

Short-term energy storage for a mid-size wind turbine with a hydrostatic transmission

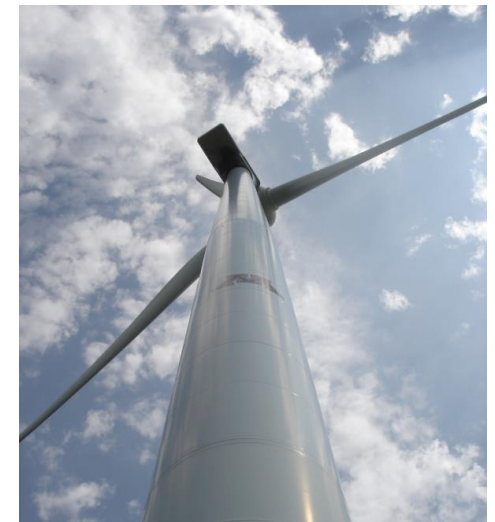
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Turbine snapshot at U of M - Morris



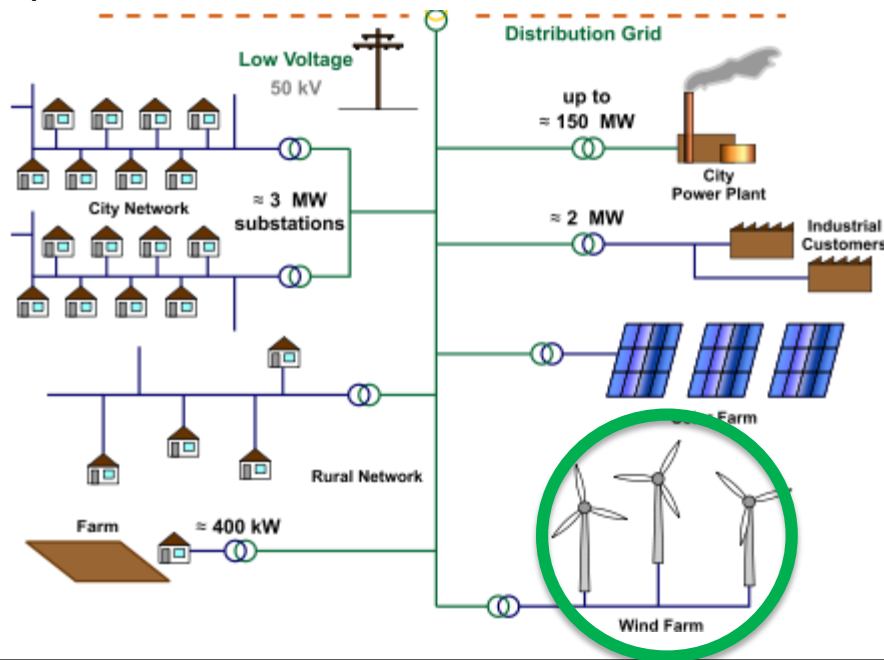
Three ideas

- 1. Community wind can reduce the load on the transmission grid.**
- 2. A hydrostatic transmission is a cost-effective reliable alternative for community wind turbines.**
- 3. Short-term energy storage increases the annual energy production of a hydrostatic wind turbine**

Community wind

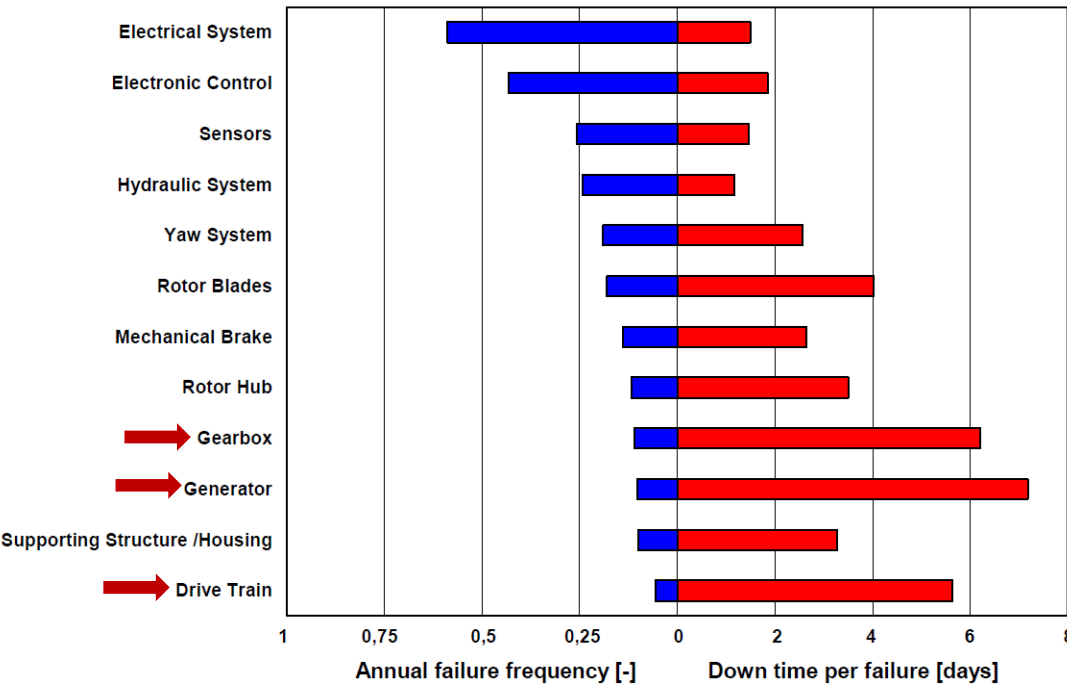
Community wind (midsize wind): 100 kW-1 MW:

- ❑ Cost-effective method for moderate power demands such as farms, communities and factories;
- ❑ Generates the wind power where it is needed;
- ❑ Reduces the required capacity of the transmission grid;
- ❑ Range of commercially available hydraulic components.



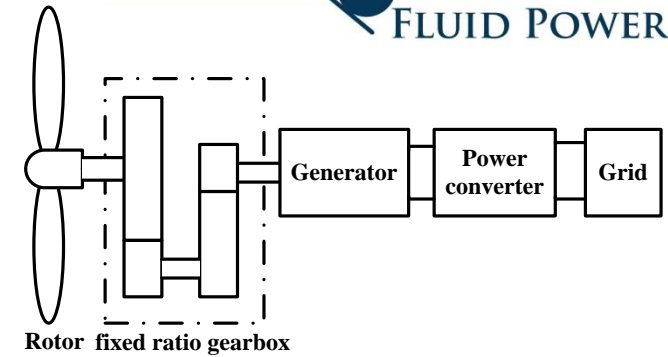
Community wind

Hydrostatic wind turbine

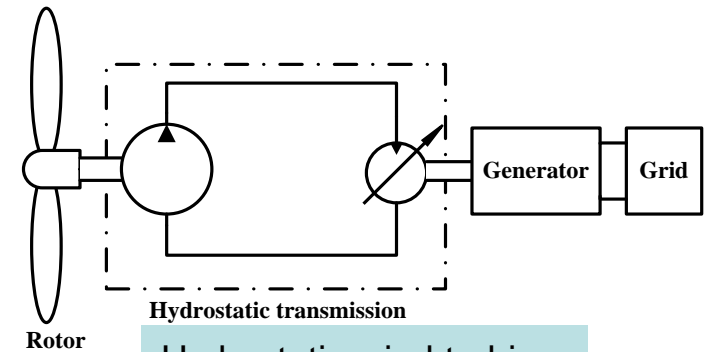


Failure frequency and downtimes of components

❑ Studies show the major components contributing to low reliability and increased downtime of turbines are found to be the **gearbox, generator and the drive train**.



Conventional gearbox turbine



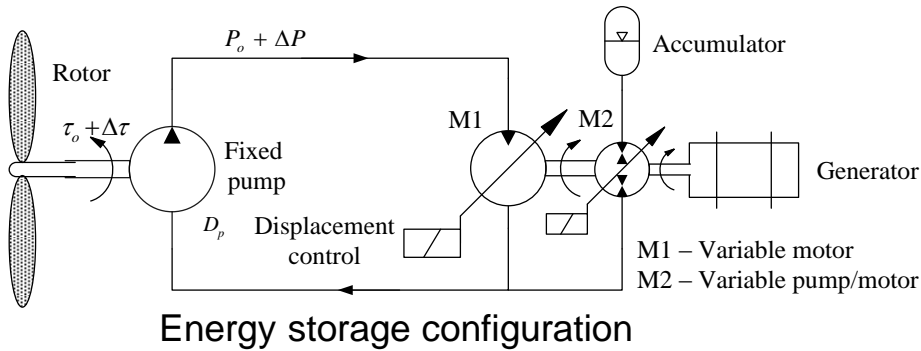
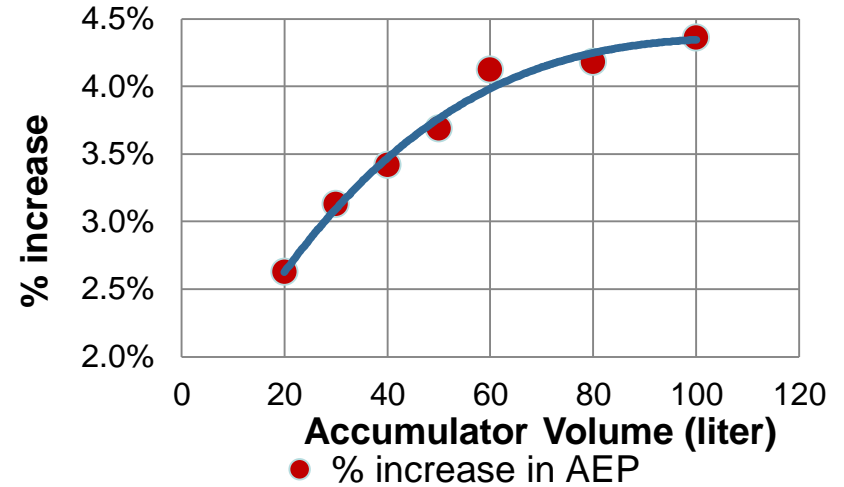
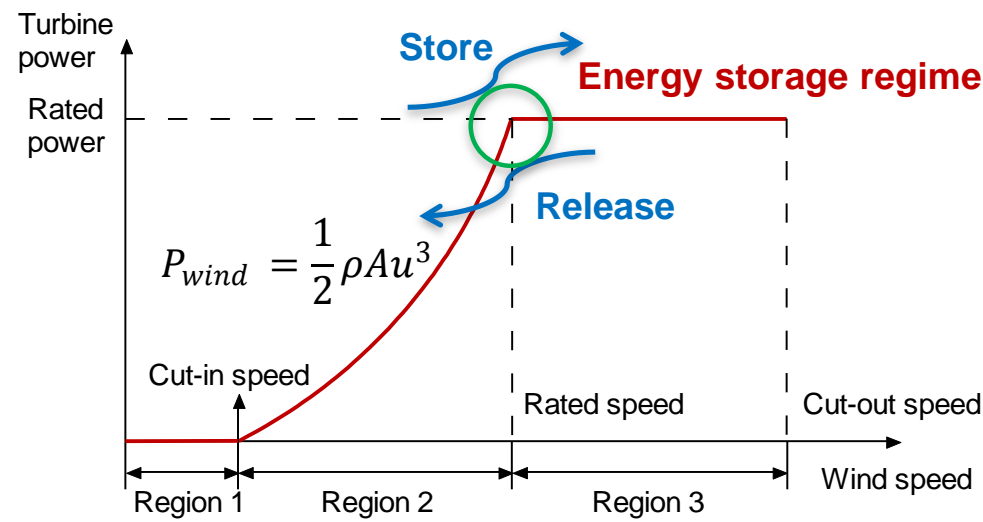
Hydrostatic wind turbine

Advantages of a hydrostatic transmission:

- ❑ CVT with simple system structure
- ❑ No need for power converter
- ❑ Fluid compressibility reduces shock load
- ❑ Improve reliability and reduce cost

Commercial hydraulic components (pumps and motors) match the power level of mid-size wind turbines, reducing the technology risk.

Short-term energy storage



Sensitivity study: accumulator size on annual energy production (AEP) in a 50 kW turbine:

- ❑ 40 liter accumulator increases AEP by 3.4%
- ❑ 60 liter accumulator increases AEP by 4.1%

A cost analysis is required to determine whether the turbine energy production increase will offset the cost increase of implementing the energy storage system.