DISTRIBUTED ENERGY RESOURCES AND COMBINED HEAT AND POWER: A DECLARATION OF TERMS *BY ANNA MONIS SHIPLEY AND R. NEAL ELLIOTT*

EXECUTIVE SUMMARY

It has become clear from several recent meetings of analysts (Energetics 1999a, 1999b) that the distributed energy resources (DER) and combined heat and power (CHP) communities are in need of a common set of definitions to describe segments of the marketplace. Two parameters appear to require inclusion in the taxonomy: (1) system size and (2) system design and operation. Defining the terms is not an academic issue—it has significance for the enumeration of current systems and the estimation of market potential because it will allow analysts to explicitly declare what is included in (and excluded from) their estimates and projections.

Because of the increased demands on the electrical power grid and the incidence of widespread power outages during peak times in the past few years, many utility customers have sought to generate their own power. Businesses are becoming much more dependent on the reliability of their electrical systems and many of these systems also require increasingly high-quality power. The implementation of DER can be beneficial for both the customer and the utility in many ways, but it should be noted once again that the aim of local systems should be to increase the quality and reliability of service. A customer that completely removes itself from the electrical grid faces the possibility of outages and decreased reliability.

DER Taxonomy

The terms that have been used by the electric industry include distributed generation (DG), distributed power (DP), and DER. We will attempt to clarify and define these terms in a manner that will appeal to the majority of the power generating community and create the groundwork for a unified industry terminology (see Table ES-1 for the definitions we developed). Note that we use DER in this report to refer to the broadest range of technologies that can provide power to the user outside of the grid, and also to cover demand-side measures.

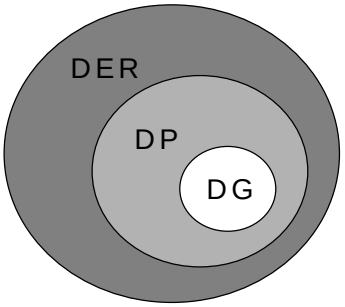
Table ES-1: Definitions of Distributed Energy Resources

Distributed Generation	Any technology that produces power outside of the utility grid**.**
Distributed Power	Any technology that produces power or stores power.
Distributed Energy Resources	Any technology that is included in DG and DP as well as demand-side measures.

DG is defined as anything outside of the conventional utility grid that produces electricity. DG technologies include internal combustion engines, fuel cells, gas turbines and micro-turbines, hydro and micro-hydro applications, photovoltaics, wind energy, solar energy, and waste/biomass fuel sources. DG also includes non-utility combined heat and power plants.

DP encompasses all of the technologies included in DG as well as electrical storage technologies. DP includes batteries, flywheels, modular pumped hydro-electric power, regenerative fuel cells, superconducting magnetic energy storage, and ultracapacitors.

Figure ES-1: The DER Sphere

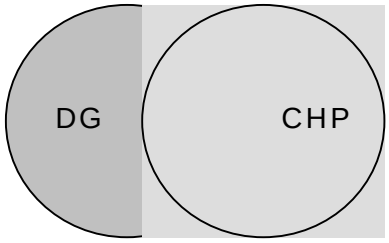


DER includes all technologies in DP and DG and also includes demand-side measures. Under this configuration, power can be sold back to the grid. Figure ES-1 graphically displays the relationships between these terms.

CHP Taxonomy

Combined heat and power technologies represent a special area within the realm of DG. CHP systems that are installed at or near the point of use for off-grid applications are considered to be DG systems (see Figure ES-2). However, large central station CHP units are not included in DG. The size of this type of unit is typically between 40–400 megawatts (MW). This non-DG CHP encompasses about 40 percent of all CHP-produced power (Elliot and Spurr 1999).

Figure ES-2: DG, CHP Overlap



CHP systems are classified according to their size and system design and operation. Table ES-2 displays the six areas of classification for CHP systems.

We are presenting the terms in this report to bring clarification to the growing and complicated areas of distributed energy resources and combined heat and power. The next step in this process is for the industry to adopt this set of terms and to begin to establish a consistency in the language used. Such consistency is necessary for accurate data collection. A global terminology will make possible the development of metrics to track DER and CHP installations and the integration of these systems into the nation's energy portfolio.

Table ES-2: CHP Market Segments

	Typical Size (MW)	Dominant Ownership	Typical Power-to-Heat Ratio	Design Strategy	Power Utilization
Traditional	3–40 (small to medium)	owner operated	0.2 – 1.5	Match existing process thermal base-load	on-site
Regulatory-Driven	50–1,000 (large)	3rd party	> 2 (CTCC) > 0.5 (Steam)	Maximize power generation	merchant
Market-Driven	1–20 (small to medium)	3rd party	0.5 – 2	Balance power and thermal loads	on-site/ merchant
District Energy	1–40 (small to medium)	3rd party	0.2 – 2	Match existing thermal load	on-site/ merchant
Building CHP	0.1–10 (micro-small)	3rd party	0.4 – 2	Match building space conditioning load	on-site
Direct Drive	0.1–4 (micro-small)	3rd party and owner operated	05 – 1.5	Size to driven load with heat recovery	on-site