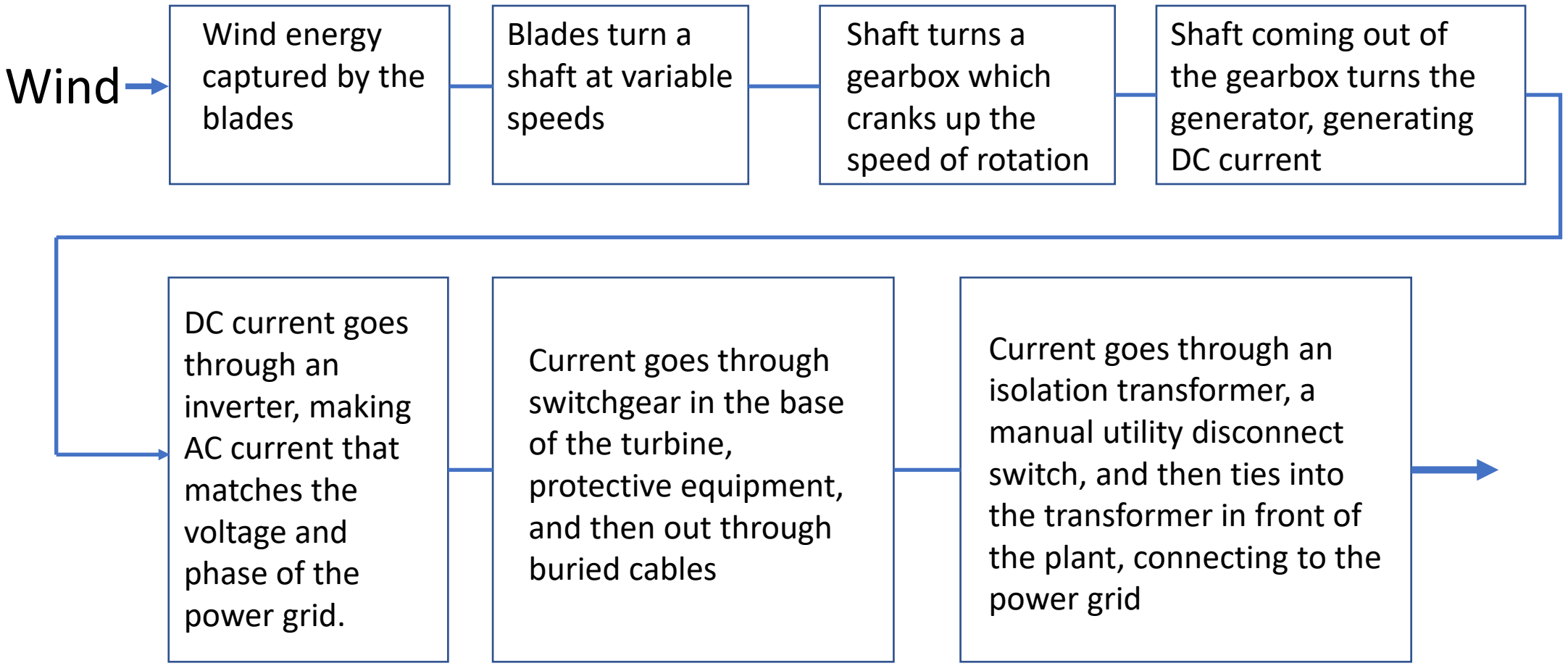
April 4, 2022



What we hope to cover today

- How does a wind turbine work?
- Why has our turbine stop working?
- Description of the development process
- Why did the project get derailed?
- What are the options moving forward?
- What went wrong? What did we learn from the process?

How does a wind turbine work?



Blades

Nacelle – contains gear box, generator, braking system, various mechanical controls

Tower – contains ladder, resting platforms, control and power cables

Base – contains controls, switch gear, protective relays, etc…

Foundation – extends deep into the ground. Supports the turbine and heavy enough to keep it from toppling over

Development Process

- The turbine was an initiative of the Board of Selectmen prior to the Town Manager Act. It was intended to be a demonstration project as a precursor to a potentially bigger turbine with the most likely sites either on the Lutheran Church hill or behind the high school.
- The energy consultant hired by the Selectmen used state wind atlases and predicted the turbine would generate enough power for approx. 50% of the Pond Street WTP's demand (approx. $50,000 in savings per year).
- It was hoped that a local manufacturer that had purchased rights to proven wind technology out of Europe would ramp up local turbine production. This never materialized.

Development Process

- The project was designed and procured in accordance with Mass General Laws. The Selectmen's consultant struggled to understand the state's procurement process and as such they were advised to partner with a traditional engineering firm which they did.
- Due to the lack of an American made product in the size that we wanted, the low bidder turned to an India based manufacturer.
- The manufacturer experienced production delays. There were also issues associated with shipping, including the alleged theft of a major controller while in transit to the US.
- During construction, the vendor had supply chain issues which were caught and corrected during commissioning.

Development Process

- The selected turbine, a 250/50 KW SIVA turbine, has two generators. The lower 50 KW generator works when winds are light. The 250 KW generator kicks in when winds exceed a certain threshold.
- In practice, the amount of wind available to kick in the higher generator was not available as often as predicted by the consultant and the State's wind atlas. As such, the turbine spun but never met the anticipated energy output.
- The commissioning process stalled as the vendor struggled to solve the problems that came up. DPW was unable to push the process through. The Town Manager took over and he too was unable to advance the process. Ultimately the Town pulled the bond and forced the bonding company to meet the expectations. It was a long, drawn out process.

Development Process

- Prior to construction, the maintenance costs were estimated at $15,000 per year. They turned out to be $35,000 per year.
- The generator only had enough wind and up-time to produced an estimated $15,000-$20,000 a year in energy.
- Land based wind as a source of renewable energy proved to have many challenges and was ultimately overtaken by advances in the solar market which simply were not available at the time we started this process.

What happened to derail the project

- The vendor and manufacturer struggled to deliver a reliable product.
- The use of an overseas vendor complicated the commissioning of the turbine. Time differences, language barriers, and customs and immigration restrictions limited the amount of on-site help the manufacturer could provide.
- The vendor had financial difficulties during construction which seemed to impact their ability to advance the project in a timely manner.
- The bonding company stepped in to complete the project. After months of adjustments, threats of litigation, and negotiations, the turbine was brought to a state of functionality, albeit not as successful as had been hoped.

What happened to derail the project

- As predicted, maintenance of mechanical equipment proved to be difficult 50 meters off the ground.
- On March 9, 2018, a catastrophic electrical fire destroyed the switch gear in the base of the turbine and compromised the turbine controls as well as likely the power cabling.
- Due to inactivity, National Grid withdrew our Interconnection Service Agreement which had allowed connection to the grid.

What are the options moving forward

- We engaged a firm, Associated Energy Developers, to assess the turbine and provide options moving forward.
  - Option 1: Repair and place the turbine back in service (*est. cost $95,000-$142,500*)
  - Option 2: Remove upper nacelle and blades and use as a cell tower (*est. cost $48,000-$65,000*)
  - Option 3: Remove the blades only (*est. cost $37,000*)
  - Option 4: Do nothing

What are the options moving forward

- AT&T's development group looked at the tower. They showed little interest, indicating that the tower was too short and would have to be extended to be useful to them. They also indicated that the monopole design is also not their preferred platform.
- Industrial Communications looked at the site as well as some surrounding towers and suggested that there was little value as the other local towers seem to be pretty well used.
- There may be some resale value in the turbine. Associated Energy indicated that the nacelle and blades had some soot on them but were not damaged. They said the control panel may still be functional but they were unable to fire it up with a generator. The turbine is an odd size and its value would be to someone who has the right wind and need. There are brokers and publications where the turbine could be advertised.

What went wrong with the project's execution?

- Initial wind estimates were overly optimistic. The Town bought into this and probably should have been more conservative.
- The winning vendor met the criteria for a contract award, but encountered difficulties and was apparently stretched a little too thin to overcome these difficulties.
- The challenge of dealing with an overseas manufacturer proved to be a big hurdle.
- Staff in both the DPW and Town Manager's office had similar effectiveness in trying to move the project along. It was only when the bonding company agreed to finish the project that a new commissioning firm was hired and the project was brought to completion.

What were the turbine's finances?

- Total spent to date is $833,270. The original bid price was $768,500. The difference is engineering and operational costs up to the point of the fire.
- The cost of operations exceeded the amount of energy savings.
- The fire was a blessing, stopping the bleeding. The Town received an insurance settlement of approximately $75,000 on estimated damages of $95,000. This was handled by the Town Manager's office.
- The Town received $55,230 in grant money.

Lessons Learned?

- Nothing is guaranteed. Wind power and other renewable energy is a fairly new industry in the US. We probably should have worked with a vendor to lease space for a turbine and purchased power rather than charge into and try to own and operate the turbine ourselves.
- Hanover is not alone in its trouble with turbines. This suggests that Towns should be very cautious when pursuing wind energy.
- Investments can be risky. This one proved to be a bad investment. We need to better evaluate the risk reward equation on future projects before proceeding with them.
- It is not known what caused the switchgear to arc and ultimately fail. Insurance ultimately largely covered the failure but could not cover the lack of wind. Neither could the safeguards of the Massachusetts procurement laws which generally worked as designed.