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STRATEGIC CONSULTING | Energy

Demand Growth: Realizing the Potential of Distributed Energy

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White Paper

Key Questions for Today's Discussion

- Distributed Energy (DE)/ Distributed Generation (DG) is not a new topic – why now?
- If it is such a good idea, why are we still talking about its 'potential'? Why hasn't DE already become the standard?
- What does a successful DE strategy look like? (Are there examples?)
- What are the questions to ask to get started?

Various factors are driving a renewed interest in integrating distributed energy resources into the nation's generation mix

Why Distributed Energy Now?

- Preference to defer large-scale central generation projects due to uncertainty around load growth, regional policies, environmental regulation/costs, and continued rate pressure
  - Low and less volatile natural gas price significantly improves gas project economics vs many options
  - Pressing need to improve grid performance and to provide lower-cost options to provide targeted backup and/or peaking power – both utility and customer sited solutions
  - Advantaged financial risk and time to complete versus large projects
  - Slow pace of development of new transmission shifts focus to localized alternatives
- Technology advancements in distributed energy technologies and implementation of smart-grid infrastructure are creating new options for consumers
  - Distributed energy fired by fossil fuels (including natural gas) is a mature, proven technology for increased reliability and lower power costs
  - Many alternative, environmentally-friendly distributed technologies, from biogas to solar, have improved
  - SmartGrid technologies are enabling net-metering and grid management/optimization
  - Advancements in technologies for smaller installations, aimed at residential and commercial applications
- Increasing regulatory and policy support for RPS and net-metering based on environmental and efficiency concerns combined with advanced technologies

There may be no perfect time, but how can it get much better?

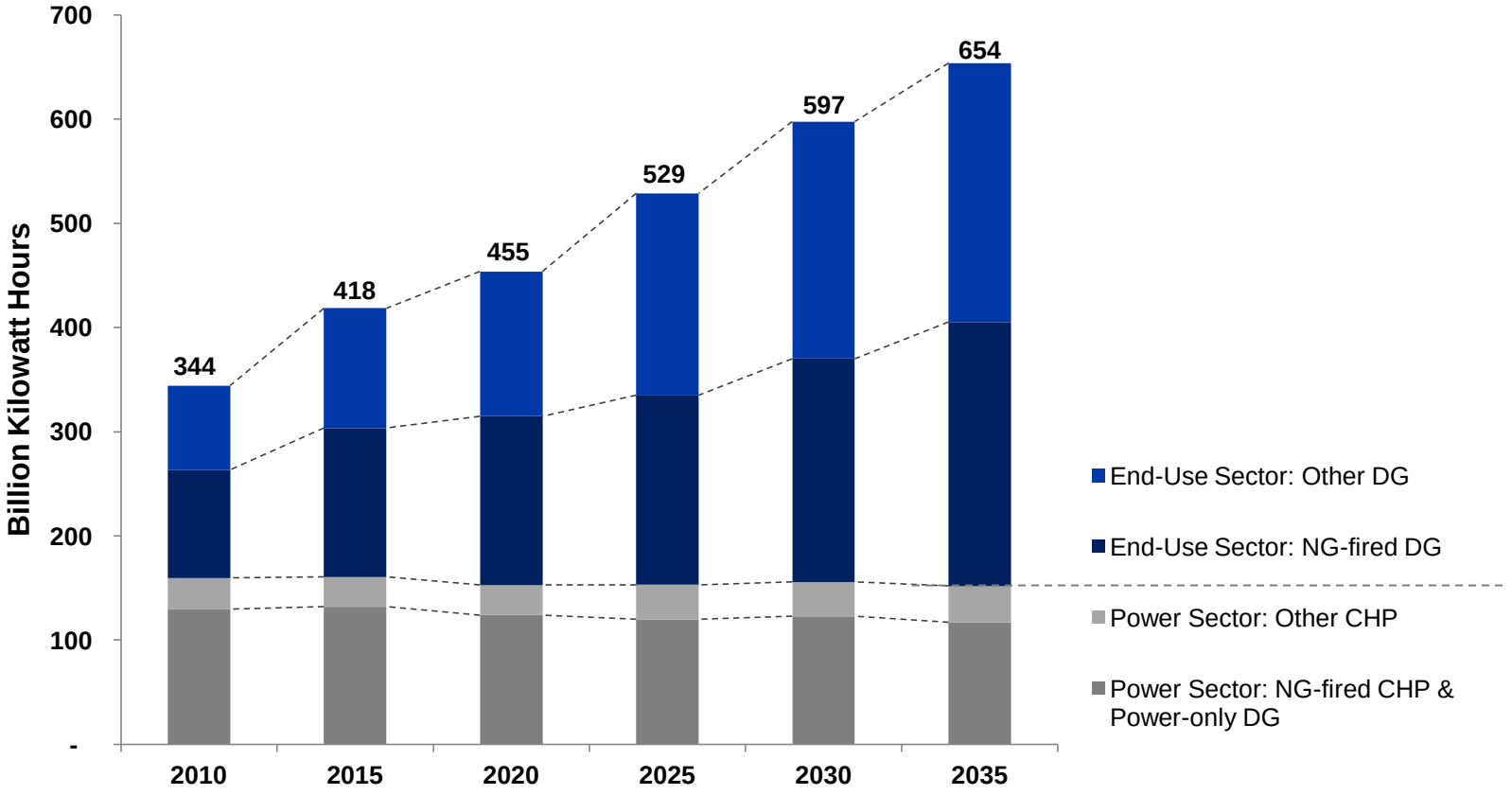
Did these Drivers Favor DE?

Drivers	1986	1996	2001	2006	2011
Natural gas price					
Long term gas supply/ perceived volatility					
GHG concerns					
Utility appetite for large-scale new build vs. DE					
Merchant appetite for new build					
Capital availability					
Cost of capital					
Customer perceptions – gas vs other fuels					
Utility ‘grid parity’					
Consumer & political preference for energy independence					
Technology evolution (Technology risk)					
Regulatory support					
Legislative support (RPS, tax incentives)					

Source: Bridge Strategy Group

The EIA estimates that distributed energy will almost double over the next 25 years, driven primarily by growth in the end-use sector

Distributed Generation Growth Projections



% of Net Generation	8%	10%	10%	11%	12%	13%

Source: Energy Information Administration, Annual Energy Outlook 2011

The Natural Gas-fired DE technologies in these projections meet a wide range of residential, commercial, and industrial needs

Applications and Markets for Gas-Fired DE Technologies

DG Technologies	Standby Power	Baseload Power	DR Peaking	Customer Peaking	Premium Power	Utility Grid Support	Combined Heat & Power	Applicable Market Sectors
Reciprocating Engines (50 kW to 5 MW)	X	X	X	X	X	X	X	• Commercial buildings • Light industrial • Utility grid • Waste fuels
Gas Turbines (500 kW to 50 MW)		X		X	X	X	X	• Large Commercial • Institutional • Utility Grid • Waste Fuels
Steam Turbines (500 kW to 100 MW)		X			X		X	• Institutional • Buildings/ Campuses • Industrial • Waste Fuels
Microturbines (30 kW to 250 kW)	X	X	X	X	X	X	X	• Commercial buildings • Light industrial • Waste fuels
Fuel Cells (5 kW to 2 MW)		X			X	X	X	• Residential • Commercial • Light industrial

The applicability and mix of DE technologies will be unique to the customer segments and needs of each utility's service area.

Source: *"Gas-Fired Distributed Energy Resource Technology Characterizations" – Gas Research Institute and National Renewable Energy Laboratory, November 2003*

Why has DE not already become the 'standard' for new development and retrofits?

Key Barriers to Realizing DE Potential

- Distributed Energy creates value in many ways for a variety of participants, much like the move towards other parts of a 'smart grid'. But the 'central generation' and 'central regulation' business model is not aligned to capture these benefits
  - Complicated and costly interconnection standards
  - Complexity of developing/ operating numerous projects and the scale of each project
  - Lack of proper pricing mechanisms
- Overall value can be compelling, but much less so if approached as a single application for all customers
  - Customer-side economics require tailored solutions
  - Leading companies are focusing on getting the business model right before committing resources
- DE represents a set of complex financial and operational decisions for customers
  - First costs of investment
  - Permitting issues: air, noise, water, etc.
  - Finding the right installation partner

Utilities can have conflicting perspectives in their support of DE

Potential Utility Perspectives

Electric

- Benefits
  - Grid stability (utility and customer-based solutions)
  - Smaller project risk
  - Potential for capex deferral
  - Customer-sited solutions
- Concerns
  - Not prepared for the distributed nature and scale of DE
  - Managing intermittency of solar & wind
  - Added complexity (costs, maintenance, and skill requirements
  - Threat of grid access and bypass

Gas

- Benefits
  - Volumetric growth for those who can benefit from it
  - Possible shift in customers from interruptible to firm use
  - Infrastructure rate base
  - Environmental profile
  - Customer experience
  - Asset ownership options
- Risks
  - To distribution infrastructure if unconstrained
  - “Is it worth the effort”? O&M costs of smaller scale projects and new businesses
  - Beyond the meter support requirements

Combination

- How to evaluate incremental electric vs gas capex and changes in O&M?
- How do the gas and electric businesses reach a decision on these issues?
- Do they need to have an integrated approach?

And like most supply decisions, state and regional factors play an important role in the process

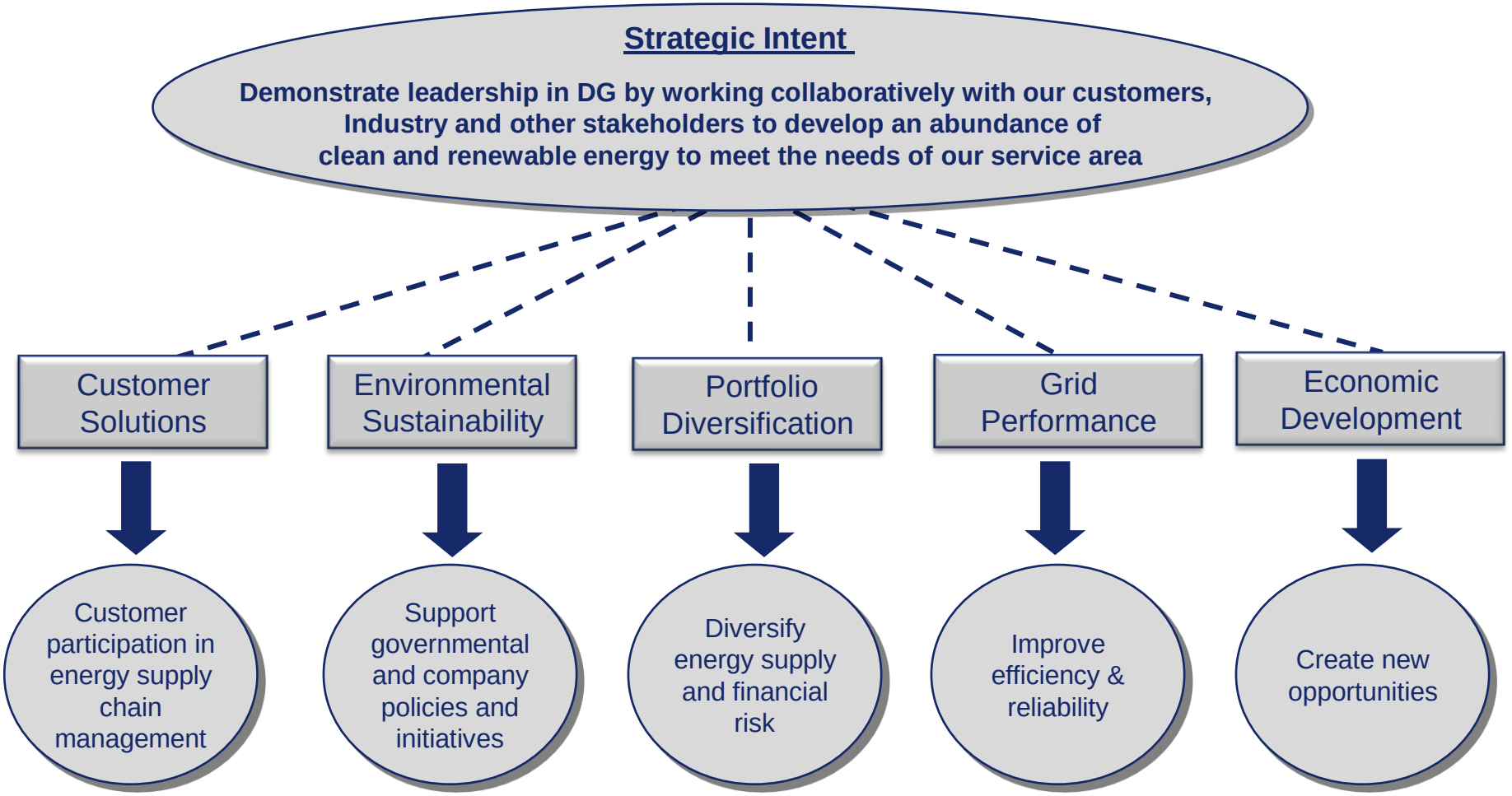
- There is a strong regional nature to DE markets
  - Oil to gas conversions in the Northeast lead to new opportunities
  - Intermittent renewable backup – solar and wind markets
  - Increase electric reliability in markets where there is little load growth and/or industrial dislocations have changed demand
  - Regional capacity and ancillary service markets
  - Interconnection policies
  - Regional air quality and GHG initiatives
  - Potential help to offset coal plant closures

- State based regulation also leads to the creation of business models tailored towards specific regulatory preferences and precedents

US CENSUS DIVISION	INTERCONNECTION LIMITATIONS (1=RESTRICTIVE, 9=PROGRESSIVE)	ELECRTIC RATES (1 =LOW , 9=HIGH)
NEW ENGLAND	8	9
MIDDLE ATLANTIC	6	8
EAST NORTH CENTRAL	7	5
WEST NORTH CENTRAL	5	2
SOUTH ATLANTIC	3	6
EAST SOUTH CENTRAL	1	1
WEST SOUTH CENTRAL	2	4
MOUNTAIN	4	3
PACIFIC	9	7

Source: EIA, Annual Energy Outlook 2011, Bridge analysis

Some utilities recognize DE provides value across multiple dimensions (Client 1 example)



One result of this utility DG strategy was recently described as: "the commercial distributed generation market in the state is moving so fast that regulators cannot keep up "

Source: Bridge Strategy Group

Some utilities recognize DE provides value across multiple dimensions (Client 2 example)

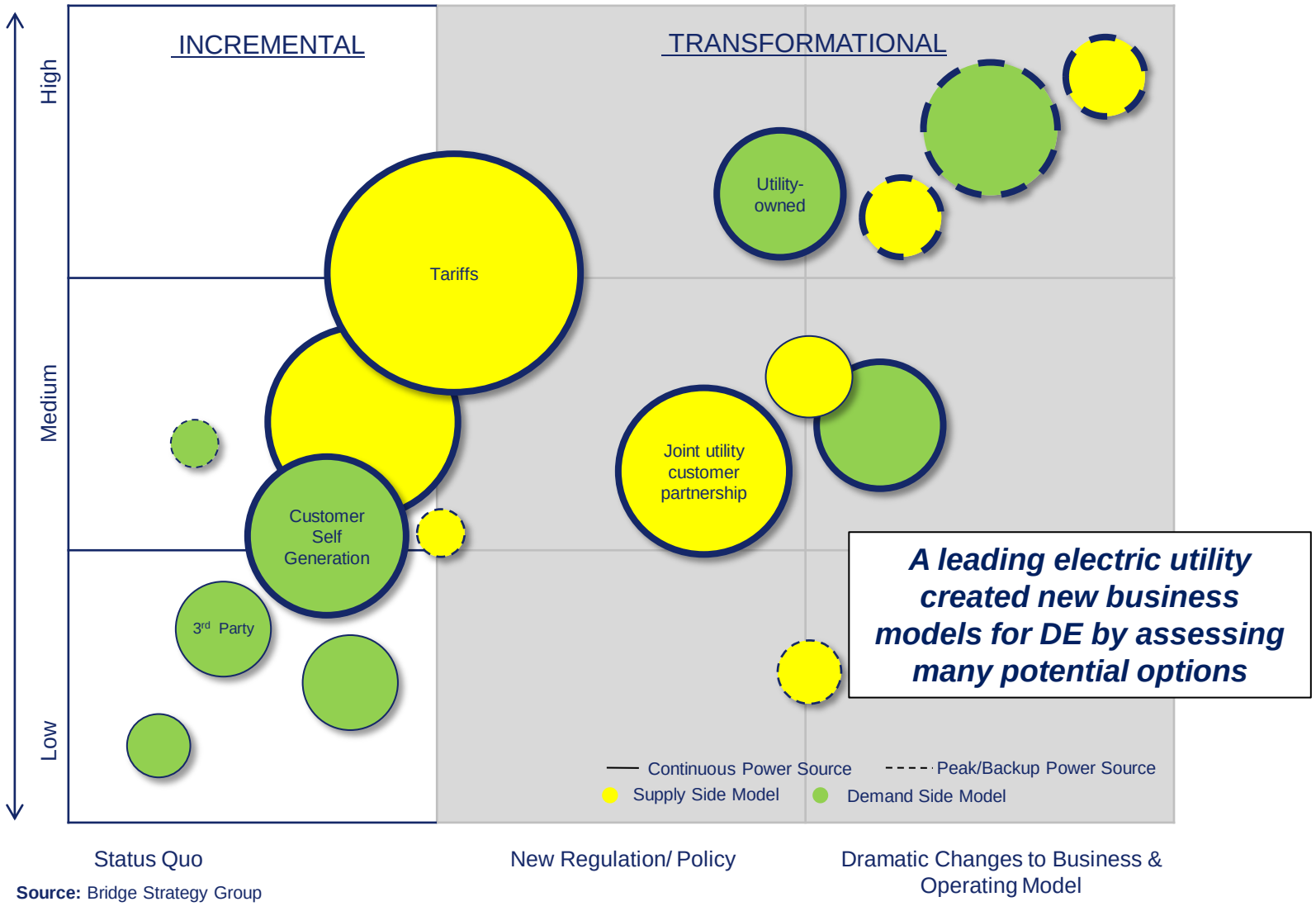
A "top 10" electric utility explicitly defines the role of DG in its strategic plan

Benefits of Distributed Generation

- **Meet Customer Requirements:** Customers are increasingly approaching the company for interconnection and rate design as well as policies for electric supply-side DG (e.g. net metering)
- **Improve Cost Effectiveness of Electric T&D System:** Reduction and/or deferral of electric system reinforcement investments due to reduction of peak demand in local load pockets and resultant reductions in peak loading on distribution transformers
- **Reduction in Electric Purchased Power Expense:** Integration of more efficient energy sources and lower line-losses from co-location may reduce kW and kWh purchases
- **Enhanced Electric Grid Performance:** DG integration will result in increased reliability and stability of the distribution network during multiple contingencies by reducing peak loading of distribution transformers
- **Environmental Sustainability:** Co-located and/or efficient distributed resources realize significantly less line loss than central resources reducing the GHG impact of electricity. In addition, utility promotion of renewable DG such as PV, small wind, and small hydro may play a significant role in achieving RPS
- **Supply Portfolio Diversification:** The Company can incorporate diverse technologies and fuel sources. DG also creates an opportunity to reduce financial risk through small geographically dispersed projects
- **Economic Development:** Opportunity to drive job creation around specific technologies and project construction. This has been jumpstarted with Federal stimulus funds

Source: *Bridge Strategy Group*

Many of the DE business models for electric utilities require business transformation (Client 3 example)



Source: Bridge Strategy Group

Successful DE results from business models tailored to specific customer segments that also meet utility needs (client example)

Results based on direct customer interviews and collaborative economic modeling

Business Model Applicability

- ● High
- ◑ Moderate
- ○ Low

		Industrial			Commercial				Municipalities			Residential	
		Paper & Pulp	Sawmills	Other	Education	Ag	Hospitals	Other	w/landfills or MSW	w/WWT	Other	Single Family	Other
Customer PPAs	Market-Based Pricing	◑	◑	○	○	○	○	○	●	●	○	○	○
	Custom Renewable Tariffs	◑	◑	◑	●	●	●	●			●	◑	◑
Utility Ownership	…	○	○								●	○	○
	Utility Owned Customer Directed	○	○								○	○	○
…	Customer Self Generation	●	●								○	◑	◑
DSM & DG Bundling	Integrated Energy Management Solutions	●	●								○	○	○
…	Aggregator	○	○	◑	○	○	◑	◑	○	○	○	●	◑

"One size fits all" is not the way to approach the market for DE

Source: Bridge Strategy Group

Full support of DE by an electric utility has major organizational implications (client example)

Grid Modernization

- Define business & technical requirements to support DG business models
- Develop and implement AMI/Smart Grid plan to support DG programs including support for pilots

Safety, Health & Environment

- Environment & Sustainability: Assess environmental benefits (or issues) attributed to DG programs/projects
- Safety & Health, External Safety - Design of safety procedures/policies relative to DG programs/projects

Customer Service/ Solutions

- Power Supply: Review and approval DG project applications
- EE/DR: Design of integrated Energy Management Solutions portfolios
- Marketing and Customer Care: Identification of customer DG opportunities, participation in customer discussions regarding DG projects, on-going customer management and site support

Operations

- Asset Management: Feeder level modeling, identification of DG opportunities to defer T&D capital upgrades or improve reliability (e.g. self-islanding).
- Planning and support on interconnection feasibility studies

Corporate Finance/Regulatory

- Strategy: Assess strategic implications of DG strategy, support on strategic DG partnerships
- Regulatory: Design and implement regulatory strategy to support DG strategy

Engineering

- Distribution Engineering: Project management/inspection pertaining to interconnection for DG projects

Source: Bridge Strategy Analysis

Developing DE strategies for utilities starts with resolving some specific questions

Perspective	Key Questions

Regional Potential	• What is the technical and market potential (energy and financial) for gas-fired DE?
	  • Evaluation of other feasible/competitive DE technologies
	  • Local regulatory and legislative support

Customer Needs and Mix	• What are the highest value customer segments?
	• At the segment level
	  • What technologies and fuels are most applicable?
	  • What are the decision points and who helps to influence?

Gas Utility Implications	• Is it meaningful enough for an LDC to support?
	  • Volume for those who benefit from volume?
	  • Implications for cost sharing, infrastructure build, and new customer attachments?
	  • Potential shifting of interruptible to firm customers?
	• Small projects – cost to support – what is sufficient scale, standardization required?
	• How will DE impact field operations?
	• What business models are best suited to accelerate DE adoption in a manner that is beneficial to all stakeholders?
	• How will the electric business respond?

Regulatory and Policy	• What regulatory and policy support is required – federal, state, local?

Summary: the role of gas-fired distributed energy

Rationale

- Improves reliability, high efficiency (no line loss)
- Natural gas delivery infrastructure already in place in many areas
- Customer interest in efficiency
- Can eliminate or defer need for large energy infrastructure investments (plants, T&D) – lowering pressure on rates
- NG has significant advantages to other DE sources…
  - Renewables – lower overall cost* and no intermittency issues
  - Other fossil fuels – lower overall cost* and significantly cleaner
- …with lower risks
  - Potentially lower community and regulatory risk than central gen
  - Proven technology and processes
  - Lower costs to build and operate

Reality

- Economic downturn
  - Significant up front investments
  - Constrained capital markets
  - Slowdown in new construction / building renovations
- Risk averse and cost-focused utilities not pushing DE, given uncertainty of smart grid and Incremental O&M cost of adopting new business models
- No coherent legislative action / response for overall DE and/or NG fueled DE
- Lingering concern of natural gas volatility, despite shale
- Existing natural gas infrastructure has to be enhanced in some cases, conflicting with regulatory pressure on cost, and raising the risk of socializing costs of targeted investments

Potential

- Economic recovery would increase demand, new construction and improve capital markets for DE projects
- Continued regulatory pressures to keep rates down in the short term may delay large-scale capacity investments and increase focus on DE
- Lack of regulatory or consumer support for any dispatchable generation fuel other than gas
- Eventual legislation and better understanding of smart grid technologies / applicability will provide clarity helping industry constituents develop a coherent response
- Some companies will experience success with transformational business models, motivating others

**Assumes natural gas prices continue to stay low (i.e., ~$4-$6) with unconventional supply*

Appendix

Gas-fired DE technologies can be used in a variety of applications to perform specific functions

	Technology	Description	Important DG Characteristics
Combined Heat & Power	**Combined Heat and Power**	End users with significant thermal and power needs can generate both thermal and electrical energy in a single combined heat and power system; can substantially increase efficiency of energy utilization, resulting in lower operating costs and emissions reductions	High useable thermal output; low maintenance costs; low emissions; high reliability
Power-Only Applications	**Base Load / Remote Power**	For commercial and industrial applications in high electric price areas or in specialized situations, such as remote sites or availability of low cost (or no cost) waste fuels	High electric efficiency; low maintenance costs; low emissions; high reliability; multi-fuel capability
	Utility-Based Grid Support	Used by an electric utility to provide ancillary services at the T&D level, or to replace or defer T&D investments	Llow installed costs; low maintenance costs; high reliability
	Demand Response Peaking	Utility offers capacity and/or commodity payments for very limited hours of use; typically require as few as 50 hours/year to as many as 400 hours/year	Low installed cost; low maintenance fees, quick start-up
	Customer Peaking	Can be used to reduce utility demand charges, defer retail electricity purchases during high-price periods, or to secure more competitive power contracts from energy service providers by smoothing site demand or by allowing interruptible service	Low installed cost; low maintenance fees, quick start-up, high efficiency
	Premium Power	Either provide high-quality power to sensitive-load customers at a higher level of reliability and/or higher power quality than is typically available from the grid; current approaches employ on-site generation as the primary power source and the grid as back-up	High efficiency; low maintenance costs; high reliability; clean power output; low emissions
	Backup Power	Backup power systems provide power only when primary source is out of service; often required for customers such as hospitals and water pumping stations and also for customers with high forced outage costs (e.g. retail, telecommunications, process industrials)	Low capital costs; black start capability; high reliability; low fixed maintenance costs

Source: *"Gas-Fired Distributed Energy Resource Technology Characterizations" – Gas Research Institute and National Renewable Energy Laboratory, November 2003*

CHP capacity additions – historical perspective

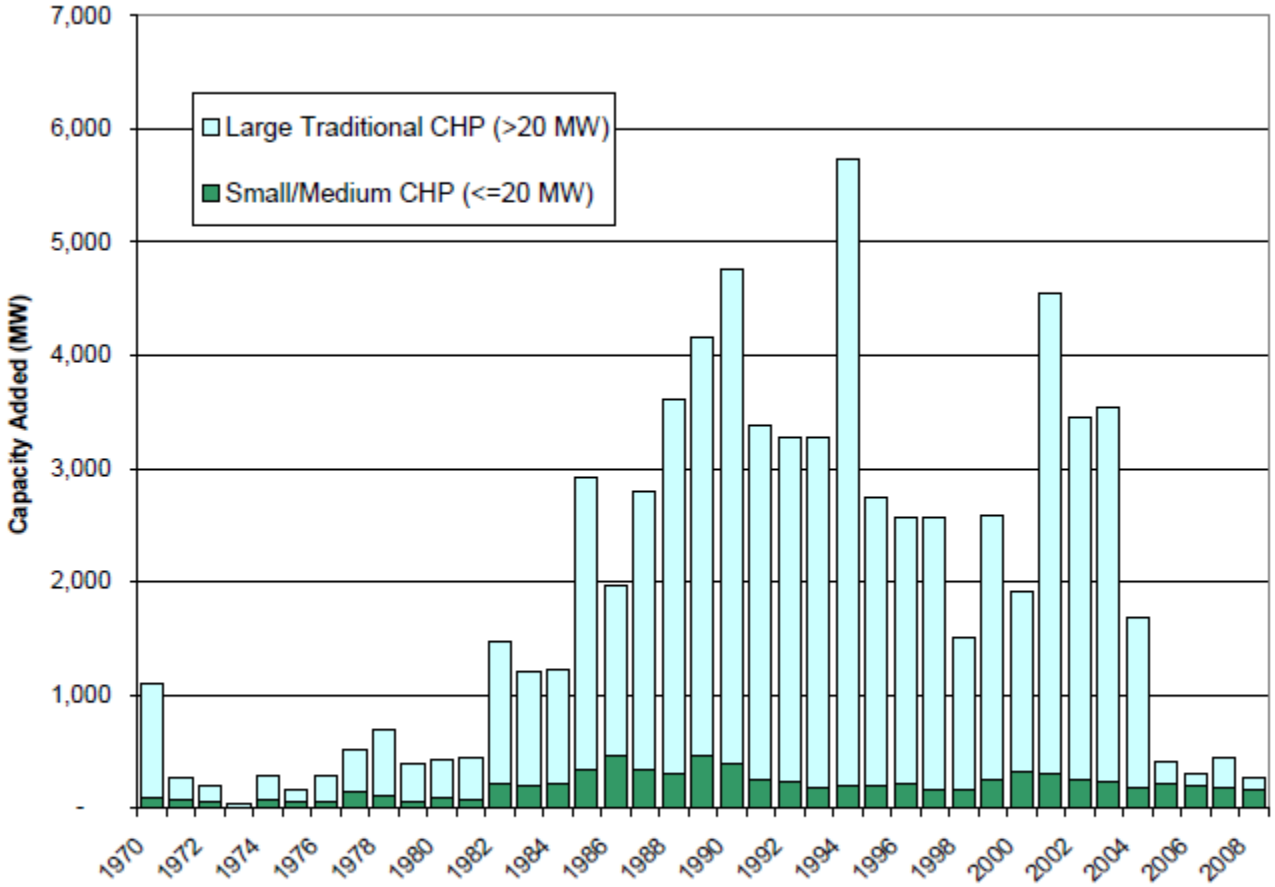
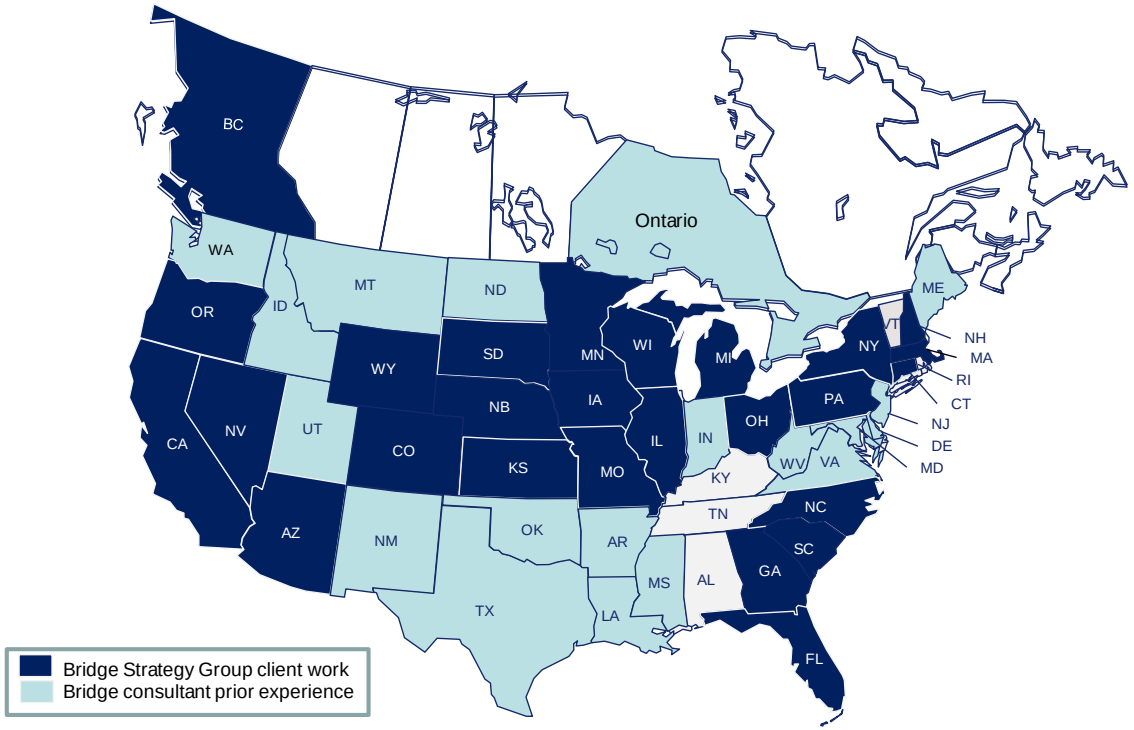


Figure 2 CHP Capacity Additions by Year

This discussion is based on our experiences in the North American electric and gas sectors

States Where Bridge Has Experience with Utilities and Energy-Related Firms



Bridge has worked with 24 of the 50 largest gas utilities and 27 of the 50 largest electric utilities in N.A.

Who We Are

- Management consulting firm with experienced practitioners in a hands-on, collaborative delivery model
- Focus areas include energy, suppliers and partners to the energy industry, technology, and consumer goods
- Help clients 'bridge the gap' from strategy development through implementation
- Issue focus – understanding and addressing a complex and continually shifting set of management challenges, rather than forcing a single standardized approach or model

Overview of our Energy Practice experiences

Some Relevant Utility Experiences

- Comprehensive long range strategy development , scenario planning, and implementation for leading gas and electric utilities[1]
- M&A pre-deal due diligence through post merger integration[2]
- Utility of the future (e.g., smart grid, distributed generation) strategy and business case development, AMI support for several electric and gas utilities
- Utility retail, core operations, and shared service strategies and performance enhancement
- District energy strategy development for utilities on the east coast and pacific northwest
- DoE program application development & program management
- State regulatory strategy, testimony and tariff design

Some Relevant Utility Supplier/Partner Experiences

- Alternative vehicle strategy development and rollout
- Corporate and utility market entry strategies for solar (PV) manufacturer and solar supplier
- Smart grid strategies for industry suppliers/partners
- Global sustainability strategy for a major nuclear company
- Market entry strategy for large retail energy services company
- Strategic planning and market development for carbon-capture technology
- Valuation of oil and gas reserves for E&P company

Sample of Published Intellectual Capital

- “One Plan, Many Pieces” (strategic planning), Electric Perspectives
- “The Utility of the Future”, EnergyBiz
- “Moving to the Distributed Utility of the Future”, World Energy
- “Energy Efficiency”, Electric Light & Power
- “10 Ways to Respond to the New Reality of Commodity Price Volatility”, Electric Light & Power
- “Rate Shock: A Matter of If or When?”, Fortnightly
- “Creating a Winning Strategy While Building a Winning Culture”, Electric Light & Power
- “Looking for Cash, Look for Inventory”, Managing Power

Industry Association Memberships

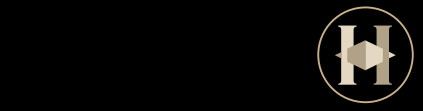
American Gas Association
Natural Gas: America's Responsible Energy Choice

EEI Edison Electric Institute

AWEA American Wind Energy Association

GridWise

[1]Electric utility client won EEI’s Edison Award as a result of our comprehensive long range strategy development efforts
[2]M&A work done for an electric utility holding company and a multi-state gas and electric utility – considered one of the most successful recent transactions



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