Utility Perspective of mCHP

John Rathbun
New Products & Services
October 14, 2010

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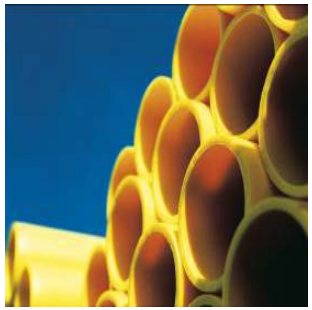
A 50:50 Company

50:50

UK

US

Transmission



Distribution

Electricity

Gas

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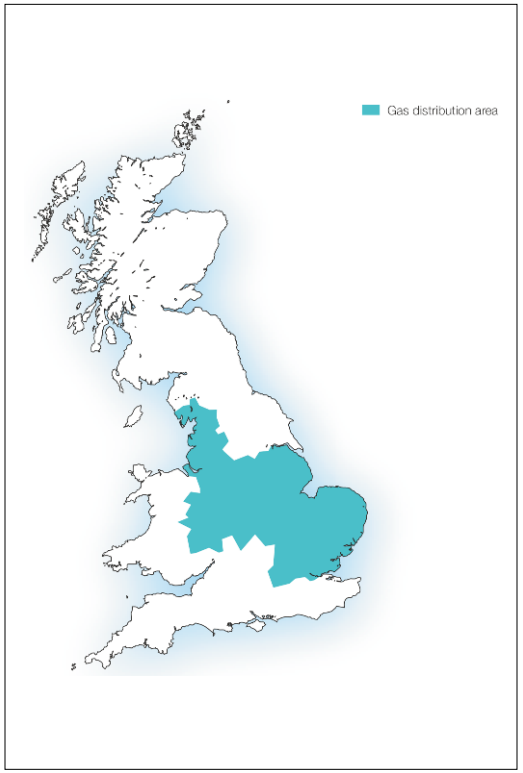
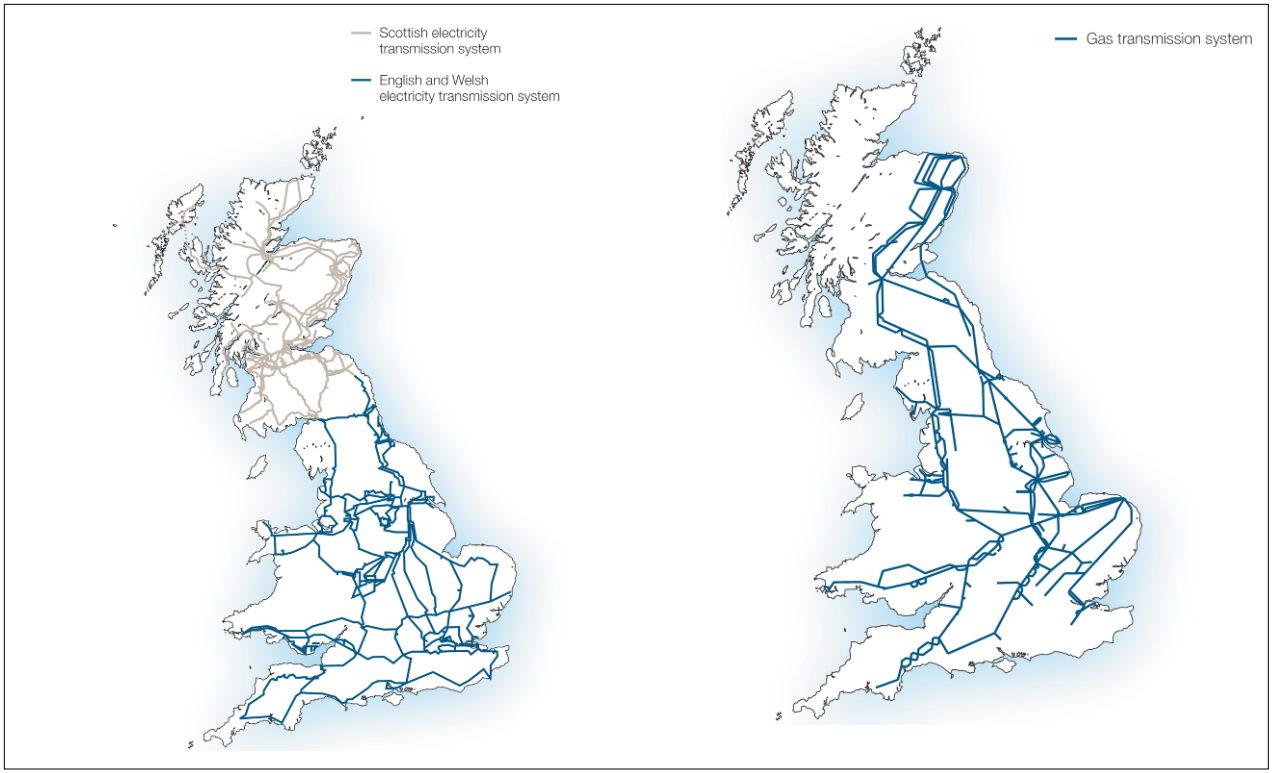
National Grid:
An international electricity and gas company

Gas Distribution - UK



Operates the UK gas distribution system; distributes gas on behalf of shippers and suppliers to 11 million consumers.

Transmission – Electricity and Gas - UK



Owns the high-voltage electricity transmission system in England and Wales and operates the system across Britain. Also owns and operates the high pressure gas transmission system in Britain.

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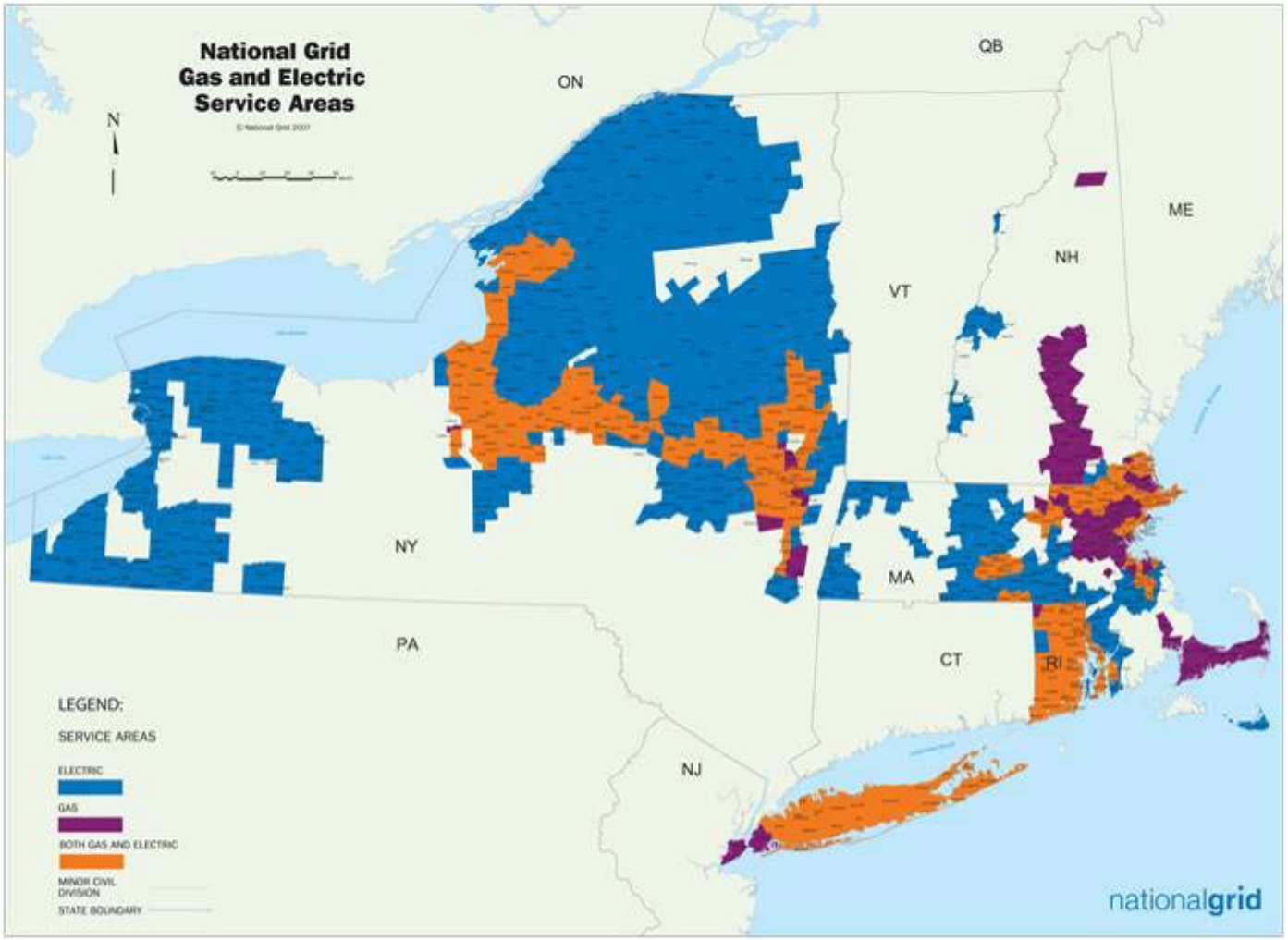
Electricity and Gas Service Areas - US



- Distributes electricity to 3.3 million customers
- Services 1.1 million customers of Long Island Power Authority (LIPA)
- Provides natural gas to 3.5 million customers
- Currently owns over 4,000MW of generation

•Based on customer numbers; includes the servicing of LIPA's 1.1 million customers

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Combined Heat Power - CHP

- Over 40 years experience DG Market and Product Development
- Product development
  - Lab test
  - Field trails and demonstration sites
  - Market Development
    - Dedicated Natural Gas rates for CHP in NY
    - Supported NYS legislation for mCHP net metering
    - Customer and A&E Seminars
    - Rebates & Programs for Feasibility Studies and Implementation

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Combined Heat Power - CHP

- 270 Mw installed on site customer owned generation
  - NE – 133 Mw 54 sites
  - UNY – 48 Mw 10 sites
  - DNY – 89 Mw 128 sites
- Over 72% below 300 kW
- Significant Projects
  - NE – 133 Mw 54 sites
    - 5.9 Mw at food manufacturer
    - 5 Mw at Medical School
    - 5.1 Mw at Pharmaceutical
  - Upstate NY
    - 29 Mw steam turbine at Healthcare facility
    - 8 Mw ICE engines at Community College
    - 6 Mw Turbine at Casino/resort
  - Downstate NY
    - 2.4 Mw at Hospital
    - 2.4 Mw at Shopping Mall
    - 2.4 Mw at College

Net Metering for mCHP

- NY
  - 10 kw limit
  - 80% Efficiency
- MA
  - 60 kW limit
  - 60% Efficiency
- Monthly net
- Full Retail
- Credit at avoided costs

NY Net Metering Law

Rates.

An electric corporation shall use net energy metering to measure and charge for the net electricity supplied by the corporation and provided to the corporation by a customer-generator, according to these requirements:

(a) In the event that the amount of electricity supplied by the corporation during the billing period exceeds the amount of electricity provided by a customer-generator, the corporation shall charge the customer-generator for the net electricity supplied at the same rate per kilowatt hour applicable to service provided to other customers in the same service class which do not generate electricity onsite.

(b) In the event that the amount of electricity produced by a customer-generator during the billing period exceeds the amount of electricity used by the customer-generator, the corporation shall apply a credit to the next bill for service to the customer-generator for the net electricity provided at the same rate per kilowatt hour applicable to service provided to other customers in the same service class which do not generate electricity onsite, EXCEPT FOR MICRO-COMBINED HEAT AND POWER OR FUEL CELL CUSTOMER-GENERATORS, WHO WILL BE CREDITED AT THE CORPORATION'S AVOIDED COSTS. THE AVOIDED COST CREDIT PROVIDED TO MICRO- COMBINED HEAT AND POWER OR FUEL CELL CUSTOMER-GENERATORS SHALL BE TREAT- ED FOR RATEMAKING PURPOSES AS A PURCHASE OF ELECTRICITY IN THE MARKET THAT IS INCLUDABLE IN COMMODITY COSTS

National Grid Investigations with Micro-CHP

plug power

PEMEAS Fuel Cell Technologies

VAILLANT GROUP Vaillant

(3.5-kW PEM)

Yanmar
(10 kW)

Climate Energy
(1.2 kW Honda Engine)

DISENCO

Kinematic Stirling

Panasonic
PEM (0.5-3kW)

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National Grid Field Demonstration Sites

- Freewatt
  - Partners: NYSERDA & ECR International
  - 5 units 2- Albany 3 – LI
  - Market Research
- Freewatt Plus
  - Partners: Enbridge & ECR International
  - 5 units 4 – Syracuse 1 – Boston
  - Smart Grid
  - Standby Power

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National Grid Field Demonstration Sites

- Plug Power GenSys Blue
  - Partners: DOE & Plug Power
  - Union College, Schenectady Museum, Balston Spa High School
  - Outreach and Education
  - 3.5 – 5 kW High Temperature PEM fuel Test period
- Yanmar System:
  - 2 – 10 kW units
  - Standby power
  - Health Facility located in proposed Smart Grid Area

LI Freewatt Sites

- Home Size
  - 1300 sq ft 3 bedroom, 2 Adults
  - 2500 sq ft 4 bedroom, 2 Adults 4 Children
- Electric Generation
  - 5,000 kwH total generation, of which 2,700 kwH exported to the Grid
  - 5,700 kwH total generation, of which 650 kwH exported to the Grid
- Energy Costs Savings
  - $850 - $950/ year
  - Net metering and oil/or gas savings
- Carbon Reduction
  - 5,400 – 7,700 lbs per year
  - Energy Use and prior heating equipment

Micro Combined Heat Power - mCHP

- mCHP Market
  - Spark Spread in NE
    - High Electric Rates $.16 - $.20 USD / kwH
    - Competitive Gas Rates $.60 - $.75 / therm
  - Thermal load (average residence)
    - Heat: 5000 – 6000 DD/yr ~ 1200 – 1500 therms
    - DHW: 250 – 350 therms/year
    - Pool Heating: 1,000 therms/season
  - 125 mCHP units installed

Micro Combined Heat Power - mCHP

- **Pilot Projects**
  - Active Projects
  - In discussion
    - Disenco 1 kW Sterling engine
    - Whispertech 1 Kw Sterling Engine
    - Marathon 4.7 kW ICE
    - Baxi – Microgen 1 kW Sterling wall mount
  - Smart Grid Technology Module
    - Dispatchable resource
    - Integration with PV,wind and storage

National Grid- Interest in micro CHP

- Climate Change Option
  - Regional Greenhouse Gas Initiative, (RGGI), NY, NH MA & RI
  - New York
    - City - 30% reduction by 2030
    - State - 15% reduction by 2015
  - Massachusetts – Lead by Example Program through 2080
- Energy Efficiency Option
  - Active Rebate Programs in MA & RI
  - Cost to Benefit Metric
- Increased Market Share vs Oil & Electricity

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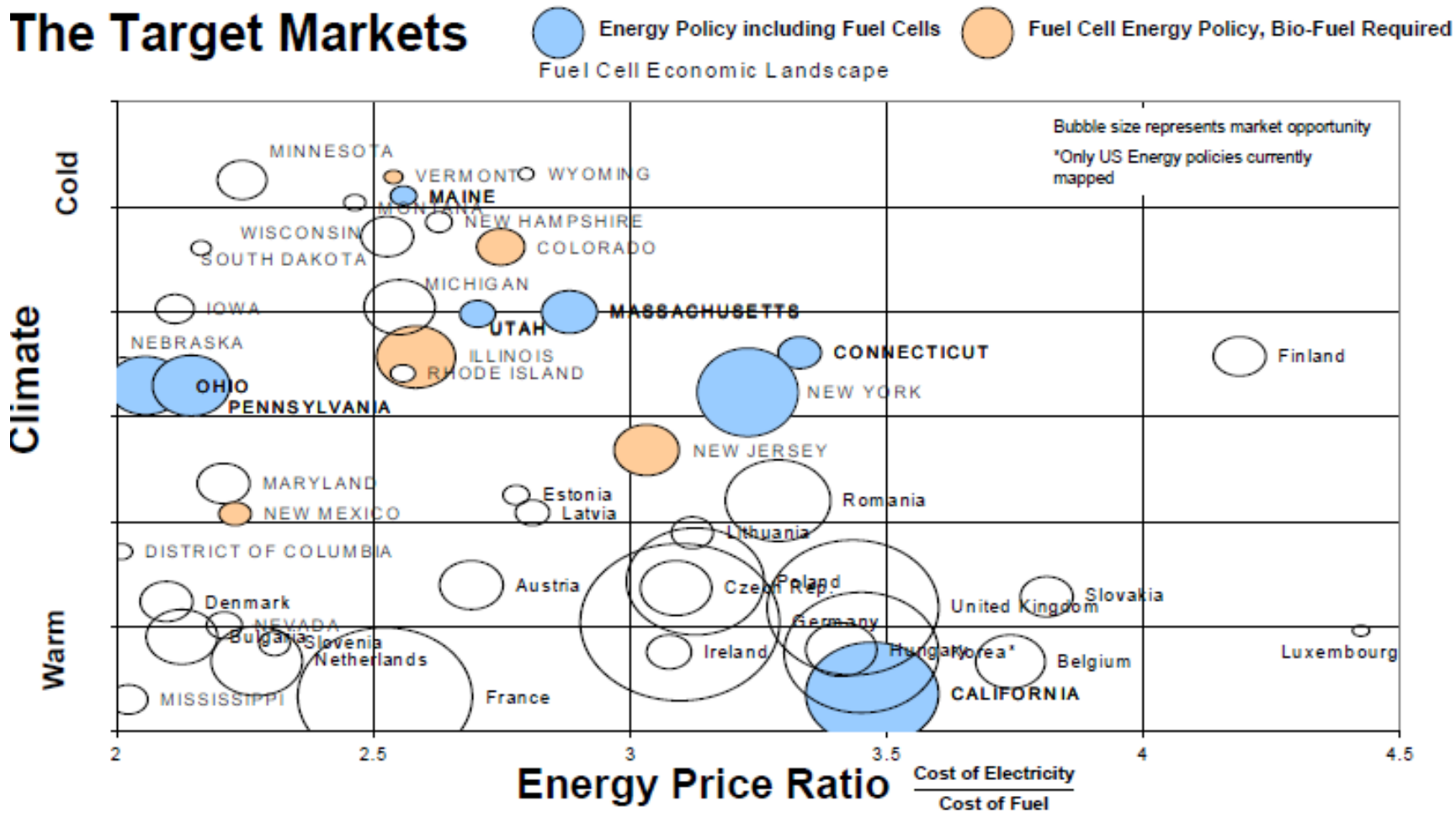
National Grid's footprint in the US includes the best market conditions for CHP.



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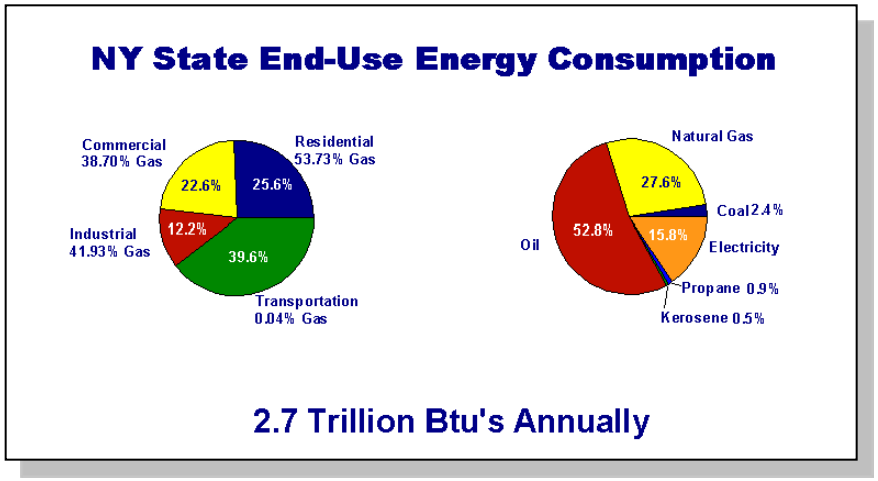
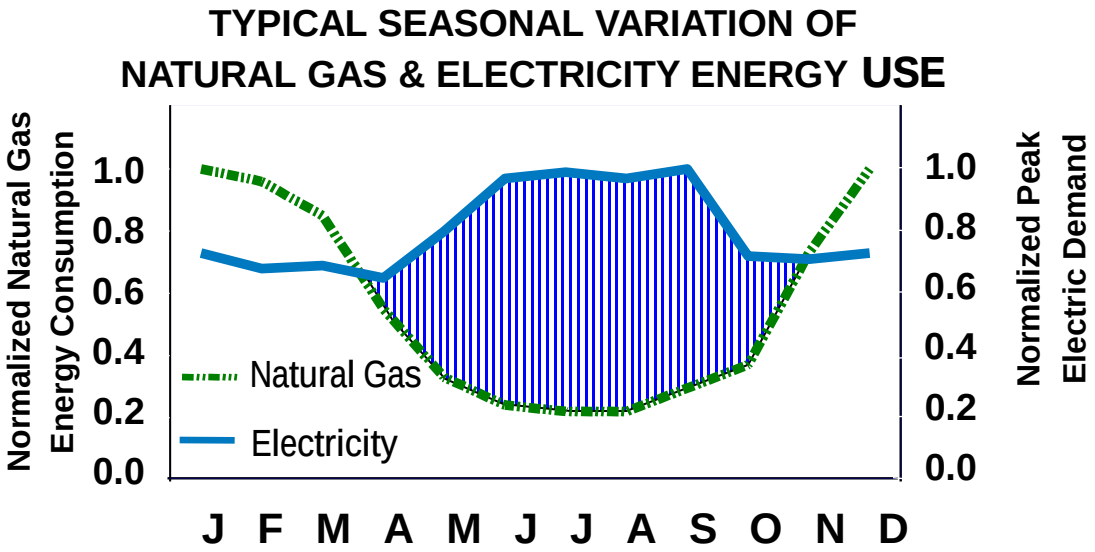
National Grid- Interest in micro CHP

- Increase in Summer Gas Load
- Potential for Customer Savings
- Increased Overall Efficiency
- Environmental Benefits
- Potential for Electric Grid Support





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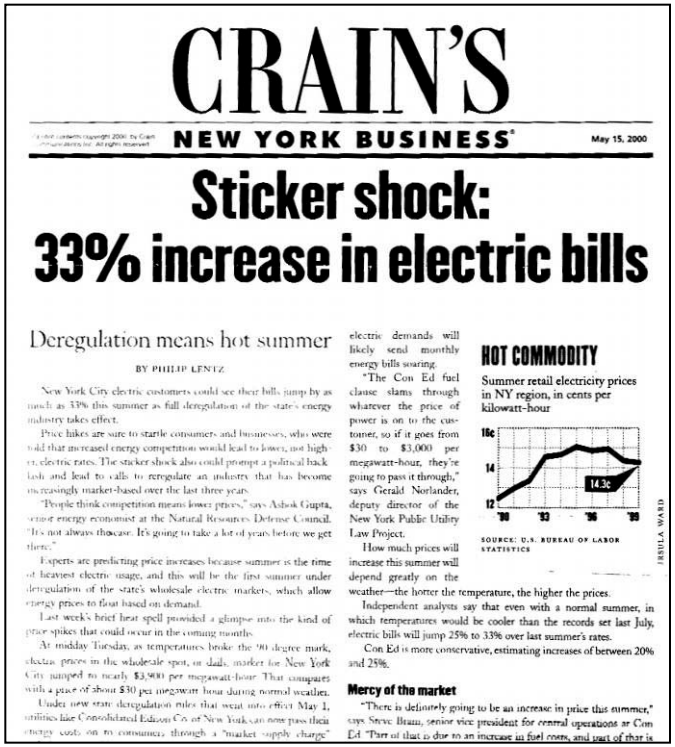
Issues Favoring Distributed Generation

- De-regulation - High Electric Rates
- Sell-back provisions
  - Net Metering & Interconnect in MA
  - Recently adopted in NY State
- Huge Potential Market
- Difficulties Siting New Power Plants
  - Community Opposition
  - Environmental Concerns
    (Air Emissions, Thermal Discharge)
- Local Electric Distribution Limits
  - High Cost (especially Urban Areas)
  - Concerns over EMF Radiation
  - Demand reduction programs
  - currently the primary tactic of electric utilities.



CRAIN'S NEW YORK BUSINESS May 15, 2000

Sticker shock: 33% increase in electric bills

Deregulation means hot summer

BY PHILIP LENTZ

New York City electric customers could see their bills jump by as much as 33% this summer as full deregulation of the state's energy industry takes effect.

Price hikes are sure to startle consumers and businesses, who were told that increased energy competition would lead to lower, not higher, electric rates. The sticker shock also could prompt a political backlash and lead to calls to reregulate an industry that has become increasingly market-based over the last three years.

"People think competition means lower prices," says Ashok Gupta, senior energy economist at the Natural Resources Defense Council. "It's not always the case. It's going to take a lot of years before we get there."

Experts are predicting price increases because summer is the time of heaviest electric usage, and this will be the first summer under deregulation of the state's wholesale electric markets, which allow energy prices to float based on demand.

Last week's brief heat spell provided a glimpse into the kind of price spikes that could occur in the coming months.

At midday Tuesday, as temperatures broke the 90 degree mark, electric prices in the wholesale spot, or daily, market for New York City jumped to nearly $3,900 per megawatt-hour. That compares with a price of about $30 per megawatt hour during normal weather.

Under new state deregulation rules that went into effect May 1, utilities like Consolidated Edison Co. of New York can now pass their energy costs on to consumers through a "market supply charge" electric demands will likely send monthly energy bills soaring.

"The Con Ed fuel clause slams through whatever the price of power is on to the customer, so if it goes from $30 to $3,000 per megawatt-hour, they're going to pass it through," says Gerald Norlander, deputy director of the New York Public Utility Law Project.

How much prices will increase this summer will depend greatly on the weather—the hotter the temperature, the higher the prices.

Independent analysts say that even with a normal summer, in which temperatures would be cooler than the records set last July, electric bills will jump 25% to 33% over last summer's rates.

Con Ed is more conservative, estimating increases of between 20% and 25%.

Mercy of the market

"There is definitely going to be an increase in price this summer," says Steve Brami, senior vice president for central operations at Con Ed. "Part of that is due to an increase in fuel costs, and part of that is

HOT COMMODITY

Summer retail electricity prices in NY region, in cents per kilowatt-hour

SOURCE: U.S. BUREAU OF LABOR STATISTICS

JESULA WARD

Energy Efficiency Vision

We, at National Grid, will be the foremost international electricity and gas company, delivering unparalleled efficiency, reliability, and safety, vital to the well-being of our customers and communities.

We are committed to being an innovative leader in energy management and to safeguarding our global environment for future generations

Customer Energy Efficiency Programs

- **Nationally Recognized Leader**
- **Increasingly valuable part of National Grid's energy management activities**
- **Strongly recognized by our customers**

ENERGY STAR® Partner of the Year — Energy Efficient Program Delivery

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Energy Efficiency's Role: New Utility Model

- **Current Revenue Growth**
  - Utility rewarded for network investment/growth that benefits customers – not commodity sales growth
    - ✓ Adding new customers to the existing network
    - ✓ Expanding, reinforcing and upgrading the current network
    - ✓ Enriching the capability on the network, e.g., smart network devices, smart meters, home display units etc, home charging stations

$$ → ROI on assets

- **Future Revenue Growth**
  - Utility rewarded for implementing climate change and customer cost management strategies
    - ✓ Delivering aggressive energy efficiency programs
    - ✓ New investments, e.g., renewables, low(er) carbon distributed generation (e.g., micro CHP)
    - ✓ Customer product choices – green power, carbon offsets, smart-enabled customer products

→ Incentive mechanism

→ ROI on Assets & Incentives

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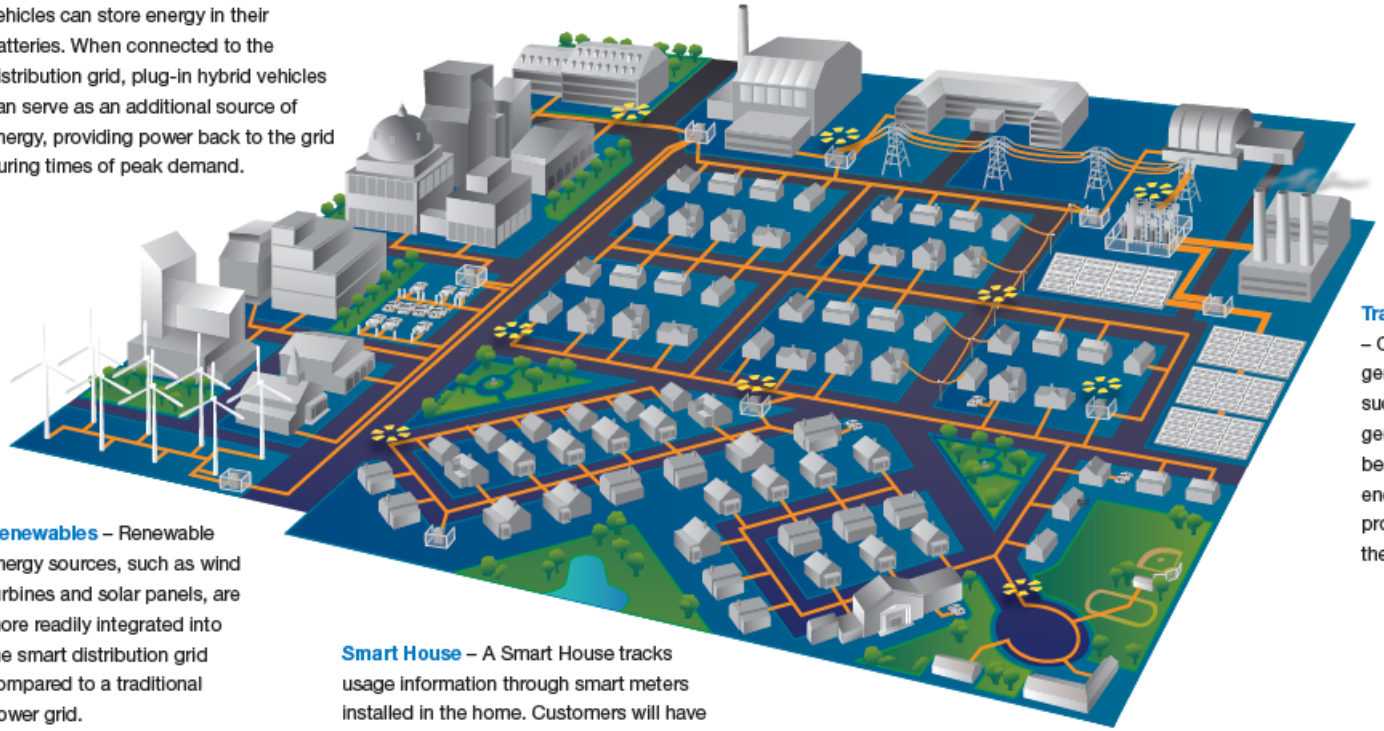
What is a Smart Grid?

Sensors – Advanced communication equipment on the grid, including sensors, enable utilities to monitor, identify and quickly correct problems. Increased reliability of power is the result.

Plug-in Hybrid Vehicles – Plug-in hybrid vehicles can store energy in their batteries. When connected to the distribution grid, plug-in hybrid vehicles can serve as an additional source of energy, providing power back to the grid during times of peak demand.



Traditional Generation – Over time, traditional generation assets such as coal-fired generation plants will be offset by renewable energy sources in providing energy to the distribution grid.

Renewables – Renewable energy sources, such as wind turbines and solar panels, are more readily integrated into the smart distribution grid compared to a traditional power grid.

Smart House – A Smart House tracks usage information through smart meters installed in the home. Customers will have a variety of options through which they can interface with to learn about the most cost-efficient energy usage patterns. Increased information empowers consumers to reduce their energy use.

National Grid Smart Grid Pilot Proposal

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