Cogeneration - business as usual is not an option

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Power & Pollution Paradigm

Electricity, a must in modern day society, is a double edge sword. Traditional generation feeds our demand for electricity powering building services systems including air conditioning, lifts, and lighting, yet the process creates vast quantities of waste heat energy. Against a background of diminishing resources, society still demands competitive costs coupled with reduced environmental impacts.

Cogeneration (also known as combined heat and power) is the simultaneous production of electricity and heat using a fuel such as natural gas, although a variety of fuels can be used, for example refuse derived fuel. And unlike traditional generation the waste heat energy is utilised to drive process, or air conditioning needs - significantly improving efficiency, and therefore lowering consumer costs.

Before explaining more about cogeneration, first it is necessary to understand a little about the traditional generation method. Most power generation, particularly in China, is based on burning a fuel; predominately coal, although oil or gas is used, producing steam. It is the steam pressure that spins the turbines turning the generators creating electricity; inherently it is inefficient. No more than one third of the fuel potential is converted into steam and the excess heat energy created during the process is generally discarded to atmosphere.

Additionally, distal generation creates an extensive T&D (distribution and transmission) network to reach consumers. Significant I^2R transmission losses require a complex system, incorporating voltage transforms, switches, protection systems, coupled with lengthy cabling, all of which are potential points of failure. Recent spectacular blackouts in London, Italy and USA were the result of T&D failures.

In contrast, cogeneration employs the local value of excess heat and minimal transmission losses. The excess steam or hot water can be used to serve applications such as building heat, process, air conditioning and domestic hot water provision. And by displacing the fuel that would have been being wasted in the process of power generation, cogeneration reaches efficiencies that triple, or even quadruple, conventional stations.

Environmental

Cogeneration is a smarter choice - eighty five percent efficient, local, on-site, power generation is presently the best technology solution for use of fuel, having the potential to reduce human greenhouse gas emissions by more than any other technology except perhaps public transit. The positive environmental impacts stem not only from the improved efficiency, but also from its decentralised character. A number of environmentally positive consequences flow from this fact:

1. Power is generated close to the consumer, reducing transmission losses, and reduced distribution equipment.
2. Cogeneration plants tend to be smaller, and owned and operated by smaller and local companies.
3. Generally built closer to populated areas, which requires them to be held to higher environmental standards.

Barriers, Barriers, Barriers

The NREL (USA) conducted a study identifying barriers for renewable energy, covering more than sixty five case histories highlights technical and organisational barriers [1].

In some cases, the utilities demand technical standards not demanded from equivalent installations, in others anti-islanding provided with micro computers was usurped demanding 19th century mechanical relays. This mindset often blocks viable projects whilst significantly delaying others.

Future Outlook

A staggering thirty two percent (32%) of the total power generated in 2000 was consumed by air-conditioning [2]. New strategies, including 21st century building and motor efficiency, coupled with cogeneration powered air conditioning systems will lower consumption, pollution and reduce greenhouse gas emissions.

The increasing market demand for renewable energy and lower pollution impacts will drive the T&D network development, moving towards bi-directional and distributed generation. The market structure, backup sources, and billing systems will need to adapt to this lively development.

References

1. Making Connections - Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects, NREL, June 2000
2. HKSAR EMSD www.emsd.gov.hk