SITING OF DR UNITS: RULES OF THE GAME

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Paul Lemar and E.J. Honton
Resource Dynamics Corporation
ejh@or.rdcnet.com
703-356-1300

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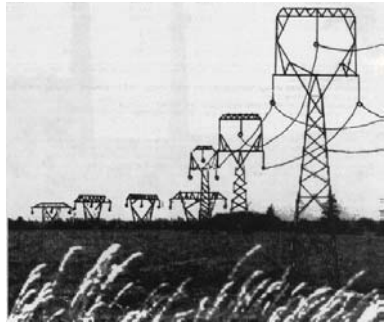
The siting game

- What DR is being sited?
- How are siting rules evolving?
- Who is siting/installing DR?
- Eight guidelines for DR siting

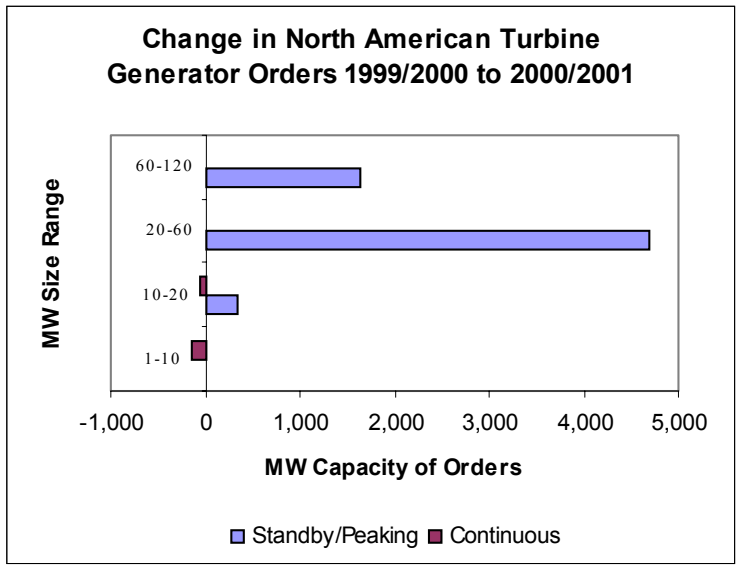
The “grid” is no longer assumed



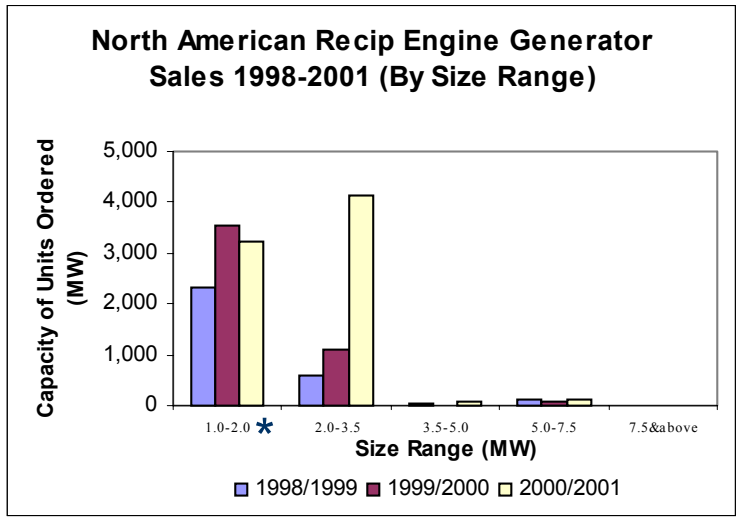
- Transition to competitive energy marketplace underway
- National concerns over grid reliability and security are well established
- Facilities seeking more control over power supply
- A diverse set of DR solutions emerging
  - Fuel cells
  - Microturbines
  - Renewables
  - Reciprocating engines and combustion turbines
- DR solution providers are seizing the opportunity

Recent DR sales show engine orders climbing and turbines dropping

- Most small turbine growth has been for central station peakers (not DR)
- Smaller, DR baseloaded turbines (mostly CHP) have actually declined, from about 160 MW to about 20 MW



- In the past two years, mid-sized engines (2-3.5 MW) provided explosive growth in new recip engine capacity



**While overall MW declined for this size range during 99-01, the number of units actually increased, but a drop in the average size led to a decline in the capacity of orders.*

Source: *Diesel and Gas Turbine Worldwide* Annual Survey

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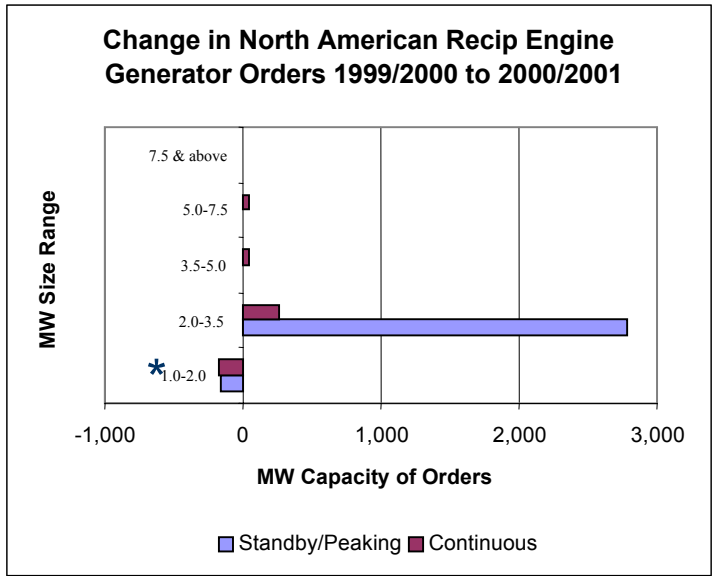
Growth in reciprocating engine sales results from need for backup power

- The 1-2 and 2-3.5 MW units are mostly peaking/standby units fueled by diesel, with some continuous duty natural gas fired applications.
- Of these, many can be attributed to data centers, as well as backup power for larger commercial and industrial facilities, particularly in California.

Detroit Diesel Prime Mover



**While overall MW declined for this size range during this period, the number of units ordered actually increased, but a drop in the average size led to a decline in the capacity of orders.*

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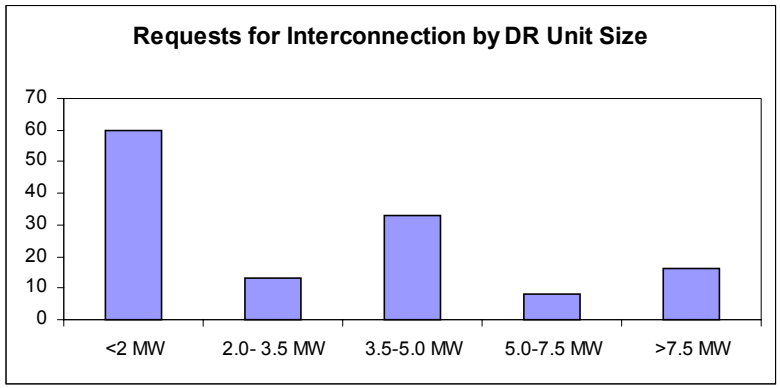
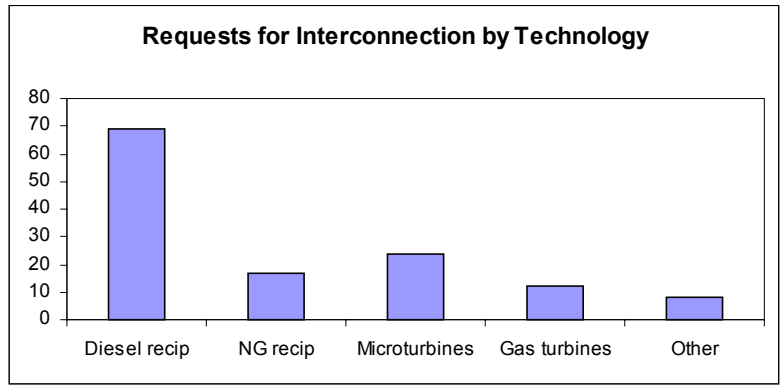
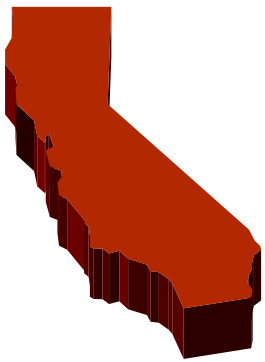
Recent siting activity has been for larger and more technologically diverse units

- From September 2000 through August 2001, 130 applications for DR interconnection were received by the 3 large California utilities. This is an increased level of activity over earlier years.

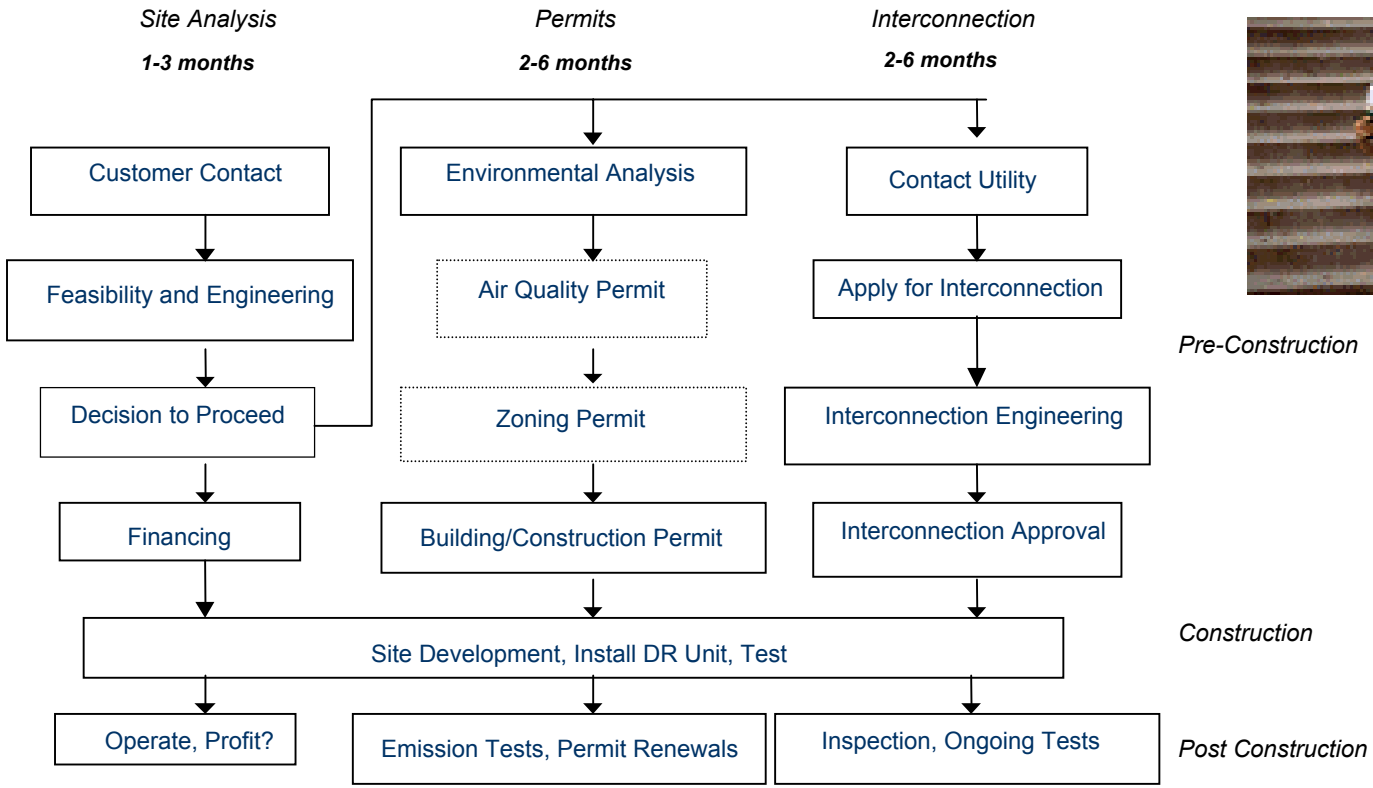






- Most requests were for < 2MW units, with a substantial number of requests for siting units in the midsize 2-5 MW range.
- On average, these are larger and more technologically diverse units than those in the installed base (>90% are < 2 MW and >90% are diesel recips).

DR siting process can be complex



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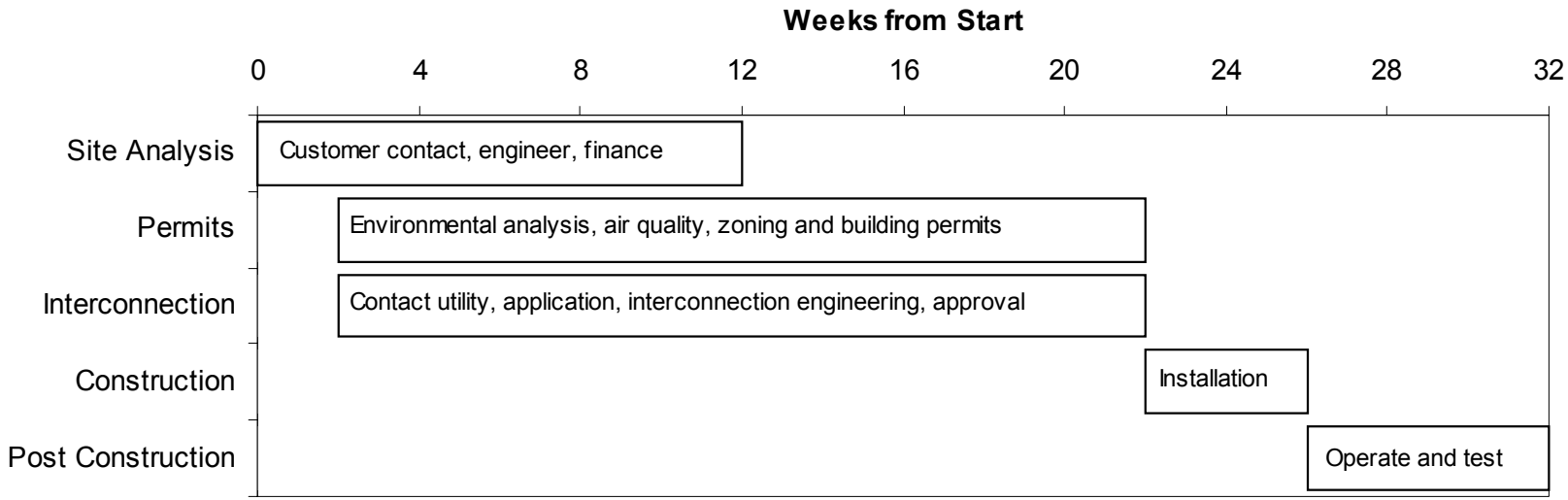
Concurrent parallel tasks reduces DR siting time



Process still takes many months.

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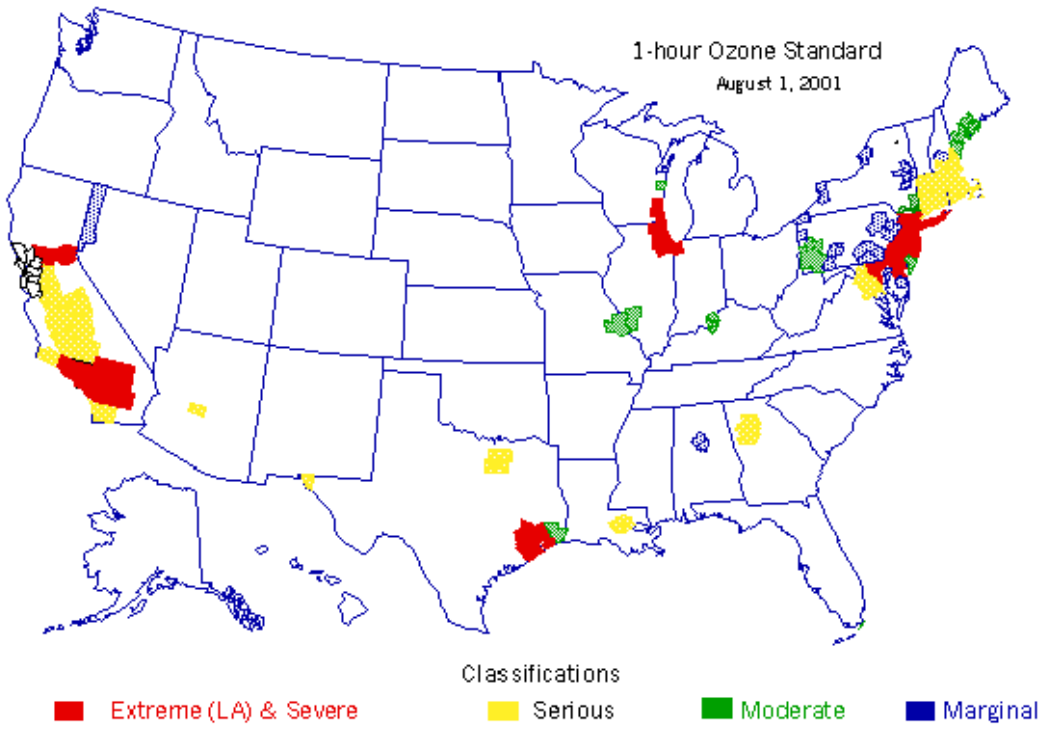
Ozone nonattainment areas within the U.S.



The type of DR unit that can be sited depends on the region where it is located.

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DR units have variable emission levels by technology

Emission Levels for Reciprocating Engines (g/bhp-hr)

Unit Type	Uncontrolled				Typical Post- Comb. Control Tech	Controlled			
	NO_x	CO	THC	PM		NO_x	CO	THC	PM
Diesel	5-7	.7-4	.2-.4	.15	SCR	.25-3.5	Not Applicable		
Dual Fuel	7-9	2-5	1.5-6	N/A	SCR	.35-2	Not Applicable		
Rich Burn NG	10-31	1-20	.4-2	.003	NSCR	.5-5	.15-5	.02-.4	.0001-.0006
Lean Burn NG	.5-2	.6-2	1-8	.001-.004	SCR	.02-.4	Not Applicable		

Emission Levels for Natural Gas-Fired Turbines (ppm)

Unit Type	CO	THC	PM	NO_x	NO_x (w/SCR)
Turbine (uncontrolled)	2-115	1-17	2-9	75-170	N/A
Turbine w/ Water/ Steam Injection	10-200	N/A	N/A	25-45	5-10
Turbine w/ Dry Low NO_x	N/A	N/A	N/A	9-25	3-5
Microturbine	5-30	3-9	2-9	9-25	N/A

Many DR units being sited/installed will require emission control technologies.

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Interconnection

- Dominant benefits of DR flow from interconnection:
  - Obtaining backup power from the grid in the event of a DR system outage, eliminating the need for complete system redundancy;
  - Taking advantage of the opportunity to export power to the grid, or to the power pool in deregulated markets; and,
  - Improving overall customer system reliability by providing an alternative power supply option.
- Requires close cooperation with the distribution utility.
- Widely variable rules (by utility) are becoming more uniform under IEEE P1547, California Rule 21, Texas Interconnection Manual, New York Interconnection standards, etc.

DR siting process is moving to integrated solution providers

Traditional siting process
- Customer hires A&E
- Customer secures financing
- Customer hires general contractor
- Contractor hires subcontractors
- Contractor works closely with utility

Integrated solution provider
- Customer hires DR developer, ESCO, or DR manufacturer
- Solution provider arranges A&E, secures permits, locates financing, oversees construction, works with utility

Integrated solution providers

- Recently, firms are offering integrated DR siting and installation services, especially in states that have
  - Undergone deregulation (allowing DR projects to proceed and to interconnect with the grid),
  - Face high electric grid prices, and
  - Face great uncertainty as to electric supply reliability.
- These integrated solution providers are
  - Energy service companies (ESCOs),
  - A&E firms that specialize in DR projects,
  - DR genset manufacturers, and
  - DR development specialist firms.
- Many operate exclusively in one state, specializing in projects that meet local regulations and permit requirements.

Typical siting costs

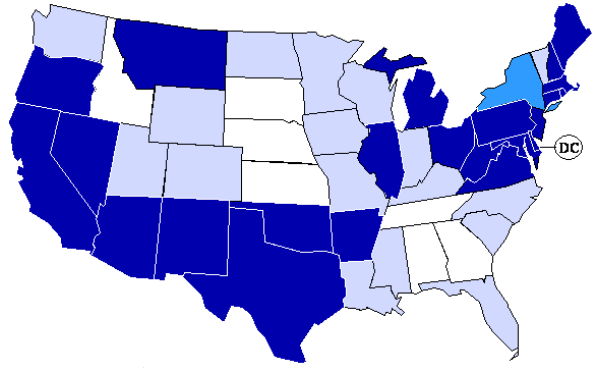
- Siting costs vary greatly by project size, location, complexity and the role of outside parties.

Typical Siting Costs

	Smaller project (< 1MW)	Larger projects, complex situations
Environmental analysis, permits	$10,000-$50,000	Up to $200,000
Interconnection studies	$5,000-$30,000	$50,000-$150,000

- Total “soft costs”, including engineering, permitting, interconnection, installation and testing, range from about $200/kW up to $900/kW for projects from 50 kW to 10 MW of capacity.
- Many costs are fixed, so larger projects have lower per kW soft costs.

Impacts of state electric restructuring on DR siting



- Some state regulators are encouraging DR development, through customer grant programs and net metering efforts.
- Some states have enacted clear DR rules regarding net metering, interconnection, air emissions and stranded costs. However, there is room for considerable improvement in consistency between state regulations.
- The regulations covering siting and permitting of DR will continue to evolve.

Eight guiding siting principles

1. Careful up front planning will reduce unnecessary risks.
2. The size of unit to install is a critical initial decision. Interconnection allows selling any excess generation.
3. Siting of DR is far from plug and play.
4. Interconnection approval is expected to continue to be a major time component in siting as well as a cost issue to deal with.
5. Pre-certification programs will mitigate uncertainty in the design and permitting process, thus lowering costs.
6. Concurrently seeking financing, permits and interconnection approval can significantly reduce project development time.
7. Hiring an integrated solutions provider may save on total project costs.
8. Documentation and communication should be paramount concerns during a project.

Conclusions

- “Rules of the game” are changing – larger DR units, more technologically diverse DR, changing regulations, restructured customer markets, and evolving integrated solution providers.
- The siting process can be straightforward with good planning, but complications often increase project time and costs.
- DR use will continue to increase, due to improving DR technologies and declining capital costs, increasing grid prices and/or grid supply uncertainty. Changes in regulatory environment can be a plus or minus.
- Integrated solution providers are now approaching likely categories/niches of customers who may benefit from DR. The siting/installation of DR is a competitive industry.