



## Fuel Cells for Municipal Government



1 September 17, 2009 – South Western Regional Planning Agency

# Supporting Organizations





## Potential Benefits

- Lower cost for heat and power
- Electric system reinforcement, voltage control
- Premium power/emergency response
- Reduced air emissions/improved air quality
- Economic development
- Improved efficiency and reliability
- Renewable Energy Portfolio Standard (20% / 2010)

# Regional Resource Center/U.S. DOE Partnership Online Models

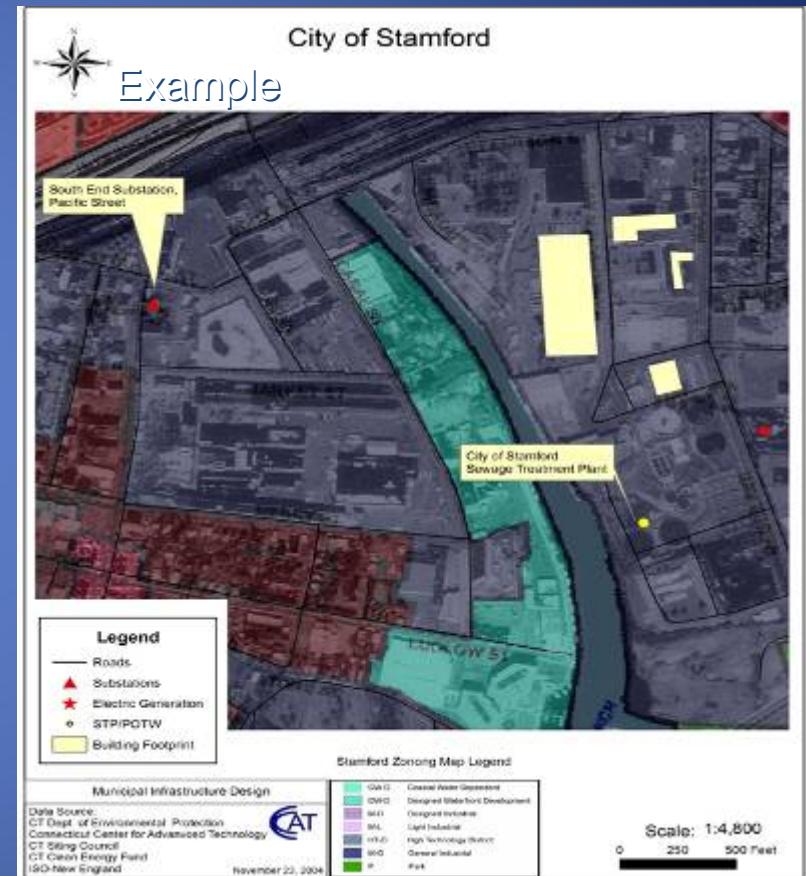


- Economic/Cost Model
  - Heating and Electricity Cost Savings
- Energy Management Model
  - Efficiency Benefits
- Distributed Technology Comparison
  - Compares Fuel Cells to Other Technologies
- Hydrogen Generation from Renewable Technology
  - Cost of Hydrogen from Renewable Resources
- Environmental Model
  - Stationary and Transportation Emissions

# Project Analysis



- Define problem/opportunities
- Identify community solutions
- Collect detailed information
- Identify application for fuel cells
- Initiate economic model



# Project Analysis



Dates			Electric Consumption				Demand		Hours Use (hrs)	Total Cost (\$)	Unit Cost (\$/kwh)
			On-Peak (kwh)	Off-Peak (kwh)	Total (kwh)	30-day avg (kwh)	On-Peak (kw)	Off-Peak (kw)			
From	To	# Days									
12/8/2005	1/10/2006	33	213,626	141,920	355,546	323,224	869.2	642.8	372	38,648	.109
1/10/2006	2/7/2006	28	198,766	119,078	317,844	340,547	1005.3	748.7	339	43,604	.137
2/7/2006	3/8/2006	29	200,241	121,652	321,893	332,993	911.1	645	365	43,121	.134
3/8/2006	4/6/2006	29	210,470	119,737	330,207	341,593	1054.9	669.6	324	47,723	.145
4/6/2006	5/7/2006	31	231,349	144,819	376,168	364,034	1118	854.5	326	52,132	.139
5/7/2006	6/7/2006	31	264,476	146,459	410,935	397,679	1306.8	1128.8	304	56,937	.139
6/7/2006	7/9/2006	32	291,478	184,120	475,598	445,873	1341.8	1208.7	332	63,753	.134
7/9/2006	8/8/2006	30	321,126	196,720	517,846	517,846	1347.8	1204.4	384	70,413	.136
8/8/2006	9/7/2006	30	279,436	161,991							
			<b>Billing</b>				<b>Gas Consumption</b>		<b>Total Cost (\$)</b>		<b>Unit Cost (\$/Ccf)</b>
<b>Dates</b>					<b>#</b>		<b>Total</b>		<b>30-day Avg</b>		
<b>From</b>	<b>To</b>	<b>Days</b>			<b>Days</b>	<b>(Ccf)</b>		<b>(Ccf)</b>			
12/31/2005	1/31/2006	31				14,653	14,180	23,495.95	1.603		
1/31/2006	2/28/2006	28				14,239	15,256	18,757.67	1.317		
2/28/2006	3/31/2006	31				12,343	11,945	14,457.48	1.171		
3/31/2006	4/30/2006	30				6,893	6,893	8,891.74	1.29		
4/30/2006	5/31/2006	31				4,135	4,002	5,976.04	1.445		
5/31/2006	6/30/2006	30				1,677	1,677	3,056.33	1.822		
6/30/2006	7/31/2006	31				792	766	2,184.01	2.758		
7/31/2006	8/31/2006	31				1,206	1,167	2,563.23	2.125		
8/31/2006	9/30/2006	30				3,194	3,194	4,691.52	1.469		
9/30/2006	10/31/2006	31				9,457	9,152	13,985.00	1.479		
10/31/2006	11/30/2006	30				9,430	9,430	11,274.37	1.196		
11/30/2006	12/31/2006	31				13,447	13,013	15,508.31	1.153		
12/31/2006	1/31/2007	31				17,225	16,669	19,081.11	1.108		

Provide one year (12 months) of utility data

# Project Analysis



Combined Heat & Power  
Connecticut

UTC FC	Technology
1,328	KWAC Peak Host Demand Capacity
47%	Host approximate Load Factor
4,728,797	kWhs Host Average Energy Demand
0%	Host Expected Return on Equity
1,198,139	btu/hr Average Host Heat Demand
400	KWAC Fuel Cell Installation
97.00%	Capacity Factor
8,126	Average Heat Rate
27,620	mmbtu Heat Input Per Year Required
3,398,880	Fuel Cell Gen is 71.9% of Host Requirement
1,560,229	btu/hr Average generated by UTC FC
15.32	Utility Avoided Energy Cost ¢/kWh
3.0%	Utility & Nat Gas & LFG Esc. Rate
3.0%	O&M Esc. Rate
\$11.95	Natural Gas \$/mmbtu
\$0.00	Fuel Oil Cost \$/mmbtu
\$11.95	Natural Gas and Fuel Oil Cost \$/mmbtu
\$30.00	Recs Market Value De-Esc @2%
2.00	O&M ¢/kWh
80.0%	Natural Gas or Oil Fired Boiler Efficiency
15	- Number of Years in the Analysis
rate 58	Host CL&P Electric Rate
Third Party Rate	0.00

CL&P     UI     Non Profit

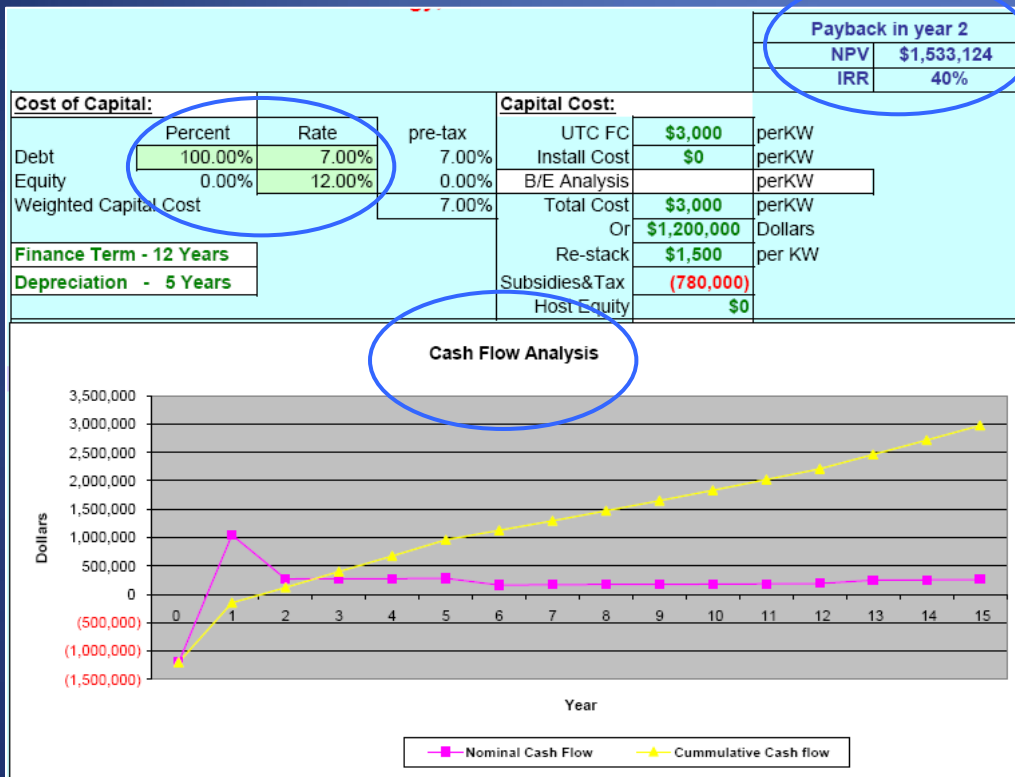
Utility Inputs

Electric Demand

Thermal Demand

Utility Rates

# Economic Financial Analysis



## Financial Variables

- Payback term
- Cash flow
- Net present value
- Depreciation
- Internal rate of return
- Financing method
- Capital costs
- Installation and restacking cost
- Investment tax credits



## Funding

- Federal Funding/American Recovery and Reinvestment Act
- Connecticut Clean Energy Fund (Approx \$8 million available for 14 projects)
- Federal tax credit of 30% of expenditures, capped at \$3,000/kW
- ISO Demand Response Program
- CT DPUC Distributed Generation Program

# Example of Potential Projects: Middletown High School, Middletown, CT



200 kW UTC Power Fuel Cell

*"This is the single biggest project Middletown has undertaken in its nearly 350-year history. We were determined to be fiscally and operationally prudent, energy conscious and environmentally responsible..."*

*- Mayor Sebastian N. Giuliano*

**900,000 BTU • Reduces CO<sub>2</sub> emissions by 470 tons annually**

**Electricity • Heat • Backup Power • Education**

# Example of Potential Projects: City of Tulare, CA Wastewater Treatment Plant



900 kW FuelCell Energy Fuel Cell

*Needing to reduce pollutant emissions and reliance on the local power grid, the Regional Wastewater Treatment Facility decided to implement a reliable clean onsite distributed power source.*

Reduces CO<sub>2</sub> emissions by approx 10,000 tons annually

**Electricity • Heat • Pre-Heating • Digester Gas**

# Example of Potential Projects: Whole Foods Market, Glastonbury, CT



200 kW UTC Power Fuel Cell

*The fuel cell provides Whole Foods Market with enhanced energy security and will ensure a reliable food supply for customers and protect against costly food spoilage if the power grid goes down.*

CO<sub>2</sub> reductions offset 21 acres of forest, NO<sub>x</sub> reductions equal to removing 100 cars of the roadway per year

**Electricity • Heat • Hot Water • Backup Power**

## Potential Partners

- Connecticut Center for Advanced Technology
- Connecticut Clean Energy Fund
- Connecticut Siting Council
- Northeast Utilities
- United Illuminating
- FuelCell Energy
- UTC Power
- U.S. Department of Energy



## Contact

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