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Presentation to
Associação Paulista de Cogeração de Energia

Tendências da Geração Distribuída nos Estados Unidos da América Pós Crise Energética Califórnia e Black Out

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INTRODUCTION AND SOME CONCLUSIONS

- Distributed generation, self-generation and cogeneration are minor sources of electric generating capacity and energy in the U.S.
- The August 14 blackout and earlier California electricity crisis have stimulated new interest in distributed generation, self-generation and even cogeneration.
- Supporters of distributed generation, self-generation and cogeneration have seized on the blackout and energy crisis as arguments for policies favoring greater use of these options.

INTRODUCTION AND SOME CONCLUSIONS

- Some states have promoted distributed generation, and have encouraged greater use of DG technologies
- The U.S. Congress is debating legislation that would provide some modest investment tax credits for new CHP (combined heat and power) facilities and would authorize funding for R&D to develop new distributed generation technologies

INTRODUCTION AND SOME CONCLUSIONS

- ***But*, experience suggests that all this renewed enthusiasm for distributed generation is *not* likely to lead to massive new investment in DG systems in the U.S. any time soon**
  - energy prices in most regions remain lower than the cost of energy produced by DG systems
  - investment capital is currently hard to come by in the U.S. where energy is involved
  - impediments to interconnection remain (though there is hope here)

INTRODUCTION AND SOME CONCLUSIONS

- **Distributed generation, self-generation and cogeneration do, however, have brighter prospects post-blackout and post-California energy crisis in specialized applications in which the loss of electric energy or fluctuations in power quality threaten a process or facility considered critical.**

SOME FACTS AND FIGURES FOR CONTEXT

- U.S. generating capacity totaled 813 GW in 2001
- In 2003 the U.S. will generate 3,836 billion kWh
  - Of this total, 3,677 billion kWh will be generated by the "electric power sector" (i.e., electric utilities and merchant generators)
  - the balance, or 159 billion kWh, will be self-generated or generated by cogeneration facilities
- Thus just over 4% of total electricity generation in 2003 will be attributable to self-generation or cogeneration.

THE U.S. (FOR THE MOMENT) HAS ENOUGH GENERATION…

- In 2000 only 0.5% of total U.S. electricity generation was from “non-utility generation for [customers'] own use.”
- U.S. electric demand grew 3.9% in 2002, but 2003 is likely to see little further growth.
- The consensus view in the U.S. is that generating capacity is currently overbuilt in most regions of the country, and that new generation is not likely to be required in most regions until late in this decade.
- The market for generating facilities is soft.

BUT IT MAY NOT HAVE ENOUGH TRANSMISSION.

- Transmission transactions in the U.S. have increased by 400% in the last four years.
- Over the last decade, U.S. transmission capacity has only increased by 10%.
- Grid investment has declined in the U.S. by about $120 million per year for the past twenty-five years.

SO TRANSMISSION IS SUDDENLY SEEN AS A PROBLEM

- Transmission constraints in key areas, such as California, regularly impede bulk power transfers from areas with surplus generation to areas that are generation short.
- Transmission failures have caused massive blackouts in California and in the Northeast U.S.-Midwest U.S.-Ontario.
- Various electric sector observers claim that from $10 billion to $50 billion to even $100 billion in grid investment may be necessary to accommodate future growth in electricity consumption.

AND INDEED IT HAS BEEN A PROBLEM OF LATE

- The August 14, 2003 blackout in New York, the upper Midwest and the Province of Ontario affected 50 million people
- In numbers of individuals affected and geographic scope, the August 14 blackout was the largest and most costly in the history of North America's electric power industry

THE AUGUST 14 BLACKOUT IN A NUTSHELL

- Unusual voltage variations experienced in the Midwest early in the day due to earlier generator trips (and, perhaps, the operation of some merchant generators)
- Major coal-fired plant near Cleveland tripped off-line, reducing generation and reactive power available in an area that is chronically short of both
- Various Ohio transmission lines failed, forcing greater load on other paths into Ohio

THE AUGUST 14 BLACKOUT IN A NUTSHELL (cont'd)

- Cascading failures of transmission lines led to further generator trips due to the low voltage
- Losses of generation and transmission led to reversals of power flows into and out of New York, Michigan and Ontario
- Voltages collapsed across much of the grid in Ohio, Michigan, New York and Ontario
- The New England and mid-Atlantic grids saved themselves by disconnecting from the Midwest and New York grids
- New York, Cleveland, Detroit, Toronto and numerous other major load centers went dark

THE ELECTRICITY GRID IS NOW A HOT TOPIC

- It's never a good thing for the energy sector when energy issues make it onto the front pages of *The New York Times* and *The Wall Street Journal* and into the nightly TV news.
- People now stop me on the street to ask me why our electric grid isn't reliable any more
- The U.S. Congress is considering the first major energy legislation in a decade, and is keeping at it because of the problem of appearing to do nothing after the August 14 blackout and California energy crisis.

AND CALIFORNIA'S ENERGY CRISIS HAS NOT BEEN FORGOTTEN, EITHER

- One major California utility is still working its way out of bankruptcy
- Investigations concerning alleged manipulation of California electric energy markets are not done yet
- California is locked into a number of high cost contracts executed by the state after the utilities lost the credit capacity to contract themselves
- California will soon have a new governor, in large part because of the energy crisis

IN THE WAKE OF THE BLACKOUT AND CRISIS, A SEARCH FOR SOLUTIONS

- U.S. federal and state authorities and their Canadian counterparts are currently engaged in a number of high profile efforts to address electric grid reliability issues, including steps intended to promote --
  - mandatory transmission grid reliability standards
  - transmission grid investment
  - investment in innovative energy technologies that could enhance grid reliability
  - distributed generation, self-generation and cogeneration

DISTRIBUTED GENERATION AS ONE POSSIBLE RESPONSE

"Distributed Generation" defined: decentralized generation (usually on or near the site of the end-user) that supplies end-user load.

- DG facilities may be owned and operated by an end-user (self-generation), or may be owned by an independent power producer.
- Some DG facilities in the U.S. are utility-owned and dispatchable by the utility.
- Many DG facilities are combined heat and power (or cogeneration) facilities (now the fashionable acronym is CHP).

DISTRIBUTED GENERATION'S ROLE IN THE U.S.

- DG currently makes up a small but important slice of the U.S.energy pie
  - 95% of Distributed Generation is cogeneration,
  - most of the cogenerators are natural-gas fired, though biomass and coal make up a portion
- Conventional fuels are likely to account for most of any near-term growth in distributed generation

DISTRIBUTED GENERATION'S ADVANTAGES

- Enhances reliability
- Reduces loadings on existing transmission capacity
- More efficient (reduced line losses)
- Could foster alternative energy use
- Could put downward pressure on wholesale electricity prices by reducing demand for utility-supplied power and increasing utilities' supply
- Could reduce carbon emissions and other air emissions

DG'S POTENTIAL DISADVANTAGES

- Could adversely affect grid reliability if system operators have difficulty in managing a much greater number of power sources
- Could adversely affect air quality
- Could result in reduced utility revenues that would have to be made up from other sources

ENCOURAGING DISTRIBUTED GENERATION: CALIFORNIA'S DG INCENTIVE PROGRAM

- Four year program (2001-04), $125 million/yr.
- Utilities administer funds to disburse to customers who deploy qualified equipment
- DG equipment must supply all or a portion of the facility's on-site energy needs (does not include "back-up" generation equipment)
- Equipment must utilize "eligible" technologies such as photovoltaics, wind turbines, fuel cells, microturbines, small gas turbines, internal combustion engines
- Financial Incentives range from $1,000/kW to $4,500/kW

CALIFORNIA PROGRAM'S RESULTS TO DATE

- 1st Year of Program (2001):
  - 19.15 MW of projects funded
  - Less than $20 million allocated in incentives
- 2nd Year of Program (2002):
  - More that 75 MW of projects funded
  - $82 million allocated in incentives
- More than 178 applications have been filed for Distributed Generation projects.
- If all were installed, the total capacity would be more than 75 MW

ENCOURAGING DISTRIBUTED GENERATION: NEW YORK CITY TASK FORCE

- The New York City Emergency Response Task Force, created to evaluate the city's response to the August 14 blackout, has recommended that city agencies and large end users install more backup generation to provide emergency power
  - City building codes may need to be revised to allow installation of emergency generators and adequately sized fuel tanks
  - One success story was a fuel cell-powered police substation located in Central Park which continued normal operations throughout the blackout

ENCOURAGING DISTRIBUTED GENERATION: GENERATOR INTERCONNECTION POLICIES

The U.S. Federal Energy Regulatory Commission is developing standard procedures that will govern generator interconnection and parallel operation with the grid

- Large generators (> 20 Mw):
  - pro forma interconnection agreement and procedures
  - standardized generator interconnection pricing (generator pays for facilities on its side of the interconnect, and pays for upgrades on the utility's side subject to refund over 5 years
  - specifies 4 interconnection studies utilities may require

ENCOURAGING DISTRIBUTED GENERATION: GENERATOR INTERCONNECTION POLICIES

- Small generators (≤ 20 Mw):
  - pro forma interconnection agreement and procedures
  - standardized generator interconnection pricing (generator pays for facilities on its side of the interconnect, and pays for upgrades on the utility's side subject to refund over 5 years
  - specifies 4 interconnection studies utilities may require
  - provides for expedited procedures for qualifying small generators

ENCOURAGING DISTRIBUTED GENERATION: GENERATOR INTERCONNECTION POLICIES

- Some state regulatory bodies have also started to limit instances in which utilities can require costly studies into the reliability and safety of particular types of equipment.
  - For example, the New York Public Service Commission pre-certifies some types of equipment, reducing the need for studies on safety and reliability, and facilitating the use of standard equipment

ENCOURAGING DISTRIBUTED GENERATION: PROPOSED ENERGY LEGISLATION

- CHP Investment Tax Credit: proposed energy legislation would introduce a 10% investment tax credit for new CHP systems.
- Research and Development: proposed energy legislation would appropriate funds for research and development to develop distributed energy and micro-cogeneration technology, and requires the Secretary of Energy to provide Congress with a strategy for a comprehensive research, development, demonstration and commercial application program within one year.

ENCOURAGING DISTRIBUTED GENERATION: PROPOSED ENERGY LEGISLATION

- *But*, the proposed energy legislation would also repeal federal law's mandatory purchase and sale requirements applicable to power produced by qualified cogeneration facilities
- So federal law may end up being *less* supportive of cogeneration than it has been for the last 15 years

PROSPECTS FOR DISTRIBUTION GENERATION IN THE U.S.? UNCLEAR.

- It is far from certain whether the surge in interest in distributed generation will last as memories of the August 2003 Blackout fade.
  - Although the California energy crisis sparked increased interest in Distributed Generation, as soon as energy prices stabilized and the rolling blackouts of 2001 did not recur, interest began to wane.
  - It continues to be difficult to attract investment for generating projects (with the exception of wind power projects)

PROSPECTS FOR DISTRIBUTION GENERATION IN THE U.S.? UNCLEAR.

- A big unknown for distributed generation, self-generation and cogeneration is the likely future path of federally-driven electricity deregulation/market restructuring:
  - If wholesale electric market restructuring is permitted to continue, federal regulators will have a major role in reducing impediments to DG development.
  - If, on the other hand, the proposed energy legislation is passed, the federal role will be constrained for several years and local utility resistance to DG will continue in some areas.

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