

Distributed Generation in Meeting Future Demand

Two solutions to the power crisis currently facing the United States are based on the traditional utility paradigm:

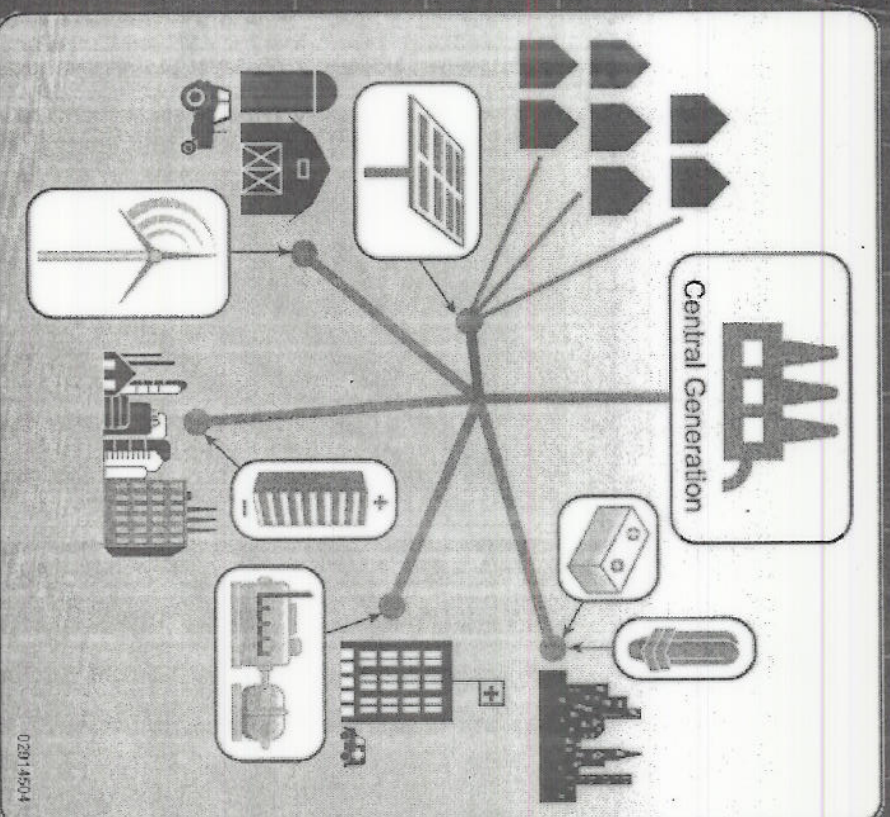
- build more power plants
- beef up the transmission system to allow more power to be shipped to where it is needed.

Distributed Generation in Meeting Future Demand (cont.)

Distributed Generation (DG) presents an alternative approach to the problem.

Rather than investing in both a source of power and a means of bringing it to the user, Distributed Generation investments bring the power solutions directly to the user's location, bypassing the need for long-distance transmission of that power

Distributed Generation in Meeting Future Demand (cont.)

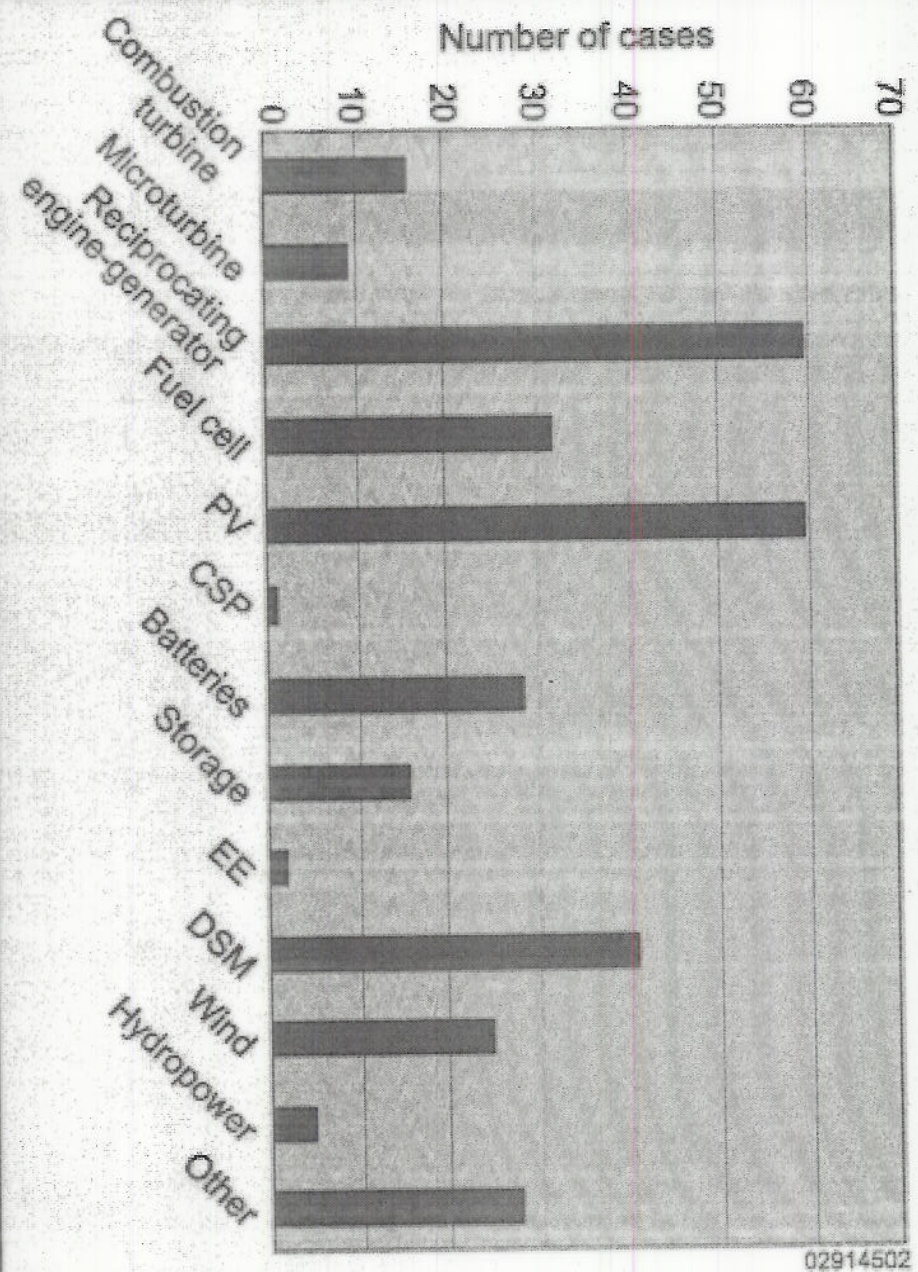


Distributed Power Generation

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Distributed Generation in Meeting Future Demand (cont.)

DER Technologies



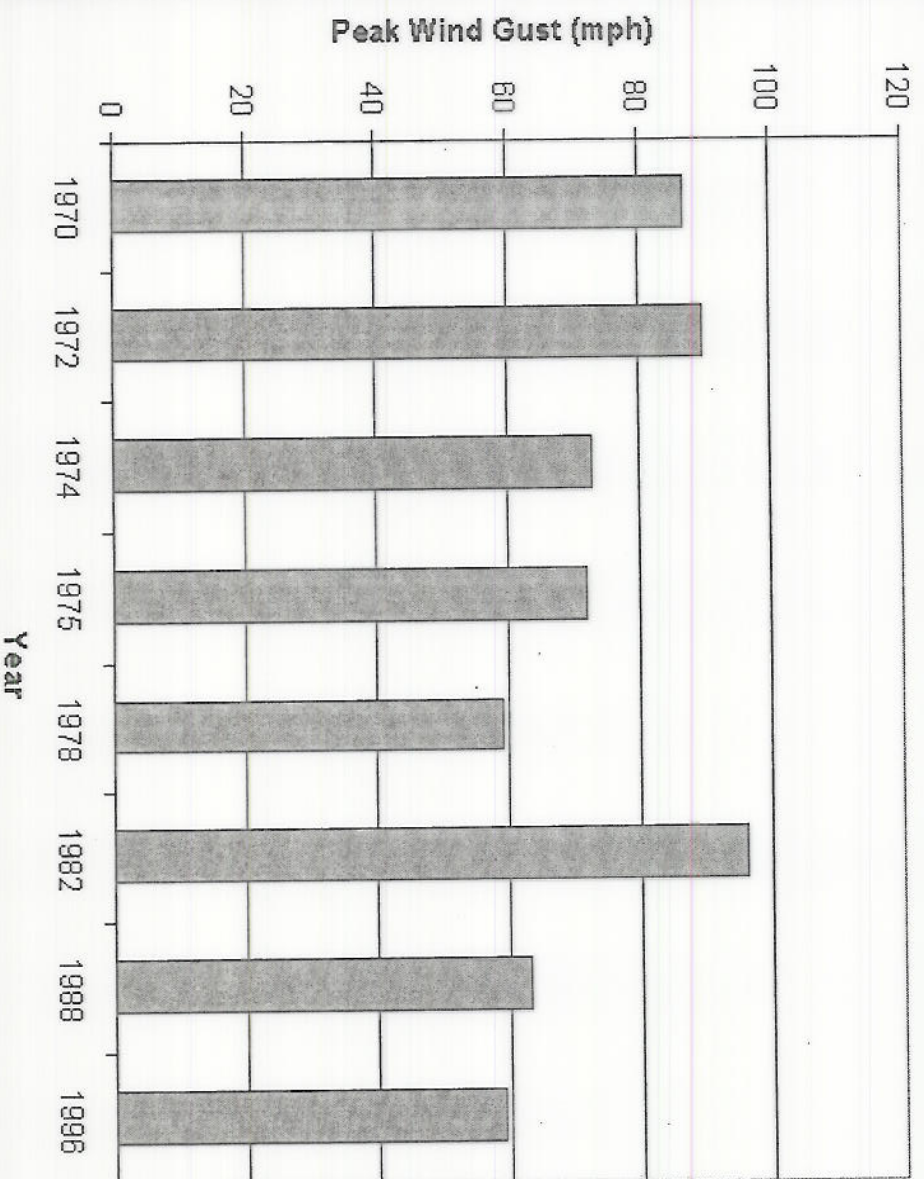
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Distributed Generation Energy Storage

Storage Technology	Development Status
Batteries	Lead-acid batteries are commercially available and widely used. Research is ongoing for advanced batteries. Most common method.
Flywheels	Flywheels are commercially available as individual products or integrated with prime movers such as engines. Significant research is also underway to develop new flywheel products.
Superconducting Magnetic Energy Storage (SMES)	Superconducting magnetic energy storage is commercially available using superconductors in liquid helium. Superconductors in liquid nitrogen are in the development stage.
Super capacitors	Small super capacitors are commercially available for use in electronic devices. Large Super capacitors are currently under development.
Compressed Air Storage Systems (CAES)	CAES use existing technologies but is not widely utilized because of the significant space requirements.

Wind Data [4]

A Plot of Peak Wind Gusts in Fort Collins vs. Year



Inverters

■ Synchronous Inverters

- Synchronous inverters change DC power into AC power to be fed into the utility grid.
- A power system with this type of inverter uses the utility company as a storage battery.
- When the sun is shining, your electricity comes from the PV array, via the inverter.
- If the PV array is making more power than you are using, the excess is sold to the utility power company through a second electric meter. If you use more power than the PV array can supply, the utility makes up the difference.
- This type of system makes the most sense if you have utility power, because there are no batteries to maintain or replace, but it has a very long payback period and may not be cost-effective at today's electric rates.
- Using a multifunction inverter allows you to sell excess power to the utility, and also maintain a battery bank for stand-by power in the event of a utility power failure.

Inverters (cont.)

■ Multi-function Inverters

- A multi-function inverter is connected to a battery bank, the utility power lines, a standby generator and the house load center.
- When batteries are in a charged condition, the SW inverter supplies AC power to the house from the batteries. If the batteries become discharged, the inverter supplies the house loads from the utility lines, while charging the batteries.
- If the batteries become fully charged by another power source, such as photovoltaic modules or a wind or hydroelectric generator, excess power may be sold back to the utility.
- If utility power fails, the inverter can still operate, supplying critical loads. If a standby generator is started, it can also supply power to loads.
- The inverter will synchronize to the generator and allow loads to be powered that are too large for either the generator or inverter to supply alone.